



# Setting Environmental Values for the Port Waterways

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## Acronyms

|       |                                  |
|-------|----------------------------------|
| CCI   | Coastal Catchment Initiative     |
| CWMB  | catchment water management board |
| NWQMS | National Water Quality Strategy  |
| TCWMB | Torrens CWMB                     |
| WQIP  | water quality improvement plan   |

## Introduction

This report presents a summary of the consultation with key stakeholders as part of developing the water quality improvement plan (WQIP) for the Port waterways. It also covers the community consultation previously undertaken by the Torrens Catchment Water Management Board and the Northern Adelaide and Barossa Catchment Water Management Board.

The Commonwealth Department of the Environment and Heritage has identified the Port Adelaide estuary and environs as a coastal water quality hotspot under the Coastal Catchments Initiative (CCI). The Federal Government, with assistance from state and local governments and community and environmental groups, is investing in the development of water quality improvement plans that are consistent with the Framework for Marine and Estuarine Water Quality Protection<sup>1</sup>.

The framework builds upon key elements of the National Water Quality Management Strategy (NWQMS) and National Principles for the Provision of Water for Ecosystems<sup>2</sup>. In response to the CCI, a WQIP is being prepared for the Port waterways regarding the nutrients nitrogen and phosphorus.

In October 2003, Eco Management Services, in association with Arup Water and Planning Partnerships, was commissioned to prepare Stage 1 of the WQIP, which involves:

- x community consultation to identify the environmental values for the Port waterways
- x a draft WQIP, which includes a technical assessment of the issues, identification of all nutrient sources, and environmental values (incorporating the community values) and water quality objectives (nutrients).

The draft WQIP is included in a separate report, *Draft Water Quality Improvement Program for the Port waterways*.

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<sup>1</sup> Environment Australia 2002; [www.deh.gov.au/coasts/pollution/cci/framework/index.html](http://www.deh.gov.au/coasts/pollution/cci/framework/index.html)

<sup>2</sup> Sustainable Land and Water Resources Committee Subcommittee on Water Resources Occasional paper No. 3, ARMCANZ and ANZECC, July 1996; [www.deh.gov.au/pcepd/anzecc/ecosystems.html](http://www.deh.gov.au/pcepd/anzecc/ecosystems.html)

## Setting environmental values—previous efforts

### Background

The Port waterways are an important economic and environmental region for the community of South Australia. In recent years there has been extensive consultation with the community on environmental issues, in particular on water quality, including the:

- x Torrens Catchment Water Management Board Catchment Plan 2002-2007
- x Northern Adelaide & Barossa Catchment Water Management Board Catchment Plan 2001-2006
- x Port Adelaide waterfront redevelopment
- x dolphin sanctuary
- x EIPs for the SA Water wastewater treatment plant discharges
- x various environmental impact statements and environmental reports including the:
  - MFP Dry Creek-Gillman urban development
  - PASA pipeline project
  - Port Adelaide expressway.

These extensive consultations, particularly by the CWMBs, have determined existing environmental values and the impacts of various activities on the environment. The conclusions drawn have been used as a basis for determining environmental values specific to the Port waterways.

The following sections provide a brief summary of the environmental values defined by the CWMB community consultation.

### Torrens Catchment Water Management Board

The Torrens Catchment Water Management Board (TCWMB) was established under the *Catchment Water Management Act 1995*. In 1997, the area of the TCWMB was extended to include the Port River/West Lakes catchment when it came under the *Water Resources Act 1997*. The catchment's northern area adjoins the Port waterways southern boundary.

In 2002, the TCWMB prepared the *Torrens Catchment Water Management Board Catchment Plan 2002-2007*. As part of the development of the plan, the TCWMB undertook a thorough program of community consultation. This process identified existing and desirable environmental values that required protection through various catchment management strategies. The consultation process consisted of workshops for the community and local government representatives.

In order to define environmental values and other issues of concern, the TCWMB interviewed stakeholders and ran public workshops. The consultation process and community expectations were summarised in the finished plan.

### ***Community workshops***

Three community workshops were held in the Port River region and issues were rated by the participants in order of priority. The top-rated issues were:

- x water quality, particularly the discharge of sewage effluent and industrial waste into the Port River
- x urban consolidation and its impact on stormwater
- x enforcement, or lack of it in many cases, including relatively minor incidents
- x measurement of the effectiveness of programs, i.e. how do we know we are making a difference?
- x sustainable groundwater management and possible future use of stormwater
- x the complexity of communication between the community, the TCWMB, councils, industry and government
- x the need to consider biodiversity and particularly the ecology of Barker Inlet and the Port River.

The Charles Sturt, Prospect and Port Adelaide communities showed they were well-informed and interested in their local environmental issues. The Port River and Barker Inlet were seen as a great asset to the region and as having been very poorly managed in the past.

### ***Local government representatives workshop***

There were 17 participants at the workshop from local government and programs in the extended catchment, such as the Our Patch and the Stormwater Pollution Prevention programs. The issues raised were:

- x the need to coordinate land use planning. In the Port Adelaide region this involves significant infrastructure investments, including stormwater and sewage facilities.
- x the need for a focus and intervention on industrial practices
- x a lack of enforcement and leadership in enforcement
- x a lack of individual responsibility and the need for an improvement in community attitudes
- x funding for the catchment plan—how much longer will the levy exist?

The group also concluded that the board should:

- x liaise between state and local governments to help solve big issues
- x help to clarify the roles, responsibilities and duties of all players
- x operate as a government lobby group—for example, on issues such as extending sewerage through Gillman and Wingfield
- x promote partnerships in related water issues with councils
- x help coordinate services, programs and information.

The councils in the extended area were very positive about the TCWMB's program and the project improvements in their region.

Following the consultation process, environmental values for the Port receiving waters (West Lakes, Barker Inlet and the metropolitan coast) were defined as:

- x protection of aquatic ecosystems
- x maintenance and improvement of recreation and aesthetic characteristics.

This consultation did not proceed to the extent of segmenting the waterways and ascribing particular values to each segment.

## Northern Adelaide & Barossa Catchment Water Management Board

The Northern Adelaide & Barossa Catchment Water Management Board (NABCWMB) was established in 1997 under the *Water Resources Act 1997*. The NABCWMB's catchment has a significant impact on the Port waterways through the discharge of industrial and domestic stormwater and industry effluents.

