Water quality monitoring is a vital part of the SCCP Action Plan

The Swan-Canning Cleanup Program and implementation of its Action Plan is managed by the Swan River Trust in partnership with the Water and Rivers Commission. As the name suggests, the actions in the plan are designed to improve the health of the Swan and Canning rivers, which have become degraded through loss of habitat and discharge of urban and agricultural runoff. As a result, our rivers have become nutrient enriched and suffer from nuisance and harmful algae blooms. The principal aim of the Swan-Canning Cleanup Action Plan is to reduce the frequency and duration of algal blooms, especially those considered potentially toxic.

Over half of the plan's budget is focused on actions to improve catchment management by reducing inflows of contaminants to the river from both the urban and rural areas. Since reductions in discharge may take some time to take effect, other projects are examining techniques to treat the symptoms of poor water quality in the river and estuarine portions of the system. Additional programs are aimed at increasing community awareness of the issues and influencing planning and development strategies such that the decline in river health is reversed.

Knowing where we are going

Our understanding of how the estuary works and its response to increased pressures has come principally from long term monitoring programs put in place at the beginning of the Swan-Canning Cleanup Program (SCCP) in 1994. Since 1994 several focused scientific studies have also contributed significantly to our understanding. These sampling programs also allow us to issue health warnings when certain potentially toxic species are present and alert us to low oxygen conditions, which may cause fish kills.

Now that the Action Plan is being implemented, the focus has shifted to developing ways to measure whether we are making a difference, although there is still the need to report on algal conditions which may require health alerts. The monitoring program has been adapted to allow us to measure changes. A later issue of River Science will describe how we set targets and measure against them.

This River Science describes the techniques and instruments used in the sampling programs, locations of sites and how we use the data gathered.

Both the catchment and the estuary are monitored

There are now three water quality monitoring programs in the SCCP Action Plan undertaken by staff from the Swan River Trust and the Water and Rivers Commission:

- Swan Estuary monitoring program;
- Canning River monitoring program; and the
- Swan-Canning Catchment monitoring program.

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Swan River Trust employee Vaughan Smith taking a flow reading for the Southern River at Anaconda Drive on the Canning Catchment

These programs track the physical dynamics and biological and chemical interactions in the water column by measuring physical properties of the water column and collecting water samples for nutrient analysis and phytoplankton counts.

Reaches of the Swan River are sampled by boat from Fremantle to Bassendean, as is the Canning River from Salter Point to beyond Nicholson Bridge. The relatively small streams and drains of the catchment are sampled from the shore.

Each sampling program is quality assured and statistically sound. This includes selecting representative sites, maintaining chain of custody procedures for samples, and quality control procedures in the data collection, analysis and management stages.

Swan Estuary and Canning River

Nine sites are sampled in the Swan Estuary from the lower reaches of the Swan near Fremantle to the upper reaches beyond Bassendean. Seven sites are sampled weekly in the Canning River above and below Kent Street weir as shown on the accompanying map (Figure 1). An additional four sites are sampled in the summer specifically to provide early warning of blooms.

