
# Beachwatch Partnership Pilot Program
# And
# Wet Weather Monitoring Program

# Final Report

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# 1. INTRODUCTION

## 1.1 Background

Over the past 12 years Ballina Shire Council has been engaged in a recreational water quality-monitoring program for faecal coliforms during the swimming season (October to March) on a monthly basis. Algae levels in Lake Ainsworth have also been monitored by Council over the past 7 years.

To further develop this existing water quality monitoring program, Ballina Shire Council received a grant of $19,625 in September 2002 from the Environment Protection Authority (EPA) to participate in the Beachwatch Partnership Pilot Program (BPPP).

The BPPP was conducted during the period October 2002 to April 2003. The ten (10) sampling sites selected for the program were popular locations used by the community for swimming and other primary contact recreation activities such as surfing and diving and included Lake Ainsworth, ocean beaches, estuaries and lakes (see Figure 1). A total of eighteen (18) individual sampling points are located at these sites.

Following completion of the BPPP in April 2003, Ballina Council received further funding from the EPA to carry out water quality monitoring during wet weather events, known as the *Extended Beachwatch Program, Wet Weather Monitoring or Wet Weather Monitoring Program (WWMP).* Sites already monitored during the Beachwatch Program which were selected for the WWMP were Shelly Beach, The Serpentine, Shaws Bay, Prospect Lake and Banyanda Lake.

The WWMP is Ballina Shire Council's first step in developing a database for wet weather water quality information. This database will provide Council with information to better understand water quality during and after rain events. Ballina's sub-tropical climate brings not only an extended swimming season but also NSW's highest and most intense rainfall. It is a combination of these factors that makes the WWMP a very worthwhile and beneficial program for Ballina Shire Council.

The EPA's Draft Information Package and Field Manual for Monitoring and Reporting Coastal Recreational Water Quality (2002) provided the practical information used in the design, implementation and reporting of both water quality monitoring programs.

The term 'primary contact recreation activities' is generally referred to as 'swimming' throughout this document but includes water activities such as diving, water skiing, surfing and windsurfing.

This report describes the results of the Beachwatch Program and Wet Weather Monitoring Program. Chapters 2 and 3 outline the design and implementation of both water quality monitoring programs. Chapter 4 outlines laboratory analysis and the management of data. Chapter 5 outlines the methods in which data collected during both programs are analysed and a summary of results. Chapter 6 provides a description of each sampling site and an assessment of the water quality data.

## 1.2 Program Objectives

The overall objective of the Beachwatch Partnership Pilot Program and Wet Weather Monitoring Program is to ensure the provision of safe recreational waters for residents and tourists and to provide the community with guidance on when to avoid swimming at particular locations.

The specific objectives of the BPPP are:

- To raise community awareness and understanding of water quality impacts associated with recreational water use.
- To improve the consistency and quality of recreational water quality monitoring undertaken by Ballina Shire Council.
- To increase community access to information on recreational water quality i.e., to provide the public with regular assessments of pollution levels at major swimming areas within Ballina Shire Council.

The specific objectives of the WWMP are:

- To commence the development of a database containing water quality information during and after wet weather events.
- To analyse data to determine trigger levels i.e. the minimum amount of rainfall that causes bacterial levels to exceed guideline limits.
- To analyse data to determine pollution recovery rates i.e. the time taken for water quality to return to a level suitable for swimming after rainfall.
- To nominate sites requiring further investigative sampling in order to identify pollution sources and recommend pollution abatement measures.

**Figure 1: Location of Sample Sites within Ballina Council**

## 2. STUDY DESIGN

Table 1 outlines the structure of the Beachwatch and Wet Weather Monitoring Programs, including the scope of the study, monitoring locations, sampling frequency and measurement parameters.

**Table 1: Study Design for BPPP and WWMP**

| STUDY TYPE | STUDY SCOPE | SAMPLING DESIGN | | |
|---|---|---|---|---|
| | | MONITORING SITES | SAMPLING FREQUENCY | MEASUREMENT PARAMETERS |
| Beachwatch Partnership Pilot Program - BPPP (Guideline Compliance Assessment) | Dec 2002 - April 2003 | • Lake Ainsworth - Freshwater lake<br>• Shaws Bay – Estuary<br>• Boulders Beach- Surf Beach<br>• Sharps Beach - Surf Beach<br>• Prospect Lake - Estuary<br>• Banyanda Lake - River<br>• Seven Mile Beach - Surf Beach<br>• Shelly Beach - Surf Beach<br>• Lighthouse Beach-Surf Beach<br>• The Serpentine - Estuary | Five samples collected each month plus weekly algal samples from Lake Ainsworth. At beaches, a single grab sample was taken at knee depth from the 'swash zone', and between the flags at patrolled beaches. At each river and lake, a total of 3 samples were collected to achieve a geometric mean. The distance between each sample was 80-250m.<br>Physico-chemical parameters were measured in-situ using a Horiba water tester. Readings were recorded on field data sheets and will be later entered into a computer database. | (1)Algal Samples at Lake Ainsworth<br>(2)Microbiological<br>(3)Physico-chemical measurements<br>(4)Field Observations |

| | | | | |
|---|---|---|---|---|
| Wet Weather Monitoring Program - WWMP (Alternative Sampling Strategy) | May 2003 – July 2003 | • Shelly Beach – Surf Beach<br>• Shaws Bay – Estuary<br>• Prospect Lake – Estuary<br>• Banyanda Lake – River<br>• The Serpentine - Estuary | Three consecutive days of sampling - last day of rain plus two days after cessation of rain. Additional dry-weather samples were collected once a month. | (1)Microbiological<br>(2)Physico-chemical measurements<br>(3) Field Observations |

Note:
Algal analysis for blue green algae identification
Microbiological analysis for faecal coliforms (FC) and enterococci (Ent) – see notes *
Physico-chemical measurements include pH, conductivity, turbidity, dissolved oxygen, temperature
Field Observations include stormwater flow and pollution, sewage pollution, odours/frothing and surface scums

*As most pathogenic organisms i.e. organisms that cause disease in humans, are not easily detected in water, indicator organisms such as faecal coliforms and enterococci are used as a monitoring tool for assessing the potential presence of pathogenic organisms. It is recognised that faecal coliforms and enterococci be used to provide an indication of potential health risks associated with swimming in contaminated water.

Faecal coliforms are almost exclusively associated with faecal waste and are therefore excellent indicators of faecal contamination. However, due to their short survival time in seawater, they are limited to the detection of recent contamination. Enterococci on the other hand survive for long periods in seawater and therefore are good indicators of aged faecal contamination (EPA, 2002).

## 3. MONITORING PROGRAM

To ensure correct documentation and field sampling techniques during the Beachwatch and Wet Weather monitoring programs, procedures were conducted in accordance with the EPA's Draft Field Manual for Monitoring and Reporting Coastal Recreational Water Quality (2002).

To safeguard against corruption of data, quality assurance and quality control procedures were in place during all monitoring stages; equipment preparation, field notations and sample collection, storage and transportation. Quality control procedures for samples included the collection and analysis of container blanks, field blanks and trip blanks.

Occupational, health and safety factors were also addressed during the design and implementation of the monitoring program to ensure the health, safety and welfare of employees.

## 4. LABORATORY ANALYSIS AND DATA MANAGEMENT

### 4.1 Laboratory Analysis

Microbiological samples collected during both water quality monitoring programs were couriered to the Northern Rivers Pathology Services, Lismore Base Hospital on the same day as sampling and analysed for the presence of two indicator organisms, faecal coliforms and enterococci. Results were available approximately 2-3 days after delivery of the samples.

Algal samples collected from Lake Ainsworth were couriered to Tweed Laboratories, Banora Point for blue green algae identification and algal count. The North Coast Regional Algal Coordinating Committee (NCRACC) protocol guides the Council as to when the public should be warned against recreational contact with water. Results were generally available within 24 hours.

Both laboratories were NATA accredited for the analyses they undertook.

### 4.2 Data Management

Microbiological and algal analysis reports were electronically mailed to Council. Upon receipt of the laboratory report, the data was checked for any anomalies and if any were identified, field sheets were cross-checked to determine possible reasons for the result.

Microbiological and algal laboratory reports are stored in hard copy and in excel databases. Original field sheets containing physico-chemical measurements are currently in hard copy and will be entered into a database at a later date. Physico-chemical measurements were pH, conductivity, turbidity, dissolved oxygen and temperature.

## 5. DATA ANALYSIS AND INTERPRETATION

This section of the report analyses and interprets microbiological data collected during both monitoring programs. Site descriptions and compliance assessments for each sample site are provided in Chapter 6.

As recommended by the EPA, the 1990 National Health and Medical Research Council (NHMRC) *Australian Guidelines for Recreational Use of Water* were used to assess water quality data collected during both programs.

The physico-chemical measurements recorded as part of the routine sampling run were not used in the assessment of the suitability of water quality for primary contact recreational use as this information does not affect the overall compliance. The physico-chemical data will be used to establish background levels for individual sites at a later date.

In regard to algal sample analysis, Ballina Council follows the protocol set by the North Coast Regional Algal Coordinating Committee (NCRACC) for recreational water when determining whether health warnings are necessary.

Warning signs are erected at Lake Ainsworth when blue green algae concentrations exceed 15,000 cells per ml and/or when concentrations of algae (slick or scum) are present. The signs are removed when two consecutive counts of less than 10,000 cells per ml are recorded and no slick or scum is present.

### 5.1 Beachwatch Partnership Pilot Program

Data collected during the BPPP was assessed against the NHMRC guidelines. Monthly compliance of microbiological levels was determined as a pass or fail and then calculated as a percentage compliance for the length of the swimming season.

The pass/fail recreational water quality results were disseminated to the local community of Ballina via a four star rating advertisement placed in the North Coast Advocate each week (Figure 2). An enquiries number and the EPA's website were included in the advertisement for residents requiring further information.

**Summary of Beachwatch Results**

Beachwatch sites within Ballina achieved a high level of compliance during the October 2002 to April 2003 summer period. Of the eighteen (18) sampling points monitored during the BPPP, eleven (11) sampling points complied 100% with faecal coliform and enterococcal guideline limits. The level of microbiological compliance of Beachwatch sites is shown in Figure 3.

Figure 3 shows the number of months during which sufficient samples were collected for compliance assessment to be conducted and the number of months during which sites complied with the NHMRC guideline criteria. Due to insufficient sample numbers being collected at certain times, a compliance calculation for each month was not possible at any of the sampling sites.

