

Environmental monitoring 2013 data report

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Table of contents

Acknowledgement	i
1 Introduction	1
2 Data management	1
2.1 General	1
3 Quality management	1
3.1 Data availability	1
3.2 How to contact us	2
4 Directions	2
4.1 Work programme 2013/2014	2
4.2 Information network	3
5 Telemetry system	3
6 Usage of data	4
6.1 Information requests	4
7 Rainfall data	5
7.1 General	5
7.2 Manual sites	5
7.3 Automatic stations	5
8 Surface water level data	5
8.1 General	5
8.2 Manual sites	5
8.3 Automatic stations	6
9 Water flow data	6
9.1 General	6
9.2 Manual sites	6
9.3 Automatic stations	6
10 Groundwater level data	7
10.1 General	7
10.2 Manual sites	7
10.3 Automatic stations	8
11 Surface water temperature data	8
11.1 General	8
11.2 Manual sites	8
11.3 Automatic stations	9
12 Water quality data	9
12.1 General	9
12.2 Manual sites	9
12.3 Automatic stations	9
12.4 Groundwater quality	9
13 Suspended sediment data	10
13.1 General	10
13.2 Manual sampling	10
13.3 Automatic sampling	10
14 Ecological stream and river monitoring data	11
14.1 Regional ecological monitoring of streams	11
14.2 Fisheries monitoring	11
15 Coastal monitoring	12

15.1	Regional estuary monitoring programme	12
15.2	Beach profiles	12
16	Geothermal data	13
16.1	General	13
16.2	Methodology	13
17	Air quality	14
17.1	Ambient air quality monitoring	14
18	Clean streams	14
18.1	General	14
18.2	Methodology	15
19	Catchment environmental monitoring	15
19.1	General	15
19.2	Methodology	15
20	Updates to report	16

Figures

Figure 1:	Information requests actioned by Environmental Monitoring staff, 2008 – 2013	4
Figure 2:	Size of flow monitoring network, 1990 – 2013	6
Figure 3:	Number of gaugings completed, 1990 - 2013	7
Figure 4:	Number of bores in the groundwater level monitoring network (manual), 1992 – 2013.	8

Tables

Table 1:	Summary of 2013 automatic recorders	3
Table 2:	Current automatic sediment sampling sites	10

1 Introduction

Waikato Regional Council is required to collect environmental information to comply with its obligations under Section 32 of the Resource Management Act 1991. The Environmental Monitoring Programme, Resource Information Group of Waikato Regional Council is responsible for much of this collection. The Environmental Monitoring Programme is ISO 9001:2008 registered through Telarc New Zealand for the supply of environmental information and services, including water quality, biological sampling, air quality, land and rating information and geographical information systems.

This report summarises the information collected during the 2013 calendar year.

Procedures used are in accordance with those outlined in the Quality Manuals. Data is stored on Waikato Regional Council's computer system.

Data is readily available. Under current policy, data is free to all users but there is a charge for the time taken to access the data. This charge is waived for certain users, such as educational organisations.

The ISO 9001-2008 quality system is given priority and the scope of registration will be increased to cover all activities completed by the Environmental Monitoring Programme. Data capture statistics and equipment performance are reviewed and used to improve performance.

2 Data management

2.1 General

Since data is being collected continuously (Environmental Monitoring's 120 automatic stations generate more than eight million data points each year) good management of the data is essential. Procedures are continually being reviewed and improved in conjunction with the quality system. Extreme events, such as floods or droughts, require that previous work (such as level/flow ratings) be reviewed for accuracy. The compilation and regular review of the procedure manuals have improved consistency of data processing, analysis and management.

3 Quality management

To ensure that the database is current and free from major errors, three monthly quality management audits are run. These present the collected data graphically, make comparisons and check for accuracy. Any deficiencies are followed up and corrected. With the introduction of new time series software (WISKI) quality assurance reports are being developed which will automate the QA checks.

3.1 Data availability

Real time data is available for all telemetered stations. Data is supplied provisionally until the satisfactory operation of the instrumentation is confirmed.

Data is downloaded at most automatic stations at eight weekly intervals but some remote telemetered stations are serviced at two or three month intervals. Data is processed, checked and archived within two weeks of the station inspection.

The flow/level relationship (rating), derived using flow gaugings, is affected by bed movement or change in the physical features controlling the stage discharge relationship. As the full range of flows is gauged, the rating is adjusted to complement

the gaugings. Since these improvements can be done at any time, users are encouraged to obtain flow data directly from Environmental Monitoring.

3.2 How to contact us

Requests for data associated with this report can be made by;

Email: inforeq@waikatoregion.govt.nz

Phone: (07) 859 0999

Fax: (07) 859 0998

Under current policy, data is free but there is a charge for the time taken to access the data. This charge is waived for certain users, such as educational institutions.

General enquiries to Waikato Regional Council may be made by:

Phone: (07) 859 0999 or Waikato Regional Council's
Freephone 0800 800 401

General information about Waikato Regional Council may be found on our website. Real time river levels and rainfall information from some sites is also available on the website.

