ExxonMobil

Underground Injection Control – Class VI Permit Application for Hummingbird Carbon Storage Project Injection Wells No. 01, No. 02, No. 03, No. 04, and No. 05

SECTION 0 – APPLICATION NARRATIVE

Hummingbird Carbon Storage Project
Allen Parish, Louisiana
ExxonMobil Low Carbon Solutions Onshore Storage, LLC
March 2025

SECTION 0 – APPLICATION NARRATIVE

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General Application Information

Project Name: Hummingbird Carbon Storage Project

Mailing Address: 22777 Springwoods Village Parkway
Spring, Louisiana 77389

Well Location(s): Allen Parish, Louisiana
Hummingbird INJ No. 01: [redacted]
Hummingbird INJ No. 02:
Hummingbird INJ No. 03:
Hummingbird INJ No. 04:
Hummingbird INJ No. 05:

*NAD 27 – North American Datum of 1927

Project Contact: [redacted]

Project Owner: ExxonMobil Low Carbon Solutions Onshore Storage

Ownership Status: Limited Liability Company

Entity Status: Public

Standard Industrial Classification (SIC) Codes: 4953 – Refuse Systems (nonhazardous waste disposal sites)

The surface facilities are not located on federal, Indian, or state lands.
Indian and state lands are located within the Area of Review.

CERTIFICATION OF PROFESSIONAL GEOLOGIST:

Sections of permit applications that represent geologic work shall be sealed, signed, and dated by a licensed professional geologist as required by LAC43: XVII **§3603.H.2.**

Applicable Sections
Section 01 – Site Characterization
Section 02 – Plume Model

[redacted]

CERTIFICATION OF PROFESSIONAL ENGINEER:

Sections of permit applications that represent engineering work shall be sealed, signed, and dated by a licensed professional engineer as required by LAC43: XVII **§3603.H.3**.

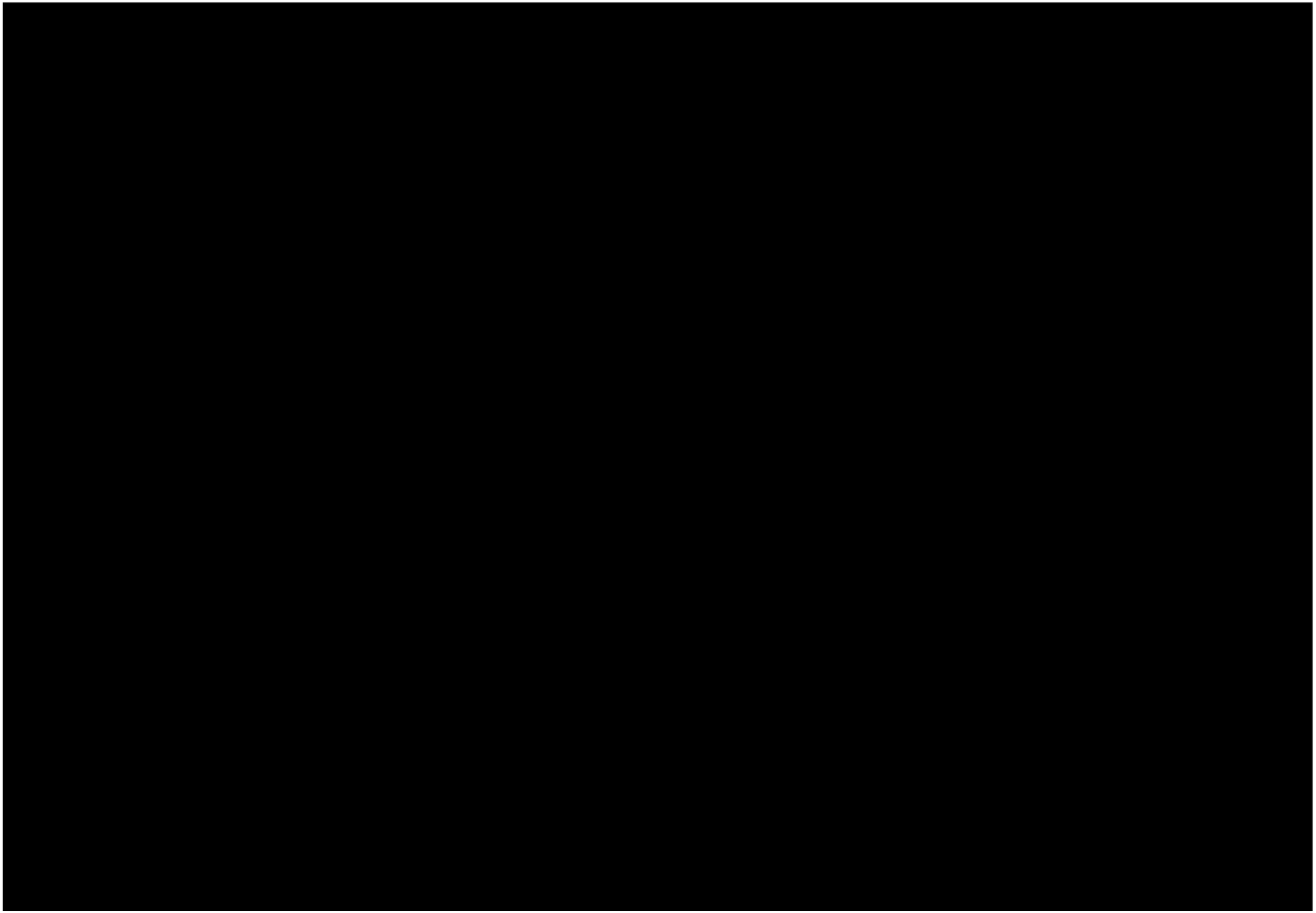
1. Additional Permits

2. Project Background

ExxonMobil Low Carbon Solutions Onshore Storage, LLC (ExxonMobil) is proposing to construct and operate five carbon sequestration wells in Allen Parish, Louisiana. The goal of the Hummingbird Carbon Storage (CS) Project (Hummingbird Project) is to permanently store anthropogenic CO_2 captured from industrial sources, thereby facilitating the United States' efforts to reduce greenhouse gas emissions. The Hummingbird Project will be a commercial-scale carbon capture system that is designed, constructed, and operated with the capability of storing CO_2 in deep geologic formations. The site was chosen based on the favorable geology—ideal for storage—and proximity to emitting sources of CO_2 and to existing CO_2 pipelines. [redacted]

This Class VI permit application thoroughly describes and characterizes the geology of the planned well locations, evaluates the formations for the qualities required to permanently contain the sequestered CO_2, and outlines the engineering design and safety requirements of the constructed wells. The application also describes and details the planned monitoring system that will be used to analyze movement of the actual injectate plume with that predicted by reservoir modeling and simulation.

This permit application has been developed to meet all requirements of the Louisiana Administrative Code, Title 43 (LAC43): XVII **§3601** through **§3633**. Once issued, the permit will be updated every 5 years thereafter for the active injection life of the wells, per LAC43: XVII **§3609.M.1**. Figure 1 displays the Hummingbird Project.



3. Site Characterization and Summary of Site Suitability

A regional and local geologic evaluation was conducted (*Section 1 – Site Characterization*) for the Hummingbird Project site using geologic, geophysical, petrophysical, hydrogeological, and well log analysis data obtained from published literature, commercial sources, proximal core data, and publicly available data sets.

Detailed discussions of the geologic features, seismic history, injection and confining zone details, and area of review (AOR) site suitability are presented in *Section 1 – Site Characterization* and *Section 2 – Plume Model*; below are some highlights from those discussions. The Hummingbird Project site is a geologically ideal location for CO_2 injection and storage operations. The injection zone is composed of thick, porous, and permeable sandstones that will support the proposed injection operations. The upper confining zone (UCZ) is characterized by low porosity and permeability, modeled to impede the upward migration of fluids. [redacted]

Consistent with the requirements of LAC43: XVII **§3615**, the Hummingbird Project area's geological system is suitable for CO_2 injection and containment in the proposed injection [redacted] The upper and lower confining zones show sufficient porosity and permeability along with lateral extent to ensure that the movement of the CO_2 plume and formation fluids is prevented—while the porosity, permeability, and lateral extent of the injection zone are sufficient to ensure the safe and permanent storage of anthropogenic CO_2.

