EXPLANATORY STATEMENT

Issued by the Authority of the Parliamentary Secretary for Climate Change and

Energy Efficiency

Carbon Credits (Carbon Farming Initiative) Act 2011

Carbon Credits (Carbon Farming Initiative) (Reforestation and Afforestation) Methodology Determination 2013

Background

The *Carbon Credits (Carbon Farming Initiative) Act 2011* (the Act) enables the crediting of greenhouse gas abatement in the land sector. Greenhouse gas abatement is achieved by either reducing or avoiding emissions or by removing carbon from the atmosphere and storing it in soil or trees.

Abatement activities are undertaken as offsets projects. The process involved in establishing an offsets project is set out in Part 3 of the Act. An offsets project must be covered by, and undertaken in accordance with, a methodology determination.

Subsection 106(1) of the Act empowers the Minister to make, by legislative instrument, a determination known as a methodology determination. The purpose of a methodology determination is to establish procedures for estimating abatement (emissions reductions and sequestration) and project rules for monitoring, record keeping and reporting on abatement.

A methodology determination must meet the offsets integrity standards set out in section 133 of the Act and the other eligibility criteria set out in section 106 of the Act. The Minister cannot make a methodology determination unless the Domestic Offsets Integrity Committee (DOIC) has endorsed the proposal for the methodology determination under section 112 of the Act and advised the Minister of the endorsement under section 113 of the Act. The DOIC is an independent expert panel established to evaluate proposals for methodology determinations.

Application of the Determination

The *Carbon Credits (Carbon Farming Initiative) (Reforestation and Afforestation) Methodology Determination 2013* (the Determination) sets out the detailed rules for implementing and monitoring an offsets project under the Carbon Farming Initiative (CFI). The Determination applies to projects to sequester carbon by establishing and maintaining trees that have the potential to attain a height of at least 2 metres, and a crown cover of at least 20%, on land that has previously been used for agricultural purposes in any part of Australia.

The Determination calculates the net project abatement of greenhouse gases during a reporting period by determining the carbon dioxide stored in the biomass of project trees, litter and fallen dead wood, known as 'project forest biomass'. Any carbon dioxide sequestered from the atmosphere and stored as carbon within project forest biomass at 1 July 2010, and emissions of carbon dioxide, methane or nitrous oxide from fossil fuel use and fire events during the reporting period, are then subtracted from the project abatement.

A project proponent wanting to implement the Determination must make an application to the Clean Energy Regulator (the Regulator) and meet the eligibility requirements for an offsets project set out in subsection 27(4) of the Act. These requirements include compliance with the rules set out in the Determination.

Offsets projects that are undertaken in accordance with the Determination and approved by the Regulator can generate Australian carbon credit units (ACCUs) that can be sold to:

- Australian companies that pay the carbon price established under the Clean Energy legislation;
- overseas entities that pay a carbon price; and
- businesses in Australia and overseas wanting to offset their own carbon pollution.

Public consultation

The methodology determination proposal for *Reforestation and Afforestation* (the proposal) was privately developed by CO2 Australia Limited (the applicant) and submitted on 28 September 2011. The proposal was published on the website of the Department of Climate Change and Energy Efficiency (the Department) from 2 April 2012 to 13 May 2012. Nine public submissions relating to the proposal were received.

The DOIC considered the issues raised in the public submissions during its assessment of the proposal as required under subsection 112(5) of the Act.

The proposal was endorsed by the DOIC on 15 November 2012.

The Department consulted with the applicant and the Regulator in the development of the Determination.

Determination details

The Determination is a legislative instrument within the meaning of the *Legislative Instruments Act 2003*.

In accordance with subsection 122(3) of the Act, the Determination takes effect retrospectively from 1 July 2010.

Subsection 12(2) of the *Legislative Instruments Act 2003* provides that, for a legislative instrument to have effect before the date it is registered, it must not adversely affect the rights of any person or impose a liability on any person in respect of anything done or not done before the date of registration. The Determination does not offend against these requirements.

Retrospective application confers a benefit in that it allows persons to apply for and generate ACCUs in circumstances where they would not normally be eligible to apply.

Details of the Determination are at Attachment A.

Statement of compatibility prepared in accordance *with Part 3 of the Human Rights (Parliamentary Scrutiny) Act 2011*

This legislative instrument does not engage any of the applicable rights or freedoms.

Conclusion

This legislative instrument is compatible with human rights as it does not raise any human rights issues.

Attachment A

Details of the Determination

Part 1 Preliminary

1.1 Name of Determination

Section 1.1 sets out the full name of the Determination, which is the *Carbon Credits (Carbon Farming Initiative) (Reforestation and Afforestation) Methodology Determination 2013*.

1.2. Commencement

Section 1.2 provides that the Determination commences retrospectively from 1 July 2010.

Subsection 122(3) of the Act provides that if:

- a methodology determination is made on or before 30 June 2013; and
- an application under section 108 for endorsement of a proposal for the determination was made on or before 30 June 2012;

the determination may be expressed to have come into force at the start of 1 July 2010.

As the Determination meets these requirements, it can apply to eligible trees established from 1 July 2010. For trees established before 1 July 2010, a project proponent can only earn credits for the abatement which occurs from 1 July 2010. Subsections 27(15) and (16) of the Act prevent the crediting of abatement before this date.

1.3 Definitions

This section defines a number of terms used in the Determination.

Key terms include:

- 'allometric function', which means a regression function fitted to a scatter of data-points that relate predictor measures collected through a non-destructive measurement process to a measure of the weight of biomass within a tree. Under the Determination, allometric functions are species-specific, meaning that a unique regression function is employed for each species of project tree that occurs within the project area.
- 'biomass components', which refers to sections of trees that are divided on the basis of structure or form, or both. Biomass components that are referenced in the Determination include stem, branches, crown, tap root or lignotuber, and lateral roots. Further subdivisions are also allowable under this definition.
- 'closing carbon stocks', which refers to the amount of carbon, expressed as carbon dioxide equivalent, estimated to be held within the project forest biomass occurring within a stratum at the end of a reporting period.

- ‘Commencement’, which refers to the earliest time at which site preparation activities begin on land within a stratum. The site preparation activities can include on-site soils descriptions, cultivation, and weed control.
- ‘crown’, which refers to part of the above-ground structures of a tree. It includes non-woody elements involved in photosynthesis or supporting photosynthetic structures, such as twigs, petioles, and leaves. The crown connects to branches and does not include a distinct, thick bark layer.
- ‘crown cover’, which refers to the amount of land covered by the outer limits of the crown of a tree, or collection of trees, viewed as a horizontal cross-section. This can be expressed in a variety of ways, including absolute coverage (in either square metres or hectares), or proportional coverage of a defined land area (as a percentage).
- ‘forest’, which has the same meaning as in the *Carbon Credits (Carbon Farming Initiative) Regulations 2011*.
- ‘forest cover’, which, unlike the term ‘forest’, refers to actual rather than potential tree height and crown cover.
- ‘full inventory’, which refers to one of 2 measurement processes (the other being PSP assessment) available under the Determination to a project proponent to estimate carbon stocks within a stratum. Compared with PSP assessment, a full inventory involves a high intensity field-based measurement approach to carbon stock estimation. This approach involves the establishment and assessment of temporary sample plots and, if the project proponent chooses, permanent sample plots to estimate carbon stocks so as to achieve a probable limit of error of no greater ±10% for the stratum. Individual project trees are measured from within plots and species-specific allometric functions are applied to estimate carbon stocks.
- ‘permanent sample plot (PSP)’, which refers to a defined area of land of at least 0.2 hectares. Measurements can be taken from within the area to estimate carbon stocks in project trees, litter and fallen dead wood. Boundaries (rectangular) or centre points (circular) of the area are marked so as to allow revisitation for up to five years or longer.
- ‘probable limit of error’, which refers to the percentage of error at the 90% confidence level.

  Note For example, a probable limit of error of 10% indicates the estimated value, based on the population sample, will be within 10% of the true value for the population with 90% confidence.

- ‘project activity’, which refers to reforestation and afforestation activities carried out within the project area, and involves the establishment and ongoing management of permanent project forest.
- ‘project emissions’, which refer to greenhouse gas emissions that arise as a result of a project activity, and include fire emissions and fuel emissions.

- ‘project tree’, which is a collective term that refers to trees that have been established within a stratum through undertaking project activities. Project trees can be live trees, live fire affected trees, dead standing trees, and dead standing fire affected trees.
- ‘PSP assessment’, which refers to one of two measurement processes (the other being a full inventory) available under the Determination to a project proponent to estimate carbon stocks within a stratum. As compared with a full inventory, PSP assessment is a lower intensity field-based measurement approach designed to be used in conjunction with the outcomes of a full inventory to estimate changes in carbon stocks over time. Individual project trees are repeatedly measured from within permanently marked plots (PSPs) and species-specific allometric functions are applied to estimate carbon stocks so as to achieve a probable limit of error of no greater ±20% for the stratum.
- ‘regional function’, which refers to an allometric function that has been specifically developed for a project to which the Determination applies and that has an allometric domain that potentially extends across multiple strata. As the function is likely to have been developed by or for the project proponent, it may not necessarily have been published in a peer reviewed journal.
- ‘stratum’, which means a carbon estimation area in the project area that is determined to have common characteristics in accordance with the requirements of Part 3 of the Determination.
- ‘stratum specific function’, which means an allometric function developed for a project to which the Determination applies. The function is developed from an allometric dataset collected exclusively from within a single stratum, to which the stratum specific function is intended to be applied. As the function is likely to have been developed by or for the project proponent, it may not necessarily have been published in a peer reviewed journal.
- ‘tree’, which has the same meaning as in the *Carbon Credits (Carbon Farming Initiative) Regulations 2011*.

Generally, terms that are not defined in the Determination have the meaning given by section 5 of the Act. The Act is available at www.comlaw.gov.au.

Note Under section 23 of the *Acts Interpretation Act 1901*, words in the Determination in the singular number include the plural and words in the plural number include the singular.

1.4 Type of project to which the Determination applies

The effect of paragraph 106(1)(a) of the Act is that a methodology determination must be expressed to apply to a specific kind of offsets project.

The Determination applies to an offsets project which will generate Australian carbon credit units through establishing and maintaining project forest on un-forested land within Australia.

Project phases

In practical effect, the Determination is likely to be implemented in three stages.

(1) Establishment phase

The establishment phase refers to a period of intensive land and project-forest management that is likely to take place from Commencement to three years after the planting is completed. The objective of this phase is the successful establishment of the project forest.

The establishment phase can involve processes such as:

- site evaluation activities – soils descriptions, on-ground land type mapping, site-management planning;
- pre-planting site preparation activities – control of competing vegetation, soil cultivation and/or soil treatments, management of weeds;
- planting or sowing – planting of seedlings or sowing of seed derived from trees; and
- post-planting management – control of competing vegetation, management of weeds, monitoring project tree health, carrying out infill planting.

Project removals are likely to be comparatively low during this early stage of project tree growth.

(2) Management phase

This phase is likely to occur from the end of the establishment phase to the time when the cumulative carbon sequestered by the project forest approaches, or reaches, a plateau state. This is normally between 15 to 40 years for many Australian forest types.

The majority of project removals will usually occur during this phase, and field-based measurement is likely to be a stronger focus than for other phases. The management phase can involve processes such as:

- monitoring project forest health including disease issues, and applying management interventions;
- remedial weed control activities;
- monitoring fire risk and carrying out fire risk reduction and management activities;
- infrastructure maintenance;
- delineation of extant project forest and mapping of stratum area; and
- in-field collection of measures of project forest performance including project tree dimensions and biomass estimates.

(3) Maintenance phase

The maintenance phase is likely to occur from the end of the management phase through to the time that the project activity is ceased, and will involve significantly lower management activity as compared with the establishment and management phases.

Project removals are likely to be low during this phase. Rather than seeking to claim small, incremental increases in carbon sequestration, the focus of the maintenance phase would be on maintaining previously claimed carbon stocks by, for example, confirming reversals are not occurring.

The maintenance phase may involve processes such as:

- monitoring changes to extant project forest boundaries, stratum area and project area by aerial imagery and/or field-based assessments;
- monitoring the occurrence of growth disturbance events and, where these occur, assessing impacts on carbon stocks; and
- infrastructure maintenance.

