San Joaquin Renewables Class VI Permit Application Post-Injection Site Care Plan

Prepared for

San Joaquin Renewables LLC
McFarland, California

Submitted to

U.S. Environmental Protection Agency Region 9
San Francisco, California

Prepared by

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POST-INJECTION SITE CARE AND SITE CLOSURE PLAN
40 CFR 146.93(a)

SAN JOAQUIN RENEWABLES

1. Facility Information

Facility name:	San Joaquin Renewables Injection Well: SJR-I1
Facility contact:	T.J. Paskach, Ph.D. 1521 West F Ave, Nevada, IA 50201 515-292-1200 x121/tpaskach@frontlinebioenergy.com
Well location:	McFarland, Kern County, California 35.688330, -119.276642

2. Introduction

This Post-Injection Site Care (PISC) and Site Closure plan describes the activities that San Joaquin Renewables (SJR) will perform to meet the requirements of 40 CFR 146.93. SJR will monitor ground water quality and track the position of the carbon dioxide plume and pressure front for the site. SJR may not cease post-injection monitoring until a demonstration of non-endangerment of USDWs has been approved by the UIC Program Director pursuant to 40 CFR 146.93(b)(3). Following approval for site closure, SJR will plug all monitoring wells, restore the site to its original condition, and submit a site closure report and associated documentation.

This plan is a component of the SJR application to the U.S. Environmental Protection Agency Region 9 (U.S. EPA) for an Underground Injection Control (UIC) Class VI permit for a planned facility located in McFarland, California. This plan is one of several separate documents submitted to the U.S. EPA Geologic Sequestration Data Tool (GSDT), and includes required information regarding planned post-injection monitoring activities and site closure. Numerical modeling used to define the areas of anticipated carbon dioxide migration and the Area of Review (AoR) are described in the Area of Review and Corrective Action Plan. Geologic analyses that underpin the conceptual model used in the AoR numerical modeling is primarily described in the Narrative permit application report.

The permit application and associated documents were prepared by a team including Daniel B. Stephens & Associates, Inc. (DBS&A), Driltek, Finsterle Geoconsulting, Keystone Diversified Energy, Inc. (KDEI), and Best Core Services.

3. Pre- and Post-Injection Pressure Differential

Pressure within the injection zone (Vedder formation) is simulated to increase during the injection phase (15 years), and decline following injection. Modeling methodologies, sensitivity analyses and detailed results are included in the AoR and Corrective Action Plan. Figure 1 displays simulated pressure at the location of the injection well. Initial pressure (prior to injection) is predicted to be approximately 259.5 bars, and increase to 265.25 bars at the end of the injection period. After the injection period pressure is predicted to rapidly decline, to 261 bars 5 years after the end of injection and 260.25 bars 15 years after the end of injection. At that point pressure decreases asymptotically, approaching the initial pre-injection pressure.

4. Predicted Position of the CO_2 Plume and Associated Pressure Front at Site Closure

Figure 2 displays the location of the separate-phase carbon dioxide plume (0.05 isoconcentration contour) 15, 40, 75 and 115 years after injection begins, corresponding to the end of injection, and 25, 60 and 100 years after the end of injection. The separate-phase carbon dioxide plume is predicted to move very slowly after the injection period, with a maximum lateral expansion of 2,300 feet from 15 to 115 years (23 feet per year). SJR is submitting a demonstration for an alternative PISC timeframe of 15 years after the end of injection (Section 6). At that point, the leading edge of the separate phase carbon dioxide plume extent is predicted to be located between the 15-Year and 40-Year contour lines on Figure 2.

The pressure front is not plotted on Figure 2 because pressure is predicted to have dissipated sufficiently 15 years after the end of injection below acceptable levels. The pressure front is defined as the threshold overpressure that can be sustained before fluid in the injection zone would flow into a USDW through a hypothetical open conduit as discussed in the AoR and Corrective Action Plan. For example, the threshold overpressure at the injection well location is plotted on Figure 1 for reference, and pressure dissipates below this level within one year after injection ends. At the injection-zone (IZ) monitoring well location, pressure is not predicted to increase above threshold levels (i.e., the pressure front is contained within the bounds of the carbon dioxide plume; see AoR and Corrective Action Plan).

5. Post-Injection Monitoring Plan

Groundwater quality and plume and pressure-front monitoring activities will continue during the PISC timeframe in a similar fashion as during the injection period, which is discussed in the Testing and Monitoring Plan.

5.1. Groundwater Quality Monitoring

Groundwater quality monitoring will be conducted above the primary confining zone (Freeman Jewett formation) and within USDWs in the vicinity. The Above-Confining Zone (ACZ) monitoring well is located on the SJR property, as shown on Figure 2. The ACZ will be fitted with a continuous pressure gauge in order to monitor increases in pressure that may indicate fluid leakage. In addition, fluid samples will be collected on an annual basis during the post-injection phase for the following per U.S. EPA (2013) protocols:

- Carbon dioxide (ASTM D513 or similar)
- Dissolved metals (EPA 200.8/200.9/7010 or similar)
- Total dissolved solids (ASTM D5907 or similar)

- Major anions (EPA 300.1 or similar)
- Major cations (EPA 6020A/6020C/700B or similar)
- pH, temperature, specific conductivity (calibrated field meter)

Samples will be collected after the well has been purged sufficiently that field parameters (e.g., pH, temperature, specific conductivity) have stabilized. Samples will be collected in bottles provided by a third-party laboratory, and will be submitted under chain-of-custody protocols to the laboratory. Quality assurance/quality control (QA/QC) samples will include one field duplicate, one equipment rinsate/blank, one matrix spike (where needed based on the analytical method) and one trip blank.

