

METHOD FOR ACCOUNTING REDUCTION IN NUTRIENT RUN-OFF THROUGH  
MANAGED FERTILISER APPLICATION – VERSION 1.1

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## CONSULTATION PROCESS

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This method was developed in consultation with the Reef Credit Methodology Technical Working Group. Members of the working group include representatives from Industry, Qld Government, CSIRO, JCU, Griffith University, advocacy groups, NRM groups and subject matter experts. The method approach arose from discussion at two workshops, the first in September 2017 and the second in March 2018.

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## 1 PROJECT DESCRIPTION

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### 1.1 GOVERNING DOCUMENTS

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Reef Credit Standard

Reef Credit Guide

### 1.2 REFERENCES

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This methodology references the following documents and tools

- Reef 2050 Long Term Sustainability Plan
- Reef 2050 Water Quality Improvement Plan 2017-2022
- Paddock to Reef Integrated Monitoring, Modelling and Reporting Program
- Paddock to Reef Program Water Quality Risk Frameworks
- Reef Trust Repeated Tenders - Wet Tropics and Burdekin Project
- Queensland Environmental Protection Act 1994
- Queensland Government Paddock to Reef Projector
- VT0001 Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities
- Sub catchment DIN Contribution to Export Spatial Layer

### 1.3 SUMMARY DESCRIPTION OF METHODOLOGY

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This methodology quantifies the reduction in Dissolved Inorganic Nitrogen (DIN) lost from agricultural land through improved soil and nutrient management practices within the catchments of the Great Barrier Reef World Heritage Area (GBRWHA).

The core methodological components are as follows:

- Determine Eligibility: Sets the criteria for eligibility of projects under the methodology and the Reef Credit Standard;
- Establish Project Boundaries and Scope: Provides guidelines for defining the geographical and temporal boundaries of the project, scope of activities and pollutant pools to be accounted for in the project;
- Quantify Baseline DIN Loss: Provides guidelines for determining average DIN loss for the baseline period;
- Quantify Project DIN Loss: Provides guidelines for determining project DIN loss for the monitoring period;
- Quantify DIN Reduction: Details how to determine the DIN reductions resulting from project activities at end of catchment for the monitoring period;
- Quantify Reef Credit Units: Outlines the steps to determine the number of reef credits based on calculated pollutant reductions;

- Project Monitoring: Provides guidelines for the implementation of a monitoring plan and identifies monitored parameters to assess soil and nutrient management strategy;
- Project Reporting and Credit Issuance: Outlines requirements for reporting project abatement to the Reef Credit Secretariat and the application process for the issuance of Reef Credits.

#### 1.4 PROJECT ACTIVITIES

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The scope of this methodology includes reducing DIN loss through more efficient soil and nutrient management practices from agricultural enterprises including (but not limited to) sugarcane, bananas, grains and fodder. The methodology allows for a range of practice changes, including land use change, that lead to a reduction in DIN loss across the project area.

There are a number of ways a farmer may reduce DIN loss within the project area. For example:

- Matching nitrogen application rate to expected crop yields at farm or paddock scale;
- Reducing nitrogen fertiliser application rate;
- Increasing areas under fallow<sup>1</sup>;
- Improving fertiliser delivery practices; or
- Conversion to land use with a lower N fertiliser application.

This methodology is not limited to the above management practices, but the project must provide a **Land management plan** that describes the proposed land management activities for the project duration which may include a nutrient management plan.

#### 1.5 DEFINITIONS

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**Additionality** – as defined in the Reef Credit Standard

**Bare fallow** – in rotational cropping, a period where no crop is grown between crop cycles

**Baseline period** – the 7 years immediately prior to project start date

**Crediting period** – as defined in the Reef Credit Standard schedule 1 and equal to 10 years commencing from project start date

**DIN** – as defined in the Reef Credit Standard

**Green fallow**– in rotational cropping, cultivation of an alternative crop between crop cycles

**Land Management Plan** – as defined in the Reef Credit Standard and for the purposes of this methodology may include a nutrient management plan.

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<sup>1</sup> If increasing the area under fallow, the proponent must manage the fallow in such a way as to prevent an increase in sediment runoff, e.g. cane trash blanket is retained or green fallow break crop is planted.

