Carbon Credits (Carbon Farming Initiative) Act 2011

Yeomans Methodology for Developing and Monitoring Methods for Rapid Soil Carbon Sequestration

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Preamble

We must recognize and appreciate that removing the one trillion tonnes of excess carbon dioxide we have added to the world's atmosphere is humanity's fundamental and overriding problem. Emissions reduction efforts are merely endeavours to slow the rate we increase that problem.

Soil Carbon Sequestration has a very real possibility of removing that excess and thereby reversing Global Warming and re-stabilizing world weather systems*. With soil carbon sequestration, (unlike planting trees) we don't lose our useful food producing agricultural land. Our soils simply become more productive.

Australia is currently the only nation on Earth where legislation exists that is designed to encourage soil carbon sequestration to combat Climate Change. That Legislation is embodied in Carbon Credits (Carbon Farming Initiative) Act 2011 with Amendments.

Australia has the largest area of agricultural land available for soil carbon sequestration of any nation on Earth. In total agricultural land area we are second only to China and slightly ahead of the United States.

Australians must accept, even embrace, the responsibility for demonstrating to the world that agricultural soils can have a huge and possibly deciding, impact on averting catastrophic Climate Change.

All that is now needed is to have our farmers know that it is easy and rewarding to develop the fertility of their soils. And if they succeed, and only if they succeed in their soil carbon sequestration endeavours will they get their Carbon Credits.

In reality the law already says "pay the farmers" for soil carbon sequestration . However the rules, and regulations, and requirements and red tape, very effectively make it not happen. They are unfortunately all structured in a manner that makes it incredibly complicated, impossible to understand and hopelessly impractical to attempt.

Global Warming is probably the greatest danger our civilization has ever faced. Yet to demand that we be "conservative" in the way we attempt to combat and monitor that danger is dangerously counterproductive. That "conservative" requirement has resulted in no CFI initiated soil carbon sequestration on any Australian agricultural land anywhere, ever. That is worse than dangerously counterproductive.

*Allan Yeomans' original 1989 US paper entitled "An Agricultural Solution to the Greenhouse Effect" . It is now considered to be the origin of the concept of soil carbon sequestration.

Contents

Methodology Title

"Carbon Credits (Carbon Farming Initiative) Act 2011

"Yeomans Methodology for Developing and Monitoring Methods for Rapid Soil Carbon Sequestration"

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This Methodology applies to sequestration offsets projects that aim to remove carbon dioxide from the atmosphere by sequestering carbon in soil in the form of organic carbon and using whatever methods designed or selected by the Project Proponent.

Part 1 Definitions and Terms Used In this Methodology and Departmental Publications:

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

activity start date means the date from which project management actions may be applied on a carbon estimation area, and which is the later of either:

(a) the first day after the last day of a carbon estimation area baseline sampling round; or

(b) the first day after the Regulator makes a decision under subsection 27(2) of the Act to declare a project to which this Determination applies to be an eligible offsets project.

ASPAC means the Australasian Soil and Plant Analysis Council.

bare fallow means land that is not seeded and has less than 40% ground cover for 3 months or longer. (Not relevant in this Protocol)

Baseline round .means a series of tests, described as a Baseline Sampling Round required to obtain a measure used to nominate the level of carbon in a CEA by LOI testing and referring to the levels existing before the commencement of the Project.

baseline emissions period not applicable in this Methodology

bulk density means soil mass per unit volume. (Not relevant in this Protocol)

carbon dioxide equivalent (CO_2-e) means the carbon dioxide equivalent mass of a greenhouse gas.

carbon estimation area baseline sampling round means the first soil sampling round undertaken in a carbon estimation area to determine the initial soil organic carbon stock value.

carbon estimation area sampling round means a sampling round conducted to develop an estimate of soil organic carbon stock in a carbon estimation area.

CEA carbon estimation area means an area of land upon which the activity is being undertaken and which excludes areas of land on which the project activity is not being undertaken.

CFI soil sampling and analysis method means the soil sampling and analysis method that is included in the CFI Soil Sampling and Analysis Method and Guidelines or as here in referred.

CFI Soil Sampling and Analysis Method and Guidelines means the guidelines of that name, as published and made available on the Department's website and includes any amendments to the guidelines uploaded by the Department to its website from time to time.

CO_2-e means a unit of measurement defined as tonnes of carbon dioxide equivalence (within the meaning of the *National Greenhouse and Energy Reporting Act 2007*).

composite means a sample created by bulking and mixing a selection of individual soil cores collected from a different nominated group of sampling locations.

continuous cropping means a system according to which land is cropped at least once every year, either with crops of the same type or rotations of different crops, and does not include pasture rotations. (Not applicable in this Methodology.)

critical soil organic carbon change means change in soil organic carbon stock over time with a defined probability of exceedance. (Not relevant in this Methodology)

Credit(s) Round means a series of tests to determine changes in soil carbon following the Baseline test series

Department means the department that administers the Australian Act.

Determination/Methodology In this Methodology are interchangeable terms.

equivalent soil mass Not applicable in this Methodology.

exclusion area means an area within the Project where soil carbon will not be monitored.

the farmer means the Project Proponent.

fertiliser is a general term and means any organic or synthetic substance that supplies chemical elements to plants and soils to enhance plant growth and/or the fertility of soils.

grazing system means a system of managing grazing by livestock on pasture. Not applicable in this Methodology

historic management actions means all management practices undertaken in a carbon estimation area between the beginning of the baseline emissions period and the activity start date. Not applicable in this Methodology.

MGA means Map Grid of Australia The official coordinate projection for use with the Geocentric Datum of Australia 1994 (GDA94).

median day means the middle date of a sampling round, or the next calendar date if the sampling round consisted of an even number of days.

National Inventory means the report of that name, as published and made available on the Department's website, and as updated from time to time.

new management action means a project management action that:

(a) is undertaken in a carbon estimation area on or after the activity start date; and

(a) differs from historic management actions.

Both not applicable in this Methodology

NATA means the National Association of Testing Authorities.

NGER Measurement Determination means the applicable determination made under subsection 10(3) of the *National Greenhouse and Energy Reporting Act 2007*.

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

nominated sampling depth means a soil sampling depth that is chosen by a Project Proponent for each carbon estimation area.

organic fertiliser means any solid or liquid organic product that:

(a) is created using waste products of other industries and processes;

(b) may be applied to the surface of, or incorporated into, agricultural soils; and

(c) does not include polymers and non-biodegradable substances such as plastics, rubber or coatings.

production livestock means livestock managed for production purposes and from which commercial products or services are derived. (Not relevant in this Methodology)

project proponent ("the farmer") means the relevant owner of the land

project area baseline sampling round see ***Baseline round***

project area sampling round means a sampling round conducted to develop an estimate of soil organic carbon stock in all carbon estimation areas in the project area.

project duration means the time in years between the baseline sampling round and the most recent sampling round for a carbon estimation area. (Effectively the current age of the Project.)

project management actions means all management actions undertaken within a carbon estimation area in the period between the activity start date and the end of the final crediting period for the project and includes one or more new management actions.

project mechanism (Not relevant in this Methodology) has the meaning given by Section 2.2 of the guide.

project start date means the date when the first reporting period for an eligible offsets project starts under subsection 76(1) of the Act.

Note The project start date is the first day of both the project crediting period and the first reporting period of the project.

percentiles and equivalent mass are not relevant in this methodology

QT means that the adjacent copy is copy derived from one or more relevant Australian Government publications.

qualified technician means a technician with qualifications from a nationally accredited course, or formal recognition of trade or prior learning (from a nationally accredited institution), in the competencies prescribed in the CFI Soil Sampling and Analysis Method and Guidelines

as modified unless (otherwise noted in this Methodology in relation to specific functions.)

Regulations means in Australia, the *Carbon Credits (Carbon Farming Initiative) Regulations 2011*.

renovation event means the rejuvenation of existing degraded pasture by sowing additional pasture seed. (Not relevant in this Methodology)

sample means a representative portion of soil from a discrete layer of soil. in this methodology means the total content of a Soil Pipe.

sampling design means instructions regarding:

(a) the spatial layout of sampling locations;

(b) the number of samples;

(c) the timing of sampling; and

(d) if relevant, the compositing or bulking of soil samples.

sampling interval means the time between consecutive sampling rounds.

sampling location means the location, specified by a latitude and a longitude, at which a sample has been, or is to be, taken and will where possible be delineated by the relevant MGA coordinates.

sampling plan means:

(a) the position of the carbon estimation areas and the strata;

(b) the number of composites; and

(c) the sample location assigned to each composite;

within the project area.

sampling round means soil sampling conducted during a finite period to develop an estimate of soil organic carbon stocks as a time defined within this Methodology. See Credits Round.

soil core means a discrete portion of soil that has been extracted with using a 100 mm nominal diameter coring device with an enclosing sleeve. It does not need to include rocks or stones.

soil organic carbon means the form of carbon contained within soil organic matter and does not include mineralised carbon. Not used in this Methodology as LOI tests used here do include mineralised but this is accepted as not changing over millennia.

soil organic carbon changes means the change in mass in a LOI test and does include mineralised carbon if any are released during a LOI test. It is accepted in this Methodology that mineralized carbon releases will not vary over less than geological time frames.

Soil Pipe means the collecting sleeve enclosing the soil sample that is being collected in the field

Standard Parameters and Emissions Factors means the document

titled *Standard Parameters and Emissions Factors for Sequestering Carbon in Soils in Grazing Systems* that is published and made available on the Department's website, and includes any amendments to those parameters and emissions factors based on updated information available to the Department, changes in the National Inventory, or changes in the carbon dioxide equivalence of the gases incorporated into those parameters and emissions factors and uploaded by the Department to its website from time to time.

stratum (strata singular) means a small subdivisional area in a CEA.

sub-sample, in relation to a soil sample, means a representative portion of an original soil sample upon which laboratory analyses are conducted.

synthetic fertilizer means any synthetic substance that supplies key chemical elements, particularly nitrogen, phosphorus and potassium, to plants and soils to enhance plant growth and the fertility of soils. (Not relevant in this Methodology)

SOM means soli organic matter as determined by the LOI testing procedures used in this Methodology.

tillage means any form of mechanical preparation of the soil.

58% means the accepted percentage of carbon in soil organic matter in this Methodology.

SOC in this Yeomans Methodology means the soil organic carbon content determined by using a LOI soil test and multiplying that figure by 58%.

CEA1 means carbon estimation area number one. (similar meaning for other numbers)

SPa means Soil Pipe effective area i.e. diameter of soil pipe squared x 3.14159 and divided by 4.

LOI in this methodology means the weight loss on ignition of a soil test sample in a forced air heating oven such as a Yeomans Carbon Still.

LOIcop means total Loss On Ignition for a composite area.

LOIha means loss on ignition per hectare i.e. LOIcop x 10,000 / Composite area in square metres.

CEAco2 means the organic matter content of a CEA x 2.126

CEAsom means the soil organic matter in a CEA.

region of disturbance means the area around a previous test hole locations enclosed within a 1 metre radius.

target MDC approximately 2 tonnes change in the levels of SOC per hectare indicated by the change in loss of weight in a composite.

air-dried soil in this Methodology to mean dried with air at a maximum temperature of 40^0 C for Baseline samples and above 40^0 C for Credits sampling.

oven dried in this Methodology to mean forced hot air flow-dried between 100^0 C and 115^0 C and to be described as "oven dried Baseline" with sample air exit temperatures to be held at the nominated temperatures for between 6 minutes and 16 minutes. All subsequent testing "oven dried " is to mean dried using forced air at between 115^0 C and 165^0 C and to be described as "oven dried for Credits Rounds, with sample air exit temperatures to be held at the nominated temperatures for greater than 16 minutes. 18/6/2017 20/6/2017 21/6/2017 26/6/2017

QT ***Note*** Other words and expressions used in this Methodology have the meaning given by the Act. These include:

baseline

crediting period

eligible offsets project

emission

greenhouse gas

maximum potential relinquishment period

offsets report

project

project area

project proponent

Regulator

reporting period

Part 2

Yeomans Methodology Design Principles

There are two basic principles on which the Yeomans Methodology is structured that are not in general use.

The first is that calculations on changes in soil carbon levels are based on land surface area, and not on soil weights and densities. To illustrate. For some pre-chosen depth, the weight of organic matter in a given soil sample, where the surface area of that sample is 100 square centimetres, That weight, when multiplied by 1,000,000, will give the weight of organic matter in one hectare of land.

The second principle nominates temperatures and time durations in Loss On Ignition procedure such that in the initial drying procedures Baseline samples are dried for shorter times and lower temperatures than those of Credit Round testing. In addition, Baseline test temperatures are higher, and are held at those higher temperatures longer, than for Credit Round tests.

The temperatures called for in this Methodology are not absolutely mandatory as different soils might be better tested at slightly different temperatures and for slightly different times. All that is necessary in this Methodology is that a positive bias is maintained and that once decided, those temperatures and times and sample depths as nominated don't vary throughout the Project duration.

Part 3

Preliminary

Yeomans Methodology is in general designed to be in compliance with the publications: "CFI Soil Sampling and Design Methods and Guidelines" and with "CFI Soil Sampling and Analysis Methods and Guidelines".

The following are the Soil Sampling and Design major exceptions and also Yeomans Methodology requirements. Where this Methodology differs from the Guidelines, the Methodology is to apply.

(1) There are no limits placed on how the carbon estimation area is farmed or managed, nor on what inputs are applied to the land.

(2) In this Methodology, calculations are based on land surface area and variations in the soil carbon content under those nominated surface area. Using a Yeomans Soil Pipe with a known diameter then a known mathematical relationship always exists between the surface area of cored samples and the surface area of the relevant ***CEA*** (Carbon Estimation Area).

(3) Baseline samples are taken to a nominated depth. All future sampling cores, as in Credit Rounds are taken to a nominated maximum depth which must always be a minimum of 50 mm less than the nominated Baseline depths selected. These Baseline samples are to be weighed and the weight recorded so that in the unlikely event that future compaction of soil occur, or be suspected to have occurred, then Test Sample weights must not exceed the weights of the original individual Baseline weights in any individual strata.

(4) In this Methodology only total depth of a core is relevant. Depth layers are not relevant.

(5) Each ***CEA*** (**Carbon Estimation Area**)is to be subdivided into strata with areas as close as practical to equal. Minor variations in strata areas have effectively minuscule and meaningless relevance in the issue of Carbon Credits in this Methodology.

(6) In *CFI Soil Sampling and Design Methods and Guidelines* Section 1,4 ref to the 6 Steps. Step 5 refers to "calculating the organic carbon content of soil samples." The tests and equipment used in Yeomans Methodology determine loss in weight of organic carbon from Loss On Ignition procedures. True organic carbon levels generally require the removal of carbon held because of the geological nature of the soil. This can involve chemical treatment of soil samples which procedures in

this Methodology are designed to circumvent. The objective here is to determine changes in soil carbon levels using Loss On Ignition procedures. It is to be presumed that Changes can only meaningfully occur in organic carbon levels but not in the basic geological composition of the soil.

(7) In CFI Soil Sampling Design Method and Guidelines Section 2.2 notes that "the same management practices are going to be applied across the project area". This is not to be a requirement in this Methodology.

It is argued that this limitation of using "same management practices" is both unnecessary, and more importantly will prevent valuable experimentation by participants along with the inevitable consequential development of innovative concepts from that experimentation.

Also within any individual CEA management practices must be allowed to vary at the Farmer's discretion. This is to actively encourage research and development in techniques that can increase soil carbon sequestration in the CEA.

R&D in the whole Project Area is likewise to be actively encouraged.

(8) CFI Soil Sampling Design Method and Guidelines Section Referring to Section 4.1 Sampling is to be conducted at the same time each year subject to weather.

(9) CFI Soil Sampling Design Method and Guidelines Section Reference Part A.1 Sampling Plan Ref 2 Sub reference 1

In the Yeomans Methodology where strata are located by MGA (map Grid of Australia) coordinates the accuracy of the strata sizing is simply validated arithmetically.

(10) CFI Soil Sampling Design Method and Guidelines Section Reference Part C Defining CEAS

Reference C.2 (1) (a) and (b) In this Methodology there is to be no "defined activity" for any CEA.

A "definitive activity" is unnecessary when the only requirement is to be able to monitor changes in SOC for valid rewards. A definitive activity could possibly be of academic interest but that benefit is surely negligible compared to the total restriction necessarily placed on the development of better means for rapid agricultural soil carbon sequestration.

(11) CFI Soil Sampling Design Method and Guidelines Section Requirements of Strata. D.2 (1) (b) Change to 10% not 5%.

It is argued here that 5% is unnecessarily burdensome, without meaningfully benefit or security to the Authority granting the benefit or Carbon Credits. However, if the requirement of 10% will delay acceptance of this Methodology then 5% will have to be accepted due to the critical urgency in the need to develop and inaugurate large scale soil carbon sequestration here in Australia.

Part 4 We Face World Weather Destabilization NOW!

At best, emissions reductions slightly decreases the rate at which things just get worse

Without removing the excess carbon dioxide now existing in the atmosphere, avoiding catastrophic climate destabilization is unavoidable.

Soil Is Our Only Chance

The problem is to remove a trillion tonnes and only soil carbon sequestration has such a potential, so without the involvement of our World's farmers, Climate Change is Unstoppable:

It's our job to get farmers involved. So we must pay them and we must ensure that they must never have to worry about long term risks in getting into the business of building soil fertility. It has to be something that looks like it could be very profitable. It has to be something they want to be involved in.

We have to understand their problems. It can be presumed that, in general, it would be a major change in farm management practices to convert to systems designed primarily to enhance soil carbon levels.

Such a management change could reasonably be expected to require years of work and planning, which cannot be expected to be undertaken lightly. A farmer would understandingly consider that his livelihood, his assets, often his sole source of income, could be at great potential risk.

It is therefore all too easy for a farmer to ***not*** participate at all in such projects. And that's ***not*** what the world needs.

The Project Proponent, the Farmer must therefore know, and understand, and believe that the money is there, and a minimum value of carbon credits is assured for the life of the project. Without that, no

reasonable man could be expected to make such farm management changes and expose themselves to possibly "great potential risks".

It follows that without Project Proponents receiving firm and binding assurances, soil carbon sequestration, of any worthwhile significance, just won't happen here in Australia.

But it has to start in Australia, or probably the system with the greatest potential for removing carbon dioxide from our overloaded atmosphere won't happen to any significance, in any country, anywhere on our planet.

It has to start here. Australia is the country with the greatest area of available agricultural land of any nation on Earth.

And "Australia **is** the country where soil carbon sequestration was invented".

Part 5 Pedantic and Unnecessary Requirements & the Effects on Nett Abatement Amount

The pedantic and pointless monitoring of "emissions from all sources", as demanded in "Sequestering Carbon in Soils in Grazing Systems Methodology Determination 2014" must be (and seems to have been) an all to effective disincentive to any farmer to even consider becoming a "project proponent" and by so doing contribute to efforts to combat the overheating of the Earth's biosphere using soil carbon sequestration.

The complex and detailed regular estimation of emissions from such things as tractors, motor vehicles and live stock in a CEA is seen as being both unnecessary, wasteful and counterproductive to an extreme.

Many research organizations and institutes report on the decrease in greenhouse gas emissions that occur when farming practices are changed to reduce chemical inputs, such techniques as are employed in organic and biodynamic agricultural systems.

Notably are reports from IFORM, and most notably papers reporting on the decades long experiments conducted by the US Rodale Institute. From these reports and papers, it is clear that there is a general and positive decline in the emission of greenhouse gasses from test areas where such practices are employed. Additionally, those same practices most notably increase the levels of soil organic carbon.

This Methodology considers that there is an established world market for food and that the levels are established by cost of production, coupled with supply and demand. If a Project Proponent does not increase the world supply of food then there is logically no nett increase in greenhouse gas emissions. If production, resulting from good management of a CEA, increases, it follows that somewhere else, it will be reduced.

In this Methodology, changes in emissions due to changes in farm practices are considered negligible in the extreme and therefore can logically and safely be taken as zero.

Increasing soil organic matter - as is the principle of soil carbon sequestration - usually reduces the input of agricultural chemicals used on the farm, which in turn reduces the greenhouse gas emissions from that farm. This, in itself must contribute to lowering emissions.

The "emissions from all sources" must rightfully be considered as a "business as usual" phenomena, and therefore safely ignored in sequestration calculations.

Additionally, in this Methodology (**and only in this methodology**) all soil testing procedures have "built in " biases to inflate Baseline test readings against those of future Credit Rounds.

One of the objectives of this Methodology is to encourage the development of systems for rapidly enhancing levels of soil organic carbon and thus the basic fertility of our Australian soils. Private, and usually voluntary and unsponsored research, dies when burdened with pointless and unnecessary regulatory demands.

In this methodology soil organic matter is understood to be humic acid, fulvic acid and similar materials and also the materials that can, over time, be expected to form those more permanent substances.

Greenhouse gas emissions from a CEA are not required to be monitored by the Project Proponent in this Methodology. However the Department may declare an activity, taking place on a nominated individual project, that produces rises in soil organic carbon from the relevant testing procedure applying, as invalid.

(By way of illustration - a CEA could be used as a dumpsite for plastic.)

The Project Proponent is to also understand that Carbon Credits deriving from such activity could be declared invalid, or be deemed refundable.

It is also to be understood that the Department is not to act in a frivolous way in monitoring the possibilities of such activities.

It is also to be understood by the Project Proponent that such activities might be considered as "fraudulent conduct" which is covered under the Act, wherein it notes:

" If a person is convicted of an offence relating to fraudulent conduct, and the issue of Australian carbon credit units is attributable to the commission of the offence, a court may order the person to relinquish a specified number of Australian carbon credit units."

In respect of Civil penalties the Act also notes:

"Pecuniary penalties are payable for contravention of civil penalty provisions."

Above all the overriding principles and considerations to apply in all these matters is to positively achieve a significant reduction in the world's atmospheric greenhouse gas levels.

For all of these reasons: In this Methodology, the cumbersome, time consuming and unnecessary monitoring of " *net change in greenhouse gas emissions from all sources*" in the Project Area is therefore to be ignored.

Part 6 Net Abatement Amount

The nett abatement amount for an eligible offsets project, to which this Methodology applies, and in relation to a reporting period for the project, is the change in soil carbon stocks, determined by measuring soil carbon levels for the total number of CEAs within the Project Area. when compared to the Baseline soil carbon levels.

The amount is to be nominated as the CO_2-e of the "weight change in total organic matter in the Project Area determined by LOI soil testing".

`Part 7 No Departmental Interference in On-farm Management Actions

The Department acknowledges there is to be no restrictions on management actions, the objective of which is to increase the organic carbon content of the soil in the CEA, and to develop techniques for so doing.

Part 8 Use of Organic Fertilizers and Inorganic Fertilizers

If an organic fertilizer includes crop residue, hay or straw, applying that fertilizer to the soil in a carbon estimation area is an approved project management action and it is of no consequence where that organic matter came from. provided only that the application of the fertilizer must precede a Sampling Round by greater than 12 weeks. or greater than 4 weeks if the material was actually formed within the Project Area.

In this Methodology the use of any fertiliser, additional to organic fertilizer is permitted with the definite exception of any nitrogenous based fertilizers. The reason being that such fertilisers can sometimes be used in the initial development of soils with very low organic matter content. Their careful and minimal use in the initial development of soils can "artificially" stimulate the growth of vegetation no matter how poor its nutritional value might be. The ultimate decomposition of that material supplies, what was a poor soil, with sufficient organic matter to trigger the conversion to highly fertile soil along with healthy soil biological activity. It is also probable and desirable that chemicals will be developed, designed to stimulate the development of rich biologically active and productive soils.

The concept being that such chemicals are to assist the development of fertile soil and not be designed to merely stimulate the weight of a saleable crop.

Part 9 Trees and Wasteland & Woody Vegetation

International Climate Change agreements include provisions, or requirements that world food production is not to be decreased by efforts to lower atmospheric greenhouse gas levels.

The Yeomans Methodology therefore does not support the destruction of agricultural land by encouraging such land to revert to unproductive wasteland.

Clearing woody vegetation from within the Project Area may be undertaken at any time at the discretion of the Project Proponent.

It is thus a stipulation in this Yeomans Methodology that Carbon Credits are not to be issued to any Project Proponent for allowing productive agricultural land to revert to scrubland.

It is a stipulation in the Yeomans Methodology that Carbon Credits are not to be issued to a project proponent based on the planting of trees on agricultural land.

Note Such clearing may be dependent on obtaining regulatory approvals, including approvals, licences or permits under State or Territory law

Part 10 Start Date of a Project

This methodology comes into force when it is made (approved) (Ref Section 122 of the Act).

The Department recognizes, or is to recognize that experimentation on soil carbon sequestration has to be actively encouraged, and the Project Proponent recognizes that such experimentation will be at no cost to the Department, unless specifically agreed, with respect to some particular line of research.

Part 11 Project Size No Maximum Nor Minimum Sizing Applies.

In this Methodology there is to be no maximum nor minimum farm size or farm area limitations. This provided only that other nominated minimum are not exceeded.

Part 12 Required Information Records

The Project Proponent must keep a time log of significant management practices used and significant changes in those management practices in all CEAs in the Project Area. This information is to be available to officers of the Department of the Environment (or the relevant authority applicable at the time) if requested and maybe in turn be distributed to other Project Proponents if requested by them.

Part 13 The 100 Year Concept. A Deal Breaker

A requirement that the Project Proponent - the Farmer, and his descendents for at least 3 generations must ensure that soil carbon levels do not fall below those achieved and recognized, for a period of one century is generally considered by many to be a massive disincentive for our 135,000 Australian farmers to participate in combating Global Warming. And their almost total lack of interest has definitely proved it to be so.

Project proponents adopting the Yeomans Methodology are expected to presume that the 100 year permanency requirements with their necessary regular rounds of soil carbon testing either

(a) Do not apply to this methodology or

(b) Do apply but will be revoked or modified or least be seriously reconsidered to more realistically conform to responsible and practical approaches to combating Climate Change.

The 100 Year Concept. Should be Cancelled For All Projects, Now

If they are designed to lower levels of atmospheric greenhouse gasses

Part 14 Appropriate Caveats Must Apply

Any land area for which payments have been made for increases in soil carbon, must be subject to a caveat, to ensure that soil carbon levels do not sustain any decrease in the relevant future. Soil tests must be carried out on the subject land to ensure that the organic carbon content is maintained.

If soil carbon levels are not maintained then they should be re-established. If they are not re-established within a period of 3 years then an appropriate caveat should be attached to the land title acknowledging it as a debt to the payment authority for Carbon credits issued.

After the initial 25 year period, or after the cessation of the issue of credits, soil carbon tests are to be undertaken on the subject land once every 5 years for a further period of 25 years. (Other alternate forms of caveats, that do not impose any more onerous demands on a land owner, are completely acceptable within this Protocol)

Part 15 Issue of Carbon Credits Only for Measured SOM Increases

Payments, Rewards, or the issue of Carbon Credits in the Yeomans Methodology are to be based on increases in soil carbon determined by actual in-field soil tests coupled with Loss On Ignition test procedures.

Payments are never to be made based on compliance with nominated and regulated farm management practices.

Part 16 $10 Minimum for the Issue of Australian Carbon Credits

Project Proponents undertaking soil carbon sequestration by enhancing the fertility and productivity of their soils are to be paid or credited at a minimum rate of $10 (cpi adjusted) a tonne carbon dioxide equivalent (CO_2-e) and there should never be any doubt, or even any consideration of doubt in the Project Proponent's mind that they will not receive these credits fairly and promptly.

As at June 2017 nothing like this has happened anywhere in Australia and for fairly obvious reasons.

One, is that the concept of an ongoing auction system to set a price for Australian carbon credits guarantees, in the minds of farmers - who could hopefully be future Prospect Proponents - an understanding that at some stage the auction price could easily slump to possibly 10 cents a ton carbon dioxide equivalent. Nobody really knows.

Of course it may well be, in the fine print, that a minimum price for Carbon Credits is somehow irrevocably assured, but Departmental officers should not reasonably expect a farmer to change the entire management structure operating on their property based on what would likely be seen as very nebulous guarantees.

A firm and absolute minimum price that a farmer could confidently expect, and trust is clearly essential if soil carbon sequestration in Australia is to be given even some small opportunity to exist and develop.

Currently the way our Australian Government attempts to issue Carbon Credits for soil carbon sequestration, does not work.

This Methodology requires that the first issue of Carbon Credits is not to occur until after two consecutive Credits Rounds, each of one year duration, show both of these two results.

One is a minimum total increase in soil carbon of 500 tonnes of CO_2-e in at least one CEA in the Project . and -

Two is a minimum total increase of 12 tonnes CO_2-e per hectare in that CEA.

It is to be understood that these the two consecutive Credit Rounds do not need to occur at the commencement of the Project.

The testing in these Credit Rounds are to otherwise comply with the requirements of Part 25 of this methodology.

The obligations of the Project Proponent shall continue for 25 years after the last Carbon Credit has been allotted to any individual project. --

or--

Termination of the any Project Proponent's obligations shall occur, if requested by the Project Proponent if, and additionally when, it is acknowledged by the Department that the prevention of continued atmospheric heating is beyond any known or seemingly possible means available to humanity. (It would not be just to impose an ongoing penalty on those farmers that actually made meaningful attempts to prevent Global Warming and Climate Change).

This Methodology includes the acknowledgement that the relevant Australian Federal Government authority will issue Carbon Credits redeemable at a minimum value of $10 per tonne of CO2-e sequestered into soil for a minimum period of 25 years after commencement of a Project under this Methodology. The issue of Carbon Credits shall then continue indefinitely at a value of Carbon Credits to be mutually agreed, and will cease only after the Project Proponent ("the Farmer") has been given 12 years notice of the termination of the issuing of Carbon Credits by the relevant Federal Authority.

Termination of the any Project Proponent's obligations shall occur if atmospheric carbon dioxide levels fall below 299 ppm, or some higher level, if nominated by the Minister.

Part 17 Minimum Claim Size

To prevent excesses and valueless administrative overloads, all subsequent application for Credit should only be lodged where expected payments would be a minimum figure of $2,500 for any individual Project.

This Methodology accepts that increases in organic matter of less than 4 tonnes per hectare, even worldwide are too small to be significant in preventing continued heating of the Earth's biosphere.

Part 18 General Methodology Requirements

In this Methodology the preparation of samples for LOI testing includes, air-drying (when required), bulking, mixing, sieving, sub-sampling, and handling must always be under the control of the NATA or ASPAC organization confirming the test results, or other people or organizations approved by the Department from time to time.

Part 19 General Principals of Project Design and Layout.

(1) In compliance with this Methodology the Project Proponent decides the CEAs and the exclusion areas and the number of composites to be used with a minimum of three.

(2) The areas and also the Strata are then delineated by a qualified surveying technician experienced in the use of Differential GPS or RTK procedures. MGA coordinates are then recorded. It is recommended that the surveying technician liaise with any local agronomists.

(3) A licensed surveyor is required to determine and locate coordinates if differential GPS is not available in the area

(4) Samples cores are collected and stored for as minimal time as possible then shipped to the testing laboratory.

(5) The Project Proponent then develops the fertility of the soils in the CEAs as best as seems wise.

(6) Next year Credit Rounds are done and the results determined.

(7) And hopefully Carbon Credits are earned.

Part 20 Laying out The Farm

The Project Area is to be totally delineated using instructions described in "Carbon Farming Initiative Soil Sampling and Design Methods and Guidelines". Part 2.1.Defining and Mapping

Or -- Using this Yeomans Methodology

In general the layout of the Project Area, the size and shapes of CEAs and Exclusion Areas must not vary throughout the project duration without specific approval.

Exceptions being that at any time in the future, new CEAs can be created from Exclusions Areas within the Project Area. Also an existing CEA can be removed from a Project Area, provided either that a caveat covering the Carbon Credits credited to the CEA is attached to the title of the land in question, or the applicable Carbon Credits are refunded at a minimum of $10 a tonne CO_2-e.

A map of the whole project area is to be obtained from a Government Agency or from a licensed surveyor or from anybody approved by the Department or the testing laboratory.

On that map, the Project Area, which in general will be the boundaries of the entire property or farm, is to be marked. That map must contain the location of all points sufficient to locate the complete Project Area. The points must be located using MGA coordinates to an accuracy of 5 decimal places.

The Project Proponent (the Farmer) is then to draw in the CEAs and Exclusion Areas as he wishes. A surveyor skilled in the art is then to accurately define the CEAs and Exclusion Areas with MGA coordinates to an accuracy of 5 decimal places

It is possible that management actions could require modifications to the shapes of CEAs and Exclusion Areas to enhance soil carbon generation processes and concepts. For this to be permitted the Prospect Proponent should submit an application, endorsed by the testing laboratory and, the local agronomist and a licensed surveyor, to the Department. New Baselines may be required. However the Project is to retain its original start date.

It is the responsibility of the Farmer to ensure all layout designs have been undertaken correctly and coordinates located correctly.

Fraudulent conduct is covered under the Act wherein it notes:

" If a person is convicted of an offence relating to fraudulent conduct, and the issue of Australian carbon credit units is attributable to the commission of the offence, a court may order the person to relinquish a specified number of Australian carbon credit units."

In respect of Civil penalties the Act notes:

"Pecuniary penalties are payable for contravention of civil penalty provisions."

Part 21 Composites

A single sampling round in a CEA is a called a "Composite".

(1) A Composite is a single sampling round in a CEA where one sample is taken from each Strata.

(2) Every single Composite is to be considered as a totally independent sampling round in a CEA.

(3) Sampling depths and test hole locations for each sample in each Strata is as defined in this Methodology.

(4) A minimum of 3 composites must be taken in each CEA in each Project where Carbon Credits allocations are being considered.

(5) In a Baseline sampling round there will be total SOM determinations for each composite.

(6) For Carbon Credit rounds the Composite may be combined for final screening, drying and LOI testing.

(7) However it is recommended that a complete testing is done on each composite in the CEA. This will then give the Farmer a constant indication of the testing accuracy and the efficiency of the sequestration process being undertaken .

(8) The number of Composites may vary from the previous round, but is never to be less than 3.

(9) The number of composite rounds may vary between CEAs in a test round in a Project area, provided only that LOI testing is conducted independently for each CEA.

(10) Where raised beds are set up, or are to be set up in a CEA and those bed are to exist for longer than 2 years, then a 6 Composite system is to be employed. Some samples are to be taken from the centre of the hilled up area, and some from the adjacent furrow.

The number of tests from the 6 Composites to be taken from beds or furrows is to be decided by a local agronomist and to be approved by the relevant testing laboratory.

The test hole locations are to be determined as described in Part 23 ***Selecting Field Test Hole Locations Within An Individual Strata.*** The test hole locations are then to be moved laterally to be within 100mm of the centre line of the bed or furrow, but to otherwise comply with the requirements of Part 23.

Part 22 Design of Strata

The shape and size and location of Strata may be determined by the **CFI Soil Sampling and Design - Methods and Guidelines.**

or-- The shape size and location may be determined by using this Methodology and as herein described.

The Farmer divides each CEA into a minimum of 9 Strata and to approximately locate the relevant boundary points of those Strata as the Farmer so wished. The Strata are to be of equal area, plus or minus 10%.

Strata are to be configured so that each is bounded by a maximum of six straight sides.

The total length of the boundaries of any single Strata must not exceed 4.5 multiplied by the square root of the average Strata area within the CEA.

The corner points of each strata are then to be adjusted slightly for accuracy and convenience and then are to be located by MGA coordinates to accuracies of 5 decimal points.

(As noted throughout: If approval of this methodology is to be delayed by the requirement of a 10% allowable error then a 5% error will be accepted).

Part 23 Selecting Field Test Holes Locations Within An Individual Strata

The Australian Government Department of the Environment publication Carbon Farming Initiative - Soil Sampling Design - Method and Guidelines, can be used in its entirety for the location of holes within a Strata for soil test sampling.

or-

This Yeomans Methodology is used wherein: The corner points of a Strata are determined and located by MGA coordinates and are to be accurate within one metre. The Strata area can therefore be considered as consisting of a grid of accurate latitude and longitude meridians at one metre spacing.

The intersection of any of these one metre spaced lines becomes a potential soil carbon test hole location point, and these location points can then be used as potential soil test hole location points. For convenience these location points should be given a reference number.

(if the Soil Sampling Design - Method and Guidelines process is selected then these location points can be used in that system)

When a test sample round is to be undertaken the location of any test hole within a Strata can be determined by some a random selection process. That process is to be suitable to either the Department or the testing laboratory.

The location, or reference number, of a selected and "used" test hole location point is to be permanently recorded.

Where a randomly selected location nominates an already used location point, then another randomly selected location point is to be selected.

When in the field a nominated point is unsuitable, for practical reasons, such as being too close to a fence, or tree, or over a rock outcrop a new point is then to be selected.

That point is to be 2 metres north of the unsuitable point. If that is unsatisfactory then a point 2 metres east is to be selected. If again unsatisfactory then 2 metres south is tried, then 2 metres west.

If all are unsatisfactory then the process is repeated starting at 3 metres north, then 4 metres, etc.

Part 24 Soil Carbon Measurements for Baseline Rounds

For the purposes of determining the soil carbon Baseline, the soil organic carbon stock must be measured at the Baseline sampling round before the commencement of project management actions in a carbon estimation area. The Baseline round shall include all Composites.

(Consideration of "soil layers" is not relevant in this methodology)

Determining Baseline Values and in field soil tests.

There is to be a minimum of three composites in this Methodology. All samples from each composite are thoroughly mixed and the combined mix is then subdivided uniformly until an individual sample weighing a little less than 2 kilograms is obtained. This is to be done with each composite.

For establishing Baselines each composite should have a LOI test. For Trial Tests the composites may be combined for a single LOI test.

Part 25 The Timing of Sampling

The baseline sampling round for each CEA (Carbon Estimation Area) in the project area must not commence until after the project start date.

Project management actions must not commence in a carbon estimation area before the activity start date.

In the Yeomans Methodology, sampling rounds for any CEA is to be always undertaken at the same time of year and within a maximum time frame of 60 days. This can only be varied if weather conditions make sampling impractical.

For a project area containing more than one CEA, Credits Rounds for all CEAs must always be started and completed within a 3 month envelope.

It is recommended that each CEA should maintain their own one year period even if all the different CEAs vary over the 3 month period.

If weather, floods or fire prevents sampling in the specified time periods, they may be conducted outside those time periods provided a Statuary Declaration signed by the Project Proponent stating the time variation and the reasons for it, is made available to the relevant authorities.

Sampling round records

The median day, month and year of the carbon estimation area baseline sampling round must be recorded to the nearest day for each carbon estimation area in the project area.

All sampling carried out in a carbon estimation area after the carbon estimation area baseline sampling round must occur no more than 30 days before, and no more than 30 days after, the median day and month of the date of the carbon estimation area baseline sampling round.

The following details regarding the timing of each CEA sampling round after the carbon estimation area Baseline sampling round must be recorded and to include:

(a) the day (or days);

(b) the month (or months);

(c) the year (or years) and

(d) the median day

Consecutive sampling rounds must not occur less than 1 year apart (for Carbon Credit calculation) and more than 5 years apart.

Note Under section 76 of the Act, a reporting period must not be longer than 5 years.
The first reporting period will need to include at least 2 sampling rounds—the baseline sampling round and a subsequent sampling round—in order to calculate net abatement for the project. The baseline sampling round should be undertaken as soon as is practicable after the project start date to enable at least 2 sampling rounds to be undertaken within the first reporting period at the desired sampling interval(s).

Sampling rounds --extension of time by Regulator

A Project Proponent may apply to the Regulator to seek an extension of time to carry out the carbon estimation area sampling round

If the Regulator extends the time for the carbon estimation area sampling round the sampling must be carried put within the timeframe specified by the Regulator

Note Exceptional circumstances may include poor weather conditions that inhibit site access or where the soil moisture content is unsuitable for sampling at the planned time, or due to fire related access problems.

Part 26 Trial of One CEA at Start of Project

If the Project area contains more than one CEA then for the first claim for Carbon Credits on the Project it may be claimed for a single CEA. If this option is taken then a Credits Round for all CEAs must be taken, following that first claim by a maximum time duration of 2 years.

Part 27 In Field Sample Collection

This Methodology is a surface based system so during all sample collection and handling procedures, plant material and rocks are to be brushed to remove and collect any attached soil material, and then discarded. Test hole locations are to be located as in Part 23.

The nominated Credits Round depth must always be at least 100 mm less than the maximum Baseline depths, or must be a minimum of 15% less than the Baseline depth, whichever is the greater. Also the weight of a sample in a Credits Round is to be always less than 90% of the average weight of samples in the Baseline round for that CEA.

The nominated Baseline depth should be as deep as practical and must never be less than 400 mm. Setting a Baseline depth nearer to one metre or more is better, if reasonably possible.

In the Yeomans Methodology soil cores are to be approximately 100 mm in diameter. In this Methodology the minimum size should be no less than approximately 75 mm.

The diameter of the auger must not be significantly less than the diameter of the soil pipe. A one to two millimetre clearance between the auger and the soil pipe is acceptable.

In the digging operation a Soil Pipe or sleeve must surround the revolving auger. The sleeve or Soil Pipe must follow the auger's cutting faces down into the soil. During operation care should be taken to ensure that the cutting face of the auger does not penetrate into the soil more than approximately half the outer diameter of the soil pipe.

When the Soil Pipe is nearing the nominated depth, which is determined by fixing the operating length of the Soil Pipe, the cutting face of the auger must then not penetrate into the soil more than a few millimetres past the bottom of the Soil Pipe.

A Collection Blanket with a central hole, sufficient in diameter to just clear the Soil Pipe, is to be laid on the ground prior to auger use to ensure the collection of all material exiting the Soil Pipe. In this way all material from the sample hole can then be easily collected to insure precisions and accuracy in sample collection.

During operation of the auger and Soil Pipe, if a rock or any other object is encountered, a 100 mm diameter sleeve gives convenient hand access to the bottom of the hole and the nature of the obstruction can easily be determined. This usually will allow for the obstacles to be removed by hand without otherwise abandoning that particular location

while still maintaining sample size accuracy. Such access is not possible with 75 mm holes.

The lower face of the Soil Pipe is itself a cutting surface. This ensures that the outer diameter of the Soil Pipe can be reliably used in calculations involving the soil core's surface area and its relationship to the size of the CEA.

In summary: Sample collection for delivery

(1) Soil hole sample locations are to be determined in accordance with Part 23.

(2) The nominated sampling depth for Baseline sampling must be . . at least 400 mm (with an absolute minimum of 350 mm)

Note The nominated sampling depth may be much greater than 400 mm. For a Baseline determination the maximum depth possible is strongly recommended as SOM can develop well into the subsoil.

(3) The sampling depth must not be less than the nominated Baseline sampling depth at all sample locations in the Baseline Round.

(4) The sampling depth in Credit Rounds must always be a least 100 mm less than those nominated for Baseline tests.

(5) Credits Round sampling depths need not be the same in any Credit Round but must always be considerably less than the original Baseline depth.

(6) Each soil sample must be promptly placed in a sealed and light and air proof bag.

(7) If sampled cannot be transported within 3 weeks of collection then they must be stored in light proof sealed containers at temperatures above freezing and not above 8^0 C

Part 28

Without delay collected samples are to be shipped to an entity acceptable to the Department for preparation for the LOI tests to be undertaken. Or shipped direct to the testing laboratory. Or delivered to an officer of the Testing Laboratory

Part 29 Preparation of Samples for Loss On Ignition Testing

Preparing Samples for Loss On Ignition Testing at the Laboratory Using a Rotary Mixer and Yeomans Bunk Bed Sieves for Sample Cleaning, Screening and Preparation

At the testing laboratory the samples should be either stored for as short a time as practical - no more than two to three weeks. Also they should, at all times be protected from light, especially sunlight and should be stored at temperatures a little above freezing, but not above 8^0C.

In a Methodology based on land surface area and not on soil densities and soil weights, removing stones and rocks from a sample has no effect on determining changes in the levels of organic carbon in a Carbon Investigation Area. It is therefore of no value or use to grind such materials to allow them to pass through the final 2 mm sieves.

For ease of screening, excessively wet or moist samples can be spread on a flat surface and air dried with a small fan. The fan air must not be heated unduly as possible LOI effects might occur and compromise the weighing results.

The drying procedure is to be conducted no more than two days prior to a LOI test.

Bunk Bed Sieves can be used for drying as an alternative to floor drying. The 2 mm size Bunk Bed Sieve is mounted above the Bunk Bed Collecting Chute and the combination becomes a drying oven.

The samples are placed in the 2 mm Bunk Bed Sieve and dried with a heated air fan set up to blow warm air into the Collection Chute and pass up through the 2 mm sieve encouraging the drying of the soil sample. The warmed air must be kept below 40^0 C for any Baseline soil tests and not significantly above 65^0 C for Credit Round tests. (Although temperatures up to 80^0 C for drying have shown no effects on final soil carbon values.)

The mechanical mixing of samples when required is easily achieved with a small electric powered cement type mixer. Mixers with a capacity of up to around 40 kilograms are most satisfactory.

The field samples from the particular paddock can be placed in this Rotary Mixer to intermix. Sometimes, if the soil is wet or damp it can clump together into balls. If this happens the combined field samples are best dried using the above described method and mixing resumed. They

are best air dried to the point where the material can be obviously and comfortably worked through the Bunk Bed Sieves.

Direct sunlight should always be avoided in all soil handling processes and avoidance is absolutely essential for soils used in Baseline determinations. The material should then be thoroughly mixed to form a homogeneous composite. The composite is then worked through the Bunk Bed Sieves.

A sample for testing must finally be screened or sieved through a 2 mm sieve prior to Loss On Ignition heating. Soil clods of all sizes must be broken down during or prior to the screening. Any remaining plant materials are best removed by hand during the screening process. Stones screened off during screening are to be brushed to remove attached soil before being discarded.

The 2 mm nomination is for two reasons. The first being that "soil" by convention is generally defined as that material capable of passing through a 2 mm sieve. The second is that the carbonaceous materials being monitored need to be in reasonably close proximity to the forced flow of oxidizing gasses. With larger particles oxygen penetration can be excessively inhibited.

The top sieve in a Yeomans Bunk Bed Sieve set has openings around 10 mm. The next sieve down has openings of approximately 5mm. The lower sieve is and must be a standard 2 mm opening sieve. Sliding a heavy metal block, or even a house brick, back and forth over the material gives quick and efficient clod break up and fast screening.

After the material has been worked through the top sieve this sieve is then tilted up to discharge any stones and rocks. (In other systems, where soil density is involved in calculations, these stones and rocks have to be retained and ground down to fit through the final 2 mm sieve.)

The top sieve is then removed to gain access to the next sieve down. As always, any fibrous material such as plant roots and plant leaves must be hand selected and discarded in the screening process. Organic carbon material from all the field samples is ultimately located in the lower collection tray.

The final well mixed material must be split, generally several times, until a sample, weighing around a maximum of 2 kilograms is obtained.

The numerical subdividing of the combined bulk sample can be done by mechanical separation, by "splitting", or simply by equal weight. (Although it must be understood that any weighing procedure are for convenience and actual weights are not relevant in this Methodology.) The subdividing process is continued until a sample size, suitable to

"cook" in the Carbon Still, or whatever LOI equipment is being used for the testing.

There is to be a minimum of three composites in this Methodology. All samples from each composite are thoroughly mixed and the combined mix is then subdivided by a "splitting procedure" uniformly until an individual sample weighing a little less than 2 kilograms is obtained from each Composite.

For establishing Baselines each composite should have a LOI test. For Credit Rounds composites may be combined for a single LOI test.

Some soils may exist that contain significant quantities of pumice type materials, and LOI tests on that soil could produce errors. In which case the following applies.

The weight of a mineral constituent in a soil sample, whose density is less than the average density of the organic matter in the sample, and where that mineral will release gas at the temperatures nominated for the Credit Round tests, that weight must not exceed 0.1% of the total weight of the sample being tested.

Part 30 Loss On Ignition Testing

This Methodology considers that there are three procedures in the processes of measuring soil carbon after the infield determination of sampling locations, those being:

(1) sample collection: collecting the samples in the field

(2) sample preparation: preparing a sample for Loss On Ignition testing

(3) LOI test : the actual Loss On ignition test

The analysis of the soil samples and the actions to determination of LOI measurements must be undertaken by a NASA or ASPAC approved organization.

The Yeomans Carbon Still can test individual samples weighing up to 2000 grams. Most LOI test units test samples weighing less than 10 grams however if the testing laboratory is satisfied with the careful sample preparation necessary with small samples; those tests are perfectly acceptable in this Methodology.

The "Yeomans Carbon Still" Loss On Ignition test unit is the preferred equipment for this Methodology.

In the Yeomans Carbon Still a test sample is separated into three, approximately equal parts and each placed in three separate and sequential trays. Temperatures are constantly being displayed for both input and output air to each tray.

In the Yeomans Carbon Still both the air input flow rate and air input temperatures are displayed and are adjustable. The soil heating chamber is capable of being heated externally to assist in maintaining even temperature in the heating chamber. The soil organic matter content of samples is highly variable between soils and the heat release from the combustion of this soil organic matter can sometimes effect test temperatures considerably. The monitoring of the setting controls of both air and electrical energy inputs is used in the Carbon Still to produce consistent, accurate and reproducible results.

Determining weight changes in samples in a Yeomans Carbon Still is conducted by disconnecting power and air lines to the central oven then adjusting weights, as for any balancing system, to achieve a balance. Fine balance is achieved by adjusting and monitoring the water content of a suitable container. Weight changes are then simply the variation in millilitres needed to achieve balance. A one millilitre variation is observable and obvious.

Specified LOI test requirements nominated in this Methodology for generating LOI determinations are :

(1) Samples must be delivered promptly to the testing laboratory.

(2) For Baseline samples, no pre-drying of samples using air above 40^0 C, and never in direct sunlight. For Credits Rounds permissible air temperatures can be up to 65^0 C.

(3) First, for testing for a CEA soil organic matter content, field samples have to be combined and divided to produce a suitable and accurate representative sample weighing under 2,000 grams and preferable more than 1,200 grams. This sample size must bear a known mathematical relationship to the area of the CEA.

(4) If it is of interest to know the water content of samples, they can be weighed before any heating in the Carbon Still takes place.

(5) For Baseline tests, air temperatures for drying for dry weight testing in the Yeomans Carbon Still are to be greater than 100^0 C but never to exceed 115^0 C. Air temperatures exiting soil samples to be maintained for between 6 minutes and 16 minutes.

(6) For Credits Round air temperatures for drying for dry weight in the Yeomans Carbon Still all exceed 115^0 C for a minimum of 17 minutes.

(6) Air temperatures; For weighing, cool air is passed through the Carbon Still and heating elements operated until all exit air temperatures are above 100^0 c and below 140^0 C.

(7) For Baseline LOI tests, input air temperatures to the samples are to be elevated progressively to above 550^0 C but to be kept below approximately 585^0 C. The above temperatures are be maintained until they stabilize but should then be held above 550^0 C for a minimum of 40 minutes.

Baseline temperatures are to be 550^0 C -0+35^0 C

(8) For Credit Round LOI tests air input temperatures are not to exceed 550^0 C. Air temperatures exiting all soil test samples should not exceed 550^0 C. Minimum recommended exit temperatures for Credit Rounds are generally determined by the nature of the soil being tested but between 450^0 C and 550^0 C are satisfactory. Temperatures are to be held in that range for a maximum of 40 minutes. In general 10 minutes is satisfactory and gives consistent and accurate results.

Credit Round temperatures are to be 550^0 C -100^0 C + 0^0 C

(9) The decrease in weight from the Baseline balance and the LOI balance is mathematically related to the change in the content of organic matter in that Carbon Estimation Area. (See Calculations)

The difference between the Baseline values and the Credits Round values allows us to equate the CO_2-e sequestered and thus the number of Carbon Credits to be allocated to the "Farmer" "or Project Proponent".

Part 31 Calculations

Calculating values for soil organic matter in a CEA using Yeomans Soil Pipe sample collection system and Methodology

In this protocol a test sample represents a known surface area and a known proportion of the area of the land being tested. The objective is to know the Loss On Ignition weight of the sample. From this, a weight, sufficiently representative of the organic matter content of the test land area, can readily be calculated. The LOI test is not to determine the ratio of the LOI weight to the soil weight, for in this protocol, this is irrelevant. It is ultimately to determine the LOI weight in tonnes for a nominated area of land.

The accuracy and consistency of test using a Yeomans Carbon Still is within approximately 0.075%. It follows that a 0.1% accuracy can safely be presumed in calculations. That 0.1% equates to a rise of approximately 4 tonnes of organic matter per hectare.

That weight in tonnes when multiplied by 0.58 gives the accepted weight in carbon. This multiplied by 3.6666 is the accepted measure of tonnes of carbon dioxide equivalent sequestered into the soil in the Project Area.

It is also the number of Australian Carbon Credits to be awarded to the farmer.

(0.58 x 3.6666 = 2.1266 -- so in round figures the number of Carbon Credits to be issued is twice the Loss On Ignition weight)

(1) A Yeomans Soil Pipe is used for sample collection. The unit has an outside diameter of 114.3 mm (described as both 4 inch and 100mm size nominal pipe, light wall category).

(2) The ground surface area to be considered will therefore be 102.608 square centimetres or 0.010268 square metres.

(3) The volume of soil in a sample will therefore be 1.02608 litres per 100 mm of sampling depth.

(4) The organic matter found under that surface area multiplied by 9745.823 will give the SOM per hectare and this multiplied by the area of the CEA gives us the relevant Soil Organic Matter in the Carbon Estimation Area.

(The Yeomans soil test equipment can be viewed at this link HTTP://YEOMANSCONCEPTS.COM/ Then go to internal link Box !.)