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DRAFT Greenhouse Gas Emissions Estimation and Reporting Guidelines for Agriculture, Fisheries and Forestry

Methodological Guidance

Chapter 2: Implementation Guidance and Data Checklists

Cataloguing data

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Acknowledgement of Country

We acknowledge the Traditional Owners of Country throughout Australia and recognise their continuing connection to land, waters and culture. We pay our respects to their Elders past and present.

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2 Methodological implementation guides

This Guidance consists of a number of estimation Modules, each relevant to a particular emissions source from within a production system.

Development of an annual emissions inventory requires the collation of a number of Modules. Selection of the relevant Modules is based on the activities being undertaken within the defined reporting boundary (Case Study 1).

Sector specific implementation guides provided in this chapter are focused on production system emissions. Therefore, data collection will be to the end of the production system e.g. 'farm-gate', 'point of harvest' or 'point of landing'. A generic post-production implementation Module has been provided in Section 2.13 for estimation of post-production emissions. For example, electricity used in post-production processing or packing should be excluded from electricity used to quantify production system emissions but can be used in the post-production Module to estimate post-production emissions.

Refer to Chapter 1, Section 1.3, for additional information on coverage and limitations of the guidance.

Some Modules can be implemented independently and others are dependent. Dependencies between modules are summarised at **Table 1**.

Table 1: Dependant relationships between Modules

If you select…	Then you SHALL also select…
Enteric Methane (Scope 1)	Manure Management (Scope 1)
Manure Management (Scope 1)	Enteric Methane (Scope 1) [excluding poultry]
Fertiliser Use (Scope 1)	Purchased Fertiliser (Scope 3)
Transport and Stationary Fuel (Scope 1)	Upstream Emission from Fuel (Scope 3)
Purchased Electricity (Scope 2)	Purchased Electricity (Scope 3)
Upstream Emissions from Fuel (Scope 3)	Transport and Stationary Fuel (Scope 1)
Purchased Electricity (Scope 3)	Purchased Electricity (Scope 2)
Purchased Fertiliser (Scope 3)	Fertiliser Use (Scope 1)

In this section, Module Maps (Tables) are provided for each production system. If a reporting boundary includes more than one production system (e.g. cropping and sheep) then each relevant Module Map should be considered, as sub-sections within Modules may differ (Case Study 1).

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24 Data checklists are also provided to support implementation of the Modules and prioritisation
25 of data collection efforts. These checklists are separated by *Required* and *Optional* data
26 types. For *Optional* farm input data, Method 1 approaches may be used when data is limited
27 or difficult to obtain (see Chapter 1 - General Guidance; Section 1.4.3 on prioritising data
28 collection efforts). Higher level methods aim to result in more accurate production system
29 specific emissions estimation compared to Method 1.

30 Table 2 and Table 3 list the characteristics required to enable linking to relevant Method 1
31 and Method 2 parameters that have an impact on the outcome of the GHG estimation. Some
32 characteristics are required regardless of the estimation method selected, while others are
33 dependent on the selected method.

34 Refer to CRF, Chapter 5 for additional information on boundary setting.

35 Chapter 1, Section 1.8.2 provides more detail on how to estimate climate zone, leaching and
36 rainfall zones.

37 **Table 2: Tranche 1 - Production system specific profile information**

Item	Beef pasture range and paddock	Beef Feedlot	Sheep	Dairy	Cropping
State/Territory	Required	Required	Required	Required	Required
Region	Method 1 only	NA	NA	NA	NA
Climate zone	Required	Required	Required	Required	Required
Temperature Zone	Method 2	Method 2	Method 2	Method 2	NA
Leaching zone	Required	NA	Required	Method 2	Required
Rainfall zone and production type (irrigated vs non irrigated, or crop-specific)	Required	Required	Required	Required	Required

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39   **Table 3: Tranche 2 - Production system specific profile information**

Item	Pig	Poultry	Other Livestock	Horticulture	Viticulture	Aquaculture	Forestry
State/Territory	Required	Required	Required	Required	Required	Required	Required
Region	NA	NA	NA	NA	NA	NA	NA
Climate zone	Required	Required	Required	Required	Required	NA	Required
Temperature zone	Method 2	Method 2	Method 2	NA	NA	NA	NA
Leaching zone	Required	Required	Required	Required	Required	NA	Required
Rainfall zone and production type (irrigated vs non irrigated, or crop-specific)	Required	Required	Required	Required	Required	NA	Required

40

41   Any requirements for additional data sub-stratification/classification will be dependent on the variable as detailed in the relevant Module Data
42   Tables listed in Chapters 3 – 15.

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43 # Case Study 1a: Modules in a mixed farming scenario

44
45 Jarrod manages a beef feedlot in central NSW and grows grains on approximately 200 ha. To estimate his production system emissions, Jarrod would apply the following Modules and their relevant sections:

Emission Activity/Source	Module	Relevant Section
Direct GHG emissions (Scope 1)		
Enteric Methane	3	3.1
Manure Management	4	4.1
Fertiliser Use	5	5.1 – 5.5
Agriculture Residue Management	6	6.2 – 6.3
Transport Fuel	8	8.1
Stationary Fuel	8	8.2
Solid Waste Treatment	10	10.1
Indirect GHG emissions from imported energy (Scope 2)		
Purchased Electricity	14	14.1
Indirect GHG emissions (Scope 3)		
Purchased Livestock	15	15.1
Purchased Feed	15	15.2
Purchased Mineral supplements	15	15.3
Purchased Fertiliser	15	15.4
Purchased Agrichemicals	15	15.5
Purchased Services/Contractors	15	15.7
Other Purchased Goods and Services	15	15.10
Upstream Emission from Fuel	15	15.10
Upstream Emissions of Purchased Electricity	15	15.11
Management of Waste	15	15.12

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47 Tranche 2 – Case Study 1: Modules in a mixed production and post-
48 production system

49 Garrett manages a viticulture business with both a vineyard and winery located on site. To estimate his
50 **production** system emissions, Garrett would apply the following Modules and their relevant sections to the
51 vineyard production system:

Emission Activity/Source	Module	Relevant Section
Direct GHG emissions (Scope 1)		
Fertiliser Use	5	5.1 – 5.5
Agriculture Residue Management	6	6.1 and 6.3
Transport Fuel	8	8.1
Stationary Fuel	8	8.2
Solid Waste Treatment	10	10.1
Indirect GHG emissions from imported energy (Scope 2)		
Purchased Electricity	14	14.1
Indirect GHG emissions (Scope 3)		
Purchased Agrichemicals	15	15.5
Purchased Services/Contractors	15	15.7
Upstream Emission from Fuel	15	15.11
Upstream Emissions of Purchased Electricity	15	15.12
Management of Waste	15	15.13

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53 Refer to Section 2.10 for additional guidance on viticulture emission estimation.

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54 To estimate his **post-production** system emissions, Garrett would apply the following Modules and their relevant
55 sections to the winery production system:

Emission Activity/Source	Module	Relevant Section
Direct GHG emissions (Scope 1)		
Transport Fuel	8	8.1
Stationary Fuel	8	8.2
Refrigerant Use	9	9.1
Solid Waste Treatment	10	10.1
Wastewater Treatment	11	11.1
Purchased CO_2	12	12.1
Indirect GHG emissions from imported energy (Scope 2)		
Purchased Electricity	14	14.1
Indirect GHG emissions (Scope 3)		
Purchased Services/Contractors	15	15.7
Purchased Packaging	15	15.8
Other Purchased Goods and Services	15	15.10
Upstream Emission from Fuel	15	15.11
Upstream Emissions of Purchased Electricity	15	15.12
Management of Waste	15	15.13
Upstream Freight	15	15.14

56

57 Refer to Section 2.13 for additional guidance on post-production emission estimation.

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58 2.1 Beef Feedlot

59 This section outlines all relevant Modules and data checklists to develop a GHG inventory
60 for a beef feedlot system. Relevant emission sources and therefore relevant Modules for a
61 specific entity will depend on an entity-specific boundary set as described in Chapter 5 of the
62 CRF. For example, if a specific entity does not use lime, then this emission source and
63 Module will not be relevant for this specific entity.

64 Module map and input data checklists are designed for estimating emissions from cradle-to-
65 end of the farming system/farm-gate. If the boundary of the organisation extends to
66 processing, packing and transport of beef products, the post-production Module can also be
67 implemented to estimate emissions from these sources. Refer to Chapter 1, Section 1.3, for
68 additional information on coverage and limitations of the guidance.

69 2.1.1 Module Map

Emission Activity/Source	Relevant Module
Direct GHG emissions (Scope 1)	
Enteric Methane	3.1
Manure Management	4.1
Transport Fuel	8.1
Stationary Fuel	8.2
Solid Waste Treatment	10.1
Indirect GHG emissions from imported energy (Scope 2)	
Purchased Electricity	14.1
Indirect GHG emissions (Scope 3)	
Purchased Livestock	15.1
Purchased Feed	15.2
Purchased Mineral supplements	15.3
Purchased Services/Contractors	15.7
Other Purchased Goods and Services	15.10
Upstream Emissions from Fuel	15.11
Upstream Emissions of Purchased Electricity	15.12
Management of Waste	15.13

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71   ## 2.1.2 Data Collection Checklist

72   The checklist below summarises all the required input data, required for **Method 1**, that should be collected at farm-level for a beef feedlot
73   production system to complete the equations detailed in subsequent chapters based on the beef feedlot module map. Data collected may be
74   listed as 'not applicable' for emissions sources that are not relevant to the specific entity. Further information regarding relevant sources and
75   sinks can be found in Chapter 5.2 of the CRF.

76   Additional information and guidance on specific parameters can be found within the beef feedlot guidance Chapter 3 – Section; 3.1 and
77   Chapter 4 – Section; 4.1. With additional related parameters found within Chapter 8, Chapter 14, Chapter 15; Sections 15.1 – 15.3, 15.7 and
78   15.10 – 15.13.

79   **Table 4: Required data for beef feedlot system**

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Source of data	Module
Required – Scope 1					
N_j	Numbers of beef cattle in each group		head	Farm stock records e.g. head counts, diary entries, purchase, and sales records	Enteric Methane & Manure Management
D_j	Duration of stay for each cattle group		days	Farm stock records; system type records, purchase and sales records and National Vendor Declarations or NLID transfer records may be evaluated to determine average length of stay.	Enteric Methane & Manure Management
$MMS_{mT=2}$	Fraction of manure at treatment stage 2 for each manure management system		fraction	Farmer records as to what fraction of manure flows to each system based on the available MMS options	Manure Management

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Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Source of data	Module
PF	Fraction of manure applied to soil within the farm boundary.		fraction	Farmer records of manure sales or transport weights compared to total manure treated on farm.	Manure Management
$Q_{Trans,q}$	Quantity of each fuel used for transportation (including off-road vehicles and equipment, aircraft, and/or vessels), up to the farm-gate.		Depends on fuel type	Invoices, fuel cards, receipts	Transport Fuel & Upstream emissions
$Q_{SC,q}$	Quantity of each fuel used for stationary combustion, up to the farm-gate.		Depends on fuel type	Invoices, fuel cards, receipts	Stationary Fuel & Upstream Emissions
Q_{wt}	Quantity of waste per type being treated within the farm-gate.		tonnes	Farm records of weight of waste disposed	Solid Waste Treatment
V_{wt}	Volume of waste per type being treated within the farm-gate.		m^3	Only required if Q_{wt} is not known. Estimated from trailer-loads, or other known volume of waste transported.	Solid Waste Treatment
Required – Scope 2					
Q_{elec}	Quantity of electricity purchased from the grid, up to the farm-gate.		kWh	Invoices from electricity supplier	Purchased Electricity & Upstream Emissions from Purchased Electricity
Required – Scope 3					
N_{co}	Number of animals purchased per livestock class, including state of origin of purchase		head	Farm stock records, invoices	Purchased Livestock
Q_j	Quantity of each feed type purchased		t	Invoices, receipts or other records of purchased quantities	Purchased Feed

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Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Source of data	Module
Q_m	Quantity of each mineral supplement purchased		t	Invoices, receipts or other records of purchased quantities	Purchased Mineral Supplements
F_{cf}	Fraction of inorganic fertiliser components in each fertiliser		wt%	Product information label	Purchased Fertiliser
A_p	Activity data for each service purchased, up to the farm-gate.		Depends on purchased service	Invoices, receipts or other records of quantity of service provided	Purchased Services and Contractors
Q_{wt}	Weight of waste sent to waste treatment facility		tonnes	Invoices for skip disposal, weighbridge receipts, farm records	Management of Waste
V_{wt}	Volume of waste being sent waste treatment facility (only required if weight is unknown)		m^3	Invoices for skip disposal, or other farm records	Management of Waste

80

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81 The checklist below summarises all the optional data points, required for **Method 2**, that may be collected at farm-level for a beef feedlot
82 system to complete the equations detailed in subsequent chapters based on the beef feedlot module map.

83 **Table 5: Optional data for beef feedlot system**

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data source	Module
Optional – Scope 1					
NDF_j	Average neutral detergent fibre as a percentage intake for each feedlot cattle group.		per-centage of dry matter intake	Farm records of neutral detergent fibre of TMR for each cattle group	Enteric Methane
EE_j	Average ether extract as a percentage of intake for each feedlot cattle group		per-centage of dry matter intake	Farm records of ether extract of TMR for each cattle group	Enteric Methane
I_j	Average dry matter intake per head for each group of beef cattle within feedlot system per day		kgDM/head/day	Farm records relating to dry matter assessment of total mixed ration (TMR), and daily feed and feed waste weights for each group	Enteric Methane & Manure Management
DMD_i	Dry matter digestibility of diet used within feedlot system		fraction	Farm records or feed receipt stating dry matter digestibility of TMR	Manure Management
CP_j	Average crude protein content of feed given to each cattle group		fraction	Farm records or feed receipt stating crude protein of TMR	Manure Management
MCF_{im}	Methane conversion factor for temperature zone and system		fraction	Select relevant MCF for MMS and temperature zone	Manure Management

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data source	Module
NR_j	Nitrogen retention, as a per cent of intake		per cent	Farm specific estimates (estimated by mass balance)	Manure Management
Optional – Scope 2					
$REC_{surrendered}$	Eligible Renewable Energy Certificates voluntarily surrendered in the reporting year		MWh	Records of transactions	Purchased Electricity & Upstream Emissions from Purchased Electricity (market-based approach only)
REC_{onsite}	Eligible Renewable Energy Certificates that have been or will be issued for electricity produced on-site during the reporting period and consumed by the entity		MWh	Records of transactions	Purchased Electricity & Upstream Emissions from Purchased Electricity (market-based approach only)
Optional – Scope 3					
W_{co}	Liveweight of purchased livestock at point of purchase		kg/head	Purchasing records/invoices and herd flow models	Purchased Livestock
EF	Supplier-provided life cycle emission factor for any of the following purchased goods: livestock, feed, mineral supplements		t CO_2e/t purchased good	Supplier-provided life-cycle emission factors that have been third-party verified as conforming either to ISO 14067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard	Corresponding Scope 3 Purchased Good Module

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85 2.2 Beef Pasture Rangeland and Paddock

86 This section outlines all relevant Modules and data checklists to develop a GHG inventory of
87 for a beef pasture, range, and paddock system. Relevant emission sources and therefore
88 relevant Modules for a specific entity will depend on an entity-specific boundary set as
89 described in Chapter 5 of the CRF. For example, if a specific entity does not use lime, then
90 this emission source and Module will not be relevant for this specific entity.

91 Module map and input data checklists are designed for estimation of emissions from cradle-
92 to-end of the farming system/farm-gate. If the boundary of the organisation extends to
93 processing, packing and transport of beef products, the post-production Module can also be
94 implemented to estimate emissions from these sources. Refer to Chapter 1, Section 1.3, for
95 additional information on coverage and limitations of the guidance.

96 2.2.1 Module Map

Emission Activity/Source	Relevant Module
Direct GHG emissions (Scope 1)	
Enteric Methane	3.2
Manure Management	4.2
Fertiliser Use	5.1 – 5.5
Agriculture Residue Management	6.2 – 6.3
Transport Fuel	8.1
Stationary Fuel	8.2
Solid Waste Treatment	10.1
Indirect GHG emissions from imported energy (Scope 2)	
Purchased Electricity	14.1
Indirect GHG emissions (Scope 3)	
Purchased Livestock	15.1
Purchased Feed	15.2
Purchased Mineral Supplements	15.3
Purchased Fertiliser	15.4
Purchased Agrichemicals	15.5
Purchased Lime	15.6

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Emission Activity/Source	Relevant Module
Purchased Services/Contractors	15.7
Other Purchased Goods and Services	15.10
Upstream Emissions from Fuel	15.11
Upstream Emissions of Purchased Electricity	15.12
Management of Waste	15.13

97

98 2.2.2 Data Collection Checklist

99 The checklist below summarises all the required input data, required for **Method 1**, that should be collected at farm-level for a beef pasture
100 range paddock system to complete the equations detailed in subsequent chapters based on the beef pasture range paddock module map. Data
101 collected may be listed as 'not applicable' for emissions sources that are not relevant to the specific entity. Further information regarding
102 relevant sources and sink can be found in Chapter 5.2 of the CRF.

103 Additional information and guidance on specific parameters can be found within the beef pasture range paddock guidance Chapter 3 – Section;
104 3.2 and Chapter 4 – Section; 4.2. With additional related parameters found within Chapter 5 – Sections; 5.1 - 5.5, Chapter 6 – Sections; 6.2 and
105 6.3 and Chapter 8, Chapter 14, Chapter 15; Sections 15.1 – 15.7 and 15.10 – 15.13.

106 **Table 6: Required data for beef pasture range paddock system**

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Source of data	Module
Required – Scope 1					
N_{jkl}	Number of beef cattle per time-period, and input class		head	Stock records – see herd flow modelling in Chapter 1 Section 1.3.7	Enteric Methane & Manure Management
$LC_{jk=5}$	Ratio of the number of births to the number of cows over 2 years old		fraction	Farm records: Proportion of cows > 2 in calf may be based on scanning numbers where available. If scanning results are not available weaning numbers may also be used to approximate the proportion of cows > 2 years lactating. For farms with multiple calving seasons, the proportion of cows >	Enteric Methane & Manure Management

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Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Source of data	Module
				2 years in calf $LC_{jk=5}$ should be reported separately for each season. Noting that for all other seasons $LC_{jk=5} = 0$	
TM_{jf}	Amount of each inorganic fertiliser applied to each production system		kg	Receipts, invoices, farm records	Fertiliser Use – Inorganic Fertiliser Use & Purchased Fertiliser
$FN_{inorganic,f}$	Fraction of nitrogen in each inorganic fertiliser		kg N/kg	Default values for common inorganic fertilisers based on average fertiliser composition from [1], or calculated from product label information.	Fertiliser Use – Inorganic fertiliser Use
FU_f	Fraction of urea in each inorganic fertiliser applied		kg urea/kg	Default values for common inorganic fertilisers based on average fertiliser composition from [1], and or calculated from product label information.	Fertiliser Use – Inorganic fertiliser Use
$M_{organic,jf}$	Amount of each organic fertiliser applied to soils in production system		kg	Invoices of purchases, farm records of application rates	Fertiliser Use – Organic Fertiliser Use
$FN_{organic,f}$	Nitrogen fraction of each organic fertiliser applied to soils		kg N/kg	Supplier-provided values or product label information	Fertiliser Use – Organic Fertiliser Use
M_{lime}	Total amount of lime applied to soils		kg	Invoices, receipts	Fertiliser Use – Lime Application
FracLime	Fraction of lime as limestone		dimensionless	Product information label	Fertiliser Use – Lime Application

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Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Source of data	Module
FracDol	Fraction of lime as dolomite		dimensionless	Product information label	Fertiliser Use – Lime Application
A_p	Area of each pasture crop renewed or removed		ha	Geospatial files, farm records	Agriculture Residue Management - Pasture Residues
$Q_{Trans,q}$	Quantity of each fuel used for transportation (including off-road vehicles and equipment, aircraft, and/or vessels), up to the farm-gate.		Depends on fuel type	Invoices, fuel cards, receipts	Transport Fuel & Upstream Emissions
$Q_{SC,q}$	Quantity of each fuel used for stationary combustion, up to the farm-gate.		Depends on fuel type	Invoices, fuel cards, receipts	Stationary Fuel & Upstream Emissions
Q_{wt}	Quantity of waste per type being treated within the farm-gate.		tonnes	Farm records of weight of waste disposed	Solid Waste Treatment
V_{wt}	Volume of waste per type being treated within the farm-gate.		m^3	Only required if Q_{wt} is not known. Estimated from trailer-loads, or other known volume of waste transported.	Solid Waste Treatment
Required – Scope 2					
Q_{elec}	Quantity of electricity purchased from the grid, up to the farm-gate.		kWh	Invoices from electricity supplier	Purchased Electricity & Upstream Emissions from Purchased Electricity
Required – Scope 3					
N_{co}	Number of animals purchased per livestock class, including origin of purchase		head	Farm stock records, invoices	Purchased Livestock

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Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Source of data	Module
Q_j	Quantity of each feed type purchased		t	Invoices, receipts or other records of purchased quantities	Purchased Feed
Q_m	Quantity of each mineral supplement purchased		t	Invoices, receipts or other records of purchased quantities	Purchased Mineral Supplements
F_{cf}	Fraction of inorganic fertiliser components in each fertiliser		wt%	Product information label	Purchased Fertiliser
Q_h	Quantity of each agrichemical used		kg	Invoices, receipts or other records of purchased quantities	Purchased Herbicides/Pesticides
A_p	Activity data for each service purchased, up to the farm-gate.		Depends on purchased service	Invoices, receipts or other records of quantity of service provided	Purchased services and contractors
Q_{wt}	Weight of waste sent to waste treatment facility		tonnes	Invoices for skip disposal, weighbridge receipts, farm records	Management of Waste
V_{wt}	Volume of waste being sent waste treatment facility (only required if weight is unknown)		m^3	Invoices for skip disposal, or other farm records	Management of Waste

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108 The checklist below summarises all the optional data points, required for **Method 2**, that may be collected at farm-level for a beef pasture range
109 paddock system to complete the equations detailed in subsequent chapters based on the beef pasture range paddock module map.

110 **Table 7: Optional data for beef pasture range paddock system**

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data source	Module
Optional – Scope 1					
D_j	Number of days in each time period animals in each class are on the farm		Days	Farm stock records and herd flow model	Enteric Methane & Manure Management
W_{jkl}	Average liveweight of beef pasture cattle per time-period, and input class		kg	Farm stock records and herd flow model	Enteric Methane & Manure Management
LWG_{jkl}	Average liveweight gain of beef pasture cattle per time-period, and input class		kg/head/day	Farm stock records and herd flow model	Enteric Fermentation & Manure Management
DMD_j	Dry matter digestibility of feed		fraction	Farm source records for seasonal dry matter digestibility of feed.	Manure Management
CP_j	Crude protein content of feed		fraction	Records for seasonal crude protein of feed.	Manure Management
MCF_{im}	Methane conversion factor for temperature zone and system		fraction	Select relevant MCF for MMS and temperature zone	Manure Management
N_{fj}	N application rate of inorganic fertiliser used in production system		kg N/ha	Farm records of fertiliser application rates, or calculated from:	Fertiliser Use – Inorganic Fertiliser Use

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data source	Module
				N_{fj} $= \dfrac{Total\ fertiliser\ applied\ (kgN)}{Total\ area\ (ha)}$ Data on total fertiliser applied and total area should be sourced from farm invoices and spatial records respectively.	
$EF_{j,N2O}$	Emission factor for direct nitrous oxide emissions from inorganic fertiliser		kg N_2O-N/kg N	Calculated from relevant equations in Chapter 5, sections 5.1.1.2	Fertiliser Use – Inorganic Fertiliser Use
Y_p	Average yield of pasture crop		tDM/ha	Yield records	Agriculture Residue Management - Pasture Residues
Optional – Scope 2					
$REC_{surrendered}$	Eligible Renewable Energy Certificates voluntarily surrendered in the reporting year		MWh	Records of transactions	Purchased Electricity & Upstream Emissions from Purchased Electricity (market-based approach only)
REC_{onsite}	Eligible Renewable Energy Certificates that have been or will be issued for electricity produced on-site during the reporting period and consumed by the entity		MWh	Records of transactions	Purchased Electricity & Upstream Emissions from Purchased Electricity (market-based approach only)

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Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data source	Module
Optional – Scope 3					
W_{co}	Liveweight of purchased livestock at point of purchase		kg/head	Purchasing records/invoices and herd flow models	Purchased Livestock
EF	Supplier-provided life cycle emission factor for any of the following purchased goods: livestock, feed, mineral supplements, fertiliser, agrichemicals, or lime		t CO_2e/t purchased good	Supplier-provided life-cycle emission factors that have been third-party verified as conforming either to ISO 14067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard	Corresponding Scope 3 Purchased Good Module

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112 ## 2.3 Cropping

113 This section outlines all relevant Modules and data checklists to develop a GHG inventory
114 for the following cropping systems: grains, legumes, cotton, sugarcane, rice and forage.
115 Relevant emission sources and therefore relevant Modules for a specific entity will depend
116 on an entity-specific boundary set as described in Chapter 5 of the CRF. For example, if a
117 specific entity does not use lime, then this emission source and Module will not be relevant
118 for this specific entity.

119 Module map and input data checklists are designed for estimation of emissions from cradle-
120 to-end of the farming system/farm-gate. If the boundary of the organisation extends to
121 processing, packing and transport of crop products or byproducts, the post-production
122 Module can also be implemented to estimate emissions from these sources. Refer to
123 Chapter 1, Section 1.3, for additional information on coverage and limitations of the
124 guidance.

125 ### 2.3.1 Module Map

Emission Activity/Source	Relevant Module
Direct GHG emissions (Scope 1)	
Fertiliser Use	5.1 – 5.5
Agriculture Residue Management	6.1 – 6.4
Rice Cultivation (only applicable to rice-growers)	7.1
Transport Fuel	8.1
Stationary Fuel	8.2
Refrigerant Use	9.1
Solid Waste Treatment	10.1
Indirect GHG emissions from imported energy (Scope 2)	
Purchased Electricity	14.1
Indirect GHG emissions (Scope 3)	
Purchased Fertiliser	15.4
Purchased Agrichemicals	15.5
Purchased Lime	15.6
Purchased Services/Contractors	15.7
Other Purchased Goods and Services	15.10

Emission Activity/Source	Relevant Module
Direct GHG emissions (Scope 1)	
Upstream Emissions from Fuel	15.11
Upstream emissions of Purchased Electricity	15.12
Management of Waste	15.13

126

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127 2.3.2 Data Collection Checklist

128 The checklist below summarises all the required input data, required for **Method 1**, that should be collected at farm-level for a cropping system
129 to complete the equations detailed in subsequent chapters based on the cropping module map. Data collected may be listed as 'not applicable'
130 for emissions sources that are not relevant to the specific entity. Further information regarding relevant sources and sink can be found in
131 Chapter 5.2 of the CRF.

132 Additional information and guidance on cropping specific parameters can be found within Chapter 5 – Section; 5.1 – 5.5, Chapter 6 – Sections;
133 6.1 – 6.4, and Chapter 7 – Sections; 7.1, Chapter 8 – Sections; 8.1 and 8.2, Chapter 9 – Section; 9.1, Chapter 14 – Section; 14.1 and Chapter
134 15 – Sections; 15.4 – 15.7 and 15.10 – 15.13.

135 **Table 8: Required data for cropping system**

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data source	Module
Required – Scope 1					
TM_{jf}	Amount of each inorganic fertiliser applied to each production system		kg	Receipts, invoices, farm records	Fertiliser Use – Inorganic Fertiliser Use & Purchased Fertiliser
$FN_{inorganic,f}$	Fraction of nitrogen in each inorganic fertiliser		kg N/kg	Default values for common inorganic fertilisers based on average fertiliser composition from [1], or calculated from product label information.	Fertiliser Use – Inorganic fertiliser Use
FU_f	Fraction of urea in each inorganic fertiliser applied		kg urea/kg	Default values for common inorganic fertilisers based on average fertiliser composition from [1], and or calculated from product label information.	Fertiliser Use – Inorganic fertiliser Use

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data source	Module
$M_{organic,jf}$	Amount of each organic fertiliser applied to soils in production system		kg	Invoices of purchases, farm records of application rates	Fertiliser Use – Organic Fertiliser Use
$FN_{organic,f}$	Nitrogen fraction of each organic fertiliser applied to soils		kg N/kg	Supplier-provided values or product label information	Fertiliser Use – Organic Fertiliser Use
M_{lime}	Total amount of lime applied to soils		kg	Invoices, receipts	Fertiliser Use – Lime Application
FracLime	Fraction of lime as limestone		dimensionless	Product information label	Fertiliser Use – Lime Application
FracDol	Fraction of lime as dolomite		dimensionless	Product information label	Fertiliser Use – Lime Application
P_c	Annual production of each crop		kg	Farm yield records from the reporting year. Where crop failure has occurred, may be estimated based on the expected harvest of that year or historical yield data.	Agricultural Residue Management – Crop Residues & Field Burning
F_c	Fraction of crop residue that is burnt		dimensionless	Calculated from records of area burnt and area cultivated	Agricultural Residue Management – Crop Residues & Field Burning
A_p	Area of each pasture crop renewed or removed		ha	Farm records	Agriculture Residue Management - Pasture Residues
$A_{rice,wpo}$	Annual area of rice cultivation under each water regime during the growing season, pre-season water regime, and organic amendment condition		ha	Spatial analysis, farm records	Rice Cultivation

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Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data source	Module
$t_{rice,wpo}$	Number of days in rice growing under each water regime during the growing season, pre-season water regime, and organic amendment condition		days	Monitoring records	Rice Cultivation
ROA_o	Rate of application of each organic amendment		Straw: t (dry weight)/ha Other: t (fresh weight)/ha	Farm records of purchased organic amendments	Rice Cultivation
$Q_{Trans,q}$	Quantity of each fuel used for transportation (including off-road vehicles and equipment, aircraft, and/or vessels), up to the farm-gate.		Depends on fuel type	Invoices, fuel cards, receipts	Transport Fuel & Upstream Emissions
$Q_{SC,q}$	Quantity of each fuel used for stationary combustion, up to the farm-gate.		Depends on fuel type	Invoices, fuel cards, receipts	Stationary Fuel & Upstream Emissions
$charge_{Ra}$	Amount of each refrigerant gas contained in each appliance		kg	Manufacturer's product specification	Refrigerant Use
Q_{wt}	Quantity of waste per type being treated within the farm-gate.		tonnes	Farm records of weight of waste disposed	Solid Waste Treatment
V_{wt}	Volume of waste per type being treated within the farm-gate.		m^3	Only required if Q_{wt} is not known. Estimated from trailer-loads, or other known volume of waste transported.	Solid Waste Treatment
Required – Scope 2					
Q_{elec}	Quantity of electricity purchased from the grid, up to the farm-gate.		kWh	Invoices from electricity supplier	Purchased Electricity & Upstream Emissions from Purchased Electricity

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Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data source	Module
Required – Scope 3					
F_{cf}	Fraction of inorganic fertiliser components in each fertiliser		wt%	Product information label	Purchased Fertiliser
Q_h	Quantity of each agrichemical used		kg	Invoices, receipts or other records of purchased quantities	Purchased Herbicides/Pesticides
A_p	Activity data for service purchased, up to the farm-gate.		Depends on purchased service	Invoices, receipts or other records of quantity of service provided	Purchased services and Contractors
Q_{wt}	Weight of waste sent to waste treatment facility		tonnes	Invoices for skip disposal, weighbridge receipts, farm records	Management of Waste
V_{wt}	Volume of waste being sent waste treatment facility (only required if weight is unknown)		m^3	Invoices for skip disposal, or other farm records	Management of Waste

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138 The checklist below summarises all the optional data points, required for **Method 2**, that may be collected at farm-level for a cropping system to
139 complete the equations detailed in subsequent chapters based on the cropping module map.

140 **Table 9: Optional data for cropping system**

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data source	Module
Optional – Scope 1					
N_{fj}	N application rate of inorganic fertiliser used in production system (only relevant for production systems where a Method 2 option exists)		kg N/ha	Farm records of fertiliser application rates, or calculated from: $$N_{fj} = \frac{Total\ fertiliser\ applied\ (kgN)}{Total\ area\ (ha)}$$ Data on total fertiliser applied and total area should be sourced from farm invoices and spatial records respectively.	Fertiliser Use – Inorganic Fertiliser Use
$EF_{j,N2O}$	Emission factor for direct nitrous oxide emissions from inorganic fertiliser		kg N_2O-N/kg N	Calculated from relevant equations in Chapter 5, sections 5.1.1.2	Fertiliser Use – Inorganic Fertiliser Use
$FFOD_c$	Fraction of the crop residue that is removed per crop type		dimensionless	Calculation from equation in Chapter 6, equation 6.1.1.2	Agricultural Residue Management – Crop Residues
B	Number of bales generated		dimensionless	Invoices for the number of bales sold off-farm, or other farm records documenting the number of bales made	Agricultural Residue Management – Crop Residues

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data source	Module
M_B	Average mass of each bale generated		kg	Invoices from bale sales	Agricultural Residue Management – Crop Residues
Y_p	Average yield of pasture crop		t DM/ha	Yield records	Agriculture Residue Management - Pasture Residues
Optional – Scope 2					
$REC_{surrendered}$	Eligible Renewable Energy Certificates voluntarily surrendered in the reporting year		MWh	Records of transactions	Purchased Electricity & Upstream Emissions from Purchased Electricity (market-based approach only)
REC_{onsite}	Eligible Renewable Energy Certificates that have been or will be issued for electricity produced on-site during the reporting period and consumed by the entity		MWh	Records of transactions	Purchased Electricity & Upstream Emissions from Purchased Electricity (market-based approach only)
Optional – Scope 3					
EF	Supplier-provided life cycle emission factor for any of the following purchased goods: fertiliser, agrichemicals, or lime		t CO_2e/t purchased good	Supplier-provided life-cycle emission factors that have been third-party verified as conforming either to ISO	Corresponding Scope 3 Purchased Good Module

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Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data source	Module
				14067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard	

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142 ## 2.4 Dairy

143 This section outlines all relevant Modules and data checklists to develop a GHG inventory
144 for dairy farming system. Relevant emission sources and therefore relevant Modules for a
145 specific entity will depend on an entity-specific boundary set as described in Chapter 5 of the
146 CRF. For example, if a specific entity does not use lime, then this emission source and
147 Module will not be relevant for this specific entity.

148 Module map and input data checklists are designed for estimation of emissions from cradle-
149 to-end of the farming system/farm-gate. If the boundary of the organisation extends to
150 processing, packing and transport of dairy products, the post-production Module can also be
151 implemented to estimate emissions from these sources. Refer to Chapter 1, Section 1.3, for
152 additional information on coverage and limitations of the guidance.

153 ### 2.4.1 Module Map

Emission Activity/Source	Relevant Module
Direct GHG emissions (Scope 1)	
Enteric Methane	3.3
Manure Management	4.3
Fertiliser Use	5.1 – 5.5
Agricultural residue management	6.2 – 6.3
Transport Fuel	8.1
Stationary Fuel	8.2
Refrigerant Use	9.1
Solid Waste Treatment	10.1
Indirect GHG emissions from imported energy (Scope 2)	
Purchased Electricity	14.1
Indirect GHG emissions (Scope 3)	
Purchased Livestock	15.1
Purchased Feed	15.2
Purchased Mineral Supplements	15.3
Purchased Fertiliser	15.4
Purchased Agrichemicals	15.5

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Emission Activity/Source	Relevant Module
Purchased Lime	15.6
Purchased Services/Contractors	15.7
Other Purchased Goods and Services	15.10
Upstream Emissions from Fuel	15.11
Upstream Emissions of Purchased Electricity	15.12
Management of Waste	15.13

154

155 **2.4.2 Data Collection Checklist**

156 The checklist below summarises all the required input data, required for **Method 1**, that should be collected at farm-level for a dairy system to
157 complete the equations detailed in subsequent chapters based on the dairy module map. Data collected may be listed as 'not applicable' for
158 emissions sources that are not relevant to the specific entity. Further information regarding relevant sources and sink can be found in Chapter
159 5.2 of the CRF.

160 Additional information and guidance on specific parameters can be found within the dairy guidance in Chapter 3 – Section; 3.3 and Chapter 4 –
161 Section; 4.3. With additional related parameters found within Chapter 5 – Sections; 5.1 - 5.5, Chapter 6 – Sections; 6.2 and 6.3 and Chapter 8 –
162 Sections; 8.1 and 8.2, Chapter 9 – Section; 9.1, Chapter 14 – Section; 14.1 and Chapter 15 – Sections; 15.1 – 15.7 and 15.10 – 15.13.

163 **Table 10: Required data for dairy system**

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data source	Module
Required – Scope 1					
N_j	Number of dairy cattle in each class		head	Farm stock records and herd flow model see Chapter 1 Section 1.4.6	Enteric Methane & Manure Management
MP_j	Daily milk production per milking cow		L/head/day	Average farm milk sales records and average number of milking cows overt the reporting period may be used to calculate the daily milk production. The average amount of milk sold per day (in litres) may be divided by the average number of milking cows on the farm to calculated the daily milk production per milking cow.	Enteric Methane & Manure Management

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data source	Module
MS_j	Daily milk solid production per milking cow (Only required where MP_j is not known)		kgMS/head/day	Farm milk sales records and number of milking cows. The average amount of milk sold per day (in kg of milk solids) may be divided by the average number of milking cows on the farm to calculate the daily milk production per milking cow.	Enteric Methane
PF	Fraction of manure from MMS applied to soil within the farm boundary		fraction	Farmer records of manure sales or transport weights	Manure Management
TM_{jf}	Amount of each inorganic fertiliser applied to each production system		kg	Receipts, invoices, farm records	Fertiliser Use – Inorganic Fertiliser Use & Purchased Fertiliser
$FN_{inorganic,f}$	Fraction of nitrogen in each inorganic fertiliser		kg N/kg	Default values for common inorganic fertilisers based on average fertiliser composition from [1], or calculated from product label information.	Fertiliser Use – Inorganic fertiliser Use
FU_f	Fraction of urea in each inorganic fertiliser applied		kg urea/kg	Default values for common inorganic fertilisers based on average fertiliser composition from [1], and or calculated from product label information.	Fertiliser Use – Inorganic fertiliser Use
$M_{organic,jf}$	Amount of each organic fertiliser applied to soils in production system		kg	Invoices of purchases, farm records of application rates	Fertiliser Use – Organic Fertiliser Use

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data source	Module
$FN_{organic,f}$	Nitrogen fraction of each organic fertiliser applied to soils		kg N/kg	Supplier-provided values or product label information	Fertiliser Use – Organic Fertiliser Use
M_{lime}	Total amount of lime applied to soils		kg	Invoices, receipts	Fertiliser Use – Lime Application
FracLime	Fraction of lime as limestone		dimensionless	Product information label	Fertiliser Use – Lime Application
FracDol	Fraction of lime as dolomite		dimensionless	Product information label	Fertiliser Use – Lime Application
A_p	Area of pasture crop renewed or removed		ha	Geospatial files, farm records	Agriculture Residue Management - Pasture Residues
$Q_{Trans,q}$	Quantity of each fuel used for transportation (including off-road vehicles and equipment, aircraft, and/or vessels), up to the farm-gate.		Depends on fuel type	Invoices, fuel cards, receipts	Transport Fuel & Upstream Emissions
$Q_{SC,q}$	Quantity of each fuel used for stationary combustion, up to the farm-gate.		Depends on fuel type	Invoices, fuel cards, receipts	Stationary Fuel & Upstream emissions
$charge_{Ra}$	Amount of each refrigerant gas contained in each appliance		kg	Manufacturer's product specification	Refrigerant Use
Q_{wt}	Quantity of waste per type being treated within the farm-gate.		tonnes	Farm records of weight of waste disposed	Solid Waste Treatment

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Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data source	Module
V_{wt}	Volume of waste per type being treated within the farm-gate.		m^3	Only required if Q_{wt} is not known. Estimated from trailer-loads, or other known volume of waste transported.	Solid Waste Treatment
Required – Scope 2					
Q_{elec}	Quantity of electricity purchased from the grid, up to the farm-gate.		kWh	Invoices from electricity supplier	Purchased Electricity & Upstream Emissions from Purchased Electricity
Required – Scope 3					
N_{co}	Number of animals purchased per livestock class, including origin of purchase		head	Farm stock records, invoices	Purchased Livestock
Q_j	Quantity of each feed type purchased		tonnes	Invoices, receipts or other records of purchased quantities	Purchased Feed
Q_m	Quantity of each mineral supplement purchased		tonnes	Invoices, receipts or other records of purchased quantities	Purchased Mineral Supplements
F_{cf}	Fraction of inorganic fertiliser components in each fertiliser		wt%	Product information label	Purchased Fertiliser
Q_h	Quantity of each agrichemical used		kg	Invoices, receipts or other records of purchased quantities	Purchased Herbicides/Pesticides
A_p	Activity data for each service purchased, up to the farm-gate.		Depends on purchased service	Invoices, receipts or other records of quantity of service provided	Purchased Services and Contractors

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Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data source	Module
Q_{wt}	Weight of waste sent to waste treatment facility		tonnes	Invoices for skip disposal, weighbridge receipts, farm records	Management of Waste
V_{wt}	Volume of waste being sent waste treatment facility (only required if weight is unknown)		m^3	Invoices for skip disposal, or other farm records	Management of Waste

164

165 The checklist below summarises all the optional data points, required for **Method 2**, that may be collected at farm-level for a dairy system to
166 complete the equations detailed in subsequent chapters based on the dairy module map.

167 **Table 11: Optional data for dairy system**

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data source	Module
Optional – Scope 1					
D_j	Duration of stay for each dairy cattle input class		days	Farm stock records; system type records or purchase and sales may be evaluated to determine average duration of each cattle input class	Enteric Methane & Manure Management
W_j	Liveweight of livestock		kg	Farm stock records and herd flow model	Enteric Methane & Manure Management
LWG_j	Liveweight gain of livestock		kg/day	Farm stock records and herd flow model	Enteric Methane & Manure Management
DMD_j	Dry matter digestibility of feed		fraction	If average DMD for the reporting period of different livestock classes is known based on farm records of feed sources and quality, a farm-specific DMD value may be used. The ADCC, 2025 [2] provides support on how to calculate DMD from feed sources.	Enteric Methane & Manure Management
FC_j	Fat content in fat and protein corrected milk		per cent	Farm records specific to the milk production of the reporting period	Enteric Methane

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data source	Module
PC_j	Protein content in fat and protein corrected milk		per cent	Farm records specific to the milk production of the reporting period	Enteric Methane
MMS_m	Fraction of waste voided in each manure management system		fraction	Annual fraction of time spent in each area may be estimated from farm records for time split between paddock and housed for each livestock class. Alternatively, the ADCC tool provides a questionnaire-based approach to these calculations, which may be utilised to calculate f_m [2].	Manure Management
SS_j	Fraction of waste separated by pre-treatment of manure		fraction	Farm records on what fraction of waste is screened before flowing to primary MMS	Manure Management
CP_j	Crude protein of feed		fraction	Farm records or feed receipt stating crude protein of TMR (total mixed ration) for different livestock classes. The ADCC, 2025 [2] provides support on how to calculate CP from feed sources.	Manure Management
MCF_{im}	Methane conversion factor for temperature zone and system		fraction	Select relevant MCF for MMS and temperature zone	Manure Management

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data source	Module
N_{fj}	N application rate of inorganic fertiliser used in production system		kg N/ha	Farm records of fertiliser application rates, or calculated from: $$N_{fj} = \frac{Total\ fertiliser\ applied\ (kgN)}{Total\ area\ (ha)}$$ Data on total fertiliser applied and total area should be sourced from farm invoices and spatial records respectively.	Fertiliser Use – Inorganic Fertiliser Use
$EF_{j,N2O}$	Emission factor for direct nitrous oxide emissions from inorganic fertiliser		kg N_2O-N/kg N	Calculated from relevant equations in Chapter 5, sections 5.1.1.2	Fertiliser Use – Inorganic Fertiliser Use
Y_p	Average yield of pasture		t DM/ha	Yield records	Agriculture Residue Management - Pasture Residues
Optional – Scope 2					
$REC_{surrendered}$	Eligible Renewable Energy Certificates voluntarily surrendered in the reporting year		MWh	Records of transactions	Purchased Electricity & Upstream Emissions from Purchased Electricity (market-based approach only)
REC_{onsite}	Eligible Renewable Energy Certificates that have been or will be issued for electricity produced on-		MWh	Records of transactions	Purchased Electricity & Upstream Emissions from

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Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data source	Module
	site during the reporting period and consumed by the entity				Purchased Electricity (market-based approach only)
Optional – Scope 3					
W_{co}	Liveweight of purchased livestock at point of purchase		kg/head	Purchasing records/invoices and herd flow models	Purchased Livestock
EF	Supplier-provided life cycle emission factor for any of the following purchased goods: livestock, feed, mineral supplements, fertiliser, agrichemicals, or lime		t CO_2e/t purchased good	Supplier-provided life-cycle emission factors that have been third-party verified as conforming either to ISO 14067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard	Corresponding Scope 3 Purchased Good Module

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170 2.5 Sheep

171 This section outlines all relevant Modules and data checklists to develop a GHG inventory
172 for a sheep farming system. Relevant emission sources and therefore relevant Modules for a
173 specific entity will depend on an entity-specific boundary set as described in Chapter 5 of the
174 CRF. For example, if a specific entity does not use lime, then this emission source and
175 Module will not be relevant for this specific entity.

176 Module map and input data checklists are designed for estimation of emissions from cradle-
177 to-end of the farming system/farm-gate. If the boundary of the organisation extends to
178 processing, packing and transport of sheep or wool products, the post-production Module
179 can also be implemented to estimate emissions from these sources. Refer to Chapter 1,
180 Section 1.3, for additional information on coverage and limitations of the guidance.

181 2.5.1 Module Map

Emission Activity/Source	Relevant Module
Direct GHG emissions (Scope 1)	
Enteric Methane	3.4
Manure Management	4.4
Fertiliser Use	5.1 – 5.5
Agriculture residue management	6.2 – 6.3
Transport Fuel	8.1
Stationary Fuel	8.2
Solid Waste Treatment	10.1
Indirect GHG emissions from imported energy (Scope 2)	
Purchased Electricity	14.1
Indirect GHG emissions (Scope 3)	
Purchased Livestock	15.1
Purchased Feed	15.2
Purchased Mineral Supplements	15.3
Purchased Fertiliser	15.4
Purchased Agrichemicals	15.5
Purchased Lime	15.6

Emission Activity/Source	Relevant Module
Purchased Services/Contractors	15.7
Other Purchased Goods and Services	15.10
Upstream Emissions from Fuel	15.11
Upstream Emissions of Purchased Electricity	15.12
Management of Waste	15.13

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183 **2.5.2 Data Collection Checklist**

184 The checklist below summarises all the required input data, required for **Method 1**, that should be collected at farm-level for a sheep farming
185 system to complete the equations detailed in subsequent chapters based on the sheep module map. Data collected may be listed as 'not
186 applicable' for emissions sources that are not relevant to the specific entity. Further information regarding relevant sources and sink can be
187 found in Chapter 5.2 of the CRF.

188 Additional information and guidance on specific parameters can be found within the sheep guidance in Chapter 3 – Section; 3.4 and Chapter 4
189 – Section; 4.4. With additional related parameters found within Chapter 5 – Sections; 5.1 - 5.5, Chapter 6 – Sections; 6.2 and 6.3 and Chapter 8
190 – Sections; 8.1 and 8.2, Chapter 14 – Section; 14.1 and Chapter 15 – Sections; 15.1 – 15.7 and 15.10 – 15.13.

191 **Table 12: Required data for sheep system**

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data Source	Module
Required – Scope 1					
N_{jk}	Number of sheep in each time-period and class		head	Farm records and herd flow model	Enteric Methane & Manure Management
$LR_{jk=3,4}$	Number of ewes and maidens lambing in the season as a proportion of the total number of ewes and maidens carried in the season		per cent	Lambing rate should be based on weaning numbers. The percentage of ewes carrying a lamb at weaning and percentage of maidens carrying lamb at weaning should be reported separately where available.	Enteric Methane
$LMR_{jk=3,4}$	Lamb marking rate for ewes and maidens in each lambing season or time period		per cent	Lamb marking rate should be calculated by number of lambs marked per ewe mated.	Enteric Methane

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data Source	Module
GW_k	Average greasy wool fleece weight for each sheep class		kg/head	Should be based on average wool fleece weight for each class. Invoices from wool sales may be used to confirm the weight of wool sold in the reporting period. If not known this may be calculated from the total greasy weight sold divided by the number of head in each class shorn.	Manure Management
Y_k	Average clean wool yield for each sheep class		fraction	Wool testing results at point of sale for the clean wool percentage for each class. If only total greasy and total clean weights are known the fraction of clean may be calculated as: $$Y = \frac{cleanweight}{greasyweight}$$	Manure Management
TM_{jf}	Amount of each inorganic fertiliser applied to each production system		kg	Receipts, invoices, farm records	Fertiliser Use – Inorganic Fertiliser Use & Purchased Fertiliser
$FN_{inorganic,f}$	Fraction of nitrogen in each inorganic fertiliser		kg N/kg	Default values for common inorganic fertilisers based on average fertiliser composition	Fertiliser Use – Inorganic fertiliser Use

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Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data Source	Module
				from [1], or calculated from product label information.	
FU_f	Fraction of urea in each inorganic fertiliser applied		kg urea/kg	Default values for common inorganic fertilisers based on average fertiliser composition from [1], and or calculated from product label information.	Fertiliser Use – Inorganic fertiliser Use
$M_{organic,jf}$	Amount of each organic fertiliser applied to soils in production system		kg	Invoices of purchases, farm records of application rates	Fertiliser Use – Organic Fertiliser Use
$FN_{organic,f}$	Nitrogen fraction of each organic fertiliser applied to soils		kg N/kg	Supplier-provided values or product label information	Fertiliser Use – Organic Fertiliser Use
M_{lime}	Total amount of lime applied to soils		kg	Invoices, receipts	Fertiliser Use – Lime Application
FracLime	Fraction of lime as limestone		dimensionless	Product information label	Fertiliser Use – Lime Application
FracDol	Fraction of lime as dolomite		dimensionless	Product information label	Fertiliser Use – Lime Application
A_p	Area of pasture crop renewed or removed		ha	Geospatial files, farm records	Agriculture Residue Management - Pasture Residues
$Q_{Trans,q}$	Quantity of each fuel used for transportation (including off-road vehicles and equipment, aircraft, and/or vessels), up to the farm-gate.		Depends on fuel type	Invoices, fuel cards, receipts	Transport Fuel & Upstream Emissions

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Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data Source	Module
$Q_{SC,q}$	Quantity of each fuel used for stationary combustion, up to the farm-gate.		Depends on fuel type	Invoices, fuel cards, receipts	Stationary Fuel & Upstream Emissions
Q_{wt}	Quantity of waste per type being treated within the farm-gate.		tonnes	Farm records of weight of waste disposed	Solid Waste Treatment
V_{wt}	Volume of waste per type being treated within the farm-gate.		m^3	Only required if Q_{wt} is not known. Estimated from trailer-loads, or other known volume of waste transported.	Solid Waste Treatment
Required – Scope 2					
Q_{elec}	Quantity of electricity purchased from the grid, up to the farm-gate.		kWh	Invoices from electricity supplier	Purchased Electricity & Upstream Emissions from Purchased Electricity
Required – Scope 3					
N_{co}	Number of animals purchased per livestock class, including sheep type		head	Farm stock records, invoices	Purchased Livestock
Q_j	Quantity of each feed type purchased		t	Invoices, receipts or other records of purchased quantities	Purchased Feed
Q_m	Quantity of each mineral supplement purchased		t	Invoices, receipts or other records of purchased quantities	Purchased Mineral Supplements
F_{cf}	Fraction of inorganic fertiliser components in each fertiliser		wt%	Product information label	Purchased Fertiliser

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Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data Source	Module
Q_h	Quantity of each agrichemical used		kg	Invoices, receipts or other records of purchased quantities	Purchased Herbicides/Pesticides
A_p	Activity data for each service purchased, up to the farm-gate.		Depends on purchased service	Invoices, receipts or other records of quantity of service provided	Purchased Services and Contractors
Q_{wt}	Weight of waste sent to waste treatment facility		tonnes	Invoices for skip disposal, weighbridge receipts, farm records	Management of Waste
V_{wt}	Volume of waste being sent waste treatment facility (only required if weight is unknown)		m^3	Invoices for skip disposal, or other farm records	Management of Waste

192 The checklist below summarises all the optional data points, required for **Method 2**, that may be collected at farm-level for a sheep system to
193 complete the equations detailed in subsequent chapters based on the sheep module map.

194 **Table 13: Optional data for sheep system**

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data source	Module
Optional – Scope 1					
D_j	Duration of stay for each sheep input class		days	Farm stock records and herd flow model	Enteric Methane & Manure Management
W_{jk}	Liveweight of livestock per sheep class and season		kg	Farm stock records and herd flow model	Enteric Methane & Manure Management

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Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data source	Module
DMD_{jk}	Dry matter digestibility of feed		fraction	Farm records	Enteric Methane & Manure Management
DMA_{ik}	Dry matter availability of feed per livestock group		per cent	Calculated based on available pasture growth and supplementary feed provided. During periods of containment feeding, if DMA can be calculated more readily due to control of intake, this may be applied to the sheep classes and time periods when this feeding is taking place and DMA is known.	Enteric Methane
CP_{jk}	Crude protein of feed		fraction	Farm records for each season and class of stock.	Manure Management
LWG_{ik}	Liveweight gain of livestock		kg	Farm records and see herd flow model	Manure Management
MCF_{im}	Methane conversion factor for temperature zone and system		fraction	Select relevant MCF for MMS and temperature zone	Manure Management
N_{fj}	N application rate of inorganic fertiliser used in production system		kg N/ha	Farm records of fertiliser application rates, or calculated from: $$N_{fj} = \frac{Total\ fertiliser\ applied\ (kgN)}{Total\ area\ (ha)}$$ Data on total fertiliser applied and total area should be sourced	Fertiliser Use – Inorganic Fertiliser Use

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Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data source	Module
				from farm invoices and spatial records respectively.	
$EF_{j,N2O}$	Emission factor for direct nitrous oxide emissions from inorganic fertiliser		kg N_2O-N/kg N	Calculated from relevant equations in Chapter 5, sections 5.1.1.2	Fertiliser Use – Inorganic Fertiliser Use
Y_p	Average yield of pasture		t DM/ha	Yield records	Agriculture Residue Management - Pasture Residues
Optional – Scope 2					
$REC_{surrendered}$	Eligible Renewable Energy Certificates voluntarily surrendered in the reporting year		MWh	Records of transactions	Purchased Electricity & Upstream Emissions from Purchased Electricity (market-based approach only)
REC_{onsite}	Eligible Renewable Energy Certificates that have been or will be issued for electricity produced on-site during the reporting period and consumed by the entity		MWh	Records of transactions	Purchased Electricity & Upstream Emissions from Purchased Electricity (market-based approach only)
Optional – Scope 3					
W_{co}	Liveweight of purchased livestock at point of purchase		kg/head	Purchasing records/invoices and herd flow models	Purchased Livestock

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Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data source	Module
EF	Supplier-provided life cycle emission factor for any of the following purchased goods: livestock, feed, mineral supplements, fertiliser, agrichemicals, or lime		t CO_2e/t purchased good	Supplier-provided life-cycle emission factors that have been third-party verified as conforming either to ISO 14067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard	Corresponding Scope 3 Purchased Good Module

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197 2.6 Poultry

198 This section outlines all relevant Modules and data checklists to develop a GHG inventory
199 for a poultry farming system. Relevant emission sources and therefore relevant Modules for
200 a specific entity will depend on an entity-specific boundary set as described in Chapter 5 of
201 the CRF. For example, if a specific entity does not use lime, then this emission source and
202 Module will not be relevant for this specific entity.

203 Module map and input data checklists are designed for estimation of emissions from cradle-
204 to-end of the farming system/farm-gate. If the boundary of the organisation extends to
205 processing, packing and transport of poultry products or eggs, the post-production Module
206 can also be implemented to estimate emissions from these sources. Refer to Chapter 1,
207 Section 1.3, for additional information on coverage and limitations of the guidance.

208 2.6.1 Module Map

Emission Activity/Source	Relevant Module
Direct GHG emissions (Scope 1)	
Manure Management	4.6
Transport Fuel	8.1
Stationary Fuel	8.2
Solid Waste Treatment	10.1
Indirect GHG emissions from imported energy (Scope 2)	
Purchased Electricity	14.1
Indirect GHG emissions (Scope 3)	
Purchased Livestock	15.1
Purchased Feed	15.2
Purchased Services/Contractors	15.7
Other Purchased Goods and Services	15.10
Upstream Emission from Fuel	15.11
Upstream Emissions of Purchased Electricity	15.12
Management of Waste	15.13

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210 **2.6.2 Input Data Checklist**

211 The checklist below summarises all the required input data, required for **Method 1**, that should be collected at farm-level for a poultry system to
212 complete the equations detailed in subsequent chapters based on the poultry module map. Data collected may be listed as 'not applicable' for
213 emissions sources that are not relevant to the specific entity. Further information regarding relevant sources and sink can be found in Chapter
214 5.2 of the CRF.

215 Additional information and guidance on specific parameters can be found within Chapter 4 – Section; 4.6 for a poultry system. With additional
216 related parameters found within, Chapter 6 – Sections; 6.1 and 6.2, Chapter 10 – Section; 10.1, Chapter 14 – Section; 14.1, and Chapter 15 –
217 Sections; 15.1, 15.2, 15.7, 15.10 – 15.12.

218 **Table 14: Required data for a poultry system**

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data Source	Module
Required – Scope 1					
N_{jk}	Numbers of poultry in each class and subclass		birds	Farm flock records.	Manure Management
D_{jk}	Duration of stay for each class and subclass of poultry		days	Farm flock records; housing/system records and placement and dispatch documentation may be used to determine average duration of stay For broiler chickens records of depletions, or "flock thinning" may be used to ascertain length of stay within each class and subclass of poultry.	Manure Management
$MMS_{jmT=1}$	Fraction of manure in each primary MMS		fraction	Farmer records as to what fraction of manure flows to each	Manure Management

				system based on the available MMS options (m). If treatment is different for different poultry groups this may also be recorded per poultry group.	
$MMS_{jmT=2}$	Fraction of manure at treatment stage 2 for each MMS. i.e. what fraction of manure goes to what MMS once it has been removed from the house. If there is only one available MMS then this should be equal to 1. This may be different for different poultry groups.		fraction	Farmer records as to what fraction of manure flows to each system based on the available MMS options (m). If treatment is different for different poultry groups this may also be recorded per poultry group.	Manure Management
PF	Fraction of manure from MMS applied to soil within the farm boundary		fraction	Farm source data of manure sales or transport weights. When all manure treated in MMS is applied within the farm boundary and none is sold off-site to be used in a different enterprise, then PF = 1.	Manure Management
$Q_{Trans,q}$	Quantity and type of fuel used for transportation, (including off-road vehicles and equipment, aircraft, and/or vessels) up to the farm-gate.		Depends on fuel type	Invoices, fuel cards, receipts.	Transport Fuel & Upstream Emissions
$Q_{SC,q}$	Quantity and type of fuel used for stationary equipment, up to the farm-gate.		Depends on fuel type	Invoices, fuel cards, receipts.	Stationary Fuel & Upstream Emissions
Q_{wt}	Quantity of waste per type being treated within the farm-gate.		tonnes	Farm records (e.g., number and weight of deceased livestock).	Solid Waste Treatment

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V_{wt}	Volume of waste per type being treated within the farm-gate.		m^3	Only required if Q_{wt} is not known. Estimated from trailer-loads, or other known volume of waste transported.	Solid Waste Treatment
Required – Scope 2					
Q_{elec}	Quantity of electricity purchased from the grid, up to the farm-gate.		kWh	Invoices.	Purchased Electricity & Emissions from Purchased Electricity
Required – Scope 3					
N_{co}	Number of animals purchased per livestock type and origin		head	Farm stock records, invoices.	Purchased Livestock
Q_j	Quantity of feed type purchased		t	Invoices, receipts or other records of purchased quantities.	Purchased Feed
A_p	Activity data for service purchased, up to the farm-gate		Depends on purchased service	Invoices, receipts, farm records.	Purchased services and contractors
Q_{wt}	Quantity of waste per type being disposed beyond the farm-gate boundary.		tonnes	Weighbridge records, skip disposal invoices.	Management of Waste
V_{wt}	Volume of waste per type being disposed beyond the farm-gate boundary.		m^3	Only required if Q_{wt} is not known. Estimated from known volumes of waste transported (e.g., number of skips filled).	Management of Waste

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221 The checklist below summarises all the optional data points, required for **Method 2**, that may be collected at farm-level for a poultry system to
222 complete the equations detailed in subsequent chapters based on the poultry module map.

223 **Table 15: Optional data for a poultry system**

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data Source	Module
Optional – Scope 1					
I_{jk}	Dry matter intake for each class and subclass		kg DM/head/day	Farm records relating to dry matter assessment of total mixed ration (TMR), and daily feed weights for each class. For layers the Australian Egg Tool [3] provides a calculation of intake based on total feed delivered for each subclass of layer (cage, barn, free range) and feed composition, if known.	Manure Management
DMD_{jk}	Dry matter digestibility		fraction	If average DMD for the reporting period of different poultry classes is known based on farm records of feed sources and quality, a farm specific DMD value may be used. For any stock classes where farm records of feed sources and quality are not available, the National Inventory Report default shall be applied.	Manure Management

CP_j	Crude protein content of feed intake		fraction	Farm records or feed receipt stating crude protein of TMR (total mixed ration) for different poultry classes. For any poultry classes where farm records of feed sources and quality are not available, the National Inventory Report default shall be applied.	Manure Management
Optional – Scope 2					
$REC_{surrendered}$	Eligible Renewable Energy Certificates voluntarily surrendered in the reporting year.		MWh	Retailer invoice or Clean Energy Regulator REC registry.	Purchased Electricity & Emissions from Purchased Electricity (market-based approach only)
REC_{onsite}	Eligible Renewable Energy Certificates that have been or will be issued for electricity produced on-site during the reporting period and consumed by the entity.		MWh	Clean Energy Regulator REC registry and Meter readings.	Purchased Electricity & Emissions from Purchased Electricity (market-based approach only)
Optional – Scope 3					
W_{co}	Liveweight of purchased livestock at point of purchase		kg/head	Purchasing records/invoices and herd flow models.	Purchased Livestock
EF_{co}	Emission factor for purchased livestock per type of livestock		kg CO_2e/kg	Supplier-provided life-cycle emission factors that have been third-party verified as conforming either to ISO 15067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard.	Purchased Livestock

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EF_j	Emission factor of purchased feed type		kg CO_2e/kg	Supplier-provided life-cycle emission factors that have been third-party verified as conforming either to ISO 15067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard.	Purchased Feed

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225 ## 2.7 Swine

226 This section outlines all relevant Modules and data checklists to develop a GHG inventory
227 for a swine system. Relevant emission sources and therefore relevant Modules for a specific
228 entity will depend on an entity-specific boundary set as described in Chapter 5 of the CRF.
229 For example, if a specific entity does not use lime, then this emission source and Module will
230 not be relevant for this specific entity.

231 Module map and input data checklists are designed for estimation of emissions from cradle-
232 to-end of the farming system/farm-gate. If the boundary of the organisation extends to
233 processing, packing and transport of pork, the post-production Module can also be
234 implemented to estimate emissions from these sources. Refer to Chapter 1, Section 1.3, for
235 additional information on coverage and limitations of the guidance.

236 ### 2.7.1 Module Map

Emission Activity/Source	Relevant Module
Direct GHG emissions (Scope 1)	
Enteric Methane	3.5
Manure Management	4.5
Transport Fuel	8.1
Stationary Fuel	8.2
Solid Waste Treatment	10.1
Indirect GHG emissions from imported energy (Scope 2)	
Purchased Electricity	14.1
Indirect GHG emissions (Scope 3)	
Purchased Livestock	15.1
Purchased Feed	15.2
Purchased Services/Contractors	15.7
Other Purchased Goods and Services	15.10
Upstream Emission from Fuel	15.11
Upstream Emissions of Purchased Electricity	15.12
Management of Waste	15.13

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238 **2.7.2 Input Data Checklist**

239 The checklist below summarises all the required input data, required for **Method 1**, that should be collected at farm-level for a swine system to
240 complete the equations detailed in subsequent chapters based on the swine module map. Data collected may be listed as 'not applicable' for
241 emissions sources that are not relevant to the specific entity. Further information regarding relevant sources and sink can be found in Chapter
242 5.2 of the CRF.

243 Additional information and guidance on specific parameters can be found within Chapter 3 – Section; 3.5 and Chapter 4 – Section; 4.5 for a
244 swine system. With additional related parameters found within Chapter 6 – Sections; 6.1 and 6.2, Chapter 10 – Section; 10.1, Chapter 14 –
245 Section; 14.1, and Chapter 15 – Sections; 15.1, 15.2, 15.7, 15.10 – 15.12.

246 **Table 16: Required data for a swine system**

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data Source	Module
Required – Scope 1					
N_j	Number of swine of each class		head	Farm stock records; system type records, purchase and sales records and National Vendor Declarations or NLID transfer records may be evaluated to determine average length of stay of each class.	Enteric Fermentation & Manure Management
D_j	Average number of days on farm for each swine class		days	Farm stock records; system type records or purchase and sales records and National Vendor Declarations or NLID transfer records may be evaluated to determine average length of stay of each class. Breeding stock that are kept year-round shall be	Enteric Fermentation & Manure Management

				assumed to be on the farm for 365 days.	
$MMS_{jmT=1}$	Fraction of manure in each primary MMS		fraction	Farmer records as to what fraction of manure flows to each system based on the available MMS options (m). This fraction should be based on either weight or volume of manure. If treatment is different for different swine groups this may also be recorded per swine group. See Chapter 4, Section 4.5.2.1 for primary MMS options.	Manure Management
$MMS_{jmT=2}$	Fraction of manure in each secondary MMS		fraction	Farmer records as to what fraction of manure flows to each system based on the available MMS options (m). This fraction should be based on either weight or volume of manure. If treatment is different for different swine groups this may also be recorded per swine group. See Chapter 4, Section 4.5.2.1 for secondary MMS options.	Manure Management
PF	Fraction of manure from MMS applied to soil within the farm boundary		fraction	Farmer to specify fraction of manure applied to soil within the farm boundary.	Manure Management
$Q_{Trans,q}$	Quantity and type of fuel used for transportation, (including off-road vehicles and equipment, aircraft, and/or vessels) up to the farm-gate.		Depends on fuel type	Invoices, fuel cards, receipts.	Transport Fuel & Upstream Emissions

$Q_{SC,q}$	Quantity and type of fuel used for stationary equipment, up to the farm-gate.		Depends on fuel type	Invoices, fuel cards, receipts.	Stationary Fuel & Upstream Emissions
Q_{wt}	Quantity of waste per type being treated within the farm-gate.		tonnes	Farm records (e.g., number and weight of deceased livestock).	Solid Waste Treatment
V_{wt}	Volume of waste per type being treated within the farm-gate.		m^3	Only required if Q_{wt} is not known. Estimated from trailer-loads, or other known volume of waste transported.	Solid Waste Treatment
Required – Scope 2					
Q_{elec}	Quantity of electricity purchased from the grid, up to the farm-gate.		kWh	Invoices.	Purchased Electricity & Emissions from Purchased Electricity
Required – Scope 3					
N_{co}	Number of animals purchased per livestock type and origin		head	Farm stock records, invoices.	Purchased Livestock
Q_j	Quantity of feed type purchased		t	Invoices, receipts or other records of purchased quantities.	Purchased Feed
A_p	Activity data for service purchased, up to the farm-gate		Depends on purchased service	Invoices, receipts, farm records.	Purchased services and contractors
Q_{wt}	Quantity of waste per type being disposed beyond the farm-gate boundary.		tonnes	Weighbridge records, skip disposal invoices.	Management of Waste
V_{wt}	Volume of waste per type being disposed beyond the farm-gate boundary.		m^3	Only required if Q_{wt} is not known. Estimated from known volumes	Management of Waste

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				of waste transported (e.g., number of skips filled).	

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249 The checklist below summarises all the optional data points, required for **Method 2**, that may be collected at farm-level for a swine system to
250 complete the equations detailed in subsequent chapters based on the swine module map.

251 **Table 17: Optional data for a swine system**

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data Source	Module
Optional – Scope 1					
I_j	Average weight of fed ingested per head class of swine within farming system per day.		kg/head/day	Farm records relating to daily feed and feed waste weights for each class. PigBal [4] may be utilized to support the calculation annual feed fed per head to different classes of swine. It should be noted that feeding weights may change over time therefore an average should be calculated based on the amount of feed throughout time period reported for the swine class.	Enteric Methane
SS_j	Fraction of volatile solids separated by pre-treatment of manure		fraction	User specified input as to what fraction of volatile solids is screened before flowing into primary MMS. PigBal [4] may be used to support the estimation of this fraction based on the options effluent pre-treatment.	Manure Management
VS_i	Volatile solids production from swine in each class		kg/head/day	PigBal [4] may be used to calculate the excretion of volatile solids per swine class per head	Manure Management

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				per day. This calculation is based on the total solids excreted less the fixed solids excreted.	
MCF_{im}	Methane conversion factor for climate zone and system		fraction	Selection relevant MCF for MMS and temperature zone.	Manure Management
SN_j	Fraction of nitrogen separated by pre-treatment of manure		fraction	User specified input as to what fraction of nitrogen is screened before flowing into primary MMS. PigBal [4] may be used to support the estimation of this fraction based on the options effluent pre-treatment.	Manure Management
NW_j	Nitrogen waste production per pig and swine class per day including both animal waste and feed waste		kgN/head/day	PigBal [4] may be used to calculate the nitrogen waste produced per swine class per head per day. This is calculated by mass balance, as the difference between the amount in the ingested feed and the amount retained by the animal as live weight gain and the nitrogen in the waste feed.	Manure Management
Optional – Scope 2					
$REC_{surrendered}$	Eligible Renewable Energy Certificates voluntarily surrendered in the reporting year.		MWh	Retailer invoice or Clean Energy Regulator REC registry.	Purchased Electricity & Emissions from Purchased Electricity (market-based approach only)

REC_{onsite}	Eligible Renewable Energy Certificates that have been or will be issued for electricity produced on-site during the reporting period and consumed by the entity.		MWh	Clean Energy Regulator REC registry and Meter readings.	Purchased Electricity & Emissions from Purchased Electricity (market-based approach only)
Optional – Scope 3					
W_{co}	Liveweight of purchased livestock of type c from origin or at point of purchase		kg/head	Purchasing records/invoices and herd flow models.	Purchased Livestock
EF_{co}	Emission factor for purchased livestock per type of livestock c and origin o		kg CO_2e/kg	Supplier-provided life-cycle emission factors that have been third-party verified as conforming either to ISO 15067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard.	Purchased Livestock
EF_j	Emission factor of purchased feed type j		kg CO_2e/kg	Supplier-provided life-cycle emission factors that have been third-party verified as conforming either to ISO 15067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard.	Purchased Feed

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253 ## 2.8 Other Livestock

254 This section outlines all relevant Modules and data checklists to develop a GHG inventory of
255 for other livestock systems. Relevant emission sources and therefore relevant Modules for a
256 specific entity will depend on an entity-specific boundary set as described in Chapter 5 of the
257 CRF. For example, if a specific entity does not use lime, then this emission source and
258 Module will not be relevant for this specific entity.

259 Other livestock systems included in this guidance are

260 - Buffalo,

261 - Goats,

262 - Deer,

263 - Camels,

264 - Alpacas,

265 - Horses,

266 - Mules/asses, and

267 - Emus/ostriches.

268 Module map and input data checklists are designed for estimation of emissions from cradle-
269 to-end of the farming system/farm-gate. If the boundary of the organisation extends to
270 processing, packing and transport of animal products, the post-production Module can also
271 be implemented to estimate emissions from these sources. Refer to Chapter 1, Section 1.3,
272 for additional information on coverage and limitations of the guidance.

273 ### 2.8.1 Module Map

Emission Activity/Source	Relevant Module
Direct GHG emissions (Scope 1)	
Enteric Methane	3.6
Manure Management	4.7
Fertiliser Use	5.1 – 5.5
Agriculture Residue Management	6.2 – 6.4
Transport Fuel	8.1
Stationary Fuel	8.2
Solid Waste Treatment	10.1

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Emission Activity/Source	Relevant Module
Indirect GHG emissions from imported energy (Scope 2)	
Purchased Electricity	14.1
Indirect GHG emissions (Scope 3)	
Purchased Livestock	15.1
Purchased Feed	15.2
Purchased Mineral Supplements	15.3
Purchased Fertiliser	15.4
Purchased Agrichemicals	15.5
Purchased Lime	15.6
Purchased Services/Contractors	15.7
Other Purchased Goods and Services	15.10
Upstream Emission from Fuel	15.11
Upstream Emissions of Purchased Electricity	15.12
Management of Waste	15.13

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275 **2.8.2 Input Data Checklist**

276 The checklist below summarises all the required input data, required for **Method 1**, that should be collected at farm-level for other livestock

277 systems to complete the equations detailed in subsequent chapters based on the other livestock module map. Data collected may be listed as

278 'not applicable' for emissions sources that are not relevant to the specific entity. Further information regarding relevant sources and sink can be

279 found in Chapter 5.2 of the CRF.

280 Additional information and guidance on specific parameters can be found within Chapter 3 – Section; 3.6 and Chapter 4 – Section; 4.7 for other

281 livestock system. With additional related parameters found within Chapter 5 – Sections; 5.1 – 5.5, Chapter 6 – Sections; 6.1 and 6.2, Chapter

282 10 – Section; 10.1, Chapter 14 – Section; 14.1, and Chapter 15 Sections; 15.1 – 15.7, 15.8 15.10 – 15.12.

283 **Table 18: Required data for other livestock systems**

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data Source	Module
Required – Scope 1					
N_j	Average annual numbers of each other livestock type		head	Farm stock records noting that the enteric fermentation factor applies assumes animals are on farm all year. If there are changes in livestock numbers throughout the year, calculate the average numbers of livestock on farm for the reporting year.	Enteric Methane & Manure Management
TM_{jf}	The total mass of inorganic fertiliser type applied to production system		kg	Receipts, invoices, farm records.	Fertiliser Use – Inorganic Fertiliser Use & Purchased Fertiliser
$FN_{inorganic,f}$	Fraction of nitrogen in inorganic fertiliser		kg N/kg	Default values for common inorganic fertilisers based on average fertiliser composition	Fertiliser Use – Inorganic Fertiliser Use

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				from [1], or calculated from product label information. See additional guidance information in Chapter 5, Section 5.1.2.1.	
FU_f	Fraction of urea in inorganic fertiliser		kg urea/kg	Default values for common inorganic fertilisers based on average fertiliser composition from [1] and [5] or calculated from product label information. See additional guidance information in Chapter 5, Section 5.1.2.1.	Fertiliser Use – Inorganic Fertiliser Use
$M_{organic,jf}$	Mass of organic fertiliser type (manure) applied to soils in production system		kg	Invoices of purchases, farm records of application rates Where the manure was generated on-farm, $M_{manure,jf}$ is not required and instead the value of $MNSoil$ shall be calculated using outputs from the MMS emission estimation equations (Chapter 4).	Fertiliser Use – Organic Fertiliser Use
$FN_{organic,f}$	Nitrogen fraction of the organic fertiliser type (manure) applied to soils		kg N/kg	Supplier-provided values or product label information should be used. Default values from IPCC Volume 4 Chapter 5, Table 5.5c [6] (provided in Table A.1.2.2.6 of the Appendix) may be used for manure-based organic fertiliser that was purchased off-farm, where the livestock that	Fertiliser Use – Organic Fertiliser Use

				generated the organic fertiliser is known. See additional guidance information in Chapter 5, Section 5.2.2.1.	
M_{lime}	The mass of lime applied to soils		kg	Invoices, receipts.	Fertiliser Use – Lime Application & Purchased Lime
FracLime	The fraction of lime as limestone		dimensionless	The limestone (calcium carbonate - $CaCO_3$) content of lime may be determined based on the content by weight per cent (wt%) stated on the product information label. Product information label values expressed as wt% shall be converted into a fraction (e.g., for a 60 wt% content of limestone, $FracLime$ = 0.6).	Fertiliser Use – Lime Application
FracDol	The fraction of lime as dolomite		dimensionless	The dolomite (magnesium carbonate - $CaMg(CO_3)_2$) content of lime may be determined based on the content by weight per cent (wt%) on the product information label Product information label values expressed as wt% shall be converted into a fraction (e.g., for a 35 wt% content of dolomite, $FracDol$ = 0.35).	Fertiliser Use – Lime Application

A_p	Area of pasture crop renewed or removed		ha	Geospatial files, farm records.	Agriculture Residue Management - Pasture Residues
$Q_{Trans,q}$	Quantity and type of fuel used for transportation, (including off-road vehicles and equipment, aircraft, and/or vessels) up to the farm-gate.		Depends on fuel type	Invoices, fuel cards, receipts.	Transport Fuel & Upstream Emissions
$Q_{SC,q}$	Quantity and type of fuel used for stationary equipment, up to the farm-gate.		Depends on fuel type	Invoices, fuel cards, receipts.	Stationary Fuel & Upstream Emissions
Q_{wt}	Quantity of waste per type being treated within the farm-gate.		tonnes	Farm records (e.g., number and weight of deceased livestock).	Solid Waste Treatment
V_{wt}	Volume of waste per type being treated within the farm-gate.		m^3	Only required if Q_{wt} is not known. Estimated from trailer-loads, or other known volume of waste transported.	Solid Waste Treatment
Required – Scope 2					
Q_{elec}	Quantity of electricity purchased from the grid, up to the farm-gate.		kWh	Invoices.	Purchased Electricity & Emissions from Purchased Electricity
Required – Scope 3					
N_{co}	Number of animals purchased per livestock type and origin		head	Farm stock records, invoices.	Purchased Livestock
Q_j	Quantity of feed type purchased		t	Invoices, receipts or other records of purchased quantities.	Purchased Feed
Q_m	Quantity of mineral supplement per type purchased		t	Invoices, receipts or other records of purchased quantities.	Purchased Mineral Supplements

F_{cf}	Fraction of component (N, P, K and S) contained within the inorganic fertiliser, by weight		wt%	Product information label. This data is only required where inorganic fertilisers are used for which default values of EF_f are not provided in the Constant Parameters section below.	Purchased Fertiliser
Q_h	Total quantity of agrichemical per type purchased		kg	Receipts, invoices, or records of quantities purchased. Farm records for quantities used or application rates specific to the reporting period.	Purchased Agrichemicals
A_p	Activity data for service purchased, up to the farm-gate		Depends on purchased service	Invoices, receipts, farm records.	Purchased services and contractors
Q_{wt}	Quantity of waste per type being disposed beyond the farm-gate boundary.		tonnes	Weighbridge records, skip disposal invoices.	Management of Waste
V_{wt}	Volume of waste per type being disposed beyond the farm-gate boundary.		m^3	Only required if Q_{wt} is not known. Estimated from known volumes of waste transported (e.g., number of skips filled).	Management of Waste

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285 The checklist below summarises all the optional data points, required for **Method 2**, that may be collected at farm-level for another livestock
286 system to complete the equations detailed in subsequent chapters based on the other livestock module map.

287 **Table 19: Optional data for other livestock systems**

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data Source	Module
Optional – Scope 1					
D_j	Average duration of stay on the farm for each other livestock class in the year reported		days	Farm stock records; system type records or purchase and sales may be evaluated to determine average duration of each other livestock input class	Enteric Fermentation & Manure Management
N_{fj}	N application rate of inorganic fertiliser per type in production system		kg N/ha	Farm records of fertiliser application rates, or calculated. Data on total fertiliser applied and total area should be sourced from farm invoices and spatial records respectively. See Chapter 5, Section 5.1.2.2 for calculation method.	Fertiliser Use – Inorganic Fertiliser Use
$EF_{j,N2O}$	Emission factor for direct nitrous oxide emissions from inorganic fertiliser applied to production system		kg N_2O-N/kg N	An appropriate value of $EF_{j,N2O}$ should be selected from Table A.1.2.2.3 in the Appendix depending on the production system. See Chapter 5, Section 5.1.2.2 for guidance.	Fertiliser Use – Inorganic Fertiliser Use

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Y_p	Average yield of pasture crop		t DM/ha	Where yield, in dry matter, of pasture crops is known, this may be used to replace the default (Method 1) values. Yield records shall be used to justify the use of the Method 2 approach, rather than estimates.	Agriculture Residue Management - Pasture Residues
Optional – Scope 2					
$REC_{surrendered}$	Eligible Renewable Energy Certificates voluntarily surrendered in the reporting year.		MWh	Retailer invoice or Clean Energy Regulator REC registry.	Purchased Electricity & Emissions from Purchased Electricity (market-based approach only)
REC_{onsite}	Eligible Renewable Energy Certificates that have been or will be issued for electricity produced on-site during the reporting period and consumed by the entity.		MWh	Clean Energy Regulator REC registry and Meter readings.	Purchased Electricity & Emissions from Purchased Electricity (market-based approach only)
Optional – Scope 3					
W_{co}	Liveweight of purchased livestock at point of purchase		kg/head	Purchasing records/invoices and herd flow models.	Purchased Livestock
EF_{co}	Emission factor for purchased livestock per type of livestock		kg CO_2e/kg	Supplier-provided life-cycle emission factors that have been third-party verified as conforming either to ISO 15067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard.	Purchased Livestock

EF_j	Emission factor of purchased feed type		kg CO_2e/kg	Supplier-provided life-cycle emission factors that have been third-party verified as conforming either to ISO 15067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard.	Purchased Feed
EF_m	Emission factor of purchased mineral supplement type		kg CO_2e/kg	Supplier-provided life-cycle emission factors that have been third-party verified as conforming either to ISO 15067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard.	Purchased Mineral Supplements
EF_f	Emission factor of purchased inorganic fertiliser type		kg CO_2e/kg	Supplier-provided life-cycle emission factors that have been third-party verified as conforming either to ISO 15067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard.	Purchased Fertiliser
EF_h	Emission factor of purchased agrichemical type		kg CO_2e/kg	Supplier-provided life-cycle emission factors that have been third-party verified as conforming either to ISO 15067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard.	Purchased Agrichemicals

EF_l	Emission factor for purchased lime		kg CO_2e/kg	Supplier-provided life-cycle emission factors that have been third-party verified as conforming either to ISO 15067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard.	Purchased Lime

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289 ## 2.9 Horticulture

290 This section outlines all relevant Modules and data checklists to develop a GHG inventory of
291 for a horticulture system. Relevant emission sources and therefore relevant Modules for a
292 specific entity will depend on an entity-specific boundary set as described in Chapter 5 of the
293 CRF. For example, if a specific entity does not use lime, then this emission source and
294 Module will not be relevant for this specific entity.

295 Module map and input data checklists are designed for estimation of emissions from cradle-
296 to-point of harvesting. If the boundary of the horticulture organisation extends to processing,
297 packing and transport of product the post-production Module can also be implemented to
298 estimate these post-production emissions. Refer to Chapter 1, Section 1.3, for additional
299 information on coverage and limitations of the guidance.

300 Additional information and guidance on specific parameters can be found within Chapter 5 –
301 Sections; 5.1 – 5.5, Chapter 6 – Sections; 6.1, 6.3 and 6.4, Chapter 8 – Sections; 8.1 and
302 8.2, Chapter 9 – Sections 9.1, Chapter 10 – Section; 10.1, Chapter 14 – Section; 14.1, and
303 Chapter 15 – Sections; 15.4 – 15.12

304 ### 2.9.1 Module Map

Emission Activity/Source	Relevant Module
Direct GHG emissions (Scope 1)	
Fertiliser Use	5.1 – 5.5
Agriculture Residue Management	6.1, 6.3, 6.4
Transport Fuel	8.1
Stationary Fuel	8.2
Solid Waste Treatment	10.1
Indirect GHG emissions from imported energy (Scope 2)	
Purchased Electricity	14.1
Indirect GHG emissions (Scope 3)	
Purchased Fertiliser	15.4
Purchased Agrichemicals	15.5
Purchased Lime	15.6
Purchased Services/Contractors	15.7
Purchased Packaging (including pots)	15.8
Purchased Grow Media	15.9

Emission Activity/Source	Relevant Module
Other Purchased Goods and Services	15.10
Upstream Emissions from Fuel	15.11
Upstream Emissions of Purchased Electricity	15.12
Management of Waste	15.13

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Emission Activity/Source	Relevant Module

306 **2.9.2 Input Data Checklist**

307 The checklist below summarises all the required input data, required for **Method 1**, that should be collected at farm-level for a horticulture
308 system to complete the equations detailed in subsequent chapters based on the horticulture module map. Data collected may be listed as 'not
309 applicable' for emissions sources that are not relevant to the specific entity. Further information regarding relevant sources and sink can be
310 found in Chapter 5.2 of the CRF.

311 Additional information and guidance on specific parameters can be found within Chapter 5 – Sections; 5.1 – 5.5, Chapter 6 – Sections; 6.1, 6.3
312 and 6.4, Chapter 8 – Sections; 8.1 and 8.2, Chapter 10 – Section; 10.1, Chapter 14 – Section; 14.1, and Chapter 15 – Sections; 15.4 – 15.13.

313 **Table 20: Required data for horticulture system**

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data Source	Module
Required – Scope 1					
TM_{jf}	The total mass of inorganic fertiliser type applied to production system		kg	Receipts, invoices, farm records.	Fertiliser Use – Inorganic Fertiliser Use & Purchased Fertiliser
$FN_{inorganic,f}$	Fraction of nitrogen in inorganic fertiliser		kg N/kg	Default values for common inorganic fertilisers based on average fertiliser composition from [1], or calculated from product label information. See additional guidance information in Chapter 5, Section 5.1.2.1.	Fertiliser Use – Inorganic Fertiliser Use
FU_f	Fraction of urea in inorganic fertiliser		kg urea/kg	Default values for common inorganic fertilisers based on average fertiliser composition	Fertiliser Use – Inorganic Fertiliser Use

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				from [1] and [5] or calculated from product label information. See additional guidance information in Chapter 5, Section 5.1.2.1.	
$M_{organic,jf}$	Mass of organic fertiliser type (manure) applied to soils in production system		kg	Invoices of purchases, farm records of application rates Where the manure was generated on-farm, $M_{manure,jf}$ is not required and instead the value of $MNSoil$ shall be calculated using outputs from the MMS emission estimation equations (Chapter 4).	Fertiliser Use – Organic Fertiliser Use
$FN_{organic,f}$	Nitrogen fraction of the organic fertiliser type (manure) applied to soils		kg N/kg	Supplier-provided values or product label information should be used. Default values from IPCC Volume 4 Chapter 5, Table 5.5c [6] (provided in Table A.1.2.2.6 of the Appendix) may be used for manure-based organic fertiliser that was purchased off-farm, where the livestock that generated the organic fertiliser is known. See additional guidance information in Chapter 5, Section 5.2.2.1.	Fertiliser Use – Organic Fertiliser Use
M_{lime}	The mass of lime applied to soils		kg	Invoices, receipts.	Fertiliser Use – Lime Application & Purchased Lime

FracLime	The fraction of lime as limestone		dimensionless	The limestone (calcium carbonate - $CaCO_3$) content of lime may be determined based on the content by weight per cent (wt%) stated on the product information label. Product information label values expressed as wt% shall be converted into a fraction (e.g., for a 60 wt% content of limestone, $FracLime$ = 0.6).	Fertiliser Use – Lime Application
FracDol	The fraction of lime as dolomite		dimensionless	The dolomite (magnesium carbonate - $CaMg(CO_3)_2$) content of lime may be determined based on the content by weight per cent (wt%) on the product information label Product information label values expressed as wt% shall be converted into a fraction (e.g., for a 35 wt% content of dolomite, $FracDol$ = 0.35).	Fertiliser Use – Lime Application
P_c	Annual production of crop		kg	Farm records.	Agriculture Residue Management – Crop Residues to Soil
F_c	Fraction of crop residue that is burnt for crop c		dimensionless	Farm records of area burnt and area cultivated. See Chapter 6, Section 6.1.2.1 for guidance on calculation method and sources.	Agriculture Residue Management – Crop Residues to Soil

$Q_{Trans,q}$	Quantity and type of fuel used for transportation, (including off-road vehicles and equipment, aircraft, and/or vessels) up to and including harvesting		Depends on fuel type	Invoices, fuel cards, receipts.	Transport Fuel & Upstream Emissions
$Q_{SC,q}$	Quantity and type of fuel used for stationary equipment, up to and including harvesting		Depends on fuel type	Invoices, fuel cards, receipts.	Stationary Fuel & Upstream Emissions
Q_{wt}	Quantity of waste per type being treated within the farm-gate.		tonnes	Farm records of weight of waste disposed	Solid Waste Treatment
V_{wt}	Volume of waste per type being treated within the farm-gate.		m^3	Only required if Q_{wt} is not known. Estimated from trailer-loads, or other known volume of waste transported.	Solid Waste Treatment
Required – Scope 2					
Q_{elec}	Quantity of electricity purchased from the grid, up to and including harvesting		kWh	Invoices.	Purchased Electricity & Emissions from Purchased Electricity
Required – Scope 3					
F_{cf}	Fraction of component (N, P, K and S) contained within the inorganic fertiliser, by weight		wt%	Product information label. This data is only required where inorganic fertilisers are used for which default values of EF_f are not provided in the Constant Parameters section below.	Purchased Fertiliser
Q_h	Total quantity of agrichemical per type purchased		kg	Receipts, invoices, or records of quantities purchased. Farm records for quantities used or application rates specific to the reporting period.	Purchased Agrichemicals

A_p	Activity data for service purchased, up to and including harvesting		Depends on purchased service	Invoices, receipts, farm records.	Purchased services and contractors
Q_p	Units of purchased packaging		units	Invoices, or other records	Purchased Packaging
Q_g	Mass of purchased grow media		kg	Invoices, or other records	Purchased Grow Media
Q_{wt}	Quantity of waste per type being disposed beyond the farm-gate boundary.		tonnes	Weighbridge records, skip disposal invoices.	Management of Waste
V_{wt}	Volume of waste per type being disposed beyond the farm-gate boundary.		m^3	Only required if Q_{wt} is not known. Estimated from known volumes of waste transported (e.g., number of skips filled).	Management of Waste

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315 The checklist below summarises all the optional data points, required for **Method 2**, that may be collected at farm-level for a horticulture system
316 to complete the equations detailed in subsequent chapters based on the horticulture module map.

317 **Table 21: Optional data for horticulture system**

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data Source	Module
Optional – Scope 1					
N_{fj}	N application rate of inorganic fertiliser per type in production system		kg N/ha	Farm records of fertiliser application rates, or calculated. Data on total fertiliser applied and total area should be sourced from farm invoices and spatial records respectively. See Chapter 5, Section 5.1.2.2 for calculation method.	Fertiliser Use – Inorganic Fertiliser Use
$EF_{j,N2O}$	Emission factor for direct nitrous oxide emissions from inorganic fertiliser applied to production system		kg N_2O-N/kg N	An appropriate value of $EF_{j,N2O}$ should be selected from Table A.1.2.2.3 in the Appendix depending on the production system. See Chapter 5, Section 5.1.2.2 for guidance.	Fertiliser Use – Inorganic Fertiliser Use
$FFOD_c$	Fraction of the crop residue that is removed per crop type		dimensionless	See Chapter 6 equation 6.1.1.2 (1) for more guidance. Where residues are stubble-grazed, the default value for $FFOD_c$ should be used.	Agriculture Residue Management – Crop Residues to Soil

B	Number of bales generated		dimensionless	Invoices for the number of bales sold off-farm, or other farm records documenting the number of bales made.	Agriculture Residue Management – Crop Residues to Soil
M_B	Average mass of each bale generated		kg	Invoices from bale sales.	Agriculture Residue Management – Crop Residues to Soil
Optional – Scope 2					
$REC_{surrendered}$	Eligible Renewable Energy Certificates voluntarily surrendered in the reporting year.		MWh	Retailer invoice or Clean Energy Regulator REC registry.	Purchased Electricity & Emissions from Purchased Electricity (market-based approach only)
REC_{onsite}	Eligible Renewable Energy Certificates that have been or will be issued for electricity produced on-site during the reporting period and consumed by the entity.		MWh	Clean Energy Regulator REC registry and Meter readings.	Purchased Electricity & Emissions from Purchased Electricity (market-based approach only)
Optional – Scope 3					
EF_f	Emission factor of purchased inorganic fertiliser type		kg CO$_2$e/kg	Supplier-provided life-cycle emission factors that have been third-party verified as conforming either to ISO 15067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard.	Purchased Fertiliser
EF_h	Emission factor of purchased agrichemical type		kg CO$_2$e/kg	Supplier-provided life-cycle emission factors that have been third-party verified as	Purchased Agrichemicals

				conforming either to ISO 15067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard.	
EF_l	Emission factor for purchased lime		kg CO_2e/kg	Supplier-provided life-cycle emission factors that have been third-party verified as conforming either to ISO 15067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard.	Purchased Lime
EF_p	Emission factor for purchased packaging		kg CO_2e/unit	Supplier-provided life-cycle emission factors that have been third-party verified as conforming either to ISO 15067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard.	Purchased Packaging
EF_g	Emission factor for purchased grow media		kg CO_2e/kg	Supplier-provided life-cycle emission factors that have been third-party verified as conforming either to ISO 15067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard.	Purchased Grow Media

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319 ## 2.10 Viticulture

320 This section outlines all relevant Modules and data checklists to develop a GHG inventory of
321 for a viticulture system. Relevant emission sources and therefore relevant Modules for a
322 specific entity will depend on an entity-specific boundary set as described in Chapter 5 of the
323 CRF. For example, if a specific entity does not use lime, then this emission source and
324 Module will not be relevant for this specific entity.

325 Module map and input data checklists are designed for estimation of emissions from cradle-
326 to-point of harvesting. If the boundary of the organisation extends to processing, packing and
327 transport of grapes, the post-production Module can also be implemented to estimate
328 emissions from these sources. Refer to Chapter 1, Section 1.3, for additional information on
329 coverage and limitations of the guidance.

330 ### 2.10.1 Module Map

Emission Activity/Source	Relevant Module
Direct GHG emissions (Scope 1)	
Fertiliser Use	5.1 – 5.5
Agriculture Residue Management	6.1, 6.3, 6.4
Transport Fuel	8.1
Stationary Fuel	8.2
Solid Waste Treatment	10.1
Indirect GHG emissions from imported energy (Scope 2)	
Purchased Electricity	14.1
Indirect GHG emissions (Scope 3)	
Purchased Fertiliser	15.4
Purchased Agrichemicals	15.5
Purchased Lime	15.6
Purchased Services/Contractors	15.7
Other Purchased Goods and Services	15.10
Upstream Emissions from Fuel	15.11
Upstream Emissions of Purchased Electricity	15.12
Management of Waste	15.13

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332 **2.10.2 Input Data Checklist**

333 The checklist below summarises all the required input data, required for **Method 1**, that should be collected at farm-level for a viticulture system
334 to complete the equations detailed in subsequent chapters based on the viticulture module map. Data collected may be listed as 'not
335 applicable' for emissions sources that are not relevant to the specific entity. Further information regarding relevant sources and sink can be
336 found in Chapter 5.2 of the CRF.

337 Additional information and guidance on specific parameters can be found within Chapter 5 – Sections; 5.1 – 5.5, Chapter 6 – Sections; 6.1, 6.3
338 and 6.4, Chapter 8 – Sections; 8.1 and 8.2, Chapter 9 – Sections 9.1, Chapter 10 – Section; 10.1, Chapter 14 – Section; 14.1, and Chapter 15
339 – Sections; 15.4 – 15.7 and 15.10 – 15.12.

340 **Table 22: Required data for viticulture system**

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data Source	Module
Required – Scope 1					
TM_{jf}	The total mass of inorganic fertiliser type applied to production system		kg	Receipts, invoices, farm records.	Fertiliser Use – Inorganic Fertiliser Use & Purchased Fertiliser
$FN_{inorganic,f}$	Fraction of nitrogen in inorganic fertiliser		kg N/kg	Default values for common inorganic fertilisers based on average fertiliser composition from [1], or calculated from product label information. See additional guidance information in Chapter 5, Section 5.1.2.1.	Fertiliser Use – Inorganic Fertiliser Use
FU_f	Fraction of urea in inorganic fertiliser		kg urea/kg	Default values for common inorganic fertilisers based on average fertiliser composition	Fertiliser Use – Inorganic Fertiliser Use

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				from [1] and [5] or calculated from product label information. See additional guidance information in Chapter 5, Section 5.1.2.1.	
$M_{organic,jf}$	Mass of organic fertiliser type (manure) applied to soils in production system		kg	Invoices of purchases, farm records of application rates Where the manure was generated on-farm, $M_{manure,jf}$ is not required and instead the value of $MNSoil$ shall be calculated using outputs from the MMS emission estimation equations (Chapter 4).	Fertiliser Use – Organic Fertiliser Use
$FN_{organic,f}$	Nitrogen fraction of the organic fertiliser type (manure) applied to soils		kg N/kg	Supplier-provided values or product label information should be used. Default values from IPCC Volume 4 Chapter 5, Table 5.5c [6] (provided in Table A.1.2.2.6 of the Appendix) may be used for manure-based organic fertiliser that was purchased off-farm, where the livestock that generated the organic fertiliser is known. See additional guidance information in Chapter 5, Section 5.2.2.1.	Fertiliser Use – Organic Fertiliser Use
M_{lime}	The mass of lime applied to soils		kg	Invoices, receipts.	Fertiliser Use – Lime Application & Purchased Lime

FracLime	The fraction of lime as limestone		dimensionless	The limestone (calcium carbonate - $CaCO_3$) content of lime may be determined based on the content by weight per cent (wt%) stated on the product information label. Product information label values expressed as wt% shall be converted into a fraction (e.g., for a 60 wt% content of limestone, $FracLime$ = 0.6).	Fertiliser Use – Lime Application
FracDol	The fraction of lime as dolomite		dimensionless	The dolomite (magnesium carbonate - $CaMg(CO_3)_2$) content of lime may be determined based on the content by weight per cent (wt%) on the product information label Product information label values expressed as wt% shall be converted into a fraction (e.g., for a 35 wt% content of dolomite, $FracDol$ = 0.35).	Fertiliser Use – Lime Application
P_c	Annual production of crop		kg	Farm records.	Agriculture Residue Management – Crop Residues to Soil
F_c	Fraction of crop residue that is burnt for crop c		dimensionless	Farm records of area burnt and area cultivated. See Chapter 6, Section 6.1.2.1 for guidance on calculation method and sources.	Agriculture Residue Management – Crop Residues to Soil

$Q_{Trans,q}$	Quantity and type of fuel used for transportation, (including off-road vehicles and equipment, aircraft, and/or vessels) up to and including harvesting		Depends on fuel type	Invoices, fuel cards, receipts.	Transport Fuel & Upstream Emissions
$Q_{SC,q}$	Quantity and type of fuel used for stationary equipment, up to and including harvesting		Depends on fuel type	Invoices, fuel cards, receipts.	Stationary Fuel & Upstream Emissions
Q_{wt}	Quantity of waste per type being treated within the farm-gate.		tonnes	Farm records of weight of waste disposed	Solid Waste Treatment
V_{wt}	Volume of waste per type being treated within the farm-gate.		m^3	Only required if Q_{wt} is not known. Estimated from trailer-loads, or other known volume of waste transported.	Solid Waste Treatment
Required – Scope 2					
Q_{elec}	Quantity of electricity purchased from the grid, up to and including harvesting		kWh	Invoices.	Purchased Electricity & Emissions from Purchased Electricity
Required – Scope 3					
F_{cf}	Fraction of component (N, P, K and S) contained within the inorganic fertiliser, by weight		wt%	Product information label. This data is only required where inorganic fertilisers are used for which default values of EF_f are not provided in the Constant Parameters section below.	Purchased Fertiliser
Q_h	Total quantity of agrichemical per type purchased		kg	Receipts, invoices, or records of quantities purchased. Farm records for quantities used or application rates specific to the reporting period.	Purchased Agrichemicals

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A_p	Activity data for service purchased, up to and including harvesting		Depends on purchased service	Invoices, receipts, farm records.	Purchased services and contractors
Q_{wt}	Quantity of waste per type being disposed beyond the farm-gate boundary.		tonnes	Weighbridge records, skip disposal invoices.	Management of Waste
V_{wt}	Volume of waste per type being disposed beyond the farm-gate boundary.		m^3	Only required if Q_{wt} is not known. Estimated from known volumes of waste transported (e.g., number of skips filled).	Management of Waste

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342 The checklist below summarises all the optional data points, required for **Method 2**, that may be collected at farm-level for a viticulture system
343 to complete the equations detailed in subsequent chapters based on the viticulture module map.

344 **Table 23: Optional data for viticulture system**

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data Source	Module
Optional – Scope 1					
N_{fj}	N application rate of inorganic fertiliser per type in production system		kg N/ha	Farm records of fertiliser application rates, or calculated. Data on total fertiliser applied and total area should be sourced from farm invoices and spatial records respectively. See Chapter 5, Section 5.1.2.2 for calculation method.	Fertiliser Use – Inorganic Fertiliser Use
$EF_{j,N2O}$	Emission factor for direct nitrous oxide emissions from inorganic fertiliser applied to production system		kg N_2O-N/kg N	An appropriate value of $EF_{j,N2O}$ should be selected from Table A.1.2.2.3 in the Appendix depending on the production system. See Chapter 5, Section 5.1.2.2 for guidance.	Fertiliser Use – Inorganic Fertiliser Use
$FFOD_c$	Fraction of the crop residue that is removed per crop type		dimensionless	See Chapter 6 equation 6.1.1.2 (1). Where residues are stubble-grazed, the default value for $FFOD_c$ should be used.	Agriculture Residue Management – Crop Residues to Soil

B	Number of bales generated		dimensionless	Invoices for the number of bales sold off-farm, or other farm records documenting the number of bales made.	Agriculture Residue Management – Crop Residues to Soil
M_B	Average mass of each bale generated		kg	Invoices from bale sales.	Agriculture Residue Management – Crop Residues to Soil
Optional – Scope 2					
$REC_{surrendered}$	Eligible Renewable Energy Certificates voluntarily surrendered in the reporting year.		MWh	Retailer invoice or Clean Energy Regulator REC registry.	Purchased Electricity & Emissions from Purchased Electricity (market-based approach only)
REC_{onsite}	Eligible Renewable Energy Certificates that have been or will be issued for electricity produced on-site during the reporting period and consumed by the entity.		MWh	Clean Energy Regulator REC registry and Meter readings.	Purchased Electricity & Emissions from Purchased Electricity (market-based approach only)
Optional – Scope 3					
EF_f	Emission factor of purchased inorganic fertiliser type		kg CO_2e/kg	Supplier-provided life-cycle emission factors that have been third-party verified as conforming either to ISO 15067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard.	Purchased Fertiliser
EF_h	Emission factor of purchased agrichemical type		kg CO_2e/kg	Supplier-provided life-cycle emission factors that have been third-party verified as	Purchased Agrichemicals

				conforming either to ISO 15067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard.	
EF_l	Emission factor for purchased lime		kg CO_2e/kg	Supplier-provided life-cycle emission factors that have been third-party verified as conforming either to ISO 15067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard.	Purchased Lime

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346 ## 2.11 Aquaculture and Wildcatch Fisheries

347 This section outlines all relevant Modules and data checklists to develop a GHG inventory
348 for aquaculture and wild fisheries. Relevant emission sources and therefore relevant
349 Modules for a specific entity will depend on an entity-specific boundary set as described in
350 Chapter 5 of the CRF. For example, if a specific entity does not use lime, then this emission
351 source and Module will not be relevant for this specific entity.

352 **Question Reference 2.1.**

353 The current module map reflects that globally some aquaculture systems may use fertiliser
354 or lime to increase available nutrients or control pH. Is this also the case in Australian
355 aquaculture systems? Would inorganic or organic fertilisers be used or are these sources
356 not applicable to Australian aquaculture?

357 Module map and input data checklists are designed for estimation of emissions from cradle-
358 to-point of landing (from ponds/pens/sea as applicable). If the boundary of the organisation
359 extends to processing, packing and transport of seafood post landing, the post-production
360 Module can also be implemented to estimate emissions from these sources. Refer to
361 Chapter 1, Section 1.3, for additional information on coverage and limitations of the
362 guidance.

363 ### 2.11.1   Module Map

Emission Activity/Source	Relevant Module
Direct GHG emissions (Scope 1)	
Fertiliser Use	5.1 – 5.5
Transport Fuel	8.1
Stationary Fuel	8.2
Refrigerant Use	9.1
Solid Waste Treatment	10.1
Wastewater Treatment	11.1
N_2O Emissions from Aquaculture	13.1
Indirect GHG emissions from imported energy (Scope 2)	
Purchased Electricity	14.1
Indirect GHG emissions (Scope 3)	
Purchased Feed	15.2
Purchased Fertiliser	15.4
Purchased Lime	15.6

Emission Activity/Source	Relevant Module
Direct GHG emissions (Scope 1)	
Other Purchased Goods and Services	15.10
Upstream Emissions from Fuel	15.11
Upstream emissions of Purchased Electricity	15.12
Management of Waste	15.13

364

Emission Activity/Source	Relevant Module
Direct GHG emissions (Scope 1)	

365 **2.11.2 Input Data Checklist**

366 The checklist below summarises all the required input data, required for **Method 1**, that should be collected at entity-level for an aquaculture
367 and/or wild fisheries system to complete the equations detailed in subsequent chapters based on the aquaculture and wild fisheries module
368 map. Data collected may be listed as 'not applicable' for emissions sources that are not relevant to the specific entity. Further information
369 regarding relevant sources and sink can be found in Chapter 5.2 of the CRF.

370 Additional information and guidance on aquaculture and wild fisheries parameters can be found within Chapter 5 – Sections; 5.1 – 5.5, Chapter
371 6 – Sections; 6.1 – 6.3, Chapter 10 – Section; 10.1, Chapter 11 – Section; 11.1, Chapter 13 – Section; 13.1, Chapter 14 – Section; 14.1, and
372 Chapter 15 – Sections; 15.2, 15.4, 15.6 15.10 – 15.12

373 **Table 24: Required data for aquaculture and/or wild fisheries system**

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data Source	Module
Required – Scope 1					
TM_{jf}	The total mass of inorganic fertiliser type applied to production system		kg	Receipts, invoices, entity records.	Fertiliser Use – Inorganic Fertiliser Use & Purchased Fertiliser
$FN_{inorganic,f}$	Fraction of nitrogen in inorganic fertiliser		kg N/kg	Default values for common inorganic fertilisers based on average fertiliser composition from [1], or calculated from product label information. See additional guidance information in Chapter 5, Section 5.1.2.1.	Fertiliser Use – Inorganic Fertiliser Use
FU_f	Fraction of urea in inorganic fertiliser		kg urea/kg	Default values for common inorganic fertilisers based on average fertiliser composition	Fertiliser Use – Inorganic Fertiliser Use

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				from [1] and [5] or calculated from product label information. See additional guidance information in Chapter 5, Section 5.1.2.1.	
$M_{organic,jf}$	Mass of organic fertiliser type (manure) applied to soils in production system		kg	Invoices of purchases, entity records of application rates Where the manure was generated by the entity, $M_{manure,jf}$ is not required and instead the value of $MNSoil$ shall be calculated using outputs from the MMS emission estimation equations (Chapter 4).	Fertiliser Use – Organic Fertiliser Use
$FN_{organic,f}$	Nitrogen fraction of the organic fertiliser type (manure) applied to soils		kg N/kg	Supplier-provided values or product label information should be used. Default values from IPCC Volume 4 Chapter 5, Table 5.5c [6] (provided in Table A.1.2.2.6 of the Appendix) may be used for manure-based organic fertiliser that was purchased outside the entity, where the livestock that generated the organic fertiliser is known. See additional guidance information in Chapter 5, Section 5.2.2.1.	Fertiliser Use – Organic Fertiliser Use

M_{lime}	The mass of lime applied to soils		kg	Invoices, receipts.	Fertiliser Use – Lime Application & Purchased Lime
FracLime	The fraction of lime as limestone		dimensionless	The limestone (calcium carbonate - $CaCO_3$) content of lime may be determined based on the content by weight per cent (wt%) stated on the product information label. Product information label values expressed as wt% shall be converted into a fraction (e.g., for a 60 wt% content of limestone, $FracLime$ = 0.6).	Fertiliser Use – Lime Application
FracDol	The fraction of lime as dolomite		dimensionless	The dolomite (magnesium carbonate - $CaMg(CO_3)_2$) content of lime may be determined based on the content by weight per cent (wt%) on the product information label. Product information label values expressed as wt% shall be converted into a fraction (e.g., for a 35 wt% content of dolomite, $FracDol$ = 0.35).	Fertiliser Use – Lime Application
$Q_{Trans,q}$	Quantity and type of fuel used for transportation, (including off-road vehicles and equipment, aircraft, and/or vessels) up to and including point of landing		Depends on fuel type	Invoices, fuel cards, receipts.	Transport Fuel & Upstream Emissions
$Q_{SC,q}$	Quantity and type of fuel used for stationary equipment, up to and including point of landing		Depends on fuel type	Invoices, fuel cards, receipts.	Stationary Fuel & Upstream Emissions

charge$_{Ra}$	The amount of refrigerant gas R contained in appliance, up to and including point of landing		kg	Manufacturer's product specification should contain information of the charge of the refrigerant contained in each appliance.	Refrigerant Use
Q_{wt}	Quantity of waste per type being treated within the farm-gate.		tonnes	Entity records of weight of waste disposed	Solid Waste Treatment
V_{wt}	Volume of waste per type being treated within the farm-gate.		m^3	Only required if Q_{wt} is not known. Estimated from trailer-loads, or other known volume of waste transported.	Solid Waste Treatment
Q_t	Quantity of wastewater treated at each facility type, up to and including point of landing		m^3	Direct measurement of daily or hourly flows scaled to give an annual average	Wastewater Treatment
COD_{in}	Average inlet COD concentration of wastewater		kg COD/m^3	Direct measurement	Wastewater Treatment
COD_{out}	average outlet COD concentration of wastewater		kg COD/m^3	Direct measurement	Wastewater Treatment
F_{sludge}	Fraction of COD removed from the wastewater treatment facility as sludge		dimensionless	Measurement records, averaged over the reporting period	Wastewater Treatment
$F_{removed}$	Fraction of COD removed from the wastewater treatment facility and transferred to landfill, biochar production, or other site		dimensionless	Measurement records, averaged over the reporting period	Wastewater Treatment
Q_{cap}	Quantity of methane in sludge biogas captured for combustion for the operation of the treatment facility		m^3 CH$_4$	Direct measurement of methane content of sludge biogas, multiplied by total volume of biogas combusted by the facility	Wastewater Treatment
Q_{flared}	Quantity of methane in sludge biogas flared by the treatment facility		m^3 CH$_4$	Direct measurement of methane content of sludge biogas, multiplied by total volume of biogas combusted by the facility	Wastewater Treatment

Q_{out}	Quantity of methane in sludge biogas transferred out of the treatment facility		m^3 CH_4	Direct measurement of methane content of sludge biogas, multiplied by total volume of biogas combusted by the facility	Wastewater Treatment
Q	Quantity of fish produced in aquaculture ponds in in the reporting period		tonnes	Production records, sales records	N_2O Emissions from Aquaculture in Wetlands
Required – Scope 2					
Q_{elec}	Quantity of electricity purchased from the grid, up to and including point of landing		kWh	Invoices.	Purchased Electricity & Emissions from Purchased Electricity
Required – Scope 3					
Q_j	Quantity of feed type purchased		t	Invoices, receipts or other records of purchased quantities.	Purchased Feed
F_{cf}	Fraction of component (N, P, K and S) contained within the inorganic fertiliser, by weight		wt%	Product information label. This data is only required where inorganic fertilisers are used for which default values of EF_f are not provided in the Constant Parameters section below.	Purchased Fertiliser
Q_{wt}	Quantity of waste per type being disposed beyond the farm-gate boundary.		tonnes	Weighbridge records, skip disposal invoices.	Management of Waste
V_{wt}	Volume of waste per type being disposed beyond the farm-gate boundary.		m^3	Only required if Q_{wt} is not known. Estimated from known volumes of waste transported (e.g., number of skips filled).	Management of Waste

374

375 The checklist below summarises all the optional data points, required for **Method 2**, that may be collected at entity-level for an aquaculture
376 and/or wild-fisheries system to complete the equations detailed in subsequent chapters based on the aquaculture and wild-fisheries module
377 map.

378 **Table 25: Optional data for aquaculture and/or wild fisheries system**

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data Source	Module
Optional – Scope 1					
$EF_{j,N2O}$	Emission factor for direct nitrous oxide emissions from inorganic fertiliser applied to production system		kg N_2O-N/kg N	An appropriate value of $EF_{j,N2O}$ should be selected from Table A.1.2.2.3 in the Appendix depending on the production system. See Chapter 5, Section 5.1.2.2 for guidance.	Fertiliser Use – Inorganic Fertiliser Use
Optional – Scope 2					
$REC_{surrendered}$	Eligible Renewable Energy Certificates voluntarily surrendered in the reporting year.		MWh	Retailer invoice or Clean Energy Regulator REC registry.	Purchased Electricity & Emissions from Purchased Electricity (market-based approach only)
REC_{onsite}	Eligible Renewable Energy Certificates that have been or will be issued for electricity produced on-site during the reporting period and consumed by the entity.		MWh	Clean Energy Regulator REC registry and Meter readings.	Purchased Electricity & Emissions from Purchased Electricity (market-

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					based approach only)
Optional – Scope 3					
EF_j	Emission factor of purchased feed type		kg CO_2e/kg	Supplier-provided life-cycle emission factors that have been third-party verified as conforming either to ISO 15067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard.	Purchased Feed
EF_f	Emission factor of purchased inorganic fertiliser type		kg CO_2e/kg	Supplier-provided life-cycle emission factors that have been third-party verified as conforming either to ISO 15067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard.	Purchased Fertiliser
EF_l	Emission factor for purchased lime		kg CO_2e/kg	Supplier-provided life-cycle emission factors that have been third-party verified as conforming either to ISO 15067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard.	Purchased Lime

379

380 2.12 Forestry

381 This section outlines all relevant Modules and data checklists to develop a GHG inventory
382 for forestry. Relevant emission sources and therefore relevant Modules for a specific entity
383 will depend on an entity-specific boundary set as described in Chapter 5 of the CRF. For
384 example, if a specific entity does not use lime, then this emission source and Module will not
385 be relevant for this specific entity.

386 Module map and input data checklists are designed for estimation of emissions from cradle-
387 to-point of delivery at the mill. If the boundary of the forestry organisation extends to
388 processing of product the post-production Module can also be implemented to estimate
389 these post-production emissions. Refer to Chapter 1, Section 1.3, for additional information
390 on coverage and limitations of the guidance.

391 ### 2.12.1 Module Map

Emission Activity/Source	Relevant Module
Direct GHG emissions (Scope 1)	
Fertiliser Use	5.1 – 5.2
Transport Fuel	8.1
Stationary Fuel	8.2
Solid Waste Treatment	10.1
Indirect GHG emissions from imported energy (Scope 2)	
Purchased Electricity	14.1
Indirect GHG emissions (Scope 3)	
Purchased Fertiliser	15.4
Purchased Agrichemicals	15.5
Purchased Services/Contractors	15.7
Other Purchased Goods and Services	15.10
Upstream Emissions from Fuel	15.11
Upstream Emissions of Purchased Electricity	15.12
Management of Waste	15.13

392

393 **2.12.2 Input Data Checklist**

394 The checklist below summarises all the required input data, required for **Method 1**, that should be collected at entity-level for a forestry system
395 to complete the equations detailed in subsequent chapters based on the forestry module map. Data collected may be listed as 'not applicable'
396 for emissions sources that are not relevant to the specific entity. Further information regarding relevant sources and sink can be found in
397 Chapter 5.2 of the CRF.

398 Additional information and guidance on specific parameters can be found within Chapter 5 – Sections; 5.1 – 5.2, Chapter 8 – Sections; 8.1 and
399 8.2, Chapter 10 – Section; 10.1, Chapter 14 – Section; 14.1, and Chapter 15 – Sections; 15.4, 15.5, 15.7, 15.10 – 15.12

400 **Table 26: Required data for forestry system**

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data Source	Module
Required – Scope 1					
TM_{jf}	The total mass of inorganic fertiliser type applied to production system		kg	Receipts, invoices, entity records.	Fertiliser Use – Inorganic Fertiliser Use & Purchased Fertiliser
$FN_{inorganic,f}$	Fraction of nitrogen in inorganic fertiliser		kg N/kg	Default values for common inorganic fertilisers based on average fertiliser composition from [1], or calculated from product label information. See additional guidance information in Chapter 5, Section 5.1.2.1.	Fertiliser Use – Inorganic Fertiliser Use
FU_f	Fraction of urea in inorganic fertiliser		kg urea/kg	Default values for common inorganic fertilisers based on average fertiliser composition	Fertiliser Use – Inorganic Fertiliser Use

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				from [1] and [5] or calculated from product label information. See additional guidance information in Chapter 5, Section 5.1.2.1.	
$M_{organic,jf}$	Mass of organic fertiliser type (manure) applied to soils in production system		kg	Invoices of purchases, entity records of application rates Where the manure was generated by the entity, $M_{manure,jf}$ is not required and instead the value of $MNSoil$ shall be calculated using outputs from the MMS emission estimation equations (Chapter 4).	Fertiliser Use – Organic Fertiliser Use
$FN_{organic,f}$	Nitrogen fraction of the organic fertiliser type (manure) applied to soils		kg N/kg	Supplier-provided values or product label information should be used. Default values from IPCC Volume 4 Chapter 5, Table 5.5c [6] (provided in Table A.1.2.2.6 of the Appendix) may be used for manure-based organic fertiliser that was purchased outside the entity, where the livestock that generated the organic fertiliser is known. See additional guidance information in Chapter 5, Section 5.2.2.1.	Fertiliser Use – Organic Fertiliser Use
$Q_{Trans,q}$	Quantity and type of fuel used for transportation, (including off-road vehicles and equipment,		Depends on fuel type	Invoices, fuel cards, receipts.	Transport Fuel & Upstream Emissions

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	aircraft, and/or vessels) up to and including harvesting				
$Q_{SC,q}$	Quantity and type of fuel used for stationary equipment, up to and including harvesting		Depends on fuel type	Invoices, fuel cards, receipts.	Stationary Fuel & Upstream Emissions
Q_{wt}	Quantity of waste per type being treated within the farm-gate.		tonnes	Entity records of weight of waste disposed	Solid Waste Treatment
V_{wt}	Volume of waste per type being treated within the farm-gate.		m^3	Only required if Q_{wt} is not known. Estimated from trailer-loads, or other known volume of waste transported.	Solid Waste Treatment
Required – Scope 2					
Q_{elec}	Quantity of electricity purchased from the grid, up to and including harvesting		kWh	Invoices.	Purchased Electricity & Emissions from Purchased Electricity
Required – Scope 3					
Q_h	Total quantity of agrichemical per type purchased		kg	Receipts, invoices, or records of quantities purchased. Entity records for quantities used or application rates specific to the reporting period.	Purchased Agrichemicals
A_p	Activity data for service purchased, up to and including harvesting		Depends on purchased service	Invoices, receipts, entity records.	Purchased services and contractors
Q_{wt}	Quantity of waste per type being disposed beyond the farm-gate boundary.		tonnes	Weighbridge records, skip disposal invoices.	Management of Waste
V_{wt}	Volume of waste per type being disposed beyond the farm-gate boundary.		m^3	Only required if Q_{wt} is not known. Estimated from known volumes of	Management of Waste

			waste transported (e.g., number of skips filled).	

401

402 The checklist below summarises all the optional data points, required for **Method 2**, that may be collected at entity-level for a forestry system to
403 complete the equations detailed in subsequent chapters based on the forestry module map.

404 **Table 27: Optional data for forestry system**

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data Source	Module
Optional – Scope 1					
N_{fj}	N application rate of inorganic fertiliser per type in production system		kg N/ha	Entity records of fertiliser application rates or calculated. Data on total fertiliser applied and total area should be sourced from entity invoices and spatial records respectively. See Chapter 5, Section 5.1.2.2 for calculation method.	Fertiliser Use – Inorganic Fertiliser Use
$EF_{j,N2O}$	Emission factor for direct nitrous oxide emissions from inorganic fertiliser applied to production system		kg N_2O-N/kg N	An appropriate value of $EF_{j,N2O}$ should be selected from Table A.1.2.2.3 in the Appendix depending on the production system. See Chapter 5, Section 5.1.2.2 for guidance.	Fertiliser Use – Inorganic Fertiliser Use
Optional – Scope 2					

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REC_{surrendered}	Eligible Renewable Energy Certificates voluntarily surrendered in the reporting year.		MWh	Retailer invoice or Clean Energy Regulator REC registry.	Purchased Electricity & Emissions from Purchased Electricity (market-based approach only)
REC_{onsite}	Eligible Renewable Energy Certificates that have been or will be issued for electricity produced on-site during the reporting period and consumed by the entity.		MWh	Clean Energy Regulator REC registry and Meter readings.	Purchased Electricity & Emissions from Purchased Electricity (market-based approach only)
Optional – Scope 3					
EF$_f$	Emission factor of purchased inorganic fertiliser type		kg CO$_2$e/kg	Supplier-provided life-cycle emission factors that have been third-party verified as conforming either to ISO 15067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard.	Purchased Fertiliser
EF$_h$	Emission factor of purchased agrichemical type		kg CO$_2$e/kg	Supplier-provided life-cycle emission factors that have been third-party verified as conforming either to ISO 15067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard.	Purchased Agrichemicals

405

406 2.13 Post-production Module

407 This section outlines Modules and data checklists relevant to the development of a GHG
408 inventory for post-processing. The Module map and data checklists are focused on
409 estimation of Scope 1 and Scope 2 emissions from post-production activities and the
410 associated upstream Scope 3 emissions. Individual users need to determine which, if any,
411 post-processing activities fall within their Scope 1 or 2 or upstream Scope 3 emissions.
412 Inclusion and scope categorisation of post-production activities will depend on control,
413 ownership, boundary and materiality of emission sources. Refer to CRF, Chapter 5 for
414 additional information boundary setting and materiality.

415 While some of the upstream Scope 3 modules, such as freight (5.14) and packaging (5.8),
416 may also be relevant for estimating downstream Scope 3 emission sources this guidance
417 does not cover to the full scope of downstream post-production emissions. Users will be
418 required to set their own boundary for Scope 3 downstream emissions, collect the
419 appropriate activity data, and identify associated emissions factors for the full boundary of
420 their downstream Scope 3 emissions.

421 2.13.1   Module Map

Emission Activity/Source	Relevant Module
Direct GHG emissions (Scope 1)	
Transport Fuel	8.1
Stationary Fuel	8.2
Refrigerant	9.1
Solid Waste Treatment	10.1
Wastewater Treatment	11.1
Supplementary CO_2	12.1
Indirect GHG emissions from imported energy (Scope 2)	
Purchased Electricity	14.1
Indirect GHG emissions (Scope 3)	
Purchased Packaging	15.8
Other Purchased Goods and Services	15.10
Upstream Emissions from Fuel	15.11
Upstream Emissions of Purchased Electricity	15.12
Management of Waste	15.13
Upstream Freight	15.14

422

423 2.13.2   Input Data Checklist

424 The checklist below summarises all the required input data, required for **Method 1**, that should be collected at entity-level for a post-production
425 system to complete the equations detailed in subsequent chapters based on the post-production module map. Data collected may be listed as
426 'not applicable' for emissions sources that are not relevant to the specific entity. Further information regarding relevant sources and sink can be
427 found in Chapter 5.2 of the CRF.

428 Additional information and guidance on specific parameters can be found within Chapter 8 – Sections; 8.1 and 8.2, Chapter 9 – Sections 9.1,
429 Chapter 10 – Section; 10.1, Chapter 11 – Section; 11.1, Chapter 12 – Section; 12.1, Chapter 14 – Section; 14.1, and Chapter 15 – Sections;
430 15.8, 15.10 – 15.14

431 **Table 28: Potentially required data for post-production**

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data Source	Module
Required – Scope 1					
$Q_{Trans,q}$	Quantity and type of fuel used for transportation, occurring post-production		Depends on fuel type	Invoices, fuel cards, receipts.	Transport Fuel & Upstream Emissions
$Q_{SC,q}$	Quantity and type of fuel used for stationary equipment, occurring post-production		Depends on fuel type	Invoices, fuel cards, receipts.	Stationary Fuel & Upstream Emissions
$charge_{Ra}$	The amount of refrigerant gas R contained in appliance, occurring post-production		kg	Manufacturer's product specification should contain information of the charge of the refrigerant contained in each appliance.	Refrigerant Use
Q_{wt}	Quantity of waste per type being treated within the post-production boundary.		tonnes	Entity records of weight of waste disposed	Solid Waste Treatment
V_{wt}	Volume of waste per type being treated within the post-production boundary.		m^3	Only required if Q_{wt} is not known. Estimated from trailer-loads, or	Solid Waste Treatment

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				other known volume of waste transported.	
Q_t	Quantity of wastewater treated at each facility type, occurring post-production		m^3	Direct measurement of daily or hourly flows scaled to give an annual average	Wastewater Treatment
COD_{in}	Average inlet COD concentration of wastewater		kg COD/m^3	Direct measurement	Wastewater Treatment
COD_{out}	Average outlet COD concentration of wastewater		kg COD/m^3	Direct measurement	Wastewater Treatment
F_{sludge}	Fraction of COD removed from the wastewater treatment facility as sludge		dimensionless	Measurement records, averaged over the reporting period	Wastewater Treatment
$F_{removed}$	Fraction of COD removed from the wastewater treatment facility and transferred to landfill, biochar production, or other site		dimensionless	Measurement records, averaged over the reporting period	Wastewater Treatment
Q_{cap}	Quantity of methane in sludge biogas captured for combustion for the operation of the treatment facility		m^3 CH_4	Direct measurement of methane content of sludge biogas, multiplied by total volume of biogas combusted by the facility	Wastewater Treatment
Q_{flared}	Quantity of methane in sludge biogas flared by the treatment facility		m^3 CH_4	Direct measurement of methane content of sludge biogas, multiplied by total volume of biogas combusted by the facility	Wastewater Treatment
Q_{out}	Quantity of methane in sludge biogas transferred out of the treatment facility		m^3 CH_4	Direct measurement of methane content of sludge biogas, multiplied by total volume of biogas combusted by the facility	Wastewater Treatment
Q	Quantity of supplementary CO_2 used in post-production		kg CO_2	Purchase records.	Supplementary CO_2

Required – Scope 2					
Q_{elec}	Quantity of electricity purchased from the grid for post-production activities		kWh	Invoices.	Purchased Electricity & Emissions from Purchased Electricity
Required – Scope 3					
W_f	Mass of goods transported per freight type		tonnes	Invoices for freight, weighbridge receipts or other entity records	Upstream Freight
D_f	Total distance transported per freight type		km	Data from supplier, or other entity records	Upstream Freight
Q_p	Units of purchased packaging per packaging type		units	Invoices for packaging purchased, or other entity records	Purchased Packaging
Q_{wt}	Quantity of waste per type being disposed beyond the post-production boundary.		tonnes	Weighbridge records, skip disposal invoices.	Management of Waste
V_{wt}	Volume of waste per type being disposed beyond the post-production boundary.		m^3	Only required if Q_{wt} is not known. Estimated from known volumes of waste transported (e.g., number of skips filled).	Management of Waste

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433 The checklist below summarises all the optional data points, required for **Method 2**, that may be collected at entity-level for a post-production
434 system to complete the equations detailed in subsequent chapters based on the post-production module map.

435 **Table 29: Potential optional data for post-production**

Parameter	Data to be collected	Data collected Yes/No/N/A	Unit	Data Source	Module
Optional – Scope 2					
$REC_{surrendered}$	Eligible Renewable Energy Certificates voluntarily surrendered in the reporting year.		MWh	Retailer invoice or Clean Energy Regulator REC registry.	Purchased Electricity & Emissions from Purchased Electricity (market-based approach only)
REC_{onsite}	Eligible Renewable Energy Certificates that have been or will be issued for electricity produced on-site during the reporting period and consumed by the entity.		MWh	Clean Energy Regulator REC registry and Meter readings.	Purchased Electricity & Emissions from Purchased Electricity (market-based approach only)
Optional – Scope 3					
EF_p	Emission factor for purchased packaging		kg CO_2e/unit	Supplier-provided life-cycle emission factors that have been third-party verified as conforming either to ISO 15067:2018 (carbon footprints of products) or the GHG Protocol Product Life Cycle Accounting and Reporting Standard.	Purchased Packaging

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