

Farming 4R Land 4R Toolkit

Supporting farmers and communities with practical tools to implement Beneficial Management Practices that protect soil quality and grow agriculture.

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1. Introduction

The Canadian Fertilizer Institute (CFI) in partnership with Alberta Innovates Bio Solutions and financial support from the Climate Change and Emissions Management (CCEMC) Corporation, has initiated Phase II of the Farming 4R Land program in Alberta; demonstrating economic, social and environmental returns by implementing 4R Nutrient Stewardship[®]. Farming 4R Land Phase II will provide producers in Alberta with science-based information and advice on how to use beneficial management practices (BMPs) under the 4R (Right Source @ Right Rate, Right Time, Right Place[®]) Nutrient Stewardship to reduce emissions of greenhouse gases (GHGs) when they apply fertilizer or other crop nutrients on their fields. This program is facilitating a unique network of Alberta producers, agronomy experts, scientists, fertilizer and agri-business industry leaders, community leaders, academic leaders and government officials to participate in a dialogue.

The project goals are to minimize barriers to wide spread adoption of 4R Nutrient Management on farm resulting in quantifiable GHG emission reductions from the use of Nitrous Oxide Emissions Reductions Protocol (NERP). This can be accomplished through working with all stakeholders to raise awareness, increase 4R capacity in the grower community through training, providing templates and data management tools to ease accessibility, and to demonstrate through economic analysis real potential benefits.

This 4R toolkit encompasses a set of tools and templates to facilitate implementation of the NERP within the context of this project. Along with the quantification spreadsheet, 4R Plan Template and 4R Designation Checklist, this NERP Kit provides the necessary information for the successful application of Alberta's Offset System Quantification Protocol for Nitrous Oxide Emissions Reductions from Farm Operations Protocol. Within these guidelines you will find:

Section 1 Introduction: An overview of the project and the purpose of the toolkit.

Section 2 Roles and Responsibilities: A description of the roles and responsibilities for all members of the project including the Producer, the Accredited Professional Advisor, the Aggregator and the Quantifier & Pre-verifier.

Section 3 General Overview of the NERP: This section contains a general overview of the Nitrous Oxide Emission Reduction Protocol including the baseline and project condition, a summary of fundamental requirements and general overview of data requirements.

Section 4 NERP Requirements: This section contains an overview of the NERP data requirements for both the baseline and the project condition.

Section 5 Project Reporting: This section includes the project reporting that should be completed including the farm-specific offset project plan and offset project report and the aggregated offset project report.

Section 6 Appendix:

Appendix A: This appendix including more information about the NERP including the applicability and an overview of the NERP Performance Levels.

Appendix B: This appendix includes the possible changes to the baseline & project condition and the data and documentation section of the proposed NERP Version 2.0, February 2014.

Appendix C: This appendix includes an excel document that lists all of the data requirements with types of supporting documentation and a template to help with data management and tracking.

Appendix D: This appendix includes an excel calculator that should be used to quantify emission reductions from each field in the project and a spreadsheet to calculate total aggregated emission reductions.

1.1. Next Steps for this Draft

As this document is still in draft form there are still a number of elements to add, edit or complete including:

- Based off of discussions and meetings with participating aggregators the data requirements section may be updated to reflect the type and format of their data.
- A review of the potential changes to data requirements and protocol applicability based off of the revised version of the NERP Protocol¹
- The Excel Quantification spreadsheet may need to be updated based on the above two statements

2. Roles and Responsibilities

Agricultural professionals and aggregation service companies will be assisting farmers in implementing the 4R Consistent Nutrient Stewardship Plan. These professionals must be trained and accredited to apply the NERP Protocol. More detail on this accreditation program is given in the next few sections. The project developer/aggregator will work with the farmer and agricultural professional to compile the project(s) in accordance with this protocol and the criteria of the Alberta offset system.

2.1. Producer:

Working with the project developer/aggregator and agricultural professional, the grower is responsible for applying the appropriate practices defined by the protocol on the field. The role of the grower is as follows;

¹ Note: This version of the protocol may not be accepted during the lifetime of this project; however it is still important to determine how this will affect the data collection.

