

## A COMMUNITY THAT RESPECTS ITS ENVIRONMENT

### 6. Environmental behaviours

#### Why is this important?

A clean, healthy environment is important for people's physical and emotional wellbeing. There are a number of personal and public actions that people can take to protect or improve the environment, including re-using waste, composting garden waste and lobbying decision-makers for policy changes.


#### What are the measures?

6a Personal environmental actions

6b Public environmental actions

#### How are we doing?

- The most common actions Rotorua people take to protect the environment are recycling bottles, cans, paper or plastic (77%), getting their car tuned regularly (76%) and deciding for environmental reasons to re-use things instead of throwing them away (75%).
- At the regional level the proportion of people involved in public environmental actions, meetings, official hearings or consent processes has declined over the past decade. Rotorua District residents are slightly less likely than the Waikato regional average to undertake some form of public action. Of the 13.6% of Rotorua residents who had undertaken some kind of public action in the previous year, the most common actions were attending meetings (79.2%) and joining an action group (34.0%).

	Indicator	State – Rotorua	State – Regional/NZ	Trend – Rotorua	Trend – Regional/NZ
6a	Personal environmental actions	77% of residents recycle bottles, cans, paper or plastic	?	B	

Anyone can make a difference, however small, to protect and enhance the environment. It is important to understand what people are doing to protect the environment and what stops them trying. This can help set priorities and goals for environmental education and other environmental programmes. Some members of the Rotorua community put in substantial time and effort to protect and enhance the District's natural environment. For example:

- The Mount Ngongotaha Bush Restoration Trust ([www.ngongotaha.org](http://www.ngongotaha.org)) aims to create a predator-free sanctuary on the upper slopes of Mount Ngongotaha.
- The Lake Okareka community and Forest and Bird have undertaken animal and weed pest work to protect the rare and endangered native mistletoe in the surrounding forests.
- The Kaharoa Kokako Trust has prevented local extinction of kokako.
- A regionally significant wetland at Hannah's Bay is being restored with community assistance.
- Community action has helped return Ngongotaha Stream to a more pristine state, including tree planting and litter collection.
- Farmers in Rerewhakaaitu and other areas are adopting new land management practices to minimise nutrient losses into waterways.


Over the past decade Environment Waikato has surveyed people throughout the Waikato Region about their personal environmental actions. Latest results for 2006 show that people are making greater efforts in their daily lives through recycling plastic, glass, tins/cans (49%), disposing of rubbish properly (17%) and composting (9%). Planting trees (13%) was also frequently mentioned.

The 2007 Rotorua Community Outcomes Survey asked a sample of 400 Rotorua residents what actions they regularly undertake to protect the environment, from a list of ten selected actions. The results are based on a prompted survey item and are therefore not directly comparable with Waikato regional results. Table 6a shows that the most common actions people took to protect the environment were recycling bottles, cans, paper or plastic (77%), getting their car tuned regularly (76%) and deciding for environmental reasons to re-use things instead of throwing them away (75%).

**Table 6a: Personal environmental actions**

Action	Frequency
Decided for environmental reasons to re-use things instead of throwing them away	75.4%
Composted your food and/or garden waste	62.7%
Recycled bottles or cans or paper or plastic instead of throwing them away	76.5%
Bought household products that you thought are better for the environment	56.0%
Got the car tuned regularly	76.0%
Made an effort to reduce water consumption for environmental reasons	59.8%
Made an effort to reduce energy consumption for environmental reasons	66.0%
Used buses, walked or rode a bicycle to reduce car use	30.2%
Contributed time towards an environmental group or project	15.6%
Picked up rubbish in a public place	72.6%

**Source: Rotorua Community Outcomes Survey 2007**

	Indicator	State – Rotorua	State – Regional/NZ	Trend – Rotorua	Trend – Regional/NZ
6b	Public environmental actions	14% of residents involved in any kind of public action in the past year	16% of residents involved in any kind of public action in the past year	<b>B</b>	

The nature and extent of people’s public actions to protect the environment is indicative of people’s attitudes towards environmental issues. Public actions include writing a letter to the newspaper or local council, attending a public meeting, joining an action group or signing a petition.

Over the past decade Environment Waikato has surveyed people throughout the Waikato Region about their public environmental actions. Latest results for 2006 show that 16% of respondents had been involved in any kind of public meeting, official hearing or consent process with the aim of protecting the environment. This continued a downward trend from a high of 26% in the initial 1998 survey.

The 2007 Rotorua Community Outcomes Survey asked a sample of 400 Rotorua residents whether they had been involved in any kind of public action in the last year or so with the aim of protecting the environment and, if so, what type of action they had undertaken. Table 6b(i) shows that Rotorua District residents are slightly less likely than the Waikato regional average to undertake some form of public action. Of the 13.6% of Rotorua residents who had undertaken some kind of public action in the previous year, the most common actions were attending meetings (79.2%) and joining an action group (34.0%). Note these figures are similar to results for the Rotorua sub-sample in the 2006 Environment Waikato survey, based on a relatively small sample size of 43 people.

**Table 6b(i): Involved in any kind of public action?**

	Rotorua District	Waikato Region
Public action undertaken?	13.6%	16.0%

**Source: Rotorua Community Outcomes Survey 2007; Environment Waikato Perception Survey 2006**

**Table 6b(ii): Actions undertaken 2006/07**

	Rotorua District	Waikato Region
Wrote letter to the paper	3.8%	5.0%
Attended meeting	79.2%	42.0%
Formal submission	18.9%	9.0%
Wrote to council or other organisation	22.6%	11.0%
Phoned council or other organisation	17.0%	2.0%
Complained to council or other organisation	11.3%	8.0%
Protested	9.4%	6.0%
Complained directly to person	3.8%	1.0%
Joined action group	34.0%	25.0%
Sought/read information	24.5%	5.0%
Participated in resource consent process	13.2%	7.0%
Signed petition	13.2%	6.0%

**Source: Rotorua Community Outcomes Survey 2007; Environment Waikato Perception Survey 2006**

## **7. Environmental attitudes**

### **Why is this important?**


People's attitudes toward the natural environment are an important determinant of subsequent environmental actions.

### **What are the measures?**

7a Attitudes towards caring for the environment

### **How are we doing?**

- Rotorua residents' environmental attitudes are broadly similar to the Waikato regional average. Overall, 90% of Rotorua residents feel that rules and laws should be enforced to make sure the environment is well looked after, and 94% feel that businesses should be obliged to treat the environment well.

	Indicator	State – Rotorua	State – Regional/NZ	Trend – Rotorua	Trend – Regional/NZ
7a	Attitudes towards caring for the environment	90% of residents feel that rules and laws should be enforced to protect the environment	96% of residents feel that rules and laws should be enforced to protect the environment	B	

Over the past several years Environment Waikato has carried out telephone surveys with a random selection of adults throughout the Waikato Region to find out about their attitudes towards the environment. People were given a set of statements relating to environmental attitudes, using adapted versions of the New Environmental Paradigm (NEP) scale developed in the United States, and were asked to what extent they agreed or disagreed with each statement. The results show that overall, people in the Waikato Region tend to have positive (ie, pro-ecological) attitudes towards the environment. However comparisons over time are difficult due to changes in the scales and questions over successive survey years.

The 2007 Rotorua Community Outcomes Survey asked a sample of 400 Rotorua residents a modified version of Environment Waikato’s environmental attitudes question. Table 7a shows that Rotorua residents’ environmental attitudes are broadly similar to the Waikato regional average. Overall, approximately 90% of Rotorua residents feel that rules and laws should be enforced to make sure the environment is well looked after, and 94% feel that businesses should be obliged to treat the environment well.

**Table 7a: Attitudes towards caring for the environment - Strongly agree or agree (%)**

Item	Rotorua District	Waikato Region
(A) Rules and laws should be enforced to make sure the environment is well looked after	89.5%	96.0%
(B) The public have enough say in the way the environment is managed	39.4%	48.0%
(C) Landowners should be allowed to do what they like on their own land regardless of the impact on the environment	79.1%	n/a
(D) The most important objective of any business should be to maximise profit even if that means damaging the environment	3.1%	6.0%
(E) Businesses usually find it is too expensive to be environmentally friendly	33.5%	53.0%
(F) Businesses should be obliged to treat the environment well	94.1%	97.0%
(G) Water quality in rivers and streams should be protected regardless of the cost	86.5%	90.0%
(H) I would not like to see a wind turbine out my window	36.1%	40.0%
(I) There should be tighter provisions for construction of homes and buildings in areas at risk from natural hazards	81.0%	88.0%
(J) It is too hard to make any real difference for the environment	9.8%	n/a

**Source: Rotorua Community Outcomes Survey 2007; Environment Waikato Perception Survey 2006**

## 8. Solid waste management

### Why is this important?



New Zealanders throw away more than three million tonnes of “rubbish” every year, around 65% of which could be recycled or composted instead. While the Government is working on ways to address New Zealand's waste problem, it is local actions that will really make the difference.

