SECTION 6 – INJECTION WELL PLUGGING PLAN

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[redacted]

6.1 Introduction

The plugging plan for ExxonMobil Low Carbon Solutions Onshore Storage LLC (ExxonMobil) Pecan Island Injection Well No. 001 and Injection Well No. 002 was prepared to meet the requirements of Statewide Order (SWO) 29-N-6, **§3631** [Title 40, U.S. Code of Federal Regulations (40 CFR) **§146.92**]. This section provides a general description of the steps that will be taken to plug and abandon each well in the project. For the injection wells, this plan will include the proposed stages of well development through final abandonment. The plugging and abandoning of each monitoring well is also covered in this section. Complete plugging and abandonment prognoses are included in *Appendix H*.

6.2 Injection Well Zonal Isolation and Final Plug and Abandonment

As described in *Section 4 – Engineering Design and Operating Strategy*, the injection wells will be completed in multiple intervals within the gross injection zone. Each injection interval will be used for a discrete period as identified in the plume model. Once that period has been completed, the current injection interval will be isolated to prevent crossflow conditions between the new and old injection intervals. Once an injection stage is isolated, a new injection horizon will be opened. This process will repeat until the entire gross injection interval is fully developed. After approximately [redacted] years of injection, the uppermost plug will be set, and the wells will continue to be used for monitoring purposes until the plume monitoring is no longer required. After that, the wells will be permanently plugged. The plugging and abandonment procedures for the injection wells are designed to prevent CO_2 or formation fluids in the injection interval from migrating to the Underground Sources of Drinking Water (USDW).

The following details outline the procedures for both types of plugs to be installed in the injection wells. The two types of plugs are:

- Isolation of the active injection section via recompletion operations
- Final plug and abandonment of the wellbore

6.2.1 Zonal Isolation of Injection Zone / Intermediate Plugback Plan

When the current, active injection zone has reached the end of its injection period, that zone will be isolated and abandoned. The general procedure for zonal isolation includes:

6.2.1.1 Pre-Zonal Isolation Activities

1. ExxonMobil will comply with all reporting and notification provisions.
    a. ExxonMobil will notify the Underground Injection Control (UIC) Program Director (UIC Director) 60 days before planned plugging efforts. [40 CFR ***§*146.92(c)**]
    b. Notice of Intent to Plug will be communicated to the Louisiana Department of Natural Resources (LDNR) by submitting Form UIC-17 with detailed plans. (SWO 29-N-6 **§3631.A.4**)

2. Bottomhole reservoir pressure will be measured using the externally mounted pressure-sensing array installed in the tubing casing annulus as discussed in *Section 5 – Testing and Monitoring Plan*. (SWO 29-N-6 **§3631. A.2** [40 CFR ***§*146.92(a)**])
3. External mechanical integrity will be demonstrated through approved monitoring methods described in *Section 5*. (SWO 29-N-6 **§3631.A.2** [40 CFR ***§*146.92(a)**])

Figures 6-1 and 6-2 show schematics of the first intermediate isolation plans for Pecan Island Injection Wells No. 001 and No. 002.

