Underground Injection Control – Class VI Permit Application for Luz Solar No. 1

Liberty County, Texas

SECTION 8 – EMERGENCY AND REMEDIAL RESPONSE PLAN

January 2024

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8.1 Emergency and Remedial Response Plan Overview

This Emergency and Remedial Response Plan (ERRP) for the Whites Bayou Sequestration Site was prepared to meet the requirements of 16 Texas Administrative Code (TAC) ***§*5.203(i)** [Title 40, US Code of Federal Regulations (40 CFR) **§146.94**]. This section is organized into six distinct parts. These parts identify and discuss issues surrounding (1) potentially affected infrastructure and parties, (2) definitions of degrees of severity, (3) specific events and their response plans, (4) training, (5) communications plans and notification procedures, and (6) emergency response plan review and updates. These sections aim to ensure that a rapid and appropriate response is taken to protect any Underground Source of Drinking Water (USDW). The strategies consider the protection of the environment, surrounding community, and company property.

This plan will remain in place during the construction, operation, closure, and post-closure periods for the proposed BKVerde, LLC (BKVerde) injection well Luz Solar No. 1. Copies of the ERRP will be maintained and made available at the Whites Bayou Sequestration Site facilities and at the company headquarters.

8.2 Resources/Infrastructure in the Area of Review

The area of review (AOR) for Luz Solar No. 1 is in Liberty County, Texas. [redacted] Local resources in the vicinity of the storage facility that may be impacted by an emergency event are limited to the USDW, plus any related use of irrigation or domestic use of private and community water wells in the Chicot or Evangeline aquifers. Infrastructure with a potential for impact has been identified and is shown in Figure 8-1 and *Appendix G-3*.

