

Foreword

Welcome to The Rotorua Lakes Education Resource.

There are 14 lakes in the Rotorua region, all of volcanic origin. The water quality ranges from oligotrophic (excellent) to supertrophic (very poor) e.g. Lake Tarawera is an oligotrophic lake while Lake Okaro is a supertrophic lake.

Our vision is...

Waiora – He Taonga Tuku Iho

A Future with Clean, Clear Water

The Rotorua Lakes Education Resource for schools was written in 2006 and aims to:

- help create a future with healthy water for the Rotorua Lakes through education and action in and by schools.
- help ensure that water quality and quantity are protected for healthy aquatic ecosystems and future human use.

This education resource looks at:

- the area's historical and cultural background
- the geology of the area
- the relationship of people with the lakes
- the life in the lakes
- some of the issues surrounding the Rotorua Lakes
- actions we could take

A lake visit is an excellent tool for investigative and action purposes and Environment Bay of Plenty can help you with the loan of monitoring equipment and staff support.

For more help or information please contact:

Environmental Education Officer

Address: Freepost Environment Bay of Plenty
PO Box 364
5 Quay Street
Whakatane

Email: info@envbop.govt.nz

Phone: 0800 368 267 (0800 ENV BOP)

Acknowledgements

This project was initiated by Environment Bay of Plenty working in collaboration with the Te Arawa Maori Trust Board and Rotorua District Council. A group with an interest in the Rotorua Lakes and education then carried it forward to the next stage.

Thanks go to the 'Working Group party' who set the vision and the path of the project: Jim Schuster, Ron Marsden, Morley West, Julie Hall, Murray Pearce, Kate Akers, Lynnette Brown, Denise La Grouw, Sarah McCorkindale, Kerry Gosling and Sunila Prasad.

The following people are the dedicated group of teachers who attended a two day workshop to gain 'expert' knowledge then spent many hours writing and trialling activities with their own classes. Environment Bay of Plenty would like to thank these teachers most sincerely for their time and for their courage in putting their work forward:

Veronica Aislabie	Kaharoa Primary School
Susan Bentley	Rotorua Intermediate School
Meling Eagar	Aorangi Primary School
Michelle Goeth	Rotorua Girls' High School
Wendy Joyes	Western Heights High School
Jyothi Lamba	Western Heights High School
Wai Morrison	Rotorua Intermediate School
Murray Pearce	Western Heights High School
Carrick Robertson	Aorangi Primary School
Matt Sabapathy	Kawaha Point School
Patti Sutton	Western Heights High School
Hewa Thompson	Kawaha Point School
Mark Tiedt	Western Heights High School

Thanks also to the following schools for encouraging and supporting the teachers in this:

Kawaha Point, Western Heights High School, Aorangi Primary, Kaharoa Primary, Rotorua Intermediate and Rotorua Girls' High School.

Lynnette Rogers of School Support Services has contributed many hours in supporting the development of this resource, thanks to both her and School Support Services for this.

Contents

Foreword	1
Acknowledgements	2
Contents	3
Introduction	5–6
Underlying Curriculum Considerations	7
Activities Lists	13–24

Contexts:

1. Gathering Prior Knowledge	25–34
2. Geology	35–67
3. History/Culture	69–106
4. People and the Lakes	107–159
5. Water Quality	161–215
6. Life in the Lakes	217–249

Templates	251–262
-----------------	---------

Glossary and Maps

Pollution Busters Club Newsletters

Introduction

Why a Rotorua Lakes Education Resource?

The resource helps teachers to:

- enable students to increase their knowledge and understanding of the lakes of the Rotorua region.
- encourage action 'for' the environment by enabling students to take independent and appropriate actions for a sustainable lakes environment.

What is the resource?

The Rotorua Lakes Education Resource is unusual in that it has aspects relating to primary, intermediate and secondary levels.

This is an integrated resource, which offers a variety of learning opportunities, across a number of contextual/theme areas. Teachers are encouraged to use the activities to support or build their own programmes. The activities are not designed as a prescribed learning programme or as a stand-alone sequence of lessons. A folder houses the kit so that teachers can add other activities to include their own ideas. Most activities can be extended to include action for the environment, either from the students themselves or by linking the Issues and Action Ideas sections.

