Findings of the statutory review of the Agricultural Environmentally Relevant Activity standards for sugarcane and banana cultivation and beef cattle grazing in the Great Barrier Reef catchment

Contents

Executive Summary

The Agricultural Environmentally Relevant Activity standards for commercial sugarcane and banana cultivation and beef cattle grazing (the standards) are a measure under the Reef protection regulations and apply in the Great Barrier Reef catchment. The standards aim to improve the quality of water flowing to the Great Barrier Reef by requiring producers to implement minimum agricultural practices that retain nutrients (nitrogen and phosphorus) and sediment on agricultural land. The standards were introduced in 2019 and are supported by a range of materials, including prescribed methodologies for sugarcane and bananas and guides.

In accordance with obligations under the *Environmental Protection Act 1994*, the Department of the Environment, Tourism, Science and Innovation (DETSI) undertook a statutory review of the standards. The objective of the statutory review was to identify whether changes to the standards (and supporting materials) are required to ensure they are easy to understand and clear to comply with and remain fit for purpose and evidence based.

DETSI received feedback on the standards from representatives across the agricultural industry, conservation sector and public during a three-month public consultation process. Following analysis of this feedback against the review criteria and scope, DETSI recommends the following suggestions are used to develop proposed changes to the standards and supporting materials:

For all standards and supporting materials:

- Revise the wording to improve the clarity of requirements and associated definitions.
- Provide voluntary templates or worked examples to better support producers in record keeping.
- Extend the timeframe for making a record from three business days to five business days.
- Reduce the timeframe for keeping records from at least six years to two years.

For sugarcane:

- Allow drones to be used at any time for foliar application of fertiliser.
- Extend the validity of soil tests from 12 months to 18 months.

For bananas:

- Allow the threshold rates for phosphorus to be adjusted in accordance with professional advice (independently of leaf tests).
- Revise the nitrogen threshold rate for plant crops.
- Allow drones to be used at any time for foliar application of fertiliser.

For beef cattle grazing:

- Remove the requirement to keep records of fertiliser and mill mud/mill ash mix applications.

DETSI also recommends implementing the following broader suggestions to **enhance the way information is provided** to stakeholders:

- Revise engagement materials and methods to better communicate requirements to stakeholders.
- Collaborate across Queensland Government departments to deliver integrated information, extension and compliance services.

It is also recommended to continue to support the sugarcane industry to build capacity of producers to develop, review and verify their own nitrogen and phosphorus budget.

Implementing the recommended suggestions is expected to make the standards and supporting documents more user-friendly, address minor technical issues and increase flexibility for producers without increasing risk to water quality.

This report will be provided to the Minister for the Environment and Tourism and Minister for Science and Innovation to consider. If the recommendations are supported, proposed changes to the standards and supporting materials will be developed and implemented via a regulatory process that includes public consultation.

Abbreviations

BMP programs	Industry Best Management Practices programs, such as the Smartcane BMP program and the Freshcare BMP program.
DIN	Dissolved inorganic nitrogen
N	Nitrogen (a nutrient)
N&P budget	The nitrogen and phosphorus budget under the sugarcane standard
P	Phosphorus (a nutrient)
Reef	Refers to the Great Barrier Reef and the Great Barrier Reef World Heritage Area
Reef catchment	The Great Barrier Reef Catchment, i.e., the drainage area of the Great Barrier Reef
Reef protection regulations	Chapter 4A and associated regulatory provisions under the *Environmental Protection Act 1994*
Standards	The Agricultural Environmentally Relevant Activity standards for commercial sugarcane cultivation, banana cultivation and beef cattle grazing in the Great Barrier Reef catchment, https://www.qld.gov.au/environment/agriculture/sustainable-farming/reef/reef-regulations
SCS	The 2022 Scientific Consensus Statement, https://reefwqconsensus.com.au/
WQIP	The Reef 2050 Water Quality Improvement Plan 2017 – 2022, https://www.reefplan.qld.gov.au/

1. Introduction

The Agricultural Environmental Relevant Activity standards for commercial banana and sugarcane cultivation and beef cattle grazing in the Great Barrier Reef (the Reef) catchment (the standards) require producers to adopt practices that minimise nutrient and sediment run-off flowing to local waterways and the Reef. The Queensland Government made the standards in 2019 following significant consultation and based on the best available science about reducing pollution run-off while maintaining farm profitability and productivity. In 2022, small administrative updates were made to the standards to remove duplication and clarify existing requirements.

This report documents the approach to, and findings of, a statutory review of the standards that was undertaken by the Department of the Environment, Tourism, Science and Innovation (DETSI). The review was required under section 81 of the *Environmental Protection Act 1994*, which specifies that the review must commence within five years of the standards being made and be completed within one year of commencement. The review commenced on 17 November 2024 and was completed on 16 November 2025

For each component of the sugarcane, banana and grazing standards, sections 3 to 5 provide:

- a summary of the current requirements;
- a table setting out the key issues and ideas raised during public consultation (grouped into suggestions) and whether DETSI recommends these are implemented and why;
- an overview of relevant scientific evidence from the 2022 Scientific Consensus Statement (SCS)[1]; and
- a summary of the recommended changes.

Section 6 contains a table of suggestions and recommendations about broader matters associated with the standards and their implementation.

This report will be provided to the Minister for the Environment and Tourism and Minister for Science and Innovation to consider. If the recommendations are supported, they will be used to develop proposed changes to the standards and supporting materials. A regulatory process is required to implement the changes, which must include public consultation on the proposed changes in accordance with Chapter 5A of the *Environmental Protection Act 1994*.

2. Approach

DETSI gathered experiences, issues and proposed improvements to the standards from a range of stakeholders, including producers, industry representatives, environment groups, government officers and topic experts. Feedback was provided in a number of ways, including via a survey, workshops, written submissions and discussions with the review team (see **Appendix A and B** for more information). The three-month public consultation period resulted in over 400,000 impressions across social media, 43 survey responses, 54 attendees across four public workshops, 14 written submissions and four discussions with a member of the review team. For the sugarcane standard, feedback was received from producers, industry peak bodies, sugar manufacturers, sugar researchers, advisors, fertiliser suppliers, environmental and conservation groups and interested members of the public. For the banana standard, feedback was received from producers, the peak industry body, advisors, researchers, fertiliser suppliers and environmental and conservation groups. For the grazing standard, feedback was received from producers, peak industry bodies and interested members of the public.

Similar issues and ideas raised by stakeholders were grouped into 57 **suggestions:** 19 for sugarcane, 18 for bananas, 13 for grazing and 7 on broader matters.

DETSI assessed the suggestions against the following criteria and recommended implementing suggestions that align with at least one of them:

- Will the change make the standards and/or supporting materials easier to understand and clearer to comply with (criteria 1)?
- Will the change ensure the standards and/or supporting materials remain fit for purpose (criteria 2) and evidence based (criteria 3)?

[1] Not included for the sections on record keeping requirements.

DETSI did not recommend suggestions that were inconsistent with at least one of these criteria, that have already been addressed or are out of scope. The following types of matters were out of scope:

- changes that would undermine progress towards water quality outcomes;
- assessing whether standards are the most effective tool for achieving water quality outcomes; and
- developing standards for other commodities, such as horticulture or grains.

Supported suggestions were categorised according to whether the resulting changes to the standard and supporting materials were likely to be minor or moderate. Changes were categorised as:

- minor if they were likely to have no effect on the way the standards are implemented (for example, changes to wording); and
- moderate if they were likely to affect the way the standards are implemented, including potential minor (positive) impact on producers.

None of the supported suggestions were assessed as likely to result in major changes to the way the requirements are implemented or significant impacts on producers.

3. Sugarcane standard

Sugarcane is the most widely grown crop in the Reef catchment, covering approximately 400,000 hectares (1.2 percent of the total area). Sugarcane cultivation contributes 42 percent of the total dissolved inorganic nitrogen load, 15 percent of the particulate phosphorus load and 10 percent of the fine sediment load exported to the Reef (Bartley and Murray 2024 Question 3.5 and Prosser and Wilkinson 2024, Question 4.4 of the SCS).

The requirements in the Agricultural Environmentally Relevant Activity standard for sugarcane cultivation (sugarcane standard) focus on retaining nitrogen, phosphorus and sediment on-farm to minimise losses and improve water quality. They include requirements for fertiliser application, erosion and sediment control, nitrogen and phosphorus application and record keeping.

The sugarcane standard is supported by requirements in the Prescribed methodology for sugarcane cultivation and guidance on how to comply in the Sediment and erosion control guide, Fertiliser placement guide and Farm nitrogen and phosphorus budget guide.

Fertiliser application methods

Overview of requirements

The intent of the *fertiliser application methods* (SC1 and SC2) is to minimise the loss of fertiliser to waterways by regulating how fertiliser is applied:

- Ground-based application of nitrogen to an entire block (i.e., broadcast application) is not allowed.
- Ground-based broadcast application of phosphorus is only allowed in preparation for a plant crop (i.e., the initial crop after planting) if the fertiliser is incorporated into the soil within three days.
- Broadcast application using an aircraft is only allowed if it is not practical to use ground-based methods (e.g. following significant rainfall when the terrain is not accessible with ground-based equipment).

SC1 and SC2 are prescriptive conditions (in that they specify the ‘how’ rather than the environmental outcome to be achieved), which is necessary due to the elevated risk to water quality from broadcast application of fertiliser compared to more targeted methods, such as applying fertiliser close to the plant stems.

Feedback

Table 1 Feedback and recommendations on the requirements for fertiliser application methods for sugarcane.

Suggestion	Recom-mended?	Rationale
Clarify and amend the requirements for aerial application of fertiliser to allow the use of aircrafts (such as drones) at any time for foliar application (i.e., applying fertiliser to the leaves), while application of granular fertiliser by air remains restricted to when it is not practical to use ground-based methods. Some drone models can apply fertiliser to the leaves in a targeted manner, such as via 3D mapping. However, as drones are classified as aircraft, they are subject to the same restrictions under the standard as planes and helicopters. Requirements for aerial application of fertiliser are difficult to understand as they are set via the definition for broadcast application (used in SC1) and aerial broadcast application (used in the definition of broadcast application).	Yes*	**Meets criteria 1 and 2** – The changes allow for innovation that may reduce the risk of fertiliser run-off and will make the documents easier to use. **Benefit for producers** **Moderate change**
Clarify the definition of broadcast application. It is not clear whether the following application methods are allowed: foliar (applying directly to plant leaves), fertigation (applying through an irrigation system) and side-dressing (applying to the side of plant stems).	Yes*	**Meets criteria 1** – The changes will make the documents more user-friendly. **Benefit for producers** **Minor change**

* If supported by the Queensland Government, the recommended suggestions will be used to develop proposed changes to the standard. The changes must be implemented via a regulatory process, in accordance with Chapter 5A of the *Environmental Protection Act 1994*, which includes public consultation.

Scientific evidence

While the SCS assessed the below nutrient management practices, the available evidence does not yet allow any conclusions to be drawn about the benefits of these practices for water quality and associated economic costs (Thorburn et al. 2024, Question 4.6 of the SCS). It is therefore recommended to maintain current requirements around fertiliser application methods under the standard, which reflect widely accepted minimum practices. Some minor changes to requirements are recommended based on industry knowledge and suggestions for improvements (see Table 1 and recommendations 1.1 and 1.2).

Enhanced efficiency fertilisers were found to reduce nitrogen losses in some situations (Thorburn et al. 2024, Question 4.6 of the SCS). These fertilisers can maintain nitrogen in the soils for longer and in a less mobile form than conventional (urea-based) fertiliser, potentially allowing crops to take up nitrogen over an extended period. However, the benefits of enhanced efficiency fertilisers were variable across sites and years. There is limited evidence quantifying the benefits of enhanced-efficiency fertilisers in reducing dissolved inorganic nitrogen losses. It is not yet feasible to provide a simple, industry-wide recommendation for the use of enhanced efficiency fertilisers.

There was a lack of information on the effect of **improved irrigation practices** on nutrient run-off (Thorburn et al. 2024, Question 4.6 of the SCS). While well-designed automated furrow irrigation systems on sugarcane farms were found to be profitable, water quality outcomes were not clear.

