RECLAMATION

Managing Water in the West

Hydrogeology Monitoring for the 5-Year Groundwater Acquisitions for South of Delta Central Valley Project Improvement Act Refuges

Groundwater Level and Subsidence Monitoring Plan

U.S. Department of the Interior
Bureau of Reclamation
Mid-Pacific Region

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A.1 PROJECT BACKGROUND

The Bureau of Reclamation (Reclamation) proposes entering into the "5-Year Groundwater Acquisitions for South of Delta Central Valley Project Improvement Act Refuges" (Project). The Proposed Action involves acquiring up to 29,000 acre-feet (AF) of Incremental Level 4 (IL4) water annually for a period of 5 years. A portion of the groundwater developed and delivered to the SOD Refuges could be purchased or exchanged with others for SOD Refuge Level 2 (L2) water supplies. These uneven L2 exchanges would provide additional water supplies to SOD Refuges for wetland habitat development and water districts for crop irrigation or domestic purposes.

For further description of the action and background please refer to the "5-Year Groundwater Acquisitions for South of Delta Central Valley Project Improvement Act Refuges" Environmental Assessment (EA Number 15-30-MP).

A.1.1 Groundwater Levels

Groundwater levels will be monitored from all wells utilized in the 5 year project to determine if these water supplies are pumped in a sustainable manner that does not lead to long-term adverse groundwater conditions or third party impacts.

A.1.2 Land Subsidence

Information and data collected for analysis of land subsidence will include land surface elevations data and related information acquired from Reclamation's San Joaquin River Restoration Program (SJRRP) and from United States Geological Survey (USGS) studies in the area around the Project area to ensure that the Project's groundwater pumping does not lead to long-term adverse subsidence impacts that could adversely impact critical infrastructure.

A.2 MONITORING AND REPORTING PLAN

A.2.1 Groundwater Level Measurements

Measure water levels in all wells listed in **Table 1** of **Appendix C** on the following schedule:

> Static water level measurements will be made (i.e after the well pump is turned off) in the wells prior to start up (August or September) and after shut down (December – February) and prior to and following operation of the well if it is utilized for spring and summer irrigation of refuge habitat. Water levels will be measured with an electric well sounder or steel tape no sooner than 24 hours after

the well pump is shut off. The date, time and depth to water from the reference point shall be recorded and entered into an EXCEL spreadsheet.

Measure water levels from a reference point clearly marked on the well by the well owner. Measure water levels from the reference point to the water surface in the well to the nearest tenth of a foot (0.1 feet).

If available, download data collected monthly by the well owner as part of the regional groundwater level monitoring network and incorporate and archive that data with the Project's collected data. DWR's data is available online through the California Statewide Groundwater Elevation Monitoring (CASGEM) database (http://www.water.ca.gov/groundwater/casgem/).

Provide the combined data (e.g., groundwater level data collected on-site and from DWR) in quarterly monitoring reports and in the final annual report as part of the groundwater monitoring program for the Project wells as identified on Table 1.

Measure or estimate pumping volumes from each well and include these data in the quarterly monitoring reports. Measurements shall be made with flow meters or other approved methods. Alternatively, pumping estimates can be made using the methods described in the Water Measurement Manual (USDOI, BOR, 1997). The date and time that the well pumps are turned on and off shall be recorded and reported in the quarterly monitoring reports.

Use the DWR form Excel spreadsheet file named "Groundwater Data Collection Form v1 4-22-15_Generic.xlsx" (See **Appendix D**) for recording groundwater level measurements in the field.

A.2.2 Land Subsidence

Annually, collect land subsidence information and data available for the vicinity of the Project area, including surface level elevations, from various sources including Reclamation's SJRRP, USGS, San Luis & Delta-Mendota Water Authority (SLDMWA), and Central California Irrigation District (CCID).

Annually, analyze the results of the land subsidence data collection and document in a report along with conclusions. Upon completion the annual report will be distributed to all Project parties.