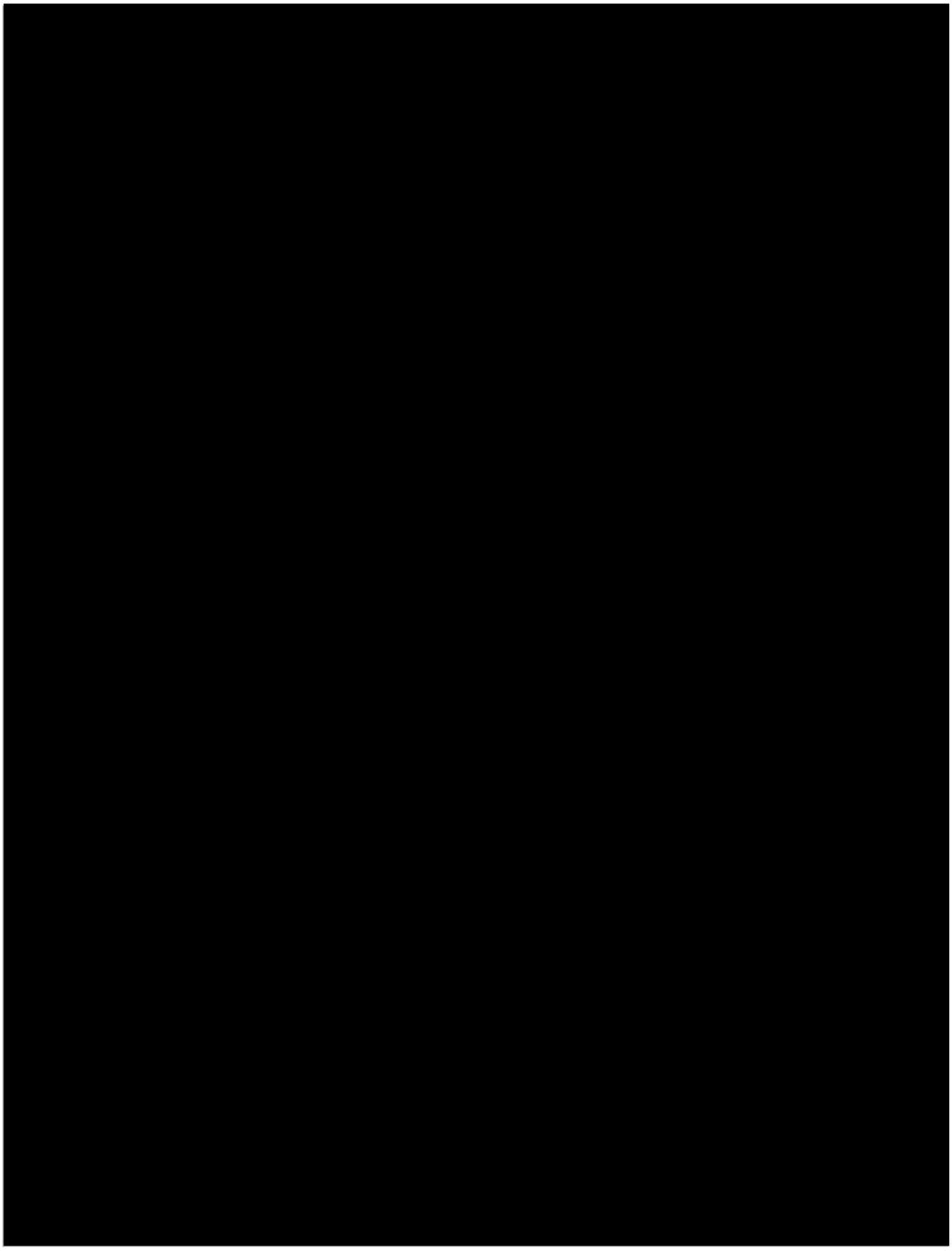

Figure 6-1 – First Plugging Schematic for Pecan Island Injection Well No. 001

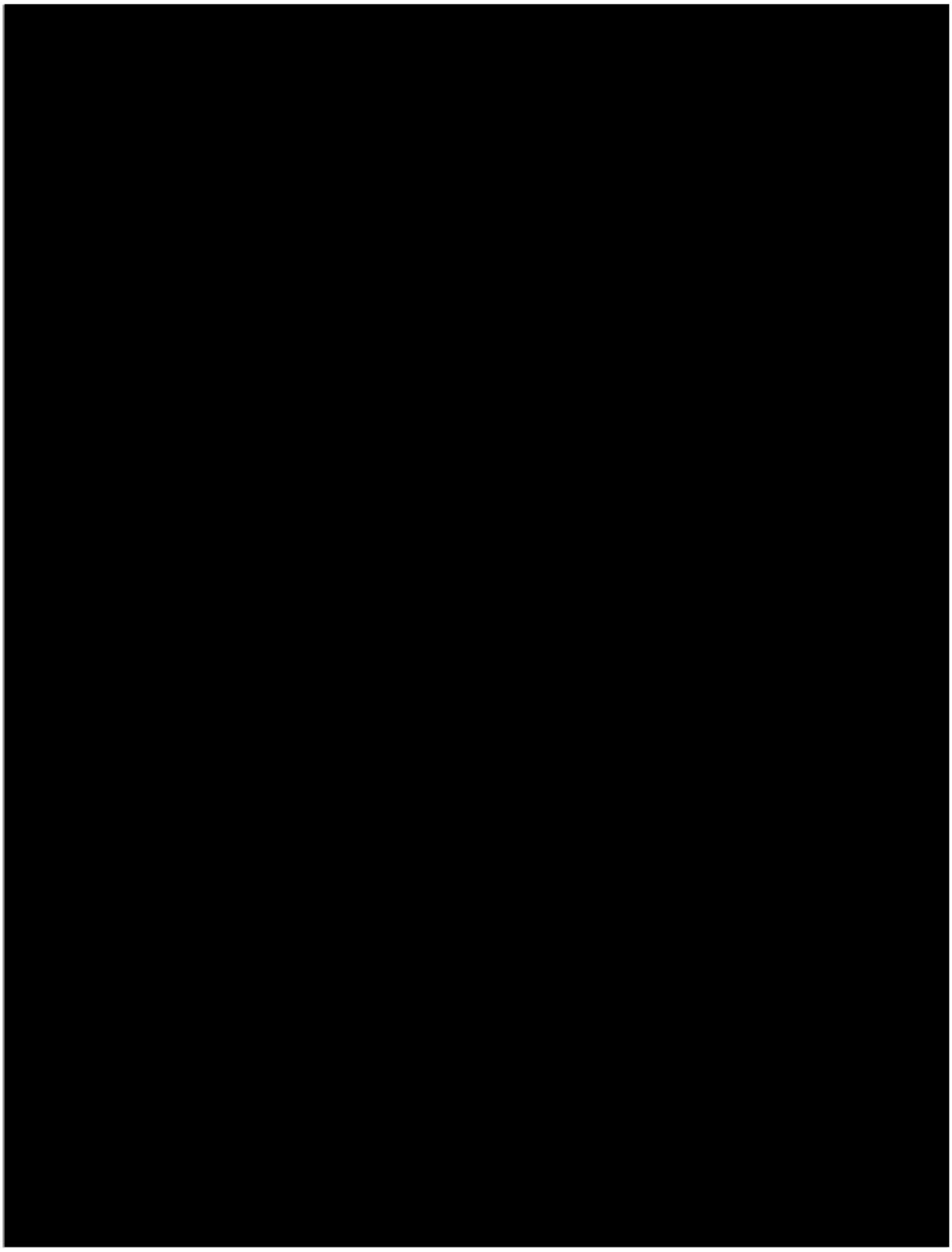

Figure 6-2 – First Plugging Schematic for Pecan Island Injection Well No. 002

6.2.1.2 Zonal Isolation Activities

1. A CO_2-compatible barrier will be set above the injection zone to be isolated.
2. The plug will be confirmed by conducting a successful pressure test.
3. To allow for pressure monitoring of the isolated zone during the life of the storage project, the perforations will not be squeezed.

The design of the wells does not require any well components to be removed during zonal-isolation operations in the permitted injection zone. All intermediate plugging operations can be conducted with wireline services to allow a more efficient and safe recompletion process.

6.2.2 Final Plug and Abandonment

After injection operations cease, and after the available pore space has been depleted, the injection wells will be prepared for final plug and abandonment (P&A). The general final P&A procedures will include:

6.2.2.1 Pre-Plugging Activities

1. ExxonMobil will comply with all reporting and notification provisions.
    a. ExxonMobil will notify the UIC Director 60 days before planned plugging efforts. [40 CFR **§146.92(c)**)]
    b. Notice of Intent to Plug will be communicated to the LDNR by submitting Form UIC-17 with detailed plans. (SWO 29-N-6 **§3631.A.4**)
2. Bottomhole reservoir pressure will be measured using the fiber optic pressure-sensing array installed in the tubing casing annulus as discussed in *Section 5 – Testing and Monitoring Plan*. (SWO 29-N-6 **§3631.A.2** [40 CFR **§146.92(a)**])
3. External mechanical integrity will be demonstrated through approved testing methods described in *Section 5*. (SWO 29-N-6 **§3631.A.2** [40 CFR **§146.92(a)**])
4. The injection well will be flushed with a buffer fluid prior to pulling the injection tubing and packer. (SWO 29-N-6 **§3631.A.2** [40 CFR **§146.92(a)**])
5. All uncemented, non-permanent components of the well will be removed, as described in Table 6-1.
6. Casing inspection and cement bond logs will be performed before plugging.

Table 6-1 – Description of Casing, Tubing, and Other Well-Construction Materials to be Removed

Well Component	Size	Well No. 001 Amount	Well No. 002 Amount	Notes / Comments
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

6.2.2.2 Plugging Procedure, Injection Well No. 001

1. Check tubing and casing pressures; verify that the lower safety valve is functional. Determine bottomhole pressure (BHP) with sensor and record all annuli pressures. [40 CFR **§146.92(a)**]
    a. Verify the annulus integrity and positive pressure on the annulus.
2. Pump kill-weight brine (buffer fluid compatible with CO_2) for a minimum of two times the wellbore volume.
3. Rig up slickline unit, run in hole with injection safety valve retrieval tool. Pull out of hole with the injection valve from [redacted]
    a. Note: The injection tool mandrel has a slight restriction, [redacted]
4. Run in hole with [redacted].
5. Move in and rig up workover unit.
6. Run in hole with jet cutter to 15 ft above the packer top. Cut [redacted]
7. Trip out of hole and lay down 5-1/2 in. tubing and cables.
8. [redacted]
    a. Evaluate cement bond behind production casing.
    b. Adjust procedure as necessary.
9. Trip in hole with workstring.
10. Pump a balanced cement plug from [redacted] from the packer across the intermediate casing shoe with CO_2-compatible cement or equivalent. [40 CFR **§146.92(b)**]
11. Wait on cement. Tag and test to confirm placement.
12. Pump balanced cement plug at the base of surface casing with 500-ft Portland cement plug from [redacted] [40 CFR **§146.92(b)**]
13. Wait on cement. Tag and test to confirm placement.
14. Pump balanced cement plug across the base of the USDW with 200-ft Portland cement plug from [redacted] [40 CFR **§146.92(b)**]
15. Wait on cement. Tag and test to confirm placement.
16. Pump surface cement plug with at least 30 ft of Portland cement. (SWO 29-B **§137(F)(3)(g)**)
17. Cut and cap casing to a minimum of 15 ft below the mud line. (SWO 29-B **§137(F)(3)(j)**)
18. Rig down and move off location.
19. Perform site closure requirements. [40 CFR **§146.93(a)**]

6.2.2.3 Plug Details, Injection Well No. 001

Tables 6-2 and 6-3 provide the plugging details for Injection Well No. 001.

Table 6-2 – Plug Details for Plugs [redacted] Injection Well No. 001

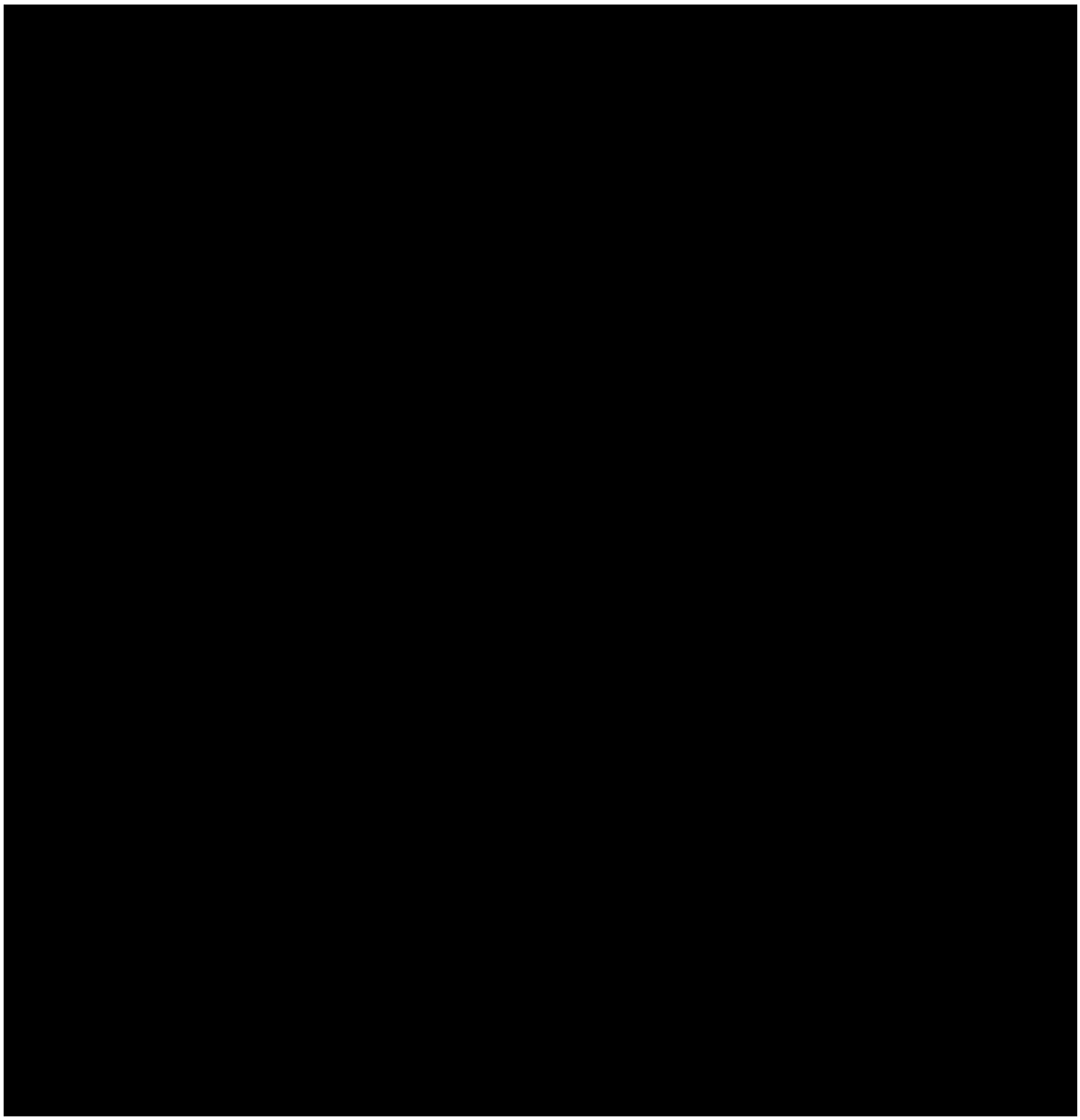

Table 6-3 – Plug Details for [redacted] Injection Well No. 001

Figure 6-3 shows the final plugged schematic for Pecan Island Injection Well No. 001.

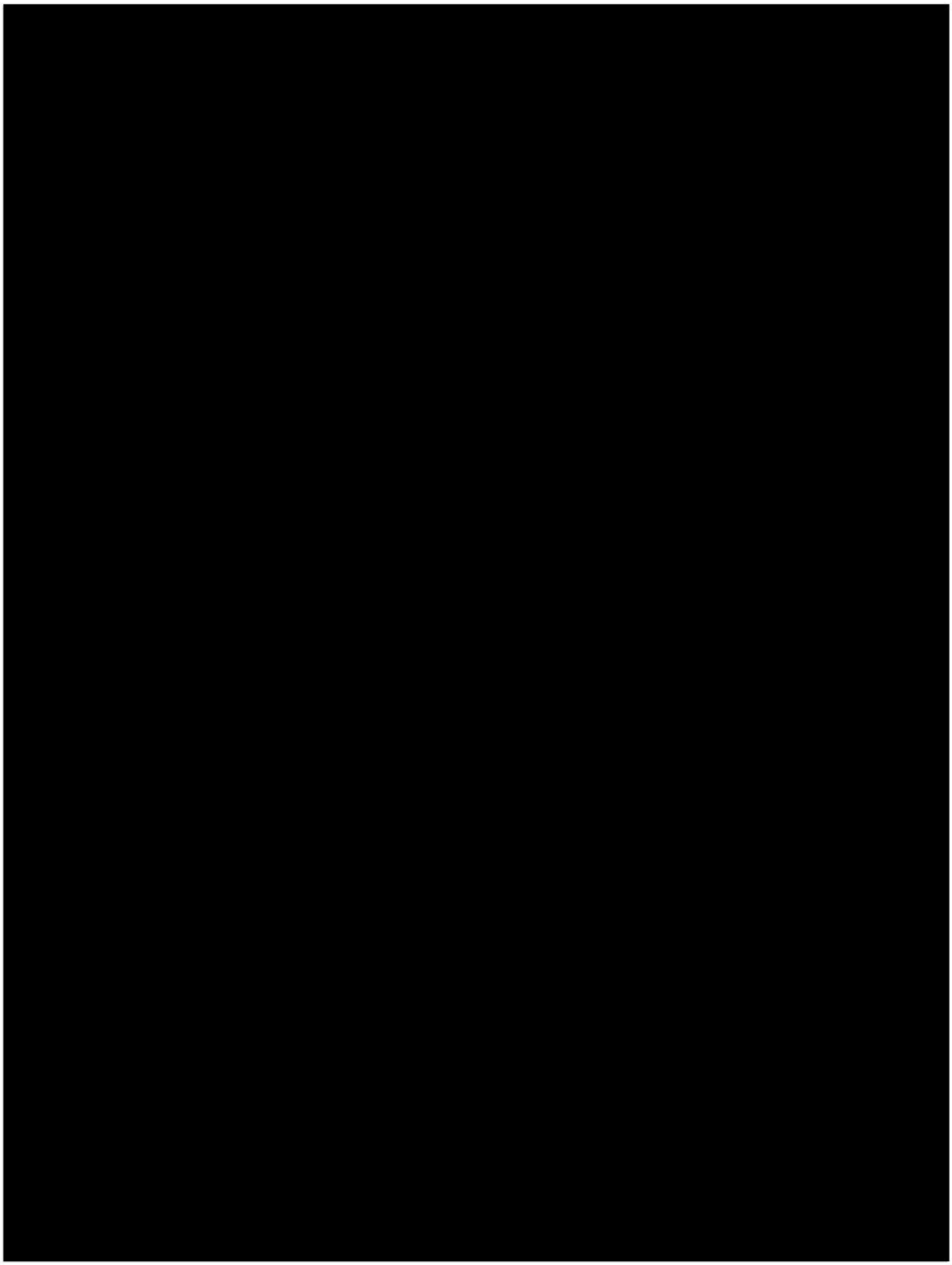

Figure 6-3 – Final Plugging Schematic for Pecan Island Injection Well No. 001

6.2.2.4 Plugging Procedure, Injection Well No. 002

1. Check tubing and casing pressures; verify that the lower safety valve is functional. Determine BHP with sensor and record all annuli pressures. [40 CFR **§146.92(a)**]
    a. Verify the annulus integrity and positive pressure on the annulus.
2. Pump kill-weight brine (buffer fluid compatible with CO_2) for a minimum of two times the wellbore volume.
3. Rig up slickline unit, run in hole with retrieval tool, or equivalent. Pull out of hole with the injection valve from [redacted].
    a. Note: The injection tool mandrel has a slight restriction, [redacted].
4. Run in hole with [redacted].
5. Move in and rig up workover unit.
6. Run in hole with jet cutter to [redacted] KB. [redacted].
7. Trip out of hole and lay down [redacted] in. tubing and cables.
8. Run cement-bond log and casing-inspection log on [redacted].
    a. Evaluate cement bond behind production casing.
    b. Adjust procedure as necessary.
9. Trip in hole with workstring.
10. Pump a balanced cement plug from [redacted] across the intermediate casing shoe with CO_2 resistant cement or equivalent (40 CFR **§146.92(b)**).
11. Wait on cement. Tag and test to confirm placement.
12. Pump balanced cement plug at the base of surface casing with 500-ft Portland cement plug from [redacted]. [40 CFR **§146.92(b)**]
13. Wait on cement. Tag and test to confirm placement.
14. Pump balanced cement plug across the base of the USDW with 200-ft Portland cement plug from [redacted] [40 CFR **§146.92(b)**]
15. Wait on cement. Tag and test to confirm placement.
16. Pump surface cement plug with at least 30 ft of Portland cement. (SWO 29-B **§137(F)(3)(g)**)
17. Cut and cap casing to a minimum of 15 ft below the mud line. (SWO 29-B **§137(F)(3)(j)**)
18. Rig down and move off location.
19. Perform site closure requirements. [40 CFR **§146.93(a)**]

6.2.2.5 Plug Details, Injection Well No. 002

Tables 6-4 and 6-5 provide the plugging details for Injection Well No. 002.

Table 6-4 – Plug Details for [redacted] Injection Well No. 002

[redacted]

Table 6-5 – Plug Details for [redacted], Injection Well No. 002

[redacted]

Figure 6-4 shows the final plugged schematic for Pecan Island Injection Well No. 002.

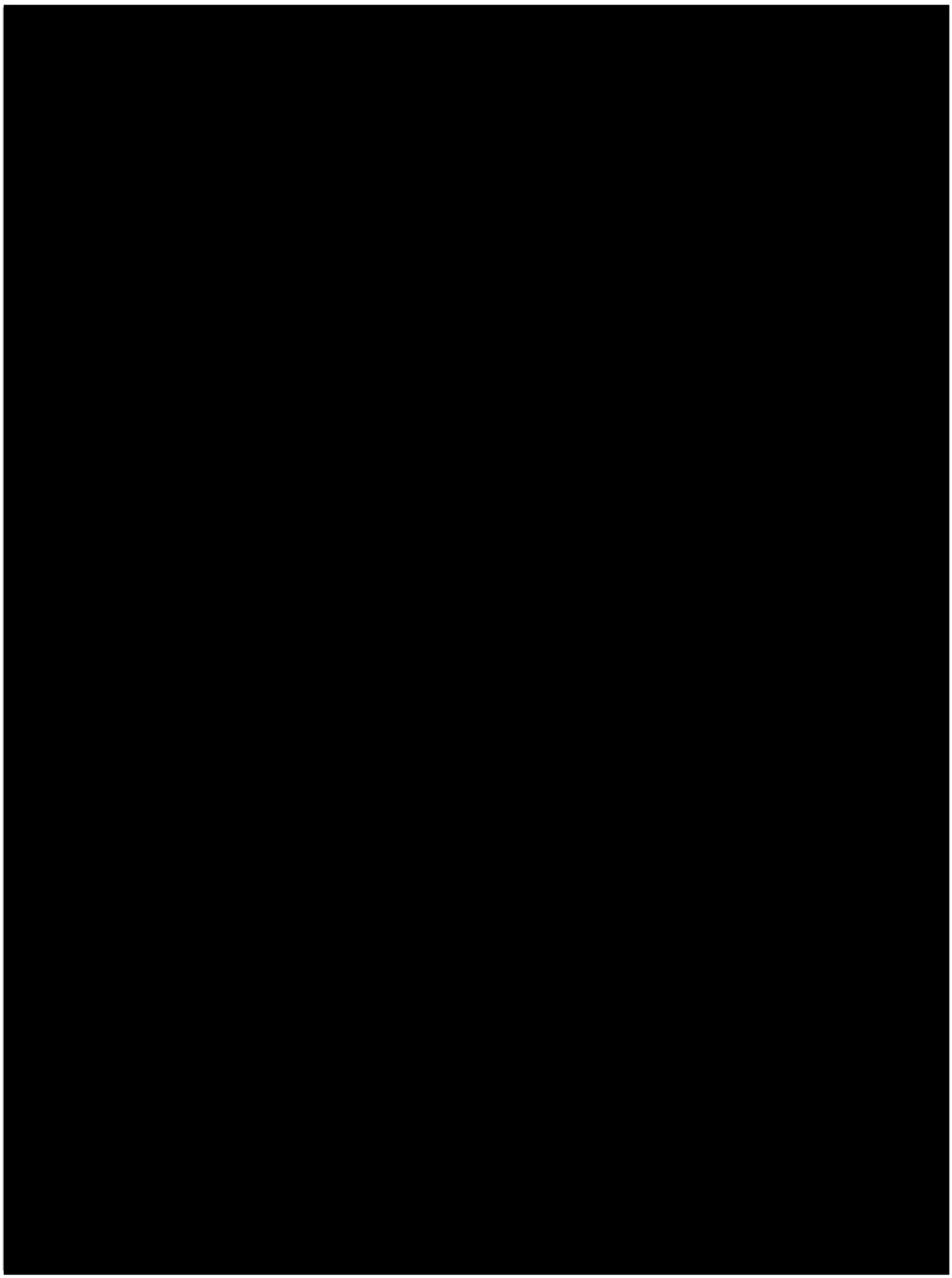

Figure 6-4 – Final Plugging Schematic for Pecan Island Injection Well No. 002

6.3 Monitoring Wells Plugging and Abandonment Plans

The following sections will outline the plan for the plugging and abandonment of the monitoring wells associated with the Pecan Island Injection Wells No. 001 and No. 002.

6.3.1 Pre-Plugging Activities for All Wells

ExxonMobil will comply with all reporting and notification provisions.

1. The UIC Director will be notified 60 days in advance of planned plugging efforts. [40 CFR ***§*146.92(c)**]
2. Notice of Intent to Plug will be communicated to the Louisiana DNR by submitting Form UIC-17 with detailed plans. [SWO 29-N-6 **§3631.A.4**]

6.3.2 USDW Monitoring Well Plugging Procedure (USDW Wells No. 1–5)

Each of the five monitoring wells will be plugged by pulling and removing the submersible pump and tubing. Portland cement will then be placed along the entire casing string through a workstring. The plugging schematics for the five wells are provided in Figures 6-5 to 6-9.

6.3.2.1 Final P&A Wellbore Schematics – USDW Monitoring Wells No. 001- 005

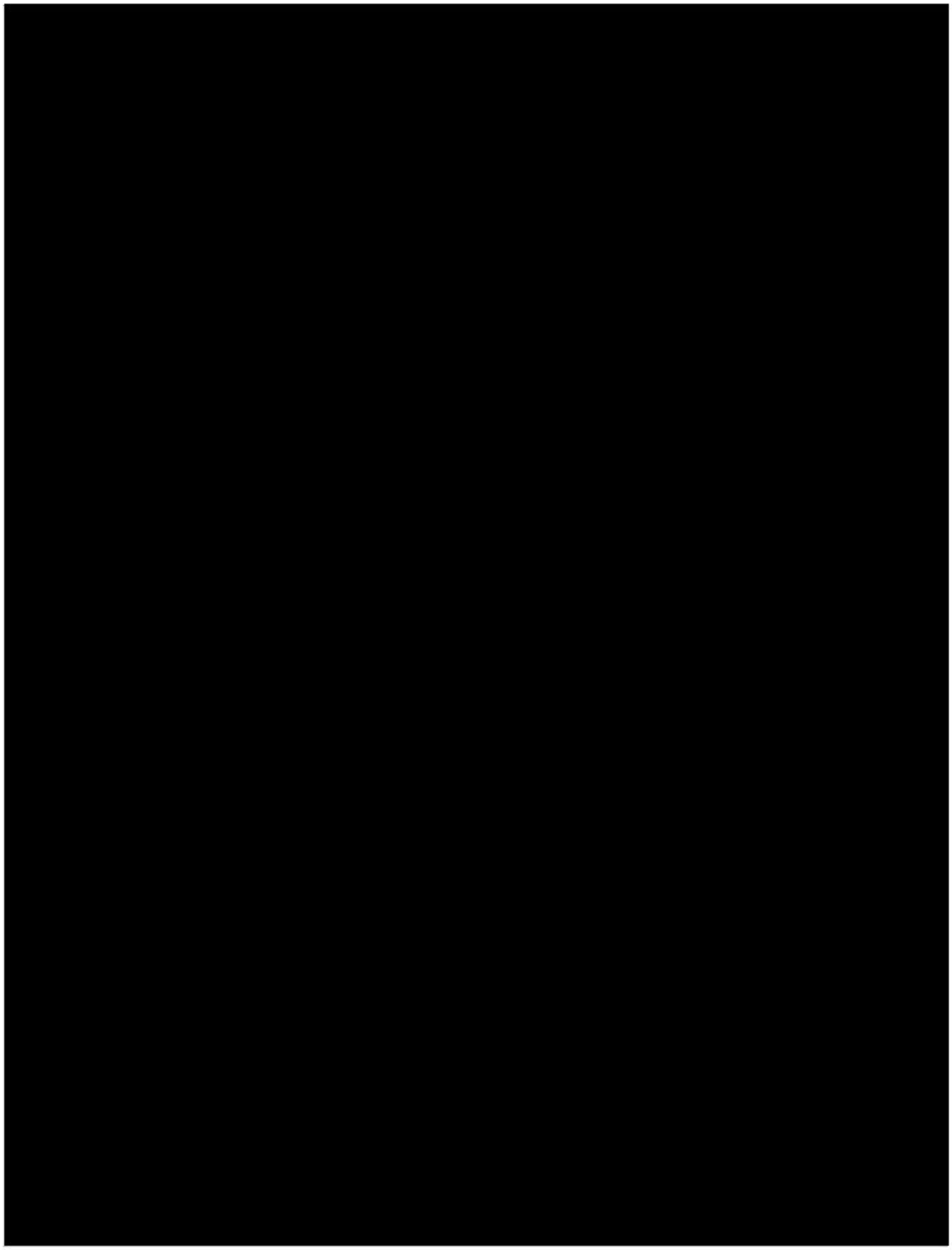

Figure 6-5 – Final Plugging Schematic for USDW Monitoring Well No. 001

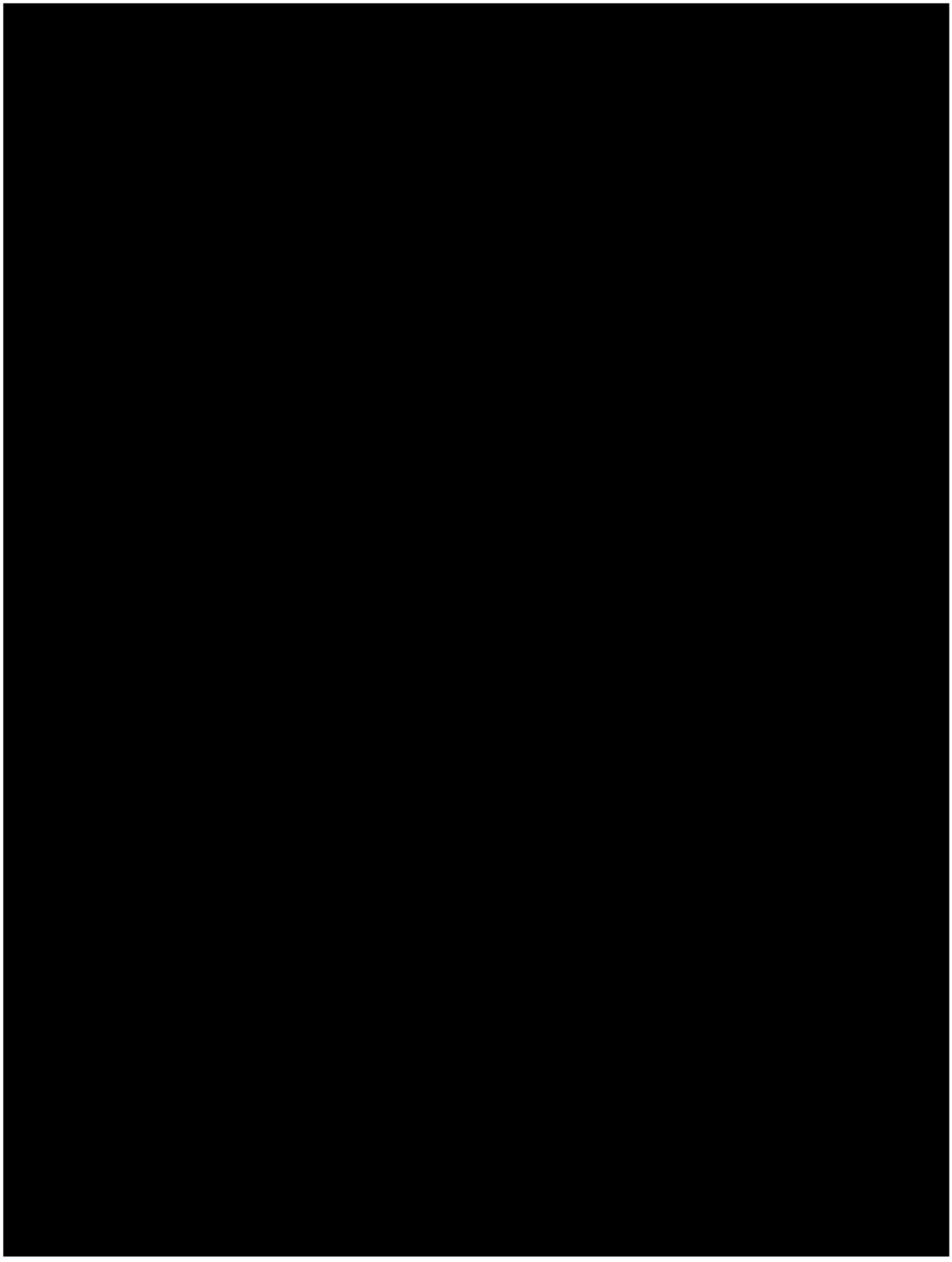

Figure 6-6 – Final Plugging Schematic for USDW Monitoring Well No. 002

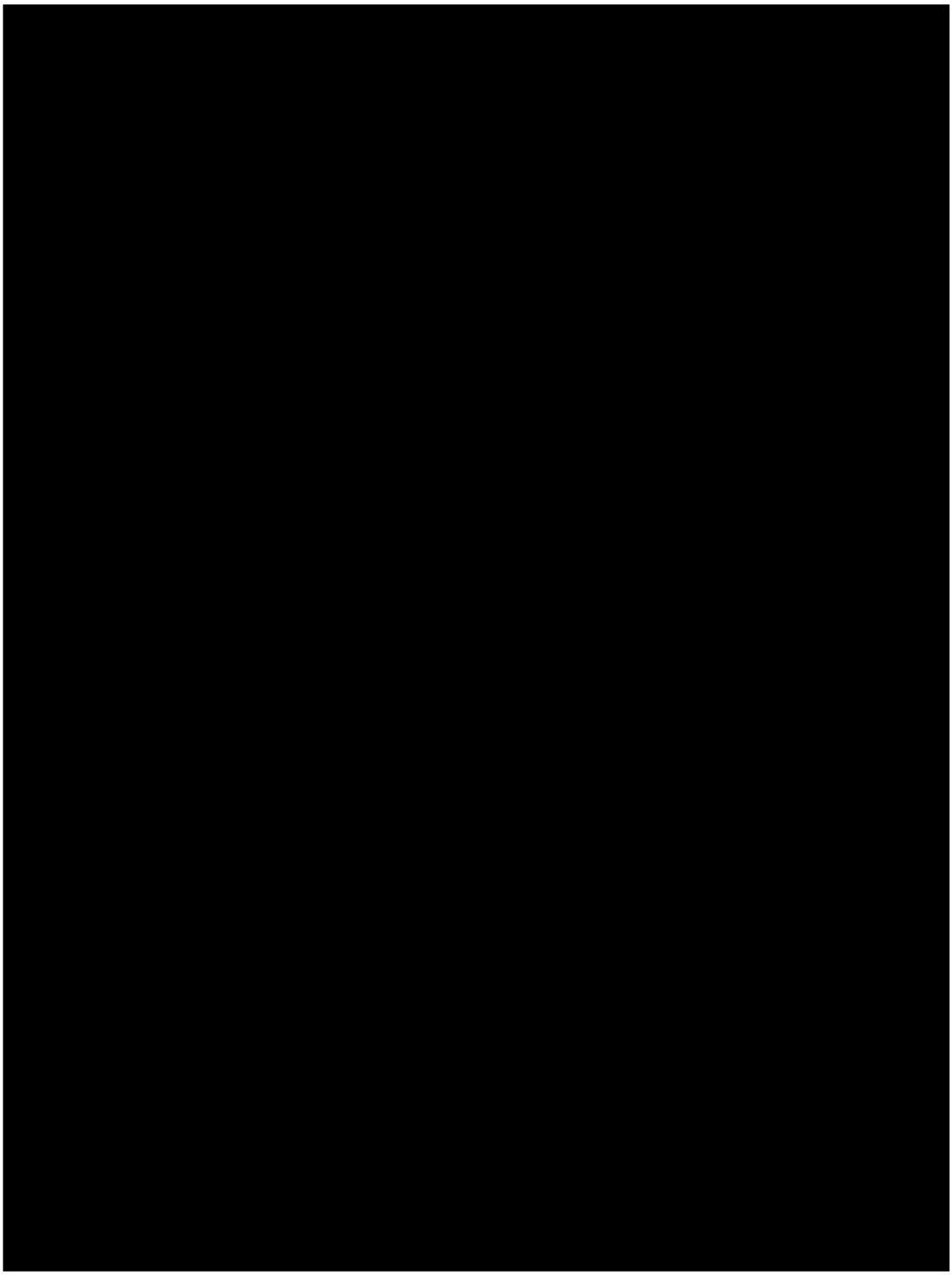

Figure 6-7 – Final Plugging Schematic for USDW Monitoring Well No. 003

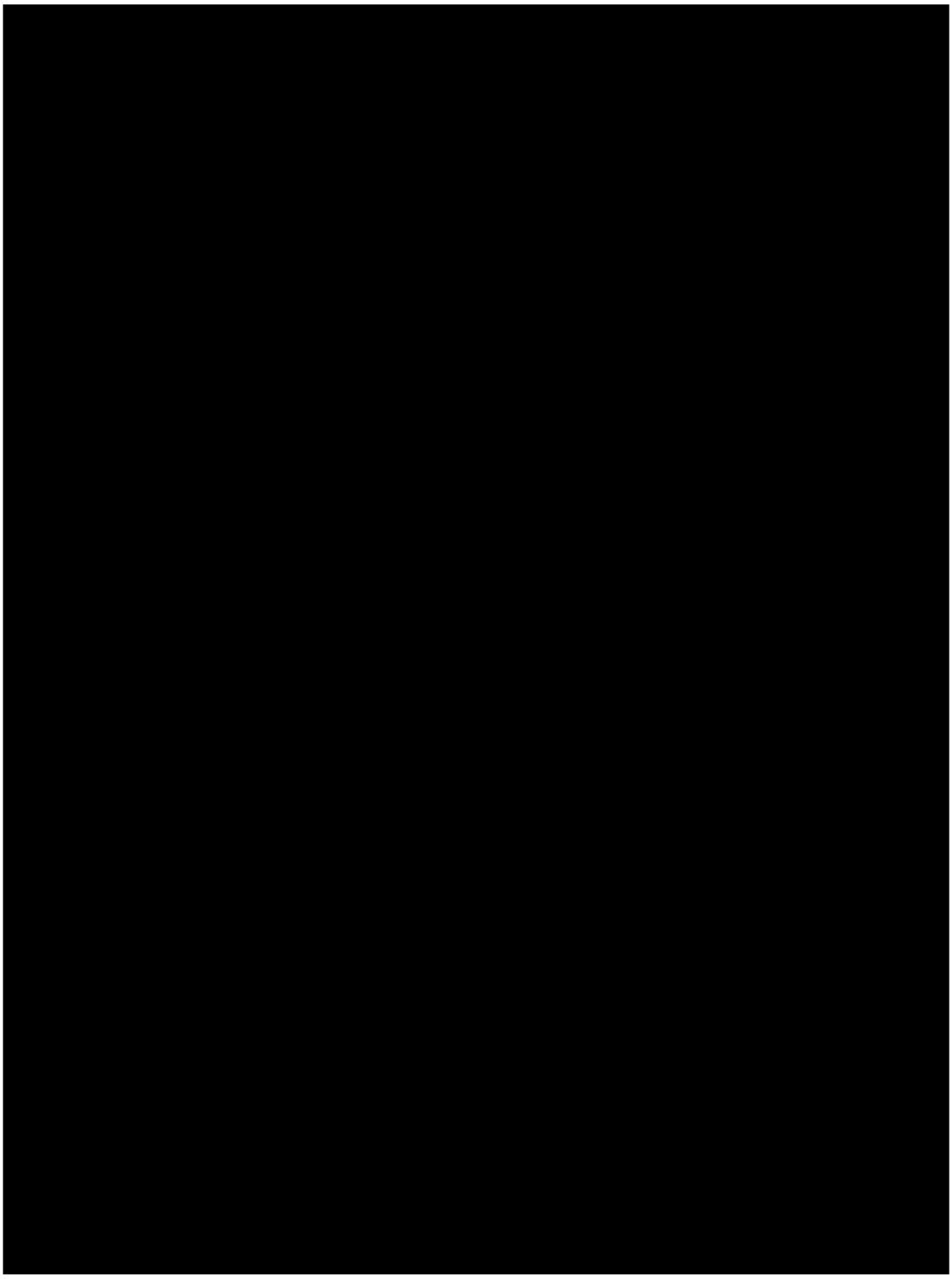

Figure 6-8 – Final Plugging Schematic for USDW Monitoring Well No. 004

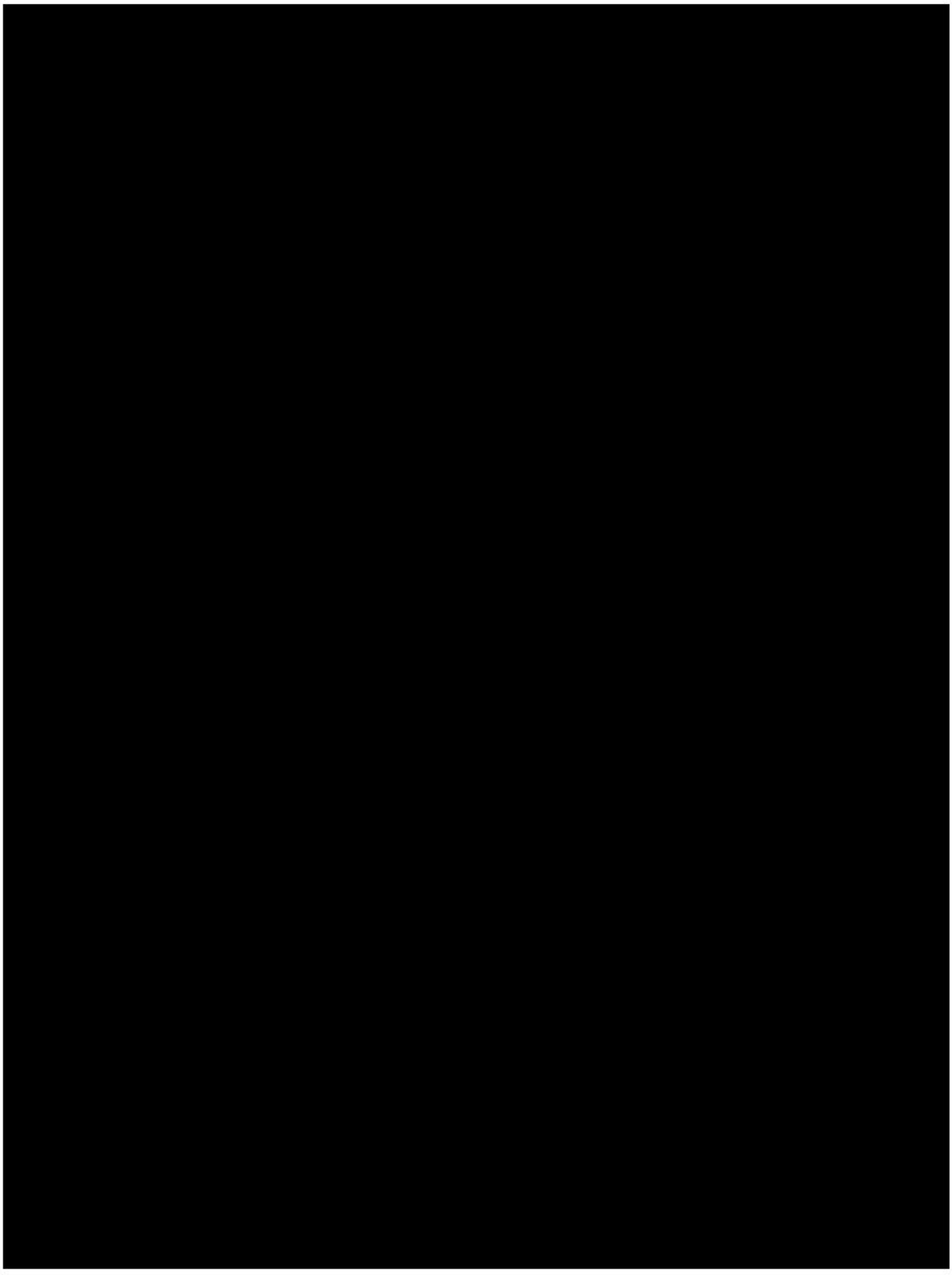

