Hancock Agricultural Investment Group (HAIG)
2020 GHG Inventory Verification Report
(Final Version - Updated)

Hancock Natural Resource Group
197 Clarendon St.
Boston, MA 02116

10-05-2021

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Lead Verifier 	Stephen Boles May 7, 2021
Independent Reviewer Matthew Lutes	Matthew Lutes May 5, 2021
This verification report is approved when signed and dated by an NSF independent reviewer.	

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Executive Summary

Hancock Natural Resource Group manages farmland and timberland portfolios through several investment structures for institutional investors, including public and private pension funds, foundations and endowments, high net-worth individuals, and Taft-Hartley plans. The Hancock Agricultural Investment Group (HAIG), HNRG's agricultural investment manager, manages agricultural properties in USA, Canada, and Australia. The portfolio includes a mix of both direct-operated and leased properties. A wide range of crop types are farmed in the HAIG portfolio, including almonds, pistachios, rice, cotton, corn, soybeans, grapes, cranberries, and more.

(HNRG) engaged NSF to verify at a limited level of assurance its emissions of carbon dioxide, methane, and nitrous oxide from the HAIG portfolio for the year ending 31 December 2020. The verification of the emissions of carbon dioxide, methane, and nitrous oxide from HAIG was conducted to satisfy third-party verification requirements of the CDP, and to provide limited assurance to HNRG stakeholders that the reporting of HAIG emissions is fairly stated.

Scope of Verification

HNRG reported direct emissions of carbon dioxide, methane, and nitrous oxide from HAIG, primarily from stationary and mobile fossil fuel combustion, nitrogen fertilizer applications, lime and urea applications, and biomass combustion (methane and nitrous oxide emissions only). HNRG also reported energy indirect emissions associated with the purchase of electricity. HNRG also reported other indirect emissions associated with the operation of leased farm properties and rice agriculture water management. HNRG also reported biogenic carbon dioxide emissions from the combustion of crop residue biomass. Total reported emissions (expressed in tonnes of carbon dioxide equivalent) are broken down as follows:

- Direct emissions (Scope 1): 36,634 tonnes CO_2e
- Energy indirect emissions (Scope 2): 10,177 tonnes CO_2e
- Other indirect emissions (Scope 3): 199,569 tonnes CO_2e
- Biogenic emissions: 1,768 tonnes CO_2

Note that HNRG has elected not to report soil carbon GHG emissions / removals, which are optional for reporting under the GHG Protocol Corporate Standard. HNRG has indicated an intent to incorporate this into future year reporting once a method that is sufficiently accurate and practical to implement is identified.

Verification Process

NSF conducted the verification in accordance with the requirements of ISO 14064: 2006, Part 3, *Greenhouse gases – Specification with guidance for the validation and verification of greenhouse gas assertions*. NSF reviewed the HAIG GHG inventory methodology document, the associated inventory calculation spreadsheet, and a sample of farm survey reports. Total reported emissions (Scope 1 + Scope 2 + Scope 3) were considered to be free of material misstatement if found to be less than 10% on a carbon dioxide–equivalent basis. HNRG's assertion was tested according to a risk-based approach and the review of controls to manage these risks, including:

- Verification of the organizational boundaries of the HAIG GHG inventory;
- Assessment of the capability of HNRG's management system and procedures to produce accurate, reliable and reproducible data and information;

- Determination of HNRG's conformity in all material respects with the requirements of *WBCSD/WRI GHG Protocol Corporate Standard (Revised Edition, 2004)*;
- Reviewing the basis for and results achieved from the calculated emissions of carbon dioxide, methane, and nitrous oxide from a sampling of source data (farm operator surveys on fuel consumption, nitrogen applications, and cropland management) for the HAIG GHG inventory;
- Interviewing personnel from HNRG and their third-party GHG management consultants and reviewing relevant documents and records.

Verification Findings

No material misstatements were identified by NSF in this verification engagement.

During the course of the verification engagement, two corrections were made by HNRG that resulted in updated versions of the GHG Assertion being delivered to NSF on April 21, 2021 and April 23, 2021 for the following issues that were identified by NSF:

- Unreported natural gas consumption for some direct-operated properties in Wisconsin;
- Accuracy of the fuel estimation methodology proposed by HNRG for leased properties that are farming corn, soybean, grapes, olives, and vegetables

The verification statement that has been prepared by NSF for this engagement is issued against the revised version of the GHG Assertion that was delivered to NSF on April 23, 2021.

NSF's verification process also revealed several recommendations that are being provided to HNRG as opportunities for improvement of the HAIG GHG management system going forward:

- Implementation of proper version control for HAIG GHG inventory documents
- Revise Appendix VIII of GHG methodology document with updated and improved description of fuel estimation methodology
- Provide source of fuel volume-to-energy conversion equations in the GHG calculation spreadsheet
- Preparation of a more detailed description of quality assurance/quality control procedures applied to the HAIG GHG inventory

Conclusion

Based upon the above, NSF has concluded that there is no evidence that HNRG's reported emissions of carbon dioxide, methane, and nitrous oxide for the year ending 31 December 2020 are not, in all material aspects, fairly stated in accordance with the criteria referenced above.

1. Verification Objectives, Scope and Criteria

The scope of the verification engagement is presented in Table 1; the objectives and criteria of the verification engagement are presented in Table 2.

Table 1: Verification Scope

Scope	
Organizational Boundary: GHG emissions from HAIG's network of agricultural properties (directly-operated and leased) in the USA, Canada, and Australia. ***Operational Boundary (GHG Sources, Sinks, Reservoirs):*** Scope 1: • Fuel combustion (stationary and mobile) • Nitrogen application from fertilizers • Biomass combustion (CH_4 and N_2O only) • Lime and urea applications (CO_2 only) Scope 2: • Electricity consumption Scope 3 (from leased properties): • All Scope 1 and Scope 2 GHG sources listed above occurring on leased properties • Methane (CH_4) emissions from water management on leased rice properties No GHG sinks or reservoirs are being reported in HAIG's 2020 GHG inventory, however in future years the soil carbon sink will be reported when the quantification methodology is refined and uncertainty is reduced ***Temporal Boundary:*** January 1, 2020 – December 31, 2020 ***Chemical Boundary:*** CO_2, CH_4, N_2O	***Intended Users:*** CDP, HNRG Stakeholders ***Infrastructure, Activities, Technologies or Processes:*** Hancock Natural Resource Group (HNRG) manages farmland and timberland portfolios through several investment structures for institutional investors, including public and private pension funds, foundations and endowments, high net-worth individuals, and Taft-Hartley plans. HNRG's agricultural investment manager, referred to as HAIG, manages agricultural properties in USA, Canada, and Australia. The portfolio includes a mix of both directly-operated and leased properties. A wide range of crop types are farmed in the HAIG portfolio, including almonds, pistachios, rice, cotton, corn, soybeans, grapes, cranberries, and more. The HAIG GHG inventory includes emissions from energy combustion (fossil fuel, biomass, electricity) and other emissions specific to agricultural land management (N2O release from fertilizer applications, CH4 emissions from rice water management, CO2 from lime/urea applications).

Table 2: Verification Objectives and Criteria

Objectives and Criteria	
Objective: To provide limited assurance to the stakeholders of Hancock Agricultural Investment Group (HAIG) that there is no evidence that the Assertion of stated 2020 GHG emissions made by HAIG is not materially correct and is not in conformance with the stated criteria. ***Level of Assurance:*** Limited	***Criteria:*** WBCSD/WRI Greenhouse Gas Protocol Corporate Accounting and Reporting Standard, Revised Edition (2004) *GHG Protocol Agricultural Guidance* supplement ISO 14064-1 IPCC Guidelines for National Greenhouse Gas Inventories 2019 Refinement ***Materiality Threshold:*** 10% of total reported emissions (Scope 1 + Scope 2 + Scope 3)

2. Description of Data Acquisition, Tracking, Emissions Calculation Data Systems

NSF conducted a review of the data management system for the HAIG GHG inventory. Details on the HAIG GHG inventory data management system were obtained from the following sources:

1. Interview with HNRG and Delphi representatives during the on-site planning audit meeting conducted on April 8 2021
2. Review of the HAIG GHG methodology document where the data management system is described
3. Review of supporting evidence that corroborates the implementation of the data management system, including:
   - completed surveys from direct-operated properties
   - email exchanges between HNRG, Delphi, and farm property managers
   - Delphi's data tracking spreadsheet: this is a consolidated and detailed 'issues log' at the farm property level that describes issues observed, email exchanges, and issue resolutions

The data management system for the HAIG GHG inventory is a function of the parties described below:

HNRG Sustainability Manager

Overall coordination of the HAIG GHG inventory project including:

- decision-making on inventory parameters,
- scheduling and initiation of annual farm survey data request to managers of direct-operated properties,
- oversight of communications between farm property managers and third-party consultants,

- review of reasonableness of data reported by farm property managers
- engagement with property managers if data issues arise

Managers of Direct-Operated Properties

- management, collection, and reporting of consolidated GHG inventory activity data (fuel consumption, electricity consumption, fertilizer applications, etc.) through the annual farm data surveys circulated by HNRG
- quality control procedures including review and reconciliation by multiple levels of administration (e.g. Farm Manager, Operations Manager, Regional Manager)

Third Party Consultants (Delphi)

- development and on-going management of HAIG GHG methodology document and GHG inventory spreadsheet
- processing and analysis of completed data collection surveys filled out by managers of direct-operated properties
- maintenance of the HAIG data tracking spreadsheet

3. Data Checks for Emission Data Sources

Data checks of the GHG emission data sources was based on the verification plan and sampling plan developed by NSF. The sampling plan ensures that sufficient and appropriate evidence is collected and reviewed by NSF to assess the methodology and procedures that formed the GHG Assertion made by HNRG and to disclose any material discrepancies that may exist. The verification plan for this engagement is provided as Appendix A to this report. The sampling plan to assess the accuracy and appropriate application of the source activity data in the GHG Assertion calculations is presented in Table 3. The sampling plan has been designed to be representative of the diversity (spatial distribution, direct-operated vs leased operation, crop type) of the properties in the HAIG GHG inventory.

