

Queensland  
**REEF WATER  
QUALITY**



Farming in Reef catchments

**Prescribed methodology  
for banana cultivation**

Prepared by:

Office of the Great Barrier Reef, Environmental Policy and Programs, Department of Environment and Science

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## Glossary

**Activity:** The agricultural environmentally relevant activity (ERA) to which this agricultural ERA standard applies.

**Appropriate Person:** A person who has professional qualifications, training or skills or experience relevant to completing a nutrient management plan. This must include the ability to give an authoritative assessment, advice and analysis relevant to the farm, block and management zone, using protocols, standards, methods or literature, where relevant.

**Block:** An area of land that is typically used to grow bananas.

**Calculated amount:** The calculated amount relates to the kilograms of nitrogen or phosphorus contained in fertiliser products applied per hectare, kg/ha.

**Fertiliser:** Means a product that contains a quantified amount, obtained by analysis, of nitrogen and/or phosphorus.

**Great Barrier Reef catchment:** Has the same meaning in the *Environmental Protection Act 1994*. The Great Barrier Reef catchment is the area shown on a map prescribed by regulation as the Great Barrier Reef catchment.

**Leaf testing:** Means a test of the characteristics of leaves, analysed by a National Association of Testing Authorities (NATA) or Australasian Soil and Plant Analysis Council (ASPAC) accredited laboratory, or one holding an equivalent certification.

**Management zone:** A group of blocks that are of the same soil type, planted at the same time and treated the same for nutrient application.

**Nutrient management plan:** Means the farm map and any other documents (including records, fertiliser recommendations, and leaf test and analysis results) used to prepare the nutrient management plan.

**Plant crop:** For the purposes of this standard means the initial banana crop after planting.

**Ratoon crop:** For the purposes of this standard means a new crop of bananas produced from suckers of the harvested plant.

**Relevant primary document:** Means a document relating to the carrying out of the activity that is the subject of the record from which information in the record was obtained, and can include:

- Receipts and invoices for the purchase of a chemical or fertiliser product;
  - A summary of tailored advice about carrying out the agricultural ERA (e.g. recommended application rates and frequency); and
- Leaf test and analysis reports.

**Threshold rate:** The annual nitrogen and or phosphorus application rate, over which, a nutrient management plan is required, i.e. 280 kg N/ha/year for plant crops and 400 kg N/ha/year for ratoon crops and 60 kg P/ha/year for plant and ratoon crops.

**Whole-of-farm:** Means an area to which the nutrient management plan can apply where:

- the activity is carried out under the day-to-day management of a single responsible individual, for example, a site or operations manager
- the activity is operationally interrelated
- the activity is, or will be, carried out at 1 or more places
- places where the activities are carried out are separated by distances short enough to make feasible the integrated day-to-day management of the activities;

**Yield:** Means an annual record of banana production. The yield measurement used can be determined by the farmer, but the same measure should be used each year. Example yield measurements include:

- the number of cartons per year per farm
- the amount of bananas produced per year per farm
- the amount of bananas sent to market per year per farm
- or any other annual quantifiable measurement of production.

## Introduction

The *Environmental Protection Act 1994* requires commercial beef graziers, sugarcane growers, banana growers and horticulture and grain growers in the Wet Tropics, Burdekin, Mackay Whitsunday, Fitzroy or Burnett Mary regions of the **Great Barrier Reef catchment** to comply with commodity-specific minimum practice standards.

The minimum practice standards for each commodity are outlined in an Agricultural ERA standard that is prescribed by regulation. The regulated minimum agricultural practice standards are based on the best available science and agricultural industry expertise to deliver significant water quality benefits for the Reef while driving better land management practices for profitable and productive farming.

In this document, the standards and associated regulatory provisions under the legislation are collectively referred to as the Reef protection regulations.

The purpose of the Reef protection regulations is to protect the health of the Great Barrier Reef by reducing pollutant run-off (nutrients, sediment and pesticides) in waterways that flow to the Reef. The nutrient amounts in this guide focus on nitrogen (N) and phosphorus (P), the two nutrients of environmental importance because of the risk they pose to water quality in Great Barrier Reef coastal and marine ecosystems.

