

DARWIN HARBOUR REGION REPORT CARD 2015

www.lrm.nt.gov.au

Message from the Minister

Darwin Harbour is a boon to both our flourishing community and our prosperous economy. It is a well-managed, commercial asset which contributes significantly to the sustainable economic development of our city. On the social side, local residents and tourists alike continue to enjoy the wide range of recreational opportunities which the harbour offers in such abundance.

Careful planning and monitoring is essential to guarantee the ongoing health of our harbour, as the city of Darwin continues to grow in population and industrial development. Consequently, the Department of Land Resource Management (DLRM) - in concert with other government agencies and private sector organisations - continues to collect a range of environmental data. This information assists us in making prudent decisions to nurture and protect our harbour.

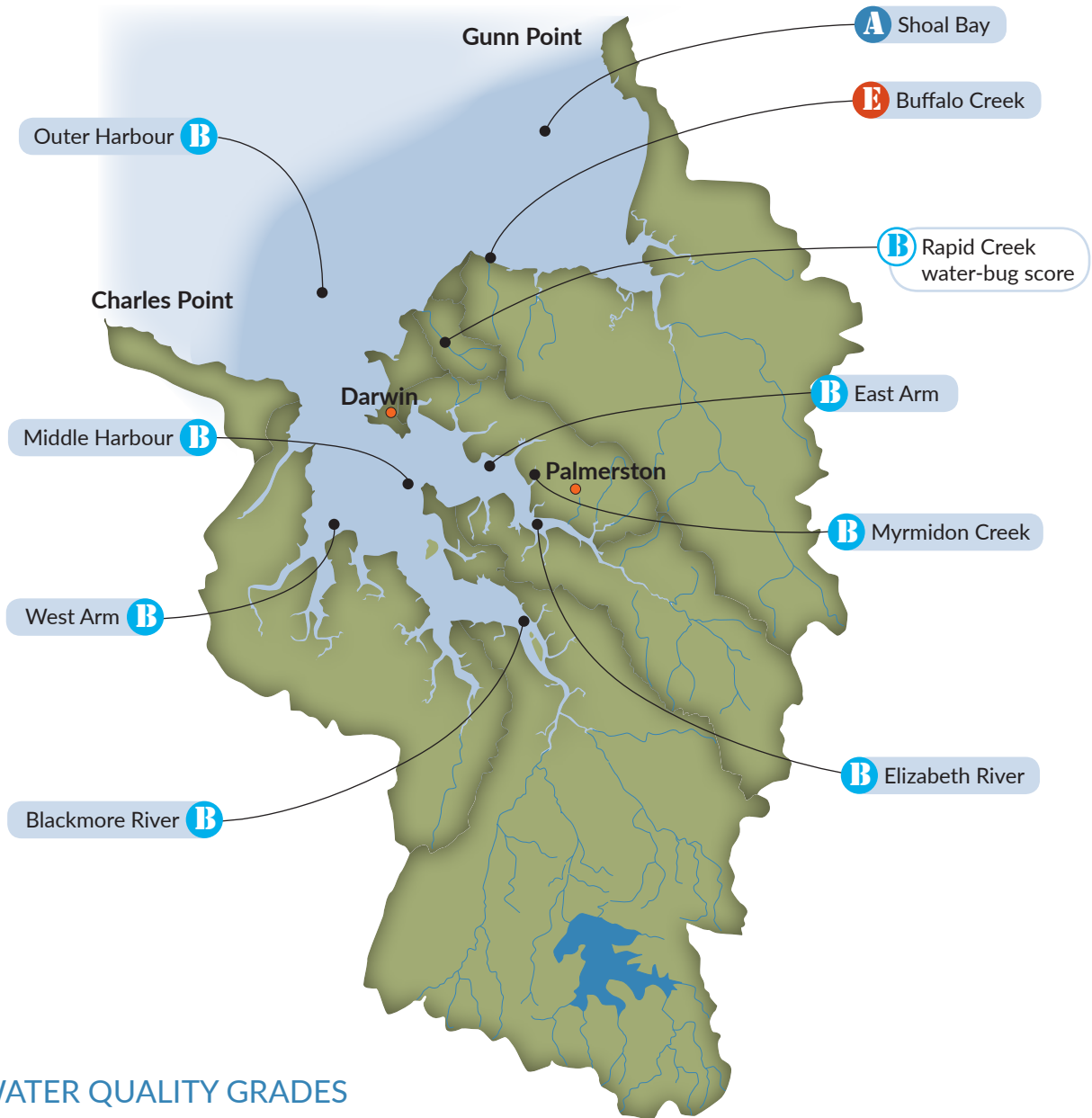
To help this along my department has established the Darwin Harbour Region Integrated Monitoring and Research Program Coordination Committee. This group will co-ordinate environmental monitoring and research to maximise outcomes for our harbour. This committee consists of a range of stakeholder groups including Power and Water Corporation, ConocoPhillips, Darwin Port Operations, INPEX Operations Pty Ltd, Charles Darwin University, Australian Institute of Marine Science and the Department of Land Resource Management.