### What are the measures?

8a Waste to landfill  
8b Recycling volumes

### How are we doing?

- Per capita levels of waste to landfill almost halved between 1996 and 2009 to a low of 956kg per annum. Compared to the national rate of waste to landfill per resident (790kg per person per annum), Rotorua's volume of waste to landfill is relatively high. However these figures are not directly comparable due to the absence of a cleanfill site in the District. The three largest sources of waste are commercial (28.9%), construction and demolition waste (24.9%) and sludge from the Wastewater Treatment Plant (14%). Tourism may be a substantial contributor to waste from the commercial sector.
- The volume of recycling steadily increased from 229kg per capita in 2002 to 300kg per capita in 2007 but has subsequently declined. According to Council's Works Manager, the recent decline was due to lower volumes of concrete being recycled, which was a direct reflection of a downturn in construction. Recycling volumes currently represent around 18% of the total waste stream.

	Indicator	State – Rotorua	State – Regional/NZ	Trend – Rotorua	Trend – Regional/NZ
8a	Waste to landfill	956kg per resident	Not comparable due to reporting differences between councils		

The amount of waste disposed to landfill per person per week provides information about how well the Rotorua community manages its waste. If not effectively managed, waste can create a range of adverse environmental and human health effects. Waste produces leachate (liquid waste) that can contaminate land and water.

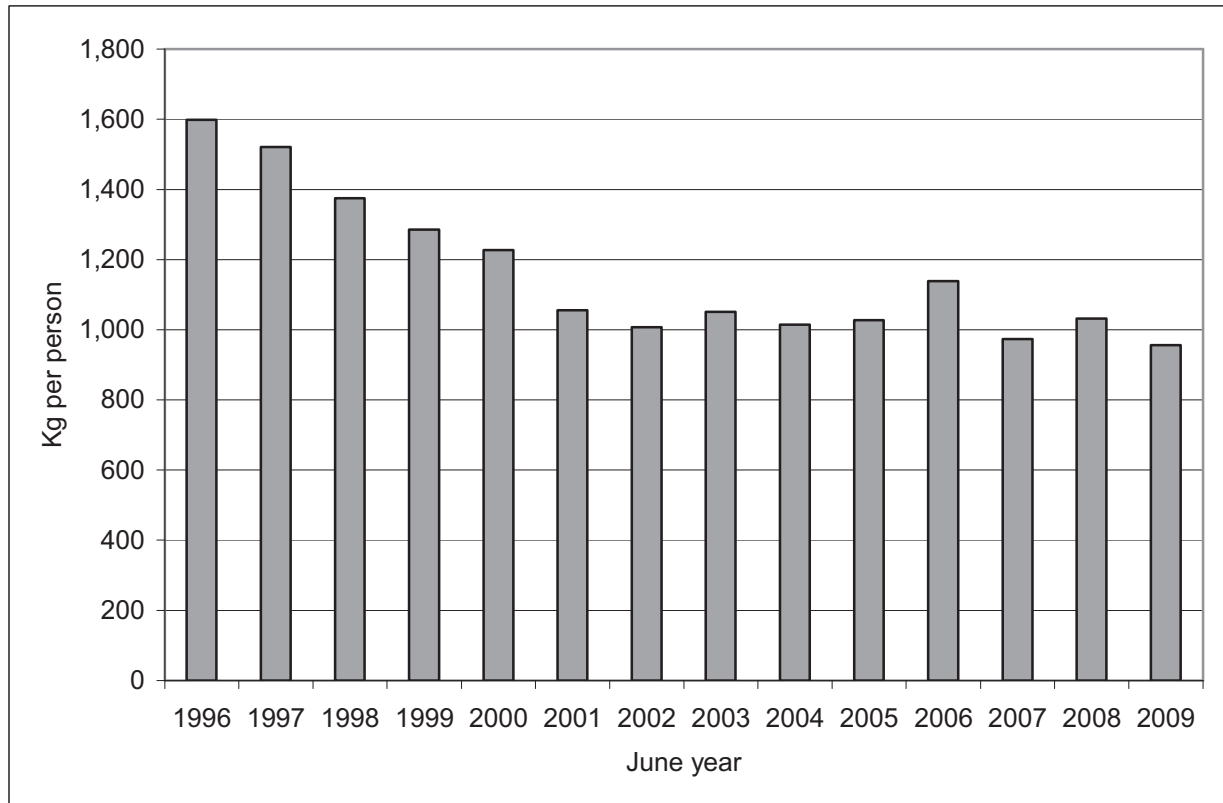
According to Rotorua District Council records, per capita levels of waste to landfill almost halved between 1996 and 2009 to a low of 956kg. Compared with the national rate of waste to landfill per resident (approximately 790kg per person), Rotorua District's volume of waste to landfill appears relatively high. However these figures are not directly comparable due to the absence of a cleanfill site in the District. According to estimates from the Ministry for the Environment ("Targets in the New Zealand Waste Strategy: 2006 Review of Progress"), the national average volume of waste disposed to cleanfills is in the range 0.65 to 0.91 tonnes per person per year. There is limited monitoring of cleanfills generally, but councils have collectively suggested there may be approximately 300 cleanfills throughout New Zealand. According to staff at Rotorua District Council, if cleanfills were added to landfills in the national MfE data, the national figure would be approximately 1,440kg of waste per resident per annum compared to Rotorua's 956kg.

An analysis of waste to landfill in Rotorua in 2005 showed the three largest sources are commercial (28.9%), construction and demolition (C&D) waste (24.9%) and sludge from the Wastewater Treatment Plant (14%). Composting of sludge stopped in 2001, meaning all sludge had to be disposed of to landfill, but in 2003 a limited amount of composting restarted. Data for the year ended June 2007 showed that C&D waste dropped to approximately 14% of waste. This type of waste was targeted with a differential charge which appears to have worked. Sludge is still at about 14% and remains the major issue.

Some of the waste to landfill could be attributed to the large number of visitors to the District, which make up more than ten percent of Rotorua's average nightly population. Discounting for estimated differences in visitor patterns would narrow the gap by approximately one-third between Rotorua and the national average (ie, to a gap of approximately 270 kg per resident).



A range of initiatives are under way to promote waste minimisation. Current waste programmes in the District include cleaner production programmes for industries (eg, Rotorua Sustainable Tourism Charter), Solid Waste Analysis Protocol (SWAP) for analysis of the waste stream, introduction of transfer stations, environmental education programmes, management of illegal dumping and differential charging (aimed at commercial and domestic waste). Future programmes under investigation include 'waste to energy' technologies, such as landfill gas harvesting and leachate nutrient stripping. A sludge strategy project is investigating alternative uses for sludge such as worm casting, land application and waste to energy.

**Figure 8a: Quantity of waste disposed of to landfill per person**



**Source: Rotorua District Council**

*Note: Annual sub-national population estimates are from Statistics New Zealand.*

	Indicator	State – Rotorua	State – Regional/NZ	Trend – Rotorua	Trend – Regional/NZ
8b	Recycling volumes	212kg per resident	Not comparable due to reporting differences between councils		

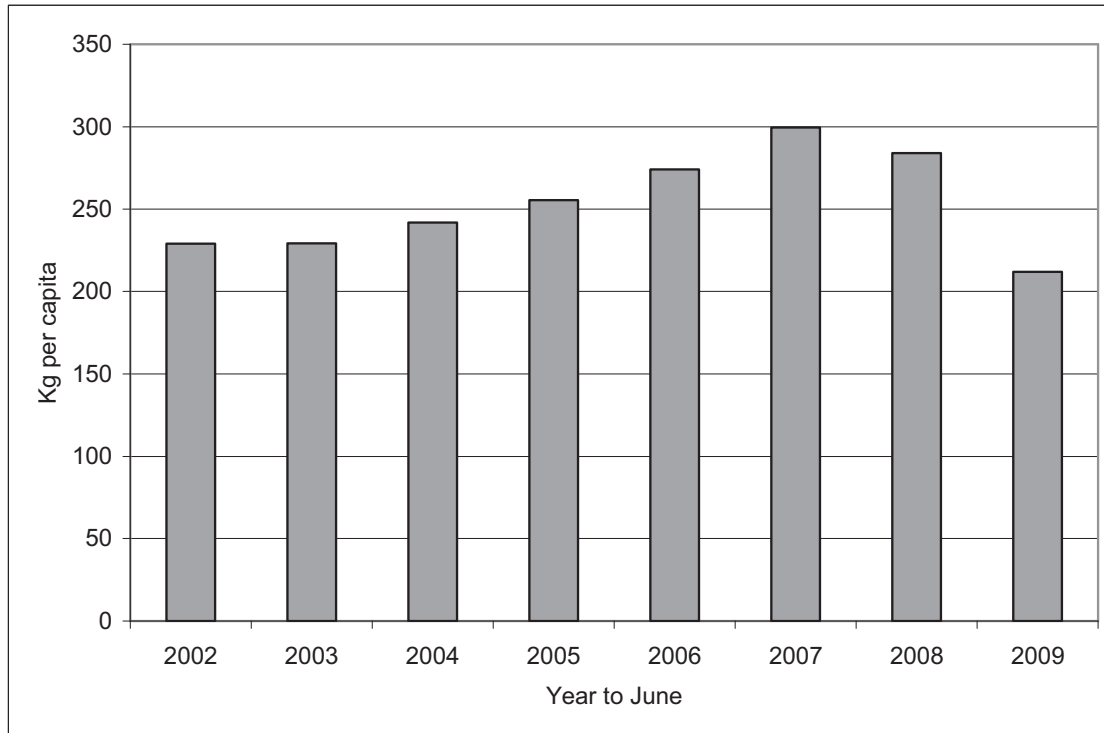
Much of what is considered by some people to be waste can be reused or recycled. Recycling reduces the amount disposed to landfill or into the environment. As operating landfills becomes more expensive and the long term effects of human activity on the environment become more apparent, recycling becomes more attractive.