As discussed in the Testing and Monitoring Plan, several groundwater production wells located within the vicinity of the project are routinely monitored for groundwater level and water quality as a component of compliance with the California Sustainable Groundwater Management Act (SGMA). The AoR coincides with the Southern San Joaquin Municipal Utility District (SSJMUD) Management Area, which is located within the larger Kern County groundwater subbasin (GEI, 2019). Wells are owned by the City of Delano, the City of McFarland, and private parties. All supply wells in the vicinity, including those designated for monitoring, are screened within USDWs overlying the SJR project site. SSJMUD monitors each of these wells for water-quality data (GEI, 2019).

SJR will seek to enter into a memorandum of understanding (MOU) with SSJMUD to (1) gain access to water-quality data obtained from each of the monitoring wells in their network within the vicinity of the project as listed in the Testing and Monitoring Plan; and (2) if needed in order to obtain necessary water-quality parameters, obtain access to the wells for periodic direct sampling. Should any of the USDW wells be plugged by their owners, SJR will notify U.S. EPA and identify whether additional monitoring wells are needed and revise the plan if necessary.

SJR will seek to collect the following data on an annual basis during the post-injection period (lasting 15 to 50 years – see Section 6 below):

- Carbon dioxide (ASTM D513 or similar)
- Dissolved metals (EPA 200.8/200.9/7010 or similar)
- Total dissolved solids (ASTM D5907 or similar)
- Major anions (EPA 300.1 or similar)
- Major cations (EPA 6020A/6020C/700B or similar)
- pH, temperature, specific conductivity (calibrated field meter)

All data, including original laboratory reports and field notes, will be obtained from SSJMUD if possible. If SJR needs to collect samples independently, samples will be collected after the well has been purged sufficiently that field parameters (e.g., pH, temperature, specific conductivity) have stabilized. Samples will be collected in bottles provided by a third-party laboratory, and will be submitted under chain-of-custody protocols to the laboratory. Quality assurance/quality control (QA/QC) samples will include one field duplicate, one equipment rinsate/blank, one matrix spike (where needed based on the analytical method) and one trip blank.

5.2. Carbon Dioxide Plume and Pressure Front Tracking

Carbon dioxide plume and pressure-front tracking will continue during the post-injection period with similar methods as during the injection phase, which is discussed in the Testing and Monitoring Plan.

The IZ monitoring well will be installed updip of the project in order to track pressure increases in the vicinity and ensure that pressure increase is similar to model projections. Figure 2 displays the planned location of the Injection-Zone (IZ) monitoring well (35.692503, -119.242309). The IZ monitoring well will be perforated exclusively within the Vedder formation, which is approximately 6,672 ft bgs at this location. Final perforated interval will be determined based on updated stratigraphy obtained during monitoring well drilling. The IZ monitoring well will be fitted with a downhole transducer for continuous pressure measurement.

Figure 3 presents the simulated pressure changes at the IZ monitoring well location during the lifetime of the project based on the project TOUGH numerical model. Pressure measurements at the IZ well and injection well will be compared to corresponding model-simulated pressure profiles to confirm that pressure increases within the Vedder formation are not greater than simulated.

Indirect plume monitoring will include time-lapse three-dimensional surface seismic surveys covering the entire extent of the area anticipated to be subject to carbon dioxide migration. Figure 2 displays the anticipated seismic area overlaid with model simulated extent of carbon dioxide during the lifetime of the project. The anticipated area for seismic surveys is approximately six square miles. The 3D seismic survey will be conducted prior to injection (baseline), at years 2, 5 and 10 during the injection phase, and at years 15 (end of injection) and 30 (15 years after end of injection). Seismic methods will be consistent with U.S. EPA (2013) including ensuring that the exact same methodology is used in repeat surveys.

Surface-seismic results will provide an indication of if supercritical-phase carbon dioxide is present in any given location, but does not generally provide an estimate of carbon dioxide saturation. Plan-view maps of survey results will be compared to model-predicted carbon dioxide extent as shown in Figure 2. All geophysical surveys and reporting will be overseen by a California Registered Professional Geophysicist.

5.3. Schedule and Reporting

All post-injection site care monitoring results will be submitted to U.S. EPA on an annual basis, within 60 days following the anniversary date on which injection ceases. Annual reports will include the following:

- Updated electronic database of all groundwater monitoring results

- Groundwater quality data review as discussed in the Testing and Monitoring Plan
- Comparison of groundwater quality data against baseline (pre-injection) samples for any indication of increasing TDS, changing cation/anion signature, increasing carbon dioxide concentration, decreasing pH, or increasing concentration of dissolved metals
- Original groundwater monitoring laboratory reports
- Calibration records for field meters
- All records from pressure-monitoring, including raw pressure transducer data and plots of pressure over time
- Comparison of model-simulated pressure decline at the IZ-monitoring well location and measured data
- Detailed independent report by the geophysical contractor of all seismic survey methods, map(s) showing all survey equipment positions, date/time of all survey data collection, near surface conditions during the test, raw seismic data and interpreted diagrams, maps showing the location of the carbon dioxide plume, and maps comparing the carbon dioxide plume progression over time to model simulated projections

6. Alternative Post-Injection Site Care Timeframe

An alternative PISC timeframe of 15 years (as compared to the default of 50 years) is appropriate based on the results of the detailed geologic analyses and numerical plume and pressure-front modeling presented in the narrative permit application report and AoR and Corrective Action Plan. In addition to the factors discussed below, a shorter PISC timeframe is supported because the SJR project plans to inject for only 15 years. This demonstration is based on the following sections.

In addition, injection well and monitoring well construction are discussed in the Attachment A Narrative Report and Attachment C Testing and Monitoring Plan, respectively, and wells will be constructed (and plugged for the case of the injection well) in order to maintain integrity and prevent fluid leakage.

