RECYCLING ROADWAYS FOR CARBON EMISSION REDUCTIONS – MIDSTATE RECLAMATION AND TRUCKING

Project title	Recycling Roadways for Carbon Emission Reductions – Midstate Reclamation and Trucking
Project ID	VCS 3616
Monitoring period	26-September-2021 to 31-December-2024
Original date of issue	06-February-2025
Most recent date of issue	23-October-2025
Version	v4
VCS Standard Version	4.7
Prepared by	Julian Estrada, Carbon Project Manager Global Emissionairy, LLC PO Box 6, Phoenix, Maryland 21131 project.proponent@globalemissionairy.com

CONTENTS

PROJECT DETAILS 4
1.1 Summary Description of the Implementation Status of the Project 4
1.2 Audit History 5
1.3 Sectoral Scope and Project Type 5
1.4 Project Proponent 5
1.5 Other Entities Involved in the Project 6
1.6 Project Start Date 7
1.7 Project Crediting Period 7
1.8 Project Location 7
1.9 Title and Reference of Methodology 8
1.10 Double Counting and Participation under Other GHG Programs 8
1.11 Double Claiming, Other Forms of Credit, and Scope 3 Emissions 8
1.12 Sustainable Development Contributions 9
1.13 Commercially Sensitive Information 12
2 SAFEGUARDS AND STAKEHOLDER ENGAGEMENT 13
2.1 Stakeholder Engagement and Consultation 13
2.2 Risks to Stakeholders and the Environment 16
2.3 Respect for Human Rights and Equity 18
2.4 Ecosystem Health 20
3 IMPLEMENTATION STATUS 23
3.1 Implementation Status of the Project Activity 23
3.2 Deviations 23
3.3 Grouped Projects 24
3.4 Baseline Reassessment 28
4 DATA AND PARAMETERS 29
4.1 Data and Parameters Available at Validation 29
4.2 Data and Parameters Monitored 32
4.3 Monitoring Plan 38
5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS 41
5.1 Baseline Emissions 41

5.2 Project Emissions 42
5.3 Leakage Emissions 44
5.4 GHG Emission Reductions and Carbon Dioxide Removals 44

APPENDIX A: COMMERCIALLY SENSITIVE INFORMATION 47

APPENDIX B: PROJECT LOCATIONS 48

APPENDIX C: PROJECT SPECIFICATIONS 50

APPENDIX D: ADDITIONALITY TESTING 52

APPENDIX E: PROJECT EMISSIONS AND CALCULATIONS 54

APPENDIX E.1: ENGINEERING JUDGEMENTS SUPPORTING ER CALCULATIONS 55

APPENDIX E.2: RAW MATERIAL PRODUCTION EMISSIONS 56

APPENDIX E.3: TO-SITE DELIVERY EMISSIONS 58

APPENDIX E.4: PAVEMENT INSTALLATION EMISSIONS 60

APPENDIX E.5: TOTAL PROJECT EMISSIONS 62

APPENDIX E.6: BASELINE EMISSIONS 64

APPENDIX E.7: EMISSION REDUCTIONS 66

APPENDIX E.8: EX-ANTE CREDITING PERIOD CALCULATIONS 68

PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

This project aims to enlist road construction contractors performing work within the United States of America with the purpose of reducing greenhouse gas emissions (GHG) generated during roadway maintenance and reconstruction by using Foam Stabilized Base (FSB) or Asphalt Emulsion in place of traditional construction and maintenance techniques that use hot mix asphalt (HMA). Prior to project implementation, construction projects would utilize either HMA or Warm Mix Asphalt (WMA) as well as virgin aggregate which has a significant greenhouse gas footprint that comes from mining virgin aggregate, transporting it to the site of the hot-mix plant and heating the aggregate up, along with the asphalt binder, to temperatures of 310°F. The mix is then trucked out to the project location in heated trucks.

In comparison, FSB and Asphalt Emulsions greatly reduce GHG emissions by making use of recycled aggregates and mixing them with foamed or emulsified asphalt at ambient temperatures. This eliminates the need for long distance trucking of virgin aggregates, heating up of aggregates and asphalt binder which in turn reduces emissions related to electricity, diesel or natural gas consumption at the mix plant and delivering the mix to the site.

The geographical boundary of the project activity is limited to the United States per the requirements set out in VM0039. The states with project instances include Iowa, Minnesota, Wyoming, Tennessee, Wisconsin, and Colorado.

All project instances in this project have already been implemented (i.e. construction has already been completed). The first instance of the project crediting period occurred on 27-04-2021 while the first and last instance within this monitoring period occurred on 07-05-2022 and 12-09-2024. There are a total of 57 instances in this project monitoring period.

The project activity instances quantify the reductions in GHG emissions associated with the use of FSB and/or asphalt emulsions as substitutes to HMA for a group of highway asphalt construction projects. The current and future project instances consist of existing highway roads in need of repair to extend the usable lifespan for conveying vehicular traffic.

The project instances will have a total GHG reduction of 89,606 tCO_2e over this current monitoring period.

1.2 Audit History

Audit type	Period	Program	Validation/verification body name	Number of years
Validation/ verification	27-April-2021 to 25-September-2021	VCS	SCS Global Services	0.41
Verification	26-September-2021 to 31-December 2024	VCS	SustainCert	2.59

1.3 Sectoral Scope and Project Type

Sectoral scope[1]	6
Project activity type	Construction

1.4 Project Proponent

Organization name	Global Emissionairy, LLC
Contact person	Harold Green
Title	CEO
Address	PO Box 6, Phoenix, Maryland, 21131
Telephone	202-288-4130
Email	project.proponent@globalemissionairy.com

[1] *Projects, activities, or methodologies may be developed under any of the 16 VCS sectoral scopes: https://verra.org/programs/verified-carbon-standard/vcs-program-details/#sectoral-scopes*

1.5 Other Entities Involved in the Project

Organization name	Global Emissionairy, LLC
Role in the project	Technical Consultant, Methodology Development
Contact person	Dr. Chandra Akesitty
Title	Senior Pavement Engineer
Address	7035 Southmoor Street, Hanover, MD 21076
Telephone	301-405-3104
Email	chandra@globalemissionairy.com

Organization name	Global Emissionairy, LLC
Role in the project	Account Manager
Contact person	Jim Peacock
Title	Account Manager
Address	PO Box 6, Phoenix, Maryland 21131
Telephone	443-864-3683
Email	jp@globalemissionairy.com

Organization name	Surface Cycle
Role in the project	Asphalt Contractor and Stakeholder
Contact person	Dan Schellhammer, P.E.
Title	Vice President of Business Development
Address	21955 Grenada Ave., Lakeville, MN 55044

Telephone	952-985-6156
Email	dan.schellhammer@surface-cycle.com

1.6 Project Start Date

Project start date	27-April-2021
Justification	The project start date of a non-AFLOU project is the date on which the project began GHG reduction activities. In terms of VM0039 which defines emission reductions from construction activity, this relates to the time when roadway construction begins. The earliest start date for the project crediting period was 27-April-2021 which was obtained from invoices sent to the client. For QA/QC purposes, the start dates of all projects were cross verified bill of lading tickets documenting the first shipment of materials and ensures that no project emissions occurred prior to this date. Refer to Appendix B for a list of all project instance start dates

1.7 Project Crediting Period

Crediting period	☐ Seven years, twice renewable ☒ Ten years, fixed ☐ Other (state the selected crediting period and justify how it conforms with the VCS Program requirements)
Start and end date of first or fixed crediting period	27-April-2021 to 26-April-2031

1.8 Project Location

All project instances in this grouped project are located within the United States of America. Each of the project instances location has been provided to the VVB in past monitoring periods and will be provided to the VVB in a similar manner as a KML file in this monitoring period as well. This is done in accordance with Section 3.6.8 of the VCS Standard v4.7.

1.9 Title and Reference of Methodology

Type (methodology, tool or module).	Reference ID, if applicable	Title	Version
Methodology	VM0039	VM0039: Methodology for the use of Foam Stabilized Base and Emulsion Asphalt Mixtures in Pavement Application	1.1

1.10 Double Counting and Participation under Other GHG Programs

1.10.1 No Double Issuance

Is the project receiving or seeking credit for reductions and removals from a project activity under another GHG program?

☐ Yes ☒ No

1.10.2 Registration in Other GHG Programs

Was the project registered or seeking registration under any other GHG programs?

☐ Yes ☒ No

1.11 Double Claiming, Other Forms of Credit, and Scope 3 Emissions

1.11.1 No Double Claiming with Emissions Trading Programs or Binding Emission Limits

Are project reductions and removals or project activities also included in an emissions trading program or binding emission limit? See the VCS Program Definitions for definitions of emissions trading program and binding emission limit.

☐ Yes ☒ No

If yes, provide all required evidence of no double claiming as outlined by the VCS Standard.

1.11.2 No Double Claiming with Other Forms of Environmental Credit

Has the project activity sought, received, or is planning to receive credit from another GHG-related environmental credit system? See the VCS Program Definitions for definition of GHG-related environmental credit system.

☐ Yes ☒ No

If yes, provide all required evidence of no double claiming as outlined by the VCS Standard.

1.11.3 Supply Chain (Scope 3) Emissions

Do the project activities affect the emissions footprint of any product(s) (goods or services) that are part of a supply chain?

☒ Yes ☐ No

If yes:

Is the project proponent(s) or authorized representative a buyer or seller of the product(s) (goods or services) that are part of a supply chain?

☒ Yes ☐ No

If yes:

Has the project proponent(s) or authorized representative posted a public statement on their website saying, “Carbon credits may be issued through the Verified Carbon Standard project [project ID] for the greenhouse gas emission reductions or removals associated with [project proponent or authorized representative organization name(s)] [name of product(s) whose emissions footprint is changed by the project activities].”

☒ Yes ☐ No

If yes to all:

Provide evidence of the public statement. Evidence must be provided in this section or in an appendix.

The public statement can be viewed on the VCS 3616 project page on the Global Emissionairy website (https://globalemissionairy.com/project/the-recycling-roadways-for-carbon-emission-reductions-4547/)

1.12 Sustainable Development Contributions

The United Nations (UN) Sustainable Development Goals (SDGs) provide a global sustainability framework for all developed and developing countries to implement which contributes to a more sustainable future for all. While the United States has committed to the UN SDGs, it does not have any specific national target goals established for each SDG. However, several of the SDGs align with the grouped project instance, including SDG 9 – Target 9.4, SGD 12 – Target 12.5, and SDG 13.

- SDG 9 – Target 9.4 aims to upgrade infrastructure and retrofit industries to make them sustainable using increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes. The grouped project instances

utilize the CIR processe technology to rehabilitate roadways through recycling of the existing roadway material resulting in a significant reduction of virgin aggregate mining and greater resource-use efficiency.

- SDG 12 – Target 12.5 aims to substantially reduce waste generation through prevention, reduction, recycling, and reuse by 2030. The grouped project instances meet this design criteria through the CIR processe by re-using asphalt pavement millings onsite, greatly reducing wasted material.

- SDG 13 – aims to take urgent action to combat climate change and its impacts. While the grouped project instances do not directly correspond with an official SDG indicator, the very nature of the VCS Program aligns with this SDG through quantification of GHG emission reductions. The grouped project instances use the CIR process to greatly reduce CO_2 emissions as compared to the baseline HMA scenario.

Table 1: Sustainable Development Contributions

Row number	SDG target	SDG indicator	Net impact on SDG indicator	Current project contributions	Contributions over project lifetime
1)	9.4	By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities	Implemented activities to increase	The project has upgraded 1,082 lane miles of roadway infrastructure using more sustainable construction processes than the typical baseline scenario project.	The project has upgraded 1273 lane miles of roadway infrastructure using more sustainable construction processes than the typical baseline scenario project.
2)	12.5	By 2030, substantially reduce waste generation through prevention, reduction, recycling, and reuse	Implemented activities to increase	The project has reduced 1,185,654 tonnes of waste through the recycling and reuse of asphalt millings in roadway construction.	The project has reduced 1,615,852 tonnes of waste through the recycling and reuse of asphalt millings in roadway construction.
3)	13.0	Tonnes of greenhouse gas emissions avoided or removed	Implemented activities to increase	The project has prevented the release of 89,606 tonnes of carbon into the atmosphere during the monitoring period.	The project has prevented the release of 118,521 tonnes of carbon into the atmosphere during the project lifetime.

1.13 Commercially Sensitive Information

Commercially sensitive information includes contractual agreements related to ownership and the names of the companies that Global Emissionairy partners with. No commercially sensitive information has been excluded from this document. All excluded information has to demonstrate project ownership has been provided to the VVB for each successive monitoring period including this one.

2 SAFEGUARDS AND STAKEHOLDER ENGAGEMENT

2.1 Stakeholder Engagement and Consultation

2.1.1 Stakeholder Identification

Stakeholder Identification	Stakeholder engagement begins when the roadway owner-typically state agencies- posts the projects for bidding. This process is posted on the agency website as a formal announcement and is publicly available for scrutiny. There is a predetermined period where contractors can bid on projects. For the project instances in this grouped project, the first date of bidding was 28-August 2020. The stakeholders involved in the process are: • Asphalt contractors • Roadway owners
Legal or customary tenure/access rights	Each project instance location (roadway) is owned by a government agency, typically the state or town. Contractors are the owners of all equipment and material sourcing/storage facilities. Occasionally, contractors source project materials like Portland Cement from third parties, often manufacturers, who own their own plants and storage locations.
Stakeholder diversity and changes over time	The instances for this monitoring report occur in the states of Iowa, Minnesota, Wyoming, Wisconsin, Tennessee, and Colorado. Most of the roads are owned by city or state agencies, which is almost always the case with projects of this nature. State agencies put these projects out to bid in a transparent process where the contractor with the lowest bid wins the contract. This is important in terms of potential carbon financing since contractors may not always prefer cold recycling techniques due to narrower profit margins and carbon

	financing incentivizes contractors to opt for recycling methods over traditional HMA.
Expected changes in well-being	In-place recycling treatments can benefit the roadway owner (state agencies), and contractors as well as the traveling public when compared to the baseline scenario. The expected changes in stakeholder well-being from the baseline scenario for a recycling project are as follows: A reduced demand on mining aggregate can reduce overall pollution in areas surrounding aggregate quarries. Traditional HMA mill and fill, and HMA overlay treatments require longer construction times, more traffic control and longer delays for the traveling public. A cold in-place project can produce a ride-ready surface within a day.
Location of stakeholders	The stakeholders of each project are located primarily within the same state as the project instance. State agencies tend to favor local contractors and hence most of the contractors are from the same state as the recycling project. There are some instances where the contractor is from a neighboring state. Impacts to stakeholders are also localized with traffic control measures affecting the immediate surroundings of each project. Since most of the aggregate is recycled in place, there is a limited effect of each project instance on locations outside its vicinity.
Location of resources	Unlike conventional HMA treatments, recycling treatments do not depend on virgin aggregate stockpiles and hence are not dependent on quarries to source their materials. The contractors involved in projects in this report use the aggregate for CIR from the same road that is being treated. A contractor may have access to their own stockpiles of asphalt binder and cement but may also source this from a third party. The roads being treated are typically owned by the town or state.

2.1.2 Stakeholder Consultation and Ongoing Communication

Ongoing consultation	In addition to the public solicitation process, our projects are publicly listed on our website, which provides a platform for anyone to access project details and submit

	on-going comments or inquiries at: https://globalemissionairy.com/contact/ or email contact@globalemissionairy.com.
Date(s) of stakeholder consultation	21-04-2022
Communication of monitored results	The pavement contractor was kept informed during each phase of the previous monitoring period through emails and phone calls in order to keep them abreast of the status of the project. Issuance was also promptly communicated to the contractor as well as timely notification of carbon credit sales.
Consultation records	Consultation with the roadway contractor was done via phone calls and emails
Stakeholder input	Global Emissionairy considers all stakeholder inputs and comments during the bidding and enquiry phase. Till date, no stakeholder input has been received.

2.1.3 Free, Prior, and Informed Consent

Consent	The roadway project instances that are listed in this project are all public entities that are government owned by either a town, county, or state. The stakeholders mentioned in this document, i.e. roadway contractors are hired on a contract to rehabilitate the road. Because all the project instances in this grouped project are rehabilitation only, there is no consent required from private stakeholders, because there aren't additional property impacts beyond the existing road. The mode of consent between the stakeholder and the local agency is in the form of bid approval. Project initiation is testament to the fact that the bid from the contractor was approved and the government agency has signaled its approval for the project to go ahead. Because project initiation follows the same standard process, the process of obtaining consent mentioned above will continue to be applicable for future monitoring periods for all instances in this grouped process.
Outcome of FPIC	As discussed above, no FPIC was carried out due to the nature of the project instances in this project.

