

Australian Government

Department of the Environment

EMISSIONS REDUCTION ASSURANCE COMMITTEE

19 February 2015 Meeting

Agenda Item 5: Method assessment: Endorsement decision – Avoided Deforestation (020VG2014)

For Decision

Recommendation

That the ERAC:

1. **note** the draft determination *Carbon Credits (Carbon Farming Initiative – Avoided Deforestation – 1.1) Methodology Determination 2015* (020VG2014) at Attachment A and the draft Explanatory Statement at Attachment B;
2. **agree** to endorse the draft determination; and
3. **agree** to the draft letter to the Minister and statement of reasons for endorsement at Attachment C.

Key points

The draft Determination covers projects that avoid emissions by not clearing native forest.

The draft Determination is based on the existing Carbon Farming Initiative method for avoided deforestation released in 2013. It sets out the eligibility criteria and carbon accounting framework for determining abatement from protecting native vegetation from being cleared.

The original method has been updated to make it consistent with the Emissions Reduction Fund. It will ensure that new projects can be registered after 1 July 2015, when the existing CFI method expires.

Other substantive changes in the draft Determination are based on a proposed variation to the existing method submitted to the Domestic Offsets Integrity Committee (DOIC) by Climate Friendly in 2014. An overview of these changes is provided in Attachment I. The method is similar to the method for avoided clearing of native regrowth endorsed in February 2015. Both methods apply to avoided deforestation of Kyoto forests. This method requires that the project proponent has a clearing permit issued before 1 July 2010. This is an additionality requirement; proponents holding a permit issued before 1 July 2010 are considered to have applied for the permit with the intent of undertaking clearing, and not for the purpose of obtaining carbon credits.

Unlike the 'avoided clearing of native regrowth' method, which uses the Full Carbon Accounting Model to estimate abatement, this method uses allometric equations, and requires data obtained from measurements taken within the project area. Allometric equations are statistical models that estimate the amount of biomass (and therefore carbon) in trees based on the size of one of the tree's parameter, for example the tree's stem diameter. A number of the changes outlined in Attachment I streamline the abatement estimation process.

The existing CFI method has a 20 year crediting period, whereas the new method adopts a 15 year crediting period, to better reflect when abatement occurs.

The draft determination was developed in consultation with the GreenCollar Group (developers of the original method), and Climate Friendly (see Attachment J). The main issues arising during consultation relate to the variations proposed by Climate Friendly (see Attachments E). Both organisations made submissions supporting the draft determination. Given the transitional nature of the draft Determination, the Department did not establish a Technical Working Group.

Technical assessment

A technical assessment of the variation proposal submitted to the DOIC was completed by the NSW Department of Primary Industries (see Attachment D). A document setting out the Department's response to the recommendations in the technical assessment is at Attachment E.

Public consultation

The draft Determination and explanatory statement were released for public consultation by the Department from 5 to 19 December 2014. Two public submissions were received. A fourteen day consultation period was used for this method as it had already been released for public consultation as a variation proposal under the DOIC process.

A summary of the public submissions received and a full copy of the submissions is at Attachment F. A document setting out the Department's response to each of the recommendations and issues raised in the public submissions is at Attachment G.

Clean Energy Regulator Advice

In providing its advice to the Minister, the ERAC must have regard to any relevant advice given by the Clean Energy regulator under subsection 123A(5) of the *Carbon Farming Initiative Amendment Act 2014* (the Act).

The CER participated in the development of the method and is supportive of the draft Determination.

A letter of support for the method from the CER is at Attachment H.

Attachments

Attachment A	Draft determination
Attachment B	Draft Explanatory Statement
Attachment C	Advice to the Minister
Attachment D	Technical assessment report
Attachment E	Response to technical assessment
Attachment F	Public submissions
Attachment G	Response to public submissions
Attachment H	Clean Energy Regulator advice
Attachment I	Issues Paper – Transitioning
Attachment J	Consultation Issues Summary

Carbon Credits (Carbon Farming Initiative—Avoided Deforestation 1.1) Methodology Determination 2015

I, Greg Hunt, Minister for the Environment, make the following determination.

Dated [Date]

Version v1.1 **DRAFT** **11 February 2015**

Greg Hunt **[DRAFT ONLY—NOT FOR SIGNATURE]**
Minister for the Environment

Contents

Part 1—Preliminary

1 Name

This is the *Carbon Credits (Carbon Farming Initiative—Avoided Deforestation 1.1) Methodology Determination 2015*.

2 Commencement

This determination commences on the day after it is registered.

3 Authority

This determination is made under subsection 106(1) of the *Carbon Credits (Carbon Farming Initiative) Act 2011*.

4 Duration

This determination remains in force for the period that:

(a) begins when this instrument commences; and

(b) ends on the day before this instrument would otherwise be repealed under subsection 50(1) of the *Legislative Instruments Act 2003*.

5 Definitions

(1) In this determination:

above-ground biomass means:

(a) the stem, stump, branches, bark, seeds and foliage of a living tree; and

(b) dead matter (other than dead roots) attached to a living tree.

Act means the *Carbon Credits (Carbon Farming Initiative) Act 2011*.

allometric equation means an equation that quantifies the allometric relationship between different dimensions of an organism.

avoided deforestation project—see section 7.

basal area means the cross-sectional area of the stem or stems of a plant or of all plants in a stand, measured at a constant height above ground level.

baseline deforestation plan—see section 25.

below-ground biomass means living biomass of the root system.

biomass means vegetation-derived organic matter, and includes living and non-living matter.

biomass fraction means the proportion of biomass in a tree component relative to the tree of which the component is a part.

biomass residue means the estimated biomass in an area following the deforestation of the area.

biomass stock means the amount of biomass held in a native forest or part of a native forest.

biomass survey means a field-based survey of biomass.

carbon estimation area—see section 21.

carbon stock means the amount of carbon held in a native forest or part of a native forest.

CFI Mapping Guidelines means the guidelines of that name, as published from time to time, and available on the Department's website.

clearing means the conversion, caused by people, of native forest to a land cover other than forest.

clearing buffer—see section 21.

clearing consent: where, under Commonwealth, State or Territory law, an area of land cannot be cleared without an approval issued by the appropriate authority, such an approval is a ***clearing consent*** for the area of land.

CO_2-e means carbon dioxide equivalent.

conservation covenant has the meaning it has in section 995-1 of the *Income Tax Assessment Act 1997*.

controlled burn means the controlled application of fire within a carbon estimation area.

cropland means arable or tillable land that is used for producing annual or perennial crops.

debris pool means the biomass from trees cleared.

deforestation means the direct human-induced conversion of forest, on or after 1 January 1990, to non-forest.

degradation means a detectable reduction in the biomass of the native forest in the project area where, notwithstanding the reduction, the area remains, or has the potential to remain, a native forest, and includes a reduction caused by management activities.

disturbance means:

(a) degradation; or

(b) natural disturbance.

eligible native forest—see section 10.

exclusion area—see section 21.

forest means land of a minimum area of 0.2 of a hectare on which trees:

(a) have attained, or have the potential to attain, a crown cover of at least 20% across the area of land; and

(b) have reached, or have the potential to reach, a height of at least 2 metres.

forest cover—land has ***forest cover*** if the land covers at least 0.2 of a hectare and is dominated by trees that:

(a) have attained a crown cover of at least 20% of the area of land; and
(b) have reached a height of at least 2 metres

fuel wood means biomass collected from trees for burning.

grassland includes:
(a) rangeland; and
(b) pasture land that is not cropland; and
(c) vegetated land that is not a forest or native forest.

growth form means a general habit of growth of a plant determined by the direction and extent of growth, and any branching of the main-shoot axis or axes and includes: subshrub form; mallee form; shrub form; and tree form.

IBRA bioregion means a region described in the latest version of the Interim Biogeographic Regionalisation for Australia published by the department that administers the *Environment Protection and Biodiversity Conservation Act 1999.*

irregular feature—see section 22.

Major Vegetation Group means a category of vegetation described in the National Vegetation Information System published by the department that administers the *Environment Protection and Biodiversity Conservation Act 1999.*

National Inventory Report means the most recently published document that is:
(a) known as the National Inventory Report; and
(b) prepared by the Department in fulfilment of obligations that Australia has under the Climate Change Convention.

National Inventory System means the national inventory of greenhouse gas emissions published by the Department.

native forest means an area of land that:
(a) is dominated by trees that:
(i) are located within their natural range; and
(ii) have attained, or have the potential to attain, a crown cover of at least 20% of the area of land; and
(iii) have reached, or have the potential to reach, a height of at least 2 metres; and
(b) is not a plantation.

NGER Regulations means the *National Greenhouse and Energy Reporting Regulations 2008*.

non-project tree—see section 25.

non-project tree buffer means the proportion of non-project tree biomass to tree biomass in a carbon estimation area.

pre-existing clearing consent—see section 10.

project commencement means the day on which the declaration in relation to the project under subsection 27(2) of the Act takes effect.

project mechanism—see section 12.

project native forest—see section 12.

pseudo-random number generator means computer software used for generating a sequence of numbers that approximates the properties of random numbers.

residual means the deviation of one of a set of observations or numbers from the mean of a set.

root:shoot ratio means the ratio of below-ground biomass to above-ground biomass.

seed number means a number input into a pseudo-random number generator for the purposes of generating a sequence of numbers that approximates the properties of random numbers.

shrub means a living plant with a stem diameter of less than 50 millimetres at a height of 1.3 metres.

stratification means the division of the project area into strata in accordance with Division 2 of Part 4.

stratum—see section 21.

Targeted Precision—see section 45.

thinning means the selective removal of trees from native forest, where the removal does not:

(a) amount to clearing; or

(b) result in a reduction of estimated abatement below that already credited under the determination.

tree means a perennial plant that has primary supporting structures consisting of secondary xylem.

wildfire means a fire that is not a controlled burn.

Note Other words and expressions used in this determination have the meaning given by the Act. These terms include:

Australian carbon credit unit

crediting period

eligible offsets project

emission

greenhouse gas

natural disturbance

offsets project

offsets report

project

project area

project proponent

Regulator

reporting period

6 Crediting period

For the purposes of paragraphs 69(2)(b) and 70(2)(b) of the Act, the crediting period for an avoided deforestation project is the period of 15 years.

Part 2—Avoided deforestation projects

7 Avoided deforestation projects

(1) For paragraph 106(1)(a) of the Act, this determination applies to an offsets project that:

(a) involves:

(i) removing carbon dioxide from the atmosphere by sequestering carbon in trees in one or more native forests; and

(ii) avoiding emissions of greenhouse gases attributable to the clearing of one or more native forests; and

(b) can reasonably be expected to result in eligible carbon abatement.

(2) A project covered by subsection (1) is an ***avoided deforestation project***.

Part 3—Project requirements

Division 1—General

8 Operation of this Part

For paragraph 106(1)(b) of the Act, this Part sets out requirements that must be met for an avoided deforestation project to be an eligible offsets project.

Division 2—Requirements relating to project area

9 Location

The project area must be within Australia.

10 Project area to include eligible native forest

(1) The project area must include native forest:
  (a) that has forest cover at the time of the application under section 22 of the Act; and
  (b) for which there is clearing consent that:
    (i) was issued before 1 July 2010; and
    (ii) is valid at the time of the application under section 22 of the Act; and
    (iii) provides that clearing is permitted for the purpose of converting the native forest to cropland or grassland; and
    (iv) does not provide that clearing is permitted for the purpose of converting the native forest to plantation or settlements; and
    (v) provides that the conversion of the native forest to cropland or grassland must be maintained in perpetuity; and
    (vi) does not require an offset to mitigate any effect from the clearing to which it relates; and
  (c) from which removal of wood for the purposes of creating timber or wood products is not authorised by law; and
  (d) for which there is no permit for the collection of fuel wood.

(2) Such native forest is ***eligible native forest*** and the clearing consent is the ***pre-existing clearing consent*** for the forest.

11 Evidence relating to eligible native forest

(1) An application under section 22 of the Act for a declaration of an eligible offsets project to which this determination applies must be accompanied by evidence as provided by this section.

(2) In relation to paragraph 10(1)(a) the project proponent must provide:
  (a) the most recent National Inventory System forest cover layer data expressed in a vector or raster array in relation to the project area; or
  (b) aerial or remotely-sensed imagery of the project area produced no later than one year before the day on which an application under subsection 22(1) of the Act is made.

(3) The project proponent must provide a copy of the pre-existing clearing consent.

Division 3—Requirements relating to project mechanism

12 Project mechanism

(1) The project must be one in which the eligible native forest that is in a carbon estimation area or clearing buffer (the ***project native forest***) is protected.

(2) In particular, the project must be one in which the project native forest:
  (a) is not cleared; and
  (b) is managed in order to achieve a mix of native trees, shrubs and understorey species that reflects the structure and composition of a vegetation community in:
    (i) if the IBRA bioregion in which the project area is situated contains a national park, flora reserve or state forest—any such national park, flora reserve or state forest; and
    (ii) otherwise—a native forest in the IBRA bioregion.

(3) To avoid doubt, if a tree monoculture can naturally occur within the IBRA bioregion in which the project area is situated, the mix of native trees can be a monoculture.

Division 4—Restrictions on activities

13 No commercial harvesting

The project must be one in which biomass is not removed from a carbon estimation area or clearing buffer for commercial purposes.

14 Wood for personal use, fencing and thinning

The project must be one in which, in carbon estimation areas and clearing buffers:
  (a) if:
    (i) wood is removed for personal use; or
    (ii) wood is removed for the purposes of erecting or repairing fences;
  no more than 5% of carbon stocks are removed; and
  (b) if trees are thinned for the purposes of:
    (i) promoting biodiversity; or
    (ii) enhancing carbon stocks;
  95% of the biomass thinned remains within the carbon estimation area or clearing buffer in which it was thinned.

Division 5—Other requirements

15 Requirement in lieu of regulatory additionality

(1) For the purposes of subparagraph 27(4A)(b)(ii) of the Act, this requirement applies in lieu of the regulatory additionality requirement.

(2) The project must not be required to be carried out by or under a law of the Commonwealth, a State or a Territory.

(3) A requirement to carry out an activity under a conservation covenant entered into with:

(a) the Commonwealth, a State, a Territory or a local governing body; or

(b) an authority of the Commonwealth, a State or a Territory;

is not a requirement for the purposes of subsection (2).

Part 4—Net abatement amount

Division 1—Preliminary

16 Operation of this Part

For paragraph 106(1)(c) of the Act, this Part specifies the method for working out the carbon dioxide equivalent net abatement amount for a reporting period for an avoided deforestation project that is an eligible offsets project.

17 Overview of gases accounted for in abatement calculations

The following table provides an overview of the greenhouse gas abatement and emissions that are relevant to working out the carbon dioxide equivalent net abatement amount for an avoided deforestation project.

Table 1: Carbon pools and events accounted for in the abatement calculations

Carbon pool or emission source	**Greenhouse gas**
Above-ground biomass	Carbon dioxide (CO_2)
Below ground biomass	Carbon dioxide (CO_2)
Emissions from fire—wildfire and controlled burn	Methane (CH_4) Nitrous oxide (N_2O) Carbon dioxide (CO_2)
Emissions from non-fire disturbances	Carbon dioxide (CO_2)
Emissions from fossil fuel use	Methane (CH_4) Nitrous oxide (N_2O)

18 Carbon dioxide equivalent net abatement amount

This section sets out an outline of the method for calculating the carbon dioxide equivalent net abatement amount.

- ***First***, the project area is stratified into carbon estimation areas, clearing buffers and exclusion areas. See Division 2.
- ***Second***, a baseline deforestation plan is developed, indicating the clearing that would have been carried out in the absence of the project. See Division 3.
- ***Third***, the carbon dioxide equivalent net abatement amount for the reporting period is calculated. See Division 4. This calculation involves the following steps:
  - First, allometric equations are developed and/or validated, in accordance with Subdivision 1.
  - Then, a biomass survey is conducted in accordance with Subdivision 2. The biomass survey is used to calculate the carbon stock in the forests that would have been subject to clearing in the absence of the project.

- These equations, and the results of this survey, are then used to calculate baseline emissions in accordance with Subdivision 3. The method calculates baseline emissions by modelling the clearing and decay of the carbon stock over 100 years, from which a long term average baseline is calculated.

- Project emissions and removals are then calculated in accordance with Subdivision 4. The calculations take into account emissions from natural disturbances such as fire, and can also take into account enhancements of carbon stocks through tree growth.

- The net greenhouse gas abatement in the crediting period, as calculated at the end of reporting period r, is then calculated as the difference between the net greenhouse gas emissions in the baseline from planned deforestation (as determined in accordance with Subdivision 3) and the net project carbon dioxide equivalent emissions (as determined in accordance with Subdivision 4). See Equation 39 in Subdivision 5.

- Finally, the carbon dioxide equivalent net abatement amount for reporting period r, A_r, in tonnes of CO_2-e, is worked out by averaging this total abatement across the crediting period, and issuing it pro-rata. See Equations 40A and 40B of Subdivision 5.

19 References to factors and parameters from external sources

(1) If a calculation in this determination includes a factor or parameter that is defined or calculated by reference to another instrument or writing, the factor or parameter to be used for a reporting period is the factor or parameter referred to in, or calculated by reference to, the instrument or writing as in force at the end of the reporting period.

(2) Subsection (1) does not apply if:
  (a) the determination specifies otherwise; or
  (b) it is not possible to define or calculate the factor or parameter by reference to the instrument or writing as in force at the end of the reporting period.

20 Use of data—pre-existing projects

If:
  (a) the project was previously an eligible offsets project registered under the *Carbon Credits (Carbon Farming Initiative)(Avoided Deforestation) Methodology Determination 2013*; and
  (b) data had previously been collected in accordance with that determination; and
  (c) the data was accepted by the Regulator for a previous offsets report;

the project proponent may use that data for Subdivision 3 and Subdivision 4 of Division 4.

Division 2—Stratification

21 Stratification of project area

(1) Before the submission of the first offsets report, the project area must be divided into areas, each of which is one of the following:
  (a) a carbon estimation area;
  (b) a clearing buffer;
  (c) an exclusion area.

(2) Each such area is a ***stratum***.

Clearing buffers

(3) If the pre-existing clearing consent includes conditions that require that an area of the eligible native forest not be cleared, the strata must include clearing buffers that are sufficient to satisfy the conditions.

Definitions

(4) In this determination:

carbon estimation area means an area of eligible native forest that:
  (a) in the absence of the project, would have been cleared in accordance with the pre-existing clearing consent; and
  (b) in which the project mechanism will be applied.

clearing buffer means an area (if any) of eligible native forest that:
  (a) in the absence of the project, would have been left uncleared in order to comply with conditions of the pre-existing clearing consent; and
  (b) under the project, will not be cleared.

exclusion area means an area of the project area that is neither:
  (a) a clearing buffer; nor
  (b) a carbon estimation area.

22 Remotely-sensed imagery of project area

(1) Remotely-sensed imagery of the project area must be acquired for the purposes of stratification and re-stratification.

(2) The remotely-sensed imagery must:
  (a) be consistent with the requirements of the CFI Mapping Guidelines; and
  (b) be pre-processed in order to correct for irregular features.

(3) If an irregular feature comprising more than 10% of the total area of the carbon estimation area or areas and the clearing buffer or buffers is detected:
  (a) the irregular feature must be deleted; and
  (b) the remotely-sensed imagery must be filled from the same imagery source within the nearest possible data range.

(4) For this section, ***irregular feature*** includes the following:

(a) cloud cover;
(b) shadows;
(c) geometric distortions;
(d) radiometric distortions;
(e) sensor errors.

23 Re-stratification of carbon estimation areas

(1) This section applies to each carbon estimation area in which:
(a) disturbance has been detected; and
(b) the disturbance has resulted in a crown cover loss of more than 5% over an area larger than 5% of the project native forest; and
(c) the disturbance has not previously been re-stratified.

(2) Before the next offsets report following the detection of the disturbance, the spatial extent of the disturbance must be delineated as a new carbon estimation area.

(3) Any carbon estimation area the boundary of which encloses or is crossed by the carbon estimation area in subsection (2) must be re-stratified to exclude the carbon estimation area in subsection (2) before the next offsets report following the detection of the disturbance.

24 Strata boundaries

The geographic boundaries of each stratum within the project area must be identified on a geospatial map in accordance with the CFI Mapping Guidelines.

Division 3—Baseline deforestation plan

25 Baseline deforestation plan

(1) A plan of the project area that complies with this section (the ***baseline deforestation plan***) must be prepared before the first offsets report.

(2) The plan must identify the following:
(a) for each area of eligible native forest that would have been cleared but for the project—the land use that would have applied following the clearing;
(b) the spatial extent of each of the following:
(i) the project area;
(ii) the eligible native forest;
(iii) any part of the eligible native forest that would have been left uncleared in order to comply with conditions of the pre-existing clearing consent;
(iv) any part of the eligible native forest in relation to which clearing is not possible or practicable;
(v) each carbon estimation area;
(vi) each clearing buffer;
(vii) each proposed land use referred to in paragraph (a);
(c) any requirements, whether in accordance with the pre-existing clearing consent or otherwise, to not clear certain kinds of trees (***non-project trees***);
(d) an estimate of canopy cover had the authorised clearing occurred.

(3) The plan must include a map prepared in accordance with the CFI Mapping Guidelines depicting the spatial information in subsection (2).

Division 4—Net abatement amount

Subdivision 1—Allometric equations

26 Allometric equations to be validated or developed

(1) This section applies in relation to:
  (a) each tree species to which an allometric equation is applied; and
  (b) each group of species to which an allometric equation is applied.

(2) The project proponent must:
  (a) develop and validate a new allometric equation; or
  (b) validate an existing allometric equation in accordance with section 38, if:
    (i) the allometric equation has been published in a peer-reviewed journal as a valid allometric equation; and
    (ii) the allometric equation was developed using a dataset of more than 15 trees; and
    (iii) the allometric domain is known; and
    (iv) the allometric domain is consistent with the carbon estimation area to which the allometric equation is to be applied; and
    (v) the measurement protocols for the allometric equation are known and are consistently applied; or
  (c) validate an allometric equation developed in accordance with this determination for another avoided deforestation project.

27 Validating or developing allometric equations

Each allometric equation must be validated and developed using destructive sampling by carrying out the steps specified in this Subdivision.

28 Step 1—Scope of allometry

(1) Allometric equations developed or validated in accordance with this Subdivision apply only to the above-ground biomass of the project native forest.

Note The below-ground biomass of the native forest in the project area is determined using root:shoot ratios as provided by section 41.

(2) The use of an allometric equation is restricted to its allometric domain as defined in section 29.

29 Step 2—Determination of allometric domains

(1) An allometric domain describes the specific conditions under which an allometric equation is likely to apply because the assumptions that underpin the allometric equation are satisfied.