6.1. Computational Modeling Results

AoR delineation modeling, including methods, results, and sensitivity analyses, are presented in the AoR and Corrective Action Plan. These results are used for discussion of plume and pressure front migration below.

6.2. Predicted Timeframe for Pressure Decline

Figure 1 displays simulated pressure at the location of the injection well. Initial pressure (prior to injection) is predicted to be approximately 259.5 bars, and increase to 265.25 bars at the end of the injection period. After the injection period pressure is predicted to rapidly decline, to 261 bars 5 years after the end of injection and 260.25 bars 15 years after the end of injection. At that point pressure decreases asymptotically, approaching the initial pre-injection pressure. The threshold overpressure at the injection well location is plotted on Figure 1 for reference, and pressure dissipates below this level within one year after injection ends.

6.3. Predicted Rate of Plume Migration

Figure 2 displays the location of the separate-phase carbon dioxide plume 15, 40, 75 and 115 years after injection begins, corresponding to the end of injection, and 25, 60 and 100 years after the end of injection. The separate-phase carbon dioxide plume is predicted to move very slowly after the injection period, with a maximum lateral expansion of 2,300 feet from 15 to 115 years (23 feet per year). From 15 to 40 years the rate of movement is less than 51 feet per year. At no time during the lifetime of the project or afterwards is the separate-phase carbon dioxide plume predicted to reach sensitive receptors including abandoned wells. U.S. EPA (2016) guidance states that when the plume is migrating at a negligible rate as compared to the location of sensitive receptors the plume migration rate may be considered sufficiently minor as to not pose an endangerment to USDWs. The rate of movement predicted for the SJR project and lack of interface with sensitive receptors supports a PISC timeframe of 15 years.

6.4. Site-Specific Trapping Processes

At the SJR site, we predict that trapping occurs primarily by capillary trapping and carbon dioxide dissolution in the brine. Equilibrium geochemical modeling presented in the narrative permit application report indicates minor carbon dioxide mineralization. The AoR and Corrective Action Plan includes a detailed discussion of simulated carbon dioxide fate after injection. Most of the carbon dioxide is trapped as separate-phase carbon dioxide (“capillary trapping”), consistent with scientific understanding of key storage processes in saline reservoirs (e.g., Krevor et al., 2015).

A total of 6.57 million metric tons of carbon dioxide are emplaced during the 15-year injection period. At the end of the injection period, 5.23 million tons are present in the free supercritical carbon dioxide (scCO2) phase, whereas 1.34 million tons are dissolved in the brine. After injection ceases, the scCO2 plume redistributes itself and continues to dissolve into the aqueous phase. At the end of the 100-year post-injection period, about 64 percent (4.24 million tons) of the injected CO2 is stored in the Vedder pore space as a supercritical phase, whereas the remaining 36 percent (2.33 million tons) are dissolved in the aqueous phase. The increased dissolution percentage leads to a slight reduction in the total gas volume even though the plume has moved upward, where it encounters lower pore pressures and thus slightly expands. The final plume has a gas volume of 6.27 million cubic meters with an average scCO2 density of 804 kg/m^3.

6.5. Confining Zone Characterization

The narrative permit application report includes a detailed evaluation of the Freeman Jewett formation (a Miocene shale and mudstone) which is the confining zone for the project. The Freeman Jewett is approximately 625 feet thick at the injection site. Based on core laboratory analyses the Freeman Jewett formation horizontal permeability is calculated to be 0.26 mD, and vertical permeability is 0.0036 mD. Geochemical modeling indicates that the Freeman-Jewett will not be significantly reactive with carbon dioxide. There are no transmissive faults through the Freeman Jewett at the Site.

6.6. Assessment of Fluid Movement Potential

There are no wells within the AoR that penetrate the Freeman Jewett formation, as discussed in the AoR and Corrective Action Plan.

6.7. Location of USDWs

Delineation of the depth to the top of the injection zone and the depth of the lowermost USDW are discussed in the narrative permit application report. Figure 4 presents the calculated distance between the top of the injection zone and lowermost USDW within the AoR. Distance between the injection zone and the lowermost USDW ranges from 1,774 to 6,907 feet. At the injection-well location the distance is 5,284 feet. This analysis demonstrates that there is significant thickness that exists between the injection zone and lowermost USDW, which as described in the Narrative permit application report consists of several fine-grained geologic units. Along with the other analyses described above, the significant thickness between the injection zone and lowermost USDW is another assurance of the limited risk to USDWs and supports a shorter PISC timeframe.

7. Non-Endangerment Demonstration Criteria

Prior to approval of the end of the post-injection phase, SJR will submit a demonstration of non-endangerment of USDWs to the UIC Program Director, per 40 CFR 146.93(b)(2) and (3).

The owner or operator will issue a report to the UIC Program Director. This report will make a demonstration of USDW non-endangerment based on the evaluation of the site monitoring data used in conjunction with the project's computational model. The report will detail how the non-endangerment demonstration evaluation uses site-specific conditions to confirm and demonstrate non-endangerment. The report will include all relevant monitoring data and interpretations upon which the non-endangerment demonstration is based, model documentation and all supporting data, and any other information necessary for the UIC Program Director to review the analysis. The report will include the following sections:

- Introduction and Overview: A summary of relevant background information will be provided, including the operational history of the injection project, the date of the non-endangerment demonstration relative to the post-injection period outlined in this PISC and Site Closure Plan, and a general overview of how monitoring and modeling results will be used together to support a demonstration of USDW non-endangerment.

- Summary of Existing Monitoring Data: A summary of all previous monitoring data collected at the site, pursuant to the Testing and Monitoring Plan of this permit and this PISC and Site Closure Plan, including data collected during the injection and post-injection phases of the project, will be submitted to help demonstrate non-endangerment. Data submittals will be in a format acceptable to the UIC Program Director [40 CFR

146.91(e)], and will include a narrative explanation of monitoring activities, including the dates of all monitoring events, changes to the monitoring program over time, and an explanation of all monitoring infrastructure that has existed at the site. Data will be compared with baseline data collected during site characterization [40 CFR 146.82(a)(6) and 146.87(d)(3)]. Data summary will include water quality monitoring, seismic survey results, and downhole pressure data.

- AoR evaluation: Model results, calibrated to all available actual field data (including pressure data, groundwater quality data, and surface seismic results), will be provided in order to support the AoR delineation as revised during PISC. The same delineation model that supported the initial AoR delineation will be used in AoR reevaluations and to make the non-endangerment demonstration.

- Status of potential conduits for fluid movement: All abandoned wells requiring corrective action will be addressed prior to PISC and Site closure. The non-endangerment demonstration will provide all relevant information on abandoned well identification, assessment, and plugging where necessary.

- Evaluation of Reservoir Pressure. Demonstration of pressure decline to levels below those required to mobilize fluids into a USDW will be made based on injection-zone pressure monitoring data, collected as described above. This demonstration will also be supported by the most recent (calibrated) numerical model to support pressure decline demonstrations throughout the AoR.

- Evaluation of Carbon Dioxide Plume. Monitoring data (e.g., surface seismic) and the most recent (calibrated) numerical model will be used to demonstrate that any supercritical plume movement at the time of Site Closure is negligible (e.g., less than 100 feet per year) and poses no danger of intercepting potential conduits for fluid movement. Modeling results will also be used to assess the location of dissolved-phase carbon dioxide, and monitoring results from USDWs and above the confining zone will be used to demonstrate the lack of carbon dioxide leakage over the project lifetime.

- Evaluation of Emergencies. The Emergency and Remedial Response (ERR) Plan includes a list of potential emergencies that may occur. The non-endangerment demonstration will provide a review of any emergencies that did or did not occur as compared to the ERR Plan, and demonstration that any related issues if emergencies did occur have been resolved such that they will no longer endanger USDWs.

8. Site Closure Plan

SJR will conduct site closure activities to meet the requirements of 40 CFR 146.93(e) as described below. SJR will submit a final Site Closure Plan and notify the permitting agency at least 120 days prior of its intent to close the site. Once the permitting agency has approved closure of the site, SJR will plug the monitoring wells and submit a site closure report to EPA. The activities, as described below, represent the planned activities based on information provided to EPA. The actual site closure plan may employ different methods and procedures. A final Site

Closure Plan will be submitted to the UIC Program Director for approval with the notification of the intent to close the site.

8.1. Plugging Monitoring Wells

In practice, the most significant site closure activity will include monitoring well plugging. The recommended plugging and abandonment (P&A) operations described below will squeeze cement into the perforations through a cement retainer. A coiled tubing unit (CTU) will be used to place cement at intervals from plugged back total depth (PBTD) to surface to conform with applicable U.S. EPA standards for a Class VI well. Monitoring well plugging schematics are included in Appendix A.

An annular pressure test to verify external casing integrity will be done prior to plugging. Plugging procedures will include the following:

Objective: Kill well, remove completion equipment, squeeze perforations with cement.

Summary Procedure, ACZ Monitoring Well:

1. Move in and rig up (MIRU) equipment on location including blowout prevention equipment (BOPE).
2. Tag well to confirm PBTD (~7,700 feet).
3. Kill well as necessary with brine of appropriate density to prevent flowback.
4. Pull any completion equipment.
5. Circulate well with kill fluid.
6. Rig up (RU) cementers and coil tubing.
7. RIH to PBTD.
8. Place continuous cement plug from clean out depth to surface.
9. Verify cement and top off as necessary.
10. Rig down CTU and cementers.
11. Nipple down (ND) BOPE. Rig down move out (RDMO).
12. Dig out cellar, cut casing 7.5 feet below ground level (GL) and flush with outer casings. Top off any annuli not filled with cement to surface
13. Weld steel plate on top of casing marked with well API and injection permit number.
14. Reclaim surface to matching surrounding land.

Summary Procedure, IZ Monitoring Well

1. Move in and rig up (MIRU) equipment on location including blowout prevention equipment (BOPE).
2. Run wireline survey to measure bottomhole pressure and confirm PBTD (~7,200').
3. Kill well with brine of appropriate density to prevent flowback.
4. Pull any completion tubing and packers.
5. Circulate well with buffered kill brine flush.
6. Rig up (RU) cementers and coil tubing.
7. RIH to PBTD
8. Place continuous cement plug from clean out depth to 100' above USDW (~2,520 feet).
9. Tag cement and place continuous cement plug from tag to surface.
10. Rig down CTU and cementers.
11. Nipple down (ND) BOPE. Rig down move out (RDMO).
12. Dig out cellar, cut casing 7.5 feet below ground level (GL) and flush with outer casings.
13. Top of any annuli not filled with cement to surface
14. Weld steel plate on top of casing marked with well API and injection permit number.
15. Reclaim surface to matching surrounding land.

8.2. Site Closure Report

A site closure report will be prepared and submitted within 90 days following site closure, documenting the following:

- Plugging of the verification and geophysical wells (and the injection well if it has not previously been plugged),
- Location of sealed injection well on a plat of survey that has been submitted to the local zoning authority,
- Notifications to state and local authorities as required at 40 CFR 146.93(f)(2),
- Records regarding the nature, composition, and volume of the injected CO_2, and
- Post-injection monitoring records.