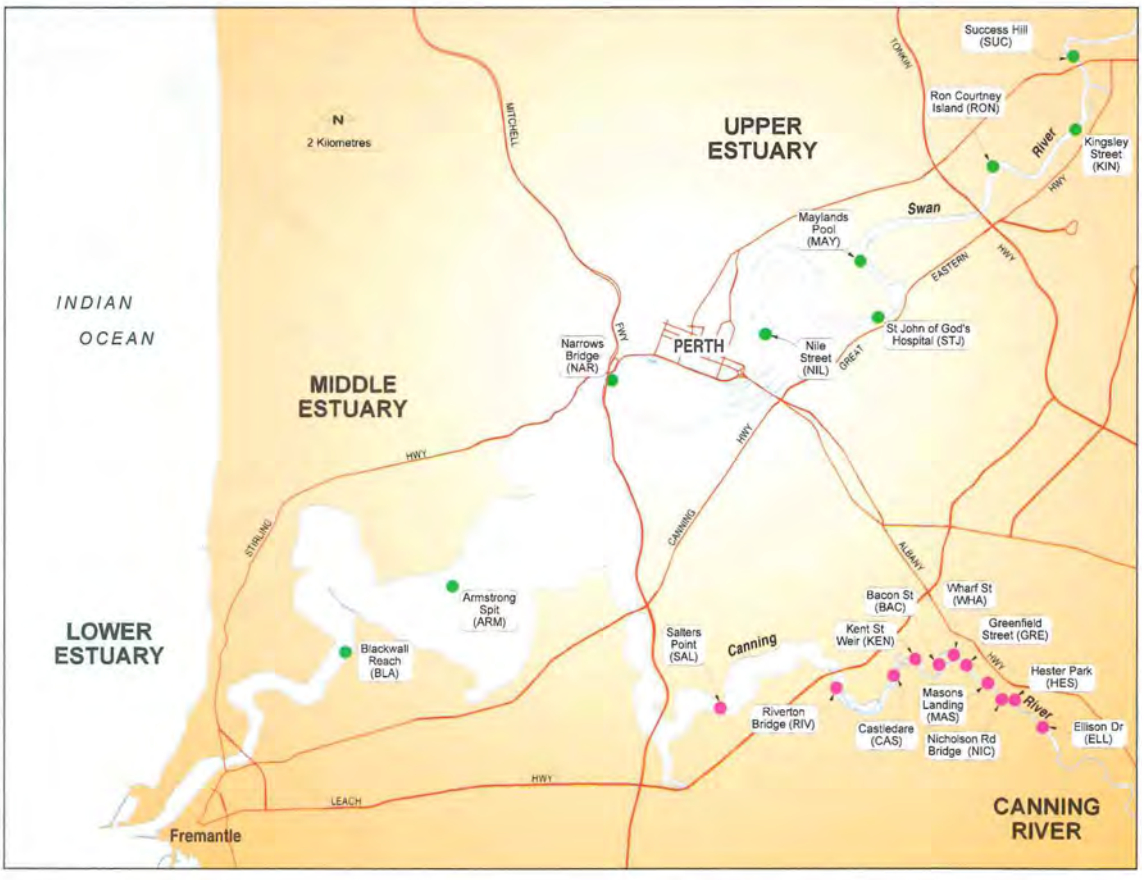

Figure 1. *Swan-Canning fixed sampling sites*

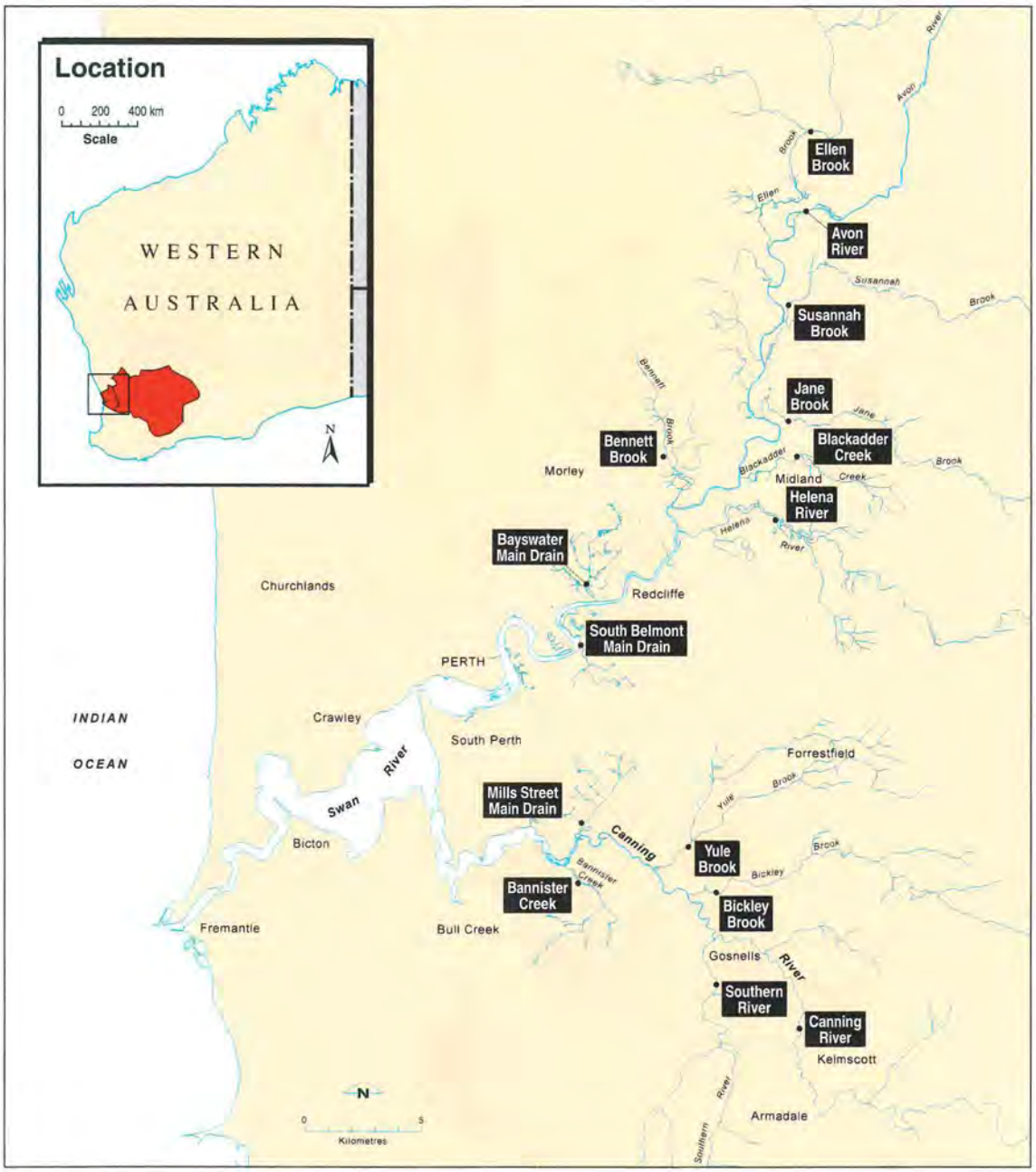

Figure 2. *Swan and Canning Catchment sampling sites*

Swan-Canning Catchment

Fifteen sites representing the main tributaries that flow into the estuary are sampled in the catchment program as shown in Figure 2. All sites have been sampled weekly in the past although some are not sampled year-round, as they tend to dry out during the summer months. Since the winter of 2000 all sites are now sampled fortnightly based on the results of statistical analysis of the data that showed fortnightly sampling was adequate to detect changes over time. In addition automatic samplers that allow us to sample storm events are situated on Ellen Brook, the Avon at Walyunga, and on Mills St drain. These sites are representative of the main inflow types and the data will be used to calculate nutrient loads to the estuary. These data will be discussed in later issues of River Science.

Deciding what to measure

The water quality parameters that are measured weekly cover physical, chemical and biological aspects. They are measured on site or through the analytical services of chemical or biological laboratories. The data is managed by the Water and Rivers Commission and reported regularly to the Swan River Trust.

Physical parameters

Physical water quality parameters include:

- pH;
- water temperature;
- dissolved oxygen (mg/L and % saturation);
- conductivity and salinity;
- turbidity; and
- Secchi disk depth;

These are measured in the field with a 'Hydrolab' multi-probe data logger. This instrument measures these parameters at various depths throughout the water column. New instruments are being evaluated for chlorophyll and light. For example a Lycor sensor allows the measurement of PAR or photosynthetically active light, which is a more complete measure than Secchi depth of the light, required to sustain phytoplankton growth.

Together these parameters describe the basic conditions of the water that support life. Dissolved oxygen for example is good measure of the life support capacity of the river. Water is considered fully saturated with oxygen at 10 mg/L or lower in warm water, about 8 mg/L in the summer months. Values below 4 mg/L are considered unhealthy.