This document is directly referred to in the Agricultural ERA standard for banana cultivation. If you grow bananas commercially in the Wet Tropics, Burdekin, Mackay Whitsunday, Fitzroy or Burnett Mary regions of the Great Barrier Reef catchment, this methodology must be used to calculate **fertiliser** application rates to comply with the Reef protection regulations for nutrient application. The explanatory information in this document is to be used by growers, and others involved in providing nutrient recommendations on agricultural properties.

The Great Barrier Reef catchment consists of the Cape York, Wet Tropics, Burdekin, Mackay Whitsunday, Fitzroy or Burnett Mary regions, as shown on a map prescribed by regulation as the Great Barrier Reef catchment. You can find out if your property is in one of these regions by completing this [online form](http://www.qld.gov.au/ReefRegulations) available at [www.qld.gov.au/ReefRegulations](http://www.qld.gov.au/ReefRegulations).

## Purpose of this document

The purpose of this document is to describe the methodology for determining the amount of nitrogen and phosphorus to apply to banana agricultural properties (banana farms) in accordance with the Agricultural ERA standard for banana cultivation – version 1 under the *Environmental Protection Act 1994* by:

- outlining the methods for determining fertiliser rates on banana growing properties
- outlining requirements for **leaf testing**, which is required when using a **Nutrient Management Plan** to determine fertiliser rates
- providing information on where to find help and further information

## Regulation timeframe for commercial banana growing

The Reef protection regulations apply to different regions at different times. Please refer to the table below for the timeframes for when the Reef protection regulations take effect for commercial banana growing.

Commodity	Region	General record keeping requirements	Regulated agricultural practice standards
Banana	Wet Tropics	1 December 2019	1 December 2020
	Burdekin, Mackay Whitsunday, Fitzroy and Burnett Mary	1 December 2019	1 December 2022

## What do I need to do?

The **calculated amount** relates to the kilograms of nitrogen and phosphorus contained in fertiliser products to be applied per hectare (kg/ha), per year. The amount per year for ratoon crops is defined as twelve months from the first application of fertiliser containing nitrogen and/or phosphorus after the commencement of the regulated agricultural standards (refer to table above on page 4). For new plant crops established after commencement of the regulations, the amount per year is defined as twelve months from the first application of fertiliser containing nitrogen and/or phosphorus after the crop is established. This date must be maintained as the crop is ratooned.

This methodology refers to the actual amount (kg) of nitrogen or phosphorus (i.e. the nutrient content) in the fertiliser product. The nutrient content of the fertiliser product can be found on the label or from the supplier for a custom blend.

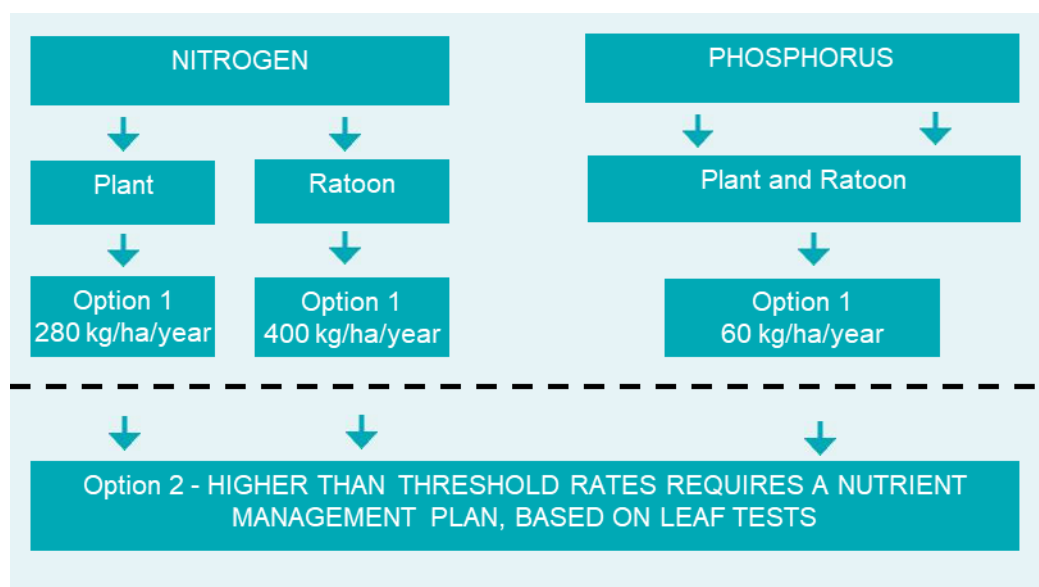
When working out your crop's nutrient requirements on a **block** basis or **management zone** there are two options available for you to determine the amount of fertiliser containing nitrogen and/or phosphorus to apply to your crop.