Preliminary evidence showed **sub-surface application of fertiliser** reduced the loss of dissolved phosphorus, but results for nitrogen losses were mixed (Thorburn et al. 2024, Question 4.6 of the SCS). Similarly, there was lack of information about other practices aimed at reducing nutrient losses, including **crop residue management** and **improved farming systems** (e.g., growing fallow crops, reduced tillage).

Recommendations

DETSI recommends the following suggestions are used to develop proposed changes to the requirements on fertiliser application methods in the sugarcane standard:

1.1 Clarify and amend the current restrictions for applying fertiliser using aircrafts to allow foliar application of fertiliser at any time, while application of granular fertiliser by air remains restricted to when it is not practical to use ground-based methods.

1.2 Clarify the definition of broadcast application.

Erosion and sediment control

Overview of requirements

The *erosion and sediment control requirements* (SC3 to SC5) for sugarcane aim to minimise soil loss and surface water run-off by requiring producers to implement erosion and sediment control measures, including measures to adequately cover the surface of fallow blocks[2]. These measures also reduce the export of particulate nutrients.

SC3 is outcomes-focused with producers able to implement any erosion and sediment control measures, such as sediment traps and sugarcane trash, to achieve the outcome of minimising soil loss and surface water run-off. This provides producers the flexibility to implement measures that are appropriate to their circumstances (e.g. landscape, management practices, weather).

SC4 prescribes that a cover crop or sugarcane trash must be in place to provide adequate surface cover.

SC5 allows for a prescribed methodology for the harvesting of sugarcane trash to be developed, if required due to increasing demand for sugarcane trash for commercial uses, such as to produce biofuels. Green trash blanketing is an important erosion and sediment control method, and the intent of a prescribed methodology would be to ensure sufficient sugarcane trash remains on the property after harvest for adequate ground cover.

Feedback

Table 2 Feedback and recommendations on the requirements for erosion and sediment control for sugarcane.

Suggestion	Recom-mended?	Rationale
Revise SC4 and the associated definitions to: • Focus on the outcome of having adequate surface cover for all fallow blocks rather than prescribing that a cover crop or sugarcane trash must be in place. • Clarify that short periods of reduced cover are allowed for necessary land management practices (such as laser leveling and establishing beds). • Clarify that producers can replant in less than six months when necessary (e.g. due to late harvesting or wet weather) and how the requirements apply in these circumstances.	Yes*	**Meets criteria 1 and 2** – The changes will make the documents more user-friendly and provide producers the flexibility to implement different methods to achieve adequate surface cover. **Benefit for producers** **Minor change**

* If supported by the Queensland Government, the recommended suggestions will be used to develop proposed changes to the standard. The changes must be implemented via a regulatory process, in accordance with Chapter 5A of the *Environmental Protection Act 1994*, which includes public consultation.

[2] Fallow blocks are areas of land that are typically used to grow sugarcane but are intentionally left without sugarcane for a period, often to improve soil health. The formal definition in the sugarcane standard is 'An area of land that is typically used to grow sugarcane, and that is left with either grass/weedy cover, green manure or a leguminous crop (i.e., crop or ground cover with low or no nitrogen demand) for a period of at least six months. The fallow period begins on the harvest date of the previous sugarcane crop.'

Scientific evidence

The sediment and erosion control requirement (SC3) under the sugarcane standard is outcome-focused and hence does not prescribe management practices. The examples of management practices provided under the advice note to SC3 are consistent with the findings of the SCS outlined below and changes to the examples are therefore not required.

The SCS identified water furrows and plant blocks as the most important sources of sediment in sugarcane land (Bartley and Murray 2024, Question 3.5 of the SCS). The gradual **elimination of water furrows** by laser-levelling was estimated to reduce sediment export by as much as 20 percent but is significantly more expensive than other options.

Land with a slope greater than 1 percent was associated with an increased risk of erosion (Bartley and Murray 2024, Question 3.5 of the SCS). **Contour banks** and conservation structures were found to be effective at reducing erosion under such circumstances.

Zero tillage (i.e., low soil disturbance) and **controlled traffic farming** (i.e., dedicated wheel tracks) were found to have good water quality outcomes as well as improved production outcomes across different soils and mechanisation systems (Bartley and Murray 2024, Question 3.5 of the SCS).

Repairing or revegetating eroding drain banks were effective at reducing run-off but were associated with a net production cost, as were **sediment traps** and riverbank and **streambank stabilisation** (Bartley and Murray 2024, Question 3.5 of the SCS). **Grass and tree buffers** of 4 - 6 metres can reduce sediment loss by more than 50 percent.

The management practices outlined above provide examples of measures that producers may implement to meet the sediment and erosion control requirement (SC3). Since SC3 is an outcome-focused requirement, it enables producers to choose measures that are appropriate for their individual circumstances.

Green sugarcane trash blanketing on fallow blocks was found to significantly reduce run-off, soil loss and the loss of particulate nutrients (Bartley and Murray 2024, Question 3.5 of the SCS). Green sugarcane trash blanketing was also associated with a likely net production benefit for producers. **Ground cover** of approximately 50 percent was found to reduce soil loss by an order of magnitude. These findings around green sugarcane trash blanketing and ground cover support the requirements under the standard to maintain adequate surface cover on fallow blocks (SC4) and a prescribed methodology for the harvesting of sugarcane trash, if required in the future (SC5).

Recommendations

DETSI recommends the following suggestion is used to develop proposed changes to the erosion and sediment control requirements in the sugarcane standard:

1.3 Revise SC4 and the associated definitions to improve clarity and focus on outcomes.

Nitrogen and phosphorus budget

Overview of requirements

The *nitrogen and phosphorus (N&P) budget requirements* (SC6 to SC19) aim to minimise the loss of excess nutrients to waterways and optimise yield by requiring an N&P budget. The budget is used to calculate the annual application rate of nitrogen and phosphorus (in kilograms per hectare per year) using soil test data and the SIX EASY STEPS® method, which is the industry standard. All nitrogen and phosphorus applied to plant and ratoon blocks (not fallow blocks) must be included in the N&P budget, regardless of the application method(s) used.

The N&P budget must be developed/updated and verified every five years by an appropriate person or a producer if they are accredited under the Smartcane Best Management Practice (BMP) program. Producers can become an appropriate person by completing a recognised training program, such as the free, self-paced online course by Sugar Research Australia. Once accredited by the course, producers are allowed to develop and verify N&P budgets for their own farms, saving costs associate with professional advice.

Producers must also update the N&P budget annually prior to fertilising.

Feedback

Table 3 Feedback and recommendations on the requirements for the N&P budget for sugarcane.

Suggestion	Recom-mended?	Rationale
Amend SC6 to extend the validity of soil tests from 12 months to 18 months. The best time to take a soil sample is straight after harvesting the last ratoon crop before the soil is cultivated, as this will give the most accurate nutrient analysis (Sugar Research Australia, 2022). However, producers may not be able to plant within 12 months due to weather events or a cover crop.	Yes*	**Meets criteria 2** – This change will allow producers to use the same soil test to improve fallow management and provide time to respond to unforeseen weather events. This change is unlikely to increase risk to water quality as the soil properties that are relevant to the standards (i.e., organic carbon, BSES (acid) extractable phosphorus, phosphorus buffer index (PBI)) are unlikely to change significantly within 18 months. **Benefit for producers** **Moderate change**
Revise the phosphorus requirements for alkaline soils in the Prescribed methodology once Sugar Research Australia's research is complete in June 2027. The current method of analysing soils to determine how much phosphorus is available for plant uptake is calibrated to acidic soils and may overestimate the available phosphorus in neutral to alkaline soils (which are common in the Burdekin). In the meantime, clarify that the Prescribed methodology recognises this limitation and allows the amount of phosphorus that can be applied for neutral to alkaline soils to be adjusted in accordance with professional advice.	Yes*	**Meets criteria 3** – Sugar Research Australia is undertaking research to develop a calibrated method for neutral to alkaline soils. The requirements should be reviewed once the research results are available after June 2027. **Benefit for producers** **Moderate change**
Provide a voluntary register of appropriate persons to support producers access professional advice.	No	**Out of scope** – Between 2019 to 2022, the Queensland Government provided support for producers to access professional advice via a rebate and register of advisors. Both were discontinued in 2022 due to low use. **Alternatives to help address issue:** • Clarify who can be considered an appropriate person (*recommendation 1.6*). • Continue to support industry to build producer capacity to develop, review and verify their own N&P budget (*recommendation 1.7*).
Remove the requirement to have an N&P budget, reduce how frequently budgets must be updated, and/or provide simple alternatives that do not require soil testing, such as fixed fertiliser application rates. These suggestions are to address concerns about: • The difficulties some producers have with understanding N&P budgets. • The cost* and shortage of professional advisors available to develop, review and update N&P budgets. • The cost of soil tests.	No	**Out of scope / inconsistent with criteria 2** – N&P budgets, including soil tests, are minimum practice and provide flexibility for producers to tailor application rates to the crop requirements (see other considerations for further information). Annual updates of the N&P budget are necessary because farms change each year, e.g. a plant block will become a ratoon block in the next year. **Alternatives to help address issue:** • Continue to support industry to build producer capacity in this area through the Smartcane

Suggestion	Recom-mended?	Rationale
• While growers can review their own N&P budget each year, some find it challenging or too time consuming to do without the help of an agronomist. • Some find it difficult to understand who an appropriate person is and how to become an appropriate person. • Some believe the N&P budgets are not useful to producers. * Personal communication with industry stakeholders indicates that the cost of an agronomist to develop an N&P budget is between $3000 to $5000.		BMP Program and recognised growers' training programs such as the free SIX EASY STEPS® online nutrient management training (delivered by Sugar Research Australia) (*recommendation 1.7*).
Amend the nitrogen and phosphorus application rates. Proposals included: • Provide a buffer (e.g. up to 10 percent) to allow small exceedances of the whole of farm amount for nitrogen and phosphorus. Some producers find it difficult to precisely comply with the whole of farm amount due to variations in equipment set up and fertiliser composition. They worry DETSI will undertake enforcement action against them for minor, unintended exceedances. • Increase or remove the phosphorus application rates. Some producers find it difficult to manage phosphorus application rates using standard fertiliser blends and noted using customised blends increases costs. Others assert that phosphorus regulation is not scientifically justified and is unnecessary, stating that phosphorus originates from sediment erosion, not fertiliser run-off, and its impact on Reef health is poorly understood. • Increase the nitrogen application rates so producers can fertilise stand-over cane (i.e., sugarcane left unharvested at the end of the harvest season that will be harvested in the following season or destroyed). Stand-over sugarcane is increasing in farming operations due to seasonal changes and season length delays and there is no allowance of nitrogen for stand-over sugarcane. • Amend the requirement to reduce nitrogen and phosphorus application rates after mill mud (a by-product of sugarcane milling) is used. Some stakeholders wanted the requirement removed stating mill mud provides soil health benefits, while others wanted the deductions increased.	No	**Inconsistent with criteria 2 and 3** – These proposals would increase the risk of nutrient run-off and would reduce flexibility for producers. Of note: • As the amount of nitrogen and phosphorus is calculated across the whole farm, there are multiple opportunities to refine application rates and remain within the whole of farm amount. • While the origins, levels and impacts of phosphorus on the Reef are not as well understood as for nitrogen, the available evidence is sufficient to support the regulation of phosphorus based on the precautionary principle (see also section 4 broader matters). • Producers can apply fertiliser to stand-over sugarcane, but they must reduce fertiliser elsewhere to stay within the farm's maximum limit. Applying nitrogen to stand-over sugarcane provides little to no yield benefit[3] and increases the risk of run-off. • The requirements recognise that mill mud contains high levels of nutrients and the deductions are evidence based. • Deductions for cover crops are not included in the requirements because the effect of cover crops on nitrogen and phosphorus in the soil can be highly variable. **Alternatives to help address issue:** • Update the guidance on N&P budgets to help producers not exceed the whole of farm amount (*recommendation 1.6*). • Make readily available materials that explain the purpose of, and process for, compliance visits and how DETSI considers natural disasters, events and personal circumstances of producers when planning compliance visits (*recommendation 4.1*).

[3] Sugar Research Australia Limited 2022 edition of the *Australian Sugarcane Nutrition Manual*, first published in 1994 by BSES Limited.