(2) Allometric domains must be determined in accordance with the requirements of this section.

(3) For each allometric equation that is to be developed or validated, the following must be defined:
   (a) a unique identifier and reference;
   (b) the species or group of species for which the allometric equation has been or will be developed;
   (c) the species growth form for which the allometric equation has been or will be developed;
   (d) the range of values of measurements for each variable used to develop the allometric equation.

(4) If a new allometric equation is to be developed, the allometric domain must include the spatial extent in which the allometric equation applies.

(5) If a pre-existing allometric equation is to be validated, the allometric domain must include the spatial extent in which the allometric equation applies if the spatial extent is defined.

(6) If an allometric equation is developed in respect of a group of species:
   (a) the growth form of each species to which the allometric equation applies must be the same; and
   (b) each species must be identified prior to the commencement of destructive sampling as provided by this Subdivision; and
   (c) individual trees in the group of species must be selected independently of their species for destructive sampling.

30 Step 3—Sample size

(1) For each allometric equation to be validated, at least 6 trees must be selected for destructive sampling, including at least one tree from each class size as defined in section 34.

(2) For each new allometric equation to be developed, at least 20 trees must be selected for destructive sampling, including at least one tree from each class size as defined in section 34.

31 Step 4—Determination of plot design for tree selection

(1) The plot design for tree selection must be determined in accordance with section 42.

(2) Enough plots must be allocated to capture at least 100 trees per species or species group represented by the allometric equation across the area mentioned in section 32.

32 Step 5—Allocation of plots for tree selection

(1) When developing an allometric equation, plots for tree selection must be allocated within:
   (a) one or more carbon estimation areas; and
   (b) the spatial extent of each allometric domain as defined in section 29.

(2) When validating an allometric equation, plots for tree selection must be allocated across the carbon estimation area or areas in which the allometric equation is to be applied.

(3) Waypoints for plot locations within the areas mentioned in subsection (1) or (2) must be allocated using a pseudo-random number generator with a known seed number.

33 Step 6—Survey and random selection of trees for destructive sampling

(1) Waypoints must be established using a GPS device with an accuracy of at least ± 4 metres.

(2) A plot at each waypoint must be established as provided by section 31.

(3) A unique identifier must be assigned to each tree within each plot.

(4) For each tree, each variable to be used in an allometric equation must be measured.

(5) Enough plots to achieve the sample size prescribed in section 31 must be established.

34 Step 7—Size classes

(1) The trees mentioned in section 33 must be:
- (a) classified according to the species or group of species for which an allometric equation is to be developed; and
- (b) further classified into at least 3 size classes per species or group of species mentioned in paragraph (a).

(2) Each size class must have:
- (a) a minimum range identifying the smallest variable for tree selection; and
- (b) a maximum range identifying the largest variable for tree selection; and
- (c) a defined class size interval.

(3) Use a pseudo-random number generator with a known seed number to rank the trees mentioned in subsection (1) within the class sizes mentioned in subsection (2).

(4) At least the first tree in each class size ranked in accordance with subsection (3) must be selected for destructive sampling in accordance with section 35.

(5) If more than one tree per class size is needed to achieve the sample size specified in section 30:
- (a) trees must be selected sequentially within each size class according to the ranking in subsection (3); or
- (b) the trees with the maximum or minimum variable in relation to each size class must be selected.

35 Step 8—Destructive sampling procedure

Step 8.1—Wet weight of sample trees

(1) Each sample tree selected in section 34 must be cut down at ground level.

(2) The wet weight of each sample tree must be measured.

Note Trees may be cut into smaller parts for the purposes of measuring their wet weight.

Step 8.2—Allometric equations for single species

(3) If an allometric equation is to be developed for a single species:

(a) select:
(i) at least every fourth tree cut down in accordance with subsection (1) in the order of cutting; and
(ii) at least one tree from each class size mentioned in section 34; and
(b) cut each tree into its component parts.

(4) For the purposes of this section, component parts include the following:
(a) stem;
(b) branches;
(c) crown;
(d) dead material, including dead branches, dead stem and dead crown, attached to the sample tree.

Step 8.3—Allometric equations for groups of species

(5) If an allometric equation is to be developed for a group of species, each of the trees cut down in accordance with subsection (1) must be cut into component parts

36 Step 9—Biomass analysis

(1) For each tree cut into its component parts in accordance with section 35:
(a) estimate its dry weight by the following steps:
(i) record the wet weight of each component part (the ***component wet weight***);
(ii) cut at least 3 representative subsamples from each component part;
(iii) for each subsample, undertake the following steps:
(A) record its wet weight immediately after being cut (the ***subsample wet weight***);
(B) dry it in an oven with a temperature between 70 and 80 degrees Celsius until it has achieved a constant weight;
(C) record its weight after drying (the ***subsample dry weight***);
(D) divide the subsample dry weight by the subsample wet weight (the ***subsample dry to wet weight ratio***);
(iv) average the subsample dry to wet weight ratios of the subsamples of each component part (the ***component average dry to wet weight ratio***);
(v) multiply the component wet weight by the component average dry to wet weight ratio (the ***estimated component dry weight***);
(vi) sum each estimated component dry weight for each component part of the sample tree to estimate the dry weight of the sample tree; and
(b) estimate the whole tree dry to wet weight ratio of the sample tree by dividing its estimated dry weight calculated in accordance with paragraph (a) by its wet weight measured in accordance with subsection 35(2).

(2) If:
(a) an allometric equation is to be developed for a single species; and
(b) each of the trees cut down in accordance with subsection 35(1) was not analysed in accordance with this section;

the coefficient of variation of tree dry to wet weight ratio must be estimated by dividing the standard deviation of tree dry to wet weight ratio by its average.

(3) If the coefficient of variation estimated in accordance with subsection (2) exceeds 15%:
   (a) all measurements associated with trees not analysed in accordance with this section must be discarded; and
   (b) destructive sampling for the equivalent number of sample trees discarded in accordance with paragraph (a) must be repeated in accordance with subsection 35(1); and
   (c) analysis of the sample trees must be completed in accordance with this section.

(4) If the coefficient of variation calculated in accordance with subsection (2) is equal to or less than 15%, the dry weight of any sample trees not analysed in accordance with this section must be estimated by multiplying the tree wet weight by the average tree dry to wet weight ratio.

37 Step 10—Data exploration and analysis

(1) The whole tree dry weight data obtained in section 36 must be compiled into a database or spreadsheet suitable for statistical analysis or importation into a statistical analysis software package.

(2) If an existing allometric equation is to be validated, Step 10.1 in this section must be skipped and Step 11 in section 38 must be completed.

(3) If a new allometric equation is to be validated, Step 10.1 in this section must be completed.

Step 10.1—Allometric development

(4) An allometric equation being developed must take the form of a statistical model fitted using:
   (a) simple linear regression; or
   (b) multiple regression; or
   (c) polynomial regression; or
   (d) non-linear regression.

(5) Each allometric equation developed must satisfy the assumptions that:
   (a) the response variables change in a systematic way with variation in the explanatory variable; and
   (b) errors are:
      (i) independent; and
      (ii) normally distributed.

(6) To satisfy the assumptions in subsection (5), data may be transformed.

(7) If data is transformed, power transformations may be used.

(8) If a logarithmic transformation is applied to the response variable, the proportional bias must be estimated and applied using the ratio of the arithmetic sample mean to the mean of the back-transformed predicted variables.

(9) Each explanatory variable used in an allometric equation must be statistically significant.

(10) For the purposes of subsection (9), a variable is statistically significant if the outcome of an F-test or a two-tailed t-test has a probability value of less than 5%.

(11) Each allometric equation developed must be verified by comparing the predictions from the corresponding allometric equation with observations of trees mentioned in subsection (1).

(12) The mean of the weighted residuals for the observed and predicted biomass estimates of the dataset of trees used to derive the allometric equation must be computed by completing Equation 1 and Equation 2.

$WR_{j,m} = WF_{j,m} \times (Q_{ob,j,m} - Q_{Pr,j,m})$	**Equation 1**

Where:

$WR_{j,m}$ = weighted residual (kilograms) for tree (j, m).

j,m = a test tree (j) from the data set (m) used to derive the allometric equation.

$Q_{ob,j,m}$ = observed biomass (kilograms) for tree (j, m) measured by destructive sampling.

$Q_{Pr,j,m}$ = biomass (kilograms) for tree (j,m) predicted from the allometric equation.

$WF_{j,m}$ = weighting factor applied to tree (j,m) calculated in accordance with Equation 2.

$WF_{j,m} = \frac{1}{(BA_{j,m})^{0.5}}$	**Equation 2**

Where:

$WF_{j,m}$ = weighting factor applied to tree (j, m).

$BA_{j,m}$ = basal area of tree (j, m) (square metres).

j, m = a test tree (j) from the data set (m) used to derive the allometric equation.

(13) The mean of the weighted residuals calculated in Equation 1 must not be significantly different from zero, as determined by applying a two-tailed student t-test where $\alpha = 0.05$.

(14) If the allometric equation satisfies subsection (13), proceed to Step 11 in section 38.

(15) If the allometric equation does not satisfy subsection (13):

(a) an existing equation must be selected in accordance with section 26 and validated using the procedure outlined in section 38; or

(b) a new equation must be developed following the procedure outlined in this Subdivision.

38 Step 11—Validation of allometric equation

(1) Each allometric equation must be validated in respect of the native forest to which the pre-existing clearing consent applies.

(2) Each allometric equation must be validated in:

(a) the first reporting period in which the allometric equation is applied; and

(b) the last reporting period in the crediting period.

Step 11.1—Confirmation of allometric domain

(3) Once a biomass survey has been completed in accordance with Subdivision 2, an allometric domain must be confirmed in accordance with this section for each allometric equation to be applied.

(4) Before applying an allometric equation, the project proponent must confirm that the characteristics of the species or group of species whose biomass is to be predicted fall within a valid allometric domain as defined in section 29.

(5) For trees measured in the biomass survey, a table must be prepared listing the following:
  (a) the species of tree(s);
  (b) the species growth form;
  (c) the spatial extent of the species;
  (d) the range of values of all explanatory variables measured.

(6) The information collated in the table mentioned in subsection (5) must fall within the range of values described by the dataset used to develop the allometric equation.

(7) Trees that do not fall within the allometric domain must be excluded from the results of the biomass survey.

Step 11.2—Predicted biomass of sample trees

(8) An estimate of the biomass contained within each sample tree mentioned in section 30 must be predicted using the allometric equation to be validated.

(9) For the purposes of subsection (8), the explanatory variable measurements collected for each test tree must be used as inputs.

Step 11.3—Comparison between predicted and observed biomass

(10) The validity of each allometric equation for prediction must be established by comparing its predictions with observed values estimated by the destructive sampling of trees selected in accordance with sections 30 to 36.

(11) Destructively sampled trees used for the validation of an allometric equation must not have been included in the development of the allometric equation.

(12) The mean of weighted residuals for the observed and predicted biomass estimates of the set of test trees generated in accordance with Step 11.2 in this section must be computed using Equation 3 and Equation 4.

$WR_j = WF_j \times (Q_{ob,j} - Q_{pr,j})$	**Equation 3**

Where:

WR_j = weighted residual in kilograms (kg) for tree (j).

j = a test tree from a dataset not used to derive the allometric equation.

$Q_{ob,j}$ = observed biomass (kilograms) for tree (j) measured through destructive sampling.

$Q_{pr,j}$ = biomass (kilograms) for tree (j) predicted from the allometric equation.

WF_j = weighting factor applied to tree (j) calculated in accordance with Equation 4.

$WF_j = \frac{1}{(BA_j)^{0.5}}$	**Equation 4**

Where:

WF_j = weighting factor applied to tree (j).

BA_j = basal area (square metres) of tree (j).

j = a test tree from a dataset not used to derive the allometric equation.

Step 11.4—Minimum requirements for validation of allometric equations

(13) An allometric equation is validated and may be applied only if:

(a) the characteristics of the species or group of species, the biomass of which is to be predicted, fall within the valid domain of the allometric equation to be applied, in accordance with Step 11.1 in this section; and

(b) the mean of the weighted residuals calculated by applying Equation 3 is not significantly different from zero, as determined by applying a two-tailed student t-test where $\alpha = 0.05$.

39 Procedure if allometric equation cannot be validated

If an allometric equation cannot be validated:

(a) select another equation to validate in accordance with section 26; or

(b) develop a new equation in accordance with section 26.

Subdivision 2—Biomass survey

40 Determination of native forest biomass

(1) A field-based survey must be undertaken by following the steps in this Subdivision in order to determine the biomass stocks in the native forest in each carbon estimation area.

(2) A biomass survey must be undertaken for all carbon estimation areas within 6 months of the submission of the first offsets report for the project.

(3) If no disturbance has been detected in a carbon estimation area:

(a) the data collected in respect of the carbon estimation area and used for the most recent offsets report may be used; and

(b) no further biomass survey must be undertaken.

41 Determination of root:shoot ratios

In order to determine the root:shoot ratio in Equation 8 and Equation 14:

(a) the Major Vegetation Group class in which plot (p) is located must be identified; and

(b) the root:shoot ratio for the class in paragraph (a) must be selected as specified in Schedule 1.

42 Step 1—Plot design

(1) A plot design must be selected in accordance with this section.

(2) Each plot in a carbon estimation area must:
  (a) have a fixed orthogonal area and shape with a definite spatial boundary; and
  (b) be able to be re-established for auditing purposes; and
  (c) be circular, square or rectangular; and
  (d) have an area equal to or greater than 0.05 hectares.

(3) If the plot is circular, the plot waypoint is the centre of the circle and the plot must be established around the waypoint.

(4) If the plot is square or rectangular, the plot waypoint is the south-west corner of the plot and the plot must be oriented along a north-south axis.

(5) If the plot is located on a slope greater than 10 degrees, then a correction must be applied in order to achieve a constant orthogonal area.

(6) The plot design selected in accordance with this section must be used for each biomass survey conducted for the purposes of this determination.

43 Step 2—Allocation of plots

(1) At least 200 waypoints must be assigned to each carbon estimation area in accordance with subsection (2).

(2) A pseudo-random number generator must be used with a defined seed number in order to allocate plot points to each carbon estimation area.

(3) The plot points obtained in subsection (2) are the waypoints of the plots.

(4) A pseudo-random generator with a known seed value must be used to assign a different number to each waypoint.

(5) The numbers assigned as provided by subsection (4) must be ranked from lowest to highest.

(6) The lowest ranked plot in subsection (5) is *plot 1* and the highest ranked is equal to the number of waypoints assigned in subsection (1).

(7) For the purposes of a biomass survey, all the plots ranked from 1 until the number of plots obtained in Step 4.2 in section 45 must be surveyed.

(8) The area boundary used to allocate plots as provided by this section must be retained in order to enable the replication of the plot allocation using the defined seed number.

(9) Attributes for each plot waypoint must be assigned, including:
  (a) the project name [NAME]; and
  (b) the carbon estimation area number to which points are allocated [CEA_NUM];
  (c) the plot point number [PLOT_NUM]; and
  (d) the X coordinate in decimal degrees [X_VALUE]; and
  (e) the Y coordinate in decimal degrees [Y_VALUE]; and
  (f) the date of allocation points to the carbon estimation area [DATE_REG].

44 Step 3—Pilot survey

(1) For each carbon estimation area, a pilot survey must be undertaken in order to perform a pre-biomass survey estimate of variance in relation to each carbon estimation area.

(2) In order to undertake a pilot survey:

(a) at least the first 5 plot points allocated in accordance with section 43 must be surveyed; and

(a) a biomass survey must be undertaken in accordance with sections 46 and 47.

(3) Data collected as part of the pilot survey may be used in order to determine the biomass of plots as provided by section 48.

45 Step 4—Number of plots

(1) In order to determine the final sample size required to estimate carbon stocks in each carbon estimation area, Steps 4.1 and 4.2 in this section must be completed in relation to each carbon estimation area.

Step 4.1—Coefficient of variation of each carbon estimation area

(2) The data from the pilot survey undertaken in accordance with section 44 must be used when completing Step 4.1.

(3) In order to determine the population coefficient of variation within each carbon estimation area, the following formula must be completed:

$CV_i = \left(\frac{\sigma_{pre,i}}{\bar{x}_i}\right) \times 100$	**Equation 5**

Where:

CV_i = coefficient of variation of pilot sample in carbon estimation area (i).

$\sigma_{pre,i}$ = sample standard deviation from pilot data in carbon estimation area (i) (tonnes of biomass).

$\bar{x}_i$ = sample mean from pilot data in carbon estimation area (i) (tonnes of biomass).

Step 4.2—Number of plots to sample in each carbon estimation area

(4) For the purposes of this determination, carbon stocks for each carbon estimation area must be estimated within ±10% of the true value of the mean at a 90% confidence level.

(5) In this determination, the requirement in subsection (4) is referred to as the ***Targeted Precision***.

(6) In order to estimate the required sample size to achieve the Targeted Precision in each carbon estimation area, the following formula must be completed:

$n_i = \frac{CV_i^2 \times t_{val}^2}{SE^2}$	**Equation 6**

Where:

n_i = estimated number of sample plots required to meet Targeted Precision (i).

CV_i = coefficient of variation in pilot data as calculated in Equation 5 (expressed as a percentage).

t_{val} = two-sided students t-value, at the degree of freedom equal to (n-1) where (n) is the number of plots established in the biomass survey, for a 90% confidence level.

SE = allowable level of sampling error (expressed as a percentage and fixed as 10%).

46 Step 5—Preparation of biomass survey

In order to ensure accuracy in measurements and to minimise error, for each carbon estimation area:

(a) if the tree species or group of species has an associated allometric equation—the explanatory variables required to be surveyed must be identified for all allometric equations used in the project area in accordance with Subdivision 1; and

(b) if the tree species or group of species does not have an associated allometric equation—the diameter of the stem must be recorded as an explanatory variable; and

(c) each plot that must be surveyed must be identified; and

Note These will be the plots identified in Step 2 numbering from *plot 1* through to *plot* n_i.

(d) a survey protocol that states the requirements and processes of the biomass survey must be developed, including for the checking and calibration of measuring equipment.

47 Step 6—Measurements within plots

(1) Waypoints must be established using a GPS device with an accuracy of at least ± 4 metres.

(2) A plot at each waypoint must be established as provided by section 42.

(3) The explanatory variables identified in section 46 must be measured for all trees in each plot established in accordance with subsection (2).

(4) For the purposes of subsection (3), each explanatory variable required by the allometric equation applicable to each species or group of species within the plot must be measured.

48 Step 7—Biomass of plots

(1) The biomass of each plot surveyed as provided by section 47 must be determined in accordance with Steps 7.1 to 7.4.

Step 7.1—Determination of above-ground biomass by applying allometric equations

(2) The measurements made in the field sample plots as provided by section 47 must be converted into above-ground biomass stock estimates for each tree, $Q_{AGB,j,p,i,r}$, for tree (j) in sample plot (p) in carbon estimation area (i) in reporting period (r).

(3) For the purposes of the conversion in subsection (2), the allometric equation obtained in Subdivision 1 applicable to the species or group of species to which the tree belongs must be used.

Step 7.2—Determination of above-ground biomass in survey plots

(4) The above-ground biomass stock in survey plot (p) in carbon estimation area (i) must be determined using the following formula:

$Q_{AGB,p,i,r} = \sum_{j} Q_{AGB,j,p,i,r}$	**Equation 7**

Where:

$Q_{AGB,p,i,r}$ = total above-ground biomass of all trees in sample plot (p) in carbon estimation area (i) for reporting period (r) (tonnes of dry matter).

$Q_{AGB,j,p,i,r}$ = above-ground biomass of tree (j) in sample plot (p) in carbon estimation area (j) for reporting period (r) (tonnes of biomass per tree).

j = tree (j) in sample plot (p) in carbon estimation area (i) in reporting period (r).

i = carbon estimation area (i).

p = sample plot (p) in each carbon estimation area (i).

r = reporting period (r).

Step 7.3—Determination of below-ground tree biomass in survey plots

(5) The below-ground tree biomass in each plot surveyed in accordance with section 47 must be determined using the following formula:

$Q_{BGB,p,i,r} = RSR \times Q_{AGB,p,i,r}$	**Equation 8**

Where:

$Q_{BGB,p,i,r}$ = total below-ground tree biomass stock of trees in plot (p), in carbon estimation area (i) for reporting period (r) (tonnes of dry matter).

$Q_{AGB,p,i,r}$ = total above-ground tree biomass stock of trees in plot (p) in carbon estimation area (i) for reporting period (r) (tonnes of dry matter).

RSR = root:shoot ratio determined in accordance with section 41 (tonnes of root biomass per tonnes of shoot biomass).

i = carbon estimation area (i).

p = sample plot (p) in each carbon estimation area (i).

r = reporting period (r).

Step 7.4—Determination of total tree biomass in each plot

(6) The total tree biomass for each plot surveyed in accordance with section 47 must be determined using the following formula:

$Q_{p,i,r} = Q_{AGB,p,i,r} + Q_{BGB,p,i,r}$	**Equation 9**

Where:

$Q_{p,i,r}$ = total biomass stock in sample plot (p) in carbon estimation area (i) for reporting period (r) (tonnes of biomass).

$Q_{AGB,p,i,r}$ = total above-ground tree biomass stock of trees in plot (p) in carbon estimation area (i) for reporting period (r) (tonnes of dry matter).

$Q_{BGB,p,i,r}$ = total below-ground tree biomass stock of trees in plot (p), in carbon estimation area (i) for reporting period (r) (tonnes of dry matter).

i = carbon estimation area (i).

p = sample plot (p) in each carbon estimation area (i).

r = reporting period (r).

49 Step 8—Edge corrections for plots crossing carbon estimation area boundaries

(1) If a plot crosses the boundary of a carbon estimation area, the resulting edge effects must be corrected in accordance with this section.

(2) If more than 20% of the plot falls outside the carbon estimation area that is to be surveyed, the plot must be omitted from the biomass survey.

(3) If less than 20% of the plot falls outside the carbon estimation area that is to be surveyed, the mirage method must be used.

(4) The effective orthogonal area of plots established using the mirage method must be consistent with the area of all other plots.

(5) In this section:

mirage method means the process whereby the area of the plot falling outside of the carbon estimation area is established within the carbon estimation area that is being surveyed.

50 Step 9—Validation of sample size

(1) An ex-post analysis of the data obtained in the biomass survey must be performed in order to verify that the survey performed in accordance with this Subdivision has achieved Targeted Precision.

Step 9.1—Standard error

(2) The standard error must be calculated using the following formula:

$SE_{i,r} = \frac{\sigma_{i,r}}{\sqrt{n_{i,r}}}$	**Equation 10**

Where:

$SE_{i,r}$ = standard error of the biomass survey in carbon estimation area (i) for reporting period (r).