Web home page: <http://www.waikatoregion.govt.nz>

Web river levels (real time): <http://www.waikatoregion.govt.nz/riverlevelsandrainfall/cgi-bin/hydwebserver.cgi/catchments/details?catchment=17>

Web rainfall (real time): <http://www.waikatoregion.govt.nz/riverlevelsandrainfall/cgi-bin/hydwebserver.cgi/catchments/details?catchment=16>

Web groundwater: <http://www.waikatoregion.govt.nz/Environment/Natural-resources/Water/Groundwater/>

Web air quality: <http://www.waikatoregion.govt.nz/Environment/Natural-resources/Air/>

Web Water Temp: <http://www.waikatoregion.govt.nz/Environment/Natural-resources/Water/Rivers/Water-temperature-levels-in-the-Waikato-region/>

4 Directions

4.1 Work programme 2013/2014

Data capture will continue and quality control methods for incoming data will be improved as required.

A new database (WISKI) used to store environmental information has been introduced.

Environmental Monitoring's role is being widened to include responsibility for the importation, quality assurance and archiving of more diverse forms of environmental information.

The ISO 9001-2008 quality system will ensure procedures are closely followed and modified as required. As additional areas of work are added to the programme, they will be incorporated in the quality system.

Providing information to customers is an integral part of Environmental Monitoring's service. Regular requests for resource consent information for data analyses are anticipated, particularly in response to extreme events.

4.2 Information network

Table 1 shows the Environmental Monitoring Programme collected over 285 separate time series data sets from 201 permanent recorders and 84 temporary automatic recorder sites in the region during 2013. These are installed for specific purposes, such as flood and resource management and resource consent monitoring. Over fifty stations are linked directly to the office by a telemetry system.

Table 1: Summary of 2013 automatic recorders

Permanent recorders			
Sites	Type	Parameters measured	Data sets
25	Rainfall	Rainfall (25)	25
53	Surface Water	Level (53), Flow (40), Water Temperature (12)	105
6	Coastal	Sea Level (6), Water Temperature (2), Wave Amplitude, Wind Speed, Wind Direction, Wind Gust, Barometric Pressure (3)	15
10	Groundwater	Level	10
9	Air Quality	Wind Speed (5), Wind Direction (5), Air Temperature (5), Particulate Matter <10 microns (9)	24
1	Climate	Rainfall, Groundwater Level (4), Climate parameters (2)	7
15	Lake Level	Level (15)	15
119	Totals		201
Temporary/portable recorders			
Sites	Type	Parameters measured	Data sets
30	Water Quality	Water Temperature (Onset Loggers)	30
6	Water Quality	Water Temperature, pH, Dissolved Oxygen (mg/l & %), Turbidity, Conductivity, Chlorophyll A, Algae	36
8	Water Quality	Suspended Solids, Turbidity	12
44	Totals		78

In addition to the automatic stations there are manual sites where measurements are taken at regular intervals. Manual sites are operated where less detailed information is required and the information collected may be correlated with adjacent automatic stations once a base of data is established.

5 Telemetry system

The flood warning and data acquisition system, *HydroTel* is a SCADA (supervisory, control and data acquisition) system and is capable of handling a wide range of field interfaces. It is also versatile in output and can direct messages to phone, pager, facsimile, modem or database. *HydroTel* handles alarms and data transfer to the Hamilton office.

Some of these sites are used for extreme event warning and are programmed with thresholds that trigger alarms, which are sent back to Waikato Regional Council's Hamilton office and then out to duty officers.

The telemetry system is also used to operate three floodgates (Lake Waikare Outlet, Whangamarino Control Structure and Te Onetea Stream) in the Lower Waikato Waipa Control Scheme and ten flood pumps on the lower Waihou flood scheme.

The locations of some telemetered stations can be found at:

Web river levels: <http://www.waikatoregion.govt.nz/riverlevelsandrainfall/cgi-bin/hydwebserver.cgi/catchments/details?catchment=17>

Web rainfall: <http://www.waikatoregion.govt.nz/riverlevelsandrainfall/cgi-bin/hydwebserver.cgi/catchments/details?catchment=16>

Latest readings and earlier data can be found using the web links shown above. For data from sites not listed please contact the following:

Email : infoREQ@waikatoregion.govt.nz

Phone: (07) 859 0999

Fax : (07) 859 0998

6 Usage of data

6.1 Information requests

Usage of archived data is significant. A database was set up during 1993 to monitor this usage and to ensure that all requests are satisfactorily and promptly answered. Figure 1 below shows the number of information requests actioned by Environmental Monitoring staff between 2008 and 2013.

