Ministry of Environment and Climate Change Strategy

British Columbia Greenhouse Gas Offset Protocol:

Forest Carbon

_____ _____

Director XXX XX, 2022

Greenhouse Gas Industrial Reporting and Control Act

SUMMARY OF REVISIONS

Version	Date	Description
1	July 2011	Original version.
-	June 2016	Removed from approved protocol list.

2	November 2022	• Definitions added and updated
		• Guidance notes added
		• Project types modified to the following:
		  ○ Afforestation / Reforestation
		  ○ Conservation / Improved Forest Management
		  ○ Avoided Conversion
		• Baseline Scenarios selection reduced to two approaches
		• Modelling requirements more specific
		• Emission factors and parameter constants updated
		• Default external Market Leakage factors updated
		• Requirement for a Monitoring and Maintenance Plan
		• Contingency Account and Risk of Reversal requirements added
		• Risk of Reversal tool added as Appendix H

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1.0 GUIDANCE

*This document contains both a protocol for the carrying out of certain emission offset projects that reduce or remove emissions with forest Sinks and Reservoirs, and guidance associated with such projects. The protocol is established under Section 10 of the Greenhouse Gas Industrial Reporting and Control Act ("**GGIRCA**", or the Act). It creates legal requirements that Project Proponents, Validation Bodies and Verification Bodies must follow for the proponent to obtain offset units under GGIRCA. The document also contains guidance which is intended to assist proponents, Verification Bodies and Validation Bodies. Such guidance is not a legal requirement imposed although it may refer to binding legal requirements, for example, explaining implications of a Protocol requirement, providing recommendations, or reminding Project Proponents that they may be subject to other legislation or regulations and that nothing in the protocol affects those obligations.*

*Terms that are capitalized, other than for grammatic purposes, have the definitions ascribed to them in this Protocol, GGIRCA or the Greenhouse Gas Emission Control Regulation ("**GGECR**", or the Regulation).*

The Protocol expands on GGECR requirements for Eligible Projects and provides detailed rules for quantification of the Project Reduction from Eligible Projects. The Protocol must be read in conjunction with GGECR as most of the requirements of GGECR apply fully to Eligible Projects.

Unless this Protocol specifically states that a requirement of GGECR under GGIRCA is inapplicable, all Project Plans, Validation Statements, Project Reports and Verification Statements related to Eligible Projects must meet the requirements of both this Protocol and GGECR.

The Project Proponent is responsible to ensure compliance with all applicable laws, including, but not limited to the Forests and Range Practices Act and Forests Act.

Project Proponents are also responsible for understanding the interaction of Projects under this Protocol with other regulatory and funding programs.

Eligible Projects under this Protocol may be combined with other projects as applicable. For such projects, two separate Project Plans, Validation Statements, Project Reports and Verifications Statements will be required, but these may be submitted in a single document that includes appropriate cross references.

The Interpretation Act applies to this Protocol.

A reference to an enactment, is a reference to that enactment as amended from time to time, and if it is repealed and replaced is a reference to the Act that replaces the original Act.

A definition or requirement that is expressed as including items in a list is not limited to those items.

Sections 1(3) and (4) of the Greenhouse Gas Emission Reporting Regulation applies to the calculation of carbon dioxide equivalent and

(a) The global warming potential that applies to a calculation contained in a Project Plan is the global warming potential in effect as of the date of the Project Plan and Validation Statement; and,

(b) The global warming potential that applies to a calculation contained in a Project Report is the global warming potential in effect as of the end of the Project Report Period.

Any assertion that this Protocol requires in a Project Report is an assertion for the Project Report Period.

Note that eligibility does not guarantee a project will be able to generate Offset Units. Project Proponents are strongly encouraged to test the feasibility of potential projects prior to developing a Project Plan under this Protocol.

2.0 DEFINITIONS AND ABBREVIATIONS

2.1 DEFINITIONS

In this Protocol, a word or expression that is capitalized other than for grammatic purposes has the same meaning as in GGIRCA or GGECR or as set out below:

"AC Project" means a Project for which the Primary Activity is Avoided Conversion;

"**Activities"** means the activities in either the Baseline Scenario or Project Scenario;

"Activity Leakage" means Leakage caused by shifts in deforestation to sources or sinks that have not been selected;

"Additionality Assertions" means the assertions referred to in Section 5.0 and Section 6.0;

"AFF Project" means a Project for which the Primary Activity is Afforestation;

"Afforestation" means activities that meet the criteria defined in Section 3.3.1;

"Atmospheric Benefit Agreement" means, an atmospheric benefit agreement, Indigenous atmospheric benefit agreement, atmospheric benefit sharing agreement, or other agreement respecting entitlement to claim Offset Units, carbon credits, emission offsets or other benefits resulting from a project's reductions in greenhouse gas (GHG) emissions or enhancement of GHG removals;

"Avoidable Reversal Event" has the meaning ascribed to it in Section 8.4;

"Avoided Conversion" means activities that meet the criteria defined in Section 3.3.3;

"Baseline Scenario" has the meaning provided in Section 11 of GGECR;

"B.C. Tool for Assessing Risk of Reversal for Forest Carbon Offset Projects" means Appendix H;

"Biomass" means non-fossilized plants or parts of plants, animal waste, or any product made of either of these and includes, without limitation, Biomass derived fuels, wood and wood products, agricultural residues and wastes, biologically derived organic matter found in municipal and industrial wastes, black liquor, kraft pulp fibres and sludge gas;

"CO2e" or **"Carbon Dioxide Equivalent"** means carbon dioxide equivalent as determined in accordance with GGIRCA. (*See Section 1(3) of GGERR)*;

"Contingency Account" has the same meaning as contained in GGIRCA;

"CONS/IFM Project" means a Project for which the Primary Activity is Conservation and Improved Forest Management;

"Conservation and Improved Forest Management" means activities that meet the criteria defined in Section 3.3.2;

"Crediting Period" has the same meaning as contained in GGECR;

"Crown land" means land, whether or not it is covered by water, or an interest in land, vested in the Province;

"Effective Date" means the date on which public notice of this Protocol was provided under Section 10 (3) of GGIRCA and as shown for guidance purposes on the cover page of this Protocol;

"**Eligible"** in relation to a Project, means the Project meets the eligibility requirements specified in Section 3.0;

"Emissions" means emissions of GHGs;

"Emissions Reduction" has the meaning provided in Section 11 of GGECR;

"External Activity Leakage" is net increases in GHG emissions, or decreases in Removals, shifting to other lands outside the ownership or control of the Project Proponent due to the Project;

"External Market Leakage" is the shifting of harvesting to other lands outside the ownership or control of the Project Proponent;

"Forest Land" means an area:

(a) that is greater than or equal to one hectare in size measured tree-base to tree-base (Stand-Alone to Stand-Alone), and

(b) in which trees within the area are capable of achieving

  (i) a minimum height of 5 metres at maturity, and

  (ii) a minimum crown cover of greater than or equal to 25% at maturity.

"Fuel" includes electricity and material that is combusted or transformed to generate usable energy or do work;

"Fossil Fuel" means a Fuel formed in the geological past from the remains of living organisms, including coal, oil and gas.

"GHG" or **"Greenhouse Gas"** means carbon dioxide, methane, and/or nitrous oxide, measured in metric tonnes of carbon dioxide equivalent;

"GGECR" means "Greenhouse Gas Emission Control Regulation", B.C. Reg 250/2015;

"GGERR" means "Greenhouse Gas Emission Reporting Regulation", B.C. Reg 249/2015;

"GGIRCA" means the Greenhouse Gas Industrial Reporting and Control Act;

"GWP" or **"Global Warming Potential"** means the GWP referred to in Section 2.2 and Appendix A;

"Government Reversal Event" means a Government reversal event as determined in accordance with Section 8.4;

"Harvested Wood Products" means all wood material, including bark, that is removed from harvest sites;

"Impaired Project Reduction" has the meaning ascribed to it in Section 8.4;

"Internal Activity Leakage" is net increases in GHG emissions, or decreases in Removals, shifting to other lands owned or controlled by the Project Proponent due to the Project;

"Internal Market Leakage" is the shifting of harvesting to other lands owned or controlled by the Project Proponent;

"Leakage" has the meaning ascribed to it in Section 11 of GGECR;

"Market Leakage" means Leakage caused by shifts in production of lumber and other forest products from selected sources and sinks to other sources or sinks;

"Monitoring" means the continuous or periodic assessment and documentation of Emissions and Removals or other GHG-related data;

"Monitoring and Maintenance Plan" means a monitoring and maintenance plan referred to in Section 14(3)(o) of GGECR;

"Monitoring Period" means the 100-year period through which a Project Proponent must monitor the Project Site to confirm that Emission Reductions and Removals Enhancements are Permanent;

"Monitoring Report" has the same meaning as contained in GGECR;

"Offset Project" means a Project which results in reductions in greenhouse gas emissions or increases in greenhouse gas removals that are quantified and applied toward a regulatory requirement, or recognized under a voluntary or regulatory program, for the purposes of offsetting greenhouse gas emissions;

"Performance Standard" means either a technical, activity or performance measure used to establish the Baseline Scenario, and determine Baseline Emissions or a component of Baseline Emissions, identified in Section 5.1;

"Permanent" means the sequestration of Greenhouse Gases for a 100-year period following the end of the Crediting Period, or the sequestration of Greenhouse Gases for less than 100 years on an adjusted basis in accordance with this Protocol;

"Primary Activity" means the following, as applicable to a Project:

(a) Afforestation;
(b) Avoided Conversion;
(c) Conservation and Improved Forest Management;
(d) Reforestation;

"PoA" or "**Program of Activities**" means a Project made up of activities occurring at multiple Project Instances which would individually constitute Eligible Projects;

"Project" has the same meaning as contained in GGECR and GGIRCA;

"Project Instance" means an individual Eligible Project within a Program of Activities;

"Project Plan" means a plan prepared in accordance with GGECR and this Protocol;

"Project Proponent" has the same meaning as contained in GGIRCA;

"Project Reduction" has the same meaning as contained in GGECR;

"Project Report" has the same meaning as contained in GGECR;

"Project Report Period" has the same meaning as contained in GGECR;

"Project Scenario" means the activities taken by the Project Proponent that reduce or remove Emissions;

"Project Site" has the same meaning as contained in GGECR;

"Project Specific" means an approach to establish the Baseline Scenario that is specific to the Project;

"Qualified Professional" means an applied scientist or technologist specializing in a particular applied science or technology, who

(a) is registered in British Columbia with a professional organization responsible for that person's area of expertise, acting under that professional association's code of ethics and subject to disciplinary action by the association, and

(b) through suitable education, experience, accreditation and knowledge, may be reasonably relied on to provide advice or determinations within his or her area of expertise as it relates to a matter for which a professional's advice or determinations are required under this Protocol;

"REF Project" means a Project for which the Primary Activity is Reforestation;

"Reforestation" means activities that meet the criteria defined in Section 3.3.1;

"Removals" has the meaning contained in Section 11 of GGECR;

"Removals Enhancement" has the meaning contained in Section 11 of GGECR;

"Reservoir" has the meaning contained in Section 11 of GGECR;

"Retirement Account" has the meaning contained in GGIRCA;

"Reversal Event" means a Reversal Event as determined in accordance with Section 8.4;

"Risk of Reversal" means a risk factor addressed in Section 8.4 and determined using Appendix H that represents the magnitude and likelihood that a Reversal will occur during the Crediting Period and Monitoring Period;

"Source" means any process or activity through which a GHG is released into the atmosphere;

"Start Date" in relation to a Project, means the date determined in accordance with this Protocol;

"Stand-Alone" means a Project in which the Primary Activities are limited to a single Project Site;

"Unavoidable Reversal Event" has the meaning ascribed to it in Section 8.4;

"Validation Body" has the definition ascribed to it in GGIRCA;

Guidance Note: see Section 13 of GGECR for prescribed requirements. See Guidance Note at Section 3.2.5 for information on necessary sector qualifications.

"Validation Statement" means a validation statement referred to in GGECR;

"Verification Body" has the definition ascribed to it in GGIRCA;

Guidance Note: see Section 13 of GGECR for prescribed requirements. See Guidance Note at Section 3.2.5 for information on necessary sector qualifications.

"Verification Statement" means a statement referred to in GGECR.

Text in this Protocol that is italicized, other than a reference to an Act, is for guidance only and is not part of the Protocol.

The *Interpretation Act* applies to this Protocol.

A definition or requirement that is expressed as including items in a list is not limited to those listed items.

For certainty, unless a contrary intention appears, a requirement imposed by this Protocol applies to Eligible Projects.

For certainty, an assertion required by this Protocol to be included in a Project Plan is

(a) an assertion of the Project Proponent, and

(b) an assertion for the purposes of Section 15 (1) (a) of GGECR.

2.2 Abbreviations and Acronyms

"AAC"	Annual Allowable Cut
"AC"	Avoided Conversion
"AFF"	Afforestation
"B.C."	British Columbia
"BE"	Baseline Emission
"BR"	Baseline Reservoir
"C"	Carbon
"CO2"	Carbon Dioxide
"CH4"	Methane
"CONS"	Conservation
"IFM"	Improved Forest management
"ISO"	International Organization for Standardization
"GHG"	Greenhouse Gas(es)
"GWP"	Global warming potential
"HWP"	Harvested wood product
"MW"	Molecular weight
"N2O"	Nitrous oxide
"NIR"	National Inventory Report
"PoA"	Program of Activities
"PE"	Project Emission
"PR"	Project Reservoir
"REF"	Reforestation
"SSR"	Source, Sink and/or Reservoir
"TASS"	Tree and Stand Simulator
"TIPSY"	Table Interpolation Program for Stand Yield
"TSA"	Timber Supply Area
"VDYP"	Variable Density Yield Projection

"VRI"	Vegetation Resources Inventory
"WCI"	Western Climate Initiative

2.3 APPLICATION OF PROTOCOL

This Protocol applies to forest carbon offset projects in British Columbia.

3.0 ELIGIBILITY

Guidance Note: This section presents the general eligibility criteria for Projects for each Project type covered under the Protocol. The criteria presented apply to both Stand-Alone and Program of Activities Projects, unless otherwise specified.

3.1 GENERAL PROJECT PLAN REQUIREMENTS

Guidance Note: For guidance purposes, a summary of eligibility requirements in the protocol is included in Table 1. For greater clarity, Table 1 is strictly a summary of eligibility requirements and should not be interpreted as a comprehensive accounting of all FCOP eligibility requirements.

Table 1: Summary of FCOP Eligibility Requirements

Eligibility criteria	***Requirements***	***Frequency of testing/assertion***
Location	*Project activities must take place in B.C.*	*Once in the Project Plan*
Start date	*The Project Start Date must be in accordance with the requirements provided in Section 3.4.*	*Once in the Project Plan*
Project-type specific eligibility criteria	*Projects must meet the specific requirements presented in Sections 3.2 and 3.3 of the Protocol depending on the Project type.*	*Once in the Project Plan*
Financial obstacles test	*Project Plans must demonstrate that the revenue from the sale of offset units was required to move forward with the Project.*	*Once in the Project Plan and in each Project Report*
Legal obstacles test	*Project Proponents must assert that the Project Activities exceed all regulatory requirements in place.*	*Once in the Project Plan and in each Project Report*
Exclusive ownership test	*Project Proponents must assert that no funding has been received on a per unit of emission reductions basis (i.e., funding was not received for each tonne of CO_2e reduced through the Primary Activity) and that the emission*	*Once in the Project Plan and in each Project Report*

	reductions realized through the Project Activities have not been credited or claimed under another regime.	

Eligibility Assertion

Every Project Plan must contain the following assertions:

(a) the Project is an Eligible Project under this Protocol;
(b) the Project has a Start Date determined in accordance with Section 3.4.

General Eligibility of Projects

A Project is eligible under this Protocol only if the Project is one of the following:

(a) an AC Project;
(b) an AFF/REF Project;
(c) a CONS/IFM Project;

Project Plan Requirements

1. A Project Plan must include the following:
   (a) an assertion that the Primary Activities take place in British Columbia;
   (b) an assertion that the Project Start Date is not before the Effective Date of this Protocol, except as provided in Section 3.4.3;
   (c) a Monitoring and Maintenance Plan in accordance with ISO 14064-2:2019;
   (d) an assertion that
      (i) no funding has been received on a per unit of emission reduction basis *(i.e., funding was not received for each tonne of CO_2e reduced through the Primary Activity)*, and
      (ii) the emission reductions realized through the Primary Activities have not been credited or claimed under another regime.

2. In addition to the requirement under Section 14(3)(n)(xi) of GGECR, a Project Plan must include an assertion and supporting evidence that the revenue from the sale of Offset Units is required to move forward with the Project.

3. The technical description referred to in Section 14(3)(c) of GGECR must include a detailed description of the following:
   (a) the Primary Activities that began or will begin on the Start Date;
   (b) the Primary Activities that began or will begin after the Start Date;
   (c) all Relevant Facilities and Practices.

4. All information in a Project Plan must be reported by calendar year (January 1 to December 31).

Project Report Requirements

1. A Project Report must include the following:
   (a) an assertion that the Primary Activities exceed all regulatory requirements that apply to the Primary Activities in accordance with Section 6.2;
   (b) an assertion that

(i) no funding has been received on a per unit of emission reduction bases *(i.e. funding was not received for each tonne of CO_2e reduced through the Primary Activity)*, and

(ii) the emission reductions realized through the Primary Activities have not been credited or claimed under another regime;

2. A Project Report must demonstrate that the Project continues to meet financial additionality requirements in order to move forward with the Project.

3. All information in a Project Report must be reported by calendar year.

3.2 REQUIREMENTS IN RELATION TO SPECIFIC PROJECTS

3.2.1 Requirements in relation to Projects on Crown Land

1. A Project Plan for a Project on Crown lands must include all of the following:
   (a) evidence that the Project Proponent has
      (i) the entitlement to submit the Project Plan to the Director,
      (ii) the entitlement to Offset Units or any other benefit issued in respect of the Sequestration Project from every other person who could reasonably have a claim to those rights, and
      (iii) appropriate agreements with the Province regarding access to the Project Site for the Monitoring Period;
   (b) an assertion that the Project Proponent
      (i) has undertaken the engagement required by, and in accordance, with Section 3.2.1.3, and
      (ii) has considered the input received from the engagement and has either incorporated the input into the Project design or justified why the input is not incorporated into the Project design;
   (c) a description of how, under paragraph (b) (ii), any input was incorporated into the Project design, as applicable;
   (d) justification for why, under paragraph (b) (ii), any input was not incorporated into the Project design, as applicable;
   (e) a description of how the Project Proponent will provide ongoing engagement with local stakeholders, community members and First Nations during the Project's Crediting Period to allow them to raise concerns about the impacts of the Project's implementation;
   (f) an assertion that the Project will
      (i) use genetically diverse and productive seed stock whenever planting activity happens on Crown lands, and
      (ii) whenever possible, apply the current version of the B.C. Chief Forester's Standards for Seed Use Best Practices and any other applicable guidance from the Province;
   (g) if the Project's Start Date began before the date on which the Project Plan is validated, an assertion that the Project
      (i) used genetically diverse and productive seed stock whenever planting activity happened on Crown lands, and

(ii) whenever possible, applied. the current version of the B.C. Chief Forester's Standards for Seed Use Best Practices and any other applicable guidance.

2. A Project Report for a Project on Crown lands must include the following:

(a) an assertion that the Project used genetically diverse and productive seed stock whenever planting activity happened on Crown lands;

(b) an assertion that, whenever it was possible, the Proponent applied the current version of the B.C. Chief Forester's Standards for Seed Use Best Practices and any other applicable guidance from the Province;

3. Before completing a Project Plan for a Project on Crown lands, a Proponent must engage with local stakeholders, community members and First Nations, in accordance with Section 3.2.1.4, for the purposes of

(a) providing information to those persons about the design of the project, and

(b) obtaining feedback from those persons.

4. For the purposes of conducting the public engagement for a Project on Crown lands, the Project Proponent must do as follows:

(a) give notice of the Project to

(i) each local government who has jurisdiction over the Project Site, and

(ii) each local government or First Nation whose interests, the Project Proponent believes, will be affected by the proposed Project;

(b) include, with the notice given under paragraph (a), copy of the Project proposal;

(c) accept feedback from the persons referred to in paragraph (a) for no less than **60 calendar days** of providing notice under that paragraph;

(d) make the Project proposal publicly available;

(e) host a public hearing for the purposes of providing information, and receiving feedback, on the Project;

(f) publish notice of the public hearing as follows:

(i) publication must be in at least 2 issues of a newspaper, a publication or local periodical that contains items of news and advertising that is circulated in the municipality or regional district within which the proposed Project Site is located; and

(ii) the last publication must be circulated not less than 3 calendar days and not more than 10 calendar days before the date of the public hearing;

(g) include in the notice referred to in paragraph (f) the following:

(i) a statement of the general intent of the Project;

(ii) identification of the land affected, whether by using the legal description, Property Identification number, geographic coordinates, or by describing the land generally;

(iii) the date, time and place of the public hearing;

(iv) information on how the public may submit feedback;

(v) a description of where the Project proposal may be accessed.

3.2.2 Requirements in relation to Projects on Private Land

1. For Projects on private land, the Project Plan must include the following:

(a) evidence of fee-simple ownership by the Project Proponent, which must include
    (i) the current certificate(s) of title, any associated charges on title(s), and any agreements between persons carrying out Project activities;
(b) evidence that the Project Proponent has
    (i) the entitlement to submit the Project Plan to the Director, and
    (ii) the entitlement to Offset Units or any other benefit issued in respect of the Sequestration Project from every other person who could reasonably have a claim to those rights;
(c) a statement of intent that the Proponent will seek to register a covenant under Section 219 (3) of the *Land Title Act*, in a form and with content acceptable to the Director, in favour of the Crown and granted in priority to other interests on the land.

2. The covenant referred to above must be in favour of the Crown and must require:
(a) management of the Project Site in accordance with the Monitoring and Maintenance Plan within the Project Plan;
(b) prohibition of actions or allowances by the landowner that would result in an Avoidable Reversal;
(c) that all reasonable actions by the landowner are taken to avoid Avoidable Reversal Events; and,
(d) that the Crown is indemnified in respect of any cost in replacing any Offset Units retired from the Contingency Account due to Avoidable Reversal Events.

3. In accordance with Section 23 (1) (d) of GGECR, evidence that the covenant referred to above has been registered must be included within the first Project Report. Each Monitoring Report must include an assertion that the Project Proponent has complied with the requirements under the covenant. The covenant must have a term extending to the end of the Monitoring Period. The covenant may provide that the obligations under 3.2.2.2(a) to (c) cease at the end of the Monitoring Period.

3.2.3 Requirements in relation to Projects on First Nations or Treaty Land

1. For Projects on First Nations Reserves, Treaty Land, Treaty Settlement Lands, and Aboriginal Title Land the Project Plan must include the following:
(a) evidence that the Project Proponent has
    (i) the entitlement to submit the Project Plan to the Director, and
    (ii) the entitlement to Offset Units or any other benefit issued in respect of the Sequestration Project from every other person who could reasonably have a claim to those rights, and
(b) a statement of intent that land management will endure in accordance with the Monitoring and Maintenance Plan in the Project Plan.

3.2.4 Assertions in respect of GHGs Forming Part of the Reduction

A Project Plan and each Project Report must include an assertion that none of the Project Reduction will result from, or were the result of, as applicable, reductions in GHGs other than carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).

3.2.5 Validation Statements and Verification Statements

A validation statement of a validation body must include a statement that, for the purposes of validating the Project Plan, the validation body employed the services of a professional forester who

(a) is registered with the Association of British Columbia Forest Professionals, and
(b) has credentials that are relevant to the Project.

A verification statement of a verification body must include a statement that, for the purposes of verifying the Project Report, the verification body employed the services of a professional forester who

(a) is registered with the Association of British Columbia Forest Professionals, and
(b) has credentials that are relevant to the Project.

Guidance Note: A person may only be qualified as a validation body or verification body under Section 13 of GGECR for the purposes of projects validated or verified under this protocol if the person is accredited by the Standards Council of Canada Technical Sector C: GHG Emission Reductions & Removals from Agriculture, Forestry & Other Land Use (AFOLU), or by the American National Standards Institute Sector for Group 3: Land Use, Land Use Change, & Forestry.

Development of Project Plans, Validation Statements, Project Reports and Verification Statements often necessitate the inclusion, direction, or sign off of qualified professionals such as Registered Professional Foresters, Professional Engineers and Geologists, or Registered Professional Biologists. The Project Proponent, Validation Body, and Verification Body must all have a Registered Professional Forester (RPF) on their teams. The RPF must be accredited with the Association of BC Forest Professionals for Practice in B.C. and must have credentials that are pertinent to the project as defined by the Professional Governance Act and Forest Professional's Regulation.

Note that eligibility does not guarantee a project will be able to generate Offset Units. Project Proponents are strongly encouraged to test the feasibility of potential projects prior to developing a Project Plan under this Protocol.