Figure 6-9 – Final Plugging Schematic for USDW Monitoring Well No. 005

6.3.3 AZMI Monitoring Well No. 001

6.3.3.1 Plugging Procedure, Above-Zone Monitoring Interval (AZMI) Monitoring Well No. 001

1. Move in and rig up workover unit.
2. Check casing and annulus pressures. Record all annuli pressures.
3. Run in hole with workstring.
4. Section-mill [redacted] across the surface casing shoe, circulate hole clean.
5. Pump viscous reactive pill to base of milled section.
6. Pump a balanced cement plug from [redacted] across the section-milled casing with Portland cement.
7. Wait on cement. Tag and test to confirm placement.
8. Section-mill [redacted], circulate hole clean.
9. Pump viscous reactive pill to base of milled section.
10. Pump a balanced cement plug from [redacted] across the section-milled casing with Portland cement.
11. Wait on cement. Tag and test to confirm placement.
12. Pump surface cement plug with at least 30 ft of Portland cement. (SWO 29-B **§137(F)(3)(g)**)
13. Cut and cap casing to a minimum of 15 ft below the mud line. (SWO 29-B **§137(F)(3)(j)**)
14. Rig down and move off location.
15. Perform site closure requirements.

Figure 6-10 shows the plugging schematic for AZMI Monitoring Well No. 001.

