

# Understanding water quality and pollution sources



*The Leanyer/Sanderson sewage treatment facility*

## Introduction

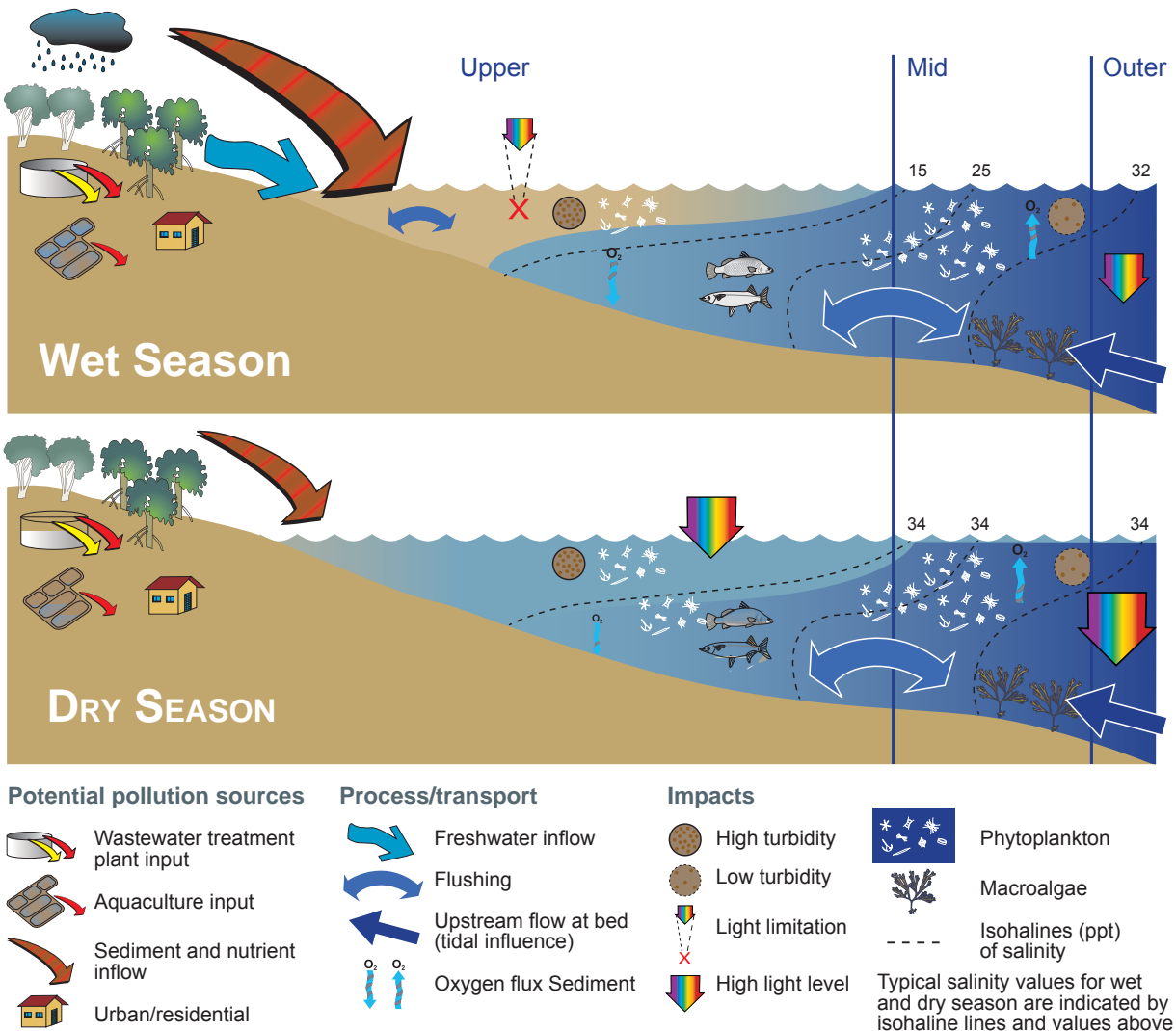
This section briefly describes some of the factors that affect the water quality of the Harbour.

### Potential pollutant sources

Potential pollutants to the waterways of the Darwin Harbour region include sediments, nutrients, heavy metals and human-related compounds (pharmaceuticals, petroleum compounds and chemicals). Pollutants can originate from both 'point' and 'diffuse' catchment sources. Point sources include discharges from a point, such as sewage treatment plant or an aquaculture facility. Point source discharges can occur throughout the year. Sewage treatment plants, for instance, have been identified as a major source of nutrients to the Harbour. Diffuse, or non-point, sources occur across a wide area, such as stormwater that enters waterways primarily during the wet season.

### Seasonal impacts on water quality

In estuaries, the main processes influencing water quality are subject to variation at seasonal and tidal time scales. Seasons and tides affect many aspects of water quality in the upper, mid and outer parts of the estuary. A simple representation is shown in the diagram below. Actual processes may be more complicated owing to the effect of salinity on sediment and possibly the resuspension of sediment due to monsoonal winds and wave action.



## Ecosystem health

Darwin Harbour and its catchment will come under increasing pressure in the future from human impacts. Reducing potential pollutants, such as nutrients and sediments from point and diffuse sources, maintaining riparian vegetation, and implementing improved management practices such as water sensitive urban design (WSUD) are important to protecting water quality.

Ecosystems meeting water quality objectives (local guidelines) are considered to be healthy, though there may be impacts not entirely related to water quality per se. Systems failing water quality objectives have poorer water quality and may have reduced ecosystem health. The diagram shows a general estuarine system which is meeting water quality objectives and conversely a system which is non-compliant with water quality objectives for nutrient, sediment and chlorophyll.

Environmental goals shown in the diagram include:

- Maintaining or improving water quality;
- Protecting or restoring marine and freshwater habitats;
- Protecting marine and freshwater biodiversity;
- Minimising algal blooms; and
- Minimising nutrients, sediment and other pollutants to waterways.



*Darwin Harbour and its catchment will come under increasing pressure in the future from human impacts. Implementing improved management practices such as water sensitive urban design (WSUD) are important to protecting water quality. New suburb of Bellamack under construction.*

## Achieving water quality objectives

## Not achieving water quality objectives

100% of indicators comply with water quality objectives

Less than 30% of indicators comply with water quality objectives

Excellent rating (e.g. A)

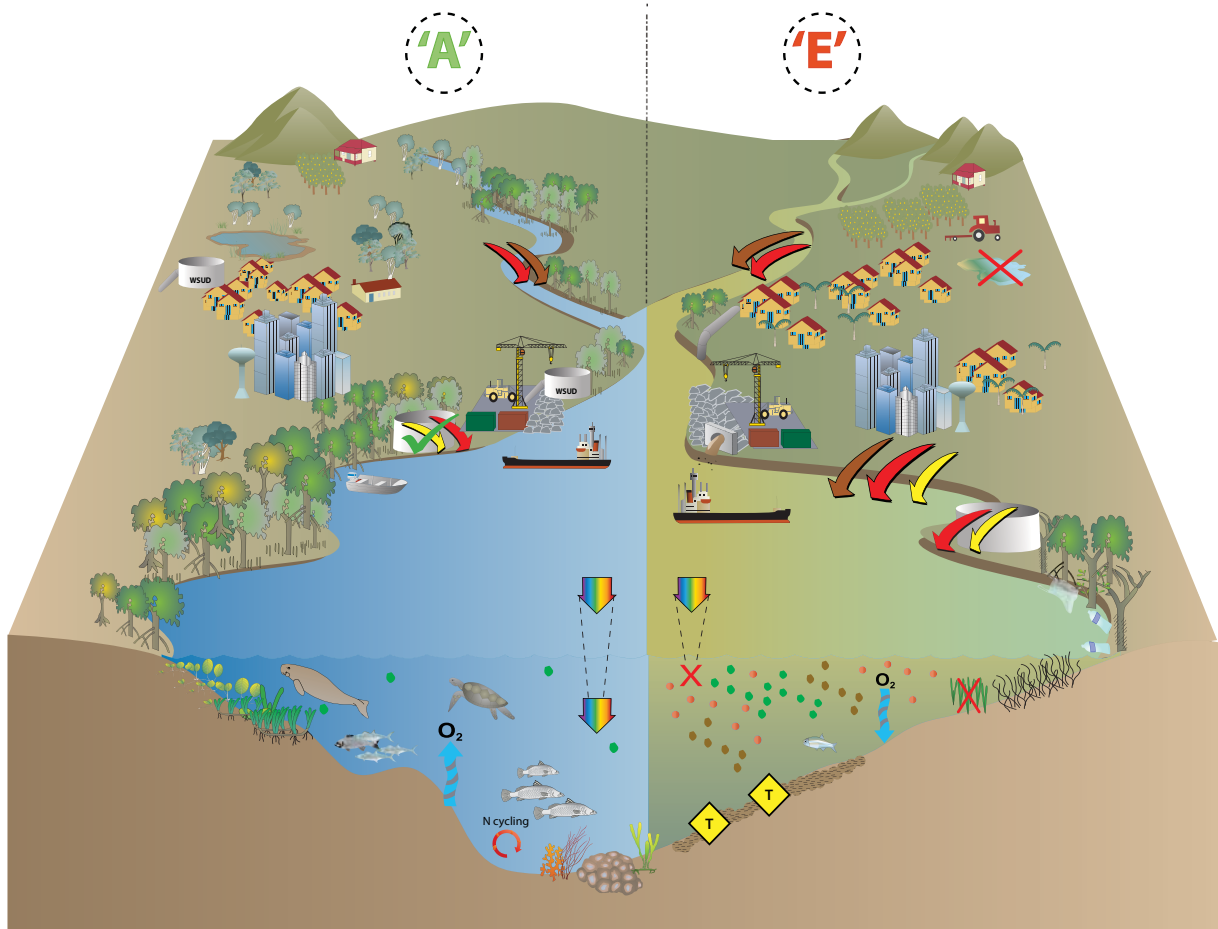
Poor rating (e.g. E)

Good ecosystem health – diverse species, iconic species present, seagrass present, low chlorophyll levels

Poor ecosystem health – few species, iconic species absent, seagrass abundance low, high chlorophyll levels

Good management practices implemented (e.g. WSUD, riparian zone planting, good stormwater practices)

Good management practices not implemented (e.g. no WSUD, minimal riparian zone planting, poor stormwater practices).



	Nutrient inputs		O <sub>2</sub> O <sub>2</sub> Oxygen depletion (arrow down) and availability (arrow up)		Seagrass		Seagrass loss
	Toxicant inputs		Toxicants		Mangroves		Suspended sediment
	Sediment inputs		N cycling Nitrogen cycling		<i>Lyngbya majascula</i>		Nutrients
	Wastewater treatment plant		Good light infiltration		Orchards		Phytoplankton
	Positive check: wastewater treatment - higher standard		Poor light infiltration		Urban development		Stormwater discharge
	Positive check				Water sensitive urban design		
	Negative or loss						

## Monitoring programs contributing to the Report Cards

The Northern Territory Government undertakes water quality monitoring and testing throughout the Darwin Harbour region. While most of this monitoring is undertaken to determine the water quality and ecosystem health of the region, monitoring is also undertaken to determine the suitability of beaches for swimming, and as part of licence conditions for waste discharges under the *Water Act* (for example, at the discharge points for sewage treatment plants).

The Darwin Harbour Region Report Cards include data collected from the following monitoring programs.

### Water quality monitoring

Between May 2010 and June 2011, NRETAS monitored water quality at 61 sites in Darwin Harbour. This includes quarterly monitoring at:

Report Card	Estuary region and class*	Number of sites sampled quarterly	Number of sites with other sample frequencies
Darwin Harbour	Outer	5	
Darwin Harbour	Mid	5	
Darwin-Palmerston	Upper	4	
Darwin-Palmerston	Myrmidon	1	3
Elizabeth	Upper	3	3
Blackmore	Upper	8	4
West Arm and Woods Inlet	Upper	4	
Rapid Creek	Upper		1
Shoal Bay	Outer	2	
Shoal Bay	Upper	3	
Beaches	Beaches		12**
	Tidal Creeks		3

\*Water class is typically derived from the sites location in the estuary, water quality and the hydrodynamic characteristics (flushing) it is subject to. This categorisation is considered in the determination of appropriate water quality objectives to apply. \*\*Sampled weekly between May and October

### Freshwater monitoring

NRETAS also monitored water quality annually at 25 sites in 2011 in the Darwin Harbour catchment. Sites monitored during May 2011 were:

Report Card	Freshwater routine annual sites 2011	Other freshwater sites 2011
Darwin-Palmerston	2	
Elizabeth	9	
Blackmore	7	
Rapid Creek	3	4*
Shoal Bay	4	

\* data supplied by Darwin International Airport

## Tidal creek and algal bloom monitoring

Water quality monitoring was undertaken on a fortnightly basis by NRETAS at the entrance of four tidal creeks (Vesteys Creek, Rapid Creek, Mindil Creek and Little Mindil Creek) from June to October 2011. Monitoring was conducted for bacteriological indicators, nutrients and the presence of the naturally occurring cyanobacteria (also known as blue-green algae), *Lyngbya majuscula*, which can proliferate in some urban tidal creeks and wash up on Darwin beaches in the dry season in most years. Large amounts of the algae have not grown in the tidal creeks or washed up on the beaches, this year, unlike in 2010.

## Beach water quality monitoring

Weekly sampling was undertaken by NRETAS, on behalf of the Department of Health, at twelve beaches from Darwin city centre to Lee Point. These were: Vesteys Beach, Nightcliff Beach, Rapid Creek Beach, Little Mindil Beach, Mindil Beach, East Point Reserve, Casuarina Beach, Cullen Bay Beach, Lee Point Beach and Lameroo Beach. Monthly sampling was undertaken at Wagait Beach and Mandorah Beach.

The water samples were tested for levels of *E. coli* and enterococci until 30 June 2011. From 1 July 2011, samples were only tested for enterococci, as required by the National Health and Medical Research Council guidelines for recreation.

## Conceptual diagram of sampling effort to inform report cards.

The diagram below demonstrates sampling undertaken by NRETAS at tidal creeks and beaches. Outer harbour sampling is also undertaken as part of a broader monitoring program to inform water quality condition. Water quality measurements are taken at these sites quarterly to inform the Report Card grading for catchments.

