Carbon Credits (Carbon Farming Initiative—Measurement of Soil Carbon Sequestration in Agricultural Systems) Methodology Determination 2018

I, Josh Frydenberg, Minister for the Environment and Energy, make the following determination.

Dated 25/1/18

Josh Frydenberg
Minister for the Environment and Energy

Contents

Part 1—Preliminary

1 Name

This is the *Carbon Credits (Carbon Farming Initiative—Measurement of Soil Carbon Sequestration in Agricultural Systems) Methodology Determination 2018*.

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(b) ends on the day before this instrument would otherwise be repealed under subsection 50(1) of the *Legislation Act 2003*.

5 Definitions

In this determination:

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

bare fallow, in relation to land, means land that is not seeded and has less than 40% ground cover for 3 months or longer.

baseline period means the 10 years immediately before the section 22 application or section 29 application relating to the project area.

biochar means organic material (other than tyres, rubber products or human effluent) that has undergone a pyrolysis process.

CEA—see section 17.

CFI Rule means the *Carbon Credits (Carbon Farming Initiative) Rule 2015*.

clearing means the conversion of forest land to non-forest land through the destruction of trees or saplings by intentional burning, mechanical or chemical means.

CO_2-e means carbon dioxide equivalent.

designated waste-stream means an organic waste-stream from one of the following:

(a) intensive animal production;

(b) food processing;

(c) manufacturing;

(d) sawmill residue;

(e) municipal or commercial waste collection processes (other than processes involving human effluent).

de-stocking: an area of land under pasture is considered destocked if land which is permanent pasture, or pasture for the period of at least 2 years, is never grazed, nor intended to be grazed, by production livestock.

eligible land—see subsection 9(1).

eligible management activity—see subsection 7(2).

emissions accounting area—see section 17.

exclusion area—see section 17.

fertiliser means any synthetic or non-synthetic substance that supplies key chemical elements to plants and soils to enhance plant growth and the fertility of soils.

forest land means land with a tree height of at least 2 metres, and crown canopy cover of 20% or more and covering at least 0.2 of a hectare.

gypsum means a product which is mainly composed of calcium sulfate dihydrate ($CaSO_4 \cdot 2H_2O$) and is used to manage soil sodicity or magnesic properties, or improve the structure of sodic clay soils.

hypersulfidic material has the meaning given by the *Australian Soil Classification (Second Edition)* published by the Commonwealth Scientific and Industrial Research Organisation in 2016.

Note: In 2018, the second edition of the Australian Soil Classification could be accessed from http://www.clw.csiro.au/ with the glossary available at http://www.clw.csiro.au/aclep/asc_re_on_line_V2/soilglos.htm#br

ineligible non-synthetic fertiliser: a non-synthetic fertiliser is ineligible if it includes organic matter that does not satisfy one of the following:

(a) the organic matter previously formed part of a designated waste stream;

(b) the organic matter is sourced from within a CEA that is part of the project.

irrigation efficiency savings means improvements to the efficiency of irrigated water that:

(a) results from improving the efficiency of one or both of the following:

(i) on-farm irrigation infrastructure;

(ii) management practices; and

(b) are not achieved by new or upgraded on-farm irrigation infrastructure funded by a Commonwealth, State or Territory program.

land management strategy—see subsection 13(1).

lime means a product which is mainly comprised of calcium carbonate ($CaCO_3$) or calcium magnesium carbonate ($CaMg(CO_3)_2$), or both, and which is used to manage acidity in agricultural soils.

Note: Calcium magnesium carbonate is commonly known as dolomite.

maintain: maintaining a land management activity at a point in time includes the circumstance where a completed activity has a continuing impact on the storage of additional soil organic carbon in the land at that point in time.

material deficiency means a concentration or availability of one or more nutrients in the soil, where the concentration or availability limits plant growth to materially less than could otherwise have been achieved in that location.

National Inventory Report means the report of that name produced by Australia in fulfilment of its obligations under the Climate Change Convention and the Kyoto Protocol, as in force from time to time.

Note: In 2018, the National Inventory Report could be accessed from http://www.environment.gov.au.

net abatement amount, for an eligible offsets project in relation to a reporting period, means the carbon dioxide equivalent net abatement amount for the project in relation to the reporting period for the purposes of paragraph 106(1)(c) of the Act (see also section 25).

new irrigation means applying new or additional irrigation to land which involves obtaining water from irrigation efficiency savings made after the declaration of the project, which may occur inside or outside of the CEA on which the new or additional irrigation is carried out.

NGER Act means the *National Greenhouse and Energy Reporting Act 2007*.

NGER Measurement Determination means the applicable determination made under subsection 10(3) of the NGER Act.

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

non-synthetic fertiliser means any biologically-derived solid or liquid substance that:

(a) where relevant—must be applied to the surface of, or incorporated into, agricultural soils in accordance with the laws and regulations of the relevant State, Territory or local government; and

(b) is used to do one or both of the following:
  (i) supply nutrients to plants and soils;
  (ii) enhance plant growth and soil fertility; and

(c) does not include:
  (i) non-biodegradable substances, such as plastics, rubber or coatings; or
  (ii) ineligible non-synthetic fertiliser; or
  (iii) biochar.

nutrient includes trace minerals, macro-nutrients (such as Nitrogen, Phosphorus, Potassium and Sulphur) and micro-nutrients.

pasture means land that is continuously under any combination of perennial grasses, annual grasses, or legumes, and on which production livestock is raised.

permanence obligation period, in relation to a soil carbon project, means the period from the declaration of the project until the last day the Regulator could issue a notice to relinquish Australian carbon credit units under Division 3 of Part 7 of the Act.

production livestock means livestock managed for production purposes and from which commercial products or services are derived.

responsible environmental protection agency, for a State or Territory, means:

(a) if a government agency responsible for environmental protection in the State or Territory notifies the Regulator, in writing, that it is the only responsible soil agency for the State or Territory for the purposes of this definition—that agency; or

(b) if paragraph (a) does not apply—a government agency responsible for environmental protection in the State or Territory.

section 22 application in relation to an eligible offsets project means the application under section 22 of the Act for the declaration of the project as an eligible offsets project.

section 27 declaration in relation to an eligible offsets project means the declaration under section 27 of the Act that the project is an eligible offsets project.

section 29 application means an application made under regulations or legislative rules made for the purposes of section 29 of the Act to vary a section 27 declaration.

section 128 application in relation to an eligible offsets project means a request under subsection 128(1) of the Act to approve the application of this methodology determination to the project with effect from the start of a reporting period.

soil amendment means a substance to improve the health or quality of soil, such as fertiliser, recycled organic materials, lime or gypsum.

soil carbon project—see subsection 7(3).

soil landscape modification activities—see subsection 7(4).

soil organic carbon means the carbon contained within soil organic matter, other than mineralised carbon.

stubble means the residue remaining after crops have been harvested.

Supplement means the document entitled 'The Supplement—for Measurement of Soil Carbon Sequestration in Agricultural Systems', published by the Department and as in force from time to time.

Note: In 2018 the Supplement could be viewed on the Department's website (http://www.environment.gov.au).

synthetic fertiliser means any synthetic substance that:

(a) is used to supply nutrients to plants and soils to enhance plant growth and the fertility of soils; and

(b) where relevant—must be applied to the surface of, or incorporated into, agricultural soils in accordance with the laws of the relevant State, Territory or local government; and

(c) does not include biochar.

thinning, in relation to land within a CEA, means the selective removal of trees or saplings from productive agricultural land, where the removal does not reduce the total amount of woody vegetation in that CEA to less than the lowest amount present in that CEA during the baseline period.

tillage means any form of mechanical preparation of the soil.

wetland includes lakes, rivers, natural wetlands, and human-made dams.

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

25-year permanence period project
100-year permanence period project
Australian carbon credit unit
crediting period
Climate Change Convention
eligible offsets project
emission
greenhouse gas
Kyoto Protocol

offsets project
offsets report
project
project area
project proponent
Regulator
reporting period

6 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.

Part 2—Soil carbon projects

7 Soil carbon projects

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

(a) involves the sequestration of carbon in soil in an agricultural system through carrying out one or more eligible management activities; and

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

(c) has its project area within Australia, excluding the external territories.

(2) For this determination, a management activity is an ***eligible management activity*** if it:

(a) involves one of the following land management activities:

(i) applying nutrients to the land in the form of a synthetic or non-synthetic fertiliser to address a material deficiency;

(ii) applying lime to remediate acid soils;

(iii) applying gypsum to remediate sodic or magnesic soils;

(iv) undertaking new irrigation;

(v) re-establishing or rejuvenating a pasture by seeding;

(vi) establishing, and permanently maintaining, a pasture where there was previously no pasture, such as on cropland or bare fallow;

(vii) altering the stocking rate, duration or intensity of grazing;

(viii) retaining stubble after a crop is harvested;

(ix) converting from intensive tillage practices to reduced or no tillage practices;

(x) modifying landscape or landform features to remediate land;

(xi) using mechanical means to add or redistribute soil through the soil profile; and

(b) is an improvement on the land management activities conducted in the agricultural system during the baseline period such that:

(i) at least one of the land management activities is new or materially different from the equivalent land management activity conducted during the baseline period; and

(ii) more carbon can reasonably be expected to be sequestered in that system as a result of carrying out that land management activity; and

(c) does not involve activities excluded by section 11 or the carrying out of activities restricted by section 12.

(3) A project covered by subsection (1) is a ***soil carbon project***.

(4) A land management activity covered by subparagraphs (2)(a)(x) or (xi) is a ***soil landscape modification activity***.

Authorised Version F2018L00089 registered 07/02/2018

Projects not covered by determination

(5) However, this determination does not cover an offsets project whose applicable methodology determination is the *Carbon Credits (Carbon Farming Initiative—Estimating Sequestration of Carbon in Soil Using Default Values) Methodology Determination 2015*.

Note: As a result of subsection (5):

- this determination cannot be applied to a project, under sections 128 to 130 of the Act, if its applicable methodology determination is the *Carbon Credits (Carbon Farming Initiative—Estimating Sequestration of Carbon in Soil Using Default Values) Methodology Determination 2015*; and
- a project area cannot be transferred, under a variation of a section 27 declaration as described in section 57 of the Act, from a project to which the *Carbon Credits (Carbon Farming Initiative—Estimating Sequestration of Carbon in Soil Using Default Values) Methodology Determination 2015* applies to a project to which this determination applies.

This does not impact the ability of an eligible offset project with the *Carbon Credits (Carbon Farming Initiative) (Sequestering Carbon in Soils in Grazing Systems) Methodology Determination 2014* as its applicable methodology determination using either of the processes above.

Part 3—Project requirements

Division 1—General

8 General

For paragraph 106(1)(b) of the Act, to be an eligible offsets project, a soil carbon project must meet the requirements in this Part.

9 Project area and eligible land

(1) The project area must include land (***eligible land***) meeting the following requirements:
  (a) during the whole of the baseline period the land was used for one or more of the following:
    (i) pasture;
    (ii) cropping;
    (iii) bare fallow;
  (b) the land was not forest land at any point during the baseline period and is not currently forest land;
  (c) there are no dwellings or other structures on the land;
  (d) during the baseline period the land has not been subject to the drainage of a wetland;
  (e) as at the end of the baseline period, it was reasonable to expect that carrying out the eligible management activities proposed by the relevant land management strategies will increase the carbon sequestered in the land;
  (f) it is possible to sample the soil on the land consistently with the requirements of this determination.

(2) The project area may include land which is not eligible land only if that land will not be part of a CEA for the project or is to remain part of a CEA in accordance with subsection 17(5).

(3) A project area, or area to be added to a project area under the legislative rules, must include at least one CEA meeting the requirements of section 17.

(4) A project area may be varied under the legislative rules only if one or more of the following apply:
  (a) the first offsets report for the project under subsection 76(1) of the Act has not been submitted;
  (b) the variation removes only areas that are exclusion areas or emissions accounting areas from the project area;
  (c) the whole of the project area is removed from the project;
  (d) one or more whole CEAs are removed in circumstances where:
    (i) either:
      (A) the sum of the most recent values for $\Delta SOC_{60\ CEA}$ from equation 27 of Schedule 1 or $\Delta SOC_{60\ CEA\ (t_0 - t_x)}$ from equation 40 of Schedule 1 for each CEA removed from the project is positive; or
      (B) the removal is not for a purpose of increasing the credits issued under the Act in relation to the project area; and
    (ii) if land management activities in a CEA to be removed from a project have moved carbon from that CEA to one or more other CEAs that are part of the

project—all the CEAs that had received that carbon are also removed from the project;

(e) one or more whole CEAs or project areas are removed from the project after the end of the crediting period for the project.

Note: Any variation of a project area will also need to meet the requirements of the legislative rules and this will involve the relinquishment of any Australian Carbon Credit Units issued in relation to any CEAs removed from the scheme. The removal of part of a project area that is a CEA or emissions accounting area will involve the recalculation of the baseline for the project area.

(5) If the *Carbon Credits (Carbon Farming Initiative) (Sequestering Carbon in Soils in Grazing Systems) Methodology Determination 2014* was previously the applicable methodology determination in relation to a project area, an area of land is also eligible land if:

(a) it could be included in a carbon estimation area under that determination; and

(b) was mapped as part of a carbon estimation area at the commencement of this determination.

10 Activities to be conducted

(1) The project proponent must, in all areas of land included in a CEA, carry out or maintain at least one eligible management activity until the end of the permanence obligation period for the project.

Note: The kind of eligible management activity may change for an area of land over time, so long as during each reporting period one eligible management activity is conducted.

(2) The first eligible management activity on each area of land included in a CEA must begin:

(a) after the project is declared an eligible offsets project; and

(b) before the first subsequent sampling round for the CEA; and

(c) before the end of the first reporting period after the CEA was included in the project area for the project.

(3) If a CEA includes land that is a permanent pasture, or has been used as pasture for a period of at least 2 years, the pasture must be grazed, or intended to be grazed, by production livestock at least once every 2 years.

(4) The project proponent may undertake additional management provided those activities are not excluded under section 11 or would result in a breach of section 12.

11 Activities not to be conducted

(1) Activities excluded by this section must not be conducted on land that is, or is to be, part of a CEA in the permanence obligation period for the project.

(2) The following activities must not be conducted:

(a) de-stocking of land under pasture, unless the land is converted to be a cropping system;

(b) applying ineligible non-synthetic fertilisers;

(c) the application of soil amendments containing coal;

(d) the application of pyrolysised material that is not biochar.

(3) After the completion of the baseline sampling round, land management activities must not disturb the soil any deeper than the sampling depth under section 19.

(4) Land management activities must not be conducted on hypersulfidic material that would result in one or more of the following:

(a) drainage;

(b) physical disturbance;

(c) the application of lime to the land.

Note: Project proponents may choose to exclude soils with hypersulfidic material (ie acid sulfate soils) from CEAs to avoid the risks of breaching this subsection.

(5) An activity notified to the project proponent in writing by the Regulator under subsection (6) must not be conducted.

(6) The Regulator may notify a project proponent of one or more activities that must not be conducted if:

(a) the Regulator is satisfied that the activity is expected to result in the crediting of non-genuine carbon abatement; and

Note: Actions which directly or indirectly increase the value of $\Delta CO_2e_{60\ PA\ (RP)}$ or reduce the value of $Eall_{RP,PA}$ result in additional crediting under the Act. Non-genuine carbon abatement could include activities which increase crediting under this Determination without a corresponding overall benefit from the removals or reduced emissions, such as through leakage.