4. Issues Log/List of Findings

Risk assessment is a procedure conducted NSF that involves:

- Reviewing the GHG Assertion and other available documentation specific to the Assertion (GHG Inventory Methodology Manual, HAIG 2020 GHG emissions calculator spreadsheet);
- Assessing the likelihood that a material misstatement might exist in the GHG Assertion, if no controls were used to prevent misstatements in the GHG Assertion;
- Assessing the control environment and the corporate governance process; and
- Reviewing each GHG emissions source identified in the Assertion, and evaluating the contribution of each source to the GHG Assertion and the associated potential material misstatement for each.

NSF's verification procedures were developed to address the identified risks, such that a verification conclusion could be reached with a limited level of assurance. The complete results and findings of the Verification Risk Assessment is provided as Appendix B, including NSF's procedure for addressing each identified risk. A summary log of issues and findings resulting from this verification engagement is presented in Table 4.

Table 3: Sampling Plan Design

	Direct-Operated	Leased
% of Total GHG Emissions	17	83
# of Sample Plan Properties	6	9
Regions Represented in Sample Plan	California, Washington, Wisconsin, Australia	Arkansas, Illinois, Louisiana, Mississippi, Texas, Wisconsin, Alberta
Crops Represented	Almond, Apple, Cranberry, Cotton	Rice, Corn, Soybean, Cotton, Vegetable, Wheat, Canola
Focus of Sample Plan Verification Analysis	Appropriate nitrogen application rate based on survey responses Reasonableness and consistency of survey responses	Appropriate nitrogen application rate based on decision rules in GHG inventory methodology document

Table 4: Issues Log and List of Findings

Risk # (see Appendix B)	Observed Risk / Issue	Verification Finding
1	Incomplete version control in GHG inventory methodology document.	**Opportunity for Improvement #1:** HNRG is encouraged to implement a proper version control system to manage its HAIG GHG inventory products, including the methodology document and the inventory spreadsheet. The version control should include a section in the methodology and spreadsheet that provides the number of each version, a description of updates for that version, and the person responsible for the update. The version number should also be included in the naming of the methodology document and inventory spreadsheet.
2a	Exclusion of soil carbon sequestration from reported GHG inventory (soil carbon is a potentially significant source of GHG reductions for agricultural projects).	Exclusion of soil carbon sequestration from reported GHG Assertion would be recognized limitation in the Verification Statement.

2c	Accuracy of estimated fuel consumption totals for leased properties.	**Opportunity for Improvement #2:** HNRG is encouraged to update Appendix VIII in the HAIG GHG methodology document with the updated fuel consumption rates for corn, soybean, grapes, olives, and vegetables. **Opportunity for Improvement #3:** HNRG is encouraged to update Appendix VIII in the HAIG GHG methodology document with a description of how the data from USDA energy consumption publication (Bulletin Number 159) is converted from dollars/acre to gallons/acre.
3	Consistency and accuracy of emission factors and conversion equations used.	**Opportunity for Improvement #4:** HNRG is encouraged to include the source of conversion equations used for volume-to-energy conversions (e.g. m3 natural gas to kWh) as these conversions are based on assumptions for variables such as pressure that should be traceable for the verifier.
6	Methodology for estimation of N inputs and energy consumption for leased properties is reasonable and is being applied consistently and accurately	**Opportunity for Improvement #5:** HNRG is encouraged to update Appendix VIII in the HAIG GHG methodology document, as the current version of the document has an incorrect description of the methodology used for estimating fuel consumption in leased vegetable properties. The current version of Appendix VIII states that the fuel consumption for vegetable properties is estimated using the apple fuel consumption rate obtained for direct-operated apple properties. However, in the inventory spreadsheet the fuel consumption for vegetable leased properties is estimated using the average consumption reported from known direct-operated soybean properties in the HAIG portfolio.
8	Data management system and procedures for identifying errors is effective and being appropriately applied	**Opportunity for Improvement #6:** In the HAIG GHG methodology document, HNRG is encouraged to prepare a more detailed description of the data management system and associated QA/QC procedures. Section 6 of the GHG methodology document is a dedicated section for describing the GHG inventory's data management system, but the section is currently lacking in detail and directs the reader to the appendices of the report. The methods used to describe the data management procedures in the appendices are inconsistent in terms of their detail and terminology. HNRG should utilize Section 6 of the GHG methodology document to prepare a detailed description of the full HAIG inventory data management system and associated QA/QC procedures.

5. List of Corrections Made During the Verification

During the course of the verification engagement, two corrections were made by HNRG (see Table 5) that resulted in updated versions of the GHG Assertion being delivered to NSF on April 21, 2021 and April 23, 2021. The verification statement that has been prepared by NSF for this engagement is issued against the revised version of the GHG Assertion that was delivered to NSF on April 23, 2021.

Table 5: List of Corrections Made During the Verification

Risk # (see Appendix B)	Observed Issue	Impact of Correction
2b	Natural gas consumption is calculated for a very small number of the HAIG properties. An email was sent to HNRG and Delphi about this issue on April 12, 2021.	The italicized text below is the emailed response received from HNRG and Delphi on April 13, 2021: *<u>NG - For direct operate properties</u>* • *California and Quebec properties have reported natural gas use.* • *Australia properties do not need heating so they do not use natural gas as well.* • *As for Washington and Wisconsin, we have confirmed with property managers in both states that they do not use natural gas, because the farms are in remote locations, and they do not have access to natural gas pipelines. Instead, for both states, they use propane for heating.* • *Washington's propane consumption has already been captured in the current inventory.* • *As for Wisconsin, we did realize that propane consumption used for heating (for homes that are owned by HNRG but rented to HNRG employees) has been missed in the current inventory. The Wisconsin property manager has reached out to propane vendors to ask for the 2020 consumption data, and we will include it in the calculator as soon as we have it. Please also note that: 1) electricity consumption from these homes has already been included in the current inventory; and 2) HNRG is responsible for paying utility bills for these homes.* *<u>For leased properties</u>* *We have only collected data for some rice properties, but do not have HNRG specific activity data for other row crop properties.* An updated version of the HAIG GHG inventory calculation spreadsheet was provided to NSF on April 21, 2021. **The inclusion of natural gas consumption from the Wisconsin properties resulted in an increase of 349 tonnes of CO2e to the GHG Assertion.**

2c	Accuracy of estimated fuel consumption totals for leased properties. An email was sent to HNRG and Delphi about this issue on April 22, 2021.	The italicized text below is the emailed response received from HNRG and Delphi on April 23, 2021: **Corn & Soybean Properties** Fuel consumption rates for leased corn, soybean, and corn/soybean properties are suspected to be significantly overestimated. For each of these crop types, fuel consumption was estimated based on a small sample of known fuel consumption rates reported for the same crop type within the HAIG portfolio. The fuel consumption rates used in the HAIG GHG inventory for these crop types was significantly greater than the average rate published by the USDA in the Bulletin Number 159 document used by HNRG for fuel consumption rates of other crop types: Crop Type — HAIG (gal/acre) — USDA (gal/acre) Corn — 24 — 6 Soybean — 24 — 6 Corn / soybean — 45 — 6 Note that NSF assumes that the fuel consumption rate for a 'corn/soybean' rotation would be the same as the average rate for the single rotation corn and soybean crops. Based on the fuel consumption rates shown above, the GHG emissions associated with fuel consumption are as follows: Crop Type — Acres — HAIG (CO2e) — USDA (CO2e) Corn — 45,781 — 11,488 — 2872 Soybean — 14,717 — 3676 — 919 Corn / soybean — 37,228 — 17,490 — 2332 Total predicted error from over-estimated fuel consumption from leased corn, corn/soybean, and soybean properties is 26,531 tonnes CO2e. *Thank you for the cross-checking. We agree that the fuel consumption rate for corn, soybean, and corn/soybean in HAIG inventory comes from a small sample of HAIG's farms and may not be representative for the rest of the corn and soybean farms. As such, we have updated the calculator using the USDA numbers in the reference. Please refer to row 90, 91, and 96 in tab 4.1 of the updated calculator (attached to the email).* **Orchard, Vine, Vegetable Properties** NSF compared the fuel consumption rates for orchard, vine, and vegetable crops to a reference dataset ("Analysis of California's Diesel Agricultural Inventory according to Fuel Use, Farm Size and Equipment Horsepower", California Air Resources Board, 2018). The fuel consumption rates used in the HAIG GHG inventory for these crop types was significantly different than the average rate published in the CARB report: Crop Type — HAIG (gal/acre) — CARB (gal/acre) Apple/Olive — 59 — 28 Grape — 14 — 28 Vegetable — 25 — 37 Based on the fuel consumption rates shown above, the estimated GHG emissions associated with fuel consumption are as follows: Crop Type — Acres — HAIG (CO2e) — CARB (CO2e) Apple/Olive — 304 — 254 — 121 Grape — 7859 — 2792 — 5584

Vegetable	5594	6811	10,016

Total predicted error for under-estimated fuel consumption from leased apple, olive, grape, and vegetable properties is 5864 tonnes CO2e.