In 2002, Rotorua’s ‘in town’ recycling facility was established to supplement existing recycling opportunities. The total volume of recycling steadily increased from 229kg per capita in 2002 to 300kg per capita in 2007. This could be attributed to increasing environmental awareness and greater availability of recycling facilities. Total volume subsequently decreased to 212kg per capita in 2009. According to Council’s Works Manager, the decline was due to lower volumes of concrete being recycled, which was a direct reflection of a downturn in construction.

Recycling volumes currently represent around 18% of the total waste stream. A decreasing amount of mulch and woodwaste has been offset by generally increasing volumes of recycled concrete, cardboard, paper, glass and other materials (refer Figure 8b(ii)). Rotorua District Council addresses the issue of recycling in its Solid Waste Management Plan. Regional councils such as Environment Bay of Plenty also have waste strategies in place that are in line with the New Zealand Waste Strategy. Education programmes for schools and other interests groups are delivered by Council staff. Council is further considering the merits of kerbside recycling.

According to estimates from the Ministry for the Environment (“Targets in the New Zealand Waste Strategy: 2006 Review of Progress”), community recycling diverted an estimated 329,300 tonnes of materials from landfill in 2005. Based on the 2005 national population estimate (4,098,300) this equates to 80kg per resident, representing approximately 10% of the total waste stream. As territorial authorities improve their services and increase household participation in recycling schemes, this amount is anticipated to increase. Note that the national figures are not directly comparable with Rotorua figures due to differences in reporting between councils. The figure of 212kg for Rotorua includes greenwaste and concrete (but not steel). The national data purportedly includes only paper, plastic, card, glass, steel and aluminium. Staff at Rotorua District Council estimate that the Rotorua equivalent of the national 80kg per resident figure would be approximately 65kg per resident for the year ended June 2007. This extrapolation includes the diversion of cars, whiteware and steel from the tip face (as recorded by landfill both contractors). A small amount of sludge is also diverted each year for compost.

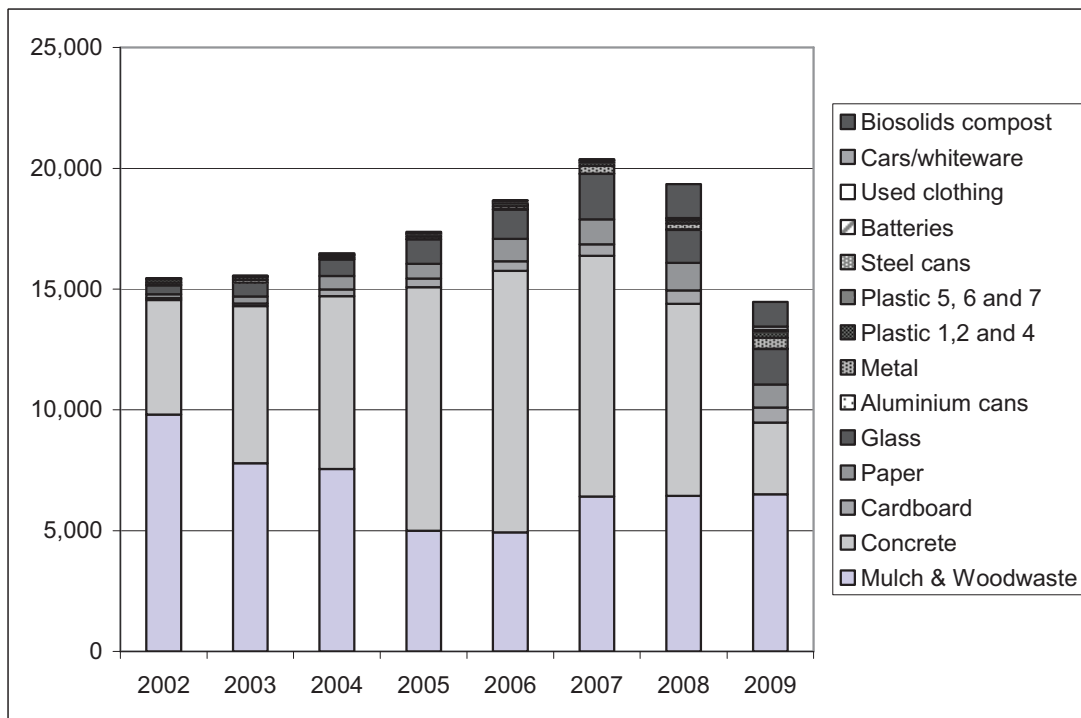
**Figure 8b(i): Quantity of recycling (kg) per person**



**Source: Rotorua District Council**

Notes: (1) Annual sub-national population estimates are from Statistics New Zealand except 2007 which is estimated; (2) Figures exclude sludge composted from Wastewater Treatment Plant.

**Figure 8b(ii): Tonnes diverted from solid waste stream by type**



**Source: Rotorua District Council**

Note: Figures exclude sludge composted from Wastewater Treatment Plant.

Note: Steel cans were included in steel 2008/09 and batteries were 10.5t in 2008 and 5t in 2009. In addition there were 134t of cars/whiteware in 2009 that might have been included in metal in previous years. In addition there was 1398t and 1016t of biosolids compost for 2008 and 2009 respectively

## 9. Lake water quality

### Why is this important?


For many decades, Rotorua's lakes have been under increasing pressure from human activities such as residential settlement and farming. Water quality in a number of Rotorua lakes has become eutrophic or super-eutrophic, meaning high in nutrients. Rotorua District Council, Te Arawa Lakes Trust (formerly Te Arawa Māori Trust Board) and Environment Bay of Plenty are working intensively with the community to protect and improve the water quality of Rotorua's Lakes in a joint project called the Rotorua Lakes Protection and Restoration Action Programme. A major focus is the development of Action Plans for nine lakes: Rotorua, Rotoiti, Okareka, Okaro, Rotoehu, Tarawera, Rotoma, Tikitapu and Okataina. Some actions tackle nutrients already in the water while others focus on cutting back the amount of nitrogen and phosphorus washed overland or leaching through groundwater systems.

### What are the measures?

- 9a Protection of lake and stream margins
- 9b Sewerage reticulation of lakeside settlements
- 9c Algal blooms
- 9d Nitrate loadings in groundwater
- 9e Water quality index

### How are we doing?

- Beginning in the 1980s, Environment Bay of Plenty and Rotorua District Council have worked together with farmers to support fencing off of lake margins and streambanks where livestock have access. As at 2008/09, approximately 98% of lake margins were protected from livestock access for the twelve main Rotorua lakes. Work is ongoing with farmers to ensure stock exclusion from waterways, using a property plan approach. The ultimate goal is to see 100% protection of all lake and stream margins.
- Work is completed on sewerage reticulation in Mourea/Okawa Bay, Hinemoa Point and Brunswick/Rotokawa. Other lakeside communities scheduled for sewerage reticulation over the next 5-6 years include Okareka/Blue Lake, Okere/Otaramarae/Whangamarino, Gisborne Point/Hinehopu, Hamurana/Awahou, Rotoma and Tarawera. New rules will require high-tech septic tanks in some areas.
- There are frequent severe algal blooms on lakes Rotoehu, Rotoiti, Rotorua and Okaro each year which lead to the issuing of localised and increasingly lake-wide health warnings for these lakes.
- Approximately 271 tonnes of nitrogen per year is discharged to Lake Rotorua through groundwater. Nitrogen discharge in groundwater is a relatively large portion of the total discharge because nitrogen concentrations in groundwater are typically larger than in surface water.
- Around half of Rotorua's lakes have measurably poor water quality. Lake Okaro is supereutrophic, meaning it is saturated in phosphorus and nitrogen and has very high algae growth and blooms during calm sunny periods. Eutrophic lakes such as Lakes Rotorua, Rotoiti and Rotoehu are green and murky, with higher amounts of nutrients and algae. Mesotrophic lakes (eg, Lake Rerewhakaaitu) have moderate levels of nutrients and algae, while oligotrophic lakes (eg, Lake Rotoma) are clear and blue, with low levels of nutrients and algae.

	Indicator	State – Rotorua	State – Regional/NZ	Trend – Rotorua	Trend – Regional/NZ
9a	Protection of lake and stream margins	98% protected from livestock access	N/A		N/A

Stock access to lakes and streams contributes nutrients to the water. Environmental protection of waterways is carried out in partnership with land owners, supported by funding grants from Environment Bay of Plenty and Rotorua District Council. Lake and stream fencing is a recent solution to a long-term problem. There are considerable amounts of nutrients already in Rotorua's groundwater.