1. The grower will provide baseline data and required supporting documentation for sign-off by the APA. The full list of supporting documentation options for each data point is provided in the quantification spreadsheet.
2. In working with the other stakeholders, the grower will contribute to the development of a 4R plan and implement that plan in the project year. In addition, data and supporting documentation will be collected for the project year and provided to the APA.
3. Growers are responsible for gathering and retaining a copy of all documentation pertaining to the offsets generated on their fields.

2.2. Accredited Professional Advisor

Participation in the projects prescribed by the Protocol will require the services of an Accredited Professional Advisor (APA). A number of variations on the relationship between the grower and the APA can be conceived. The APA may be retained by the grower, by an agronomic services provider, or by an aggregator. Despite the commercial arrangement, it is expected the Protocol-related services of the APA to the grower will be integrated with regular agronomic advisory services.

The expertise of the APA is assured by the required accreditation. Accreditation requires basic credentials as an agricultural professional (P.Ag. CCA, etc.) along with supplementary training on the 4-R stewardship model and the requirements of the Protocol.

The role of the APA in implementing Protocol projects will be threefold;

1. The APA will sign-off on the Baseline calculations made by the participating grower. This will involve review of the documentation for Baseline practices, providing an opinion concerning the propriety of the conclusions supported by the documentation, and attesting to the accuracy of calculations based on the documentation.
2. The APA will design and sign-off on a 4R plan for the participating farm. This 4R plan will address all fields and all crops at the performance level selected by the grower.
3. The APA will provide written attestation that the 4-R nitrogen plan was implemented as designed. This will involve post-harvest assessment of activities (including responses to weather-related disruptions), of yield data and of testing results. It is expected this assessment will form the basis for the next year's 4R nitrogen plan.

2.3. Aggregator:

The aggregator will work with the producer and the agricultural professional to ensure that the protocol is being followed but is also involved in the marketing and selling of credits into the Alberta Offset System. More specifically, the role of the aggregator is to gather the data on both the baseline and new management system in order that the generation of offset credits can be justified. In this regard, the aggregator has to gather data that can be used to justify the selling of credits into the offset market.

2.4. Quantifier & Pre-Verifier:

This positions will work the accredited professional advisor (APA's) and the Aggregator to; 1) ensure that the data collected meets the requirements of the protocol, 2) quantify offset's from each field for each producer and determine the aggregated offsets from the project; 3) to complete a pre-verification of all data collected to ensure compliance with NERP protocol.

3. General Overview of the Nitrous Oxide Emission Reduction Protocol

Application of nitrogen from various sources such as manure, biological fixation, fertilizer, etc. is an important component of agricultural production. Such applications, however, can lead to emissions of N₂O. Beneficial practices for nitrogen management, which synchronize the availability of nitrogen (N) with the requirements of the crop, can minimize the emissions of N₂O per unit of crop production².

The Protocol quantifies carbon offsets from projects which implement beneficial management practices (BMPs) in the context of a comprehensive 4R (Right Source, Right Rate, Right Time and Right Place™) nitrogen stewardship plan (from here on called a 4R plan) for their farms. The implementation of a 4R plan, including the BMPs specified in the 4R plan, reduces the N₂O emitted per kg of crop grown. The degree of reduction achieved by implementation of the Basic performance level of the Protocol is lower than that achieved by implementation of the more landscape-directed Intermediate and Advanced performance levels (See Table 2 for a description of the performance levels).

3.1. Summary of Fundamental Requirements

- Any crop is eligible for participation, providing that nitrogen is added in the cropping system in the form of synthetic or organic fertilizer — the protocol quantifies emissions on a crop by crop basis. However, any grazed land is ineligible.
- Emissions and emission reductions are quantified per kg of crop produced, so rotations used on the farm can be accommodated.
- Baseline N₂O emissions are the three-year average of N₂O emissions per kg of crop produced, prior to project implementation — Canada's National Greenhouse Gas Inventory Report quantification method is used to calculate the emissions.
- The 4R plan, designed and implemented in consultation with an Accredited Professional Advisor, at the selected performance level of Basic, Intermediate, or Advanced is the implementation platform of the protocol; and
- Project N₂O emissions per kg of crop produced under the 4R plan are calculated using Canada's National Inventory Report quantification method and the Reduction Modifier for the performance level.

² For a literature review of the beneficial nitrogen management practices to minimize N₂O emissions, see Snyder *et al.* 2009. Review of greenhouse gas emissions from crop production systems and fertilizer management effects. *Agric. Ecosys. Environ.* 133: 247-266.

Table 1: General Overview of Data Requirements to Justify the Baseline and Project Condition

Data Requirements:	What is needed?	Why do you need it?
At minimum, legal Land location and aerial photographs of all fields. For more advanced performance levels, will need GPS coordinates or digital field maps.	Legal land description for the registration of the project and ownership agreements between land lessees/land title owners (in tenure situations).	Clear title to all or a portion of the offset credits (checked through the Alberta Registry). Actual size of fields and sub-fields.
For baseline, need documented proof of crops grown, total area under each crop, summerfallow area, applied N rates for each crop, and yields achieved for each crop — 3 years worth.	Aerial or digital maps of fields. Purchase receipts for seed, fertilizer. Sales and/or delivery records for crops. Spreading records for manure and/ or fertilizer. Depending on the types of nitrogen management practices used in the project, it may be necessary to track fuel use (fuel purchase receipts).	To support calculations of baseline emissions of N ₂ O per kg of crop produced.
For project, need a signed-off 4R plan designed and implemented under supervision of an Accredited Professional Advisor (APA).	Written 4R plan, prepared according to requirements of the selected performance level of the Protocol. Must be signed and/or stamped by APA to attest that plan was designed and implemented according to 4-R principles and in conformance to the NERP.	The 4R plan ensures the applied N is available in amount and in time according to the crop needs for nitrogen. The 4R plan tells the grower what to do, when to do it, and how to do it, in keeping with the requirements of the Protocol at the chosen performance level.
For project, need documented proof of crops grown, summerfallow area, crop event areas, nitrogen recommendations derived, fertilizer applied for each crop, yields achieved for each crop, test results (soils, tissues, manure, etc.).	Aerial or digital maps of fields or sub-fields. Purchase receipts for seed, fertilizer. Sales and/or delivery records for grains and oilseeds. Spreading records for manure and/ or fertilizer. Test results (at resolution required for selected performance level) of soil, plant tissue, manure, and crop yield. Depending on the types of nitrogen management practices used in the project, it may be necessary to track fuel use (fuel purchase receipts).	These data provide proof that the 4R plan was followed, and support calculations of project emissions of N ₂ O per kg or crop produced.

For more information on the NERP applicability and performance levels see the Appendix in Section 5.

4. NERP Data Requirements

The data required under the protocol for the three year baseline and project years must be collected and retained by both the grower and aggregator.

A full list of the supporting records required to substantiate the data provided is included in the quantification spreadsheet, including a description of why it is required and who is the responsible party.

Producer Information:

- ✓ Producer's Name
- ✓ Current Address
- ✓ Contact Information

Field Information:

- ✓ Field Name and Description
- ✓ Legal land description of field
- ✓ GPS Coordinates of field
- ✓ Landowner(s) name
- ✓ Landowners Address
- ✓ Year Land was Purchased
- ✓ Land Title Certificate ID Number
- ✓ Size of Field in Project (ha)
- ✓ 4R Consistent Plan Performance Level (basic, intermediate or advanced)
- ✓ Seeded Area (ha)
- ✓ Period of Tenancy

Baseline Data (3 years):

- ✓ Cropping Year
- ✓ Crop Type
- ✓ Area Seeded (ha)
- ✓ Yield (kg/ha)
- ✓ Area in Fallow
- ✓ Fertilizer N (kg/ha)
- ✓ Manure N (kg/ha)
- ✓ Other N Source (kg/ha)
- ✓ Total N Applied from all Sources (kg/ha)
- ✓ Was the Crop Irrigated
- ✓ Are the Baseline Years Consecutive
 - If no, justification for the exclusion of one or more years