1) Apple/Olive

In terms of the 304 acres of Apple/Olive (highlighted below), it includes 33 acres of apple in Oregon + 271 acres of Olive in California.

- *For the 33 acres of apple in Oregon, we think it would be more accurate to use the current approach in HAIG inventory because:*
  - *The rate in HAIG inventory is specific for apple, as opposed to the aggregated rates for tree fruit in the CARB report.*
  - *Oregon is geographically closer to Washington as opposed to California, so it is likely that the climate and soil characteristics in Oregon is similar to Washington. Therefore, Washington apple's fuel consumption rate would be more representative for apple farms in Oregon.*

- *For the 271 acres of Olives, we have updated the calculator using the tree fruit number from the CARB report you provided. Please refer to row 99 in tab 4.1 of the updated calculator.*

2) Grape

Similar to our responses to corn, soybean, corn/soybean above, we agree that the fuel consumption rate for grape in HAIG inventory comes from a small sample of HAIG farms and it may not be representative for the rest of the grape farms. As such, we have updated the calculator using the grape number from the CARB report. Please refer to row 93 and 94 in tab 4.1 of the updated calculator.

3) Vegetable

We checked the CARB report you provided, it seems like the fuel consumption rate of 37 gal/acre is for machine-picked vegetables (Figure 3.3). However, we also noticed that a rate for hand-picked vegetables has been provided, which is 32 gal/acre.

As indicated in table 2.3 of the same CARB report (screenshot below), there is a certain amount of hand-picked vegetables in California. Therefore, we were thinking it would be more "accurate" if we use the average of (32, 37) as opposed to 37 for this estimate.

Table 2.3 Survey Representation by Commodity Group

Commodity	Number of Surveys	Percent of Statewide Commodity Acres in the Survey
Nut Crops	506	13%
Hay, Forage, Pasture, Grains	474	15%
Grapes	413	9%
Tree Fruit	226	6%
Citrus	166	23%
Row Crops	136	16%
Vegetables, hand-picked	87	15%
Vegetables, machine-picked	29	8%
Beef Cows[3]	71	N/A*
Nursery, Greenhouse, Floriculture	37	N/A*
Milk Cows	12	N/A*

		We have updated the calculator using the average of (32,37) for the estimation (please refer to row 102 in tab 4.1 of the updated calculator). **Total predicted error due to fuel consumption estimates for leased properties is 20,667 tonnes CO2e (7.6% of GHG Assertion).** An updated version of the HAIG GHG inventory calculation spreadsheet was provided to NSF on April 23, 2021. ***With all the above changes, HAIG's total emissions decreased from 272,604 tonnes CO2e to 246,380 tonnes CO2e (reduced by 26,224 tonnes CO2e).*** NSF accepts the explanations and GHG inventory updates provided by HNRG on April 23, 2021.

6. Material Misstatement Assessment

No material misstatements were identified by NSF in this verification engagement.

7. Conclusions with Respect to Data Quantification Including Qualifying Comments

Based on the verification process and procedures conducted by NSF, there is no evidence that the GHG Assertion:

- is not materially correct; and
- is not a fair representation of GHG data and information; and
- has not been prepared in accordance with the stated criteria.

8. Verification Statement

A copy of the verification statement issued by NSF for this engagement is provided as Appendix C to this verification report and as a stand-alone document.

APPENDIX A: Verification Plan

NSF Greenhouse Gas Validation/Verification Plan

Client Name:	Hancock Natural Resource Group	**FRS #:**	C0588203
Lead Verifier:	Stephen Boles	**Task #:**	T6736451
Team Verifier:	0	**Date (current rev):**	4-May-2021
		Initials indicating Lead Verifier approval of plan:	SB

Engagement: HAIG 2020 Corporate GHG Inventory Verification

Objective: To provide limited assurance to the stakeholders of Hancock Agricultural Investment Group (HAIG) that there is no evidence that the GHG Assertion made by HAIG is not materially correct and is not in conformance with the stated criteria.

Scope:

Entries are required for all scope elements a-e.

a) Organizational boundaries or the GHG project and its baseline scenarios

GHG emissions from HAIG's network of agricultural properties (direct-operated and leased) in the USA, Canada, and Australia.

b) Physical infrastructure, activities, technologies and processes of the organization or the GHG project

Hancock Natural Resouce Group (HNRG) manages farmland and timberland portfolios through several investment structures for institutional investors, including public and private pension funds, foundations and endowments, high net-worth individuals, and Taft-Hartley plans.

HNRG's agricultural investment manager, referred to as HAIG, manages agricultural properties in USA, Canada, and Australia. The portfolio includes a mix of both direct-operated and leased properties. A wide range of crop types are farmed in the HAIG portfolio, including almonds, pistachios, rice, cotton, corn, soybeans, grapes, cranberries, and more.

The HAIG GHG inventory includes emissions from energy combustion (fossil fuel, electricity) and other emissions specific to agricultural land management (N2O release from fertilizer applications, CH4 emissions from rice water management, CH4 and N2O emissions from burning of crop residue biomass, CO2 emissions from lime/urea applications).

c) GHG sources, sinks and reservoirs

SCOPE 1 & SCOPE 2 GHG SOURCES (from direct-operated properties):

Scope 1:

1. Fuel combustion (stationary and mobile sources)
2. Nitrogen application from fertilizers
3. Biomass combustion (CH4 and N2O only)
4. Lime and urea applications (CO2 only)

Scope 2:

1. Electricity consumption

SCOPE 3 SOURCES (from leased properties):

1. All Scope 1 and Scope 2 GHG sources listed above occurring on leased properties
2. Methane (CH4) emissions from water management on leased rice properties

No GHG sinks or reservoirs are being reported in HAIG's 2020 GHG inventory, however in future years the soil carbon sink will be reported when the quantification methodology is refined and uncertainty is reduced.

d) Types of GHGs

CO2, CH4, N2O

e) Time periods

January 1 2020 - December 31 2020

Criteria:

WRI/WBCSD GHG Protocol Corporate Accounting and Reporting Standard
GHG Protocol Agricultural Guidance supplement
ISO 14064-1 (2018)
IPCC Guidelines for National Greenhouse Gas Inventories 2019 Refinement

Materiality: 10% of total reported Scope 1 + Scope 2 + Scope 3 GHG emissions

Level of Assurance:

_____ Reasonable
__x__ Limited

Use of Marks:

_____ The Responsible Party **does use** NSF or accreditation body marks and will be assessed against requirements for use.
__x__ The Responsible Party **does not use** NSF or accreditation body marks and will not be assessed against requirements for use.

Per-Product Unit Assertions:

_____ The Responsible Party **does assert** per unit of product emissions, and has met IAF MD6 A.1.2 requirements.
__x__ The Responsible Party **does not assert** per unit of product emissions.

Tentative Schedule of Activities

April 1 2021	Notification Letter sent to client
March 29 - April 2, 2021	Document Review
April 6 2021	Document Review Letter sent to client

April 8 2021	Kick-Off Meeting / On-Site Planning Audit Meeting
April 9 2021	Verification Plan sent to client
April 12-13, 2021	Verification Audit (no virtual site visit planned for Verification Audit phase)
April 14-16, 2021	Preparation of Draft Verification Report and Statement
April 19 - 21, 2021	Independent Review
23-Apr-21	Delivery of draft verification report and statement to client

Sampling Plan

		Owned				Leased				
Country	Region	properties	tonnes GHG	% of pop'n	Sample props.	properties	tonnes GHG	% of pop'n	Sample props.	Crop types
USA	Arkansas	0	0	0.0		25	81741	30.0	3	rice, corn, soybean
	California	10	23224	8.5	2	26	3515	1.3		grapes, nuts
	Florida	0	0	0.0		6	2746	1.0		peanut, vegetable
	Georgia	0	0	0.0		8	7375	2.7		cotton
	Idaho	0	0	0.0		6	4315	1.6		potato, barley, alfalfa
	Illinois	0	0	0.0		33	16581	6.1	1	corn, soybean
	Indiana	0	0	0.0		4	1557	0.6		corn, soybean
	Louisiana	0	0	0.0		7	20201	7.4	1	rice
	Michigan	0	0	0.0		5	1763	0.6		corn, soybean
	Mississippi	0	0	0.0		12	16797	6.2	1	rice, corn, soybean
	Nebraska	0	0	0.0		4	4002	1.5		corn, soybean
	North Carolina	0	0	0.0		1	723	0.3		cotton
	Ohio	0	0	0.0		4	1537	0.6		corn, soybean
	Oregon	1	35	0.0		2	380	0.1		apples, alfalfa
	Texas	0	0	0.0		9	33744	12.4	1	corn, soybean
	Washington	1	5415	2.0	1	5	5459	2.0		apples, potato, wheat
	Wisconsin	13	3621	1.3	1	8	18245	6.7	1	corn, soybean, vegetable, cranberry
Canada	Alberta	0	0	0.0		6	3142	1.2	1	canola, wheat
	Ontario	0	0	0.0		1	1341	0.5		corn, soybean
	Quebec	1	626	0.2		0	0	0.0		cranberry
Australia	New South Wales	3	8318	3.1	1	0	0	0.0		almond
	Queensland	1	3025	1.1	1	0	0	0.0		cotton
	South Australia	2	2196	0.8		1	628	0.2		almond

APPENDIX B: Results of Verification Risk Assessment

Risk #	Observed Potential Risk	Verification Approach	Verification Finding
1	Incomplete version control in methodology document: 1.change log (section 1.4) does not contain date of revisions or responsible party 2. Doc. version referenced in change log does not appear anywhere else in document (including file name)	Data management system will be reviewed by NSF through: 1.interviews with HNRG and Delphi staff 2. inspection of evidence of data quality and management process being implemented	Results of NSF assessment of data management system used for HAIG GHG inventory is described for Risk #8 below. The following opportunity for improvement was identified pertaining to version control of the methodology document and GHG inventory spreadsheet: HNRG is encouraged to implement a proper version control system to manage its HAIG GHG inventory products, including the methodology document and the inventory spreadsheet. The version control should include a section in the methodology and spreadsheet that provides the number of each version, a description of updates for that version, and the person responsible for the update. The version number should also be included in the naming of the methodology document and inventory spreadsheet.
2a	Completeness of list of GHG SSRs included in reported GHG Assertion: 1. Exclusion of soil carbon sequestration from reported GHG inventory (soil carbon is a potentially significant source of GHG reductions for agricultural projects)	NSF will review the reasons for excluding soil carbon sequestration with HNRG and Delphi. NSF will determine the appropriate form of the verification statement if soil carbon sequestration is excluded from verified and reported totals	Soil carbon sequestration is recognized by HNRG as a significant source of GHG reductions. It is being quantified by HNRG currently using an emission factor approach. HNRG intends to begin including soil carbon GHG reductions in the reported GHG inventory in future years when the methodology has been revised and the accuracy has been improved. HNRG and Delphi are currently developing a model-based quantification approach for soil carbon sequestration that they claim is much more accurate than the current method. During the on-site planning audit meeting with HNRG, NSF discussed the options for addressing the exclusion of soil carbon sequestration from the verified and reported GHG total. NSF raised the issue that the excluded soil carbon would be addressed using one of the following methods in the verification statement: 1. It would be a recognized limitation in the statement 2. The statement would be modified or qualified
2b	Completeness of list of GHG SSRs included in reported GHG Assertion: 2. Natural gas consumption is calculated for a very small number of the HAIG properties	An email was sent to HNRG and Delphi on April 12 2021 regarding the issue. This issue will be considered closed when an updated version of the GHG inventory spreadsheet with Wisconsin natural gas is provided to NSF. *(updated spreadsheet provided by HNRG on April 21, 2021)*	*The green text below is the emailed response received from Delphi on April 13 2021:* NG - For direct operate properties • California and Quebec properties have reported natural gas use. • Australia properties do not need heating so they do not use natural gas as well. • As for Washington and Wisconsin, we have confirmed with property managers in both states that they do not use natural gas, because the farms are in remote locations, and they do not have access to natural gas pipelines. Instead, for both states, they use propane for heating. • Washington's propane consumption has already been captured in the current inventory. • As for Wisconsin, we did realize that propane consumption used for heating (for homes that are owned by HNRG but rented to HNRG employees) has been missed in the current inventory. The Wisconsin property manager has reached out to propane vendors to ask for the 2020 consumption data, and we will include it in the calculator as

			soon as we have it. Please also note that: 1) electricity consumption from these homes has already been included in the current inventory; and 2) HNRG is responsible for paying utility bills for these homes. For leased properties We have only collected data for some rice properties, but do not have HNRG specific activity data for other row crop properties. *This explanation is acceptable to NSF.*
2c	Completeness of list of GHG SSRs included in reported GHG Assertion: 3. The estimated fuel consumption for leased properties (where internal survey data is not used for average consumption rates) only includes diesel consumption - natural gas and gasoline is omitted even though the source references report consumption of these fuels	When analyzing the source document for the estimated fuel combustion on leased corn/soybean/wheat/cotton properties, inspection of Figure 5 seems to show that gasoline + natural gas consumption are approx. 20 – 30% of diesel consumption for these crop types. The HAIG inventory only estimates diesel consumption for corn/soybean/wheat/cotton – please explain why gasoline and NG are excluded. Email sent to HNRG and Delphi on April 14 2021 regarding the issue.	*The green text below is the emailed response received from Delphi on April 16 2021:* 1) For leased corn/soybean/cotton properties that we do not have actual fuel use, we firstly looked at if we have the actual HAIG specific information available (note that actual HAIG activity data was collected from all direct operate and some rice properties.). If so, we would use the same information (i.e. fuel consumption rate) and apply it to leased properties with the same crop type. - Some direct operate properties grow both almond and cotton. As such, fuel consumption rate from almond/cotton properties was used for the estimation. (Please refer to row 92 in tab 4.1 of the calculator.) - Some rice properties also grow corn and soybean. a) For corn, we do have the actual fuel consumption rate specifically from corn properties. (Please refer to row 90 in tab 4.1 of the calculator.); b) For corn/soybean properties, we used average fuel consumption rate from rice/corn/soybean properties. (Please refer to row 91 in tab 4.1 of the calculator.) *Fuel consumption rates for leased corn, soybean, and corn/soybean properties are suspected to be significantly overestimated. For each of these crop types, fuel consumption was estimated based on a small sample of known fuel consumption rates reported for the same crop type within the HAIG portfolio. The fuel consumption rates used in the HAIG GHG inventory for these crop types was significantly greater than the average rate published by the USDA in the Bulletin Number 159 document used by HNRG for fuel consumption rates of other crop types:* *Crop Type — HAIG GHG Inventory (gallons/acre) — USDA (gallons/acre)* *Corn — 24 — 6* *Soybean — 24 — 6* *Corn / soybean — 45 — 6* *Note that NSF assumes that the fuel consumption rate for a 'corn/soybean' rotation would be the same as the average rate for the single rotation corn and soybean crops. Based on the fuel consumption rates shown above, the GHG emissions associated with fuel consumption are as follows:* *Crop Type — Acres — HAIG (CO2e) — USDA (CO2e) — Difference (CO2e)* *Corn — 45,781 — 11,488 — 2872 — 8616* *Soybean — 14,717 — 3676 — 919 — 2757* *Corn / soybean — 37,228 — 17,490 — 2332 — 15,158* ***TOTAL — 26,531***

Total predicted error from over-estimated fuel consumption from leased corn, corn/soybean, and soybean properties is 26,531 tonnes CO2e.

Orchard, Vine, Vegetable Properties

NSF compared the fuel consumption rates for orchard, vine, and vegetable crops to a reference dataset ("Analysis of California's Diesel Agricultural Inventory according to Fuel Use, Farm Size and Equipment Horsepower", California Air Resources Board, 2018). The fuel consumption rates used in the HAIG GHG inventory for these crop types was significantly different than the average rate published in the CARB report:

Crop Type	*HAIG (gal/acre)*	*CARB (gal/acre)*
Apple/Olive	*59*	*28*
Grape	*14*	*28*
Vegetable	*25*	*37*

Based on the fuel consumption rates shown above, the estimated GHG emissions associated with fuel consumption are as follows:

Crop Type	*Acres*	*HAIG (CO2e)*	*CARB (CO2e)*
Apple/Olive	*304*	*254*	*121*
Grape	*7859*	*2792*	*5584*
Vegetable	*5594*	*6811*	*10,016*

Total predicted error for under-estimated fuel consumption from leased apple, olive, grape, and vegetable properties is 5864 tonnes CO2e.

Total predicted error due to fuel consumption estimates for leased properties is 20,667 tonnes CO2e over-statement (7.6% of GHG Assertion).

Corn & soybean properties

Thank you for the cross-checking. We agree that the fuel consumption rate for corn, soybean, and corn/soybean in HAIG inventory comes from a small sample of HAIG's farms and may not be representative for the rest of the corn and soybean farms. As such, we have updated the calculator using the USDA numbers in the reference. Please refer to row 90, 91, and 96 in tab 4.1 of the updated calculator (attached to the email).

Orchard, Vine, Vegetable Properties

Apple/Olive

In terms of the 304 acres of Apple/Olive (highlighted below), it includes 33 acres of apple in Oregon + 271 acres of Olive in California.

- For the 33 acres of apple in Oregon, we think it would be more accurate to use the current approach in HAIG inventory because:
  - The rate in HAIG inventory is specific for apple, as opposed to the aggregated rates for tree fruit in the CARB report.
  - Oregon is geographically closer to Washington as opposed to California, so it is likely that the climate and soil characteristics in Oregon is similar to Washington. Therefore, Washington apple's fuel consumption rate would be more representative for apple farms in Oregon.

- For the 271 acres of Olives, we have updated the calculator using the tree fruit number from the CARB report you provided. Please refer to row 99 in tab 4.1 of the updated calculator.

Grape

Similar to our responses to corn, soybean, corn/soybean above, we agree that the fuel consumption rate for grape in HAIG inventory comes from a small sample of HAIG farms and it may not be representative for the rest of the grape farms. As such, we have updated the calculator using the grape number from the CARB report. Please refer to row 93 and 94 in tab 4.1 of the updated calculator.

