

**SECTION G. POST-INJECTION SITE CARE AND SITE CLOSURE PLAN**  
**40 CFR 146.93(a)**

**MONTEZUMA NORCAL CARBON SEQUESTRATION HUB**

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Sec 28   T 3 N   R 1 E

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## List of Acronyms and Abbreviations

AoR = area of review CO <sub>2</sub> = carbon dioxide ft = feet ft bgs = feet below ground surface ft NGVD = feet elevation referenced to the National Geodetic Vertical Datum of 1929 MMA = maximum monitoring area MC = PureField Carbon Capture, LLC	PISC = Post-Injection Site Care psi = pounds per square inch TBD = to be determined UIC = Underground Injection Control USDW = Underground Source of Drinking Water US EPA = United States Environmental Protection Agency
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**G.1. SUMMARY**

This Post-Injection Site Care (PISC) and Site Closure plan describes the activities that Montezuma Carbon, LLC (MC) will perform to meet the requirements of 40 CFR 146.93. MC plans to monitor groundwater quality and track the position of the CO<sub>2</sub> plume and pressure front for the default PISC 50-year timeframe, unless an alternative timeframe request is submitted and approved in accordance with 40 CFR 146.93(c).

MC may not cease post-injection monitoring until a demonstration of non-endangerment of Underground Sources of Drinking Water (USDWs) has been approved by the Underground Injection Control (UIC) Program Director pursuant to 40 CFR 146.93(b)(3). Following approval for site closure, MC will plug all monitoring wells, restore the site, and submit a site closure report and associated documentation.

**G.2. PRE- AND POST-INJECTION PRESSURE DIFFERENTIAL [40 CFR 146.93(A)(2)(I)]**

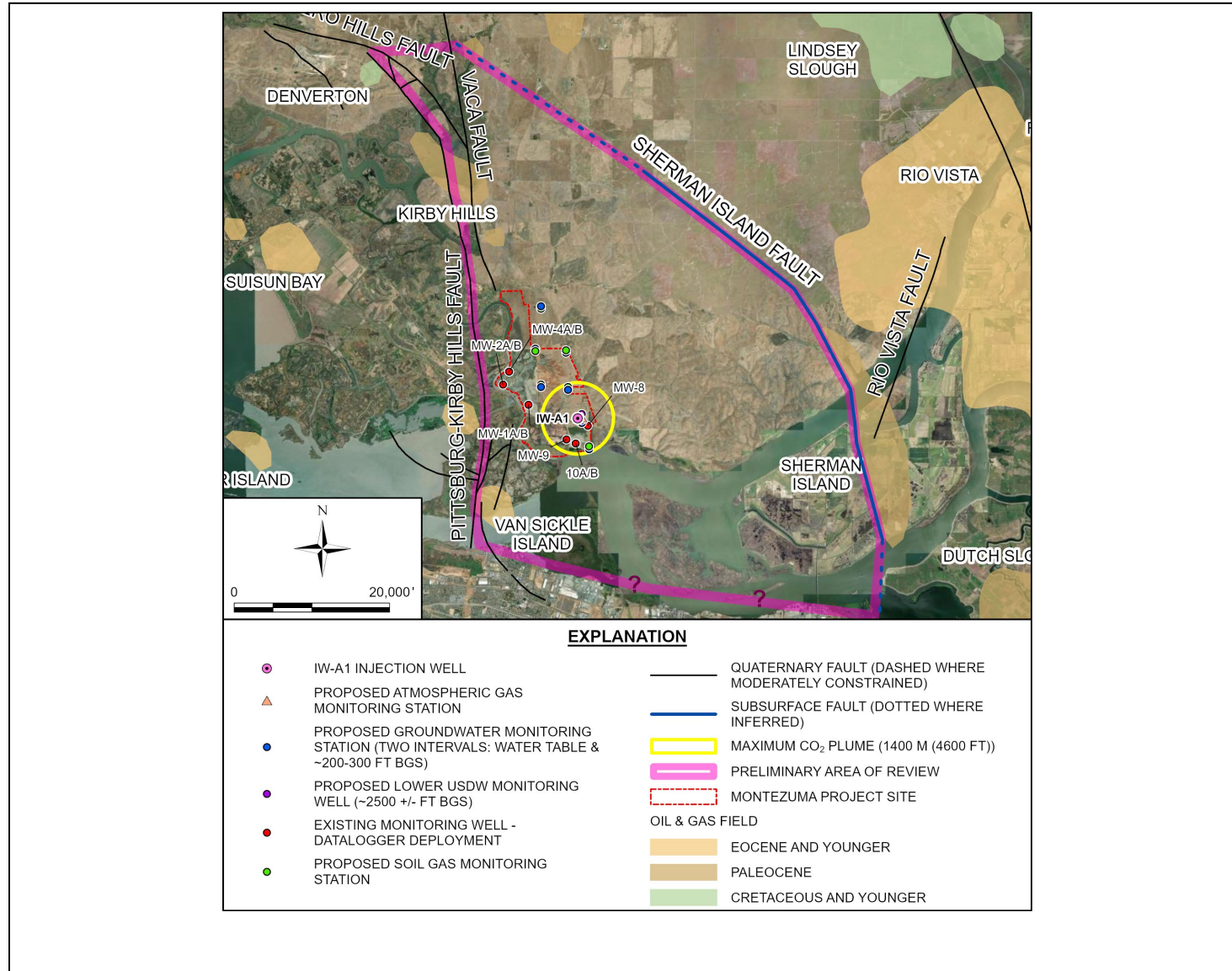
The preliminary computational reservoir storage complex model for the anticipated operational conditions predicts pressures across the injection zone will remain elevated for a long period after injection stops. One of the primary reasons for this is that our preliminary modeling assumes that the faults surround the project site are effectively sealed and therefore create a closed reservoir storage system. This elevated residual pressure differential is a primary reason why MC plans to implement this long-term PISC monitor period (50 years or possibly longer). See Section B.3 of the Area of Review and Corrective Action Plan for a more detailed presentation of the computational model predictions for pressure differential over time.

