CALIFORNIA
Water Boards

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ENVIRONMENTAL PROTECTION

Central Valley Regional Water Quality Control Board

26 April 2016

Casey Creamer
Kings River Watershed Coalition Authority
P.O. Box 8259
Fresno, CA 93747

CONDITIONAL APPROVAL OF THE KINGS RIVER WATERSHED COALITION AUTHORITY GROUNDWATER QUALITY ASSESSMENT REPORT

Thank you for the 20 November 2014 submittal of the Kings River Watershed Coalition Authority (Coalition) Groundwater Quality Assessment Report (GAR), as required by Waste Discharge Requirements General Order R5-2015-0120 (General Order). The purpose of the GAR is to provide the foundational information necessary for design of the Management Practice Evaluation Program, the Groundwater Quality Trend Monitoring Program, and the Groundwater Quality Management Plan(s).

As outlined in the enclosed staff review, the information provided in the submittal partially addresses the General Order's main GAR objectives. However, additional data and information need to be collected, evaluated, and incorporated into the Coalition's conceptual hydrogeologic model as it moves forward with the Management Practice Evaluation Program, the Groundwater Quality Trend Monitoring Program, and the Groundwater Quality Management Plan(s).

In order to facilitate implementation of the General Order's post-GAR groundwater requirements I am conditionally approving the Coalition's GAR upon submittal of a copy that is signed and stamped by a California registered professional geologist or engineer (see Item 17 of the attached memorandum), and which contains the appropriate certification statement (see Section IX.3 of the General Order). This conditional approval acknowledges changes in HVAs made in response to Revising Order R5-2014-0143, and provides a pathway for the Coalition to address issues identified in the staff review through future work plans and the 5-year GAR update while also allowing the Coalition to expeditiously proceed with the important work of the Management Practice Evaluation

Program, the Groundwater Quality Trend Monitoring Program, and the Comprehensive Groundwater Quality Management Plan.

By 26 May 2016, please submit signed and stamped copy of the Coalition's GAR. All other items identified in the staff review need to be addressed in accordance with the schedule in Table 1 - *Summary of Issues to be Addressed in Forthcoming Work Plans* (enclosed).

If you have any questions, please contact David Sholes at (559) 445-6279 or by e-mail at David.Sholes@waterboards.ca.gov.

Sincerely,

Original signed by:

Pamela C. Creedon
Executive Officer
Enclosure: Staff Review Memorandum

cc: Sue McConnell, Central Valley Water Board, Rancho Cordova

Table 1
Summary of Issues to be Addressed in Forthcoming Work Plans

Staff Memorandum Item	Management Practice Evaluation Program	Groundwater Quality Trend Monitoring Program	Groundwater Quality Management Plan(s)	Groundwater Quality Assessment Report 5 Year Update
1.A	X	X		X
1.B		X		X
1.C		X		X
1.D		X		X
1.E		X		X
1.F		X		X
1.G		X		X
3.A	X	X		X
3.B	X	X		X
4	X	X		X
6.A	X	X		X
6.B	X	X		X
8.A		X		X
8.B		X		X
10.A		X		X
10.B		X		X
10.C		X		X
12.A		X		X
12.B		X		X
15	X	X		X
16.A		X		X
16.B		X		X
17	X	X		X

TO: David Sholes, CEG
Senior Engineering Geologist
Irrigated Lands Regulatory Program

FROM: Eric Warren
Water Resource Control Engineer
Irrigated Lands Regulatory Program

DATE: 26 April 2016

SUBJECT: **REVIEW OF 20 NOVEMBER 2014 GROUNDWATER QUALITY ASSESSMENT REPORT FOR THE KINGS RIVER WATERSHED COALITION AUTHORITY**

On 20 November 2014, the Kings River Watershed Coalition Authority (KRWCA or Coalition) submitted a Groundwater Quality Assessment Report (GAR) in accordance with the Monitoring and Reporting Program (MRP) for Waste Discharge Requirements General Order R5-2013-0120 (General Order or Order). The GAR provides the foundational information necessary for design of the Management Practices Evaluation Program (MPEP), the Groundwater Quality Trend Monitoring Program, and the Groundwater Quality Management Plan(s) (GQMPs).