3.3 PROJECT TYPES

3.3.1 AFF/REF

AFF is the activity of direct human-induced conversion of land that has not been Forest Land prior to Project commencement to Forest Land through planting, seeding and/or human-induced promotion of natural seed sources. Areas suitable for AFF Projects include, but are not limited to,

(a) marginal productivity land,
(b) urban land,
(c) agricultural land, and
(d) degraded industrial lands.

REF is the activity of re-establishing trees through planting, seeding and/or human-induced promotion of natural seed sources on land that has been Forest Land prior to Project commencement.
REF does not include planting trees or enhancing natural regeneration following harvest where the land has not been converted to another use incompatible with continued use for timber production.
Where an AFF/REF Project also involves IFM (other than tree planting) the Project must be treated as an IFM Project, and not an AFF/REF Project.

Specific Requirements for AFF/REF Projects
In assessing whether land is capable of achieving the height and crown cover criteria specified in the Forest Land definition, a Project Proponent must demonstrate in the Project Plan how they considered what the land is capable of achieving in the absence of a change in current (i.e., pre-Project) management practice.

An AFF Project is eligible under this Protocol only if there is no legal obligation to establish a free growing stand and/or to implement the Primary Activity on the Project Site.

Where a requirement for an AFF/REF Project is more stringent than for an IFM Project (e.g., for determination of relevant versus optional or not relevant SSRs), the more stringent requirement is to be applied.

3.3.2 CONS/IFM

CONS/IFM is a system of practices for stewardship and use of Forest Land. CONS/IFM Projects are not prevented from including a planned harvest cycle.

Management activities for CONS/IFM may include one or more of a variety of approaches, including but not limited to the following:

(a) increased sequestration rates (e.g., through fertilization, improving stocking, reducing regeneration delays, use of faster growing trees/seed, etc);
(b) reduced Emissions (e.g., through partial cutting, reduced new road width);
(c) increased long-term carbon storage in forests and wood products (e.g., through establishment of conservation areas, reduced harvesting through forest cover constraints, increasing rotation age, etc.).

Specific Requirements for CONS/IFM Projects
A CONS/IFM Project is eligible only if the Project lands meet the definition of "Forest Land" immediately prior to the start of the Project.

3.3.3 AC

AC Projects are activities that prevent the direct human-induced conversion of Forest Land to a non-Forest Land use.

Avoided non-Forest Land uses include

(a) the use of land for residential, commercial, industrial and/or agricultural purposes, and
(b) Crown land held in fee-simple for use by municipalities.

Specific Requirements for AC Projects

An AC project is eligible only if the Project lands meet the definition of "Forest Land" for the 20 years immediately prior to the start of the Project in order to demonstrate that the Project avoids the conversion of Forest Land.

A Project Plan for an AC Project must include the following:

(a) an assertion that the Project lands are suitable for conversion;
(b) an assertion that there is a threat of conversion of the Project land to a non-Forest Land use, according to the applicable baseline selection requirements set out in this Protocol;
(c) to support the above assertions, an appraisal report that meets the following requirements:
    (i) the report is prepared by a designated member of the Appraisal Institute of Canada;
    (ii) the report is certified by the appraiser to be in accordance with the Canadian Uniform Standards of Professional Appraisal Practice;
(d) a market assessment of the Baseline Scenario candidates provided in Section 5.2.1.

3.4 PROJECT START DATE

1. Subject to Sections 3.4.3 and 3.4.4, for the purposes of paragraph (a) of the definition of "start date" in GGECR, the Project Start Date is the earlier of the following:
(a) the first date on which the Primary Activity for the Project started;
(b) the date on which the Project Plan is accepted by the Director.

2. For the purposes of determining the Project Start Date for a Program of Activities, the first date on which the Primary Activity for the Project starts is the date on which the Primary Activity at the first Project Instance starts.

3. A Project that has a Start Date that occurred before public notice of the Protocol is eligible under the Protocol only if:
(a) as at the date on which the Project Plan is validated, no more than one year has elapsed since public notice of the Protocol was given, or
(b) as at the date on which the Project Plan is validated, no more than 5 years has elapsed since the start of the Project's Primary Activity.

4. A Project Start Date may not be earlier than the date on which the Project Proponent obtains the entitlement
(a) to submit the Project Plan to the Director, and
(b) to Offset Units or any other benefit issued in respect of the Project from every other person who could reasonably have a claim to those rights.

5. For Projects that were accepted under the *Greenhouse Gas Reduction Targets Act*, the Start Date is the project start date determined for the Project in accordance with that Act.

Guidance Note: Section 10(6) of GGIRCA prohibits the Director from accepting a Project Plan that has a start date that occurred before public notice of the Protocol, or before public notice of an amendment to the Protocol, if:
(a) more than one year has elapsed since that public notice was given, or
(b) more than 5 years have elapsed since the project was started.

For example, if the Director accepts a Project Plan on December 31, 2023, the earliest Start Date for that Project's Primary Activity, in order for the Project to be eligible, is December 31, 2018.

3.5 PROJECT CREDITING AND MONITORING PERIOD

For the purposes of Section 18 (1) (b) (i) of GGECR, the Crediting Period length for an Eligible Project is 25 years from the Project Start Date, unless the Project Proponent, in the Project Plan, chooses a shorter Crediting Period.

A Project Proponent must substantiate in the Project Plan the Crediting Period selected.

The Monitoring Period begins at the end of the Crediting Period (see Section 10.1).

Guidance Note: While there is a possibility that a Project may receive a revalidation based on any applicable protocol in effect at the end of the Crediting Period, this will be based on the continuation of the Project meeting all GGECR and protocol requirements in place at that time, e.g., that the continuation of the Project exceeds regulatory requirements and requires the financial incentives of credits.

3.6 MATERIALITY THRESHOLD

For the purposes of Sections 15 (3) (c) and 21 (4) (c) of GGECR, errors, omissions, or misrepresentations are considered material if the individual or aggregate effects of those errors, omissions or misrepresentations result in an overestimation or underestimation of the Project Emissions, Emission Reductions, or Removals Enhancements of more than 5% per calendar year.

3.7 PROJECT REPORT PERIOD AND PROJECT REPORTS

The first Project Report Period begins on the Start Date of a Project.

Each Project Report Period is a minimum of 12 consecutive months and a maximum of five consecutive years to the anniversary of the Start Date, as determined by the Project Proponent. All information in Project Reports must be reported by calendar year, and must begin on January 1 and end on December 31.

If the Project Start Date is not January 1st, the information may be reported for the period between the Project Start Date and the end of that corresponding calendar year. As the Project proceeds into the second calendar year, the information must be reported in full calendar years.

The Project Reduction must be reported in tCO2e per year and will be assigned a vintage of that corresponding calendar year.

Project Reports must be submitted continuously and on time. Offset Unit issuances will be withheld until all required Project Reports for a Project are received by the Director.

3.8 DEMONSTRATING ADDITIONALITY

Section 5.0 justifies the selection of the Baseline Scenario, while Section 6.0 justifies the selection of the Project Scenario. See Section 5.0 and Section 6.0 regarding assertions and justifications regarding the Baseline Scenario and the Project Scenario. A Project Plan is not required to include the assertion in Section 14 (3) (n) (xi) of GGECR but must include an assertion that the revenue from the sale of Offset Units was or will be required to implement the Project and a justification for that assertion.

4.0 PROJECT SITE

4.1 DESCRIPTION OF THE PROJECT

The technical description referred to in Section 14 (3) (c) of GGECR must include a detailed description of the Primary Project Activities, including where the Project will be carried out and where the Project's Emission Reductions and/or Removals Enhancements will occur.

The Project Plan must indicate whether the Project is a Stand-Alone or a Program of Activities.

4.2 IDENTIFICATION OF THE PROJECT SITE

The Project identification information referred to in Section 14 (3) (d) of GGECR must include geographical information about the location where the Project will be carried out and any other information allowing for the unique identification of the Project.

A Project may be carried out on one or both of contiguous parcels of land and separated (non-contiguous) parcels of land.

4.2.1 Stand-Alone Location(s)

For a Stand-Alone Project, the geographic information included in a Project Plan must include a geo-referenced map that shows the Project Site. The Project Proponent is required to use Provincial base mapping stored by Data BC. Project Site consists of, and must be assessed along the following boundary types:

(a) a regional study area, which is typically based on a natural transition (e.g., watershed boundary, ecological zone) or an artificial delineation (e.g., political or economic district or zone) that is relevant to the Project;
(b) an Activity Leakage assessment-area, which comprises a slightly smaller area, but where the Project Proponent identifies areas that may be influenced by the Project (see Section 8.3);
(c) the Project Site.

The map provided must be at a large scale, the minimum requirements being 1:10 000 to 1:50 000, and must include features, place names and administrative boundaries to enable field interpretation and positive identification of the Project Site.

The following information must be provided on the map:

(a) forest ownership and Project Site (as discussed above);
(b) the size of the parcels owned/leased by the Proponent on which the Project is located;
(c) latitude/longitude, land title, or land survey plan;
(d) previous and existing land cover and land use, including any previous and existing timber supply areas, *Forest Act* tenure, etc.

4.2.2 Program of Activity Locations

Project Plans for a Project involving a PoA must identify the geographic boundary within which the Primary Activity of the Project Scenario will be occurring, and how each Project Instance will be uniquely identified.

For all Project Instances implemented at the time of validation, Project Plans must provide Global Positioning System coordinates for the location of each Project Instance and any other relevant information allowing for the unique identification of all Project Instances. Each of the Project Instances must include a geo-referenced map with the same requirements as those Projects that are Stand-Alone location(s).

Project Plans of PoAs must describe in detail the approach that will be used for identification of Project Instances that are not determinable when the Project Plan is validated. Project Plans must include a description of how this approach will enable future verifications and inspections to identify each individual Project Instances and ensure the reported Project Instances that have been implemented are uniquely identifiable.

If a Project is a Program of Activities, the Project Report must include:

(a) a list of all Project Instances not described in the Project Plan, and
(b) a list of all Project Instances described in the Project Plan that have not proceeded.

5.0 ESTABLISHMENT OF BASELINE SCENARIO

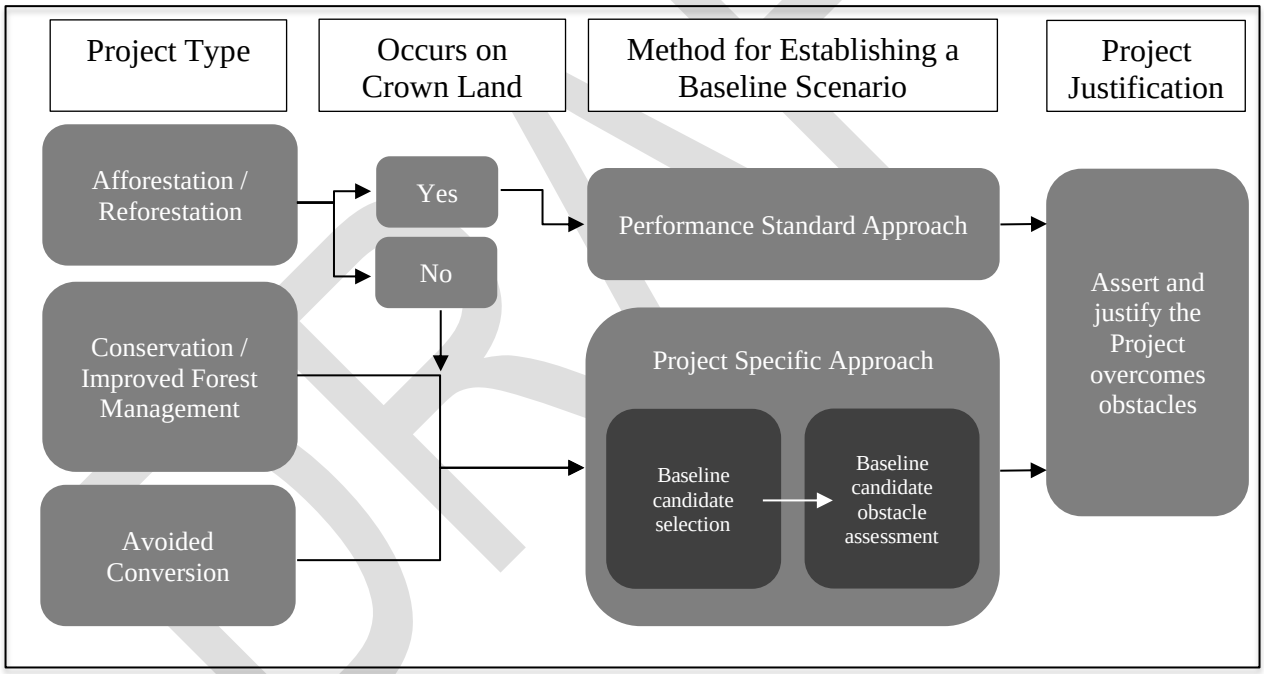
Project Proponents must establish a Baseline Scenario, which describes the activities on the Project Site and associated emissions that would have most likely occurred in the absence of the Project.

The Baseline Scenario must be determined using either a pre-established Performance Standard approach, or a Project Specific approach of Baseline Scenario candidates, as indicated in Figure 1.

For all Baseline Scenario approaches, Project Proponents must determine whether their Project meets specific eligibility criteria described in Section 3.0. Project Proponents must provide evidence to support the assertion that the Project meets the requirements of each Baseline Scenario approach.

Guidance Note: Eligibility for the Performance Standard and Project Specific approaches varies by Project type, as demonstrated for guidance purposes in Figure 1.

Figure 1: Selection of Baseline Scenario Approaches and Project Justification



5.1 PERFORMANCE STANDARD APPROACH

5.1.1 Identifying a Performance Standard Baseline

AFF/REF Projects on Crown land must use the Performance Standard Approach for determining the Baseline Scenario. AFF/REF Projects on non-Crown land, including private, municipal, First Nations Reserves, Treaty Land, Treaty Settlement Land, Aboriginal title land, or other non-Crown land, must use the Project Specific Approach under Section 5.2.

AFF/REF Project Proponents on Crown Land must select one of the following three types of Performance Standard Baseline Scenarios that may apply depending on attributes specific to the Project:

(a) a regulatory requirements Baseline Scenario,
(b) a continuation of historic activities Baseline Scenario, or
(c) a hybrid of continuation of historic activities and regulatory requirements Baseline Scenario.

The Project Plan must demonstrate that the Performance Standard Baseline Scenario chosen for the Project is the most conservative of reasonable alternatives. The Project Plan must identify and supply evidence to demonstrate which Performance Standard Baseline requirements have been met.

Regulatory requirements Baseline Scenario evidence requirements

To determine regulatory requirements that may apply to natural resource management activities, proponents must list existing regulatory requirements and any proposed regulatory requirements that the Project Proponent is aware of that may come into force.

Continuation of historic activities Baseline Scenario evidence requirements

To determine the historic natural resource management activities in place prior to commencement of the Project, the Project Proponent must prepare a verifiable record of historic natural resource management (including timber harvesting) practices occurring on the Project Site prior to the Project, for a period of at least 20 years immediately prior to the Project Start Date. The Project Proponent must also assess (with documentation) whether or not in the absence of the Project, the land would continue to be managed according to historic natural resource management practices.

Performance Standard Baseline Scenario Conditions

Projects without any regulatory requirement must use a continuation of historic practices/activities as the Baseline Scenario.

Projects subject to regulatory requirements that were not a result of the Project being implemented as determined in Section 6.0 must use those regulatory requirements as the Baseline Scenario. Project Proponents must also take into account provincial or federal incentives or regulatory requirements relevant to any aspect of the Baseline Scenario, including tax incentives and grants.

5.1.2 Selecting a Performance Standard Baseline Scenario

The selected Baseline Scenario for a Performance Standard approach must be the most conservative option of reasonably possible alternatives. The Project Plan must contain an assertion that the Baseline Scenario will result in the most conservative estimate of the Project Reduction of reasonably possible alternatives.

5.2 PROJECT SPECIFIC APPROACH

AFF/REF Projects on private land, and CONS/IFM Projects and AC Projects (whether on Crown land or private land), must use the Project Specific approach for determining the Baseline Scenario. Under this Baseline Scenario approach, Project Proponents must identify and select a Baseline

Scenario representing the most conservative option of reasonably possible alternatives of what would have occurred in the absence of the Project. The Project Proponent must first identify applicable Baseline Scenario candidates assuming the Project will not take place and then systematically assess the validity of each, considering any obstacles and regulatory requirements facing each Baseline Scenario candidate.

5.2.1 Identification of Baseline Scenario Candidates

The Project Specific Baseline Scenario approach must identify all applicable Baseline Scenario candidates.

The assessment must consider each type of candidate (hypothetical natural resource management practice or activity) individually and include a clear description of what each activity involves (associated activities, schedules, etc.). Candidates must use a time-horizon identical to the length of the Crediting Period and 100-year Monitoring Period of the proposed Project.

All Project types using the Project Specific Baseline Scenario approach must include the following candidates:

- Initiating the project without revenues from the sale of offset units, and
- Continuation of historic practices (unless, for projects on fee-simple or Indigenous title land, there has been a change in ownership of the Project Site in the past 20 years, or data is not available; in which case this candidate is optional).

Optional Baseline Scenario Candidates for each Project Type can be found in **Table 2**.

In Table 2, a checkmark under the column for a Project type means that the Baseline Scenario Candidate specified in the corresponding row may be used for that Project type. An 'x' means that the Baseline Scenario Candidate may not be used for that Project type.

Table 2: Baseline Scenario Candidates for each Project Type

Baseline Scenario Candidate	AFF/REF	CONS/IFM	AC
Production of commercial crops	✓	✗	✗
Pastureland, abandoned land, or degraded land	✓	✗	✗
Land development (i.e., residential, commercial, or industrial)	✓	✗	✓
Park or protected area status	✗	✓	✗
Harvest to projected Annual Allowable Cut (AAC) of the surrounding or immediate management unit (Crown land)	✗	✓	✓
New regulatory requirements that do not justify the Project as determined in Section 6.0	✓	✓	✓
Harvest to long-term sustainable yield given availability of inventory, established land use designations, forest management requirements, and market demand	✗	✓	✗

Scenarios that reflect the nature of land or resource development activities in the region	✘	✘	✓

Harvest to long-term sustainable yield criteria

For CONS/IFM on Crown land, the Project Proponent must estimate sustainable harvest flows for the Baseline Scenario in accordance with timber supply analysis standards commonly used by the Forest Analysis and Inventory Branch in Timber Supply Reviews in B.C. Timber supply projections must be generated using methods that are documented and repeatable. The Project Proponent must demonstrate in the Project Plan that the long-term harvest level would be sustainable, as indicated by a stable long-term total growing stock. Long-term is usually a period starting from 60 to 100 years following the Project Start Date and is the time period during which the projected harvest level is at the sustainable long-term level (which in turn is defined as the level that results in a flat total growing stock over the long term).

Continuation of historic practices baseline candidate evidence requirements

To determine the historic natural resource management activities in place prior to commencement of the Project, the Project Proponent must prepare a verifiable record of historic natural resource management (including timber harvesting) practices occurring on the Project Site prior to the Project, for a period of at 20 years immediately prior to the start of the Primary Activity. The Project Proponent must also assess (with documentation) whether in the absence of the Project, the land would continue to be managed according to historic natural resource management practices by considering at minimum:

- Existing regulatory requirements,
- Provincial or Federal incentives, and
- Financial implications of historic forest management practices.

The Baseline Scenario selected by the Project Proponent must be the average of the 20 years of historic harvest. Time periods where there was a suspension of harvesting due to land use planning and/or negotiation must be omitted from the average.

Baseline Scenario Candidates for AC Projects

For AC projects, a Project Proponent must provide the following documentary and explanatory evidence for each of the Baseline Scenario candidates:

(a) An assessment of development practices, including development density, typical development area to meet the stated need for that development type, typical extent of deforestation, and timing of development. For land uses selected as equivalent to the selected Baseline Scenario candidate, the size of the region and time period must be justified by the Project Proponent.

(b) If the Baseline Scenario candidate does not reflect identified common development practices, then the Project Proponent must provide an explanation of why the Baseline Scenario candidate would be different for the Project Site, including the identification and explanation of key criteria used to make the assessment.

Where the Baseline Scenario candidate involves scenarios that reflect the nature of land or resource development activities in the region, the Project Proponent must provide:

(a) An approved development plan / permit for the Project Site issued within the two years prior to the Project Start Date indicating that the Baseline Scenario candidate development has been approved,

(b) A written offer to purchase the Project Site issued within the two years prior to the Project Start Date, by a developer that is completely independent of the Project Proponent, and where it can be convincingly demonstrated that the developer would have undertaken the development and deforestation of the Project lands according to the selected Baseline Scenario candidate (including how any identified obstacles to the Baseline Scenario would be overcome), or

(c) An economic analysis of the selected Baseline Scenario candidate demonstrating the Baseline Scenario candidate is financially viable and more attractive than maintaining the Project lands as Forest Land without development, and more financially attractive than the Project.

Projects Plans for Projects that involve developing the Project Site in a way that satisfies non-Forest Land demand in the Baseline Scenario must include an evaluation of the financial viability of the Project as part of the Project justification assessment described in Section 6.0. The Project Plan must include a comparison of sales records from B.C. Assessment and the Land Title Office to confirm comparable sales data.

5.2.2 Identification of Baseline Scenario Candidate Obstacles

The Project Plan must identify any potential obstacles associated with each of the Baseline Scenario candidates identified as per Section 5.2.1, in order to assess, as per Section 5.2.3, which of the Baseline Scenario candidates would have been the most likely to occur in the absence of the Project, considering both the number and magnitude of the obstacles.

5.2.2.1 Baseline Scenario Candidate Obstacle Types

Project Plans must include an identification of obstacles that would discourage a decision to implement the Baseline Scenario candidates. Project Plans must include a discussion, at minimum, of financial, legal and technical obstacles that each identified Baseline Scenario candidate may face.

Examples of Baseline Scenario candidate obstacles include:

- The Baseline Scenario candidate is less financially attractive than the Project Proponent's established and documented internal investment hurdle rate, even taking into account existing government climate change strategy or other incentives.
- The Baseline Scenario candidate faces restrictions on access to capital (e.g., due to high up-front capital costs).
- The Baseline Scenario candidate faces certain supply chain challenges (e.g., cost effectively getting their product to market cost or delivering an important input to the Project site).

- The Baseline Scenario candidate faces legal obstacles that prevent it from being undertaken.

1. Afforestation / Reforestation

The Project Plan must include in the assessment of each Baseline Scenario candidate obstacles, at minimum, when evaluating each Baseline Scenario candidate for AFF/REF Projects:

- The Baseline Scenario candidate faces legal obstacles that prevent it from being undertaken.

2. Conservation / Improved Forest Management Baseline Scenario Candidate Obstacles

The Project Plan must include in the assessment of each Baseline Scenario candidate obstacles, at minimum, when evaluating each Baseline Scenario candidate for CONS/IFM Projects:

- The Baseline Scenario candidate faces legal obstacles that prevent it from being undertaken,
- Inadequate transport infrastructure for harvesting, and
- Marginal and internal returns on investment.

3. Avoided Conversion Baseline Scenario Candidate Obstacles

The Project Plan must include in the assessment of each Baseline Scenario candidate obstacles, at minimum, when evaluating each Baseline Scenario candidate for AC Projects:

- Legal, including consideration of zoning by-laws, development permits, tree protection by-laws, riparian regulations, covenants, easements, existing right of ways and any other relevant Project land-specific, local or other legal requirements,
- Official community plans,
- Official regional growth strategies, and
- Strategic land-use plans and higher-order plans (e.g., has emerged from land and resource management planning processes).

5.2.3 Comparative Assessment of Baseline Obstacles

Project Plans must present a comparative assessment of obstacles for each of the Baseline Scenario candidates. Project Plans must identify both the presence of an obstacle and estimate the magnitude of the obstacle for each Baseline Scenario candidate identified as per Section 5.2.2. The magnitude of an obstacle must be quantified as much as practicable. In addition, the magnitude of an obstacle must also be characterized qualitatively using descriptive explanations and justifications for the characterization. In the Project Plan, Project Proponents must substantiate and explain the cumulative effects of the obstacles for each Baseline Scenario candidate. The results of cumulative effects must be presented so that a reasonable person could form an opinion as to which of the Baseline Scenario candidates is most likely to occur.

For clarity, as part of this selection, in accordance with Section 14(3)(n)(v)(A) of GGECR, Project Proponents must consider provincial or federal incentives or regulatory requirements relevant to any aspect of the Baseline Scenario, including tax incentives and grants. In accordance with Section 14(3)(n)(v)(B) of GGECR, in the Project Plan, the Project Proponent must also include in the assessment the financial implications of carrying out a course of action referred to in the Baseline Scenario, and any other factor relevant to justifying the assertion that the estimate of the

future Project Reduction will be conservative in accordance with Section 14(3)(n)(v)(C) of GGECR.