I am pleased to advise Darwin Harbour remains healthy. This report has assessed water quality across nine key regions using indicators of water clarity, dissolved oxygen, nutrients and algae. The water quality of Darwin harbour is in very good condition.

The Hon. Gary Higgins
Minister for Land Resource Management

Environmental
data assists
us in making
prudent
decisions to
nurture and
protect our
harbour.

The Health of the Harbour



WATER QUALITY GRADES

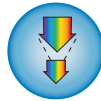
- A** Excellent water quality. All four water quality indicators meet desired levels.
- B** Very good water quality. Three water quality indicators meet desired levels.
- C** Good water quality. Two water quality indicators meet desired levels.
- D** Poor water quality. Only one water quality indicator meets desired levels.
- E** Very poor water quality. No water quality indicators meet desired levels.

- ✓ No aquatic pests were found in Darwin Harbour for 2015
- ✓ The beaches had suitable microbiological water quality that met the guidelines for swimming
- ✓ Overall the water quality of Darwin Harbour is in very good condition

The Report Card

Each region in the harbour was assessed for water quality from 1st November 2014 to 30th October 2015, and assigned a grade against four key water quality health indicators. These indicators are explained below.

Water clarity



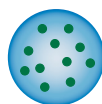
Plants, such as seagrasses and microscopic algae, need sunlight to grow. Clear water allows sunlight to reach these plants. Darwin Harbour has a naturally wide range of water clarity which varies over the tidal cycle, and is also affected by storm water and dredging activity. Turbidity is often used as a measure of how clear the water is.

Dissolved oxygen



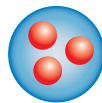
Water contains small amounts of dissolved oxygen which is used by aquatic animals. However, storm water and wastewater from treatment plants, and the disturbance of mangrove muds by boats and the tides, can reduce oxygen concentrations to potentially harmful levels. Large amounts of algae can sometimes reduce oxygen to very low levels at night.

Algae



Algae are microscopic plants which are a natural part of the ecosystem and provide food for large animals like mangrove snails and microscopic creatures such as tiny shrimps. When waters become polluted with nutrients, large amounts of algae can adversely affect the marine ecosystem.

Nutrients



Nitrogen and phosphorus are nutrients required by algae to grow. However, pollution by nutrients can produce too much algae, and adversely affect the ecosystem.

The Report Card grades were assessed against the Water Quality Objectives (WQO) for Darwin Harbour.

Rapid Creek is the largest freshwater stream in the Darwin suburban area. The ecological health of Rapid Creek has been assessed using the AUSRIVAS assessment method since 2001. In 2015 the AUSRIVAS score at sampling sites of Rapid Creek was given a B. This is consistent with previous years.