Project Data:

- ✓ Have You Implemented a 4R Consistent Plan
- ✓ 4R Plan Level
- ✓ Is the Plan Signed off by an APA
- ✓ Cropping Year
- ✓ Crop Type
- ✓ Area Seeded (ha)
- ✓ Yield (kg/ha)
- ✓ Area in Fallow
- ✓ Fertilizer N (kg/ha)
- ✓ Manure N (kg/ha)
- ✓ Other N Source (kg/ha)
- ✓ Total N Applied from all Sources (kg/ha)
- ✓ Was the Crop Irrigated
- ✓ Fertilizer Placement:
 - Implement:

- Make:
- Model #:
- Purchase Date:
- Row Spacing:
- Concentration:
- Photo #:
- ✓ Incremental fossil fuel consumption (additional hours of equipment operation needed to implement the 4R plan):
- ✓ Were Soil and/or Tissue Test Completed
- ✓ Was Straw Baled and Removed?
- ✓ Percentage of Straw that Remained on the Field
- ✓ Was Fertilizer Applied in the fall?
- ✓ Was the temperature of the soil is less than 10° Celsius for three consecutive days?

5. Project Reporting

Once carbon offsets have been quantified for each field and farm the project reporting should be completed. The project developer should have familiarity with ISO 14064-2-principles and be familiar with the offset Protocol.

5.1. ISO 14064-2 Principles

Relevance: Requires relevant greenhouse gas sources and sinks, data and supporting information, project records, and calculation methodologies used to support the baseline and project condition be discussed in context of the Alberta offset system program requirements and project implementation.

Completeness: Requires the project developer to include all relevant greenhouse gas emissions and reductions/removals as indicated in the approved quantification protocol.

Consistency: Enables a meaningful comparison of greenhouse gas-related information. Project developers must use calculation methodologies consistent with the approved protocol requirements that are accurate and appropriate for the project. Consistent methodology must be used to calculate the project baseline and annual emission reductions to ensure offset credits represent real emission reductions. Changes in methodology may require a restatement of the project baseline.

Accuracy: Project developers must reduce bias and uncertainties as much as practical and must use the most appropriate quantification methodologies available as discussed in the approved protocol.

Transparency: Requires that sufficient and appropriate information be disclosed to allow intended user (buyers and AESRD) to make decisions on the project with reasonable confidence.

Conservativeness: Use conservative assumptions, values and procedures to ensure that greenhouse gas emission reductions or removal enhancements are not over-estimated.

5.2. Aggregated Projects

Some project activities individually result in too small a volume of reductions/removals to be economic; however, if aggregated into a single larger volume project, they can be economic and result in significant greenhouse gas emissions reductions. The following is a list of considerations when developing an aggregated project:

- Since this project will occur on different sites belonging to different landowners; ownership and assignment of carbon rights should be negotiated through contractual obligations.
- Farms being included in the aggregated project should be identified in the offset project plan.
- Each farm should be tracked separately and should include an individual offset project plan (described below)
- Each farm should have a complete set of records to support the emission reductions/removals generated by that farm.
- Copies of records from each farm should be retained by the aggregator consistent with the requirements of the quantification protocol.
- The aggregator should implement a data management system appropriate for collecting and compiling farm information.

5.3. Farm Specific Offset Project Plan

For each farm where carbon offsets have been generated an offset project plan should be developed before the project is implemented in order to ensure that the farm meets the requirements and conditions of the protocol. The following section outlines what should be included in the Offset Project Plan for each farm.