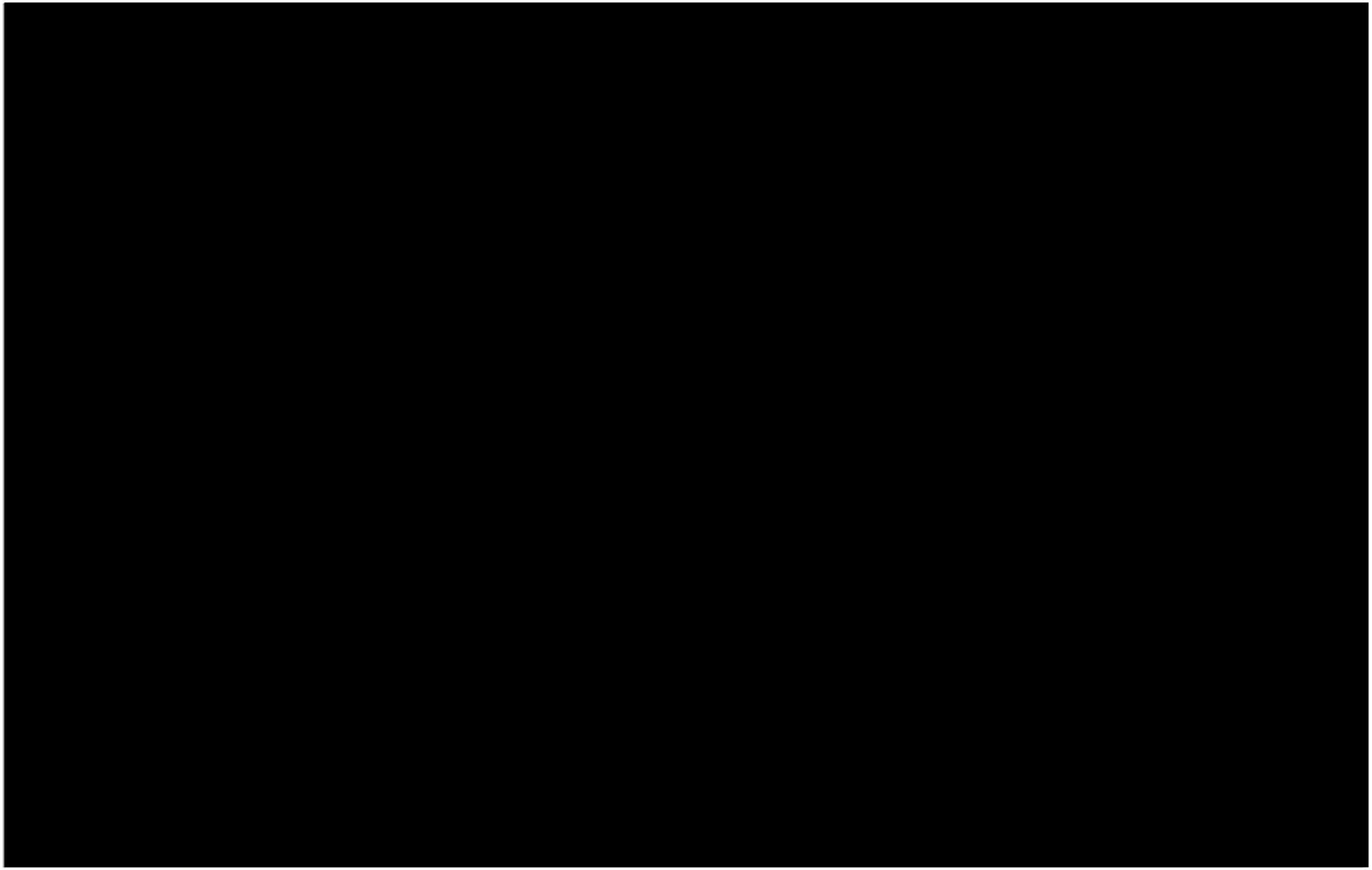

Figure 8-1 – Map of AOR Showing Resources and Infrastructure

The infrastructure in the AOR includes [redacted] Local resources may be used if required to minimize the impact of an event. Those resources are listed in Table 8-1.

Table 8-1 – List of Infrastructure Resources in AOR

Type	Resource	Phone Number
[redacted]		
Police	Liberty County Sheriff	936-336-4500
Medical	Liberty-Dayton Community Hospital	281-393-7096
[redacted]		

[redacted] Figure 8-2 illustrates the location of these resources in relation to the Whites Bayou Sequestration Site.

[redacted]

Figure 8-2 – Map of Emergency Resources

8.2.1 Degree of Risk for Emergency Events

To identify events that may occur during the operations of the Whites Bayou Sequestration Site, BKVerde has developed a matrix of risks—grouped into seven major categories, as summarized in Table 8-2. This matrix combines the severity of the consequences of a given adverse event and the likelihood that the event will occur. The severity score is weighted 40% for safety, 40% environmental, and 20% financial. The risk and severity scores are weighted into total scores for the final risk assessment and then graded as shown in that table. These total scores represent a risk severity as described in Table 8-3. The risk matrix provides a framework for mitigation efforts during emergency response planning and as an input for the financial assurance determination. The full risk matrix is provided in *Appendix G-1*.

Table 8-2 – Risk Activity Summary

Risk Activity Table							
		Likelihood	Severity				
			Safety	Environmental	Financial		
			40%	40%	20%		
Section	Risk (Feature, Event, or Process)	1-Remote, 5-Eminent	1-Very Low, 5-Very High				
		Assigned	Assigned	Assigned	Assigned	Estimated Costs	Total Score
[redacted]							

Table 8-3 – Degree of Severity

Risk Assessment Score	Description
>15	Avoid to the degree possible. Mitigate through an immediate responsive action plan to reduce likelihood to an acceptable level.
10–14.9	Preventative and mitigative measures are required.
3.5–9.9	Preventative and mitigative measures are optional. Monitoring is required.
0–3.4	No preventative or mitigative measures are required. Monitor the situation.

