



Western Australian Auditor General's Report

Environmental Management of Cockburn Sound

Report 8 – September 2010



Courtesy Wild Encounters Rockingham



Courtesy CSMC – Melissa Robins



THE PRESIDENT
LEGISLATIVE COUNCIL

THE SPEAKER
LEGISLATIVE ASSEMBLY

PERFORMANCE AUDIT – ENVIRONMENTAL MANAGEMENT OF COCKBURN SOUND

This report has been prepared for submission to Parliament under the provisions of section 25 of the *Auditor General Act 2006*.

Performance audits are an integral part of the overall audit program. They seek to provide Parliament with assessments of the effectiveness and efficiency of public sector programs and activities, and identify opportunities for improved performance.

The information provided through this approach will, I am sure, assist Parliament in better evaluating agency performance and enhance parliamentary decision-making to the benefit of all Western Australians.

A handwritten signature in black ink, appearing to read 'C. Murphy'.

COLIN MURPHY
AUDITOR GENERAL
22 September 2010

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Auditor General's Overview

Cockburn Sound is a unique marine environment on Perth's southern doorstep. It is bounded by the Kwinana industrial strip to the east, the rapidly developing centre of Rockingham to the south east and Garden Island to the west. The diversity of land and water based activities in and around Cockburn Sound, combined with a variety of sometimes competing interests make its environmental management a complex and challenging task.

The State Government recognised the unique challenges faced in managing Cockburn Sound and established an independent stakeholder-based Cockburn Sound Management Council (CSMC) in 2000. At the same time the Environmental Protection Authority developed a State Environmental Protection Policy for Cockburn Sound.

The CSMC is tasked with working cooperatively with state government agencies, industry and the local community to develop and implement a management plan to give effect to the State Environmental Policy. This is essentially a consultative and advisory role. The CSMC receives some funding from government, it also receives some contributions from industry.

The CSMC's role is backed by the Department of Environment and Conservation which has overarching responsibility for protecting and conserving the state's environment. This includes protection of the marine environment in Cockburn Sound.

My audit provides assurance that the environmental management framework for Cockburn Sound is for the most part working well. However the audit also brings attention to gaps in policy implementation and management oversight which need to be addressed to ensure the marine ecosystem of Cockburn Sound is protected.

This is particularly important as ecosystem health in Cockburn Sound remains under pressure, a situation that is likely to increase into the future.

Executive Summary

Introduction

Cockburn Sound is highly valued by the community for its ecological, economic and recreational attributes. The area is home to a vital part of the state's economy, incorporating the Kwinana industrial area, international shipping, port facilities, national defence and Perth's desalination plant. The diversity of activity in the Sound keeps it under constant environmental pressure from increasing industrial, urban and recreational use.

In response to the many pressures, government established the Cockburn Sound Management Council (CSMC) in 2000 to "facilitate and coordinate ongoing environmental management of Cockburn Sound."

Cockburn Sound is unique in having Western Australia's (WA) only State Environmental Policy to protect its environmental quality. The State Environmental Policy for Cockburn Sound (SEP) was released in 2005 and is a cabinet approved government policy. The purposes of the SEP are:

- to declare, protect and maintain the environmental values of Cockburn Sound
- to abate pollutants and restrict activities that diminish the environmental values of Cockburn Sound
- to establish a program to protect and enhance environmental quality to support the environmental values of Cockburn Sound
- to give effect to the environmental quality objectives and the environmental quality criteria for Cockburn Sound
- to give effect to the Environmental Management Plan for Cockburn Sound.

In the same year, the management council produced its *Environmental Management Plan for Cockburn Sound and its Catchment 2005*. The plan guides implementation of the SEP.

Maintenance of healthy and productive marine ecosystems is fundamental to the environmental management of Cockburn Sound. Seagrass is used as a key indicator of ecosystem health in the Sound. Seagrasses provide food and shelter for many organisms, and are a nursery ground for commercially important prawn and fish species. These plants support numerous food chains and are considered highly productive 'pastures of the sea'.

This performance audit examined whether the environmental management framework and supporting arrangements promote a healthy ecosystem in Cockburn Sound. Seagrass is a key indicator of ecosystem health.

Audit conclusion

A strong environmental management framework has been established for Cockburn Sound. However gaps in policy implementation and management oversight mean the framework has not been fully effective in maintaining ecosystem health.

Key findings

A strong environmental management framework has been established:

- Cockburn Sound has a strong environmental policy framework in place. The framework includes the State Environmental Policy and the Environmental Management Plan for Cockburn Sound and its Catchment. These are supported by guidance documents that define environmental quality criteria and procedures for monitoring and reporting against the criteria.
- Management responsibility for the policy framework is clear:
 - The CSMC brings together a diverse group of stakeholders to identify, address and resolve issues as they arise. The council provides independent advice to government and publically reports annually on the health of the Sound.
 - The Department of Environment and Conservation (DEC) has responsibility for ensuring that the requirements of the *Environmental Protection Act 1986* which includes the marine environments of Cockburn Sound are met.
 - The Environmental Protection Authority (EPA) has responsibility for reviewing the SEP, assessing the environmental impact of referred development proposals and providing other advice to the Minister for Environment as requested.

Implementation and management oversight need to be strengthened to ensure the environmental management framework is fully effective:

- Monitoring indicates that seagrass in Cockburn Sound remains under pressure. Since 2005, three out of seven monitoring sites in Cockburn Sound have fallen below the required seagrass health standard and one other site has come close to falling below the standard.
- The SEP requires use of a monitoring methodology that benchmarks seagrass health against a reference site in Warnbro Sound. We found a decline in seagrass shoot density in Warnbro Sound has caused a lowering of the standards used for determining healthy seagrass in Cockburn Sound. The decline had not been recognised by the EPA, the DEC or CSMC due to a combination of factors linked to the monitoring methodology; specifically, no requirement to report trend analysis of seagrass health and insufficient quality assurance.
- Monitoring does not adequately measure the total area of seagrass in Cockburn Sound. Although the Environmental Management Plan for Cockburn Sound requires periodic mapping, total seagrass area has not been mapped since 2004.
- Total contaminant discharges into Cockburn Sound are not monitored. This reduces government's ability to take appropriate and timely management action. Common discharges include nitrogen and phosphorus which have a significant detrimental impact on water quality and seagrass health.