**Monitoring period** - as defined in the Reef Credit Standard but must be equal to 12 months for this methodology

**Nitrogen application rate** – the quantity of nitrogen applied over an area expressed in kilograms per hectare

**Project application** – as defined in the Reef Credit Standard

**Project application date** – the date on which the project proponent submits the project application for a Reef Credit project

**Project area** – the area on which project activities are being undertaken

**Project start date** – as defined in the Reef Credit Standard

**Project end date** – as defined in the Reef Credit Standard

**Reef Credit** – as defined in the Reef Credit Standard

**Reef Credit Accounting Zones (RCAZ)** – spatially explicit area delineated according to section 3 of this methodology in which project activities occur and are accounted.

## 1.6 DOCUMENTATION REQUIREMENTS

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This section outlines the documentation required for project application and for issuance of Reef Credits.

### 1.6.1 PROJECT APPLICATION

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When applying for a project the project documentation must include a **Project Description**. The Project Description must include:

- a. Names of project proponents and names of any individual or entity with interest in the land parcel or enterprise;
- b. Project location;
- c. Description of project including:
  - i. Project area spatial files defining project implementation zones;
  - ii. Estimate of average Baseline DIN Loss;
  - iii. Estimate of abatement potential over the crediting period.

The project application must also include a **Project Eligibility Report** describing how the project complies with the Reef Credit Standard and the methodology eligibility requirements, and a **Land Management Plan**.

### 1.6.2 PROJECT CREDITING

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When applying for issuance of Reef Credits, project documentation must include:

1. Project Description;
2. Project Eligibility Report;
3. Project Spatial Report;
4. Land Management Plan;
5. Project Abatement Report;

6. Monitoring Report;
7. Evidentiary Documents.

In addition to the requirements outlined in this methodology, the proponent must address how the project complies with all Reef Credit Standard rules when applying this methodology (e.g. documentary evidence of land ownership or rights to land management over the project area). Crediting applications must be accompanied by a third-party verification report prepared in accordance with the Reef Credit Standard.

## 2 ELIGIBILITY

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This section outlines the project eligibility criteria to be eligible to implement this methodology under the Reef Credit Standard. For each of the eligibility criteria, credible evidence in the form of analysis, documentation and/or third-party expert reports is required as part of the project application. In addition, all projects must meet the eligibility criteria outlined in the Reef Credit Standard.

### 2.1 LOCATION

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The proposed project area must be located within the boundaries of Great Barrier Reef NRM Regions that have a target outlined in the Reef 2050 Water Quality Improvement Plan to reduce DIN exports to the GBR at the time of project application.

### 2.2 PROJECT LAND CHARACTERISTICS

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The project area must include land that:

1. has been under cultivation\* during the baseline period; and
2. has been treated with nitrogen-based fertiliser during the baseline period; and
3. the project proponent has the legal right to manage and undertake the implementation of project activities.

\*note that project eligibility is limited to land uses where DIN loss can be modelled by Paddock to Reef Projector. At the time of writing this included sugarcane and bananas but is expected to increase in scope.

### 2.3 PROJECT ACTIVITIES

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Project activities must:

1. reduce the quantity of DIN loss relative to the baseline period through improved management practices and/or reduced nitrogen fertilizer application; and
2. ensure that fertiliser application rates must comply with any applicable government regulations; and
3. demonstrate moderate risk nutrient management practices as defined by the **Reef 2050 Water Quality Improvement Plan<sup>2</sup>** or equivalent framework in place at time of project application across the property for the duration of the crediting period; and
4. be consistent with the local NRM Plan<sup>3</sup>, or otherwise provide a justification as to why the NRM Plan should be over-ridden; and
5. be compliant with all federal, state and local regulations.

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<sup>2</sup> <https://www.reefplan.qld.gov.au/tracking-progress/paddock-to-reef/management-practices>

<sup>3</sup> Proponents should contact their local NRM group for the NRM Plan in force at the time

## 2.4 LAND USE CHANGE

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If the project involves a change in land use, the project proponent must have obtained any necessary permits and demonstrate that the project will not have a negative impact on catchment water quality relative to the baseline by implementing one or more Reef Credit Accounting methodologies. In the absence of an applicable method, the proponent must demonstrate that the proposed land use change implements moderate risk, or better, management practices under the relevant **Reef 2050 Water Quality Improvement Plan**<sup>4</sup> or equivalent framework in place at time of project application across the property for the duration of the crediting period.