8.3 Infrastructure/Resource-Specific Events and Response Plans

Any incident response will be managed via the Incident Command System (ICS) to plan, scale, and coordinate an appropriate response with third parties—and communicate using common emergency response language. Response teams will, at a minimum, be comprised of BKVerde operations specialists and the Whites Bayou Project team. Those teams will be expanded as needed to include specialty environmental response resources, specialty well-intervention specialists, local first responders, and Liberty County officials. All responses will be coordinated and communicated, as necessary, with the relevant regulatory bodies, including county, state, and federal levels.

The following section outlines the general response procedures to be followed during identified emergency events. The responses are not intended to be exhaustive in nature; different emergencies may require unique response procedures. If, at any time during the operation of the Whites Bayou Sequestration Site, an employee or facility operator encounters a situation in which the injected CO_2 stream may endanger the USDW, the following actions will be conducted:

1. Cease injection immediately.
2. Take all steps reasonably necessary to identify and characterize any release.
3. Notify the Underground Injection Control (UIC) Program director (UIC Director) within 24 hours if an emergency event was confirmed by field operations to have occurred.
4. Implement the ERRP approved by the UIC Director.

The evaluation of each situation will be based on the specific incident, with a focus on prioritizing the safety of human life, stabilizing the incident, and containing CO_2 using engineering best practices. The response actions will involve implementing emergency and remedial measures to address any risks posed by the movement of either injectate or formation fluids that may endanger the USDW—or pose a threat to human health, safety, or the environment.

8.3.1 General Risk Scenarios

8.3.1.1 Mineral Rights Infringement

If the plume extends into adjacent oil-and-gas mineral resources beyond the controlled or leased pore space, mineral rights may be infringed. The failure of containment may be caused by a confining zone breach, natural seismic events, or formation fluid impact because of CO_2 injection. The plume can cause interactions between the formation fluids and CO_2 and could economically impact nearby producing minerals if left unmitigated.

If the CO_2 plume moves differently than expected, several courses of action can be taken to remedy the situation, including the cessation of injection and corrective action. BKVerde has carefully designed the sequestration site to ensure CO_2 migrates through the injection zone as planned. Monitoring wells, for example, that BKVerde is placing in optimal locations, will help prevent injected CO_2 from impacting adjacent minerals. BKVerde's robust monitoring, reporting, and verifying (MRV) program will provide early detection of an unexpected occurrence.

Risk Level: Low

Prevention and Detection: Site characterization shows minimum potential impact to productive oil and gas areas. The CO_2 plume will be monitored, as described in *Section 5 – Testing and Monitoring Plan.*

Potential Response Actions:

- Stop the injection and notify the UIC Director within 24 hours, if field personnel confirm the event.
- Use vertical seismic profile (VSP) technology to assess the location and degree of CO_2 movement, as described in *Section 5.*
- Restart the injection, if possible, at a reduced rate.
- Continue monitoring the plume more frequently to determine if migration continues.
- Demonstrate mechanical integrity according to the methods discussed in *Section 5*.
- Notify the UIC Director when injection can be expected to resume.

8.3.1.2 Water Quality Contamination

Water quality can be affected throughout all phases of the storage project. The drilling fluid can leak into the potable aquifer during drilling operations. The injected fluid can interact with the formation fluid. Seismic events can alter the storage environment and allow for a pathway into freshwater aquifers.

Risk Level: Low

Prevention and Detection: Freshwater-based drilling fluid, designed to prevent fluid loss from the drilled well, will be used while drilling the surface casing section, and the surface casing will be cemented to the surface. The CO_2 plume will be monitored as described in *Section 5.* The USDW

will be protected by three layers of protective casing, separating injected CO_2 from groundwater.

