

# SUMMER WATER QUALITY MONITORING

## COCKBURN SOUND



Figure 1: Location of water quality monitoring sites in Cockburn Sound and the reference sites in Warnbro Sound

Note: Light attenuation is measured at SF-L, MB-L and WSSB-L which are located close to the shallow water quality monitoring sites SF, MB and WSSB respectively.

### Background

Declining water quality in Cockburn Sound became a major concern in the 1970s. Industrial discharges, in particular increases in nutrient loading, were identified as the primary cause of increases in phytoplankton<sup>1</sup> levels and the loss of seagrass in the Sound. In response, industry reduced contaminant and nutrient discharges to the extent that by the early 1980s, water quality was much improved compared to the late 1970s. Water quality declined again in the late 1980s. At that time, contaminated groundwater was identified as the main source of nitrogen entering Cockburn Sound.

To assess the effects of changes in nutrient loading to Cockburn Sound, measurements of water quality (including nutrients, chlorophyll *a* and light attenuation) over the summer have been undertaken since 1977. The current monitoring program commenced in 1982 at eight sites, with additional sites incorporated into the program since that time. Monitoring commenced at the two reference sites in Warnbro Sound in 2001. This monitoring has been funded by government and industry.

The Cockburn Sound Management Council (CSMC) is responsible for overseeing the annual program of summer water quality monitoring in Cockburn Sound. Funding is provided by the Department of Environment Regulation.

1 Single-celled plants and other photosynthetic organisms (including cyanobacteria, diatoms and dinoflagellates) that live in the water column.



## What is the Purpose of the Water Quality Monitoring?

- To determine whether the environmental quality objectives set in the *State Environmental (Cockburn Sound) Policy 2015* are being met and the environmental values identified for the Cockburn Sound marine area are being protected and maintained.
- To identify changes and trends in water quality over time.

## What Water Quality Data are Collected?

Data collected during the water quality monitoring include:

Nutrients	<i>Different forms of nitrogen (total nitrogen, ammonium, nitrate and nitrite) and phosphorus (total phosphorus and filterable reactive phosphorus) which are essential for the growth of aquatic plants (for example, phytoplankton, seagrass, and seaweed).</i>
Chlorophyll <i>a</i>	<i>The green pigment present in plants which is responsible for the absorption of light to provide energy for photosynthesis. The concentration of chlorophyll <i>a</i> is used as a measure of phytoplankton biomass.</i>
Light attenuation	<i>A measure of the gradual loss in light intensity through the water column. Light availability is considered one of the primary environmental factors affecting the distribution of seagrasses.</i>
Temperature	<i>Temperature affects many of the physical, chemical and biological characteristics of the water.</i>
Salinity	<i>A measure of the total salts dissolved in water. Salinity fluctuates depending on freshwater river inflows and rainfall.</i>
Dissolved oxygen	<i>A measure of how much oxygen is dissolved in the water. Most organisms have an optimal range of dissolved oxygen and dissolved oxygen is an important indicator of water quality.</i>
pH	<i>A measure of the acidity or alkalinity of the water.</i>
Secchi depth	<i>A measure of the clarity of the water.</i>
Visual aesthetics	<i>The appearance of the water.</i>

## When, Where and How are the Water Quality Data Collected?

Water quality monitoring is undertaken at approximately weekly intervals over the period between 1 December and 31 March. The summer period, when there is low river flow into Cockburn Sound, is the preferred season for nutrient-related monitoring (chlorophyll *a*, phytoplankton biomass and light attenuation).

Murdoch University's Marine and Freshwater Research Laboratory undertakes the collection and analysis of water samples. The methods for collection and analysis of water samples are in accordance with the *Standard Operating Procedures* for environmental monitoring in Cockburn Sound.<sup>2</sup> All analyses are carried out in accordance with the laboratory's quality system and the terms of its National Association of Testing Authorities (NATA) accreditation.

Water quality is monitored at 18 sites in Cockburn Sound and two reference sites in Warnbro Sound (**Figure 1**).

<sup>2</sup> Environmental Protection Authority (2005). *Manual of Standard Operating Procedures for Environmental Monitoring against the Cockburn Sound Environmental Quality Criteria (2003-2004)*.



(Source: Marine and Freshwater Research Laboratory, Murdoch University)

Figure 2: Collection of water samples



(Source: Marine and Freshwater Research Laboratory, Murdoch University)

Figure 3: On-board processing of water samples

Depth-integrated water quality samples are collected at each site using a submersible pump and extendable hose (**Figure 2**). Sub-samples are collected for nutrient and chlorophyll *a* analysis in the laboratory (**Figure 3**).

Light attenuation is simultaneously measured using two underwater Li-Cor light sensors. One light sensor is positioned one metre (m) below the surface and a second, seven metres below the surface.

*In situ* measurements of temperature, salinity, dissolved oxygen and pH are made at each site using a Sea-Bird Electronics SBE19plusV2 vertical profiling CTD. Measurements are taken 0.5 m below the water surface and 0.5 m above the sediment surface.

Secchi depth is measured using a 20 centimetre diameter Secchi disk.<sup>3</sup>

On each sampling occasion the field team records the presence of algal blooms, dead organisms, surface or submerged debris and surface films, as well as water colour and clarity at each site.

## Environmental Quality Criteria

The *Environmental Quality Criteria Reference Document for Cockburn Sound*<sup>4</sup> details the environmental quality criteria for protecting Cockburn Sound from the effects of physical and chemical stressors. The data collected through the summer water quality monitoring program are assessed against these criteria in accordance with the Reference Document.

## Reporting on the Results of Water Quality Monitoring

Water quality monitoring programs are also implemented by a number of public authorities with responsibilities in Cockburn Sound. To facilitate compilation and reporting, the data from these programs are provided to the CSMC.

The CSMC reports annually to the Minister for Environment and the community on the results of water quality monitoring in Cockburn Sound. The full report and the Report Card can be found on the [CSMC's website](#).

Water quality data are available on request from CSMC.

For more information please contact the Cockburn Sound Management Council:

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Or visit the Cockburn Sound Management Council's website:  
[www.der.wa.gov.au/about-us/csmc](http://www.der.wa.gov.au/about-us/csmc)

- 3 A Secchi disc is a circular plate with alternating black and white quadrants and which is attached to a rope. The Secchi disc is lowered into the water until it is at a depth where the pattern can no longer be seen. This is the Secchi depth.
- 4 Environmental Protection Authority (2017). *Environmental Quality Criteria Reference Document for Cockburn Sound. A supporting document to the State Environmental (Cockburn Sound) Policy 2015*.