Federal Offset Protocol: Improved Forest Management on Private Land

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Canada's Greenhouse Gas Offset Credit System

Environment and Climate Change Canada
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Foreword

Canada's Greenhouse Gas (GHG) Offset Credit System is established under Part 2 of the *Greenhouse Gas Pollution Pricing Act* to provide an incentive to implement projects that result in domestic GHG reductions that would not have been generated in the absence of the project, that go beyond legal requirements and that are not subject to carbon pollution pricing mechanisms.

Canada's GHG Offset Credit System consists of:

- The *Canadian Greenhouse Gas Offset Credit System Regulations* (the Regulations), which establish the system, implement the operational aspects and set the general requirements applicable to all project types
- Federal offset protocols, included in the *Compendium of Federal Offset Protocols* (the Compendium), each containing requirements for project implementation and methods for quantifying GHG reductions for a given project type; and
- The Credit and Tracking System (CATS) to register offset projects, issue and track offset credits, and share key information through Canada's GHG Offset Credit System Public Registry

Only projects following a federal offset protocol included in the Compendium and meeting all requirements outlined in the Regulations can generate GHG reductions for which federal offset credits may be issued under the Regulations.

Document revision history

Version number	Publication date	Summary of changes
1.2	March 31, 2026	The approach to update the uncertainty factor was revised to ensure it reflects the most recent and conservative information (Section 8.3). Some unnecessary provisions were removed (Sections 3.2.3 and 6.1). Some provisions were clarified or streamlined consistent with the original intent.
1.1	October 15, 2024	The requirement for the timing of initiation of the initial forest carbon inventory was revised while still ensuring there is no crediting of GHG reductions generated before the crediting period start date (Section 9.1.1). The approach to quantify sampling uncertainty was updated to align with the Intergovernmental Panel on Climate Change (IPCC) Good Practice Guidance for National Greenhouse Gas Inventories (Section 8.3). Some requirements were added or clarified for records used to determine the project-specific baseline scenario (Section 3.2.1). Some provisions were clarified or streamlined consistent with the original intent.
1.0	May 6, 2024	Initial version of the protocol.

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1.0 Introduction

Forests have a large capacity to sequester carbon by removing carbon dioxide (CO_2) from the atmosphere and converting it into biomass through photosynthesis. This carbon is stored in the forest as live biomass as well as dead organic matter and forest soil. The implementation of improved forest management relative to the baseline can reduce the amount of carbon lost from managed forests and/or increase the rate of carbon sequestration in forest biomass.

The *Improved Forest Management on Private Land* federal offset protocol is intended for use by a proponent implementing a project to carry out forest management activities on managed forestlands that go beyond a business-as-usual management scenario in order to generate greenhouse gas (GHG) emission reductions and removals (GHG reductions) for which federal offset credits may be issued under the *Canadian Greenhouse Gas Offset Credit System Regulations* (the Regulations).

The proponent must follow the methodology and requirements set out in this protocol, including those to quantify and report GHG reductions generated by the eligible project activities. The requirements contained in this protocol are part of the Regulations and must be read in conjunction with provisions in the Regulations.

This protocol is designed to ensure the project generates GHG reductions that are real, additional, quantified, verified, unique and permanent. This protocol is also developed in accordance with the principles of ISO 14064-2:2019 *Greenhouse gases – Part 2 – Specification with guidance at the project level for quantification, monitoring and reporting greenhouse gas emission reductions or removal enhancements* to ensure reported GHG reductions generated as a result of implementing a project are relevant, complete, consistent, accurate, transparent, and conservative.

GHG reductions generated by a project under this protocol can only result from the implementation of improved forest management. GHG reductions under this protocol cannot be generated from afforestation/reforestation or avoided conversion of forestlands.

This protocol is applicable to projects on private land and is not applicable to projects on provincial and federal Crown lands and public lands in the territories. This protocol is also applicable on provincial and federal Crown lands where a First Nation has exclusive use and occupation.

The Government of Canada is committed to advancing Indigenous climate leadership and ensuring that federal policies and programs are designed to address Indigenous peoples' climate priorities. During the development of this protocol, Indigenous peoples were consulted on a distinctions basis, and Indigenous perspectives informed protocol development. Recognizing the relationship of Indigenous peoples to the land and their extensive knowledge of past and current environmental conditions and disturbances, some of the measures that reduce the contribution to the environmental integrity account are related to the involvement of Indigenous communities in permanence monitoring and reversal risk management planning.

2.0 Terms and definitions

Act

means the *Greenhouse Gas Pollution Pricing Act*.

Activity-shifting leakage

means an increase in GHG emissions as a result of shifting forest management activities from the project site to controlled lands.

Afforestation

means the process of introducing trees to an area of land from which trees have been absent for at least 50 years before the project start date.

Avoided conversion of forestland

means preventing the loss of forestland to a non-forest land use.

Conservation easement

means a legal agreement, registered on title, between a landowner and a qualified organization, specifically a land trust, government agency, or municipality, that protects the property for a specified period of time, and includes restrictions on land use and forest management activities that ensure the conservation of the property covered by the agreement. Other easement types that are not for the purpose of conservation are not included in this definition (e.g., right-of-way easements).

Controlled lands

means lands not included in the project site and for which the forest operator has the legal right to, and is responsible for, carrying out forest management activities.

Critical habitat

means the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species, as defined under section 2 of the *Species at Risk Act*.

Equivalent forest professional

means an individual who received a degree in forestry from a Canadian accredited forestry program, has at least 10 years of experience working in the forest sector developing and/or approving forest management plans, and practices in a province or territory where there is no professional association for foresters.

Forestland

means treed areas of 1 hectare (ha) or more with at least 10% crown cover and trees capable of reaching at least 5 meters (m) in height.

Forest management activities

means activities that enhance or recover forest growth or harvest yield (e.g., site preparation, planting, thinning, fertilizing, harvesting, etc.) and other silvicultural activities.

Forest operator

means the entity or individual(s) who has the legal right to, and is responsible for, carrying out forest management activities on a given forestland. On land where a First Nation has exclusive use and occupation, the forest operator is the First Nation.

Forest tree breeding

means the genetic manipulation of trees through species selection, testing, and controlled mating, to solve some specific problem or to produce a specially desired product.

Genetic engineering

means a method used to directly transfer DNA from one tree into another that results in a genetically modified tree.

Genetically modified tree

means a tree that has had its DNA sequence altered through genetic engineering.

Global Warming Potential (GWP)

means a metric representing the ability of a GHG to trap heat in the atmosphere compared to CO_2, as set out in Schedule 3 of the Act.

Harm

means a measurable decline in the quality or quantity of key environmental attributes of the project site over the crediting period, as it relates to environmental safeguards described in Section 6.4.

Indigenous-led project

means a project for which the proponent or the forest operator is registered in the Indigenous Business Directory (IBD) and can provide a registration number, or is a Certified Aboriginal Business as identified in the Canadian Council for Aboriginal Business (CCAB) member directory.

Land use management plan

means maps, policy statements, land codes, laws, regulations and by-laws that document the locations and boundaries of current and future use of land.

Managed forestland

means forestland where carrying out forest management activities is legally permissible and is considered merchantable.

Market leakage

means an increase in GHG emissions on lands outside of the project site and controlled lands as a result of changing market conditions from the reduction in the production of forest products within the project site.

Merchantable

means forestland that is of sufficient size, quality, and/or volume to make it suitable for harvesting, and it is economically beneficial to do so.

Native species

means species that naturally occur within the project site and species that occur within the project site as a result of practices by Indigenous peoples that pre-date colonization.

Natural forest

means forestland that does not meet the definition of plantation forest.

Non-native species

means a species that that does not meet the definition of native species.

Permanence monitoring period

means the period of time for which the proponent must monitor the permanence of GHG reductions generated by the project in accordance with subsection 22(1) of the Regulations.

Plantation forest

means forest stands established by planting and/or seeding which are either of non-native species (all planted stands) or intensively managed stands of native species, which meet all the following criteria: one or two species at plantation, even age class, regular spacing, and lacking most of the principal characteristics and key elements of natural forests.

Private land

means land where the ownership is held either in fee simple or fee simple equivalent, or where the forest operator has exclusive use and occupation. This excludes provincial and federal Crown land and public land in the territories, but it includes such land where a First Nation has exclusive use and occupation.

Project period

means the period of time for which the proponent is subject to the Regulations for a registered project, inclusive of the crediting period and the permanence monitoring period.

Project site

means the area, contiguous or non-contiguous, where forest management activities are being carried out as a part of a project and for which there is a single forest operator.

Reconciliation unit

means the spatial units used in the National Forest Carbon Monitoring, Accounting and Reporting System (NFCMARS) that combine ecological reporting zones with provincial and territorial boundaries.

Regulations

means the *Canadian Greenhouse Gas Offset Credit System Regulations*.

Reforestation

means renewal of forestland on an area that was previously forestland but has not been restored through planting or natural regeneration for at least 10 years before the project start date.

Silvicultural activities

means practices aimed at ensuring sustainable harvesting of forest resources, such as conservation, regeneration, reforestation, natural disturbance management and cutting.

Sustainable forestry

means the management of forestland to provide wood products or services in perpetuity while maintaining soil and watershed integrity, persistence of most native species and maintenance of highly sensitive species or suitable conditions.

Sustained yield

means the yield of defined forest products of specific quality and in a projected quantity that a forest can provide continuously at a given intensity of management.

3.0 Baseline scenario

3.1 Baseline condition

For a project to be eligible under this protocol, the following baseline conditions must be met before the project start date:

- All areas included in the project site's geographic boundaries meet the definition of managed forestland as defined in Section 2.0. However, areas within the project site that have been recently harvested and met the definition of managed forestland less than 10 years prior to the project start date may be included within the project site if the proponent can demonstrate that the area is capable of meeting the definition of managed forestland during the crediting period and the project activities will be applied and/or expanded into these areas.
- The project site is on private land.
- The project site is capable of, but not necessarily adhering to, sustainable forestry through demonstration of one or more of the following:
    - The project site or the forest operator of the project site is certified under the Forest Stewardship Council (FSC) or the Sustainable Forestry Initiative (SFI);
    - The project site adheres to a forest management plan, land use management plan prepared by a First Nation or another form of long-term management plan, demonstrating sustained yield and natural forest management; or
    - For projects where no forest management has previously taken place but for which harvesting is planned, the proponent must demonstrate that the project site would be capable of supporting sustainable forestry through certification or adhering to a management plan as described above before any planned harvests occur.
- The project site is not subject to a restriction prior to the project start date that mandates conservation, such as conservation easements and Other Effective Area-based Conservation Measures, excluding any restrictions that were put in place less than or equal to one year prior to the project start date and where the proponent can demonstrate these restrictions were implemented for the purpose of implementing the project. Areas under a restriction that mandates conservation and put in place more than one year prior to the project start date must not be included in the project site's geographic boundaries.

3.2 Determining the baseline scenario

The baseline scenario for the project is the carbon stocks associated with the forest management activities that would have most likely been carried out within the project site in the absence of the project and lead to the most carbon storage over a 100-year period.

The proponent must determine the baseline scenario for the project by following the procedure in Section 3.2.1.

3.2.1 Procedure to determine the baseline scenario

The proponent must reflect in the baseline scenario all legal requirements referred to in Section 5.1 that directly or indirectly impact baseline GHG removals. Further, the proponent must not include either of the following in the baseline scenario:

- Any type of land use change, such as the conversion of forestlands to a non-forest land use, excluding land use conversion for the purpose of carrying out forest management activities (e.g., construction of forest roads) within the project site. Re-establishment of forest cover after harvest is not considered a land use change and the proponent must project recovery after harvest (e.g., natural regeneration or planting).
- Natural disturbances.

To determine the baseline scenario, the proponent must follow this 3-step process:

1. Step 1: Determine the regional forest management baseline scenario based on the geographic region in which the project is located.
2. Step 2: Determine the project-specific baseline scenario based on a continuation of historical practices and other project-specific information.
3. Step 3: Select the most conservative baseline scenario applicable to the project.

Step 1: Determine the regional forest management baseline scenario

To determine the regional forest management baseline scenario for the geographic region in which the project is located, the proponent must:

- Step 1a: Identify reference forestlands that are managed similarly to the project site;
- Step 1b: Of the identified reference forestlands, determine the forestlands that match the project site based on shared biophysical forest attributes (matched forestlands);
- Step 1c: Assess the typical forest management activities carried out on the matched forestlands;
- Step 1d: Assess the financial and operational feasibility within the project site of the typical forest management activities carried out on the matched forestlands; and
- Step 1e: Determine the regional forest management baseline scenario.

<u>Step 1a: Identify reference forestlands</u>

The proponent must identify a minimum of five[1] forestlands that are managed similarly to the project site and located in the same reconciliation unit[2] to be used as reference forestlands. The reference forestlands must share the same or similar land tenure or ownership structure (e.g., a project on fee simple land should be compared to forestlands on fee simple land land) and meet at least one of the following conditions:

- Produce similar forest products; and/or

[1] In general, the higher number of available reference forestlands, the higher the likelihood that the k-nearest neighbors (k-NN) algorithm used in Step 1b will find suitable matches for the project site based on the Mahalanobis distance.
[2] A copy of a shapefile of the reconciliation units is provided on ECCC's website to ensure accurate interpretation of the project location.

- Share the same or similar management structure (e.g., the forest operator of the project site is a non-governmental organization (NGO), the reference forestlands should be managed by an NGO or similar entity).

If the ownership of the project site changed within 10 years prior to the project start date, the management of the project site prior to the change in ownership[3] can be used to determine the reference forestlands using the above conditions.

The proponent must gather information that supports the selection of the reference forestlands based on the condition(s) used to identify them, which may include aerial photographs, remote sensing (e.g., Landsat), national or sub-national forest database information, landowner statements/surveys or land title records.

The proponent must not use reference forestlands that are included in a project registered in the system set out in the Regulations or another GHG offset credit system (compliance or voluntary). The proponent may use national or provincial/territorial forest inventory plots as reference forestlands where such information is available and where the forest inventory plots conform to the conditions to identify reference forestlands.

The proponent may use provincial Crown land as a reference forestland. However, the proponent must justify the use of provincial Crown land as a reference forestland by demonstrating that there were no other forestlands that met the conditions to identify reference forestlands in the same reconciliation unit as the project site and show that this will not lead to an overestimation of GHG reductions generated by the project. The proponent must take into consideration any applicable legal requirements on provincial Crown land that may impact regional forest management practices (e.g., buffer zone requirements).

For lands where Indigenous peoples have exclusive use and occupation (e.g., reserve lands), if the proponent cannot find reference forestlands (e.g., other reserves) within the same reconciliation unit, the proponent can use forestlands that may not adhere to the conditions to identify reference forestlands (e.g., fee simple lands), provided the proponent can demonstrate:

- No other forestlands in the reconciliation unit met at least one of the conditions to identify reference forestlands;
- The forest management practices of the other forestlands are not indicative of the practices that would be implemented within the project site due to socio-economic or legal constraints; and
- This will not lead to an overestimation of GHG reductions generated by the project.

Step 1b: Determine the matched forestlands

Using the reference forestlands, the proponent must use the k-nearest neighbor (k-NN) optimal matching approach with replacement[4,5], utilizing the Mahalanobis distance[6] to identify the nearest

[3] ECCC recognizes that the project site may be acquired for the purpose of implementing the project and in the absence of the project, the pre-purchase management scenario of the project site would have continued.
[4] Stuart, E. A. (2010). Matching methods for causal inference: A review and a look forward. Stat. Sci. 25(1):1. doi:10.1214/09-STS313.
[5] Sävje, F. (2022). On the inconsistency of matching without replacement. Biometrika. 109(2):551-558. doi: 10.1093/biomet/asab035.
[6] The Mahalanobis distance is a multivariate measure between a point and a distribution that considers the correlation between variables and the distribution's mean and covariance. In k-NN analysis, the Mahalanobis distance is used to determine nearness (i.e., similarity) between data points, which enables the identification of

neighbours to the project site based on shared biophysical forest attributes. The shared biophysical forest attributes will serve as the matching conditions (i.e., covariates) for this analysis and the resulting matched reference forestlands will be used as the matched forestlands for the assessment of regional forest management activities.

The proponent must gather supporting information on the biophysical forest attributes of the reference forestlands to be used in the matching analysis, which could include aerial photographs, remote sensing (e.g., Landsat), or national or sub-national forest database information. Ideally, biophysical forest attribute information is collected at the plot- or stand-level for the reference forestlands, but where this is not possible the proponent may provide information averaged across the reference forestland to be used in the matching analysis.

Matching conditions must, at a minimum, be based on species composition and average forest age, but additional biophysical forest attributes may include:

- Stand density;
- Even-aged or uneven-aged management;
- Area of forestland;
- Other biophysical forest attributes that could reasonably be used to match the project site and influence forest management and/or forest carbon stocks.

The proponent must identify a minimum of three of the reference forestlands that match the project site to be used as matched forestlands, and the matched forestlands are then used to determine the typical forest management activities that inform the regional forest management baseline scenario in Step 1c.

Match results are valid if the standardized difference of means for each covariate is less than or equal to 0.25[7]. If the match results are invalid, the matching analysis is repeated with progressively fewer reference forestlands, ensuring that the number of reference forestlands does not fall below four, until valid match results are achieved. If, after reducing the number of reference forestlands, valid match results are still not achieved, the proponent must include additional forestlands that conform to the conditions to identify reference forestlands that were not originally included in the dataset and must repeat the matching analysis. If valid match results are still not achieved after including new reference forestlands in the dataset, the proponent may include forestlands outside the reconciliation unit in which the project site is located to be used in the matching analysis, provided the additional forestlands still conform to the conditions to identify reference forestlands and are located within the same ecozone as the project site.

To perform the matching analysis, the R packages optmatch[8], MatchIt[9] or MASS[10] may be used.

nearest neighbours. In this context, the term "nearest neighbors" denotes the reference forestlands that are more similar to the project site, as defined by the algorithm.

[7] Linden, A., & Samuels, S. J. (2013). Using balance statistics to determine the optimal number of controls in matching studies. J. Eval. Clin. Pract. 19(5):968-975. doi:10.1111/jep.12072.

[8] Hansen, B. B. (2007). Optmatch: Flexible, optimal matching for observational studies. R News. 7(2):18-24. Available from https://journal.r-project.org/articles/RN-2007-014/RN-2007-014.pdf.

[9] Stuart, E. A., King, G., Imai, K., & Ho, D. (2011). MatchIt: nonparametric preprocessing for parametric causal inference. J. Stat. Software. 42(8):1-28. doi:10.18637/jss.v042.i08.

[10] Venables, W. N., & Ripley, B. D. (2002). Modern applied statistics with S (J. Chambers, W. Eddy, W. Hardle, S. Sheather and L. Tierney, Ed.). (4th Edition). Springer. doi:10.1007/978-0-387-21706-2.

It is possible that for projects located in smaller provinces and territories, or where projects within an aggregation of projects (aggregation) are located very close to each other, the same reference forestlands and matched forestlands apply to more than one project within the aggregation. In this case, the proponent may use the same reference forestlands and matched forestlands for all projects within the aggregation.

Step 1c: Assess the typical forest management activities carried out on the matched forestlands

After the proponent has determined the matched forestlands, the proponent must assess the typical forest management activities carried out on these forestlands. Information supporting the assessment of the typical forest management activities must be recent (i.e., not older than five years relative to the project start date) to reflect current market and management conditions.

To assess the typical forest management activities for the matched forestlands, the proponent must gather the following information for the matched forestlands, where relevant:

- Silvicultural treatments and systems in use, and their prevalence across the matched forestlands;
- Annual harvest volumes in m^3 ha^{-1} $year^{-1}$ and/or annual harvest area in ha $year^{-1}$;
- Typical rotations ages for similar forest types to that of the project site where the clearcut system is used, or the typical ages of intervention when partial cutting systems (e.g., commercial thinning, single tree or group selection, shelterwood, etc.) are used, including the typical age of final harvest;
- Average minimum harvest restriction criteria, including minimum tree age, size and/or stand volume;
- Average tree retention policies for single or grouped merchantable and un-merchantable trees, such as riparian buffers and wildlife trees;
- Operational constraints which would limit regional logging equipment, including maximum harvest slope;
- Reforestation and stand management practices for regeneration, including site preparation activities, typical machinery used, and planting density; and
- Harvest/silvicultural activities that are required by federal, provincial, or territorial laws, and/or municipal bylaws regarding private forest lands.

Supporting information can include an expert opinion from a Registered Professional Forester or an equivalent forest professional who practices within the same jurisdiction as the project site, as well as landowner statements/surveys, remote sensing, models, satellite imagery or national or sub-national database information.

Where forest management activity information is qualitative and cannot be averaged across the matched forestlands, the proponent must justify an approach to be used to determine how the typical forest management activities will be reflected in the regional forest management baseline scenario. Where possible, the proponent must select the most prevalent activities to be reflected in the baseline scenario (e.g., activities are carried out on two out of three matched forestlands). In cases where prevalence cannot be used (e.g., all matched forestlands carry out different activities), the proponent can justify another approach, such as using forest estate models or comparing to a forest management plan prepared for the project site.

Step 1d: Assess the financial and operational feasibility within the project site of the typical forest management activities carried out on the matched forestlands

The proponent must assess the financial and operational feasibility within the project site of the typical forest management activities carried out on the matched forestlands.

The forest management regime in the baseline scenario must be financially feasible, meaning it must be profitable in the practice of carrying out long-term forest management activities within the project site, such as road construction and management, watercourse restoration, and fuels management. The proponent must ensure the typical forest management activities are consistent with the regional market capacity for the projected baseline scenario activities and products (i.e., availability of contractors and their capacity, timber markets, mill capacity, etc.) and are financially feasible within the project site. Any consideration for market capacity and products outside the project site's reconciliation unit must be demonstrated to be financially feasible and must be standard practice for the forest operator of the project site.

The baseline scenario cannot include activities that would not be operationally feasible for the project geographic location, such as projecting a level of harvest that local mills could not handle annually without considerable additional investment into local logging infrastructure, or including harvesting equipment that is not available in the defined geographic region.

Any constraints that would impact the financial or operational feasibility of the baseline scenario must be incorporated into the baseline scenario.

Step 1e: Determine the regional forest management baseline scenario

The proponent must determine a 100-year growth and harvesting regime that represents the typical forest management activities of the matched forestlands that are financially and operationally feasible within the project site to determine the regional forest management baseline scenario, which is then modelled as per Section 9.2.3.

Step 2: Determine the project-specific baseline scenario

To determine the project-specific baseline scenario for the project site, the proponent must:

- Step 2a: Assess projected forest management activities;
- Step 2b: Assess historical practices previously implemented within the project site; and
- Step 2c: Determine the project-specific baseline scenario.

Step 2a: Assess projected forest management activities

The proponent must at a minimum assess the following records, if they are available for the project site, to determine the baseline scenario:

- A forest management plan for the project site.
- For a project on a First Nation reserve or Treaty Land Entitlement land with an exclusive use permit, a land use management plan and/or a license or permit to harvest.
- Contract(s) or signed written offer(s) from local mill(s) or harvester(s) to purchase forest products or harvest from the project site or offer(s) to purchase the project site.

The project-specific baseline scenario must be informed by records indicating the following:

- The forward-looking forest management and silvicultural activities and harvest volumes.
- A management scenario that would be financially and operationally feasible within the project site.

The records above must have been approved or prepared by a Registered Professional Forester or an equivalent forest professional who practices within the same jurisdiction as the project site. The records must not reflect the planned project activities as part of the project, but rather the activities that would have taken place in the absence of the project.

A combination of records may be used to inform the project-specific baseline scenario. For example, a single document might not contain both the harvest volumes and a feasibility assessment. Records used to inform the project-specific baseline scenario must have been prepared within five years of the project start date and the combination of records must cover the entire project site.

Step 2b: Assess historical practices

The proponent must assess the historical management of the project site according to the following:

- The proponent must use a lookback period to the most recent harvest or of at least 10 years, whichever results in a longer lookback period, and must gather information on the forest management and silvicultural activities and harvest volumes carried out within the project site during this period.
- Where ownership changed in the 10 years prior to the project start date, the proponent may use the historical practices associated with the original landowner before the change in ownership, where records are available.
- In cases where there are no historical records for the project site, but there are controlled lands within the same province or territory of the project site of the same forest type that provides the same forest products, the proponent may use the historical practices of the controlled lands if the proponent can demonstrate that similar activities would have been carried out within the project site.
- For Indigenous-controlled lands, historical practices may not be indicative of future forest management practices that would be implemented within the project site due to socio-economic or legal constraints. In this case, the proponent can exclude the assessment of historical practices.
- The proponent must gather information that demonstrates that past management practices were implemented within the project site. This could include aerial photographs, remote sensing (e.g., Landsat), or national or sub-national forest database information. The proponent must also note any environmental and socio-economic influences that may have caused anomalies in business-as-usual management practices in the historical lookback period (e.g., the COVID-19 pandemic, historic drought, wildfire, etc.).

Step 2c: Determine the project-specific baseline scenario

The proponent must determine a 100-year growth and harvesting regime that is either the projected forest management activities as per Step 2a, or a continuation of historical practices as per Step 2b, to represent the project-specific baseline scenario, which is then modelled as per Section 9.2.3.

In cases where there has been no historical forest management within the project site, the assessment of projected forest management activities alone is used to inform the project-specific baseline scenario.

Conversely, if these records are not available for the project site, the assessment of historical practices alone is used to inform the project-specific baseline scenario.

If the proponent can carry out both the assessment of projected forest management activities and the assessment of historical practices, and these assessments yield different or contrasting future harvest volumes and/or forest management and silvicultural activities, the proponent must prioritize the information indicated in the assessment of projected forest management activities to determine the project-specific baseline scenario.

Step 3: Select the baseline scenario

The proponent must select the baseline scenario that is the most conservative between the regional forest management baseline scenario (outcome of Step 1 above) and the project-specific baseline scenario (outcome of Step 2 above). When comparing the two baselines, the baseline scenario that results in the most carbon storage over a 100-year period is the most conservative and must be selected. To determine which baseline scenario results in the highest carbon stocks, the proponent must compare the average annual carbon stocks over the 100-year period.

3.2.2 Baseline scenario for projects previously registered in other GHG offset credit systems

For a project that was previously registered in a GHG offset credit system other than the one set out in the Regulations, the proponent must determine the baseline scenario for the project as follows:

1. If no credits were issued for the project in the other GHG offset credit system, or if credits were issued and all credits issued, including those for a buffer pool, were cancelled and/or compensated for in the other GHG offset credit system, the proponent uses the procedure to determine the baseline scenario as per Section 3.2.1.
2. If credits were issued for the project in the other GHG offset credit system and were not cancelled and/or compensated for in the other GHG offset credit system, the proponent determines the baseline scenario as follows:
    a. The baseline scenario is the initial carbon stocks within the project site for each included source, sink and reservoir (SSR) as determined in the initial forest carbon inventory as per Section 9.1, and the initial carbon stocks must remain static[11] for the entire crediting period; or
    b. The baseline scenario is determined using the procedure in Section 3.2.1, but the total quantity of credits issued in the other GHG offset system (before any deductions for a buffer pool) must be deducted from the project scenario GHG removals, where the total quantity of credits issued in the other GHG offset system represents the value of PER in Equation 14.

[11] A proponent using a baseline scenario that is the initial carbon stocks held static for the entire crediting period does not need to model the baseline scenario carbon stocks as per Section 9.2.3, there is no value associated with $\mathrm{SC_{Baseline,HWP,C}}$ and they only need to use Equation 7 to calculate the change in baseline scenario carbon stocks in Section 8.1, and there is no leakage risk as per Section 8.4.

3.2.3 Updating the baseline scenario during the crediting period

The proponent may update their baseline scenario during the crediting period, but there can be no less than five years between updates and the proponent must adhere to the time interval set for the whole crediting period as specified in Section 13.1.1.

To update the baseline scenario, the proponent must follow the procedure for determining the baseline scenario in Section 3.2.1 using new and/or updated information. The proponent must use any updated information that improves the accuracy of the baseline scenario and project scenario carbon stock modelling (see Section 9.2.3). For the project-specific baseline scenario (Step 2), this can include new and/or updated information on the projected forest management activities, such as a new forest management plan for the project site or an update to the existing plan to reflect current environmental and market conditions. However, the proponent does not re-assess the historical lookback period, as this is fixed to the project start date. Since this approach is based on assuming a continuation of historical activities, the proponent determines the historical practices that would have taken place over the same period as the update to the baseline scenario.

3.2.4 Updating the baseline scenario at renewal of the crediting period

If the proponent requests renewal of the crediting period for a project, the proponent must update the baseline scenario. To update the baseline scenario, the proponent must follow the procedure for determining the baseline scenario in Section 3.2.1 using updated information. However, only the assessment of the projected forest management activities in Step 2 needs to be re-assessed. When updating the baseline scenario, the proponent must also update the forest carbon inventory following the requirements of Section 9.1. The proponent must use any updated information that improves the accuracy of the baseline scenario and project scenario carbon stock modelling (see Section 9.2.3).

4.0 Project scenario

The project scenario for a project is the carbon stocks associated with the forest management activities carried out within the project site that go beyond the baseline scenario.

4.1 Project condition

To be eligible under this protocol, a project must meet the following project condition on and after the project start date:

- Carry out one or more eligible project activities on private land, as described in Section 4.2.

4.2 Eligible project activities

Any forest management activity that enhances carbon stocks within the project site relative to the baseline scenario is an eligible project activity under this protocol, except those outlined in Section 4.3. Eligible project activities could include, but are not limited to:

- Reducing competing brush and short-lived forest species;
- Thinning diseased and suppressed trees;

- Minimizing site degradation;
- Increasing the rotation age; and
- Reduced volume of harvest (i.e., conservation).

4.3 Ineligible project activities

Any activity that involves a land use change, prevents a land use change, or change of land cover, such as afforestation/reforestation and avoided conversion of forestlands, is not eligible under this protocol. This excludes land use conversion for the purpose of carrying out forest management activities (e.g., construction of forest roads).

The proponent may carry out salvage harvesting and avoided burning of slash within the project site, but any GHG reductions as a result of carrying out these activities are not eligible for the issuance of federal offset credits.

5.0 Additionality

5.1 Legal additionality

GHG reductions generated by a project must not occur as a result of federal, provincial or territorial law (including regulations), municipal bylaws, or any other legally binding mandates that would impact the GHG reductions associated with any of the included SSRs, including those that indirectly result in the requirement to maintain or store forest carbon or implement the project activities, such as harvest restrictions (herein referred to as a legal requirement).

A legal requirement may include, but is not limited to:

1. Federal, provincial, and territorial laws (including regulations) and municipal bylaws related to harvest restrictions or minimum stocking standards and soil disturbance, as well as forest practice rules established by any of these governments;
2. Restrictions on land use and management such as easements, conservation plans or other relevant environmental plans, and deed restrictions;
    - This excludes restrictions on land use and management that were put in place and/or recorded within one year of the project start date, so long as the proponent can demonstrate these restrictions were implemented for the purpose of carrying out the project activities; and
3. Silvicultural treatments that impact harvesting and forest management within the project site due to a legally required forest management plan. This applies to plans that have been submitted, active, or approved at the time of the project start date.

5.1.1 New legal requirements

If at any time after project registration GHG reductions generated by the project become subject to a new legal requirement, the GHG reductions will no longer be additional and the new legal requirement must be reflected in the baseline scenario as per Section 3.2.1.

If GHG reductions become subject to a new legal requirement during the crediting period, federal offset credits can only be issued for the GHG reductions generated up to the date immediately preceding the date on which the legal requirement comes into force. The proponent must update the baseline scenario to reflect the new legal requirement to ensure GHG reductions generated by the project are additional. The proponent must begin using the updated baseline scenario to calculate the baseline scenario GHG removals on the date the legal requirement came into force.

A legal requirement that comes into force during the crediting period that mandates the protection of the project site (e.g., a conservation easement) or that is necessary to enable the continuation of the project (e.g., changes to municipal zoning) does not require an update to the baseline scenario if the proponent can demonstrate that the legal requirement is for the purpose of implementing the project.

5.2 Provincial or federal pricing mechanisms for GHG emissions

GHG reductions resulting from sources that are subject to a federal or provincial pricing mechanism for GHG emissions are not eligible for federal offset credits.

5.3 Business-as-usual additionality

A project implemented under this protocol automatically meets the requirements for business-as-usual additionality. The project activities are considered additional provided they result in greater GHG removals than the forest management activities that are most likely to be carried out within the project site in the absence of the project, as determined by following the requirements to determine the baseline scenario in Section 3.2.

6.0 General requirements

6.1 Project start date

The start date of a project corresponds to one of the following:

- The project registration date; or
- The date of the initiation of the forest carbon inventory for the project if the forest carbon inventory is initiated after the registration date for that project.

However, if a project was previously registered in a GHG offset credit system other than the one set out in the Regulations, the project start date is the date on which the project was registered in the other GHG offset credit system or the project start date as defined by the other GHG offset credit system, whichever is earlier.

To be eligible under this protocol, a project must have a start date that is on or after January 1, 2017.

For an aggregation of projects, the start date of each project in the aggregation must be established using one of the abovementioned options. However, for projects being added to an aggregation of projects after the registration of the aggregation, and if the proponent of the aggregation does not develop a separate forest carbon inventory (see Section 9.1) for each project in the aggregation, the start date of each project being added to the aggregation must be the registration date for each of these projects.

6.2 Crediting period

A project implemented under this protocol has a crediting period of 25 years, notwithstanding requirements in subsections 5(4), (5) and (6) of the Regulations.

6.3 Project site location and geographic boundaries

The proponent must document the location and geographic boundaries of the project site and prepare a site plan. The site plan must be displayed on a geo-referenced map that shows and clearly labels:

- The location and geographic boundaries of the project site, which comprises the area in which the project activities will be implemented; and
- The location and geographic boundaries of any controlled lands located in the same province or territory as the project site.

If the project site is non-contiguous, the geographic boundaries of each discrete area making up the project site must be identified on the site plan. The site plan must be at a sufficiently large scale and display geographical features such as watercourses, wetlands, place names, administrative boundaries, etc. to enable field interpretation and identification of the project site.

The following features must be included as part of the site plan for both the project site and any controlled lands within the same province or territory as the project site:

- Total area;
- Existing land cover and land use;
- Topography;
- All roads and trails, labelling which type of road and/or trail (e.g., access roads); and
- Watercourses.

The project location and the site plan must be submitted as SHP, GDB or GeoJSON file formats.

For an aggregation of projects, the proponent may provide a single site plan that reflects the project sites of all projects.

The geographic boundary of the project site cannot change after the first reporting period, but the proponent may carry out additional project activities or expand where existing project activities are carried out within the boundary.

If an involuntary reversal[12] occurs during the crediting period or the permanence monitoring period, the proponent must update the site plan to identify the area of the project site impacted by the reversal. Any changes to the site plan must be communicated as specified in the Regulations.

6.4 Environmental and social safeguards

6.4.1 Compliance with applicable environmental legal requirements

The proponent must ensure that the project activities and the project site comply with any federal, provincial and territorial regulations, municipal by-laws, operating permits or licenses applicable to the

[12] Defined in Section 10.0.

project site, such as those related to species at risk and the protection of ecological goods and services.

6.4.2 Avoiding potential negative environmental impacts

The proponent must not carry out any of the following activities as a part of the project:

- Broadcast fertilization;
- Altering the hydrology of the project site (e.g., draining or flooding of wetlands);
- Use of non-native species on the project site, unless there is evidence that these species now naturally occur in the area of the project site or the presence of the non-native species within the project area would not cause adverse environmental impacts compared to the baseline scenario;
- Removal of snags and standing deadwood beyond the volumes in the baseline scenario, unless the proponent can demonstrate they are managing deadwood as the result of a natural disturbance, such as carrying out risk mitigation measures in accordance with the reversal risk management plan;
- Conversion of natural forests to plantation forests or to different forest types, unless there is a conservation restoration plan in place and the project site is already considered a plantation forest;
- Clear-cutting in uneven-aged forests, unless the proponent can justify that it would be necessary for adhering to best management practices, the prevention of natural disturbance (e.g., preventing pest/disease outbreaks, implementing fire breaks, etc.) or if it would not cause adverse environmental impacts compared to the baseline scenario; and
- Use of genetically modified trees, including clonal species. This does not include forest tree breeding for the purpose of tree improvement within the project site (e.g., selective breeding to build climate resistance).

6.4.3 Project-specific assessment of environmental impacts

Prior to carrying out any project activities, the proponent must conduct an assessment of the project site to determine the environmental safeguards that must be in place.

The proponent must take a “no net harm” approach to determining which environmental safeguards are required to ensure that any project activities carried out as a part of the project do not have a net negative impact on any environmental attribute of the project site compared to the baseline scenario. The proponent of a project where the only project activity is conservation must only consider ecosystem resilience and integrity as a part of the project-specific assessment. Similarly, any portion of the project site where conservation is the only activity that is being implemented may exclude all other environmental attributes from the project-specific assessment except ecosystem resilience and integrity.

The assessment must determine whether the project activities are likely to have positive, neutral, or negative impacts on the following environmental attributes within the project site:

- Biodiversity, including consideration for impacts on genetic diversity, species at risk and species endemic to the project site;

- Habitat protection and creation, including consideration for impacts to threatened or rare ecosystems and forest stands;
- Water resources, including consideration for impacts on watershed management, hydrology of the project site, and water quality;
- Soil quality and fertility, including consideration for impacts on erosion and compaction; and
- Ecosystem resilience and integrity, including consideration for impacts on key ecosystem services and resiliency against natural disturbances.

The proponent must assess the potential positive, neutral, or negative impacts on the above-mentioned environmental attributes of all the project activities, including, but not limited to:

- Forest stand or soil alteration from harvesting, tree planting, site preparation, and/or tending activities for pre-commercial trees;
- Alteration of fire regimes and/or burning conditions;
- Development of forest roads;
- Use of forest machinery; and
- Fertilizer, insecticide, and herbicide application.

The proponent must use the result of the assessment to identify the environmental safeguards that must be implemented to address any potential negative impacts and must provide a description of each safeguard, including an explanation of how it will mitigate potential negative impacts.

7.0 Project GHG boundary

The project GHG boundary (Figure 1) contains the SSRs that must be included or excluded in the baseline and project scenarios to determine the GHG reductions generated by the project.

Table 1 provides additional details on the SSRs identified for the baseline and project scenarios, as well as justification for their inclusion or exclusion in the quantification of GHG reductions. For SSR5, SSR6, SSR7, and SSR12, the proponent may exclude any of these if they can meet the conditions described in the corresponding row in Table 1.

Three GHGs are relevant to the SSRs in this protocol: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).

Figure 1: Illustration of the project GHG boundary

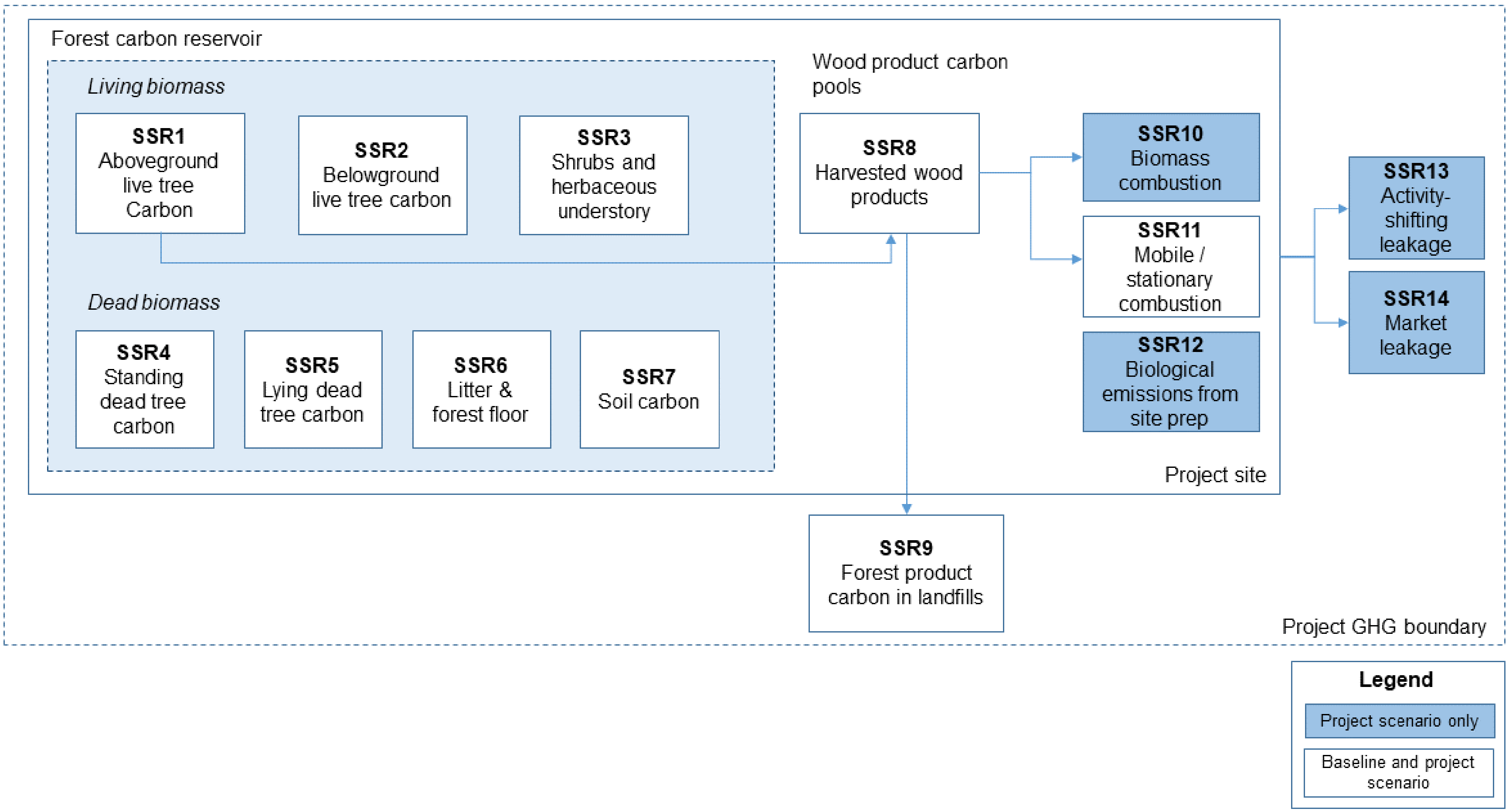

Table 1: Details on baseline and project scenario SSRs

SSR	Title	Description	Type	Baseline or project scenario	GHG	Included or excluded
1	Aboveground live tree carbon	Standing live trees include the stem, branches, leaves or needles of all aboveground biomass, regardless of species. Standing trees are trees that are self supporting and would remain standing if all supporting materials were removed, otherwise these trees should be treated as standing dead trees (see SSR4). Trees must be ≥1.3 m in height, have a DBH ≥9 cm and must be able to reach a mature height of 5 m within its natural range. However, the proponent may define and justify an alternative minimum tree DBH and height used to develop the inventory, if appropriate.	Controlled	Baseline (B1)	CO_2	**Included:** modelled in tonnes of carbon (t C), following the requirements of Section 9.2, to be used in Equation 4. In the case of a project previously registered in a GHG offset credit system other than the one set out in the Regulations and that is using a baseline scenario where baseline scenario carbon stocks for included SSRs remain static at the levels indicated in the initial forest carbon inventory, this SSR remains static at the initial carbon stocks as determined in the initial forest carbon inventory following the requirements in Section 9.1.
				Project (P1)	CO_2	**Included:** quantified in tonnes of carbon (t C) through direct measurements and updating the forest carbon inventory, following the requirements of Sections 9.1 and 9.2, to be used in Equation 16.

SSR	Title	Description	Type	Baseline or project scenario	GHG	Included or excluded
2	Belowground live tree carbon	Carbon in belowground portions of the aboveground live tree carbon (i.e., SSR1), principally roots.	Controlled	Baseline (B2)	CO_2	**Included:** modelled in tonnes of carbon (t C) as a function of the proportion of aboveground biomass using growth and yield models, following the requirements of Section 9.2, to be used in Equation 4. In the case of a project previously registered in a GHG offset credit system other than the one set out in the Regulations and that is using a baseline scenario where baseline scenario carbon stocks for included SSRs remain static at the levels indicated in the initial forest carbon inventory, this SSR remains static at the initial carbon stocks as determined in the initial forest carbon inventory following the requirements of Section 9.1.
				Project (P2)	CO_2	**Included:** estimated in tonnes of carbon (t C) based on aboveground live tree biomass, which is measured via direct measurement and updating forest carbon inventory, following the requirements of Sections 9.1 and 9.2,

SSR	Title	Description	Type	Baseline or project scenario	GHG	Included or excluded
						to be used in Equation 16.
3	Shrubs and herbaceous understory	Aboveground living woody and herbaceous plant biomass that does not meet the description of aboveground live tree carbon (i.e., SSR1).	Controlled	Baseline (B3) Project (P3)	CO_2	**Excluded:** CO_2 emissions from this carbon pool are not significant relative to the size of the total forest carbon pool.
4	Standing dead tree carbon	Carbon in standing dead trees, which includes the stem, branches, or section thereof, regardless of species. Dead trees must be ≥1.3 m in height and would be able to reach a mature height of 5 m within its natural range if it were still living. Stumps are not considered standing dead tree carbon, and the proponent must define a maximum stump height (above ground) used to develop the inventory.	Controlled	Baseline (B4)	CO_2	**Included:** quantified in tonnes of carbon (t C) through direct measurement from the initial forest carbon inventory, following the requirements of Sections 9.1 and 9.2, to be used in Equation 4. This SSR remains static at the initial carbon stocks as determined in the initial forest carbon inventory.
				Project (P4)	CO_2	**Included:** quantified in tonnes of carbon (t C) through direct measurement and updating the forest carbon inventory, following the requirements of Sections 9.1 and 9.2, to be used in Equation 16.
5	Lying dead tree carbon	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 with a diameter >7.5 cm. Stumps are not	Controlled	Baseline (B5)	CO_2	**Included:** Included if this SSR is included in the project scenario. Modelled in tonnes of carbon (t C), following the requirements of Section 9.2, to be used in Equation 4.

SSR	Title	Description	Type	Baseline or project scenario	GHG	Included or excluded
		considered lying dead tree carbon.				In the case of a project previously registered in a GHG offset credit system other than the one set out in the Regulations and that is using a baseline scenario where baseline scenario carbon stocks for included SSRs remain static at the levels indicated in the initial forest carbon inventory, this SSR remains static at the initial carbon stocks as determined in the initial forest carbon inventory following the requirements in Section 9.1.
				Project (P5)	CO_2	**Included:** This SSR is included if it cannot be justified that the project activities would result in equal or greater carbon storage compared to the baseline. If it can be justified that the project will result in equal or greater carbon stocks compared to the baseline, such as reduced harvesting in the project scenario relative to the baseline, this SSR is optional. If this SSR is included in the project scenario it must be included in the baseline scenario.

SSR	Title	Description	Type	Baseline or project scenario	GHG	Included or excluded
						Quantified in tonnes of carbon (t C) through direct measurement and updating the forest carbon inventory, following the requirements of Sections 9.1 and 9.2, to be used in Equation 16.
6	Litter and forest floor	Any pieces of dead woody material from a tree on the ground in forest stands that is ≤7.5 cm in diameter.	Controlled	Baseline (B6)	CO_2	**Included:** Included if this SSR is included in the project scenario. Modelled in tonnes of carbon (t C), following the requirements of Section 9.2, to be used in Equation 4. In the case of a project previously registered in a GHG offset credit system other than the one set out in the Regulations and that is using a baseline scenario where baseline scenario carbon stocks for included SSRs remain static at the levels indicated in the initial forest carbon inventory, this SSR remains static at the initial carbon stocks as determined in the initial forest carbon inventory following the requirements in Section 9.1.
				Project (P6)	CO_2	**Included:** This SSR is included if it cannot be justified that the project activities

SSR	Title	Description	Type	Baseline or project scenario	GHG	Included or excluded
						would result in equal or greater carbon storage compared to the baseline. If it can be justified that the project will result in equal or greater carbon stocks compared to the baseline, such as reduced harvesting in the project scenario relative to the baseline, this SSR is optional. If this SSR is included in the project scenario it must be included in the baseline scenario. Quantified in tonnes of carbon (t C) through direct measurement and updating the forest carbon inventory, following the requirements of Sections 9.1 and 9.2, to be used in Equation 16.
7	Soil carbon	Belowground carbon not included in other SSRs. This SSR can be a net source or sink depending on circumstances (see SSR12).	Controlled	Baseline (B7)	CO_2	**Included:** Included if this SRR is included in the project scenario. Quantified in tonnes of carbon (t C) through direct measurement from the initial forest carbon inventory, following requirements of Sections 9.1 and 9.2, to be used in Equation 4. This value remains static at the initial carbon

SSR	Title	Description	Type	Baseline or project scenario	GHG	Included or excluded
						stocks as determined in the initial forest carbon inventory.
				Project (P7)	CO_2	**Included:** This SSR is included if it cannot be justified that the project activities would result in equal or greater carbon storage compared to the baseline. If it can be justified that the project will result in equal or greater carbon stocks compared to the baseline, such as reduced harvesting in the project scenario relative to the baseline, this SSR is excluded. If this SSR is included in the project scenario it must be included in the baseline scenario. If the project scenario includes site preparation activities or the construction of forest roads that exceed baseline levels, this SSR must be included. Quantified initially through direct measurement from the forest carbon inventory in tonnes of carbon (t C), then subsequently modelled, following the requirements of Sections 9.1 and 9.2, to be used in Equation 16.

SSR	Title	Description	Type	Baseline or project scenario	GHG	Included or excluded
8	Harvested wood products (HWPs)	Wood that is harvested or otherwise collected from the forest, transported outside of the project site, and is being processed or is In-use.	Controlled	Baseline (B8)	CO_2	**Included:** estimated from modelled harvest volumes from the 100-year growth and harvesting regime that represents the baseline scenario using Equations 8 through 13.
				Project (P8)	CO_2	**Included:** estimated based on measured harvest volumes using Equations 20 through 25.
9	Forest product carbon in landfills	Harvested wood products decomposing in landfills and dumps.	Related	Baseline (B9) Project (P9)	CO_2	**Excluded:** There is considerable uncertainty and variability in waste disposal practices and the volume of harvested wood products that would be delivered to a landfill.
10	Biomass combustion	Combustion of harvested forest biomass within the project site, or downstream of the project site for various purposes, including heating, slash pile burning, or HWP processing.	Controlled	Project (P10)	CH_4 N_2O	**Included:** estimated from measured quantities of burned biomass using Equations 17 through 19.
11	Mobile / stationary combustion	Combustion of fossil fuels as part of site preparation activities, and ongoing operation and maintenance.	Controlled	Baseline (B11) Project (P11)	CO_2 CH_4 N_2O	**Excluded:** emissions from this SSR in the project scenario are not significantly different from baseline levels.

SSR	Title	Description	Type	Baseline or project scenario	GHG	Included or excluded
12	Biological emissions from site preparation	Increased decomposition and release of CO_2 emissions due to disturbing stored organic carbon during site preparation.	Controlled	Project (P12)	CO_2	**Included:** Included if the soil carbon pool (SSR7) is included. Emissions from this SSR are captured through the quantification of SSR7.
13	Activity-shifting leakage	Shifting forest management activities from the project site to controlled lands.	Controlled	Project (P13)	CO_2	**Included:** included when it cannot be demonstrated that there is no risk of activity-shifting leakage to lands controlled by the project proponent, following the requirements of Section 8.4.1. When included, this SSR is estimated from measured increases in harvest volumes occurring on controlled lands as described in Section 8.4.1 using Equation 28.
14	Market leakage	Changing market conditions due to the reduction in the production of forest products within the project site which results in changes to harvesting on lands outside of the project site and controlled lands.	Affected	Project (P14)	CO_2	**Included:** estimated based on a regional leakage risk discount factor following the requirements of Section 8.4.2 using Equation 29 or Equation 30.

8.0 Quantification methodology

This section contains the quantification methodology that the proponent must follow to quantify baseline and project scenario GHG removals and subsequently, the GHG reductions generated by the project.

Baseline scenario GHG removals are the GHG removals from the SSRs within the project GHG boundary that would likely have been generated in the absence of the project, and quantified as per Section 8.1.

Project scenario GHG removals are the GHG removals from SSRs within the project GHG boundary that are generated from the eligible project activities, and quantified as per Section 8.2.

The GHG reductions generated by the project are quantified by deducting the baseline scenario GHG removals from the project scenario GHG removals, as per Section 8.5.

The quantification of both the baseline and project scenario GHG removals must include all the GHG removals that were likely to occur in the absence of the project (baseline scenario) and did occur (project scenario) during a reporting period. The quantification must produce sub-totals in tonnes of CO_2 equivalent (t CO_2e) for each full or partial calendar year of the reporting period to support issuance of the offset credits by calendar year.

For an aggregation of projects, default factors, such as those for leakage, must be specific to each project in the aggregation.

Some reference values used in the quantification methodology are provided in the *Emission Factors and Reference Values* document. To be used along with federal offset protocols, the *Emission Factors and Reference Values* document contains general and protocol-specific emission factors and other reference values that are needed for the quantification of GHG reductions. Raw data must be converted to align with the units presented in the quantification methodology, if necessary.

8.1 Baseline scenario GHG removals

The proponent must use Equation 1 and the subsequent equations in Section 8.1 to quantify the baseline scenario GHG removals for each full or partial calendar year covered by the reporting period, based on the included SSRs. The baseline scenario GHG removals are quantified by calculating the baseline scenario carbon stocks based on the modelled baseline scenario as per Section 9.2.3.

The proponent will need the following information to calculate baseline scenario carbon stocks:

1. Total baseline scenario carbon stocks for each calendar year covered by the reporting period for each included SSR (i.e., $\mathrm{SC_{B1,C}}$, $\mathrm{SC_{B2,C}}$ and $\mathrm{SC_{B4,C}}$, as well as $\mathrm{SC_{B5,C}}$, $\mathrm{SC_{B6,C}}$ and $\mathrm{SC_{B7,C}}$ if included as per Table 1), determined following the requirements of Sections 9.1 and 9.2;
2. Average baseline scenario carbon stocks (i.e., $\mathrm{SC_{Baseline,AVG}}$), determined following the requirements of Sections 9.1 and 9.2; and
3. Average annual harvest volume (i.e., $\mathrm{SC_{Baseline,dm,i,C}}$, $\mathrm{HV_{Baseline,i,C}}$ or $\mathrm{HW_{Baseline,i,C}}$), as determined by following the requirements of Section 9.2.

In the case of a project previously registered in a GHG offset credit system other than the one set out in the Regulations and that is using a baseline scenario where carbon stocks remain static at the levels determined in the initial forest carbon inventory as per Section 9.1, the total baseline scenario carbon stocks for each included SSR in Equation 4 are equal to the initial carbon stocks determined in the initial forest carbon inventory. Further, there will be no value associated with the baseline scenario carbon stocks that would have been stored in harvested wood products for 100 years after harvest (i.e., $\mathrm{SC_{Baseline,HWP,C}}$ in Equation 1 is 0) and the proponent does not need to follow the quantification methodology set out in Section 8.1.1. There will also not be a change in baseline scenario carbon stocks ($\Delta\mathrm{SC_{Baseline,C}}$) between calendar years covered by a reporting period or between reporting periods, so the proponent must only use Equation 7 to determine $\Delta\mathrm{SC_{Baseline,C}}$.

Equation 1: Baseline scenario GHG removals for a calendar year covered by the reporting period

$$\mathrm{BR_C} = \Delta\mathrm{SC_{Baseline,C}} + \mathrm{SC_{Baseline,HWP,C}}$$

Parameter	Description	Units
$\mathrm{BR_C}$	Baseline scenario GHG removals for a calendar year covered by the reporting period	t CO_2e
$\Delta\mathrm{SC_{Baseline,C}}$	Change in baseline scenario carbon stocks for a calendar year covered by the reporting period, as per Equation 5, 6 or 7	t CO_2e
$\mathrm{SC_{Baseline,HWP,C}}$	Total baseline scenario carbon that would have remained stored in harvested wood products for 100 years after harvest for a calendar year covered by the reporting period, as per Equation 13 (SSR B8)	t CO_2e
C	Calendar year	unitless

The proponent must use the total baseline scenario carbon stocks to calculate $\Delta\mathrm{SC_{Baseline,C}}$ until the total baseline scenario carbon stocks in a given calendar year are equal to the average baseline scenario carbon stocks. For each calendar year throughout the remainder of the crediting period, the average baseline scenario carbon stocks are used to calculate $\Delta\mathrm{SC_{Baseline,C}}$. To determine whether the proponent must begin using the average baseline scenario carbon stocks to calculate $\Delta\mathrm{SC_{Baseline,C}}$ for the remainder of the crediting period, the proponent uses Equation 2 if initial carbon stocks (as determined from the initial forest carbon inventory, see Section 9.1) are above the average baseline scenario carbon stocks and Equation 3 if initial carbon stocks are lower than the average baseline scenario carbon stocks. The proponent must repeat this process for each calendar year covered by a reporting period until the “IF” statement in Equation 2 or 3 is satisfied.

The proponent does not need to repeat this process if the baseline has been dynamically updated as per Section 3.2.3. If the “IF” statement in Equation 2 or 3 has already been satisfied, the proponent must use the updated averaged baseline scenario carbon stocks to calculate $\Delta\mathrm{SC_{Baseline,C}}$ using Equation 6, where $\mathrm{SC_{Baseline,C-1}}$ is the previous average baseline scenario carbon stocks. In all subsequent calendar years covered by a reporting period, Equation 7 must be used. If the “IF” statement in either Equation 2 or 3 has not been satisfied upon updating the baseline, the proponent must use the updated total baseline scenario carbon stocks to calculate $\Delta\mathrm{SC_{Baseline,C}}$ in each calendar year covered by a reporting period until the relevant “IF” statement is satisfied.

Equation 2: Determining whether average baseline scenario carbon stocks are used to determine $\Delta SC_{Baseline,C}$ for the remainder of the crediting period when initial carbon stocks are greater than average carbon stocks

$$\text{IF } SC_{Baseline,C} + SC_{Baseline,HWP,C} \leq SC_{Baseline,AVG},$$
$$\text{then } SC_{Baseline,AVG} \text{ is used for remainder of crediting period}$$

Parameter	Description	Units
$SC_{Baseline,C}$	Total baseline scenario carbon stocks for a calendar year covered by the reporting period, as per Equation 4	t CO_2e
$SC_{Baseline,HWP,C}$	Total baseline scenario carbon that would have been stored in harvested wood products for 100 years after harvest for a calendar year covered by the reporting period, as per Equation 13 (SSR B8)	t CO_2e
$SC_{Baseline,AVG}$	Average baseline scenario carbon stocks based on the 100-year growth and harvesting regime that represents the baseline scenario, as determined in Section 9.2.3	t CO_2e
C	Calendar year	unitless

Equation 3: Determining whether average baseline scenario carbon stocks are used to determine $\Delta SC_{Baseline,C}$ for the remainder of the crediting period when initial carbon stocks are less than average carbon stocks

$$\text{IF } SC_{Baseline,C} + SC_{Baseline,HWP,C} \geq SC_{Baseline,AVG},$$
$$\text{then } SC_{Baseline,AVG} \text{ is used for remainder of crediting period}$$

Parameter	Description	Units
$SC_{Baseline,C}$	Total baseline scenario carbon stocks for a calendar year covered by the reporting period, as per Equation 4	t CO_2e
$SC_{Baseline,HWP,C}$	Total baseline scenario carbon stocks that would have been stored in harvested wood products for 100 years after harvest for a calendar year covered by the reporting period, as per Equation 13 (SSR B8)	t CO_2e
$SC_{Baseline,AVG}$	Average baseline scenario carbon stocks based on the 100-year growth and harvesting regime that represents the baseline scenario, as determined in Section 9.2.3	t CO_2e
C	Calendar year	unitless

Equation 4: Total baseline scenario carbon stocks for a calendar year covered by the reporting period

$$SC_{Baseline,C} = \left(SC_{B1,C} + SC_{B2,C} + SC_{B4,C} + SC_{B5,C} + SC_{B6,C} + SC_{B7,C}\right) \times 3.667$$

Parameter	Description	Units
$SC_{Baseline,C}$	Total baseline scenario carbon stocks for a calendar year covered by the reporting period	t CO_2e
$SC_{B1,C}$	Total baseline scenario carbon stored in SSR B1 for a calendar year covered by the reporting period	t C
$SC_{B2,C}$	Total baseline scenario carbon stored in SSR B2 for a calendar year covered by the reporting period	t C
$SC_{B4,C}$	Total baseline scenario carbon stored in SSR B4 for a calendar year covered by the reporting period	t C
$SC_{B5,C}$	Total baseline scenario carbon stored in SSR B5 for a calendar year covered by the reporting period, if required to be included as per Table 1	t C
$SC_{B6,C}$	Total baseline scenario carbon stored in SSR B6 for a calendar year covered by the reporting period, if required to be included as per Table 1	t C
$SC_{B7,C}$	Total baseline scenario carbon stored in SSR B7 for a calendar year covered by the reporting period, if required to be included as per Table 1	t C
3.667	Conversion factor to convert to t CO_2e	unitless
C	Calendar year	unitless

In the years prior to the year when the total baseline scenario carbon stocks are equal to the average baseline scenario carbon stocks, the proponent uses Equation 5 to determine $\Delta SC_{Baseline,C}$. During these years, $\Delta SC_{Baseline,C}$ will most likely be negative for projects where initial carbon stocks are higher than average baseline scenario carbon stocks and positive when lower than average baseline scenario carbon stocks.

Equation 5: Change in baseline scenario carbon stocks for a calendar year covered by the reporting period

$$\Delta SC_{Baseline,C} = SC_{Baseline,C} - SC_{Baseline,C-1}$$

Parameter	Description	Units
$\Delta SC_{Baseline,C}$	Change in baseline scenario carbon stocks for a calendar year covered by the reporting period	t CO_2e
$SC_{Baseline,C}$	Total baseline scenario carbon stocks for a calendar year covered by the reporting period, as per Equation 4	t CO_2e
$SC_{Baseline,C-1}$	Total baseline scenario carbon stocks for the previous calendar year covered by the reporting period or reported in the final year of	t CO_2e

Parameter	Description	Units
	the previous project report if calendar year C represents the beginning of a new reporting period	
C	Calendar year	unitless
C-1	Previous calendar year covered by the reporting period, or the final year covered by the previous project report if calendar year C represents the beginning of a new reporting period	unitless

In the year in which total baseline scenario carbon stocks are now equal to average baseline scenario carbon stocks (i.e., the year in which the "IF" statement in Equation 2 or 3 is satisfied), the proponent must use Equation 6 to calculate $\Delta SC_{\mathrm{Baseline,C}}$.

Equation 6: Change in baseline scenario carbon stocks when total baseline scenario carbon stocks equal average baseline scenario carbon stocks for a calendar year covered by the reporting period

$$\Delta \mathrm{SC}_{\mathrm{Baseline,C}} = \mathrm{SC}_{\mathrm{Baseline,AVG}} - \mathrm{SC}_{\mathrm{Baseline,C-1}}$$

Parameter	Description	Units
$\Delta \mathrm{SC}_{\mathrm{Baseline,C}}$	Change in baseline scenario carbon stocks for a calendar year covered by the reporting period	t CO_2e
$\mathrm{SC}_{\mathrm{Baseline,AVG}}$	Average baseline scenario carbon stocks based on the 100-year growth and harvesting regime that represents the baseline scenario, as per Section 9.2.3	t CO_2e
$\mathrm{SC}_{\mathrm{Baseline,C-1}}$	Total baseline scenario carbon stocks for the previous calendar year covered by the reporting period or reported in the final year of the previous project report if calendar year C represents the beginning of a new reporting period	t CO_2e
C	Calendar year	unitless
C-1	Previous calendar year covered by the reporting period, or the final year covered by the previous project report if calendar year C represents the beginning of a new reporting period	unitless

In all subsequent years after the year in which the total baseline scenario carbon stocks equal the average baseline scenario carbon stocks, the proponent must use Equation 7 to calculate $\Delta SC_{\mathrm{Baseline,C}}$.

Equation 7: Change in baseline scenario carbon stocks using average baseline scenario carbon stocks for a calendar year covered by the reporting period

$$\Delta \mathrm{SC}_{\mathrm{Baseline,C}} = 0$$

Parameter	Description	Units
$\Delta SC_{Baseline,C}$	Change in baseline scenario carbon stocks for a calendar year covered by the reporting period	t CO_2e
0	Default value for change in baseline scenario carbon stocks when using average baseline scenario carbon stocks. Average baseline scenario carbon stocks will be the same for each calendar year, resulting in no change in baseline scenario carbon stocks between calendar years or reporting periods for the remainder of the crediting period	unitless
C	Calendar year	unitless

8.1.1 Calculating baseline scenario carbon stored in harvested wood products (SSR B8)

The proponent must model the level of harvesting within the project site that would have occurred in the baseline scenario (see Section 3.2) following the requirements of Section 9.2 and convert this to an average annual harvesting volume by species to determine the baseline scenario carbon stocks for SSR B8. From this modelled harvest volume, the proponent must then determine the quantity of carbon that would have remained stored in harvested wood products 100 years after harvest using Steps 1-5 below. The proponent must use the same measured or default parameters used in the calculation of SSR P8 in Section 8.2.1 to calculate the carbon stored in SSR B8. For a project where the harvest in the project scenario is greater than or equal to harvest volumes in the baseline scenario, the proponent has the option to assume all the carbon in harvested wood is immediately emitted as CO_2.

Step 1: Determining the quantity of baseline scenario carbon in aboveground live tree biomass that would have been harvested and delivered to mill

The proponent must determine the quantity of baseline scenario carbon in aboveground live tree biomass (bole only, no bark) (SSR B1) that would have been harvested and delivered to mill for each calendar year within the reporting period.

If the model used to develop the baseline scenario carbon stocks provides the output in metric tonnes of carbon (t C) in the bole, without bark, for each species that would have been harvested, the proponent can skip to Step 2. The output data from the model for the quantity of baseline scenario carbon in aboveground live tree biomass that would have been harvested and delivered to mill for a calendar year within the reporting period is used in Equation 10.

If the model used to develop the baseline scenario carbon stocks does not provide the output metric tonnes of carbon (t C) in the bole, without bark, for each species that would have been harvested, the proponent must use Equation 8 if based on volume (m^3) and Equation 9 if based on green weight (kg) to determine the quantity of baseline scenario carbon in aboveground live tree biomass that would have been harvested and delivered to mill. A proponent following Equation 8 obtains the wood density factor (specific gravity) from Table 5-3a from the USFS Wood Handbook.[13] If a species is not listed in the

[13] Forest Products Laboratory. (2010). *Wood handbook — Wood as an engineering material* (General Technical Report FPL-GTR-190). U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. Madison, WI. 508 p.

USFS Wood Handbook, the proponent must select an appropriate substitute species, and any substitute must be consistently applied across the baseline and project scenarios.