In 2001, the NABCWMB prepared the *Northern Adelaide & Barossa Catchment Water Management Board Catchment Plan 2001-2006* following extensive interviews with stakeholders and public workshops. The main the issues raised by stakeholders are illustrated in Figure 1.

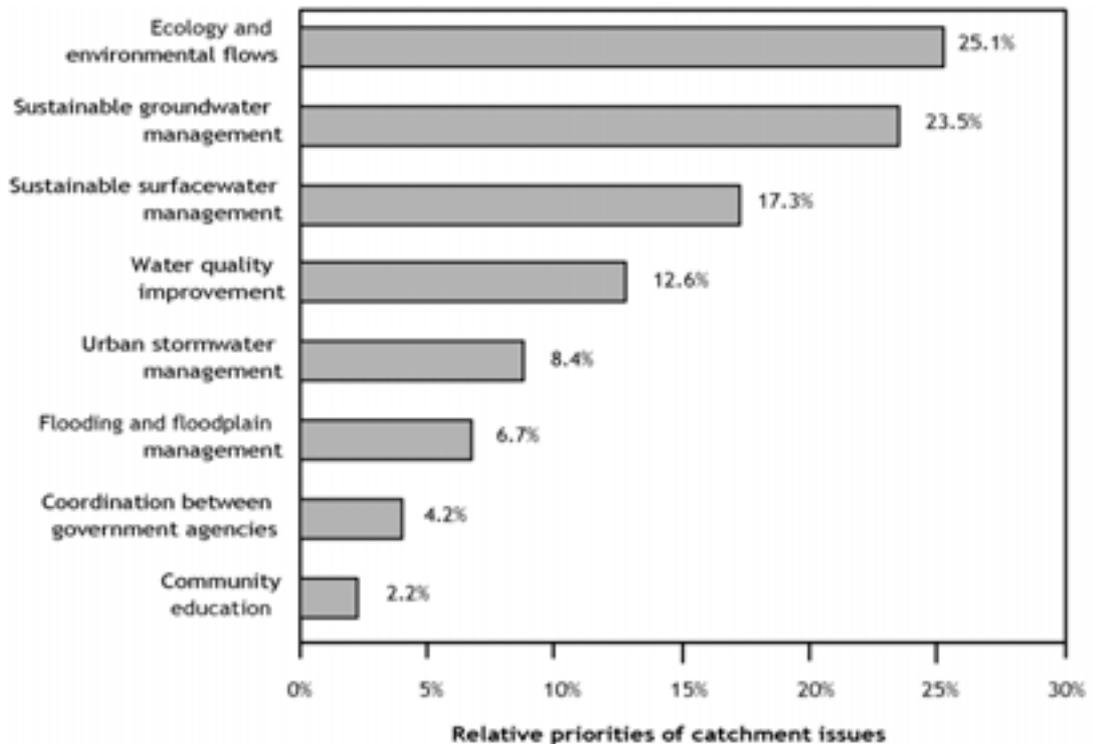


Figure 1: NABCWMB community views on the priority of catchment issues to be addressed (NABCWMB Catchment Water Management Plan 2001-2006)

The plan summarised the results of the consultation into the following key issues:

1. provide water to meet environmental needs
2. identify and protect ecologically significant areas
3. pursue sustainable water sharing and efficient water use
4. pursue opportunities for productive use of alternative water sources
5. achieve improvements in land management practices
6. improve community awareness to underpin behavioural change
7. improve monitoring and evaluation of key catchment processes
8. facilitate the implementation of floodplain management strategies.

Key issues 1, 5, 6 and 7 are considered priority areas for the Port waterways, given the importance of physical and human use in the area.

The Plan outlines a series of goals, strategies, targets and indicators for its catchment. The goal most relevant to the Port waterways WQIP is Goal 1: Improve Water Quality, which includes the protection of aquatic ecosystems.

The three strategies aimed at achieving Goal 1 are:

1. identify point and diffuse pollution sources, including land use practices, and prioritise and implement actions to minimise their impacts on water quality
2. develop and protect wetlands
3. control erosion and minimise sediment inputs to streams.

## **Confirming environmental values—project consultation**

The consultation phase of the project was conducted from October 2003 to March 2004, culminating in a Community Discussion Meeting (CDM) held on 15 March at Port Adelaide Town Hall.

### **Consultation methodology**

Technical and community consultation was undertaken throughout this project. During the initial weeks of the project, consultation was organised with various stakeholders to discuss both the technical and community consultation components of the project.

The technical component of the project was consolidated before the final CDM in order to present up-to-date information about the state of the Port waterways. In preparation for the CDM the following supporting activities were undertaken:

- x consultation start-up meeting with the EPA and the relevant local government authority, the City of Port Adelaide Enfield (see below for more detail)
- x liaison with key technical personnel, who provided information about community attitudes and expectations based on their previous works
- x coordination of a venue and date for the proposed CDM
- x development of a community information brochure for broad community distribution (see below for more detail)
- x coordination of community liaison with key stakeholders
- x coordination of the presentations and structure for the CDM.

### **Stakeholder consultation**

A range of stakeholders were consulted both for technical information collection and verification, and about recommended or expected community participation. Table 1 presents a list of the stakeholders who were consulted during the project.

### **Community consultation**

The objectives of community consultation were for the stakeholders and the wider community to:

- x suggest the most effective ways of ongoing consultation with the community
- x be informed of the current nutrient loads discharged to the Port waterways
- x understand where the nutrients are coming from and how they get there
- x contribute their knowledge to the above
- x discuss and identify the desired water quality values in the waterways
- x understand what will be involved in achieving these values

- x explain where this project fits relative to former and current initiatives in the area.

### ***Consultation before the CDM***

At the outset, meetings were held with the EPA to determine the aims and preferred methodology, which resulted in the following outcomes:

- x Before contact with stakeholders, a letter was sent from the EPA CEO to key stakeholders. The letter was sent as a matter of courtesy and to explain the project.
- x The EPA Project Manager visited industry stakeholders before Christmas to explain the project and allay any unnecessary anxieties.
- x A short leaflet was prepared to hand out during the networking phase.
- x Early discussions were undertaken with the Port Adelaide Enfield Council to access mailing lists and key contacts.
- x The EPA and Port Adelaide Enfield Council cooperated to determine the venue and date for the CDM.
- x A space was arranged for a community display in both the Port Adelaide Enfield Council office and the Port Adelaide Maritime Museum.
- x The Northern Adelaide & Barossa and the Torrens Catchment Water Management Boards and BIPEC were made aware of the purpose of the project and the process of the community consultation.