Potential Response Actions:

- Stop the injection and notify the UIC Director within 24 hours, if field personnel confirm the event.
- Use the VSP system to assess the location and degree of CO_2 movement, as described in *Section 5 – Testing and Monitoring Plan*.
- Restart the injection, if possible, at a reduced rate.
- Continue monitoring the plume more frequently to determine if migration continues.
- If groundwater/USDW is impacted, then conduct the following actions:
    - Pump CO_2-contaminated groundwater to the surface and aerate it to remove CO_2.
    - Apply "pump and treat" methods to remove trace elements, including multiple dual-phase extraction (MDPE).
    - Drill wells that intersect the accumulations in groundwater and extract CO_2.
    - Provide an alternative water supply if groundwater-based public water supplies are contaminated.
    - Perform soil vapor extraction (SVE) of CO_2 vapor.
- If surface water is impacted, create a hydraulic barrier by increasing reservoir pressure upstream of the leak.
- Demonstrate mechanical integrity according to the methods discussed in *Section 5*.
- Notify the UIC Director when injection can be expected to resume.

8.3.1.3 Single Large-Volume CO_2 Release to the Surface

A CO_2 release at the surface can create a potential risk to human health and the environment. This risk can be from unidentified orphan wells, well integrity issues, operating equipment exceeding designed parameters, geological complications, and major mechanical and integrity failures of the distribution and storage facilities.

Risk Level: Low

Prevention and Detection:

- Proper operation and preventative maintenance of all surface facility equipment will be conducted.
- Due diligence will be exercised when collecting information from offset wells in the AOR.
- Pressure and rate monitoring, pressure falloff tests, annulus pressure tests, etc., will all be performed according to *Section 5*.
- Tubing and annular pressures will be monitored and maintained below the maximum allowed values.
- The wellhead will be regularly maintained and tested for integrity.

Potential Response Actions:

- Stop the injection and notify the UIC Director within 24 hours.

- Close the wellhead valve.
- Evacuate personnel from the facility and begin gas monitoring operations.
- Allow pressure to bleed off the equipment and the processing system and allow atmospheric gas levels to return to normal.
- Determine the cause and severity of the failure to initiate repairs.
- Demonstrate mechanical integrity according to the methods discussed in *Section 5 – Testing and Monitoring Plan.*
- Notify the UIC Director when injection can be expected to resume.

8.3.1.4 Entrained Contaminant (Non-CO_2) Releases

During injection operations, the composition and properties of the injectate can deviate from chemically desired conditions. The change in composition can have metallurgical effects and induce corrosion. Additionally, the injectate can interact with biological activity to produce hydrogen sulfide (H_2S) gas, impact dissolution, and chemically affect wellbore cement.

Risk Level: Low

Prevention and Detection: This event is unlikely to occur because chemical compatibility studies indicate that the injection stream will not adversely affect the formation fluid. Also, the extreme conditions near the wellbore limit the capability for biological life support. Biocide chemical treatment will be applied if bacterial growth is detected along the pipeline or in surface equipment. The CO_2 plume will be monitored by a robust MRV program, as described in *Section 5.*

Potential Response Actions:

- Lower injection rates or stop the injection.
- Notify the UIC Director within 24 hours, if field personnel confirm the event.
- Chemically treat the stream to reduce compatibility issues.
- Restart the injection, if possible, at a reduced rate.
- Demonstrate mechanical integrity according to the methods discussed in *Section 5.*
- Notify the UIC Director when injection can be expected to resume.

8.3.1.5 Well Blowout

A well control event could occur during the drilling phase of the injection well or the drilling of the monitor wells. Theoretically, during this period an unexpected influx of formation fluid could enter the wellbore and cause a sudden release of hydrocarbons. However, in the specific case of Luz Solar No. 1, the geologic formations to be drilled through are not hydrocarbon-bearing. BKVerde's robust local drilling experience in these formations significantly reduces the risk of an unexpected event while drilling.

Risk Level: Low

Prevention and Detection:

- Maintain appropriate mud weights, as expected for the area, based on known offset well data.
- Monitor the rate of drilling fluid returns vs. rates pumped, penetration rates, pump pressures, etc.

Potential Response Actions:

- Stop drilling.
- Close the blowout preventer; insert rams into the well.
- Read and record stabilized shut-in pressures.
- Kill the well by pumping down the wellbore fluid that is heavier than the current fluid, until the well stops flowing.
- Notify the UIC Director within 24 hours of the event.

Response Personnel: Onsite drilling personnel and supervisors

Equipment: Drilling rig, mud logging equipment, blowout preventers with annular rams, and drilling fluid materials to increase mud weight adequately

8.3.1.6 Spill

During drilling and completion or workover operations, accidental release of drilling fluids, hydrocarbons, chemicals, etc., could occur.

Risk Level: Low

Prevention and Detection:

- Properly maintain blowout preventers to prevent accidental release of drilling fluids or hydrocarbons.
- Maintain awareness of offset drilling activities.
- Keep spill prevention equipment on drilling or workover rig.

Potential Response Actions:

- Contain the spill using available equipment, such as absorbents, booms, etc.
- Notify the appropriate regulatory authority and supervisory personnel.
- Immediately take samples around the point of entry.
- Initiate the Spill Prevention, Control, and Countermeasures (SPCC) Plan for the facility.

Response Personnel: Drilling/workover crews or operations personnel

Equipment: Absorbents, containment equipment

8.3.1.7 Loss of Mechanical Integrity

Well barrier components have failed, thereby causing fluid migration along the wellbore. This failure could be caused by a cement failure behind the casing, an improperly seated packer, or a tubing leak.

Risk Level: Low

Prevention and Detection: An appropriate well design will be implemented in the construction phase, including proper cement and metallurgy of the casing and tubing. Pressure and rate monitoring, pressure falloff tests, annulus pressure tests, etc., will all be performed according to *Section 5 – Testing and Monitoring Plan*.

Potential Response Actions:

- Stop injection and notify the UIC Director within 24 hours, if field personnel confirm the event.
- Close the wellhead valve.
- Monitor the well and annulus pressures.
- Determine the cause and severity of failure to determine if any release of either the CO_2 stream or formation fluids may have been released into any unauthorized zone.
- Pull and replace the tubing or packer.
- Install chemical sealant barrier and/or attempt cement squeeze to block leaks.
- Demonstrate mechanical integrity according to the methods discussed in *Section 5*.
- Notify the UIC Director when injection can be expected to resume.

8.3.1.8 Accidents/Unplanned Events (Typical Insurable Events)

Unforeseen events may occur while operating the Whites Bayou Sequestration Site, such as surface infrastructure damage, pipeline leak, compressor failure, animal damage, and weather-related events.

Risk Level: Medium

Prevention and Detection: Equipment will be maintained regularly to prevent or minimize damage. Damage prevention infrastructure will be installed, and markers will be placed to alert the public of potential hazards. The markers will include the name of the operator and telephone number. Barricades or fencing will be installed to prevent both accidental damage to equipment and animals from entering the facility. The weather will be continuously monitored, and during a possible adverse event, precautions will be taken to limit the potential impact.

Potential Response Actions:

- Stop the injection and notify the UIC Director within 24 hours, if field personnel can confirm the event.
- Activate the downhole safety valve, if necessary.
- Determine the cause and severity of the failure and initiate repairs.

- Demonstrate mechanical integrity according to the methods discussed in *Section 5*.
- Notify the UIC Director when injection can be expected to resume.

8.4 Training

Personnel responsible for implementing this plan will be trained in their duties and responsibilities related to these facilities during annual on-site or tabletop training exercises. All sequestration site personnel, visitors, and contractors must attend an overview orientation before obtaining permission to enter any of the facilities. A refresher course on this training is required annually.

All BKVerde personnel will be considered the primary first responders to any event within the facility boundary. Personnel will have access to and be alerted by the Supervisory Control and Data Acquisition (SCADA) system, which is the first alert for abnormal conditions. After an initial triage, additional response personnel will be contacted, as determined by the significance of the event. These additional responders could include public (county and state resources) or private contract responders. BKVerde will have a contractual relationship with such private response contractors in case the need arises.