The wells are located within or near the study area of ongoing land subsidence monitoring being conducted by the USGS and the SLDMWA as a continuation of the land subsidence monitoring conducted from 2003 – 2010 that is summarized in USGS Scientific Investigations Report 2013-5142 (Sneed, 2013). The SLDMWA is the Monitoring Agency for the Delta-Mendota Subbasin. Groundwater pumping from below the Corcoran Clay has been identified as the primary cause of aquifer-system compaction and resultant land subsidence in the study area. Although significant land subsidence has been measured within the Delta-Mendota

Subbasin, most of it has occurred south and east of the Project area and has been associated with pumping from the lower zone, beneath the Corcoran Clay. The area in the vicinity of the wells has not been identified as a critical land subsidence area. Both the SLDMWA and CCID maintain land subsidence monitoring programs. Reclamation and CDFW will review the results of those monitoring programs annually, along with the annual analysis of land subsidence data, and collaborate with those agencies to the extent practical to address problems associated with land subsidence and the Proposed Action.

Additionally, the SJRRP is monitoring the subsidence GPS (global positioning system) stations depicted on Map 1 in **Appendix E**. Acquire and review all of the annual data collected by the SJRRP. This information will be summarized in the annual monitoring report.

B.1 ADAPTIVE MANAGEMENT

An adaptive management process will be utilized to ensure that the monitoring for the action achieves the stated objectives and pumping can continue annually without causing cumulative adverse impacts to the local aquifer or land surface elevation. The process should follow the guidance provided in "Adaptive Management: The U.S. Department of Interior Technical Guide" (Williams, 2009). This document can be found at http://www.doi.gov/initiatives/AdaptiveManagement/documents.html.

By May 30 after the first Contract Water Year (beginning March 1 and continuing through the last day of February of the following year) of groundwater pumping, the project proponents and Reclamation shall complete a project management plan to clarify and formalize the monitoring/reporting tasks and schedule. The plan will include explicit and measurable management objectives for future years. The plan may also address any issues related to flow meter calibration certification updates, and any issues related to collecting flow meter values. Each year, Reclamation will review the previous year's monitoring data to determine if water level or subsidence problems have occurred or may occur if pumping continues.

If it is determined that continued pumping of some or all of the wells will lead to adverse irreversible impacts or third party impacts, well owners will cease pumping under the Proposed Action and both parties to the agreement shall identify and agree on an appropriate course of action.

Reference Citations

Sneed, Michelle, Brandt, Justin, and Solt, Mike, 2013, Land Subsidence along the Delta-Mendota Canal in the Northern Part of the San Joaquin Valley, California, 2003–10: U.S. Geological Survey Scientific Investigations Report 2013–5142, 87 p., http://dx.doi.org/10.3133/sir20135142

Williams, B.K.R.C. Szaro, and C.D. Shapiro. 2009, Adaptive Management: The U.S. Department of the Interior Technical Guide. Adaptive Management Working Group, U.S. Department of the Interior, Washington, DC. http://www.doi.gov/initiatives/AdaptiveManagement/documents.html

US Department of Interior, Bureau of Reclamation, 1997. Water Measurement Manual – A Water Resource Technical Publication, U.S. Government Printing Office, Denver CO.

Appendix A: Project Management Plan

To be developed after the first year of pumping.

Appendix B: Acronyms

BOR	Bureau of Reclamation
CCID	Central California Irrigation District
CDWR	California Department of Water Resources
CVPIA	Central Valley Project Improvement Act
GPS	Global Positioning System
Reclamation	United States Bureau of Reclamation
SJRRP	San Joaquin River Restoration Program
SLDMDWA	San Luis Delta Mendota Water Authority
SOP	Standard Operating Procedure
USGS	Unites States Geological Survey
WA	Wildlife Area