Suggestion	Recom-mended?	Rationale
• Reduce fertiliser application rates following a cover crop due to the high nutrient levels of some cover crops.		• Clarify the guidance on stand-over sugarcane (*recommendation 1.6*).
In the Burdekin, allow the higher baseline nitrogen rate to be used when a farm has been purchased. A farm may have been underperforming under a previous owner. The new owner should be able to improve yield by applying the higher baseline nitrogen application rate.	No action required	The N&P budget provides the flexibility for a producer to apply a higher amount on a block than the baseline block application rate as long as the whole of farm amount is not exceeded (i.e., they would need to reduce the amount on other blocks). [The Burdekin district has two baseline application rates (190 and 220 kilograms of nitrogen per hectare). The higher baseline application rate can only be used where records show that yields have been higher than 150 tonnes per hectare in at least three harvest periods.]
Allow the nutrient application rates to be adjusted based on professional agronomic advice and validated planning tools, such as the SIX EASY STEPS® methodology. The application rates for nitrogen and phosphorus are rigid and do not allow for adaptive nutrient management, and fail to account for improvements in agronomy, technology, or seasonal variability.	No action required	Producers are already allowed to identify opportunities to refine their nutrient application rates using the SIX EASY STEPS® Toolbox. Producers may also have other methods or property specific information or advice to guide the refinement of rates. It is important that producers record where and why they have refined their rates.
Update the nitrogen and phosphorus application rates to incorporate the latest evidence. The regulated rates are based on research that is over 15 years old.	No action required	The latest evidence was considered as part of the review and did not warrant changes to be recommended to the application rates. The nitrogen application rates are well supported by scientific evidence (Thorburn et al. 2024, Question 4.6 of the SCS). While there is a lack of scientific studies examining the effectiveness of the phosphorus application rates, they are based on SIX EASY STEPS® and are consistent with minimum practices.
Revise the standard to account for differences across regions and farms, e.g. soils, climate and farming practices. The current requirements impose a uniform approach across the Reef catchments.	No action required	The standard contains minimum industry practices that provide flexibility to account for regional and site-specific differences. For example, the N&P budget is based on the SIX EASY STEPS®, which is a site-specific approach to nutrient management and is the accepted industry standard. The N&P budget further allows producers to vary the application rates of nitrogen and/or phosphorus freely across their farm to account for specific circumstances as long as the whole of farm amount is not exceeded.
Parts of the N&P budget requirements are difficult to understand: • Remove duplication of requirements for different regions. • Include a definition for 'harvest'. • Revise SC16 and/or the definition of appropriate person to make it clearer under what circumstances producers can develop and verify N&P budgets.	Yes*	**Meets criteria 1** – The changes will make the documents more user-friendly. **Benefit for producers** **Minor change**

Suggestion	Recom-mended?	Rationale
• Clarify that the amount of phosphorus that can be applied for neutral to alkaline soils can be adjusted in accordance with professional advice. • Clarify that 10 kilograms phosphorus per hectare can be applied to plant crops (but not included in the N&P budget) where the method determines an application rate of less than 10 kilograms of phosphorus per hectare. • Clarify that for ratoon crops planted prior to 1 December 2022, it is an option to use soil tests of these blocks to determine phosphorus application rates. • Clarify guidance on fertilising stand-over sugarcane. • Clarify when/how crop yields are used i.e., historical yields (from the past 15 years) are used to increase the baseline nitrogen application rate in the Burdekin only; they are not used to reduce rates. • Clarify that the N&P budget can be updated more often than annually if required due to changes. • Clarify how the requirements apply if a paddock is used for different crops, including that the N&P budget does not apply to cover crops.		

* If supported by the Queensland Government, the recommended suggestions will be used to develop proposed changes to the standard. The changes must be implemented via a regulatory process, in accordance with Chapter 5A of the *Environmental Protection Act 1994*, which includes public consultation.

Scientific evidence

The findings of the SCS support the requirements under the standard for the application of nitrogen. There was clear evidence that reducing **nitrogen fertiliser application rates** reduces the run-off of nitrogen to waterways (Thorburn et al. 2024, Question 4.6 of the SCS). Nitrogen applications to sugarcane above SIX EASY STEPS® results in avoidable nitrogen loss (unless nitrogen uptake can be increased), increases the cost of production and generally reduces economic returns, while application rates below SIX EASY STEPS® may reduce productivity. The SCS outlined the complex interactions between climate, soils, crop start times and seasonal climate effects and their effects on yield. These findings highlight the importance of tailoring nitrogen application rates to the requirements of a particular crop to ensure optimum application rates.

Mill mud contains substantial amounts of nitrogen and phosphorus (Thorburn et al. 2024, Question 4.6 of the SCS). However, the SCS found a lack of information on the impact of mill mud applications on discharge of dissolved inorganic nitrogen and dissolved phosphorus. Only one study was identified that investigated the nitrogen and phosphorus losses through run-off (leaching losses were not measured) and found that mill mud applications did not increase dissolved inorganic nitrogen losses, but increased phosphorus losses. In the absence of further information, using the precautionary principle, it is not recommended to amend current deductions for mill mud applications. Deductions required for mill mud applications under the standard are lower than under SIX EASY STEPS®, reflecting more conservative values consistent with minimum practices.

While it is well established that some **cover (and fallow) crops**, such as legumes, can contain high amounts of nitrogen (Thornburn et al. 2024, Question 4.6 of the SCS), there is insufficient information available to be able to introduce requirements around deductions for cover (and fallow) crops to the standard.

The SCS found limited information about the effects of management practices on the loss of **phosphorus** or the effects of phosphorus application rates on crop productivity or profitability (Thorburn et al. 2024, Question 4.6 of the SCS). However, some evidence suggested that reducing the application of phosphorus reduces the run-off of dissolved phosphorus. Phosphorus availability can become a limiting factor for marine phytoplankton growth at certain times and locations

(Robson et al. 2024, Question 4.1 of the SCS). Based on the limited availability of information about the effects of phosphorus on marine ecosystems (see part 4 *broader matters*), and using the precautionary principle, it is recommended to maintain current requirements around phosphorus application rates under the standard, which are based on SIX EASY STEPS® and are consistent with minimum practices.

Recommendations

DETSI recommends the following suggestions are used to develop proposed changes to the N&P budget requirements in the sugarcane standard:

1.4 Amend SC6 to extend the validity of soil tests from 12 months to 18 months.

1.5 Revise the phosphorus requirements for alkaline soils in the Prescribed methodology once Sugar Research Australia's research is complete in June 2027. In the meantime, clarify that the Prescribed methodology recognises this limitation and allows the amount of phosphorus that can be applied for neutral to alkaline soils to be adjusted in accordance with professional advice.

1.6 Revise N&P budget requirements for clarity.

1.7 It is also recommended to continue to support industry to build producer's capacity to develop, review and verify their own N&P budget and to implement best management practices.

Record keeping

Overview of requirements

The *record keeping requirements* (SC20 to SC25) and appendices 1 to 4 require producers to make and keep records. DETSI uses the records during inspections to assess whether activities being undertaken on the property are in accordance with the standard conditions. Key information that must be recorded includes fertiliser and mill mud (and mill mud/mill ash mix) applications, fertiliser application methods, details of the N&P budget, and details of the property and person. Records must be made within three business days and must be kept for six years, alongside relevant primary documents (such as fertiliser tax invoices).

Feedback

Table 4 Feedback and recommendations on the record keeping requirements for sugarcane.

Suggestion	Recommended?	Rationale
Provide voluntary templates or worked examples of the record keeping requirements. Some producers find the requirements onerous and difficult to understand.	Yes*	**Meets criteria 1** – The changes will make record keeping easier. **Benefit for producers** **Minor change**
Extend the timeframe for making a record from three business days to five business days. For some producers, three business days is too short and does not align with farming practices.	Yes*	**Meets criteria 2** – Extending the timeframe to five business days will better align with farming practices. It is also consistent with the timeframe under the *Environmental Protection Act 1994* that professional advisers have to record advice they provide to producers about complying with the standards. **Benefit for producers** **Moderate change**
Reduce the timeframe for keeping records from at least six years to two to reduce producers' administrative burden.	Yes*	**Meets criteria 2** – Consistent with the majority of chemical record keeping requirements which are a minimum of two years.

Suggestion	Recommended?	Rationale
		Some producers will need to keep records for a longer period. For example, if a producer wants to apply phosphorus at higher rates to a block through the crop cycle[4], records of the amount of phosphorus applied during that period (i.e., five years) is required. In the Burdekin, to justify the higher baseline nitrogen application rate, yield records or other reasonable evidence for the past 15 years is required[5]. **Benefit for producers** **Moderate change**
Remove duplication of requirements for different regions and streamline appendices.	Yes*	**Meets criteria 1** – The changes will make the documents more user-friendly. **Benefit for producers** **Minor change**
Clarify that records can be in any form (such as hand-written notes in a diary) and that data does not need to be transferred to a formal format, such as an Excel spreadsheet. As it is not sufficiently clear that records can be in any form, producers are often making more extensive records than required under the standard.	Yes*	**Meets criteria 1 –** The changes will make the documents more user-friendly. **Benefit for producers** **Minor change**
Remove or significantly reduce the record keeping requirements to reduce administrative burden. Some producers find the record keeping requirements onerous and difficult to understand.	No	**Inconsistent with criteria 2** – Record keeping is a minimum practice and essential for producers and DETSI to understand compliance with the sugarcane standard. **Alternatives to help address issue:** • Clarify record keeping by removing duplication of requirements and streamlining appendices (*recommendation 1.11*). • Reduce the minimum record keeping period (*recommendation 1.10)*.

* If supported by the Queensland Government, the recommended suggestions will be used to develop proposed changes to the standard. The changes must be implemented via a regulatory process, in accordance with Chapter 5A of the *Environmental Protection Act 1994*, which includes public consultation.

Recommendations

DETSI recommends the following suggestions are used to develop proposed changes to record keeping requirements in the sugarcane standard:

1.8 Provide voluntary templates or worked examples of the record keeping requirements.

1.9 Extend the timeframe for making a record from three business days to five.

1.10 Reduce the timeframe for keeping records from at least six years to two to reduce producers' administrative burden.

1.11 Remove duplication of requirements for different regions and streamline appendices.

[4] See page 32 of the Prescribed methodology for sugarcane cultivation, Version 2.
[5] See page 25 of the Prescribed methodology for sugarcane cultivation, Version 2.

4. Banana standard

Banana cultivation and horticulture cover 0.2 percent of the Reef catchment and contribute around 1 percent of the total fine sediment load and 1 percent of total exports of dissolved inorganic nitrogen flowing to the Reef (Bartley and Murray 2024 Question 3.5 and Prosser and Wilkinson 2024, Question 4.4 of the SCS).

The requirements in the in the Agricultural Environmentally Relevant Activity standard for banana cultivation (banana standard) focus on retaining nitrogen, phosphorus and sediment on-farm to minimise losses and improve water quality. The banana standard is supported by requirements in the Prescribed methodology for banana cultivation and guidance on how to comply in the Erosion and sediment control guide and the Fertiliser placement guide.

Nitrogen and phosphorus application

Overview of requirements

Standard conditions 1 to 8 minimise the loss of nutrients to waterways by outlining threshold rates for the application of nitrogen and phosphorus fertiliser. The threshold rates can only be exceeded if a Nutrient Management Plan is developed and the increased rates are justified by leaf tests. The threshold rate for nitrogen is lower during the plant stage (280 kilograms per hectare per year) than the ratoon stage (400 kilograms per hectare per year) because there is a higher risk of nutrient run-off during this stage. An appropriate person must develop/update and verify the Nutrient Management Plan every five years.

Feedback

Table 5 Feedback and recommendations on the requirements for nitrogen and phosphorus application for bananas.