Equation 8: Baseline scenario carbon in aboveground live tree biomass that would have been harvested and delivered to mill using wood volume for a calendar year covered by the reporting period

$$SC_{Baseline,dm,i,C} = (HV_{Baseline,i,C} \times WDF_i) \times 0.5$$

Parameter	Description	Units
$SC_{Baseline,dm,i,C}$	Baseline scenario carbon stored in aboveground live tree biomass that would have been harvested and delivered to mill calculated separately for each species for a calendar year covered by the reporting period	t C
$HV_{Baseline,i,C}$	Volume of harvested wood in the baseline scenario determined separately for each species for a calendar year covered by the reporting period	m^3
WDF_i	Wood density factor determined by species	$t\ m^{-3}$
0.5	Conversion factor to total carbon weight	unitless
C	Calendar year	unitless
i	Tree species	unitless

Equation 9: Baseline scenario carbon in aboveground live tree biomass that would have been harvested and delivered to mill using green weight of wood for a calendar year covered by the reporting period

$$SC_{Baseline,dm,i,C} = \frac{(HW_{Baseline,i,C} - WW_i) \times 0.5}{1000}$$

Parameter	Description	Units
$SC_{Baseline,dm,i,C}$	Baseline scenario carbon stored in aboveground live tree biomass that would have been harvested and delivered to mill calculated separately for each species for a calendar year within the reporting period	t C
$HW_{Baseline,i,C}$	Weight of harvested wood in the baseline scenario determined separately for each species for a calendar year within the reporting period	kg
WW_i	Water weight of wood based on moisture content of the wood harvested, determined by species	kg
0.5	Conversion factor to total carbon weight	unitless
1000	Conversion factor to convert from kg of carbon to metric tonnes of carbon	unitless

Parameter	Description	Units
C	Calendar year	unitless
i	Tree species	unitless

Step 2: Determining the quantity of baseline scenario carbon in aboveground live tree biomass that would have been transferred to wood products

The proponent must determine the total quantity of baseline scenario carbon in harvested aboveground live tree biomass (bole only, no bark) (SSR B1) delivered to mill that would have been transferred into wood products for each calendar year covered by the reporting period ($CHWP_{Baseline,i,C}$) using Equation 10.

The proponent must use the actual mill efficiencies (ME_i) from the mill or derived from monitored data, where available. The proponent must use mill efficiencies at the species level where available, otherwise an aggregate mill efficiency may be used. If data are not available on the actual mill efficiency or cannot be derived from monitored data, the proponent must use a default average mill efficiency factor of 40%[14], meaning 40% of the total carbon in harvested wood is assumed to be transferred to wood products. For projects located in British Columbia (B.C.), the proponent must use an average mill efficiency factor of 50%.[15] Any mill residues and by-products are considered to have been immediately emitted to the atmosphere under this methodology.

Equation 10: Baseline scenario carbon that would have been transferred to wood products for a calendar year covered by the reporting period

$$CHWP_{Baseline,i,C} = SC_{Baseline,dm,i,C} \times ME_i$$

Parameter	Description	Units
$CHWP_{Baseline,i,C}$	Baseline scenario carbon stored in aboveground live tree biomass that would have been transferred to wood products calculated separately for each species for a calendar year covered by the reporting period	t C
$SC_{Baseline,dm,i,C}$	Baseline scenario carbon stored in aboveground live tree biomass that would have been harvested and delivered to mill calculated separately for each species for a calendar year covered by the reporting period, as per Equation 8 or 9 (if used)	t C
ME_i	Mill efficiency determined separately for each species where available	unitless
C	Calendar year	unitless

[14] A Cradle-to-Gate Life Cycle Assessment of Canadian Surface Dry Softwood Lumber. March 2018. Table 8. http://www.athenasmi.org/wp-content/uploads/2018/07/CtoG-LCA-of-Canadian-Surfaced-Dry-Softwood-Lumber.pdf
[15] A Cradle-to-Gate Life Cycle Assessment of Surfaced Dry Softwood Lumber Produced in British Columbia. March 2021. Table 8. http://www.athenasmi.org/wp-content/uploads/2022/01/CtoG-LCA-of-BC-Surfaced-Dry-Softwood-Lumber-20210331-1.pdf

Parameter	Description	Units
i	Tree species	unitless

Step 3: Determining the quantity of baseline scenario carbon that would have been transferred to each wood product class

The proponent must determine the quantity of baseline scenario carbon that would have been transferred to each wood product class, calculated separately for each species if wood product classes are broken down by species, using Equation 11.

The proponent must first determine the percentage of harvested wood that would have ended up in each wood product class for each calendar year covered by the reporting period ($\mathrm{PC_{i,C}}$), determined separately for each species if data are available at the species level. The proponent must obtain $\mathrm{PC_{i,C}}$ by:

- Obtaining a report from the mill where the project site's logs are sold indicating the product class categories the mill sold that year;
- Providing peer-reviewed literature that identifies the wood product class breakdowns applicable to the geographic location where the project site is located; or
- If breakdowns for wood product classes are not available from either the mill or in peer-reviewed literature, percentage of harvested wood that would have ended up in each wood product class must be obtained from the *Emission Factors and Reference Values* document.

Equation 11: Baseline scenario carbon that would have been transferred to each wood product class for a calendar year covered by the reporting period

$$\mathrm{CWPC_{Baseline,i,C}} = \mathrm{CHWP_{Baseline,i,C}} \times \mathrm{PC_{i,C}}$$

Parameter	Description	Units
$\mathrm{CWPC_{Baseline,i,C}}$	Baseline scenario carbon that would have been transferred to each product class calculated for each species (if wood product classes are broken down by species) for a calendar year covered by reporting period	t C
$\mathrm{CHWP_{Baseline,i,C}}$	Baseline scenario carbon stored in aboveground live tree biomass that would have been transferred to wood products calculated separately for each species (if mill efficiency was broken down by species) for a calendar year covered by the reporting period, as per Equation 10	t C
$\mathrm{PC_{i,C}}$	Percentage of harvest that ends up in each product class for each species (if data is broken down by species) for a calendar year covered by the reporting period	%
C	Calendar year	unitless
i	Tree species	unitless

Step 4: Determining the quantity of baseline scenario carbon that would have been stored in harvested wood products for 100 years after harvest for each wood product class

The proponent must determine the quantity of baseline scenario carbon stored in harvested wood products for each wood product class for each species (if Equation 11 was broken down by species) using Equation 12.

The proponent must estimate the carbon stored in harvested wood products 100 years after harvest by applying the appropriate 100-year storage factor based on the wood product class as set out in the *Emission Factors and Reference Values* document.

If the percentage of harvested wood that ends up in each wood product class was obtained from the *Emission Factors and Reference Values* document in Step 3, the proponent must use a weighted average of the 100-year storage factors for softwood plywood, oriented strandboard and non-structural panels in order to assign a 100-year storage factor to panels. Pulp and paper and fuelwood do not have storage factors as it is assumed that there would be no carbon remaining in these products after 100 years.

Equation 12: Baseline scenario carbon that would have been stored in harvested wood projects 100 years after harvest for a calendar year covered by the reporting period

$$\mathrm{SCHWP}_{\mathrm{Baseline,i,j,C}} = \mathrm{CWPC}_{\mathrm{Baseline,i,C}} \times \mathrm{SF}_{\mathrm{j}}$$

Parameter	Description	Unit
$\mathrm{SCHWP}_{\mathrm{Baseline,i,j,C}}$	Baseline scenario carbon that would have been stored in harvested wood products 100 years after harvest for each species (if broken down by species) for a calendar year covered by the reporting period for each wood product class	t C
$\mathrm{CWPC}_{\mathrm{Baseline,i,C}}$	Baseline scenario carbon that would have been transferred to each product class calculated for each species (if wood product classes are broken down by species) for a calendar year covered by the reporting period, as per Equation 11	t C
SF_{j}	100-year storage factor by wood product class, as set out in the *Emission Factors and Reference Values* document	unitless
C	Calendar year	unitless
i	Tree species	unitless
j	Wood product class	unitless

Step 5: Determining the total quantity of baseline scenario carbon that would have been stored in harvested wood products for 100 years after harvest

Finally, to determine the total quantity of baseline scenario carbon that would have been stored in harvested wood products 100 years after harvest (SSR B8), the proponent must sum all the resulting values from Step 4 across all species (if calculated separately for each species) using Equation 13.

Equation 13: Total amount of baseline scenario carbon that would have been stored in harvested wood products 100 years after harvest for a calendar year covered by the reporting period

$$SC_{Baseline,HWP,C} = \sum_{i,j}^{n} [\, SCHWP_{Baseline,i,j,C} \times 3.667]$$

Parameter	Description	Units
$SC_{Baseline,HWP,C}$	Total baseline scenario carbon that would have remained stored in harvested wood products for 100 years after harvest for a calendar year covered by the reporting period (SSR B8)	t CO_2e
$SCHWP_{Baseline,i,j,C}$	Baseline scenario carbon that would have been stored in harvested wood products 100 years after harvest for each species (if broken down by species) for a calendar year covered by the reporting period for each wood product class, as per Equation 12	t C
3.667	Conversion factor to convert to t CO_2e	unitless
C	Calendar year	unitless
i	Tree species	unitless
j	Wood product class	unitless
n	Number of combination of species and wood product class	unitless

8.2 Project scenario GHG removals

The proponent must use Equation 14 and the subsequent equations in Section 8.2 to quantify the project scenario GHG removals for each full or partial calendar year covered by the reporting period, based on the included SSRs outlined in Table 1.

The project scenario GHG removals are quantified by calculating the total project scenario carbon stocks and quantifying the incremental change in project scenario carbon stocks throughout the crediting period.

Project scenario carbon stocks are determined from the initial forest carbon inventory and by periodically updating the forest carbon inventory (see Section 9.1). This is supported by model projections (see Section 9.2) in the years the forest carbon inventory is not updated. The proponent will need the following information to determine project scenario carbon stocks:

1. Total project scenario carbon stocks for each calendar year covered by the reporting period for each included SSR as per Table 1 (i.e., $SC_{P1,C}$, $SC_{P2,C}$ and $SC_{P4,C}$, as well as $SC_{P5,C}$, $SC_{P6,C}$ and $SC_{P7,C}$ if included as per Table 1), determined following the requirements of Sections 9.1 and 9.2;
2. Total project scenario carbon stocks for the previous calendar year covered by the reporting period and reported on in the previous project report (i.e., $SC_{Project,C-1}$);

3. Quantity of biomass burned during each calendar year covered by the project report (i.e., $\mathrm{SC}_{\mathrm{Burn,C}}$), determined by updating the forest carbon inventory following the requirements of Section 9.1; and
4. Annual harvest volume (i.e., $\mathrm{HV}_{\mathrm{Baseline,i,C}}$ or $\mathrm{HW}_{\mathrm{Baseline,i,C}}$), as determined by updating the forest carbon inventory by following the requirements of Section 9.1.

Equation 14: Project scenario GHG removals for a calendar year covered by the reporting period

$$\mathrm{PR}_{\mathrm{C}} = (\Delta\mathrm{SC}_{\mathrm{Project,C}} + \mathrm{SC}_{\mathrm{Project,HWP,C}} - \mathrm{GHG}_{\mathrm{Project,C}} - \mathrm{L}_{\mathrm{Activity,C}} - \mathrm{L}_{\mathrm{Market,C}}) - \mathrm{PER}$$

Parameter	Description	Units
PR_{C}	Project scenario GHG removals for a calendar year covered by the reporting period	t CO_2e
$\Delta\mathrm{SC}_{\mathrm{Project,C}}$	Change in project scenario carbon stocks for a calendar year covered by the reporting period, as per Equation 15	t CO_2e
$\mathrm{SC}_{\mathrm{Project,HWP,C}}$	Total project scenario carbon remaining stored in harvested wood products for 100 years after harvest for a calendar year covered by the reporting period, as per Equation 25 (SSR P8)	t CO_2e
$\mathrm{GHG}_{\mathrm{Project,C}}$	Total GHG emissions as a result of carrying out the project activities for a calendar year covered by the reporting period, as per Equation 17 (SSR P10)	t CO_2e
$\mathrm{L}_{\mathrm{Activity,C}}$	Total change in carbon stored on controlled lands for a calendar year covered by the reporting period to capture activity-shifting leakage, as per Equation 28 (SSR P13)	t CO_2e
$\mathrm{L}_{\mathrm{Market,C}}$	Total carbon lost due to market leakage risk for a calendar year covered by the reporting period, as per Equation 29 or Equation 30 (SSR P14)	t CO_2e
PER	Deduction to account for GHG reductions credited to the project in a previous GHG offset credit system, as per Section 3.2.2. This value is only applied in the first reporting period and is subsequently treated as negative GHG reductions as per Section 8.5	t CO_2e
C	Calendar year	unitless

The proponent must use Equation 15 to determine the total change in project scenario carbon stocks for a calendar year covered by the reporting period.

Equation 15: Calculating change in project scenario carbon stocks for a calendar year covered by the reporting period

$$\Delta\mathrm{SC}_{\mathrm{Project,C}} = \left[\mathrm{SC}_{\mathrm{Project,C}} \times (1 - \mathrm{UF}_{\mathrm{C}})\right] - \left[\mathrm{SC}_{\mathrm{Project,C-1}} \times (1 - \mathrm{UF}_{\mathrm{C-1}})\right]$$

Parameter	Description	Units
$\Delta SC_{Project,C}$	Change in project scenario carbon stocks for a calendar year covered by the reporting period	t CO_2e
$SC_{Project,C}$	Total project scenario carbon stocks for a calendar year covered by the reporting period, as per Equation 16	t CO_2e
UF_C	Uncertainty factor to reflect uncertainty for a calendar year covered by the reporting period, as per Section 8.3	%
$SC_{Project,C-1}$	Total project scenario carbon stocks in the previous calendar year covered by the reporting period or reported in the final calendar year of the previous project report if calendar year C represents the beginning of a new reporting period, unless a reversal has occurred in the previous calendar year, in which case the total carbon stocks reported in the reversal report are used	t CO_2e
UF_{C-1}	Uncertainty factor to reflect uncertainty for the previous calendar year covered by the reporting period or reported in the final calendar year of the previous project report if calendar year C represents the beginning of a new reporting period, unless a reversal has occurred since the previous project report, in which case the uncertainty factor that was re-calculated as a part of updating the forest carbon inventory after the reversal is used	%
C	Calendar year	unitless
$C\text{-}1$	Previous calendar year covered by the reporting period or the final calendar year in the previous project report if calendar year C represents the beginning of a new reporting period	unitless

In Equation 16, the proponent must include $SC_{P7,C}$ only if it is less than $SC_{B7,C}$ in Equation 4 for a given calendar year covered by the reporting period.

Equation 16: Total project scenario carbon stocks for a calendar year covered by the reporting period

$$SC_{Project,C} = \left(SC_{P1,C} + SC_{P2,C} + SC_{P4,C} + SC_{P5,C} + SC_{P6,C} + SC_{P7,C}\right) \times 3.667$$

Parameter	Description	Units
$SC_{Project,C}$	Total project scenario carbon stocks for a calendar year covered by the reporting period	t CO_2e
$SC_{P1,C}$	Total project scenario carbon stored in SSR P1 for a calendar year covered by the reporting period	t C
$SC_{P2,C}$	Total project scenario carbon stored in SSR P2 for a calendar year covered by the reporting period	t C

Parameter	Description	Units
$SC_{P4,C}$	Total project scenario carbon stored in SSR P4 for a calendar year covered by the reporting period	t C
$SC_{P5,C}$	Total project scenario carbon stored in SSR P5 for a calendar year covered by the reporting period, if required to be included as per Table 1	t C
$SC_{P6,C}$	Total project scenario carbon stored in SSR P6 for a calendar year covered by the reporting period, if required to be included as per Table 1	t C
$SC_{P7,C}$	Total project scenario carbon stored in SSR P7 for a calendar year covered by the reporting period, if required to be included as per Table 1	t C
3.667	Conversion factor to convert to t CO_2e	unitless
C	Calendar year	unitless

The proponent must determine the quantity of GHG emissions associated with the burning of biomass as a result of carrying out the project activities. Only methane (CH_4) and nitrous oxide (N_2O) emissions are included in quantification, as the quantity of CO_2 that is burned is captured through updating plot data in the forest carbon inventory after harvest following the requirements of Section 9.1. The proponent must use Equation 17 to determine the total quantity of GHG emissions occurring in the project scenario for a calendar year covered by the reporting period, to be used in Equation 14. The proponent must include all SSRs impacted by burning and must follow the requirements of Section 9.1 to determine the amount of carbon in bark, tops, branches and deadwood that is burned to inform the value of $SC_{burn,C}$ to be used in Equations 18 and 19 below.

For calendar years where no burning of biomass occurs, the value of $GHG_{Project,C}$ is 0.

Equation 17: Total GHG emissions released in the project scenario for a calendar year covered by the reporting period

$$GHG_{Project,C} = GHG_{Project,CH4,C} + GHG_{Project,N2O,C}$$

Parameter	Description	Units
$GHG_{Project,C}$	Total GHG emissions as a result of carrying out the project activities for a calendar year covered by the reporting period (SSR P10)	t CO_2e
$GHG_{Project,CH4,C}$	CH_4 emissions from the burning of biomass in the project scenario for a calendar year covered by the reporting period (SSR P10), as per Equation 18	t CO_2e
$GHG_{Project,N2O,C}$	N_2O emissions from the burning of biomass in the project scenario for a calendar year covered by the reporting period (SSR P10), as per Equation 19	t CO_2e

Parameter	Description	Units
C	Calendar year	unitless

Equation 18: CH_4 emissions from the burning of biomass in the project scenario for a calendar year covered by the reporting period

$$GHG_{Project,CH4,C} = SC_{Burn,C} \times ER_{CH4} \times \frac{16}{12} \text{ x } GWP_{CH4}$$

Parameter	Description	Units
$GHG_{Project,CH4,C}$	CH_4 emissions from the burning of biomass in the project scenario for a calendar year covered by the reporting period (SSR P10)	t CO_2e
$SC_{Burn,C}$	Carbon stocks burned from the combustion of biomass for a calendar year covered by the reporting period	t C
ER_{CH4}	Emission ratio for the mass of CH_4 released relative to the mass of total carbon lost from burning. The proponent must use local data on combustion efficiency if available, otherwise the proponent uses the default value of 0.012 (IPCC, Good Practice Guidance for Land Use, Land-Use Change and Forestry (GPG-LUCUCF), 2003, Table 3A.1.15, Annex 3A.1)	unitless
$\frac{16}{12}$	Ratio of the molar mass of CH_4 to C	unitless
GWP_{CH4}	GWP of CH_4, as set out in Schedule 3 to the Act	unitless
C	Calendar year	unitless

Equation 19: N_2O emissions from the burning of biomass in the project scenario for a calendar year covered by the reporting period

$$GHG_{Project,N2O,C} = SC_{Burn,C} \times N/C_{ratio} \times ER_{N2O} \times \frac{44}{28} \text{ x } GWP_{N2O}$$

Parameter	Description	Units
$GHG_{Project,N2O,C}$	N_2O emissions from the burning of biomass in the project scenario for a calendar year covered by the reporting period (SSR P10)	t CO_2e
$SC_{Burn,C}$	Carbon stocks burned from the combustion of biomass for a calendar year covered by the reporting period	t C
N/C_{ratio}	Ratio of N to C in the fuel. The proponent uses the IPCC 2003 default value of 0.01 (3.2.1.4.2.2, Chapter 3, GPG-LULUCF)	unitless
ER_{N2O}	Emission ratio for the mass of N_2O released relative to the mass of total nitrogen lost from burning. The proponent must use local data on combustion efficiency if available, otherwise the proponent	unitless

Parameter	Description	Units
	uses the IPCC 2003 default value of 0.007 (Table 3A.1.15, Annex 3A.1, GPG-LULUCF)	
$\frac{44}{28}$	Ratio of the molar mass of N_2O to N	unitless
GWP_{N2O}	GWP of N_2O, as set out in Schedule 3 to the Act	unitless
C	Calendar year	unitless

8.2.1 Calculating project scenario carbon stored in harvested wood products (SSR P8)

The proponent must determine the carbon stocks associated with wood harvested from within the project site (SSR P8) for each calendar year covered by the reporting period for the purpose of producing harvested wood products. The proponent must use the measured harvest volumes from updating the forest carbon inventory following the requirements of Section 9.1, combined with mill receipts, to determine the total biomass harvested from the forest. Trees of non-commercial sizes and species must be excluded from the quantification of total harvest. The proponent must determine the quantity of carbon remaining stored in harvested wood products for 100 years after harvest using steps 1-5 below. For a project where the harvest in the project scenario is greater than or equal to harvest volumes in the baseline scenario, the proponent may assume all the carbon in harvested wood is immediately emitted as CO_2.

Step 1: Determining the quantity of project scenario carbon in aboveground live tree biomass harvested and delivered to mill

The proponent must determine the quantity of carbon in aboveground live tree biomass (bole only, no bark) (SSR P1) that is harvested and delivered to mill for each calendar year covered by the reporting period.

The proponent must use actual harvested wood volumes, and the species reported must be based on 3rd party scaling reports or weigh tickets. If such documentation is not available, the proponent must gather other supporting documentation to justify the quantity of wood volume harvested stated in the project report.

The proponent must determine the quantity of carbon in aboveground live tree biomass (bole only, no bark) (SSR P1) that was harvested and sent to mill for a calendar year covered by the reporting period using Equation 20 if based on harvest volume (m^3) or Equation 21 if based on green weight (kg). A proponent following Equation 20 obtains the wood density factor (specific gravity) from Table 5-3a from the USFS Wood Handbook.[13] If a species is not listed in the USFS Wood Handbook, the proponent must select an appropriate substitute species, and any substitute must be consistently applied across the baseline and project scenarios.

Equation 20: Project scenario carbon in aboveground live tree biomass delivered to mill using wood volume for a calendar year covered by the reporting period

$$SC_{Project,dm,i,C} = (HV_{Project,i,C} \times WDF_i) \times 0.5$$

Parameter	Description	Units
$SC_{Project,dm,i,C}$	Project scenario carbon stored in aboveground live tree biomass harvested and delivered to a mill calculated separately for each species for a calendar year covered by the reporting period	t C
$HV_{Project,i,C}$	Volume of harvested wood in the project scenario determined separately for each species for a calendar year covered by the reporting period	m^3
WDF_i	Wood density factor determined by species	t m^{-3}
0.5	Conversion factor to total carbon weight	unitless
C	Calendar year	unitless
i	Tree species	unitless

Equation 21: Project scenario carbon in aboveground live tree biomass delivered to mill using green weight of wood for a calendar year covered by the reporting period

$$SC_{Project,dm,i,C} = \frac{(HW_{Project,i,C} - WW_i) \times 0.5}{1000}$$

Parameter	Description	Units
$SC_{Project,dm,i,C}$	Project scenario carbon stored in aboveground live tree biomass harvested and delivered to a mill calculated separately for each species for a calendar year covered by the reporting period	t C
$HW_{Project,i,C}$	Weight of harvested wood in the project scenario for a calendar year covered by the reporting period	kg
WW_i	Water weight of wood based on moisture content of the wood harvested, determined by species	kg
0.5	Conversion factor to total carbon weight	unitless
1000	Conversion factor to convert from kg of carbon to metric tonnes of carbon	unitless
C	Calendar year	unitless
i	Tree species	unitless

Step 2: Determining the quantity of project scenario carbon in aboveground live tree biomass transferred to wood products

The proponent must determine the total quantity of project scenario carbon in harvested aboveground live tree biomass (bole only, no bark) (SSR P1) delivered to mill and transferred into wood products for each calendar year covered by the reporting period ($CHWP_{Project,i,C}$) using Equation 22.

