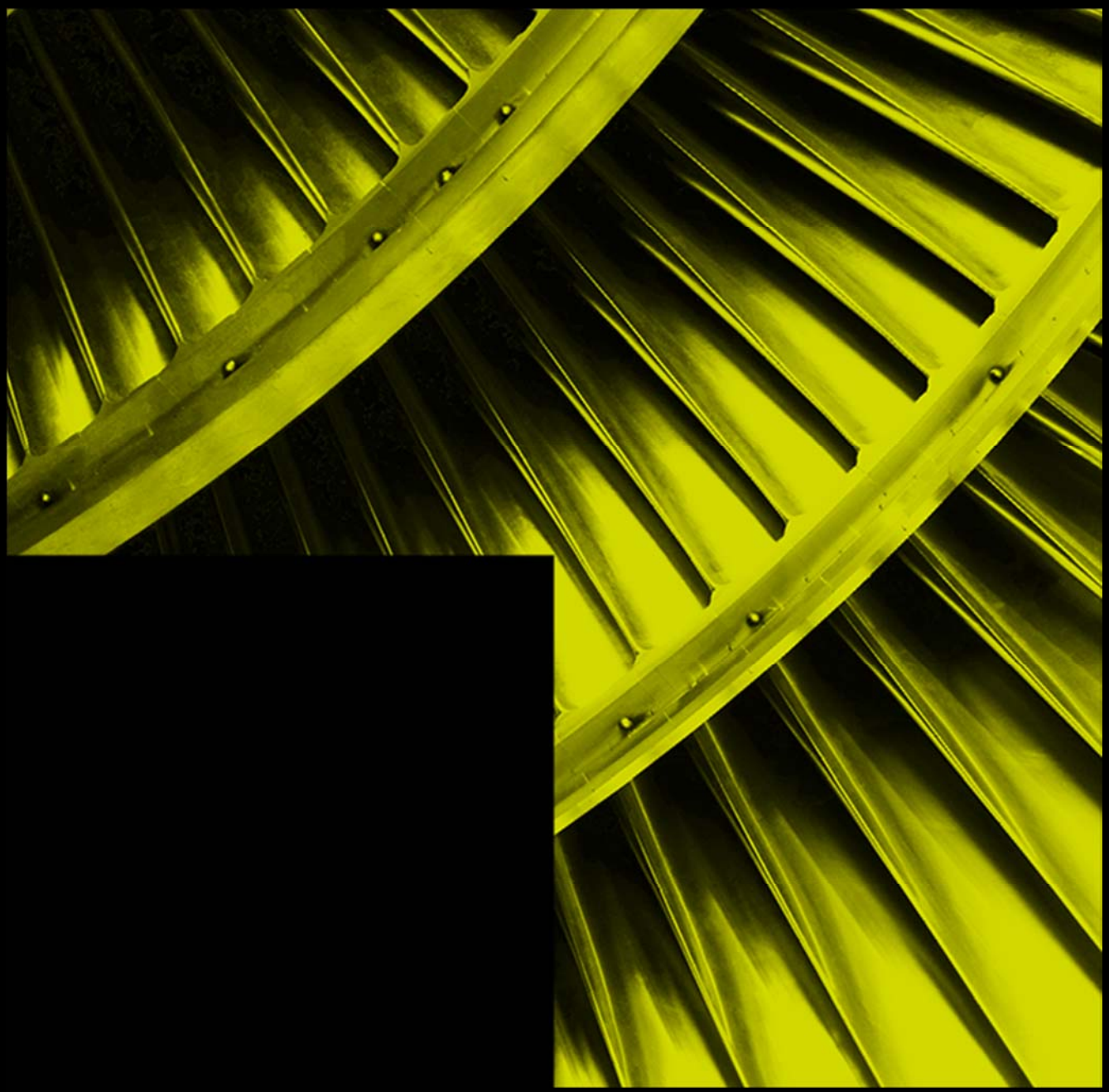
STRATFORD WASTEWATER TREATMENT PLANT

Stratford District Council



DOCUMENT CONTROL RECORD

CLIENT	Stratford District Council
PROJECT	Stratford Wastewater Treatment Plant
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DOCUMENT	Regional Permit Application and Assessment of Effects on the Environment

ISSUE AND REVISION RECORD

DATE OF ISSUE	November 2015
STATUS	Final
ORIGINATOR	Emma-Jane Hayward – Planner Rebecca Upton-Birdsall – Chemical and Process Engineer
REVIEWED	Nick Grala – Senior Planner / Senior Associate Anita Simpson – Senior Process Engineer / Associate
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CONTENTS

APPENDICES

EXECUTIVE SUMMARY

This resource consent application is seeking to undertake a series of plant upgrades and a 20 year discharge permit to continue to discharge treated effluent from the Stratford Wastewater Treatment Plant into the Patea River.

A 20 year timeframe provides the required certainty to enable the upgrades to be investigated and undertaken over time.

The proposed plant upgrades are aimed at improving the effluent quality while remaining cost effective for the rate payers. There is no requirement for upgrading the plant capacity.

The timeframe of the upgrade stages are based on economic considerations. The upgrades proposed are:

- **2020:** Phosphorous reduction (in pond chemical dosing) upgrade
- **2022:** Investigate land disposal options
- **2025:** Land disposal or nitrogen reduction (in pond media) upgrade depending on the outcomes of the land disposal investigation

The timeframe and works are dependent on the monitoring results and ensuring ratepayer affordability. The current Taranaki Regional Council ecological monitoring requirements will continue to apply and be undertaken. This means that the wastewater treatment requirements may evolve based on the Patea River ecological results.

The proposal is a Discretionary Activity under the Regional Plan.

The application should be considered on a limited notified basis to the following parties:

- Department of Conservation
- Taranaki Fish & Game
- Ngāti Ruanui
- G & M Collins Family Trust
- DF & KJ Hinton

The proposal is not contrary to the relevant objectives, policies, and assessment criteria of the Reginal Plan.

It is appropriate for consent to be granted subject to fair and reasonable conditions.

1.0
THE APPLICATION AND PROPERTY DETAILS

APPLICANT	Stratford District Council
SITE ADDRESS	Victoria Road, Stratford
ADDRESS FOR SERVICE	Harrison Grierson PO Box 5760, Wellesley Street Auckland 1141
LEGAL DESCRIPTION	Lot 7 & 8 DP 1942, Lot 1 DP 9529 and Pt Lots 9 & 10 DP 1942 (**Appendix 1)**
DISCHARGE CO-ORDINATE	262880mE 6206138mN (approximately)
REGIONAL PLAN	Regional Air Quality plan for Taranaki 2011 (the 'Air Quality Plan') Regional Fresh Water Plan for Taranaki 2001 (the 'Freshwater Plan')
DISTRICT PLAN	Operative Stratford District Plan 2009 (the 'District Plan')
DESIGNATIONS / SPECIAL LIMITATIONS	Designations D38 (Proposed Oxidation Ponds) and D40 (Oxidation Ponds) National Policy Statement – Freshwater Management

LOCALITY DIAGRAM

2.0 INTRODUCTION

The Stratford wastewater treatment plant (WwTP) is owned and operated by Stratford District Council (SDC), consisting of an inlet screen, oxidation pond, maturation pond and rock filter outfall. The treated wastewater is discharged to the Patea River.

The current consent 0193-4 (refer to **Appendix 2**) was granted on 23 October 2013 and will expire on 1 June 2016. This consent allows up to 4,800 m^3/day of treated wastewater to be discharged from the plant to Patea River. The consent contains various conditions relating to the operation of the plant and to the quality of the treated effluent.

SDC are applying for a 20 year extension of their existing consent to discharge treated wastewater to the Patea River (renewal of 0193-4).

This report has been prepared in accordance with section 88 and the Fourth Schedule of the Resource Management Act 1991 (RMA). It includes a description of the existing wastewater scheme and the proposed upgrades and changes. It also describes the environment and the changes to the environment that will result from the proposed upgrades to the existing wastewater scheme.

The ecological report *Stratford Waste Water Treatment Plant Ecological Assessment of Effects on the Patea River* (refer to **Appendix 3)** has been produced based on the data provided in the four annual monitoring reports completed by Taranaki Regional Council (TRC). The full report is included in (**Appendix 3**) and the findings of it along with Stratford District Council Municipal Oxidation Pond System Monitoring Programme Annual Report 2014-2015 are used as the basis for the Assessment of Environmental Effects (AEE).

3.0 THE SUBJECT SITE AND ITS IMMEDIATE SURROUNDS

The Stratford WwTP is located on Victoria Road, Stratford, to the east of the Stratford township and south of the Patea River. The WwTP consists of an oxidation pond, maturation pond and associated influent flow measurement and effluent discharge structures. The surrounding land is privately owned farmland.

The topography of the site is fairly uniform gentle slope with an eastward aspect. Within the boundary land is mown grass.

The Stratford WwTP discharges into the Patea River. This river has both aesthetic and recreational value to the Stratford community. There are walkways on both sides of the river and fishing is practiced in stretches of the river both upstream and downstream of the discharge point.

Lake Rotorangi is approximately 40km downstream of the treatment plant and is used by the community for recreational boating, fishing and for electricity generation.

The distance to the nearest house is 25m from the WwTP. It is directly across the road and separated from the WwTP by a hedge on the road frontage.

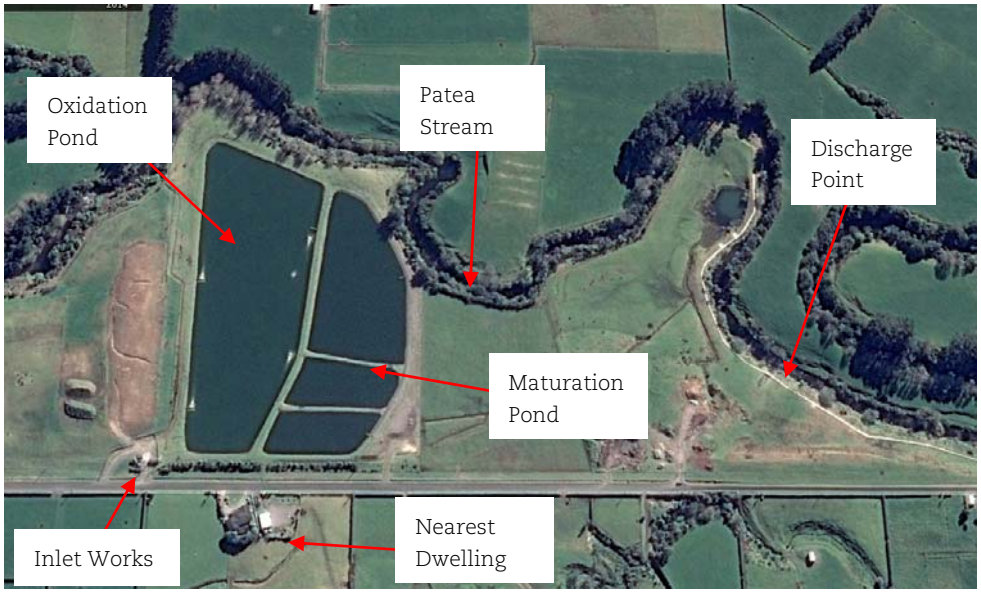


FIGURE 1: Stratford WwTP and Surrounding Environments

4.0 EXISTING TREATMENT PLANT PROCESS

The Stratford WwTP has undergone several upgrades since it was first constructed. The process flow diagram in the figure below is representative of the plant as it currently operates.

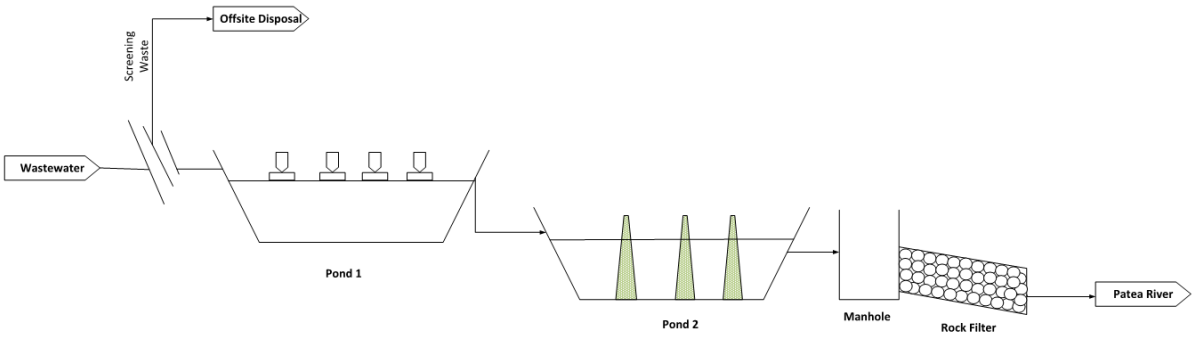


FIGURE 2: Process Flow Diagram of Existing WwTP

4.1 INFLUENT STEP SCREEN

The influent step screen removes organic and inorganic solids, and reduces the solids loading on the downstream ponds. The solids accumulated on the screen are conveyed to a sealed bin (to minimise odour emissions) via a screw press.

FIGURE 3: Influent Step Screen, Screw Conveyor and Sealed Bin

4.2 OXIDATION POND

The oxidation pond (Pond 1) is 2.6ha in area and is a facultative pond which utilises algae and the atmosphere to provide oxygen for the organic degradation of wastewater. In addition to this natural aeration capacity it is aerated by four 5.5 kW cage aerators. All of the aerators are operated continuously, except for when maintenance is required.

The oxidation pond provides aerobic stabilisation of biochemical oxygen demand (BOD) in the upper oxygenated layer and decomposition of the settled solids, by anaerobic bacteria.

FIGURE 4: Oxidation Pond – Pond 1

4.3 MATURATION POND

The maturation pond (Pond 2) provides disinfection following the oxidation pond. It utilised natural UV light to disinfect the oxidised wastewater. It has an area of 1.7 ha and is separated into three pond sections. There are rock partitions between each section, which prevent short cutting and increases the retention time in the pond.

FIGURE 5: Maturation Pond – Pond 2

4.4 ROCK FILTER OUTFALL

A rock riprap structure is used to provide land contact for the treated effluent prior to discharge to the final receiving environment of the Patea River. In addition to this the rock filter disperses the energy of the discharge and minimises the risk of scouring of the bankside adjacent to the discharge in the Patea River.

FIGURE 6: Rock Filter Outfall

4.5 SOLID WASTE

4.5.1 SCREENED WASTE

The solids accumulated on the influent step screen are conveyed to a sealed bin, the contents of which are disposed of offsite.

4.5.2 SLUDGE

Sludge is generated from the biological treatment of organic matter. The excess sludge solids settle to the bottom of the ponds, accumulating and degrading over time. Sludge removal from the ponds is undertaken on an as required basis, typically once every 10 years. Once collected, solids waste is dewatered onsite with geotextile bags to an acceptable consistency before disposal onsite.

5.0 PLANT PERFORMANCE

The performance of the Stratford WwTP is discussed below with reference to the effluent quality. SDC undertook a more intensive summer monitoring programme during October 2014 to March 2015 in order to develop a robust profile of the final effluent quality and plant performance.

5.1 FLOWS

The volumetric flow is measured by a flowmeter at the inlet of the plant.

Historical wastewater flow data (from 27/10/2009 to 04/02/2013) has been analysed and is summarised in the table below.

TABLE 1: INFLUENT FLOW DATA (2009 – 2013)

STATISTIC	INFLUENT FLOW (m^3/d)
Minimum	430
Median	1,930
Average	6,675
75th Percentile	11,090
90th Percentile	19,390
Maximum	19,394

5.1.1 DOMESTIC WASTEWATER

The volume of domestic wastewater is largely dependent on the population of the town. The Stratford population is expected to remain relatively stable in future years, with a slight decline. This negates the need to upgrade the capacity of the plant.

As the ponds will provide buffering for the high storm flows, the median and 75th percentile have been used for the design of the upgraded components.

5.1.2 TRADE WASTE

SDC has implemented a formal trade waste bylaw that covers the range of trade waste discharges in the Stratford area. As part of this bylaw, SDC staff actively collect information on trade waste volumes and quality to ensure that there is nothing hazardous or otherwise being discharged into the sewer network that could affect the treatment process at the plant.

5.2 ORGANIC COMPONENTS

5.2.1 SUSPENDED SOLIDS

The suspended solid concentrations measured in the effluent are presented in the figure below.

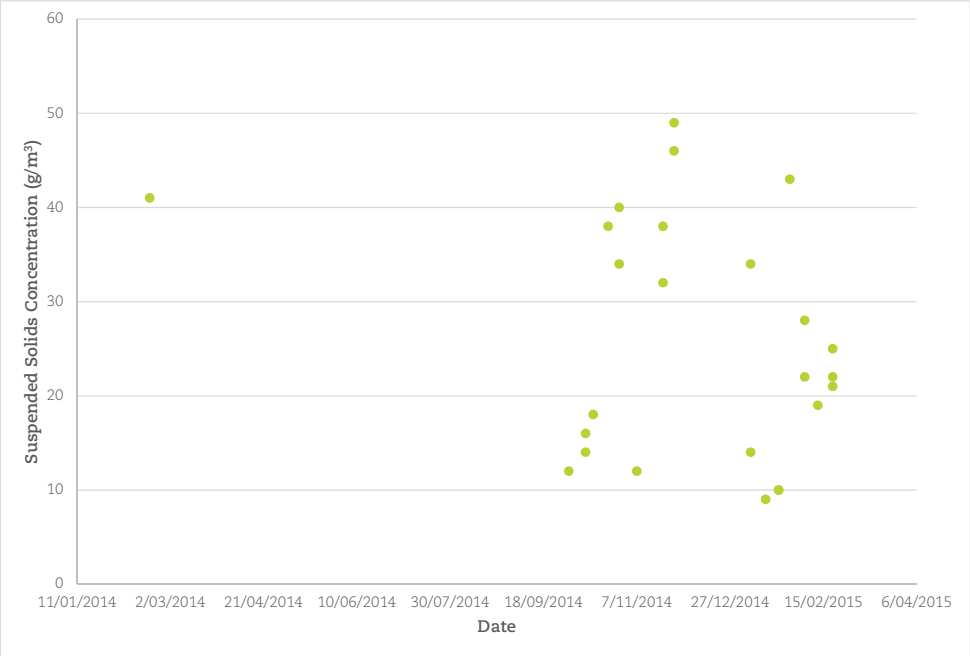


FIGURE 7: Final Effluent Suspended Solids

The suspended solids tends to vary between 10 and 50g/m^3. This variance is expected given the potential algae solids in the discharge and it is in line with typical performance from wastewater treatment ponds.

5.2.2 OXYGEN DEMAND

The current resource consent limits for oxygen demand compliance points are following the mixing zone, approximately 50 m downstream of the discharge point:

"*that after allowing for reasonable mixing, being a mixing zone extending from the discharge point, to a point 50 metres downstream of the discharge point, the discharge shall not cause the receiving waters of the Patea River to exceed the following concentrations: Filtered carbonaceous* BOD_5*: 2.0* gm^{-3}".

While the compliance point is downstream of the discharge, in order to assess the performance of the wastewater treatment plant, the chemical oxygen demand (COD), carbonaceous BOD and soluble carbonaceous BOD measured in the effluent are presented in the figure below.

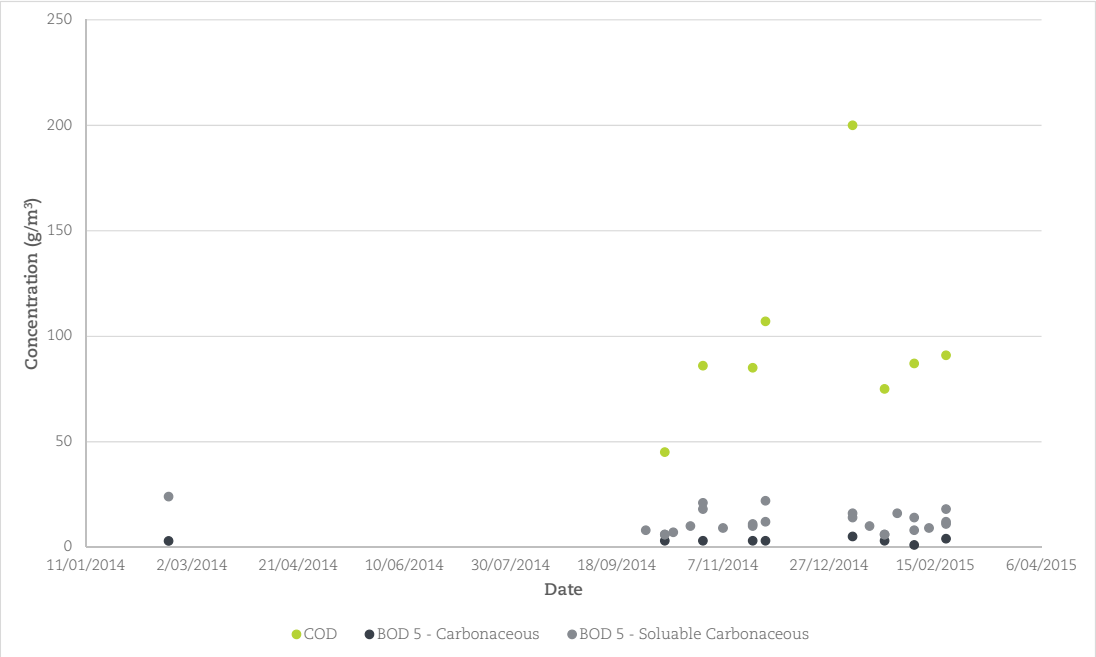


FIGURE 8: Final Effluent Oxygen Demand Concentrations

The average BOD_5 carbonaceous is approximately 10 g/m^3, which indicates that the ponds are performing better than typical pond systems (which are usually between 20 to 30 g/m^3).

5.3 NUTRIENTS

5.3.1 AMMONIA

The current resource consent limits for ammonia compliance points are following the mixing zone, approximately 50 m downstream of the discharge point:

"*that after allowing for reasonable mixing, being a mixing zone extending from the discharge point, to a point 50 metres downstream of the discharge point, the discharge shall not cause the receiving waters of the Patea River to exceed the following concentrations: Unionised ammonia 0.025 gm^{-3}*".

While the compliance point is downstream of the discharge, in order to assess the performance of the wastewater treatment plant, the ammonia concentrations measured in the effluent are presented in the figure below.

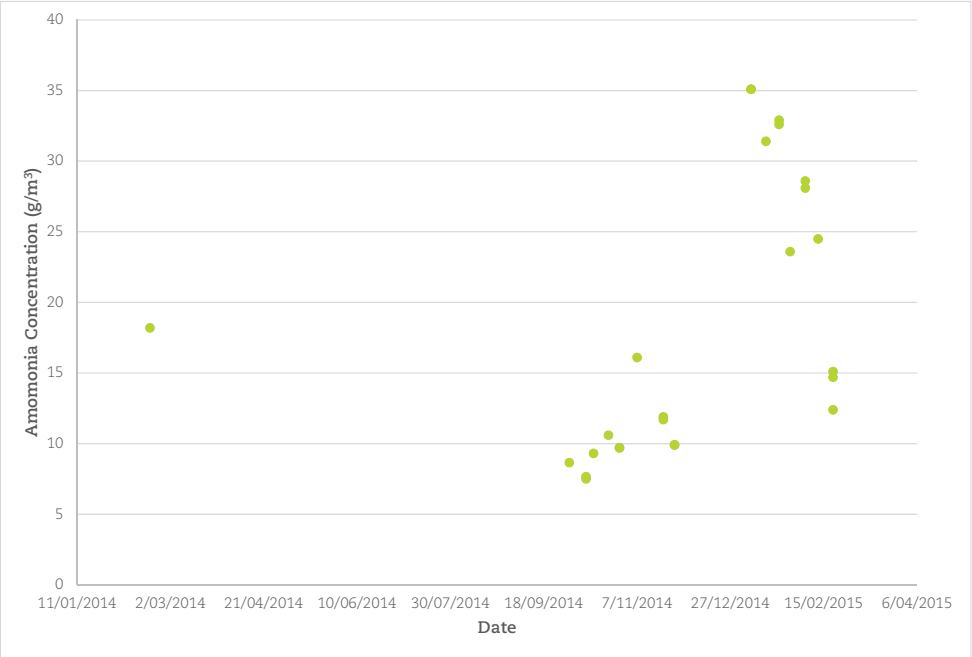


FIGURE 9: Final Effluent Ammonia Concentrations

The ammonia in the effluent varied significantly over the period of monitoring, varying from an average of 12g/m^3 in late December to approximately 30g/m^3 in early February, and then back to a level of 12g/m^3 by late February. Discussions with Council staff, indicated that all aerators were in service, and no significant trade wastes were discharged to the plant. The cause of the ammonia spikes are unknown.

5.3.2 PHOSPHOROUS

The dissolved reactive phosphorous and total phosphorous concentrations measured in the effluent are presented in the figure below.

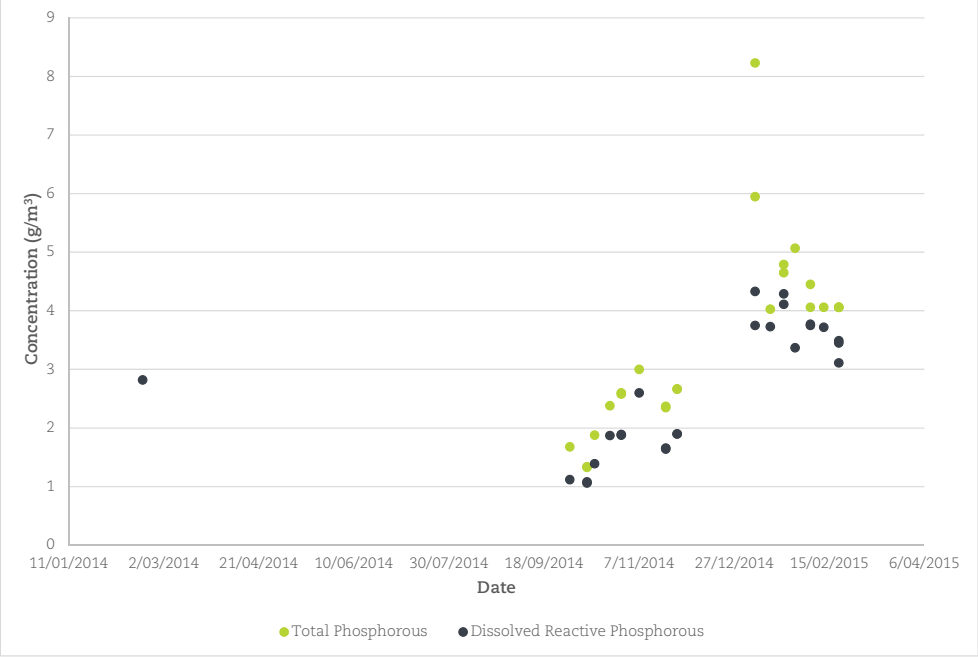


FIGURE 10: Final Effluent Phosphorous Concentrations

The dissolved reactive and total phosphorus concentrations tended to follow the same pattern as ammonia, spiking during the late December to early February period.

5.3.3 TOTAL NITROGEN

The total nitrogen concentrations measured in the effluent are presented in the figure below.

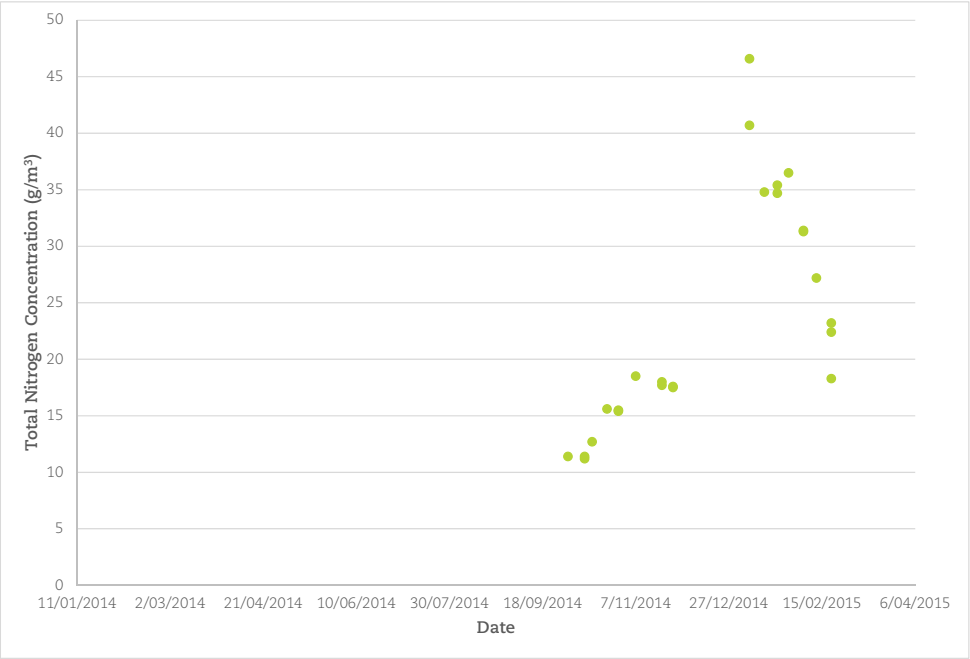


FIGURE 11: Final Effluent Total Nitrogen Concentrations

The total nitrogen concentrations follow the same trend as ammonia and phosphorus concentrations, spiking during the late December to early February period. Excluding the December to February period, the effluent was below 25g/m³ which is typically expected from a pond system with a 3 cell maturation system.

5.4 INDICATOR BACTERIA

5.4.1 PATHOGENS

The pathogen counts (E.coli and faecal coliforms) measured in the effluent are presented in the figure below.

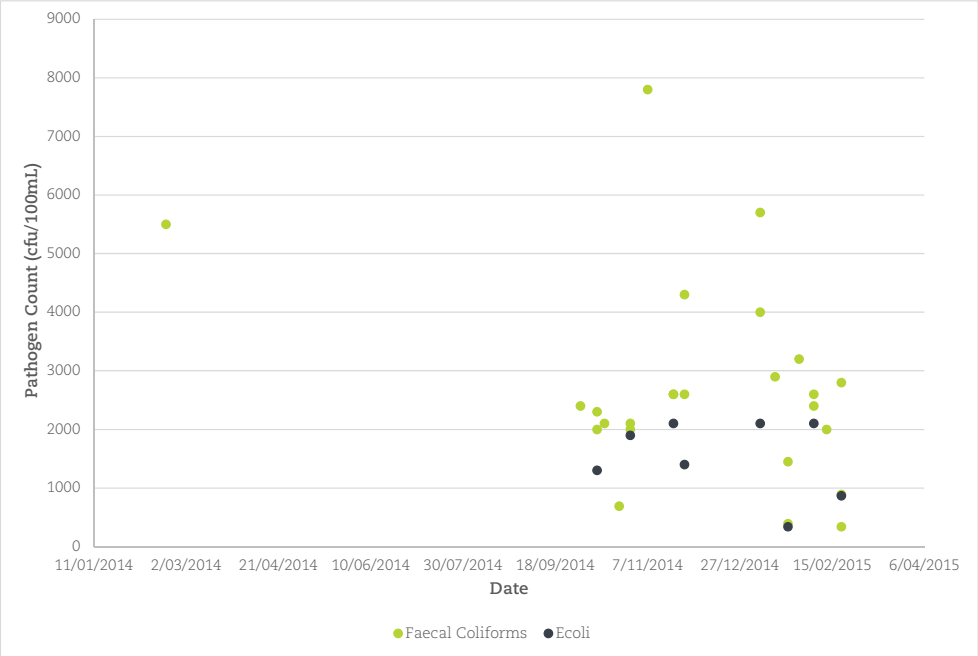


FIGURE 12: Final Effluent Pathogen Count

The final effluent concentrations of faecal coliforms and E.coli vary, with an average removal rate of approximately 3 to 4 logs. This is in line with the expected pathogen removal based on the plant's treatment process.

5.5 PERFORMANCE SUMMARY

Overall the Stratford oxidation plant performs to an acceptable level for the type of treatment system. However, during the monitored period there was a noticeable spike in ammonia, total nitrogen and phosphorus over the summer period.

Discussions with Council staff indicated that all aerators were in service, and no significant trade wastes were discharged to the plant during this time period. This spike in the concentrations is unexpected as Stratford does not have a significant holiday population fluctuation, and during the summer months the treatment capacity of the ponds is at its highest. This spike has been treated as an outlier.

6.0 PROPOSAL

6.1 PROPOSED PLANT UPGRADE

The proposed plant upgrade is aimed at improving the effluent quality while remaining cost effective for the rate payers.

There is no requirement for upgrading the plant capacity because there is little to no growth expected in Stratford in the next 15 years.

As required by the special conditions of the existing consent 0196-4, an issues and options report (*Stratford WwTP Issues and Options Report* refer to **Appendix 4**) was produced which covers the following items:

- The environmental effects of the discharge on the Patea River, including water quality, periphyton growth and aquatic biota;
- Options available for further treatment of wastewater from Stratford, giving particular emphasis to the reduction of nutrients in the discharge; and
- Detail costs, expected levels of reduction in adverse effects, and practical implications of introducing each option to the Stratford wastewater treatment system.

The full report is provided in **Appendix 4** and the recommended upgrade outcomes from this investigation are detailed below.

The proposed plant upgrades will be staged, with each stage targeted at nutrient reduction:

STAGE 1: PHOSPHORUS REDUCTION WITH IN POND CHEMICAL DOSING.

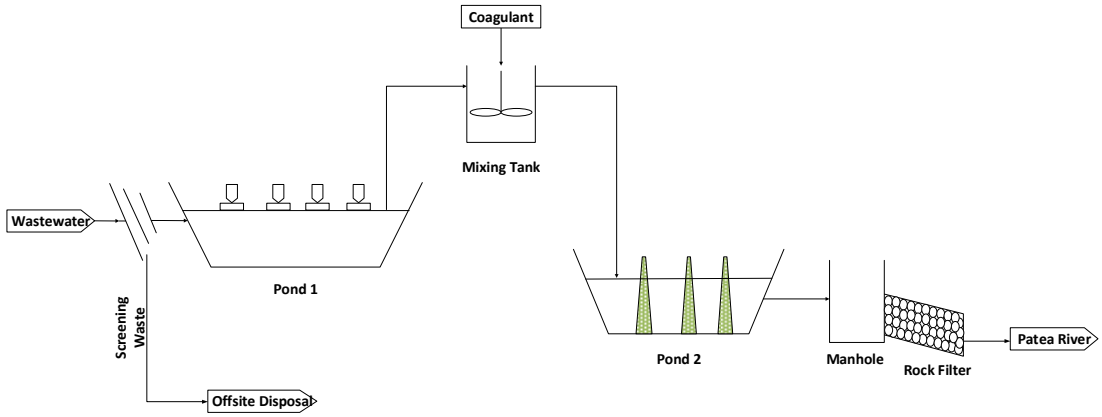


FIGURE 13: Stratford WwTP Process Flow Diagram With In Pond Chemical Dosing

STAGE 2: NITROGEN REDUCTION WITH IN POND MEDIA.

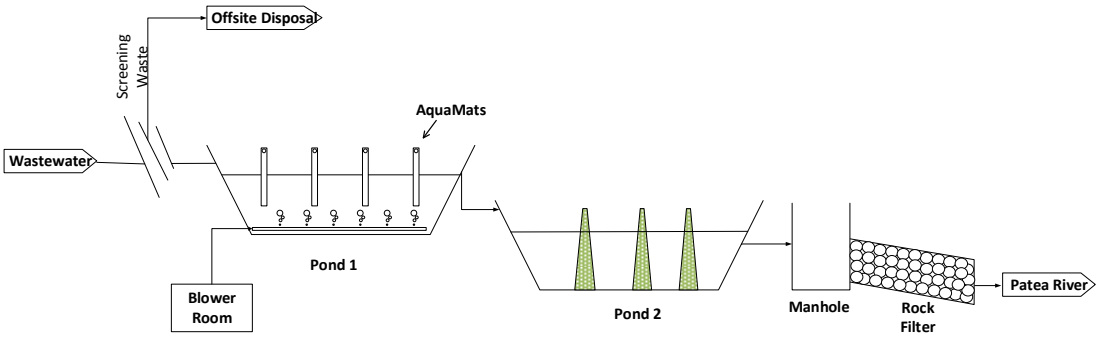


FIGURE 14: Stratford WwTP Process Flow Diagram With In Pond Media

6.1.1 ANTICIPATED IMPROVEMENTS

The proposed upgrades discussed above may not have any perceivable impact on the Patea River due to the concentrations of nitrogen and phosphorous upstream of the plant's discharge point, as discussed in the ecology report; Stratford Waste Water Treatment Plant Ecological Assessment of Effects on the Patea River (refer to Appendix 3).

The nutrient levels upstream of the treatment plant are already above limits that would restrict the growth of periphyton. Therefore, any upgrades to the WwTP are unlikely to affect periphyton and macroinvertebrates.

As the upgrades to the plant would represent significant financial investment from the Council, it is proposed to stage these upgrades and also to re-investigate alternative land disposal options (which might have a more meaningful environmental improvement) at a future date.

6.2 PROGRAMME FOR UPGRADES

The timeframe of the upgrade stages is based on economic considerations.

6.2.1 TIMEFRAME

The following timeframe is proposed:

- **2020:** Phosphate reduction (in pond chemical dosing) upgrade
- **2022:** Investigate land disposal options
- **2025:** Land disposal or nitrogen reduction (in pond media) upgrade depending on the outcomes of the land disposal investigation

The timeframe and works are dependent on the monitoring results and ensuring ratepayer affordability. The current TRC ecological monitoring requirements will continue and the wastewater treatment requirements may evolve based on the Patea River ecological results.

6.2.2 DISPOSAL TO LAND

Disposal of effluent to land would have a number of benefits, including additional treatment through land application and removal/reduction of discharge to the Patea River, which could improve the river water quality. However, there are a number of limitations affecting the implementation of land disposal. The most prominent of which is the land area required. The rate at which effluent can be applied on land

depends on the category of the soils and their permeability, which impacts the land area required and volume of effluent that can be disposed.

Earthtech were engaged in October 2015, to carry out a preliminary assessment of ground disposal options for Stratford WwTP refer to **Appendix 5** for the whole report. The site investigation was carried out to determine the feasibility of disposal of 1,200m^3/d on the adjacent Council land to the east.

> *'On the basis of existing ground and groundwater conditions at the site, shallow drip lines and deep infiltration trenches have been considered. For both of these options, insufficient 2.13ha area is available on site. For the deep trench disposal option the permeable gravelly sand layers have insufficient hydraulic capacity for the disposal volume.'*

Therefore, ground disposal of 1,200m^2/d of WwTP effluent on the adjacent land to the east, is not considered feasible. The land does not have the capacity to handled that volume of discharge due to the soils and the area is not large enough. This has meant that further investigation around ground disposal will need to occur in the next five to ten years, which may require additional land to be purchased.

These factors will be investigated to determine if land disposal is possible for the Stratford WwTP. If land disposal is not feasible, the nitrogen reduction upgrade of installing in pond media will be progressed (given this treatment is still relevant).

7.0 ASSESSMENT OF ALTERNATIVES

An options assessment, *Stratford WwTP Issues and Options Report* (**Appendix 4**), was undertaken to determine the most suitable upgrade options for the Stratford WwTP. This assessment considered the upgrade options detailed in the table below.

TABLE 2: CONSIDERED UPGRADE OPTIONS

TARGET	TREATMENT OPTIONS
Phosphorous reduction	• DAF • Actiflo • In pond chemical dosing
Nitrogen reduction	• In pond media • Mechanical plant upgrade
Turbidity/suspended solids reduction	• Tertiary filters • DAF • Actiflo • Ultra-filtration

These options and their feasibility are discussed further in the subsections below.

7.1 UPGRADE OPTIONS

7.1.1 PHOSPHOROUS REDUCTION

Further detail on the treatment options investigated (aside from in pond chemical dosing) for phosphorous reduction are included in the table below.

TABLE 3: PHOSPHOROUS UPGRADE OPTIONS CONSIDERED

TREATMENT OPTION	REASONS PROCESS NOT CONSIDERED FURTHER
DAF	• Highly complex system which would require daily operator attendance • Requires significant mechanical maintenance • Increased desludging • High capital expenditure • High operating expenditure
Actiflo	• Highly complex system which would require daily operator attendance • Requires significant mechanical maintenance • Increased desludging • High capital expenditure • High operating expenditure

7.1.2 NITROGEN REDUCTION

Further detail on the treatment options investigated (aside from in pond media) for nitrogen reduction are included in the table below.

TABLE 4: NITROGEN UPGRADE OPTIONS CONSIDERED

TREATMENT OPTION	REASONS PROCESS NOT CONSIDERED FURTHER
Mechanical plant upgrade	• Highly complex system which would require daily operator attendance • Requires significant mechanical maintenance • Very high capital expenditure • High operating expenditure

7.1.3 TURBIDITY/SUSPENDED SOLIDS REDUCTION

Further detail on the treatment options for turbidity/suspended solids reduction are included in the table below.

TABLE 5: TURBIDITY/SUSPENDED SOLIDS UPGRADE OPTIONS CONSIDERED

TREATMENT OPTION	REASONS PROCESS NOT CONSIDERED FURTHER
Tertiary filters	• Not a proven treatment for pond effluent – normally used for secondary activated sludge plants • Not a proven treatment when algal solids are present
DAF	• Highly complex system which would require daily operator attendance • Requires significant mechanical maintenance • Increased desludging • High capital expenditure

TABLE 5: TURBIDITY/SUSPENDED SOLIDS UPGRADE OPTIONS CONSIDERED

TREATMENT OPTION	REASONS PROCESS NOT CONSIDERED FURTHER
	• High operating expenditure
Actiflo	• Highly complex system which would require daily operator attendance • Requires significant mechanical maintenance • Increased desludging • High capital expenditure • High operating expenditure
Ultra-filtration	• Highly complex system which would require daily operator attendance • Requires significant mechanical maintenance • High capital expenditure • High operating expenditure

7.2 EFFLUENT DISPOSAL

As discussed in Section 6.2.2, disposal of effluent to land would be advantageous, however limited by the amount of land area is required. Further investigation is required to determine if this is a viable option.

8.0 VALUE OF INVESTMENT

The Stratford WwTP has a replacement cost of $2.459M. This value relates to the treatment plant only and excludes all system reticulation. This works out at some $447 per capita of the population of Stratford. This level of investment is appropriate per head of population served and compares favourably to waste water treatment plant values in major centres (e.g. the equivalent value in Hamilton is $516 per capita of population (treatment plant only). The Stratford WwTP is a significant item of infrastructure in the Stratford District.

9.0 REASONS FOR THE APPLICATION

A Regional Discharge Permit pursuant to the provisions of the Freshwater Plan is required for the following reasons.

9.1 ACTIVITY

The consent implication for the proposed upgrade under the Regional Freshwater Plan is outlined in below:

TABLE 6 : REGIONAL FRESH WATER PLAN FOR TARANAKI

ACTIVITY	PLAN PROVISION	ACTIVITY STATUS	LAPSE OF CONSENT	DURATION SOUGHT
Discharge of Contaminates to Water	Rule 43	Discretionary	June 2016	20 years

9.2 PERFORMANCE STANDARDS

The discharge of treated waste water is not provided for as a Permitted or Controlled activity under the Fresh Water Plan. As such, Pursuant to Rule 43 the "*Discharge of contaminants or water into surface water(excluding the wetlands listed in Appendix II) which is not provided for in Rules 21-42 or which is provided for but does not meet the standards, terms or conditions*" is a **Discretionary** activity.

9.3 STATUS OF THE APPLICATION

Overall, the proposal required assessment under Freshwater Plan as a **Discretionary** activity.

9.4 OTHER CONSENT REQUIREMENTS

9.4.1 REGIONAL COUNCIL REQUIREMENTS

REGIONAL AIR PLAN 2011

The discharge of odour arising from treatment plant is a **Permitted** activity pursuant to Rule 41 of the Regional Air Plan, provided that:

"a) Discharge must not result in offensive or objectionable odour at or beyond the boundary of the property;

No odour complaints have been received on the Stratford WwTP during the past six years.

b) Discharge must not result in noxious or toxic levels of airborne contaminants at or beyond the boundary of the property.

There will be no noxious or toxic levels of airborne contaminants at or beyond the boundary of the property.

c) Discharge must not result in dangerous levels of airborne contaminants at or beyond the boundary of the property including, but not limited to, any risk of fire or explosion".

There will not be dangerous levels of airborne contaminants at or beyond the boundary of the WwTP site.

Overall, the discharge to air arising from the treatment plant is considered to be a **Permitted** activity under the Regional Air Plan.

DRAFT REGIONAL FRESHWATER AND LAND MANAGEMENT PLAN

The Draft Regional Freshwater and Land Management Plan and the proposed plan is due to be notified in December 2015 and as such has no legal effect at the time this application was made.

10.0
ASSESSMENT OF ENVIRONMENTAL EFFECTS

Section 88(2)(b) of the Resource Management Act 1991 (the "Act") stipulates that an application shall include an assessment of environmental effects prepared in accordance with the Fourth Schedule and be in such detail as corresponds with the scale and significance of the effects that the activity may have on the environment.

The assessment within the following sections is based on the following documents:

- "Stratford Waste Water Treatment Plant Ecological Assessment of Effects on the Patea River" prepared by Brian Coffey date March 2015 (**appendix 3)**. This report presents a review of the monitoring data undertaken from 2010 to 2014 by TRC and presents analysis of the effect on receiving environment.

- "Stratford District Council Municipal Oxidation Pond System Monitoring Programme Annual Report 2014-2015" prepared by Taranaki Regional Council, dated September 2015. This report covers the results and findings of the monitoring programme as required by the current consent conditions.

10.1 EFFECTS ON THE RECEIVING ENVIRONMENT

The Patea River runs 105 km from the eastern slopes of Mount Taranaki to the South Taranaki Bight (near Patea). The river is mainly surrounded by farming pastures and bush.

There is a closed landfill immediately upstream of the plant and the Kahouri Stream enters the Patea River approximately 2.5 km downstream of the rock filter outfall.

The Patea Stream is assessed in four different points as part of TRC annual reporting:

- At the Swansea Road Bridge upstream of the plant's discharge point and also the discharge point from the neighbouring landfill site (site code PAT000315);

- Approximately 350 m upstream of the plant's discharge point (site code PAT000345);

- Approximately 130 m downstream of the plant's discharge point (site code PAT000350);

- Approximately 1 km upstream of the Kahouri Stream confluence (site code PAT000356).

Monitoring is also undertaken at the manhole upstream of the rock filter outfall (site code OXP005002).

All of these locations are also identified on the figure below.

FIGURE 15: TRC Annual Monitoring Sample Locations

Any differences in water quality and instream community structure between sampling sites PAT00345 and PAT000350 can be associated with the effects of the plant's discharge after reasonable mixing in the Patea River.

Any difference in water quality and instream community structure between sampling sites PAT000350 and PAT000356 can be associated with the effects of the plant's discharge after assimilation in the Patea River, but before the river quality and instream habitat is potentially changed by the discharge from the Kahouri Stream. The Piakau Stream discharges into the Kahouri Stream approximately 500 m upstream of confluence of the Kahouri Stream and the Patea River.

10.2 MACROINVERTEBRATE AND PERIPHYTON EFFECTS

The discharge from the wastewater treatment plant has been found to have a relatively minor effect on instream macroinvertebrate community structure and periphyton growth in the Patea River.

"The relatively minor effects of the SWWTP discharge on instream macroinvertebrate community structure in the Patea River are likely to be associated with increased growths of periphyton downstream, relative to upstream, of the treatment plant.

This suggests that contaminants from the SWWTP are generally not toxic to aquatic life after reasonable dilution with river water and this is supported by dissolved oxygen concentrations, nitrate nitrogen concentrations, ammonia concentrations and $cBOD_5$ concentrations all being within guideline values during the monitoring period."

10.2.1 POTENTIAL WATER QUALITY EFFECTS

The potential effects of the plant's discharge are presented in the following table.

TABLE 7: SUMMARY OF WATER ANALYSIS FOR THE PATEA RIVER

PARAMETER	COMMENT
Temperature	Temperature in the Patea River is monitored as part of the monitoring program. During monitoring the Patea River samples did not exceeded the guideline maximum water temperature of 20°C and the discharge only exceeded 20°C on two occasions. This indicates that there is no impact of the discharge on the temperature in the river.
pH	The pH of the Patea River appears to be unaffected by the plant's discharge, with pH levels upstream and downstream of the discharge between 7.3 and 7.8 during each monitoring period.
Turbidity and Suspended Solids	The Patea River turbidity was measured upstream and downstream of the discharge, with a notable increase in turbidity at sampling site PAT000350 when compared with PAT000345. The increase in turbidity ranged from 44% - 86% during the 2014-15 monitoring period. The higher turbidity is likely a result of the potential algae solids in the discharge (which is typical of wastewater treatment ponds). This indicates that the impact of the discharge on the turbidity/suspended solids in the river is likely to be minor.
Dissolved Oxygen	The dissolved oxygen concentration in the Patea River appears to be unaffected by the plant's discharge.
Ammonia and Nitrate	The upstream sampling sites PAT000315 and PAT000345 generally have lower ammonia and nitrate concentrations, and it appears that the discharge from the oxidation ponds is influencing the concentrations at PAT000350. However at the Kahouri Stream confluence (PAT00356) the discharge is significantly diluted and concentrations are similar to upstream of discharge. Whilst the ammonia and nitrate concentrations downstream were elevated, both upstream and downstream concentrations were below the guideline limits, indicating that the discharge is not toxic to aquatic life. This indicates that the impact of the discharge on the ammonia and nitrate concentrations in the river is likely to be less than minor.
Dissolved Reactive Phosphorous	The upstream sampling sites PAT000315 and PAT000345 generally have lower dissolved reactive phosphorus concentrations, and it appears that the discharge from the oxidation ponds is influencing the concentrations at PAT000350 and PAT00356. However the dissolved reactive phosphorous concentration in the Patea River is above Ministry for the Environment nutrient guidelines both upstream and downstream of the plant's discharge. The plant is adding to the phosphorous

TABLE 7: SUMMARY OF WATER ANALYSIS FOR THE PATEA RIVER

PARAMETER	COMMENT
	loading in the Patea River, with higher concentrations downstream of the discharge. The nutrient levels upstream of the treatment plant are already above limits that would restrict the growth of periphyton. So even if the plant completely reduced phosphorus, this is unlikely to affect downstream periphyton growth and macroinvertebrate communities. This indicates that the impact of the discharge on the dissolved reactive phosphorous concentrations in the river is likely to be moderate.
Pathogens	There is a slight increase in the pathogen concentration measured downstream compared to that upstream of the plant's discharge (24% increase in faecal coliform concentration). The downstream concentrations are still well within the National Objective Framework bottom line value of 1,000 cfu/100mL.
Visual Appearance	There is some discolouration in the Patea River beyond the permitted mixing zone (50 m) of the plant's discharge. This is most likely a result of the potential algae solids in the discharge and low flow conditions. This indicates that the impact of the discharge on the visual appearance of the river is likely to be minor.

10.2.2 AQUATIC PLANT GROWTH

High concentrations of nutrients such as phosphorus and nitrogen can contribute to excessive growth of nuisance aquatic plants. While the discharge has increased the nutrient load to the river, the upstream nutrient levels are such that aquatic plant growth could occur based on these loads alone.

The proposed phosphorus reduction upgrade will reduce phosphorus load from wastewater plant. However as the levels are already exceeded upstream, it is not likely that reducing the plant's nutrient load will reduce the elevated periphyton presence.

10.2.3 FISH PASSAGE AND SPAWNING

The discharge outfall does not block or create a barrier in the Patea River in anyway, therefore there is no physical restriction on fish passage.

The findings from the *Stratford Waste Water Treatment Plant Ecological Assessment of Effects on the Patea River* indicate that the discharge from plant is generally not toxic to aquatic life, which is supported by the contaminant concentrations (such as low ammonia concentrations). This indicates that the discharge does not provide toxic barrier to fish passage.

Therefore it is unlikely that the plant's discharge has an adverse effect on fish passage and spawning in the Patea River.

10.3 PUBLIC HEALTH

The Stratford WwTP is having a minimal contribution to the elevated levels of pathogens in the Patea River. The faecal coliform concentrations from the monitoring results and the calculated E.coli and faecal coliforms concentrations are presented in the table below. The results included were obtained when the discharge, upstream and downstream samples were all taken during the sampling survey.

TABLE 8: INDICATOR BACTERIA IN THE EFFLUENT AND STREAM COMPARISON

PARAMETER	UPSTREAM OF DISCHARGE PAT000345 (cfu/100mL)	DISCHARGE OXP005002 (cfu/100mL)	DOWNSTREAM OF DISCHARGE PAT000350 (cfu/100mL)
Faecal coliforms	255	4,100	305
E.coli[1]	204	21,056	275
Enterococci[2]	128	13,266	173

The pathogen concentrations in the Patea River are within the National Objective Framework bottom line value of 1,000 cfu/100mL.

10.4 EFFECT ON PUBLIC ACCESS

The Patea River is easily accessible from Victoria Road and from the Stratford Township to the west of the site. The plant is separated from the public walkway along the river by a fence and as such poses no impediment to public access to the Patea River.

10.5 SOCIAL AND ECONOMIC EFFECTS

The proposal is expected to result in continuing positive social and economic benefits for the local community and wider district. The plant provides an important infrastructural service to the Stratford community and is a valued physical resource in this respect.

Past practice has shown that the WwTP generally functions well and that Stratford District Council operates the plant to a satisfactory standard. This is reflected with the satisfactory effluent quality.

10.6 CULTURAL AND SPIRITUAL EFFECTS

Māori generally believe that the discharge of wastewater to a body of water decreases the mauri of that water regardless of the level of treatment. As such the discharge of treated effluent to the Patea River may produce some negative spiritual effects.

10.7 EFFECTS ON NATURAL CHARACTER

The discharge outfall has been upgraded in recent years to trickle into the Patea River through a rip rap rock filter, as opposed to discharging directly. This has minimised the impact of the plant's discharge on initial entry to the natural habitat.

Depending on the discharge's solids/algae loading and river flow rates, there can be some discolouration in the Patea River downstream of the plant's discharge. This

[1] Based on the general ratio of E.coli to faecal coliforms provided by the Ministry for the Environment.
[2] Based on the relationship between faecal coliforms and enterococci concentrations defined in the *Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas*.

discolouration disperses as it moves downstream, however does extend beyond the permitted mixing zone, which has a minor impact on the natural character of the river.

10.8 SUMMARY

The discharge from the Stratford WwTP contributes incrementally to the already elevated levels of nitrogen and phosphorous in the Patea River. These parameters are both elevated in respect to the guidelines for environmental health. This potentially contributes to growth of periphyton downstream of the discharge, however, a reduction of these nutrients is not likely to reduce the periphyton concentration downstream due to the elevated levels of periphyton upstream of the discharge.

The plant's discharge has a minor impact on the Patea River's turbidity and suspended solids, resulting in a visual impact at times.

The river temperature, pH levels, dissolved oxygen concentrations, nitrate nitrogen concentrations, ammonia concentrations, $cBOD_5$ concentrations and pathogen concentrations were all within guideline values during the monitoring period. This indicates that it is unlikely that the plant's discharge has a negative impact on the Patea River in regard to these parameters.

Overall, the potential adverse effects on the environment are considered to be minor.

11.0 NOTIFICATION ASSESSMENT

11.1 PUBLIC NOTIFICATION TEST

Section 95A(1) of the Act states that a consent authority has discretion to decide whether or not to publicly notify a resource consent application.

Section 95A(2) states, however, that despite subsection (1), a consent authority must publicly notify an application if:

a) it decides that the activity will have or is likely to have adverse effects on the environment that are more than minor; or

b) the applicants requests public notification; or

c) a rule or national environmental standard requires public notification:

Only clause (a) requires evaluation in this case, and this is provided shortly. Clause (b) is not applicable as Stratford District Council does not request public notification and clause (c) is also not applicable in this case.

Sections 95A(3) and (4) set out circumstances when a consent authority must not publicly notify an application (unless special circumstances exist), and these are not applicable in this case.

If the application is concerned to have 'more than minor' adverse effects on the environment then it must be publicly notified. However, if the application is concerned to have 'less than minor' effects on the environment, then Council has discretion how to process the application.