### Option 1 Threshold annual rates

Apply nitrogen and/or phosphorus rates lower than, or equal to the **threshold rates** (shown in Figure 1 and Table 1) for either plant or ratoon crops. For more detailed information see [Option 1 - I am not going to apply more than the threshold annual rates](#).

### Option 2 Nutrient Management Plan

If you want to apply more than the threshold rates, you must develop a Nutrient Management Plan using the results of leaf testing to adjust rates of nitrogen and/or phosphorus according to the plant's needs, and apply fertiliser accordingly. For more information see [Stage 2 How do I collect a leaf sample to determine the amount of nitrogen and phosphorus that I can apply?](#) For more detailed information see [Option 2 - Developing a nutrient management plan](#).



**Figure 1:** Summary of options for applying nitrogen and phosphorus.

Whichever option you choose, you must not apply more than the application rate determined by either method. You can find more detail on how to follow each method in the following sections.

### Option 1 - I am not going to apply more than the threshold annual rates

If you decide to use nitrogen and/or phosphorus application rates that are lower than, or equal to the threshold rates outlined in Table 1, you are required to make a record of your application in accordance with Agricultural ERA standard for banana cultivation – version 1 under the *Environmental Protection Act 1994* i.e. nitrogen and phosphorus rates applied and method of application. There are no further requirements under this method when implementing Option 1.

**Table 1:** Threshold annual rates of nitrogen and phosphorus

Crop stage	Nitrogen kg/ha/year	Phosphorus kg/ha/year
Plant	280	60
Ratoon	400	60

### Option 2 - developing a Nutrient Management Plan

A Nutrient Management Plan must be developed and used for the **whole-of-farm**, block or management zone when the annual nitrogen and/or phosphorus application rates will be higher than the threshold annual rates in Table 1.

One Nutrient Management Plan can be used to inform application rates on:

- a number of farms if those farms meet the requirements outlined for whole-of-farm, as explained in the definition table below,
- an individual block or blocks, which will be treated differently for nutrient application,
- a management zone, which meets the glossary definition of management zone.

A Nutrient Management Plan must meet all the requirements outlined under the Agricultural ERA standard for banana cultivation – version 1 under the *Environmental Protection Act 1994*. These include (but are not limited to) the following elements:

- farm map/s showing block boundaries, block identifiers, block area (ha), and leaf sampling locations
- the results of leaf testing for nitrogen and phosphorus
- nitrogen and phosphorus recommendations by an **appropriate person** including recommended application rates and frequency of application
- annual nitrogen and phosphorus application rates applied
- once established, the Nutrient Management Plan must record the annual **yields** achieved (for example as the total number of cartons per year per farm, the amount of bananas produced per year per farm, or the amount of bananas sent to market per year per farm)
- names, date and contact details of the appropriate person/s.

#### Defining whole-of-farm

For the purposes of this methodology, whole-of-farm means the area to which the Nutrient Management Plan applies where:

- (a) the **activity** is carried out under the day-to-day management of a single responsible individual, for example, a site or operations manager
- (b) the activity is operationally interrelated
- (c) the activity is, or will be, carried out at one or more places
- (d) places where the activities are carried out are separated by distances short enough to make feasible the integrated day-to-day management of the activities.








Your Nutrient Management Plan must use the results from leaf testing to justify the need to apply nitrogen and phosphorus rates above the threshold annual rates. Leaf testing is only required for those areas (e.g. blocks or management zones) where threshold rates will be exceeded. However, your Nutrient Management Plan should include a farm map for the whole-of-farm, including those areas where rates will not exceed the threshold.