On 4 December 2014, the California Regional Water Quality Control Board, Central Valley Region (Central Valley Water Board or Water Board) adopted Revising Order R5-2014-0143. The revising Order included requirements for the Coalition to meet with Water Board staff to discuss the proposed process for determining high and low vulnerability areas (HVAs). As a result of this meeting, the HVAs proposed in the GAR were revised in a separate submittal to the Water Board. The GAR and subsequent submittal were reviewed to determine compliance with requirements pursuant to section VIII.D.1 of the Order, section IV.A of the MRP, and the Revising Order R5-2014-0143.

Water Board staff's review of the GAR concluded that modifications and additions are necessary to the GAR to meet the terms and conditions of the General Order; however, many of the required modifications can be included in subsequent work plans or GAR updates. Table 1 provides descriptions of the required GAR components from the General Order and MRP and lists the section in the GAR that addresses each component. Recommended revisions/additions for incomplete items are provided below. The memorandum item numbers correspond to item numbers in Table 1.

Item 1. Assessment of Readily Available, Applicable, and Relevant Data and Information to Determine High and Low Vulnerability Areas

The General Order (Section VIII.D.1) requires that the GAR provide an assessment of all readily 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. While a portion of the available data was identified and discussed in the GAR, a large quantity of available information was ultimately not utilized. This has given rise to a variety of assumptions that have affected the interpretation of the water quality data present within and adjacent to the Coalition's boundaries. Recommended revisions include the following:

A. Figure 4-1 of the GAR depicts the major water sources, reservoirs, and regional conveyance systems that cross or lie within the Coalition area. Based on this figure, it is unclear whether the GAR considered the influence of a majority of the constructed agricultural conveyance structures (e.g., canals, ditches) present throughout the Coalition area. The Coalition should utilize the Unites States Geological Survey (USGS) National Hydrography Dataset (NHD) in conjunction with available irrigation district data to evaluate the contribution of these waterways to local and regional groundwater recharge, and their overall effect on groundwater vulnerability. In addition, the GAR does not provide sufficient information regarding how quantity of recharge is estimated, or address the variance in recharge rates due to allocation of available supply in wet or dry years. Table 2-1 of the GAR includes a statement that "expert knowledge is used to roughly approximate the allocation of imported surface waters (and use of groundwater) to the demand sinks associated with agricultural and urban uses." No further information was provided regarding the qualifications of the individual, the process used to calculate or estimate the values, or whether annual climate variations and changes in distribution were accounted for. Additional explanation of these factors is needed.

B. Nitrate groundwater data from the Department of the Interior Bureau of Reclamation's Pump-in Program (wells discharging into the Friant-Kern Canal) should be obtained, evaluated, and included in the GAR's discussion of the influence of the Friant-Kern Canal on regional groundwater quality and recharge (Temporary Change in Water Quality Requirements for the Friant-Kern Canal Groundwater Pump-in Program, 2014, U.S. Department of the Interior Bureau of Reclamation, Draft Finding of No Significant Impact, October 2014, FONSI-14-043).

C. Section 4.2 of the GAR should include a discussion/acknowledgement that well bores may provide potential preferential pathways for vertical migration between aquifers and how this may reflect on groundwater chemistry. As stated by a variety of USGS investigators (Lofgren and Klausing 1969, Williamson et al. 1989, Bertoldi et al. 1991, Burow et al. 2012), the high density of wells constructed with long perforated sections or multiple well screens provides vertical hydraulic connections within the aquifer system. The presence of tens of thousands of irrigation wells perforated at various levels (Harou and Lund 2008) has lead USGS investigators and modelers to the concept of a single heterogeneous aquifer within the Central Valley with varying vertical leakage and confinement. This

concept/discussion should be carried forward into the groundwater recharge discussions presented in the GAR.