Part 2 Requirements for declaration as eligible project

2.1 Eligible projects

The effect of paragraph 106(1)(b) of the Act is that a methodology determination must set out requirements that must be met before a project can be an *eligible offsets* project.

To be declared an eligible offsets project, a project to which the Determination applies must meet the requirements specified in Part 2 of the Determination. These requirements are in addition to those set out in the Regulations for applications for a declaration of an eligible offsets project.

2.2 Project mechanisms

Section 2.2 clarifies how sequestration offsets projects to which the Determination applies will operate to generate Australian carbon credit units.

> ***Note*** Australian carbon credit units are issued under Part 11 of the Act.

2.3 Land with abatement potential

Section 2.3 sets out the requirements for land in the project area where project activities will occur and, as a consequence, project abatement estimated. This land is referred to in the Determination as land with abatement potential. Areas where project activities will not occur are considered to be land that does not have abatement potential. These areas include roads, water courses or large rock outcrops. These areas are not counted as land with abatement potential so that they do not affect the abatement calculation.

Under the Determination, the land with abatement potential is land that has been predominantly used for grazing or cropping, and/or fallow between those activities, for at least 5 years before the land is prepared for planting. Five years is generally considered sufficient time to establish the long-term land-use trend for land with abatement potential that will be used in the project.

Subsection 2.3(2) specifies requirements for trees that will be planted on land with abatement potential within the project area. These trees are referred to in the Determination as ‘project trees’. Regardless of species, project trees must have the potential to grow at least 2 metres tall and to cover with their crown at least 20% of the area in which they are located.

2.4 Identification of project area

Section 2.4 provides that the boundaries of the project area must be delineated in accordance with Part 3 of the Determination. Part 3 sets out the requirements for delineating land boundaries under the Determination.

A project proponent is required to define the geographic boundaries of the project area when seeking a declaration of an eligible offsets project. The information and documents required to identify a project area are specified in Division 3.1 of the Regulations.

Part 3 Delineating boundaries

3.1 Delineation of project area

Under the CFI scheme, proponents of carbon sequestration projects can include their whole land title as their project area, even if the project is only being undertaken on a part of that land. If the project area will be narrower than the whole land title, the boundaries must be determined in accordance with Part 3 of the Determination.

Section 3.1 sets out the requirements for delineating project area boundaries under the Determination.

3.2 Delineating stratum boundaries

The Determination creates sub-units of areas within a project area for the purposes of abatement calculations. These sub-units of areas are referred to in the Determination as strata. They are also known generally as Carbon Estimation Areas. Under the Determination, a stratum is the base land unit used to calculate change in carbon stocks occurring within the project area.

The process for identifying strata is generally referred to as stratification. In general, stratification improves the precision of forest and forest-carbon measurements, and must be carried out according to actual site characteristics that affect growth rates of trees. These characteristics are set out in section 3.4 of the Determination.

Under subsection 3.2(1), the first step in delineating stratum boundaries is generating a set of spatial coordinates in order to determine the geographic limits of the particular land area. The spatial coordinates can be generated by conducting an on-the-ground survey with a differential global positioning system with sub 1-metre relative accuracy, or by using ortho-rectified aerial imagery, or by a combination of these 2 methods.

Once the limits of the extant project forest area have been established, paragraph 3.2(1)(b) requires the project proponent to use a geographic information system to generate spatial data-files of outer boundaries such as ‘stratum buffers’. Paragraph 3.2(1)(c) requires the project proponent to use the information collected under the subsection to produce hard and soft copy maps to illustrate the boundaries.

Use of ortho-rectified aerial imagery

Subsection 3.2(2) sets out the requirements that ortho-rectified aerial imagery captured over the land must meet before it can be used when required under the Determination.

This imagery can also be used to:

- confirm the status or health of project trees within the stratum;
- define the boundaries of extant project forest;
- map stratum area;
- assess crown cover; and
- confirm compliance with project requirements.

Stratum buffer

The stratum buffer consists of land that lies a certain distance beyond the extant project forest area of the stratum. This distance is referred to as the 'crown radius'. Subsection 3.2(7) defines the crown radius as being the average expected radius of a fully mature project tree in the stratum or, if the radius cannot be calculated, then a set distance of 2 metres.

Subsection 3.2(4) clarifies that the following land cannot be included in stratum buffer:

- land outside of the project area as a whole;
- land that falls within the extant project forest area of another stratum;
- land that is non-project forest.

Paragraph 3.2(5)(a) provides that if the stratum buffer lies within the crown radius of another stratum, then the boundary of the buffer must be drawn so that it is an equal distance from both strata. Paragraph 3.2(5)(b) clarifies that the stratum buffer boundary cannot exceed the project area boundary.

3.3 Division of project area into strata

Subsection 3.3(1) specifies that before submitting the first offsets report for the project, the project proponent must define within the project area at least one stratum that has the characteristics set out in section 3.4.

Subsection 3.3(2) clarifies that further strata can be defined at any time during the project.

Subsection 3.3(3) details the circumstances in which new strata may be defined.

Subsections 3.3(5) and (6) specify that strata boundaries may be redefined in accordance with section 3.6 and that the new strata boundaries and areas must be recorded.

3.4 Requirements for a stratum

Section 3.4 sets out the general requirements for a stratum. The section provides that a stratum is made up of extant project forest and a stratum buffer.

Subsection 3.4(2) provides that the extant project forest area of a stratum must consist of land with abatement potential, which is dealt with in section 2.3. The other important characteristic of an extant project forest area is that it must consist of project trees that are planted within 120 days of each other so that their growth can be expected to be uniform.

Beyond the mandatory requirement regarding tree ages set out in paragraph 3.4(2)(b), the project proponent can choose to define strata on the basis of other common characteristics, including those set out in the note to subsection 3.4(2).

3.5 Growth disturbances and revision of strata

Section 3.5 deals with disturbance events that affect the growth characteristics of project trees in a stratum. These 'growth disturbances' include events such as fires and outbreaks of disease. These events are important because they will have a long-term influence on carbon stocks.

Subsection 3.5(2) requires the project proponent to delineate the boundaries of the land on which the project trees affected by the disturbance are located. The boundaries must be delineated within 6 months after the occurrence of the growth disturbance.

If the growth disturbance has affected more than 10 hectares of project trees in a stratum, the project proponent must revise the affected stratum in accordance with subsections 3.5(5) to (7). If an area of 10 hectares or less has been affected, this approach is optional. Where the approach is adopted, the revision must occur before the project proponent submits the offsets report that relates to the time when the disturbance happened.

Subsection 3.5(5) specifies that if the whole stratum has been affected by the disturbance, the stratum is 'revised' by creating a new stratum identifier and labelling the new stratum as either a 'fire affected' or 'disturbance affected' stratum, depending on the nature of the disturbance.

Subsection 3.5(6) sets out the requirements for revising partially affected strata. This process must be applied to affected areas of more than 10 hectares within a stratum, but is optional for areas of 10 or less hectares.

Subsection 3.5(6) specifies that partially affected strata are revised by excising the affected area. The non-affected area is retained under its original stratum identifier. The new stratum that consists of the affected area must meet the requirements for strata set out in section 3.4, and be labelled according to the nature of the disturbance as required by paragraph 3.5(6)(b).

If a stratum has been revised due to the occurrence of fire, subsection 3.5(8) requires that a full inventory be carried out in both the original stratum and the excised stratum within 12 months of the fire. Subsection 3.5(8) also requires that an estimate of the fire emissions, and the associated standard error, be calculated in accordance with Equations 26a to 27d in Subdivision 6.2.12.

3.6 Requirements for revisions of strata boundaries

Section 3.6 sets out the requirements that must be met when revising strata for reasons other than growth disturbance events. This may occur where, for example, project trees have died and decomposed.

In these cases the project proponent may choose to continue to use the original stratum boundary as the basis for calculating carbon stocks, because the sampling approach specified in Part 5 will account for project tree losses.

In many cases, however, it will be in the interests of the project proponent to generate updated estimates of the stratum area and use these as the basis for defining the area over which measurement and calculation of carbon stocks will apply. This reduces between-plot sampling variation and improves measurement efficiency.

Subsection 3.6(1) provides that if the project proponent chooses to update estimates of the stratum area, the boundaries of the stratum can be revised, provided the revised boundaries comply with the delineation requirements set out in section 3.2.

If a stratum has been referenced in an offsets report and the stratum area is then changed by more than 5% in a subsequent report, then paragraph 3.6(2)(a) requires that a full inventory be conducted within the revised stratum at some point in the 6 months before that stratum is referenced in an offsets report. If the stratum area is reduced to zero, then subsection 3.6(3) provides that the requirements in paragraph 3.6(2)(a) do not apply.

An adjustment limit of ±5% is considered adequate tolerance to account for any minor adjustments relating to, for example, amending mapping with reference to superior data sources (e.g. aerial imagery) so as to reflect stratum boundaries more accurately.

If the boundary of a stratum referenced in an offsets report changes by 5% or less, then the boundaries do not have to be revised.

Subsection 3.6(4) provides that stratum identifiers must continue to be reported in offsets reports even where the strata with which they are associated no longer exist for the reasons outlined in paragraphs 3.6(4)(a) and (b). Subsection 3.6(5) specifies that the closing carbon stocks and associated standard error will be zero for the strata that no longer exist, and that these zero values will be used when calculating the carbon stock change for the strata in accordance with section 6.11.

Part 4 Operation of the project

Part 4 of the Determination sets out general rules relating to the operation of offsets projects to which the Determination applies.

The note under the heading to the Part refers to section 27 of the Act, which sets out the criteria for declarations of eligible offsets projects. Paragraph 27(4)(c) of the Act specifies that projects must meet the requirements set out in the applicable methodology determination under s106(1)(b) of the Act. If paragraph 27(4)(c) is not met, the declaration can be revoked under section 35 of the Act and regulation 3.26 of the Regulations. Projects can also be audited to assess whether the project is operating in accordance with the section 27 declaration and the applicable methodology determination for the project (see regulation 1.12 of the Regulations).

4.1 Removal of trees

Subsection 4.1(1) sets out the general rule that native forest and other non-project trees must not be removed from the project area, or otherwise disturbed, for the purposes of undertaking project activities such as pre-planting preparations.

In addition to the general rule in subsection 4.1(1), paragraphs 3.36 (e) and (f) of the Regulations provide that a project will be excluded if it involves the establishment of vegetation on land that has been subject to:

- unlawful clearing of a native forest; or
- lawful clearing of a native forest within:
    - 7 years; or
    - if there is a change in ownership of the land that constitutes the project area after the clearing – 5 years;

  of the lodgement of an application for the project to be declared an eligible offsets project.

Subsection 4.1(2) of the Determination sets out exceptions to the general rule regarding the removal of trees. Under paragraphs 4.1(2)(a) and 4.1(2)(b), non-project trees can be removed from the project area at any time if they are prescribed weeds of any height or crown coverage, or if the removal of the trees is otherwise required by law.

Under paragraph 4.1(2)(c), non-project trees may also be removed if the trees do not meet the definition of 'native forest' set out in the Act, and if they are less than 2 metres in height at the time of their removal. Trees meeting these specifications can be removed or otherwise disturbed at any time from Commencement for a stratum to 6 months after planting, provided that the crown cover of the trees to be removed covers less than 5% of the project area.

Subsection 4.1(3) allows project trees to be removed from the project area in certain limited circumstances. Paragraph 4.1(3)(a) allows the removal of project trees for biomass sampling. Under paragraph 4.1(3)(b) project trees may be removed either before or after the occurrence of a natural disturbance. For example, project trees could be removed as a precautionary measure during bushfire or flood seasons. Paragraph 4.1(3)(c) specifies that project trees may be removed where otherwise required or authorised by law, such as improving pathways along shared boundaries, removing trees growing near power lines, or for other risk-management purposes.

The effect of subsection 4.1(3) is that large-scale removal of project trees such as harvesting is prohibited under the Determination.

4.2 Prescribed burns

Sections 4.2 and 4.3 restrict certain activities from occurring in the project area. These activities are restricted because of their potential to affect carbon stocks. The restrictions relate to prescribed burns and fertiliser use in the project area.

Section 4.2 sets out various restrictions relating to when prescribed burns can be carried out. Subsection 4.2(1) specifies that only one prescribed burn can be carried out within each stratum as part of pre-planting site preparation activities. A burn in these circumstances could be carried out to reduce the cover of competing ground-level vegetation such as grasses, forbs and herbaceous species. Where the prescribed burn is carried out as part of pre-planting preparations, the burn must comply with the restrictions on removing trees set out in section 4.1.

Prescribed burns can only be carried out in strata after they are planted with project trees in the circumstances set out in subsection 4.2(2). Circumstances in which a prescribed burn would be required or authorised by law in circumstances such as bushfire prevention.

4.3 Restrictions relating to fertiliser use

Section 4.3 sets out the general rule that fertiliser application within the stratum is no more frequent than 4 times in a 100-year period. It is unlikely that this threshold would need to be exceeded since there would be insufficient economic incentive to warrant intensive nutrient management for project plantings.

Fertiliser use is restricted under section 4.3 so that the fertiliser regime applied under the project is not more intensive than that which was likely to have been applied under the baseline scenario of cleared agricultural land. A frequency of only four applications in 100 years is considered to be below average inputs for the baseline scenario. This means that emissions associated with fertiliser use are equivalent under the baseline scenario and project scenario. Accounting for this emissions source is therefore not required under either scenario.

The one-hundred-year time period corresponds to the period of time for which sequestration must be maintained under subparagraph 133(1)(f)(i) of the Act.

Part 5 Methods for estimating net project abatement

Division 5.1 Estimating project removals

Division 5.1 outlines the methods that must be conducted when estimating carbon stocks for a stratum at the end of a reporting period.

The methods are based on regularly collecting field-based measurements from strata to determine carbon stocks and changes in carbon stocks.

The Part allows the project proponent to choose between two measurement processes, or a combination of both, for these purposes. The processes are referred to as 'full inventory' and 'PSP assessment'. If a full inventory is conducted, an offsets report can be submitted once every five years. Where the preference is to submit an offsets reports more frequently than once every five years, the project proponent can apply a full inventory either alone to inform estimates of changes in carbon stocks between reporting periods, or in combination with PSP assessments.

At a minimum, a full inventory should be conducted within six months prior to the submission of the first offsets report that references a particular stratum, and then every five years through until the end of either the crediting period or the management phase, whichever comes first.

The following example scenarios illustrate some combinations of full inventory and PSP assessment that meet differing offsets report schedules.

Example scenario 1: Annual Offsets Reports from year 1.

Year/Activity	1	2	3	4	5	6	7	8	9	10
Full Inventory										
PSP Assessment										

Example scenario 2: Offsets Reports at years 2,5,8 & 10.

Year/Activity	1	2	3	4	5	6	7	8	9	10
Full Inventory		■			■					■
PSP Assessment		■			■			■		■

Example scenario 3: Offsets Reports at years 2, 5-10.

Year/Activity	1	2	3	4	5	6	7	8	9	10
Full Inventory		■			■					■
PSP Assessment		■			■	■	■	■	■	■

Example scenario 4: Offsets Reports at years 5 & 10.

Year/Activity	1	2	3	4	5	6	7	8	9	10
Full Inventory					■					■
PSP Assessment										

Subdivision 5.1.2 Conducting a full inventory

A full inventory is an assessment of forest biomass for calculation of carbon amounts using plot-based assessments. Compared with PSP assessment, a full inventory is a higher intensity field-based measurement approach to carbon stock estimation that involves the establishment and assessment of TSPs – and, if desired, PSPs – across strata. Individual project trees are measured from within plots and species-specific allometric functions are applied to estimate carbon stocks.

<u>5.2 Conducting a full inventory</u>

Section 5.2 sets out the processes that a project proponent must undertake when conducting a full inventory of a stratum. These processes are detailed in other Subdivisions in Part 5 of the Determination.

Subdivision 5.1.3 Sampling plans

A sampling plan is a document that identifies the quantity and location of TSPs, PSPs, and biomass sample trees within a stratum, or the geographic limits of an allometric domain.

A project proponent is required to develop and document a sampling plan when:

- a full inventory or PSP assessment is conducted; and
- an allometric function is developed, updated, or validated.

It is acceptable to develop a sampling plan that documents multiple activities conducted within a single stratum, such as validating an allometric function and conducting a full inventory.

In all cases a sampling plan must include a description of the activity to which the sampling plan relates, including the dates during which the activity is to be conducted.

Section 5.4 specifies matters that must be included in a sampling plan when a full inventory or PSP assessment is being conducted. Paragraph 5.4(2)(j) requires that a sampling plan includes details of corrective measures that were taken when the variation specified in paragraph 5.4(2)(i) exceeds the threshold specified in Subdivision 5.1.5.

Sections 5.5 and 5.6 specify the additional matters that a project proponent must include in a sampling plan in relation to allometric functions. The additional matters include the spatial coordinates defining the location of biomass sample sites, biomass sample plots and biomass sample trees generated both off site and on the ground. Recording the coordinates in a sample plan allows the off-site coordinates to be cross-checked with the actual location recorded in the field.

In some instances sections 5.4, 5.5 and 5.6 require both *ex ante* and *ex post* information and processes. A project proponent should therefore create and maintain both *ex ante* and *ex post* versions of the sampling plans required under Subdivision 5.1.3.

Subdivision 5.1.4 Location of plots

5.7 Determining the location of plots

The location of plots within a stratum must be determined according to randomly selected points of intersection from a grid overlay as described in section 5.7.

The section specifies the process for establishing the grid overlay and selecting grid intersections as plot locations. It also sets out the options for treatment of plot location and configuration at the randomly selected points of intersection.

The diagram at Attachment B represents the process for establishing a grid overlay for a stratum. The process requires that the location of a plot within a stratum be determined using a map of the stratum (see subsection 5.7(2)). The map must have been developed in accordance with Part 3, and must reflect the current boundaries of the stratum.

Paragraph 5.7(3)(b) requires the grid size be sufficiently small so that probable limits of error (as specified in Subdivision 5.1.5) can be achieved where all points of intersection are selected as plot locations.

Subsection 5.7(5) provides that if the number of grid intersections determined in accordance with subsections 5.7(2) to 5.7(4) is equal to the desired number of plots to be established in the stratum, then plots in the field are to be located according to the location of each grid intersection within the stratum.

Subsection 5.7(6) specifies the steps that are to be undertaken if the number of grid intersections that occur within the stratum exceed the desired number of plots to be established in the stratum.

Subsection 5.7(9) specifies the two options for the treatment of plot location and configuration at the randomly selected points of intersection. The two lay-out options permitted under the Determination are the ‘centroid’ and the ‘consistent edge’ options.

Subsection 5.7(10) makes clear that the ‘consistent edge’ option can be applied only within a stratum that is exclusively comprised of belt plantings. ‘Belt plantings’ is a defined term and means discrete patches of project trees that have been established in a linear or curvilinear ‘belt’ pattern where width measured across the belt is no wider than 50 metres.

Attachment C illustrates examples of a series of belt plantings of varying shapes. Attachment D contains examples of plot orientation in belt plantings.

Subdivision 5.1.5 Establishing and assessing plots

5.8 Establishing and assessing plots during full inventory

Section 5.8 provides that project proponents must follow the processes set out in Subdivision 5.1.5 when establishing and assessing sample plots within a stratum during a full inventory.

5.9 Target probable limit of error – full inventory

Section 5.9 sets out the target number of plots that will be required to achieve the target probable limit of error specified in the section.

The estimate of the number of plots per stratum required to achieve the target probable limit of error must be documented in a sampling plan that has been developed in accordance with Subdivision 5.1.3, and in which plot locations have been determined using the process specified in section 5.7. For full inventories and PSP assessments the sampling plan must include the *ex post* analysis confirming that the target probable limit of error has been achieved in accordance with section 5.16.

5.10 Establishing plots

During a full inventory, a project proponent is required to establish and assess TSPs within the stratum. Additionally, where a PSP assessment is to be conducted to inform estimates of carbon stock change in between full inventory events, PSPs should also be established during a full inventory. Collectively, TSPs and PSPs are referred to in the Determination as ‘plots’. Additional considerations relating to establishing and assessing plots during a PSP assessment are set out in Subdivision 5.1.6.

Section 5.10 details the specifications for the establishment of plots during a full inventory. Subsection 5.10(1) provides that at least 5 plots must be established per stratum. In general, this could be temporary or permanent sample plots. If, however, the project proponent wishes to conduct PSP assessments in the future, the 5 plots specified in subsection (1) should consist entirely of permanent sample plots (as required by paragraph 5.10(2)(c)).

The intended location coordinates determined in accordance with section 5.10 must be uploaded into a geographic positioning system, which is used by field crews to navigate to these coordinates. It is important that plots are established according to the intended location coordinates as shown on the global positioning system in the field, without any deliberate positioning of plots with reference to, for example, planting lines, inter-rows, compartment breaks, unplanted land or extant project forest or stratum boundaries.

For practical reasons, some forest inventory programs consistently adjust plot position in relation to planting lines. This is not, however, an acceptable approach for projects to which the Determination applies, because it may introduce systematic bias to the estimation processes outlined in the Determination.

If establishing a plot according to the process outlined in section 5.10 would constitute a serious safety risk, subsection 5.10(8) allows the plot to be relocated to the nearest safe point to the intended location coordinates. In this case the requirements at subsections 5.14(4) and (5) regarding plot visits during a full inventory may be ignored.

In circumstances where grid intersections and plot locations fall close to the boundary of a stratum, the process set out in Subdivision 5.1.7 must be applied.

5.11 Plot configuration

Section 5.11 describes the requirements that must be met in relation to the shape of plots that are established in a stratum.

5.12 Plot size

Section 5.12 sets out the requirements that must be met in relation to the size of plots in a stratum. Plots must be consistently established to a pre-defined target plot size (which is documented in a sampling plan) to ensure that plots are all approximately equivalent in size to each other. This is necessary because of the arithmetic, rather than weighted, averaging approach that is applied in Equations 7 and 8.

5.13 Identifying and marking plots

Section 5.13 requires that the corners of a rectangular plot, or centre point of a circular plot, must be marked to allow for a return visit to the plot, including by independent verifiers.

Under subsection 5.13(3), the marking of a TSP must allow for its identification on return visits for at least 12 months after a full inventory assessment. PSPs must be able to be identified on return visits for 5 years from its establishment. Subsection 5.13(4) requires that the PSP boundary markers be fire and flood resistant, so that the plots can be identified in the event of any natural disturbance that occurs in the 5 years from establishment.

5.14 Plot visits during full inventory

Section 5.14 provides that all TSPs and PSPs must be visited when conducting a full inventory. The procedures set out in the section must be undertaken during those visits. PSPs must be visited even if the PSP assessment is intended to be conducted in the future.

5.15 Collection of information during plot visits

Section 5.15 specifies the minimum information that must be collected during plot visits.

Paragraph 5.15(1)(c) requires that information about the position of plots must be collected. In particular, it must be noted whether the plot is located completely inside the stratum, or is an edge plot that includes land that is outside the stratum. Stratum edges will not always be obvious in the field, so this assessment can be performed *ex ante* and *ex post*, and either on or off site. Off site assessment of this matter would allow access to a geographic information system and spatial data files showing the location of the plot relative to the stratum boundary.

5.16 Ex post analysis of plots

The purpose of section 5.16 is to ensure that the target probable limit of error specified in section 5.9 has been met or exceeded.

Subdivision 5.1.6 PSP assessments

This Subdivision sets out the processes that must be undertaken when conducting a PSP assessment.

If a project proponent wishes to conduct a PSP assessment within a stratum, PSPs must have already been established in the stratum as part of a previous full inventory (see subsection 5.2(5)).

5.18 General requirements for PSP assessments

Section 5.18 specifies the general requirements in relation to undertaking a PSP assessment. These processes are set out in more detail in other provisions in Part 5 of the Determination.

5.19 Ex post analysis of PSPs

Section 5.19 requires an *ex post* analysis to confirm that the target probable limit of error around the mean PSP carbon stocks is achieved.