The current annual threshold rates and the methods in this guide are based on the best available science and agricultural industry expertise.

## A guide to the stages of creating a Nutrient Management Plan

There are a number of stages associated with developing your Nutrient Management Plan. More details are provided in the following stages.

<b>Stage 1: Farm map</b>	Develop a farm map clearly showing block boundaries, area of each block (ha) and soil types	
<b>Stage 2: Leaf testing</b>	Leaf sample collection	
<b>Stage 3: Leaf analysis in the laboratory</b>	Laboratory selection	
<b>Stage 4: Interpretation of results</b>	Use leaf test results to determine nitrogen and phosphorus rates for plant and ratoon crops	
<b>Stage 5: Records</b>	Record keeping	



### Nutrient Management Plan Stage 1 Development of a farm map

Your Nutrient Management Plan must include a farm map for your property that includes as a minimum:

- Block boundaries
- Block identifiers
- Block area (ha)
- Leaf sampling locations (e.g. the block identifier).

You may choose to record the other elements of your Nutrient Management Plan (e.g. leaf test results, fertiliser application rates or yield) on your farm map, or in any alternative format. Your farm

map should include all areas of the farm, including any areas where threshold rates will not be exceeded.

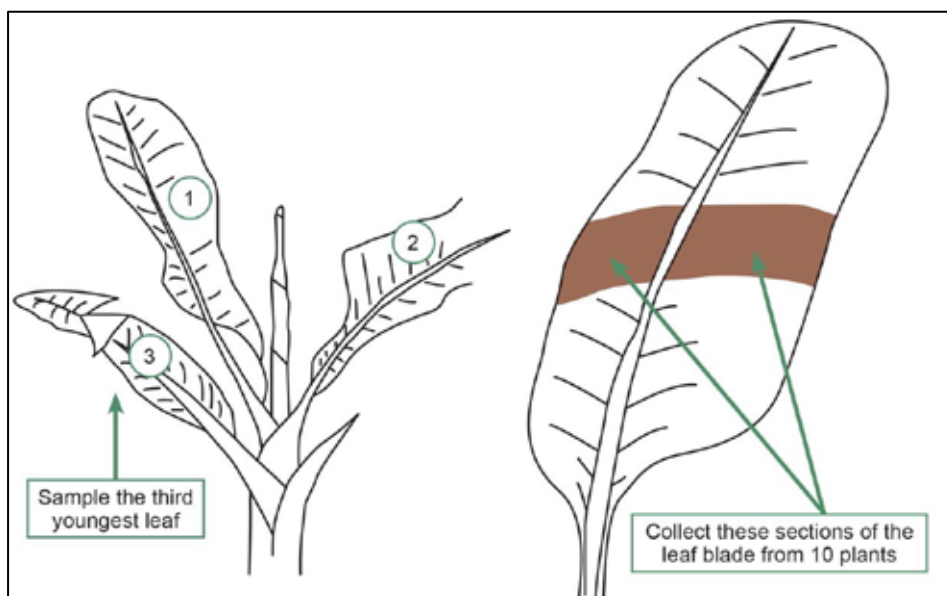


## Nutrient Management Plan Stage 2 Leaf Testing

### How do I collect a leaf sample to determine the amount of nitrogen and phosphorus that I can apply?

You must take leaf samples and use the results of leaf testing if you will be using fertiliser above the threshold annual rates. The leaf test results will allow you to monitor the effectiveness of nitrogen and phosphorus application.

Collect the sample from the third fully expanded leaf, from at least 10 plants in the representative area (Figure 2). Samples should be obtained from plants with a similar age, and at a similar time of year to allow year-to-year comparisons to be made.



**Figure 2:** How to collect a leaf sample (Source: Armour 2018; NSW DPI 2016).

Place the leaf samples into a clean unused paper bag and label using a permanent ink marker with the:

- date
- block or area sampled
- farm name.

Make a record of the leaf sampling locations. For example, this could be using GPS locations, or a record made of the block where sampling occurred.