- There has been no formal environmental risk assessment for Cockburn Sound since 2001. Such an assessment would help focus monitoring on areas of greatest concern.
- Insufficient quality assurance and management oversight by the CSMC, the Office of the EPA and DEC has led to errors and inconsistencies in reporting on ecosystem health. This has masked a decline in key indicators of seagrass health and water quality at some monitoring sites.
- Reporting on ecosystem health needs to be strengthened to better highlight areas of concern and provide sufficient information to allow a clear assessment of trends in ecosystem health. The current focus on reporting the health of broad zones can mask areas of concern and hot spots at some individual monitoring sites can be overlooked.
- CSMC do not always investigate when environmental quality criteria are exceeded at individual monitoring sites and then report what corrective action is being taken. This reflects their focus on zones rather than individual sites. The SEP is not always clear about when investigation and reporting is required.

Recommendations

The EPA, DEC and the CSMC should bring forward the planned 2012 review of the SEP. The review should consider the following measures to strengthen the current monitoring methodology and practice:

- confirm that Warnbro Sound remains a valid reference site
- improve transparency and reporting when benchmark standards for environmental quality criteria are adjusted
- clarify the requirement to report against zones or specific monitoring sites
- periodic seagrass mapping to assess overall trends in seagrass coverage in the Sound
- monitoring cumulative contaminant inputs
- updating the environmental risk assessment of Cockburn Sound
- strengthening quality assurance frameworks for how data is collected and used.

The EPA, DEC and the CSMC should strengthen the current reporting framework by providing sufficient information to allow an assessment of trends in ecosystem health. Reports should include monitoring results from the reference site and should place more emphasis on individual monitoring sites within zones.

CSMC should set realistic timeframes to ensure that appropriate action is taken when environmental guidelines and standards are exceeded.

Response from Cockburn Sound Management Council

We welcome the affirmation of the CSMC's key role in protecting the Sound's environmental values within the strong framework of the SEP and EMP. While focusing mainly on seagrass, the audit identifies future needs and directions including expanding the scope of monitoring in the context of the forthcoming review of the SEP.

Response from the Environmental Protection Authority

The EPA welcomes the finding that the Cockburn Sound SEP provides a strong management framework to support sound decision-making and to focus management action. The EPA also supports the findings related to improving SEP implementation and will consider the merits of bringing forward its planned 2012 review.

Response from the Department of Environment and Conservation

DEC generally supports the key findings and recommendations, and agrees that they should be addressed through the review of the State Environmental Policy for Cockburn Sound. Interaction between the CSMC, DEC and EPA should be examined as part of that review to address findings regarding quality assurance and management oversight.

Cockburn Sound has important and sometimes competing environmental, economic and recreational uses that put the ecosystem under pressure

The diversity of activities in Cockburn Sound put the ecosystem under pressure

Cockburn Sound is a shallow coastal basin just south of Fremantle, between Garden Island and Woodman Point. It covers an area of about 124 square kilometres and is the most intensively used coastal area in Western Australia (WA).

The diversity of activity in the Sound keeps it under constant environmental pressure. The area is important economically, socially and environmentally as it is used for multiple activities including commercial, industrial, aquaculture and recreational purposes. It is home to a vital part of the state's economy, incorporating the Kwinana industrial area, international shipping, port facilities, national defence, Perth's desalination plant and the largest snapper spawning area outside Shark Bay.

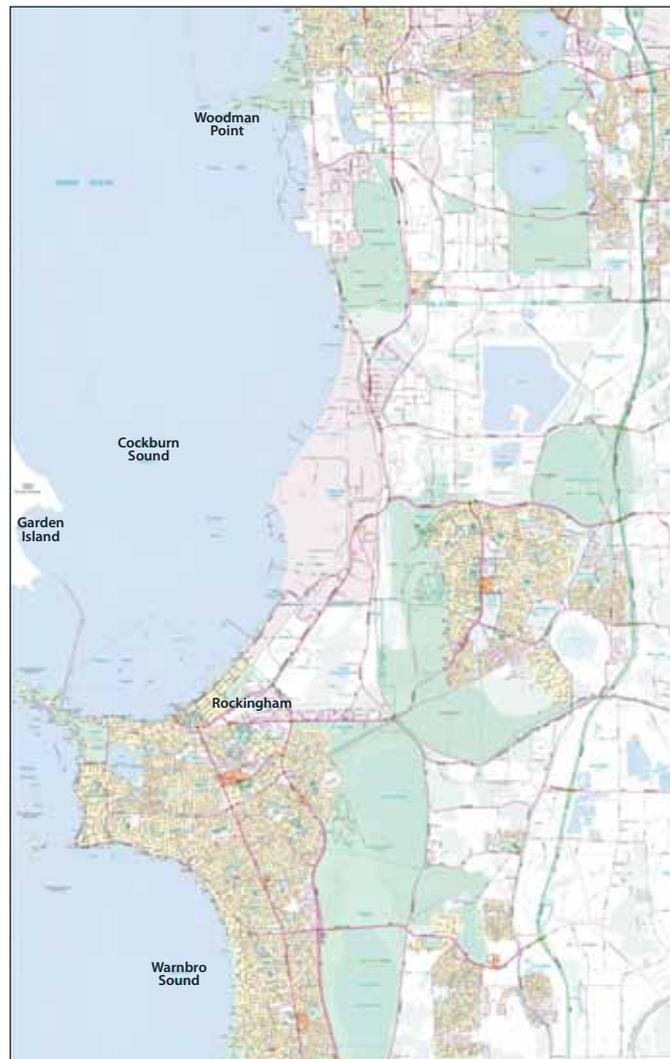


Figure 1: Cockburn Sound covers an area of about 124 square kilometres and is the most intensively used marine coastal area in WA

Seagrass is a key indicator of ecosystem health in Cockburn Sound

The temperate coastal waters of WA are recognised for containing one of the world's richest seagrass floras. Seagrasses are important primary producers. They provide food and shelter for many organisms, and are a nursery ground for commercially important prawn and fish species. The high primary production rates of seagrasses are closely linked to high production rates of associated fisheries. These plants support numerous food chains and are considered highly productive 'pastures of the sea'.

In Cockburn Sound, seagrass meadows originally occupied nearly 4 000 hectares, covering most of the seabed at depths of 10 metres or less. In the late 1960s and early 1970s most of the seagrass meadows in Cockburn Sound were severely degraded because of nutrient enrichment. By 2004 it was estimated that only 872 hectares of seagrass remained, 78 per cent of the original coverage had been lost.