According to a 2007 report by Environment Bay of Plenty, since the publication of its October 2003 report on "Riparian Protection in the Rotorua Catchments" the percentage of lake margins protected from existing and potential livestock access increased from 93% to 98%. Similarly, the percentage of protected stream margins increased from 88% to 89%. The 2006/07 situation is summarised in Table 9a(i). Ongoing works are supported by stock exclusion rules in the Regional Water and Land Plan. Environment Bay of Plenty staff proactively advise stock exclusion rules on a property-by-property basis and are also engaged in the development of a 'toolbox' of nutrient management actions for incorporation into Environmental Programmes.

More recent summary information is contained in Environment Bay of Plenty's Annual Reports. Central Government funding for the Rotorua Lakes Protection and Restoration Action Programme was announced in July 2007. This was matched by funding from Environment Bay of Plenty and Rotorua District Council, covering a wide range of initiatives in addition to riparian protection. Table 9a(ii) shows that the percentage of lake margins protected from existing and potential livestock access remains at around 98% as at 2008/09.

**Table 9a(i): Protection status of Rotorua District lakes as at 2006**

Lake	Situation
Rotorua	Some 24 land parcels bordering the lake (representing 2% of all lake margins) have been identified as having possible stock access, although these areas are not regularly used for livestock grazing. Landowners have been advised of their obligations under the pending Regional Water and Land Plan, and have been offered Environmental Programme assistance if required. An estimated 45,000m of channel not under formal protection remains on pastoral land. Since 2003 new Environmental Programmes have been initiated to protect around 20% (9,000m) of these channels. Programmes for further work are currently in negotiation.
Rotoiti	The 2003 report listed 4,280m of potential stock access to lake margins. All of these areas now have works completed or are in progress under formal agreement. Of the estimated 14,590m of channel with potential stock access, most is on land currently used for plantation forestry.
Rotoehu	The 2003 report identified 10,140m of lake margin in negotiation for riparian protection work, and a further 220m requiring protection. Agreements have now been negotiated with all landowners and protection works are progressing.
Rotoma	The 2003 report identified 230m of lake margins under negotiation on Department of Conservation reserve, which has since been addressed. Meanwhile arrangements are in hand to fence an estimated 290m of lake margin with irregular stock access.
Okataina	The 2003 report estimated 850m of stream channel required protection. Negotiations with landowners are proceeding. Lake margins are otherwise 100% protected.
Okareka	The 70m of lake margin identified in the 2003 report is now fully fenced as part of the outlet channel protection works. Lake margins are otherwise protected by Reserve land use. Some 120m of perennial stream still requires protection. Negotiation with the landowner is continuing.
Tikitapu (Blue Lake)	All lake margins and perennial stream margins are fully protected by Reserve land use.


Lake	Situation
Tarawera	All lake margins remain fully protected through a combination of Reserve and residential land uses. The 2003 report identified 1,910m of channel along Te Wairoa Stream exposed to intermittent or potential stock access. Some interest has been received in forming a local Care Group for weed control and re-vegetation. Multiple parties are likely to be involved and some facilitation is anticipated to establish a Care Group. Elsewhere the 2003 report identified 3,270m of channel in the headwaters of Te Wairua Stream that is regularly exposed to stock grazing, over which negotiations are continuing.
Rotokakahi (Green Lake)	The 2003 survey identified 440m of lake margin with regular stock access, for which agreement has been negotiated and works have commenced. Fencing of lake frontage adjacent to the livestock farm has been completed. Elsewhere in the catchment, perennial stream margins are otherwise protected by Reserve or forestry land use.
Rotomahana	Existing Reserve land use and a major Environmental Programme on adjoining pastoral land provide full lake margin protection. The 2003 report estimated that up to 9,940m of perennial stream channel within the catchment might have potential stock access. Since 2003 around 10% of this has been incorporated in Environmental Programme works. The extent of channel remaining exposed to livestock access will require further field inspection on a property-by-property basis.
Okaro	The lake margin falls entirely within a District Reserve and recent fencing by adjoining land owners has ensured the margin is fully protected. The 2003 report estimated some 3,700m of channel were exposed to regular stock access, all of which has now been addressed under Environmental Programmes.
Rerewhakaaitu	The lake margin falls within a combination of Scenic and District Reserves and is fully protected. The 2003 report identified 5,230m of channel with intermittent or potential stock access. Much of this was fenced as historic soil conservation retirements, and an Environmental Programme has been initiated for the remainder.

**Source: Colin Stace, Senior Land Management Officer Environment Bay of Plenty, May/June 2007.**

**Table 9a(ii): Performance targets and measures for riparian protection of Rotorua lakes**

	2006/07	2007/08	2008/09	Target	Performance as at 2008/09
All lakes margins	98%	98%	98%	100%	Not achieved
Lake Rotorua rivers/streams	89%	89%	90%	90%	Achieved
All lakes, rivers and streams	91%	91%	92%	85%	Achieved

**Source: Environment Bay of Plenty Annual Reports.**

	Indicator	State – Rotorua	State – Regional/NZ	Trend – Rotorua	Trend – Regional/NZ
9b	Reticulation of lakeside settlements	Rotorua's Lakeside Communities Sewerage Scheme Programme is well under way	N/A		N/A

A number of small lakeside settlements are currently on septic tanks. Failed septic tanks in these areas have been known to contribute to nutrients entering lake water and to be the source of faecal contamination which endangers public health. Eliminating these problems is one of the measures necessary to improve the water quality of Rotorua's major lakes.

Rotorua District Council is committed to providing sewerage schemes to service the majority of lakeside communities. The sewerage scheme programme will connect about 2,300 dwellings currently serviced by conventional septic tank and soakage field systems with a reticulated sewerage network.


Table 9b shows the indicative costs, programmed completion date and current status of implementation for the Lakeside Communities Sewerage Scheme Programme (as at June 2010). The capital cost of the proposed sewerage schemes is covered in part by a 50% subsidy from Central Government; through the Ministry of Health (for Mourea/Okawa Bay) and the Ministry for the Environment (for Brunswick/Rotokawa, Okareka/Blue Lake, Okere Falls/Otaramarae/Whangamarino, Gisborne Point/Hinehopu and Hamurana/Awahou). Further subsidy applications will be made to Central Government for Mamaku, Rotoma and Tarawera lakes. The remainder of capital costs will be funded by a combination of Environment Bay of Plenty grants, commercial users' contributions, Rotorua District Council general rates and individual ratepayer contributions. A specific amount of contribution from each property that will be connected to the above schemes will be set by a Funding Policy to be developed for each scheme.

Council has also identified sewer servicing options for communities that are not part of the Lakeside Communities Sewerage Scheme Programme. Consultation is planned in the Tumoana Road and Rerewhakaaitu areas to gauge community support for a sewerage scheme to proceed. A proposed Mamaku sewerage scheme is now included in Council's Ten Year Plan, the Kennedy Bay/Otautu Bay area is included in the proposed Rotoma sewerage scheme, and the Curtis Road area is included in the Gisborne Point sewerage scheme. The servicing of Morehu Road has also been reviewed and is now included in the proposed Gisborne Point sewerage scheme. In addition, Keith Road and surrounding area, Te Waerenga Road, Unsworth Road, Wilson Bay and three clusters of properties along Hamurana Road near Central Road have all been included in the Hamurana/Awahou Sewerage Scheme. Various other communities have been informed that it is impractical to implement a community sewerage scheme in their area, including Paradise Valley Road, Oturoa Road and Tauranga Direct Road (3 clusters of properties).

**Table 9b: Lakeside Communities Sewerage Scheme Programme (as at June 2010)**

Sewerage scheme area	Indicative cost (\$m)	Programmed completion date	Current project status
Mourea/ Okawa Bay	8.9	Completed June 2006	60% of properties connected.
Hinemoa Point	1.4	Completed July 2008	50% of properties connected.
Brunswick/ Rotokawa	12.5	Completed January 2010	Properties are currently being connected.
Okareka/ Blue Lake	9.7	2010	Construction work well under way.
Okere/ Otaramarae/ Whangamarino	14.7	2011	Construction contract let as part of the Okareka/Blue Lake construction.
Gisborne Point/ Hinehopu	11.9	2012	Detailed design well under way.
Hamurana/ Awahou	15.0	2013	Detailed design well under way.
Rotoma	12.4	2013	Detailed design well under way.
Tarawera	13.8	2014	Detailed feasibility study completed.
Mamaku	6.0	2016	Initial scoping study completed.

**Source: HYDRUS Engineering Consultants (a business unit of Rotorua District Council).**

	Indicator	State – Rotorua	State – Regional/NZ	Trend – Rotorua	Trend – Regional/NZ
9c	Algal blooms	Frequent algal blooms on lakes Rotoehu, Rotoiti, Rotorua and Okaro	N/A		N/A

Algae are a diverse group of plants that are a vital part of lakes, as they are the main producers of food and oxygen. Organisms across a variety of trophic (feeding) levels depend on algae, directly or indirectly for sustenance. Blue-green algae (cyanobacteria) are a group of bacteria, rather than true algae, that have acquired chlorophyll to capture light and behave like plants. Blue-green algae blooms can occur in nutrient enriched water. They can be harmful to other aquatic organisms, prevent recreation and make the water dangerous to drink or bath in. Some cyanobacteria produce toxins which may cause damage to the nervous system or liver. Short-term exposure can cause severe skin rashes and stomach upsets and may spark hay fever and asthma attacks. Blue-green algae blooms can also produce offensive odours and, by clouding the water, affect a lake's visual amenity, having negative consequences for tourism.