$\sigma_{i,r}$ = standard deviation of the primary biomass survey data in carbon estimation area (i) for reporting period (r) (tonnes of dry matter).

$n_{i,r}$ = number of sample plots in carbon estimation area (i) for reporting period (r).

i = carbon estimation area (i).

r = reporting period (r).

Step 9.2.—Determination of Targeted Precision

(3) In order to determine whether the survey has achieved Targeted Precision, the following formula must be used:

$TP_{i,r} = \frac{SE_{i,r} \times t_{val}}{\overline{Q}_{i,r}}$	**Equation 11**

Where:

$TP_{i,r}$ = Targeted Precision error limit of the primary biomass survey for a carbon estimation area (i) for reporting period (r).

$SE_{i,r}$ = standard error of the biomass survey in carbon estimation area (i) for reporting period (r).

t_{val} = two-sided students t-value, at the degree of freedom equal to (n-1) where (n) is the number of plots established in the biomass survey in each carbon estimation area, for a 90% confidence level.

$\overline{Q}_{i,r}$ = sample mean from biomass survey data in carbon estimation area (i) for the reporting period (r) (tonnes of biomass).

i = carbon estimation area (i).

r = reporting period (r).

(4) The 90% confidence level must be used when determining the t-value.

(5) The final value of $TP_{i,r}$ must be less than or equal to 10%.

(6) If $TP_{i,r}$ is greater than 10%, additional plots must be surveyed consistently with the requirements of this Subdivision until the Targeted Precision is less than or equal to 10%.

Subdivision 3—Calculation of baseline emissions

51 Calculating baseline emissions

The steps outlined in this Subdivision must be followed for the purposes of calculating the baseline emissions in the project area.

52 Baseline relevant carbon pools

For the purposes of this Subdivision, relevant carbon pools are limited to:

(a) above-ground tree biomass;
(b) below-ground tree biomass; and
(c) the burning of biomass for the purposes of clearing.

53 Step 1—Surveying requirements

Data must be collected in accordance with Subdivision 2.

54 Step 2—Calculating carbon stocks in carbon estimation area

Step 2.1—Determination of mean carbon stocks in each carbon estimation area

(1) Following a biomass survey, the mean carbon stock in each carbon estimation area must be calculated using the following formula:

$\bar{C}_{i,r} = \frac{\left(\sum_p \frac{Q_{p,i,r}}{S_{p,i}}\right)}{n_{i,r}} \times CF \times \frac{44}{12} \times (1 - NPT_i)$	**Equation 12**

Where:

$\bar{C}_{i,r}$ = mean carbon stock in all pools in carbon estimation area (i) for reporting period (r) (tonnes of carbon dioxide equivalent per hectare).

$Q_{p,i,r}$ = total biomass stock of trees in sample plot (p) of carbon estimation area (i) for reporting period (r) (tonnes of dry matter) as calculated in section 48.

$S_{p,i}$ = area of sample plot (p) in carbon estimation area (i) (hectares).

CF = 0.5, being the fraction of carbon in biomass.

NPT_i = buffer representing the proportion of non-project tree biomass within carbon estimation area (i) as calculated using Equation 13.

i = carbon estimation area (i).

p = sample plot (p) in each carbon estimation area (i).

r = reporting period (r).

$n_{i,r}$ = number of sample plots (n) measured in carbon estimation area (i) for reporting period (r).

Note 1 The factor $^{44}/_{12}$ represents the ratio of the molecular weight of carbon dioxide to the molecular weight of carbon.

Note 2 Equation 12 is also used to calculate the mean carbon stocks in carbon estimation areas for each reporting period in which a biomass survey is undertaken.

Step 2.2—Non-project tree buffer

(2) If the baseline deforestation plan provides that a kind of tree in the project area must not be cleared, the project proponent may:

(a) do both of the following:

(i) set the biomass of that kind of tree to zero;

(ii) not include that kind of tree in the results of any biomass survey; or

(b) calculate a non-project tree buffer for each carbon estimation area using data collected in the first reporting period, in accordance with Equation 13.

$NPT_i = \frac{\sum_p Q_{NPT,p,i,r}}{\sum_p Q_{p,i,r}}$	**Equation 13**

Where:

NPT_i = buffer representing the proportion of non-project tree biomass within carbon estimation area (i) in the first reporting period (r=1) estimated from in-field measurements as provided by Subdivision 2 and expressed as a decimal.

$Q_{p,i,r}$ = total biomass stock of trees in sample plot (p) of carbon estimation area (i) for the first reporting period (r = 1) (tonnes of biomass).

$Q_{NPT,p,i,r}$ = total biomass stock of non-project trees in sample plot (p) of carbon estimation area (i) for the first reporting period (r = 1) (tonnes of biomass) calculated by completing Equation 14.

i = carbon estimation area (i).

p = sample plot (p) in each carbon estimation area (i).

r = reporting period (r).

(3) If, after proceeding in accordance with paragraph (2)(a) in relation to a particular kind of tree, the project proponent subsequently wishes to include that kind of tree in a biomass survey the project proponent must, using data from the first biomass survey:

(a) calculate the biomass for the kind of tree in accordance with Subdivision 1 and Subdivision 2; and

(b) recalculate the non-project tree buffer in accordance with Equation 13.

(4) If a carbon estimation area is re-stratified following disturbance, the non-project tree buffer of the carbon estimation area after re-stratification is equal to the non-project tree buffer of the carbon estimation area before re-stratification.

Step 2.3—Total biomass of non-project trees within each plot

(5) For all kinds of tree the biomass for which was not set to zero under subsection (2), the total biomass for those trees in each plot must be calculated using the following formula using data collected in the first reporting period:

$Q_{NPT,p,i,r} = \sum_{j} (Q_{NPT,j,p,i,r} + (Q_{NPT,j,p,i,r} \times RSR))$	**Equation 14**

Where:

$Q_{NPT,p,i,r}$ = total biomass of non-project trees in sample plot (p), in carbon estimation area (i) in the first reporting period (r=1) (tonnes of biomass).

$Q_{NPT,j,p,i,r}$ = above-ground biomass of trees that may not be cleared under baseline deforestation plan (j) in sample plot (p) in carbon estimation area (i) in the first reporting period (r=1) (tonnes of biomass per tree).

RSR = root:shoot ratio determined in accordance with section 41 (tonnes of root biomass per tonne of shoot biomass).

j = tree (j) in sample plot (p) in carbon estimation area (i) in reporting period (r).

i = carbon estimation area (i).

p = sample plot (p) in each carbon estimation area (i).

r = reporting period (r).

55 Step 3—Calculating carbon stocks in carbon estimation area following clearing

(1) The long-term average carbon stocks in each carbon estimation area if clearing had been carried out in accordance with the baseline deforestation plan must be calculated in accordance with this section.

(2) The long-term average mean carbon stocks in all pools in each carbon estimation area if clearing had been carried out in accordance with the baseline deforestation plan must be calculated using the following formula:

$\bar{C}_{B,i} = \frac{\left(\sum_{p=1} \frac{\bar{Q}_{lt,p,i}}{S_{p,i}}\right)}{n_{i,r}} \times CF \times \frac{44}{12}$	**Equation 15**

Where:

$\bar{C}_{B,i}$ = baseline (B) long term average mean carbon stock in all pools in carbon estimation area (i) following clearing in accordance with the baseline deforestation plan (tonnes of carbon dioxide equivalent per hectare).

$\bar{Q}_{lt,p,i}$ = long term average biomass stock of trees in sample plot (p) of carbon estimation area (i) following clearing in accordance with the baseline deforestation plan (tonnes of biomass) calculated in accordance with Equation 20.

$S_{p,i}$ = area of sample plot (p) in carbon estimation area (i) (hectares).

i = carbon estimation area (i).

p = sample plot (p) in each carbon estimation area (i).

CF = fraction of carbon in biomass, set at 0.5 as consistent with the National Inventory System.

$n_{i,r}$ = number of sample plots measured in carbon estimation area (i) in the first reporting period (r=1).

Note The factor $^{44}/_{12}$ represents the ratio of the molecular weight of carbon dioxide to the molecular weight of carbon.

Step 3.1—100 year average of biomass within sample plots following clearing

(3) Steps 3.1.1 to 3.1.5 must be completed in order to determine the 100 year average biomass stock in the sample plots following clearing in accordance with the baseline deforestation plan.

Step 3.1.1—Model biomass in debris pool

(4) The biomass stock in the debris pool within each plot must be calculated using the following formula:

$Q_{Debris,p,i} = Q_{p,i,r}$	**Equation 16**

Where:

$Q_{Debris,p,i}$ = biomass in the debris pool following clearing in accordance with the baseline deforestation plan in sample plot (p) in carbon estimation area (i) (tonnes of biomass).

$Q_{p,i,r}$ = biomass stock in all pools within plot (p) prior to clearing in accordance with the baseline deforestation plan in carbon estimation area (i) for the first reporting period (r=1) (tonnes of dry matter) as calculated in accordance with Equation 9.

i = carbon estimation area (i).

p = sample plot (p) in each carbon estimation area (i).

r = reporting period (r).

Step 3.1.2—Partition of biomass into Major Vegetation Group tree components

(5) The biomass of each plot must be partitioned into its Major Vegetation Group tree components in order to determine the impact of treatment and decay on each component of the tree.

(6) Biomass partitioning must be performed in accordance with the biomass fractions in Schedule 1.

(7) The biomass of stems, branches, bark, leaves, coarse roots and fine roots in each sample plot in each carbon estimation area must be determined using the applicable biomass fractions in Schedule 1 and the following formula:

$Q_{k,p,i} = Q_{Debris,p,i} \times QF_{k,p,i}$	**Equation 17**

Where:

$Q_{k,p,i}$ = biomass of tree component (k) in sample plot (p) in carbon estimation area (i) as determined for each tree component (k) (tonnes of biomass).

k = tree component (stem, branch, bark, leaves, coarse roots, fine roots).

i = carbon estimation area (i).

p = sample plot (p) in each carbon estimation area (i).

$Q_{Debris,p,i}$ = biomass in the debris pool following clearing in accordance with the baseline deforestation plan in sample plot (p), in carbon estimation area (i) (tonnes of biomass).

$QF_{k,p,i}$ = the value given by subsection (8).

(8) In relation to $QF_{k,p,i}$ the biomass fraction for each tree component is the following:

(a) $QF_{stem,p,i}$ is the biomass fraction of stems for Major Vegetation Group of plot (p) in carbon estimation area (i);

(b) $QF_{branch,p,i}$ is the biomass fraction of branches for Major Vegetation Group of plot (p) in carbon estimation area (i);

(c) $QF_{bark,p,i}$ is the biomass fraction of bark for Major Vegetation Group of plot (p) in carbon estimation area (i);

(d) $QF_{leaves,p,i}$ is the biomass fraction of leaves for Major Vegetation Group of plot (p) in carbon estimation area (i);

(e) $QF_{coarse\_roots,p,i}$ is the biomass fraction of coarse roots for Major Vegetation Group of plot (p) in carbon estimation area (i);

(f) $QF_{fine\_roots,p,i}$ is the biomass fraction of fine roots for Major Vegetation Group of plot (p) in carbon estimation area (i);

as specified in Table 1.1 and Table 1.2 in Schedule 1.

Step 3.1.3—Treatment of the debris pool

(9) The biomass residue following a burning event must be calculated using the following formula:

$Q_{residue,k,p,i} = Q_{k,p,i} \times (BF - (BF \times BE_k) + UF)$	**Equation 18**

Where:

$Q_{residue,k,p,i}$ = biomass residue post burning event, of tree component (k) in sample plot (p) in carbon estimation area (i) (tonnes of dry matter).

$Q_{k,p,i}$ = biomass of tree component (k) in sample plot (p) in carbon estimation area (i) as determined for each tree component in Step 3.1.2 in this section (tonnes of biomass).

BF = 0.25, being the fraction of biomass burnt as a result of fire.

BE_k = burn efficiency for tree component (k) (see Schedule 1 for tree component burn efficiencies).

UF = 0.75, being the fraction of biomass unburnt as a result of fire.

k = tree component (stem, branch, bark, leaves, coarse roots, fine roots).

i = carbon estimation area (i).

p = sample plot (p) in each carbon estimation area (i).

Step 3.1.4—Average long term carbon stock of tree components

(10) The long-term average carbon stock of the biomass residue must be calculated using the following formula:

$\overline{Q}_{lt,k,p,i} = \frac{(\sum_{Y=1}^{100}(Q_{residue,k,p,i} \times (1 - DR)^{Y})) + Q_{residue,k,p,i}}{100}$	**Equation 19**

Where:

$\overline{Q}_{lt,k,p,i}$ = Long term (lt), 100 year, average biomass of tree component (k) in sample plot (p) in carbon estimation area (i) (tonnes of biomass).

$Q_{residue,k,p,i}$ = biomass residue post burning event, of tree component (k), in sample plot (p), in carbon estimation area (i) (tonnes of dry matter).

DR = decay rate for tree component (k) in sample plot (p), as determined in Schedule 1.

Y = the Y^{th} year for each year of decay in the 100 year modelling period where Y = 1 to 100.

k = tree component (stem, branch, bark, leaves, coarse roots, fine roots).

i = carbon estimation area (i).

p = sample plot (p) in each carbon estimation area (i).

Step 3.1.5—Sum of average long term carbon stock of each tree component

(11) The average biomass in each sample plot in each carbon estimation area must be calculated using the following formula:

$\overline{Q}_{lt,p,i} = \sum_{k} \overline{Q}_{lt,k,p,i}$	**Equation 20**

Where:

$\overline{Q}_{lt,p,i}$ = long term average biomass for sample plot (p) in carbon estimation area (i) (tonnes of biomass).

$\overline{Q}_{lt,k,p,i}$ = 100 year average biomass of tree component (k) for sample plot (p) in carbon estimation area (i) (tonnes of biomass).

k = tree component (stem, branch, bark, leaves, coarse roots, fine roots).

i = carbon estimation area (i).

p = sample plot (p) in each carbon estimation area (i).

56 Step 4—Calculating changes in baseline carbon stock in each carbon estimation area

The change in baseline carbon stocks during the crediting period as a result of the implementation of the baseline deforestation plan must be calculated in the first reporting period using the parameters obtained in Step 2.1 in section 54 and Step 3 in subsection 55(2) and the following formula:

$\Delta\overline{C}_{B,i} = \overline{C}_{i,r} - \overline{C}_{B,i}$	**Equation 21**

Where:

$\Delta\overline{C}_{B,i}$ = mean carbon stock changes in all pools in the baseline within carbon estimation area (i) (tonnes of carbon dioxide equivalent per hectare).

$\overline{C}_{i,r}$ = mean carbon stock in all pools within carbon estimation area (i) in carbon estimation area (i) for the first reporting period (r = 1) (tonnes of carbon dioxide equivalent per hectare) calculated in Equation 12.

$\overline{C}_{B,i}$ = mean carbon stock in all pools in the baseline at end of crediting period in carbon estimation area (i) (tonnes of carbon dioxide equivalent per hectare) calculated in Equation 15.

i = carbon estimation area (i).

r = reporting period (r).

57 Step 5—Calculation of emissions in each carbon estimation area in the baseline

(1) The methane and nitrous oxide emissions released as a result of the burning of biomass following clearing in accordance with the baseline deforestation plan must be accounted for in accordance with this section.

Step 5.1—Pre-fire above-ground biomass stock

(2) The above-ground biomass stock in each carbon estimation area that will be burned must be calculated using the following formula:

$Q_i = \bar{C}_{i,r} \times S_i \times \frac{12}{44} \times \frac{1}{CF}$	**Equation 22**

Where:

Q_i = biomass within the debris pool from clearing in carbon estimation area (i) (tonnes of biomass).

S_i = area of carbon estimation area (i) (hectares).

$\bar{C}_{i,r}$ = mean carbon stock in all pools in the baseline in the carbon estimation area (i) for the first reporting period (r = 1) (tonnes of carbon dioxide equivalent per hectare) calculated in Equation 12.

i = carbon estimation area (i).

r = reporting period (r).

CF = 0.5, being the carbon fraction of biomass.

Note The factor $^{12}/_{44}$ is the ratio of the molecular weight of carbon to carbon dioxide.

Step 5.2—Determination of methane and nitrous oxide emissions from biomass burns

(3) The methane and nitrous oxide emissions associated with the burning event must be calculated using the following formulas:

Step 5.2.1—Determination of methane emissions from fire events

$E_{CH_4,i} = Q_i \times CF \times EF_{CH_4} \times GWP_{CH_4} \times M$	**Equation 23**

Step 5.2.2—Determination of nitrous oxide emissions from fire events

$E_{N_2O,i} = Q_i \times CF \times NC \times EF_{N_2O} \times GWP_{N_2O} \times M$	**Equation 24**

Where:

$E_{CH_4,i}$ = methane emissions due to fire events in carbon estimation area (i) (tonnes of carbon dioxide equivalent).

$E_{N_2O,i}$ = nitrous oxide emissions due to fire events in carbon estimation area (i) (tonnes of carbon dioxide equivalent).

Q_i = biomass within the debris pool from forest conversion activities in carbon estimation area (i) (tonnes of biomass).

CF = 0.5, being the carbon mass fraction of vegetation.

NC = 0.011, being the nitrogen to carbon ratio of the biomass.

EF_{CH_4} = emission factor for methane (CH_4) in tonnes element in species / tonnes element in fuel burnt, as given by the National Inventory Report.

EF_{N_2O} = emission factor for nitrous oxide (N_2O) in tonnes element in species / tonnes element in fuel burnt, as given by the National Inventory Report.

GWP_{CH_4} = Global warming potential for methane (CH_4) (tonnes of carbon dioxide per tonne of methane) as given by the NGER Regulations.

GWP_{N_2O} = Global warming potential for nitrous oxide (N_2O) (tonnes of carbon dioxide per tonne of methane) as given by the NGER Regulations.

M = factor to convert elemental mass of gas species (g) to molecular mass, as accessed from table 7.22 of the National Inventory Report, 2010: Volume 2.

i = carbon estimation area (i).

Step 5.3—Determination of greenhouse gas emissions from biomass burning

(4) The greenhouse gas emissions associated with the biomass burning event must be calculated using the following formula:

$E_{B,Q,i} = E_{CH_4,i} + E_{N_2O,i}$	**Equation 25**

Where:

$E_{B,Q,i}$ = baseline (B) greenhouse gas emissions due to biomass burning in carbon estimation area (i) (tonnes of carbon dioxide equivalent).

$E_{CH_4,i}$ = methane emissions due to biomass burning, as determined in accordance with Equation 23, in carbon estimation area (i) (tonnes carbon dioxide equivalent).

$E_{N_2O,i}$ = nitrous oxide emissions due to biomass burning, as determined in accordance with Equation 24, in carbon estimation area (i) (tonnes of carbon dioxide equivalent).

i = carbon estimation area (i).

(5) The total greenhouse gas emissions from burning in relation to each carbon estimation area must be redefined using the following formula:

$E_{B,i} = E_{B,Q,i}$	**Equation 26**

Where:

$E_{B,i}$ = baseline (B) greenhouse gas emissions as a result of clearing in accordance with the baseline deforestation plan within carbon estimation area (i) (tonnes of carbon dioxide equivalent).

$E_{B,Q,i}$ = baseline (B) greenhouse gas emissions due to biomass burning in carbon estimation area (i) (tonnes of carbon dioxide equivalent).

i = carbon estimation area (i).

58 Step 6—Calculating net baseline greenhouse gas emissions

The net baseline greenhouse gas emissions and removals must be calculated using the parameters derived in Equations 21 and 26 and the following formula:

$E_B = \sum_i \left(\left(S_i \times \Delta \bar{C}_{B,i} \right) + E_{B,i} \right)$	**Equation 27**

Where:

E_B = net greenhouse gas emissions in the baseline from clearing in accordance with the baseline deforestation plan (tonnes of carbon dioxide equivalent).

S_i = area of carbon estimation area (i) (hectares).

$\Delta \bar{C}_{B,i}$ = baseline (B) mean carbon stock changes in all pools in the carbon estimation area (i) (tonnes of carbon dioxide equivalent) during the crediting period.

$E_{B,i}$ = baseline (B) greenhouse gas emissions as a result of clearing in accordance with the baseline deforestation plan within carbon estimation area (i) (tonnes of carbon dioxide equivalent).

i = carbon estimation area (i).

Subdivision 4—Calculation of project emissions and removals

59 Calculating project emissions and removals

The steps outlined in this Subdivision must be followed for the purposes of calculating the project emissions in the project area.

60 Project relevant carbon pools

For the purposes of this Subdivision, relevant carbon pools are limited to:

(a) above-ground tree biomass; and

(b) below-ground tree biomass; and

(c) the combustion of fossil fuels in vehicles, machinery and equipment; and

(d) the burning of biomass from fires.

61 Step 1—Project forest carbon stock changes in carbon estimation area resulting from disturbances

Step 1.1—Accounting for degradation and natural disturbances in the project

(1) When an area of degradation or natural disturbance has been re-stratified into a new carbon estimation area as required by section 23, the biomass stocks of that area must be:

(a) calculated by resurveying the new carbon estimation area in accordance with Subdivision 2; or

(b) set to zero.

(2) For the purposes of paragraph (1)(a):

(a) all dead biomass in the new carbon estimation area is taken to have a biomass of zero; and

(b) the survey must include only standing living trees in the new carbon estimation area.

(3) When the requirements of subsection (1) have been met, the following formula must be completed:

$\Delta\bar{C}_{DEG,i,r} = \bar{C}_{i,pre} - \bar{C}_{i,r}$	**Equation 28**

Where:

$\Delta\bar{C}_{DEG,i,r}$ = mean carbon stock changes in all pools as a result of degradation or natural disturbance in carbon estimation area (i) (tonnes of carbon dioxide equivalent per hectare).

$\bar{C}_{i,pre}$ = mean carbon stock in all pools ($\bar{C}_{i,r}$) in carbon estimation area (i) as reported in the preceding offsets report. For the first offsets report following disturbance, carbon estimation area (i) means the original (not re-stratified) carbon estimation area.

$\bar{C}_{i,r}$ = mean carbon stock in all pools measured in carbon estimation area (i) for reporting period (r) (tonnes of carbon dioxide equivalent per hectare).

i = carbon estimation area (i).

r = reporting period (r).

(4) When Step 1.1 in this section has been completed, Step 1.2 must be completed.