5.2.4 Selecting a Project Specific Baseline Scenario

Based on the results of the comparative assessment of Baseline Scenario obstacles, a Project Proponent must determine and justify which of the Baseline Scenario candidates is the most reasonably likely to occur. Where there is only one Baseline Scenario candidate that is reasonably likely to occur, the Project Plan establishes that Baseline Scenario candidate as the Baseline Scenario. Where there are multiple Baseline Scenario candidates that are reasonably likely to occur, the selected scenario should be the Baseline Scenario which results in the most conservative and reasonable estimate of the Project Reduction. The Project Proponent must assert in the Project Plan that that the Baseline Scenario will result in the most reasonable and conservative estimate of the Project Reduction.

5.3 Adjustments to the Baseline Scenario

The Baseline Scenario may be adjusted if there are substantive changes to applicable inputs, candidates, or candidate obstacles.

6.0 Project Scenario Justification

Section 14(3)(n)(iv) and (xi) of GGECR require the Project Plan to include assertions that there are financial, technological, or other obstacles to carrying out the Project that are overcome or partially overcome by the incentive of having the Project Reduction recognized as Offset Units under the *Act*, and justification for the assertions required under Section 14(3)(n)(xi). Project scenario obstacle identification uses the same process as Section 5.2.2.

6.1 Financial Additionality

1. A Project Plan must include the following in support of the justification required under Section 14(3)(n)(xi) of GGECR:
   (a) Financial analysis including the impact of carbon finance on investment hurdle rates and decision-making (taking into consideration the total planned Project timeframe),
   (b) How the economic business case and values used in the financial analysis compare to those commonly used by the Project Proponent and industry-specific standards,
   (c) An overview of any provincial or federal incentives (tax incentives or grants), and assertion that there are still financial obstacles to carrying out the Project, and
   (d) If the Project has received financial incentives in addition to the revenue generated from offsets, and that incentive is predicated on a per-unit of emissions basis, an assertion that the Proponent has adjusted the number of units claimed under this Protocol.

2. Each Project Report for a Project Report Period must demonstrate that the Project continues to meet financial additionality requirements in order to move forward with the Project.

6.2 REGULATORY ADDITIONALITY

1. A Project Plan must include
   (a) an assertion that the Primary Activities are not required, directly or indirectly, by a regulatory requirement, or
   (b) an assertion that the Primary Activities are required, directly or indirectly, by a regulatory requirement, but the Primary Activities exceed the standards required by the regulatory requirement.

2. For the purposes of validation of a Project Plan, if a Project Plan includes an assertion referred to in subsection (1) (b), the Project Proponent must demonstrate in the Project Plan that the Primary Activities exceed the standards required by the regulatory requirement.

3. Each Project Report for a Project Report Period must include either
   (a) an assertion that the Primary Activities are not required, directly or indirectly, by a new regulatory requirement that arose during the Project Report Period, or
   (b) an assertion that the Primary Activities are required, directly or indirectly, by a new regulatory requirement that arose during the Project Report Period, but the Primary Activities exceed the standards required by the new regulatory requirement.

4. If a Project Report includes an assertion referred to in subsection (3) (b), the Project Proponent must demonstrate, in the Project Report, that the Primary Activities exceed the standards referred to in that subsection.

The situation where a Project creates Emission Reductions and/or Removals Enhancements partially or wholly, through an agreement with the Province to change legislation or regulation for the purposes of increasing carbon sequestration and thereby creating an incremental Project Reduction, may constitute evidence of overcoming or partially overcoming obstacles.

Project Proponents must assert in the Project Plan that the Project Reduction forecast in the Project Plan has not been or will not be applied as credits under a different offset market, protocol, or program.

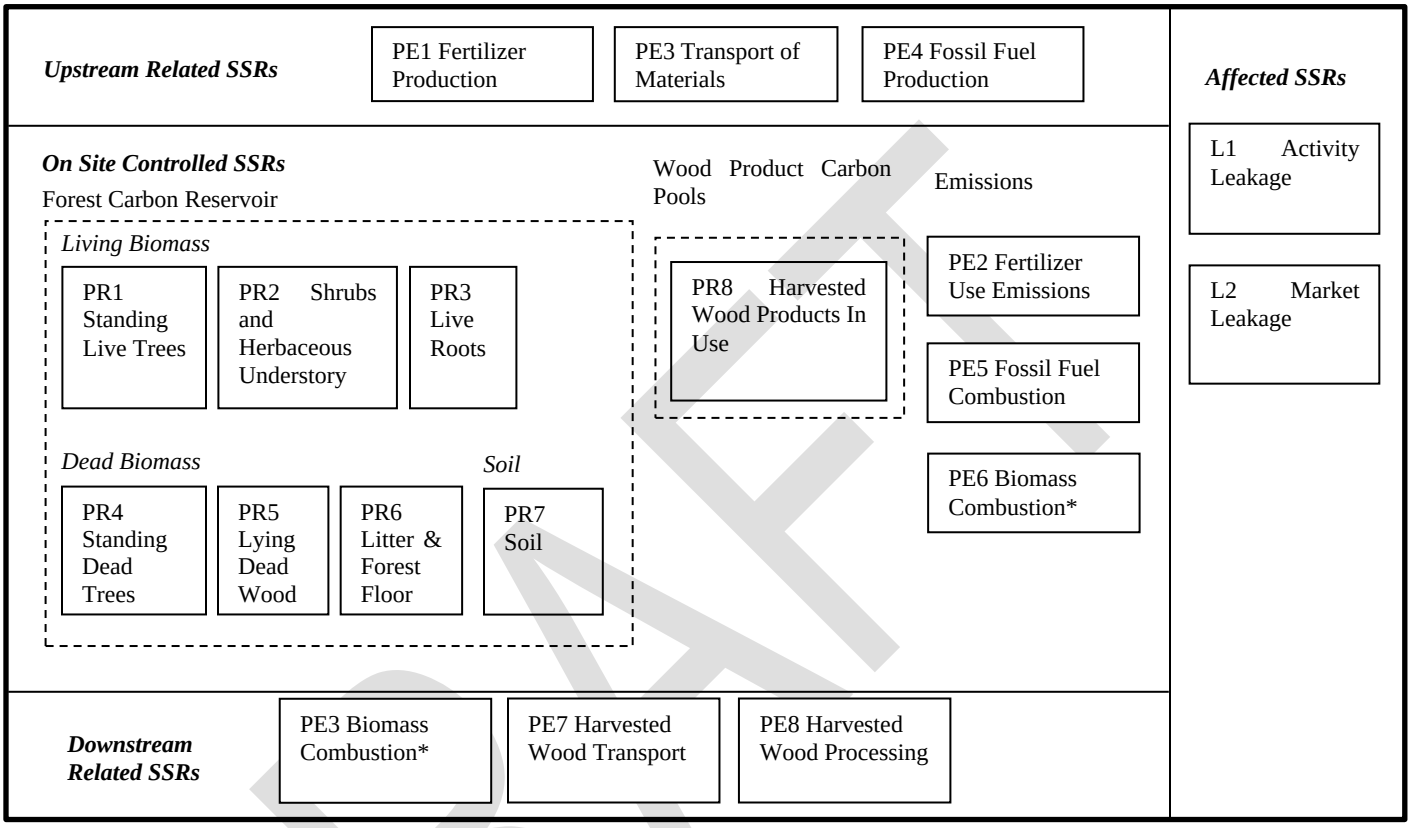
The Proponent must ensure, and the Project Plan and every Project Report must include an assertion that no Emissions Reduction that is included in the determination of the Project Reduction has been or will be counted as an Emissions Reduction from other Offset Projects.

7.0 CATEGORIZATION AND DESCRIPTION OF SELECTED PROJECT AND BASELINE SSRS

All Sinks, Sources and Reservoirs (SSRs) are categorized as controlled, related, or affected (C / R / A) based on their relation to the Project Proponent, where the Project Proponent is assumed to control all on-site and mobile SSRs and upstream and downstream SSRs are assumed to be controlled by others and, thus, are related to the Project. If applicable, affected SSRs are

determined separately in Section 8.3. Figure 2 shows the various SSRs and their relation to a Project.

Figure 2: Project SSRs – All Eligible Project Types



* PE3 Biomass Combustion is determined both on-site and downstream

7.1 Categorization of Project and Baseline SSRs

Subject to any limitations in the description column of Table 3, the Project Plan must include all SSRs identified in Table 3 that are applicable to their Project type as 'included' and may include SSR identified as "Project Proponent Justification" as applicable by the Project Proponent. The Project Plan must not include any SSRs that are not listed in Table 3. Potential SSRs that would be subject to carbon pricing are omitted from this protocol. Where the Project Plan lists an SSR, Emissions or Removals of all GHGs listed for that SSR are to be included. In Table 3, the letter in column 1 under heading SSR denotes whether the SSR is Project (P), or Baseline (B) and the number denotes the SSR reference value.

7.2 SELECTED RELEVANT PROJECT AND BASELINE SSRS

Table 3: Selected Relevant Project and Baseline SSRs

SSR	Controlled, Related or Affected		GHG	Included/Excluded			Description
	Baseline	Project		AFF/REF	C/IFM	AC	
Removal Sinks and Reservoirs							
PR1/BR1 Standing Live Trees	Controlled	Controlled	CO_2	Included	Included	Included	Standing live trees include the stem, branches, and leaves or needles of all above ground live biomass, regardless of species. A minimum diameter at breast height threshold may be justified by the Project Proponent based on the requirements of models and field sampling techniques used.
PR2/BR2 Shrubs and Herbaceous Understory	Controlled	Controlled	CO_2	Included	Optional	Optional	All above-ground live woody and other plant biomass that does not meet the description of standing live trees. Note on optional for CONS/IFM Projects and AC Projects: Project Proponent may elect to consider this SSR to be relevant, but this carbon Reservoir is typically very small in established forests and IFM Projects.
PR3/BR3 Live Roots	Controlled	Controlled	CO_2	Included	Included	Included	Portions of living trees, shrubs or herbaceous biomass located below ground, principally roots.
PR4/BR4 Standing Dead Trees	Controlled	Controlled	CO_2	Included	Included	Included	Standing dead trees include the stem, branches, roots, or section thereof, regardless of species. Stumps are not considered standing dead stocks. A minimum diameter at breast height threshold may be justified by the Project Proponent based on the requirements of models and field sampling techniques used.
PR5/BR5 Lying Dead Wood	Controlled	Controlled	CO_2	Project Proponent Justification	Project Proponent Justification	Project Proponent Justification	Any piece(s) of dead woody material from a tree (e.g., dead boles, limbs, and large root masses) on the ground in forest stands. Lying dead wood is all dead tree material with a minimum average diameter of 12.5cm and a minimum length of 2.4m. Anything not meeting the measurement criteria for lying dead wood will be considered litter. Stumps are not considered lying dead wood. Note on Project Proponent justification: Project Proponent may elect to consider this SSR to be

SSR	Controlled, Related or Affected		GHG	Included/Excluded			Description
	Baseline	Project		AFF/REF	C/IFM	AC	
							relevant, but explanation is not required to deem this SSR as not relevant, since AFF/REF projects would increase carbon stored in the lying dead wood carbon Reservoir relative to the Baseline. This SSR is included if it cannot be demonstrated that the Project will involve the same amount or more carbon being stored in the lying dead wood carbon Reservoir than the Baseline.
PR6/BR6 Litter & Forest Floor	Controlled	Controlled	CO_2	Project Proponent Justification	Project Proponent Justification	Project Proponent Justification	Any piece(s) of dead woody material from a tree (e.g., dead boles, limbs, and large root masses) on the ground in forest stands. Lying dead wood is all dead tree material with a minimum average diameter of 12.5cm and a minimum length of 2.4m. Anything not meeting the measurement criteria for lying dead wood will be considered litter. Stumps are not considered lying dead wood. Note on Project Proponent justification: Project Proponent may elect to consider this SSR to be relevant, but explanation is not required to deem this SSR as not relevant, since AFF/REF projects would increase carbon stored in the lying dead wood carbon Reservoir relative to the Baseline. This SSR is included if it cannot be demonstrated that the Project will involve the same amount or more carbon being stored in the lying dead wood carbon Reservoir than the Baseline.
PR7/BR7 Soil	Controlled	Controlled	CO_2	Conditional	Conditional	Conditional	Belowground carbon not included in other Reservoirs including Stand-Alone. Soil pits are ≥ 60 cm deep, unless bedrock or a water table is encountered before reaching this depth (depth starting at surface of the mineral soil). In deep organic soils, the soil pit should be excavated to a minimum depth of 100 cm when possible. Can be a net Sink or Emission Source depending on the circumstances. Note on Included: SSR is included if the Project exceeds the soil disturbance limits as set out in Section 35 (3), Part 4, Practice Requirements,

SSR	Controlled, Related or Affected		GHG	Included/Excluded			Description
	Baseline	Project		AFF/REF	C/IFM	AC	
							Division 1 — Soils of the *Forest and Range Practices Act*, *Forest Planning and Practices Regulation*, regardless of whether or not the Regulation would otherwise apply to the Project Site. This SSR is also relevant where the Project involves lowering the water table relative to the Baseline case through physical alteration of the Project Site (e.g., trenching).
PR8/BR8 Harvested Wood Products in Use	Related	Related	CO_2	Included	Included	Included	Wood that is harvested or otherwise collected from the forest, transported outside the forest Project Site, and being processed or in use. Includes raw wood products, finished wood products, and any wood residuals generated during the HWP lifecycle that is still in use (i.e., has not been burned, disposed of, etc.).
Emission Sources							
PE1/BE1 Fertilizer Production	Related	Related	CO_2 CH_4 N_2O	Included if PE > > BE. If not, then Excluded	Included if PE > BE. If not, then Excluded	Included if PE > BE. If not, then Excluded	Raw material extraction through to final production of fertilizers that are used throughout the Project.
PE2/BE2 Fertilizer Use Emissions	Controlled	Controlled	N_2O	Included if PE > > BE. If not, then Excluded	Included if PE > BE. If not, then Excluded	Included if PE > BE. If not, then Excluded	Application of nitrogen-based fertilizers and associated Emission pathways, including Emission from soil, volatilization, leaching and runoff.
PE3/BE3 Transport Material, Equipment, Inputs and Personnel to Site	Related	Related	CO_2 CH_4 N_2O	Included if PE > > BE. If not, then Excluded	Included if PE > BE. If not, then Excluded	Included if PE > BE. If not, then Excluded	Transportation of all construction materials, equipment, inputs and personnel to the Project Site as required during the Project. Typically conducted by various fossil fuel-burning modes of transportation (e.g., truck, rail, etc.). Note on Included: Only transport of fossil fuels and fertilizer were identified as having the potential to result in material levels of emissions. Transport of seedlings was considered, but one truck is estimated to be able to transport tens of thousands of seedlings and thus associated emissions are very small. Other chemical inputs tend to be minor, and thus associated transport emissions also expected to be not relevant.
PE4/BE4 Fossil Fuel Production	Related	Related	CO_2 CH_4 N_2O	Included if PE > > BE. If not, then Excluded	Included if PE > BE. If not, then Excluded	Included if PE > BE. If not, then Excluded	Extraction and production / refining of the fuel used to operate vehicles and equipment throughout the Project, including for both site development activities (e.g., site clearing, road construction,

SSR	Controlled, Related or Affected		GHG	Included/Excluded			Description
	Baseline	Project		AFF/REF	C/IFM	AC	
							etc.) and on-going silvicultural and other forest management activities.
PE5/BE5 Fossil Fuel Combustion – Vehicles and Equipment	Controlled	Controlled	CO_2 CH_4 N_2O	Included if PE > BE. If not, then Excluded	Included if PE > BE. If not, then Excluded	Included if PE > BE. If not, then Excluded	On-site vehicles and equipment may burn fossil fuels.
PE6/BE6 Biomass Combustion	Controlled	Controlled	CO_2 CH_4 N_2O	Included if PE > BE. If not, then Excluded	Included if PE > BE. If not, then Excluded	Included if PE > BE. If not, then Excluded	Emissions from the combustion of harvested forest Biomass at the Project Site, or downstream of the Project Site for various purposes, including for heating, slash pile burning, or HWP processing.
PE7/BE7 Harvested Wood Transport	Related	Related	CO_2 CH_4 N_2O	Included if PE > BE. If not, then Excluded	Included if PE > BE. If not, then Excluded	Included if PE > BE. If not, then Excluded	Transport of harvested wood will occur at various points in the lifecycle of the wood, including but not limited to: Transport from the forest to one or more processing and manufacturing locations Transport of wood products to end users Transport of residuals from processing / manufacturing to end-use / disposal / recycling locations (e.g., landfills, places where residuals sold for mulch, etc.) Transport of wood products to disposal / recycling locations at end of life
PE8/BE8 Harvested Wood Processing	Related	Related	CO_2 CH_4 N_2O	Included if PE > BE. If not, then Excluded	Included if PE > BE. If not, then Excluded	Included if PE > BE. If not, then Excluded	Raw harvested wood will be processed in some fashion off-site post harvesting, unless all required processing (e.g., chipping) is completed at the forest site (in which case, emissions from such activities would be captured under PR6). Processing could include but is not limited to: Chipping Milling Manufacture into finished wood products (e.g., paper, furniture, etc.) Processing would require energy that may be provided by fossil fuel combustion or use of electricity generated using fossil fuels.
Leakage							
L1/L2 Forest Carbon and Wood Product Reservoirs Located Outside of the Project	Affected	Affected	CO_2 CH_4 N_2O	Conditional – see Section 8.3 for Included and Excluded	Conditional – see Section 8.3 for Included and Excluded	Conditional – see Section 8.3 for Included and Excluded	Changes in the amount of carbon stored in forest and/or wood product carbon Reservoirs located outside of the Project Site indirectly caused by the Project. See Section 8.3 for more information.

SSR	Controlled, Related or Affected		GHG	Included/Excluded			Description
	Baseline	Project		AFF/REF	C/IFM	AC	
Physical Boundary that are Indirectly Affected by the Project Activity							

7.3 EXCLUSIONS

Project Proponents may exclude Sources from calculation if it can be demonstrated that Project Emissions will be less than Baseline Emissions. Project Proponents may only exclude Reservoirs if indicated in Table 3.

8.0 QUANTIFICATION OF EMISSION REDUCTIONS AND REMOVALS ENHANCEMENTS

For each selected SSR identified in Table 3, a calculation method is provided for quantifying associated GHG Emissions in the Project and Baseline Scenarios in the following sections. All SSRs must be reported in tonnes of carbon dioxide equivalent (tCO_2e).

Net Project Emission Reductions and/or Removals Enhancements are determined through Equation 1.

Equation 1: Net Project Emission Reductions and/or Removals Enhancements in tCO_2e

$$\Delta CO_2e_{net,t} = \Delta GHG_{net,t} - \mathrm{CON}_{\beta} - Other\ deductions$$

Where,

Parameter	Description	Default Value
$\Delta CO_2e_{net,t}$	Project Reduction of CO_2e achieved by the Project Proponent during calendar year *t* as compared to the Baseline. A net increase in Project Reduction is expressed as a positive number. Expressed in tCO_2e.	N/A
$\Delta GHG_{net,t}$	Net incremental Emission Reductions and Removals Enhancements of CO_2e before Risk of Reversal deductions, achieved by the Project during calendar year *t* as compared to the Baseline. Expressed in tCO_2e. A net increase in Emission Reductions and Removals Enhancements is expressed as a positive number. Determined using Equation 2.	N/A
CON_{β}	Contributions to the Contingency Account during calendar year *t*. Expressed in tCO_2e. Determined using Equation 35.	N/A
Other deductions	Other deductions established in an Atmospheric Benefits Agreement. Expressed in tCO_2e.	N/A
t	The reporting calendar year in question, where the value of *t* indicates the number of calendar years that have occurred since the start of the project up to the reporting calendar year in question.	N/A

Emissions factors can be found in the National Inventory Report (NIR) unless stated otherwise. A summary table of current emission factors and constants can be found in Appendix A.

Equation 2: Net Sequestration Before Risk of Reversal

$$\Delta GHG_{net,t} = \Delta GHG_{Project,t} - \Delta GHG_{Baseline,t} - L1 - L2$$

Where,

Parameter	Description	Default Value
$\Delta GHG_{net,t}$	Net incremental Emissions Reduction and Removals Enhancement of CO_2e before Risk of Reversal deductions, achieved by the Project during calendar year *t* as compared to the Baseline. Expressed in tCO_2e. A net increase in Emission Reductions and Removals Enhancements is expressed as a positive number.	N/A
$\Delta GHG_{Project,t}$	Total Emissions or Removals of CO_2e occurring in the Project during calendar year *t.* Expressed in tCO_2e. Determined using Equation 3.	N/A
$\Delta GHG_{Baseline,t}$	Total Emissions or Removals of CO_2e occurring in the Baseline during calendar year *t.* Expressed in tCO_2e. Determined using Equation 24.	N/A
L1	Net increase in Project Emissions due to Activity Leakage from all affected carbon Reservoirs during calendar year *t.* Expressed in tCO_2e. Determined using Equation 25.	N/A
L2	Net increase in Project Emissions due to Market Leakage from all affected carbon Reservoirs during calendar year *t.* Expressed in tCO_2e. Determined in Section 8.3.2.	N/A

Retroactive adjustments to Baseline or Project Emission Reductions or Removals Enhancements from previous Project Report Periods is encouraged but will not be considered as justification for retroactive crediting by the Regulator in the event adjustments to estimates or modelling occur resulting in additional Emission Reductions or Removals Enhancements for retroactive Project Report Periods. If it is determined that the use of modelled results led to over-crediting of the Project, then the Project Proponent must indicate such on the current Project Report and must deduct credits from Net Emission Reductions and Removals Enhancements of that current Project Report Period (and subsequent Project Report Periods if applicable).

Throughout Section 8.1, numerous models are referenced. Regardless of the model used, the same model must be used for both the Baseline and Project Scenarios to ensure consistency in the subsequent carbon projections.

While reported in tCO_2e, Project harvest data must also be included in meters cubed and hectares for each Project Report Period. Where a Project is a Program of Activities, each Project Instance must itemize Baseline and Project harvest data in meters cubed and hectares for each Project Report Period.

The same methodology for deriving the harvest flow must also be used for both the Baseline and the Project scenario (except where monitored Project data is being used and the Baseline is based on estimates), and the specific method must be documented (including quantities such as maximum allowable inter-period change in long-term growing stock in determining the long-term sustainable level and the inter-period change in projected timber supply level).

Gaming or exploiting differences between models in Project Planning is not acceptable. Validation Bodies and Verification Bodies must ensure the conservative and consistent use of model parameters and assumptions.

Guidance Note: The Province does not assume any liability in the case of model errors that affect Project Reduction.

8.1 QUANTIFICATION OF PROJECT EMISSIONS AND REMOVALS

Project Emission Reductions and Removals Enhancements are determined with **Equation 3**.

Equation 3: Total Project Emission Reductions or Removals Enhancements

$$\Delta GHG_{Project,t} = \Delta T_{(PR_1\ to\ PR_7),t} + T_{PR_8,t} - \sum_j \sum_i (PE_{i,j,t}) \times GWP_j$$

Where,

Parameter	Description	Default Value
$\Delta GHG_{Project,t}$	Total Emissions or Removals of CO_2e occurring in the Project during calendar year *t*. Expressed in tCO_2e.	N/A
$\Delta T_{(PR1\ to\ PR7),t}$	Emissions or Removals by Project live and dead forest carbon Reservoir (excluding HWPs) during calendar year *t*. Expressed in tCO_2e. Determined using Equation 4.	N/A
$T_{PR8,t}$	Mass of CO_2 stored in Project HWPs during calendar year *t*. Expressed in tCO_2e. Determined using Equation 7.	N/A
GWP_j	Global Warming Potential specified by the BC government for GHG *j*.	N/A
$PE_{i,j,t}$	Total Project Emissions of GHG *j* from PE_i identified in Table 3 during calendar year *t*. Expressed in tonnes. PE_i shall be calculated based on the requirements of Section 8.1.3 – 8.1.10	N/A
I	SSR in question, where the value of *I* denotes the SSR reference value as listed in column 1 of Table 3.	N/A
J	The relevant GHGs in this protocol: CO_2, CH_4, and N_2O.	N/A

8.1.1 PR1 to PR7 Live and Dead Forest Carbon Reservoirs

Project Reservoirs (PR) PR1 to PR7 associated with Project forest growth must be determined using Equation 4, Equation 5, and Equation 6 below.