Subsection 5.19(1) provides that the target probable limit of error for the Subdivision is $\leq$ 20% at the 90% confidence level.

Subsection 5.19(2) requires a project proponent to use Equation 28 to confirm that the probable limit of error specified in subsection 5.19(1) is met.

Subsection 5.19(3) provides that if the *ex post* analysis confirms that the probable limit of error target is met, then the project proponent must calculate closing carbon stocks for the stratum using Equation 6a.

Subsection 5.19(4) provides that if the target probable limit of error is not met, then it is not acceptable to use the data from the PSP assessment to calculate closing carbon stocks for the stratum. Instead, the project proponent must conduct a full inventory in accordance with section 5.2. In addition, if a PSP assessment is to be conducted in the future, the proponent must establish further PSPs in accordance with Subdivisions 5.1.5 and 5.1.6, sufficient to meet the target probable limit of error.

Subdivision 5.1.7 Plots located close to stratum boundaries

This Subdivision specifies the process that a project proponent must apply in cases where the intended location coordinates for a plot fall close to the boundary of a stratum (section 5.20). If part of the boundary of the plot falls outside the stratum boundary, then the plot is known as an edge plot (section 5.21).

Subsection 5.21(3) sets out the requirements for plot markers in rectangular edge plots. The minimum marker requirement for circular plots is to mark the centre (as required under paragraph 5.13(2)(b)). This may make it possible to establish the marker wholly within the stratum boundary in the case of circular plots. Further requirements for marking plots are set out in section 5.13.

Attachment E contains a diagrammatic example of the treatment of an edge plot.

Section 5.22 clarifies how carbon stocks in these plots are to be assessed. The process specified in section 5.22 is highly likely to provide for a conservative estimate of carbon stocks, but it can be applied easily and consistently.

Subdivision 4.1.8 Allometric functions

5.23 Applying species specific allometric functions

The development and use of allometric functions for the purposes of accounting biomass and carbon in forests is a well-established practice. Under the Determination, the biomass contained within a project tree is estimated by using a species specific allometric function to convert measures of project tree dimensions into an estimate of the total biomass within the project tree.

A project proponent is able to apply the following classes of allometric function to estimate the biomass within project trees:

- Stratum specific function: an allometric function developed by the project proponent, that is not necessarily published in a peer reviewed journal and that has been developed from data collected exclusively from within a single stratum, the boundaries of which define the geographic limits of the allometric domain.
- Regional function: an allometric function developed by a project proponent, that is not necessarily published in a peer reviewed journal and that is assumed to have an allometric domain that extends across a relatively large geographic area, potentially including multiple strata.

In all cases, the use of an allometric function is only possible where the requirements detailed under Subdivisions 5.1.8 to 5.1.11 are met and the compatibility and validation tests in Subdivision 5.1.12 are applied.

If a stratum specific function is applied outside of the stratum from which the allometric dataset was collected, the allometric function must be treated as a regional function subject to the validation process set out in section 5.42.

In accordance with subsection 5.23(3), an allometric function can only be applied to project trees that occur within the allometric domain for that allometric function. Allometric domains are dealt with in section 5.24.

5.24 Allometric domain

An allometric domain describes the specific conditions under which an allometric function is assumed to be applicable. Section 5.24 specifies the processes that a project proponent must undertake when determining the allometric domain that relates to an allometric function.

For each allometric function applied under the Determination, subsection 5.24(1) provides that the project proponent must clearly define and document the allometric domain that relates to the allometric function within an allometric report.

Procedures used to assess predictor measures for the purposes of paragraph 5.24(1)(c) include, for example, using a hypsometer or a height pole. The procedures used to collect predictor measures from trees included within plots assessed during a full inventory or PSP assessment must replicate the procedures to collect predictor measures from the biomass sample trees used to develop the applicable allometric function. This avoids introducing error and bias into carbon stock estimation processes.

In accordance with subsection 5.24(3), an allometric function must not be used if there is insufficient information available to develop an allometric domain that meets the requirements in section 5.24.

5.25 Regression fitting

Section 5.25 sets out the requirements for conducting regression analyses for the purposes of deriving allometric functions.

Allometric functions are only allowable under the Determination where they have been derived by using regression analyses to relate predictor measures collected from biomass sample trees to biomass estimates obtained for the same set of biomass sample trees. (inclusive of both above-ground and below-ground components)

It should be noted that the Determination is not applicable where the project proponent wishes to apply assumed below-ground biomass values, such as assumed root-shoot ratios.

Basic concepts and approaches to performing regression analyses are detailed in the *National Carbon Accounting System Technical Report No. 31: Protocol for Sampling Tree and Stand Biomass*, Australian Greenhouse Office, 2002 (the Protocol for Sampling Tree and Stand Biomass). This Report is available on the Department of Climate Change and Energy Efficiency's website at www.climatechange.gov.au.

If a single predictor measure such as tree height is to be considered, linear or non-linear regression techniques may be applied. Where multiple predictor measures such as tree height and diameter are to be considered, multiple linear or non-linear regression techniques may be applied to develop a multivariate allometric function.

In both cases, data must not be transformed but raw data values must be applied, and the weighted least squares method must be applied to estimate the line of best fit.

5.26 Minimum data requirements

Section 5.26 sets out the minimum data requirements for conducting regression analyses for the purpose of deriving allometric functions.

An allometric function can only be applied under the Determination where the regression analyses used to develop the allometric function reference data collected from at least 20 individual biomass sample trees sampled from within the geographic limits of the allometric domain.

All biomass sample trees must have had both above-ground and below-ground biomass components directly assessed as part of the sampling process. Allometric functions that assume a below-ground biomass fraction (for example, the application of an assumed root:shoot ratio in place of excavating and directly assessing root components) are not permitted under the Determination.

5.27 Minimum regression fit requirements

For an allometric function to be considered acceptable for estimating biomass within a given allometric domain, the requirements specified in subsection 5.27(3) must be met.

Where the requirements specified in subsection 5.27(3) are not met, one of the processes set out in subsection 5.27(4) may be applied. Paragraph 5.27(4)(a) provides that the allometric domain may be redefined *ex post* so as to reduce variability or to remove bias. This process could include separating the allometric dataset on the basis of geographic location, size, or growing conditions, then applying regression analyses to data sub-sets. This would result in a more narrowly defined allometric domain. The minimum data requirements set out in section 5.26 would still need to be met in this case.

5.28 Variance of weighted residuals

Section 5.28 provides that the project proponent must calculate and report the variance of weighted residuals for an allometric function using Equation 32a. The allometric function cannot be used as part of the Determination unless this calculation has occurred.

5.29 Allometric report

Section 5.29 sets out the matters that must be documented in an allometric report for each allometric function applied to project trees in a project. The listed requirements apply to both stratum specific and regional allometric functions, and to all tree types.

Subdivision 5.1.9 Allometric functions for live trees

5.30 Developing allometric functions for live trees

This Subdivision describes the processes for developing stratum specific functions, updating stratum specific functions, and developing regional functions for live trees. A treatment for live fire affected, dead standing, and dead fire affected trees is set out in Subdivision 5.1.11.

Details of all biomass sample site and tree selections must be documented in a sampling plan, including:

- the size classes applied;
- the seed value used in the pseudo random number generator;
- the TSPs within which biomass sample trees are located; and
- the spatial coordinates for the location of biomass sample trees (collected in-field using a global positioning system).

5.31 Developing stratum specific functions

A stratum specific function is developed as part of a full inventory, where TSPs have been established and assessed in accordance with the processes set out in Subdivisions 5.1.2 and 5.1.5.

Section 5.31 sets out the process for selecting and assessing biomass sample trees from within TSPs for the tree type of interest.

The process set out in subsections 5.31(3) and (4) of ranking the predictor measures according to size and then selecting the project trees with the highest and lowest predictor measures, ensures that the full range of project tree sizes occurring within the TSPs during the full inventory is represented in the allometric dataset.

Subsection 5.31(10) deals with situations where the sampling processes, and in particular destructive sampling processes, may pose a safety, environmental, cultural or property risk.

5.32 Updating pre-existing stratum specific functions

It is likely that project trees will grow beyond the allometric data range for a stratum specific function from reporting period to reporting period. For this reason the Determination allows for an existing stratum specific function to be updated in accordance with the process described in section 5.32. The updating process is based on the process specified in subsections 5.31(2) to (8) for the selection of biomass sample trees, with the exception that a minimum of only 10 biomass sample trees – rather than 20 as specified in subsection 5.31(7) – must be selected (see subsection 5.32(4)).

5.33 Regional functions

A regional function may be developed at any time from trees that occur inside or outside the project area. The development of a regional function does not need to be linked to a full inventory.

Section 5.33 sets out the process for developing a regional function.

Subdivision 5.1.10 Assessing biomass sample trees

5.35 Assessing above-ground biomass of biomass sample trees

Section 5.35 sets out the processes that a project proponent must undertake when assessing the above-ground biomass of a biomass sample tree. These processes are based on the Protocol for Sampling Tree and Stand Biomass. When assessing the above-ground biomass of biomass sample trees, the 'Complete Harvest Method' outlined at pages 6-16 of the Protocol should therefore be applied.

Subsection 5.35(2) requires that measures of candidate predictor measures be collected. The predictor measures may include:

- stem diameter;
- tree height;
- crown dimensions; or
- other predictor measures that may be correlated with tree biomass.

Subsection 5.35(3) requires that the biomass sample tree must be cut at ground-level and separated into biomass components. The Protocol for Sampling Tree and Stand Biomass provides a framework for separating components based on dry-wet weight ratio and carbon content. As a minimum, the biomass components must include the stem, branches, crown and attached dead material associated with the biomass sample tree.

Definitions of 'stem', 'branches' and 'crown' are set out in section 1.4.

'Dead material' means dead, project-tree derived material (for example, dead branches, dead stem and dead crown) that remains attached to the biomass sample tree. The dead material must be attached to the tree and suspended above the ground. It may include dead material that is merely hanging from the tree.

For the purposes of the processes outlined in section 5.35, it is important that sub-samples are collected and weighed as soon as possible after the wet weight of each biomass component is recorded so as to ensure the wet to dry weight ratio obtained for sub-samples remains applicable to the biomass component.

For each biomass sample tree, a minimum of three sub-samples should be collected from each biomass component, so as to allow for an estimate of the level of variation between sub-samples.

An alternative, acceptable approach to sub-sampling is to record the wet weight and oven dry weight of the entire biomass component. This will generally only be feasible where biomass sample trees are small. Where the entire biomass component is used, there is no need to calculate the average of the dry-wet ratios as specified in subsection 5.35(11) since a single value is returned.

5.36 Assessing root biomass of biomass sample trees

Once the above-ground biomass components of a biomass sample tree have been assessed in accordance with section 5.35, the processes set out in section 5.36 must be undertaken to assess the below-ground biomass of the same tree. These processes are based on 'Section 3 – Estimating root biomass' (pages 27- 35) in the Protocol for Sampling Tree and Stand Biomass.

Subsection 5.36(2) requires that the roots of each individual biomass sample tree be excavated using the root 'diameter limit' approach. Under this approach, the project proponent defines those parts of the root system that will be included in the sampling and measurement process. Subsection 5.36(3) specifies that roots of a diameter less than 2 millimetres should not be included, except where these remain attached to larger root sections.

Once the root system is excavated and cleaned, subsection 5.36(5) requires that it be divided into its separate biomass components which, at a minimum, must include the tap root or lignotuber, and the lateral roots. The project proponent may also elect to apply further separation, including into root crown, coarse lateral roots and fine lateral roots.

Subsection 5.36(7) requires that for each biomass sample tree, a minimum of three sub-samples should be collected from each biomass component, so as to allow for an estimate of the level of variation between sub-samples.

An alternative, acceptable approach to sub-sampling is to record the wet weight and oven dry weight of the entire biomass component. Where the entire biomass component is used, there is no need to calculate the average of the dry-wet ratios as specified in subsection 5.36(12) since a single value is returned. In addition, the word 'sub-sample' should be replaced with 'biomass component'.

5.37 Assessing biomass of entire biomass sample tree

Once the processes specified in sections 5.35 and 5.36 have been undertaken, the project proponent must estimate the biomass for the entire biomass sample tree by using Equation 30 in the Determination.