**Table 1: Stakeholder consultation list**

| <b>Name</b>        | <b>Organisation</b>            |
|--------------------|--------------------------------|
| Verity Sanders     | Port Adelaide Enfield Council  |
| Monica Smith       | Port Adelaide Enfield Council  |
| Sarah Gilmour      | Port Adelaide Enfield Council  |
| Barry Duffie       | Port Adelaide Enfield Council  |
| David Truran       | Port Adelaide Enfield Council  |
| Wally Isaiello     | Port Adelaide Enfield Council  |
| Keith Smith        | NABCWMB                        |
| Ray Ledger         | EPA                            |
| Catherine Fullston | EPA                            |
| Desmond Collins    | EPA                            |
| Bill Sager         | Port Maritime Museum           |
| Terry Clark        | EPA                            |
| Peter Pfennig      | EPA                            |
| Jo Kneebone        | EPA                            |
| Jade Ballantine    | EPA                            |
| Peter Christie     | EPA                            |
| Keith Downard      | TCWMB                          |
| Rob Taverner       | Ausbulk                        |
| Sean Reardon       | Flinders Ports                 |
| Peter Cheers       | Flinders Ports                 |
| Jon Emmett         | DEH                            |
| Stuart Taylor      | LMC                            |
| Brent Danks        | LMC                            |
| Dennis Ryan        | LMC                            |
| Sue Britten Jones  | LMC                            |
| John Eastick       | LMC                            |
| Rod Hook           | OFID                           |
| Lino Di Lernia     | OFID                           |
| Scott Douglas      | BIPEC                          |
| Peri Coleman       | Delta Environmental Consulting |
| Pat Harbison       | PH Environmental               |

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During the technical component of the project there were many opportunities to obtain input from experts involved in the Port waterways. This information was used to complement the community consultation process.

The next phase was the development of a community information brochure and a four-poster display. See Appendices A and B for copies of the brochure and poster.

Public notices were also placed in the *Messenger* and *The Advertiser* newspapers to promote the meeting.

### ***Distribution of community information***

To ensure that the community information was available to the Port waterways community, a stakeholder list was developed using the contacts made during the project and built upon with the BIPEC contact list supplied by Scott Douglas. Table 2 identifies the distribution of community information:

**Table 2: Distribution of community information**

| <b>Name</b> | <b>Surname</b> | <b>Organisation</b>   |
|-------------|----------------|---|
| Pat         | Harbison       | PH Environmental  |
| David       | Ellis          | CSIRO   |
| Mike        | Bossley        | Australian Dolphin Research Foundation  |
| Keith       | Downard        | TCWMB   |
| Louisa      | Halliday       | PISRSA Fisheries  |
| Cameron     | Harker         | Penrice Soda Products   |
| Dr Keith    | Jones          | SA Aquatic Science Centre   |
| Henri       | Mueller        | District Council of Mallala   |
| Brett       | Pendlebury     | Senior Conservation Officer, Coast & Marine Branch, Dept for Environment & Heritage and representing Project Dolphin Safe |
| Harry       | Pitrans        | City of Salisbury   |
| Patricia    | Von Baumgarten | Department for Environmental & Heritage   |
| Keith       | Smith          | NABCWMB   |
| Scott       | Douglas        | BIPEC   |
| Simone      | Williams       | Waterwatch SA EPA   |
| Emma        | Lowe           | Department for Environment & Heritage   |
| Rodney      | May            | Transport SA  |
| Tim         | Kildea         | SA Water  |
| Jason       | Rollison       | Land Management Corporation   |
| Jon         | Emmett         | Coast & Marine Branch, Department for Environment & Heritage  |
| Peri        | Coleman        | Delta Environmental Consultants   |

| Name                              | Surname   | Organisation   |
|-----------------------------------|-----------|--|
| Sean                              | Reardon   | General Manager Infrastructure Flinders Port                 |
| Rob                               | Taverner  | Manager Business Development AusBulk                         |
| Sean                              | Kotz      | School of Fish   |
| Verity                            | Sanders   | City of Port Adelaide  |
| Lorraine                          | Rosenberg | SAFIC  |
| Cathy                             | Chesson   | Transport SA   |
|                                   |           | Community Action for Port & Peninsula                        |
|                                   |           | Port Adelaide Library  |
|                                   |           | Semaphore Library  |
|                                   |           | West Lakes Library   |
|                                   |           | The Cruising Yacht Club of SA                                |
|                                   |           | Largs Bay Sailing Club                                       |
| General community                 |           | North Haven Yacht Club                                       |
|                                   |           | Port Adelaide Sailing Club                                   |
|                                   |           | Garden Island Yacht Club Incorporated                        |
|                                   |           | Port Adelaide Enfield Council (Brochures and Public Display) |
|                                   |           | Port Maritime Museum (Brochures and Public Display)          |
|                                   |           | LeFevre Peninsula Residents Association                      |
| Others contacted but no response: |           |  |
| Aaron                             | Machado   | Project Dolphin Safe   |
| Adrian                            | Marshall  | City of Playford   |
| David                             | Blackburn | BIPEC contact list   |
| Geoff                             | Thomas    | BIPEC contact list   |
| Glen                              | Jones     | Boating SA   |
| Jason                             | Ting      | City of Salisbury  |
| Jeff                              | Wait      | BIPEC contact list   |
| John                              | Wood      | CWMB   |
| Karen                             | Rouse     | SA Water   |
| Liz                               | Matthews  | BIPEC contact list   |
| Neil                              | MacDonald | BIPEC contact list   |
| Patricia                          | Buckskin  | BIPEC contact list   |
| Tony                              | Flaherty  | BIPEC contact list   |
| Trevor                            | Watts     | SARFAC   |

### **Community discussion meeting process**

The CDM was held on 15 March 2004 at the Port Adelaide Town Hall. The objectives of the CDM were to:

1. understand where the Water Quality Improvement Plan (WQIP) for Port waterways fits with other planning and activities
2. understand and discuss the current nutrient levels as described in community discussion paper
3. contribute any additional knowledge about nutrients in the Port waterways
4. discuss the environmental values for protection in the Port waterways and consider the changes necessary to achieve these values
5. identify any areas that need special protection
6. determine the water quality option best suited to the plan and community.