2.1.4 Grievance Redress Procedure

Grievances received	Resolution and outcome
No grievances were received in the past or current monitoring period	No grievances were received in the past or current monitoring period. Our grievance redress procedure is accessible to stakeholders on our website, ensuring opportunities for ongoing consultation and feedback.[2]

2.1.5 Public Comments

Summary of comments received	Actions taken
No public comments received in prior or current monitoring periods	No public comments received in prior or current monitoring periods. However, in the event a grievance or public comment is received, the project proponent will take a proactive and communicative approach, ensuring that concerns are acknowledged, reviewed, and addressed in a transparent and supportive manner. The process will prioritize the well-being of communities and stakeholders, foster open dialogue, and maintain proper records of actions taken and resolutions achieved.

2.2 Risks to Stakeholders and the Environment

2.2.1 Management Experience

Both the project proponent and the stakeholders have the expertise and experience in conducting project activities. Surface Cycle is a combination of several asphalt pavement recycling companies who pool several years of recycling experience into a combined entity. The organization has registered professional engineers who ensure that each project is executed and carried out according to plans and follows all local and national design specifications for optimal performance. Surface Cycle has detailed information on their management team, qualifications, relevant experience, partnerships and associations, and products/services. This information is publicly available on their website (https://www.surface-cycle.com/about/).

[2] Global Emissionairy Grievance Redress Policy - https://www.globalemissionairy.com/project/the-recycling-roadways-for-carbon-emission-reductions-4547

Global Emissionairy has team members with experience in carbon accounting and managing GHG emission reduction projects using VM0039 right from project kickoff to credit issuance. GE has civil engineers both on its team and as consultants who assist with QA/QC and ensure that the data it receives from stakeholders is of the highest quality and accurately reflects the amount of GHG's reduced during project implementation. Global Emissionairy also has detailed information on their team, qualifications, relevant experience, partnerships and associations, and services. This information is publicly available on our website (https://www.globalemissionairy.com/about).

2.2.2 Risk assessment

	Risk identified	Mitigation or preventative measure(s) taken
Natural and human-induced risks to stakeholders' wellbeing	Operation of heavy machinery and equipment.	State agencies outline safety requirements for all projects that go to bid. Stakeholders are required by law to ensure that operators of heavy equipment and machinery have received appropriate training and are provided with adequate PPE.
Risks to stakeholder participation	No risks identified.	Not applicable. Once contractors win project bids, they are allowed to carry on with work schedules that were agreed on in bid documents.
Working conditions	Operating of heavy machinery and fair labor hours	State agencies outline safety requirements for projects as well as fair labor hours in project bid documents, so the contractor is aware of any and all safety requirements on site during construction
Safety of women and girls	No risks identified.	All bid documents emphasize that safety guidelines surrounding the operation of heavy equipment must be strictly followed. All personnel, irrespective of gender, are required to undergo the same standard training on operating equipment prior to being allowed to operate equipment on site. Bid documents also include requirements for fair labor hours. In addition, the stakeholder provides

		Global Emissionairy with labor timesheets which confirm that fair labor work hours were followed.
Safety of minority and marginalized groups, including children	No risks identified.	Roadway contractors must adhere to any and all work zone safety put forward by local agencies in the bid documents as well as general guidelines on workplace safety. United States labor laws require contractors to be equal opportunity employers and therefore no risks exist in this category
Pollutants (air, noise, discharges to water, generation of waste, and release of hazardous materials and chemical pesticides and fertilizers)	Emissions and noise levels associated with the operation of heavy construction equipment.	Projects produce significantly less CO2 emissions than the standard baseline practice. Noise levels on cold recycling projects are comparable to the baseline practice, which includes milling off existing roadway surfaces.

2.3 Respect for Human Rights and Equity

2.3.1 Labor and Work

	Risks identified[3]	Mitigation or preventative measure(s) taken
Discrimination	No risks identified. All project instances in this grouped project take place in the United States which has strict laws and regulations that prohibit discrimination and sexual harassment. Title VII of the Civil Rights Act of 1964 provides protection for all employees of US based companies and also extends to roadway construction	N/A

[3] The identified risks and commensurate mitigation or preventative measure(s) for forced labor, child labor, and human trafficking, must be inclusive of staff and contracted workers employed by third parties.

	sites for the project instances in this monitoring report.	
Sexual harassment	No risks identified. See above	N/A
Gender equity in labor and work	No risks identified. See above	N/A
Forced labor	No risks identified. See above	N/A
Child labor	No risks identified. See above	N/A
Human trafficking	No risks identified. See above	N/A

2.3.2 Human Rights

Risks identified	Mitigation or preventative measure(s) taken
The project instances in this grouped project are required to uphold criteria set forth in the bid documents on fair labor hours, equal opportunity employment, safe working conditions and human rights. If violations occur, the project can be prematurely terminated by the local agency that owns the roadway	Not applicable

2.3.3 Indigenous Peoples and Cultural Heritage

Risks identified	Mitigation(s) or preventative measure taken
This grouped project focuses on the rehabilitation of the existing roadways, reducing the need for land acquisition or intrusion into new areas. The scope of work is strictly roadway reconstruction which does not involve displacing indigenous people or their cultural heritage. This grouped project involves rehabilitation of existing roadways and hence does not pose a risk to indigenous people or cultural heritage.	Not applicable

2.3.4 Property Rights

Risks identified	Mitigation or preventative measure(s) taken
Territories and resources for roadway rehabilitation are typically owned by the	Not applicable

state, county or town and are public property. The project activities remain confined to public land allocated for transportation infrastructure. Property boundaries are established and no encroachment onto privately-owned land occurs. The stakeholders involved merely provide a service to the local agency by reconstructing the roadway, hence no risks are identified	

2.3.5 Benefit Sharing

Summary of the benefit sharing plan	As described in Section 2.3.4, the project activities defined by VM0039 do not involve any benefit sharing or transferring of property since the land in question is owned by a local agency and is public property. Therefore, no benefit sharing plan exists
Benefit sharing during the monitoring period	Not applicable

2.4 Ecosystem Health

	Risk identified	Mitigation or preventative measure(s) taken during the monitoring period
Impacts on biodiversity and ecosystems	Negligible risk to plant and animal life during construction	The project instances under this methodology are small to medium scale and do not significantly impact biodiversity and local ecosystems. An environmental impact assessment is carried out prior to construction by the local agency who owns the roadway
***S*oil degradation and soil erosion**	None	Soil degradation is highly unlikely in a roadway

		project of this nature, which requires a stable soil structure prior to construction. These projects will often improve the soil structure and drainage along the roadway to increase the longevity of the highway and therefore will reduce the risk of future soil erosion
Water consumption and stress	None	Cold recycling uses 1-2% water by weight of mix and this consumption does not have an adverse effect on the water needs of surrounding areas. Water is frequently sourced from hydrants along the project.

2.4.1 Rare, Threatened, and Endangered species

Species or habitat	Not applicable under VM0039 v1.1. Roadway rehabilitation does not endanger plant or animal species since the roadway exists prior to project implementation and is merely being rehabilitated
Areas needed for habitat connectivity	Not applicable due to reason mentioned above

	Risks identified	Mitigation or preventative measure(s) taken
Habitats for rare, threatened, and endangered species	No risk identified. See section 2.4.1	Not applicable
Areas for habitat connectivity	No risk identified. See section 2.4.1	Not applicable

2.4.2 Introduction of species

Not applicable under project VCS 3616 Recycling Roadways for Carbon Emission Reductions – Midstate Reclamation and Trucking

2.4.3 Ecosystem Conversion

Risks identified		Mitigation or preventative measure(s) taken
Ecosystem conversion	Because the roadway being rehabilitated is pre-existing. There is no risk of ecosystem conversion since the roadway existed prior to the start of emission reduction activities	Not applicable

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

This project uses a patented paving technology to replace HMA in asphalt paving projects. The emission reductions and removals are achieved during the road construction process and therefore the project must be fully implemented before any emission reductions are realized. All projects included in this project description monitoring period have been fully implemented and the emission reductions have been achieved. During project implementation all required documentation was collected to ensure all emission reduction claims are true and accurate. Leakage is not considered an issue under VM0039 methodology and is therefore set at zero, refer to section 5.3 for more information related to leakage.

During this monitoring period, the primary stakeholder's name has been updated to Surface Cycle following the acquisition of Midstate Reclamation and Trucking and The Coughlin Company by Surface Cycle. Both these companies have similar expertise in Cold in-place recycling techniques that are applicable to project instances in this monitoring period.

3.2 Deviations

3.2.1 Methodology Deviations

1. Deviation to determine the total emissions produced by the addition of lime as a stabilizing agent in one project activity instance (PAI) titled "Coughlin Colorado Project".

The project instance "Coughlin Colorado Project" that utilized quicklime has been properly accounted for, emission-wise, in our documentation. This project still meets all applicability conditions of the methodology 1) reconstructed a roadway in the United States 2) utilized CIR construction process 3) project reconstructed a single roadway 4) the project contained an FSB or AE stabilizer in the asphalt mixture.

While quicklime is not specifically mentioned in the methodology, as inputs can vary, it has no bearing on the inclusion as a qualified project as it meets all applicability conditions. Quicklime was added based on site-specific conditions of the existing roadway. Based on the laboratory mix design testing it was deemed necessary to add this additive to ensure a structurally sound pavement, as the addition of quicklime resulted in the best structural strength of the ultimate asphalt product. Since an additional additive was required to achieve structural integrity, we accounted for that input material by tracking the source (miles driven for delivery) and the upstream emission factor to account for this additive.

This is considered conservative since we properly accounted for all material inputs. If we ignored the addition of quicklime we would have under accounted for project emissions, but since we used verified data for this input, we have properly quantified all project emissions ensuring an accurate claim on the resulting emission reductions. The quicklime emission factor was sourced from credible third-party

data from Ecoinvent, which is an industry standard for lifecycle assessments commonly used in the construction industry. The emission factor has been reviewed and verified by the VVB.

2. For this monitoring period, Methodology VM0039 v1.1 was applied in place of the originally registered version v1.0. The only change in v1.1 is the introduction of an upstream discount factor, which results in a more conservative quantification of emission reductions. The update does not affect applicability conditions, as they remain unchanged between the two versions. Additionally, The calculation structure and quantification of the emission reductions remain the same in both versions of Methodology VM0039.

3.2.1 Project Description Deviations

No deviations were made to the project description during the monitoring period

3.3 Grouped Projects

No.	New Project Activity Instance Eligibility Criteria	How the new project activity instances comply	VCS Standard, v4.7 Reference
1	Meet the applicability conditions set out in the methodology applied to the project.	All project activities instances in this monitoring period consist of road construction projects.	3.6.16
2	Use the technologies or measures specified in the project description.	All project activity instances in this monitoring period utilize the CIR process stabilized with FSB or asphalt emulsions.	3.6.16
3	Apply the technologies or measures in the same manner as specified in the project description.	All project activity instances in this monitoring periods production plants served roadway pavements and included one FSB or asphalt emulsion base layer.	3.6.16
4	Are subject to the baseline scenario determined in the project description for the specified project activity and geographic area.	All project activity instances in this monitoring period are subject to the baseline scenario of business-as-usual HMA pavement constructed in the United States.	3.6.16

No.	New Project Activity Instance Eligibility Criteria	How the new project activity instances comply	VCS Standard, v4.7 Reference
5	Have characteristics with respect to additionality that are consistent with the initial instances for the specified project activity and geographic area.	All project activity instances in this monitoring period have demonstrated regulatory surplus and emit less than the predetermined performance benchmark.	3.6.16
6	Occur within one of the designated geographic areas specified in the project description.	All project activity instances in this monitoring period occurred within the United States.	3.6.17
7	Conform with at least one complete set of eligibility criteria for the inclusion of new project activity instances. Partial conformance with multiple sets of eligibility criteria is insufficient.	All project activity instances in this monitoring period conform to all eligibility criteria set forth in this table.	3.6.17
8	Be included in the monitoring report with sufficient technical, financial, geographic, and other relevant information to demonstrate conformance with the applicable set of eligibility criteria and enable evidence gathering by the validation/verification body.	All project activity instances in this monitoring period provided all data and documentation as required to sufficiently demonstrate conformance with all the eligibility criteria and allowed for an impartial audit and were validated at the time of verification against the applicable set of eligibility criteria by the validation/verification body.	3.6.17
9	Have evidence of project ownership, in respect of each project activity instance, held by the project proponent from the respective start date of each project activity instance (i.e., the	All project activity instances in this monitoring period provided proof of ownership through a contractual agreement between project proponent and road contractor that was active prior to the start of emission reduction activities.	3.6.17

No.	New Project Activity Instance Eligibility Criteria	How the new project activity instances comply	VCS Standard, v4.7 Reference
	date upon which the project activity instance began reducing or removing GHG emissions).		
10	Have a start date that is the same as or later than the grouped project start date.	All project activity instances in this monitoring period provided evidence that project activities and emission reduction began to be generated on or after the project start date 27-April-2021	3.6.17
11	Only be eligible for crediting from the later date of the project activity instance or the start of the verification period in which they were added to the grouped project, through to the end of the total project crediting period.	All project activity instances in this monitoring period provided evidence of when project activities and emission reduction began to ensure to meet this eligibility requirement. Each instance occurred on or after the project start date of 27-April-2021.	3.6.17
12	Not be or have been enrolled in another VCS project.	All project activity instances in this monitoring period have provided evidence that each was a distinct activity and were not enrolled in another VCS project.	3.6.17
13	Adhere to the clustering and capacity limit requirements for multiple project activity instances set out in 3.6.8 – 3.6.9.	All project activity instances in this monitoring period did not occur within 10 kilometers of another instance of the same project activity and with the same project proponent. Please note that VM0039 does not apply a capacity limit, therefore that requirement is not applicable.	3.6.17
14	A grouped project shall be described in a single project description.	All project activity instances in this monitoring period are described in a singular project description.	3.6.22

No.	New Project Activity Instance Eligibility Criteria	How the new project activity instances comply	VCS Standard, v4.7 Reference
15	A delineation of the geographic area(s) within which all project activity instances shall occur. Such area(s) shall be specified by geodetic polygons. For projects with multiple project activity instances and grouped projects, a geodetic coordinate for each instance, provided in a KML file.	All project activity instances in this monitoring period occurred within the delineated United States boundary provided in the project KML file within the Verra registry and each individual project activity instance was included with geodetic coordinates.	3.6.22 / 3.11.1
16	One or more determinations of the baseline for the project activity in accordance with the requirements of the methodology applied to the project.	All project activity instances in this monitoring period were subject to the baseline scenario which is the continuation of reconstructing roadways in the United States with HMA pavement. The crediting baseline was applied according to the year the asphalt installation took place; thus, all inclusions documented the year the project took place with sufficient evidence. Each project activity instance was included in Section 5.1 of this monitoring report for a baseline determination.	3.6.22
17	One or more demonstrations of additionality for the project activity in accordance with the requirements of the methodology applied to the project.	All project activity instances in this monitoring period were included in Section 3.5 of the PD to demonstrate the results of the additionality testing requirements of VM0039.	3.6.22
18	One or more sets of eligibility criteria for the inclusion of new project activity instances at	All project activity instances in this monitoring period were	3.6.22

No.	New Project Activity Instance Eligibility Criteria	How the new project activity instances comply	VCS Standard, v4.7 Reference
	subsequent verification events.	evaluated against all criteria listed within this table.	
19	A description of the central GHG information system and controls associated with the project and its monitoring.	All project activity instances in this monitoring period were implemented according to the monitoring plan provided in Section 6.3 of this monitoring report which documents the central GHG information system and controls applied to the project. There were no variations in procedures encountered during this monitoring period.	3.6.22

3.4 Baseline Reassessment

Did the project undergo baseline reassessment during the monitoring period?

☐ Yes ☒ No

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

4.1.1 Parameters Available at Validation for CIR or FDR

Data / Parameter	EF_M
Data unit	kgCO2e/kg
Description	Material emission factor
Equations	2
Source of data	CMUGDI (2008), Portland Cement Association EPD (2023)[4], European Lime Association EPD for quicklime
Value applied	RAP: 0 Cement: 0.922 Bitumen: 0.48 Water: 0 Crushed Rock: 0.056 Sand: 0.005 Manufactured Aggregates: 0.006 Quicklime: 1.25
Justification of choice of data or description of measurement methods and procedures applied	The cement material emission factor is based on the Portland Cement Association Environmental Product Declaration revised October 2023. This EPD is applicable to North American cement mixes produced between 12-March-2021 and 12-March-2026. CMUGDI (2008) is comprised of national economic input-output models and publicly available resources use and emission data, which has been accessed over 1 million times by researchers or business users. The European Lime Association provides a conservative and up to date value of quicklime production emissions.