All five ocean beach sites complied 100% with guideline limits during the six months of monitoring. Sites that at times did not comply with NHMRC criteria during the Beachwatch Program were the estuarine sites of Banyanda Lake, Prospect Lake and Shaws Bay.

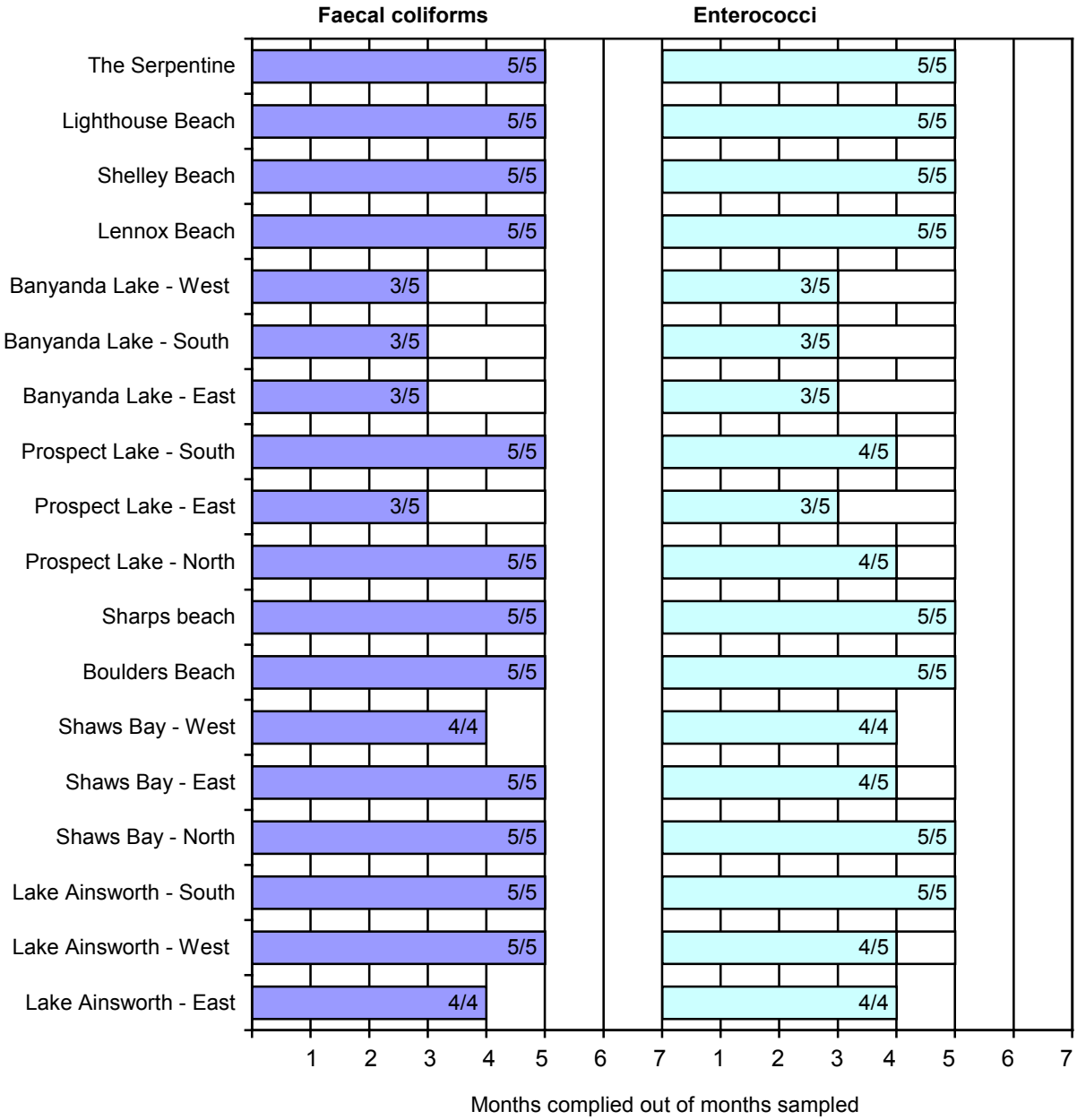
All three sampling sites (east, west and south) on Banyanda Lake exceeded guideline limits for enterococci during the months of February, March and April. Faecal coliform levels exceeded guideline limits during March and April.

**Figure 2: Beachwatch Newspaper Advertisement**

During April, enterococcal levels exceeded guideline limits at all three sampling sites at Prospect Lake (north, east and south). Faecal coliform levels were also above guideline limits at the eastern sampling point of Prospect Lake during April.

The eastern sampling site at Shaws Bay failed to comply with enterococci guideline limits in March. Microbiological assessment at the western sampling site during March was unable to be performed as the sample leaked during transit.

**Figure 3: Microbiological Compliance of Ballina Council Beachwatch Sites (October 2002 – April 2003)**




Source: Environment Protection Authority

## 5.2 Wet Weather Monitoring Program

As this is the first time Ballina Shire Council has collected this particular suite of water quality data during wet weather events, statements made in this report regarding data and models do not provide perfect predictions of actual conditions, only estimates of current conditions (EPA, 2002). The accuracy of trigger level predictions using rainfall-based models will become more accurate in the longer term as more data is collected and added to the model. Recovery rate predictions will also become more accurate with more data.

It is noted that an extreme wet weather event occurred on the 26 June 2003, when 190mm of rain was recorded at the Ballina Airport rain gauge. The intensity of this rainfall caused extreme pollution levels at all sampling sites and which continued at some sites during the dry weather conditions that followed. The microbiological results recorded following this event may have distorted trigger level and recovery rate predictions and this should be considered when reading these results.

It is also timely to mention that northern NSW experiences flood events and whilst there was no flood during the period covered by this report, a significant flood in the Richmond would almost certainly impact on water quality for considerable lengths of time (possibly weeks) at the previously mentioned sites. Predicted trigger levels and recovery rates determined in this report therefore could not be relied upon during such events. Water quality at ocean beaches would also experience high pollution levels due to the northerly long shore drift, particularly those beaches located closest to the mouth of the Richmond River such as Lighthouse Beach and Shelly Beach.

Rainfall figures used for wet weather data analyses were recorded by the Bureau of Meteorology from the rain gauge located at the Ballina Airport.

Microbiological data collected during the wet weather monitoring program was assessed to determine:

a) non-compliance dry weather sampling
b) trigger levels
c) recovery rates

**(a) Non-compliance dry weather sampling (May to July 2003)**

Microbiological data collected during the non-compliance dry weather sampling could not be referenced to the 1990 NHMRC water quality guidelines to determine a pass or fail or a percentage compliance. Instead, the median, 4/5, and geometric mean values for faecal coliform and enterococci were used to *conservatively estimate the suitability for swimming*.

**(b) Trigger Levels**

To determine trigger levels for each swimming location, a rainfall-based model was developed. The objective of the model is to determine the minimum amount of rainfall that caused microbiological levels to exceed median guideline limits. This serves as a management tool for developing advisory warnings or closure procedures.

Trigger levels for each sampling site were established by sorting microbiological data under rainfall categories determined by the volume of rainfall recorded on the day of sample collection. The median bacterial density of each rainfall grouping was calculated for both faecal coliform and enterococci and compared against guideline

limits. Data used in the rainfall-based models included all wet weather data and Beachwatch data, for the period January to April 2003.

**(c) Recovery Rates**

Recovery rates indicate the time it takes for water quality to return to a level suitable for swimming after rainfall. This is determined by using data collected during and after a range of wet weather events. As the amount of data collected during the wet weather monitoring program is not sufficient to determine recovery rates using the method recommended by the EPA, daily microbiological levels recorded during two separate rain events have been analysed for the purpose of this report. The geometric mean for faecal coliform and enterococcal densities were plotted against the three consecutive days of sampling and assessed against the guideline limits.

In this report, the two rain events used to assess recovery rates occurred between 7-9 May and 27–29 June 2003. Rainfall recorded on 26 June was 190mm and therefore analysis of water quality following this wet weather event provides an extreme case at the monitored locations.

**Summary of WWMP Results**

In general, water quality at all five (5) sampling sites showed an increase in microbiological levels following rainfall. This was evident when microbiological levels recorded during wet weather were compared against microbiological levels recorded during dry weather. However, the degree in which water quality at each site was affected by rainfall varied significantly depending on factors such as the catchment area, tidal flushing rates and surf dynamics.

The highest microbiological levels were recorded in Banyanda Lake and Prospect Lake. The lowest faecal contamination levels were recorded at Shelley Beach and Shaws Bay, followed by The Serpentine.

Lower microbiological levels at Shelley Beach, Shaws Bay and The Serpentine can be attributed to quicker flushing times and better dilution and dispersion capacity. With all three sites located on large open water bodies, the Pacific Ocean, the Richmond River and North Creek respectively, capacity to dilute and disperse pollutants associated with rainfall is much greater than in semi-enclosed water bodies such as Banyanda Lake and Prospect Lake.

The higher microbiological levels of Banyanda Lake and Prospect Lake can be attributed a number of factors including slower flushing rates, poor dilution and dispersion capacity, the quality of the water in the local tidal region, their distance to clean oceanic waters and variations in catchments.

**Non-compliance dry weather sampling results**

During the non-compliance dry weather monitoring from May to July, all five sites met the median guideline limit for faecal coliforms.

Enterococcal guideline limits were exceeded at two of the five sampling sites. Banyanda Lake exceeded enterococcal levels in May and June and Prospect Lake exceeded enterococcal levels during June only. These results indicated these waters may have been contaminated by aged sewage matter at the time of sampling and were unsuitable for swimming.

**Trigger Levels**
Trigger levels for each sampling site varied significantly, with Shelley Beach and Shaws Bay displaying the highest rainfall-category trigger levels for enterococci and no trigger level for faecal coliform exceedence. Predicted rainfall trigger levels for each site are shown in Table 2. Rainfall-models developed for each site are provided in Appendix A.