D. Section 3.3 of the GAR includes a discussion regarding the readily available sources of groundwater quality data, and the selection criteria for the datasets deemed appropriate to use in the assessment of groundwater quality within the Coalition area. The GAR utilized water quality data compiled for the Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) Task 3 requirement of the Phase II Conceptual Model Workplan, and a subset of the GeoTracker Groundwater Ambient Monitoring and Assessment Program (GAMA) dataset for pesticides. While the CV-SALTS dataset is a large compilation of existing datasets, it does not include readily available monitoring data collected as part of the Central Valley Dairy Representative Monitoring Program. This data should be obtained, evaluated, and incorporated into the vulnerability analysis.

E. Section 5.3.2 of the GAR states that the groundwater quality results contained in the GeoTracker GAMA dataset were filtered only for constituents which came from the Department of Pesticide Regulation (DPR), but does not provide an explanation of why. USGS data, including the GAMA studies, contain pesticide detections within the Coalition area and should be incorporated into the vulnerability analysis. If the accurate location of some of the wells is unknown, the vulnerability designations should reflect the inexact nature of the data.

F. Section 5.3.1 of the GAR mentions the GAMA-Electronic Deliverable Format (EDF) portion of the CV-SALTS dataset, which contains groundwater monitoring data collected from environmental cleanup sites and other regulated facilities. The section notes that this data was omitted due to an assumption that the data would contain anomalously high values, and identifies the regulated facilities as the potential source of constituent concentrations. Environmental monitoring data collected at regulated facilities includes site-specific constituents of concern (e.g., gasoline constituents) in addition to other constituents which may provide supplemental information (e.g., monitoring of nitrate is often conducted to assess the presence/concentrations of electron acceptors for remediation purposes). It is not appropriate to omit potentially useful groundwater quality data based on the provided assumptions. The Coalition should evaluate the dataset to determine what monitoring data may aid in the assessment of groundwater quality and identification of areas where discharges from irrigated lands may result in groundwater quality degradation.

G. Evaluating groundwater quality data without knowing the depth within the aquifer from which the sample was obtained provides an incomplete picture for purposes of assigning vulnerability. While some portion (likely a large portion) of the evaluated wells may not have construction information available, where such information is available it should be utilized in the evaluation of water quality data (e.g., well construction details should be compared to the depth to groundwater maps contained in the GAR and the historical maps presented on the California Department of Water Resources website to determine potential differences between shallow and deeper groundwater quality).

Well construction in relation to the depth of first encountered groundwater is particularly important as it has been established by a variety of USGS investigators and academics that nitrate concentrations decline with depth below first encountered groundwater (Burow et al. 1998; Burow et al. 2012; Fuhrer et al. 1999, Rupert 1999). Therefore, areas for which only deep groundwater quality data are available cannot be assumed to be low vulnerability based solely on this data. Additional efforts need be made to obtain shallow groundwater quality data to comply with the requirements of the General Order (MRP Section IV. A. 2). A discussion should be developed regarding differences in shallow groundwater concentrations of constituents of concern (COC's) and deeper groundwater chemistry obtained from the same region. Any such discussion should be tied to an evaluation of the apparent age of the groundwater sampled, the depth to groundwater in these wells, and how this reflects on data interpretation.

Item 3. Basis for Establishing Monitoring Work Plans Developed to Assess Groundwater Quality Trends

The General Order (Section VIII.D.1) requires that the GAR provide the basis for establishing work plans to assess groundwater quality trends. To address this requirement the GAR included information regarding agricultural commodities produced within the Coalition area, an analysis of the conditions contributing to groundwater vulnerability and where the conditions exist, and the identification of areas contributing significant recharge to communities where groundwater serves as a significant source of supply.