BKVerde personnel will attend, as a minimum, annual training associated with Health, Safety, and Environment (HSE). This training will include all the required Occupational Safety and Health Administration (OSHA) training (e.g., Hazardous Waste Operations and Emergency Response (HAZWOPER), etc.). Moreover, the staff will be trained regarding the ICS to ensure efficient response to incidents. BKVerde personnel will also be provided with technical training regarding the specific properties associated with CO_2 and the standard operating procedures related to CO_2 storage.

Training will be required annually and reinforced by emergency drills that create scenarios to highlight specific incident responses. For these drills, local county first responders will be invited. BKVerde will also provide a copy of the ERRP to local first responders and discuss potential response scenarios.

8.5 Communications Plan and Emergency Notification Procedures

BKVerde intends to implement the ICS to respond to emergencies. The system is widely used by emergency response professionals and provides a common language and hierarchy to emergency response. The system provides for unified command so that multiple agencies can effectively work together.

A high-level structure of the ICS is displayed in Figure 8-3:

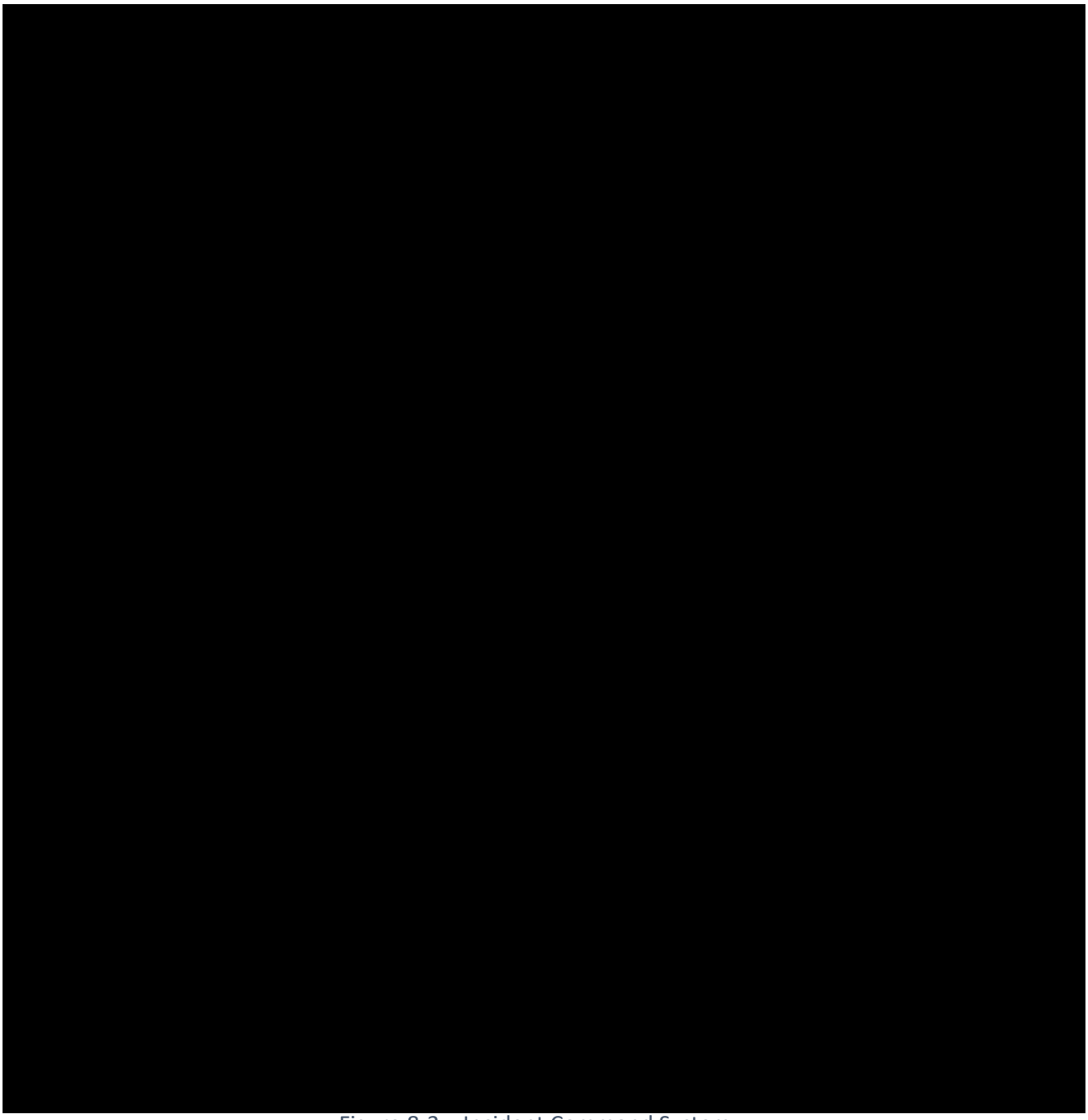

Figure 8-3 – Incident Command System

The chain of command has not been identified at this stage of the project. The individuals will be recognized after the operating company has been formed and commercial agreements have been arranged. This section will then be updated to reflect the nomination of chain-of-command members.

Local emergency response contacts are provided in Table 8-3, contacts for government agencies in Table 8-4, and an internal call list in Table 8-5.

Table 8-4 – Emergency Services – **CALL 911**

Agency	Telephone Number
Liberty County Sherriff (Liberty, Texas Office)	936-336-4500
[redacted]	
Liberty County Emergency Management (Liberty, Texas)	936-334-3219
Texas Department of Public Safety (Liberty, Texas)	936-336-7343
Environmental Services Contractor (ERDI)	225-405-7398

Table 8-5 – Government Agency Notification

Agency	Telephone Number
Underground Injection Control (UIC) Program Director	TBD
Environmental Protection Agency (EPA) National Response Center	800-424-8802

Table 8-6 – Internal Call List

Name	Title	Telephone Number
24-hr Emergency Number		833-425-8677
[redacted]		

BKVerde will have a dedicated emergency phone number staffed 24 hours per day. As appropriate, BKVerde will communicate with the public regarding events that require an emergency response, including the impact of the event on drinking water, the severity of the event, actions taken or planned, etc.

8.6 Flood Risk

Luz Solar No. 1 is in an agricultural area in Liberty County, Texas. According to the FEMA Flood Map Service Center site, the well is outside the designated flood zones and therefore has a less than 1% annual chance of flooding[2], as shown in Figure 8-4.

[2] https://msc.fema.gov/portal/home (accessed January 2024).