**Table 2: Predicted Rainfall Trigger Levels for Sampling Sites.**

| SITE | TRIGGER | LEVELS |
|---|---|---|
| | Faecal coliforms (FC) | Enterococci (Ent) |
| Banyanda Lake | 0-10mm | 0mm |
| Prospect Lake | 10-20mm | 0mm |
| Shaws Bay | None of the median microbiological densities in any rainfall category exceeded 150cfu/100mL. | 10-20mm |
| The Serpentine | 20-40mm | 0mm |
| Shelly Beach | None of the median microbiological densities in any rainfall category exceeded 150cfu/100mL. | 20-40mm |

Note*:
The median guideline limit for enterococci is 33cfu/100mL
The median guideline limit for faecal coliforms is 150cfu/100mL

**Recovery Rates**
Following the two rain events during May and June, Shelley Beach indicated the fastest recovery rate. Water quality at this beach had returned to an acceptable standard for swimming 24 hours after rainfall i.e. faecal coliforms did not exceed guideline limits during both rain events whilst enterococcal levels had returned to an acceptable standard for swimming 24 hours after rainfall.

For the remaining four sites monitored during the wet-weather program, enterococcal levels remained above guideline limits even after 48 hours of relatively little or no rainfall. Whilst enterococcal levels fell during this time they remained above acceptable guideline limits.

## 6. SAMPLE SITE DESCRIPTION & COMPLIANCE ASSESSMENT

### 6.1 Seven Mile Beach, Lennox Head

**Site Description**
Seven Mile Beach is 8.4km long stretching between Lennox Head and Broken Head. It forms part of the Cape Byron Marine Park which was declared in November 2002. This beach crosses between the two local government areas of Ballina Shire and Byron Shire Councils.

Seven Mile Beach is a very popular swimming beach for local residents and tourists and receives high usage during the swimming season by swimmers, surfers, four-wheel drive enthusiasts and beach anglers. Swimming at the southern end of the beach is very popular with young families at low tide as an outer reef creates a safe swimming area.

From the southern end of Seven Mile Beach to the Surf Life Saving Club near Lake Ainsworth, a narrow sand dune system separates the township of Lennox Head and the beach. A variety of vegetation communities occur between Seven Mile Beach and Byron Bay Road including heathland, forest and woodland and shrubland

The sampling site was located near the main swimming area, adjacent to the surf life saving club near Lake Ainsworth. Lifeguards patrol this area of the beach during the peak usage period of the summer months (refer to Figure 4).

**Priority:** High

**Pollution Sources**
A stormwater drain which collects surface runoff from the township of Lennox Head discharges at the southern end of the beach, near the boat channel.

**Guideline Compliance Assessment (Beachwatch Program)**
Faecal coliform and enterococcal levels at Seven Mile Beach complied with swimming guidelines 100% during the BPPP.

**Actions**
There are no specific actions identified for this beach.

Figure 4:  Seven Mile Beach, Lennox Head

## 6.2 Lake Ainsworth, Lennox Head

**Site Description**
Lake Ainsworth is a freshwater coastal dune lake located at the northern end of the township of Lennox Head. The lake is not only a unique natural asset to the area but also an important asset economically as it attracts many tourists. Lake Ainsworth is a very popular swimming spot for local residents and tourists with the main swimming area located at the south-eastern corner of the lake. Wind surfing, sailing and canoeing are other water activities enjoyed on the lake.

Land uses around the lake include The Lake Ainsworth Caravan Park and urban development to the south, the Department of Sport and Recreation Centre to the north and the surf life saving club to the east. Coastal heath vegetation covers the area west of the lake, which is managed by the Department of Sport and Recreation. Land immediately surrounding the southern half of the lake is a public recreation reserve and land at the northern end is both a "bird and animal" sanctuary and a reserve for fitness and physical education (AWACS, 1996).

For several years the lake has experienced algal blooms, primarily during the spring and summer months from September to March. These blooms have caused concern to Ballina Council as they not only present a health risk to humans and animals but also may impact on the recreation and tourism of the area.

The three sampling sites monitored at Lake Ainsworth were located near the most popular swimming spots on the lake, at the southern half of the lake (refer to Figure 5).

**Priority:** High

**Pollution Sources**
The surface runoff catchment of the lake is about six times the lake surface and comprises of a relatively narrow band of less than 300m wide around the west, south and eastern sides and extends 1.5km to the north (AWACS, 1996).

Potential pollution sources include surface runoff from the Lake Ainsworth Caravan Park, Pacific Parade and the Sport and Recreation Centre. Three stormwater drains at the southern end of the lake also discharge pollutants directly into the lake.

**Guideline Compliance Assessment (Beachwatch Program)**
Faecal coliform and enterococcal levels in Lake Ainsworth complied with recreational swimming guideline limits 100% of the time during the summer 2002-2003 period.

**Algal Sampling Results**
Quoting from a report prepared by Council in May 2003 to the North Coast Regional Algal Coordinating Committee:

"Lake Ainsworth has been affected by blue green algae (the most persistent species being *microcystis*) for the majority of the 2002/2003 summer swimming season, with the exception of a 3 week period during January when the signs were down.

Algal warning signs were originally placed on the 24 October 2002 and removed on the 7 January 2003 when algal counts dropped. They were re-erected on the 29 January when algal slicks became evident and algal counts exceeded 20,000 cells per ml. Signs remained up until 3 April when a second algal count below 10,000 cells per ml was recorded and visible algae was minimal. Monitoring since that date has showed a generally declining count with blue green species persisting until 24 June 2003.

Whilst persistent for a very long time the actual counts of algae this summer have been considerably less than some of those encountered prior to the aeration scheme being implemented. Nonetheless the public health safety protocols endorsed by the North Coast Regional Algal Coordinating Committee were exceeded and hence the warnings were issued. Research by the Department of Land and Water Conservation was able to establish that the species of algae present was of a genotype capable of releasing algal toxin without warning. This is the first occasion to Council's knowledge that toxicity testing has been undertaken on blue green algae in Lake Ainsworth."

**Actions**
There are no specific actions identified for this site in relation to compliance with NHMRC microbiological guidelines.

In regard to the blue green algae problem in Lake Ainsworth it is recommended that:

- regular monitoring of the level of blue green algae in the lake continue and advisory signs be exhibited in accordance with the protocol endorsed by the Regional Algal Co-Ordinating Committee (RACC)
- the trial aeration scheme continue, with ongoing monitoring aimed at eventually establishing an environmental database of variations over time.

Note: Council has recently adopted a Management Plan for Lake Ainsworth guided by the NSW Government's Estuary Management Manual. The management plan is to be implemented over the next ten years. A copy may be downloaded from Council's website.

Figure 5:  Lake Ainsworth, Lennox Head

## 6.3 Boulders Beach, Skennars Head

**Site Description**
Boulders Beach lies between Lennox Head to the north and the Iron Peg to the south. As its name describes, its shoreline consists of small boulders and sand. The southern end of the beach is very popular with surfers but not commonly used by swimmers. Access to Boulders Beach is via a car park located at the end of Rocky Point Road and a walking track off The Coast Road.

Land lying immediately behind Boulders Beach is predominantly undeveloped, comprising of remnant littoral rainforest and coastal banksia to the south and a freshwater lagoon to the north. A single residential property is located at the end Rocky Point Road, adjoining the car park.

The sample site was located south of the Iron Peg at Little Boulders Beach, approximately 100m north of the Lennox Head Sewage Treatment Plant ocean outfall (refer to Figure 6).

**Priority:** Medium

**Potential Pollution Sources**
A potential source of pollution at Boulders Beach is the ocean outfall which discharges tertiary treated sewage effluent from the Lennox Head Sewage Treatment Plant into the Pacific Ocean at Skennars Head.

As the tertiary treated waters from the Lennox Head Sewage Treatment Works are discharged to the Pacific Ocean at Skennars Head, Council's Civil Services Group continues to regularly monitor near shore and offshore at Boulders Beach and Little Boulders Beach. Regular monitoring and testing of treated effluent quality is required by the Environment Protection Authority (EPA) as a condition of licence.

The surface runoff catchment area of Boulders Beach includes the residential area located east of the ridge along which North Creek Road runs. Stormwater runoff from these urban areas are discharged into the lagoon behind Boulders Beach and during periods of heavy rain, this lagoon overflows onto the beach and hence is a potential source of pollution.

**Guideline Compliance Assessment (Beachwatch Program)**
Faecal coliform and enterococcal levels at Boulders Beach complied with recreational swimming guideline limits 100% of the time during the summer 2002-2003 period.

**Actions** There are no specific actions identified for this beach.

Figure 6:  Boulders Beach, Skennars Head

## 6.4 Sharpes Beach, Skennars Head

**Site Description**
Sharpes Beach lies between Whites Head to the north and Flat Rock Point to the south. Sharpes Beach is an important swimming beach for the local residents of Headlands Estate as well as tourists. Lifeguards patrol this beach during the summer period.

Land lying between Sharpes Beach and The Coast Road is a recreation reserve and covered predominantly with coastal dune vegetation.

The sampling site at Sharpes Beach was located at the main swimming area at the northern end of the beach, adjacent to the car park (refer to Figure 7).

**Priority**: Medium

**Potential Pollution Sources**
Sharpes Beach is the closest patrolled beach to the Lennox Head Sewage Treatment Plant ocean outfall, thereby being a potential pollution source. A stormwater drain collects surface runoff from the Headlands Estate and discharges at the northern end of the beach is also a potential source of a range of pollutants.

As the tertiary treated waters from the Lennox Head Sewage Treatment Works are discharged to the Pacific Ocean at Skennars Head, Council's Civil Services undertakes regular monitoring near shore and offshore at Sharpes Beach North. Regular monitoring and testing of treated effluent quality is required by the Environment Protection Authority (EPA) as a condition of discharge licence.

**Guideline Compliance Assessment (Beachwatch Program)**
Faecal coliform and enterococcal levels at Sharpes Beach complied with recreational swimming guideline limits 100% of the time during the summer 2002-2003 period from October 2002 and April 2003.

**Actions** There are no specific actions identified for this beach.

Figure 7:  Sharpes Beach, Skennars Head

## 6.5 Shelly Beach, Ballina

**Site Description**
Shelly Beach lies between Black Head to the north and Ballina Head to the south. Shelly Beach is Ballina's main swimming beach during spring and summer for both tourists and residents. A small rock pool located south of the surf club is popular with young families as it provides safe swimming conditions.

A recreation reserve lies between Shelly Beach and Shelly Beach Road.

The sampling site at Shelly Beach was located at the southern end of the beach, in the main swimming area (refer to Figure 8).