While the GAR has demonstrated the Coalition has a sufficient understanding of the Trend Monitoring Work Plan development process, the effectiveness of the work plan is ultimately dependent upon the quality of the data and evaluation provided in the GAR. Item 1 of this review addresses readily available data that needs to be incorporated into the GAR in order for it to provide a sufficient basis for the development of a Trend Monitoring Work Plan. In addition, several issues potentially effecting the development of groundwater monitoring work plans were identified during the review and are summarized below:

A. Section 7.4.1.3 of the GAR addresses the sampling and testing of private wells as part of the Coalition's groundwater monitoring activities. The section notes the presence of existing data gaps, and agreements with growers and well owners that will be needed to provide data in these areas. It continues to state that, "Agreements may require confidentiality of location. The location could be kept confidential in a similar fashion to the municipal supply wells, and results could be reported only by the section or quarter section." Per Section V.C. of the MRP, the annual monitoring report submitted by the Coalition must include location map(s) showing sampling sites/monitoring wells with latitude and longitude provided in decimal degree at a minimum of five decimal places. The Coalition should develop any groundwater monitoring work plans with the understanding that the location of sampling points will be provided.

B. In June 2015, subsequent to the GAR submittal, Senate Bill 83 amended California Water Code §13752 to allow public access to well completion reports. The Department of Water Resources is currently in the process of redacting personal information from the reports, which are expected to become available online within the next year and are currently available upon request. The Coalition should utilize the available resource during the development of groundwater monitoring work plans.

Item 4. Basis for Establishing Management Practices Evaluation Program (MPEP) Work Plans

A coordination agreement submitted to the Central Valley Water Board on 20 November 2014 indicated that that the Coalition has elected to participate in the group option for developing the Management Practice Evaluation Work Plan (MPEP) required under the General Order. The GAR also specifies that, "The MPEP objective is primarily to document the water quality protection benefits of the specific on-farm and commodity activities to be included in the MPEP."

While the GAR clearly states the purpose and objectives of the MPEP as written in the Order, it does not provide the specific information necessary to form the basis for the monitoring program. As the emphasis of the MPEP is specifically related to shallow first encountered groundwater, the GAR should be revised to identify geographically where existing shallow groundwater data are available and evaluate these data for evidence of discharges of waste from irrigated lands. The GAR also needs to specify how the Coalition intends to incorporate this information into the development of the MPEP.

Item 6. Land Use and Management Practices Information

Section IV.A.2 of the Monitoring and Reporting Program requires that the GAR include detailed land use information for the Coalition's area and identify the largest acreage commodity types (including the most prevalent commodities comprising up to at least 80% of the Coalition's irrigated agricultural acreage). The information provided in Section 4.3 of the GAR related to agricultural land use indicates that the 2010 California Augmented Multisource Landcover (CAML) was used in the assessment. The following issues were identified regarding the land use data presented, and need to be addressed:

A. The referenced CAML dataset is composed of California Department of Water Resources (DWR) Land Use Surveys from 1999, 2000, and 2003 for Tulare, Fresno, and Kings counties, respectively. Land use data is a key component of the GAR, and the accuracy of these data is particularly important in the design and implementation of the MPEP. More recent data have been published by DWR for Tulare (2007) and Eastern Fresno County (2009), and should be reviewed by the Coalition during the development of the MPEP. In addition, the United States Department of Agriculture, National Agricultural Statistics Service has utilized satellite imagery to produce crop-specific maps and acreage estimates for the major agricultural commodities grown within the state. Future updates to the GAR submittal should include the most recent land use information available, with consideration for the quality of the data source.

B. Section 4.3.3 of the GAR concludes that the DWR Land Use Surveys used in the CAML datasets compare well to the County Agricultural Commissioner's Pesticide Use Reports for the corresponding years. Following this logic, it is unclear why the Coalition would not choose to use the most recent pesticide use reports, which are updated annually. