

Plan revision number: 0

Plan revision date: 07/31/23

## INJECTION WELL CONSTRUCTION PLAN

### 40 CFR 146.82(a)(11) and (12), 146.86, 146.87, and 146.88 (a), (b), (c), and (e)

#### Bluebonnet Sequestration Project

1.0 Facility Information .....	1
2.0 Overview.....	2
3.0 Operating parameters and specifications CO <sub>2</sub> Injector wells .....	2
4.0 Well design CO <sub>2</sub> Injector Wells.....	4
5.0 Blowout preventer and wellhead requirements.....	11
5.1 Blowout preventer equipment (BOPE) .....	11
5.2 Choke manifolds and kill line .....	12
5.3 Closing units .....	12
5.4 Pressure testing .....	12
5.5 CO <sub>2</sub> Injector Well - Wellhead mechanical drawing .....	13
6.0 Monitoring Well Construction Details.....	14
6.1 In-zone monitoring wells .....	14
6.2 Above-confining-zone monitoring well.....	18
6.3 USDW monitoring wells .....	19

#### 1.0 Facility Information

Facility name:      Bluebonnet Sequestration Project  
                            Bluebonnet CCS 1 Well

Facility contact:      [REDACTED], Project Manager  
                            5 Greenway Plaza Houston, TX 77046  
[REDACTED]

Well location:      Winnie, Chambers County, Texas  
[REDACTED] (North American Datum 1927)

The Bluebonnet Sequestration Hub, LLC will construct the injection well according to the procedures below.

The matter of construction details is relevant to the requirements of Environmental Protection Agency (EPA) document 40 CFR Subpart H – Criteria and Standards Applicable to Class VI Wells. The main topics covered in this attachment are special construction requirements, open hole

Plan revision number: 0

Plan revision date: 07/31/23

diameters and intervals, casing specifications, tubing specifications, data acquisition and testing plan, and demonstration of mechanical integrity.

## **2.0 Overview**

The Bluebonnet CCS 1 injection well and monitoring wells are designed with the highest standards and best practices for drilling and well construction. The operational parameters and material selection are aimed to ensure mechanical integrity in the system, prevent any endangerment of the USDW, and optimize the operation during the life of the project.

The Bluebonnet Sequestration Hub, LLC will drill a new well as a CO<sub>2</sub> injector, Bluebonnet CCS 01, that will target injection in the ██████████. The development scenario for the Bluebonnet CCS 1 proposes an initial completion in ██████████ ft estimated measured depth (MD)) to inject for ██████████ years (see Figure CON-1). After ██████████ years of injection, the well will go under a recompletion procedure to add perforations in the ██████████ formation (██████████ ft estimated MD) and move the packer above the new perforated zone. The original perforations will continue to be open during the rest of the injection period (see Figure CON-2).

There will be ██████████ In Zone Monitoring wells drilled, ██████████ ██████████, and one recompletion in the stratigraphic well, Encanto 01, as an In Zone Monitoring well that will target the ██████████ section to track CO<sub>2</sub> plume extension and pressure front, as described in the Testing and Monitoring Plan.

Additionally, the Project plans to drill ██████████ ██████████, targeting the ██████████ seal. This well will track any potential leak in the main confining systems above the injection target.

Three USWD monitoring wells will be drilled to track quality and variations in the Evangeline Aquifer that represent the base of the USDW. These are shallow water wells that will be swabbed/produced and sampled based on the requirements described in the Testing and Monitoring Plan.

## **3.0 Operating parameters and specifications CO<sub>2</sub> Injector wells**

The well is designed to maximize the rate of injection and reduce the surface pressure and friction alongside the tubing, while maintaining the bottomhole pressure below 90% of the frac gradient. The selected design provides enough clearance to deploy the pressure and temperature gauges on tubing and to ensure continuous surveillance of external integrity and conformance through the external fiber optic cable.

Well materials were selected based on the operating conditions expected during the life of the well, as shown in Table CON-1 and Table CON-2, and on CO<sub>2</sub> specifications for the project as shown in Table CON-3. A nodal analysis was used to perform sensitivities on the tubing size, rate of erosion, stresses, and potential movement of the tubulars.

Plan revision number: 0

Plan revision date: 07/31/23

**Table CON-1—Operating Parameters – First Completion**

Parameter	Value
Perforations Interval (TVDSS ft)	
Perforation Interval (TVD estimated ft)	
Injection Rate (MMscfd)	
Tubing Pressure (psi)	
Annular Surface Pressure (psi)	
Surface Temperature (°F)	
Frac Gradient (psi/ft)	
Bottomhole Temperature (°F)	

**Table CON-2—Operating Parameters – Recompletion (Add Perforations)**

Parameter	Value
Perforations Interval (TVDSS)	
Perforation Interval (TVD estimated ft)	
Injection Rate (MMscfd)	
Tubing Pressure (psi)	
Annular Surface Pressure (psi)	
Surface Temperature (°F)	
Frac Gradient (psi/ft)	
Bottomhole Temperature (°F)	

**Note:**

- Annular surface pressure between the tubing and long string will be kept between █ and █0 psi to monitor changes during injection. It is not recommended to apply the maximum injection pressure to the tubing-long string casing annulus to avoid unnecessary stress on the cement sheath that could lead to a micro-annulus or microfractures.

Plan revision number: 0

Plan revision date: 07/31/23

**Table CON-3—CO<sub>2</sub> Specification for Bluebonnet CCS 1**

Component	Specification
CO <sub>2</sub> (% mol)	
Water (lbs/MMCF)	
Nitrogen (% mol)	
Oxygen (ppm by wgt)	
Hydrogen (% mol)	
SOx (ppm by wgt)	
NOx (ppm by wgt)	
Hydrogen Sulfide (ppm by wgt)	
Hydrocarbons (%mol)	
Carbon Monoxide (ppm by wgt)	
Glycol (gal/MMSCF)	
Ammonia (ppm by wgt)	
Argon (%mol)	
Sulfur (ppm by wgt)	

#### **4.0 Well design CO<sub>2</sub> Injector Wells**

The development scenario for the Bluebonnet CCS 1 proposes an initial completion in [REDACTED] ft estimated measured depth (MD) to inject for [REDACTED] years (see Figure CON-1). After [REDACTED] years of injection, the well will go under a recompletion procedure to add perforations in the [REDACTED] ft estimated MD) and move the packer above the new perforated zone. The original perforations will continue to be open during the rest of the injection period (see Figure CON-2).

Confidential Business Information subject to a Business Confidentiality Claim under FOIA has been redacted by the applicant.

Pursuant to 40 C.F.R. §2.213, please contact Renee Willis, LCV Coordinator, Oxy Low Carbon Ventures, 5 Greenway Plaza, Houston, TX 77046, (713) 215-7632 if the EPA receives a request for disclosure of or seeks to disclose the data claimed to be confidential.