**Priority:** High

**Potential Pollution Sources**
One stormwater drain discharges at the southern end of Shelly Beach.

**Guideline Compliance Assessment (Beachwatch Program)**
Faecal coliform and enterococcal levels at Shelly Beach complied with recreational swimming guideline limits 100% of the time during the summer 2002-2003 period from October 2002 and April 2003.

**Non-compliance dry weather sampling**
Assessment of bacteriological data collected during the months of May, June and July showed minimal to no microbiological levels.

**Trigger Level**
The rainfall model developed for Shelly Beach indicated none of the median faecal densities in any rainfall category exceeded 150cfu/100mL. The median guideline limit of 33cfu/100mL for enterococci was exceeded in the 20-40mm rainfall category. On the basis of this information, it can be assumed that rainfall events greater than 20mm in 24 hours generally result in elevated enterococci levels more regularly than lower rainfall levels and therefore may pose a health risk to swimmers.

**Recovery Rate**
Analysis of data collected during two rain events (May 7-9) and June
(27-29) indicated faecal coliform densities were well below acceptable guideline limits during and following rainfall. Refer to Figures 9 to 12.

Enterococcal densities reduced dramatically to below guideline limits after 24 hours of no rainfall. If regular wet-weather monitoring at this site followed this trend, it may be considered that water quality returns to an acceptable standard for swimming within 24 hours after heavy rain.

Figure 8:  Shelly Beach, Ballina

Figure 9 : Rainfall & faecal coliform densities, Shelly Beach, 7-9 May, 2003.

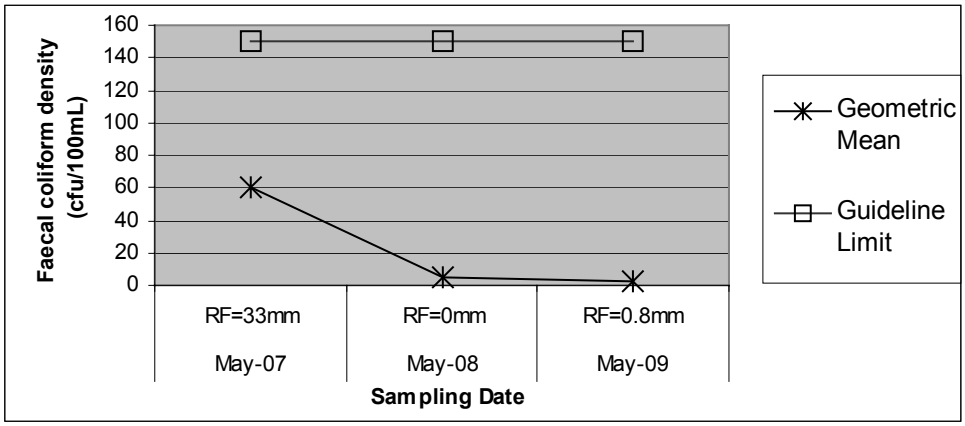



Figure 10 : Rainfall & enterococcal densities, Shelly Beach, 7-9 May, 2003.

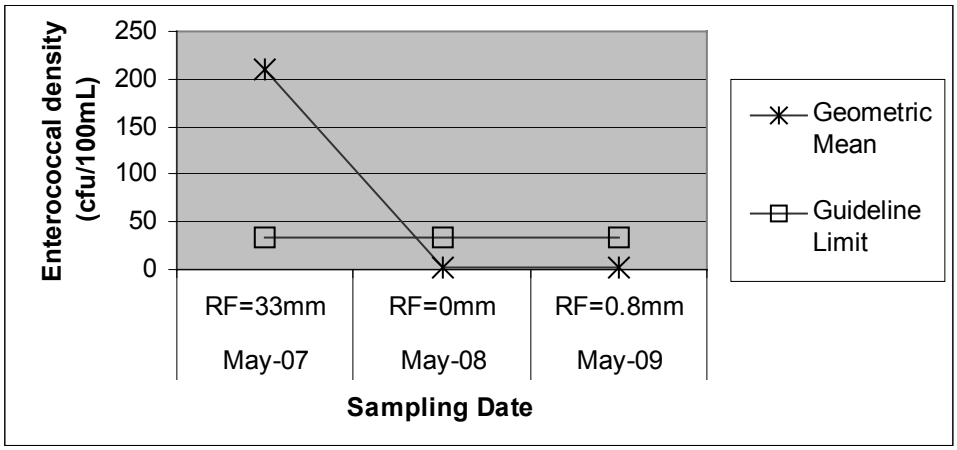



Figure 11: Rainfall & faecal coliform densities, Shelly Beach, 27-29 June, 2003.

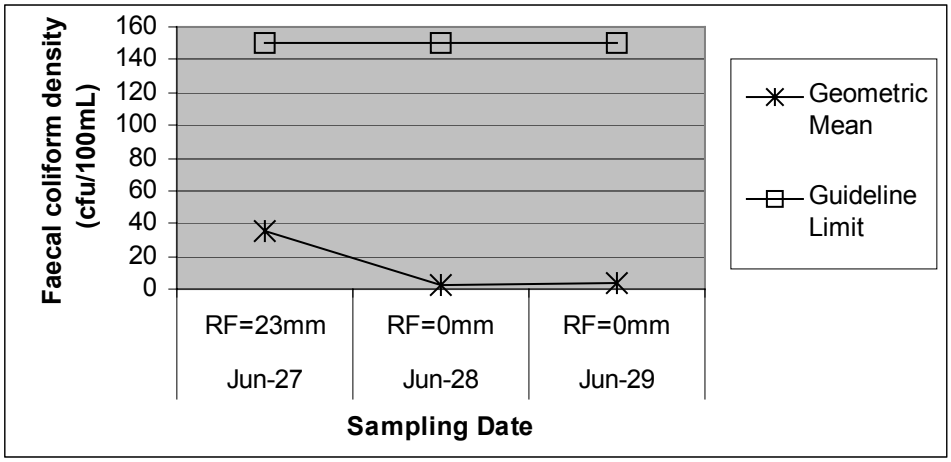
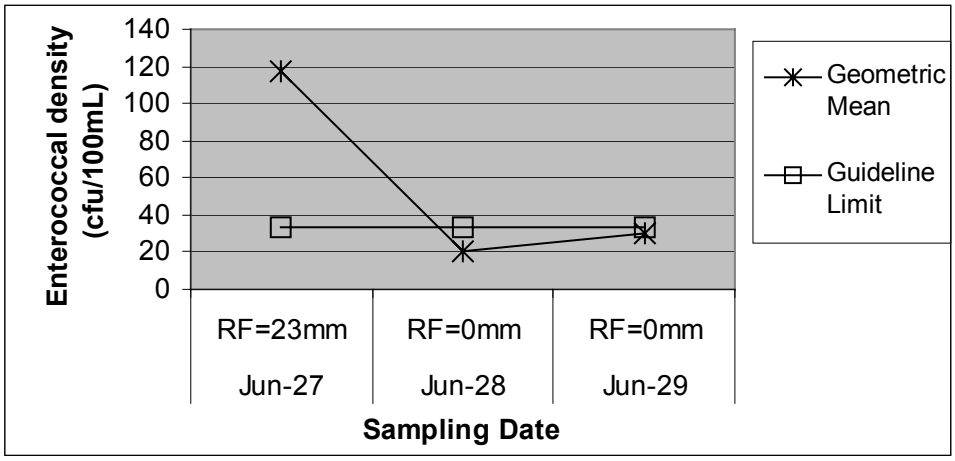


Figure 12: Rainfall & enterococcal densities, Shelly Beach, 27-29 June, 2003.




**Actions** There are no specific actions identified for this beach.

## 6.6 Lighthouse Beach, Ballina

**Site Description**
Lighthouse Beach lies between Ballina Head to the north and North Wall to the south. The beach is backed by a recreation reserve covered with coastal dune vegetation. Access to this beach is easy, via a car park and several walking tracks leading off Lighthouse Parade.

Lighthouse Beach is a popular surfing beach all year round and a popular swimming spot for residents and tourists during the summer season. This beach is unpatrolled. A range of tourist accommodation types are in close vicinity to Lighthouse beach, including numerous holiday apartments, Ballina Beach Resort and the Ballina Lakeside caravan park.

The sampling site at Lighthouse Beach was located at the northern end of the beach, adjacent to the car park (refer to Figure 13).

**Priority:** Medium

**Potential Pollution Sources**
A stormwater drain discharges at the northern end of Lighthouse Beach.

**Guideline Compliance Assessment (BPPP)**
Faecal coliform and enterococcal levels at Lighthouse Beach complied with recreational swimming guideline limits 100% of the time during the summer 2002-2003 period from October 2002 and April 2003.

**Actions** There are no specific actions identified for this beach.

Figure 13:  Lighthouse Beach, Ballina

## 6.7 The Serpentine, Ballina

**Site Description**
The Serpentine is located along North Creek, above the Missingham Bridge at Ballina. This beach is popular with young families as it provides safe swimming conditions.

Land use around The Serpentine is predominantly residential, with Pioneer Memorial Park to the south, Serpentine Park to the north and Richmond Oyster Co. Pty Ltd located north of the sampling site.

The sampling site is located at the northern end of the beach (refer to Figure 14).

**Priority:** High

**Potential Pollution Sources**
Three stormwater drains discharge into North Creek at The Serpentine, one either side of the sampling point and the other located north of the Richmond Oyster. Co Pty Ltd premises. Numerous other discharges occur to North Creek upstream of the beach and with tidal flows Richmond River water also flows into North Creek in this locality.

**Guideline Compliance Assessment (Beachwatch Program)**
Faecal coliform and enterococcal levels at The Serpentine complied with recreational swimming guideline limits 100% of the time during the summer 2002-2003 period from October 2002 and April 2003.

**Non-compliance dry weather sampling**
Assessment of raw microbiological data collected each month at The Serpentine showed microbiological levels well below guideline limits.

**Trigger Levels (Wet Weather Monitoring Program)**
The rainfall model developed for The Serpentine indicated the median guideline limit for faecal coliforms was exceeded in the 20-40mm rainfall category. From this information it can be assumed that rainfall events greater than 20mm in 24 hours generally result in elevated faecal coliform levels more regularly than lower rainfall levels.

Enterococcal densities exceeded guideline limits in the 0mm rainfall category and therefore it can be assumed that swimming at The Serpentine may pose a health risk in dry-weather.

**Recovery Rate**
Analysis of data collected during two rain events May (7-9) and June
(27-29) indicated microbiological levels exceeded guideline limits after 48 hours of relatively little to no rainfall. Refer to Figures 15 to 18.

During the rain event in May, both faecal coliform and enterococcal densities had reduced dramatically after 48 hours of relatively little rainfall, although they were still above guideline limits.

Following the June rain event, microbiological levels remained well above guideline limits after 48 hours of no rain. Faecal coliform levels remained the same during the

Figure 14:  The Serpentine, Ballina

three days of sampling whilst enterococcal densities began to drop after 48 hours of no rain. Ongoing monitoring of water quality at The Serpentine during and after wet weather events would be necessary in order to accurately predict recovery rates.

Figure 15: Rainfall & faecal coliform densities,The Serpentine, 7-9 May, 2003.

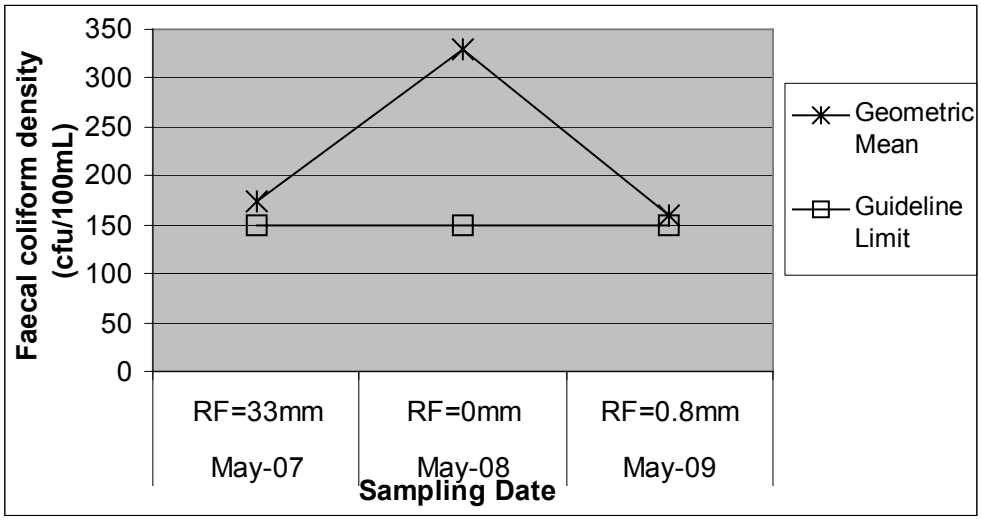



Figure 16: Rainfall & enterococcal densities, The Serpentine, 7-9 May, 2003.

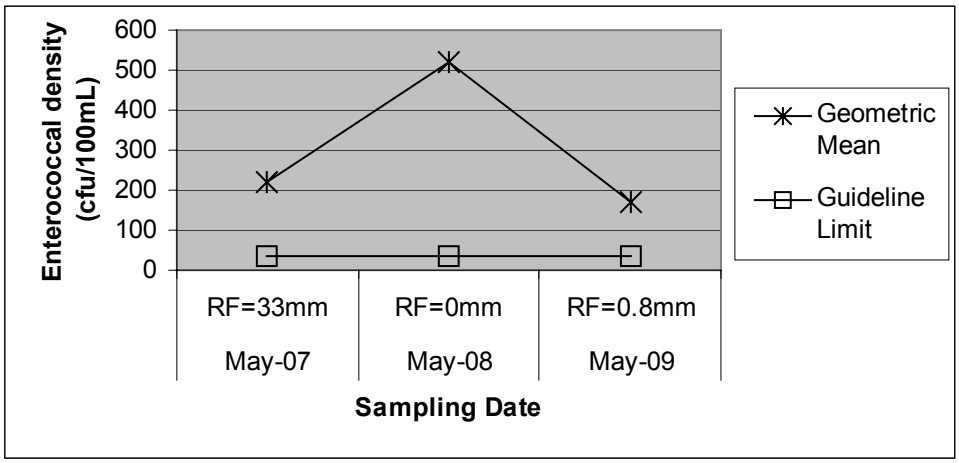


Figure 17: Rainfall & faecal coliform densities, The Serpentine, 27-29 June, 2003.

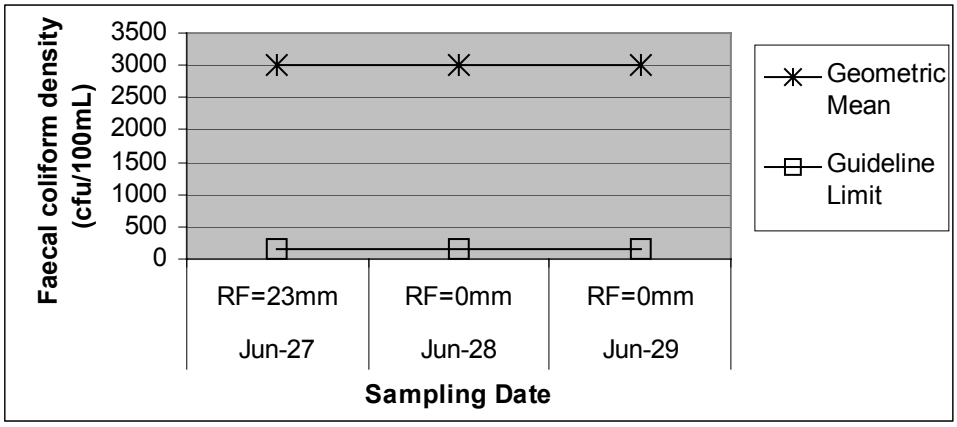
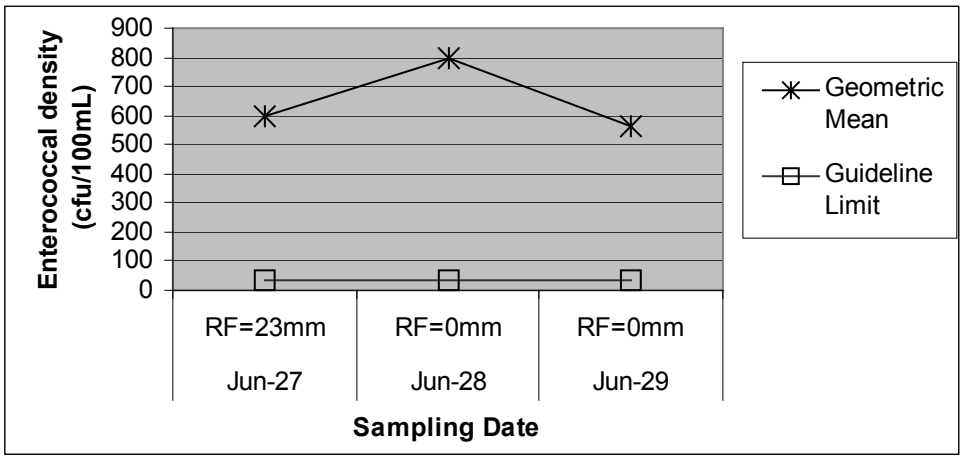



Figure 18: Rainfall & enterococcal densities, The Serpentine, 27-29 June, 2003.




**Actions** It is recommended that wet-weather monitoring continue at this site in order to more accurately predict recovery rates and trigger levels.

## 6.8 Shaws Bay, East Ballina

**Site Description**
Shaws Bay is a small tidal embayment located adjacent to the mouth of the Richmond River at East Ballina that was created as a consequence of river entrance training wall construction. Around the turn of the century, training walls for the Richmond River were constructed to improve navigation through the entrance. With time, marine sands worked their way into the coastal embayment which was formed on the northern side of the northern training wall. A small water body at the western edge of the embayment is all that remains of the former Richmond River entrance channel. This water body is known as Shaws Bay (Patterson Britton & Partners P/L, 2000)

Shaws Bay has become one of Ballina's most popular locations for water-based recreational activities due to its protection from large waves, no boating traffic and, good and easy access into the water.

Land use around the bay is predominantly residential and recreational reserve. A portion of the Shaws Bay catchment is commercial, including two caravan parks, the Shaws Bay Hotel and holiday accommodation.

The three sampling sites on Shaws Bay were located at the northern end of the Bay, on the eastern, northern and western shoreline (refer to Figure 19).

**Priority:** High

**Potential Pollution Sources**
The Shaws Bay Estuary Management Plan (2000) identified seventeen stormwater drains discharging into Shaws Bay. These drains service the vast majority of the local Shaws Bay catchment (see Figure 19). The Shaws Bay EMP (2000) found that the pollutants entering the bay from stormwater runoff were diluted and dispersed within the bay relatively quickly. Hence, any potential impacts of the stormwater drainage on water quality are likely to be short-lived. The good flushing times of Shaws Bay is assisted to some extent by the constant input of groundwater seepage flows, circulation within the bay generated by prevailing wind conditions and the tidal interaction with the river.

The Estuary Management Plan (2000) also found the amount of sediment generated from the catchment was likely to be small and much less than the amount of fine sediment entering the bay from the river during times of flooding.

**Guideline Compliance Assessment (Beachwatch Program)**
Faecal coliform and enterococcal levels at the northern and western sampling sites at Shaws Bay complied with recreational swimming guideline limits 100% of the time during the summer 2002-2003 period.

Faecal coliform levels at the eastern sampling point complied 100% with guideline limits however enterococcal levels at this point exceeded guideline limits in March.

Figure 19:  Shaws Bay, East Ballina

**Non-compliance dry weather monitoring**
During the three months of non-compliance dry weather sampling (May 03 – July 03) faecal coliform and enterococcal levels were well below guideline limits. On the basis of this data, water quality in Shaws Bay was suitable for swimming in dry weather.

**Table 3: Non-compliance dry weather sampling, Shaws Bay May – July 2003**

| | Faecal Coliform (FC) | | | Enterococci (Ent) | | |
|---|---|---|---|---|---|---|
| Month | Raw Data | Median g.limit | 4/5 g.limit | Raw Data | Geometric Mean | Suitability |
| May | 6<br>4<br>0 | Not exceeded | Not exceeded | 11<br>9<br>Nil | 4.57<br>Not exceeded | Water quality suitable for swimming in dry weather. |
| June | 60<br>12<br>2 | Not exceeded | Not exceeded | 50<br>3<br>6 | 9.77<br>Not exceeded | Water quality suitable for swimming in dry weather. |
| July | 13<br>43<br>36 | Not exceeded | Not Exceeded | 10<br>28<br>15 | 16.22<br>Not exceeded | Water quality suitable for swimming in dry weather. |

**Trigger Levels (Wet Weather Monitoring Program)**
Based on the rainfall model developed for Shaws Bay, none of the median faecal coliform densities in any rainfall category exceeded guideline limits.

