Special DATASHEET: MONITORING WATERWAYS Watershed Torbay 2004

WATERWAYS MONITORING PROGRAM

Why monitor water quality?

Where are we monitoring?

How much water flows down the waterways?

What is being measured:
- ***sources & types***
- ***concentrations***
- ***total loads***
- ***trends in data***
- ***the 'snapshot'***
- ***invertebrates***

Find out more and help out!

Visit Watershed Torbay WEBSITE www.torbay.scric.org

Ring: 9842 5760 Department of Environment, or 9845 1081 Torbay Catchment Group for project information

Why monitor water quality in waterways?

This leaflet will summarise aspects of the catchment monitoring program. Another leaflet (yet to be written!) will concentrate on the lake and estuarine monitoring program. For a more detailed report of the catchment monitoring program visit the Watershed Torbay project website in the near future.

The community has consistently raised concerns about the incidence and severity of algal blooms in the Lake Powell and Torbay Inlet system. The Department of Environment has been carrying out detailed water quality monitoring program in the Torbay catchment and waterways since 1997. This monitoring program provides data and information for us to understand more about the water entering the Torbay waterways and the changes occurring within the system. This is important to help us make informed decisions on how to improve management practices for the benefit of the waterways.

Algal blooms are influenced by: the increases in nutrients, particularly nitrogen and phosphorus, from the catchment since clearing for farming and residential development; changes to the natural drainage system through the establishment of drains and structures; and also likely from the regulation of water levels in the Torbay system.

The main component of the catchment monitoring program is regular water quality and quantity measurement at six key stream gauging stations on the major tributaries of the Lake Powell-Torbay Inlet system. These stream gauging sites were chosen to represent the major inputs of water and nutrients to the system.

Stream gauging stations, such as the one on Torbay drain near Torbay townsite, consist of a weir, a water level recording system and a cableway.

The water level within the large concrete floatwell rises in tune with the river level and is recorded onto an electronic datalogger. The Department of Environment officers download this data using a laptop computer and tansfer it to the office computer system. A relationship called a rating curve is developed between river level and the actual flow-rate passing over the weir. This rating curve is checked by taking several flow-rate measurements using the cableway and the current meter . The rating curve and the recorded river level data are combined on the office computer to produce stream flow-rate and yield information.

Torbay drain gauging station

Where are we monitoring?

The Water Corporation is planning future water sources for the Lower Great Southern Water Supply. Current usage from the scheme is approximately 6GL per year with a heavy reliance on ground water, 4.6GL.

Marbellup Brook is being considered as a source for the region's water supply because it is closer than several other surface water supplies and is fresh most of the year. Serious planning for the piping of up to 6GL of water during the winter from the Brook is underway. The process for this planning will be reported in next newsletter. Monitoring is an important part of gathering information for discussion concerning potential use of Marbellup Brook for future water supplies.

Location of gauging stations in the Torbay Catchment monitored by Department of Environment Albany (previously Water and Rivers Commission!)

catchment snapshots sampling?

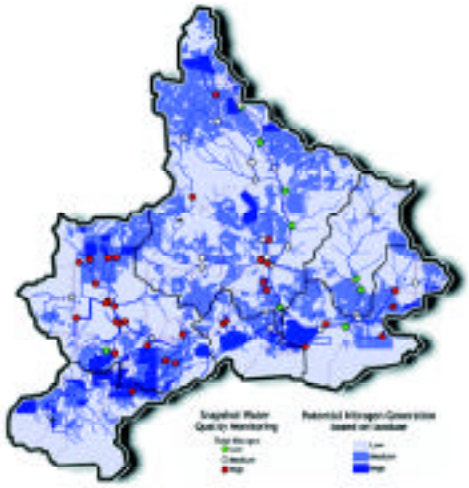
hours of one day.

This is useful because most of the water quality monitoring we do occurs at the lowest points of the major sub-catchments which does not tell us much about which parts of the sub-catchments might be nutrient or sediment 'hotspots', contributing the greatest amounts of contaminants.

While having just one sample from each creek doesn't allow us to say much about the range of possible water quality that might occur, we are able to compare all of the sites sampled under the same conditions and make some assumptions. This information is best viewed and analysed graphically and other information can also be displayed such as land use and creek foreshore condition.

You can help!

The organisms that live or depend on streams are sensitive to changes in water quality and we can detect change by identifying and counting indicators such as macro-invertebrates during different seasons. There are methods in place to score a waterway depending on the number of different bugs found



Where the snapshot water quality sampling was carried out across the Torbay catchment.

Did You Know?

Current water usage from all sources including the Lower Great Southern Water Supply is 249kL per year per person for all purposes: domestic, agricultural, industrial and commercial.