(b) the Regulator has consulted the project proponent on the need to make such a notification.

12 Restricted activities

(1) Activities mentioned this section must be conducted in accordance with this section on land that is, or is to be, part of a CEA in the permanence obligation period for the project.

(2) Woody vegetation may be cleared or thinned only if:

(a) any clearing or thinning is undertaken in accordance with any applicable regional natural resource management plan and Commonwealth, State, Territory or local government environmental and planning laws; and

(b) at least one of the following apply:

(i) the clearing is in accordance with a right or approval from the relevant government body (such as a valid clearing permit) that was already in force before the land became part of the soil carbon project;

(ii) the clearing is to manage growth of invasive woody weeds;

(iii) the thinning is to manage pasture;

(iv) the clearing or thinning is to manage the stock of woody horticulture crop, as part of standard business operations;

(v) the clearing or thinning is to manage forage crops.

(3) Non-synthetic fertiliser must not be applied to land at a time that would make it impossible to comply with the requirements for sampling rounds in this determination and the Supplement.

(4) Land management activities may involve the addition or redistribution of soil using mechanical means (including through clay delving, clay spreading or water ponding) only if:

(a) any soil is sourced from CEAs that are part of the project; and

(b) sampling is undertaken at a depth greater than the depth of any soil:

(i) sourced for the land management activities; and

(ii) added to the soil profile; and

(iii) incorporated through the soil profile; and

(c) the land where any soil is sourced is remediated as soon as is practical.

Note: Remediation could involve returning sandy topsoil to a clay pit immediately after the clay is extracted.

(5) Soil amendments containing biochar may be added to soil within a CEA only if:

(a) the use of the biochar is:

(i) in accordance with a license or permit from a State or Territory which specifically authorises the use of biochar in relation to the area of land; or

(ii) if a licence or permit under subparagraph (i) is not available—authorised or approved in a written statement from the head (or delegate) of a responsible environmental protection agency in relation to the area of land that references this subparagraph; and

(b) the biochar was sourced or created from:

(i) CEAs that are part of the project; or

(ii) organic matter that previously formed part of a designated waste stream.

(6) After the baseline sampling round, irrigation may only be applied to CEAs within a project area if:

(a) both of the following apply:

(i) the annual level of irrigation for the project area, or the CEAs within the project area, is not more than 20% greater than the highest annual level of irrigation in the baseline period;

(ii) the 5-yearly total level of irrigation for the project area, or the CEAs within the project area, is not more than 10% greater than the highest 5-yearly total level of irrigation in the baseline period; or

(b) the requirements of paragraph (a) would be met if all new irrigation is disregarded.

13 Land management strategy

(1) An independent person must prepare or review one or more written strategies (a ***land management strategy***) for the implementation of all eligible land management activities to be carried out as part of the soil carbon project until the end of the permanence obligation period for the project that:

(a) demonstrates the eligible management activities satisfy the requirements in subsection 7(2); and

(b) for all land included, or to be included, in a CEA, includes the carrying out or maintenance of at least one eligible management activity until the end of the permanence obligation period for the project; and

(c) documents and takes into account each of the following:

(i) all the eligible management activities and other land management activities that will be conducted on the land; and

(ii) the limitations on increasing soil carbon stocks within each CEA; and

Note: Limitations may include soil sodicity, soil structure, environmental factors and micronutrients.

(iii) risks to soil carbon stocks from environmental factors and the land management activities being carried out; and

Note: Environmental factors include changes in climate impacting the project area.

(d) specifies any additional steps the project proponent needs to take to monitor the project or keep records relating to the land management activities to verify the objectives of the land management strategies are being achieved; and

(e) includes a statement that, in the opinion of the independent person:

(i) activities excluded by section 11, or in breach of section 12, are not being conducted or proposed to be conducted; and

(ii) the eligible management activities meet the requirements of paragraph 7(2)(b); and

(iii) the overall impact of all land management activities conducted on the land could reasonably be expected to improve soil carbon stocks over time.

(2) The land management strategies must:

(a) cover all of the land included in the CEAs for the project; and

(b) cover all of the land in a given CEA in a single strategy.

(3) The initial land management strategies for the project must be prepared:

(a) if this determination is the applicable methodology determination as a result of a 128 application—before the first offsets report submitted after that application; or

(b) otherwise—before the section 22 application.

(4) If a project area is added to a project as a result of a section 29 application:

(a) one or more existing land management strategies must be revised to cover the additional project area before the section 29 application; or

(b) one or more new land management strategies must be prepared to cover the additional project area before the section 29 application.

(5) The project proponent and each relevant landholder must:

(a) sign and agree to implement, or oversee the implementation of, each land management strategy; and

(b) take reasonable steps to implement, or oversee the implementation of, the applicable land management strategies until the end of the permanence obligation period for the project.

(6) An independent person must review, and if necessary revise, each strategy:

(a) at least once every 5 years until the end of the crediting period for the project; and

(b) at least once every 10 years until the end of the permanence obligation period for the project; and

(c) if land management activities being conducted change materially from those outlined in the land management strategy; and

(d) if the Regulator notifies a project proponent that a particular issue needs to be addressed in the strategy—by the date specified in the notification (which must be at least 3 months from the date of the notification).

(7) In providing a notification under paragraph (6)(d), the Regulator must take into account whether the carrying out of the land management strategy could reasonably be expected to result in the crediting of non-genuine carbon abatement.

(8) For the purposes of this section, an ***independent person*** must:

(a) have knowledge of agronomy and plant nutrition; and

(b) have experience in the provision of agricultural production advice; and

(c) have a good understanding of the influence of agricultural management on soil carbon; and

(d) have no financial interest in the soil carbon project; and

(e) meet any requirements included in the Supplement.

Note: Being paid for preparing a land management strategy would not involve a breach of paragraph (d).

(9) In this section:

relevant landholder, in relation to a land management strategy, means any person other than the project proponent who, whether by reason of ownership or otherwise, is in lawful occupation or possession, or has lawful management or control, of land that is covered by the land management strategy.

14 Information to be included in applications relating to the project

(1) The section 22 application, section 29 application or section 128 application must include:
   (a) a detailed description of the land management activities that were carried out during the baseline period; and
   (b) a detailed description of the eligible management activities that will be carried out as part of the project until the end of the permanence obligation period; and
   (c) a detailed explanation of how the eligible management activities to be carried out satisfy the requirements in subsection 7(2); and
   (d) evidence that all of the land included, or to be included, in a CEA is eligible land; and
   (e) if biochar is to be applied to the soil—evidence that the requirements of subsection 12(5) have been met.

(2) The section 22 application or section 29 application must include copies of the land management strategies prepared for the project.

(3) However, if the Regulator is not satisfied that the land management strategies included under subsection (2) meet the requirements of 13, the project is not an eligible offsets project or covered by this determination unless one or more revised land management strategies are provided which satisfy the Regulator that the requirements of section 13 have been met.

Division 2—Operation of soil carbon projects

Subdivision 1—Operation of Division

15 Operation of eligible projects

A soil carbon project that is an eligible offsets project must be operated in accordance with this Division.

Subdivision 2—Project accounting

16 Steps involved in accounting for a soil carbon project

(1) For each area of land included as part of a project area for a soil carbon project:
   (a) the land must be mapped into one or more CEAs that, subject to subsection 17(6), remain fixed for the permanence obligation period for the project or are removed in accordance with subsection 9(4); and
   (b) a baseline sampling round must be conducted for each CEA:
      (i) if the land is included in the project area at declaration—within the first reporting period for the project; or
      (ii) if the land is included in the project area as the result of a section 29 application—within 18 months of the land being included in the project area for the project; and

(c) at least one subsequent sampling round must be conducted during each reporting period in the crediting period for the project; and

Note: Note in the first reporting period after an area of land becomes part of a project, this requires both a baseline sampling round and a subsequent sampling round to be conducted. Sampling is not conducted on exclusion areas or emissions accounting areas.

(d) for each sampling round, each CEA must be divided into strata consistent with any requirements in the Supplement; and

(e) for each reporting period, all CEAs within a project area must have the same number of sampling rounds.

Note: Separate project areas within a project can have a different number of sampling rounds, such as where project areas are added to a project under a section 29 application.

(2) Unless the Regulator agrees in writing that exceptional circumstances exist, a subsequent sampling round must meet any timing requirements specified in the Supplement.

Note: Exceptional circumstances may include poor weather conditions that inhibit site access or where the soil moisture is unsuitable for sampling at the planned time.

17 Carbon estimation areas (CEAs), exclusion areas and emissions accounting areas

(1) The project proponent must map land within the project area for the project into one or more ***carbon estimation areas*** (CEAs) such that:

(a) all the land included in the CEA:

(i) is eligible land; and

(ii) is subject to the carrying out or maintenance of at least one eligible management activity until the end of the permanence obligation period for the project; and

(iii) is within a single State or Territory; and

(b) non-contiguous parts of the project area are mapped as separate CEAs; and

(c) the boundaries of the CEA used in the baseline sampling round must be the same as the boundaries used in each subsequent sampling round; and

(d) the mapping is completed before the baseline sampling round for each CEA.

(2) The project proponent may map other land within the project area for the project into one or more ***exclusion areas*** such that:

(a) either:

(i) no land management or agricultural activities are to be conducted in the area; or

(ii) the land is forest land where no emissions occur that are relevant to the calculations in Schedule 2; and

(b) none of the land is included in a CEA.

Note: Exclusion areas would generally be forests, dwellings, roads, dams or other infrastructure.

(3) Any part of the project area which is neither a CEA nor an exclusion area is an ***emissions accounting area.***

Note: The carbon stock change of an emissions accounting area is not included in the net abatement amount, but emissions from these areas are included in the net abatement amount calculations. Emissions accounting areas are likely to include agricultural land which is not suitable or conducive to sampling (such as rocky outcrops) and forest land where land management activities are applied.

(4) Subsections (5) and (6) apply to a CEA that:

(a) has been mapped in accordance with this section; and

(b) includes land that is not eligible, or has ceased to be eligible, because it does not satisfy paragraph 9(1)(b) (forest land) or 9(1)(c) (dwelling or structures); and

(c) has not been removed from the project area of the project.

(5) Despite subparagraph (1)(a)(i), the CEA must remain unchanged if:
   (a) less than the smaller of 1% or 50 hectares of the area of the CEA is forest land or is covered by dwellings or other structures; or
   (b) the most recent values for $\Delta SOC_{60\ CEA}$ from equation 27 of Schedule 1 or $\Delta SOC_{60\ CEA\ (t_0 - t_x)}$ from equation 40 of Schedule 1 for the CEA are negative; or
   (c) the Regulator determines, in accordance with subsection (7), that the land can continue to be mapped as a CEA.

(6) If subsection (5) does not apply, the CEA must be removed from the project area.

(7) The Regulator may determine that land can continue to be mapped as a CEA if:
   (a) the Regulator has consulted with the project proponent about making such a determination; and
   (b) the continued mapping of the CEA is unlikely to result in the crediting of non-genuine carbon abatement; and
   (c) either:
      (i) within 5 years there is a reasonable expectation that less than the smaller of 1% or 50 hectares of the area of the CEA will be forest land; or
      (ii) less than 5% of the area of the CEA is forest land or is covered by dwellings or other structures; and
   (d) the Regulator considers that the continued mapping of the CEA is appropriate, having regard to all the circumstances.

(8) The mapping of each CEA, exclusion area or emissions accounting area must be done in accordance with the Supplement.

Note: Note that project previously covered by the *Carbon Credits (Carbon Farming Initiative) (Sequestering Carbon in Soils in Grazing Systems) Methodology Determination 2014* may need to remap their projects in accordance with this section.

18 Sampling design

(1) Each sampling round must involve, consistent with any requirements in the Supplement:
   (a) the division of each CEA into at least three strata; and
   (b) taking at least three samples in each strata.

(2) The sampling design must:
   (a) take into account any recommendations in the Supplement; and
   (b) meet any requirements included in the Supplement.

19 Sampling

The sampling undertaken must:
   (a) be either:
      (i) to a depth of 30 centimetres; or
      (ii) if separate information is obtained and analysed for the first 0 to 30 centimetre layer of the soil and the soil layers greater than 30 centimetres in depth—to a depth greater than 30 centimetres; and
   (b) be undertaken by an independent person who:
      (i) has experience in the collection of soil samples; and
      (ii) has a good understanding of the sampling requirements of this determination and the Supplement; and

(iii) has no financial interest in the soil carbon project; and

(iv) did not prepare the land management strategy for the project; and

(v) meets any requirements included in the Supplement; and

Note: Being paid to undertake the sampling would not involve a breach of subparagraph (iii).

(c) take into account any recommendations in the Supplement; and

(d) meet any requirements included in the Supplement.

20 Sample analysis

The preparation of the soil sample and analysis of the soil sample must:

(a) use a consistent soil carbon estimation technology within each CEA and each sampling round; and

Note: The technologies, such as combustion or sensors, may change between sampling rounds but this does not change the requirement to use combustion analysis to calibrate and validate sensor models.

(b) take into account any recommendations in the Supplement; and

(c) meet any requirements included in the Supplement.

Division 3—Additionality

21 Newness requirement

For subparagraph 27(4A)(a)(ii) of the Act, a requirement in lieu of the newness requirement for a soil carbon project is that the project complies with subparagraph 27(4A)(a)(i) of the Act, disregarding the preparation of any land management strategy before the eligible management activity commences.

Part 4—Net abatement amount

Division 1—Preliminary

22 Operation of this Part

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

23 Overview of gases accounted for in abatement calculations

The following table provides an overview of the emissions sources and carbon pools, and the associated greenhouse gases, that are relevant to working out the net abatement amount for a soil carbon project.

Overview of gases accounted for in abatement calculations

Item	Relevant carbon pool or emission source		Greenhouse gas
1	Carbon pool	Soil	Organic carbon (C)
2	Emissions source	Livestock	Methane (CH_4) Nitrous oxide (N_2O)
3	Emissions source	Synthetic fertiliser	Nitrous oxide (N_2O) Carbon dioxide (CO_2)
4	Emissions source	Lime	Carbon dioxide (CO_2)
5	Emissions source	Tillage events	Nitrous oxide (N_2O) Carbon dioxide (CO_2) Methane (CH_4)
6	Emissions source	Soil landscape modification activities	Nitrous oxide (N_2O) Carbon dioxide (CO_2) Methane (CH_4)
7	Emissions source	Residues	Nitrous oxide (N_2O) Carbon dioxide (CO_2) Methane (CH_4)
8	Emissions source	Irrigation energy	Nitrous oxide (N_2O) Carbon dioxide (CO_2) Methane (CH_4)

Division 2—Calculation of net abatement amount—general

24 Overview

This section sets out an overview of the method specified in this Part.

This determination accounts for carbon abatement from undertaking eligible management activities in accordance with this determination, crediting abatement from the carbon dioxide that is removed from the atmosphere and sequestered in soils.

A project covered by this determination is a sequestration offsets project, and is therefore subject to the obligations under the Act that relate to the permanence obligation period.

The net abatement amount in relation to a reporting period, for a soil carbon project under this determination, is given by the change in soil organic carbon in the CEAs that make up the project area between reporting periods, less an adjustment for when:

- project emissions in the project area during the reporting period exceed average project emissions levels during the baseline period; and

- this is not offset by previous reporting periods where project emissions were lower than average project emissions levels during the baseline period.