The proponent must use the actual mill efficiencies (ME_i) from the mill or derived from monitored data, where available. The proponent must use mill efficiencies at the species level where available, otherwise an aggregate mill efficiency may be used. If data are not available on the actual mill efficiency or cannot be derived from monitored data, the proponent must use a default average mill efficiency factor of 40%[14], meaning 40% of the total carbon in harvested wood is transferred to wood products. For projects located in B.C., the proponent must use an average mill efficiency factor of 50%.[15] Any mill residues and by-products are considered to have been immediately emitted as CO_2 under this methodology.

Equation 22: Project scenario carbon transferred to wood products for a calendar year covered by the reporting period

$$CHWP_{Project,i,C} = SC_{Project,dm,i,C} \times ME_i$$

Parameter	Description	Units
$CHWP_{Project,i,C}$	Project scenario carbon stored in aboveground live tree biomass transferred to wood products calculated separately for each species for a calendar year covered by the reporting period	t C
$SC_{Project,dm,i,C}$	Project scenario carbon stored in aboveground live tree biomass harvested and delivered to a mill calculated separately for each species for a calendar year covered by the reporting period, as per Equation 20 or 21 (if used)	t C
ME_i	Mill efficiency determined separately for each species where available	%
C	Calendar year	unitless
i	Tree species	unitless

Step 3: Determining the quantity of project scenario carbon transferred to each wood product class

The proponent must determine the quantity of project scenario carbon that is transferred to each wood product class, determined separately for each species if wood product classes are broken down by species, using Equation 23.

The proponent must first determine the percentage of harvested wood that ends up in each wood product class for each calendar year covered by the reporting period ($PC_{i,C}$), determined separately for each species if data are available at the species level. The proponent can obtain $PC_{i,C}$ by:

- Obtaining a report from the mill where the project site's logs are sold indicating the product class categories the mill sold that year;
- Providing peer-reviewed literature that identifies the wood product class breakdowns applicable to the geographic location where the project site is located; or
- If breakdowns by wood product classes are not available from either the mill or in peer-reviewed literature, percentage of harvested wood that ends up in each wood product class must be obtained from the *Emission Factors and Reference Values* document.

Equation 23: Project scenario carbon transferred to each wood product class for a calendar year covered by the reporting period

$$CWPC_{Project,i,C} = CHWP_{Project,i,C} \times PC_{i,C}$$

Parameter	Description	Units
$CWPC_{Project,i,C}$	Project scenario carbon transferred to each product class calculated for each species (if wood product classes are broken down by species) for a calendar year covered by the reporting period	t C
$CHWP_{Project,i,C}$	Project scenario carbon stored in aboveground live tree biomass transferred to wood products calculated separately for each species (if mill efficiency was broken down by species) for a calendar year covered by the reporting period, as per Equation 22	t C
$PC_{i,C}$	Percentage of harvest that ends up in each product class for each species (if data is broken down by species) for a calendar year covered by the reporting period	%
C	Calendar year	unitless
i	Tree species	unitless

Step 4: Determining the quantity of project scenario carbon stored in harvested wood products for 100 years after harvest for each wood product class

The proponent must determine the quantity of project scenario carbon stored in harvested wood products for each wood product class for each species, if Equation 23 was broken down by species, using Equation 24.

The proponent must estimate the carbon stored in harvested wood products 100 years after harvest by applying the appropriate 100-year storage factor based on the wood product class, as set out in the *Emission Factors and Reference Values* document.

If the percentage of harvested wood that ends up in each wood product class was obtained from the *Emission Factors and Reference Values* document in Step 3, the proponent must use a weighted average of the 100-year storage factors for softwood plywood, oriented strandboard and non-structural panels in order to assign a 100-year storage factor to panels. Pulp and paper and fuelwood do not have storage factors as it is assumed that there would be no carbon remaining in these products after 100 years.

Equation 24: Project scenario carbon stored in harvested wood products 100 years after harvest for a calendar year covered by the reporting period

$$SCHWP_{Project,i,j,C} = CWPC_{Project,i,C} \times SF_j$$

Parameter	Description	Units
$SCHWP_{Project,i,j,C}$	Project scenario carbon stored in harvested wood products 100 years after harvest for each species (if broken down by species) for a calendar year covered by the reporting period for each wood product class	t C
$CWPC_{Project,i,C}$	Project scenario carbon transferred to each product class calculated for each species (if wood product classes are broken down by species) for a calendar year covered by the reporting period, as per Equation 23	t C
SF_j	100-year storage factor by wood product class, as set out in the *Emission Factors and Reference Values* document	unitless
C	Calendar year	unitless
i	Tree species	unitless
j	Wood product class	unitless

Step 5: Determining the total quantity of project scenario carbon stored in harvested wood products for 100 years after harvest

Finally, to determine the total quantity of project scenario carbon remaining stored in harvested wood products 100 years after harvest (SSR P8), the proponent must sum all the resulting values from step 4 across all species (if calculated separately for each species) using Equation 25.

Equation 25: Total quantity of project scenario carbon stored in harvested wood products 100 years after harvest for a calendar year covered by the reporting period

$$SC_{Project,HWP,C} = \sum_{i,j}^{n} \left[SCHWP_{Project,i,j,C} \times 3.667 \right]$$

Parameter	Description	Units
$SC_{Project,HWP,C}$	Total project scenario carbon stored in harvested wood products for 100 years after harvest for a calendar year covered by the reporting period (SSR P8)	t CO_2e
$SCHWP_{Project,i,j,C}$	Project scenario carbon remaining stored in harvested wood products 100 years after harvest for each species (if broken down by species) for a calendar year covered by the reporting period for each wood product class, as per Equation 24	t C
3.667	Conversion factor to convert to t CO_2e	unitless
C	Calendar year	unitless
i	Tree species	unitless

Parameter	Description	Units
j	Wood product class	unitless
n	Number of combination of species and wood product class	unitless

8.3 Quantification of sampling uncertainty

This section describes the process the proponent must follow to determine the uncertainty associated with carbon stock estimates due to sampling uncertainty when developing the forest carbon inventory (Section 9.1).

The proponent must apply an uncertainty factor for each full or partial calendar year covered by the reporting period to the total project scenario carbon stocks within the project site as per Equation 15. To determine this factor, the proponent must calculate the combined sampling error based on the measured forest carbon pools (i.e., SSR1, SSR2, and SSR4, as well as SSR5 and SSR6 if included as per Table 1) at a 90% confidence level, which is calculated as a percentage of the mean.

To determine the combined sampling error, the proponent must use Equation 26. Given that SSR7 is only measured in the initial forest carbon inventory and subsequently modelled, this SSR is not included in the calculation of the sampling error of the forest carbon inventory estimate.

Equation 26: Quantification of the combined sampling error for the forest carbon inventory estimate

$$E_{Sampling} = \left(\frac{\sqrt{(SE_{SSR1} \times SC_{SSR1,C})^2 + \left(SE_{SSR2} \times SC_{SSR2,C}\right)^2 + \ldots + (SE_{SSRn} \times SC_{SSRn,C})^2}}{\left|SC_{SSR1,C} + SC_{SSR2,C} + \ldots + SC_{SSRn,C}\right|} \right) \times 100$$

Parameter	Description	Units
$E_{Sampling}$	Combined sampling error at the 90% confidence level for the forest carbon inventory estimate	%
SE_{SSRn}	Sampling error as a percentage of the mean carbon pool estimate calculated separately for each SSR that represents a forest carbon pool that is measured in the forest carbon inventory, as per Equation 28	%
$SC_{SSRn,C}$	Mean metric tonnes of carbon per hectare determined separately for each included SSR that represents a forest carbon pool that is measured in the forest carbon inventory for a calendar year covered by the reporting period	t C ha^{-1}
$SSRn$	A given SSR that represents a forest carbon pool that is measured in the forest carbon inventory (e.g., SSR P1, SSR P2, etc.)	unitless
100	Conversion factor to convert to percentage	unitless
C	Calendar year	unitless

Equation 27: Sampling error as a percentage of the mean carbon pool estimate for each included SSR

$$\mathrm{SE_{SSRn}} = \frac{\mathrm{z^*} \times \sigma_{\mathrm{M,SSRn,C}}}{\mathrm{SC_{SSRn,C}}}$$

Parameter	Description	Units
$\mathrm{SE_{SSRn}}$	Sampling error as a percentage of the mean carbon pool estimate calculated separately for each included SSR that represents a forest carbon pool that is measured in the forest carbon inventory	%
$\mathrm{z^*}$	Critical value for a 90% confidence level. The proponent uses a default value of 1.645	unitless
$\sigma_{\mathrm{M,SSRn,C}}$	Standard error calculated separately for each included SSR that represents a forest carbon pool that is measured in the forest carbon inventory for a calendar year covered by the reporting period	unitless
$\mathrm{SC_{SSRn,C}}$	Mean metric tonnes of carbon per hectare determined separately for each included SSR that represents a forest carbon pool that is measured in the forest carbon inventory for a calendar year covered by the reporting period	t C $\mathrm{ha^{-1}}$
SSRn	A given SSR that represents a forest carbon pool that is measured in the forest carbon inventory (e.g., SSR P1, SSR P2, etc.)	unitless
C	Calendar year	unitless

The proponent must use the result of Equation 26 and Table 2 below to determine the uncertainty factor ($\mathrm{UF_C}$ in Equation 15) to be applied to the forest carbon inventory estimate of carbon stocks to quantify project scenario GHG removals for each calendar year covered by the reporting period. Under this methodology, the combined sampling error (expressed as a percentage of the total mean inventory estimate for forest carbon SSRs that are measured) must be lower than 20%.

The uncertainty factor is not applied to the baseline scenario.

The uncertainty factor must be updated each time the forest carbon inventory is updated, i.e., any time there are remeasurements (see Sections 9.1.2 and 9.1.3). In between updates to the inventory, the same uncertainty factor must be applied to each calendar year covered by the reporting period. If upon an update to the inventory a new uncertainty factor is calculated, the new uncertainty factor is applied to each calendar year covered by the current reporting period.

Table 2: Forest carbon inventory uncertainty factor[16]

$E_{Sampling}$	Uncertainty factor
0% – 5.0%	0%
5.1% – 19.9%	Sampling error % minus 5.0%
≥20%	100%

8.4 Leakage

A project that reduces harvest in the project scenario compared to baseline scenario levels poses a leakage risk, which includes both the activity-shifting leakage risk and market leakage risk.

If harvest levels are reduced in the project scenario compared to the baseline scenario, the proponent must follow the requirements outlined in Section 8.4.1 to determine the activity-shifting leakage risk ($L_{Activity,C}$) and Section 8.4.2 to determine the market leakage risk ($L_{Market,C}$) associated with a project. These values are to be used in Equation 14.

If harvest levels remain the same or are greater in the project scenario compared to the baseline scenario, it is conservatively assumed the project does not pose a leakage risk. In this case, the proponent must use a value of 0 for $L_{Activity,C}$ and $L_{Market,C}$ in Equation 14. This is the case for projects previously registered in a GHG offset credit system other than the one set out in the Regulations and that is using a baseline scenario where carbon stocks remain static at the levels indicated in the initial forest carbon inventory as per Section 3.2.2.

Under this protocol, activity-shifting leakage and market leakage are considered SSRs. GHG emissions as a result of leakage (Sections 8.4.1 and 8.4.2) are incorporated directly into the quantification of the project scenario GHG removals, so there is no leakage discount factor that corresponds with parameter C_i in the formula in subsection 20(1) and paragraph 20(3)(a) of the Regulations.

8.4.1 Activity-shifting leakage (SSR P13)

For a project where harvest is reduced within the project site, the proponent does not have to account for activity-shifting leakage if it can be demonstrated that there is no risk of activity-shifting leakage within all controlled lands. Acceptable evidence includes:

- Controlled lands are not forestlands or are not legally able to be harvested (e.g., conservation areas).
- All lands controlled and/or owned by the forest operator are included within the project site.
- Covenants, conservation easements, existing right of ways, or other restrictions are in place on all controlled lands, and the restrictions are in place for an equivalent or greater length of

[16] Projects cannot have an $E_{Sampling}$ that is greater than 20%, therefore the corresponding uncertainty factor is 100%. Project proponents that calculate an $E_{Sampling}$ at 20% must increase the sampling intensity until an $E_{Sampling}$ of less than 20% is achieved.

time compared to the project period. The restrictions must demonstrate that the activity-shifting leakage risk is 0, such as putting limits on the level of harvest.

- Historical records that establish baseline harvesting trends for controlled lands to be compared to the project scenario, and that demonstrate there are no increases in the trend of harvesting levels, using a historical lookback period of 10 years.
- Forest management plans prepared a minimum of two years prior to the project start date that demonstrate harvest plans on all controlled lands to compare to the project scenario to ensure no deviation from management plans has occurred on controlled lands.

If the proponent is not able to demonstrate that there is no risk of activity-shifting leakage, the proponent must determine the change in carbon storage in the aboveground live tree biomass harvested and delivered to mill for all controlled lands within the same province or territory as the project site and quantify the change in carbon storage as a result of activity-shifting leakage using Equation 28. The proponent must use the same methods used for establishing the baseline scenario and project scenario aboveground live tree biomass harvested and delivered to mill for the project site to establish equivalent values for the controlled lands.

Equation 28: Total change in the carbon storage associated with activity-shifting leakage for a calendar year covered by the reporting period

$$L_{Activity,C} = (SC_{ProjectCL,dm,i,C} - SC_{BaselineCL,dm,i,C}) \times 3.667$$

Parameter	Description	Units
$L_{Activity,C}$	Total change in carbon stored in controlled lands for a calendar year covered by the reporting period to capture activity-shifting leakage	t CO_2e
$SC_{ProjectCL,dm,i,C}$	Project scenario carbon stored in aboveground live tree biomass harvested and delivered to a mill for a calendar year covered by the reporting period for controlled lands, calculated separately for each species, determined using Equations 20 or 21 following the requirements of Step 1 in Section 8.2.1	t C
$SC_{BaselineCL,dm,i,C}$	Baseline scenario carbon stored in aboveground live tree biomass harvested and delivered to mill calculated separately for each species for a calendar year covered by the reporting period for controlled lands, determined using Equations 8 or 9 or models, following the requirements of Step 1 in Section 8.1.1	t C
3.667	Conversion factor to convert to t CO_2e	unitless
C	Calendar year	unitless

8.4.2 Market leakage (SSR P14)

The proponent of a project that poses a market leakage risk by reducing harvest levels compared to the baseline scenario must select the regional market leakage factor that applies to their project using

Table 5 in Schedule A based on the geographic location of the project site.[17] In cases where a project site falls within two or more reconciliation units, the proponent must determine the weighted average of the applicable leakage factors based on the percent area of the project site that falls into each reconciliation unit.

The proponent has two options in applying the regional market leakage factor to the GHG reductions generated by the project for a given reporting period to determine the carbon lost as a result of market leakage risk:

1. The regional market leakage factor is applied to the total GHG reductions generated by the project (this option is best suited for projects where the only project activity carried out in the project scenario is conservation), in which case Equation 29 is used; or
2. The regional market leakage factor is applied only to GHG reductions that are related to harvesting activities, in which case Equation 30 is used.

Equation 29: Total carbon lost as a result of market leakage risk for a calendar year covered by the reporting period – option 1

$$\mathrm{L_{Market,C}} = (\Delta \mathrm{SC_{Project,C}} + \mathrm{SC_{Project,HWP,C}} - \mathrm{L_{Activity,C}} - \mathrm{BR_C}) \times \mathrm{LF}$$

Parameter	Description	Units
$\mathrm{L_{Market,C}}$	Total carbon lost due to market leakage risk during a calendar year covered by the reporting period	t CO_2e
$\Delta\mathrm{SC_{Project,C}}$	Change in project scenario carbon stocks for a calendar year covered by the reporting period, as per Equation 15	t CO_2e
$\mathrm{SC_{Project,HWP,C}}$	Total project scenario carbon remaining stored in harvested wood products for 100 years after harvest for a calendar year covered by the reporting period, as per Equation 25	t CO_2e
$\mathrm{L_{Activity,C}}$	Total change in carbon stored in controlled lands for a calendar year covered by the reporting period to capture activity-shifting leakage, as per Equation 28	t CO_2e
$\mathrm{BR_C}$	Baseline scenario GHG removals for a calendar year covered by the reporting period	t CO_2e
LF	Regional market leakage factor applicable to the project, as per Table 5 in Schedule A	%
C	Calendar year	unitless

The result of Equation 30 cannot be a negative value as this would result in a higher credit issuance when following Equation 14 and would not necessarily represent real GHG reductions. If the results of the calculation within the brackets is a negative number, the proponent must use a default value of 0 for $\mathrm{L_{Market,C}}$.

[17] A copy of a shapefile of the reconciliation units used to delineate regional market leakage factors is provided on ECCC's website to ensure accurate interpretation of the project location and selection of the applicable market leakage factor.

Equation 30: Total carbon lost as a result of market leakage risk for a calendar year covered by the reporting period – option 2

$$L_{Market,C} = (\Delta SC_{Market,C} + \Delta SC_{HWP,C} - L_{Activity,C}) \text{ x } LF$$

Parameter	Description	Units
$L_{Market,C}$	Total carbon lost due to market leakage risk for a calendar year covered by the reporting period	t CO_2e
$\Delta SC_{Market,C}$	Difference in carbon stocks as a result of biomass removed from the project site from harvest-related activities in the project scenario compared to the baseline scenario for a calendar year covered by the reporting period, as per Equation 31	t CO_2e
$\Delta SC_{HWP,C}$	Difference in carbon remaining stored in harvested wood products 100 years after harvest in the project scenario compared to the baseline scenario for a calendar year covered by the reporting period, as per Equation 32	t CO_2e
$L_{Activity,C}$	Total change in carbon stored in controlled lands for a calendar year covered by the reporting period to capture activity-shifting leakage, as per Equation 28	t CO_2e
LF	Regional market leakage factor applicable to the project, as per Table 5 in Schedule A	%
C	Calendar year	unitless

A proponent following Equation 30 must determine the quantity of carbon that is lost from the project site as a result of harvesting activities in the project scenario compared to the baseline scenario ($\Delta SC_{Market,C}$). To determine $\Delta SC_{Market,C}$, the proponent must determine the harvest efficiency ($HE_{i,C}$), which is the ratio of green weight harvested biomass to total green weight of woody biomass prior to harvest. The harvest efficiency captures the carbon lost from the project site after harvesting as a result of the following:

- Losses associated with harvesting that are assumed to be released into the atmosphere as CO_2 in the calculation of $SC_{Project,HWP,C}$, which includes branches, tops, etc. (i.e., all the biomass that is not in the bole); and
- Biomass that is combusted as a result of harvesting activities.

Harvest efficiency will be specific to the project based on the species harvested, harvesting equipment, and the forest management and silvicultural activities within the project site, as well as other relevant factors. As a result, the proponent must justify the harvest efficiency used in Equation 31 and demonstrate how the harvest efficiency was determined. In doing so, the proponent must consider tree species, age of trees at harvest, harvesting equipment and silvicultural treatment. The proponent must produce a harvest efficiency for each species harvested but may provide a single harvest efficiency if it can be demonstrated to not under-estimate leakage. The proponent must use the same harvest efficiency for the project and baseline scenarios.

Equation 31: Difference in carbon stocks as a result of harvest for a calendar year covered by the reporting period

$$\Delta SC_{Market,C} = \left[\left(\sum_{i} SC_{Baseline,dm,i,C} \div HE_{i,C}\right) - \left(\sum_{i} SC_{Project,dm,i,C} \div HE_{i,C}\right)\right] \text{ x } 3.667$$

Parameter	Description	Units
$\Delta SC_{Market,C}$	Difference in carbon stocks as a result of biomass removed from the project site from harvest-related activities in the project scenario compared to the baseline scenario for a calendar year covered by the reporting period	t CO_2e
$SC_{Baseline,dm,i,C}$	Baseline scenario carbon stored in aboveground live tree biomass that would have been harvested and delivered to a mill for a calendar year covered by the reporting period, calculated separately for each species, as per Equation 8 or 9 or from baseline modelling (see Step 1 in Section 8.1.1)	t C
$HE_{i,C}$	Harvest efficiency factor as justified by the proponent and determined separately for each species (if using a species-specific harvest efficiency)	unitless
$SC_{Project,dm,i,C}$	Project scenario carbon stored in aboveground live tree biomass harvested and delivered to a mill for a calendar year covered by the reporting period, calculated separately for each species, as per Equation 20 or 21	t C
3.667	Conversion factor to convert to t CO_2e	unitless
C	Calendar year	unitless
i	Tree species	unitless

Equation 32: Difference in carbon stored in harvested wood products for a calendar year covered by the reporting period

$$\Delta SC_{HWP,C} = SC_{Project,HWP,C} - SC_{Baseline,HWP,C}$$

Parameter	Description	Units
$\Delta SC_{HWP,C}$	Difference in carbon stored in harvested wood products 100 years after harvest in the project scenario compared to the baseline scenario for a calendar year covered by the reporting period	t CO_2e
$SC_{Project,HWP,C}$	Total project scenario carbon remaining stored in harvested wood products for 100 years after harvest achieved by the project for a calendar year covered by the reporting period (SSR P8), as per Equation 25	t CO_2e

Parameter	Description	Units
$SC_{Baseline,HWP,C}$	Total baseline scenario carbon that would have remained stored in harvested wood products for 100 years after harvest achieved by the project for a calendar year covered by the reporting period (SSR B8), as per Equation 13	t CO_2e
C	Calendar year	unitless

8.5 Project GHG reductions

The proponent must use Equation 33 to quantify the GHG reductions (ER_C) generated by the project, which correspond to the GHG reductions determined in accordance with section 20 of the Regulations.

Equation 33: Project GHG reductions for a calendar year covered by the reporting period

$$ER_C = PR_C - BR_C$$

Parameter	Description	Units
ER_C	Project GHG reductions for a calendar year covered by the reporting period	t CO_2e
PR_C	Project scenario GHG removals for a calendar year covered by the reporting period, as per Equation 14	t CO_2e
BR_C	Baseline scenario GHG removals for a calendar year covered by the reporting period, as per Equation 1	t CO_2e
C	Calendar year	unitless

In the first reporting period of a project, the GHG reductions may be negative as a result of the uncertainty factor applied to the project scenario or the deduction to account for GHG reductions credited to the project previously registered in a GHG offset credit system other than the one set out in the Regulations despite there being no net increase in GHG emissions compared to the baseline scenario.

In this case, any negative GHG reductions must be carried forward to the next period covered by a project report in accordance with subsection 20(5) of the Regulations. The absolute value of the negative GHG reductions (i.e., the net increase in GHG emissions) corresponds with variable D_i in subsection 29(2) of the Regulations. This balance will apply to the issuance of offset credits in the first calendar year of the next reporting period and is subsequently carried forward to each calendar year until enough GHG reductions have been generated to account for the entirety of the initial negative GHG reductions.

9.0 Measurement and data

9.1 Field measurement and forest carbon inventory development

9.1.1 General requirements for the forest carbon inventory

The proponent must determine the total carbon stocks within the project site by estimating the carbon stored in each of the included SSRs that represent forest carbon pools (i.e., SSR1, SSR2 and SSR4, as well as SSR5, SSR6 and SSR7 if included as per Table 1). The sum of the individual SSR carbon stocks represents the total carbon stocks for the project site (see Equation 16). Estimates of project scenario carbon stocks based on field measurements are used as the basis for establishing uncertainty in Section 8.3.

The proponent must estimate carbon stocks by developing a forest carbon inventory and must determine the initial carbon stocks for each included SSR, which represents the carbon stocks at the beginning of the crediting period.

The proponent may initiate the forest carbon inventory before the project registration date provided that carbon stocks are projected forward to the crediting period start date following the modelling requirements in Section 9.2. However, the forest carbon inventory must not have been initiated greater than three years prior to the date of submission of the registration application. The forest carbon inventory must still follow the requirements for updating the forest carbon inventory as per Section 9.1.2, meaning the inventory cannot go more than 10 years without being remeasured.

If a disturbance has occurred between the initiation of the forest carbon inventory and the submission of a project registration application, and the area impacted by the disturbance is equal to or greater than the area represented by a singular sample plot, the proponent must update the forest carbon inventory before the end of the first reporting period, following the requirements of Section 9.1.3.

The initial carbon stocks estimate from the inventory must represent the entire project site and be based on a complete forest carbon inventory with the required number of plots to achieve a 90% confidence level with a standard error of ±10% of the mean, as per Section 8.3, and this must be verified as a part of the initial project report. For inventories initiated prior to the submission of the project registration application, remeasurement of established plots or establishment of additional plots may be required to meet the sampling uncertainty requirements.

The proponent may use a provincial or territorial standard, or the procedures of the National Forest Inventory[18] for developing a forest carbon inventory. The proponent may also develop their own forest carbon inventory methodology. If the proponent develops their own methodology, the proponent must support the forest carbon inventory methodology selected with peer-reviewed literature and verifiable documentation, provide enough information to be repeatable by another forest professional and be demonstrated to produce accurate estimates of forest carbon stocks that do not overestimate carbon storage. Sampling and measurement methods used to develop the forest carbon inventory must be statistically sound and must be able to achieve the required level of uncertainty as per Section 8.3.

The proponent may supplement the forest carbon inventory estimations and subsequent modelled carbon stock estimates (see Section 9.1.2) with remote sensing technology. However, the proponent

[18] National Forest Inventory. (2008). Canada's National Forest Inventory Ground Sampling Guidelines: specifications for ongoing measurement, version 5.0. Available from http://nfi.nfis.org.

must still develop and continually update the forest carbon inventory using measurements from ground sample plots following the requirements described in this section to ground truth carbon stock estimates and true-up the forest carbon inventory. If the proponent chooses to use remote sensing technology, the proponent must not factor in the use of this technology into the calculation of sampling uncertainty in Section 8.3.

The proponent of an aggregation of projects may develop a single forest carbon inventory inclusive of all the projects within the aggregation. However, the proponent must generate estimates of carbon stocks (see 4 below) for each included SSR for each project within the aggregation.

The proponent must ensure that the forest carbon inventory provides the information necessary to estimate the carbon stocks for each included SSR that represents a forest carbon pool. All tree species within the sample plots, living and dead, must be measured regardless of the merchantability of the species.

All forest carbon inventories, regardless of the methodology used, must at a minimum include:

1. A description of the forest management activities, physical site characteristics, and land use patterns that influence carbon stocks within the project site, using this information to inform the initial design of the forest carbon inventory and estimates of carbon stocks. At a minimum, the proponent must have descriptions of how the following factors influenced inventory design:
    a. Age class distribution;
    b. Disturbance history;
    c. Harvesting practices employed;
    d. Vegetation type, species composition and species distribution of merchantable species;
    e. Topography;
    f. Legal and financial constraints that would impact plot selection[19];
    g. Ownership structure;
    h. Management history and planned management activities;
    i. Whether there is a legal restriction that mandates conservation (e.g., conservation easement) within the project site, and any associated land management and/or land use requirements; and
    j. Whether there are any known or potential threats of disease(s) or pest(s) that would impact the health of either the aboveground live tree carbon or standing dead tree carbon included in the forest carbon inventory.
2. For SSR1, SSR2 and SSR4, the methodology and sampling procedure to determine measured tree attributes that support the tree volume and/or biomass equations described in Section 9.1.4, with references to peer-reviewed literature or official government publications to support the chosen methodologies and procedures. Live tree-based estimates must include wood, bark, branches, and foliage. The methodology and sampling procedure must be described in enough detail that measurements could be easily replicated by any Registered Professional Forester or an equivalent forest professional. The description must include:
    a. Tools used for estimating tree or stand volume or biomass, such as for measuring height, diameter, age, density and plot, where relevant;

[19] There may be feasibility constraints that limit access to certain areas of the project site, or legal constraints that impact when and where areas of the project site could be accessed.

   b. Where and how to measure parameters used in volume and biomass equations, models, and associated calculations, such as diameter at breast height (DBH), height and age (including irregular trees);
   c. How structural loss is assessed when either live trees or standing dead trees are missing biomass (i.e., any deformities that reduce tree biomass, including cavities and broken tops);
   d. How deadwood is classified; and
   e. Any other aspect of sampling where a consistent method needs to be documented.
3. If SSR5, SSR6 and SSR7 are included, the proponent must follow the sampling requirements in Section 9.1.5 for SSR5 and SSR6, and Section 9.1.6 for SSR7.
4. A distinct inventory estimate for each included SSR representing forest carbon pools as per Sections 9.1.4, 9.1.5 and 9.1.6, including:
   a. Mean carbon stocks per hectare (t C ha^{-1}) by stratum;
   b. Total carbon stocks (t C) by stratum; and
   c. Total carbon stocks (t C) for the entire project site.
5. Stratification, including a description of the pre- and post-sampling stratification rules. The description must include a map of the strata, the area of each stratum, the tools used to develop the stratification (e.g., GIS, aerial photos), and a description of how the strata boundaries were determined (i.e., by age class, management regime, vegetation type, etc.).
6. Monumented plots, and a description of the procedure used to establish these plots. The proponent must include a description of the resulting plot layout and plot locations.
   a. The proponent must mark the plot center. The GPS coordinates of the plot centers must also be provided.
   b. The proponent must establish enough plots to reach the confidence level set for limiting uncertainty and ensuring accuracy as per Section 8.3. Plots can be added to the sampling pool if the initial plots are unable to reach the required confidence level.
   c. If randomly generated plots fall in a location that is inaccessible or hazardous, a new randomly generated plot can be selected.
7. Standards for minimum tree and plot size, and a justification for the chosen standards.
8. A procedure for the frequency for updating or replacing sample plots and the forest carbon inventory as a whole.
9. A log that documents any changes in the inventory methods or volume and biomass equations used to calculate carbon stocks. Once an inventory methodology is established for a project in the first project report, it must remain consistent for the entirety of the project period unless the proponent can demonstrate that a new methodology would achieve an equal or greater accuracy as compared to the initial inventory methodology. If changes of this nature do occur, they must be reflected in the change log.
10. Standard operating procedures for updating the forest carbon inventory, including procedures to account for:
    a. Harvest;
    b. Growth;
    c. Age;
    d. Mortality;
    e. Disturbance;
    f. Incorporating new inventory and plot data;
    g. Retiring older sample plots;
    h. Changes in modelling; and
    i. Application of appropriate uncertainty factor.

9.1.2 Updating the forest carbon inventory to capture growth

After the initial forest carbon inventory, the proponent must continue to quantify changes in carbon stocks for included SSRs representing forest carbon pools using periodic field measurements to update the forest carbon inventory (excluding SSR7, see Section 9.1.6). Inventory plot data must be remeasured at least every 10 years. A final complete inventory update must also take place in the last calendar year of the crediting period. The proponent may decide to perform all their inventory sampling in a given year or distribute it throughout the 10-year timeframe, but no single plot can go more than 10 years without being remeasured.

The proponent must generate estimates of total carbon stocks for each calendar year covered by a reporting period throughout the crediting period to support the quantification of project scenario GHG removals. The proponent may choose to exclusively use a field measurement-based approach, where annual carbon stock estimates are solely based on forest carbon inventory measurements. Alternatively, the proponent may update plot data using growth models that mimic the DBH and height increment of trees in the inventory or use Natural Resources Canada's Carbon Budget Model of the Canadian Forest Sector (CBM-CFS3)[20], following the requirements of Section 9.2. If a modelling approach is used, the proponent must incorporate field measurements from the forest carbon inventory into modelled projections of project scenario carbon stocks on an ongoing basis throughout the crediting period when updates occur. The proponent must use the initial carbon stocks as the starting point for the initial modelled projection of both the baseline and project scenarios.

Updated plot data must coincide with the end of the reporting period covered by a project report and the proponent must use the most recent plot data to support growth models. If plot data are collected before the end of the reporting period covered by a project report, growth must be forecasted to coincide with the end date of the reporting period or backcasted to coincide with the beginning of the reporting period. The proponent must establish and document a method for apportioning growth to the end and beginning of the reporting period as a part of the forest carbon inventory methodology, and this method must be used for all subsequent inventory updates.

9.1.3 Updating the forest carbon inventory after disturbance

The forest carbon inventory must be updated for each calendar year covered by a reporting period during which a disturbance (e.g., harvest, implementation of risk mitigation measures, natural disturbances) occurs if the area impacted by the disturbance is equal to or greater than the area represented by a singular sample plot.

The update to the inventory will support the determination of the values for $\mathrm{HV_{Project,i,C}}$, $\mathrm{HW_{Project,i,C}}$ and $\mathrm{SC_{Burn,C}}$ used to quantify project scenario GHG removals in Section 8.2. Impacted plots must be remeasured to determine the magnitude of stored carbon that has been lost as a result of the disturbance. A proponent that carries out salvage harvesting must treat the removed biomass as an immediate release of CO_2 into the atmosphere when updating the forest carbon inventory. Any modelled projections of project scenario carbon stocks must be updated after a disturbance and must be based on the updated plot data.

[20] Kurz, W. A., C. C. Dymond, T. M White, G. Stinson, C. H. Shaw, G. J. Rampley, C. Smyth, B. N. Simpson, E. T. Neilson, J. A. Trofymow, J. Metsaranta and M. J. Apps. (2009). CBM-CFS3: a model of carbon-dynamics in forestry and land-use change implementing IPCC standards. Ecol. Model. 220(4):480–504. doi:10.1016/j.ecolmodel.2008.10.018

Federal offset credits cannot be issued for GHG reductions generated from natural regeneration after a natural disturbance, so plots impacted by natural disturbances, such as wildfire, must be removed from the forest carbon inventory and replacement plots must be selected following the procedure outlined in the forest carbon inventory methodology, achieving the required confidence level as per Section 8.3. If the inventory is stratified, the area that was disturbed must be re-stratified to reflect the post-disturbance conditions, following the stratification rules outlined in the forest carbon inventory methodology. The proponent must adjust both the baseline and project scenarios to reflect the area removed from quantification as a result of a natural disturbance.

9.1.4 Estimation of tree-based forest carbon pools (SSR1, SSR2, and SSR4)

The proponent must generate estimates of mean biomass in metric tonnes per hectare (t ha^{-1}) by stratum for SSR1, SSR2 and SSR4 to support the quantification of total carbon stocks (t C).

The proponent must use measurements of tree height and DBH from the forest carbon inventory to calculate aboveground live tree (SSR1), belowground live tree (SSR2) and standing dead tree (SSR4) biomass and must justify the equations selected to convert these measured attributes into biomass.

For tree-level estimates to determine aboveground live tree biomass, the proponent must use the equations found in Lambert et al. (2005)[21] and Ung et al. (2008).[22] Individual tree-level biomass estimates are then summed to provide plot-level estimates. The proponent must use the equations in Li et al. (2003)[23] for belowground live tree biomass, which predict belowground biomass from total aboveground biomass at the plot level. Tree-level belowground live tree biomass equations, such as Brassard et al. (2011)[24], are also acceptable if the proponent can demonstrate that the equations are appropriate based on tree species present within the project site, calibrated to the geographic region of the project site, and have undergone peer-review.

The proponent may also use the stand-level equations of Boudewyn et al. (2007)[25] to estimate aboveground live tree biomass. These equations use merchantable wood volume per hectare (m^3 ha^{-1}) as input, and have parameters that vary by species, province, and terrestrial ecozone. Wood volume must be compiled to specific standards of merchantability, defined by stump height, minimum DBH, and minimum top diameter. These standards vary by province and territory and in some cases by region and species within provinces and territories. The proponent must ensure that volumes are compiled in accordance with the applicable provincial/territorial/regional standards when using the stand level equations of Boudewyn et al. (2007)[25] to convert volume to biomass. To determine the plot-level estimates of merchantable wood volume to support the estimation of aboveground biomass using these equations, the proponent must use peer-reviewed wood volume or taper equations appropriate for the

[21] Lambert, M.-C., C.-H. Ung, and F. Raulier. (2005). Canadian national tree aboveground biomass equations. Can. J. For. Res. 35:1996-2018. doi:10.1139/X05-112
[22] Ung C.-H., P. Bernier, and X.-J. Guo. (2008). Canadian national biomass equations: new parameter estimates that include British Columbia data. Can. J. For. Res. 38:1123-1132. doi:10.1139/X07-224.
[23] Li, Z., Kurz, W.A., Apps, M.J. and Beukema, S.J. (2003). Belowground biomass dynamics in the Carbon Budget Model of the Canadian Forest Sector: recent improvements and implications for the estimation of NPP and NEP. Can. J. For. Res. 33:126-136. doi:10.1139/x02-165.
[24] Brassard, B. W., H. Y. H. Chen, Y. Bergeron, and D. Paré. (2011). Coarse root biomass allometric equations for Abies balsamea, Picea mariana, Pinus banksiana, and Populus tremuloides in the boreal forest of Ontario, Canada. Biomass. Bioenrg. 35:4189-4196. doi:10.1016/j.biombioe.2011.06.045
[25] Boudewyn, P., X. Song, S. Magnussen, and M.D. Gillis. (2007). Model-based, volume-to-biomass conversion for forested and vegetated land in Canada. Natural Resources Canada. Available from https://cfs.nrcan.gc.ca/pubwarehouse/pdfs/27434.pdf.

tree species present within the project site and the geographic region, or the National Standards for Ground Plots Compilation Procedures of Canada's National Forest Inventory.[26] The proponent must justify the procedures selected. Tree-level volume estimates are summed to obtain plot-level estimates. Merchantable wood volume estimates may also be obtained as an output from growth and yield models as per Section 9.2.

The CBM-CFS3 uses the equations in Boudewyn et al. (2007)[25] to estimate aboveground biomass and the equations of Li et al. (2003)[23] to estimate belowground biomass. The proponent may use the CBM-CFS3 to perform these calculations. Similar to using the equations directly, the proponent must ensure that the inputs are consistent with the required assumptions.

For standing dead tree biomass, the proponent may use tree-level equations to convert measured tree attributes to biomass as described for aboveground live tree biomass. Dead trees have less carbon than live trees, so the following adjustment factors[27] must be applied to the live tree biomass estimate to account for the status of structural loss of dead trees:

1. For trees that contain structural components (branches and twigs) and resemble live trees excluding foliage: 0.97;
2. For trees with no twigs but with lasting small and large branches: 0.95;
3. For trees with large branches only: 0.90;
4. For trees with bole only: 0.80.

Individual tree-level estimates of standing dead tree biomass are then summed to provide plot-level estimates. The stand-level equations of Boudewyn et al. (2007)[25] and the CBM-CFS3 are also capable of generating estimates of standing dead tree biomass. The proponent may, if necessary for the sake of methodological consistency, also use these approaches for estimating standing dead tree biomass.

Once the proponent has estimates of mean biomass per hectare (t ha^{-1}) by stratum for SSR1, SSR2 and SSR4, the proponent must carry out the following steps to produce an estimate of total carbon stocks for SSR1, SSR2 and SSR4 ($SC_{P1,C}$, $SC_{P2,C}$ and $SC_{P4,C}$) to be used in Equation 16 in Section 8.2:

1. For each SSR, multiply the estimate of mean biomass (t ha^{-1}) by 0.5 to convert mass to mean metric tonnes of carbon per hectare (t C ha^{1}) by stratum;
2. For each SSR, multiply the mean metric tonnes of carbon per hectare (t C ha^{-1}) by stratum by the area in each stratum to get total carbon stocks (t C) by stratum; and
3. Sum the estimate of total carbon stocks per stratum, keeping each SSR separate, to get the estimate of total carbon stocks across the project site for SSR1, SSR2 and SSR4.

9.1.5 Estimation of lying deadwood (SSR5 and SSR6)

The proponent must generate estimates of mean biomass in metric tonnes per hectare (t ha^{-1}) by stratum for SSR5 and SSR6, if included.

The proponent must use line transects to determine the biomass of lying deadwood (SSR5 and SSR6) within the project site following the sampling procedures for woody debris measurements found in

[26] National Forest Inventory. 2021. Canada's National Forest Inventory - national standards for ground plots compilation procedures, version 2.4. Available from http://nfi.nfis.org.

[27] Penman, J., Gytarsky, M., Hiraishi, T., Krug, T., Kruger, D., Pipatti, R., Buendia, L., Miwa, K., Ngara, T., Tanabe, K. and Wagner, F. (2003). Good practice guidelines for land use, land-use change and forestry. ISBN 4-88788-003-0. Available from https://www.ipcc.ch/site/assets/uploads/2018/03/GPG_LULUCF_FULLEN.pdf.

Canada's National Forest Inventory Ground Sampling Guidelines.[18] The proponent must follow the methods for large and medium coarse woody debris for SSR5 and the methods for small and fine woody debris for SSR6 and must apply the same procedure for classifying deadwood as used for SSR4.

The proponent must use the volume and biomass equations found in the National Standards for Ground Plots Compilation Procedures based on Marshall et al. (2000)[28] and Van Wagner (1982)[29] separately for each density class (i.e., sound, intermediate and rotten) to determine the biomass of lying deadwood from the measured transect information from the forest carbon inventory.

Similar to standing deadwood, lying deadwood contains less carbon than live trees, so the following deductions must be applied to volume estimates based on the density class, as recommended by IPCC Good Practice Guidance for LULUCF[27]:

1. Hardwoods, sound: no deduction
2. Hardwoods, intermediate: 0.45
3. Hardwoods, rotten: 0.42
4. Softwoods, sound: no deduction
5. Softwoods, intermediate: 0.71
6. Softwoods, rotten: 0.45

Once the proponent has estimates of mean biomass per hectare (t ha^{-1}) by stratum for SSR5 and SSR6, the proponent must carry out the following steps to produce an estimate of total carbon stocks for SSR5 and SSR6 ($SC_{P5,C}$ and $SC_{P6,C}$) to be used in Equation 16 in Section 8.2:

1. For each SSR, multiply the estimate of mean biomass per hectare (t ha^{-1}) by 0.5 to convert mass to mean metric tonnes of carbon per hectare (t C ha^{1}) by stratum;
2. For each SSR, multiply the mean biomass per hectare (t ha^{-1}) by the area in each stratum to get total carbon stocks (t C) by stratum; and
3. Sum the estimate of total carbon stocks by stratum, keeping each SSR separate, to get the estimate of total carbon stocks across the project site for SSR5 and SSR6.

9.1.6 Estimation of soil carbon pool (SSR7)

The proponent must determine the initial soil carbon stocks (SSR7) using the sampling procedures for soil attributes found in Canada's National Forest Inventory Ground Sampling Guidelines.[18] Soil pits must reach a depth of ≥ 60 cm unless bedrock or the water table prevents this sampling depth from being reached. Depth starts at the surface of the mineral soil. In deep organic soils, the soil pit should be excavated to a minimum depth of 100 cm when possible.

The proponent must achieve a 20% sampling error or less for the estimate of initial soil carbon stocks. After the initial soil carbon stocks are established, changes in project scenario carbon stocks for SSR7 are exclusively modelled using the CBM-CFS3 and therefore the initial soil carbon stock estimate is only used in the baseline scenario, which is held static at the initial carbon stock levels throughout the

[28] Marshall, P.L., Davis, G. and LeMay, V.M. (2000). Using line intersect sampling for coarse woody debris. Research Section, Vancouver Forest Region, BC Ministry of Forests, Nanaimo, BC, Canada. Technical Report TR-003. 34 pp. See equations 8 and 16. Available from www.for.gov.bc.ca/rco/research/cwd/tr003.pdf
[29] Van Wagner, C.E. (1982). Practical aspects of the line intersect sampling method. Canadian Forest Service. Information Report PI-X-12. See equations 1 and 2. Available from https://d1ied5g1xfgpx8.cloudfront.net/pdfs/6862.pdf

crediting period. As a result, SSR7 is excluded from the quantification of sampling uncertainty in Section 8.3.

The proponent must generate estimates of initial mean soil carbon stocks in metric tonnes per hectare (t C ha^{-1}) by stratum for SSR7 using established, peer-reviewed methods and procedures to convert measured attributes from the initial forest carbon inventory into carbon stocks in order to support the quantification of total baseline scenario carbon stocks. The proponent must provide a description of the methods and procedures used to determine the initial carbon stocks associated with the soil carbon pool and justify how these methods and procedures will not lead to overestimation of GHG reductions generated by the project. Once the proponent has determined the initial mean soil carbon stocks per hectare (t C ha^{-1}) by stratum, the proponent must carry out the following steps to produce an estimate of initial total baseline scenario carbon stocks for SSR7 ($SC_{B7,C}$) to be used in Equation 4 in Section 8.1:

1. Multiply mean soil carbon stocks (t C ha^{-1}) by stratum by the area in each stratum to get total carbon stocks (t C) by stratum; and
2. Sum the estimate of total carbon stocks by stratum to get the estimate of total carbon stocks across the project site for SSR7.

9.2 Growth models and carbon modelling

To estimate baseline scenario carbon stocks for included SSRs representing forest carbon pools, the proponent must use a modelled projection of the baseline scenario determined by following the requirements in Section 9.2.3. This excludes projects previously registered in a GHG offset credit system other than the one set out in the Regulations and that are using a baseline scenario where baseline scenario carbon stocks for included SSRs remain static at the levels indicated in the initial forest carbon inventory, as per Section 9.1.

To estimate project scenario carbon stocks for included SSRs representing forest carbon pools, the proponent can choose an exclusively field measurement-based approach or may use models between forest carbon inventory updates as per Section 9.1.2. This excludes SSR7, which is exclusively modelled in the project scenario.

Where modelling is selected and/or necessary (i.e., SSR7 is included), the proponent has two choices for modelling project and baseline scenario carbon stocks:

1. If only SSR1, SSR2 and SSR4 are included, then growth and yield models can provide sufficient information to support the estimate of project and baseline scenario carbon stocks following the requirements of Section 9.2.1.
2. If SSR5, SSR6 and/or SSR7 are included, then the proponent must forecast the project and baseline scenarios using the CBM-CFS3.

However, in both approaches the proponent must use growth and yield models to support estimations of tree growth, following the requirements in Section 9.2.1.

All modelled outputs for both the project scenario or the baseline scenario must include periodic harvest, forest carbon inventory, and growth estimates as total tonnes of carbon (or t CO_2e) and mean tonnes of carbon per hectare (t C ha^{-1}), provided for the whole project area. For harvest yield on modelled stands (i.e., the baseline scenario), the output must:

- Be averaged by silvicultural treatment and constraints associated with those methods;

- Include the period over which the harvest occurred; and
- Include the estimate of average tonnes of carbon, volume or green weight of harvested wood removed (i.e., the amount of harvested wood that was delivered to mill ($SC_{Baseline,dm,i,C}$, $HV_{Baseline,i,C}$ or $HW_{Baseline,i,C}$) to be used in the calculation of carbon stored in harvested wood products as per Section 8.1.1).

9.2.1 Growth and yield models

Growth and yield models are mathematical models that predict tree growth, mortality and recruitment using various input data and a series of component equations (sub-models) that produce outputs for indicators of interest. A proponent who has selected to use a modelling-based approach must use a growth and yield model to project forest growth and must use the same model for both the project and baseline scenarios.

The proponent must ensure that the forest carbon inventory procedures described in Section 9.1 gather all the measurements required by the selected growth and yield model. The selected growth and yield model must generate all the outputs required by the selected tree carbon estimation procedures outlined in Section 9.1.4.

If tree-level biomass equations are used, then the growth and yield model must output a tree list identifying tree species, tree height (m) and/or DBH (cm). If stand-level volume to biomass equations are used, then the output may be a tree list or merchantable wood volume per hectare (m^3 ha^{-1}). The proponent must compile the merchantable wood volume output according to the merchantability standards (stump height, minimum DBH, and top diameter) assumed by the stand level volume to biomass estimation models in Boudewyn et al. (2007).[25]

The following is a list of acceptable growth and yield models the proponent can select based on their geographic region and characteristics of the project site (e.g., even-aged vs uneven-aged):

- AB: GYPSY, MGM
- BC: TASS (SYLVER, TIPSY), VDYP7, MGM
- MB: Manitoba growth and yield model, MGM
- NB/NS/PEI/NL: Open Stand Model, OSM-ACD, NSGYM
- ON: FVSOntario, CropPlanner, MIST
- QC: NATURA, ARTEMIS, CroiRePlant, SaMARE
- SK: MGM, GYPSY

The proponent can use a model not listed above if it can be demonstrated that the selected growth and yield model is applicable to conditions of the project site, including jurisdiction, forest type, and the forest management activities carried out within the project site. The proponent must document any relevant assumptions, known limitations, embedded hypotheses, assessment of uncertainties, and/or other factors potentially relevant to the use of the model. The proponent must justify the model selected using reference to scientific and/or technical literature, reference to specific software packages (name and version number), reference to open-source data and code repositories containing the equations, coefficients, data, and/or other information that supports the model. Sources for equations, data sets, factors or parameters must also be listed and described.

The proponent must report on carbon stock changes on an annual basis to quantify GHG reductions for each full or partial calendar year covered by the reporting period (i.e., to calculate Equations 4 and 16).

If model projections are based on time increments other than annual increments (e.g., 5 or 10 years), the proponent must annualize the output to report on carbon stock change for each full or partial calendar year covered by the reporting period.

9.2.2 Carbon modelling with the CBM-CFS3

A proponent using the CBM-CFS3 to model the baseline and/or project scenario carbon stocks must match the included SSR definitions with the component estimates generated by the CBM-CFS3 and ensure consistency in these definitions in the project and baseline scenarios. The latest publicly available version of the CBM-CFS3 must be used for modelling in the project and baseline scenario.

Natural Resources Canada may release new versions of carbon budget models, which could include next-generation versions. If a new version of the model is released, the proponent must evaluate whether the new features and functionality of the model could impact the project and baseline scenario GHG removals by evaluating the following conditions:

- Updates to the model resulting in improvements to the factors that influence carbon dynamics in the model.
- Updates to the model resulting in changes to the baseline scenario carbon stocks by greater than 10% (either the total baseline scenario carbon stocks or average baseline scenario carbon stocks if the proponent has begun using the average baseline scenario carbon stocks to calculate the change in baseline scenario carbon stocks as per Section 8.1).
- Increased spatial resolution of the model.

If any of the above conditions are met, the proponent must use the new version of the model to determine the project scenario carbon stocks, and the baseline scenario must be remodelled. If the proponent has begun using the average baseline scenario carbon stocks to calculate the change in baseline scenario carbon stocks as per Section 8.1, the proponent must use the updated averaged baseline to calculate $\Delta SC_{\text{Baseline,C}}$ using Equation 6, where $SC_{\text{Baseline,C}-1}$ is the previous average baseline scenario carbon stocks. In all subsequent calendar years covered by a reporting period, Equation 7 must be used.

9.2.3 Modelling the baseline scenario

Except in the case of a project previously registered in a GHG offset credit system other than the one set out in the Regulations and that is using a baseline scenario where baseline scenario carbon stocks for included SSRs remain static at the levels indicated in the initial forest carbon inventory as per Section 9.1, the proponent must model the baseline scenario following the requirements of Sections 9.2.1 and 9.2.2. The proponent must model both the regional forest management baseline scenario and the project-specific baseline scenario to determine the carbon stocks associated with each baseline scenario, which are used to carry out Step 3 in Section 3.2.1. The proponent must model the baseline scenario carbon stocks for included SSRs separately, beginning at the start of the crediting period.

Only the modelled total baseline scenario carbon stocks (i.e., $SC_{\text{B1,C}}$, $SC_{\text{B2,C}}$ and $SC_{\text{B4,C}}$, as well as $SC_{\text{B5,C}}$, $SC_{\text{B6,C}}$ and $SC_{\text{B7,C}}$ if included as per Table 1) associated with the resulting baseline scenario from Step 3 in Section 3.2.1 are used to support the calculation of $SC_{\text{Baseline,C}}$ in Equation 4 in Section 8.1.

The proponent must average the periodic model outputs over the first 25 years, which will result in a 25-year average value for each of the included baseline SSRs. The sum of the average carbon stocks for each included SSR multiplied by 3.667 represents the average baseline scenario carbon stocks and is the value for $SC_{Baseline,AVG}$ used in the quantification of baseline scenario GHG removals in Section 8.1. The proponent must assume that the standing dead tree carbon (SSR4) and soil carbon (SSR7) pools would remain static at the initial forest carbon inventory levels over the 100-year growth and harvesting regime modelled in the baseline scenario.

Baseline scenario carbon stock projections must be displayed on a graph that includes time in years on the x-axis and t C or t CO_2e on the y-axis. The graph must be supported by a qualitative description of the growth and harvesting regime informing annual changes in baseline scenario carbon stocks over time based on the expected forest management activities that would be taking place in baseline scenario as per Section 3.2.

In cases where the proponent must update the baseline scenario (see Sections 3.2.3, 3.2.4 and 5.1.1), the update to the baseline scenario must include any new information that would improve the accuracy of the baseline and project scenario carbon stock modelling, such as updates to any assumptions, user-input data or parameters, growth and yield projections, or any other relevant information used to model baseline scenario carbon stocks. The proponent must begin using the updated baseline scenario in the reporting period in which the update occurs and must use the updated baseline scenario carbon stocks to determine baseline scenario GHG removals for each calendar year covered by the report. If the proponent has begun using the average baseline scenario carbon stocks to calculate the change in baseline scenario carbon stocks as per Section 8.1, the proponent must use the updated averaged baseline to calculate $\Delta SC_{Baseline,C}$ using Equation 6, where $SC_{Baseline,C-1}$ is the previous average baseline scenario carbon stocks. In all subsequent calendar years covered by a reporting period, Equation 7 is to be used.

9.3 Measurement and modelling method and frequency

Table 3 identifies the parameters in the quantification methodology that must be measured or modelled and provides details regarding measurement or modelling method and frequency.

Table 3: Measurement or modelling method and frequency for measured or modelled parameters

Parameter	Description	Units	Measurement or modelling method and frequency	Equation(s)
$SC_{B1,C}$	Total baseline scenario carbon stored in SSR B1 for a calendar year covered by the reporting period.	t C	Modelled once at the beginning of the crediting period, unless a dynamic baseline approach is used as per Section 3.2.3, in which case this parameter is modelled periodically throughout the crediting period using the time interval specified by the proponent. In the case of a project previously registered in a GHG offset credit system other than the one set out in the Regulations and that is using a	4

Parameter	Description	Units	Measurement or modelling method and frequency	Equation(s)
			baseline scenario where baseline scenario carbon stocks for included SSRs remain static at the levels indicated in the initial forest carbon inventory, measured once at the beginning of the crediting period.	
$SC_{B2,C}$	Total baseline scenario carbon stored in SSR B2 for a calendar year covered by the reporting period.	t C	Modelled once at the beginning of the crediting period, unless a dynamic baseline approach is used as per Section 3.2.3., in which case this parameter is modelled periodically throughout the crediting period using the time interval specified by the proponent. In the case of a project previously registered in a GHG offset credit system other than the one set out in the Regulations and that is using a baseline scenario where baseline scenario carbon stocks for included SSRs remain static at the levels indicated in the initial forest carbon inventory, measured once at the beginning of the crediting period.	4
$SC_{B4,C}$	Total baseline scenario carbon stored in SSR B4 for a calendar year covered by the reporting period.	t C	Measured once at the initial forest carbon inventory and remains static over the 100-year growth and harvesting regime.	4
$SC_{B5,C}$	Total baseline scenario carbon stored in SSR B5 for a calendar year covered by the reporting period, if required to be included.	t C	Modelled once at the beginning of the crediting period, unless a dynamic baseline approach is used as per Section 3.2.3., in which case this parameter is modelled periodically throughout the crediting period using the time interval specified by the proponent. In the case of a project previously registered in a GHG offset credit system other than the one set out in the Regulations and that is using a	4

Parameter	Description	Units	Measurement or modelling method and frequency	Equation(s)
			baseline scenario where baseline scenario carbon stocks for included SSRs remain static at the levels indicated in the initial forest carbon inventory, measured once at the beginning of the crediting period.	
$SC_{B6,C}$	Total baseline scenario carbon stored in SSR B6 for a calendar year covered by the reporting period, if required to be included.	t C	Modelled once at the beginning of the crediting period, unless a dynamic baseline approach is used as per Section 3.2.3., in which case this parameter is modelled periodically throughout the crediting period using the time interval specified by the proponent. In the case of a project previously registered in a GHG offset credit system other than the one set out in the Regulations and that is using a baseline scenario where baseline scenario carbon stocks for included SSRs remain static at the levels indicated in the initial forest carbon inventory, measured once at the beginning of the crediting period.	4
$SC_{B7,C}$	Total baseline scenario carbon stored in SSR B7 for a calendar year covered by the reporting period, if required to be included.	t C	Measured once at the initial forest carbon inventory and then remains static over the 100-year growth and harvesting regime.	4
$HV_{Baseline,i,C}$	Volume of harvested wood by species for a calendar year covered by the reporting period according to baseline model.	m^3	Modelled once at the beginning of the crediting period, unless a dynamic baseline approach is used as per Section 3.2.3., in which case this parameter is modelled periodically throughout the crediting period using the time interval specified by the proponent.	8
$HW_{Baseline,i,C}$	Weight of harvested wood by species for a calendar year covered by the	kg	Modelled once at the beginning of the crediting period, unless a dynamic baseline approach is	9

Parameter	Description	Units	Measurement or modelling method and frequency	Equation(s)
	reporting period according to baseline model.		used as per Section 3.2.3., in which case this parameter is modelled periodically throughout the crediting period using the time interval specified by the proponent.	
$SC_{Baseline,dm,i,C}$	Baseline scenario carbon stored carbon in aboveground live tree biomass harvested that would have been delivered to a mill calculated separately for each species for a calendar year covered by the reporting period.	t C	Modelled once at the beginning of the crediting period if the model used to project the baseline scenario uses t C as the output, unless a dynamic baseline approach is used as per Section 3.2.3., in which case this parameter is modelled periodically throughout the crediting period using the time interval specified by the proponent. If the model does not use t C as the output, this parameter is calculated based on Equation 8 or 9.	10
$SC_{P1,C}$	Total project scenario carbon stored in SSR PR1 for a calendar year covered by the reporting period.	t C	Measured via forest carbon inventory with updates at least every 10 years and after disturbance, and modelled for each calendar year covered by the reporting period between inventory updates.	16
$SC_{P2,C}$	Total project scenario carbon stored in SSR PR2 for a calendar year covered by the reporting period.	t C	Measured via forest carbon inventory with updates at least every 10 years and after disturbance, and modelled for each calendar year covered by the reporting period between inventory updates.	16
$SC_{P4,C}$	Total project scenario carbon stored in SSR PR4 for a calendar year covered by the reporting period.	t C	Measured via forest carbon inventory with updates at least every 10 years and after disturbance, and modelled for each calendar year covered by the reporting period between inventory updates.	16

Parameter	Description	Units	Measurement or modelling method and frequency	Equation(s)
$SC_{P5,C}$	Total project scenario carbon stored in SSR PR5 for a calendar year covered by the reporting period, if required to be included.	t C	Measured via forest carbon inventory with updates at least every 10 years and after disturbance, and modelled for each calendar year covered by the reporting period between inventory updates.	16
$SC_{P6,C}$	Total project scenario carbon stored in SSR PR6 for a calendar year covered by the reporting period, if required to be included.	t C	Measured via forest carbon inventory with updates at least every 10 years and after disturbance, and modelled for each calendar year covered by the reporting period between inventory updates.	16
$SC_{P7,C}$	Total project scenario carbon stored in SSR PR7 for a calendar year covered by the reporting period, if required to be included.	t C	Modelled for each calendar year covered by the reporting period.	16
$SC_{Burn,C}$	Amount of stored carbon released from the combustion of biomass for a calendar year covered by the reporting period.	t C	Measured in each calendar year covered by the project report when burning of biomass occurs.	18, 19
$HV_{Project,i,C}$	Volume of harvested wood for species for a calendar year covered by the reporting period.	m^3	Measured in each calendar year covered by the reporting period where there is a harvest via updates to the forest carbon inventory.	20
$HW_{Project,i,C}$	Weight of harvested wood for species for a calendar year covered by the reporting period.	kg	Measured in each calendar year covered by the reporting period where there is a harvest via updates to the forest carbon inventory.	21

9.4 Quality assurance and quality control

The proponent must have documented quality assurance and quality control (QA/QC) procedures and must implement them to ensure that all measurements, modelling, and calculations are made in accordance with this protocol and can be verified.

In addition, the proponent must have and implement a documented QA/QC procedure for an internal review process to ensure standard operating procedures outlined in the forest carbon inventory methodology are adhered to and update it continuously throughout the project period. The QA/QC procedure for the forest carbon inventory must include:

- An assessment and description of the quality of data collection;
- A description of how field data is transferred and archived;
- Processes for data entry and analysis, as well as data maintenance and archiving procedures; and
- Any other relevant processes to ensure quality and consistency for the collection and maintenance of data used to quantify the GHG reductions generated by the project and indicated in project reports.

10.0 Permanence and reversals

A reversal has occurred if there is a decrease in the difference between project and baseline scenario carbon stocks, meaning GHG reductions for which offset credits have already been issued have been released back into the atmosphere.

A voluntary reversal occurs as a result of an activity or action within the control of the proponent, such as overharvesting, forest conversion, failure to implement the reversal risk management plan or growth model overestimation of project scenario carbon stocks. If an update to the forest carbon inventory shows that the growth models have overestimated project scenario carbon stocks, any overestimated carbon stocks for which offset credits have been issued are to be treated as a voluntary reversal. Any voluntary reversal is considered to be an immediate emission of CO_2 into the atmosphere.

An involuntary reversal occurs as a result of an activity or action not within the control of the proponent, such as natural disturbance (e.g., wildfire, pests, or disease), and 3rd party illegal harvesting.

10.1 Reversal risk management plan

Section 21 of the Regulations requires that the proponent develop and implement a reversal risk management plan based on the relevant reversal risks to improved forest management projects.

The proponent must identify the reversal risks present within the project site and must include descriptions of how these reversal risks will be managed throughout the project period. Assumptions used to inform the identification of reversal risks and the appropriate reversal risk mitigation measures and monitoring activities must be supported by recent[30] peer-reviewed literature, government publications, Indigenous knowledge, or other justifiable sources of information (e.g., Canadian Council of Forest Ministers, IPCC, etc.).

The following should be considered for the reversal risk management plan:

- Fire risk;
- Pest and disease risks;
- Drought risk;
- Wind risk;
- Hydrological and/or flooding risks;
- Geomorphic and/or geological risks; and

[30] Recent publications include those published within the last 10 years.

- Climate change risks, such as reduced tree growth and vigour.

The proponent must consider the geographic location (e.g., ecozone), forest age structure and species composition within the project site in determining what reversal risks are relevant to include in the reversal risk management plan and what reversal risk mitigation measures and monitoring activities are appropriate. The proponent must list and describe the potential appropriate reversal risk mitigation measures that will be implemented to reduce the likelihood, magnitude and frequency of each identified reversal risk. The proponent must also describe how each identified reversal risk will be monitored throughout the project period and how monitoring activities will ensure reversals are caught in a timely manner.

The use of Indigenous community-based monitoring programs is a potential mitigation measure under this protocol. A proponent that implements this mitigation measure must provide a description of the governance structure of the monitoring program and demonstrate that the program has community support. The monitoring program should include monitoring and reporting of natural disturbance or environmental impacts on forest ecosystems. An example of an Indigenous community-based monitoring program includes the Indigenous Guardians Program.

10.2 Permanence monitoring

Subsection 22(1) of the Regulations requires that the proponent of a sequestration project monitor the quantity of GHGs emitted or GHGs removed from the atmosphere and submit a monitoring report with each project report submitted during the crediting period and every six years during the permanence monitoring period. The proponent must monitor all included SSRs related to forest carbon pools as per Table 1.

In order to determine whether a reversal has occurred, the proponent must continue to monitor the total GHG reductions generated by the project for each calendar year covered by a monitoring report throughout the project period.

10.2.1 Permanence monitoring period

To monitor the GHG reductions generated by the project during the permanence monitoring period, the proponent must continue to follow the quantification methodology outlined in Section 8.2 and the measurement and data requirements outlined in Section 9.0. The proponent must continue to use the equations of Section 10.3 to determine whether a reversal has occurred either during the crediting period or the permanence monitoring period.

To carry out monitoring, the proponent must continue to update the forest carbon inventory in accordance with Section 9.1 after the end of the crediting period. During the permanence monitoring period, inventory plot data must be remeasured at least every 20 years (compared to the 10-year interval specified for during the crediting period) following the requirements of Section 9.1. In the years when sampling is not conducted, proponents can use modelling to determine changes in project scenario carbon stocks following the requirements of Section 9.2. As per Section 9.1, if a reversal occurs during the permanence monitoring period, the forest carbon inventory must be updated.

The proponent may use remote sensing and satellite imagery to monitor for reversals during the permanence monitoring period and does not have to exclusively rely on ground-level monitoring. If reversals are identified using these technologies, the proponent must estimate the magnitude of the reversals by updating the forest carbon inventory following the requirements of Section 9.1.

10.3 Identification of a reversal

Subsection 37(1) of the Regulations requires that the proponent of a sequestration project notify the Minister when they become aware of a reversal. Subsection 37(2) requires that within 18 months after the date of the notice, the proponent submits to the Minister a reversal report.

During the crediting period, the proponent must use Equation 34 to determine, for each full or partial calendar year covered by the reporting period(s) impacted by the reversal, whether a reversal has occurred. If the result of Equation 34 is negative, a reversal has occurred within the project site. The result of Equation 34 represents the magnitude of the reversal during the affected reporting period(s).

During the performance monitoring period, the proponent must continually assess whether a reversal has occurred by using Equation 34 for each calendar year covered by a monitoring report for the duration of the permanence monitoring period. If the result of Equation 34 is negative during the permanence monitoring period, the proponent uses Equation 35 to determine whether a reversal has occurred. If the result of Equation 37 is also negative, a reversal has occurred during the permanence monitoring period. During this period, the values of ΔBR_C in Equation 34 and the value of $SC_{Baseline,HWP,C}$ in Equation 31 used to determine $\Delta SC_{HWP,C}$ in Equation 34 are 0. The result of Equation 37 represents the magnitude of the reversal.