Section 95D(a), any effects on persons who own or occupy the land in, on or over which the activity will occur, or any effects on land adjacent to the land on which the activity will occur must be disregarded. In this case, the adjoining properties to the west and east of the ponds are owned by Stratford District Council, (Lots Pt 4, 5-6, Pt 9-10, DP

1942 and Lot 1 DP 9529). The dwelling opposite the ponds is privately owned, 52 Victoria Road, (Lot 19-20 DP 1945).

Section 95D(b), an adverse effect of the activity on the environment may be disregarded if the plan or national environmental standard permits an activity with that effect (i.e. the 'permitted baseline'). In this case, the discharge of odour to air from the treatment plant is a Permitted activity under the Regional Plan and forms the permitted baseline for the proposal.

In accordance with section 95D(e), any effect on a person who has given written approval to the application must be disregarded. No affected party approvals have been sought regarding this proposal.

Having regard to the above, the potential adverse effects on the environment are considered to primarily relate to effects of discharging treated wastewater into the Patea River. These have been assessed in section 11, where they were found to be minor.

11.2 LIMITED NOTIFICATION TEST

Section 95B(1) of the Resource Management Act states that if a consent authority does not publicly notify an application, it must decide if there are any affected persons in relation to this activity.

Section 95B(2) of the Resource Management Act states that a consent authority must give limited notification to any affected person unless a rule or national environmental standard precludes this (which is not the case here).

Section 95E(1) of the Resource Management Act states that a person is an affected person if an activity's effects on the person are minor or more than minor (but are not less than minor).

Section 95E(2)(a), a person may be treated as not being adversely affected if a plan or national environmental standard permits an activity with that effect (i.e. the 'permitted baseline'). The permitted baseline is formed by compliance with the odour requirements of the Regional Air Quality Plan.

Section 95E(3)(a), any effect on a person who has given written approval to the application must be disregarded. In this case, no written approvals have been obtained.

The previous consent was limited notified by the Taranaki Regional Council to the following parties:

- Department of Conservation
- Taranaki Fish & Game
- Ngāti Ruanui
- G & M Collins Family Trust
- DF & KJ Hinton

The proposal is for the continued discharge of treated wastewater into the Patea River with no substantial difference in adverse effects on the environment. The potential adverse effects of the discharge will be minor. Therefore, the consent should be limited notified to the following parties:

- Department of Conservation
- Taranaki Fish & Game
- Ngāti Ruanui
- G & M Collins Family Trust
- DF & KJ Hinton

11.3 SPECIAL CIRCUMSTANCES

Section 95A(4) states that an application for resource consent must be notified if it considers that special circumstances exist.

In this case, it is not considered that this application will give rise to special circumstances because it relates to an existing discharge associated with an established WwTP, therefore notification is not warranted under this section.

11.4 NOTIFICATION SUMMARY

Pursuant to sections 95A-95E, this application should be processed on a limited notified basis as:

- In accordance with section 95D, the adverse effects of the proposal are considered to be minor;
- In accordance with section 95E, the identified parties are considered to be potentially adversely affected by the proposal; and
- In accordance with section 95A(4), there are no special circumstances to warrant notification.

Accordingly, it is considered that this proposal be processed on a limited notified basis in accordance with section 95B of the Act, with notice served on those properties identified in section 10.8 of this report.

12.0
SECTION 104 ASSESSMENT

Subject to Part 2 of the Act, when considering an application for resource consent in accordance with section 104(1) of the Act, regard must be given to; any actual and potential effects on the environment of allowing the activity; any relevant provisions of a national policy statement, a New Zealand coastal policy statement; a national environmental standard; a regional policy statement or proposed regional policy statement; a plan or proposed plan; and any other matter relevant and reasonably necessary to determine the application.

12.1 ACTUAL AND POTENTIAL EFFECTS ON THE ENVIRONMENT

Section 104(1)(a) of the Act requires that regard is given to any actual and potential effects on the environment of allowing the activity.

The actual and potential adverse effects of the proposal have been considered in Section 7.0 of this report where, overall, they were considered to be minor, and thereby considered to be acceptable.

The proposal is expected to result in continuing positive social and economic benefits for the local community and wider district. The treatment plant provides an important infrastructural service to the Stratford community and is a valued physical resource in this respect.

Past practice has shown that the treatment plant generally functions well and the Stratford District Council operates the plant to a satisfactory standard and this is reflected in the satisfactory effluent quality.

12.2 NATIONAL POLICY STATEMENT FOR FRESHWATER MANAGEMENT

The National Policy Statement for Freshwater Management 2014 (NPS-FM) was released on 1 August 2014. The NPS-FM emphasises the importance of identifying the value and recognising the national significance of fresh water and Te Mana o te Wai (the mana of the water).

The NPS-FM directs Regional Councils to:

- safeguard fresh water's life supporting capacity, ecosystem processes, and indigenous species including their associated ecosystems;
- manage freshwater bodies so people's health is safeguarded;
- maintain or improve the overall quality of fresh water within a region;
- protect the significant values of wetlands and outstanding freshwater bodies;
- require more efficient use of fresh water by end users;
- avoid the over allocation of water takes and inputs of contaminants, and to phase out existing over allocation;
- set freshwater objectives according to a specified process (the national objectives framework) to meet community and tāngata whenua values which include the compulsory values of ecosystem health and human health for recreation;
- use a specified set of water quality measures (attributes) to set the freshwater objectives (an objective can only be set below national bottom lines in specified circumstances);

- set limits which allow freshwater objectives to be met (e.g., a total catchment contaminant-load or a total rate of water take);
- put in place measures to account for water takes and sources of contaminants, and monitor achievement towards meeting objectives;
- take a more integrated approach to managing fresh water and coastal water;
- fully implement the National Policy Statement by 2025.

Decision-makers are required to have regard to the provisions of the NPS-FM in consenting decisions and to give effect to the provisions in their regional plans. Policy A4 requires Regional Council to ensure that plans include the following policy, as stated below:

POLICY A4 AND DIRECTION (UNDER SECTION 55) TO REGIONAL COUNCILS

By every regional council amending regional plans (without using the process in Schedule 1) to the extent needed to ensure the plans include the following policy to apply until any changes under Schedule 1 to give effect to Policy A1 and Policy A2 (freshwater quality limits and targets) have become operative:

"1. When considering any application for a discharge the consent authority must have regard to the following matters:

a. the extent to which the discharge would avoid contamination that will have an adverse effect on the life-supporting capacity of fresh water including on any ecosystem associated with fresh water and

b. the extent to which it is feasible and dependable that any more than minor adverse effect on fresh water, and on any ecosystem associated with fresh water, resulting from the discharge would be avoided.

2. When considering any application for a discharge the consent authority must have regard to the following matters:

a. the extent to which the discharge would avoid contamination that will have an adverse effect on the health of people and communities as affected by their secondary contact with fresh water; and

b. the extent to which it is feasible and dependable that any more than minor adverse effect on the health of people and communities as affected by their secondary contact with fresh water resulting from the discharge would be avoided.

3. This policy applies to the following discharges (including a diffuse discharge by any person or animal):

a. a new discharge or

b. a change or increase in any discharge –of any contaminant into fresh water, or onto or into land in circumstances that may result in that contaminant (or, as a result of any natural process from the discharge of that contaminant, any other contaminant) entering fresh water.

4. Paragraph 1 of this policy does not apply to any application for consent first lodged before the National Policy Statement for Freshwater Management 2011 took effect on 1 July 2011.

5. Paragraph 2 of this policy does not apply to any application for consent first lodged before the National Policy Statement for Freshwater Management 2014 takes effect."

As directed by the NPS, the Taranaki Regional Council has amended Section 5A [NPS on Freshwater Management - transitional policies] of the Regional Fresh Water Plan for Taranaki.

Section 5A of the Plan inserts policies A4 and B7 from the NPS. The new policies apply to resource consent applications for the use of, discharge into and effects on, fresh water lodged after 1 August 2014 and is therefore relevant to this application.

The proposal is not considered a new activity and there is no increase in the volume of discharge into the Patea River. This application involves the renewal of the existing discharge permits to allow for a continuation of the operation of Stratford WwTP.

Upgrades to the existing WwTP since consents were previously issued and continuous monitoring has been carried out to monitor the potential changes within the river and ecosystem. The proposal has been broken up into stages which will help improve the quality of the discharge which is released. Monitoring and research will be continued to ensure the best is achieved for the community, environment and the ecosystem.

The proposal is not considered to be contrary with the NPS-FM for these reasons.

12.3 TARANAKI REGIONAL POLICY STATEMENT

The Regional Policy Statement (RPS) for Taranaki, provides an overview of the resource management issues for the Taranaki region and the policies and methods that will be adopted to address those issues.

The objectives and policies contained in the chapter 6 of the RPS – Freshwater. Section 6.2 relate to maintaining and enhancing the quality of water in rivers, streams, lakes and wetlands.

WQU OBJECTIVE 1

To maintain and enhance surface water quality in Taranaki's rivers, streams, lakes and wetlands by avoiding, remedying or mitigating any avoiding, remedying or mitigating any adverse effects of point source and diffuse source discharges to water.

WQU POLICY 5

Waste reduction and waste treatment and disposal practices, which avoid, remedy or mitigate the adverse environmental effects of the point source discharge of contaminants into water or onto or into land will be required. This includes the cumulative adverse effects of multiple point source discharges to the same waterbody.

In considering policies in regional plans or resource consent proposals to discharge contaminants or water to land or water, matters to be considered by the Taranaki Regional Council will include:

(a) the actual or potential effects of the discharge on the natural character, ecological and amenity values of the water body, including indigenous biodiversity values, fishery values and the habitat of trout;

(b) the relationship of tangata whenua with the water body;

(c) the use of water for domestic and community water supply purposes;

(d) the actual or potential risks to human and animal health from the discharge;

(e) the significance of any historic heritage values associated with the waterbody;

(f) the degree to which the needs of other resource users might be compromised;

(g) the allowance for reasonable mixing zones and sufficient dilution (determined in accordance with (a) to (o) of this Policy);

(h) the potential for cumulative effects;

(i) measures to reduce the volume and toxicity of the contaminant;

(j) off set mitigation of the effects of the contaminants;

(k) measures to reduce the risk of unintended discharges of contaminants;

(l) the necessity of the discharge and the use of the best practicable option for the treatment and disposal of contaminants;

(m) the availability and effectiveness of alternative means of disposing of the contaminant;

(n) relevant national guidelines and national environmental standards on catchment management; and

(o) the sensitivity of the receiving environment.

WQU POLICY 6

Where the life-supporting capacity of rivers, streams, lakes or wetlands is under pressure as a result of point or diffuse discharges to surface water, improvements in the biological health and quality of water will be promoted.

For the purposes of this policy, in determining the desired life supporting capacity, the matters to be considered will include:

(a) the existing status of water quality according to a selection of chemical parameters and its consequences for life-supporting capacity;

(b) the existing habitat quality, including the need to maintain and enhance aquatic ecosystems and species;

(c) the degree to which cultural and spiritual values of or customary uses by tangata whenua are affected by existing water quality; and

(d) the natural character, ecological and amenity values of the water body, including indigenous biodiversity values, fishery values and the habitat of trout and the potential for enhancement of those values.

COMMENT:

The proposal is considered to be consistent with the RPS because:

- The upgrade has be staged due to economic reasons;
- There will be continued ecological monitoring and the wastewater treatment upgrades may evolve based on the Patea River ecological results.
- Water quality within the Patea River will be maintained in the short term and is expected to improve in the long term following the proposed up-grades.
- The adverse effects of the discharge have been assessed within the previous sections and are considered to be minor and acceptable.
- Consultation with Ngāti Ruanui has been initiated and is ongoing.

12.4 RELEVANT REGIONAL POLICY PLANS

Sections 104(1)(b)(v)-(vi) of the Act states that consideration must be given to any relevant provisions of a regional fresh water plan.

OBJECTIVES

"OBJ 3.1.1 To protect the waters of the Hangatahua (Stony) River catchment for regionally important fisheries and angling features, scenic characteristics and recreational features and cultural, historical and educational features.

OBJ 3.1.2 To maintain and enhance the natural, ecological and amenity values of rivers and streams of value in the region, and regionally significant wetlands.

OBJ 3.1.3 To protect the natural character of all of Taranaki's rivers, lakes and wetlands from inappropriate use and development and the adverse effects of appropriate use and development.

OBJ 3.1.4 To safeguard the life-supporting capacity of water and aquatic ecosystems from the adverse effects of the use and development of fresh water.

OBJ 3.1.5 To maintain and enhance amenity values and the quality of the environment of Taranaki's rivers, lakes and wetlands and their margins.

OBJ 3.1.6 To manage the fresh water resources of the Taranaki region in a way that promotes the sustainable management of natural and physical resources, by recognising and providing for the differences in and between rivers, streams, lakes and wetlands in the region."

POLICIES

"POL 3.1.1 The quantity, level and rate of flow of water and the quality of water within the Hangatahua (Stony) River catchment will be retained, as far as possible, in their natural state.

POL 3.1.2 The adverse effects of activities on the natural character, ecological and amenity values of all rivers, lakes and wetlands and their margins in the Taranaki region will be avoided, remedied or mitigated, having regard to:

(a) the topography and form of the river, lake or wetland;

(b) the natural flow characteristics, hydrological functions and natural water levels and their fluctuations in rivers, lakes and wetlands;

(c) ecosystems, habitats and species;

(d) existing water quality and the need to maintain or enhance that quality;

(e) recreational, fishery, aesthetic and scenic values, natural, ecological and amenity values

POL 3.1.3 The life-supporting capacity of fresh water will be safeguarded and the adverse effects of activities on aquatic habitats and fresh water ecosystems will be avoided, remedied or mitigated having regard to:

(a) the maintenance of biological and physical processes;

(b) the existing and potential productivity, diversity, importance and variability of aquatic ecosystems;

(c) habitat characteristics, including habitats for aquatic species at different stages of their life cycle, habitats of threatened, vulnerable or rare species, and habitats for terrestrial life that use the water body;

(d) the significance of indigenous flora and fauna, including the habitat of indigenous fish;

(e) the habitat of trout.

POL 3.1.4 The high natural, ecological and amenity values of those rivers and streams listed in Appendix IA will be maintained and enhanced as far as practicable. Adverse effects of activities on these values will be avoided as far as practicable, or remedied or mitigated.

POL 3.1.5 The natural, ecological and amenity values and life-supporting capacity of those rivers and streams listed in Appendix IB will be enhanced as far as practicable.

POL 3.1.6 The natural, ecological and amenity values of those wetlands listed in Appendix IIA will be preserved and protected.

POL 3.1.7 The natural, ecological and amenity values of those wetlands listed in Appendix IIB will be protected and enhanced, as far as practicable."

COMMENT

It is considered that the proposal is consistent with the Objective and Policies of the Fresh Water Plan because:

- The proposal is not considered to be contrary with the NPS-FM, and has taken into consideration the national policy statement, which have been insert as policies within the Fresh Water Plan. The proposal meets these high level policy at a national level, therefore, is consistent with the regional policy that are added under section 5a of the plan.
- Water quality within the Patea River will be maintained in the short term with continued ecological investigation and is expected to improve when upgrades are carried out in the long term.
- The adverse effects of the discharge have been assessed within the previous sections and are considered to be minor and acceptable.
- The continued operation of the Stratford WwTP is a suitable use of the site.
- The continued operation of the Stratford WwTP will not significantly affect the natural character of the surrounding area or Taranaki Region.

12.5 104 CONCLUSION

The above assessments, and the consideration of effects on the environment contained within section 10 of this report, demonstrate that the effects of the proposal will, overall, be minor and therefore acceptable.

The proposal is therefore considered to have no significant adverse effect in terms of the purpose of the above objectives and policies.

12.6 OTHER MATTERS

Section 104(1)(c) of the Act also states that consideration must be given to "any other matters that the consent authority considers relevant and reasonably necessary to determine the application."

Ngāti Ruanui Environmental Management Plan (NREMP)

Chapter 4 refers to 'Te Puna Waiora – Water' and they are three main issues identified by Ngāti Ruanui in relation to water: 1) Environmental Effects, 2) Water Allocation, and 3) Specific Catchment Areas. The issue and subsequent objectives and policies relating to Environmental Effects that is of most relevance to the proposal.

Discharges are acknowledged to have a significant impact on the quality of water contained in the waterways of the takiwā, be they non-point discharges such as runoff from farmland or point discharges such as the Stratford WwTP. The NREMP also advocates for the development of land-based sewage treatment systems as an alternative to discharging treated wastewater into streams and the coastal environment. The NREMP also identifies the need to protect the ability to gather food at Mahinga Kai and to ensure that the food gathered is safe to eat.

In relation to the NREMP it is noted that:

- Land based sewage treatment and disposal has been and will continue to be investigated, as addressed within section 6.2.2 of this report.
- Water quality within the Patea River will be maintained in the short term with continued ecological investigation and is expected to improve when upgrades are carried out in the long term.

12.7 SECTION 104B

The proposed activity is deemed to be a Discretionary activity under the provisions of the Fresh Water Plan. Accordingly, after considering this application for resource consent the Council may grant or refuse the application and if it grants the application may impose conditions.

13.0
RESOURCE MANAGEMENT ACT 1991

With respect to the purpose and principles of the Resource Management Act 1991 which are contained in sections 5 to 8 of the Act, it is considered that the proposed development will be an appropriate and sustainable use of the site. The proposal is to provide continued wastewater treatment and disposal services for the community of Stratford. Wastewater treatment will be provided at the existing WwTP and discharged into the Patea River. The proposal is expected to be limited notified due to the way Taranaki Regional Council processed the precious consent. The potential affected parties are stated above under section 12.8 of this report.

13.1 PART 2 OF THE ACT

The application must be considered in relation to the purpose and principles of the Resource Management Act 1991 which are contained in Sections 5 to 8 of the Act, inclusive.

13.1.1 SECTION 5 - PURPOSE OF THE ACT

Section 5 in Part 2 of the Act identifies the purpose of the Act as being the sustainable management of natural and physical resources. This means managing the use of natural and physical resources in a way that enables people and communities to provide for their social, cultural and economic well-being while sustaining those resources for future generations, protecting the life supporting capacity of ecosystems, and avoiding, remedying or mitigating adverse effects on the environment.

It is considered that the proposal accords with the purpose of the Act and will not have an adverse effect on the sustainable management of natural and physical resources. The effects of the proposal in terms of adverse effects on the environment are discussed in detail in section 10 of this report.

13.1.2 SECTION 6 - MATTERS OF NATIONAL IMPORTANCE

Section 6 of the Act sets out a number of matters of national importance, including:

a) The preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use, and development:

b) The protection of outstanding natural features and landscapes from inappropriate subdivision, use, and development:

c) The protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna:

d) The maintenance and enhancement of public access to and along the coastal marine area, lakes, and rivers:

e) The relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga.

f) The protection of historic heritage from inappropriate subdivision, use, and development.

g) The protection of recognised customary activities.

The proposal is not considered to affect any matters of national importance, as it will enable the long term upgrade of an existing WwTP and will result in an improvement in downstream water quality and a reduction of nutrient loading to the Patea River.

13.1.3 SECTION 7 - OTHER MATTERS

Section 7 identifies a number of "other matters" to be given particular regard to in the consideration of any assessment for resource consent, and includes:

a) Kaitiakitanga:

b) The ethic of stewardship:

c) The efficient use and development of natural and physical resources:

d) The efficiency of the end use of energy:

e) The maintenance and enhancement of amenity values:

f) Intrinsic values of ecosystems:

g) Maintenance and enhancement of the quality of the environment:

h) Any finite characteristics of natural and physical resources:

i) The protection of the habitat of trout and salmon.

j) The effects of climate change:

k) The benefits to be derived from the use and development of renewable energy.

Ngāti Ruanui have association with the Patea River.

In this case the Ngāti Ruanui Environmental Management Plan (NREMP) is considered to be relevant to the proposal and has been assessed within section 13.6 above.

13.1.4 SECTION 8 - TREATY OF WAITANGI

Section 8 requires the principles of the Treaty of Waitangi to be taken account of. It is considered that the proposal raises no Treaty issues.

13.2 PART 2 CONCLUSION

Overall, and for the reasons stated above, the proposal is considered to be in accordance with the purpose and principles of the Act, as stated in sections 5 to 8 of Part 2.

14.0 PROPOSED CONDITIONS

14.1 EXISTING CONDITIONS

It is proposed to maintain the existing special conditions 1 – 6 and 8 to 11, as per consent 0196-4 (**Appendix 2**).

14.2 MODIFIED CONDITIONS

14.2.1 CONDITION 7

During the last consent renewal the mixing zone was reduced from 100m to 50m. We propose that this be extended back to the original 100m.

In the TRC monitoring report attached in Appendix 5, TRC indicated that they undertook a fluorescein dye tracing exercise on the 28 March 2014 under relatively low river flow conditions. The findings of this exercise indicated that by 100m the discharge was fully mixed.

Therefore we propose the mixing zone be extended back to 100m to reflect this.

14.2.2 CONDITION 12

The existing special condition 12 has been completed – refer to the *Stratford WwTP Issues and Options Report* (**Appendix 4**).

14.3 NEW CONDITIONS

In addition to the existing conditions, the following special conditions are proposed. These proposed special conditions have been staggered to ensure it does not place an undue economic burden on the community.

2. Before 30 June 2020 the treatment plant shall be upgraded (Stage 1) by in pond chemical dosing for phosphorous reduction.

3. The consent holder shall supply progress reports on implementation of the upgrade referenced in Special Condition 12, by 30 June 2019 and 30 June 2020 to the Chief Executive, Taranaki Regional Council.

4. Before 30 June 2022 the consent holder shall provide to the Chief Executive, Taranaki Regional Council a report which investigates the feasibility of effluent disposal to land for Stratford Wastewater Treatment Plant.

5. Before 30 June 2023 the consent holder shall provide to the Chief Executive, Taranaki Regional Council a report which outlines Stage 2 upgrade basis of design, whether the upgrade be in pond media for nitrogen reduction or effluent disposal to land for reduction/elimination of effluent discharge to the Patea River (dependent on the outcomes of the land disposal feasibility investigation).

6. Before 30 June 2025 the treatment plant shall be upgraded (Stage 2) by either in pond media for nitrogen reduction or by effluent disposal to land for reduction/elimination of effluent discharge to the Patea River (dependent on the outcomes of the land disposal feasibility investigation).

7. The consent holder shall supply progress reports on implementation of the upgrade referenced in Special Condition 16, by 30 June 2024 and 30 June 2025 to the Chief Executive, Taranaki Regional Council.

15.0 CONCLUSION

The applicant seeks resource consent for 20 years to discharge permit to continue to discharge treated effluent from the Stratford Wastewater Treatment Plant into the Patea River.

The adverse effects of the proposal on the environment are considered to be minor, as discussed in Section 12.0 of this report. It is considered that the following parties may be adversely affected by the proposal. As such, the applicant is requested the application be limited notified to these identified parties.

- Department of Conservation
- Taranaki Fish & Game
- Ngāti Ruanui
- G & M Collins Family Trust
- DF & KJ Hinton

In terms of section 104(1)(a), the adverse effects of the proposal will be acceptable. The proposal is not contrary to the relevant objectives, policies, and assessment criteria of the National Policy Statement, the Regional Policy Statement or the Regional.

Hence, in accordance with section 104B of the Act, it is considered appropriate for consent to be granted subject to fair and reasonable conditions.

16.0 LIMITATIONS

16.1 GENERAL

This report has been prepared for the particular project described and for the purpose of satisfying the statutory information requirements for an application being made under the Resource Management Act 1991. No responsibility is accepted by Harrison Grierson Consultants Limited (or its directors, agents or employees) for the use of the report or any part of it in any other context or for any other purpose.

APPENDICES

APPENDIX 1
CERTIFICATE OF TITLE

COMPUTER FREEHOLD REGISTER
UNDER LAND TRANSFER ACT 1952

Search Copy

R.W. Muir
Registrar-General
of Land

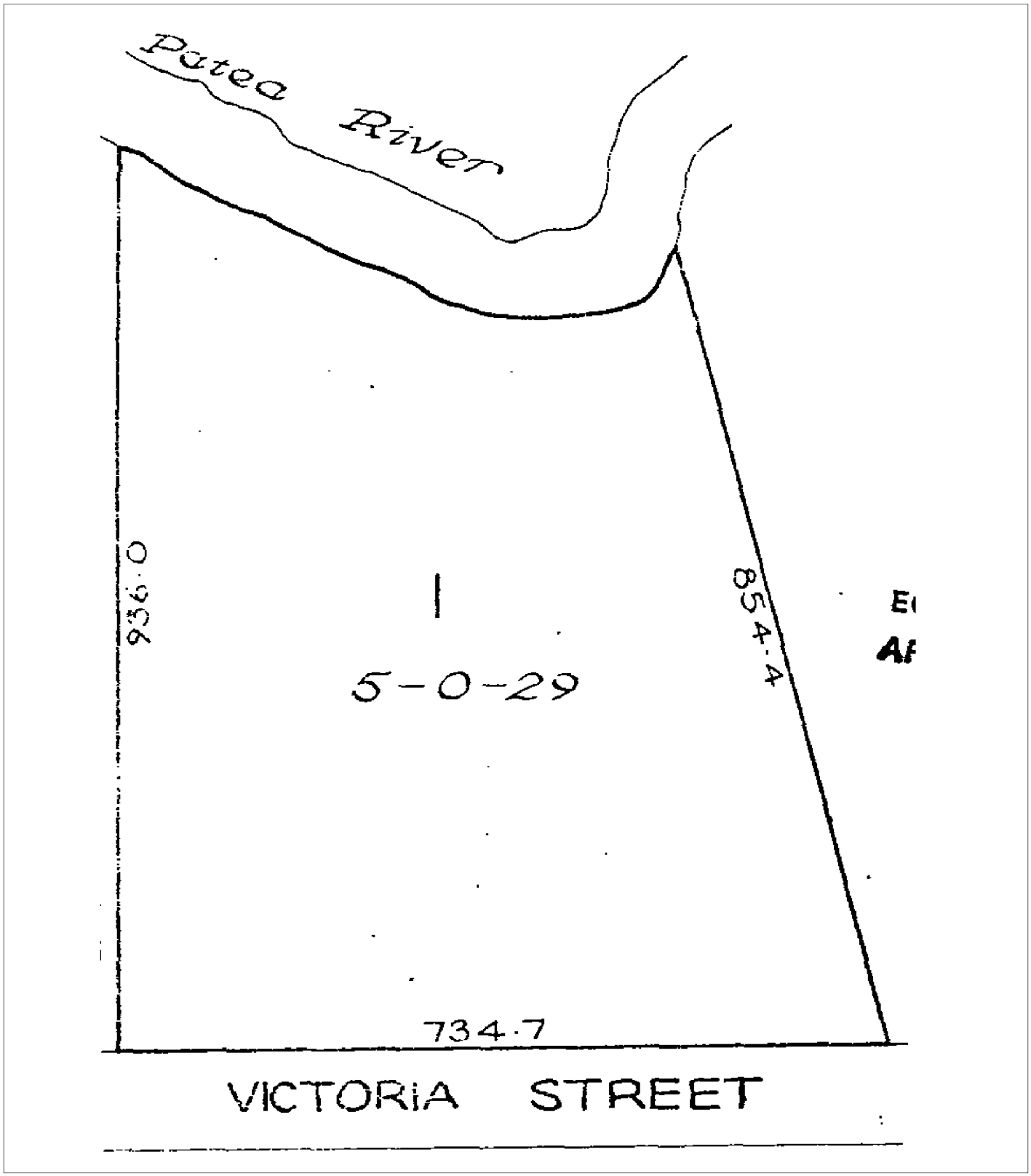
Identifier	**TNB1/195**
Land Registration District	**Taranaki**
Date Issued	22 December 1966

Prior References
TN55/174

Estate	Fee Simple
Area	2.0968 hectares more or less
Legal Description	Lot 1 Deposited Plan 9529

Proprietors
The Stratford District Council

Interests


Patea River
936·0
1
5-0-29
854·4
734·7
VICTORIA STREET

COMPUTER FREEHOLD REGISTER
UNDER LAND TRANSFER ACT 1952

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**TNE2/124**
Land Registration District	**Taranaki**
Date Issued	13 October 1977

Prior References
TNB1/196

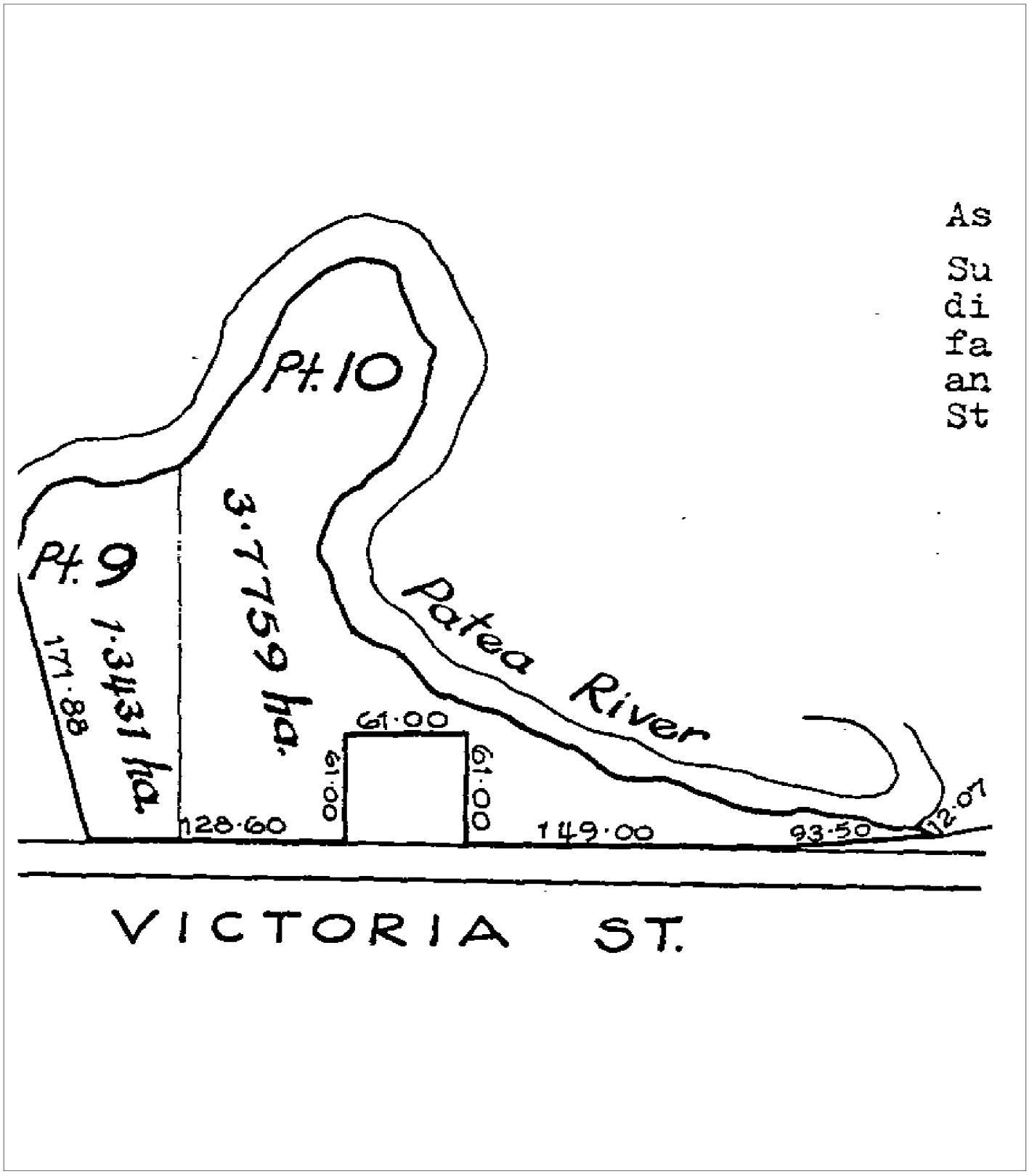
Estate	Fee Simple
Area	5.1190 hectares more or less
Legal Description	Part Lot 9-10 Deposited Plan 1942

Proprietors
The Stratford District Council

Interests

Subject to the rights (in gross) to divert water from the Patea River in favour of The Stratford Borough Council created by Transfer 15736

Subject to a right (in gross for the purposes of the New Zealand Walkways Act 1990) and a right of way on foot over part shown F on DP 15764 in favour of Her Majesty the Queen for the use and pleasure of any member of the public created by Transfer 395541 - 16.10.1992 at 10.23 am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93.50
12.07
VICTORIA ST.

COMPUTER FREEHOLD REGISTER
UNDER LAND TRANSFER ACT 1952

Search Copy

R.W. Muir
Registrar-General
of Land

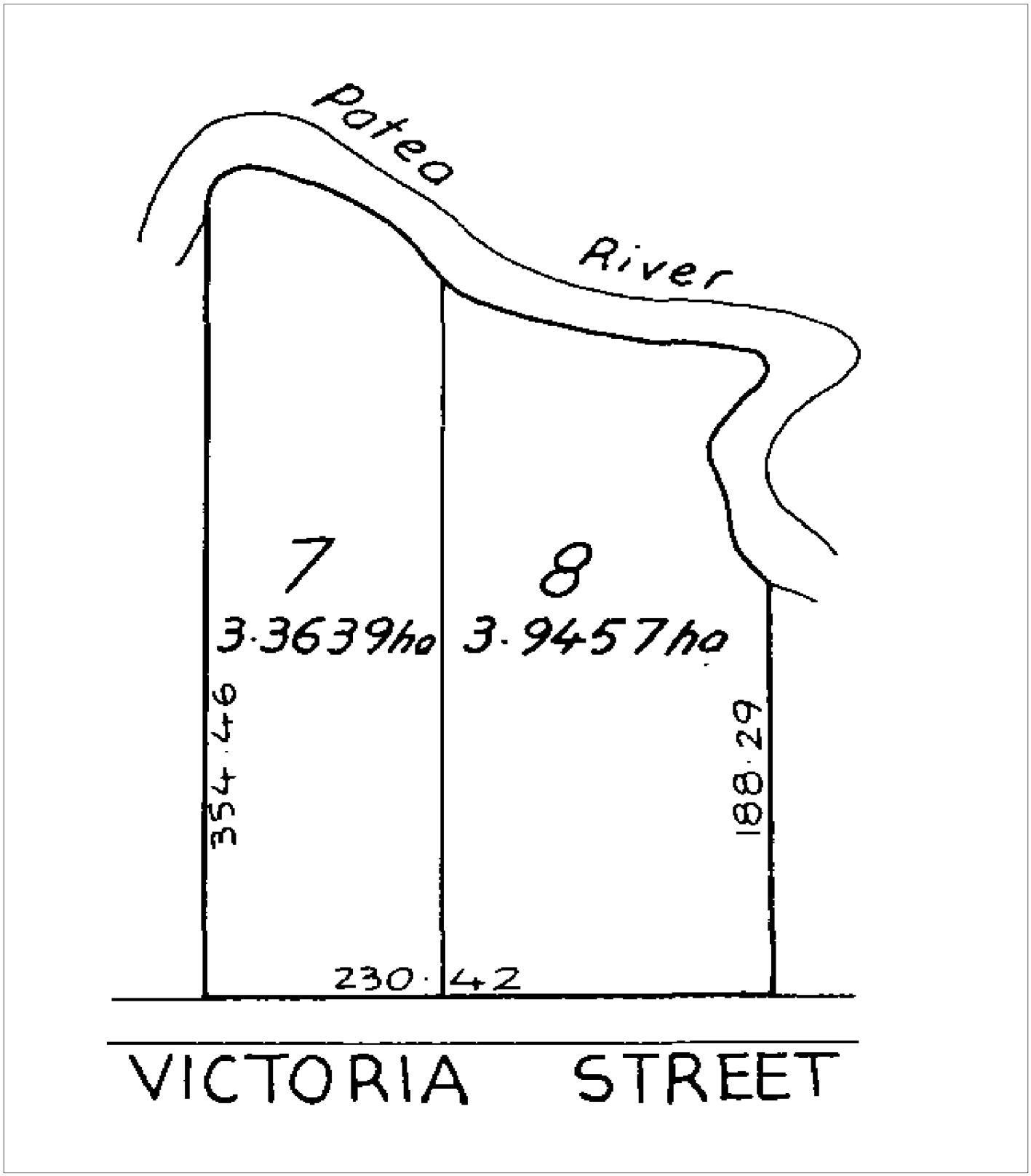
Identifier	**TNH4/176**
Land Registration District	**Taranaki**
Date Issued	29 September 1989

Prior References
TN56/147

Estate	Fee Simple
Area	7.3096 hectares more or less
Legal Description	Lot 7-8 Deposited Plan 1942

Proprietors
Stratford District Council

Interests
Subject to water rights (in gross) over part in favour of The Stratford Borough Council created by Transfer 16072 (affects Lot 8 DP 1942)


Potea
River
7
3.3639ho
8
3.9457ho
354.46
188.29
230.42
VICTORIA STREET

APPENDIX 2
EXISTING CONSENT 0196-4

Taranaki
Regional Council

23 October 2013
Document: 1267880
File: 0196-4[5829]

25 OCT 2013

Stratford District Council
Mike Oien
P O Box 320
STRATFORD 4352

Dear Mr Oien

Notification of decision on resource consent application

The Taranaki Regional Council granted your resource consent [0196-4] on 23 October 2013. The Council's decision is enclosed.

The decision documentation includes a consent certificate and a report by Council officers. The report assesses the application and details the reasons for granting the consent, and for its terms and conditions.

It is important that you read and understand the consent and its conditions.

The Resource Management Act 1991 (the RMA) provides for you to appeal the whole or any part of this decision. Any appeal must be lodged within 15 working days of you receiving this notice[1]. The procedure for making an appeal is set out in Section 121 of the RMA.

Please note this consent does not commence until after this appeal period has ended.

If you have any queries, please contact Darlene Ladbrook, Senior Consents Administration Officer.

Yours faithfully
B G Chamberlain
Chief Executive

per: CH McLellan
Consents Manager

cc: Harrison Grierson
Nick Grada
P O Box 5760
Auckland 1141

[1] In accordance with section 352 of the RMA.

Taranaki Regional Council

Discharge Permit

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

Name of Consent Holder:	Stratford District Council P O Box 320 STRATFORD 4352
Decision Date:	23 October 2013
Commencement Date:	14 November 2013

Conditions of Consent

Consent Granted:	To discharge treated wastewater from the Stratford Wastewater Treatment Plant into the Patea River
Expiry Date:	1 June 2016
Site Location:	Victoria Road, Stratford
Legal Description:	Lot 1 DP 9529 Lots 7, 8, 9 & 10 DP 1942 Blk II Ngaere SD (Discharge source & site)
Grid Reference (NZTM)	1712836E-5644349N
Catchment:	Patea

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

47 Cloten Road · Private Bag 713 · Stratford 4352 · New Zealand
T: 06 765 7127 · F: 06 765 5097 · www.trc.govt.nz
Please quote our document number in your reply

General condition

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

Special conditions

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

2. The volume of treated wastewater discharge shall not exceed 4,800 cubic metres per day, unless there has been a total of more than 10 mm of rain over the previous three days (as measured by the Taranaki Regional Council rain gauge at Stratford).

3. The consent holder shall implement an inflow and infiltration reduction programme to minimise the stormwater inflow to the ponds. The programme shall include taking all practicable actions to ensure that all unauthorised stormwater connections to the sewage reticulation system are removed and remain disconnected. The consent holder shall report on progress under this condition to the Chief Executive, Taranaki Regional Council, by 30 June each year.

4. The consent holder shall implement and maintain a Management Plan which shall include operating procedures to avoid, remedy or mitigate against potential adverse effects arising from:

   a) the operation of the wastewater treatment plant;

   b) the build up of sludge in the ponds; and

   c) stormwater and groundwater infiltration into the sewerage system.

5. The oxidation ponds shall be maintained in aerobic conditions at all times during daylight hours.

6. The consent holder shall consult with the Taranaki Regional Council prior to accepting new trade wastes, which may contain toxic or hazardous wastes, into the consent holder's wastewater system.

7. After allowing for reasonable mixing, being a mixing zone extending from the discharge point, to a point 50 metres downstream of the discharge point, the discharge shall not give rise to any of the following effects in the receiving waters of the Patea River:

   a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;

   b) any conspicuous change in the colour or visual clarity;

   c) any emission of objectionable odour;

   d) any significant adverse effect on aquatic ecosystems.

8. After allowing for reasonable mixing within a mixing zone extending 50 metres downstream of the discharge point, the discharge shall not give rise to an increase in turbidity of more than 50% (as determined using NTU (nephelometric turbidity units)) in the Patea River.

9. The consent holder shall, in conjunction with the Taranaki Regional Council, undertake chemical, bacteriological and ecological monitoring of the oxidation pond system and Patea River as deemed reasonably necessary by the Chief Executive, Taranaki Regional Council subject to Section 36 of the Resource Management Act 1991. That monitoring shall include wastewater quality monitoring to provide for an assessment of possible further upgrade requirements in relation to potential impacts on the biological communities of the receiving water.

10. The monitoring, evaluation and assessment required by condition 9 shall specifically include monitoring, evaluation and assessment of dissolved reactive phosphorus (DRP) and other nutrient-species.

11. After allowing for reasonable mixing, being a mixing zone extending from the discharge point, to a point 50 metres downstream of the discharge point, the discharge shall not cause the receiving waters of the Patea River to exceed the following concentrations:

Contaminant	**Concentration**
Unionised ammonia	0.025 gm^{-3}
Filtered carbonaceous BOD_5	2.0 gm^{-3}

12. Before 30 June 2015 the consent holder shall provide to the Chief Executive, Taranaki Regional Council a report detailing issues and options for the Stratford Wastewater Treatment Plant.

    The report shall document the environmental effects of the discharge from the Stratford Wastewater Treatment Plant, and set out the options available to address the effects on the receiving environment resulting from the discharge.

    The report shall be to the reasonable satisfaction of the Chief Executive, Taranaki Regional Council and shall, as a minimum, address the following:

    a) the environmental effects of discharge on the Patea River, including water quality, periphyton growth and aquatic biota;

    b) options available for further treatment of wastewater from Stratford, giving particular emphasis to the reduction of nutrients in the discharge; and

    c) detail the: costs; expected levels of reduction in adverse effects; and practical implications of introducing each option to the Stratford wastewater treatment system.

Signed at Stratford on 23 October 2013

For and on behalf of
Taranaki Regional Council

Director-Resource Management

Information Sheet

Taranaki Regional Council

The following information has been prepared as a guide only, and in no way affects the conditions on which any consent is granted. This guide is subject at all times to the provisions of the Resource Management Act 1991, and the express provisions of the relevant consent.

Powers and Liabilities of Consent Holder

a) The holder of a resource consent is liable to prosecution for any breach of the consent conditions by, or permitted by, the holder.

b) The holder of a resource consent granted by the Taranaki Regional Council may apply to the Taranaki Regional Council for the change or cancellation of any condition of the consent [other than a condition as to the duration of the consent] at any time on the grounds that a change in circumstances has caused the condition to become inappropriate or unnecessary.

c) The holder of a resource consent granted by the Taranaki Regional Council may surrender the consent, either in whole or part, by written notice to the Taranaki Regional Council, but remains liable for any breach of conditions of the consent which occurred before the surrender, and is liable to complete any work to give effect to the consent [unless the Taranaki Regional Council directs otherwise].

Duration of Consent

a) The consent is granted for the period specified in the consent.

b) The consent will lapse if not given effect to before the end of five years of the date of commencement.

c) The Taranaki Regional Council may cancel the consent by written notice served on the consent holder if the consent has been exercised, but is then not exercised for a continuous period of five years.

Review of Consent Conditions

a) The Taranaki Regional Council may review the conditions of any consent it granted.

b) Following a review of consent conditions, the Taranaki Regional Council may change the conditions of any consent it granted.

Memorandum

To	Colin McLellan, Consents Manager
From	Kim Giles, Consents Officer
File	0196-4 (5829)
Job Manager	Chris Fowles, Scientific Officer
Document	1226900
Date	23 October 2013

To discharge treated wastewater from the Stratford Wastewater Treatment Plant into the Patea River

Applicant	Stratford District Council
Postal address	P O Box 320, Stratford 4352
Site location	Victoria Road, Stratford
Grid reference(s)	1712836E-5644349N (approximate discharge point)
Legal description	Lot 1 DP 9529 Lots 7, 8, 9 & 10 DP 1942 Blk II Ngaere SD (Discharge source & site)
Catchment	Patea No: 343.000
Expiry date	1 June 2016

1. Introduction

Stratford District Council ('the applicant') has lodged an application to discharge treated wastewater from the Stratford Wastewater Treatment Plant (SWWTP) into the Patea River.

Consent 0196-3 was granted on 24 April 2008 and expired on 1 June 2013. Application 5829 to renew this consent was received by the Taranaki Regional Council (Council) on 27 February 2013.

Section 124(2) of the Resource Management Act 1991 (RMA) states that provided a consent application is made at least three months before the expiry of the existing consent, the Council, at its discretion, may allow the consent holder to continue to operate under their existing consent. In this case, the Council has allowed the applicant to continue to operate under the existing consent (past its expiry of 1 June 2013) until a new consent is granted.

The application included an Assessment of Environmental Effects (AEE) report that sets out:

- the status of the application under the relevant Regional plan;
- a description of the environment;
- a description of the proposed activity;
- an assessment of environmental effects and mitigation measures; and
- an assessment of the regulatory context.

This report assesses the application under the RMA and recommends that the consent be issued subject to conditions. The recommended conditions are reasonably needed to avoid and mitigate adverse environmental effects, monitor the environmental effects, and ensure the nature and scale of the activity is consistent with the application.

A draft of this report was sent to the applicant and they indicated that they would accept the recommendations.

2. Consent history

Consent 0196-3 authorises the discharge of 4,800 m^3 per day of treated wastewater. This consent was renewed in April 2008 for a five year term on the basis that particular plant improvements were to be undertaken by June 2009, and that a report would be produced evaluating further long term upgrade options by June 2012.

Special condition 1 of this consent required the consent holder to make the following upgrades to the wastewater treatment system before 30 June 2009:

a) *continuous operation of an appropriate influent pre-screening structure;*

b) *installation and operation of appropriate mechanical aeration of the first oxidation pond;*

c) *refurbishment of the ponds' wavebands;*

d) *partitioning of the final ponds into a minimum of three cells by way of rock barriers, and installation of a subsurface outlet to minimise the loading of microflora in the final discharge; and*

e) *relocation of the piped discharge and passage of the treated effluent through an appropriately designed rock riprap structure prior to discharge to the river.*

These upgrades were undertaken within the required timeframe.

Special condition 15 of this consent also required the consent holder to provide a report to the Council before 30 June 2012, detailing issues and options available to address the effects on the receiving environment resulting from the discharge from the wastewater treatment plant. The report was required to include the following information:

a) *the environmental effects of discharge on the Patea River, including water quality, periphyton growth and aquatic biota;*

b) *options available for further treatment of wastewater from Stratford, giving particular emphasis to the reduction of nutrients in the discharge; and*

c) *detail the: costs; expected levels of reduction in adverse effects; and practical implications of introducing each option to the Stratford wastewater treatment system.*

It was later agreed between the Council and the consent holder that the report would be undertaken in two stages. Stage one would assess the ecological effects of the discharge on the Patea River, and stage two would evaluate options for plant upgrades based on the findings in stage one.

Analytical data was used from upstream and downstream sampling sites to produce a report for stage one[1]. The report recommended that a further 18 months of detailed ecological monitoring data was required to assess and quantify the impact of the discharge on the receiving environment, specifically in relation to periphyton effects.

The additional monitoring is not due to be completed until April 2014, therefore the evaluation of plant upgrade options is not expected to be completed until after the data has been made available.

3. Activity detail

As the evaluation of long-term upgrade options for the SWWTP is not expected to be completed until 2014, the applicant has applied for a short term consent to cover the interim period of investigations. As a result, the proposal is to continue the status quo for a period of 5 years by which time the applicant will have decided on a long-term treatment option for the plant.

The application states that other incremental improvements have already been made to the treatment system, including:

- reduction of the secondary pond level using an overflow riser on the original outlet – this enabled diluted flows in excess of the outlet capacity to be discharged via the new outlet; and
- examination of areas of faulty embankment and taking measures to strengthen them as required.

3.1 Influent to the SWWTP

The SWWTP currently receives waste from:

- approximately 2200 properties connected to the reticulation network;
- tanker waste from properties using septic tanks and campervans; and
- trade wastes.

The application states that an existing trade waste bylaw covers a range of trade waste discharges in the Stratford area. Staff employed by the applicant, actively collect information on trade waste volumes and quality to ensure there is nothing hazardous being discharged into the network that may affect the wastewater treatment process.

[1] The report was prepared by Harrison Grierson which was based largely on recommendations by Brian Coffey (Ecologist)

3.1.1 Historical flow data

Table 1 below summarises the annual wastewater discharge rates between 2008 and 2012.

Table 1: Annual discharge rates

Reporting year	Discharge rate range (m^3/day)	Discharge rate during rainfall event (m^3/day)
2008-2009	518-1728	8640
2009-2010	518-1728	4320
2010-2011	864-1296	5184
2011-2012	1296-2160	-

The applicant does not expect significant population growth to occur within the Stratford District during the proposed consent period. Therefore the maximum discharge rate of 4800 m^3 per day is considered appropriate.

3.1.2 Inflow and infiltration

The application states that inflow and infiltration has been identified as having contributed significantly to high loads at the SWWTP during high rainfall events. In accordance with special condition 5 of consent 0196-3, the applicant has introduced an inflow and infiltration reduction programme which is still in progress.

To date, one sub-catchment has been identified as having a high risk of being a major contributor to inflow and infiltration. This sub-catchment was used to undertake a full-rehabilitation trial to determine the effectiveness of the rehabilitation process. Investigations included visual flow surveys, smoke testing, property inspections and CCTV. Rehabilitation work consists of a combination of trenchless lining of the existing sewer mains, work to seal all the service lateral mains on to the new main, and the replacement of deteriorated manholes.

A second sub-catchment has been identified for the next round of rehabilitation work. The application states that this work will continue as finances allow.

3.2 Treatment process

The SWWTP comprises of:

- an inlet screen;
- a primary facultative pond;
- a maturation pond (divided into three cells); and
- a rock filter outlet structure.

The original reticulation system was built in 1965 with significant extensions between 1970 and 1980, and minor additions between 1981 and 1996. The majority of the flow to the SWWTP is gravity fed, as are the flows within the plant, and the flow to the outlet.

3.2.1 Inlet works

The inlet works at the SWWTP consist of the following:

- A flume with a flow meter, which was installed in 2000-2001. The upstream water level in the flume is measured with an ultrasonic level sensor, and the data is send back to the applicant by telemetry;
- An influent splitter chamber at the end of the main truck sewer. The chamber allows the incoming wastewater to be directed to either of the two oxidation ponds or to both simultaneously. The flow splitter is manually operated using a slide gate, and is intended for use during periods of high flow when the first pond is at risk of overflowing; and
- An influent step screen, which was installed in 2009. The step screen captures both inorganic and organic solids. The installation of the inlet screen significantly reduced the amount of solids that were building up in the ponds. The solids accumulated on the step screen are transported to a sealed bin via a screw press.

3.2.2 Oxidation ponds

The twin ponds were constructed in 1965 for a population of 6,600.

Pond 1 is a facultative oxidisation pond with an area of approximately 2.6 hectares and a depth of approximately 1.5 metres. Pond 1 has two submerged inlets in the south western corner and a single screened outlet at the north eastern end. The outlet is formed by a vertical manhold acting as a fixed weir, with a grating and a wooden walking providing access from the shore. Pond 1 is mechanically aerated, the aerators were installed in June 2008.

Pond 2 is a maturation pond with an area of approximately 1.7 hectares and a depth of approximately 1.5 metres. The water level in Pond 2 is approximately 1.6 metres lower than Pond 1. In its normal configuration, Pond 2 is joined to Pond 1 through a transfer pipe located at the north western edge. Pond 2 has a single screen outlet at the south eastern edge. The outlet is formed by a concrete channel into the embankment with a vertical screen across the front. The screen is punched with 20 mm diameter holes. Pond 2 is partitioned into three cells (Figure 1) and has a subsurface outlet to minimise the microfloral content of the treated wastewater. The cell walls have contoured shallow spillways to alleviate overtopping.

Figure 1: Photo illustrating the three cells of oxidation Pond 2

A number of years ago, a problem with the outlet of Pond 2 meant that the outlet in the first cell overflowed into the new diversion pipeline before joining the final wastewater discharge. The overflow meant that the full treatment process was effectively being short circuited. To remedy this, the problematic pipe was sealed in 2009. In 2010, the outlet was re-engineered to provide the hydraulic capacity in the discharge pipeline (Figure 2).

Figure 2: Photo illustrating the re-engineered outlet structure

The ponds were last desludged during 2004-2005 and are not likely to require desludging for another 5-10 years.

3.2.3 Outfall structure

An existing rock rip rap structure is used to provide land contact for the treated wastewater prior to entering the Patea River. The structure underwent remedial work in 2009, and again in 2010 when a manhole upstream of the rip rap surcharged severely following a very wet period. Engineering extensions were undertaken to modify the rock rip rap and outfall structure.

4. Existing Environment

The SWWTP is located on Victoria Road, east of Stratford, and south of the Patea River. The SWWTP consists of two oxidations ponds, and associated influent flow measurement and wastewater discharge structures. The location of the SWWTP is illustrated in Figure 3 below.

The SWWTP discharges into the Patea River. The headwaters of the Patea River drain from the eastern slopes of Mt Taranaki and through the surrounding ring plain. The highest levels of precipitation occur in the headwaters of the catchment on Mt Taranaki and can reach as high as 8000 mm per annum. The land use in upper part of the Patea catchment, especially around the ring plain, is primarily intensive dairy farming.

The Patea River is recognised in the *Regional Fresh Water Plan for Taranaki* (RFWP) as having excellent to good water quality in the upper reaches above Cardiff Road, and moderate access for native fish. The river is very highly rated for its recreational uses and values, and for its aesthetic and scenic values. The upper reaches of the river near Stratford, provide suitable habitat and food sources for brown trout and hence supports a regionally significant trout fishery. Native fish species such as koaro, crans bully, upland bully, brown mudfish, longfin and shortfin eels are also present in the upper catchment.

Lake Rotorangi is located approximately 40 km downstream of the SWWTP and is used by the community for recreational boating and fishing, and for power generation.

The Patea River is also a Statutory Acknowledgement Area of both Ngati Ruanui and Nga Rauru Iwi.

5. Activity status

The RFWP details Council policies in relation to fresh water. The RFWP has been operative since 2001.

The application is a discretionary activity under Rule 43 of the RFWP, as there is no permitted activity rule for the discharge of treated wastewater to water.

Figure 3: Aerial photo illustrating the location of the Stratford WWTP and the outfall structure

6. Consultation

The applicant has consulted with the following parties:

- Department of Conservation (DOC);
- Taranaki Fish & Game; and
- Ngati Ruanui.

7. Notification

Section 95A(2) of the RMA states that a consent authority must publicly notify an application if the activity will have or is likely to have adverse effects on the environment that are more than minor. In this case, any adverse effects associated with the proposed activity are considered to be no more than minor. Therefore the application has not been publicly notified.

Section 95B(1) of the RMA states that if a consent authority does not publicly notify an application for a resource consent for an activity, it must decide if there are any affected persons in relation to the activity. Section 95B(2) also states that the consent authority must give limited notification of the application to any affected person (who hasn't already provided their written approval).

In this case, the Council has determined the parties identified in Table 2 to be adversely affected by the application.

Table 2: Potentially affected parties

Affected party	Reason
DOC	The Patea River is identified in Appendix IA of the RFWP as being a river with high natural, ecological and amenity values
Taranaki Fish & Game	
Ngati Ruanui	The Patea River is of particular cultural and spiritual significance to Tangata Whenua. It is also a Statutory Acknowledgement Area for Ngati Ruanui and Ngaa Rauru Kiitahi
Ngaa Rauru Kiitahi	
G & M Collins Family Trust	Downstream landowners
DF & KJ Hinton	

As written approval was not obtained from the parties identified above, the application was 'limited notified'. Notice was served on these parties on 11 June 2013.

8. Submissions

Submissions were received from Ngati Ruanui on 19 June 2013, and from Taranaki Fish & Game on 9 July 2013.

The submission from Ngati Ruanui is that:

- The effluent quality requirements should remain the same as set out in existing consent conditions 4, 8, 10, 11 and 14;
- That condition 5 is also carried over to the new consent demonstrating the applicant's on-going commitment to address the issue of stormwater intrusion;
- The following condition is included in the new consent:

"The consent holder shall consult with Ngati Ruanui prior to accepting new trade wastes, which may contain toxic or hazardous wastes, into the consent holder's wastewater system. Consultation will be as follows:

1. *Stratford District Council shall notify Ngati Ruanui of the intention to accept a new trade waste;*
2. *Stratford District Council will give Ngati Ruanui enough time to provide feedback in relation to the waste being accepted; and*
3. *Stratford District Council will provide Ngati Ruanui with a response addressing how feedback from Ngati Ruanui has been taken into consideration in Stratford District Council's final decision."*

- Condition 16 is carried over to the new consent but amended to include a requirement for the Stratford District Council to formally report back to Ngati Ruanui at the 2 year anniversary of the renewed consent with an update as to where Stratford District Council is progressing with monitoring and the potential options to upgrade the Stratford WWTS;
- The following condition be included in the new consent:

  "Nothwithstanding the stated limits in conditions x (to be inserted once consent numbers are known), the consent holder shall operate the treatment system with the objective of achieving the highest final effluent quality that can reasonably and practicably be achieved having regard to the capabilities of the treatment system, financial implications, the current state of technical knowledge and best water management practice."

The submission from Taranaki Fish & Game is that:

- The Patea River supports a regionally significant trout fishery and they wish to be involved in discussions relating to this application for resource consent. They support the granting of a short-term discharge permit (with conditions) to cover the proposed interim period of investigations;
- Grant a short-term discharge permit to cover the proposed interim period of investigations and set conditions which ensure that any actual or potential adverse effects of the discharge on trout habitat and the fishery and ecological values of the Patea River are avoided, remedied or mitigated.

Both submitters wish to be heard in support of their submission.

9. Assessment of effects

9.1 Treatment pond system

The Council undertakes sampling of wastewater quality and receiving water physiochemical quality, for plant performance and impact assessment purposes. The most recent annual monitoring report published by the Council (TRC, 2012) includes results of effluent analysis. These results are provided in Table 3 below.

Table 3: Effluent analysis from the final cell of the Stratford oxidation ponds' system, 16 March 2012 and past records of secondary pond data (for the period 1987 to mid 2009) and final tertiary cell data (for the period mid 2009-2011)

Parameter	Unit	Survey of 16 March 2012	Secondary pond			Final (tertiary) cell		
			No. of samples	Range	Median	No. of samples	Range	Median
Time	NZST	0805	-	-	-	-		
Temperature	°C	17.4	105	7.4-24.1	14.0	27	6.2-21.5	15.1
Dissolved oxygen	g/m³	3.7	98	0.2-15.9	4.6	27	1.2-15.1	3.4
Dissolved oxygen saturation	%	40	95	2-177	43	25	11-141	34
BOD_5	g/m³	22	32	9-56	20	25	5-36	12
BOD_5 filtered	g/m³	2.2	17	2.0-11	4.6	2	5-15	10
pH		7.3	24	6.9-8.8	7.5	25	7.1-7.8	7.5
Conductivity @ 20°C	mS/m	19.6	32	18.0-61.6	31.5	26	15.6-41.6	25.2
Chloride	g/m³	15.8	19	22-92	27.2	26	11.7-30.9	17.6
Dissolved reactive phosphorus	g/m³P	1.43	25	1.44-11.1	4.08	26	0.70-4.97	1.76
Total phosphorus	g/m³P	2.05	9	1.7-5.8	4.8	24	1.02-5.80	2.22
Ammonia-N	g/m³N	5.60	37	0.59-24.9	13.1	26	3.74-25.4	10.0
Nitrate + nitrite-N	g/m³N	2.41	14	<0.01-0.60	0.10	2	1.13-2.84	-
Total nitrogen	g/m³N	11.6	-	-	-	24	7.2-30.8	14.6
Turbidity	NTU	23	29	5.6-89	15	26	6.0-71	15
Suspended solids	g/m³	44	35	4-120	37	26	5-49	20
Faecal coliform bacteria	nos/100/ml	4900	32	70-160000	3400	26	270-14,000	2000
Metals (acid soluble)								
Cadmium	g/m³	<0.005	17	<0.005<0.01	<0.005	2	<0.005-	<0.005
Chromium	g/m³	<0.03	15	<0.03-0.04	<0.03	2	<0.005	<0.03
Zinc	g/m³	0.021	18	0.009-0.118	0.036	2	<0.03-<0.03	0.035
							0.031-0.035	
Appearance		sl. turbid, green						

Note: with the exception of DO results, secondary pond data has been recorded mainly from summer surveys

The report states that the tertiary cell effluent quality was typical of a well treated secondary oxidation pond waste, with relatively low total BOD_5 and suspended solids levels, and moderate faecal coliform bacteria number. Nutrient levels were better than those typical of secondary oxidation pond treated effluent, and turbidity and appearance were indicative of a well treated wastewater effluent quality with only a moderate algal component.

Metal concentrations were less than minimum detectable levels, with the exception of zinc, which has remained at low, but detectable, concentrations after an incident in August 1991 where galvanising wastes were disposed of into the treatment system. None of the metal concentrations measured in the effluent at the time of the 2012 survey were expected to exceed toxic levels for aquatic fauna given the dilution provided in the receiving waters of the Patea River.

The report also states that the partitioning of the second pond into a three cell system (with aeration of the primary pond) appears to have resulted in a treated wastewater with narrower ranges for most parameters, particularly total BOD_5, pH, conductivity, dissolved reactive phosphorus, suspended solids, and faecal coliform bacteria.

9.2 Effects on receiving environment

Monitoring of the Patea River is undertaken by the Council in order to assess the impacts of treated wastewater on the physicochemical quality and biological communities of the receiving water.

The Council prepares annual monitoring reports, summarising the results of this monitoring. Four monitoring reports[2] have been prepared over the duration of the previous consent, and the following assessment is based on these reports.

9.2.1 Physicochemical

The physicochemical effects that may be associated with the discharge from the SWWTP are described in Table 4.

Table 4: Contaminants found in the discharge and their potential effects

Contaminant	Potential effects on receiving environment
Suspended solids (SS)	SS is a measure of the organic material that remains suspended in the wastewater. High levels of SS can settle out in some conditions and smother benthic fauna. High levels of SS may also increase the risk of pathogens being discharged to the receiving environment as pathogens may be attached to the particles.
Biochemical oxygen demand (BOD)	High levels of BOD can lower dissolved oxygen in the receiving environment, reducing its capacity to support existing ecosystems.
Nutrients	High levels of nutrients can lead to excessive aquatic plant growths in the receiving water and alters stream habitat.
Faecal bacteria	The presence of faecal bacteria in the receiving environment can cause adverse health effects.
Metals	Metals have the potential to impact on biological aquatic life in the receiving environment if concentrations exceed certain levels of toxicity.

Annual physicochemical monitoring of the Patea River is principally performed during summer-autumn (generally lower dilution) periods, with additional more limited compliance monitoring undertaken at intervals during the year. The results for 2009-2012 are summarised in Table 5 and Table 6. The monitoring programme requires samples to be taken from five different sites (two upstream of the discharge, one at the discharge location, and two downstream of the discharge). However in order to summarise these results, the tables below only include sample results from one upstream site and one downstream site.

[2] TRC, 2009: Stratford District Council, Municipal oxidation ponds system, Monitoring programme, Annual report 2008-2009. Technical report 2009-32
TRC, 2010: Stratford District Council, Municipal oxidation ponds system, Monitoring programme, Annual report 2009-2010. Technical report 2010-24
TRC, 2011: Stratford District Council, Municipal oxidation ponds system, Monitoring programme, Annual report 2010-2011. Technical report 2011-25
TRC, 2012: Stratford District Council, Municipal oxidation ponds system, Monitoring programme, Annual report 2011-2012. Technical report 2012-26

Table 5: Physicochemical sampling survey results 2009-2012 – 350m upstream of outfall

Year		2009	2010	2011	2012
Parameter	**Unit**				
Time	NZST	0755	0850	0850	0820
Temperature	°C	12.1	16.1	15.2	12.3
Dissolved oxygen	g/m³	10.2	9.3	9.1	10.3
DO Saturation	%	98	98	94	98
BOD_5 (total)	g/m³	0.5	0.7	0.8	0.6
BOD_5 (filtered)	g/m³	-	<0.7	<0.5	<0.5
pH		7.5	7.6	7.6	7.4
Conductivity @ 20°C	mS/m	9.3	10.1	10.3	9.0
Chloride	g/m³	8.6	8.4	9.0	8.7
Zinc (dissolved)	g/m³	0.005	0.007	-	<0.005
Cadmium (dissolved)	g/m³	<0.005	<0.005	<0.005	<0.005
Chromium (dissolved)	g/m³	<0.03	<0.03	<0.03	<0.03
Dissolved reactive phosphorus	g/m³P	0.019	0.021	0.009	0.018
Ammonia-N	g/m³N	0.050	0.069	0.094	0.057
Un-ionized ammonia-N	g/m³N	0.00042	0.00097	0.00124	0.0004
Nitrate + nitrite-N	g/m³	0.80	0.44	0.61	0.80
Turbidity	NTU	0.8	1.2	0.7	0.7
Black disc	m	3.06	1.86	2.25	3.00
Suspended solids	g/m³	<2	<2	<2	2
Faecal coliform bacteria	nos/100ml	160	260	280	200

Table 6: Physicochemical sampling survey results 2009-2012 – 130m downstream of outfall

Year		2009	2010	2011	2012
Parameter	**Unit**				
Time	NZST	0905	0920	0900	0840
Temperature	°C	12.6	16.5	15.8	12.6
Dissolved oxygen	g/m³	10.2	9.8	9.2	10.3
DO Saturation	%	99	104	96	98
BOD_5 (total)	g/m³	1.7	3.1	2.4	1.3
BOD_5 (filtered)	g/m³	-	-	0.6	0.6
pH		7.6	7.8	7.7	7.4
Conductivity @ 20°C	mS/m	10.0	10.5	10.8	9.5
Chloride	g/m³	9.2	9.3	9.4	9.1
Zinc (dissolved)	g/m³	<0.005	<0.005	-	<0.005
Cadmium (dissolved)	g/m³	<0.005	<0.005	<0.005	<0.005
Chromium (dissolved)	g/m³	<0.03	<0.03	<0.03	<0.03
Dissolved reactive phosphorus	g/m³P	0.093	0.180	0.101	0.078
Ammonia-N	g/m³N	0.313	0.544	0.264	0.226
Un-ionized ammonia-N	g/m³N	0.00341	0.01253	0.0046	0.0016
Nitrate + nitrite-N	g/m³	0.80	0.58	0.72	0.91
Turbidity	NTU	1.0	4.8	1.7	1.8
Black disc	m	1.72	1.35	1.16	1.21
Suspended solids	g/m³	<2	5	3	2
Faecal coliform bacteria	nos/100ml	170	240	340	190

The results show that the wastewater discharge has had minimal impact on the receiving waters of the Patea River in terms of temperature, dissolved oxygen, pH, dissolved metals, and bacteria. This is consistent with moderate dilution of the discharge by river flow and a good effluent quality in terms of these parameters. However there has been some impact on the visual clarity of the Patea River as indicated by the reduction in black disc clarity and the increase in turbidity, downstream of the discharge. However, all turbidity and clarity data are still within the ANZECC guideline values.

There is some elevation in total BOD_5 but this has not been sufficient to cause significant downstream lowering of dissolved oxygen concentrations. Nutrient levels in the river indicate that the ANZECC guideline value for DRP (0.010 g/m^3 P) is slightly exceeded upstream of the discharge and markedly exceeded downstream of the discharge. The nitrate nitrogen guideline value (0.444 g/m^3 N) is not exceeded upstream but is exceeded downstream.

Un-ionized ammonia and filtered carbonaceous BOD_5 concentrations downstream of the permitted mixing zone were well within the limits required by consent conditions.

9.2.2 Biological

The Council also undertakes annual biomonitoring surveys of the Patea River under summer low flow conditions. The methodology for these surveys involves a "kick sampling" technique, used to collect samples of streambed macroinvertebrates. These samples are processed to determine:

- Macroinvertebrate taxa richness;
- Macroinvertebrate Community Index (MCI); and
- Semi Quantitative Macroinvertebrate Community Index ($SQMCI_5$).

All biomonitoring surveys have been reported in the Council's annual compliance monitoring reports since 1990. An ecological assessment report[3] provided with the application provides a summary of the biomonitoring survey results between November 2009 and February 2011. Results of the surveys are plotted for three sample sites, including, an upstream control site (PAT000330), a site immediately downstream of the mixing zone for the discharge (PAT000350), and a site approximately 2 km downstream of the discharge point itself (PAT000356).

Figure 4 below illustrates the taxa richness at the Patea River sampling sites. The ecological report states that taxa richness reflects the "health" of instream communities and generally increases with increasing water quality, habitat diversity and/or habitat suitability. The report also states that overall taxa richness varied in the relatively narrow range of 19 to 27, and on no occasion was the taxa richness lower than at the upstream site. Therefore there is no indication that the discharge from the SWWTP is having an adverse effect on instream community structure on the basis of taxa richness.

[3] Harrison Grierson, May 2012: Stratford District Council. Stratford Wastewater Treatment Plant. Ecological Assessment.

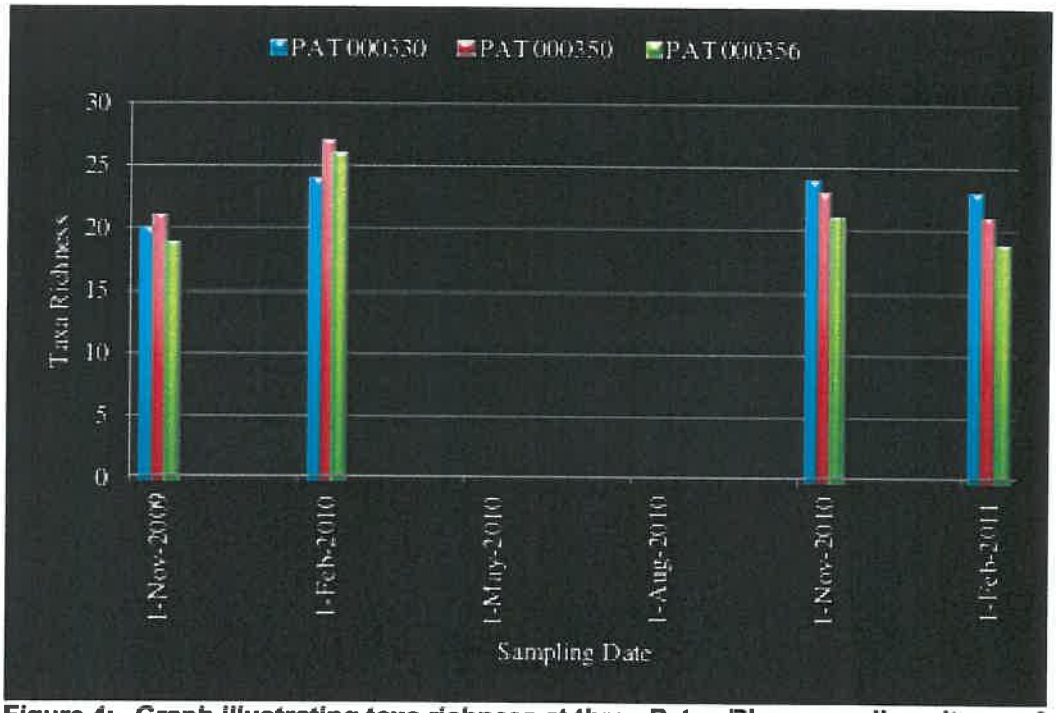


Figure 4: Graph illustrating taxa richness at three Patea River sampling sites on four occasions between November 2009 and February 2011 (blue = upstream, red = immediately downstream of mixing zone, green = 2 km below discharge).

The ecological report describes MCI as a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The $SQMCI_5$ also takes into account taxa abundance as well as sensitivity to pollution, and may reveal more subtle changes in communities, particularly if non-organic impacts are occurring.

The report states that:

- an MCI higher than 120 and a $SQMCI_5$ higher than 6 are associated with clean water;
- an MCI of 100-120 and a $SQMCI_5$ of 5-6 are associated with water of doubtful quality or possible mild pollution; and
- an MCI of 80-100 and a $SQMCI_5$ of 4-5 are associated with probable moderate pollution; and
- an MCI less than 80 and a $SQMCI_5$ less than 4 are associated with probably severe pollution.

Figure 5 and Figure 6 below illustrate the MCI and $SQMCI_5$ values at the Patea River sampling sites. Figure 5 indicates that water quality at all three sampling sites was of 'doubtful' quality or had possible mild pollution. It also shows that in 2009 and 2010, there was a 10 point difference between the upstream site and the site immediately downstream of the mixing zone, and in 2011 there was a 15 point difference between these sites. The ecological report states that samples need to differ by 10.83 units for the differences to be significant, therefore this suggests that there is some impact of the discharge from the SWWTP during summer low flow conditions.

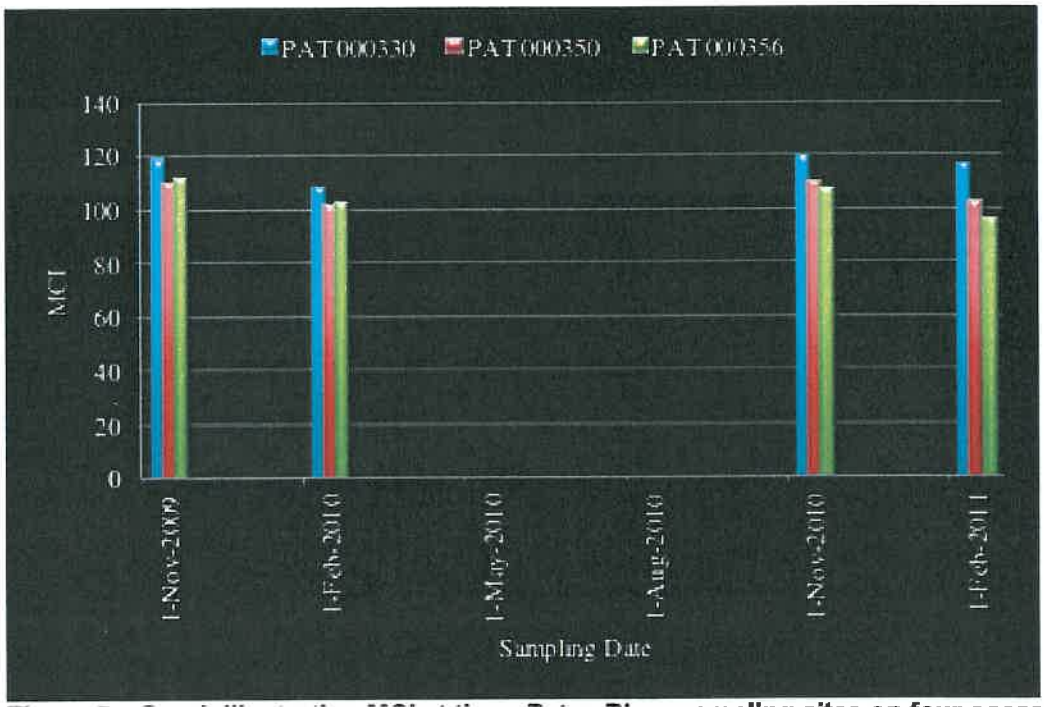


Figure 5: Graph illustrating MCI at three Patea River sampling sites on four occasions between November 2009 and February 2011.

Figure 6 shows that $SQMCI_5$ indicated good water quality at all sites during Nov 2009 and Nov 2010. During Feb 2010, $SQMCI_5$ indicated good water quality upstream of the discharge, but probable moderate pollution downstream of the discharge. During Feb 2011, $SQMCI_5$ also indicated good water quality upstream of the discharge and immediately downstream of the mixing zone, but doubtful quality or possible mild pollution 2 km downstream of the discharge.

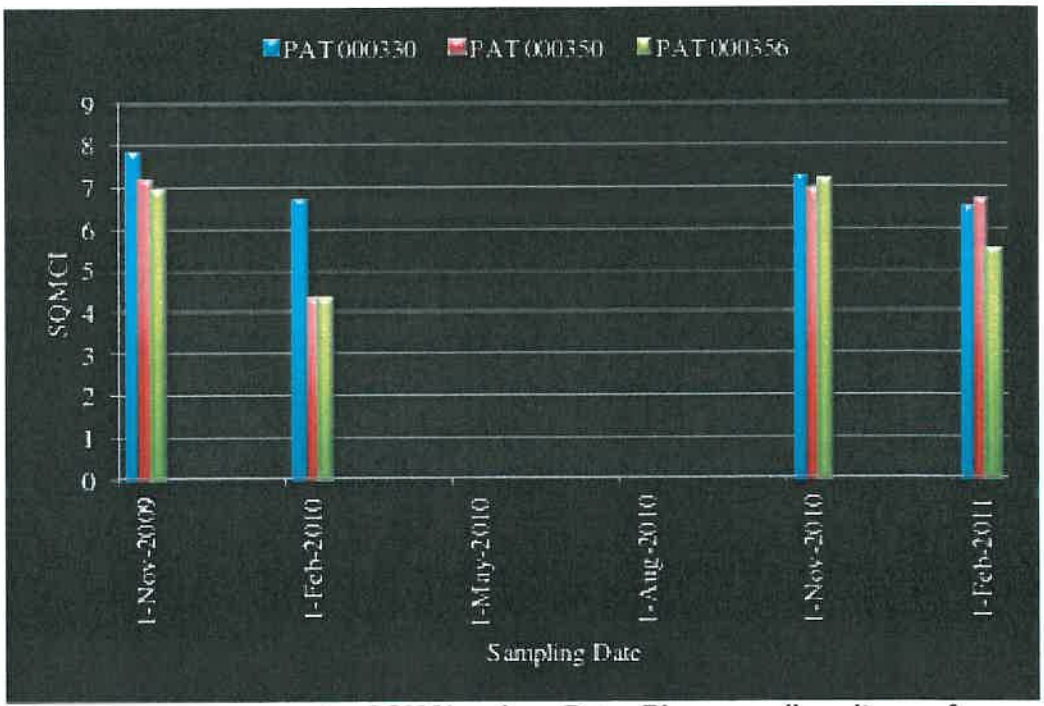


Figure 6: Graph illustrating SQMCI at three Patea River sampling sites on four occasions between November 2009 and February 2011.

Overall, the ecological report concludes that the discharge from the SWWTP does appear to be having occasional impacts on instream community structure within the Patea River.

9.2.3 Plant nutrients and periphyton growth

The ecological report summarises provisional periphyton data collected by the Council. The data has been collected from two sample sites, one upstream of the discharge near Barclay Road (PAT000200), and the other downstream of the discharge near Skinner Road (PAT000360).

As identified in the report, Figure 7 below indicates that the cover of thick mats of periphyton at both sampling sites have been below the nuisance threshold of 60% bed cover since the summer of 2006.

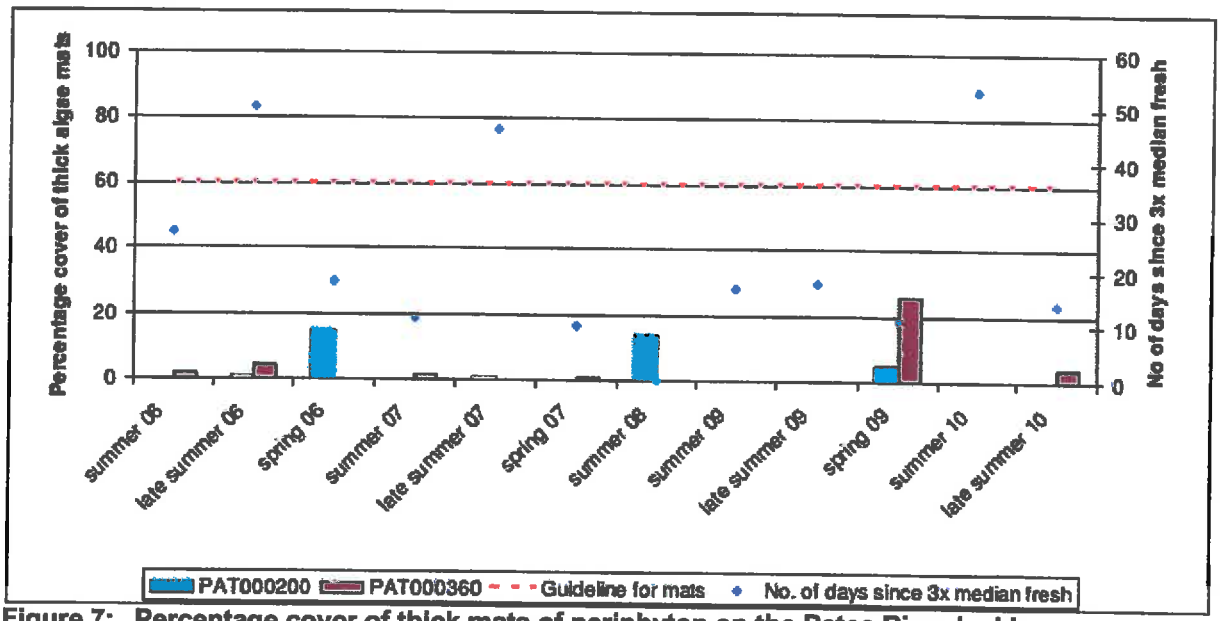


Figure 7: Percentage cover of thick mats of periphyton on the Patea River bed in relation to the guideline for recreational values and number of days since 3x median fresh events

However, Figure 8 demonstrates that since the summer of 2006, the percentage of long filamentous periphyton cover at the downstream site has exceeded the nuisance threshold of 25% bed cover by filaments >2 cm long on several occasions.

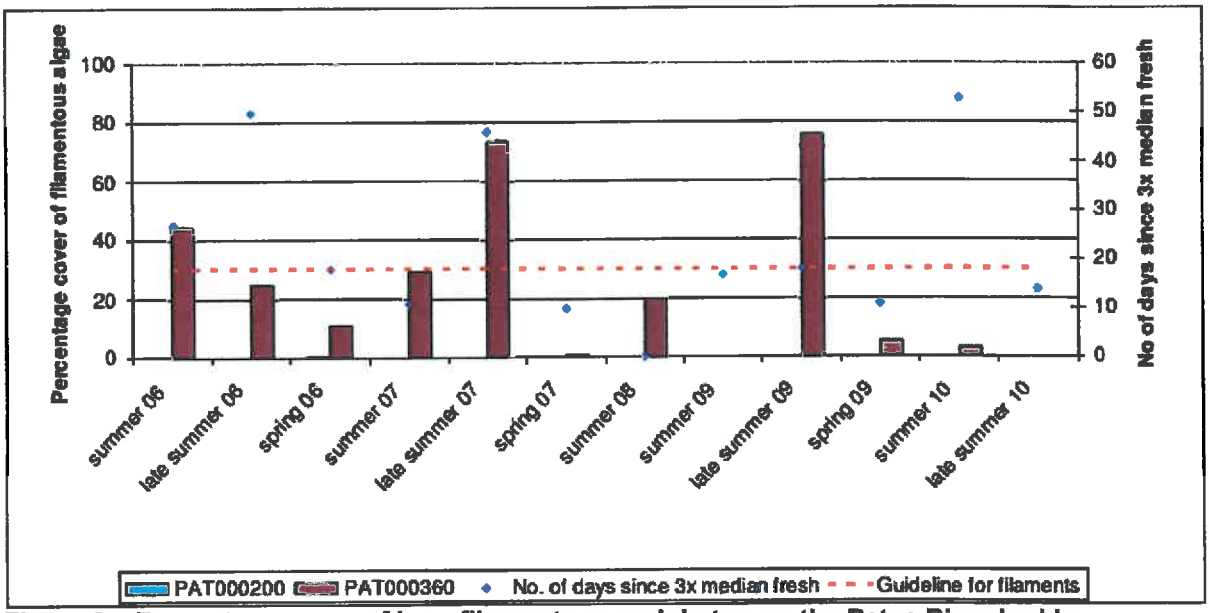


Figure 8: Percentage cover of long filamentous periphyton on the Patea River bed in relation to the guideline for recreational values and number values and number of days since 3x median fresh events

The report therefore states that somewhere between the two sampling sites, ambient nutrient concentrations in the Pater River have increased to the extent that nuisance growths of periphyton can occur. It also recommends that a further 18 months of more detailed ecological monitoring data be made available to determine the feasibility of phosphorus stripping and nitrogen removal. This work has commenced and is due for completion in autumn 2014.

9.3 Overflow events

There have been a number of overflow discharges at the SWWTP between 2008 and 2012. Table 7 below summarises these events and the action taken by the applicant in order to mitigate any adverse effects.

Table 7: Summary of overflow events at the SWWTP, 2008-2012

Year	Event	Reason	Remedial action
2009	High hydraulic loading and very high levels in Pond 2	Heavy rainfall	Old outlet from Pond 1 was opened to allow the water to bypass Pond 2
2009	Treated effluent surcharging from the manhole immediately upstream of the outfall	Heavy rainfall	Outfall was re-engineered in 2010 to cater for a higher hydraulic capacity
2009	Overflows from and adjacent to Pond 2	Heavy rainfall	Metal compaction raising the pond margins by 30 cm
2010	Secondary cell walls overtopped and minor seepage to adjacent farmland		
2011	Overflows from a raw influent flume	Heavy rainfall	Raised the height of the bund and installed a pipe linking the bund to Pond 1 (which may be used at times of high flow)

At this point it should be noted that these overflow events are not consented. However as these events have the potential to cause adverse effects on the receiving environment, it is important that the applicant uses measures to avoid and/or mitigate the occurrence of these discharges.

9.4 Summary of environmental effects

The effects of the discharge from the SWWTP on the receiving waters of the Patea River have varied particularly in relation to the amount of dilution available in the river and seasonal changes in wastewater characteristics.

It is evident that the discharge is having some impact on the receiving environment with regards to nutrient levels and aesthetic quality. However, effects arising as a result of an increase in nutrients immediately downstream of the discharge can only be remedied by wastewater nutrient reduction, which the applicant is still investigating.

Overall, bearing in mind that the current application is for a short-term consent, any adverse effects associated with the discharge are considered minor and can not appropriately be avoided and/or mitigated until further upgrades are undertaken to the SWWTP.

10. Statutory assessment

10.1 Part 2 of the RMA

Part 2 of the RMA is titled *Purpose and Principles* and comprises Sections 5, 6, 7 and 8.

Section 5 states that the purpose of the RMA is to promote the sustainable management of natural and physical resources. 'Sustainable management' means managing the use, development and protection of these resources in a manner which enables people and communities to provide for their social, cultural and economic wellbeing while:

a) *sustaining the potential of natural resources to meet the reasonably foreseeable need of future generations;*
b) *safeguarding the life supporting capacity of water and ecosystems; and*
c) *avoiding, remedying and mitigation adverse effects of the application on the environment.*

In achieving the purpose of the RMA the Council must;

- recognise and provide for the matters of national importance (section 6);
- have particular regard for other matters (section 7); and
- take account of the principles of the Treaty of Waitangi (section 8).

The activity, undertaken in accordance with the recommended conditions, enables people and communities to provide for their social, cultural and economic wellbeing, and meets the other requirements of Part 2.

10.2 Section 104 requirements

Subject to Part 2 of the RMA, Section 104(1) requires the Council, when considering an application for a resource consent, to have regard to:

a) any actual and potential effects on the environment of allowing the activity; and
b) any relevant provisions of-
   i) a national environmental standard:
   ii) other regulations;
   iii) a national policy statement:
   iv) a New Zealand coastal policy statement:
   v) a regional policy statement or proposed regional policy statement:
   vi) a plan or proposed plan; and
c) any other matter the consent authority considers relevant and reasonably necessary to determine the application.

The actual and potential effects of allowing the activity have been assessed and discussed in *Assessment of effects* above. The recommendation reflects appropriate regard for the environmental effects, and appropriately avoids, remedies or mitigates them as required by Part 2.

Section 104(2A) requires that when considering an application for a renewal of consent, the Council has regard to the value of the investment of the existing consent holder (i.e. the applicant). In this case, the applicant has a major investment that is dependent on the consent.

The plans and policy statements that are relevant to this application are:

- the *National Policy Statement for Fresh Water Management 2011* (FWNPS);
- the *Regional Policy Statement for Taranaki* (RPS); and
- the RFWP.

The RPS has 'high level' resource management policies including policies relating to the natural and physical resources of Taranaki. However, policies relevant to this application are given effect to by the RFWP. In having regard to the RFWP the Council is therefore also having appropriate regard to the RPS.

Where relevant to this application, regard has been had to the general objectives and policies of the FWNPS such as those relating to integrated management and to Tangata Whenua roles and interests. The FWNPS policies that directly relate to avoiding adverse effects on the life-supporting capacity of freshwater are included in the RFWP.

Regard has been had for the relevant policies of the RFWP, specifically policies listed in
Table 8, and the recommendation reflects this.

Table 8: Policies of particular relevance

Policy number	Commentary
3.1.2 & 3.1.3	Having regard to matters such as fishery values, aesthetic values, ecosystems and habitats and hydrological characteristics, adverse effects will be avoided, remedied or mitigated.
3.1.4	Maintain and enhance as far as practicable the high natural, ecological and amenity values of rivers and streams listed in Appendix IA and avoid, remedy or mitigate adverse effects of activities on these values.
4.1.1	Protecting as far as practicable, adverse effects on wahi tapu and other sites of cultural significance to Maori.
4.1.2	Avoiding to the fullest extent practicable adverse effects on mahinga kai and habitats of species harvested by Tangata whenua
5.1.1	When managing the use and development of fresh water and the beds of rivers and lakes, Council will recognise such matters that need to avoid remedy or mitigate adverse environmental effects and also positive effects on people and communities.

Policy number	Commentary
5A.1.1 & 5A.1.2	Avoiding contamination that has any more than minor effect on the life supporting capacity of freshwater
6.2.1	When managing point source discharges to land and surface water, Council will recognise and provide for the different values and uses of surface water.
6.2.2	Ensuring adverse effects from point-source discharge of contaminants to land and surface water are avoided remedied or mitigated.
6.2.3	Requiring waste reduction and treatment practices which avoid, remedy or mitigate the adverse environmental effects of point-source discharge of contaminants into surface water, or, onto or into land.
6.2.4	Requiring the adoption of the best practicable option to prevent or minimise the effects on the environment when discharging contaminants.

The policies listed above, while requiring consideration of effects on such matters as ecology, amenity, Maori culture and traditions, are about allowing for the appropriate use of fresh water while avoiding, remedying or mitigating adverse environmental effects.

Policies 3.1.2, 3.1.3 and 3.1.4 aim to protect the natural character of rivers, and to safeguard the life-supporting capacity of freshwater and aquatic ecosystems. Monitoring of the Patea River demonstrates that any adverse effects on the natural character and life-supporting capacity of the river, and aquatic ecosystems will be no more than minor, however it is evident that the discharge is having some impact on the receiving environment with regards to nutrient levels and aesthetic quality.

Policy 4.1.1 states that cultural and spiritual values associated with freshwater will be protected as far as practicable. In this case, the discharge of treated waste to the Patea River will ultimately have some impact on these values, however the discharge is currently being treated to the greatest extent practicable. The long-term quality of the discharge will also be improved once further upgrades have been undertaken at the plant. It is also noted that the two Iwi with significant connections to the river have accepted any effects of this activity, at least in the short term.

Policy 5.1.1 requires the Council to recognise the positive benefits of the use and development of freshwater and river and lake beds. Therefore the Council must consider the positive benefits to people and the community as a result of the activity. Policy 5A.1.1 requires the Council to have regard to the extent to which the discharge would avoid contamination that will have an adverse effect on the life-supporting capacity of fresh water and ecosystems, and the extent to which it is feasible and dependable that any more than minor adverse effects of fresh water and ecosystems would be avoided. In this case, any adverse effects on fresh water and ecology are no more than minor.

Policies 6.2.1 to 6.2.4 address adverse effects on surface water quality as a result of point source discharges. These policies are generally met by:

- recognising and providing for different values and uses of the river, in particular natural, ecological amenity values; maintenance and enhancement of aquatic ecosystems; the relationship of Tangata Whenua with water and the use of water for water supply and contact recreation; and
- recommended consent conditions that ensure the discharge is carried out in a way that will avoid remedy or mitigate adverse effects on aquatic ecosystems, and require implementation of the best practicable option.

Overall, having regard for the policies of the RFWP does not provide any impediment to the granting of the consent under similar conditions to that of the expired consent.

10.3 Section 105 requirements

Section 105(1) of the RMA requires that the Council, in addition to the matters in section 104(1), have regard to:

a) *the nature of the discharge and the sensitivity of the receiving environment to adverse effects;*
b) *the applicant's reasons for the proposed choice; and*
c) *any possible alternative methods of discharge, including discharge into any other receiving environment.*

Regard has been had to the nature of the discharge and the sensitivity of the receiving environment. In this case, there are no practicable alternative methods of discharge or receiving environments. However the applicant is currently investigating options for long-term improvements to the discharge quality.

10.4 Section 107 requirements

Under section 107(1) of the RMA, the Council cannot grant this consent if, after reasonable mixing, the contaminant discharged (either by itself or in combination with contaminants), is likely to give rise to any of the following effects in the receiving waters:

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

Provided the recommended consent conditions are complied with, the Council is satisfied that these standards will be met.

11. Submitters concerns addressed

The submitters are generally accepting of the application, provided the conditions of the previous consent are carried over. They have also indicated support for a shorter duration than that applied for.
Although the recommendation does not impose specific consent conditions requested by the submissions, the submitter's concerns have been addressed by the recommended special conditions attached to the consent. Among other things, these conditions require the applicant to:

- adopt the best practicable option to minimise any adverse effects on the Patea River as a result of the continued discharge, while achieving the highest final effluent quality that can reasonably be achieved;
- continue to meet effluent quality standards as required by the previous consent;
- continue to demonstrate its ongoing progress towards the reduction of stormwater inflow to the ponds; and
- provide a report detailing upgrade options for the SWWTP by 30 June 2015.

The submitters have since withdrawn their right to be heard on the application.

12. Consent duration and review dates

The application requests a 5 year consent duration. However, as the applicant will receive the outstanding periphyton data no later than June 2014, it is reasonable to expect that the appropriate upgrade option for the SWWTP can be identified and evaluated in time to meet a significantly shorter duration.

In this case an expiry of June 2016 is considered reasonable as the investigation into possible upgrade options for the SWWTP has been ongoing since granting the previous consent in 2008. Therefore, an expiry date of 1 June 2016 is recommended to ensure the upgrades are undertaken as soon as reasonably practicable.

13. Monitoring

Monitoring of this consent is required to ensure that the activity undertaken complies with what is authorised by the consent, and that environmental effects are consistent with the assessment presented in this report.

The Council currently undertakes a detailed monitoring programme for the SWWTP and this consent will continue to be monitored in accordance with that programme (Council reference: SPORDMON 8). The cost of this programme is about $9000 per year.

14. Consent conditions

The special conditions recommended are reasonably necessary to avoid, remedy or mitigate adverse environmental effects and to ensure that the nature and scale of the activity is consistent with the application and the assessment of environmental effects presented.

Specific reasons for each special condition are included in the Condition Analysis Table attached.

15. Reasons for decision

The reasons for the recommended decision are detailed in this report, but in summary they are:

a) The granting of this application is consistent with the RPS, Regional Plans and in keeping with the purpose and principles of the RMA; and

b) Undertaking the proposed activity in accordance with the conditions recommended is unlikely to cause any significant adverse effects on the environment.

16. Recommendation

That application 5829, to discharge treated wastewater from the Stratford Wastewater Treatment Plant into the Patea River, be approved for a period to 1 June 2016, subject to the following conditions:

General condition

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

Special conditions

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

2. The volume of treated wastewater discharge shall not exceed 4,800 cubic metres per day, unless there has been a total of more than 10 mm of rain over the previous three days (as measured by the Taranaki Regional Council rain gauge at Stratford).

3. The consent holder shall implement an inflow and infiltration reduction programme to minimise the stormwater inflow to the ponds. The programme shall include taking all practicable actions to ensure that all unauthorised stormwater connections to the sewage reticulation system are removed and remain disconnected. The consent holder shall report on progress under this condition to the Chief Executive, Taranaki Regional Council, by 30 June each year.

4. The consent holder shall implement and maintain a Management Plan which shall include operating procedures to avoid, remedy or mitigate against potential adverse effects arising from:

   a) the operation of the wastewater treatment plant;

   b) the build up of sludge in the ponds; and

   c) stormwater and groundwater infiltration into the sewerage system.

5. The oxidation ponds shall be maintained in aerobic conditions at all times during daylight hours.

6. The consent holder shall consult with the Taranaki Regional Council prior to accepting new trade wastes, which may contain toxic or hazardous wastes, into the consent holder's wastewater system.

7. After allowing for reasonable mixing, being a mixing zone extending from the discharge point, to a point 50 metres downstream of the discharge point, the discharge shall not give rise to any of the following effects in the receiving waters of the Patea River:

   a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;

   b) any conspicuous change in the colour or visual clarity;

   c) any emission of objectionable odour;

   d) any significant adverse effect on aquatic ecosystems.

8. After allowing for reasonable mixing within a mixing zone extending 50 metres downstream of the discharge point, the discharge shall not give rise to an increase in turbidity of more than 50% (as determined using NTU (nephelometric turbidity units)) in the Patea River.

9. The consent holder shall, in conjunction with the Taranaki Regional Council, undertake chemical, bacteriological and ecological monitoring of the oxidation pond system and Patea River as deemed reasonably necessary by the Chief Executive, Taranaki Regional Council subject to Section 36 of the Resource Management Act 1991. That monitoring shall include wastewater quality monitoring to provide for an assessment of possible further upgrade requirements in relation to potential impacts on the biological communities of the receiving water.

10. The monitoring, evaluation and assessment required by condition 9 shall specifically include monitoring, evaluation and assessment of dissolved reactive phosphorus (DRP) and other nutrient-species.

11. After allowing for reasonable mixing, being a mixing zone extending from the discharge point, to a point 50 metres downstream of the discharge point, the discharge shall not cause the receiving waters of the Patea River to exceed the following concentrations:

Contaminant	**Concentration**
Unionised ammonia	0.025 gm^{-3}
Filtered carbonaceous BOD_5	2.0 gm^{-3}

12. Before 30 June 2015 the consent holder shall provide to the Chief Executive, Taranaki Regional Council a report detailing issues and options for the Stratford Wastewater Treatment Plant.

    The report shall document the environmental effects of the discharge from the Stratford Wastewater Treatment Plant, and set out the options available to address the effects on the receiving environment resulting from the discharge.

    The report shall be to the reasonable satisfaction of the Chief Executive, Taranaki Regional Council and shall, as a minimum, address the following:

    a) the environmental effects of discharge on the Patea River, including water quality, periphyton growth and aquatic biota;

    b) options available for further treatment of wastewater from Stratford, giving particular emphasis to the reduction of nutrients in the discharge; and

    c) detail the: costs; expected levels of reduction in adverse effects; and practical implications of introducing each option to the Stratford wastewater treatment system.

Recommending Officer

Kim Giles
Consents Officer

Recommendation Confirmed

AD McLay
Director-Resource Management

Condition Analysis Table

No.	Description	Reasons for condition	Determination of compliance	Reason for limit
1	Adoption of best practicable option (BPO)	This condition requires that a higher standard than that required by the conditions be met if it can reasonably be achieved. It also requires the consent holder to continually review methods and practices and make reasonable improvements even though the conditions are being met. The condition is reasonably necessary to avoid adverse environmental effects	General observation and assessment of monitoring information	N/A
2	Limit on discharge volume	Limits the scale and effect of activity to that considered in the application.	Assessment of information by a Council Officer	As provided in the application
3	Reduction of stormwater inflow	This condition is reasonably necessary to avoid adverse effects associated with overflow events resulting from stormwater inflows to the oxidation ponds	Report received by the Council	Timeframe is considered reasonable
4	Implementation and maintenance of a Management Plan	Ensures the discharge is within the scope of the application and the authorised activity. The condition ensures that the consent holder continues to review (in a pro-active manner) the way in which operations at the site are undertaken to ensure compliance with the consent. It also ensures that procedures in place for staff to follow to ensure consent compliance remain relevant. For the consent holder, it is also a means of documenting how special condition 1 (adoption of the best practicable option) has been determined, and put into practice at the site	Assessment of plan by a Council Officer	N/A
5	Maintaining oxidation ponds in aerobic conditions	This condition is reasonably necessary to maintain treatment efficiency and therefore avoid or mitigate adverse effects	General observation and assessment of monitoring information	N/A
6	Acceptance of new trade wastes	The assessment of the application, and the decision made, were based on the information provided at the time of application. Changes to operations may affect the nature of the discharge and the effects of the discharge on the receiving environment may therefore be different. Changes may also result in overloading of the treatment system. This condition is therefore necessary to avoid or mitigate adverse effects	Notification received by the Council	N/A
7	Effects on surface water	The standard specified in this condition is required by Section 107 of the Resource Management Act. The other conditions of this consent are expected to ensure that these standards are met, but the inclusion of this condition provides more certainty and specifies the mixing zone.	Assessment of monitoring information by a Council Officer	Standards from S107 RMA. The 50 metre mixing zone is considered appropriate given the rate of discharge and the dilution available in the stream
8	No increase in turbidity of more than 50%	This condition is reasonably necessary to ensure the aesthetic quality of the river is maintained	Assessment by a Council Officer	The 50 metre mixing zone is considered appropriate given the rate of discharge and the dilution available in the stream
9-12	Monitoring of the oxidation pond system and inclusion of DRP Receiving water standards Upgrade options report	These conditions are reasonably necessary to identify environmental effects and provide information for use in evaluating future upgrade options to ensure adverse effects are appropriately avoided, remedied or mitigated.	Report received by the Council, and assessment of monitoring information	Timeframe is reasonably achievable

APPENDIX 3
STRATFORD WASTE WATER TREATMENT PLANT ECOLOGICAL ASSESSMENT OF EFFECTS ON THE PATEA RIVER

Brian T. Coffey and Associates Limited
Environmental Consultants

Stratford Waste Water Treatment Plant
Ecological Assessment of Effects on the Patea River

Prepared for:

Harrison Grierson Consultants Limited
P.O. Box 5760 Wellesley Street Auckland 1141

Attention: Anita Simpson
Associate & Senior Process Engineer

Prepared by:

Brian Coffey

Inquiries and reference: please quote:
Brian T. Coffey and Associates Limited
EA: Stratford WWTP, H/G March 2015.

P.O. Box 83, Whangamata (3643), New Zealand
Telephone: 027 493 7865. Email: briantcoffey@vodafone.co.nz

1. Introduction and Background

Our brief from Harrison Grierson Consultants for this report is as follows.

1. Review the results of the most up to date monitoring data (Annual reports 2010-2011, 2011-2012, 2012-2013, and 2013-2014).
2. Analyse and interpret data effect on the receiving environment (Patea River). This should take into account the National Objective Framework standards (noting the likely TRC targets attached – not public information).
3. Suggest / recommend target effluent quality and what type of upgrade (high level - N removal, P removal, pathogen reduction etc) will be required.

2. Receiving Water Quality

Water quality data provided in the four annual reports (Taranaki Regional Council, 2011, Taranaki Regional Council, 2012, Taranaki Regional Council, 2013 and Taranaki Regional Council, 2014) for the treated wastewater discharge and the Patea River upstream and downstream of the discharge is summarised in Figures 1 to 11.

Sampling sites to which water quality relates are summarised in Table 1.

Table 1: Location of water quality sampling sites

Site	Location	GPS location	Site code
Patea River	at Swansea Road bridge (upstream of landfill and WWTP discharges)	E1711801 N5644382	PAT000315
Patea River	approximately 250 m downstream of the WWTP original discharge (and 350m upstream of the new outfall)	E1712748 N5644549	PAT000345
Discharge from oxidation ponds	at manhole upstream of rock riprap outfall	E1712834 N5644344	OXP005002
Patea River	approximately 130 m downstream of the WWTP new outfall	E1713033 N5644266	PAT000350
Patea River	approximately 1 km upstream of the Kahouri Stream confluence	E1714497 N5645112	PAT000356

Water Quality Limits and standards specified in Consent 0196-4 for the Stratford Oxidation pond discharge are as follow (see Taranaki Regional Council, 2014A).

7. After allowing for reasonable mixing, being a mixing zone extending from the discharge point, to a point 50 metres downstream of the discharge point, the discharge shall not give rise to any of the following effects in the receiving waters of the Patea River:
   a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
   b) any conspicuous change in the colour or visual clarity;
   c) any emission of objectionable odour;
   d) any significant adverse effect on aquatic ecosystems.
8. After allowing for reasonable mixing within a mixing zone extending 50 metres downstream of the discharge point, the discharge shall not give rise to an increase in turbidity of more than 50% (as determined using NTU (nephelometric turbidity units) in the Patea River.

11. After allowing for reasonable mixing, being a mixing zone extending from the discharge point, to a point 50 metres downstream of the discharge point, the discharge shall not cause the receiving waters of the Patea River to exceed the following concentrations:

- Unionised ammonia 0.025 $g.m^{-3}$,
- Filtered carbonaceous BOD_5 2.0 $g.m^{-3}$.

National Bottom Lines prescribed in the National Policy Statement for Freshwater Management (N.Z. Government, 2014) for Ecosystem, Health in rivers includes;

- <200 mg chl a /m^2 for periphyton biomass,
- 6.9 mg/l nitrate nitrogen,
- annual median of <1.34 mg/l and annual maximum of <2.20 mg/l for NH_4-N,
- dissolved oxygen concentration of > 4 – 5 mg/l,
- *Escherichia coli* at <1000 cfu/100 ml as annual median, and
- Planktonic cyanobacteria <1.8 mm^3/l of potentially toxic taxa or < 10 mm^3/l total cyanobaterial biovolume.

Defaults and guidelines being considered by the Taranaki Regional Council to comply with the National Policy Statement for Freshwater Management in the Patea River at Stratford are summarised in Table 2.

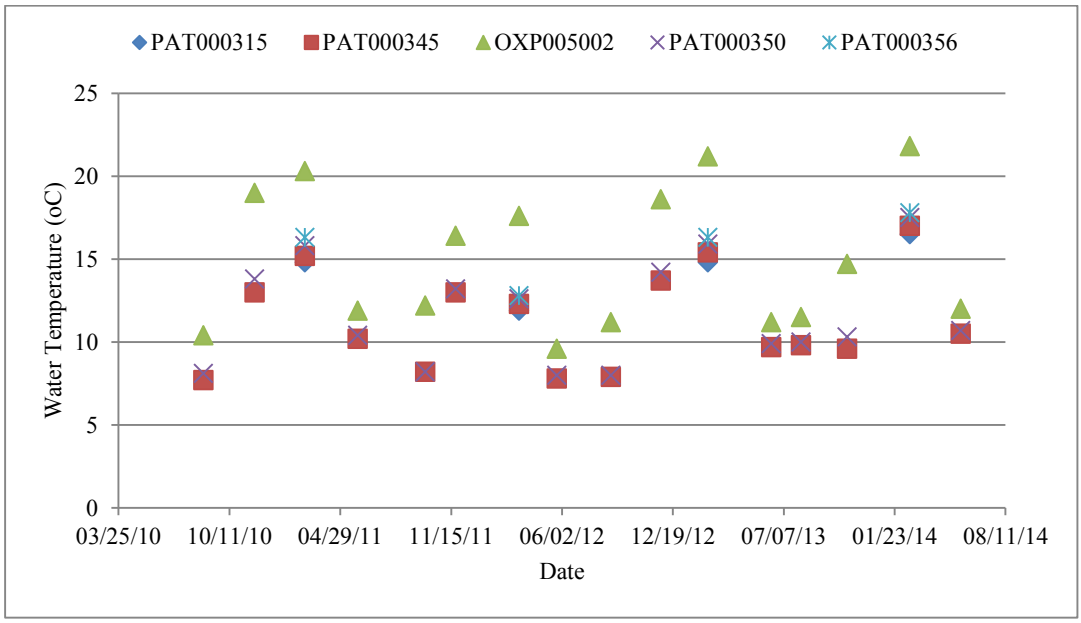
Table 2: Default Limits and Targets for Freshwater Quality being considered by the Taranaki Regional Council for Lower Reaches of Flow Sourced from inside the Egmont National Park (as provided with the brief for this review).

Parameter	Default Limit Target	Protection for
MCI	not applicable	life supporting capacity, mauri, fisheries
cBOD5	2 $g.m^{-3}$,	fisheries
Dissolved Oxygen	>80%	fisheries
Water temperature	20 °C	fisheries
Maximum algal biomass	50 / 100 $mg.m^2$ chlorophyll a	life supporting capacity, mauri, natural form and character, contact recreation and fisheries
Filamentous algae	30% max cover of bed with > 2 mm long filaments	life supporting capacity, mauri, natural form and character, contact recreation and fisheries
Diatom or cyanobacterial mats	60% max cover of bed with > 2 mm long filaments	life supporting capacity, mauri, natural form and character, contact recreation and fisheries
E. coli	50 / < 1000 cfu/100 mls	contact recreation, secondary contact, community water supply, stock watering, irrigation, mahinga kai
Turbidity	<3.0 NTU	contact recreation, community water supply
Black Disc Clarity	>1.6 m	contact recreation, community water supply
Nitrate	<3.5 $g.m^{-3}$	life supporting capacity, mauri, fisheries
Total Ammoniacal N	0.9 $g.m^{-3}$	life supporting capacity, mauri, fisheries
Unionised ammonia N	0.25 $g.m^{-3}$	life supporting capacity, mauri, fisheries

Whilst they are not yet operative, the draft limits and targets listed in Table 2 specify a maximum water temperature of 20 °C to meet fisheries requirements in the Patea River at Stratford.

It can be seen from Figure 1 that the Stratford Wastewater Treatment Plant (SWWTP) Discharge may exceed 20 °C but Patea River samples have all been less than 20 °C during the monitoring period.

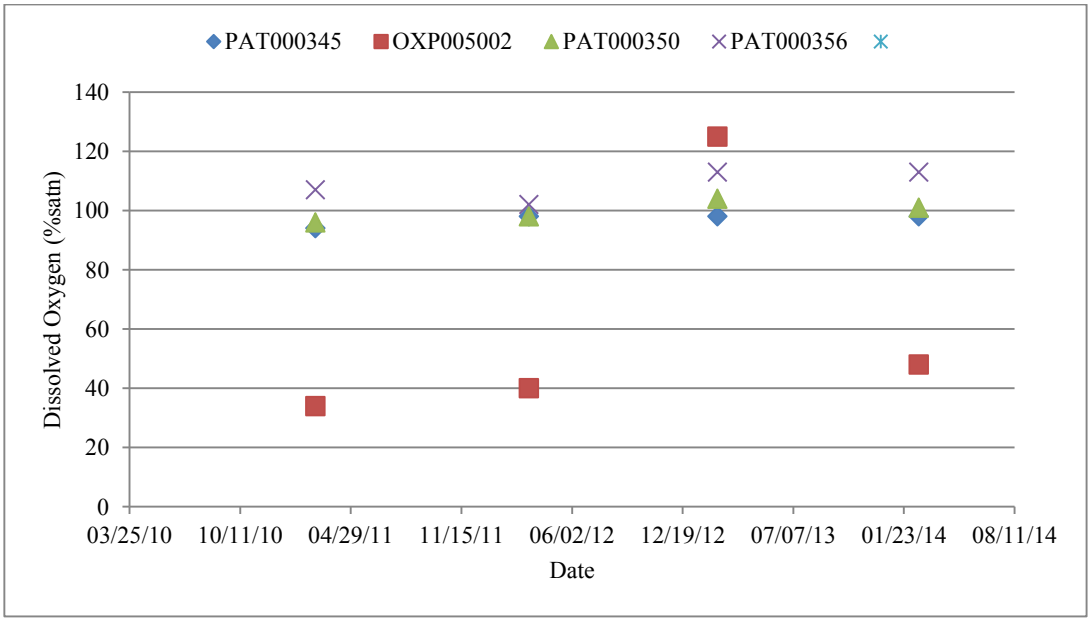
Figure 1: Water Temperature data provided in the last four annual monitoring reports by the Taranaki Regional Council for Resource Consent 0196-4.



