



Verification Report

CAR887 City of Thomasville MSW Landfill

Reporting Period: January 1, 2017 – December 31, 2017

Prepared for:

City of Thomasville

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1.0 Introduction

The City of Thomasville contracted Ruby Canyon Engineering (RCE) to perform the verification of the City of Thomasville MSW Landfill project (Project) for the reporting period January 1, 2017 through December 31, 2017 to the Climate Action Reserve (Reserve) Landfill Project Protocol Version 3.0 (Protocol). The Project involves GHG emission reductions from the capture and destruction of landfill gas (LFG) through an open flare at the City of Thomasville MSW Landfill (Landfill) located in Thomasville, Georgia. The crediting period for this facility is March 1, 2011 until December 31, 2020.

1.1 Project Background & Site Description

The City of Thomasville Landfill opened in 1975 and is made up of four phases on 108 acres designated for construction and demolition and municipal solid waste disposal. Phase I and Phase II are both closed, and Phase III is active and consists of construction and demolition waste only. Phase IV includes active cells that receive municipal solid waste. The City of Thomasville Landfill is estimated to close in 2085.

The collection system was installed in 2010 with 18 vertical gas extraction wells and 10 leachate cleanouts located on Phase IV of the landfill. Initial testing and commissioning for the flare was completed and the Project officially came online March 1, 2011.

The Project Developer is the City of Thomasville, Georgia (Thomasville), while the landfill owner is Thomas County, GA. The Project Developer owns the rights to all of the GHG credits that result from the Project.

1.2 Responsible Party

City of Thomasville
Steve Sykes, City Manager
111 Victoria Place
Thomasville, GA 31792

1.3 Verification Team

The RCE verification team consisted of the following individuals who were selected based upon verification experience and knowledge of the landfill methane sector.

Lead Verifier: David LaGreca
Senior Internal Reviewer: Jessica Stavole-Carter

1.4 Objectives

The goal of the verification activities was to ensure that the claimed GHG emission reductions were complete, consistent, accurate, transparent, and permanent and that the Project was in compliance with the Reserve's project additionality, monitoring, and reporting requirements. Furthermore, the verification activities ensure that the data provided to RCE is well documented and free of any material errors or omissions.

1.5 Scope

The scope of the verification consisted of the following independent and objective activities:

- Review the reporting period's Project Monitoring Plan;
- Conduct a site visit to the Project location;
- Review the Project data acquisition and quality control procedures;
- Review the Project's baseline emissions and confirm the baseline and Project boundaries;

- Review the Project's evidence of environmental and regulatory requirements to ensure that the Project is additional;
- Review the Project's emission reduction calculations;
- Review the Project documents and data against the criteria listed in Table 1;
- Issue requests for additional documentation, clarifications, and corrective actions as necessary; and
- Issue a verification report, verification statement, and list of findings to Thomasville and the Reserve.

1.6 Verification Criteria

Table 1 – Summary of Verification Criteria

Criteria	Details
Standard of Verification	• The Reserve Landfill Project Protocol Version 3.0 (December 2, 2009) • Errata and Clarifications to Landfill Project Protocol Version 3.0 (June 18, 2015) • The Reserve Program Manual (September 1, 2015) • The Reserve Verification Program Manual (February 8, 2017)
Verification Process	The Reserve Verification Program Manual and ISO 14064-3 Specification with guidance for the validation and verification of greenhouse gas assertions
Level of Assurance	Reasonable assurance
Materiality	97% accuracy level (less than 3% error) because total annual emission reductions are greater than 25,000 tCO ₂ e and less than 100,000 tCO ₂ e.

2.0 Verification Activities Summary

The Verification process consisted of the following activities as outlined in the verification plan:

- RCE completed a NOVA/COI form to identify any potential conflict of interest with the Project or Thomasville. RCE submitted the NOVA/COI form to the Reserve and the COI assessment revealed no conflicts of interest and the Reserve approved the COI assessment on March 22, 2018.
- RCE held a verification kick-off meeting with Thomasville on March 29, 2018. During the kick-off meeting RCE reviewed the verification objectives and process and the verification schedule, and requested the verification background documents.
- RCE performed a strategic review and risk assessment of the received data and support documents in order to understand the scope and areas of potential risk in the GHG emissions reductions.
- RCE developed a risk-based sampling plan based upon the strategic review and risk assessment. The Lead Verifier used the verification plan and sampling plan throughout the verification and revised these documents as needed based upon additional risk assessments.
- RCE conducted a site visit on May 2, 2018. During the site visit RCE performed key personnel interviews; inspected the Project equipment; and observed the onsite GHG management systems and data gathering, monitoring, and handling practices.
- RCE performed a risk-based desktop review of the submitted verification documents. The desktop review included an assessment of the GHG calculation methods and inputs, source data completeness, GHG management and monitoring systems, evidence of regulatory compliance, and record retention practices.
- RCE submitted requests for corrective actions, additional documentation, and clarifications to Thomasville throughout the verification.
- RCE's senior internal reviewer conducted a review of the verification sampling, report, and statement.

- RCE issued a final verification report, verification statement, and list of findings.
- RCE held an exit meeting with Thomasville.

3.0 Verification Findings

3.1 *Assessment of the GHG Emission Reductions Project Operations*

The Project collects LFG from the City of Thomasville landfill and destroys it via combustion in an open flare mounted on a flare skid adjacent to the landfill. The LFG collection system pulls LFG using two blowers located at the flare skid. Prior to combustion, the LFG passes through a continuous methane analyzer and flow meter that measure methane concentration and LFG flow to the flare respectively. The monitoring equipment records the methane concentration and landfill gas flow on a dry basis.

Construction of the LFG collection system commenced on September 28, 2010, and it was fully operational on March 1, 2011. The collection system includes gas header and collection piping, eighteen vertical gas extraction wells, ten leachate cleanouts, condensate management structures, and a blower/flare skid. Prior to the installation of the project, there were no destruction devices in use at the landfill. RCE confirmed that the project is not a bioreactor and does not add any liquid, including leachate, in a controlled manner to the landfill.

3.2 *GHG Project Boundary (sources, sinks and/or reservoirs)*

According to the Protocol, carbon dioxide and methane are the only GHGs included in the Project boundary from both the baseline and Project activities. The emissions resulting from the Project activity must be deducted from the Project baseline emissions in order to calculate total emission reductions. These Project emissions include the carbon dioxide resulting from the consumption of electricity from the grid related to Project activities. The calculation of baseline emissions takes into account the total methane destroyed based on the destruction efficiency of the Project destruction devices and the oxidation of methane by soil bacteria. Table 2 lists the sources of GHG emissions reviewed during the verification of the Project.

Table 2 – Summary of the Project GHG Sources, Sinks and Reservoirs

Activity	GHG Sources, Sinks & Reservoirs
Baseline	• CH₄ vented to the atmosphere • Percent methane oxidized by soil bacteria. As the landfill is not covered with a synthetic liner, a 10% oxidation factor resulting from natural oxidation by soil bacteria was applied to the baseline emissions
Project	• CH₄ from the incomplete combustion of LFG sent to the flare • CO₂ from the combustion of fossil fuels used during operation and maintenance of the Project activity. • CO₂ resulting from the consumption of imported electricity.

3.3 *Project Eligibility Criteria*

The Protocol specifies four eligibility rules that a project must meet in order to register emission reductions with the Reserve: Location, Project Start Date, Additionality, and Regulatory Compliance. Below is a summary of the Reserve eligibility requirements and the Project's compliance to each requirement.

- **Eligibility Rule 1: Location**

The Project is a U.S.-based landfill located in Thomasville, Georgia; it therefore meets this eligibility requirement.

- **Eligibility Rule 2: Project Start Date**

The start date is defined as the date on which a qualifying destruction device becomes operational. During the Project's first reporting period, RCE confirmed a start date of March 1, 2011.

The Project began gas destruction by flaring on March 1, 2011. The Project submittal form was submitted to the Reserve on June 6, 2011 which is no more than six months after the Project start date. RCE reviewed the flare commissioning report and raw data from the chart recorder in support of this start date.

- **Eligibility Rule 3: Additionality**

Performance Standard Test

Prior to the Project activity, the Landfill did not collect or destroy LFG. RCE confirmed this through the site visit; no evidence was observed that would indicate there was ever a pre-project destruction device. In addition, RCE viewed historical photos of the Landfill from Google earth that were taken before and after the Project commenced. No evidence suggested that any destruction devices existed before the Project was implemented.

Thus, the Project passes the Performance Standard Test number 1 since it involves:

“Installation of a landfill gas collection system and a new qualifying destruction device at an eligible landfill where landfill gas has never been collected and destroyed prior to the project start date.”

Legal Requirement Test

During the site visit, RCE interviewed the City of Thomasville landfill personnel about the procedures to ensure that the Project meets environmental compliance requirements and the Regulatory Test. Thomasville reviews federal, local, and state regulations to ensure that there is no mandate to collect and combust LFG. RCE determined that the procedures provide adequate awareness of any legal requirements of the Landfill to collect and destroy LFG.

The Landfill has a design capacity above 2.5 million mega grams (Mg) and 2.5 million cubic meters of municipal solid waste. Therefore, the New Source Performance Standard (NSPS) regulation requires the facility to conduct non-methane organic compound (NMOC) emission rate testing. Carlson Environmental Consultants, PC performed the Tier II test on February 23 and 24, 2015. RCE reviewed the Tier I NMOC Emissions Rate Report (dated February 26, 2018) which indicates that the estimated emission rate for 2017 was 6.83 Mg/year, below the 50 Mg/year regulatory threshold. RCE concluded that the City of Thomasville Landfill is not required to destroy LFG.

RCE also reviewed the Attestation of Voluntary Implementation form signed after the end of the reporting period and uploaded to the Reserve website which states that the project was implemented and established voluntarily.

- **Eligibility Rule 4: Regulatory Compliance**

RCE searched the Environmental Protection Agency's Enforcement & Compliance History Online (ECHO) database and the Georgia Environmental Protection Division for notices of violation. RCE also contacted a representative with the GA DNR SW District Office, who confirmed that there were no Notice of Violations issued during 2017, although they were issued a Letter of Non-compliance for minor operational deficiencies. RCE confirmed that these non-compliances were related to a minor leachate outbreak and some pond maintenance and were not related to air quality nor to the landfill gas system. These events were therefore not project related. RCE also confirmed that the landfill was in compliance with all applicable regulatory requirements during the final inspection of 2017.

RCE confirmed that Thomasville is following its Monitoring Plan procedures to assure that it passes the Regulatory Test and the Project is in compliance with all federal, state and local regulations. RCE also confirmed signature of the Attestation of Regulatory Compliance after the end of the reporting period, which Thomasville uploaded to the Reserve.

3.4 Ownership of Generated Emission Reductions

RCE reviewed the completed Attestation of Title which states that the City of Thomasville, Georgia owns the emission reduction credits that the Project generates. RCE also reviewed an agreement between Thomasville and Thomas County. This document clearly states that Thomasville has full legal and beneficial title to emission reductions that the Project generates. The presented evidence clearly demonstrates that Thomasville holds the legal title and exclusive ownership rights of the emission reductions associated with the Project.

3.5 GHG Monitoring and Management Systems

RCE reviewed the data management systems during the site visit and desktop review. RCE completed the majority of the GHG management systems review during the site visit by observing the onsite procedures and interviewing Thomasville personnel, the Landfill manager, and third party personnel. The onsite review included an assessment of the Project data collection, processing, and handling procedures; recordkeeping and data storage; quality control and assurance procedures; record retention systems; and a field tour of the Project equipment. The desktop review included a detailed review of the Project monitoring plan and its conformance to Protocol requirements. RCE also confirmed that the Project was implemented according to the Monitoring Plan.

During the site visit, RCE observed that the flow meter is installed correctly to allow for laminar flow of landfill gas. The primary project data include the LFG flow to the flare, temperature of the flare, and methane content of the LFG. A thermal mass flow meter measures the LFG flow and is configured to record LFG flow at 75°F and 1 atm. RCE confirmed that Thomasville used the Protocol equation 5.2 to adjust the data to 60°F and 1 atm. in the emission reduction calculation spreadsheet. The flow meter was replaced on August 17, 2017 after subsequent calibration events on 3/30/2017 and 5/31/2017 found the meter to operating beyond the +/- 5% threshold set by the Reserve (14.62% and 12.7% respectively). All gas flows from 1/1/17-8/16/17 were adjusted “based on the greatest calibration drift recorded at the time of calibration” according to point 2 on section 3.6 of the protocol. A Eurotherm digital data recorder measures LFG flow continuously and records the output on ten-second intervals.

A thermocouple installed in the flare housing continuously measures the flare temperature. Thomasville uses flare temperature to determine whether the flare is operational. A Siemens Ultramat 23 gas analyzer continuously measures the methane content of the landfill gas. A Eurotherm digital data recorder measured the methane data every ten seconds when the analyzer was in operation. Where continuous data was not available, Thomasville began recording weekly methane readings using a LandTec GEM2000 portable methane analyzer and substituted these readings in order to calculate emission reductions. RCE confirmed that Thomasville applied a 10 percent discount to emission reductions from weeks where the GEM2000 portable methane analyzer was utilized.

During the site visit, RCE reviewed the data storage and retention policies and verified they were in conformance with the Protocol requirements and followed the Monitoring Plan. All data is kept for a period of ten years after the information is generated or seven years after the last verification.

3.6 Instrument QA/QC

RCE confirmed that all monitoring equipment was inspected, cleaned, and field checked quarterly (3/30/2017, 5/31/17, 8/17/17, and 12/18/17) per the requirements of the Protocol. Carlson Environmental Consultants performed the quarterly cleaning, inspection, and field checks with the final check occurring at the end of, but no more than two months prior to, the end date of the reporting period. The gas analyzer was inoperable from 6/26/2017 through 8/20/2018, and as such Thomasville used a GEM 2000 to make weekly methane measurements during these periods. LandTec calibrated the GEM 2000 every six months. The GEM 2000, newly installed flow meter, and continuous methane analyzer were never outside the Protocol stipulated threshold of +/- 5 percent error. The flow meter in use from 1/1/17-8/16/17 was out of calibration and required adjustment to calculated flow, as described in section 3.5.