APPENDIX C: Table 1 – Proposed Action Details for Groundwater Wells

Table 1 Proposed Action Details for Groundwater Wells

New Well No.	Current Well Designation	Well Production			Discharge Location	GPS Coordinates
		CFS	AF Per Day	MaximumAF/Agreement #		
1	1	5.1	10.1	10,000/ #08-WC-20-3748	Santa Fe Canal	37°06’21.45"N 120°50’9.74W
2	2	1.1	2.2		Santa Fe Canal	37° 06’34.71"N 120°50’21.67"W
3	3	1.1	2.2		Santa Fe Canal	37° 06’51.37"N 120°50’38.43"W
4	5	4.0	7.9		Almond Drive/Habitat Direct	36°59’53.48"N 120°48’0.04"W
5	4	3.0	5.9		Almond Drive/Habitat Direct	37° 00’37.83"N 120°47’59.91"W
6	1	1.0	2.0	3,500/#14-WC-20-4640	Santa Fe Canal	37°06’14.74" N 120°50’01.76"W
7	2	1.0	2.0		Santa Fe Canal	37°06’12.47"N 120°50’00.03"W
8	4	4.5	8.9		Standard Ditch	37°07’35.69"N 120°49’24.53"W
9	7	4.0	7.9	*Wells J & K - Maximum AF is included in 10,000 AF total listed for Wells A-E.	Habitat Direct	37°15’13.34"N 120°56’24.56"W
10	6	2.6	5.1		San Luis Canal	37° 02’18.98"N 120°49’0.68"W
11	R10	8.2	16.3	4,000/ #14-WC-20-4655	San Luis Canal	37°02’06.28"N 120°48’29.93"W
12	R4	5.5	10.9		San Luis Canal	37°04’17.07"N 120°49’33.73"W
13	R3	5.1	10.1		San Luis Canal	37°05’07.36"N 120°50’26.67"W
14	R1	4.2	8.3		San Luis Canal	37°05"23.76"N 120°49’53.90"W
15	G-5(OR-5)*	4.5	8.9	10,000/#08-WC-20-3748 2,000/#14-WC-20-4636	Standard Ditch	37°07’50.02"N 120°49’52.96"W
16	G-4(8.04)*	3.4	6.7		Santa Fe Canal/Habitat Direct	37°07’25.83"N 120°51’11.98"W
17	G-3(8.03)	3.6	7.1	2,000/#14-WC-20-4636	Santa Fe Canal/Habitat Direct	37°08’36.61"N 120°52’20.30"W
18	OR-6	3.6	7.1		Santa Fe Canal	37°06’12.56"N 120°49’59.40"W

Table 1 (Cont.) – Well Information continued

Well	Current Well Designation	Well Production			Discharge Location	GPS Coordinates
		CFS	AF Per Day	Maximum AF/Agreement #		
19	N/A	4.2*	8.3*	N/A	San Luis Canal	37°02’11.68"N 120°48’29.51" W
20	N/A	4.2*	8.3*	N/A	San Luis Canal	37°02’18.94"N 120°48’32.36" W
21	N/A	6.9*	13.7*	N/A	San Luis Canal	37°05’29.11"N 120°50’8.89"W
22	N/A	6.5*	12.9*	N/A	San Luis Canal	37°05’35.86"N 120°50’23.17" W
23	N/A	3.0	5.94	N/A	Santa Fe Canal	37°14’0.59"N 120°54’21.10" W

*Estimated

APPENDIX D: Groundwater Data Collection Form v1 4-22-15_Generic.xlsx

STATE OF CALIFORNIA
THE NATURAL RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

5-Year Groundwater Acquisitions for South of Delta Central Valley Project Improvement Act Refuges

