Appendix D - USGS Studies in the Yucaipa Basin

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
California Water Science Center
San Diego Projects Office
4165 Spruance Road, Suite 200
San Diego, California 92101-0812
Office: (619) 222-2243 Fax: (619) 225-6101
http://water.wr.usgs.gov

June 4, 2012

Mr. Douglas Headrick, General Manager
San Bernardino Valley Municipal Water District
380 East Vanderbilt Way
San Bernardino, California 92408

Subject: Accomplishments and additional work for 2012 SBVMWD-USGS program

Dear Mr. Headrick,

This letter describes accomplishments and additional work during federal fiscal year 2012 as part of our cooperative water-resources program between the San Bernardino Valley Municipal Water District (SBVMWD) and the United States Geological Survey (USGS). Specific tasks are described for the three study areas (Bunker Hill/Lytle Creek Basins, Yucaipa Basin, and Rialto-Colton Basin) and for the new Santa Ana Sucker biologic study. Text from the program letter is included for each task; also included at the end of this letter is the funding table for federal fiscal year 2012, which extends from October 1, 2011 through September 30, 2012.

1. Optimal Water Management in the Bunker Hill and Lytle Creek Basins

Work in federal fiscal year 2012 includes:

1a. Providing hydrogeologic support

Hydrogeologic technical support will be provided as requested by SBVMWD. Historically, this support has included (a) ensuring that revisions to the USGS basinwide groundwater flow model are done correctly, (b) reviewing the hydrogeologic work of others, (c) providing technical mediation on difficult topics, and (d) presenting explanations to the SBVMWD board and other groups. Cost for this task is $22,000.

Accomplishments to date include:

- (a) Critique of a new MODFLOW package (MNW2) that will more accurately simulate pumpage and likely could/should be used for the Bunker Hill groundwater flow model. This new package automatically adjusts flow to the well from multiple model layers (geologic formations) based on pressures and flowrate; it also simulates inter-borehole flow when a well is turned off, aiding in correctly tracking contaminated water;

- (a) Modification to MODFLOW so that offset of layers across faults is handled more correctly. This would improve simulation especially in the Lytle Basin and in parts of Redlands;
- (b) Revising the sampling plan for the state-funded GAMA water-quality sampling plan to better characterize the possible groundwater flow from the San Bernardino mountain block to the Bunker Hill Basin. This effort will improve the model water budget and calculation of safe yield;
- (b) Critiquing the U.S. Bureau of Reclamation project to calculate safe yield for the upper Santa Ana basins. This approach seems simplistic and could cause unwanted problems when much more sophisticated groundwater flow models are available to accomplish the same goal;
- (d) Gave the USGS ArkStorm presentation at the request of board member Steve Copelan to the Special Districts meeting in Yucaipa, December 2011. ArkStorm describes atmospheric rivers, which cause much of the flooding and recharge opportunities in the San Bernardino area; and
- (d) Attended several meetings with SBVMWD staff about technical issues.

Additional work will include:

- (b) Attendance at BTAC, Yucaipa, Rialto-Colton, and SAR sucker meetings; and
- (d) Coordinating presentations to the SBVMWD staff and board as requested, probably on the Yucaipa water issues and the Santa Ana sucker.

1b. Publishing USGS Professional Paper 1734

USGS Professional Paper 1734, which provides final documentation of the USGS basinwide groundwater flow model, will be published. Most of this work is complete, including preparation of color figures and a preliminary layout. Remaining work is for the authors to proof the work, make any necessary revisions including those suggested by SBVMWD after publication of the Open-File version of the report, and prepare required electronic and paper copies of the report and requested stand-alone figures, plates, and Powerpoint presentations. Cost for this task is $16,000.

Accomplishments to date include:

- Equations have been type-set;
- Tables have been formatted; and
- A new layout has been prepared.

Additional work will include:

- Figures will be included in layout;
- Document will be checked for accuracy; and
- Document will be sent to printer.

1c. Tracking recharge of imported water

Imported water was recharged in the lower Santa Ana spreading basin in 2009. Since then, groundwater quality data have been collected from the Cone Camp and Riverview multiple-completion well sites in order to track the horizontal and vertical movement of the recharge. This understanding is important (a) in making wise decisions about purchasing and recharging

imported water, and (b) in calibrating the groundwater flow model so it can be used to accurately predict the effects of recharge. A few additional water samples will be collected, and a report summarizing these findings will be prepared. Cost for this task is $132,000.

Accomplishments to date include:

- Water-quality samples were collected bimonthly from the Cone Camp multiple-completion monitoring well site and analyzed for major and minor ions and for tritium, carbon, strontium, and boron isotopes;
- Constituents (ions, trace elements, and isotopes) were identified that characterize imported water and distinguish it from native groundwater; and
- Outline was prepared for the journal article that will identify sources of recharge to the Bunker Hill Basin, track the movement of imported water, and estimate the extent and timing of groundwater flow in the Bunker Hill Basin.

Additional work will include:

- Journal article will be completed and submitted for publication.