Although organised as an integrated unit, activities from a single curriculum area can be taught by pulling out those activities that suit your level from the Activity Grid, which is included within each context section.

Each activity is outlined with its own purpose, ideas for prior learning, possible next steps and reflective questions. The activities may be used to support student's pathways through an inquiry based learning process.

Each activity is clearly labelled with its context, curriculum area and suggested level (although most activities can be adapted to suit a different level as already noted).

Whatever levels you are teaching, the Rotorua Lakes Resource Kit can be used. For example Level 1–4 may identify the 'bugs' by common names whereas L5+ may be using the scientific names and looking more in depth at taxonomic classification.

Each Rotorua Lakes Resource Kit includes:

- Teaching resource
- Resuscilake board game (Intermediate and Secondary levels only)
- Food web activity cards
- Posters – lakes and creatures
- 'In the Footsteps of Kahumatamomoe' DVD (video available on request)
- 'The story of drinking water' booklet
- Fact sheets
- Photopack
- Environment Bay of Plenty's Pollution Busters Club newsletters

How does the Rotorua Lakes Education Resource fit into the curriculum?

The core curriculum areas of this resource are science and social studies, with environmental education interwoven through all aspects of the learning. It's closely linked to the Waiora resource and other readily available resources. Throughout this resource activities from Waiora are referred to.

It offers opportunities for co-operative and experiential learning. Skills and opportunities to develop the key competencies and explore values are embedded within the activities. The Inquiry Learning process is student centred, so teachers and students can select activities they require.

Underlying Curriculum Considerations

The New Zealand curriculum requires teachers to allow their students opportunities to explore the following **values**:

- **diversity, as found in our different cultures and heritages**
- **community and participation for the common good**
- **respect for themselves, for others, and for human rights**
- **equity, which means fairness and social justice**
- **integrity, which involves being honest, responsible and accountable, and acting ethically**
- **care for the environment (the Earth and its interrelated eco-systems)**
- **innovation, inquiry and curiosity, by thinking creatively, critically and reflectively**
- **excellence, by aiming high and by persevering in the face of difficulties.**

Teachers will reflect on the values as they design learning activities, and interact with students.

The Rotorua Lakes Education Resource (as all environmental education does), encourages the incorporation of values education into learning programmes. It also offers opportunities for teachers to include activities which will enable students to develop their key competencies.

The New Zealand Curriculum identifies the following **five key competencies**:

- **managing self**
- **relating to others**
- **participating and contributing**
- **thinking**
- **using language, symbols, and texts.**

What is Environmental Education?

Environmental Education is a multi disciplinary approach to learning that develops Action Competence – the ability of individuals and the community to take action towards sustainability.

Aims

This resource aims at developing:

- **awareness and sensitivity** to the quality of the Rotorua Lakes natural environment and biodiversity
- **knowledge and understanding** of katiakitanga responsibilities, of our environment and what is impacting on the lakes
- **attitudes and values** that reflect feelings that recognise that water is a taonga and of concern for our natural environment
- **skills** involved in identifying, investigating and problem-solving issues related to the lakes
- a sense of responsibility through **participation and action** as individuals and as members of a group, in addressing some of the Rotorua lakes issues. (Refer to: Guidelines for Environmental Education in New Zealand Schools, Ministry of Education, 1999, pg 9)

Key dimensions

Key dimensions of Environment Education within the context of this resource involve education occurring:

- **about** the lakes, their people, history and environment
- **in** the lakes environment – valuable learning occurs outside the classroom at the lakes themselves
- **for** the environment – action to enhance the environment; the desired outcome of any Environmental Education programme.

Key concepts

The key concepts underlying learning in Environmental Education are:

- **interdependence – how life in and around the lakes is connected**
- **sustainability – using our water in ways that safeguard its future**
- **biodiversity – understanding the wide variety of life forms dependent on the lakes' ecosystem**
- **personal and social responsibility for action – recognising that everyone of us can help our lakes**

These concepts support many of the activities in this resource.

Which teaching and learning styles are relevant?

The learning strategies promoted throughout this resource are those that encourage students to actively participate in their own learning. One of the key outcomes of Environmental Education is students becoming action competent – empowered to make and explore solutions, decisions, understand consequences and take appropriate action for the environment.

The following teaching and learning pedagogies are those that have been effective in Environment Education. They also include and meet the requirements of the NZ National Curriculum.

Inquiry learning

Inquiry is a complex and multifaceted approach to teaching and learning. It is a teaching practice that involves exploration, question asking, discovering, testing and understanding of new learning. The Inquiry process develops skills such as observation, reasoning, critical thinking, and the ability to justify or negate existing knowledge. It is based on relevant contexts which are meaningful to students and is usually motivated by questions and wonderings that drive the inquiry process (see page 10).

Action learning

Action learning is a variation of Inquiry learning with an emphasis on students taking action and reflecting upon the resulting changes (see pages 11 and 12).

Cooperative learning

Cooperative learning is a teaching approach that offers students learning opportunities by working together in groups. Similar outcomes and skills are developed as mentioned above, with the addition of interpersonal skills developed through group work and shared responsibility for learning.

Experiential learning

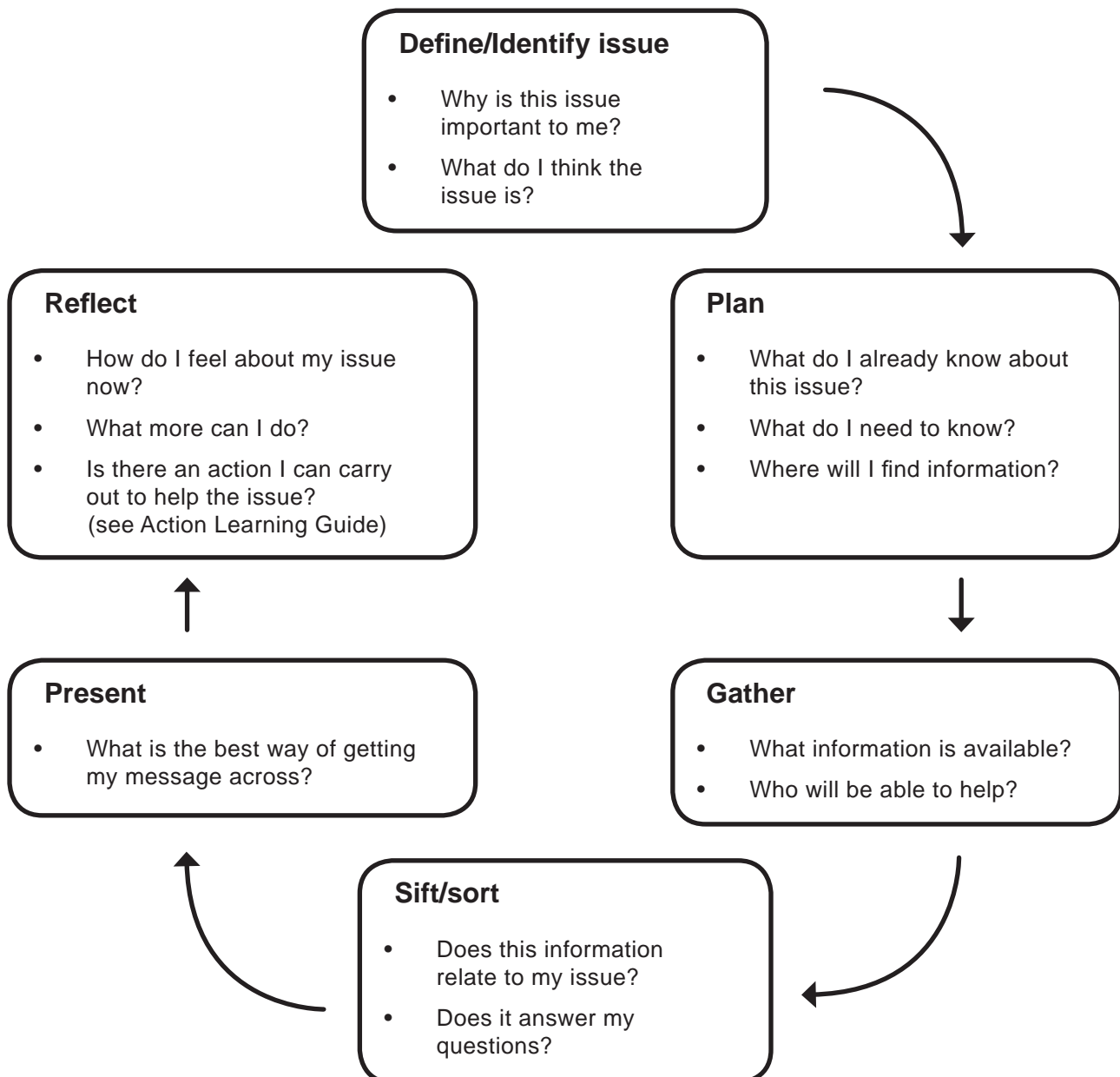
Experiential learning is learning that is determined by the experiences offered by students. Students are actively involved in activities designed to offer an experience from which new learning can emerge.

