ROTORUA TE ARAWA LAKES PROGRAMME

Annual Report 2012-2013

Proud Partners

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Purpose

This purpose of the Annual Report is to provide the results achieved against the Annual Work Programme of the Funding Deed for the financial year ending June 2013.

The report covers all operation, policy and support work undertaken as well as water quality results and cumulative progress towards Deed of Funding outcomes. While the report focusses on Deed funded lakes, information is also provided for non-deed funded lakes.

Context

This report details progress made in the fifth year of Crown funded works relating to the four priority lakes. It also provides an update on work undertaken to protect and restore the eight non-deed funded lakes in the Rotorua Te Arawa Lakes Programme.

The overarching goal of the Deed of Funding agreement is to reach community aspirations for water quality in four lakes.

To date all crown funded sewerage schemes scheduled for the Rotorua catchment are complete, phosphorus locking plants and a pilot de-nitrification plant have been constructed, some land use change agreements have been negotiated, and large floating wetlands are in place in Lake Rotoehu and Rotorua. Crown funded interventions have had a positive impact in treating nutrients in the four priority lakes and improving water quality.

Crown funds are still to be spent on development of a full scale geothermal de-nitrification plant, on-going management of phosphorus locking plants, land use and management change in several lake catchments, on-going weed harvesting, aeration trials and sewerage reticulation of Gisborne Point.

Key achievements

The Rotorua Te Arawa Lakes Programme had another successful year with significant progress being made towards the restoration and protection of the Rotorua Te Arawa Lakes.

Key achievements 2012-2013		
Land based interventions	**Lake based interventions**	**Policy, Planning & Action Plans**
• 7 detainment bunds installed in Lake Rotorua catchment • Completed Hamurana sewerage scheme with 525 households connected • Completed 501 ha of planting for Lake Rotoehu agreement • Project plan developed for Waste Water Treatment Plant and Land Treatment System upgrade Rotorua and Rotoiti/Rotoma	• Successful installation and initial testing of aeration devices in Lake Rotoehu • Completed zeolite trial for geothermal nitrogen removal • Tikitere De-nitrification trial issues resolved and trial plant operating • Rotorua Alum Dosing programme assessed • Continued Ohau Diversion Wall monitoring	• Oturoa Agreement and resolution of appeals against Regional Policy Statement policy WL 6B • Lake Okataina Action Plan adopted • Strategy for the Lakes of the Rotorua District publicly consulted • Established Stakeholder Advisory Group and held monthly meetings for Lake Rotorua rules and incentives development • Developed allocation principles and framework for Lake Rotorua rules development • Gorse Policy approved • High level principles for incentive fund developed
Science	**Communications**	**Programme**
• Renewal of Chair in Lakes Management and Restoration for further five years • Geological model for Lake Tarawera complete • Progress made for modelling of Lakes Rerewhakaaitu, Rotokakahi and Tikitere. • Rotorua PhD completed on Rotorua inflows • Rotorua Alum Dosing programme assessed with protocol now in place • Completed Lake Rotorua long term impact modelling for planning future interventions and land use requirements • Completed Fisheries PhD on smelt and Rainbow trout in the Rotorua Lakes.	• Completed Communications and Stakeholder Engagement Plan • New branding and name of programme • Launch of programme website • Regular communication updates • Developed stakeholder database	• Implement new programme structure • Establishment of Partnership Steering Group as part of the governance of the programme • Review of programme contracts completed • Project Management Principles have been embedded into the management of the programme • Programme Management Plan prepared

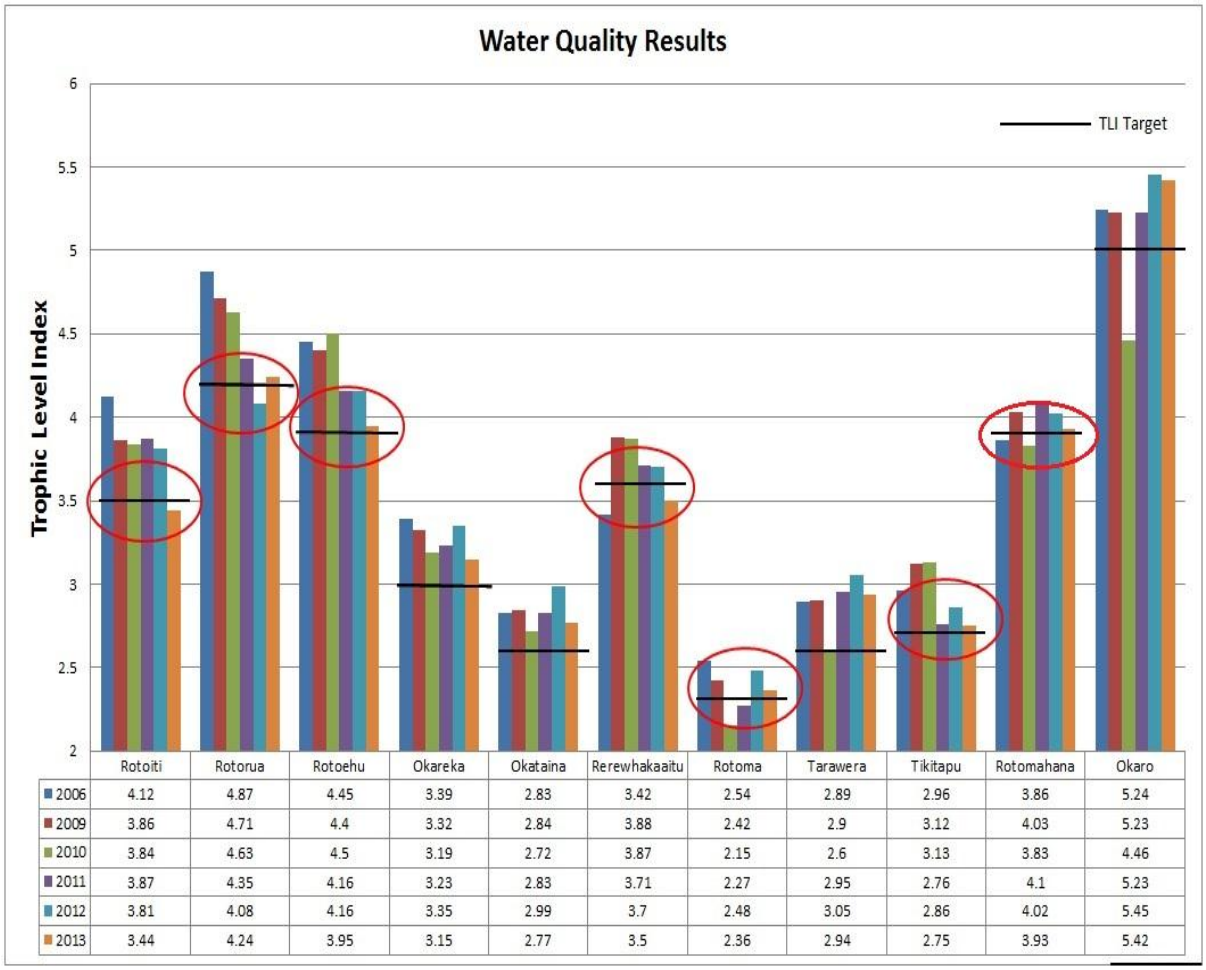
The milestones not reached include the targeted nutrient reduction from land in the Rotorua catchment and the Tikitere de-nitrification pilot plant. The Gisborne point sewage scheme was re-base-lined in the programme plan and a project plan has been developed.

Rotorua Te Arawa Lakes annual water results

All work undertaken in the Rotorua Te Arawa Lakes Programme is to achieve water quality targets set in consultation with the community.

The 2012-2013 annual water quality results were very positive and showed that:

- Eight lakes had improved water quality as shown by improved Trophic Level Indexes (TLI's) from the previous year
- Seven lakes met or were just above the water quality target (see graph below)
- Lakes Rotoiti was below its TLI target for the first time since the programme began
- Lake Rerewhakaaitu 'sTLI dropped in the last year to bring the annual TLI to below the target.



