



Northern  
Territory  
Government

Department of Land Resource Management

# Darwin Harbour Region Report Card 2014





## Message from the Minister

The people of Darwin are justly proud of our working tropical harbour which also offers a wide range of leisure activities for locals and visitors alike. This well-managed commercial asset also offers fishing, sailing and other water sports, both for residents and for the thousands of tourists who flock to Darwin every year to sample the delights of our tropical paradise.

I am pleased to advise that once again our vigilant monitoring of the health of the harbour confirms that it is in very good condition. The Department of Land Resource Management (DLRM), in concert with other government agencies and private sector organisations, collects the information which enables us to report each year on the ongoing health of our harbour. The DLRM continues to expand the range of information it collects to ensure that all significant aspects of the harbour – including the dolphin population and the ecologically important seagrass habitats - are closely watched.

Our government will continue to ensure that the long-term sustainability of this wonderful economic, social, and cultural asset is protected into the future.

**The Hon. Willem Westra Van Holthe**  
**Minister for Land Resource Management**



# Darwin Harbour – A Wonderful Community Asset

## Water quality of the Darwin Harbour region

The Darwin Harbour region comprises a number of impressive marine, coastal and wetland ecosystems. It is a tropical working port for a city which enjoys well-managed and sustainable growth in population and industry, as well as a valuable cultural, recreational and environmental asset. Intact natural systems and water resources are key elements of the ecological sustainability of the region. Our monitoring of the water quality of these natural systems helps us understand how they are coping, and allows us to take any action necessary to protect these valuable marine and freshwater environments.

Ongoing monitoring of the harbour provides the 'baseline' information against which future change can be measured. It enables trends to be assessed over time, and offers early warning of impending changes. Monitoring also provides feedback about the effectiveness of our management of the environment. This information is critically important, since the decisions we make today will substantially determine the health of our harbour in the future.

The water quality of Darwin Harbour and its catchment has been monitored regularly since 2008, and the results presented annually as a Report Card. This document provides a snapshot of water quality at a range of sites spanning the main body and arms of the harbour, and extending to Shoal Bay in the east. The data required for these reports is collected by the Department of Land Resource Management (DLRM), PowerWater Corporation and the aquaculture industry.

NT Fisheries continues to monitor our waters for aquatic pests - such as the non-native black- striped mussel - which pose a threat to local aquatic species. We are pleased to report that no marine pest species were detected in the Darwin region during the monitoring period. Further, our monitoring confirms that pathogen levels on our public beaches remain within public health guidelines. The condition of Rapid Creek freshwater sites is similar to last year, and overall the creek is in good condition considering its urban setting.

Further technical information supporting the Report Card is available in the publication *Darwin Harbour Water Quality: Supplement to the 2014 Darwin Harbour Region Report Card*.



### **Battlefield Sponge**

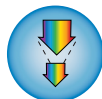
Colonies of this sponge can grow to 12 cm in diameter and individual fingers can grow to 4 cm high. The distinctive bright red colour and sheer abundance of this sponge on shallow silty reefs can give the appearance of a blood-spattered battlefield. Even though Battlefield Sponge is brightly coloured and grows in the open it is not grazed by predators or overgrown by other sponges because it produces compounds called toxins which even at low concentrations are toxic to other organisms.

## The Report Card

Each region in the harbour was assessed for water quality from September 2013 to September 2014, and assigned a grade against four key water health indicators: water clarity, dissolved oxygen, algae and nutrients. These indicators are explained in more detail below.

### Indicators used in the report card

**Water clarity**



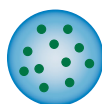
Plants, such as seagrasses and microscopic algae, need sunlight to grow. Clear water allows sunlight to reach these plants. Darwin Harbour has a naturally wide range of water clarity which varies over the tidal cycle, and is also affected by storm water and dredging activity.

**Dissolved oxygen**



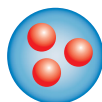
Water contains the small amounts of oxygen which are needed by aquatic animals to survive. However, storm water and wastewater from treatment plants, and the disturbance of mangrove muds by boats and the tides, can reduce oxygen concentration to potentially harmful levels. Large amounts of algae can sometimes reduce oxygen to very low levels during the night-time.

**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.

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.