The calculation of the change in soil organic carbon levels is done in accordance with Schedule 1. The calculation of project emissions in the baseline period and reporting period is done in accordance with Schedule 2.

If the project has 2 or more project areas, the net abatement amount is calculated separately for each project area and added together.

25 The net abatement amount, *A*

For paragraph 106(1)(c) of the Act, the net abatement amount for a reporting period, ***A***, is given by the following equation:

$$A = \sum_{PA} A_{PA} \qquad \text{equation 1}$$

where:

A_{PA} is the net abatement amount for the reporting period of each project area *PA* included in the project, in tonnes of CO_2-*e*, given by equation 2.

26 The net abatement amount for a project area, A_{pa}

(1) For equation 1, A_{PA} is worked out using the following equation:

$$A_{PA} = \Delta CO_2e_{60\ PA\ (RP)} - EA_{PA} \qquad \text{equation 2}$$

where:

$\Delta \boldsymbol{CO_2e_{60\ PA\ (RP)}}$ is the creditable change in soil organic carbon associated with a 60% probability of exceedance for a reporting period *RP*, in tonnes of CO_2-*e*, given by Division 4 of Schedule 1.

$\boldsymbol{EA_{PA}}$ is the emissions adjustment for the project area and reporting period that is:

(a) if $\Delta Eall_{RP,PA}$ given by equation 77 in Schedule 2 is less than or equal to 0—0;

(b) if $\Delta Eall_{RP,PA}$ given by equation 77 in Schedule 2 is less than or equal to any value for $PEB_{PA,RP-1}$ given by section 27 for the previous reporting period *RP-1*—0;

(c) otherwise—given by equation 3.

Note: See also section 39 which may adjust the value of A_{PA} to 0 if parameters are not monitored.

(2) For paragraph (c) of the definition of EA_{PA} in equation 2, EA_{PA} is worked out using the following equation:

$$EA_{PA} = \Delta Eall_{RP,PA} - PEB_{PA,RP-1} \qquad \text{equation 3}$$

where:

$\Delta \boldsymbol{Eall_{RP,PA}}$ is the difference between the emissions in the current reporting period *RP* and the baseline period, in tonnes of CO_2-*e*, given by equation 77 in Schedule 2.

$\boldsymbol{PEB_{PA,RP-1}}$ is project emissions buffer (if any) for the project area and previous reporting period *RP-1*, in tonnes of CO_2-*e*, given by section 27 for the previous reporting period.

27 The project emissions buffer for a project area for a reporting period

(1) The project emissions buffer (the $\boldsymbol{PEB_{PA,RP}}$) for each project area at the end of each reporting period must be calculated after the net abatement amount for the reporting period has been calculated.

(2) If $\Delta Eall_{RP,PA}$ given by equation 77 in Schedule 2 is less than or equal to 0, $PEB_{PA,RP}$ is given by the following equation:

$$PEB_{PA,RP} = PEB_{PA,RP-1} - \Delta Eall_{RP,PA} \qquad \text{equation 4}$$

where:

$\boldsymbol{PEB_{PA,RP-1}}$ is project emissions buffer (if any) for the project area and previous reporting period *RP-1*, in tonnes of CO_2-*e*, given by this section for the previous reporting period.

$\boldsymbol{\Delta Eall_{RP,PA}}$ is the difference between the emissions in the current reporting period *RP* and the baseline period, in tonnes of CO_2-*e*, given by equation 77 in Schedule 2 .

(3) If $\Delta Eall_{RP,PA}$ given by equation 77 in Schedule 2 is greater than zero and less than any value for $PEB_{PA,RP-1}$ given by this section for the previous reporting period, the project emissions buffer $PEB_{PA,RP}$ is given by the following equation:

$$PEB_{PA,RP} = PEB_{PA,RP-1} - \Delta Eall_{RP,PA} \qquad \text{equation 5}$$

where:

$\boldsymbol{PEB_{PA,RP-1}}$ is project emissions buffer (if any) for the project area and previous reporting period *RP-1*, in tonnes of CO_2-*e*, given by this section for the previous reporting period.

$\boldsymbol{\Delta Eall_{RP,PA}}$ is the difference between the emissions in the current reporting period *RP* and the baseline period, in tonnes of CO_2-*e*, given by equation 77 in Schedule 2.

(4) If $\Delta Eall_{RP,PA}$ given by equation 77 in Schedule 2 is greater than or equal to any value for $PEB_{PA,RP-1}$ given by this section for the previous reporting period, the project emissions buffer $PEB_{PA,RP}$ is 0.

Part 5—Reporting, record-keeping, notification and monitoring requirements

Division 1—Offsets report requirements

28 Operation of this Division

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

Note: Other reporting requirements are set out in rules made under the Act.

29 Information that must be included in offsets reports

(1) Each offsets report must include the following for the project:

(a) copies of the land management strategies applicable to the project during the reporting period;

(b) a description of the land management activities undertaken during the reporting period including an explanation of:

(i) how eligible management activities have been undertaken in each CEA during the reporting period; and

(ii) the extent to which the land management activities undertaken have implemented the relevant land management strategies;

(c) the number of sampling rounds conducted during the reporting period for the CEAs included in the report;

(d) for each sampling round conducted in relation to a CEA included in the report from the declaration of the project until the end of the reporting period:

(i) the start and end date of that sampling round; and

(ii) the median date of the sampling round (within the meaning of section 31 of Schedule 1);

(e) in respect of each sampling round conducted during the reporting period:

(i) any spatial data files required to be created by the Supplement;

(ii) the accuracy of the GPS used to locate and record the location for each core collected;

(iii) the approach used to relocate a core location when an obstacle obstructs the intended core location;

(iv) an explanation of how the core points were randomly located;

(v) the diameter of the inner cutting edge of the coring device used for the sample;

(vi) the depth of the samples;

(vii) if a sample is not a composite sample—the latitude and longitude of the location of each sample;

(viii) if a sample is a composite sample—the latitude and longitude of the location of each soil core sourced for the sample;

(ix) the laboratory used for the analysis of each sample;

(x) the carbon content (as a percent of oven dry mass) of each sample analysed;

(f) the result of the following equations for the reporting period:

(i) the creditable change in soil carbon over the reporting period ($\Delta CO_2e_{60\,PA\,(RP)}$ from equation 30 or 43 in Schedule 1);

(ii) if a sampling depth of greater than 30 centimetres is used—the creditable change in soil carbon over the reporting period based upon only the first 30 centimetres of the sample ($\Delta CO_2e_{60\ PA\ (RP)}$ from equation 30 or 43 in Schedule 1 calculated on the basis of the 0-30 cm layer);

(iii) average annual emissions in the baseline emissions period from all sources – ($\bar{E}_{all_{BP,PA}}$ from equation 44 in Schedule 2);

(iv) average annual emissions in the reporting period from all sources ($\bar{E}all_{RP,PA}$ from equation 62 in Schedule 2);

(v) total change in emissions from all sources in the reporting period compared to baseline emissions period ($\Delta Eall_{RP,PA}$ from equation 77 in Schedule 2);

(g) if activities are undertaken in a reporting period that were restricted under section 12—evidence that those requirements were met;

(h) if the Supplement requires a matter to be documented—that matter;

(i) a written statement from the project proponent verifying that the activities, or sampling or calculation approaches, have not been undertaken which could be reasonably expected to result in the crediting of non-genuine carbon abatement;

(j) a written statement from the person, or persons, responsible for carrying out the sampling round verifying that:

(i) the sample collection and preparation was undertaken in accordance with this determination and the requirements of the Supplement; and

(ii) the sampling was not conducted in a manner, or at a time, that was likely to overestimate any increase in soil carbon in each carbon estimation area.

(2) If an offsets report is the first report after the declaration of the offsets project, it must include:

(a) the date the eligible management activities started in each CEA; and

(b) a description of all land management activities undertaken during the baseline period in each CEA, including the timing and duration of each activity.

(3) If an offsets report is the first report after an area was included in the project area for the project, it must include:

(a) the date the eligible management activities started in each CEA relating to the area added to the project; and

(b) a description of all management undertaken during the baseline period in each CEA relating to the area added to the project, including the timing and duration of each activity.

Division 2—Notification requirements

30 Operation of this Division

For paragraph 106(3)(b) of the Act, this Division sets out requirements to notify one or more matters relating to the project to the Regulator for a soil carbon project that is an eligible offsets project during the permanence obligation period for the project.

Note: Other notification requirements are set out in rules made under the Act.

31 Notification requirements

(1) The project proponent must notify the Regulator within 60 days of becoming aware that an activity contrary to section 11 or 12 is conducted in the area of a CEA.

(2) If a land management strategy for the project changes, the project proponent must, within 60 days, notify the Regulator of the change and provide a copy of the new strategy.

(3) If the land management activities on land that is included in a CEA changes materially after the end of the first reporting period for the project, the project proponent must, within 60 days, notify the Regulator of:
  (a) the nature of the changes; and
  (b) whether the changes are likely to materially impact the sequestration of carbon in the project area.

(4) Before the start each sampling round, the project proponent must notify the Regulator of the intended latitude and longitude of each sample to be taken.

Division 3—Record-keeping requirements

32 Operation of this Division

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

Note: Other record-keeping requirements are set out in rules made under the Act.

33 Record-keeping requirements

The project proponent must keep records of the following:
  (a) each land management strategy prepared for the project;
    Note: This includes the initial land management strategy and all subsequent revised strategies.
  (b) the identity, relevant experience and qualifications of all independent persons involved in:
    (i) the creation of the land management strategies under section 13; or
    (ii) soil sampling under section 19;
  (c) material and evidence used in the preparation of a land management strategy;
  (d) material and evidence supporting any eligible management activities;
  (e) the results of any testing undertaken as part of the project;
  (f) material to demonstrate that each eligible management action nominated for a carbon estimation area has been carried out;
  (g) each input and calculation used to determine the net abatement amount for the project;
  (h) records which demonstrate that the requirements of this determination and Supplement have been met;
  (i) anything which is specified in a land management strategy for the project under paragraph 13(1)(f);
  (j) if activities restricted by section 12 are conducted—evidence that the requirements of section 12 have been met;
  (k) if a project proponent changes an eligible management activity or other land management activity from the land management strategy—the information and evidence of the change.

Division 4—Monitoring requirements

34 Operation of this Division

For paragraph 106(3)(d) of the Act, this Division sets out:

(a) monitoring requirements for a soil carbon project that is an eligible offsets project; and

Note: Other monitoring requirements are set out in rules made under the Act.

(b) certain consequences if the project proponent fails to monitor the project as required.

35 Monitoring requirements

The project proponent for a soil carbon project must comply with the monitoring requirements set out in the following table in accordance with the instructions given in the table.

Monitoring requirements

Item	Parameter	Description	Units	Instructions
1	$Q_{LS_{gijk},B,PA}$ (see schedule 2, equation 46)	Number of animals in livestock group *gijk* within the CEAs and emissions accounting areas of each project area in each year (*B*) of the baseline period.	Livestock head	Determined in accordance with section 36.
2	$D_{gijk,B,PA}$ (see schedule 2, equation 46)	Period (in days) in year *B* of the baseline period that livestock group *gijk* was within the CEAs and emissions accounting areas of each project area.	Days	Determined in accordance with section 36.
3	$Q_{LS_{gijk},RP,PA}$ (see schedule 2, equation 64)	Number of animals in livestock group *gijk* that were within the CEAs and emissions accounting areas of each project area.	Livestock head	Determined in accordance with section 36.
4	$AU_{Y,PA}$ (see schedule 2, equation 47)	Stocking rate of the CEAs and emissions accounting areas of each project area for the first year Y of the project.	Animal units	Determined consistently with section 36 for the first year of the project.
5	$G_{SF_{fij},RP,PA}$ (see schedule 2, equation 66)	quantity of synthetic fertiliser group *fij* applied to the CEAs and emissions accounting areas of each project area.	t fertiliser	Evidenced by invoices, contractual arrangements or sales records.
6	$U_{RP,PA}$ (see schedule 2, equation 65)	Quantity of urea applied to the CEAs and emissions accounting areas of each project area.	t urea	Evidenced by invoices, contractual arrangements or sales records.
7	$L_{l,RP,PA}$ (see schedule 2, equation 68)	Quantity of lime type *l* applied in the CEAs and emissions accounting areas of each project area.	t	Evidenced by invoices, contractual arrangements or sales records.
8	$VQ_{v,RP,PA}$ (see schedule 2, equation 72)	Quantity of harvested crop by crop type *v* in the reporting period in the CEAs and emissions accounting areas of each project area.	t of crop	Evidenced by invoices, contractual arrangements or other industry standard practices.

Monitoring requirements				
Item	**Parameter**	**Description**	**Units**	**Instructions**
9	$RF_{v,RP,PA}$ (see schedule 2, equation 72)	Fraction of crop residue from crop type *v* that was removed from the CEAs and emissions accounting areas of each project area.	Decimal	Evidenced by industry standard practices, such as cover rating assessments.
10	$Area\text{-}T_{RP,PA}$ (see schedule 2, equation 70)	Tilled area for pasture establishment or renovation in the CEAs and emissions accounting areas of each project area.	ha	Using mapping approach under the Supplement.
11	$Q_{I,RP,PA}$ (see schedule 2, equation 75)	Quantity of fuel used to irrigate the CEAs and emissions accounting areas of each project area.	kL	Evidenced by invoices or contractual arrangements and apportioned based on hectares of the carbon estimation area irrigated as a fraction of the total hectares of land irrigated and the fuel used to run all pumps on that land
12	$Q_{IP,RP,PA}$ (see schedule 2, equation 76)	Quantity of electricity used to irrigate the CEAs and emissions accounting areas of each project area.	kWh or GJ	Evidenced by invoices or contractual arrangements and apportioned based on hectares of the carbon estimation area irrigated as a fraction of the total hectares of land irrigated and the fuel used to run all pumps on that land. Where electricity purchased is measured in gigajoules, the quantity of kWh must be calculated by dividing the amount of GJ by 0.0036.
13	Q_F (see schedule 2, equation 70)	Quantity of fuel used to carry out soil landscape modiciation activities in the CEAs and emissions accounting areas of each project area.	kL	Evidenced by invoices or contractual arrangements.
14	$Q_{B,PA}$ (see schedule 1, equations 29 and 42)	Quantity of carbon in biochar (if known), or the quantity of biochar, applied in a CEA.	t	Evidenced by invoices, contractual arrangements or sales records. The carbon content should be evidenced by appropriate documentation, such as product labels, specifications or laboratory reports.

Note: As emissions under Schedule 2 are calculated with reference to the CEAs and emissions accounting areas within a project area (see section 3 of Schedule 2), any emissions in exclusion areas do not need to be monitored.

36 Project monitoring—livestock

(1) Subject to section 37, for the baseline period and the crediting period, the project proponent must determine the following parameters at least once a year:
   (a) the number of animals within each project area, according to species, state/region and livestock class;
   (b) the number of days, according to season, that the animals are on the CEA within a year.

(2) For the purposes of determining the number of animals in each livestock class, the date of birth of each animal is deemed to be the first day of summer.

(3) For the purposes of this section, data collection:
   (a) may include the use of log books, farm gate records, or similar methods; and
   (b) must be sufficiently accurate to capture stock movements according to group characteristics, by day and by season.

37 Project monitoring—assumed baseline for livestock

(1) If the project proponent is unable to access records to apply section 36 to the baseline period, the section must be used to calculate an assumed average annual baseline emissions number for livestock emissions $\bar{E}_{LS,BP,PA}$ for section 6 of Schedule 2.

(2) An assessment of carrying capacity for the relevant project area must be obtained from the relevant government body.

(3) The carrying capacity must:
   (a) be expressed as a total number of animal units; and
   (b) have regard to any available property-specific data; and
   (c) be based on:
      (i) the recommended pasture utilisation rate for the relevant district; and
      (ii) an assessment that the carrying capacity is sustainable over a minimum of 10 years; and
      (iii) the assumption that annual rainfall will be at the 10 year average for that district.

(4) An auditable description of the process that was used to calculate the carrying capacity of the relevant carbon estimation area must be obtained from the relevant government body.

38 Project monitoring—land management strategy

(1) The project proponent must monitor the implementation of the land management strategy in the project area.

(2) If a land management strategy specifies additional steps to monitor a project in accordance with paragraph 13(1)(d), those requirements must be met.

39 Consequences of not meeting requirement to monitor certain parameters

(1) If, during a particular period in a reporting period, a project proponent for a soil carbon project fails to monitor a parameter as required by the monitoring requirements for a project area, the value of A_{PA} in equation 2 for that reporting period is taken to be 0.

(2) Subsection (1) does not apply if the Regulator determines that:
   (a) either:

(i) the failure to monitor the parameter is likely to have only a minor or trivial impact on the value of A_{PA}; or

(ii) alternative means have been applied to calculate a conservative estimate of the parameter; and

(b) the project proponent is taking steps to monitor the parameter consistently with the monitoring requirements in subsequent reporting periods.

(3) To avoid doubt, this determination does not prevent the Regulator from taking action under the Act, or regulations or rules made under the Act, in relation to the project proponent's failure to monitor a parameter as required by the determination.

Note: Examples of action that may be taken include the following:

(a) if the failure constitutes a breach of a civil penalty provision in section 194 of the Act (which deals with project monitoring requirements), the Regulator may apply for a civil penalty order in respect of the breach;

(b) if false or misleading information was given to the Regulator in relation to the failure, the Regulator may revoke the project's section 27 declaration under regulations or rules made for the purposes of section 38 of the Act;

(c) if the giving of false or misleading information in relation to the failure led to the issue of Australian carbon credit units, the Regulator may require all or some of those units to be relinquished under section 88 of the Act.

Part 6—Partial reporting

40 Partial reporting

For section 77A of the Act, the division of the overall project must not result in the division of a project area.

Schedule 1—Calculation of Soil Organic Carbon

Division 1—Preliminary

1 Simplified outline of this Schedule

This Schedule provides for the calculation of the change in soil organic carbon between reporting periods.

To determine this amount, in tonnes of CO_2-*e*:

- samples of soil need to be collected and analysed consistent with the requirements of this determination and the Supplement;

- the soil organic carbon stock in a sample needs to be calculated in accordance with Division 2;

- the soil organic carbon stock and variance in a CEA needs to be calculated in accordance with Division 3;

- the change in soil organic carbon stock between the baseline and first sampling round needs to be calculated in accordance with Subdivision 2 of Division 4;

- the change in soil organic carbon stock once three rounds of sampling have been completed needs to be calculated in accordance with Subdivision 3 of Division 4.

The sampling, analysis and calculations in this Schedule need to be done separately for the upper soil layer (first 30 centimetres) and the deeper layer of soil. The net abatement amount will be calculated based on the full sampling depth, but data on the upper soil layer will be included in offsets reporting to help Australia report its removals of greenhouse gases in its National Inventory Report.

2 Definitions

In this Schedule:

$\Delta \boldsymbol{CO_2e_{60\,PA\,(RP)}}$—see subsection 20(1) of this Schedule.

0–30 cm layer—see subsection 4(2) of this Schedule.

0–x cm layer—see paragraph 4(3)(b) of this Schedule.

30–x cm layer—see paragraph 4(3)(a) of this Schedule.

ESM—see section 6 of this Schedule.

sample—see section 3 of this Schedule.

$\boldsymbol{SOC_{CEA}}$—see paragraph 8(1)(a) of this Schedule.

SOC stock—see subsection 4(1) of this Schedule.

$\boldsymbol{V(SOC_{CEA})}$—see paragraph 8(1)(b) of this Schedule.

3 What is a sample?

(1) In this Schedule a ***sample*** may be:

(a) an individual sample taken from a particular location; or

(b) a composite sample which combines samples taken from a number of locations consistent with any requirements in the Supplement into a single sample under this Schedule.

(2) All samples must be obtained and analysed consistent with the requirements in Division 2 of Part 3 of this determination.

Division 2—Calculating the soil organic carbon stock in a sample

4 Steps for calculating the soil organic carbon stock in a sample

(1) The soil organic carbon stock of sample *i* (***SOC***$_i$), in tonnes of soil organic carbon per hectare, must be calculated for each sample taken in a sampling round in accordance with this Division.

(2) The Division must first be applied to the upper layer of soil in each sample, which extends from the surface soil to a depth of 30 centimetres (the ***0–30 cm layer***).

(3) If samples are taken at a depth of greater than 30 centimetres:

(a) the deeper layer of soil in each sample (from a depth of 30 centimetres to the nominated sampling depth) (the ***30–x cm layer***) must be analysed separately: and

(b) the results of the analysis of the 0–30 cm layer and the 30–x cm layer must be added together or combined to apply this Division to the whole sample (***0–x cm layer***) in accordance with any requirements in the Supplement.

Note: The addition or combining of the results in accordance with the Supplement may include requirements for weighting or adjustments to ensure that they are applicable to the equations and overall carbon stock of the sample.

5 Soil mass of each sample

(1) Calculate the mass of the soil, M_i, in each sample *i* for the 0-30 cm layer or 0-x cm layer (in tonnes of soil per hectare) using the following equation:

$$M_i = M_a \times \frac{t_n}{t_a} \qquad \text{equation 6}$$

where:

$\boldsymbol{M_a}$ is the mass of the soil in the sample layer for sample *i*, in tonnes of soil per hectare, calculated in accordance with any requirements in the Supplement.

Note: This is based on the actual sample thickness.

$\boldsymbol{t_n}$ is the nominated thickness of the sample layer for sample *i*, either 30 or x centimetres.

$\boldsymbol{t_a}$ is the actual thickness of the sample layer for sample *i*, in centimetres.

Note: See subsection (3) for composite samples.

(2) The actual thickness t_a of a composite sample is the average thickness of the layer across all samples that make up the composite sample.

6 Determining Equivalent Soil Mass (ESM) from sampling round masses

(1) The equivalent soil mass (the ***ESM***), in tonnes per hectare, for each CEA must be calculated in accordance with this section.

(2) The corrected soil masses M_i from equation 6 must be:
  (a) ranked from lowest to highest for each CEA; and
  (b) assigned a sequential rank *k* from 1 to the number of samples in the CEA *N*.

(3) A percentile *P* must be calculated for each value of *k* using the following equation:

$$P = 100 \times \frac{(k-1)}{(N-1)} \qquad \text{equation 7}$$

(4) If one of the percentiles given by equation 7 is 10—the *ESM* for the CEA is the mass of the soil layer given by equation 6 for the relevant rank of *k*.

(5) If subsection (4) does not apply—the *ESM* for each CEA is given by the following equation:

$$ESM = M_{LB} + (M_{UB} - M_{LB}) \times \left(\frac{10 - P_{LB}}{P_{UB} - P_{LB}}\right) \qquad \text{equation 8}$$

where:

$\boldsymbol{M_{LB}}$ is the corrected soil mass M_i of the sample *i*, which has been assigned the lower bound rank *LB* as having the value of *P* from equation 7 closest to and lower than 10, in tonnes of soil per hectare, as given by equation 6.

$\boldsymbol{M_{UB}}$ is the corrected soil mass M_i of the sample *i,* which has been assigned the upper bound rank *UB* as having the value of *P* from equation 7 closest to and higher than 10, in tonnes of soil per hectare, as given by equation 6.

$\boldsymbol{P_{LB}}$ is the percentile *P* associated with the lower bound rank *LB* given by equation 7.

$\boldsymbol{P_{UB}}$ is the percentile *P* associated with the upper bound rank *UB* given by equation 7.

7 Calculation of SOC stock in each sample

(1) If carbon analysis is undertaken on a homogenised sample as outlined in the Supplement—the SOC_i for each sample *i*, in tonnes of carbon per hectare, is given by the following equation:

$$SOC_i = ESM \times \frac{OC_i}{M_i} \times (1 - gG_i) \times \frac{1}{100} \times \frac{t_a}{t_n} \qquad \text{equation 9}$$

where:

ESM is determined in accordance with section 6 of this Schedule for the CEA to which the sample belongs, in tonnes per hectare.

$\boldsymbol{OC_i}$ is the total mass of organic carbon in the sample layer of sample *i*, in grams, determined in accordance with any requirements in Supplement.

gG_i is the total mass of gravel content of the sample layer of the sample *i*, in grams, determined in accordance with any requirements in Supplement.

t_a is the actual thickness of the sample layer for sample *i*, in centimetres.

Note: See subsection (3) for composite samples.

t_n is the nominated thickness of the sample layer for sample *i*, either 30 or x centimetres.

(2) If carbon analysis is undertaken on an intact core as outlined in the Supplement—the SOC_i for each sample *i*, in tonnes of carbon per hectare, is given by the following equation:

$$SOC_i = ESM \times \frac{OC_i}{M_i} \times \frac{1}{100} \times \frac{t_a}{t_n} \qquad \text{equation 10}$$

where:

ESM is determined in accordance with section 6 of this Schedule for the CEA to which the sample belongs, in tonnes per hectare.

OC_i is the total mass of organic carbon in the sample layer of sample *i*, in grams, determined in accordance with any requirements in Supplement.

t_a is the actual thickness of the sample layer for sample *i*, in centimetres.

Note: See subsection (3) for composite samples.

t_n is the nominated thickness of the sample layer for sample *i*, either 30 or x centimetres.

Note: Carbon analysis on intact cores is undertaken using spectroscopy.

(3) The actual thickness t_a for a composite sample is the average thickness of the layer across all samples that make up the composite sample.

Division 3—Calculating the soil organic carbon stock and variance for a CEA

Subdivision 1—Purpose of this Division

8 Calculating the soil organic carbon stock for a CEA and sampling variance

(1) The following parameters must be calculated in accordance with Subdivision 2 or 3 for each sampling round:

(a) the soil organic carbon stock in a CEA (the SOC_{CEA}), in tonnes of soil organic carbon per CEA, for each sampling round;

(b) the sampling variance of the SOC_{CEA} for the CEA (the $V(SOC_{CEA})$), in tonnes of carbon per CEA squared.

(2) The relevant Subdivision must first be applied to the 0–30 cm layer**.**

(3) If samples are taken at a depth of greater than 30 centimetres:

(a) the 30–x cm layer must be analysed separately: and

(b) the results of the analysis of the 0–30 cm layer and the 30–x cm layer must be added together or combined to apply the relevant Subdivision to the 0–x cm layer in accordance with any requirements in the Supplement.

Note: The addition or combining of the results in accordance with the Supplement may include requirements for weighting or adjustments to ensure that they are applicable to the equations and overall carbon stock of the sample.

Subdivision 2—Where both compositing of cores across strata and equal area stratification are used

9 Application of this Subdivision

This subdivision applies to sampling which involves:

(a) compositing of cores across strata for carbon analysis; and

(b) strata which are equal in area across a CEA.

Note: For other sampling designs—see Subdivision 3. Because of these requirements all samples in this Subdivision are composite samples.

10 Soil organic carbon stock for a CEA

Calculate the soil organic carbon stock for a CEA for each sample *i* (the $\boldsymbol{SOC_{CEAi}}$), in tonnes of soil organic carbon per CEA, using the following equation:

$$SOC_{CEA_i} = SOC_i \times A_{CEA} \qquad \text{equation 11}$$

where:

$\boldsymbol{SOC_i}$ is SOC_i for each sample *i*, in tonnes of carbon per hectare, given by equation 9 or 10.

$\boldsymbol{A_{CEA}}$ is the area of the CEA, in hectares.

11 Total soil organic carbon stock for a CEA

The SOC_{CEA}, in tonnes of carbon per CEA, is given by the following equation:

$$SOC_{CEA} = \frac{\sum_{i=1}^{n} SOC_{CEA_i}}{n} \qquad \text{equation 12}$$

where:

$\boldsymbol{SOC_{CEAi}}$ is the SOC_{CEAi} for each sample *i*, in tonnes of carbon per CEA, given by equation 11.

n is the number of samples for the CEA.

12 Sampling variance of the soil organic carbon stock for a CEA

(1) If carbon analysis is undertaken on a homogenised sample as outlined in the Supplement—the $V(SOC_{CEA})$, in tonnes of carbon per CEA squared, is given by the following equation:

$$V(SOC_{CEA}) = \frac{\sum_{i=1}^{n_{CEA}} (SOC_{CEA_i} - SOC_{CEA})^2}{n_{SOC}(n_{SOC} - 1)} \qquad \text{equation 13}$$

where:

$\boldsymbol{SOC_{CEAi}}$ is the SOC_{CEAi} for each sample *i*, in tonnes of carbon per CEA, given by equation 11.

$\boldsymbol{SOC_{CEA}}$ is the SOC_{CEA}, in tonnes of carbon per CEA, given by equation 12.

$\boldsymbol{n_{SOC}}$ is the number of samples analysed for SOC in the CEA.

(2) If carbon analysis is undertaken on an intact core as outlined in the Supplement—the $V(SOC_{CEA})$, in tonnes of carbon per CEA squared, is given by the following equation:

$$V(SOC_{CEA}) = \frac{\sum_{i=1}^{n_{CEA}}(SOC_{CEA_i} - SOC_{CEA})^2}{n_{SOC}(n_{SOC} - 1)} + \frac{\sum_{i=1}^{n_{gG}}(gG_{CEA_i} - gG_{CEA})^2}{n_{gG}(n_{gG} - 1)} \quad \text{equation 14}$$

where:

$\boldsymbol{SOC_{CEAi}}$ is the SOC_{CEAi} for each sample *i*, in tonnes of carbon per CEA, given by equation 11.

$\boldsymbol{SOC_{CEA}}$ is the SOC_{CEA}, in tonnes of carbon per CEA, given by equation 12.

$\boldsymbol{n_{SOC}}$ is the number of samples analysed for SOC in the CEA.

$\boldsymbol{gG_{CEA_i}}$ *is* the total mass of gravel for a CEA calculated using the mass of gravel in a single sample *i*, in tonnes, and determined in accordance with any requirements in Supplement.

$\boldsymbol{gG_{CEA}}$ is the mass of gravel across the CEA based on the average gravel mass of all samples from the CEA, in tonnes of gravel per CEA, determined in accordance with any requirements of the Supplement.

$\boldsymbol{n_{gG}}$ is the number of samples analysed for gravel in the CEA.

Note: Carbon analysis on intact cores is undertaken using spectroscopy.