## 2.5 ADDITIONALITY

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For a project to qualify as additional it must initially fulfil three requirements:

1. The law must not require the proposed project activity/ies;
2. The project activity/ies must be on the 'positive list' outlined in the Reef Credit Standard; and
3. The project activity/ies must not be on the 'negative list' outlined in the Reef Credit Standard.

Project proponents must demonstrate additionality by applying the Reef Credit Additionality Test. Alternatively, proponents may use the *Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities VT0001 version 3.0*<sup>5</sup>. When applying the tool project proponents shall consider any activity eligible under this method as an "eligible AFOLU activity". Further project proponents should substitute "pollutant reductions" for "GHG emissions" and "Reef Credits" for "GHG Credits" and where appropriate "Reef Credit Standard" for "VCS".

## 2.6 LEAKAGE

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Leakage may be considered to occur if there is an increase in fertiliser application or a move to higher risk land management practices on areas outside the project RCAZ but under the management of the same land owner and/or land manager, that is responsible for implementation of project activities as a result of the implementation of the project.

Project proponents must complete steps under 2.6.1 at the time of project application and each monitoring period to determine if there is a risk of project leakage and if so the appropriate procedure to account for it.

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### 2.6.1 DETERMINE IF THE PROJECT MAY BE AT RISK OF LEAKAGE

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<sup>4</sup> <https://www.reefplan.qld.gov.au/tracking-progress/paddock-to-reef/management-practices>

<sup>5</sup> <https://verra.org/methodology/vt0001-tool-for-the-demonstration-and-assessment-of-additionality-in-vcs-agriculture-forestry-and-other-land-use-afolu-project-activities-v3-0/>

Step 1. Determine if the land owner and/or land manager is responsible for the management of other crops outside the project RCAZ.

If the answer is no, then the risk of project leakage is considered to be zero and the project proponent should proceed to section 3. If answer is yes, then proceed to Step 2.

Step 2. The project proponent must determine the area of **land subject to leakage** under their control that is not a part of the project RCAZ. This would include, for example, areas of land that would be under the same kind of agricultural enterprise as the areas within the RCAZ. Project proponents should follow the same procedures for mapping land subject to leakage as described in Section 3. Project Mapping.

Step 3. Once the area of **land subject to leakage** has been identified the project proponent must determine the *credible risk* of the **land subject to leakage** shifting to a management scenario as a result of the project where either a) the fertiliser application rate is higher than that calculated in the baseline period or b) a higher risk level of management practice is undertaken as defined in the **Reef Plan Water Quality Risk Framework** or equivalent framework in place at time of project application date.

*Credible risk* should be qualified as either likely or unlikely. If the risk is considered to be likely the area must be monitored and reported on at the end of each monitoring period and project proponents must complete Step 4 at the end of each monitoring period.

Step 4. At the end of each monitoring period if it is found that either scenario a) or b) described in Step 3 has occurred, then the change must be accounted in accordance with the procedures described in Section 5: 'Project Accounting' and deducted from the final RC volume.

### 3 PROJECT MAPPING

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The project area boundaries must be delineated in accordance to the requirements of this section.

For the purposes of stratification of the project area into RCAZ, the project proponent must use GIS datasets.

#### 3.1 GEOSPATIAL CAPTURE

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A project proponent may use any of the following sources of data to delineate the boundaries of project zones:

- a) UAV (drone) derived photogrammetry
- b) Air-photo photogrammetry
- c) ortho-rectified aerial photographs
- d) ortho-rectified satellite imagery
- e) cadastral database

#### 3.2 FITNESS FOR PURPOSE

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Prior to using a dataset, project proponents should assess the appropriateness of the dataset for the intended use, or its fitness for purpose against criteria that include:

- Age
- Scale
- Resolution
- Accuracy
- Classification, aggregation, generalisation systems (for example, smoothing)
- Integrity of dataset

#### 3.3 ACCURACY

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For all projects under this method, the minimum requirement for spatial data is a horizontal accuracy of 10 metres at 95 per cent threshold.

#### 3.4 REEF CREDIT ACCOUNTING ZONES

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The project area must be stratified into RCAZ according to uniform:

- a. crop;
- b. soil type;
- c. climate zone; and
- d. proposed land management;

for each year of the baseline period and for each year of the monitoring period such that each zone has a single land-use and/or crop and a uniform nitrogen application rate across

the entirety of the zone for each crop cycle. Proponents employing Variable Rate Technology (VRT) with zonal or variable rate fertiliser application across the block are excepted.

