

Decision support framework for management options to maintain and improve water quality across the Great Barrier Reef catchment area

ABOUT THE PROJECT

Purpose and overview

This project provides practical guidance for managing water quality across the Great Barrier Reef and its catchment areas. The project defines management responses to reduce pollutant exposure and recognises the importance of protecting Great Barrier Reef ecosystems in good condition. This requires both targeted pollution reduction and preservation and/or rehabilitation of ecosystems, especially as climate change impacts intensify. Water quality plays a critical role in Great Barrier Reef ecosystem resilience.

The assessment helps answer critical questions for decision-makers:

- ▶ Where should management efforts be focused?
- ▶ What level of management response is recommended in different areas?
- ▶ Which pollutants require the most attention in each catchment or management unit?

This document provides a high-level overview of the methods used to carry out the assessment. The full report is available from the joint Australian and Queensland governments' ['Reef 2050 Catchment Water Quality Strategy'](#) website.

Key steps of the assessment

The framework connects several important elements to build a comprehensive picture of Great Barrier Reef water quality management needs with the following steps:

- ▶ **Assess landscape characteristics** by examining the features of the 35 catchments, including size, rainfall patterns, river discharge, and land uses.
- ▶ **Analyse landscape drivers** that affect the quantity and movement of pollutants in the landscape, including assessments of vegetation clearing, wetland loss and/or modification, groundcover condition, and erosion hotspots.
- ▶ **Identify pollutant sources and loads**, focusing on the sources of nutrients, sediment, and pesticides and the amount reaching waterways.
- ▶ **Evaluate ecosystem hazard / exposure** to determine where freshwater floodplain wetlands and marine environments (coral reefs and seagrass meadows) are most exposed to pollutant impacts.
- ▶ **Assess ecosystem condition** to understand the current health of freshwater floodplain wetlands, coral reefs and seagrass meadows, recognising water quality as one of several contributing factors.
- ▶ **Examine management options** including available tools, their effectiveness in improving water quality, and where data exists, rates of adoption needed to support change.
- ▶ **Recommend management responses** by combining this information to define four different scales and intensity of management approaches that maximise water quality outcomes in each catchment.

Management Response Framework

The four levels of management response are:

Foundational: The core components that set the foundation of water quality management in all areas to maintain good water quality and prevent future issues.

Proactive: Builds on foundational management with localised actions where pollutant exposure is low but may be increasing.

Accelerated: More coordinated and targeted approaches where exposure is moderate and action to reduce pollutants needs to be stepped up.

Intensive: Comprehensive, urgent action across multiple land uses where exposure is high and ecosystems may be under significant stress.

This approach gives decision-makers flexibility to balance immediate pollutant reduction needs with long-term ecosystem protection and rehabilitation, while allocating resources effectively across the diverse Great Barrier Reef catchment area.

Decision support framework process and underpinning evidence base

MANAGEMENT RESPONSE ASSESSMENT

1. Landscape characteristics

- Area
- Climate and rainfall
- River discharge
- Land use

2. Landscape drivers

- Vegetation including clearing
- Floodplain wetland loss
- Groundcover
- Gully density

3. Pollutants sources and loads

- Primary pollutants: Nutrients, pesticides, sediments
- Pollutant sources: agricultural and non-agricultural
- Pollutant pathways e.g. erosion, surface runoff, seepage, point source

6. Management options

- Types of management actions
- Cost and cost effectiveness
- Current and future adoption

4a. Wetlands hazard & exposure

Assess exposure of freshwater floodplain wetlands to hazard from sediment, nutrients and pesticides

4b. Wetland condition

Assess current condition of freshwater floodplain wetlands

7. Water quality management response decision support framework

		Pollutant exposure			
		Minimal	Low	Moderate	High
Ecosystem condition	Poor	Foundational response + investigate	Proactive response + investigate	Accelerated response + evaluate	Intensive response + evaluate
	Moderate	Foundational response + Investigate	Proactive response + Investigate	Accelerated response + further assessment	Intensive response + further assessment
	Good	Foundational response	Proactive response	Accelerated response + increased vigilance	Intensive response + increased vigilance
		Trust development, prepare for the future	Small-scale intervention	Targeted intervention	Comprehensive intervention
		Management approach			

5a. Marine exposure

Assess area of coral reefs and seagrass meadows exposed to fine sediments, dissolved inorganic nitrogen, and where possible, pesticides

5b. Marine condition

Assess current condition of coral reefs and seagrass meadows

Steps 1 & 2: Understanding the landscape and identifying biophysical drivers of water quality conditions

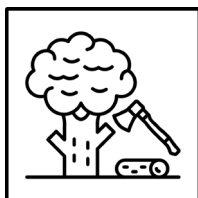
The first step of the assessment involved mapping the basic characteristics of each of the 35 catchments including their size, rainfall patterns, river flows and land uses. This provides a foundation to understand what activities might affect water quality and puts each catchment in context, relative to others.



Climate and rainfall patterns tell us about the frequency and intensity of rainfall events and the variability in the longer-term patterns. **River discharge data** identifies the amount of water transported into the Great Barrier Reef from each catchment. **Land use mapping** identifies which activities are happening where - whether it's cattle grazing, sugarcane farming, urban development, or natural vegetation/conservation areas. Land use information can help us understand why certain land conditions and pollutants are more prevalent in some areas than others and tailor management responses accordingly. [Learn more about land use mapping](#)



Next, the biophysical factors that directly influence how pollutants move through the landscape were examined. These drivers help us understand how the condition of the landscape can influence water quality, and why some areas have more water quality challenges than others. This is important to target the management approaches used to improve water quality.



Vegetation clearing

Tree roots and groundcover hold soil in place and slow down rainfall runoff, and tree or shrub canopies can intercept rainfall. When vegetation is removed, the land loses its natural protection against erosion. Without this protection, particularly along waterways, soil washes away more easily, carrying sediment and nutrients into waterways.

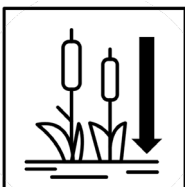
[Learn more](#)



Groundcover

Good groundcover protects the soil and reduces erosion by intercepting rainfall, slowing overland flow and increasing infiltration. Bare soil is vulnerable to erosion. Whether from farming practices including overgrazing, or urban development, areas with little groundcover allow rainfall to wash away topsoil and create runoff carrying sediment and nutrients.

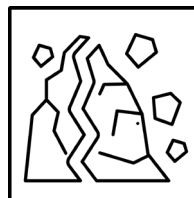
[Learn more](#)



Wetland loss and/or modification

Natural wetlands can act like filters in the landscape. They can slow down flood waters, trap sediment, and potentially process nutrients and pesticides before they reach the Great Barrier Reef. When wetlands are drained, filled in for development or cleared for agriculture, this natural filtering system is lost and water moves faster, meaning more pollutants flow directly into creeks and rivers to the sea.

[Learn more](#)



Gully formation and erosion hotspots

Gullies are created where flowing water is concentrated and carves deep channels into the landscape, particularly in erodible soils. Vegetation clearing or poor groundcover, development of linear features such as roads or drains, and soil cultivation can influence gully development.

[Learn more](#)

Step 3: Priority pollutants, main sources and delivery to the Great Barrier Reef

Three key pollutants are currently assessed and managed to improve the quality of water entering the Great Barrier Reef, and are prioritised due to their ecological impacts and widespread presence in runoff from land-based activities. These pollutants are:

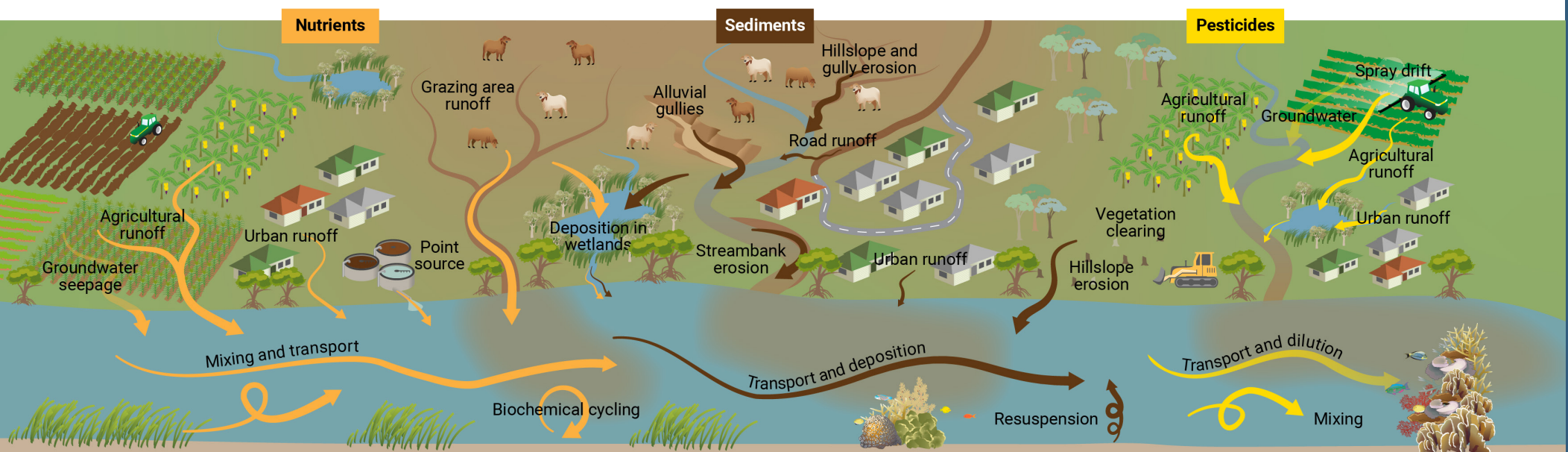
- ▶ **Nutrients** including dissolved and particulate forms of nitrogen and phosphorus
- ▶ **Sediments** particularly finer sediments which can travel furthest into the marine environment and are easily resuspended by wind, waves and currents
- ▶ **Pesticides** including herbicides, insecticides and fungicides

Sources and transport pathways for pollutants

Pollutants reach Great Barrier Reef waterways through various sources and pathways across the landscape. Agricultural areas typically generate nutrients from fertilisers and animal waste, sediment from soil erosion, and pesticides from crop protection. Urban areas contribute nutrients from sewage systems, industrial areas and gardens, and sediment from construction and roads. Pollutants can be transported from their source to waterways through several pathways:

- ▶ Surface runoff carries pollutants directly across the land surface during rainfall events
- ▶ Erosion processes transport sediment and attached nutrients through hillslope, gully, and streambank erosion
- ▶ Groundwater seepage slowly delivers dissolved nutrients through soil into waterways
- ▶ Direct discharge from point sources like sewage treatment plants and stormwater outlets

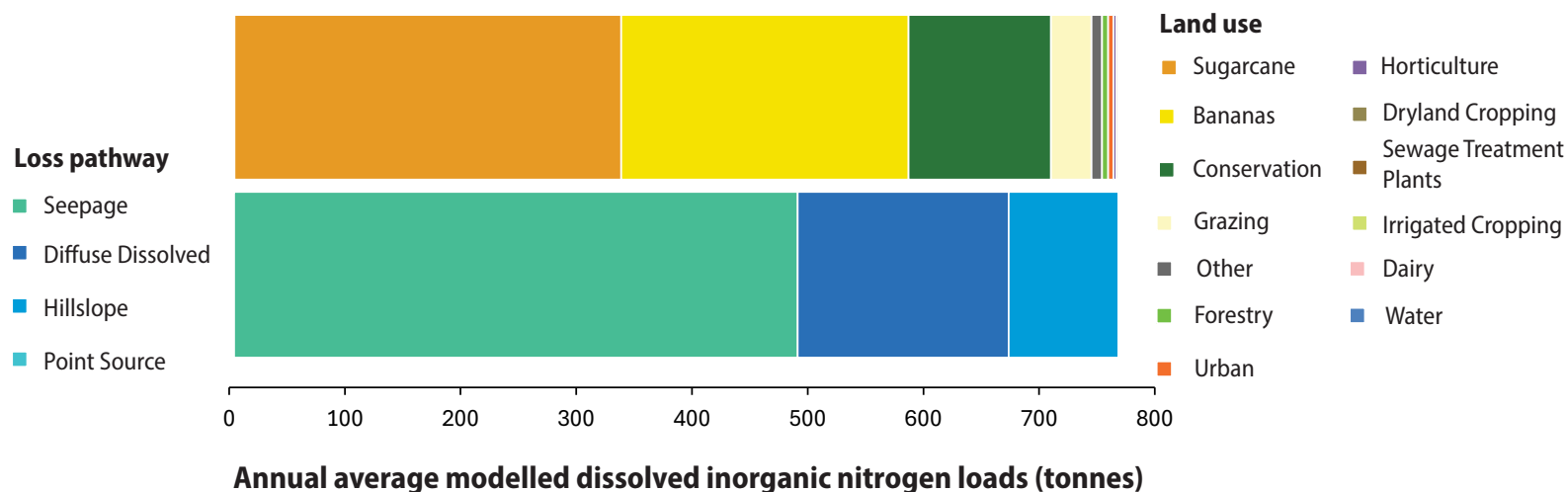
Importantly, not all pollutants generated on land reach the Great Barrier Reef—vegetation can intercept them, soils can absorb them, riverbeds and wetlands can trap them, or they may break down naturally before reaching areas downstream. The diagram below illustrates the various sources and transport pathways for nutrients, sediment and pesticides.



Step 3: Calculating pollutant loads to the Great Barrier Reef

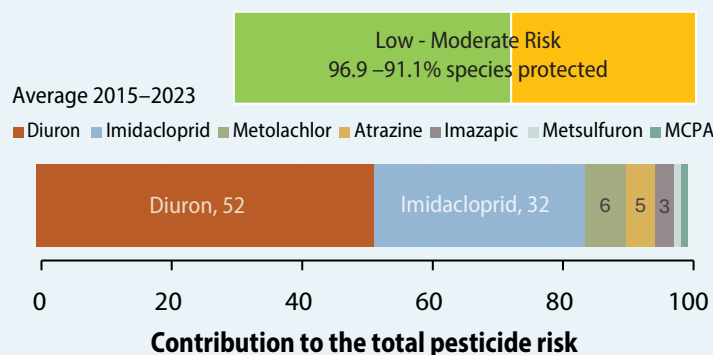
Pollutant loads entering aquatic ecosystems can vary significantly from year to year, primarily due to fluctuations in annual rainfall and runoff. To estimate long-term annual **fine sediment and nutrient** loads associated with various land uses and loss pathways (e.g. types of erosion and runoff), the [Paddock to Reef Integrated Monitoring, Modelling and Reporting Program](#) combines monitoring data with computer modelling across the Great Barrier Reef catchment area. Modelling also supports assessments of how changes in land management practices influence pollutant loads, and scenarios can be used to estimate the difference between pre-development and current conditions (i.e. 'anthropogenic' loads).

Catchment models integrate landscape characteristics (e.g. soil types, slope, vegetation cover), rainfall, land use and management practices, with the best available understanding of pollutant processing to estimate **fine sediment and nutrient loads** entering the Great Barrier Reef. Importantly, the models are calibrated and refined using water quality data from monitoring stations throughout the catchment, ensuring the reliability of estimates and validating underlying assumptions.



Example of pollutant load result showing the modelled annual average dissolved inorganic nitrogen for the Tully catchment by land use (top) and loss pathway (bottom)

The types and concentrations of **pesticides** in the fresh, estuarine and marine ecosystems vary between catchments and regions, reflecting dominant land uses in each area. Pesticide levels are assessed by measuring the concentrations in waterways and evaluating the ecological risk posed by individual pesticides or mixtures. Pesticides can take a long time to break down in the environment, ranging from months to years.



Example of pesticide result showing the risk (top) and dominant pesticides (bottom) in the Tully catchment, Wet Tropics

These estimates of catchment-level pollutant contributions inform the development of more targeted management responses.

Step 4: Assessing freshwater floodplain wetland ecosystem condition and exposure to land-based pollutant runoff

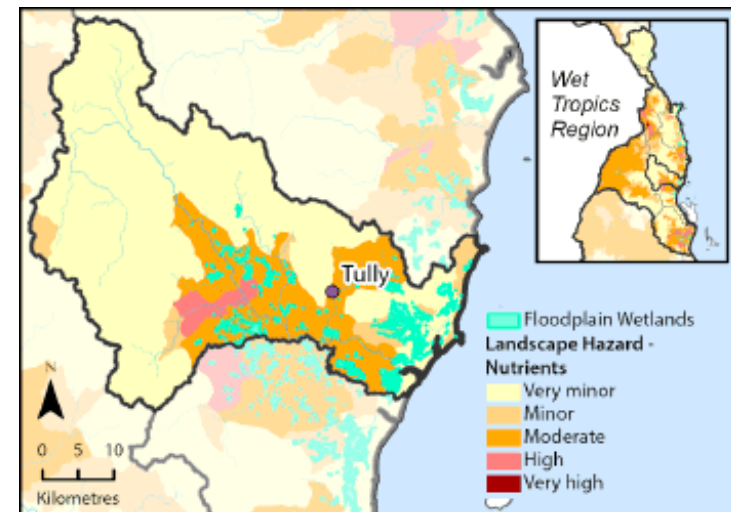
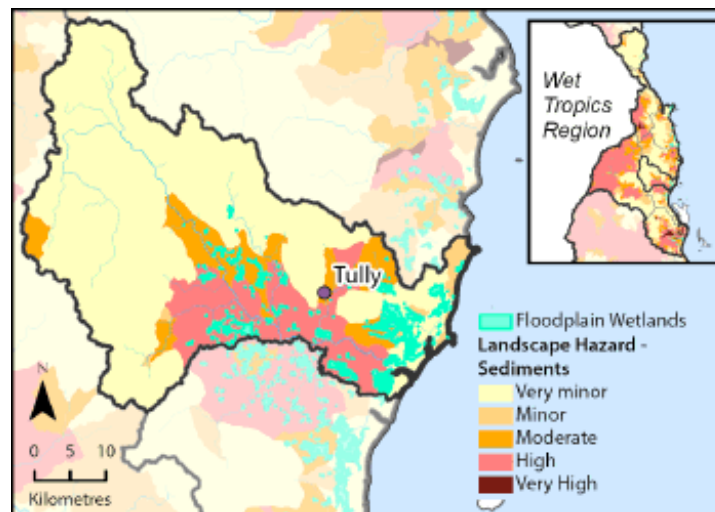
HAZARD ASSESSMENT

Floodplains and their wetlands have strong hydrological and ecological connections with Great Barrier Reef coastal waters and ecosystems and are a highly valued ecosystem in the landscape. Although wetlands have the potential to act as natural filters, they can also be harmed by pollutants.

There is limited information about direct exposure of wetlands to pollutants in the Great Barrier Reef catchment area. This project assessed the potential of different land uses to influence the amount of nutrients, sediment, and pesticides reaching freshwater floodplain wetlands, using a systematic hazard mapping approach.

The **hazard assessment** divided the landscape into smaller scale mapping units (usually a sub-catchment) and examined the land uses in each unit. **Different land uses pose different levels of hazard to wetlands** within and downstream of the land use. For instance, low hazard land uses like native forest and conservation areas contribute very few pollutants, whereas intensive agriculture, urban areas, or poorly managed land can contribute significant amounts of pollutants. **Each land use received a hazard weighting** based on its potential to generate pollution if it is not sustainably managed.

The hazard maps were then overlaid with detailed wetland mapping to identify which wetlands are located within or downstream of high-hazard areas. This recognises that pollutants can be carried downstream, so wetlands can be affected by land uses some distance away. For each management unit, the area of freshwater floodplain wetlands in the highest pollutant hazard categories was calculated, relative to the total area of freshwater floodplain wetlands in the management unit. These percentages were then categorised to define an **overall exposure rating from 'Very Minor' to 'Very High'** for each pollutant (as shown in the example).



Examples of freshwater floodplain wetland sediment (left) and nutrient (right) hazard assessment in the Tully catchment, Wet Tropics

CONDITION ASSESSMENT

The latest data from the Paddock to Reef [Wetland Condition Monitoring Program](#) was used to assess the current condition of natural freshwater wetlands on floodplains. Some wetlands are monitored every year, while others are monitored on a rotational basis every four years. Condition is assessed using indicators of habitat integrity, water regime, hydrology, physical integrity and connectivity. Indicator scores range from 1 (pre-European settlement condition) to 5 (most degraded). A composite index was calculated from the indicators to classify condition as Good, Moderate, or Poor.