During the late 1970s, an environmental study identified significant industrial discharge as the primary cause of poor water quality and the widespread loss of seagrass. In response, industry reduced its contaminant and nutrient discharges such that by the early 1980s water quality had improved.

Water quality declined again in the late 1980s triggering another investigation, the *Southern Metropolitan Coastal Waters Study (1991-94)*. This study determined that although seagrass dieback had slowed, nutrient related water quality was only marginally better than it was in the late 1970s. Contaminated groundwater was now considered the main nitrogen input entering the Sound.

Cockburn Sound Management Council was established to coordinate environmental management of the Sound

In response to the many pressures, government established the Cockburn Sound Management Council (CSMC) in 2000 to facilitate and coordinate ongoing environmental management of Cockburn Sound. The CSMC is a non-regulatory advisory body to the Minister for Environment with funding provided through the Department of Environment and Conservation (DEC).

The CSMC's initial priority was to develop an Environmental Management Plan for Cockburn Sound and its catchment. In parallel with this, the Environmental Protection Authority (EPA) and the then Department of Environmental Protection were tasked with developing an Environmental Protection Policy for the Sound. Environmental Protection Policies are prepared under Part III of the *Environmental Protection Act 1986* (EP Act) and have the force of law as though they had been enacted as part of the EP Act.

Government then decided to release a State Environmental Policy to protect the environmental quality of Cockburn Sound. In 2005, the EPA released the *State Environmental (Cockburn Sound) Policy 2005* (SEP). The SEP defines environmental quality objectives and specific quality criteria against which to audit environmental performance. In the same year, CSMC produced its *Environmental Management Plan for Cockburn Sound and its Catchment 2005*. Although the SEP does not have the force of law it is a cabinet endorsed government policy and is implemented through the statutory powers of relevant Acts.

In December 2009, the EPA issued an Environmental Assessment Guideline entitled *Protection of Benthic Primary Producer Habitats in Western Australia's Marine Environment*. The EPA developed this particular guideline in recognition of "the fundamental ecological importance of benthic primary producer habitats and the potential consequences of their loss for marine ecological integrity".

Benthic primary producer habitats are defined as seabed communities within which algae, seagrass, mangroves, corals or mixtures of these groups are prominent components. Cockburn Sound is specifically identified in the guideline as a degraded area where a substantial portion of habitat has already been lost. The EPA's environmental objective in Cockburn Sound is to ensure no net loss of the remaining seagrass habitat and where possible, generate a net gain.

The combination of current guiding documents has the underlying purpose of preserving the remaining seagrass areas within Cockburn Sound as well as establishing water quality at levels that would encourage regrowth in areas previously destroyed or weakened. This focus recognises the essential role seagrass has in maintaining the healthy diversity and abundance of marine species dependent upon their existence.

The DEC has overall responsibility to ensure the EP Act and its requirements are met. This broad legislation covers all areas of the state, including marine environments such as Cockburn Sound.

The EPA is an independent statutory authority established under the EP Act. It is an advisory body established to provide independent environmental advice to government. Although it provides advice, it cannot make decisions, approve proposals, grant licences or enforce action. Its key functions are drafting Environmental Protection Policies, advising on the environmental impact of development proposals and providing other advice to the Minister for Environment. The Office of the EPA was established as an agency in November 2009 and supports the EPA in fulfilling its function.

In its role of providing independent advice, the EPA developed the State Environmental Policy for Cockburn Sound. The SEP was approved by Cabinet and adopted as government policy.

The CSMC was originally established under the now repealed *Water and Rivers Commission Act 1995*. It is now established under the EP Act, and is responsible for administering and coordinating the implementation of the Environmental Management Plan for Cockburn Sound. This involves a broad range of activities including:

- investigate, review, monitor, report and continually improve on the achievement of environmental objectives
- coordinate and encourage research and investigations to support environmental management
- promote the understanding of the environmental management plan
- report annually to the Minister for Environment on the implementation of the management plan.

The primary accountability document for CSMC to discharge its responsibilities is the annual report on the *State of the Sound*. The CSMC also plays an important role in raising community concerns with relevant government agencies relating to development proposals and other potential pressures in the Sound.

Examination focus and approach

Our audit focused on management of ecosystem health. The SEP addresses the protection of four values: ecosystem health, fishing and aquaculture, recreation and aesthetics and industrial water supply. The Environmental Management Plan for Cockburn Sound indicates that the maintenance of healthy and productive marine ecosystems is fundamental to the management of the marine and land environments and where conflicting options exist, priority should be given to maintaining ecosystem health and integrity. For this reason our audit focused on the protection of ecosystem health which is the principal environmental value for Cockburn Sound.

The purpose of our audit was to determine whether existing environmental management practices promote a healthy ecosystem in Cockburn Sound. To answer this question, three lines of inquiry were used:

- Are environmental management standards, policies, and accountability arrangements well defined and effective to promote a healthy ecosystem in Cockburn Sound?
- Are inputs appropriately controlled in accordance with established standards to promote the ecosystem in Cockburn Sound?
- Is ecosystem health appropriately measured and reported and results used to inform environmental management practices in Cockburn Sound?

Three primary agencies were involved in our audit: the Department of Environment and Conservation, the Office of the Environmental Protection Authority, and the Cockburn Sound Management Council. We gathered evidence from December 2009 to July 2010. In conducting this audit we:

- performed detailed file reviews at the agencies involved and conducted interviews with relevant staff at each of the agencies
- examined the primary activities relating to protection of ecosystem health in Cockburn Sound
- analysed data reported as well as raw data provided by CSMC.

We did not audit the effectiveness of the Council in fulfilling its broader roles in implementing the environmental management plan for Cockburn Sound.

The audit was carried out in accordance with the Australian Auditing Standards.

The environmental management framework for Cockburn Sound has many strengths

Findings

- A strong environmental policy framework for Cockburn Sound provides a solid foundation to focus management action and enable transparent decision-making.
- Having a management council for Cockburn Sound has been instrumental in bringing specific attention to pressures on the Sound.

A strong environmental policy framework for Cockburn Sound provides a solid foundation to focus management action and enable transparent decision-making

The combination of policy, plans and environmental guidance in place for Cockburn Sound is unique in WA and sets out a strong framework within which to base decision-making and focus management actions. Specifically the documents:

- set out environmental values and measurable objectives
- clearly define responsibility for achieving and reporting results
- establish a monitoring program with associated procedures for implementation and analysis
- define actions required where problems are identified
- define a timeframe for review of the policy and management plan.