Salinity is computed from the electrical conductivity of the water, the temperature and the depth. Knowledge of change in salinity from the surface to the bottom tells us much about the movement of the water, the degree of stratification and the position of the salt wedge.

Temperature of course is a vital indicator of the ability of the water to support growth, as is the Secchi depth, which is a simple measure of light penetration. The Secchi disk has white and black quadrants and is lowered through the water until the disk just becomes invisible. This is called the Secchi depth.

Chlorophyll a is the active constituent of all plants required for photosynthesis and is therefore a measure of phytoplankton abundance. Although normally analysed in the lab from filtered samples, chlorophyll a can also be measured with a fluorometer which measures the fluorescence of the chlorophyll pigment. One is being evaluated for use on the Swan.

Smaller hand-held meters are used for streams and drains in the catchment to measure pH, temperature, conductivity, and dissolved oxygen.

Water and Rivers Commission employee Amanda Wilson taking physical measurements with a hydrolab

Water and Rivers Commission employee measuring Secchi disk depth on the Canning River

Chemical parameters

Chemical parameters measured in the Swan and Canning monitoring programs include:

- total nitrogen and phosphorous;
- nitrates, nitrites and ammonia;
- filterable reactive phosphorus (phosphate);
- total suspended solids;
- alkalinity (estuary only).
- chlorophyll a (estuary only)

Nutrients such as phosphorus and nitrogen are particularly important because of their role in the eutrophication or nutrient enrichment of water bodies and the growth of algae. Phytoplankton use dissolved N (nitrate, ammonia) or P (phosphate) for growth, however the particulate N and P is eventually available for growth through transformations in the sediment which release nutrients into the dissolved phase. Alkalinity is an indirect measure of the carbon in the system which is also a critical component for phytoplankton growth

Water samples are filtered or preserved by field staff before being submitted for analysis and analysed by NATA (National Association of Testing Authorities) registered analytical laboratories which are also audited by WRC chemists.