Step 1.2—Net carbon stock changes resulting from degradation or natural disturbance in carbon estimation area

(5) The net project carbon stock changes in all pools as a result of degradation or natural disturbance must be calculated using the following formula:

$\Delta C_{DEG,i,r} = S_{DEG,i} \times \Delta\bar{C}_{DEG,i,r}$	**Equation 29**

Where:

$\Delta C_{DEG,i,r}$ = net project carbon stock changes in all pools as a result of degradation or natural disturbance, in carbon estimation area (i) for reporting period (r) (tonnes of carbon dioxide equivalent).

$S_{DEG,i}$ = area of delineated degradation or natural disturbance event in the carbon estimation area (i) (hectares).

$\Delta\bar{C}_{DEG,i,r}$ = mean carbon stock changes in all pools from the degradation or natural disturbance event, in carbon estimation area (i) for reporting period (r) (tonnes of carbon dioxide equivalent per hectare).

i = carbon estimation area (i).

r = reporting period (r).

62 Step 2—Optional calculation of carbon stock enhancements

(1) Project carbon stock enhancements may be accounted for in accordance with this section.

Step 2.1—Biomass survey to determine current biomass carbon stocks in carbon estimation areas where carbon stock enhancements are occurring

(2) Each carbon estimation area for which carbon stock enhancements are calculated must be surveyed.

(3) The survey must:
  (a) meet the requirements of Subdivision 2; and
  (b) achieve the Targeted Precision.

(4) The net carbon stock changes as a result of forest carbon stock enhancement must be calculated using the following formula:

$\Delta C_{ENH,i,r} = (\bar{C}_{i,r} - \bar{C}_{i,pre}) \times S_{ENH,i}$	**Equation 30**

Where:

$\Delta C_{ENH,i,r}$ = net carbon stock changes as a result of forest carbon stock enhancement in carbon estimation area (i) for reporting period (r) (tonnes of carbon dioxide equivalent).

$\bar{C}_{i,r}$ = mean carbon stock in all pools measured in carbon estimation area (i) for reporting period (r) (tonnes of carbon dioxide equivalent per hectare).

$\bar{C}_{i,pre}$ = mean carbon stock in all pools ($\bar{C}_{i,r}$) as reported at the time of the preceding offsets report in carbon estimation area (i).

$S_{ENH,i}$ = area of carbon estimation area (i) in which carbon stock enhancements are being undertaken and monitored (hectares).

i = carbon estimation area (i).

r = reporting period (r).

63 Step 3—Calculating project emissions

(1) The emissions resulting from fire events and the combustion of fossil fuels must be calculated in accordance with this section.

Step 3.1—Determination of emissions from degradation or natural disturbance events involving a fire event

Step 3.1.1—Determination of mass of biomass burnt from fires

(2) The biomass burnt from fires in each carbon estimation area must be determined using the following formula:

$QB_{ft,i,r} = S_{burn,i,r} \times FL_i \times BE_{ft}$	**Equation 31**

Where:

$QB_{ft,i,r}$ = biomass burned from fire type (ft) in carbon estimation area (i) for reporting period (r) (tonnes of biomass).

$S_{burn,i,r}$ = area burned in carbon estimation area (i) during reporting period (r) (hectares).

FL_i = fuel load of carbon estimation area (i) (tonnes of biomass per hectare) (specified in table 7.17 of the National Inventory Report, 2010: Volume 2).

BE_{ft} = burn efficiency for either controlled burning or wildfires (specified in table 7.19 of the National Inventory Report, 2010: Volume 2).

ft = fire type (ft), either wildfire or controlled burn.

i = carbon estimation area (i).

r = reporting period (r).

Step 3.1.2 – Determination of methane and nitrous oxide emissions from wildfires and controlled burns

(3) The methane and nitrous oxide emissions associated with each fire event must be determined using Equations 32, 33 and 34.

Step 3.1.2.1—Determination of methane emissions from fire events

$E_{CH_4,ft,i,r} = QB_{ft,i,r} \times CF \times EF_{CH_4} \times GWP_{CH_4} \times M$	**Equation 32**

Step 3.1.2.2—Determination of nitrous oxide emissions from fire events

$E_{N_2O,ft,i,r} = QB_{ft,i,r} \times CF \times NC \times EF_{N_2O} \times GWP_{N_2O} \times M$	**Equation 33**

Step 3.1.3—Determination of emissions from fire events

$E_{f,i,r} = \sum_{ft} E_{CH_4,ft,i,r} + E_{N_2O,ft,i,r}$	**Equation 34**

Where:

$E_{f,i,r}$ = greenhouse gas emissions due to fire events in carbon estimation area (i) for reporting period (r) (tonnes of carbon dioxide equivalent).

$E_{CH_4,ft,i,r}$ = methane emissions due to fire events in carbon estimation area (i) for reporting period (r) (tonnes of carbon dioxide equivalent).

$E_{N_2O,ft,i,r}$ = nitrous oxide emissions due to fire events in carbon estimation area (i) for reporting period (r) (tonnes of carbon dioxide equivalent).

CF = 0.5, being the carbon mass fraction in vegetation.

EF_{CH_4} = emission factor for methane (CH_4), in tonnes element in species per tonnes element in fuel burnt, as given by the National Inventory Report.

EF_{N_2O} = emission factor for nitrous oxide (N_2O), in tonnes element in species per tonnes element in fuel burnt, as given by the National Inventory Report.

GWP_{CH_4} = Global warming potential for methane (CH_4) (tonnes of carbon dioxide per tonne of methane) as given by the NGER Regulations.

GWP_{N_2O} = Global warming potential for nitrous oxide (N_2O) (tonnes of carbon dioxide per tonne of methane) as given bythe NGER Regulations.

M = factor to convert elemental mass of gas species g to molecular mass (as given by table 7.22 of the National Inventory Report, 2010: Volume 2).

NC = 0.011, being the nitrogen to carbon ratio in biomass.

g = greenhouse gas methane (CH_4) or nitrous oxide (N_2O).

i = carbon estimation area (i).

r = reporting period (r).

ft = fire type (ft), either wildfire or controlled burn.

Step 3.2—Determine emissions from fossil fuel combustion

(4) The emissions from fuel use for each carbon estimation area during each reporting period must be calculated using the following formula:

$E_{FC,i,r} = \sum_{g}\sum_{a} E_{g,a,i,r}$	**Equation 35**

Where:

$E_{FC,i,r}$ = net emissions of fuel consumption in carbon estimation area (i) for reporting period (r) (tonnes of carbon dioxide equivalent).

$E_{g,a,i,r}$= emissions of greenhouse gas (g) from consumption of fuel type (a) for carbon estimation area (i) during reporting period (r) (tonnes of carbon dioxide equivalent).

a = fuel type (a) (e.g. diesel, Gasoline, etc.) as specified in Schedule 1, Part 4 of the *National Greenhouse and Energy Reporting (Measurement) Determination 2008*.

g = greenhouse gas type: carbon dioxide (CO_2), methane (CH_4) or nitrous oxide (N_2O).

i = carbon estimation area (i).

r = reporting period (r).

Step 3.3—Calculating emissions for fossil fuel types

(5) Emissions of carbon dioxide, methane and nitrous oxide from the consumption of fossil fuels for reporting period (r) must be calculated using the following formula:

$E_{g,a,i,r} = \frac{FF_{a,i,r} \times ECF_a \times EF_{g,a}}{1000}$	**Equation 36**

Where:

$E_{g,a,i,r}$= emissions of greenhouse gas (g) from consumption of fuel type (a) for carbon estimation area (i) during reporting period (r) (tonnes of carbon dioxide equivalent).

$FF_{a,i,r}$ = the quantity of fossil fuel type (a) consumed in carbon estimation area (i) during reporting period (r) (kilolitres).

ECF_a = energy content factor of fossil fuel type (a) (gigajoules per kilolitre) determined in Schedule 1, Part 4 of the *National Greenhouse and Energy Reporting (Measurement) Determination 2008*.

$EF_{g,a}$ = emission factor for each gas type (g) for fossil fuel type (a) (kilograms of carbon dioxide equivalent per gigajoule) determined in Schedule 1, Part 4 of the *National Greenhouse and Energy Reporting (Measurement) Determination 2008*.

g = greenhouse gas type: carbon dioxide (CO_2), methane (CH_4) or nitrous oxide (N_2O).

a = fuel type (a) (e.g. diesel, Gasoline, etc.) as specified in Schedule 1, Part 4 of the *National Greenhouse and Energy Reporting (Measurement) Determination 2008*.

i = carbon estimation area (i).

r = reporting period (r).

Step 3.4—Determination of project greenhouse gas emissions for a reporting period

(6) The project greenhouse gas emissions during a reporting period must be calculated using the following formula:

$E_{Pr,i,r} = E_{FC,i,r} + E_{f,i,r}$	**Equation 37**

Where:

$E_{Pr,i,r}$ = project (Pr) greenhouse gas emissions, for carbon estimation area (i) for reporting period (r) (tonnes of carbon dioxide equivalent).

$E_{FC,i,r}$ = emissions from fossil fuel combustion in carbon estimation area (i) for reporting period (r) calculated in accordance with Equation 35 (tonnes of carbon dioxide equivalent).

$E_{f,i,r}$ = nitrous dioxide and methane emissions due to biomass burnt due to fires in carbon estimation area (i) for reporting period (r), calculated in accordance with Equation 34 (tonnes of carbon dioxide equivalent).

i = carbon estimation area (i).

r = reporting period (r).

64 Step 4—Calculating total net greenhouse gas project emissions at the end of the reporting period

(1) The total net greenhouse gas project emissions for each carbon estimation area at the end of the reporting period must be calculated using the following formula:

$E_{Pr,r} = E_{Pr,r-1} + \left(\sum_{i} \Delta C_{DEG,i,r} + E_{Pr,i,r} - \Delta C_{ENH,i,r} \right)$	**Equation 38**

Where:

$E_{Pr,r}$ = project (Pr) emissions (tonnes of carbon dioxide equivalent) in the project area calculated at the end of the current reporting period (r).

$\Delta C_{DEG,i,r}$ = net project carbon stock change as a result of any degradation events in the project area in carbon estimation area (i) during reporting period (r) (calculated in accordance with Equation 29) (tonnes of carbon dioxide equivalent).

$E_{Pr,i,r}$ = emissions within the project area in carbon estimation area (i) during reporting period (r) (calculated in accordance with Equation 37) (tonnes of carbon dioxide equivalent).

$\Delta C_{ENH,i,r}$ = net carbon stock change as a result of forest growth and sequestration during the project in areas projected to be deforested in the baseline in carbon estimation area (i) during reporting period (r) (calculated in accordance with Equation 30) (tonnes of carbon dioxide equivalent).

i = carbon estimation area (i).

r = current reporting period (r).

r-1 = previous reporting period (r-1).

(2) In subsection (1), $E_{Pr,r-1}$ is equal to zero (0) for the first reporting period (r=1).

Subdivision 5—Calculating net abatement amounts

65 Net abatement amount

(1) The carbon dioxide equivalent net abatement amount for the project for the reporting period must be calculated in accordance with this Subdivision.

(2) The net greenhouse gas abatement in the crediting period, as calculated at the end of reporting period (r), must be calculated in accordance with the following formula:

$CA_r = E_B - E_{Pr,r}$	**Equation 39**

Where:

CA_r = net greenhouse gas abatement for the crediting period calculated at the end of current reporting period (r) (tonnes of carbon dioxide equivalent).

E_B = net greenhouse gas emissions in the baseline from planned deforestation (tonnes of carbon dioxide equivalent) as determined in accordance with Subdivision 3

$E_{Pr,r}$ = net project carbon dioxide equivalent emissions (tonnes of carbon dioxide equivalent) as determined in accordance with Subdivision 4.

(3) The project proponent must calculate the carbon dioxide equivalent net abatement amount A_r for each offsets report:

(a) for the first reporting period under this determination – in accordance with Equation 40A; and

(b) for subsequent reporting periods – in accordance with Equation 40B.

$A_r = \left(\frac{CA_r - A_{AD}}{15 - t_{start} + R_r}\right) \times R_r$	**Equation 40A**

$A_r = \left(\frac{CA_r - A_{AD} - \sum_{rp=1}^{r-1} A_{rp}}{15 - t_{start} + R_r}\right) \times R_r$	**Equation 40B**

Where:

A_r = carbon dioxide equivalent net abatement amount for the current reporting period r (tonnes of carbon dioxide equivalent).

CA_r = net greenhouse gas abatement for the crediting period calculated at the end of the current reporting period (tonnes of carbon dioxide equivalent).

A_{rp} = carbon dioxide equivalent net abatement amount (A_r) for each previous reporting period (rp) (tonnes of carbon dioxide equivalent) since project commencement (that is, not including the current reporting period).

A_{AD} = net greenhouse gas abatement already credited to projects under the *Carbon Credits (Carbon Farming Initiative)(Avoided Deforestation) Methodology Determination 2013* determined in accordance with subsection (4) (Equation 41).

t_{start} = number of years since project commencement.

R_r = number of years in the current reporting period (years).

Note 1 Only projects that were registered and credited under *Carbon Credits (Carbon Farming Initiative) (Avoided Deforestation) Methodology Determination 2013* will have a non-zero value for A_{AD}.

Note 2 The number 15 represents the length of the crediting period.

(4) Project proponents must calculate the abatement already credited under *Carbon Credits (Carbon Farming Initiative) (Avoided Deforestation) Methodology Determination 2013*.

$A_{AD} = \frac{ACCU}{0.95}$	**Equation 41**

Where:

A_{AD} = net greenhouse gas abatement already credited to projects under the *Carbon Credits (Carbon Farming Initiative) (Avoided Deforestation) Methodology Determination 2013*.

ACCU = the total number of Australian carbon credit units issued for the project in *accordance* with the *Carbon Credits (Carbon Farming Initiative) (Avoided Deforestation) Methodology Determination 2013*.

Note 1 0.95 is a constant which accounts for a risk of reversal buffer of 5%.

Note 2 Credits are not adjusted to account for any relinquished credits associated with adopting a 25-year permanence period.

Part 5—Reporting, record-keeping and monitoring requirements

Division 1—Offsets report requirements

66 Operation of this Division

For paragraph 106(3)(a) of the Act, this Division sets out information that must be included in an offsets project report about an avoided deforestation project that is an eligible offsets project.

67 Requirements for first offsets report

The first offsets report must include:

(a) the baseline deforestation plan; and

(b) evidence of the mix of species mentioned in subsection 12(2); and

(c) the map referred to in section 24; and

(d) the information specified in section 68.

68 Requirements for all offsets reports

If a carbon estimation area is re-stratified in accordance with section 23, the next offsets report that is submitted to the Regulator must include the map referred to in section 24, amended to show the new strata boundaries.

69 Determination of certain factors and parameters

If, in the circumstances described in paragraph 19(2)(b), a factor or parameter is defined or calculated for a reporting period by reference to an instrument or writing as in force from time to time, the offsets report about the project for the reporting period must include the following information for the factor or parameter:

(a) the versions of the instrument or writing used;

(b) the start and end dates of each use;

(c) the reasons why it was not possible to define or calculate the factor or parameter by reference to the instrument or writing as in force at the end of the reporting period.

Division 2—Record-keeping requirements

70 Operation of this Division

For paragraph 106(3)(c) of the Act, this Division sets out record-keeping requirements for an avoided deforestation project that is an eligible offsets project.

71 Information relating to remotely-sensed imagery

Records must be kept in relation to each of the requirements for remotely-sensed imagery set out in section 22.

Division 3—Monitoring requirements

72 Operation of this Part

For paragraph 106(3)(d) of the Act, this Division sets out requirements to monitor an avoided deforestation project that is an eligible offsets project.

73 Monitoring for disturbance

(1) The project area must be monitored for disturbances in the course of each reporting period.

(2) For the purposes of subsection (1), remotely-sensed imagery of the project area must:
  (a) be acquired no longer than one year before the submission of the next offsets report; and
  (b) comply with the requirements in section 22.

Division 4—Reporting under section 77A of the Act

74 No division of carbon estimation area

For subsection 77A(2) of the Act, the division of the overall project must not result in the division of a carbon estimation area.

Schedule 1—Partitioning of biomass

Table 1.1: Partitioning of biomass (stems, branches, bark)

National Vegetation Information System Major Vegetation Groups	Biomass fraction to stems (fraction)	Biomass fraction to branches (fraction)	Biomass fraction to bark (fraction)
Rainforest and Vine Thickets	0.78	0.06	0.06
Eucalypt Tall Open Forest	0.67	0.09	0.1
Eucalypt Open Forest	0.45	0.12	0.1
Eucalypt Low Open Forest	0.45	0.12	0.1
Eucalypt Woodlands	0.44	0.15	0.1
Acacia Forest and Woodland	0.42	0.15	0.1
Callitris Forest And Woodland	0.42	0.15	0.1
Casuarina Forest and Woodland	0.42	0.15	0.1
Melaleuca Forest and Woodland	0.42	0.15	0.1
Other Forest and Woodlands	0.42	0.15	0.1
Tropical Eucalypt Woodland/Grassland	0.41	0.18	0.1
Eucalypt Open Woodland	0.41	0.18	0.1
Acacia Open Woodland	0.22	0.165	0.1
Mallee Woodland and Shrubland	0.22	0.165	0.1
Low Closed Forest and Closed Shrubland	0.22	0.165	0.1
Acacia Shrubland	0.22	0.165	0.1
Other Shrubland	0.22	0.165	0.1
Heath	0	0.3	0.18
Chenopod Shrub, Samphire Shrubland, Forbland	0	0.3	0.18
Unclassified Native Vegetation	0.39	0.14	0.09

Table 1.2: Partitioning of biomass (leaves, coarse roots and fine roots)

National Vegetation Information System Major Vegetation Groups	**Biomass fraction to leaves (fraction)**	**Biomass fraction to coarse roots (fraction)**	**Biomass fraction to fine roots (fraction)**	**Root:shoot ratio**
Rainforest and Vine Thickets	0.01	0.06	0.03	0.10
Eucalypt Tall Open Forest	0.02	0.08	0.04	0.14
Eucalypt Open Forest	0.02	0.25	0.06	0.45
Eucalypt Low Open Forest	0.02	0.25	0.06	0.45
Eucalypt Woodlands	0.02	0.23	0.06	0.41
Acacia Forest and Woodland	0.02	0.25	0.06	0.45
Callitris Forest and Woodland	0.02	0.16	0.15	0.45
Casuarina Forest and Woodland	0.02	0.25	0.06	0.45
Melaleuca Forest and Woodland	0.02	0.25	0.06	0.45
Other Forest and Woodlands	0.02	0.25	0.06	0.45
Tropical Eucalypt Woodland/Grassland	0.02	0.23	0.06	0.41
Eucalypt Open Woodland	0.02	0.23	0.06	0.41
Acacia Open Woodland	0.025	0.42	0.07	0.96
Mallee Woodland and Shrubland	0.025	0.42	0.07	0.96
Low Closed Forest and Closed Shrubland	0.025	0.42	0.07	0.96
Acacia Shrubland	0.025	0.25	0.24	0.96
Other Shrubland	0.025	0.25	0.24	0.96
Heath	0.03	0.25	0.24	0.96
Chenopod Shrub, Samphire Shrubland, Forbland	0.03	0.25	0.24	0.96
Unclassified Native Vegetation	0.02	0.25	0.11	0.56

Table 2: Burn Efficiency

	Stem	**Branch**	**Bark**	**Leaves**	**Coarse roots**	**Fine roots**
All National Vegetation Information System Major Vegetation Groups	0.9	0.9	0.95	0.95	0.8	0.7

Table 3: Decay Rate

	Leaves	**Stem**	**Branch**	**Bark**	**Coarse roots**	**Fine roots**
All National Vegetation Information System Major Vegetation Groups	1	0.1	0.1	0.5	0.1	0.3

EXPLANATORY STATEMENT

Carbon Credits (Carbon Farming Initiative) Act 2011

Carbon Credits (Carbon Farming Initiative—Avoided Deforestation 1.1) Methodology Determination 2015

Background: Emissions Reduction Fund

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

In 2014, the Act was amended by the Carbon *Farming Initiative Amendment Act 2014* (the amending Act), which establishes the Emissions Reduction Fund (ERF). The ERF expands on the Carbon Farming Initiative (CFI) by extending the scope of eligible emissions reduction activities and by streamlining existing processes. The ERF has three elements: crediting emissions reductions, purchasing emissions reductions, and safeguarding emissions reductions.

Emissions reduction 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 methodology determination. The purpose of a methodology determination is to establish procedures for estimating abatement (emissions reductions and sequestration) and rules for monitoring, record keeping and reporting. These determinations will ensure that emissions reductions are genuine—that they are both real and additional to business as usual.

In deciding to make a methodology determination, the Minister must have regard to the advice of the Emissions Reduction Assurance Committee (ERAC), an independent expert panel established to advise the Minister on proposals for methodology determinations. The Minister will also consider whether any adverse environmental, economic or social impacts are likely to arise as a result of projects to which the determination applies.

The ERAC must include in its advice to the Minister the Committee's opinion on whether the proposed determination complies with the offsets integrity standards set out in section 133 of the Act. The offsets integrity standards require, among other things, that an eligible project should result in carbon abatement that is unlikely to occur in the ordinary course of events and is eligible carbon abatement under the Act. In summary, the offsets integrity standards also include requirements that:

- amounts are measurable and capable of being verified
- the methods used are supported by clear and convincing evidence
- material emissions which are a direct consequence of the project are deducted, and

- estimates, assumptions or projections used in the determination should be conservative.

Offsets projects that are undertaken in accordance with a methodology determination and approved by the Clean Energy Regulator (the Regulator) can generate Australian Carbon Credit Units (ACCUs), representing emissions reductions from the project.

Project proponents can receive funding from the ERF by submitting their projects into a competitive auction run by the Regulator. The Government will enter into contracts with successful proponents, which will guarantee the price and payment for the future delivery of emissions reductions.

Further Information on the Emissions Reduction Fund is available at: www.environment.gov.au/emissions-reduction-fund.

Application of the Determination

The *Carbon Credits (Carbon Farming Initiative—Avoided Deforestation 1.1) Methodology Determination 2015* (the Determination) sets out the detailed rules for implementing and monitoring offsets projects that avoid emissions by not clearing native forest, and which meet the eligibility requirements in Part 2 of the Determination. These rules have been designed to reflect the requirements of the offsets integrity standards, including to ensure that emissions reductions are real and additional to business as usual.

A project proponent wishing to implement the Determination must make an application to the Clean Energy Regulator (the Regulator) under section 22 of the Act and meet the general eligibility requirements for an offsets project set out in subsection 27(4), which include compliance with the rules set out in the determination, and the additionality requirements in subsection 27(4A) of the Act. The additionality requirements are:

- the newness requirement
- the regulatory additionality requirement, and
- the government program requirement.

Subsection 27(4A) provides that a methodology determination that covers the project may specify requirements in lieu of any of the above requirements. However, the determination does not specify any requirements in lieu, and so all three requirements apply to projects under the Determination.