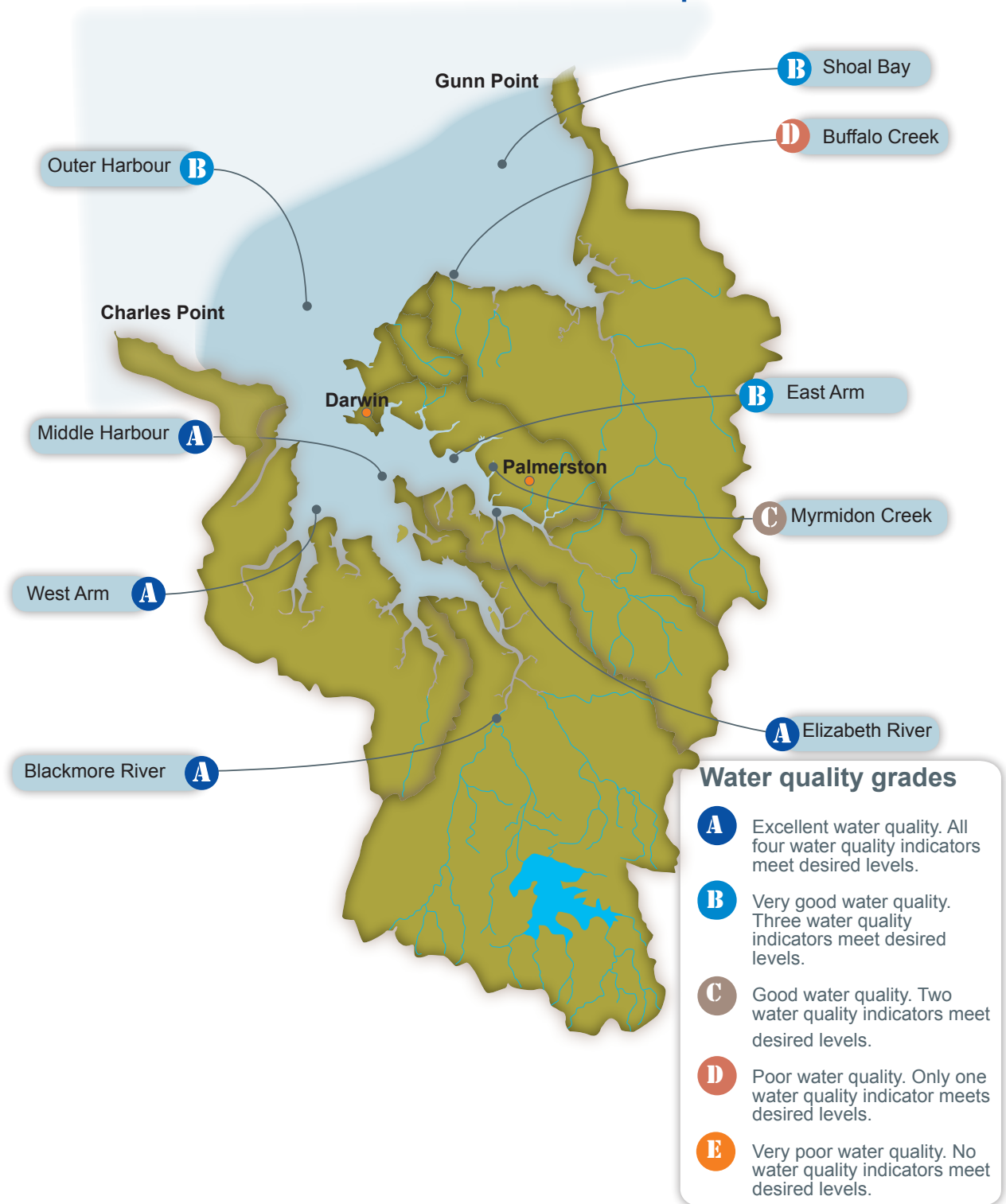
The bottom of the table shows the Water Quality grades for 2014 and past years.