Biological parameters

Samples are taken from sites within the Swan-Canning Estuary to assess the groups and species of phytoplankton and the density of their cells in the water. Phytoplankton occur naturally and are an important part of the food chain in the estuary. In a nutrient enriched estuary however, harmful species of phytoplankton often develop and can at times grow very fast in response to changes in nutrients and light. Some species are potentially toxic and can pose a risk to public health and to the aquatic environment. Other species are a nuisance to river users because of their appearance, odour or because they stain clothing.

A team of algal taxonomists from the Water and Rivers Commission identify and count phytoplankton species in the water samples using microscope techniques.

Regular reports to the Swan River Trust describe the phytoplankton communities and the numbers of particular species at each site and also form the basis of health alerts when potentially toxic species are detected.

Swan River Trust employee Brian Graco collecting water samples for nutrient analysis

Dealing with the data

All water quality data collected on the Swan and Canning rivers are managed on a central database developed by the Water and Rivers Commission. This data management system includes a mechanism to verify data and the methods used in its collection and analysis.

These data are available for managers and interpreted by the Water and Rivers Commission and reported to relevant parties. Future issues of River Science will describe how these data are used.

SWAN RIVER TRUST

WATER AND RIVERS COMMISSION

Coasts & Clean Seas

Eco Action
Our environment, our future.

How is this helping our rivers?

Monitoring the water quality in the Swan and Canning River system is enabling us to understand how eutrophication and algae blooms are affected by rainfall and water chemistry. It can also help show us the major sources of nutrients to feed algae, derive targets for water quality, and also enable us to assess the success of remedial strategies both in the catchment, and in the Estuary.

Increasing our knowledge in the Swan Canning River systems is a major part of the Swan Canning Clean up Program. Additional issues in the River Science series show how this information can be used to improve the health of these systems.

About River Science

The River Science series brings the scientific understanding underpinning the Swan-Canning Cleanup Program to interested community members. In this way we all gain an appreciation of how the river-estuary responds to the pressures placed on it and the management options resulting from those pressures.

This first report in the series has explained why and how we sample the river. The series will then progress to talking about the cycle of algal blooms in the river, where nutrients come from and what happens to them when they leave the catchment and enter the estuary. Later in the series, intervention techniques such as oxygenation are explained. When assembled in numerical order the series will act as chapters in a book.

It is intended that the series will be current and keep the community informed of new understanding as it develops.

Acknowledgments

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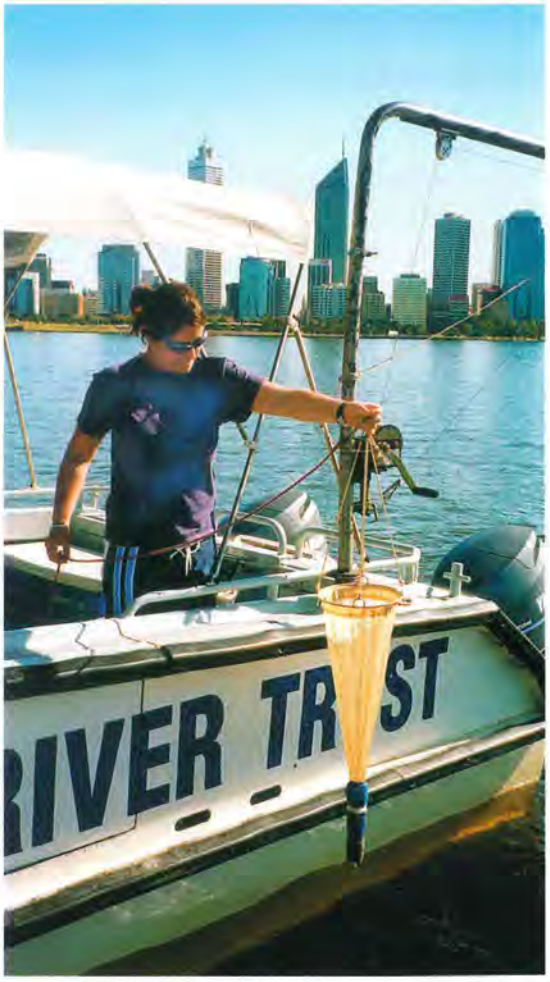

Water and Rivers Commission employee Amanda Wilson taking a phytoplankton sample using a concentrating net

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