Section 23 of the Act provides that, if a project is a sequestration offsets project, an application to the Regulator under section 22 must include a request that the project be treated as either a 100-year or 25-year permanence period project. Then, if the Regulator declares that the project is an eligible offsets project, the Regulator will declare that the project is a 100-year or 25-year permanence period project, as appropriate. Once declared, the permanence period is fixed at either 100 years or 25 years, and it will not be possible for projects to ‘move between’ permanence periods. (However, it is possible for the regulations

or legislative rules to specify a period that is longer or shorter than 100 years – section 87 of the Act.)

If the project proponent elects a 25-year permanence period, a permanence discount applies in accordance with section 16 of the Act. The permanence discount is 20 per cent of the net abatement number unless another percentage is specified in accordance with the legislative rules.

As they are sequestration offsets projects under section 54 of the Act, projects undertaken in accordance with the Determination are subject to a risk of reversal buffer, as provided by section 16 of the Act.

The Determination is derived from the *Carbon Credits (Carbon Farming Initiative) (Avoided Deforestation) Methodology Determination 2013*, referred to as the original *Avoided Deforestation* method. The Determination applies to the same activity as the original *Avoided Deforestation* method—avoided deforestation of Kyoto forests—but has slightly different eligibility requirements, different crediting periods, and some minor changes in the sampling protocol.

Public Consultation

An exposure draft of a draft of the Determination was published on the Department's website for public consultation from 5 December 2014 to 19 December 2014. As a result of the public consultation the Department received two written submissions.

Determination Details

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

The Determination commences on the day after it is registered.

The Determination ends when it is either revoked under section 123 of the Act, or on the day before it would otherwise be repealed under the *Legislative Instruments Act 2003*, whichever happens first. Under subsection 50(1) of that Act, a legislative instrument such as the Determination is repealed on the first 1 April or 1 October falling on or after the tenth anniversary of registration of the instrument on FRLI. For example, if the Determination is registered before 1 April 2015, it would expire on 31 March 2025.

Details of the Determination are at Attachment A.

A Statement of Compatibility prepared in accordance with the *Human Rights (*Parliamentary *Scrutiny) Act 2011* is at Attachment B.

Note on this explanatory statement

Numbered sections in this explanatory statement align with the relevant sections of the Determination.

Attachment A

Details of the Determination

Part 1—Preliminary

1. Name

Section 1 provides that the Determination is the *Carbon Credits (Carbon Farming Initiative—Avoided Deforestation 1.1) Methodology Determination 2015*.

2. Commencement

Paragraph 122(1)(a) of the Act provides that a methodology determination comes into force either when it is made, or at a later time specified in the determination. Section 2 provides that the Determination commences on the day after it is registered.

3. Authority

Section 3 provides that the Determination is made under subsection 106(1) of the Act.

4. Duration

Paragraph 122(1)(b) of the Act provides that, unless sooner revoked, a methodology determination remains in force for either the period specified in the determination, or a longer period specified, in a legislative instrument, by the Minister. Section 4 specifies a period for the purposes of this paragraph.

Section 4 provides that the Determination remains in force for the period that begins when the Determination commences, and ends on the day before this instrument would otherwise be repealed under subsection 50(1) of the *Legislative Instruments Act 2003*.

5. Definitions

Section 5 defines a number of terms used in the Determination.

The note at the foot of section 5 lists terms that are not defined in the Determination but which instead have the meaning given to them by section 5 of the Act.

Under section 23 of the *Acts Interpretation Act 1901* and paragraph 13(1)(a) of the *Legislative Instruments Act 2003*, words in the Determination in the singular number include the plural and words in the plural number include the singular.

6. Crediting period

Section 6 provides that projects covered by this Determination have a 15 year crediting period. This represents a revision in the crediting period from 20 years, as provided for with the original *Avoided Deforestation* method, to better reflect when abatement occurs.

Part 2—Avoided deforestation projects

7. Avoided deforestation projects

The effect of paragraphs 27(4)(b) and 106(1)(a) of the Act is that a project must be covered by a methodology determination, and that the methodology determination must specify the kind of offsets project to which it applies.

Subsection 7(1) provides that the Determination applies to an offsets project that:

- involves:
  - removing carbon dioxide from the atmosphere by sequestering carbon in trees in one or more native forests; and
  - avoiding emissions of greenhouse gases attributable to the clearing of one or more native forests; and
- can reasonably be expected to result in 'eligible carbon abatement'.

Subsection (2) provides that a project covered by subsection (1) is an 'avoided deforestation project'.

Part 3—Project requirements

Division 1—General

8. Operation of this Part

The effect of paragraph 106(1)(b) of the Act is that a determination must set out requirements that must be met for a project to be an eligible offsets project. Under paragraph 27(4)(c) of the Act, the Regulator must not declare that an offsets project is an eligible offsets project unless the Regulator is satisfied that the project meets these requirements. The effect of section 35 of the Act is that the Regulator may, if an appropriate regulation or legislative rule is made, revoke the declaration that a project is an eligible offsets project if eligibility requirements have not been met.

Part 3 of the Determination specifies a number of requirements that must be met in order for an avoided deforestation project to be an eligible offsets project.

Division 2—Location

9. Location

This section requires that the project area must be located in Australia. The term 'Australia' is defined in the Act as including the external Territories. The term 'external Territory' is defined in the *Acts Interpretation Act 1901*.

'Project area' is defined in the Act as meaning, in relation to an area-based offsets project, 'an area of land on which the project has been, is being, or is to be carried out'.

10. Project area to include eligible native forest

Section 10 provides that the project area must include 'native forest' that meets the requirements specified in that provision. 'Native forest' is defined in section 5 of the Determination. The requirements of subsection (1) of this section are summarised below.

Paragraph (a) provides that the native forest in the project area must have attained forest cover at the time of the application under section 22 of the Act. Forest cover means an area of at least 0.2 of a hectare that has 20 per cent or more canopy cover and trees greater than 2 metres in height. This differs from the definition of 'native forest', which may be satisfied by trees with the 'potential' to attain these qualities. Unlike the original *Avoided Deforestation* method, the project area does not have to have been forest on 31 December 1989 or at all times between 1990 and project commencement.

Paragraph (b) provides that there must be a clearing consent in relation to the native forest which satisfies the requirements of that paragraph. The terms 'clearing' and 'clearing consent' are defined in section 5 of the Determination. The requirements of paragraph (b) are needed because the broad definition of 'clearing' could otherwise capture the conversion of native forest to settlements, and the broad definition of 'clearing consent' could otherwise capture approval to convert native forest to plantation, neither of which are permitted by the Determination.

The requirements of paragraph (b) are discussed in more detail below.

- Subparagraph (i) provides that the clearing consent had to be issued before 1 July 2010. This requirement protects the integrity of the additionality as permits issued after this date may have been obtained by landholders with the sole intention to access revenue from carbon, rather than intending to clear land.
- Subparagraph (ii) provides that at the time the project proponent applies to the Regulator for a project under section 22 of the Act, the clearing consent must be valid.
- Subparagraph (iii) provides that the clearing consent must provide that clearing is permitted for the purpose of converting the native forest to cropland or grassland. The Determination may be applied only to native forests that would otherwise be converted to cropland or grassland because other land uses could result in abatement which the calculations in the Determination are not intended to capture. For example, a plantation on the project land in the baseline could sequester a significant amount of carbon, which would have to be subtracted from the abatement achieved in the project. However, the Determination does not provide for the calculation of this kind of sequestration and so would over-estimate the amount of abatement achieved in the project.
- Subparagraph (iv) provides that the clearing consent must not allow the conversion of the native forest to plantation or settlements.
- Subparagraph (v) provides that the clearing consent must specify that once the native forest is converted to cropland or grassland, these land-uses must be maintained into the future. This supports the assumption under the baseline calculation that the native forest would not be permitted to regenerate. If other land-uses which resulted in sequestration were to occur in the future, they would require a different baseline calculation that reflected increasing baseline carbon stocks.
- Subparagraph (vi) provides that the clearing consent must not require an offset to mitigate any effect from the clearing. For example, the clearing consent must not require that another area of forest be protected or restored as compensation for the forest that is cleared. This requirement is necessary as these offsets would also offset some of the emissions from the clearing event.

Paragraph (c) has the effect that project proponents must not have a licence or permit that enables them to remove wood from the native forest for commercial purposes. The carbon in such wood may be sequestered in wood products for a considerable time, and this would affect the accuracy of the baseline calculation which assumes that deforestation would cause that carbon to be emitted into the atmosphere as carbon dioxide.

Paragraph (d) provides that there must be no permit allowing the collection of firewood from the native forest. Permits are not required for the collection of firewood for personal use, which is permitted under the Determination because of its immaterial impact on carbon stocks. However, a permit for the collection of firewood would indicate that the large-scale collection of firewood is intended or possible, and this is prohibited under the Determination because it would have a material effect on carbon stocks.

Subsection (2) contains two definitions that are used throughout the Determination:

- a native forest that satisfies the requirements of subsection (1) is known as an 'eligible native forest', and
- a clearing consent that satisfies the requirements of subsection (1) is known as a 'pre-existing clearing consent'.

11. Evidence relating to eligible native forest

Section 11 lists the evidence that must be provided to the Regulator with an application under subsection 22(1) of the Act. The section does not operate to limit the evidence the Regulator may require from project proponents. For example, section 11 does not affect subsection 24(1) of the Act, which provides that the Regulator may, by written notice given to an applicant, require the applicant to give the Regulator, within the period specified in the notice, further information in connection with the application.

Division 3—Requirements relating to project mechanism

12. Project mechanism

Section 12 specifies the project mechanism. The specification of the project mechanism presupposes that the project area has been 'stratified'.

Section 24 requires division of the project area into strata, each of which is a 'carbon estimation area', a 'clearing buffer' or an 'exclusion area'. Under the project mechanism, subsection (1) of section 12 requires the project to protect eligible native forest that is in a carbon estimation area or a clearing buffer. Native forest in those areas is known as a 'project native forest'. The project mechanism does not require protection of native forest in exclusion areas.

Paragraph 12(2)(a) provides that the project must be one in which the project native forest is not cleared.

Paragraph 12(2)(b) provides that the project must be one in which the project native forest is managed in order to achieve a mix of trees, shrubs and understory species that reflects the structures described in subparagraphs (b)(i) and (ii). This provision ensures that native forests are not simply 'locked away' but rather are managed responsibly. It ensures that the project does not result in perverse or unintended environmental effects.

Division 4 Restrictions on activities

13. No commercial harvesting

Section 13 provides that the project must be one in which biomass is not removed from a carbon estimation area or clearing buffer for commercial purposes. For example, selling timber from these areas of the eligible native forest is prohibited. Permitting the removal of biomass for commercial purposes would likely have a material impact on carbon stocks for the project which are not accounted for under the Determination.

14. Wood for personal use, fencing and thinning

Section 14 applies only in respect of carbon estimation areas and clearing buffers. The Determination does not seek to restrict the activities project proponents can undertake in exclusion areas.

Paragraph (a) provides that the project must be one in which, if wood is removed for personal use or for the purpose of erecting or repairing fences, no more than 5 per cent of carbon stocks from the carbon estimation area or clearing buffer are removed. These activities are permitted because it is assumed that their effect on project carbon stocks is immaterial.

Paragraph (b) provides that the project must be one in which, if trees are thinned for the purpose of promoting biodiversity or enhancing carbon stocks, 95 per cent of the biomass thinned remains within the carbon estimation area or clearing buffer in which it was thinned. Although it constitutes the short-term loss of living biomass, thinning may lead to the enhancement of carbon stocks in the project area by promoting vegetation growth. Thinning may also result in greater biodiversity in the project area, a desirable environmental outcome.

The definition of 'thinning' in the Determination makes it clear that thinning must not amount to clearing, and that project proponents must not thin the native forest to the extent that thinning results in a reduction of estimated abatement below that which has already been credited under the Determination.

Division 5—Other requirements

15. Requirement in lieu of regulatory additionality

Section 15 specifies a requirement in lieu of the regulatory additionality requirement specified in the Act, for the purposes of subparagraph 27(4A)(b)(ii) of the Act. Subsection (2) provides that the project must not be required to be carried out by or under a law of the Commonwealth, a State, or a Territory. Subsection (3) provides that a requirement to carry out an activity under a conservation covenant that is entered into with the Commonwealth, a State, or a Territory, or with an authority of any of those bodies politic, is not a 'requirement' for the purposes of subsection (2). The term 'conservation covenant' is defined in section 5 of the Determination.

Part 4—Net abatement amount

Division 1—Preliminary

16. Operation of this Part

Section 16 is a standard provision that describes the operation of Part 4 of the Determination. This section provides that, for paragraph 106(1)(c) of the Act, Part 4 specifies the method for working out the carbon dioxide equivalent net abatement amount for a reporting period for an avoided deforestation project that is an eligible offsets project.

The calculations in the Determination differ from those in the original *Avoided Deforestation* method, which calculated the abatement only for the crediting period.

17. Overview of gases accounted for in abatement calculations

Section 17 is a standard provision that sets out an overview of the gases that are accounted for in abatement calculations in Part 4. This table is primarily an overview only; the gases taken into account are built into each equation set out in Part 4.

18. Carbon dioxide equivalent net abatement amount

Section 18 sets out an outline of the method for calculating the carbon dioxide equivalent net abatement amount that is set out in detail in Part 4. This section is primarily an overview only; the method is set out in more detail in the subsequent provisions of Part 4.

19. References to factors and parameters from external sources

Section 19 is a standard provision that explains how references to factors and parameters from external sources are to be construed for the purposes of the Determination. Under this provision, where a calculation references a parameter in another instrument or writing, the parameter, as defined at the end of the reporting period, should be applied for the reporting period. That is, if the value of a parameter changes between the end of the reporting period and the submission of an offsets report for that period, then the value of the parameter is that at the end of the reporting period, not the new value current at the time of drafting the offsets report.

20. Use of data—pre-existing projects

Section 20 applies to projects that have been registered under the original *Avoided Deforestation* determination, and have had data collected and accepted by the Regulator in a previous offsets report that was accompanied with an audit report. A certificate of entitlement issued by the Regulator would show that the data underpinning the corresponding offsets report had been accepted. In this situation, the data previously collected can be used to estimate the carbon dioxide equivalent net abatement amount, as calculated under Subdivision 3 and Subdivision 4 of Part 4 of the Determination.

Division 2—Stratification

21. Stratification of project area

Subsection 21(1) provides that the project area must be stratified, that is, divided into carbon estimation areas, exclusion areas and clearing buffers. Subsection (2) provides that each such area is a 'stratum'. The effect of this is that the project area is equal to the sum of all strata. The project area must be stratified before the submission of the first offsets report.

Subsection (3) provides that, if the pre-existing clearing consent includes conditions that require that an area of the eligible native forest not be cleared, the project area must include at least one stratum that is a clearing buffer. The clearing buffer, or clearing buffers, must be sufficient to satisfy the conditions in the pre-existing clearing permit (See Subsection (4) for details on the clearing buffer). The size of the clearing buffer is dependent on the total area of the eligible native forest, not the area of eligible native forest in carbon estimation areas.

Subsection (4) defines the terms 'carbon estimation area', 'clearing buffer' and 'exclusion area' for the purposes of the Determination.

Carbon estimation areas

A 'carbon estimation area' is an area of eligible native forest that:

- in the absence of the project, would have been cleared in accordance with the pre-existing clearing consent; and
- in which the project mechanism will be applied.

Carbon estimation areas are areas of native forest in the project area that are protected in accordance with the project mechanism. Accordingly, the abatement calculations in the Determination are made in relation to the abatement and emissions which occur in the carbon estimation area.

Clearing buffers

A 'clearing buffer' means an area (if any) of eligible native forest that:

- in the absence of the project, would have been left uncleared in order to comply with conditions of the pre-existing clearing consent; and
- under the project, will not be cleared.

Clearing consents may specify a proportion of the eligible forest that must not be cleared. That is, the clearing consent refers to a proportion of area rather than a specific geographic area that cannot be cleared (see Example 1). Such an area is known as a clearing buffer.

The project proponent may delineate two or more clearing buffers so long as, taken together, they cover an area containing the specified proportion (see Example 2).

If the clearing consent specifies that *particular* trees (or kinds of tree), for example trees of a certain species or size, must not be cleared, those trees must be categorised as non-project trees where they are found in biomass surveys in a carbon estimation area (see section 5).

Clearing buffers are part of the project area but are not counted in the abatement calculations in the Determination.

The monitoring requirements in Part 5 of the Determination apply in respect of clearing buffers.

It is important to note that the size of the clearing buffer(s) is governed by the size of the eligible native forest to which the clearing permit applies and not the area of native forest in carbon estimation areas. This is of particular importance where the carbon estimation areas do not cover the entire eligible native forest (see Example 3). The reason for this is that trees in the project area may not be used to offset other land-use requirements.

Example 1

Ashley has a clearing consent for the native forest on her land. The clearing consent specifies that 20 per cent of the native forest must not be cleared. When stratifying the project area, which covers the entire native forest on her land, Ashley delineates a single clearing buffer covering 20 per cent of the eligible native forest.

Example 2

Iain has a clearing consent for the native forest on his land. The clearing consent specifies that up to 80 per cent of the native forest can be cleared. When stratifying the project area, which covers the entire native forest on her land, Iain delineates two clearing buffers, one covering 15 per cent of the native forest, and the other 5 per cent.

Example 3

Rachel has a clearing consent for the 2000 hectare native forest on her land. The clearing consent specifies that 20 per cent (400 hectares) of the native forest must not be cleared. Rachel decides to convert 1000 hectares of the native forest to cropland, but to conduct an offsets project in relation to the remaining 1000 hectares. Accordingly, her project area contains 1000 hectares, of which Rachel must delineate a clearing buffer covering 400 hectares (20 per cent of the total native forest) and not 200 hectares (20 per cent of the project area).

Exclusion areas

An ‘exclusion area’ is an area of the project area that is neither:

- a clearing buffer; nor
- a carbon estimation area.

Exclusion areas are considered part of the project area but do not contribute to sequestration and are not included when calculating net abatement for the project. Exclusion areas provide

proponents a degree of flexibility in managing and maintaining mapping of the project area without requiring an application for a variation to be submitted to the Regulator. The project mechanism is not implemented in exclusion areas.

22. Remotely-sensed imagery of project area

Subsection (1) provides that remotely-sensed imagery of the project area must be acquired for the purposes of stratification.

Subsection (2) provides that the remotely-sensed imagery must be consistent with the requirements of the CFI Mapping Guidelines, and corrected for any irregular features.

Subsection (3) provides that the remotely-sensed imagery must be pre-processed in order to correct any irregular feature that comprise more than 10 per cent of the total area of the carbon estimation area or areas. For example, if more than 10 per cent of the carbon estimation area has heavy cloud cover, these areas would need to be delineated from the image and deleted, then filled with data from another image. This is necessary to ensure that the land cover assessment conducted in accordance with the next section is accurate.

Subsection (4) provides examples of what constitutes an irregular feature, but it is not an exhaustive list.

23. Re-stratification of carbon estimation areas

Section 23 provides for the re-stratification of carbon estimation areas.

This section provides that, when a disturbance of sufficient magnitude has been detected, the area affected by the disturbance must be re-stratified into a new carbon estimation area before the submission of the next offsets report.

Subsection (3) provides that when an area of disturbance is re-stratified, the carbon estimation area touching its boundaries must be re-stratified too. In order to prevent double-crediting, carbon estimation areas must not overlap.

The Determination does not provide for the re-stratification of exclusion areas. This is because exclusion areas do not count towards project abatement. Exclusion areas that become areas of native forest during the crediting period cannot be re-stratified into carbon estimation area because they could not have been cleared in the baseline.

Similarly, the Determination does not provide for the re-stratification of clearing buffers. Like exclusion areas, clearing buffers are established in relation to the baseline and do not contribute toward the project abatement.

24. Strata boundaries

Section 24 provides that the geographic boundaries of each carbon estimation area, exclusion area and clearing buffer in the project area must be identified on a geospatial map in accordance with the CFI Mapping Guidelines. The strata map does *not* have to be submitted with an application for an eligible offsets project under subsection 22(1) of the Act.

Division 3—Baseline deforestation plan

25. Baseline deforestation plan

Subsection (1) provides that a deforestation plan must be prepared in relation to the project area (the 'baseline deforestation plan'). The baseline deforestation plan describes what would have occurred in the project area if the project proponent were not protecting the native forest. The deforestation plan corresponds to the activities permitted and/or prohibited by the clearing consent.

Subsection (2) sets out the required content of the deforestation plan. Paragraph (a) provides that the deforestation plan must detail the alternative land use for each area that is not being cleared due to the project. Paragraph (b) provides that the deforestation plan must include the spatial extent of each of the listed project characteristics. The spatial extent refers to the geographic area associated with each project characteristic, and should include the location and area of each characteristic. Paragraph (c) provides that the deforestation plan must detail any requirements to not clear certain kinds of tree, this maybe a particular species or a tree above a certain size. These kinds of trees are defined as non-project trees. Paragraph (d) provides that the deforestation plan must include an estimate of the canopy cover had the authorised clearing occurred. Canopy cover is the percentage of the area that is covered by the canopy of trees. This estimate can be gained by multiplying the estimate of the average number of non-project trees per hectare for a carbon estimation area by the expected canopy cover of each individual non-project tree (in square metres), and dividing this by 10,000 (the number of square metres in a hectare).

Subsection (3) provides that the content of the deforestation plan must be represented spatially, as in a map, in accordance with the CFI Mapping Guidelines.

Division 4—Net abatement amount

Subdivision 1—Allometric equations

Subdivision 1 of Division 4 sets out the process for developing or validating allometric equations in order to calculate the biomass in the project area. Allometric equations are used to estimate biomass from one or more non-destructive measures such as the diameter of the trunk at 1.3 metres (diameter at breast height). Different equations give different estimates for biomass because each one is designed for a specific range of variables including the type of forest and climate.

26. Allometric equations to be validated or developed

Section 26 provides that for each tree species or group of species for which an allometric equation will be applied, an allometric equation must have been developed or validated in accordance with this section. A species refers to a single species, such as *Callitris endlicheri*, whereas a species group refers to a collection of species that have the same growth form. Project proponents can validate existing equations or develop new ones provided that they too are validated. The process for developing a new equation is set out in sections 27 to 39. Paragraph (2)(b) sets out the requirements that an existing equation must meet if it is to be

validated under the Determination. Validation ensures that carbon stocks in the project area are correctly accounted for. While the project proponent does not have to develop an allometric equation for all tree species all trees within a plot must be measured in accordance with sections 46 and 47.