5.38 Record keeping and reporting

Section 5.38 specifies the records that a project proponent must retain. These include records of all measures collected, as well as quality assurance records that identify the type of equipment used to collect measures, the equipment calibration that was undertaken, and the error checks that were applied throughout the measurement process. The project proponent must also retain records that demonstrate constant weight is achieved in sections 5.35 and 5.36.

Subdivision 5.1.11 Allometric functions for other trees

5.39 Developing allometric functions for trees other than live trees

Under the Determination, project proponents can choose to account carbon stocks in dead standing trees, dead standing fire affected trees and live fire affected trees. Where a project proponent wishes to account carbon stocks in these pools, the project proponent is required to develop species-specific allometric functions that relate to these tree types. The procedure for this is the same as that detailed in Subdivision 5.1.8 and 5.1.9, but subject to the exceptions specified in section 5.39.

In the case of dead standing trees and dead standing fire affected trees, only biomass contained within the stem component can be considered. This ensures that the allometric function relates the preferred predictor measure to stem biomass alone, rather than biomass for the entire tree. Biomass contained in non-stem components, such as branches, crown and below-ground biomass components, must conservatively be assumed to be zero. This approach is applied because it obviates the need to categorise levels of degradation in trees that have died.

In the case of live fire affected trees, a project proponent may adopt either the stem-only approach for dead tree types set out in section 5.39, or the approach detailed in Subdivision 5.1.10 to develop allometric functions based on sampling of the whole tree.

For live fire affected trees, it can be expected that over time these may recover from the fire event and that their form may once again approach that of live trees. In this case, the project proponent can revert to use of the allometric function developed for live trees, provided that it can be demonstrated that there is no statistically significant difference in the relationships between predictor measures and above-ground biomass for live fire affected trees and live trees. This should be demonstrated through the processes set out in Subdivision 5.1.12.

Subdivision 5.1.12 Applicability of allometric functions

An allometric function can only be applied to estimating biomass for project trees that fall within the domain of that allometric function. A project proponent is required to perform the compatibility checks set out in section 5.41 on each occasion that an allometric function is applied to project trees within a stratum. The outcomes of the checks must be documented in an offsets report.

In addition to the compatibility checks set out in section 5.41, a project proponent must perform a validation test at the times specified in subsection 5.42(1). In all cases, the test must be performed as part of a full inventory and is to be documented in an offsets report.

Subsection 5.42(16) provides that an upper one-tailed F-Test must be applied in accordance with the process in subsection 5.42(17). This is required to test for statistical difference between the variance of weighted residuals calculated for the allometric function in accordance with Subdivision 5.1.8, and the variance of weighted residuals calculated at subsection 5.42(15) for the test trees.

Section 5.43 requires that the outcomes of all compatibility and validation tests set out in Subdivision 5.1.12 be detailed in an offsets report. This includes any substitution or development of stratum specific functions arising as a result of these tests.

Subdivision 5.1.13 Assessing carbon stocks in fallen dead wood and litter

<u>5.44 Assessing carbon stocks in litter</u>

Litter is dead project tree derived biomass that occurs at ground level. It can include bark, leaves, and smaller woody components such as stem and branch material with cross-sectional diameter of less than or equal to 2.5 centimetres. It is optional under the Determination for a project proponent to account for carbon in litter.

If choosing to assess the carbon stock in litter, the project proponent must undertake the processes specified in section 5.44. This involves collecting four litter samples from within each TSP and PSP to be assessed. Subsection 5.44(2) requires that the samples are to be collected from a square or rectangular sampling frame placed randomly in separate, non-overlapping locations within the plot. Care needs to be taken to ensure that litter is not collected from outside the boundaries of the sampling frame and that as little dirt or other contaminants as possible is included in the sample.

Subsections 5.44(3) and (4) require that the four samples from the plot be combined into a single bulked sample for the plot. The single bulked sample must then be weighed and its 'wet weight' recorded in an allometric report.

Once at least three plots have been assessed each day, subsection 5.44(5) requires that a sub-sample be taken from the bulked sample for each of those plots. The wet weight of the sub-samples must then be recorded in an allometric report. The remainder of the bulked sample may then be discarded by being scattered uniformly over the area sampled with the sampling frame.

Subsections 5.44(6) to (10) require that the sub-samples be oven dried and then weighed. This 'dry weight' must also be recorded in an allometric report. The dry-to-wet ratio of the sub-samples must then be calculated and used to estimate the dry weight of the bulked samples collected each day.

5.45 Assessing carbon stock in fallen dead wood

Fallen dead wood is dead project tree derived biomass that occurs at ground level. It includes larger woody stem and branch components with cross-sectional diameter of more than 2.5 centimetres. It is optional under the Determination for a project proponent to account for carbon in fallen dead wood.

The processes set out in section 5.45 must be applied where a project proponent chooses to assess the carbon stock in fallen dead wood. The processes involve collecting as much as possible of the fallen dead wood that occurs in the plot. Subsection 5.45(3) deals with fallen dead wood that partially extends over the boundaries of the plot. Subsection 5.45(5) specifies how to obtain sub-samples of the dead wood that has been collected from each plot. Once obtained, the sub-samples must be weighed as they are, then oven-dried and weighed again. The ratio of the two weights must be calculated for each sub-sample in accordance with subsection 5.45(10). The average of the dry-to-wet ratios of the sub-samples must then be calculated and used to estimate the dry weight of the fallen dead wood collected that day. Under subsection 5.45(12), the project proponent must ensure that the sub-samples and the fallen dead wood used in the processes set out in section 5.45 are collected on the same day. This means that sub-samples collected on one day cannot be used to estimate the dry weight of fallen dead wood collected on a different day.

Division 5.2 Calculating project emissions

This Division specifies the parts of the Determination that must be used to calculate fire and fuel emissions that occur during the life of the project.

Part 6 Calculating the carbon dioxide equivalent net abatement amount for a project in relation to a reporting period

Under the Determination, abatement is calculated as the change in the amount of carbon stored in a project area through the growth of trees, natural decay, and disturbance events such as fire, pest, disease and storm, minus emissions resulting from fire and from fuel used to establish and maintain the project.

Division 6.1 Preliminary

6.1 General

Section 6.1 clarifies that all calculations are in respect of activities done or outcomes achieved during the reporting period for a project.

6.2 Greenhouse gas assessment boundary

Section 6.2 describes the greenhouse gas sources and sinks and relevant carbon pools that need to be assessed in order to determine the amount of carbon dioxide removed from the atmosphere when undertaking the project activity. The greenhouse gas assessment boundary includes the tree and debris carbon pools within the project area and the emission of greenhouse gases from establishing and managing the project.

The carbon pools and emission sources that need to be taken into account when calculating abatement for the project are set out in the table below. The table also sets out emissions that are specifically excluded from the project.

Source		**Greenhouse gas/carbon pools**	**Included / excluded**	**Justification for exclusion**
Baseline	**Source 1**	CO_2, CH_4, N_2O, emissions from land management activities.	Excluded	Exclusion is conservative.
	Source 2	CO_2, CH_4, N_2O arising from fire events (prescribed burns and wild fires).	Excluded	Exclusion is conservative.
	Source 3	CH_4, N_2O arising from livestock grazing and fertiliser application.	Excluded	Exclusion is conservative.

Source		Greenhouse gas/carbon pools	Included / excluded	Justification for exclusion
	Sink 1	CO_2, above and below-ground non-tree vegetative biomass.	Excluded	Net removals assumed to be zero. Sequestration is unlikely to increase in the absence of the project activity. Biomass in this pool will likely be no greater than that under the project scenario, which also excludes this pool. This is a conservative assumption.
	Sink 2	CO_2, above and below-ground non-project tree biomass.	Excluded	Assumed to be zero. The applicability conditions require that the project forest is established on cleared lands.
	Sink 3	CO_2, soil organic carbon.	Excluded	Under the baseline scenario, short-term fluxes in soil carbon stocks are likely to occur, no long-term trend for increase is expected. In addition, soil carbon stores are excluded for the project scenario.
Project Activity	**Source 1**	CH_4, N_2O emissions arising from fuel use in relation to project forest establishment and management activities within the project area.	Included	

Source		Greenhouse gas/carbon pools	Included / excluded	Justification for exclusion
	Source 2	CO_2, CH_4, N_2O arising from fires occurring within the project area.	A single pre-planting prescribed burn is not accounted for. For all other fires, CO_2 included in all cases; CH_4 and N_2O are included only where the fire event affects >10 hectares of a stratum within a reporting period.	CO_2 is accounted for through calculations of carbon stock changes within the project area, under Subdivision 6.2.2. CH_4 and N_2O are included for larger (>10 ha Stratum Area) fire events, on the basis that these are potentially large emissions sources.
	Source 3	N_2O arising from fertiliser use	Excluded	The fertiliser regime under the project should not exceed that of the baseline scenario.
	Sink 1	CO_2, above-ground and below-ground live tree biomass (including fire affected).	Included	This is the major carbon pool that arises as a direct result of the project activity. This pool is expected to increase over time and achieve abatement well in excess of the baseline.

Source		Greenhouse gas/carbon pools	Included / excluded	Justification for exclusion
		CO_2, above-ground dead standing tree biomass (including fire affected).	Optional	In most situations this will be a secondary carbon pool that arises as a direct result of project implementation. This pool is expected to increase over time and achieve abatement in excess of the baseline scenario. Inclusion is optional on the basis that exclusion is conservative. Below-ground components are excluded.
		CO_2, ground-level litter and fallen dead wood.	Optional	These are secondary carbon pools that arise as a direct result of the project activity. This pool is expected to increase over time and achieve abatement in excess of the baseline scenario. Inclusion is optional, on the basis that exclusion is conservative.
	Sink 2	CO_2, above-ground non-tree biomass.	Excluded	Exclusion is conservative. Sequestration is insignificant compared to sequestration by project tree biomass. This pool is also excluded from the baseline scenario.

Source		Greenhouse gas/carbon pools	Included / excluded	Justification for exclusion
	Sink 3	CO_2, soil organic carbon.	Excluded	Exclusion is conservative because soil organic carbon increases more, or decreases less, under the project activity as compared with the baseline scenario. The project activity involves long term continuous vegetation cover, whereas the baseline scenario involves repeated vegetation removal as well as occasional soil disturbance events.

6.3 Calculating the baseline for the project

Section 6.3 specifies the project baseline as required under paragraph 106(4)(f) of the Act.

The Determination's baseline scenario is assumed to be continued management under a cleared agricultural regime, being a cropping regime, a grazing regime, or a combination of the two, and including any fallow periods, for at least five years before the project begins.

Under the Determination, it is conservatively assumed that emissions associated with the baseline scenario are zero. Baseline removals are also assumed to be zero.

6.4 Requirements for calculating carbon dioxide equivalent net abatement

Section 6.4 sets out the general requirements and timeframes for calculating the carbon dioxide equivalent net abatement for a reporting period.

Subsection 6.4(5) provides that a full inventory must be conducted within a stratum at least every five years for the period between the first offsets report through to the commencement of the maintenance phase. During the maintenance phase of the project, the rate of increase in carbon stocks is comparatively low and, in many instances, may not be cost-effectively measured through field-based processes. Consequently, a project proponent is not required to continue with full inventories or PSP assessments once a stratum has entered the maintenance phase.

It is optional for a project proponent to perform PSP assessments and, subject to the condition in subsection 6.4(4), PSP assessments may be conducted at any time. Subsection 6.4(6) clarifies that PSP assessments can only be carried out if a full inventory has been previously conducted in the stratum in accordance with the timeframes set out in subsection 6.4(5).

Division 6.2 Calculations

Division 6.2 sets out the formulas used for calculating net greenhouse gas abatement for the project area.

General

The basis for the calculation of the net greenhouse gas abatement occurring within a given reporting period for the project is provided at Equation 1a. The process for calculating uncertainty for the estimate of net greenhouse gas abatement (expressed as a 90% confidence interval) is set out in Equations 1b to 1d.

To estimate net greenhouse gas abatement for a reporting period, the change in carbon stocks that has occurred within the project area for the reporting period is calculated using Equation 2a and project emissions (calculated using Equation 23a) are subtracted from this figure. The standard error for changes in carbon stocks within the project area is calculated in accordance with Equation 2b. The standard error for project emissions is calculated in accordance with Equation 23b.