Attachment 1 provides a form suitable for recording information about the block or sampled areas, which you can submit with the leaf sample to the testing laboratory. Keep a copy of this form for your records. Records can be kept in any form. Submit the leaf sample to a certified laboratory for testing (see Stage 3 below for laboratory selection).



## Nutrient Management Plan Stage 3 Leaf analysis in the laboratory

Leaf samples are only required for determination of nitrogen and/or phosphorus when application rates exceed, or are expected to exceed, the threshold annual rates, i.e. you can sample for nitrogen alone and maintain phosphorus rates under or equal to the threshold annual rate, or vice versa.

Your leaf samples must be sent to a certified laboratory. This ensures that the tests comply with Australian standards and that the results are applicable to Australian conditions. A laboratory must be certified by either:

- the Australasian Soil and Plant Analysis Council (ASPAC)
- the National Association of Testing Agencies (NATA).

**Note:** Other tests, such as soil tests, to determine soil pH or available potassium, calcium and magnesium for example, are encouraged (but are not compulsory under the Reef regulations) for assessing the overall fertility status of the soil and to develop a balanced nutritional program for the crop.



## Nutrient Management Plan Stage 4 Interpretation of results

### How do I determine nitrogen and phosphorus application rates using the results of leaf tests for both plant and ratoon crops?

The following steps show you how to determine nitrogen and phosphorus application rates for plant and ratoon crops based on leaf sampling results.

Your first Nutrient Management Plan (and then every five years following) must be developed and verified by an **appropriate person** (see box below), and they must provide recommendations consistent with the methodology outlined in this document.

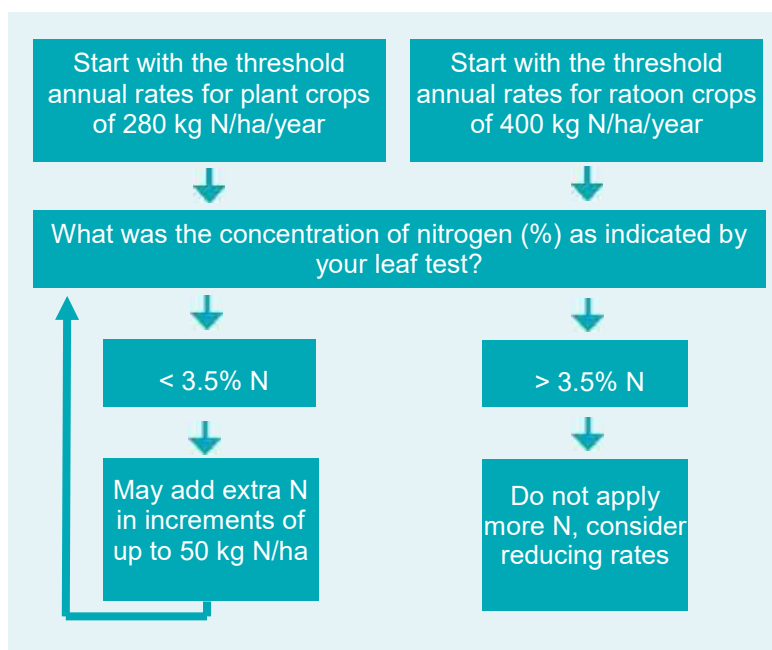
#### Defining appropriate person

An appropriate person is a person who has professional qualifications, training or skills or experience relevant to completing a Nutrient Management Plan. This must include the ability to give an authoritative assessment, advice and analysis relevant to the farm, block and management zone, using protocols, standards, methods or literature, where relevant.

You can find contact details of organisations to help you determine fertiliser rates in the [Contacts](#) section at the end of this document.

### How do I determine the application rate of nitrogen fertiliser to apply to plant and ratoon crops?

Figure 3 outlines the process to determine the application rate of nitrogen fertiliser as part of your Nutrient Management Plan. Use a starting nitrogen application rate of up to 280 kg N/ha/year for **plant crops**, and up to 400 kg N/ha/year for **ratoon crops**, adjust nitrogen rates depending on the concentration of nitrogen determined through leaf testing.



**Figure 3:** The process for determining the application rate of nitrogen on banana crops and ratoon crops.

**Step 1.1:** Take a leaf sample half-way through the crop’s growth period (for both plant and ratoon crops) and send them to a certified laboratory to be tested for nitrogen concentration (see [leaf sample collection](#) on page 8 for more information).

**Step 1.2:** Once you have your leaf tests results, use Table 2 to determine if the nitrogen rates for plant and /or ratoon crops can be modified.

**Table 2:** Concentration of nitrogen in leaf tests.

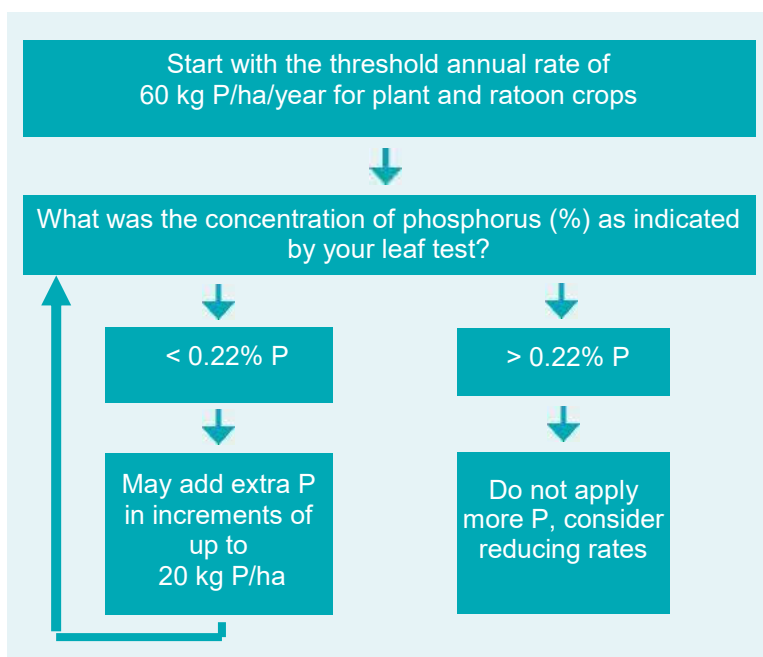
Element	May add extra N in increments of up to 50 kg N/ha	Do not apply more N, consider reducing
% of Nitrogen	< 3.5	> 3.5

**Step 1.3:** If the results show that nitrogen concentration for either plant and/or ratoon crops is greater than 3.5% N, you must not adjust the nitrogen application amount above the rate that was being used to result in a leaf concentration above 3.5% N (see Figure 3). However, you may choose to reduce nitrogen application rates, and continue to monitor nitrogen levels.

**Step 1.4:** If the results show that nitrogen concentration for either plant and/or ratoon crops is less than 3.5% N, you can add extra nitrogen in increments of up to 50 kg N/ha. You will need to conduct further leaf testing to apply each extra increment of 50 kg N/ha for plant, and ratoon crops.

### How do I determine the application rate of phosphorus fertiliser to apply to plant and ratoon crops?

Figure 4 outlines the process to determine the application rate of phosphorus fertiliser as part of your Nutrient Management Plan. Use a starting phosphorus application rate of up to 60 kg P/ha/year for plant crops or ratoon crops, then adjust phosphorus rates depending on the concentration of phosphorus determined by leaf testing.



**Figure 4:** The process for determining the application rate of phosphorus on banana blocks.

**Step 2.1:** Take a leaf sample half-way through the crop’s growth period and send it to a certified laboratory to be tested for phosphorus concentration (see [leaf sample collection](#) on page 8 for more information).

**Step 2.2:** Once you have your leaf test results, use Table 3 to determine if the phosphorus rate can be modified.

**Table 3:** Concentration of phosphorus in leaf tests.

Element	May add extra P in increments of up to 20 kg N/ha	Do not apply more P, consider reducing
% of Phosphorus	< 0.22	> 0.22

**Step 2.3:** If the results show that phosphorus concentration is greater than 0.22% P, you must not adjust phosphorus application amount above the rate that was being used to result in a leaf concentration above 0.22% (see Figure 4). However, you may choose to reduce phosphorus rates and continue to monitor phosphorus levels.