27. Validating or developing allometric equations

Section 27 provides that each allometric equation must be validated or developed using destructive sampling by carrying out the steps specified in the present Subdivision.

28. Step 1—Scope of allometry

Subsection (1) provides that allometric equations developed or validated apply only to the above-ground biomass of the native forest in the project area. A note refers to section 41, which provides that below-ground biomass is determined using prescribed root:shoot ratios.

Subsection (2) provides that an allometric equation may be applied only within its allometric domain.

29. Step 2—Determination of allometric domains

Subsection (1) defines 'allometric domain' as describing the specific conditions under which an allometric equation is likely to apply because the conditions that underpin it are satisfied. An allometric domain may apply to a single species or group of species.

Subsection (2) provides that an allometric domain must be defined for each allometric equation.

Subsection (3) sets out the requirements for defining an allometric domain. For example, an allometric domain may include:

Reference: *C. endlicheri* 1

Species: *Callitris endlicheri*

Form: Single stem tree form

Measurement range: DBH 3.5cm-15cm

Subsection (4) requires that if a new allometric equation is developed, the spatial extent of the equation must be specified. That is, the geographic area for which the allometric equation is likely to apply. This may be defined by a number of site factors such as soil type and annual rainfall.

Subsection (5) requires that if a pre-existing allometric equation is to be validated, the spatial extent of the equation must be specified if it has previously been defined for the equation.

Subsection (6) sets out additional requirements for defining an allometric domain for a group of species. Additional guidance for developing allometric equations for groups of species may be found in:

- Picard, N, et al. (2012) *Manual for building tree volume and biomass allometric equations: from field measurements to prediction.* Food and Agricultural Organization of the United Nations, Rome and Centre de Coopération Internationale en Recherche Agronomique pour le Développement, Montpellier.

30. Step 3—Sample size

The sample size required to generate a valid allometric equation will vary depending on whether the project proponent validates an existing equation or develops a new equation.

Subsection (1) provides that for each equation to be validated, at least six trees must be selected for destructive sampling, including at least one from each class size as defined in section 34.

Subsection (2) provides that for each equation to be developed, at least 20 trees must be selected for destructive sampling, including at least one tree from each class size as defined in section 34

31. Step 4—Determination of plot design for tree selection

Once the sample size has been determined for validating or developing an allometric equation, the project proponent must determine the plot design for tree selection. Trees for the destructive sampling procedure will be collected from these plots.

Subsection (2) provides that enough plots must be allocated to capture at least 100 trees across the spatial domain of the study site. One hundred trees are specified as the minimum selected in order to increase the probability of identifying the full range of variables within the study site. In highly variable sites, project proponents may aim to capture more than 100 trees.

32. Step 5—Allocation of plots for tree selection

Once the plot design has been established for validating or developing an allometric equation, the project proponent must allocate plots for tree selection. Subsection (1) provides that when developing an allometric equation, the plots must be within one or more carbon estimations areas as well as within the spatial extent of the allometric domain defined in section 29.

Subsection (2) provides that when validating an allometric equation, the plots must be allocated across the carbon estimation area or areas in which the allometric equation is to be applied.

Subsection (2) provides that plots must be allocated using a pseudo-random number generator with a known seed number. Such a random number generator generates a list of points which are effectively random, but by knowing the seed number, the list can be reproduced. This allows a process for demonstrating that plot locations were in fact random. While programs such as Microsoft Excel often have pseudo-random number generators, such as the ‘rand()’ function, such a function does not allow for a known seed number to be used and would not be appropriate for this Determination.

33. Step 6—Survey and random selection of trees for destructive sampling

Section 33 details the process for the selection of trees for destructive sampling.

Project proponents must establish plots and measure all trees within the plot. Each tree within the plot must be assigned a unique identifier so it can then be relocated if it is identified for destructive sampling. For each tree, project proponents must measure all parameters that will be used in the allometric equation (for example, diameter at breast height, total height, or species).

Project proponents must survey and establish enough plots such that the minimum sample size prescribed in section 31 has been achieved.

34. Step 7—Size classes

Prior to undertaking destructive sampling field work, the project proponent must classify the trees measured in section 33 by species or species group, and then into size classes in order to carry out the procedures to develop or validate an allometric equation.

Subsection (1) has the effect that individual tree species or species groups must be stratified into at least three size classes meeting the requirements of subsection (2). Project proponents may wish to choose the size classes based on the variation and sizes in the trees being sampled in order to optimise the process. Additional guidance on establishing size classes may be found in:

- Snowdon, P, et al. (2002) NCAS Technical Report no.31: Protocol for Sampling Tree and Stand Biomass, Australian Greenhouse Office.

Subsection (2) specifies that each class must have a minimum and maximum variable range identified and size class interval defined.

Subsection (3) requires project proponents to use a pseudo-random number generator with a known seed number to give each tree a random ranking. By sorting the list of trees by the ranking number, each size class is effectively randomized.

Subsection (4) requires that at a minimum the first tree in each size class ranked in accordance with subsection (3) must be selected for destructive sampling.

Subsection (5) specifies the requirements if more than one tree per size class is needed to achieve the minimum sample size specified in section 30.

35. Step 8—Destructive sampling procedure

Section 35 sets out the procedure for destructive sampling of trees identified in accordance with section 33 and 34.

Subsection 35(3) provides that if developing an allometric equation for a single species, then at least every fourth tree and one tree from each size class must be cut into components using the procedure in section 35. An individual tree can represent both the fourth tree cut in a

sequence and an individual from a size class. This requirement is to ensure there is a distribution of trees being fully analysed in accordance with section 35.

Subsection 35(5) provides that if developing an allometric equation for a group of species, then all trees must be cut into components using the procedure in section 35.

The destructive sampling protocol in section 35 was adapted from:

- Walker, S, et al. (2012) Standard Operating Procedures for Terrestrial Carbon Measurement: Version 2012, Winrock International.

The sampling design and statistical analyses were adapted from:

- Snowdon, P. et al. (2002) NCAS Technical Report no.31: Protocol for Sampling Tree and Stand Biomass, Australian Greenhouse Office.
- Dietz, J. and Kuyah, S. (2011) Guidelines for establishing regional allometric equations for biomass estimation through destructive sampling. World Agroforestry Centre (ICRAF), United Nations Avenue, Gigiri.
- Picard, N, et al. (2012) *Manual for building tree volume and biomass allometric equations: from field measurements to prediction.* Food and Agricultural Organization of the United Nations, Rome and Centre de Coopération Internationale en Recherche Agronomique pour le Développement, Montpellier.

36. Step 9—Biomass analysis

Section 36 sets out the procedure for undertaking a biomass analysis in order to convert wet weight measurements into dry weight. The analysis is undertaken using the samples obtained in Step 8.

Subsection (1) specifies the process for calculating the whole tree dry to wet weight ratio. Subparagraph (1)(a)(ii) requires that representative subsamples be collected for each tree component. Different components may require different procedures for determining what is representative. In relation to this requirement, proponents may wish to consult:

- Snowdon, P et al. (2002) NCAS Technical Report no.31: Protocol for Sampling Tree and Stand Biomass, Australian Greenhouse Office.

Subsections (2) and (3) detail the process for determining the coefficient of variation for dry:wet weight ratios in allometric equations for single species where not all trees were analysed for dry weight. The coefficient of variation is only required to be measured when a sub-sample of trees are used to determine a dry to wet weight ratio. This is done to minimise error in the final estimates of tree biomass. Where the error is potentially large, in that the coefficient of variation is greater than 15 per cent, further sampling will be required. The requirements for the treatment of samples where the coefficient exceeds 15 per cent are also specified.

Subsection (4) specifies the treatment of samples where the coefficient of variation for dry:wet weight ratios in allometric equations for single species is below 15 per cent.

37. Step 10—Data exploration and analysis

With the exception of subsection (1), section 37 only applies to the development of new allometric equations.

Subsection (1) requires that the whole tree dry weight data obtained in section 36 must be compiled into a database or spreadsheet suitable for statistical analysis or importation into a statistical analysis software package.

Subsection (2) provides that to validate an existing allometric equation the steps in Step 11 in section 38 must be completed.

Subsection (3) provides that the steps in 10.1 in section 37 are to be used when developing a new allometric equation.

Subsections (4) to (13) specify the detailed process for developing and testing the appropriateness of an allometric equation from the data obtained in section 35.

An allometric equation being developed must take the form of a statistical model fitted using:

- simple linear regression;
- multiple regression;
- polynomial regression; or
- non-linear regression.

Each allometric equation developed is required to satisfy the assumptions that the response variables change in a systematic way with variation in the predictor variable and that errors are statistically independent and normally distributed.

Applying a transformation to the data may be needed to satisfy the above assumptions. As logarithmic transformation introduces bias, this bias must be corrected. Therefore, subsection (8) provides that if a logarithmic transformation is applied to the response variable, the proportional bias must be estimated and applied using the ratio of the arithmetic sample mean to the mean of the back-transformed predicted variables.

Proponents may wish to consult:

- Snowdon, P (1991) A ratio estimator for bias correction in logarithmic regressions. *Canadian Journal of Forest Research* 21, 720–724.

Subsection (13) provides that the mean of the weighted residuals calculated in Equation 1 must not be significantly different from zero, as determined by applying a two-tailed student t-test.

Subsection (14) provides that if the allometric equation satisfies the requirements of subsection (13), the allometric equation can progress to validation in Step 11 in section 38.

Subsection (15) requires that if the allometric equation does not satisfy subsection (13):

- an existing equation must be selected in accordance with section 26 and validated using the procedure outlined in section 38; or
- a new equation must be developed.

38. Step 11—Validation of allometric equation

Section 38 requires that the effectiveness of an allometric equation to predict biomass (or tree volume) must be validated by comparing its predictions to observations made using an independent dataset.

Subsections (1) and (2) provide that each allometric equation must be validated with respect to the native forest covered by pre-existing clearing consent. Each allometric equation must also be validated during the first reporting period in which the allometric equation is applied and the last reporting period in the crediting period.

Each allometric equation to be applied in the project area must be validated in accordance with the process set out in the subsections summarised in the following steps:

Step 11.1—Confirmation of allometric domain

Subsections (3) to (7) set out the procedure for confirming the allometric domain of an equation to be validated for the carbon estimation areas in which it will be applied.

Step 11.2—Predicted biomass of sample trees

The effect of subsections (8) and (9) is that a predicted estimate of the biomass contained within each test tree must be generated using the allometric equation to be validated using as inputs the predictor variable measurements collected from each test tree.

Step 11.3—Comparison between predicted and observed biomass

Subsections (10) to (12) set out the procedure for comparing the predictions of a allometric equation with the observations estimated by the destructive sampling of test trees selected in accordance with Step 3 in section 30.

Step 11.4—Minimum requirements for validation of allometric equations

Subsection (13) specifies the minimum requirements for validation of allometric equations.

39. Procedure if allometric equation cannot be validated

Section 39 sets out the procedure that must be followed if an allometric equation cannot be validated and requires that another equation be selected for validation in accordance with section 26 or that a new allometric equation be developed in accordance with section 26.

Subdivision 2—Biomass survey

40. Determination of native forest biomass

Section 40 provides that a field-based survey must be undertaken in order to determine the biomass stocks in the native forest in the project area. Biomass surveys must be carried out in the first reporting period for all carbon estimation area. After this time, biomass surveys are only required for carbon estimation areas in which there is a disturbance. In the absence of a disturbance, project proponents can assume that biomass in the carbon estimation area remains unchanged after the first reporting period. That is, the biomass data (e.g. stem diameter measures) or the output from the biomass survey (e.g. carbon stocks) calculated in accordance with the Determination can be reused for subsequent offsets reports. Alternatively, project proponents can choose to re-survey carbon estimation area in order to detect increases in tree growth in accordance with section 62.

The steps detailed in this Subdivision must be followed for the initial assessment of biomass stocks and whenever a biomass survey is conducted to account for changes to carbon stocks during the project period.

41. Determination of root:shoot ratios

Section 41determines the procedure for determining the root:shoot ratio for a Major Vegetation Group class. These root:shoot ratios are used to determine the below-ground biomass of trees in the project area. Root:shoot ratios are applied in Equation 8 and Equation 14.

42. Step 1—Plot design

Section 42 sets out the requirements for the plot design for a biomass survey. Due to the variety of forest ecosystems in Australia and the variable condition of the forest stand in the ecosystems, the method of determining a specific plot design should be based on maximising efficiency and minimising variance when determining the biomass content of carbon estimation area.

Subsection (5) provides that if the plot is located on a slope greater than 10 degrees, then a correction must be applied in order to correct for the slope. In relation to this requirement, project proponents may wish to consult:

- Walker, S, et al. (2012) Standard Operating Procedures for Terrestrial Carbon Measurement: Version 2012, Winrock International.

43. Step 2—Allocation of plots

Section 43 sets out the procedure for allocating plot points to a carbon estimation area.

Subsections (1) to (3) provide for the identification of waypoints. A minimum of 200 waypoints must be assigned to each carbon estimation area. These represent the potential plot points that can be surveyed in the pilot survey, primary biomass survey and any additional surveys that are required to achieve the Targeted Precision. The actual number of

plots to be surveyed is determined in Step 4 in section 45 and validated in Step 9 in section 50. However, this step is applied first in order to avoid multiple allocations of plot points. The plots allocated for a biomass survey should be different than those allocated for tree selection for the development or validation of an allometric equation.

Subsections (4) to (7) provide for allocation of plots using a method that is both random and replicable. Accordingly, project proponents must use a pseudo-random number generator with a defined seed number when allocating plots to carbon estimation area. The final plot points become the waypoint of the plots. Potential plot points should be assigned a random ranking (i.e. a number) using the pseudo-random number generator with a know seed number. Then all potential plot points are numerically sorted by the ranking from lowest to highest. The lowest ranked plot will become *plot 1* and the highest ranked will be the last ranked plot. For example, if 200 potential plot points are generated, the highest ranked would be *plot 200*. Project proponents must survey the required number of plots as estimated in Step 4.2 in section 45. For example, if on completion of Equation 6 the estimated number of plots is 50, project proponents must survey plots 1-50.

Subsection (8) provides that the project proponent must retain the area boundary used to allocate plots as provided by this section in order to enable the replication of the plot allocation using the defined seed number. This enables audits of the project area.

Subsection (9) lists attributes that must be assigned for each plot waypoint.

In all survey scenarios, project proponents must survey the allocated plots in numerical order according to the plot point number [PLOT_NUM].

44. Step 3—Pilot survey

Section 44 sets out the requirements for undertaking a pilot survey. The pilot survey is used to estimate the variation in biomass that is present within each carbon estimation area. The plots for the pilot survey will be selected from those allocated in section 43 starting at plot 1. While a minimum of five plots is required for the pilot study, project proponents may choose to measure more than this to improve the accuracy of the estimate of variation. An improved estimation of the variation will improve the efficiency of the biomass survey and reduce the risk of over or under sampling.

The effect of subsection (3) is that data collected in the pilot survey, such as diameter at breast height, may be included in the biomass survey.

45. Step 4—Number of plots

The number of plots that need to be measured in a biomass survey are a function of the inherent variability of the forest and the Target Precision. The variability of the forest is estimated in section 44 and the Target Precision is provided in section 45. With this information, section 45 sets out the procedure for determining the number of plots in the biomass survey.

Step 4.1—Coefficient of variation of each carbon estimation area

Subsections (2) and (3) have the effect that project proponents must use the data obtained in the pilot survey in Step 3 to calculate the coefficient of variation of each carbon estimation area by completing Equation 5.

Step 4.2—Number of plots to sample in each carbon estimation area

Subsection (4) provides that, for the purposes of the Determination, native forest carbon stocks must be estimated within ±10 per cent of the true value of the mean at a 90 per cent confidence level.

Subsection (5) provides that the requirement in subsection (4) is referred to as the 'Targeted Precision'. The estimate of carbon stocks for each carbon estimation area must meet the Targeted Precision, as this limits the potential error of the estimate. The results of the biomass survey are tested against the Targeted Precision in section 50.

Subsection (6) provides that in order to estimate the required sample size to achieve the Targeted Precision in each carbon estimation area, project proponents must complete Equation 6.

46. Step 5—Preparation of biomass survey

Section 46 sets out the requirements project proponents must meet when preparing a biomass survey. These requirements are intended to ensure the accuracy of measurements and minimise error. Paragraph (b) specifies that if trees do not have an associated allometric equation, then the diameter of the stem must be recorded. The proponent should select a standard height to measure the stem diameter. For example, a common measurement place for trees is diameter at breast height (DBH), which is 1.3m, whereas for mallee species diameter at 30cm height may be more appropriate. This provision is to ensure that all trees in the plot have a variable to be measured.

47. Step 6—Measurements within plots

Section 47 sets out the requirements for navigating to, establishing and undertaking measurements within plots.

The survey team must use a GPS device that that has an accuracy of ± 4 metres when navigating to each waypoint. When the survey team has navigated to the plot, it must establish the plot as detailed in Step 1 in section 42. Once the plot is established, specific measurements must be taken within the plot to accurately estimate plot biomass.

When measuring above-ground biomass within the plot, project proponents must measure the explanatory variable(s) required by the allometric equation that is to be used for each species or group of species that is found within the plot. This is often a stem diameter at some distance from the ground and can include height along with other independent variables required by the allometric equation. Measurements are needed from all trees within a plot, not only project trees. These measurements are important in determining the number of non-

project trees per hectare within the project area, which is used to demonstrate that clearing would occur with the implementation of the permit.

No measurement is required for below-ground biomass as National Greenhouse Account default root:shoot ratios are applied.

48. Step 7—Biomass of plots

Subsection (1) provides that project proponents must determine the biomass of each plot surveyed as provided by Step 6 in section 47 by following Steps 7.1 to 7.4.

Step 7.1—Determination of above-ground biomass by applying allometric equations

Project proponents must have developed or validated all allometric equations used in the estimation of above-ground biomass in accordance with Subdivision 1 —Allometric equations. Once this is complete, proponents must convert the measurements made in the field sample plots into the above-ground biomass stock estimates for each tree, using the allometric equation for the species or group of species.

Step 7.2—Determination of above-ground biomass in survey plots

Subsection (4) provides that project proponents must determine the above-ground biomass stock in survey plot (sp) in carbon estimation area (i) by completing Equation 7.

Step 7.3—Determination of below-ground tree biomass in survey plots

Subsection (5) provides that project proponents must determine the below-ground tree biomass in each plot surveyed as provided by Step 6 in section 47 by completing Equation 8.

Equation 8 requires the input of the appropriate root:shoot ratios, which are determined in accordance with section 41.

Step 7.4—Determination of total tree biomass in each plot

Subsection (6) provides that project proponents must determine the total tree biomass for each plot surveyed as provided by Step 6, section 47, by completing Equation 9.

49. Step 8—Edge corrections for plots crossing carbon estimation area boundaries

Section 49 sets out the steps for correcting the edge effects that occur when a plot crosses the boundary of a carbon estimation area.

An edge correction must be applied if a plot, once established, moves into one or more strata outside of the carbon estimation area that is being surveyed. If it is determined that a plot, once established, will span multiple strata, then the collection of biomass data within the plot will lead to an erroneous plot estimate.

Project proponents must omit the plot if more than 20 per cent of the plot falls outside of the carbon estimation area that is to be surveyed.

For all other scenarios where plots have edge effects, project proponents must first use the mirage method to mirror the plot into the carbon estimation area that is being surveyed. Further details on implementing the mirage method can be found in:

- Beers, T.W. (1977) Practical correction of boundary overlap. *Southern Journal of Applied Forestry* 1, 16–18.

With circular plots, for example, the proponents would measure the distance from the plot centre to the edge of the carbon estimation area, then locate a second plot the same distance beyond the edge of the carbon estimation area. The proponent would then measure all trees located within the carbon estimation area as determined from the second plot, and allocate these measures to the first plot. The effect of this is that trees that fall in both the original and mirage plot will be measured twice.

50. Step 9—Validation of sample size

Subsection (1) provides that the project proponent must perform an ex-post analysis of the data obtained in the biomass survey in order to verify that the survey performed as provided by this Subdivision has achieved Targeted Precision.

Step 9.1—Standard error

Subsection (2) requires that project proponents must complete Equation 10 in order to determine the standard error.

Step 9.2—Determination of Targeted Precision

Subsection (3) provides that project proponents must complete Equation 11 in order to verify that the survey has achieved Targeted Precision.

Subsection (4) provides that project proponents must use the 90 per cent confidence level when determining the t-value.

Subsection (5) provides that the final value of the Targeted Precision error limit of the primary biomass survey must be less than or equal to 10 per cent.

Subdivision 3—Calculation of baseline emissions

51. Calculating baseline emissions

Emissions from the baseline are calculated once for the project, using data collected for the first reporting period. Once calculated, the baseline is set for the remainder of the crediting period. Section 51 explains that Subdivision 3 contains the steps to be followed for calculating the baseline emissions in the project area.

52. Baseline relevant carbon pools

Section 52 provides that carbon pools relevant to the baseline are limited to above-ground tree biomass, below-ground tree biomass, and the burning of biomass for clearing purposes.

53. Step 1—Surveying requirements

Section 53 explains that the first step for calculating the baseline emissions is to conduct a biomass survey according to the process outlined in Subdivision 3. This ensures that project proponents have accurate carbon stock data for their project area as a basis for which to conduct subsequent calculations.

54. Step 2—Calculating carbon stocks in carbon estimation area

Section 54 contains calculations that project proponents must complete in order to calculate carbon stocks in each carbon estimation area.

Step 2.1—Determine mean carbon stocks in each carbon estimation area

First, subsection 54 (1) provides that Equation 12 must be used to estimate the mean carbon stock in all pools in each carbon estimation area. Under the Determination, it is assumed that the carbon stock at the time of the first offsets report is equivalent to the carbon stock prior to the planned deforestation. These forest carbon stocks represent the carbon stocks that would have been cleared in accordance with the deforestation plan. This same equation is used to estimate the carbon stocks for future reporting periods when a biomass survey is carried out.

Step 2.2—Non-project tree buffer

If the clearing consent excludes certain trees in a carbon estimation area from being cleared, the biomass in these trees cannot contribute to estimates of abatement. For example, some clearing consents may protect particular species or trees above a certain size from being cleared. To address this, subsections (2) to (5) provide that the 'non-project tree buffer' is either calculated for each carbon estimation area using Equation 13, or biomass from-non-project trees is always excluded from the results of biomass surveys. The result is a proportion of biomass that is not at threat of being cleared.