Plan revision number: 0

Plan revision date: 07/31/23

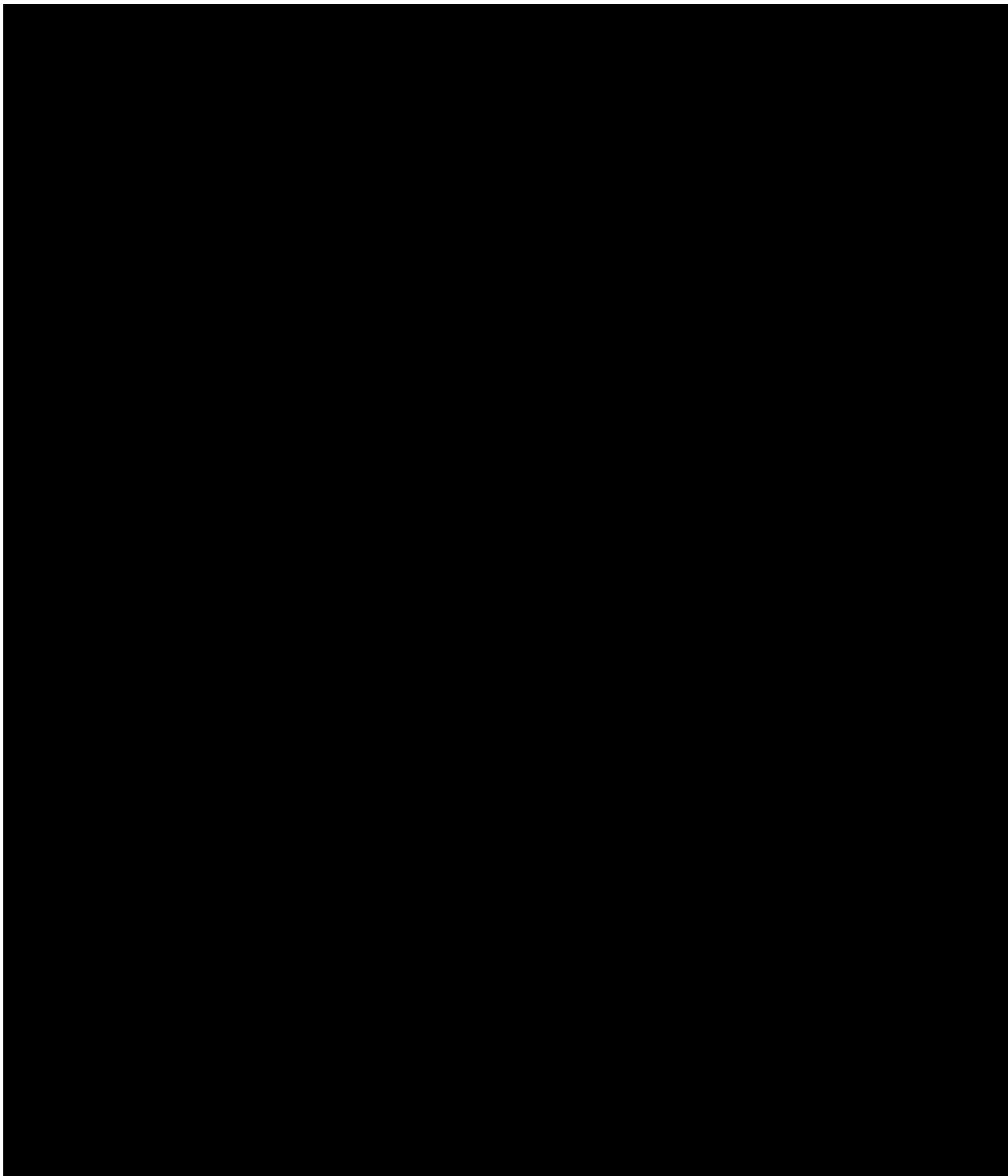


Figure CON-1—Bluebonnet CCS 1 Well Proposed Schematic – First Completion

Confidential Business Information subject to a Business Confidentiality Claim under FOIA has been redacted by the applicant.

Pursuant to 40 C.F.R. §2.213, please contact Renee Willis, LCV Coordinator, Oxy Low Carbon Ventures, 5 Greenway Plaza, Houston, TX 77046, (713) 215-7632 if the EPA receives a request for disclosure of or seeks to disclose the data claimed to be confidential.

Plan revision number: 0

Plan revision date: 07/31/23

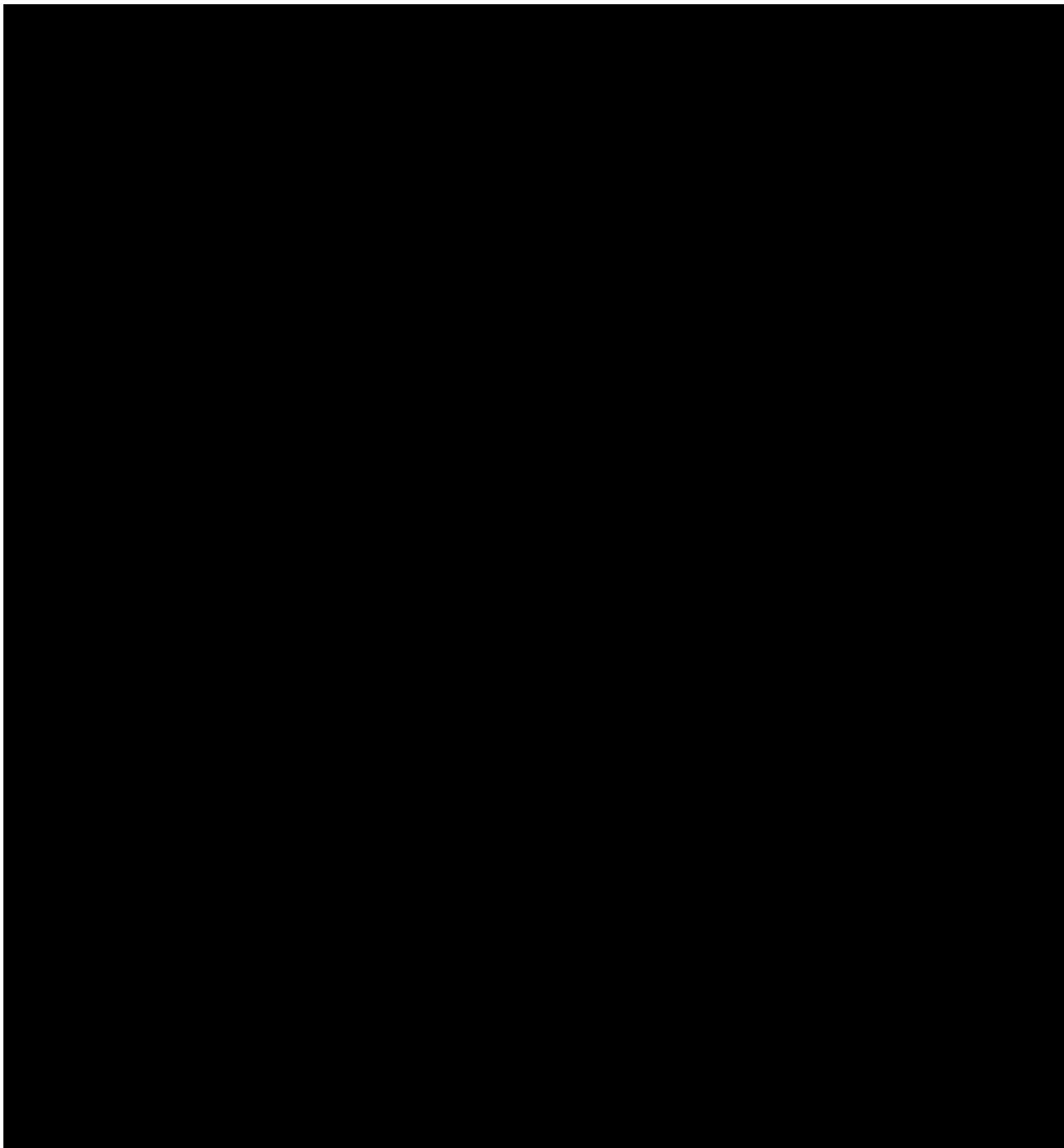
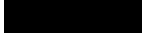