Bottom line limits for dissolved oxygen in the receiving waters for the SWWTP are included in both the National Policy Statement for Freshwater Management (> 4-5 mg/l) and in Table 2.

Whist these targets are not always met in the discharge from the SWWTP, the more stringent standard of 80% saturation of dissolved oxygen proposed by the Council (see Table 2) has been met in all river samples during the monitoring period (see Figure 2).

Figure 2: Dissolved Oxygen data provided in the last four annual monitoring reports by the Taranaki Regional Council for Resource Consent 0196-4.



Condition 11 of Consent 0196-4 states filtered carbonaceous BOD_5 must be <2.0 $g.m^{-3}$ downstream of the SWWTP discharge in the Patea River. Reference to Figure 3 shows that whilst this concentration has been exceeded in the discharge from the SWWTP, all river samples have complied with this condition during the monitoring period.

Monitoring data for Total Phosphorus and Dissolved Reactive Phosphorus are summarised in Figures 4 and 5.

Figure 3: Filtered $cBOD_5$ data provided in the last four annual monitoring reports by the Taranaki Regional Council for Resource Consent 0196-4.

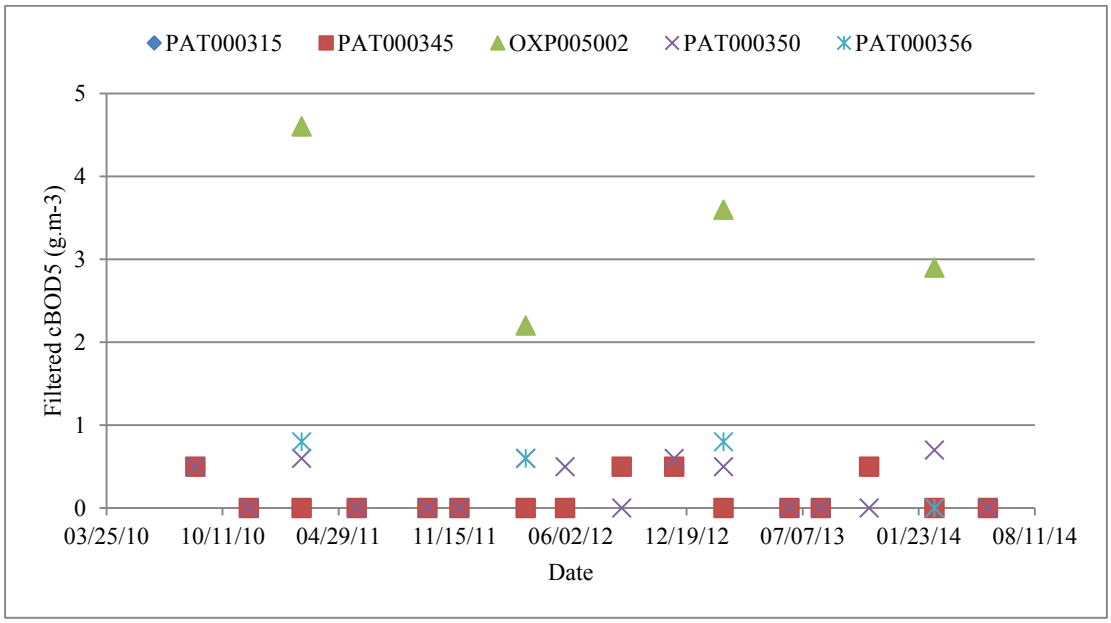


Figure 4: Total Phosphorus data provided in the last four annual monitoring reports by the Taranaki Regional Council for Resource Consent 0196-4.

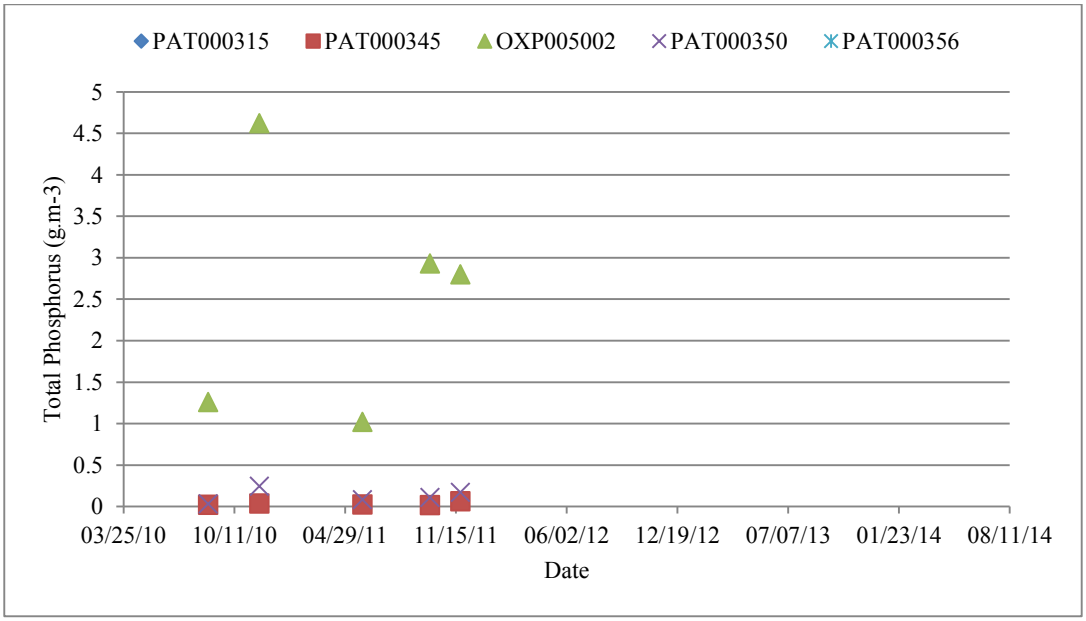
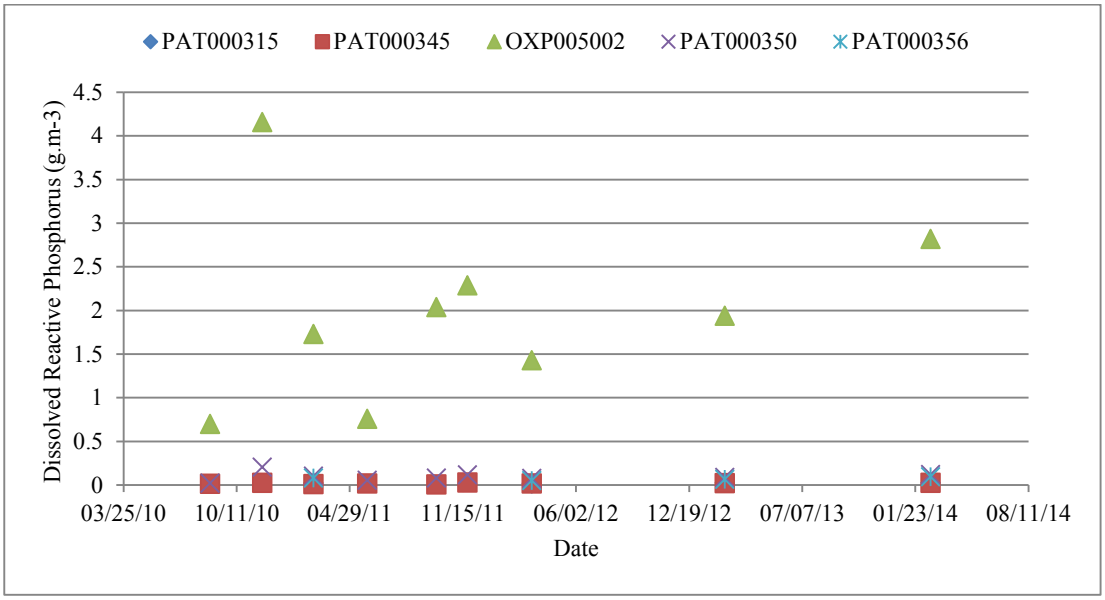


Figure 5: Dissolved Reactive Phosphorus data provided in the last four annual monitoring reports by the Taranaki Regional Council for Resource Consent 0196-4.



No national bottom line limits are specified for these nutrients (TP and DRP) and the Taranaki Regional Council is not proposing to do so at this stage (see Table 2). However, given the periphyton limits proposed in the National Policy Statement for Freshwater Management and by the Regional Council in Table 2 are related to soluble reactive P (equivalent to dissolved reactive P concentrations), Council may wish to revisit this matter.

The National Policy Statement for Freshwater Management has prescribed a national bottom line for ammonia in rivers (1.3 to 2.2 $g.m^{-3}$) and the Taranaki Regional Council is considering regional limits for both ammonia (0.9 $g.m^{-3}$) and un-ionised ammoniacal nitrogen (0.25 $g.m^{-3}$) in river waters.

None of these proposed limits for ammonia in river water have been exceeded in the vicinity of SWWTP discharge to the Patea River during this monitoring period (see Figures 6 and 7).

However these proposed concentrations were regularly exceeded in the SWWTP discharge.

Figure 6: Ammonia N data provided in the last four annual monitoring reports by the Taranaki Regional Council for Resource Consent 0196-4.

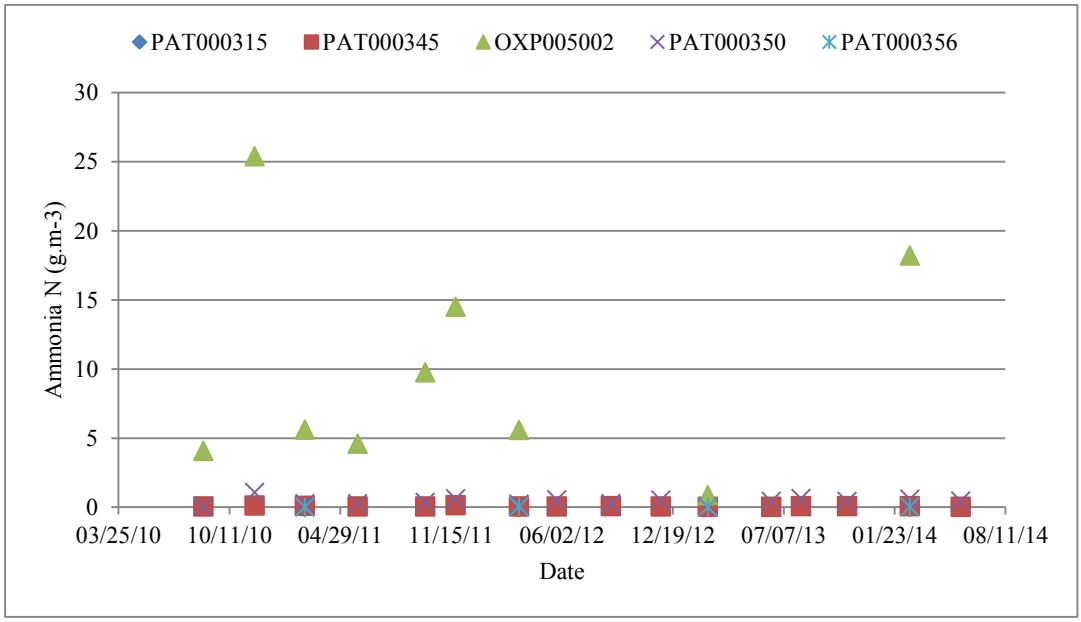
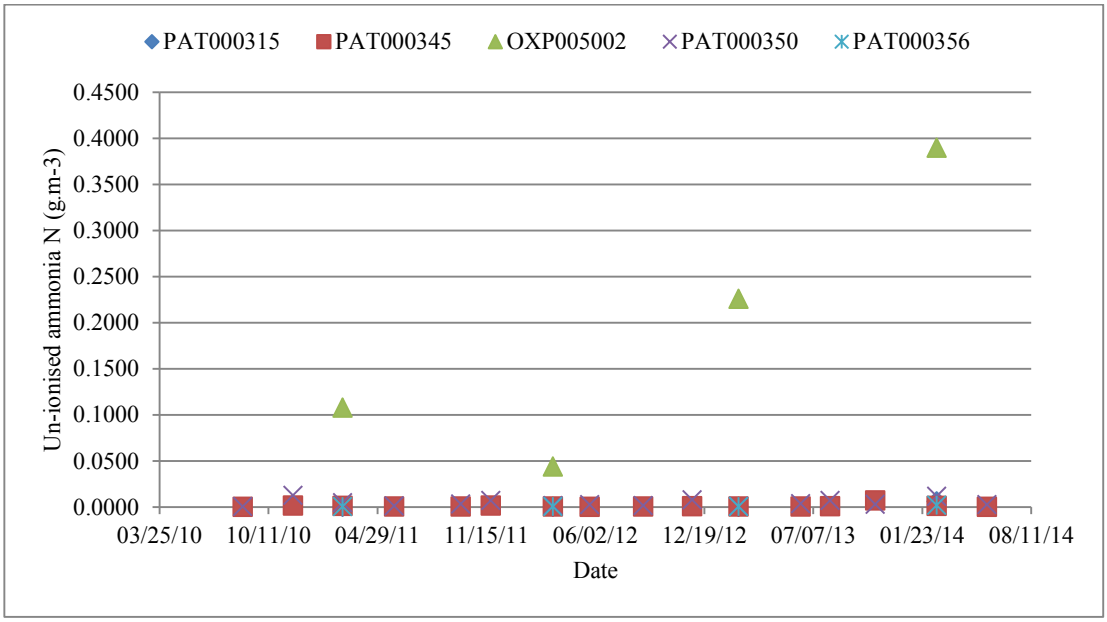
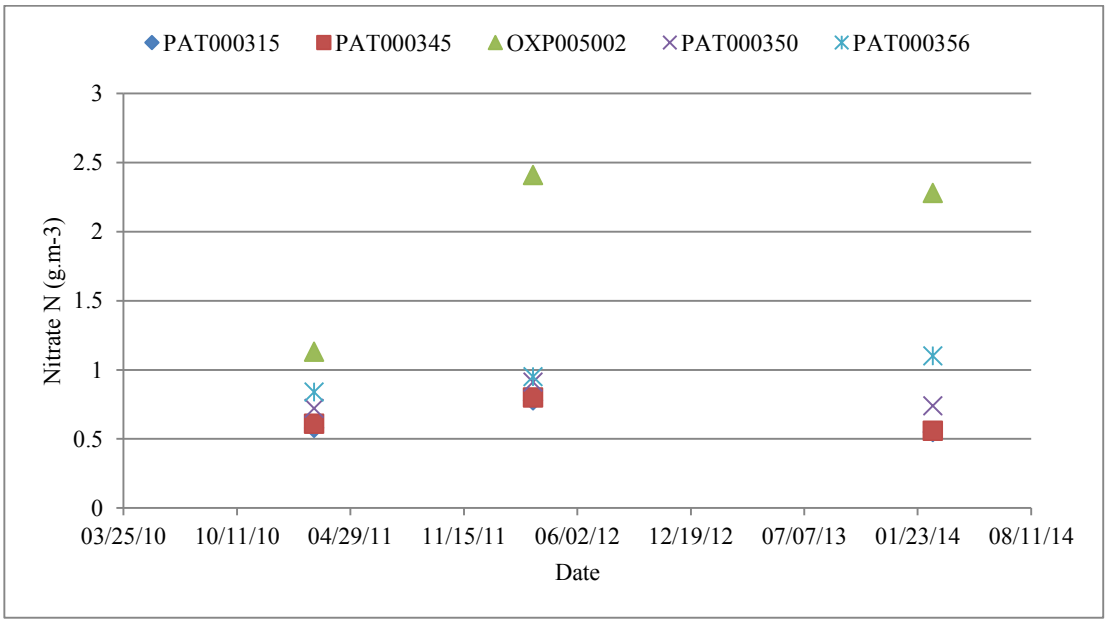


Figure 7: Un-ionised Ammoniacal N data provided in the last four annual monitoring reports by the Taranaki Regional Council for Resource Consent 0196-4.



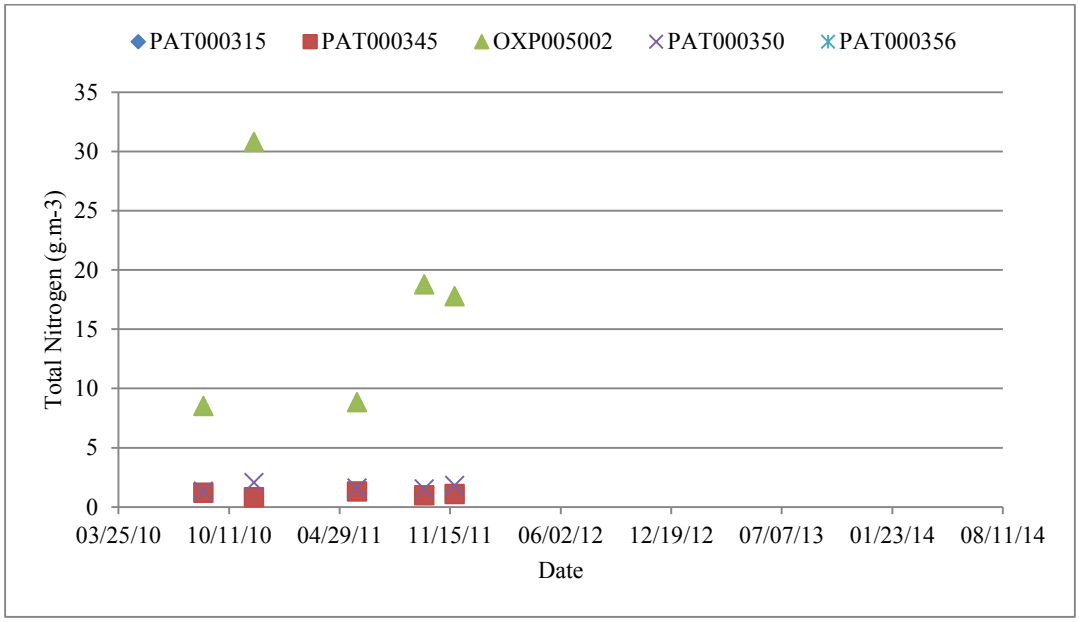
In the case of nitrate nitrogen concentrations in river water, the national bottom line is < 6.9 $g.m^{-3}$ whereas the Taranaki Regional Council is proposing a more stringent limit of <3.5 $g.m^{-3}$ (see Table 2). Reference to Figure 8 shows the more conservative standard proposed by the Regional Council was complied with in Patea River water throughout this monitoring period.

Figure 8: Nitrate N data provided in the last four annual monitoring reports by the Taranaki Regional Council for Resource Consent 0196-4.



Again, no national bottom line limit is specified for total nitrogen concentrations in river water (see Figure 9) and neither is the Taranaki Regional Council proposing to do so at this stage (see Table 2). This appears to be reasonable as it is soluble inorganic N (equivalent to dissolved inorganic N) concentrations that have been associated with nuisance growths of periphyton (Matheson et. al, 2012).

Figure 9: Total Nitrogen data provided in the last four annual monitoring reports by the Taranaki Regional Council for Resource Consent 0196-4.

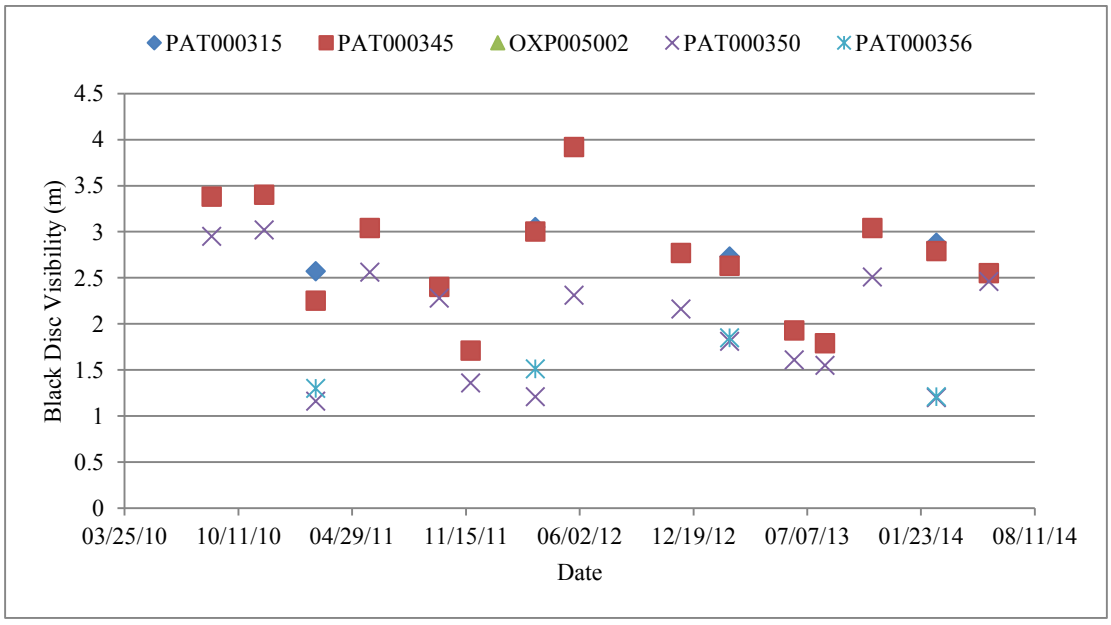


Black disc visibility data for the monitoring period is summarised in Figure 10. The Taranaki Regional Council is proposing a limit of >1.6 m for water clarity in rivers (see Table 1) but this proposed standard has been compromised at sampling sites downstream of the SWWTP discharge during this monitoring period.

Reference to the last four years monitoring data (Taranaki Regional Council 2011, 2012, 2013 and 2014A) provides observation data on water clarity / colour that suggests water colour and clarity in the Patea River may at times be compromised by the SWWTP discharge (compare and contrast water clarity and colour in the Patea River at Sampling Sites PAT000345 and PAT 000350 (Taranaki Regional Council, 2011, 2012, 2013 and 2014).

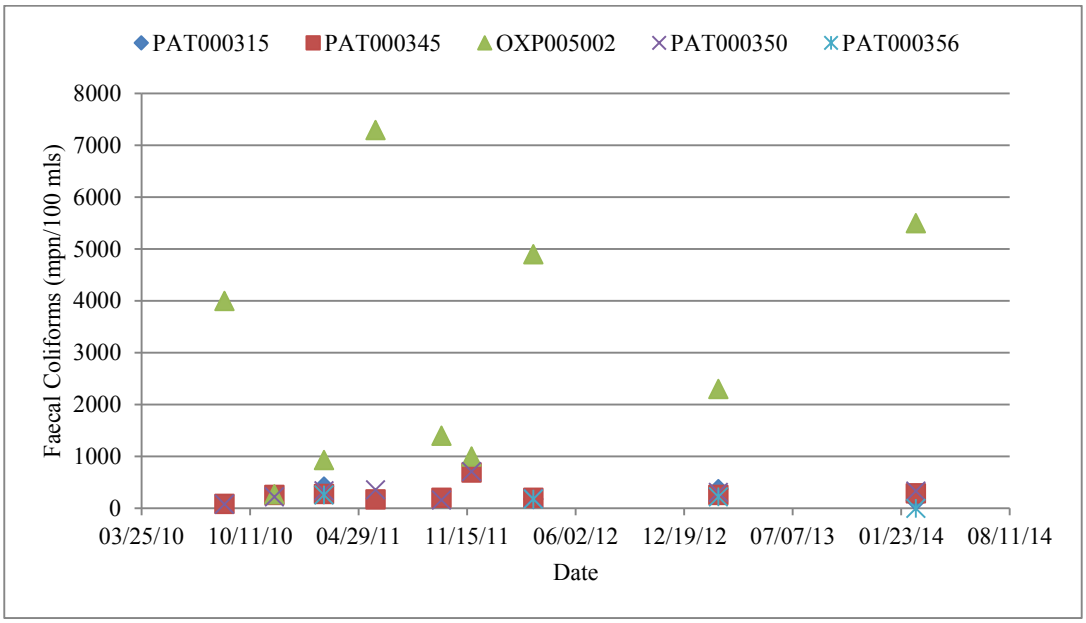
Interestingly, the National Policy Statement for Freshwater Management has, and the Taranaki Regional Council propose, concentration limits for *E. coli* in river water but the monitoring programme continues to describe faecal coliform bacteria (see Figure 11).

Figure 10: Black Disc Visibility data provided in the last four annual monitoring reports by the Taranaki Regional Council for Resource Consent 0196-4.



River water during the monitoring period complied with faecal coliform concentrations of <1000 cfu per 100 millilitres.

Figure 11: Faecal Coliform data provided in the last four annual monitoring reports by the Taranaki Regional Council for Resource Consent 0196-4.



3. Macroinvertebrate Monitoring Data

Sampling Sites at which macroinvertebrates were monitored are summarised in Table 3.

Table 3: Location of Invertebrate Sampling Sites

Site No	Site code	GPS reference	Location
1	PAT 000315	E1711801 N5644382	Swansea Road bridge (upstream of landfill and oxidation ponds' discharge)
2	PAT 000330	E1712403 N5644580	Upstream of WWTP discharge (and downstream of landfall)
3a	PAT 000350	E1712956 N5644292	Approximately 130 m downstream of the WWTP new outfall
4	PAT 000356	E1714497 N5645112	Approximately 1 km upstream of the Kahouri Stream confluence

Reference to Figure 12 suggests that taxa richness varied in the relatively narrow range of 17 to 30 and there was no consistent pattern of taxa richness upstream and downstream of the SWWTP discharge.

Similarly, Macroinvertebrate Community Index estimates upstream and downstream of the SWWTP discharge (see Figure 13) also suggested a relatively benign effect of the SWWTP discharge on instream community structure.

However, a mentioned previously (Coffey, 2011), there is no replication of samples for the invertebrate surveys and hence there is no indication of the statistical significance of the differences in the metrics of macroinvertebrate community structure that are described at the four sampling sites.

Figure 12: Macroinvertebrate Taxa Richness data provided in the last four annual monitoring reports by the Taranaki Regional Council for Consent 0196-4.

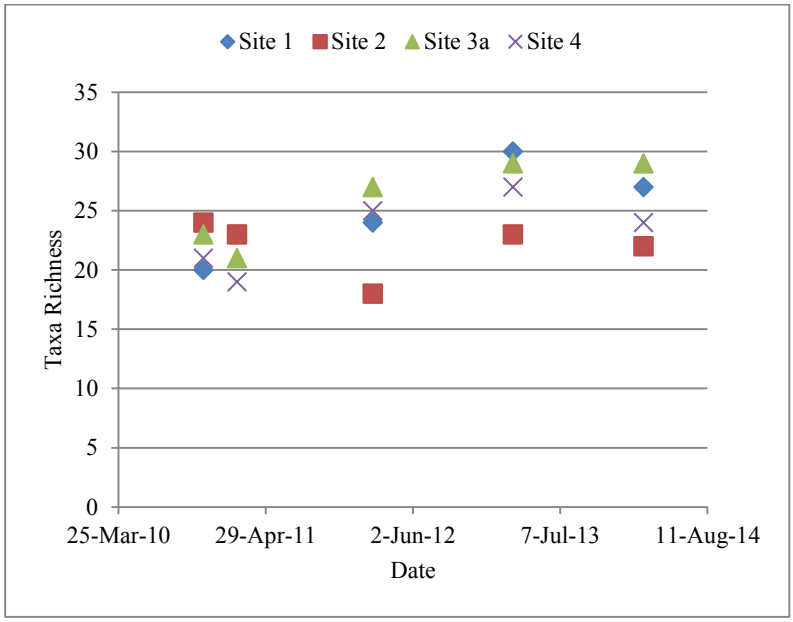
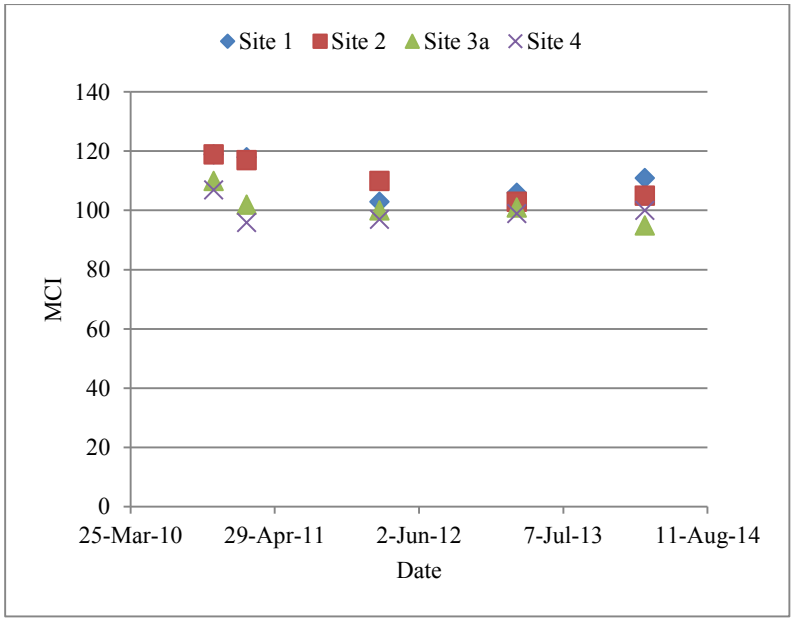


Figure 13: Macroinvertebrate Community Index data provided in the last four annual monitoring reports by the Taranaki Regional Council for Resource Consent 0196-



4. Periphyton Monitoring Data

Sampling Sites at which periphyton was monitored are summarised in Table 4.

There has been significantly more periphyton present in the Patea River downstream of the Stratford WWTP outfall relative to the two upstream control sites for the period of record (Taranaki Regional Council, 2013, 2014A and 2014B).

Long filamentous algae exceeded the nuisance threshold of 30% cover during the summer of 2014 downstream, but not upstream, of the Stratford WWTP outfall in the Patea River.

Chlorophyll levels are higher downstream of discharge and it is possible some algal solids (TSS) from the ponds are settling out in the periphyton community. However, it is not possible to verify this from the report provided.

Table 4: Location of periphyton monitoring sites along the Patea River

Site code	Easting	Northing	Location
PAT000200	7702620	5646598	Upstream site on the Patea River at Barclay Road.
PAT000345	1712748	5644549	250m d/s Stratford oxidation ponds (original) discharge (i.e. u/s of new outfall)
PAT000350	1712956	5644292	130m d/s of 'new' WWTP outfall at Victoria Street, Stratford
PAT000356	77L4497	5645112	1 km u/s of Kahouri confluence (u/s SPL discharge).
PAT000360	171.591.9	5644681.	Downstream site on the Patea River at Skinner Road.

4. Target effluent quality and upgrade requirements

The relatively minor effects of the SWWTP discharge on instream macroinvertebrate community structure in the Patea River are likely to be associated with increased growths of periphyton downstream, relative to upstream, of the treatment plant.

This suggests that contaminants from the SWWTP are generally not toxic to aquatic life after reasonable dilution with river water and this is supported by dissolved oxygen concentrations, nitrate nitrogen concentrations, ammonia concentrations and $cBOD_5$ concentrations all being within guideline values during the monitoring period.

It is recommended that the Taranaki Regional Council consider including plant nutrient limits (for both nitrogen and phosphorus) in its proposed plans (see Table 2) to reduce nuisance growths of instream periphyton in the Patea River downstream of the SWWTP discharge.

Nutrient discharges from the SWWTP are also of importance in terms of managing the trophic status of Lake Rotorangi and the estuarine environs at the mouth of the Patea River.

However, it is recognised that periphyton growth /biomass is not simply a result of nutrient concentrations in river water. The magnitude and nature of instream plant growth is controlled by a number of physicochemical and biological factors including light and nutrient availability, flow and substrate characteristics, temperature, the availability of nuisance colonist species, and herbivory (Matheson et. al., 2012).

Regional Councils are currently charged with defining the appropriate instream plant abundances and defensible dissolved nutrient (N & P) concentrations as water quality standards for a broad range of river types and hydrological regimes under the National Policy Statement for Freshwater Management.

Matheson et. al. (2012) have highlighted that the relationship between nuisance plant abundance and nutrient concentrations in rivers is complex due to:

- feed-backs between nutrients and plant biomass/growth (i.e., instream plants need nutrients to grow but this growth reduces ambient the nutrient concentrations in the water column, so that nutrient/biomass relationships are not straight-forward)
- the limiting nutrient (nitrogen (N) vs. phosphorus (P)) differing among streams, depending on whether the other is available at saturating levels (but note that the form of nutrient limitation can vary spatially and temporally within a river system and that is usually wise to manage both N and P (Wilcock et al. 2007)
- the wide range of potential nuisance plant species that differ in nutrient requirements and other environmental optima
- other river environmental characteristics that influence plant growth (light reaching the streambed, flow variability, temperature, substrate type, invertebrate grazing)
- availability of invasive macrophyte propagule and colony forming algal material

- human values (e.g., biodiversity, aesthetics, flow conveyance) potentially differing in their nuisance abundance thresholds.

Ministry for the Environment (1992) nutrient guidelines indicate "the limited available data indicate that the concentration of dissolved reactive phosphorus needs to be below approximately 15-30 mg.m^{-3} or the concentration of dissolved inorganic nitrogen (DIN=NO_3 - N+NH_4-N) needs to be below approximately 40-100 mg.m^{-3} for nutrients to have any significant effect on periphyton biomass in flowing waters. If either nutrient occurs at lower concentrations, periphyton biomass yield is expected to decline. However, a blanket imposition of nutrient limits to prevent undesirable periphyton growth is not recommended, because a number of other factors have strong influences and should be considered on a site-specific basis."

In 2000, the Ministry for the Environment released the New Zealand Periphyton Guidelines (Biggs, 2000) "to help prevent degradation of aesthetic/recreational, biodiversity and angling values by excessive enrichment of streams (and resultant proliferations of periphyton)."

The biomass and cover guidelines for periphyton growing in gravel/cobble bed streams for three main instream values are as follows (Biggs, 2000).

Instream value/variable	Diatoms/cyanobacteria	Filamentous algae
Aesthetics/recreation		
(1 November to 30 April)		
Maximum cover of visible stream bed	60% >0.3 cm thick	30% >2cm long
Maximum AFDM (g.m^{-2})	N/A	35
Maximum chl a (mg.m^{-2})	N/A	120
Benthic biodiversity		
Mean monthly chl a (mg.m^{-2})	15	15
Maximum chl a (mg.m^{-2})	50	50
Trout habitat and angling		
Maximum cover of whole stream bed	N/A	30% >2cm long
Maximum AFDM (g.m^{-2})	35	35
Maximum chl a (mg.m^{-2})	200	120

"The percentage cover values apply to the part of the bed that can be seen from the bank during summer low flows (usually <0.75 m deep) or walked on. The biomass guidelines are expressed in terms of biomass per unit of exposed substrate (i.e., tops and sides of stones) averaged across the full width of the stream or river in a reach. A reach is defined as a relatively homogeneous section of stream channel. Most commonly this will be a run, but this should be clearly specified in setting consent conditions."

The nutrient guidelines (mean monthly concentrations over a year) to ensure that peak periphyton biomass does not exceed the biomass guidelines are as follow (Matheson et. al., 2012):

Study	Chl a = 50 mg.m^{-2}		AFDM = 35 g.m^{-2} Chl a = 120 mg.m^{-2} (filamentous) Chl a = 200 mg.m^{-2} (diatom)	
Days of accrual	SIN mg m	SRP mg m	SIN mg.m^{-3}	SRP mg.m^{-3}
20	<20	<1	<295	<26
30	<10	<1	<75	<6
40	<10	<1	<34	<2.8
50	<10	<1	<19	<1.7
75	<10	<1	<10	<1
100	<10	<1	<10	<1

SIN=soluble inorganic N (equivalent to dissolved inorganic N).
SRP=soluble reactive P (equivalent to dissolved reactive P).

"In using the soluble nutrient guidelines for developing consent conditions, it is important to recognise that the specific nutrient limiting periphyton growth needs to be identified and consent conditions set in terms of that single nutrient. It is usually unnecessary to specify conditions in terms of both nitrogen and phosphorus. One of these nutrients will generally be in surplus and therefore at much higher concentrations than the guideline shown in the above table. Also, it is important that the background soluble nutrient concentrations coming into the reach of interest are evaluated thoroughly. This will usually involve monthly sampling for a year to characterise temporal dynamics and get an estimate of the mean concentrations. This will provide the basis for nutrient supply calculations associated with any discharges in relation to the instream management objective and associated guideline biomass (Matheson et. al, 2012).

Default trigger values for physical and chemical stressors in New Zealand for slightly disturbed ecosystems to assess risk of adverse effects due to nutrients, biodegradable organic matter and pH in various ecosystem types (ANZECC, 2000) are as follow where Chl a = chlorophyll a, TP = total phosphorus, FRP = filterable reactive phosphate (d), TN = total nitrogen, NOx = oxides of nitrogen, NH_4 = ammoniacal nitrogen, DO = dissolved oxygen.

Ecosystem Type	Chl a	TP	DRP	TN	NOx	NH_4	DO(e) (%satn)		pH(e)	
	$\mu g.L^{-1}$	$\mu g.L^{-1}$	$\mu g.L^{-1}$	$\mu g.L^{-1}$	$\mu g.L^{-1}$	$\mu g.L^{-1}$	Lower limit	Upper limit	Lower limit	Upper limit
Upland River	na(a)	26(b)	9(b)	295(b)	167(b)	10ba)	99	103	7.3	8.0
Lowland River	No data	33(c)	10(c)	614(c)	444(c)	21(c)	98	105	7.2	7.8

na = not applicable

a = monitoring of periphyton and not phytoplankton biomass is recommended in upland rivers — values for periphyton biomass (mg Chl $a.m^{-2}$) to be developed. New Zealand is currently making routine observations of periphyton cover.

b = values for glacial and lake-fed sites in upland rivers are lower;

c = values are lower for Haast River which receives waters from alpine regions;

d = commonly referred to as dissolved reactive phosphorus in New Zealand;

e = DO and pH percentiles may not be very useful as trigger values because of diurnal and seasonal variation — values listed are for daytime sampling.

However, Willcock et.al. (2007) contend:

- Both N and P need to be managed because of the interconnectivity of waterways (where different nutrients might be limiting in the same stream network).

- Periphyton growth and vigour is determined by antecedent water quality. This affects periphyton recovery from major disturbance events (floods). Lengthy exposure to high concentrations of nutrients is likely to give rise to a vigorous growth of periphyton that will respond more quickly than if it had grown in low-nutrient waters. For this reason, year-round control of both N and P is important.

- The most rigorous method for assessing periphyton response to nutrients is to conduct nutrient diffusing substrate (NOS) assays, but the soluble N:P ratio offers a useful tool for exploring the potential for one nutrient to be identified as limiting growth and to predict the likelihood of periphyton blooms.

- Other means for assessing the risk of periphyton blooms include: ratios of PC/PN (or %PN) and PC/PP (or %PP) of algal biomass, but care needs to be taken to avoid confounding results caused by entrained particulate material within the periphyton matrix biasing the PN/PC and PIC ratios. Bioassays can also be used to investigate nutrient limitation and are generally considered the "gold standard" against which other methods are assessed.

- It is important to carry out N:P calculations or NDS methods down a catchment with sites selected in relation to inflows, land use and point sources. If these are not known about 3-4 sites should be selected.

- As a general rule, a reduction in concentration of a given limiting nutrient will reduce periphyton biomass. There are few reported observations of this happening for diffuse source inputs of nutrients but there is supporting literature where point source inputs have been reduced.

- Applying controls only to the "limiting" nutrient (and not the other nutrient) is not recommended. Nutrient limitation for unwanted algae growth may vary spatially (e.g. estuaries versus upland rivers) and temporally (i.e., seasonally). Where there is a key indication of a single limiting nutrient (e.g. P), it would be sensible to focus on managing that nutrient without neglecting controls on the other macronutrient (e.g. N).

On this basis, it appears reasonable to suggest that the discharge from the SWWTP does not result in soluble inorganic N (equivalent to dissolved inorganic N) concentrations in river water exceeding.0.2 $g.m^{-3}$ or soluble reactive P (equivalent to dissolved reactive P) concentrations exceeding 0.01 grams per cubic metre.

These thresholds are currently exceeded in Patea River water upstream of the SWWTP discharge and the degree of exceedance is substantially increased downstream of the SWWTP discharge to the Patea River (see Table 5 of Taranaki Regional Council 2014A).

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APPENDIX 2 COST ESTIMATES

DAF COST SHEET

STRATFORD WASTEWATER TREATMENT PLANT

DATE: 22 February 2015

HG PROJECT NUMBER: 1014-137311-01

ITEM	DESCRIPTION	SIZE	QTY	RATE	AMOUNT
1.0	PRELIMINARY AND GENERAL				$ 103 000
2.0	FEED PUMPS				$ 45 000
3.0	DAF INSTALLATION				$ 696 000
4.0	CHEMICALS				$ 45 000
5.0	ELECTRICAL, INSTRUMENTATION AND CONTROL				$ 220 000
6.0	MISCELLANEOUS				$ 25 000
	TOTAL WORKS COST				$1,133,900
	NON-WORKS COSTS				$ 170 000
	TOTAL – WORKS plus NON-WORKS COSTS				$ 1 303 900
	CONTINGENCY		20%	on works cost	$ 227 000
	TOTAL ESTIMATED CAPITAL COST (-5%/+30%)				$ 1 531 000
	ESTIMATED OPERATING COST (-5%/+30%)				$ 116 000
	TOTAL ESTIMATED NET PRESENT VALUE (-5%/+30%)				$ 3 960 000

N:\1014\137311_01\400 Tech\430 Cost Schedules\[Costs.xlsx]DAF

ACTIFLO COST SHEET

STRATFORD WASTEWATER TREATMENT PLANT

DATE: 22 February 2015

HG PROJECT NUMBER: 1014-137311-01

ITEM	DESCRIPTION	SIZE	QTY	RATE	AMOUNT
1.0	PRELIMINARY AND GENERAL				$ 118 000
2.0	FEED PUMPS				$ 45 000
3.0	ACTIFLO				$ 864 000
4.0	CHEMICALS				$ 45 000
5.0	ELECTRICAL, INSTRUMENTATION AND CONTROL				$ 205 000
6.0	MISCELLANEOUS				$ 25 000
	TOTAL WORKS COST				$1,302,000
	NON-WORKS COSTS				$ 195 000
	TOTAL – WORKS plus NON-WORKS COSTS				$ 1 497 000
	CONTINGENCY		20%	on works cost	$ 260 000
	TOTAL ESTIMATED CAPITAL COST (-5%/+30%)				$ 1 757 000
	ESTIMATED OPERATING COST (-5%/+30%)				$ 128 000
	TOTAL ESTIMATED NET PRESENT VALUE (-5%/+30%)				$ 4 540 000

N:\1014\137311_01\400 Tech\430 Cost Schedules\[Costs.xlsx]ACTIFLO

IN POND DOSING COST SHEET

STRATFORD WASTEWATER TREATMENT PLANT

DATE: 22 February 2015

HG PROJECT NUMBER: 1014-137311-01

ITEM	DESCRIPTION	SIZE	QTY	RATE	AMOUNT
1.0	PRELIMINARY AND GENERAL				$ 26 000
2.0	CHEMICAL PLANT				$ 132 000
3.0	ELECTRICAL, INSTRUMENTATION AND CONTROL				$ 103 000
4.0	MISCELLNEOUS				$ 25 000
	TOTAL WORKS COST				$285,800
	NON-WORKS COSTS				$ 65 000
	TOTAL – WORKS plus NON-WORKS COSTS				$ 350 800
	CONTINGENCY		20%	on works cost	$ 57 000
	TOTAL ESTIMATED CAPITAL COST (-5%/+30%)				$ 408 000
	ESTIMATED OPERATING COST (-5%/+30%)				$ 39 000
	TOTAL ESTIMATED NET PRESENT VALUE (-5%/+30%)				$ 1 107 000

N:\1014\137311_01\400 Tech\430 Cost Schedules\[Costs.xlsx]IN POND DOSING

IN POND MEDIA COST SHEET

STRATFORD WASTEWATER TREATMENT PLANT

DATE: 22 February 2015

HG PROJECT NUMBER: 1014-137311-01

ITEM	DESCRIPTION	SIZE	QTY	RATE	AMOUNT
1.0	PRELIMINARY AND GENERAL				$ 17 000
2.0	IN POND MEDIA				$ 1 029 000
3.0	ELECTRICAL, INSTRUMENTATION AND CONTROL				$ 145 000
4.0	MISCELLNEOUS				$ 25 000
	TOTAL WORKS COST				$1,216,000
	NON-WORKS COSTS			15%	$ 182 000
	TOTAL – WORKS plus NON-WORKS COSTS				$ 1 398 000
	CONTINGENCY		20%	on works cost	$ 243 000
	TOTAL ESTIMATED CAPITAL COST (-5%/+30%)				$ 1 641 000
	ESTIMATED OPERATING COST (-5%/+30%)				$ 89 000
	TOTAL ESTIMATED NET PRESENT VALUE (-5%/+30%)				$ 3 888 000

N:\1014\137311_01\400 Tech\430 Cost Schedules\[Costs.xlsx]IN POND MEDIA

DRUM FILTER COST SHEET

STRATFORD WASTEWATER TREATMENT PLANT

DATE: 22 February 2015

HG PROJECT NUMBER: 1014-137311-01

ITEM	DESCRIPTION	SIZE	QTY	RATE	AMOUNT
1.0	PRELIMINARY AND GENERAL				$ 36 000
2.0	FEED PUMPS				$ 40 000
3.0	DRUM FILTER				$ 197 000
4.0	ELECTRICAL, INSTRUMENTATION AND CONTROL				$ 95 000
5.0	MISCELLNEOUS				$ 25 000
	TOTAL WORKS COST				$393,100
	NON-WORKS COSTS				$ 59 000
	TOTAL – WORKS plus NON-WORKS COSTS				$ 452 100
	CONTINGENCY		20%	on works cost	$ 79 000
	TOTAL ESTIMATED CAPITAL COST (-5%/+30%)				$ 531 000

	ESTIMATED OPERATING COST (-5%/+30%)	$ 42 000

	TOTAL ESTIMATED NET PRESENT VALUE (-5%/+30%)	$ 1 347 000

N:\1014\137311_01\400 Tech\430 Cost Schedules\[Costs.xlsx]TERTIARY FILTER

ULTRAFILTRATION COST SHEET

STRATFORD WASTEWATER TREATMENT PLANT

DATE: 22 February 2015

HG PROJECT NUMBER: 1014-137311-01

ITEM	DESCRIPTION	SIZE	QTY	RATE	AMOUNT
1.0	PRELIMINARY AND GENERAL				$ 199 000
2.0	FEED PUMPS				$ 30 000
3.0	ULTRAFILTRATION				$ 1 820 000
4.0	CHEMICALS				$ 30 000
5.0	SLUDGE TREATMENT				$ 39 000
6.0	ELECTRICAL, INSTRUMENTATION AND CONTROL				$ 50 000
7.0	MISCELLNEOUS				$ 25 000
	TOTAL WORKS COST				$2,192,600
	NON-WORKS COSTS				$ 329 000
	TOTAL – WORKS plus NON-WORKS COSTS				$ 2 521 600
	CONTINGENCY		20%	on works cost	$ 439 000
	TOTAL ESTIMATED CAPITAL COST (-5%/+30%)				$ 2 961 000
	ESTIMATED OPERATING COST (-5%/+30%)				$ 109 000
	TOTAL ESTIMATED NET PRESENT VALUE (-5%/+30%)				$ 6 178 000

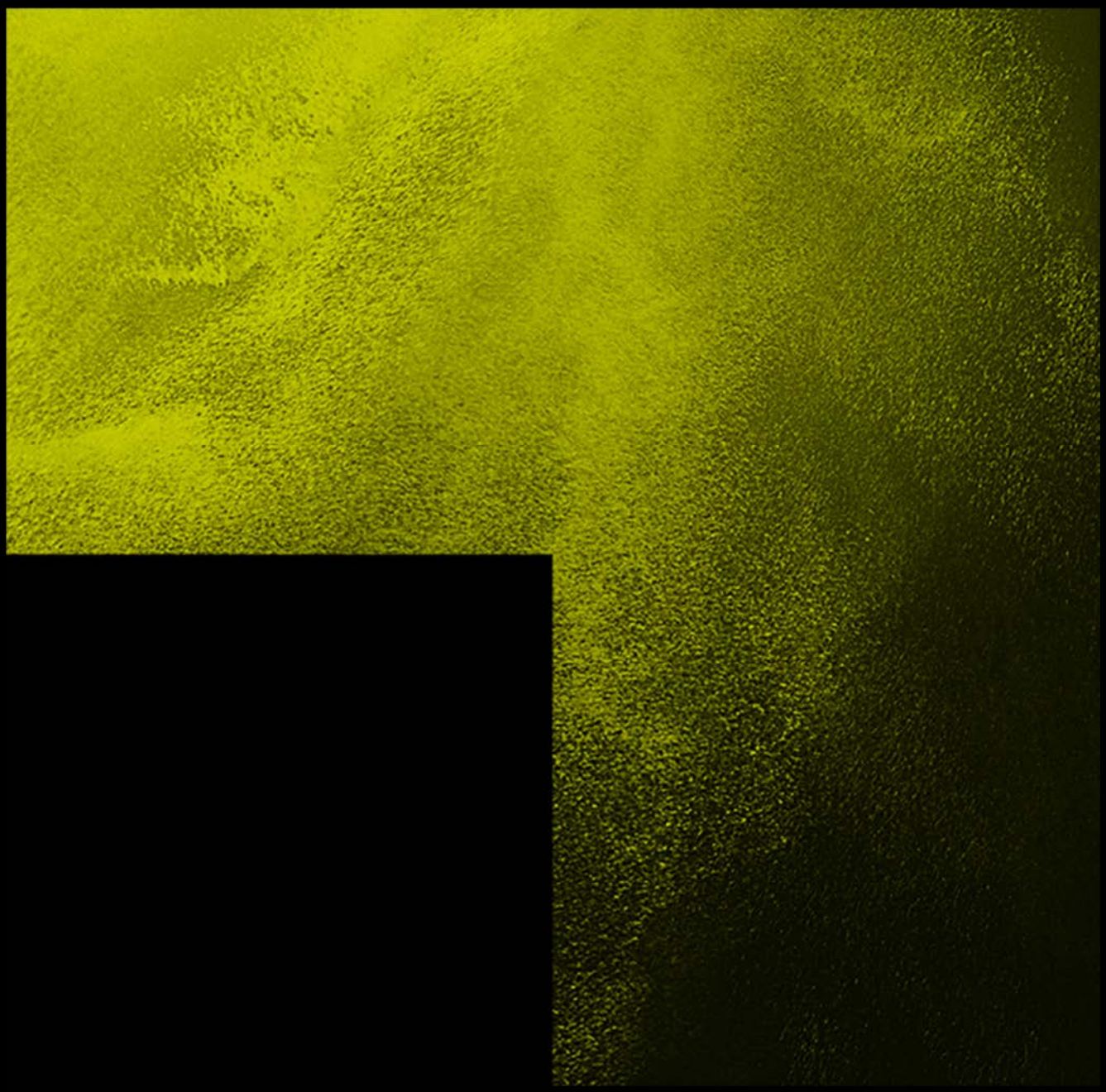
N:\1014\137311_01\400 Tech\430 Cost Schedules\[Costs.xlsx]ULTRAFILTRATION

APPENDIX 4
STRATFORD WASTEWATER TREATMENT PLANT ISSUES AND OPTIONS REPORT

STRATFORD WWTP

Issues and Options

Stratford District Council



DOCUMENT CONTROL RECORD

CLIENT	Stratford District Council
PROJECT	Stratford WwTP
HG PROJECT NO.	1014-137311-01
HG DOCUMENT NO.	R001v4
DOCUMENT	Issues and Options

ISSUE AND REVISION RECORD

DATE OF ISSUE	October 2015
STATUS	Final
ORIGINATOR	Anita Simpson
REVIEWED	Ash Deshpande
APPROVED FOR ISSUE	Ash Deshpande
OFFICE OF ORIGIN	Newmarket
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CONTENTS

APPENDICES

EXECUTIVE SUMMARY

This report presents an evaluation of the current plant performance, environmental effects and assessment of upgrade options.

ASSESSMENT OF PLANT PERFORMANCE

Overall the wastewater treatment plant performs to an acceptable level, and conforms to the existing consent.

ECOLOGICAL ASSESSMENT

The discharge from the wastewater treatment plant appears to be having an impact on the periphyton growth, and slight change in macroinvertebrate community downstream of the discharge point. To address this, any upgrades should target a reduction in either Total Nitrogen or Phosphorus. Upstream of the discharge nutrient levels in the Patea River are already above acceptable limits therefore upgrades to the WWTP alone, may not result in a measurable improvement.

PRIORITY OF IMPROVEMENTS

The preferred option is In Pond Chemical Dosing (Capex of $0.39 to $0.53 million) and In Pond Media (Capex of $1.6 to $2.1 million). This combined upgrade option will provide a marked reduction in total phosphorus and total nitrogen, has lower maintenance/operator requirements and utilises the existing infrastructure. However given the significant cost it is recommended that upgrades are staged with In Pond Chemical Dosing is undertaken as a Stage 1, followed by In Pond Media upgrade as Council budgets allow.

1.0 INTRODUCTION

The Stratford Wastewater Treatment Plant (WwTP) is located east of the Stratford township and is operated by Stratford District Council (SDC). Wastewater from the town is treated in twin oxidation ponds before it is discharged to the Patea River.

The current resource consent allows up to 4,800 m^3/d of treated wastewater to be discharged from the treatment plant. The consent expires on 1 June 2016. The resource consent contains special conditions pertaining to the maintenance, operation and monitoring of the plant.

This report has been prepared to meet condition 12 of the resource consent. As per the consent condition the following items will be discussed in the report:

1. The environmental effects of the discharge on the Patea River, including water quality, periphyton growth and aquatic biota;

2. Options available for further treatment of wastewater from Stratford, giving particular emphasis to the reduction of nutrients in the discharge; and

3. Detail the costs, expected levels of reduction in adverse effects, and practical implications of introducing each option to the Stratford wastewater treatment system.

1.2 BASIS OF ASSESSMENT

The following data was made available for the purposes of this report:

- Additional Effluent Quality Monitoring Data – October 2014 to February 2015
- Taranaki Regional Council, 2011: Stratford District Council Municipal oxidation ponds system Monitoring Programme Annual Report 2010-2011. Technical Report 2011-25.
- Taranaki Regional Council, 2012: Stratford District Council Municipal oxidation ponds system Monitoring Programme Annual Report 2011-2012. Technical Report 2012-26.
- Taranaki Regional Council, 2013: Stratford District Council Municipal oxidation ponds system Monitoring Programme Annual Report 2012-2013. Technical Report 2013-32.
- Taranaki Regional Council, 2014A: Stratford District Council Municipal oxidation ponds system Monitoring Programme Annual Report 2013-2014. Technical Report 2014-15.
- Taranaki Regional Council 2014B: Patea River Periphyton. Taranaki Regional Council Document 1354737, dated 28 May 2014.

In addition to these documents, information on plant operation and performance was gathered during a site visit (18 November 2014) with Council staff.

2.0
INFLUENT TO PLANT

2.1 POPULATION

The Stratford WwTP was commissioned in 1965 for a design population of 6,300 persons. The treatment plant serves approximately 2,481 connections. A tanker discharge system is in place for those properties with septic tanks.

The Stratford population is expected to remain relatively stable in future years. Population projections based on statistics New Zealand projections are presented in Table 1 below.

TABLE 1: STRATFORD POPULATION PROJECTIONS

YEAR	2014	2016	2021	2026	2031
Stratford District		9,191	9,180	9,130	9,020
Stratford Township*		5,520	5,520	5,490	5,420

*The Stratford township projected population has been calculated with the assumption that the rate of change of the town population will be the same as that used by Statistics New Zealand for the district

2.2 WASTEWATER FLOWS

The historical flow data from 27/10/2009 to 4/02/2013 has been analysed. This data is presented in Figure 1 below.

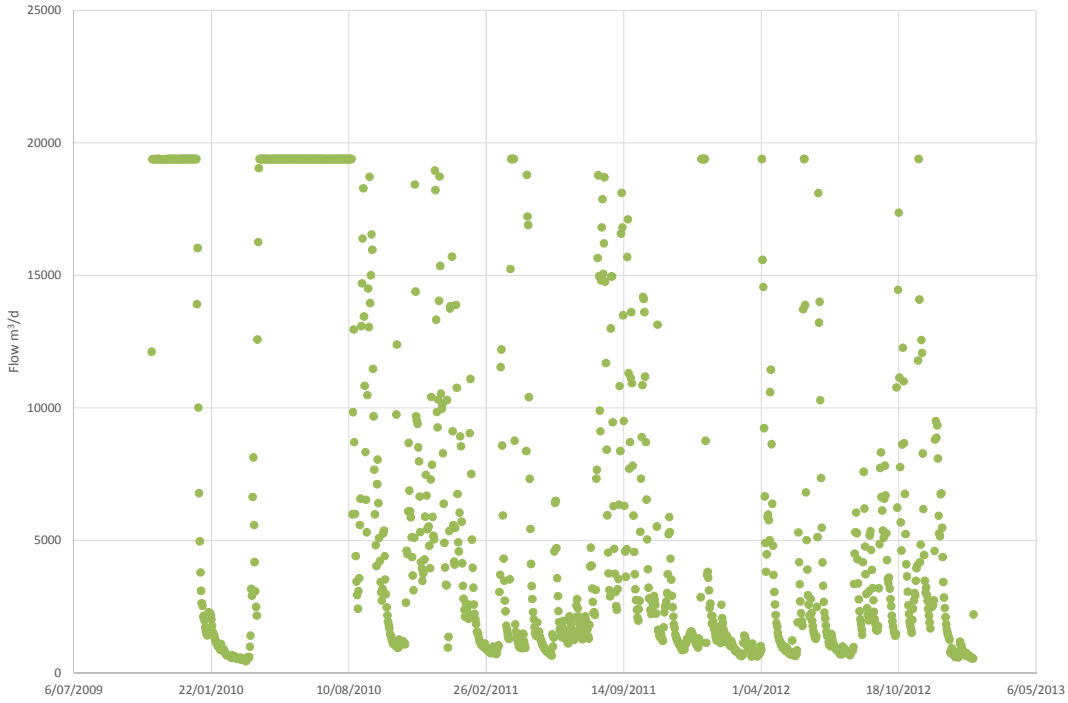

FIGURE 1: INFLUENT WASTEWATER FLOW.

As presented in Figure 1 the influent to the wastewater treatment plant varies significantly and is strongly influenced by inflow and infiltration. At the higher influent flows, currently a portion of the wastewater flow bypasses the flow meter, as the capacity of the flume is exceeded. Council are currently investigating options to remedy this, outside of the scope of this study.

Table 2 below summaries the data during this period. While the average and percentiles are influenced by the very high maximum flows, the median flows are in line with typical influent (i.e. not associated with storm events) for a township/population of this size.

TABLE 2: INFLUENT FLOW DATA 2009 TO 2013

	INFLUENT FLOW (m^3/d)
Minimum	430
Median	2,930
Average	6,675
75th Percentile	11,090
90th Percentile	19,390
Maximum	19,394

As the pond will provide buffering for the high storm flows, for the purposes of this evaluation, the median and 75th percentile have been used for design of additional equipment.

2.3 POLLUTANT LOADS

Currently Council don't analyse the influent to the wastewater treatment plant, and therefore to establish influent pollutant mass loads, these have been based on typical domestic wastewater characteristics. These influent pollutant loads are presented in Table 3 below.

TABLE 3: ESTIMATED AVERAGE INFLUENT LOADS TO THE WASTEWATER PLANT

	TYPICAL DOMESTIC LOADS (g/p/d)	ESTIMATED AVERAGE INFLUENT LOAD (kg/d)
Biological Oxygen Demand (BOD_5)	65	355
Total Suspended Solids (TSS)	70	380
Total Kjeldahl Nitrogen (TKN)	12	65
Total Phosphorus (TP)	3	16

The pollutant loads presented in Table 3 above are based on a connected population of 5,420 as presented in Table 1.

3.0 ASSESSMENT OF PROCESS PERFORMANCE

The Stratford WWTP comprises of an inlet screen, a primary facultative pond, secondary maturation pond and a rock filter with the final receiving environment being the Patea River. The twin ponds are were constructed in 1965 for a population of 6,300. The sizes of the two ponds are 2.6 ha and 1.7 ha respectively.

3.1 RETICULATION SYSTEM

The original reticulation system was built in 1965 with significant extensions between 1970 and 1980, and minor additions between 1981 and 1996. The majority of the flow to the treatment plant is gravity fed and all the flows within the treatment plant as well as the flow to the outlet are by gravity.

The reticulation has historically had problems with inflow and infiltration, which is reflected in the large variation in flow to the plant, as presented in Section 2.2 above.

3.2 INLET WORKS

The inlet works at the Stratford WWTP consist of the following: screen, flowmeter and splitter chamber.

3.2.1 INFLUENT STEP SCREEN

An influent step screen, was installed in 2009. The step screen captures both inorganic and organic solids. The installation of the inlet screen significantly reduced the amount of solids that were building up in the ponds. The solids accumulated on the step screen are conveyed to a sealed bin (to minimise odour emissions) via a screw press.

3.2.2 FLOW METER

A flume with a flow meter, was installed in 2000-2001. The upstream water level in the flume is measured with an ultrasonic level sensor. The data from the flume is sent back to the Stratford WWTP by telemetry.

As discussed in Section 2.2 above the flume capacity is exceeded during extremely high flow events as the influent bypasses the flume. Council is currently undertaking investigations to locate the influent flow meter in an alternative location, to ensure all influent flow is captured.

3.2.3 FLOW SPLITTER CHAMBER

An influent splitter chamber is located at the end of the main town trunk sewer. The chamber allows the incoming wastewater to be directed to either of the two oxidation ponds or to both simultaneously. The flow splitter is manually operated using a slide gate. Directing flow straight in to Pond 2 requires manual operation of the gate. This use is only intended for periods of high flows (due to storm water infiltration) when Pond 1 is at risk of overflowing.

3.3 POND 1

Pond 1 is a facultative oxidation pond covering an area of approximately 2.6 ha and having a depth of about 1.5 m. Pond 1 has two submerged inlets in the south western corner and a single screened outlet in the north eastern end. The outlet for Pond 1 is formed by a vertical manhole acting as a fixed weir, with a grating and a wooden walkway providing access from the shore.

The pond is mechanically aerated by four cage aerators of 5.5kW each, which all run constantly (apart from maintenance). The aerators were installed in June 2008.

3.3.1 HYDRAULIC AND ORGANIC LOAD

The hydraulic retention of the pond under median flow is approximately 11 days, this drops down to 1.8 days during the 95 percentile influent flow events.

Pond 1 is a facultative pond, which utilises algae and the atmosphere to provide oxygen for the organic degradation of wastewater. Aerobic stabilisation of BOD occurs in the upper oxygenated layer via aerobic bacteria in addition to mechanical aeration. The solids settle in the base of the pond, and are decomposed there by anaerobic bacteria.

Table 4 below presents the BOD treatment capacity of the oxidation pond and aerator system.

TABLE 4: POND 1 TREATMENT CAPACITY

PARAMETER	UNITS	WINTER	SUMMER
BOD Treatment Capacity (winter)	kg BOD_5/d	197[1]	426
	kg O_2/d	295	
Aerator Treatment Capacity	kg O_2/d	606	
TOTAL TREATMENT CAPACITY	**kg O_2/d**	**901**	

The current average oxygen requirements are 828 kgO_2/d, based on the assumed influent Total Kjeldahl Nitrogen and BOD_5 concentrations during average dry weather flow conditions. Therefore the existing system has sufficient capacity to cope with the influent loads.

3.4 POND 2

Pond 2 is a maturation pond of approximately 1.7 ha and is approximately 1.5 m deep. The water level in Pond 2 is approximately 1.6 m lower than Pond 1. In its normal configuration, Pond 2 is joined to Pond 1 through a transfer pipe located at the north western edge. Pond 2 has a single screen outlet at the south eastern edge. The outlet is formed by a concrete channel into the embankment with a vertical screen across the front. The screen is punched with 20 mm diameter holes.

Pond 2 is partitioned in to three cells and has a subsurface outlet to minimise the micro floral count in the treated effluent. The cell walls have contoured shallow spillways to alleviate topping.

Maturation ponds are commonly used on the end of oxidation ponds to provide disinfection. The maturation ponds rely on natural UV light to disinfect, as such these ponds require large exposed surface areas. As maturation ponds are a natural process and require little operation or control these can have varied performance due to a number of factors such as temperature, light intensity, plantings and predominant algae species.

3.4.1 PATHOGEN REMOVAL

Based on the typical pathogen levels for a population of Stratford's size and the retention time provided by each of the three cells, the faecal coliform concentration is expected to be in the order of 2,000 to 3,000cfu/100ml. This is equivalent to a three log reduction from typical influent concentrations and in-line with typical maturation pond performance.

3.5 FINAL OUTFALL

A rock riprap structure is used to provide land contact for the treated effluent prior to discharge to the final receiving environment of the Patea River. The structure

[1] Based on a BOD loading rate of 84kg BOD/ha.d during the winter months

underwent remedial work following 2009 and 2010 when the manhole upstream of the riprap surcharged severely following a very wet period. Engineering extensions were undertaken to modify the rock riprap and outfall structure. Following that period no issues have been identified with the outfall structure.

3.6 FINAL EFFLUENT QUALITY

As part of the analysis for this report SDC undertook a more intensive summer monitoring programme during October 2014 to March 2015, to build up a good picture of the final effluent quality, and performance of the plant. This data is analysed in the following subsections.

3.6.1 ORGANICS

Suspended Solids

The suspended solids in the final effluent from the plant is presented below in Figure 2. There are no current limits on suspended solids in the discharge consent. Limits on turbidity have been set, as these will be discussed in the Assessment of Environmental Effects –Section 4.0.

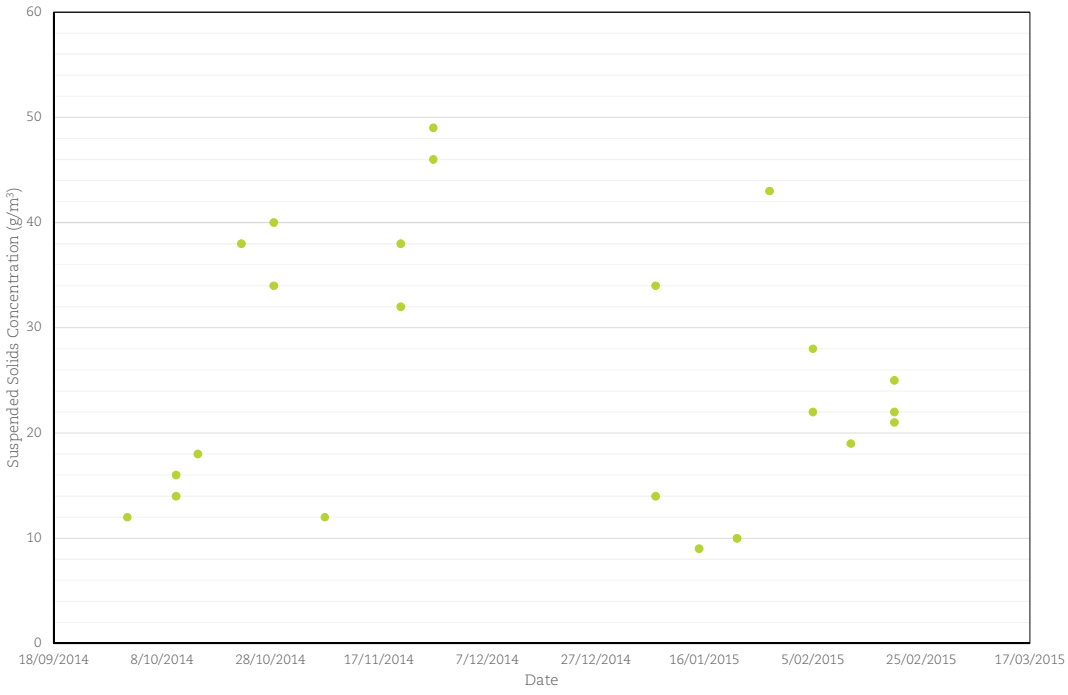

FIGURE 2 FINAL EFFLUENT SUSPENDED SOLIDS CONCENTRATIONS

As presented in Figure 2 above, the suspended solids tends to vary between 10 and 40g/m3. This variance is expected given the potential algae solids in the discharge, and however it is in line with typical performance from wastewater treatment ponds.

Oxygen Demand

The chemical oxygen demand, carbonaceous biological oxygen demand and soluble carbonaceous biological oxygen demand in the final effluent is presented in Figure 3 below. The current discharge consent has no limits on the effluent quality in terms of oxygen demand, but states *"that after allowing for reasonable mixing, being a mixing zone extending from the discharge point, to a point 100 metres downstream of the discharge point, the discharge shall not cause the receiving waters of the Patea River to exceed the following*

concentrations: Filtered carbonaceous BOD_5: 2.0 gm^{-3}". Impacts of the discharge on the Patea River are discussed further in Section 4.0 below.

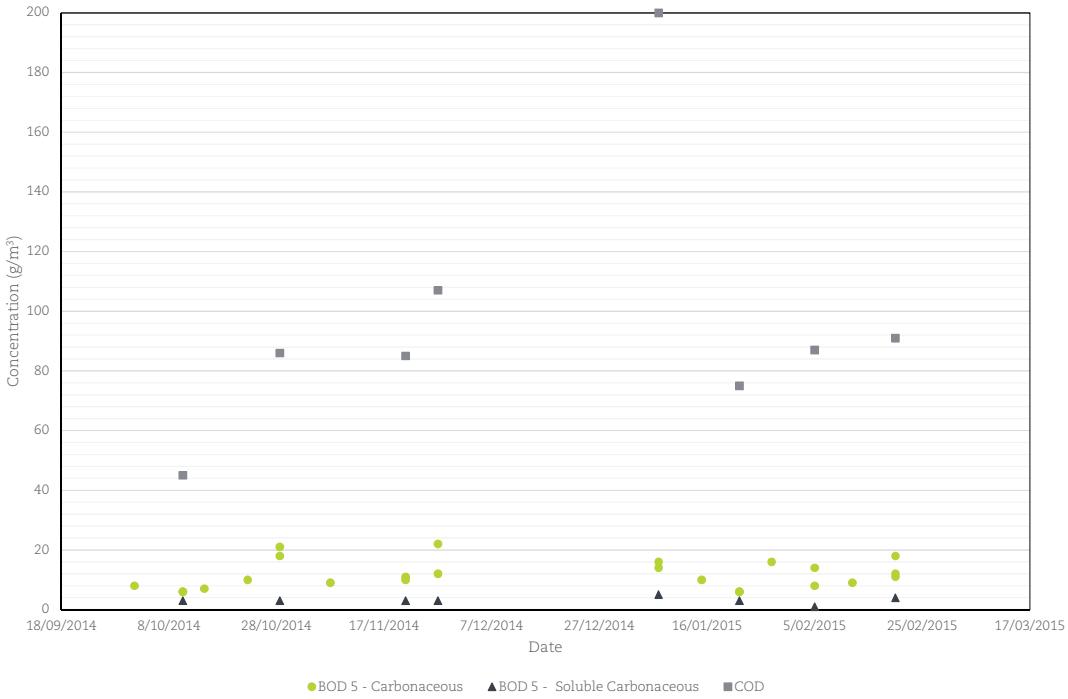

FIGURE 3 OXYGEN DEMAND FINAL EFFLUENT CONCENTRATIONS

As presented in Figure 3 above, the average BOD_5 carbonaceous is around 10g/m³, which indicates that the ponds are performing better than typical pond systems which are usually around 20 to 30g/m³. The performance is better than expected, given the load to the ponds is within the plant's capacity, as discussed in Section 3.3.

3.6.2 NUTRIENTS

Ammonia

The ammonia concentrations in the final effluent is presented in Figure 4 below. The current discharge consent has no limits on the effluent quality in terms of ammonia, but states *"that after allowing for reasonable mixing, being a mixing zone extending from the discharge point, to a point 100 metres downstream of the discharge point, the discharge shall not cause the receiving waters of the Patea River to exceed the following concentrations: Unionised ammonia 0.025 gm^{-3}".* Impacts of the discharge on the Patea River are discussed further in Section 4.0 below.

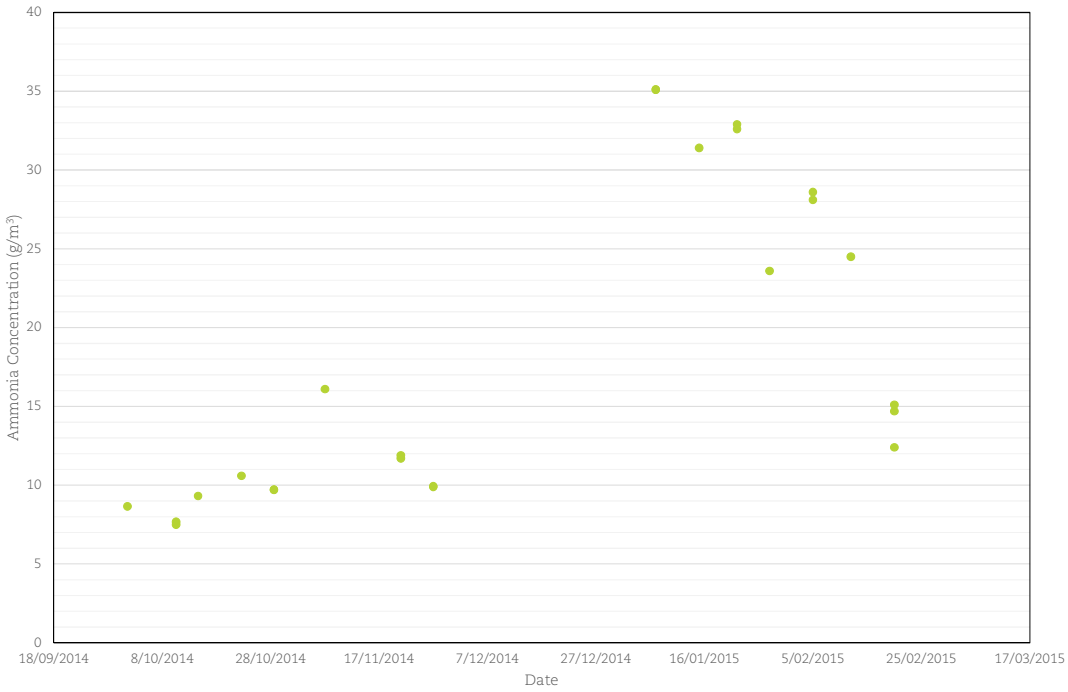

FIGURE 4 AMMONIA FINAL EFFLUENT CONCENTRATIONS

As presented in Figure 4 above, the ammonia in the effluent varied significantly over the period of monitoring. Moving from an average of 12g/m^3 to around 30g/m^3 in late December to early February, and then back to a level of 12g/m^3 by late February. Discussions with Council staff, indicated that all aerators were in service, and no significant trade wastes were discharged to the wastewater treatment plant.

This spike in the ammonia concentrations is unexpected as Stratford does not have a significant holiday population fluctuation, and during the summer months the treatment capacity of the ponds is at its highest. The cause of spikes in ammonia are unknown at this stage.

Phosphorous

The phosphorus concentrations in the final effluent from the plant is presented below in Figure 5. There are no current limits on phosphorus in the discharge consent. Impacts of the phosphorus concentrations in the discharge on the Patea River are discussed in the Assessment of Environmental Effects –Section 4.0.

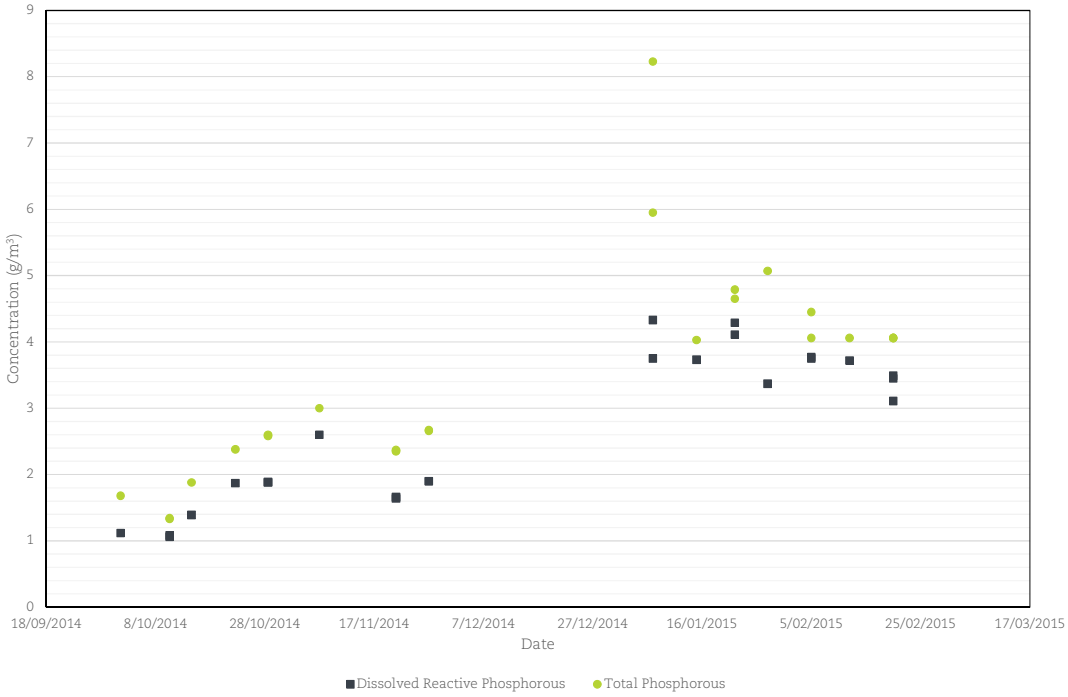

FIGURE 5 FINAL EFFLUENT CONCENTRATIONS OF TOTAL AND DISSOLVED REACTIVE PHOSPHOROUS

As presented in Figure 5 above, the total and dissolved reactive phosphorus concentrations tended to follow the same pattern as ammonia, spiking during the late December to early February period. Similar to ammonia, the cause is unknown.

Total Nitrogen

The total nitrogen concentrations in the final effluent from the plant is presented below in Figure 6. There are no current limits on total nitrogen or other nitrogen species in the discharge consent. Impacts of the total nitrogen concentrations in the discharge on the Patea River are discussed in the Assessment of Environmental Effects –Section 4.0.

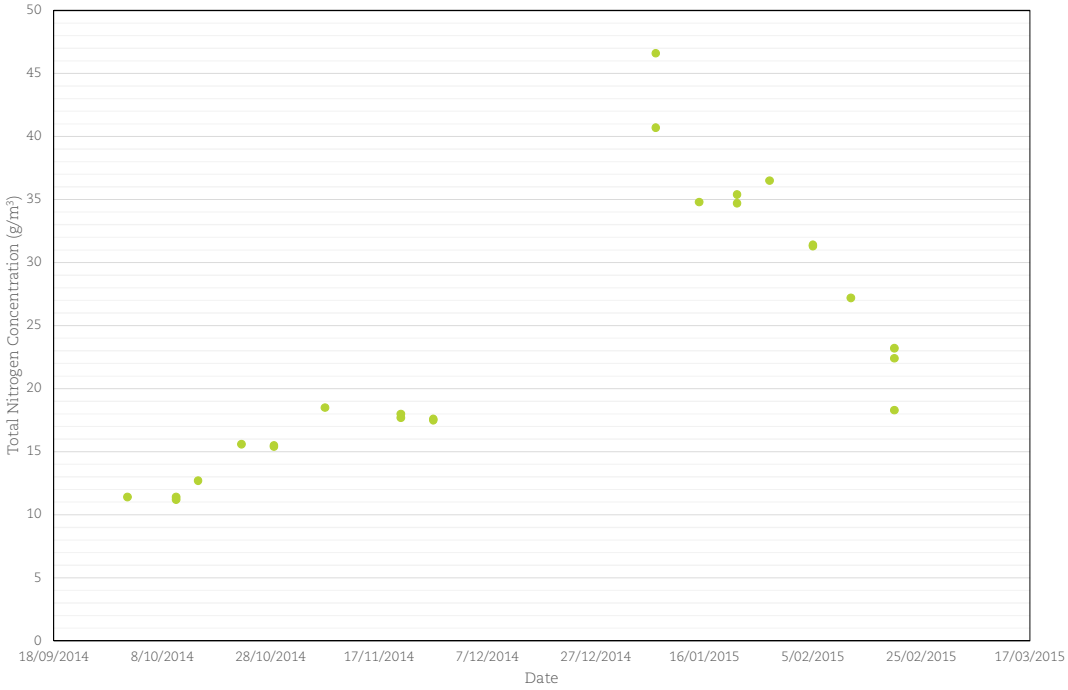

FIGURE 6 FINAL EFFLUENT CONCENTRATIONS OF TOTAL NITROGEN

As presented in Figure 6 above the total nitrogen concentrations follow the same trend as ammonia concentrations, spiking during the late December to early February period. Excluding the December to February period, the effluent was below 25g/m^3 which is typically expected from a pond system with a 3 cell maturation system. Similar to ammonia and phosphorus, the cause is unknown.

3.6.3 PATHOGENS

The pathogen concentrations in the final effluent from the plant is presented below in Figure 7. There are no current limits in the discharge consent. Impacts of the pathogen concentrations in the discharge on the Patea River are discussed in the Assessment of Environmental Effects –Section 4.0.

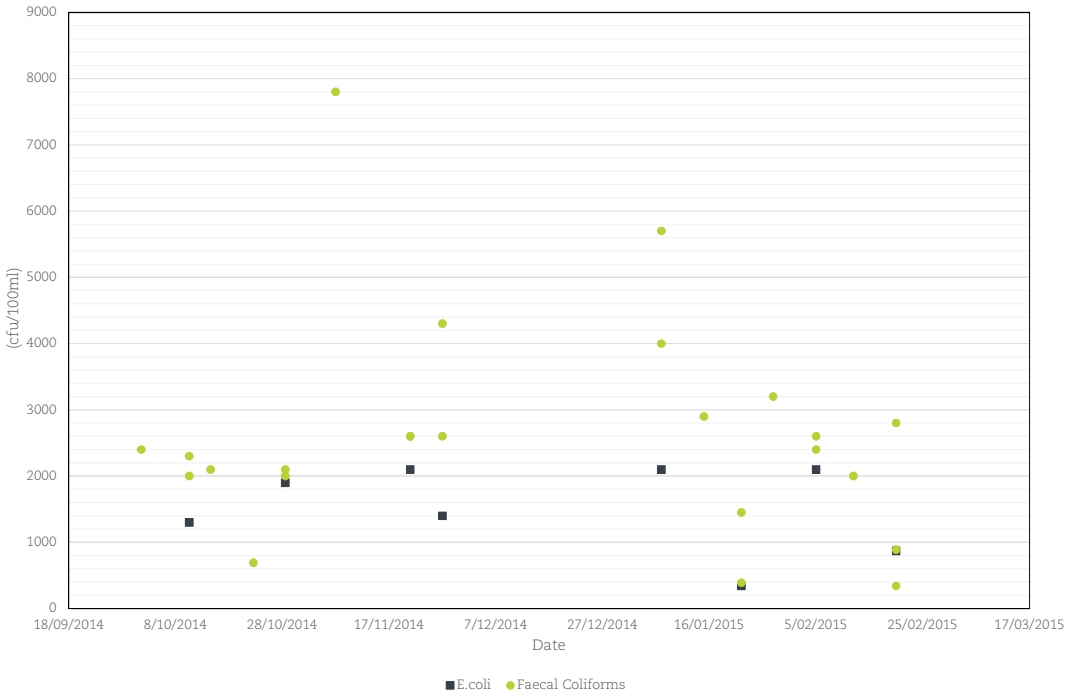

FIGURE 7 FINAL EFFLUENT CONCENTRATIONS OF FAECAL COLIFORMS AND E-COLI

As presented in Figure 7 above, while the final effluent concentrations of faecal coliforms and E.coli do vary, the average rate of removal is approximately 3 to 4 logs. This is in line with the expected pathogen removal throughout the plant as discussed in Section 3.4.1 above.

3.7 OVERALL PLANT PERFORMANCE

Overall the Stratford oxidation plant performs to an acceptable level for the type of treatment system, as discussed in the subsections above. However, during the monitored period there was a noticeable spike in ammonia, total nitrogen and phosphorus.

Discussions with Council staff, indicated that all aerators were in service, and no significant trade wastes were discharged to the wastewater treatment plant. This spike in the concentrations is unexpected as Stratford does not have a significant holiday population fluctuation, and during the summer months the treatment capacity of the ponds is at its highest.

As discussed in Section 2.0 above there is little to no growth expected in Stratford in the next 15 years, and given the good overall level of performance currently, there is no need to upgrade the plant for capacity purposes.

4.0 ASSESSMENT OF ENVIRONMENTAL EFFECTS

The ecological assessment of the impact of the discharge on the Patea River has been based on the data provided in the four annual monitoring reports completed by Taranaki Regional Council. The full analysis is presented in the ecological report, "Ecological Assessment of Effects on the Patea River", attached in Appendix 1.

4.1 PERIPHYTON

The discharge from the wastewater treatment plant appears to be effecting/contributing to the growth of periphyton, downstream of the discharge in the Patea River. The Ecological report concluded the following:

"There has been significantly more periphyton present in the Patea River downstream of the Stratford WWTP outfall relative to the two upstream control sites for the period of record".

"Long filamentous algae exceeded the nuisance threshold of 30% cover during the summer of 2014 downstream, but not upstream, of the Stratford WWTP outfall in the Patea River."

As discussed in the Ecological Report the growth of the periphyton is controlled by a number of physiochemical and biological factors which include the following:

- Light;
- Nutrient availability;
- Flow and substrate characteristics;
- Temperature;
- The availability of nuisance colonist species;
- And, Herbivory.

As the discharge from the wastewater treatment plant affects potentially the temperature and nutrient availability, the measures to limit periphyton growth have focussed on the analysis of the wastewater treatment plant discharge on these components in the stream.

The ecological report provides significant discussion in Section 4 on the instream water quality levels that the Patea River would need to achieve to ensure a reduction in periphyton growth. This report concludes that to achieve this the concentrations of soluble inorganic nitrogen in the Patea River would need to be less than 0.2g/m^3 or soluble reactive phosphorus less than 0.01g/m^3. Currently these water quality levels are exceeded upstream of the discharge, and therefore any reduction from the Stratford wastewater treatment plant may on its own, not result in any measurable improvement in periphyton growth in the Patea River.

4.2 MACROINVERTEBRATES

As discussed in the Ecological Assessment of the Effects on the Patea River attached in Appendix 1, the taxa richness and macroinvertebrate community estimates indicates a relatively benign effect of the wastewater treatment plant discharge on the communities.

4.3 WATER QUALITY PARAMETERS

All the water quality parameters analysed (temperature, dissolved oxygen, BOD_5, total phosphorus, dissolved reactive phosphorus, ammonia, unionised ammonia, nitrate nitrogen, total nitrogen and faecal coliforms) in the Patea River upstream and downstream are within the proposed National Standards from the National Objective Framework and the Taranaki Regional Draft Standards. While some parameters exceed the in-stream guidelines in the final effluent quality from the Stratford Wastewater Treatment Plant, after reasonable mixing all are within appropriate levels downstream.

The ecological review concludes that *"this suggests that contaminants from the SWWTP are generally not toxic to aquatic life after reasonable dilution with river water and this is supported*

by dissolved oxygen concentrations, nitrate nitrogen concentrations, ammonia concentrations and $cBOD_5$ concentrations all being within guideline values during the monitoring period."

There are some concerns regarding turbidity levels downstream of the outfall. Of the four surveys conducted from September 2014 to February 2015, three surveys showed turbidity levels exceeding the consent limits.

4.4 LAKE ROTORANGI

While no downstream assessment of the impact on Lake Rotorangi have been completed, it is important to consider the impacts of the discharge on this final receiving environment. Consideration with any upgrades should be given to the potential impacts of nutrients on the trophic status of the Lake, and the estuarine environs at the mouth of the Patea River.

4.5 SUMMARY

The current discharge from the Stratford Wastewater Treatment Plant appears to be having an impact on the periphyton growth, and slight change in macroinvertebrate community downstream of the discharge point. The water quality parameters are all within acceptable levels post a zone of reasonable mixing, indicating there is sufficient assimilative capacity in the stream to cope with the discharge and that the contaminants from the wastewater plant are not toxic to aquatic life.

Therefore any upgrades to the Stratford Wastewater Treatment Plant will need to be focussed on periphyton and macroinvertebrate improvements. To achieve this Stratford District Council will need to consider improvements that target phosphorus or nitrogen removal. However it should be noted that upstream of the wastewater plant nutrient levels in the Patea River are already above limits that would restrict the growth of periphyton/biomass and therefore upgrades to the Stratford Wastewater Treatment Plant alone may not result in a measurable improvement in periphyton and macroinvertebrates.

5.0 PROJECT OBJECTIVES

Based on the results of the capacity and ecological assessments any upgrades to the plant will need to be targeted at improving effluent quality not capacity. As discussed in Section 4.0, the plant upgrades need to focus on:

- Phosphorus reduction, and/or
- Nitrogen reduction.
- Turbidity reduction

The timing of upgrades should be tempered with the economic constraints of Council as it is noted from the Ecological Assessment that these upgrades may not have any perceivable impact on the Patea River due to the concentrations of Nitrogen and Phosphorus upstream of the plant.

However it is prudent that Council plan upgrades to reduce their load on the environment long term, as other upstream users could be working to reduce their load.

6.0
OPTIONS FOR UPGRADE

As discussed in the project objectives any upgrades to the wastewater treatment plant should focus on phosphorus and nitrogen removal as a priority. It is noted that Council wish to also consider solids upgrade options, so while not a priority upgrade these have been included for assessment as well.

The options considered are as follows:

- Phosphorus Removal – DAF, Actiflo and In-Pond Chemical Dosing;
- Nitrogen Removal – In Pond Media, Mechanical Plant Upgrade;
- Suspended Solids Removal (turbidity) – Tertiary Filters, DAF, Actiflo, Ultra-filtration.

These options are discussed further in the subsections below. It should be noted that options for reduction in suspended solids are deemed to have addressed the turbidity levels.

6.1 DAF AND ACTIFLO

Both DAF and Actiflo system would be installed in a similar manner for phosphorus and suspended solids removal, and will therefore be discussed together to avoid repetition.

Dissolved air flotation (DAF) is a proven and effective physical/chemical technology for treating a variety of industrial and municipal process and wastewater streams. DAF systems have been used on the end of pond systems, to remove algae solids and phosphorus (through chemical precipitation).

ACTIFLO is a high rate compact water clarification process in which water is flocculated with microsand and polymer. This enhances the formation of robust flocs and acts as ballast, significantly increasing the settling velocity of the flocs. In the Actiflo unit this enables the clarifier portion to be designed with very short retention times, high rise rates which results in extremely compact system footprints.

The DAF or Actiflo unit would be located following Pond 2 and prior to the rock filter. The effluent from Pond 2 would be pumped to the unit (which would be located by the inlet screens and flowmeter), and then returned to the rock filter for discharge. Both technologies are established and well-proven to remove algal solids. Figure 8 below presents a process schematic of the proposed Actiflo system.

Until a dewatering unit is installed, it is proposed that the settled sludge from the Actiflo be returned to Pond 1. This presents a risk of faster sludge accumulation in Pond 1 which will then need to be de-sludged every 5 to 7 years, rather than once every 10 years.

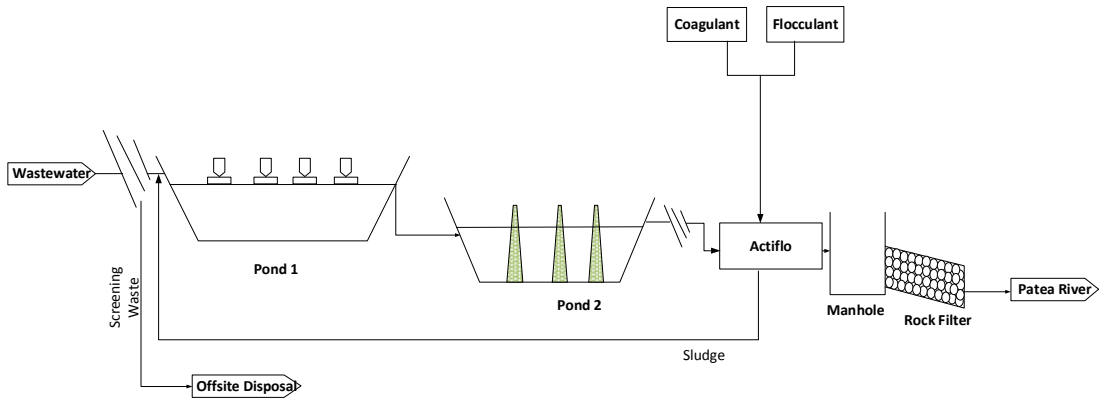

FIGURE 8 ACTIFLO PROCESS CONFIGURATION

An Actiflo has been installed at Ngaruawahia to improve pond effluent quality prior to discharge. Veolia Water indicated that an Actiflo package plant of APWW-4 (8m long by 4m wide) will be adequate for the range of flows experienced at Stratford. The DAF option would require a larger unit footprint (18m long by 5m wide).

Both treatment units require a coagulant (e.g. aluminium sulphate) which will be delivered via tankers. A self bunded tank will be used to store the chemical on site. A new access road will be provided to enable delivery of the chemicals. .

Sludge stream will be pumped to Pond 1 for co-settling with influent solids, this will mean that the Pond 1 will need to be more regularly de-sludged than current operations.

Typical effluent quality expected from the units will be suspended solids of <20g/m^3 and phosphorus of <2g/m^3.

6.2 IN POND CHEMICAL DOSING

In pond chemical dosing would consist of adding alum to Pond 1, adjacent to an aeration zone to get beneficial mixing from the aerator. The proposed chemical selected would be alum due to its lower consumption and lower associated sludge production when compared to phosphorus removal by lime dosing.

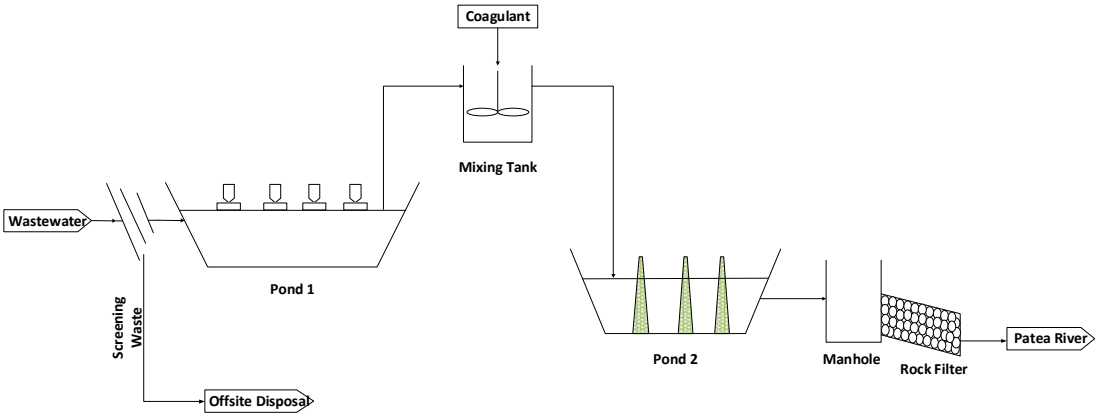

FIGURE 9 CHEMICAL DOSING PROCESS CONFIGURATION

Alum would be combined with the effluent of Pond 1, in a mixing tank prior to connection back into Pond 2. This upgrade will require the installation of the following components: a mixing tank and mixer; feed pumps; an alum dosing system; and a chemical storage area.

A self bunded tank will be used to store the alum on site. A new access road, with bunded delivery area will be provided to enable delivery of the chemicals. .

The removal of phosphorus from the system is highly dependent on the amount of alum added, therefore Stratford District Council could remove to low levels such as 1g/m^3 or to a higher more affordable level (in terms of operating cost related to chemical costs).

Alternative configurations could include installing a manhole as the mixing tank, to remove the need for pumping. However at this stage it is thought that this would be cost equivalent to the proposed configuration.

6.3 IN POND MEDIA

In Pond Media consists of fabric curtains installed in ponds to provide surface area for the bacteria, achieves longer sludge residence times hence removes nitrogen. Aeration is provided between the curtains via diffused aeration pipes. This media and the diffused aeration pipes would be installed in Pond 1. Figure 10 below presents a process schematic of the proposed upgrade.

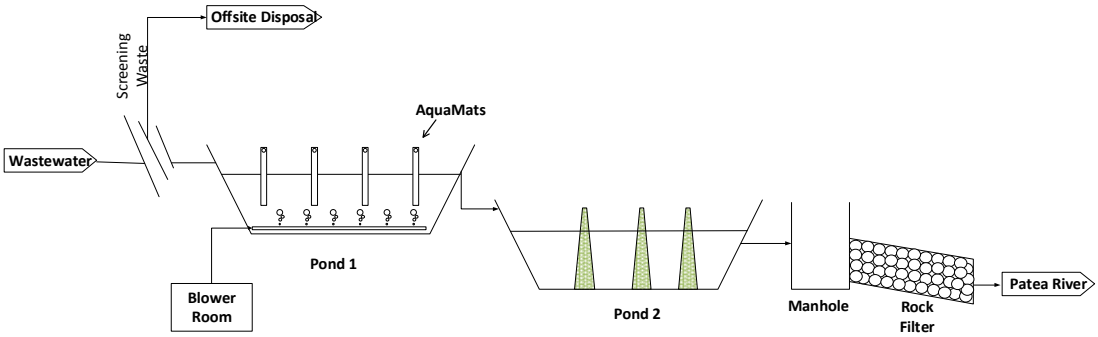

FIGURE 10 IN POND MEDIA PROCESS CONFIGURATION

These systems have been retrofitted to other oxidation pond based treatment systems successfully in Te Kauwhata, Raglan, Matamata. The advantages of the system are as follows:

- Easy retrofit to existing ponds i.e. additional pond works generally not required.
- Proven technology for nitrogen removal even in sub zero temperatures
- Proprietary system – process risks are partially taken or shared by the suppliers.
- Much lower risk of algal blooms compared to other pond treatment options.
- Easy facilitation of chemical phosphorus removal (in pond chemical dosing).

The In Pond Media could reduce the Total Nitrogen in the effluent to 15g/m3 or less, and would assist with treating ammonia spikes currently experienced.

6.4 MECHANICAL PLANT UPGRADE

A completely new mechanical plant would achieve higher effluent quality in terms of total nitrogen, phosphorus and solids reduction. This option would have the highest capital expenditure, and has therefore not been costed at this stage, but presented for discussion only.

There are at least three suitable mechanical plant options which would adequately reduce the nitrogen levels in the treated effluent. The options are sequencing batch reactors (SBR), submerged aerated filters (SAF) and membrane bio-reactors (MBR).

The three techniques listed above are all variations of the traditional activated sludge treatment process. All three options can be designed and configured to achieve a high degree of nitrogen removal, for the conditions at the Stratford WwTP. For the purposes of this analysis we have selected an SBR as the preferred option.

SBRs are a modified form of more traditional activated sludge processes. Traditional activated sludge processes carry out aeration and settlement sequentially in a single tank, whereas an SBR operates with separate stages for aeration and settling. An SBR processes wastewater in batches with each batch being processed through different stages.

At Stratford wastewater treatment plant influent would be diverted from the screen to the SBR (a concrete tank) and bypass the existing ponds. All treatment would occur in the SBR, and the final effluent discharged to the rock filter. The existing ponds could potentially be re-used as influent buffer ponds and/or sludge storage.

The benefits associated with using an SBR include consistently high effluent quality and the reactor's ability to cope with large fluctuations in loads. The construction works are less than those needed for a typical activated sludge process because a final clarifier is not required.

6.5 TERTIARY FILTERS

In order to improve the suspended solids removal from the plant a tertiary filters could be added following Pond 2. The tertiary filters considered are a disc filter or drum filter, for the purposes of this assessment we have considered a drum filter only.

The wastewater will be pumped from pond 2 to the drum filter. The drum filter unit will be housed in a stainless steel tank placed at ground level and installed on a concrete pad. There can be some maintenance issues with the drum filter as the cloth can rip if significant solids pass through it, this can be remedied by installation of a submerged pond outlet or by installation of a screen prior to the drum filter.

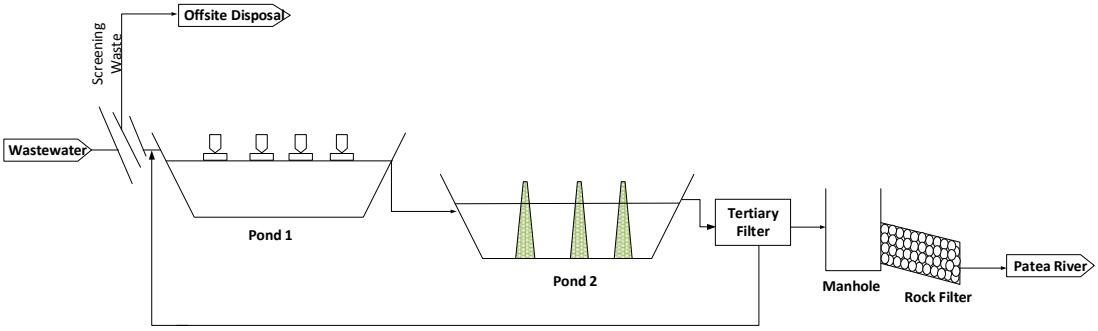

FIGURE 11 TERTIARY FILTERS PROCESS CONFIGURATION

Pond effluent enters the drum filter via the inside of the rotating drum. The rotating drum consists of a frame with mounted filter panels of polyester or stainless steel filter cloth that is of specific micron porosity. Solid waste particles (larger than the micron porosity rating of the filter screens) are captured on the filter screens. Water passes through the filter screens. These filter screens are intermittently backwashed based on timer or level to remove the captured solids. Drum filters produce a high level of effluent with removal of 60 to 80% suspended solids.

Drum filters have also been used in WwTP's around the world for tertiary treatment. Reference checks conducted by Harrison Grierson recently, has indicated that such units have been installed in US, UK and Italy at more than 50 locations (each) and they are running efficiently. It is reported that provided the fabric is not subject to pressures above 150mm WG and that there is no chemical dosing upstream of the filter, the unit has the ability to remove 70 to 80% of TSS. Drum filters are operating successfully at Putaruru and Te Awamutu wastewater treatment plants. Initially there were maintenance issues associated with cloth selection however these have now been resolved.

However, it should be noted that the drum filters could prove to be inadequate for pond effluent due to the presence of algal solids. There are no proven installations of tertiary filters operated on pond effluent. Such filters are successful in treating effluent from secondary activated sludge plants.

A standalone tertiary filtration plant consisting of drum of disc filters is not recommended.

6.6 ULTRAFILTRATION

In this option, a containerised membrane filtration system will be installed post Pond 2. The system consists of ultrafiltration membranes with scouring aeration blower, permeate pumps and backwash pumps.

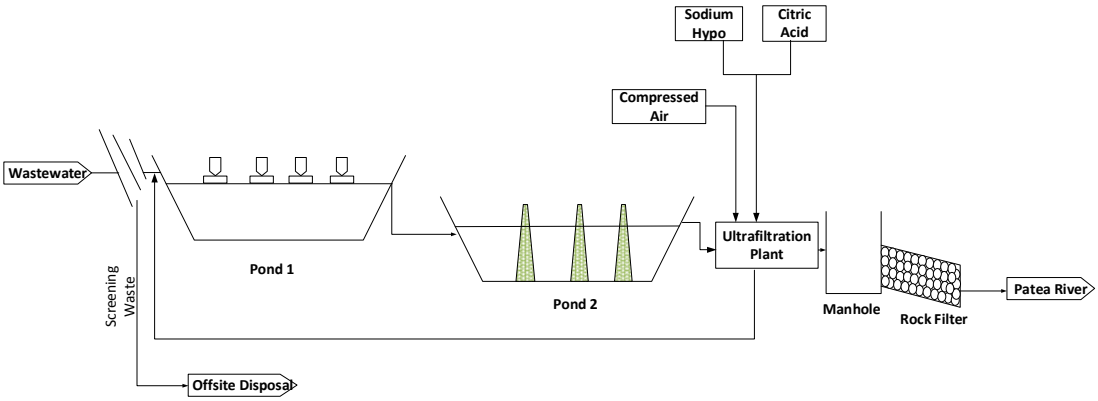

FIGURE 12 ULTRAFILTRATION PROCESS CONFIGURATION

Such systems have been successfully implemented in Hahei, Matamata, Maungaturoto, Hikurangi, Dannevirke and Dunedin Airport.

A new in pond pump station will be built to transfer the holding pond effluent to the membrane filtration system (located adjacent to the inlet screen and flowmeter). Effluent from the membrane filtration system will be discharged to the existing rock filter for disposal. CIP wastes and sludge stream, which is collected in a new sump, will be pumped to Pond 1.

The proposed ultrafiltration system will achieve final effluent quality of less than 10g/m3 total suspended solids. In addition to the solids treatment, the membrane filters act as a barrier for pathogens, and therefore the final effluent will have an added disinfection stage.

7.0 EVALUATION OF OPTIONS

7.1 COST

The following assumptions and exclusions have been made:

a) The sizing and indicative costs are based on the flow and quality data made available by Stratford District Council.

b) The costs presented in this section are indicative only with an accuracy of -5%/+30%.

c) No sludge disposal costs have been included for the DAF system. It is assumed for the Drum/Disc Filter option and the Membrane option that any solids will be pumped back into the oxidation pond and removed along with future de-sludging operations. These future de-sludging operations have not been included in the costs.

d) Any land acquired will be located close to the existing wastewater treatment plant and minimal pumping will be required.

e) No transformer upgrade costs included

f) No allowance has been made for geotechnical ground improvements (i.e. piling, raft foundations).

g) No allowance has been made for any modification to the existing oxidation ponds.

h) No allowance has been made for compliance costs.

i) Preliminary and general is assumed to be 10% of the plant cost.

j) Contingency is assumed to be 10%.

k) Power costs are assumed to be $0.15kWh.

l) Operators are assumed to be paid $45 per hour.

m) Mechanical maintenance costs are assumed to be 4% of capital costs per year.

n) Interest rate on loan is at 7.25%.

o) Depreciation on mechanical equipment is 15 years.

7.1.2 ESTIMATED CAPITAL EXPENDITURE

Table 5 below presents a summary of the estimated capital expenditure required for each option. A more detailed breakdown is attached in Appendix 2.

TABLE 5: ESTIMATED CAPITAL EXPENDITURE (-5%/+30%)

	UPGRADE	UPGRADE REMOVES	ESTIMATED CAPITAL COST RANGE
1.	DAF	TSS, TP	$1,454,000 to $1,990,000
2.	Actiflo	TSS, TP	$1,669,000 to $2,284,000
3.	In Pond Chemical Dosing	TP	$388,000 to $530,000
4.	In Pond Media	TN	$1,559,000 to $2,133,000
5.	Mechanical Plant Upgrade	TSS, TN,TP	Not costed
6.	Tertiary Filters	TSS	$504,000 to $690,000
7.	Ultrafiltration	TSS	$2,813,000 to $3,849,000
8	In Pond Chemical Dosing + In Pond Media	TP, TN	$1,947,000 to $2,664,000

As presented in Table 5 above the only upgrade that achieves all of the project objectives on its own, is the Mechanical Plant Upgrade, however this upgrade would be the highest capital expenditure of all options.

For options that remove phosphorus the most economic option for Council is In Pond Dosing. This options requires minimal additional equipment, and would be constructed adjacent to the existing screen and flowmeter.

For options targeted at Total Nitrogen removal: In Pond Media is the most affordable option, as it utilises the existing asset of Pond 1 as the reactor.

7.1.3 ESTIMATE OPERATING EXPENDITURE

An estimate of the operating expenditure for the proposed upgrades has been calculated, this is based on assumed power, operational, maintenance and chemical consumption only. Assumptions used to calculate cost are stated in Section 7.1.1 above. Table 6 below presents a summary of the operating costs for the proposed options.

TABLE 6: ESTIMATED OPERATING EXPENDITURE (-5%/+30%)

	UPGRADE	UPGRADE REMOVES	ESTIMATED OPERATING EXPENDITURE
1.	DAF	TSS, TP	$116,000
2.	Actiflo	TSS, TP	$128,000
3.	In Pond Chemical Dosing	TP	$39,000
4.	In Pond Media	TN	$89,000
5.	Mechanical Plant Upgrade	TSS, TN,TP	Not costed
6.	Tertiary Filters	TSS	$42,000
7.	Ultrafiltration	TSS	$109,000
8	In Pond Chemical Dosing + In Pond Media	TP, TN	$128,000

As presented in Table 6 above the most expensive in terms of operating costs are the DAF and Actiflo units due to their high operational input, power usage and chemical usage.

7.1.4 NET PRESENT VALUE ANALYSIS

The proposed upgrades have been analysed using a net present value analysis. For the purposes of this analysis, inflation has been assumed to be 3%, discount rate 6% and it is assessed over a 20 year period. Table 7 below presents the Net Present Value Analysis.

TABLE 7: ESTIMATED NET PRESENT VALUE ANALYSIS (-5%/+30%)

	UPGRADE	UPGRADE REMOVES	ESTIMATED NET PRESENT VALUE
1.	DAF	TSS, TP	$3,960,00
2.	Actiflo	TSS, TP	$4,540,000
3.	In Pond Chemical Dosing	TP	$1,107,000
4.	In Pond Media	TN	$3,888,000
5.	Mechanical Plant Upgrade	TSS, TN,TP	Not costed
6.	Tertiary Filters	TSS	$1,347,000
7.	Ultrafiltration	TSS	$6,178,000
8	In Pond Chemical Dosing + In Pond Media	TP, TN	$4,995,000

7.2 MULTI CRITERIA EVALUATION

Table 8 below presents a summary of the analysis of the options considered against a number of criteria, to assess the preferred option for upgrade.

TABLE 8: EVALUATION UPGRADE OPTIONS

CRITERIA	DAF	ACTIFLO	IN POND DOSING	IN POND MEDIA	MECHANICAL PLANT UPGRADE	TERTIARY FILTERS	ULTRAFILTRATION
Ability to achieve project objectives	Achieves one objective only, phosphorus removal.	Achieves one objective only, phosphorus removal.	Achieves one objective only, phosphorus removal.	Achieves one objective only, total nitrogen removal.	Achieves high Total Nitrogen and Total Phosphorus Removal	Does not achieve project objectives.	Does not achieve project objectives.
Practicality and constructability of implementation	Constructed as an addition to the existing treatment system, easy to incorporate and construct.	Constructed as an addition to the existing treatment system, easy to incorporate and construct.	Constructed as an addition to the existing treatment system, easy to incorporate and construct.	Would require significant works in Pond 1, with this decommissioned and drained during the installation process.	Would be constructed separate to the existing treatment system.	Constructed as an addition to the existing treatment system, easy to incorporate and construct.	Constructed as an addition to the existing treatment system, easy to incorporate and construct.
Consentability and cultural value	Consentable, but no perceived cultural benefit.	Consentable, but no perceived cultural benefit.	Consentable, but no perceived cultural benefit.	Consentable, but no perceived cultural benefit.	Consentable. Potential perceived cultural benefit due to improved in-stream conditions.	Consentable, but no perceived cultural benefit.	Consentable, but no perceived cultural benefit.
Complexity of operation and manpower requirement	Highly complex system, would require operator attendance daily.	Highly complex system, would require operator attendance daily	Simple chemical dose system, low complexity and manpower requirement.	Low complexity operation and manpower requirement, due to increase in aeration provision.	Highly complex system, would require operator on-site	Simple fine screening system, low complexity and manpower requirement.	Complex system, highly automated would require significant operator attendance.
Ease of maintenance	Requires significant mechanical	Requires significant mechanical	Easy to maintain as all components	Would require increased level of	Highly mechanical plant and therefore	Easy to maintain as all components	Highly mechanical system will need

TABLE 8: EVALUATION UPGRADE OPTIONS

CRITERIA	DAF	ACTIFLO	IN POND DOSING	IN POND MEDIA	MECHANICAL PLANT UPGRADE	TERTIARY FILTERS	ULTRAFILTRATION
	maintenance, and increased desludging.	maintenance and increased desludging.	outside pond system. Would require increased desludging of Pond 1.	desludging. Potential difficult maintenance of In Pond media and diffused aeration pipework.	requires significant mechanical maintenance.	outside pond system	close operator attendance and maintenance.
Convenience of modular expansion	Typically designed for maximum capacity and not staged modularly due to cost.	Typically designed for maximum capacity and not staged modularly due to cost.	Easy to expand capacity of dosing, but will be limited by existing treatment system.	Limited to size of existing treatment plant system.	Can be designed to be highly modular system.	Could duplicate system if additional capacity required.	Can be designed to be highly modular system.
Ability to 'fit-in' with future process upgrades	Stand alone upgrade, could be superseded if nitrogen upgrades undertaken in the future. Would work well with sludge thickening system.	Stand alone upgrade, could be superseded if nitrogen upgrades undertaken in the future. However provides treatment for high PWWF.	Represents a good use of existing assets, compatible with In Pond Media and Tertiary Filter upgrades.	Represents a good use of existing assets, compatible with In Pond Dosing and Tertiary Filter upgrades.	Unlikely to require further upgrades post this upgrade.	Add on upgrade to end of treatment system. Would be beneficial to other upgrades such as In Pond Dosing and In Pond Media.	Stand alone upgrade, could be superseded if nitrogen upgrades undertaken in the future.
Net present values	$3,960,000	$4,540,000	$1,107,000	$3,888,000	Very High	$1,347,000	$6,178,000

7.2.1 ABILITY TO ACHIEVE PROJECT OBJECTIVES

The only option that achieves all objectives on its own is the full mechanical plant upgrade.