[4] Portland Cement Association EPD (2023) https://www.cement.org/a-sustainable-future/reaching-our-goal/quantifying-environmental-impact/

Purpose of Data	Calculation of material production emissions
Comments	Data to be updated when the material emissions factor is updated Mix design results and pavement evaluations did not require the use of crushed rock, sand, or manufactured aggregates. Therefore, these materials were not used in this monitoring period. Their exclusion did not affect the production or performance of FSB or asphalt emulsion. Additionally, Quicklime was added for a specific project due to pavement property evaluations and mix design results.

Data / Parameter	EF_T
Data unit	kgCO2e/mile
Description	Truck's emission per mile travelled
Equations	3, 4
Source of data	TCR (2015)
Value applied	10.2
Justification of choice of data or description of measurement methods and procedures applied	Emission factors from TCR are compiled from publicly available data sources and updated each year to ensure that project proponents have the most accurate and up-to-date greenhouse gas data.
Purpose of Data	Calculation of CIR or FDR delivery emission
Comments	Data to be updated when the diesel emissions factor is updated

Data / Parameter	EF_{EQ}
Data unit	kgCO2e/hour
Description	Equipment emissions per hour
Equations	6, 7

Source of data	EPA (2022). "Engine Certification Data for Heavy Truck, Buses, and Engines." http://www.epa.gov/oms/certdata.htm#largeng
Value applied	Appendix 2 of VM0039 Methodology v1.1
Justification of choice of data or description of measurement methods and procedures applied	The engine emission information is obtained from the EPA off-road engine certification database and further stratified equipment types by engine maker and horsepower rating. The database created for equipment emission estimation is presented in Appendix 2 of VM0039 Methodology v1.1
Purpose of Data	Calculation of CIR or FDR emission
Comments	Data was collected one time and must be updated when more strict emission standard is implemented nationwide

Data / Parameter	DF_D
Data unit	Between 0 and 1
Description	For conservativeness, a discount factor for distance calculation (DFD) must be applied when a map distance calculator is used to estimate hauling distance. DFD is equal to 0 if using actual logged miles.
Equations	3, 4
Source of data	On-site observations
Value applied	0.1
Justification of choice of data or description of measurement methods and procedures applied	Ten projects were observed on site to count the distance between map and equipment odometer. Hauling distance = Map distance × (1+DFD)
Purpose of Data	Calculation of baseline transportation emissions Calculation of CIR transportation emissions
Comments	Data does not need to be updated

Data / Parameter	DF
Data unit	Dimensionless
Description	Discount factor for upstream displacement
Equations	15 to 26
Source of data	VCS Methodology Requirements, v4.4
Value applied	Patching < 40 miles: 0.15 Patching > 40 miles: 0.12 Roadway: 0.15
Justification of choice of data or description of measurement methods and procedures applied	The default value of 30% for upstream displacement was applied to raw materials production and delivery to determine the discount factor on the overall baseline emissions for each category. Refer to VM0039, v1.1 for further information. Project proponents may propose a methodology revision with a different discount factor for upstream displacement in accordance with the latest version of the VCS Methodology Requirements.
Purpose of Data	Calculation of baseline emissions
Comments	N/A

4.2 Data and Parameters Monitored

4.2.1 Data and Parameters Monitored for CIR or FDR

Data / Parameter:	W_M
Data unit:	kg
Description:	The weight of each raw material used to produce FSB or asphalt emulsions
Source of data:	Data derived from monitoring
Description of measurement methods and procedures to be applied:	The data can be obtained from project records.

Frequency of monitoring/recording:	Once per project instance
Value monitored:	The value applied will differ for each instance since this project involves a significant number of project instances. Therefore, specific values are provided to the VVB for each verification period. Refer to Appendix E.2 columns 6, 9, 12, & 15
Monitoring equipment:	Truck scales
QA/QC procedures to be applied:	The reported quantity can be verified from any one of the following documents: • Trucking manifests • Bill of lading tickets • Quantity estimates in plan sets • Recommended quantities in mix designs
Purpose of data:	Calculation of CIR or FDR material emissions
Calculation method:	-
Comments:	Data does not need to be updated

Data / Parameter:	Project amount
Data unit:	t
Description:	Output quantity of FSB and asphalt emulsions
Source of data:	Data provided by the paving contractor Data derived through monitoring
Description of measurement methods and procedures to be applied:	The data can be reported according to plant production records
Frequency of monitoring/recording:	Once per project instance
Value applied:	The value applied will differ for each instance since this project involves a significant number of project instances. Therefore, specific values are provided to the VVB for each verification period. Refer to Appendix E.2 column 5

Monitoring equipment:	N/A
QA/QC procedures to be applied:	Cross-checking of reported quantity versus trucking manifests to confirm quality measurement.
Purpose of data:	Calculation of CIR or FDR emission
Calculation method:	-
Comments:	-

Data / Parameter:	L
Data unit:	miles
Description:	Length of damaged pavement
Source of data:	Road Contractor Data derived from monitoring
Description of measurement methods and procedures to be applied:	The data can be obtained from project records
Frequency of monitoring/recording:	Once per project instance
Value applied:	The value applied will differ for each instance since this project involves a significant number of project instances. Therefore, specific values are provided to the VVB for each verification period.
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Cross-checking of reported length versus mapped project length on plan sets to confirm quality measurement.
Purpose of data:	Calculation of CIR or FDR emission
Calculation method:	-
Comments:	-

Data / Parameter:	$Distance_S$

Data unit:	miles
Description:	The total miles that trucks travelled to supply raw materials to the job site
Source of data:	To-site delivery mileage is obtained by mapping out the driving distance between the raw material supplier and the project instance site. Data derived from monitoring on site
Description of measurement methods and procedures to be applied:	Distance can be obtained from the daily report of truck drivers or measured by approximation
Frequency of monitoring/recording:	Once per project instance
Value applied:	The value applied will differ for each instance since this project involves a significant number of project instances. Therefore, specific values are provided to the VVB for each verification period. Refer to Appendix E.3 columns 7, 10, 13 & 16
Monitoring equipment:	The distance that trucks traveled to supply raw materials to the job site was measured using online mapping software
QA/QC procedures to be applied:	Cross-checking of reported mileage versus distances measured on google maps using addresses for raw material sources and the project site
Purpose of data:	Calculation of CIR or FDR emission
Calculation method:	-
Comments:	-

Data / Parameter:	S
Data unit:	Miles per hour or feet per minute
Description:	Running speed of cold recycler
Source of data:	Road contractor Data derived from monitoring project site
Description of measurement methods and procedures to be applied:	Data can be obtained from production records.

Frequency of monitoring/recording:	Once per project instance
Value applied:	Varies based on project. If documentation is unavailable to corroborate contractor provided values, the cold recycler running speed is assumed to be 22 feet per minute, which is the lower end of a range of 22-25 feet per minute determined by case studies on CIR projects across the US.
Monitoring equipment:	Speedometer on one of the pieces of equipment attached to the CIR train.
QA/QC procedures to be applied:	Cross-checking of reported speed versus driver's log to confirm quality measurement. OR If precise values of running speed are not available, running speeds can be estimated from case studies of similar projects in the United States.
Purpose of data:	Calculation of CIR or FDR installation emissions
Calculation method:	-
Comments:	-

Data / Parameter:	DE
Data unit:	lb/cu.ft
Description:	Density of FSB or asphalt emulsions
Source of data:	Project specific or general mix designs. Data derived from monitoring
Description of measurement methods and procedures to be applied:	Density data can be obtained from project specifications
Frequency of monitoring/recording:	Once per project instance
Value applied:	The value applied will differ for each instance since this project involves a significant number of project instances. Therefore, specific values are provided to the VVB for each

	verification period. Refer to Appendix E.6 column 8 for values used in each project instance.
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Cross-checking of reported data versus theoretical density to confirm quality measurement. Theoretical density can be obtained from any of the following documents • Mix designs • Daily testing reports
Purpose of data:	Calculation of CIR or FDR installation emissions
Calculation method:	-
Comments:	-

Data / Parameter:	LC
Data unit:	-
Description:	Layer coefficient of FSB or asphalt emulsions
Source of data:	Data derived from monitoring
Description of measurement methods and procedures to be applied:	Layer coefficient values are obtained from research done by NCAT (National Center or Asphalt Technology) on CIR test tracks for determining the structural coefficient of recycled asphalt stabilized with FSB and AE.
Frequency of monitoring/recording:	Once per project instance
Value applied:	CIR = 0.38 FDR = 0.18
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Cross-checking of reported data versus DOT commonly used coefficients to confirm quality measurement.
Purpose of data:	Calculation of CIR or FDR installation emissions
Calculation method:	-
Comments:	-

4.3 Monitoring Plan

The monitoring plan details the procedures for collecting and reporting all data and parameters listed in Section 4.2. The Project Proponent's monitoring plan consists of the collection of project data relating to travel distances, energy and equipment usage, quantity of asphalt materials produced, asphalt material composition, and equipment type and usage.

The Data/Parameters that are typically collected on site are listed below:

1) Wm (weight of raw materials)
2) Project amount (quantity of FSB and AE)
3) $Distance_S$ (total truck travel miles to supply raw materials)
4) DE (density of FSB or AE CIR mix)
5) CIR milling depth
6) Project length, L in miles

Project Proponent and Data Collection Control:

Project data collection was conducted for each project instance by obtaining project documents from the asphalt contractor under Surface Cycle. The asphalt contractor foreman collects documents from suppliers of raw materials at the job site, such as pay items, material tickets, and weight documentation. The asphalt contractor personnel, that report to the foreman, are responsible for collecting all data monitored at the asphalt production facility and the construction site.

The foreman collects information on all materials received and for all roads constructed as pay items. Examples of pay items include the quantities of raw materials used, tons of materials produced, and the number of square yards paved per day. The foreman reconciles his or her informal checks through a visual inspection while walking on the site, as tanks arrive and deliver asphalt and cement, with material tickets to ensure accuracy. If any amount was returned for any reason, this amount was deducted from the total quantities from the project at the end of each working day.

At the main office, all documents that include physical copies and electronic versions are reconciled by the cost payable division, and payments are issued directly to the vendors. The original documents are generally delivered to the office every two weeks. The physical paper copies of all aforementioned documents are kept in the office for no less than two years after the job has been completed.

The asphalt contractor's server retains separate project folders for each project for four years, where all pertinent data for each project is stored. The electronic versions of the documents are stored by the asphalt contractor indefinitely.

Additional Quality Control Procedures:

The communication process and handling of changes and obstacles on-site involve the Owner's representative, the prime contractor's representative, and the QC representative. Minor changes in the process and test results will be communicated to the agency for permission to proceed. However, if there is any major change or obstacle, work will be halted until all responsible parties on-site address

and resolve the issue collectively. In such cases, the issue will typically be escalated to the design team.

The asphalt mix composition undergoes testing at several stages, including before and during its production and before, during, and after its installation.

Project Proponent Data Collection and Quality Control:

The data required for quantifying and reporting GHG emissions is typical of the data that asphalt contractors are required to monitor, collect, and have on hand as part of any asphalt installation project. Global Emissionairy begins collecting data during the end of the paving season, which is typically in late October/early November, and reviews each project instance for its viability to produce sufficient emission reductions. If the project is deemed a viable candidate for earning carbon credits, Global Emissionairy verifies all the information on the data intake form with extensive backup documentation collected for each project instance.

Global Emissionairy's data collection process consists of two phases. Phase one uses an Excel spreadsheet data intake form to collect information for each project instance. The data intake form includes space for the contractor to enter values for each of the monitored parameters. Phase two includes collecting relevant documentation from the contractor to verify the data entered in the excel sheet in phase one. This includes engineering plans, project drawings, asphalt mix designs (CIR only), material bill of lading receipts, and equipment operator timesheets. The data intake form is a summary form that allows for an initial calculation of GHG emission reductions while the supporting documentation provides a QAQC check to ensure that the values entered by the contractor represent a conservative approach to GHG emission reduction calculations.

The information from data intake forms is manually entered into Excel spreadsheets used for calculations from the methodology equations. These spreadsheets are backchecked by another staff member to ensure the transcription of data and the correct calculation of formulas. Global Emissionairy also analyses the data and cross-checks the testing data for consistency. If the data provided by the contractor had any discrepancies or missing information, the Global Emissionairy team communicates with the contractor to obtain the corrected data required. If discrepancies cannot be resolved through revised documentation, Global Emissionairy's team will use their best engineering judgement to ensure that the values used in these scenarios balance accuracy and conservative carbon accounting.

After completing the calculations in spreadsheets and writing project descriptions, Global Emissionairy stores the calculations at two electronic data storage networks. The data drives are also archived to preserve the data indefinitely in case of future reference requirements.

Calibration of Equipment:

1. The raw material inputs to the project are weighed using truck scales. All truck scales are outside of the project boundary as the truck scales are owned and operated by an external third-party material supplier. The project monitors and documents third party supplier raw material inputs using Bill of Lading (BOL) tickets provided by the third-party suppliers. This shows the weight of each raw material delivered to the project site. Therefore, the requested calibration on monitoring equipment used for data monitoring

can be safely assumed adequate, because the truck scale calibration is performed by third parties outside of the carbon reduction project.

2. Quality control and assurance practices are used to verify weights, densities, amount of asphalt, and water added to further justify the calibration of the equipment.
3. A third-party independent lab is hired to perform quality control testing on these jobs and the results are documented.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

The baseline equations below are not separated in Methodology VM0039 but are separated here to meet v4.4 template requirements.

Baseline emissions for the second monitoring period running from September 26th, 2021, to December 31st 2024 are calculated below. The crediting baseline (CB) and correction factors (θ_{AE} or Θ_{FSB}) variables are determined and available at validation as defined in Section 4.1. Projects that occurred in year 2022 have a crediting baseline of 94.3 $KgCO_2e$/tonne of CIR, and the performance benchmark drops by 0.1 $KgCO_2e$/tonne of CIR for subsequent years, as stated in VM0039 v1.1. The Project Amount variables are monitored and have been defined in Section 4.1 above for each project instance.

Baseline GHG emission reductions for a single asphalt emulsion project are calculated as follows:

$$BE_{AE-CIR} = \left(\frac{CB \times (1 - DF)}{\Theta_{AE}}\right) * \frac{Project\ Amount}{1{,}000}$$

Where:

BE_{AE-CIR}	=	Baseline Emissions of asphalt emulsions using CIR (tCO2e)
CB	=	Crediting baseline (kgCO2e/tonne)
Θ_{AE}	=	Correction factor for asphalt emulsion (default value is 1.17)
Project amount	=	Amount of asphalt emulsions manufactured (tonne)
DF	=	Discount factor for uncertainty in upstream displacement

Baseline GHG emission reductions for a single FSB project are calculated as follows:

$$BE_{FSB-CIR} = \left(\frac{CB \times (1 - DF)}{\Theta_{FSB}}\right) * \frac{Project\ Amount}{1{,}000}$$

Where:

$BE_{FSB-CIR}$	=	Baseline Emissions of asphalt emulsions using CIR (tCO2e)

CB	=	Crediting baseline (kgCO2e/tonne)
Θ_{FSB}	=	Correction factor for asphalt emulsion (default value is 1.02)
Project amount	=	Amount of asphalt emulsions manufactured (tonne)
DF	=	Discount factor for uncertainty in upstream displacement

5.2 Project Emissions

The project instances in this monitoring report are all CIR i.e. there are no CCPR or FDR projects available for this monitoring period. Therefore, the project emission equations for CCPR projects are omitted from this monitoring report. Section 5.2.1 lists the equations that are used to determine CIR project emissions

5.2.1 CIR Project Emissions

CIR or FDR emission intensity (CIR EI or FDR EI) represents the quantity of GHGs emitted from producing and installing one metric ton of FSB or asphalt emulsions using CIR or FDR. CIR EI or FDR EI is calculated using the following equation below:

$$CIR\ EI\ (or\ FDR\ EI) = EI_M + EI_{SD} + EI_I\ (Eq. 11)$$

Where:

CIR EI	=	Emission intensity of CIR (kgCO2e/tonne)
FDR EI	=	Emission intensity of FDR (kgCO2e/tonne)
EI_M	=	Emission intensity of raw material production (kgCO2e/tonne)
EI_{SD}	=	To-site delivery emission intensity (kgCO2e/tonne)
EI_I	=	On-site installation emission intensity (kgCO2e/tonne)

For a complete list of CIR/FDR project emissions, refer to Appendix E.6.

Emission Intensity of raw material production (EI_M) is calculated using the following equation below:

$$EI_M = \frac{EF_M \times W_M}{Project\ Amount}\ (Eq. 2)$$

Where:

EI_M	=	Emission intensity of raw material production (kgCO2e/tonne)
EF_m	=	Raw material emission factor (kgCO2e/tonne)
W_m	=	Raw material weight (kg)

Project amount = Amount of FSB/asphalt emulsions manufactured (tonnes)

For a complete list of CIR/FDR raw material production emissions, refer to Appendix E.2.