Project Scope and Site Description

This should include:

- Project Start Date
- Credit Start Date
- Estimated Emission Reductions/Removals
- Legal land description including legal land location, latitude, longitude and any additional details to assist in identifying not just the farm but the fields that have been quantified.
- Ownership of the field
- Reporting and verification details

Contact Information

This section should include the project developer's contact information

Other Project Information

This section should include:

- Baseline conditions prior to project initiation
- Project Eligibility

- Identification of Risks

Identification of the Baseline and Project Conditions

This section should include:

- Baseline Condition
- Project Condition

Quantification Plan

This section describes the methodology being used to quantify GHG emissions associated with the specific project and baseline conditions, including:

- A description of included sources and sinks to be quantified
- A full list of parameters required for quantification indicating which parameters will be measured and which will be estimated
- A description of the measurement and estimation procedures for each parameter
- A list of data records and documentation to be collected
- Sample calculations

Monitoring Plan

This monitoring plan explains how measured parameters required for calculating the emission reduction or removals for the project will be monitored and input into the data management system.

Data Management System and Records

This section describes data management system, internal QA/QC checks and records available to support the baseline and project.

5.4. Farm Specific Offset Project Report

For each farm where carbon offsets have been generated an offset project report should be developed after the project is implemented. It identifies changes that occurred such as modifications to calculation procedures, emission factors or other variables that occurred. The following section outlines what should be included in the Offset Project Plan for each farm.

Introduction

The introduction should include the protocol used to estimate emission reduction/removals, the scope of the protocol and the project scenario.

Project Scope and Site Description

This should include:

- Project Start Date
- Credit Start Date
- Estimated Emission Reductions/Removals

- Legal land description including legal land location, latitude, longitude and any additional details to assist in identifying not just the farm but the fields that have been quantified.
- Ownership of the field
- Reporting and verification details

Quantification Plan

Equations used to quantifying emission reductions/removals.

Project Implementation and Variances

This section should describe any changes to the project such as modification to the calculation procedures, data collection/record keeping procedures, emission factors, etc.

Baseline Data Requirements

This section outlines the data requirements and lists the type of record that was collected in the baseline.

Project Data Requirements

This section outlines the data requirements and lists the type of record that was collected in the project.

Baseline and Project Condition

This section outlines the baseline and project condition including the main data points used to quantify emission reduction/removals.

GHG Emissions

This section outlines baseline and project emissions for each field and each source in the protocol and it also outlines the total GHG reductions for each source on the farm.

5.5. Aggregated Offset Project Report

Once an offset project report is created for each farm and aggregated version of the report should be developed, this report should include the following;

Introduction

The introduction should include the protocol used to estimate emission reduction/removals, the scope of the protocol and the project scenario.

Quantification Plan

Equations used to quantifying emission reductions/removals.

Baseline Data Requirements

This section outlines the data requirements and lists the types of record that were collected in the baseline.

Project Data Requirements

This section outlines the data requirements and lists the types of record that were collected in the project

Data Monitoring and Documentation

This section outlines the record keeping requirements for the projects.

Project Location and GHG Emissions for each Farm and the Aggregated Total Emission

This section outlines the location and the baseline and project emissions for each farm in the project and the aggregated total emissions.

Appendix

This section includes any supporting documentation that may be necessary.

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6. Appendix

6.1. Appendix A – NERP Protocol Applicability

To apply this protocol, the project developer must prove the following requirements:

1. The 4R Plan has been approved and signed by an Accredited Professional Advisor (APA), along with proper identification of the baseline scenario and project condition;
2. The project is following the 4R plan as designed and signed;
3. For new crops, three years of Baseline data on crop events are required prior to implementing the crop to the Project;
4. The quantification of reductions achieved by the Project is based on actual measurement and monitoring (except where indicated in this protocol) as indicated by the proper application of this protocol; and,
5. The Project must meet the requirements for offset eligibility as specified in the applicable regulation and guidance documents for the Alberta Offset System. [Of particular note:
 - a. [The date of equipment installation, operating parameter changes or process reconfiguration are initiated or have effect on the project on or after January 1, 2002 as indicated by operational records;]
 - b. [The project may generate emission reduction offsets for a period of eight years unless an extension is granted by Alberta Environment, as indicated by facility and offset system records. Additional credit duration periods require a reassessment of the baseline condition; and,]
 - c. [Ownership of the emission reduction offsets must be established as indicated by land owner/land lessee agreements]