The geometric mean guideline limit for enterococci was exceeded in the 10-20mm rainfall category. On the basis of this information, it can be assumed that rainfall events greater than 10mm in 24 hours generally result in elevated enterococci levels more regularly than lower rainfall levels and therefore may pose a health risk for swimming.

**Recovery Rates**
During the rain event that occurred on 7-9 May, faecal coliform levels in Shaws Bay were well below guideline limits however enterococcal levels remained above guideline limits 48 hours after relatively no rain. Refer to Figures 20 & 21.

Elevated faecal coliform and enterococcal levels were recorded during the 27-29 June rain event. Faecal coliform levels dropped dramatically after 48 hours of heavy rain however enterococcal levels continued to increase after 48hours of no rainfall. Refer to Figure 22 & 23.

Regular wet-weather monitoring at this site would be required to more accurately predict the time taken for enterococcal levels to return to an acceptable standard for primary contact.

Figure 20: Rainfall & faecal coliform densities, Shaws Bay, 7-9 May 2003.

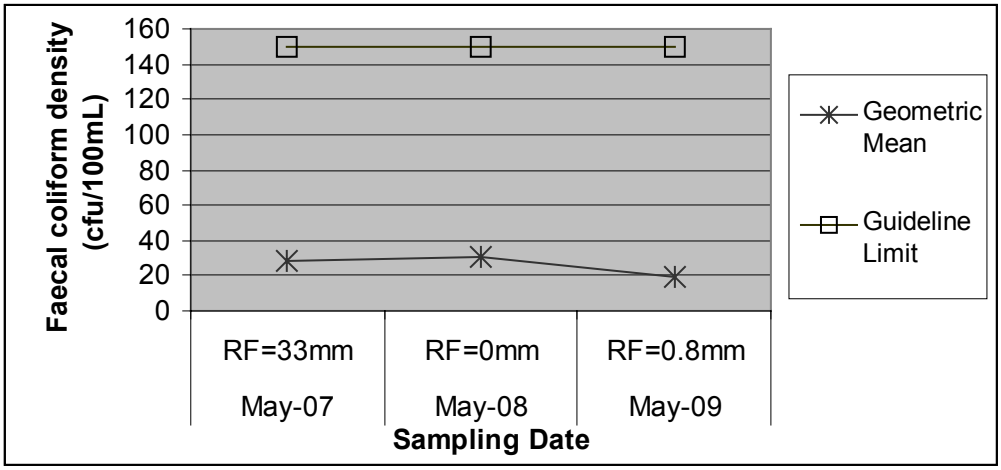



Figure 21: Rainfall & enterococcal densities, Shaws Bay, 7-9 May 2003.

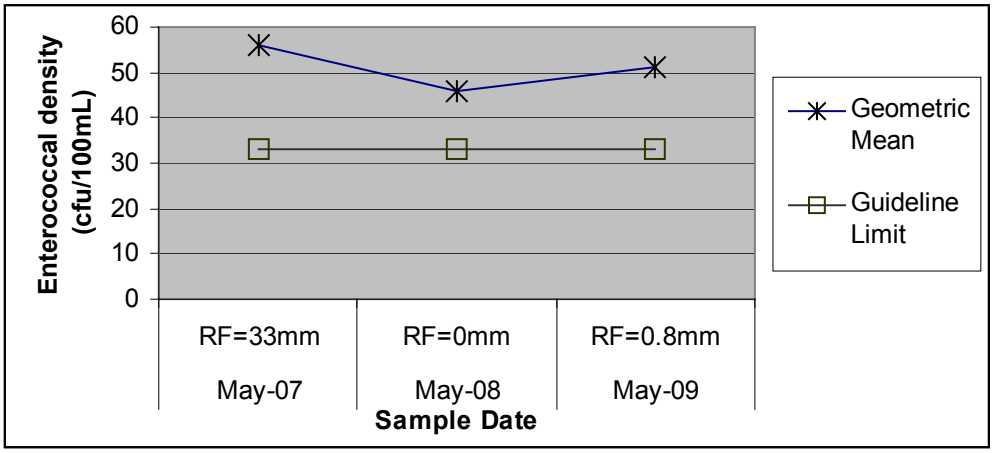



Figure 22: Rainfall & faecal coliform densities, Shaws Bay, 27-29 June 2003.

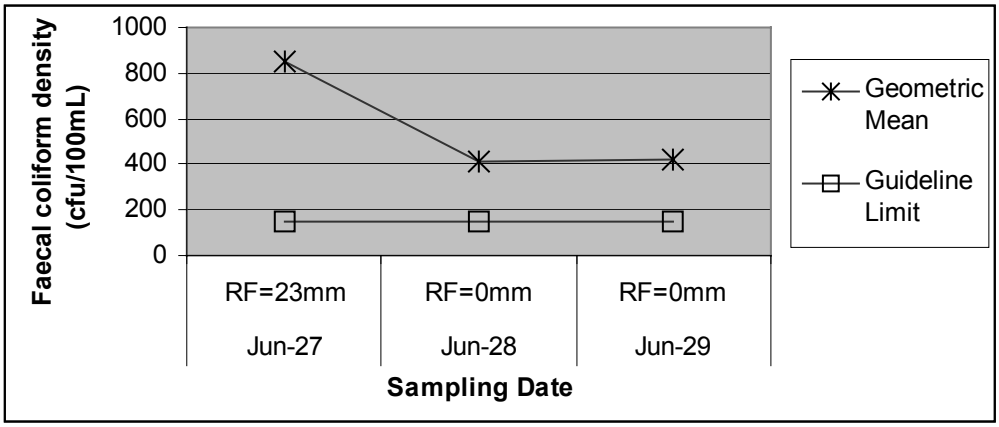
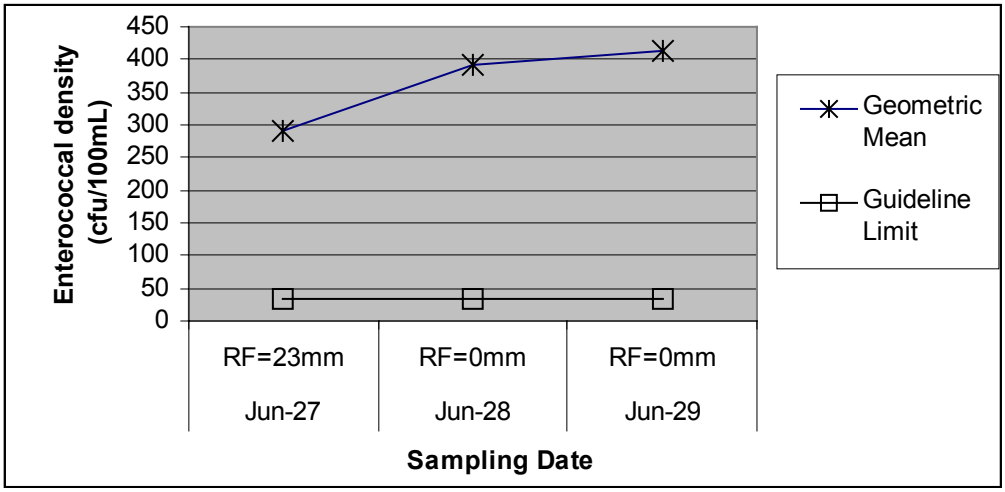


Figure 23: Rainfall & enterococcal densities, Shaws Bay, 27-29 June 2003.




**Actions** It is recommended that:

- Regular wet-weather monitoring continue at Shaws Bay in order to more accurately predict recovery rates and trigger levels.
- Water quality data collected in Shaws Bay prior to the installation of enviropods in April 2002 is compared against data collected during programs outlined in this report. This will provide an indication of the effectiveness of these devices in improving water quality.

## 6.9 Banyanda Lake, Ballina Island

**Site Description**
Banyanda Lake is a man-made lake which opens into North Creek Canal. Land use surrounding the lake is predominantly residential development, with a Council reserve located at the southern entrance of the lake. Land opposite the entrance of the lake is undeveloped and used primarily for grazing cattle.

The sampling sites in Banyanda Lake were located at the eastern, western and southern shoreline (refer to Figure 24).

**Priority:** Medium

**Pollution Sources**
Sources of pollution into Banyanda Lake include three stormwater drains that discharge directly into the lake. These drains collect surface runoff from the surrounding residential area. Land use along North Creek Canal that may be potential pollution sources include The Ballina Racecourse, private stables and the Ballina Industrial Estate. Runoff from The Ballina Racecourse and nearby stables is also a potential source of faecal contamination.

Discharges from sewage treatment plants can be a significant source of faecal contamination and hence the Ballina Sewage Treatment Works which discharges treated sewage effluent into Fishery Creek is a potential source of pollution. It should be noted that Ballina Council's Civil Services Group regularly monitors water quality in the lower Richmond River Estuary, including North Creek and North Creek Canal and Fishery Creek to ensure compliance with the EPA licence to discharge. Additionally the canal links North Creek and the Richmond River. Both these waterways have numerous discharges over their lengths.

**Guideline Compliance Assessment (Beachwatch Program)**
At all three sampling sites in Banyanda Lake, faecal coliform levels complied with swimming guidelines 71% of the time and enterococcal levels 57% of the time. Water quality did not comply with guideline limits during the months of February, March and April. High microbiological levels recorded during these months can be attributed to the very high rainfall during February, March and April being 311mm, 325mm and 456mm respectively.

**Non-compliance dry weather monitoring**
During the three months of non-compliance dry weather sampling (May 03 – July 03) faecal coliform levels were below guideline limits whilst enterococcal levels exceeded limits in May & June. Based on these results Banyanda Lake was possibly contaminated by aged sewage at the time of sampling and the water quality not suitable for swimming. These water quality results followed five days of dry weather prior to sampling in May and two days of dry weather prior to sampling in June (refer to Table 4).