In order to estimate the total change in carbon stocks occurring across the project area within a reporting period, the change in carbon stocks that has occurred within each individual stratum is calculated. Two separate calculation approaches are applied (Equation 3a or 3b) depending on whether:

(a) the stratum is being referenced in an offsets report for the first time; or

(b) the stratum has been previously referenced in an offsets report.

(a) Calculating change in carbon stocks for a stratum that is being referenced in an offsets report for the first time – apply Equation 3a.

Before referencing a stratum within an offsets report for the first time, a full inventory must have been conducted within the stratum no earlier than six months before the submission of the first offsets report to reference the stratum. This ensures carbon stock estimates align closely with actual carbon stocks at the close of the reporting period. As a consequence, the Determination does not require pro-rata adjustment from the date of the full inventory to the date of the close of the reporting period. This is conservative with respect to estimating abatement, since carbon stocks are likely to increase from the full inventory to the close of the reporting period.

Where the project proponent wishes to utilise PSP assessment to inform future offsets reports, the project proponent must establish PSPs as part of this first full inventory.

The data collected from the full inventory is then used to estimate the total amount of carbon sequestered within the stratum at the close of the reporting period (referred to in the Determination as 'closing carbon stocks') using Equation 5a.

Section 6.12 specifies that if the planting finish date for a stratum is earlier than 1 July 2010, the project proponent must calculate the initial carbon stocks, which in this case is the amount of carbon estimated to have been stored within the stratum at 1 July 2010. This is calculated by estimating the average annual change in carbon stocks for the stratum to the date of the full inventory and then multiplying this by the number of years between the planting finish date for the stratum and 1 July 2010. This calculation is detailed at Equation 4a.

Subsection 6.12(1) specifies that if the stratum was planted after 1 July 2010, the initial carbon stock and the standard error for the initial carbon stock are both set at zero.

The value for initial carbon stocks is then subtracted from closing carbon stocks to derive the change in carbon stocks for the stratum over the reporting period using Equation 3a.

The standard error for the change in carbon stocks for strata referenced for the first time must be calculated using Equation 3c. The standard error for initial carbon stocks for project trees planted before 1 July 2010 must be calculated using Equation 4b. The standard error for the closing carbon stocks for a stratum based on a full inventory must be calculated using Equation 5b.

(b) Calculating change in carbon stocks for a stratum that has been previously referenced in an offsets report – apply Equation 3b

Before submitting an offsets report for a stratum that has already been referenced in an offsets report for a previous reporting period, either a full inventory or PSP assessment is to be conducted within the stratum. The assessment is to be undertaken no earlier than six months before the submission of the next offsets report to reference the stratum.

The data collected from the full inventory or PSP assessment must then be used to estimate the closing carbon stocks for the stratum for the current reporting period. Where data from a full inventory is used as the basis for estimating closing carbon stocks, Equation 5a is applied. Where data from a PSP assessment is used, Equation 6a is applied.

The standard error for closing carbon stocks for strata must be calculated using Equation 5b if a full inventory has been undertaken, or using Equation 6b if a PSP assessment has been undertaken.

To calculate the change in carbon stocks for a stratum over a reporting period, the closing carbon stocks for the stratum for the previous reporting period is subtracted from the closing carbon stocks estimated for the stratum for the current reporting period using Equation 3b.

The standard error for the change in carbon stocks for strata that have been previously referenced in an offsets report must be calculated using Equation 3d.

Treatment of error

The Determination deals with sampling error for all influential elements of the project abatement estimation process through a variety of mechanisms, including those set out below.

(a) Acceptable probable limit of error thresholds are prescribed at the stratum level for carbon stock estimates generated through full inventory and PSP assessment. These are set out in Subdivisions 5.1.2, 5.1.5 and 5.1.6. If these thresholds are not met, then before the project proponent can calculate carbon stocks for a stratum additional plots must be established until the thresholds are met.

(b) Where PSP assessment is applied, carbon stock change is estimated based on a highly conservative lower confidence bound that mitigates the influence of sampling error arising from reduced sampling intensity as compared with a full inventory (Equations 6a to 10).

(c) A process for calculating overall error associated with estimated carbon stocks is prescribed. The process requires calculation of standard errors at key points in the carbon stock and project emissions estimation process. Key requirements include:

(i) estimation and reporting of the standard errors and 90% confidence intervals for estimates of net greenhouse gas abatement for the project area (Equations 1b to 1d);

(ii) estimation and reporting of within-stratum standard errors and probable limits of error for estimates of carbon stocks derived through full inventory and PSP assessment (Equations 4b, 5b, 6b, 28); and

(iii) estimation and reporting of the standard error for estimates of project emissions and stratum emissions (Equations 23b and 27 respectively).

The main form of modelling error referenced within the Determination is prediction error associated with the application of allometric functions to generate biomass estimates. This is dealt with through the following processes:

(a) Prescription of a series of minimum data requirements and minimum regression fit requirements (sections 5.26 and 5.27).

(b) Requirement to perform validation tests according to prescribed procedures and statistical tests (Subdivision 5.1.12).

(c) Requirement to calculate and report variance of residuals for allometric functions (Equation 32).

Sources of measurement error referenced within the Determination are assumed to be zero or immaterial to carbon stock estimates.

Where this assumption is found to be invalid through, for example, identifying a systematic measurement bias for which magnitude and direction of the error is known, the effect of this bias must be accounted for by applying a correction factor to affected carbon stock estimates.

Subdivision 6.2.1 Calculating carbon dioxide equivalent net abatement amount

Subdivision 6.2.1 outlines the equations required to calculate the carbon dioxide equivalent of greenhouse gases sequestered within the project area. This is done by calculating the carbon stock change within the project area.

6.6 Calculating the carbon dioxide equivalent net abatement amount

The net greenhouse gas abatement for a project occurring within a given reporting period (Ri) is calculated using Equation 1a.

The process for calculating uncertainty for the estimate of net greenhouse gas abatement (expressed as a 90% confidence level) is detailed at Equations 1b to 1d.

Ri is a generic reference to a reporting period, and is applied interchangeably in the calculations in Subdivision 5.2.1 to refer to reporting periods referencing full inventory ($\mathrm{R_{FI}}$) or PSP assessment ($\mathrm{R_{PS}}$) events within a stratum.

6.7 Calculating uncertainty for net abatement amount

The 90% confidence interval for net greenhouse gas abatement for the project area is calculated according to Equation 1b using inputs from Equation 1c and Equation 1d.

6.8 Calculating standard error for net abatement amount

Equation 1c is used to calculate the standard error for the net abatement amount for a project for a reporting period.

6.9 Calculating degrees of freedom for net abatement amount

Equation 1d is used to calculate the degrees of freedom for calculating the confidence interval for the net greenhouse gas abatement for a project. This equation uses the formula for estimating degrees of freedom of a comparison of two means with unequal sample sizes and variances (known as the Welch-Satterthwaite equation).

Subdivision 6.2.2 Calculating carbon stock change

6.10 Calculating carbon stock change for a project

The change in carbon stocks occurring for a project for a reporting period is calculated using Equation 2a.

The standard error for the change in carbon stocks within the project area for a reporting period is calculated according to Equation 2b.

6.11 Calculating carbon stock change for a stratum

In order to estimate the total change in carbon stocks occurring across the project area within a reporting period, the change in carbon stocks that has occurred within each individual stratum must be calculated.

There are two separate calculation approaches which may be applied to estimate the carbon stock change within a stratum (Equation 3a and Equation 3b). Which approach applies in relation to a particular case depends on whether:

(a) the stratum is being referenced within an offsets report for the first time; or

(b) the stratum has been previously referenced within an offsets report.

For the first reporting period to reference the stratum, the change in carbon stocks occurring within the stratum (ΔC_{Strata}) to the end of reporting period Ri is calculated using Equation 3a.

When calculating the carbon stock change for the first reporting period in which a stratum is referenced (Ri), the standard error is calculated using Equation 3c.

Where an offsets report that references the stratum has been previously submitted (referred to as reporting period $Ri - 1$), the change in carbon stocks occurring within the stratum ($\Delta C_{Stratum}$) during the current reporting period (Ri) is calculated using Equation 3b.

When calculating the carbon stock change within a stratum that has been referenced in a previous offsets report ($Ri - 1$), the standard error is calculated using Equation 3d.

Subdivision 6.2.3 Calculating initial carbon stocks for a stratum

6.12 Calculating initial carbon stocks for a stratum

If the planting finish date for a stratum is earlier than 1 July 2010, the project proponent is required to calculate the initial carbon stock, which in this case is the amount of carbon estimated to have been stored within the stratum at 1 July 2010.

This is calculated using Equation 4a, which estimates the average annual change in carbon stocks for the stratum to the date of the full inventory and then multiplies this by the number of years between the planting finish date for the stratum and 1 July 2010.

When calculating the initial stock for project trees planted before 1 July 2010 within a stratum, the standard error is calculated using Equation 4b.

If the stratum was planted on or after 1 July 2010 then:

(a) the initial carbon stocks for the stratum is zero; and

(b) the standard error for the initial carbon stock for the stratum is zero.

Subdivision 6.2.4 Calculating closing carbon stocks for a stratum

6.13 Calculating closing carbon stocks for a stratum based on full inventory

Where a full inventory has been conducted within a stratum in the six months leading up to the end of the reporting period R_{FI}, the closing carbon stocks for the stratum ($CC_{Stratum}$) to the end of the reporting period R_{FI} are calculated using Equation 5a.

Where a full inventory has been conducted within a stratum no earlier than six months leading up to the end of reporting period R_{FI}, the standard error for closing carbon stocks for the stratum to the end of the reporting period R_{FI} is calculated using Equation 5b.

6.14 Calculating closing carbon stocks for a stratum based on PSP assessment

If a stratum has been referenced in an offsets report produced for a prior reporting period (R_{FI}):

(a) during which a full inventory was conducted, and

(b) where PSP assessment has been conducted within the stratum no earlier than six months from the end of the current reporting period (R_{PS});

then the closing carbon stocks for the stratum to the end of the reporting period R_{PS} must be calculated using equation 6a.

When calculating the closing carbon stocks for a stratum in accordance with this section, the standard error includes both:

(a) the standard error for carbon stocks for a full inventory assessment; and

(b) the standard error for the ratio between carbon stocks in PSPs.

The standard error for the closing carbon stocks for a stratum based on PSP assessment is calculated using equation 6b, which uses the formula for estimating the variance of the product of independent variables.

Subdivision 6.2.5 Calculating lower confidence bound

6.15 Calculating the lower confidence bound for closing carbon stocks for a stratum

For the purposes of Equations 6a and 6b, the lower confidence bound for closing carbon stocks for a stratum for a reporting period is calculated using Equation 7.

6.16 Calculating the lower confidence bound for mean ratio of change in PSP carbon stocks

For the purposes of Equations 6a and 6b, the lower confidence bound for the mean ratio of change in PSP carbon stocks is calculated using Equation 8.

Subdivision 6.2.6 Calculating mean ratio of change in PSP carbon stocks

6.17 Calculating the mean ratio of change in PSP carbon stocks

Equation 9a is used to calculate the weighted average for the values for PSP carbon stock change ratios calculated at Equation 10.

The standard error for the mean ratio of changes in PSP carbon stocks is calculated using Equation 9b.

6.18 Calculating the ratio of change in PSP carbon stocks

Equation 10 calculates the ratio between PSP carbon stocks for an individual PSP (*p*) for the current report period, and the carbon stocks reported for *p* in the most recent offsets report to reference a full inventory.

Subdivision 6.2.7 Calculating mean plot carbon stocks for a stratum

6.19 Calculating mean plot carbon stocks for a stratum

For the purposes of Equations 5a, 26a, and 28, the mean plot carbon stocks for a stratum must be calculated using Equation 11a.

When calculating the mean plot carbon stocks for a stratum, the standard error is to be calculated using Equation 11b.

Subdivision 6.2.8 Calculating carbon stocks in a plot

6.20 Calculating carbon stocks within a plot assessed as part of full inventory

Equation 12a is used to calculate the carbon stocks contained within all of the sampled project forest carbon pools within a TSP or PSP assessed as part of a full inventory.