Equation 4: Converting Carbon to Carbon Dioxide Units

$$\Delta T_{(PR1\ to\ PR7),t} = \Delta TC_{PR1\ to\ PR7,t} \times \frac{MW_{CO2}}{MW_C}$$

Where,

Parameter	Description	Default Value
$\Delta T_{(PR1\ to\ PR7),t}$	Emissions and Removals by Project live and dead forest carbon Reservoir (excluding HWPs) during calendar year *t*. Expressed in tCO_2e.	N/A
$\Delta TC_{PR1\ to\ PR7,t}$	Total change in carbon by all Project carbon Reservoirs in mass during calendar year *t*. Expressed in tonnes carbon (tC). Determined using Equation 5.	N/A
MW_{CO_2}	Molecular weight of CO_2.	44 g/mole
MW_C	Molecular weight of carbon.	12 g/mole

Equation 5: Summation of Change in Carbon Reservoirs

$$\Delta TC_{PR1\ to\ PR7,t} = \sum_{i=1} \Delta PR_i$$

Where,

Parameter	Description	Default Value
$\Delta TC_{PR1\ to\ PR7,\ t}$	Change in total Project carbon Reservoir in mass for SSR *i* in the current calendar year *t*. Expressed in tonnes carbon (tC)	N/A
ΔPR_i	Change in carbon by Project Reservoir *i* identified in Table 3. Expressed in tonnes carbon (tC). Determined using Equation 6.	N/A

Equation 6: Reporting Change of Carbon in Reservoirs

$$\Delta PR_i = PR_{i,t} - PR_{i,t-1}$$

Where,

Parameter	Description	Default Value
ΔPR_i	Change in carbon by Project Reservoir *i* identified in Table 3 at the end of current calendar year. Expressed in tonnes C (tC).	N/A
$PR_{i,\,t}$	Amount of carbon in Project Reservoir *i* in the current calendar year *t*.	N/A
$PR_{i,\,t-1}$	Amount of carbon in Project Reservoir *i* in the previous calendar year *t-1*.	N/A

The Reservoirs are identified by a Project Proponent in the Project Plan as selected based on the requirements in Section 7.2. Project Proponents must demonstrate in the Project Plan that the components of forest carbon included in the definitions of each selected Reservoir were assessed as part of the quantification approach used.

Guidance Note: PR7 Soil

Where soil carbon is selected as a carbon Reservoir by the Project Proponent, the Project Proponent shall ensure that either:

- *The forest carbon model employed have the capability to quantify changes in soil carbon between the Project and Baseline over time, or*
- *Direct field sampling for assessing soil carbon is selected and paired with the selected forest carbon models.*

A Project Proponent must justify their selection of a soil carbon quantification method, taking into account Project-specific details including the Baseline Scenario. The Project Proponent must indicate in the Project Plan how their approach will result in a conservative estimate of the Project Reduction, considering the associated uncertainty. The frequency of field measurement must be consistent with the requirements for assessing other forest carbon Reservoirs as described later in the Protocol (i.e., at least every 10 years). Soil carbon assessment must include a full site-specific soil profile.

Where uncertainty cannot be effectively managed (as defined in the field sampling method), and where soil carbon is an optional Reservoir in ***Table*** *3, this carbon Reservoir must not be selected for quantification.*

8.1.1.1 Quantification Approach and Associated Uncertainty

To track Reservoir changes in the Project Scenario, Project Proponents will develop and update forest inventories of the Project Site. Disturbance activities (i.e., harvesting and natural), and growth and yield will be modelled and monitored. Inventory attributes, disturbances, and growth and yield data will be linked and inputted into a carbon budget model to ascertain tCO2e equivalent values per year.

8.1.1.1.1 Forest Inventory

The Project Proponent must develop a forest inventory of the Project Site. Development of a forest inventory must be supervised by a qualified Registered Professional Forester. At a minimum, Vegetation Resource Inventory (VRI) data standards must be used. Development of a forest inventory can be done in two ways:

- Using the VRI as a base inventory with periodic updates for any disturbances (harvesting, etc.), or
- Developing a forest inventory using alternative approaches such as periodic field sampling or remote sensing methods in combination with ground sampling according to VRI sampling standard.

a) Vegetation Resource Inventory Method

VRI photo-estimates and statistically valid ground sample data will be used as the base inventory for project development. For Crown land, the accuracy assessments and quality assurance associated with VRI datasets are currently available and updated on an ongoing basis. Project Proponents are required to use the best available inventory data at project reporting intervals. Where the Project Start Date is later than the date that the VRI datasets were last updated, models being used for the Project shall be used to forecast forest carbon to the start date of the project using assumptions for baseline pre-project forest management practices. The result of this forecast shall be used as the basis for assessing starting carbon levels in the project and baseline.

Where there is no recent VRI data during the Monitoring Period, more field samplings may be conducted to reach required statistical significance. Such field measurement must be conducted at least once every twenty years, to align with the field sampling requirements of b) Alternative Approach, below.

b) Alternative Approach

In some circumstances (e.g., Project Site having insufficient VRI data), the VRI method may be less desirable to use. Project Proponents may develop their own forest inventories through periodic field sampling or remote sensing methods in combination with ground truthing. When using the alternative approach, at a minimum, Project Proponents must use VRI data standards for conducting any field sampling and developing forest inventories. Project Proponents must report the resulting inventory attributes in a geodatabase by following the VRI data standards. The geodatabase must be included as a separate file accompanying the Project Plan.

Project Proponents that conduct field sampling must assert in the Project Plan that the following requirements will be met:

- Field sampling must be conducted at minimum once every 20 years. A Project Proponent may report on and claim Offset Units from Emission Reductions and Removals Enhancements in years where sampling was not conducted (e.g., annual reporting is still permitted) based on modelled forest carbon projections.
- Sample plots must be chosen using a justified statistically valid approach appropriate for the Project (e.g., that reflects any site stratification, etc.). Results of the sampling must be converted into amounts of stored carbon in relevant forest carbon Reservoirs based on justified assumptions. The targeted sampling error for total Biomass/carbon for all species

combined should be less than or equal to 20% at 90% confidence level for both plantation and natural forests. In converting sampling results to amount of forest carbon, the principle of conservativeness must apply.

- When sampling is conducted, results must be used to re-calibrate carbon projection model results.
- Where a Project includes multiple Project Instances, Project Instances must be homogenous, otherwise non-homogenous Project Instances must be measured separately.
    - Homogeneity in this instance means each Project Instance is in the same biogeoclimatic zone site series.

8.1.1.1.2 Disturbance Projections

Forest estate and landscape dynamics models project forest dynamics over time across large areas due to management and/or natural processes. Models may be used for identifying sustainable harvest levels in a timber supply analysis, and for modelling natural disturbances (e.g., fire, mountain pine beetle, etc.). Forest estate and landscape dynamics models that have been used in B.C. and are recommended for use by Project Proponents include the Spatially Explicit Landscape Event Simulator-Spatially Explicit Timber Supply Model (SELES-STSM), Forest Simulation and Optimization System (FSOS), Patchworks, and Woodstock/Stanley.

Project Proponents should select an appropriate model for their Project Site.

Selection of the forest estate and landscape dynamics models is subject to the following criteria:

- Models must have been used in or calibrated for B.C.,
- Proponents must demonstrate that the model is appropriate for the proposed use,
- Proponents must note the deficiencies of the models, and
- A summary rationale accepting and justifying the model used in the Project Plan must be included as an attachment to the Validation Statement.

8.1.1.1.3 Growth and Yield

Growth and yield models must be used to estimate values for existing and projected stand volume and other characteristics given starting conditions and site characteristics. The Variable Density Yield Projection (VDYP), and Tree & Stand Simulator (TASS)/Table Interpolation for Stand Yields (TIPSY) are officially used in B.C. for province-wide growth and yield projections. TASS and/or TIPSY must be used for harvested and regenerated second-growth stands, while the VDYP must be used for unmanaged natural stands. Default Operational Adjustment Factor (OAF) values of OAF1 and OAF2 are 0.85 and 0.95, respectively.

8.1.1.1.4 Carbon Budget Model

The latest version of the Carbon Budget Model of the Canadian Forest Service (CBM-CFS3) or Generic Carbon Budget Model is required for use to estimate carbon stocks of carbon pools in this Protocol. Both models approximate national and forest management unit-level forest carbon accounting in Canada to estimate forest carbon values.

8.1.1.1.5 Uncertainty Analysis

To manage the associated uncertainty and ensure that results are conservative, the following requirements must be met:

- When field sampling is conducted, the type and level of measurement is to be determined by the Project Proponent but must include a VRI method. However, the type and level of measurement shall be reflected in an overall assessment of uncertainty prepared by the Project Proponent.
- In assessing the overall uncertainty of the forest carbon Reservoir quantification approach, the Project Proponent must conduct a sensitivity analysis of modelled results to determine the key potential sources of uncertainty and then evaluate the uncertainty associated with those sources. During this process, any field measurements conducted and their impact on associated model uncertainty shall be considered.
- Based on the results of this uncertainty assessment, the Proponent shall justify an appropriate approach to managing uncertainty that will ensure that reported changes in forest carbon Reservoirs between Project Scenario and Baseline Scenario are conservative.
- To ensure accuracy of Baseline and Project Scenario forecasts, Project Proponents must update the carbon projection model with newly available inventory data, growth and yield data, and disturbances data. If it is determined that use of modelled results led to over crediting of the project, the Director may withhold future issuances of Offset Units.
- Project Proponents should provide a justification for the modelling assumptions.

8.1.1.2 Requirements for Reporting Quantification Results

Project Proponents must show precisely how the model inputs and outputs are compatible with available data and the requirements of the other models in the overall quantification approach. A summary of model inputs (including changes to model default values for climate, disturbance events and management activities, disturbance matrices, growth and yield curves, inventory, transition rules, and all assumptions) must be included as appendices to the Project Plan. Where model settings in the Project Scenario differ from the Baseline Scenario, those must be qualified.

For all Projects, Proponents must summarize the following in a table for both the Baseline and the Project:

- Annual area of implementation (if applicable),
- Mean per-hectare biomass (tC/ha),
- Mean per-hectare total ecosystem carbon (tC/ha),
- Mean per-hectare atmospheric GHG balance (tCO2e/ha/yr) broken down by reservoir,
- Cubic metres of carbon sequestration gained or GHG emissions avoided per Project Report Period (m^3/yr),
- Mean cubic metre per hectare (m^3/ha),
- Mean carbon per cubic metre (tC/m^3),
- Mean carbon per cubic metre of carbon sequestration gained or GHG emissions avoided (tC/m^3/yr) for each Project Report Period.

8.1.2 PR8 Harvested Wood Products In-Use

The method contains approaches for calculating carbon quantities in the HWP Reservoir for both North America (US and Canada) and offshore uses. The method assumes a standard downstream product mix, and uses a fixed factor intended to represent the storage of carbon in HWP after 100

years for both North American and offshore markets. The standard factor was provided by Natural Resources Canada and used in the National Inventory Report and excludes temporary storage.

The methodology described in this section applies to HWP In-Use Reservoirs and does not consider storage within landfills or dumps. HWP sent to landfill is conservatively assumed to be emitted as CO_2 in this Protocol.

The Project Proponent may choose one of the following two approaches for quantifying HWP storage:

1. **Default approach** – standard HWP mixes for both North American and offshore HWP utilization.

2. **Optional approach** – all harvested wood carbon is assumed to be immediately emitted as CO_2. This approach is only available to Projects where the actual harvest is greater than or equal to the harvest volumes of the Baseline Scenario.

Harvest flow for both the Project and Baseline Scenario must be developed in accordance with the requirements stipulated in Section 5.2.1.

Equation 7: GHGs from Harvested Wood Products

$$T_{PR8,t} = GrossHWPCO_{2,t} \times HWPfact$$

Where,

Parameter	Description	Default Value
$T_{PR8,t}$	Mass of CO_2 stored in Project HWPs during calendar year *t*. Expressed in tCO_2e.	N/A
$GrossHWPCO_{2,t}$	Mass of tCO_2e in delivered roundwood extracted from the Project Site during calendar year *t* destined for use in North America and offshore. Expressed in tCO_2e. Determined using Equation 8.	N/A
HWPfact	The proportion of CO_2 remaining after harvest, for products used in North America and offshore. Assumed to be 6% permanently sequestered for a standard mix of products after 100 years.	6%

Determining Gross Mass of HWP (*GrossHWPCO2*)

For each Project Report Period and location of use, convert volumes to tonnes of dry Biomass.

Equation 8: Gross Mass of Carbon in Harvested Wood Products

$$GrossHWPCO_{2,t} = RWBiomass_t \times f_{C,wood} \times \frac{MW_{CO_2}}{MW_C}$$

Where,

Parameter	Description	Default Value

$GrossHWPCO_{2,t}$	Mass of tCO_2e in delivered roundwood extracted from the Project Site during calendar year *t*. Expressed in tCO_2e.	N/A
$RWBiomass_t$	Dry mass of the delivered roundwood extracted from the Project Site during calendar year *t*. Expressed in tonnes dry Biomass. Determined using Equation 9.	N/A
$f_{C,wood}$	Fraction of the dry mass of wood, excluding bark, that is carbon.	Assumed to be 50% for all wood species.
MW_{CO2}	Molecular weight of CO_2.	44 g/mole
MW_C	Molecular weight of carbon.	12 g/mole

Roundwood Biomass (*RWBiomass*)

Calculate or estimate volume of roundwood delivered to the mill or exported, from the Project Site, by species, year and wood product destination. Harvest flow for both Project and Baseline must be developed in accordance with the requirements stipulated in Section 5.2.1. Volumes must be for wood only (not including bark).

Equation 9: Roundwood Biomass

$$RWBiomass_t = \sum_s vol_s \times wdf_s$$

Where,

Parameter	Description	Default Value
$RWBiomass_t$	Dry mass of the delivered roundwood extracted from the Project Site during calendar year *t*. Expressed in tonnes of dry Biomass.	N/A
vol_s	Volume of delivered roundwood in m^3 of species *s*, extracted from the Project Site during calendar year *t*. Expressed in m^3.	N/A
wdf_s	Wood density factor for species *s*. Measured in t/m^3.	See below for Table 4 or Table 5
s	Relevant tree species types being harvested in the Project and Baseline area.	N/A

Table 4: BC-specific wood density factors (wdf_s) for oven-dry stemwood to convert from inside-bark harvested volume (m^3) to mass

B.C. Species or genus	Wood density to 2 significant figures ($t\ m^{-3}$)
Red alder (*Alnus rubra*)	0.42
Trembling aspen (*Populus tremuloides*)	0.42
Western red cedar (*Thuja plicata*)	0.35
Yellow cypress (*Chamaecyparis nootkatensis*)	0.45

Douglas-fir (*Pseudotsuga menziesii*)	0.50
True firs (*Abies* spp.)	0.40
Western hemlock *(Tsuga heterophylla*)	0.47
Western larch (*Larix occidentalis*)	0.64
Lodgepole pine (*Pinus contorta*)	0.46
Ponderosa pine (*Pinus ponderosa*)	0.46
Spruce (*Picea* spp.)	0.43
Sitka spruce (*Picea sitchensis*)	0.41

Table 5: BC-specific wood density factors (wdf_s) for green stemwood to convert from inside-bark harvested volume (m^3) to mass

B.C. Species or genus	**Wood density to 2 significant figures ($t\ m^{-3}$)**
Red alder (*Alnus rubra*)	0.40
Trembling aspen (*Populus tremuloides*)	0.42
Western red cedar (*Thuja plicata*)	0.34
Yellow cypress (*Chamaecyparis nootkatensis*)	0.44
Douglas-fir (*Pseudotsuga menziesii*)	0.45
True firs (*Abies* spp.)	0.38
Western hemlock (*Tsuga heterophylla*)	0.43
Western larch (*Larix occidentalis*)	0.45
Lodgepole pine (*Pinus contorta*)	0.41
Ponderosa pine (*Pinus ponderosa*)	0.41
Spruce (*Picea* spp.)	0.36
Sitka spruce (*Picea sitchensis*)	0.41

8.1.3 PE1 Fertilizer Production Emissions

Emissions from upstream fertilizer production are to be determined using Equation 10.

Equation 10: PE1 Fertilizer Production Emissions

$$PE_{1,j,t} = \sum_{f} EF_{f,j} \times AL_{f,t} \times CF_f$$

Where,

Parameter	Description	Default Value
$PE_{1,j,t}$	Emissions of GHG *j* from PE1 from fertilizer production that will be applied during the calendar year *t*. Expressed in tonnes.	N/A
$EF_{f,j}$	Emission factor for GHG *j* and fertilizer type *f*.	See below
$AL_{f,t}$	Quantity of fertilizer of type *f* applied during the calendar year *t*.	N/A
CF_f	Conversion factor to be used if the units of the activity level do not match those of the Emission factor for a particular fertilizer type *f*. Where both the activity level and Emission factor are expressed in the same units, CF would be set to 1.	N/A
f	Fertilizer type.	N/A

Determining the Emission factor

Emission factors appropriate for the production of nitrogen-based fertilizers in question must be selected from the Canadian NIR. In the event that an appropriate Emission factor is not included in the NIR, the latest IPCC factor may be used. Otherwise, Emission factors found in peer reviewed Sources relevant to the Project Site conditions may be used. A summary table of Emission factors can be found in Appendix A.

Determining the activity level

Quantities of different types of fertilizer applied must be monitored during the Project.

8.1.4 PE2 Fertilizer Use Emissions

N_2O Emissions from Fertilizer Use

N_2O Emissions that result from anthropogenic N inputs occur (i) directly, from the soil to which N is added, and (ii) indirectly, from volatilization and redeposition of nitrogen compounds and leaching and runoff of nitrogen compounds, mainly as nitrate. Both direct and indirect Emissions are quantified for this SSR from the following sources:

- Synthetic nitrogen fertilizer.
- Organic nitrogen applied as fertilizer (e.g., manure, compost, and other organic soil additives).

Total N_2O Emissions related to fertilizer use is determined using Equation 11.

Equation 11: PE2 Fertilizer Use Emissions

$$PE_{2,N_2O,t} = N_2O_{direct,t} + N_2O_{indirect,t}$$

Where,

Parameter	Description	Default Value

$PE_{2,N2O,t}$	Total emissions of N_2O, as a result of nitrogen application within the Project Site during calendar year *t*. Expressed in tonnes N_2O.	N/A
N_2O_{direct}	Direct Emissions of N_2O as a result of nitrogen application within the Project Site during calendar year *t*. Expressed in tonnes N_2O. Determined using Equation 12.	N/A
$N_2O_{indirect}$	Indirect Emissions of N_2O as a result of nitrogen application within the Project Site during calendar year *t*. Expressed in tonnes N_2O. Determined using Equation 15.	N/A

Direct N_2O Emissions

The direct nitrous oxide Emissions from nitrogen fertilization must be estimated using the following equations:

Equation 12: Direct Fertilizer Use Emissions

$$N_2O_{direct,t} = [\left(M_{SN,t} \times (1 - Frac_{GASF}) + (M_{ON,t} \times (1 - Frac_{GASM})\right)) \times EF_{direct} \times \frac{MW_{N_2O}}{MW_N}$$

Where,

Parameter	Description	Default Value
$N_2O_{direct,t}$	Direct Emissions of N_2O as a result of nitrogen application within the Project Site during calendar year *t*. Expressed in tonnes N_2O.	N/A
$M_{SN,t}$	Mass of synthetic fertilizer nitrogen applied during calendar year *t*. Expressed in tonnes. Determined using Equation 13.	N/A
$Frac_{GASF}$	Fraction of Nitrogen that volatilizes as NH_3 and NO_x for synthetic fertilizers.	0.1
$M_{ON,t}$	Mass of organic fertilizer nitrogen applied during calendar year *t*. Expressed in tonnes. Determined using Equation 14.	N/A
$Frac_{GASM}$	Fraction of Nitrogen that volatilizes as NH_3 and NO_x for organic fertilizers.	0.2
EF_{direct}	Emission factor for N additions from fertilizers, tonne N_2O-N / tonne N input.	0.010
MW_{N_2O}	Molecular weight of N_2O.	44 g/mole
MW_N	Molecular weight of N_2.	28 g/mole

Equation 13: Mass of Synthetic Fertilizer Nitrogen Applied

$$M_{SN,t} = \sum_f M_{SF_{f,t}} \times NC_{SF_f}$$

Where,

Parameter	Description	Default Value

$M_{SN,t}$	Mass of synthetic fertilizer nitrogen applied during calendar year *t*. Expressed in tonnes.	N/A
M_{SF_f}	Mass of synthetic fertilizer nitrogen applied in the Project Site during calendar year *t*. Expressed in tonnes.	N/A
NC_{SF_f}	Nitrogen content (mass fraction) of synthetic fertilizer type f applied.	N/A
f	Synthetic fertilizer type.	N/A

Equation 14: Mass of Organic Fertilizer Nitrogen Applied

$$M_{ON,t} = \sum_{v} M_{OF_{v,t}} \times NC_{OF_v}$$

Where,

Parameter	Description	Default Value
$M_{ON,t}$	Mass of organic fertilizer nitrogen applied during calendar year *t*. Expressed in tonnes.	N/A
$M_{oFv,t}$	Mass of organic fertilizer of type *v* applied in the Project Site during calendar year *t*. Expressed in tonnes.	N/A
NC_{Ofv}	Nitrogen content (mass fraction) of organic fertilizer type *v* applied.	N/A
v	Organic fertilizer type.	N/A

Project Proponents must identify the nitrogen content for each synthetic and organic fertilizer applied, as reported by the fertilizer manufacturer or determined by laboratory analysis.

Indirect N_2O Emissions

Indirect nitrous oxide Emissions from nitrogen fertilization are estimated using the following equations:

Equation 15: Indirect Fertilizer Use Emissions

$$N_2O_{indirect,t} = \left(N_2O_{(ATD)} + N_2O_{(L)}\right) \times \frac{MW_{N_2O}}{MW_N}$$

Where,

Parameter	Description	Default Value
$N_2O_{indirect}$	Indirect Emissions of N_2O as a result of nitrogen application within the Project Site during calendar year *t*. Expressed in tonnes N_2O.	N/A
$N_2O_{(ATD)}$	Amount of N_2O-N produced from atmospheric deposition of N volatilized during calendar year *t*. Expressed in tonnes. Determined using Equation 16.	N/A

$N_2O_{(L)}$	Amount of N_2O-N produced from leachate and runoff of N, during calendar year *t*. Expressed in tonnes. Determined using Equation 17.	N/A
MW_{N2O}	Molecular weight of N_2O.	44 g/mole
MW_N	Molecular weight of N_2.	28 g/mole

Equation 16: Amount of N_2O-N Produced from Atmospheric Deposition of N Volatilized

$$N_2O_{(ATD),t} = [M_{SN,t} \times (Frac_{GASF}) + M_{ON,t} \times (Frac_{GASM})] \times EF_{ATD}$$

Where,

Parameter	Description	Default Value
$N_2O_{(ATD),t}$	Amount of N_2O-N produced from atmospheric deposition of N volatilized during calendar year *t*. Expressed in tonnes.	N/A
$M_{SN,t}$	Mass of synthetic fertilizer nitrogen applied during calendar year *t*. Expressed in tonnes. Determined using Equation 13.	N/A
$Frac_{GASF}$	Fraction of Nitrogen that volatilizes as NH_3 and NO_x for synthetic fertilizers.	0.11
$M_{ON,t}$	Mass of organic fertilizer nitrogen applied during calendar year *t*. Expressed in tonnes. Determined using Equation 14.	N/A
$Frac_{GASM}$	Fraction of Nitrogen that volatilizes as NH_3 and NO_x for organic fertilizers.	0.21
EF_{ATD}	Emission Factor for N_2O Emissions from atmospheric deposition of N on soils and water surfaces, tonne N_2O-N / tonne N input.	0.01

Equation 17: Amount of N_2O-N Produced from Leachate and Runoff of N

$$N_2O_{(L)} = (M_{SN} + M_{ON}) \times Frac_{LEACH-(H)} \times EF_{(L)}$$

Where,

Parameter	Description	Default Value
$N_2O_{(L)}$	Amount of N_2O-N produced from leachate and runoff of N, tonnes of NO_2 in each Project Report Period.	N/A
$M_{SN,t}$	Mass of synthetic fertilizer nitrogen applied during calendar year *t*. Expressed in tonnes. Determined using Equation 13.	N/A
$M_{ON,t}$	Mass of organic fertilizer nitrogen applied during calendar year *t*. Expressed in tonnes. Determined using Equation 14.	N/A
$Frac_{LEACH-(H)}$	Fraction of N lost by leaching and runoff.	0.24 or 0 (see below)
$EF_{(L)}$	Emission factor for N_2O-N Emissions from N leaching and runoff, tonne of N_2O / tonne N input.	0.011

The fraction of nitrogen lost by leaching and runoff ($Frac_{LEACH-H}$) applies only in those cases where soil water-holding capacity is exceeded as a result of precipitation or irrigation (i.e., precipitation

is greater than evapotranspiration). Where this condition exists, the default value for $Frac_{LEACH-H}$ = 0.24. Where evapotranspiration is greater than precipitation, the value for this parameter is zero.