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	✓	✗ <sup>1</sup>	✓	✓	✓	✓	✓	✓ <sup>3</sup>	✓
Algae	✓	✓	✓	✓	✓	✓	✓	✗	✓
Nutrients	✗ <sup>2</sup>	✓	✓	✓	✗	✓	✓	✗	✗ <sup>4</sup>
Report Card grades									
2014	<b>B</b>	<b>B</b>	<b>A</b>	<b>A</b>	<b>B</b>	<b>A</b>	<b>A</b>	<b>D</b>	<b>C</b>
2013	<b>B</b>	<b>B</b>	<b>B</b>	<b>A</b>	<b>B</b>	<b>A</b>	<b>A</b>	<b>E</b>	<b>C</b>
2012	<b>B</b>	<b>B</b>	<b>A</b>	<b>A</b>	<b>A</b>	<b>A</b>	<b>A</b>	<b>E</b>	<b>C</b>
2011	<b>A</b>	<b>C</b>	<b>A</b>	<b>C</b>	<b>A</b>	<b>A</b>	<b>A</b>	<b>E</b>	-
2010	<b>A</b>	<b>C</b>	<b>B</b>	<b>B</b>	<b>A</b>	<b>A</b>	<b>A</b>	<b>E</b>	<b>C</b>

## Rating table notes:

1. Shoal Bay had dissolved oxygen levels slightly above the desired range, however these are not considered harmful.
2. Total Nitrogen was higher than the Water Quality Objective. Locally high nutrient levels do occur in the vicinity of East Point due to discharge from the Ludmilla Wastewater Treatment Plant but do not cause higher amounts of algae in the water. Overall, the outer harbour has levels less than the Water Quality Objective.
3. Buffalo Creek receives wastewater from the Leanyer-Sanderson Wastewater Treatment Plant and stormwater during the wet season. The improved Buffalo Creek dissolved oxygen levels are due to better day-time levels. Low night-time levels still occur.
4. Myrmidon Creek receives wastewater from the Palmerston Wastewater Treatment Plant. No grade was calculated in 2011.

## Darwin Harbour Graded Map



## Working Together for a Common Purpose

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 diverse range of plants and animals. A healthy harbour is especially important to our local Indigenous peoples. If we allow the quality of the water in our harbour to deteriorate, it will be expensive and inconvenient to rectify the situation.

The focus of this Report Card is on water quality, but harbour health is also about the wellbeing of plants and animals. Many organisations monitor the environment of Darwin Harbour. The amount of monitoring will increase, and enable us to be even more prudent in the management of the health of our harbour.

The stories on the following pages offer a number of snapshots that provide further insight into the important job of monitoring the health of the harbour, and the research activities which help underpin this important task. More information is available from web sites listed on the last page of this Report Card.

### The 'All Clear' in the catchment – pesticide monitoring

As the population of Darwin continues to grow, and as more land in the rural area is used for agriculture, there is concern that chemicals from pesticides and herbicides may move through the soil into the groundwater.

During the dry season, this groundwater feeds the permanent springs and creeks in the Darwin rural area. In 2014, five springs in the region were monitored by the DLRM, using sophisticated equipment with the capacity to detect very low levels of chemicals, to assess whether any contamination of the groundwater was occurring. The springs monitored were: Palm Creek (Holmes Jungle), Howard Springs, Berry Springs, Melacca Springs and Whitewood Jungle. Water quality was also tested, including nutrients which can come from fertilizers and septic tanks.

The results of these tests confirmed the good water quality of Darwin's rural springs. Very low levels of four herbicides and one insecticide were found in two springs, and traces of insecticide were detected in one other spring. All the concentrations found were all far below levels that could cause harm to humans or aquatic animals. These springs are amongst the cleanest in Australia.

The water quality information will be used as a baseline to compare against in the future to see whether there are any changes in water quality.

Meanwhile, our monitoring and management practices continue to improve, enabling us to be even more vigilant in the steps that we take to protect the quality of our water.



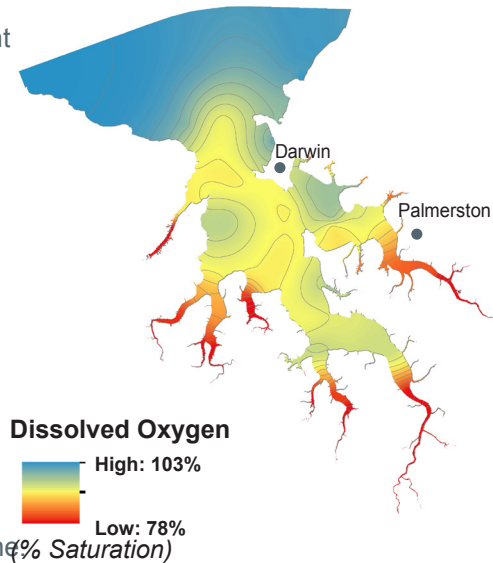
## Water quality across Darwin Harbour estuary

DLRM has conducted tests to monitor water quality across Darwin Harbour to better understand patterns in water quality in the harbour. Water quality can be influenced by season, location, and the range of very large tides that we experience in the harbour.