**G.3. PREDICTED POSITION OF THE CO<sub>2</sub> PLUME AND ASSOCIATED PRESSURE FRONT AT SITE CLOSURE [40 CFR 146.93(A)(2)(II)]**

Figure G-1 shows the predicted extent of the plume and pressure front at site closure, representing the maximum extent of the plume and pressure front. This map is based on the results obtained from the Area of Review (AoR) delineation modeling effort. This preliminary storage reservoir modeling analysis will be updated to reflect the final AoR delineation modeling upon completion of the computational modeling efforts that include review and comment from the US EPA. The updated map will be submitted pursuant to 40 CFR 146.84.

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**FIGURE G-1. MAP OF THE PREDICTED MAXIMUM EXTENT OF THE CO<sub>2</sub> PLUME AND PRESSURE FRONT AT SITE CLOSURE**



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**G.4. POST-INJECTION MONITORING PLAN [40 CFR 146.93(B)(1)]**

PISC period monitoring requirements of 40 CFR 146.93(b)(1) will be met using a combination of Well Integrity testing, Groundwater Quality and Geochemical Monitoring, Plume and Pressure Front Tracking, and Additional Testing & Monitoring as described in the Testing and Monitoring Plan and the Quality Assurance Surveillance Plan. The results of all post-injection phase testing and monitoring will be submitted annually, within 60 days of the anniversary date on which injection ceased, or an alternate date with the prior approval of the UIC Program Director, as described under “Schedule for Submitting Post-Injection Monitoring Results,” below.

IW-A1 will be re-permitted and re-completed as an injection zone monitoring well at the end of the Initial PISC period, serve as a monitoring well during the Maintenance PISC period, and then will be plugged and abandoned as described in the Injection Well Plugging Plan.

MW-IZA1 will continue to be utilized as an injection zone monitoring well during PISC. It will be plugged and abandoned as described later in this plan.

The monitoring stations will continue to be utilized throughout the PISC. The wells at each monitoring station will be plugged and abandoned as described later in this plan.

**G.4.1. MONITORING ABOVE THE CONFINING ZONE**

External mechanical integrity testing of IW-A1 and MW-IZA1 during PISC are described in Section E.7 of the Testing and Monitoring Plan.

Groundwater Quality and Geochemical Monitoring during PISC are described in Section E.5 of the Testing and Monitoring Plan.

Soil Gas Monitoring during PISC is described in Section E.11 of the Testing and Monitoring Plan.

Surface Air Monitoring during PISC is described in Section E.12 of the Testing and Monitoring Plan.