#### **The process**

The meeting was designed to use the participants' time effectively and efficiently and at the same time to be lively, interactive and enjoyable. On arrival at the meeting people were given a colour coded nametag and their names and contact details were noted for providing feedback. After the presentations participants were divided into small groups based on the colour on their nametags. The small groups were arranged in a circle with a flip chart, but without tables (which tend to create barriers to communication).

Objective 1 was achieved at the early part of the meeting, through a brief presentation from the project manager.

Objective 2 was addressed by a presentation from Vic Neverauskas and Paul Manning.

A skilled and independent facilitator led each small group through a series of steps that would achieve Objectives 3, 4 and 5.

The facilitators first explained their own role and then established some guidelines for good communication and ground rules for accommodating conflicting points of view. The aim was to allow passionately held views to be heard in an environment where ideas could be expressed without fear of personal attack.

Following brief introductions a member of the technical team or the EPA joined the group to explain and clarify the discussion paper (further contributing to Objective 2). The technical adviser then left the group. Members of the technical team remained on hand to offer assistance throughout the session.

Participants then joined together as a full forum in one large circle to both symbolise and promote inclusion and consensus. Participants reported that the process successfully highlighted the common ground between groups.

### Small group facilitators

The facilitators ensured that every member of the group had an equal opportunity to express their ideas in order to reach the group's objectives. The facilitator did not get involved in the content of the discussion, nor express personal views.

### Briefing and rehearsal

The CDM briefing and rehearsal were held on 4 March. It gave:

- x participants an opportunity to understand the process
- x facilitators an opportunity to go through their written guidelines and to become familiar with the background material
- x presenters a chance to understand their role as resource people, to rehearse their presentations and receive feedback from colleagues and the facilitators.

| CDM program |   |                 |
|-------------|---|-----------------|
| 7:00 pm     | Welcome, confirm objectives and program   | Marg Dougdale   |
| 7:10 pm     | Where does this plan fit with other activities?   | Peter Pfennig   |
| 7:20 pm     | What are the nutrient levels in the Port waterways and where do they come from?   | Vic Neverauskas |
| 7:40 pm     | Questions to Vic Neverauskas and Paul Manning   | CDM attendees   |
| 7:50 pm     | Small facilitated groups-<br>Questions:<br>Is there anything in the presentation or the discussion paper that you would like clarified?<br>Do you have any additional information or local knowledge that you wish to contribute?<br>Which of the environmental values that are listed in the discussion paper would you like to see protected? Do you have a priority for these?<br>Given the value that you want to protect, which water quality option is the most appropriate for the Port waterways? |                 |
| 9:00 pm     | Supper  |                 |
| 9:20 pm     | Return to full forum to collate findings of small groups  | Marg Dougdale   |
| 9:50 pm     | What happens next?  | Peter Pfennig   |
| 10:00 pm    | Thank you and close   | Marg Dougdale   |

### **CDM attendance**

Eighteen people attended the CDM including agency people, representatives of CWMBs and eight people from the general public.

The disappointing CDM attendance was not altogether unexpected, given there had been so much consultation about the Port River and environs over the last few years. However, the environmental values determined at the CDM are consistent with the values previously identified. There is a clear focus of community expectations on the future of the Port waterways.

### **CDM outcomes**

Following the formal presentation participants asked questions and raised the following issues for discussion and clarification:

#### **Focus on nutrients**

Concerns were raised about the choice of nutrients as a focal point and additional clarification was sought on the implications for the monitoring and reduction of other pollutants, such as heavy metals. Current information on nitrogen and phosphorus pollution was provided and future information requirements were discussed.

A request was made for future discussion papers to include additional information on the reasons why nutrients were chosen as the point of focus. Specifically it was agreed that values and management strategies covering the whole gamut of pollutant types should be addressed for the fish nursery in the Barker Inlet, which is critical to the State's commercial and recreational fishing industry.

#### **Targets versus environmental values**

Questions were raised about past targets that were established, but in some instances not met. The difference between the past system of setting targets and the proposed system of establishing environmental values was clarified.

It was explained that:

- x these targets required that polluters use the 'best available technology at the time'
- x the environmental value system is designed to establish what people want out of their waterways and then to follow a process of improvement, which does not stop until these requirements are met.

#### **Modelling**

The benefits of modelling were discussed and clarified. For example, it was explained that modelling will help our understanding of the relative importance of Penrice's nitrogen contribution. Comments were made that Penrice has long-term plans to reduce nitrogen.

Clarification was sought as to whether the modelling included groundwater. It was recommended that groundwater should be included in the study,

given that it may be an ongoing source of pollution to the river over a long period of time.

### **Monitoring**

One of the groups wanted all pollutants to have targets set and a monitoring base established.

Clarification was sought as to whether Bolivar monitors the sea side of its output. The point was made that this information would be useful for the whole coast and that the receiving waters should be monitored.

### **Ballast**

It was noted that ballast is in fact not monitored by AQIS and related authorities—ships simply report their ballast and discharge on a voluntary basis. This was thought to be very inadequate, given the risk of the importation of pest species.

### **Toxins and algal blooms**

One participant wanted more information on levels of toxicity, the effect on human and animal health and the levels at which the toxins were fatal. It was indicated that algal toxins affect the nervous system, but that human poisoning has never been linked to taking in water by mouth. Ingestion of shellfish with concentrated levels of algae was cited as the primary problem.

Information was given on toxins and it was observed that although Fisheries banned the taking of shellfish approximately 50 years ago, at any one time it would be difficult to identify what toxins were present.

Clarification was sought on the effect of low levels of toxins over a period of time. Contact details of an expert was later provided to the questioner.

### **Groundwater**

Additional information was sought on data available on the contamination of groundwater. The EPA indicated that shallow areas are difficult to document and that they had just received some new data on this issue.

### **Implementation of past studies**

Concerns were raised about past studies and it was implied that past recommendations have not been implemented. References were made by some participants to a study 10 years ago and to a 30-year-old CSIRO study.

### **Sea grass regeneration**

Clarification was sought in the small group discussions about seagrass regeneration. The expert advice was that, while it is true artificial planting of seagrass has been unsuccessful, there is now natural recolonisation of previously bare areas.

### **Riverbed build-up of nutrients**

A question was raised about the impact of riverbed nutrients that are disturbed by dredging. It was indicated that it will take a long time for nutrient levels to be reduced in sediments. Although the rate of nutrient

release (flux) is likely to decrease over time, sediments are a major source of nutrients.