Project Proponents for each calculation must identify the nitrogen content for each synthetic and organic fertilizer applied, as reported by the fertilizer manufacturer or determined by laboratory analysis.

8.1.5 PE3 Transport of Material, Equipment, Inputs, and Personnel to Site

Emissions from transportation of materials, equipment, inputs, and personnel to the Project / baseline site are to be calculated using the following two approaches

Approach 1: Distance and assumed fuel economy approach

Equation 18: PE3 Distance and Fuel Economy Approach

$$PE_{3,j,t} = \sum_{m} \left[EF_{m,j} \times \sum_{g} \left(FE_m \times D_{m,g} \times C_{m,g,t} \div L_{m,g} \right) \times CF_m \right]$$

Where,

Parameter	Description	Default Value
$PE_{3,j,t}$	Emissions of GHG *j* from the transport of materials, equipment, inputs, and personnel to the Project Site during calendar year *t*. Expressed in tonnes.	N/A
$EF_{m,j}$	The emission factor for GHG *j* and fuel combusted by transportation mode *m* (e.g., g CO_2 per L diesel).	See below
FE_m	Fuel economy of transportation mode *m* (e.g., L / 100 km).	N/A
$D_{m,g}$	Transport distance for material, equipment, input, or personnel *g* using transport mode *m*.	N/A
$C_{m,g,t}$	Total quantity of material, equipment, input, or personnel *g* transported using transport mode *m* during calendar year *t*.	N/A
$L_{m,g}$	Cargo load per transport vehicle of mode *m*.	N/A
CF_m	The conversion factor to be used if the units of the various parameters do not match (e.g., fuel economy in L/100km but distance in km) for a particular transport mode *m*. Where both the activity level and emission factor are expressed in the same units, CF would be set to 1.	N/A
m	Transportation mode.	N/A
g	Material, equipment, input, or personnel being transported.	N/A

Determining the emission factor

For standard mobile combustion fuels (e.g., gasoline, diesel, etc.), an emission factor from the latest Canadian NIR must be used if the emission factor selected is appropriate for the vehicle and fuel type used and separate emission factors for CO_2, CH_4, and N_2O are available. Where different types of vehicles or fuels are used in fuel transportation, associated emission calculations must be performed separately for each vehicle and fuel type. In the event that an up-to-date emission factor cannot be found in the NIR, a default emission factor from the latest version of relevant emission factors under General Stationary Combustion of the Greenhouse Gas Emission Reporting Regulation (WCI.020) must be used. In the event that an appropriate emission factor is not included in the NIR or WCI, the latest IPCC factor may be used. A summary table of 2020 emission factors can be found in Appendix A.

Determining the activity level and other parameters

Quantity of material, equipment, input, or personnel must be monitored for the Project.

Since it is not possible to directly monitor transportation in the Baseline Scenario, baseline transportation quantities and assumptions must be estimated based on the activities described for the selected baseline scenario and Project assumptions where applicable.

Other parameters, such as transport modes used, transport distance by mode, fuel efficiency, and cargo load per transport vehicle must be conservatively determined and justified based on typical distances and types of transport modes used.

<u>Approach 2: Amount and distance shipped approach</u>

Equation 19: PE3 Amount and Distance Approach

$$PE_{3,j,t} = \sum_{m} \left[EF_{m,j} \times \sum_{g} \left(D_{m,g} \times C_{m,g,t} \right) \times CF_{m} \right]$$

Where,

Parameter	Description	Default Value
$PE_{3,j,t}$	Emissions of GHG *j* from the transport of materials, equipment, inputs, and personnel to the Project Site during calendar year *t*. Expressed in tonnes.	N/A
$EF_{m,j}$	The emission factor for GHG *j* and the amount and distance shipped by transportation mode *m* (e.g., g CO_2 per tonne-km).	See below
$D_{m,g}$	Transport distance for material, equipment, input, or personnel *g* using transport mode *m*.	N/A
$C_{m,g,t}$	Total quantity of material, equipment, input, or personnel *g* transported the same distance using transport mode *m* during calendar year *t*. Where the same type of good is transported different distances to arrive at the Project or baseline site, they should be treated as separate goods for the purposes of this calculation.	N/A
CF_m	The conversion factor to be used if the units of the various parameters do not match for a particular transport mode *m*. Where both the activity level and emission factor are expressed in the same units, CF would be set to 1.	N/A

Determining the emission factor

For standard mobile combustion fuels (e.g., gasoline, diesel, etc.), an emission factor from the latest Canadian National Inventory Report must be used if the emission factor selected is appropriate for the vehicle and fuel type used, and separate emission factors for CO_2, CH_4, and N_2O are available. Where different types of vehicles or fuels are used in fuel transportation, associated emission calculations must be performed separately for each vehicle and fuel type. In the event that an up-to-date emission factor cannot be found in the NIR, a default emission factor from the latest version of relevant emission factors under General Stationary Combustion of the Greenhouse Gas Emission Reporting Regulation (WCI.020) must be used. In the event that an appropriate emission factor is not included in the NIR or WCI, the latest IPCC factor may be used. A summary table of 2020 emission factors can be found in Appendix A.

Determining the activity level and other parameters

Transport distance by good and by mode must be conservatively determined and justified based on typical distances and types of transport modes used.

8.1.6 PE4 Fossil Fuel Production

Emissions from production of fossil fuels consumed on-site are to be calculated using the standard emissions factor multiplied by the activity level described in Equation 20.

Equation 20: PE4 Fossil Fuel Production

$$PE_{4,j,t} = \sum_{f} EF_{f,j} \times AL_{f,t} \times CF_f$$

Where,

Parameter	Description	Default Value
$PE_{4,j,t}$	Emissions of GHG *j* from production of fossil fuels consumed on the Project Site during each calendar year *t*. Expressed in tonnes.	N/A
$EF_{f,j}$	The emission factor for GHG *j* and fuel type *f*.	See below
$AL_{f,t}$	The quantity of fuel of type f consumed by machinery throughout the project, including for both site development and forest management activities as described in Table 3 during the calendar year *t*.	N/A
CF_f	The conversion factor to be used if the units of the activity level do not match those of the emission factor for a particular fuel type f. Where both the activity level and emission factor are expressed in the same units, CF would be set to 1.	N/A
f	Fuel type.	N/A

Determining the emission factor

Fossil fuel production emission factors for the fuels in question should be selected from the Canadian NIR. In the event that an up-to-date emission factor cannot be found in the NIR, a default emission factor from the latest version of relevant emission factors under General Stationary Combustion of the Greenhouse Gas Emission Reporting Regulation (WCI.020) must be used. In the event that an appropriate emission factor is not included in the NIR or WCI, the latest IPCC factor may be used. A summary table of 2020 emission factors can be found in Appendix A.

Determining the activity level

The most accurate approach to calculating fossil fuel production is to use consumption volumes for the site. Since it is not possible to directly monitor fuel consumption in the baseline, baseline fuel consumption must be estimated based on justified vehicle and equipment usage estimates in the baseline and considering fuel consumption observed during the project period as applicable.

8.1.7 PE5 Fossil Fuel Combustion – Vehicles and Equipment

Emissions from fossil fuel combustion in on-site vehicles and equipment are to be calculated using the standard emission factor times activity level approach described in **Equation 21**.

Equation 21: PE5 Fossil Fuel Combustion – Vehicles and Equipment Emissions

$$PE_{5,j,t} = \sum_{f} \left[\sum_{e} \left(EF_{f,e,j} \times AL_{f,e,t} \times CF_{f,e} \right) \right]$$

Where,

Parameter	Description	Default Value
$PE_{5,j,t}$	Emissions of GHG *j* from combustion of fossil fuels consumed on the Project Site during each calendar year *t*. Expressed in tonnes.	N/A
$EF_{f,e,j}$	The emission factor for GHG *j*, fuel type *f* and equipment/vehicle type e (e.g., tonnes CO_2 per L diesel).	See below
$AL_{f,e,t}$	The quantity of fuel of type f combusted on-site during calendar year *t*.	N/A
$CF_{f,e}$	The conversion factor to be used if the units of the activity level do not match those of the emission factor for a particular fuel type f and equipment/vehicle type *e*. Where both the activity level and emission factor are expressed in the same units, CF would be set to 1.	N/A
e	Equipment/vehicle type.	N/A

Determining the emission factor

Fossil fuel production emission factors for the fuels in question should be selected from the Canadian NIR. In the event that an up-to-date emission factor cannot be found in the NIR, a default emission factor from the latest version of relevant emission factors under General Stationary Combustion of the Greenhouse Gas Emission Reporting Regulation (WCI.020) must be used. In the event that an appropriate emission factor is not included in the NIR or WCI, the latest IPCC factor may be used.

Determining the activity level

The activity level may be measured / tracked directly using mass or volumetric flow meter to Project Scenario equipment or estimated using a summation of fuel sales invoices. Where given quantity of purchased fuel is used for both Project and non-Project equipment, the proportion of fuel used by the Project must be estimated by considering the expected rates of fuel consumption by Project and non-Project equipment consuming the fuel. The Project Proponent must clearly document how the estimated proportion was determined and that it is conservative (i.e., not under-estimated for the Project Emissions, not over-estimated for the Baseline Emissions). Baseline Scenario values may require adjustment for project-specific circumstances.

8.1.8 PE6 Biomass Combustion

Emissions from controlled burning of Biomass on-site, including burning of wood residuals, controlled burning for land clearing, and burning associated with downstream manufacturing, etc., are to be determined using Equation 22.

Equation 22: PE6 Biomass Combustion

$$PE_{6,j,t} = \sum_{b} EF_{b,j} \times AL_{b,t} \times CF_b$$

Where,

Parameter	Description	Default Value
$PE_{6,j}$	Emissions of GHG from PE6 from Biomass combustion within the Project Site and downstream during each calendar year *t*. Expressed in tonnes.	N/A
$EF_{b,j}$	Emission factor for GHG *j* and Biomass type *b* (e.g., tonnes CH_4, CO_2, and N_2O per tonne of Biomass burned).	See below
$AL_{b,t}$	Quantity of Biomass of type *b* combusted during calendar year *t*.	N/A
CF_b	Conversion factor to be used if the units of the activity level do not match those of the Emission factor for a particular Biomass type *b*. Note, special care must be taken to ensure that if the Emission factor and activity level do not assume the same moisture content of Biomass (often dry mass is assumed for Emission factors), an appropriate conversion factor is used based on measured or conservatively assumed Biomass moisture content. Where both the activity level and Emission factor are expressed in the same units, CF would be set to 1.	N/A
b	Biomass type.	N/A

Determining the activity level

Project Proponents must propose and justify an approach for determining the total mass of Biomass combusted during controlled burning events during a reporting period. The guidance given in Approach B in the VCS Module VMD0031; Estimation of Emissions from Burning should be used as a basis for developing a method. It is expected that such a method will be tailored to the standard operating practices of the Project Proponent. It must be possible to verifiably demonstrate that the method results in a conservative estimate of associated Project Emissions as compared to Baseline Emissions. Wherever possible, measured amounts of Biomass should be used (e.g., mass or volume of Biomass combusted), though it is recognized that in many cases (e.g., land clearing) such a measurement may not be possible and estimates based on site observations will be necessary.

The Project Proponent may either use monitored data or may estimate the amount of HWP produced using monitored quantities of wood sent to the processing facility and a B.C.-specific default production loss factor of 41%.

Determining the Emission factor

Some Biomass combustion Emission factors are available in the WCI 2011 Quantification Methodologies and must be used so long as the Emission factor selected is appropriate for the type of Biomass and conditions under which it is being combusted. Otherwise, Emission factors found in peer reviewed Sources relevant to the Project Site conditions may be used. Where more site-specific data is not available, values from the Intergovernmental Panel on Climate Change Good

Practice Guidance for Land Use, Land Use Change, and Forestry (Table 3A.1.16) (see Appendix B: References) may be used. Where figures from Table 3A.1.16 are used, they must be divided by 1000, to adjust the results from units of g/kg to units of t/t.

8.1.9 PE7 Harvested Wood Transport

An approach identical to that described for PE3 is to be used to calculate emissions from PE7, except that $C_{m,g,\ t}$ will refer to the total quantity of harvested wood transported. Quantities and distances transported must be estimated for two stages in the HWP lifecycle:

- Transport of logs to the site of primary production.
- Transport of primary HWPs to the location of use.

It is assumed that HWPs are disposed of within 20 km to their point of use, and that associated emissions are immaterial compared to other sources.

Determining the emission factor

Emission factors will be determined in an identical manner to that described for PE3.

Determining the activity level and other parameters

Quantity of harvested wood sent to primary production must be monitored by the Project. Quantities of primary HWPs produced must be based on the assumptions used for calculating HWP storage in Section 8.1.2.

Distance to the location of primary production must be based on actual locations where Project harvested wood is sent, or conservative estimates of distance. Distance from the site of primary production to end use must be estimated based on reasonable, conservative estimates of the locations of final markets.

All other required parameters will be determined in an identical manner to that described for PE3.

8.1.10 PE8 Harvested Wood Processing

Emissions from primary processing of harvested wood are to be calculated using Equation 23.

Equation 23: PE8 harvested wood processing

$$PE_{8,j,t} = \sum_{H} EF_{H,j} \times AL_{H,t} \times CF_{H}$$

Where,

Parameter	Description	Default Value
$PE_{8,j}$	Emissions of GHG *j*, in tonnes, from the processing of HWP sent for primary production from the Project Site during each calendar year *t*.	N/A
$EF_{H,j}$	The emission factor for GHG *j* and harvested wood product *H* produced (e.g., CO_2 per quantity of raw harvested wood converted to wood product *H*). Note: for processes that rely solely on electricity, $EF_{H,j}$, the Project Proponent shall use the B.C. transmission grid emission factor for the Project Report Period published on the Ministry of Environment and Climate Change Strategy's website.	See below
$AL_{H,t}$	The quantity of harvested wood product *H* produced from wood harvested during calendar year *t*.	N/A
CF_H	The conversion factor to be used if the units of the activity level do not match those of the emission factor for a particular HWP *H*. The emission factor and the activity level must both refer to the same quantity (either amount of HWP produced, or amount of harvested wood processed). If not, then an appropriate conversion factor must be selected. Where both the activity level and emission factor are expressed in the same units, CF would be set to 1.	N/A
H	Harvested wood product.	N/A

Determining the emission factor

The Project Proponent may use a standardized emission factor of 267 kg CO2e per m³ of harvested roundwood. This factor was derived from manufacturing mill data and weighted by the average product mix for the Province (see Table 6).

Table 6: Derivation of Manufacturing Fossil Carbon Emission Factor

HWP	Emissions per cubic meter of product (kg CO_2e/m^3)	Source	Relative rate of products from roundwood (% of Roundwood)	Emissions weighted by rate of products
Lumber	72.650	Athena Sustainable Materials Institute. A Cradle-to-Gate Life Cycle Assessment of Canadian Softwood Lumber: An Update. Ottawa. 2021.	0.395	28.7
Plywood	129.760	Athena Sustainable Materials Institute. A Cradle-to-Gate Life	0.041	5.29

		Cycle Assessment of Canadian Softwood Plywood Sheathing: An Update Ottawa. 2012.		
OSB	248.300	Athena Sustainable Materials Institute. A Cradle-to-Gate Life Cycle Assessment of Canadian Oriented Strand Board: An Update. Ottawa 2018	0.018	4.47
MDF	525.500	A Cradle-to-Gate LCA of Canadian Medium Density Fiberboard. Ottawa 2013	0.018	9.46
Paper	1194.000	American Forest & Paper Association. Printing & Writing Papers Life-Cycle Assessment Summary Report. Washington, DC 2010	0.183	219
Bioenergy at mills	0	Athena Sustainable Materials Institute. A Cradle-to-Gate Life Cycle Assessment of Canadian Softwood Lumber: An Update. Ottawa. 2021.	0.345	0
Weighted average kg CO_2e/m^3				267

Determining the activity level

The Project Proponent may either use monitored data or may estimate the amount of HWP produced using monitored quantities of wood sent to the processing facility and a B.C.-specific default production loss factor of 25% for all HWP types (as described previously in Section 8.1.9).

8.2 BASELINE EMISSIONS AND REMOVALS

Baseline Emission Reductions and Removals Enhancements are determined with **Equation 24**.

Equation 24: Total Baseline Emission Reductions or Removals Enhancements

$$\Delta GHG_{Baseline,t} = \Delta T_{(BR_1 \text{ to } BR_7),t} + T_{BR_8,t} - \sum_j \sum_i (BE_{i,j,t}) \times GWP_j$$

Where,

Parameter	Description	Default Value
$\Delta GHG_{Baseline,t}$	Total Emissions or Removals of CO_2e occurring in the Baseline during calendar year *t*. Expressed in tCO_2e.	N/A
$\Delta T_{(BR1\ to\ BR7),t}$	Emissions or Removals by Baseline live and dead forest carbon Reservoir (excluding HWPs) during calendar year *t*. Expressed in tCO_2e. Determined in Section 8.2.1.	N/A
$T_{BR8,t}$	Mass of CO_2 stored in Baseline HWPs up to time since the last Project Report Period (tCO_2e). Determined in Section 8.2.2.	N/A
GWP_j	Global Warming Potential specified by the BC government for GHG *j*.	N/A
$BE_{i,j,t}$	Total Project Emissions of GHG *j* from BE_i identified in Table 3 during calendar year *t*. Expressed in tonnes. BE_i shall be calculated based on the requirements of Section 8.2.3 – 8.2.10	N/A

8.2.1 BR1 to BR7 Live and Dead Forest Carbon Reservoirs (Excluding HWP)

The Quantification Methodology for PR1 to PR7 in Section 8.1.1 must be used for BR1 to BR7, with BR1 to BR7 replacing PR1 to PR7 and with the addition of the proceeding further instructions.

Estimating Harvest Flow

While reported in tCO_2e, Baseline harvest data must be included in meters cubed and hectares for each Project Report Period. Where a Project is a Program of Activities, each Project Report must itemize Baseline and Project harvest data for each Project Instance and in meters cubed and hectares for each Project Report Period.

8.2.2 BR8 Harvested Wood Products In-Use

The Quantification Methodology for PR8 in Section 8.1.2 must be used for BR8, with BR8 replacing PR8 and with the addition of the proceeding further instructions.

Determining an Activity Level

In determining $RWBiomass_d$, for the Baseline Scenario, for species that are also harvested in the Project, the assumed HWPs produced from a given species must be the same as for the Project. For species harvested in the Baseline Scenario but not the Project, the Project Proponent must conservatively select and justify the HWPs produced from those species. Where the primary HWP produced cannot be identified for the Baseline Scenario, the HWP with the greatest overall storage in-use must conservatively be assumed.

8.2.3 BE1 Fertilizer Production

The Quantification Methodology for PE1 in Section 1.0 must be used for BE1, with BE1 replacing PE1 and with the addition of the proceeding further instructions.

Determining the activity level

Baseline fertilizer application must be estimated based on a justified application rate based on the practices described for the selected Baseline Scenario.

8.2.4 BE2 Fertilizer Use Emissions

The Quantification Methodology for PE2 in Section 8.14**.** must be used for BE2, with BE2 replacing PE2 and with the addition of the proceeding further instructions.

Determining the activity level

Baseline fertilizer application must be estimated based on a justified application rate based on the practices described for the selected Baseline Scenario.

8.2.5 BE3 Transport of Material, Equipment, Inputs and Personnel to Site

The Quantification Methodology for PE3 in Section 8.1.5 must be used for BE3, with BE3 replacing PE3 .

Determining the activity level and other parameters

Since it is not possible to directly monitor transportation in the Baseline Scenario, transportation quantities as assumptions must be conservatively estimated based on the activities described for the selected Baseline scenario and Project assumptions where applicable.

8.2.6 BE4 Fossil Fuel Production

The Quantification Methodology for PE4 in Section 8.1.6 must be used for BE4, with BE4 replacing PE4 and with the addition of the proceeding further instructions.

Determining the activity level

Since it is not possible to directly monitor fuel combustion in the Baseline Scenario, fuel amounts and associated CO2e quantities as assumptions must be conservatively estimated based on the activities described for the selected Baseline scenario and Project assumptions where applicable.

8.2.7 BE5 Fossil Fuel Combustion – Vehicles and Equipment

The Quantification Methodology for PE5 in Section 8.1.7 must be used for BE5, with BE5 replacing PE5 and with the addition of the proceeding further instructions.

Determining the activity level

Fuel consumption records by type of equipment or vehicle and fuel type must be used when available. Where fuel is not tracked by type of equipment or vehicle, but rather only in total for the entire project site, a conservative emission factor must be chosen based on the range of vehicles and equipment that would consume a particular fuel.

Since it is not possible to directly monitor fuel consumption in the Baseline Scenario, it must be estimated based on justified vehicle and equipment usage estimates in the Baseline Scenario and considering fuel consumption observed during the Project Report Period as applicable.

8.2.8 BE6 Biomass Combustion

The Quantification Methodology for PE6 in Section 8.1.8 must be used for BE6, with BE6 replacing PE6 and with the addition of the proceeding further instructions.

Determining the activity level

It must be possible to verifiably demonstrate that the method results in a conservative estimate of Baseline Emissions. Wherever possible, measured amounts of Biomass should be used (e.g., mass or volume of Biomass combusted), though it is recognized that in many cases (e.g., land clearing) such a measurement may not be possible, and estimates based on site observations will be necessary.

8.2.9 BE7 Harvested Wood Transport

The Quantification Methodology for PE7 in Section 8.1.9 must be used for BE7, with BE7 replacing PE7 and with the addition of the proceeding further instructions.

Determining the activity level

Baseline Scenario quantities must be estimated based on the activities described for the selected Baseline Scenario and any available, relevant information from the Project Report Period.

8.2.10 BE8 Harvested Wood Processing

The Quantification Methodology for PE8 in Section 8.1.10 must be used for BE8, with BE8 replacing PE8 and with the addition of the proceeding further instructions.

Determining the activity level

Baseline Scenario quantities must be estimated based on the activities described for the selected Baseline Scenario.

8.3 LEAKAGE

Leakage occurs when net increases in GHG emissions, or decreases in Removals, occur outside of selected SSRs as a result of the Primary Activity. Project activities that result in the change in the level of a service provided from within the Project Site (e.g., amount of wood harvested, wood

products produced, or increase in demand for land development) may result in changes in the level of services provided outside the Project Site, including areas within as well as outside B.C., due to market forces or shifting of forestry activities to another location.

Such changes, which are often referred to as 'Leakage,' may result in changes in the amount of carbon stored in forest and/or wood product carbon Reservoirs located outside of the Project Site. These changes, caused by the Primary Activity, might serve to cancel out or mitigate the Project Reduction achieved within the Project Site.

Where a risk of Leakage exists, Project Proponents must undertake Leakage mitigation measures to reduce Leakage. If any increase in Emissions occurs as a result of these measures, the resulting Emissions must be accounted using the methods given in this section.

Guidance Note: SSRs that are not selected for the Project but are necessary for the Proponent to calculate Leakage are referred to as "affected SSRs"

There are two potentially relevant forms of Leakage that must be assessed:

- L1 (Activity Leakage), and
- L2 (Market Leakage).

Table 7 lists which Project types must assess which types of Leakage.

Table 7: Summary of potentially relevant Leakage types by Project Type

Project Type	**Leakage Type**	
	Activity	**Market**
AFF/REF	Internal only	No
CONS/IFM	Yes	Yes, if Project harvesting < Baseline harvesting
AC	Yes	Yes

Project Proponents must include a determination of Leakage in the Project Plan and Project Report. A net decrease in GHG emissions, or increase in Removals, that occurs outside of the selected SSRs does not count towards the Project Reduction.

8.3.1 L1 Activity Leakage

Activity Leakage (L1) is divided into two categories, and is determined with Equation 25:

1. Internal Activity Leakage, and
2. External Activity Leakage.

Equation 25: L1 Activity Leakage

$$L1 = \Delta GHG_{CO2,Internal\ Activity\ Leakage,t} + \Delta GHG_{CO2,External\ Activity\ Leakage,t}$$

Where,

Parameter	Description	Default Value
L1	Net increase in Emissions or reduction in Removals from all affected carbon Reservoirs during each calendar year *t*. Expressed in tCO_2e.	N/A
$\Delta GHG_{CO2,\ Internal\ Activity\ Leakage,t}$	Activity Leakage caused by shifts in deforestation from selected SSRs to affected SSRs owned or controlled by the Project Proponent during each calendar year *t*. Expressed in tCO_2e. Determined in Section 8.3.1.1 below.	N/A
$\Delta GHG_{CO2,\ External\ Activity\ Leakage,t}$	Activity Leakage caused by shifts in deforestation from selected SSRs to affected SSRs that are not owned or controlled by the Project Proponent during each calendar year *t*. Expressed in tCO_2e. Determined in Section 8.3.1.2.	N/A

8.3.1.1 Internal Activity Leakage

Determining $GHG_{CO2,\ Internal\ Activity\ Leakage}$

Internal Activity Leakage occurs where a Project Proponent engages in CONS/IFM Activities or AC Activities in order to prevent deforestation of a portion of land that they own or control and is within areas covered by selected SSRs, while also deforesting another portion of land that they own or control and is outside areas covered by selected SSRs. Internal Activity Leakage can also occur when part of a Project Proponent's lands are afforested or reforested (AFF/REF), causing another part to be deforested to compensate for loss of land for non-forest purposes, e.g. livestock grazing.