Subdivision 3—In all circumstances other than when compositing of cores is used in equal area strata

13 Application of this Subdivision

This subdivision applies to sampling which:

(a) involves either:
  (i) compositing of cores within strata for carbon analysis; or
  (ii) analysis of a single core; and
(b) comprises strata which are equal or unequal in area across a CEA; and
(c) is not covered by Subdivision 2.

14 Average soil organic carbon stock for a stratum

Calculate the average soil organic carbon stock for each stratum *h* (the $\boldsymbol{\overline{SOC}_h}$), in tonnes of soil organic carbon per hectare, using the following equation:

$$\overline{SOC}_h = \frac{\sum_{i=1}^{n} SOC_i}{n}$$ equation 15

where:

$\boldsymbol{SOC_i}$ is the SOC_i for each sample *i* from stratum *h*, in tonnes of carbon per hectare, given by equation 9 or 10.

$\boldsymbol{n}$ is the number of samples from the stratum *h*.

15 Sampling variance of the soil organic carbon stock for a stratum

Calculate the sampling variance of the average soil organic carbon for each stratum *h* (the $\boldsymbol{V(\overline{SOC}_h)}$), in tonnes of carbon per stratum squared, using the following equation:

$$V(\overline{SOC}_h) = \frac{\sum_{i=1}^{n}(SOC_i - \overline{SOC}_h)^2}{n(n-1)}$$ equation 16

where:

$\boldsymbol{SOC_i}$ is the SOC_i for each sample *i* from stratum *h*, in tonnes of carbon per hectare, given by equation 9 or 10.

$\boldsymbol{\overline{SOC}_h}$ is the average soil organic carbon stock in each stratum *h*, in tonnes of soil organic carbon per hectare, given by equation 15.

$\boldsymbol{n}$ is the number of samples for stratum *h*.

16 Average total soil organic carbon stock for a CEA

Calculate the average soil organic carbon stock for each CEA (the $\boldsymbol{\overline{SOC}_{CEA}}$), in tonnes of carbon per hectare, using the following equation:

$$\overline{SOC}_{CEA} = \sum_{h=1}^{H}(a_h \times \overline{SOC}_h)$$ equation 17

where:

$\boldsymbol{a_h}$ is the relative area of the CEA covered by the stratum, as a percentage.

$\boldsymbol{\overline{SOC}_h}$ is the average soil organic carbon stock in each stratum *h*, in tonnes of soil organic carbon per hectare, given by equation 15.

$\boldsymbol{H}$ is the number of strata for the CEA.

17 Sampling variance of the average soil organic carbon stock for a CEA

Calculate the sampling variance of the average soil organic carbon for each CEA (the $\boldsymbol{V(\overline{SOC}_{CEA})}$), in tonnes of carbon per CEA squared, using the following equation:

$$V(\overline{SOC}_{CEA}) = \sum_{h=1}^{H} \left({a_h}^2 \times V(\overline{SOC}_h) \right)$$ equation 18

where:

$\boldsymbol{H}$ is the number of strata for the CEA.

$\boldsymbol{a_h}$ is the relative area of the CEA covered by the stratum, as a percentage.

$\boldsymbol{V(\overline{SOC}_h)}$ is the sampling variance of the average soil organic carbon for each stratum *h*, in tonnes of carbon per CEA squared, given by equation 16.

18 Soil organic carbon stock for a CEA

(1) If carbon analysis is undertaken on a homogenised sample as outlined in the Supplement—the SOC_{CEA}, in tonnes of soil organic carbon per CEA, is given by the following equation:

$$SOC_{CEA} = \overline{SOC}_{CEA} \times A_{CEA}$$ equation 19

where:

$\boldsymbol{\overline{SOC}_{CEA}}$ is the average soil organic carbon stock for a CEA, in tonnes of carbon per hectare, given by equation 17.

$\boldsymbol{A_{CEA}}$ is the area of the CEA, in hectares.

(2) If carbon analysis is undertaken on an intact core as outlined in the Supplement—SOC_{CEA}, in tonnes of soil organic carbon per CEA, is given by the following equation:

$$SOC_{CEA} = \overline{SOC}_{CEA} \times A_{CEA} \times \left(\frac{ESM \times A_{CEA} - gG_{CEA}}{ESM \times A_{CEA}} \right)$$ equation 20

where:

$\boldsymbol{\overline{SOC}_{CEA}}$ is the average soil organic carbon stock for a CEA, in tonnes of carbon per hectare, given by equation 17.

$\boldsymbol{A_{CEA}}$ is the area of the CEA, in hectares.

$\boldsymbol{ESM}$ is the equivalent soil mass, in tonnes per hectare, for the CEA determined in accordance with section 6 of this Schedule.

$\boldsymbol{gG_{CEA}}$ is the mass of gravel across the CEA based on the average gravel mass of all samples from the CEA, in tonnes of gravel per CEA, determined in accordance with any requirements of the Supplement.

Note: Carbon analysis on intact cores is undertaken using spectroscopy.

19 Sampling variance of the soil organic carbon stock for a CEA

(1) If carbon analysis is undertaken on a homogenised sample as outlined in the Supplement—the $V(SOC_{CEA})$, in tonnes of carbon per CEA squared, is given by the following equation:

$$V(SOC_{CEA}) = {A_{CEA}}^2 \times V(\overline{SOC}_{CEA}) \qquad \text{equation 21}$$

where:

$\boldsymbol{A_{CEA}}$ is the area of the CEA, in hectares.

$\boldsymbol{V(\overline{SOC}_{CEA})}$ is the sampling variance of the soil organic carbon in each CEA, in tonnes of carbon per CEA squared, given by equation 18.

(2) If carbon analysis is undertaken on an intact core as outlined in the Supplement—the $V(SOC_{CEA})$, in tonnes of carbon per CEA squared, is given by the following equation:

$$V(SOC_{CEA}) = \left({A_{CEA}}^2 \times V(\overline{SOC}_{CEA})\right) + \frac{\sum_{i=1}^{n}(gG_{CEA_i} - gG_{CEA})^2}{n(n-1)} \qquad \text{equation 21A}$$

where:

$\boldsymbol{A_{CEA}}$ is the area of the CEA, in hectares.

$\boldsymbol{V(\overline{SOC}_{CEA})}$ is the sampling variance of the soil organic carbon in each CEA, in tonnes of carbon per CEA squared, given by equation 18.

$\boldsymbol{gG_{CEA_i}}$ *is* the total mass of gravel for a CEA calculated using the mass of gravel in a single sample *i*, in tonnes, and determined in accordance with any requirements in Supplement.

$\boldsymbol{gG_{CEA}}$ is the mass of gravel across the CEA based on the average gravel mass of all samples from the CEA, in tonnes of gravel per CEA, determined in accordance with any requirements of the Supplement.

$\boldsymbol{n}$ is the number of samples analysed for gravel in the CEA.

Note: Carbon analysis on intact cores is undertaken using spectroscopy.

Division 4—Calculating the creditable change in soil organic carbon stock

Subdivision 1—Purpose of this Division

20 Calculating the creditable change in soil organic carbon stock in a project area for a reporting period

(1) The creditable change in soil organic carbon in a project area associated with a 60% probability of exceedance for a reporting period (the $\boldsymbol{\Delta CO_2e_{60\ PA\ (Rc)}}$), in tonnes of CO_2-*e*, must be calculated in accordance with Subdivision 2 or 3.

(2) The relevant Subdivision must first be applied to the 0–30 cm layer**.**

(3) If samples are taken at a depth of greater than 30 centimetres:

(a) the 30–x cm layer must be analysed separately; and
(b) the results of the analysis of the 0–30 cm layer and the 30–x cm layer must be added together or combined to apply the relevant Subdivision to the 0–x cm layer in accordance with any requirements in the Supplement.

Note: The addition or combining of the results in accordance with the Supplement may include requirements for weighting or adjustments to ensure that they are applicable to the equations and overall carbon stock of the sample.

Subdivision 2—Where only baseline and 1 subsequent sampling round conducted

21 Application of this Subdivision

This subdivision applies to the calculation of $\Delta CO_2e_{60\ PA\ (RP)}$ if only the baseline sampling round and 1 subsequent sampling round have been conducted in relation to the project area.

Note: For when 2 or more subsequent sampling rounds have been conducted—see Subdivision 3.

22 Change in carbon stock between sampling rounds

Calculate the change in soil organic carbon stock between the baseline sampling round t_0 to the first subsequent sampling round t_1 (the $\boldsymbol{\Delta SOC_{CEA(t_0-t_1)}}$), in tonnes of soil organic carbon per CEA, using the following equation:

$$\Delta SOC_{CEA(t_0-t_1)} = SOC_{CEA\ t_1} - SOC_{CEA\ t_0} \qquad \text{equation 22}$$

where:

$\boldsymbol{SOC_{CEA\ t_1}}$ is the value for SOC_{CEA} for the subsequent sampling round, in tonnes of soil organic carbon per CEA, given by equation 12, 19 or 20.

$\boldsymbol{SOC_{CEA\ t_0}}$ is the value for SOC_{CEA} for the baseline sampling round, in tonnes of soil organic carbon per CEA, given by equation 12, 19 or 20.

23 Standard error for change in carbon stock

Calculate the standard error of the mean difference between total soil organic carbon for each CEA between the baseline sampling round t_0 and subsequent sampling round t_1 (the $\boldsymbol{SE}$), in tonnes of soil organic carbon per CEA, using the following equation:

$$SE = \sqrt{V\left(SOC_{CEA\ t_0}\right) + V\left(SOC_{CEA\ t_1}\right)} \qquad \text{equation 23}$$

where:

$\boldsymbol{V\left(SOC_{CEA\ t_0}\right)}$ is the value for $V(SOC_{CEA})$ for the baseline sampling round, in tonnes of soil organic carbon per CEA, given by equation 13, 14, 21 or 21A.

$\boldsymbol{V\left(SOC_{CEA\ t_1}\right)}$ is the value for $V(SOC_{CEA})$ for the subsequent sampling round, in tonnes of soil organic carbon per CEA, given by equation 13, 14, 21 or 21A.

24 Alpha value for students t test

Calculate the alpha value $\boldsymbol{\alpha}$ for the one-tail student's t test in equation 27, using the following equation:

$$\alpha = \frac{(100 - \ probability\ of\ exceedance)}{100} \qquad \text{equation 24}$$

where:

$\boldsymbol{probability\ of\ exceedance}$ is deemed to be 60, based on a conservative estimate of the probability that the true soil organic carbon stock value will exceed the calculated value.

25 Degrees of freedom for students t test

(1) If Subdivision 2 of Division 3 applied—calculate the degrees of freedom ***df*** to use the one-tail student's t test in equation 27, using the following equation:

$$df = \frac{\left(V(SOC_{CEA\,t_0}) + V(SOC_{CEA\,t_1})\right)^2}{\left(\frac{\left(V(SOC_{CEA\,t_0})\right)^2}{(n_{t_0} - 1)} + \frac{\left(V(SOC_{CEA\,t_1})\right)^2}{(n_{t_1} - 1)}\right)} \qquad \text{equation 25}$$

where:

$\boldsymbol{V(SOC_{CEA\,t_0})}$ is the is the value for $V(SOC_{CEA})$ for the baseline sampling round, in tonnes of soil organic carbon per CEA, given by equation 13 or 14.

$\boldsymbol{V(SOC_{CEA\,t_1})}$ is the value for $V(SOC_{CEA})$ for the subsequent sampling round, in tonnes of soil organic carbon per CEA, given by equation 13 or 14.

$\boldsymbol{n_{t_0}}$ is the number of samples taken in the baseline sampling round t_0 in the CEA.

$\boldsymbol{n_{t_1}}$ is the number of samples taken in the subsequent sampling round t_1 in the CEA.

(2) If Subdivision 3 of Division 3 applied—calculate the degrees of freedom ***df*** to use the one-tail student's t test in equation 27, using the following equation:

$$df = (n_{it_0CEA} - n_{ht_0}) + (n_{it_1CEA} - n_{ht_1}) \qquad \text{equation 26}$$

where:

$\boldsymbol{n_{it_0CEA}}$ is the number of samples i taken in the baseline sampling round t_0 in the CEA.

$\boldsymbol{n_{ht_0}}$ is the number of strata h in the baseline sampling round t_0 in the CEA.

$\boldsymbol{n_{it_1CEA}}$ is the number of samples i taken in the subsequent sampling round t_1 in the CEA.

$\boldsymbol{n_{ht_1}}$ is the number of strata h in the subsequent sampling round t_1 in the CEA.

26 Change in carbon stock in a CEA with 60% probability of exceedance

Calculate the change in soil organic carbon stock for the CEA between the baseline sampling round and subsequent sampling round associated with a 60% probability of exceedance (the $\Delta SOC_{60\ CEA}$), in tonnes of carbon per CEA, using the following equation:

$$\Delta SOC_{60\ CEA} = \Delta SOC_{CEA\ (t_0 - t_1)} + SE \times t_{\alpha(df)} \qquad \text{equation 27}$$

where:

$\Delta SOC_{CEA\ (t_0 - t_1)}$ is the is the value for $\Delta SOC_{CEA\ (t_0 - t_1)}$, in tonnes of soil organic carbon per CEA, given by equation 22.

SE is the value for SE given by equation 23.

$t_{\alpha(df)}$ is t value derived from a one-tailed student's t-distribution with the value for alpha α given by equation 24 and the degrees of freedom df given by equation 25 or 26.

27 Change in carbon stock in a project area with 60% probability of exceedance

Calculate the change in soil organic carbon stock for a project area between the baseline sampling round and subsequent sampling round associated with a 60% probability of exceedance (the $\Delta SOC_{60\ PA}$), in tonnes of carbon per project area, using the following equation:

$$\Delta SOC_{60\ PA} = \sum_{CEA=1}^{n_{CEA}} \Delta SOC_{60\ CEA} \qquad \text{equation 28}$$

where:

$\Delta SOC_{60\ CEA}$ is the value for $\Delta SOC_{60\ CEA}$, in tonnes of soil organic carbon per CEA, given by equation 27.

n_{CEA} is the number of CEAs in the project area.

28 Carbon dioxide equivalence of change carbon stock for a project area with 60% probability of exceedance

Calculate the carbon dioxide equivalence of the change in soil organic carbon stock for a project area between the baseline sampling round and subsequent sampling round associated with a 60% probability of exceedance (the $\Delta SOC_{60\ PA}$), in tonnes of CO_2-e, using the following equation:

$$\Delta CO_2 e_{60\ PA} = \Delta SOC_{60\ PA} \times \frac{44}{12} - Q_{B,PA} \times \frac{44}{12} \qquad \text{equation 29}$$

where:

$\Delta SOC_{60\ PA}$ is the value for $\Delta SOC_{60\ PA}$, in tonnes of soil organic carbon per project area, given by equation 28.

$\boldsymbol{Q_{B,PA}}$ is the sum of:

(a) if the carbon content of any biochar applied in all CEAs in the project area from the declaration of the project to the end of the reporting period is known—the amount of carbon in that biochar, in tonnes; and

(b) if the carbon content of any biochar applied in all CEAs in the project area from the declaration of the project to the end of the reporting period is not known—the total quantity of that biochar (if any) applied in all CEAs in the project area from the declaration of the project to the end of the reporting period, in tonnes.

Note: The value $\frac{44}{12}$ converts tonnes of carbon to tonnes of CO_2-e.