The primary documents making up the environmental management policy framework include the State Environmental Policy and the Environmental Management Plan for Cockburn Sound and its Catchment. These are supported by guidance documents that define environmental quality criteria and procedures for monitoring and reporting against the criteria.

The environmental management of Cockburn Sound is guided by the SEP. The original intention for Cockburn Sound was to have an Environmental Protection Policy that allowed for fines and enforcement action in the event of non-compliance with the policy. Following industry and community consultation it was agreed a State Environmental Policy was more appropriate. The SEP relies on public authorities who have management responsibilities under relevant legislation, to accept their responsibilities. It also relies on a cooperative approach to influence action in the event of non-compliance. Before the SEP was approved by Cabinet, it went through an extensive public consultation.

The SEP acts as a framework to guide environmental impact assessments, licensing, regulation and decisions affecting the environment within Cockburn Sound. Its purpose is:

- to declare, protect and maintain the environmental values of Cockburn Sound
- to abate pollutants and restrict activities that diminish the environmental values of Cockburn Sound
- to establish a program to protect and enhance environmental quality to support the environmental values of Cockburn Sound

- to give effect to the environmental quality objectives and the environmental quality criteria for Cockburn Sound
- to give effect to the Environmental Management Plan for Cockburn Sound.

The SEP is supported by a set of complex operating procedures designed to monitor environmental criteria against benchmarks in order to evaluate success. This process uses a risk based approach, triggering management response where monitoring indicates a risk of significant environmental impact. Guidance on measuring and reporting ecosystem health is detailed in a supporting document to the SEP – *the environmental quality criteria reference document for Cockburn Sound (2003-04)*.

The Environmental Management Plan guides implementation of the policy and details a five point plan of action to:

- protect the environmental values of Cockburn Sound
- facilitate multiple use of Cockburn Sound and its foreshore
- integrate management of the land and marine environments
- coordinate research and investigations
- monitor and report on performance.

The Environmental Management Plan details how the requirements of the SEP will be implemented and who is responsible for implementation. The plan recognises the importance of having planning, assessment and monitoring processes that are easily understood, provide certainty and have clear lines of accountability to deliver outcomes. Both the policy and the plan are scheduled for review in 2012.

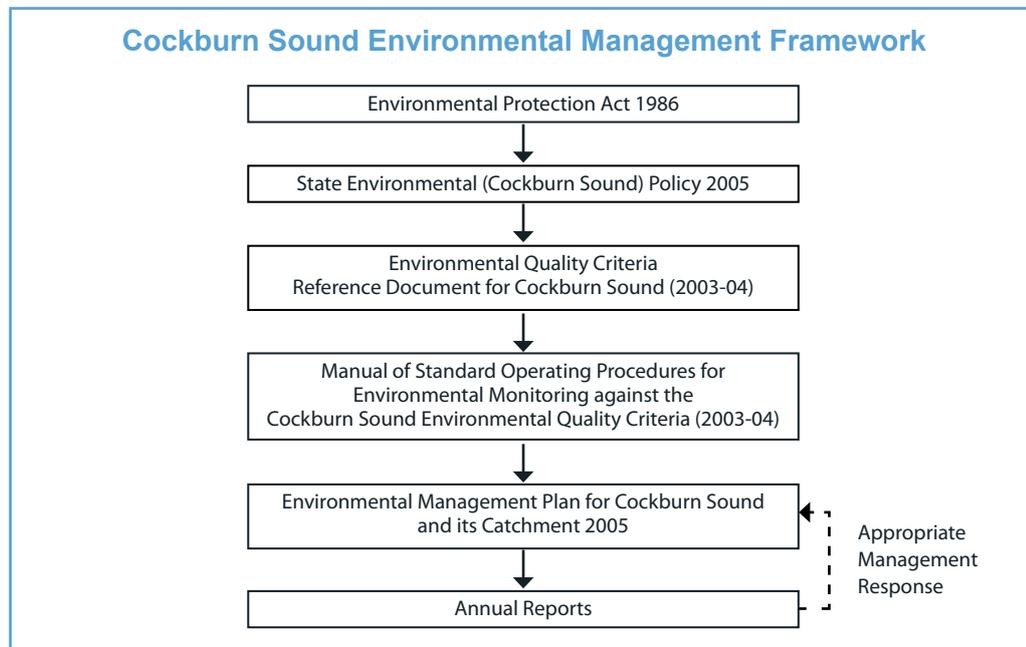


Figure 2: Cockburn Sound Environmental Quality Management Framework

This figure highlights the relationship between the SEP and its associated documents. The CSMC helps to facilitate and coordinate the environmental management of Cockburn Sound.

Source: Environmental Quality Criteria Reference Document for Cockburn Sound (2003-04) and OAG.

Having a management council for Cockburn Sound has been instrumental in bringing specific attention to pressures on the Sound

The CSMC was established in 2000. It has primary responsibility for implementing the environmental management framework, monitoring and reporting the health of the Sound and facilitating management action if required.

The purpose of the CSMC was to bring major stakeholders together to work cooperatively in managing the Sound. Its membership brings together senior individuals from industry, federal and local governments, state agencies including DEC, Departments of Fisheries and Water, as well as the general community, and recreation and conservation groups. Particular strengths of the CSMC include:

- the broad membership allows issues to be raised and considered from differing perspectives and enables transparency in decision-making
- enabling a communication channel with decision makers, proponents of developments, the community and other stakeholders

- holding forums to discuss results of monitoring and investigations with members of the public and the business community and to highlight specific matters relevant to the state of the Sound
- publishing non-technical report cards to inform the community on the health of the Sound
- preparing a report for the Minister for Environment for tabling in Parliament. This report highlights activities for the year as well as presents annual monitoring results against agreed measures
- making submissions and providing advice to the Minister for Environment, DEC and the EPA, on significant developments or proposals with a potential for affecting Cockburn Sound
- the undertaking of important environmental research.

Although the CSMC is primarily an independent advisory body, most developers recognise the important role the CSMC has in Cockburn Sound. Developers often seek the CSMC's input to any development and planning proposals before making a submission to the relevant government agency.

The state provides annual funding and resources for the CSMC, including the office staff and building lease through DEC. The CSMC has been successful over the years in leveraging additional funds from other sources including industry and local governments. Additional funding is typically for a specific purpose or research study to identify or address a particular issue. In 2009-10 the CSMC received \$509 000 from DEC and an additional \$182 000 in funding leveraged from other sources.