Overview of NERP Performance Levels

Table 2: Overview of the 4R N Stewardship Plans and BMP/Performance Levels for the Drier Soils in Canada³

Performance Level	Right Source	Right Rate	Right Time	Right Place	Reduction Modifier
Basic	<ul style="list-style-type: none"> Ammonium-based formulation; 	<ul style="list-style-type: none"> Apply nitrogen according to recommendation of 4-R N stewardship plan*, using annual soil testing and/or N balance to determine application rate. 	<ul style="list-style-type: none"> Apply in spring; or Split apply; or Apply after soil cools in fall 	1. Apply in bands / Injection	0.85
Intermediate	<ul style="list-style-type: none"> Ammonium-based formulation; and Use slow / controlled release fertilizers; or Inhibitors; or Stabilized nitrogen. 	<ul style="list-style-type: none"> Apply nitrogen according to qualitative estimates of field variability (landscape position, soil variability). May involve use of digitized data. 	<ul style="list-style-type: none"> Apply fertilizer in spring; or Split apply; or Apply after soil cools in fall if using slow / controlled release fertilizer or inhibitors / stabilized nitrogen 	2. Apply in bands / Injection	0.75
Advanced	<ul style="list-style-type: none"> Formula must be Ammonium-based formulation; and Use slow / controlled release fertilizers; or Inhibitors; or Stabilized nitrogen. 	<ul style="list-style-type: none"> Apply nitrogen according to quantified field variability (e.g. digitized soil maps, grid sampling, satellite imagery, real time crop sensors.) and complimented by in season crop monitoring. 	<ul style="list-style-type: none"> Apply fertilizer in spring; or Split apply; or Apply after soil cools in fall if using slow / controlled release fertilizer or inhibitors / stabilized nitrogen 	3. Apply in bands / Injection	0.75

³ Note – “drier soils”, the classification for all Alberta soils, are defined as those found in Ecodistricts with a Precipitation/Potential Evapotranspiration ratio (P/PE) of less than 1.0 (see Appendix B of the standardized Alberta Protocol).

Table 3: Overview of the 4R Consistent Plan and BMP Performance Levels for Moister Soils in Canada⁴.

Performance Level	Right Source	Right Rate	Right Time	Right Place	Reduction Modifier
Basic	<ul style="list-style-type: none"> Ammonium-based formulation; 	<ul style="list-style-type: none"> Apply N according to recommendation of 4R N stewardship plan*, using annual soil testing and/or N balance to determine application rate. 	<ul style="list-style-type: none"> Apply fertilizer in spring only; or Split apply. Apply liquid or solid manure in spring; or After soil cools in fall 	<ul style="list-style-type: none"> Apply in bands /Injection 	0.85
Intermediate	<ul style="list-style-type: none"> Ammonium based formulation; 	<ul style="list-style-type: none"> Apply N according to qualitative estimates of field variability (landscape position, soil variability) 	<ul style="list-style-type: none"> Apply fertilizer or liquid manure in spring only; or Split apply. Apply solid manure in spring; or Apply after soil cools in fall 	<ul style="list-style-type: none"> Apply in bands / Injection 	0.75
Advanced	Ammonium based formulation; and/or <ul style="list-style-type: none"> Use slow / controlled release fertilizers; or Inhibitors; or Stabilized nitrogen. 	<ul style="list-style-type: none"> Apply N according to 4R N stewardship plan*, modified by quantified field variability (e.g. digitized soil maps, grid sampling, satellite imagery, real time crop sensors.), and complemented by in season crop monitoring 	<ul style="list-style-type: none"> Apply controlled release fertilizer or inhibitor / stabilized nitrogen fertilizer; or Apply liquid manure in spring; or Split apply; Apply solid manure in spring; or Apply after soil cools in fall. 	Apply in bands / Injection	0.75

⁴ Note – moister soils are defined as those found in Ecodistricts with a Precipitation/Potential Evapotranspiration ratio (P/PE) of 1.0 or higher (see Appendix B). 5 Consensus was not achieved at the science workshop to determine an actual measurable difference with the Advanced level in terms of emission modifier values; therefore more research is required to apply a lower value.

6.2. Appendix B – NERP Version 2.0 – Feb 2014

Note these are proposed changes only which have not yet been accepted by Alberta Environment and Sustainable Resource Development. The most notable changes proposed are bolded below.

Changes to the Flexibility Mechanism (Section 1.3)

- **2 types of dynamic baseline approaches** are now offered along with the original farm-specific three year crop event baseline. Most notably these baseline approaches only require **1 year of data** for substantiation.

Addition of Applicability Conditions

- The need for evidence that a 4R Plan has been implemented on each farm in the project;
- **The ability to complete emission reduction quantification at the field or farm level under certain conditions** (See the Quantification section below);
- The 4R Plan must be signed/sealed by an APA at the selected performance level;
- Crops under irrigation in the baseline must also be irrigated in the project;
- The requirement that all fields/crops for a farm enrolled in an aggregation program need to be part of the project and baseline GHG accounting;
- Acceptable crop mass determination methods; and
- The requirement to **calculate emission reductions on a mass of crop produced basis**.

Protocol Flexibility

- Further guidelines on data requirements to select non-consecutive years for crop events to set the baseline were added.
 - Trend data on extreme weather events is required to demonstrate how the excluded year is extraordinary.
 - Gaps between baseline seasons or gaps between the baseline period and project implementation must be justified to show they are not contributing to an over-estimation of GHG reductions.
- A flexibility mechanism allowing the use of one of two dynamic baseline approaches was added
- A flexibility mechanism allowing the **exclusion of residue nitrogen** for a crop if the concentration of residue nitrogen inputs results in GHG emissions of less than 5% of the overall reduction for the project was added.
- A flexibility mechanism allowing the **exclusion of manure nitrogen** for a crop if the concentration of manure nitrogen inputs results in GHG emissions of less than 5% of the overall reduction for the project was added.

Quantification

- The emission reduction quantification can now be completed either:
 - At the field level for each crop (rather than the management zone level) if EF_{Eco} , crop type and performance level are constant across a field; or
 - At the farm level for each crop if the EF_{Eco} , crop type and performance level are constant across the farm.

- Two types of dynamic baseline approaches have been added as well as the conventional baseline currently offered:
 - Dynamic Baseline Approach 1 uses measured crop mass from each farm
 - Dynamic Baseline Approach 2 uses conservative default yields for crop risk ones across the province.

Data and Documentation

- Clarification on determining the mass of each crop produced on the farm – the following crop mass determination methods can be applied to the protocol:
 - Mobile Weighing Device
 - Fixed Scale
 - Commercial scale certified by Industry Canada with accompanying Scale Tickets (i.e. elevator or grain processors)
 - Storage Volume Measurement
 - Business Records
 - Business records show the total weight sold (adjusted for moisture) within a tax year, declared to Customs and Revenue Agency
 - The weight sold will be adjusted to exclude inclusions from previous tax years and inclusions of weights deferred to future tax years.
 - Risk Event Claim
- Ecodistrict location for each field in the baseline and project
- Manure analysis if manure is used on-farm including manure nutrient values
- Record recording for fertilizer placement include date stamped photos of fertilizer spreading equipment and openers and the width of fertilizer openers of invoices from custom fertilizer application.
- Added documentation to the post-harvest assessment:
 - Documentation of in-season changes to the 4R plan in response to weather and other factors
 - Assessment of crop production data and key performance indicators set out in the 4R Plan.
 - Identification of opportunities for potential improvement.

6.3. Appendix C – Data Requirements and Supporting Documentation

This appendix includes an excel document (attached separately) that lists all of the data requirements with types of supporting documentation and a template to help with data management and tracking.

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6.4. Appendix D- Calculator to determine emission reductions and removals

This appendix includes an excel calculator (attached separately) that should be used to quantify emission reductions from each field in the project and a spreadsheet to calculate total aggregated emission reductions.

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