To gain better insight into how water quality varies recent sampling was conducted during the dry season and during the same tide (the small neap tides).

This monitoring showed how water quality changed with the location in the harbour. The smaller arms of the harbour have a different water quality to main body of the harbour. This is due mainly to their closeness to mangroves. It also indicates, along with information about harbour water movement, that these waters are more vulnerable to pollution than the main body of the harbour.

Understanding the processes that affect water quality is important when interpreting water quality trends over time.



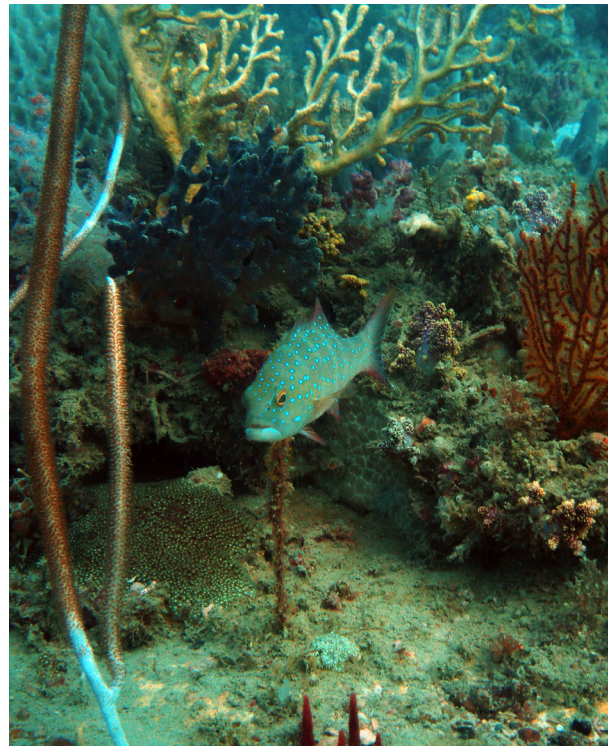
## Protecting our special seascapes

Under the sometimes hazy waters of Darwin Harbour lie some interesting underwater environments, including extensive sponge, coral and seagrass communities. These communities are highly responsive to changes in water quality, so the characteristics of the physical environment can be used to indicate where they are likely to be found.

Key factors in this environment include the surface of the seafloor, be it rock, sand or mud. Additionally, factors such as currents, depth, light, and water clarity all provide indications of the seascapes likely to be found in these different environments.

Understanding where these different communities are located in the harbour obviously helps us to better manage and monitor their health.

Sophisticated equipment is used to gather information about, depth and water clarity, and the nature of the seafloor. This information is verified by 'ROV' (Remotely Operated Vehicle) divers which are equipped with underwater cameras to provide scientists with images of the seafloor. The data collected can be used to develop maps of the sea floor which will guide the development of further marine flora and fauna monitoring programs. The more we learn about these environments and the way they respond to changes in water quality, the better able we are to protect and conserve these special areas.



## Taking care of our dolphins

In October 2011, the DLRM and INPEX began a coastal dolphin monitoring program in Darwin Harbour. The aim of the program was to identify any change in population of three species of coastal dolphins found in the harbour: the Australian Snubfin, Australian Humpback and the Bottlenose.

The good news is that the significant amount of dredging which has been undertaken in the harbour during the past two years has made no difference to the number of dolphins in the harbour.

Surveys are undertaken in March and October each year to photograph dolphin dorsal fins, which act as unique identifiers of individuals (see below). The number of times an individual dolphin is recorded during each survey enables the number of dolphins in the harbour to be calculated in a process known as 'mark-recapture'.

So far six surveys have been undertaken indicating that the population for each species is small but stable. There has also been some movement of all three species between Darwin Harbour, Bynoe Harbour and Shoal Bay. The monitoring program will continue until 2015.

Departmental officers take an active role in nurturing and protecting marine life in the Darwin Harbour. For example, the DLRM's Wildwatch Program offers a 'call-in hot line' (1800 453 941) which members of the public can use to notify the department of stranded or injured marine animals like turtles or dolphins. The department responds to these calls by dispatching skilled scientists to assist these creatures.