Internal Activity Leakage must be addressed in the Project Plan as follows:

a) For all Project types, Internal Activity Leakage may be assumed to be zero if one of the conditions i, ii, or iii apply:

(i) All lands owned or controlled by the Project Proponent outside the Project Site are not Forest Land,

(ii) Existing restrictive covenants under s.219 of the *Land Titles Act* in favour of the Crown or zoning or land use restrictions are in place on all Forest Lands owned or controlled by the Project Proponent outside the Project Site for as long as those restrictions remain in place and to the extent that these restrictions demonstrate that Leakage is zero, and/or

(iii) Demand for the land use that may cause Internal Activity Leakage is satisfied or removed due to the actions of the Project Proponent (it is possible that a Project Proponent will not be able to demonstrate this initially but may be able to do so at some point during the Project).

b) Otherwise, justify an appropriate geographic area for assessment of Internal Activity Leakage (see Section 4.2.1), considering economic and other relevant factors affecting demand for land-use types in the Baseline Scenario affected by the Project, given that land use demand is typically local in nature (e.g. demand for housing, commercial land, etc.). A Project Proponent may skip this step by including all land that they own or control within the Leakage assessment-area.

In each Project Report and Monitoring Report, the Project Proponent must report on any deforestation activities that have occurred:

(a) Within the Leakage assessment-area and where the Project Proponent owns or controls the land, and
(b) Where the new land use is equivalent to the Project's land use in the Baseline Scenario.

Where such deforestation is identified, the increase in Emissions or decrease in Removals that occurs as a result of the deforestation must be assessed using Equation 26 and must be recorded as an affected Activity Leakage Emission for the Project.

Internal Activity Leakage is equal to the net increase in GHG emissions, or net decrease in Removals outside the Project Site as indicated in Equation 26.

Equation 26: Internal Activity Leakage

$$\Delta GHG_{CO2,Internal\ Land\ Use\ Leakage,t} = \left(\Delta T_{(DR1\ to\ DR7),t}\right) - \left(\Delta T_{(NDR1\ to\ NDR7),t}\right)$$

Where,

Parameter	Description	Default Value
$\Delta GHG_{CO2,Internal\ Land\ Use\ Leakage,\ t}$	Total net increase in Emissions or decrease in Removals outside the Project Site during each calendar year *t*. Expressed in tCO_2e.	N/A
$\Delta T_{DR1\ to\ DR7,\ t}$	Emissions by live and dead forest carbon Reservoirs (excluding HWPs) due to deforestation of lands outside the Project Site and owned or controlled by the Project Proponent during calendar year *t*. Expressed in tCO_2e. Determined using a process similar to Equation 4 for the Project.	N/A
$\Delta T_{NDR1\ to\ NDR7,t}$	Non-deforested Emissions and Removals by live and dead forest carbon Reservoirs (excluding HWPs) due to deforestation lands outside the Project Site and owned or controlled by the Project Proponent during calendar year *t*. Expressed in tCO_2e. Determined using a process similar to Section 8.2.1 for the Baseline.	N/A

External Activity Leakage

Determining $GHG_{CO2,\ External\ Land\ Use\ Leakage}$

AC Projects must address External Activity Leakage as follows:

a) External Activity Leakage may be assumed to be zero if it can be verifiably shown that demand for the land use in the Baseline Scenario is satisfied or removed in some way by

or due to the actions of the Project Proponent that does not lead to deforestation outside of the Project Site.

b) Otherwise, using the Leakage assessment area (see Section 4.2), considering economic and other relevant factors affecting demand for land-use types in the Baseline Scenario affected by the Project, given that land use demand is typically local in nature (e.g. demand for housing, commercial land, etc.).

An External Activity Leakage-assessment must consider, at minimum, the following:

(a) The state of supply and demand for the land use in the Baseline Scenario type, including historic trends over the past 5 years, the current situation, and a projection of anticipated future trends over 25 years,

(b) All local zoning bylaws and other restrictions on land development such as covenants, easements, and existing right of ways,

(c) Official community plans and regional growth strategies,

(d) Whether there are restrictions in place such that there is no opportunity for the land use in the Baseline Scenario to shift to other Forest Land within the Leakage assessment-area. Consequently, the demand for land will remain unfilled (note, zoning restrictions are likely not sufficient to demonstrate this, as zonings may be changed based on applications by developers), and

(e) Availability of Forest Land (private, municipal, Crown-owned, First Nations, reserves, or other) that might be suitable for the land use in the Baseline Scenario, subject to the above assessment of zoning, plans and strategies, but with consideration of the potential for zoning changes to occur that might permit additional Forest Lands to be eligible for deforestation and conversion to the land use in the Baseline Scenario type.

The External Activity Leakage assessment must be prepared by a Designated Member of the Appraisal Institute of Canada and must accompany an assessment of the suitability of the land for the conversion required in Section 3.3.3.

Guidance Note: The use of average development rates for lands over a broad geographic area (e.g., all of B.C.) will not be appropriate for assessing Leakage, as by definition, an AC Project is occurring in an area of sufficient non-Forest Land use demand that the deforestation Baseline can be justified. It is likely that local land use demand will exceed average land use demand across a broader area.

Based on the results of this assessment, the Project Proponent must verifiably provide a conservative assessment of the quantity of Emissions that would occur from affected carbon Reservoirs, based on the per hectare Removals to be achieved by the Project from forest carbon Reservoirs relative to the Baseline Scenario over the Project Crediting Period in Equation 27. The deforested hectares developed must reflect the assessed likelihood / risk that Leakage might occur.

Equation 27: External Activity Leakage

$$\Delta GHG_{CO2,External\ Activity\ Leakage,t} = \frac{(\Delta T_{(PR1\ to\ PR7),t}) - (\Delta T_{(BR1\ to\ BR7),t})}{Ha_{Project\ Sit}} \times Ha_{deforested\ hectares,t}$$

Where,

Parameter	Description	Default Value
$\Delta GHG_{CO2,\ External\ Activity\ Leakage,t}$	Net decrease in Project Reduction due to External Activity Leakage during each calendar year *t*. Expressed in tCO_2e.	N/A
$\Delta T_{(PR1\ to\ PR7),t}$	Emissions and Removals by Project live and dead forest carbon Reservoir (excluding HWPs) during each calendar year *t*. Expressed in tCO_2e. Determined using Equation 4.	N/A
$\Delta T_{(BR1\ to\ BR7),t}$	Emissions and Removals by Baseline live and dead forest carbon Reservoir (excluding HWPs) during each calendar year *t*. Expressed in tCO_2e. Determined in Section 8.2.1.	N/A
$Ha_{Project\ Site}$	Area of the Project. Expressed in hectares (ha).	N/A
$Ha_{deforested\ hectares,t}$	Area of deforestation expected outside the Project Site and not owned or controlled by the Project Proponent in each calendar year *t*. Expressed in hectares (ha).	N/A

8.3.2 L2 Market Leakage

Market Leakage occurs where there is an increase in Emissions or decrease in Reductions caused by the Project at areas outside the Project Site, unless the SSRs at those area are selected SSRs, and this increase or decrease is a result of the Project reducing production of a commodity, causing a change in the supply and market demand equilibrium, resulting in a shift of production elsewhere to make up for the lost supply. Certain Non-Project Site SSRs must be labelled as affected SSRs where the Project results in a decrease in HWP production relative to the Baseline.

Market Leakage is excluded as an affected SSR where the Project results in no change or an increase in HWP production relative to the Baseline, including Projects where there was no harvesting in the Baseline.

For Projects that are required to assess both Activity Leakage and Market Leakage, Activity Leakage must be assessed first. Market Leakage is to be assessed based only on the amount of decreased Project harvesting relative to the Baseline Scenario that is not already accounted for by Activity Leakage.

Market Leakage must only be assessed in a given Project Report Period where Project HWP production from the Project Site, in terms of amount of carbon or carbon dioxide stored, is less than HWP production in the Baseline Scenario. Where HWP production in the Baseline Scenario is zero (e.g., typically in AFF/REF Projects), Market Leakage would be zero. In AC Projects, the Baseline Scenario must include harvesting until the lands in the Baseline Scenario have been fully developed and further deforestation ceases.

For example, if half of the deforestation in the Baseline Scenario avoided by a Project at the Project Site is determined to shift to other areas outside of the Project due to non-Forest Land use demand, Market Leakage would only be assessed on the portion of AC (i.e., avoided harvesting) that would not have shifted to other areas due to non-Forest Land use demand. For Internal Market Leakage,

this must be factored into the analysis conducted by the Project Proponent, External Market Leakage has been explicitly factored into the equations provided below.

Two options are available for Project Proponents to determine Market Leakage; assessing the total change in carbon in all Reservoirs, or assessing the total change in harvesting in affected Reservoirs. The estimate approach may not be revised once established in the Project Plan.

8.3.2.1 Market Leakage (Option 1 – Change in Forest Carbon Reservoirs)

This approach uses the total change in affected SSRs in a Project Report Period, rather than just the change associated with harvesting, as the basis for the external harvesting Leakage calculation. This approach is most suitable for Projects that reduce the amount of harvesting relative to the Baseline Scenario without undertaking any other changes to forest management practices.

Equation 28: Total Market Leakage Emissions – Option 1

$$L2_{option1} = max\{0, \Delta GHG_{CO2,R,t} + \Delta GHG_{CO2,RHWP,t} - L1\} \times \%Leakage_{External\ Harvest\ Shifting}$$

Where,

Parameter	Description	Default Value
$L2_{option1}$	Net increase in Project Emissions due to Market Leakage from all affected SSRs during each calendar year *t*. Expressed in tCO_2e.	N/A
$\Delta GHG_{CO2,R,t}$	Net incremental mass of CO_2e stored by the Project in SSRs *R* (excluding HWPs) during each calendar year *t* as compared to the Baseline Scenario. Expressed in tCO_2e. Determined using Equation 29.	N/A
$\Delta GHG_{CO2,R\ HWP,t}$	Net incremental mass of carbon dioxide stored in Project Reservoir *R* HWPs harvested during each calendar year *t* that will endure for a period of 100 years as compared to the Baseline Scenario. Expressed in tCO_2e. Determined using Equation 30.	N/A
$L1$	Net increase in Project Emissions due to Activity Leakage from all affected carbon Reservoirs during each calendar year *t*. Expressed in tCO_2e. Determined using Equation 25 .	N/A
$\%Leakage_{External\ Market}$	Increase in Project Emissions due to external Market Leakage during each Project Report Period, expressed as a percentage of the net Removals that is expected to shift to lands outside the ownership or control of the Project Proponent over the calendar year. See Section 8.3.2.3.1 or Section 8.3.2.3.2 below.	N/A

Equation 29: Net incremental Project carbon dioxide stored in forest carbon Reservoirs (excluding HWPs)

$$\Delta GHG_{CO2,Rt} = \Delta T_{(PR1\ to\ PR7),t} - \Delta T_{(BR1\ to\ BR7),t}$$

Where,

Parameter	Description	Default Value
$\Delta GHG_{CO2,Rt}$	Net incremental mass of CO_2e stored by the Project in forest carbon Reservoirs *R* (excluding HWPs) during each calendar year *t* as compared to the Baseline Scenario (tCO_2e).	N/A
$\Delta T_{(PR1\ to\ PR7),t}$	Emissions and Removals by Project live and dead forest carbon Reservoir (excluding HWPs) during each calendar year *t*. Expressed in tCO_2e. Determined using Equation 4.	N/A
$\Delta T_{(BR1\ to\ BR7),t}$	Emissions and Removals by Baseline live and dead forest carbon Reservoir (excluding HWPs) during each calendar year *t*. Expressed in tCO_2e. Determined in Section 8.2.1.	N/A

Equation 30: Net incremental Project carbon dioxide stored only in Harvested Wood Products

$$\Delta GHG_{CO_2,R,HWP,t} = (T_{PR8,t} - T_{PR8,t-1}) - (T_{BR8,t} - T_{BR8,t-1})$$

Where,

Parameter	Description	Default Value
$\Delta GHG_{CO2,R\ HWP,t}$	Net incremental mass of CO_2 stored in Project Reservoir *R* HWPs harvested during each calendar year *t* that will endure for a period of 100 years as compared to the Baseline Scenario. Expressed in tCO_2e.	N/A
$T_{PR8,t}$	Mass of CO_2 stored in Project HWPs at the end of the current calendar year *t*. Expressed in tonnes. Determined using Equation 7.	N/A
$T_{PR8,t-1}$	Mass of CO_2 stored in Project HWPs at the end of the previous calendar year *t-1*. Expressed in tonnes. Determined using Equation 7.	
$T_{BR8,t}$	Mass of CO_2 stored in Baseline HWPs at the end of the previous calendar year *t-1*. Expressed in tonnes. Determined in Section 8.2.2.	N/A
$T_{BR8,t-1}$	Mass of CO_2 stored in Baseline HWPs at the end of the previous calendar year *t-1*. Expressed in tonnes. Determined in Section 8.2.2.	

Determining External Market Leakage factor (*%Leakage*$_{External\ Market}$)

See Section 8.3.2.3.

8.3.2.2 Market Leakage (Option 2 – Harvesting only)

Option 2 uses changes in affected SSRs related to harvesting only, rather than the total change in affected SSRs, as the basis for the external harvesting Leakage calculation.

Guidance Note: If a Project contains activities that increase carbon stocks through harvest reduction and silviculture activities, Market Leakage would be determined solely on the reduction of carbon stocks resulting from harvest reduction.

Equation 31: Total Market Leakage – Option 2

$$L2_{option2} = GHG_{CO2,Internal\ Market,t} + max\{0, \Delta GHG_{CO_2,Harvesting,t} + \Delta GHG_{CO_2,R\ HWP,t} - GHG_{CO_2,Internal\ Market,} - L1\} \times \%Leakage_{External\ Harvest-shifting}$$

Where,

Parameter	Description	Default Value
$L2_{option2}$	Net increase in Project Emissions due to Market Leakage from all affected SSRs during each calendar year *t*. Expressed in tCO_2e.	N/A
$GHG_{CO2,Internal\ Market,t}$	Increase in Project Emissions due to Internal Market Leakage during calendar year *t*. See below.	N/A
$\Delta GHG_{CO2,Harvesting,\ t}$	Net incremental mass of CO_2 removed from the Project Site during calendar year *t* compared to the Baseline Scenario, via the following mechanisms: • Physical Removal of harvested wood from the Project forest. • Harvesting-related losses that occur within the forest (e.g., lost branches, tops, etc.) that are assumed to rapidly decay and release CO_2 to the atmosphere. • Biomass combustion. Expressed in tCO_2e. Determined using Equation 32.	N/A
$\Delta GHG_{CO2,R,HWP,t}$	Net incremental mass of CO_2 stored in Project Reservoir *R* HWPs harvested during calendar year *t* that will endure for a period of 100 years as compared to the Baseline Scenario. Determined using Equation 30. Expressed in tCO_2e.	N/A
$L1$	Net increase in Project Emissions due to Activity Leakage from all affected SSRs during each Project Report Period (tCO2e). Determined using Equation 25.	N/A
$\%Leakage_{External\ Market\text{-}shifting}$	Increase in Project Emissions due to External Market Leakage during each Project Report Period, expressed as	N/A

Parameter	Description	Default Value
	a percentage of the net Removals that is expected to shift to lands outside the ownership or control of the Project Proponent over the Project Report Period. See Section 8.3.2.3.1 or Section 8.3.2.3.2 below.	

As with Activity Leakage, Market Leakage is divided into two categories: Internal Market Leakage and External Market Leakage.

Determining Internal Market Leakage ($GHG_{CO2,\ Internal\ Market}$)

Internal Market occurs where a Project Proponent decides to reduce harvesting on a portion of their lands and establish a Project while increasing harvesting on another portion of land that they own, but which is outside the defined Project Site.

Internal Market Leakage is to be addressed by the Project Proponent in each Project Report Period as follows:

a) If it can be verifiably shown that demand for harvested wood that is no longer harvested by the Project is satisfied or removed in some way by or due to the actions of the Project Proponent, then Internal Market Leakage can be assumed to be zero for the remainder of the Project (it is possible that a Project Proponent will not be able to demonstrate this initially but may be able to do so at some point during the Project).
b) Assess the opportunities for increasing harvesting on other lands owned or controlled by the Project Proponent by:
    i. For Crown land licensed by the Project Proponent, report on the difference between the Proponent's total current harvesting levels and allowable harvesting levels in Timber Supply Areas (TSAs) in which the Proponent has a forest license and in Tree Farm Licence (TFL) areas held by the Proponent. In the case of TSAs, this may require the consideration of land not controlled by the Project Proponent, but that still falls within a TSA in which the Project Proponent holds a license (for the purposes of this Internal Market Leakage assessment, such lands will be considered owned or controlled).
    ii. For private land, assess the extent to which other Forest Land owned or controlled by the Project Proponent could be harvested (which could consider the existence of restrictive covenants in favour of the Crown that would prohibit harvesting).

If there are no opportunities for further harvesting identified, then Internal Market Leakage may be assumed to be zero.

c) If opportunities for increased harvest are identified, then the Project Proponent has two options:
    i. Expand affected SSRs to encompass areas with additional harvesting potential, thereby bringing all potential Sources of Internal Market Leakage within the controlled SSRs of the Project, and assume Internal Market Leakage is zero, or
    ii. Prepare, and include within each Project Report, a report that assesses the extent to which Internal Market Leakage has occurred, by considering historic harvesting

amounts per hectare per year on all owned and controlled lands outside of the Project Site for the 5 years prior to the start of the current Project Report Period and all years within the current Project Report Period as well as regional or provincial trends in amounts of harvesting over the same timeframe (with the selected geographic area to be justified by the Project Proponent). Where owned and controlled harvesting trends indicate that harvesting has increased relative to regional or provincial trends, and where these increases cannot be explained by factors independent from the Project, Internal Market Leakage is to be assessed as the minimum of:

a. The difference between owned and controlled harvesting per hectare per year and regional or provincial harvesting per hectare per year multiplied by the total hectares of owned and controlled forest outside of the Project Site and by the number of years in the Project Report Period,
b. The maximum potential amount of increased harvesting that could occur over the Project Report Period based on the assessment described in ii., above, and,
c. The total amount of decreased harvesting that occurred due to the Project relative to the Baseline during the current reporting period plus decreases in harvesting between the Project and Baseline for the five years prior to the start of the current reporting period minus any Internal Market Leakage assessed against the Project due to decreased harvesting in the five years prior to the start of the current reporting period.

Equation 32: In-forest harvesting impacts (for Market Leakage Option 2)

$$\Delta GHG_{CO2,Harvesting,t} = \left[\sum_{s}\left(M_{s,baseline,t} \div Harvest\ Efficiency_s\right) - \sum_{s}\left(M_{s,project,t} \div Harvest\ Efficiency_s\right)\right] \times f_{C,wood} \times \frac{MW_{CO_2}}{MW_C}$$

Where,

Parameter	Description	Default Value
$\Delta GHG_{CO2,Harvesting,t}$	Net incremental mass of CO_2 removed from the Project Site during each calendar year *t* as compared to the Baseline Scenario, via the following mechanisms: • Physical Removal of harvested wood from the Project forest. • Harvesting-related losses that occur within the forest (e.g., lost branches, tops, etc.) that are assumed to rapidly decay and release CO2 to the atmosphere. • Biomass combustion.	N/A
$M_{s,Baseline,t}$	Dry mass of harvested wood, minus bark, harvested in the Baseline during each calendar year *t* that will be processed into HWP. Measured in tonnes dry Biomass. This value is	N/A

Parameter	Description	Default Value
	determined in a manner analogous to $RWBiomass_t$ in Equation 9.	
Harvest Efficiency$_s$	The ratio of $M_{s,Baseline,t}$ to total woody dry mass of a tree of species *s* prior to harvest. See below.	See below.
$M_{s,Project,t}$	Dry mass of harvested wood, minus bark, harvested in the Project during each calendar year *t* that will be processed into HWP. Measured in tonnes dry Biomass. This value is determined in a manner analogous to $RWBiomass_t$ in Equation 9.	N/A
$f_{C,wood}$	Fraction of the dry mass of wood, excluding bark, that is carbon.	Assumed to be 50% for all wood species.
MW_{CO_2}	Molecular weight of CO_2.	44 g/mole
MW_C	Molecular weight of carbon.	12 g/mole

Determining Harvest Efficiency$_s$

The Project Proponent will be responsible for justifying harvesting efficiencies appropriate for the Project and Baseline Scenario.

Harvesting efficiency is determined by considering tree species (*s*) involved, typical age of trees at harvest, and any other relevant factors. A Project Proponent may choose to use a single harvest efficiency value, rather than one for each relevant species, as long as the approach is demonstrated to be conservative (i.e., does not under-estimate Leakage).

External Market Leakage (*%Leakage$_{External\ Market}$*)

If it can be verifiably shown that demand for wood products that are no longer produced by the Project relative to the Baseline Scenario during the Project Report Period is satisfied or removed in some way by or due to the actions of the Project Proponent that does not involve increasing harvesting outside the Project Site, then External Market Leakage may be assumed to be zero for that Project Report Period. Otherwise, External Market Leakage must be assessed in a manner consistent with Section 8.3.2.1.

8.3.2.3 External Market Leakage

To determine the external harvesting-shifting Leakage factor, two options are provided:

1) Provincial default Leakage factor estimates (Option 1), and
2) Project-specific external Market Leakage factor (Option 2)

Proponents that select the Project-specific approach for determining External Market Leakage must reassess estimates every 10 years.

8.3.2.3.1 Provincial default external Market Leakage estimates (Option 1)

The Project Proponent may use a provincial default Leakage estimate from Table 8 below for their Project Leakage estimate, provided that the value is supported by a statement of acceptance that the Project is representative of average timber commodities and the Project Proponent has no reason to believe Leakage would be higher than the provincial default Leakage estimate.

Table 8: Provincial default external Market Leakage estimates ($\%Leakage_{External\ Market}$)

Geographic Area	Estimated Leakage
Northern Interior	71.89%
Southern Interior	69.18%
Coast	47.37%

The default Leakage factors referenced in the above table have been derived using the Project-specific approach based on the average mix of tree species in the total harvest of each respective geographic area (see Appendix C: Project-specific external Market Leakage Determination). There are certain tree species in specific regions of B.C. which are less substitutable in terms of developing certain wood products than others. The substitutability of wood products has a significant effect on the ultimate Leakage estimate. The Project Proponent should use the provincial default Leakage estimates as a guide. When Project Sites have proportions of tree species that differ from the default averages, and perhaps higher proportions of tree species with low or moderate substitutability than what is reflected in the default for the Project's Site, it is recommended that the Project Proponent utilize the guidance indicated in this document to adjust the Leakage estimates to reflect these Project-specific estimates accordingly.

8.3.2.3.2 Project-specific external Market Leakage estimates (Option 2)

The Project Proponent may estimate Project Specific Leakage rates using the methodology in Appendix C: Project-specific External Market Leakage Determination.

8.4 Reversal Events, Impaired Project Reduction, and the Contingency Account

In accordance with Section 25 of GGECR, the Project Proponent of a sequestration project must ensure that, for 100 years after the Crediting Period for the Project ends:

(a) the Project Site is monitored at the frequency and in the manner specified in this Protocol and the Project Proponent's Monitoring and Maintenance Plan, and

(b) the amount of greenhouse gas, or components of greenhouse gas, sequestered or stored, as applicable, is maintained, and the maintenance activities are carried out, in accordance with this Protocol and the Project Proponent's Monitoring and Maintenance Plan.

Reversal Events and Impaired Project Reduction are managed through the implementation of the Monitoring and Maintenance Plan (see Section 8.4.1), Reversal Events and Impaired Project Reduction (see Section 8.4.2), and the Contingency Account (see Section 8.4.3).

8.4.1 Monitoring and Maintenance Plan for Reversal Events during and after the Project

For the purposes of Section 14 (3) (o) of GGECR, Project Proponents must include in the Project Plan a Monitoring and Maintenance Plan which (along with data collection considerations included in Section 10.0) includes descriptions on how Risk of Reversal will be managed throughout the Crediting Period and Monitoring Period. Project Proponents must prepare their Monitoring and Maintenance plan in accordance with ISO 14064-2:2019 (Sections 6.9 and 6.10).

In addition to the identification of each risk below, the Project Proponent must document how each risk will be monitored, mitigated, and reported on in a time period consistent with the Project Report Periods and Monitoring Periods:

- Prevention of avoidable reversal events (such as harvest or conversion to non-forest use),
- Financial risk,
- Fire risk,
- Drought risk,
- Pest and disease risk,
- Wind risk,
- Hydrological or flooding risks, and
- Geomorphic and/or geological risks.