4. Plume Model

A compositional model delineated the AOR for the Hummingbird Project consistent with the requirements of LAC43: XVII **§3615.B.3**. Advanced modeling workflows within Schlumberger's (SLB) industry-standard software were employed to construct geological and dynamic models. An extensive literature and public data search was conducted to help generate model inputs. Additional site-specific data will be acquired during the upcoming evaluation and development phase to enhance the model and validate storage capacity and containment integrity.

Intersect™ was chosen to build the dynamic model for its ability to handle large data sets and multiple grids, offering various tools for data management, visualization, and uncertainty analysis. This software is a widely recognized tool used for modeling both compositional and unconventional reservoirs. Intersect employs cutting-edge computational techniques and equation of state (EOS) algorithms to simulate compositional processes with high fidelity, making it well-suited for CS applications. The dynamic model accounts for the various trapping mechanisms that may occur in the subsurface. Structural, residual gas, and solubility trapping are all included to predict the migration of CO_2 and delineate the AOR.

[redacted] the project aims to maximize storage capacity while mitigating potential impacts on subsurface integrity and preventing the movement of fluid into USDWs. After injection operations cease, the reservoir model shows that pressure will stabilize to near in situ conditions. *Section 2 – Plume Model* presents a complete discussion on the generation of the model.

5. Area of Review and Corrective Action

Section 2 – Plume Model lays the foundation for *Section 3 – Area of Review and Corrective Action Plan* by detailing the methodology behind the determination of the AOR. *Section 3* focuses on the subsequent assessment of all of the artificial penetrations in the AOR. Two distinct evaluations comprise the final AOR: (1) the determination of the CO_2 plume; and (2) the determination of the extent of the critical pressure front. *Section 3* outlines in detail how both of those were determined. [redacted] A complete discussion on each well and the proposed schedule of corrective actions are also presented in this section per LAC43: XVII **§3615.C**.

6. Injection Well Construction and Operations

As discussed in *Section 4 – Well Construction Plan and Operating Conditions*, ExxonMobil plans to construct five CO_2 injection wells in Allen Parish, Louisiana. The wells are to be constructed in compliance with the Class VI Underground Injection Control (UIC) injection-well construction requirements of LAC43: XVII **§3617**. The goal of the operating parameters and material selection is to guarantee the system's mechanical integrity—ensuring protection of the underground source of drinking water (USDW)—and to maximize performance during the life of the Hummingbird Project. The casing and cementing, and tubing and packer materials to be used in the construction of the wells will be of sufficient strength and design to last the life of the carbon sequestration project—and to be compatible with the fluids with which those materials will be expected to come into contact. Information about those materials is included in *Section 4*, along with wellbore schematics and a more in-depth discussion of the injection well construction procedures.

The wells are designed to allow maximum injection volume while ensuring that the bottomhole pressure does not exceed 90% of the formation's fracture gradient. The well design maintains enough clearance for the continuous monitoring of bottomhole pressure and temperature (P/T), using a P/T gauge deployed on the tubing.

The high-concentration CO_2 stream will be provided by industrial sources under contract. A description of the physical and chemical characteristics along with the corrosiveness of the CO_2 stream will be provided to the Louisiana Department of Energy and Natural Resources once it is prepared.

