



# Great Barrier Reef Catchment Loads Monitoring Program

Central Queensland Big Data Forum – May 2022

Water Quality and Investigations - Department of Environment and Science, Australia

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Queensland  
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# Overview

- Where do we sit in the broader framework of Reef Science?
- What exactly do we do?
- Locally relevant results and reporting products
- Linkages to the Central Queensland Sustainability Strategy 2030



# Great Barrier Reef

## World Heritage Area:

- World's largest coral reef
- 2300 km long
  - 70 to 250 km wide
  - 3000 reefs
  - 900 islands
- 35 catchments
  - 500 000 km<sup>2</sup>
- ~\$6 billion annually to the Australian economy
- ~66 000 jobs
- Outstanding universal values



# Tiered approach to protecting the Reef

- Reef 2050 Long-Term Sustainability Plan (2021-2025)
- Reef 2050 Water Quality Improvement Plan (2017-2022)
- 2017 Scientific Consensus Statement
- Paddock to Reef Integrated Monitoring, Modelling and Reporting Program (2017-2022)





# Report cards

- Reef WQIP Report Card
- Wet Tropics Healthy Waterways Partnership
- Dry Tropics Partnership for Healthy Waters
- Mackay-Whitsunday-Isaac Healthy Rivers to Reef Partnership
- Fitzroy Partnership for River Health
- Gladstone Healthy Harbour Partnership



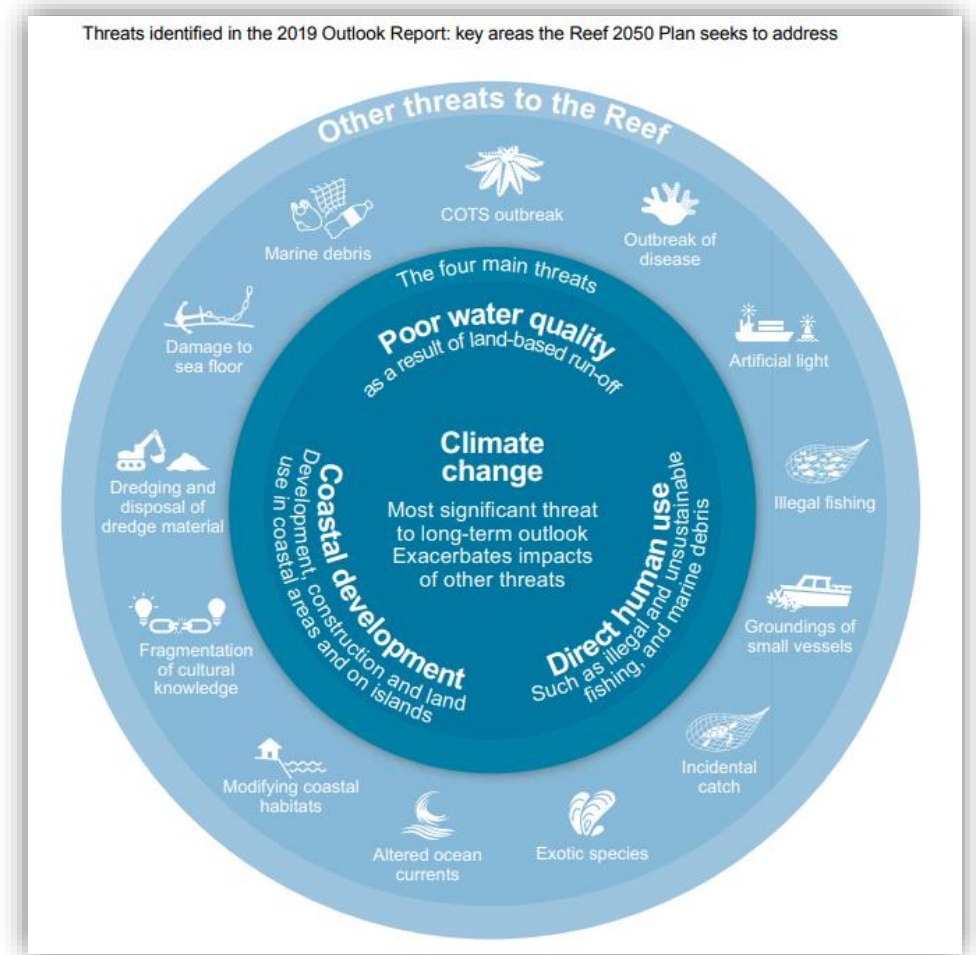
# Reef 2050 Long-Term Sustainability Plan (2021-2025)

- Vision statement: **“The Great Barrier Reef is sustained as a living natural and cultural wonder of the world”**
- Guides collaboration to improve water quality in the GBR
- Builds on previous work and is continually improved upon
- Collaborative document; Reef 2050 Independent Expert Panel, Reef 2050 Advisory Committee, Traditional Owners, Open public consultation



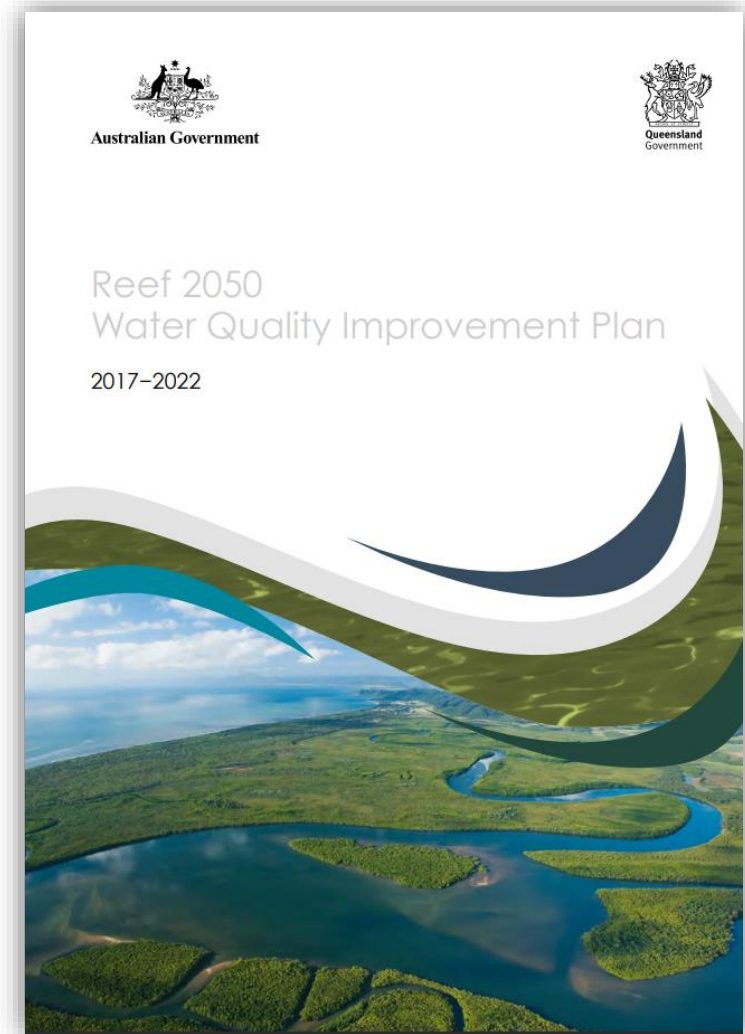
# Priority areas for action

1. Limit the impacts of climate change
2. Reduce impacts from land-based activities
3. Reduce impact from water based activities
4. Influence a reduction in international sources of impact
5. Protect, rehabilitate and restore Reef habitats, species and heritage sites