Figure CON-2—Bluebonnet CCS 1 Well Proposed Schematic – After Recompletion to add perforations in



Plan revision number: 0

Plan revision date: 07/31/23

The Bluebonnet CCS 1 well design includes two main sections: 1) surface casing and 2) long string section to cover the USDW, provide integrity while drilling the injection zone, acquire formation data, and isolate the target formation while running the upper completion.

The [ ] " surface section will be drilled to [ ] ft to cover base of the USDW, estimated at [ ] ft, and to provide mechanical integrity on the surface shoe to continue the next section. While drilling, a deviation survey will be taken every [ ] ft. Once total depth (TD) is reached, the well will be circulated and conditioned to run [ ] logs according to the testing program. Then, [ ] " casing will be run and cemented to the surface with conventional [ ]. If there are no cement returns to the surface, the Project Manager will inform the EPA Director, determine the top of cement with a temperature log or equivalent, and complete the annular cement program with a top job procedure after approval by the Director. After the tail cement reaches at least [ ] psi compressive strength, the rig will install Section A of the wellhead and blowout preventor (BOP) equipment. The rig will then test the BOP, test the casing, and pick up the drilling assembly. After drilling out the shoe track, an additional [ ]

A [ ] " hole will be drilled from [ ] ft to TD while taking deviation surveys every [ ] ft. Once TD is reached, the well will be circulated and conditioned to run [ ] logs and acquire samples based on the testing program. During this run, [ ] logs will be acquired over the previously set [ ] " surface casing. Then, the long string of [ ] " casing will be deployed with the [ ]. The casing will be cemented to the surface with a combination of CO<sub>2</sub>-resistant and conventional cement slurries. Based on simulations, a stage tool will be used to perform a two-stage cementing job to ensure good cement from bottom to surface. The depth of the [ ]

After the tail slurry cement develops a minimum compressive strength of [ ] psi, Section B of the wellhead will be installed, and the [ ]

During the completion operations, the rig will test the casing to [ ] psi, condition the long string with a bit and scraper, run a [ ] log to evaluate cement bonding and casing conditions, perforate the injection zone, and run the upper completion. The [ ] " tubing and packer completion will be run to approximately [ ] 0 ft, in conjunction with [ ]. The fluid in the well will be displaced with packer fluid and the packer will be set. Once the packer is set, an annular pressure test will be performed to 500 psi on surface to validate the mechanical seal and integrity in the annular between the tubing and casing. The well will be tested for injectivity with a step rate test procedure and a fall off test before starting injection.

Materials and metallurgy selections in well construction provide protection from corrosion and assurance of external and internal mechanical integrity. The injection casing materials were selected based on corrosion modeling with OLI software and materials testing as well as best

Plan revision number: 0

Plan revision date: 07/31/23

practices to be able to withstand downhole and surface operating conditions based on the projected CO<sub>2</sub> specifications and reaction with the formation waters.

The tubing was selected as carbon steel [REDACTED] metallurgic and will be coated internally with a [REDACTED] product since the expected CO<sub>2</sub> stream that is in contact with the internal ID of the tubing will be mainly dehydrated, reducing the risk of corrosion, in comparison with the bottom section of the wellbore that will be in contact with the formation waters. Tail pipes below the packers were selected with special metallurgic to prevent damage should formation water enter the well during short periods of shut down.

The injection packer elements in contact with the fluid will [REDACTED]. The annular of the injection well will be filled with packer fluid to prevent corrosion.

Cement across injection zone will be formulated to avoid degradation of the properties due to the effect of carbonic acid and provide protection to the casing as well.

The tables listed below provide further details regarding the Bluebonnet CCS 1 well. Table CON-4 contains the open hole diameters and intervals, Table CON-5 lists the casing specifications and Table CON-6 details the casing material properties.

**Table CON-4—Openhole Diameters and Intervals**

Name	Depth Interval (ft)	Openhole Diameter (inches)	Comment
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

**Notes:**

- The well total depth (TD) includes a minimum 600 ft of rat hole below Frio Basal Shale.
- The USDW depth will be confirmed with open hole logs. The USDW is estimated at 2089 ft MD.

**Table CON-5—Casing Specifications**

Name	Depth Interval (ft)	OD (inches)	ID (inches)	Drift (inches)	Weight (lb/ft)	Grade (API)	Coupling
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

Plan revision number: 0

Plan revision date: 07/31/23

**Table CON-6—Casing Material Properties**

Casing	Depth Interval (ft)	Burst (psi)	Collapse (psi)	Body Yield (Klb)	Max Allowed Bending	Thermal Conductivity @ 77 °F (BTU/ft.hr.°F)

## Notes:

- A stage tool will be located at [REDACTED] ft in the [REDACTED]" casing to perform the two-stage cementing job.
  - The centralization program will aim at 90% standoff and be adjusted using the field data for deviation, caliper, and hole conditions.
  - [REDACTED]

In addition, Table CON-7 and Table CON-9 contain the upper completion specifications and Table CON-8 and Table CON-10 show the tubing material properties. Table CON-11 shows the specification of the injection packer.

**Table CON-7—Upper Completion Specifications – Initial Completion**

Name	Depth Interval (ft)	OD (inches)	ID (inches)	Drift (inches)	Weight (lb/ft)	Grade (API)	Coupling

Plan revision number: 0

Plan revision date: 07/31/23

Table CON-8—Tubing Material Properties – Initial Completion

Tubing	Depth Interval (ft)	Burst (psi)	Collapse (psi)	Body Yield (Klb)	Max Allowable Bending	Thermal Conductivity @ 77 °F (BTU/ft.hr.°F)

Table CON-9—Upper Completion Specifications – Re-Completion

Name	Depth Interval (ft)	OD (inches)	ID (inches)	Drift (inches)	Weight (lb/ft)	Grade (API)	Coupling

Table CON-10—Tubing Material Properties – Re-Completion

Description	Depth Interval (ft)	Burst (psi)	Collapse (psi)	Body Yield (Klb)	Max Allowable Bending	Thermal Conductivity @ 77 °F (BTU/ft.hr.°F)

**Notes:**

- Pressure and temperature gauges will be tubing-deployed above and below casing. Cable material will be [REDACTED] and gauge carriers will be CO<sub>2</sub>-resistant material.
- Approximately [REDACTED] ft of tail pipe will be left below the packer.
- The annular space between the [REDACTED] " tubing and [REDACTED] " casing will be filled with [REDACTED]  
[REDACTED]
- The packer depth will be adjusted once the final perforation depth interval is known.

Plan revision number: 0

Plan revision date: 07/31/23

**Table CON-11—Packer Specifications**

Packer type and material	Nominal casing weight (ppf)	Packer main body outer diameter (inch)	Packer main body inner diameter (inch)	Temperature rating (°F)	Pressure rating (psi)
Burst Pressure (psi)	Collapse Pressure (psi)	Tensile Strength (ksi)	Comments		

Finally, Table CON-12 outlines the cementing program and Table CON-13 shows the mud program details.

**Table CON-12—Cementing Program**

Section	Type	Depths (ft)	Density (ppg)	Sacks	Excess

**Notes:**

- The slurry design might change in cement type, density, excess, and volumes once the conditions of the well are known after drilling.
- A staged cementing job is proposed to ensure good cement to the surface and excellent cement bonding across the injection, confining, and USDW zones. The stage tool is estimated at [REDACTED] ft, but the depth will be adjusted based on final drilling conditions.

**Table CON-13—Mud Program**

Hole	Type	Depths (ft)	Density (ppg)	YP (cP)	YP (lb/100 ft <sup>2</sup> )	Funnel Viscosity (sec)	API Fluid Loss (cm <sup>3</sup> )	LGS (%)

**5.0 Blowout preventer and wellhead requirements*****5.1 Blowout preventer equipment (BOPE)***

- BOPE must be API-monogrammed and adhere to API Standard 53 and Specifications 16A and 16C, as a minimum, and meet or exceed all applicable regulatory specifications.

Plan revision number: 0

Plan revision date: 07/31/23

- BOPE other than annular preventers must have a minimum working pressure exceeding the maximum anticipated surface pressure (MASP).
- All BOPE stacks must incorporate a set of blind or blind/shear rams.
- All rigs must have a calibrated trip tank. The trip tank and trip sheet are used to measure the fluid required to fill or displace from the hole during all tripping operations including casing or completion string running.
- A Full Opening Safety Valve (FOSV) and an Inside BOP Safety Valve (IBOPSV) must be always available on the rig floor for each drill pipe, drill collar size, and connection type in use.
- If a wireline lubricator is utilized for wireline operations, it shall not be the type that slips into and is held by the annular preventer or rams. A hydraulic cutter or other means of safely cutting the wireline must be available if a lubricator is not in use.

## **5.2 Choke manifolds and kill line**

- The choke manifold must be API-monogrammed, meet API SPEC 16C as a minimum, and meet or exceed all applicable regulatory specifications.
- All BOPE must include a choke manifold with at least one remotely operated choke and one manual choke installed.
- Flare/vent lines must be as long as practical (a minimum of 150 ft from the well center), as straight as possible (without sumps, collection areas, or uphill flow areas to prevent fluid buildup and resulting backpressure) and be securely anchored.

## **5.3 Closing units**

- BOPE closing units must adhere to API Spec 16D and API STD 53 as a minimum and meet or exceed all applicable regulatory specifications.
- BOPE control systems must include full controls on the closing unit and at least one remote control station. One control station must be located within 10 ft of the driller's console.
- BOPE closing units must have two separate charging pumps with two independent power sources, as specified in API Spec 16D, or have N<sub>2</sub> bottle backup.

## **5.4 Pressure testing**

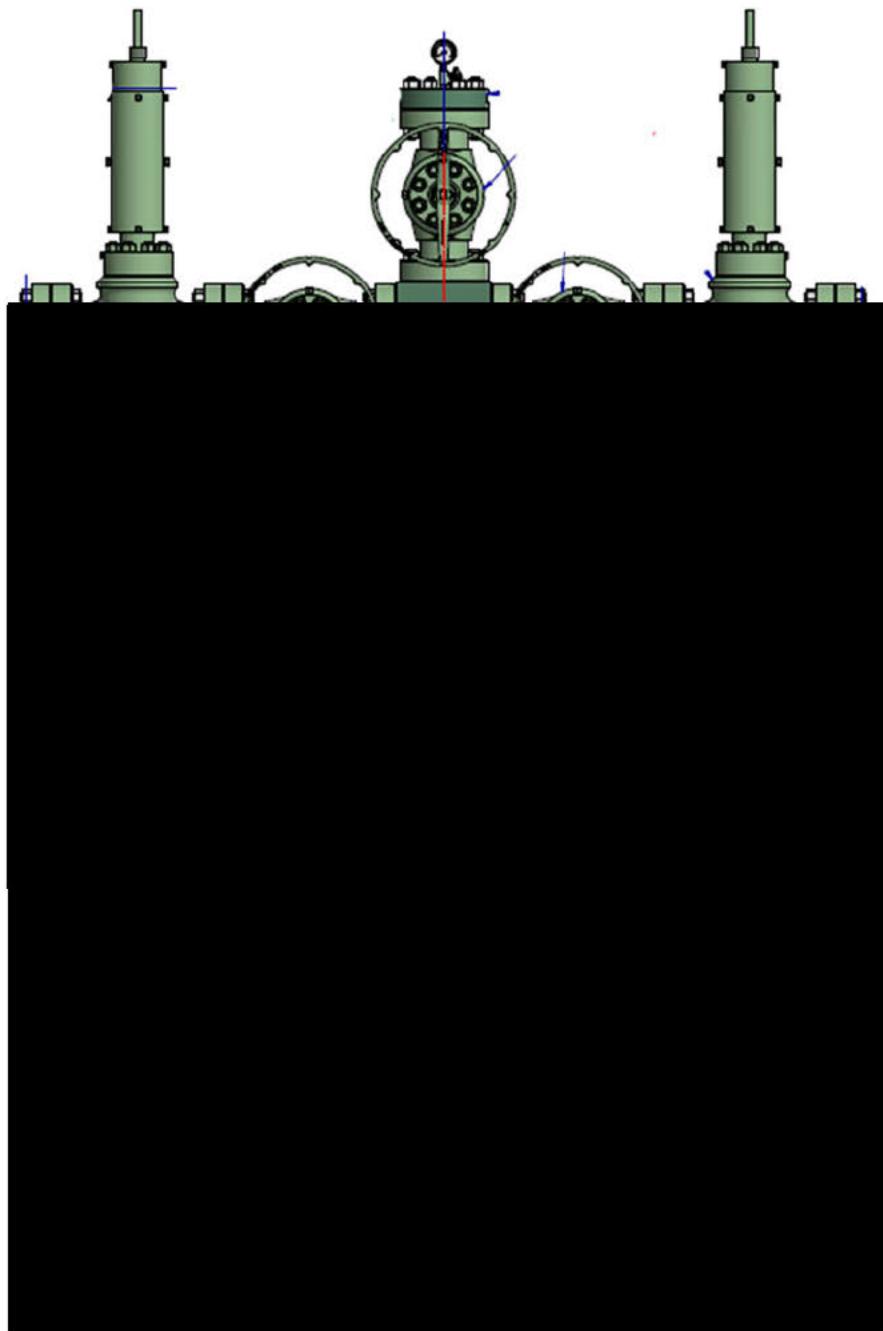
- BOPE components (including the BOP stack, choke manifold, and choke lines) must be pressure tested at the following frequency:
  - When installed. If the BOPE is stump tested, only the new connections are required to be tested at installation.
  - Before 21 days have elapsed since the last BOPE pressure test. When the 21-day test is due soon, consider testing the BOPE prior to drilling any H<sub>2</sub>S, abnormal pressure, or lost return zones to avoid having to test while drilling these intervals.
  - Anytime a BOPE connection seal is broken, the break must be pressure tested.

Plan revision number: 0

Plan revision date: 07/31/23

### ***5.5 CO<sub>2</sub> Injector Well - Wellhead mechanical drawing***

Figure CON-3 below is a basic mechanical drawing of the wellhead to be used for the Bluebonnet CCS 1 well.



**Figure CON-3—Schematic Diagram of Bluebonnet CCS 1 Well**

Plan revision number: 0

Plan revision date: 07/31/23

## **6.0 Monitoring Well Construction Details**

### ***6.1 In-zone monitoring wells***

Figures CON-4, CON-5, CON-6, and CON-7 show well construction details for the [REDACTED]

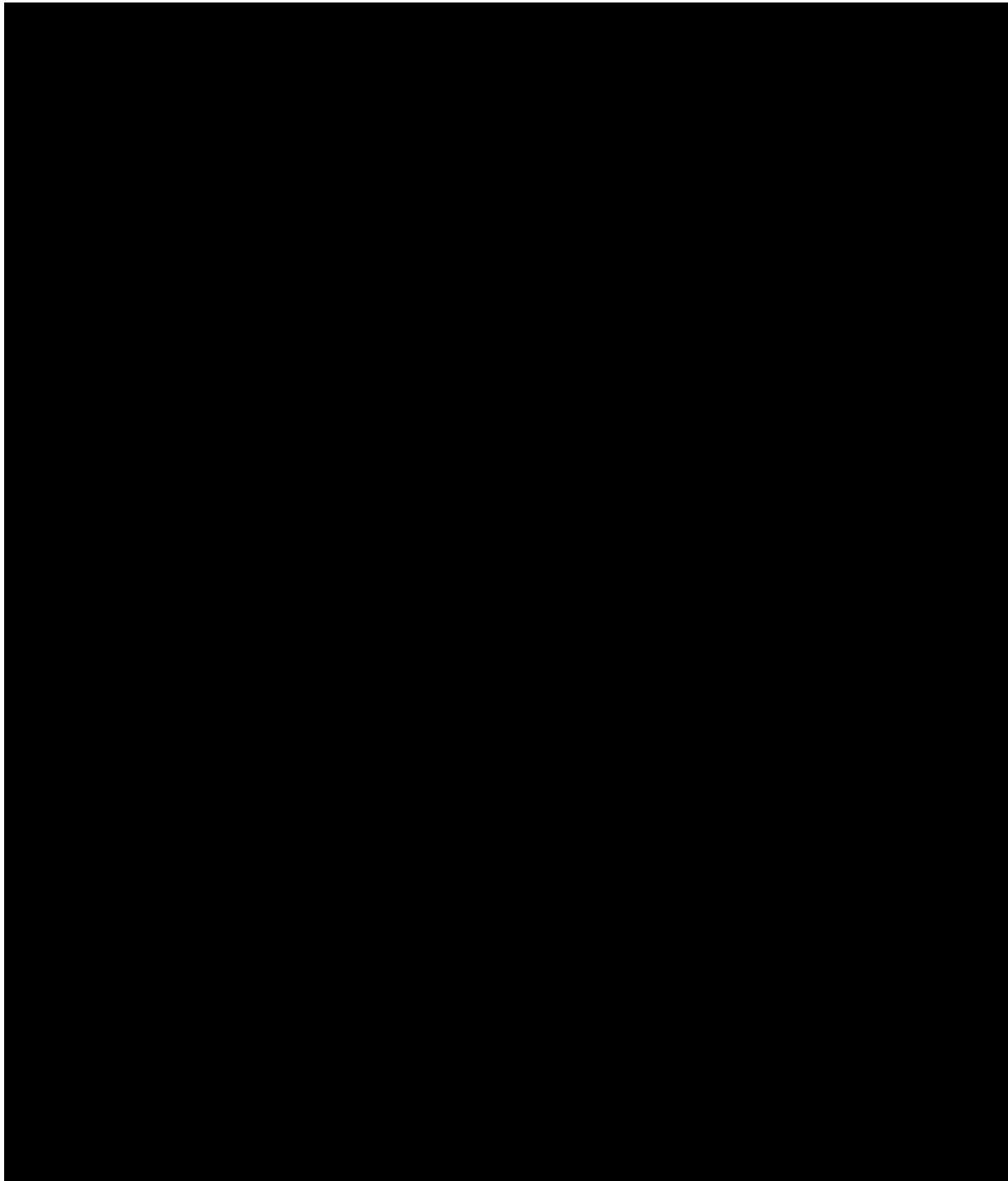


Figure CON-4—Schematic Diagram of [REDACTED]

Confidential Business Information subject to a Business Confidentiality Claim under FOIA has been redacted by the applicant.