SJR will record a notation to the property's deed on which the injection well was located that will indicate the following:

- That the property was used for carbon dioxide sequestration,
- The name of the local agency to which a plat of survey with injection well location was submitted,
- The volume of fluid injected,
- The formation into which the fluid was injected, and
- The period over which the injection occurred.

The site closure report will be submitted to the permitting agency and maintained by the owner or operator for a period of 10 years following site closure. Additionally, the owner or operator will maintain the records collected during the post-injection period for a period of 10 years after which these records will be delivered to the UIC Program Director.

References

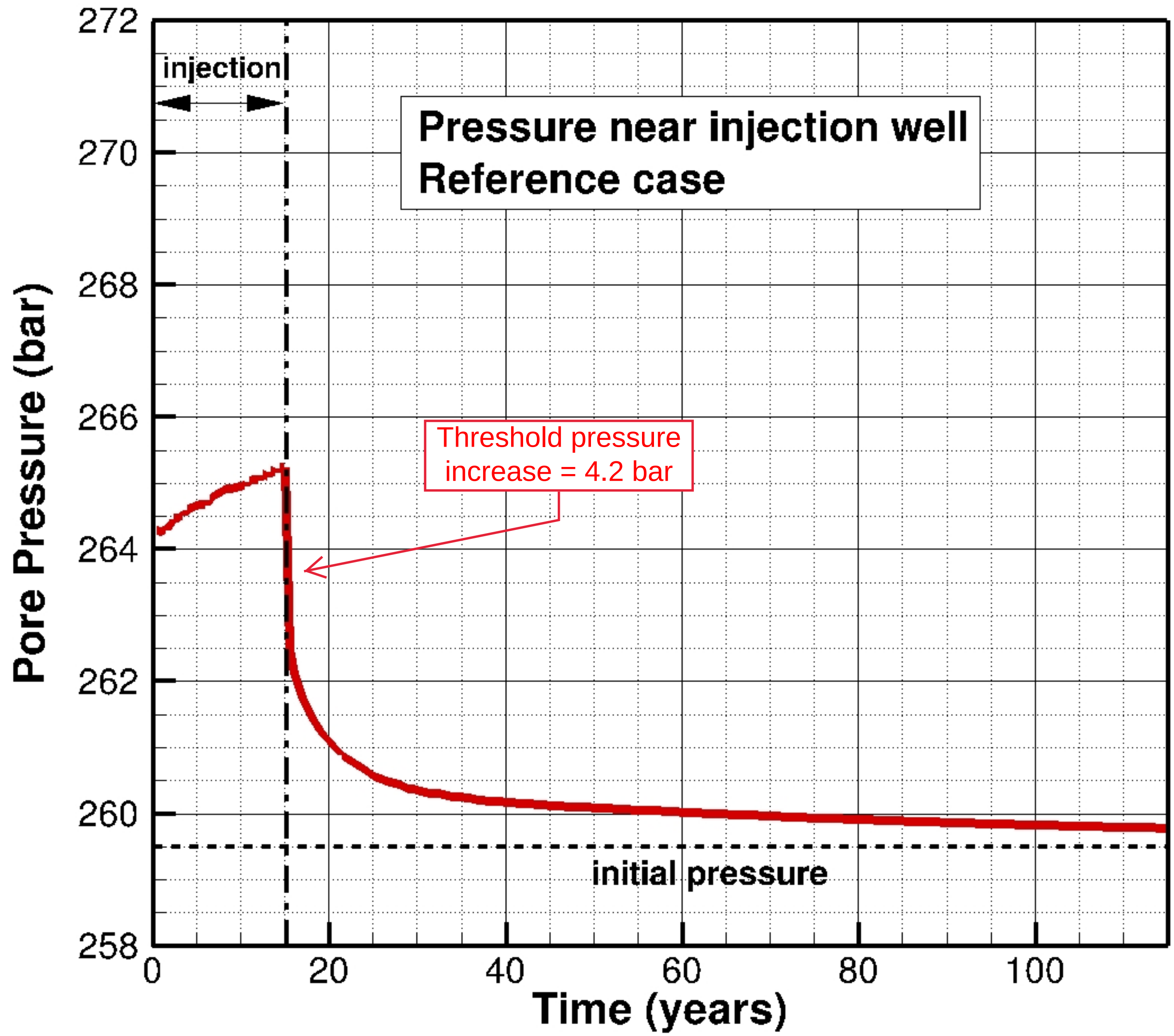
GEI Consultants (GEI), 2019. Southern San Joaquin Municipal Utility District Management Area Plan. Submitted to Southern San Joaquin Municipal. December 2019.

Krevor S., Martin J. Blunt, Sally M. Benson, Christopher H. Pentland, Catriona Reynolds, Ali Al-Menhali, Ben Niu, Capillary trapping for geologic carbon dioxide storage – From pore scale physics to field scale implications, International Journal of Greenhouse Gas Control, v40, 2015, Pages 221-237.

United States Environmental Protection Agency (U.S. EPA), 2013. Underground Injection Control (UIC) Program Class VI Well Testing and Monitoring Guidance. Office of Water (4606M) EPA 816-R-13-001, March 2013.

United States Environmental Protection Agency (U.S. EPA), 2016. Underground Injection Control (UIC) Program Class VI Well Plugging, Post-Injection Site Care and Site Closure Guidance. Office of Water (4606M) EPA 816-R-16-006, December 2016.