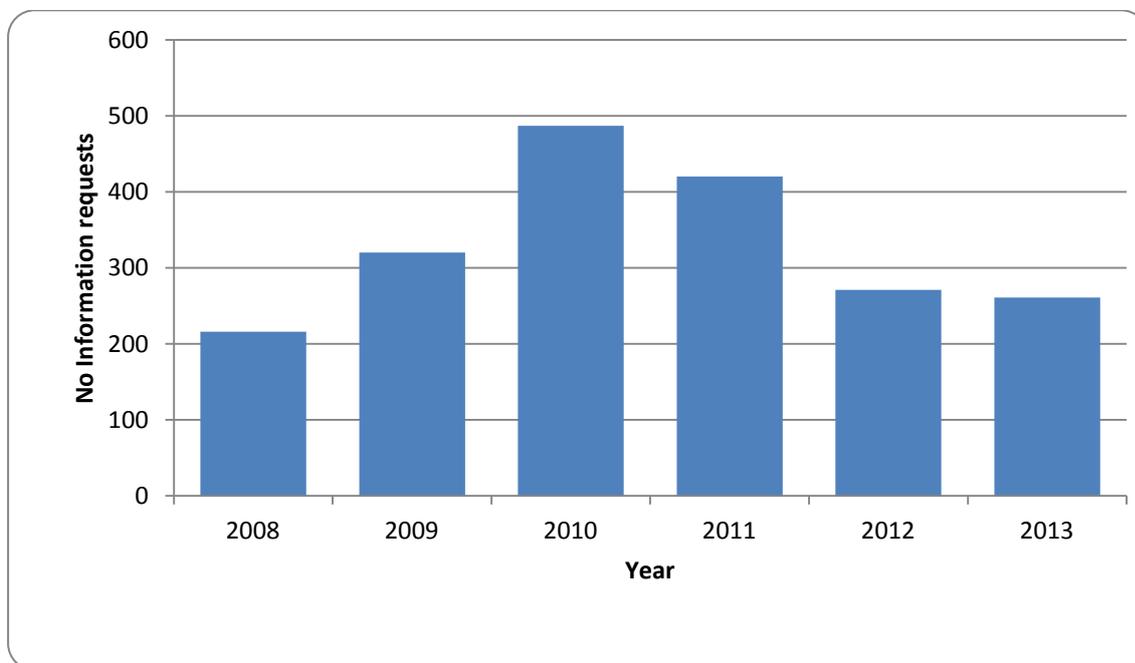


Figure 1: Information requests actioned by Environmental Monitoring staff, 2008 – 2013

Since the database is not accessible to all Waikato Regional Council computer users and agencies who contribute to the NIWA National Archive, the number of requests is likely to be well in excess of the number of requests logged and actioned. Also not included is real time data (available 24 hours per day and used in the flood warning, river system management) and the large number of data sets that are accessible to all staff through corporate applications and databases. e.g. GIS layers, Internet, Smartmaps. The decrease in requests since 2011 is due in part to more Environmental

monitoring data being published on the web and clients accessing the data directly rather than through the request system.

7 Rainfall data

7.1 General

Environmental Monitoring archives rainfall data collected by observers and from automatic stations. Additional sources of rainfall data include NIWA, Genesis Energy and Mighty River Power. Enquiries regarding NIWA rainfall data should be directed to the address shown below.

The National Climate Database

NIWA

PO Box 14-901

Kilbirnie

WELLINGTON

Email: climate-enquiries@niwa.co.nz

Tel: (04) 386 0300

Fax: (04) 386 0574

7.2 Manual sites

Manual sites are operated by observers who typically take readings of accumulated rainfall from a gauge each day at 9am. The results are returned to Waikato Regional Council every two months and are entered onto the computer database.

The archived data come from sites operated by Waikato Regional Council volunteers in the region.

7.3 Automatic stations

Where rainfall intensity information is needed, an automatic station is installed and readings of accumulated rain are taken every five minutes during each rain event. All gauges measure rainfall to a precision of 0.5 mm. Checks are carried out at each station at six weekly intervals. Most Waikato Regional Council stations are also telemetered for flood warning purposes.

8 Surface water level data

8.1 General

A manual surface water level station is used mainly in water resource allocation projects and water level readings taken are converted to flow using a rating.

An automatic surface water level station will typically measure the level of a stream, river, wetland, lake or coastal sea levels.

Levels are used for many purposes, including flood warning, resource management and resource consent applications.

8.2 Manual sites

The installation at a manual site typically includes a staff gauge in the water channel and one or more benchmarks. Greater emphasis is now given to correlating flow rather than establishing a rating; however if the control is stable, rating can be a cost-effective method of accumulating basic flow information.

8.3 Automatic stations

An installation includes a recorder and sensor, staff gauge and at least three benchmarks. Stations are visited typically at six weekly intervals to check recorder and sensors and a two yearly inspection check undertaken for changes in any of the reference points.

9 Water flow data

9.1 General

Water flow (discharge) may be measured using a number of techniques including volumetric measurement, chemical dilution, slope/area, float gauging, current meter gauging and acoustic doppler current profiling. The one most commonly used at Waikato Regional Council is acoustic doppler current profiling. Current meter gauging is still undertaken at some sites especially during low flow conditions.

9.2 Manual sites

A manual flow site has a site installation similar to that of a manual water level station, with perhaps structures such as slack lines, to assist in flow measurement. Flow gaugings are done on a regular basis to build up a level/flow relationship (rating). The accuracy of the rating required by the customer will determine the gauging frequency. A stream or riverbed that is unstable or affected by weed will necessitate more frequent measurements.

9.3 Automatic stations

A continuous record of flow at a station is obtained by combining water level data with the flow rating. To ensure that the rating is accurate over the range of recorded levels, it is important to gauge at low, medium and high levels. Flood events or channel modification due to flood events or engineering works may cause a rating change, which then requires another series of gaugings to define the new rating curve. Figure 2 below shows the size of the flow monitoring network 1990 to 2013.

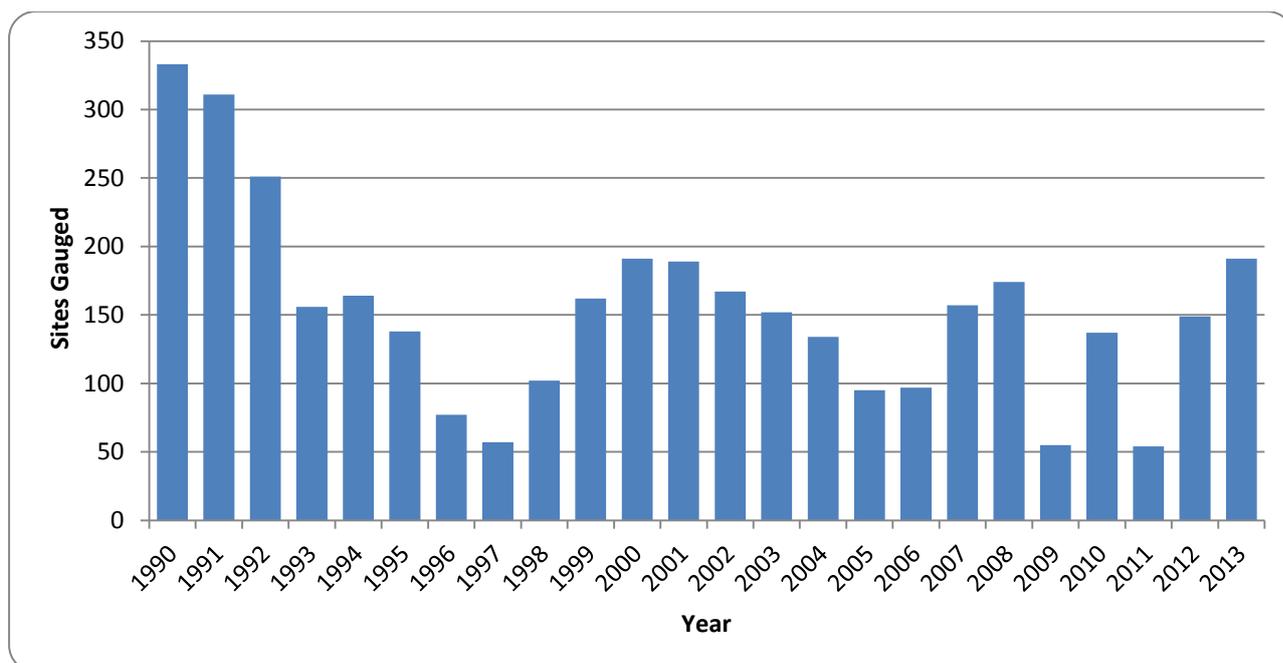


Figure 2: Size of flow monitoring network, 1990 – 2013

Gaugings are generally done only at sites where customers have requested flow information. Figure 3 below shows the number of gaugings completed between 1990 and 2013.

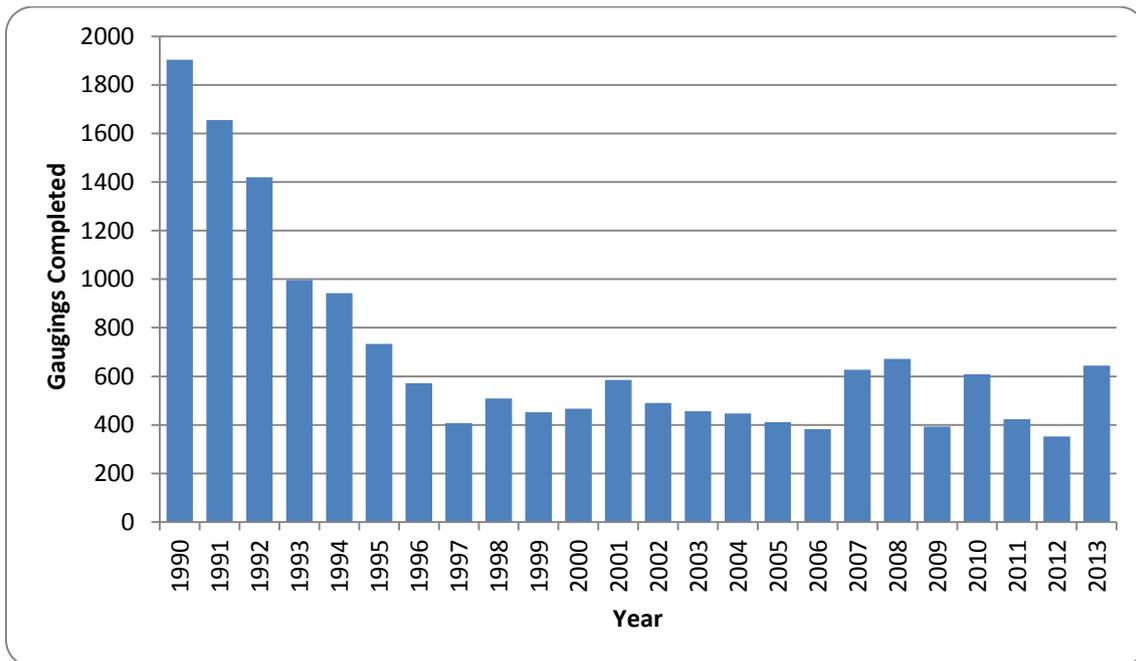


Figure 3: Number of gaugings completed, 1990 - 2013

10 Groundwater level data

10.1 General

Groundwater level is measured using a calibrated depth probe. These are checked for stretch on a regular basis.

Groundwater level measurements (both manually and automatically collected) are filed as the distance down from the top of the bore or well. The levels for these reference points have been surveyed in terms of Mean Sea Level.

It is important to contrast the above with surface water stations which operate above (not below) a specific reference level.

10.2 Manual sites

Previous emphasis in groundwater level data collection has been on manual observations; however adequate data has been collected to enable selected bores to predict levels at adjacent sites. In 2013, 431 individual bores were manually monitored. Figure 4 below shows the number of groundwater bores manually monitored between 1992 and 2013.

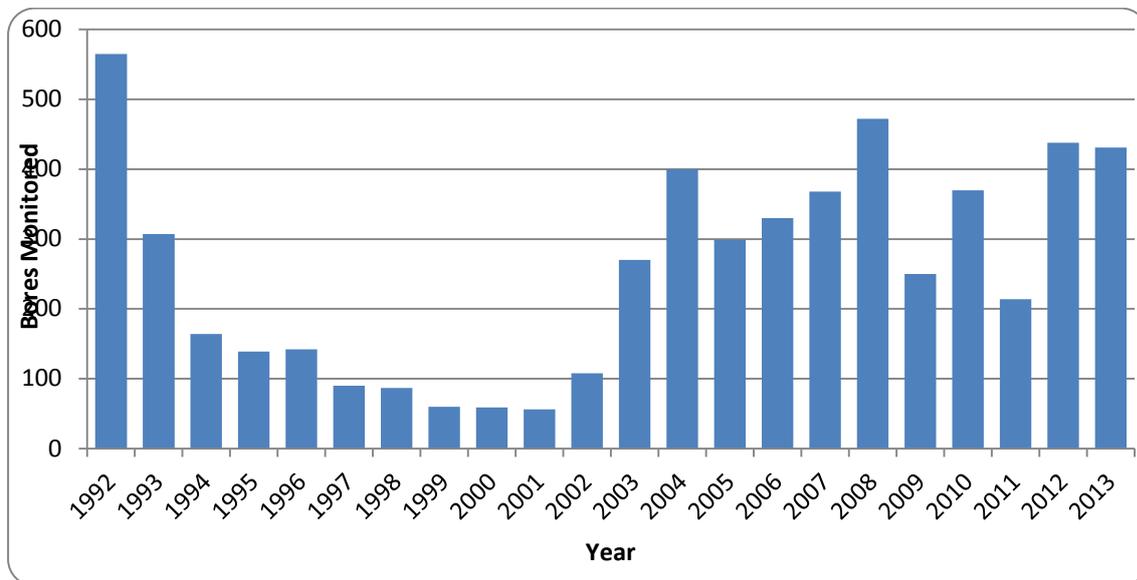


Figure 4: Number of bores in the groundwater level monitoring network (manual), 1992 – 2013.

10.3 Automatic stations

Ten automatic stations, continuously recording groundwater levels, were operating during 2013.

- Matamata Airfield - has 4 bores with continuous records. These bores are at depths of 9m, 20m, 40m and 163m deep.
- Hamilton - is a shallow 4 metre large diameter 750 mm bore, with a diver, measuring water level.
- Cooks Beach - is a shallow 11.0 metre deep bore, 50 mm in diameter, with a diver, measuring water level.
- Hahei Beach - is a shallow 10.6 metre deep bore, 50 mm in diameter, with a diver measuring water level and temperature.
- Opoutere - is a shallow 20 metre deep bore, 50 mm in diameter, with a diver measuring water level.
- Matarangi - is a shallow bore 6 metres deep bore, 25 mm diameter, with a diver measuring water level.
- Taupo - a thermal stream has a diver measuring level and temperature. There are 4 divers measuring water levels.

11 Surface water temperature data

11.1 General

Surface water temperature is measured manually and automatically at selected flow stations. Manual temperature readings may be taken at the time of flow gaugings and as part of regional water quality sampling.

11.2 Manual sites

Manual readings of water temperature are usually taken using a calibrated digital thermometer. Samples as part of flow gaugings are taken in the channel as far into the

flow as practicable. Temperature measurements are taken during water sampling collected mid-stream or from the stream bank.

11.3 Automatic stations

Water temperatures are taken at least hourly at automatic stations. Station inspections occur at 8 to 10 weekly intervals and manual readings with a calibrated digital thermometer are used to detect deviation of the logged temperature from the true temperature.

12 Water quality data

12.1 General

All Waikato Regional Council water quality results with a geographic location are stored in the database. Over 55000 analysis results were recorded in 2013; over 95 percent of these were related to a geographic location.

Automatic samples are also taken at selected sites for specific projects. These water quality measurements are taken using Datasonde logger/sensor instruments.

Reports on the regional rivers and Waikato river are available and can be obtained by contacting Waikato Regional Council's freephone 0800 800 401 or emailing inforeq@waikatoregion.govt.nz These reports are available on our website at <http://www.waikatoregion.govt.nz>

12.2 Manual sites

Water was sampled from lakes, rivers, streams, groundwater and the coast. The Regional River Monitoring project, with 1200 samples from 100 sites, is the largest project. The most comprehensive project is the Waikato River Monitoring Programme, which routinely determines 30 parameters at ten sites each month. The 2012 Regional River report is available at

<http://www.waikatoregion.govt.nz/PageFiles/26217/TR201313.pdf>

and the 2012 Waikato River report is available at:

<http://waikatoregion.govt.nz/PageFiles/28280/TR201312.pdf>

12.3 Automatic stations

12.3.1 Datasondes

Datasondes were deployed at six sites. Readings taken at 20 minute intervals typically measure water temperature, pH, dissolved oxygen and conductivity, with chlorophyll *a* and turbidity monitored at five sites and blue green algae at two sites.

DOpto Dissolved Oxygen loggers were deployed at 6 Piako and Waitoa sites from September 2012 to November 2013 logging every 15 minutes over that time.

12.3.2 Onset temperature loggers

Onset temperature loggers were deployed at thirty river sites. These loggers recorded water temperature at either 15 or 30 minute intervals.

12.4 Groundwater quality

In 2013 a total of 451 samples were taken from 253 groundwater sites which are broken into several monitoring programmes (Regional Groundwater, National

Groundwater monitoring program, Taupo Groundwater, Coromandel Groundwater, Waitetoko groundwaters and Pesticides and Nitrates programmes).

Regional groundwater monitoring is undertaken on an annual basis with 23 parameters determined for 107 sites. 29 sites are monitored quarterly as part of the GNS National Groundwater Monitoring Programme.

13 Suspended sediment data

13.1 General

Suspended sediment is currently sampled at 23 sites when appropriate river levels are reached in an effort to provide regional coverage of suspended sediment yield. Seven of these sites have ISCO automatic samplers installed. Sampling is conducted over the full range of flow conditions and from this the general relationship between flow and sediment concentration can be determined.

13.2 Manual sampling

Water samples are collected and analysed to determine sediment concentrations. The typical method used is depth integrated sampling whereby a sample is collected vertically through the entire water column at three predetermined distances across the channel. A single sediment discharge value can then be calculated from these three samples when they are combined with the concurrent flow gauging data.

13.3 Automatic sampling

The automatic sediment sampling programme was initiated in 1997 with seven sites presently having ISCO automatic water samplers installed (three further sites have previously had ISCO's installed). The automatically sampled data is calibrated by sampling manually simultaneously.

Table 2 details the sites where automatic samplers are currently deployed along with the corresponding start date and number of high flow events sampled.

Table 2: Current automatic sediment sampling sites

Site number	Source	Location name	Start Date	No. of events sampled
660.1	Optonui River	Downstream Awaroa Confluence	16/07/1999	65
1191.7	Waipa River	Otewa	01/10/2000	45
1167.4	Waingaro River	Ruakiwi Rd off SH22	10/06/2002	52
516.22	Matahuru Stream	Myjers	19/07/2006	33
476.7	Mangatutu Stream	Walker Rd Bridge	22/06/2004	53
1253.3	Waitomo Stream	Aranui Caves	24/09/1997	56
1312.1	Wharekawa	Adams Farm Bridge	20/04/2000	32

In March 2007 a turbidity sensor was added to the Waingaro river site. The aim is to be more effective in determining suspended sediment yields by establishing the relationship between suspended sediment concentration (SSC) and turbidity and then applying this relationship to the nearly continuous turbidity data to produce a record of estimated SSC. The product of river discharge and the estimated SSC is then used to obtain suspended sediment yield data.

A report on the effectiveness of the turbidity sensor was completed in 2013 (Doc # 2381975).

14 Ecological stream and river monitoring data

14.1 Regional ecological monitoring of streams

The Regional Ecological Monitoring of Streams (REMS) programme was established by Waikato Regional Council to assess the physical habitat and biological condition of streams and small river systems. It is a bio-assessment method using protocols developed by the New Zealand Macro invertebrate Working Group. Investigators use a series of habitat scores and benthic invertebrate community compositions as indicators of ecological condition.

Sampling involves evaluating habitat attributes throughout a representative 100-metre reach of each stream, followed by sampling of stream invertebrates and aquatic plants from representative stream habitat types with a kick net. Invertebrates are identified and counted to provide a picture of community structure.

Sites are either reference sites or monitoring sites. Reference sites were selected to represent relatively, unmodified stream habitats. Monitoring sites (random, long term, clean stream, project watershed, urban or restoration) provide information on the impact of major resource use in the Waikato region. Sixty randomly selected sites are sampled each year along with approximately 20 long term monitoring sites. Included in the sampling regime are 'clean streams' and 'project watershed' restoration sites. Usually 150 sites are monitored each year but approximately 170 sites were sampled in the 2012/13 due to an extra 20 reference sites being sampled for a one-off project.

14.2 Fisheries monitoring

Healthy and abundant fish populations are essential to maintaining the value of the region's water bodies. However, little is known about fish communities and for this reason, a fish monitoring programme was initiated in 2008/09 to develop a robust, standardised and cost efficient procedure for assessing fish communities in wadeable streams. This will be used to expand current routine monitoring of the region's ecological health and will be achieved by:

- Reporting on the state of fish communities in the Waikato region at selected sites through time;
- Identifying environmental factors related to stream ecological condition, and assist with developing policies that mitigate adverse effects on stream ecosystems;
- Selecting and monitoring a core set of sites to be used for informing flow setting and consent conditions in streams across the region;
- Determining baseline reference condition metrics for fish and other physical and chemical parameters in a number of unimpacted and impacted streams for use in setting restoration/rehabilitation targets for similar streams elsewhere in region;
- Establishing whether structures (e.g. culverts) have deleterious effects on aquatic biota and then retrofitting these structures and quantifying resulting changes in abundance and/or biodiversity.

At the 60 random monitoring sites mentioned in Section 1.1 freshwater fish surveys were undertaken in the large majority of these sites in order to monitor the fish communities present. These 60 sites are sampled on a three-yearly rotational basis whilst nine 'minimally impaired' reference sites are sampled on an annual basis. One pass electric fishing techniques are used at the majority of sites. However, where this method was not suitable (8 sites) netting/trapping protocols were used following the newly established New Zealand Freshwater Fish Sampling Protocols developed by Joy *et al* (2013).