## Dolphin 'fingerprints'

Remarkably, every dolphin dorsal fin (the 'top' fin we see as the animal cuts through the water) is unique to that particular creature. This is more a matter of life's 'wear and tear' than one of genetics, but it nevertheless enables researchers to identify individual dolphins in the manner that fingerprints are used to identify human beings. This classification system is known as DolFin.



### 'A Youngster'

This Bottlenose Dolphin was sighted in the harbour on a number of occasions between November 2008 and April 2010. This creature was classified as a juvenile (less than 10 years old).  
*I.D. 228*



### 'Mum'

This Bottlenose Dolphin was first sighted in October 2008 and continues to be seen regularly in the harbour. Since early November 2011 'mum' has been seen in the company of her calf.  
*I.D. 21*



### 'An Earlier Visitor'

This Bottlenose Dolphin was sighted in Darwin Harbour a number of times in November 2011, but has not visited us since.  
*I.D. 38*

## Improving water quality of Buffalo Creek

Most of Darwin Harbour enjoys very good water quality. However, there are a number of “hot spots” – such as Buffalo Creek - where treated sewage effluent may have damaged the ecosystem. We are very pleased to report that our monitoring shows that the quality of water in Buffalo Creek has improved since last year, however there is still more work to be done.

A project undertaken by Charles Darwin University in conjunction with research partners Power Water Corporation, DLRM, INPEX, and CSIRO is measuring the impact of treated sewage effluent on the health of tropical mangrove creeks. This innovative research focuses on the health of microscopic animals – known as microbes – which live in this water, and which are highly sensitive to environmental impacts. These tiny life forms provide a very effective indication of changes in the quality of the water and the sediment.

Researchers are using this approach to compare the impact of effluent discharges on tropical mangrove-lined creeks. We are seeking to develop a greater understanding of this discharge, so that we can better monitor the health of the harbour.



## Fish are flourishing in our harbour

The Darwin Harbour is the most important recreational fishing location in the Northern Territory, with more than 30% of all recreational fishing occurring in Darwin Harbour, Shoal Bay and nearby areas.

Darwin harbour is home to over 400 fish species. These range in size from large tiger sharks which may grow to a length of four metres to the tiny goby fish, which rarely exceeds 16 millimetres in length.

The fish population in Darwin Harbour is very healthy. Over the last three years, scientists from DLRM have used the ‘Baited Remote Underwater Video System’ (BRUVS) to assess the numbers and types of fish at sites around the harbour. This technique provides us with useful long-term monitoring data. Bait is used to lure fish to be photographed by a video camera, and they are identified and counted later.

Surveys conducted at two artificial reefs in the harbour – ‘Rick Mills’ and ‘Bottle Washer’ - showed that sharks and fish were even more numerous and diverse in these locations, demonstrating the positive effect these reefs have on fish populations.

It is important to protect biodiversity and to sustainably maintain fish numbers in the harbour so that locals and visitors alike can continue to enjoy the great fishing that the harbour offers.



## Seasonal slicks to our shores

In November 2014 extensive slicks of algae appeared in Darwin Harbour and washed up on Darwin's beaches. This raised much public attention. The slicks appeared as an oily, green to black film and can be mistaken as an oil spill or other pollution but these instances are natural. When the slicks wash up on Darwin's beaches and decay, they produce a strong, rank smell.

The slicks, also called algal blooms, naturally occur in the Timor Sea between September and December each year, and are caused partly by the warming of the surface waters.

The type of algae causing these slicks is a blue-green algae, and belongs to the genus *Trichodesmium*. Slicks form aggregations of tiny brownish green flakes, each composed of hairy bundles of bacterial filaments taking on the appearance of 'sawdust'. These sea sawdust blooms are not known to be toxic to humans, though bacteria associated with the decomposing algae could pose some harm.

From November swimming in Darwin's beaches is not advised due to the danger of box-jelly fish.



## Our community working together to keep a watch on Seagrass

Seagrasses are important in the harbour because they absorb nutrients from coastal run-off and stabilise sediment, which helps to keep the water clear. Seagrasses are the main diet of dugong and green turtles, and they also provide a habitat for many smaller marine species, including commercially important species like prawns and fish. Poor water quality and sedimentation are the biggest threats to seagrass.