Step 5: Assessing marine ecosystem condition and exposure to land-based pollutant runoff

MARINE EXPOSURE TO NUTRIENTS AND SEDIMENT

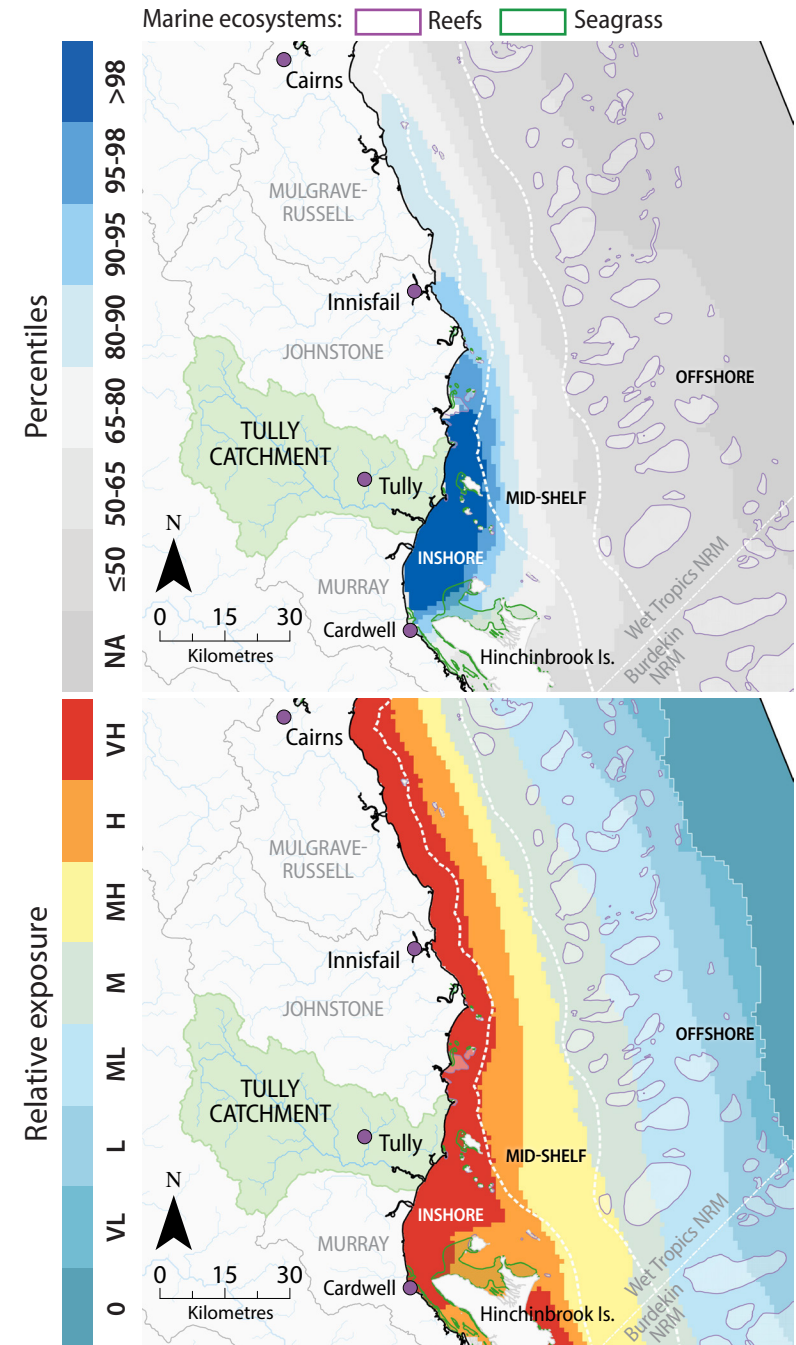
The marine pollutant exposure assessment combined four key components to calculate the exposure of coral reefs and seagrass meadows to land-based dissolved inorganic nitrogen (DIN) and fine sediment:

1. **Pollutant maps:** Exposure maps were created for DIN and fine sediment using the sophisticated eReefs computer model and information from the [Marine Monitoring Program](#). This approach accounts for wet season and annual influences and represents 'anthropogenic' conditions using modelling scenarios that estimate the difference between pre-development and current conditions.
2. **River footprints:** The 'footprint' of each catchment is mapped to represent the marine areas influenced by its river discharge over a 12-year period (2011 to 2022) using outputs from the eReefs model. A range of percentiles are applied to indicate the relative degree of influence within each footprint. Higher percentiles reflect areas that are more frequently or intensely affected by river discharge, providing a spatial gradient of influence.
3. **Exposure assessment:** The pollutant exposure maps were overlaid with the river footprints and weighted using:
 - **Frequency of river influence:** Areas receiving river water more often get higher weightings.
 - **Pollutant exposure:** Areas with higher pollutant exposure get higher weightings.This information can support management prioritisation by identifying marine areas with persistent exposure to land-based pollutants.
4. **Ecosystem distribution:** Using up-to-date spatial data, detailed maps were produced to define the location of coral reefs and seagrass meadows across the Great Barrier Reef, and the adjacent marine areas in Hervey Bay.

The final exposure index combined the exposure assessment with ecosystem distribution to show the relative exposure of ecosystems to DIN and fine sediment in each river footprint.

MARINE ECOSYSTEM CONDITION

Assessing current marine ecosystem condition is useful for prioritisation as it can help to determine the type and intensity of interventions required to support the marine ecosystem. Marine ecosystem condition was assessed using the Marine Monitoring Program's results for coral reefs and seagrass in 2022–23 and taking into account long-term trends. Monitoring takes place across the inshore Great Barrier Reef at a regional or sub-regional level (rather than more specific catchment scale). The Coral Index integrates measures of coral cover, juvenile abundance, macroalgae cover, coral cover change, and community composition. The Seagrass Index combines abundance and resilience indicators. These indices classify ecosystem condition as Very Good, Good, Moderate, Poor, or Very Poor.



Example of a river footprint (top), and the likelihood of dissolved inorganic nitrogen (DIN) exposure (bottom) in the Tully catchment, Wet Tropics.

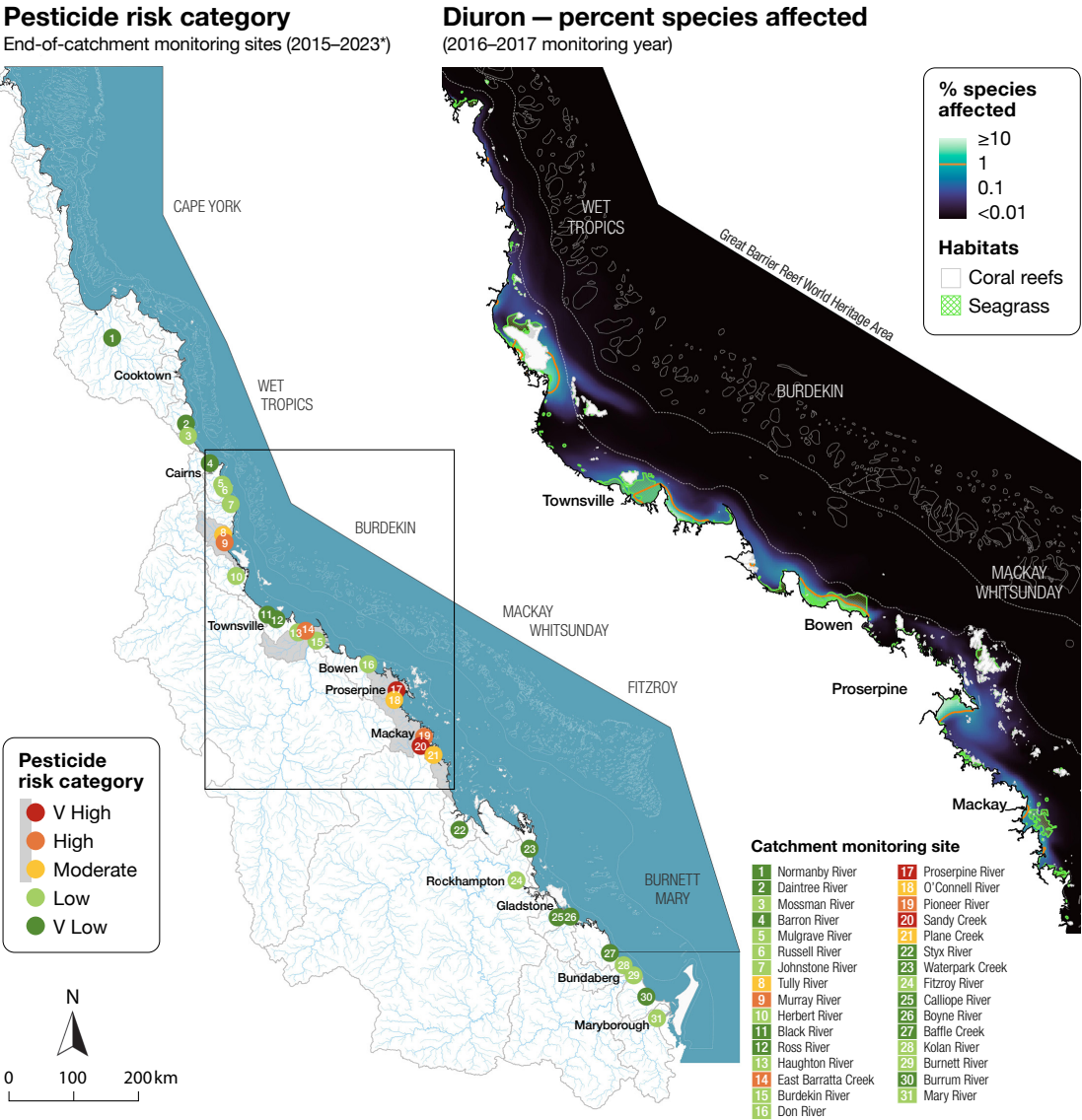
Step 5: Assessing marine ecosystem exposure to pesticides

MARINE EXPOSURE TO PESTICIDES

The pesticide exposure assessment drew on multiple lines of evidence to determine pesticide risk to inshore marine ecosystems. Combining monitoring data, risk assessments, and marine modelling provides the most comprehensive understanding of pesticide exposure to marine ecosystems to date.

- ▶ **End-of-catchment monitoring:** The most reliable data comes from water samples collected at the end-of-catchments, detecting concentrations of herbicides and insecticides and estimating the combined ecological risk of 22 different pesticides using the [‘Pesticide Risk Metric’](#). This shows what’s actually leaving catchments over time and entering marine waters.
- ▶ **Catchment-level risk assessment:** For areas not monitored, pesticide risk is estimated based on land-use proportions in the catchment. There are strong relationships between the proportion of the catchment where pesticides are applied and pesticide risk detected at the end-of-catchments. This helps fill gaps where monitoring data isn’t currently available.
- ▶ **Marine modelling case study:** Recent advances in computer modelling, applied in a two-year case study for the herbicide diuron, provide insights into how pesticides disperse in marine waters. The modelling highlights areas where diuron tends to accumulate, often close to seagrass meadows. For catchments with higher pesticide risk, diuron typically represents 30–40% of total pesticide risk, providing an indication of the potential inshore marine exposure patterns from pesticide mixtures.

The final exposure assessment considered these three lines of evidence for each of the Great Barrier Reef catchments to estimate the potential exposure of mixtures of pesticides on their inshore marine ecosystems.



*includes the years within this range where monitoring data is available, not all catchments have monitoring data for all years between 2015 and 2023.

End-of-catchment pesticide risk (left side) averaged across years from 2015–2023, and diuron exposure in the inshore marine zone (inset) based on marine modelled diuron concentrations presented as the wet season average percentage species affected computed on the near surface for the 2016–2017 wet season (15 October to 15 April). Marine modelling demonstrates potential exposure areas of seagrass and coral ecosystems (right side). The pesticide risk category of each catchment monitoring site is listed north to south.

Step 6: Understanding potential management options to improve or maintain Great Barrier Reef water quality

The **Management Response Framework** identifies the types of management tools and the most effective actions for achieving improved water quality outcomes.

MANAGEMENT OPTIONS

The project identified management options that can reduce pollutant loads from agricultural and non-agricultural land uses for nutrients, sediments, and pesticides. The options include management practices, engineered solutions including gully and streambank rehabilitation and treatment systems, and systems repair including wetland rehabilitation and revegetation of riparian buffers. The project used the latest evidence from a range of sources including the [2022 Scientific Consensus Statement](#) on land-based impacts on Great Barrier Reef water quality and ecosystem condition, the [Paddock to Reef Water Quality Risk Frameworks](#), the [Gully and Stream Bank Toolbox](#), an urban water quality management prioritisation for the Great Barrier Reef catchment area, and information from the [Queensland Wetlands Program](#) and [WetlandInfo](#).

COST EFFECTIVENESS

Using the results of several economic analyses, the project explored which management options provide the best value for money in terms of cost-effectiveness of water quality improvement. This information helps to ensure that limited resources are directed toward the most effective interventions.

ADOPTION POTENTIAL

The outcomes of the Review of Land Management Targets were incorporated to provide an indication of current management practice adoption and adoption potential. The Review used a specialised tool (ADOPT) to consider how factors like cost, complexity, risk, and potential benefits influence the likelihood of landholders and communities adopting different management practices. The project discusses adoption levels associated with particular management practices across the Great Barrier Reef catchment area, the level of adoption needed to achieve certain water quality improvements, and identifies aspects that may promote or impede adoption across different industries.

SUPPORTING ACTIONS

Supporting actions including **monitoring, evaluation and applied research**, and **planning, extension, trust building and collaboration** were also reviewed as essential components of the Management Response Framework.



Step 7: The four management response levels explained

FRAMEWORK LOGIC

All of the previous steps feed into a systematic decision-making process that considers both pollutant hazard / exposure and ecosystem condition to recommend appropriate management responses.

The framework recommends one of four management response levels for each pollutant in each catchment, with specific actions that build upon each other to create an escalating scale of intervention.

The management response level is determined by pollutant hazard / exposure. Within the management response levels, specific actions are included depending whether ecosystems are in Good, Moderate, or Poor condition with different emphasis on protection versus recovery and rehabilitation.

		Pollutant exposure			
		Minimal	Low	Moderate	High
Ecosystem condition	Poor	Foundational response + investigate	Proactive response + investigate	Accelerated response + evaluate	Intensive response + evaluate
	Moderate	Foundational response + investigate	Proactive response + investigate	Accelerated response + further assessment	Intensive response + further assessment
	Good	Foundational response	Proactive response	Accelerated response + increased vigilance	Intensive response + increased vigilance
		Trust development, prepare for the future	Small-scale intervention	Targeted intervention	Comprehensive intervention
		Management approach			

FOUNDATIONAL

Management aim: Good water quality is maintained to ensure that ecosystems remain protected from impacts of poor water quality into the future.

- Broadscale, widespread application of actions across all land uses within the catchment.
- Apply 'Whole-of-System, values-based' management principles.

PROACTIVE

Management aim: Ensure that emerging pollutant hazard / exposure issues are addressed, and good water quality is maintained into the future.

- Implement Foundational management response.
- Small-scale, localised areas and programs for actions in specific land uses within the catchment.

ACCELERATED

Management aim: Accelerate efforts to reduce pollutant hazard / exposure, protect ecosystems and support recovery from escalating climate impacts.

- Implement Foundational and Proactive management responses.
- Small to medium scale, tailored interventions in strategic and targeted sub-catchment areas across multiple land uses.

INTENSIVE

Management aim: Maximise efforts to address high pollutant hazard / exposure levels to reduce widespread water quality impacts within critical timeframes, enabling ecosystem recovery in response to escalating climate impacts.

- Implement Foundational, Proactive and Accelerated management responses.
- Comprehensive and large-scale land management, targeting all dominant pollutant sources, multiple land uses and water quality drivers.

Cape York Region | ASSESSMENT OUTCOMES - 1

Regional Summary

The Cape York region has the best overall ecosystem condition across the GBR catchment area with generally good inshore coral reef and seagrass health. The region requires predominantly Foundational management responses, indicating that while current water quality conditions are relatively good, ongoing maintenance of the status of water quality drivers including groundcover, vegetation and freshwater floodplain extent is needed to prevent degradation. Key management priorities should focus on sediment management in the Normanby catchment (the only catchment requiring an Intensive response for any pollutant) and the Endeavour catchment, where extensive grazing and associated management regimes including fire and road management contribute to elevated sediment loads. Anthropogenic pollutant contributions from all other catchments are minimal. The Region's relatively intact natural systems provide an opportunity for cost-effective protection strategies with targeted restoration in some areas, making it a priority area for maintaining ecosystem condition and associated ecosystem services that also benefit connected environments.

Management responses for each catchment were determined based on the wetland and marine ecosystem condition assessment and hazard or exposure to each pollutant type. Each catchment below contains two rows of information. The first row shows the hazard or exposure assessment (Minimal, Low, Moderate or High), and the second row shows the management response required (Foundational, Proactive, Accelerated or Intensive).

+ Depending on ecosystem condition, the management response includes recommendations for additional activities that should be undertaken e.g. increasing vigilance or investigating other drivers.

* Low confidence due to insufficient data or observations – requires validation or investigation.

Catchment	Freshwater floodplain wetlands				Marine					Dominant pollutant source for targeting management (ranked) <i>Pathway</i> (ranked)	Overall management and focus areas
	Condition	Hazard / Management Response			Condition		Exposure / Management Response				
	Wetlands	Nutrients	Sediments	Pesticides	Seagrass meadows	Coral reefs	Dissolved inorganic nitrogen	Fine sediment	Pesticides		
Jacky Jacky	No data*	Minimal	Low	Minimal	Good	Good*	Minimal	Minimal	Minimal	Sediment & particulate nutrients: Minimal anthropogenic sources <i>Hillslope</i> Pesticides: No high-risk land uses	Broadscale foundational management across the catchment for all pollutants. Validate wetland sediment hazard assessment and where required, implement appropriate management for wetlands in sediment hazard exposed areas. Investigate wetland and coral condition.
		Foundational	Proactive	Foundational			Foundational	Foundational	Foundational		
Olive-Pascoe	No data*	Minimal	Minimal	Minimal	Good	Good*	Minimal	Minimal	Minimal	Sediment & particulate nutrients: Minimal anthropogenic sources <i>Hillslope</i> Pesticides: No high-risk land uses	Broadscale foundational management across the catchment for all pollutants. Investigate wetland and coral condition.
		Foundational	Foundational	Foundational			Foundational	Foundational	Foundational		
Lockhart	No data*	Minimal	Minimal	Minimal	Good	Good*	Minimal	Minimal	Minimal	Sediment & particulate nutrients: Minimal anthropogenic sources <i>Hillslope</i> Pesticides: No high-risk land uses	Broadscale foundational management across the catchment for all pollutants. Investigate wetland and coral condition.
		Foundational	Foundational	Foundational			Foundational	Foundational	Foundational		
Stewart	No data*	Minimal	Minimal	Minimal	Moderate*	Good*	Minimal	Minimal	Minimal	Sediment & particulate nutrients: Minimal anthropogenic sources <i>Hillslope</i> Pesticides: No high-risk land uses	Broadscale foundational management across the catchment for all pollutants. Investigate wetland and coral condition. Further assessment of seagrass condition to understand additional pressures, increase confidence in status (including trends) and assess the role of pollutant impacts.
		Foundational	Foundational	Foundational			Foundational	Foundational+	Foundational+		

Cape York Region | ASSESSMENT OUTCOMES - 2

Management responses for each catchment were determined based on the wetland and marine ecosystem condition assessment and hazard or exposure to each pollutant type. Each catchment below contains two rows of information. The first row shows the hazard or exposure assessment (Minimal, Low, Moderate or High), and the second row shows the management response required (Foundational, Proactive, Accelerated or Intensive).

+ Depending on ecosystem condition, the management response includes recommendations for additional activities that should be undertaken e.g. increasing vigilance or investigating other drivers.

* Low confidence due to insufficient data or observations – requires validation or investigation.

¹ The freshwater floodplain wetland nutrient hazard exposure does not distinguish particulate and dissolved nutrient forms but based on land use, the dominant nutrient influence is likely to be particulate nutrients in the catchment.