Monitoring needs to be strengthened to effectively manage ecosystem health

Findings

- Monitoring indicates that seagrass in Cockburn Sound remains under pressure.
- The monitoring methodology has allowed standards for measuring seagrass health to decline, without being reported or causing investigation of the potential causes.
- Monitoring does not adequately measure the total area of seagrass in Cockburn Sound.
- Total contaminant discharges into Cockburn Sound are not adequately monitored, reducing government's ability to target appropriate management action.
- There has been no recent environmental risk assessment for Cockburn Sound to focus monitoring and analysis in areas of greatest concern.

Seagrass shoot density is a key indicator of ecosystem health

Maintaining existing seagrass is one of the primary objectives for Cockburn Sound as seagrass health is considered a barometer of a healthy marine ecosystem. Shoot density is used as an indicator of seagrass health.

Seagrass meadows continually change in terms of shoot density, area, depth, or a combination of each. These changes can result from human activity but they also occur naturally and on a seasonal basis.

The environmental monitoring program within Cockburn Sound has been designed to identify declines in ecosystem health that are directly related to contaminants as opposed to natural variation.

Cockburn Sound is benchmarked against a reference site in Warnbro Sound which is assumed to be unaffected by the same pollution pressures as Cockburn Sound. Monitoring allows benchmarks for most environmental quality criteria to be adjusted annually to reflect natural variation at the reference site. This is intended to avoid triggering investigation or management response when decline is not directly related to contaminants.

Monitoring measures a large number of indicators under five different quality criteria. The criteria are:

- seagrass shoot density and seagrass depth limits
- physical and chemical measures of water quality: including chlorophyll 'a', light attenuation and dissolved oxygen
- direct biological measures of water health: measured by phytoplankton biomass activity
- contaminants in water
- contaminants in sediments.

For each criterion, guideline values and standards are set at a level that if exceeded trigger investigation and management response. The SEP recognises the different environmental pressures within Cockburn Sound and has split the Sound into three zones known as the high, moderate and low level protection

areas. Benchmark guidelines and standards are highest in the high level protection area, are reduced for the moderate level protection area and are not applied in the low level protection areas. Low level protection areas are located around known discharge points in the Sound.

Seagrass in Cockburn Sound remains under pressure

Monitoring indicates that since 2005, three out of seven monitoring sites in Cockburn Sound have fallen below the standards in recent years and one other site (Southern Flats) has come close to falling below the standard. The EPA and CSMC advised that overall monitoring indicates seagrass remains under pressure.

The table below shows whether the median seagrass shoot densities at monitoring sites within Cockburn Sound have been above (✓) or below (✗) the accepted standard. Each monitoring site is at a specific depth. Standards for shoot density are lower at greater depths.

Monitoring Site	Depth	2005	2006	2007	2008	2009	2010
High Level Protection Area							
Garden Island Settlement	2 metres	✓	✓	✓	✗	✗	✗
Luscombe Bay	2 metres		✓	✓	✗	✓	✓
Southern Flats	2.7 metres	✓	✓	✓	✓	✓	✓
Mangles Bay	3.2 metres	✓	✓	✓	✗	✗	✗
Kwinana	5 metres	✓	✓	✓	✓	✓	✓
Garden Island	7 metres	✓	✓	✓	✓	✓	✓
Moderate Level Protection Area							
Jervoise Bay	3.2 metres	✓	✓	✓	✓	✓	✓

Table 1: Years that seagrass shoot density has been above or below standards at the different monitoring sites in Cockburn Sound

Source: OAG

The monitoring methodology has allowed standards for seagrass health to decline

Seagrass shoot density in Cockburn Sound is compared to the reference site at Warnbro Sound to account for natural variation. We found that median seagrass shoot density has declined at some depths within the reference site. The results of annual monitoring of seagrass shoot densities at the reference site are shown in Figure 3.

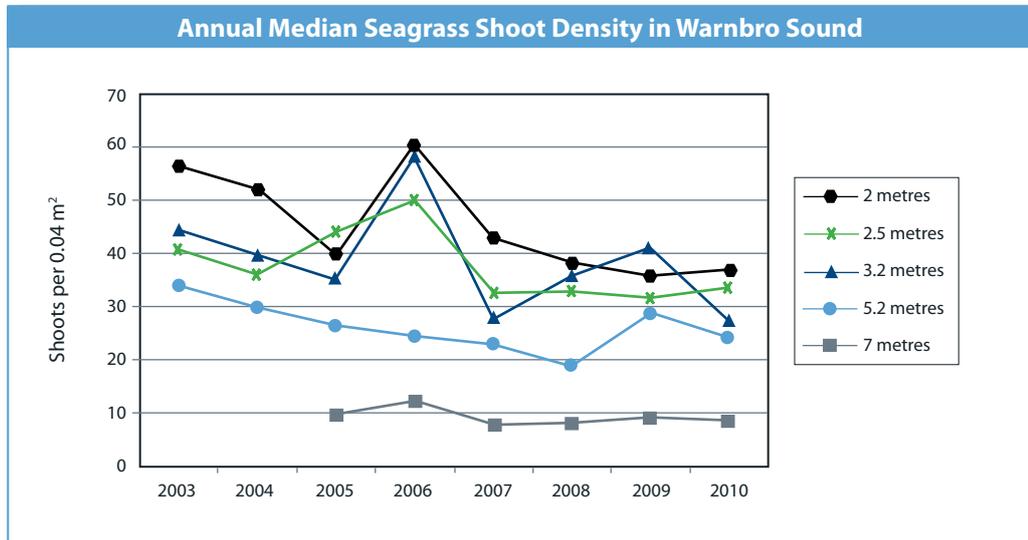


Figure 3: Annual median shoot density at various depths in Warnbro Sound

Source: OAG

The change in seagrass density at the Warnbro Sound reference site has resulted in the standard for seagrass shoot density in Cockburn Sound being adjusted downwards by between 14 per cent and 25 per cent for four out of five depths. This has also lowered the trigger for investigation of seagrass health in Cockburn Sound. At one depth (3-4 metres) the standard has been adjusted upwards by 18 per cent.

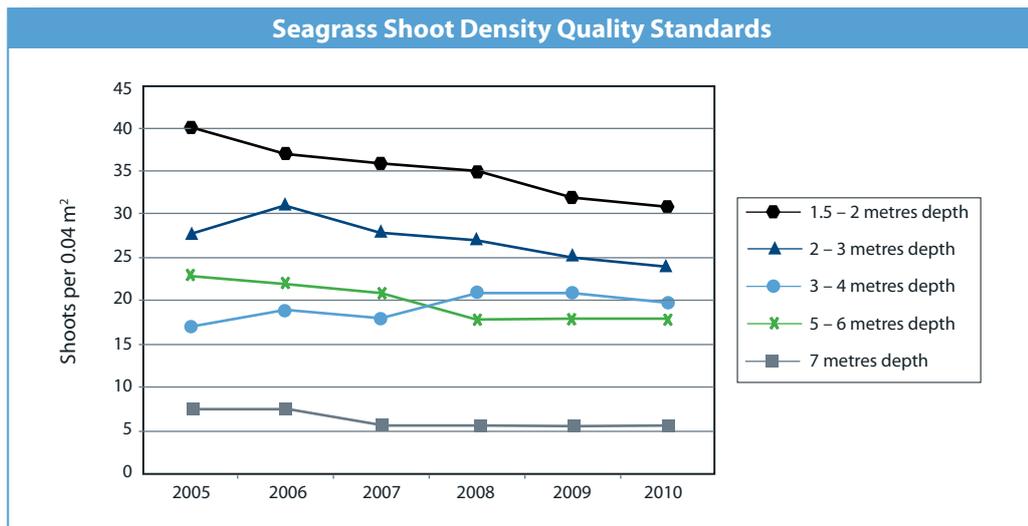


Figure 4: Changes in seagrass shoot density standard in the high level protection area since 2005

This figure highlights the general fall in the environmental quality standard benchmark used to monitor seagrass health in the high level protection area within Cockburn Sound since 2005.

Source: OAG

Benchmarks for seagrass shoot density in Cockburn Sound's high level protection area are set at values below (25 to 60 per cent) the median densities found in Warnbro Sound. The lower values are to recognise the declined state of Cockburn Sound when monitoring against Warnbro Sound commenced in 2005.

Allowing the benchmarks to be adjusted further downwards increases the risk that seagrass could reach a point of no return without triggering a management response. We note that possible permanent loss of seagrass at one monitoring site was raised as a concern in the most recent 2010 monitoring results.

We were concerned that the decline in shoot density at some depths within the reference site and the consequent downward adjustment of standards had not been identified, subject to more detailed analysis, or reported. This in turn meant that:

- no analysis was done to determine the reasons for the change at the reference site and its continued validity as a benchmark
- the downward adjustment to the standards hid the declines in seagrass shoot density at monitoring sites within Cockburn Sound and did not lead to the triggering of management reporting or response at some sites.

The EPA, the DEC or CSMC did not recognise the decline in the standards for a combination of reasons:

- there is no requirement within the SEP to analyse or report trends in monitoring results at the reference site in Warnbro Sound or changes to the standards
- insufficient quality assurance of the monitoring arrangements.

Monitoring does not adequately measure the total area of seagrass in Cockburn Sound

Existing monitoring of seagrass in Cockburn Sound does not measure whether the total area of seagrass is decreasing. The SEP does not require CSMC to monitor or attempt to quantify direct losses. While it addresses some indicators of seagrass health, it does not address others making it more difficult to identify and focus management action.

In determining health of seagrass, there are two important characteristics to be determined. The first is shoot density which looks at how patchy or dense the seagrass is within the sample area. The second relates to the extent of the seagrass bed and whether it is expanding or retreating over time. We found that shoot density has been regularly monitored at seven sites within Cockburn Sound. CSMC has a good basis of continuous data within which to monitor shoot density. However, information available on the extent of the seagrass bed is limited to three sites near the north of Garden Island and does not provide a strong basis for determining whether the total area is expanding or retreating.

The Environmental Management Plan for Cockburn Sound identifies that seagrass mapping should be conducted every three to four years. The last time this was done was in 2004 and it was only of the eastern foreshore. At that time, it was estimated there was 872 hectares of seagrass in Cockburn Sound.

Periodic mapping of the total area could be supplemented with an annual reassessment of known changes such as losses due to anchor scouring and boat moorings. Although CSMC has taken action to address unregulated boat moorings, direct losses can be significant and if they are not factored into the overall monitoring program, it is difficult to target an appropriate and timely management response.



Figure 5: Example of halos of seagrass die-off around boat moorings in Mangles Bay

This figure highlights an example of direct seagrass loss. In 2000 it was estimated that boat moorings had caused 1.8 ha of seagrass loss in Mangles Bay.

Source: CSMC

Monitoring seagrass is one important measure to allow government to determine the effectiveness of existing management practices and to know whether the resources devoted to maintaining ecosystem health have been successful. Early detection of change allows government to take remedial actions and identify and prioritise future requirements and initiatives. Monitoring seagrasses can be a costly exercise, making it important to ensure that the methods used are adequate to address the outcome sought.

Total contaminant discharges into Cockburn Sound are not adequately monitored, reducing government's ability to target appropriate management action

Contaminants are a major cause of seagrass loss. The National Pollutant Inventory provides some useful information relating to total emissions from individual activities in Cockburn Sound. However it does not provide data on total contaminant discharges.

Source inputs are not adequately monitored and this severely limits effective and timely decision-making and targeted response.

Direct industrial discharge from prescribed premises is the only category for which the current levels of contaminants entering into the Sound are quantified. However, these represent only about one-fifth of contaminant inputs entering the Sound based on the most recent estimates.

Significant nitrogen inputs to Cockburn Sound were last identified and quantified in 2000. At that time, nitrogen inputs from human activities were estimated at 300 tonnes a year, down from about 1 080 tonnes in 1990. The 2000 study projected a shifting profile of contaminant inputs away from industrial discharge towards a larger proportion of inputs entering the Sound from groundwater sources and stormwater drainage. The estimated sources of nitrogen inputs in 2000 were:

- groundwater (71 per cent)
- industrial discharges (19 per cent)
- atmospheric fallout (7 per cent)
- ship loading spills (2 per cent)
- surface drainage (1 per cent).

Industrial discharges are regulated in accordance with established standards and licence conditions requiring companies to monitor and report discharges to the DEC. However, total contaminants discharged from the eight prescribed premises which are licensed to discharge wastewater directly into the Sound are not aggregated.

Documents supporting the SEP recognise the importance of monitoring all contaminant sources on an ongoing basis. The Environmental Management Plan also identified the need for a better understanding of the relationship between nutrient inputs and water quality in the Sound. This has not been done. Doing so would validate the total inputs by source and strengthen CSMC's ability to target appropriate actions when problems are identified.

We noted other states such as South Australia and Victoria emphasise the importance of nitrogen inputs in the marine environment and both recommended targets to reduce inputs on the basis that high nutrient levels are a major cause of seagrass loss.

There has been no recent environmental risk assessment of Cockburn Sound to focus monitoring and analysis on areas of greatest concern

An effective monitoring program should focus effort on areas posing the most significant threats to the environmental quality objectives for Cockburn Sound. These threats should be assessed over time to ensure the existing monitoring program is addressing the most significant risks and modifications are made when information gaps arise.

The last formal assessment of the pressures on Cockburn Sound was conducted in 2001 when the CSMC published a detailed pressure-state-response report. This provided a thorough 'point in time' assessment of the state of the Sound and identified threats and information gaps relating to these threats. At that time, physical alterations to the Sound and nutrient enrichment were the two pressures identified as having had the greatest impact. Over the last 10 years new environmental pressures have emerged, including increasing urbanisation, recreational boating and fishing and encroaching contaminated groundwater plumes.

Although CSMC advise that risks were discussed at a meeting of key stakeholders in 2006, we found no current risk assessment to ensure the locations and number of monitoring sites as well as the monitoring periods were appropriate. Nor was there a current assessment of whether the contaminants being monitored were the most relevant and focused on the areas of greatest risk.

The planned review of the SEP should consider updating the environmental risk assessment for Cockburn Sound. CSMC advised they have trialled electronic decision support tools that would assist this process.

Reporting and management oversight need to be improved to ensure timely response to problems

Findings

- Insufficient quality assurance and management oversight by the CSMC, the Office of EPA and DEC has led to errors and inconsistencies in reporting and management action being delayed or not taken.
- Reporting on ecosystem health needs to be strengthened to better highlight areas of concern, and provide sufficient information to allow a clear assessment of trends in ecosystem health.
- CSMC do not always investigate when environmental quality criteria are exceeded at individual monitoring sites and then report what corrective action is being taken. This reflects their focus on zones rather than individual sites. The SEP is not always clear about when investigation and reporting is required.

Quality assurance and management oversight need to be strengthened to prevent errors and inconsistencies in reporting

We found a number of errors, omissions and inconsistencies in CSMC's annual report cards published in *State of the Sound* reports. In some cases this has resulted in management action either being delayed or not taken. The errors, omissions and inconsistencies in reporting indicate that quality assurance and management oversight need to be strengthened. We found:

- errors in the calculation of two water quality standards and guidelines contained in the draft 2009 *State of Cockburn Sound* report. This meant that low water quality standards at one monitoring site would not have been reported as below the guideline had the error not been corrected
- analysis of 2009 monitoring results did not recognise that one of the key water quality standards in Cockburn Sound had been exceeded at one site
- a number of examples where site specific issues had not been reported. This is a consequence of a focus on reporting the health of zones rather than individual monitoring sites
- inconsistent interpretation and reporting of results, including health status of monitoring sites and highlighting when further investigation or management action is required.

The primary mechanism for drawing attention to ecosystem health in Cockburn Sound is through the annual reporting of monitoring results. Accurate reporting requires strong quality assurance over the collection, maintenance, analysis and interpretation of data. This is essential for public confidence in what is reported and to enable the protection of environmental values.

Quality assurance and oversight is necessary at three levels: at CSMC, at the Office of EPA and at DEC:

- the CSMC should ensure the reported data is complete, represents an accurate reflection of results and is consistently reported
- the Office of EPA should ensure the operating procedures are correctly applied and are functioning as intended
- DEC should ensure the government's overall expectations contained in the SEP and related Environmental Management Plan for Cockburn Sound are fulfilled as intended and if they are not, ensure appropriate action is taken until they are.

The CSMC is heavily dependent on other agencies and consultants for monitoring water quality and surveying seagrass. Water quality and seagrass monitoring programs are coordinated by a number of different agencies including CSMC, Land Corporation, Fremantle Port Authority, and the Department for Defence. The results of the monitoring programs are provided to the CSMC who contract out annual analysis of results using the prescribed operating procedures. The results are fed back to the CSMC in a formal report for it to consider and publish in annual report cards.

Given the importance and complexity of this information, scrutiny of the results is necessary to ensure consistency in methods and reporting. In light of the complexities of environmental science and the newness of the SEP we also expected an appropriate quality review by the Office of the EPA and DEC. However, this has not occurred:

- we found staff at CSMC relied heavily on the work of its contractors and that results were not always checked for validity and reasonableness
- the EPA has not assessed the accuracy of the reported results, the effect of annual adjustments made to the standards or the general trend of ecosystem health against the environmental values
- DEC has overall responsibility to ensure the expectations outlined in the SEP and the Environmental Management Plan for Cockburn Sound are being adequately addressed. This obligation has largely been limited to its role as a committee member on the CSMC.

Reporting on ecosystem health needs to be strengthened to better highlight areas of concern, and provide sufficient information to allow a clear assessment of trends in ecosystem health

The *State of Cockburn Sound* reports do not adequately highlight concerns, or where concerns are highlighted at individual monitoring sites, how they are being addressed. Reporting focuses on whether an environmental quality indicator is within its benchmark guideline and standard. In addition, the reports do not provide readers with information, such as trends and comparisons with the reference site, to determine whether ecosystem health has improved, remained steady or declined over time.

The annual *State of Cockburn Sound* report is the primary accountability tool available to the CSMC. The report uses a simple report card format with traffic lights to indicate whether environmental criteria have been achieved and whether investigations or management actions are required. Report cards are supplemented with maps to provide additional information.

We found that the SEP and monitoring procedures set standards by averaging monitoring results across broad areas or zones. Other standards are site specific. Combining results from a number of monitoring sites within a zone can mask areas of concern and 'hot spots' at some monitoring sites can be overlooked. This may prevent site specific investigation and precautionary action being taken.

An example of this is a monitoring site near Mangles Bay which has consistently exceeded the chlorophyll 'a' environmental guideline since 2005 and, in 2009 exceeded it by 60 per cent. This site has not been consistently reported as exceeding the standard, nor has any management action been taken.