Seismic Monitoring during PISC is described in Section E.10 of the Testing and Monitoring Plan.

**G.4.2. CARBON DIOXIDE PLUME AND PRESSURE FRONT TRACKING**  
**[40 CFR 146.93(A)(2)(III)]**

Plume Tracking during PISC is described in Section E.10 of the Testing and Monitoring Plan.

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Pressure Front Tracking during PISC is described in Section E.10 of the Testing and Monitoring Plan.

**G.4.3. SCHEDULE FOR SUBMITTING POST-INJECTION MONITORING RESULTS**  
**[40 CFR 146.93(A)(2)(IV)]**

All post-injection site care monitoring data and monitoring results collected using the methods described above will be submitted to the United States Environmental Protection Agency (US EPA) in reports annually, within 60 days of the anniversary date on which injection ceased, or an alternative date with the prior approval of the UIC Program Director. The reports will contain information and data generated during the reporting period (e.g., well-based monitoring data, sample analysis, and the results from updated site models).

**G.5. ALTERNATIVE POST-INJECTION SITE CARE TIMEFRAME [40 CFR 146.93(C)]**

MC will conduct post-injection monitoring for the 50-year default timeframe following the cessation of injection operations, unless a justification for an alternative PISC timeframe is provided to and approved by the US EPA. Regardless of the alternative PISC timeframe, monitoring and reporting as described in the sections above will continue until MC demonstrates, based on monitoring and other site-specific data, that no additional monitoring is needed to ensure that the project does not pose an endangerment to any USDWs, per the requirements at 40 CFR 146.93(b)(2) or (3).

The results in this section are based on the preliminary reservoir storage complex modeling effort, as discussed in the Area of Review and Corrective Action Plan. MC expects the shape and areal extent of the current AoR predictions may change slightly in the final version of the storage complex modeling effort associated with this application. The analysis provided in this section will be updated, as and when appropriate, based upon the completion of the final modeling results for this application.

**G.5.1. COMPUTATIONAL MODELING RESULTS – 40 CFR 146.93(C)(1)(I)**

In this initial Class VI application, MC anticipates following the 50-year default timeframe, but in the future may propose an alternative PISC timeframe to the US EPA if supported by both the monitoring and reservoir modeling results for both the pressure front and the CO<sub>2</sub> plume. See Section B.3.1 the Area of Review and Corrective Action Plan for further discussion.

**G.5.2. PREDICTED TIMEFRAME FOR PRESSURE DECLINE – 40 CFR 146.93(C)(1)(II)**

The pressure front at IW-A1 will drop substantially once injection is stopped. However, given that our injection reservoir system was conservatively modeled to be a closed system surrounded by sealed faults, it is also expected the pressure differential will remain well above the background conditions for a long time, as

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discussed in the Area of Review and Corrective Action Plan. As the reservoir modeling effort is revised to incorporate site specific data collected during the Pre-Operational Testing Program, the pressure decline will also be updated and revised.

**G.5.3. PREDICTED RATE OF PLUME MIGRATION – 40 CFR 146.93(C)(1)(III)**

The predicted rate of CO<sub>2</sub> plume migration over time is discussed in the Area of Review and Corrective Action Plan. The predicted timeframe for cessation of migration is within the 100-year timeframe of the computational model.

**G.5.4. SITE-SPECIFIC TRAPPING PROCESSES – 40 CFR 146.93(C)(1)(IV)-(VI)**

The current computational model accounts for structural, hydrodynamic, and solubility trapping processes, along with a simplified non-hysteretic representation of residual trapping. A more realistic hysteretic representation of residual trapping due to imbibition will be incorporated into a future iteration of the model. CO<sub>2</sub> mineralization is anticipated to be relatively slow given the site geochemistry, and the time required for CO<sub>2</sub> dissolution and kinetic mineral reactions. Ignoring CO<sub>2</sub> mineralization as a trapping process in the computational model is conservative in that actual field results may show slightly faster plume stabilization rates and pressure reductions than predicted by the computational model, particularly over the post-injection period.

**G.5.5. CONFINING ZONE CHARACTERIZATION – 40 CFR 146.93(C)(1)(VII)**

Faults and fractures within the confining zones are discussed in Section A.I.4 of the Site Characterization attachment to the Application Narrative.

The thicknesses of the confining zones are discussed in Section A.I.5 of the Site Characterization attachment to the Application Narrative.