In all the approaches above, the student is at the centre of learning and the teacher is the facilitator. Reflection on learning and change is an essential common aspect.

The Inquiry Learning Process

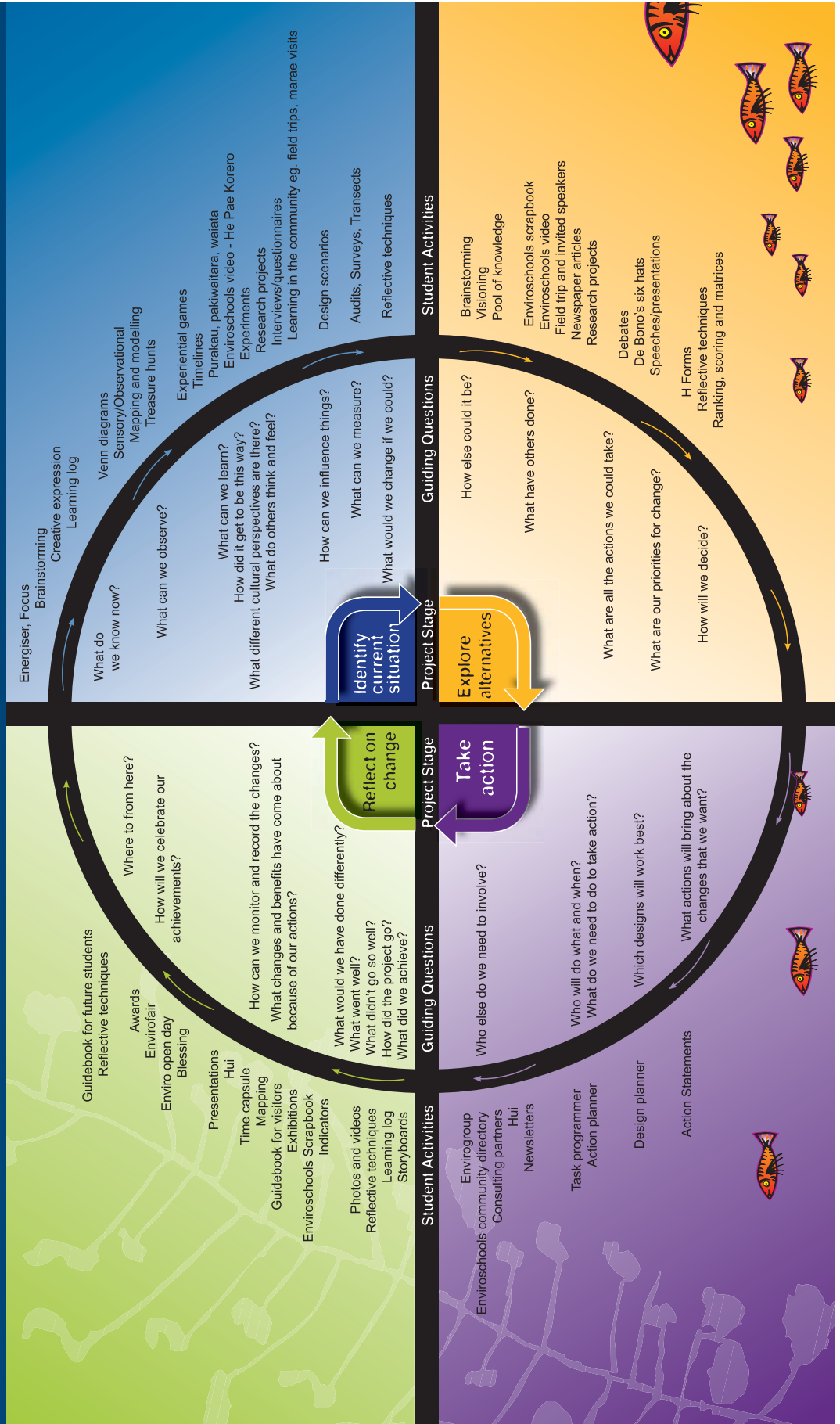
Although there are many models of Inquiry Learning, we have chosen to highlight the following two examples as they focus on action as a key outcome. Both processes develop generic skills such as: finding information, examining different view points and problem solving related to environmental issues. They also foster the development of the Key Competencies and allow students to explore relevant values. Support and guidance are very important for the success of these processes. Additional activities sourced to support students learning can be added to the resource.