There were two flow meters used during the RP; the flow meter in use during the first and second quarter of the reporting period was replaced on August 17, 2017 and used for the duration of the reporting period. The first flow meter (SN E103F302000) was factory calibrated in August 2016, whereas the replacement flow meter (SN F9087502000) was factory calibrated on August 13, 2017, and subsequently checked at quarterly inspections. Endress + Hauser recommends that devices located outside should be calibrated every 1-4 years depending on the extremes of the environment. It was previously calibrated in September 2012, meeting the manufacturer requirement. The flow meter was replaced with the same t-mass 65 I DN175 type as was originally installed. Carlson Environmental Consultants calibrated the Endress + Hauser flow meter every quarter recording the as found/as left conditions per the requirements of the Protocol. Thomasville verifies the calibration of the output of the flow meter on an annual basis and it was verified to be reading within the +/- 5% Protocol stipulated threshold this reporting period. Thomasville will factory calibrate Project flow meters every five years according to their monitoring plan. Siemens recommends that the Ultramat 23 be calibrated with calibration gas every 12 months. Carlson Environmental Consultants calibrates the Ultramat 23 every quarter using system calibration gas which exceeds this requirement.

3.8 Assessment of GHG Emission Reductions Calculations

RCE reviewed the emission reduction calculations assessment, Project assumptions, raw data inputs, and accuracy of calculations. RCE first assessed the completeness of the raw data and how the data is transferred to the calculation spreadsheet. The Lead Verifier reviewed the formulas and raw data inputs for accuracy and compliance with the Protocol. RCE sampled selections of data and recalculated the methane destroyed by the Project and compared these values to Thomasville's values in their assertion spreadsheet. RCE also reviewed the check built into the spreadsheet that totalizes flow only at times when the flare is operational (thermocouple readings greater than 500°F).

RCE confirmed that Thomasville applied the default destruction efficiency of 96 percent to the data because the destruction device is an open flare and a 10 percent discount for the oxidation of methane by soil bacteria because the entire landfill does not incorporate a synthetic liner as part of the final cap system. RCE reviewed source documentation for Project emissions from purchased electricity and confirmed that the Project Developer applied appropriate emission and conversion factors and reviewed the use of Protocol equations for Project emissions in the GHG assertion.

RCE's review involved recalculation of LFG flow, checking that percent methane was correctly applied, checking and recalculating project fossil fuel use, and confirming correct use of conversion factors. RCE checked all calculations against the Project Developer's assertion with percent differences noted. There were no instances of data substitution during this reporting period. The difference between RCE's and Thomasville's emission reductions was non-material.

4.0 Verification Results

Thomasville provided sufficient documentation of its emission reductions, data collection procedures, and monitoring and quality control procedures. The verification process focused on verifying the emission reductions claimed and the source data used by Thomasville to quantify the emission reductions in accordance with the Reserve Landfill Project Protocol Version 3.0. The following is a summary of the verification results.

The Project reported emission reductions of 50,378 metric tons CO₂e for the current reporting period. During the final review, RCE identified no material misstatements in the data or emission reduction calculations. The emission reductions verified are listed in Table 3. During the verification process, RCE made requests for corrective actions and clarifications as necessary to complete the verification. Thomasville sufficiently addressed all requests. The details of these requests are documented in RCE's List of Findings provided to the Reserve and Thomasville.

5.0 Conclusion

RCE conducted a risk-based analysis of the CAR887 City of Thomasville MSW Landfill GHG assertion including a strategic review of the Project data and evidence. Based upon the processes and procedures and the evidence collected, RCE concludes that the GHG assertion is a fair representation of the Project emission reductions resulting from the capture and utilization of LFG during the reporting period January 1, 2017 through December 31, 2017 and can be considered:

- In conformance with the Reserve Landfill Project Protocol, Version 3.0,
- Without material discrepancy, and
- Verified to a reasonable level of assurance.

The verified emission reductions are listed in Table 3.

Table 3 - Emission Reductions Verified for January 1, 2017 through December 31, 2017

Year	Baseline Emissions CO ₂ e (tonnes)	Project Emissions CO ₂ e (tonnes)	Emission Reductions CO ₂ e (tonnes)
2017	50,402	24	50,378

Note: Due to rounding, individual values might not equal totals and values are not representative of raw data used in the emission reductions calculation.

Lead Verifier Signature



David LaGreca

Senior Internal Reviewer Signature



Jessica Stavole-Carter