Assumptions used to inform the Monitoring and Maintenance Plan must use peer-reviewed research, government publications (from the Government of Canada or Government of B.C.), or data from within the previous 10 years. The Monitoring and Maintenance Plan must include clear, verifiable commitments regarding what actions the Project Proponent commits to taking to maintain carbon stocks at levels that will ensure against an Impaired Project Reduction.

Reversal Event Monitoring must be described in detail as part of the Project design and Project Monitoring procedures in the Project Plan.

8.4.2 Reversal Events and Impaired Project Reduction

8.4.2.1 Identifying a Reversal Event

Reversal Events occur where, as determined by Equation 33, the total of Emissions Reduction and Removals Enhancement are negative during a year. Reversal Events generally occur where

there has been a loss of forest carbon stocks, relative to the Baseline (e.g., a release of carbon dioxide to the atmosphere).

Equation 33: Determining a Reversal Event

$$Rev_t = \Delta GHG_{Project,t} - \Delta GHG_{Baseline,t}$$

Where,

Parameter	Description	Default Value
Rev_t	Where the result is negative, the number of units that constitute a Reversal Event during calendar year *t*. Expressed in tCO_2e.	N/A
$\Delta GHG_{Project,t}$	Total Emissions or Removals of CO_2e occurring in the Project during calendar year *t*. Expressed in tCO_2e. Determined using Equation 3.	N/A
$\Delta GHG_{Baseline,t}$	Total Emissions or Removals of CO_2e occurring in the Baseline during calendar year *t*. Expressed in tCO_2e. Determined using Equation 24.	N/A

Project Plans must include modelling of Project and Baseline Emissions and Removals that includes disturbances and harvesting that are anticipated to occur on a predictable basis for the Project Site(s). This modelling must show that there will be no Reversal Events or Impaired Project Reduction during the Crediting Period or Monitoring Period based on predictable disturbances and harvesting (modelling must consider reasonable scenarios that may affect the risk of disturbance, including projected climate change). Assumptions used to inform the modelling must use peer-reviewed research, government publications (from the Government of Canada or Government of B.C.), or data from within the previous 10 years.

The Project Plan must include an assertion that, considering climate change and other risks, an Impaired Project Reduction during the Crediting Period or Monitoring Period that cannot be compensated through application of Offset Units generated by the Project and allocated to the Contingency Account is unlikely.

8.4.2.1.1 Avoidable Reversal Events

Avoidable Reversal Events are a Reversal Event the risk of which has been substantially increased by either a Proponent's failure to comply with Maintenance Requirements or failure to exercise due diligence to prevent the Reversal in accordance with this Protocol, or as described in GGECR.

8.4.2.1.2 Unavoidable Reversal Events

Unavoidable Reversal Events are Reversal Events that are not Avoidable Reversal Events, generally involving any loss in the Project Reservoir due to events outside the control of the Proponent (e.g., pests, wildfire, theft, etc.) that result in Emissions that exceed the expected Baseline Scenario of that Project in a single year.

In addition to requirements of GGECR, Project Reports must identify what, if any portion of a Reversal Event was caused directly by Provincial government decision-making on Crown land (e.g., construction of roads). These are referred to as Government Reversal Events.

Guidance Note: Reversal Events undertaken or authorized by the Province or undertaken pursuant to a disposition of an interest in land by the Province are handled through the Province retaining and managing a share of atmospheric benefits resulting from projects on Crown Land in the Atmospheric Benefit Agreements.

8.4.2.1.3 Identifying an Impaired Project Reduction

Project Proponents are required to identify if there has been any Impaired Project Reduction. An Impaired Project Reduction occurs when a Reversal Event during the Crediting Period or Monitoring Period impairs the Project Reduction. Project Proponents must make an assertion as to how many tonnes of carbon dioxide equivalent by which the Project Reduction was impaired, in the opinion of the Project Proponent, was avoidable. See Equation 34.

Guidance Note: A Reversal Event during the Crediting Period is an Impaired Project Reduction. A Reversal Event during the Monitoring Period may not result in an Impaired Project Reduction if it is absorbed by Removals Enhancement and/or Emissions Reduction occurring during the Monitoring Period that do not form part of the Project Reduction.

Equation 34: Determining an Impaired Project Reduction

$IPRt = TRE + Revt$

Where,

Parameter	Description	Default Value
$IPRt$	If negative, the amount of an Impaired Project Reduction occurring in calendar year *t*. Expressed in tCO2e. A positive result indicates that *TRE* was greater than the Rev_t therefore, there is no Impaired Project Reduction.	N/A
TRE	If applicable, the Total Removals Enhancement and Emissions Reduction occurring since the beginning of the Monitoring Period. Determined adding Equation 3 for each calendar year occurring since the start of the Monitoring Period, prior to calendar year *t*, or expressed as "0" if Rev_t occurs during the Crediting Period. Expressed in tCO2e. *Note: Offset units will not be issued for increased Emissions Reduction and Removals Enhancement during the Monitoring Period.*	N/A
Rev_t	A Reversal Event during calendar year *t*. Expressed as a negative and in tCO2e. Determined using Equation 33.	N/A

8.4.2.3 Reporting and Compensating for an Impaired Project Reduction

8.4.2.3.1 Reporting an Impaired Project Reduction

Project Proponents that have identified an Impaired Project Reduction must detail the cause of that Impaired Project Reduction in the Project or Monitoring Report for each Project or Monitoring Report Period.

Assessment of the impact of an Impaired Project Reduction must be consistent with the same field sampling, modeling, and/or quantification procedures employed by the Project for assessing Project and Baseline Emissions and Removals Enhancements. The Proponent will specify the number of offset units to be retired by the Director in the Contingency Account that represents the magnitude of the Impaired Project Reduction and will state whether the Impaired Project Reduction was caused by an Avoidable Reversal Event or an Unavoidable Reversal Event.

8.4.2.3.2 Compensating for an Impaired Project Reduction

If the Director is satisfied that all or part of a Reversal Event that gave rise to an Impaired Project Reduction is an Unavoidable Reversal Event, the Director may retire from the Contingency Account one Offset Unit for each tonne of carbon dioxide equivalent that was impaired.

If the Director is satisfied that all or part of a Reversal Event that gave rise to an Impaired Project Reduction is an Avoidable Reversal Event, the Proponent may be required to provide one replacement Offset Unit for each tonne of carbon dioxide equivalent that was impaired.

8.4.2.3.3 Project and Baseline Scenario Adjustments

Once a Reversal Event occurs, the Project and Baseline Scenarios must be adjusted for subsequent Project Reports.

The impact of the Reversal Event on forest carbon must, in addition to being assessed for the Project, also be modeled for the Baseline Scenario (except where the Baseline is non-Forest Land at the start of the Crediting Period).

Modeling must include observations of the type and extent of Reversal Event experienced by the Project, as well as assumptions regarding the Baseline Scenario. In preparing the revised Baseline model, the Project Proponent must demonstrate in the Project Report how the model will provide a conservative estimate of the Baseline (i.e., does not overstate the impact of the Reversal on the Baseline) to manage the uncertainty of predicting the impact of a particular Reversal on a hypothetical Baseline Scenario.

8.4.3 Contingency Account

8.4.3.1 Contributions to Contingency Account

To mitigate the risk of potential Reversal Events that can cause an Impaired Project Reduction, Project Proponents are required to contribute a percentage of the Net Sequestration Before Risk of Reversal (determined through Equation 2) during each Project Report Period to the Contingency Account.

In accordance with Section 24 of GGECR, Offset Units issued in relation to a sequestration and storage Project may be required to be credited to the Contingency Account. Each Project's

contribution of Offset Units to the Contingency Account is determined and verified using a Risk of Reversal described in Section 8.4.3.2. If a Project experiences an Impaired Project Reduction, the Director may retire from the Contingency Account a number of Offset Units equal to the Impaired Project Reduction. Subsequently, the Project Proponent must contribute the equivalent number of Compliance Units to the Contingency Account until full replacement is achieved. Determined using Equations 34 and 35.

Guidance Note: The Contingency Account is a holding account into which the Director issues Offset Units in accordance with the Act. When issuing Offset Units based upon Project Reports and Verification Statements for forest carbon sequestration and storage Projects, the Director issues a specified volume of verified Offset Units into the Contingency Account to account for the Risk of Reversal. The purpose of the Contingency Account is to act as a form of insurance and to maintain environmental integrity of the program.

8.4.3.2 Risk of Reversal

The purpose of establishing the Risk of Reversal of a Project is to determine the likelihood and magnitude that a Reversal Event will occur up to 100 years after the Crediting Period ends. The Risk of Reversal is based upon Project-specific attributes and must be determined using the approach described in Appendix H: B.C. Tool for Assessing Risk of Reversal for Forest Carbon Offset Projects. Once established, the Risk of Reversal is multiplied against the Project Reduction before Risk of Reversal to determine the portion of Offset Units that the Director will issue into the Contingency Account. See Equation 35 for more details.

Equation 35: Determining Contingency Account Remittance

$$CON_{\beta} = (\beta \times \Delta GHG_{net,t)} + IPRt$$

Where,

Parameter	Description	Default Value
CON_{β}	Contributions to the Contingency Account by the Project Proponent during each calendar year *t*. Expressed in tCO_2e.	N/A
B	Percentage of units contributed to the Contingency Account at each Project Report Period. Determined using Appendix H: The B.C. Tool for Assessing Risk of Reversal for Forest Carbon Offset Projects.	N/A
$\Delta GHG_{net,t}$	Net incremental Emission Reductions and Removals Enhancements of CO_2e before Risk of Reversal deductions, achieved by the Project during calendar year *t* as compared to the Baseline. Expressed in tCO_2e. A net increase in Emission Reductions and Removals Enhancements is expressed as a positive number. Determined using Equation 2.	N/A

Parameter	Description	Default Value
IPRt	If applicable, the number of units withdrawn from the Contingency Account during the previous applicable calculation period due to an Impaired Project Reduction. The Proponent must replenish units retired from the Contingency Account for the purposes of compensating for an Impaired Project Reduction. Not applicable if no Impaired Project Reduction has occurred. Determined using Equation 34 and expressed as a positive.	N/A

9.0 PROJECT ESTIMATES

In accordance with Section 14 (3) (l) of GGECR, a Proponent must include in a Project Plan the Project Reduction expected to be achieved by the Project during its Crediting Period and identification of

(a) the basis on which the Project Emissions and Project Removals were estimated for the Project Plan, and
(b) the formulas from this Protocol that will be used to calculate the Project Reduction for each Project Report Period.

In addition to the above, a Project Plan must

(a) include the estimated Project Reduction for each Project Instance, if applicable, and
(b) explain the anticipated variability of Project Reduction across Project Report Periods.

For each SSR identified in the Project Plan, Project Proponents must justify the calculation methodology used for the Project Crediting Period and why the activity levels that were estimated are reasonable.

In the Project Plan, the Project Proponent must present these estimates of the Project Reduction for each SSR in each Project Report Period for both the Project Scenario and Baseline Scenario for the entire Project Crediting Period.

10.0 DATA COLLECTION AND MONITORING

In the Project Plan, the Project Proponent must detail their Monitoring and Maintenance plan in accordance with ISO 14064-2:2019 (Sections 6.9 and 6.10) and Section 26 of GGECR and identify the retention period for records associated with the Project, as referred to in Section 27 (1) of GGECR. The data collection and monitoring approach must be validated and must be followed throughout the Crediting Period and Monitoring Period.

Guidance Note: For PoA Projects, some of the data or parameters may only be available for aspects of the Project included at initial Validation. Project Instances added afterwards would be evaluated during the next Verification.

10.1 MONITORING PERIOD

Section 25 of GGECR stipulates a 100-year period for sequestration or storage Projects during which a Project Site must be monitored.

Section 26 of GGECR requires that Monitoring Reports be submitted at periodic intervals. For the purposes of that section, Table 9 sets out the periods in relation to which a Monitoring Report must be submitted. The Monitoring Report required in relation to a period set out in Table 9 must be submitted within 6 months after the end of that period. For the purposes of Table 9, Year 1 begins on the first day after the end of the Crediting Period.

Table 9: Monitoring Report Periods

Monitoring Report Period
Years 1 to 25
Years 26 to 50
Years 51 to 75
Years 76 to 100

Monitoring Reports must include requirements contained in GGECR and must be in the same form as Project Reports, as approved by the Director under Section 20 (1) (a) of GGECR.

Guidance Note: In accordance with Section 26 of GGECR, the Project Proponent must submit the Monitoring Report to a Verification Body for verification.

APPENDIX A: PARAMETER CONSTANTS USED IN EQUATIONS

Parameter	Description	Value	Units	Equations Used	Source and notes (if applicable)
GWP	The global warming potential specified by the B.C. government for each GHG.	N/A	tCO_2e	Equation 3 Equation 24	The latest values from the B.C. Carbon Neutral Government Regulation must be used.
MW_{CO_2}	Molecular weight of CO_2.	44	g/mole	Equation 4 Equation 8 Equation 32	
MW_C	Molecular weight of carbon.	12	g/mole	Equation 4 Equation 8 Equation 32	
HWPfact	The factor for the proportion of CO_2 remaining after the number of years between harvest and the Project Report Period, for products used in North America (*NA)*. Measured as a proportion.	6%	Measured as a percentage.	Equation 7	Using a standard product mix, 6% of tCO2e is remaining in HWP after 100 years.
$f_{C,\ wood}$	Fraction of the dry mass of wood, excluding bark that is carbon.	50%	Mass fraction	Equation 8 Equation 32	Petterson, R.C. (1984). The Chemical Composition of Wood. In R. Rowell (Ed.) *The Chemistry of Solid Wood*, (pp. 57-126). Advances in Chemistry. DOI:10.1021/ba-1984-0207.ch002
vol_s	Volume of delivered roundwood in m^3 of species *s*, extracted from the Project Site in each Project Report Period.	N/A	m^3	Equation 9	Based on sales invoices.
wdf_s	Wood density factor for species *s*, from Table 4 or Table 5.	N/A	t/m^3	Equation 9	Values after Gonzalez, J.S. (1990). *Wood density of Canadian tree species.* (Information Report (Northern Forestry Centre (Canada)); NOR-X-315).The trees known in BC as "balsam" are true firs. Spruce includes Engelmann Spruce, White Spruce, and Hybrid Spruce. Determined in Table 4 or Table 5.
EF_f	Emission factor for GHG and fertilizer type *f*.	Dolomite (CO_2): 0.13	kg C/ kg	Equation 10	2006 IPCC Guidelines, Vol. 4, Ch. 11. Table 11.1. Or, if applicable, in order of preference: B.C. Reporting Regulation Latest version of the B.C. GHG Inventory Report Latest version of Canada's National GHG Inventory Report
		Limestone (CO_2): 0.12	kg C/ kg		

Parameter	Description	Value	Units	Equations Used	Source and notes (if applicable)
		Urea (CO_2): 0.2	kg C/ kg		Other recognized, justified reference Sources, with a preference for B.C.-specific data over national or international level data.
		Ammonia (CO_2): 671	M^3/tNH_3		
		Ammonia (natural gas (CO_2)): 2.162	kg CO_2/m^3		
		Ammonia (urea - (CO_2)): 720	g CO_2 / kg		
AL_f	Quantity of fertilizer of type *f* applied during each Project Report Period.	N/A	kg of nitrogen-based fertilizer produced	Equation 10	Based on sales invoices.
$Frac_{GASF}$	Fraction of Nitrogen that volatilizes as NH_3 and NO_x for synthetic fertilizers.	0.11	Mass fraction	Equation 12 Equation 16	2019 Refinement to the 2006 IPCC Guidelines, Vol. 4, Ch. 11. Table 11.3.
$Frac_{GASM}$	Fraction of Nitrogen that volatilizes as NH_3 and NO_x for organic fertilizers.	0.21	Mass fraction	Equation 12 Equation 16	2019 Refinement to the 2006 IPCC Guidelines, Vol. 4, Ch. 11. Table 11.3.
$EF_{f,direct}$	Emission Factor for N additions from fertilizers.	0.010	Tonne N_2O-N / tonne N input	Equation 12	2006 IPCC Guidelines, Vol. 4, Ch. 11. Table 11.1
MW_{N2O}	Molecular weight of N_2O.	44	g/mole	Equation 12 Equation 15	
MW_N	Molecular weight of N_2.	28	g/mole	Equation 12 Equation 15	
M_{SFf}	Mass of synthetic fertilizer of type *f* applied in during each Project Report Period, measured in tonnes.	N/A	Tonnes of nitrogen-based synthetic fertilizer	Equation 13	Estimated.
NC_{SFf}	Nitrogen content (mass fraction) of synthetic fertilizer type *f* applied.	N/A	Mass fraction	Equation 13	Manufacturer specifications.
M_{OFv}	Mass of organic fertilizer of type *v* applied in each Project Report Period, measured in tonnes.	N/A	Tonnes of nitrogen-based organic fertilizer	Equation 14	Based on sales invoices.
NC_{OFv}	Nitrogen content of organic fertilizer type v applied.	N/A	Mass fraction	Equation 14	Manufacturer specifications.

Parameter	Description	Value	Units	Equations Used	Source and notes (if applicable)
EF_{ATD}	Emission Factor for N_2O Emissions from atmospheric deposition of N on soils and water surfaces, tonne N_2O-N / tonne N input.	0.01	Tonne N_2O-N / tonne N input	Equation 16	2006 IPCC Guidelines, Vol. 4, Ch. 11. Table 11.3
$Frac_{Leach-(H)}$	Fraction of N lost by leaching and runoff.	0.24 or 0	Mass fraction	Equation 17	2019 Refinement to the 2006 IPCC Guidelines, Vol. 4, Ch. 11. Table 11.3.
$EF_{(L)}$	Emission factor for N_2O-N Emissions from N leaching and runoff, tonne N_2O / tonne N input	0.011	Tonne N_2O-N / tonne N input	Equation 17	2019 Refinement to the 2006 IPCC Guidelines, Vol. 4, Ch. 11. Table 11.3.
EF_b	The Emission factor for each GHG and Biomass type *b* (e.g. tonnes CH_4 per tonne of brush burned) (50% moisture content).	CO_2: 0.95 CH_4: 0.0005 N_2O: 0.00002	kg/kg	Equation 18	IPCC LULUCF Good Practice Guide (Table 3A.1.16). Other peer-reviewed Sources will be accepted. Some Biomass combustion Emission factors are / may be available in the B.C. Reporting Regulation, or B.C. or National Inventory Reports (in that order of preference, though note that at the time of protocol development such factors were not included in the B.C. inventory) and may be used so long as the Emission factor selected is appropriate for the type of Biomass and conditions under which it is being combusted. Otherwise, the Project Proponent will need to justify the use of an adjusted or alternative Emission factor based on recognized Sources wherever possible.
AL_b	The quantity of Biomass of type *b* combusted during each Project Report Period.	N/A	Tonnes of nitrogen-based synthetic fertilizer	Equation 22	Fuel consumption records or records by fuel type. Measured or Estimated - The Project Proponent must propose and justify an approach for determining the total mass of Biomass combusted during controlled burning events during a reporting period. Wherever possible, measured amounts of Biomass should be used (e.g., mass or volume of Biomass combusted), though it is recognized that in many cases (e.g., land clearing) such a measurement may not be possible, and estimates based on site observations will be necessary. The guidance given in Approach B in the VCS Module VMD0031, Estimation of Emissions from Burning should be used as a basis for developing a method.
e	Supply price elasticity	Interior: 0.31	The proportionate	Equation 36	Determined with Table 10: Default values for estimating Project-specific leakage.

Parameter	Description	Value	Units	Equations Used	Source and notes (if applicable)
		Coastal: 0.66	change in quantity supplied over change in price.		Determined with Table 12: Additional Requirements for using coefficients in the Leakage equation. See Table 13: Leakage Estimate and Parameters Using the Price Elasticities of Total Supply and Demand of BC Logs
E	Demand price elasticity	Interior: -0.12 Coastal: -0.55	The proportionate change in quantity demanded over change in price.	Equation 36	Determined with Table 10: Default values for estimating Project-specific leakage. Determined with Table 12: Additional Requirements for using coefficients in the Leakage equation. See Table 13: Leakage Estimate and Parameters Using the Price Elasticities of Total Supply and Demand of BC Logs.
C_N	Carbon sequestration Reversal per unit of harvest from the non-reserved forest.	1	tCO_2e/m^3	Equation 36	Determined with Table 10: Default values for estimating Project-specific leakage. Determined with Table 12: Additional Requirements for using coefficients in the Leakage equation. See Table 13: Leakage Estimate and Parameters Using the Price Elasticities of Total Supply and Demand of BC Logs.
C_R	Carbon sequestration per unit of (forgone) harvest gained by preserving the reserved forest.	1	tCO_2e/m^3	Equation 36	Determined with Table 10: Default values for estimating Project-specific leakage. Determined with Table 12: Additional Requirements for using coefficients in the Leakage equation. See Table 13: Leakage Estimate and Parameters Using the Price Elasticities of Total Supply and Demand of BC Logs.
γ	The "substitution" parameter. A parameter introduced into the referenced Leakage equation to take into account specialty woods (i.e. the degree to which a particular HWP can be substituted for another).	Northern: 1.0000 Southern: 0.9622 Coast: 0.8719	m^3	Equation 36 Equation 37	Determined with Table 11: Variables recommended to be developed by the Project Proponent for estimating Project Specific Leakage Estimates. See Table 13: Leakage Estimate and Parameters Using the Price Elasticities of Total Supply and Demand of BC Logs. Also see Appendix C: Project-Specific External Market Leakage Determination, Appendix D: The Provincial Default Values for Addressing Leakage from Forest Carbon Projects, and Appendix E: Example Substitutability Equations.

Parameter	Description	Value	Units	Equations Used	Source and notes (if applicable)
Φ	The "preservation" parameter. This is the ratio of timber supply being set aside for the Project (quantity Q_R) to the timber supply outside the offset area (quantity Q_N). The ratio can be represented as and can be thought of as the market share of the timber in the Project.	0.01	m^3/m^3	Equation 36 Equation 38	Determined with Table 11: Variables recommended to be developed by the Project Proponent for estimating Project Specific Leakage Estimates. See Table 13: Leakage Estimate and Parameters Using the Price Elasticities of Total Supply and Demand of BC Logs.

APPENDIX B: REFERENCES

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APPENDIX C: PROJECT-SPECIFIC EXTERNAL MARKET LEAKAGE DETERMINATION

If a Project Proponent chooses not to select the provincial default estimates in Table 8 to calculate External Market Leakage, they may use **Equation 36** to determine that rate.

The Project Proponent must assert in the Project Plan that Project-specific Leakage rates are representative of the Project and include justification for this assertion.

Equation 36: % Leakage from external Market

$$\%Leakage_{External\ Harvest\ Shifting} = \frac{(100 * e * \gamma * C_N)}{([e - E * (1 + \gamma * \Phi)] * C_R)}$$

Where,

Parameter	Description	Default Value
$\%Leakage_{ExternalMarket}$ *(shortened as %Leakage in Appendix B)*	Total increase in Project Emissions due to External Market Leakage during each Project Report Period, expressed as a percentage of the net Removals that is expected to shift to lands outside the ownership or control of the Project Proponent over the Project Report Period.	
e	Supply price elasticity.	See Below
E	Demand price elasticity.	
C_N	Carbon sequestration reversal per unit of harvest from the non-reserved forest.	
C_R	Carbon sequestration per unit of (forgone) harvest gained by preserving the reserved forest.	
Φ	The "preservation" parameter. This is the ratio of timber supply being set aside for the Project (quantity Q_R) to the timber supply outside the offset area (quantity Q_N). The ratio can be represented as and can be thought of as the market share of the timber in the Project.	
γ	The "substitution" parameter. A parameter introduced into the referenced Leakage equation to take into account specialty woods (i.e., the degree to which a particular HWP can be substituted for another).	

The Project Proponent may use the variables that are used in the *Provincial Default Approach for Estimating Leakage* provided in Appendix D for supply price elasticity (*e*), demand price elasticity (*E*), and the carbon sequestration values (C_N and C_R) as identified in Table 10.

Table 10: Default values for estimating Project-specific leakage

Variable description	Default Equation Values (Interior)	Default Equation Values (Coast)
Supply price elasticity.	e = 0.31	e = 0.66
Demand price elasticity	E = -0.12	E = -0.55
Carbon sequestration Reversal per unit of harvest from the non-reserved forest.	$C_N = 1$	$C_N = 1$
Carbon sequestration per unit of (forgone) harvest gained by preserving the reserved forest.	$C_R = 1$	$C_R = 1$

In order to tailor Leakage estimates to reflect a Project Specific Leakage case, it is recommended that the Project Proponent focus on developing their own Project Specific parameters to reflect the preservation parameter (Φ) and the substitutability parameter (γ).