Clarification as to the requirement to report the health of broad zones or individual monitoring sites needs to be addressed in the forthcoming review of the SEP.

Where problem sites are identified, the report does not consistently inform the reader what is being done to investigate or address those areas of concern. To be more complete, reporting should include a summary of actions taken. This would be addressed if there was more emphasis on monitoring sites rather than zones.

We found the reports did not provide sufficient information to provide a clear assessment of overall ecosystem health. The reporting does not provide any trend analysis over time, or any comparison with the reference site in Warnbro Sound.

Incorporating trend analysis and a comparison between Cockburn Sound and the reference site in the report would help to identify change in ecosystem health and may trigger an earlier management response within decision-making agencies.

Trend analysis and comparisons would also assist in assessing the validity and appropriateness of the chosen environmental quality criteria and the continuing use of Warnbro Sound as a valid reference site. Such reporting is also important in the context of the SEP to understand whether changes in ecosystem health are a result of natural variability, are specific to Cockburn Sound or a combination of both.

CSMC do not always investigate when environmental quality criteria are exceeded at individual monitoring sites and then report what corrective action is being taken

The SEP defines two types of environmental quality criteria; an environmental quality guideline and an environmental quality standard. A guideline is an indicator of possible risk, while a standard is a known threshold that should not be exceeded. Initiating appropriate investigations and management responses when either a guideline or standard are exceeded is a critical step in the environmental management framework for Cockburn Sound.

CSMC has taken appropriate action when overall zones have exceeded environmental quality standards. However, the SEP is not as clear as it could be on when investigation and reporting is required if a standard is exceeded at an individual monitoring site. We found several cases where site specific ecosystem health standards have been exceeded and action was not taken to address site specific issues. This reflects the Council's interpretation of the SEP and their focus on zones rather than individual monitoring sites.

Between 2007 and 2009 monitoring results indicate that seagrass shoot density in Garden Island Settlement, Mangles Bay, and Luscombe Bay had fallen below the required environmental quality standards. Of particular concern, both Garden Island Settlement and Mangles Bay have been below the required quality standard since 2008, including the most recent count in 2010.

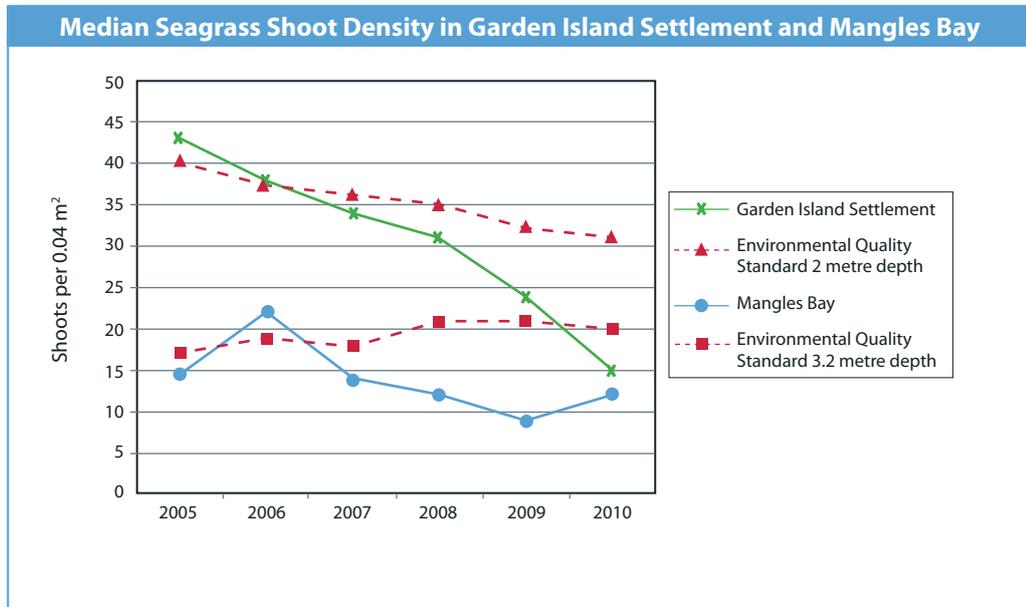


Figure 6: Median seagrass shoot densities in the Garden Island Settlement and Mangles Bay monitoring sites

This figure highlights that median seagrass shoot densities in two monitoring sites have fallen below the required standard.

Source: OAG

The Garden Island Settlement monitoring site has had a known groundwater contamination problem since 2001. The cause of the contamination is the wastewater management facilities on the island. Mangles Bay has also been a known problem for many years. However there is no clearly identifiable single source contributing to excessive nutrient loads, making its resolution more difficult. The 2001 report on the pressure facing the Sound identified the Lake Richmond stormwater drain as a significant contributing factor to the nutrient enrichment at Mangles Bay, but also highlighted poor water circulation. Although discussions have been held between CSMC and relevant stakeholders, CSMC has not reported what management action has been agreed to address seagrass health in Garden Island Settlement and Mangles Bay.

The EPA and CSMC should clarify the investigation and reporting requirements of the SEP when guidelines and standards are exceeded at individual monitoring sites.

We also found that notifications to the EPA and the Minister for Environment ranged from six to 17 months after the monitoring results were completed for the year. CSMC should establish realistic timeframes for notifying their concerns and reporting what actions are taken when environmental guidelines and standards are exceeded.

When CSMC becomes aware that an environmental quality guideline has been exceeded, it is required to determine whether there is a relevant public authority to which the matter can be referred for investigation. If there is no relevant authority then the CSMC is expected to investigate the cause. The results of this investigation and any recommendations are to be reported to the EPA and the public.

If an environmental standard is exceeded, then the CSMC must report it to the EPA and the Minister for Environment as soon as practical. If no relevant public authority can be identified who has responsibility, the CSMC is required to investigate the matter. The CSMC is then required to advise the EPA and Minister for Environment on the likely cause and the best means of meeting the environmental quality objectives for Cockburn Sound.

Glossary of Acronyms

CSMC	Cockburn Sound Management Council
DEC	Department of Environment and Conservation
EMP	<i>Environmental Management Plan for Cockburn Sound and its Catchment 2005</i>
EP Act	<i>Environmental Protection Act 1986</i>
EPA	Environmental Protection Authority
OAG	Office of the Auditor General
Office of the EPA	Office of the Environmental Protection Authority
SEP	<i>State Environmental (Cockburn Sound) Policy 2005</i>
WA	Western Australia