To calculate the emission intensity of raw material to-site delivery, the number of trips to the site, the number of trips from production plant to job site, discount factor, and truck emission factor are multiplied together and divided by the amount of the FSB or asphalt emulsions manufactured for the project. When hauling distance is not directly monitored, the distance is estimated using a map distance calculator. For conservativeness, a discount factor (DF) of 0.1 is applied when a map distance calculator is used to estimate hauling distance.

Emission Intensity of to-site delivery (EI_{SD}) is calculated using the following equation below:

$$EI_{SD} = \frac{Trip_S \times Distance_S \times (1 + DF) \times EF_T}{Project\ Amount} \quad (Eq. 4)$$

Where:

$Trip_S$ = Number of trips from production plant to job site

$Distance_S$ = Distance to site (miles)

DF = Discount factor

EF_T = Truck emission factor (kgCO2e/mile)

Project amount = Amount of FSB/asphalt emulsions manufactured (tonnes)

For a complete list of CIR/FDR to-site delivery emissions, refer to Appendix E.3.

On-site installation emissions intensity (EI_I) is derived from diesel consumption from the equipment used for the installation project. For CIR or FDR installation, this equipment typically includes a cold recycler (e.g., Wirtgen 3800 CR), cement spreader, water truck, bitumen truck, vibratory roller, pneumatic roller, skid steer, etc. A list of common emission factors used for FSB and asphalt emulsion CIR projects are provided in Appendix B of VM0039.

Emission Intensity of on-site installation equipment (EI_I) is calculated using the following equation below:

$$EI_I = \frac{EF_{EQ} * HR_{EQ}}{Project\ Amount} \quad (Eq. 8)$$

Where:

EI_I = Emission intensity of pavement installation (kgCO2e/tonne)

EF_{EQ} = Equipment emission factor (kgCO2e/tonne)

HR_{EQ} = Equipment operation hours (hour)

Project amount = Amount of asphalt emulsions manufactured (tonne)

For a complete list of CIR on-site installation emissions, refer to Appendix E.5.

This grouped project does not contain any CCPR or FDR projects in this monitoring period so the equations used for the calculation of CCPR and FDR emissions have been omitted.

5.3 Leakage Emissions

Leakage is not considered an issue under VM0039 methodology and is therefore set at zero. It is reasonable to assume zero leakage because there is no difference in site preparation activities between baseline and project scenarios. Replacing HMA with FSB or asphalt emulsions for the pavement base layer does not entail a change in carbon efflux or carbon sink at the construction site

5.4 GHG Emission Reductions and Carbon Dioxide Removals

Net GHG emission reductions and removals are calculated as follows. All calculations are performed for each individual project instance and then aggregated together for each given year. Global Emissionairy has provided spreadsheet documentation to the VVB so that all calculations can be traced accordingly.

Net GHG emission reductions for FSB and asphalt emulsions are the emission intensity differences adjusted by the weight differences.

A correction factor (θ) is calculated as follows:

$$\Theta = \frac{0.0025 * DE}{LC} Eq. 14$$

Where:

DE = Density of FSB or Asphalt Emulsions (lb/cu. Ft)

LC = Layer coefficient of FSB or Asphalt Emulsions

Net GHG emission reductions for a single project using CIR must be calculated as follows:

$$ER_{CIR} = \left(\frac{CB \times (1 - DF)}{\Theta} - CIR\ EI\right) * \frac{Project\ Amount}{1{,}000}\ Eq. 16$$

Where:

$ER_{FSB-CIR}$	=	Net emission reductions of FSB using CIR (tCO2e)
CB	=	Crediting baseline (kgCO2e/t)
Θ	=	Correction factor
CIR EI	=	Emission intensity of CIR project (kgCO2e/t)
Project amount	=	Amount of FSB or asphalt emulsion manufactured (t)
DF	=	Discount factor for uncertainty in upstream displacement

For a complete list of CIR emission reductions, refer to Appendix E.7

Vintage period	Baseline emissions (tCO_2e)	Project emissions (tCO_2e)	Leakage emissions (tCO_2e)	Reduction VCUs (tCO_2e)	Removal VCUs (tCO_2e)	Total VCUs (tCO_2e)
26-Sept-2021 to 31-Dec-2021[5]	0	0	0	0	0	0
01-Jan-2022 to 31-Dec-2022	34,686	10,736	0	23,950	0	23,950
01-Jan-2023 to 31-Dec-2023	45,717	8,948	0	36,769	0	36,769
01-Jan-2024 to 31-Dec-2024	37,844	8,957	0	28,887	0	28,887
Total	118,247	28,641	0	89,606	0	89,606

[5] Cold In-Place Recycling operations are seasonal and depend on regional climate conditions throughout the country. While the monitoring period began on September 26, 2021, no project activities occurred until May 2022 due to weather constraints during the winter and early spring months.

Vintage period	Ex-ante estimated reductions/ removals	Achieved reductions/ removals	Percent difference	Explanation for the difference
26-Sept-2021 to 31-Dec-2021	0	0	0%	No work took place during these dates
01-Jan-2022 to 31-Dec-2022	35,250	23,950	-32.05%	Lower than expected annual FSB/AE production. 15% upstream discount factor applied to baseline emissions.
01-Jan-2023 to 31-Dec-2023	42,250	36,769	-12.97%	Lower than expected annual FSB/AE production. 15% upstream discount factor applied to baseline emissions
01-Jan-2024 to 31-Dec-2024	50,570	28,887	-42.87%	Lower than expected annual FSB/AE production. 15% upstream discount factor applied to baseline emissions
Total	128,070	89,606	-30.03%	Lower than expected FSB/AE production over 3 years resulting in lower emissions reduced. 15% upstream discount factor applied to baseline emissions

APPENDIX A: COMMERCIALLY SENSITIVE INFORMATION

Section	Information	Justification
N/A	N/A	N/A

APPENDIX B: PROJECT LOCATIONS

Project Instance Start Date and Locations

Project Number	Project Start Date	Project Location
Coughlin Colorado Project	07-May-22	37°44'38.8"N, 107°01'30.3"W
50431 Mower MN	12-May-22	43°36'58.5"N, 92°27'54.3"W
50432 Mower MN	15-May-22	43°40'01.3"N, 92°54'07.3"W
50433 Scott MN	18-May-22	44°35'40.9"N, 93°30'14.3"W
50392 Pottawattamie IA	31-May-22	41°13'57.61"N, 95°32'24.11"W
50524 Washington MN	09-Jun-22	45°12'37.5"N, 92°53'04.6"W
50403 Redwood Brown MN	15-Jun-22	44°14'19.4"N, 95°03'59.5"W
50422 Redwood MN	23-Jun-22	44°27'22.6"N, 95°14'22.0"W
50389 Cherokee OBrien IA	07-Jul-22	42°50'12.1"N, 95°33'15.3"W
50374 Casper WY	18-Jul-22	43°9'45.56"N, 106°20'5.55"W
50346 Hennepin MN	10-Aug-22	45°06'56.2"N,93°35'18.8"W
50485 MnROAD MN	22-Aug-22	45°15'52.65"N, 93° 42' 57.1W
50363 Poweshiek IA	07-Sep-22	41° 42' 50.63"N, 92° 21' 28.01"W
50393 Shelby IA	14-Sep-22	41°33'47.2"N, 95°03'36.7"W
51123 Fayette IA-Echo Valley Road	03-May-23	42° 56' 49"N, 91° 47' 41"W
51123 Fayette IA-Ivy Road	08-May-23	42° 52' 50"N, 91° 46' 59"W
51049 Franklin IA	15-May-23	42°44'17.0"N, 93°07'28.8"W
50834 Pocahontas IA-CR 15	17-May-23	42°52'42.3"N, 94°39'37.4"W
50834 Pocahontas IA-CR 56	17-May-23	42°37'55.0"N, 94°38'20.4"W
51126 Brown MN	30-May-23	44° 13' 31"N, 94° 27' 51"W
51028 Blue Earth Faribault MN	30-May-23	43°50'53.6"N, 93°50'07.1"W
51086 Worth IA	12-Jun-23	43°23'11.0"N, 93°07'27.1"W
51026 Chickasaw IA	19-Jun-23	42°57'23.4"N, 92°19'2.16"W
51085 Mitchell IA	19-Jun-23	43°21'25.8"N, 93°00'17.4"W
51052 Warren IA	27-Jun-23	41°26'08.8"N, 93°41'28.6"W
51165 Warren TN	08-Jul-23	35° 43' 52"N, 85° 39' 59"W
51027 Boone IA	12-Jul-23	42°1'22.48"N, 93°44'16.19"W
51042 Sioux IA	25-Jul-23	42°56'53.6"N, 95°57'28.2"W
51043 Scott IA	26-Jul-23	41°36'07.2"N, 90°55'07.7"W
51013 Clarke Decatur IA	31-Jul-23	40°54'56.6"N, 93°46'03.6"W
51112 Clay MN	02-Aug-23	46°54'21.6"N, 96°35'02.1"W
51014 Lyon IA	11-Aug-23	43°27'45.0"N, 96°11'42.4"W
51176 Wood WI	21-Aug-23	44°22'24.1"N, 89°44'51.5"W
51057 Shelby IA	24-Aug-23	41°43'17.3"N, 95°20'39.6"W
51125 Keokuk IA	05-Sep-23	41° 12' 45"N, 92° 28' 58"W
51280 Lyon IA	16-Sep-23	43° 26' 51"N, 96° 27' 32"W
51361 Coffee TN	05-Oct-23	35° 57' 13"N, 85° 59' 50"W
51404 Worth IA	21-Aug-23	43°28'13.1"N 93°07'28.7"W
51692 KOSSUTH IA	02-May-24	43° 29' 18"N, 94° 25' 15"W
51687 MARTIN MN	06-May-24	43°46'31.0"N 94°29'32.6"W
51691 BUTLER IA	14-May-24	42° 53' 28"N, 92° 43' 56"W
51758 PLYMOUTH IA	28-May-24	42° 43' 15"N, 96° 20' 55"W
51644 POTTAWATTAMIE IA	10-Jun-24	41° 13' 57"N, 95° 24' 8"W
51596 PINE MN	08-Jul-24	46°09'39.4"N 92°51'58.0"W
51643 SIOUX IA	18-Jul-24	43° 11' 10"N, 96° 3' 34"W
51469 MARTIN WANTONWAN MN	09-Jul-24	43°48'11.8"N 94°42'29.9"W
51833 W26 BENTON IA	31-Jul-24	42° 6' 7"N, 91° 52' 24"W
51832 E24 BENTON IA	06-Aug-24	42° 9' 21"N, 92° 0' 45"W
51702 AITKIN MN	12-Aug-24	46°21'58.1"N 93°37'39.0"W
51463 HUMBOLT IA	14-Aug-24	42° 44' 6"N, 94° 14' 45"W
51749 DODGE MN	20-Aug-24	44°03'33.4"N 92°43'46.5"W
51585 DODGE MN	28-Aug-24	43°58'08.4"N 92°59'07.6"W
51878 WINNESHIEK IA	04-Sep-24	43° 9' 3"N, 91° 57' 29"W
51525 MARSHALL IA	12-Sep-24	42° 0' 28"N, 93° 8' 39"W
51560 ST LOUIS MN	30-May-24	47°28'42.7"N 92°49'49.7"W
51645 BROWN MN	14-Aug-24	44°17'50.1"N 94°42'15.0"W
51927 HOWARD IA	29-Jul-24	43°26'21.4"N 92°29'43.7"W

APPENDIX C: PROJECT SPECIFICATIONS

Project Number	Project Process	Specifications
Coughlin Colorado Project	CIR	CDOT Section 406 Cold Asphalt Pavement (Recycle)
50431 Mower MN	CIR	2018 MNDOT Cold In-Place Recycled/Cold Central Plant Recycling Section 2390.504
50432 Mower MN	CIR	2018 MNDOT Cold In-Place Recycled/Cold Central Plant Recycling Section 2390.504
50433 Scott MN	CIR	2018 MNDOT Cold In-Place Recycled/Cold Central Plant Recycling Section 2390.504
50392 Pottawattamie IA	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
50524 Washington MN	CIR	2018 MNDOT Cold In-Place Recycled/Cold Central Plant Recycling Section 2390.504
50403 Redwood Brown MN	CIR	2018 MNDOT Cold In-Place Recycled/Cold Central Plant Recycling Section 2390.504
50422 Redwood MN	CIR	2018 MNDOT Cold In-Place Recycled/Cold Central Plant Recycling Section 2390.504
50389 Cherokee OBrien IA	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
50374 Casper WY	CIR	Wyoming Department of Transportation Cold in-Place Recycling
50346 Hennepin MN	CIR	2018 MNDOT Cold In-Place Recycled/Cold Central Plant Recycling Section 2390.504
50485 MnROAD MN	CIR	2018 MNDOT Cold In-Place Recycled/Cold Central Plant Recycling Section 2390.504
50363 Poweshiek IA	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
50393 Shelby IA	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
51123 Fayette IA-Echo Valley Road	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
51123 Fayette IA-Ivy Road	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
51049 Franklin IA	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
50834 Pocahontas IA-CR 15	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
50834 Pocahontas IA-CR 56	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
51126 Brown MN	CIR	2018 MNDOT Cold In-Place Recycled/Cold Central Plant Recycling Section 2390.504
51028 Blue Earth Faribault MN	CIR	2018 MNDOT Cold In-Place Recycled/Cold Central Plant Recycling Section 2390.504
51086 Worth IA	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
51026 Chickasaw IA	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
51085 Mitchell IA	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
51052 Warren IA	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
51165 Warren TN	CIR	Tennessee Special Provisions 308CIR Cold in-Place Recycled Bituminous Pavement
51027 Boone IA	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
51042 Sioux IA	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
51043 Scott IA	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
51013 Clarke Decatur IA	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
51112 Clay MN	CIR	2018 MNDOT Cold In-Place Recycled/Cold Central Plant Recycling Section 2390.504
51014 Lyon IA	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
51176 Wood WI	CIR	Wisconsin County Highway F Cold In-Place Recycling Project # 2023-72-03
51057 Shelby IA	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
51125 Keokuk IA	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
51280 Lyon IA	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
51361 Coffee TN	CIR	Tennessee Special Provisions 308CIR Cold in-Place Recycled Bituminous Pavement
51404 Worth IA	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
51692 KOSSUTH IA	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
51687 MARTIN MN	CIR	2018 MNDOT Cold In-Place Recycled/Cold Central Plant Recycling Section 2390.504
51691 BUTLER IA	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
51758 PLYMOUTH IA	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
51644 POTTAWATTAMIE IA	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
51596 PINE MN	CIR	2018 MNDOT Cold In-Place Recycled/Cold Central Plant Recycling Section 2390.504
51469 MARTIN WANTONWAN MN	CIR	2018 MNDOT Cold In-Place Recycled/Cold Central Plant Recycling Section 2390.504
51643 SIOUX IA	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
51833 W26 BENTON IA	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
51832 E24 BENTON IA	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
51702 AITKIN MN	CIR	2018 MNDOT Cold In-Place Recycled/Cold Central Plant Recycling Section 2390.504
51463 HUMBOLT IA	CIR	Iowa DOT Specifications, section 2318. Cold in Place Recycled Asphalt Pavement
51749 DODGE MN	CIR	2019 MNDOT Cold In-Place Recycled/Cold Central Plant Recycling Section 2390.504
51585 DODGE MN	CIR	2019 MNDOT Cold In-Place Recycled/Cold Central Plant Recycling Section 2390.504