An inquiry approach for environmental education



Action learning cycle

The EnviroSchools action learning cycle can be used to plan any topic, issue or project (see EnviroSchools Handbook pg 43-47).



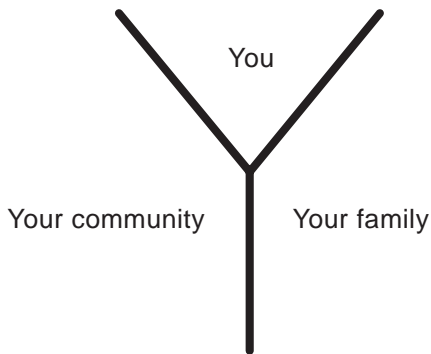
Action Ideas

The lists included in sections 4, 5 and 6 are a sample of actions that students could take.

Initially students should brainstorm their own ideas for taking action and use the lists in this resource as a back-up.

The action ideas should all lead to a positive impact on an aspect of the lakes ecosystem.

Using the Y Form (Template 2) as per below will help students decide on what action to take.



Templates 7–11 can then be used to determine the process to be followed.

1. Gathering Prior Knowledge Activities		
Activity title	Curriculum link	Page
1a What We Know Now	English	27
1b Knowledge Bingo	English	29
1c What Makes a Lake Different?	Science/Social Studies	31
1d Know Your Lakes	Social Studies	33
1e The Lakes and Us	Social Studies/English	34

Relevant resources:

- www.brainstorming.co.uk
- www.waterlink.org.nz/Water4Me/BrainStorming.pdf
- www.waterlink.org.nz/Water4Me/BrainStormingAndMindMapping.html

2. Geological History Activities		
Activity title	Curriculum link	Page
2a Formation of the Rotorua Lakes	Science	37
2b Silent Card Shuffle	Science	39
2c Mt Ngongotaha	Science	42
2d Looking at Sediment	Science	53
2e How Wet is Your Sediment?	Science	55
2f What is in Your Sediment?	Science	58

Relevant resources:

- Rotorua’s Volcanic Past – video – hire from Rotorua Public Library
- Rotorua Museum Education Resources
- Te Arawa – Mai Maketu ki Tongariro
 - » Legends, Landforms and Learning
 - » Tarawera photo kit
 - » Tarawera Resource kit
- Pollution Busters newsletter # 5 Volcanoes
- Learning Media - Building Science Concepts
 - » Book 12 – Volcanoes: Hot Rock in a Cool World, Levels 3–4
 - » Book 52 – The Land Changes: Keeping Earth’s Systems in Balance, Levels 3–4
- Learning Media – readers
 - » The Changing Land, Jane Buxton, ISBN 0478214162, explores how the elements can affect Earth and change its shape

3. History and Culture Activities

Activity title	Curriculum link	Page
3a Knowledge Map	Social Studies/English	71
3b Lakes and Legends	Social Studies/English/Arts	72
3c Maori Cultural Spiritual Values	Social Studies/English	79
3d Mourea: Then and Now	Social Studies	85
3e Lakes History	Social Studies	89
3f Mokoia	Social Studies/English	90
3g Exploring Rotorua	Social Studies/English/Arts	95
3h The Lakes: Now and Then	Social Studies	103

Relevant resources:

- Stitchbirds for Mokoia – video 158 – Department of Conservation Conservancy Office
- Rotorua Museum Education Resources
 - » Te Arawa – Mai Maketu ki Tongariro
 - » Legends, Landforms and Learning
 - » Tarawera photo kit
 - » Grandparents photo kit
 - » History of Tourism Rotorua Timeline
 - » Tarawera Resource kit
- The Story of Rangi and Papa – School Journal: 1994 Part 1 No. 5, pages 18–23
- Ihenga and the Turehu – School Journal: 1993 Part 2 No. 1, pages 31–35
- The Rock Warriors – D Stafford

Note: Rotorua Museum Photographic services offers photocopying of their wide selection of photos.

- A History of the Arawa People – D Stafford
- The Romantic Past of Rotorua – D Stafford
- Pakiwaitara – Te Arawa stories as told by D Stafford – D Stafford

4. People and the Lakes Activities		
Activity title	Curriculum link	Page
4a Uses of the Lakes	Social Studies	113
4b Lakes Use Analysis	Social Studies	114
4c Water Around the World	Social Studies/English	115
4d Bioaccumulation	Science	118
4e Impact of Industry: 1	Social Studies/English	121
4f Impact of Industry: 2	Social Studies/English	124
4g Impact of Industry: 3	Social Studies/English	126
4h Impact of Industry: 4	Social Studies	127
4i The Stormwater Problem	Social Studies/English/ Science	133
4j Watery Wastes	Social Studies/English/ Science	135
4k Stormwater	Social Studies/English/ Science	137

4l Pollution – What Happens?	English	142
4m Water Pollution -- Nutrient, Biological, Toxic	Science/English	143
4n Slogan	English	147
4o Lifestyles and Personal Choices	Social Studies/English	148
4p Scenario	Social Studies/English	150
4q S.O.S – Save our Streams	Science/Social Studies/ English	155

Relevant resources:

- Caring for Our Land – video 162 – Department of Conservation Conservancy Office
- Sustainable Agriculture and Water Quality– video 154 – Department of Conservation Conservancy Office
- The Impact of Forestry on Aquatic Resources – video 155 – Department of Conservation Conservancy Office
- Invaders in Paradise – video 144 – Department of Conservation Conservancy Office
- www.h2ouse.org
- http://nwp.rsnz.org/content/Pollution_Detectives/projects_pollutiondetective.htm
- www.watercare.net/wll
- www.protectyourwaters.net/prevention_generic.php
- Waioira – Environment Bay of Plenty teachers resource – sections 3-5
- Rotorua Museum Education Resources
 - » Te Arawa – Mai Maketu ki Tongariro
 - » Grandparents photo kit
 - » History of Tourism Rotorua Timeline
- Wastewater-Rotorua District Council resource
- Environment Bay of Plenty fact sheets on Rotorua Lakes
- In the footsteps of Kahumatamomoe Video/DVD