In Pond Dosing and In Pond Media could be combined to achieve both project objectives, at a lower NPV than all other options (excluding the Tertiary Filter).

7.2.2 PRACTICALITY AND CONSTRUCTABILITY OF IMPLEMENTATION

The In Pond Media option would require the decommissioning of Pond 1 during upgrade and therefore this reduces the practicality and constructability of this option when compared to the others.

The mechanical plant upgrade is a completely new treatment so while there is the potential to incorporate some of the existing ponds as flow buffering, this option has low reuse of existing assets.

All other options are add ons to the existing treatment system and represent good practicality and constructability of implementation.

7.2.3 CONSENTABILITY AND CULTURAL VALUE

All options assessed are consentable and have been considered equal on this point.

The perceived cultural benefits assessment will need to be commented on/confirmed by Iwi, but it is likely that those options which may reduce nuisance periphyton growth (by meeting the project objectives in terms of total nitrogen removal and phosphorus removal) would result in improved in-stream conditions and therefore a perceived cultural benefit. Therefore Mechanical Upgrades and the combined In Pond Dosing and In Pond Media would have potential cultural benefits.

7.2.4 COMPLEXITY OF OPERATION AND MANPOWER REQUIREMENT

The Mechanical plant upgrades is the most complex operation which correspondingly requires the most operator input to run and maintain.

The next most complex upgrades are the DAF, Actiflo and Ultrafiltration, due to their high level of components and automation. While these systems are typically fully automated, it is anticipated that an operator would be required to attend site daily when they are in operation, to ensure smooth operation and regular maintenance occurs.

The least complex upgrades are the In Pond Dosing, In Pond Media and Tertiary Filters. While these upgrades do add additional mechanical items and automated systems to the plant, they are all more robust systems and able to operate with only bi-weekly operator inspections.

7.2.5 EASE OF MAINTENANCE

The ease of maintenance follows the same pattern as the complexity of operation discussed in 7.2.4 above. Those upgrades which are more complex, are correspondingly more difficult in terms of maintenance.

7.2.6 CONVENIENCE OF MODULAR EXPANSION

The convenience of modular expansion has been considered in terms of the potential for staging upgrades. However as no significant growth expected in Stratford and the Plant is therefore unlikely to require additional stages for growth, just treatment

improvements the impact of the potential for modular expansion on which option is selected as the preferred option is low.

7.2.7 ABILITY TO 'FIT-IN' WITH FUTURE PROCESS UPGRADES

The DAF, Actiflo and Ultrafiltration upgrades are all standalone upgrades which could potentially be made redundant if nitrogen upgrades were undertaken in the future.

The Mechanical Plant upgrade would upgrade the treatment plant to the either the highest treatment, or be constructed to allow future upgrades and therefore has a high ability to fit in with future process upgrades.

The In Pond Dosing, In Pond Media and Tertiary Filters are all upgrades that build on using the existing infrastructure at the plant, and are compatible with each other, therefore ensuring that a staged approach could be undertaken to reduce all project objectives.

7.2.8 NET PRESENT VALUES

As presented in Tables 6 and 7 above, the options with high NPV are the DAF, Actiflo, Mechanical Plant Upgrade and Ultrafiltration options. These options all are highly mechanical plants with a large degree of automation.

The In Pond dosing has the lowest NPV, followed by the In Pond Media.

7.2.9 OVERALL RECOMMENDATIONS

Based on the criteria listed above, and the results of the treatment plant performance and environmental assessment of effects the recommended upgrade is In Pond Dosing. While it is recognised that this upgrade on its own may not improve the periphyton growth in the Patea River downstream of the discharge point, it is a step towards improving the impact of the discharge on the water quality of the Patea River.

8.0 EFFLUENT DISPOSAL

8.1 BENEFITS

It is understood that there are concerns regarding the existing discharge to the Patea River through the rock filter.

Disposal of Stratford's treated effluent to land will have the following benefits.

- Removal (or reduction, if seasonal) of discharge from Patea River
- Additional treatment through land application
- Improvement in water quality in summer low flow period

8.2 SEASONAL

As per TRC's Annual Monitoring Report, 2014-15, the plant demonstrated good environmental performance and good level of administrative compliance with the resource consent. The water quality issues highlighted in the earlier sections are related to summer low flow conditions, when dilution is at the lower end of the range. Therefore, a land disposal can be undertaken in the summer period, when the effects in

the river are enhanced compared to winter. In addition, land disposal in summer will not be hampered by ground saturation as it will during winter.

8.3 LIMITATIONS

There are a number of factors that influence disposal of effluent on land. These are discussed below.

As is widely known, the rate at which effluent can be applied on land depends on the category of the soils and their permeability. Based on the soil type, typical application rates may vary from 2mm/day to 15mm/day. This has an impact on land area required and volume of effluent that can be disposed.

There are a number of irrigation methods available including drip line, sub-surface, spray. Spray irrigation is generally preferred where the disposal area is isolated and away from residential area and water courses. Sub-surface irrigation requires a high quality of wastewater with very low levels of suspended solids. Therefore, the treatment plant needs to have an efficient solids removal process. Drip line irrigation can afford a lower quality of effluent. This type of system is generally seen in forests or tree plantations.

Finally, depending on the land area required and its distance from the treatment plant, the option may or may not be economical to the Council.

8.4 SUGGESTIONS

Due to the benefits offered by a land disposal system, especially in Stratford, it is suggested that Council investigate options available for disposal of treated effluent to land. Brief scope and methodology of this investigation is mentioned below.

- Identification of potential areas available
- Short listing of areas based on desk top assessment in terms of geology and practicality.
- Geotechnical field tests in terms of soil categorisation, groundwater levels and permeability rates.
- Assessment of quantity of wastewater that can be discharged based on soil permeability
- Type of irrigation system, pre-treatment required and pumping/storage requirements.

9.0 INFLOW AND INFILTRATION ISSUES

The treatment plant experiences high I&I flows during winter. This compromises the hydraulic capacity of the plant.

It is understood that Council have taken a number of measures to alleviate the situation, as described below.

- Flow and smoke testing in the past 10 years
- All properties have been surveyed to investigate storm water entry into sewer

- 2456m of leaky mains replaced or relined
- 35 leaky manholes replaced or rehabilitated
- Investigation and upgrading expenditure in the last 10 years is $793K
- Current expenditure id $150,000 per year
- Forward I&I funding: 2015-2017 - $150,000/year; 2017-2035 - $250,000/year

10.0 CONCLUSIONS AND RECOMMENDATIONS

The existing Stratford Wastewater Treatment Plant performs well, and achieves a satisfactory level of treatment based on the process system. There have been spikes of ammonia identified during the monitoring period, which are unexpected given the connected population and identified trade waste discharges. Further investigation is needed to confirm the reason for these spikes.

As discussed in the Environmental Assessment of Effects, the current discharge from the Stratford Wastewater Treatment Plant appears to be having an impact on the periphyton growth, and slight change in macroinvertebrate community downstream of the discharge point. Therefore any upgrades should target a reduction in either Total Nitrogen or Phosphorus, or both. As noted upstream of the wastewater plant nutrient levels in the Patea River are already above limits that would restrict the growth of periphyton/biomass and therefore upgrades to the Stratford Wastewater Treatment Plant alone may not result in a measurable improvement in periphyton and macroinvertebrates.

The evaluation of options has found that the preferred options are In Pond Chemical Dosing combined with In Pond Media upgrades. These upgrade options will provide a marked reduction in total nitrogen and total phosphorus, has low maintenance/operator requirements, utilises the existing infrastructure.

However these options represent significant capital expenditure for Council, with a combined NPV of $4,995,000. This significant expenditure, combined with the uncertainty as to whether in instream improvements would occur as a result of any upgrade and therefore we would recommend staging the upgrades in line with community and Council affordability.

It is recommended that:

- Measures and investigations to control I&I be continued
- Phosphorus reduction measures be installed
- Continue monitoring of receiving environment for a few years to ascertain if nitrogen removal is required
- Land disposal investigation be undertaken.

11.0 LIMITATIONS

11.1 GENERAL

This report is for the use by Stratford District Council only, and should not be used or relied upon by any other person or entity or for any other project.

This report has been prepared for the particular project described to us and its extent is limited to the scope of work agreed between the client and Harrison Grierson Consultants Limited. No responsibility is accepted by Harrison Grierson Consultants Limited or its directors, servants, agents, staff or employees for the accuracy of information provided by third parties and/or the use of any part of this report in any other context or for any other purposes.

11.2 ESTIMATES

Should this report contain estimates for future works or services, physical or consulting, those estimates can only be considered current and will only reflect the extent to which the detail of the project is known to the consultant (feasibility, concept, preliminary, detailed, tender etc.) at the time given.

The client is solely responsible for obtaining updated estimates from the consultant as the detail of the project evolves and/or as time elapses.

11.3 PEER REVIEW

Should this report be a peer review of the work of another consultant ("the designer"), the following limitations apply:

- The review is limited to only those aspects of the designer's work specified in the peer reviewer's scope of engagement.
- The liability for the reviewed work remains at all times solely with the designer.
- If any comments or recommendations by the peer reviewer are adopted by the designer, the responsibility for their adoption is assumed totally by the designer.

APPENDIX 1 ECOLOGICAL ASSESSMENT OF EFFECTS ON THE PATEA RIVER

APPENDIX 2 COST ESTIMATES

APPENDIX 5
PRELIMINARY ASSESSMENT OF GROUND DISPOSAL OPTIONS FOR STRATFORD WASTE WATER TREATMENT PLANT EFFLUENT

EARTHTECH
HYDROGEOLOGY • GEOTECHNICAL ENGINEERING • ENGINEERING GEOLOGY

PIK/R3243-1/cam

11 November 2015

Harrison and Grierson Consultants Limited
P O Box 5760
Wellesley Street
Auckland

Attention: Mr Ash Deshpande
Lead Process Engineer

Dear Sir

RE: PRELIMINARY ASSESSMENT OF GROUND DISPOSAL OPTIONS FOR STRATFORD WWTP EFFLUENT

1. Background

The Stratford District Council (SDC) are currently consented to discharge treated WWTP effluent to the Patea River through a rock filter.

The SDC wish to assess the feasibility of ground disposal of effluent on adjacent land during the summer low flow conditions.

The principal objective for this study is to determine the hydraulic capacity of the identified site for effluent disposal. In-ground treatment of the effluent is a secondary objective.

Earthtech were engaged on 20 October 2015 to carry out the feasibility assessment in terms of the following parameters:

i. Partial secondary treated wastewater by WWTP.
ii. Summer WWTP flows of 1,200m^3/d.
iii. Disposal area extending over Council owned land directly to the east of the WWTP ponds.

For the assessment, a site walkover and test pitting was carried out by the undersigned on 20 October 2015.

2. Site Conditions

The site plan is presented on Figure 1. The site extends over flat to gently rolling topography between the Patea River and Victoria Road. Slopes are shown on Figure 1.

In the eastern end of the site a 3.1*m* cut face with an intermediate bench is present. The cut face marks the southern boundary of an old borrow area and exposes the soil sequence described in Section 3.2. The floor of the old borrow area is poorly drained due to flat gradients. Discussions

with SDC staff indicate that the borrow was used for the Stratford Landfill, located immediately to the west of the WWTP which is now closed.

To the west of the old borrow area is a cleanfill currently operated by SDT. The cleanfill includes separate areas for cleanfill placement and the stockpiling of green waste and topsoil. The cleanfilling is currently reinstating the western margins of the old borrow area.

The northeastern portions of the site extends over a lower terrace with a manmade pond and associated swampy area immediately adjacent to the Patea River. The western margins of the site extend over gently sloping ground. Within both of these areas, shallow farm drains have been constructed. Observed zones of groundwater seepage associated with the drains are shown on Figure 1.

To the west of the site are the oxidation ponds associated with the WWTP. The ponds are understood to be clay lined.

The site is bounded to the north and the east by the Patea River. The river is located within a 5*m* to 10*m* deep incised channel.

3. Ground and Groundwater Conditions

3.1 Published Geology

The regional 1:250,000 geological map by Townsend et al. (2008) shows that the site is underlain by the Ngaere Formation which is a Pleistocene (dated at 23,000 years old) debris avalanche deposit (pyroclastic eruption deposit from Mt Taranaki) described as consisting of *"blocks and boulders of andesite bound in a clay rich matrix"*.

The unit as described was not encountered on-site.

3.2 Ground Conditions

Ground conditions to 4*m* depth were investigated by TP1-01 to TP1-04, the locations of which are shown on Figure 1. Associated logs are presented in Appendix A.

Outside of the cleanfill and old borrow areas, a relatively consistent ground condition profile is present which is summarised as follows:

i. *Topsoil*

- Thickness range 01.*m* to 0.25*m*.

ii. *Brown Ash*

- Fine to medium SANDY SILT with minor fine gravel, stiff, light and dark yellowish brown (oxidised texture), allophanic (sensitive on reworking).
- Thickness range of 0.6*m* to 1.6*m*.

iii. *Ngaere Formation*

- Interlayered sequence of
  - SILTY medium to coarse SAND.
  - Gravelly medium to coarse SAND.

  - SANDY SILT.
- Thickness range of 2.1*m*+ to 3.4*m*+.

The brown ash unit forms the parent material for the locally extensive Stratford sandy loam. From SDF (2007)[1] the Stratford sandy loam is locally described as having good drainage. However, extensive tile drains are required in some areas.

The observed Ngaere Formation is significantly different to the clayey andesite boulder deposits described on the regional geological sheet by Townsend et al. (2008). The site Ngaere Formation soils are considered to represent the related pyroclastic cover deposits to the deeper boulder unit.

The distinctive dark grey dense gravelly sands within the Ngaere Formation range in thickness between 0.25*m* and 1.0*m* with an average of 0.6*m*. One gravelly sand layer was observed in TP1-01, 1-02 and 1-03. In TP1-04, three gravelly sand layers were logged.

3.3 Groundwater Conditions

From the observation of seepage zones in test pit walls and saturated soils, the following groundwater table depths are assessed:

Location	Depth to Groundwater
TP1-01	2.2*m*
TP1-02	3.1*m*
TP1-03	1.1*m*
TP1-04	3.7*m*

Of the above results, the greater depths to groundwater (2.2*m* to 3.7*m*) relate to the more elevated portions of the site. The shallower depth to groundwater (1.1*m*) is associated with the lower terrace area.

Groundwater seepage with associated Fe-oxide staining was observed in the shallow drains. Groundwater levels are expected to be near the ground surface in the vicinity of the drains.

The majority of Brown Ash and Ngaere Formation soils are sandy silts and silty sands which are characterized by low to moderate permeability ($10^{-7}m/s$ to $10^{-5}m/s$). The Ngaere Formation gravelly sands are expected to be characterised by moderate to high permeability ($10^{-5}m/s$ to $10^{-3}m/s$).

The sub-horizontal layering in the soil sequence and specifically the presence of the permeable gravelly sand layers indicates a strong preference for lateral groundwater flow. Therefore, effluent discharged in these soils will have a preference to flow laterally either to the Patea River or site drains.

4. Effluent Disposal Assessment

4.1 Effluent Disposal Options and Assessment Methodology

In view of the sites ground and groundwater conditions, the following effluent disposal options have been considered.

[1] Stratford Demonstration Farm (2007). Demonstration Farm Booklet dated 27 June 2007.

i. Shallow Drip Lines. Sub-surface irrigation lines installed at the base of the topsoil layer. Discharge to top of Brown Ash.

ii. Deep Infiltration Trenches. Two to three metre deep trenches to discharge effluent to the top of the gravelly sand layer.

Deeper disposal options are unlikely to be feasible due to the Ngaere Formation matrix expected to become more clay rich with depth (see Section 3.1). Spray irrigation of effluent was not considered due to concerns over aerosol drift of pathogens.

The assessment follows the methodology outlined in TP58 (2004)[2]. TP58, although developed for Auckland has been adopted by other North Island local authorities including Horizons (Barnett and Ormiston, 2007)[3].

4.2 Soil Category and Design Loading Rates

For the shallow dripper system, discharge will be to the Brown Ash. In terms of TP58:

i. *Brown Ash*

- Sandy loam of moderate drainage.
  ⇨ Category 4 soil.
  ⇨ Aerial effluent loading rate = 5*mm*/*d*.

For the deep trench system, discharge will be to the top of the gravelly sand layer.

ii. *Ngaere Formation Gravelly Sand*

- Free draining medium to coarse sand.
  ⇨ Category 2 soil.
  ⇨ Trench base effluent loading rate = 35*mm*/*d* for secondary treated wastewater.

4.3 Disposal Area Requirements

On the basis of the above loading rates, the following disposal areas are required.

i. *Shallow Drip Lines*

Area = $\frac{1200m^3/d}{0.005m/d}$ = 24 hectares.

i. *Deep Infiltration Trenches*

For deep infiltration trenches, associated basal area required:

Trench basal area = $\frac{1200m^3/d}{0.035m/d}$ = 3.4 hectares.

[2] Auckland Regional Council Technical Publication No. 58 (3rd edition, 2004). On-site Wastewater Systems Design and Management Manual.
[3] Barrett, H. and Ormiston, A.W. (2007). Manual for On-site Wastewater System Design and Management. Dated April 2007.

4.4 Disposal Area Available

Figure 2 shows that 2.13*ha* of effluent disposal area is available taking into account the following:

i. Avoidance of existing cleanfill and old borrow cut areas. Old borrow area required for future cleanfill operations.
ii. 20*m* setback from Patea riverbank slopes to avoid bank instability.
iii. 10*m* setback from surface water drains and swampy ground.
iv. Avoidance of low-lying poorly drained ground.

4.5 Discussion of Disposal Options

4.5.1 *Shallow Drip Lines*

Shallow drip lines installed in the 2.13*ha* available area have the potential to discharge 106m^3/d of effluent clearly well below the design flow. For this option 24 hectares of similar land is required.

The shallow drip lines are not a feasible solution for the 1,200m^3/d discharge volume.

4.5.2 *Deep Infiltration Trenches*

For trenches 0.5*m* wide and installed at 2*m* centres, the basal area is 25% of the total area. Therefore the associated disposal volume is:

- 25% of 2.13*ha* = 0.53*ha* trench basal area.
- 0.53*ha* . 0.035m/d = 186m^3/d.

The 186m^3/d disposal capacity is also well below the design flow. For this option 13.6*ha* of similar ground conditions is required.

A check of the discharge capacity of the gravelly sand layers has been carried out as follows:

i. Parameters

- Permeability say $k = 1 \times 10^{-4} m/s = 8.6 m/d$.
- Horizontal gradient, $i_h = 0.05$.
- Flowpath area
  L = 350*m* (flowpath length around northern and eastern sides of disposal area)
  h = 0.6*m* (average thickness of sand bed)

ii. Darcy Flow

- $Q = kiA$
  $= 8.6 m/d \cdot 0.05 \cdot 350 m \cdot 0.6 m$
  $= 90 m^3/d$

The above Darcy calculation indicates that the gravelly sand layers have a hydraulic capacity of about 100m^3/d. The limited capacity is primarily due to the restricted

thickness (h = 0.6m) of the gravelly sands. For the deep infiltration trenches the Darcy flux calculations govern.

On the basis of the above, the deep infiltration trenches are not a feasible solution for the 1,200m^3/d discharge volume.

5. Conclusions

Site specific investigations have been carried out to determine the feasibility of disposing of 1,200m^3/d from the Stratford WWTP on adjacent Council land to the east.

On the basis of existing ground and groundwater conditions at the site, shallow drip lines and deep infiltration trenches have been considered. For both of these options, insufficient 2.13ha area is available on site. For the deep trench disposal option the permeable gravelly sand layers have insufficient hydraulic capacity for the disposal volume.

Therefore, ground disposal of 1,200m^3/d of WWTP effluent on the adjacent land to the east of the ponds is not considered feasible.

Yours faithfully

P I KELSEY
Senior Hydrogeologist
EARTHTECH CONSULTING LTD

Encls. Figure 1 – Site Plan
Figure 2 – Available Effluent Disposal Area
Appendix A – Test Pit Logs TP1-01 to TP1-04

NOT FOR CONSTRUCTION 2001 AERIAL PHOTOGRAPH RETRIEVED FROM GOOGLE EARTH, 19 OCTOBER 2015

EARTHTECH
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STRATFORD WWTP
Preliminary Effluent Disposal Investigation
Harrison Grierson

Site Plan

DRAWING NO.: FIG. 1

DRAWN:	P.K	CHECKED:	P.K	SCALE (A3):	1:1500	VERSION:	A
TRACED:	C.M	DATE:	27/10/15			REF:	3243

EARTHTECH
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STRATFORD WWTP
Preliminary Effluent Disposal Investigation
Harrison Grierson

Available Effluent Disposal Area

DRAWING NO.: FIG. 2

DRAWN:	P.K	CHECKED:	P.K	SCALE (A3):	VERSION: A
TRACED:	C.M	DATE:	27/10/15	1:1500	REF: 3243

APPENDIX A

Test Pit Logs – TP1-01 to TP1-04

STRATFORD DISTRICT COUNCIL

NORTH

Stratford WWTP

Date Printed: 28 Oct 2015

Job No. 3243 Location: Stratford WW

Logged by: PIK 027227759 Date: 20/10/15

Excavated: Craig Taylor Date: 20/10/15

Checked: J.M R.L. (ground level): ———

TEST PIT No. 1-01

Project: Stratford WWTP Ground Disposal

Geology	SOIL / ROCK DESCRIPTION	Graphic Log	Depth (m)	Sample Type	Field Shear Strength (kPa) DIAL GAUGE DR4328	Natural Water Content (%)	Testing	Groundwater Data and Comments
BROWN ASH	TOPSOIL 0.25m Fine to medium SANDY SILT with minor fine to medium gravel; dark yellowish brown. Stiff to very stiff; moist; sensitive on reworking; allophanic. [TEPHRA] 1.0m: Tree roothole.		0.25 0.5 0.75 1 1.25 1.50		90/18 108/32 124/45 98/37 116/42 84/29			
NGAERE FORMATION	— — — — gradational — — — 1.8m SILTY medium to coarse SAND with some fine gravel; dark yellowish brown. Medium dense to dense; moist; sensitive on reworking. 2.2m Fine GRAVELLY medium to coarse SAND; dark grey. Dense; moist. 2.45m SILTY medium to coarse SAND with some fine gravel; yellowish brown. Medium dense to dense; saturated. 3.6m: dark grey SILTY SAND with gravel		2 3 4 5 6					Iron pan 10mm thick at 2.2m. Minor groundwater seepage on top of pan. 2.2m difficult to excavate. Minor seepage 2.7m. Below 2.9m minor diffuse seepage. Groundwater table at 2.7m. Low volume seepage indicates low to moderate hydraulic conductivity.
	EOP 3.9m Target Depth							

MACHINE TYPE: Hitachi 12t

TEST PIT TERMINATED AT:

Target Depth ☑ Refusal ☐

Near Refusal ☐ Flooding ☐

SAMPLE TYPE:

☐ bulk sample

☐ tube sample

☐ disturbed profile sample

FIELD SHEAR STRENGTH:

(V) Shear vane

P Hand penetrometer

E Estimate only

TEST PIT SECTION **SCALE:** 1:10

EARTHTECH CONSULTING LTD

Job No. 3243 Location: Stratford WW

Logged by: PIK 027227759 Date: 20/10/15

Excavated: Craig Taylor Date: 20/10/15

Checked: J.M R.L. (ground level): ———

TEST PIT No. 1-02

Project: Stratford WWTP Ground Disposal

Geology	SOIL / ROCK DESCRIPTION	Graphic Log	Depth (m)	Sample Type	Field Shear Strength (kPa) DIAL GAUGE DR4328	Natural Water Content (%)	Testing	Groundwater Data and Comments
BROWN ASH	TOPSOIL 0.2m Fine to medium SANDY SILT with minor fine to medium gravel; dark yellowish brown. Stiff to very stiff; moist; sensitive to reworking; allophanic. 1.45m		0.5 1		71/47 119/34			
NGAERE FORMATION	SILTY medium to coarse SAND with some fine gravel; dark yellowish brown. Medium dense; moist. 2.05m		2					2.05m - 3.0m: difficult to excavate. Distinctive dark grey gravelly sand layer, not oxidised.
	Fine GRAVELLY medium SANDY SILT; dark grey. Dense; moist; massive. 2.95m		3					Minor groundwater seepage below 3.1m. Groundwater table <3m.
	Fine to medium SANDY SILT; dark brownish grey. Firm to stiff; wet. 3.4m: Some fine gravel SILTY medium to coarse SAND; dark brownish grey. Medium dense; wet.		4					
	EOP 4.0m Target Depth		5 6					

MACHINE TYPE: 12t Hitachi

TEST PIT TERMINATED AT:

Target Depth ☑ Refusal ☐

Near Refusal ☐ Flooding ☐

SAMPLE TYPE:

☐ bulk sample

☐ tube sample

☐ disturbed profile sample

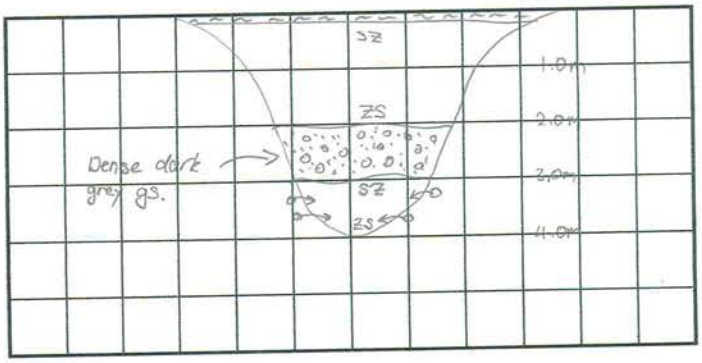
FIELD SHEAR STRENGTH:

(V) Shear vane

P Hand penetrometer

E Estimate only

TEST PIT SECTION SCALE: 1:10



EARTHTECH CONSULTING LTD

Job No. 3243 Location: Stratford WW

Logged by: PIK 027227759 Date: 20/10/15

Excavated: Craig Taylor Date: 20/10/15

Checked: J.M R.L. (ground level): ____

TEST PIT No. 1-03

Project: Stratford WWTP Ground Disposal

Geology	SOIL / ROCK DESCRIPTION	Graphic Log	Depth (m)	Sample Type	Field Shear Strength (kPa)	Natural Water Content (%)	Testing	Groundwater Data and Comments
BROWN ASH	TOPSOIL 0.15m Fine to coarse SANDY SILT with minor fine gravel light yellowish brown. Stiff; moist; sensitive. 0.7m							
NGAERE FORMATION	SILTY medium to coarse SAND with some fine gravel; dark yellowish brown. Dense. Fe pans. 1.1m		1					Fe oxide pans above dark grey layer. Minor groundwater seepage. Dark grey dense silty sand anerobic - aquitard
	SILTY fine SAND with some fine gravel; dark grey. Medium dense; wet; massive. 1.7m							minor seepage below 1.45m.
	SILTY fine SAND with some fine gravel; light yellowish brown. Medium dense; wet; sensitive. 3.0m		2					Difficult to excavate. 3.0m - 3.7m
	Fine gravelly coarse SAND with some SILT; light grey. Dense; saturated.		3					
	EOP 3.7m Target Depth.		4					
			5					
			6					

MACHINE TYPE: Hitachi 127

TEST PIT TERMINATED AT:

Target Depth [✓] Refusal [ ]

Near Refusal [ ] Flooding [ ]

SAMPLE TYPE:

[ ] bulk sample

[ ] tube sample

[ ] disturbed profile sample

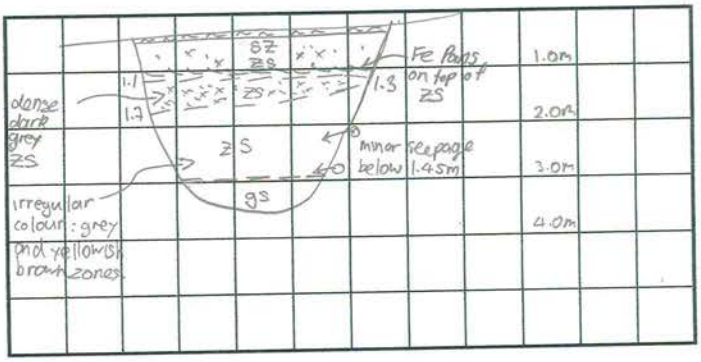
FIELD SHEAR STRENGTH:

[V] Shear vane

[P] Hand penetrometer

[E] Estimate only

TEST PIT SECTION SCALE: 1:10



EARTHTECH CONSULTING LTD

Job No. 3243 Location: Stratford WW

Logged by: PIK 02722759 Date: 20/10/15

Excavated: Craig Taylor Date: 20/10/15

Checked: J.M R.L. (ground level): ———

TEST PIT No. 1-04

Project: Stratford WWTP Ground Disposal

Geology	SOIL / ROCK DESCRIPTION	Graphic Log	Depth (m)	Sample Type	Field Shear Strength (kPa)	Natural Water Content (%)	Testing	Groundwater Data and Comments
BROWN ASH	TOPSOIL 0.1m Fine to medium SANDY SILT with some gravel; light yellowish brown. Stiff; moist. 0.8m							
NGAERE FORMATION	Fine GRAVELLY medium to coarse SAND; dark grey. Dense; moist 1.3m		1					
	Fine SANDY SILT; light greyish brown. Firm-stiff wet. 1.6m							
	Fine GRAVELLY medium to coarse SAND; dark grey. Dense; wet. 2.2m		2					minor seepage at 2.2m
	SILTY medium to coarse SAND with some fine gravel; dark grey and greyish brown. Medium dense; wet. 2.8m							
	Fine SANDY SILT; dark grey. Wet; sensitive. 3.2m		3					
	Fine GRAVELLY medium to coarse SAND; dark grey and greenish grey. Medium dense to dense; saturated.		4					Moderate seepage below 3.7m.
	EOP 4.2m Target Depth		5					
			6					

MACHINE TYPE: Hitachi 12t

TEST PIT TERMINATED AT:

Target Depth [✓] Refusal [ ]

Near Refusal [ ] Flooding [ ]

SAMPLE TYPE:

[ ] bulk sample

[ ] tube sample

[ ] disturbed profile sample

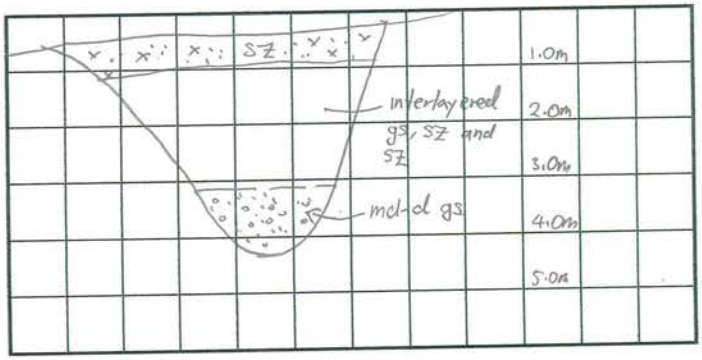
FIELD SHEAR STRENGTH:

[V] Shear vane

[P] Hand penetrometer

[E] Estimate only

TEST PIT SECTION SCALE: 1:10



EARTHTECH CONSULTING LTD

APPENDIX 6
TARANAKI REGIONAL COUNCIL MONITORING REPORT

28 May 2014
Document: 1354131

03 JUN 2014

Taranaki Regional Council

Stratford District Council
PO Box 320
STRATFORD 4352

Attention: Mike Oien

Dear Mr Oien

Contractual periphyton work in the Patea River

Enclosed is the final report which we have prepared for you and your HG consultant on the contractual periphyton work in the Patea River. This provides the results of the two years of spring-summer periphyton/chlorophyll-a data collection that Taranaki Regional Council has performed. Please note that this is the final report and that some of last year's data required re-calculation of results, i.e. don't use the interim report's data of April, 2013.

Any queries may be directed to Ms Fiza Hafiz (Scientific Officer) who prepared the final report.

Yours faithfully
BG Chamberlain
Chief Executive

for per: G K Bedford
Director - Environment Quality

Patea River Periphyton

There is a full freshwater nuisance periphyton report with analysis and interpretation available from the Council. This most recent report includes periphyton index information for 2006 to 2010. The next report will concentrate on the 2010-2012 period and is currently in preparation. Chlorophyll-a data is now available for summer 2011-2014 .

Please find below periphyton index data for the period 2006-2014 and chlorophyll-a data for 2011-2014 at the two sites Council monitors (PAT000200 and PAT000360) on the Patea River as part of the State of Environment Monitoring (SEM) programme. Also included are results from the 6 surveys undertaken in the 2012/2013 (3 surveys) and 2013/2014 (3 surveys) monitoring years for sites PAT000345, PAT000350 and PAT00360 which have been included by SDC request. The 2013/2014 monitoring is the last monitoring carried out for the additional contractual periphyton survey.

Site details

Five sites were monitored for periphyton along the Patea River. The detail for each site is described in Table 1 below.

Table 1: Location of periphyton monitoring sites along the Patea River

Site code	Easting	Northing	Location
PAT000200	1702620	5646598	Upstream site on the Patea River at Barclay Road.
PAT000345	1712748	5644549	250m d/s Stratford oxidation ponds (original) discharge (ie u/s of new outfall)
PAT000350	1712956	5644292	130m d/s of 'new' WWTP outfall at Victoria Street, Stratford.
PAT000356	1714497	5645112	1km u/s of Kahouri confluence (u/s SPL discharge).
PAT000360	1715919	5644681	Downstream site on the Patea River at Skinner Road.

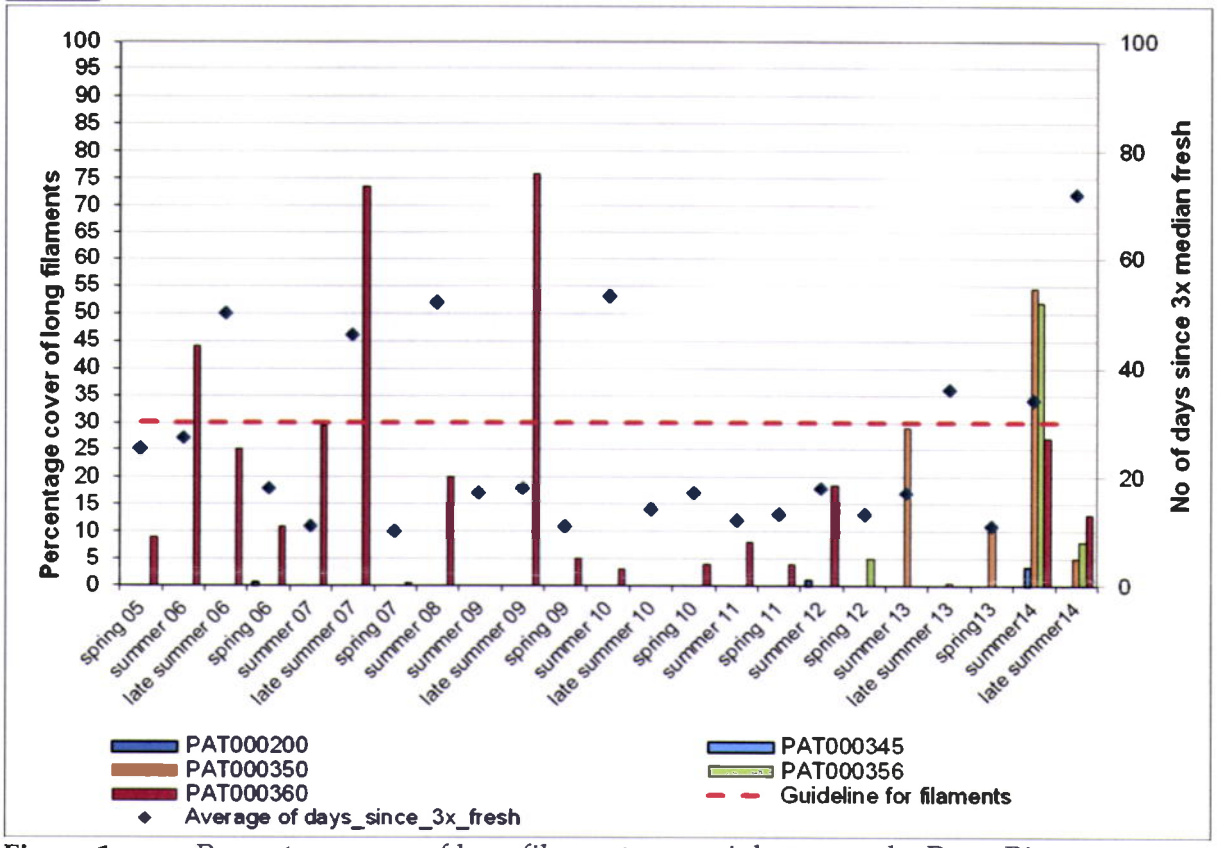


Figure 1 Percentage cover of long filamentous periphyton on the Patea River streambed in relation to the guideline for recreational values and number of days since 3x median fresh events. Monitoring year period 2005/2006 to 2013/2014.

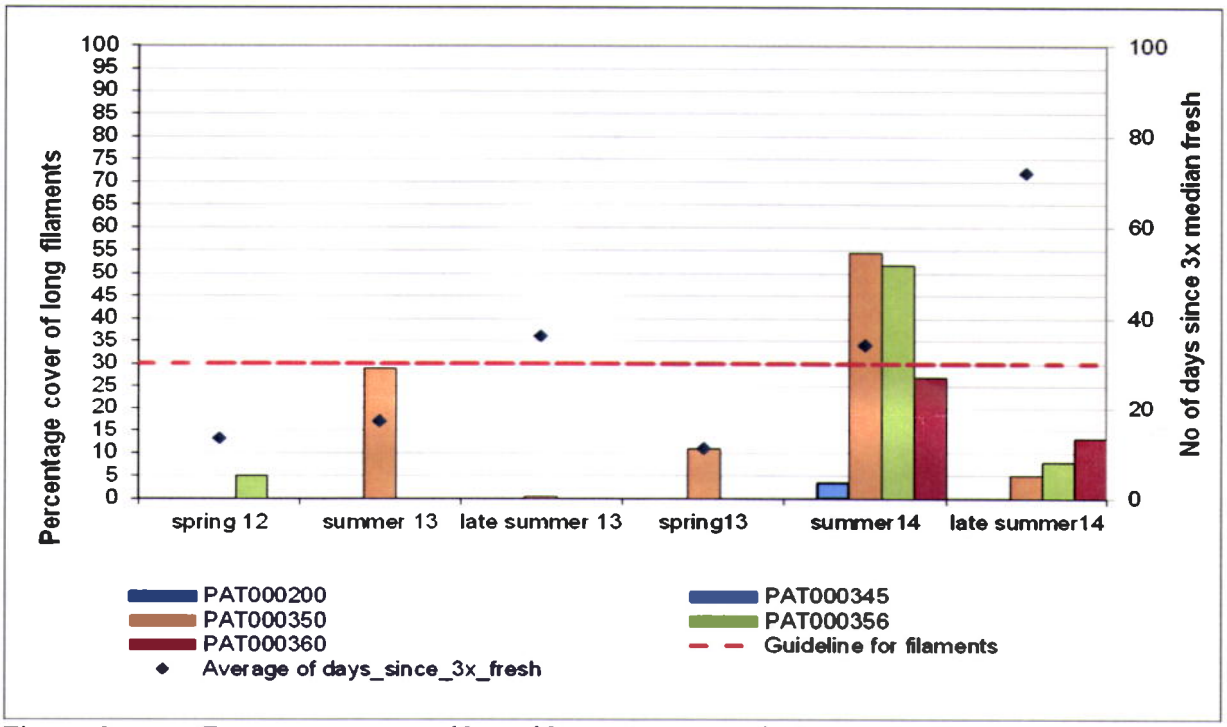


Figure 2 Percentage cover of long filamentous periphyton on the Patea River streambed in relation to the guideline for recreational values and number of days since 3x median fresh events. Monitoring year period 2012/2013 and 2013/2014.

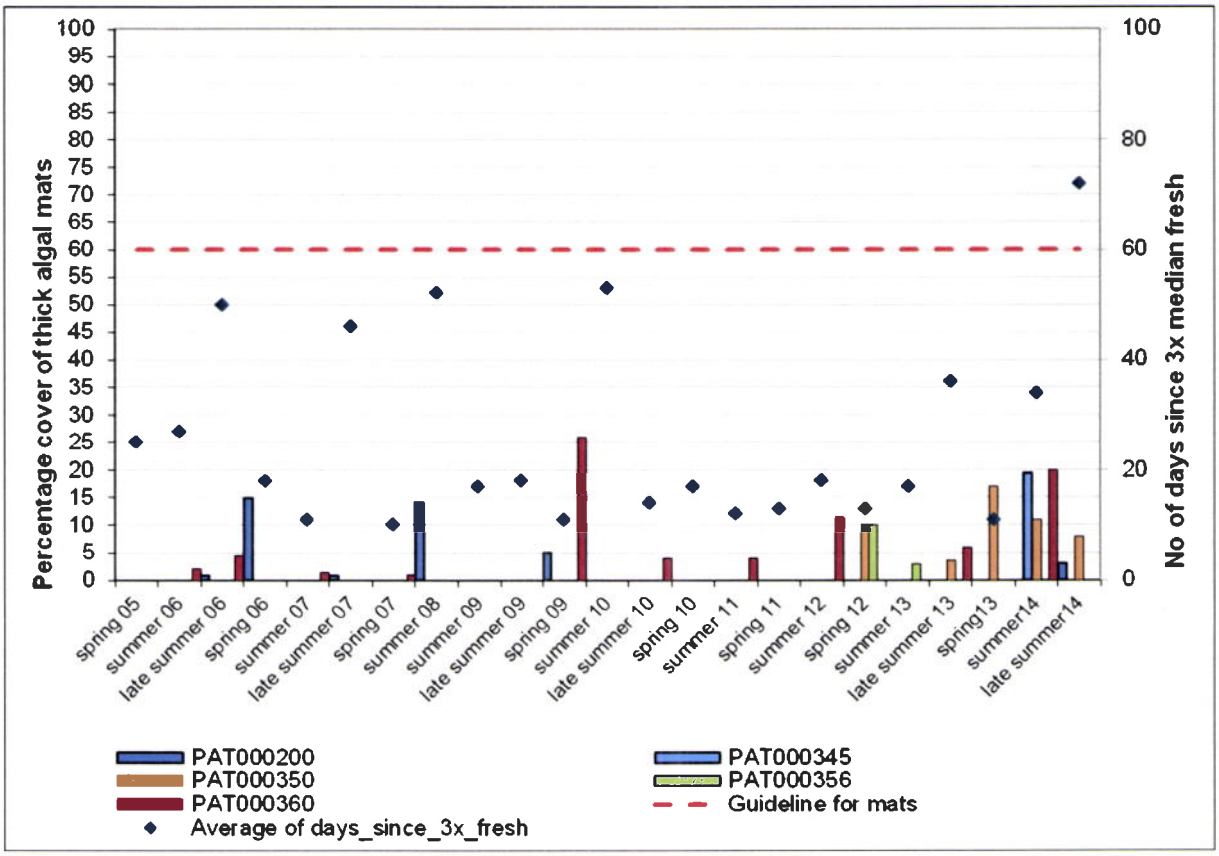


Figure 3 Percentage cover of thick mats of periphyton on the Patea River streambed in relation to the guideline for recreational values and number of days since 3x median fresh events. Monitoring period 2005/2006 to 2013/2014.

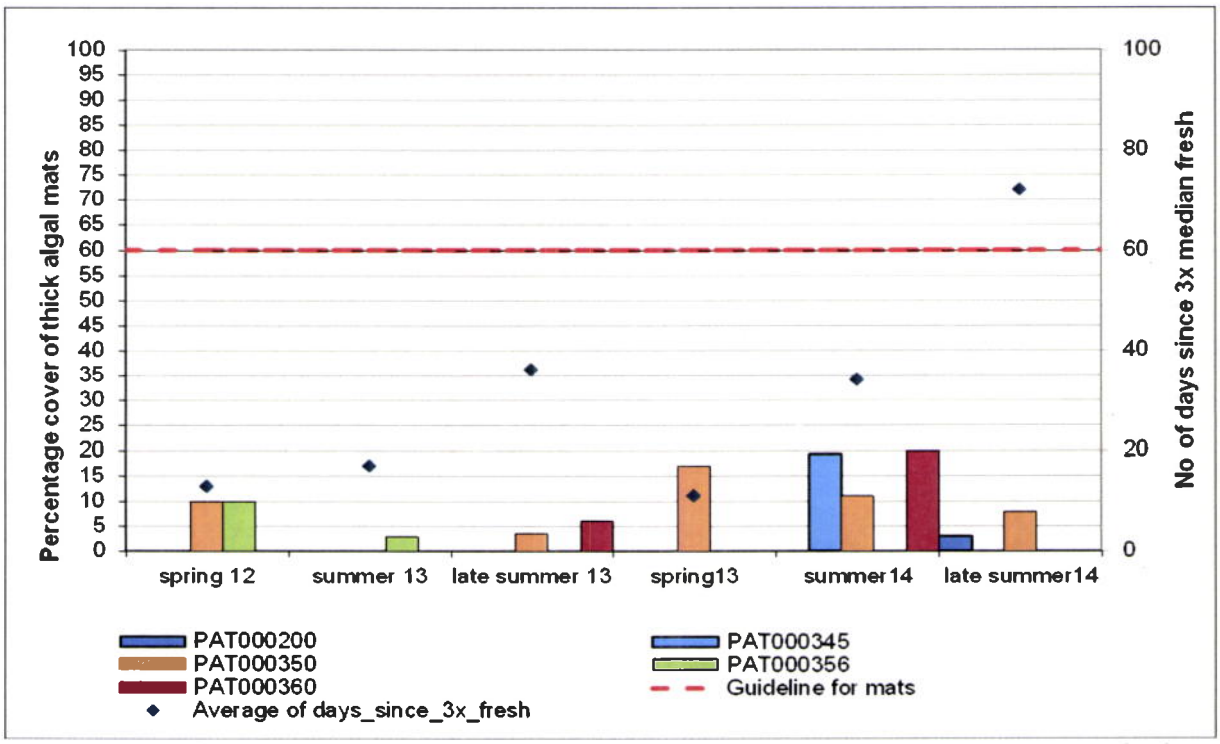


Figure 4 Percentage cover of thick mats of periphyton on the Patea River streambed in relation to the guideline for recreational values and number of days since 3x median fresh events. Monitoring period 2012/2013 to 2013/2014.

Document Number: 1351443
Document Name: SDC_periphyton_data_May14

Periphyton Index Score

Table 2 Median seasonal periphyton index scores for the two sites monitored on the Patea River from 2010-2014. The difference given is the PI for the most upstream site minus the PI for the most downstream site from 2010-2014. [The SEM programme no longer includes late summer surveys. However, two surveys were conducted (one each in 2012/2013 and 2013/2014) in response to a request for information from SDC].

Site	Spring (4 surveys)		Summer (4 surveys)		Late Summer (2 survey)		Overall median	
	SHMAK	TRC	SHMAK	TRC	SHMAK	TRC	SHMAK	TRC
PAT000200	9.7	9.8	9.9	9.9	9.9	9.9	9.8	9.8
PAT000360	9.0	9.1	6.5	6.6	6.7	6.8	7.0	7.1
Difference	0.7	0.7	3.4	3.3	3.2	3.1	2.8	2.7

Table 3 Median seasonal periphyton index scores for the five sites monitored on the Patea River for the 2013/2014 monitoring year. The difference given is the PI for the most upstream site minus the PI for the most downstream site from 2012-2014. [The SEM programme no longer includes late summer surveys. However, two surveys were conducted (one each in 2012/2013 and 2013/2014) in response to a request for information from SDC].

Site	Spring (1 survey)		Summer (1 survey)		Late Summer (1 survey)		Overall median	
	SHMAK	TRC	SHMAK	TRC	SHMAK	TRC	SHMAK	TRC
PAT000200	9.9	9.9	9.8	9.8	9.7	9.7	9.8	9.8
PAT000345	9.8	9.8	7.1	7.1	8.1	8.1	8.1	8.1
PAT000350	7.0	7.0	3.7	5.2	7.1	7.1	7.0	7.0
PAT000356	8.9	8.9	4.7	4.7	7.9	7.9	7.9	7.9
PAT000360	9.3	9.3	4.5	4.5	6.8	6.8	6.8	6.8
Difference	0.5	0.5	5.3	5.3	3.0	3.0	3.0	3.0

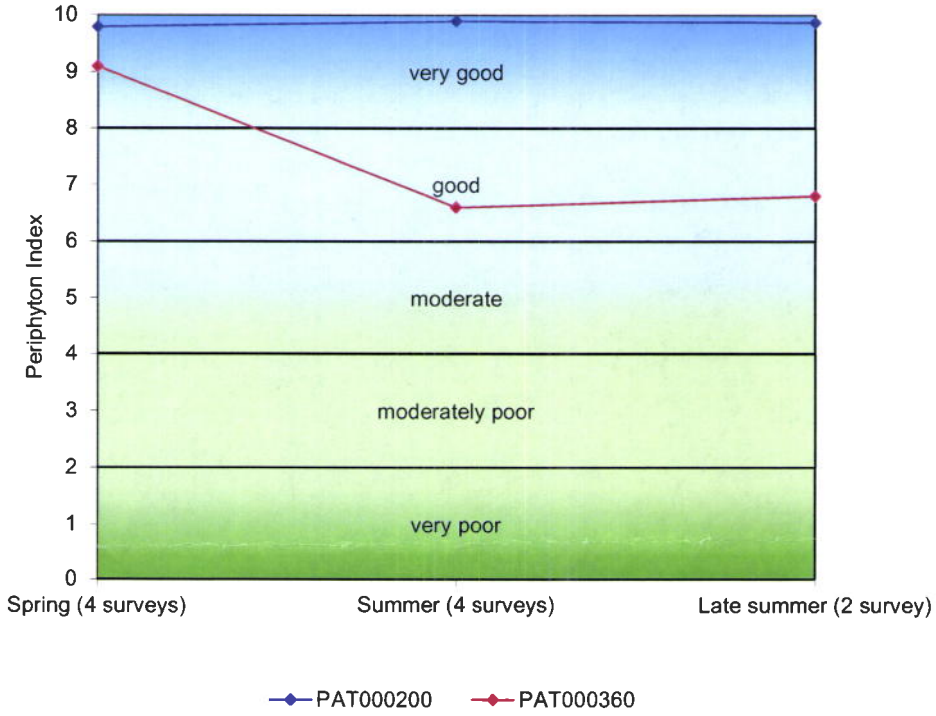


Figure 5a. Change in median TRC PI scores with season in the Patea River at PAT000200 and PAT000360 from 2010-2014 (spring, summer and late summer surveys)

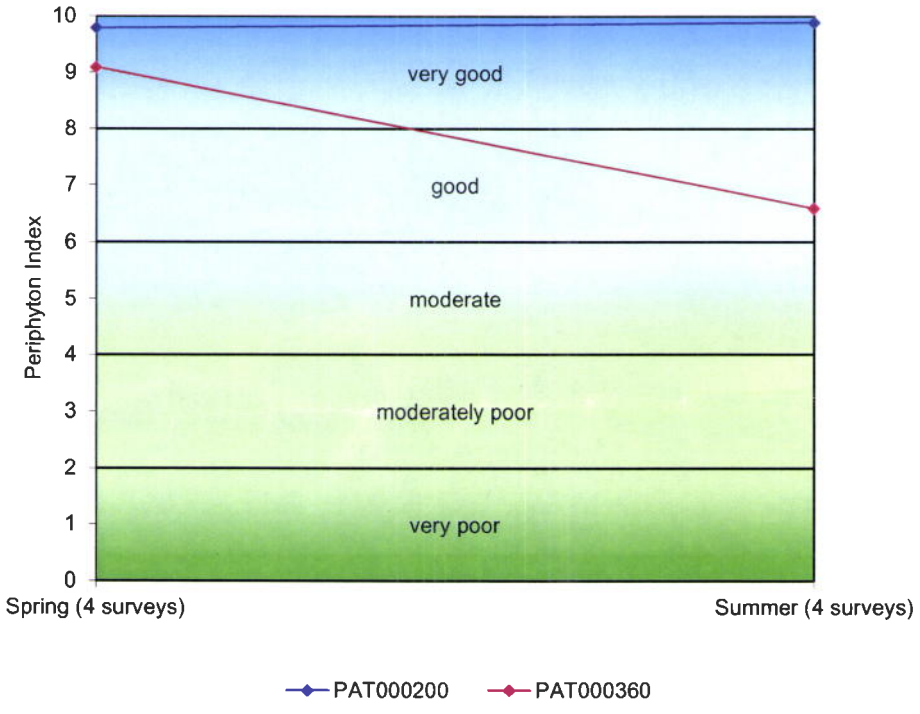


Figure 5b Change in median TRC PI scores with season in the Patea River at PAT000200 and PAT000360 from 2010-2014 (spring and summer surveys only)

Document Number: 1351443
Document Name: SDC_periphyton_data_May14

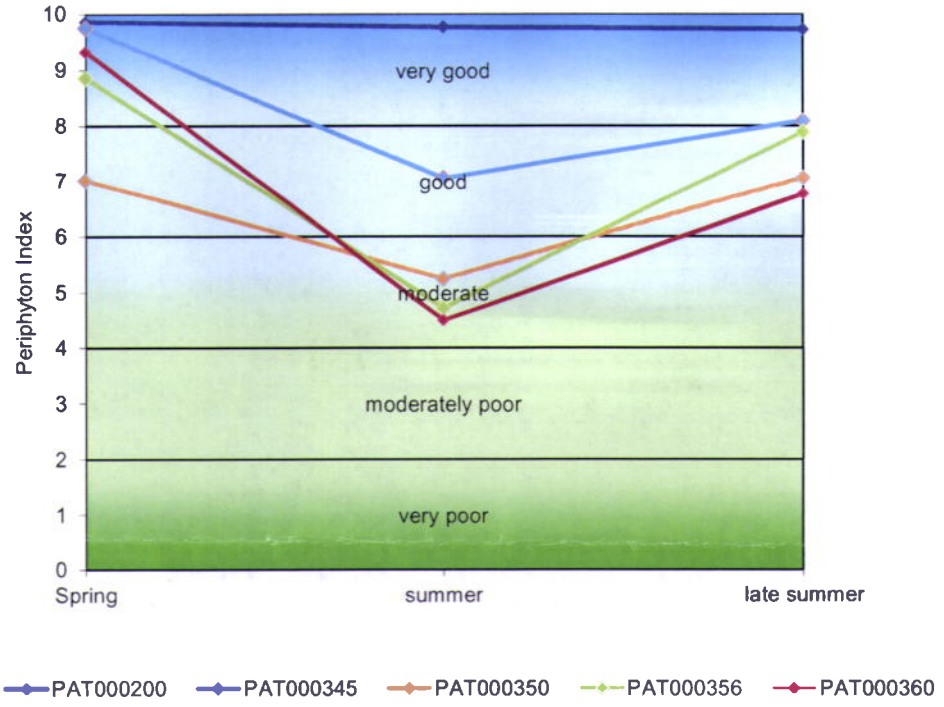


Figure 6 Change in median TRC PI scores with season in the Patea River at PAT000200, PAT000345, PAT000350, PAT000356 and PAT000360 from 2010-2014 (spring, summer and late summer surveys).