Catchment	Freshwater floodplain wetlands				Marine					Dominant pollutant source for targeting management (ranked) <i>Pathway</i> (ranked)	Overall management and focus areas
	Condition	Hazard / Management Response			Condition		Exposure / Management Response				
	Wetlands	Nutrients	Sediments	Pesticides	Seagrass meadows	Coral reefs	Dissolved inorganic nitrogen	Fine sediment	Pesticides		
Normanby	Good	Low	Moderate	Minimal	Moderate	Good*	Minimal	High	Minimal	Sediment & particulate nutrients: Grazing <i>Gully & Hillslope</i> Pesticides: Dryland Cropping, Bananas & Irrigated Cropping	Large-scale intensive management of sediment at the catchment level. Broadscale foundational management in all other areas across the catchment. Accelerated management of sediments for wetlands in hazard exposed areas. Validate wetland nutrient ¹ hazard assessment and where required, implement appropriate management for wetlands in hazard exposed areas. Investigate coral condition.
		Proactive	Accelerated+	Foundational			Foundational	Intensive+	Foundational+		
Jeannie	No data*	Minimal	Minimal	Minimal	Moderate	Good*	Minimal	Minimal	Minimal	Sediment & particulate nutrients: Minimal anthropogenic sources <i>Hillslope</i> Pesticides: Dryland Cropping & Horticulture	Broadscale foundational management across the catchment for all pollutants. Investigate wetland and coral condition. Further assessment of seagrass condition to understand additional pressures, increase confidence in status (including trends) and assess the role of pollutant impacts.
		Foundational	Foundational	Foundational			Foundational	Foundational+	Foundational+		
Endeavour	No data*	Moderate	Moderate	Minimal	Moderate	Good*	Minimal	Low	Minimal	Sediment & particulate nutrients: Grazing <i>Hillslope</i> Pesticides: Dryland Cropping, Horticulture & Bananas	Broadscale foundational management across the catchment for all pollutants, with localised proactive management of sediment. Accelerated management of sediments for wetlands in hazard exposed areas. Validate wetland nutrient ¹ hazard assessment and where required, implement appropriate management for wetlands in hazard exposed areas. Investigate wetland condition and coral condition. Further assessment of seagrass condition to understand additional pressures, increase confidence in status (including trends) and assess the role of pollutant impacts.
		Accelerated+	Accelerated+	Foundational			Foundational	Proactive+	Foundational+		

Wet Tropics Region | ASSESSMENT OUTCOMES - 1

Regional Summary

The Wet Tropics region shows clear differences in terms of water quality drivers and ecosystem condition between the northern and southern sub-regions. Seagrass condition is good or moderate in the northern marine areas (primarily influenced by the Daintree, Mossman and Barron catchments) and deteriorates to poor condition in the central and southern marine areas (all other catchments). Inshore coral reefs maintain moderate condition across the Region and face mounting pressures from poor water quality and other disturbances. Freshwater floodplain wetland condition varies from moderate to poor, with extensive historical loss and/or modification in some catchments including the Mossman, Barron, Johnstone, Tully and Murray. The region has the highest total dissolved inorganic nitrogen loads and ranks third for fine sediment loads across the Great Barrier Reef catchment area. Accordingly, the region is a high-priority area for water quality improvement and requires Accelerated to Intensive management responses across multiple pollutants. Nutrient management is critical, with Intensive responses needed in agricultural catchments dominated by sugarcane, bananas, and horticulture, plus urban contributions in key population centres including Cairns. Pesticide management requires Intensive management in the Murray catchment and Accelerated responses across most other catchments. Management priorities should focus on integrated, sustainable land use management across the landscape, while protecting remaining wetland areas. For ecosystems in poor condition, it is recommended that the ecological, social and cultural values are evaluated in conjunction with other potential drivers of the poor condition, and the ecosystem's potential for recovery. Other intervention options for ecosystem repair and recovery may need to be considered (based on the values assessment).

Management responses for each catchment were determined based on the wetland and marine ecosystem condition assessment and hazard or exposure to each pollutant type. Each catchment below contains two rows of information. The first row shows the hazard or exposure assessment (Minimal, Low, Moderate or High), and the second row shows the management response required (Foundational, Proactive, Accelerated or Intensive).

+ Depending on ecosystem condition, the management response includes recommendations for additional activities that should be undertaken e.g. increasing vigilance or investigating other drivers.

* Low confidence due to insufficient data or observations – requires validation or investigation.

Catchment	Freshwater floodplain wetlands				Marine					Dominant pollutant source for targeting management (ranked) <i>Pathway</i> (ranked)	Overall management and focus areas
	Condition	Hazard / Management Response			Condition		Exposure / Management Response				
	Wetlands	Nutrients	Sediments	Pesticides	Seagrass meadows	Coral reefs	Dissolved inorganic nitrogen	Fine sediment	Pesticides		
Daintree	No data*	Minimal	Minimal	Minimal	Moderate	Moderate	Moderate	Minimal	Minimal	Nutrients (DIN): Sugarcane Sediment & particulate nutrients: Streambank in various land uses & Grazing <i>Hillslope & Streambank</i> Pesticides: Sugarcane	Broadscale foundational management across the catchment for all pollutants, with accelerated management of nutrients in targeted sub-catchment areas. Validate wetland pesticide hazard assessment and where required, implement appropriate management for wetlands in hazard exposed areas. Investigate wetland condition.
		Foundational	Foundational	Foundational			Accelerated+	Foundational+	Foundational+		
Mossman	No data*	Minimal	Minimal	High	Good	Moderate	Moderate	Minimal	Low	Nutrients (DIN): Sugarcane Sediment & particulate nutrients: Minimal anthropogenic sources (some Sugarcane & Urban) <i>Hillslope</i> Pesticides: Sugarcane	Accelerated management of nutrients in targeted sub-catchment areas, and localised proactive management of pesticides. Broadscale foundational management in all other areas across the catchment. Validate wetland pesticide hazard assessment and where required, implement appropriate management for wetlands in hazard exposed areas. Investigate wetland condition.
		Foundational	Foundational	Intensive+			Accelerated+	Foundational+	Proactive+		

Wet Tropics Region | ASSESSMENT OUTCOMES - 2

Management responses for each catchment were determined based on the wetland and marine ecosystem condition assessment and hazard or exposure to each pollutant type. Each catchment below contains two rows of information. The first row shows the hazard or exposure assessment (Minimal, Low, Moderate or High), and the second row shows the management response required (Foundational, Proactive, Accelerated or Intensive).

+ Depending on ecosystem condition, the management response includes recommendations for additional activities that should be undertaken e.g. increasing vigilance or investigating other drivers.

* Low confidence due to insufficient data or observations – requires validation or investigation.

Catchment	Freshwater floodplain wetlands				Marine					Dominant pollutant source for targeting management (ranked) <i>Pathway</i> (ranked)	Overall management and focus areas
	Condition	Hazard / Management Response			Condition		Exposure / Management Response				
	Wetlands	Nutrients	Sediments	Pesticides	Seagrass meadows	Coral reefs	Dissolved inorganic nitrogen	Fine sediment	Pesticides		
Barron	No data*	High	High	High	Good	Moderate	Moderate	Moderate	Minimal	Nutrients (DIN): Urban, Sewage Treatment Plant, Sugarcane & Bananas Sediment & particulate nutrients: Streambank in various land uses & Grazing <i>Streambank & Hillslope</i> Pesticides: Sugarcane, Irrigated Cropping, Horticulture & Bananas	Accelerated management of nutrients and sediment in targeted sub-catchment areas. Intensive management of all pollutants for wetlands in hazard exposed areas following validation. Broadscale foundational management in all other areas across the catchment. Validate wetland hazard assessment for nutrients, sediments and pesticides. Investigate wetland condition.
		Intensive+	Intensive+	Intensive+			Accelerated+	Accelerated+	Foundational+		
Mulgrave-Russell	Moderate	Low	Low	High	Moderate	Moderate	Moderate	Low	Moderate	Nutrients (DIN): Sugarcane, Bananas, Urban & Sewage Treatment Plants Sediment & particulate nutrients: Streambank in various land uses, Sugarcane & Grazing <i>Hillslope & Streambank</i> Pesticides: Sugarcane & Bananas	Accelerated management of nutrients & pesticides across multiple land uses in targeted sub-catchment areas. Localised proactive management of sediment. Broadscale foundational management in all other areas across the catchment. Validate wetland nutrient hazard assessment and where required, implement appropriate management for wetlands in hazard exposed areas. Intensive management of pesticides and localised management of sediment for wetlands in hazard exposed areas. Further assessment of wetland condition to understand the role of pollutant impacts and actively manage other drivers of condition.
		Proactive+	Proactive+	Intensive+			Accelerated+	Proactive+	Accelerated+		

Wet Tropics Region | ASSESSMENT OUTCOMES - 3

Management responses for each catchment were determined based on the wetland and marine ecosystem condition assessment and hazard or exposure to each pollutant type. Each catchment below contains two rows of information. The first row shows the hazard or exposure assessment (Minimal, Low, Moderate or High), and the second row shows the management response required (Foundational, Proactive, Accelerated or Intensive).

+ Depending on ecosystem condition, the management response includes recommendations for additional activities that should be undertaken e.g. increasing vigilance or investigating other drivers.

* Low confidence due to insufficient data or observations – requires validation or investigation.

Catchment	Freshwater floodplain wetlands				Marine					Dominant pollutant source for targeting management (ranked) Pathway (ranked)	Overall management and focus areas
	Condition	Hazard / Management Response			Condition		Exposure / Management Response				
	Wetlands	Nutrients	Sediments	Pesticides	Seagrass meadows	Coral reefs	Dissolved inorganic nitrogen	Fine sediment	Pesticides		
Johnstone	Poor	High	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	Nutrients (DIN): Sugarcane, Bananas & Urban Sediment & particulate nutrients: Streambank in various land uses & Grazing Hillslope & Streambank Pesticides: Sugarcane, Bananas & Urban	Accelerated management of nutrients, sediment and pesticides across multiple land uses in targeted sub-catchment areas. Intensive management of all pollutants for wetlands in hazard exposed areas. Broadscale foundational management in all other areas across the catchment.
		Intensive+	Intensive+	Intensive+			Accelerated+	Accelerated+	Accelerated+		
Tully	Moderate	High	High	High	Poor	Moderate	High	Moderate	Moderate	Nutrients (DIN): Sugarcane & Bananas Sediment & particulate nutrients: Streambank in various land uses & Sugarcane Hillslope & Streambank Pesticides: Sugarcane & Bananas	Multi-pollutant, strategic management required across multiple land uses, with intensive large-scale management of nutrients and accelerated management of sediment and pesticides in targeted sub-catchment areas. Intensive management of all pollutants for wetlands in hazard exposed areas. Broadscale foundational management in all other areas across the catchment.
		Intensive+	Intensive+	Intensive+			Intensive+	Accelerated+	Accelerated+		

Wet Tropics Region | ASSESSMENT OUTCOMES - 4

Management responses for each catchment were determined based on the wetland and marine ecosystem condition assessment and hazard or exposure to each pollutant type. Each catchment below contains two rows of information. The first row shows the hazard or exposure assessment (Minimal, Low, Moderate or High), and the second row shows the management response required (Foundational, Proactive, Accelerated or Intensive).

+ Depending on ecosystem condition, the management response includes recommendations for additional activities that should be undertaken e.g. increasing vigilance or investigating other drivers.

* Low confidence due to insufficient data or observations – requires validation or investigation. # Assessment scores vary depending on the Management Unit (MU) within the Herbert catchment.

Catchment	Freshwater floodplain wetlands				Marine					Dominant pollutant source for targeting management (ranked) Pathway (ranked)	Overall management and focus areas
	Condition	Hazard / Management Response			Condition		Exposure / Management Response				
	Wetlands	Nutrients	Sediments	Pesticides	Seagrass meadows	Coral reefs	Dissolved inorganic nitrogen	Fine sediment	Pesticides		
Murray	Poor	High	High	High	Poor	Moderate	Moderate	Minimal	High	Nutrients (DIN): Sugarcane & Bananas Sediment & particulate nutrients: Streambank in various land uses & Sugarcane <i>Hillslope & Streambank</i> Pesticides: Sugarcane & Bananas	Multi-pollutant, strategic management required across multiple land uses, with large-scale intensive management of pesticides and accelerated management of nutrients in targeted areas. Intensive management of nutrients and pesticides for wetlands in hazard exposed areas. Broadscale foundational management in all other areas across the basin. Validate wetland sediment hazard assessment and where required, implement appropriate management for wetlands in hazard exposed areas. Evaluate wetland and seagrass ecological, social and cultural values, other potential drivers of the poor condition and the ecosystem’s potential for recovery.
		Intensive+	Intensive+	Intensive+			Accelerated+	Foundational+	Intensive+		
Herbert [#]	Moderate to Poor [#]	High	High	Moderate to High [#]	Poor	Moderate	High	High	Moderate	Nutrients (DIN): Sugarcane Sediment & particulate nutrients: Grazing, Streambank in various land uses & Sugarcane <i>Hillslope & Streambank</i> Pesticides: Sugarcane & Irrigated Cropping	Multi-pollutant, strategic management required across multiple land uses, with large-scale intensive management of nutrients and sediment and accelerated management of pesticides in targeted sub-catchment areas. Intensive management of all pollutants for wetlands in hazard exposed areas in the Lower Herbert Management Unit (MU) and for sediments in the Upper Herbert MU. Validate wetland nutrient and pesticide hazard assessment in the Upper Herbert MU and where required, implement appropriate management for wetlands in hazard exposed areas. Evaluate wetland ecological, social and cultural values in the Lower Herbert, other potential drivers of the poor condition and the ecosystem’s potential for recovery. Further assessment of wetland condition in the Upper Herbert MU to understand the role of pollutant impacts and actively manage other drivers of wetland. Evaluate seagrass ecological, social and cultural values, other potential drivers of the poor condition and the ecosystem’s potential for recovery. Other intervention options for ecosystem repair/ recovery may need to be considered (based on values assessment).
		Intensive+	Intensive+	Accelerated+ to Intensive+ [#]			Intensive+	Intensive+	Accelerated+		

Burdekin Region | ASSESSMENT OUTCOMES - 1

Regional Summary

The Burdekin region’s inshore coral reefs, seagrass meadows and freshwater wetlands are in moderate to poor condition. The Burdekin region has the highest fine sediment loads and ranks second for total dissolved inorganic nitrogen loads across the Great Barrier Reef catchment area, primarily driven by the Burdekin catchment. The Region requires multi-pollutant Intensive management responses for the Burdekin and Haughton catchments. Intensive nutrient management responses are required in the Burdekin Delta management unit and Haughton catchment, primarily driven by sugarcane production, with Accelerated nutrient management responses required across most other catchments in the Region. Accelerated local management of nutrients is recommended for the Townsville urban area (Ross catchment) largely related to sewage treatment plant sources. Intensive sediment management responses are required in several catchments where extensive grazing contributes significantly to loads and is heavily dominated by the Burdekin catchment. Pesticide management is most critical in the Haughton catchment (Intensive response) with varying levels across other areas. The Region’s consistent moderate to poor ecosystem condition coupled with more intensive management response requirements makes it a priority for strategic, large-scale land management improvements, particularly in sugarcane and grazing systems. For ecosystems in poor condition, it is recommended that the ecological, social and cultural values are evaluated, in conjunction with other potential drivers of the poor condition, and the ecosystem’s potential for recovery. Other intervention options for ecosystem repair and recovery may need to be considered (based on the values assessment).

Management responses for each catchment were determined based on the wetland and marine ecosystem condition assessment and hazard or exposure to each pollutant type. Each catchment below contains two rows of information. The first row shows the hazard or exposure assessment (Minimal, Low, Moderate or High), and the second row shows the management response required (Foundational, Proactive, Accelerated or Intensive).

+ Depending on ecosystem condition, the management response includes recommendations for additional activities that should be undertaken e.g. increasing vigilance or investigating other drivers.

* Low confidence due to insufficient data or observations – requires validation or investigation.

¹ The freshwater floodplain wetland nutrient hazard exposure does not distinguish particulate and dissolved nutrient forms but based on land use, the dominant nutrient influence is likely to be particulate nutrients in the catchment.

Catchment	Freshwater floodplain wetlands				Marine					Dominant pollutant source for targeting management (ranked) Pathway (ranked)	Overall management and focus areas
	Condition	Hazard / Management Response			Condition		Exposure / Management Response				
	Wetlands	Nutrients	Sediments	Pesticides	Seagrass meadows	Coral reefs	Dissolved inorganic nitrogen	Fine sediment	Pesticides		
Black	Poor	High	High	Moderate	Poor	Moderate	Minimal	Minimal	Minimal	Nutrients (DIN): Sugarcane Sediment & particulate nutrients: Grazing Hillslope Pesticides: Sugarcane, Horticulture & Urban	Broadscale foundational management for all pollutants. Validate wetland nutrient ¹ & sediment hazard assessment and where required, implement appropriate management for wetlands in hazard exposed areas.
		Intensive+	Intensive+	Accelerated+			Foundational+	Foundational+	Foundational+		
Ross	Moderate	Moderate	High	Low	Moderate	Moderate	Moderate	Minimal	Minimal	Nutrients (DIN): Sewage Treatment Plants Sediment & particulate nutrients: Grazing Hillslope Pesticides: Horticulture, Irrigated Cropping & Urban	Broadscale foundational management across the catchment for all pollutants, with accelerated management of nutrients in targeted sub-catchment areas including for wetlands in hazard exposed areas. Validate wetland sediment and pesticide hazard assessment and where required, implement appropriate management for wetlands in hazard exposed areas. Further assessment of wetland condition to understand the role of pollutant impacts and actively manage other drivers of wetland condition.
		Accelerated+	Intensive+	Proactive++			Accelerated+	Foundational+	Foundational+		

Burdekin Region | ASSESSMENT OUTCOMES - 2

Management responses for each catchment were determined based on the wetland and marine ecosystem condition assessment and hazard or exposure to each pollutant type. Each catchment below contains two rows of information. The first row shows the hazard or exposure assessment (Minimal, Low, Moderate or High), and the second row shows the management response required (Foundational, Proactive, Accelerated or Intensive).

+ Depending on ecosystem condition, the management response includes recommendations for additional activities that should be undertaken e.g. increasing vigilance or investigating other drivers.

* Low confidence due to insufficient data or observations – requires validation or investigation; # Assessment scores vary depending on the Management Unit (MU) within the Burdekin catchment.

¹ The freshwater floodplain wetland nutrient hazard exposure does not distinguish particulate and dissolved nutrient forms but based on land use, the dominant nutrient influence is likely to be particulate nutrients in the catchment.

Catchment	Freshwater floodplain wetlands				Marine					Dominant pollutant source for targeting management (ranked) <i>Pathway</i> (ranked)	Overall management and focus areas
	Condition	Hazard / Management Response			Condition		Exposure / Management Response				
	Wetlands	Nutrients	Sediments	Pesticides	Seagrass meadows	Coral reefs	Dissolved inorganic nitrogen	Fine sediment	Pesticides		
Haughton	Poor	High	High	High	Poor	Moderate	High	Moderate	High	Nutrients (DIN): Sugarcane Sediment & particulate nutrients: Grazing & Sugarcane <i>Gully & Hillslope</i> Pesticides: Sugarcane	Multi-pollutant, strategic management required across multiple land uses, with intensive large-scale management of nutrients and pesticides & accelerated management of sediment in targeted sub-catchment areas. Intensive management of all pollutants for wetlands in hazard exposed areas.
		Intensive+	Intensive+	Intensive+			Intensive+	Accelerated+	Intensive+		
Burdekin [#]	Good to Poor [#]	Moderate to High [#]	High	Minimal to High [#]	Moderate	Moderate	High	High	Low	Nutrients (DIN): Sugarcane Sediment & particulate nutrients: Grazing <i>Gully</i> Burdekin Delta - Streambank in various land uses <i>Streambank</i> Pesticides: Dryland Cropping, Irrigated Cropping & Sugarcane	Multi-pollutant, strategic management required across multiple land uses at the catchment level, with intensive large-scale management of nutrients and sediment (including for wetlands in hazard exposed areas). Localised, proactive management of pesticides except for wetlands in hazard exposed areas where pesticide management increases to intensive in the Burdekin Delta. Broadscale foundational management in all other areas across the catchment. Validate wetland nutrient ¹ hazard assessment for Belyando, Suttor, Upper Burdekin, Bowen Bogie and Cape Campaspe, and where required, implement appropriate management for wetlands in nutrient hazard exposed areas. Validate wetland pesticide hazard assessment for East Burdekin Management Unit (MU), and pesticide and sediment hazard for Suttor MU. Where required, implement appropriate management for wetlands in hazard exposed areas. Investigate wetland condition in the Belyando, Suttor and Bowen Bogie MU. Evaluate wetland ecological, social and cultural values, other potential drivers of the poor condition and the ecosystem's potential for recovery in the Burdekin Delta. Further assessment of wetland condition in the Upper Burdekin MU to understand the role of pollutant impacts and actively manage other drivers of wetland condition.
		Intensive+	Intensive+	Intensive+			Intensive+	Intensive+	Intensive+		
Don	Moderate	High	High	Moderate	Moderate	Moderate	Minimal	Moderate	Low	Nutrients (DIN): Horticulture Sediment & particulate nutrients: Grazing <i>Gully</i> Pesticides: Horticulture & Irrigated Cropping	Accelerated management of sediment in targeted sub-catchment areas and localised proactive management of pesticides. Intensive management of nutrients and sediment for wetlands in hazard exposed areas. Validate wetland pesticide hazard assessment and where required, implement appropriate management for wetlands in hazard exposed areas. Further assessment of wetland condition to understand the role of pollutant impacts and actively manage other drivers of wetland condition.
		Intensive+	Intensive+	Accelerated+			Foundational+	Accelerated+	Proactive+		