Paragraph (2)(a) provides that proponents can opt to exclude the biomass of non-project trees from the results of the biomass estimate thereby setting the biomass as zero. The effect of this is that if future biomass surveys are conducted, for example if re-stratifying or measuring for carbon stock enhancement, then the same kinds of trees must also be excluded. For example, if trees with a stem diameter greater than 30cm cannot be cleared, and the project proponent opts to exclude these trees from the first biomass survey, then trees with a stem diameter greater than 30cm must be excluded for the first and all subsequent biomass surveys, regardless of their size at project commencement. That is, if only trees with a stem diameter of less than 30cm were included in the first biomass survey and the stem diameter of those trees is now greater than 30cm, these trees will need to be excluded as they are now of a size that cannot be cleared in accordance with the pre-existing clearing consent. While non-project trees can be excluded from the results of the biomass survey, such trees must always be measured in accordance with Subdivisions 1 and 2.

Paragraph (2)(b) provides an alternative approach, where proponents do not exclude non-project trees from the results of the biomass survey, but instead estimate the non-project tree buffer. This buffer is determined for each carbon estimation area at the beginning of the

project and only ever references the data collected for the first offsets report. It must be applied in assessing the project baseline and for all future assessments of tree biomass during the project period, including the monitoring of any biomass enhancement. That is, the non-project tree buffer is a fixed value throughout the crediting period except if it needs to be recalculated in accordance with subsection (3). In the circumstance that a new carbon estimation area is delineated as a result of a disturbance event, the non-project tree buffer of the original, un-delineated carbon estimation area must be used.

Subsection (3) provides that proponents may re-introduce kinds of trees that have previously been excluded, so long as the non-project tree buffer is re-calculated using the original data from the first biomass survey. For example, if trees with a stem diameter greater than 30cm were excluded from the results of first biomass survey, they could be included in the second biomass survey so long as the non-project tree buffer is recalculated using the data from the first biomass survey and includes trees with a stem diameter greater than 30cm. If a kind of non-project tree is not represented in the non-project tree buffer, it cannot be included in the results of a biomass survey.

Step 2.3—Total biomass of non-project trees within each plot

Equation 14 calculates the total biomass of non-project trees in each plot by applying the non-project tree buffer.

55. Step 3—Calculating carbon stocks in carbon estimation area following clearing

Section 55 contains equations to calculate the long-term average carbon stock in each carbon estimation area that would have existed in the baseline following clearing as stated in Subsection (1).

Subsection (2) provides that Equation 15 is to be used to calculate the long-term average mean carbon stock in all pools in each carbon estimation area following clearing according to the deforestation plan. This represents the long-term average carbon stock that would have remained following deforestation, accounting for stock changes resulting from burning and decay of biomass. To complete Equation 15, Equations 16 to 20 must first be calculated.

Because the post-deforestation land use in the baseline is cropping or grazing, regrowth events are assumed to be continuously suppressed and so would be immaterial. Accordingly, the Determination limits baseline calculations to the degradation of the debris pool remaining after deforestation. This is calculated by determining the impact of any treatment on the debris pool after clearing and the decay of the residual biomass after treatment.

Step 3.1—100 year average of biomass within sample plots following clearing

Subsection (3) provides that project proponents must complete Equations 16 to 20 in order to determine the 100 year average biomass stock that would exist in the sample plots following clearing.

Step 3.1.1—Model biomass in debris pool

Subsection (4) provides that Equation 16 is used to calculate the biomass in the debris pool within each sample plot, post-deforestation in the baseline. All biomass subject to clearing, consistent with the National Inventory approach, is treated as moved to the debris pool following the clearing event; and therefore the biomass stock sampled within plots represents the biomass stock of the debris pool. Under the Determination, the non-project tree buffer is not applied for estimating the long-term carbon stocks. The effect of this is a conservative baseline.

Step 3.1.2—Partition of biomass into Major Vegetation Group tree components

In order to determine the impact of treatment (such as fire) and decay on each component of the tree, subsection (5) requires the biomass of each sample plot to be partitioned into its Major Vegetation Group tree components (stem, branch, bark, leaves, coarse roots and fine roots). Subsection (6) provides that biomass partitioning must be done in accordance with the yield allocations in Schedule 1. Subsection (7) provides that Equation 17 must be used to calculate the biomass of each tree component in each sample plot in order to determine the impact of treatment and decay on each component of the tree, using the applicable biomass fractions in Schedule 1.

Step 3.1.3—Treatment of the debris pool

Once the debris pool has been partitioned into the respective tree components, the debris pool is assumed to be treated by fire. Equation 18 must be completed to determine the biomass of each tree component after burning, using Schedule 1 for burn efficiency data. Where fire is not used as a treatment and the biomass is left to decay, this step can be omitted and decay modelled using Equation 19.

Step 3.1.4—Average long-term carbon stock of tree components

Once the biomass residue has been determined for each tree component in each plot (using Equations 18), the long-term average carbon stock (for each tree component in each plot), must be determined while accounting for decay. Equation 19 is to be used to calculate the 100 year average biomass of each tree component in each sample plot.

Step 3.1.5—Sum of average long-term carbon stock of each tree component

Subsection (10) provides that the long-term average biomass in each sample plot must then be calculated by using Equation 20, which sums the 100 year average biomass of each tree component in the sample plot (calculated in Equation 19).

56. Step 4—Calculating changes in baseline carbon stock in each carbon estimation area

Section 56 provides that the parameters obtained in sections 54 and 55 are to be used to complete Equation 21, which estimates the change in baseline carbon stocks during the crediting period as a result of the implementation of the deforestation plan.

57. Step 5—Calculation of emissions in each carbon estimation area in the baseline

Subsection (1) provides that project proponents must account for methane and nitrous oxide emissions released as a result of the burning.

Step 5.1—Pre-fire above-ground biomass stock

Subsection (1) specifies that the first step in this calculation is to determine the pre-fire above-ground biomass stock in each carbon estimation area that would have been burned. This is calculated from data collected from the biomass survey for the first reporting period. Subsection (2) provides that this is to be done using Equation 22.

Step 5.2—Determination of methane and nitrous oxide emissions from biomass burns

Subsection (3) provides that methane and nitrous oxide emissions from fire events are to be determined using Equation 23 (for methane) and Equation 24 (for nitrous oxide). These equations use the results obtained in Equation 22.

Step 5.3—Determination of greenhouse gas emissions from biomass burning

Having determined the methane and nitrous oxide emissions from biomass burning, greenhouse gas emissions from a biomass burning event must be calculated for each carbon estimation area by completing Equation 25, which sums the results of Equations 23 and 24. Equation 25 is also used when estimating emissions from a post-deforestation biomass burn in the project.

Subsection (5) redefines the output of Equation 25 to refer specifically to the baseline for each carbon estimation area.

58. Step 6—Calculating net baseline greenhouse gas emissions and removals

Section 58 provides that Equation 27 is to be used to calculate the net greenhouse gas emissions in the baseline. The results of Equations 21 and 26 are to be used as inputs in Equation 27.

Subdivision 4—Calculation of project emissions and removals

Subdivision 4 provides calculations to enable project proponents to calculate the net greenhouse gas emissions and removals arising from project activities. The output is the parameter $E_{Pr,r}$, which is used in Subdivision 5 to calculate net greenhouse gas abatement for the project.

59. Calculating project emissions and removals

Section 59 provides that project emissions must be calculated by following the steps in the present Subdivision. At the end of each reporting period, emissions data collected during the reporting period must be used for the equations in the present Subdivision. The Determination also provides a mechanism for proponents to account for any removals detected during the reporting period.

60. Project relevant carbon pools

Section 60 specifies the relevant carbon pools for the purposes of the present Subdivision. Relevant carbon pools are limited to:

- above-ground tree biomass;
- below-ground tree biomass;
- the combustion of fossil fuels in vehicles, machinery and equipment; and
- the burning of biomass from fires.

61. Step 1—Project forest carbon stock changes in carbon estimation area resulting from disturbances

Section 61 provides calculations to determine emissions in areas where degradation or natural disturbance have been detected in a carbon estimation area or clearing buffer.

If a disturbance is detected in a carbon estimation area (where 'disturbance' is defined in section 5 as degradation or a natural disturbance), then the carbon estimation area must be re-stratified by delineating a new carbon estimation area where the disturbance has occurred, in accordance with section 23. Subsections (1) to (5) provide instructions for calculating the mean carbon stock changes in a new carbon estimation area that has been created under section 3.6 due to a disturbance.

Instructions for calculating the biomass stocks in the new carbon estimation area after degradation or natural disturbance are contained in subsections (1) to (3). These subsections specify that project proponents can calculate the new biomass stocks by either re-surveying the new carbon estimation area in accordance with Subdivision 2, or by conservatively electing to set carbon stocks at zero in the deforested area. Re-surveyed carbon estimation areas must achieve the Targeted Precision.

After determining the carbon stocks remaining after the disturbance, project proponents must determine the mean carbon stock changes per hectare as a result of the disturbance in each affected carbon estimation area using Equation 28. The net carbon stock changes in all pools as a result of the disturbance must then be calculated using Equation 29. These equations specify that the net carbon stock changes within each carbon estimation area resulting from the disturbance are equal to the spatial extent of the disturbance event multiplied by the emissions from the event, represented by the change in carbon pools.

62. Step 2—Optional calculation of carbon stock enhancements

Section 62 specifies optional calculations to determine net carbon stock changes in each carbon estimation area as a result of forest carbon stock enhancement. Forest carbon stock enhancement may occur through both natural growth and human assisted growth in biomass stocks in a carbon estimation area. These calculations are optional as the omission of the calculations is conservative.

If project proponents wish to account for carbon stock enhancements, subsections (2) to (4) provide that to determine growth in biomass stocks, a complete biomass survey must be conducted at the end of each reporting period in the carbon estimation area that undergo carbon stock enhancements. Carbon estimation area must be surveyed in accordance with Subdivision 2 and must achieve the Targeted Precision.

For each of the surveyed carbon estimation area, the net carbon stock changes as a result of forest carbon stock enhancement are then calculated for the relevant reporting period using Equation 30.

63. Step 3—Calculating project emissions

Section 63 contains instructions for calculating the emissions resulting from fires in the project area and from the combustion of fossil fuels used in the project.

Calculations to determine emissions from fires in the project area are specified in subsections (2) and (3).

Subsection (2) provides that the biomass burnt by fires in each carbon estimation area for a reporting period must be calculated using Equation 31, which requires project proponents to determine the area burned and the fire type. The burn efficiency factor in this equation adjusts the biomass burnt according to fire type (wildfire or controlled burn), recognising that the mass of biomass burnt varies with different types of fire.

Subsection (3) provides that the mass of biomass burned in each carbon estimation area (calculated in Equation 31) must be used to calculate the methane and nitrous oxide emissions associated with each fire event in each carbon estimation area. Emissions are to be calculated using Equation 32 (for methane emissions) and Equation 33 (for nitrous oxide emissions). These emissions must then be summed in Equation 34 to determine total emissions due to fire events in the carbon estimation area. Section 61 accounts for any changes in carbon stocks as a result of a fire.

Calculations to determine emissions from fuel use in the project are specified in subsections (4) and (5). Subsection (4) provides that net total emissions of fuel consumption during a reporting period must be calculated for each carbon estimation area using Equation 35. This equation sums the results of Equation 36 in subsection (5), which provides that the emissions of each greenhouse gas (carbon dioxide, methane and nitrous oxide) must be separately calculated for each fuel type (diesel, gasoline, etc.) for fuel used for each carbon estimation area during the reporting period.

Subsection (6) provides that total greenhouse gas emissions for the project during a reporting period are to be calculated using Equation 37. This equation sums the emissions from fossil fuel combustion calculated using Equation 35 and the emissions from biomass burnt due to fires in the reporting period calculated using Equation 36.

64. Step 4— Calculating total net greenhouse gas project emissions at the end of the reporting period

Section 64 specifies that the total net greenhouse gas project emissions for the project at the end of a reporting period are to be calculated using Equation 38.

The output of Equation 38 is a cumulative total of project emissions through time. Equation 38 requires total net greenhouse gas emissions to be calculated for each carbon estimation area for the current reporting period, and then requires these results to be summed to determine total net project emissions for the current reporting period. The emissions for the reporting period are then added to the emissions reported for the previous reporting period to get an estimate of all emissions across all reporting periods for the project.

Total net greenhouse gas emissions for each carbon estimation area are calculated as the sum of all net carbon stock changes as a result of degradation and natural disturbance (calculated in Equations 28 and 29), plus the total greenhouse gas emissions from fire and fuel use (calculated in Equation 37), less the net carbon stock change as a result of forest carbon stock enhancement (calculated in Equation 30). For the first reporting period under this Determination for projects transitioning from the original *Avoided Deforestation* method, $E_{Pr,r-1}$ is equivalent to $GHG_{NET\ P}$ in the original *Avoided Deforestation* method.

Subdivision 5—Calculating net greenhouse gas abatement

65. Net abatement amount

Subdivision 5 specifies calculations to determine the project's net abatement amount for the reporting period. This is calculated by estimating the net greenhouse gas abatement for the crediting period (Equation 39), from which the carbon dioxide equivalent net abatement amount for the project for the reporting period can be calculated as an annual rate (Equation 40A and Equation 40B).

In Equations 40B there is reference to both A_{rp} and A_{AD}. A_{AD} is net greenhouse gas abatement already credited to projects under the *Carbon Credits (Carbon Farming Initiative) (Avoided Deforestation) Methodology Determination 2013*. This is only applicable for projects that were registered and credited under the original *Avoided Deforestation* method. On the other hand, A_{rp} is carbon dioxide equivalent net abatement amount for each previous reporting period since project commencement. As A_{rp} is not calculated in the original *Avoided Deforestation* method, this only applies reporting periods where this Determination is applied.

For example, a project proponent had their project registered under the original *Avoided Deforestation* method. Under that method they were credited for 1000 tonnes of abatement as calculated from Equation 41. For the first reporting period under this Determination, the proponent would report A_{AD} as 1000, and A_{rp} as zero. In this example, assume A_r is calculated as 500 at the end of the first reporting period. For the second reporting period the project proponent would report A_{AD} as 1000 and A_{rp} as 500.

For projects that have transitioned from the original *Avoided Deforestation* method, credits already issued for the project must be accounted for in the calculations (Equation 41).

Part 5— Reporting, record-keeping and monitoring requirements

Subsection 106(3) of the Act provides that a methodology determination may provide that the project proponent of an eligible offsets project to which the determination applies is subject to specified monitoring, record-keeping and reporting requirements.

Under Parts 17 and 21 of the Act, a failure to comply with these requirements may constitute a breach of a civil penalty provision, and a financial penalty may be payable.

The offsets report, record-keeping and monitoring requirements specified in Part 5 of the Determination are in addition to any requirements specified in the regulations or rules made under the Act.

Division 1—Offsets report requirements

66. Operation of this Division

Section 66 provides that, for paragraph 106(3)(a) of the Act, this Division sets out information that must be included in an offsets project report about an avoided deforestation project that is an eligible offsets project.

67. Requirement for first offsets report

Section 67 sets out the 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 section 68.

68. Information that must be included in all offsets reports

An offsets report is required to set out any information that has to be submitted in the report under the applicable methodology determination.

Section 68 sets out the information that must be submitted in all offsets reports for the project. This includes the first and all subsequent reports.

69. Determination of certain factors and parameters

Section 69 provides that the offsets reporting requirements in this section apply where it is not possible to meet the requirements of subsection 19(1), as outlined in paragraph 19(2)(b). Further explanation of these circumstances is provided in section 19. The purpose of section 69 is to provide the Regulator with information on which version of the *NGER (Measurement) Determination* or other relevant external source has been used by a project proponent to meet the monitoring requirements. The proponent is required to detail in their offsets report the version of the *NGER (Measurement) Determination* or external source that was used when undertaking monitoring, the dates that the version was used and why it was not possible for the proponent to use the version that was in force at the end of the reporting period.

Division 2—Record-keeping requirements

70. Operation of this Division

Section 70 provides that, for paragraph 106(3)(c) of the Act, this Division sets out record keeping requirements for an avoided deforestation project that is an eligible offsets project.

Other requirements are specified in the Act and in other instruments under the Act.

71. Information relating to remotely sensed imagery

Section 71 provides that records must be kept in relation to each of the requirements for remotely sensed imagery set out in section 22.

Division 3—Monitoring Requirements

72. Operation of this Division

Section 72 provides that, for paragraph 106(3)(d) of the Act, this Division sets out monitoring requirements for an avoided deforestation project that is an eligible offsets project.

Other requirements are specified in the Act and in other instruments under the Act.

73. Monitoring for disturbance

Subsection (1) provides that the project area must be monitored for disturbances during the reporting periods.

Subsection (2) specifies that monitoring is undertaken through land cover assessments with remotely sensed imagery.

Division 4—Reporting under section 77A of the Act

74. No division of carbon estimation area

Section 74 provides that the project proponent can partially report on a project in accordance with subsection 77A(2) of the Act; however they may not partially report on only a part of a carbon estimation area.

Schedule 1 Partitioning of Biomass

Schedule 1 provides four tables which specify numeric values for the partitioning of biomass, burn efficiency and decay rates. The values are used as specified input values for the Equations 14, 17, 18, 19.

Attachment B

Statement of Compatibility with Human Rights

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

Carbon Credits (Carbon Farming Initiative—Avoided Deforestation 1.1) Methodology Determination 2015

This legislative instrument is compatible with the human rights and freedoms recognised or declared in the international instruments listed in section 3 of the *Human Rights (Parliamentary Scrutiny) Act 2011*.

Overview of the Legislative Instrument

The *Carbon Credits (Carbon Farming Initiative—Avoided Deforestation 1.1) Methodology Determination 2015* (the Determination) sets out the detailed rules for implementing and monitoring offsets projects that sequester carbon by not clearing native forests. The Determination applies to projects on land with native forest cover at risk of clearing. It uses historical clearing practices to estimate when the clearing was going to occur, and abatement is estimated from this clearing event onwards.

Project proponents wishing to implement the Determination must make an application to the Clean Energy Regulator (the Regulator) and meet the eligibility requirements set out under the *Carbon Credits (Carbon Farming Initiative) Act 2011*. Offsets projects that are approved by the Regulator can generate Australian carbon credit units.

Human rights implications

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.

Greg Hunt, Minister for the Environment

EMISSIONS REDUCTION ASSURANCE COMMITTEE

C/- ERAC Secretariat
GPO Box 787
CANBERRA ACT 2601

The Hon Greg Hunt MP
Minister for the Environment
Parliament House
CANBERRA ACT 2600

Dear Minister

On behalf of the Emissions Reduction Assurance Committee (ERAC), I am pleased to inform you that it has considered the draft *Carbon Credits (Carbon Farming Initiative—Avoided Deforestation – 1.1) Methodology Determination 2015* (our reference: 020VG2014) and advises that it is suitable to be made into a Determination.

The draft Determination was developed by the Department of the Environment to transition the *Carbon Credits (Carbon Farming Initiative) (Avoided Deforestation) Methodology Determination 2013* to the Emissions Reduction Fund. The Department invited public submissions on the draft Determination.

Having considered the information from this process, advice from the Clean Energy Regulator, the draft Explanatory Statement and the text of the draft Determination, the ERAC concluded that the draft Determination complies with the offsets integrity standards specified in section 133 of the *Carbon Credits (Carbon Farming Initiative) Act 2011*. On this basis, the ERAC agreed it was suitable to be made into a Determination.

In reaching its decision, the ERAC noted the importance of ensuring consistency in the assessment of compliance with the offsets integrity standards. The ERAC also recommends that, if the Determination is made, the Committee monitor its operation to ensure it continues to meet the offsets integrity standards.

Further details of the reasons for the ERAC's advice are included in the attached notice.

Yours sincerely

Andrew Macintosh
Chair
Emissions Reduction Assurance Committee

19 February 2015

EMISSIONS REDUCTION ASSURANCE COMMITTEE

Notice of advice to the Minister for the Environment under subsection 123A(2) of the *Carbon Credits* (*Carbon Farming Initiative) Act 2011* (the Act)

Draft Carbon Credits (Carbon Farming Initiative—Avoided Deforestation – 1.1) Methodology Determination 2015 **(draft Determination)**

On 19 February 2015 the Emissions Reduction Assurance Committee (ERAC) agreed that the draft Determination is suitable to be made into a Determination.

In forming this view, the ERAC considered:

1. the offsets integrity standards specified in section 133 of the Act;

2. the public submissions received during the public consultation period; and

3. advice from the Clean Energy Regulator.

The ERAC was not directed to have regard to any additional issues under section 123B of the Act in providing its advice on the draft Determination.

1. Assessment against the offsets integrity standards

Section*	Requirement	Statement
133(1)(a)	The draft Determination's requirements and method should result in carbon abatement that is unlikely to occur in the ordinary course of events (disregarding the effect of the Act).	The draft Determination specifies appropriate requirements to ensure that projects are delivering additional abatement, including that it only applies to new or transitioning projects and requires proponents to go beyond applicable regulatory requirements in order to generate credits. Accordingly, the ERAC considers that the above draft Determination complies with this offsets integrity standard.
133(1)(b)	Estimations of removal, reduction or emission, as the case may be, are measurable and capable of being verified.	Appropriate equations are specified for the calculation of emissions reduction and project emissions. Appropriate methods to enable verification of these estimations are specified for data collection, monitoring and reporting. Accordingly, the ERAC considers that the above draft Determination complies with this offsets integrity standard.
133(1)(c)	Carbon abatement used in ascertaining the carbon dioxide net abatement amount for a project must be eligible carbon abatement from the project.	The carbon abatement used in ascertaining the abatement amount is eligible carbon abatement from the project. Accordingly, the ERAC considers that the above draft Determination complies with this offsets integrity standard.
133(1)(d)	The draft Determination is supported by clear and convincing evidence.	The draft Determination is supported by clear and convincing evidence. Accordingly, the ERAC considers that the above draft Determination complies with this offsets integrity standard.
133(1)(e)	Material amounts, in carbon dioxide equivalent, of greenhouse gases that are emitted as a direct consequence of carrying out the project are deducted.	The method accounts for emissions from fuel use and fire events occurring as a direct consequence of carrying out the project. Accordingly, the ERAC considers that the above draft Determination complies with this offsets integrity standard.

133(1)(f)	Estimates, projections or assumptions included in the methodology are conservative.	The assumptions and estimates included in the draft Determination are conservative. The net abatement estimate is conservative. Accordingly, the ERAC considers that the above draft Determination complies with this offsets integrity standard.
133(1)(g)	Such other standards that are set out in the legislative rules.	Not applicable.

* Section of the Act

2. Submissions received during public consultation period

The ERAC received two public submissions regarding the draft Determination published on the Department's website between 5 December 2014 and 19 December 2015 consistent with the requirements of section 123D of the Act.

Except for those submissions subject to a request not to publish under subsection 123D(5), all public submissions have been published on the Department's website.

3. Relevant advice from the Clean Energy Regulator

The Clean Energy Regulator advised the ERAC that it supports the above draft Determination.