This compares to 180kL for Perth, 210kL for the United States, 31kL per person per year in Asia and a low 17kL per person per year in Africa.

There is plenty of room to reduce per capita water usage!

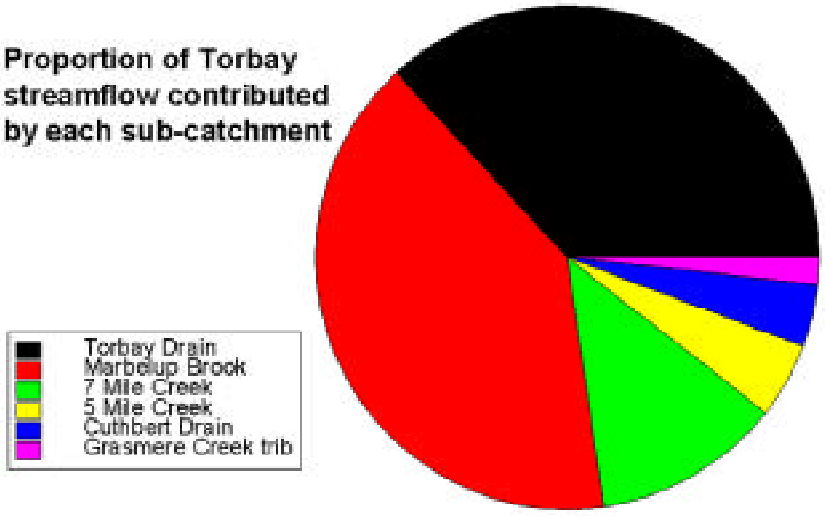
down the catchment waterways?

The Torbay Drain and Marbelup Brook catchments are the largest catchments in the Torbay system, between them they account for over three quarters of the streamflow of the catchment. These two catchments flow directly to Torbay Inlet. At certain times of the year some of the Marbelup Brook flow is directed into Lake Powell via 'The Plug'. We don't know precisely what proportion this is.

The main tributaries of Lake Powell, via four smaller catchments produce just less than one quarter of the streamflow of the Torbay system. 7 Mile Creek produces the largest flow of these catchments and Grasmere Creek the least.

The streamflow to Manarup Lagoon via Nortl Creek Drain, and some of the flow into the western side of Torbay Inlet is not presently monitored although these contributions are thought to be relatively minor.

Each of the stream gauging stations are visited once every fortnight and measurements and samples are taken of the water.



What is being measured?

Water samples are laboratory analysed for concentrations of: total nitrogen, nitrite and nitrate, ammonium, total phosphorus, soluble or filterable reactive phosphorus, and total suspended sediment.

Field measurements are taken of the following parameters to support the water sample data: temperature, pH or acidity, dissolved oxygen content, electrical conductivity which is a measure of salinity.

This water quality and streamflow data provide information on:

- the different forms and concentrations of nutrients, contaminants and other elements
- the total quantity of these substances entering waterways
- trends in data collected over time.

To find out more about the water quality of the various parts of the Torbay catchment we occasionally carry out 'Snapshot' style water sampling where a team of people sample many creeks in the catchment over a few

Monitoring expanded - bugs in waterways

compared to what would be expected. The Department of Environment Albany now have a macro-invertebrate sampling program at about 20 sites in the Torbay catchment.

This is a great chance for landholders, students and other local residents to join sampling trips to get an insight into the nature of local streams and help out.

Macro-invertebrate sampling provides an important additional way to help detect short term trends in catchment water quality.

Contact Andrew Maughan if you would like to help with macro-invertebrate sampling - 9842 5760.

Sources and types of nutrients?

Nitrogen is a vital element required by all organisms but excess nitrogen in aquatic systems can lead to excessive algal growth. Excess nitrogen is mostly from agricultural and garden fertilisers, animal and human wastes and from establishment of leguminous crops.

Phosphorus is also required by all organisms and like nitrogen, too much phosphorus in aquatic systems can lead to excessive algal growth. Phosphorus concentrations in natural systems are low, however the application of agricultural and garden fertilisers can lead to elevated concentrations in waterways.

Phosphorus may be present as free reactive phosphorus (FRP or phosphate) or may have attached to sediment particles. This particulate phosphorus is not readily available to plants and may accumulate in sediments. But it may be transformed to the bio-available form under suitable conditions.

It is important to know which catchments have runoff containing elevated concentrations of nitrogen and phosphorus and it is important to know which forms these nutrients are in. This knowledge helps us to figure out where to target changes in management and whether intervention is being effective.

This plot shows the average values of the collected nitrogen and phosphorus concentration analysis from1997 to 2002.

Cuthbert Drain has the highest nitrogen concentration and Torbay Drain and Grasmere

ment Strategy (NWQMS) guideline for aquatic ecosystems.

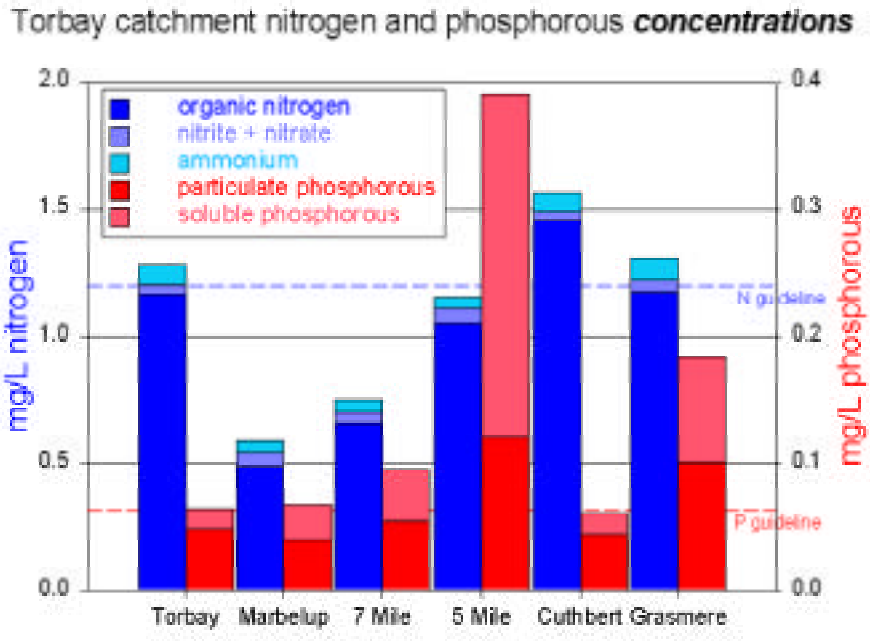
Most of the measured nitrogen is organic with just over 10% available in inorganic forms and there are minor differences between catchments.

5 Mile creek has extremely elevated levels of phosphorus and most of this phosphorus is in the form immediately available for algal growth.

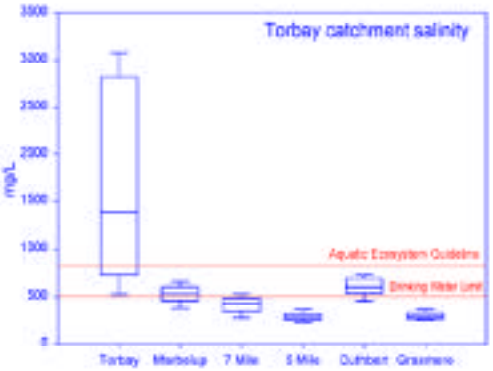
Grasmere Creek also has quite elevated phosphorus levels and 7 Mile Creek also has phosphorus levels above the recommended NWQMS guideline for aquatic ecosystems.

There is considerable variation in phosphorus concentration and forms, with Torbay Drain, Marbelup Brook and Cuthbert Drain having the lowest levels of phosphorus and having most of the phosphorus in particulate form.

Suspended sediment concentrations are not shown on these plots, however we know that Torbay and Cuthbert Drains are quite high in sediment. 7 Mile and Grasmere Creeks also have slightly elevated levels and occasionally very high levels of sediment.



Catchment



Salinity varies through the Torbay catchment with Torbay sub-catchment having marginal to brackish quality water.

Cuthbert sub-catchment is marginal and all other catchments are generally fresh although Marbellup Brook is marginal during summer. Marbellup Brook catchment extends inland to lower rainfall areas with extensive clearing resulting in summer baseflows being higher in salinity.

Since monitoring began in the 1960's, the quality of water in Marbellup Brook has deteriorated from fresh to seasonally marginal as a result of clearing in the catchment.

The higher salinity experienced in the Torbay sub-catchment is due to the artificial drain network intercepting the higher salinity groundwater underlying most of the sub-catchment.

It is not clear why Cuthbert sub-catchment is marginal quality, although it may be due to the intensive horticultural landuse in the area.

Natural Peace - Lake Powell *Photographer Brenda Howe Watershed Torbay Photographic Exhibition 2002*

able to confidently detect any trend.

Statistical trend analysis was recently carried out on the sampling data from 1997 to 2002. While there were some indications of possible trends at some sites, the only significant trend was a decrease in total nitrogen concentrations in 7 Mile Creek. There were also indications of possible improvement with decreases in turbidity for 7 Mile Creek and nitrogen and turbidity for 5 Mile Creek.

These improvements may be the result of some improvement in land and riparian use or management in these catchments.

The only indication of significant deterioration detected was a possible increase in total phosphorus concentrations in Cuthbert Drain which may be a result of horticultural activities in that catchment.

The full version of the monitoring report will be put on the website and will contain:

- additional plots of all of the water quality variables measured or sampled at the stream gauging stations
- full results and summary report of the nitrogen, phosphorus and turbidity trend analysis
- additional figures and plots of the streamflow and mass load data
- additional plots and figures from the snapshot monitoring
- a detailed explanation of how the stream gauging stations work
- some photographs of the sampling sites and the sampling process
- links to DoE and other internet sites of interest

http://www.torbay.scric.org/head.html

Contact Andrew Maughan at the Department of Environment Albany office on 9842 5760 to discuss aspects of the monitoring program and how to interpret and use the results. The catchment needs your interest!

Who is responsible for this data?

Geoff Bastyan, a consultant biologist, has collected all ot the water quality datafor this project. Shane Lawrence works for the Department of Environment, operating stream gauging stations across the South Coast Region. Shane provides the river level and flow rate data for this project. Emma Van Looij from the Department of Environment's Aquatic Science Branch in Perth performed the statistical trend analysis and is assisting with the macro-invertebrate program. Louise Duxbury from

about total loads?

It is important to take into account both nutrient concentration as well as total quantities of nutrients and streamflow volume when looking at possible management changes.

By multiplying the contaminant concentration by the streamflow rate or volume we can calculate the mass load or rate of contaminant transport in say milligrams per second (mg/s) or tonnes per year (t/yr).

This information tells us which catchments supply the greatest total quantities of nutrients or sediment entering the Torbay waterways.

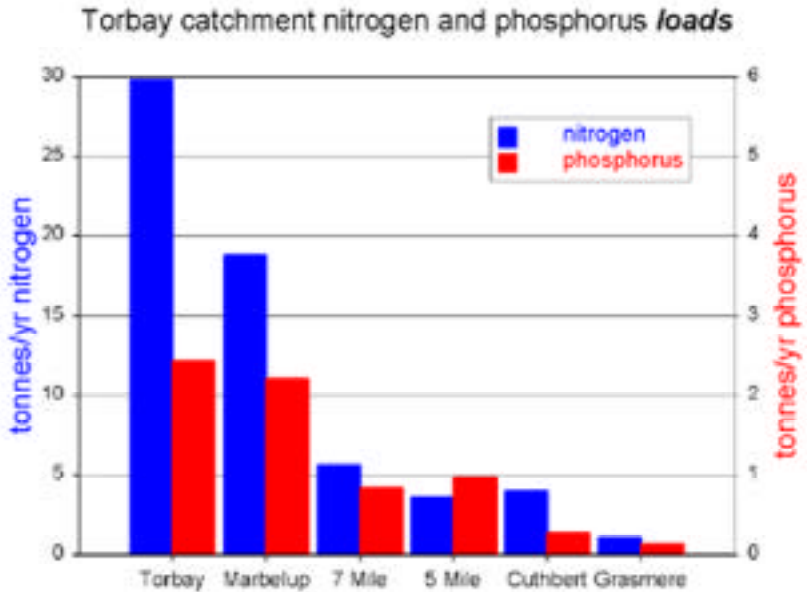
Depending on our increased understanding of how the Torbay waterways behave, we may decide it is most beneficial to intervene in catchments producing the greatest total quantities of nutrients. However we must also study and understand the concentrations of the nutrients in each stream because the catchments producing the greatest mass loads may actually have low concentrations and it may therefore be difficult to reduce these further.

This plot shows the average annual loads of nitrogen and phosphorus entering the Torbay waterway system from 1997 to 2002.

As could be expected the loads of nutrients are very closely related to streamflow volumes. nitrogen or phosphorus out of proportion to their flow.

- Torbay Drain and Marbelup Brook have very similar streamflow yields and contribute similar loads of phosphorus, however due to Torbay Drain's high nitrogen concentration it has a disproportionately high load of nitrogen (40% higher than Marbelup Brook).
- 5 Mile Creek contributes less than one quarter of the streamflow to Lake Powell but contributes almost half of the phosphorus load.
- Cuthbert Drain contributes a nitrogen load disproportionately high compared to its streamflow.
- Grasmere Creek produces a disproportionately high nitrogen and phosphorus load relative to its streamflow however this contribution is low relative to the other tributaries.
- 7 Mile Creek tends to produce a lower nitrogen and phosphorus load relative to its streamflow.

As our water quality monitoring program progresses we are able to start to analyse the data to assess whether the water quality leaving each sub-catchment is improving or getting worse. Because of the large variation in water quality concentrations measured at each site, a long period of sampling data is required to be



Green Skills and Andrew Maughan from the Department of Environment wrote this datasheet with assistance from Dave Rushton, the Watershed Torbay Project Officer.