Figures



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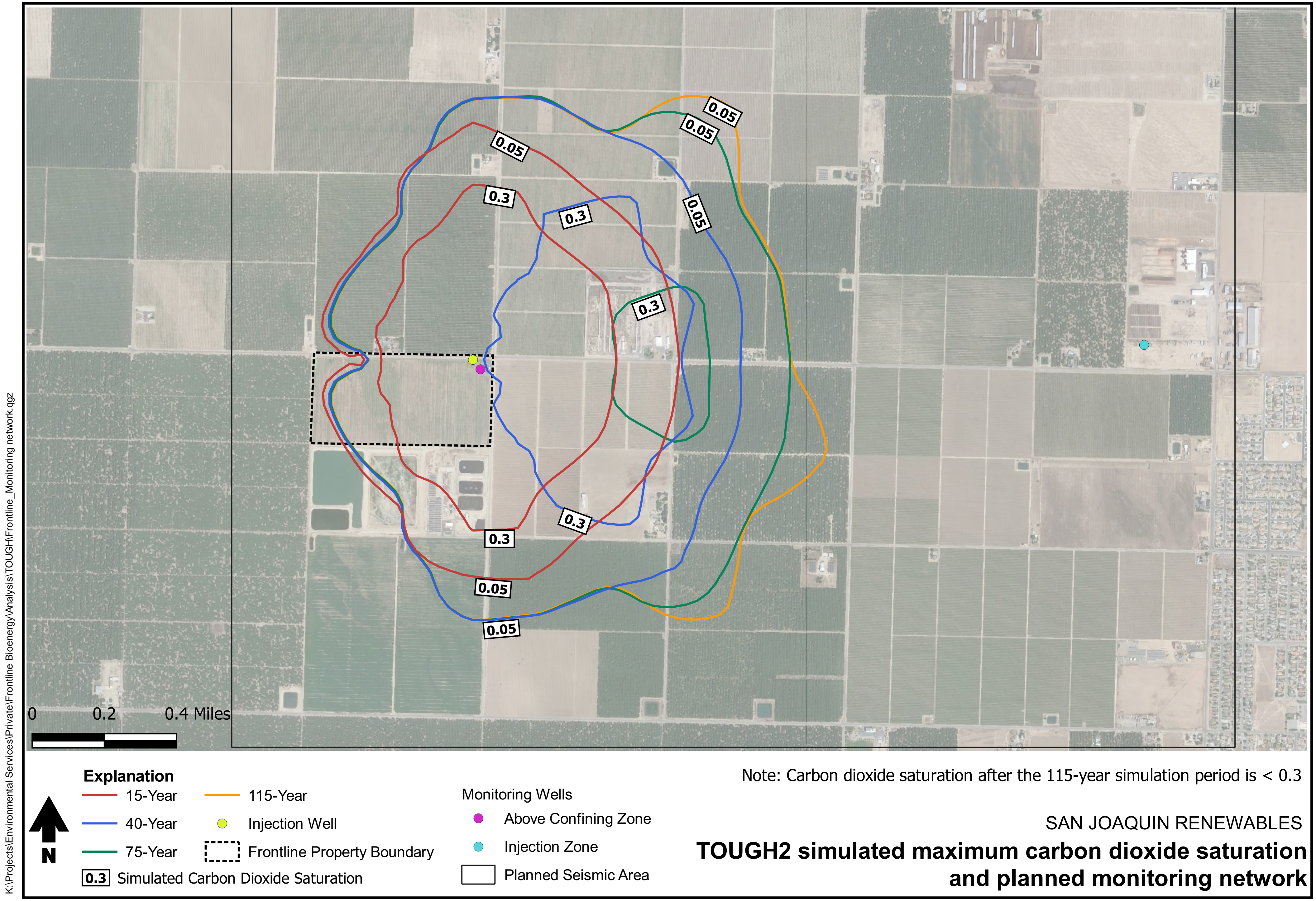
Average Pressure within a 10-m Radius of the Injection Well, Base Case



Note: Carbon dioxide saturation after the 115-year simulation period is < 0.3

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TOUGH2 simulated maximum carbon dioxide saturation and planned monitoring network

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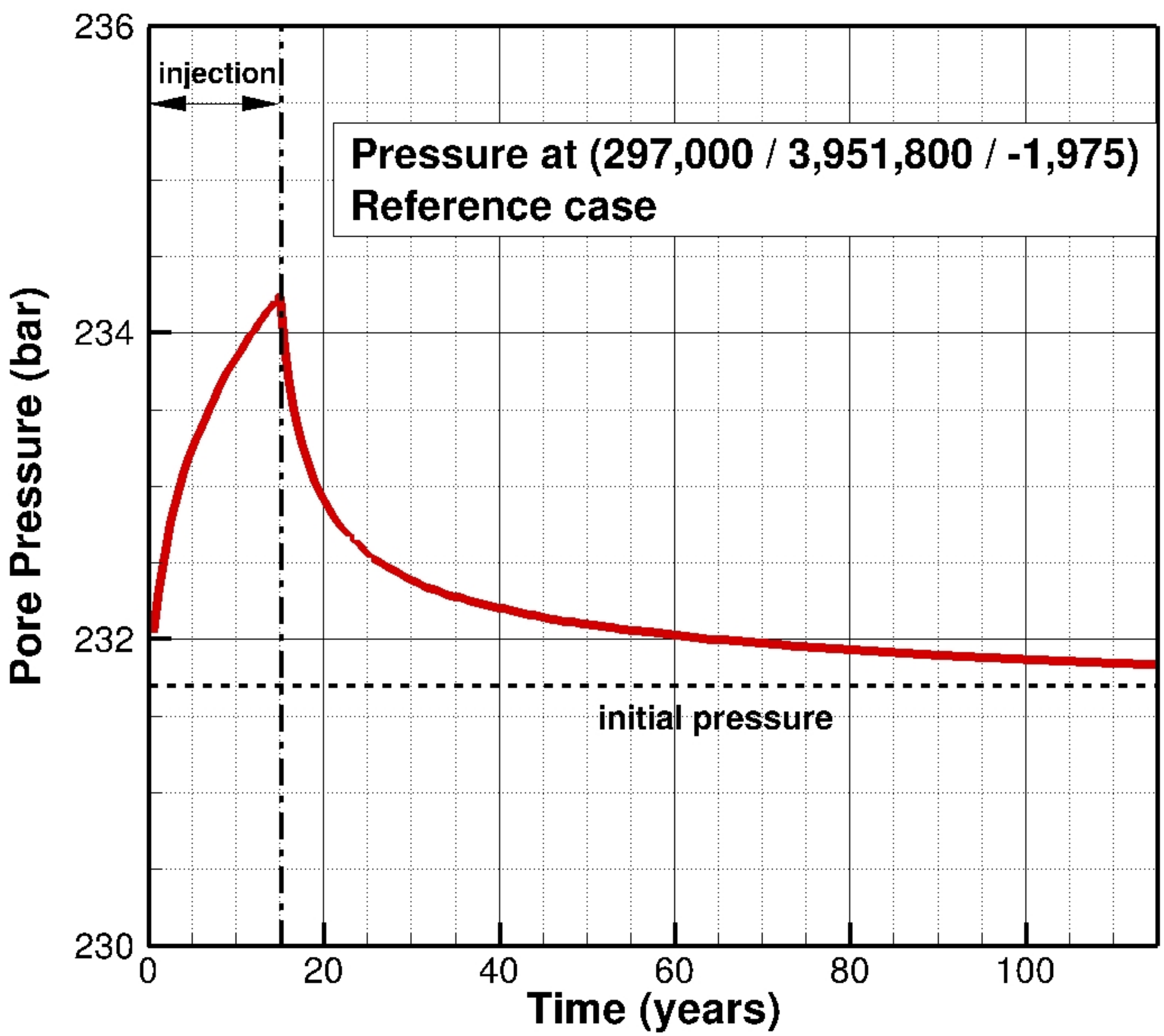
Figure 2