The frequency of algal blooms on Rotorua lakes is an indicator of nutrient enrichment and a lake's overall water quality. The key to reducing the frequency of algal blooms is to restrict the supply nutrients to algae. Environment Bay of Plenty conducts regular blue-green algae monitoring during high risk periods, targeting Rotorua lakes with a history of frequent or prolonged blooms to ensure the lakes are safe for swimming and other recreational activities. Frequent and severe algal blooms (typically dominated by blue-green algae) routinely occur from late spring to late autumn each year in lakes Rotoehu, Rotoiti, Rotorua and Okaro. As a result the issuing of localised or lake-wide health warnings now occurs on an almost annual basis in these lakes. In addition there is a moderate risk of algal blooms occurring in Lake Tarawera over summer and a potential (as yet unquantified) risk of blooms occasionally exceeding contact recreation thresholds on Lake Okareka.

Public health authorities refer to the New Zealand Guidelines for Cyanobacteria in Recreational Fresh Waters (Interim Guidelines) to decide when to impose health warnings. There is currently a three-tiered alert-level framework for planktonic cyanobacteria. Surveillance (green mode) occurs when the cell concentration of total cyanobacteria does not exceed 500 cells/mL or when the biovolume equivalent for the combined total of all cyanobacteria does not exceed 0.5 mm<sup>3</sup>/L. Alert (amber mode) occurs when there is a biovolume equivalent of 0.5 to less than 1.8 mm<sup>3</sup>/L of potentially toxic cyanobacteria or 0.5 to less than 10 mm<sup>3</sup>/L total biovolume of all cyanobacterial material. Action (red mode) occurs when there is 12 or more µg/L total microcystins; or biovolume equivalent of 1.8 or more mm<sup>3</sup>/L of potentially toxic cyanobacteria, or 10 or more mm<sup>3</sup>/L total biovolume of all cyanobacterial material, or if cyanobacterial scums are consistently present. The development of algal blooms is a long-term issue which is not expected to be remedied in the short-term.

**Table 9c(i): Indicative days per year of health warnings issued in respect of cyanobacteria blooms in Rotorua lakes**

Calendar year	Lake Rotorua	Lake Rotoiti/ Okawa Bay	Lake Rotoehu	Lake Okaro	Lake Tarawera
1999	0	180	200	0	40
2000	0	180	365	0	0
2001	30	90	280	0	0
2002	0	90	240	0	0
2003	20	240	100	0	10
2004	140	150	0	30	0
2005	10	140	210	220	0
2006	30	60	140	80	0
2007	0	11	134	165	0
2008	0	0	156	222	0
2009	110	129	102	30	0

**Source: Estimated from EBOP/Toi Te Ora information on health warnings issued.**


Notes: (1) Figures are indicative only, based on tracking notes kept by EBOP staff; (2) Excludes some highly localised health warnings; (3) Prior to 2004, Lake Okaro was excluded from Toi Te Ora Public Health's regular "Lake Warnings" but had been identified as having algal bloom issues most years.

**Table 9c(ii): Lake water quality summary as at 2010**

Lake	Water quality problems	Steps to improve water quality
Okareka	Low to moderate risk of cyanobacterial blooms. Historically low risk of blooms forming. However, recent one-off samples have confirmed the potential for counts to occasionally exceed the recreational threshold.	Action Plan operational. Sewerage reticulation. Constructed wetlands. Treatment of hypolimnetic water with flocculants to remove phosphorus. Environmental programmes for farmers. Land use change for lower nutrient export. Lake Okareka will be sampled for cyanobacteria on a needs basis over high risk months.
Okaro	Has a history of severe cyanobacterial blooms (alternates between blue-green and green algal). In recent years these have been less severe. Previous scientific reports dating back to 1966 describe Lake Okaro as having 'clear water' with a pH of 7. Today the lake has a very low clarity in summer months due to the recurrence of cyanobacteria blooms. The presence of blooms has driven up pH. Daily pH peaks of 8 in surface waters are not uncommon.	Action Plan operational. Chemical flocculant trials, constructed wetland and riparian retirement.
Okataina	Low risk of cyanobacterial blooms. Just one short lived cyanobacteria bloom has been recorded in the lake since cyanobacteria sampling began in 1997. Possible water quality degradation that could come from lake level changes or other natural fluctuations.	Action Plan process not yet commenced. At present Lake Okataina is not routinely monitored because of the low risk of blooms.
Rerewhakaaitu	Potential risk of cyanobacterial blooms during summer where lake is shallow and calm. Water quality fluctuations noted in the past.	Local projects undertaken in catchment with landowners. Trials of treatment boxes to remove nitrogen from streams. Phosphorus-absorbing socks in the Mangakino Stream.
Rotoehu	This is a eutrophic lake with a history of cyanobacterial blooms which have persisted to the present day. 2003/04 summer had no cyanobacterial blooms, but a large bloom returned in the 2004/05 summer along with a large hornwort infestation and there have perennial blooms since 2003/04.	Action Plan operational. Riparian retirement programme. Constructed wetlands. Treatment box to remove stream nitrate. Hornwort harvesting trial to remove nutrients.

Lake	Water quality problems	Steps to improve water quality
Rotoiti	Severe cyanobacterial blooms in Okawa Bay up to the early 2000s but less so since. In recent times, blooms have not been such a feature. The last two seasons, Okere Arm has experienced late-season blooms. Receives nutrient rich water from Lake Rotorua (~72% nutrients are from Rotorua). Massive algal bloom in early 2003.	Action Plan operational. Riparian retirement. Sewage reticulation for lakeside settlements. Diversion of inflow from Ohau Channel down the Kaituna River.
Rotokakahi (Green Lake)	Moderate risk of algal blooms (while algae blooms are reasonably common, it is not clear presently whether cyanobacteria form a large bloom component). Water quality is lower than in the 1950s, but there has been no discernible change since 1970/71. Although the recent Trophic Level Index trend shows some improvement in water quality, Lake Rotokakahi's deep occurring macrophytes appear to be in a state of decline and have largely disappeared. This may be due to declining water quality and specifically to presence of algae blooms.	Actions to improve lake water quality to be negotiated with lake owners.
Rotoma	None. Low risk of cyanobacterial blooms.	Action Plan operational.
Rotomahana	Occasional algal blooms.	No action at this time.
Rotorua	Experienced water quality decline between 1978 and 1983. Sporadic episodes of foam production associated with kirchneriella algae species. Isolated blooms of nuisance algae, including occasional lake-wide blooms, but more often wind-concentrated blooms along the shoreline. There is potential for blooms to be blown practically anywhere in the lake and onto any section of shoreline. Moderate to high risk of cyanobacterial blooms occurring.	Action Plan operational. Rotorua District Council diversion of treated sewage to land disposal in 1991, and further improvements in progress. Riparian retirement since 1970 as part of Kaituna Catchment Control Scheme. Diversion of nutrient rich spring flows investigated. Flocculant dosing of nutrient-rich streams. Stormwater upgrades. Environmental Programmes.
Tarawera	Occasional cyanobacterial blooms over summer months. Potential nutrient issues from septic tanks around some lakeshore areas.	Action Plan process under way. Land use change to lower nitrogen and phosphorus export encouraged. Planning for future sewerage reticulation.
Tikitapu (Blue Lake)	Lake water decline, possibly from septic tanks. Low risk of cyanobacterial blooms.	Action Plan process scheduled to begin. Sewerage reticulation as part of the Lake Okareka scheme.

**Source: Adapted from Environment Bay of Plenty website (accessed 26 April 2007), as amended by EBOP staff June 2007. Subsequently updated to June 2010.**

	Indicator	State – Rotorua	State – Regional/NZ	Trend – Rotorua	Trend – Regional/NZ
9d	Nitrate loadings in groundwater	271 tonnes of nitrogen per year discharged to Lake Rotorua through groundwater	N/A		N/A

For many decades, water quality in the Rotorua lakes has been under increasing pressure from human activities such as residential settlement and farming. Wastewater from lakeside communities has been one contributor of nutrients (nitrogen and phosphorus) to the lakes. However, the greatest contribution, with a few exceptions, has come from intensification of farming. By fencing off streams and lake edges from livestock, planting gullies and riparian margins, levels of phosphorus loss to the lakes has been largely offset. However, nitrogen inputs from rural land use have continued to increase around the more degraded lakes. The nutrient pressures show up through deterioration in lake quality over time. Algal blooms occur where the water quality becomes noticeably affected. In worst cases, such as Lake Rotorua, the lake condition is seriously affected for much of the year.

A considerable body of scientific literature has been developed over the past decade to assess nitrogen loadings in the Rotorua lakes, as well as around nutrient reduction targets to improve lakes water quality over time. Various technical reports are available through the Bay of Plenty Regional Council website, including:

- Morgenstern *et al* (2004) 'Groundwater age, time trends in water chemistry and future nutrient load in the Lakes Rotorua and Okareka areas', IGNS Client Report 2004/17.
- Morgenstern *et al* (2004) 'Groundwater age and chemistry, and future nutrient loads for selected Rotorua lakes catchments', IGNS Science Report 2004/31.
- Morgenstern and Gordon (2006) 'Prediction of future nitrogen loading to Lake Rotorua', IGNS Science Consultancy Report 2006/10.