Pursuant to 40 C.F.R. §2.213, please contact Renee Willis, LCV Coordinator, Oxy Low Carbon Ventures, 5 Greenway Plaza, Houston, TX 77046, (713) 215-7632 if the EPA receives a request for disclosure of or seeks to disclose the data claimed to be confidential.

Plan revision number: 0

Plan revision date: 07/31/23

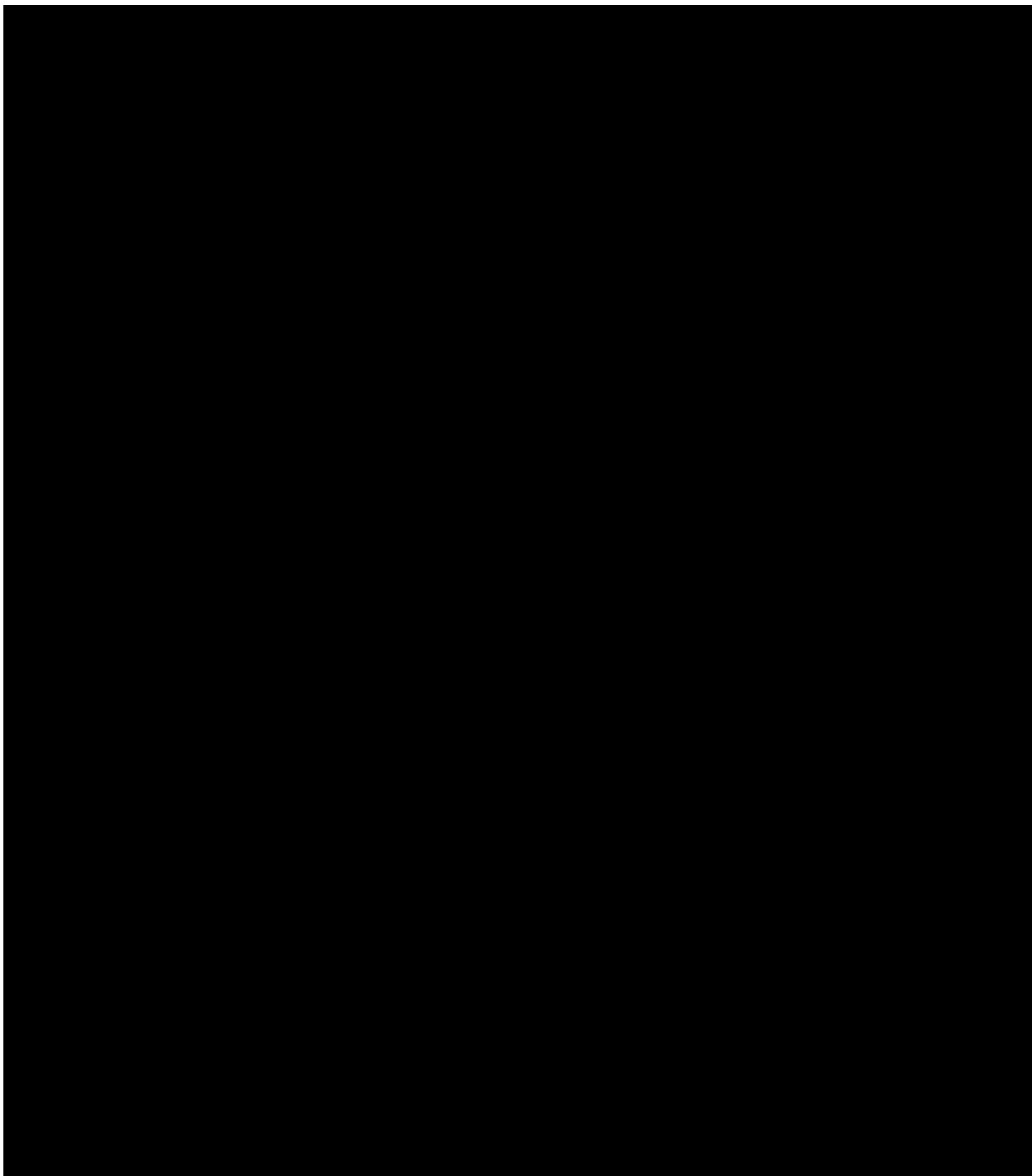


Figure CON-5—Schematic Diagram of [REDACTED]

Confidential Business Information subject to a Business Confidentiality Claim under FOIA has been redacted by the applicant.

Pursuant to 40 C.F.R. §2.213, please contact Renee Willis, LCV Coordinator, Oxy Low Carbon Ventures, 5 Greenway Plaza, Houston, TX 77046, (713) 215-7632 if the EPA receives a request for disclosure of or seeks to disclose the data claimed to be confidential.