Mackay Whitsunday Region | ASSESSMENT OUTCOMES - 1

Regional Summary

The Mackay Whitsunday region’s inshore coral reefs, seagrass meadows and freshwater floodplain wetlands are in moderate to poor condition. The ecosystems in the inshore marine zone are still recovering from past cyclone and bleaching events. All catchments require Intensive pesticide management and an Accelerated nutrient management response, driven predominantly by sugarcane production across the Region. Sediment management responses vary from Proactive to Accelerated, with a focus on streambank and grazing sources. Localised and intensive management of pollutants is required for the majority of wetland hazard exposed areas. Management priorities should focus on a comprehensive pollutant reduction strategy across multiple pollutants and land uses across all catchments. For ecosystems in poor condition, it is recommended that the ecological, social and cultural values are evaluated, in conjunction with other potential drivers of the poor condition, and the ecosystem’s potential for recovery. Other intervention options for ecosystem repair and recovery may need to be considered (based on the values assessment).

Management responses for each catchment were determined based on the wetland and marine ecosystem condition assessment and hazard or exposure to each pollutant type. Each catchment below contains two rows of information. The first row shows the hazard or exposure assessment (Minimal, Low, Moderate or High), and the second row shows the management response required (Foundational, Proactive, Accelerated or Intensive).

+ Depending on ecosystem condition, the management response includes recommendations for additional activities that should be undertaken e.g. increasing vigilance or investigating other drivers.

* Low confidence due to insufficient data or observations – requires validation or investigation.

Catchment	Freshwater floodplain wetlands				Marine					Dominant pollutant source for targeting management (ranked) Pathway (ranked)	Overall management and focus areas
	Condition	Hazard / Management Response			Condition		Exposure / Management Response				
	Wetlands	Nutrients	Sediments	Pesticides	Seagrass meadows	Coral reefs	Dissolved inorganic nitrogen	Fine sediment	Pesticides		
Proserpine	Poor	High	High	High	Moderate	Poor	Moderate	Minimal	High	Nutrients (DIN): Sugarcane & Urban Sediment & particulate nutrients: Grazing & Streambank in various land uses <i>Hillslope & Streambank</i> Pesticides: Sugarcane	Multi-pollutant, strategic management required across multiple land uses, with large-scale intensive management of pesticides and accelerated management of nutrients in targeted sub-catchment areas. Intensive management of all pollutants in wetland hazard exposed areas. Broadscale foundational management in all other areas across the catchment.
		Intensive+	Intensive+	Intensive+			Accelerated+	Foundational+	Intensive+		
O'Connell	No data*	High	High	High	Moderate	Poor	Moderate	Moderate	High	Nutrients (DIN): Sugarcane & Urban Sediment & particulate nutrients: Streambank in various land uses, Grazing & Sugarcane <i>Streambank & Hillslope</i> Pesticides: Sugarcane	Multi-pollutant, strategic management required across multiple land uses, with large-scale intensive management of pesticides and accelerated management of nutrients and sediment in targeted sub-catchment areas. Broadscale foundational management in all other areas across the catchment. Validate wetland nutrient, sediment and pesticide hazard assessment, and where required, implement appropriate management for wetlands in hazard exposed areas. Investigate wetland condition.
		Intensive+	Intensive+	Intensive+			Accelerated+	Accelerated+	Intensive+		

Mackay Whitsunday Region | ASSESSMENT OUTCOMES - 2

Management responses for each catchment were determined based on the wetland and marine ecosystem condition assessment and hazard or exposure to each pollutant type. Each catchment below contains two rows of information. The first row shows the hazard or exposure assessment (Minimal, Low, Moderate or High), and the second row shows the management response required (Foundational, Proactive, Accelerated or Intensive).

+ Depending on ecosystem condition, the management response includes recommendations for additional activities that should be undertaken e.g. increasing vigilance or investigating other drivers.

* Low confidence due to insufficient data or observations – requires validation or investigation.

Catchment	Freshwater floodplain wetlands				Marine					Dominant pollutant source for targeting management (ranked) Pathway (ranked)	Overall management and focus areas
	Condition	Hazard / Management Response			Condition		Exposure / Management Response				
	Wetlands	Nutrients	Sediments	Pesticides	Seagrass meadows	Coral reefs	Dissolved inorganic nitrogen	Fine sediment	Pesticides		
Pioneer	No data*	High	High	High	Moderate	Poor	Moderate	Moderate	High	Nutrients (DIN): Sugarcane & Urban Sediment & particulate nutrients: Streambank various land uses <i>Streambank & Hillslope</i> Pesticides: Sugarcane & Urban	Multi-pollutant, strategic management required across multiple land uses, with large-scale intensive management of pesticides and accelerated management of nutrients and sediment in targeted sub-catchment areas. Broadscale foundational management in all other areas across the catchment. Validate wetland nutrient, sediment and pesticide hazard assessment and where required, implement appropriate management for wetlands in nutrient hazard exposed areas. Investigate wetland condition.
		Intensive+	Intensive+	Intensive+			Accelerated+	Accelerated+	Intensive+		
Plane	Poor	High	Moderate	High	Moderate	Poor	Moderate	Low	High	Nutrients (DIN): Sugarcane & Urban Sediment & particulate nutrients: Grazing, Streambank in various land uses & Sugarcane <i>Hillslope & Streambank</i> Pesticides: Sugarcane	Multi-pollutant, strategic management required across multiple land uses, with large-scale intensive management of pesticides, accelerated management of nutrients in targeted sub-catchment areas, and localised proactive management of sediment. Intensive management of pesticides and nutrients, and accelerated management of sediment in wetland hazard exposed areas. Broadscale foundational management in all other areas across the catchment.
		Intensive+	Accelerated+	Intensive+			Accelerated+	Proactive+	Intensive+		

Fitzroy Region | ASSESSMENT OUTCOMES - 1

Regional Summary

The Fitzroy region's inshore coral reefs and seagrass meadows are in poor condition, with a documented long-term declining trend, making ecosystem recovery a critical priority. Freshwater floodplain wetlands are only monitored in the Waterpark and Fitzroy catchments and are in moderate to poor condition. The Fitzroy region has the second highest fine sediment loads across the Great Barrier Reef catchment area. Intensive sediment management responses are required across most catchments, driven by extensive grazing land use throughout the Region. Nutrient management for wetland outcomes varies from a Foundational response in upper catchment areas to Intensive responses in lower catchment areas like the Lower Fitzroy (largely associated with particulate nutrients). Pesticide management responses are Foundational to Proactive at the catchment scale, with potentially some Intensive pesticide management required within wetland hazard exposed areas. Comprehensive, large-scale management strategies need to be implemented, with a particular focus on reducing sediment erosion from grazing lands incorporating streambank and gully restoration actions. The less developed Styx, Shoalwater and Waterpark catchments could be a focus for cost-effective protection strategies with targeted sediment management and/or restoration in some areas. For ecosystems in poor condition, it is recommended that the ecological, social and cultural values are evaluated, in conjunction with other potential drivers of the poor condition, and the ecosystem's potential for recovery. Other intervention options for ecosystem repair and recovery may need to be considered (based on values assessment).

Management responses for each catchment were determined based on the wetland and marine ecosystem condition assessment and hazard or exposure to each pollutant type. Each catchment below contains two rows of information. The first row shows the hazard or exposure assessment (Minimal, Low, Moderate or High), and the second row shows the management response required (Foundational, Proactive, Accelerated or Intensive).

+ Depending on ecosystem condition, the management response includes recommendations for additional activities that should be undertaken e.g. increasing vigilance or investigating other drivers.

* Low confidence due to insufficient data or observations – requires validation or investigation.

Catchment	Freshwater floodplain wetlands				Marine					Dominant pollutant source for targeting management (ranked) Pathway (ranked)	Overall management and focus areas
	Condition	Hazard / Management Response			Condition		Exposure / Management Response				
	Wetlands	Nutrients	Sediments	Pesticides	Seagrass meadows	Coral reefs	Dissolved inorganic nitrogen	Fine sediment	Pesticides		
Styx	No data*	Minimal	Moderate	Minimal	Poor*	Poor*	Minimal	Minimal	Minimal	Sediment & particulate nutrients: Grazing Gully & Hillslope Pesticides: Sugarcane	Broadscale foundational management across the catchment for all pollutants. Validate wetland sediment hazard assessment and where required, implement appropriate management for wetlands in hazard exposed areas. Investigate wetland condition, and immediate investigation of drivers of coral and seagrass condition.
		Foundational	Accelerated+	Foundational			Foundational+	Foundational+	Foundational+		
Shoalwater	No data*	Minimal	Moderate	Minimal	Poor*	Poor*	Minimal	Minimal	No data	Sediment & particulate nutrients: Grazing Hillslope & Gully Pesticides: No high-risk land uses	Broadscale foundational management across the catchment for all pollutants. Validate wetland sediment hazard assessment and where required, implement appropriate management for wetlands in sediment hazard exposed areas. Investigate wetland condition, and immediate investigation of drivers of coral and seagrass condition.
		Foundational	Accelerated+	Foundational			Foundational+	Foundational+	Foundational+		
Waterpark	Moderate	Minimal	Minimal	Minimal	Poor*	Poor*	Minimal	Minimal	Minimal	Sediment & particulate nutrients: Grazing Hillslope Pesticides: Horticulture & Dryland Cropping	Broadscale foundational management across the catchment for all pollutants. Further assessment of wetland condition to understand the role of pollutant impacts and actively manage other drivers of wetland condition. Immediate investigation of drivers of coral and seagrass condition.
		Foundational+	Foundational+	Foundational+			Foundational+	Foundational+	Foundational+		

Fitzroy Region | ASSESSMENT OUTCOMES - 2

Management responses for each catchment were determined based on the wetland and marine ecosystem condition assessment and hazard or exposure to each pollutant type. Each catchment below contains two rows of information. The first row shows the hazard or exposure assessment (Minimal, Low, Moderate or High), and the second row shows the management response required (Foundational, Proactive, Accelerated or Intensive).

+ Depending on ecosystem condition, the management response includes recommendations for additional activities that should be undertaken e.g. increasing vigilance or investigating other drivers.

* Low confidence due to insufficient data or observations – requires validation or investigation.

Assessment scores vary depending on the Management Unit (MU) within the Fitzroy catchment.

¹ The freshwater floodplain wetland nutrient hazard exposure does not distinguish particulate and dissolved nutrient forms but based on land use, the dominant nutrient influence is likely to be particulate nutrients in the catchment.

Catchment	Freshwater floodplain wetlands				Marine					Dominant pollutant source for targeting management (ranked) Pathway (ranked)	Overall management and focus areas
	Condition	Hazard / Management Response			Condition		Exposure / Management Response				
	Wetlands	Nutrients	Sediments	Pesticides	Seagrass meadows	Coral reefs	Dissolved inorganic nitrogen	Fine sediment	Pesticides		
Fitzroy [#]	Moderate to Poor [#]	High	High	Minimal to High [#]	Poor	Poor	Minimal	High	Low	Sediment & particulate nutrients: Grazing, Streambank in various land uses & Dryland Cropping (Dawson, Comet, Theresa Creek) <i>Gully & Streambank</i> Pesticides: Dryland Cropping, Irrigated Cropping & Urban	Multi-pollutant, strategic management across multiple land uses at the catchment level, with intensive large-scale management of sediment (including for wetlands in hazard exposed areas), and localised proactive management of pesticides. Broadscale foundational management in all other areas across the catchment. Investigate sources of DIN marine exposure. Validate wetland nutrient ¹ and pesticide hazard assessment and where required, implement appropriate management response. Validate wetland sediment hazard assessment in the Comet, Nogoa and Theresa Creek Management Units (MUs) and where required, implement appropriate management response Investigate wetland condition in the Comet and Theresa Creek MUs. Further assessment of wetland condition in Dawson, Isaac and Mackenzie MU to understand the role of pollutant impacts and actively manage other drivers of wetland condition.
		Intensive+	Intensive+	Intensive+			Foundational+	Intensive+	Proactive+		
Calliope	No data*	Moderate	High	Minimal	Poor	Poor	Minimal	Minimal	Minimal	Sediment & particulate nutrients: Grazing <i>Hillslope & Gully</i> Pesticides: Horticulture, Dryland Cropping & Irrigated Cropping	Broadscale foundational management across the catchment for all pollutants. Validate wetland nutrient ¹ and sediment hazard assessment and implement appropriate management response where required. Investigate wetland condition, and immediate investigation of drivers of coral and seagrass condition.
		Accelerated+	Intensive+	Foundational			Foundational+	Foundational+	Foundational+		
Boyne	No data*	High	High	Minimal	Poor	Poor	Minimal	Minimal	Minimal	Sediment & particulate nutrients: Grazing <i>Hillslope & Gully</i> Pesticides: Dryland Cropping & Irrigated Cropping	Broadscale foundational management across the catchment for all pollutants. Validate wetland nutrient ¹ and sediment hazard assessment and implement appropriate management response where required. Investigate wetland condition.
		Intensive+	Intensive+	Foundational			Foundational+	Foundational+	Foundational+		

Burnett Mary Region | ASSESSMENT OUTCOMES - 1

Regional Summary

The Burnett Mary region’s seagrass meadows are in poor condition and the condition of inshore coral reefs is moderate (though with low confidence in available data). Freshwater floodplain wetlands are in variable condition, ranging from good in the Burrum catchment to moderate or poor in other catchments. Management responses vary significantly by pollutant: sediment management requires Intensive responses in the Mary catchment and Accelerated responses in the Burnett catchment, driven by extensive grazing and streambank erosion; nutrient management requires Intensive responses in the Burnett catchment primarily associated with sugarcane production; and pesticide management largely associated with sugarcane requires Accelerated responses in several catchments. Management priorities should target sediment reduction from grazing lands, and nutrient and pesticide management in sugarcane areas. For ecosystems in poor condition, it is recommended that the ecological, social and cultural values are evaluated, in conjunction with other potential drivers of the poor condition, and the ecosystem’s potential for recovery. Other intervention options for ecosystem repair and recovery may need to be considered (based on the values assessment).

Management responses for each catchment were determined based on the wetland and marine ecosystem condition assessment and hazard or exposure to each pollutant type. Each catchment below contains two rows of information. The first row shows the hazard or exposure assessment (Minimal, Low, Moderate or High), and the second row shows the management response required (Foundational, Proactive, Accelerated or Intensive).

+ Depending on ecosystem condition, the management response includes recommendations for additional activities that should be undertaken e.g. increasing vigilance or investigating other drivers.

* Low confidence due to insufficient data or observations – requires validation or investigation.

¹ The freshwater floodplain wetland nutrient hazard exposure does not distinguish particulate and dissolved nutrient forms but based on land use, the dominant nutrient influence is likely to be particulate nutrients in the catchment.

Catchment	Freshwater floodplain wetlands				Marine					Dominant pollutant source for targeting management (ranked) Pathway (ranked)	Overall management and focus areas
	Condition	Hazard / Management Response			Condition		Exposure / Management Response				
	Wetlands	Nutrients	Sediments	Pesticides	Seagrass meadows	Coral reefs	Dissolved inorganic nitrogen	Fine sediment	Pesticides		
Baffle	Moderate	High	High	Moderate	Poor*	Moderate*	Minimal	Minimal	Minimal	Sediment & particulate nutrients: Grazing & Urban Hillslope & Gully Pesticides: Horticulture, Sugarcane & Irrigated Cropping	Broadscale foundational management across the catchment for all pollutants, with accelerated management of pesticides for wetlands in hazard exposed areas. Validate wetland nutrient ¹ and sediment hazard assessment and implement appropriate management response where required. Investigate coral and seagrass condition. Further assessment of wetland condition to understand the role of pollutant impacts and actively manage other drivers of wetland condition.
		Intensive+	Intensive+	Accelerated+			Foundational+	Foundational+	Foundational+		
Kolan	No data*	High	High	High	Poor	Moderate*	Low	Minimal	Low	Nutrients (DIN): Sugarcane Sediment & particulate nutrients: Streambank in various land uses & Grazing Hillslope & Streambank Pesticides: Sugarcane, Horticulture & Urban	Localised, proactive management for nutrients, sediment and pesticides. Validate wetland nutrient, sediment and pesticide hazard assessment and where required, implement appropriate management response. Investigate wetland and coral condition.
		Intensive+	Intensive+	Intensive+			Proactive+	Foundational+	Proactive+		

Burnett Mary Region | ASSESSMENT OUTCOMES - 2

Management responses for each catchment were determined based on the wetland and marine ecosystem condition assessment and hazard or exposure to each pollutant type. Each catchment below contains two rows of information. The first row shows the hazard or exposure assessment (Minimal, Low, Moderate or High), and the second row shows the management response required (Foundational, Proactive, Accelerated or Intensive).

+ Depending on ecosystem condition, the management response includes recommendations for additional activities that should be undertaken e.g. increasing vigilance or investigating other drivers.

* Low confidence due to insufficient data or observations – requires validation or investigation.

Catchment	Freshwater floodplain wetlands				Marine					Dominant pollutant source for targeting management (ranked) Pathway (ranked)	Overall management and focus areas
	Condition	Hazard / Management Response			Condition		Exposure / Management Response				
	Wetlands	Nutrients	Sediments	Pesticides	Seagrass meadows	Coral reefs	Dissolved inorganic nitrogen	Fine sediment	Pesticides		
Burnett	Poor	High	High	High	Poor	Moderate*	High	Moderate	Low	Nutrients (DIN): Sugarcane Sediment & particulate nutrients: Streambank in various land uses & Grazing <i>Streambank</i> Pesticides: Dryland Cropping, Irrigated Cropping, Sugarcane, Horticulture & Urban	Multi-pollutant, strategic management required across multiple land uses at the catchment level, with intensive large-scale management of nutrients, accelerated management of sediment in targeted sub-catchment areas, and localised proactive management of pesticides. Intensive management of all pollutants for wetlands in hazard exposed areas. Broadscale foundational management in all other areas across the catchment. Investigate coral condition.
		Intensive+	Intensive+	Intensive+			Intensive+	Accelerated+	Proactive+		
Burrum	Good	High	High	Moderate	Poor	Moderate*	Minimal	Minimal	Moderate	Nutrients (DIN): Sugarcane Sediment & particulate nutrients: Urban & Horticulture <i>Hillslope</i> Pesticides: Sugarcane, Horticulture & Urban	Broadscale foundational management across the catchment for all pollutants, with accelerated management of pesticides in targeted sub-catchment areas including for wetlands in hazard exposed areas. Intensive management of nutrients and sediment for wetlands in hazard exposed areas. Investigate coral condition.
		Intensive+	Intensive+	Accelerated+			Foundational+	Foundational+	Accelerated+		
Mary	Moderate	High	High	High	Poor	Moderate	Moderate	High	Low	Nutrients (DIN): Sugarcane & Urban Sediment & particulate nutrients: Streambank in various land uses, Grazing & Urban <i>Streambank & Hillslope</i> Pesticides: Sugarcane, Horticulture, Irrigated Cropping & Urban	Multi-pollutant, strategic management required across multiple land uses at the catchment level, with intensive large-scale management of sediment, accelerated management of nutrients in targeted sub-catchment areas, and localised proactive management of pesticides. Intensive management of all pollutants for wetlands in hazard exposed areas. Broadscale foundational management in all other areas across the catchment. Further assessment of wetland condition to understand the role of pollutant impacts and actively manage other drivers of wetland condition.
		Intensive+	Intensive+	Intensive+			Accelerated+	Intensive+	Proactive+		