29 Creditable change in soil organic carbon for a project area for a reporting period

The $\Delta CO_2e_{60\ PA\ (RP)}$, in tonnes of CO_2-e, is given by the following equation:

$$\Delta CO_2e_{60\ PA\ (RP)} = \Delta CO_2e_{60\ PA} \times 0.5 \qquad \text{equation 30}$$

where:

$\Delta CO_2e_{60\ PA}$ is the value for $\Delta CO_2e_{60\ PA}$, in tonnes of CO_2-e, given by equation 29.

Note: The 0.5 is a temporary discount to the creditable amount of change in carbon stock due to the use of only 2 sampling rounds.

Subdivision 3—Where 3 or more sampling rounds are conducted

30 Application of this Subdivision

This subdivision applies to the calculation of $\Delta CO_2e_{60\ PA\ (RP)}$ if the baseline sampling round and 2 or more subsequent sampling rounds have been conducted in relation to the project area.

31 Median day of a sampling round

In this Subdivision, the ***median day*** of a sampling round is:

(a) if the sampling was conducted on a single day—that day; or

(b) if the sampling was conducted over an odd number of days counting from the first to last day—the middle day; or

(c) if the sampling was conducted over an even number of days counting from the first to last day—the second of the two middle days.

32 Average project duration

Calculate the average project duration between all completed sampling rounds (the $\overline{\boldsymbol{PD}}$), in years, using the following equation:

$$\overline{PD} = \frac{\sum_{t=0}^{T} PD_t}{T} \qquad \text{equation 31}$$

where:

$\boldsymbol{PD_t}$ is the duration of the project associated with each sampling round *t* calculated as the time, in decimal years, between the median day of sampling round and the median day of the baseline sampling round.

$\boldsymbol{T}$ is the number of sampling rounds completed (including the baseline sampling round).

33 Average carbon stock across all completed sampling rounds

Calculate the average carbon stock across all completed sampling rounds (the $\overline{\boldsymbol{SOC_{CEA_{(t_0-t_x)}}}}$), in tonnes of soil organic carbon per CEA, using the following equation:

$$\overline{SOC_{CEA_{(t_0-t_x)}}} = \frac{\sum_{t0}^{T} SOC_{CEA_t}}{T} \qquad \text{equation 32}$$

where:

$\boldsymbol{SOC_{CEA_t}}$ is the value for SOC_{CEA} for the sampling round, in tonnes of soil organic carbon per CEA, given by equation 12, 19 or 20.

$\boldsymbol{T}$ is the number of sampling rounds completed (including the baseline sampling round).

34 Average rate of change in carbon stock across all completed sampling rounds (slope of linear regression)

Calculate the average rate of change of carbon stock across all completed sampling rounds (the $\boldsymbol{b_1}$), in tonnes of soil organic carbon per CEA per year, using the following equation:

$$b_1 = \frac{\sum_{t=1}^{T}(PD_t - \overline{PD}) \times (SOC_{CEA_t} - \overline{SOC_{CEA_{(t_0-t_x)}}})}{\sum_{t=1}^{T}(PD_t - \overline{PD})^2} \qquad \text{equation 33}$$

where:

$\boldsymbol{PD_t}$ is the duration of the project associated with each sampling round *t* calculated as the time, in decimal years, between the median day of sampling round and the median day of the baseline sampling round.

$\boldsymbol{\overline{PD}}$ is the value of $\overline{PD}$, in years, given by equation 31.

$\boldsymbol{SOC_{CEA_t}}$ is the value for SOC_{CEA} for the sampling round, in tonnes of soil organic carbon per CEA, given by equation 12, 19 or 20.

$\boldsymbol{\overline{SOC_{CEA_{(t_0-t_x)}}}}$ is the value for $\boldsymbol{\overline{SOC_{CEA_{(t_0-t_x)}}}}$, in tonnes of soil organic carbon per CEA, given by equation 32.

$\boldsymbol{T}$ is the number of sampling rounds completed (including the baseline sampling round).

35 Y-intercept of linear regression (line of best fit)

Calculate the y-intercept of the linear regression (the $\boldsymbol{b_0}$), in tonnes of soil organic carbon per hectare, using the following equation:

$$b_0 = \overline{SOC_{CEA_{(t_0-t_x)}}} - b_1 \times \overline{PD} \qquad \text{equation 34}$$

where:

$\boldsymbol{\overline{SOC_{CEA_{(t_0-t_x)}}}}$ is the value for $\boldsymbol{\overline{SOC_{CEA_{(t_0-t_x)}}}}$, in tonnes of soil organic carbon per CEA, given by equation 32.

$\boldsymbol{b_1}$ is the value of b_1, in tonnes of soil organic carbon per CEA per year, given by equation 33.

$\boldsymbol{\overline{PD}}$ is the value of $\overline{PD}$, in years, given by equation 31.

36 Predicted soil organic carbon stock from linear regression

Calculate the predicted soil organic carbon stock of the CEA from the linear regression (the $\boldsymbol{PredictedSOC_{CEA}}$), in tonnes of soil organic carbon per CEA, using the following equation:

$$PredictedSOC_{CEA} = b_0 + b_1 \times PD_t \qquad \text{equation 35}$$

where:

$\boldsymbol{b_0}$ is the value of b_0, in tonnes of soil organic carbon per hectare, given by equation 34.

$\boldsymbol{b_1}$ is the value of b_1, in tonnes of soil organic carbon per CEA per year, given by equation 33.

$\boldsymbol{PD_t}$ is the duration of the project associated with the last completed sampling round *t* calculated as the time, in decimal years, between the median day of sampling round and the median day of the baseline sampling round.

$\boldsymbol{T}$ is the number of sampling rounds completed (including the baseline sampling round).

37 Alpha value for students t test

Calculate the alpha value $\boldsymbol{\alpha}$ for the one-tail student's t test in equation 39, using the following equation:

$$\alpha = \frac{(100 - \ probability\ of\ exceedance)}{100} \qquad \text{equation 36}$$

where:

$\boldsymbol{probability\ of\ exceedance}$ is deemed to be 60, based on a conservative estimate of the probability that the true soil organic carbon stock value will exceed the calculated value.

38 Degrees of freedom for students t test

Calculate the degrees of freedom $\boldsymbol{df}$ to use the one-tail student's t test in equation 39, using the following equation:

$$df = T - 2 \qquad \text{equation 37}$$

where:

$\boldsymbol{T}$ is the number of sampling rounds completed (including the baseline sampling round).

39 Standard error of slope of linear regression

Calculate the standard error of the slope of the linear regression b_1 (the $\boldsymbol{SE_{b_1}}$) using the following equation:

$$SE_{b_1} = \frac{\sum_{t=0}^{T}(SOC_{CEA_t} - PredictedSOC_{CEA_t})^2 \Big/ df}{\sum_{x=1}^{T}(PD_t - \overline{PD})^2} \qquad \text{equation 38}$$

where:

$\boldsymbol{SOC_{CEA_t}}$ is the value for SOC_{CEA} for the sampling round, in tonnes of soil organic carbon per CEA, given by equation 12, 19 or 20.

$\boldsymbol{PredictedSOC_{CEA_t}}$ is the value for $PredictedSOC_{CEA_t}$ for the sampling round, in tonnes of soil organic carbon per CEA, given by equation 35.

$\boldsymbol{df}$ is the value of df given by equation 37.

$\boldsymbol{PD_t}$ is the duration of the project associated with the last completed sampling round *t* calculated as the time, in decimal years, between the median day of sampling round and the median day of the baseline sampling round.

$\overline{\boldsymbol{PD}}$ is the value of $\overline{PD}$, in years, given by equation 31.

$\boldsymbol{T}$ is the number of sampling rounds completed (including the baseline sampling round).

40 Rate of change in carbon stock for a CEA with 60% probability of exceedance

Calculate the rate of change in soil organic carbon stock for the CEA between the baseline sampling round and the last sampling round associated with a 60% probability of exceedance (the $\Delta\boldsymbol{SOC_{60\ CEA}}$), in tonnes of carbon per CEA per year, using the following equation:

$$\Delta SOC_{60\ CEA} = b_1 + SE_{b_1} \times t_{\alpha(df)} \qquad \text{equation 39}$$

where:

$\boldsymbol{b_1}$ is the value of b_1, in tonnes of soil organic carbon per CEA per year, given by equation 33.

$\boldsymbol{SE_{b_1}}$ is the value for SE_{b_1} given by equation 38.

$\boldsymbol{t_{\alpha(df)}}$ is the t value derived from a one-tailed student's t-distribution with the value for alpha α given by equation 36 and the degrees of freedom df given by equation 37.

41 Total change in carbon stock for a CEA with 60% probability of exceedance

Calculate the total change in soil organic carbon stock for the CEA between the baseline sampling round t_0 and the last sampling round t_x associated with a 60% probability of exceedance (the $\Delta SOC_{60\ CEA\ (t_0 - t_x)}$), in tonnes of carbon per CEA, using the following equation:

$$\Delta SOC_{60\ CEA\ (t_0 - t_x)} = \Delta SOC_{60\ CEA} \times PD_t \qquad \text{equation 40}$$

where:

$\Delta\boldsymbol{SOC_{60\ CEA}}$ is the value for $\Delta SOC_{60\ CEA}$ given by equation 39.

$\boldsymbol{PD_t}$ is the duration of the project associated with the last completed sampling round *t* calculated as the time, in decimal years, between the median day of sampling round and the median day of the baseline sampling round.

42 Change in carbon stock for a project area with 60% probability of exceedance

Calculate the change in soil organic carbon stock for a project area between the baseline sampling round and the last sampling round associated with a 60% probability of exceedance (the $\Delta \boldsymbol{SOC_{60\ PA}}$), in tonnes of carbon per project area, using the following equation:

$$\Delta SOC_{60\ PA} = \sum_{CEA=1}^{n_{CEA}} \Delta SOC_{60\ CEA\ (t_0 - t_x)} \qquad \text{equation 41}$$

where:

$\Delta \boldsymbol{SOC_{60\ CEA\ (t_0 - t_x)}}$ is the value for $\Delta SOC_{60\ CEA\ (t_0 - t_x)}$, in tonnes of soil organic carbon per CEA, given by equation 40.

$\boldsymbol{n_{CEA}}$ is the number of CEAs in the project area.

43 Carbon dioxide equivalence of change carbon stock for a project area with 60% probability of exceedance

Calculate the carbon dioxide equivalence of the change in soil organic carbon stock for a project area between the baseline sampling round and the last sampling round associated with a 60% probability of exceedance (the $\Delta \boldsymbol{CO_2 e_{60\ PA\ (t_0 - t_x)}}$), in tonnes of CO_2-e, using the following equation:

$$\Delta CO_2 e_{60\ PA\ (t_0 - t_x)} = \Delta SOC_{60\ PA} \times \frac{44}{12} - Q_{B,PA} \times \frac{44}{12} \qquad \text{equation 42}$$

where:

$\Delta \boldsymbol{SOC_{60\ PA}}$ is the value for $\Delta SOC_{60\ PA}$, in tonnes of soil organic carbon per project area, given by equation 41.

$\boldsymbol{Q_{B,PA}}$ is the sum of:

(a) if the carbon content of any biochar applied in all CEAs in the project area from the declaration of the project to the end of the reporting period is known—the amount of carbon in that biochar, in tonnes; and

(b) if the carbon content of any biochar applied in all CEAs in the project area from the declaration of the project to the end of the reporting period is not known—the total quantity of that biochar (if any) applied in all CEAs in the project area from the declaration of the project to the end of the reporting period, in tonnes.

Note: The value $\frac{44}{12}$ converts tonnes of carbon to tonnes of CO_2-e.

44 Creditable change in soil organic carbon for a project area for a reporting period

The $\Delta CO_2 e_{60\ PA\ (RP)}$, in tonnes of CO_2-e, is given by the following equation:

$$\Delta CO_2 e_{60\ PA\ (RP)} = \Delta CO_2 e_{60\ PA\ (t_0 - t_x)} - \left(\sum_{RP=1}^{n_{RP}} \Delta CO_2 e_{60\ PA\ (pRP)} - RC \right) \qquad \text{equation 43}$$

where:

$\Delta \boldsymbol{CO_2e_{60\ PA\ (t_0 - t_x)}}$ is the value for $\Delta CO_2e_{60\ PA\ (t_0 - t_x)}$, in tonnes of CO_2-e, given by equation 42.

$\boldsymbol{n_{RP}}$ is the number of previous reporting periods.

$\Delta \boldsymbol{CO_2e_{60\ PA\ (pRP)}}$ is the value for $\Delta CO_2e_{60\ PA\ (RP)}$, in tonnes of CO_2-e, given by equation 43 or equation 30 for the project area for each previous reporting period *pRP*, in tonnes of CO_2-e.

$\boldsymbol{RC}$ is the total number of Australian carbon credits relinquished:

(a) in relation to a CEA removed from the project area at or before the start of the reporting period in tonnes of CO_2-e; and

Note: The ability to remove CEAs from a project area is limited by subsection 9(4) and any credits issued for the CEA would need to be relinquished to allow the Regulator to approve the variation to the project area.

(b) in relation to the project area and a notice issued by the Regulator under sections 90 or 91 of the Act if at least three sampling rounds included in the offsets report for the reporting period have been conducted since the date of the notice.

Note: Section 90 and 91 of the Act relate to certain reversals of removals of sequestered carbon. After three more sampling rounds are undertaken, the $\Delta CO_2e_{60\ PA\ (t_0 - t_x)}$ should have taken into account the impact of the reversal on the project area and subsequent increases in carbon stock can be credited.

Schedule 2—Calculation of Emissions

Division 1—Preliminary

1 Simplified outline of this Schedule

This Schedule provides for the calculation of the change is emissions in a reporting period from the average annual baseline emissions, known as $\Delta Eall_{RP,PA}$.

It does this by first calculating the annual average emissions in the baseline period and comparing that to emissions in the reporting period.

2 Definitions

In this Schedule:

$\Delta \boldsymbol{Eall_{RP,PA}}$—see section 17 of this Schedule.

NGA Factors document means the document entitled "National Greenhouse Accounts Factors", published by the Department and as in force from time to time.

Note: In 2018 the NGA Factors document could be viewed on the Department's website (http://www.environment.gov.au).

3 Application of Schedule to CEAs and emissions accounting areas in a project area

The emissions calculated for a project area under this Schedule relate to all the CEAs and emissions accounting areas for the project area as at the end of the reporting period.

Note: Any emissions which relate to an exclusion area within a project area are not relevant to this Schedule. If the project area is varied between reporting periods, average annual baseline emissions will need to be recalculated for the new project area.

Division 2—Calculating average annual baseline emissions for a project area

4 Average annual baseline emissions for a project area

(1) The annual average emissions for the baseline period for a project area (the $\boldsymbol{\bar{E}_{all_{BP,PA}}}$), in tonnes of CO_2-*e* per year, must be calculated and is given by the following equation:

$$\bar{E}_{all_{BP,PA}} = \bar{E}_{LS,BP,PA} + \bar{E}_{SF,BP,PA} + \bar{E}_{L,BP,PA} + \bar{E}_{Res,BP,PA} + \bar{E}_{IEnergy,BP,PA} \quad \text{equation 44}$$

where:

$\boldsymbol{\bar{E}_{LS,BP,PA}}$ is the average annual emissions from livestock during the baseline period *BP* for the project area *PA,* in tonnes of CO_2-*e* per year, given by equation 45 or 47.

$\boldsymbol{\bar{E}_{SF,BP,PA}}$ is the average annual emissions from synthetic fertiliser applied to project area *PA* during the baseline period *BP,* in tonnes of CO_2-*e* per year, given by equation 49.

$\bar{E}_{L,BP,PA}$ is the average annual carbon dioxide emissions from lime applied in the baseline period *BP* to project area *PA*, in tonnes of CO_2-*e* per year, given by equation 52.

$\bar{E}_{Res,BP,PA}$ is the average annual emissions from all tillage events in the baseline period *BP* in project area *PA*, in tonnes of CO_2-*e* per year, given by equation 54.

$\bar{E}_{IEnergy,BP,PA}$ is average annual emissions from irrigation energy in the baseline period *BP* in project area *PA*, in tonnes of CO_2-*e* per year, given by equation 59.

(2) The project proponent may elect for one or all of the components of equation 44 to be zero.

Note: A project proponent may need to may such an election if the component cannot be calculated from data available for the baseline emissions period.

5 Livestock emissions—if historical stock rate data is known

(1) This section applies if the project proponent is able to access records to apply section 36 of this determination to the baseline period.

(2) For equation 44, $\bar{E}_{LS,BP,PA}$ is given by the following equation:

$$\bar{E}_{LS,BP,PA} = \frac{1}{10}\sum_{B=1}^{10} E_{LS,B,PA} \qquad \text{equation 45}$$

where:

$E_{LS,B,PA}$ is the total emissions from livestock during year *B* of the baseline period *BP* for the project area *PA*, in tonnes of CO_2-*e*, given by equation 46.

B is the year of the baseline period, from 1 to 10.

(3) For equation 45, $E_{LS,B,PA}$ is given by the following equation:

$$E_{LS,B,PA} = \sum_{\left(\substack{\text{all groups}\\ gijk}\right)} Q_{LS_{gijk},B,PA} \times D_{gijk,B,PA} \times \frac{EF_{LS_{gijk}}}{1000} \qquad \text{equation 46}$$

where:

$Q_{LS_{gijk},B,PA}$ is number of animals in livestock group *gijk* within project area *PA* in year *B* of the baseline emissions period, in livestock head.

$D_{gijk,B,PA}$ is the number of days in year *B* of the baseline period that livestock group *gijk* was within the project area *PA*, in days.

$EF_{LS_{gijk}}$ is the default emission factor for livestock group *gijk*, as set out in the Supplement, in kilograms of CO_2-e per livestock head per day.

B is the year of the baseline period, from 1 to 10.

Note: The components of livestock group *gijk* are set out in the Supplement.

6 Livestock emissions—if historical stock rate data is not known

(1) This section applies if the project proponent is unable to access records to apply section 36 to the baseline period.

(2) For equation 44, $\bar{E}_{LS,BP,PA}$ is given by the following equation:

$$\bar{E}_{LS,BP,PA} = \left(\frac{AU_{PA}}{AU_{Y,PA}}\right) E_{LS,Y,PA} \qquad \text{equation 47}$$

where:

$\boldsymbol{E_{LS,Y,PA}}$ is the total emissions from livestock during year first year of the project for the project area *PA*, in tonnes of CO_2-*e*, given by equation 48.

$\boldsymbol{AU_{PA}}$ is the assessed annual carrying capacity of project area *PA*, in animal units, determined in accordance with section 37 of this determination.

$\boldsymbol{AU_{Y,PA}}$ is the stocking rate of project area *PA* for the first year *Y* of the project, in the same animal units as the value for AU_{PA}.

(3) For equation 47, $E_{LS,Y,PA}$ is given by the following equation:

$$E_{LS,Y,PA} = \sum_{\binom{\text{all groups}}{gijk}} Q_{LS_{gijk},Y,PA} \times D_{gijk,Y,PA} \times \frac{EF_{LS_{gijk}}}{1000} \qquad \text{equation 48}$$

where:

$\boldsymbol{Q_{LS_{gijk},Y,PA}}$ is number of animals in livestock group *gijk* within project area *PA* in the first year of the project *Y*, in livestock head.

$\boldsymbol{D_{gijk,Y,PA}}$ is the number of days in year *Y* that livestock group *gijk* was within the project area *PA*, in days.

$\boldsymbol{EF_{LS_{gijk}}}$ is the default emission factor for livestock group *gijk*, as set out in the Supplement, in kilograms of CO_2-e per livestock head per day.

Note: The components of livestock group *gijk* are set out in the Supplement.

7 Synthetic fertiliser emissions

(1) For equation 44, $\bar{E}_{SF,BP,PA}$ is given by the following equation:

$$\bar{E}_{SF,BP,PA} = \frac{1}{10}\sum_{B=1}^{10} E_{SF,B,PA} \qquad \text{equation 49}$$

where:

$\boldsymbol{E_{SF,B,PA}}$ is the total emissions from synthetic fertiliser during year *B* of the baseline period *BP* for the project area *PA*, in tonnes of CO_2-*e*, given by equation 50.

$\boldsymbol{B}$ is the year of the baseline period, from 1 to 10.

(2) For equation 49, $E_{SF,B,PA}$ is given by the following equation:

$$E_{SF,B,PA} = E_{SF_N,B,PA} + U_{B,PA} \times EF_U$$ equation 50

where:

$\boldsymbol{E_{SF_N,B,PA}}$ is nitrous oxide emissions from synthetic fertiliser applied to project area *PA* during year *B* of the baseline period, in tonnes of CO_2-e, given by equation 51.

$\boldsymbol{U_{B,PA}}$ is the quantity of urea applied to project area *PA* during year *B* of the baseline period, in tonnes of urea.

$\boldsymbol{EF_U}$ is the default emission factor for carbon dioxide emissions from urea as set out in the Supplement, in tonnes of of CO_2-e per tonne of urea.

$\boldsymbol{B}$ is the year of the baseline period, from 1 to 10.

(3) For equation 50, $E_{SF_N,B,PA}$ is given by the following equation:

$$E_{SF_N,B,PA} = \sum_{\binom{\text{all groups}}{fij}} G_{SF_{fij},B,PA} \times P_f \times EF_{SF_{fij}}$$ equation 51

where:

$\boldsymbol{G_{SF_{fij},B,PA}}$ is the quantity of synthetic fertiliser group *fij* applied to project area *PA* during year *B* of the baseline period, in tonnes of fertiliser.

$\boldsymbol{P_f}$ is the percentage nitrogen content of fertiliser *f* in synthetic fertiliser group *fij*, as provided by the manufacturer, in tonnes of Nitrogen per tonne of fertiliser.

$\boldsymbol{EF_{SF_{fij}}}$ is the default emission factor for synthetic fertiliser group *fij* as set out in the Supplement, in tonnes of CO_2-e per tonne of fertiliser.

$\boldsymbol{B}$ is the year of the baseline period, from 1 to 10.

8 Lime emissions

(1) For equation 44, $\bar{E}_{L,BP,PA}$ is given by the following equation:

$$\bar{E}_{L,BP,PA} = \bar{Q}_{L,BP,PA} \times EF_L$$ equation 52

where:

$\boldsymbol{\bar{Q}_{L,BP,PA}}$ is the average annual quantity of carbonates ($CaCO_3$) applied during the baseline period *BP* to the project area, in tonnes, given by equation 53.

$\boldsymbol{EF_L}$ is the default emission factor for carbonates as set out in the Supplement, in tonnes of of CO_2-e per tonne of fertiliser.

(2) For equation 52, $\bar{Q}_{L,BP,PA}$ is given by the following equation:

$$\bar{Q}_{L,BEP,PA} = \frac{1}{10}\sum_{l=1}^{n}\left(L_{l,B,PA} \times P_l\right) \quad \text{equation 53}$$

where:

$\boldsymbol{L_{l,B,PA}}$ is the quantity of lime type *l* applied in year *B* baseline period *BP* in the project area *PA*, in tonnes.

$\boldsymbol{P_l}$ is the percentage carbonate content of lime type *l*, as provided by the manufacturer, as a percentage.

Note: The percentage carbonate content of lime is described as its neutralising value.

l is the type of lime as defined by the percentage carbonate content.

n is the number of types of lime applied in the baseline period.

9 Residue, tillage and soil landscape modification emissions

(1) For equation 44, $\bar{E}_{Res,BP,PA}$ is given by the following equation:

$$\bar{E}_{Res,BP,PA} = \frac{1}{10}\sum_{B=1}^{10} E_{Res,B,PA} \quad \text{equation 54}$$

where:

$\boldsymbol{E_{Res,B,PA}}$ is the total emissions from residues and tillage events and soil landscape modification activities during year *B* of the baseline period *BP* for the project area *PA,* in tonnes of CO_2-*e*, given by equation 55.

B is the year of the baseline period, from 1 to 10.

(2) For equation 54, $E_{Res,B,PA}$ is given by the following equation:

$$E_{Res,B,PA} = E_{F,B,PA} + E_{R,B,PA} \quad \text{equation 55}$$

where:

$\boldsymbol{E_{F,B,PA}}$ is the emissions from diesel fuel used for tillage events and soil landscape modification activities in year *B* of the baseline period in project area *PA,* in tonnes of CO_2-*e*, given by equation 56**.**

$\boldsymbol{E_{R,B,PA}}$ is the emissions from the residues of all crop types in year *B* of the baseline period in project area *PA,* in tonnes of CO_2-*e*, given by equation 57.

(3) For equation 53, $E_{F,B,PA}$ is given by the following equation:

$$E_{F,B,PA} = \left(\sum_{g=1}^{n} Area\text{-}T_{B,PA}\left(\frac{0.012 \times EC_F \times EF_{Fg}}{1000}\right)\right) + \left(\frac{Q_F \times EC_F \times EF_{Fg}}{1000}\right) \quad \text{equation 56}$$

where:

$\boldsymbol{n}$ is the number of gas types *g*.

$\boldsymbol{Area\text{-}T_{B,PA}}$ is the tilled area in year *B* of the baseline period in a project area *PA*, in hectares.

$\boldsymbol{EC_F}$ is the energy content factor for diesel fuel set out in the NGER (Measurement) Determination, in gigajoules per kilolitre.

$\boldsymbol{EF_{Fg}}$ is the emissions factor for each gas type *g* for diesel fuel set out in the NGER (Measurement) Determination, in kilograms of CO_2-*e* per kilolitre.

$\boldsymbol{Q_F}$ is the quantity of fuel used for soil landscape modification activities in the baseline period, in kilolitres.

Note: The value 0.012 is a default estimate of diesel fuel use per hectare and the value 1000 converts kilograms to tonnes

(4) For equation 53, $E_{R,B,PA}$ is given by the following equation:

$$E_{R,B,PA} = \sum_{v=1}^{n} E_{R,v,B,PA} \qquad \text{equation 57}$$

where:

$\boldsymbol{E_{R,v,B,PA}}$ is the emissions from the residues of crop type *v* in year *B* of the baseline period in project area *PA,* in tonnes of CO_2-*e*, given by equation 58.

$\boldsymbol{n}$ is the number of crops grown in year *B* in the project area *PA.*

$\boldsymbol{v}$ is the crop type as specified in the Supplement.

(5) For equation 57, $E_{R,v,B,PA}$ is given by the following equation:

$$E_{R,v,B,PA} = VQ_{v,B,PA} \times EF_R \times \left(NC_{v,AB} \times \left(1 - RF_{v,B,PA}\right) + NC_{v,BG}\right) \qquad \text{equation 58}$$

where:

$\boldsymbol{VQ_{v,B,CEA}}$ is quantity of harvested crop by crop type *v* in year *B* of the baseline period in project area *PA*, in tonnes of crop.

$\boldsymbol{EF_R}$ is the emissions factor for residues as set out in the Supplement, in tonnes of CO_2-e per tonne of Nitrogen.

$\boldsymbol{NC_{v,AB}}$ is the nitrogen content in crop residue above ground *AB* from crop type *v* as set out in the Supplement, in tonnes of Nitrogen per tonne of crop.

$\boldsymbol{RF_{v,B,PA}}$ is the fraction of crop residue from crop type *v* that was removed in year *B* of the baseline emissions period in project area *PA*, as a decimal value.

$\boldsymbol{NC_{v,BG}}$ is the nitrogen content in crop residue below ground *BG* from crop type *v* as set out in the Supplement, in tonnes of Nitrogen per tonne of crop.

$\boldsymbol{v}$ is the crop type as specified in the Supplement.

$\boldsymbol{B}$ is the year of the baseline period, from 1 to 10.

10 Irrigation energy emissions

(1) For equation 44, $\bar{E}_{IEnergy,BP,PA}$ is given by the following equation:

$$\bar{E}_{IEnergy,BP,PA} = \bar{E}_{IFuel,BP,PA} + \bar{E}_{IP,BP,PA} \quad \text{equation 59}$$

where:

$\bar{E}_{IFuel,BP,PA}$ is the average annual emissions from irrigation fuel in the baseline period *BP* for the project area *PA*, in tonnes of CO_2-*e*, given by equation 60.

$\bar{E}_{IP,BP,PA}$ is the average annual emissions from irrigation electricity in the baseline period *BP* for the project area *PA*, in tonnes of CO_2-*e*, given by equation 61.

(2) For equation 59, $\bar{E}_{IFuel,BP,PA}$ is given by the following equation:

$$\bar{E}_{IFuel,BP,PA} = \frac{1}{10}\sum_{g=1}^{n}\left(\frac{Q_{I,BP,PA} \times EC_F \times EF_{Fg}}{1000}\right) \quad \text{equation 60}$$

where:

n is the number of gas types *g*.

$Q_{I,BP,PA}$ is quantity of fuel used to irrigate project area *A* in the baseline period, in kilolitres.

EC_F is the energy content factor for diesel fuel set out in the NGER (Measurement) Determination, in gigajoules per kilolitre.

EF_{Fg} is the emissions factor for each gas type *g* for diesel fuel set out in the NGER (Measurement) Determination, in kilograms of CO_2-*e* per kilolitre.

(3) For equation 59, $\bar{E}_{IP,BP,PA}$ is given by the following equation:

$$\bar{E}_{IP,BP,PA} = \frac{1}{10}\left(Q_{IP,BP,PA} \times \frac{EF_{Elec}}{1000}\right) \quad \text{equation 61}$$

where:

$Q_{IP,BP,PA}$ is the quantity of electricity used to irrigation the project area *PA* over the baseline period, in kilowatt hours.

EF_{Elec} is:

(a) for electricity obtained from an electricity grid that is a grid in relation to which the NGA Factors document, in force on the day the project is declared to be an eligible offsets project, includes an emissions factor—that factor, in kilograms CO_2-e per kilowatt hour; or

(b) for electricity obtained from an electricity grid not covered by paragraph (a) or obtained from a source other than an electricity grid:

(i) if the supplier of the electricity is able to provide an emissions factor that reflects the emissions intensity of the electricity (worked out in accordance with subsection (4)) and is applicable on the day the project is declared to be

an eligible offsets project—that factor, in kilograms CO_2-e per kilowatt hour (or its equivalent of tonnes CO_2-e per megawatt hours); or

(ii) otherwise—the emissions factor, in kilograms CO_2-e per kilowatt hour (or its equivalent of tonnes CO_2-e per megawatt hours), for off-grid electricity included in the NGA Factors document in force on the day the project is declared to be an eligible offsets project.

(4) For subparagraph (b)(i) of the definition of EF_{Elec} in subsection (3), the emissions factor must be worked out:

(a) on a sent-out basis; and

(b) using a measurement or estimation approach that is consistent with the NGER (Measurement) Determination.

Division 3—Calculating average annual project emissions for a project area

11 Average annual project emissions for a project area

The annual average emissions for the reporting period for a project area (the $\bar{\boldsymbol{E}}_{\boldsymbol{all_{RP,PA}}}$), in tonnes of CO_2-e per year, must be calculated and is given by the following equation:

$$\bar{E}all_{RP,PA} = \frac{(E_{LS,RP,PA} + E_{SF,RP,PA} + E_{L,RP,PA} + E_{Res,RP,PA} + E_{IEnergy,RP,PA})}{years_{RP}} \quad \text{equation 62}$$

where:

$\boldsymbol{E_{LS,RP,PA}}$ is the total emissions from livestock during the reporting period *RP* for the project area *PA*, in tonnes of CO_2-e per year, given by equation 63.

$\boldsymbol{E_{SF,RP,PA}}$ is the total emissions from synthetic fertiliser applied to project area *PA* during the reporting period *RP*, in tonnes of CO_2-e per year, given by equation 65.

$\boldsymbol{E_{L,RP,PA}}$ is the total carbon dioxide emissions from lime applied in the reporting period *RP* to project area *PA*, in tonnes of CO_2-e per year, given by equation 67.

$\boldsymbol{E_{Res,RP,PA}}$ is the total emissions from all tillage events in the reporting period *RP* in project area *PA*, in tonnes of CO_2-e per year, given by equation 69.

$\boldsymbol{E_{IEnergy,RP,PA}}$ is the total emissions from irrigation energy in the reporting period *RP* in project area *PA*, in tonnes of CO_2-e per year, given by equation 74.

$\boldsymbol{years_{RP}}$ is the number of years in the reporting period, in years.

12 Livestock emissions

(1) For equation 62, $E_{LS,RP,PA}$ is given by the following equation:

$$E_{LS,RP,PA} = \sum_{\binom{\text{all groups}}{gijk}} E_{LS_{gijk},RP,PA} \quad \text{equation 63}$$

where:

$\boldsymbol{E_{LS_{gijk},RP,PA}}$ is the total emissions from livestock group *gijk* for the reporting period for the project area *PA*, in tonnes of CO_2-e, given by equation 64.

(2) For equation 63, $E_{LS_{gijk},RP,PA}$ is given by the following equation:

$$E_{LS_{gijk},RP,PA} = Q_{LS_{gijk},RP,PA} \times D_{LS_{gijk},RP,PA} \times \frac{EF_{LS_{gijk}}}{1000} \quad \text{equation 64}$$

where:

$\boldsymbol{Q_{LS_{gijk},RP,PA}}$ is the number of animals in livestock group *gijk* within project area *PA* in the reporting period *RP*, in livestock head.

$\boldsymbol{D_{gijk,RP,PA}}$ is the number of days in the reporting period that livestock group *gijk* was within the project area *PA*, in days.

$\boldsymbol{EF_{LS_{gijk}}}$ is the default emission factor for livestock group *gijk*, as set out in the Supplement; in kilograms of CO_2-e per livestock head per day.

Note: The components of livestock group *gijk* are set out in the Supplement.

13 Synthetic fertiliser emissions

(1) For equation 62, $E_{SF,RP,PA}$ is given by the following equation:

$$E_{SF,RP,PA} = E_{SF_N,RP,PA} + U_{RP,A} \times EF_U \quad \text{equation 65}$$

where:

$\boldsymbol{E_{SF_N,RP,PA}}$ is nitrous oxide emissions from synthetic fertiliser applied to project area *PA* during the reporting period in tonnes of CO_2-e, given by equation 66**.**

$\boldsymbol{U_{RP,PA}}$ is the quantity of urea applied to project area *PA* during the reporting period, in tonnes of urea..

$\boldsymbol{EF_U}$ is the default emission factor for carbon dioxide emissions from urea as set out in the Supplement, in tonnes of of CO_2-e per tonne of urea.

(2) For equation 65, $E_{SF_N,RP,PA}$ is given by the following equation:

$$E_{SF_N,B,PA} = \sum_{\binom{\text{all groups}}{fij}} G_{SF_{fij},RP,PA} \times P_f \times EF_{SF_{fij}} \quad \text{equation 66}$$

where:

$\boldsymbol{G_{SF_{fij},RP,PA}}$ is the quantity of synthetic fertiliser group *fij* applied to project area *PA* during the reporting period, in tonnes of fertiliser.

$\boldsymbol{P_f}$ is the percentage nitrogen content of fertiliser *f* in synthetic fertiliser group *fij,* as provided by the manufacturer, in tonnes of Nitrogen per tonne of fertiliser.

$\boldsymbol{EF_{SF_{fij}}}$ is the default emission factor for synthetic fertiliser group *fij* as set out in the Supplement, in tonnes of CO_2-e per tonne of fertiliser.

14 Lime emissions

(1) For equation 62, $E_{L,RP,PA}$ is given by the following equation:

$$E_{L,RP,PA} = Q_{L,RP,PA} \times EF_L \quad \text{equation 67}$$

where:

$\boldsymbol{Q_{L,RP,PA}}$ is the quantity of carbonates ($CaCO_3$) applied during the reporting period to the project area, in tonnes, given by equation 68.

$\boldsymbol{EF_L}$ is the default emission factor for carbonates as set out in the Supplement, in tonnes of of CO_2-e per tonne of fertiliser.

(2) For equation 67, $Q_{L,RP,PA}$ is given by the following equation:

$$Q_{L,RP,PA} = \sum_{l=1}^{n} \left(L_{l,RP,PA} \times P_l \right) \quad \text{equation 68}$$

where:

$\boldsymbol{L_{l,RP,PA}}$ is the quantity of lime type *l* applied in the reporting period in the project area *PA*, in tonnes.

$\boldsymbol{P_l}$ is the percentage carbonate content of lime type *l*, as provided by the manufacturer, as a percentage.

Note: The percentage carbonate content of lime is described as its neutralising value.

l is the type of lime as defined by the percentage carbonate content.

n is the number of types of lime applied in the reporting period.

15 Residue, tillage and soil landscape modification emissions

(1) For equation 62, $E_{Res,RP,PA}$ is given by the following equation:

$$E_{Res,RP,PA} = E_{F,RP,PA} + E_{R,RP,PA} + E_{P,RP,PA} \quad \text{equation 69}$$

where:

$\boldsymbol{E_{F,RP,PA}}$ is the emissions from diesel fuel used for tillage events and soil landscape modification activities in the reporting period *RP* in project area *PA,* in tonnes of CO_2-*e*, given by equation 70**.**

$\boldsymbol{E_{R,RP,PA}}$ is the emissions from the residues of all crop types in the reporting period *RP* in project area *PA,* in tonnes of CO_2-*e*, given by equation 71.

$\boldsymbol{E_{P,RP,PA}}$ is the emissions from pasture tillage events in the reporting period *RP* in project area *PA,* in tonnes of CO_2-*e*, given by equation 73.

(2) For equation 69, $E_{F,RP,PA}$ is given by the following equation:

$$E_{F,RP,PA} = \left(\sum_{g=1}^{n} Area\text{-}T_{RP,PA}\left(\frac{0.012 \times EC_F \times EF_{Fg}}{1000}\right)\right) + \left(\frac{Q_F \times EC_F \times EF_{Fg}}{1000}\right) \quad \text{equation 70}$$

where:

$\boldsymbol{n}$ is the number of gas types *g*.

$\boldsymbol{Area\text{-}T_{RP,PA}}$ is the tilled area in the reporting period in a project area *PA*, in hectares.

$\boldsymbol{EC_F}$ is the energy content factor for diesel fuel set out in the NGER (Measurement) Determination, in gigajoules per kilolitre.

$\boldsymbol{EF_{Fg}}$ is the emissions factor for each gas type *g* for diesel fuel set out in the NGER (Measurement) Determination, in kilograms of CO_2-*e* per kilolitre.

$\boldsymbol{Q_F}$ is the quantity of fuel used for soil landscape modification activities in the reporting period, in kilolitres.

Note: The value 0.012 is a default estimate of diesel fuel use per hectare and the value 1000 converts kilograms to tonnes

(3) For equation 69, $E_{R,RP,PA}$ is given by the following equation:

$$E_{R,RP,PA} = \sum_{v=1}^{n} E_{R,v,RP,PA} \quad \text{equation 71}$$

where:

$\boldsymbol{E_{R,v,RP,PA}}$ is the emissions from the residues of crop type *v* in the reporting period in project area *PA,* in tonnes of CO_2-*e*, given by equation 72.

$\boldsymbol{n}$ is the number of crops grown in the reporting period in the project area *PA*.

$\boldsymbol{v}$ is the crop type as specified in the Supplement.

(4) For equation 71, $E_{R,v,RP,PA}$ is given by the following equation:

$$E_{R,v,RP,PA} = VQ_{v,RP,PA} \times EF_R \times \left(NC_{v,AB} \times \left(1 - RF_{v,RP,PA}\right) + NC_{v,BG}\right) \quad \text{equation 72}$$

where:

$\boldsymbol{VQ_{v,RP,CEA}}$ is quantity of harvested crop by crop type *v* in the reporting period in project area *PA*, in tonnes of crop.

$\boldsymbol{EF_R}$ is the emissions factor for residues as set out in the Supplement, in tonnes of CO_2-e per tonne of Nitrogen.

$\boldsymbol{NC_{v,AB}}$ is the nitrogen content in crop residue above ground *AB* from crop type *v* as set out in the Supplement, in tonnes of Nitrogen per tonne of crop.

$\boldsymbol{RF_{v,RP,PA}}$ is the fraction of crop residue from crop type *v* that was removed during the reporting period in project area *PA*, as a decimal value.

$\boldsymbol{NC_{v,BG}}$ is the nitrogen content in crop residue below ground *BG* from crop type *v* as set out in the Supplement, in tonnes of Nitrogen per tonne of crop.

$\boldsymbol{v}$ is the crop type as specified in the Supplement.

(5) For equation 69, $E_{P,RP,PA}$ is given by the following equation:

$$E_{P,RP,PA} = O_P \times Area\text{-}T_{RP,PA} \times EF_R \times \left(NC_{P,AB} \times \left(1 - RF_{P,RP,PA}\right) + NC_{P,BG}\right) \quad \text{equation 73}$$

where:

$\boldsymbol{O_P}$ is annual dry matter yield for pasture as set out in the Supplement, in tonnes per hectare.

$\boldsymbol{Area\text{-}T_{RP,PA}}$ is the tilled area for pasture establishment or renovation in the reporting period in a project area *PA*, in hectares.

$\boldsymbol{EF_R}$ is the emissions factor for residues as set out in the Supplement, in tonnes of CO_2-e per tonne of Nitrogen.

$\boldsymbol{NC_{P,AB}}$ is the nitrogen content in crop residue above ground *AB* as set out in the Supplement, in tonnes of Nitrogen per tonne of crop.

$\boldsymbol{RF_{P,RP,PA}}$ is the fraction of crop residue from pasture that was removed during the reporting period in project area *PA*, as a decimal value.

$\boldsymbol{NC_{P,BG}}$ is the nitrogen content in crop residue below ground *BG* from crop type *v* as set out in the Supplement, in tonnes of Nitrogen per tonne of crop.

16 Irrigation energy emissions

(1) For equation 62, $E_{IEnergy,RP,PA}$ is given by the following equation:

$$E_{IEnergy,RP,PA} = E_{IFuel,RP,PA} + E_{IP,RP,PA} \quad \text{equation 74}$$

where:

$\boldsymbol{E_{IFuel,RP,PA}}$ is the emissions from irrigation fuel in the reporting period *RP* for the project area *PA,* in tonnes of CO_2-*e*, given by equation 75.

$\boldsymbol{E_{IP,RP,PA}}$ is the emissions from irrigation electricity in the reporting period *RP* for the project area *PA,* in tonnes of CO_2-*e*, given by equation 76.

(2) For equation 74, $E_{IFuel,RP,PA}$ is given by the following equation:

$$E_{IFuel,RP,PA} = \sum_{g=1}^{n} \left(\frac{Q_{I,RP,PA} \times EC_F \times EF_{Fg}}{1000}\right) \quad \text{equation 75}$$

where:

$\boldsymbol{n}$ is the number of gas types *g*.

$\boldsymbol{Q_{I,RP,PA}}$ is the quantity of fuel used to irrigate project area *A* in the reporting period, in kilolitres.

$\boldsymbol{EC_F}$ is the energy content factor for diesel fuel set out in the NGER (Measurement) Determination, in gigajoules per kilolitre.

$\boldsymbol{EF_{Fg}}$ is the emissions factor for each gas type *g* for diesel fuel set out in the NGER (Measurement) Determination, in kilograms of CO_2-*e* per kilolitre.

(3) For equation 74, $E_{IP,RP,PA}$ is given by the following equation:

$$E_{IP,RP,PA} = Q_{IP,RP,PA} \times \frac{EF_{Elec}}{1000} \qquad \text{equation 76}$$

where:

$\boldsymbol{Q_{IP,RP,PA}}$ is the quantity of electricity used to irrigation the project area *PA* over the reporting period, in kilowatt hours.

$\boldsymbol{EF_{Elec}}$ is:

(a) for electricity obtained from an electricity grid that is a grid in relation to which the NGA Factors document, in force on the day the project is declared to be an eligible offsets project, includes an emissions factor—that factor, in kilograms CO_2-e per kilowatt hour; or

(b) for electricity obtained from an electricity grid not covered by paragraph (a) or obtained from a source other than an electricity grid:

(i) if the supplier of the electricity is able to provide an emissions factor that reflects the emissions intensity of the electricity (worked out in accordance with subsection (4)) and is applicable on the day the project is declared to be an eligible offsets project—that factor, in kilograms CO_2-e per kilowatt hour (or its equivalent of tonnes CO_2-e per megawatt hours); or

(ii) otherwise—the emissions factor, in kilograms CO_2-e per kilowatt hour (or its equivalent of tonnes CO_2-e per megawatt hours), for off-grid electricity included in the NGA Factors document in force on the day the project is declared to be an eligible offsets project.

(4) For subparagraph (b)(i) of the definition of EF_{Elec} in subsection (3), the emissions factor must be worked out:

(a) on a sent-out basis; and

(b) using a measurement or estimation approach that is consistent with the NGER (Measurement) Determination.

Division 4—Calculating change in emissions

17 Change in project emissions from baseline in a reporting period

The difference between the emissions in the current reporting period *RP* and the baseline period (the $\boldsymbol{\Delta All_{RP,PA}}$) in tonnes of CO_2-*e,* is given by the following equation:

$$\Delta All_{RP,PA} = (\bar{E}all_{RP,PA} - \bar{E}_{all_{BP,PA}}) \times years_{RP} \qquad \text{equation 77}$$

where:

$\overline{E}_{all_{RP,PA}}$ is the average annual emissions from all sources during the reporting period *RP* for the project area *PA*, in tonnes of CO_2-*e*, given by equation 62.

$\overline{E}_{all_{BP,PA}}$ is the average annual emissions from all sources during the baseline period *BP* for the project area *PA*, in tonnes of CO_2-*e*, given by equation 44.

$years_{RP}$ is the number of years in the reporting period, in years.