Figure 24:  Banyanda Lake, Ballina Island

**Table 4: Non-compliance dry weather sampling, Banyanda Lake May – July 2003**

| | Faecal Coliform (FC) | | | Enterococci (Ent) | | |
|---|---|---|---|---|---|---|
| Month | Raw Data | Median g.limit | 4/5 g.limit | Raw Data | Geometric Mean | Suitability |
| May | 130<br>110<br>110 | Not exceeded | Not exceeded | 60<br>48<br>20 | Exceeded | Possibly contaminated. Water may not be suitable for swimming. |
| June | 48<br>23<br>30 | Not exceeded | Not exceeded | 40<br>30<br>54 | Exceeded | Possibly contaminated. Water may not be suitable for swimming. |
| July | 25<br>34<br>29 | Not exceeded | Not Exceeded | 18<br>14<br>22 | Not exceeded | Water quality suitable for swimming in dry weather. |

**Trigger Levels (Wet Weather Program)**

The rainfall-based model developed for Banyanda Lake indicated the median densities for faecal coliforms exceeded guideline limits when rainfall events between 0-10mm occurred in a 24 hour period. On the basis of this information, it can be predicted that < 10mm of rain in 24 hours generally results in elevated microbiological levels and the water quality becoming unsuitable for swimming.

The geometric mean for enterococci exceeded the guideline limit in the 0mm rainfall category, indicating bacterial contamination of these waters with aged sewage during dry weather, making the water quality unsuitable for swimming. This is consistent with the findings of the dry weather non-compliance monitoring during the months of May and June where enterococcal levels exceeded guideline limits.

**Recovery Rates**

Analyses of microbiological data collected in Banyanda Lake during rain events in May (7-9) and June (27-29) indicated faecal coliform and enterococci densities exceeded guideline limits (refer to figures below). Faecal coliform and enterococcal densities reduced dramatically after 24 hours of no rainfall although they remained well above guideline limits. Refer to Figure 25 to 28.

Figure 25: Rainfall & faecal coliform densities, Banyanda Lake, 7-9 May 2003.

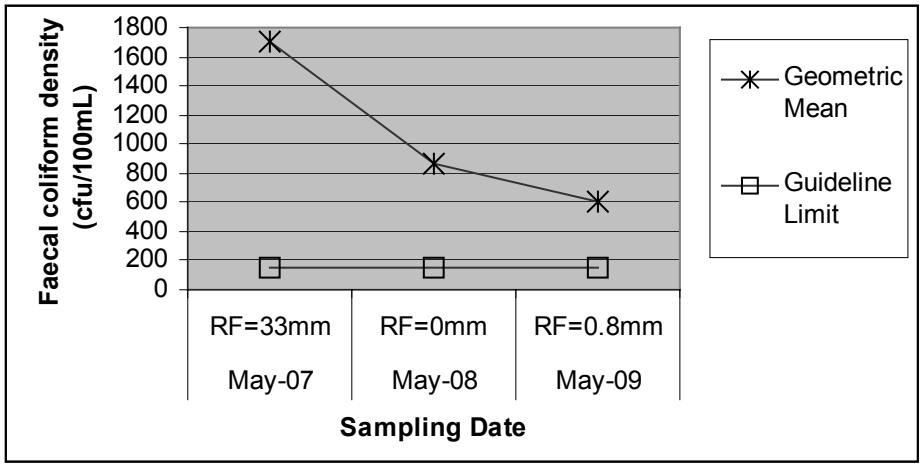



Figure 26: Rainfall & enterococcal densities, Banyanda Lake, 7-9 May 2003.

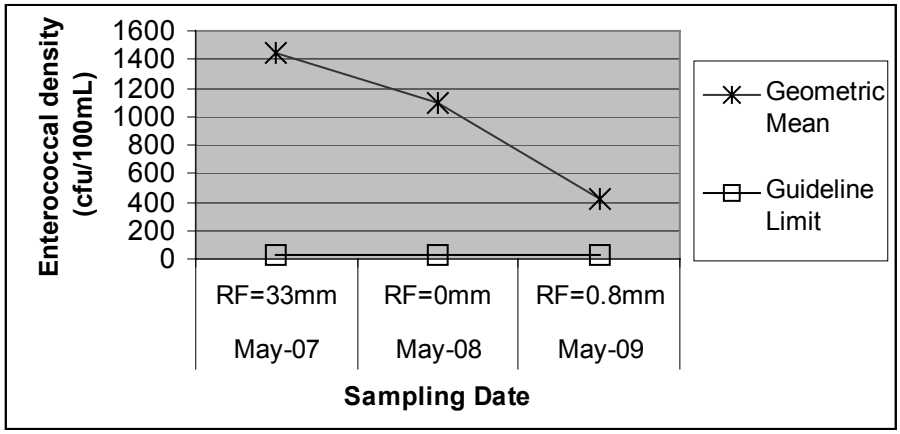



Figure 27: Rainfall & faecal coliform densities, Banyanda Lake, 27-29 June 2003.

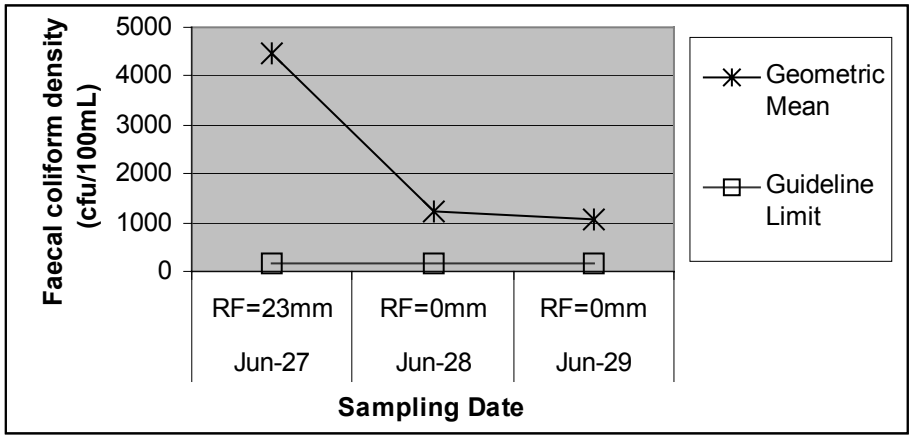
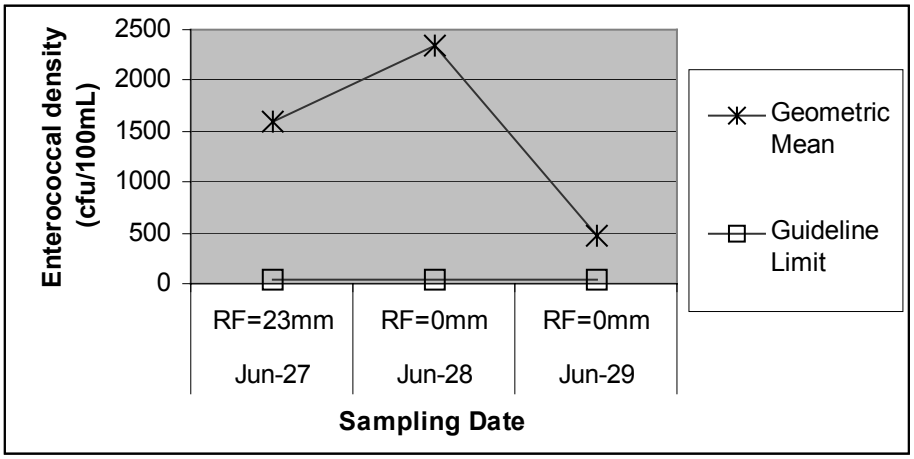


Figure 28: Rainfall & enterococcal densities, Banyanda Lake, 27-29 June 2003.




**Actions**

Recommended that wet and dry weather water quality monitoring in Banyanda Lake continue and be extended to include sampling sites along North Creek Canal in order to:

- further develop the existing database to enable more accurate trigger level and recovery rate predictions
- identify point pollution sources, and
- recommend pollution abatement measures

## 6.10 Prospect Lake, East Ballina

**Site Description**
Prospect Lake is located at East Ballina and is part of a man-made lake system that drains into Chickiba Creek. Residential properties border the lake to the south and west, Angels Beach Drive to the North and Links Avenue to the east. A council reserve surrounds most of the lake except for the northern boundary.

Prospect Lake is a popular swimming spot for local residents of the adjoining residential area as well as students from the nearby high school and triathlon club. The lake is used by rowers, with the East Ballina Rowing Club located adjacent to eastern sampling point. The NSW Department of Sport & Recreation also uses Prospect Lake extensively during the summer period when Lake Ainsworth is unsuitable for swimming in due to high levels of blue green algae.

The three sampling sites monitored at Prospect Lake were located on the southern, eastern and northern shoreline of the lake (refer to Figure 29).

**Priority:** Medium

**Pollution Sources**
There are several stormwater drains collecting surface runoff from the adjacent residential area and nearby golf course discharge directly into Prospect Lake. Oil and grease from Angels Beach Drive is also considered a potential source of pollution, particularly at the north sampling point, which is located directly below a bridge along Angels Beach Drive. Chickiba Creek also has a range of discharge points servicing urban and rural developments in its catchment.

**Guideline Compliance Assessment (Beachwatch Program)**
Overall, high levels of compliance were recorded at all three sites on Prospect Lake. At the northern and southern sampling sites, enterococcal levels complied with swimming guideline limits 86% of the time and 100% of the time for faecal coliform levels whilst at the eastern sampling site, faecal coliform and enterococcal levels complied with guideline limits 86% of the time.

**Non-compliance dry weather monitoring**
During the three months of non-compliance dry weather sampling faecal coliform levels did not exceed guideline limits in Prospect Lake whilst enterococcal levels exceeded guideline limits in June.

Figure 29: Prospect Lake, East Baliina

**Table 5: Non-compliance dry weather sampling results, Prospect Lake, May–July 2003**

| | Faecal Coliform (FC) | | | Enterococci (Ent) | | |
|---|---|---|---|---|---|---|
| MONTH | Raw Data | Median g.limit | 4/5 g.limit | Raw Data | Geometric Mean | Suitability |
| May | 54<br>28<br>32 | Not exceeded | Not exceeded | 38<br>38<br>20 | 30.9<br>Not exceeded | Water quality suitable for swimming in dry weather. |
| June | 100<br>136<br>90 | Not exceeded | Not exceeded | 114<br>250<br>84 | 134.9<br>Exceeded | Possibly contaminated. Water may not be suitable for swimming. |
| July | 22<br>56<br>62 | Not exceeded | Not Exceeded | 14<br>8<br>26 | 14.23<br>Not exceeded | Water quality suitable for swimming in dry weather. |

**Trigger Levels (Wet Weather Monitoring Program)**

Assessment of the rainfall model developed for Prospect Lake shows the median faecal coliform density exceeds 150cfu/100mL in the 10-20mm rainfall category. Based on this information, it is predicted that rainfall events >10mm in 24 hours result in elevated faecal coliform levels more regularly than lower rainfall levels.