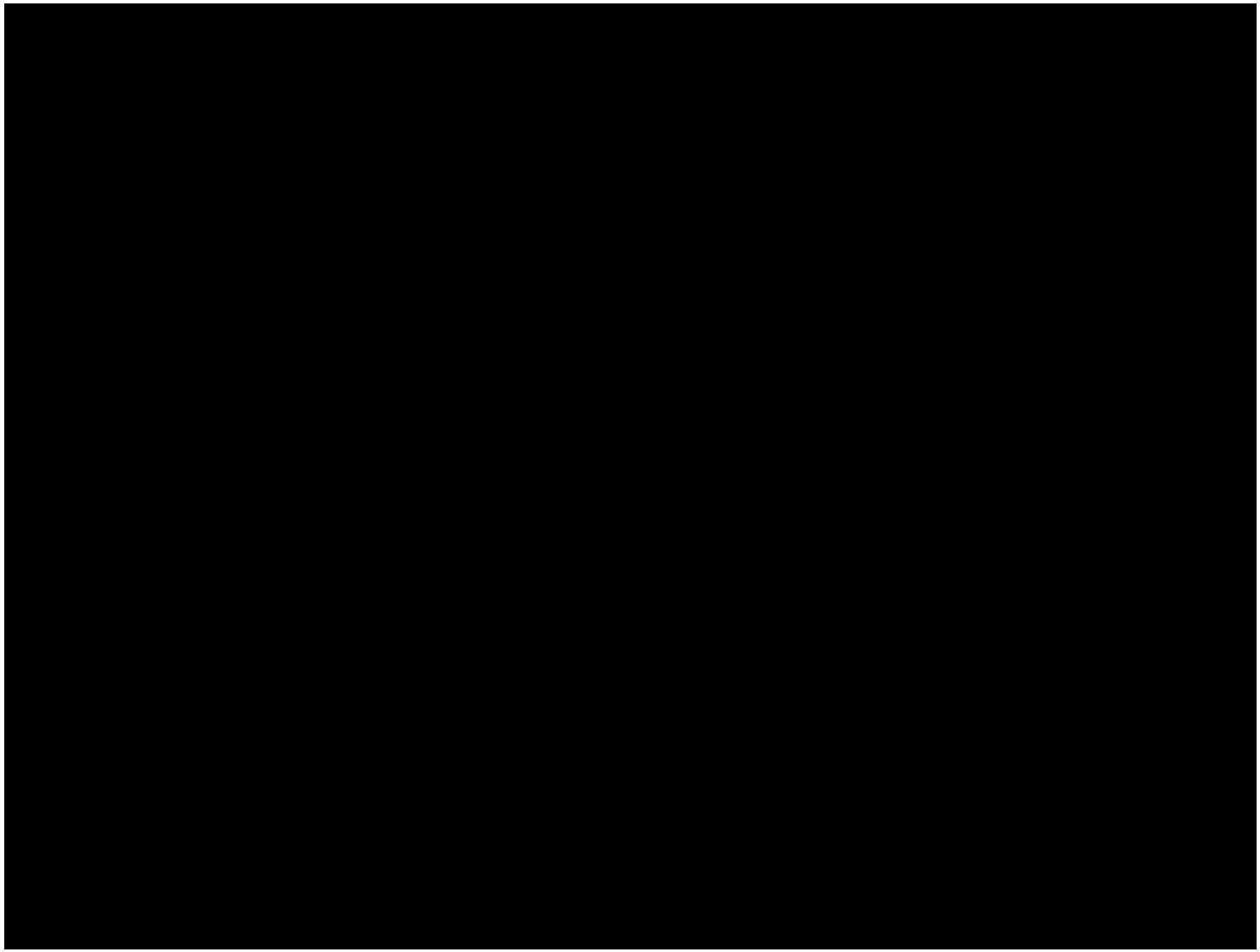

Figure 8-4 – FEMA Flood Zone Hazards Map.[3] The black outline represents the property boundary; the yellow star, the location of Luz Solar No. 1.

[3] https://msc.fema.gov/portal/home (accessed January 2024).

8.7 Site Security

The Whites Bayou Sequestration Site will be secured to protect against unauthorized activity. BKVerde will install security fences with gates around the injection and monitoring wells. Concrete barriers will be installed around the injection and in-zone monitoring well. Additionally, 360° signage will be placed at each well. Well operations will be monitored through automatic data systems and will include remote control access to shut down the injection well, if needed.

8.8 Emergency and Remedial Response Plan Review and Updates

This ERRP will be reviewed and updated at least once every 5 years following 40 CFR **§146.94(d)**. Any amendments to the plan must be approved by the UIC Director and will be incorporated into the permit. This plan will also be reviewed and submitted to the UIC Director within 1 year of an AOR evaluation following any significant changes to the facility, such as the addition of injection or monitoring wells, change in personnel, or when required by the UIC Director.

The following attachments are included in *Appendix G – Emergency Operations*:

- Appendix G-1 Risk Matrix
- Appendix G-2 FEMA Flood Zone Hazards Map
- Appendix G-3 Map of the AOR Showing Resources and Infrastructure