Soil type and climate zone stratification must correspond to soil type and climate zones utilised in the Queensland Government's Paddock to Reef Projector.

Each RCAZ may correspond to a 'block' land management unit as referenced in farm records if each of the above criteria are met. RCAZ boundaries may change from year to year to reflect variations in land management but the total project area boundary must remain fixed for the duration of the baseline and project crediting period. Any changes to land management within a project RCAZ resulting in crop or applied nitrogen heterogeneity across the entirety of the RCAZ must be re-stratified in accordance to this section.

For example, Bruce has implemented nutrient run-off reduction Reef Credit project on his 100ha cane farm. In the first year of his project he applied fertiliser to four 20ha blocks (RCAZ 1-4) of sugarcane and left 20ha (RCAZ 5) under fallow with no N fertiliser added. In the second year of his project Bruce subdivided the four blocks to which he applied N fertiliser in the previous year and put half of each under fallow (RCAZ 1-4), increasing his fallow area to 40ha. He applied N fertiliser to the remaining 60ha with one 20ha block of plant cane (RCAZ 5) and four 10ha blocks of ratoon cane (RCAZ 5-9). Although, Bruce's cane farm was managed as 5 blocks (RCAZ 1-5) in year 1 and 9 blocks (RCAZ 1-9) in year 2, the overall project area of 100ha and boundary remained the same.

The geographic boundary of the project area must be identified on a geospatial map consistent with the requirements of this section and submitted at the time of project application.

In addition, evidence that the entire project area was under cultivation for the duration of the baseline period is required at the time of project application.

A Land Management Plan for the property must be prepared outlining soil, nutrient and irrigation management strategies. The Land Management Plan must include:

- 1) Maps of project area at project commencement;
- 2) Description of Baseline soil, nutrient and irrigation management activities including nitrogen application rates and fertiliser types in accordance with the relevant Paddock to Reef Program Water Quality Risk Framework;
- 3) Maps of project area and RCAZs for each monitoring period;
- 4) Description of soil, nutrient and irrigation management activities in each monitoring period including N application rates and fertiliser types
- 5) Proposed soil and nutrient management activities for the remainder of the crediting period.
- 6) In the event of land use change to a zero nitrogen application, details of analysis that change will not have a negative impact on water quality.

A Nutrient Management Plan can form the basis of the Land Management Plan providing criteria 1-6 are addressed. The Land Management Plan must be kept up to date for the duration of the crediting period and be submitted at the end of each monitoring period with the application for Reef Credits.

This section outlines the steps which must be followed to determine project DIN loss reductions as a result of project activities. The method utilised a modelled approach to estimate DIN loss in the baseline and monitoring periods. Models must take into account significant factors that influence DIN loss including, soil, nutrient and water management activities, geomorphology, climate, soil type and spatial location.

### 5.1 RELEVANT NITROGEN POOLS

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For the purpose of this section relevant nitrogen pools must include all nitrogen sources regulated under the Queensland Government *Environmental Protection Act 1994* or legislation in force at the time of fertiliser application. The relevant volumes must reflect the actual nitrogen content (kg N/year) of the fertiliser, not the total amount of fertiliser applied.

### 5.2 BASELINE SCENARIO

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This section outlines the procedure to calculate average annual DIN loss in the baseline period, 7 years preceding project start, based on historical nitrogen fertiliser application rates. Proponents must include a summary of the baseline scenario and provide an explanation of why the baseline was chosen including an assessment of the barriers to implementation of the proposed project activities.

#### 5.2.1 BASELINE PERIOD NITROGEN APPLICATION CALCULATIONS

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Project proponents must provide evidence of the historical nitrogen fertiliser application during the baseline period. Evidence may include, but is not limited to, agricultural records, nitrogen application rate determinations, tax receipts, farm management diaries, chemical inventories, consultant records, etc.

##### 5.2.1.1 NITROGEN APPLICATION FOR EACH RCAZ IN EACH YEAR OF BASELINE PERIOD

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The total nitrogen applied to each RCAZ for each year of the baseline period must be calculated by applying the following equation:

$$N_{i,j} = Nb_{i,j} * A_{i,j}$$

EQUATION 1

where:

$N_{i,j}$  is the total nitrogen applied to each RCAZ,  $i$ , in year,  $j$ , of each year of the baseline period;

$Nb_{i,j}$  is the nitrogen application rate, in kg ha<sup>-1</sup>, in RCAZ,  $i$ , in year,  $j$ , of the baseline period;  
and

$A_{i,j}$  is the area, in ha, of RCAZ,  $i$ , in year,  $j$ , of the baseline period.

If a Reef Credit Accounting Zone is under bare fallow or green fallow any year during the baseline period, the nitrogen application rate must be set to zero in the absence of evidence for nitrogen application in the fallow period.

#### 5.2.1.2 TOTAL NITROGEN APPLICATION RATE FOR EACH YEAR OF THE BASELINE

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The nitrogen application rate in the project area for each year of the baseline period must be calculated by applying the following equation:

$$Nbr_j = \frac{\sum N_{i,j}}{\sum A_{i,j}}$$

EQUATION 2

where:

$Nbr_j$  is the nitrogen application rate in the project area in year,  $j$ , of the baseline period;

$N_{i,j}$  is the total nitrogen applied, in kg, in RCAZ,  $i$ , in year,  $j$ , of the baseline period; and

$A_{i,j}$  is the area, in ha, of RCAZ,  $i$ , in year,  $j$ , of the baseline period.

If a Reef Credit Accounting Zone is under bare fallow or green fallow any year during the baseline period, the nitrogen application rate must be set to zero in the absence of evidence for nitrogen application in the fallow period.

#### 5.2.1.3 REGULATED NITROGEN APPLICATION RATE FOR EACH YEAR OF BASELINE PERIOD TEST

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The nitrogen application rate for each year of the baseline period must not exceed the regulated nitrogen application rate calculated in accordance with the *Environmental Protection Act 1994* or legislation in force at the time of application.

Project proponents must calculate the regulated nitrogen application rate for each year of the baseline period in accordance with the relevant legislation or if not regulated, by an industry standard method<sup>6</sup>.

For example, a cane farmer must calculate the N application rate using the method outlined in “Farming in Reef Catchments: the method for calculating the optimum amount of nitrogen and phosphorus to be applied to sugarcane properties regulated under the *Environmental Protection Act 1994*”

Evidence for method and calculations of regulated nitrogen application rates must be provided with the first crediting application.

If the nitrogen application rate ( $Nbr_j$ ) during any year of the baseline period, as determined by Equation 2, exceeds the regulated rate, then the baseline rate must be defined as the regulated rate for each RCAZ for that year.

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<sup>6</sup> Evidence is required to establish the method used for calculating optimum N is industry standard in the absence of applicable regulated methods.

For projects registered under the Reef Credit pilot phase, the nitrogen application rate for the first three years of the baseline period ( $j=1, j=2, j=3$ ) may be set to the regulated nitrogen application rate calculated for that year.

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## 5.2.2 BASELINE PERIOD DIN LOSS CALCULATIONS

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Project proponents must provide evidence of the historical soil and nutrient management practices during the baseline period. Evidence may include, but is not limited to, agricultural ERA records, nitrogen application rate determinations, tax receipts, farm management diaries, chemical inventories, consultant records, etc.

### 5.2.2.1 DIN LOSS FOR EACH YEAR OF THE BASELINE PERIOD

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To determine the quantity of applied nitrogen lost as DIN for each year of the baseline period utilise the Queensland Government Paddock to Reef Projector<sup>7</sup>. The Paddock to Reef Projector is underpinned by the Queensland Government's Catchment Load Modelling Program and takes into account the impact of soil, nutrient and water management activities as well as spatially explicit factors such as location, climate, geomorphology and soil features.

The total DIN loss, in kg, from each RCAZ in each year of the baseline period, must be calculated by applying the following equation:

$$DINb_{i,j} = A_{i,j} * DLRb_{i,j}$$

EQUATION 3

where:

$DINb_{i,j}$  is the total DIN loss, in kg, from each RCAZ,  $i$ , in each year,  $j$ , of the baseline period;

$A_{i,j}$  is the area, in ha, of RCAZ,  $i$ , in year,  $j$ , of the baseline period; and

$DLRb_{i,j}$  is the DIN loss rate, in kg ha<sup>-1</sup>, from RCAZ,  $i$ , in year,  $j$ , of the baseline period as determined by the Queensland Government Paddock to Reef Projector.

The total DIN loss, in kg, in each year of the baseline period, must be calculated by applying the following equation:

$$DINb_j = \sum DINb_{i,j}$$

EQUATION 4

where:

$DINb_j$  is the total DIN loss, in kg, from the project area in each year,  $j$ , of the baseline period;

$DINb_{i,j}$  is the total DIN loss, in kg, from each RCAZ,  $i$ , in each year,  $j$ , of the baseline period;

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<sup>7</sup> Queensland Government Paddock to Reef Projector is available via the web. Usage may incur a subscription fee. <https://p2rprojector.net.au/>

### 5.2.2.2 AVERAGE DIN LOSS FOR THE BASELINE PERIOD

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The average DIN loss, in kg, for the 7-year baseline period, must be calculated by applying the following equation:

$$\overline{DINb} = \frac{\sum DINb_j}{t_b}$$

EQUATION 5

where:

$\overline{DINb}$  is the average total per annum DIN loss in the project area during the baseline period;

$DINb_j$  is the total DIN loss, in kg, from the project area in each year,  $j$ , of the baseline period;

$t_b$  is the number of years in the baseline period,  $b$ , equal to 7 years.

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### 5.2.3 ACCOUNTING BASELINE DIN LOSS IN AREAS SUBJECT TO LEAKAGE

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To determine average DIN loss in the baseline period for areas subject to leakage, carry out the calculations in sections 5.2.2 and 5.2.3 for the areas identified as being at risk in section 2.6.

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## 5.3 PROJECT MONITORING PERIOD CALCULATIONS

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This section provides guidelines for quantifying project nutrient loss for the monitoring period.

Total nutrient loss rates for the monitoring period,  $DLRp_{i,r}$ , for each RCAZ in the project area must be determined by utilising the Paddock to Reef Projector outlined in Section 5.2.2. The project proponent must update modelling input parameters to reflect management activities implemented during the monitoring period.

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### 5.3.1 CALCULATION OF PROJECT NITROGEN APPLICATION RATES

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Project proponents will need to be able to provide evidence of their nitrogen fertiliser application and land management practices for the duration of each monitoring period at the end of each monitoring period. Evidence may include, but is not limited to, agricultural ERA records, nitrogen application rate determinations, tax receipts, farm management diaries, chemical inventories, consultant records, etc.

For the purposes of accounting, the monitoring period should span the same period as the baseline year, e.g. if nitrogen application rates determined in the baseline period are averaged from January to December then the monitoring period must also cover January to December.

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#### 5.3.1.1 NITROGEN APPLICATION FOR EACH RCAZ FOR PROJECT MONITORING PERIOD

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The nitrogen applied to each RCAZ for the monitoring period must be calculated by applying the following equation:

$$N_{i,r} = Np_{i,r} * A_{i,r}$$

EQUATION 6

where:

$N_{i,r}$  is the total nitrogen applied to each RCAZ,  $i$ , for the monitoring period,  $r$ ;

$Np_{i,r}$  is the nitrogen application rate, in kg ha<sup>-1</sup>, in RCAZ,  $i$ , in current monitoring period,  $r$ ;  
and

$A_{i,r}$  is the area, in ha, of RCAZ,  $i$ , in year,  $r$ , of the monitoring period.

If a Reef Credit Accounting Zone is under bare fallow or green fallow during the monitoring period, the Nitrogen application rate must be set to zero in the absence of evidence for nitrogen application in the fallow period.

#### 5.3.1.2 TOTAL NITROGEN APPLICATION RATE FOR PROJECT MONITORING PERIOD

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The nitrogen application rate for the monitoring period must be calculated by applying the following equation:

$$Np_r = \frac{\sum N_{i,r}}{\sum A_{i,r}}$$

EQUATION 7

where:

$Np_r$  is the nitrogen application rate in the project area monitoring period,  $r$ ;

$N_{i,r}$  is the total nitrogen applied, in kg, in RCAZ,  $i$ , in monitoring period,  $r$ ; and

$A_{i,r}$  is the area, in ha, of RCAZ,  $i$ , in monitoring period,  $r$ .

Note: Nitrogen must not exceed the optimum amount calculated in accordance with Section 5.3.1.3.

If a Reef Credit Accounting Zone is under bare fallow or green fallow any year during the baseline period, the Nitrogen application rate must be set to zero in the absence of evidence for Nitrogen application in the fallow period.

#### 5.3.1.3 REGULATED NITROGEN APPLICATION RATE FOR PROJECT MONITORING PERIOD TEST

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The average nitrogen application rate for the project monitoring period must not exceed the regulated nitrogen application rate calculated in accordance with the *Environmental Protection Act 1994* or legislation in force at the time of fertiliser application.