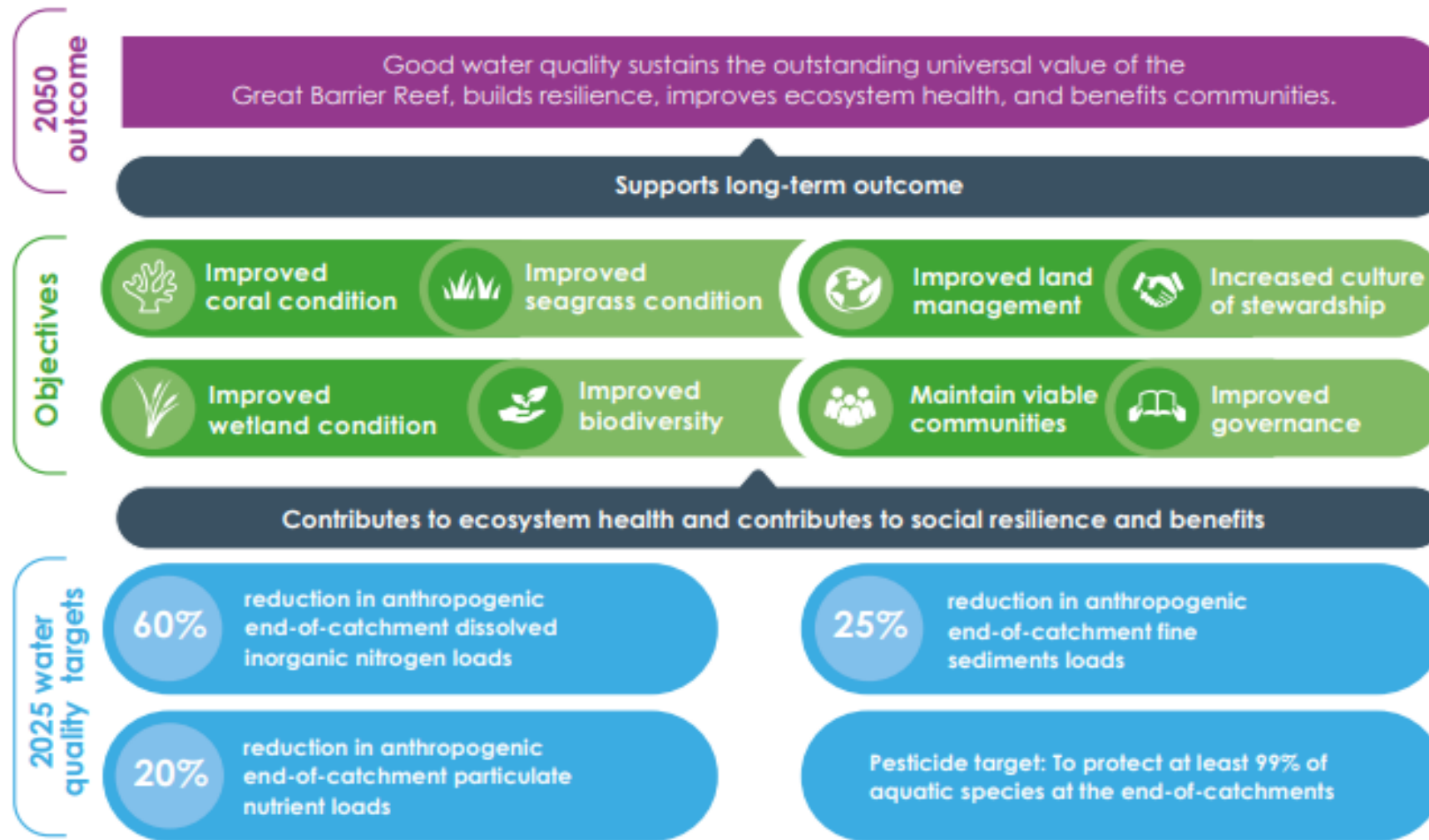
# Reef 2050 Water Quality Improvement Plan (2017-2022)

- Provides framework for water quality improvement
- Outlines catchment specific water quality targets





# Reef 2050 WQIP



# Fitzroy targets

## FITZROY REGION Fitzroy catchment water quality targets

### Catchment profile

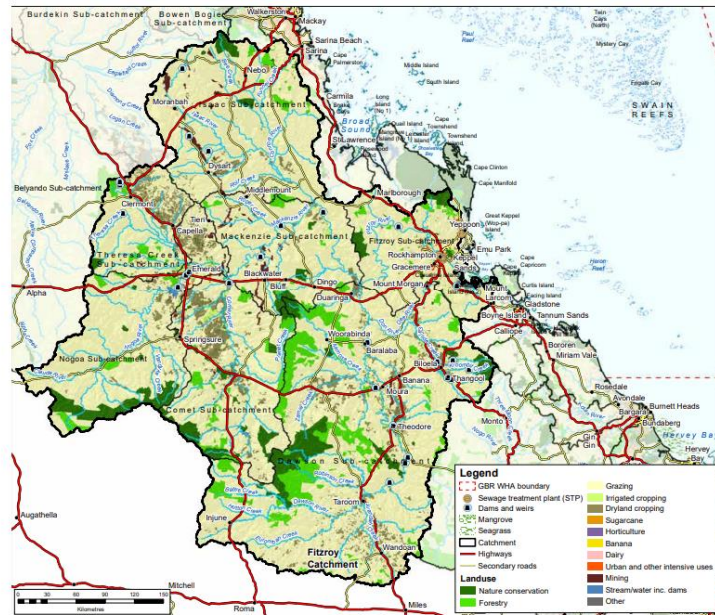
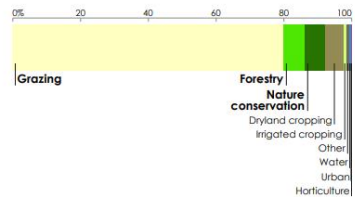
Under the Reef 2050 Water Quality Improvement Plan, water quality targets have been set for each catchment that drains to the Great Barrier Reef. These targets (given over the page) consider land use and pollutant loads from each catchment.

The Fitzroy catchment covers 142,552 km<sup>2</sup> (92% of the Fitzroy region). Rainfall averages 445 mm a year, which results in river discharges to the coast of about 40.18 GL each year.

The Fitzroy catchment covers the majority of the Fitzroy region. Lying inland of the region's smaller coastal catchments, it is the largest catchment draining to the Great Barrier Reef lagoon. The Fitzroy River forms the main channel transporting run-off from the whole catchment, which comprises an extensive network of tributaries. Some of these are an extensive area in their own right. There are five main tributaries: the Connors and Isaac rivers in the north of the catchment; the Nogoa River in the western reaches of the catchment, which joins the Mackenzie; and the Dawson River in the south of the catchment, which also joins the Mackenzie to form the Fitzroy River. Agriculture is the major land use in the catchment; this is mostly grazing but also includes large areas of cropping, forestry and horticulture. The Fitzroy catchment also contains a diverse array of wetlands, waterways, floodplains and lagoon systems. It includes a number of urban centres, including Rockhampton and Emerald, and the area is known for mining.

### Land uses in the Fitzroy catchment

The main land uses are grazing (80%), forestry (6%), and nature conservation (6%).



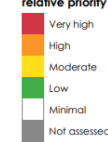
### 2025 water quality targets and priorities

End-of-catchment anthropogenic load reductions required from 2013 baseline				Pesticides
Dissolved inorganic nitrogen (DIN)	Fine sediment	Particulate phosphorus (PP)	Particulate nitrogen (PN)	
maintain current load	<b>30%</b> 390 kilotonnes	<b>30%</b> 380 tonnes	<b>30%</b> 640 tonnes	To protect at least <b>99%</b> of aquatic species at the end of catchment

The 2025 targets aim to reduce the amounts of fine sediments, nutrients (nitrogen and phosphorus) and pesticides flowing to the reef. Where there are minimal anthropogenic pollutant loads, the aim is to maintain current water quality so there are no increases in loads. Each target for sediment and nutrients is expressed as: (a) the percentage load reduction required compared with the 2013 estimated load of each pollutant from the catchment; and (b) the load reductions required in tonnes. Progress made since 2013 will count towards these targets. Previously reported progress between 2009 and 2013 has already been accounted for when setting the targets. The pesticide target aims to ensure that concentrations of pesticides at the end of each catchment are low enough that 99% of aquatic species are protected. The targets are ecologically relevant for the Great Barrier Reef, and are necessary to ensure that broadscale land uses have no detrimental effect on the reef's health and resilience.

A high percentage reduction target may not necessarily mean it is the highest priority. The priorities (ranked by colour) reflect the relative risk assessment priorities for water quality improvement, based on an independent report, the 2017 Scientific Consensus Statement. The priorities reflect scientific assessment of the likely risks of pollutants damaging coastal and marine ecosystems.

