



Guide to completing this document

This document describes what information must be supplied in each Section to enable validation and verification, noting the following key points:

- Section Requirements are highlighted in green and must be followed

- Requirements for filling in tables (e.g., Key Information) appear as follows <<guidance text>>

- Guidance is highlighted in grey (the colour of this box) to help understand how to meet requirements

All Information should be transparently presented along with supporting evidence as annexed documents or calculations. The aim being that another person reading the information can easily understand it and also access supporting information to validate their understanding.

Where supporting evidence is supplied, it helps to refer to it in this document (maintaining confidentiality) for easy cross checking (e.g., Implementation start date was 02/03/2020 as evidenced by stove contracts.pdf).

If a section has a numbered requirement that you believe to be non-applicable, please clearly quote the requirement stating it is not applicable and justify why to avoid being asked why information is missing. If you do not understand a requirement, please discuss with SustainCERT.

Please do not delete any sections of this document.

Please refer to SustainCERT's criteria document called '*SustainCERT Verification Requirements for Value Chain Interventions*' for additional information and guidance.

SustainCERT Value Chain Intervention or Program Design Document (SC VC-IDD/Program DD)

Scope 3 - Category 1 Purchased Goods & Services

NON TRANSFERABLE REPORTING CLAIMS (SC VCI LEVEL 1)
TRANSFERABLE REPORTING CLAIMS (SC VCI LEVEL 2)

Version 0.9 – Dec 2021

Key Information

Title of Intervention or Program:	Soil Capital climate change mitigation Program for arable farming ('the Program')
ID Number (if known):	TBC by SustainCERT
Version of VC-IDD/Program DD:	This is Version 1.0 of the VC-IDD
Version Date:	Date of submission: 20 July 2023
Certificate Holder:	Soil Capital Belgium SRL, with registered office in 1360 Perwez (Belgium), Rue du Buisson 19, VAT BE 0655.917.958
Intervention/Program Representative:	Andrew Voysey, Chief Impact Officer, a.voysey@soilcapital.com

3.0. GENERAL INFORMATION & DESCRIPTION

3.1. Description of Stand-alone Intervention or Program

Stand-alone Intervention:

An Intervention is made of one or several activities of same or different type following the same validation and verification cycle from start to end of the Intervention.

Activities alter the conditions of a GHG baseline and cause GHG emission reductions or removal enhancements in the considered value chain.

Activities included in an Intervention can be of any type as long as they lead to validated expected emissions reductions or removals enhancements compared with a validated baseline.

An Intervention is limited in physical space and in time through the definition of one single baseline scenario and quantification approach per type of activity included in the Intervention.

The geographical limits of an Intervention is such that for a given type of activity included in the Intervention, the same baseline scenario is applicable to all considered activities. When this condition is not met, separate Interventions have to be submitted for validation and verification.

The starting date of an Intervention is taken as the earlier starting date of the various activities included.

Demonstrate functional and service equivalence in the type and level of activity of products or services provided between the Intervention and the baseline scenario and explain, as appropriate, any significant differences between the Intervention and the baseline scenario. Where service equivalence is not met, associated leakage shall be accounted for. See example provided in the SC VC Requirements section 3.3 for wheat grown in the U.S.

Demonstration must be made that the activities result in GHG emissions reductions or removal enhancements beyond what would occur in comparison to the determined GHG baseline including any leakage if applicable.

Program of Interventions:

A Program of Interventions ('Program') refers to an unlimited number of Interventions, grouped under the same 'umbrella Program', where each activity complies with the validated Quantification Approach. A Program is designed together with one or more initial Interventions. Initial Interventions may include any planned Interventions, provided that they are sufficiently described in the Program DD to go through a validation auditing process.

All new Interventions joining the Program post-initial validation will have to apply the relevant quantification approach validated at Program level and will have to be compliant with a set of inclusion criteria defined by the Program at the outset.

The Program is not limited in time, but its geographical boundaries within which all future Interventions will take place must be defined from the outset. Geographical boundaries may change, but this is considered a design change and will require complementary validation.

The starting date of a Program is taken as the implementation start date of the first Intervention included.

A Program submitted for validation must include at least one initial Intervention.

This section (1 page max) must:

- 3.1.1. *Describe the purpose of the stand-alone Intervention/Program.*
- 3.1.2. *Describe all Intervention activities (e.g., different forestry or agricultural practices, technology types, measures) included in the stand-alone Intervention/Program, and their respective starting dates (estimated starting dates may be provided for planned Program Interventions).*
- 3.1.3. *Define the activities targeted by the Intervention/Program and describe causality; how the Certificate Holder is causing the Intervention/Program relative to business-as-usual.*
- 3.1.4. *Describe the amount of productivity/yield expected to be impacted (including any change caused by the Intervention).*
- 3.1.5. *State the implementation start date (date when the activities actually began) of the Intervention OR of the first Intervention within the Program.*
- 3.1.6. *State the duration of the activity(ies) (months) within the Intervention(s) and the reporting period.*

This Program targets arable farmers in France, Belgium and the UK who are committed to adopting regenerative agriculture practices and maintaining them. It has been developed by Soil Capital, an independent agronomy firm whose headquarters are in Belgium. Since 2013, the Soil Capital team has managed, or advised on, nearly 200,000 ha of farmland under transition to regenerative agriculture across five continents.

Regenerative agriculture can be defined as, “farming and grazing practices that...reverse climate change by rebuilding soil organic matter and restoring degraded soil biodiversity, resulting in both carbon drawdown and improving the water cycle” (Carbon Underground, 2017, page 1). Regenerative agriculture differentiates itself from other sustainable agriculture practices by focusing on more than the reduced negative impacts of farming practices and instead ensures that agriculture has a net positive effect on environmental issues, ranging from climate change to soil erosion to overuse of pesticides.

However, several barriers prevent farmers, on the one hand, from transitioning to regenerative agriculture practices on a large scale today (Groupe BPCE, 2019) and, on the other hand, from maintaining their practices. These barriers include, among others: (i) farmers fear making an economic loss during their transition, either because of new operational costs that are introduced or lower yields that result (or both); (ii) farmers see little market incentive that rewards them for taking the risks they see in the transition; and (iii) they lack the confidence that alternative practices will work for them when they face any number of agronomic and operational challenges.

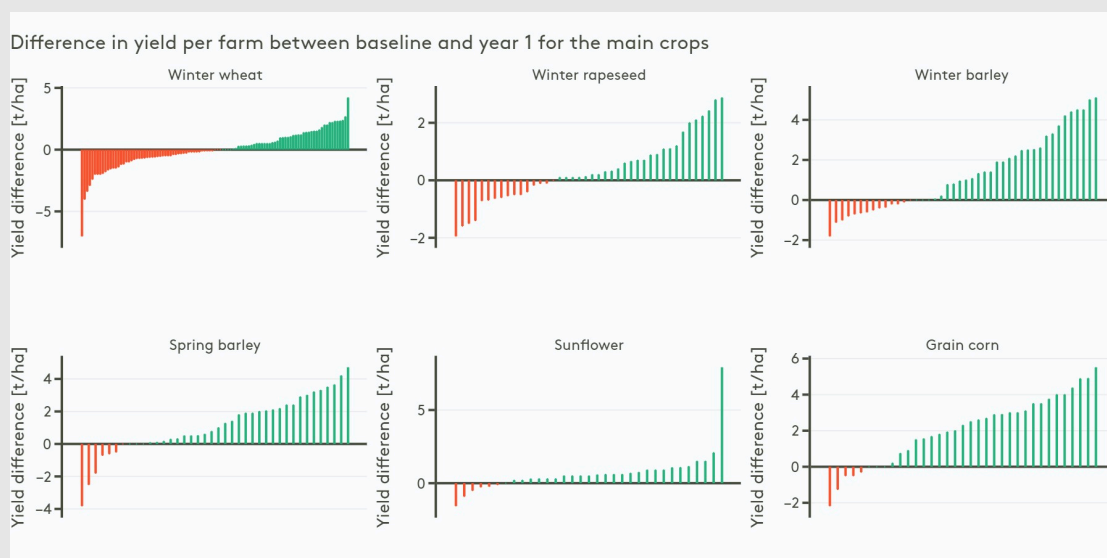
The purpose [3.1.1] of the Program is to empower more farmers to transition from conventional to regenerative agriculture practices and maintain their efforts by enabling them to gain technical support and earn new financial rewards for farming practice changes that result in the reduction and removal of GHG emissions.

The regenerative agriculture practices, or Intervention activities [3.1.2], that are often enabled by improved crop rotations and contribute the most to emission reductions and removals in this Program are described and defined [3.1.3] as:

- the reduction of synthetic fertiliser use via increased fertiliser use efficiency and / or its replacement with organic fertilisers;
- the switch from full inversion ploughing practices to minimum (reduced) tillage or no (zero) tillage;
- the increasingly systematic implementation of cover crops (including catch crops, intercrops);
- greater incorporation of crop residues into the soil post-harvest;
- reductions in fuel and pesticide use;
- improved manure management; and
- the introduction of trees and perennial tree crops into arable fields using agroforestry techniques.

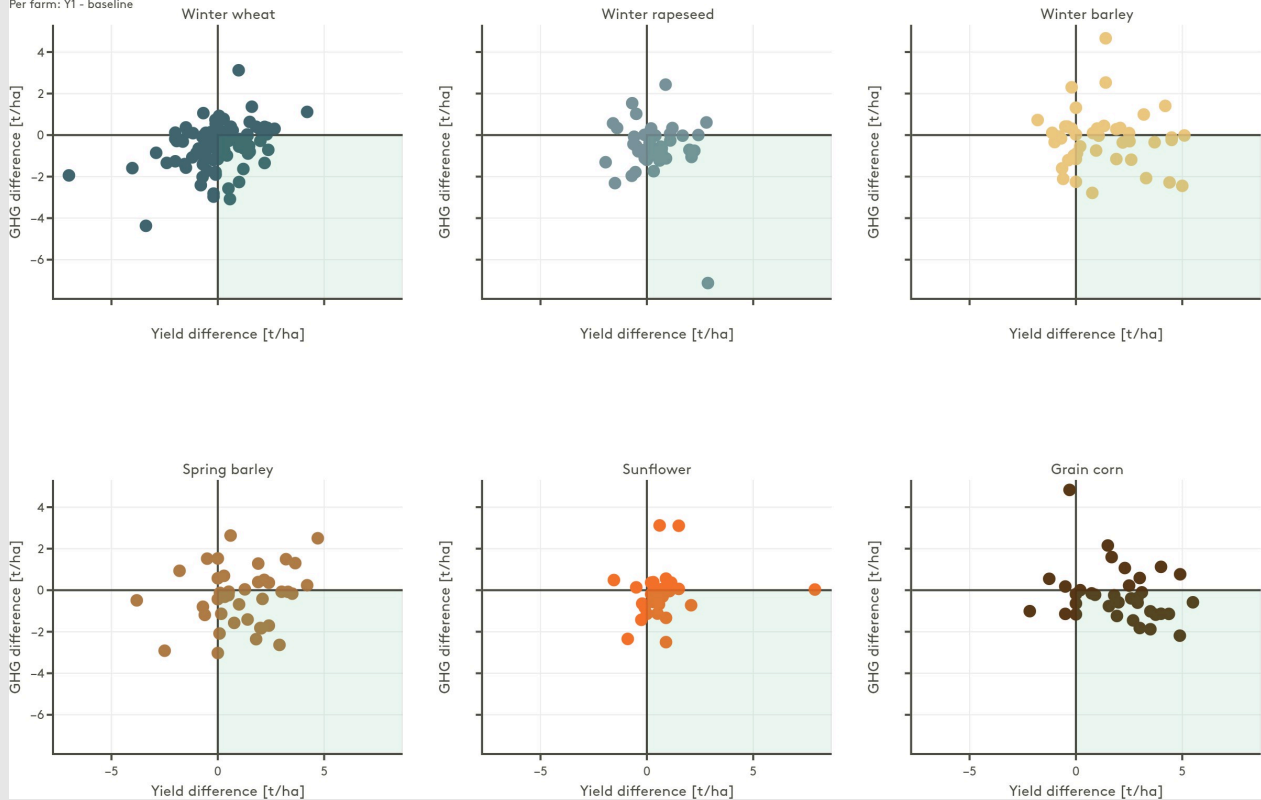
As a result of implementing these activities during the Program in a way that is independently verified, farmers earn payments from the Program proportionate to the climate impact of the activities compared to their baseline. It is the role of these payments in enabling farmers to overcome barriers preventing them from adopting and maintaining regenerative agriculture practices that demonstrates the Program’s causality [3.1.3].

Productivity or yield impacts [3.1.4] from land use [change](#) are a common consequence of Programs such as this one. However, this Program does not allow for land use change that would change the use of land from arable farming during the Program and cropland must have been managed as cropland for at least 10 years prior to the Program start date. On the other hand, observers and farmers alike share fears that changes to land use [practices](#) in line with the Intervention activities of this Program can lead to productivity or yield reductions. We observe that there is no single truth here and that, in fact, the impact of implementing the Intervention activities on productivity or yields is a function of the nature and implementation strategy of an individual farmer's transition to adopt the Intervention activities. It is noted, for example, that there are many long-term experiments which demonstrate the capacity of improved crop rotations and cover crop adoption to increase soil organic matter levels, while maintaining or increasing yields, without requiring additional nitrogen inputs compared to conventional management (e.g. Dick et al., 1998; Abdalla et al., 2019). Nevertheless, yield is monitored routinely during the Program for all farmers. Data already collected in this way substantiates the above. For instance, after the first verification for the year 1 September 2020 to 31 August 2021, yields for six crops in the Baseline and Project Intervention ("Year 1") were compared. A positive difference means that the Year 1 yield was higher than the baseline yield.

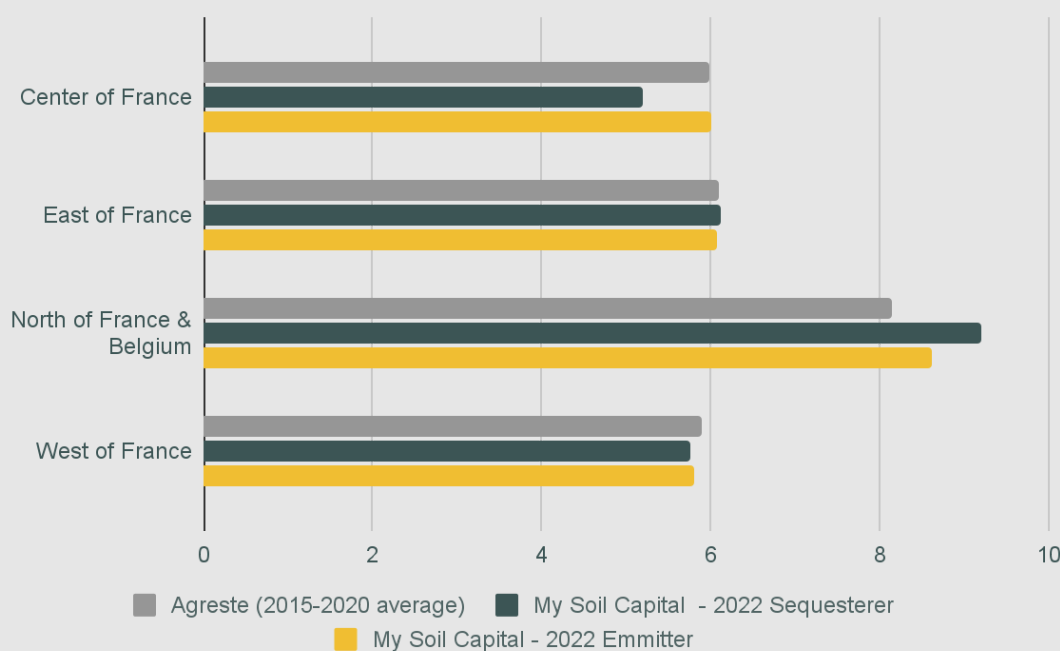


To control for the extent to which the Intervention activities were implemented, this analysis was supplemented by comparing yield change between the two years with the change in the GHG footprint of the crop in question, as per the below, where the green quadrant highlights both yield improvement and GHG footprint improvement. This highlights that, indeed, productivity or yield reductions are by no means guaranteed as a result of implementing the Intervention activities, but rather the opposite can be achieved with a prudent and appropriate approach to execution.

Difference in yield compared to difference in GHG
Per farm: Y1 - baseline



A final control was performed by comparing the yields of farmers in the Program to average yields in their local regions using publicly available Government data. The following chart focuses on barley yields as an illustration, whereby Agreste is the regional average yield and farmers in the Program are categorised into those that net sequester or net emit GHGs. As above, we observe that it is by no means a guarantee that implementing the Intervention activities leads consistently to any measurable yield reduction – sometimes (e.g. North of France & Belgium) to a marked increase.



The start [3.1.5] of the Program was set at the beginning of the 2020–2021 growing season, i.e., 1 September 2020. This means that the first date for the first incidence of each of the Intervention activities is 1 September 2020. A new intake of farmers is enrolled in the Program each year.

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Information relative to number of farmers in the program today and in the future

In terms of duration [3.1.6], each farmer commits to an initial five-year crediting period, which can be repeated a maximum of four times, followed by a 10-year retention period, during which reversals are monitored. The duration of the Program is 30 years maximum. Monitoring during the crediting period is conducted on each farm on an annual basis, drawing on farmers reporting annually on their practices, supported by a comprehensive range of data records and independent data sources, during the crediting period.

The Program has already been validated by a third-party auditor against ISO 14064, once for an original geographical scope of France and Belgium (see Validation Statement on p.26 of the Validation Report listed as “TUV Rheinland_Validation Report_Soil Capital Carbon_FR BE_March 2021” in Annex 6) and then once more when the Program scope was expanded to include the UK (see Validation Statement on p.25 of the Validation Report listed as “TUV Rheinland_Validation Report_Soil Capital Carbon_FR BE UK_July 2023” in Annex 6). In addition, there have already been two verification cycles completed by the same third-party auditor (Verification Reports listed as “TUV Rheinland_Verification Report_Soil Capital Carbon_Vintage 2021_Final” and “TUV Rheinland_Verification Report_Soil Capital Carbon_Vintage 2022_Final” in Annex 6). Impact Units already verified in these verification cycles will not be verified again in the future by SustainCert.

3.2. Location

Program of Interventions:

Geographic areas included in the Program shall be associated with an initial Intervention. When no initial Intervention is associated with a geographic area, that geographical area shall not be part of the Program unless its baseline scenario has been included in the Program DD.

This section must:

- 3.2.1. *Provide a brief description of the stand-alone Intervention/Program location and geographical boundaries.*
- 3.2.2. *Provide a map of the stand-alone Intervention/Program geographical boundary (i.e., the geographic area where the Intervention is implemented)*
- 3.2.3. *Include an assessment of the potential number of activities (i.e., including georeferenced location of each activity).*

This Program targets arable farmers that are located [3.2.1]
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Location of farmers in the program

who are committed to adopting regenerative agriculture practices and maintaining them. The locations of some of the farmers already enrolled in the Program are illustrated by this map [3.2.2]:

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Map of farmers in the program today

The Program does not prescribe to farmers which specific Interventions or activities to implement, believing instead that farmers are the best placed to judge what is appropriate for their farm's particular conditions. An assessment of the potential number of activities [3.2.3] is therefore, at a maximum, all seven of the activities defined in 3.1 multiplied by the number of farmers enrolled in the Program at a given time. The actual or projected number of farmers in the Program each year and in total is as per the following table:

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Table per region of #of farmers and surfaces

The georeferenced location of each farm enrolled in the Program at the most recent verification is available, subject to appropriate GDPR-compliant data handling policies being in place. Soil Capital collects this data via the farmer facing software platform, mySoilCapital, that is detailed in Section 4.3. When the farmer is first enrolling their farm in the Program, they select their different fields in one of the following ways:

- (1) Uploading a supported .shp file, including the ones provided by EU governments for a CAP subsidy declaration;
- (2) Selecting pre-determined polygons from the publicly available geo-referenced files used for subsidy payments;
- (3) Drawing on the map using dedicated tools.

These fields are then stored and geo-referenced in Soil Capital's database. By doing so, we ensure that each field polygon in mySoilCapital is geo-referenced and can be traced through time. The images below illustrate this process.

segment (the “market”) from which Company sources. It also allows some flexibility for the coming and going of individual suppliers within that market, while maintaining overall integrity of accounting.

Companies are recommended to consider the following two questions when assessing this:

1. Is it demonstrably possible that the tier two or above supplier (for example farm) provides products to the tier one supplier (for example mill). If not, then the farm is not in the supply-shed.
2. Does the Intervention impact on the tier two or above supplier? If not, then the supplier is not included in the Intervention.

Options are provided below in decreasing order of preference to justify upstream suppliers as part of the supply-shed.

Option 1 - upstream suppliers providing the same type and quality of goods and services can be demonstrated as supplying these goods and services to actual direct suppliers (Tier 1 suppliers) of the reporting Company over the reporting period considered.

Option 2 - it can be demonstrated that there is a pre-defined market (national or subnational) for the type and quality of specific goods and services considered (market segment), and that the reporting Company sourced these goods and services from this market over the reporting period considered. Examples could include regulated areas or areas covered by industry associations.

Note: Other options for demonstrating supply shed will only be considered on a case-by-case basis.

This section must:

- 3.3.1. Define the primary commodity(ies) supply-shed(s) within which the Intervention(s) (for each Intervention in the case of a Program) are taking place. This should include: market segment, type and quality of specific goods.*

Farmers in the Program must enrol their whole arable crop rotation and therefore all crops that they grow. This makes the scope of primary commodity supply sheds across the three countries that the Program operates in potentially large.

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Definition of the supply sheds

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Primary commodity	Market segment	Type and quality
Wheat	Commodity crop used in both food and feed industries	Wheat, buckwheat, durum wheat, spelt, rye and triticale with both winter and spring seeding ¹
Barley	Commodity crop used in both food and feed industries	2-row and 6-row with both winter and spring seeding
Rapeseed	Commodity crop used in both food and fuel industries	Both winter and spring seeding
Sunflower	Commodity crop used in both food and fuel industries	No variation
Alfafa	Commodity crop used in the feed industry	No variation
Corn	Commodity crop used in both food and feed industries	Grain and feed corn
Sugar beet	Commodity crop used in both food and feed industries	No variation
Peas	Commodity crop used in both the food and feed industry	Protein, canning, pod and fodder peas with both winter and spring seeding
Beans	Commodity crop used in both the food and feed industry	Horse, dry and fava beans with both winter and spring seeding
Potatoes	Commodity crop used in the food industry	Potatoes for consumption and seed
Flax	Commodity crop used in the food and fibre industries	Oilseed and textile flax with both winter and spring seeding

¹ As per, for example, classifications used in [UK Government statistics](#)

Lentils	Commodity crop used in the food industry	No underlying aggregation
Soybean	Commodity crop used in both the food and feed industry	No underlying aggregation
Oats	Commodity crop used in the food industry	Both winter and spring seeding

4.0. EMISSIONS AND /OR REMOVALS

Apply the following fundamental principles systematically in all the information provided:

Relevance - considered sources, sinks, data, and quantification approaches are appropriate; for reporting claims, materiality threshold at aggregated level set at maximum 5% of the total validated, expected emissions/removals at lower end of confidence interval.

Completeness - all relevant (material) GHG emissions and removals are included, together with all relevant information to support criteria and procedures.

Consistency - approach considered enables meaningful comparisons in GHG-related information (uniform procedures over time, and for both baseline and Intervention, functional/service equivalence, etc.).

Accuracy - bias and uncertainties are discussed and reduced as far as practical (where high cost make accuracy difficult, conservativeness serves as a moderator to accuracy to maintain the credibility).

Transparency - sufficient and appropriate GHG-related information is disclosed to allow intended users to make decisions with reasonable confidence.

Conservativeness - conservative assumptions, values and procedures are used to ensure GHG emissions reductions or removal enhancements are not over-estimated.

4.0. Approach to Determine Activity Based Reporting

Activity Based Reporting is relevant if the Certificate Holder is the Company that will eventually use the outcomes of the Intervention to support scope 3 reporting.

This section must:

4.0.1. Provide details of how the Certificate Holder intends to assess the impact on the emissions changes from the activity linked to goods and services targeted.

To assess the impact on the emissions linked to goods and services targeted [4.0.1], the Program's quantification approach combines soil analysis, modelling and remote sensing techniques. In brief, soil analysis is used to verify soil conditions at Baseline and Year 5 in the Intervention scenario, modelling is used to quantify the emissions and removals under the Intervention scenario on an annual basis and remote sensing is used to verify management practices such as cover cropping and tillage that are disclosed by farmers.

This methodology is further elaborated in Section 4.1.

4.1. Intervention Boundary (SSRs)

For complete, accurate, and transparent quantification of Intervention-based GHG reductions, identify all sources and sinks (and related GHGs) relevant to the baseline and the Intervention/Program, and if applicable, leakage.

Exclusion of GHG sources from quantification is justified when comparisons of the Intervention(s) and baseline(s) scenario sources show no change from the baseline scenario to the Intervention. However, whenever the goal is to translate the impact of the Intervention/Program into one or more emissions factors (or removals factor), the inventory of sources must be conducted on a life cycle basis and exclusion as discussed above is not permitted for upstream emissions (within the material threshold).

The concept of materiality is used to identify information that, if omitted or misstated, would significantly misrepresent a compilation of quantitative environmental information to its intended application, thereby creating confusion or misunderstanding.

Differences between Level 1 and Level 2 in materiality thresholds: limited vs reasonable levels of assurance, materiality threshold: Level 1 = 5%; Level 2 = 2%

This section must:

4.1.1. Describe the criteria & procedures used to identify all sources, sinks and reservoirs relevant to the stand-alone Intervention or the various Interventions included in the Program.

4.1.2. Explain and apply, where necessary, additional criteria for identifying SSRs in the baseline, and compare baseline(s) and Intervention(s) SSRs.

4.1.3. For complete, accurate, and transparent quantification of Intervention-based GHG reductions, identify all sources and sinks (and related GHGs) relevant to the baseline(s) and the Intervention(s), and if applicable, leakage.

Use Table 1.0 to describe all emission SSRs and GHGs included in the Intervention/Program boundary for the purpose of calculating project scenario (i.e., Intervention) emissions/removals, baseline emissions/removals and if applicable, leakage.

Since the Program was first validated against ISO 14064, the SSRs that are “controlled by” or “related to” the Program were identified by analysing widely adopted frameworks for farm-level sources, sinks and reservoirs of GHGs. In particular, frameworks analysed were the IPCC guidelines for Agriculture, Forestry and Other Land Use (2006² and then updated in 2019³), which serves as the underlying scope for the Cool Farm Tool, as well as the output from the European Commission’s iMAP (Integrated Modelling platform for Agro-economic and resource Policy analysis) project⁴, which includes a systematic review of the farming practices linked to decreasing GHG emissions and increasing soil carbon sequestration.

The following the definitions provided by ISO 14064 itself as the defining criteria [4.1.1]:

- Controlled SSR: a GHG source, sink or reservoir whose operation is under the direction and influence of the GHG Program through financial, policy, management or other instruments
- Related SSR: a GHG source, sink or reservoir that has material or energy that flows into, out of or within the Program

The same SSRs listed in Table 1.0 below are used in both the baseline and Intervention scenarios, so no further explanation on variance is needed [4.1.2].

A full assessment of leakage potential from the Program’s Intervention activities has been conducted resulting in a conclusion that there is no material opportunity for leakage from these SSRs or others [4.1.3]. This assessment is summarised below.

- Leakage resulting from yield reduction. A common concern regarding similar Programs is that the introduction of the Intervention activities will result in lower yields. Since food demand continues to grow, the concern is that such Programs would displace food production to other areas, potentially leading to increased GHG emissions if the GHG intensity of production in those areas was higher than in the Program area. Section 3.1 presents an analysis that this risk is not material, resulting in the conclusion that leakage via SSRs related to this potential source of leakage is not material to the Program.
- Leakage resulting from the substitution of synthetic for organic fertiliser. From a single farm point of view, this Intervention results in an increased demand for organic manure. In theory, it is technically possible that this could result in an increase in the production of farmyard manure in response, via expansion of livestock farming elsewhere. If this was the case, it would result in increased GHG emissions from livestock. In practice, manure is a waste product from livestock production whose value is immaterial to a livestock producer compared to the value of meat or livestock products. An increase in demand therefore does not lead to an increase in supply. The other possible effect is that manure could be diverted from other activities that are more beneficial to the climate. In Europe, the vast majority of manure is used to fertilise farmland (Andurand et al. 2018), rather than being used in bioenergy, for example. Therefore, this is also not considered to be a material risk. Finally, depending on the volumes of synthetic fertilisers being avoided, it is theoretically possible that the project could lead to a reduction in price for such fertilisers and subsequently an increased consumption by other farmers (i.e. a ‘rebound effect’). However, the synthetic fertiliser market is a global commodity market. In the EU alone, there were over 10 million different farms in 2016 (Eurostat – Agriculture statistics, 2016). So, the behaviour of 2,000 farmers in this project is highly unlikely to have a material impact on fertiliser pricing. The risk of leakage via this mechanism is negligible.

² <https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html>

³ <https://www.ipcc-nggip.iges.or.jp/public/2019rf/index.html>

⁴ <https://wikis.ec.europa.eu/pages/viewpage.action?pageId=44167087>

- Leakage via displacement of livestock. For those arable farms that do have livestock (and are eligible), all relevant emissions from enteric fermentation and manure management are included as SSRs for the Program. It is plausible that farmers would respond to this by selling livestock, which would result in simply moving their associated emissions outside of the Program area, leading to leakage. To manage this risk, for those arable farms that do have livestock (and are eligible), the GHG emissions calculated during their baseline assessment are held constant throughout the Project Years, irrespective of changes to livestock management practice or reductions in livestock numbers. Thus, if livestock displacement does occur and livestock numbers go down during the Project Years, the GHG emissions calculated during the baseline will continue to be applied to the farm's GHG analysis, thus ensuring no leakage.

Table 1.0: SSRs – Sources and Sinks

Source		GHG	Included ?	Justification/Explanation
Baseline	Emissions from soil organic carbon	CO ₂	Yes	Soil organic carbon is a major carbon pool controlled by the Program activities. While the overarching goal is to increase soil organic carbon under regenerative agriculture practices, there is also the possibility of CO ₂ emissions from soil organic carbon, mainly via increased tillage, which is material since soil disturbance is known, via oxidation, to result in CO ₂ emissions.
		CH ₄	No	
		N ₂ O	No	
	Emissions from fossil fuel and electricity use for field operations, e.g. mechanical operations, irrigation	CO ₂	Yes	Fuel use, resulting in CO ₂ emissions, is included in scope for this Program since it is a source of emissions directly controlled by the choice of farming practices. CO ₂ is the relevant.
		CH ₄	No	
		N ₂ O	No	
	Emissions from the production and use of synthetic fertiliser	CO ₂	Yes	CO ₂ emissions associated with the production of synthetic fertilisers, a key farming input, are known to be a material source of farm emissions. Synthetic fertiliser use is a practice that will be directly affected by the Program activities because of its relationship to soil health improvement. For the same reason, N ₂ O emissions associated with the in-field application of synthetic fertilisers, known to be a material source of farm emissions, are included in scope.
		CH ₄	No	
		N ₂ O	Yes	
	Emissions associated with the production of synthetic pesticides	CO ₂	Yes	CO ₂ emissions associated with the production of synthetic pesticides, a key farming input, are known to be a material source of farm emissions. Pesticide use is a practice that will be directly affected by Program activities because of its relationship to soil health improvement.
		CH ₄	No	
		N ₂ O	No	
	Emissions from crop residue management	CO ₂	No	N ₂ O and CH ₄ emissions associated with the management of crop residues are known to be a material source of farm emissions, both positive and negative. Residue management is a practice that will be directly affected by the Program activities because of its relationship to soil health improvement.
		CH ₄	Yes	
		N ₂ O	Yes	
	Emissions from manure management practices for livestock managed on participating farms	CO ₂	No	If a participating farm has livestock, CH ₄ and N ₂ O emissions from manure management are included in scope. This is because such emissions are known to be a material source of farm emissions and are under the direct control of participating farmers.
		CH ₄	Yes	
		N ₂ O	Yes	
	Emissions from enteric fermentation of livestock managed on participating farms	CO ₂	No	If a participating farm has livestock, CH ₄ emissions from enteric fermentation are included in scope. This is because such emissions are known to be a material source of farm emissions and are under the direct control of participating farmers.
		CH ₄	Yes	
		N ₂ O	No	
Intervention	Exactly as above	CO ₂		
		CH ₄		
		N ₂ O		
	Exactly as above	CO ₂		
		CH ₄		

Source	GHG	Included ?	Justification/Explanation
	N ₂ O		

Sink		GHG	Included ?	Justification/Explanation
Baseline	Removals via build-up of soil organic carbon from organic matter inputs and tillage reduction	CO ₂	Yes	Soil organic carbon is a major carbon pool controlled by the project activities. The overarching goal is to increase soil organic carbon under regenerative agriculture practices (i.e., towards net removals).
		CH ₄	No	
		N ₂ O	No	
	Removals via growth of biomass in trees planted within field boundaries to integrate with productive arable systems (e.g., following agroforestry techniques).	CO ₂	Yes	Sequestration of carbon in tree biomass is a material sink that can be directly affected by the Program activities. Tree planting to form new hedgerows, woodland or forests is excluded, as is the maintenance of existing hedgerows, woodland or forests, as these activities are the focus of existing public policy support.
		CH ₄	No	
		N ₂ O	No	
		CH ₄		
		N ₂ O		
Intervention	Exactly as above	CO ₂		
		CH ₄		
		N ₂ O		
	Exactly as above	CO ₂		
		CH ₄		
		N ₂ O		

4.2. Description of the Baseline

Establishing one or more baseline scenarios for the Intervention/Program is necessary to demonstrate that the Intervention/Program has genuinely reduced emissions and/or enhanced removals.

It is important to clearly define and measure the emissions and/or removals of the impacted goods and services prior to the Intervention/Program taking place. The baseline should account for the condition as close to reality and as consistent with the accounting for the post-Intervention state as is feasible.

The baseline can be static (remain the same during the Intervention period) or dynamic (change over time during the Intervention period) but shall take into account likely future behaviour of the baseline scenario to meet the conservativeness principle.

The baseline time period shall be long enough to ensure that the variability in operating patterns (e.g., seasonal fluctuations) is accounted for by the performance indicators (representativeness).

Program of Interventions:

A baseline scenario shall be established for each different geographic area included in the Program. In a given geographic area, where several baseline scenarios are coexisting, the area shall be stratified such that a single baseline scenario can be described for each stratum.

This section must:

- 4.2.1. Describe the baseline status of the proposed stand-alone Intervention or various Interventions included in the Program, including the total baseline emissions or removals for the targeted goods or services
- 4.2.2. State the total amount of goods affected (relevant for the assessment of leakage).

Each farmer that enrolls in the Program individually provides historical management practice data for their whole arable rotation (enrolment of individual fields is not permitted). This is either derived from the complete growing season directly preceding enrolment (Cohorts 1-3) or the three complete growing seasons directly preceding enrolment (Cohort 4 onwards)⁵. This is known as their individual historical practice assessment.

Where it is required for inventory accounting, this enables each farm's own individual crop-specific emission factors to serve as their baseline [4.2.1]. Their baseline is static and fixed for the following five years, comprising that farmer's crediting period.

The baseline emissions and removals [4.2.1] and total yields [4.2.2] for farmers in Cohorts 1 and 2 of the Program that result from these individual historical practice assessments, independently verified by the Program's existing verification body following the most recent verification, are as follows:

Cohort	Baseline emissions (T CO ₂ e)	Baseline removals (T CO ₂ e)	Total yield (T)
1	33,903	44,717	213,771
2	117,079	143,929	740,270

Where an intervention accounting approach is preferred by reporting companies, and in order to assign a financial value to improvements achieved in each farm's crop-specific emission factors under an inventory accounting approach, the Program also uses an intervention accounting approach in parallel, based off the same farm-level data. Here, one of two baseline scenarios apply:

- Baseline scenario 1 – continuation of the current situation, i.e., common practice of the individual farm;
- Baseline scenario 2 – stepwise conversion to regional common practice, i.e., common practice of the region.

Baseline Scenario 1: most farmers will have a conventional farmer profile upon entering the Program. This type of farming profile is characterised by high disturbance tillage (i.e., full inversion ploughing) for land preparation, systematic use of synthetic fertilisers, short rotations of mono-cultured crops and use of cover crops only as the law requires it. The resulting GHG balance of a typical conventional farm will be net emitting. Farmers enrolling in the Program with practices that result in net emissions therefore use their own individual GHG inventory, as calculated in their individual historical practice assessment, as their baseline throughout the crediting period for the Intervention accounting component of the Program. This baseline is static and fixed for the following five years.

⁵ For further details regarding Cohorts, see Section 4.3

Baseline Scenario 2: the remaining farmers will demonstrate a more regenerative farmer profile upon entering the Program and their practices will result in the net removal of GHGs from the atmosphere, as calculated in their individual historical practice assessment. In this scenario, it is demonstrated that, in the absence of the Program, such farmers could very reasonably be expected to undergo a stepwise conversion back to common practice in their region due to the barriers they face in maintaining these regenerative practices. A detailed review of these barriers is presented in Annex 3. Such farmers therefore use an Adapted Regional Default Value (ARDV) as their baseline, which is constructed from the modelling of a transition from regenerative agriculture practices to what are considered 'common practices' for a specific region in the Program area by a group of independent experts. A conservative approach to this modelling is applied in a number of ways. This baseline is static and fixed for the following five years, subject to annual confirmation from independent experts that the assumptions used to construct each ARDV have not materially changed. The full methodology for defining common practices in a specific region, the definition of a region and what is meant by a stepwise conversion back to common practice is detailed in Section 5.1.1.2 (p.58) of the PDD for the Program already validated against ISO 14064, which is listed in Annex 6 "Soil Capital Carbon PDD_FR BE UK_VALIDATED".

4.3. Quantification Approach

Select or establish criteria and procedures or methodologies for quantifying GHG emissions and/or removals for selected GHG SSRs for each one of the types of activities included in the stand-alone Intervention/Program. If the Quantification Approach is using a computer simulation model (e.g., process-based model), then the Intervention/Program Representative must fill out Annex B of the IDD/Program DD.

Describe the proposed approach to quantifying emissions in both baseline(s) and Intervention(s) scenarios – and clearly reference any existing Methodologies/Protocols approved under an established standard where used (e.g., Gold Standard, Verra, etc.).

Account for changes in emissions and removals by GHG sources and sinks affected by the Intervention/Program through activity shifting or market transformation (leakages).

Level 1: Perform a qualitative or quantitative uncertainty assessment for the design phase and implementation phase.

Level 2: Perform an uncertainty analysis (quantitative and systematic procedure to ascertain and quantify uncertainty) for the design phase and implementation phase.

Complete a self-assessment of potential risks which could affect the expected emissions reductions or removals enhancements and discuss related mitigation measures introduced.

This section must:

- 4.3.1. *Describe how criteria and procedures or methodologies for quantifying GHG emissions and/or removals for selected GHG SSRs for each one of the types of activities included in the stand-alone Intervention/Program were selected and established. If the quantification approach is using a computer simulation model (e.g., process-based model), Certificate Holder must fill out Annex B of the VC-IDD.*
- 4.3.2. *Describe the proposed approach to quantifying emissions in both baseline(s) and Intervention(s) scenarios – and clearly reference any existing methodologies/protocols approved under an established standard where used (e.g., Gold Standard, Verra, etc.).*
- 4.3.3. *Demonstrate functional and service equivalence in the type and level of activity of goods or services provided between the project and the baseline scenario and explain, as appropriate, any significant differences between the Intervention(s) and the baseline(s) scenario. Where service equivalence is not met, associated leakage shall be accounted for.*
- 4.3.4. *Describe how the activities result in GHG emissions reductions or removal enhancements beyond what would occur in comparison to the determined GHG baseline(s).*
- 4.3.5. *Describe how the quantification approach is conservative*
- 4.3.6. *Justify the relevance, completeness, consistency and accuracy of the quantification approach for the activities included in the Intervention/Program (baseline and activity).*

- 4.3.7. Detail any references, limitations (including data quality) and assumptions applied (this may be a summary in the IDD/Program DD but must be given for each parameter in appended calculation sheets).
- 4.3.8. *No specific action is required in the VC-IDD/Program DD*
- 4.3.9. [Level 1] Describe the qualitative or quantitative uncertainty assessment (see guidance for Uncertainty assessment for SustainCERT's Value Chain Interventions in Annex II).
- 4.3.10. [Level 2] Describe the quantitative uncertainty analysis (see guidance for Uncertainty analysis for SustainCERT's Value Chain Interventions in Annex II).
- 4.3.11. Describe the assessment of risks potentially affecting expected emissions reductions or removals enhancements and discuss related mitigation measures introduced (these measures shall be included in the Monitoring Plan).
- 4.3.12. State the total amount of goods affected and if relevant amount of sold goods.

The Program's quantification approach always combines soil analysis, modelling and remote sensing techniques. In brief, soil analysis is used to verify soil conditions at Baseline and Year 5 in the Intervention scenario, modelling is used to quantify the emissions and removals under the Intervention scenario on an annual basis and remote sensing is used to verify management practices such as cover cropping and tillage that are disclosed by farmers.

While none of the SSRs or activities/Interventions in scope have yet, the modelling used by the Program has evolved in the spirit of continuous improvement and as the science and technology for soil carbon sequestration quantification has itself developed. When it was first launched, the Program only used an empirical model called the Cool Farm Tool (CFT) for all soil-based emissions and removals as well as all other emissions. More recently, Regrow Ag's Denitrification Decomposition (DNDC) process-based biogeochemical model has been added to the Program's quantification approach. Since the Program recruits farmers on an annual basis, this has been applied as follows:

Cohort	First year in Intervention Scenario	Model used for soil-based emissions and removals	Model used for all other emissions
1	Harvest 2021	CFT	CFT
2	Harvest 2022	CFT	CFT
3	Harvest 2023	CFT	CFT
4 onwards	Harvest 2024	DNDC	CFT

Since different levels of assurance are sought for different Cohorts (Cohorts 1-3 = Level 1, Cohorts 4 onwards = Level 2), the quantification approaches for the two groups of cohorts are presented separately.

Quantification approach: Cohorts 1-3

The model used in the Program, the CFT, was selected [4.3.1] based on a clear set of criteria. The main ways in which the model meets these criteria are as follows:

Model	CFT
Criteria	
Scientific integrity	The CFT is an empirical model that uses the latest IPCC emission factors ("IPCC. 2019 refinement to the 2006 IPCC guidelines for national greenhouse gas inventories. Technical Report, IPCC, 2019"). It has a dedicated Science Advisory Council holds responsibility for strategic decisions regarding science and methods for the CFT, including updates according to the latest IPCC and peer-reviewed science. For crops, the CFT incorporates Tier 1, Tier 2 and when it comes to N2O emissions and soil carbon sequestration, a "simple Tier 3" model – as described by Prof. Pete Smith.
Relevance to the Program's geographies	The CFT covers virtually all crops and livestock globally. It can therefore be used seamlessly across the countries within scope for this Program.
Applicability across national borders	
Readiness for automated connectivity	The CFT can be accessed via an API connection that is managed by the Cool Farm Alliance (CFA) and has a dedicated team of product managers and developers maintaining it.
Acceptance by the food and beverage industry	The CFT is owned and developed by an alliance of more than <u>100 global food and beverage companies</u> , with the intention of having a common model for quantifying emissions and removals in their supply chains.
Annex 2 has been completed for the CFT. The approach to quantifying emissions in the Intervention(s) scenarios [4.3.2] is exactly the same as in the individual historical practice assessment used for the Baseline. It requires the summing of the emissions and removals of the same stated SSRs in both scenarios, with the quantification approach as detailed in the following table.	

Arable:	
Emissions from crop residue management	CFT
Emissions from synthetic fertiliser production	
Emissions from synthetic fertiliser use	
Emissions from use of pesticides	
Emissions from fossil fuel use for field operations	
Emissions (or removals) from SOC stock changes	
Livestock:	
Emissions from enteric fermentation	IPCC emission factors
Emissions (direct and indirect) from manure management	

This approach has already been validated by a third-party auditor against ISO 14064 (see Section 3.5, p.18 of the Validation Report listed as "TUV Rheinland_Validation Report_Soil Capital Carbon_FR BE UK_July 2023" in Annex 6). The references, limitations and assumptions [4.3.7] applied by the CFT are transparently detailed via the technical documentation that lists every equation and emission factor used by the model. It is found in Annex IV (p.110) and Annex V (p.121) of the PDD already validated against ISO 14064 and listed as "Soil Capital Carbon PDD_FR BE UK_VALIDATED" in Annex 6.

Supporting evidence demonstrating the application of this quantification approach is accessible via [this Google Sheet](#), which contains real data for the Baseline Year (Programme Year 0) and Project Year (Programme Year 1) of two farmers (for illustrative purposes) already participating in the Programme. Farm ID 440 is illustrative of Baseline scenario 1 and Farm ID 526 is illustrative of Baseline scenario 2.

The way in which uncertainty is assessed in this quantification approach is described [4.3.9; 4.3.10] in Section 5.1.

Quantification approach: Cohort 4 onwards

All models used in the Program, namely the CFT and DNDC, were selected [4.3.1] based on a clear set of criteria. The main ways in which each model meets these criteria are as follows:

Model	CFT	DNDC
Criteria		
Scientific integrity	The CFT is an empirical model that uses the latest IPCC emission factors ("IPCC. 2019 refinement to the 2006 IPCC guidelines for national greenhouse gas inventories. Technical Report, IPCC, 2019"). It has a dedicated Science Advisory Council holds responsibility for strategic decisions regarding science and methods for the CFT, including updates according to the latest IPCC and peer-reviewed science. For crops, the CFT incorporates Tier 1, Tier 2 and when it comes to N2O emissions and soil carbon sequestration, a "simple Tier 3" model – as described by Prof. Pete Smith.	DNDC was developed at the University of New Hampshire and has been reviewed in over 500 publications. The model is calibrated and validated locally and consistently, using data specific to locations and corroborating results with academic studies and research.
Relevance to the Program's geographies	The CFT covers virtually all crops and livestock globally. It can therefore be used seamlessly across the countries within scope for this Program.	DNDC is a global model that has been calibrated for use across Europe, including in all of the countries within scope for this Program.
Applicability across national borders		
Readiness automated for connectivity	The CFT can be accessed via an API connection that is managed by the Cool Farm Alliance (CFA) and has a dedicated team of product managers and developers maintaining it.	DNDC can be accessed via an API connection that is managed by Regrow Ag and has a dedicated team of product managers and developers maintaining it.
Acceptance by the food and beverage industry	The CFT is owned and developed by an alliance of more than <u>100 global food and beverage companies</u> , with the intention of having a common model for quantifying emissions and removals in their supply chains.	Regrow's Science is already deployed with a <u>number of leading food and beverage industry brands</u> .

Annex 2 has been completed for both models.

The approach to quantifying emissions in the Intervention(s) scenarios [4.3.2] is exactly the same as in the individual historical practice assessment used for the Baseline. It requires the summing of the emissions and removals of the same stated SSRs in both scenarios, with the quantification approach as detailed in the following table.

Arable:	
Emissions from crop residue management	DNDC
Emissions from synthetic fertiliser production	CFT
Emissions from synthetic fertiliser use	DNDC
Emissions from use of pesticides	CFT
Emissions from fossil fuel use for field operations	CFT
Emissions (or removals) from SOC stock changes	DNDC
Livestock:	
Emissions from enteric fermentation	IPCC emission factors
Emissions (direct and indirect) from manure management	

The references, limitations and assumptions [4.3.7] applied by the CFT are transparently detailed via the technical documentation that lists every equation and emission factor used by the model. It is found in Annex IV (p.110) and Annex V (p.121) of the PDD already validated against ISO 14064 and listed as “Soil Capital Carbon PDD_FR BE UK_VALIDATED” in Annex 6. The references, limitations and assumptions [4.3.7] applied by DNDC are derived from its underlying the scientific framework, which has been well established in over 200 peer-reviewed publications since its development in the 1990s (see a list of publications here: <https://www.globaldndc.net/publications>). A full description of each data parameter used by the model, including their units, sources, limitations, assumptions and references are found in Annex 7.

The way in which uncertainty is assessed in this quantification approach is described [4.3.9; 4.3.10] in Section 5.1.

With respect to the applicability and suitability of DNDC to the Program's geographies, this model is a process-based biogeochemical model built to capture globally relevant first principles of soil biogeochemistry. The model is therefore capable of simulating management impacts on soil carbon and greenhouse gas emissions in any geography provided the management practice can be adequately parameterised. Its applicability and suitability for use in Europe was explicitly recognised by the European Commission's Joint Research Centre in a peer-reviewed paper⁶ it lead authored in 2017, in which it is stated, "The most widely used process-based models to quantify agricultural GHG emissions for landscapes or regions are DNDC, EPIC/APEX and DayCent, each of which are regarded as being well validated". The version of DNDC used in this Program (v.10.30) is in the process of being calibrated and validated for the three European countries of the Program's current scope and its primary commodities. This process will be concluded by the end of September 2023, at which time all underlying datasets used in this calibration and validation process can be made available upon request. The calibration and validation process being undertaken follows the Requirements and Guidance for Model Calibration, Validation, Uncertainty, and Verification For Soil Enrichment Projects, which are publicly available through the Climate Action Reserve ([linked here](#)).

Supporting evidence demonstrating the application of this quantification approach is the same as for Cohorts 1-3 for the emissions sources using the CFT. For those using DNDC, illustrative data is provided in Annex 8. It should be noted that since this validation is being conducted in advance of the first verification for Cohort 4, real data is not yet available, hence the use of dummy data.

Features common to all Cohorts

Note that the Program targets arable farmers, but to accommodate the market reality that arable farms do sometimes have a small amount of livestock, farms with livestock under their operational control for more than six consecutive months are eligible if the GHG emissions from those livestock account for no more than 50% of the farm's overall GHG emissions, resulting from common practice in the region at the baseline assessment. Emissions related to livestock are then held constant from the baseline throughout the crediting period, unless there is an increase in heads of livestock during the project, in which case the same equations are used to calculate the increase in emissions.

Regarding the functional and service equivalence of goods [4.3.3], which are as listed in Section 3.3, the Program's scope covers three European countries to date, all of which are western European countries in close proximity to each other (with broadly similar pedo-climatic conditions in temperate and moist climatic zones) and frequently representing one sourcing region for companies. The Intervention activities do not affect the service equivalence of the goods and the Program does not allow for land use change outside of arable farming; cropland must have been managed as cropland for at least 10 years prior to the Program start date. Therefore, the functional and service equivalence is judged to remain the same through both Baseline and Intervention(s) scenarios.

It is by comparison of the emissions and removals achieved in the Intervention(s) scenario against the baseline, as described in Section 4.2, that explains how the activities result in GHG emissions reductions or removal enhancements beyond what would occur in comparison to the determined GHG baseline(s) [4.3.4].

Since the quantification approach was originally developed and validated against ISO 14064, the principles of relevance, completeness, consistency, accuracy, transparency [4.3.6] and conservativeness [4.3.5] have been core design features from the outset. Their application is described and justified as follows:

⁶ <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0176111#pone.0176111.ref017>

Relevance

The Program uses modelling for annual calculations of emissions and removals, with soil analysis and remote sensing for verification of key data parameters as described above, because of the accuracy and cost challenges that still characterise many readily available soil analysis and remote sensing techniques and technologies when deployed at scale. The relevance of the models used by the Program is justified as per the above table setting out selection criteria.

Completeness

Whether the Program uses just the CFT (Cohorts 1-3) or the CFT together with DNDC (Cohort 4 onwards), the emissions of all three main GHGs associated with the production of agricultural products – carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O) – as well the removal of CO₂ in the form of carbon sequestered in soil or biomass are all calculated by the Program's quantification approach.

In both the Baseline and Intervention scenarios used in this Program, all these GHGs are included in scope, as detailed in Table 1.0.

Consistency

All farmers enrolled in the Program must use the same dedicated farm diagnostic software that has been specifically developed by Soil Capital for the Program, and is called "mySoilCapital", for analysis of their emissions and removals in both the Baseline and Intervention scenarios.

mySoilCapital is a farmer-facing piece of software that allows a farmer to input their farm's operational and practice data and then calculates its emissions and removals and other key agronomic metrics on a per crop and whole farm basis. mySoilCapital was developed by Soil Capital and benchmarks one farm's performance against relevant local peers. When analysing a farm's emissions and removals, mySoilCapital draws on the back-end on the functionality of the CFT and DNDC models via bespoke API connections.

Therefore, via the mySoilCapital tool, the underlying methodologies of the CFT and DNDC are implemented consistently and accurately throughout the Program.

Accuracy

There are two main sources of possible bias and uncertainty considered in this Program: parameter uncertainty and model uncertainty.

- i. parameter uncertainty: the uncertainty associated with quantifying the parameters used as inputs (e.g., activity data, emission factors, or other parameters) to estimation models.
- ii. model uncertainty: the uncertainty associated with the mathematical equations (i.e., models) used to characterize the relationships between various parameters and emission processes.

These are assessed in detail, together with descriptions of how uncertainties are reduced as far as is possible, in Section 5.1.

Transparency

This document discloses all sources of information, calculations, types of data and assumptions required for easy understanding and/or reproduction of the Program's quantification approach.

At each verification, all the data necessary to replicate the emissions and removals quantified are made available to the appointed verification body. For each farm enrolled in the Program, this includes:

- analysis of the soil organic matter of its soils at Baseline;
- data records accounting for all inputs and operations;

- remote sensing information (i.e., tillage practice, cover crop use).

Conservativeness

Aside from the fact that both models used by the Program are based on widely peer-reviewed scientific studies, two key conservative approaches and assumptions are used in the project to ensure that GHG emission reductions are not over-estimated.

Firstly, if, during any verification event, the verification body deems that a farmer cannot provide any reasonable evidence (noting, for instance, that manure is sometimes traded informally) to satisfactorily account for at least 75% of their inputs (by volume), then the farm will not be permitted to generate Impact Units for that season.

Secondly, the methodology used to calculate the ARDV for each region includes a number of specific steps so as to adopt a conservative approach:

- variance analysis, to ensure that the data collected from relevant experts is sufficiently aligned to be reliable;
- upper and lower bound analysis, to ensure that where ranges exist for the data used to represent common practice for a region, the end of the range that is conservative and results in a lower GHG balance at farm level is selected;
- use of the most regenerative farmer profile within the transition pathway, to ensure that the starting point for the transition is associated with the maximum realistic level of removals;
- four-to-five-year timeline for the transition pathway, to reflect a more gradual transition over a rapid one;
- focus only on changes to the soil carbon stock, rather than the change in the whole farm emissions;
- averaging over five years and rounding to the nearest 250 kg.

The full protocol for determining the ARDV in a specific region is detailed in Section 5.1.1.2 (p.58) of the PDD for the Program already validated against ISO 14064, which is listed in Annex 6 "Soil Capital Carbon PDD_FR BE UK_VALIDATED".

The risks potentially affecting expected emissions reduction or removals enhancements and their related mitigation measures are described [4.3.11] in detail in Table 2, Section 4.4. In addition, the risks to the measurement or estimation of data and the resulting emissions reductions and removals figures are assessed as below. This assessment is derived from the reality that the Program has already enrolled and collected data from close to 1,000 farmers.

Risk	Mitigant
Farmers report insufficient data	• Soil Capital has made a significant investment in a bespoke piece of software (mySoilCapital) that farmers use to report their data; it has been designed specifically for farmers to make it as user friendly and time-efficient as possible • Soil Capital employs an experienced Chief Agronomic Advisor and team of agronomic experts whose role is to support farmers in encoding their data on an annual basis • Each farmer can only conclude their annual reporting when all required parameters have been completed
Farmers do not report data in a timely manner	• A clear timeline is consistently communicated to all farmers such that a failure to report sufficient data by a stated deadline precludes a farmer from participating in that year's verification process
Farmers report data of insufficient quality	• The Program's data quality management procedure is discussed in detail in Section 5
Data farmers have reported to Soil Capital is corrupted or lost	• A range of control procedures are in place to safeguard the security of farmer data throughout their reporting process • For example, access to mySoilCapital is restricted by password access and Soil Capital's database is hosted on a secure server (https) protected by Microsoft Azure
Soil Capital's API connection to external GHG emissions and soil carbon sequestration models fails	• Soil Capital employs an experienced Chief Technology Officer and team of technology developers whose role is to ensure that all API connections to external models are built and thoroughly tested in advance of them being used for a verification exercise • Soil Capital has legally binding Service Level Agreements with both the Cool Farm Alliance (for the CFT) and Regrow Ag (for DNDC)
The total amount of goods affected [4.3.12] is stated in Section 4.2.	

4.4. Accounting for Sequestration and Permanence

Applicable to removals from Land Use and Forestry Activities Interventions only.

Please declare this section non-applicable if no removals are generated from the Intervention/Program

Establish and apply criteria, procedures and/or methodologies to assess and mitigate the risk of reversal of removal enhancements (i.e., permanence of removal enhancements). In the case of a Program, this applies to each geographic area included in the Program.

For every reporting / verification period, sequestration and permanence has to be assessed.

The Requirement is to avoid permanence issues in the first place, or to conduct a risk assessment. When the result from the risk assessment is high, only a certain % will be issued. Refer to Non Permanence Risk Assessment guidance in Annex IV of the SustainCERT Verification Requirements for Value Chain Interventions Version 0.9.

Note: this requirement is always related to a verification period within the reporting period (e.g., 12 months) and not related to the possible achievable removals in the future.

If applicable, this section must:

4.4.1. Assess sequestration and permanence by conducting a risk assessment *use Table 2

When the result from the risk assessment is high, only a certain % will be issued. Refer to Non Permanence Risk Assessment guidance in Annex IV of the SustainCERT Verification Requirements for Value Chain Interventions Version 0.9.

Note: This requirement is always related to a verification period within the reporting period (e.g., 12 months) and is not related to the possible achievable removals in the future.

Table 2: Risk Assessment

Category	Risk Indicator	Risk Score	Justification	Mitigation Measure
Natural Disturbance	Fire Damage	Low	As a condition of participation in the Program, farms must be located in an area with access to fire services. If a farm has suffered a fire in its fields that destroyed more than 10% of the crops in affected fields 10 years prior to enrolment, the farmer must confirm that a valid crop insurance policy covering the enrolled cropland is in place to show that adequate risk management measures have been taken	
	Wind damage (e.g., hurricanes, typhoon)	Low	The Program is located in Western Europe which has very low risk of hurricanes	
	Animals (e.g., domestic or wild animals encroachment)	Low	Localised instances of wild animal encroachment on farmland are reported in Western Europe but such animal activity does not lead to release of carbon from the soil	

	Pest and disease outbreaks (e.g., insects, bacteria, viruses, fungi)	Low	While such outbreaks can certainly happen within the Program geographies, they would not be linked to release of carbon from the soil but rather to crop damage	
	Temperature extremes (e.g., extreme heat, frost)	Low	Such weather extremes are becoming more common in Western Europe but the release of carbon from soils as a result would be most commonly associated with the melting of permafrost which is not relevant to the Program geographies	
	Water extremes (e.g., droughts, heavy rains, floods, mudslides, avalanches, ice-storms)	Medium	Such weather extremes are becoming more common in Western Europe and soil erosion from heavy flooding or disrupted microbial activity from drought could be associated with release of carbon from the soil. Given the Program has already enrolled more than 1,000 farms across three countries, this would most likely always be a very localised impact.	The Program has enrolled farmers across diverse climate zones in three countries.
	Changing climate (e.g., long draught period, seasonal variability of rainfall pattern, water availability)	Medium	Such weather extremes are becoming more common in Western Europe and soil erosion from heavy flooding or disrupted microbial activity from drought could be associated with release of carbon from the soil. Given the Program has already enrolled more than 1,000 farms across three countries, this would most likely always be a very localised impact.	The Program has enrolled farmers across diverse climate zones in three countries.

	Earthquake and induced landslides	Low	The Program is located in Western Europe which has very low risk of earthquakes	
	Geological risk (e.g., volcanic eruption, desert progression)	Low	The Program is located in Western Europe which has very low risk of volcanoes	
Political Risks	Political Interventions (e.g., wars, riots, civil strife, terrorism, corruption, land occupation, community resistance)	Low	The Program operates in Western Europe with good political stability and rule of law	
	Confiscation of property (e.g., expropriation, infrastructure development)	Low	The Program operates in Western Europe with good political stability and rule of law	
	Irregular resettlement	Low	The Program operates in Western Europe with good political stability and rule of law	
	Exploitation of natural resources (e.g., mining, water, oil)	Low	The Program operates in Western Europe with good political stability and rule of law	
Program Management	Program failure due to: - insufficient internal technical capacity (e.g., due to high fluctuation of season workers or permanent staff, not sufficient training), OR - dependency on continuous external technical support	Low	As a condition of participation in the Program, farmers must confirm that they have access to suitable expert agronomic advice	
	Program failure due to dependency on key technical individuals in the organization that are difficult to replace	Low	As a condition of participation in the Program, farmers must confirm that they have access to suitable expert agronomic advice. In addition, the Program has already enrolled more than 1,000 farms across three countries so any such risk would have only a very localised impact	

	Program failure due to: • to the lack of technical equipment (e.g., machinery), OR • planting material (e.g., import barriers such as taxes, bureaucracy)	Low	The Program Interventions do not rely on access to specific machinery, though access to reduced tillage or direct drilling equipment is within scope. Such equipment is widely available in Western Europe via a diversity of means. Access to specific planting materials is not required by the Program Interventions.	
	Program failure due to: • insufficient internal financial accounting and management capacity, OR • dependency on continuous external financial accounting and management support	Low	This is not of material relevance to the Program Interventions	
	Program failure due to dependence on key financial accounting and management expertise of individuals in the organization that are difficult to replace	Low	This is not of material relevance to the Program Interventions	
	Program failure due to: • insufficient internal legal management capacity, OR • dependency on continuous external legal management support	Low	This is not of material relevance to the Program Interventions	
	Program failure due to dependence on key legal management individuals in the organization that are difficult to replace	Low	This is not of material relevance to the Program Interventions	
	Program failure due to: • insufficient internal capacity to support to maintain third-party certification, OR • dependency on continuous external support to support to maintain third-party certification	Low	Soil Capital has a team of individuals capable to maintaining certification, having been through one validation and two verifications already	

	Program failure due to dependence on key individuals to support to maintain third-party certification in the organization that are difficult to replace	Low	Soil Capital has a team of individuals capable to maintaining certification, having been through one validation and two verifications already	
Financial Risks	Lack of secured continued financial resources for Program implementation until the project's the cumulative break-even cash flow (for profit projects) / total cost until end of crediting (non-profit projects)	Medium	The Scope 3 carbon market that the Program uses to generate financial incentives for participating farmers is nascent	The Certificate Holder has invested – and continues to do so – in significant in-house sales and marketing efforts targeting the Scope 3 market and has already secured business with a number of high profile brands in the food and beverage sector.
Market Risks	Lack of liquidity/financial resources due to price variations (e.g., crop/timber produced, CO2-certificates, fertilizer, machines)	Medium	The economic incentive offered to participating farmers by payments from the Scope 3 carbon market are not significant enough to drive management practice change on their own; farmers will always be making affordability decisions based on existing financial resources, including in the context of normal cost/revenue volatility. Nevertheless, this market risk is relevant.	The Certificate Holder has invested – and continues to do so – in significant in-house sales and marketing efforts targeting the Scope 3 market and has already secured business with a number of high profile brands in the food and beverage sector.
	Program failure due to competing commodities (e.g., palm oil, soya)	Low	Farms participating in the Program produce a wide variety of crops and so have diversified their risk exposure	

	Program failure due to competing infrastructure (e.g., settlements, roads)	Low	The Program has already enrolled more than 1,000 farms across three countries so any competing infrastructure impacts would be extremely localised	
Other Risks	Individual farmers decide to revert to conventional agricultural practices	Medium	Farmers are exposed to a number of technical, financial, market and social drivers for reverting to conventional agricultural practices (see Annex 3) and it is easy to do so but the financial, market, well-being and social co-benefits of implementing regenerative agriculture practices successfully, especially after a sustained period of at least 10 years, are also broad and multi-faceted	20% of all Impact Units generated will be held in a pooled buffer for 10 years and only released for sale if remote sensing confirms that the farmer has not been at significant risk of causing a reversal during the retention period.
Average Intervention Risk Score		1.19		
The overall non-permanence risk score (Intervention Average Risk Score)		Low		

4.5. Monitoring Plan – Data and Parameters to be Monitored

Establish and maintain a Monitoring Plan for both Intervention(s) and baseline(s) (if dynamic baseline) scenarios.

A monitoring plan represents a means to assure that sufficient and relevant data is collected throughout the lifetime of the Intervention/Program. Typically, this data is used in the quantification approach and provides assurances in the auditing process.

Where measurement and monitoring equipment is used, ensure that calibrated or verified monitoring and measurement equipment is used and maintained, as appropriate.

All data and information related to the monitoring of the Intervention/Program shall be recorded and documented.

The monitoring plan shall include the following, as applicable:

- All parameters measured and monitored.
- Purpose of monitoring.
- Data and information reported, including units of measurement.
- Origin of the data;
- Approach: parameter estimation, modelling, measurement, calculation and uncertainty;
- Monitoring frequency;
- Roles and responsibilities, including procedures for authorizing, approving and documenting changes to recorded data;
- Controls that include internal data check for input, transformation and output, and procedures for corrective actions;
- Data management systems, including location and retention of stored data and procedure for transfers of data between different forms of systems or documentation.

This section must:

4.5.1. Describe the Monitoring Plan for both Intervention and baseline

4.5.2. No specific action is required in the VC-IDD/Program DD

4.5.3. No specific action is required in the VC-IDD/Program DD

4.5.4. List what data/parameters will be monitored in a table. See Guidance below.

4.5.5. Describe how data/parameters will be collected in the selected quantification approach.

4.5.6 Establish and maintain a Sampling Plan.

4.5.6.1.1 Explain the sampling approach and rationale behind it.

4.5.6.1.2 Provide a description of the sampling approach.

This Program uses a static baseline, as outlined in 4.2, therefore the Monitoring Plan described below [4.5.1] applies to the intervention scenario.

Monitoring of emissions reductions and removals is done on an ex-post basis and is conducted annually across the whole arable rotation before each verification. A monitoring period covers a period of time that encompasses the full growing to harvesting cycle of an individual cash crop, including any cover crops that precede it. Following typical farming operations these cycles occur between the beginning of September until the end of August of the following year. Operational cycle periods exceeding these 12 months monitoring periods, if any, will be considered ex-post as being fully part of these monitoring periods.

Individual farmer reporting has been used successfully in other Programs as a key input for monitoring results. Usually, a regular census is undertaken to collect the necessary data during the Program before each verification can take place. Each farmer is responsible for keeping records about the operations undertaken on their own fields and, ahead of each annual verification, a full census is taken of all farms participating in the Program. This type of monitoring is suitable for a Program such as this one, as each farmer is rewarded for their individual practice changes. Additionally, since this Program is located in European countries, it benefits from being able to draw from farm data held by public authorities (e.g. precise areas and locations of fields within a farm boundary) that farmers must submit to receive subsidies under the CAP or equivalent UK regulations, which is already subject to a stringent, regulatory audit process.

Each participating farmer accepts terms and conditions when they join the Program, which commit them to provide operational data for the preceding season into the Program's dedicated software, mySoilCapital, once every year with the support of a trained agronomist. All farmers enrolled in the Program must use mySoilCapital, as it is a dedicated farm assessment tool that is crucial for the analysis of the farmers' net GHG balances. Since 100% of farmers are monitored in this way, no further sampling plan is required [4.5.6].

The data from the mySoilCapital tool is then transferred into the relevant GHG emissions and soil carbon sequestration model via a bespoke application programming interface (API), where the emission reductions and removals are calculated. The specific data and parameters monitored at each verification [4.5.4] and how they are collected [4.5.5] are detailed separately in Annex 4. Roles and responsibilities, controls and data management systems are further detailed in 5.1.

As an overview, farmers must collect and retain data relating to:

- Purchased inputs (fertilisers, pesticides, etc.) and purchased operations (i.e., those conducted by third-party contractors);
- The farm area under cropland and crops in the rotation as and when reported under the CAP;
- Inventory reporting of pesticide purchased but not used and stored;
- Key management practice changes over the last 20 years, (e.g., changes in the tillage practices);
- Any farm management software used;
- Fuel and energy use for the farm;
- Official accounting details for the farm; and
- The number of livestock animals at the farm.

To ease the data encoding process for farmers while also making it more objective, and since mySoilCapital requires data entry at the field level, farmers benefit from publicly available map-based information created by third parties related to soil characteristics (e.g. soil type, soil moisture and natural soil drainage).

In addition to individual farmer reporting, remote sensing is used as part of the Monitoring Plan and this is described fully under 5.1.

It may not be practical to list all monitored parameters here. If this is the case, this contextual information must be included in your supporting calculation sheet.

In all cases, calculation sheets should clearly distinguish between default and monitored parameters.

Data / Parameter	<<What data is collected? >>
Unit	
Description	<<Describe the purpose of this data, how is it used>>
Source of data	<<Where is the data obtained from (e.g., surveys) >>
Value(s) applied	<<What is the (expected) monitored value? >>
Measurement methods and procedures, including QA/QC	<<How is the data collected, how is the quality of data managed? >>
Monitoring frequency	<<How often is the data collected? >>
Roles & responsibilities	<<Who is responsible for authorizing, approving, documenting changes to recorded data >>
Controls	<<What mechanism is in place to check data quality, identify issues, and take corrective action where necessary? >>
Data management	<< Where are stored data located and what are procedures transfers of data between different forms of systems or documentation? >>

5.0. DATA QUALITY AND MANAGEMENT

Intent: A data management plan documents the GHG inventory process and the internal quality assurance and quality control (QA/QC) procedures in place to enable the preparation of the inventory from its inception through to final reporting. The data management plan is a valuable tool to manage data and track progress of the inventory over time. Companies may already have similar procedures in place for other data collection efforts to guide their inventory process to meet the accounting requirements of the GHG Protocol, or for ISO standards. Where possible, these processes should be aligned to reduce data management burdens.

Guidance: Quality management procedures may include systems of routine, planned technical activities implemented by inventory development teams to measure and control the quality of the inventory as it is being prepared, including, for example:

- Checks to ensure data integrity, correctness and completeness
- Checks to identify errors and omissions
- Checks on data acquisition and calculations and the use of approved standardized procedures for emissions calculations, emissions measurements, estimating uncertainties, documentation, archiving and reporting
- Technical reviews of data, methods and results

The data management plan should be divided into two portions, quality control (QC) and quality assurance (QA). There are several steps involved to create a data management plan.

At a minimum the data management plan should contain:

- Description of the Intervention(s) and relevant details.
- Information on the entity(ies) or person(s) responsible for measurement and data collection procedures
- Data collection procedures

5.1. Quality Management Procedures and Data Quality

This section must:

- 5.1.1. Describe how quality management procedures to manage data (i.e., data management plan) and information, including the assessment of uncertainty, relevant to the Intervention(s) and baseline(s) scenario(s) have been established and applied.*
- 5.1.2. Describe how, as far as is practical, uncertainties related to the quantification of GHG emission reductions or removal enhancements have been reduced.*
- 5.1.3. Describe the quality of the data used that reduce bias and uncertainty. Data quality shall be characterized by both quantitative and qualitative aspects.*
- 5.1.4. Describe how site-specific data for unit processes that are most important, and those which together contribute at least 80% to the overall emissions or removals, starting from the largest to the smallest contributions after cut-off (material threshold) were collected.*

Challenges to data quality emanate from two fundamental types of uncertainty that the Program can assess and manage:

- parameter uncertainty:** the uncertainty associated with quantifying the parameters used as inputs (e.g., activity data, emission factors, or other parameters) to estimation models.

- ii. **model uncertainty:** the uncertainty associated with the mathematical equations (i.e., models) used to characterize the relationships between various parameters and emission processes.

The detail of how these sources of uncertainty are assessed and managed so that they are reduced as far as is practical [5.1.2] is set out below. As with Section 4.3, the following section is broken down into sections relating to the two different Quantification Approaches.

Assessment and Management / Reduction for Quantification approach: Cohorts 1-3

For the Program, “parameter uncertainty” relates to the data that is collected from farmers and third-party sources each year and how that data is encoded into the mySoilCapital platform.

To assess random error associated with collecting data from farmers, the Program applies a **qualitative assessment system** to categorise input data uncertainty for each parameter required for the monitoring report as low, medium or high, detailed in Annex 4 [4.3.9].

Following this assessment, rigorous **data quality management** procedures and controls are implemented, constituting the Program’s data management plan [5.1.1], also forming a core part of the **Monitoring Plan** [4.5.1]. The key steps are:

1) **data records:** each participating farmer must retain data records for all inputs (e.g., fertilisers, pesticides, seeds and fuel) and operations that are relevant to a given monitoring period. Reasonable precautions to ensure the safe storage of these records in line with national, legal, and contractual requirements (e.g., insurance contracts) must be taken. These records must be readily available for inspection by the verification body when it is preparing its verification report. Records include:

- i) all invoices for purchased inputs and purchased operations (i.e., those conducted by third-party contractors);
- ii) data relating to the farm area under cropland and crops in the rotation, as reported under the CAP or equivalent UK regulation;
- iii) inventory reporting of pesticides purchased but not used and stored, as required by laws relating to pesticide use, for the season in question;
- iv) data from any farm management software used to log operational and input use data for the farm;
- v) if relevant, operational and input use data reported to organic certification bodies; and
- vi) official accounting details for the farm.

2) **uncertainty management:** to incentivise uncertainty reduction around data inputs [5.1.2] if, during any verification event, the verification body deems that a farmer cannot provide any reasonable evidence to satisfactorily account for at least 75% of their inputs by volume (while noting, for instance, that manure is sometimes traded informally), then the farm is not permitted to generate Impact Units for that season;

3) **parameter and source consistency:** to further manage parameter uncertainty within the Program, various parameters that are needed as inputs to be modelled are verified during each farmer’s individual historical practice assessment and then fixed for the duration of the five-year crediting period. For example:

- Soil type, soil drainage and pH are identified from third-party, publicly available maps and then held constant
- Soil organic matter (SOM) at Baseline for each farm is verified via direct soil analysis organised by the farmer with guidance provided by the Program to improve the consistency and representativeness of sampling and analysis methodologies
- Emission factors for the GHG intensity of electricity usage are determined based on the farm’s location and then held constant
- Climatic and weather data for each farm is sourced from the same third-party datasets throughout the Program

4) **remote sensing:** as quality assurance cannot be conducted for all of the data set against the parameters in Annex 4 using the above data records, remote sensing techniques are also employed by the Program. This service is provided by a third-party, Regrow, and is used throughout the Program as a quality management procedure and control to improve the certainty of input data provided by farmers regarding land management practices. This capability enables the Program and its verification body to check for any

intensification of tillage practice year on year. The table below summarises the use of remote sensing throughout the Program:

Land management practice	Baseline	Monitoring during the crediting period	Monitoring during the retention period
Tillage practices	Applied to: all farms, sampling one ha per field	Applied to: all farms, sampling one ha per field;	Applied to: all farms, sampling one ha per field;
Cover crop practices	Period: upon first verification	Period: annual verification of growing seasons in crediting period	Period: ongoing monitoring for the 10 growing seasons after the end of the crediting period

Cover crops are mapped by observing a field over the autumn, winter and spring following a given growing season. Within each season, Regrow observes the vegetation dynamics of each field, taking into account both field management activities (summer crop harvest, planting in the spring, etc) and regional variations in weed and snow cover. At each step, the persistence of vegetation on the field (a collection of pixels) and likelihood it is a cover crop is assessed. Accuracy for the cover crop model varies regionally and has a baseline performance level of 80% at the field level.

Residue cover at the field level is evaluated using remote sensing estimates of non-photosynthetically active vegetation cover on a field during two periods: post-harvest and pre-planting. During each of these periods, Regrow evaluates both the change in residue over time and the minimum residue coverage, normalising the data to minimise the effects of precipitation and soil colour. Tillage intensity on a field is classified as one of the following: no-till, reduced till, or conventional tillage using residue coverage on a field as a proxy for tillage. Since different crops generate differing amounts of crop residue (e.g. corn is a high residue crop, soybeans are a low residue crop), the tillage classification also considers the prior crop on the field. Accuracy of the tillage model varies regionally, generally classifying tillage practices at a level of 60% - 80%.

When encoding farmer data into the mySoilCapital tool, the possibility of data entry error arises. For example, incorrect quantities of farming inputs may be encoded unintentionally by putting a decimal point in the wrong place, adding a zero, etc. Several further quality management procedures and controls are implemented to address this risk, including:

5) training of encoders: data that is more sensitive and/or complicated is encoded by farmers into the mySoilCapital tool with the help of agronomists, who are trained by Soil Capital in the correct usage of mySoilCapital and are supported on an ongoing basis;

6) two-step verification: to manage the risk of data entry errors, Soil Capital has implemented a two-step verification procedure for data entry. This procedure automatically requires additional verification from a trained agronomist as soon as data that is outside of a normal expected range is inputted. It applies at two moments in the data encoding process, namely data entry and data validation:

i) at the moment of data entry, minimum and maximum quantities constituting a normal expected range have been defined within mySoilCapital. Originally, this was done manually using the expert judgement of trained agronomists, but as soon as three validated examples of a given farming input used in the last two seasons have been fed into mySoilCapital by real users, the system is designed to use these examples to automatically set and update the minimum and maximum thresholds to +/- 20% of the outlier data points. This means that the system becomes smarter and more accurate to the market reality over time. Thus, at the moment of data entry, if the data encoder inputs data that is outside of the normal expected range, an alert pops up requiring the encoder to either confirm that the data is intended to fall outside of that range or to change the data so that the error is corrected.

ii) data validation occurs once all data entry is complete. If the encoder has confirmed at the point of data entry that they do want to insert data outside of the normal expected range, an automatic alert pops up drawing the encoder's attention to the data in question. The farmer, who is the encoder, must either change the data to fall within the normal expected range or confirm, once more, that it is correct and should fall outside of this range.

7) API connection to the relevant GHG emissions / soil carbon model: once data has been encoded into mySoilCapital, there is no further opportunity for human error, as the connection to the relevant model is made via a bespoke API that has been thoroughly tested to confirm its reliability.

Finally, when GHG emission and removal calculations are pulled from the relevant model by the API, a further quality management procedure and control is implemented:

8) quality assurance review: each farm-level assessment is reviewed at this point by at least one member of the Soil Capital team, composed of experienced agronomists and farm managers. An individual farmer's data is only signed off and, subsequently, put into the monitoring report once this quality assurance review has been completed.

In terms of data management systems, a range of control procedures are in place to safeguard the security of farmer data throughout this process. For example, access to mySoilCapital is restricted by password access and the database is hosted on a secure server (https) protected by Microsoft Azure. Soil Capital takes responsibility for archiving all of the data digitally for the duration of each farmer's participation in the Program.

Overall roles and responsibilities are clearly established as follows:

- Farmers
 - Input of data into mySoilCapital against parameters in the Monitoring Plan on an annual basis
 - Safe retention of required farm data records to verify the accuracy of data entered into mySoilCapital
 - Access to above farm data records upon request of verification body
- Soil Capital
 - Quality control and quality assurance for data collected from farmers in mySoilCapital, following the data management plan above
 - Processing via secure API connection of farmer data by third-party GHG emissions and soil carbon sequestration models, verification using third-party remote sensing services and aggregation of modelled outputs into crop and farm-level GHG emission factors
 - Implementation of changes to recorded data in line with policy for correcting errors and maintenance of a Change Log
 - Data storage and archiving
- Verification body
 - Independent verification of quality of all data collected under the Monitoring Plan and modelled results derived from it

The quality of the data used in the Program is characterized [5.1.3] as follows:

- a) Age – monitoring is performed annually and ex-post, soon after the completion of the relevant harvest. The data being collected is therefore no more than 18 months old and is based on actuals.
- b) Geography – **THIS PART WAS CLEANED TO PROTECT SENSITIVE INFO**
Denomination of supply sheds
- c) Technology – data collection happens via one, central software (mySoilCapital)
- d) Precision – if, during any verification event, the verification body deems that a farmer cannot provide any reasonable evidence (noting, for instance, that manure is sometimes traded informally) to satisfactorily account for at least 75% of their inputs (by volume), then the farm will not be permitted to generate VERRs for that season.
- e) Completeness – all parameters needed for the Program's quantification method are collected directly from participating farmers
- f) Representativeness – since primary and site-specific data is collected from each and every farmer in the Program, representativeness of this population of interest is maximized.
- g) Consistency – data collection happens via one, central software (mySoilCapital) and is overseen by a central team of trained agronomist. Both factors design for consistency.

- h) **Reproducibility** – someone with expertise in agriculture and access to a given farm’s records should be able to reproduce the data, though approaches to on-farm data management vary between farmers.
- i) **Sources** – all parameters in the Monitoring Plan (except weather data which is sourced from a global third-party meteorological service) come directly from the farmer who has direct management responsibility for the farm, minimizing uncertainty from lack of familiarity. Independent checks (see 5.1.1) control for bias.
- j) **Uncertainty** – each data parameter in the Monitoring Plan is given a qualitative uncertainty rating in Annex 4

In this Program, site-specific data [5.1.4] is used for the vast majority of monitored parameters required for quantification of emissions and removals. This is enabled by the fact that every individual farmer in the Program provides primary and site-specific data – whether direct measurement or activity data – via mySoilCapital. The Monitoring Plan is detailed in Section 4.5 and clarity for which unit-processes site-specific data is used and how it is collected is provided in Annex 4. Soil Capital is able to achieve this because, as an agronomy firm by background, we are able to collect this information from farmers in as time-efficient a manner as possible and then add value to the farmer by providing data-driven analytics in return.

With respect to model uncertainty within this quantification approach, current versions of the CFT are empirical models that draw on emissions factors provided by the IPCC. Even though those emission factors are reported by the IPCC with uncertainty values, current versions of the CFT do not produce a quantitative assessment of model uncertainty. Introducing such quantitative assessments is planned for upcoming versions.

That said, to manage model uncertainty overall, the model used to calculate an individual farmer’s Program Year emissions and removals is the same as used to calculate that farmer’s Baseline emissions and removals. This ensures that emissions reductions and removals calculated are solely based on differences in input data for a given farm, rather than differences in constants applied by the model; bias associated with the application of the methodology is reduced to a practical minimum.

Assessment and Management / Reduction for Quantification approach: Cohort 4 onwards

The data management plan [5.1.1] for the quantification approach for Cohorts 1-3, which is described above and leverages the initial qualitative assessment of input data uncertainty, is also applied in full for the quantification approach for Cohort 4 onwards.

The overall roles and responsibilities are also the same, except for the addition of a roles and responsibilities for Regrow (for DNDC modelling):

- o Field data submitted by Soil Capital to Regrow via API for modelling with DNDC is further validated by Regrow upon submission to ensure data corresponds with reasonable agronomic practices. Automated rules are used to quantify baseline soil emissions and removals. Subsequently, the relevant data for intervention scenario is modelled through DNDC using data provided by Soil Capital.

The quantification approach for Cohort 4 onwards, however, is enhanced by the addition of a quantitative assessment of uncertainty for all soil-based emission sources (including soil-based removals). This analysis is derived from Regrow’s uncertainty model within DNDC.

In summary, for a given field in a given verification period, DNDC initially produces 1,000 estimates as its modelled output. These represent the uncertainty distribution for the modelled output for that field. The model then aggregates these field level uncertainties across the whole Program area, in an area-weighted fashion. The Bayesian approach used by Regrow’s uncertainty model leverages this aggregation of datapoints to adjust for model bias. The exceedance probability chosen for the Program then determines the uncertainty deduction to be applied to the median estimate of field level results across the Program, to ensure a conservative reporting percentile. This approach quantifies model uncertainty directly and incorporates the impact of input parameter uncertainty by virtue of the fact that, first, the data quality

management procedures and controls detailed above ensure that measurement errors related to farmer input data are uncorrelated (following Verra's VM0042, p.50) and, second, uncertainty associated with initial SOC% has been shown to be *de minimis* (Zhou et al, 2022).

To expand on important components of this process, Regrow's uncertainty model uses a Bayesian framework to simplify the model's parameter uncertainties along with its prediction uncertainty to new modelling units. A half-Cauchy distribution with location parameter 0 and scale parameter 1 is used for the non-informative prior distribution of δ following a recommendation by Gelman (2006), while a Normal distribution centred at 0 with a large standard deviation of 100 is used as the prior distribution for σ . Posterior probability distributions for both parameters are sampled using Markov Chain Monte Carlo (MCMC) methods, a standard Bayesian sampling method that iteratively draws samples from approximate distributions called transition distributions, which through the use of a Markov Chain are improved with each iteration until the chain converges to the target posterior distribution (Gelman et al., 2013). Sampling is done in Stan software (Carpenter et al., 2017) using the No-U-Turn Sampler developed by Hoffman and Gelman (2014). Initial warm-up samples from each MCMC run (the so-called "burn-in") are discarded yielding a final distribution of 1000 samples. Convergence is evaluated using the Gelman-Rubin statistic, which approaches 1 as the model converges (Gelman & Rubin, 1992). Once sampled, the posterior distributions of δ and σ are used to propagate the structural uncertainty in the validation dataset to DNDC offset estimates of new fields via Monte Carlo integration.

Quantitative assessment of uncertainty for non soil-based emissions is not performed, as per the quantification methodology set out in Verra's VM0042 *Methodology for Improved Agricultural Land Management*, v2.0 (Equation 37)⁷.

6.0. CAUSALITY AND FUNDING SOURCES OF INTERVENTION/PROGRAM

For a company (or group of companies acting collectively) to take advantage of supply shed Intervention(s) benefits, that company (or group of companies) should demonstrate that their contribution is what caused the Intervention(s) to happen (causality).

Causality is defined as "demonstration that the Intervention/Program Certificate Holder has substantively contributed to or enabled the Intervention/Program and the resulting benefits (material role in the occurrence of the Intervention(s))."

This contribution can be demonstrated in a number of ways, for example:

- Direct financial investment: for example, the Certificate Holder directly purchases or finances the procurement of new equipment for the supplier.
- Incentives: for example, the Certificate Holder offers improved contractual terms or preferential sourcing in return for changes in production practices.

The Certificate Holder may also wish to demonstrate their contribution in other ways but, if they are going to attribute an emissions reduction to an Intervention, they should be able to demonstrate overall that the activities associated with and the improvements being generated by the Intervention were not occurring prior to the causal action and that the changes would not have occurred without the Intervention.

6.1. Causality and Funding

This section must:

- 6.1.1. Explain how the Certificate Holder has contributed to or enabled the stand-alone Intervention or the various Interventions within the Program, and the resulting emissions benefit.
- 6.1.2. Provide supporting evidence to support the explanations made (this will remain confidential) and to demonstrate that the activities supported were not taking place prior to the considered contributions.

⁷ <https://verra.org/methodologies/vm0042-methodology-for-improved-agricultural-land-management-v2-0/>

The central reason for the existence of this Program is that farmers face too many financial, operational, agronomic and even social risks to implement the Interventions without new financial rewards to incentivise that risk-taking. These barriers have already been elaborated in section 3.1.

Farmers thus join the Program to earn a new revenue proportionate to the Interventions that they personally implement on their farm.

This new revenue comes via the Certificate Holder [6.1.1], which is Soil Capital. In turn, Soil Capital raises this revenue exclusively from external companies ("Investors") – particularly those operating in the same supply shed as the farmers – that wish to invest in Interventions that can be demonstrated to reduce their Scope 3 inventory.

Even when these Investors may be claiming the benefits of the Interventions under an inventory accounting framework, an intervention accounting framework is always used simultaneously within the Program in order to place a fair and consistent value on the verified emission factor achieved by a given farmer for a given crop in a given year. Thus the way in which the Certificate Holder raises the revenue to pass to the farmers is via the sale and purchase of Impact Units (which Soil Capital calls "carbon certificates") generated under this intervention accounting framework, each of which is allocated to a specific crop grown by a specific farmer and thus also carries with it an associated emission factor.

The benefit of this approach is that existing market infrastructure in the voluntary carbon markets can be leveraged to provide publicly accessible evidence [6.1.2] of these financial transactions and therefore evidence of causality. Every carbon certificate that has been generated through the Program and verified to date has been registered via the same, third-party registry (the [CSA Registry](#)) and the Program has a [dedicated, public webpage](#) that lists all of the certificates and their ultimate owner. Previously verified carbon certificates will not be verified again under SustainCert's process. Should a decision be taken to proceed with verification and registry services with SustainCert, the Program will no longer use the CSA Registry for any affected Impact Units, so as to prevent double counting.

In the meantime, since the CSA Registry does not make provisions for such level of detail, the Certificate Holder (Soil Capital) maintains an internal database records the allocation of Investors to the Impact Units (carbon certificates) allocated to each individual crop that each individual farmer produces.

At the time of writing, close to €4 million has been disbursed by the Certificate Holder to more than 400 farmers under this approach, the first disbursement in June 2022 (see press coverage [here](#) and [here](#), for example) and the second in June 2023 (press coverage forthcoming). Illustrative copies of purchase orders from farmers and proof of payment by Soil Capital are found in the files listed as "Farmer 1/2/3 Purchase Order" and "Farmer 1/2/3 Bank extract" in Annex 6.

The Interventions supported by these Investors either were not taking place prior [6.1.2] to the farmers joining the Program, or would not have continued, as described and assessed in Section 4.2 and its supporting Annex.

7.0. IMPACT QUANTIFICATION FOR REPORTING

Intent: Activity based reporting is relevant if the Certificate Holder is the Company that will eventually use the outcomes of the Intervention/Program to support scope 3 reporting. If the Company is not known from the outset, it may not be possible to define what sits within or outside its reporting boundaries.

Guidance: In some instances, an Intervention/Program can contain activities that are within the boundary and outside. The company may report the GHGs from both activities separately. Removals are also separated from emissions reductions.

Example 1: A company may be implementing removal activities such as tree planting, but may also be distributing cookstoves to the farmers to help alleviate poverty. In this case, the plantations are inside the boundary, but the cookstoves are outside.

Example 2: A company may be implementing reduction activities through the use of large cookstoves for Shea nut processing within reporting boundaries, while also distributing small cookstoves for household use outside reporting boundaries.

Example 3: A company may be implementing removal activities by planting shade trees in cocoa agroforestry plantations within its reporting boundaries, while also planting fruit trees for smallholder farmers outside reporting boundaries.

7.1. Activity Based Reporting

This section must:

7.1.1. Summarize which activities within the stand-alone Intervention or the various Interventions included in the Program are inside/outside the reporting boundaries of the Company using the outcomes of the Intervention/Program for Scope 3 related claims, and which Impacts are emission reductions/carbon removals enhancements.

Use the table below to summarise which activities within the stand-alone Intervention/Program are inside/outside the reporting boundaries of the Company using the outcomes of the Intervention for scope 3 related claims, and which Impacts are emission reductions / carbon removals enhancements.

Table 3: Activity based reporting

Activity	Inside Scope 3 boundary?	Reduced MT CO ₂ e	Removed MT CO ₂ e
The reduction of synthetic fertiliser use and its replacement with organic fertilisers	Yes	Yes	Yes
The switch from full inversion ploughing practices to minimum (reduced) tillage or no (zero) tillage	Yes	Yes	Yes
The increasingly systematic implementation of cover crops between cash crops	Yes	No	Yes
Greater incorporation of crop residues into the soil post-harvest	Yes	Yes	Yes
Reductions in fuel and pesticide use	Yes	Yes	No
Improved manure management	Yes	Yes	No
The introduction of trees and perennial tree crops into arable fields using agroforestry techniques	Yes	No	Yes

7.2. Emission Factor Reporting

EF reporting is relevant for activities that result in emissions reductions as a result of an Intervention and whenever the reporting company wants to translate this into an improved emissions factor.

For example, the following may be subject to reporting, if applicable:

1. Total volume of commodity at baseline (i.e., Yield for each crop type)
2. Total volume of commodity affected by the Intervention for each supply shed (i.e., Yield for each crop type)
3. Total emissions in baseline(s) and Intervention(s) related to sources/sinks targeted by Intervention per goods
4. Emissions Factors in baseline(s) scenario
5. Emissions Factors in Intervention(s) scenario

Note: The Emission factors for some commodities are subject to certain variations in the class/variety/quality of the commodity, for example. If possible, it is best to report EFs for each class/variety of goods, assuming EFs are sensitive to such distinctions. For example, wheat has the following classification, some EFs are reported according to these classes:

- Hard Red Winter Hard Red Spring
- Soft Red Winter
- Soft White
- Hard White
- Durum

If the IR does not know the type of class/variety/quality of the commodity, then IR can simply use corn, wheat, and soy as the type of commodity, for example. Moreover, if EFs are not important for the outcome of the Intervention/Program verification, then reporting per commodity type is not necessary and/or can be accomplished at another time should the need occur.

This section must:

7.2.1. Provide details on if and how the Certificate Holder intends to assess the impact on the EF.

The Program does translate activities that result in emissions reductions as a result of an Intervention into an improved emissions factor when reporting companies wish to report in this way. Details of the process [7.2.1] are as follows.

1. Identify Program farmers that are in the reporting company's Supply Shed
 - The Value Change Initiative definition (2021, subsequently updated) is used to define a Supply Shed
 - Commodities are as listed in Section 3.3
2. Allocate the impact units for individual crops of individual farmers' to individual reporting companies to prevent double counting
 - In the absence of market infrastructure to do this, Soil Capital currently manages this via an internal database (available to view upon request)
3. Report the relevant emission factor to the reporting company
 - For the Baseline, as required by the reporting company:
 - o Total volume of commodity affected by the Intervention for each supply shed at Baseline (i.e., Yield for each crop type)
 - o Total emissions at Baseline following the Interventions related to sources/sinks targeted by Intervention per commodity
 - o Total removals at Baseline following the Interventions related to sources/sinks targeted by Intervention per commodity
 - o Resultant Emissions Factor at Baseline following the Interventions related to sources/sinks targeted by Intervention per commodity, presented as a weighted average for the volume of commodity affected
 - For the Program Year:
 - o Total volume of commodity affected by the Intervention for each supply shed in Program Year (i.e., Yield for each crop type)
 - o Total emissions in Program Year following the Interventions related to sources/sinks targeted by Intervention per commodity
 - o Total removals in Program Year following the Interventions related to sources/sinks targeted by Intervention per commodity
 - o Resultant Emissions Factor in Program Year following the Interventions related to sources/sinks targeted by Intervention per commodity, presented as a weighted average for the volume of commodity affected

8.0. LOCAL STAKEHOLDER CONSULTATION

Unless necessary to ensure an appropriate implementation of the Intervention/Program, stakeholder consultation is not mandatory. It is, however, recommended at an early stage, as well as in the context of feedback mechanism.

If any stakeholder consultations have taken place (for example due to local legislation or on a voluntary basis), and a feedback mechanism is in place, outcomes shall be summarized and included below on time for validation and verification. Questions to assist with summarizing stakeholder consultations and outcomes (non-exhaustive and not mandatory):

- Was a diverse set of relevant stakeholders identified prior to the start of the Intervention/Program?
- Was a consultation with a physical meeting carried out with a diverse group of relevant stakeholders? If so, when and where?
- Was an equal and effective participation by both men and women encouraged in the stakeholder consultation? (This also includes the suitability of place and timing of the consultation(s))
- Were the Intervention/Program's details and its potential socio-environmental impacts explained and discussed in an easy-to-understand manner for stakeholders?
- Was stakeholder feedback captured/recorded? If so, how?
- Was stakeholder feedback acted on or incorporated into the Intervention/Program design (where appropriate)?
- Were stakeholders provided with a formal response to their feedback?
- Is there a 'continuous input and grievance mechanism' for stakeholders to submit further feedback and raise concerns about the Intervention/Program?

8.1. Local Stakeholder Consultation

This section must:

8.1.1. Summarize stakeholder consultations and related outcomes whenever such consultations have taken place.

Since the Program enables the adoption of regenerative agriculture practices, it is not expected to have negative impacts on local stakeholders. For instance, a reduction in synthetic fertiliser and pesticide use will lead to less air and groundwater pollution for surrounding communities.

However, Soil Capital did conduct a range of consultations directly with farmers to inform the development of the Program. This included events on 7 July 2020 (Belgium), 3 September 2020 (Belgium), 11 September 2020 (France) and 16 September 2020 (France). Relevant outcomes from these consultations were compiled and integrated into the development of this document.

The two most important outcomes [8.1.1] that led to changes in the Program were:

- livestock integration – earlier versions of the Program did not allow for any livestock integration on arable farms at all. Farmer feedback stated that this exclusion, in effect, penalised those arable farmers who had started to find ways to achieve more regenerative farming systems by integrating small numbers of livestock. As a result, a limited number of on-farm livestock was made permissible.
- landowner approval – earlier versions of the Program set a fairly stringent requirement for landowner approval of tenants participating in the Program. It was noted by many tenant farmers that they simply do not have direct relationships with their landowners and that they may, in practice, rent land from a large number of small landowners. This resulted in more stringent requirements for landowner approval, creating significant practical barriers to participation. As a result, the requirement for landowner approval was redesigned to be risk-sensitive.

Since these initial consultations, more than 1,000 farmers across France, Belgium and the UK have voluntarily enrolled in the Program, demonstrating the relevance of its design to their needs.

9.0. RISKS SELF-ASSESSMENT OF SAFEGUARDING PRINCIPLES

Applicability: Not mandatory

This self-assessment checklist aims to assist the Certificate Holder with mitigating any business, reputational, or community risks that could potentially emerge from their Intervention or Program of Interventions. It includes questions related to social and environmental risks, including occupational health and safety, and community/stakeholder inclusivity, to ensure that Certificate Holders do not inadvertently harm their company's reputation or overlook a potential community issue (especially in underserved communities or in developing countries).

Fill out the risks self-assessment of safeguarding principles section in the IDD by answering the questions with a 'yes', 'no', or 'not applicable'. Add any notes or optional actions taken in the final column. It is recommended that identified risks and their related mitigation measures are summarized in the risks table.

9.1 Risk Self-Assessment

This section must:

9.1.1. If applicable, complete the self-assessment checklist in Annex 1 of the IDD/Program DD.

See Annex 1, which has been voluntarily completed [9.1.1]

10.0. PROGRAM OF INTERVENTIONS

For Interventions that are designed as Programs (simplified approval procedures to facilitate future expansion), a set of pre agreed criteria for new Interventions to join the Program must be defined and approved.

New Interventions can be included in an existing Program at subsequent verification following the initial validation of the Program, as long as they meet Inclusion Criteria. There are as many sets of inclusion criteria as combinations of activities and geographic area. Compliance with the totality of applicable criteria must be validated at verification for inclusion through a Compliance Check.

Geographical boundaries of the new Interventions included in the Program must be consistent with the geographical boundaries of the Program. Types of sources of emissions and sinks must be in line with those defined at Program level for the corresponding type of activity. Quantification Approach must follow the one validated at Program level for the corresponding type of activity. The baseline scenario must fit to the one defined in the Program DD, for the relevant combination of geographic area and ER/carbon removals generating activities. Finally, causality as defined in section 6.0, must be demonstrated for the new Intervention.

10.1. Inclusion Criteria

This section must:

10.1.1 At Program level, provide the set of inclusion criteria that new Interventions must meet for inclusion in the Program.

10.1.2. At Intervention level, discuss in a systematic way how the Intervention meets the inclusion criteria established at Program level.

Use the table below to define one or more set of eligibility criteria, including at least one set of eligibility criteria per combination of geographic area and ER/carbon removals generating activities described in the Program DD.

When including new Interventions, use the column justification to provide sufficient information or refer to supporting documents, to demonstrate compliance with all criteria set out in the applicable set of criteria.

Criteria for new Interventions to be included in the Program are detailed in the table below [10.1.1]. This

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Set of eligibility criteria ID	1
Geographic area	THIS PART WAS CLEANED TO PROTECT SENSITIVE INFO
ER/carbon removals generating activities	THIS PART WAS CLEANED TO PROTECT SENSITIVE INFO

Checklist for new Interventions intended to be included in the Program		
Eligibility Criteria	Compliant (Yes/No)	Justification
Can apply the GHG quantification approach set out in the Program DD?		
Can apply ER/carbon removals generating activities defined in this set of eligibility criteria?		
Can apply the baseline scenarios defined in the Program DD, corresponding to this combination of geographic area and ER/carbon removals generating activities?		
Can demonstrate causality as required in section 6 of the Program DD?		

10.2. Sampling Approach

In the context of a Program of Interventions, a sampling approach to verification can be proposed and adopted if approved by the validation process. This approach allows for only a subset of the included Interventions to be fully verified in a given reporting year, although all included Interventions can deliver verified outcome statements upon successful completion of the verification process.

Sampling verification is possible whenever Interventions are similar enough to lead to a sufficient level of assurance while benefiting from economies of scale and reduced transaction costs (e.g., statistically sound sampling).

It is important to understand that all Interventions seeking verified statements must monitor activities and submit monitoring reports to SustainCERT. Sampling verification only applies to how verification will be conducted. The approach proposed must describe how and on what basis Interventions and corresponding documentation are selected for full verification.

The approach should build on a risk-based assessment and typically consider risks related to the type of activity, uncertainty with monitoring, permanence, leakage, double counting.

This section must:

10.2.1. At Program level, describe the proposed sampling approach for the verification of Interventions within the Program.

The Program does adopt a sampling approach for its annual verification of Interventions, once all interventions seeking verified statements have been subjected to the monitoring activities detailed above. This is described as follows [10.2.1] and was developed by the independent validation and verification body that has performed this exercise twice now for the Program, TUV Rheinland, itself accredited by German accreditation body DAkkS under the terms of DIN EN ISO 14065, among others for validation and verification of greenhouse gas emission reports and assertions according to DIN EN ISO 14064-1/ -2 and / -3.

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ANNEX 1: Risks self-assessment of safeguarding principles (RECOMMENDED)

This self-assessment checklist aims to assist the Intervention Certificate Holder with mitigating any business, reputational, or community risks that could potentially emerge from their Intervention.

It includes questions related to social and environmental risks, including occupational health and safety, and community/stakeholder inclusivity, to ensure that the Certificate Holder does not inadvertently harm their company's reputation or overlook a potential community issue (especially in underserved communities or in developing countries).

(Questions are derived from Gold Standard Safeguarding Principles. Where relevant, questions have been simplified for ease of understanding.)

This self-assessment will not be validated, nor verified.

It is recommended in this section that the Certificate Holder:

1. Complete the self-assessment checklist by answering the questions with a 'yes', 'no', or 'not applicable'.
2. Add any notes or optional actions taken in the final column.
3. It is recommended that identified risks and their related mitigation measures are summarized in the risks table.

Note that no supporting evidence is required, as this is an optional self-assessment.

Questions related to Safeguarding Principles	Answer (Yes, No, or Not Applicable - NA)	Notes / Actions taken
Does the Intervention/Program and Certificate Holder ensure that Projects safeguard against the same emissions reductions being both sold as credits and counted in inventories?	Yes	We maintain an inventory that details the named buyer to which an individual crop's emissions reductions and removals are allocated, ensuring they cannot be allocated to two companies at once
Does the Intervention/Program and the Certificate Holder respect internationally proclaimed human rights and furthermore, not discriminate with regards to participation and inclusion?	Yes	We operate in Western Europe – markets with good rule of law and do not impose any participation restrictions that could be considered as discriminating against human rights
Does the Intervention/Program and the Certificate Holder apply the principles of equal treatment/equal pay for equal work and ensure that it does not lead to adverse impacts on gender equality and/or the situation of women (for example, limit women's ability to use natural resources, increase women's workload etc.)?	Yes	Each farmer in the Program is rewarded entirely on merit of their own farm's emissions reductions and removals with no implication on gender
Does the Intervention/Program and the Certificate Holder ensure that the health of workers and the community are not adversely affected (which includes avoiding exposure to increased health risks)?	Yes	We operate in Western Europe – markets with good rule of law

Does the Intervention/Program and the Certificate Holder ensure that the Project is not involved, complicit in or inadvertently contributing to or reinforcing corruption or corrupt projects?	Yes	We operate in Western Europe – markets with good rule of law. Most participating farms receive payments from the EU Common Agricultural Policy, meaning they are subject to governmental due diligence
Does the Intervention/Program and the Certificate Holder ensure that Intervention employment complies with national labour laws and remain consistent with the principles and standards embodied in the International Labour Organization (ILO) fundamental conventions including ILO Convention on Minimum Age?	Yes	We operate in Western Europe – markets with good rule of law. Most participating farms receive payments from the EU Common Agricultural Policy, meaning they are subject to governmental due diligence
Does the Intervention/Program and the Certificate Holder ensure that the Intervention has considered potential negative impacts and - where appropriate - mitigated risks to the local economy?	Yes	The Interventions incentivised by the Program on balance increase the resilience and profitability of farm enterprises in the short- and long-term, making them more attractive to younger generations
Does the Certificate Holder ensure that the Intervention/Program will not affect the availability and reliability of energy supply to other users?	Not applicable	The Program Interventions have no impact on energy supply
Where an Intervention/Program involves the use of Genetically Modified Organisms, were these already present in the baseline(s)? Does the Intervention/Program avoid using Genetically Modified Organisms in its activities?	Not applicable	Only one GMO crop is authorised for cultivation in the EU and <u>it is not grown in the Program's countries</u>
Where present within the boundary, does the Certificate Holder ensure that sites, structures, or objects with historical or cultural significance are preserved?	Yes	The Program has no bearing on land use change since it is not included amongst the Interventions
Where an Intervention proposes to commercially utilise knowledge, innovations, or practices of local communities, does the Certificate Holder ensure that the affected communities are informed of their rights and the potential consequences?	Not applicable	This is not included in the Program's Interventions
Where the Intervention/Program's area of influence is susceptible to excessive erosion and/or water body instability, have measures been taken to mitigate this risk?	Yes	The Program Interventions include the reduction of tillage and implementation of cover crops, both of which reduce soil erosion risk
Where the Intervention/Program involves the use of land and soil for production of crops or other products, have measures been taken to ensure no degradation of existing landscape function and services?	Yes	The Program Interventions are designed to increase the natural health and fertility of agricultural soils
Where Interventions are located in areas vulnerable to Natural Disaster, have potential exacerbation of impacts as a result of the Intervention been avoided?	Yes	The Program Interventions are designed to increase the natural health of agricultural soils which increases their water infiltration and storage capacity, increasing resilience to flood and drought respectively
Where Interventions release pollutants to air, water, and/or land, is pollution prevention and control consistent with national regulation or international good practice?	Not applicable	The Program Interventions incentivise the reduction of synthetic fertiliser and pesticide use

Where Interventions involve the manufacture, trade, release, and/ or use of hazardous substances, these substances are not subject to international bans or phase outs and all health risks to humans have been addressed appropriately? For non-hazardous waste, is there a strategy to reduce, recover and reuse waste, and where reuse is not possible, ensure it is disposed of in an environmentally sound manner?	Not applicable	This is not relevant to the Program's Interventions
Where Interventions involve the application of pesticides, are the pesticides low in human toxicity, known to be effective against the target species with minimal effects on non-target species and is a 'Chemical Pesticides Policy' in place (Provisions for safe transport, storage, handling and application, AND Provisions for emergency situations)?	Not applicable	The Program Interventions incentivise the reduction of synthetic pesticide use. We operate in Western Europe – markets with good rule of law. Most participating farms receive payments from the EU Common Agricultural Policy, meaning they are subject to governmental due diligence
Where Interventions involve the application of fertilisers, is their use minimised and justified?	Yes	The Program Interventions incentivise the reduction of synthetic fertiliser use.
Where Interventions involve the harvesting of forests, are they sustainably managed, and biodiversity and ecosystem functionality maintained?	Not applicable	This is not relevant to the Program's Interventions as the Program targets active arable farmland only
Where Interventions modify the local quantity of food (e.g., via crop regime alteration or export or economic incentives), does local access to and availability of food for people remain unaffected?	Not applicable	The Program Interventions do not have a material impact on food output directly or indirectly
Where Interventions involve animal husbandry, is the welfare of animals ensured, the excessive or inadequate use of veterinary medicines avoided, synthetic growth promoters including hormones are avoided and appropriate space per animal and stocking rates per land unit set?	Not applicable	This is not relevant to the Program's Interventions; where livestock are present on a participating farm, their emissions are included in scope but Program Interventions do not incentivise any changes in animal husbandry
Where the Intervention/Program involves the relocation/displacement of people, has a Resettlement Action Plan or Livelihood Action Plan been developed and the recommendations of an Expert Stakeholder been included in the Intervention/Program's design?	Not applicable	The Program has no bearing on land use change since it is not included amongst the Interventions
Where the Intervention/Program requires any change to land tenure arrangements, does the Certificate Holder hold uncontested land title for the entire Intervention/Program Boundary?	Not applicable	The Program does not require any change to land tenure arrangements
Where the Intervention/Program requires any change to land tenure arrangements, have the recommendations of an Expert Stakeholder been included in the Intervention/Program's design?	Not applicable	The Program does not require any change to land tenure arrangements
Where indigenous peoples are present in or within the area of influence of the Intervention/Program, or the Intervention/Program is located on land/territory claimed by indigenous peoples, have the recommendations of an Expert Stakeholder been included in the Intervention/Program's design?	Not applicable	This is not relevant to the Program which operates exclusively in Western Europe

Where the Intervention/Program affects the natural or pre-existing pattern of watercourses, groundwater and/or watershed(s), have the recommendations of an Expert Stakeholder been included in the Intervention/Program's design?	Not applicable	The Program Interventions do not affect the natural or pre-existing pattern of watercourses, groundwater and/or watershed(s)
Where Interventions physically affect or alter largely intact or High Conservation Value (HCV) ecosystems, critical habitats, landscapes, key biodiversity areas, have the recommendations of an Expert Stakeholder been included in the Intervention/Program's design?	Not applicable	This is not relevant to the Program Interventions, which only incentivise changes to management practices on existing arable farmland and not land use change
Where the Intervention has the potential to lead to the reduction or negative impact of any recognised Endangered, Vulnerable or Critically Endangered species, have the recommendations of an Expert Stakeholder been included in the Intervention/Program's design?	Not applicable	This is not relevant to the Program Interventions, which only incentivise changes to management practices on existing arable farmland and not land use change

It is recommended that any risks identified above are summarized in the risks table below, along with their related mitigation measures.

Note that no supporting evidence is required, as this is an optional self-assessment.

Risks Self-assessment	
Risk identified	Mitigation measure
Risk 1 n/a	n/a
Risk 2 n/a	n/a
Risk N n/a	n/a

Annex B: Model Evaluation

Value Chain Interventions/Programs that are using models (e.g., process-based) to calculate the baseline(s) or Intervention(s) scenario must fill out this Annex.

The information provided will be used to assess the modelling approach. Since no two models and no two contexts are the same, the assessment will be undertaken by an expert, recognizing that while presented stepwise, the process may require a non-linear, iterative review approach. Expert assessors may also come from diverse backgrounds, experiences and qualifications.

In this section, the:

1. Certificate Holder (or an Intervention Representative, IR, acting on its behalf) shall fill out the Tables below
2. Certificate Holder or its IR shall submit the calibration and validation data set(s) as links (URLs) or attachments (submitted documents)

Modelling Approach: General Information and Self-Assessment

Table 4: General Information of Scope and Quality of the Modelling Approach: [Cool Farm Tool \(CFT\)](#)

Criteria		Recommended Criteria	Justification/Response
Scope			
G1	Model version	A uniquely traceable record of all files needed to reproduce a given model output from its calibrated parameter set and model-driving input data. These may include source code, internal parameters that are not adjusted during calibration, default values for parameters or input data, or generally any other information that may change model behaviour. A model version must change any time there is a change in any of the model files. For a given parameter set and set of model-driving inputs, any copy of the model reporting the same model version must always produce the same output.	The Cool Farm Alliance (CFA) operates a clear and transparent versioning policy for the CFT, with release notes made available publicly. Major releases follow an annual cadence and are clearly labelled as a different model version such that changes which impact methods calculations and emissions results are delivered in major releases which only happen once a year. In line with Verra requirements, if a new version of the CFT is released during the five-year crediting period for a farmer and is deemed by a qualified auditor to produce materially different results to previous versions, the CFT version that was used at the beginning of the crediting period will be valid throughout the duration of that crediting period, since variations in GHG estimates could otherwise be attributed to a change in the methodology, rather than a change in farmer practices. Cohorts 1 and 2 of the Program therefore use CFT v0.12. Cohort 3 uses v1.0.

G2	Is the modelling approach suitable for the context of the Intervention, notably geography and activity?	Some modelling approaches are global/generic but most are targeted at specific activity types and geographies. Companies should not try to apply modelling approaches that do not properly account for their activity or that use approaches intended for other geographies that are different from the context of the Intervention.	Yes. The CFT covers virtually all crops and livestock globally. For crops, the CFT incorporates Tier 1, Tier 2 and when it comes to N2O emissions and soil carbon sequestration, a “simple Tier 3” model – as described by Prof. Pete Smith – as it is a multi-factoral empirical model based on Bouwman, which is widely acknowledged in the public domain. Furthermore, the European Commission’s 2021 Technical Guidance Handbook “Setting up and implementing result-based carbon farming mechanisms in the EU” identified the CFT in its assessment as one of the existing tools that calculate greenhouse gas emissions and other sustainability indicators with the same input data such as water quality, biodiversity impacts and farm economic measures such as carbon efficiency of output. 48% of the CFT’s global users in 2022 where in Europe.
G3	Is the approach suitable for the reporting purpose sought?	Companies may report for many reasons, most notably for Greenhouse Gas Protocol or other reporting protocols such as GRI and CDP. The company should satisfy themselves that the method chosen conforms with any criteria stated in the reporting protocols it is intended for. Likewise, if any part of the Intervention is seeking carbon credits, a methodology that is approved by the credit issuer is likely necessary.	Yes. Companies investing in this Program do so to report on reductions to their Scope 3 GHG emissions or to substantiate contributions to climate action (never compensation). Regarding supply chain emissions reductions and removals claims, SBTi FLAG identifies a number of accounting frameworks to be used in the absence of a finalised GHG Protocol Land Sector and Removals Guidance, including ISO 10464. The Program’s use of the CFT has been validated by a third-party auditor as suitable against ISO 14064.
Quality			

G4	Is the scientific framework of the model third party authored or reviewed?	It is generally not recommended that companies create their own models. Relying on well-chosen third-party models may avoid accusations of poor quality or conflicts of interest. Where self-authoring of models are unavoidable, these should be based on peer-reviewed science and reviewed and approved by a suitable third party.	Yes. The CFA, a community interest company, is responsible for the development and maintenance of the CFT, not Soil Capital. Within the governance structure of the CFA, a dedicated Science Advisory Council holds responsibility for strategic decisions regarding science and methods for the CFT, including updates according to the latest IPCC and peer-reviewed science.
G5	Is the models recent and based on up to date science?	It is recommended that the latest version of a models is applied. Ideally the version would have been published within the two to three years prior to application though longer may be necessary in circumstances where this is unavoidable. It is recommended in such cases that the company highlights this transparently in reporting and explores ways to bring the method up to date.	Yes. As above, the CFA's dedicated Science Advisory Council holds responsibility for strategic decisions regarding science and methods for the CFT, including updates according to the latest IPCC and peer-reviewed science. Changes which impact methods calculations and emissions results are delivered in major releases which only happen once a year. For instance, in 2022 v1.0 of the CFT was released, implementing key updates to emission factors that resulted from the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
G6	Is the modelling approach scientifically peer reviewed?	Modelling approaches that are peer reviewed or include scientifically peer-reviewed approaches should be chosen over those that do not.	Yes. The CFT greenhouse gas emissions calculator is based on empirical research from a broad range of published data sets and IPCC methods. The tool calculates emissions estimates from: • N2O emissions based on an empirical model built from an analysis of over 800 global datasets. These datasets refine IPCC Tier 1 estimates of N2O emission by factoring in the guiding drivers of N2O emissions such as rate of N applied, soil texture, soil carbon, moisture and soil pH, • Soil carbon sequestration based the results of published studies built from over 100 global datasets • Embedded fertilizer production emissions based on the most up to date, peer reviewed industry data.

G7	Has the model been approved by a Standards body, such as Gold Standard, CAR, VERRA?	For enhanced confidence in the model chosen, or where it is desirable to use for the purposes of certification, then the selection of a model that has been approved by a body such as Gold Standard may be beneficial.	The CFT has not been approved by Gold Standard, CAR or Verra. However, Soil Capital's IDD using the CFT for quantification has been validated by a third-party auditor, TUV Rheinland, against ISO 14064. Copies of relevant Validation Reports have been submitted to SustainCert as part of this validation exercise (specifically see Section 3.5.1, p.18, Section 3.5.2, p.20, and Checklist Section 5, p.36 of the Validation Report listed as "TUV Rheinland Validation Report Soil Capital Carbon_FR BE UK_July 2023" in Annex 6).
G8	Does the company have the technical capacity and resource to properly use the model?	Companies should choose an modelling approach commensurate with their skill and capacity to implement. While more rigorous approaches are often desirable, it is better to choose an approach that can be realistically implemented than one that is unlikely to be properly maintained.	Yes. Soil Capital has teams of agronomic and scientific experts as well as software developers that have already been using the CFT – both directly via the web application and via an established API connection – for more than 3 years.
G9	Are all assumptions and the level of uncertainty/confidence in the model output generated clear and transparent?	Per the Interventions Guidance, companies should transparently report any assumptions inherent in the modelling approach chosen and the level of uncertainty in the results generated. This helps to avoid accusations of over-reporting or over-stating results where a more practical but less rigorous approach is being applied. Different sources of uncertainty should be distinguished (e.g., sample uncertainty vs. heterogeneity). Choice and form of distributions need to be set for all parameter values to reflect second order uncertainty.	Yes. A complete technical description of the Cool Farm Tool GHG method is available to all Cool Farm Alliance members and by request via info@coolfarmtool.org. This technical documentation contains all relevant emission factors and equations needed to run the CFT, meaning that all assumptions are fully transparent. It is found in Annex IV (p.110) and Annex V (p.121) of the PDD already validated against ISO 14064 and listed as "Soil Capital Carbon PDD_FR BE UK_VALIDATED" in Annex 6. A full discussion of uncertainty is found in Section 5.1.

Table 3: Self-Assessment [Cool Farm Tool \(CFT\)](#)

Criteria	Justification/Response (Provide a summary in the box below)
Assessment of Model Calibration	

SA1	Provide a clear explanation and rationale for how the model calibration was conducted and how validation statistics were selected and applied, including the adjustment of model parameters with directly measured values.	The CFT uses the latest IPCC emission factors ("IPCC. 2019 refinement to the 2006 IPCC guidelines for national greenhouse gas inventories. Technical Report, IPCC, 2019"). In the Program, these emission factors are applied in the context of primary data from each individual field pertaining to its actual soil characteristics (SOM, soil type).
SA2	Explain any rationale behind underlying assumptions or limitations of the model.	The CFT uses the latest IPCC emission factors and model ("IPCC. 2019 refinement to the 2006 IPCC guidelines for national greenhouse gas inventories. Technical Report, IPCC, 2019"). The model is described in the technical description of the CFT (available to all CFA members via the CFT web platform, access available upon request; it is found in Annex IV (p.110) and Annex V (p.121) of the PDD already validated against ISO 14064 and listed as "Soil Capital Carbon PDD_FR BE UK_VALIDATED" in Annex 6) but in summary: • The model is derived from the tier 1 method described by the IPCC. A couple of additional elements have been added to this: to account for changes that only affect a portion of a field, and to factor in a historical measured value. All values are calculated per hectare of land, effectively meaning that area can drop out of the equations. All "SOC" values are assumed at a 30cm depth. • The basis of the calculation is the 20-year rule, whereby each change that results in a new equilibrium value will take 20 years to reach it from its current value. Delta SOC is the overall annualised 20-year change in soil organic carbon storage (SOC). • It follows that if no changes have been made in the previous 20 years, the soil would already be at equilibrium, and hence there would be no annual change in carbon stocks. • Therefore, the model looks in 20 years chunks for changes. Changes in land use, tillage, and inputs along with the year in which they took place are requested from the user. • The starting equilibrium is defined by the user default and is the basis for calculating further equilibrium values following changes to the land. • Once the equilibrium SOC value is calculated using the stock factors, the 20-year rule is applied within each period between management practice changes to calculate an absolute SOC value for each year. The difference in SOC values between the most recent two years can be taken, and hence the current annual change in carbon stock calculated.

SA3	Provide an evaluation of the extent the model is either underestimating or overestimating the variable/s to be estimated and how this is to be rectified if required. Describe and explain the modelled spatial patterns and relate them to the landscape characteristics for the intended application.	Versions of the CFT issued to date do not provide uncertainty quantification.
SA4	Provide an assessment of applicability of the model to the project area, specifically the spatial scale appropriateness, including any intended or expected expansion of activity areas.	The CFT is designed first and foremost to provide crop-level GHG emission inventory assessments on individual farms and indeed this is the spatial scale at which it is applied in the Program, allowing for field-by-field variation in soil characteristics and differences in management practices for a given crop in a given year.
SA5	Provide an assessment of applicability of the model to the project area, specifically for temporal boundaries (e.g., does the model covers all growing seasons and rotations of the crop type).	The Program includes in scope all crops found in arable rotations in three Western European countries: France, Belgium and UK. The CFT covers virtually all annual crops and livestock globally, so is comfortably applicable to the Program area.
SA6	Provide datasets used for model calibration, including but not limited to full citation, experimental locations, specific crops and practices studied, climate zones/nationally defined agricultural land regions, soil textures and clay contents, and number of observations.	The CFT uses the latest IPCC emission factors and model ("IPCC. 2019 refinement to the 2006 IPCC guidelines for national greenhouse gas inventories. Technical Report, IPCC, 2019"). In the Program, these emission factors are applied in the context of primary data from each individual field pertaining to its actual soil characteristics (SOM, type, drainage, pH).
SA7	Describe how overall uncertainty ⁱ for calculation of emissions reduction was performed.	To date, the CFA has not published results from exercises to calculate uncertainty in model performance.
Explanation of the Validated Data		
SA8	Where and when did the data set come from and who was responsible for its development?	To date, the CFA has not published results from Validation exercises.
SA8	What is the variable/s to be estimated by the model (for example SOC, SOM, N2O, CH4, other)?	SOC, N2O, CH4, CO2

SA9	Is a more up to date data set available and, if so, why was it not applied?	To date, the CFA has not published results from Validation exercises.
SA10	Provide a description of data requirements to initialize and run the model version and parameter sets, as well as the process for addressing missing information.	All of the parameters contained within Annex 4 are required data to run the CFT. They are routinely collected from all farmers throughout the Program.
SA11 SA12	Provide full accounting of the studies comprising the validation dataset for each ecozone/nationally defined agricultural land region and activity, for each emissions source. Study attributes include, for example: • Citation • Climate zone/nationally defined agricultural land region • Soil texture(s) and clay contents being studied • Experimental time period • Depths of SOC measurements • Measurement technique, e.g. dry combustion for SOC, or chambers for N₂O • Methods of temporal aggregation used for observations of N₂O and CH₄ • Portions of the calendar year covered by all N₂O and/or CH₄ measurements, with justification provided when portions are missing. • Number of observations used in validation • Measurement uncertainty associated with replicates, where reported • Experimental location (only when split between calibration and validation)	To date, the CFA has not published results from Validation exercises.
Assessment of Model Bias ⁱⁱ and Model Prediction Error ⁱⁱⁱ		
SA13	Provide the approach and statistics used to calculate model bias.	To date, the CFA has not published results from exercises to calculate model bias.
SA14	Describe how the model bias was assessed against uncertainty estimates (e.g., mean bias should be less than or equal to an estimate of pooled measurement uncertainty (PMU) ^{iv})	To date, the CFA has not published results from exercises to calculate model bias.

SA1 5	Describe how the uncertainty of the model's predictions were estimated (i.e., the model prediction error and evaluate model fit).	To date, the CFA has not published results from exercises to calculate uncertainty in model performance.
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i For example, see the GS4GG SOIL ORGANIC CARBON FRAMEWORK METHODOLOGY.

ii Parameter sets', in this context, mean all values internal to a model that determine how input data drive model performance and behaviour, and that are changed using processes independent of model-driving input datasets. This means model parameters that are not dependent on input datasets when the model is run must be declared and shown to be set appropriately following the above calibration requirements. See VMD0053, Version 1.0

iii This is done using the calculation of bias, a simplified version of average relative error, calculated between measured data and model predictions. Bias indicates the average tendency of the modelled estimates to be larger or smaller than their observed counterparts

iv Model prediction error is quantified from paired modelled and direct-re-measured sites in an experimental sampling regime subject to control and treatment scenarios

v Pooled measurement uncertainty (PMU) is defined as the pooled standard error of all the measured values for a practice change, where standard error is derived from replicates of the measurements. See VMD0053, Version 1.0

Table 4: General Information of Scope and Quality of the Modelling Approach: [DNDC](#)

Criteria		Recommended Criteria	Justification/Response
Scope			
G 1	Model version	A uniquely traceable record of all files needed to reproduce a given model output from its calibrated parameter set and model-driving input data. These may include source code, internal parameters that are not adjusted during calibration, default values for parameters or input data, or generally any other information that may change model behaviour. A model version must change any time there is a change in any of the model files. For a given parameter set and set of model-driving inputs, any copy of the model reporting the same model version must always produce the same output.	This will be included at time of final IDD submission in which outcomes will be generated by an updated version of DNDC calibrated and validated for the project scope. The calibration and validation process follows the CAR SEP protocol and includes datasets from peer-reviewed research sites as well as additional sources of government data in the project scope.
G 2	Is the modelling approach suitable for the context of the	Some modelling approaches are global/generic but most are targeted at specific	DNDC is a process-based biogeochemical model built to capture globally relevant first principles of soil biogeochemistry. The model is therefore capable of simulating management impacts on soil carbon and greenhouse gas emissions in any geography provided

	Intervention, notably geography and activity?	activity types and geographies. Companies should not try to apply modelling approaches that do not properly account for their activity or that use approaches intended for other geographies that are different from the context of the Intervention.	the management practice can be adequately parameterized. The following input parameters in DNDC are able to capture the interventions specified in this IDD: • Cover Crops - o Crop_id - o Plant_date - o End_date - o Harvest_date - o Residue_fraction • Tillage - o Till_date - o Till_depth - o Invert • Fertilizer Application Event - o Nutrient_product_type - o Application_date - o Application_name - o Application_amount - o Application_amount_type
G 3	Is the approach suitable for the reporting purpose sought?	Companies may report for many reasons, most notably for Greenhouse Gas Protocol or other reporting protocols such as GRI and CDP. The company should satisfy themselves that the method chosen conforms with any criteria stated in the reporting protocols it is intended for. Likewise, if any part of the Intervention is seeking carbon credits, a methodology that is approved by the credit issuer is likely necessary.	While reporting standards from Greenhouse Gas Protocol have not yet been finalized, the quantification approach used by Regrow on behalf of the program is based on both the best available science and precedence set by Scope 1 standards like CAR and Verra. The updated version DNDC Validation Process document Calibrated/Validated for this project scope will include further details.
Quality			
G 4	Is the scientific framework of the model third party authored or reviewed?	It is generally not recommended that companies create their own models. Relying on well-chosen third-party models may avoid accusations of poor quality or conflicts of interest. Where self-authoring of models are unavoidable, these should be based on peer-reviewed science and reviewed and approved by a suitable third party.	The scientific framework of DNDC has been well established in over 200 peer-reviewed publications since its development in the 1990s (see a list of publications here: https://www.globaldndc.net/publications). Regrow is an independent third-party that maintains versions of DNDC that support corporate emissions reporting.
G 5	Is the models recent and based on up to date science?	It is recommended that the latest version of a models is applied. Ideally the version would have been published within the	DNDC v10.3 has been approved by CAR SEP. This model and its uncertainty quantification will be updated to reflect the specific geographies and scope for this project at time of submission.

		two to three years prior to application though longer may be necessary in circumstances where this is unavoidable. It is recommended in such cases that the company highlights this transparently in reporting and explores ways to bring the method up to date.	
G 6	Is the modelling approach scientifically peer reviewed?	Modelling approaches that are peer reviewed or include scientifically peer-reviewed approaches should be chosen over those that do not.	The scientific framework of DNDC has been well established in over 200 peer-reviewed publications since its development in the 1990s (see box G4 of this Annex).
G 7	Has the model been approved by a Standards body, such as Gold Standard, CAR, VERRA?	For enhanced confidence in the model chosen, or where it is desirable to use for the purposes of certification, then the selection of a model that has been approved by a body such as Gold Standard may be beneficial.	DNDC v10.3 has been approved by CAR SEP.
G 8	Does the company have the technical capacity and resource to properly use the model?	Companies should choose an modelling approach commensurate with their skill and capacity to implement. While more rigorous approaches are often desirable, it is better to choose an approach that can be realistically implemented than one that is unlikely to be properly maintained.	Regrow's business model is to provide ecosystem monitoring, reporting, and verification through a SaaS framework. Regrow's team includes 70+ employees (and 15 PhDs) across eight countries and several areas of expertise, from software development to soil science.
G 9	Are all assumptions and the level of uncertainty/confidence in the model output generated clear and transparent?	Per the Interventions Guidance, companies should transparently report any assumptions inherent in the modelling approach chosen and the level of uncertainty in the results generated. This helps to avoid accusations of over-reporting or over-stating results where a more practical but less rigorous approach is being applied. Different sources of uncertainty should be distinguished (e.g., sample uncertainty vs. heterogeneity). Choice	The sole source of uncertainty quantified and reported for DNDC is model structural uncertainty, which is reported separately for each validated GHG. This represents the uncertainty in model predictions of measured "credits" from the validation database and is quantified for each GHG using two statistics: 1. Model bias (delta) 2. Model error (sigma)

		and form of distributions need to be set for all parameter values to reflect second order uncertainty.	
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Table 3: Self-Assessment **DNDC**

Criteria		Justification/Response (Provide a summary in the box below)
Assessment of Model Calibration		
SA1	Provide a clear explanation and rationale for how the model calibration was conducted and how validation statistics were selected and applied, including the adjustment of model parameters with directly measured values.	Regrow's approach to model calibration and validation follows the methods defined in the Climate Action Reserve's Requirements and Guidance for Model Calibration, Validation, Uncertainty, and Verification for Soil Enrichment Projects v1.1a.
SA2	Explain any rationale behind underlying assumptions or limitations of the model.	DNDC v10.3 has been approved by CAR SEP. This model will be updated to reflect the geographies and scope for this project at time of submission.
SA3	Provide an evaluation of the extent the model is either underestimating or overestimating the variable/s to be estimated and how this is to be rectified if required. Describe and explain the modelled spatial patterns and relate them to the landscape characteristics for the intended application.	The distributions of the delta parameters in Section 5 – Bias and Uncertainty Histograms of the DNDC Validation Report shows the bias of the model for both SOC and Direct N ₂ O. Both over and/or underestimates are corrected for via the propagation of model bias to credit estimates (Section 7 – Propagating DNDC Bias and Uncertainty to Credit Estimates of the DNDC Validation Process document).
SA4	Provide an assessment of applicability of the model to the project area, specifically the spatial scale appropriateness, including any intended or expected expansion of activity areas.	The model will be applicable within the reported validation domain (Section 3 – Validation Domain of the DNDC Validation Report). This domain covers both the geographies, practices, and crops of the program.
SA5	Provide an assessment of applicability of the model to the project area, specifically for temporal boundaries (e.g., does the model covers all growing seasons and rotations of the crop type).	DNDC models daily GHG fluxes and can therefore capture these dynamics during all growing seasons and rotations of interest to the program. DNDC will be calibrated and validated to include the target cash crops for the project in its validation domain.
SA6	Provide datasets used for model calibration, including but not limited to full citation, experimental locations, specific crops and practices studied, climate zones/nationally defined agricultural land regions, soil textures and clay contents, and number of observations.	The studies used to define the validation domain will be listed upon validation and calibration of DNDC to target the project domain.
SA7	Describe how overall uncertainty ⁱ for calculation of emissions reduction was performed.	For those asset calculations generated by DNDC, uncertainty is applied at the field-level for SOC and Direct N ₂ O modelled offsets using a Monte Carlo statistical method to generate a distribution of values with introduced uncertainty. The range of statistically probable values contained within the uncertainty distribution is used to derive credit values at a conservative reporting percentile (recommend 30% as per CAR SEP Equation 5.1).

Explanation of the Validated Data		
SA8	Where and when did the data set come from and who was responsible for its development?	Regrow has compiled the validation dataset through extensive review of the peer-reviewed literature within the target validation domain of the program.
SA9	What is the variable/s to be estimated by the model (for example SOC, SOM, N ₂ O, CH ₄ , other)?	DNDC provides estimates of four sources, sinks, and reservoirs (SSRs) for use in corporate reporting: 1. Soil Organic Carbon (SOC) 2. Direct N₂O 3. Indirect N₂O (nitrate leaching and NO_x emissions) 4. Soil CH₄ Two of these SSRs, SOC and Direct N₂O, have a validated uncertainty model that captures the model structural uncertainty in their estimation.
SA10	Is a more up to date data set available and, if so, why was it not applied?	The most up-to-date datasets will be gathered from the studies used to build the validation domain.
SA11	Provide a description of data requirements to initialize and run the model version and parameter sets, as well as the process for addressing missing information.	This information will be provided upon submission of the updated DNDC model.
SA11 SA12	Provide full accounting of the studies comprising the validation dataset for each ecozone/nationally defined agricultural land region and activity, for each emissions source. Study attributes include, for example: • Citation • Climate zone/nationally defined agricultural land region • Soil texture(s) and clay contents being studied • Experimental time period • Depths of SOC measurements • Measurement technique, e.g. dry combustion for SOC, or chambers for N₂O • Methods of temporal aggregation used for observations of N₂O and CH₄ • Portions of the calendar year covered by all N₂O and/or CH₄ measurements, with justification provided when portions are missing. • Number of observations used in validation • Measurement uncertainty associated with replicates, where reported • Experimental location (only when split between calibration and validation)	This information will be provided upon submission of the updated DNDC model calibrated and validated for the project scope. The calibration and validation process follows the CAR SEP protocol and includes datasets from peer-reviewed research sites as well as additional sources of government data in the project scope.
Assessment of Model Bias ⁱⁱ and Model Prediction Error ⁱⁱⁱ		
SA13	Provide the approach and statistics used to calculate model bias.	Model bias is calculated for the SSR of interest using a simple statistical model. Bias is estimated as a distribution using Bayesian inference and Monte Carlo methods.

		Model bias will be reported in the updated DNDC Validation Report specific to this program's Validation domain. (Section 5 – Bias and Uncertainty Histograms of the DNDC Validation Report).
SA14	Describe how the model bias was assessed against uncertainty estimates (e.g., mean bias should be less than or equal to an estimate of pooled measurement uncertainty (PMU) ^{iv})	Model bias for each validated SSR was compared to PMU for that SSR. PMU is calculated using the measurement data in the validation data studies (see updated DNDC Validation report for additional information).
SA15	Describe how the uncertainty of the model's predictions were estimated (i.e., the model prediction error and evaluate model fit).	Model prediction uncertainty is estimated from the posterior predictive distribution estimated via Monte Carlo integration of the validation data likelihood, and the posterior distributions of delta and sigma. The posterior predictive distributions are used to calculate 90% prediction intervals for each validation point and the coverage is evaluated as the percent of measured validation points that are included in the 90% prediction interval. (see updated DNDC Validation report for additional information.)

Annex 3: Overview of the barriers that farmers can face over their pathway to achieving and maintaining regenerative agriculture practices

Farmers seeking to transition from conventional to regenerative agriculture practices face a number of barriers throughout their transition. Yet, even when they have adopted regenerative practices, a number of powerful barriers persist that prevent them from maintaining these practices. These barriers are summarised below.

Stage of transition	Barrier	Summary
Moving from conventional to regenerative agriculture practices	Upfront investments	While it is true that regenerative agriculture practices can result in lower costs, farmers commonly report a fear of loss associated with the transition. This is fuelled by the upfront investments that they see as necessary, for example, new land preparation equipment like direct drills for no till planting, cover crop seed mixes, trees for agroforestry or organic fertiliser, which is more expensive than its synthetic equivalent.
	Uncertainty about economic benefits	Today, there is no market premium commonly paid for crops that are grown regeneratively. Therefore, regenerative farmers mostly continue to sell into conventional commodity markets. In addition, if a farmer is diversifying their crop rotation as part of their transition, they may not be confident that they can sell new crops as readily, or what they will earn for them. Together, this makes the economic benefits of the transition uncertain. The importance of this barrier is put into context by the reality that 50% of French farmers on medium or large farms earned less than EUR 14,000 per year in net income in 2016, and the majority of UK arable farmers were only able to return a positive net margin per hectare on three crops between 2017 and 2020.
	Technical difficulties	Conventional agriculture has developed a system of tried and tested synthetic solutions to combat pests and support yields and relies on intensive land preparation to maintain optimal seeding conditions. All of these solutions are 'quick fixes' that undermine soil health. Regenerative agriculture is more complex and knowledge-intensive for the farmer to implement. Since its underlying philosophy is to 'farm with nature' rather than against it, it requires proactively managing the agricultural ecosystem to prevent problems arising, instead of relying on prescriptions of agrochemicals and other synthetic inputs in reaction to problems that have already emerged. Regenerative agriculture simply isn't as easy as conventional farming and can lead to multiple technical difficulties.

Stage of transition	Barrier	Summary
	Lack of information and knowledge	Connected to the above barrier, farmers commonly report a lack of confidence in implementing regenerative solutions to everyday farming solutions. Since regenerative agriculture is still a niche activity, examples of local peer farmers already demonstrating such practices are rare. Similarly, since the agriculture advice industry is still orientated around conventional agriculture – with most advisors being employed by input dealers – professional advice on regenerative practices is hard to come by.
Maintaining regenerative agriculture practices	Bad weather	i) If waterlogging of soils is a result of intense periods of rainfall, this presents a direct threat to continued operations in affected fields, and therefore to yields and revenue opportunities. Farmers will be easily tempted to resume ploughing in order to turn the soil profile and deliver drier soil to the surface in order to facilitate seeding of Winter crops. This has been seen far and wide in France, Belgium and the UK in recent years. ii) If the season post-harvest is very dry, or even in drought conditions, farmers will have little incentive to spend money trying to establish cover crops. Equally, if the weather conditions have led to a very late harvest, the available window for seeding and growing cover crops may appear too short to make it worthwhile. In both of these circumstances, the weather conditions incentivise farmers to abandon their plans to do cover-cropping. iii) Organic fertilisation requires greater volumes of fertiliser to be applied and, because more time is needed for manure to break down into the soil as compared to synthetic fertiliser, it needs to be applied after summer harvest. Synthetic fertiliser, on the other hand, is applied in lower volumes and is applied just before seeding. Wet conditions delay the delivery of manure since the conditions prevent the logistics needed to clear livestock barns and complete transport operations. This alone means farmers relying on organic fertilisation can be several weeks behind conventional farmers in seeding their crops. Also, if conditions are wet and fields impassable, this can make application of organic fertiliser very difficult, if not impractical. In both of these circumstances, it is the lower risk and more practical option to resume synthetic fertilisation.

Stage of transition	Barrier	Summary
	Pest pressures	In no-till farming systems, pressure from pests such as rodent populations, can get out of control. In addition, severe outbreaks of weeds such as blackgrass, can be experienced in minimum or no-till farming systems. In both cases, the resumption of ploughing is often seen as the quickest and most effective way to regain control of pest pressures, which directly threatens yields and therefore revenue from the farm.
	Lack of premium pricing	Today, there is no market premium commonly paid for crops that are grown regeneratively. Therefore, regenerative farmers mostly continue to sell into conventional commodity markets. However, because regenerative agriculture is more complex and knowledge-intensive for the farmer to implement, the lack of premium pricing to reward farmers for maintaining a more complex approach to farming is a powerful factor in a farmer's decision-making.
	Lack of access to organic fertiliser	The more farmers seeking to undertake a transition to regenerative agriculture means that access to organic fertilisation becomes more challenging. The absolute volume of supply of organic fertilisation is limited, so, whether through increased prices or lack of availability, farmers can find procurement of organic fertiliser increasingly challenging.
	Loss of yield	When a farmer transitions from conventional to organic practices (typically over a three-year period), the relatively sudden shift from synthetic fertilisation to relying on the natural fertility of the soil can result in short-term declines in yield. If the transition from conventional to regenerative agriculture follows a similar speed and abruptness as the transition to organic – especially with regard to shifting from synthetic to organic fertilisation and reduction in agrochemicals to control pests – a similar decline in yield of up to 21% can be experienced. For the farmer, this represents a decline in revenue in the short-term.

Stage of transition	Barrier	Summary
Throughout the process	Social and peer pressure	Farming communities remain important sources of influence over a farmer's decision-making, a reality that is only enhanced by social media. Furthermore, the practices that a farmer implements on their fields are visible for all to see, leaving them more exposed to social and peer pressure than in many other industries. Since conventional agriculture remains the common practice, those practising regenerative agriculture remain outliers, breaking with the tradition of social norms. Concretely, leaving crop residues ('trash') to be incorporated into the soil and feed the soil biology stands in stark contrast to the common practice of ploughing the soil, leaving a 'clean' field. Therefore, regenerative farmers continue to be subject to peer pressure from those practising conventional agriculture, and this is known from survey data across Europe to be a material factor in their decision-making.

Annex 4: Detailed data management within the Monitoring Plan

Parameter	Data unit	Description	Source of data	Measurement methods	Monitoring frequency	QA/QC & uncertainty rating (UR) ⁸
Area	ha	Purpose: Define the area over which each farmer is applying the Program of Interventions				
A	ha	Program area	Shape files as provided by public authorities for subsidy payments or from farm management software if not available	Calculation	Annually	Majority of data already verified by public authorities for subsidy payments. Note that shape files also provide longitude and latitude information to enable further cross-checking. UR: low
Crop Type	Dimensionless	Name of cash crop grown	Farmer reporting	Calculation	Annually	Cross-reference with farm data records (including invoices, farm management software) and disclosures to public authorities UR: low
Yield	T / ha	Harvested yield	Farmer reporting	Measured (direct from harvester)	Annually	Cross-reference with farm data records (including sales receipts, farm management software) UR: low
Crop residue management	kg CO ₂ e	Purpose: Calculate emissions and/or soil carbon sequestration from crop residue management				

⁸ Low = most likely will not allow for input data uncertainty post-verification; medium = possible to allow for input data uncertainty post-verification; high = likely to allow for input data uncertainty post-verification.

Parameter	Data unit	Description	Source of data	Measurement methods	Monitoring frequency	QA/QC & uncertainty rating (UR) ⁸
R_{above}	kg CO ₂ e	Amount of above-ground residues	Simeos AMG tool (available at http://www.simeos-amg.org/), as a function of farmer reported crop type and yield	Estimation	Annually	Crop type and yield cross-referenced with farm data records (including sales receipts, farm management software) UR: low
Fertiliser emissions						
	kg CO ₂ e	Purpose: Calculate emissions from mineral fertiliser production and application				
R_i	kg	Application rate [†] of fertiliser type i	Farmer reporting	Calculation	Annually	Cross-reference with farm data records (including invoices, farm management software) UR: low
Pesticide emissions						
	kg CO ₂ e	Purpose: Calculate emissions related to the different kinds of pesticides used				
$N_{\text{app. pest.}}$	#	Number of pesticide applications for post-emergence and seed treatment	Farmer reporting	Calculation	Annually	Cross-reference with farm data records (including pesticide inventory reporting, invoices, farm management software) UR: low
$R_{\text{app.}}$	kg ha ⁻¹	Application rate	Farmer reporting	Calculation	Annually	Cross-reference with farm data records (including pesticide inventory reporting, invoices, farm management software) UR: low
Energy use for mechanical operations						
	kg CO ₂ e	Purpose: Calculate emissions from petrol and diesel use for common mechanical operations like tillage, spraying, spreading, harvesting				

Parameter	Data unit	Description	Source of data	Measurement methods	Monitoring frequency	QA/QC & uncertainty rating (UR) ⁸
$C_{\text{fuel \& energy}}$	l or megajoule (MJ)	Consumption of fuel or energy i	Farmer reporting of equipment used, fuel usage derived from industry look-up table	Parameter estimation	Annually	Cross-reference with farm data records (including farm management software, invoices) UR: low
N	#	Number [†] of operations of machinery	Farmer reporting	Calculation	Annually	Cross-reference with farm data records (including farm management software, invoices) UR: low
Energy use for irrigation kg CO ₂ e Purpose: Calculate emissions from irrigation						
D_{irri}	mm	Irrigation depth	Farmer reporting	Calculation	Annually	Cross-reference with farm data records UR: low
A_{irri}	ha	Area [†] under irrigation	Farmer reporting	Calculation	Annually	Cross-reference with farm data records UR: low
dist_h	m	Horizontal distance to water source	Farmer reporting	Calculation	Annually	Cross-reference with farm data records UR: low
dist_v	m	Vertical transport defined by borehole depth	Farmer reporting	Calculation	Annually	Cross-reference with farm data records UR: low
Carbon stock changes kg CO ₂ e Purpose: Calculate carbon sequestration in soil and tree biomass						
BF	Dimensionless	Base factor for land use change	Farmer reporting	Calculation	Annually	Cross-reference with farm data records (including official CAP reporting) UR: low

Parameter	Data unit	Description	Source of data	Measurement methods	Monitoring frequency	QA/QC & uncertainty rating (UR) ⁸
TF	Dimensionless	Tillage factor (depth and inversion)	Farmer reporting; remote sensing for verification	Calculation	Annually	Cross-reference with farm data records (including invoices, farm management software) and remote sensing UR: low
IF _{cc}	Dimensionless	Input factor for cover crops [†]	Farmer reporting; remote sensing for verification	Calculation	Annually	Cross-reference with farm data records (including invoices, farm management software) and remote sensing UR: low
LA	ha	Land area for a particular land use and management system	Farmer reporting; remote sensing for verification	Calculation	Annually	Cross-reference with farm data records (including invoices, farm management software) and remote sensing UR: low
A _{FYM}	t ha ⁻¹	Dry weights [†] of added farmyard manure	Farmer reporting	Calculation	Annually	Cross-reference with farm data records (including farm management software) UR: low, although it could be medium if manure is produced on farm or traded locally and informally and farmer does not use farm management software
A _{straw}	t ha ⁻¹	Dry weights [†] of added straw	Farmer reporting	Calculation	Annually	Cross-reference with farm data records (including farm management software) UR: low, although it could be medium if straw is produced on farm or traded locally and informally and farmer does not use farm management software

Parameter	Data unit	Description	Source of data	Measurement methods	Monitoring frequency	QA/QC & uncertainty rating (UR) ⁸
A_{compost}	t ha ⁻¹	Dry weights [†] of added compost	Farmer reporting	Calculation	Annually	Cross-reference with farm data records (including farm management software) UR: low, although it could be medium if compost is produced on farm or traded locally and informally and farmer does not use farm management software
$T_{y=0}$	# ha ⁻¹	Number of trees at year of assessment	Farmer reporting; remote sensing for verification	Measurement	Annually	Cross-reference with farm data records and remote sensing UR: low
T_{y-1}	# ha ⁻¹	Number of trees in year prior to year of assessment	Farmer reporting; remote sensing for verification	Measurement	Annually	Cross-reference with farm data records and remote sensing UR: low
$DBH_{y=0}$	cm	Trunk diameter at breast height at year of assessment	Farmer reporting	Measurement	Annually	Verifiable via a site visit UR: low
DBH_{y-1}	cm	Trunk diameter at breast height in year prior to year of assessment	Farmer reporting	Measurement	Annually	Verifiable via a site visit UR: low
t°	°C	Local daily temperature	Third-party meteorological service	Measurement	Daily	All data taken from same global provider of high repute UR: low

Parameter	Data unit	Description	Source of data	Measurement methods	Monitoring frequency	QA/QC & uncertainty rating (UR) ⁸
Precip	mm	Local daily precipitation	Third-party meteorological service	Measurement	Daily	All data taken from same global provider of high repute UR: low
Livestock emissions	kg CO ₂ e	Purpose: Calculate emissions from livestock and related manure production				
T	Cattle beef, cattle dairy, pigs, sheep, poultry, etc.	Species/category of livestock	Farmer reporting	Calculation	Annually	Cross-reference with farm data records (including official reporting for subsidy payments) UR: low
N _(T)	#	The number of head of livestock species/category	Farmer reporting	Calculation	Annually	Cross-reference with farm data records (including official reporting for subsidy payments) UR: low
S	Dimensionless	Manure management system	Regional common practice from Tables 10.14 and 10.15, Chapter 10, 2006 IPCC Guidelines for National Greenhouse Gas Inventories	Estimated	Annually	Conservative common practice factor used for all anyway UR: low

Parameter	Data unit	Description	Source of data	Measurement methods	Monitoring frequency	QA/QC & uncertainty rating (UR) ⁸
MS (T,S)	Dimensionless	Fraction of total annual nitrogen excretion for each livestock species/category T that is managed in manure management system S	Regional common practice from Tables 10.14 and 10.15, Chapter 10, 2006 IPCC Guidelines for National Greenhouse Gas Inventories	Estimated	Annually	Conservative common practice factor used for all anyway UR: low

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Annex 6: Supporting Evidence

The following documents are provided in support of this validation process:

Project Design Documents (PDD) using ISO 14064

- Soil Capital Carbon PDD_FR BE_VALIDATED
- Soil Capital Carbon PDD_FR BE UK_VALIDATED

Validation Reports:

- TUV Rheinland_Validation Report_Soil Capital Carbon_FR BE_March 2021
- TUV Rheinland_Validation Report_Soil Capital Carbon_FR BE UK_July 2023

GHG Reports:

- Soil Capital Carbon_GHG Report_Vintage 2021_Final
- Soil Capital Carbon_GHG Report_Vintage 2022_Final

Verification Reports:

- TUV Rheinland_Verification Report_Soil Capital Carbon_Vintage 2021_Final
- TUV Rheinland_Verification Report_Soil Capital Carbon_Vintage 2022_Final

Proof of farmer payments:

- Farmer 1 Purchase Order
- Farmer 1 Bank extract
- Farmer 2 Purchase Order
- Farmer 2 Bank extract
- Farmer 3 Purchase Order
- Farmer 3 Bank extract

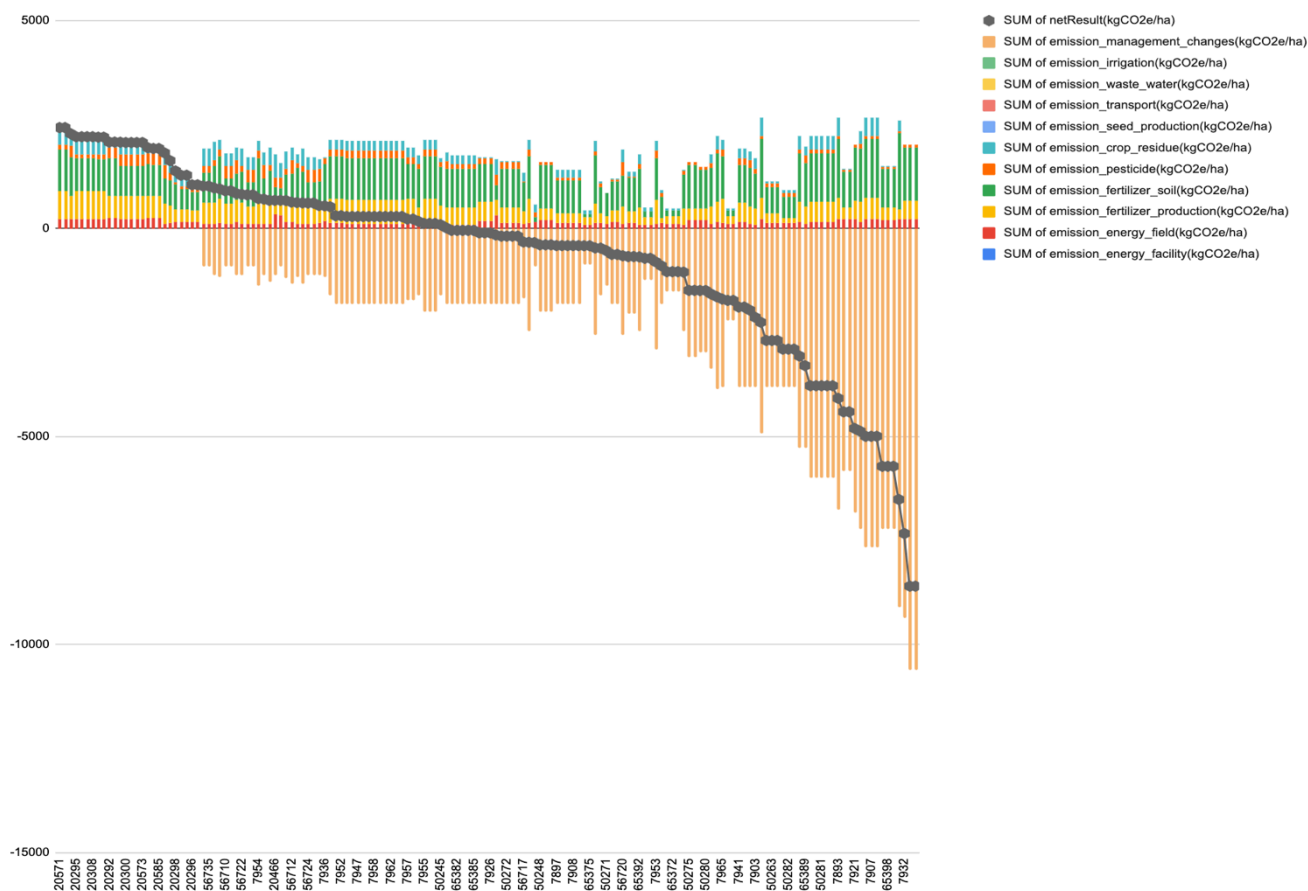
Annex 7: DNDC Parameter references, limitations and assumptions

THIS PART WAS CLEANED TO PROTECT SENSITIVE INFO

Annex 8: Illustrative output data from DNDC, including related uncertainty

THIS PART WAS CLEANED TO PROTECT SENSITIVE INFO

Annex 9: Extract of quantification approach per field



netResu lt(kgCO 2e/ha)	farmSea sonField CropID	SU M of field Are a(ha)	SU M of yel d(t/ ha)	SUM of emission_en ergy_facility(k gCO2e/ha)	SUM of emission_en ergy_field(kg CO2e/ha)	SUM of emission_ferti zer_production(kgCO2e/ha)	SUM of emission_fer tilizer_soil(kg CO2e/ha)	SUM of emission_p esticide(kg CO2e/ha)	SUM of emission_cro p_residue(kg CO2e/ha)	SUM of emission_see d_production(kgCO2e/ha)	SUM of emission_tr ansport(kg CO2e/ha)	SUM of emission_wa ste_water(kg CO2e/ha)	SUM of emission_ir rigation(kg CO2e/ha)	SUM of netResu lt(kgCO 2e/ha)	SUM of emission_manage ment_changes(kg CO2e/ha)
2427.74	20571	10.6 3	4.1	0	223.5	678.57	1000.3	102.5	422.87	0	0	0	0	2427.74	0
	20572	0.76	4.1	0	223.5	678.57	1000.3	102.5	422.87	0	0	0	0	2427.74	0
2283.21	20574	6.23	8.4	0	225.08	551.19	945.6	266.5	294.84	0	0	0	0	2283.21	0
2206.79	20295	24.8 4	4.1	0	223.5	678.57	779.35	102.5	422.87	0	0	0	0	2206.79	0
	20306	2.89	4.1	0	223.5	678.57	779.35	102.5	422.87	0	0	0	0	2206.79	0
	20307	11.4 2	4.1	0	223.5	678.57	779.35	102.5	422.87	0	0	0	0	2206.79	0
	20308	3.62	4.1	0	223.5	678.57	779.35	102.5	422.87	0	0	0	0	2206.79	0
2198.64	20566	12.0 2	4.1	0	223.5	678.57	771.2	102.5	422.87	0	0	0	0	2198.64	0
	20568	2.53	4.1	0	223.5	678.57	771.2	102.5	422.87	0	0	0	0	2198.64	0
2081.15	20292	12.4 1	8.4	0	241.73	551.19	896.95	266.5	124.78	0	0	0	0	2081.15	0
	20293	11.4 7	8.4	0	241.73	551.19	896.95	266.5	124.78	0	0	0	0	2081.15	0
2077.28	20302	7.5	8.4	0	225.08	551.19	739.67	266.5	294.84	0	0	0	0	2077.28	0
2069.28	20300	6.45	8.4	0	225.08	551.19	731.67	266.5	294.84	0	0	0	0	2069.28	0
2069.27	20301	14.4 6	8.4	0	225.08	551.19	731.66	266.5	294.84	0	0	0	0	2069.27	0
	20570	5.29	8.4	0	225.08	551.19	731.66	266.5	294.84	0	0	0	0	2069.27	0
	20573	14.1 2	8.4	0	225.08	551.19	731.66	266.5	294.84	0	0	0	0	2069.27	0
1943.17	20305	21.4 5	8.4	0	241.73	551.19	758.97	266.5	124.78	0	0	0	0	1943.17	0
1923.87	20294	22.4 7	8.4	0	241.73	551.19	739.67	266.5	124.78	0	0	0	0	1923.87	0
	20585	8.88	8.4	0	241.73	551.19	739.67	266.5	124.78	0	0	0	0	1923.87	0
1820.81	56739	2.89	8.6	0	115.01	480.91	615.52	307.5	301.87	0	0	0	0	1820.81	0
1636.33	81714	14.5 4	8.6	0	144.16	418.03	587.77	184.5	301.87	0	0	0	0	1636.33	0
1386.4	20298	5.82	7.1	0	154.3	314.34	584.32	61.5	271.94	0	0	0	0	1386.4	0
1281.57	20297	2.71	7.1	0	154.3	314.34	479.49	61.5	271.94	0	0	0	0	1281.57	0
	20304	7	7.1	0	154.3	314.34	479.49	61.5	271.94	0	0	0	0	1281.57	0
1054.37	20296	7.85	6.6	0	153.79	285.77	437.66	61.5	115.65	0	0	0	0	1054.37	0
	20575	8.52	6.6	0	153.79	285.77	437.66	61.5	115.65	0	0	0	0	1054.37	0
1021.17	56728	8.83 7	4.4	0	105.2	526.16	719.5	143.5	431.29	0	0	0	0	1021.17	-904.48
	56735	1.14	4.4	0	105.2	526.16	719.5	143.5	431.29	0	0	0	0	1021.17	-904.48
976.2	56711	5.82	4.4	0	105.2	526.16	880.1	143.5	431.29	0	0	0	0	976.2	-1110.05
956.58	7949	3.51	6.5	0	146.61	576.22	1007.23	164	228.07	0	0	0	0	956.58	-1165.55
909.84	56710	2.60 3	8.6	0	115.01	480.91	609.03	307.5	301.87	0	0	0	0	909.84	-904.48
	56715	8.87 7	8.6	0	115.01	480.91	609.03	307.5	301.87	0	0	0	0	909.84	-904.48
844.87	56729	8.88	8.6	0	153.95	532.36	638.74	328	301.87	0	0	0	0	844.87	-1110.05
824.13	56722	2.71	4.4	0	105.2	526.16	728.03	143.5	431.29	0	0	0	0	824.13	-1110.05
813.17	56727	12.0 2	8.6	0	108.87	418.03	581.39	307.5	301.87	0	0	0	0	813.17	-904.49
	56736	2.53	8.6	0	108.87	418.03	581.39	307.5	301.87	0	0	0	0	813.17	-904.49
722.28	7954	14.2	6.5	0	107.67	576.22	1007.22	184.5	228.07	0	0	0	0	722.28	-1381.4
710.76	56723	7.5	8.6	0	115.01	480.91	615.52	307.5	301.87	0	0	0	0	710.76	-1110.05
680.12	56725	21.4 5	4.4	0	105.2	526.16	750.26	143.5	431.29	0	0	0	0	680.12	-1276.29
679.6	20466	14.5 4	114	0	339.2	411.06	241.82	225.5	572.07	0	0	0	0	679.6	-1110.05
677.54	56734	4.16	73	0	329.96	365.9	273.85	246	366.32	0	0	0	0	677.54	-904.49
677.03	56721	16.2 13	4.4	0	156.98	390.55	757.62	123	431.29	0	0	0	0	677.03	-1182.41
639.31	56712	22.4 7	8.6	0	153.95	532.36	638.74	328	301.87	0	0	0	0	639.31	-1315.61
627.68	65391	38.4 2	6	0	117.03	421.4	921.31	123	210.49	0	0	0	0	627.68	-1165.55
618.57	56733	7	4.4	0	105.2	526.16	728.03	143.5	431.29	0	0	0	0	618.57	-1315.61
613.99	56724	11.4 2	8.6	0	108.87	418.03	587.77	307.5	301.87	0	0	0	0	613.99	-1110.05

	56732	3.62	8.6	0	108.87	418.03	587.77	307.5	301.87	0	0	0	0	613.99	-1110.05
555.06	56714	24.8 4	8.6	0	125.52	418.03	587.77	307.5	226.29	0	0	0	0	555.06	-1110.05
545.88	7936	9.83	6.5	0	183.93	451.44	919.58	143.5	12.98	0	0	0	0	545.88	-1165.55
524.88	7963	21.8 9	6.5	0	146.61	576.22	1007.22	164	228.07	0	0	0	0	524.88	-1597.24
309.04	7944	10.9 4	6.5	0	146.61	576.22	1007.22	164	228.07	0	0	0	0	309.04	-1813.08
309.01	7952	0.06	6.5	0	146.67	576.17	1007.17	164	228	0	0	0	0	309.01	-1813
290.6	7945	18.9	6.5	0	107.67	576.22	1007.22	184.5	228.07	0	0	0	0	290.6	-1813.08
	7946	38.0 1	6.5	0	107.67	576.22	1007.22	184.5	228.07	0	0	0	0	290.6	-1813.08
	7947	22.1 9	6.5	0	107.67	576.22	1007.22	184.5	228.07	0	0	0	0	290.6	-1813.08
	7948	29.9 5	6.5	0	107.67	576.22	1007.22	184.5	228.07	0	0	0	0	290.6	-1813.08
	7956	13.7 1	6.5	0	107.67	576.22	1007.22	184.5	228.07	0	0	0	0	290.6	-1813.08
	7958	32.8 4	6.5	0	107.67	576.22	1007.22	184.5	228.07	0	0	0	0	290.6	-1813.08
	7960	9.72	6.5	0	107.67	576.22	1007.22	184.5	228.07	0	0	0	0	290.6	-1813.08
	7961	1.47	6.5	0	107.67	576.22	1007.22	184.5	228.07	0	0	0	0	290.6	-1813.08
	7962	2.05	6.5	0	107.67	576.22	1007.22	184.5	228.07	0	0	0	0	290.6	-1813.08
	7967	17.8 5	6.5	0	107.67	576.22	1007.22	184.5	228.07	0	0	0	0	290.6	-1813.08
	7968	10.5	6.5	0	107.67	576.22	1007.22	184.5	228.07	0	0	0	0	290.6	-1813.08
229.45	7957	14.4 2	6.5	0	146.61	576.22	833.07	164	228.07	0	0	0	0	229.45	-1718.52
	7959	8.25	6.5	0	146.61	576.22	833.07	164	228.07	0	0	0	0	229.45	-1718.52
172.85	65388	18.1 6	6	0	93.89	421.4	921.31	123	210.49	0	0	0	0	172.85	-1597.24
124.08	7955	8.02	6.5	0	146.61	576.22	1007.22	164	228.07	0	0	0	0	124.08	-1998.04
	7964	12.3 9	6.5	0	146.61	576.22	1007.22	164	228.07	0	0	0	0	124.08	-1998.04
124.07	7951	0.82	6.5	0	146.61	576.22	1007.22	164	228.06	0	0	0	0	124.07	-1998.04
95.59	50245	5.05 5	6	0	130	421.4	921.31	123	97.12	0	0	0	0	95.59	-1597.24
22.18	65390	68.6 5	6	0	97.56	421.4	921.31	184.5	210.49	0	0	0	0	22.18	-1813.08
-42.99	65379	20.6 25	6	0	93.89	421.4	921.31	123	210.49	0	0	0	0	-42.99	-1813.08
	65382	18.3 2	6	0	93.89	421.4	921.31	123	210.49	0	0	0	0	-42.99	-1813.08
	65383	9.55	6	0	93.89	421.4	921.31	123	210.49	0	0	0	0	-42.99	-1813.08
	65384	4.32	6	0	93.89	421.4	921.31	123	210.49	0	0	0	0	-42.99	-1813.08
	65385	12.5 5	6	0	93.89	421.4	921.31	123	210.49	0	0	0	0	-42.99	-1813.08
-101.63	7938	1.81	6.5	0	183.93	451.45	919.59	143.5	12.98	0	0	0	0	-101.63	-1813.08
-101.65	7923	65.6 2	6.5	0	183.93	451.44	919.58	143.5	12.98	0	0	0	0	-101.65	-1813.08
	7926	73.7 4	6.5	0	183.93	451.44	919.58	143.5	12.98	0	0	0	0	-101.65	-1813.08
-152.99 94239	56726	11.4 56	73	0	329.96	365.9	351.1114385	246	366.33	0	0	0	0	-152.99 94239	-1812.300862
-182.88	50258	6.48 1	6	0	132.47	368.26	924.4	164	41.07	0	0	0	0	-182.88	-1813.08
	50272	6.22	6	0	132.47	368.26	924.4	164	41.07	0	0	0	0	-182.88	-1813.08
	50285	17.8 5	6	0	132.47	368.26	924.4	164	41.07	0	0	0	0	-182.88	-1813.08
	50293	2.18	6	0	132.47	368.26	924.4	164	41.07	0	0	0	0	-182.88	-1813.08
-322.64 38865	56717	4.23	5.8	0	122.1710189	285.7710189	712.58	20.501018 91	205.3310189	0	0	0	0	-322.64 38865	-1668.997962
-330.02	7966	8.06	6.5	0	146.61	576.22	1007.22	164	228.07	0	0	0	0	-330.02	-2452.14
-336.13	56716	5.14	6	0	170.8	0	102.91	123	171.64	0	0	0	0	-336.13	-904.48
-387.76	50248	8.02	7	0	202.59	284.52	1048.37	61.5	9.64	0	0	0	0	-387.76	-1994.38
-387.77	50265	12.3 9	7	0	202.59	284.52	1048.37	61.5	9.64	0	0	0	0	-387.77	-1994.39
-387.79	50289	0.82	7	0	202.59	284.51	1048.37	61.5	9.63	0	0	0	0	-387.79	-1994.39
-406.43	7897	12.5 5	2.5	0	128.16	241.01	782.27	82	173.21	0	0	0	0	-406.43	-1813.08

-411.10 5	7898	4.32	2.5	0	128.16	241.01	782.27	82	173.21	0	0	0	0	-406.43	-1813.08
	7899	9.55	2.5	0	128.16	241.01	782.27	82	173.21	0	0	0	0	-406.43	-1813.08
	7908	5.05	2.5	0	128.16	241.01	782.27	82	173.21	0	0	0	0	-406.43	-1813.08
	7909	18.3 2	2.5	0	128.16	241.01	782.27	82	173.21	0	0	0	0	-406.43	-1813.08
	65374	8.25	5	0	85.48	190.51	71.095	0	100.59	0	0	0	0	-411.10 5	-858.78
-464.07	65375	14.4 2	5	0	85.48	190.51	71.095	0	100.59	0	0	0	0	-411.10 5	-858.78
	65378	12.9 9	3.2	0	131.92	465.92	1161.97	102.5	237.83	0	0	0	0	-464.07	-2564.21
	50246	16.2 41	4	0	147.46	216.6	633.74	82	47.2	0	0	0	0	-470.24	-1597.24
	50271	6.51 2	4	0	109.18	190.51	554.36	0	0	0	0	0	0	-527.35	-1381.4
	50276	1.33	7	0	161.67	284.52	677.41	61.5	9.64	0	0	0	0	-618.34	-1813.08
-655.26 06644	50291	0.9	7	0	161.67	284.52	677.41	61.5	9.64	0	0	0	0	-618.34	-1813.08
	56720	11.3 64	8.6	0	108.87	418.03	757.47	307.5	301.87	0	0	0	0	-655.26 06644	-2549.000664
	56713	12.4 1	5.8	0	138.82	285.77	810.75	20.5	120.37	0	0	0	0	-672.1	-2048.31
	56718	11.4 7	5.8	0	138.82	285.77	810.75	20.5	120.37	0	0	0	0	-672.1	-2048.31
	65392	34.2 2	6	0	97.56	421.4	921.31	123	210.49	0	0	0	0	-678.38	-2452.14
-712.35	65370	3.51	5	0	85.48	190.51	135.7	0	100.59	0	0	0	0	-712.35	-1224.63
	65377	8.06	5	0	85.48	190.51	135.7	0	100.59	0	0	0	0	-712.35	-1224.63
	7953	17.6 6	6.5	0	107.67	576.22	1007.22	184.5	228.07	0	0	0	0	-802.56	-2906.24
	50267	9.66 5	1	0	145.41	105.36	514.57	82	69.51	0	0	0	0	-896.23	-1813.08
	65371	0.82	5	0	104.95	190.51	135.7	0	55.83	0	0	0	0	-1033.8 5	-1520.84
-1033.8 5	65372	8.02	5	0	104.95	190.51	135.7	0	55.83	0	0	0	0	-1033.8 5	-1520.84
	65373	12.3 9	5	0	104.95	190.51	135.7	0	55.83	0	0	0	0	-1033.8 5	-1520.84
	7935	12.9 9	6	0	88.19	397.55	814.67	82	23.6	0	0	0	0	-1046.1 3	-2452.14
	50275	3.51	7	0	202.59	284.52	1048.37	61.5	9.64	0	0	0	0	-1482.8 9	-3089.51
	50296	8.06	7	0	202.59	284.52	1048.37	61.5	9.64	0	0	0	0	-1482.8 9	-3089.51
-1487.8 65	50279	8.25	7	0	202.59	284.52	926.195	61.5	9.64	0	0	0	0	-1487.8 65	-2972.31
	50280	14.4 2	7	0	202.59	284.52	926.195	61.5	9.64	0	0	0	0	-1487.8 65	-2972.31
	65394	12.4 1	6	0	113.36	421.4	921.31	123	210.49	0	0	0	0	-1570.7 8	-3360.34
	50290	9.83	3.2	0	170.86	465.92	1161.97	102.5	313.67	0	0	0	0	-1635.8 8	-3850.8
	7965	1.76	6.5	0	146.61	576.22	1007.22	164	228.07	0	0	0	0	-1692.3 2	-3814.44
-1725.1 4	65369	7.59 9	5	0	104.95	190.51	135.7	0	55.83	0	0	0	0	-1725.1 4	-2212.13
	65376	17.6 6	5	0	104.95	190.51	135.7	0	55.83	0	0	0	0	-1725.1 4	-2212.13
	7941	1.33	6.5	0	167.29	451.44	919.59	143.5	249	0	0	0	0	-1883.6 2	-3814.44
	7940	0.9	6.5	0	167.29	451.44	919.58	143.5	249	0	0	0	0	-1883.6 3	-3814.44
	65396	65.6 2	6	0	117.03	421.4	921.31	184.5	210.49	0	0	0	0	-1959.7 1	-3814.44
-2132.4 7	7903	9.61	5	0	86.84	403.82	820.8	123	247.51	0	0	0	0	-2132.4 7	-3814.44
	7937	34.2 2	3.3	0	229.5	509.22	1406.97	82	448.88	0	0	0	0	-2252.3 6	-4928.93
	50273	2.05	4	0	147.46	216.6	633.75	82	47.2	0	0	0	0	-2687.4 3	-3814.44
	50263	29.9 5	4	0	147.46	216.6	633.74	82	47.2	0	0	0	0	-2687.4 4	-3814.44
	50288	1.47	4	0	147.46	216.6	633.74	82	47.2	0	0	0	0	-2687.4 4	-3814.44
-2897.5 9	50264	18.9	1	0	145.41	105.36	514.57	82	69.51	0	0	0	0	-2897.5 9	-3814.44
	50282	10.5	1	0	145.41	105.36	514.57	82	69.51	0	0	0	0	-2897.5 9	-3814.44
	50278	6.55	1	0	145.41	105.36	514.56	82	69.51	0	0	0	0	-2897.6	-3814.44
	50283	21.8 9	3.2	0	170.86	465.92	1161.97	102.5	313.67	0	0	0	0	-3062.1 1	-5277.03
	65389	38.0 1	6	0	118.02	421.4	1038.91	184.5	210.49	0	0	0	0	-3291.5 9	-5264.91

-3775.1 7	50294	0.06	3.2	0	170.83	466	1162	102.5	313.67	0	0	0	0	-3775.1 7	-5990.17
-3775.2 2	50247	73.7 4	3.2	0	170.86	465.92	1161.97	102.5	313.67	0	0	0	0	-3775.2 2	-5990.14
	50281	13.7 1	3.2	0	170.86	465.92	1161.97	102.5	313.67	0	0	0	0	-3775.2 2	-5990.14
	50284	10.9 4	3.2	0	170.86	465.92	1161.97	102.5	313.67	0	0	0	0	-3775.2 2	-5990.14
-3775.2 3	50274	1.81	3.2	0	170.86	465.92	1161.96	102.5	313.67	0	0	0	0	-3775.2 3	-5990.14
-4077.8 9	7893	12.4 1	3.3	0	229.49	509.22	1406.97	82	448.88	0	0	0	0	-4077.8 9	-6754.45
-4403.2 5	50262	17.6 6	7	0	222.78	284.52	852.93	61.5	9.64	0	0	0	0	-4403.2 5	-5834.62
	50268	7.59 9	7	0	222.78	284.52	852.93	61.5	9.64	0	0	0	0	-4403.2 5	-5834.62
-4802.7 1	7921	38.4 2	12	0	229.07	444.07	1269.71	61.5	16.52	0	0	0	0	-4802.7 1	-6823.58
-4873.0 7	50249	21.6 52	3.2	0	170.72	465.92	1288.57	102.5	313.67	0	0	0	0	-4873.0 7	-7214.45
-4990.6 5	7894	68.6 5	3.3	0	229.5	509.22	1406.97	82	448.88	0	0	0	0	-4990.6 5	-7667.22
	7907	22.3 9	3.3	0	229.5	509.22	1406.97	82	448.88	0	0	0	0	-4990.6 5	-7667.22
-4990.6 6	7920	6.55	3.3	0	229.49	509.22	1406.97	82	448.88	0	0	0	0	-4990.6 6	-7667.22
-5712.9 7	65397	32.8 4	7	0	214.56	284.52	931.26	61.5	9.64	0	0	0	0	-5712.9 7	-7214.45
	65398	1.76	7	0	214.56	284.52	931.26	61.5	9.64	0	0	0	0	-5712.9 7	-7214.45
	65399	9.61	7	0	214.56	284.52	931.26	61.5	9.64	0	0	0	0	-5712.9 7	-7214.45
-6511.2 1	7933	21.3 5	8	0	227.1	234.13	1827.53	61.5	248.93	0	0	0	0	-6511.2 1	-9110.4
-7329.9 6	7932	18.1 6	12	0	229.07	444.07	1269.71	61.5	16.52	0	0	0	0	-7329.9 6	-9350.83
-8593.5 9	7913	2.18	12	0	229.07	444.07	1269.71	61.5	16.52	0	0	0	0	-8593.5 9	-10614.46
	7914	6.22	12	0	229.07	444.07	1269.71	61.5	16.52	0	0	0	0	-8593.5 9	-10614.46