CENTRAL VALLEY REGIONAL WATER QUALITY CONTROL BOARD

MONITORING AND REPORTING PROGRAM R5-2020-0801
FOR
AQUIFER STORAGE AND RECOVER PROJECTS
THAT INJECT DRINKING WATER INTO GROUNDWATER
CITY OF DAVIS, AQUIFER STORAGE AND RECOVERY PILOT TEST AT WELL 27
YOLO COUNTY

This Monitoring and Reporting Program (MRP) allows determination of the potential for groundwater degradation and incorporates requirements for monitoring of injected water and groundwater for the Aquifer Storage and Recovery (ASR) pilot test at Well 27 in the City of Davis. This MRP is issued pursuant to Water Code Section 13267. The Permittee shall not implement any changes to this MRP unless and until a revised MRP is issued by the Executive Officer. As appropriate, California Regional Water Quality Control Board, Central Valley Region (Central Valley Water Board) staff shall approve specific sample station locations prior to implementation of sampling activities.

All samples should be representative of the volume and nature of the monitored medium. The time, date, and location of each grab sample shall be recorded on the sample chain of custody form.

Field test instruments (such as those used to monitor pH) may be used provided that:

1. The operator is trained in the proper use of the instrument;
2. The instruments are field calibrated prior to each use;
3. Instruments are serviced and/or calibrated by the manufacturer at the recommended frequency; and
4. Field calibration reports are submitted as described in the “Reporting” section of this MRP.

INJECTION WELL MONITORING

The injection well shall be monitored when water is being injected into the aquifer. Monitoring of the injection well shall include, at a minimum, the following shown in the table below. Well operational status shall be reported for each well associated with the ASR project. Injection activity shall be recorded on a daily basis.

Constituent/Parameter	**Units**	**Type of Sample**	**Sampling Frequency**
Well Operational Status	N/A	Recorded	Daily
Daily Average Injection Rate	gpm	Meter	Continuous

Constituent/Parameter	Units	Type of Sample	Sampling Frequency
Injected Water, cumulative total for year to date	ac-ft/yr	Meter	Continuous
Extracted Water, cumulative total for year to date	ac-ft/yr	Meter	Continuous

INJECTED WATER MONITORING

Injected water is limited to potable water that the Permittee receives from the Woodland-Davis Clean Water Agency (WDCWA), which is produced through WDCWA's CDPH permitted domestic water supply permit. Section 116470 of the California Health and Safety Code requires:

1. An Annual Water Quality Report (AWQR). The AWQR characterizes the injected water.

2. Public water systems that serve more than 10,000 service connections and that detect one or more contaminants in drinking water that exceed the applicable public health goal, are required to prepare a report that addresses the contaminant issue.

Both of the reports shall be submitted as part of the Technical Addendum to be submitted at the completion of the pilot test.

Additionally, potable water used as injected water shall be monitored during periods when injection is occurring. Monitoring of the injected water shall include at least the following as shown in the table below.

Constituent	Unit	Type of Sample	Sampling Frequency/Events
pH	pH units	Grab	Daily (first and last day of injection)
Arsenic	mg/L	Grab	Daily (first and last day of injection)
Iron	mg/L	Grab	Daily (first and last day of injection)
Manganese	mg/L	Grab	Daily (first and last day of injection)
Nitrate (as Nitrogen)	mg/L	Grab	Daily (first and last day of injection)

Constituent	Unit	Type of Sample	Sampling Frequency/Events
Total Dissolved Solids	mg/L	Grab	Daily (first and last day of injection)

EXTRACTION WELL MONITORING

Monitoring of the extraction well shall include at least the following as shown in the table and meet the following requirements below.