Table 11: Variables recommended to be developed by the Project Proponent for estimating Project Specific Leakage estimates

Variable description	Equation Variable
Substitution Parameter – A parameter introduced into the referenced Leakage equation to take into account specialty woods. Project Proponents who can demonstrate that specialty woods are prevalent in their Project Site develop the substitutability parameter using Equation 30. Otherwise, the default values provided in Table 8 must be used, reflecting the location of the Project.	γ
Preservation parameter – The ratio of timber supply being set aside for the Project to the timber supply outside the Project Site (the market share of the timber in the Project).	Φ

Methodology for deriving a substitutability parameter (γ)

There are two key factors to consider when determining the substitutability parameter of a Project 1) tree species breakdown of the Project Site, and 2) cross-species product substitutability of each given species, e.g., how many cedar products can be replaced with pine products?

A Project Proponent must use a representative and validated sample of tree species harvest makeup for their Project Site.

Equation 37: Weighted Substitution Parameter

$$\gamma = \sum_{s=1}^{n} T_s * S_s$$

Where,

Parameter	Description	Default Value
γ	The "substitution" parameter. A parameter introduced into the referenced Leakage equation to take into account specialty woods (i.e., the degree to which a particular HWP can be substituted for another).	
s	A specific tree type	N/A
n	Number of tree types within the Project	N/A
T_s	Tree type i's share of Project's total marketable tree volume	N/A
S_s	Substitutability of tree type i	N/A

If a substitution parameter is determined for this representative sample, on average it is going to be accurate (representative) of a Project in this area, taking into account "specialty woods" that are more difficult to substitute, such as cedar or cypress. The contribution to total harvest of these specialty woods is combined with species-specific substitutability to create a weighted average for the substitutability parameter. The weighted average is then applied to the Leakage equation, reducing Leakage from a Project by the weighted average (represented as a percentage) of its original level.

Methodology for deriving a preservation parameter (Φ)

The preservation parameter (Φ) represents the ratio of timber set aside for the offset Project (quantity Q_R) to the timber supply outside the Project Site (quantity Q_N). The ratio can be represented as and can be thought of as the market share of the timber in the Project.

Option 1: The Project Proponent may determine their own preservation parameter according to Equation 38.

Equation 38: Preservation parameter

$$\Phi = \frac{Q_R}{Q_N}$$

Where,

Parameter	Description	Default Value
Φ	The "preservation" parameter. This is the ratio of timber supply being set aside for the Project (quantity QR) to the timber supply outside the offset area (quantity QN). The ratio can be represented as QR/QN and can be thought of as the market share of the timber in the Project.	N/A
Q_R	Quantity of harvestable timber (m^3) to be claimed during Project Report Period.	N/A
Q_N	Quantity of harvestable timber supply (m^3) remaining in the market.	N/A

The remaining supply of timber (Q_N) will be the five-year average annual total timber harvest in North America for the most recent period.

Option 2: The provincial default Leakage values use a 1% (.01) preservation parameter.

Additional requirements Project Specific Leakage

Where a Project-specific Leakage approach is taken for deriving any of the parameters in Equation 37, the additional requirements detailed in Table 12 must also be satisfied.

Table 12: Additional Requirements for using coefficients in the Leakage equation

Supply (*e*) and Demand (*E*) Elasticities	North American market data must be used when estimating elasticities for the purpose of determining Leakage from Projects in B.C. The price elasticities of total demand and supply of BC logs should be used that incorporate the dynamics of domestic and significant international markets relative to BC (e.g., US, China, and Japan). Otherwise, relevant price elasticities of total demand and supply for BC lumber may be used with appropriate justification. The uniqueness of B.C. forests, and therefore a B.C. based Project, will be captured by the substitution parameter. Elasticity estimates used by a Project Proponent for both supply and demand must be derived from the same data sets and information/ study in order to ensure consistency in derivation and validate their application for estimating Project Leakage. Both market supply and market demand elasticities used in the Protocol Leakage methodology must be long-run elasticity estimates.
Carbon sequestration values ($\mathbf{C_N}$ and $\mathbf{C_R}$)	Project Proponents choosing to develop their own Leakage value must use a value of 1 for C_N and C_R in the Leakage formula.
Preservation Parameter (Φ)	Project Proponents that estimate this parameter must demonstrate the harvest potential (or forgone harvest since the last Project Report Period) that their respective Project has in terms of total North American timber sales over the previous year.

Substitutability Parameter (γ)	The Project Proponent must follow the substitution guidelines when calculating their own substitution parameter (see Appendix E: Example Substitutability Equations). Project Proponents must demonstrate the tree species contribution/makeup within their Project Site. The Project Proponent must demonstrate the substitutability of tree species in terms of potential wood products. The Project Proponent must apply long-run, own- and cross-price elasticities of demand for substitutable wood products in North American market to derive the substitutability parameters.

APPENDIX D: THE PROVINCIAL DEFAULT VALUES FOR ADDRESSING LEAKAGE FROM FOREST CARBON PROJECTS

Growing conditions, the destinations of wood, and tree type vary considerably between the interior and coastal regions of B.C. In addition, areas in the southern interior of B.C. can vary considerably from the northern interior. These differences impact the parameters of the Leakage equation (Appendix C, Equation 36) and as such we examine default values for the northern interior, southern interior and coastal regions separately.

Assumptions made for the default values of both the coast and northern and southern interior reflect what are simple and representative offset Projects in each respective region. Assumptions such as tree type, location, and product type can all impact the estimated Leakage. As a result, these calculations could be modified on a Project-to-Project basis by the Project Proponent by using the Leakage equation guidelines in the Protocol and by referring to the default Scenarios.

A Project timeline of 100 years is considered to be consistent with monitoring provisions in the Regulation. To reflect this, long-run market elasticities are used instead of short-run elasticities. The market share of the default offset Project is assumed to be 1% (Φ = .01) of the total North America market. CR and CN are assumed to be the same and are given values of 1 as a conservative assumption to lower the chance of underestimating Leakage.

Table 13: Leakage Estimate and Parameters Using the Price Elasticities of Total Supply and Demand of BC Logs

	Total Supply Price Elasticity (E)	Total Demand Price Elasticity (E)	Preservation Parameter (φ)	Carbon Sequestration Reversal from Non-reserved Forest (CN)	Carbon Sequestration gained from the reserved Forest (CR)	Substitution (γ)	%Leakage
Northern Interior	0.31	-0.12	0.01	1	1	1.0000	**71.89**
Southern Interior	0.31	-0.12	0.01	1	1	0.9622	**69.18**
Coast	0.66	-0.55	0.01	1	1	0.8719	**47.37**

1) Northern Interior B.C. Default Values:

In this guideline, the northern interior region of B.C. is generally referred to as the northern part of the Province that contains pine and spruce trees as the dominant leading species. Although the majority of BC lumber products are exported to the US, domestic and other significant international export markets need to be considered to reflect a more complete and accurate picture of market conditions when determining default Leakage parameters. Specifically, we examine the Canadian export market to the US, China, and Japan. Therefore, supply and demand elasticities of BC logs in both domestic and the three predominant international markets mentioned are used. Default Leakage values are estimated via using export supply price elasticity (E) of 0.31, and a demand price elasticity (E) of -0.12 (Latta and Adams, 2000). From this, the provincial default estimate of Leakage for the Northern Interior is 71.9%, as seen in Table 14 below.

Table 14: Northern Interior Leakage Estimation

e = 0.31
E = -0.12
$C_R = 1$
$C_N = 1$
$\Phi = .01$
$\gamma = 1$
L = 71.9%

For the northern interior default values, it is assumed that the wood supplied from this geographic area can be substituted with any number of other wood alternatives (harvested in B.C. or elsewhere) to generate the same product lines. Tree species that have a high number of alternative species, in terms of the product lines they are geared for are referred to as highly substitutable. This is generally the case for species such as pine and spruce which are the leading commercial timber species in the northern interior.

There may be instances where the Project Proponent have other species of commercially harvestable timber within their Project Site. If the Project Proponent can demonstrate that these commercial tree species have low or moderate substitutability, it is recommended that the Project Proponent utilize the methodology applied in the coastal and southern interior default values to refine/tailor the northern interior default values to reflect their specific Project dynamics.

2) **Coastal B.C. Default Values:**

This default value represents an offset Project in coastal B.C. Good growing conditions for trees on the coast, allowing trees to become larger more quickly than other areas of the Province, make coastal areas desirable for offset Projects.

Supply and demand elasticities for coastal logs are comparatively higher than the interior (Sun et al., 2015; Latta & Adams, 2000). For regions that grow certain woods that have few substitutes for their product lines, such as cedar on the coast, Leakage is likely lower. This is simply due to the fact that the constrained supply is not replaced, or less easily replaced by the supply of another wood species. There is a supply constraint and less likelihood of Market relieving that constraint. Therefore, coastal Projects (or Projects in areas containing woods with low substitutability) warrant lower Leakages.

Applying the substitutability parameter to reflect low substitutability woods on the coast indicates the Leakage estimate is reduced to 47.4% for the coastal default value as indicated in Table 15 below. It is important to note that the default value for the coast represents the average mix of tree species in the total harvest area of the coastal region. Leakage estimates for Projects on the coast can vary according to species composition and the proportion of low substitutability species to high substitutable species in the Project Site. An example calculation result of 54.3% Leakage is also shown in Table 15 below if we assumed perfect substitutability of species on the coast:

Table 15: Coastal Leakage Estimation

Perfect Substitutes	**Moderate Substitutes**
e = 0.66	
E = -0.55	
$C_R = 1$	
$C_N = 1$	
Φ = .01	
γ = 1	γ = .8719
%Leakage = 54.3%	**%Leakage = 47.4%**
e = .342	
E = -.181	
$C_R = 1$	
$C_N = 1$	
Φ = .01	
γ = 1	γ = .8479
%Leakage = 65%	**%Leakage = 55.3%**

For the coastal default value, the average tree species mix for the entire coastal harvest region was used. To derive a substitutability parameter (γ) for a specific Project, a Project Proponent needs to ascertain the representative tree species mix for their specific Project Site (in place of the average tree species mix for the coastal harvest area). For the coastal default value, red cedar and cypress are identified as low substitutability woods, white pine is identified as moderately substitutable. All other commercially harvested trees in the coastal region are assumed to be perfectly substitutable (100% substitutability).

A total of 21.28% of wood (cedar and cypress) has 40% substitutability. White Pine, making up 0.12%, is 70% substitutable. The remaining 78.59% of the wood is 100% substitutable, this means that all products from a tree in this category can be replaced by the same or similar products of other trees.

This weight is then applied to the Leakage equation, reducing Leakage from the 'perfectly substitutable' default value (the northern interior default value) to approximately 87% of its original level and is now representative of the total average coastal market. See Table 16 and associated calculation below.

Table 16: Low and moderately substitutable wood as a contribution of total coastal harvest

	Cedar	Cypress	White Pine	Other	Total
Harvest Contribution (T)	18.71%	2.57%	0.12%	78.59%	100.00%

Substitution (S)	40%	40%	70%	100%	87.19%

Coastal Substitution Calculation:

$$\gamma_{Coast} = T_{cedar} * S_{cedar} + T_{cypress} * S_{cypress} + T_{white\ pine} * S_{white\ pine} + T_{other} * S_{other}$$

$$\gamma_{Coast} = .1871 * .4 + .0257 * .4 + .0012 * .7 + .7859 * 1 = .8719$$

3) Southern Interior B.C. Default Value:

The southern interior default value represents the general geographic extent of cedar trees (a low substitutability wood) in the interior of B.C. The southern interior of B.C. has a diversity of tree species and growing sites. Project Sites can be highly variable and it may be appropriate to derive a substitution parameter specific to individual Projects.

The methodology for estimating Leakage for the southern interior default value follows that of the coastal default value. In this default value, a substitutability parameter is derived to reflect the average tree species mix for the total southern interior harvest region.

Table 17: Low and moderately substitutable wood as contribution of total southern interior harvest

	Cedar	Larch, Yellow & White Pine	Other	Total
Harvest Contribution	4.63%	3.34%	92.03%	100%
Substitution	40%	70%	100%	96.22%

Southern Interior Substitution Calculation:

$$\gamma_{South} = T_{cedar} * S_{cedar} + T_{larch} * S_{larch} + T_{other} * S_{other}$$

$$\gamma_{South} = .0463 * .4 + .0334 * .7 + .9203 * 1 = .9622$$

Although the southern interior uses the same supply and demand elasticities as the northern interior and there is a higher substitutability of species than on the coast, it is not perfect substitutability. Therefore, the default Leakage estimate for the south interior is slightly lower at 69.2% when compared to the northern interior. See Table 18 below:

Table 18: Southern Interior Leakage Estimation

e = 0.31
E = -0.12
C_R = 1
C_N = 1

Φ = .01
γ = 0.9622
L = 69.2%

As with the coastal case, to derive a substitutability parameter (γ) for a specific Project in the southern interior, a Project Proponent needs to ascertain the representative tree species mix for their specific Project Site and reflect that in the calculation with the respective substitutability of those tree species.

APPENDIX E: EXAMPLE SUBSTITUTABILITY EQUATIONS

The substitution parameter measures the rate of response of quantity demanded of product *N* due to the quantity change of product *R*. Hence, in order to get the substitution parameter from cross price elasticity, the following calculation is applied:

Substitution parameter = cross price elasticity for product *R** inverse of own price elasticity of product *R*

$$S = \frac{dq_N/q_N}{dq_R/q_R} = \frac{dq_N/q_N}{dp_R/p_R} * \frac{dp_R/p_R}{dq_R/q_R}$$

The substitutability of low/ moderately substitutable wood (imperfect substitutes) in this Appendix are determined based on the references listed below.

Table 19: Own and cross-price elasticities of demand for softwood lumber products (US: January 1989 to July 2001)

Own- and cross-price elasticities of demand for softwood lumber products, US: Jan. 1989 to July 2001.*						
Percentage effect on the quantity demanded of	For a 1% change in the price of					
	SPF	SYP-U	SYP-R	DF	WSP	Other
SPF	-0.6196**	0.2365**	0.0015	0.0223	0.2985**	0.0608
	(0.022)	(0.015)	(0.012)	(0.014)	(0.013)	(0.035)
SYP-U	0.3985**	-0.7189*	-0.0420	0.0070	0.3811**	-0.0257
	(0.025)	(0.035)	(0.024)	(0.018)	(0.020)	(0.056)
SYP-R	0.0093	-0.1569	-1.7949**	2.0646**	0.2163	-0.3384
	(0.076)	(0.089)	(0.234)	(0.178)	(0.211)	(0.381)
DF	0.0661	0.0123	0.9707**	-1.6226**	0.3994**	0.1741
	(0.040)	(0.031)	(0.084)	(0.147)	(0.142)	(0.227)
WSP	0.3460**	0.2622**	0.0398	0.1565**	-1.1059**	0.3014**
	(0.015)	(0.013)	(0.039)	(0.056)	(0.072)	(0.101)
Other	0.0837	-0.0210	-0.0740	0.0810	0.3577**	-0.4275*
	(0.048)	(0.045)	(0.083)	(0.105)	(0.120)	(0.192)
** and * indicate significance at the 1% and 5% levels, respectively. Figures in parentheses are standard errors: $SE(\eta_j) = SE(\beta_i)/m_i$ (Binswanger 1974, Pindyck 1979)						

Source: Nagubadi et al. (2004)

Table 20: Long-term elasticities of demand for US softwood lumber imports from Canada by species

	Elasticities							
	P_d	Y	Spruce	Pine	Fir	Hemlock	Red Cedar	Others
Spruce	2.33*	0.63*	-2.76*	0.16	0.20	0.13	0.11	0.20
	(0.76)	(0.07)	(0.57)	(0.10)	(0.13)	(0.08)	(0.07)	(0.13)
Pine	2.33*	0.63*	2.73*	-6.33*	0.53*	0.33*	0.29*	0.53*
	(0.76)	(0.07)	(0.74)	(0.95)	(0.14)	(0.09)	(0.08)	(0.14)
Fir	2.33*	0.63*	-1.07*	-1.17*	-0.31	-0.13*	-0.11*	-0.21*
	(0.76)	(0.07)	(0.48)	(0.08)	(0.32)	(0.06)	(0.05)	(0.09)
Hemlock	2.33*	0.63*	1.14	0.18	0.22	-3.83*	0.12*	0.22
	(0.76)	(0.07)	(0.62)	(0.10)	(0.12)	(0.71)	(0.06)	(0.12)
Red Cedar	2.33*	0.63*	-0.57	-0.09	-0.11	-0.07	-1.03*	-0.11
	(0.76)	(0.07)	(0.45)	(0.07)	(0.09)	(0.05)	(0.15)	(0.09)
Others	2.33*	0.63*	-0.62	-0.10	-0.12	-0.08	-0.07	-1.01*
	(0.76)	(0.07)	(0.45)	(0.07)	(0.09)	(0.06)	(0.05)	(0.20)

NOTE: Numbers in parentheses are approximate standard errors that ignore possible correlation between the import shares and elasticities in the equations provided. Elasticity values indicate the price of imports of various species.

*Significantly different from zero at the 5% significance level using a two-tailed test.

Source: Hseu and Buongiorno (1993)

Only substitutable woods with the price elasticities that are higher than 5% significance level are considered in calculating the substitution parameters. For example, to calculate the substitution parameter for red cedar:

$$S_{red\ cedar} = \frac{E_{pine}}{E_{red\ cedar}} + \frac{E_{hemlock}}{E_{red\ cedar}} = \frac{.29}{-1.03} + \frac{.12}{-1.03} = -40\%$$

To calculate the substitution parameter for larch, the table from Nagubadi *et al.* (2004) is used:

$$S_{larch} = \frac{E_{wsp}}{E_{other}} = \frac{.3014}{-.4275} = -70\%$$

Note that the price elasticities of larch, ponderosa pine, redwood, white pine, and other lumber were grouped together in the "Other" group in this reference.

APPENDIX F: B.C. TIMBER HARVESTING VOLUME BY SPECIES AND REGION

Table 21: Timber harvesting volume proportion five-year average (2015-2019)

North Interior	5 Year Avg. Harvest % by Species
Alder	0.00%
Aspen	4.45%
Balsam	13.30%
Birch	0.07%
Cedar	0.82%
Cottonwood	1.01%
Cypress	0.01%
Fir	0.81%
Hemlock	2.18%
Larch	0.00%
Lodge-Pine	42.46%
Spruce	34.90%
White Bark Pine	0.00%
White Pine	0.00%
Yellow Pine	0.00%

South Interior	5 Year Avg. Harvest % by Species
Alder	0.00%
Arbutus	0.00%
Aspen	0.30%
Balsam	9.09%
Birch	0.09%
Cedar	4.63%
Cottonwood	0.03%
Cypress	0.00%
Fir	23.48%
Hemlock	3.43%
Larch	2.87%
Lodge-Pine	33.77%
Maple	0.00%
Spruce	21.82%
White Bark Pine	0.01%
White Pine	0.32%
Willow	0.00%
Yellow Pine	0.14%

Coast	5 Year Avg. Harvest % by Species
Alder	0.72%
Arbutus	0.00%
Aspen	0.01%
Balsam	10.21%
Birch	0.02%
Cedar	18.71%
Cottonwood	0.29%
Cypress	2.57%
Fir	30.24%
Hemlock	34.56%
Lodge-Pine	0.31%
Maple	0.11%
Spruce	2.12%
White Bark Pine	0.00%
White Pine	0.12%
Willow	0.00%
Yellow Pine	0.00%
Yew	0.00%

Source: Harvest Billing System, FLNRORD

* All logs, special forest products, species and grades billed to Crown, private and federal land excluding waste and reject. Christmas trees are excluded. For all scale invoiced as of date of reporting - December 16, 2019.

APPENDIX G: B.C. FOREST DISTRICTS BY REGION

Forest districts used for identifying average tree species mix for the North, South and Coast areas of B.C. are described in Table 22.

Table 22: Forest Districts by Region

Coast Area
Chilliwack
Campbell River
North Island – Central Coast
Queen Charlotte Islands
Sunshine Coast
South Island
Metro Vancouver - Squamish
North Area
Fort Nelson
Fort St James
Kalum
MacKenzie
Nadina
Peace
Prince George
Skeena Stikine
Vanderhoof
South Area
Cariboo-Chilcotin
Cascades
Thompson Rivers
Selkirk
100 Mile
Okanagan Shuswap
Quesnel
Rocky Mountain

APPENDIX H: B.C. TOOL FOR ASSESSING RISK OF REVERSAL IN FOREST CARBON OFFSET PROJECTS

Determining the Risk of Reversal

Contributions to the Contingency Account will be determined by natural disturbance type and is equal to the percentage likelihood of non-survival, as represented by Equation 39.

Equation 39: Percentage of units contributed to the Contingency Account

$$\beta = R_{ND} + R_{NND}$$

Where,

Parameter	Description	Default Value
β	Percentage of units contributed to the Contingency Account at each Project Issuance.	N/A
R_{ND}	Natural disturbance risk of reversal, determined with Equation 40, and expressed as a percentage.	N/A
R_{NND}	Non-natural disturbance risk of reversal, determined with Equation 41, and expressed as a percentage.	N/A

Equation 40: Natural disturbance risk

$$R_{ND} = P_{ND} - (\sum RMM \times P_{ND})$$

Where,

Parameter	Description	Default Value
R_{ND}	Natural disturbance risk of reversal, expressed as a percentage.	N/A
P_{ND}	Default natural disturbance risk, determined in Table 23 (%).	Table 23
RMM	Sum of risk mitigation measures specific to the project, supported by evidence of each measure. Determined in Table 24.	Table 24

Table 23: Default natural disturbance risk

Region	$P_{ND\ (\%)}$
Coast	18
S. Interior	37
N. Interior	27

Selecting default natural disturbance risk values

Units are percent per year of crediting period and must be adjusted where Project Report Periods are not equal to one year. In determining what default natural disturbance risk value applies, refer to the Ministry

of Forests regional district map. For the purposes of this tool, projects located in the Skeena Coast Mountain region will use the Coastal default value.

How default natural disturbance risk values are established

Default natural disturbance risk factors are intended to represent the risk of mortality of generic stands over the timespan of 100 years. Default natural disturbance risk factors were developed by assessing annual area burned time series data from 1950 to 2018. Annual area burned was modelled using age-independent random draws from a log-normal distribution, with parameters estimated from an observed time series of annually burned areas, and then applied in a Monte Carlo simulation framework used to assess the probability of survival for 100 years into the future. As a proxy for future climate change impacts, the mean of the log-normal distribution is doubled over the time period examined.

Table 24: Risk mitigation measures

Mitigation Measure	Coast	S. Interior	N. Interior
Project takes place within a FireSmart area	5	10	10
Project takes place under Indigenous stewardship, or has an Indigenous Guardianship program in place	20	20	20
Annual fire plan in place	3	6	6
Fire line construction protecting >5% of Project Site	2	3	3
Initial fire suppression equipment on or adjacent to project site protecting >5% of Project Site	1	3	3
Regular low-intensity burning used to control fuel loads, protecting >5% of Project Site	0	1	1
Diversity of tree species in project	10	10	10
Relevant improved tree genotypes used (e.g., drought resistant)	10	10	15
Road accessibility	10	8	8
Adequate moisture regime	0	2	2
Area-weighted average slope is less than 10%	5	2	2
Entirety of project site is more than 5 km from railroad	0	2	2

Determining and applying risk mitigation measures

Natural disturbance risk of reversal expressed in Equation 40 may be reduced by applying deductions which represent mitigating attributes of the measure. For each deduction the Project Proponent must identify where or how that measure is applied in the Project. Selection of RMMs must be supported by evidence for each measure. Such evidence is not time-bound but must be current. Where evidence cannot be provided or are not applicable in the Project Report Period, the proponent must not use that deduction.

Equation 41: Non-natural disturbance risk

$$R_{NND} = ND_F + ND_M$$

Where,

Parameter	Description	Default Value
R_{NND}	Non-natural disturbance risk of reversal, expressed as a percentage. Value cannot be negative.	N/A
ND_F	Financial non-natural disturbance risk of reversal, expressed as a percentage, determined in Table 25.	Table 25
ND_M	Management non-natural disturbance risk of reversal, expressed as a percentage, determined in Table 25.	Table 25

Table 25: Non-natural disturbance risk factor selection

Type of non-natural disturbance risk	Risk factor	Score
Financial	Project Proponent has identified how a reserve of funds will be developed to manage long-term monitoring costs.	-2
	Project Proponent has callable financial resources or upfront funding	0
	Project Proponent does not have callable financial resources or upfront funding, has debt-financed the project, or will not see a cash flow breakeven point for more than five years.	4
Management	Team has experience in B.C. forestry and has an adaptive management plan in place.	-1
	Team does not have experience in B.C. but does have an adaptive management in place.	1
	Team does not have experience in B.C. or an adaptive management plan in place.	3