A more recent report commissioned by the Regional Council is White *et al* (2007) 'Lake Rotorua groundwater and Lake Rotorua nutrients – phase 3 science programme technical report', GNS Client Report 2007/220. According to pages 24-25 of this report, trends in nitrogen discharge between 1975-78 and 2002-07 include:

- A significant increase in nitrogen discharge from Puarenga Stream and Waingaehe Stream.
- Removal of Rotorua treated sewage discharge direct to lake.
- Mild increases in nitrogen discharge from Awahou Stream, Hamurana Stream, Ngongotaha Stream and Waiteti Stream.
- Similar nitrogen discharge from Waiowhiro Stream.
- Decrease in nitrogen discharge from Waiohewa Stream.

Note that this analysis of nitrogen discharge trends is not statistically robust and should therefore be considered indicative only.

According to page 92 of the White *et al* report, the sum of discharge from the Lake Rotorua catchment (refer Table 9d) is estimated at approximately 648 tonnes N/year, made up of:

- Approximately 271 tonnes total nitrogen/year with direct groundwater discharge.
- Approximately 377 tonnes (NNN plus ammonium)/year with surface water baseflow.

Estimated nitrogen discharge to Lake Rotorua is in the approximate proportions:


- 42% with direct groundwater from about 24% of the catchment water discharge.
- 58% with surface baseflow from about 76% of the catchment.

The White *et al* report therefore concludes that nitrogen discharge with groundwater to Lake Rotorua is probably a significant component of total nitrogen discharge to the lake. Nitrogen discharge in groundwater is a relatively large portion of the total discharge because nitrogen concentrations in groundwater are typically larger than in surface water.

Table 9d: Estimated nitrogen discharge into Lake Rotorua from groundwater and surface baseflow

Surface (stream) catchment	Estimated total nitrogen discharge to Lake Rotorua with direct groundwater (kg N/year)	Estimated NNN plus NH4 discharge to Lake Rotorua with surface baseflow (kg N/year)	Sum of groundwater direct and surface water
Waiteti	0	52,100	52,100
Waimehia	2,700	700	3,400
Awahou and Awahou Point	12,700	63,800	76,500
Hauraki	0	70	70
Hamurana	2,300	59,900	62,200
Mission Bay	3,200	0	3,200
Pohue Bay	18,400	100	18,500
Waiohewa	0	32,100	32,100
Rotokawa	18,600	1,900	20,500
Waingaehe	0	12,100	12,100
Waitawa	69,700	3,900	73,600
Puarenga	0	59,000	59,000
Utuhina	0	36,300	36,300
Motutara	89,100	1,800	90,900
Waiowhiro	36,900	11,300	48,200
Ngongotaha	17,300	41,900	59,200
<b>TOTAL</b>	<b>270,900</b>	<b>376,970</b>	<b>647,870</b>

Source: Table 38 (page 95), White *et al* (2007) 'Lake Rotorua groundwater and Lake Rotorua nutrients – phase 3 science programme technical report', GNS Client Report 2007/220.

	Indicator	State – Rotorua	State – Regional/NZ	Trend – Rotorua	Trend – Regional/NZ
9e	Water quality index	Around half of Rotorua's lakes have measurably poor water quality	N/A		N/A

The Trophic Level Index (TLI) is an indicator of lake water quality. Four parameters are combined to construct the TLI Index, namely total nitrogen, total phosphorus, water clarity and chlorophyll a. The parameters reflect the dynamics of the annual lake cycle.

Nitrogen and phosphorus are essential plant nutrients. In large quantities they can encourage the growth of nuisance aquatic plants such as algal blooms. High levels of water-bound nitrogen and phosphorus most often come from agricultural runoff and urban wastewater, but can also come from geothermal inputs and deep springs that leach phosphorus from the rock geology. Clarity is measured using a Secchi disc attached to a tape measure. The depth at which the disc disappears from sight is recorded by the tape measure. Chlorophyll a is the green pigment in plants used for photosynthesis. It is a good indicator of the total quantity of algae in a lake. Algae are a natural part of any lake system, but large amounts of algae decrease water clarity, make the water look green, can form surface scums, reduce dissolved oxygen levels, can alter pH levels, and can produce unpleasant tastes and smells.

In general terms, the higher the TLI index, the lower the water quality. Lake water quality can be grouped into different 'trophic states'. Supertrophic lakes such as Lake Okaro are fertile and saturated in phosphorus and nitrogen, and have very high algae growth and blooms during calm sunny periods. Eutrophic lakes such as Lakes Rotorua, Rotoiti and Rotoehu are green and murky, with higher amounts of nutrients and algae. Mesotrophic lakes (eg, Lake Rerewhakaaitu) have moderate levels of nutrients and algae, while oligotrophic lakes (eg, Lake Rotoma) are clear and blue, with low levels of nutrients and algae.

**Table 9e: Three yearly average Trophic Level Index (TLI) values for the Rotorua Lakes**

Lake	2004	2005	2006	2007	2008	Lake type (based on latest TLI)
Okaro	5.5	5.6	5.5	5.5	5.3	Supertrophic (very sick)
Rotorua	4.9	4.9	4.9	4.8	4.8	Eutrophic (sick)
Rotoehu	4.6	4.6	4.5	4.6	4.5	Eutrophic (sick)
Rotoiti	4.3	4.5	4.3	4.1	4.0	Eutrophic (sick)
Rotomahana	3.7	3.8	3.9	3.9	3.9	Mesotrophic (stable/unstable)
Rerewhakaaitu	3.4	3.4	3.5	3.5	3.6	Mesotrophic (stable/unstable)
Okareka	3.2	3.2	3.3	3.3	3.3	Mesotrophic (stable/unstable)
Tikitapu (Blue Lake)	3.2	3.1	3.1	3.0	3.0	Oligotrophic (healthy)
Okataina	3.0	2.9	2.9	2.8	2.8	Oligotrophic (healthy)
Tarawera	2.9	2.8	2.9	2.9	2.9	Oligotrophic (healthy)
Rotoma	2.5	2.5	2.5	2.5	2.6	Oligotrophic (healthy)
Rotokakahi (Green Lake)	3.5	3.4	3.4	3.5	3.8	Mesotrophic (stable/unstable)

**Source: Environment Bay of Plenty website (keyword TLI), accessed June 2010.**

## 10. Forest and farmlands

### Why is this important?


Rotorua is renowned for the quality of its natural environment. Through community consultation, the enhancement of forest and farmland has been identified as something that is important to local residents.

### What are the measures?

10a Extent of native vegetation  
10b Extent of commercial forestry  
10c Stock density

### How are we doing?

- In the Rotorua District, approximately 22% of total land area comprises native vegetation compared to 50% nationwide.
- Approximately 24% of total land area in the Rotorua District comprises planted forest compared to 9% nationwide.
- Stock numbers in the Rotorua District peaked during the 1970s, followed by a significant reduction which coincided with the removal of farm subsidies. Total Stock Units have remained almost constant since the 1980s but dairy units have increased and sheep units have decreased. The most recent figure for Rotorua is approximately 5.4 Stock Units per hectare in 2007. Comparative regional or national data is not available.

	Indicator	State – Rotorua	State – Regional/NZ	Trend – Rotorua	Trend – Regional/NZ
10a	Extent of native vegetation	22% native vegetation	50% native vegetation	B	

The New Zealand Land Cover Database (LCDB) is a digital map of the land surface of the country. It is created by grouping together similar classes which can be identified in satellite images. LCDB version 2 contains snapshots of land cover at 1996-1997 and 2001-2002 incorporated into the data layer. It provides the basis for better resource management decisions, more effective use of natural resources and improved environmental management.

Based on statistics derived from LCDB 2, New Zealand's land cover is 50% native forest, native vegetation and other native land cover.


Different territorial authorities have different mixes of land use. For example, Hamilton City comprises 60% urban development, the Waipa and Matamata-Piako and Franklin districts comprise 80% or more pastoral farming, South Waikato comprises 30% or more plantation forestry, and Thames-Coromandel District comprising 65% indigenous vegetation. In the Rotorua District, approximately 22% of total land area comprises native vegetation compared to 50% nationwide. Due to changes in the way data is collected and reported, it is unclear whether or not there is a trend over time. Future monitoring should help to clarify this.

**Table 10a: Extent of native vegetation, Rotorua District**

	Area of native vegetation (ha)	% of total area
1996-1997	45,902	17.6%
2001-2002	57,171	21.9%

**Source: New Zealand Land Cover Database (LCDB) via RDC GIS department.**

*Notes: Due to changes in the way data is collected and reported, comparisons between the 1996/97 and 2001/02 data should be treated cautiously. For the 1996/97 data, the figures relate to total hectares in Indigenous Forest. For the 2001/02 data, figures relate to the sum of total hectares in Afforestation (imaged, post LCDB 1); Afforestation (not imaged); Alpine Grass/Herbfield; Broadleaved Indigenous Hardwoods; Flaxland; Indigenous Forest; Manuka and/or Kanuka; Matagouri; Sub Alpine Shrubland; and Tall Tussock Grassland.*

	Indicator	State – Rotorua	State – Regional/NZ	Trend – Rotorua	Trend – Regional/NZ
10b	Extent of commercial forestry	24% planted forest	9% planted forest	<b>B</b>	

The New Zealand Land Cover Database (LCDB) version 2 contains snapshots of land cover at 1996-1997 and 2001-2002.