Conclusion

On the basis that all the offsets integrity standards are met, the ERAC agreed that the draft Determination is suitable to be made into a Determination.

Responses to the technical assessment report recommendations for the methodology determination '*Carbon Credits (Carbon Farming Initiative—Avoided Deforestation 1.1) Methodology Determination 2015*'

The variations to the existing method proposed in 2014 were subjected to a technical assessment. The proposed variations, technical reviewer's findings and the Department's responses are provided below.

No.	Proposed variation	Original Section	Current reference	Reviewer's Response	DoE Response
1	Introduction text "In relation to each tree species or group of species in the project area measured as part of the biomass survey undertaken in accordance with Subdivision 3.4.3, the project proponent must:" Modified to: "In relation to each tree species or group of species mentioned in the clearing consent and for which abatement shall be calculated in the project area, the project proponent must:"	Section 3.13	Section 26	The proposed variation excludes non-project trees (i.e. trees not permitted for removal in the clearing consent) from the biomass survey. Consequently, there will be no need to develop and validate biomass equations for species of non-project trees. This variation will not change the calculation of baseline carbon stocks of project trees or the final abatement calculations in a carbon estimation area. For this reason there will be no technical deficiencies if it is implemented.	Section 26 has been revised to clarify that only allometric equations that are used by the proponent must meet the requirements of the Determination.

No.	Proposed variation	Original Section	Current reference	Reviewer's Response	DoE Response
2	Added requirement: "(7) For clarity, species groups of allometric equations must have the same species-dependent growth form as defined in section 1.3 Definitions.	Section 3.13	Section 26	The proposed variation intends to clarify the common practice in forestry that trees with multiple stems forked below the defined breast height of 1.3 m are treated as separate trees during field measurements and their biomass is estimated accordingly. There are no technical issues associated with this proposed variation.	No change required. Section 26 of the determination requires that measurement protocols are consistent with those used when the allometric equation is developed. Given the multitude of potential measurement protocols, expanding on the definition of growth form beyond that already included in the determination would limit the application of some allometric equations.
3	"(2) Enough plots must be allocated to capture at least 100 trees per species or species group represented by the allometric equation across the area mentioned in subsection 3.19(1)."	Section 3.18	Section 31	The proposed variation clarifies the original statement in the existing methodology determination so that it is no longer ambiguous. There is no technical issue associated with this proposed variation.	Section 31 was amended to clarify the requirements of the statement.
4	Introduced the concept of allometric survey sites: (1) When developing an allometric equation, plots for tree selection must be allocated within: (a) an allometric survey site, and	Section 3.19	Section 32	The proposed variation confines the allocation of plots for tree selection during destructive sampling within an "allometric survey site" determined by project proponents. The phrase, "allometric survey site", does not make sense as a technical term or concept. A better and commonly understood term may be "destructive sampling site". Spatially the "allometric survey site" is not well defined for it may or may not be in a carbon estimation area	The proposed variation was not made due to the concerns raised by the technical reviewer.

No.	Proposed variation	Original Section	Current reference	Reviewer's Response	DoE Response
	(b) the spatial extent of the allometric domain as defined in section 3.16. (2) The geographic extent of the allometric survey sites is determined by project proponents. (3) When validating an allometric equation, plots for tree selection must be allocated across the carbon estimation area or areas in which the allometric equation is to be applied. (4) Plots are allocated for tree selection across the allometric survey sites and carbon estimation areas using a pseudo- random number generator with a known seed number.			within a larger project area. The introduction of this seemingly new concept may cause unnecessary confusion. Sampling trees in plots located in one or more carbon estimation areas as originally described in the existing methodology determination is clearer and more straightforward than the proposed variation. Therefore we do not endorse the proposed variation and recommend the original description of section 3.19, Step-5-Allocation of plots for tree selection, be kept unchanged.	

No.	Proposed variation	Original Section	Current reference	Reviewer's Response	DoE Response
5	Added requirement: "(6) If for a species or species group the minimum number of measured trees (100) is reached, this species no longer needs to be measured in destructive sampling plots henceforth. If the proponent opts to not measure trees after 100 area reached, then plots allocated following section 3.19 must be measured in the order of the random numbers generated and not at convenience." "(7) Trees measured in destructive sampling plots are not to be included in the biomass survey."	Section 3.20	Section 33	The proposed variation (item (6)) ensures that the minimum number of sample trees are measured and destructively sampled for developing allometric equations for a species or species group (i.e. a subset of at least 20 trees from a minimum of 100 measured trees as specified in Section 3.18, Step 4 on page 17 of the existing methodology determination). Once this minimum number is reached, no further destructive sampling is required unless the project proponent chooses to do so. As the original specification on the number of trees to be destructively sampled and that on the random selection of plots is met, there is no technical issue with this proposed variation. The additional statement (item (7)) clarifies the fact that trees already destructively sampled are not to be included in the final results of a biomass survey. However, the plot data can be used in the calculation of mean carbon stock of a carbon estimation area at least over the first reporting period. This addition will result in unnecessary exclusion of destructively sampled plots in the calculation of mean carbon stock in the first reporting period. If so, the project proponent may have to establish and measure a greater number of	No change was made, as the Determination already allows proponents to stop measuring after they measure 100 trees of each species or species group.

No.	Proposed variation	Original Section	Current reference	Reviewer's Response	DoE Response
				plots in the field. From this perspective, this added requirement (7) is not necessary and therefore the variation is not supported.	
6	Modified requirement (3a i): "(i) at least every fourth tree cut down in accordance with subsection (1) in the order of cutting; and	Section 3.20	Section 33	The proposed variation reduces the intensity of destructive sampling of trees for dry weight determination as described in Section 3.23, Step 9 Biomass Analysis of the existing methodology determination. The proposed change from sampling every third tree to every fourth tree for allometric equation development will reduce the sampling intensity by about 8.3% when considering it as a percentage of the total number of destructively sampled trees. While there are no published studies on the effect of such sampling intensity on the predictive accuracy of biomass equations for native forest tree species, both published and unpublished research works have used sampling intensities for the determination of tree moisture content ranging from just under 20% to about 30% (e.g. Ximenes et al. 2008). By setting the sampling intensity for moisture content determination at 25% of all trees cut down for fresh weight, the proposed variation is well within the range of sampling intensity commonly adopted in biomass studies. Therefore the variation is not likely to significantly reduce the	Section 33 of the determination has been amended to reflect the proposed variation.

No.	Proposed variation	Original Section	Current reference	Reviewer's Response	DoE Response
				predictive accuracy of biomass equations to be developed using the sample data.	
7	Deleted requirement (5) & (6): (5) The trees mentioned in subsection (3) must have been cut down within a 30 day period. (6) Subsection (5) does not apply if each tree mentioned in subsection (1) has been analysed in accordance with section 3.23.	Section 3.22	Section 33	We concur with the proposed variation that clause (5) and (6) be deleted from the original documentation of the existing methodology determination as the 30 day period specified for the completion of destructive sampling for a native forest tree species is overly restrictive. In biomass studies, field sampling can potentially span over a year or more. Often biomass data are accumulated over time rather than gathered through a single sampling exercise over a short period of time due to weather conditions, availability of lab space and ovens, logistic issues and other practical constraints. Deleting these two clauses will allow biomass data sampled over a much longer period of time to be pooled together for a more comprehensive analysis when developing biomass equations.	Section 33 of the Determination has been amended to reflect the proposed variation.
8		Section 3.22	Section 33	For the same reasons as stated for variation 6, this proposed variation is not likely to significantly reduce the predictive accuracy of biomass	This change was not made due to concerns that it would reduce the accuracy of allometric equations given the relatively

No.	Proposed variation	Original Section	Current reference	Reviewer's Response	DoE Response
	Modified requirement (7 in original, now 5 after variation above): "(5) If an allometric equation is to be developed for a group of species, at least every second tree per species cut down in accordance with subsection (1) must be cut into component parts in accordance with subsection (4)."			equations to be developed using the sample data. There is therefore no technical issue with this addition.	low number (20) of samples required. The technical assessment did not refer to the effect of the proposed change given this number of samples. Climate Friendly and the GreenCollar Group were consulted on this position, with both organisations supporting the approach taken.
9	Clarification added to requirement (10): "...This mandates the sub-sampling of tree components for establishment of dry-weight of every second tree used for validation of an allometric equation."	Section 3.25	Section 38	This addition simply clarifies the requirement for validating a biomass equation using data from trees that are destructively sampled. There is no technical issue with this addition.	Section 38 has been revised to improve the clarity of instruction.
10	For the value NPT; in the variable explanations of equation 12, added: "If the option (a) is selected in Step 2.2, NPTi is automatically 0."	Section 3.41	Section 54	The proposed variations concern only two equations in Section 3.41, Step 2-Calculating carbon stocks in carbon estimation area, and more specifically Step 2.2-Non-project tree buffer, of Subdivision 3.4.4, Calculation of baseline emissions,	Section 54 detailing the rules for non-project trees has been revised in line with the recommended change to provide more flexibility in their treatment.

No.	Proposed variation	Original Section	Current reference	Reviewer's Response	DoE Response
				on page 33 and 34 of the existing methodology determination. The first is equation 12 for calculating the mean carbon stock in each carbon estimation area following a biomass survey. As shown on page 33 of the existing methodology determination, the equation takes the following form: ....[equation removed].... In this equation, variable p was left undefined in the original documentation of the existing methodology determination, possibly because of a typing error. This error can potentially cause confusion when the equation is used to calculate the mean carbon stock in a carbon estimation area following a biomass survey. The second is equation 13 for calculating the proportion of non-project tree biomass within area of carbon estimation area. As shown on page 34 of the existing methodology determination, this equation takes the following form: ....[equation removed]....	

No.	Proposed variation	Original Section	Current reference	Reviewer's Response	DoE Response
				In this equation, variable SP in upper case was left undefined in the original documentation of the existing methodology determination. This may cause unnecessary confusion. The proposed variation introduces an option for the project proponent to exclude the biomass for all trees not to be cleared in the deforestation plan in the calculation of the mean carbon stock in a carbon estimation area. If this option is chosen, NPTi in equation 12 is automatically set to zero. Otherwise, the existing method of calculating NPTi will apply by following equation (13). If NPTi in equation 12 is set to zero, the kinds of trees for which the biomass has been set to zero must not be included in the results of the biomass survey. This minor modification to the existing methodology of determination will not change the results of the calculation of the baseline carbon stocks in a carbon estimation area, but will reduce the scope of field measurements and thus bring significant cost savings to project proponents.	
11	Changed requirement 2 to:	Section 3.41	Section 54	As above (Variation number 10)	As above (Variation number 10)

No.	Proposed variation	Original Section	Current reference	Reviewer's Response	DoE Response
	"(2) If the deforestation plan provides that a certain kind of tree in the project area must not be cleared, the project proponent must select either or both options: (a) either the biomass for all trees not to be cleared in the deforestation plan is automatically set to 0 or (b) the following formula must be used to compute the constant, non project tree buffer for each carbon estimation area using data collected in the first reporting period:... (3) If project proponents includes option (a) then the kinds of trees for which the biomass				

No.	Proposed variation	Original Section	Current reference	Reviewer's Response	DoE Response
	has been set to zero must not be included in the results of any biomass survey. This does not include project trees which have been excluded from the results biomass survey due to a lack of allometric equation according to Section 3.25 step 11.1. Such trees can be later included if an allometric equation is validated in accordance with Section 3.25.				
12	Changed the requirement (5) in original, now (6=: "If under step 2.2 option (b) is selected the total biomass of non-project trees in each plot must be calculated using the following formula:	Section 3.41	Section 54	As above (Variation number 10)	As above (Variation number 10)

PUBLIC SUBMISSIONS AND SUMMARY

Determination	Avoided deforestation
Reference Number	020VG2014
Public Comment Period	5 December 2014 – 19 December 2014
Number of Submissions	2
Submitting organisations / individuals	1. Climate Friendly 2. GreenCollar

Summary of comments

The submissions were generally supportive of the draft determination but raised some specific issues including the following.

- Include guidance on how to estimate canopy cover had the clearing consent occurred.
- There is a potential error in the final equation.

Adverse impacts

The submissions did not identify any potential adverse impacts.

Responses to the public submissions: exposure draft determination '*Carbon Credits (Carbon Farming Initiative—Avoided Deforestation 1.1) Methodology Determination 2015*'

Number	Issue	Submissions	Method Determination Reference	DoE Response
1	Include guidance on how to estimate canopy cover had the clearing consent occurred.	Climate Friendly	Section 25	Guidance is provided in the Explanatory Statement on how to estimate canopy cover had the clearing occurred. This involves estimating the number of non-project trees and multiplying them by the projected surface area of the trees crown.
2	A potential error in the final equation.	Climate Friendly	Equation 41	The equation was checked, and it was confirmed that it does not contain an error. The determination is correct in that a value of 0.95 is applied to account for the risk of reversal buffer of 5 per cent. That is, the abatement credited is equal to the number of ACCUs issued plus the risk of reversal buffer, or ACCUs divided by 0.95.

Overview of changes to the existing avoided deforestation method

Purpose

This document outlines the more significant changes made to the determination while transitioning the original avoided deforestation method to the Emissions Reduction Fund (ERF).

Discussion

Changes made to the original avoided deforestation method for transitioning to the ERF include amending the document structure, equation styles, monitoring and reporting provisions to match ERF requirements and simplifying text. These changes do not change the function of the original method.

In addition to the above changes, a number of amendments were made to simplify the eligibility criteria and modify the sampling requirements. These changes take into account the variations proposed by Climate Friendly and findings of the technical review of those proposals. The modifications to sampling requirements will improve efficiencies for projects using the method, without compromising integrity. The main changes are described below.

Section	Change
6	The crediting period has been defined as 15 years, a reduction from the current 20 years. This is to reflect the lifetime of the clearing permits most commonly applicable for projects using the method. The change allows crediting to better match the time over which clearing would occur. The effect is that the annual entitlement of credits increases by 25%, with no change in the total number of credits issued.
10	The method has been adjusted so the land only needs to be forest at project commencement. Under the original method, and to comply with the definition of 'deforestation' under the first Kyoto commitment period, land was required to be forest on 31 December 1989 and remain forest until project commencement. With the change in definition of 'deforestation' for the second Kyoto commitment period, the land no longer needs to have been forest on 31 December 1989.
26	The method has been amended to clarify that allometric equations that are used in the project must meet the requirements of the method, rather than requiring that an allometric equation be developed or validated for each tree measured as part of the project. This reduces the burden of sampling trees that have minimal contribution to the overall abatement estimate.
31	The method was adjusted to clarify plot selection for the development and validation of allometric equations. More specifically, the method now refers to '100 trees per species or species group represented by the allometric equation across the area....' a change from '100 trees across the area'. The change clarifies that the trees selected for destructive sampling for each allometric equation must be selected from a pool of at least 100 trees.
33	The method allows for full sampling of every fourth tree, a change from the previous method which required sampling of every third tree. On the advice of the technical assessment, the method was also amended to remove a clause which required destructive sampling within a 30 day period. This change increases the efficiency of developing an allometric equation without affecting the accuracy of the abatement estimate.

54	The method now explicitly allows two options for the treatment of non-project trees, which are trees that cannot be cleared under the clearing permit. These options are to either not include them in the result of a biomass survey, or include them but deduct their contribution to abatement through the non-project tree buffer. The original method only provided instructions for the non-project tree buffer option for accounting for non-project trees. This amendment clarifies that project proponents do not have to develop and validate allometric equations for non-project trees.
65	The Act previously included equations for calculating abatement for avoided deforestation projects, but these equations are not included in the amended Act. Given this, Equations 40A, 40B and 41 have been amended in the method to replace the function of the equations removed from the Act.

Attachment J

Draft Carbon Credits (Carbon Farming Initiative—Avoided Deforestation 1.1) Methodology Determination 2015– Consultation Issues Summary

The draft determination is based on the existing *Carbon Credits (Carbon Farming Initiative) (Avoided deforestation) Methodology Determination 2013*. The existing method was developed by the GreenCollar Group. In developing the draft determination, consideration was given to variations proposed by Climate Friendly in 2014. GreenCollar Group and Climate Friendly were consulted throughout the development of the draft determination.

Technical working group meetings -	
No technical working group was established, as the method is the transition of an existing method.	
Organisations consulted	
GreenCollar Group Climate Friendly	
Key issues raised through consultations	**Department's response**
No issues were raised beyond the original variations proposed by Climate Friendly. These are covered in Attachments E and I.	

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AUSTRALIAN CONSERVATION FOUNDATION

6 February 2019

Emissions Reduction Assurance Committee
By email: erac@environment.gov.au

Dear Committee

I am writing to bring to your attention some concerns held by the Australian Conservation Foundation in relation to methodologies under the Emission Reduction Fund (ERF). We are currently researching projects and outcomes of the ERF and have developed concerns that at least three of the methodologies are producing perverse outcomes that require your consideration.

Industrial Electricity and Fuel Efficiency

We understand that the Committee completed a review into this methodology in early 2018, however we would like to respectfully bring additional concerns to your attention. We are particularly concerned about 'fuel switch' projects registered under this methodology. Two facilities with an obligation to reduce their emissions under the safeguard mechanism have been issued Australia Carbon Credit Units (ACCUs) for burning substitute fossil fuels. Rio Tinto made a commercial decision to close their energy-hungry alumina refinery at Gove (NT) which entailed a fuel switch from heavy-oil to diesel to power their remaining operations at the site. Public statements by the company suggest that the fuel switch was substantially implemented by 2014, however the 'Gove Alternate Power Generation Project' became a registered ERF project in 2015 (ERF101428). The ACCUs generated at the site are being sold back to the Regulator to meet Rio Tinto's obligations under the safeguard mechanism.

Similarly, Gold Fields Australia made a commercial decision to switch from diesel to natural gas at their Granny Smith facility (WA), saving $1 million a year. The 'Granny Smith Gas Power Station' was registered as an ERF project (EOP101217) in 2015. Gold Fields Australia used their ACCUs from their Granny Smith facility to offset a safeguard baselines exceedance at their St Ives facility.

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This exposes three issues with the Industrial Electricity and Fuel Efficiency methodology:

- Commercial additionality should be a factor – we are concerned that big emitters are being given public funding for projects that were ultimately commercial decisions for the proponents. As mentioned in your report from the 2017/18 review, the methodology should require an additionality declaration from the Chief Financial Officer. It is unclear - due to transparency issues - whether this is now occurring with projects registered under this method.
- Buying compliance with the safeguard mechanism – the Department of the Environment and Energy's 'double counting' policy allows for facilities to sell their ACCUs to the Regulator to reduce their net emissions under the safeguard baseline. Big emitters are required by law to remain under baselines emissions, we do not need to pay them for it.
- Switching from fossil fuel to fossil fuel – while it may reduce net emissions in the short term, the methodology still functions to incentivise the use of fossil fuels. We are concerned that the methodology encourages industry to invest in infrastructure, like gas pipelines, that maintains the sector's fossil fuel dependency.

Facilities

While the Facilities methodology has no attributable contracts to date, we are concerned about the perverse outcomes it could produce. One of its two registered projects, Vales Point Power Station, is an old coal-fired power station that appears to be seeking ERF funding for operational changes that will extend its projected lifespan by more than 20 years. The facility is captured under the safeguard mechanism and was responsible for nearly 7 million tonnes of carbon emissions in 2016/17 alone.

This exposes three issues with the Facilities methodology:

- Explicitly designed to buy compliance – we hold the same concerns with this methodology as with the Industrial Electricity and Fuel Efficiency methodology, however in the case of Facilities it appears to be designed for the explicit purpose of buying compliance with the safeguard mechanism.
- Narrow interpretation of facility emissions – while upgrades at a facility may reduce annual emissions, the methodology does not consider that upgrades may extend the longevity of a facility and ultimately result in additional emissions in the long-term (as opposed to a business-as-usual decommissioning scenario).

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- Incentivised fossil fuel dependence – as with the Industrial Electricity and Fuel Efficiency methodology, this methodology can have the perverse effect of encouraging industry to make decisions that will maintain fossil fuel dependency.

Avoided Deforestation 1.1

It would be reasonable to expect that land clearing is not occurring at properties registered under the Avoided Deforestation methodology. However, by comparing publicly available satellite images, it appears that in recent years land clearing may have occurred at some properties receiving funding for projects under this methodology.

This exposes three issues with the Avoided Deforestation 1.1 methodology:

- Transparency and public access to Carbon Estimation Areas – Carbon Estimation Areas for ERF projects should be publicly available. There is no opportunity for interested members of the public to determine where, specifically, the avoidance is taking place on these properties and whether obligations are being met.
- Enforceability of commitments – if the apparent clearing *has* occurred in the Carbon Estimation Areas, we are concerned that the Clean Energy Regulator is unable to take compliance action. Our initial reading of the legislation is that penalties do not apply unless the proponent voluntarily elected for their project to be classed as a 'sequestration' offset.
- The potential for 'leakage' to occur – if the apparent clearing *has not* occurred in the Carbon Estimation Areas, we are concerned that the Government's purchase of ACCUs generated by these projects has provided landholders the upfront capital needed to clearing vegetation elsewhere on the properties.

In light of these concerns, we ask that you review—and if you deem it appropriate, suspend—the discussed methodologies. If you have any questions please contact me on s22 or s22 .

Yours sincerely,

Kelly O'Shanassy
Chief Executive Officer

cc: Clean Energy Regulator cer-referrals@cleanenergyregulator.gov.au

EMISSIONS REDUCTION ASSURANCE COMMITTEE

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Ms Kelly O'Shanassy
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Dear Ms O'Shanassy

Thank you for your letter of 6 February 2019 asking the Emissions Reduction Assurance Committee to undertake reviews of three methods under the Emissions Reduction Fund.

In accordance with section 255AA of the *Carbon Credits (Carbon Farming Initiative) Act 2011*, the Committee has considered whether to undertake a review in response to your request. The outcomes of this consideration are outlined below.

s22

Avoided Deforestation 1.1

As you will be aware, the Committee aims to review every method under the Fund approximately every four years. As part of its routine schedule of reviews, the Committee has previously agreed to commence a review of the *Avoided Deforestation 1.1* Method during the second quarter 2019, subject to the completion of other reviews.

The Committee notes the issues you have raised. While the Committee does not intend to bring forward its review of the method, the Committee will consider the issues you have raised during the review to commence later this year.

As with the Facilities Method review, the Committee has requested the Department to include the Australian Conservation Foundation in consultations to be conducted as part of the review, and looks forward to your detailed submission.

Thank you once again for drawing these matters to the Committee's attention.

Yours sincerely

s22

Andrew Macintosh
Chair
Emissions Reduction Assurance Committee
13 March 2019

cc: Clean Energy Regulator