Vegetable

We checked the CARB report you provided, it seems like the fuel consumption rate of 37 gal/acre is for machine-picked vegetables (Figure 3.3). However, we also noticed that a rate for hand-picked vegetables has been provided, which is 32 gal/acre.

As indicated in table 2.3 of the same CARB report (screenshot below), there is a certain amount of hand-picked vegetables in California. Therefore, we were thinking it would be more "accurate" if we use the average of (32, 37) as opposed to 37 for this estimate.

Table 2.3 Survey Representation by Commodity Group

Commodity	Number of Surveys	Percent of Statewide Commodity Acres in the Survey
Nut Crops	506	13%
Hay, Forage, Pasture, Grains	474	15%
Grapes	413	9%
Tree Fruit	226	6%
Citrus	166	23%
Row Crops	136	16%
Vegetables, hand-picked	87	15%
Vegetables, machine-picked	29	8%
Beef Cows[3]	71	N/A*
Nursery, Greenhouse, Floriculture	37	N/A*
Milk Cows	12	N/A*

We have updated the calculator using the average of (32,37) for the estimation (please refer to row 102 in tab 4.1 of the updated calculator).

With all the above changes, HAIG's total emissions decreased from 272,604 tonnes CO2e to 246,380 tonnes CO2e (reduced by 26,224 tonnes CO2e).

NSF accepts the explanations and GHG inventory updates provided by HNRG on April 23, 2021.

NSF is issuing the following Opportunity for Improvement regarding the estimated fuel consumption methodology in Appendix VIII of the methodology document

HNRG is encouraged to update Appendix VIII in the HAIG GHG methodology document with an updated description of the fuel consumption estimations for corn, soybean, olives, grapes, vegetables.

			- For wheat, we do not have actual HAIG specific data, so reference data was used. Please refer to row 98 in tab 4.1 of the calculator, with the link to the original reference provided. *This approach was confirmed by NSF as being applied as described. NSF accepts this methodological approach for estimating fuel consumption on leased corn and corn/soybean properties.* *NSF is issuing the following Opportunity for Improvement regarding the estimated fuel consumption methodology for wheat leased properties:* *HNRG is encouraged to update Appendix VIII in the HAIG GHG methodology document with a description of how the data from USDA energy consumption publication (Bulletin Number 159) is converted from dollars/acre to gallons/acre.* 2) In fact, we did consider gasoline and propane when estimating fuel consumption for leased properties. However, instead of using the actual consumption breakdowns, we "converted" all propane and gasoline into "diesel" using their respective heating values and the equation below (you can find it on page 60 of methodology document as well as row 230 in tab 2.1 of the calculator): $$Consumption\ rate_{Diesel} = \frac{\sum_{i=1,j=1}^{i=n,j=m} Fuel\ consumption_{i,j} \times Fuel\ heating\ value_{i,j}}{Diesel\ heating\ value \times \sum_{i=1}^{n} Acre_i}$$ There are two reasons that we were using this approach: 1) the specific types of fuel could vary significantly from one farm to another (depending on the farm characteristic, location, crop type, equipment type, etc.), and we were not able to get the accurate breakdowns between diesel, gasoline and propane consumption for leased properties. 2) based on the actual information we received for direct operate properties, the most commonly used fuel for the farms is diesel. Therefore, we assumed the diesel is the only fuel that is used by leased properties. However, the "diesel" does not only include diesel, but also propane and gasoline as explained above. *This explanation is acceptable to NSF.* Based on the actual data received from direct operate properties, natural gas was only consumed in California and Quebec. When we looked at the responses received from property managers more closely, it seems like the practices in California and Quebec may not be applicable to other regions. • California: the natural gas usage is for Ag Wells on some of the new properties in the southern region. • Quebec: it is used for heating and air conditioning for the office and food processing plant (note that there is a cranberry food processing facility in Quebec, which is the only food processing facility that is operated by HAIG). As such, we did not estimate natural gas usage for leased properties. In addition, it seems like most of the farms are in remote locations, and do not have access to natural gas pipeline. In those cases, heat is provided by propane, which has likely been captured. *This explanation is acceptable to NSF.*

3	Consistency and accuracy of emission factors and conversion equations used	Confirm all emission factors used against original sources Confirm accuracy of conversion equations used	Emission Factors NSF assessment results presented in verification file "HAIG 2020 EF Check.xls". All emission factors were confirmed against the original source document. Conversion Equations NSF assessment results presented in verification file "HAIG 2020 EF Check.xls". All conversion equations were confirmed as accurate. One opportunity for improvement was identified: *NSF is issuing the following Opportunity for Improvement regarding the consistency and accuracy of emission factors and conversion equations:* HNRG is encouraged to include the source of conversion equations used for volume-to-energy conversions (e.g. m3 natural gas to kWh) as these conversions are based on assumptions for variables such as pressure that should be traceable for the verifier.
4	The HAIG methodology does not include N emissions from manure	NSF to investigate publicly-available statistics on manure application rates for states & crops present in HAIG GHG inventory NSF to conduct interview with HNRG and Delphi representatives to assess rationale for exclusion of manure N applications	NSF reviewed statistics published by the US EPA on manure-based nitrogen application rates in the USA for each state (https://www.epa.gov/nutrient-policy-data/estimated-animal-agriculture-nitrogen-and-phosphorus-manure). The US EPA statistics confirmed that manure is a significant source of nitrogen applications in the states that HAIG is active. Based on the review of the US EPA statistics NSF raised the issue of excluded manure nitrogen with HNRG and Delphi in the on-site planning audit meeting. HNRG stated that no livestock is raised on any of the HAIG direct-operated or leased properties, therefore the likelihood of manure nitrogen applications was deemed to be minimal. *NSF accepts this explanation for excluded manure nitrogen.*
5	Assignment of 'wet' or 'dry' climate type has been incorrectly assigned	NSF to assess the process used by HNRG and Delphi to assign climate type for properties NSF to determine the 'All' climate type that is listed in the fertilizer calculation worksheet of the HAIG inventory spreadsheet	The assignment of climate type (wet or dry) impacts the emission factors used for nitrogen-based GHG emissions. Climate types are defined in the IPCC guidelines and are based on a combination of precipitation and evapotranspiration data. If the climate variables are not known for a particular location then an aggregated climate type (with averaged nitrogen emission factors) should be assigned. The process used by HNRG and Delphi for defining the climate type of direct-operated properties with precisely-know spatial location is described in the GHG methodology document and is determined by NSF to be appropriate. NSF identified that the majority of leased properties in the HAIG inventory have a climate type described as 'All'. NSF raised this issue of the 'All' climate type in the on-site planning meeting. HNRG and Delphi stated that 'All' climate indicates that aggregated emission factors were used for these properties, as the spatial location of the property was not known to the level of detail that the precise 'wet' or 'dry' assignment could be made. *NSF accepts this explanation and has determined that it is in conformance with the IPCC guidelines for assignment of climate type.*
6	Methodology for estimation of N inputs and energy consumption for leased properties is reasonable and is being applied consistently and accurately	Appendix VIII of the methodology document describes the process for estimating fossil fuel combustion on leased properties. It states that the fossil fuel consumption for vegetable and olive properties would be based on direct-operated apple properties.	Similar to the response to Question 2, the “diesel” here not only included diesel, but also propane and gasoline. We “converted” propane and gasoline to diesel using their heating values, that means, all energy consumed has been captured. *This approach was confirmed by NSF as being applied as described. NSF accepts this methodological approach for estimating fuel consumption on leased vegetable and olive properties.*

	(for properties where N applications and energy consumption are based on averaged survey data of direct-owned properties)	Six leased vegetable or olive properties in the GHG inventory only have diesel combustion estimated, even though there are Wisconsin direct-operated apple properties with diesel, gasoline, and propane consumption reported. Please explain why the gasoline and propane consumption from the apple properties is not being applied to the leased vegetable and olive properties.	*NSF is issuing the following Opportunity for Improvement regarding the documented fuel consumption methodology for vegetable leased properties:* *HNRG is encouraged to update Appendix VIII in the HAIG GHG methodology document, as the current version of the document has an incorrect description of the methodology used for estimating fuel consumption in leased vegetable properties. The current version of Appendix VIII states that the fuel consumption for vegetable properties is estimated using the apple fuel consumption rate obtained for direct-operated apple properties. However in the inventory spreadsheet the fuel consumption for vegetable leased properties is estimated using the average consumption reported from known direct-operated soybean properties in the HAIG portfolio.*
7	Methodology for estimation of N inputs and energy consumption for leased properties is reasonable and is being applied consistently and accurately **(for properties where N applications and energy consumption are based on USDA data or other public references)**	Based on verification sampling plan: • NSF to confirm N application rate and energy consumption against original source (e.g. USDA) • NSF to determine that the estimated N application rate and energy consumption is being properly applied based on crop type and region	For all properties in the verification sampling plan: 1. NSF confirmed the N application rate against the original source 2. NSF confirmed that the estimated N application rate and energy consumption is being appropriately applied in the GHG inventory spreadsheet as per HNRG's rules determined by crop type and region. NSF's verification of the source data for energy consumption estimates revealed a likely overestimation of fuel consumption for leased properties. This issue is addressed in Risk #2c and was appropriately addressed by HNRG in the updated version of the GHG inventory provided to NSF on April 23, 2021.
8	Data management system and procedures for identifying errors is effective and being appropriately applied	Data management system will be reviewed by NSF through: 1. interviews with HNRG and Delphi staff 2. inspection of evidence of data quality and management process being implemented	NSF conducted a review of HNRG's data management system for the HAIG GHG inventory. Details on the HAIG GHG inventory data management system were obtained from the following sources: 1. Interview with HNRG and Delphi representatives during the on-site planning audit meeting conducted on April 8 2021 2. Review of the HAIG GHG methodology document where the data management system is described 3. Review of supporting evidence that corroborates the implementation of the data management system, including: - completed surveys from direct-operated properties - email exchanges between HNRG, Delphi, and farm property managers - Delphi's data tracking spreadsheet: this is a consolidated and detailed 'issues log' at the farm property level that describes issues observed, email exchanges, and issue resolutions The data management system for the HAIG GHG inventory is a function of the parties described below: <u>HNRG Sustainability Manager</u> Overall coordination of the HAIG GHG inventory project including: - decision-making on inventory parameters, - scheduling and initiation of annual farm survey data request to managers of direct-operated properties, - oversight of communications between farm property managers and third-party consultants, - review of reasonableness of data reported by farm property managers - engagement with property managers if data issues arise