Based on statistics derived from LCDB 2, New Zealand's land cover is 9% exotic forest and exotic shrubland, much of which would be dedicated toward commercial forestry.


Approximately 24% of total land area in the Rotorua District comprises planted forest compared to 9% nationwide. Due to changes in the way data is collected and reported, it is unclear whether or not there is a trend over time. Future monitoring should help to clarify this.

**Table 10b: Extent of planted forest, Rotorua District**

	Area of planted forest (ha)	% of total area
1996-1997	54,930	21.0%
2001-2002	63,337	24.2%

**Source: New Zealand Land Cover Database (LCDB) via RDC GIS department.**

*Notes: Due to changes in the way data is collected and reported, comparisons between the 1996/97 and 2001/02 data should be treated cautiously. For the 1996/97 data, the figures relate to total hectares in Planted Forest. For the 2001/02 data, figures relate to the sum of total hectares in Deciduous Hardwoods; Forest Harvested; Major Shelterbelts; Mixed Exotic Shrubland; Other Exotic Forest; Pine Forest – Closed Canopy; and Pine Forest – Open Canopy.*

	Indicator	State – Rotorua	State – Regional/NZ	Trend – Rotorua	Trend – Regional/NZ
10c	Stock density	5.4 Stock Units per hectare	N/A		N/A

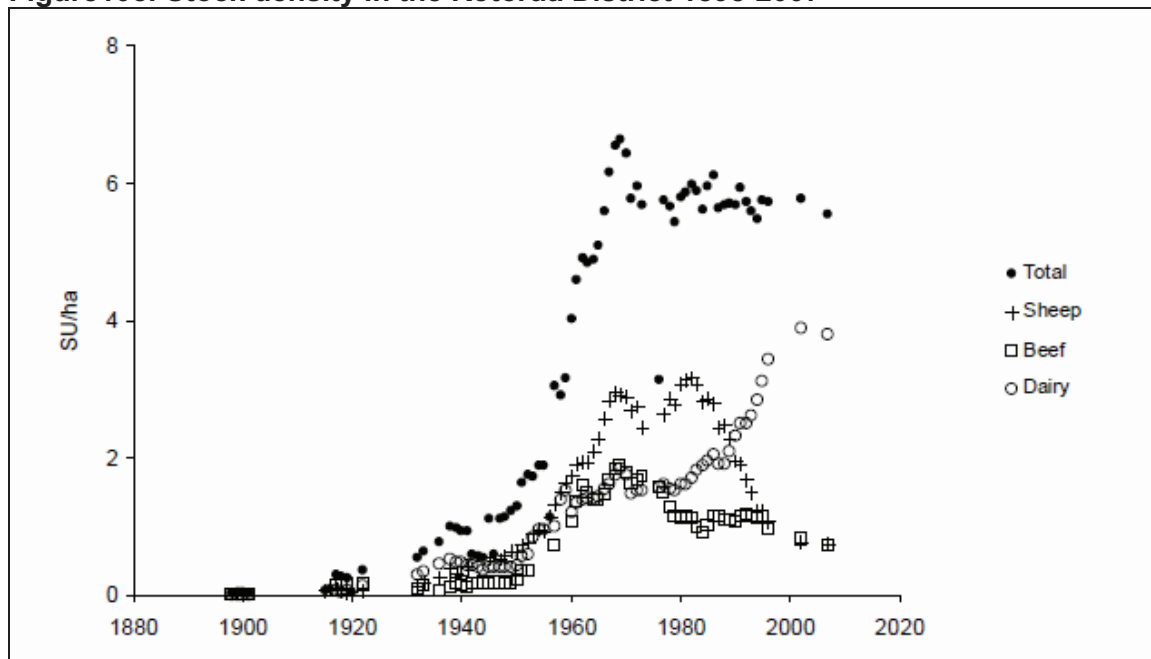
As part of its work modelling nutrient losses to Rotorua lakes, NIWA has prepared long-term estimates of local stock density trends (refer Rutherford, K., Palliser, C; and Wadhwa, S., 'Nitrogen exports from the Lake Rotorua catchment – calibration of the ROTAN model', April 2009). Data was collected from New Zealand Yearbooks, Agricultural Production Reports, Statistics New Zealand and the Ministry of Agriculture and Forestry.

Stock density is calculated by converting each farm animal to a common Stock Unit (SU) and dividing by the area of land that the stock graze on. For the purpose of calculating stock density, NIWA used the following SU conversion rates, as previously adopted by Environment Waikato:

Animal type	Stock Unit
Dairy	6.3
Beef	4.8
Deer	5.0
Sheep	0.93

Figure 10c below shows total Stock Units divided by the total area of the Rotorua District. There was a slow increase from 1900 to 1950, then an increase following World War II which coincided with an increased work force, aerial topdressing and methods to overcome 'bush sickness' in the local area. Stock numbers peaked during the 1970s, followed by a significant reduction which coincided with the removal of farm subsidies. Total Stock Units have remained almost constant since the 1980s but dairy units have increased and sheep units have decreased. The points labelled 'Total' provide a reliable estimate of the average stocking rate for all animals combined. The most recent figure for Rotorua is approximately 5.4 Stock Units per hectare in 2007. Comparative regional or national data is not available.

**Figure10c: Stock density in the Rotorua District 1898-2007**



Source: Rutherford, Palliser and Wadhwa (2009), 'Nitrogen exports from the Lake Rotorua catchment – calibration of the ROTAN model', NIWA.

## 11. Energy conservation

### Why is this important?



The majority of climate scientists in the world agree that the climate is changing due to human activity, and it is now only a matter of how quickly it changes. Even if climate change wasn't occurring, policies to conserve energy would still make sense for economic, health and environmental reasons.

### What are the measures?

11a Greenhouse gas emissions  
11b Energy conservation initiatives

### How are we doing?

- A total of 2.1 million tonnes per year of greenhouse gases were estimated to be emitted from the Rotorua District in 2001 (in CO<sub>2</sub> equivalent terms). Almost 50% of this was due to nitrous oxide (N<sub>2</sub>O), of which 81% was classified as natural emissions and 19% due to agricultural activity. Agricultural emissions also contribute CH<sub>4</sub> from the digestion process of farm stock, especially cattle. Most of the 482,000 tonnes per year of CO<sub>2</sub> emissions *per se* were due to transport and industrial emissions.
- During 2008/09, Rotorua District Council formally adopted a Sustainability Policy. Part of Council's approach is to identify and implement best-practice energy management, including an aim to increase the use of renewable energy resources and reduce reliance on non-renewable energy resources. In addition, as part of its Sustainability Policy, Council has said it will contribute toward a Rotorua Community Action Plan for Climate Protection, to be developed through a community engagement process. Council's goal is to seek to encourage energy efficiency amongst Rotorua households and other local stakeholders.

	Indicator	State – Rotorua	State – Regional/NZ	Trend – Rotorua	Trend – Regional/NZ
11a	Greenhouse gas emissions	2.1 million tonnes per annum (CO <sub>2</sub> equivalent)	118 million tonnes per annum (CO <sub>2</sub> equivalent)		

Human activity has impacted significantly on the Earth's atmosphere. There is evidence of climate change effects, including raised temperatures and sea levels and increased frequency of extreme weather events. The occurrence of these changes is projected to become more pronounced in the future. Energy efficiency and conservation initiatives can help slow this effect, as well as having considerable cost savings.

The National Centre for Climate-Energy Solutions at NIWA has compiled a 2001 Inventory of New Zealand Greenhouse Gas Emissions. This presents data on six greenhouse gases as recommended by the Intergovernmental Panel on Climate Change (1996), namely Carbon Dioxide (CO<sub>2</sub>), Nitrous Oxide (N<sub>2</sub>O), Methane (CH<sub>4</sub>), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and Sulphur Hexafluoride (SF<sub>6</sub>). The inventory is divided into five activity sectors: Agriculture, Area, Industry, Natural and Transport. Data is also available for sub-sectors within these activity sectors but are not presented here. The emissions are calculated using Territorial Local Authority boundaries and using the 2001 Census base.