6.21 Calculating carbon stock within a PSP assessed as part of PSP assessment

Equation 12b is used to calculate the carbon stocks contained within a PSP as part of a PSP assessment.

Subdivision 6.2.9 Calculating carbon stocks in trees, fallen dead wood, and litter

6.22 Calculating carbon stocks in live trees within a plot

The amount of carbon contained within the biomass of live trees within plot p is calculated using Equation 13.

6.23 Calculating carbon stocks in live fire affected trees within a plot

The amount of carbon contained within the biomass of live fire affected trees within plot p is calculated using Equation 14.

6.24 Calculating carbon stocks in dead standing trees within a plot

The amount of carbon contained within the biomass of dead standing trees within plot p is calculated using Equation 15.

6.25 Calculating carbon stocks in dead standing fire affected trees within a plot

The amount of carbon contained within the biomass of dead standing fire affected trees within plot p is calculated using Equation 16.

6.26 Calculating carbon stocks in litter within a plot

Equation 17 is used to calculate the amount of carbon contained within litter occurring within a TSP or PSP.

6.27 Calculating carbon stocks in fallen dead wood within a plot

Equation 18 is used to calculate the amount of carbon contained within fallen dead wood within a TSP or PSP.

Subdivision 6.2.10 Calculating biomass in trees

6.28 Calculating biomass in live trees within a plot

The total biomass contained in live trees within plot p is calculated using Equation 19.

6.29 Calculating biomass in live fire affected trees within a plot

The total biomass contained in live fire affected trees within plot p is calculated using Equation 20.

6.30 Calculating biomass in dead standing trees within a plot

The total biomass contained in dead standing trees within plot p is calculated using Equation 21.

6.31 Calculating biomass in dead standing fire affected trees within a plot

The total biomass contained in dead standing fire affected trees within plot p is calculated using Equation 22.

Subdivision 6.2.11 Calculating project emissions

6.32 Calculating project emissions

The emissions for a project for a reporting period (Ri) are calculated using Equation 23a.

The Determination requires that emissions arising from fuel use (fuel emissions) and fire events that affect more than 10 hectares of a stratum (fire emissions) during a reporting period (Ri) be accounted as project emissions (PE). These project emissions must be netted from the change in carbon stocks for the project area ($\Delta C_{Project\ ,Ri}$) in order to calculate net greenhouse gas abatement for the project area (GA_{Ri}) (refer to Equation 1a).

It is assumed that there is no error in estimated emissions from fossil fuel use and that all error is associated with estimates of carbon losses due to fire. The standard error for Project Emissions (PE) is calculated using Equation 23b.

6.33 Calculating fuel emissions for a stratum

The Determination requires that greenhouse gas (carbon dioxide, methane and nitrous oxide) emissions arising from fossil fuel used in delivering the project activity be accounted as project emissions. Equation 24 is used to calculate fuel emissions for a stratum (j) for a reporting period (Ri).

When calculating the emissions from fuel use within a stratum for a reporting period, it is assumed that the standard error is zero.

6.34 Calculating emissions for fossil fuel types

Equation 25 is used to calculate the greenhouse gas (carbon dioxide, methane and nitrous oxide) emissions associated with the combustion of different fossil fuel types.

Subdivision 6.2.12 Calculating emissions for fire affected stratum

6.35 Calculating emissions for a fire affected stratum

Where a stratum (y) experiences a fire event during a reporting period (Ri) that exceeds the area threshold of 10 hectares and the fire affected portion is subsequently separated as fire affected stratum j (see section 3.5), Equation 26a is used to estimate the weight (t) of elemental carbon (C) released as a result of the fire.

The outcome ($FCE_{j,Ri}$) of Equation 26a is used in:

(a) Equation 26b to calculate the amount of methane emitted from the fire-affected stratum for a reporting period; and

(b) Equation 26c to calculate the amount of nitrous oxide emitted from the fire-affected stratum for a reporting period.

Equation 26d is then used to calculate the total emissions of methane and nitrous oxide ($FireE_{j,Ri}$) from the fire-affected stratum for a reporting period.

Before applying Equations 26a to 26d, a Full Inventory must have been conducted within both stratum (y) and fire affected stratum (j) within 12 months of the date of the fire event. The data from this full inventory must be used in Equations 26a to 26d.

6.36 Calculating the standard error for fire emission calculations

When calculating the emissions for a fire affected stratum using Equations 26a to 26d, the standard error must be calculated using Equations 27a to 27d.

Subdivision 6.2.13 Calculating probable limit of error

6.37 Calculating probable limit of error for carbon stock estimates

Equation 28 is used to calculate the probable limit of error around mean carbon stock values for a set of plots within a stratum. This calculation uses the standard error around the mean estimate for the sample population calculated at Equation 11b ($SEMPC_{Stratum\ ,j,Ri}$).

6.38 Calculating number of plots required for probable limit of error

Equations 29a and 29b are used to make *ex ante* or *ex post* estimates of the number of plots required to meet a target probable limit of error.

Equation 29a is first used to calculate the coefficient of variation for the sample population; in this case, carbon stock estimates for a set of plots derived using Equations 12a & 12b.

The result of Equation 29a is then used in Equation 29b to calculate an estimate of the number of plots required.

Subdivision 6.2.14 Calculating biomass for biomass sample trees and test trees

6.39 Calculating total biomass for biomass sample trees and test trees

Equation 30 is used to add the dry weight of each biomass component in order to estimate the total biomass for a biomass sample tree or a test tree.

6.40 Calculating the dry weight of biomass components for biomass sample trees and test trees

Equation 31 is used to calculate the dry weight of biomass components for a biomass sample tree or a test tree.

This equation is applied in order to use dry weights of biomass component sub-samples to estimate the dry weight of entire biomass components for biomass sample trees or test trees.

At a minimum, the biomass components consist of the parts of a tree listed in section 6.40 (stems, branches, crowns, tap roots or lignotubers, and lateral roots). If the tree or biomass components are divided into further parts, these further biomass divisions must also be taken into account in this Equation.

6.41 Calculating the variance of weighted residuals for biomass sample trees and test trees

Equation 32a is used to calculate the variance of weighted residuals for a set of biomass sample trees that have been assessed as part of the process for developing an allometric function, or a set of test trees that have been assessed as part of the process for validating an allometric function.

Equation 32b is used in order to estimate the weighted residual in kilograms for a biomass sample tree or test tree (WR_i), which is one of the inputs to Equation 32a.

Equation 32c is used to estimate the weighting factor applied to the biomass sample tree or test tree (w_i), which is one of the inputs to Equation 32b.

6.42 Calculating the F-test statistic

Equation 33a is used to calculate the F-test statistic, which is compared against a table of critical F-values ($F_\propto$) to determine if there is a statistically significant difference (a<0.05) between the variance of weighted residuals for test trees and the variance of weighted residuals for the allometric function subject to the validation test.

The appropriate degrees of freedom to apply are calculated using Equation 33b.

Subdivision 6.2.15 Data Collection

6.43 Project Emissions

Emissions from fossil fuel combusted within the project area must be accounted and netted from the change in carbon stocks for the project area using Equation 1a and Equation 23a. A project proponent is required to retain records of fuel use, calculate the amount of fuel used for each stratum and then calculate the amount of CO_2, CH_4 and N_2O emissions arising from the combustion of this fuel (using Equation 24).

A record of the quantity of each fossil fuel type to establish and maintain the project for each reporting period must be kept by the project proponent in order to calculate project emissions from fuel use.

Carbon dioxide emissions arising from fire events are considered in the Determination through calculations of the change in carbon stocks occurring within strata (see section 3.5 and Equations 3a and 3b). Additionally, in situations where one or more fire events have affected more than 10 hectares of a stratum during a reporting period, section 3.5 is applied and the CH_4 and N_2O emissions arising from the event are calculated using Equations 26a-d. The standard error for these emissions estimates are calculated using Equation 27a-d.

Data relating to the occurrence of fires must be collected by a project proponent. This data will assist in the estimation of the change in carbon stocks arising from fire related CO_2 liberation, as well as the amount of CH_4 and N_2O released in accordance with section 3.5.

6.44 Project Removals

Section 6.44 requires the measurement of the specified items used to calculate increases in carbon stocks.

Part 7 Monitoring, record-keeping and reporting requirements

Division 7.1 General

7.1 Application

The effect of paragraph 106(3)(d) of the Act is that a methodology determination may require the proponent of an offsets project to comply with specified requirements to monitor the project.

A project proponent who fails to monitor a project in accordance with the monitoring requirements in the applicable methodology determination will have contravened a civil penalty provision (section 194 of the Act).

The monitoring, record-keeping and reporting requirements specified in Part 7 are in addition to any requirements specified in the Regulations.

Division 7.2 Monitoring requirements

7.2 Project monitoring

The assessment processes required under the Determination ensure that, at a minimum, an intensive in-field inspection and measurement will be conducted no later than every five years during the establishment and management phases of the project. This assessment process involves the collection of measurement data used to confirm that project requirements continue to be met during these phases.

Outside of the full inventory process which applies through to the end of the management phase, a project proponent can use a combination of on-ground surveys, field inspections and remote monitoring approaches, such as interpretation of aerial or satellite imagery, to monitor that the project continues to meet project requirements. Records relating to these and other relevant forest management activities should be retained and made available to the Regulator on request.

Subsections 7.2(5) and (6) set out what a project proponent must do if the monitoring specified in subsections 7.2(1) to (3) reveal that the height and crown cover requirements for project trees in a stratum are not met. These requirements are set out in subsection 2.3(2). If they are not met, then the project proponent must:

- record the stratum area as zero;
- exclude any carbon stocks from the stratum; and
- redefine the stratum boundaries in accordance with Part 3 so that the land that does not meet the height and crown cover requirements is not included in the stratum area.

Subsection 7.2(7) specifies that if a large growth disturbance event occurs (that is, when more than 10 hectares of a stratum has been affected), section 3.5 applies so that a new disturbance or fire affected stratum is created and referenced in the offsets report. Where an affected stratum is created it is considered to be in the same phase it was in before the growth disturbance event, until pre-disturbance carbon stocks are re-attained.

Under subsection 7.2(2) of the Determination, a project proponent is required to continue to monitor strata that have entered the maintenance phase so as to confirm that there are no changes to stratum area and to record the occurrence and extent of any growth disturbance events. This monitoring activity can include in-field visits or remote monitoring approaches such as review of aerial imagery, or a combination of these activities.

Division 7.3 Offsets report requirements

Subdivision 7.3.1 Information that must be included in the first offsets report

Subdivision 7.3.1 sets out the additional information that must be included in the first offsets report submitted for the project. General information that must be contained in all offsets reports is set out in Subdivision 7.3.2. Subsection 7.3(2) clarifies that the first report must also contain this general information.

Subdivision 7.3.2 Information that must be included in all offsets reports

Paragraph 6.2(j) of the Regulations requires that an offsets report must set out any information that has to be submitted in the report under the applicable methodology determination.

Subdivision 7.3.2 sets out the information that must be submitted in all offsets reports for the project. This includes the first and all subsequent reports.

Division 7.4 Record-keeping requirements

Under paragraph 106(3)(c) of the Act, a methodology determination can require project proponents to comply with record-keeping requirements relating to the project. A project proponent who fails to comply with a record-keeping requirement relating to the project will have contravened a civil penalty provision under section 193 of the Act.