APPENDIX D: ADDITIONALITY TESTING

Project Number	Project Start Date	Stabilizing Agent	Project Year/Type	Crediting baseline (KgCO2e/t)	Relation	CIR EI_{Total} (kgCO2e/t)	Result
Coughlin Colorado Project	07-May-22	Asphalt Emulsions	2022/Roadway	94.30	>	55.68	Additional
50431 Mower MN	12-May-22	FSB	2022/Roadway	94.30	>	18.38	Additional
50432 Mower MN	15-May-22	FSB	2022/Roadway	94.30	>	10.89	Additional
50433 Scott MN	18-May-22	Asphalt Emulsions	2022/Roadway	94.30	>	21.50	Additional
50392 Pottawattamie IA	31-May-22	FSB	2022/Roadway	94.30	>	17.71	Additional
50524 Washington MN	09-Jun-22	Asphalt Emulsions	2022/Roadway	94.30	>	27.18	Additional
50403 Redwood Brown MN	15-Jun-22	Asphalt Emulsions	2022/Roadway	94.30	>	24.63	Additional
50422 Redwood MN	23-Jun-22	Asphalt Emulsions	2022/Roadway	94.30	>	16.23	Additional
50389 Cherokee OBrien IA	07-Jul-22	FSB	2022/Roadway	94.30	>	14.35	Additional
50374 Casper WY	18-Jul-22	Asphalt Emulsions	2022/Roadway	94.30	>	26.03	Additional
50346 Hennepin MN	10-Aug-22	Asphalt Emulsions	2022/Roadway	94.30	>	17.37	Additional
50485 MnROAD MN	22-Aug-22	Asphalt Emulsions	2022/Roadway	94.30	>	30.66	Additional
50363 Poweshiek IA	07-Sep-22	FSB	2022/Roadway	94.30	>	17.98	Additional
50393 Shelby IA	14-Sep-22	FSB	2022/Roadway	94.30	>	20.11	Additional
51123 Fayette IA-Echo Valley Road	03-May-23	FSB	2023/Roadway	94.20	>	19.30	Additional
51123 Fayette IA-Ivy Road	08-May-23	FSB	2023/Roadway	94.20	>	18.87	Additional
51049 Franklin IA	15-May-23	FSB	2023/Roadway	94.20	>	14.51	Additional
50834 Pocahontas IA-CR 15	17-May-23	FSB	2023/Roadway	94.20	>	15.79	Additional
50834 Pocahontas IA-CR 56	17-May-23	FSB	2023/Roadway	94.20	>	20.70	Additional
51126 Brown MN	30-May-23	Asphalt Emulsions	2023/Roadway	94.20	>	17.98	Additional
51028 Blue Earth Faribault MN	30-May-23	Asphalt Emulsions	2023/Roadway	94.20	>	26.18	Additional
51086 Worth IA	12-Jun-23	FSB	2023/Roadway	94.20	>	17.90	Additional
51026 Chickasaw IA	19-Jun-23	FSB	2023/Roadway	94.20	>	13.92	Additional
51085 Mitchell IA	19-Jun-23	FSB	2023/Roadway	94.20	>	15.47	Additional
51052 Warren IA	27-Jun-23	FSB	2023/Roadway	94.20	>	17.94	Additional
51165 Warren TN	08-Jul-23	Asphalt Emulsions	2023/Roadway	94.20	>	19.01	Additional
51027 Boone IA	12-Jul-23	FSB	2023/Roadway	94.20	>	20.94	Additional
51042 Sioux IA	25-Jul-23	FSB	2023/Roadway	94.20	>	16.79	Additional
51043 Scott IA	26-Jul-23	FSB	2023/Roadway	94.20	>	14.42	Additional
51013 Clarke Decatur IA	31-Jul-23	FSB	2023/Roadway	94.20	>	20.79	Additional
51112 Clay MN	02-Aug-23	Asphalt Emulsions	2023/Roadway	94.20	>	20.13	Additional
51014 Lyon IA	11-Aug-23	FSB	2023/Roadway	94.20	>	18.49	Additional
51176 Wood WI	21-Aug-23	Asphalt Emulsions	2023/Roadway	94.20	>	18.40	Additional
51057 Shelby IA	24-Aug-23	FSB	2023/Roadway	94.20	>	14.31	Additional
51125 Keokuk IA	05-Sep-23	FSB	2023/Roadway	94.20	>	18.22	Additional
51280 Lyon IA	16-Sep-23	FSB	2023/Roadway	94.20	>	20.76	Additional
51361 Coffee TN	05-Oct-23	Asphalt Emulsions	2023/Roadway	94.20	>	27.43	Additional
51404 Worth IA	21-Aug-23	Asphalt Emulsions	2023/Roadway	94.20	>	17.09	Additional
51692 KOSSUTH IA	02-May-24	FSB	2024/Roadway	94.10	>	16.73	Additional
51687 MARTIN MN	06-May-24	Asphalt Emulsions	2024/Roadway	94.10	>	22.56	Additional
51691 BUTLER IA	14-May-24	FSB	2024/Roadway	94.10	>	14.70	Additional
51758 PLYMOUTH IA	28-May-24	FSB	2024/Roadway	94.10	>	17.72	Additional
51644 POTTAWATTAMIE IA	10-Jun-24	FSB	2024/Roadway	94.10	>	16.36	Additional
51596 PINE MN	08-Jul-24	Asphalt Emulsions	2024/Roadway	94.10	>	21.00	Additional
51469 MARTIN WANTONWAN MN	09-Jul-24	Asphalt Emulsions	2024/Roadway	94.10	>	35.83	Additional
51643 SIOUX IA	18-Jul-24	FSB	2024/Roadway	94.10	>	15.99	Additional
51833 W26 BENTON IA	31-Jul-24	FSB	2024/Roadway	94.10	>	15.47	Additional
51832 E24 BENTON IA	06-Aug-24	FSB	2024/Roadway	94.10	>	17.42	Additional
51702 AITKIN MN	12-Aug-24	Asphalt Emulsions	2024/Roadway	94.10	>	22.01	Additional
51463 HUMBOLT IA	14-Aug-24	FSB	2024/Roadway	94.10	>	12.08	Additional
51749 DODGE MN	20-Aug-24	Asphalt Emulsions	2024/Roadway	94.10	>	17.75	Additional
51585 DODGE MN	28-Aug-24	Asphalt Emulsions	2024/Roadway	94.10	>	17.54	Additional
51878 WINNESHIEK IA	04-Sep-24	FSB	2024/Roadway	94.10	>	18.49	Additional
51525 MARSHALL IA	12-Sep-24	FSB	2024/Roadway	94.10	>	18.22	Additional
51560 ST LOUIS MN	30-May-24	Asphalt Emulsions	2024/Roadway	94.10	>	33.65	Additional
51645 BROWN MN	14-Aug-24	Asphalt Emulsions	2024/Roadway	94.10	>	25.12	Additional
51927 HOWARD IA	29-Jul-24	FSB	2024/Roadway	94.10	>	22.89	Additional

APPENDIX E: PROJECT EMISSIONS AND CALCULATIONS

APPENDIX E.1: ENGINEERING JUDGEMENTS SUPPORTING ER CALCULATIONS

The following engineering judgements were made where data and documentation from the contractor was unavailable.

1) Cold recycler running speed: A running speed of 22 feet per minute was assumed for the cold recycler running speed based on data from CIR case studies across the US. Within the case study, recycling speeds vary between 22-28 feet per minute. For conservativeness, we used the lowest value of 22 feet per minute in our emission reduction calculations. The source of this data can be found on this website.[6]
2) Weight of water: Water is not typically measured on a job site, and where documentation is unavailable, the project proponent assumed 1.5% moisture content for FSB mixes. Iowa does not require mix designs for CIR and 1.5% is considered a general rule of thumb for the amount of water to be added in order to obtain a total moisture content of 2%. Furthermore, mix designs for other project instances in Minnesota show a similar moisture content of about 2% required for optimal performance.
3) Distance from the water source to the project site: Water travel distance is another parameter that isn't typically documented because of the variety of sources which the contractor may draw water from. A contractor may draw water from a nearby town or from hydrants along the project route. It is reasonable to assume at least one hydrant along the length of a project, therefore a conservative estimate for water distance was half the overall project length. In reality, this distance would be much less because of either multiple hydrants or towns that the project passes through that could be used to source water.

[6] https://www.forconstructionpros.com/asphalt/article/12265200/cold-inplace-asphalt-recycling-around-the-us

APPENDIX E.2: RAW MATERIAL PRODUCTION EMISSIONS

VCS 3616 Emission Intensity of Raw Material Production (VM0039, v1.0 - Eq.2)

Project Number	Project Start Date	Contractor	Process	Project Amount (tonnes)	W_M RAP (kg)	EF RAP (kg CO_2e/kg)	EI_M RAP (kg CO_2e/t)	W_M Bitumen (kg)	EF Bitumen (kg CO_2e/kg)	EI_M Bitumen (kg CO_2e/t)	W_M Cement (kg)	EF Cement (kg CO_2e/kg)	EI_M Cement (kg CO_2e/t)	W_M Water (kg)	EF Water (kg CO_2e/kg)	EI_M Water (kg CO_2e/t)	$EI_{M\ Total}$ (kg CO_2e/t)
Coughlin Colorado Project	07-May-22	Surface Cycle	CIR	105,375	98,397,306	0	-	3,427,127	0.48	15.61	1,970,406	1.25	23.37	1,580,632	0	-	**38.98**
50431 Mower MN	12-May-22	Surface Cycle	CIR	38,397	36,995,214	0	-	825,820	0.48	10.32	-	0.922	-	575,955	0	-	**10.32**
50432 Mower MN	15-May-22	Surface Cycle	CIR	11,644	11,382,903	0	-	86,899	0.48	3.58	-	0.922	-	174,667	0	-	**3.58**
50433 Scott MN	18-May-22	Surface Cycle	CIR	28,674	27,554,456	0	-	548,656	0.48	9.18	141,267	0.922	4.54	430,117	0	-	**13.73**
50392 Pottawattamie IA	31-May-22	Surface Cycle	CIR	25,905	24,981,707	0	-	535,067	0.48	9.91	-	0.922	-	388,580	0	-	**9.91**
50524 Washington MN	09-Jun-22	Surface Cycle	CIR	5,389	5,139,880	0	-	137,892	0.48	12.28	30,844	0.922	5.28	80,842	0	-	**17.56**
50403 Redwood Brown MN	15-Jun-22	Surface Cycle	CIR	18,945	18,145,947	0	-	389,064	0.48	9.86	126,071	0.922	6.14	284,179	0	-	**15.99**
50422 Redwood MN	23-Jun-22	Surface Cycle	CIR	27,062	26,183,398	0	-	472,426	0.48	8.38	-	0.922	-	405,926	0	-	**8.38**
50389 Cherokee OBrien IA	07-Jul-22	Surface Cycle	CIR	28,735	27,871,287	0	-	432,863	0.48	7.23	-	0.922	-	431,028	0	-	**7.23**
50374 Casper WY	18-Jul-22	Surface Cycle	CIR	35,405	33,927,418	0	-	680,298	0.48	9.22	266,114	0.922	6.93	531,074	0	-	**16.15**
50346 Hennepin MN	10-Aug-22	Surface Cycle	CIR	12,925	12,491,670	0	-	187,796	0.48	6.97	51,973	0.922	3.71	193,880	0	-	**10.68**
50485 MnROAD MN	22-Aug-22	Surface Cycle	CIR	449	428,104	0	-	11,757	0.48	12.56	2,649	0.922	5.44	6,739	0	-	**18.00**
50363 Poweshiek IA	07-Sep-22	Surface Cycle	CIR	5,016	4,852,013	0	-	89,022	0.48	8.52	-	0.922	-	75,244	0	-	**8.52**
50393 Shelby IA	14-Sep-22	Surface Cycle	CIR	11,922	11,511,677	0	-	231,568	0.48	9.32	-	0.922	-	178,831	0	-	**9.32**
51123 Fayette IA-Echo Valley Road	03-May-23	Surface Cycle	CIR	3,811	3,666,314	0	-	87,752	0.48	11.05	-	0.922	-	57,169	0	-	**11.05**
51123 Fayette IA-Ivy Road	08-May-23	Surface Cycle	CIR	7,164	6,894,854	0	-	162,114	0.48	10.86	-	0.922	-	107,467	0	-	**10.86**
51049 Franklin IA	15-May-23	Surface Cycle	CIR	28,644	27,778,080	0	-	436,274	0.48	7.31	-	0.922	-	429,660	0	-	**7.31**
50834 Pocahontas IA-CR 15	17-May-23	Surface Cycle	CIR	6,447	6,247,470	0	-	103,274	0.48	7.69	-	0.922	-	96,712	0	-	**7.69**
50834 Pocahontas IA-CR 56	17-May-23	Surface Cycle	CIR	6,421	6,193,212	0	-	131,787	0.48	9.85	-	0.922	-	96,320	0	-	**9.85**
51126 Brown MN	30-May-23	Surface Cycle	CIR	36,529	35,184,739	0	-	796,554	0.48	10.47	-	0.922	-	547,938	0	-	**10.47**
51028 Blue Earth Faribault MN	30-May-23	Surface Cycle	CIR	39,963	38,129,630	0	-	1,067,757	0.48	12.82	166,296	0.922	3.84	599,447	0	-	**16.66**
51086 Worth IA	12-Jun-23	Surface Cycle	CIR	17,577	16,972,617	0	-	341,156	0.48	9.32	-	0.922	-	263,662	0	-	**9.32**
51026 Chickasaw IA	19-Jun-23	Surface Cycle	CIR	10,411	10,112,202	0	-	142,700	0.48	6.58	-	0.922	-	156,166	0	-	**6.58**
51085 Mitchell IA	19-Jun-23	Surface Cycle	CIR	20,777	20,133,155	0	-	332,211	0.48	7.67	-	0.922	-	311,655	0	-	**7.67**
51052 Warren IA	27-Jun-23	Surface Cycle	CIR	13,092	12,672,602	0	-	223,131	0.48	8.18	-	0.922	-	196,382	0	-	**8.18**
51165 Warren TN	08-Jul-23	Surface Cycle	CIR	37,060	35,684,498	0	-	686,594	0.48	8.89	132,866	0.922	3.31	555,898	0	-	**12.20**
51027 Boone IA	12-Jul-23	Surface Cycle	CIR	3,025	2,910,772	0	-	68,765	0.48	10.91	-	0.922	-	45,374	0	-	**10.91**
51042 Sioux IA	25-Jul-23	Surface Cycle	CIR	14,097	13,604,320	0	-	281,572	0.48	9.59	-	0.922	-	211,460	0	-	**9.59**
51043 Scott IA	26-Jul-23	Surface Cycle	CIR	13,685	13,269,723	0	-	209,777	0.48	7.36	-	0.922	-	205,272	0	-	**7.36**
51013 Clarke Decatur IA	31-Jul-23	Surface Cycle	CIR	34,827	33,535,190	0	-	768,975	0.48	10.60	-	0.922	-	522,398	0	-	**10.60**
51112 Clay MN	02-Aug-23	Surface Cycle	CIR	14,381	13,835,171	0	-	329,871	0.48	11.01	-	0.922	-	215,711	0	-	**11.01**
51014 Lyon IA	11-Aug-23	Surface Cycle	CIR	10,633	10,283,585	0	-	189,801	0.48	8.57	-	0.922	-	159,493	0	-	**8.57**
51176 Wood WI	21-Aug-23	Surface Cycle	CIR	6,150	5,951,825	0	-	105,778	0.48	8.26	-	0.922	-	92,248	0	-	**8.26**
51057 Shelby IA	24-Aug-23	Surface Cycle	CIR	58,078	56,393,372	0	-	813,164	0.48	6.72	-	0.922	-	871,166	0	-	**6.72**
51125 Keokuk IA	05-Sep-23	Surface Cycle	CIR	28,869	27,884,677	0	-	551,614	0.48	9.17	-	0.922	-	433,040	0	-	**9.17**
51280 Lyon IA	16-Sep-23	Surface Cycle	CIR	21,655	20,755,894	0	-	574,185	0.48	12.73	-	0.922	-	324,824	0	-	**12.73**
51361 Coffee TN	05-Oct-23	Surface Cycle	CIR	22,205	21,036,172	0	-	719,398	0.48	15.55	116,600	0.922	4.84	333,079	0	-	**20.39**
51404 Worth IA	21-Aug-23	Surface Cycle	CIR	24,394	23,569,146	0	-	459,281	0.48	9.04	-	0.922	-	365,915	0	-	**9.04**
51692 KOSSUTH IA	02-May-24	Surface Cycle	CIR	15,648	15,134,038	0	-	278,896	0.48	8.56	-	0.922	-	234,715	0	-	**8.56**
51687 MARTIN MN	06-May-24	Surface Cycle	CIR	13,459	12,881,873	0	-	375,584	0.48	13.39	-	0.922	-	201,890	0	-	**13.39**
51691 BUTLER IA	14-May-24	Surface Cycle	CIR	23,157	22,465,391	0	-	343,769	0.48	7.13	-	0.922	-	347,348	0	-	**7.13**
51758 PLYMOUTH IA	28-May-24	Surface Cycle	CIR	19,786	19,096,472	0	-	392,548	0.48	9.52	-	0.922	-	296,787	0	-	**9.52**
51644 POTTAWATTAMIE IA	10-Jun-24	Surface Cycle	CIR	38,866	37,634,062	0	-	649,109	0.48	8.02	-	0.922	-	582,992	0	-	**8.02**
51596 PINE MN	08-Jul-24	Surface Cycle	CIR	6,726	6,506,800	0	-	86,428	0.48	6.17	31,806	0.922	4.36	100,889	0	-	**10.53**
51469 MARTIN WANTONWAN MN	09-Jul-24	Surface Cycle	CIR	40,088	37,986,574	0	-	1,080,766	0.48	12.94	418,920	0.922	9.64	601,314	0	-	**22.58**
51643 SIOUX IA	18-Jul-24	Surface Cycle	CIR	21,217	20,515,042	0	-	383,984	0.48	8.69	-	0.922	-	318,259	0	-	**8.69**
51833 W26 BENTON IA	31-Jul-24	Surface Cycle	CIR	10,389	10,096,062	0	-	136,803	0.48	6.32	-	0.922	-	155,830	0	-	**6.32**
51832 E24 BENTON IA	06-Aug-24	Surface Cycle	CIR	15,122	14,604,693	0	-	290,871	0.48	9.23	-	0.922	-	226,836	0	-	**9.23**
51702 AITKIN MN	12-Aug-24	Surface Cycle	CIR	31,760	30,492,976	0	-	613,257	0.48	9.27	176,901	0.922	5.14	476,393	0	-	**14.40**
51463 HUMBOLT IA	14-Aug-24	Surface Cycle	CIR	4,931	4,791,046	0	-	66,279	0.48	6.45	-	0.922	-	73,969	0	-	**6.45**
51749 DODGE MN	20-Aug-24	Surface Cycle	CIR	3,500	3,393,015	0	-	54,050	0.48	7.41	-	0.922	-	52,493	0	-	**7.41**
51585 DODGE MN	28-Aug-24	Surface Cycle	CIR	26,722	25,797,893	0	-	523,373	0.48	9.40	-	0.922	-	400,831	0	-	**9.40**
51878 WINNESHIEK IA	04-Sep-24	Surface Cycle	CIR	11,868	11,453,633	0	-	236,313	0.48	9.56	-	0.922	-	178,019	0	-	**9.56**
51525 MARSHALL IA	12-Sep-24	Surface Cycle	CIR	13,340	12,893,270	0	-	246,509	0.48	8.87	-	0.922	-	200,098	0	-	**8.87**
51560 ST LOUIS MN	30-May-24	Surface Cycle	CIR	51,436	48,799,749	0	-	1,607,532	0.48	15.00	256,733	0.922	4.60	771,533	0	-	**19.60**
51645 BROWN MN	14-Aug-24	Surface Cycle	CIR	29,964	28,498,004	0	-	1,016,047	0.48	16.28	-	0.922	-	449,453	0	-	**16.28**
51927 HOWARD IA	29-Jul-24	Surface Cycle	CIR	20,913	20,051,360	0	-	547,940	0.48	12.58	-	0.922	-	313,695	0	-	**12.58**