			Managers of Direct-Operated Properties - management, collection, and reporting of consolidated GHG inventory activity data (fuel consumption, electricity consumption, N applications, etc.) through the annual farm data surveys circulated by HNRG - quality control procedures including review and reconciliation by multiple levels of administration (e.g. Farm Manager, Operations Manager, Regional Manager) Third Party Consultants (Delphi) - development and on-going management and updating of HAIG GHG methodology document and GHG inventory spreadsheet - processing and analysis of completed data collection surveys filled out by managers of direct-operated properties - maintenance of the HAIG data tracking spreadsheet Based on NSF's review of the HAIG GHG inventory data management system, it is NSF's opinion that the procedures in place for identifying errors or issues is effective. *The following opportunity for improvement has been identified by NSF pertaining to the HAIG GHG data management system:* In the HAIG GHG methodology document, HNRG is encouraged to prepare a more detailed description of the data management system and associated QA/QC procedures. Section 6 of the GHG methodology document is a dedicated section for describing the GHG inventory's data management system, but the section is currently lacking in detail and directs the reader to the appendices of the report. The methods used to describe the data management procedures in the appendices are inconsistent in terms of their detail and terminology. HNRG should utilize Section 6 of the GHG methodology document to prepare a detailed description of the full HAIG inventory data management system and associated QA/QC procedures.
9	HAIG has chosen to report market-based Scope 2 GHG emissions using the same emission factors used for location-based Scope 2 GHG emissions. This is based on the fact that HNRG does not have any contractual arrangements for RECs or other power-purchase agreements in place with electricity suppliers that would contain supplier-specific GHG emission factors.	NSF to review GHG Protocol to assess whether HAIG's interpretation of market-based Scope 2 reporting is correct and in conformance with The GHG Protocol	Multiple NSF representatives met to discuss the handling of market-based Scope 2 emissions on April 9 2021. It was decided that the GHG Protocol's Scope 2 guidance document is written in such a way that NSF can issue a non-qualified verification statement of HAIG's Scope 2 market-based emissions (assuming that the rest of the verification engagement allows for a positive statement to be issued). The decision was based on the following sentence from Section 6.11 of the GHG Protocol Scope 2 guidance: "If companies have access to multiple market-based emission factors for each energy consuming operation, they should use the most precise for each operation based on the list in Table 6.3." The use of the word 'should' in the statement gives HNRG leeway on how to report their market-based Scope 2, and gives NSF leeway on how to assess and verify the reported Scope 2. If the guidance had used the word 'shall' in the sentence above then HNRG would be required to look for supplier-specific emission factors or a qualified verification statement would have to be made.
10	Determination of accuracy of GHG emissions from biomass combustion and lime application	An email was sent to HNRG and Delphi on April 12 regarding the issue. Delphi responded on April 13	*The green text below is the emailed response received from Delphi on April 16 2021:* Biomass:

		2021 and reported the following figures: <u>Biomass</u> • 2019 biomass burning GHG = 11,842 tonnes CO2e (assumed biogenic CO2 + CH4 + N2O) • 2020 biomass burning GHG = 1871 tonnes CO2e (biogenic CO2 + CH4 + N2O) This is an 84% reduction in biomass burning GHG from 2019 to 2020 – is this reasonable? Was this reduction investigated for its cause? How is this massive reduction explained? <u>Lime / Urea</u> • 2019 lime application GHG = 12,643 tonnes CO2e • 2020 lime application GHG = 5011 tonnes CO2e This is 60% reduction in lime application GHG from 2019 to 2020 – is this reasonable? Was this reduction investigated for its cause? How is this massive reduction explained?	The big emission drop for biomass combustion between the 2019 and 2020 inventories was primarily attributed to the methodology / activity data collection procedure update occurred for the 2020 inventory. The activity data used for the 2019 GHG inventory was solely based on assumption / estimation, but not based on the actual practices at HAIG's farm properties. In addition, from a conservative / safe perspective, we did assume that all properties had biomass combustion, which in fact, was not the reflection of the actual situation. For example, based on the surveys that we received from property managers for direct operate and some rice properties, most properties did not have biomass combustion at all. Even though some properties reported biomass combustion, the amount was very small. This explains why there has been a big drop between the 2019 and 2020 emissions. *This explanation is acceptable to NSF.* <u>Lime / Urea</u> The 12,643 tonnes were based on the assumption that <u>all</u> properties had lime usage. However, similar to biomass, based on the actual information collected from the direct operation and rice property managers, lime is rarely used by HAIG. In fact, the majority of the 5,011 tonnes of CO2e emissions was attributed to urea application, which was not captured previously. *This explanation is acceptable to NSF.*
11	Calculation of GHG emissions from N applications in Australian direct-operated properties	N applications for Australia direct-operated properties are determined based on a mass balance approach (difference between start and end of year fertilizer stocks plus purchases). This is different than the volume application approach used in other regions. NSF to determine that the mass balance approach is acceptable based on the IPCC methodology.	NSF reviewed the IPCC guidelines to determine if the mass balance approach is an acceptable methodology to use for fertilizer N application rates. Section 11.2.1.3 of Volume 4 of the IPCC guidelines ("Choice of Activity Data") specifically reference fertilizer sales data as an appropriate type of activity data to use for N application rates.
12	GHG inventory spreadsheet calculation accuracy	NSF to review HAIG GHG inventory spreadsheet to confirm the accuracy of all calculations used in the Assertion and agreement with the Methodology document	Calculations in the HAIG GHG inventory spreadsheet were reviewed by NSF using the following verification procedures: 1. The sample plan farm properties were used to trace the calculations performed for each source of GHG emissions in the GHG inventory spreadsheet. This analysis confirmed that the spreadsheet calculations for individual sources of GHG are functioning appropriately. 2. In the HAIG inventory spreadsheet, total GHG emissions for each source of GHG were tracked from the individual GHG calculation worksheets to the main inventory summary worksheet to confirm that all summary totals are being appropriately calculated. 3. All calculations embedded in the individual GHG calculation worksheets were assessed against the GHG methodology document to confirm they have been developed as per the HAIG methodology. NSF's assessment of the spreadsheet calculations did not reveal any issues or concerns.

<table>
<tr>
<td>13</td>
<td>Assess the impact and data collection procedure for N applied through fertilizer and irrigation water in California</td>
<td>NSF to determine the following:

1. What is the contribution of N applied through irrigation water compared to fertilizer in California?

2. Are instances where the planned N application rates are used in the GHG calculations instead of the actual rates logged in the HAIG GHG inventory database? Does HNRG have an understanding of how much the planned rates are used in the GHG calculations and what the discrepancy between planned vs actual rates are?</td>
<td>The green text below is the emailed response received from Delphi on April 16 2021:

1) The nitrogen fertilizer added to the irrigation system has already been included in the fertilizer quantities that are being reported and already accounted for in the inventory.

The “annualized” nitrogen in irrigation water is much smaller compared to nitrogen in applied fertilizers. I randomly picked four 2019 INMPs (nutrient management plan) received from different locations in California, and summarized the nitrogen rates below. Depending on the location, the contribution of nitrogen in irrigation water varies, but typically it represents <5% of total nitrogen applied.

<table>
<tr><th>Property</th><th colspan="2">Planned (lbs/acre)</th><th colspan="2">Actual (lbs/acre)</th><th>Actual</th></tr>
<tr><th></th><th>In Irrigation water</th><th>In Fertilizer</th><th>In Irrigation water</th><th>In Fertilizer</th><th>Irrigation N / (Irrigation N + Fertilizer N)</th></tr>
<tr><td>Madera 10</td><td>10</td><td>176.8</td><td>2.56</td><td>185.61</td><td>1.4%</td></tr>
<tr><td>Kern Tulare</td><td>10</td><td>180</td><td>0.16</td><td>133.51</td><td>0.1%</td></tr>
<tr><td>Tulare 8</td><td>5</td><td>100</td><td>2.85</td><td>127.27</td><td>2.2%</td></tr>
<tr><td>Shasta Ash Creek</td><td>6</td><td>110</td><td>0.96</td><td>97.2</td><td>1.1%</td></tr>
</table>

This explanation is acceptable to NSF.

2) For all direct operate properties and some rice properties that have reported nitrogen application amounts, those are all based on actual consumption, but not on planned amount.

This explanation is acceptable to NSF.</td>
</tr>
<tr>
<td>14</td>
<td>Robustness of the data management procedure used for leased rice properties</td>
<td>Appendix I-VI of the GHG methodology document describes the data management procedure for leased rice properties. The procedure uses a high number of soft terms such as 'should', 'could', and 'would'.

HNRG / Delphi: Please describe whether the procedures described in Appendix I-VI are actually implemented or are they a planned / desired outcome (not the current condition).</td>
<td>The green text below is the emailed response received from Delphi on April 16 2021:

The procedures described in appendix I-VI (Regional Data Collection Procedures for Leased Delta US Rice Properties, prepared by Joseph Bell) are what are implemented, and should reflect the current condition. Unlike direct operate properties, HAIG does not have a robust tracking record of activities on leased properties. Instead, the regional manager collected the information from conservations with farmers via phone calls, emails, etc., and complied all the information together.

This explanation is acceptable to NSF.</td>
</tr>
</table>

APPENDIX C: Verification Statement

Verification Statement (GHG Inventory)

Greenhouse Gas Validation/Verification Program

Independent Assurance Statement for Hancock Natural Resource Group on its emissions of carbon dioxide, methane, and nitrous oxide from the Hancock Agricultural Investment Group (HAIG) for the year ending 31 December 2020.

To the Management of:

Hancock Natural Resource Group
197 Clarendon St.
Boston, MA 02116
USA

Mr. Brandon Lewis
Associate Director, Sustainability
Hancock Natural Resource Group
Boston, MA

Introduction

Hancock Natural Resource Group (HNRG) engaged NSF to verify its emissions of carbon dioxide, methane, and nitrous oxide from the Hancock Agricultural Investment Group (HAIG) reported in accordance with the requirements of the WBCSD/WRI GHG Protocol (Chapter 9) for the year ending 31 December 2020. HNRG manages farmland and timberland portfolios through several investment structures for institutional investors, including public and private pension funds, foundations and endowments, high net-worth individuals, and Taft-Hartley plans. HNRG's agricultural investment manager (HAIG), manages agricultural properties in USA, Canada, and Australia. The portfolio includes a mix of both direct-operated and leased properties. A wide range of crop types are farmed in the HAIG portfolio, including almonds, pistachios, rice, cotton, corn, soybeans, grapes, cranberries, and more.

HNRG reported direct emissions of carbon dioxide, methane, and nitrous oxide from HAIG, primarily from stationary and mobile fossil fuel combustion, nitrogen fertilizer applications, lime and urea applications, and biomass combustion (methane and nitrous oxide emissions only). HNRG also reported energy indirect emissions associated with the purchase of electricity. HNRG also reported other indirect emissions associated with the operation of leased farm properties and rice agriculture water management. HNRG also reported biogenic carbon dioxide emissions from the combustion of crop residue biomass.

Note that HNRG has elected not to report soil carbon GHG emissions / removals, which are optional for reporting under the GHG Protocol Corporate Standard. HNRG has indicated an intent to incorporate this into future year reporting once a method that is sufficiently accurate and practical to implement is identified.

It was the responsibility of HNRG's management to quantify and report its emissions of carbon dioxide, methane, and nitrous oxide from HAIG. It was the responsibility of NSF to express our conclusion on the reported emissions based on the work described below.

Basis for Our Work

HNRG reported its carbon dioxide, methane, and nitrous oxide emissions from HAIG in accordance with the requirements of WBCSD/WRI GHG Protocol Corporate Standard (Revised Edition, 2004). The scope of HNRG's reporting was worldwide. The objective of this verification was to determine with limited assurance whether HNRG had fairly stated its carbon dioxide, methane, and nitrous oxide emissions from HAIG in its report ["HAIG GHG 2020 Emissions Calculator_20210423.xls"]. HNRG reported emissions in the following amounts:

- Direct emissions (combustion, process, fugitive): 36,634 metric tons of carbon dioxide–equivalent;

CO_2-e	Metric Tons of CO_2-equivalent					
Total	CO_2	CH_4	N_2O			
36,634	25,131	64	11,439			

- Energy indirect emissions (imported electricity): 10,177 metric tons of carbon dioxide–equivalent;

CO_2-e	Metric Tons of CO_2-equivalent					
Total						
10,177						

- Other indirect emissions from leased farm operations and rice agriculture water management: 199,569 metric tons of carbon dioxide–equivalent;

CO_2-e	Metric Tons of CO_2-equivalent					
Total	CO_2	CH_4	N_2O			
199,569	37,954	63,680	97,935			

- Carbon dioxide emissions from the combustion of biomass: 1,768 metric tons of carbon dioxide;

Quantification Methodologies and Emissions Factors Used by HNRG

NSF's verification scope included a review of the reasons for selecting quantification methodologies and emission factors, the appropriateness of their use, and explanations for any changes to quantification methodologies and emission factors from those previously used by HNRG.

Impact of Uncertainty

To the extent that HNRG has included a description of the impact of uncertainties on the accuracy of the GHG emissions data that it reported, NSF has reviewed it.

Base Year and Base Year Adjustments

HNRG's designated base year for GHG inventory reporting is calendar year 2020. As this was the first year of inventory emissions reporting to be verified by an independent third party, the scope of this verification engagement included review of the explanations provided by HNRG for its selection of base year.

Criteria Used for Verification

We conducted our work in accordance with the requirements of ISO 14064:2006, Part 3, Greenhouse gases – Specification with guidance for the validation and verification of greenhouse gas assertions. NSF obtained HNRG's reported emissions from the HAIG GHG inventory ("HAIG GHG 2020 Emissions Calculator_20210423.xls") and evaluated the reported assertions for conformity with the requirements of the WBCSD/WRI GHG Protocol (Chapter 9).

The HAIG inventory report was considered accurate if it varied by no more than 10% from a complete statement of the organization's emissions of carbon dioxide, methane, and nitrous oxide (total Scope 1 + Scope 2 + Scope 3).

Work Conducted

NSF's verification approach is risk-based. It draws upon our understanding of risks to fair statement of reported emissions and the operation of controls to reduce such risks. Based upon a risk-based sampling plan, we have tested HNRG's assertions related to its reported emissions for the year ending 31 December 2020.

We planned and performed our work to obtain all the information and explanations that we considered for us to give limited assurance that there is no evidence that HNRG's carbon dioxide, methane, and nitrous oxide emissions data for the year ending 31 December 2020 are not fairly stated.

Our work included:

- Verification of the organizational boundaries of the HAIG GHG inventory;
- Assessment of the capability of HNRG's management system and procedures to produce accurate, reliable and reproducible data and information;
- Determination of HNRG's conformity in all material respects with the requirements of WBCSD/WRI GHG Protocol Corporate Standard (Revised Edition, 2004);
- Reviewing the basis for and results achieved from the calculated emissions of carbon dioxide, methane, and nitrous oxide from a sampling of source data (farm operator surveys on fuel consumption, nitrogen applications, and cropland management) for the HAIG GHG inventory;
- Interviewing personnel from HNRG and their third-party GHG management consultants and reviewing relevant documents and records.

Conclusion

Based upon the above, NSF has concluded that there is no evidence that HNRG's reported emissions of carbon dioxide, methane, and nitrous oxide for the year ending 31 December 2020 are not, in all material aspects, fairly stated in accordance with the criteria referenced above.

Matthew Lutes

Senior Technical Reviewer, GHG Program

NSF

Ann Arbor, Michigan

2021-05-05

ANSI accredited

APPENDIX D: Acceptance of Conflict-of-Interest/Compromised Impartiality Assessment

Greenhouse Gas Program Inventory Conflict of Interest Assessment Form

Use this form to record evaluation of COI only where the GHG program does not require submission of a program-specific form (e.g. ISO 14064-1, GHG Protocol).

NSF management shall complete this form with respect to any prior work conducted for the GHG client or responsible party. The lead verifier shall complete this form on his/her behalf and, after consultation, on behalf of the verification team members. Once completed, the lead verifier shall forward a copy to the GHG program manager and retain a copy of this form to be filed with the applicable audit package.

Date	01/11/2021
Lead Verifiers	Kim Mattson for Forestry and Stephen Boles for Agriculture
Telephone	Kim Mattson: 530-925-5943, Stephen Boles: 519-872-6250
Email	Kim Mattson: mattson@ecosystemsnw.com, Stephen Boles: sboles@aet98.com
Mailing address	Kim Mattson: Mount Shasta, California Stephen Boles: Kitchener, Ontario, Canada
Organization Issuing Inventory	Hancock Natural Resource Group
Issuing Facility Name	Multiple properties in the agricultural and forestry sectors
Issuing Facility Location	Australia, Canada, United States, Chile and New Zealand
Org. or Parent is Publicly Traded	☒ Yes ☐ No *Manulife Financial Corporation is the parent corp.
Inventory Document Title	TBD. The verification scope is the 2020 GHG emissions and removals of Hancock Natural Resource Group properties in the agricultural and forestry sectors under HNRG's operational control (scope 1 and 2) and properties leased to third parties (scope 3).
Inventory Issue Date & Version	TBD. Emissions and removals for the calendar year 2020
Inventory Criteria	☐ ISO 14064-1 ☒ GHG Protocol ☐ Other (Specify):
Organization Contact	Brandon Lewis
Title	Manager of Sustainability
Telephone	617-747-1532
Email	blewis@hnrg.com
Mailing address	197 Clarendon Street, Boston, Massachusetts
Technical Consultant	N/A
Title	N/A
Telephone	N/A
Email	N/A
Mailing address	N/A
Other Parties w/ a Mat'l Interest	N/A
Title	N/A
Telephone	N/A
Email	N/A
Mailing address	N/A

Part A: Schedule and Planning of Verification Activities

1. Total number of facilities in inventory: Agricultural sector has 227 properties in Australia, Canada, and the United States. Additionally, there are 129 leased properties in Australia, Canada, and the United States. HNRG directly operates forest lands in five countries: Australia, 828,042 ac.; Canada, 49,352 ac.; Chile, 183,130 ac.; New Zealand, 429,880; and the United States, 3,341,211 ac.