- Pollution Busters newsletter # 7 Stormwater
- Pollution Busters newsletter # 12 Water
- Pollution Busters newsletter # 14 Lakes
- Pollution Busters newsletter # 16 Weeds
- Pollution Busters newsletter # 24 Wetlands
- Starters & Strategies Issue 66 2005 June
- Starters & Strategies: www.teachingonline.org/riverslakes.html
- Learning Media – Connected Series
- Connected 2, 2002
- Learning Media – readers
 - » Lake Life, Sharon Holt, ISBN 0790310104 shows support plants, animals, bacteria – and even people. This text examines the importance of lakes and explores some of the potential threats to this precious resource.
 - » The World of Water, Susan Paris, ISBN 0 7903 0458 9 Water is one of the most important resources on Earth. This book explains where water comes from and how it gets to our homes. It also explores pollution and the importance of water conservation.
 - » Water - Item 88136 – This picture series has been planned for generating discussion and written work as part of the language programme. Each picture depicts some aspect of water, for example, in the home, at play, and for recreation
 - » A Fishy Mystery, Anna MacKenzie, Item No. 30444 A group of children discover some dead fish floating in the local river and they are determined to find out what's killing them. They start by asking their teacher for help, then they conduct some research of their own.
- RSNZ – Alpha Series – www.rsnz.org/education/alpha
 - » Alpha 109 – Tourism and The Environment

5. Water Quality Activities

Activity Title	Curriculum Link	Page
5a Lakes Research	Social Studies/Science/ English	166
5b Jack and Jill	Social Studies/English/ Science	168
5c Journey of a Water Drop	Science	171
5d Rotorua's Catchment	Social Studies	171
5e Just Passing Through	Science	173
5f Calligrams	English	176
5g Watery Quiz	English	177
5h Puzzlemaker	Social Studies	178
5i Treasure Hunt	Science/Social Studies	179
5j Household Water Use	Science	182
5k Testing Water – A	Science	184
5l Testing Water – B	Science	186
5m Comparing Water	Science	189

5n Safe to Swim?	Science/English	191
5o Littering	English	192
5p Why Do People Build Walls?	Science/Social Studies	197
5q Lake Dynamics	Science	198

Relevant resources:

- www.teara.govt.nz
- www.niwa.cri.nz
- www.niwascience.co.nz/edu/resources/
- www.niwascience.co.nz/edu/students/faq/hydro-terms
- www.tki.org.nz/r/environ_ed
- www.tki.org.nz/r/environ_ed/primary_units/streams_water_e.php
- www.tki.org.nz/r/hot_topics/freshwater_e.php
- http://nwp.rsnz.org/content/Pollution_Detectives/projects_pollutiondetective.htm
- www.ew.govt.nz/enviroinfo/water/wetlands/index.htm
- www.protectyourwaters.net/prevention/prevention_generic.php
- www.habitattitude.net/impacts/degrade.php
- www.scienceclarified.com
- www.wateryear2003.org
- www.waitakere.govt.nz go to the education section – an excellent site.
- Waioira – Environment Bay of Plenty teachers resource
- Saving Our Wetlands – video 163 – Department of Conservation Conservancy Office
- Kaituna Wildlife Management Reserve – video 191 – Department of Conservation Conservancy Office
- ‘Take Action For Water’, Greater Wellington Regional Council, teachers resource
- RSNZ – Alpha Series – www.rsnz.org/education/alpha
 - » Alpha 117 – NZ Streams & Rivers
- RSNZ – Gamma Series – www.rsnz.org/education/gamma
 - » Gamma Series – May 2004, The Business of Drinking Water
- Learning Media – Building Science Concepts – www.learningmedia.co.nz
 - » Book 1: Levels 2-3 Waterways: How Rivers and Streams Work
 - » Book 15: Levels: 1-2 Where's the Water?: Water's Forms and Changes