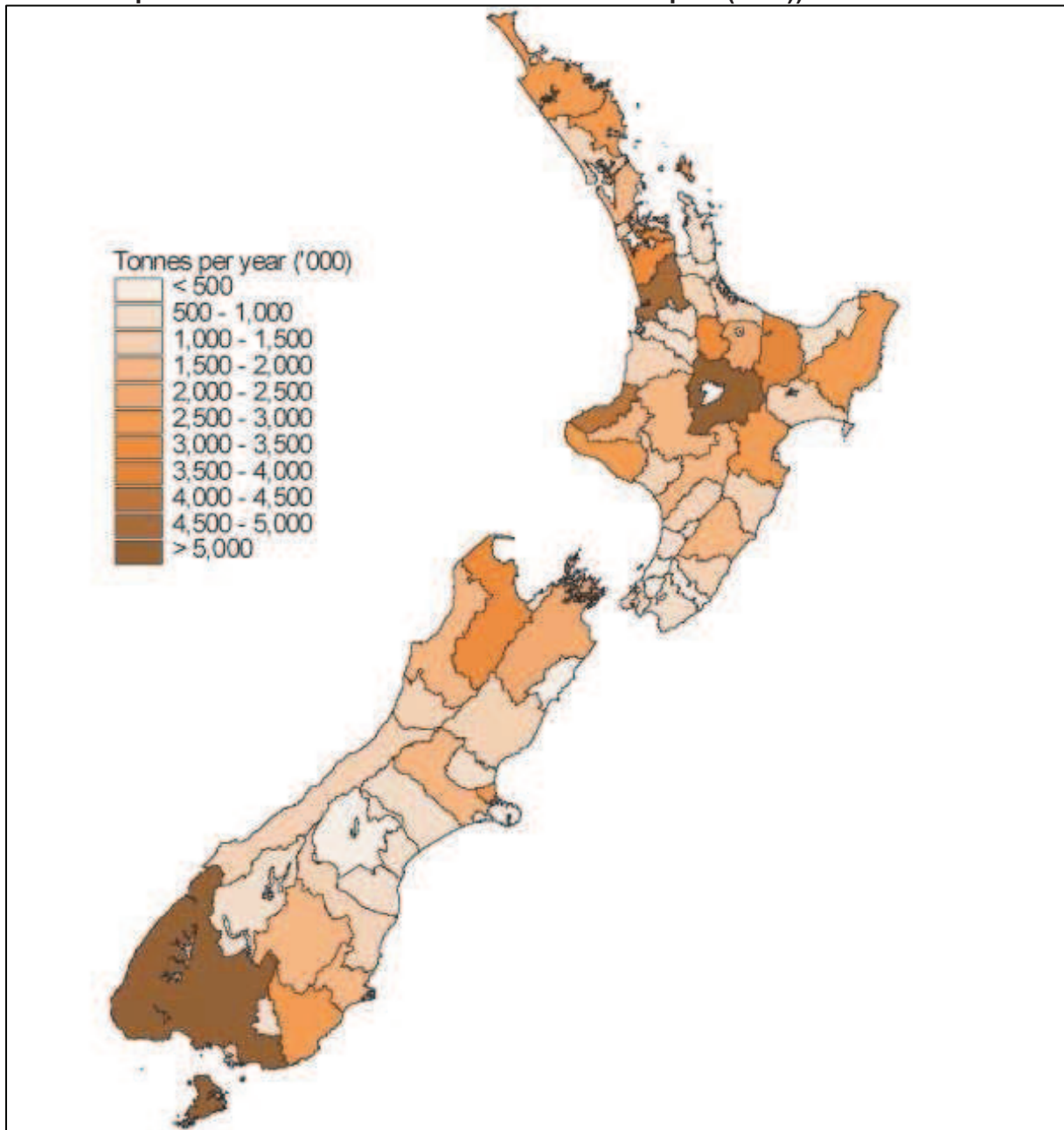
According to NIWA estimates, the main greenhouse gas emissions from the Rotorua District are N<sub>2</sub>O (48% of total emissions, in CO<sub>2</sub> equivalent terms), CH<sub>4</sub> (29%) and CO<sub>2</sub> (23%). Overall, the Rotorua District contributes approximately 1.8% of New Zealand's total greenhouse gas emissions. The main sources of greenhouse gas emissions in the Region are natural (eg, geothermal activity) (50%), agricultural (29%), transport (11%), industrial (6%) and area emissions such as domestic and commercial fuel combustion, open burning, landfills, lawn mowing, refrigeration and wastewater (4%). Agricultural emissions contribute CH<sub>4</sub> from the digestion process of farm stock, especially cattle. A total of 2.1 million tonnes per year of greenhouse gases were estimated to be emitted from the Rotorua District in 2001 (in CO<sub>2</sub> equivalent terms). Almost 50% of this was due to nitrous oxide (N<sub>2</sub>O), of which 81% was classified as natural emissions and 19% due to agricultural activity. Most of the 482,000 tonnes per year of CO<sub>2</sub> emissions *per se* were due to transport and industrial emissions.

**Table 11a(i): Estimated total emissions of six greenhouse gases, Rotorua District 2001 (estimates are reported in units of CO<sub>2</sub> equivalents using Global Warming Potentials published in the IPCC Third Assessment Report (TAR)).**



	CO <sub>2</sub> (t/yr)	CH <sub>4</sub> (t/yr)	N <sub>2</sub> O (t/yr)	HFC's (t/yr)	PFC's (t/yr)	SF <sub>6</sub> (t/yr)	Total - 6 greenhouse gases
Agricultural emissions	12,462	411,274	184,159	0	0	0	607,895
Area emissions	39,278	46,987	2,023	2,569	0	0	90,857
Industrial emissions	106,271	8,488	1,573	1,284	0	135	117,752
Natural emissions	100,065	138,082	807,462	0	0	0	1,045,608
Transport emissions	224,272	1,151	1,802	0	0	0	227,225
<b>Total</b>	<b>482,348</b>	<b>605,982</b>	<b>997,019</b>	<b>3,853</b>	<b>0</b>	<b>135</b>	<b>2,089,337</b>

**Source: NIWA National Centre for Climate-Energy Solutions.**

**Figure 11a(ii): Estimated total emissions of six greenhouse gases by territorial authority, 2001 (estimates are reported in units of CO<sub>2</sub> equivalents using Global Warming Potentials published in the IPCC Third Assessment Report (TAR))**



Source: NIWA National Centre for Climate-Energy Solutions.

	Indicator	State – Rotorua	State – Regional/NZ	Trend – Rotorua	Trend – Regional/NZ
11b	Energy conservation initiatives	A range of initiatives under way	A range of initiatives under way		

Rotorua District Council (RDC) is seeking a more co-ordinated and corporate-wide approach to environmental management, energy management and sustainable development, to ensure these become a central part of its operations. The aim is to lead by example and “walk the talk” before promoting increased sustainability amongst Rotorua communities. Some examples of what the Council is doing in terms of energy conservation initiatives are provided below:

- Through its background work in the Communities for Climate Protection (CCP-NZ) programme, RDC has compiled considerable information on its corporate energy use. RDC has been a CCP-NZ council since 2005.
- An ‘energy audit’ for different sectors of RDC was undertaken in 2007. Energy audits have been completed for the Rotorua Museum of Art and History (stage 2 and 3 developments), Rotorua Energy Events Centre, Rotorua Aquatic Centre and Castlecorp Vaughan Road Depot (minimal/initial audit only).
- In addition to those units which have undertaken energy audits, other departments have also recorded their approach to energy efficiency. RDC’s Property Asset Manager undertakes informal communications with cost centre managers on an ongoing basis to encourage less use of energy and water. An Energy Manager was recently contracted to work across Council’s departments and identify key areas for energy minimisation.
- The Wastewater Treatment Plant requires a considerable amount of energy to operate. RDC is investigating options for using sewerage sludge to generate electricity and heat. There is also a proposal under consideration to use bio-diesel fuelled electricity generators at major pumping stations. In terms of energy conservation, effluent is pumped to the forest for land disposal during night hours when WWTP electricity use is low. Additional opportunities have been identified for avoiding electricity peak loads.
- Council introduced a Green Fleet programme in late 2006 which includes seven initiatives to promote sustainability: increased fuel economy, decrease fleet size, alternatives to driving, vehicle job match, reduction in idling/smarter trip management, maintenance and future technology.

During 2008/09, Council formally adopted a Sustainability Policy. Part of Council’s approach is to identify and implement best-practice energy management, including an aim to increase the use of renewable energy resources and reduce reliance on non-renewable energy resources. In addition, as part of its Sustainability Policy, Council has said it will contribute toward a Rotorua Community Action Plan for Climate Protection, to be developed through a community engagement process. Council’s goal is to seek to encourage energy efficiency amongst Rotorua households and other local stakeholders.

## 12. Beautiful urban environment

### Why is this important?


Maintaining an attractive urban environment is important not just for local community pride but also as a contribution to Rotorua's attraction to domestic and international visitors. Rotorua's parks and gardens are recognised as some of the most attractive and well-maintained in New Zealand.

### What are the measures?

12a Beautiful City status

### How are we doing?

- Rotorua has been voted the most beautiful city in New Zealand five times in the last ten years.

	Indicator	State – Rotorua	State – Regional/NZ	Trend – Rotorua	Trend – Regional/NZ
12a	Beautiful City status	Award recipient 5 times in the past decade	N/A		N/A

In 2009, Rotorua was voted New Zealand most beautiful city for the fifth time in ten years at the annual Keep New Zealand Beautiful conference. Rotorua previously won the award in 1999, 2000, 2002 and 2006. Rotorua's success has been attributed to the many volunteers and Council staff members who work to keep the city looking tidy.

**Table 12a: Years in which Rotorua has been voted 'Most Beautiful City'**

Year	Rotorua winner
1999	Yes
2000	Yes
2001	
2002	Yes
2003	
2004	
2005	
2006	Yes
2007	
2008	
2009	Yes

Source: Keep New Zealand Beautiful.