Following the installation of a pest fish trap in the Lake Waikare fish pass at the end of 2012, this year saw the removal of tonnes of invasive pest fish such as Koi Carp, Goldfish and Brown bullhead catfish. Automated systems count, capture and remove targeted pest fish which are then manually processed and transferred into an automated organic bacterial digester. The final raw product has many potential applications which are currently under development. This has been a hugely successful project which has the potential to be expanded on a much bigger scale throughout the lower Waikato river system where pest fish are abundant.

15 Coastal monitoring

15.1 Regional estuary monitoring programme

The Regional Estuary Monitoring Programme (REMP) was established by Waikato Regional Council for the purpose of monitoring the long-term changes in benthic macro fauna communities and the sediments they live in which may occur as a direct or indirect consequence of catchment activity and/or estuary development.

Currently the REMP involves routinely monitoring five permanent sites in the southern Firth of Thames, three sites in Whaingaroa (Raglan) Harbour and five sites in Tairua Harbour. The ecological component is based on monitoring a suite of 26 “indicator” species/taxa characteristic of intertidal communities. Sampling involves the collection of 10 - 12 replicate core samples (13 cm diameter and 15 cm deep) from a permanent 5625 – 10,000 m² area at each permanent site. Macro fauna are separated from the sediment by sieving (500 µm mesh), preserved with 70% isopropyl alcohol (in tap water) and stained with 0.1% Rose Bengal. In the laboratory, the macro fauna are sorted, and the indicator species/taxa identified and counted. The sediment component of the REMP involves the collection of sediment samples from each site for the analysis of a suite of parameters including surface sediment grain size distribution, organic matter content and pigment concentration. The rate of deposition/erosion at each site (in Whaingaroa (Raglan) Harbour and Firth of Thames) is measured using square concrete tiles (0.3 x 0.3 m) buried to a depth of 0.2 m, where the distance from the sediment surface to the plate is measured using knitting needles. Macro benthic community composition and measured sediment variables are analysed using multivariate statistics. Trends in environmental gradients and macro benthic communities can then be used to infer estuary health. A dedicated website for the Regional Estuary Monitoring Programme can be found at www.waikatoregion.govt.nz/REMP.

15.2 Beach profiles

Beach profile sampling is done to monitor dune erosion. Many beaches on the Coromandel Peninsula (predominantly the eastern seaboard) are in the network. The frequency of sampling depends on the occurrence of storm events and demand for data, but is typically done three monthly.

The number and spacing of manual sites (profiles) along each beach is determined by historical and potential damage to property on the frontal dunes. Consideration is also given to Waikato Regional Council’s responsibility to collect baseline data as outlined in the Resource Management Act.

Each profile is referenced to a benchmark of known level and distance to enable comparison. Each survey runs from this point toward and beyond the water's edge. All surveys were converted to one common datum.

The archive containing the profile data has been amalgamated with that of NIWA and now includes their data collected prior to March 1997, along with all Waikato Regional Council data.

Surveys also include photographs of the profile from four positions: seaward, landward, up and down the beach.

At present consultants survey profiles from Whiritoa to Whangapoua inclusive on a regular basis (usually two-monthly). Waikato Regional Council's emphasis at present is to survey the remainder of the network, where possible in conjunction with this work. Sites involved are from Port Jackson to Kennedy Bay and at Opoutere Beach.

Sites north of Coromandel township are profiled three monthly. They were profiled in March (17 profiles completed), June (17), September (17), and December (17). The sites at Opoutere were profiled in March (5 profiles completed), June (5), September (5), and December (5). The three sites immediately to the south of the Whangamata harbour entrance were surveyed in March, June, September and December.

The 5-7 sites along the rock wall at Buffalo Beach were surveyed in January, June and November. 9 surveys were also done at the Tairua Harbour in July to monitor the beach prior to scheduled sand dumping.

16 Geothermal data

16.1 General

Areas which are monitored for groundwater, or have the potential to be, commercial geothermal sources of energy are regularly monitored. These areas include Ohaaki, Wairakei and Taupo.

Geothermal surface features are monitored quarterly. The aim of the monitoring is to observe the natural state of geothermal surface features and assess what changes are occurring over time, reporting on any threats or damage to the features. Quarterly monitoring includes the following areas: Ngatamariki, Orakei Korako, Tauhara, Waikite Waiotapu and Whangairohe. Additionally annual monitoring is carried out at Atiamuri, Horohoro, Reporoa, Rotokawa, and Te Kopia. Three quarterly Internal Series reports and one Annual Technical Report are completed for each year monitored.

16.2 Methodology

Groundwater levels are taken six weekly from a representative network of 23 bores. Levels in 5 additional bores in Taupo are measured twice yearly.

Water temperature profiles are also constructed for some of these bores using a calibrated thermocouple, which is lowered down the bore.

Flows from De Brett's hot pools and Spa Road hot water springs are measured using calibrated weirs. Water temperature is also taken.

Geothermal surface feature temperatures are measured using a Fluke Infra Red (IR) gun and a 6m long thermocouple. pH indicator paper has been used to determine pH, samples are cooled before being tested. Flow is estimated where it is visible, as is water level where it could be compared to a benchmark or is overflowing. Photographs are taken to compare with previous visits. An infrared camera is used to capture temperature fluctuations across a feature.

17 Air quality

17.1 Ambient air quality monitoring

Air quality monitoring was carried out by Waikato Regional Council at a number of sites within the region during 2013. These included East Hamilton (Peachgrove Road), West Hamilton (Corner Ohaupo Road and Lorne Street), Tokoroa, Te Kuiti, Taupo, Matamata, Putaruru, Ngaruawahia, Cambridge, Te Awamutu and Turangi. Monitoring at Matamata and Ngaruawahia sites finished in April 2013 because no exceedences were recorded in the 3 year period prior to 2013. The site instrumentation from Matamata and Ngaruawahia was transferred to new sites in Cambridge and Te Awamutu where monitoring commenced in May and June respectively. The East Hamilton (Peachgrove Road) site was closed down in October 2013 due to new owners of the property. This site will be relocated to Claudelands showgrounds early in 2014.

In Hamilton, concentrations of suspended particles (PM_{10}), and benzene were measured at the Peachgrove Road air quality monitoring site. In addition, benzene monitoring was carried out at “traffic peak” monitoring sites in Bridge Street, Victoria Street, London Street, Greenwood Street and Peachgrove Road near the Peachgrove Intermediate School. In Taupo, Te Kuiti, Tokoroa, Matamata, Putaruru, Ngaruawahia Turangi, Cambridge and Te Awamutu monitoring was carried out for PM_{10} . The West Hamilton site monitored PM_{10} , Carbon Monoxide (January to March) and Oxides of Nitrogen (April to September).

Information on the air quality indicators can be found on the following web page:

<http://www.waikatoregion.govt.nz/Environment/Natural-resources/Air/Air-around-the-region---map/>

Information regarding local fine particle (PM_{10}) levels as recorded at our air quality monitoring sites can be found at:

<http://www.waikatoregion.govt.nz/Environment/Natural-resources/Air/Air-quality/Fine-particle-levels-in-the-air/>

18 Clean streams

18.1 General

Clean Streams is a Waikato Regional Council project to encourage and support farmer efforts to reduce the impacts of farming on waterways. Fencing off streams, lakes, rivers and wetlands to keep stock out of them is one of the most effective ways of protecting waterways from the effects of farming. The fenced area filters out pollutants and can be planted with trees and shrubs to further enhance the environment.

The initial monitoring period runs for 10 years starting in 2003 with nine representative sites currently monitored throughout the region. The monitoring approach includes the recording of stream temperatures, ecological sampling, and the taking of water samples for turbidity analysis. The results of this monitoring can be used as indicators of the quality of stream habitat. At each location a control site is also monitored to illustrate that any changes in stream temperature observed over time are a result of fencing and planting along a given reach of stream rather than some other external factor. Photographing the planted and fenced reaches of stream is another part of the monitoring strategy and is undertaken to provide a visual reference of change.

The initial data sets will provide baseline information to which subsequent data can be compared.

18.2 Methodology

Water temperature loggers are deployed in the stream securely attached to a metal stake driven into the stream bed. Typically the loggers are deployed in early December and retrieved in March to capture the higher summer water temperatures which are most likely to influence stream habitat.

The ecological monitoring is a bio-assessment method using protocols developed by the New Zealand Macro invertebrate Working Group. Investigators use a series of habitat scores and benthic invertebrate community compositions as indicators of stream ecological condition. This monitoring is conducted in mid-summer.

Water samples are taken downstream and upstream of the planted/fenced reach of stream for turbidity analysis to determine if water clarity changes through the reach. These samples are taken when the temperature loggers are retrieved toward the end of summer.

Photos are taken starting at the location of the logger downstream of the planted and fenced reach moving upstream into the upper stream reaches. The photos are taken when the temperature loggers are retrieved.

19 Catchment environmental monitoring

19.1 General

As part of Project Watershed and Peninsula Project implementation, the Catchment Environmental Monitoring (CEM) Programme was established to demonstrate the long term benefits of soil conservation. To date monitoring has been established in selected priority soil conservation catchments in the Waipa, Lower Waikato, Upper Waikato and Coromandel management zones. The monitoring period will initially run for 10 years starting in 2003.

The aim of the CEM programme is to provide a representative (and where possible quantitative) indication of changes in various environmental parameters resulting from soil conservation and river management work. Parameters include changes in hill slope erosion, sedimentation in surface water, water temperature and in-stream ecological habitat. Stream bank erosion, riparian vegetation and fencing are monitored in the Riparian Characteristics Survey (RCS), completed once every two years in each priority catchment. Technical reports are completed annually detailing the results for the previous year.

19.2 Methodology

The RCS monitoring involves field observations in selected catchments to quantify estimates of the amount of fencing, vegetation, and erosion along a series of 1 kilometre stretches of riparian margin. The data is collected with GIS software using a handheld computer. In conjunction with the RCS survey, photo points are taken at 250 metre intervals to provide a visual reference of change.

Water temperature loggers are deployed both downstream and upstream of where soil conservation work has commenced or is planned. It is anticipated that as planted vegetation along the treated reach of stream grows and increases shading influence over the stream, the temperatures recorded at the downstream site will decrease relative to the temperatures recorded at the upstream site. Typically the loggers are deployed in early December and retrieved in March so as to capture the higher summer water temperatures as these are most likely to influence stream habitat.

The ecological monitoring is a bio-assessment method using protocols developed by the New Zealand Macro invertebrate Working Group. Investigators use a series of habitat scores and benthic invertebrate community compositions as indicators of stream ecological condition. This monitoring is conducted in mid-summer.

Water samples are taken downstream and upstream of the planted/fenced reach of stream for turbidity analysis to determine if water clarity changes through the reach. These samples are taken when the temperature loggers are retrieved toward the end of summer.

20 Updates to report

Environmental Monitoring will continue to collect environmental information and will update and modify this report as necessary.