APPENDIX E.3: TO-SITE DELIVERY EMISSIONS

VCS 3616 Emission Intensity of To-Site Delivery (VM0039, v1.0 Eq.4)

Project Number	Project Start Date	Contractor	Process	Project Amount (tonnes)	$Trip_S$ Bitumen (each)	$Distance_S$ Bitumen (miles)	EI_{SD} Bitumen ($kgCO_2e/t$)	$Trip_S$ Cement (each)	$Distance_S$ Cement (miles)	EI_{SD} Cement ($kgCO_2e/t$)	$Trip_S$ Water (each)	$Distance_S$ Water (miles)	EI_{SD} Water ($kgCO_2e/t$)	$Trip_S$ Mix (each)	$Distance_S$ Mix (miles)	EI_{SD} Mix ($kgCO_2e/t$)	EI_{SD} Total ($kgCO_2e/t$)
Coughlin Colorado Project	07-May-22	Surface Cycle	CIR	105,375.47	189	268.0	5.39	109	336	3.90	88.0	21.8	0.20	0.0	0.0	-	**9.50**
50431 Mower MN	12-May-22	Surface Cycle	CIR	38,396.99	35	132.0	1.35	0	0	-	32.0	3.5	0.03	0.0	0.0	-	**1.38**
50432 Mower MN	15-May-22	Surface Cycle	CIR	11,644.47	5	144.0	0.69	0	0	-	10.0	2.3	0.02	0.0	0.0	-	**0.72**
50433 Scott MN	18-May-22	Surface Cycle	CIR	28,674.50	25	122.0	1.19	8	58	0.18	24.0	5.0	0.05	0.0	0.0	-	**1.42**
50392 Pottawattamie IA	31-May-22	Surface Cycle	CIR	25,905.35	24	110.0	1.14	0	0	-	22.0	4.5	0.04	0.0	0.0	-	**1.19**
50524 Washington MN	09-Jun-22	Surface Cycle	CIR	5,389.46	8	29.3	0.49	2	56	0.23	5.0	1.5	0.02	0.0	0.0	-	**0.74**
50403 Redwood Brown MN	15-Jun-22	Surface Cycle	CIR	18,945.26	16	133.0	1.26	7	113	0.47	16.0	4.2	0.04	0.0	0.0	-	**1.77**
50422 Redwood MN	23-Jun-22	Surface Cycle	CIR	27,061.75	21	134.0	1.17	0	0	-	23.0	5.3	0.05	0.0	0.0	-	**1.22**
50389 Cherokee OBrien IA	07-Jul-22	Surface Cycle	CIR	28,735.18	20	67.9	0.53	0	0	-	24.0	2.0	0.02	0.0	0.0	-	**0.55**
50374 Casper WY	18-Jul-22	Surface Cycle	CIR	35,404.90	20	204.0	1.29	12	242	0.92	30.0	5.4	0.05	0.0	0.0	-	**2.26**
50346 Hennepin MN	10-Aug-22	Surface Cycle	CIR	12,925.32	11	39.9	0.38	3	42	0.11	11.0	2.3	0.02	0.0	0.0	-	**0.51**
50485 MnROAD MN	22-Aug-22	Surface Cycle	CIR	449.25	1	127.0	3.17	1	56	1.39	1.0	0.1	0.00	0.0	0.0	-	**4.56**
50363 Poweshiek IA	07-Sep-22	Surface Cycle	CIR	5,016.28	5	32.7	0.37	0	0	-	5.0	2.0	0.02	0.0	0.0	-	**0.39**
50393 Shelby IA	14-Sep-22	Surface Cycle	CIR	11,922.08	13	152.0	1.86	0	0	-	10.0	2.9	0.03	0.0	0.0	-	**1.89**
51123 Fayette IA-Echo Valley Road	03-May-23	Surface Cycle	CIR	3,811.23	5	108.0	1.59	0	0	-	4.0	0.9	0.01	0.0	0.0	-	**1.60**
51123 Fayette IA-Ivy Road	08-May-23	Surface Cycle	CIR	7,164.43	9	104.0	1.47	0	0	-	6.0	1.6	0.01	0.0	0.0	-	**1.48**
51049 Franklin IA	15-May-23	Surface Cycle	CIR	28,644.01	19	81.5	0.61	0	0	-	24.0	4.5	0.04	0.0	0.0	-	**0.65**
50834 Pocahontas IA-CR 15	17-May-23	Surface Cycle	CIR	6,447.46	6	121.0	1.26	0	0	-	6.0	3.4	0.04	0.0	0.0	-	**1.30**
50834 Pocahontas IA-CR 56	17-May-23	Surface Cycle	CIR	6,421.32	8	109.0	1.52	0	0	-	6.0	4.0	0.04	0.0	0.0	-	**1.57**
51126 Brown MN	30-May-23	Surface Cycle	CIR	36,529.23	19	131.0	0.76	0	0	-	31.0	7.5	0.07	0.0	0.0	-	**0.84**
51028 Blue Earth Faribault MN	30-May-23	Surface Cycle	CIR	39,963.13	42	185.0	2.18	7	105	0.21	34.0	7.9	0.08	0.0	0.0	-	**2.46**
51086 Worth IA	12-Jun-23	Surface Cycle	CIR	17,577.43	17	185.0	2.01	0	0	-	15.0	3.9	0.04	0.0	0.0	-	**2.04**
51026 Chickasaw IA	19-Jun-23	Surface Cycle	CIR	10,411.07	8	67.4	0.58	0	0	-	9.0	1.6	0.02	0.0	0.0	-	**0.60**
51085 Mitchell IA	19-Jun-23	Surface Cycle	CIR	20,777.02	15	177.0	1.43	0	0	-	18.0	4.5	0.04	0.0	0.0	-	**1.48**
51052 Warren IA	27-Jun-23	Surface Cycle	CIR	13,092.11	13	87.3	0.97	0	0	-	11.0	4.1	0.04	0.0	0.0	-	**1.01**
51165 Warren TN	08-Jul-23	Surface Cycle	CIR	37,059.86	31	123.0	1.15	8	87	0.21	31.0	4.3	0.04	0.0	0.0	-	**1.41**
51027 Boone IA	12-Jul-23	Surface Cycle	CIR	3,024.91	4	67.8	1.01	0	0	-	3.0	1.0	0.01	0.0	0.0	-	**1.02**
51042 Sioux IA	25-Jul-23	Surface Cycle	CIR	14,097.35	12	50.6	0.48	0	0	-	12.0	3.6	0.03	0.0	0.0	-	**0.52**
51043 Scott IA	26-Jul-23	Surface Cycle	CIR	13,684.77	12	87.6	0.86	0	0	-	12.0	2.6	0.03	0.0	0.0	-	**0.89**
51013 Clarke Decatur IA	31-Jul-23	Surface Cycle	CIR	34,826.56	34	129.0	1.41	0	0	-	29.0	9.8	0.09	0.0	0.0	-	**1.50**
51112 Clay MN	02-Aug-23	Surface Cycle	CIR	14,380.75	14	244.0	2.67	0	0	-	12.0	3.0	0.03	0.0	0.0	-	**2.69**
51014 Lyon IA	11-Aug-23	Surface Cycle	CIR	10,632.88	11	78.0	0.91	0	0	-	9.0	2.5	0.02	0.0	0.0	-	**0.93**
51176 Wood WI	21-Aug-23	Surface Cycle	CIR	6,149.85	6	106.0	1.16	0	0	-	6.0	1.3	0.01	0.0	0.0	-	**1.17**
51057 Shelby IA	24-Aug-23	Surface Cycle	CIR	58,077.70	36	85.5	0.59	0	0	-	49.0	7.6	0.07	0.0	0.0	-	**0.67**
51125 Keokuk IA	05-Sep-23	Surface Cycle	CIR	28,869.33	25	67.9	0.66	0	0	-	24.0	5.9	0.06	0.0	0.0	-	**0.71**
51280 Lyon IA	16-Sep-23	Surface Cycle	CIR	21,654.90	25	96.3	1.25	0	0	-	18.0	4.3	0.04	0.0	0.0	-	**1.29**
51361 Coffee TN	05-Oct-23	Surface Cycle	CIR	22,205.25	26	90.6	1.19	7	63	0.22	19.0	3.1	0.03	0.0	0.0	-	**1.44**
51404 Worth IA	21-Aug-23	Surface Cycle	CIR	24,394.34	21	139.0	1.34	0	0	-	21.0	7.0	0.07	0.0	0.0	-	**1.41**
51692 KOSSUTH IA	02-May-24	Surface Cycle	CIR	15,647.65	12	190.0	1.63	0	0	-	13.0	3.4	0.03	0.0	0.0	-	**1.67**
51687 MARTIN MN	06-May-24	Surface Cycle	CIR	13,459.35	17	164.0	2.32	0	0	-	12.0	2.9	0.03	0.0	0.0	-	**2.35**
51691 BUTLER IA	14-May-24	Surface Cycle	CIR	23,156.51	19	127.0	1.17	0	0	-	20.0	5.0	0.05	0.0	0.0	-	**1.22**
51758 PLYMOUTH IA	28-May-24	Surface Cycle	CIR	19,785.81	18	24.3	0.25	0	0	-	17.0	5.5	0.05	0.0	0.0	-	**0.30**
51644 POTTAWATTAMIE IA	10-Jun-24	Surface Cycle	CIR	38,866.16	47	119.0	1.61	0	0	-	33.0	7.4	0.07	0.0	0.0	-	**1.69**
51596 PINE MN	08-Jul-24	Surface Cycle	CIR	6,725.92	5	148.0	1.23	2	97	0.32	6.0	1.8	0.02	0.0	0.0	-	**1.58**
51469 MARTIN WANTONWAN MN	09-Jul-24	Surface Cycle	CIR	40,087.57	39	299.0	3.26	24	137	0.92	34.0	6.5	0.06	0.0	0.0	-	**4.25**
51643 SIOUX IA	18-Jul-24	Surface Cycle	CIR	21,217.29	17	60.2	0.54	0	0	-	18.0	5.2	0.05	0.0	0.0	-	**0.59**
51833 W26 BENTON IA	31-Jul-24	Surface Cycle	CIR	10,388.70	8	45.7	0.39	0	0	-	9.0	2.9	0.03	0.0	0.0	-	**0.42**
51832 E24 BENTON IA	06-Aug-24	Surface Cycle	CIR	15,122.40	17	42.8	0.54	0	0	-	13.0	3.7	0.04	0.0	0.0	-	**0.58**
51702 AITKIN MN	12-Aug-24	Surface Cycle	CIR	31,759.53	21	129.0	0.96	6	95	0.20	27.0	6.4	0.06	0.0	0.0	-	**1.22**
51463 HUMBOLT IA	14-Aug-24	Surface Cycle	CIR	4,931.29	3	132.0	0.90	0	0	-	5.0	0.3	0.00	0.0	0.0	-	**0.90**
51749 DODGE MN	20-Aug-24	Surface Cycle	CIR	3,499.56	3	71.7	0.69	0	0	-	3.0	1.1	0.01	0.0	0.0	-	**0.70**
51585 DODGE MN	28-Aug-24	Surface Cycle	CIR	26,722.10	23	126.0	1.22	0	0	-	23.0	5.2	0.05	0.0	0.0	-	**1.27**
51878 WINNESHIEK IA	04-Sep-24	Surface Cycle	CIR	11,867.97	14	178.0	2.36	0	0	-	10.0	2.7	0.03	0.0	1.0	-	**2.38**
51525 MARSHALL IA	12-Sep-24	Surface Cycle	CIR	13,339.88	11	33.1	0.31	0	0	-	12.0	3.2	0.03	0.0	2.0	-	**0.34**
51560 ST LOUIS MN	30-May-24	Surface Cycle	CIR	51,435.55	59	416.0	5.35	10	78	0.17	43.0	7.4	0.07	0.0	3.0	-	**5.59**
51645 BROWN MN	14-Aug-24	Surface Cycle	CIR	29,963.50	56	111.0	2.33	0	0	-	25.0	0.1	0.00	0.0	4.0	-	**2.33**
51927 HOWARD IA	29-Jul-24	Surface Cycle	CIR	20,912.99	31	220.0	3.66	0	0	-	18.0	8.1	0.08	0.0	5.0	-	**3.74**

APPENDIX E.4: PAVEMENT INSTALLATION EMISSIONS

VCS 3616 Emission Intensity of Pavement Installation (VM0039, v1.0 - Eq. 8)

Project Number	Project Start Date	Process	Project Amount (tonnes)	Equipment Configuration	HR_{EQ} (hours)	EF_{EQ} Total (kgCO2e/hr)	EI_i (kgCO2e/t)
Coughlin Colorado Project	07-May-22	CIR	105,375.47	Surface Cycle	373.95	2,028	7.20
50431 Mower MN	12-May-22	CIR	38,396.99	Surface Cycle	126.34	2,028	6.67
50432 Mower MN	15-May-22	CIR	11,644.47	Surface Cycle	37.87	2,028	6.59
50433 Scott MN	18-May-22	CIR	28,674.50	Surface Cycle	89.85	2,028	6.35
50392 Pottawattamie IA	31-May-22	CIR	25,905.35	Surface Cycle	84.42	2,028	6.61
50524 Washington MN	09-Jun-22	CIR	5,389.46	Surface Cycle	23.62	2,028	8.89
50403 Redwood Brown MN	15-Jun-22	CIR	18,945.26	Surface Cycle	64.17	2,028	6.87
50422 Redwood MN	23-Jun-22	CIR	27,061.75	Surface Cycle	88.48	2,028	6.63
50389 Cherokee OBrien IA	07-Jul-22	CIR	28,735.18	Surface Cycle	93.18	2,028	6.58
50374 Casper WY	18-Jul-22	CIR	35,404.90	Surface Cycle	132.91	2,028	7.61
50346 Hennepin MN	10-Aug-22	CIR	12,925.32	Surface Cycle	39.34	2,028	6.17
50485 MnROAD MN	22-Aug-22	CIR	449.25	Surface Cycle	1.80	2,028	8.10
50363 Poweshiek IA	07-Sep-22	CIR	5,016.28	Surface Cycle	22.44	2,028	9.07
50393 Shelby IA	14-Sep-22	CIR	11,922.08	Surface Cycle	52.32	2,028	8.90
51123 Fayette IA-Echo Valley Road	03-May-23	CIR	3,811.23	Surface Cycle	12.49	2,028	6.65
51123 Fayette IA-Ivy Road	08-May-23	CIR	7,164.43	Surface Cycle	23.07	2,028	6.53
51049 Franklin IA	15-May-23	CIR	28,644.01	Surface Cycle	92.49	2,028	6.55
50834 Pocahontas IA-CR 15	17-May-23	CIR	6,447.46	Surface Cycle	21.62	2,028	6.80
50834 Pocahontas IA-CR 56	17-May-23	CIR	6,421.32	Surface Cycle	29.41	2,028	9.29
51126 Brown MN	30-May-23	CIR	36,529.23	Surface Cycle	120.34	2,028	6.68
51028 Blue Earth Faribault MN	30-May-23	CIR	39,963.13	Surface Cycle	139.08	2,028	7.06
51086 Worth IA	12-Jun-23	CIR	17,577.43	Surface Cycle	56.72	2,028	6.54
51026 Chickasaw IA	19-Jun-23	CIR	10,411.07	Surface Cycle	34.61	2,028	6.74
51085 Mitchell IA	19-Jun-23	CIR	20,777.02	Surface Cycle	64.70	2,028	6.31
51052 Warren IA	27-Jun-23	CIR	13,092.11	Surface Cycle	56.46	2,028	8.74
51165 Warren TN	08-Jul-23	CIR	37,059.86	Surface Cycle	98.82	2,028	5.41
51027 Boone IA	12-Jul-23	CIR	3,024.91	Surface Cycle	13.45	2,028	9.01
51042 Sioux IA	25-Jul-23	CIR	14,097.35	Surface Cycle	46.48	2,028	6.69
51043 Scott IA	26-Jul-23	CIR	13,684.77	Surface Cycle	41.70	2,028	6.18
51013 Clarke Decatur IA	31-Jul-23	CIR	34,826.56	Surface Cycle	149.20	2,028	8.69
51112 Clay MN	02-Aug-23	CIR	14,380.75	Surface Cycle	45.54	2,028	6.42
51014 Lyon IA	11-Aug-23	CIR	10,632.88	Surface Cycle	47.13	2,028	8.99
51176 Wood WI	21-Aug-23	CIR	6,149.85	Surface Cycle	27.22	2,028	8.97
51057 Shelby IA	24-Aug-23	CIR	58,077.70	Surface Cycle	198.28	2,028	6.92
51125 Keokuk IA	05-Sep-23	CIR	28,869.33	Surface Cycle	118.68	2,028	8.34
51280 Lyon IA	16-Sep-23	CIR	21,654.90	Surface Cycle	72.06	2,028	6.75
51361 Coffee TN	05-Oct-23	CIR	22,205.25	Surface Cycle	61.30	2,028	5.60
51404 Worth IA	21-Aug-23	CIR	24,394.34	Surface Cycle	79.86	2,028	6.64
51692 KOSSUTH IA	02-May-24	CIR	15,647.65	Surface Cycle	50.20	2,028	6.51
51687 MARTIN MN	06-May-24	CIR	13,459.35	Surface Cycle	45.21	2,028	6.81
51691 BUTLER IA	14-May-24	CIR	23,156.51	Surface Cycle	72.56	2,028	6.35
51758 PLYMOUTH IA	28-May-24	CIR	19,785.81	Surface Cycle	77.09	2,028	7.90
51644 POTTAWATTAMIE IA	10-Jun-24	CIR	38,866.16	Surface Cycle	127.66	2,028	6.66
51596 PINE MN	08-Jul-24	CIR	6,725.92	Surface Cycle	29.51	2,028	8.90
51469 MARTIN WANTONWAN MN	09-Jul-24	CIR	40,087.57	Surface Cycle	178.04	2,028	9.01
51643 SIOUX IA	18-Jul-24	CIR	21,217.29	Surface Cycle	70.23	2,028	6.71
51833 W26 BENTON IA	31-Jul-24	CIR	10,388.70	Surface Cycle	44.72	2,028	8.73
51832 E24 BENTON IA	06-Aug-24	CIR	15,122.40	Surface Cycle	56.79	2,028	7.62
51702 AITKIN MN	12-Aug-24	CIR	31,759.53	Surface Cycle	100.02	2,028	6.39
51463 HUMBOLT IA	14-Aug-24	CIR	4,931.29	Surface Cycle	11.48	2,028	4.72
51749 DODGE MN	20-Aug-24	CIR	3,499.56	Surface Cycle	16.63	2,028	9.63
51585 DODGE MN	28-Aug-24	CIR	26,722.10	Surface Cycle	90.49	2,028	6.87
51878 WINNESHIEK IA	04-Sep-24	CIR	11,867.97	Surface Cycle	38.33	2,028	6.55
51525 MARSHALL IA	12-Sep-24	CIR	13,339.88	Surface Cycle	59.31	2,028	9.02
51560 ST LOUIS MN	30-May-24	CIR	51,435.55	Surface Cycle	214.34	2,028	8.45
51645 BROWN MN	14-Aug-24	CIR	29,963.50	Surface Cycle	96.24	2,028	6.51
51927 HOWARD IA	29-Jul-24	CIR	20,912.99	Surface Cycle	67.80	2,028	6.57

APPENDIX E.5: TOTAL PROJECT EMISSIONS

VCS 3616 Total Emission Intensity (VM0039, v1.0 - Eq. 11)

Project Number	Project Start Date	Vintage	Process	EI_M (kgCO2e/t)	EI_{PD} (kgCO2e/t)	EI_P (kgCO2e/t)	EI_{SD} (kgCO2e/t)	EI_I (kgCO2e/t)	CIR EI_{Total} (kgCO2e/t)	Project Amount (tonnes)	Project Emissions (tCO2e)
Coughlin Colorado Project	07-May-22	2022	CIR	38.98	0.00	0.00	9.50	7.20	55.68	105,375.47	**5,868**
50431 Mower MN	12-May-22	2022	CIR	10.32	0.00	0.00	1.38	6.67	18.38	38,396.99	**706**
50432 Mower MN	15-May-22	2022	CIR	3.58	0.00	0.00	0.72	6.59	10.89	11,644.47	**127**
50433 Scott MN	18-May-22	2022	CIR	13.73	0.00	0.00	1.42	6.35	21.50	28,674.50	**617**
50392 Pottawattamie IA	31-May-22	2022	CIR	9.91	0.00	0.00	1.19	6.61	17.71	25,905.35	**459**
50524 Washington MN	09-Jun-22	2022	CIR	17.56	0.00	0.00	0.74	8.89	27.18	5,389.46	**147**
50403 Redwood Brown MN	15-Jun-22	2022	CIR	15.99	0.00	0.00	1.77	6.87	24.63	18,945.26	**467**
50422 Redwood MN	23-Jun-22	2022	CIR	8.38	0.00	0.00	1.22	6.63	16.23	27,061.75	**440**
50389 Cherokee OBrien IA	07-Jul-22	2022	CIR	7.23	0.00	0.00	0.55	6.58	14.35	28,735.18	**413**
50374 Casper WY	18-Jul-22	2022	CIR	16.15	0.00	0.00	2.26	7.61	26.03	35,404.90	**922**
50346 Hennepin MN	10-Aug-22	2022	CIR	10.68	0.00	0.00	0.51	6.17	17.37	12,925.32	**225**
50485 MnROAD MN	22-Aug-22	2022	CIR	18.00	0.00	0.00	4.56	8.10	30.66	449.25	**14**
50363 Poweshiek IA	07-Sep-22	2022	CIR	8.52	0.00	0.00	0.39	9.07	17.98	5,016.28	**91**
50393 Shelby IA	14-Sep-22	2022	CIR	9.32	0.00	0.00	1.89	8.90	20.11	11,922.08	**240**
51123 Fayette IA-Echo Valley Road	03-May-23	2023	CIR	11.05	0.00	0.00	1.60	6.65	19.30	3,811.23	**74**
51123 Fayette IA-Ivy Road	08-May-23	2023	CIR	10.86	0.00	0.00	1.48	6.53	18.87	7,164.43	**136**
51049 Franklin IA	15-May-23	2023	CIR	7.31	0.00	0.00	0.65	6.55	14.51	28,644.01	**416**
50834 Pocahontas IA-CR 15	17-May-23	2023	CIR	7.69	0.00	0.00	1.30	6.80	15.79	6,447.46	**102**
50834 Pocahontas IA-CR 56	17-May-23	2023	CIR	9.85	0.00	0.00	1.57	9.29	20.70	6,421.32	**133**
51126 Brown MN	30-May-23	2023	CIR	10.47	0.00	0.00	0.84	6.68	17.98	36,529.23	**657**
51028 Blue Earth Faribault MN	30-May-23	2023	CIR	16.66	0.00	0.00	2.46	7.06	26.18	39,963.13	**1,047**
51086 Worth IA	12-Jun-23	2023	CIR	9.32	0.00	0.00	2.04	6.54	17.90	17,577.43	**315**
51026 Chickasaw IA	19-Jun-23	2023	CIR	6.58	0.00	0.00	0.60	6.74	13.92	10,411.07	**145**
51085 Mitchell IA	19-Jun-23	2023	CIR	7.67	0.00	0.00	1.48	6.31	15.47	20,777.02	**322**
51052 Warren IA	27-Jun-23	2023	CIR	8.18	0.00	0.00	1.01	8.74	17.94	13,092.11	**235**
51165 Warren TN	08-Jul-23	2023	CIR	12.20	0.00	0.00	1.41	5.41	19.01	37,059.86	**705**
51027 Boone IA	12-Jul-23	2023	CIR	10.91	0.00	0.00	1.02	9.01	20.94	3,024.91	**64**
51042 Sioux IA	25-Jul-23	2023	CIR	9.59	0.00	0.00	0.52	6.69	16.79	14,097.35	**237**
51043 Scott IA	26-Jul-23	2023	CIR	7.36	0.00	0.00	0.89	6.18	14.42	13,684.77	**198**
51013 Clarke Decatur IA	31-Jul-23	2023	CIR	10.60	0.00	0.00	1.50	8.69	20.79	34,826.56	**725**
51112 Clay MN	02-Aug-23	2023	CIR	11.01	0.00	0.00	2.69	6.42	20.13	14,380.75	**290**
51014 Lyon IA	11-Aug-23	2023	CIR	8.57	0.00	0.00	0.93	8.99	18.49	10,632.88	**197**
51176 Wood WI	21-Aug-23	2023	CIR	8.26	0.00	0.00	1.17	8.97	18.40	6,149.85	**114**
51057 Shelby IA	24-Aug-23	2023	CIR	6.72	0.00	0.00	0.67	6.92	14.31	58,077.70	**832**
51125 Keokuk IA	05-Sep-23	2023	CIR	9.17	0.00	0.00	0.71	8.34	18.22	28,869.33	**527**
51280 Lyon IA	16-Sep-23	2023	CIR	12.73	0.00	0.00	1.29	6.75	20.76	21,654.90	**450**
51361 Coffee TN	05-Oct-23	2023	CIR	20.39	0.00	0.00	1.44	5.60	27.43	22,205.25	**610**
51404 Worth IA	21-Aug-23	2023	CIR	9.04	0.00	0.00	1.41	6.64	17.09	24,394.34	**417**
51692 KOSSUTH IA	02-May-24	2024	CIR	8.56	0.00	0.00	1.67	6.51	16.73	15,647.65	**262**
51687 MARTIN MN	06-May-24	2024	CIR	13.39	0.00	0.00	2.35	6.81	22.56	13,459.35	**304**
51691 BUTLER IA	14-May-24	2024	CIR	7.13	0.00	0.00	1.22	6.35	14.70	23,156.51	**341**
51758 PLYMOUTH IA	28-May-24	2024	CIR	9.52	0.00	0.00	0.30	7.90	17.72	19,785.81	**351**
51644 POTTAWATTAMIE IA	10-Jun-24	2024	CIR	8.02	0.00	0.00	1.69	6.66	16.36	38,866.16	**636**
51596 PINE MN	08-Jul-24	2024	CIR	10.53	0.00	0.00	1.58	8.90	21.00	6,725.92	**142**
51469 MARTIN WANTONWAN MN	09-Jul-24	2024	CIR	22.58	0.00	0.00	4.25	9.01	35.83	40,087.57	**1,437**
51643 SIOUX IA	18-Jul-24	2024	CIR	8.69	0.00	0.00	0.59	6.71	15.99	21,217.29	**340**
51833 W26 BENTON IA	31-Jul-24	2024	CIR	6.32	0.00	0.00	0.42	8.73	15.47	10,388.70	**161**
51832 E24 BENTON IA	06-Aug-24	2024	CIR	9.23	0.00	0.00	0.58	7.62	17.42	15,122.40	**264**
51702 AITKIN MN	12-Aug-24	2024	CIR	14.40	0.00	0.00	1.22	6.39	22.01	31,759.53	**700**
51463 HUMBOLT IA	14-Aug-24	2024	CIR	6.45	0.00	0.00	0.90	4.72	12.08	4,931.29	**60**
51749 DODGE MN	20-Aug-24	2024	CIR	7.41	0.00	0.00	0.70	9.63	17.75	3,499.56	**63**
51585 DODGE MN	28-Aug-24	2024	CIR	9.40	0.00	0.00	1.27	6.87	17.54	26,722.10	**469**
51878 WINNESHIEK IA	04-Sep-24	2024	CIR	9.56	0.00	0.00	2.38	6.55	18.49	11,867.97	**220**
51525 MARSHALL IA	12-Sep-24	2024	CIR	8.87	0.00	0.00	0.34	9.02	18.22	13,339.88	**244**
51560 ST LOUIS MN	30-May-24	2024	CIR	19.60	0.00	0.00	5.59	8.45	33.65	51,435.55	**1,731**
51645 BROWN MN	14-Aug-24	2024	CIR	16.28	0.00	0.00	2.33	6.51	25.12	29,963.50	**753**
51927 HOWARD IA	29-Jul-24	2024	CIR	12.58	0.00	0.00	3.74	6.57	22.89	20,912.99	**479**

APPENDIX E.6: BASELINE EMISSIONS

VCS 3616 Project Baseline Emissions

Project Number	Project Start Date	Project Vintage	Contractor	Process	Stabilizing Agent	Layer Coefficient	Density (lb./c.f.)	Correction Factor, Theta	Crediting Baseline (kgCo2e/t)	Project Amount (tonnes)	Upstream displacement factor	Baseline Emissions with discount factor (tCO2e)
Coughlin Colorado Project	07-May-22	2022	Surface Cycle	CIR	Asphalt Emulsions	0.38	117.66	0.77	94.30	105,375.47	15%	**10,911**
50431 Mower MN	12-May-22	2022	Surface Cycle	CIR	FSB	0.38	126.9	0.83	94.30	38,396.99	15%	**3,686**
50432 Mower MN	15-May-22	2022	Surface Cycle	CIR	FSB	0.38	128.4	0.84	94.30	11,644.47	15%	**1,104**
50433 Scott MN	18-May-22	2022	Surface Cycle	CIR	Asphalt Emulsions	0.38	133.25	0.88	94.30	28,674.50	15%	**2,621**
50392 Pottawattamie IA	31-May-22	2022	Surface Cycle	CIR	FSB	0.38	128.13	0.84	94.30	25,905.35	15%	**2,463**
50524 Washington MN	09-Jun-22	2022	Surface Cycle	CIR	Asphalt Emulsions	0.38	127.03	0.84	94.30	5,389.46	15%	**516**
50403 Redwood Brown MN	15-Jun-22	2022	Surface Cycle	CIR	Asphalt Emulsions	0.38	123.28	0.81	94.30	18,945.26	15%	**1,872**
50422 Redwood MN	23-Jun-22	2022	Surface Cycle	CIR	Asphalt Emulsions	0.38	127.7	0.84	94.30	27,061.75	15%	**2,581**
50389 Cherokee OBrien IA	07-Jul-22	2022	Surface Cycle	CIR	FSB	0.38	128.77	0.85	94.30	28,735.18	15%	**2,718**
50374 Casper WY	18-Jul-22	2022	Surface Cycle	CIR	Asphalt Emulsions	0.38	127.12	0.84	94.30	35,404.90	15%	**3,393**
50346 Hennepin MN	10-Aug-22	2022	Surface Cycle	CIR	Asphalt Emulsions	0.38	137.18	0.90	94.30	12,925.32	15%	**1,147**
50485 MnROAD MN	22-Aug-22	2022	Surface Cycle	CIR	Asphalt Emulsions	0.38	139.3	0.92	94.30	449.25	15%	**39**
50363 Poweshiek IA	07-Sep-22	2022	Surface Cycle	CIR	FSB	0.38	124.45	0.82	94.30	5,016.28	15%	**491**
50393 Shelby IA	14-Sep-22	2022	Surface Cycle	CIR	FSB	0.38	126.86	0.83	94.30	11,922.08	15%	**1,144**
51123 Fayette IA-Echo Valley Road	03-May-23	2023	Surface Cycle	CIR	FSB	0.38	127.4	0.84	94.20	3,811.23	15%	**364**
51123 Fayette IA-Ivy Road	08-May-23	2023	Surface Cycle	CIR	FSB	0.38	129.65	0.85	94.20	7,164.43	15%	**672**
51049 Franklin IA	15-May-23	2023	Surface Cycle	CIR	FSB	0.38	129.31	0.85	94.20	28,644.01	15%	**2,695**
50834 Pocahontas IA-CR 15	17-May-23	2023	Surface Cycle	CIR	FSB	0.38	124.51	0.82	94.20	6,447.46	15%	**630**
50834 Pocahontas IA-CR 56	17-May-23	2023	Surface Cycle	CIR	FSB	0.38	121.56	0.80	94.20	6,421.32	15%	**642**
51126 Brown MN	30-May-23	2023	Surface Cycle	CIR	Asphalt Emulsions	0.38	126.75	0.83	94.20	36,529.23	15%	**3,507**
51028 Blue Earth Faribault MN	30-May-23	2023	Surface Cycle	CIR	Asphalt Emulsions	0.38	137.12	0.90	94.20	39,963.13	15%	**3,547**
51086 Worth IA	12-Jun-23	2023	Surface Cycle	CIR	FSB	0.38	129.4	0.85	94.20	17,577.43	15%	**1,653**
51026 Chickasaw IA	19-Jun-23	2023	Surface Cycle	CIR	FSB	0.38	125.6	0.83	94.20	10,411.07	15%	**1,008**
51085 Mitchell IA	19-Jun-23	2023	Surface Cycle	CIR	FSB	0.38	134.09	0.88	94.20	20,777.02	15%	**1,885**
51052 Warren IA	27-Jun-23	2023	Surface Cycle	CIR	FSB	0.38	129.1	0.85	94.20	13,092.11	15%	**1,234**
51165 Warren TN	08-Jul-23	2023	Surface Cycle	CIR	Asphalt Emulsions	0.38	125.27	0.82	94.20	37,059.86	15%	**3,600**
51027 Boone IA	12-Jul-23	2023	Surface Cycle	CIR	FSB	0.38	125.25	0.82	94.20	3,024.91	15%	**293**
51042 Sioux IA	25-Jul-23	2023	Surface Cycle	CIR	FSB	0.38	126.63	0.83	94.20	14,097.35	15%	**1,354**
51043 Scott IA	26-Jul-23	2023	Surface Cycle	CIR	FSB	0.38	137.02	0.90	94.20	13,684.77	15%	**1,215**
51013 Clarke Decatur IA	31-Jul-23	2023	Surface Cycle	CIR	FSB	0.38	129.95	0.85	94.20	34,826.56	15%	**3,261**
51112 Clay MN	02-Aug-23	2023	Surface Cycle	CIR	Asphalt Emulsions	0.38	131.85	0.87	94.20	14,380.75	15%	**1,327**
51014 Lyon IA	11-Aug-23	2023	Surface Cycle	CIR	FSB	0.38	125.6	0.83	94.20	10,632.88	15%	**1,030**
51176 Wood WI	21-Aug-23	2023	Surface Cycle	CIR	Asphalt Emulsions	0.38	125.8	0.83	94.20	6,149.85	15%	**594**
51057 Shelby IA	24-Aug-23	2023	Surface Cycle	CIR	FSB	0.38	122.3	0.80	94.20	58,077.70	15%	**5,779**
51125 Keokuk IA	05-Sep-23	2023	Surface Cycle	CIR	FSB	0.38	126.96	0.84	94.20	28,869.33	15%	**2,767**
51280 Lyon IA	16-Sep-23	2023	Surface Cycle	CIR	FSB	0.38	125.48	0.83	94.20	21,654.90	15%	**2,100**
51361 Coffee TN	05-Oct-23	2023	Surface Cycle	CIR	Asphalt Emulsions	0.38	121	0.80	94.20	22,205.25	15%	**2,233**
51404 Worth IA	21-Aug-23	2023	Surface Cycle	CIR	Asphalt Emulsions	0.38	127.54	0.84	94.20	24,394.34	15%	**2,327**
51692 KOSSUTH IA	02-May-24	2024	Surface Cycle	CIR	FSB	0.38	130.16	0.86	94.10	15,647.65	15%	**1,461**
51687 MARTIN MN	06-May-24	2024	Surface Cycle	CIR	Asphalt Emulsions	0.38	124.3	0.82	94.10	13,459.35	15%	**1,316**
51691 BUTLER IA	14-May-24	2024	Surface Cycle	CIR	FSB	0.38	133.26	0.88	94.10	23,156.51	15%	**2,112**
51758 PLYMOUTH IA	28-May-24	2024	Surface Cycle	CIR	FSB	0.38	122.48	0.81	94.10	19,785.81	15%	**1,963**
51644 POTTAWATTAMIE IA	10-Jun-24	2024	Surface Cycle	CIR	FSB	0.38	127.125	0.84	94.10	38,866.16	15%	**3,717**
51596 PINE MN	08-Jul-24	2024	Surface Cycle	CIR	Asphalt Emulsions	0.38	126.88	0.83	94.10	6,725.92	15%	**644**
51469 MARTIN WANTONWAN MN	09-Jul-24	2024	Surface Cycle	CIR	Asphalt Emulsions	0.38	125.35	0.82	94.10	40,087.57	15%	**3,888**
51643 SIOUX IA	18-Jul-24	2024	Surface Cycle	CIR	FSB	0.38	126.143	0.83	94.10	21,217.29	15%	**2,044**
51833 W26 BENTON IA	31-Jul-24	2024	Surface Cycle	CIR	FSB	0.38	129.33	0.85	94.10	10,388.70	15%	**976**
51832 E24 BENTON IA	06-Aug-24	2024	Surface Cycle	CIR	FSB	0.38	127.06	0.84	94.10	15,122.40	15%	**1,446**
51702 AITKIN MN	12-Aug-24	2024	Surface Cycle	CIR	Asphalt Emulsions	0.38	132.58	0.87	94.10	31,759.53	15%	**2,912**
51463 HUMBOLT IA	14-Aug-24	2024	Surface Cycle	CIR	FSB	0.38	119.6	0.79	94.10	4,931.29	15%	**501**
51749 DODGE MN	20-Aug-24	2024	Surface Cycle	CIR	Asphalt Emulsions	0.38	117.19	0.77	94.10	3,499.56	15%	**363**
51585 DODGE MN	28-Aug-24	2024	Surface Cycle	CIR	Asphalt Emulsions	0.38	123.3	0.81	94.10	26,722.10	15%	**2,634**
51878 WINNESHIEK IA	04-Sep-24	2024	Surface Cycle	CIR	FSB	0.38	129.27	0.85	94.10	11,867.97	15%	**1,116**
51525 MARSHALL IA	12-Sep-24	2024	Surface Cycle	CIR	FSB	0.38	125.22	0.82	94.10	13,339.88	15%	**1,295**
51560 ST LOUIS MN	30-May-24	2024	Surface Cycle	CIR	Asphalt Emulsions	0.38	133.6	0.88	94.10	51,435.55	15%	**4,680**
51645 BROWN MN	14-Aug-24	2024	Surface Cycle	CIR	Asphalt Emulsions	0.38	130	0.86	94.10	29,963.50	15%	**2,802**
51927 HOWARD IA	29-Jul-24	2024	Surface Cycle	CIR	FSB	0.38	128.8	0.85	94.10	20,912.99	15%	**1,974**

APPENDIX E.7: EMISSION REDUCTIONS

VCS 3616 Emission Reductions (VM0039,v1.0 - Eq. 16)

Project Number	Project Start Date	Project Vintage	Process	Stabilizing Agent	Project Amount (tonnes)	Baseline Emissions (tCO2e)	Project Emissions (tCO2e)	Emission Reductions (tCO2e)
Coughlin Colorado Project	07-May-22	2022	CIR	Asphalt Emulsions	105,375.47	10,911.00	5,868.00	**5,043**
50431 Mower MN	12-May-22	2022	CIR	FSB	38,396.99	3,686.00	706.00	**2,980**
50432 Mower MN	15-May-22	2022	CIR	FSB	11,644.47	1,104.00	127.00	**977**
50433 Scott MN	18-May-22	2022	CIR	Asphalt Emulsions	28,674.50	2,621.00	617.00	**2,004**
50392 Pottawattamie IA	31-May-22	2022	CIR	FSB	25,905.35	2,463.00	459.00	**2,004**
50524 Washington MN	09-Jun-22	2022	CIR	Asphalt Emulsions	5,389.46	516.00	147.00	**369**
50403 Redwood Brown MN	15-Jun-22	2022	CIR	Asphalt Emulsions	18,945.26	1,872.00	467.00	**1,405**
50422 Redwood MN	23-Jun-22	2022	CIR	Asphalt Emulsions	27,061.75	2,581.00	440.00	**2,141**
50389 Cherokee OBrien IA	07-Jul-22	2022	CIR	FSB	28,735.18	2,718.00	413.00	**2,305**
50374 Casper WY	18-Jul-22	2022	CIR	Asphalt Emulsions	35,404.90	3,393.00	922.00	**2,471**
50346 Hennepin MN	10-Aug-22	2022	CIR	Asphalt Emulsions	12,925.32	1,147.00	225.00	**922**
50485 MnROAD MN	22-Aug-22	2022	CIR	Asphalt Emulsions	449.25	39.00	14.00	**25**
50363 Poweshiek IA	07-Sep-22	2022	CIR	FSB	5,016.28	491.00	91.00	**400**
50393 Shelby IA	14-Sep-22	2022	CIR	FSB	11,922.08	1,144.00	240.00	**904**
51123 Fayette IA-Echo Valley Road	03-May-23	2023	CIR	FSB	3,811.23	364.00	74.00	**290**
51123 Fayette IA-Ivy Road	08-May-23	2023	CIR	FSB	7,164.43	672.00	136.00	**536**
51049 Franklin IA	15-May-23	2023	CIR	FSB	28,644.01	2,695.00	416.00	**2,279**
50834 Pocahontas IA-CR 15	17-May-23	2023	CIR	FSB	6,447.46	630.00	102.00	**528**
50834 Pocahontas IA-CR 56	17-May-23	2023	CIR	FSB	6,421.32	642.00	133.00	**509**
51126 Brown MN	30-May-23	2023	CIR	Asphalt Emulsions	36,529.23	3,507.00	657.00	**2,850**
51028 Blue Earth Faribault MN	30-May-23	2023	CIR	Asphalt Emulsions	39,963.13	3,547.00	1,047.00	**2,500**
51086 Worth IA	12-Jun-23	2023	CIR	FSB	17,577.43	1,653.00	315.00	**1,338**
51026 Chickasaw IA	19-Jun-23	2023	CIR	FSB	10,411.07	1,008.00	145.00	**863**
51085 Mitchell IA	19-Jun-23	2023	CIR	FSB	20,777.02	1,885.00	322.00	**1,563**
51052 Warren IA	27-Jun-23	2023	CIR	FSB	13,092.11	1,234.00	235.00	**999**
51165 Warren TN	08-Jul-23	2023	CIR	Asphalt Emulsions	37,059.86	3,600.00	705.00	**2,895**
51027 Boone IA	12-Jul-23	2023	CIR	FSB	3,024.91	293.00	64.00	**229**
51042 Sioux IA	25-Jul-23	2023	CIR	FSB	14,097.35	1,354.00	237.00	**1,117**
51043 Scott IA	26-Jul-23	2023	CIR	FSB	13,684.77	1,215.00	198.00	**1,017**
51013 Clarke Decatur IA	31-Jul-23	2023	CIR	FSB	34,826.56	3,261.00	725.00	**2,536**
51112 Clay MN	02-Aug-23	2023	CIR	Asphalt Emulsions	14,380.75	1,327.00	290.00	**1,037**
51014 Lyon IA	11-Aug-23	2023	CIR	FSB	10,632.88	1,030.00	197.00	**833**
51176 Wood WI	21-Aug-23	2023	CIR	Asphalt Emulsions	6,149.85	594.00	114.00	**480**
51057 Shelby IA	24-Aug-23	2023	CIR	FSB	58,077.70	5,779.00	832.00	**4,947**
51125 Keokuk IA	05-Sep-23	2023	CIR	FSB	28,869.33	2,767.00	527.00	**2,240**
51280 Lyon IA	16-Sep-23	2023	CIR	FSB	21,654.90	2,100.00	450.00	**1,650**
51361 Coffee TN	05-Oct-23	2023	CIR	Asphalt Emulsions	22,205.25	2,233.00	610.00	**1,623**
51404 Worth IA	21-Aug-23	2023	CIR	Asphalt Emulsions	24,394.34	2,327.00	417.00	**1,910**
51692 KOSSUTH IA	02-May-24	2024	CIR	FSB	15,647.65	1,461.00	262.00	**1,199**
51687 MARTIN MN	06-May-24	2024	CIR	Asphalt Emulsions	13,459.35	1,316.00	304.00	**1,012**
51691 BUTLER IA	14-May-24	2024	CIR	FSB	23,156.51	2,112.00	341.00	**1,771**
51758 PLYMOUTH IA	28-May-24	2024	CIR	FSB	19,785.81	1,963.00	351.00	**1,612**
51644 POTTAWATTAMIE IA	10-Jun-24	2024	CIR	FSB	38,866.16	3,717.00	636.00	**3,081**
51596 PINE MN	08-Jul-24	2024	CIR	Asphalt Emulsions	6,725.92	644.00	142.00	**502**
51469 MARTIN WANTONWAN MN	09-Jul-24	2024	CIR	Asphalt Emulsions	40,087.57	3,888.00	1,437.00	**2,451**
51643 SIOUX IA	18-Jul-24	2024	CIR	FSB	21,217.29	2,044.00	340.00	**1,704**
51833 W26 BENTON IA	31-Jul-24	2024	CIR	FSB	10,388.70	976.00	161.00	**815**
51832 E24 BENTON IA	06-Aug-24	2024	CIR	FSB	15,122.40	1,446.00	264.00	**1,182**
51702 AITKIN MN	12-Aug-24	2024	CIR	Asphalt Emulsions	31,759.53	2,912.00	700.00	**2,212**
51463 HUMBOLT IA	14-Aug-24	2024	CIR	FSB	4,931.29	501.00	60.00	**441**
51749 DODGE MN	20-Aug-24	2024	CIR	Asphalt Emulsions	3,499.56	363.00	63.00	**300**
51585 DODGE MN	28-Aug-24	2024	CIR	Asphalt Emulsions	26,722.10	2,634.00	469.00	**2,165**
51878 WINNESHIEK IA	04-Sep-24	2024	CIR	FSB	11,867.97	1,116.00	220.00	**896**
51525 MARSHALL IA	12-Sep-24	2024	CIR	FSB	13,339.88	1,295.00	244.00	**1,051**
51560 ST LOUIS MN	30-May-24	2024	CIR	Asphalt Emulsions	51,435.55	4,680.00	1,731.00	**2,949**
51645 BROWN MN	14-Aug-24	2024	CIR	Asphalt Emulsions	29,963.50	2,802.00	753.00	**2,049**
51927 HOWARD IA	29-Jul-24	2024	CIR	FSB	20,912.99	1,974.00	479.00	**1,495**

APPENDIX E.8: EX-ANTE CREDITING PERIOD CALCULATIONS

2021 - 2028 Crediting Period Ex-Ante Projections

LEGEND

=Projections

=user entry

Assumed Annual % increase = 20%

Year	BASELINE EMISSIONS	PROJECT EMISSIONS	NET REDUCTION
2021	38,821	9,703	29,118
2022	34,686	10,736	23,950
2023	45,717	8,948	36,769
2024	37,844	8,957	28,887

Count	Vintage Start		Vintage End	Year	Crediting Baseline	Baseline Emissions (rounded)	Project Emissions	Net GHG Reduction	Cumulative Net GHG Reduction
						Tonnes Co2	Tonnes Co2	Tonnes Co2	Tonnes Co2
0.4	27-Apr-2021	to	31-Dec-2021	2021	94.4	38,808	9,893	28,915	28,915
1.4	01-Jan-2022	to	31-Dec-2022	2022	94.3	34,686	10,736	23,950	52,865
2.4	01-Jan-2023	to	31-Dec-2023	2023	94.2	45,717	8,948	36,769	89,634
3.4	01-Jan-2024	to	31-Dec-2024	2024	94.1	37,844	8,957	28,887	118,521
4.4	01-Jan-2025	to	31-Dec-2025	2025	94.0	80,250	19,500	60,750	179,271
5.4	01-Jan-2026	to	31-Dec-2026	2026	93.9	96,250	23,500	72,750	252,021
6.4	01-Jan-2027	to	31-Dec-2027	2027	93.8	115,250	28,000	87,250	339,271
7.4	01-Jan-2028	to	31-Dec-2028	2028	93.7	138,250	33,750	104,500	443,771
8.4	01-Jan-2029	to	31-Dec-2029	2029	93.6	165,750	40,500	125,250	569,021
9.4	01-Jan-2030	to	31-Dec-2030	2030	93.5	198,500	48,500	150,000	719,021
10	01-Jan-2031	to	26-April-2031	2031	93.4	-	-	-	719,021
					Totals	**951,305**	**232,284**	**719,021**	

Average Annual Reductions **71,902**