Plan revision number: 0

Plan revision date: 07/31/23

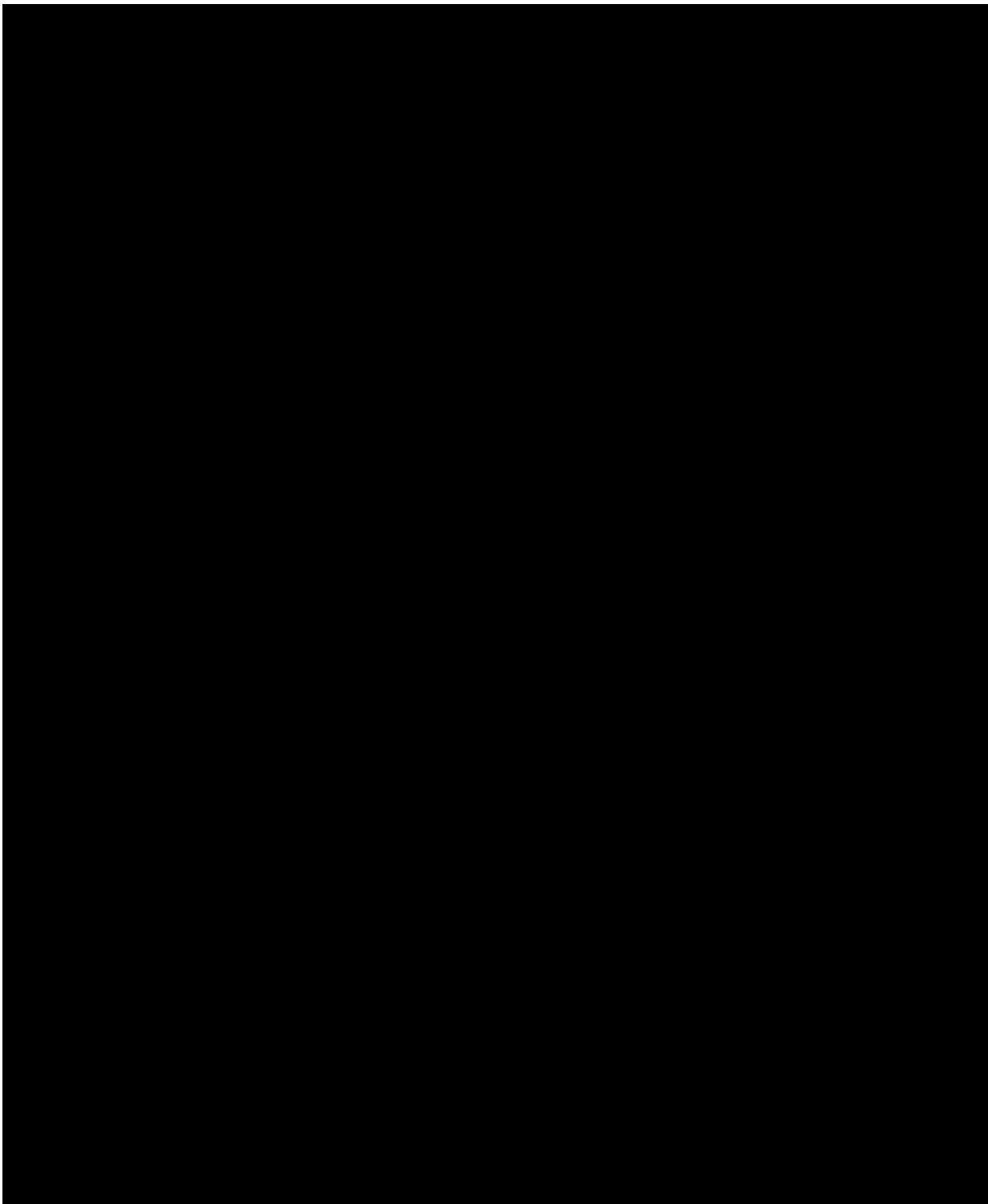


Figure CON-6—Schematic Diagram of Existing

Confidential Business Information subject to a Business Confidentiality Claim under FOIA has been redacted by the applicant.

Pursuant to 40 C.F.R. §2.213, please contact Renee Willis, LCV Coordinator, Oxy Low Carbon Ventures, 5 Greenway Plaza, Houston, TX 77046, (713) 215-7632 if the EPA receives a request for disclosure of or seeks to disclose the data claimed to be confidential.

Plan revision number: 0

Plan revision date: 07/31/23

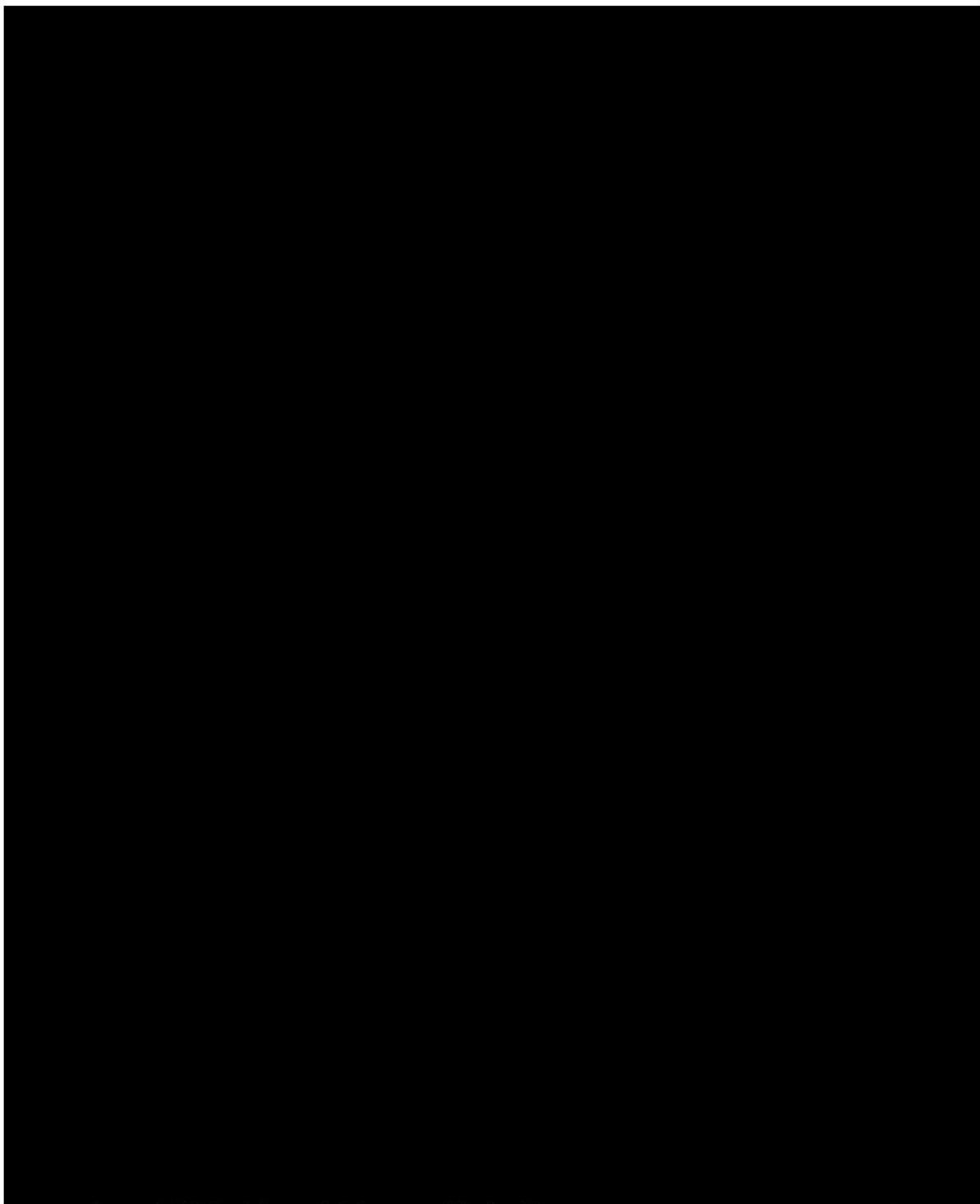


Figure CON-7—Schematic Diagram of Updated

Plan revision number: 0

Plan revision date: 07/31/23

## ***6.2 Above-confining-zone monitoring well***

Figure CON-8 shows well construction details for the [REDACTED].