Future more detailed and definitive statements regarding the permeability of the confining zones and their integrity to impede fluid movements will be provided upon completion of the proposed Pre-Operational Testing Program.

**G.5.6. ASSESSMENT OF FLUID MOVEMENT POTENTIAL –**  
**40 CFR 146.93(C)(1)(VIII)-(IX)**

All known potential conduits for fluid movement within the AoR have been identified and appropriate precautions will be taken as discussed below:



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- IW-A1 – This well will be designed, constructed, operated, monitored, abandoned, and plugged to Class VI standards. No corrective action is anticipated to be necessary. See Section A.II.2 of the Well Construction Details attachment to the Application Narrative for details on the construction of IW-A1. See Section F.4 of the Injection Well Plugging Plan for details on the planned plugs for IW-A1.
- IZMW-A1 – This well will be design, constructed, operated, monitored, abandoned, and plugged to Class VI standards. No correction action is anticipated to be necessary. See Section A.II.3 of the Well Construction Details attachment to the Application Narrative for details on the construction of IZMW-A1. See Section G.7.2 for details on the planned plugs for IZMW-A1.

Known conduits for potential fluid movement within the preliminary, structurally controlled AoR have been identified from comprehensive searches of public databases. Seven (7) legacy gas wellbores were identified as probable candidates for further detailed evaluation of their well construction, geology, and plugging records for future corrective action, which if needed would likely be performed prior to the Injection period. Furthermore, 37 additional legacy gas wellbores were identified as potential candidates for further review and screening for potential future corrective action. The Area of Review and Corrective Action Plan provides detailed descriptions of well construction of these legacy gas wells that penetrate the confining zones within the AoR, with additional information being provided in the appendices to that same plan.

**G.5.7. LOCATION OF USDWS – 40 CFR 146.93(C)(1)(X)**

The top of the injection (CO<sub>2</sub> sequestration) zone for IW-A1 is the Anderson Sandstone at a depth of 11,300 feet below ground surface (ft bgs). The base of the lowermost USDW within the Tehama formation is at roughly 2,000 ft bgs, which is a difference of 9,300 feet (ft). Primary upper confinement is low permeability zones within the Meganos/Upper Martinez Shales (9,900 to 11,300 ft bgs) with additional confinement provided by several thick shales layers and sequences separating these units. The lowermost USDW was determined from local and regional published field data from the vicinity of IW-A.

**G.6. NON-ENDANGERMENT DEMONSTRATION CRITERIA**

Prior to approval of the end of the post-injection phase, MC 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

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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
- Summary of Existing Monitoring Data
- Summary of Computational Modeling History
- Evaluation of Reservoir Pressure
- Evaluation of Carbon Dioxide Plume
- Evaluation of Emergencies and Other Events

**G.6.1. 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.

**G.6.2. 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)].

**G.6.3. SUMMARY OF COMPUTATIONAL MODELING HISTORY**

The results of computational modeling used for AoR delineation will be compared to monitoring data collected during the Injection and PISC periods. The testing and monitoring data will be used to monitor the site and update the computational model throughout the project. Data generated during the PISC period will be used to show that the computational model accurately represents the storage site and can be used as a proxy to determine the plume size and properties. Model accuracy will be demonstrated by comparing the monitoring data obtained during the PISC period against the model's predicted properties (i.e., plume location, rate of movement, and pressure decay). Statistical methods will be employed to correlate the data and confirm the model's ability to accurately represent the storage site. The validation of the computational model with the

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large amount of data generated over the project lifetime will be a significant element to support any future non-endangerment demonstration. Further, the validation of the model at the locations where direct data collection have taken place will help to ensure confidence in the model for those locations where surface infrastructure, site access, or other restrictions preclude geophysical data collection and where direct observation wells cannot be placed.

#### **G.6.4. EVALUATION OF RESERVOIR PRESSURE**

Both direct and indirect geophysical methods will be used to evaluate the extent of the pressure front, as discussed more fully in Section E.10 of the Testing and Monitoring Plan. These data may be used in the future to support a Non-Endangerment Demonstration per the previous discussion in Section G.6.

#### **G.6.5. EVALUATION OF CARBON DIOXIDE PLUME**

Both direct and indirect geophysical methods will be used to evaluate the extent of the CO<sub>2</sub> plume, as discussed more fully in Section E.10 of the Testing and Monitoring Plan. These data may be used in the future to support a Non-Endangerment Demonstration per the previous discussion in Section G.6.

#### **G.6.6. EVALUATION OF EMERGENCIES OR OTHER EVENTS**

Mobilized formation fluids may pose a risk to USDWs. The pressure front within the injection zone at IW-A1 is predicted to rapidly fall below the minimum threshold pressure after cessation of injection, as discussed in the Area of Review and Corrective Action Plan. There is little risk of the project forcing formation fluids into any overlying USDW anywhere within the project site beyond this point in time, given the IW-A1 bottom hole pressure differential always represents the largest pressure differential within the project site.

Section G.5.6 discusses the locations of artificial penetrations within the AoR and in the general proximity of the project site. The Area of Review and Corrective Action Plan discusses how artificial penetrations will be evaluated.

### **G.7. SITE CLOSURE PLAN**

MC will conduct site closure activities to meet the requirements of 40 CFR 146.93(e) as described below. MC will submit a final Site Closure Plan and notify the permitting agency at least 120 days prior to its intent to close the site. Once the US EPA has approved closure of the site, MC will plug the monitoring wells, including the IW-A1 converted to a monitoring well during the PISC project phase, and following completion of these efforts submit a site closure report to the US EPA. The activities, as described below, represent the planned activities based on information provided to the US EPA. The actual site closure plan may employ

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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.

**G.7.1. PLUGGING AND ABANDONMENT OF IW-A1**

See the Injection Well Plugging Plan for a full description of the plugging plan for IW-A1. See Section G.7.4 for discussion on site restoration.

**G.7.2. PLUGGING AND ABANDONMENT OF IZMW-A1**

The plugging and abandonment plan for IZMW-A1 is patterned off the plugging and abandonment plan for IW-A1. It follows similar procedures, utilizes similar materials, utilizes similar methods for volume calculations, follows similar well tests before plugging, and follows other associated activities for plugging and abandonment. See Section G.7.4 for discussion on site restoration.

The intention of the IZMW-A1 well plugging plan is to prevent any fluid or gas migration from the injection zone, to prevent any additional crossflow as a result of the well penetrating formations above the target zone, to resist the corrosive aspects of carbon dioxide mixed with water, and to protect USDWs. Any revisions to the plan due to new information collected during logging and testing will be made after construction, logging, and testing of IZMW-A1 has been completed, and a final well plugging plan for IZMW-A1 will be provided to the UIC Program Director.

To prepare the well for plugging, it will first be flushed with a kill weight brine fluid. A minimum flushing of three tubing volumes will be completed without exceeding formation fracture pressure. Prior to plugging, bottom hole pressure measurements will be made, and the well will be logged, and pressure tested to ensure mechanical integrity inside and outside of the casing. If mechanical integrity is determined to be lost, repairs will be made prior to continuation of plugging activities. The casing of this well will have been cemented during construction and will not be retrievable during abandonment. Internal tubing (if present) and packer will be removed as part of abandonment. The balanced plug placement method will be used to plug the well. If present and after flushing, the tubing and packer cannot be released, an electric line with tubing cutter will be used to cut off the tubing above the packer and the packer will be left in the well, and the cement retainer method will be used for plugging the injection formation below the abandoned packer.

Cement used for the lower most (roughly bottom 5,220 feet [ft]) cement plugs will be designed to resist any corrosive effects of contact with CO<sub>2</sub>, carbonic acid, or other fluids or gases associated with or generated as a direct result of the sequestration of carbon dioxide.

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MC will record bottom hole pressure throughout the operating lifetime of the well. Kill fluid density and reservoir pressure can be determined from these measurements.

MC will conduct at least one of the tests listed in Table G-1 to verify external mechanical integrity prior to plugging the monitoring well IZMW-A1.

**TABLE G-1. POTENTIAL MECHANICAL INTEGRITY TESTS**

<b>Test Description</b>	<b>Location</b>
Temperature Log	Along wellbore using distributed temperature sensor or wireline logging
Noise Log	Wireline logging

MC will use the materials and methods noted in Table G-2 and illustrated in Figure G-2 to plug IZMW-A1. Several lifts will be used during the installation of Plug # 1 and Plug # 2 as illustrated in Figure G-2. The cement(s) formulated for plugging will be compatible with and resistant to the CO<sub>2</sub> stream. The cement formulation and required certification documents will be submitted to the agency with the well plugging plan. MC will report the wet density and will retain duplicate samples of the cement used for each plug.