Suggestion	Recom-mended?	Rationale
Further investigate phosphorus requirements for bananas and, until then, allow the threshold rates for phosphorus to be adjusted in accordance with professional advice. Preliminary research indicates that the level of phosphorus in leaves as shown by leaf tests is not a reliable predictor of whether additional phosphorus is required. There is no alternative method (e.g. calibrated soil test) currently.	Yes*	**Meets criteria 2 and 3** – Allowing adjustments to threshold rates based on professional advice provides flexibility for producers in the short-term while a longer term approach is investigated. **Benefit for producers** **Moderate change**
Revise the nitrogen threshold rate for plant crops, including reviewing: • The duration (e.g. shorten from 12 months to 6 months with a corresponding reduction in the rate). • When it commences (e.g. from when fertiliser is first applied to the day of planting). • How the rate applies if the plant crop transitions into a ratoon crop. These suggestions are to address: • Producers are concerned that the nitrogen threshold rate for plant crops (which is lower than the rate for ratoon crops) may constrain productivity because it is too low for this critical stage of growth. • The current requirements incentivise the application of fertiliser: 1) prior to planting because this fertiliser does not count towards	Yes*	**Meets criteria 1 and 2** – Options should be identified and evaluated in collaboration with industry experts and stakeholders to ensure concerns are addressed without increasing the risk to water quality. **Benefit for producers** **Moderate change**

Suggestion	Recom-mended?	Rationale
the threshold rates and 2) as soon as possible after planting to "start the clock" on the 12-month period until the higher rate for ratoon crops can be used. • It is not obvious that the threshold rates for plant crops apply for the entire 12 months regardless of whether the plant crop transitions into a ratoon crop.		
Standardise nitrogen threshold rates for plant and ratoon crops. Some producers have difficulties applying different rates and may need to upgrade their equipment or infrastructure to do so.	No	**Inconsistent with criteria 2** – Tailoring application rates to crop requirements is minimum practice. **Alternatives to help address issue:** • Revise the nitrogen threshold rate for plant crops (*recommendation 2.2*).
Provide a buffer (for example, tolerance of up to 10 percent exceedance of the threshold rates). Some producers find it difficult to precisely comply with the threshold rates due to variations in equipment and fertiliser composition. They are concerned that DETSI will undertake enforcement action against them if they (accidentally) exceed threshold rates by a small amount.	No	**Inconsistent with criteria 2** – Providing an increased tolerance for exceedances of threshold rates would increase risk of nutrient run-off. **Alternatives to help address issue:** • Update the guidance to help producers ensure they do not exceed the threshold rates due to variations in equipment and fertiliser composition (*recommendation 2.3*). • Make readily available materials that explain the purpose of, and process for, compliance visits and how DETSI considers natural disasters, events and personal circumstances of producers when planning compliance visits (*recommendation 4.1*).
Remove or increase the phosphorus application rates. Some producers find it difficult to manage phosphorus application rates using standard fertiliser blends and using customised blends increases costs.	No	**Inconsistent with criteria 2** – Tailoring application rates to crop requirements is minimum practice.
Requirements around the application of nitrogen and phosphorus are difficult to understand: • Remove the reference in SC1 to the methodology for calculating annual application rates (method does not exist). • Amend SC2 to clarify that a Nutrient Management Plan does not need to be in place prior to applying fertiliser (i.e., it must be in place prior to exceeding threshold rates). • Clarify that a Nutrient Management Plan does not need to be updated or verified by an appropriate person in years when threshold rates are not exceeded. • Clarify in the Prescribed methodology the individual steps for developing a Nutrient Management Plan. • Ensure the use of the terms 'year' and 'annual' is consistent throughout the banana standard, with year meaning calendar year unless otherwise defined.	Yes*	**Meets criteria 1** – The changes will make the documents more user-friendly. **Benefit for producers** **Minor change**

* If supported by the Queensland Government, the recommended suggestions will be used to develop proposed changes to the standard. The changes must be implemented via a regulatory process, in accordance with Chapter 5A of the *Environmental Protection Act 1994*, which includes public consultation.

Scientific evidence

The SCS highlighted the lack of studies examining management practices for banana cultivation (Thorburn et al. 2024, Question 4.6 of the SCS). While there were only a small number of studies available, evidence suggested that **reducing nitrogen applications** results in reduced nitrogen loss and economic benefits. Some evidence was identified that **reducing the application of phosphorus** also reduces the run-off of dissolved phosphorus. In the absence of further scientific information, it is recommended to work with industry to address concerns over the potential impact of the current nitrogen application rate for plant crops on productivity (see *recommendation 2.2*). Using the precautionary principle, it is recommended to maintain the nitrogen application rate for ratoon crops and the phosphorus application rate for plant and ratoon crops, which reflect accepted minimum practices.

Recommendations

DETSI recommends the following suggestions are used to develop proposed changes to nitrogen and phosphorus application requirements in the banana standard:

2.1 Further investigate phosphorus requirements for bananas and, until then, allow the threshold rates for phosphorus to be adjusted in accordance with professional advice.

2.2 Revise the nitrogen threshold rate for plant crops, including reviewing the duration, when it commences and how the rate applies when the plant crop transitions into a ratoon crop.

2.3 Revise requirements around the application of nitrogen and phosphorus to improve clarity.

Fertiliser application methods

Overview of requirements

Standard conditions 9 and 10 minimise the unintentional loss of fertiliser by regulating how fertiliser is applied:

- Application of nitrogen fertiliser to an entire block (i.e., broadcast application) is not allowed.
- Broadcast application of phosphorus fertiliser is only allowed in preparation for a plant crop if it is incorporated into the soil within three business days.

Broadcast application using an aircraft is allowed if it is not practical to use ground-based methods (e.g. following significant rainfall).

Feedback

Table 6 Feedback and recommendations on the requirements for fertiliser application methods for bananas.

Suggestion	Recom-mended?	Rationale
Clarify and amend the current restrictions for applying fertiliser using aircrafts, i.e., allow foliar application of fertiliser using aircrafts (such as drones) at any time, while application of granular fertiliser by air remains restricted to when it is not practical to use ground-based methods.	Yes*	**Meets criteria 1 and 2** – Foliar application of fertiliser via aircraft is considered of equal or lower risk than ground-based application of fertiliser. Clarifying the restrictions on aerial fertiliser application (e.g. by including the requirements in a standard condition) will make the documents easier to use. **Benefit for producers** **Moderate change**
To further reduce the risk of fertiliser run-off, amend the requirements to:	No	**Inconsistent with criteria 2** – The purpose of the standard is to ensure minimum practices are in

Suggestion	Recom-mended?	Rationale
• Regulate irrigation. • Regulate the frequency and timing of fertiliser application. • Require fertiliser to be placed subsurface only.		place that retain nitrogen, phosphorus and sediment on farm. The standard focuses on setting the outcomes that must be achieved, rather specifying how the outcomes are to be met. The suggested practices are beyond minimum practices and would reduce flexibility for producers. **Alternatives to help address issue:** • Allow foliar application by air at any time (*recommendation 2.4*).
Requirements around fertiliser application methods are difficult to understand: • Better explain the term 'broadcast application' to avoid confusion, given industry use this term to refer to the application of granular fertiliser. • Clarify that aerial application of fertiliser contributes towards the threshold rates. • Clarify that foliar application is allowed.	Yes*	**Meets criteria 1** – The changes will make the documents more user-friendly. **Benefit for producers** **Minor change**

* If supported by the Queensland Government, the recommended suggestions will be used to develop proposed changes to the standard. The changes must be implemented via a regulatory process, in accordance with Chapter 5A of the *Environmental Protection Act 1994*, which includes public consultation.

Scientific evidence

The SCS identified no studies relevant to the requirements around fertiliser application methods under the banana standard (Thorburn et al. 2024, Question 4.6 of the SCS). While requirements around fertiliser application methods under the standard have not yet been scientifically evaluated in terms of their effectiveness, the requirements are based on accepted minimum practices. Some changes to requirements are recommended based on industry knowledge and suggestions for improvements (see Table 6 and *recommendations 2.4* and *2.5*).

Recommendations

DETSI recommends the following suggestions are used to develop proposed changes to the fertiliser application requirements in the banana standard:

2.4 Clarify and amend the current restrictions for applying fertiliser using aircraft to allow foliar application of fertiliser at any time, while application of granular fertiliser by air remains restricted to when it is not practical to use ground-based methods.

2.5 Revise requirements around fertiliser application methods and associated definitions to improve clarity.

Erosion and sediment control

Overview of requirements

Standard conditions 11 to 13 ensure minimum practices are implemented to reduce soil erosion. These measures also reduce the loss of particulate nutrients. Plant blocks and inter-rows of ratoon blocks must have at least 60 percent covered ground by the start of the wet season and fallow blocks must have adequate ground cover. Standard condition 14 requires producers to implement erosion and sediment control measures in areas of high risk of erosion. The selection of appropriate measures is left to the discretion of producers.

Feedback

Table 7 Feedback and recommendations on the requirements for erosion and sediment control for bananas.

Suggestion	Recom-mended?	Rationale
Improve the examples of erosion and sediment control measures provided under the advice note to SC14 to reflect the latest scientific evidence and industry knowledge, including the outcomes of the Banana Industry Erosion and Sediment Control Management engagement project.	Yes*	**Meets criteria 3** – The changes will ensure the examples under SC14 are based on the latest evidence and industry understanding. **Benefit for producers** **Minor change**
To further reduce soil erosion, the banana standard should require: • Controlled traffic farming. • Zero tillage. • Use of native species only as ground cover.	No	**Inconsistent with criteria 2** – The purpose of the standard is to ensure minimum practices are in place across the Reef catchment. The standard focuses on setting the outcomes that must be achieved, rather than specifying how the outcomes are to be met. The suggested practices are beyond minimum standard and would reduce flexibility for producer. **Alternatives to help address issue:** • Improve the examples of measures under SC14 (*recommendation 2.6*).
Remove or relax the ground cover requirements in inter-rows and on fallow blocks. It can be difficult to meet these requirements due to weather constraints or other factors (such as shade in narrow inter-rows not supporting the growth of grass).	No	**Inconsistent with criteria 2** – Ground cover requirements under the banana standard are essential to decrease the risk of sediment run-off. Producers have flexibility to use whichever measures suit their circumstances. The Reef compliance program takes weather events into consideration. **Alternatives to help address issue:** • Improve the examples of measures under SC14 (*recommendation 2.6*). • Make readily available materials that explain the purpose of, and process for, compliance visits and how DETSI considers natural disasters, events and personal circumstances of producers when planning compliance visits (*recommendation 4.1*).
Parts of erosion and sediment control requirements are difficult to understand: • Clarify and expand the definition of covered ground to include alive, dead and other objects. • Clarify that short periods of bare soil on fallow blocks are allowed for necessary land management practices, such as laser leveling. • Clarify SC13, including the definition of fallow and adequate covered ground.	Yes*	**Meets criteria 1** – The changes will make the documents more user-friendly. **Benefit for producers** **Minor change**

* If supported by the Queensland Government, the recommended suggestions will be used to develop proposed changes to the standard. The changes must be implemented via a regulatory process, in accordance with Chapter 5A of the *Environmental Protection Act 1994*, which includes public consultation.

Scientific evidence

The SCS identified a lack of studies examining the effectiveness of erosion and sediment control practices for banana cultivation (Bartley and Murray 2024, Question 3.5 of the SCS). However, the SCS concluded that management practices tested on sugarcane lands may potentially provide water quality benefits for banana cultivation as well, including reducing tillage, controlled traffic farming, repairing or revegetating eroding banks, retaining ground cover and implementing soil conservation structures on lands with a greater than 1 percent slope.

DETSI is currently delivering a project to benchmark industry practices around erosion and sediment control for bananas and it is recommended that outcomes of the project will be considered, once available, to update the examples of management practices under the advice note to SC14 (see Table 7 and *recommendation 2.6*).

While the SCS did not identify any studies on the effects of ground cover on run-off on banana lands, there is strong evidence that ground cover reduces the run-off of sediment and particulate nutrients based on studies in sugarcane and grazing lands (Bartley and Murray 2024, Question 3.5 of the SCS). Using the precautionary principle, it is hence recommended to maintain requirements around ground cover in inter-rows, plant blocks and fallow blocks (SC11 to SC13), with minor changes based on suggestions for improvements by industry (see Table 7 and *recommendation 2.7*).

Recommendations

DETSI recommends the following suggestions are used to develop proposed changes to the erosion and sediment control requirements in the banana standard:

2.6 Improve the examples of erosion and sediment control measures provided under the advice note to SC14 to reflect the latest scientific evidence and industry knowledge, including the outcomes of the Banana Industry Erosion and Sediment Control Management engagement project.