### Water quality relative priority

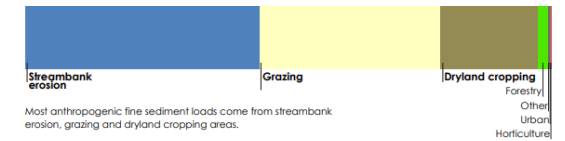


### Modelled water quality pollutant loads

The Fitzroy has minimal anthropogenic loads of dissolved inorganic nitrogen.

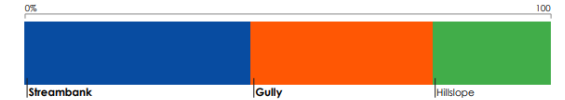
The Fitzroy catchment contributes the largest loads of anthropogenic fine sediment in the region, and is the second biggest contributor of the 35 catchments that drain to the Great Barrier Reef. Most of the sediment comes from grazing lands, and includes gully and streambank erosion.

### Fine sediment



Most anthropogenic fine sediment loads come from streambank erosion, grazing and dryland cropping areas.

### Types of sediment erosion



Most sediment erosion comes from streambanks and gullies in the Fitzroy catchment.

[reefplan.qld.gov.au](http://reefplan.qld.gov.au)



Australian Government



Queensland Government

# Calliope targets

## FITZROY REGION Calliope catchment water quality targets

### Catchment profile

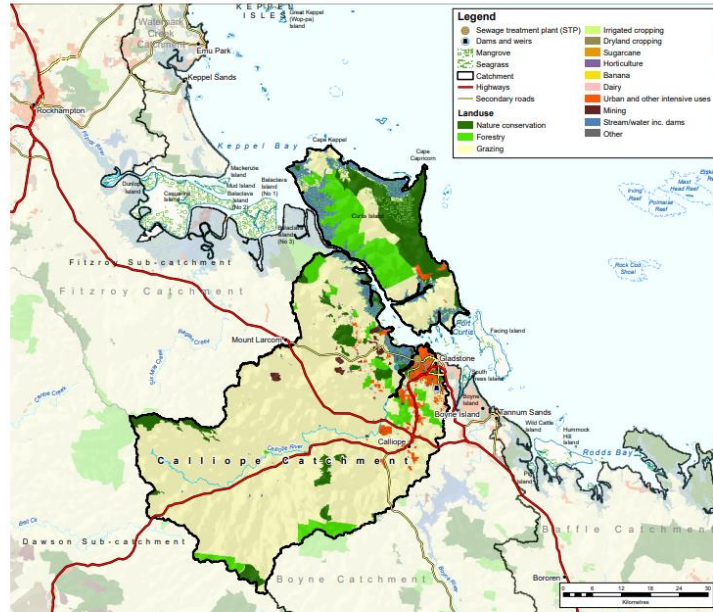
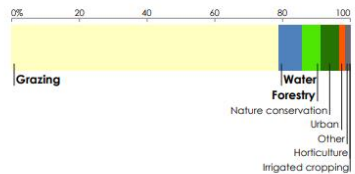
Under the Reef 2050 Water Quality Improvement Plan, water quality targets have been set for each catchment that drains to the Great Barrier Reef. These targets (given over the page) consider land use and pollutant loads from each catchment.

The Calliope catchment covers 2241 km<sup>2</sup> (1% of the Fitzroy region). Rainfall averages 837 mm a year, which results in river discharges to the coast of about 412 GL each year.

The Calliope catchment is a small southern coastal catchment of the Fitzroy region. It is located just south of the Tropic of Capricorn and discharges to the Port Curtis area and the Great Barrier Reef Marine Park. The Calliope River catchment comprises the main stem of the Calliope River and a number of creeks as tributaries, including Paddock Creek, Larcum Creek and Olky Creek. The Calliope River joins the coast at the northern fringe of the city of Gladstone. A number of intermittent smaller creeks discharge directly to the coast north of the Calliope River, including Mundurum, Mosquito and Sandy creeks. Land use is dominated by grazing, with very small amounts of horticulture. The coastal zone surrounding the city of Gladstone is an important industrial area that includes an international port facility within Port Curtis and a prominent heavy industrial strip.

### Land uses in the Calliope catchment

The main land uses are grazing (79%), water (7%), and forestry (5%).



### 2025 water quality targets and priorities

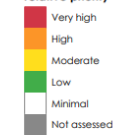
#### End-of-catchment anthropogenic load reductions required from 2013 baseline

Disolved inorganic nitrogen (DIN)	Fine sediment	Particulate phosphorus (PP)	Particulate nitrogen (PN)
maintain current load	30% 15 kilotonnes	30% 54 tonnes	30% 107 tonnes

#### Pesticides

To protect at least **99%** of aquatic species at the end of catchment

#### Water quality relative priority



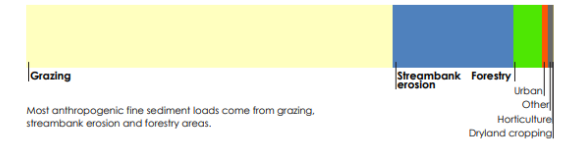
The 2025 targets aim to reduce the amounts of fine sediments, nutrients (nitrogen and phosphorus) and pesticides flowing to the reef. Where there are minimal anthropogenic pollutant loads, the aim is to maintain current water quality so there are no increases in loads. Each target for sediment and nutrients is expressed as: (a) the percentage load reduction required compared with the 2013 estimated load of each pollutant from the catchment; and (b) the load reductions required in tonnes. Progress made since 2013 will count towards these targets. Previously reported progress between 2009 and 2013 has already been accounted for when setting the targets. The pesticide target aims to ensure that concentrations of pesticides at the end of each catchment are low enough that 99% of aquatic species are protected. The targets are ecologically relevant for the Great Barrier Reef, and are necessary to ensure that broadscale land uses have no detrimental effect on the reef's health and resilience.

A high percentage reduction target may not necessarily mean it is the highest priority. The priorities (ranked by colour) reflect the relative risk assessment priorities for water quality improvement, based on an independent report, the [2012 Scientific Consensus Statement](#). The priorities reflect scientific assessment of the likely risks of pollutants damaging coastal and marine ecosystems.

### Modelled water quality pollutant loads

The Calliope catchment has minimal loads of anthropogenic dissolved inorganic nitrogen and small loads of fine sediment.

#### Fine sediment



Most anthropogenic fine sediment loads come from grazing, streambank erosion and forestry areas.

#### Types of sediment erosion



Most sediment erosion comes from hillslopes and streambanks in the Calliope catchment.

[reefplan.qld.gov.au](http://reefplan.qld.gov.au)



Australian Government

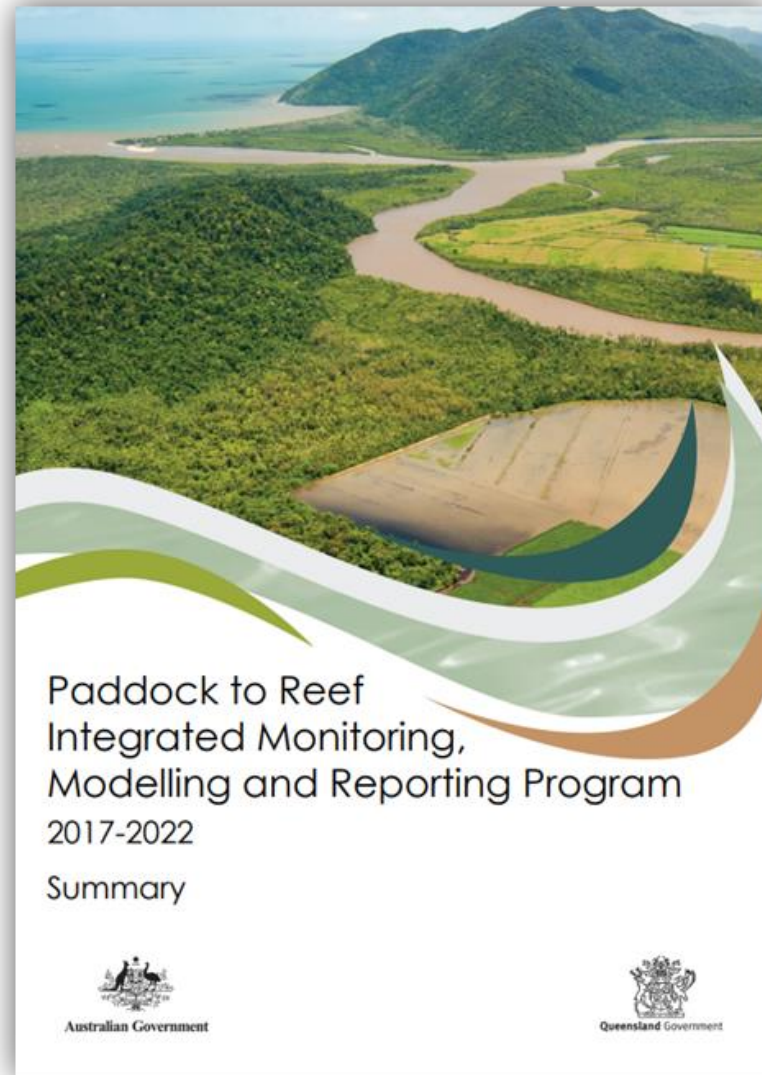


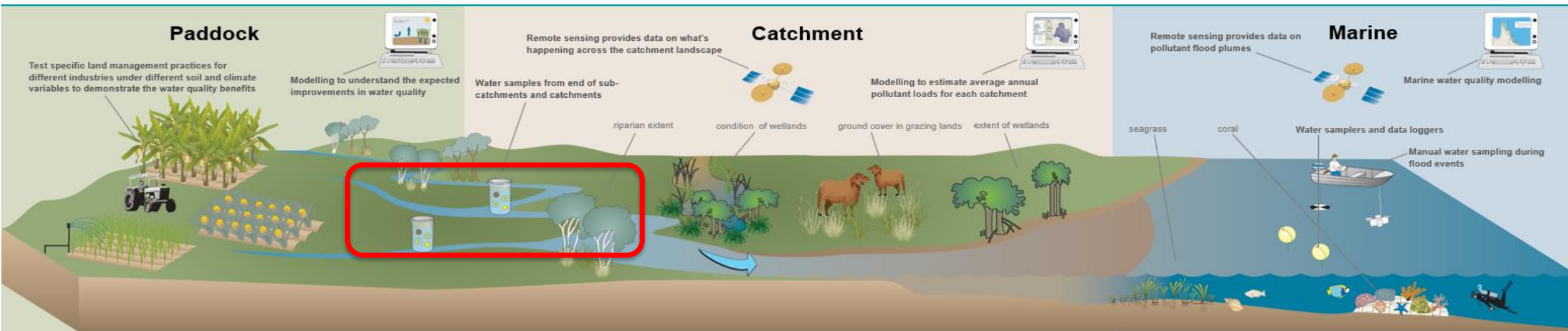
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# P2R program

- Evaluation of:
  - management practice adoption and effectiveness
  - Catchment condition
  - Pollutant runoff
  - Marine condition
- Inter-linked and integrated through common assessment and reporting framework





We're monitoring the changes in **management practice adoption** to give our best understanding of what is really happening on the ground.

We're **monitoring** the water quality from the on-farm paddock experiments to provide data for modelling and information back to landholders.

We're doing **paddock scale modelling** to build knowledge on the effectiveness of specific farming management practices in improving water quality.

We're taking water samples and **monitoring** nutrients and sediments (54 sites) and pesticides (35 sites) to produce pollutant loads data, track long-term trends in water quality and provide data for modelling.

We're using **remote sensing** to monitor changes in the extent of key **catchment indicators** of wetlands, ground cover and riparian vegetation. We're also monitoring the condition of wetlands.

We're doing **catchment scale modelling** for 35 catchments to estimate the average annual pollutant loads of dissolved inorganic nitrogen, particulate nitrogen, particulate phosphorous, sediment and pesticides.

We're doing **marine monitoring** and **modelling** to understand the condition of inshore marine ecosystem health.

We're assessing **indicators** of water quality and changes in the condition, extent and recovery of seagrass and coral.

# Monitoring v Modelling

## Modelling:

- Increases spatial coverage at a lower cost
- Normalises data for climate variability, land use, best management practice etc.
- Concentrations measured in a laboratory
- Identifies data gaps in the monitoring
- Monitoring data are used to calibrate and validate the models
- Used to calibrate and validate models
- *Good data in = good data out*
- *Good data in = good data out*





# Non-point source monitoring

## Monitoring

- Diffuse contaminants
- Event conditions
- Ambient conditions
- Weekly and monthly

## Data collected by

- Automated samplers
- Manual grab samples
- In-situ probes
- Acoustic Doppler Current Profiler







# Water quality monitoring results

Total Suspended Solids (sediment)  
Total Nitrogen  
Particulate Nitrogen  
Total Phosphorus  
Particulate Phosphorus  
Dissolved Inorganic Nitrogen (DIN)  
Dissolved Organic Nitrogen  
Dissolved Inorganic Phosphorus  
Dissolved Organic Phosphorus  
Pesticides (94 Compounds)

PSII herbicides  
Other herbicides  
Insecticides  
Fungicides





# Loads vs Concentration

Water Quality  
Sediments and Nutrients

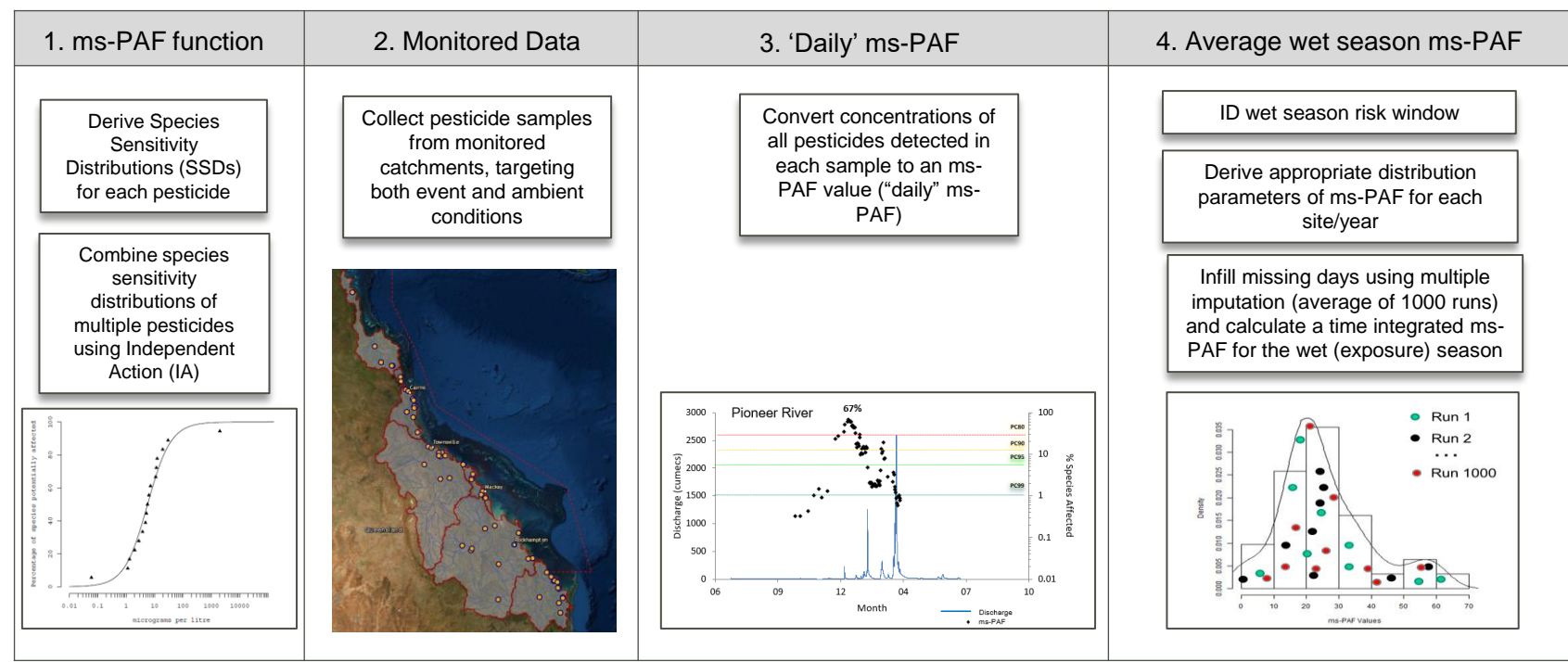


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Water Quantity  
River Flow



# The Pesticide Risk Metric (PRM) process



# Quality Assurance & Quality Control

## Quality Assurance

- Framework
- Procedures
- Methods
- Annual training
- MERI framework



## Quality Control

- Trip blanks
- Field blank
- Quality control solutions
- Duplicates
- Blind laboratory checking

