



Verification Report

CAR521 Maple Hill Landfill

Reporting Period: January 1, 2021 – December 31, 2021

Prepared for:

AQC Environmental Brokerage Services, Inc.

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1.0 Introduction

AQC Environmental Brokerage Services, Inc. (AQC) contracted Ruby Canyon Environmental, Inc. (RCE) to perform the verification of the Maple Hill Landfill (Project) for the reporting period January 1, 2021 through December 31, 2021 to the Climate Action Reserve (Reserve) Landfill Project Protocol Version 5.0 (Protocol). The Project involves greenhouse gas (GHG) emission reductions from the capture and destruction of landfill gas (LFG) from the Maple Hill Landfill (Landfill) located near Macon, MO.

1.1 Project Background & Site Description

The Maple Hill Landfill is an active municipal landfill owned and operated by Advanced Disposal Services Maple Hill Landfill, Inc. (ADS) that began operating in 1976. The Landfill has a permitted design capacity of 14.2 million cubic meters. A landfill gas (LFG) collection and control system was voluntarily installed in 2002 and currently consists of 37 LFG extraction wells with associated collection piping and a blower/flare station. Blowers are used to extract the LFG and send it to an open flare for destruction. RCE confirmed that the project is not a bioreactor.

1.2 Responsible Party

Project Developer & Landfill Owner: Advanced Disposal Services Maple Hill Landfill, Inc. (ADS)

Technical Consultant: AQC Environmental Brokerage Services, Inc. (AQC)

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: Garrett Heidrick

Senior Internal Reviewer: Bonny Crews

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 are 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;
- 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 AQC and the Reserve.

1.6 Verification Criteria

Table 1 – Summary of Verification Criteria

Criteria	Details
Standard of Verification	- Climate Action Reserve Landfill Project Protocol Version 5.0 (April 24, 2019) - Climate Action Reserve Verification Program Manual (February 3, 2021) - The Reserve Offset Program Manual (October 23, 2020)
Verification Process	The Reserve Verification Program Manual and ISO 14064-3:2006 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 emission reductions are between 25,000 tCO ₂ e and 100,000 tCO ₂ e annually

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, the project developer, or the technical consultant. The NOVA/COI form was submitted to the Reserve and the COI assessment revealed no conflicts of interest and was approved by the Reserve on April 12, 2022.
- RCE held a verification kick-off meeting with AQC on April 15, 2022. During the kick-off meeting RCE reviewed the verification objectives and process, reviewed the verification schedule, and requested the verification background documents.
- RCE performed a strategic review and risk assessment of the received data and support documents to understand the scope and areas of potential risk in the GHG emissions inventory.
- RCE developed a risk-based sampling plan based upon the strategic review and risk assessment. The verification plan and sampling plan were used throughout the verification and were revised as needed based upon additional risk assessments.
- During the 2020 verification period, RCE conducted a virtual site visit on May 10, 2021. Section 7.3.3 of The Protocol requires a site visit at least once every two reporting periods. 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's remote site visit consisted of visits to the Landfill to meet with key personnel and to review data management and handling procedures which can be completed just as effectively through a virtual site visit using video and screen sharing technologies.
- 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 AQC 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 AQC.

3.0 Verification Findings

3.1 Assessment of the GHG Emission Reductions Project Operations

The Landfill currently collects LFG and destroys it via combustion in an open flare system. The LFG is pulled by blowers located at the flare skid through a gas collection system that consists of vertical wells and a leachate collection and removal system. Methane data were measured using a handheld methane analyzer on a weekly basis for the entire duration of the reporting period. The Project correctly applied a 10% discount factor to the total quantity of methane collected and destroyed as required by the protocol.

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

The Protocol designates that CO₂ and CH₄ are the only GHGs included from the baseline and Project activities. The project emissions must be deducted from the baseline emissions to calculate GHG emission reductions. These GHG sources include methane generated from biodegradation of the landfill waste vented to the atmosphere, methane consumed by soil bacteria through natural oxidation, incomplete combustion of methane via Project destruction devices, fossil fuel use, and electricity use. The sources of GHG emissions reviewed during the verification of the Project are listed in Table 2.

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

Activity	GHG Sources, Sinks & Reservoirs
Baseline	• CH₄ vented to the atmosphere. • Percent CH₄ 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 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 US-based landfill located near Macon, MO, USA. The Project therefore meets this eligibility requirement.

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

RCE verified the Project start date. The Project submittal form was submitted to the Reserve on September 16, 2002. The Project began gas destruction by flaring on September 16, 2002. RCE reviewed the Project Submittal form, original installation paperwork, and field notes from the first gas extraction to support this start date. RCE also reviewed the project submittal form for the second crediting period, which started on 9/17/2012 and ends on 9/16/2022.

- **Eligibility Rule 3: Additionality**

Performance Standard Test

Prior to the Project activity, the Landfill did not collect, vent, or destroy LFG. RCE confirmed this through historical aerial photographs, onsite inspection, as well as interviews with Landfill personnel.

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 2020 verification periods’ virtual site visit, RCE interviewed AQC and Landfill staff about the procedures to ensure that the Project meets environmental compliance requirements and passes the Legal Requirement Test. ADS monitors federal, local, and state regulations to ensure that the Project is in environmental compliance and that there is no mandate to collect and combust LFG. RCE confirmed that there are currently no laws or ordinances requiring the Landfill to collect and destroy LFG.

The Landfill is a municipal solid waste (MSW) landfill with a design capacity above the 2.5 million megagrams (Mg) or 2.5 million cubic meters threshold as specified in the New Source Performance Standards (NSPS) codified in Title 40 of the Code of Federal Regulations (CFR) Part 60, Subpart WWW. The landfill is therefore subject to the requirements of the NSPS for MSW landfills.

Additionally, RCE reviewed the “FINAL – 2020 Maple Hill Tier 2 Report NMOC” dated September 11, 2020 in order to determine whether the Landfill is required to destroy LFG. The total NMOC generation rate for 2021 was estimated to be 32.91 Mg, which is below the mandatory threshold of 50 Mg.

During the review of the supporting evidence, RCE did not observe any indication that the Landfill was mandated to destroy LFG. Additionally, there are no local, state, or federal requirements for the installation of a GCCS at the Landfill. Therefore, the results of the review indicated that the Landfill is following its established procedures to assure that it passes the Legal Requirement Test.

- **Eligibility Rule 4: Regulatory Compliance**

To confirm the Landfill and Project were within regulatory compliance RCE searched the EPA’s Enforcement & Compliance History Online (ECHO) database on 6/14/2022 and reviewed the State of Missouri’s Department of Natural Resources’ online resources.

Four violations for water quality were found on the EPA ECHO database. After interviews with landfill staff and AQC, these were determined to not be project related and had been properly closed out by the Landfill. A letter of warning was found on the Missouri Department of Natural Resources website from 3/31/2022 associated with elevated total recoverable iron and total suspended solids at outfalls observed between 2Q 2021 and 4Q 2021. RCE reviewed evidence that corrective measures had been implemented and that there were no ongoing issues. No additional complaints were found on the Missouri Department of Natural Resources database.

RCE also emailed MO DEQ staff and received notice that there were no instances of violation for solid waste at the landfill for 2021.

RCE confirmed signature of the Attestation of Regulatory Compliance, after the end of the reporting period, which was uploaded to the Reserve.

3.4 Ownership of Generated Emission Reductions

RCE reviewed evidence that ADS Maple Hill Landfill has ownership of the GHG emission reductions. Evidence included landfill permits listing the Landfill as the owner and operator of the landfill. RCE also reviewed the completed Attestation of Title which was uploaded to the Reserve following the end of the reporting period.

3.5 GHG Monitoring and Management Systems

RCE reviewed the data management systems during the 2020 verification period's virtual site visit and through the desktop review. RCE completed the majority of the GHG management systems review during the virtual site visit by observing the onsite procedures and interviewing the personnel responsible for the Project. 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.

LFG flow to the open flare, methane content of the LFG, and flare thermocouple temperature were the primary data gathered for the Project during the reporting period. The site uses a Sierra Flow Meter to record LFG flow to the flare. The flow meter to the flare records the flow at 70 °F and 1 atm. RCE confirmed that these flows were properly adjusted to standard conditions using equation 5.2. RCE confirmed that the position of the flow meter is adequate to ensure laminar flow.

The site used an Elkins Earthworks Gas Analyzer for all weekly methane readings for the 2021 reporting period. RCE confirmed a 10% discount was properly applied in equation 5.3 to account for methane measurements that were less than continuous and more than weekly, in accordance with the Protocol.

The operation and temperature of the flare is continuously monitored by a thermocouple. The flow and temperature data are recorded continuously via a SCADA 3000 data transmitter which uploads to a cloud data server at least every 15 minutes and is periodically transferred via USB mass storage device to an independent computer for additional backup.

RCE reviewed the data storage and retention policies of the Landfill and AQC and verified they were in conformance with the Protocol requirements and followed the Monitoring Plan. All data are kept for a period of at least ten years after the information is generated or seven years after the last verification in accordance with the Reserve's Verification Program Manual.

3.6 Instrument QA/QC

RCE reviewed evidence that the LFG flow meter and methane analyzer met instrument QA/QC requirements as outlined in the Protocol for cleaning, inspection, and field calibration checks. The dates for the quarterly cleanings, inspections, and field calibration checks for each piece of monitoring equipment are listed in Table 3. Cleaning and inspections were conducted on 3/8/2021, 6/14/2021, 8/18/2021, 11/17/2021, and 3/8/2022 with activities and results documented. Sierra does not recommend a cleaning schedule. Cleaning and inspecting the flow meters on a quarterly basis goes above and beyond what the manufacturer recommends.

Flow meter SN# 238865 was checked for calibration accuracy with percent drift noted by RMC Environmental on 12/16/2021, which is within two months of the end of the reporting period. The field check was within the protocol-required +/-5% accuracy threshold.

Table 3 – Cleaning, Inspection and Calibration Checks

Monitoring Equipment	Regular Maintenance Inspections				
Sierra Flow Meters	3/8/2021	6/14/2021	8/18/2021	11/17/2021	3/8/2022
Elkins ENV200 and ENV100 Handhelds	Calibrated before each use				
Monitoring Equipment	Factory Calibration				
Sierra Flow Meter 220663	12/9/2020 (not used during RP)				
Sierra Flow Meter 238865	7/17/2020; 12/16/2021				
Elkins ENV200 Handheld 1806207B	7/31/2020; 8/4/2021; 12/23/2021				
Elkins ENV200 Handheld 1901212B	2/4/2022; 12/16/2021				
Elkins ENV100 Handheld 1003025B	12/7/2021				
Elkins ENV200 Handheld 1703206B	1/13/2022				

The Sierra flow meter manual recommends a calibration frequency of 24 months as a minimum. Sierra flow meter SN# 220663 was factory calibrated with as-found conditions reflecting <5% drift on 12/9/2020 and was not used during the 2021 reporting period. Sierra flow meter SN# 238865 was factory calibrated with as found conditions reflecting <5% drift on 7/17/2020 and was in use for the entirety of the reporting period. RCE confirmed that the process of annually switching out the flow meters is outlined accurately in the monitoring plan, including QA/QC and calibration frequencies. RCE confirmed that the results of the calibrations conducted on the flow meters prior to the current reporting period were within the +/-5% threshold required by the Protocol.

The Elkins ENV200 handheld methane analyzers' (SNs# 1806207B, 1901212B, and 1703206B) manuals recommend a calibration frequency of 12 months as a minimum. The handheld analyzers were factory calibrated by Elkins Earthworks, LLC with as-found conditions reflecting <5% drift (see Table 3). Weekly handheld methane readings were taken throughout the reporting period and were used for all emissions reduction calculations. RCE reviewed field calibration documentation as well as cross referenced the documented weekly readings with those asserted to ensure proper data transcription.

RCE confirmed that the handheld gas analyzer was calibrated with calibration gas prior to each use. Additionally, RCE confirmed any weekly methane measurements that did not include a calibration were recorded as "0" so that the destruction data were removed from the assertion.

3.7 Assessment of GHG Emission Reductions Calculations

The emission reduction calculation assessment included a review of Project assumptions, raw data inputs, and accuracy of calculations. RCE first assessed the completeness of the raw data and how the data are transferred to the calculation spreadsheet. Next, RCE reviewed the formulas and raw data inputs for accuracy and compliance with Protocol requirements. Lastly, RCE recalculated the GHG emission reductions and compared the results to AQC's Project calculations and determined that the GHG emission reduction calculations were materially correct.

During the desktop review, RCE compared the raw data to the LFG flow volumes, gas methane analysis, and temperature readings in AQC's emission reduction spreadsheet. The fossil fuel use and electricity data were also compared to the information in AQC's GHG emissions calculations. RCE's review consisted of data

transcription tests, data completeness review, spreadsheet functionality tests, and confirmation of calculation accuracy.

Within the emission reduction spreadsheet, data were eliminated when the flare temperature was below a threshold temperature of 500 °F. A 96% destruction efficiency was correctly assigned to the open flare. Because the landfill is not covered with a synthetic liner, a 10% discount was applied to the baseline scenario for oxidation of methane by soil bacteria.

The net amount of methane destroyed by the Project was calculated, summed for the reporting period, and converted into CO₂ equivalents (CO₂e). Project emissions consisted of indirect emissions of CO₂ from electricity consumption and direct emissions of CO₂ from the combustion of propane which is used as pilot fuel for the flare. The Project emissions were calculated from the product of activity data multiplied by an appropriate emission factor. The total Project GHG reductions in CO₂e were calculated by subtracting the Project emissions from the net amount of methane destroyed by the Project in CO₂e. The total emission reductions this reporting period decreased by approximately 10% compared to the verified total from the last reporting period in large part due to missing handheld methane analyzer calibrations on 1/4/2021, 3/8/2021, 4/15/2021, 5/24/2021, 6/1/2021, and 9/1/2021.

RCE reviewed the Project GHG emission and GHG reduction calculations for compliance to the Protocol's calculation methodologies. There are no material misstatements in the final Project GHG reduction calculations and results. Additionally, during the virtual site visit, RCE interviewed landfill technicians to confirm staff was properly trained and made efforts to reduce risk of data errors.

4.0 Verification Results

AQC 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 AQC and the Landfill to quantify the emission reductions in accordance with the Reserve Landfill Project Protocol Version 5.0. The following is a summary of the verification results.

The Project reported emission reductions of **65,770** metric tons of CO₂e from January 1, 2021 to December 31, 2021. During the final review, RCE identified no material misstatements in the data or emission reduction calculations. The emission reductions verified are listed in Table 4. During the verification process, RCE made requests for Corrective Actions, Additional Documentation, and Clarifications to complete the verification. AQC sufficiently addressed all requests and remedied the material findings. The details of these requests are documented in RCE's List of Findings provided to the Reserve and AQC.

5.0 Conclusion

RCE conducted a risk-based analysis of the CAR521 Maple Hill 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, 2021 and December 31, 2021 can be considered:

- In conformance with the Reserve Landfill Project Protocol 5.0,
- Without material discrepancy, and
- Verified to a reasonable level of assurance

The verified emission reductions are listed in Table 4.

Table 4 – Emission Reductions Verified for January 1, 2021 through December 31, 2021

Year	Baseline Emissions CO₂e (tonnes)	Project Emissions CO₂e (tonnes)	Emission Reductions CO₂e (tonnes)
2021	65,915	145	65,770

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



Garrett Heidrick

Senior Internal Reviewer Signature



Bonny Crews