The enterococcal geometric mean density exceeded 33cfu/100mL in the 0mm rainfall category. Based on this information, it is predicted the water in Prospect Lake may be contaminated during dry weather and therefore pose a risk to swimmers. This is consistent with data collected during the non-compliance dry weather sampling where enterococci levels exceeded guideline limits in June.

**Recovery Rate**

Analysis of bacteriological data collected in Prospect Lake during rain events in May (7-9) and June (27-29) indicated faecal coliform densities reduced dramatically after 24 hours of no rainfall, with levels dropping to acceptable levels 48 hours after relatively little rainfall. (refer to Figures 30 to 33).

During the June rain event, enterococcal levels increased after 24 hours of no rainfall followed by a dramatic reduction during the following 24 hours. In general, enterococcal levels remained above guideline limits even after 48 hours after rain. Regular wet-weather monitoring at Prospect Lake would be required in order to more accurately predict recovery rates.

Figure 30: Rainfall & faecal coliform densities, Prospect Lake, 7-9 May 2003.

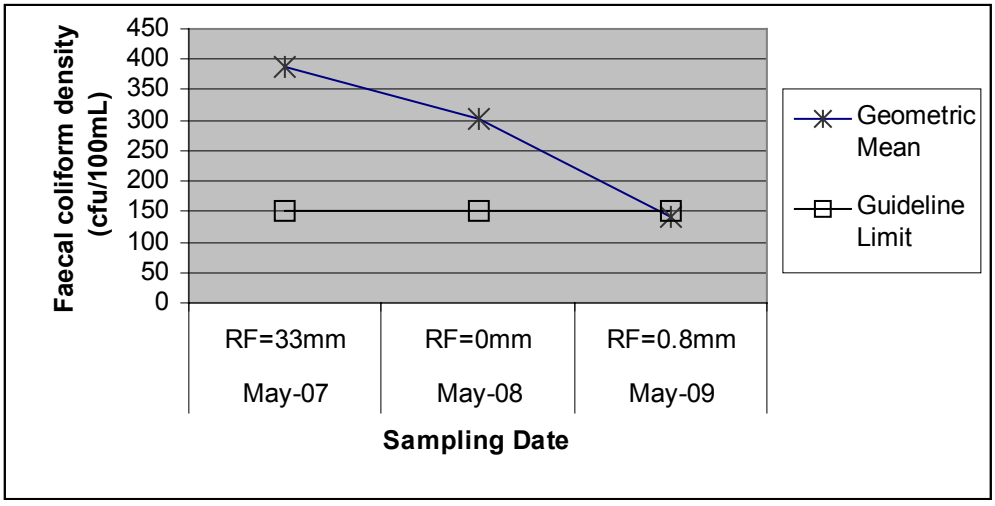



Figure 31: Rainfall & enterococcal densities, Prospect Lake, 7-9 May 2003.

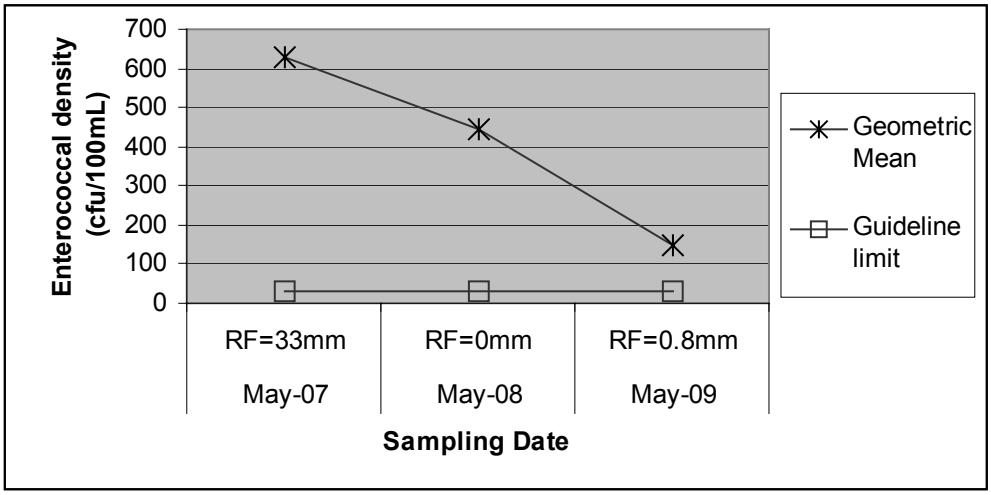


Figure 32: Rainfall & faecal coliform densities, Prospect Lake, 27-29 June 2003.

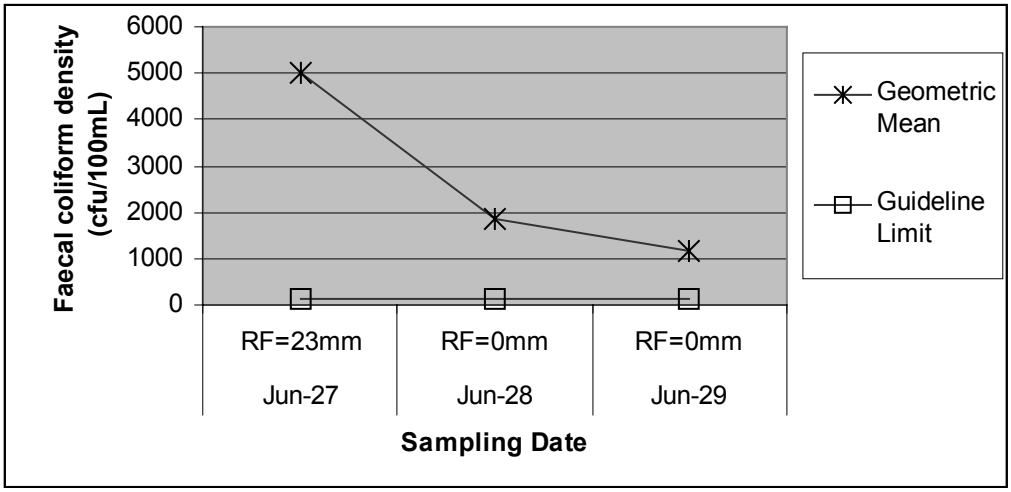
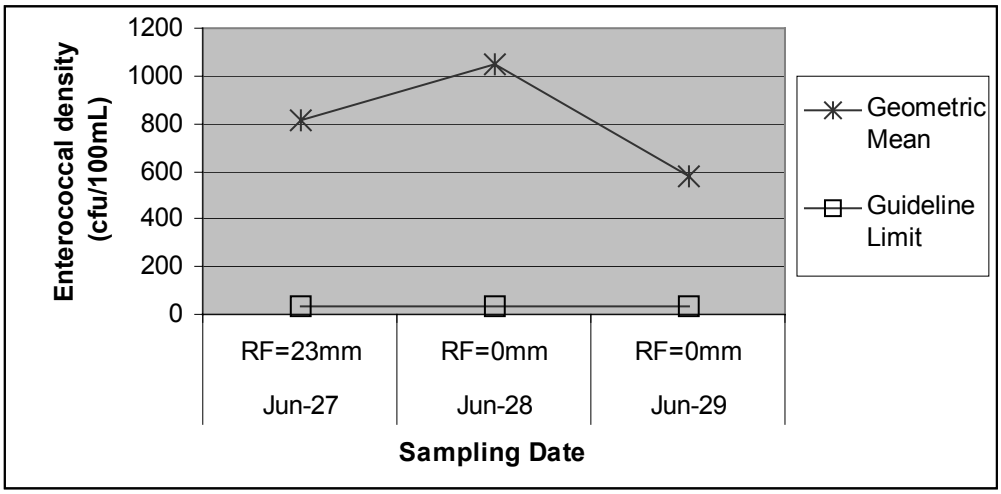



Figure 33: Rainfall & enterococcal densities, Prospect Lake, 27-29 June 2003.




**Actions**

Recommended that wet and dry weather water quality monitoring in Prospect Lake continue in order to:

- further develop the existing database to enable more accurate trigger level and recovery rate predictions
- identify point pollution sources, and
- recommend pollution abatement measures

## 7. CONCLUSION

Ballina Shire Council has a shared responsibility in ensuring swimmers and recreational water users are not exposed to health risks due to the presence of contaminants and to provide the community with guidance on when to avoid swimming at particular locations.

The Beachwatch Partnership Pilot Program has been effective in raising community awareness and access to information about water quality issues and providing Ballina Shire Council with an opportunity to develop a more integrated and consistent approach to recreational water quality monitoring than was previously in place.

The Wet Weather Monitoring Program was beneficial in providing an indication of water quality during and after rain events and the response of particular water bodies to rainfall. The usefulness of data collected during both programs and the development of effective long-term management solutions will only be fully realised with the ongoing collection of water quality data.

Unfortunately Ballina Shire Council has been unsuccessful in receiving further funding from the EPA to continue the existing pilot Beachwatch Program during the 2003/2004 swimming season. Given the absence of external funding and the high cost involved in monitoring water quality at all the ten sites included in the Beachwatch Program and at the frequency required for assessment against the NHMRC guidelines for recreational water use, it is recommended that a scaled down risk based monitoring program be developed and funded by Ballina Shire Council.

In order to minimise costs, the revised monitoring program should target high risk sites i.e. sites identified during the Beachwatch and Wet Weather Monitoring Programs as having elevated microbiological levels and which are of high importance to the community as a swimming location. At a minimum, compliance monitoring should continue during the swimming season. Beaches that should be targeted are those, which are more popular with children, the elderly, and that have a higher likelihood of being polluted.

Overall, the Beachwatch and Wet Weather Monitoring Programs have provided Council with valuable information on water quality in the local area and practical information in designing, implementing and reporting on recreational water quality monitoring programs. Thanks goes to staff at the EPA for their ongoing assistance and support and for the opportunity to participate in the pilot program.