7. Testing and Monitoring

Section 5 – Testing and Monitoring Plan describes how ExxonMobil will monitor the Hummingbird Project pursuant to LAC43: XVII **§3625**. As detailed in that section, ExxonMobil has conducted, or will conduct, required testing and monitoring activities—including analysis of the CO_2 stream, use of continuous recording devices, corrosion monitoring, groundwater quality monitoring, mechanical integrity, pressure falloff testing, and plume tracking. In addition to demonstrating that the wells are operating as planned, that the CO_2 plume and pressure front are moving as predicted, and that there is no endangerment to USDWs, the monitoring data will be used to validate and adjust the geological models used to predict the distribution of the CO_2 within the storage zone and to support AOR reevaluations. Results of the testing and monitoring activities described in the Testing and Monitoring Plan may trigger action according to the Emergency and Remedial Response Plan (*Section 8*).

8. Injection Well Plugging

After the cessation of injection, ExxonMobil plans to plug and abandon the injection wells pursuant to LAC43: XVII **§3631**. *Section 6 – Injection Well Plugging Plan* details the procedures and plans for the plugging of the injection and monitoring wells of the Hummingbird Project.

9. Post-Injection Site Care and Site Closure

Section 7 – Post-Injection Site Care and Site Closure Plan describes the activities that ExxonMobil will perform during those phases of the project pursuant to LAC43: XVII **§3633**. ExxonMobil will monitor groundwater quality and track the position of the CO_2 plume and pressure for 50 years; however ExxonMobil may petition the Commissioner of Conservation (Commissioner) to establish an Alternate Post-Injection Site Care timeframe in accordance with LAC43: XVII **§3633.A.3**. ExxonMobil may not cease post-injection monitoring until a demonstration of non-endangerment of the USDW has been approved by the Commissioner of Conservation (Commissioner). Following approval for site closure, ExxonMobil will plug all monitoring wells, restore the site to its original condition, and submit a site closure report and associated documentation.

10. Emergency and Remedial Response

In the event of an emergency that could endanger public health and safety or any USDW during the construction, operation, or post-injection site care periods, *Section 8 – Emergency and Remedial Response Plan* describes the actions that ExxonMobil will perform if needed at the

Hummingbird Project pursuant to LAC43: XVII **§3623**. If evidence is verified that the injected CO_2 stream and/or associated pressure front may cause endangerment to a USDW, ExxonMobil will initiate the shutdown plan for the injection wells, take all steps reasonably necessary to identify and characterize the release, notify the permitting agency (Commissioner) of the emergency event within 24 hours, and implement the approved Emergency and Remedial Response Plan. Key contact information related to the project is also outlined in *Section 8* (Table 8-4) for local, state, and federal agencies.

11. Financial Responsibility

Pursuant to LAC43: XVII **§3609.C**, ExxonMobil will maintain financial responsibility throughout all phases of the Hummingbird Project, as detailed in *Section 9 – Financial Assurance*. The instruments will be sufficient to cover the costs of corrective action, injection well plugging, post-injection site care, site closure, and emergency and remedial response. Adjustments to the cost estimates, including adjustments for inflation, cost estimate increases, or an event that may adversely affect financial conditions, will be provided in writing to the Commissioner.

12. Environmental Justice

ExxonMobil uses a multi-stage process to assess environmental justice (EJ) and stakeholder considerations in the Hummingbird Project area as well as a surrounding area—defined from the edge of the AOR. This process begins with an initial screening using the EPA's EJScreen tool. A secondary screening is undertaken using additional EJ indicators, including the Climate and Economic Justice Screening Tool (CEJST), the EPA's Inflation Reduction Act (IRA) tool, and the U.S. Department of Energy's (DOE) Disadvantaged Communities Reporter tool. These initial screening stages are built upon through local analysis and engagement, which may include environmental assessments, initial stakeholder engagements, and "ground-truthing" or verifying the data.

A Stakeholder Engagement Plan (SEP) and community benefits considerations are created from data collected in these stages. The engagement process is iterative and designed to incorporate findings and feedback from communities to refine and enhance overall engagement. Insights from stakeholder engagements, grievance mechanism inputs, and community activities are integrated as collected. These studies are updated as needed. [redacted]

Appendix A – Project Maps