



# EAST SAN JOAQUIN WATER QUALITY COALITION GROUNDWATER QUALITY ASSESSMENT OUTLINE

April 10, 2013

**East San Joaquin Water Quality Coalition**  
**Groundwater Quality Assessment Report**  
*Preliminary Outline*

**1. Introduction**

- a. Background
  - i. Eastern San Joaquin Water Quality Coalition
  - ii. Waste Discharge Requirements
- b. Purpose of Groundwater Quality Assessment Report (GAR)
- c. Eastern San Joaquin River Watershed
  - i. Focus: Central Valley Floor (extent of DWR Bulletin 118 groundwater basins/subbasins)
  - ii. Reconnaissance Discussion in GAR: Peripheral Area to Central Valley Floor

**2. Hydrogeology**

- a. Regional geologic setting
  - i. Sources of information
    - 1. Geologic and hydrogeologic data from published reports, including USGS Central Valley Hydrologic Model (CVHM)
  - ii. Regional geology (including existing map(s) and relevant geologic cross sections)
  - iii. DWR Groundwater basins and subbasins
- b. Soil surveys and soil surface characterization
  - i. Sources of information
    - 1. Natural Resources Conservation Service (NRCS)
    - 2. CVHM
    - 3. USGS Digital Elevation Model
    - 4. Irrigation districts (e.g., tile drain information as available)
  - ii. Soil and soil surface characteristics, including soil permeability and chemistry and surface slope and drainage characteristics; map(s) of soils
  - iii. Known tile drain distribution as readily available
- c. Groundwater hydrology
  - i. Sources of information
    - 1. CVHM
    - 2. DWR
    - 3. USGS

4. USBR
  5. SWRCB GeoTracker
  6. Local entities (irrigation districts, etc.)
- ii. Recharge to groundwater
    1. Sources of recharge (as identified in existing publications)
    2. Identification of significant recharge areas (i.e., particularly upgradient of urban areas)
    3. Recharge rates (Central Valley Floor; based on CVHM information)
  - iii. Depth to groundwater
    1. Central Valley Floor
      - a. Current “Spring” depth to groundwater contours
      - b. Current “Fall” depth to groundwater contours
      - c. Identification of potential groundwater discharge areas associated with irrigated lands
    2. Peripheral Area (as available)
      - a. Current “Spring” depth to groundwater contours (select areas with sufficient data)
      - b. Current “Fall” depth to groundwater contours (select areas with sufficient data)
  - iv. Groundwater level trends
    1. Selected illustrative hydrographs in Watershed (emphasis Central Valley Floor)
    2. Focus on “Shallower” part of aquifer system
  - v. Groundwater Flow Directions
    1. Contours of equal groundwater elevation (focus on shallow/upper part of aquifer system, as available data allow)
      - a. Current “Spring” groundwater contours
      - b. Current “Fall” groundwater contours
    2. Areas of recharge upgradient of urban areas
      - a. Identify locations of interest where irrigated land use occurs where potential for recharge exists upgradient of urban and rural communities (e.g., hydrogeology and soils conducive to recharge)

### **3. Land Use**

- a. Sources of information
  - i. Existing data of ESJWQC land cover
  - ii. DWR

- iii. USDA
  - iv. County agricultural departments
- b. Land cover (may include snapshots (maps) of historical and most current land cover pending data availability; focus on Central Valley Floor)
- c. Predominant commodities (based on current, available land cover information; particularly commodities representing the top 80% of irrigated agricultural crops)
- d. Irrigation practices generally associated with predominant commodities (as presently known and available)
- e. Fertilization methods and soil amendments generally associated with predominant commodities (as presently known and available)

#### **4. Groundwater Quality**

- a. Sources of information (existing online data sources)
  - i. DWR
  - ii. USGS
  - iii. GAMA Domestic
  - iv. California Department of Public Health (CDPH)
  - v. SWRCB GeoTracker GAMA
  - vi. RWQCB Dairy
  - vii. Department of Pesticide Regulation (DPR)
  - viii. County health dept. data for domestic wells (if readily available)
- b. Constituent focus: nitrate, salt (TDS/EC), pesticides (as monitored by DPR)
- c. Shallow groundwater quality – spatial representation of current quality
  - i. Nitrate concentrations, spatially
    - 1. Central Valley Floor
    - 2. Peripheral Area (as available)
  - ii. Salt concentrations, spatially
    - 1. Central Valley Floor
    - 2. Peripheral Area (as available)
  - iii. Pesticide detections, spatially
    - 1. Central Valley Floor
    - 2. Peripheral Area (as available)
- d. Shallow groundwater quality trends (time-series)
  - i. Nitrate concentrations (time-series plots)
    - 1. Central Valley Floor
    - 2. Peripheral Area (as available)