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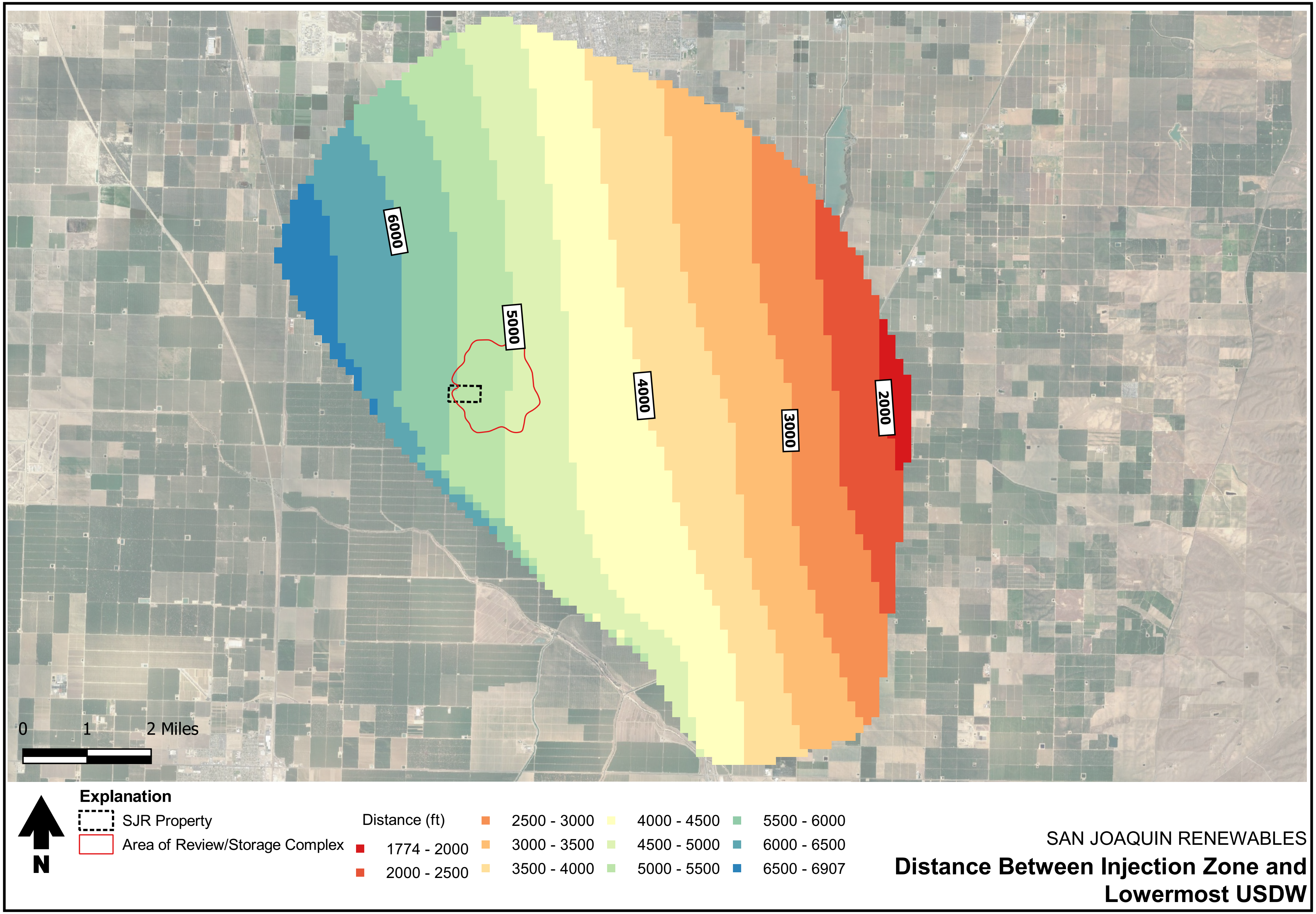
Simulated Pressure Profile at Pressure-Front Tracking Well Location, Vedder Formation