	Rotoiti	Rotorua	Rotoehu	Okareka	Okataina	Rerewhakaaitu	Rotoma	Tarawera	Tikitapu	Rotomahana	Okaro
2006	4.12	4.87	4.45	3.39	2.83	3.42	2.54	2.89	2.96	3.86	5.24
2009	3.86	4.71	4.4	3.32	2.84	3.88	2.42	2.9	3.12	4.03	5.23
2010	3.84	4.63	4.5	3.19	2.72	3.87	2.15	2.6	3.13	3.83	4.46
2011	3.87	4.35	4.16	3.23	2.83	3.71	2.27	2.95	2.76	4.1	5.23
2012	3.81	4.08	4.16	3.35	2.99	3.7	2.48	3.05	2.86	4.02	5.45
2013	3.44	4.24	3.95	3.15	2.77	3.5	2.36	2.94	2.75	3.93	5.42

Long-term water quality trends

Annual water quality results can fluctuate due to an array of reasons including climate conditions and rainfall. It is important to track the long-term trend in water quality results for each lake to track progress.

As depicted in the diagram below tracking of the long-term water quality trend shows:

- Water quality in Lakes Rotorua, Rotoiti, Rotoehu, Rerewhakaaitu, Rotoma and Tikitapu is improving
- Water quality in Lakes Okataina, Okareka and Rotomahana is stable
- Water quality in Lakes Tarawera, and Rotokakahi is declining
- Water quality in Lake Okaro fluctuates and investigation is needed.

Please see Appendix 1 for long term data on each lake.

These results clearly show that of the 12 lakes in the programme three of the lakes showing improving trends are those that are being actively restored through the Deed Funding programme of works. Rotoiti is at its target for the first time and both Rotorua and Rotoehu are very close to their targets. Lake Ōkāreka's water quality improved in 2013 and the long-term trend is stable, we expect to see further improvements as land use change and sewage reticulation works take effect.

Lake Rotorua

To meet community expectations for Lake Rotorua nitrogen inputs need to reduce by a total of 320 tonnes and phosphorus to reduce 10 tonnes per year. We also need to reduce the impact of nutrients already in the lake.

To achieve water quality targets for Lake Rotorua we are undertaking both short term and long term interventions. Short term interventions have resulted in the best water quality in decades however the lake will decline again if these are not carried out annually. The solution to sustainable improvements is reducing the amount of nutrients entering the lake.

The graphs below show total nutrient targets and planned versus achieved for the financial year ending 30 June 2013.

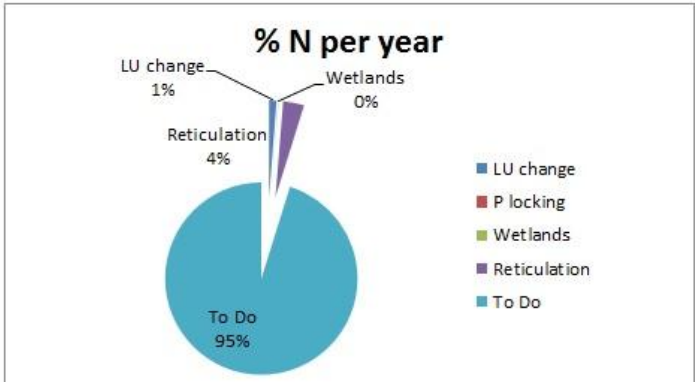
WATER QUALITY AT A GLANCE:

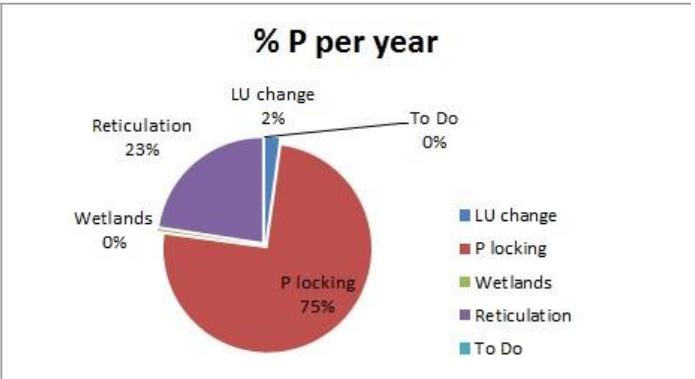
2013 TLI	4.24
2012 TLI	4.08
TARGET	4.2

The annual TLI increased slightly on last year, but is very close to the target.

Monitoring showed that there was an increase in nitrogen and phosphorus levels compared to last year and a decrease in Secchi depth.

While water quality over the last two years is the best is has been in decades, it is likely due to in-lake interventions and favourable climatic conditions. For sustainable long-term water quality nutrient reductions from land-use is required.



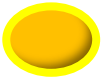


PROGRAMME UPDATE – LAKE ROTORUA

Project	Deed Funded	Total Target	Total achieved to date	Annual Target	Annual Result	Explanation of variance	Comments	Project Status	Budget Status
Land use and land management change- rules and incentives	Yes	270 T N 10 T P	4.6 T N .239T P	9.6 T N TBC P	4.6 T N .239 T P	No further reductions in N have been achieved. 7 modest phosphorus detainment bunds were established and monitoring will inform outcomes. See below for further explanation.	Land use change negotiations on hold until rules and incentive fund developed.		
Sewage Reticulation – Hamurana	Yes	5.8 T N 1.3T P	5.8 T N 1.3 T P	5.8 T N 1.3 T P	5.8 T N 1.3 T P	Completed Hamurana / Awahou sewerage scheme. 525 households connected.	Completed. The Annual Work Programme 2012-2013 listed the total capacity of the scheme of 648 properties to allow for residential growth. All connections completed.		
WWTP Options Analysis	Yes	0	0	0	0	Assesses options to minimise the discharge of nutrients from wastewater treatment plan.	Scoping report completed and 7 year project plan developed.		
Tikitere geothermal treatment	Yes	30T N	0	0	0	Pilot testing behind schedule due to high PH issues.	Construction of the full scale plant behind schedule. All issues with pilot of de-nitrification plant resolved and pilot plant now operating. Testing of an alternative solution of Zeolite completed.		

Project Status	*Green = on track*	*Amber = some delays*	*Red = major delays*
Budget Status	*Green = on budget*	*Black = underspent*	*Red = overspent*

PROGRAMME UPDATE – LAKE ROTORUA

Project	Deed Funded	Total Target	Total achieved to date	12 month Target	12 month result	Explanation of variance	Comments	Project Status	Budget Status
Phosphorus locking	Yes	4T P	8.3 T P*	11T P	8.3T P	Further science and testing as revealed the true amount of p-locking.	The phosphorus locking dosing protocol was reviewed and updated by the Technical Advisory Group. This has resulted in a lower amount of alum being dosed. P-locking has still been very successful and contributed to the lake being close to the TLI target.		
Sewage Reticulation Brunswick/ Rotokawa Hinemoa Point Tarawera Road Paradise Valley	 Yes Yes Yes No	5.5T N 1.2T P	5.5 1.2	5.5 T N 1.2 T P	5.5 T N 1.2 T P		Complete		
Floating wetland (Tanner et al 2010)	Yes	0.18T N 0.03 T P	0.18T N 0.03T P	0.18T N 0.03T P	0.18 T N 0.03 T P		Complete		
Total		**311.5T N 16.53T P**	**16.08 T N 13.77 T P**	**21.08 T N 12.57 P**	**16.08 T N 13.77 T P**	**5 Tonne behind nitrogen target due to land use change**			

Project Status *Green = on track* *Amber = some delays* *Red = major delays*
Budget Status *Green = on budget* *Black = underspent* *Red = overspent* ** updated with new modelling results*

Comments on behind schedule projects – Rotorua

Reducing nutrients from rural land

A decision was made by Regional Council to integrate the Deed of Funding incentives project with the development of regional rules to control discharges. This recognises the independencies between the two projects. The project is behind as the policy for rules needs to be developed before the incentives policy and framework can be finalised. Further contributing to delay in planned expenditure is the delay in approval for funding transfer from in-lake interventions to catchment land use reductions.

Key achievements over the past year include working with the Stakeholder Advisory Group to provide oversight, advice and recommendations on rules and incentives options. This collaborative approach has helped develop the allocation principles and framework for the Lake Rotorua rules. High level principles have also been developed for the incentive fund.