### **Beneficiaries**

Clarification was sought regarding who will benefit from future projects.

### **Jellyfish**

A question was asked about the proliferation of jellyfish and whether this was linked to algae. In the feedback session the EPA linked the shift in marine species community structure to nutrient levels.

### **Geographic variation**

The significance of Barker Inlet as a fish nursery was raised and it was asked if there are other parameters like this that need to be taken into consideration.

### **Inland areas**

Clarification was sought on the impact of activities further inland as well as activities based on the water's edge.

### **Bolivar outlet**

The question was raised as to whether future actions should include shifting the Bolivar outlet further out into the Gulf and whether this would resolve some of the problems.

### **Sewage outflow**

The influence of the Port Adelaide Wastewater Treatment Plant was queried. Confirmation was sought from the EPA to determine whether the sewage works will be diverted back and reclaimed at Bolivar. An additional question was raised as to the implications of this for Mangrove Cove in the Jervis Basin (Inner Harbour of Port River).

### **Community participants also contributed the following additional information and local knowledge:**

#### **Ballast tests**

The contribution made by commercial shipping to pollutants was raised. It was claimed that although Customs is responsible for testing ballast water, to date, not a single ship's ballast water has been tested.

#### **West Lakes**

One participant pointed out the West Lakes development area was once a forest of mangroves, which formed a filter for the Port River.

#### **Water clarity and smell**

A local resident said that the Port River has never been cleaner than it is today, but that this was not an indicator of nutrients. Many nutrients are locked up on the bottom of the riverbed. Other residents said that the water looks cleaner, and smells less than 20 years ago and there is less litter.

Feedback was given that the smell is from rotting sea lettuce, which has increased with the increase in nutrients.

### **Nutrients**

Nutrients from organic run-off from catchments were identified as an issue.

### **Turbidity**

It was observed that the water is more turbid since the release of nutrients from the Port River Wastewater Treatment Works, but that it is localised within the reach of discharge.

### **Industry**

Improvements in river water quality were attributed to a lack of industry. Numerous firms who have left the area were named, with only three firms now remaining.

### **Seagrass**

The impact of nutrients on seagrass was raised and it was claimed that nowhere in the world had seagrass been regenerated. Participants observed that much more seagrass washed up 20 years ago on the West Lakes shore.

### **Swimming bans**

A participant observed that 40 years ago there was swimming in the Port River and another participant recalled that there used to be five bathing clubs. The observation was made by the EPA that signage advising against swimming was erected some time ago and that recent monitoring data makes it arguable if the signage is valid. Additional information was put forward about WHO guidelines on recreational water quality. New signs will advise against swimming in discoloured water and three days after stormwater events.

### **Jellyfish**

It was observed that there used to be different types of jellyfish in the Port River and that these days there are big schools of jellyfish.

### **Fishing**

Forty years ago one of the participants was able to catch a 'triple header' of fish from Snowden's beach, but not now. Both groups had observed decreases in fish stocks. Once SA Water stopped sewage sludge discharges at two locations off the metropolitan beaches, the sludge reduction has led to recolonisation by seagrasses and fish stocks.

The environmental values and water quality objectives determined through the CDM are discussed in the following section and summarised in Table 3.

## Setting the environmental values

### Summary of the water quality management framework

The water quality management framework aims to protect appropriate environmental values for the given waterbody (see Figure 2 below).

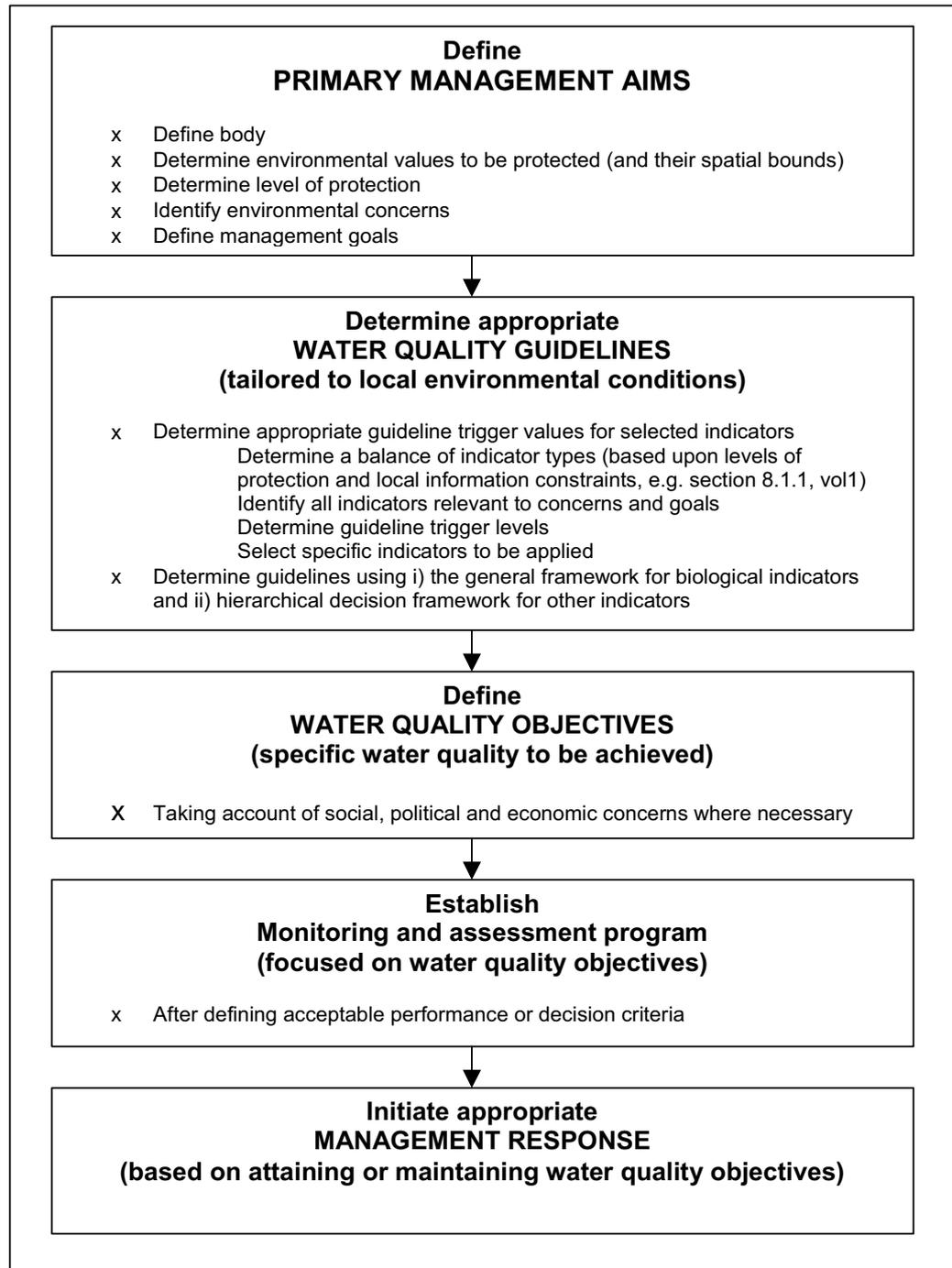


Figure 2: Water quality management framework

## Application of the water quality framework to the Port waterways

### ***Defining the Port waterways***

The Port waterways comprise five segments:

- x Segment 1: Inner Harbour
- x Segment 2: Port River
- x Segment 3: Outer Harbour
- x Segment 4: Central Barker Inlet
- x Segment 5: Northern.

### ***Environmental values and levels of protection for aquatic ecosystems***

The discussion of environmental values at the CDM identified three distinct areas with different values, namely:

- x Inner Harbour
- x Barker Inlet End (St Kilda area)
- x Middle/Outer Harbour end.

In developing the community discussion paper and following initial stakeholder consultation, the following six potential environmental values were identified to help initiate community dialogue:

- x ecosystem health
- x human consumption of fish and shellfish
- x primary contact
- x secondary contact
- x amenity
- x industrial uses.

#### **Ecosystem health**

- x ecosystem protection for fish and marine protection
- x successful dolphin breeding (Inner Harbour, Barker Inlet end, St Kilda area)
- x dolphin habitat and sea lions (Middle/Outer Harbour area)
- x a successful fish breeding habitat (Barker Inlet end)
- x healthy mangroves—bird breeding, samphire swamps, marshes (Barker Inlet end and Middle/Outer Harbour area).

#### **Human consumption of shellfish and fish**

- x fishing for consumption for 100 people a day from boats and at the edge of the River (fishing was identified for Inner Harbour, Barker Inlet end and Middle/Outer Harbour area)
- x able to catch and eat
- x shellfish harvesting (Inner Harbour, Barker Inlet end)
- x crabbing (Middle/Outer Harbour area).

**Primary contact**

- x swimming (Inner Harbour, Barker Inlet end, Middle/Outer Harbour areas)

**Secondary contact**

- x recreational boating (Inner Harbour, Barker Inlet end, Middle/Outer Harbour areas)
- x commercial shipping (Middle/Outer Harbour areas)
- x boat mooring (Middle/Outer Harbour area).

**Amenity**

- x aesthetics
- x lack of odour, not smelling of hydrogen sulphide 'rotten egg gas' (Inner Harbour, Barker Inlet end).

**Additional values of interest**

- x tourism potential, eco-tourism (Middle/Outer Harbour area)
- x economic benefits
- x industry (Middle/Outer Harbour area).

In establishing priorities between different environmental values the following areas of concern were raised:

- x compatibility of different types of activities
- x future levels of industry and employment in Port Adelaide
- x the importance of commercial shipping at both a local and state level
- x unique aspects of different areas of the waterway (i.e. fish breeding grounds at Barker Inlet and migratory wading birds at Outer Harbour).

The participants chose to group environmental values based on geographic areas and then nominated their top two values. They felt that different values may be compatible and applicable if both management and monitoring of activities are occurring.

***Inner Harbour***

1. safe swimming
2. successful dolphin breeding
3. lack of odour—no smells of hydrogen sulphide
4. equal priority to fishing and recreational boating.

***Barker Inlet end (St Kilda area):***

1. equal priority: a successful fish breeding habitat and healthy mangroves (bird breeding, samphire swamps, marshes)
2. dolphin breeding
3. lack of odour.

***Middle/Outer Harbour area:***

1. dolphin habitat and sea lions
2. healthy mangrove system
3. eco-tourism
4. equal priority: industry and commercial shipping.

The preferred environmental values listed above would lead to the adoption of Option 3 outlined in the Discussion Paper for the Port Waterways Plan. Option 3 protects the basic Port waterway health and human uses, including primary contact and human consumption of fish, shellfish and crustaceans.

Only one of the small groups contributed the 'preferred values' listed above. The other group considered the ecosystem as the bottom-line value of the waterways as a whole.

If environmental values were given the highest priority by one group then Option 1 may be suitable for the Middle/Outer Harbour area and Barker Inlet.

A number of parts of the waterway were identified which may need special protection, namely:

- x Mangrove Cove (Jervois Basin) and Barker Inlet as fish breeding grounds, habitat and ecosystem protection
- x Snowden's Beach
- x Outer Harbour for migratory birds
- x key recreational areas of the river.

The question was raised as to whether industrial areas also need special consideration.

The technical assessment initially defined segments of the waterways based on ecological status, development, water circulation, major discharges and so on. This has been redefined following the community consultation process, and the environmental values for the segments are summarised in Table 3.

During Stage 2 of the WQIP, it is likely that these segments will be redefined, using the outcome of the modelling study currently being undertaken by the EPA. This will define water movement patterns, rates of exchange of nutrients with gulf waters and so on.

Table 3: Environmental values

| Segment              | Primary industry                                 | Recreation/aesthetics                  | Drinking water | Aquatic ecosystem—Level of protection   | Industrial                       |
|----------------------|--|--|----------------|---|----------------------------------|
| Inner Harbour        | Harvesting of fish and shellfish for consumption | Primary, secondary and passive contact | N/A            | Degraded area with lower ecological value. Key community indicators are:<br><ul style="list-style-type: none"> <li>- successful dolphin breeding</li> <li>- healthy mangrove system.</li> </ul>   |                                  |
| Port River           | Harvesting of fish and shellfish for consumption | Primary, secondary and passive contact | N/A            | Slightly to moderately disturbed. Key community indicators are:<br><ul style="list-style-type: none"> <li>- healthy dolphin habitat and sea lions</li> <li>- healthy samphires</li> <li>- bird breeding.</li> </ul>   | Industry and commercial shipping |
| Central Barker Inlet | Harvesting of fish and shellfish for consumption | Primary, secondary and passive contact | N/A            | Slightly to moderately disturbed. Key community indicators are:<br><ul style="list-style-type: none"> <li>- healthy dolphin habitat and sea lions</li> <li>- healthy mangrove system.</li> </ul>  |                                  |
| Northern             | Harvesting of fish and shellfish for consumption | Primary and secondary contact          | N/A            | High conservation/ecological value but whole area is slightly to moderately disturbed. Key community indicators are:<br><ul style="list-style-type: none"> <li>- successful fish breeding habitat</li> <li>- healthy mangroves/samphire</li> <li>- healthy seagrass</li> <li>- dolphin breeding.</li> </ul> |                                  |

### ***Water quality issues***

Although previous investigations have identified nutrients as the major source of water quality degradation in the Port environs, the effects of other pollutants (heavy metals, hydrocarbons, etc.) are also significant factors. The impact of other pollutants will be investigated in future reports and strategies developed to minimise harm.