- ii. Nitrate concentrations: spatial distribution of trends (linear regression analysis of temporal trends for wells with sufficient historical records)
  - 1. Central Valley Floor
  - 2. Peripheral Area (as available)
- iii. Salt concentrations (time-series plots)
  - 1. Central Valley Floor
  - 2. Peripheral Area (as available)
- iv. Salt concentrations: spatial distribution of trends (linear regression analysis of temporal trends for wells with sufficient historical records)
  - 1. Central Valley Floor
  - 2. Peripheral Area (as available)
- v. Pesticide concentrations (time-series plots pending historical data availability from DPR)
  - 1. Central Valley Floor
  - 2. Peripheral Area (as available)
- e. Additional groundwater quality characteristics
  - i. Review regionally applicable USGS GAMA reports and summarize constituents (i.e., constituents other than salt, nitrate and pesticides) that exhibit elevated concentrations (e.g., above a drinking water standard as applicable)

## **5. Vulnerability Assessment**

- a. Summary of existing groundwater vulnerability assessment methods and methods used previously by others (e.g., SWRCB and DPR)
- b. Methodology for determining vulnerability for irrigated lands (e.g., statistical analyses to evaluate co-relationships between hydrogeologic parameters including depth to groundwater and soil permeability and groundwater quality observations)
  - i. Determine statistical analyses to evaluate relative weighting (importance) of hydrogeologic parameters based on observed groundwater quality (e.g., multiple regression)
  - ii. Establish matrix for vulnerability parameters and parameter subdivisions (i.e., decide which parameters to evaluate and as needed establish ranges of values for parameter types; Ex. – depth to water 0-10 ft, 10-20 ft, >20ft)
  - iii. Identify statistical sample datasets (areas unaffected by adjacent non-irrigated land uses or other external influences)
  - iv. Develop vulnerability formula based on hydrogeologic parameters (generated from statistical analyses which includes weighting attributes)
  - v. Apply/extrapolate formula to entire irrigated lands area
  - vi. Evaluate results with respect to observed groundwater quality

- vii. Synthesize results to generate areas of relative vulnerability based on hydrogeologic parameters
  - viii. Comparison of results with other groundwater vulnerability assessments for the area
- c. Present rationale for identifying relatively higher compared to lower vulnerability areas based on vulnerability quantification
- d. Present rationale for prioritization of higher vulnerability areas
  - i. Consideration of existing groundwater quality observations especially exceedances of water quality objectives (e.g., nitrate exceeding the MCL)
  - ii. Consideration of historical groundwater quality and trends (improving groundwater quality, declining groundwater quality, rate of trends)
  - iii. Proximity of high vulnerability areas to areas contributing recharge to urban and rural communities that rely on groundwater
  - iv. Consideration of constituent toxicity and mobility
  - v. Existing operational practices identified to be associated with irrigated agricultural waste discharges (i.e., practices as currently known and available).
  - vi. The largest acreage commodity types comprising up to at least 80% of the irrigated agricultural acreage in the high vulnerability areas and the irrigation and fertilization practices employed by these commodities (i.e., irrigation and fertilization practices as currently known and available).

## **6. Groundwater Monitoring Programs**

- a. Sources of information (existing groundwater monitoring programs)
  - i. DWR/CASGEM
  - ii. GAMA
  - iii. USGS
  - iv. DPR
  - v. Groundwater Management Plans in Watershed area
  - vi. RWQCB – Dairy monitoring programs
- b. Summary of existing groundwater monitoring programs (including map(s) and table(s))
- c. Identify key data gaps for wells in existing monitoring programs (e.g., well construction information, accurate spatial coordinates, constituents analyzed, etc.)
- d. Preliminary assessment of feasibility of using existing monitoring wells for future Trend Monitoring purposes (e.g., well has construction information)
- e. Preliminary recommendations related to information needs for purposes of preparation of Trend Monitoring Workplan (e.g., recommend effort as needed to establish monitoring network)

## 7. Summary and Recommendations

- a. Summary of GAR findings
- b. Recommendations regarding relatively higher vulnerability areas, currently observed groundwater quality, and prioritization of higher vulnerability areas
- c. Recommendations relating to data gaps and future development of the Trend Monitoring Program

**Note:** Numerous figures and tables are anticipated in order to illustrate components of the GAR; not all anticipated tables and figures are identified in the outline.