Tikitere

The Tikitere pilot de-nitrification (and subsequent full scale plant) is behind schedule due to operating and complex water quality issues at the pilot plant. All issued have been resolved and pilot plant is now operational but performance is yet to be achieved. Successful trials have been completed of an alternative solution of zeolite absorption. Once results from Tikitere are available the two options will be analysed to enable full scale plant assessment and design of the preferred option.

P-Locking

The 11 tonne target was based on known science and modelling at the time of preparing the Annual Work Programme 2012-2013. Additional information has come to hand which has forecast the actual phosphorus removed from Lake Rotorua at 8.3 tonnes for 2012-2013. This amount is still well over the total lake target for phosphorus and contributed to improved water quality.

Lake Rotoehu

To meet community expectations for water quality Lake Rotoehu needs a reduction of 8.9 tonnes of nitrogen and 708 kg of phosphorus. The main long term intervention in Lake Rotoehu is land management change which is complemented by some short term interventions.

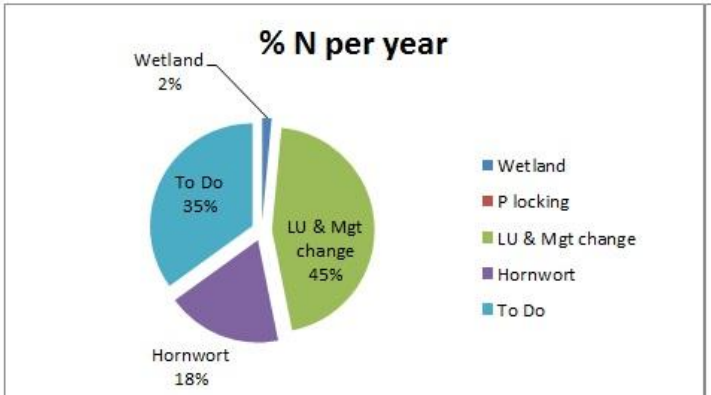
The graphs below show total nutrient targets and planned versus achieved for the financial year ending 30 June 2013.

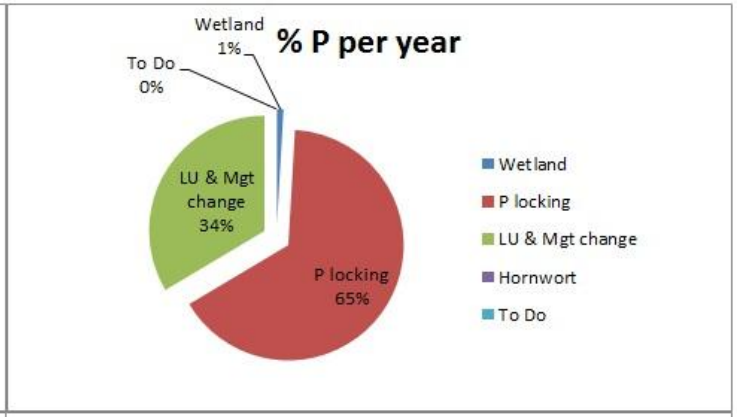
WATER QUALITY AT A GLANCE:

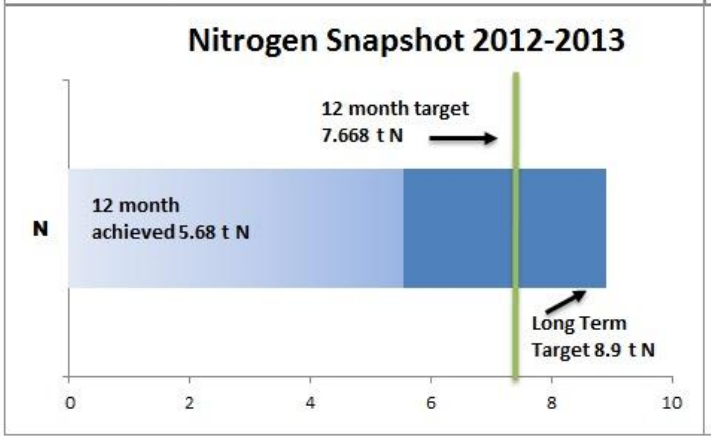
2013 TLI	3.95
2012 TLI	4.16
TARGET	3.9

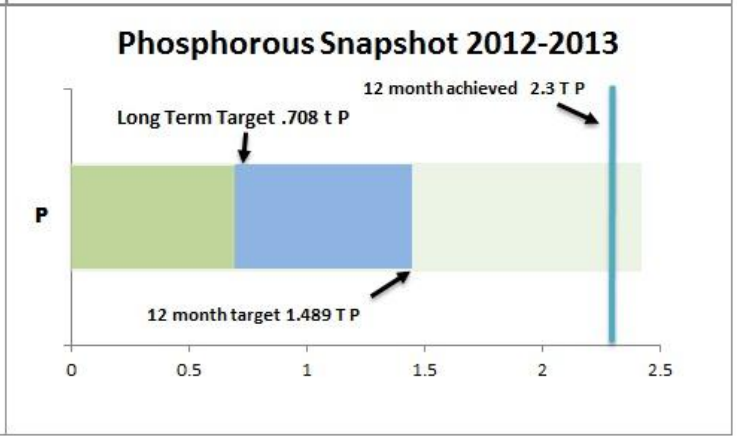
The annual TLI decreased from the previous year and is very close to the lake TLI target.

Measuring showed that nitrogen and phosphorus levels were the lowest seen in the last twenty years.

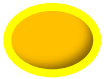








PROGRAMME UPDATE – LAKE ROTOEHU

Project	Deed Funded	Total Target	Total achieved to date	Annual Target	Annual Result	Variance	Comments	Project Status	Budget Status
Land use and land management change	Yes	6.6 T N .460T P	4.036 T N .768 T P	4.036 T N .768 T P	4.036 T N .768 T P		Land use change agreement for 668 ha has been completed and audited.		
Weed Harvesting	Yes	3.5T N	1.62 T N	3.5 T N	1.62 T N	Reduced weed harvested due to use of a digger and barge as no weed harvester available.	Work is underway to secure a weed harvester for 2014.		
Phosphorus locking plant	Yes	.700 T P	.700 T P	.700 T P	1.5 T P		Greater than anticipated effectiveness.		
Aeration	Yes	0		0	0		Successful installation and trialling of aeration devices.		
Floating wetland	Yes	0.132 T N 0.021 T P (Tanner *et al* 2010)	0.132 T N 0.021 T P	0.132 T N 0.021 T P	0.132 T N 0.021 T P		Complete		
Total		**13.23TN 1.18TP**	**5.68 T N 1.489 T N**	**7.668 T N 1.489 T P**	**5.68 T N 2.289 T P**				

Project Status	*Green = on track*	*Amber = some delays*	*Red = major delays*
Budget Status	*Green = on budget*	*Black = underspent*	*Red = overspent*

Comments on behind schedule projects – Rotoehu

Weed harvesting

The weed harvester used for the programme is no longer available. No weed harvester was available in the country for use. Weed harvesting was completed for the 2012-2013 with a digger on a barge. This led to a reduced weed harvest and therefore lower nitrogen removal than expected. Work is underway to secure a weed harvester for 2014.

Lake Rotoiti

To meet community expectations for water quality Lake Rotoiti needs a reduction of 130 tonnes of nitrogen and 19 tonnes of phosphorus. The Ohau Diversion Wall is established and protecting the lakes water quality while nutrient reductions to lake Rotorua are achieved. Additional sewage reticulation is the only outstanding action.

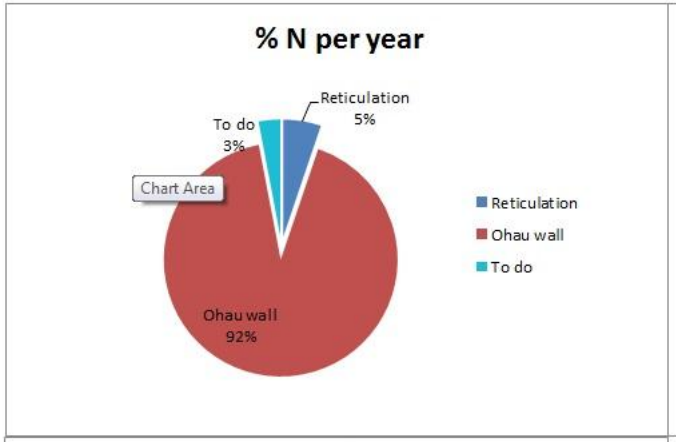
The graphs below show total nutrient targets and planned versus achieved for the financial year ending 30 June 2013.

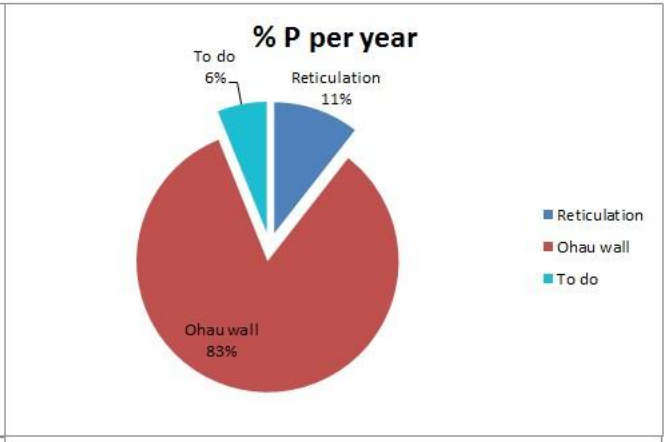
WATER QUALITY AT A GLANCE:

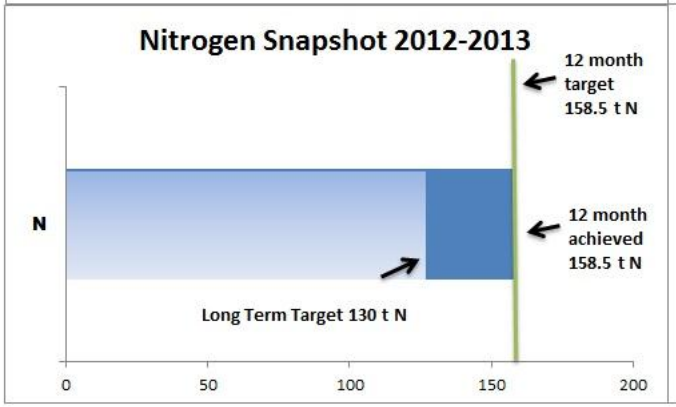
2013 TLI	3.44
2012 TLI	3.81
TARGET	3.5

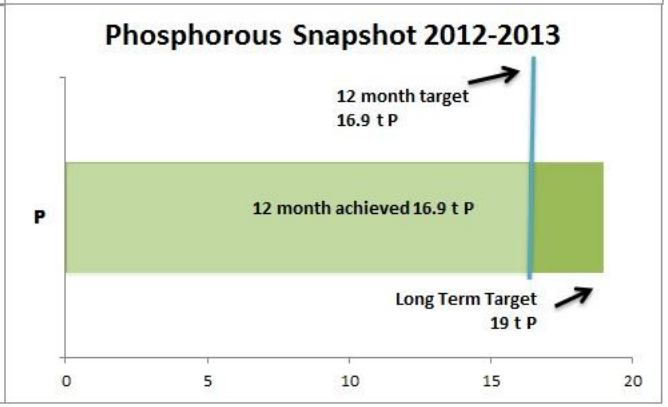
Lake Rotoiti had the best water quality in decades and met its water quality target this year for the first time since monitoring began.

Results showed the internal load of nitrogen and phosphorus levels were reduced and that the average secchi depth increased by one metre from last year.









PROGRAMME UPDATE – LAKE ROTOITI

Project	Deed Funded	Total target	Total achieved to date	Annual Target	Annual Result	Variance	Comments	Project Status	Budget Status
Sewerage Scheme – Curtis Road to Hinehopu	Yes	4.9T N 1.1T P	0	0	0		No expenditure or works forecast. Works have been delayed due to resource consent appeals in the Environment Court for the proposed wastewater treatment plant.		
Ohau Diversion wall	No	130T N 15T P	150T N 15 T P	150 T N 15 T P	150 T N 15 T P		Project complete		
Sewage schemes complete Okere/Otaramarae /Whangamarino Mourea/Okawa Bay	Yes	8.5T N 1.9T P	8.5T N 1.9T P	8.5T N 1.9T P	8.5T N 1.9T P		Project complete		
Total		**143.4 T N 18T P**	**158.5 T N 16.9 T P**	**158.5T N 16.9 T P**	**158.5 T N 16.9 T P**				

Project Status	*Green = on track*	*Amber = some delays*	*Red = major delays*
Budget Status	*Green = on budget*	*Black = underspent*	*Red = overspent*

Lake Okareka

WATER QUALITY AT A GLANCE:

2013 TLI	3.15
2012 TLI	3.35
TARGET	3.0

All TLI parameters showed an improvement in Lake Okareka's water quality resulting in an improved TLI result for 2012-2013.

To meet community expectations for water quality Lake Okareka needs a reduction of 2.5 tonnes of nitrogen and .08 tonnes of phosphorus.

No actions are planned for Lake Okareka this financial year. Nitrogen and phosphorus targets have been met according to models. On-going monitoring of existing interventions will inform if further actions are required in later years of the programme.

PROGRAMME UPDATE – LAKE OKAREKA

Project	Deed Funded	Total Target	Total achieved	Annual Target	Annual Result	Variance	Comments	Project Status	Budget Status
Sewage	Yes	2.4 T N .02 T P	1.9 T N .02 T P				Project complete		
Land use change	Yes	.9 T N .06 T P	1.1 T N .231 T P				On hold pending monitoring		
Total		**3.3 T N** **.08 T P**	**3 T N** **.233 T P**						

Actions and outcomes for all other lakes

Lake Tikitapu 2013 TLI 2.75 2012 TLI 2.86 TARGET 2.7	No actions were undertaken for Lake Tikitapu in the 2012-2013 year. The main action of sewerage reticulation was completed in October 2010. Water quality in Lake Tikitapu almost reached its TLI target and continued the trend from the last three years of improving water quality. The annual average measurement of phosphorus has decreased in the last year and water clarity has improved by more than one metre.
Lake Okataina 2013 TLI 2.77 2012 TLI 2.99 TARGET 2.6	The Lake Okataina Action Plan was publicly consulted, amended due to submissions and consequently adopted in April 2013. The main actions include: 1. Land use change 2. Looking into pest control options for the catchment 3. Investigate and measure the impacts of native bush understory health on lake water quality. A PhD study has already commenced to investigate the native bush understory and land use effect on lake water quality. This research will take three years and will help inform what actions are needed. Water quality monitoring showed improvements in all TLI parameters with the annual nitrogen being lower than previously recorded.
Lake Okaro 2013 TLI 5.42 2012 TLI 5.46 TARGET 5.1	Water quality in Lake Okaro has fluctuated over the last 10 years. A prolonged algal bloom and health warning has been in place since July 2012. All actions in the Action Plan have been completed. Additional alum dosing occurred in August 2012 to address the phosphorus levels in the lake. An impact and benefit assessment was completed with a proposal to refine dosing for coming season. Lake modelling will be undertaken in 2013-2014 to identify the medium term changes expected as a result of interventions already completed as well as understand why there has been a decline in water quality since meeting the target briefly in 2010. Construction of a retention dam to reduce peak storm flows to the lake and reduce the times when stream flows exceed the capacity of the wetland was deferred until 2013-2014.

Lake Rotoma 2013 TLI 2.36 2012 TLI 2.48 TARGET 2.3	No actions were taken in the 2012-2013. The key action for Rotoma is sewerage reticulation. No work can be done on this until the Waste Water Treatment Plan upgrade is resolved. Water quality improved in the last year and small improvements occurred in all TLI parameters.
Lake Rerewhakaaitu 2013 TLI 3.5 2012 TLI 3.7 TARGET 3.6	Lake Rerewhakaaitu was below its water quality target for 2013. Nitrogen levels in the lake have decreased over the last six years and Secchi depth has improved by over half a metre. An Action Plan has not been developed for Rerewhakaaitu as BoPRC agreed to support the Rerewhakaaitu farmers in developing their own catchment plan to improve the lake's water quality. The Primary focus of the Catchment Plan is to prepare and implement a nutrient management plan for each farm. Farmers have committed to undertake all actions and independent auditing by 2015. Progress was also made on the Rerewhakaaitu lake modelling. The trial of a de-nitrification treatment wall in the main stream leading to the lake was deferred until the 2013-2014 year.
Lake Tarawera 2013 TLI 2.94 2012 TLI 3.05 TARGET 2.6	The Lake Tarawera Action Plan was forecast to be completed by April 2013. Delays with iwi and community engagement have resulted in the Action Plan taken longer than expected. The Action Plan is due for completion by June 2014. The Tarawera nutrient budget was completed. The geological model was also completed with critical bores being installed. The outputs from both of these items will provide information for the Action Plan. The Lake still displays elevated annual phosphorus in-lake, although the TLI improved due to a decrease in annual nitrogen which has resulted in an improved annual TLI for Tarawera.

Lake Rotokakahi 2013 TLI 3.69 2012 TLI 3.9 TARGET 3.1	The Lake Rotokakahi Action Plan was scheduled to be completed by May 2013. Staff will continue to work with the private lake owners to develop an action plan. If engagement with Rotokakahi Board of Control progresses then a draft action plan will be completed in 2013/2014. A report was completed on ground water near Lake Rotokakahi to assess the Whakarewarewa sewage disposal area and determine the risk to Lake Rotokakahi. Water quality continues to show improvement since the severe algal blooms of 2009. Monitoring showed greatest improvement in the nitrogen and chlorophyll-a levels with a slight decrease in phosphorus.
Lake Rotomahana 2013 TLI 3.93 2012 TLI 4.02 TARGET 3.9	No actions were undertaken as Lake Rotomahana has not yet reached the trigger point to need an action plan. Water quality in the lake remains stable. There were improvements in all TLI parameters in the last year which has resulted in a lower annual TLI result for 2013.

Programme Management

Significant changes were implemented to the management of the programme in the last year following results from the audit completed by IQANZ in May 2012. This has included:

- Embedding programme management principles into the management of the program
- Implementing a new programme structure
- Appointment of Programme Manager and Project Co-ordinator
- Fortnightly meetings with all partners for greater collaboration between partners
- A Programme Management Plan prepared
- Full review of all programme contracts

The above changes have resulted in improved project planning, increased collaboration between partners and better programme reporting.

Communications and Stakeholder Engagement

In November 2012 the Partnership Steering Group approved the Communications and Stakeholder Engagement Plan for the lakes programme. The overall goal of the plan is to create awareness and understanding of the programme and collaborate for a solution when required.

Programme branding

The programme name changed from 'Rotorua Lakes Protection and Restoration Action Programme' to a more user-friendly 'Rotorua Te Arawa Lakes Programme'. The new name also aligns with the governance group 'Rotorua Te Arawa Lakes Strategy Group'. A new logo has been implemented as well as a 'Proud Partners' logo that is used on all programme branding.

Website

A programme website was launched in March 2013. The website www.rotorualakes.co.nz provides a one-stop shop for information on the lakes, the programme, its actions and achievements.

The new website has more than doubled web traffic to information on the lakes. Visits to the website have averaged over 700 per month, and 40 percent of visitors have returned to the website more than once.

Surveys

The effectiveness of the Communication and Engagement Plan will be measured through six-monthly surveys for the community, key stakeholders and partner agency staff. The first surveys were completed between February and April and have set a benchmark to measure future survey results.

Communications

Since the Communications and Engagement Plan was adopted in November 2012 increased communication activity occurred including:

- Regular programme updates to stakeholders and the general community
- Partner Agency Roadshow for staff
- Rotorua Professionals Seminar to update on Lake Rotorua rules and incentive development
- Science seminar presentations were more than 120 people attended

Policy and planning

Stakeholder Advisory Group

In September 2012 the Rotorua Te Arawa Lakes Strategy Group endorsed the creation of a Lake Rotorua Stakeholder Advisory Group (StAG) to provide input, advice and recommendations on the development of rules and incentives for the Lake Rotorua catchment.

The group includes 15 members from the Lake Rotorua Primary Producers Collective, Lakes Water Quality Society, Bay of Plenty Regional Council, Rotorua District Council, Te Arawa Lakes Trust, Office of the Maori Trustee, forestry sector, iwi landowners and small block owners.

Seven meetings have been held with StAG to work collaboratively to develop a preferred approach to rules and incentives. Additional meetings have been held with a sub-committee. Significant progress has been made towards reaching consensus of a preferred allocation approach.

Regional Policy Statement

In February 2013 the Lake Rotorua Primary Producers' Collective, Federated Farmers and the Bay of Plenty Regional Council signed the Oturoa Agreement, this is a Memorandum of Understanding (MOU) on a way forward to reduce nutrients entering Lake Rotorua.

Under the Oturoa Agreement, farmers and the Regional Council will cooperate and collaborate to achieve the sustainable nitrogen load by 2032, with 70 per cent of the nitrogen reduction target catchment wide achieved by 2022.

All appeals on the draft Regional Policy Statement for water quality in Section 6B were resolved and closed off.

Strategy for the Lakes of the Rotorua district

The Strategy for the Lakes of the Rotorua district was released for public consultation in April 2013. The new Strategy retains the original vision but builds on the commitment of partner organisations to provide an integrated and holistic direction for the management of the lakes catchments.

Changes have been made to the Strategy following submissions and the amended Strategy is expected to be adopted in August 2013.

Transferable Development Rights

The proposed Rotorua District Plan includes Transferable Development Rights (TDRs) to reduce nutrients entering the Rotorua Te Arawa Lakes.

The intent of TDRs is to encourage land use change from high nutrient intensive practices such as dairy farming to lower nutrient activities such as residential living.

Other policy development

Work commenced on preparing a needs analysis for rules for the other 11 Rotorua Te Arawa Lakes. This is an important piece of work for lakes currently not protected by intensification of land use, such as Lake Rotomā, Lake Tarawera, Rerewhakaaitu and Rotomahana.

A gorse policy was prepared and approved on handling gorse in the Rotorua Te Arawa Lakes catchments.

Science

Science support

The five year agreement for the Chair in Lakes Management and Restoration at the University of Waikato expired in September 2012. A new agreement has been signed with the University of Waikato for Professor David Hamilton to provide science and research support for the programme. The agreement has been renewed to 2017.

Modelling

Several modelling projects have commenced including:

- Lake Rotorua model to determine the reasons behind the significant improvement in Lake Rotorua's water quality with a focus on identifying the role of alum dosing and short term climate effects.
- Modelling for Lakes Rerwhakaaitu, Tikitapu and Rotokakahi progressed
- Completed Lake Rotorua modelling for long-term impact modelling for planning future interventions and land use requirements.

Research and reviews

Several research projects were completed during the last year, including;

1. University of Waikato undertook sediment sampling in Lake Rotorua to compare with two previous samples with the aim of identifying any changes in sediment concentrations of phosphorus and aluminium. The results do not identify any major changes. This is positive from the point of view of aluminium. The Technical Advisory Group recommended regular three year sediment sampling to get long term trends.
2. GNS completed ground water investigation work around the RDC sewage disposal area and considered any linkage with Lake Rotokakahi (Green Lake). Main conclusions support initial research that there is no linkage between the sewage disposal area and Rotokakahi.
3. PhD Student Jonathan Abell completed his PhD thesis on variations in nutrient loads coming to lakes and part of his study looked closely at nutrient loads coming to Lake Rotorua. Some key findings include:

a) Storm events can carry un-proportionally high nutrient levels
b) The bio-availability of P can be complex but is potentially available in the long term
c) 3 D modelling can be used to identify nutrient transport processes and these affect algal distribution.

4. The Rotorua Alum Dosing programme was assessed, which included;

a) A report on historic dosing completed
b) Sediment assessment reported indicating no negative impact of alum dosing
c) Utuhina and Puarenga ecological work completed showing no negative impact of alum dosing
d) In-lake assessment of impact completed,
e) NIWA assessment of chronic effects completed
f) New protocol for assessing appropriate dose rate completed and tested.

ROTORUA TE ARAWA LAKES PROGRAMME

Financials – Deed Funding Only

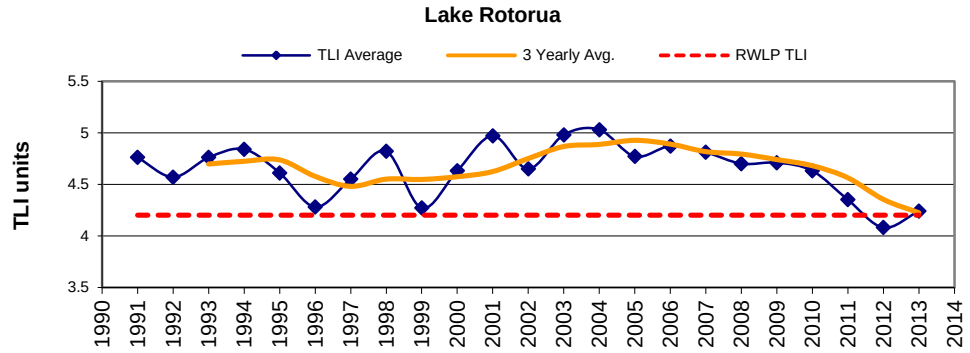
FY13 - updated 15 August 2013														Total Project to Date		
	C/FWD prior year	Budget	Expenditure to Date		Forecast	Actual + Forecast FY13 TOTAL	Variance to budget under (over)	FY13 Funding Source					Forecast Reserves EOY Balance 50/50	Actual spend to date 2011/12	Actual	Budget	Variance to budget
			BOPRC	RDC				Reserves (made up of 50% Crown & 50% BOPRC funding c/fwds)	Crown	BOPRC	RDC	TOTAL					
Lake Rotoehu	**(231,954)**	**930,000**	**981,226**	**0**	**0**	**981,226**	**(51,226)**	**977,698**	**0**	**3,528**	**0**	**981,226**	**(1,209,652)**	**2,793,060**	**3,774,286**	**3,650,000**	**(124,286)**
Crown Funded																	
Weed Harvesting	0	100,000	103,528	0	0	103,528	(3,528)	100,000	0	3,528		103,528	(100,000)	492,109	595,637	500,000	(95,637)
Land Management Change	61,596	600,000	622,804	0	0	622,804	(22,804)	622,804	0	0	0	622,804	(561,208)	438,404	1,061,208	1,100,000	38,792
P Locking Soda Springs	85,118	100,000	107,627	0	0	107,627	(7,627)	107,627	0	0	0	107,627	(22,509)	764,882	872,509	950,000	77,491
Aeration Trial	(378,668)	130,000	147,267	0	0	147,267	(17,267)	147,267	0	0		147,267	(525,935)	378,668	525,935	500,000	(25,935)
Wetlands Rotoehu	0	0	0	0	0	0	0	0		0	0	0	0	718,997	718,997	600,000	(118,997)
Lake Ōkāreka	**2,372,304**	**0**	**8,105**	**2,000**	**0**	**10,105**	**(10,105)**	**10,105**	**0**	**0**	**0**	**10,105**	**2,362,199**	**8,327,696**	**8,337,801**	**10,700,000**	**2,362,199**
Crown Funded																	
Sewerage Reticulation	1,813,000	0	0	2,000	0	2,000	(2,000)	2,000	0	0	0	2,000	1,811,000	7,887,000	7,889,000	9,700,000	1,811,000
Land Management Change	559,304	0	8,105	0	0	8,105	(8,105)	8,105	0	0	0	8,105	551,199	440,696	448,801	1,000,000	551,199
Lake Rotorua	**4,110,702**	**13,201,000**	**874,647**	**2,331,000**	**0**	**3,205,647**	**9,995,353**	**3,205,647**	**0**	**0**	**0**	**3,205,647**	**905,055**	**25,740,847**	**28,946,494**	**42,051,000**	**13,104,506**
Crown Funded																	
Phosphorous Locking	2,048,199	601,000	661,952	0	0	661,952	(60,952)	661,952	0	0	0	661,952	1,386,247	2,901,799	3,563,751	5,551,000	1,987,249
Tikitere Diversions	2,626,923	1,250,000	135,532	0	0	135,532	1,114,468	135,532	0	0	0	135,532	2,491,391	923,077	1,058,609	3,800,000	2,741,391
Land Management Change	847,354	1,700,000	77,163	0	0	77,163	1,622,837	77,163	0	0	0	77,163	770,191	1,152,646	1,229,809	3,700,000	2,470,191
Wetlands Rotorua	(451,774)	500,000	0	0	0	0	500,000	0	0	0	0	0	(451,774)	453,325	453,325	500,000	46,675
Sewerage Reticulation	(960,000)	9,150,000	0	2,331,000		2,331,000	6,819,000	2,331,000	0	0	0	2,331,000	(3,291,000)	20,310,000	22,641,000	28,500,000	5,859,000
Rotoiti	**10,368,000**	**4,450,000**	**0**	**286,000**	**0**	**286,000**	**4,164,000**	**286,000**	**0**	**0**	**0**	**286,000**	**10,082,000**	**11,781,000**	**12,067,000**	**26,600,000**	**14,533,000**
Crown Funded																	
Sewerage Reticulation	10,368,000	4,450,000	0	286,000		286,000	4,164,000	286,000	0	0	0	286,000	10,082,000	11,781,000	12,067,000	26,600,000	14,533,000
Rotorua Treatment and Disposal	**0**	**0**	**0**	**203,000**	**0**	**203,000**	**(203,000)**	**203,000**	**0**	**0**	**0**	**203,000**	**(203,000)**	**0**	**203,000**	**0**	**(203,000)**
Crown Funded - to be approved																	
Treatment and Disposal	0	0	0	203,000		203,000	(203,000)	203,000	0	0	0	203,000	(203,000)	0	203,000	0	(203,000)
TOTAL DEED FUNDED	***16,619,052***	***18,581,000***	***1,863,978***	***2,822,000***	***0***	***4,685,978***	***13,895,022***	***4,682,450***	***0***	***3,528***	***0***	***4,685,978***	***11,936,602***	***48,642,603***	***53,328,581***	***83,001,000***	***29,672,419***

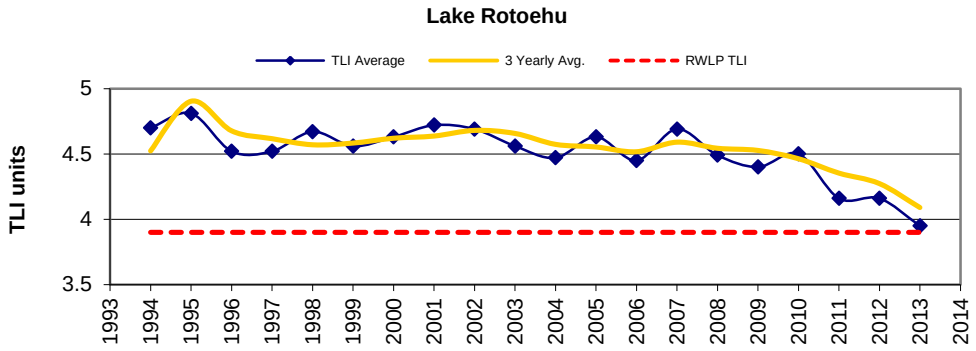
Financials – Deed Funding & Non Deed Funding

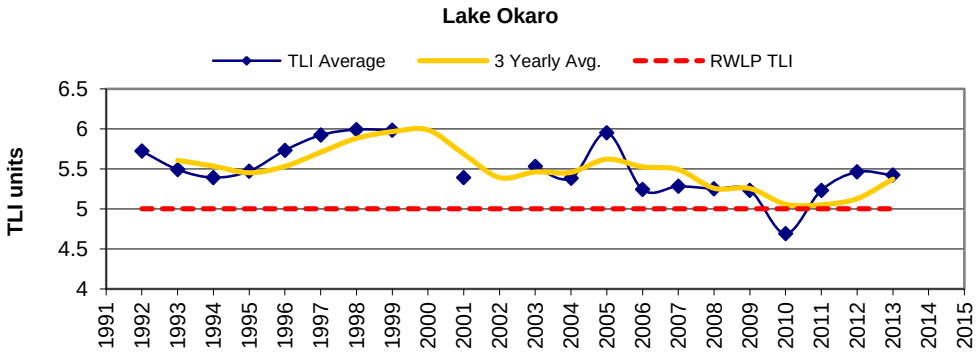
FY13 - Final Annual Report updated 13 August 2013 for RDC final numbers, grants from MfE removed													Total Project to Date		
	C/FWD prior year	Budget	Expenditure to Date		Forecast	Actual + Forecast TOTAL	Variance to budget	Funding Source							
			BOPRC	RDC				Reserves (made up of 50% Crown & 50% BOPRC/RDC funding offset)	Crown	BOPRC	RDC	TOTAL	Actual	Budget	Variance to budget under (over)
Lake Rotoehu	**(231,954)**	**961,128**	**986,622**	**0**		**986,622**	**(25,494)**	**983,094**	**0**	**3,528**	**0**	**986,622**	**3,779,682**	**3,681,128**	**(98,554)**
Crown Funded															
Weed Harvesting	0	100,000	103,528	0	0	103,528	(3,528)	100,000		3,528		103,528	595,637	500,000	(95,637)
Land Management Change	61,596	600,000	622,804	0	0	622,804	(22,804)	622,804			0	622,804	1,061,208	1,100,000	38,792
P Locking Soda Springs	85,118	100,000	107,627	0	0	107,627	(7,627)	107,627			0	107,627	872,509	950,000	77,491
Aeration Trial	(378,668)	130,000	147,267	0	0	147,267	(17,267)	147,267				147,267	525,935	500,000	(25,935)
Wetlands Rotoehu	0	0	0	0	0	0	0	0			0	0	718,997	600,000	(118,997)
sub total	*(231,954)*	*930,000*	*981,226*	*0*	*0*	*981,226*	(51,226)	*977,698*	*0*	*3,528*	*0*	*981,226*	*3,774,286*	*3,650,000*	*(124,286)*
Non Crown Funded															
Weed Harvesting	0	31,128	5,396	0		*5,396*	25,732	5,396				5,396	5,396	31,128	25,732
sub total	*0*	*31,128*	*5,396*	*0*	*0*	*5,396*	*25,732*	*5,396*	*0*	*0*	*0*	*5,396*	*5,396*	*31,128*	*25,732*
Lake Ōkāreka	**2,372,304**	**0**	**8,105**	**2,000**	**0**	**10,105**	**(10,105)**	**10,105**	**0**	**0**	**0**	**10,105**	**8,337,801**	**10,700,000**	**2,362,199**
Crown Funded															
Sewerage Reticulation	1,813,000	0	0	2,000	0	2,000	(2,000)	2,000				2,000	7,889,000	9,700,000	1,811,000
Land Management Change	559,304	0	8,105	0	0	8,105	(8,105)	8,105				8,105	448,801	1,000,000	551,199
Lake Rotorua	**4,110,702**	**13,305,534**	**1,014,083**	**2,331,000**	**0**	**3,345,083**	**9,960,451**	**3,205,647**	**0**	**139,436**	**0**	**3,345,083**	**29,085,930**	**42,155,534**	**13,069,604**
Crown Funded															
Phosphorous Locking	2,048,199	601,000	661,952	0	0	661,952	(60,952)	661,952				661,952	3,563,751	5,551,000	1,987,249
Tikitere Diversions	2,626,923	1,250,000	135,532	0	0	135,532	1,114,468	135,532				135,532	1,058,609	3,800,000	2,741,391
Land Management Change	847,354	1,700,000	77,163	0	0	77,163	1,622,837	77,163				77,163	1,229,809	3,700,000	2,470,191
Wetlands Rotorua	(451,774)	500,000	0	0	0	0	500,000	0				0	453,325	500,000	46,675
Sewerage Reticulation	(960,000)	9,150,000	0	2,331,000		2,331,000	6,819,000	2,331,000				2,331,000	22,641,000	28,500,000	5,859,000
Sediment Capping (Aeration)	0	0		0	0	0	0	0				0		0	0
sub total	*4,110,702*	*13,201,000*	*874,647*	*2,331,000*	*0*	*3,205,647*	*9,995,353*	*3,205,647*	*0*	*0*	*0*	*3,205,647*	*28,946,494*	*42,051,000*	*13,104,506*
Non Crown Funded															
LUC Management Options		104,534	113,671	0	0	113,671	(9,137)			113,671		113,671	113,671	104,534	(9,137)
Trout Barrier		0	25,765	0	0	25,765	(25,765)			25,765		25,765	25,765	0	(25,765)
sub total	*0*	*104,534*	*139,436*	*0*	*0*	*139,436*	*(34,902)*	*0*	*0*	*139,436*	*0*	*139,436*	*139,436*	*104,534*	*(34,902)*
Rotoiti	**10,368,000**	**4,450,000**	**0**	**286,000**	**0**	**286,000**	**4,164,000**	**286,000**	**0**	**0**	**0**	**286,000**	**12,067,000**	**26,600,000**	**14,533,000**
Crown Funded															
Sewerage Reticulation	10,368,000	4,450,000	0	286,000	0	286,000	4,164,000	286,000	0	0	0	286,000	12,067,000	26,600,000	14,533,000
Rotorua Treatment and Disposal	**0**	**0**	**0**	**203,000**	**0**	**203,000**	**(203,000)**	**203,000**	**0**	**0**	**0**	**203,000**	**203,000**	**0**	**(203,000)**
Crown Funded (to be confirmed)															
Treatment and Disposal	0	0	0	203,000	0	203,000	(203,000)	203,000		0	0	203,000	203,000	0	(203,000)
Programme	**0**	**3,341,433**	**3,142,880**	**0**	**0**	**3,142,880**	**198,553**	**0**	**0**	**3,142,880**	**0**	**3,142,880**	**3,142,880**	**3,341,433**	**198,553**
Non Crown Funded															
Research & Development		990,908	745,087	0	0	745,087	245,821			745,087		745,087	745,087	990,908	245,821
Comms & Stakeholder Engagement		145,264	113,716	0	0	113,716	31,548			113,716		113,716	113,716	145,264	31,548
General Administration		1,703,397	1,728,387	0	0	1,728,387	(24,990)			1,728,387		1,728,387	1,728,387	1,703,397	(24,990)
Non Deed Operations		501,864	555,690	0	0	555,690	(53,826)			555,690		555,690	555,690	501,864	(53,826)
TOTAL PROGRAMME	***16,619,052***	***22,058,095***	***5,151,690***	***2,822,000***	***0***	***7,973,690***	***14,084,405***	***4,687,846***	***0***	***3,285,844***	***0***	***7,973,690***	***56,616,293***	***86,478,095***	***29,861,802***

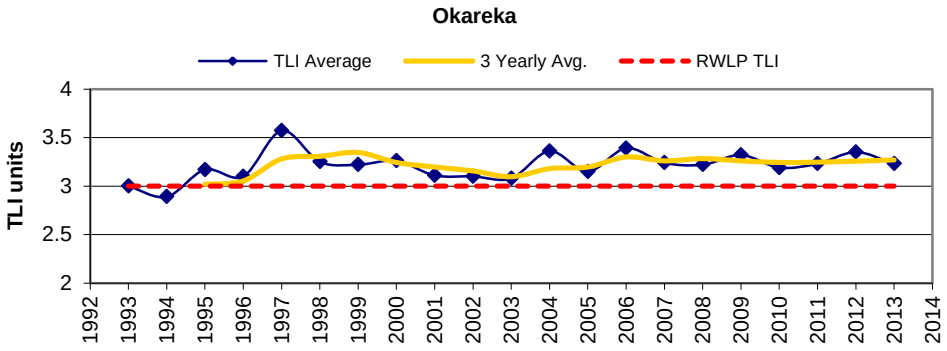
APPENDIX ONE

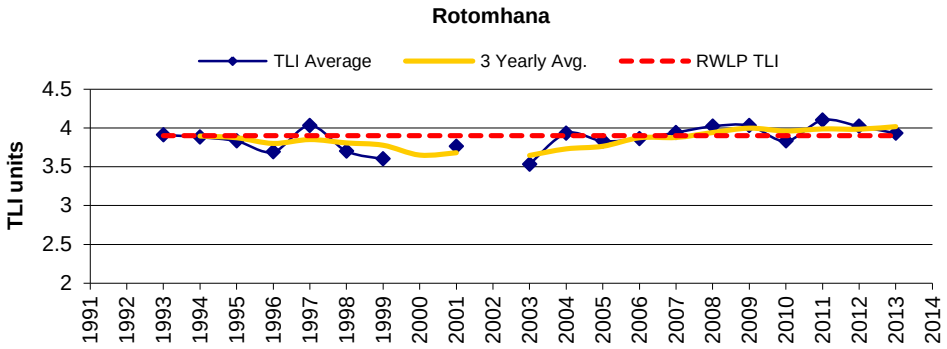
Water Quality TLI Graphs by Lake

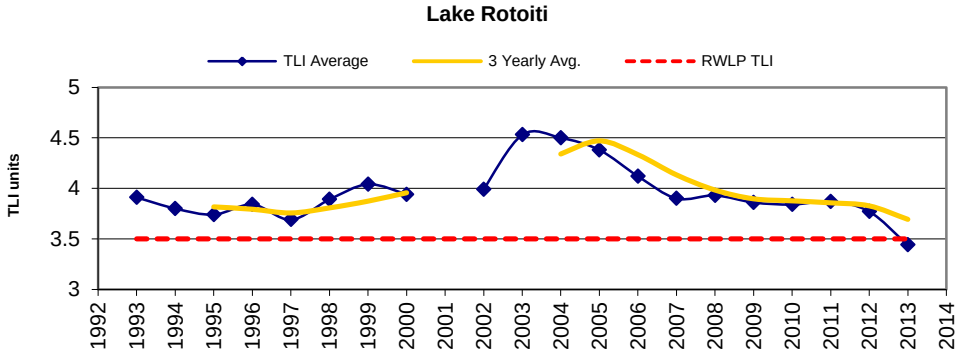


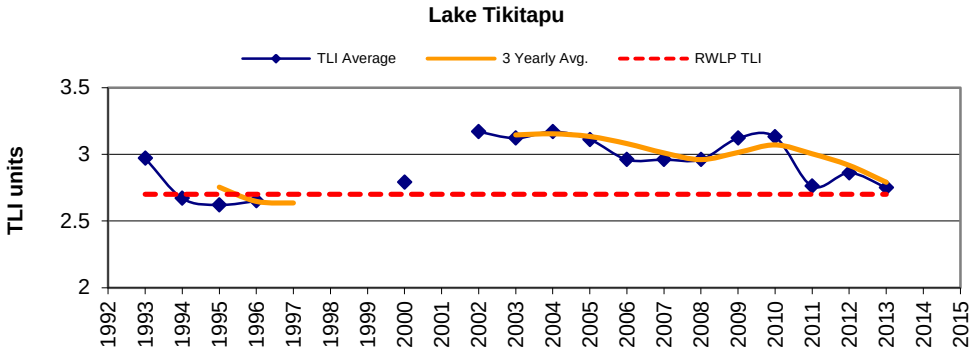


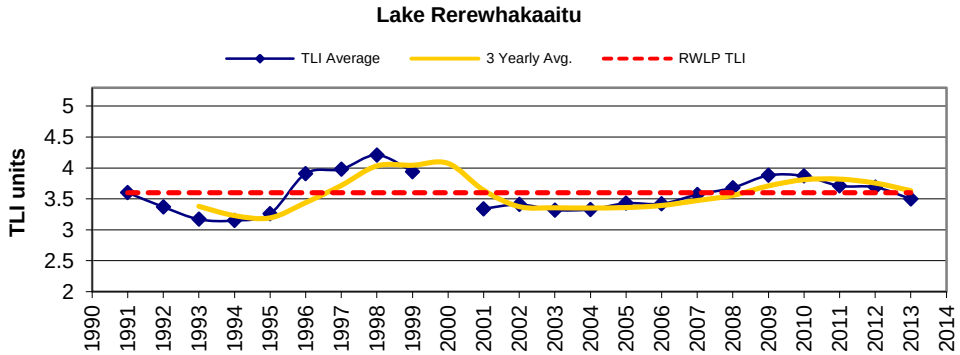


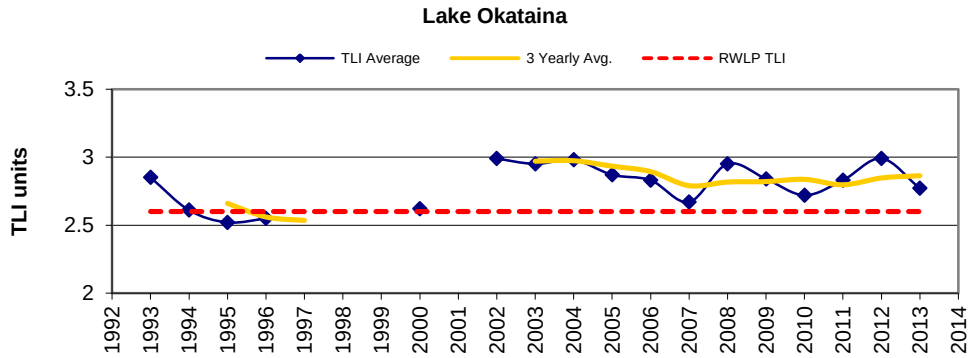


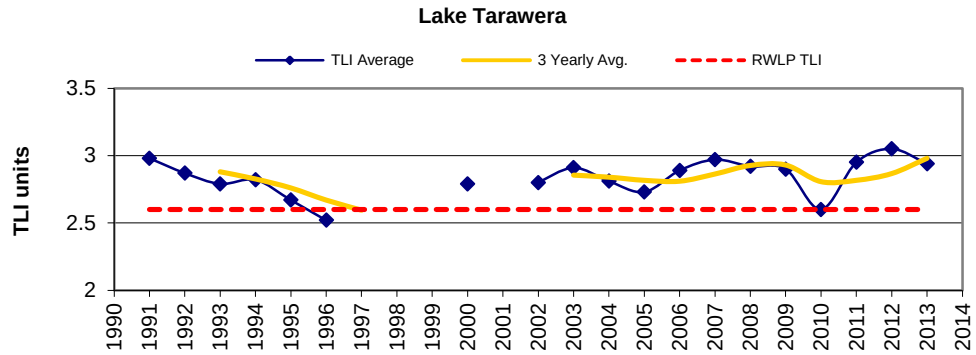

Rotomhana
TLI Average
3 Yearly Avg.
RWLP TLI
TLI units
4.5
4
3.5
3
2.5
2
1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014

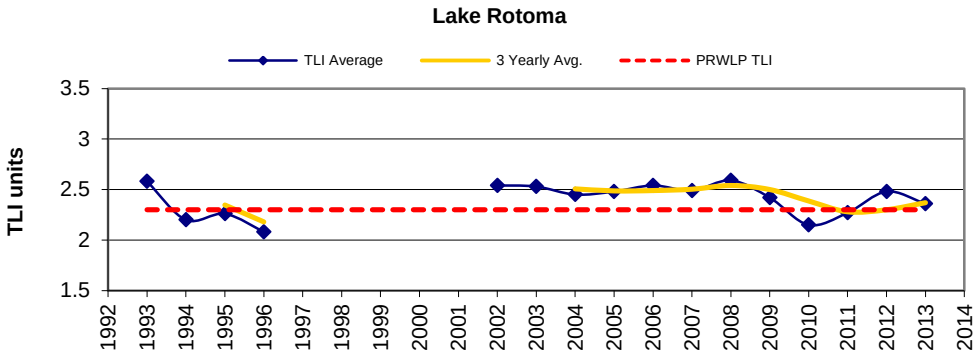

Lake Rotoiti
TLI Average
3 Yearly Avg.
RWLP TLI
TLI units
5
4.5
4
3.5
3
1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014


Lake Tikitapu
TLI Average
3 Yearly Avg.
RWLP TLI
TLI units
3.5
3
2.5
2
1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015


Lake Rerewhakaaitu
TLI Average
3 Yearly Avg.
RWLP TLI
TLI units
5
4.5
4
3.5
3
2.5
2
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014


Lake Okataina
TLI Average
3 Yearly Avg.
RWLP TLI
TLI units
3.5
3
2.5
2
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014


Lake Tarawera
TLI Average
3 Yearly Avg.
RWLP TLI
TLI units
3.5
3
2.5
2
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014


Lake Rotoma
TLI Average
3 Yearly Avg.
PRWLP TLI
TLI units
3.5
3
2.5
2
1.5
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014