The major potential water quality issues for the Port waterways due to nutrients are:

- x algal blooms (occasionally toxic)
- x occasional fish kills
- x discolouration of the Port River and Inner Harbour
- x odours from decaying algae
- x potential remobilisation of pollutants from sediments
- x ammonia toxicity
- x accumulation of toxins in shellfish
- x *Ulva* proliferation
- x loss of mangroves
- x loss of seagrass communities.

### ***Environmental flow issues***

The Port waterways are dominated by tidal flows. Before European settlement freshwater inflows from the south were intercepted by extensive freshwater/brackish wetlands, which dampened the effect of major storm flows. These wetlands no longer exist and the area is now urbanised. Although artificial wetlands have been developed over the last ten years, they cover a very small area compared to the pre-European landscape. The environmental flow issues are:

- x interruptions to, or improvements in tidal flows and the effects of sea level change due to the greenhouse effect
- x the development of constructed freshwater wetlands and fish passage opportunities
- x flows in the Dry Creek, Little Para and Smith Creek Catchments.

### ***Interim water quality objectives for each segment of the Port waterways***

The ANZECC trigger values and interim water quality objectives for the segments of the Port waterways are outlined below. In four out of the five segments, the interim water quality objectives adapted are the trigger values for estuaries. For Segment 5, which covers the outer Barker Inlet area, the trigger values for marine waters have been adopted.

These interim targets have been adopted for the following reasons:

- x Currently nutrient levels are well in excess of the adopted trigger values. There is clear evidence of environmental impacts from nutrient enrichment. A nutrient load reduction that achieves the

trigger levels will benefit the aquatic ecosystems and other related environmental values.

- x Nutrient levels for the seagrass/mangrove ecosystems are well below the trigger levels (at barely practical levels of detection). It may necessary to adopt levels below the trigger values for the sustainable marine/estuarine ecosystem levels. Stage 2 of the WQIP will provide critical information on water movement and nutrient dispersion from remaining discharge exchange with gulf waters. This will assist in defining the need for further load reductions.

### Segment 1—Inner Harbour

#### *Issues*

Algal blooms, fish kills, prohibition on taking shellfish, protection of remnant mangroves, loss of amenity.

#### *Environmental values*

Protection of aquatic ecosystems, harvesting of fish and shellfish for food, primary and secondary contact recreation, amenity.

#### *Indicators, trigger values, objectives/targets*

| Indicator             | Trigger value          | Water quality objective for nutrients | Monitoring |
|-----------------------|------------------------|---------------------------------------|------------|
| Chlorophyll <i>a</i>  | 5 g/L <sup>(1)</sup>   | 5 g/L                                 | Yes        |
| <b>Phosphorus</b>     |                        |                                       |            |
| Total P               | 100 g/L                | 100 g/L                               | Yes        |
| FRP                   | 10 g/L                 | 10 g/L                                | Yes        |
| <b>Nitrogen</b>       |                        |                                       |            |
| Total N               | 1000 g/L               | 1000 g/L                              | Yes        |
| Nitrate and nitrate N | 100 g/L <sup>(1)</sup> | 100 g/L                               | Yes        |
| Ammonia N             | 50 g/L                 | 50 g/L                                | Yes        |

<sup>(1)</sup> Estuaries



Figure 3: Main features of the Port waterways and segments for water quality

*Linkages and interim target issues*

This segment of the Port River has received the outflow from West Lakes, the Port Adelaide WWTP discharge and various stormwater discharges. It is also developing as an urban area. As a consequence, amenity and recreation will become increasingly important. Little remains of the natural estuarine ecosystem, except a small stand of mangroves, which are important to the community. The removal of the WWTP discharge will greatly improve water quality.

Reducing nutrient levels and algal growth is important to assist in maintaining oxygen levels, protecting fauna and reducing sediment remobilisation of pollutants.

**Segment 2—Port River**

*Issues*

Algal blooms, fish kills, prohibition on taking shellfish, protection of remnant mangroves and samphires, bird breeding, dolphin and sea lion protection.

*Environmental values*

Protection of aquatic ecosystems, harvesting of fish and shellfish for food, primary and secondary contact recreation, amenity.

*Indicators/trigger values objectives/targets*

| Indicator             | Trigger value          | Water quality objective for nutrients | Monitoring |
|-----------------------|------------------------|---------------------------------------|------------|
| Chlorophyll <i>a</i>  | 5 g/L <sup>(1)</sup>   | 5 g/L                                 | Yes        |
| <b>Phosphorus</b>     |                        |                                       |            |
| Total P               | 100 g/L                | 100 g/L                               | Yes        |
| FRP                   | 10 g/L                 | 10 g/L                                | Yes        |
| <b>Nitrogen</b>       |                        |                                       |            |
| Total N               | 1000 g/L               | 1000 g/L                              | Yes        |
| Nitrate and nitrate N | 100 g/L <sup>(1)</sup> | 100 g/L                               | Yes        |
| Ammonia N             | 50 g/L                 | 50 g/L                                | Yes        |

<sup>(1)</sup> Estuaries

*Linkages and interim target issues*

This is a mixed-use area, important for ecosystem protection, recreation and as a commercial shipping area. It currently receives the Penrice discharge, which may have a localised toxic effect from ammonia. Although the removal of the Port Adelaide WWTP discharge will improve water quality, high nitrogen levels (ammonia) will likely remain as a result of the Penrice discharge. The EPA modelling study will assist in defining the dispersion pattern of this discharge and the extent to which nutrients from the discharge may enter other segments. Although a modified area, high

standards of protection are required, particularly as the Lefevre Peninsula is developed and the river becomes more important for recreation.