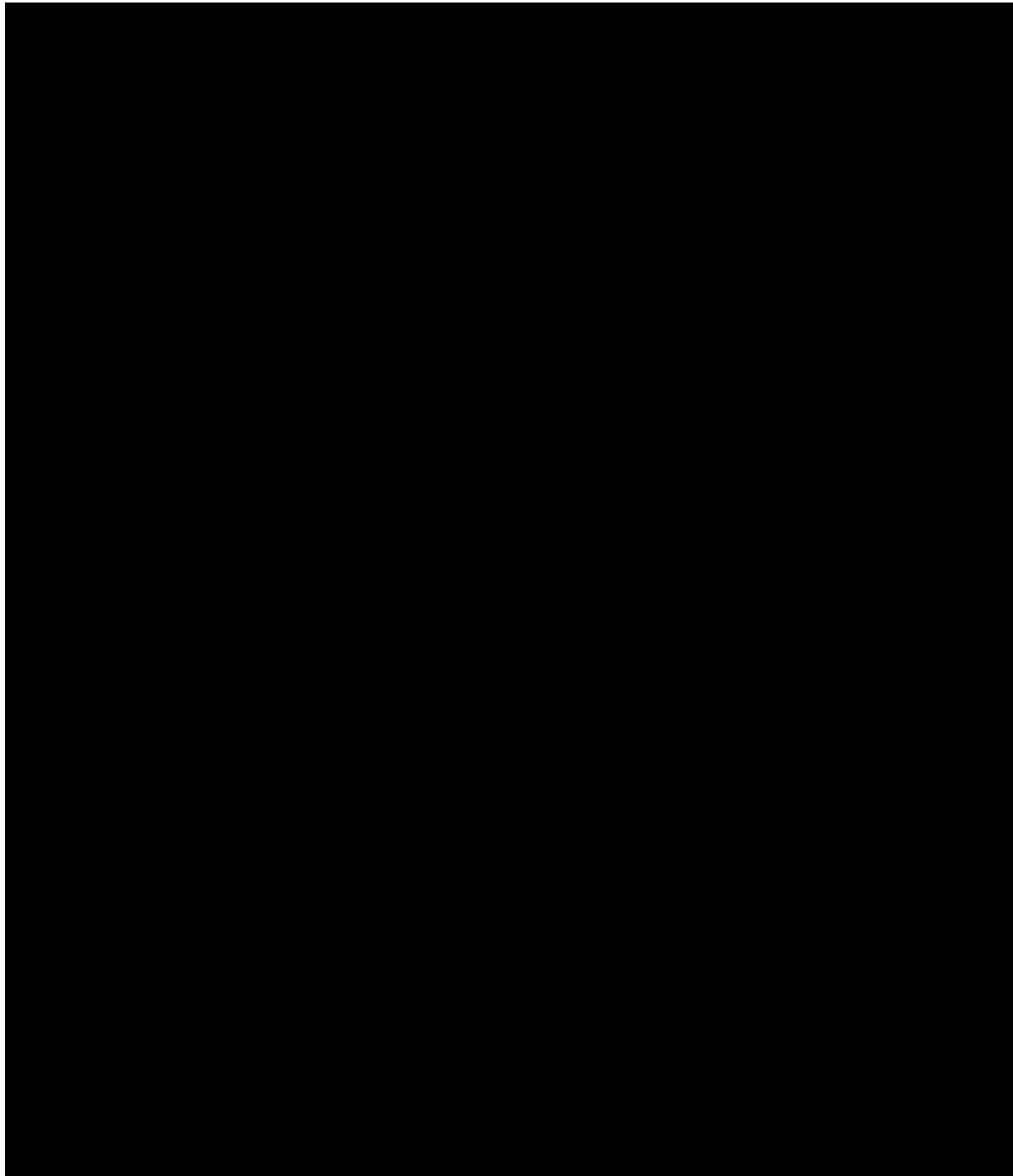


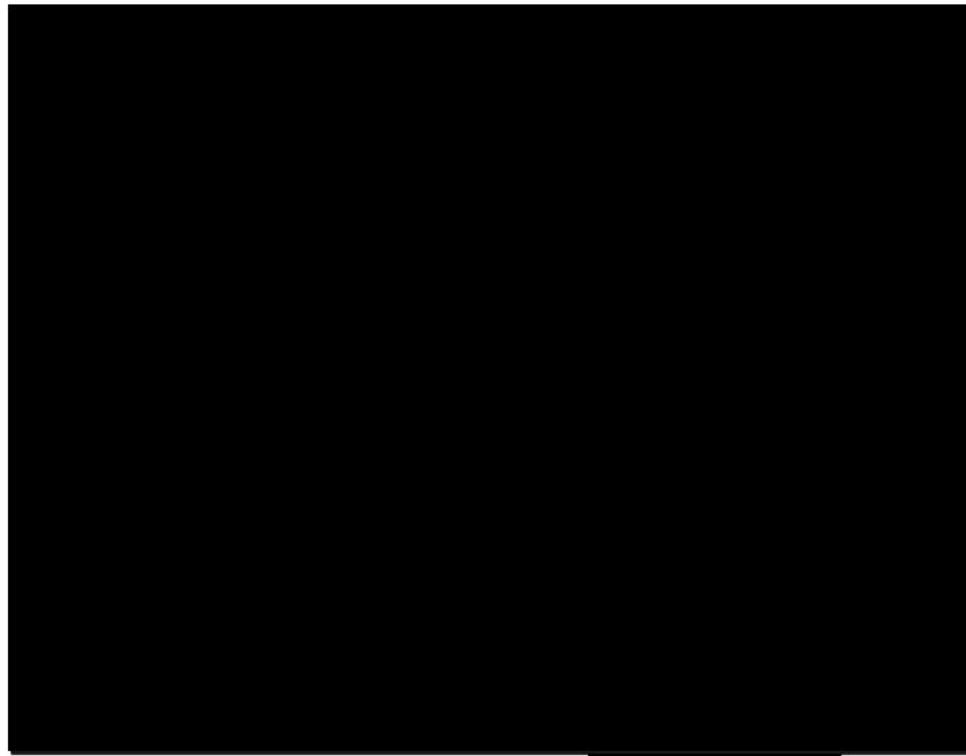
Figure CON-8—Schematic Diagram of [REDACTED]

Plan revision number: 0

Plan revision date: 07/31/23

### ***6.3 USDW monitoring wells***

Figure CON-9, CON-10, and CON-11 show well construction details for the [REDACTED]  
[REDACTED]



**Figure CON-9—Schematic Diagram of [REDACTED]**

Plan revision number: 0

Plan revision date: 07/31/23



Figure CON-10—Schematic Diagram of [REDACTED]



Figure CON-11—Schematic Diagram of [REDACTED]