Chlorophyll-a

Chlorophyll-a data for the nuisance periphyton programme has been collected for 2011-2014. Additional sites were included in the 2012/2013 and 2013/2014 years. The results for the Patea River sites are stated in the table and graphs below.

Table 4 Chlorophyll-a values for the Patea River sites monitored by the TRC nuisance periphyton programme and the SDC contractual monitoring programme

Site Code	Sample Date	Season	Chlorophyll-a (mgChla/m2)
PAT000200	29/03/2011	Late summer	5.0
PAT000200	01/02/2012	Summer	6.4
PAT000200	02/11/2012	Spring	9.0
PAT000200	01/02/2013	Summer	6.8
PAT000200	20/03/2013	Late summer	5.4
PAT000200	12/11/2013	Spring	3.6
PAT000200	24/02/2014	Summer	4.6
PAT000200	07/04/2014	Late summer	26
PAT000345	02/11/2012	Spring	6.1
PAT000345	01/02/2013	Summer	34
PAT000345	20/03/2013	Late summer	10
PAT000345	12/11/2013	Spring	6.6
PAT000345	24/02/2014	Summer	90
PAT000345	07/04/2014	Late summer	34
PAT000350	02/11/2012	Spring	64
PAT000350	01/02/2013	Summer	276
PAT000350	20/03/2013	Late summer	64
PAT000350	12/11/2013	Spring	97
PAT000350	24/02/2014	Summer	100
PAT000350	07/04/2014	Late summer	130
PAT000356	02/11/2012	Spring	55
PAT000356	01/02/2013	Summer	92
PAT000356	20/03/2013	Late summer	42
PAT000356	12/11/2013	Spring	90
PAT000356	24/02/2014	Summer	140
PAT000356	07/04/2014	Late summer	72
PAT000360	29/03/2011	Late summer	67
PAT000360	01/02/2012	Summer	220
PAT000360	02/11/2012	Spring	11
PAT000360	01/02/2013	Summer	151
PAT000360	20/03/2013	Late summer	94
PAT000360	12/11/2013	Spring	67
PAT000360	24/02/2014	Summer	88
PAT000360	07/04/2014	Late summer	150

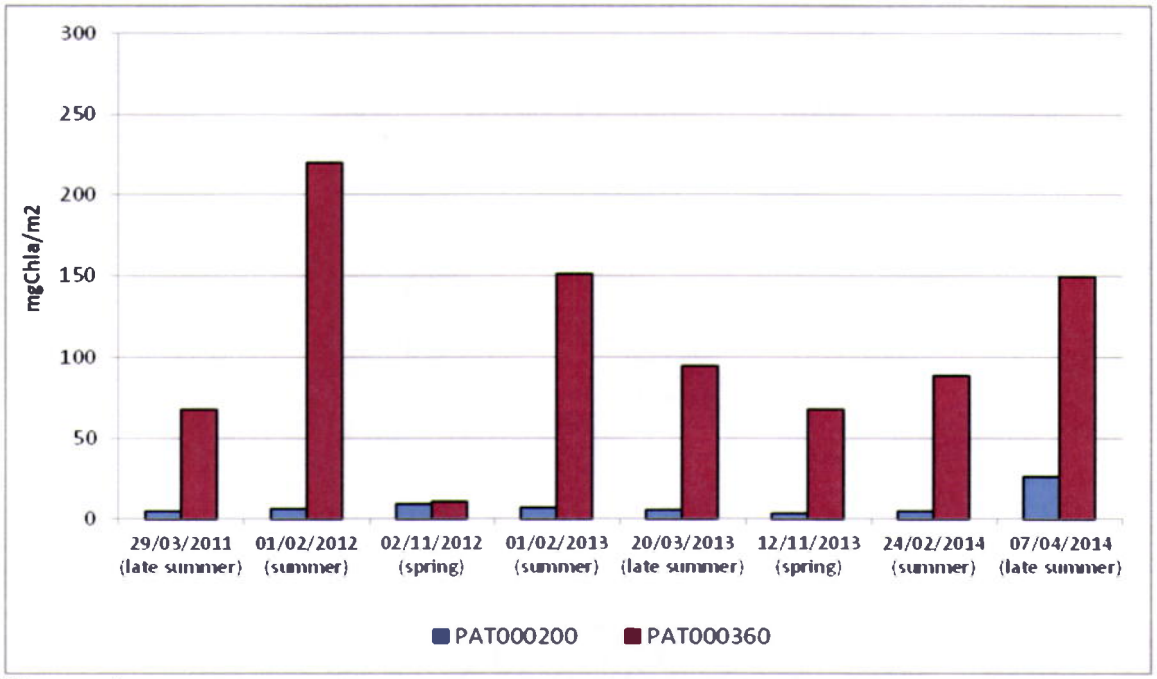


Figure 7 Chlorophyll-a results for the Patea River sites PAT000200 and PAT000360 from 2011-2014.

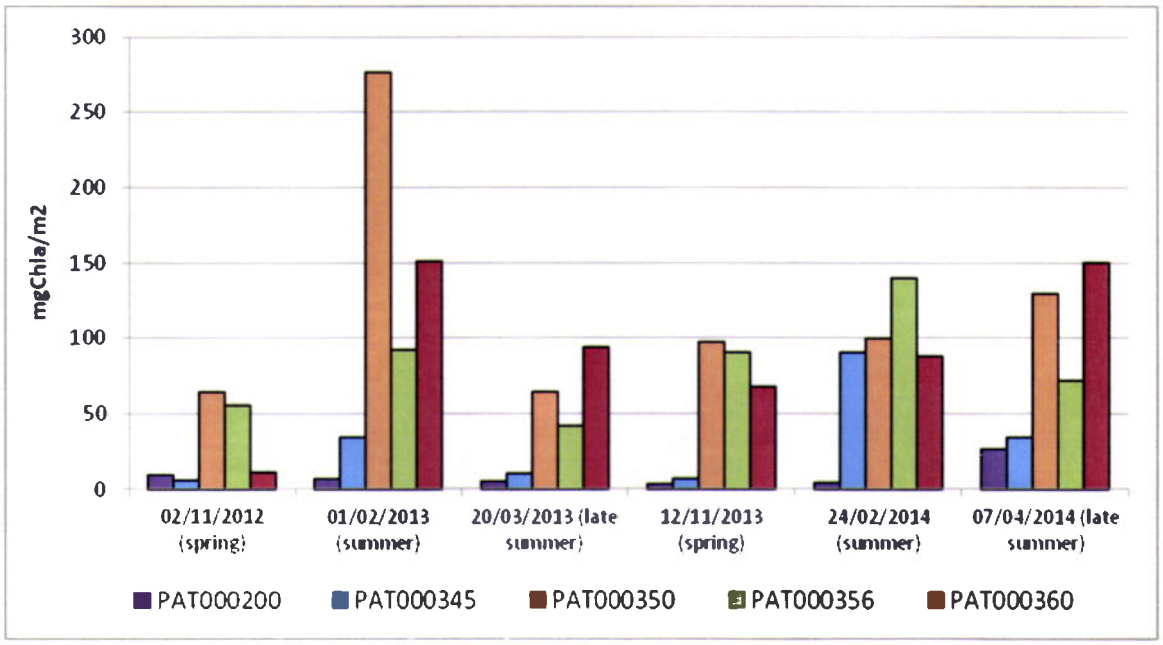


Figure 8 Chlorophyll-a results for all the Patea River sites in the 2012/2013 to 2013/2014 monitoring year.

APPENDIX 7
STRATFORD DISTRICT COUNCIL MUNICIPAL OXIDATION PONDS SYSTEM MONITORING PROGRAMME ANNUAL REPORT 2014-15

HG PROJECT NO: 1014-139079-01

Stratford District Council
Municipal oxidation ponds system
Monitoring Programme
Annual Report
2014-2015

Technical Report 2015-07

Stratford District Council
Municipal oxidation ponds system
Monitoring Programme
Annual Report
2014-2015

Technical Report 2015-07

ISSN: 1178-1467 (Online)
Document: 1537863 (Word)
Document: 1548071 (Pdf)

Taranaki Regional Council
Private Bag 713
Stratford

September 2015

Executive summary

The Stratford District Council (SDC) operates the Stratford municipal oxidation ponds system located to the east of Stratford in the Patea catchment. The SDC holds a renewed resource consent to allow it to discharge treated wastewater to the Patea River. This report for the period July 2014 to June 2015 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess the environmental performance during the period under review, and the results and effects of the content holder's activities.

During the monitoring period, SDC demonstrated an overall good level of environmental performance.

The resource consent was renewed in June 2013 for a short three year duration and included a total of 12 special conditions setting out the requirements that the SDC must satisfy. The previous short term (5 year) consent was granted in April 2008 and was conditional upon a staged upgrade of the treatment system and subsequent extensive (two year) monitoring of the effectiveness of the upgrade prior to addressing issues and options relating to longer term upgrades to the system. This upgrade involved aeration of the primary pond, division of the second pond into three cells, provision of a sub-surface outlet, and relocation and construction of a new rock riprap outfall, and was completed within the requisite time frame. More intensive monitoring commenced in September 2009 to assess the performance of the significant wastewater treatment plant (WWTP) upgrade and this contractual monthly programme was completed in August, 2011. However, further receiving water investigations, specifically in relation to riverbed periphyton impacts, were recognised as fundamental to a more complete assessment of upgrade requirements. This resulted in a further short-term consent renewal (three years) to allow for this contractual work to be completed and evaluated. This data has been integrated within a final issues and options report recently received from the consent holder as a consent requirement. The reduction of stormwater infiltration entering the reticulation, remains an issue to be minimised, with some overflow issues occurring during the monitoring period, due mainly to excessive inflows at the inlet of the plant following a very intensive rainfall event in mid-June 2015. Remedial work undertaken to improve the hydraulic capacity of the new outlet and outfall design together with additional sealing of the second pond's cells' walls has been successful in preventing seepage to adjacent pasture land.

The Council's monitoring programme included four regular inspections, wastewater analyses, and physicochemical and biological surveys of the receiving waters of the Patea River.

In recent years improvements in the consent holder's maintenance programme have generally enhanced the appearance of, and controlled odour from, the system. For the seventh year in succession, no odour complaints were received from neighbouring property owners during the monitoring period coincident with the plant upgrade. Neither were any problems of surface scum accumulation and associated nuisance odours recorded during the period (coincident with continuous mechanical aeration of the primary pond).

Stricter control of industrial waste tanker disposal was instigated by the SDC more than seventeen years ago, and a more appropriate relocation of the tanker disposal area to provide better control of this activity and fewer operational problems for the treatment system was initiated and completed toward the end of the 2008-2009 period. However, some

remedial measures and upgrades to this facility were required to alleviate localised problems at this site. Few problems were experienced with this site during the 2014-2015 period. Liaison with the Council has continued whenever uncertainties have existed with respect to proposed additional industrial loadings.

Regular inspections indicated no immediate problems with the oxidation ponds system's performance, with one overflow to land following a very intensive wet weather event despite re-engineered bunding and cell wall upgrades. Seasonal variability in secondary pond microfloral populations (as indicated by chlorophyll-concentrations) was also influenced by preceding wet-weather stormwater infiltration. Wastewater quality was good at the time of the very low flow late summer receiving water physicochemical monitoring survey with a moderate algal wastewater component. The survey found some impacts of the discharge via the re-located outfall on water quality at sites downstream of the permitted mixing zone in the Patea River, mainly related to increases in nutrient loadings and turbidity under very low receiving water flow conditions, the latter non-compliant with aesthetic consent conditions. A late summer biomonitoring survey found localised impacts upon the macroinvertebrate fauna despite improvements in aspects of the quality of the treated wastewater.

Overall, operational performance of the upgraded system and the environmental performance showed improvements with the additional remedial works generally successful in coping with hydraulic overloads resulting in good environmental compliance during the monitoring year. Issues of high hydraulic loadings will continue to need addressing in the longer term by appropriate stormwater infiltration measures. These improvements were addressed by conditions of the previously renewed consent, in particular the upgrade of the wastewater treatment system which was completed by mid 2009. Performance of the plant was also the subject of a more intensive two-year monitoring programme (required by specific consent conditions and completed in August, 2011) to ascertain the effectiveness of the upgrade and further assess impacts upon the receiving waters of the Patea River. Additional contractual receiving water periphyton work was identified as essential for consideration of WWTP upgrade options and this completed work has now been utilised within the required report detailing issues, options, and costings in relation to a further upgrading of the system.

Late in the 2011-2012 period, the consent holder had presented a report in partial fulfilment of the previous consent requirement to detail issues and options relating to the effects of the upgraded plant's discharge on the receiving environment and the options for further upgrades to the treatment system. The latter was required to give particular emphasis to nutrient reduction in the wastewater discharge which necessitated that the additional periphyton receiving environment work was performed in order for the report to be finalised. This report required by 30 June 2015 as a condition of the recently renewed consent (which will expire at 1 June 2016) has been received.

Recommendations include continuation of a similar basic monitoring programme over the 2015-2016 period and requirements relating to operation and maintenance of the treatment ponds system and liaison with the Council.

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1. Introduction

1.1 Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1 Introduction

This report is the Annual Report for the period July 2014 to June 2015 by the Taranaki Regional Council (the Council) describing the monitoring programme associated with the renewed resource consent held by Stratford District Council (SDC) for the Stratford municipal oxidation ponds' system (see Appendix I), which expires on 1 June 2016.

This report covers the results and findings of the monitoring programme implemented by the Council in respect of the consent held by SDC relating to the discharge of treated wastes into the Patea River. This is the twenty-eight annual report to be prepared by the Council to cover this discharge and its effects.

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 *Resource Management Act* 1991 (RMA) and the Council's obligations and general approach to monitoring sites through annual programmes, the resource consents held by SDC in the Patea 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 Patea catchment.

Sections 2, 3 and 4 present the results of monitoring during the period under review, including scientific and technical data, discusses the results, their interpretation, and their significance for the environment.

Section 5 presents recommendations to be implemented in the 2015-2016 monitoring year.

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

1.1.3 The Resource Management Act (1991) and monitoring

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

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

In drafting and reviewing conditions on discharge permits, and in implementing monitoring programmes, the Council is recognizing the comprehensive meaning of

'effects' inasmuch as is appropriate for each discharge source. Monitoring programmes are not only based on existing permit conditions, but also on the obligations of the RMA to asses 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 performance of resource users against regional plans and consents. Compliance monitoring, including impact monitoring, also enables the Council to continuously assess its own performance in resource management as well as that of resource users particularly consent holders. It further enables the Council to continually re-evaluate its approach and that of consent holders to resource management, and, ultimately, through the refinement of methods, to move closer to achieving sustainable development of the region's resources.

1.1.4 Evaluation of environmental and administrative performance

Besides discussing the various details of the performance and extent of compliance by the consent holder/s during the period under review, this report also assigns a rating as to each Company's environmental and administrative performance.

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

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

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

Environmental Performance

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

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

For example:

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

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

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

Administrative performance

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

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

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

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

For reference, in the 2014-2015 year, 75% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level o f environmental performance and compliance with their consents, while another 22% demonstrated a good level of environmental performance and compliance with their consents.

1.2 Treatment plant system

Stratford town sewage was treated by a twin oxidation ponds system (2.6 ha and 1.7 ha in area), designed and constructed in 1965 for a population of 6300 persons and operative in that format until upgraded in 2009. Some industrial wastes are also discharged into the system, which included an influent splitter chamber at the end of the main town trunk sewer.

This chamber provided for splitting of the raw sewage influent to flow into either, or both ponds, but this provision was only intended for utilisation when excessive stormwater infiltration may have caused an overflow directly to the second pond. The final outfall (from the second pond) was to the Patea River. However, the connection between the two ponds and the outlet to the river were originally positioned directly opposite each other, thereby having the potential to short-circuit and reduce retention time in the second pond. The consent holder re-sited the final outlet to the south of the original outlet during 1998-1999 to provide improved retention in the secondary pond. Prior to the 2000-2001 monitoring period no significant sludge accumulation had been detected in the pond's system, although only one intensive survey had been performed, fifteen years after commissioning of the treatment system. However, following significant primary pond surface scum problems recorded late in 2000, the consent holder obtained a consultant's report which indicated that considerable sludge accumulation had occurred in the primary pond in particular. Temporary work was necessary to alleviate the immediate surface scum problem, with local burial covering of the sludge. Longer term de-sludging of the pond system required detailed planning by the consent holder with the Council and was programmed for the latter part of the 2003-2004 period in accordance with an air emission consent (6262) granted specifically for this purpose. The de-sludging operation was performed during the 2004-2005 period (TRC, 2005 and TRC, 2006), after which the consent was surrendered.

In the 2000-2001 period the consent holder installed influent flow recording at the entrance to the system as the first stage of an assessment of pond loadings and performance, including stormwater infiltration to the system. This information, together with more frequent monitoring of effluent quality (which commenced under contract to the consent holder in the 2001-2002 period) provided the consent holder with data relating to the optimisation of the existing ponds' system and determination of further tertiary treatment options. Further reconstruction of the influent chamber was undertaken during the 1999-2000 period with the longer-term intention of elimination of the influent splitting facility. A building to house the area was constructed during the 2000-2001 period.

Renewal of the grating system on the original outlet from the second pond was undertaken in late 1999. This outlet was then sealed but was raised and re-opened in 2004 and was utilised whenever stormwater infiltration volumes increase effluent rates beyond the capacity of the re-positioned outlet.

Connection of the new saleyards' partially treated wastes into the sewerage reticulation was approved during the 2002-2003 period and has operated without problems since the saleyards were commissioned.

Construction of a new step screen on the influent line to the ponds system was completed in 2005, as a component of the upgrade, but was de-commissioned for a

period in 2006-2007 due to blockage problems thought to be linked with industrial waste tanker usage of the system. Waterblasting of the main reticulation upstream of the step-screen was only partially successful in alleviating this problem, necessitating relocation of the waste tanker disposal facility closer to the ponds system. A further relocation of this facility was discussed and implemented in mid 2009. The more suitable location at the Esk Road saleyards provides better facilities and an improved monitoring capability together with a suitable disposal site for campervan wastes, although regular monitoring and maintenance is required by SDC.

The consent holder advised in 2001 that $600,000 had been allocated for improvements to the ponds' system. A pond's influent waste loadings assessment was a component of an upgraded programme. Any further upgrade of ponds' wavebands was to be addressed in the upgrade. An initial meeting between the consent holder, consultant and the Council was held in February 2003 to address issues in relation to the 2004 renewal of the consent. This meeting outlined issues of upgrading options for improvements to the treatment system, which formed a component of the assessment of effects accompanying an application for consent renewal received in November 2003. Provision of additional information occurred and the final assessment of effects report was lodged with the Council late in 2007. The renewal of the consent was granted in April 2008 following a further pre-hearing meeting with several submitters.

1.2.1 Upgrading of the system

During the consent renewal process, the consent holder proposed various upgrades to address various issues which had arisen in the operation and performance of the treatment system. These short, medium and long-term measures included:

- mitigation of the risk to the secondary pond embankment by reducing the pond level by means of the recommissioned original outlet with an overflow riser to take diluted flows in excess of the capability of the newer outlet;
- identification and removal of illegal stormwater connections from properties in the town (30% of properties inspected to date have not fully complied with regulations);
- a step-screen fitted to the inlet to the ponds system;
- investigation and strengthening of the areas of faulty embankment;
- longer term replacement of old pipework to reduce stormwater infiltration into the reticulation (proceeding).

Further, the consent holder undertook (as required by conditions of the renewed consent) to upgrade the wastewater treatment system by:

- provision of mechanical aeration of the first pond (which was installed in June 2008);
- refurbishment of ponds' wavebunds;
- partitioning of the second pond into three cells and installation of a subsurface outlet to minimise the microfloral component of the treated effluent;
- relocation and redesign of the piped discharge (further downstream) with passage of the treated effluent through a rock riprap structure prior to river discharge.

These upgrades were required to be completed by 30 June 2009 after which more intensive treated wastewater monitoring (contracted to the Council) was to be

instigated to asses both the effectiveness of the upgrade and options for further improvements to the wastewater treatment system necessary to address the environmental effects of the discharge on the water quality and the aquatic biota of the Patea River.

The short-term renewed consent had an expiry date of June 2013 and various performance reporting timeframes within this period.

All components of the upgrade were completed and operative by the end of the 2008-2009 period, necessitating certain alterations to the spatial components of the receiving water monitoring programme.

An updated report on progress with implementation of the inflow and infiltration reduction programme to minimise stormwater inflow was received in mid 2010 advising that the consent holder would undertake visual infiltration surveys in winter and summer followed by CCTV surveys within the reticulation to determine sections of the mains requiring repairs or replacement. This work was intended to be priority programmed based on the severity of problems, although the consent holder anticipated that completion of the work could take several years due to financial restraints.

After completion of the winter 2010 infiltration survey, smoke testing of sewer mains and laterals was identified as required to ascertain the reasons for further significant infiltration found in specific urban areas. On completion of these investigations, SDC programmed further repair work. Further advice received from the consent holder indicated that as several areas have severe infiltration, one particular catchment had been identified for intensive work by contract prior to remedial work in other catchments.

A problem with the original outlet from the second pond had remained unresolved at the end of the 2008-2009 monitoring period. This outlet in the newly created first cell of this pond had overflowed intermittently to the new diversion pipeline prior to joining the final effluent discharge, thereby partially short-circuiting the full treatment design provided by the upgraded three cell division of the second pond. Rectification of the situation had been discussed with the consent holder (and consultant), and the pipe was sealed later in 2009, prior to the implementation of the increased contractual monitoring to assess the upgrade's effectiveness (as required by Special Conditions 12 and 13 of the renewed consent).

This additional monitoring was subsequently commenced in late September 2009 and continued at monthly intervals with completion in August 2011 after two years' duration. Data was reported to the consent holder and consultant at yearly intervals. Further assessment of the impacts of the upgraded wastewater treatment plant's discharge upon nuisance periphyton growth on the river substrate, was initiated (over a period of two spring/summer seasons) and was completed in early 2014. This delayed the full appraisal of the long term upgrade options which necessitated a further, acceptable, short-term renewal of the consent, while the consultant received and evaluated the necessary data.

Urgent remedial work was also required on the rock riprap component of the outfall where the manhole upstream of the riprap surcharged severely following a very wet-

weather period in mid 2009, August 2009, September 2009 and June 2010 (see TRC, 2010) with wastewater flooding the surrounding pastures.

Engineering extensions were undertaken to the rock riprap and the modified outfall structure performed effectively as required although the manhole surcharged from time to time under high, wet weather flow conditions. A major re-engineering of the outfall was undertaken subsequently to improve hydraulic capacity of the structure.

The secondary pond wall was raised and the pond perimeter bunded in July 2010 while the outlet was re-engineered to provide improved hydraulic capacity in the discharge pipeline. This was completed in August 2010 and the cell dividing walls were also provided with contoured shallow spillways (between the cells) to alleviate overtopping.

1.3 Resource consent

1.3.1 Water discharge permit

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

SDC holds water discharge permit 0196 which authorised the discharge of 4,800 cubic metres/day of treated wastewater from the municipal oxidation ponds system into the Patea River.

This consent was renewed in late April 2008 and again in June 2013, and expires on 1 June 2016 with no review dates. A copy of the renewed consent is attached as Appendix I and was the subject of the monitoring programme. Conditions limit the volume to be discharged, consultation on trade waste connections, reporting progress on the upgrade, proper operation of the system, implementation of an infiltration reduction programme, maintenance of a management plan, and limit effects in the receiving waters. Other conditions require monitoring which have provided information contributing to a report which will detail options and issues for reduction in nutrient discharge loadings when considering further upgrading of the waste water treatment plant (WWTP).

1.4 Monitoring programme

1.4.1 Introduction

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

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

An appropriate monitoring programme was established for the system in 1987 and upgraded annual programmes have continued since this date. The 2014-2015 monitoring programme consisted of four primary components.

1.4.2 Programme liaison and management

There is generally a significant investment of time and resources by the Council in ongoing liaison with resource consent holders over consent conditions and their interpretation and application, in discussion over monitoring requirements, preparation for any reviews, renewals, or new consents, advice on the Council's environmental management strategies and the content of regional plans, and consultation on associated matters.

1.4.3 Site inspections

The Stratford oxidation ponds system was visited four times (as programmed) during the monitoring period. The main points of interest were plant operation, maintenance, upgrades, and performance and the discharges of treated wastewater. These inspections provided for the operation, internal monitoring, and supervision of the plant to be reviewed by the Council.

1.4.4 Wastewater and receiving water quality sampling

The Council undertook sampling of wastewater quality and receiving river water physicochemical quality for plant performance and impact assessment purposes. Frequency of sampling and analytical parameters measured varied according to the purpose of monitoring. An additional site had been added to the receiving waters sampling programme since the 2008-2009 period, due to the relocation of the upgraded outfall.

1.4.5 Biological survey

The programmed summer macroinvertebrate biological receiving water survey was undertaken on 10 February 2015 at four sites in the Patea River under late summer very low flow conditions, six days prior to the physicochemical survey of the receiving waters. The additional site, added to the survey in March 2009 as necessitated by the relocation of the outfall (a component of the WWTP upgrade), was used in place of one of the original sites, which was no longer appropriate for biomonitoring purposes.

2. Results

2.1 Inspections of treatment system operation

The four regular scheduled inspections were performed during the monitoring period. During regular inspections, physical features of the components of the system were recorded, and dissolved oxygen concentrations were measured in the surface wastes adjacent to the repositioned oxidation pond outlet. Results of the dissolved oxygen measurements from scheduled inspections are summarized in Table 1. Chlorophyll-a samples were also collected from the final cell of the second pond on each scheduled inspection visit (see Section 4.6) for on-going assessments of system performance.

Table 1 Dissolved oxygen measurements from the surface of the third cell of the upgraded Stratford secondary oxidation pond at the perimeter adjacent to the outlet

Date	Time (NZST)	Temperature (°C)	Dissolved oxygen	
			Concentration (g/m^3)	Saturation (%)
3 September 2014	0855	11.2	6.1	58
3 December 2014	0745	16.2	9.2	96
16 February 2015	0925	18.4	10.5	114
18 June 2015	0900	8.9	3.7	32

As dissolved oxygen concentrations vary both seasonally and on a daily basis (with minimum concentrations recorded in the early hours of daylight), pond performance has been monitored by standardising sampling times toward mid-morning (0745 to 0925 hrs in the 2014-2015 period). Sampling was standardised in this manner for all regular inspection visits. The results in Table 1 indicate dissolved oxygen was present at all times in the surface layer of the third cell of the upgraded secondary pond near the outlet, over a moderately wide range of concentrations, with some seasonal variation (between 32% and 114% saturation) recorded during the period, although more variable than in the previous period when supersaturation was not recorded. The variation in saturation levels measured to date has been typical of a biological treatment system in which the photosynthetic contribution of the microfloral population often causes wide dissolved oxygen variations and may lead to supersaturation at times during daylight hours (particularly later in the day). Mechanical aeration of the primary pond (4 aerators) was installed as a component of the system upgrade (required by the renewed consent), late in the 2007-2008 monitoring period (see Section 3.1.1) and these aerators were operative on all inspection occasions.

The primary pond varied from turbid pale green-brown to turbid, dark green-brown while the final cell of the secondary pond system varied from relatively clear, pale green to slightly turbid, dark green to turbid, dark green in appearance on inspection occasions. No surface accumulations of floating scum were noted in the corners or at the edges of the primary pond on any inspection occasions coincident with the continual operation of the mechanical aerators which maintained noticeable circulation through this pond. However, debris accumulation was noted on three occasions on the outlet structure which also required maintenance due to partial collapse (Photos 1 and 2).

Photo 1 & 2 Primary pond outlet, December 2014 and June 2015

Localised odours were recorded in the vicinity of the ponds on all inspection times, but these were slight and no odour complaints were received from nearby residents during the period. Past complaints had been related to scum build-up on the surface of the primary pond necessitating remedial clearance. Occasional slight odours in the area around the flume shed and step screen were noted but improved management of the solid wastes screening and disposal system minimised these issues. The stepscreen area had been tidied and re-grassed during the 2011-2012 period. Tanker wastes disposal had been transferred to a better disposal site (at the Esk Road saleyards) by the consent holder near the end of the 2009-2010 period.

No sediment was observed rising to the surface in either the primary pond or cells of the secondary pond on any inspection occasion, which might be expected after the relatively recent de-sludging operation. The primary pond and secondary cells' surfaces were relatively flat on all occasions as inspections coincided with calm to relatively light wind conditions. Wildlife were present during all inspection visits with ducks (mallard, teal, and paradise) common on the primary pond and secondary pond cells at all times and black swans (up to 50 swan) also present on several occasions. Canadian geese were present in low numbers on the primary pond and secondary pond cells on one occasion where pied stilt were noted from time to time. There was a repeat of the large populations (>500) of paradise ducks present on these cells in late summer. These wildlife species are common to the avifauna associated with such treatment ponds (Don, 2004).

Photo 3 Waveband erosion June 2015

The ponds' surrounds were generally tidy due to grazing throughout the monitoring period. The waveband repairs of the mid 1990s which used gabion baskets, continue to be monitored by the consent holder with respect to weed growth, debris entrapment and/or odour problems. Further waveband replacement and repairs had been undertaken by the consent holder as a component of the consented upgrade. Some localised subsidence behind the original waveband repairs had previously required remedial backfilling (TRC, 2004). The secondary pond cells' walls were re-contoured and sealed early in the 2011-2012 monitoring period. There was some evidence of waveband scouring noted late in the monitoring period and there was consideration given to switching the aeration system off under extremely high pond level conditions (late June 2015) to prevent further undermining of the wavebands.

New access jetties to the outlet grids had been constructed by the consent holder relatively recently for cleaning and maintenance purposes. However, maintenance of the primary pond outlet grid was inadequate at times during the period.

The provision for influent splitting at the entrance to the ponds' system had been designed for use only under high (stormwater infiltration) flows. The influent splitter is checked after heavy rainfall and on a regular weekly basis by the consent holder's contractor but in September 2009 a direct inflow of raw wastewater short-circuiting to the final cell of the secondary pond was noted and required immediate remedial action to be undertaken by the consent holder to plug the connection. At that time, a new influent design to prevent inflow directly entering the secondary pond during heavy rainfall events (which had been constructed during the 2000-2001 monitoring period) was ineffective as it had been by-passed by a faulty bung. This was remedied soon after discovery of the problem.

Effluent discharge estimates ranged from 15 to 30 L/sec, depending upon preceding climatic conditions although these could have been underestimates due to the nature of the rock riprap structure which reduced visibility of the total flow at the outfall. Appearance varied from relatively clear, pale green (winter) to turbid dark green (spring and summer) through the period.

These discharges were from the new re-relocated outfall from the system upgrade, 600 metres further downstream of the original outfall, where filtration of the wastewater through rock riprap occurs on the true right bank of the river prior to discharge. This outfall was fully operative during the period after the overflow outlet in the first cell of the secondary pond was re-routed into the outlet pipeline in 2008-2009. The rock rip-rap had required some maintenance by way of debris clearance late in the 2013-2014 period as the aesthetic appearance in close proximity to the extended river walkway was unacceptable but was free of debris during the 2014-2015 period. Hydraulic problems with this new outfall structure, in mid 2009 (see TRC, 2010) required redesign of the rock riprap section early in the 2009-2010 period and further re-engineering to improve the hydraulic capacity of the structure in the 2011-2012 period. There were no particularly noticeable visual impacts of the effluent discharge under moderate winter, flow conditions. However, there was some visual discolouration beyond the mixing zone under lower river flow conditions on the other three inspection occasions.

The adequacy of the mixing characteristics within the consented 100 metres mixing zone of the river had been confirmed by a fluorescein dye-tracing exercise undertaken on 28 March 2014 under relatively low river flow conditions (Skinner Road recorder flow: 0.495 m^3/s). The dye tracer indicated complete mixing across the river at the boundary of the mixing zone, 100 m downstream of the rock riprap outfall (see TRC, 2014).

2.2 Comments and incidents

Matters relating to wavebands maintenance, scum formation, primary pond de-sludging (TRC, 2006) and ponds' overflows have been extensively documented in past reports (see references) particularly the report for the 2003-2004 period (TRC, 2004). No overflow incidents were recorded during the 2008-2009 period, but higher than normal

levels noted in the first cell of the second pond had been addressed by the consent holder. However, overflow events re-occurred in the 2009-2010 period (TRC, 2010). The secondary pond cells' walls were subsequently raised and re-metalled, spillways were constructed in the cell dividing walls, and a major re-engineering of the outlet structure was performed to improve its hydraulic capacity. The secondary cells' walls were re-contoured and sealed early in the 2011-2012 period.

Despite expectations that scum formation would be less prevalent following completion of the primary pond de-sludging programme and installation of an inlet pre-screening mechanism, monitoring prior to the 2008-2009 period found that the problem remained. However, subsequent to introduction of mechanical aeration of the primary pond (a component of the system upgrade), no scum formation or accumulation problems occurred and this continued to be the situation over the current monitoring period.

2.2.1 Step-screen at the inlet

A step-screen and associated overflow by-pass were constructed at the inlet to the ponds' system early in the 2005-2006 monitoring period.

Following a complaint in early August 2005 of raw sewage flowing down Victoria Road from the entrance gateway to the ponds' system, it was found that screens in both channels had blocked causing the channels to overflow to the adjacent roadside and drain. Following notification by Council staff, the consent holder immediately manually cleaned both screens which lowered inflow levels and stopped the overflow, and then temporarily removed the step-screen to prevent further blockages.

The problem was linked to significant gravel build-up in the main sewerage reticulation upstream of the inlet. The secondary screen on the bypass line was permanently removed and temporary barriers were installed to contain the spillage.The overflow area was limed for disinfection and tidied. Permanent bunding was constructed, planting and earthworks undertaken, and the system alarmed to provide for immediate contractual response. Monitoring of the system by the consent holder found that gravel build-up in the sewer line continued to cause problems upstream of the step-screen which was removed and re-installed when the blockage was removed. Additional inspections during 2005-2006, particularly following heavy rainfalls, found that no further overflows had occurred and none occurred during the 2006 to 2009 monitoring periods. However, smaller localised spillages were noted in the 2008-2009 period with these directed through an open channel into the primary pond. With the relocation of the septic tanker wastes disposal facility to the Esk Road saleyards this area was tidied up. Reports that unauthorised tanker usage of the system had occurred during the 2012-2013 period were conveyed to the consent holder for resolution at that time. No such reports occurred during the 2013-2014 period.

Several odour complaints during 2006-2007 and 2007-2008 from neighbouring properties suggested that surface scum build-up (responsible for the odours) had worsened since the de-commissioning of the step-screen. This facility was made operational by March 2007 and, apart from electrical maintenance, remained operative through the remainder of the 2006-2007 period. However operating problems occurred at times in the latter half of 2007, particularly in relation to the solids wastes bin disposal system. This was rectified with the provision of fully enclosed plastic bin

liners. All debris removed by the screen is pressed on site prior to transfer for disposal at the Colson Road, New Plymouth landfill. The step screen was removed for maintenance late in the 2013-2014 period. In recognition of the potential for debris build-up in the reticulation (between the tanker discharge site and the step-screen) to affect the step-screen performance, a new tanker wastes disposal facility was constructed adjacent to the entrance to the ponds system. Although this was completed for use during the 2007-2008 monitoring period, various problems at the site required that SDC relocate this facility to a more suitable site (at the Esk Road saleyards) and also that improved quality control measures regulating its usage were instigated. This system generally operated successfully during the 2009-2010,2010-2011, 2011-2012, 2012-2013, 2013-2014, and current period.

2.2.2 Esk Road trade waste facility

In early 2012 a complaint was received from a resident adjacent to the Esk Road wastewater disposal facilities in relation to the maintenance and operation of these facilities; particularly the septic tanker wastes disposal area and the potential for overflows from the sewerage reticulation manhole (toward an unnamed tributary of the Patea River). Following an onsite inspection in March 2012 with the complainant and a subsequent meeting with SDC staff it was noted that:

- general maintenance of the septic tanker wastes could be improved by sealing of the surrounds to the disposal area, together with the proposed construction of a 'solids trap' in order to prevent debris being washed by road stormwater in the direction of the complainant's property.
- debris from a recent manhole overflow would be removed from the pasture in the nearby farmer's paddock and, should any further overflows occur, these events would be notified immediately to the Council. Such overflows are to be contained (with no discharges to natural water), disinfected, and debris removed from the area adjacent to the manhole.
- a contingency/management plan would be prepared by SDC for the operation and maintenance of the several wastes disposal facilities (to the sewerage reticulation) at Esk Road.

It was acknowledged that at the time of the complaint and subsequent inspection, no discharges of wastewater were occurring to natural water; rather there were operational/maintenance issues of concern to the complainant. The implementation and monitoring of a dual alarm system by SDC in the wastewater pumping chamber would ensure that future overflow events would be minimised and/or eliminated, but should such an overflow re-occur, it must be contained with no subsequent discharge to natural surface water.

The Esk Road facility was included in subsequent Council inspections of the overall wastewater treatment system compliance monitoring programme. Some localised odours were noted during tanker disposal activities but provided that washdown and debris removal was undertaken satisfactorily by the operators at the time of disposal, no overflow problems were likely to occur. The debris from the referenced overflow incident was removed from the manhole surrounds in the adjacent farmland and the disposal area bund wall was sealed. SDC enlarged the receiving inlet to the reticulation to improve the system's operation and reduce the likelihood of overflow.

A subsequent inspection noted no operational issues with the system and no complaints were received in 2012 since the upgrade was completed, although it was noted that SDC needed to maintain regular appropriate monitoring of the usage of the facility to ensure that the system operated without causing a nuisance and within the trade wastes agreements pertinent to the users.

Some limitations were placed upon the use of this facility by wastes tanker operators (in mid period) due to concerns by the SDC that unlawful industrial dumping was occurring of wastes generated outside of the district.

A complaint was received in mid-February 2013 that wastewater was discharging from the Esk Road pump station manhole over an adjacent paddock to the nearby stream. This occurred during a power outage, but a blockage in the storage chamber reduced the planned storage capacity and an electronic failure within the alarm system resulted in a short-term overflow. Repair and disinfection of the area were undertaken in a timely manner and provisions were made for remedial work in relation to alarms and regular inspectorial monitoring of the system by SDC.

A further overflow from the Esk Road pump station facility occurred in late May 2013 when the alarm system float switches became obstructed in the wet well and therefore did not activate the pumps. A brief overflow of wastewater from the manhole occurred to the nearby stream, which was subsequently rectified. A permanent engineering solution has been installed and tested by the SDC. All debris was removed from the adjacent land.

Letters of explanation for both events were received from the SDC and accepted with no further action recommended by the Council following costs recovery. A temporary protective fence was installed around the manhole.

No complaints concerning this facility were received in the 2013-2014 or 2014-2015 periods during which inspections indicated that maintenance was adequate and there were no significant odours in the vicinity of the pump station. One overflow from the manhole into the adjoining paddock occurred under extremely heavy rainfall conditions in late June 2015 after a power surge caused a localised pump failure on site.

2.2.3 Treatment system overflows

In early October, 2011 following a very heavy rainfall event, the consent holder reported that very high levels of raw influent were causing spillage from the flume shed over the track toward a stormwater drain adjacent to Victoria Road rather than being channelled back into the primary oxidation pond. The step screen was operational at the time. The primary pond level was high and all three cells in the secondary pond had very high levels with the new spillways between cells fully operative and adequate freeboard in the ponds' cells. The re-engineered outlet appeared to have coped effectively with the high pond levels and the discharge via the rock rip-rap structure was flowing at a high rate into the river which was in flood. The flume shed overflow was sand-bagged and the overflow re-directed into the primary pond via the (recently) re-contoured area.

This incident was entered as an unauthorised, non-compliance event within the Unauthorised Incident Register and a written explanation sought and received from the consent holder. The remedial works undertaken and proposed by the consent holder were noted. These were completed in November 2011.

No further overflows occurred over the remainder of the 2011-2012 monitoring period and no overflows occurred in the 2012-2013 period. Very wet weather in July 2012 and late May 2013 caused high inflows to the system which were contained and directed into the primary pond by the re-contoured area around the flume shed. The primary pond level was very high in May 2013, in part due to a partially blocked outlet screen, which was cleaned after discussions with the consent holder. On both occasions the recently re-contoured eastern cell perimeter wavebands operated as designed to contain all wastes without overflows. No overflows occurred during the 2013-2014 period and the majority of the 2015-2015 period during which all pond levels were normal and the dividing walls between the secondary pond cells remained exposed at the time of inspections. However, extensive wet weather in late June 2015 (185 mm rainfall over 20-21 June) resulted in an overflow of the primary pond into the second cell of the tertiary system and an overflow of fully treated wastewater from a manhole in the outfall pipeline into a small watercourse. The treatment system had been extensively monitored by the consent holder under these extremely wet conditions over the two day period and maintenance performed where necessary.

3. Results of oxidation ponds' system monitoring

3.1 Plant performance

A sample of the oxidation ponds' system effluent discharge was collected for analysis on 16 February 2015 as a component of the late summer assessment of effects on the physicochemical quality of the receiving waters of the Patea River under very low flow conditions. In recognition of the industrial trade wastes component of the sewage inflow to the oxidation ponds' system (e.g. galvanising industry, tanker wastes disposal and saleyards wastes), the ponds' effluent was also analysed for selected metals' components. These metals have the potential to impact on biological aquatic life in the receiving waters if concentrations exceed certain levels of toxicity.

The results of this effluent analysis are provided in Table 2 and compared with past surveys' data, which includes the additional monthly contractual tertiary cell analyses (performed between September 2010 and August 2011).

Table 2 Results of the effluent analysis from the final cell of the Stratford oxidation ponds' system 16 February 2015 and past records of secondary pond data (for the period 1987 to mid 2009) and final tertiary cell data (for the period mid 2009-2014)

Parameter	Unit	Survey of 16 February 2015	Secondary pond			Final (tertiary) cell		
			No. of samples	Range	Median	No. of samples	Range	Median
Time	NZST	0925	-	-	-	-		
Temperature	°C	18.4	105	7.4-24.1	14.0	37	6.2-21.8	14.8
Dissolved oxygen	g/m³	10.5	98	0.2-15.9	4.6	37	0.7-15.1	3.4
Dissolved oxygen saturation	%	114	95	2-177	43	37	8-141	34
BOD_5	g/m³	30	32	9-56	20	32	5-36	13
BOD_5 filtered	g/m³	7.3	17	2.0-11	4.6	5	2-15	4
pH		7.8	24	6.9-8.8	7.5	28	7.1-8.8	7.5
Conductivity @ 20°C	mS/m	42.3	32	18.0-61.6	31.5	29	15.6-41.6	24.9
Chloride	g/m³	35.2	19	22-92	27.2	33	11.7-30.9	17.9
Dissolved reactive phosphorus	g/m³P	3.50	25	1.44-11.1	4.08	29	0.70-4.97	1.79
Total phosphorus	g/m³P	-	9	1.7-5.8	4.8	25	1.02-5.80	2.18
Ammonia-N	g/m³N	17.9	37	0.59-24.9	13.1	29	0.87-25.4	9.8
Nitrate + nitrite-N	g/m³N	2.80	14	<0.01-0.60	0.10	5	1.13-4.28	2.4
Total nitrogen	g/m³N	-	-	-	-	25	7.2-30.8	13.8
Turbidity	NTU	15	29	5.6-89	15	29	5.7-71	17
Suspended solids	g/m³	34	35	4-120	37	29	5-62	22
Faecal coliform bacteria	nos/100/ml	2,700	32	70-160,000	3400	29	270-14,000	2,300
Metals (acid soluble)								
Cadmium	g/m³	<0.005	17	<0.005<0.01	<0.005	5	<0.005-<0.005	<0.005
Chromium	g/m³	<0.03	15	<0.03-0.04	<0.03	5	<0.03-<0.03	<0.03
Zinc	g/m³	<0.009	18	0.009-0.118	0.036	5	0.021-0.035	0.030
Appearance		sl. turbid, dark green						

Note: with the exception of DO results, secondary pond data have been recorded mainly from summer surveys]

This tertiary cell effluent quality (Table 2) was typical of a well treated secondary oxidation pond waste with moderate total BOD_5 and suspended solids levels and faecal coliform bacteria number. Nutrient levels were typical of the secondary oxidation pond treated effluent prior to the plant upgrade with the exception of nitrate N which remained elevated but within the range recorded since the upgrade. Turbidity and appearance were indicative of a well treated wastewater effluent quality with only

a moderate algal component compared to that often recorded in the past in the secondary pond treated wastes (e.g. blooms of cyanobacteria, *Microcystis*), particularly as recorded by the summer 2008 survey (TRC, 2008).

Metal concentrations were less than minimum detectable levels, with the exception of zinc, which has consistently remained at low, but detectable, concentrations after a significant increase resulting from the disposal of galvanising wastes during August 1991 (see TRC 92-17). None of these metals' concentrations measured in the effluent at the time of the survey would be expected to exceed toxic levels for aquatic fauna given the dilution provided in the receiving waters of the Patea River.

Comparatively, tertiary cell effluent parameters were within ranges recorded from previous surveys of the pre-upgrade secondary pond effluent (Table 2), with the exception of nitrate N, and in most instances were similar to, or above, median values. Effluent quality was good in terms of BOD_5 concentration, faecal coliform bacteria number, and suspended solids concentration coincident with a moderate late summer microfloral population abundance as also illustrated by the median turbidity.

The partitioning of the second pond cell into a three cell system with aeration of the primary pond appears to have resulted in a treated wastewater with narrower ranges for most parameters to date (Table 2), particularly total BOD_5, conductivity, dissolved reactive phosphorus, suspended solids, and faecal coliform bacteria; and improved quality for most parameters (in terms of median levels). However, the period of operation of the refurbished system has only included six summers to date whereas the majority of the secondary pond data collected over a period of 22 years was strongly biased toward summer-autumn conditions.

3.1.1 Microflora of the Stratford ponds' system

Pond microflora are very important for the stability of the symbiotic relation with aerobic bacteria within the facultative pond. These phytoplankton may be used as a bio-indicator of pond conditions e.g. cyanobacteria are often present in under-loaded conditions and chlorophyceae are present in overloaded conditions. To maintain facultative conditions in a pond system there must be an algal community present in the surface layer.

The principal function of algae is the production of oxygen which maintains aerobic conditions while the main nutrients are reduced by biomass consumption. Elevated pH (due to algal photosynthetic activity) and solar radiation combine to reduce faecal bacteria numbers significantly.

Samples of the secondary pond final (tertiary) cell effluent had been collected at the time of most inspections of the Stratford oxidation ponds system for semi-quantitative microfloral assessment prior to curtailment of this component of the programme during the 2012-2013 period. The microflora present in the final cell of the secondary oxidation pond have been summarised and discussed in recent annual reports and historical data have been provided in a previous annual report (TRC, 2009).

Samples of the final tertiary cell effluent were collected on all four inspection occasions for chlorophyll-a analyses. Chlorophyll-a concentration can be used as a useful indicator of the algal population present in the system (Note: Pearson (1996) suggested

that a minimum in-pond chlorophyll-a concentration of 300 mg/m^3 was necessary to maintain stable facultative conditions). However, seasonal changes in algal populations and also dilution by stormwater infiltration might be expected to occur in any wastewater treatment system which together with fluctuations in waste loadings would result in chlorophyll-a variability.

The results of final cell effluent chlorophyll-a analyses are provided in Table 3 together with field observations of pond appearance.

Table 3 Chlorophyll-a measurements from the surface of the third cell of the upgraded Stratford secondary oxidation pond at the perimeter adjacent to the outlet

Date	Time (NZST)	Appearance	Chlorophyll-a (mg/m^3)	Chlorophyll-a (mg/m^3) data for period 2013 - mid 2014		
3 September 2014	0855	dark green	372	N	Range	Median
3 December 2014	0745	dark-green brown	474			
16 February2015	0925	dark green	360	4	5-450	289
18 June 2015	0900	pale green	16			

Good microfloral populations were indicated by high chlorophyll-a concentrations in late winter, early and late summer when dissolved oxygen saturation levels of 58%, 96% and 114% were measured respectively. A very low concentration (coincident with the lowest saturation (32%)) followed wet mid-winter weather conditions and stormwater dilution through the WWTP system.

3.2 Results of receiving environment monitoring

Two components of the receiving water monitoring programme were operative during the period. These assessed the impacts of treated wastes disposal from the upgraded system specifically upon the physicochemical quality and biological communities of the receiving waters of the Patea River. These surveys were also designed to assess any impacts of the adjacent and recently closed Stratford municipal landfill on the receiving waters of the river and are also discussed in this respect in the appropriate Annual Report (TRC 2015).

Three additional receiving water physicochemical compliance surveys were also undertaken in conjunction with inspections, as required for consent compliance assessment.

3.2.1 Late summer physicochemical receiving water survey

A late summer assessment of the impact of the upgraded oxidation ponds' system effluent discharge on the receiving waters of the Patea River was performed on 16 February 2015 when flow in the river (at the Skinner Road recorder) was 0.78 m^3/s, during a very low recession flow period (although not as extreme as the very low, lengthy recession flow surveyed in the summer of 2008). Sites were located (Figure 2) as summarised in Table 4.

Table 4 Location of sampling sites

Site	Location	GPS location	Site code
Patea River	at Swansea Road bridge (upstream of landfill and WWTP discharges)	E1711801 N5644382	PAT000315
Patea River	approximately 250 m downstream of the WWTP original discharge (and 350m upstream of the new outfall)	E1712748 N5644549	PAT000345
Secondary oxidation pond tertiary cell effluent	at manhole upstream of rock riprap outfall	E1712834 N5644344	OXP005002
Patea River	approximately 130 m downstream of the WWTP new outfall	E1713033 N5644266	PAT000350
Patea River	approximately 1 km upstream of the Kahouri Stream confluence	E1714497 N5645112	PAT000356

Figure 1 Aerial photo of site and location of sampling sites since the upgrade of the WWTP

This survey was performed 14 days after a small river fresh but 6 weeks after the last major fresh. The river flow was above the minimum mean monthly flow recorded for February (0.64 m^3/s) at the Skinner Road recorder site [4.5 km downstream of the new outfall (and the Kahouri Stream confluence)], and well below the monthly mean of 2.73 m^3/s. This receiving water flow was approximately one and a third-times the river flow recorded at the time of the autumn, 2008 survey and about 90% of the flow at the time of the late summer 2014 survey. An estimated river flow in the vicinity of the oxidation ponds discharge was 0.53 m^3/s.

The results of the survey are summarised in Table 5. All analyses were performed in the Council's IANZ-registered laboratory using documented standard methods.

Table 5 Patea River physicochemical sampling survey results of 16 February 2015

Site		PAT000315	PAT000345	OXP005002	PAT000350	PAT000356
Site Location		Upstream of landfill and WWTP	Downstream of landfill and 350m upstream of new WWTP outfall	Effluent discharge at new outfall	130m downstream of WWTP new outfall	1km upstream of Kahouri Stream
Parameter	Unit					
Time	NZST	0755	0905	0925	0935	1005
Temperature	°C	13.2	13.5	18.4	14.0	14.6
Dissolved oxygen	g/m³	10.2	10.0	10.5	9.7	11.4
DO Saturation	%	99	98	114	96	115
BOD_5 (total)	g/m³	0.6	0.6	30	1.9	1.6
BOD_5 (filtered)	g/m³	N/A	N/A	7.3	N/A	N/A
pH		7.7	7.6	7.8	7.6	8.1
Conductivity @ 20°C	mS/m	10.0	10.1	42.3	11.5	10.9
Chloride	g/m³	8.3	8.5	35.2	9.4	9.4
Zinc (dissolved)	g/m³	<0.005	<0.005	0.009	<0.005	<0.005
Cadmium (dissolved)	g/m³	<0.005	<0.005	<0.005	<0.005	<0.005
Chromium (dissolved)	g/m³	<0.03	<0.03	<0.03	<0.03	<0.03
Dissolved reactive phosphorus	g/m³P	0.057	0.051	3.50	0.178	0.151
Ammonia-N	g/m³N	0.010	0.048	17.9	0.632	0.026
Un-ionized ammonia-N	g/m³N	0.0001	0.0006	0.470	0.0076	0.0010
Nitrate & nitrite-N	g/m³N	0.42	0.40	2.80	0.62	0.97
Turbidity	NTU	0.9	1.0	15	1.7	1.2
Black disc	m	2.61	2.49	-	1.91	2.04
Suspended solids	g/m³	2	2	34	3	3
Faecal coliform bacteria	nos/100ml	250	220	2,700	280	530
Appearance		clear, uncoloured	clear, uncoloured	sl. turbid, dark green	slightly turbid, green-brown	rel clear, brown

[Note: N/A = not analysed]

A dilution ratio of approximately twenty-six parts river flow to one part effluent discharge at the time of the sampling survey was indicated by reference to selected analytical results assuming complete mixing at the sampling site (PAT000350).

The effluent discharge had minimal impacts on the receiving waters of the Patea River in terms of temperature, dissolved oxygen, pH, dissolved metals, and suspended solids. This was consistent with moderate dilution of the effluent by river flow and a good effluent quality in terms of these parameters. There was a 23% decrease in black disc clarity coincidental with an increase in turbidity of 0.7 NTU (representing a 70% increase) but minimal rise in suspended solids levels in the receiving waters. This decrease in black disc clarity measured at the periphery of the new mixing zone, represented a minor change in visual clarity and slight change in colour mainly due to the fine algal component in the oxidation ponds treated effluent. The increased turbidity in the receiving waters was in minor non-compliance with the relevant consent condition (Special Condition 8) under these very low flow conditions but river turbidity showed an improvement further downstream. Bacterial numbers showed a small increase (of 60 faecal coliforms/100 ml) at the site 130 m downstream of the mixing zone.

Increases in total BOD_5 (0.6 to 1.9 g/m³) recorded at the site downstream of the discharge had no impact on dissolved oxygen level at this site below the mixing zone. Dissolved reactive phosphorus was elevated at the two sites downstream of the discharge point (PAT000350 and PAT000356), while there was a significant increase in

ammonia N downstream of the discharge followed by a marked reduction at the furthest downstream site 4 which was consistent with results in most previous summer-autumn periods under low flow conditions. This was due in part to uptake by riverbed periphyton (mats and filamentous algae) which was widespread at the time of this survey, and nitrification of ammoniacal nitrogen in the receiving waters. Un-ionized ammonia concentrations downstream of the permitted mixing zone were well within the limit required by Special Condition 11 of the consent.

In general terms, Patea River water quality upstream of the oxidation ponds' outfall (and downstream of the municipal landfill) was relatively high (98% to 99% dissolved oxygen saturation, slightly alkaline pH, very low total BOD_5, and good water clarity) with moderate faecal coliform numbers. Although nutrient levels were also relatively low, an increase in ammonia-N level (but no increase in bacteria number) continued to be recorded between the two sites upstream of the WWTP discharge, possibly due to landfill leachate seepage into the river from the true right bank (TRC, 2015).

3.2.2 Receiving water compliance surveys

Receiving water physicochemical monitoring surveys were required to further assess compliance with Special Conditions 8 and 11 of the consent relating to specific limits set on the Patea River at the boundary of the mixing zone, 100m downstream of the new outfall. These sampling surveys were performed on 3 September 2014, 3 December 2014, and 18 June 2015 with results discussed beneath. The sampling sites were OXP005002, PAT000345, and PAT000350 as described in Table 4.

3.2.2.1 Survey of 3 September 2014

The wastewater discharge from the outfall was turbid and dark green in appearance with a moderate flow rate. Results are presented in Table 6.