2.7 Revise erosion and sediment control requirements and associated definitions to improve clarity.

Record keeping

Overview of requirements

The intent of the *record keeping requirements* SC15 to SC20 and appendices 1 and 2 is for producers to keep records to demonstrate activities being undertaken on the property are in accordance with the standard conditions. DETSI uses the records during inspections to assess whether the requirements have been complied with.

Key information that must be recorded includes fertiliser and mill mud (and mill mud/mill ash mix) applications, fertiliser application methods, details of the Nutrient Management Plan and details of the property and person. Records must be made within three business days and must be kept for six years, alongside relevant primary documents (such as fertiliser tax invoices).

Feedback

Table 8 Feedback and recommendations on the record keeping requirements for bananas.

Suggestion	Recom-mended?	Rationale
Provide voluntary templates or worked examples of the record keeping requirements to help reduce concerns that they are onerous and difficult to understand.	Yes*	**Meets criteria 2** – Will make record keeping easier. **Benefit for producers** **Minor change**
Extend the timeframe for making a record from three business days to five business days. For some producers, three business days for making records is too short and does not align with farming practices.	Yes*	**Meets criteria 2** – Extending the timeframe to five business days will better align with farming practices and is consistent with the timeframe under the *Environmental Protection Act 1994* for professional advisers to record advice they provide to producers about complying with the standards. **Benefit for producers**

Suggestion	Recom-mended?	Rationale
		Moderate change
Reduce the timeframe for keeping records from at least six years to two years to reduce administrative burden.	Yes*	**Meets criteria 2** – Consistent with most chemical record keeping requirements, which are a minimum of two years. **Benefit for producers** **Moderate change**
Remove or significantly reduce the record keeping requirements to reduce administrative burden. The requirements are too onerous.	No	**Inconsistent with criteria 2** – Record keeping is a minimum practice and essential for producers and DETSI to understand compliance with the banana standard. **Alternatives to help address issue:** • Clarify record keeping by removing duplication of requirements and streamlining appendices (*recommendation 2.11*). • Reduce the minimum record keeping period (*recommendation 2.10*).
Remove duplication of requirements for different regions and streamline appendices.	Yes*	**Meets criteria 1** – The changes will make the documents more user-friendly. **Benefit for producers** **Minor change**

* If supported by the Queensland Government, the recommended suggestions will be used to develop proposed changes to the standard. The changes must be implemented via a regulatory process, in accordance with Chapter 5A of the *Environmental Protection Act 1994*, which includes public consultation.

Recommendations

DETSI recommends the following suggestions are used to develop proposed changes to the record keeping requirements in the banana standard:

2.8 Provide voluntary templates or worked examples of the record keeping requirements to help reduce concerns that they are onerous and difficult to understand.

2.9 Extend the timeframe for making a record from three business days to five business days.

2.10 Reduce the timeframe for keeping records from at least six years to two years to reduce administrative burden.

2.11 Remove duplication of requirements for different regions and streamline appendices.

5. Beef cattle grazing standard

Beef cattle grazing is the dominant land use in the Reef catchment, accounting for over 70 percent of the total area. Grazing land contributes an estimated 60 percent of the total amount of fine sediment flowing to the Reef (Prosser and Wilkinson 2024, Question 3.3 of the SCS). Grazing lands also contribute 22 percent of the total dissolved inorganic nitrogen exports. Increased erosion from grazing lands contribute to nutrient export because particulate nutrients bound to sediment can transform to their dissolved form during transport.

The intent of the Agricultural Environmentally Relevant Activity standard for beef cattle grazing (grazing standard) is to implement measures to improve land condition and minimise erosion on pastures that are in poor or degraded condition. The grazing standard is supported by guidance on how to comply in the Grazing guide.

The grazing standard is an outcomes-based approach that limits the impact of regulation on well managed properties.

Ground cover and land condition

Overview of requirements

Standard conditions 1 and 2 require producers to implement measures to improve land condition if ground cover is less than 50 percent (but more than 20 percent) on 30 September each year. If ground cover is less than 20 percent on 30 September, producers are expected to implement measures to prevent land condition from further degrading.

Producers can implement any measures that achieve the intent, such as adjusting grazing pressure or establishing diversion banks. This provides producers the flexibility to choose measures that are appropriate to their circumstances (e.g. landscape, management practices, weather). Producers are not expected to remediate gullies given it may be impractical and cost prohibitive.

Feedback

Table 9 Feedback and recommendations on the requirements around ground cover and land condition on grazing lands.

Suggestion	Recom-mended?	Rationale
Revise the examples of measures to improve ground cover provided under the advice note to SC2 to reflect the latest knowledge.	Yes*	**Meets criteria 2 and 3** – This suggestion will ensure the examples under SC2 are based on the latest knowledge. **Benefit for producers** **Minor change**
Amend the standard and compliance approach to consider that producers may be unable to improve land condition due to various factors outside of their control, such as significant financial costs of remediation of gully complexes, flood damage, weed infestations etc.	Completed	The standard already considers certain factors are outside the control of producers and clearly states that producers are not required to remediate degraded land. If ground cover is less than 20 percent, producers are required to implement measures to prevent land condition from further degrading; they are not expected to improve degraded land condition or remediate gullies. The Reef compliance program takes natural disasters into consideration.
Do not use the extent of ground cover as an indicator of land condition as it is highly variable.	No	**Inconsistent with criteria 2** – The purpose of determining ground cover on 30 September each year is to ensure ground cover is sufficient before the wet season starts to prevent soil erosion through rainfall. Ground cover is a suitable indicator of land condition for the purpose of managing soil erosion under the standard. The standard already takes the variability of ground cover into account. **Alternatives to help address issue:** • Clarify the difference between ground cover and land condition in the standard and supporting materials (*recommendation 3.2*). • Make readily available materials that explain the purpose of, and process for, compliance visits and how DETSI considers natural disasters, events and personal circumstances of producers when planning compliance visits (*recommendation 4.1*).

Suggestion	Recom-mended?	Rationale
Explore alternative options to determine ground cover, such as long-term data collection. Determining ground cover on 30 September each year does not reflect the seasonal variability of ground cover.	No	**Inconsistent with criteria 2** – Determining ground cover on 30 September each year is suitable for the purpose of the standard, which is to ensure ground cover is sufficient before the wet season starts to prevent soil erosion through rainfall. Alternative options, such as long-term data collection, would introduce significant complexity and are unlikely to be practical for all producers. **Alternatives to help address issue:** • Clarify requirements (*recommendation 3.2*).
Amend the ground cover requirements to exclude weeds from contributing to ground cover and regulate weed management. Weeds are a significant problem.	No	**Inconsistent with criteria 2** – Weeds are considered ground cover for the purpose of the standard because weeds provide better protection from soil erosion than leaving the soil bare. Distinguishing between weeds and other types of ground cover under the standard would introduce significant complexity and would not be practical for all producers. The management of weeds to improve land condition is an acceptable measure to improve land condition under the standard. Weeds are regulated under the *Biosecurity Act 2014*.
Revise the standard to account for differences across regions and farms, e.g. soils, climate and farming practices. The current requirements impose a uniform approach across the Reef catchments.	No action required	The standard contains minimum industry practices that provide flexibility to account for regional and site-specific differences. The requirements under the grazing standard are outcome-focused and provide maximum flexibility to producers to implement management practices that are most appropriate for the individual characteristics of their properties. The grazing standard and guide further recognise some land types have low expected pasture densities for perennial pastures and may not achieve 50 percent ground cover even when the land is in good or fair condition.
Revise SC1 and SC2 and clarify the terms 'ground cover' and 'land condition'. Further: • Clarify the guidance around prioritising areas for improving land condition. • Clarify that managing fuel loads to reduce fire risk is an acceptable measure. • Remove obsolete commencement dates. • Update legislation references. • Simplify language.	Yes*	**Meets criteria 1** – It is not well understood that ground cover is a trigger to determine whether land improvement measures are required. It is sometimes misunderstood that properties with low ground cover are not compliant with the standard. Properties with low ground cover are compliant with the standard if measures are implemented to improve land condition. **Benefit for producers** **Minor change**

* If supported by the Queensland Government, the recommended suggestions will be used to develop proposed changes to the standard. The changes must be implemented via a regulatory process, in accordance with Chapter 5A of the *Environmental Protection Act 1994*, which includes public consultation.

Scientific evidence

The SCS found that **ground cover** levels are closely related to run-off and soil loss, with a number of studies showing that run-off and soil loss increase rapidly when cover drops below 40 percent (Bartley and Murray 2024, Question 3.5 of the SCS). Ground cover levels need to return to 70 percent to reduce run-off and sediment loss where land condition is highly degraded and therefore, ground cover preferably should be maintained above this level. The requirement to improve land condition if ground cover falls below 50 percent (SC2) is considered an appropriate and practical compromise between 40 percent (minimum) and 70 percent ground cover (preferred).

Being an outcome-focused requirement, SC2 does not prescribe management practices, but examples of suggested management practices are provided under the advice note to SC2. These examples are recommended to be updated in accordance with the findings of the SCS outlined below (*recommendation 3.1*).

Moderate, sustainable stocking rates that are regularly adjusted to support minimum ground cover and biomass levels were found to be effective at reducing sediment run-off and were generally also more profitable (Bartley and Murray 2024, Question 3.5 of the SCS). Regular periods of **strategic rest from grazing**, particularly in the wet season, were identified to be a major contributor to soil and pasture recovery and were effective at increasing ground cover over time.

Large areas of bare ground were identified as a primary source of erosion and run-off in grazing lands (Bartley and Murray 2024, Question 3.5 of the SCS). Excluding cattle, **soil amelioration** and **sowing perennial pastures** were found to assist recovery of these areas. It should be noted, however, that the recovery of degraded savanna rangelands generally takes decades and is strongly influenced by climate.

While burning of pastures as a management tool was found to increase sediment run-off, leaving a **2-metre buffer of unburnt vegetation** significantly reduced run-off (Bartley and Murray 2024, Question 3.5 of the SCS).

Recommendations

DETSI recommends the following suggestions are used to develop proposed changes to ground cover and land condition requirements in the grazing standard:

3.1 Revise the examples of measures to improve ground cover provided under the advice note to SC2 to reflect the latest knowledge.

3.2 Revise SC1 and SC2 and clarify the terms ‘ground cover’ and ‘land condition’.

Record keeping

Overview of requirements

Record keeping requirements SC3 to SC6 and appendices 1 and 2 require producers to keep records of measures undertaken to improve land condition and fertiliser and mill mud (and mill mud/mill ash mix) applications. Records must be made within three business days and must be kept for six years. Records allow producers and DETSI to monitor compliance with standard conditions.

Feedback

Table 10 Feedback and recommendations on the record keeping requirements for grazing.

Suggestion	Recom-mended?	Rationale
Remove the requirement to keep records of fertiliser and mill mud/mill ash mix applications.	Yes*	**Meets criteria 2** – Fertiliser and mill mud/mill ash mix applications are not regulated under the standard. Monitoring fertiliser use on grazing land is not considered minimum practice. Therefore these records can be removed without increasing risk to water quality, and will reduce administrative burden for producers. **Benefit for producers**

Suggestion	Recom-mended?	Rationale
		Moderate change
Provide voluntary templates or worked examples to support record keeping. Some producers find the record keeping requirements onerous and difficult to understand.	Yes*	**Meets criteria 2** – This change will make record keeping easier. **Benefit for producers** **Minor change**
Extend the timeframe for making a record from three business days to five business days. For some producers, three business days for making records is too short and does not align with farming practices.	Yes*	**Meets criteria 2** – Extending the timeframe to five business days will better align with farming practices and requirements for professional advisers under the *Environmental Protection Act 1994*. **Benefit for producers** **Moderate change**
Reduce the timeframe for keeping records from at least six years to two years to reduce administrative burden.	Yes*	**Meets criteria 2** – Consistent with most chemical record keeping requirements which are a minimum of two years. **Benefit for producers** **Moderate change**
Remove or significantly reduce the record keeping requirements to reduce administrative burden. The requirements are too onerous.	No	**Inconsistent with criteria 2** – Record keeping requirements are essential for producers and DETSI to understand compliance with the standard. **Alternatives to help address issue:** • Clarify record keeping by removing duplication of requirements and streamlining appendices (*recommendation 3.7*). • Reduce the minimum record keeping period (*recommendation 3.6*).
Streamline how the record keeping requirements are presented across the conditions and appendices.	Yes*	**Meets criteria 1 -** The changes will make the documents more user-friendly. **Benefit for producers** **Minor change**

* If supported by the Queensland Government, the recommended suggestions will be used to develop proposed changes to the standard. The changes must be implemented via a regulatory process, in accordance with Chapter 5A of the *Environmental Protection Act 1994*, which includes public consultation.

Recommendations

DETSI recommends the following suggestions are used to develop proposed changes to the record keeping requirements in the grazing standard:

3.3 Remove the requirement to keep records of fertiliser and mill mud/mill ash mix applications.

3.4 Provide voluntary templates or worked examples to support record keeping.

3.5 Extend the timeframe for making a record from three business days to five business days.

3.6 Reduce the timeframe for keeping records from at least six years to two years to reduce administrative burden.

3.7 Streamline how the record keeping requirements are presented across the conditions and appendices.

6. Broader matters

Several matters were raised during the consultation process regarding broader issues associated with the standards and their implementation.

Feedback

Table 11 Feedback and recommendations regarding broader matters relevant to all three standards.

Suggestion	Recommended?	Rationale
Revise existing, and develop new, engagement materials and methods to better communicate the requirements under the standards and overcome the challenge of DETSI not having direct access to producers contact details. This may include: • Provide materials in other languages (e.g. Punjabi) to make the standards more accessible to culturally and linguistically diverse stakeholders. • Deliver information in different ways, such as apps, additional videos, seminars and tools, to cater to diverse information preferences. • Make readily available materials that explain the purpose of, and process for, compliance visits and how DETSI considers natural disasters, events and personal circumstances of producers when planning compliance visits. • Continue to build producer mailing lists to address the inability to provide critical information directly to producers. • Use insights gained from social research with producers about what is influencing their decisions around farm management practices. • Inform producers about progress towards water quality targets and other successes and acknowledge producers as environmental stewards interested in environmental outcomes achieved by minimum practices.	Yes	**Consistent with criteria 1** – Implementing the suggestion provides an opportunity to enhance collaboration between industry, producers and government to help producers understand the requirements, improve their confidence in implementing the requirements and reduce apprehension and uncertainty. **Benefit for producers** **Minor change**
Collaborate across agencies to deliver integrated information, extension and compliance services to producers, ensuring alignment of the requirements for producers that span across multiple pieces of legislation (“one stop shop solution”). This may include, for example, an integrated government regulatory extension program.	Yes	**Consistent with criteria 1** – Implementing the suggestion provides an opportunity to adopt an integrated approach to extension and compliance services. This suggestion could reduce administrative burden on producers and support their ability to meet requirements. **Benefit for producers** **Minor change**
Consider the findings of the 2022 Scientific Consensus Statement as part of the review.	Completed	The findings of the 2022 Scientific Consensus Statement have informed the recommendations of the review (see *scientific evidence* sections).
Undertake a comprehensive regulatory impact assessment of the standards in accordance with the	Completed	As part of the Reef protection regulations, the standards underwent extensive impact analysis before commencing in 2019. This included a

Suggestion	Recommended?	Rationale
with the Queensland Government Better regulation policy.		consultation regulatory impact statement (RIS) that presented a suite of regulatory proposals for public consultation. Feedback on the consultation RIS helped to further refine the standards and a Decision RIS was subsequently published. Note, if the standards are amended post-review, DETSI must complete and publish an **impact analysis statement** that assess the impact of the proposed changes. The statement must comply with the requirements in the Queensland Government Better regulation policy.
Implement alternative approaches to the standards that are outcomes-focused, such as voluntary best practice management and producer-led environmental management plans. A regulatory approach is too prescriptive and not the best way to achieve changes in management practices.	No/partly provided for	**Out of scope** – The 2024 statutory review of the Reef protection regulations found that the standards are helping to eliminate high risk practices to reduce pollutant loads entering the Reef. The standards are part of a suite of tools and actions to improve water quality. Voluntary programs, such as the best management practice programs, complement the standards and are important in supporting producers to adopt best practices over the long-term. Both Smartcane BMP program and Freshcare Environmental Program – Reef Assured are recognised accreditation programs, which means that producers participating in these programs considered a lower priority for compliance inspections.
Repeal the standards given: • The scientific evidence underpinning the standards and the effectiveness of the standards in delivering benefits for water quality is doubtful. • The standards have created a financial burden for some producers, including a loss of productivity, with little benefit. • It is unfair that the Reef protection regulations do not apply to all agricultural commodities, renewable energy developments or urban areas.	No	**Out of scope** – This change would undermine progress towards water quality outcomes and be in opposition to UNESCO World Heritage Committee's 2025 request for full implementation of the Reef protection regulations. The standards reflect minimum practices to minimise run-off of excess sediment and nutrients. Stakeholders have reported environmental and financial benefits of minimum practices, such as improved soil health and cost savings by adjusting nutrient application to crop requirements. The 2024 statutory review of the Reef protection regulations found that the standards are helping to eliminate high risk practices from sugarcane, bananas and grazing to reduce pollutant loads entering the Reef. Other mechanisms, including the *Planning Act 2016,* regulate water quality risks from renewable energy developments and urban areas. Changes introduced by the Queensland Government in 2025 mean that wind farms and large-scale solar farms must undertake extensive impact assessment and public consultation.

Suggestion	Recommended?	Rationale
Modify the areas to which the standards apply. For example: • The standards should not apply in the Burnett Mary region as some stakeholders believe there is doubt about the underpinning scientific evidence for the transportation of nutrients and sediments in coastal waters. • The standards should apply to the entire Reef catchment, including Cape York, to ensure equity across producers.	No	**Inconsistent with criteria 3** – The 2022 Scientific Consensus Statement is clear on the drivers of poor water quality in the Reef and detrimental impacts that it has on Reef ecosystems.

Scientific evidence

The scientific evidence supports the overall objectives of the standards and the areas to which they currently apply. As summarised below and outlined in further detail in the SCS, there is a clear link between agricultural land uses in the Reef catchment and increased levels of sediment and nutrients on the Reef, with demonstrated substantial impacts on Reef ecosystems.

There is strong evidence that current **dissolved inorganic nitrogen** (DIN) loads transported to the Reef are overall substantially higher (about 1.5 to 3 times, depending on basins) than natural loads before development (Prosser and Wilkinson 2024, Question 4.4 of the SCS). The increases in DIN loads can be attributed to sugarcane lands (42 percent of the total load), grazing lands (22 percent), urban land uses (7 percent) and bananas (1 percent) and are mostly the result of fertiliser being lost to waterways. The exception to this are grazing lands, which are largely unfertilised and mainly export particulate nitrogen through erosion (see *particulate nutrients* below), which is then transformed into DIN during transport. Conservation lands contribute 24 percent of the total loads but this is natural export, not anthropogenic. The Wet Tropics, Mackay Whitsunday and Burnett Mary Natural Resource Management regions are the largest exporters of DIN to the Reef.

There is strong evidence that the increased loads of DIN transported to the Reef have led to increased DIN in inshore and, to a lesser extent, mid-shelf waters (Robson et al. 2024, Question 4.1 of the SCS). Peak concentrations are usually found during the wet season (typically December to May) in the central and southern Reef (approximately Cooktown to Gladstone) adjacent to areas of more intensive catchment development and in waters influenced by river discharge.

Most research has focused on DIN and fewer studies are available on **dissolved inorganic phosphorus** (Prosser and Wilkinson 2024, Question 4.4 of the SCS). Available evidence indicates that dissolved inorganic phosphorus levels are comparatively low. However, there is evidence for substantially increased phosphorus exports to the Reef overall, mainly of particulate phosphorus. Particulate phosphorus is transported to the Reef bound to sediment (see *particulate nutrients* below).

Dissolved inorganic nutrients play an important role in the overall health and condition of the Reef. However, there is strong evidence that increased levels of nutrients have detrimental effects on Reef ecosystems (Diaz-Pulido et al. 2024, Question 4.2 of the SCS). Increased nutrient levels can lead to an increased abundance of macroalgae, which can outcompete corals and reduce coral cover. Increased nutrient levels can also directly impact corals, such as reducing their reproduction and calcification. While there are some positive effects of increased nutrient levels on some species, such as crustose coralline algae (important for reef building), overall effects are overwhelmingly negative.

While **fine sediments** are naturally exported from catchments, there is strong evidence that current fine sediment loads transported to the Reef are overall substantially higher (about 1.4 to 5 times) than natural loads before development (Prosser and Wilkinson 2024, Question 3.3 of the SCS). The increased fine sediment loads can be attributed to grazing lands (60 percent of the total load), sugarcane lands (10 percent), irrigated and dryland cropping (4 percent), urban land uses (2 percent) and bananas and horticulture (1 percent) and are a result of erosion. Other land uses such as nature conservation and forestry collectively contribute 23 percent of total fine sediment loads but this is natural export, not anthropogenic. The Burdekin and Fitzroy basins are the largest exporters of fine sediment to the Reef, followed by the Mary, Herbert and Burnett River basins.

There is strong evidence that the increased loads of fine sediments transported to the Reef have led to increased levels of suspended sediments in inshore and mid-shelf waters (Lewis et al. 2024, Question 3.1 of the SCS). While most of the sediment is deposited and retained in close vicinity to river mouths, a proportion of the fine sediment load is carried within

flood plumes to the inner and middle shelfs. Deposited sediments are also re-suspended by waves and tide currents, transporting sediments to mangroves, beaches and sheltered embayments.

Particulate nutrients (particulate nitrogen and particulate phosphorus) are often bound to sediment and hence, particulate nutrient loads transported to the Reef are also higher than natural loads before development, following similar patterns like fine sediment (Prosser and Wilkinson 2024, Question 3.3 of the SCS). Once transported to the coast, most particulate nutrients are deposited within 10 kilometres of river mouths (Robson et al. 2024, Question 4.1 of the SCS). However, a substantial portion of particulate nutrients that is deposited is later released as dissolved nutrients into the water column. This contributes to elevated dissolved nutrient concentrations in inshore and some mid-shelf areas.

There is strong evidence that increased levels of suspended sediments and particulate nutrients as currently observed on the Reef have substantial impacts on Reef ecosystems (Collier et al. 2024, Question 3.2 of the SCS). The impacts are various and have led to changes to the presence, abundance, extent, diversity, composition and depth of coral reefs and seagrass meadows and many associated species such as fish and dugongs.

Recommendations

DETSI recommends the following suggestions are implemented to enhance the way information and support is provided to stakeholders:

4.1 Revise existing, and develop new, engagement materials and methods to better communicate the requirements under the standards and overcome the challenge of DETSI of not having direct access to producers' contact details.

4.2 Collaborate across agencies to deliver integrated information, extension and compliance services to producers, ensuring alignment of the requirements for producers that span across multiple pieces of legislation ("one stop shop solution").

7. References

Bartley R, Murray B (2024) Question 3.5 What are the most effective management practices (all land uses) for reducing sediment and particulate nutrient loss from the Great Barrier Reef catchments, do these vary spatially or in different climatic conditions? What are the costs and cost-effectiveness of these practices, and does this vary spatially or in different climatic conditions? What are the production outcomes of these practices? In Waterhouse J, Pineda M-C, Sambrook K (Eds) 2022 Scientific Consensus Statement on land-based impacts on Great Barrier Reef water quality and ecosystem condition. Commonwealth of Australia and Queensland Government.

Collier C, Brown A, Fabricius K, Lewis S, Diaz-Pulido G, Adame F (2024) Question 3.2 What are the measured impacts of increased sediment and particulate nutrient loads on Great Barrier Reef ecosystems, what are the mechanism(s) for those impacts and where is there evidence of this occurring in the Great Barrier Reef? In Waterhouse J, Pineda M-C, Sambrook K (Eds) 2022 Scientific Consensus Statement on land-based impacts on Great Barrier Reef water quality and ecosystem condition. Commonwealth of Australia and Queensland Government.

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Diaz-Pulido G, Reyes-Nivia C, Adame MF, Arthington AH, Collier C, Lovelock C (2024) Question 4.2 What are the measured impacts of nutrients on Great Barrier Reef ecosystems, what are the mechanisms for those impacts and where is there evidence of this occurring in the Great Barrier Reef? In Waterhouse J, Pineda M-C, Sambrook K (Eds) 2022 Scientific Consensus Statement on land-based impacts on Great Barrier Reef water quality and ecosystem condition. Commonwealth of Australia and Queensland Government.

Lewis S, Bainbridge Z, Smithers S (2024) Question 3.1 What are the spatial and temporal distributions of terrigenous sediments and associated indicators within the Great Barrier Reef? In Waterhouse J, Pineda M-C, Sambrook K (Eds) 2022 Scientific Consensus Statement on land-based impacts on Great Barrier Reef water quality and ecosystem condition. Commonwealth of Australia and Queensland Government.

Prosser IP, Wilkinson SN (2024) Question 3.3 How much anthropogenic sediment and particulate nutrients are exported from Great Barrier Reef catchments (including the spatial and temporal variation in delivery), what are the most important characteristics of anthropogenic sediments and particulate nutrients, and what are the primary sources? In Waterhouse J, Pineda M-C, Sambrook K (Eds) 2022 Scientific Consensus Statement on land-based impacts on Great Barrier Reef water quality and ecosystem condition. Commonwealth of Australia and Queensland Government.

Prosser IP, Wilkinson SN (2024) Question 4.4 How much anthropogenic dissolved nutrient (nitrogen and phosphorus species) is exported from Great Barrier Reef catchments? In Waterhouse J, Pineda M-C, Sambrook K (Eds) 2022 Scientific Consensus Statement on land-based impacts on Great Barrier Reef water quality and ecosystem condition. Commonwealth of Australia and Queensland Government.

Robson B, Brown A, Uthicke S (2024) Question 4.1 What is the spatial and temporal distribution of nutrients and associated indicators within the Great Barrier Reef? In Waterhouse J, Pineda M-C, Sambrook K (Eds) 2022 Scientific Consensus Statement on land-based impacts on Great Barrier Reef water quality and ecosystem condition. Commonwealth of Australia and Queensland Government.

Thorburn P, Verburg K, Farr M, Weber T, Vilas M, Connolly C, Eccles R (2024) Question 4.6 What are the most effective management practices for reducing dissolved nutrient losses (all land uses) from the Great Barrier Reef catchments, and do these vary spatially or in different climatic conditions? What are the costs of the practices, and cost-effectiveness of these practices, and does this vary spatially or in different climatic conditions? What are the production outcomes of these practices? In Waterhouse J, Pineda M-C, Sambrook K (Eds) 2022 Scientific Consensus Statement on land-based impacts on Great Barrier Reef water quality and ecosystem condition. Commonwealth of Australia and Queensland Government.

Glossary

Anthropogenic	Caused or influenced by humans.
BMP programs	Industry Best Management Practices programs, such as the Smartcane BMP program and the Freshcare BMP program.
Minimum practices	Refer to minimum management practices that are widely accepted to reduce nutrient and sediment losses from land-based activities.
Nitrogen (N)	See nutrients
Nutrients	Nutrients are the natural chemical elements and compounds that plants and animals need to grow. Carbon, hydrogen and oxygen are abundant nutrients in nature, but nitrogen and phosphorus are not always so freely available. They promote plant growth, making increased levels (e.g. from excess fertilisers) an issue for the Great Barrier Reef.
Phosphorus (P)	See nutrients
Reef catchment	The drainage area of the Great Barrier Reef, as shown by the Great Barrier Reef catchment and river basins map, dated 23 August 2019. https://www.qld.gov.au/__data/assets/pdf_file/0019/105247/gbr-catchment-river-basins-map.pdf
Water quality	Refers to the chemical, physical, biological and radiological characteristics of water. It is a measure of the condition of water relative to the requirements of one or more biotic species and/or to any human need or purpose.

Appendix A: Stakeholder engagement methods

Feedback from agricultural producers, industry peak bodies and others with an interest in the standards was an important part of the review. Public consultation was open from 20 May 2025 to the 8 August 2025, noting the public survey was available from 23 May 2025.

The review team wanted to hear about:

- whether parts of the sugarcane, banana and grazing standards (and supporting materials) may be difficult to understand and, as a result, may be difficult to comply with (criteria 1)
- suggestions for improvements to ensure the standards (and supporting materials) remain fit for purpose (criteria 2)
- relevant recent studies or projects that will help ensure the standards remain evidence based and current with industry practices that minimise nutrient and sediment run-off (criteria 3).

People could provide feedback in a number of ways:

- by completing a 15-minute anonymous survey
- taking part in a workshop
- chatting with a member of the review team, or
- providing a written submission.

Issues and suggestions for improvement raised during public consultation were synthesised and assessed against the three review criteria. Findings of the assessment are provided in this report.

Distribution of information

An online engagement platform (engagement hub) was hosted on DETSI's website that provided information about the review process, information fliers, access to the online survey and the PDF version for download, registrations for workshops, registration for a mailing list and relevant resources, including videos about the standards.

At the beginning of the project, a mailing list was established allowing people to subscribe to email updates about the review. Existing networks across government departments (email updates, newsletters etc) were used to distribute information about the review. Peak industry bodies played an active role in providing information about the review to their members. Compliance officers from the Reef Compliance Program provided materials about the review during compliance visits.

Between 10 July and 7 August 2025, a strategic social media campaign was used to further raise awareness, targeted at producers and their spouses. The campaign used the messaging "Your Farm. Your Say" and included paid social media posts and paid advertisement in the digital and print version of Queensland Country Life. Posts were seen a total of 432,784 times across channels, and there were 2,700 individual visits to the engagement hub.

Survey

An anonymous 15-minute survey (**Appendix B**) was available to complete online (preferred) or as a hardcopy to be mailed to DETSI. The survey had a range of questions to seek producers' experiences with understanding and implementing the requirements within each standard. Respondents could skip any part of the survey that was not relevant to them (e.g. producers could complete the section on the grazing standard and skip the sections on the banana and sugarcane standards).

While the survey questions were targeted at producers, advisers, everyone was welcome to complete the survey based on their knowledge of the issues that producers may experience, noting they were not to share producers' personal information. In total, 43 responses were received, including 38 online responses and 5 hardcopy responses that were mailed to DETSI. Of those, 22 respondents provided feedback on the sugarcane standard, 1 on the banana standard and 20 on the grazing standard. The majority of responses were provided by producers and were of high quality.

Industry workshops

People could register online to attend workshops for each standard:

- For the sugarcane standard, a 5-hour online workshop was held on 29 May 2025 and was facilitated by an independent consultant. The workshop was attended by 24 people external to government, including producers, industry peak bodies, sugar manufacturers, sugar researchers, advisors, fertiliser suppliers, environmental and conservation groups.
- For the banana standard, a 2-hour hybrid workshop was held on 31 July 2025. The workshop was attended by 13 people external to government, both in-person and online, including producers, the peak industry body, advisors, researchers, fertiliser suppliers and environmental and conservation groups.
- For the grazing standards, two 2-hour online workshops were held, on 29 July and 12 August 2025. The workshops were attended by 17 people external to government, including producers and peak industry bodies.

Workshops included a presentation about the review process by DETSI officers and an overview of requirements under the standards. The majority of the workshops were dedicated to open discussions, encouraging attendees to share feedback by contributing directly to discussions or sharing written comments using the chat function of Microsoft Teams.

DETSI prepared reports about the outcomes of the workshops. Discussions during all workshops were constructive and productive.

Written feedback

People could provide written feedback on the standards and supporting materials by either submitting an anonymous comment online at the 'In the Loop' engagement hub or email the Office of the Great Barrier Reef and World Heritage. In total, 14 written submissions were received, which were all provided by peak industry bodies and were of high quality.

Chatting with a member of the review team

People could register online for a 30-minute chat (online or phone) with two representatives of the review team. Four people attended chats with the review team, and all were constructive and productive.

Appendix B: Survey

Sugarcane standard – survey questions

Your input is important and will be carefully considered during the review process. Thank you for taking the time to participate and sharing your thoughts. *Note: Feedback will be accepted in any form (for example, comments provided separate to the survey). The survey questions provide guidance and are voluntary.*

1. I have read the privacy statement [This question is required]

   ☐ Yes

2. How easy or hard do you find the sugarcane standard to understand?

   ☐ Very easy
   ☐ Easy
   ☐ Neutral
   ☐ Hard
   ☐ Very hard
   ☐ I don't know

3. How easy or hard do you find the requirements in the sugarcane standard to implement?

   ☐ Very easy
   ☐ Easy
   ☐ Neutral
   ☐ Hard
   ☐ Very hard
   ☐ I don't know

4. Producers are required to have a Nitrogen and Phosphorus budget (N and P budget). Have you experienced any issues with the N and P budget?

   ☐ Understanding what information is required
   ☐ Understanding how to utilise the budget
   ☐ Accessing an appropriate person
   ☐ Developing a farm map
   ☐ Other. Please specify in comment box for question 5.
   ☐ No issues
   ☐ I don't know

5. Please enter any comments you may have to support your response about N and P budgets below. [Comment box]

6. Soil testing is required within the 12 months prior to applying fertiliser to a new plant crop (or a new crop cycle, if no fertiliser is applied to the plant crop). Have you experienced any issues with soil testing?

   ☐ Understanding when the best time is to collect samples
   ☐ Understanding how many samples must be collected
   ☐ Understanding where to collect samples
   ☐ Other. Please specify in comment box for question 7.
   ☐ No issues
   ☐ I don't know

7. Please enter below any comments you may have to support your response about soil testing. [Comment box]

8. Ground-based broadcast application of fertiliser containing nitrogen is not allowed under the standard. Have you experienced any issues with this requirement?

   ☐ Yes
   ☐ No
   ☐ I don't know

9. Please enter any comments you may have to support your response on the restrictions around the application of fertiliser containing nitrogen. [Comment box]

10. During fallow, producers are allowed to broadcast phosphorus (but not nitrogen) in preparation for establishing the plant crop. Fertiliser containing phosphorus must be incorporated into the soil within three days of application. Have you experienced any issues with these requirements?

    ☐ Understanding when phosphorus can be applied
    ☐ Incorporating fertiliser into the soil within the required timeframes (i.e., three days)
    ☐ Other. Please specify in comment box for question 11.
    ☐ No issues
    ☐ I don't know

11. Please enter below any comments you may have to support your response about the application of fertiliser containing phosphorus. [Comment box]

12. Fallow blocks must have a cover crop that maintains adequate ground cover or must have sugarcane trash in place. Have you experienced any issues with this requirement?

    ☐ Understanding what type of ground cover is allowed
    ☐ Maintaining sufficient ground cover
    ☐ Other. Please specify in comment box for question 13.
    ☐ No issues
    ☐ I don't know

13. Please enter below any comments you may have to support your response about maintaining adequate ground cover on fallow blocks. [Comment box]

14. Producers must implement erosion and sediment control measures. It is up to producers to select suitable measures (for example, vegetated buffers). Have you experienced any issues with this requirement?

    ☐ Yes
    ☐ No
    ☐ I don't know

15. Please enter below any comments you may have to support your response about implementing erosion and sediment control measures. [Comment box]

16. Record keeping requirements apply under the standard. Have you experienced any issues with these requirements?

    ☐ Understanding what information is required to be recorded
    ☐ Organising and keeping required documents
    ☐ Recording information within the required timeframe (i.e., within three business days of an activity)
    ☐ Keeping the records on file for the required timeframe (i.e., at least six years)
    ☐ Other. Please specify in comment box for question 17.
    ☐ No issues
    ☐ I don't know

17. Please enter any comments you may have to support your response about record keeping requirements below. [Comment box]

18. Almost done! We have a few final questions for you. What would be most useful to you to help you understand the standards?

    ☐ Talking with an adviser or extension officer
    ☐ Talking with other producers in the region
    ☐ Talking with the department/compliance program staff
    ☐ Seminars or workshops – online
    ☐ Seminars or workshops – in person
    ☐ Courses

☐ Radio interviews, podcasts etc.
☐ Videos
☐ Written guides with examples
☐ Factsheets, flyers etc.
☐ Apps
☐ Other:
☐ I don't know

19. What positive changes have you noticed since the regulated standards have started?

☐ Environmental (for example, improved land condition)
☐ Financial (for example, higher yield, savings)
☐ Social (for example, recognition by community)
☐ Other:
☐ None
☐ I don't know

20. Are you aware of any recent studies or projects that we should consider as part of the review to help ensure the standards remain evidence based? Please provide details below. [Comment box]

21. Are there any other issues or suggestions you would like to raise? [Comment box]

22. A little bit about you - which group(s) do you belong to?

☐ Producers/landholders
☐ Peak industry association
☐ Industry
☐ NRM group
☐ Conservation group
☐ Agricultural adviser
☐ Government
☐ Other:
☐ Prefer not to say

23. Which regions are most relevant to your feedback?

☐ Cape York Peninsula
☐ Wet Tropics
☐ Burdekin
☐ Mackay Whitsunday
☐ Fitzroy
☐ Burnett Mary
☐ All of the above
☐ Prefer not to say

24. The review team may have questions about your responses. Would you be happy for the review team to contact you to discuss your responses?

☐ No
☐ Yes. Please provide your name, email address and/or phone number:

25. If you are experiencing difficulties understanding or complying with the standards, we may be able to help you. Would you like an officer from the department to contact you?

☐ No
☐ Yes. Please provide your name, email address and/or or phone number (if you haven't already provided your contact details above):

Banana standard – survey questions

Your input is important and will be carefully considered during the review process. Thank you for taking the time to participate and sharing your thoughts. *Note: Feedback will be accepted in any form (for example, comments provided separate to the survey). The survey questions provide guidance and are voluntary.*

1. I have read the privacy statement. [This question is required]
   - ☐ Yes
2. How easy or hard do you find the banana standard to understand?
   - ☐ Very easy
   - ☐ Easy
   - ☐ Neutral
   - ☐ Hard
   - ☐ Very hard
   - ☐ I don't know
3. How easy or hard do you find the requirements in the banana standard to implement?
   - ☐ Very easy
   - ☐ Easy
   - ☐ Neutral
   - ☐ Hard
   - ☐ Very hard
   - ☐ I don't know
4. Threshold rates apply for the application of nitrogen (400 kg per hectare per year for ratoon crops and 280 kg per hectare per year for plant crops) and phosphorus (60 kg per hectare per year). Have you experienced any issues with this requirement?
   - ☐ Yes
   - ☐ No
   - ☐ I don't know
5. Please enter below any comments you may have to support your responses about the threshold rates. [Comment box]
6. A Nutrient Management Plan is required if producers want to apply more nitrogen or phosphorus than the maximum threshold rates. Are you using a Nutrient Management Plan?
   - ☐ Yes
   - ☐ No. Please continue with question 11.
7. Leaf testing is part of Nutrient Management Plans. Have you experienced any issues with leaf testing?
   - ☐ Choosing the best time to take leaf samples
   - ☐ Understanding how much extra nitrogen/phosphorus may be added based on test results
   - ☐ Other. Please specify in comment box for question 8.
   - ☐ No issues
   - ☐ I don't know
8. Please enter below any comments you may have to support your response about leaf testing. [Comment box]
9. Have you experienced any issues with any of the other parts of Nutrient Management Plans?
   - ☐ Understanding what is required/what information to include
   - ☐ Accessing an appropriate person to develop/review the plan
   - ☐ Developing a farm map
   - ☐ Keeping records
   - ☐ Other. Please specify in comment box for question 10.
   - ☐ No issues
   - ☐ I don't know
10. Please enter below any comments you may have to support your response about Nutrient Management Plans. [Comment box]

11. Ground-based application of fertiliser containing nitrogen must only be applied to the crop beds and not the inter-row space. Have you experienced any issues with this requirement?

    ☐ Yes
    ☐ No
    ☐ I don't know

12. Please enter any comments you may have to support your response about the application of fertiliser containing nitrogen below. [Comment box]
13. During fallow, producers are allowed to broadcast phosphorus (but not nitrogen) in preparation for establishing a plant crop. Fertiliser containing phosphorus must be incorporated into the soil within three days of application. Have you experienced any issues with these requirements?

    ☐ Understanding when phosphorus can be applied
    ☐ Incorporating fertiliser into the soil within the required timeframes (i.e., three days)
    ☐ Other. Please specify in comment box for question 14.
    ☐ No issues
    ☐ I don't know

14. Please enter below any comments you may have to support your response about the application of fertiliser containing phosphorus. [Comment box]
15. Inter-rows must have at least 60 percent ground cover (except when undertaking renovation works). Have you experienced any issues with this requirement?

    ☐ Determining whether existing ground cover is at least 60 percent
    ☐ Maintaining sufficient ground cover
    ☐ Other. Please specify in comment box for question 16.
    ☐ No issues
    ☐ I don't know

16. Please enter below any comments you may have to support your response about maintaining at least 60 percent ground cover in inter-rows. [Comment box]
17. Fallow blocks must have a grassy fallow or cover crop that maintains adequate ground cover. Have you experienced any issues with this requirement?

    ☐ Understanding what type of ground cover is allowed
    ☐ Maintaining sufficient ground cover
    ☐ Other. Please specify in comment box for question 18.
    ☐ No issues
    ☐ I don't know

18. Please enter below any comments you may have to support your response on maintaining adequate ground cover on fallow blocks. [Comment box]
19. Producers must implement measures to minimise run-off in areas with a high risk of erosion. It is up to producers to select suitable measures (for example, vegetated spoon drains, sediment traps). Have you experienced any issues with this requirement?

    ☐ Yes
    ☐ No
    ☐ I don't know

20. Please enter below any comments you may have to support your response about implementing measures to minimise run-off in areas with high risk of erosion. [Comment box]
21. Record keeping requirements apply for some activities. Have you experienced any issues with these requirements?

    ☐ Understanding which activities need to be recorded
    ☐ Understanding what information/details must be recorded

- ☐ Organising and keeping required documents
- ☐ Recording information within the required timeframe (i.e., within three business days of an activity)
- ☐ Keeping records on file for the required duration (i.e., at least six years)
- ☐ Other. Please specify in comment box for question 22.
- ☐ No issues
- ☐ I don't know

22. Please enter any comments you may have to support your response about record keeping requirements below. [Comment box]

23. Almost done! We have a few final questions for you. What would be most useful to you to help you understand the standards?

- ☐ Talking with an adviser or extension officer
- ☐ Talking with other producers in the region
- ☐ Talking with the department/compliance program staff
- ☐ Seminars or workshops – online
- ☐ Seminars or workshops – in person
- ☐ Courses
- ☐ Radio interviews, podcasts etc.
- ☐ Videos
- ☐ Written guides with examples
- ☐ Factsheets, flyers etc.
- ☐ Apps
- ☐ Other:
- ☐ I don't know

24. What positive changes have you noticed since the regulated standards have started?

- ☐ Environmental (for example, improved land condition)
- ☐ Financial (for example, higher yield, savings)
- ☐ Social (for example, recognition by community)
- ☐ Other:
- ☐ None
- ☐ I don't know

25. Are you aware of any recent studies or projects that we should consider as part of the review to help ensure the standards remain evidence based? Please provide details below. [Comment box]

26. Are there any other issues or suggestions you would like to raise?

27. A little bit about you - which group(s) do you belong to?

- ☐ Producers/landholders
- ☐ Peak industry association
- ☐ Industry
- ☐ NRM group
- ☐ Conservation group
- ☐ Agricultural adviser
- ☐ Government
- ☐ Other:
- ☐ I prefer not to say

28. Which regions are most relevant to your feedback?

- ☐ Cape York Peninsula
- ☐ Wet Tropics
- ☐ Burdekin
- ☐ Mackay Whitsunday

- ☐ Fitzroy
- ☐ Burnett Mary
- ☐ All of the above
- ☐ Prefer not to say

29. The review team may have questions about your responses. Would you be happy for the review team to contact you to discuss your responses?
    - ☐ No
    - ☐ Yes. Please provide your name, email address and/or phone number:

30. If you are experiencing difficulties understanding or complying with the standards, we may be able to help you. Would you like an officer from the department to contact you?
    - ☐ No
    - ☐ Yes. Please provide your name, email address and/or phone number (if you haven't already provided your contact details above):

Beef Cattle Grazing standard – survey questions

Your input is important and will be carefully considered during the review process. Thank you for taking the time to participate and sharing your thoughts. *Note: Feedback will be accepted in any form (for example, comments provided separate to the survey). The survey questions provide guidance and are voluntary.*

1. I have read the privacy statement [This question is required]
    - ☐ Yes

2. How easy or hard do you find the beef cattle grazing standard to understand?
    - ☐ Very easy
    - ☐ Easy
    - ☐ Neutral
    - ☐ Hard
    - ☐ Very hard
    - ☐ I don't know

3. How easy or hard do you find the requirements in the beef cattle grazing standard to implement?
    - ☐ Very easy
    - ☐ Easy
    - ☐ Neutral
    - ☐ Hard
    - ☐ Very hard
    - ☐ I don't know

4. If ground cover is less than 50 percent (at 30 September each year), producers are required to implement measures to improve the condition of their land. It is up to producers to select appropriate measures (for example, adjusting grazing pressure) Have you experienced any issues with this requirement?
    - ☐ Determining whether existing ground cover is less than 50 percent
    - ☐ Maintaining/improving land condition
    - ☐ Selecting suitable measures
    - ☐ No issues
    - ☐ I don't know
    - ☐ Other. Please specify in comment box of question 5.

5. Please enter any comments you may have to support your response about assessing ground cover and determining the condition of your land below. [Comment box]

6. If ground cover is less than 20 percent (at 30 September each year), producers are required to, at a minimum, prevent land condition from worsening. It is up to producers to select appropriate measures (for example, managing land around gullies). Have you experienced any issues with these requirements?

   ☐ Yes
   ☐ No
   ☐ I don't know

7. Please enter any comments you may have to support your response about implementing measures to improve land condition or prevent land condition from worsening when ground cover is less than 20 percent. [Comment box]

8. Record keeping requirements apply under the standard. Have you experienced any issues with these requirements?

   ☐ Understanding what information is required to be recorded
   ☐ Organising and keeping required documents
   ☐ Recording information within the required timeframe (i.e., within three business days of an activity)
   ☐ Keeping the records on file for the required timeframe (i.e., at least six years)
   ☐ Other. Please specify in comment box of question 9.
   ☐ No issues
   ☐ I don't know

9. Please enter any comments you may have to support your response about record keeping requirements below. [Comment box]

10. Almost done! We have a few final questions for you. What would be most useful to you to help you understand the standards?

    ☐ Talking with an adviser or extension officer
    ☐ Talking with other producers in the region
    ☐ Talking with the department/compliance program staff
    ☐ Seminars or workshops – online
    ☐ Seminars or workshops – in person
    ☐ Courses
    ☐ Radio interviews, podcasts etc.
    ☐ Videos
    ☐ Written guides with examples
    ☐ Factsheets, flyers etc.
    ☐ Apps
    ☐ Other:
    ☐ I don't know

11. What positive changes have you noticed since the regulated standards have started?

    ☐ Environmental (for example, improved land condition)
    ☐ Financial (for example, higher yield, savings)
    ☐ Social (for example, recognition by community)
    ☐ Other:
    ☐ None
    ☐ I don't know

12. Are you aware of any recent studies or projects that we should consider as part of the review to help ensure the standards remain evidence based? Please provide details below. [Comment box]

13. Are there any other issues or suggestions you would like to raise? [Comment box]

14. A little bit about you - which group(s) do you belong to?

    ☐ Producers/landholders

- ☐ Peak industry association
- ☐ Industry
- ☐ NRM group
- ☐ Conservation group
- ☐ Agricultural adviser
- ☐ Government
- ☐ Other:
- ☐ Prefer not to say

15. Which regions are most relevant to your feedback?

- ☐ Cape York Peninsula
- ☐ Wet Tropics
- ☐ Burdekin
- ☐ Mackay Whitsunday
- ☐ Fitzroy
- ☐ Burnett Mary
- ☐ All of the above
- ☐ Prefer not to say

16. The review team may have questions about your responses. Would you be happy for the review team to contact you to discuss your responses?

- ☐ No
- ☐ Yes. Please provide your name, email address and/or phone number:

17. If you are experiencing difficulties understanding or complying with the standards, we may be able to help you. Would you like an officer from the department to contact you?

- ☐ No
- ☐ Yes. Please provide your name, email address and/or phone number (if you haven't already provided your contact details above):