Below is a table that shows water quality indicators for each region of the harbour, with a ✓ indicating those that met the desired level (known formally as a Water Quality Objective) and a ✗ indicating those that were unsatisfactory.

Indicator	Harbour region								
	Outer Harbour			Inner Harbour				Tidal creeks	
	Outer Darwin Harbour	Shoal Bay	Middle Darwin Harbour	Blackmore	East Arm	Elizabeth	West Arm	Buffalo Creek	Myrmidon Creek
Water clarity	✗	✓	✓	✗	✗	✓	✗	✗	✗
Dissolved oxygen	✓	✓	✓	✓	✓	✓	✓	✗	✓
Algae	✓	✓	✓	✓	✓	✓	✓	✗	✓
Nutrients	✓	✓	✗	✓	✓	✗	✓	✗	✓
	Report Card grades								
2015	B	A	B	B	B	B	B	E	B
2014	B	B	A	A	B	A	A	D	C

Note: Natural variability influences the water quality of Darwin Harbour. The effect of strong seasonality and large tides can cause large natural variability. This is particularly notable for water clarity where wind driven turbulence during the dry season appeared to influence turbidity in some parts of the harbour.

Darwin Harbour

– A Wonderful Community Asset

Water quality of the Darwin Harbour region

There are many good reasons for our community to continue to work together to keep Darwin Harbour healthy. The harbour supports aquaculture, tourism, and recreation, and is home to a wide variety of plants and animals. A healthy harbour is also of great significance to our local Indigenous peoples.

Darwin Harbour is a working port for a prosperous tropical city. It is also a valuable cultural, recreational, and environmental asset. We monitor the health of the harbour very carefully to ensure that it will be enjoyed by future generations, even as we continue to reap the benefits of the sustainable economic development of the city.

This monitoring provides 'baseline' information which will help us to measure changes in the harbour. It enables trends to be identified, and offers early warning of change. Monitoring also provides feedback about our management of the environment. This vital work informs the decisions we take today that will determine the health of our harbour tomorrow.

The stories in this report card describe the ways in which the health of the harbour is monitored. They also offer some insight into the research activities which provide important additional information about the wellbeing of the environment. The final page of this Report Card provides details of a number of websites where further information can be obtained.





Looking after our harbour

The health of Darwin Harbour has been closely monitored for many years.

The amount, types and quality of the monitoring will be improved by the generosity of the Ichthys LNG Project in funding a significant long-term (40 year) program of monitoring and research.

This will allow us to invest in priority research in the harbour so that we can learn more about water, sediment quality and mangrove health. It will tell us more about the many plants and animals that live in the mangroves. This additional information will inform our future monitoring program and enable us to better protect the harbour.

Research projects have been initiated to find out the following:

- How mangrove sediments are polluted by metals from storm water
- How microbes in the sediments affect nutrients
- Whether mangrove sediments are accumulating or being washed away.
- Whether mangrove plant cover and types can be monitored using remote sensing satellite imagery.

In his introduction to this Report Card the Minister advised that a committee of stakeholders has been established to co-ordinate and integrate the many different monitoring and research activities being conducted in the harbour.

Marine ecosystems monitoring and cultural values meet



The Darwin Harbour Marine Ranger Program was established in 2013.

This program brings Larrakia traditional owners together with technical experts and representatives of government departments. The Indigenous rangers work with these agencies to monitor the wellbeing of the harbour, and conduct the research projects which gather the evidence to allow us to protect the harbour's resources.

The program has a strong focus on developing the skills of the rangers in marine ecosystem monitoring. These rangers played a pivotal role in Department of Land Resource Management programs in 2014-2015 as they worked closely with staff undertaking water quality and sediment sampling, and a range of other marine monitoring projects.

Rangers use electronic equipment to assess the health of the harbour's waters. This is critical to the welfare of marine plants and animals, including the shellfish which are harvested by the local Larrakia people.