Table 6 Results of the receiving water compliance survey of 3 September 2014

Site		PAT000345	OXP005002	PAT000350
Location		Upstream	Discharge	Downstream
Parameter	Unit			
Time	NZST	0945	0855	0950
Temperature	˚C	9.0	11.2	9.3
BOD_5 (carbonaceous filtered)	g/m^3	<0.5	-	<0.5
pH	pH	7.7	-	7.7
Chloride	g/m^3	8.9	17.8	9.1
Ammonia-N	g/m^3N	0.094	-	0.286
Unionised ammonia	g/m^3N	0.0010	-	0.0031
Turbidity	NTU	1.1	-	1.8
Appearance		re clear, uncoloured	turbid, pale green	turbid, green

Some visual impact of the wastewater discharge (pale green plume) was apparent on the Patea River beyond the mixing zone. The river was relatively clear and uncoloured upstream of the outfall with a relatively low flow of 1.67 m^3/s (at the Skinner Road hydrological site) during a recession from a small fresh (12 m^3/s) twenty days previously.

This turbid wastewater discharge was calculated as having a dilution ratio of about 45:1 in the receiving waters at the time of the survey. Un-ionised ammonia and carbonaceous filtered BOD_5 concentrations in the river at the boundary of the mixing zone were both well within the limits imposed by Special Condition 11 of the consent while the downstream increase in turbidity (63%) was marginally in non-compliance with Special Condition 8. Compliance with Special Conditions 7 (a) and (c) was assessed by visual inspection at the time of the survey which also assessed compliance with Special Condition 7 (b) as marginal.

3.2.2.2 Survey of 3 December 2014

The wastewater was turbid and greenish-brown in appearance with an estimated flow rate of 15 L/s, causing some visual impact (cloudier plume) on the slightly turbid pale brownish flow of the Patea River which had a relatively low flow of 1.42 m^3/s (at the Skinner Road recorder), under steady recession sixteen days after the previous fresh (11 m^3/s). Results of the survey are presented in Table 7.

Table 7 Results of the receiving water compliance survey of 3 December 2014

Site		PAT000345	OXP005002	PAT000350
Location		Upstream	Discharge	Downstream
Parameter	Unit			
Time	NZST	0820	0745	0840
Temperature	˚C	11.4	16.2	12.1
BOD_5 (carbonaceous filtered)	g/m^3	<0.5	-	0.8
pH	pH	7.3	-	7.3
Chloride	g/m^3	8.9	20.4	9.4
Ammonia-N	g/m^3N	0.097	-	0.340
Unionised ammonia	g/m^3N	0.0005	-	0.0018
Turbidity	NTU	1.2	-	2.2
Appearance		sl. turbid, pale brown	turbid, green-brown	sl. turbid, brown

This treated wastewater discharge was calculated to have been diluted at a ratio of about 22:1 by the receiving waters at the time of the survey. Both carbonaceous filtered BOD_5 and un-ionised ammonia concentrations in the river at the mixing zone boundary were in compliance with Special Condition 11 of the consent while visual compliance with Special Conditions 7 (a) and (c) was assessed by inspection. The turbidity values in the river were indicative of slightly turbid appearance (>1NTU), with a downstream increase in turbidity of 83% which was in non-compliance with Special Condition 8, confirming the visual assessment of non-compliance with Special Condition 7 (b).

3.2.2.3 Survey of 18 June 2015

Slightly turbid pale green wastewater was discharging at a moderately high rate (estimated at 30 L/s) into the relatively clear, pale green coloured river which was in recession (3.13 m^3/s at the Skinner Road recorder) eight days after the most recent fresh (28 m^3/s). There had been four freshes in the river over the preceding two weeks. No visual impact of the discharge was noticeable in the river at the mixing zone boundary. The results of the survey are presented in Table 8.

Table 8 Results of the receiving water compliance survey of 18 June 2015

Site		PAT000345	OXP005002	PAT000350
Location		Upstream	Discharge	Downstream
Parameter	Unit			
Time	NZST	0945	0900	1000
Temperature	˚C	8.8	8.9	9.0
BOD_5 (carbonaceous filtered)	g/m^3	<0.5	-	<0.5
pH	pH	7.8	-	7.7
Chloride	g/m^3	9.2	16.0	9.4
Ammonia-N	g/m^3N	0.048	-	0.344
Unionised ammonia	g/m^3N	0.0006	-	0.0036
Turbidity	NTU	0.9	-	1.3
Appearance		rel. clear, pale green	sl. turbid, pale green	rel. clear, pale green

The wastewater discharge was calculated to be diluted by about 33:1 by the receiving waters at the time of this survey.

The effects of the discharge were compliant with Special Condition 11 of the consent (carbonaceous filtered BOD_5 and un-ionised ammonia), Special Conditions 7 (a), (b), and (c) (visual assessment), and with Special Condition 8 (with an increase in turbidity of 44%).

3.2.3 Biomonitoring survey

One late-summer biomonitoring survey was performed under very low flow conditions at the four sites listed in Table 9 and illustrated in Figure 1 with the resultant report attached as Appendix II.

Table 9 Location of biomonitoring surveys' sites

Site	Site code	Location
1	PAT 000315	Swansea Road bridge (upstream of landfill and oxidation ponds' discharge
2	PAT 000330	Upstream of WWTP discharge (and downstream of landfill
3a	PAT 000350	Approximately 130m downstream of the WWTP new outfall
4	PAT 000356	Approximately 1 km upstream of the Kahouri Stream confluence

This late summer biological survey of four sites in the receiving waters of the Patea River was performed on 10 February 2015, six days prior to the physicochemical

survey and during a very low recession flow period, 40 days after the most recent river fresh. Results of this biomonitoring survey are summarised in Table 10.

Table 10 Biomonitoring results summary from the survey of 10 February, 2015

Site	Macroinvertebrate fauna	
	Taxa numbers	MCI value
1	29	110
2	23	110
3a	24	95
4	24	93

Typical macroinvertebrate communities' richnesses were found by surveys at the four Patea River sites during a very low flow recession period in the latter part of summer and under conditions of thin to widespread mats of periphyton river substrate cover and none to patchy filamentous algae. Very minor discolouration of the river's reach below the WWTP's re-located discharge was apparent and there was no planktonic pond algal deposition on the river bed, as a result of reduced algal concentration in the upgraded partitioned second oxidation pond cells. Faunal communities upstream of the WWTP discharge had higher percentages of 'sensitive' taxa whereas communities at downstream sites had increased percentages of 'tolerant' taxa. There were some differences in dominant (characteristic) taxa between these four sites' communities with a tendency toward proportionately fewer 'sensitive' and more 'tolerant' dominant taxa in a downstream direction.

MCI scores were relatively similar to scores generally typical of mid-catchment ringplain rivers in Taranaki, particularly those found during summer low flow conditions and showed a moderately wide range (17 units) along the four sites through the 4.5 km reach of the Patea River. No impacts of seepage from the Stratford landfill (situated between sites 1 and 2) were indicated by the faunal composition at these sites. An increase in number of 'tolerant' taxa, together with fewer 'sensitive' taxa downstream of the WWTP's relocated discharge, resulted in lower MCI scores at these sites, which were significant in the immediate vicinity of the discharge with minimal further deterioration downstream. There were several significant changes in individual taxon abundances including amongst some dominant taxa as reflected in a reduction in $SQMCI_s$ value between sites 2 and 3a of 2.8 units and sites 2 and 4 of 1.8 units. These lower $SQMCI_s$ scores at sites 3a and 4 (up to 2.4 km downstream of the wastewater discharge) reflected lower abundances in certain 'highly sensitive' taxa and increased numbers within 'tolerant' oligochaete worms and midges in particular.

No 'undesirable heterotrophic growths' were found on the substrate of the river at the sites surveyed downstream of the discharge under these summer very low recession flow conditions and there was no apparent deposition of oxidation ponds' planktonic algae on the river bed.

Effects of discharges on the macroinvertebrate communities of the Patea River vary in relation to the treatment provided by the WWTP, dilution available in the receiving waters, preceding climatic conditions and the microfloral component of the wastewaters. Such variations in effects have been documented by previous summer biomonitoring surveys with this summer survey illustrating some effects (significant at the boundary of the mixing zone), and therefore non-compliant with Special Condition 7 (d) of the discharge consent, during a very low recession flow period, below the discharge from the relocated rock riprap outfall following the WWTP upgrade.

3.2.4 River periphyton investigations

Contractual receiving water nuisance periphyton monitoring of the Patea River had been undertaken at four specific sites in the vicinity of the WWTP discharge over the spring, summer, late summer (2012-2013) period and was repeated over a similar 2013-2014 period. This programme assessed algal mats and long filamentous periphyton percentage substrate cover, chlorophyll-a concentrations, and periphyton index scores and provides comparisons with a reference (state of the environment) site in the Patea River near the National Park boundary.

These two years of nuisance periphyton data contribute to the consent holder's assessment of WWTP effects, a necessary requisite for WWTP upgrade considerations at the time of consent renewal.

An example of chlorophyll-a (indicator of algal biomass) results is summarised in Table 11 for the five sites from near the National Park boundary (PAT000200) to Skinner Road, about 4.5 km downstream of the WWTP outfall (PAT000360).

Table 11 Chlorophyll-a (mg/m^2) results for Patea River sites over the spring to late summer periods of 2012-2013 and 2013-2014

Period	2012-2013		2013-2014		2012-2014	
Site	Range	Median	Range	Median	Median	Median
PAT000200	5.4-9.0	6.8	3.6-26	4.6	3.6-26	6.1
PAT000345	6.1-34	10	6.6-90	34	6.1-90	22
PAT000350	64-276	64	97-130	100	64-276	99
PAT000356	42-92	55	72-140	90	42-140	81
PAT000360	11-151	94	67-150	88	11-151	91

This illustrates (Figure 3) the impact of the WWTP discharge (between sites PAT000345 and PAT000350) upon the streambed periphyton cover in the mid reaches of the Patea River in each of the two periods.

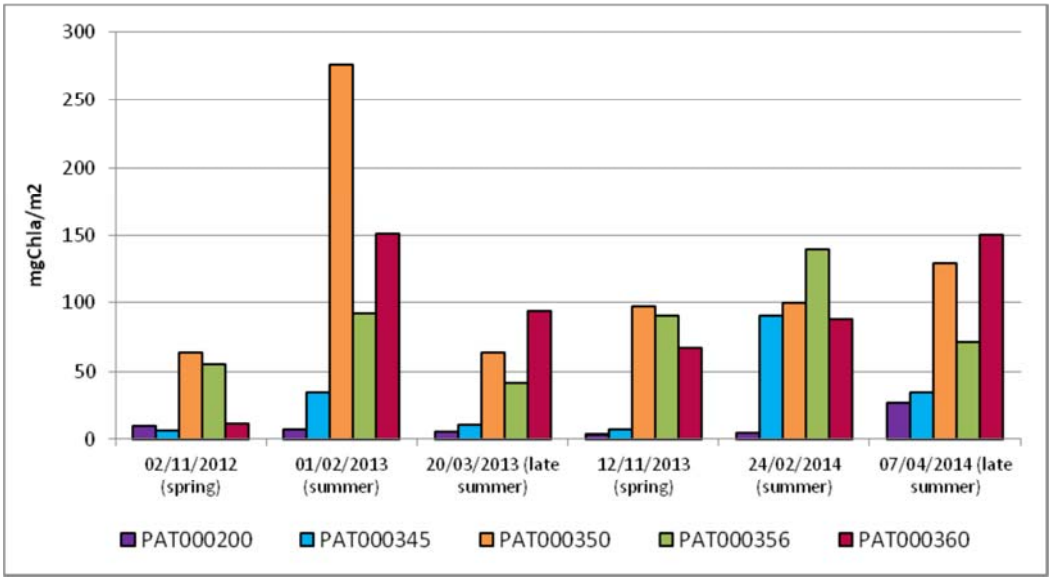

Figure 2 Chlorophyll-a concentrations in the Patea River for the spring 2012 to late summer 2013 and spring 2013 to autumn 2014 periods

3.3 Investigations, interventions, and incidents

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

The Council operates and maintains a register of all complaints or reported and discovered excursions from acceptable limits and practices, including non-compliance with consents, which may damage the environment. The Incident Register (IR) 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 2014-2015 year, there were no major incidents recorded by the Council that were associated with the consent holder in relation to the exercise of consent 0196, nor were there any incidents (not directly related to the WWTP consent) associated with the Esk Road wastewater trade waste facility (a component of the sewerage reticulation network) reported to Council. However, very wet weather in mid-June 2015 resulted in overflows from effluent manholes to nearby land under conditions of excessive stormwater infiltration into the sewage reticulation system with subsequent effective clean-up by the consent holder. For the seventh annual monitoring period in succession no odour complaints associated with the WWTP site were reported to the Council. This absence of odour incidents was coincident with the major upgrade of the WWTP which was completed during the 2008-2009 period and in particular, the introduction of mechanical aeration in the primary pond.

4. Discussion

4.1 Discussion of plant performance

The Stratford oxidation ponds' sewage treatment system has continued to perform satisfactorily with aerobic conditions maintained and a generally high standard of treated wastewater discharged, throughout the twelve month monitoring period. Effluent quality was of a good standard, particularly when excessively diluted following wet weather conditions, with low to moderate microfloral densities (as indicated by chlorophyll-a levels) on the four sampling occasions during the period. In the past, prior to the upgrade in 2009, management had attempted to regularly maintain the ponds' system, but surface debris and scum accumulation occurred, accentuated by certain prevailing wind conditions, despite the completion of the primary pond de-sludging operation in autumn 2005. However, almost continuous usage of the influent step-screen system, mechanical aeration of the primary pond, and appropriate relocation of the tanker disposal site appear to have alleviated this problem during recent years including the 2014-2015 period when no odour complaints were received and no odour incidents reported for the seventh consecutive year.

Screening of the new outlet from the secondary oxidation pond, which was constructed to provide for increased retention time, was well maintained. The inlet system, reconstructed in order to direct all raw wastes to the primary oxidation pond, functioned as designed for the majority of the monitoring period and any overflows following heavy rainfall were contained by the 2011-2012 re-contouring of the area which ensured that all raw influent was directed into the primary pond.

The ponds system experienced one further hydraulic problem following intensive rainfall events, after re-engineering of the tertiary cell outlet reticulation in order to overcome flow discharge restrictions in the pipe prior to the final river outfall. This followed a very heavy mid-winter rainfall event when the final manhole surcharged treated wastewater to nearby land. Additional remedial secondary pond wall re-contouring and sealing was successful in containing high pond wastewater levels after heavy rainfall events and prevented seepage to surrounding land. Longer term remedial work to the reticulation will provide additional capacity and will be necessary to markedly reduce stormwater reticulation infiltration. These measures have been identified and planned by the consent holder in conjunction with the system upgrades required by the renewed consent. The contracted two year programme of monitoring of the upgrade's effectiveness, which was completed in August 2011, was augmented by two years of additional nuisance periphyton receiving water assessment work for utilisation in the consideration of effects and options for further WWTP upgrade required by conditions of the consent which was renewed for a further three years for this purpose.

Trade wastes controls placed on the usage of the system by industrial tanker wastes by the SDC (during 1991-1992), although resulting in no major problems with this aspect of waste disposal to the ponds' system performance during the monitoring period, continues to require monitoring (by the consent-holder) particularly the nature and/or source of wastes being discharged to the system. The more recent relocation of the facility to the saleyards site has provided a more appropriate positioning of this facility in the reticulation system. However, further issues arose over the operation and design

of this facility which required remedial measures to be undertaken by the SDC and emphasised the need for regular management and frequent monitoring of this facility by the operator. No problems with this facility eventuated during the two most recent periods although heavy rainfall in mid-winter 2015 caused some surcharging of the manhole onto surrounding land after a localised pump failure due to a power surge prior. Timely remedial measures were undertaken by the SDC. Disposal of treated wastes from the regional stockyards through the pond system, actioned twelve years previously, had no apparent impact on the system's performance.

Capacity for additional wastes loadings to be connected to the system continues to exist (given the upgrade of the treatment plant), provided that the hydraulic issues associated with the inflow volumes and outflow reticulation can be resolved.

Monitoring of the microfloral component of the tertiary cell of the secondary pond (by means of chlorophyll-a measurements) indicated that the system had a low algal content following heavy rainfall flushing events. However, although there have been marked summer and autumn increases in microflora, there have been no apparent blooms of blue-green algae, and therefore no repeat of significant aesthetic impacts on the receiving waters of the Patea River, unlike those which had occurred on number of occasions in past summer–autumn low flow, warm periods. Microfloral populations have given no indication of poor performance of the treatment system to date and generally have indicated an improvement in microfloral conditions in the tertiary cell of the secondary pond subsequent to the WWTP upgrade. This component of the programme was replaced with chlorophyll-a monitoring for the 2013-2014 period which continued through the 2014-2015 period.

4.2 Environment effects of exercise of water permits

Some impacts of the discharge were recorded on the physical and chemical quality of the Patea River, during the more intensive late summer survey, when very low recession flow conditions provided an approximate twenty-six-fold dilution of the effluent in the receiving waters. Localised and moderate increases in nutrients and small increases in bacteria levels were recorded downstream of the more recently re-located rock riprap outfall, mitigated to a certain extent by the effluent quality which was of a good standard at the time of this survey. Some discolouration of the receiving waters occurred downstream of the discharge (beyond the permitted mixing zone) in minor non-compliance with the relevant Special Condition due mainly to the algal component of the effluent under very low river flow conditions. The late summer macroinvertebrate fauna survey showed impacts of the discharge beyond the permitted mixing zone under these low recession flow conditions, which were statistically significant at the boundary of the mixing zone.

No significant 'heterotrophic growths' were found on the substrate of the riverbed and all effluent metal concentrations were low with levels unlikely to cause problems to the biota, under the low receiving waters flow conditions experienced in late summer.

Significant increases in benthic periphyton cover have been recorded at three sites in the Patea River downstream of the discharge over two spring to late summer/autumn more recent receiving water survey periods. This data will contribute to the evaluation

of options for upgrading the WWTP in terms of nutrient reductions as required by renewed consent conditions.

Additional seasonal receiving water monitoring (on three occasions) found compliance with most Special Conditions of the consent on each occasion. Some, increases in turbidity in the Patea River were recorded coincident with the fine algal component of the wastewater in particular elevating turbidity (above the compliance limit on two occasions) under moderate dilution conditions in the relatively low to moderate flows of the Patea River.

4.3 Evaluation of performance

A tabular summary of the SDC's compliance record for the year under review is set out in Table 12 (in terms of renewed consent 0196).

Table 12 Summary of performance for consent 0196

Purpose: Discharge of oxidation ponds treated wastes to surface water		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Best practicable option	Inspections	Yes
2. Limits on wastewater volume	Inspections	Yes
3. Implementation of infiltration reduction programme	Reporting by consent-holder	Yes (continuing)
4. Implementation of management plan	Provision by consent holder	Yes
5. Maintenance of aerobic ponds conditions	Inspections & sampling	Yes
6. Trade wastes connections	Liaison with consent holder	Yes
7. Narrative limits on receiving water effects	Inspections, physicochemical sampling and biomonitoring	Partial
8. Limit on receiving water turbidity effect	Physicochemical sampling	Minority of monitoring occasions
9. Monitoring provisions	Performance of tailored programme and additional contract work	Yes
10. Nutrient monitoring provisions	Performance of tailored programme and additional contract work	Yes (completed previously)
11. Numerical limits on receiving water effects (after upgrade)	Physicochemical sampling	Yes
12. Reporting issues & options	Provision by consent holder prior to June 2015	Yes (draft report received June 2015)
Overall assessment of consent compliance and environmental performance in respect of this consent		Good
Overall assessment of administrative performance in respect of this consent		Good

During the year, the SDC demonstrated a good environmental performance and good level of administrative compliance with the resource consent.

Improvement was recorded with aspects of the operation of the WWTP although one overflow event followed very heavy rainfall in mid-winter 2015. Requirements for

improvements to wastewater treatment had been addressed by considering upgrades of the system to meet RMA requirements coincident with the short-term renewed consent granted late in the 2007-2008 period and subsequently renewed in the current period for a short 3-year term. Problems that had been experienced with hydraulic loadings on the system during previous periods generally were adequately managed by the consent holder during the 2014-2015 period. Past odour complaints resulted in the reappraisal of methods to control surface scum and its disposal including relocation of the tanker wastes disposal facility and improved pond circulation as components of the upgrade. These facets of the upgrade appear to have alleviated odour problems/scum formation over the 2010-2014 and 2014-2015 periods for the seventh year in succession. Reduction in secondary pond algal blooms and subsequent discharge impacts in part have been addressed by components of the WWTP upgrade relating to the partitioning of the secondary pond and outfall re-design. Issues with aspects of trade wastes disposal to the sewerage reticulation at the Esk Road facility which had been the subject of public complaint and subsequent remedial action by the SDC in the 2012-2013 period, were maintained adequately during the two latest periods with minor further issues.

4.4 Provision of Issues and Options Report

Special Condition 15 of the previous consent (see Appendix I, TRC, 2013) required that a report be provided by the consent holder detailing issues and options for the WWTP, specifically addressing environmental effects on aspects of receiving water quality and options for further treatment of Stratford wastewater.

This consultant's report was provided in June 2012 after provision of various wastewater and receiving water quality data (by TRC) and consultation with the consent holder. It was recognised that additional periphyton monitoring data for the Patea River over two spring-summer periods would be beneficial to provide more appropriate receiving water information relating to the potential wastewater treatment plant upgrade options which were the subject of further reporting required prior to the consent expiry date of June 2013. Such a programme was formulated, contracted, and performed by TRC over the spring 2012 to autumn 2013 period and over a similar 2013-2014 period following which the completed report is required. A short-term (three-year) consent was granted to enable this work to be completed and evaluated for the purpose of assessment of appropriate WWTP upgrade options.

Special Condition 12 of the current consent required that the completed report be provided by the consent holder by 30 June 2015. This draft report was received in late June 2015 addressing all matters referenced in Special Condition 12.

4.5 Recommendations from the 2013-2014 Annual Report

The previous Annual Report (TRC 2014-14) contained the following recommendations in relation to consents monitoring of the operation of the municipal oxidation ponds' system:

1. THAT the monitoring be continued for the 2014-2015 period by formulation of a suitable monitoring programme, similar in format to the 2013-2014 programme including the additional inspection component of the Esk Road industrial

wastewater connection facility, with a minor change to the microfloral component of the pond inspectorial requirements;

2. THAT the consent holder advise the Council whenever additional industrial waste connections are made to the sewerage reticulation system;

3. THAT regular maintenance of the oxidation ponds' system continue to be performed by the consent holder, with particular emphasis given to appropriate monitoring and operation of the system immediately following high intensity rainfall events. Suitable records are to be kept and made available to the Council as required;

4. THAT the consent holder liaise with the Council with respect to matters relating to the WWTP staged upgrade and additional monitoring assessment investigations as required by conditions of the renewed consent.

Recommendations 1, 2, 3, and 4 have been achieved. Monitoring was performed as scheduled. The consent holder undertook appropriate additional monitoring and maintenance of the system following the high intensity rainfall event in mid-June 2015.

4.6 Alterations to the monitoring programme for 2015-2016

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

In the case of the monitoring programme for the Stratford oxidation system it is proposed that for the 2015-2016 period monitoring continue at the same level as that in the 2014-2015 period (including the extended inspection component of the Esk Road industrial connection facility).

4.7 Exercise of optional review of consent

Resource consent 0196 provided for an optional review of the consent in June 2011 but additional investigations since the completion of the upgrade suggested that it was not considered necessary to review the consent at that stage. The renewal of the consent (granted in October 2013) provides for no further reviews prior to the consent expiry date of 1 June 2016.

5. Recommendations

As a result of the 2014-2015 Monitoring Programme for consent 0196, the following recommendations are made:

1. THAT monitoring be continued for the 2015-2016 period by formulation of a suitable monitoring programme, similar in format to the 2014-2015 programme including the additional inspection of the Esk Road industrial wastewater connection facility;

2. THAT the consent holder advise the Council whenever additional industrial waste connections are made to the sewerage reticulation system;

3. THAT regular maintenance of the oxidation ponds' system continue to be performed by the consent holder with particular emphasis given to appropriate monitoring and operation of the system immediately following high intensity rainfall events. Suitable records are to be kept and made available to the Council as required;

4. THAT the consent holder liaise with the Council with respect to matters relating to the staged WWTP upgrade and additional monitoring required by conditions of the renewed consent.

Glossary of common terms and abbreviations

The following abbreviations and terms are used within this report:

biomonitoring	assessing the health of the environment using aquatic organisms
BOD	biochemical oxygen demand. A measure of the presence of degradable organic matter, taking into account the biological conversion of ammonia to nitrate
BODF	biochemical oxygen demand of a filtered sample
bund	a wall around a tank to contain its contents in the case of a leak
condy	Conductivity, an indication of the level of dissolved salts in a sample, usually measure at 20˚C and expressed in mS/m
DO	dissolved oxygen
DRP	dissolved reactive phosphorus
E.coli	*Escherichia coli,* an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as the number of colonies per 100 ml
Ent	Enterococci, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as the number of colonies per 100 ml
FC	Faecal coliforms, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as the number of colonies per 100 ml
fresh	elevated flow in a stream such as after heavy rainfall
g/m^3	grammes per cubic metre, and equivalent to milligrammes per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures
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
IR	The Incident Register contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan.
l/s	litres per second
MCI	macroinvertebrate community index; a numerical indication of the state of biological life in a stream that takes into account the sensitivity of the taxa present to organic pollution in stony habitats
MfCI	microfloral community index: a numerical indication of the state of treatment pond biological life which takes into account the sensitivity of floral taxa to wastewater quality
mS/m	millisiemens per metre

mixing zone	the zone below is a discharge point where the discharge is not fully mixed with the receiving environment. For a stream, conventionally taken as a length equivalent to 7 times the width of the stream at the discharge point
NH_4	ammoniacal nitrogen, normally expressed in terms of the mass of nitrogen (N)
NTU	Nephelometric Turbidity Unit, a measure of the turbidity of water
pH	a numerical system for measuring acidity in solutions, with 7 as neutral. Numbers lower than 7 are increasingly acidic and higher than 7 are increasingly alkaline. The scale is logarithmic i.e. a change of 1 represents a ten-fold change in strength. For example, a pH of 4 is ten times more acidic than a pH of 5
physicochemical	measurement of both physical properties (e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of an environment
resource consent	refer Section 87 of the RMA. Resource consents include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15)
RMA	Resource Management Act 1991 and subsequent amendments
$SQMCI_S$	semiquantitative macroinvertebrate community index (see MCI) but taking into account each taxon's abundance
SS	suspended solids
taxa richness	number of taxa found in the macroinvertebrate community at a site
temp	temperature, measured in ˚C
turb	turbidity, expressed in NTU
UI	Unauthorised Incident

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

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Appendix I

Resource consent held by Stratford District Council

Consent 0196-3

TARANAKI REGIONAL COUNCIL

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

Please quote our file number on all correspondence

Discharge Permit

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

Name of Consent Holder:	Stratford District Council P O Box 320 STRATFORD 4352
Consent Granted Date:	29 April 2008

Conditions of Consent

Consent Granted:	To discharge treated wastewater from the Stratford wastewater treatment system into the Patea River at or about 2622604E-6206176N
Expiry Date:	1 June 2013
Review Date(s):	June 2009, June 2011
Site Location:	Victoria Road, Stratford
Legal Description:	Lot 1 DP 9529 Blk II Ngaere SD
Catchment:	Patea

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. Before 30 June 2009 the wastewater treatment system shall be upgraded by:

   a) continuous operation of an appropriate influent pre-screening structure;

   b) installation and operation of appropriate mechanical aeration of the first oxidation pond;

   c) refurbishment of the ponds' wavebands;

   d) partitioning of the final ponds into a minimum of three cells by way of rock barriers, and installation of a subsurface outlet to minimise the loading of microflora in the final discharge; and

   e) relocation of the piped discharge and passage of the treated effluent through an appropriately designed rock riprap structure prior to discharge to the river;

   substantially in accordance with drawing no. 14940-SC900 contained in the document supporting the application entitled "Stratford Wastewater Treatment System Resource Consent Application and Assessment of Environmental Effects", [Harrison Grierson July 2007].

2. The consent holder shall supply progress reports on implementation of the upgrade referenced in Special Condition 1, by 30 June 2008 and 30 June 2009 to the Chief Executive, Taranaki Regional Council.

3. Notwithstanding any conditions within this consent, the consent holder shall at all times adopt the best practicable option or options, as defined in section 2 of the Resource Management Act 1991, to prevent or minimize any actual or potential effect on the environment arising from the exercise of this consent.

4. The volume of treated wastewater discharge shall not exceed 4,800 cubic metres per day, unless there has been a total of more than 10 mm of rain over the previous three days [as measured by the Taranaki Regional Council rain gauge at Stratford].

5. The consent holder shall implement an inflow and infiltration reduction programme to minimise the stormwater inflow to the ponds. The programme shall include taking all practicable actions to ensure that all unauthorised stormwater connections to the sewage reticulation system are removed and remain disconnected. The consent holder shall report on progress under this condition to the Chief Executive, Taranaki Regional Council, by 30 June each year.

6. The consent holder shall implement and maintain a Management Plan which shall include operating procedures to avoid, remedy or mitigate against potential adverse effects arising from:

   a) the operation of the wastewater treatment plant;

   b) the build up of sludge in the ponds; and

   c) stormwater and groundwater infiltration into the sewerage system.

7. The consent holder shall ensure that the operation and maintenance of the wastewater treatment system is under the direct control of a suitably trained operator.

8. The oxidation ponds shall be maintained in aerobic conditions at all times during daylight hours.

9. The consent holder shall consult with the Taranaki Regional Council prior to accepting new trade wastes, which may contain toxic or hazardous wastes, into the consent holder's wastewater system.

10. From 30 June 2009, after allowing for reasonable mixing, being a mixing zone extending from the discharge point, to a point 100 metres downstream of the discharge point, the discharge shall not give rise to any of the following effects in the receiving waters of the Patea River:

    a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;

    b) any conspicuous change in the colour or visual clarity;

    c) any emission of objectionable odour;

    d) any significant adverse effect on aquatic ecosystems.

11. From 30 June 2009, after allowing for reasonable mixing within a mixing zone extending 100 metres downstream of the discharge point, the discharge shall not give rise to an increase in turbidity of more than 50% [as determined using NTU (nephelometric turbidity units)] in the Patea River.

12. The consent holder shall, in conjunction with the Taranaki Regional Council, undertake chemical, bacteriological and ecological monitoring of the oxidation pond system and Patea River as deemed reasonably necessary by the Chief Executive, Taranaki Regional Council subject to Section 36 of the Resource Management Act 1991. That monitoring shall include wastewater quality monitoring following the upgrade of the treatment system, sufficient to provide data necessary for an evaluation of the effectiveness of the upgrade and to provide for an assessment of possible further upgrade requirements in relation to potential impacts on the biological communities of the receiving water.

13. The monitoring, evaluation and assessment required by condition 12 shall specifically include monitoring, evaluation and assessment of dissolved reactive phosphorus (DRP) and other nutrient-species.

14. From 30 June 2009, after allowing for reasonable mixing, being a mixing zone extending from the discharge point, to a point 100 metres downstream of the discharge point, the discharge shall not cause the receiving waters of the Patea River to exceed the following concentrations:

Contaminant	**Concentration**
Unionised ammonia	0.025 gm^{-3}
Filtered carbonaceous BOD_5	2.0 gm^{-3}

15. Before 30 June 2012 the consent holder shall provide to the Chief Executive, Taranaki Regional Council a report detailing issues and options for the Stratford Wastewater Treatment Plant.

    The report shall document the environmental effects of the discharge from the Stratford Wastewater Treatment Plant, and set out the options available to address the effects on the receiving environment resulting from the discharge.

    The report shall be to the reasonable satisfaction of the Chief Executive, Taranaki Regional Council and shall, as a minimum, address the following:

    a) the environmental effects of discharge on the Patea River, including water quality, periphyton growth and aquatic biota;

    b) options available for further treatment of wastewater from Stratford, giving particular emphasis to the reduction of nutrients in the discharge; and

    c) detail the: costs; expected levels of reduction in adverse effects; and practical implications of introducing each option to the Stratford wastewater treatment system.

16. 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 2011, for the purposes:

a) of addressing the adverse effects of dissolved reactive phosphorus [DRP] and options for reducing those effects; and

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

Signed at Stratford on 29 April 2008

For and on behalf of
Taranaki Regional Council

Director-Resource Management

Appendix II

Biomonitoring report

To Sciences Manager – Hydrology/Biology – R Phipps
From Scientific Officer, C R Fowles
Doc No 1489527
Report No CF638
Date March 2015

Summer biomonitoring of the Patea River in relation to the Stratford District Council's upgraded Wastewater Treatment Plant, February 2015

Introduction

The upgrading of the wastewater treatment plant (WWTP) completed in 2009, required by conditions attached to the renewed consent 0196 (TRC, 2013), has been the subject of an additional investigative assessment of the upgrade's effectiveness in terms of system performance and its impacts on the receiving waters of the Patea River. A component of the assessment included two spring biomonitoring surveys of the river specifically in association with the upgraded treatment system and relocated, improved outfall structure (some 600 m downstream of the sealed-off original outfall). The summer survey (CF486) performed soon after completion of the WWTP upgrade, and the subsequent spring, 2009 (CF491), scheduled summer, 2010 (CF501), spring, 2010 (CF517), and summer, 2011 (CF526) surveys completed the requisite assessments. Subsequently, summer surveys (including the current survey) have been requirements of scheduled monitoring programmes for compliance monitoring purposes.

Methods

The standard '400 ml kick sampling' technique was used to collect streambed (benthic) macroinvertebrates from three established sites and one more recently established site in the Patea River (illustrated in Figures 1 and 2), on 10 February 2015.

These sites were:

Site No	Site code	GPS reference	Location
1	PAT 000315	E1711801 N5644382	Swansea Road bridge (upstream of landfill and oxidation ponds' discharge)
2	PAT 000330	E1712403 N5644580	Upstream of WWTP discharge (and downstream of landfall)
3a	PAT 000350	E1712956 N5644292	Approximately 130 m downstream of the WWTP new outfall
4	PAT 000356	E1714497 N5645112	Approximately 1 km upstream of the Kahouri Stream confluence

The upgrade to the WWTP system had included a new outfall (via rock rip-rap) to the river located a further 600m downstream of the original discharge point. The original site 3 was not required for the purpose of the current survey as no discharge from the sealed 'old' outfall was occurring at the time nor had any recent leakages occurred.

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

Samples were preserved with Kahle's Fluid for later sorting and identification under a stereomicroscope according to Taranaki Regional Council methodology using protocol P1 of

NZMWG protocols for sampling macroinvertebrates in wadeable streams (Stark et al, 2001). Macroinvertebrate taxa found in each sample were recorded as:

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

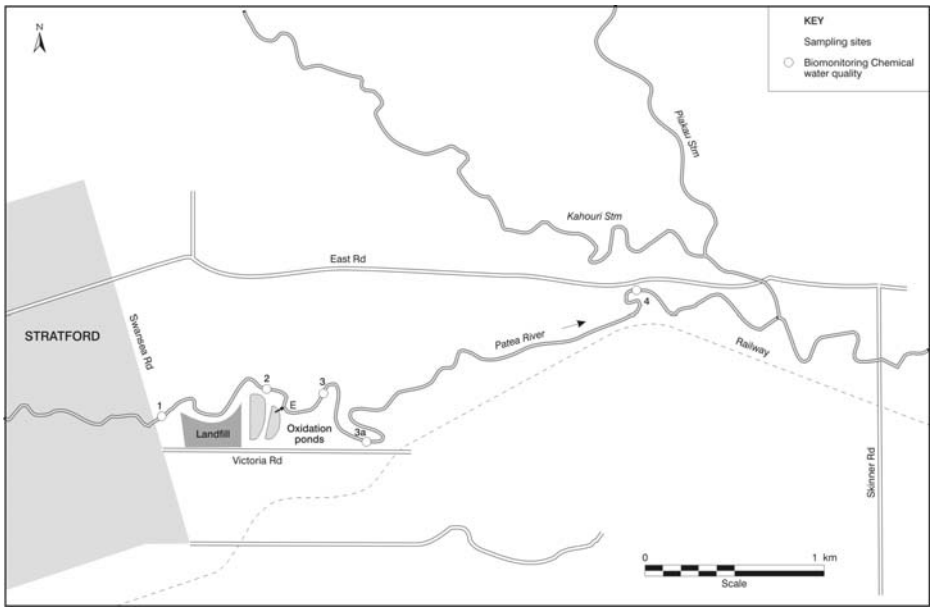

Figure 1 Biomonitoring sites in the Patea River in relation to Stratford landfill and oxidation ponds discharge

Figure 2 Aerial photo of site and location of sampling sites

Macroinvertebrate Community Index (MCI) values were calculated for taxa present at each site (Stark 1985) with certain taxa scores modified in accordance with Taranaki experience.

A semi-quantitative MCI value, SQMCIs (Stark 1999) has also been calculated for the taxa present at each site by multiplying each taxon score by a loading factor (related to its abundance), totalling these scores, and dividing by the sum of the loading factors. The loading factors were 1 for rare (R), 5 for common (C), 20 for abundant (A), 100 for very abundant (VA), and 500 for extremely abundant (XA).

Where necessary sub-samples of algal and detrital material taken from the macroinvertebrate samples were scanned to determine the presence or absence of any mats, plumes or dense growths of bacteria, fungi or protozoa ('undesirable biological growths') at a microscopic level. The presence of these organisms is an indicator of organic enrichment within a stream or river.

Results and discussion

This survey was performed on 10 February, 2015 during a very low recession flow, 40 days after a fresh in excess of 3x median flow and 41 days after a fresh in excess of 7x median flow during a dry late summer period. River flow at Skinner Road was 0.90 m^3/sec representing a flow well below the average monthly mean February flow (2.73 m^3/sec) but above the minimum mean monthly flow for February (0.64 m^3/sec) recorded for the period 1978-2014. This flow was slightly lower (by about 0.04 m^3/sec) than the flow at the time of the previous biomonitoring survey in late summer, 2014.

Periphyton mats were patchy at thin at sites 1 and 2 and patchy at sites 3a and 4, while filamentous algal growth was patchy at sites1, 3a, and 4 with none recorded at site 2. Patchy moss was recorded on the stony substrate at all sites. The algal component of the oxidation ponds discharge appeared moderate with rapid dispersion in the river downstream of the outfall and no algae were trapped or deposited amongst the river substrates at either of the downstream sites. Only site 3a did not have partial shading. Water temperatures ranged from 15.0°C to 16.3°C over the four sites at the time of this early to mid morning survey. The low discharge rate via the rock rip-rap at the re-located outfall was slightly turbid and pale green in appearance and caused a minimal increase in turbidity in the river at sites 3a and 4 downstream of the outfall.

Macroinvertebrate communities

A summary of the results of previous surveys is presented in Table 1.

Table 1 Summary of macroinvertebrate taxa numbers and MCI values for previous surveys performed between February 1985 and March 2014

Site	No of surveys	Taxa numbers		MCI Values	
		Range	Median	Range	Median
1	44	20-33	27	98-130	110
2	32	11-36	24	96-119	105
3a	8	21-29	25	95-110	101
4	39	17-31	24	82-116	98

Survey results since February 1986 are illustrated in Figure 2, while the results of the current survey are presented in Table 2 and discussed beneath.

Table 2 Macroinvertebrate fauna of the Patea River in relation to Stratford District Council WWTP discharge and closed landfill leachate discharges sampled on 10 February, 2015

Taxa List	Site Number	MCI score	1	2	3a	4
	Site Code		PAT000315	PAT000330	PAT000350	PAT000356
	Sample Number		FWB15062	FWB15063	FWB15064	FWB15065
PLATYHELMINTHES (FLATWORMS)	*Cura*	3	-	-	R	-
NEMERTEA	Nemertea	3	-	-	-	R
NEMATODA	Nematoda	3	-	-	-	R
ANNELIDA (WORMS)	Oligochaeta	1	R	C	VA	A
MOLLUSCA	*Potamopyrgus*	4	C	-	-	R
EPHEMEROPTERA (MAYFLIES)	*Austroclima*	7	C	-	-	-
	Coloburiscus	7	XA	XA	A	C
	Deleatidium	8	XA	XA	A	C
	Nesameletus	9	A	A	-	R
	Zephlebia group	7	C	R	R	-
PLECOPTERA (STONEFLIES)	*Megaleptoperla*	9	R	-	-	-
	Zelandoperla	8	C	C	-	-
COLEOPTERA (BEETLES)	Elmidae	6	VA	A	A	A
	Hydraenidae	8	A	C	R	R
MEGALOPTERA (DOBSONFLIES)	*Archichauliodes*	7	VA	VA	A	A
TRICHOPTERA (CADDISFLIES)	*Hydropsyche (Aoteapsyche)*	4	XA	XA	VA	XA
	Costachorema	7	C	A	A	C
	Hydrobiosis	5	C	C	A	A
	Neurochorema	6	C	R	C	C
	Beraeoptera	8	R	C	-	-
	Oeconesidae	5	R	-	-	-
	Olinga	9	-	R	R	-
	Oxyethira	2	-	R	C	R
	Pycnocentrodes	5	C	-	-	R
DIPTERA (TRUE FLIES)	*Aphrophila*	5	VA	VA	A	VA
	Eriopterini	5	R	-	-	-
	Harrisius	6	R	-	-	-
	Maoridiamesa	3	C	C	A	VA
	Orthocladiinae	2	A	C	VA	A
	Polypedilum	3	-	-	R	-
	Tanypodinae	5	C	R	C	R
	Tanytarsini	3	C	C	VA	A
	Empididae	3	R	-	C	R
	Muscidae	3	-	-	A	C
	Austrosimulium	3	C	R	C	C
	Tanyderidae	4	R	R	R	-
		No of taxa	29	23	24	24
		MCI	110	110	95	93
		SQMCIs	6.2	6.3	3.5	4.1
		EPT (taxa)	14	11	8	8
		%EPT (taxa)	48	48	33	33

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

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

The results from the current survey (Table 2) indicated faunal richnesses ranging from one taxon below (site 2) to two taxa above (site 1) median richnesses (ranging from 23 to 29 taxa) present at the four river sites. These taxa numbers were well within ranges previously recorded (Table 1) at the three longer established sites (1, 2 and 4).

The range of taxa richnesses was generally typical of richnesses recorded by previous surveys which have been recorded under summer, more widespread periphyton cover and tending toward low flow conditions.

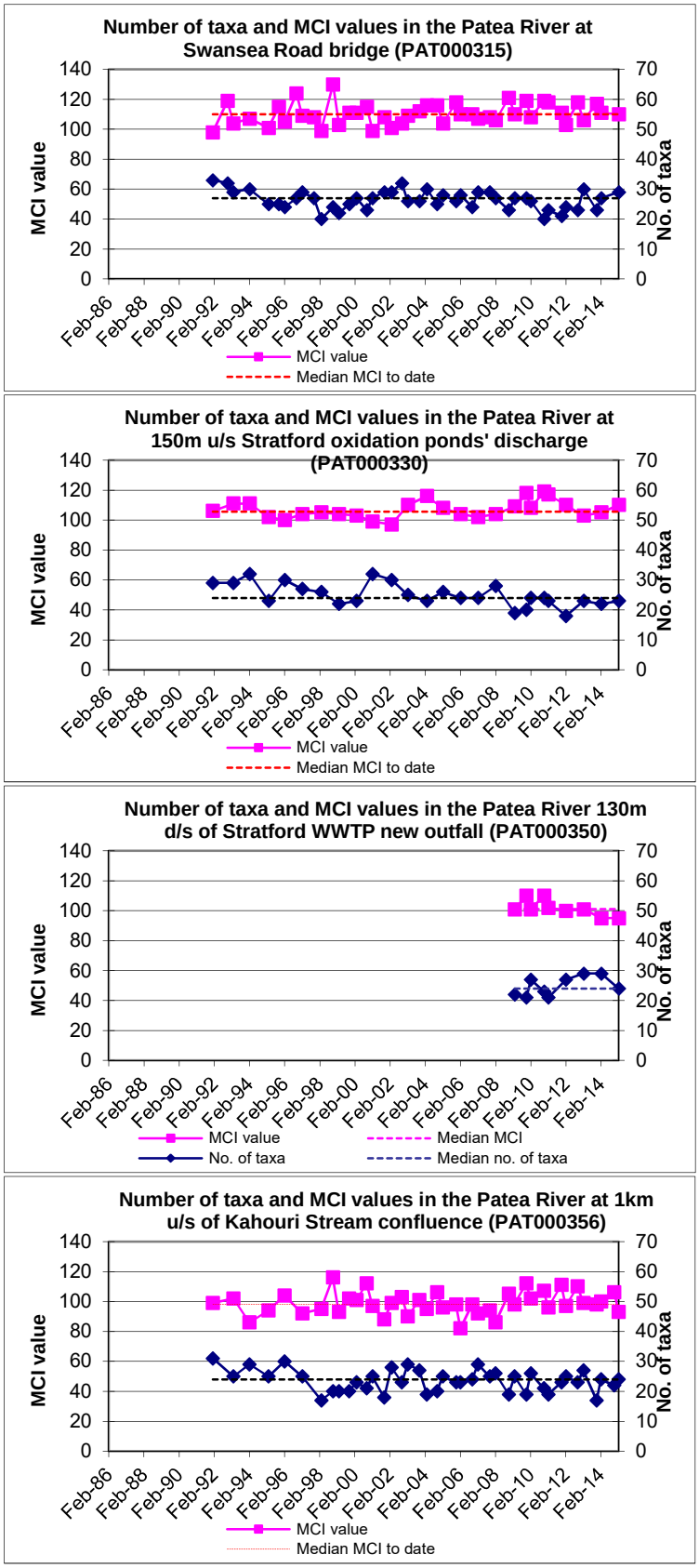

Figure 3 Taxa richness and MCI scores recorded to date at the Patea River sites

Sites upstream of the WWTP discharge (sites 1 and 2)

The macroinvertebrate communities of this reach of the river upstream of the WWTP discharge (and adjacent to the landfill) were of moderate richnesses (23 to 29 taxa) and characterised by up to three 'highly sensitive' taxa [mayflies (extremely abundant *Deleatidium*; and *Nesameletus*) and hydraenid beetles]; up to five 'moderately sensitive' taxa [mayfly (*Coloburiscus*), elmid beetles, dobsonfly (*Archichauliodes*), free-living caddisfly (*Costachorema*), and cranefly (*Aphrophila*)]; and up to two 'tolerant' taxa [net-building caddisfly (*Aoteapsyche*) and orthoclad midges]. These dominant taxa were similar to those dominant at the time of the previous summer survey (CF604) but two fewer in number of 'tolerant' taxa. In comparison with spring surveys, a lower ratio of 'sensitive' to 'tolerant' taxa generally has characterised these summer communities associated with more extensive periphyton assemblages typical of the mid and lower reaches of Taranaki rivers and streams during periods of warmer, low recession flows. The presence of up to seven 'highly sensitive' taxa at these two sites within this surveyed reach of the river was indicative of relatively good preceding physicochemical water quality upstream and adjacent to the Stratford landfill and WWTP under summer, low recession flow conditions. MCI scores (both 110 units) reflected the significant proportions of 'sensitive taxa (69% and 65%) comprising the fauna at these sites, with these scores equivalent with to five units higher than medians of previously recorded scores (Table 1). These scores were both 5 units lower than scores predicted for sites at these altitudes (280 to 300 m asl) but 7 to 8 units higher than predicted for sites this distance from the National Park (12.9 to 13.6 km) in ringplain rivers (Stark & Fowles, 2009). These scores categorised these sites as having 'good' generic river health (TRC, 2015a) at the time of this summer survey, and not different to that expected under summer low flow conditions at these two sites (Figure 3). Minimal significant differences in individual taxon abundance between sites (very similar $SQMCI_s$ scores), together with no downstream decrease in MCI score, were indicative of no recent impacts of the adjacent closed landfill on the macroinvertebrate communities of this reach of the river.

Sites downstream of the WWTP new discharge outfall (sites 3a and 4)

These sites' macroinvertebrate communities had identical taxa richnesses, very similar to medians of previous surveys (Table 1), and were within the range of richnesses recorded at the two sites upstream of the outfall. The communities were characterised by up to one 'highly sensitive' taxon [mayfly (*Deleatidium*)]; up to six 'moderately sensitive' taxa [mayfly (*Coloburiscus*), elmid beetles, dobsonfly (*Archichauliodes*), free-living caddisflies (*Costachorema* and *Hydrobiosis*), and cranefly (*Aphrophila*)]; and up to six 'tolerant' taxa [oligochaete worms, net-building caddisfly (*Aoteapsyche*), muscid flies, and midges (orthoclads, tanytarsids, and *Maoridiamesa*)]. There were no significant differences between sites in characteristic taxa. However, there were several significant differences in individual taxon abundances between the two sites (2 and 3a) immediately upstream and downstream of the WWTP discharge. These included increased abundances within five 'tolerant' taxa (oligochaete worms, midges (tanytarsids and orthoclads), and muscid and empidid flies; most of which were associated with the increased periphyton streambed cover; and decreased abundances within four 'highly sensitive' and one 'moderately sensitive' taxa. Decreases in the proportion of 'sensitive' taxa (50% and 50% of richnesses) at sites 3a and 4, resulted in significant decreases (of 15 and 17 units) in the MCI scores between site 2 (upstream of the WWTP discharge) and sites 3a and 4 (95 and 93 units). At site 3a this score was significantly lower (Stark, 1998) than the score obtained in the river reach immediately upstream of the discharge from the WWTP but not to the same degree at site 4 taking into account the distance of this site further downstream. These differences in scores were indicative of some recent impacts of the upgraded WWTP

wastes discharge on the macroinvertebrate fauna in the surveyed reach of the Patea River, with downstream sites' scores from 5 to 6 units lower than the relevant medians of past scores. The score at site 3a was equal with the lowest score recorded previously (by eight surveys) at this site and one unit lower than the historical minimum recorded at the site (2) upstream of the discharge. There was a minimal difference in MCI scores (a decrease of 2 units) between the two adjacent downstream sites (3a and 4) and the overall fall in MCI scores (17 units) over a distance of 4.3 km between the 'control' site (1) and furthest downstream site (4) was significant for this reach of the river despite the distance between these two sites. The several changes in community compositions (referenced above) resulted in a significant decrease in $SQMCI_s$ score of 2.8 units immediately downstream of the new outfall (site 3a), but a small recovery in $SQMCI_s$ score (increase of 0.6 unit) at site 4 predominantly was due to decreased abundances within four of the dominant 'tolerant' taxa at site 4.

The MCI scores categorised sites 3a and 4 as having 'fair' generic river health (TRC, 2015a) at the time of this summer survey, which was consistent with river health often recorded by previous surveys. These scores (95 and 93 units) were a significant 17 units lower than predicted for both sites at these altitudes (265 and 250 m asl) in ringplain rivers but insignificantly 6 to 7 units below predicted scores for these sites 14.8 km and 17.2 km downstream of the National Park boundary (Stark and Fowles, 2009).

The 17 unit difference in MCI scores between sites 1 ('control') and site 4 over a river distance of 4.3km represented a significant 14 unit larger difference than predicted for this reach of the Patea River some 13 to 17 km below the National Park boundary (Stark and Fowles, 2009), and the 15 units difference between sites (2 and 3a) adjacent to the discharge was indicative of some recent impacts of the WWTP point source discharge under summer, very low flow conditions.

Riverbed heterotrophic growth assessment

Microscopic assessment of material from the riverbed at the four sampling sites indicated that there were no unusual heterotrophic growths present in the river at the two upstream and two downstream sites during a period of summer low recession flow conditions. This was consistent with the visual absence of such growths noted at all sites at the time of the survey. Also, there was no increase in planktonic pond algal deposition at the site downstream of the relocated outfall but benthic algal substrate cover tended to increase through the reach surveyed downstream of the outfall.

Conclusions

Typical macroinvertebrate communities' richnesses were found by surveys at the four Patea River sites during a very low flow recession period in the latter part of summer and under conditions of thin to widespread mats of periphyton river substrate cover and none to patchy filamentous algae. This summer survey was performed as a component of the scheduled monitoring programme in relation to the assessment of compliance of the relatively recently upgraded WWTP with consent conditions. Very minor discolouration of the river's reach below the WWTP's re-located discharge was apparent and there was no planktonic pond algal deposition on the river bed, as a result of reduced algal concentration in the upgraded partitioned second oxidation pond cells. Faunal communities upstream of the WWTP discharge had higher percentages of 'sensitive' taxa whereas communities at downstream sites had increased percentages of 'tolerant' taxa. There were some differences in dominant (characteristic) taxa between these four sites' communities with a tendency toward

proportionately fewer 'sensitive' and more 'tolerant' dominant taxa in a downstream direction.

MCI scores were relatively similar to scores generally typical of mid-catchment ringplain rivers in Taranaki, particularly those found during summer low flow conditions and showed a moderately wide range (17 units) along the four sites through the 4.5 km reach of the Patea River. No impacts of seepage from the Stratford landfill (situated between sites 1 and 2) were indicated by the faunal composition at these sites. An increase in number of 'tolerant' taxa, together with fewer 'sensitive' taxa downstream of the WWTP's relocated discharge, resulted in lower MCI scores at these sites, which were significant in the immediate vicinity of the discharge with minimal further deterioration downstream. There were several significant changes in individual taxon abundances including amongst some dominant taxa as reflected in a reduction in $SQMCI_s$ value between sites 2 and 3a of 2.8 units and sites 2 and 4 of 1.8 units. These lower $SQMCI_s$ scores at sites 3a and 4 (up to 2.4 km downstream of the wastewater discharge) reflected lower abundances in certain 'highly sensitive' taxa and increased numbers within 'tolerant' oligochaete worms and midges in particular.

No 'undesirable heterotrophic growths were found on the substrate of the river at the sites surveyed downstream of the discharge under these summer very low recession flow conditions and there was no apparent deposition of oxidation ponds' planktonic algae on the river bed.

Effects of discharges on the macroinvertebrate communities of the Patea River vary in relation to the treatment provided by the WWTP, dilution available in the receiving waters, preceding climatic conditions and the microfloral component of the wastewaters. Such variations in effects have been documented by previous summer biomonitoring surveys with this summer survey illustrating some effects (significant at the boundary of the mixing zone), during a very low recession flow period, below the discharge from the relocated rock riprap outfall following the WWTP upgrade.

Summary

The Council's standard 'kick-sampling' technique was used at four established sites to collect streambed macroinvertebrates from the Patea River. Samples were sorted and identified and the number of taxa (richness), MCI score, and $SQMCI_S$ score were calculated for each site.

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

This scheduled summer, 2015 macroinvertebrate survey (which has complemented previous additional assessments of the upgraded system performance) indicated that the discharge of treated oxidation ponds wastes from the upgraded Stratford WWTP system had had localised effects on the macroinvertebrate communities of the Patea River under summer low river flow conditions with minimal further deterioration at the site 2.4 km downstream of the discharge. Some significant changes in macroinvertebrate communities' compositions were recorded between the upstream 'control' site and sites downstream of the relocated outfall from the

WWTP. However, the similarity in the community compositions at the two sites upstream of the WWTP outfall indicated that there were no significant effects associated with seepages from the closed landfill site.

The macroinvertebrate communities of the Patea River contained higher proportions of 'sensitive' taxa at the two upstream sites while 'tolerant' taxa were more predominant proportionately at the two sites downstream of the relocated WWTP discharge. Dominant taxa composition had some similarities at all four sites although proportionately tending toward more 'moderately sensitive' and 'tolerant' taxa in a downstream direction, through the surveyed reach of the river, however. Taxonomic richnesses (numbers of taxa) varied by only six taxa at the four sites in this summer survey and were slightly higher at two these sites than those found by the previous summer (2014) survey. However, higher proportions of 'tolerant' taxa were present at sites downstream of the WWTP discharge compared to the previous summer survey under slightly lower flow conditions and more widespread periphyton cover of the river bed at the time of this latest survey.

MCI and $SQMCI_S$ scores indicated that the upstream stream communities were of 'good' health (TRC, 2015a) and typical of conditions recorded in summer in the mid reaches of similar Taranaki ringplain rivers. Stream communities downstream of the WWTP discharge were of 'fair' generic health and were similar to those documented in this reach by most previous surveys during summer recession low flow conditions.

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