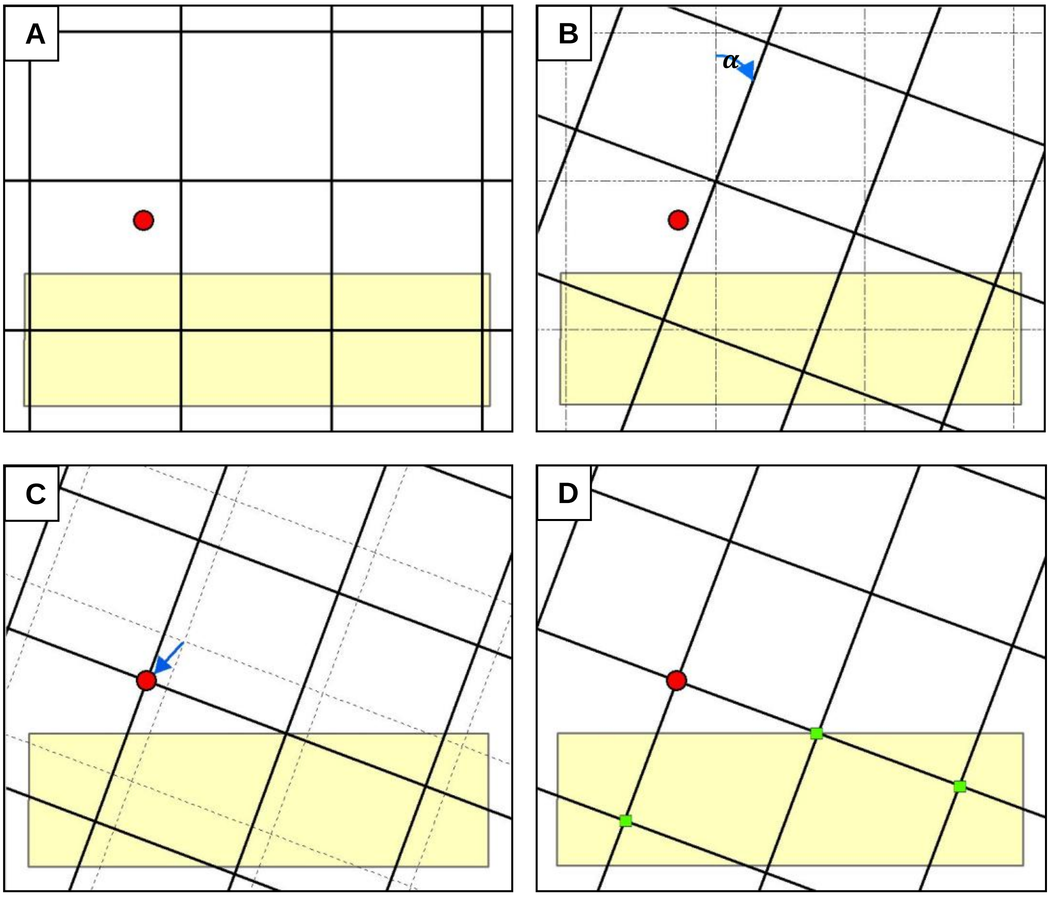
Paragraph 17.1(2)(b) of the Regulations requires a project proponent to make a record of information that the applicable methodology determination requires to be recorded.

Section 7.20 of the Determination specifies that in order to satisfy paragraph 17.1(2)(b) of the Regulations, the project proponent must make a record of the information set out in Divisions 7.3 and 7.4 of the Determination.

Subregulation 17.1(1) of the Regulations requires project proponents to retain the specified records, or copies of the records, for 7 years after the records are made.

Attachment B

Establishing a grid overlay to identify plot locations



Representation of the process for establishing a grid overlay for a stratum.

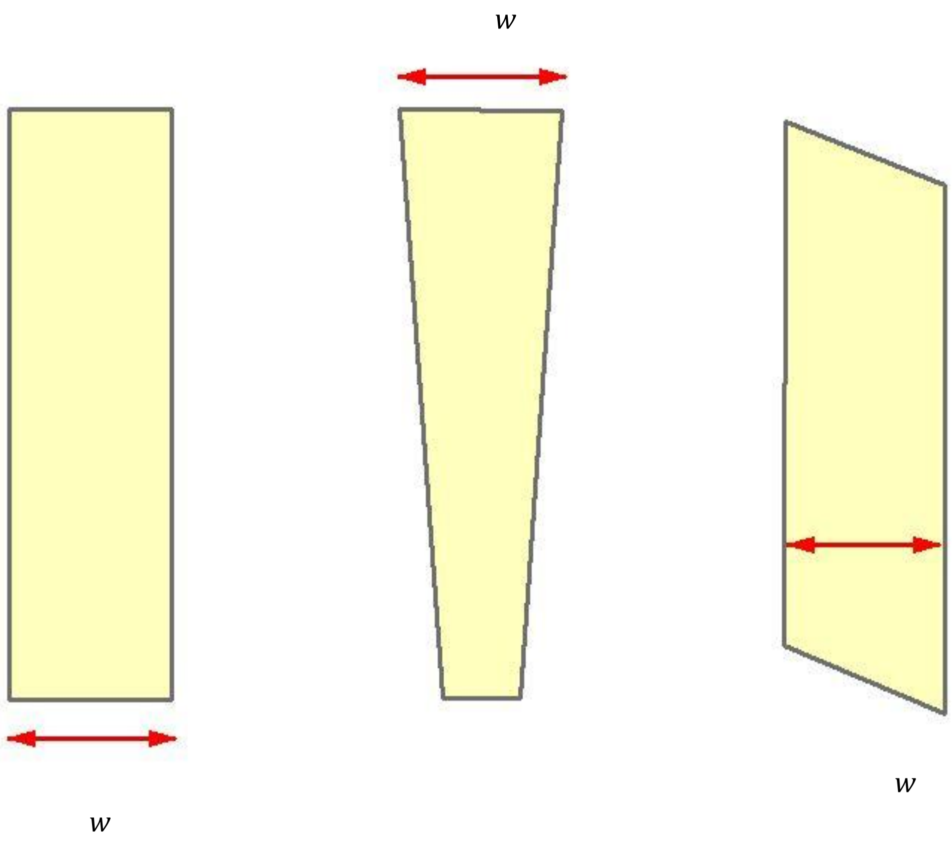
A: GIS software is used to place a grid over a map of the stratum (yellow rectangle), initially oriented north-south, east-west.

B: The grid is then rotated according to a randomly generated angle (α, value of: 0 - 89).

C: While maintaining the orientation established at B, the grid is repositioned so that an intersection is aligned with a set anchor point (red circle) defined as coordinates: X = 0m, Y = 3,500,000m.

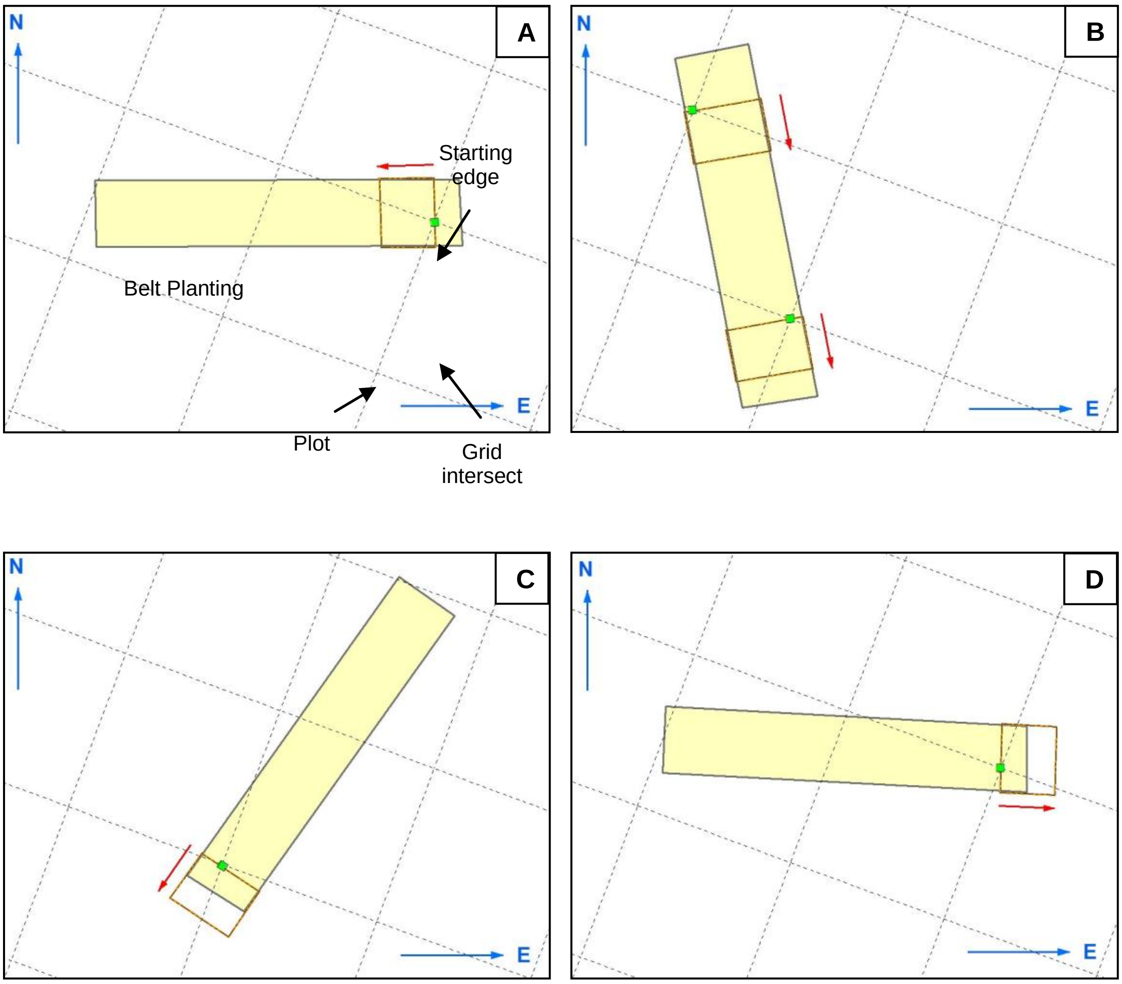
D: Randomly selected grid intersections that fall within the stratum boundary (green squares) define the spatial co-ordinates at which plots are to be established.

Belt plantings



Examples of a series of belt plantings of varying shape. Belt plantings are discrete patches of project trees that have been established in a linear ‘belt’ pattern, where width measured across the belt (w) is no greater than 50 metres at any point along the length of the belt.

Plot orientation in a belt planting

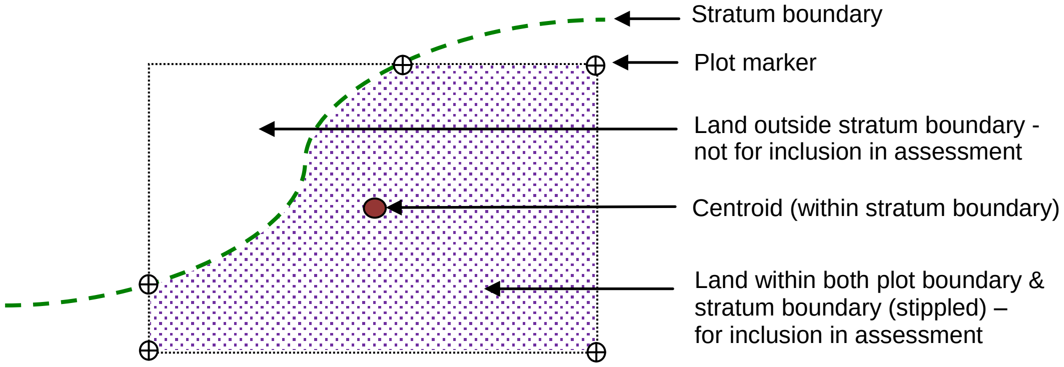


Examples of plot orientation in belt plantings.

Randomly selected grid intersections (green squares) define the spatial coordinates for plot establishment. In the field, plots are established so that starting edge passes through the spatial coordinates for the grid intersection, running perpendicular to the orientation of the belt planting. In the case of belt plantings with east-west orientation (**A**), the plot is laid out toward the most westerly end of the belt planting. For all other orientations (examples at **B, C, D**), the plot is laid out toward the most southerly end of the belt planting. In all cases, the plot must extend across the full width of belt planting.

Attachment E

Treatment of an edge plot located close to stratum boundary



Diagrammatic example of the treatment of an edge plot that is partially within the stratum boundary. Since the centroid falls within the stratum boundary, a plot must be established at this location. Markers are placed at the limits of plot corners and at the points where the stratum boundary intersects the plot. Project trees, litter (optional) and fallen dead wood (optional) are assessed from within the stippled area (land that falls within both the plot boundary and stratum boundary). For the purposes of calculating plot carbon stocks, the plot area is assumed as equivalent to the pre-defined target plot area documented in the sampling plan.