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Distance Between Injection Zone and Lowermost USDW

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09/01/2022 JN DB19.1252

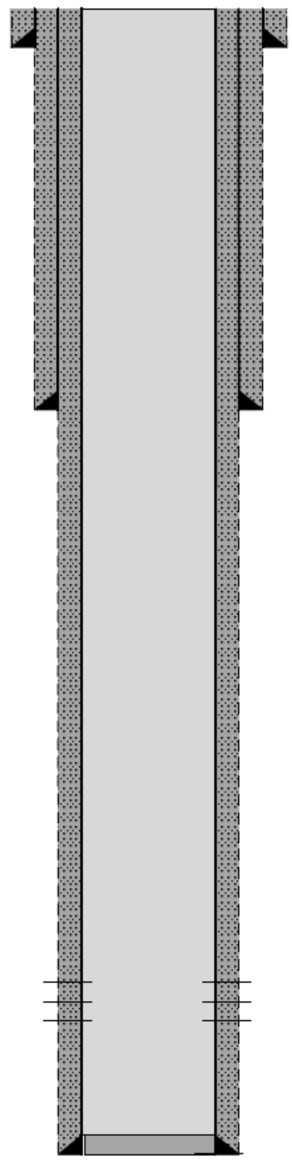
Figure 4

Appendix A: Plugging Schematics

Proposed Wellbore Schematic

Injection Monitoring Well
Above Confining Zone

Frontline BioEnergy

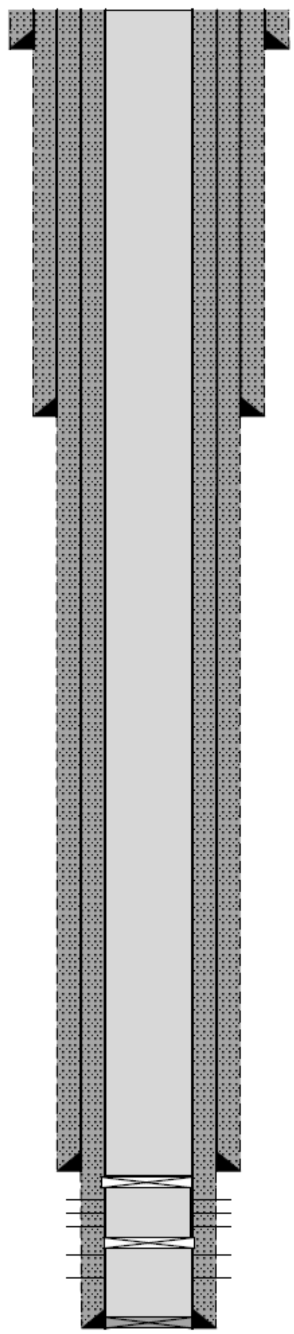
Geo Marker	INCL/TVD	Hole		Casing & Perf	Details
		26"		*Depths are MD* 20" 94# J-55 BTC Csg @ 250'	20" Csg cmt'd @ 250'-Surf w/ 489 CF cmt
				9-5/8" 53.5# N-80 LTC Csg @ 7700'	9-5/8" Csg cmt'd @ 2600'-Surf w/ 814 CF cmt
BFW @ ~1750'		12-1/4"			
USDW @ ~2495'					7" casing plugged with 1606 cuft Class G cement
Confining Zone: Olcese @ 6625'					
		8-1/2"		7" 29# N-80 Csg @ 7700'	7" Csg cmt'd @ 7700'-Surf w/ 985 CF cmt
				Perforated @ 7045-7095'	
		TD @ 7700'			
Pyramid Hills @ 7775'					

Creator & Date: JAP 8-12-2022

Proposed Wellbore Schematic

Injection Zone Monitoring Welll
Two Monitor Zones, Two Strings
Short String: Pyramid Hill + Vedder 1 + Vedder 2
Long String: Vedder 3 + Vedder 4

Frontline BioEnergy

Geo Marker	INCL/TVD	Hole		Casing & Perf	Details
				*Depths are MD*	
		26"		20" 94# J-55 BTC Csg @ 250'	20" Csg cmt'd @ 250'-Surf w/ 489 CF cement
		17-1/2"			
USDW @ ~2521'					
				13-3/8" 61# J-55 BTC Csg @ 2600'	13-3/8" Csg cmt'd @ 2600'-Surf w/ 1806 CF cement
Etchegoin @ 2951' Miocene @ 4291' Santa-Margarita @ 4921' Round Mtn @ 5632'					
Confining Zone: Olcese @ 5790'		12-1/4"			Cement Plug #2 from 6800' to surface
Freeman-Jewett @ 6322'					
				9-5/8" 53.5# N-80 LTC Csg @ 6800'	9-5/8" Csg cmt'd @ 6800'-Surf w/ 2222 CF cement
Pyramid Hills @ 6819' Vedder 1 @ 6825' Vedder 1A @ 6918' Vedder 2 @ 7154' Vedder 3 @ 7254' Vedder 4 @ 7415' Walker @ 7431'		8-1/2"		Perforated @ 6819-6825' (PH), 6825-6918' (V1), 7154-7235' (V2) Perforated @ 7256-7415' (V3), 7415-7431' (V4)	Cement Retainer #2 @ 6800' Cement Squeeze #2 7250-6800' Cement Retainer #1 @ 7250' Cement Squeeze #1 7431-7250' Cement Plug #1 7500-7431'
		TD @ 7500'		7" 29# L-80 13Cr Csg @ 7500'	7" Csg cmt'd @ 7500'-Surf w/ 973 CF cement

Creator & Date: JAP 9/8/2022