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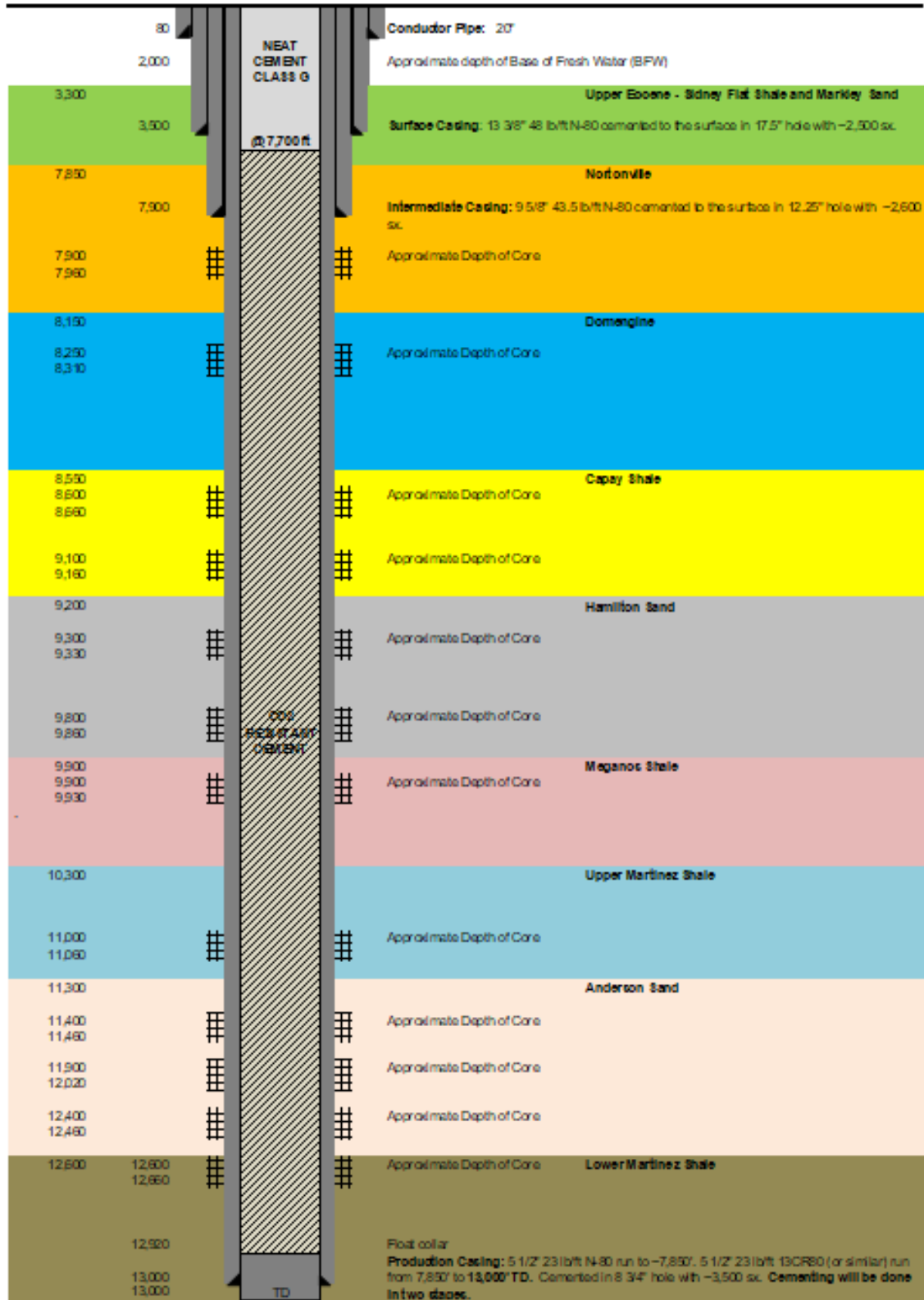
**TABLE G-2. PRELIMINARY PLUGGING DETAILS**