This program has resulted in four young Indigenous people working in jobs which will prepare them for an exciting future. They receive training in field and laboratory skills, and work towards gaining the coxswains certificate which will permit them to pilot a vessel.

The program also offers project partners the opportunity to learn about Larrakia cultural values and knowledge. This exchange builds opportunities to combine western science with Indigenous cultural knowledge, in a way that benefits all parties to the arrangement.

Protecting the catch



The Charles Point and Lorna Shoal fishing “closures” are designed to assist in the recovery of popular reef species, such as Black Jewfish and Golden Snapper, that have been overfished.

The closures occupy a combined area of approximately 250 square kilometres where fishing is not permitted. The intention of the closures is to ‘take care of the catch’ and preserve these areas so that the many recreational fishers in the harbour can continue to enjoy their sport.

The Department of Primary Industry and Fisheries is using state-of-the-art equipment called BRUVs (Baited Remote Underwater Videos) and Multibeam sonar to compare fish species and numbers inside and outside the closure areas. Importantly, these techniques do not take fish from the harbour.

The BRUV’s are used at specific times when the equipment can ‘see’ at least a few metres through the sand and silt that is suspended in the water. Many different types of fish have been identified from the video footage.

Multibeam sonar maps the seafloor and identifies locations where there are large numbers of fish. It also counts and categorises fish by size and species. Only fish within five metres of the seafloor are counted, to ensure that the mapping produces accurate estimates of the number of bottom-dwelling reef fish.

The information collected during this monitoring helps us assess the effectiveness of the closures, and the period of time they need to stay in place to promote the recovery of the reef fish species.



Mangroves, 'the lungs' of Darwin Harbour

Mangroves are important ecosystems and are often referred to as the 'lungs of the harbour'.

The 20,000 hectares of mangroves in Darwin Harbour (between Charles and Gunn Points) grow in the intertidal zone. However, they are currently threatened by land use change, industrialisation, water pollution, and sea level rise.

Mangroves provide a number of important functions. They offer a fish nursery, protect the coast line from storm surges and erosion, trap contaminants, and store large quantities of carbon in their sediment.

Our mangroves also offer a considerable buffer against the impacts of sea level rise in Darwin Harbour, particularly in low-lying coastal communities where risks are higher.

Sea level rise in the harbour is estimated at 7.5 mm per year, which is higher than the southern states of Australia, and more than twice the rate of rise in southern Victoria. Since monitoring in Darwin harbour commenced in 1993 the sea level has risen almost 19 centimetres.

Sea level rise may affect the mangroves over the long term through increasing the period of tidal inundation. The INPEX long term program will support research and monitoring of our mangrove ecosystems.

Keeping Darwin Harbour clean – “clean-up day 2015”



The sixth Darwin Harbour Clean-Up, held on Friday 26 June was again strongly supported by businesses, community and government.

We are proud to say that the event won the Environment Award at the National Seafood Awards in October 2015 and the annual Coastcare Award at the NT Landcare and Territory Natural Resource Management Awards in 2015.

The statistics from the day are amazing: Nearly 140 people worked across 15 sites, with 17 boats working around the harbour. Their 'catch' of 1.6 tonnes of rubbish included 3,220 cigarette butts and over two kilometres of fishing line. Nearly 2,000 plastic bags were dragged in, along with 10 shopping trolleys and 13 recreational crab pots.

Two thousand aluminium cans and plastic drink bottles were also collected. Happily, this was only half the number collected last year. We hope this means that those who use the harbour are heeding the message to 'bin it or take it with you'.

The clean up event is a fun day for family and community. It also brings home the message that cigarette butts dropped in the street are likely to end up in the harbour, and that we all need to be thoughtful in the way we dispose of our empty bottles and cans.

The 2015 Darwin Harbour Clean-Up was organised by the Northern Territory Seafood Council and supported by Territory Natural Resource Management through funding from the Australian Government.

Further funding, resources, staff and volunteers were provided by numerous supporters and participants. Their great work is appreciated by the people of Darwin and the visitors who gain so much enjoyment from our harbour.



Sponges soak it up!

Sponges have immense filtering capabilities, with a single sponge “cleaning” up to 20,000 litres of water every day.

Because they “drink” so much water, sponges may be prone to significant change – good or bad – when there are elevated levels of nitrogen in the water. Sponges form an intimate association with the micro-organisms which they host. It is these tiny microbes that really do the work of processing the nitrogen.

Researcher Dr Heidi Luter from the North Australia Marine Research Alliance (NAMRA) has conducted experiments to examine the effects of the excess nitrogen often found in treated sewage effluent. Nitrogen is a plant nutrient which - in excess quantities - can cause unsightly algae that could smother the sponges and prevent them filtering water. Dr Luter has focused on a sponge called the ‘cup and saucer’ sponge which is common in Darwin Harbour. She discovered that this type of sponge can tolerate a large amount of nitrogen in the water.

She also found that there were no differences between cup and saucer sponges that grew in high nitrogen areas and the same sponges found in other parts of the harbour. Nor was there any difference in the kind of microbes that lived on the sponge in the different locations. However Dr Luter did identify specific microbes that may be involved in converting nitrogen to a form that can be used by other organisms. As we learn more about the plants and animals that live in the harbour we can manage the environment more effectively.

This is just one example of the way in which research projects increase our understanding of the way in which our harbour works. The information we collect enables us to take better care of this great natural asset.

Shedding light on the biodiversity of Darwin's streams



Healthy streams not only have good water quality, but also provide a variety of habitats for aquatic creatures including fish and other animals.

Stream invertebrates or 'water bugs' include dragonflies, freshwater mussels and giant freshwater prawns, and also smaller animals such as caddisflies and mayflies. These bugs provide food for fish and other larger animals. Streams with a large number of different kinds of water bugs are generally considered to be healthy waterways.

Larval caddisflies are aquatic, but adults are terrestrial and resemble moths. Their numbers can be assessed by using a variety of methods including devices called "light traps". A light trap uses light from a small incandescent bulb to attract and trap insects at night. Streams in the Darwin area are home to about 50 species of caddisfly, or about a third of the total NT caddis fly fauna.

Baseline data has been collected at a number of streams in the Darwin area including Palm Creek at Holmes Jungle, Berry Springs Creek and Peel Creek. Individual streams can have between 30 or more species, most of which are widely distributed across northern Australia.

The water bug count in a river system provides scientists with another piece of the puzzle as they work to better understand the ecosystem of the waterways. This information enables us to continue to protect these important environmental assets.

Further information:

Previous Report Cards:

<http://lrm.nt.gov.au/water/darwin-harbour/reportcards>

Darwin Harbour Region Report Card water quality:

Darwin Harbour Water Quality: Darwin Harbour Region 2015 Report Card - Water Quality Supplement. Department of Land Resource Management.

<http://lrm.nt.gov.au/water/aquatic/publications>

Aquatic pest monitoring:

<http://www.nt.gov.au/d/Fisheries/index.cfm?header=Aquatic%20Biosecurity>

Dolphin monitoring:

<http://lrm.nt.gov.au/plants-and-animals/marine-and-coastal-biodiversity/darwin-harbour>

Beach monitoring:

http://www.health.nt.gov.au/Environmental_Health/Beach_Water_Quality/index.aspx#BeachWaterQuality

INPEX operations Pty Ltd monitoring:

<http://www.ichthysproject.com/environment>

Wildwatch:

Watch out for our wildlife. A hotline to help manage and respond to marine wildlife incidents in our seas and rivers.

<http://lrm.nt.gov.au/plants-and-animals/marine-and-coastal-biodiversity/marine-wildwatch>

Northern Territory Seafood Council:

<http://www.ntsc.com.au/darwin-harbour-clean-up-2015>