Over the last three years, the DLRM has collaborated with the Parks and Wildlife Commission of the NT, and Larrakia Nation, to survey seagrass at Casuarina Coastal Reserve, Mindil Beach and Fannie Bay. The surveys are part of Seagrass-Watch, which is the largest scientific seagrass assessment and monitoring program in the world. This monitoring is important because it provides early warning of impending environmental changes, and raises public awareness of the value of the seagrass ecosystems in Darwin Harbour.

Results indicate that the cover of seagrass in the harbour varies from year to year, but remains in good condition overall. There are many dugong feeding trails in the seagrass, indicating the significance of seagrass for the dugong in the harbour.

Projects like Seagrass-Watch give rangers the opportunity to learn how to monitor the condition of this important habitat along our coasts, and to join with community members to protect this valuable asset. Student volunteers from Darwin High School have provided valuable assistance to the rangers in carrying out this program.



## Rapid Creek – a healthy urban waterway

Rapid Creek is a small seasonally-flowing coastal stream which typically ceases to flow mid to late dry season each year. The creek runs through mixed commercial and urban land, and into the harbour between the beachside suburbs of Nightcliff and Casuarina. This area is highly regarded for its recreational value and aesthetic appeal.

Urban stormwater delivers nutrients and pollutants into the creek during the wet season, which can settle in the mangrove muds of the creek's estuary. Sediment quality can provide a long term summary of water quality and is important to sediment dwelling animals.

Scientists at Charles Darwin University and DLRM are working to develop a sediment monitoring program in the region, and have sampled Rapid Creek estuary sediments. This undertaking will enable us to establish baseline data about the presence of pollutant metals, and keep a close watch on the area to ensure early warning of any potential changes. The results of tests for hydrocarbons (oils) suggest that the sites are very clean with no contamination detected. The amounts of metals in the sediments were low and below national guidelines. An exception however was arsenic which reflects probably catchment geology rather than man-made contamination and is not high enough to be considered toxic.



## Our Coral survives and prospers during the INPEX dredging program.

During the last two years a carefully managed dredging program has been undertaken in the harbour to enable ships to dock at the Bladin Point wharf, and enable gas from the INPEX Ichthys project to be loaded for export. The DLRM's role is to support the economic development of the region, whilst protecting our marine industries, recreational opportunities, and our environment.

Dredging causes the sediment on the harbour bottom to rise and give the water a muddy appearance. When the sediment settles, there is a risk that it may smother corals and other life-forms on the harbour bottom. The large tides in our harbour naturally carry a lot of sediment, and the harbour's corals, sponges, and other life forms are regularly exposed to this sediment as it settles out.

An extensive monitoring program was undertaken during the dredging to provide early warning of any potential impacts to the health of fish, mangroves, seagrass, and other animal and plant life in the harbour. The dredging program is now finished, and the good news is that there was only minimal, and very localised, damage to the harbour.

The monitoring program also gathered a wealth of information about the harbour, including the discovery of new species of animal life. In addition, a satellite tagging program on turtles (shown to the right) has increased our understanding of diving behaviour of juvenile green turtles.

Coral communities within Darwin Harbour are hardy and they survive under quite harsh natural conditions including extreme tides, turbid waters and low levels of light. Because these corals are vulnerable to smothering by sediment, they are useful indicators of any potentially damaging environmental impacts. Happily, the corals in our harbour were largely undisturbed by the dredging, with the exception of some immediate, localised impact at dredge sites.

Other monitoring activities carried out by INPEX include water, sediment, turtle, dugong, dolphin, seagrass and mangrove monitoring.



## 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: Supplement to the 2014 Darwin Harbour Region Report Card.* Report 12/2014D. 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/major-projects-andpartnerships/darwin-harbour-monitoring-project>

### Beach monitoring:

[http://www.health.nt.gov.au/Environmental\\_Health/Beach\\_Water\\_Quality/#BeachWaterQuality](http://www.health.nt.gov.au/Environmental_Health/Beach_Water_Quality/#BeachWaterQuality)

### INPEX monitoring:

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

### Pesticide monitoring:

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

### Sediment monitoring:

*Darwin Harbour Baseline Sediment Survey 2012.*

Charles Darwin University and Department of Land Resource Management report.

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

### Rapid Creek Monitoring:

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

<http://www.rapidcreek.org.au/>

<http://www.darwinairport.com.au/working-airport/environment>

### Water Quality Protection Plan:

*Darwin Harbour Water Quality Protection Plan*, Department of Land Resource Management.

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

### 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>

**MarineWildWatch**  
**1800 453 941**