<b>Plug Information</b>	<b>Plug #1</b>	<b>Plug #2</b>
Diameter of boring in which plug will be placed, inches	4.670	4.670
Depth to bottom of tubing or drill pipe, feet	12,920	7700
Sacks of cement to be used	594	876
Slurry volume to be pumped, cubic feet	683	1,007
Slurry weight, pounds per gallon	15.8	15.8
Calculated top of plug, feet	7700	0
Bottom of plug, feet	12,920	7,700
Calculated top of plug, Elevation ft NGVD	-7,690	10
Bottom of plug, Elevation ft NGVD	-12,920	-7,690
Type of cement or other material	CO <sub>2</sub> Resistant	Neat Cement Class G
Method of emplacement (e.g., balance method, retainer method, or two-plug method)	Balanced Plug	Balanced Plug

ft NGVD = feet elevation referenced to NAVD 1988

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**FIGURE G-2. PROPOSED IZMW-A1 WELL PLUGGING PLAN SCHEMATIC**



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**G.7.3. PLUGGING AND ABANDONMENT OF ABOVE CONFINING ZONE MONITORING  
WELLS**

MC plans to plug and abandon all of the above confining zone monitoring wells and similar sample points in accordance with the applicable requirements designated by the State of California Department of Water Resources (e.g., State Well Standards – Bulletin 74-81). These well abandonment procedures will be followed to abandon the above confining zone groundwater monitoring wells, the CO<sub>2</sub> sensor wells, the seismic sensor wells, soil efflux collars, and all their related above ground well completion equipment (e.g., protective casings) due to the similar nature of their construction.

The general steps included within these procedures are as follows:

1. Upon approval of Site Closure by the US EPA, MC will notify the US EPA and State of California of the well plugging and abandonment schedule, and confirm the planned plugging activities still satisfy the applicable regulatory requirements.
2. The well/sensor point plugging will be performed by a California licensed water well contractor.
3. Measure the static water level in each well/sensor point for reporting purposes.
4. Measure the total depth of the well to verify there are no obstructions that could interfere with proper plugging of the well/sensor point.
5. Use these site-specific depth measurements along with the well/point casing diameter to calculate the volume of grout needed to properly plug each well casing.
6. The well/sensor point will be filled from its total depth to approximately three feet below ground level with a State approved or regionally accepted grout using a grout tremie pipe or other acceptable method. If dry sodium bentonite products are to be used, they must be hydrated in accordance with manufacturer specifications.
7. Verify that the volume of the grout placed during plugging operations is equal to or exceeds the volume calculated as necessary to properly plug the well based upon the casing diameter and total depth, to ensure that no bridging of the grout material has occurred.
8. Cut off and remove the well/sensor casing at approximately 3 feet below ground level. Backfill from the top of the remaining casing to the surface and level the surrounding area with clean compacted surface silts or clays.
9. Since these wellheads are completed above grade with outer protective casings, the protective casings and their cement pads will be removed.



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10. Within 30 days of completion of the well plugging/abandonment activities, submit a completed water well plugging record describing the plugging of the well/sensor points to the State. Within 60 days of completion, MC will also provide the US EPA with similar documentation of the well plugging and abandonment.

**G.7.4. INJECTION WELL SITE AND MONITORING STATION  
DECOMMISSIONING/RESTORATION**

MC also plans to decommission and restore the project site and all project well sites to a condition as closely as practicably feasible to pre-injection conditions in general compliance with any applicable State regulations.

The proposed steps for the site decommissioning and restoration efforts are as follows:

1. Upon approval of Site Closure by the US EPA, MC will notify the US EPA and the State of the well site and monitoring station decommissioning and restoration schedule, and confirm the planned activities still satisfy the applicable regulatory requirements.
2. All subsurface well casings shall be cut off approximately 3 feet below ground surface, and a steel plate cap shall be welded onto IW-A1 and MW-IZA1 casings.
3. Clear each well site and monitoring station area of any injection-related equipment, machinery, monitoring equipment, concrete base materials, and other project-related structures, materials, or debris.
4. Fill, grade level, and restore any resulting project-related pits or excavations in the immediate vicinity of each well/monitoring station.
5. Perform any additional activities that may be required by the US EPA or State, if such additional activities are determined necessary to protect human health and the environment.

**G.7.5. 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<sub>2</sub>, and
- Post-injection monitoring records.

**SECTION G. POST-INJECTION SITE CARE AND SITE CLOSURE PLAN**  
**40 CFR 146.93(a)**

MC 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 CO<sub>2</sub> 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.