## Review

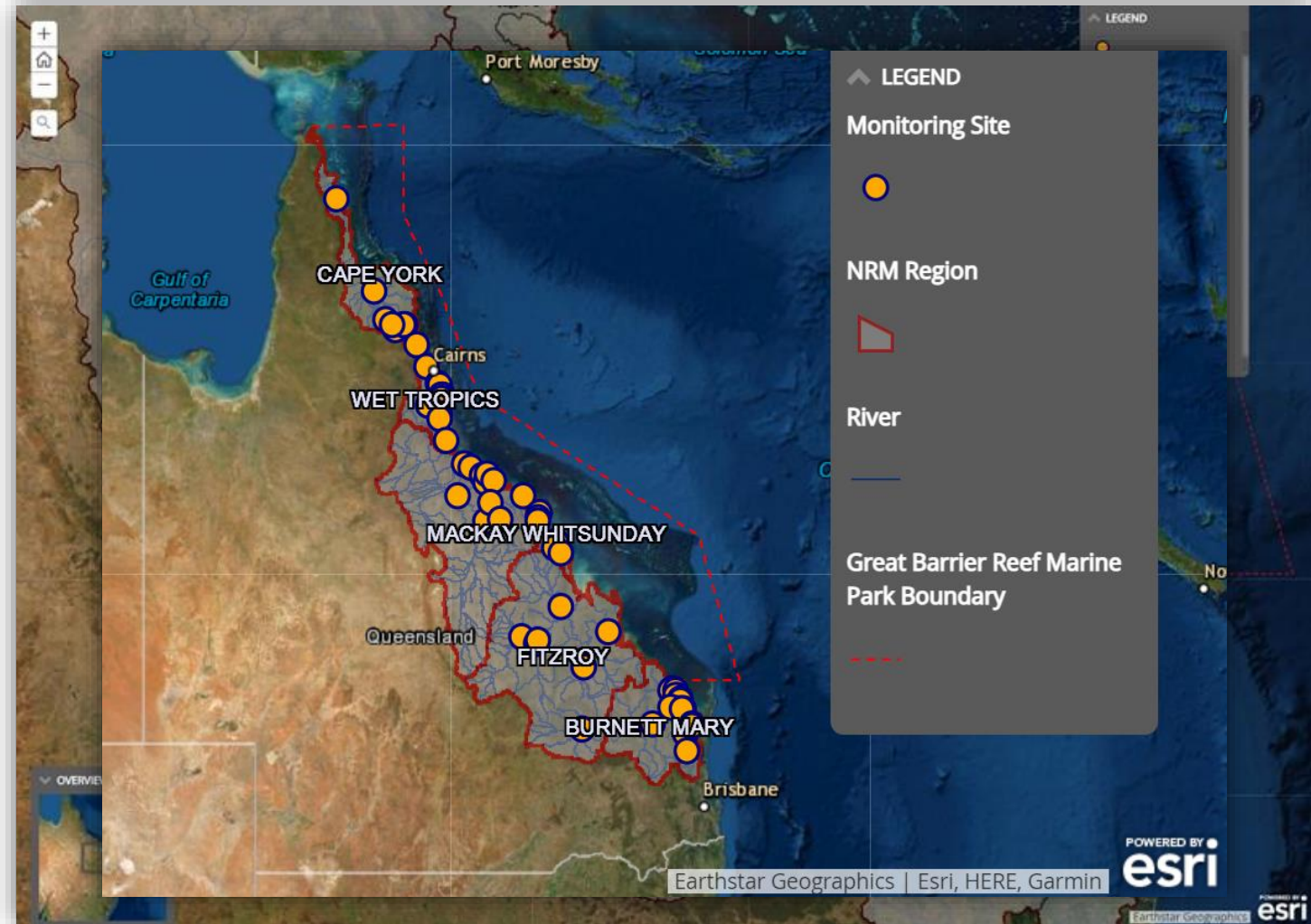
United States Geological Survey (USGS and USDA) scheduled for May 2022





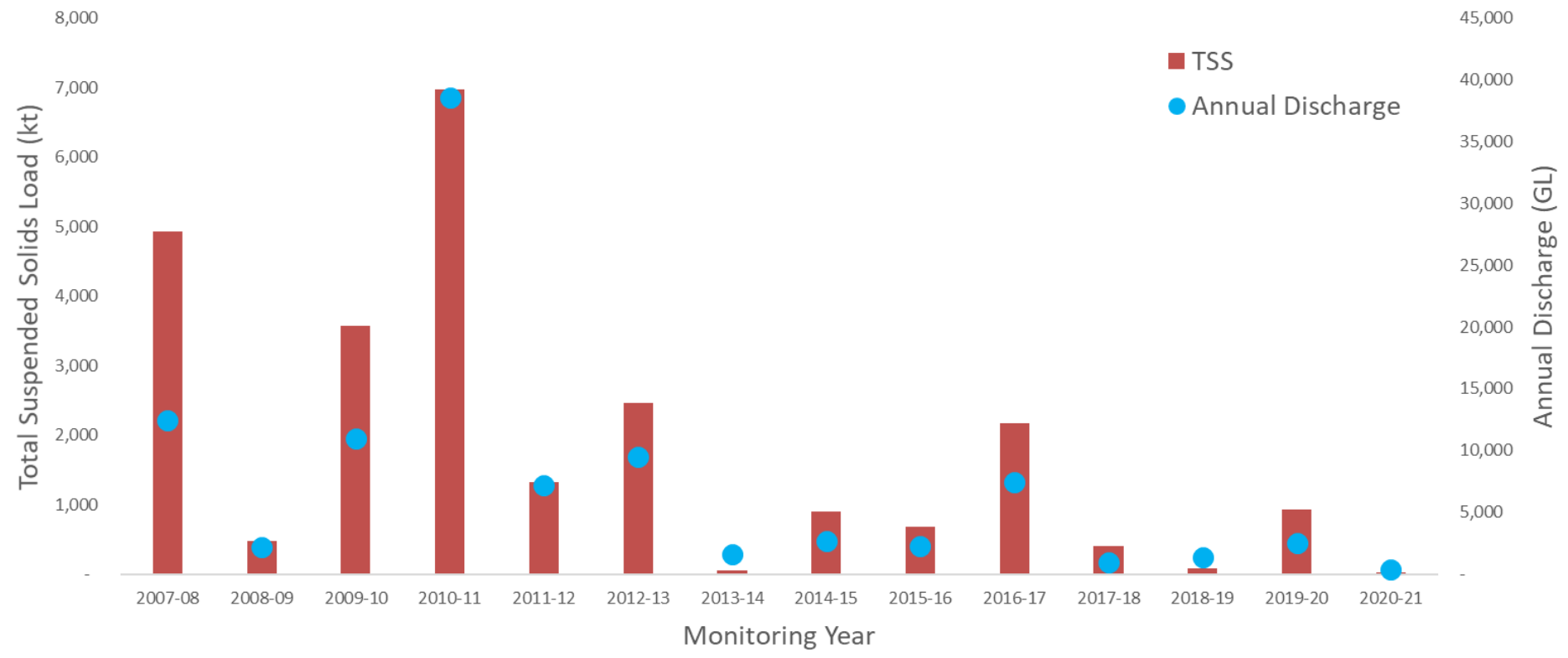
# GBRCLMP 2021-2022 Sites

- 7 Cape York sites
- 18 Wet Tropics sites
- 12 Burdekinsites
- 8 Mackay Whitsunday sites
- **8 Fitzroy sites**
  - 3 sediment, nutrient and pesticide
  - 4 sediment and nutrient only
  - 1 pesticide only
- 18 Burnett Mary sites
- 8 SEQ sites
- Approximately 50 other project sites