Equation 34: Determining whether a reversal has occurred within the project site

$$R = (\Delta PR_C - \Delta BR_C) + \Delta SC_{HWP,C} - GHG_{Project,C} - L_{Activity,C} - L_{Market,C}$$

Parameter	Description	Units
R	GHG reductions generated by the project that have been reversed. A reversal has only occurred if this value is negative	t CO_2e
ΔPR_C	Change in project scenario GHG removals since the last reporting period for a calendar year covered by the reporting period or the monitoring report, as per Equation 35	t CO_2e
ΔBR_C	Change in baseline scenario GHG removals since the last reporting period for a calendar year covered by the reporting period or the monitoring report, as per Equation 36	t CO_2e
$\Delta SC_{HWP,C}$	Difference in carbon stored in harvested wood products 100 years after harvest in the project scenario compared to the baseline scenario for a calendar year covered by the reporting period or the monitoring report, as per Equation 31	t CO_2e
$GHG_{Project,C}$	Total GHG emissions as a result of carrying out project activities for a calendar year covered by the reporting period or the monitoring report, as per Equation 19 (SSR P10)	t CO_2e

Parameter	Description	Units
$L_{Activity,C}$	Total change in carbon stored on controlled lands for a calendar year covered by the reporting period or the monitoring report to capture activity-shifting leakage, as per Equation 28 (SSR P13)	t CO_2e
$L_{Market,C}$	Total carbon lost due to market leakage risk for a calendar year covered by the reporting period or the monitoring report, as per Equation 29 or Equation 30 (SSR P14)	t CO_2e
C	Calendar year	unitless

Equation 35: Change in project scenario GHG removals since last reporting period for a calendar year covered by the reporting period

$$\Delta PR_C = \left[SC_{Project,C} \times (1 - UF_C)\right] - \left[SC_{Project,C-1} \times (1 - UF_{C-1})\right]$$

Parameter	Description	Units
ΔPR_C	Change in project scenario GHG removals since the last reporting period for a calendar year covered by the reporting period or the monitoring report	t CO_2e
$SC_{Project,C}$	Total project scenario carbon stocks for a calendar year covered by the reporting period or the monitoring report, as per Equation 16	t CO_2e
UF_C	Uncertainty factor to reflect uncertainty for a calendar year covered by the reporting period or the monitoring report, as per Section 8.3	%
$SC_{Project,C-1}$	Total project scenario carbon stocks in the final calendar year of the previous project report or monitoring report, unless a reversal has occurred since the previous project report or monitoring report, in which case the total project scenario carbon stocks reported in the reversal report are used	t CO_2e
UF_{C-1}	Uncertainty factor to reflect uncertainty in the final calendar year of the previous project report or monitoring report, unless a reversal has occurred since the previous project report or monitoring report, in which case the uncertainty factor that was re-calculated as a part of updating the forest carbon inventory after the reversal is used	%
C	Calendar year	unitless
$C-1$	The final calendar year in the previous project report or monitoring report	unitless

Equation 36: Change in baseline scenario GHG removals since last reporting period for a calendar year covered by the reporting period

$$\Delta BR_C = SC_{Baseline,C} - SC_{Baseline,C-1}$$

Parameter	Description	Units
ΔBR_C	Change in baseline scenario GHG removals since the last reporting period for a calendar year covered by the reporting period or the monitoring report	t CO_2e
$SC_{Baseline,C}$	Total baseline scenario carbon stocks for a calendar year covered by the reporting period or the monitoring report, as per Equation 4	t CO_2e
$SC_{Baseline,C-1}$	Total baseline scenario carbon stocks in the final calendar year of the previous project report or monitoring report	t CO_2e
C	Calendar year	unitless
$C\text{-}1$	The final calendar year in the previous project report or monitoring report	unitless

Equation 37: Determining the magnitude of a reversal within the project site

$$R_{Monitor} = ER_{Monitor} + R$$

Parameter	Description	Units
$R_{Mointor}$	Magnitude of GHG reductions generated by the project that have been reversed during the permanence monitoring period. A reversal has only occurred if this value is negative	t CO_2e
$ER_{Monitor}$	The sum of GHG reductions generated by the project for each calendar year during the permanence monitoring period, as per Equation 38	t CO_2e
R	GHG reductions generated by the project that have been reversed, expressed as a negative value, as per Equation 34	t CO_2e

Equation 38: Determining the total GHG reductions generated by a project during the permanence monitoring period

$$ER_{Monitor} = \sum_{C}^{n} ER_C$$

Parameter	Description	Units
$ER_{Monitor}$	The sum of GHG reductions generated by the project for each calendar year during the permanence monitoring period	t CO_2e
ER_C	GHG reductions during a calendar year covered by the monitoring period during the permanence monitoring period	t CO_2e
C	Calendar year	unitless
n	Number of calendar years that have passed since the end of the crediting period	unitless

11.0 Environmental integrity account

The variable C_i in subsection 29(2) of the Regulations represents the number of offset credits that must be deposited into the environmental integrity account for each calendar year and is based on the sum of 3% and 24%, that latter of which is the percentage that corresponds to the reversal risk mitigation measures and monitoring activities implemented for the project. However, this latter value is reduced if any of the reversal risk mitigation measures defined in Table 4 are implemented as part of the project. The percentage listed in the "Discount" column of Table 4 represents the value that is subtracted from 24% when the corresponding reversal risk mitigation measure is implemented.

If a reversal risk mitigation measure is implemented during the crediting period, the corresponding discount will be applied from the calendar year after the first year of implementation of the mitigation measure to each full or partial calendar year covered by the reporting period. Once a reversal risk mitigation measure that corresponds to a discount in Table 4 is implemented, it must continue to be implemented and/or maintained for the remainder of the project period. The reversal risk mitigation measures that require Indigenous community support (1 and 3 in Table 4) can be ceased at any time if the community no longer wishes to be involved in the project. However, the proponent must continue to have entitlement to claim the credits issued for the GHG reductions generated by the project and the necessary authorizations to carry out the project activities as specified in paragraph 8(1)(b) and 8(1)(c), respectively, of the Regulations.

Table 4: Discounts to the contribution to the environmental integrity account

Reversal risk mitigation measure	Description	Discount
1 – Indigenous community-based monitoring	Involvement of an Indigenous community-based environmental monitoring program(s) that includes monitoring and reporting of natural disturbance or environmental impacts on forest ecosystems, as described in Section 10.1. The proponent must have supporting information that demonstrates there is community support for the monitoring program by producing documentation of involvement or support from the relevant community or communities based on their engagement protocols (such as a memorandum of understanding, a Band Council resolution or a benefit sharing agreement).	4%
2 – Use of conservation easements or other restrictions on land use change/forest management	Implementation of conservation easements that explicitly restrict land use change and timber harvesting within the project site, or other restrictions that explicitly restrict land use change and timber harvesting within the project site, such as Indigenous-led Area-based Conservation Mechanisms, Other Effective Area-based Conservation Mechanisms, title transfers to conservation organizations, the Ecological Gifts Program, and gifts of land to conservation organizations. The proponent must have supporting information that demonstrates the conservation mechanism implemented includes restrictions on land use and management activities that	4%

Reversal risk mitigation measure	Description	Discount
	ensure the protection of the entire project site, and the restriction specifies a time period equal to or longer than the project period.	
3a – Indigenous-led project	The project is an Indigenous-led project, as defined in Section 2.0.	2%
3b – Indigenous involvement in risk management planning	Reversal risk management plans are developed in collaboration with, and on the advice of, Indigenous communities where it can be demonstrated there is community support for the content of the reversal risk management plan. The proponent must have supporting information that demonstrates there is community support for the reversal risk management plan, including documentation of involvement or support from the relevant community or communities based on their engagement protocols (such as a memorandum of understanding, a Band Council resolution or a benefit sharing agreement). The proponent can only apply this discount if activity 3a described above is not already implemented.	2%
4 – Natural disturbance mitigation measures	Implementation of one or two of the following activities results in a 2% discount, and, implementation of three or more of the following activities results in a 4% discount: • The project site is within a FireSmart area; • Species selection for fire, pest and/or disease resistance; • Maintaining stand diversity, including genetic diversity, on greater than 50% of the project site; • Prescribed and/or cultural burning; • Reducing fuel load on greater than 50% of the project site; • Fire suppression equipment on or adjacent to the project site protecting greater than 50% of the project site; and • Implementation of fuel breaks protecting greater than 50% of the project site.	2 or 4%

12.0 Records

In addition to the record keeping requirements specified in the Regulations, the proponent must keep a record of all data and information that support the implementation of the project and verification, including invoices, contracts, measured results, calculations, databases, and photographs. The records must be kept and retained at the location and for the period of time specified in the Regulations.

12.1 Baseline scenario

The proponent must keep a record of the following information in relation to Sections 3.1 and 3.2:

- Documentation supporting that the project meets the baseline conditions.
- Documentation supporting the determination of the baseline scenario, including:
  - Documentation supporting the assessment of the regional forest management baseline scenario, including the results of the statistical analysis to identify the reference forestlands that match the project site, and any information collected from the reference and matched forestlands used in developing the regional forest management baseline scenario;
  - Documentation that demonstrates the regional forest management baseline scenario is financially and operationally feasible within the project site;
  - Documentation supporting the assessment of projected forest management activities including forest management plans applicable to the project site, a land use management plan and/or a license or permit to harvest applicable to the project site, and/or contract or signed written offer(s) from mill(s) or harvester(s) to purchase forest products or harvest timber from the project site;
  - Documentation supporting the assessment of historical practices, including documentation that describes the harvest volumes and forest management and silvicultural activities;
  - Documentation that demonstrates the historical practices that were carried out within the project site, or, on controlled lands within the same province or territory as the project site (if relevant); and
  - Documentation that supports the market, environmental and socio-economic factors that explain historical practices, if relevant.
- Documentation supporting the selection of the procedure to determine the baseline scenario for a project that was previously registered in a GHG offset credit system other than the one set out in the Regulations, including demonstration of the volume of credits issued in the previous GHG offset credit system and evidence that the credits were cancelled and/or compensated for, where relevant.

12.2 Additionality

The proponent must keep a record of the following information in relation to Section 5.0:

- Documentation describing the legal requirements applicable to the project that impact baseline scenario carbon stocks as per Section 5.1.
- Documentation demonstrating that if a legal requirement mandating the protection of the project site came into force during the crediting period that is was for the purpose of carrying out the project.

12.3 General requirements

The proponent must keep a record of the following information in relation to Section 6.0:

- Documentation demonstrating who the forest operator is, and a copy of the land title.
- Documentation demonstrating the project start date.
- Documentation supporting the location and geographic boundaries of the project site, including the site plan.

- Documentation supporting the implementation of one or more of the prohibited activities as listed in Section 6.4.2, and this documentation must correspond to the stated exceptions that allow a proponent to carry out the prohibited activity as per Section 6.4.2.
- Documentation related to the project specific assessment of environmental impacts and that supports the determination of required environmental safeguards, including a description of each safeguard and an explanation of how it will mitigate potential negative impacts.

12.4 Quantification and measurement

The proponent must keep a record of the following information in relation to Sections 8.0 and 9.0:

- Documentation that supports the exclusion of SSR5, SSR6, SSR7 and SSR12, if relevant.
- All information and data used to support the quantification of total GHG reductions including:
    - Documentation supporting the calculation of harvested wood products, including the volume of harvested wood delivered to mill, such as mill receipts, mill efficiency data, and documentation from the mill on wood product class categories sold in a given calendar year covered by the project report.
    - Documentation that demonstrates that activity-shifting leakage is not occurring on controlled lands, if relevant.
    - Documentation that indicates the volume of harvested wood on controlled lands to support the calculation of activity-shifting leakage, if relevant.
    - Documentation supporting the determination of the harvest efficiency to support the calculation of market leakage, if relevant.
    - If the methodology used to develop the forest carbon inventory is an established published approach (e.g., provincial or territorial standard), a copy of the methodology;
    - Information supporting the forest carbon inventory methodology[31], including:
        - Any documentation that supports the methodology chosen, such as peer-reviewed literature and/or government publications;
        - Documents indicating the sampling procedures, measurement methods, tools and methods used to measure forest characteristics (e.g., DBH, height), procedures to assess structural loss, procedures to classify deadwood, and any other relevant information on the sampling method;
        - Pre- and post-sampling stratification rules, including a map of the strata, the area of each stratum, documentation on the tools used to develop the stratification, and documentation indicating how strata boundaries were determined;
        - Documentation indicating the procedure used to develop sampling plots and the location of the plots, including GPS coordinates;
        - Documentation indicating the standards for tree and plot size;
        - Documentation indicating the frequency for updating and replacing sample plots;
        - Change logs indicating any changes to the inventory methods or volume and biomass equations used to calculate carbon stocks; and
        - Documentation indicating the standard operating procedures of the forest carbon inventory.

[31] If the proponent is following an established forest carbon inventory approach such as the National Forest Carbon Inventory procedures, this information may be outlined in the procedural documents and therefore does not need to be provided again to satisfy the record retention requirement.

  - The results of conducting the forest carbon inventory and inventory updates throughout the crediting period, including all the measured data collected.
  - Documentation indicating the equations used to estimate aboveground and belowground live tree carbon, and standing dead tree carbon, and documentation demonstrating the equations are calibrated to the geographic region and tree species of the project site.
  - Documentation indicating the growth and yield model selected, and, if required, documentation demonstrating that the model selected is appropriate for the geographic region of the project site, the scope of the project, and the forest type of the project site. This includes any assumptions, limitations, embedded hypotheses, assessment of uncertainties, and/or other factors that are relevant to the use of the model for the project.
  - All documentation indicating the model inputs and outputs, including modelled projections of the project and baseline scenarios, and any databases created either to input into the model or created as a model output.
- Documentation outlining the QA/QC procedure to be applied to the forest carbon inventory, including the assessment of the quality of the data collection, procedures for data entry and analysis, data maintenance and archiving procedures, and any other relevant QA/QC procedures implemented by the proponent.

12.5 Permanence and reversals

The proponent must keep a record of the following information in relation to Sections 10.0 and 11.0:

- Documentation that supports assumptions used to identify the reversal risks and appropriate mitigation measures.
- Documentation that demonstrates the proponent met the requirements to obtain the discount(s) that reduces the number of offset credits to be deposited into the environmental integrity account, including documentation demonstrating there is community support for Indigenous community-based monitoring and the reversal risk management plan, if relevant.
- Documentation that demonstrates that there are procedures in place to ensure that the proponent will continuously meet requirements related to permanence monitoring activities and submitting monitoring reports during the project period.
- In the case of a reversal, an updated site plan showing the areas of the project site impacted by the reversal.

13.0 Reporting

13.1 Project reports

In addition to the reporting requirements specified in the Regulations, the proponent must include the following information in project reports.

13.1.1 Baseline scenario

The proponent must include the following in the initial project report in relation to Section 3.2:

- A description of the results related to the determination of regional baseline scenario, including:

    - The condition used to select reference forestlands, how many reference forestlands were selected, a description of how the reference forestlands met the condition(s) used to select reference forestlands, and a map indicating where the reference forestlands are located;
    - The biophysical forest attributes used for matching reference forestlands and the result of the statistical analysis used to determine the matched forestlands, including biophysical forest attribute data used in the analysis, how many matched forestlands were identified and a map indicating where the matched forestlands are located (this can be displayed on the same map used to identify reference forestlands);
    - Justification of the use of provincial Crown land as a reference forestland and/or the use of reference forestlands that do not conform to the conditions to select reference forestlands, if relevant (e.g., in the case of First Nation reserves), and justification that use of these forestlands will not lead to an overestimation of GHG reductions;
    - A description of the forest management activities implemented on the matched forestlands and how this information was collected, and, if applicable, the approach used to determine how to average qualitative information in the baseline scenario;
    - A description of what forest management activities are financially and operationally feasible within the project site compared to the matched forestlands, and how the financial or operational constraints impacted the regional forest management baseline scenario; and
    - A description of the resulting regional forest management baseline scenario.
- A description of the results related to the determination of the project-specific baseline scenario, including:
    - A description of the forest management and silvicultural activities and harvest volumes indicated in a forest management plan, contract or written offer from local mill(s) or harvester(s) or offer(s) from individuals or entities looking to purchase the project site, or any other record used in the assessment of projected forest management activities. The year the records were created or prepared, and, if applicable, the date they were approved or prepared by a Registered Professional Forester or equivalent forest professional who practices within the same jurisdiction of the project site, must be specified. Additionally, the description must include a justification that the forest management activities indicated in the records are financially and operationally feasible within the project site;
    - For a project on a First Nation reserve or Treaty Land Entitlement land with an exclusive use permit, a description of the forest management and silvicultural activities and harvest volumes indicated in a land use management plan and/or a license or permit to harvest;
    - A description of the result of the assessment of historical practices and the forest management practices implemented in the historical lookback period, including what forest management and silvicultural activities were implemented in the historical lookback period, the historical harvest volumes and the market, environmental and socio-economic factors explain historical practices (if relevant);
    - A description of differences between the results of the assessment of projected forest management activities and historical practices and if only one assessment was used in the determination of the project-specific baseline scenario, if relevant; and
    - A description of the resulting project-specific baseline scenario.

- A description of the result of the assessment of conservativeness and selection of the baseline scenario, indicating the baseline scenario that is applicable to the project.
- If the project was previously registered in another GHG offset credit system other than the one set out in the Regulations, the procedure used to determine the baseline scenario, justification for using that approach, the volume of credits issued in the previous GHG offset credit system and the corresponding value of PER_C used in Equation 14 (if relevant), and whether the credits were cancelled and/or compensated for in the previous GHG offset credit system.

If the proponent is using a dynamic baseline approach, the initial project report must specify the time interval that will be used to update the baseline scenario. The proponent must include a description of the changes to the baseline scenario in each project report covering a reporting period where an update to the baseline scenario occurs.

13.1.2 General requirements

The proponent must include the following in the initial project report as it relates to general requirements in the protocol:

- For a project that is Indigenous-led, the IBD registration number or demonstration that the proponent or forest operator is a Certified Aboriginal Business on the CCAB member directory.
- If any of the prohibited activities listed in Section 6.4.2 are carried out or are planned to be carried out, a description of why the proponent carried out this activity corresponding to one of the stated exceptions as per Section 6.4.2.
- The results of the assessment of environmental impacts in Section 6.4.3 including whether each project activity will have a positive, neutral or negative impact for each environmental attribute and why, a description of each environmental safeguard implemented by the proponent, and an explanation of how the safeguarding activities will ensure any potential negative impacts are mitigated.

13.1.3 Quantification and measurement

The proponent must include the following in a project report in relation to Sections 8.0 and 9.0:

- The quantified GHG removals for each SSR included in the baseline and project scenarios in t CO_2e for each full or partial calendar year covered by the reporting period.
- The uncertainty factor applicable to the project based on the most recent forest carbon inventory update.
- A description of how activity-shifting leakage is being avoided on controlled lands, if relevant.
- The approach the proponent used to quantify market leakage, and if option 2 (i.e., Equation 32) was selected, a description of how the harvest efficiency was determined.
- The absolute value of any negative GHG reductions at the beginning of the crediting period, the value that will be carried over to the next reporting period, and a description of how the negative GHG reductions occurred.
- With respect to the initial project report in relation to the forest carbon inventory:
    - The forest carbon inventory methodology used and a description of the forest carbon inventory methodology that reflects the requirements listed in items 1-10 in Section 9.1.1, providing enough information that the methodology could be repeated by another forest professional;

- The date of initiation of the initial forest carbon inventory;
- The citations of any peer-reviewed literature that support the forest carbon inventory methodology selected by the proponent, if relevant;
- The approach selected by the proponent to update the forest carbon inventory to capture growth (i.e., field measurements or models);
- The biomass equations selected for estimating carbon stocks in SSR1, SSR2 and SSR4, including justification for the equations or procedures selected as per the requirements of Section 9.1.4;
- If SSR7 is included, a description of the approach used to estimate soil carbon stocks from measured attributes in the forest carbon inventory, including any citations of peer-reviewed literature that support the approach selected by the proponent; and

- A description of any changes made to the forest carbon inventory during the reporting period, such as re-stratification as a result of natural disturbance or updates to biomass equations. The proponent may fulfill this reporting requirement by providing a copy of the change logs referred to in Section 9.1.1.
- With respect to modelling project and baseline scenario carbon stocks:
    - A description of the silvicultural methods modelled, which must include the following for each method:
        - A description of retained trees by species groups at harvest; and
        - The frequency of harvest (i.e., years between each harvest).
    - A list of all legal requirements that impact forest management activities in the project area, which must include:
        - A description of each legal requirement;
        - The government agency responsible for the legal requirement (i.e., local, provincial, territorial, or federal);
        - A description of how the legal requirement impacts forest management within the project area, including any assumptions for canopy retention and/or habitat conditions and any required conditions that have a temporal element (i.e., conditions that must be met by a certain year); and
        - A description of the silvicultural treatments that will be modelled to ensure the legal requirement(s) are captured in the baseline scenario carbon stocks.
    - If the proponent used a growth and yield model listed in Section 9.2.1, a description of model(s) used, and a description of any model calibration procedures used to ensure the model(s) were appropriate for local use. This includes descriptions of any assumptions and user-input data or parameters. Any choices made within the model(s) must be justified using scientific peer-reviewed literature or government publications.
    - If the proponent used a growth and yield model not listed in Section 9.2.1, justification of why the model selected is appropriate for the geographic region of the project site, the scope of the project, and the forest type of the project site. This includes a description of any assumptions, limitations, embedded hypotheses, assessment of uncertainties, and/or other factors that are relevant to the use of the model for the project. The justification must refer to scientific and/or technical literature, reference to specific software packages (name and version number), reference to open-source data and code repositories containing the equations, coefficients, data, and/or other information that supports the model. Sources for equations, data sets, factors or parameters must also be listed and described.
    - A description of the site indexes used for each species, which must include an explanation of the source of the site index values used.

- If the CBM-CFS3 is used, the version number of the model that was used, a description of how the component estimates generated by the CBM-CFS3 were matched to the SSR definitions, and a description of any model calibration procedures used to ensure the model(s) were appropriate for local use, including descriptions of any assumptions and user-input data or parameters.
- A graphical depiction and supporting qualitative description of the baseline scenario following the requirements of Section 9.2.3.

13.1.4 Permanence and reversals

The proponent must include the following in a project report in relation to Sections 10.0 and 11.0:

- A description of how community support was obtained for Indigenous community-based monitoring program and/or reversal risk management plans if the proponent claims the discount for mitigation measure 1 or 3b in Table 4 in Section 11.0.
- In the cases of a reversal for which a reversal report was submitted, any changes made since the previous project report as a result of the reversal, such as changes to the project activities, site plan, and/or quantification of sampling uncertainty.

13.2 Monitoring reports

As specified in subsection 22(1) of the Regulations, the proponent must monitor the quantity of GHGs emitted or GHGs removed from the atmosphere with respect to the monitoring reports. The content of a monitoring report is specified in subsection 22(3) of the Regulations. To be included in the description specified in paragraph 22(3)(b) is the discount to the contribution to the environmental integrity account corresponding to the reversal risk mitigation measures implemented during the reporting period.

14.0 Verification

14.1 Competency requirements for verification teams

In addition to the verification requirements specified in the Regulations, the verification team must include a Registered Professional Forester or an equivalent forest professional who practices within the same jurisdiction as the project site to conduct a verification for a project under this protocol.

Schedule A

Table 5: Regional market leakage factors by reconciliation unit

Province or territory	Reconciliation unit	Regional market leakage factor (%)
NL	1	46
NL	3	47
NL	4	47
NS	5	47
PE	6	47
NB	7	46
QC	11	53
QC	12	52
QC	13	47
QC	14	47
QC	15	54
ON	16	59
ON	17	60
ON	18	47
ON	19	62
MB	21	47
MB	22	50
MB	23	52
MB	24	51
MB	25	46
SK	26	49
SK	27	48
SK	28	52
SK	29	52
SK	30	52
AB	31	64

Province or territory	**Reconciliation unit**	**Regional market leakage factor (%)**
AB	32	71
AB	33	63
AB	34	64
AB	35	64
AB	36	68
AB	37	61
BC	38	74
BC	39	75
BC	40	75
BC	41	51
BC	42	71
YK	44	47
YK	45	47
YK	46	47
NT	50	48
NT	51	47
NT	52	47
NT	53	48
NU	58	50
NU	60	45