- » Book 31: Levels: 3-4 Water and Weather
- Learning Media – Connected series – www.learningmedia.co.nz
 - » Connected 3, 2004 – Item 30054 – Year 4–8, testing the water quality and ecology of local streams. Teachers’ notes item 30055
 - » Connected 2, 2002 – Item 24733 – Year 3–6, includes changes in the physical state of water; the water cycle. Teachers’ notes item 24734
- Learning Media – reader – www.learningmedia.co.nz
 - » From Sky to Sea, Joy Cowley, ISBN 0478214189, follows water as it falls from the clouds and journeys to the sea.
 - » Lake Life, Sharon Holt, ISBN 0790310104 shows support plants, animals, bacteria – and even people. This text examines the importance of lakes and explores some of the potential threats to this precious resources.
 - » The World of Water, Susan Paris, ISBN 0 7903 0458 9 Water is one of the most important resources on Earth. This book explains where water comes from and how it gets to our homes. It also explores pollution and the importance of water conservation.
 - » A Fishy Mystery, Anna MacKenzie, Item No. 30444 A group of children discover some dead fish floating in the local river and they are determined to find out what’s killing them. They start by asking their teacher for help, then they conduct some research of their own.
- Pollution Busters newsletter # 7 Stormwater
- Pollution Busters newsletter # 12 Water
- Pollution Busters newsletter # 14 Lakes
- Pollution Busters newsletter # 16 Weeds
- Pollution Busters newsletter # 24 Wetlands
- NIWA – The Environment Watch CDs provide a series of environmental education resources intended for use by community groups, environmental educators, and secondary schools. NIWA has produced the series based on Environment Watch items from the TV3 programme No8 Wired, produced by the Gibson Group and sponsored by Sustanza

6. Life in the Lakes Activities

Activity Title	Curriculum Link	Page
6a Understanding Biodiversity	Science	221
6b What Lives in Our Lakes	Science	222
6c Aquatic Treasure Hunt	Science	223
6d Microscopic Discoveries	Science	227
6e Pea Soup Lakes	Science	229
6f Looking at Algae	Science	231
6g Who Eats What/Whom?	Science	233
6h Habitat Hunt	Science	235
6i Plants Around the Lakes	Science	236
6j Lakeside Treasure Hunt	Science/Social Studies	239
6k Streaming Waters	Science/Social Studies	241
6l Healthy Habitat	Science/English	245

Relevant resources:

- www.teara.govt.nz
- www.niwas.science.co.nz/rc/freshwater/fishatlas/key
- www.niwas.science.co.nz/ncabb/aquaticplants/outreach/weedman/
- www.upthecreek.org.nz – interactive stream activity
- http://nwp.rsnz.org/content/Pollution_Detectives/projects_pollutiondetective.htm
- Under water, under threat – video 60 – Department of Conservation Conservancy Office
- NZ's Freshwater Native Fish – video 129 – Department of Conservation Conservancy Office
- Invaders in Paradise - video 144 – Department of Conservation Conservancy Office
- Starters & Strategies, Issue 66, 2005 June, www.teachingonline.org
- Learning Media –
 - » The Stream Community - focuses on living things in a variety of natural communities. It contains 23 colour pictures, teachers' notes with a description of each picture, suggested activities, and a copymaster of a sample stream community food web. ISBN 0 478 05878 0
 - » Water – Item 88136 – This picture series has been planned for generating discussion and written work as part of the language programme. Each picture depicts some aspect of water, for example, in the home, at play, and for recreation
- Learning Media – readers – www.learningmedia.co.nz
 - » Lake Life, Sharon Holt, ISBN 0790310104 shows support plants, animals, bacteria – and even people. This text examines the importance of lakes and explores some of the potential threats to this precious resource.
 - » A Fishy Mystery, Anna MacKenzie, Item No. 30444 A group of children discover some dead fish floating in the local river and they are determined to find out what's killing them. They start by asking their teacher for help, then they conduct some research of their own
- Learning Media – Connected series – www.learningmedia.co.nz
 - » Connected 3, 2004 – Item 30054 – Year 4–8, testing the water quality and ecology of local streams. Teachers' notes item 30055
- Royal Society of NZ - Alpha Series – www.rsnz.org/education/alpha
 - » Alpha 123 – Freshwater Aquatic Plants
- A History of the Lake – weed infestation of the Rotorua Lakes and the Lakes of the Waikato Hydro-electric scheme, VJ Chapman, NZ Dept of Scientific & Industrial Research, Series 78
- Aquatic Weed Control in the Rotorua Lakes, VA Froude & CJ Richmond, Department of Conservation, January 1990
- Rotorua Lakes Aquatic Weed Update, January 2002 , R Wells, P Chapman, J Clayton, A Taumoepeau, Department of Conservation