Sampling Year	River and site name	Discharge (GL)	Discharge (% of mean)	TSS (kt)	PN (t)	DIN (t)	PP (t)
2020-21	Fitzroy River at Fitzroy River Water	390	8	16	100	74	51
2019-20	Fitzroy River at Fitzroy River Water	2500	50	930	2100	1000	920
2018-19	Fitzroy River at Rockhampton	1300	26	83	290	260	130
2017-18	Fitzroy River at Rockhampton	970	19	410	740	290	480
2016-17	Fitzroy River at Rockhampton	7400	146	2200	4800	910	2600
2015-16	Fitzroy River at Rockhampton	2300	45	670	1600	680	750
2014-15	Fitzroy River at Rockhampton	2700	53	900	1600	470	960
2013-14	Fitzroy River at Rockhampton	1600	32	52	230	150	94
2012-13	Fitzroy River at Rockhampton	9500	187	2500	4300	920	2100
2011-12	Fitzroy River at Rockhampton	7200	143	1300	3000	950	1600
2010-11	Fitzroy River at Rockhampton	39000	763	7000	17000	3900	8700
2009-10	Fitzroy River at Rockhampton	11000	217	3600	4300	2100	3900
2008-09	Fitzroy River at Rockhampton	2200	43	470	800	460	470
2007-08	Fitzroy River at Rockhampton	12000	246	4900	9400	1900	4700

### Fitzroy River Total Suspended Solids Loads and Discharge





2025 water quality target: 30 percent reduction in anthropogenic end-of-catchment fine sediment loads.

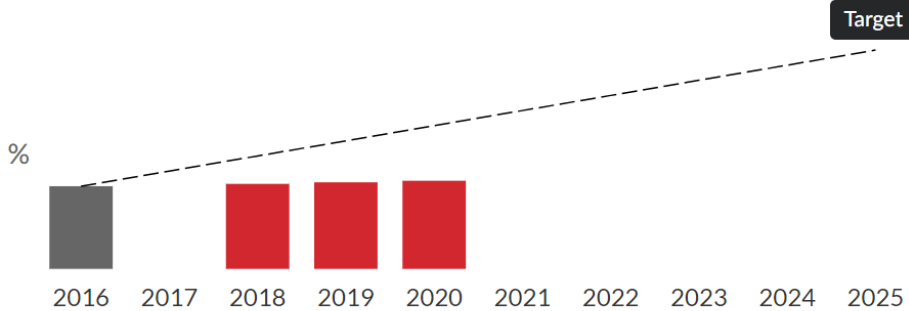
Results

Grade	2020 progress
<b>E</b>	<b>+0.2%</b> reduction
Very poor	
Data confidence	●●●○

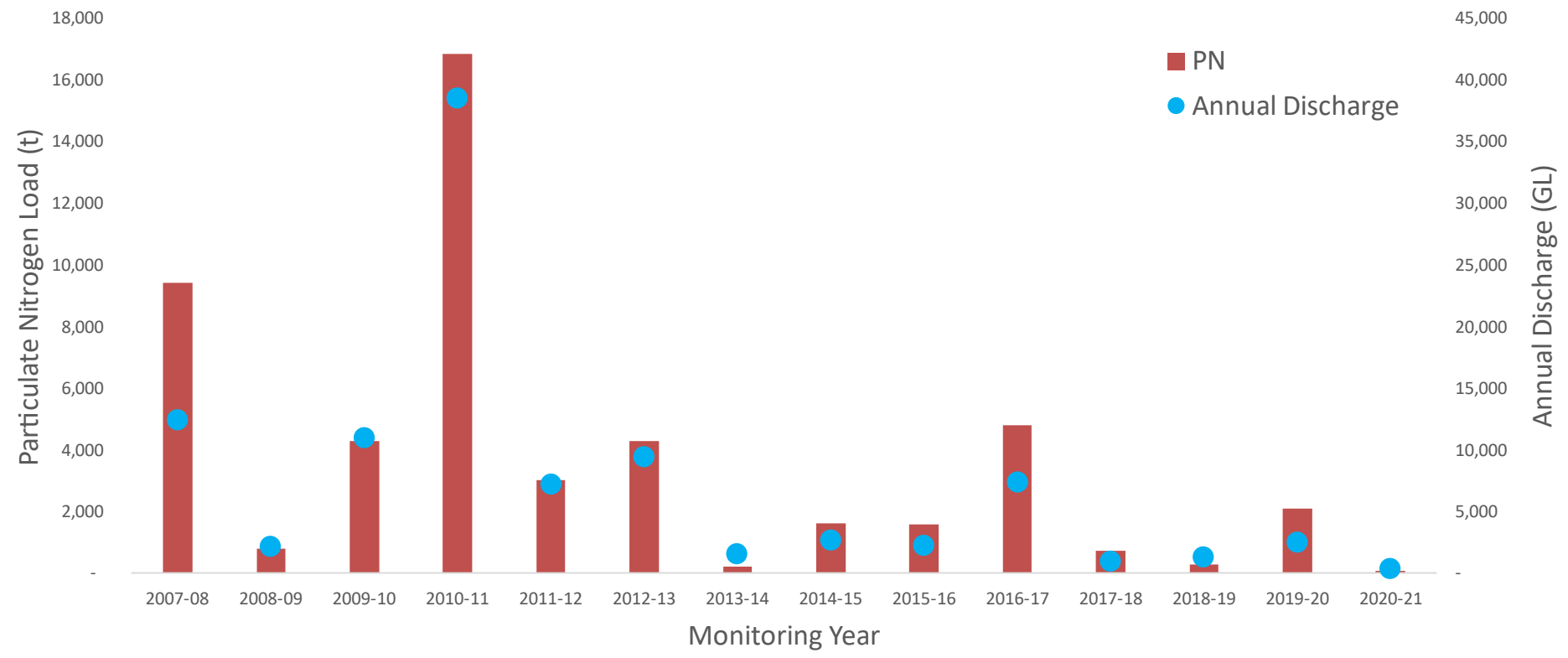
Overall progress



2025 Outlook



### Fitzroy River Particulate Nitrogen Loads and Discharge

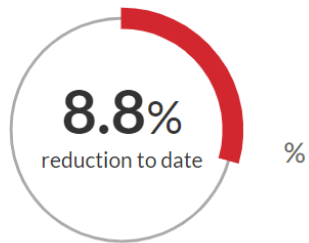


2025 water quality target: 30 percent reduction in anthropogenic end-of-catchment particulate nutrient loads.