1. All Well Activity shall be reported for all wells associated with the ASR pilot test.

2. Injection/extraction activity shall be recorded on a daily basis.

3. Average pump rate is measured in gallons per day (gpd) or alternative units.

4. Extracted Water/Year represents the total of water extracted from a well for the duration of the pilot test.

5. Sampling shall be performed at the start of the recovery period, within the middle of the recovery period, and at the end of the recovery period. See Table 1 *Sample Collection and Timing* located at the end of this MRP for the proposed sample collection during the ASR pilot test, which was based on information provided in the Technical Report. See Table 2 *Water Quality Constituents to be Analyzed* at the end of this MRP for additional constituents to be monitored.

Constituent	Units	Type of Sample	Sampling Frequency
Well Activity	N/A	Recorded	Daily
Average Pumping Rate	gpd	Meter	Continuous
Extracted Water/Year	ac•ft/yr	Meter	Continuous
Electrical Conductivity	µmhos/cm	Grab	3 samples (see requirement 5 above)
pH	pH units	Grab	3 samples (see requirement 5 above)
Arsenic	mg/L	Grab	3 samples (see requirement 5 above)

Constituent	Units	Type of Sample	Sampling Frequency
Iron	mg/L	Grab	3 samples (see requirement 5 above)
Manganese	mg/L	Grab	3 samples (see requirement 5 above)
Nitrate (as Nitrogen)	mg/L	Grab	3 samples (see requirement 5 above)
Total Dissolved Solids	mg/L	Grab	3 samples (see requirement 5 above)
See Table 2 *Water Quality Constituents to be Analyzed* at the end of this MRP		Grab	3 samples (see requirement 5 above)

GROUNDWATER AQUIFER MONITORING

If the Permittee proposes to monitor the target zone using wells other than those designated as injection or extraction wells or observation wells, the monitoring wells shall be sampled and analyzed in accordance with the Sampling and Analysis Plan (SAP) submitted as part of the Technical Report. Well completion details in accordance with Attachment B *Requirements for Monitoring Well Installation Workplans and Monitoring Well Installing Reports*, Section 2 shall be included in the Technical Addendum.

Prior to sampling, the groundwater elevations shall be measured, and the wells shall be purged of at least three well volumes until temperature, pH, and electrical conductivity have stabilized per the SAP submitted as part of the Technical Report. All samples shall be collected using approved EPA methods. Samples shall be filtered using a 0.45 micron filter if required by the SAP. Depth to groundwater shall be measured to the nearest 0.01 feet. Groundwater monitoring shall include, at a minimum, the following as shown in the table below. Sampling frequency/events pertain to sampling groundwater before the start of the pilot test, at the start and end of the storage period, and at the end of the recovery period. See Table 1 *Sample Collection and Timing* located at the end of this MRP for the proposed sample collection during the ASR pilot test. See Table 2 *Water Quality Constituents to be Analyzed* at the end of this MRP for additional constituents to be monitored.

Constituent	Units	Type of Sample	Sampling Frequency/Events
Electrical Conductivity	µmhos/cm	Grab	4
pH	pH units	Grab	4
Arsenic	mg/L	Grab	4
Iron	mg/L	Grab	4
Manganese	mg/L	Grab	4
Nitrogen (as Nitrate)	mg/L	Grab	4
Total Dissolved Solids	mg/L	Grab	4
See Table 2 *Water Quality Constituents to be Analyzed* at the end of this MRP.		Grab	4

REPORTING

All regulatory documents, submissions, materials, data, monitoring reports, and correspondence shall be converted to a searchable Portable Document Format (PDF) and submitted electronically. Documents that are less than 50 MB should be emailed to: CentralValleySacramento@waterboards.ca.gov

Documents that are 50 MB or larger should be transferred to a CD, DVD, or flash drive and mailed to the following address:

Central Valley Regional Water Quality Control Board
ECM Mailroom
11020 Sun Center Drive, Suite 200
Rancho Cordova, CA 95670

To ensure that your submittals are routed to the appropriate staff, the following information block should be included in any correspondence used to transmit documents to this office:

Facility Name: City of Davis ASR Pilot Test at Well 27, Yolo County
Program: Non-15 Compliance
Order: WQO 2012-0010-DWQ-0006
CIWQS Place ID: CW-871533