## Preliminary List of Potential Data Sources

Data Type	Database Source	Source Location or Description
Slope/DEM	USGS National Elevation Dataset (NED)	<a href="http://ned.usgs.gov/">http://ned.usgs.gov/</a>
Hydrogeology/ Recharge	Central Valley Hydrologic Model (CVHM)	<a href="http://ca.water.usgs.gov/projects/central-valley/central-valley-hydrologic-model.html">http://ca.water.usgs.gov/projects/central-valley/central-valley-hydrologic-model.html</a>
	Published hydrogeology literature	Important publications on hydrogeology of area
Soils	Natural Resources Conservation Service (NRCS)	<a href="http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm">http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm</a>
Tile Drain Locations	Irrigation districts	Readily available tile drain location data
Water Level	DWR: Water Data Library	<a href="http://www.water.ca.gov/waterdatalibrary/">http://www.water.ca.gov/waterdatalibrary/</a>
	DWR: California Statewide Groundwater Elevation Monitoring (CASGEM)	<a href="http://www.water.ca.gov/groundwater/casgem/">http://www.water.ca.gov/groundwater/casgem/</a>
	SWRCB GeoTracker	<a href="http://geotracker.waterboards.ca.gov/data_download_by_county.asp">http://geotracker.waterboards.ca.gov/data_download_by_county.asp</a>
	USGS: National Water Information System	<a href="http://waterdata.usgs.gov/nwis">http://waterdata.usgs.gov/nwis</a>
Groundwater Quality – TDS/Nitrate/ Pesticides	USGS: National Water Information System	<a href="http://waterdata.usgs.gov/nwis">http://waterdata.usgs.gov/nwis</a>
	CDPH	<a href="http://www.cdph.ca.gov/certlic/drinkingwater/Pages/Monitoring.aspx">http://www.cdph.ca.gov/certlic/drinkingwater/Pages/Monitoring.aspx</a>
	Geotracker GAMA	<a href="http://geotracker.waterboards.ca.gov/gama/">http://geotracker.waterboards.ca.gov/gama/</a>
	RWQCB (WDR Dairy Data)	San Joaquin Valley Data: SWRCB Region 5 office, Fresno, CA. Sacramento Valley Data: SWRCB Region 5 office, Sacramento, CA
	DWR: Water Data Library	<a href="http://www.water.ca.gov/waterdatalibrary/">http://www.water.ca.gov/waterdatalibrary/</a>
	County health departments	Readily available domestic well water quality data
	California Department of Pesticide Regulation (DPR)	Environmental Monitoring Branch, Sacramento, CA
Land Use/Crop	ESJWQC (Coalition)	Existing ESJWQC data
	DWR	<a href="http://www.water.ca.gov/landwateruse/lusrvymain.cfm">www.water.ca.gov/landwateruse/lusrvymain.cfm</a>
	USDA	<a href="http://www.nass.usda.gov/research/Cropland/SARS1a.htm">http://www.nass.usda.gov/research/Cropland/SARS1a.htm</a>
	County agricultural departments	Crop reports and other readily available data



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- California Department of Water Resources (DWR), no date shown, A preliminary assessment of salt-affected soils in the San Joaquin Valley. Map. Data Sources: USDA NRCS, SSURGO.

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<sup>1</sup> This is a preliminary list of potential references that may be used during the preparation of the ESJWQC's Groundwater Quality Assessment Report. Not all of the references shown at this time will necessarily be used. Other references may also be added.

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## Cross-Reference Table between GAR Outline and WDR General Order R5-2012-0116