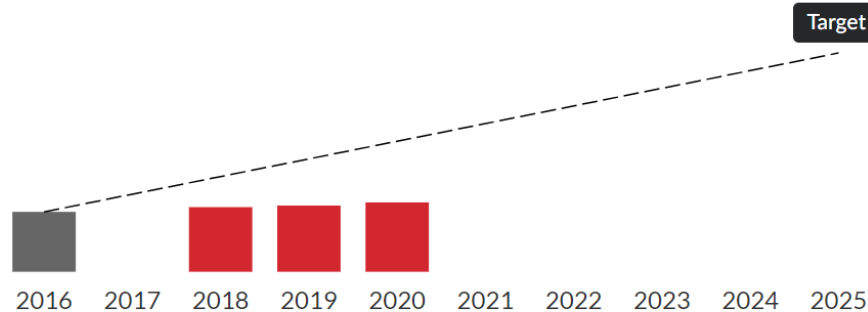
### Results

Grade	2020 progress
<b>E</b>	<b>+0.4%</b> reduction
Very poor	
Data confidence	●●●○○

### Overall progress

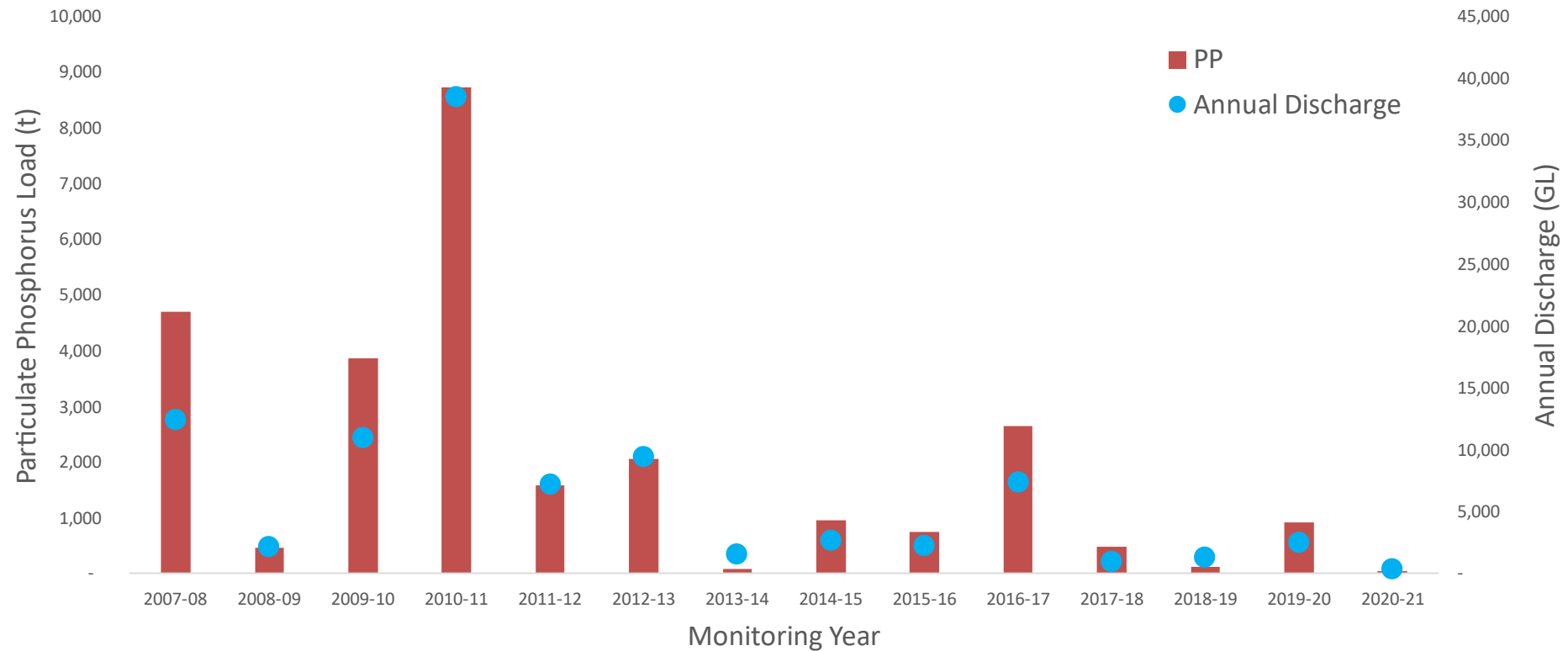


### 2025 Outlook





## Fitzroy River Particulate Phosphorus Loads and Discharge





### Results

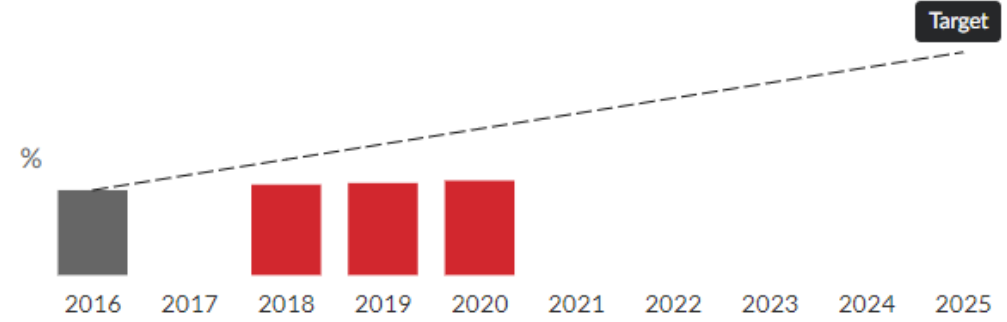


Grade	2020 progress
<b>E</b>	<b>+0.3%</b> reduction
Very poor	
Data confidence	●●●●○

### Overall progress



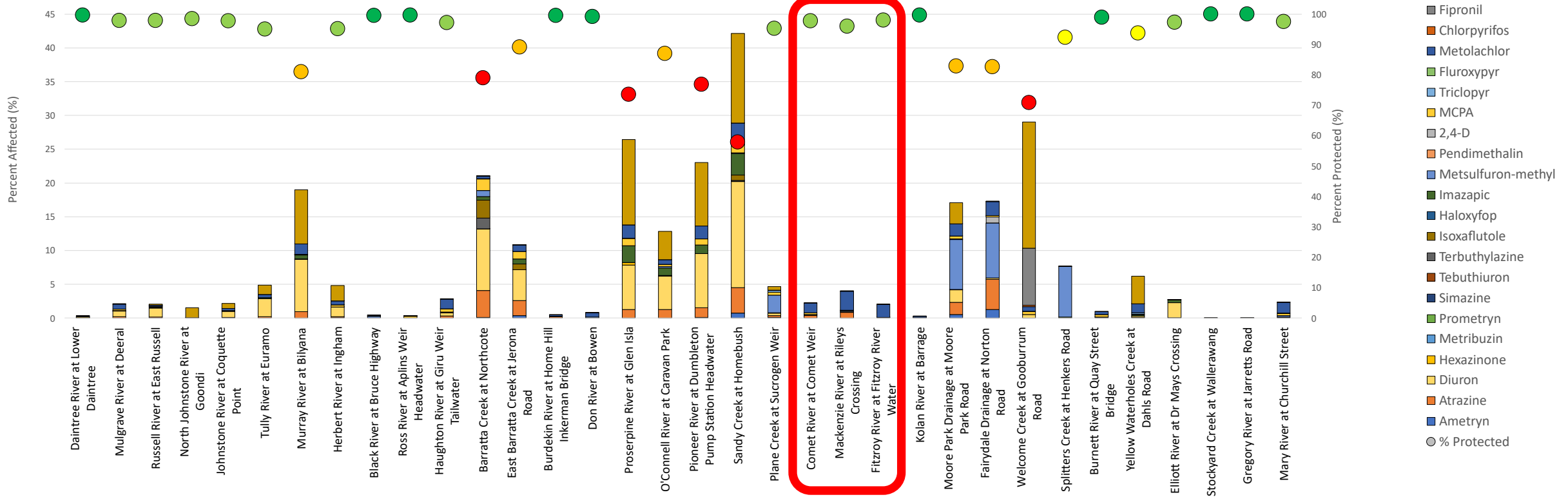
### 2025 Outlook





LEGEND

Relative contribution of each chemical to average wet season risk

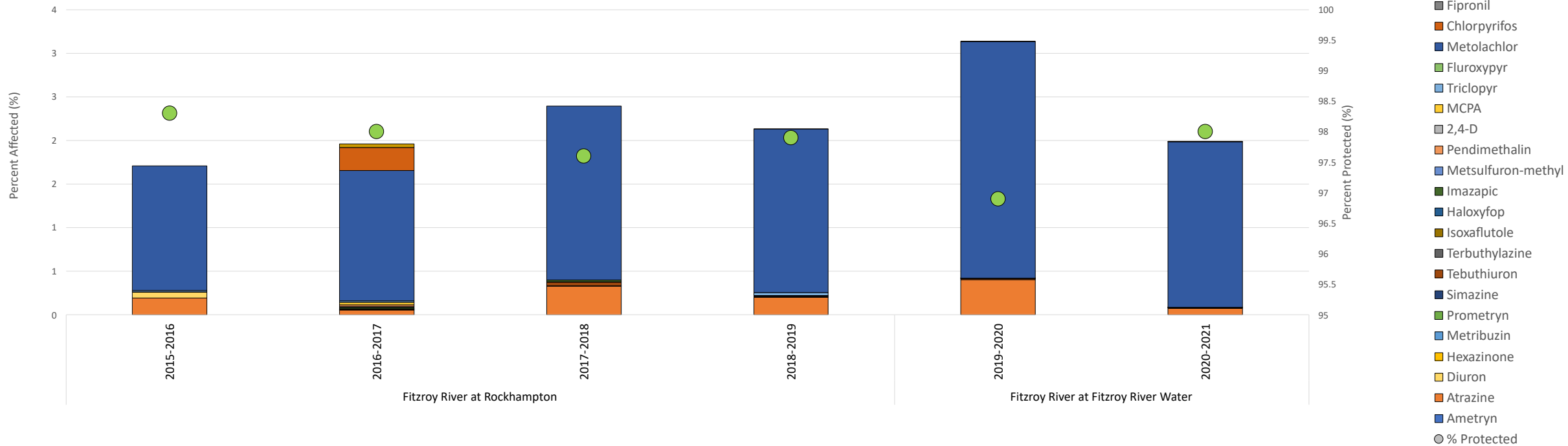


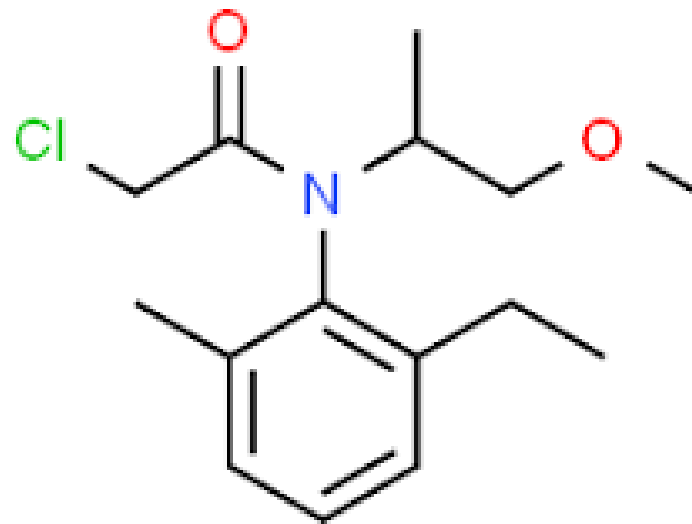
Earthstar Geographics | Esri, HERE, Garmin





Relative contribution of each chemical to average wet season risk





Sites by NRM Region	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
<b>Fitzroy</b>	94.95	94.35	97.8	98.4714286	96.13333333	97.26666667
Styx River at Ogmore			100	99.9		
Waterpark Creek at Corbett's Landing			100	100		
Comet River at Comet Weir	91.6	90.7	89.3	97.4	96.8	97.8
Mackenzie River at Rileys Crossing				94.2	94.7	96.0
Fitzroy River at Fitzroy River Water					96.9	98.0
Fitzroy River at Rockhampton	98.3	98.0	97.6	97.9		
Calliope River at Old Bruce Highway			99.9	100		
Boyne River at Boyne Island			100	99.9		



# Reef Water Quality Report Card 2020

[Change date](#)

[Overview](#)

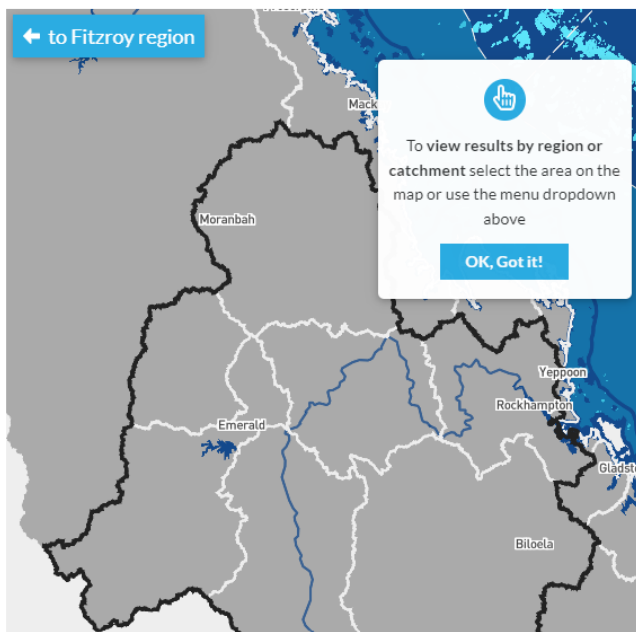
[Reef and wetland condition](#)

[2025 catchment targets](#)

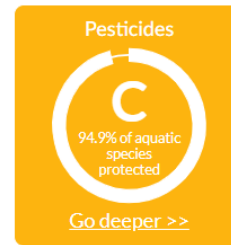
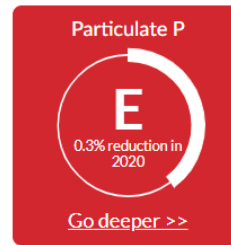
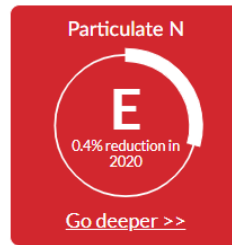
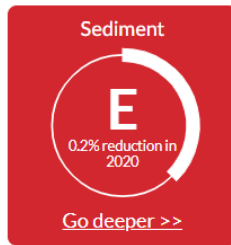
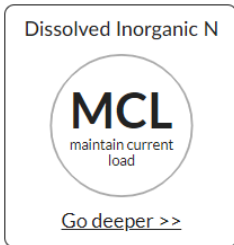
Showing [All catchment target results](#) > [Fitzroy catchment](#)

[Change indicator](#)

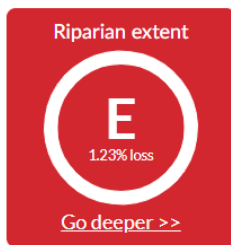
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## Water quality targets



## Catchment management targets





# Coastal and Marine Ecosystems

## Key attribute – Estuarine and shoreline ecosystems

**Goal 1** – The extent, condition, resilience and function of estuarine, shoreline and coastal ecosystems is maintained or improved

Target 1: Extent and function of high value coastal ecosystems is maintained or improved for seagrass, mangroves, rookeries and roosting sites

Target 2: Queensland Sustainable Fisheries Strategy 2017-2027 targets are met

Target 3: No additional species that rely on coastal ecosystems added to EPBC or NCA lists

Target 4: Supra-tidal wetland hydrological regimes and spatial extent are maintained

## Key attribute – Marine ecosystems

**Goal 2** – The extent, condition, resilience and function of marine ecosystems is maintained or improved

Target 1: Water quality targets to maintain Great Barrier Reef ecosystems are achieved (set through the Reef 2050 Water Quality Improvement Plan and reported annually through the reef report card)

Target 2: Extent and function of high value marine ecosystems is maintained or improved for seagrass meadows and corals

Target 3: Impact of Crown of Thorns to regional coral reefs is negligible and/or reversible within 1-2 years

Target 4: No additional species that rely on our region's marine ecosystems added to EPBC or NCA list

Target 5: Trajectory of known listed threatened species that rely on coastal ecosystems is stable or improves

Target 6: Great Barrier Reef Marine Park Zoning plan supported-compliance targets met

Target 7: Queensland Sustainable Fisheries Strategy 2017-2027 targets met



# Thank you

Any questions?

[David.orr@des.qld.gov.au](mailto:David.orr@des.qld.gov.au)

**CHECK OUT OUR  
NEW PESTICIDE  
REPORTING PORTAL  
AND STORY MAPS:**



## Pesticide Reporting Portal

Water Quality and Investigations

Last updated: | March 15, 2021



## Great Barrier Reef Catchment Loads Monitoring Program Story Maps

2017-2018: <https://arcg.is/1fOGWz>

2016-2017: <https://arcg.is/0Cj8SP>

best for desktop viewing

Water Quality & Investigations 