In reporting monitoring data, the Permittee shall arrange the data in tabular form so that the date, sample type (e.g., source water, injection well, extraction well, etc.), and reported

analytical result for each sample are readily discernible. The data shall be summarized in such a manner to clearly illustrate compliance with the *General Waste Discharge Requirements for Aquifer Storage and Recovery Projects That Inject Drinking Water into Groundwater*, Water Quality Order 2012-0010-DWQ (General Order), Notice of Applicability (NOA), and Basin Plan. The results of any monitoring done more frequently than required at the locations specified in the Monitoring and Reporting Program shall be reported in the Technical Addendum.

As required by the California Business and Professions Code sections 6735, 7835, and 7835.1, all groundwater monitoring reports shall be prepared under the supervision of a registered professional engineer or geologist and signed by the registered professional.

A. Technical Addendum

No later than **90 days** following the completion of the pilot test, the Discharger shall submit a Technical Addendum which include the following:

1. A discussion of the status (dates of injection, extraction, and idle time) for all extraction/injection wells associated with the ASR pilot test.

2. The annual water quality report and public health goal report published during the calendar year (if required by CDPH).

3. Tabular and graphical summaries of all monitoring data collected during the pilot test (reporting limits for non-detectable results).

4. A narrative description of all preparatory, monitoring, sampling, and analytical testing activities for the injection, extraction, and groundwater monitoring. The narrative shall be sufficiently detailed to verify compliance with the General Order, the NOA, this MRP, and the Standard Provisions and Reporting Requirements (SPRRs). The narrative shall be supported by field logs for each monitoring well documenting depth to groundwater; parameters measured before, during, and after purging; method of purging; calculation of casing volume; and total volume of water purged (if applicable, see notes on passive sampling in the Receiving Water section).

5. Calculation of change in groundwater elevations for each water-bearing interval monitored during the pilot testing activities. Monitoring data to be evaluated will be collected prior to injection, during injection, and during and after extraction activities.

6. A narrative discussion of the analytical results for all groundwater locations monitored including spatial and temporal trends, with reference to summary data tables, graphs, and appended analytical reports (as applicable).

7. A comparison of baseline groundwater monitoring data with the injected water data to evaluate water quality during the storage and extraction periods of the test.

8. A *Well Installation Report* for the constructed observation well in accordance with Attachment B *Requirements for Monitoring Well Installation and Monitoring Well Installation Report*, Section 2.

9. A scaled map showing relevant structures and features of the facility, the locations of monitoring wells and any other sampling stations, and groundwater elevation contours referenced to mean sea level datum.

10. Copies of laboratory analytical report(s) for groundwater monitoring.

11. A calibration log verifying calibration of all handheld monitoring instruments and devices used to comply with the prescribed monitoring program.

12. Projected ASR project activity for the next calendar year.

13. A discussion of compliance and corrective actions taken, as well as any planned or proposed actions needed to bring the discharge into full compliance with the General Order and/or the NOA.

A letter transmitting the self-monitoring reports shall accompany each report. Such a letter shall include a discussion of violations found during the reporting period, and actions taken or planned for correcting noted violations. If the Permittee has previously submitted a report describing corrective actions and/or a time schedule for implementing the corrective actions, reference to the previous correspondence will be satisfactory. The transmittal letter shall contain a statement by the Permittee, or the Permittee's authorized agent, under penalty of perjury, that to the best of the signer's knowledge the report is true, accurate and complete.

The Permittee shall implement the above monitoring program on the first day following issuance of the NOA.

This Order is issued under the authority delegated to the Executive Officer by the Central Valley Water Board pursuant to Resolution R5-2009-0027 and is effective upon signature.