Groundwater Data Collection Form

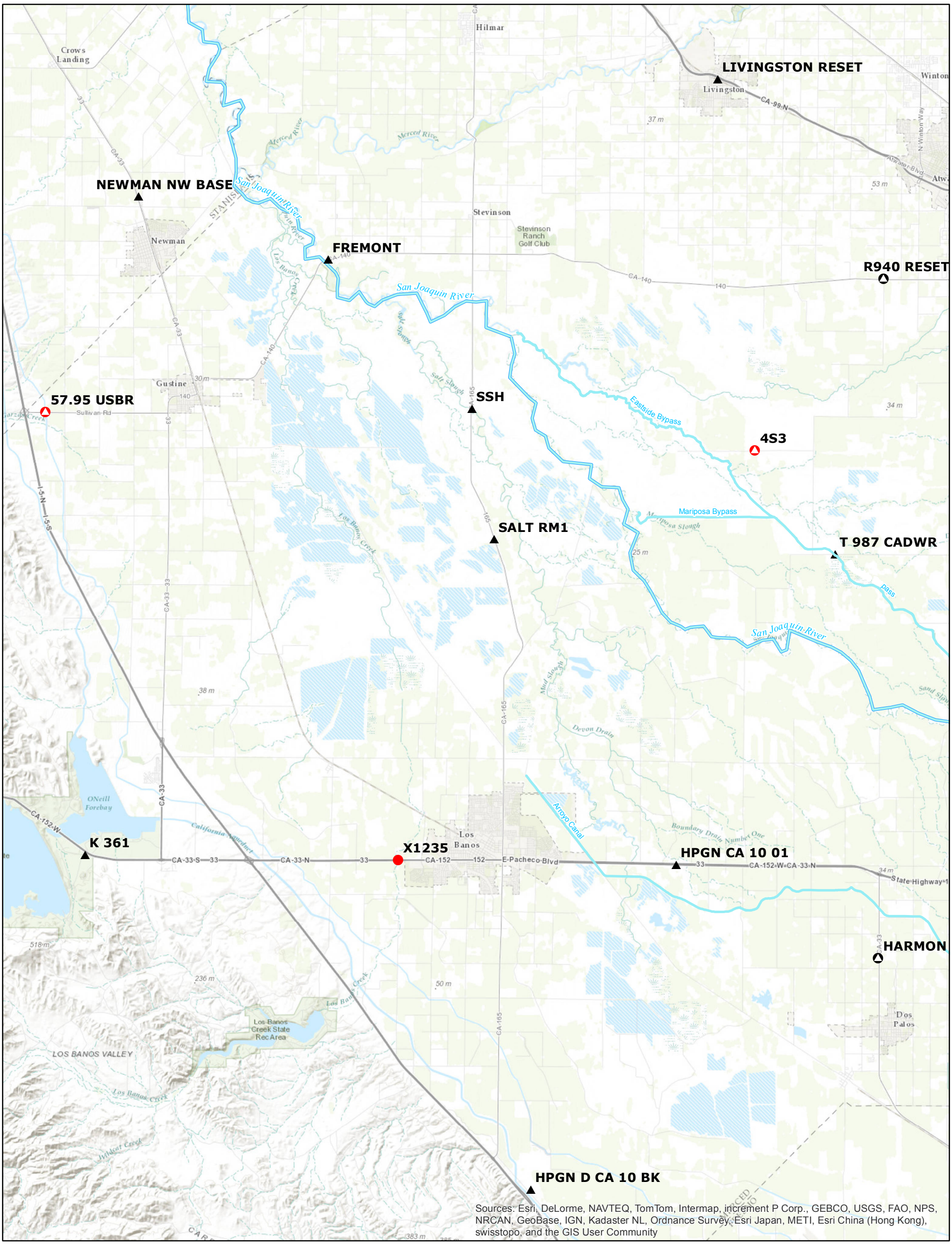
State or Agency Well Number	Production/Monitoring Well Name	County	Measuring Agency	Your Name

Measurement Date	Time (24 hour Time)	Groundwater Level		Water Quality				Production Well Flow, Volume, and Energy Usage							Comments such as water quality meter calibration information, unusual site conditions, etc…
				Optional		Optional									
		Reference Point (ex. Top of Casing, Sounding Tube, etc.)	Water Level (Feet Below Reference Point)	Specific Conductance	Units (µS/cm)	pH (pH units)	Temperature (^{0}F or C)	Pumping (Yes/No)	Instantanous Flow Rate	Flow Rate Units (gpm,cfs, etc.)	Totalizer Reading	Totalizer Units (Gallons, AF, etc.)	Power Consumption	Power Units (KWH or hours of operation)	

Populate blank spaces with **"NA"** indicating Not Applicable.

4/22/2015

APPENDIX E: San Joaquin River Restoration Program Subsidence Monitoring Locations



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Legend

GPS Coordinates

- ▲ GPS Point-December 2011
- GPS Point-added July 2012
- GPS Point-added December 2013

N

0 1 2 4 6 8 Miles

Reclamation Subsidence GPS Stations

Document Path: S:\214-CVP-Friant Division\San Joaquin River\Subsidence Mapping_GIS\20141215-Subsidence Data\SJRRP Subsiidence Mapping-Points Only.mxd