**Step 2.4:** If the results show that phosphorus concentration is less than 0.22% P, you can add extra phosphorus in increments of up to 20 kg N/ha. You will need to conduct further leaf testing for each extra increment of 20 kg P/ha for plant, and ratoon crops.



### Nutrient Management Plan Stage 5 Record keeping

It is important that you keep a record of activities relating to fertiliser application on your banana growing property. Apps and tools are available to help you with this record keeping, e.g. BetterBunch.

If completing a Nutrient Management Plan, the following records must be made within three (3) business days and must be kept for at least six (6) years:

- a farm map/s showing block boundaries, block identifiers, block area (ha), and leaf sampling locations
- the results of leaf testing for nitrogen
- the results of leaf testing for phosphorus
- nitrogen and phosphorus recommendations by an appropriate person, including:
  - recommended application rates
  - appropriate frequency of application.
- annual nitrogen and phosphorus application rates applied (kg/ha/yr)
- annual yields achieved (for example as the total number of cartons per year per farm, the amount of bananas produced per year per farm, or the amount of bananas sent to market per year per farm)
- names, date and contact details of the appropriate person/s.

You can make and keep your records in any format, including on your property map. In addition, you must keep all **relevant primary documents** that relate to the records, for example this could be leaf test and analysis reports or invoices and receipts for the purchase of fertiliser. Attachment 1 provides a record keeping form for leaf sampling which you may choose to use.

## Contacts

For further information you can contact the following organisations:

<p><b>Department of Environment and Science (DES)</b>   13 QGOV (13 74 68)   <a href="mailto:officeoftheGBR@des.qld.gov.au">officeoftheGBR@des.qld.gov.au</a></p>	<p><b>Department of Agriculture and Fisheries (DAF)</b>        Extension officers can be contacted on:   13 25 23 (cost of a local call within Queensland), or 07 3403 6999   <a href="mailto:callweb@daf.qld.gov.au">callweb@daf.qld.gov.au</a>  <b>WWW</b> <a href="http://www.daf.qld.gov.au/about-us/contact-us">www.daf.qld.gov.au/about-us/contact-us</a></p>
<p><b>Australian Banana Growers Council</b>        Extension officers can be contacted via:   07 4015 2797   <a href="mailto:info@abgc.org.au">info@abgc.org.au</a>  <b>WWW</b> <a href="http://www.abgc.org.au">www.abgc.org.au</a></p>	<p><b>Natural resource management groups</b>        You can find your local natural resource management group at:  <b>WWW</b> <a href="http://www.nrmrq.org.au/find-your-regional-group">www.nrmrq.org.au/find-your-regional-group</a></p>

## References

Armour, J. (2018), *Nutrient Management Plan for the Banana Industry (of north Queensland)*, prepared for the Australian Banana Growers' Council. Viewed 18 February 2018, <[https://abgc.org.au/wp-content/themes/abgc/assets/lib/magazine/magazine.html?file=https://abgc.org.au/wp-content/uploads/2018/04/Ban-NMP\\_submit-R1.pdf#magazineMode=true](https://abgc.org.au/wp-content/themes/abgc/assets/lib/magazine/magazine.html?file=https://abgc.org.au/wp-content/uploads/2018/04/Ban-NMP_submit-R1.pdf#magazineMode=true)>

NSW DPI (2016), *Sub-tropical banana nutrition – matching nutrition requirements to growth demands*, Department of Primary Industries, NSW Government.

## Attachment 1. Record keeping form for leaf samples

If your chosen certified laboratory doesn't provide form/s to record your leaf sampling details, you can complete this form for each representative set of leaf samples that you submit to the laboratory for testing. Whichever form you use, keep a copy for your records.

**Grower name**.....

**Property address** .....

**Farm name / ID number** .....

**Contact number** .....

Block/Area sampled (provide details below) ..... .....
Block/Area identifier ..... ..... ..... .....
List the blocks (using their identifiers) that this leaf test represents ..... ..... ..... ..... ..... ..... .....
Date of leaf sampling     ___ / ___ / ___
Leaf sample reference number