2. Hydrogeology of the Yucaipa Basin

Work in federal fiscal year 2012 includes:

2a. Tracking recharge through the Wilson Creek subbasin

Imported water was recharged in the Wilson Creek spreading basin in 2009. Since then, groundwater quality data have been collected from the Wilson Creek multiple-completion well site and nearby production wells in order to track the horizontal and vertical movement of the recharge water. Additional water samples will be collected, in particular from production wells operated by the Yucaipa Valley Water District. Identifying where the recharge water moves and how fast will allow for more effective decisions in choosing where and how much water to recharge in order to aid specific production wells. Cost for this task is $58,000.

Accomplishments to date include:

- Seven water-quality samples were collected from the Wilson Creek multiple-completion monitoring well site; and
- Eleven water-quality samples were collected from production wells operated by the Yucaipa Valley Water District.

Additional work will include:

- The last quarterly water-quality sample will be collected from the multiple-completion monitoring well site and from production wells.

2b. Preparing reports

Reports will be prepared including a data report describing the multiple-completion monitoring well sites; geologic sections to illustrate structure of the basin; and water-level maps to aid in understanding groundwater flow. A previously prepared report summarizing the vertical distribution of nitrate in the basin will be submitted for review. Cost for this task is $156,000.

Accomplishments to date include:

- For the data report documenting the multiple-completion monitoring well sites,
  - Cuttings were photographed and lithologic descriptions were tabulated;

    - Water-quality data were extracted from the USGS database;
    - Figures and tables were created; and
    - Electronic versions of the geophysical logs were archived.
- For the geologic sections and water-level maps,
    - GIS coverages showing different mapping of faults were obtained and compared to define groundwater subbasins; and
    - Gravity model, showing depth and configuration of the basin and subbasins, was updated with the new fault map.

Additional work will include:

- Data report will be finalized, including long-term hydrographs for eleven multiple-depth monitoring well sites;
- Longterm water levels will be prepared as contour maps. These maps will used to identify subbasins and to identify areas of a declining water table; and
- Nitrate report will be revised and submitted for review.

3. Rialto-Colton Basin

Work in federal fiscal year 2012 includes:

3a. Model revisions

Models revisions include modification of the conceptual model on the basis of new data and information that has become available since publication of the existing groundwater flow model; finishing the lithologic model and incorporating it into the flow model; updating the existing flow model temporally to 2010 conditions; and beginning recalibration. Cost for this task is $265,000.

Accomplishments to date include:

- Water-level and pumpage data that became available after 1996, which was the end of the simulation period of the approved model, were collected and compiled;
- Lithologic and structural characterization of the groundwater flow system was completed. Analysis included available borehole logs and INSAR data, as well as gravity, aeromagnetic, and seismic data collected during an earlier phase of this project and from other sources. The availability of lithologic data from the many recently drilled wells allowed for delineation of the location and extent of the perched aquifer which also is included in the characterization. Incorporating the perched aquifer into the flow model is important for more rigorously simulating the fate and disposition of natural and artificial recharge. The value and spatial distribution of aquifer properties in the groundwater flow model are based on the results of the lithologic model. Transport of contaminants is influenced by lithology and the detailed lithologic characterization of the basin will be useful for future transport modeling; and
- Construction of input files for the updated groundwater model was begun.

Additional work will include:

- Model input files will be completed; and

- Model calibration will begin. This revision will allow better simulation of perchlorate movement and other water-management issues.

3b. Groundwater quality sampling

Two wells at the multiple-completion site in the Lytle recharge area will be sampled. Cost for this task is $25,000.

Accomplishments to date include:

- Water-quality data were reviewed for samples collected in 2011 from two wells installed at the multiple-completion site in the recharge area near Lytle Creek north of Barrier J.

Additional work will include:

- Wells at two multiple-completion well sites in the vicinity of the Rialto-Colton Fault zone northwest of Barrier J, which were installed during an earlier phase of this project, will be developed further and sampled; and
- Two additional wells at the multiple-completion well site northwest of Barrier J in the recharge area will be developed further and sampled.

4. Santa Ana Sucker

Work in federal fiscal year 2012 includes:

4a. Phase I – Background work and initial research

The proposed work will be the first step in a multi-phased project directed at prioritizing and addressing appropriate management actions necessary for recovery of the Santa Ana sucker *Catostomus santaanae*. This first phase will include the following tasks: gather existing historical and recent hydrologic and sediment data; synthesize these data into one usable source; identify existing areas with suitable habitat for the Santa Ana sucker; and identify future information needs. This project will be the initial stepping-stone in a series of projects aimed at gaining a better understanding of the hydrologic system in order to guide and inform future management decisions. This project will identify critical partners and employ their local knowledge and expertise in order to better understand and work within this highly managed hydrologic system.

Accomplishments to date include:

- Attended and made a presentation at the Santa Ana Sucker team meeting;
- Toured the Santa Ana River watershed with local cooperators;
- Began compiling and reviewing available information on sediment transport in the Santa Ana River watershed; and
- Began scoping relevant future studies.

Additional work will include:

- Continue scoping future studies; and
- Complete a draft report by September 30, 2012.