2. Number of facilities expected to be visited for verification: No site visits
Please list all facilities to be visited. Add boxes as needed to include all facilities.

Name of Facility 1	
Address	
Anticipated Date of Visit	

Name of Facility 2	
Address	
Anticipated Date of Visit	

Name of Facility 3	
Address	
Anticipated Date of Visit	

Name of Facility 4	
Address	
Anticipated Date of Visit	

3. Provide anticipated dates for each planned verification activity.

First Verification Meeting	
Site Visit Date(s)	N/A
Final Verification Meeting	
Completion of verification activities	

4. Will an ANSI witness assessment be conducted in conjunction with the verification activities?

☐ Yes ☒ No

5. Provide a brief description of planned verification activities specific to this inventory. Your response should provide a general overview of the scope and breadth of verification activities. This may include, but should not be limited to, plans to interview which staff, types of records, emissions reductions that will be reviewed, etc.:

Document Review. In this stage, verifiers will review documents provided by HNRG that explain inventory quantification processes and controls, and both 2019 and 2020 emissions inventory results. The Document Review stage includes a strategic analysis and a risk assessment. These outputs inform NSF's verification plan and sampling plan.
On-site Planning Audit. In this stage, verifiers continue to obtain understanding HNRG's control environment, including any necessary interviews with personnel needed to complete our understanding of inventory quantification methods. The interviews will be conducted remotely using information and communication technology (videoconferencing).
Verification Audit. The verification audit stage, also performed remotely, focuses on the elements of the GHG inventory as a whole and is not as detailed as a reasonable level of assurance audit. NSF will design verification activities to address all items included in the scope of verification with a focus on those areas where we believe material misstatements are most likely to arise.

Part B: Evaluation of Potential for Conflict of Interest

1. Has the verification body or any staff member to be assigned to the proposed verification (including while employed with another organization) ever provided any additional GHG verification services for this Organization? (I.e. for another GHG program) If yes, complete the table below.

☐ Yes ☒ No

Emissions Year Verified	Dates of Service (mo/year-mo/year)	Description of Services	Value of Prior Services	% of NSF Total Revenue

2. Excluding the proposed GHG inventory verification services, has NSF International or a member of the verification team provided any of the following non-inventory services for the organization within the last five years?

Yes	No	Activity
☐	☒	Designing, developing, implementing, reviewing, or maintaining a GHG inventory or GHG information or data management system for air emissions;
☐	☒	Developing GHG emission factors or other GHG-related engineering analysis that includes GHG inventory-specific information;
☐	☒	Designing energy efficiency, renewable power, or other projects which explicitly identify GHG reductions or GHG removal enhancements as a benefit;
☐	☒	Designing, developing, implementing, conducting an internal audit, consulting, or providing technical services for a GHG emissions inventory;
☐	☒	Preparing or producing GHG-related manuals, handbooks, or procedures specifically for use with the Organization's GHG inventory or directed actions;
☐	☒	Providing GHG inventory-related training to the Organization, except where the training is confined to the provision of generic information that is freely available in the public domain (i.e. the trainer does not provide organization-specific advice or solutions).
☐	☒	Appraisal services of carbon or GHG liabilities or assets;
☐	☒	Brokering in, advising on, or assisting in any way in carbon or GHG-related markets;
☐	☒	Directly managing any health, environment or safety functions for the Organization;
☐	☒	Bookkeeping or other services related to the accounting records or financial statements of the Organization;
☐	☒	Third-party auditing of information systems unless those systems will not be reviewed as part of the inventory verification process;
☐	☒	Appraisal and valuation services, both tangible and intangible;
☐	☒	Fairness opinions and contribution-in-kind reports in which the verification body has provided its opinion on the adequacy of consideration in a transaction, unless the information reviewed in formulating the Verification Statement will not be reviewed as part of the verification services;
☐	☒	Any actuarially oriented advisory service involving the determination of amounts recorded in financial statements and related accounts;
☐	☒	Any internal audit service that has been outsourced by the Organization that relates to the Organization's internal accounting controls, financial systems, or financial statements, unless the systems and data reviewed during those services, as well as the result of those services will not be part of the verification process;
☐	☒	Acting as a broker-dealer (registered or unregistered), promoter, or underwriter on behalf of the Organization;
☐	☒	Any legal services;
☐	☒	Expert services to the Organization or a legal representative for the purpose of advocating the Organization's interests in litigation or in a regulatory or administrative proceeding or investigation, unless providing factual testimony.

If the answer to any of the above is "Yes", the conflict of interest risk is "High".

3. If services other than those listed in the table above have been provided, describe these non–GHG services in the table below. Past services only include services provided within the last five years. Include work performed by subcontractors on the verification team.

Service	Location of Service	Name of Person(s) Providing Service	Dates of Service (mo/year-mo/year)	Dollar Value of Work	Related to GHG Work?
Fish surveys	Independence,OR	Kim Mattson	3/20-5/20	$12000	No

5. What is, or was, the nature of the relationship between any part of NSF and the organization contracting for the work? No relationship. Work was performed by Mattson under his company, Ecosystems Northwest.

a. Do NSF and the project developer share any formal affiliation or management?

☐ Yes ☒ No

If yes, please describe:

b. Are NSF and the organization currently engaged in any joint ventures or partnerships?

☐ Yes ☒ No

If yes, please describe:

c. Are there any other business relationships not captured by (a) or (b) above?

☐ Yes ☒ No

If yes, please describe

6. List each staff member to be assigned to the proposed verification, identifying any previous work these individuals have conducted for the Organization including while in the employment of other organizations. Please copy the table as many times as necessary to identify all staff who will be assigned to the verification.

Independent Reviewer Name	Matthew Lutes
Telephone number	530-859-1788
Email Address	mlutes@nsf.org
Business location (city, state)	Ann Arbor, Michigan
Previous work for project Developer (description of services)	None
Date of Services (month/year to month/year)	
Employer at time of service:	

Lead Verifier 1 Name	Kim Mattson
Telephone number	530-925-5943
Email Address	mattson@ecosystemsnw.com
Business location (city, state)	Mount Shasta, California
Previous work for project Developer (description of services)	None
Date of Services (month/year to month/year)	
Employer at time of service:	

Lead Verifier 2 Name	Stephen Boles
Telephone number	519-872-6250
Email Address	sboles@aet98.com
Business location (city, state)	Kitchener, Ontario
Previous work for project Developer (description of services)	None
Date of Services (month/year to month/year)	
Employer at time of service:	

Verification Team Member 1 Name	Kyle Arvisais
Telephone number	201-558-0245
Email Address	Kyle.arvisais@maine.edu
Business location (city, state)	Woodbury, Connecticut
Previous work for project Developer (description of services)	None
Date of Services (month/year to month/year)	
Employer at time of service:	

Verification Team Member 2 Name	
Telephone number	
Email Address	
Business location (city, state)	
Previous work for project Developer (description of services)	
Date of Services (month/year to month/year)	
Employer at time of service:	

Part C: Proposed Mitigation Plan

Do you believe that your risk of COI is medium or high and that mitigation if required?

☐ Yes ☒ No

If yes, please complete and attach the Mitigation Plan form.

Part D: Written Attestation Regarding Conflict of Interest

The undersigned, on behalf of NSF, represents and warrants that information provided herein are true and correct, to the best of my knowledge.

I understand and acknowledge that if any of the above representations require amendment due to a material change or discovery of facts, I will note such changes in an amendment to this document. (Note: material changes do not include adjustments to the dates of verification services or minor changes to planned validation or verification activities).

LEAD VERIFIER 1

Authorized Signature
Title:Lead Verifier
Date:1/16/21

LEAD VERIFIER 2

Authorized Signature
Title: Lead Verifier
Date: 2/11/21

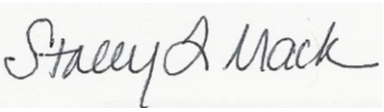
Based on the information provided, we have determined that our risk of conflict of interest is:

☒ Low ☐ Medium ☐ High

Part E: Acceptance of Attestation Regarding Conflict of Interest

The undersigned has reviewed and approved the submitted attestation concerning the risk of conflict of interest in this engagement with respect to NSF as a validation/verification body and with respect to the validation team or the verification team

FOR NSF International



Authorized Signature: Stacey Mack
Title: NSF Sustainability General Manager or Designee
Date: 2/12/2021