Project proponents must calculate the optimum nitrogen application rate for the current project monitoring period in accordance with the *Environmental Protection Act 1994* or if not

regulated, by an industry standard method<sup>8</sup>. For example, to determine the regulated nitrogen application rate in 2019 for sugarcane, the farmer must use the method outlined in “Farming in Reef Catchments: the method for calculating the optimum amount of nitrogen and phosphorus to be applied to sugarcane properties regulated under the *Environmental Protection Act 1994*”

Evidence for the method and calculation of regulated nitrogen application rates must be provided with each crediting application.

If the average nitrogen application rate during the project monitoring period, as determined by Equation 7, exceeds the optimum rate, the project must not generate any Reef Credits for that monitoring period.

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### 5.3.2 PROJECT MONITORING PERIOD DIN LOSS CALCULATIONS

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Project proponents will need to be able to provide evidence of their soil and nutrient management practices during the project period. Evidence may include, but is not limited to, agricultural ERA records, nitrogen application rate determinations, tax receipts, farm management diaries, chemical inventories, consultant records, etc.

#### 5.3.2.1 DIN LOSS FOR PROJECT MONITORING PERIOD

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To determine the proportion of applied nitrogen lost as DIN for the current project monitoring period utilise the Queensland Government Paddock to Reef Projector<sup>9</sup>. The Paddock to Reef Projector is underpinned by the Queensland Government’s Catchment Load Modelling Program and takes into account the impact of soil, nutrient and water management activities as well as spatially explicit factors such as location, climate, geomorphology and soil features.

The DIN loss, in kg, from each RCAZ for the current project monitoring period must be calculated by applying the following equation:

$$DINp_{i,r} = A_{i,r} * DLRp_{i,r}$$

EQUATION 8

where:

$DINp_{i,r}$  is the total DIN loss, in kg, from each RCAZ,  $i$ , for the monitoring period,  $r$ ;

$A_{i,r}$  is the area, in ha, of RCAZ,  $i$ , in monitoring period,  $r$ ; and

$DLRp_{i,r}$  is the DIN loss rate, in kg ha<sup>-1</sup>, from RCAZ,  $i$ , in monitoring period,  $r$ , as determined by the Queensland Government Paddock to Reef Projector.

The total DIN loss in the project area, in kg, for the monitoring period, must be calculated by applying the following equation:

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<sup>8</sup> Evidence is required to establish the method used for calculating optimum N is industry standard in the absence of applicable regulated methods.

<sup>9</sup> Queensland Government Paddock to Reef Projector is available via the web. Usage may incur a subscription fee. <https://p2rprojector.net.au/>

$$DINp_r = \sum DINp_{i,r}$$

EQUATION 9

where:

$DINp_r$  total DIN loss in the project area, in kg, for the monitoring period,  $r$ ;

$DINp_{i,r}$  is the DIN lost, in kg, from RCAZ,  $i$ , in monitoring period,  $r$ , calculated in accordance with Equation 8.

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### 5.3.3 ACCOUNTING MONITORING PERIOD DIN LOSS IN AREAS SUBJECT TO LEAKAGE

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To determine average DIN loss in the baseline period for areas subject to leakage, carry out the calculations in sections 5.3.1 and 5.3.2 for the areas identified as being at risk in section 2.6.

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### 5.4 CALCULATION OF CHANGE IN DIN LOSS

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The difference in total DIN loss between the baseline period and the monitoring period must be calculated by applying the following equation:

$$\Delta DIN_r = \overline{DINb} - DINp_r$$

EQUATION 10

where:

$\Delta DIN_r$  is the difference in total DIN loss, in kg, between the baseline period and monitoring period,  $r$ ;

$\overline{DINb}$  is the average total per annum DIN loss, in kg, in the project area during the baseline period as calculated in equation 5; and

$DINp_r$  total DIN loss in the project area, in kg, for the monitoring period,  $r$  as calculated in equation 9.