GAR Items Identified in Monitoring and Reporting Program (Appendix B) of the Eastern San Joaquin River Watershed WDR General Order	Addressed in GAR Outline
<p><b>1. Objectives</b></p> <p>A. Provide an assessment of all available, applicable and relevant data and information to determine the high and low vulnerability areas where discharges from irrigated lands may result in groundwater quality degradation.</p> <p>B. Establish priorities for implementation of monitoring and studies within high vulnerability areas.</p> <p>C. Provide a basis for establishing workplans to assess groundwater quality trends.</p> <p>D. Provide a basis for establishing workplans and priorities to evaluate the effectiveness of agricultural management practices to protect groundwater quality.</p> <p>E. Provide a basis for establishing groundwater quality management plans in high vulnerability areas and priorities for implementation of those plans.</p>	<p>Throughout</p> <p>Section 5</p> <p>Throughout</p> <p>Throughout</p> <p>Throughout</p>
<p><b>2. Components</b></p> <p>A. Detailed land use information with emphasis on land uses associated with irrigated agricultural operations. The information shall identify the largest acreage commodity types in the third-party area, including the most prevalent commodities comprising up to at least 80% of the irrigated agricultural acreage in the third-party area.</p> <p>B. Information regarding depth to groundwater, provided as a contour map(s).</p> <p>C. Groundwater recharge information, including identification of areas contributing recharge to urban and rural communities where groundwater serves as a significant source of supply.</p> <p>D. Soil survey information, including significant areas of high salinity, alkalinity and acidity.</p> <p>E. Shallow groundwater constituent concentrations (potential constituents of concern include any material applied as part of the agricultural operation, including constituents in irrigation supply water [e.g., pesticides, fertilizers, soil amendments, etc.] that could impact beneficial uses or cause degradation).</p> <p>F. Information on existing groundwater data collection and analysis efforts relevant to this Order (e.g., Department of Pesticide Regulation [DPR] United States Geological Survey [USGS] State Water Board Groundwater Ambient Monitoring and Assessment [GAMA], California Department of Public Health, local groundwater management plans, etc.). This groundwater data compilation and review shall include readily accessible information relative to the Order on existing monitoring well networks, individual well details, and monitored parameters. For existing monitoring networks (or portions thereof) and/or relevant data sets, the third-party should assess the possibility of data sharing between the data-collecting entity, the third-party, and the Central Valley Water Board.</p>	<p>Section 3</p> <p>Section 2</p> <p>Section 2</p> <p>Section 2</p> <p>Section 4</p> <p>Section 6</p>
<p><b>3. Data Review and Analysis</b></p> <p>A. Determine where known groundwater quality impacts exist for which irrigated agricultural operations are a potential contributor or where conditions make groundwater more vulnerable to impacts from irrigated agricultural activities.</p> <p>B. Determine the merit and feasibility of incorporating existing groundwater data collection efforts, and their corresponding monitoring well systems for obtaining appropriate groundwater quality information to achieve the objectives of and support groundwater monitoring activities under this Order. This shall include specific findings and conclusions and provide the rationale for conclusions.</p> <p>C. Prepare a ranking of high vulnerability areas to provide a basis for prioritization of workplan activities.</p> <p>D. The GAR shall discuss pertinent geologic and hydrogeologic information for the third-party area(s) and utilize GIS mapping applications, graphics, and tables, as appropriate, in order to clearly convey pertinent data, support data analysis, and show results.</p>	<p>Section 4</p> <p>Section 6</p> <p>Section 5</p> <p>Section 2</p>
<p><b>4. Groundwater Vulnerability Designations</b></p> <p>A. Designate high/low vulnerability areas for groundwater in consideration of high and low vulnerability definitions provided in Attachment E of the Order.</p> <p>B. The vulnerability designations will be made by the third-party using a combination of physical properties (soil type, depth to groundwater, known agricultural impacts to beneficial uses, etc.) and management practices (irrigation method, crop type, nitrogen application and removal rates, etc.).</p> <p>C. The third-party shall provide the rationale for proposed vulnerability determinations.</p>	<p>Section 5</p> <p>Section 5</p> <p>Section 5</p>
<p><b>5. Considerations for Prioritization of High Vulnerability Groundwater Areas</b></p> <p>A. Identified exceedances of water quality objectives for which irrigated agriculture waste discharges are the cause, or a contributing source.</p> <p>B. The proximity of the high vulnerability area to areas contributing recharge to urban and rural communities where groundwater serves as a significant source of supply.</p> <p>C. Existing field or operational practices identified to be associated with irrigated agriculture waste discharges that are the cause, or a contributing source.</p> <p>D. The largest acreage commodity types comprising up to at least 80% of the irrigated agricultural acreage in the high vulnerability areas and the irrigation and fertilization practices employed by these commodities.</p> <p>E. Legacy or ambient conditions of the groundwater.</p> <p>F. Identified constituents of concern, e.g., relative toxicity, mobility.</p>	<p>Section 5</p> <p>Section 5</p> <p>Section 5</p> <p>Section 5</p> <p>Sections 4 &amp; 5</p> <p>Sections 4 &amp; 5</p>