### Segment 3—Outer Harbour

#### *Issues*

Algal blooms, protection of samphire/bird breeding areas, protection of dolphins and sea lions.

#### *Environmental values*

Protection of aquatic ecosystems, harvesting of fish and shellfish for food, primary and secondary contact recreation, amenity.

#### *Indicators/trigger values objectives/target*

| Indicator             | Trigger value           | Water quality objective for nutrients | Monitoring |
|-----------------------|-------------------------|---------------------------------------|------------|
| Chlorophyll <i>a</i>  | 5 ug/L <sup>(1)</sup>   | 5 g/L                                 | Yes        |
| <b>Phosphorus</b>     |                         |                                       |            |
| Total P               | 100 ug/L                | 100 g/L                               | Yes        |
| FRP                   | 10 ug/L                 | 10 g/L                                | Yes        |
| <b>Nitrogen</b>       |                         |                                       |            |
| Total N               | 1000 ug/L               | 1000 g/L                              | Yes        |
| Nitrate and nitrate N | 100 ug/L <sup>(1)</sup> | 100 g/L                               | Yes        |
| Ammonia N             | 50 ug/L                 | 50 g/L                                | Yes        |

<sup>(1)</sup> Estuaries

#### *Linkages and interim target issues*

This outer segment of the Port River will be subject to high rates of exchange with the gulf marine waters. Although trigger values for estuaries have been adopted, the determination of final water quality objectives will be based upon the EPA modelling study. This segment contains the main shipping terminal. It is a modified area on the Peninsula, but has natural areas on the northern tip of Torrens Island and seagrass (impacted by nutrients) to the north. It requires a high level of protection to maintain and enhance existing values.

## Segment 4—Central Barker Inlet

### Issues

Algal blooms, *Ulva* proliferation, loss of seagrass and mangroves, loss of amenity, odours.

### Environmental values

Protection of aquatic ecosystems, harvesting of fish and shellfish for food, primary and secondary contact recreation, amenity.

### Indicators/trigger values objectives/targets

These are summarised in the table below.

| Indicator                    | Trigger value          | Water quality objective for nutrients | Monitoring |
|------------------------------|------------------------|---------------------------------------|------------|
| <b>Chlorophyll <i>a</i></b>  | 5 g/L <sup>(1)</sup>   | 5 g/L                                 | Yes        |
| <b>Phosphorus</b>            |                        |                                       |            |
| <b>Total P</b>               | 100 g/L                | 100 g/L                               | Yes        |
| <b>FRP</b>                   | 10 g/L                 | 10 g/L                                | Yes        |
| <b>Nitrogen</b>              |                        |                                       |            |
| <b>Total N</b>               | 1000 g/L               | 1000 g/L                              | Yes        |
| <b>Nitrate and nitrate N</b> | 100 g/L <sup>(1)</sup> | 100 g/L                               | Yes        |
| <b>Ammonia N</b>             | 50 g/L                 | 50 g/L                                | Yes        |

<sup>(1)</sup> Estuaries

### Linkages

This is an important ecological area. Nutrient enrichment has resulted in damage to aquatic ecosystems. Prolific algal growth also contributes to low oxygen conditions, which apart from direct impacts on fauna, produce conditions conducive to the remobilisation of pollutants from sediments. The reduction of pollutants in stormwater and effluent (wastewater/discharges) will facilitate system recovery—for example, mangrove recruitment. Action to improve tidal flows, such as culverts under power line easements and mangrove/samphire accretion areas like these in the Barker Inlet Wetlands, are more likely to be successful with lower nutrient levels.

## Segment 5—Northern

### *Issues*

Loss of seagrass and mangroves, *Ulva* proliferation, algal blooms.

### *Environmental values*

Protection of aquatic ecosystems, harvesting of fish and shellfish for food, primary and secondary contact recreation, amenity.

### *Indicators/trigger values objectives/targets*

This segment is described as marine rather than estuarine. The trigger values, water quality objectives for nutrients are summarised below.

| Indicator                    | Trigger value          | Water quality objective for nutrients | Monitoring |
|------------------------------|------------------------|---------------------------------------|------------|
| <b>Chlorophyll a</b>         | 1-5 g/L <sup>(1)</sup> | 5 g/L                                 | Yes        |
| <b>Phosphorus</b>            |                        |                                       |            |
| <b>Total P</b>               | 100 g/L                | 100 g/L                               | Yes        |
| <b>FRP</b>                   | 10 g/L                 | 10 g/L                                | Yes        |
| <b>Nitrogen</b>              |                        |                                       |            |
| <b>Total N</b>               | 1000 g/L               | 1000 g/L                              | Yes        |
| <b>Nitrate and nitrate N</b> | 50 g/L <sup>(1)</sup>  | 100 g/L                               | Yes        |
| <b>Ammonia N</b>             | 50 g/L                 | 50 g/L                                | Yes        |

<sup>(1)</sup> Marine

### *Linkages and interim target issues*

This area is the most important to marine ecosystems, but is severely impacted by nutrient enrichment. High standards of protection are required to protect existing environmental values. Ecosystem decline has been continuing. Even though the nutrient load reduction from Bolivar WWTP will be substantial with the WWTP EIP, the remaining nutrient load may still be sufficient to continue the loss of seagrasses and mangroves. The EPA modelling study will determine the dispersion characteristics of the remaining effluent. This will be critical in determining the need for further nutrient reduction.

## Conclusions

The Port waterways have been a key point of focus for environmental improvement for at least the last decade. There is overwhelming community concern over the long-term ecological health of these unique waterways. There is also a pragmatic acceptance of the economic importance of retaining appropriate commercial and industrial activities in the region. Community, government and industry discussion are continuing to address these issues and to find solutions to the multiple interests using the waterways.

Ecological health and economic benefits are not mutually exclusive if properly managed. The Coastal Catchments Initiative and the Port Waterways Water Quality Improvement Plan, with their focus on nutrients, are an important step in the management process.

The confirmation of community values and the delineation of the Port waterways into segments reflective of those values provide all participants in the project with an important measuring stick.

The key lessons from the consultation process are as follows:

- x The community has talked and heard enough, it is now time for action.
- x When action is taken, this needs to be communicated.
- x Before actions are taken, develop key performance indicators to measure improvement.
- x Key performance indicators should be monitored and regular and active feedback, both positive and negative, should be provided to the community.