Ordered by: John J. Baum Digitally signed by John J. Baum Date: 2021.03.05 17:59:20 -08'00'

for PATRICK PULUPA, Executive Officer

March 5, 2021

Date

Table 1 - *Sample Collection and Timing*

	Pilot Test					
	Before	**Injection**	**Storage**	**Recovery**	**Sample Events**	**Number of Samples**
Source Water		x			2	2
Well 27	x		x	x	4	4
Observation Wells (3)	x		x	x	4	12
				Total:	10	18

Based on information provided in the SAP, the above table is a summary of the sample collection to be performed at a minimum with sampling before the pilot test and during the storage and recovery periods. A 2-day recovery period would be consistent with a total of 4 samples. A longer period of 3- or 4-days would increase the number of samples to 5 and 6, respectively.

Table 2 - *Water Quality Constituents to be Analyzed.*

Constituent	EPA Method	Units	Identified COC?	Disinfection Byproducts	General Chemistry	Cation /Anion	Metals	Miscellaneous
Arsenic	6020	µg/L	X				X	
Hexavalent Chromium	218.6/7	µg/L	X				X	
Iron	6010B	µg/L	X				X	
Manganese	6010B	µg/L	X				X	
Nitrate (as N)	300.0	mg/L	X			X		
Sulfate (SO4)	300.0	mg/L	X			X		
Boron	6010B	mg/L	X					X
Selenium	6020	µg/L	X					X
Total Trihalomethanes (TTHM)	524.2	µg/L	X	X				
Bromodichloromethane	524.2	µg/L	X	X				
Bromoform	524.2	µg/L	X	X				
Chloroform	524.2	µg/L	X	X				
Dibromochloromethane	524.2	µg/L	X	X				
Haloacetic Acids (HAA)	552.2	µg/L	X	X				
Monobromoacetic Acid	552.2	µg/L	X	X				
Monochloroacetic Acid	552.2	µg/L	X	X				
Dibromoacetic Acid	552.2	µg/L	X	X				
Dichloroacetic Acid	552.2	µg/L	X	X				
Trichloroacetic Acid	552.2	µg/L	X	X				
pH* +	SM 4500	pH units	X		X			
Temperature*	field	°C			X			
ORP (redox potential/Eh)*	field	mV			X			
Dissolved Oxygen (DO)*	field	mg/L			X			
Electrical Conductivity (EC)* +	SM 2510B	µS/cm			X			
Total Dissolved Solids (TDS)	SM 2540C	mg/L			X			
Calcium	6010B	mg/L				X		
Magnesium	6010B	mg/L				X		
Sodium	6010B	mg/L				X		
Potassium	6010B	mg/L				X		
Total Alkalinity (CaCO3)	SM 2320B	mg/L				X		
Chloride (Cl)	300.0	mg/L				X		
Fluoride	300.0	mg/L				X		
Nitrite (as N)	300.0	mg/L						
Aluminum	6010B	µg/L					X	
Antimony	6010B	µg/L					X	
Barium	6010B	mg/L					X	
Beryllium	6010B	µg/L					X	
Cadmium	6010B	µg/L					X	
Total Chromium	6010B	µg/L					X	
Lithium	6010B	µg/L					X	
Mercury	7470A	µg/L					X	
Molybdenum	6020	µg/L					X	
Nickel	6010B	µg/L					X	
Strontium	6010B	µg/L					X	
Thallium	6010B	µg/L					X	
Uranium	6020	pCi/L					X	
Vanadium	6010B	µg/L					X	
Zinc	6020	µg/L					X	
Silica	6010B	mg/L						X
Chlorine Residual	SM 4500	mg/L						X
Chloramines	SM 4500	µg/L						X
Dissolved Sulfides	SM 4500	mg/L						X
Perchlorate	314	µg/L						X
Orthophosphate	365.3	mg/L						X
Total Phosphorous	365.3	mg/L						X
Dissolved Organic Carbon	SM 5310C	mg/L						X
Total Organic Carbon	SM 5310C	mg/L						X

*To be measured in field using a flow-thru cell
+Laboratory measurement too