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#### 5.4.1 CALCULATION OF CHANGE IN DIN LOSS FOR AREAS SUBJECT TO LEAKAGE

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To determine difference in DIN loss for the monitoring period relative to the baseline period for areas subject to leakage, carry out the calculations in section 5.4 for the areas identified as being at risk in section 2.6.

$$\Delta DIN_{r,leakage} = DINb_{leakage} - DINp_{r,leakage}$$

where:

$\Delta DIN_{r,leakage}$  is the difference in total DIN loss, in kg, between the baseline period and monitoring period,  $r$ , for areas identified as being at risk of leakage;

$\overline{DIN}_{b,leakage}$  is the average total per annum DIN loss, in kg, for the area identified as being at risk of leakage during the baseline period as calculated in section 5.2.3; and

$DIN_{p,r,leakage}$  total DIN loss for the area identified as being at risk of leakage, in kg, for the monitoring period,  $r$  as calculated in section 5.3.3.

A difference in DIN loss between the baseline and monitoring periods for lands subject to leakage greater than or equal to zero demonstrates that that leakage has not occurred as a result of project activities.

If the difference in DIN loss between the baseline and monitoring periods for lands subject to leakage is negative the project proponent must:

- a. calculate the impact on Reef Credit abatement in accordance with section 5.5; or
- b. submit evidence demonstrating that the difference is not a result of Reef Credit project activities carried out within the Reef Credit project area with the monitoring report for verification by audit and consideration of the Reef Credit Secretariat.

## 5.5 CALCULATION OF CHANGE IN DIN ENTERING THE GREAT BARRIER REEF

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The reduction achieved during the monitoring period in the DIN load transported to the end of catchment to the Great Barrier Reef must be calculated by applying the following equation:

$$DIN_r = (\Delta DIN_r + \Delta DIN_{r,leakage}) * DIN_{ex}$$

EQUATION 11

where:

$DIN_r$  reduction in DIN transported to the GBR during the monitoring period,  $r$ ;

$\Delta DIN_r$  is the difference in total DIN loss between the baseline period and monitoring period,  $r$ ;

$\Delta DIN_{r,leakage}$  should only be applied to Equation 11 if the value is less than 0. It is defined as the difference in total DIN loss, in kg, between the baseline period and monitoring period,  $r$ , for areas identified as being at risk of leakage;

$DIN_{ex}$  is the contribution to export which reflects the proportion of DIN that is transported to the GBR based on project location<sup>10</sup>.

## 5.6 CALCULATION OF MONITORING PERIOD REEF CREDITS

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To determine the quantity of Reef Credits generated by project activities during the monitoring year, apply the following equation:

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<sup>10</sup> Contribution to export is a dataset generated by the Queensland Government. Please refer to the Reef Credit website for information on accessing the data.

$$RC_r = DIN_r$$

EQUATION 12

where:

$RC_r$  is the number of RC created at the end of the monitoring period,  $r$ ;

$DIN_r$  reduction in DIN, in kg, transported to the end of catchment during the monitoring period,  $r$ ;

If  $RC_r$  is zero then no credits are issued for the monitoring period.

## 5.7 UNCERTAINTY

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The relationship between nitrogen application rate and DIN loss is well established with the volume of nitrogen applied being the most significant factor influencing DIN loss. Nitrogen application rates are one of the key model inputs and must be evidenced by record keeping in order to reduce uncertainty. Furthermore, in addition to nitrogen inputs, modelled DIN loss must take into account, at minimum, explicit spatial, climate, geomorphology and soil features, which are also factors known to influence DIN loss and DIN transport.

The Paddock to Reef Projector tool is underpinned by the Queensland government's Paddock to Reef Program catchment modelling (using source catchments) and catchment monitoring program. Monitoring data is collected to validate and improve model performance overtime.

With the expectation that we will gain a greater understanding of factors influencing DIN loss over time, project proponents must use the most recent release of the Paddock to Reef Projector to estimate DIN loss. If the approach outlined in this method is followed than no additional confidence deduction is required to account for uncertainty.

## 6 MONITORING AND RECORD-KEEPING REQUIREMENTS

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This section sets out monitoring and record-keeping requirements under this methodology for a registered Reef Credit project.

A Monitoring report must be submitted as a requirement for each monitoring period. The project proponent must monitor the RCAZs of the project for compliance with the project land management plan and document land management activities and any unplanned disturbances to project area.

The monitoring report must include documentary evidence of nitrogen application events during the monitoring period, this must include but is not limited to:

- a) Evidence of equipment calibration
- b) Records of date and rate of nitrogen application for each RCAZ
- c) Records of fertilizer receipts and/or farm management diaries
- d) Soil testing results
- e) Rainfall records.

Records must be kept in relation to each of the requirements for remotely-sensed imagery set out in section 3.