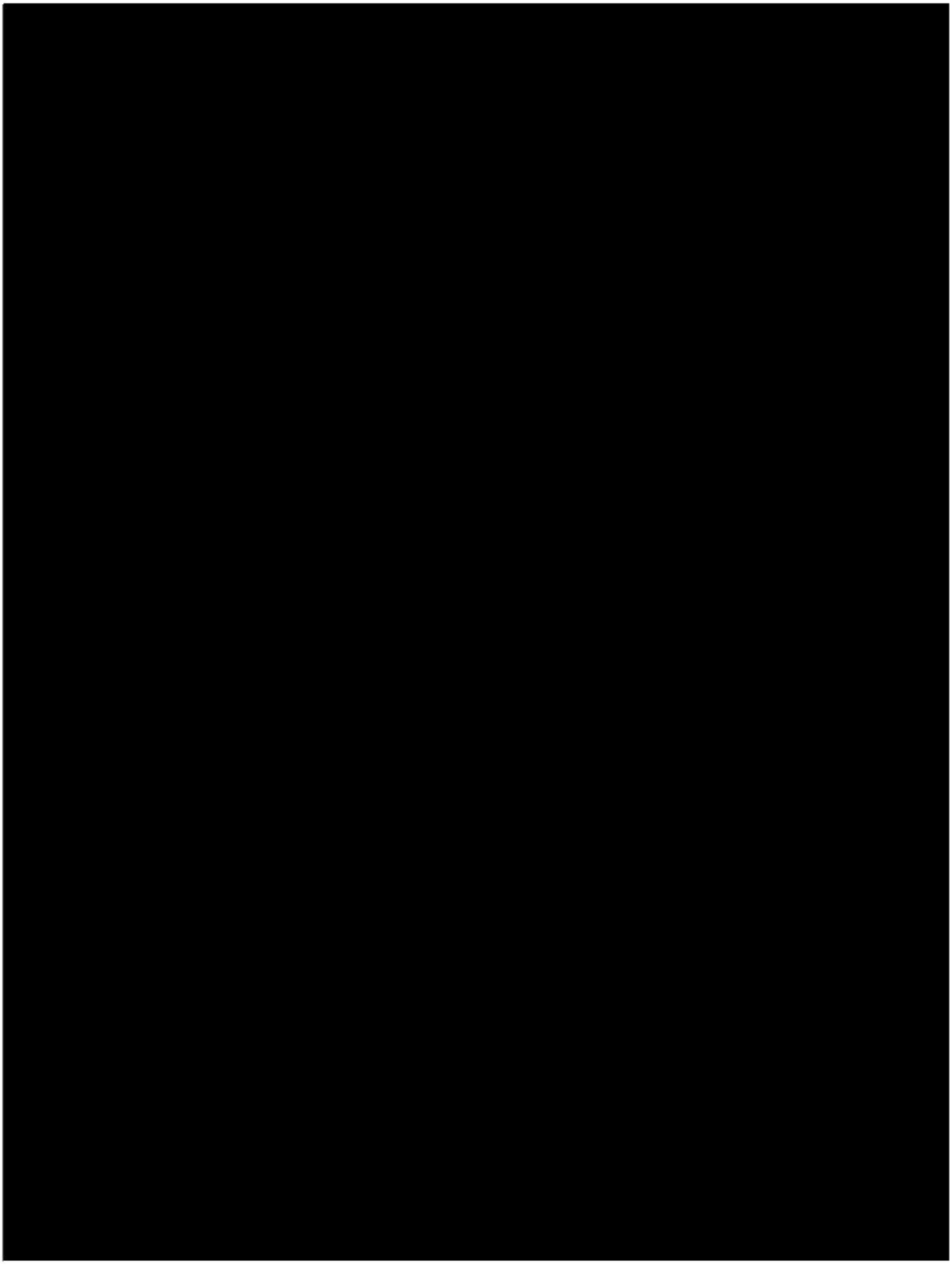

Figure 6-10 – Final Plugging Schematic for AZMI Monitoring Well No. 001

6.3.4 AZMI Monitoring Well No. 002

6.3.4.1 Plugging Procedure, AZMI Monitoring Well No. 002

1. Move in and rig up workover unit.
2. Check casing and annulus pressures. Record all annuli pressures.
3. Run in hole with workstring.
4. Section-mill [redacted] across the surface casing shoe, circulate hole clean.
5. Pump viscous reactive pill to base of milled section.
6. Pump a balanced cement plug from [redacted] across the section-milled casing with Portland cement.
7. Wait on cement. Tag and test to confirm placement.
8. Section-mill [redacted], circulate hole clean.
9. Pump viscous reactive pill to base of milled section.
10. Pump a balanced cement plug from [redacted] across the section-milled casing with Portland cement.
11. Wait on cement. Tag and test to confirm placement.
12. Pump surface cement plug with at least 30 ft of Portland cement. (SWO 29-B **§137(F)(3)(g)**)
13. Cut and cap casing to a minimum of 15 ft below the mud line. (SWO 29-B **§137(F)(3)(j)**)
14. Rig down and move off location.
15. Perform site closure requirements.

Figure 6-11 shows the plugging schematic for AZMI Monitoring Well No. 002.

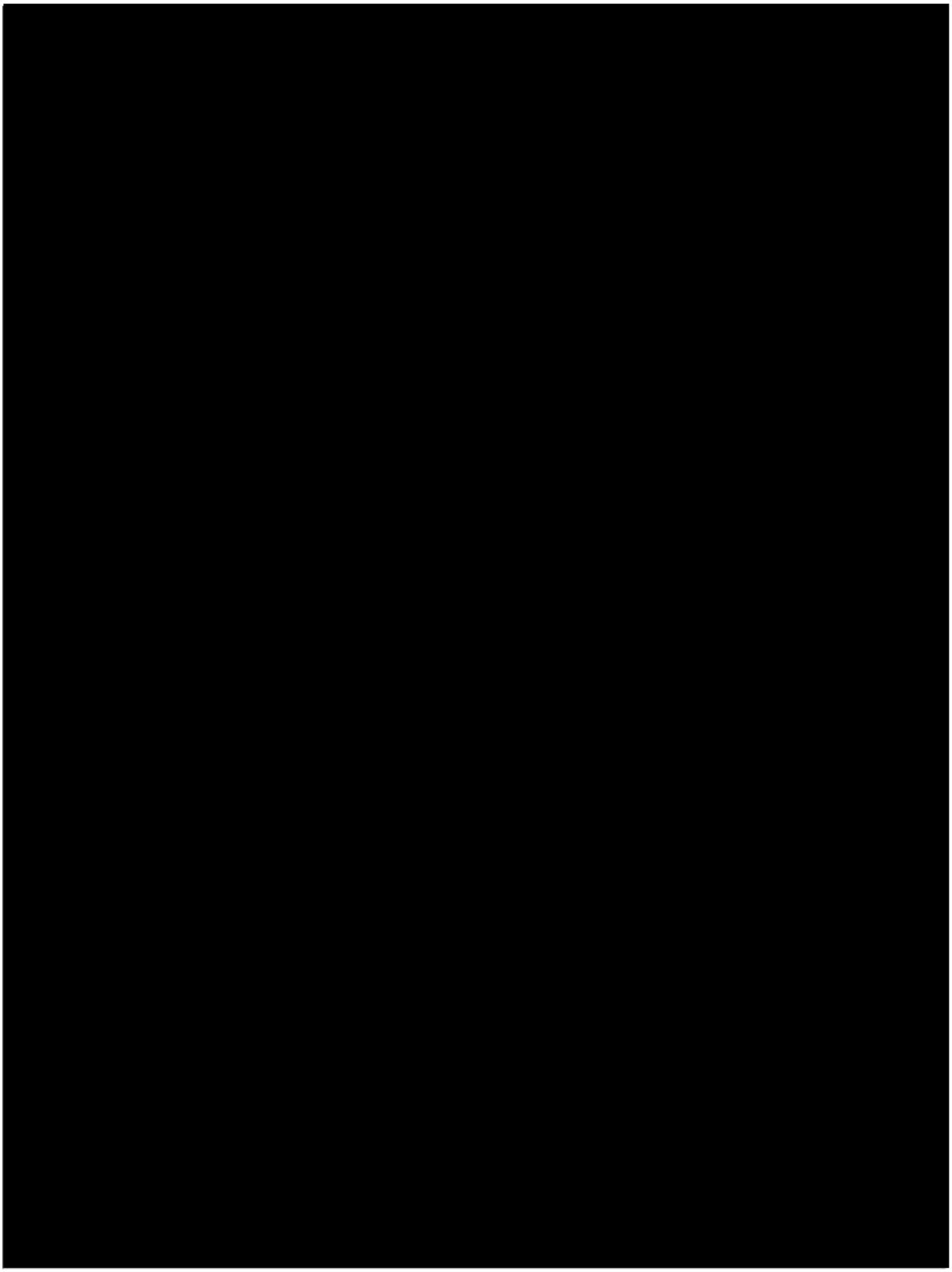

Figure 6-11 – Final Plugging Schematic for AZMI Monitoring Well No. 002

For each well in the project, final plugging reports—certified by the operator and the person who performed the plugging operation—will be submitted to the UIC Director within 60 days after plugging. Detailed plugging procedures are included in *Appendix H*.

The detailed schematics and procedures in *Appendix H* contain the following:

- Appendix H-1 Injection Wells No. 001 and No. 002 Zonal Isolation Schematics
- Appendix H-2 Injection Well No. 001 Detailed Plugging Procedure
- Appendix H-3 Injection Well No. 002 Detailed Plugging Procedure
- Appendix H-4 Injection Wells No. 001 and No. 002 Final P&A Schematic
- Appendix H-5 Above-Zone Monitoring Wells No. 001 and No. 002 – Final P&A Procedures
- Appendix H-6 Above-Zone Monitoring Wells No. 001 and No. 002 – Final P&A Schematic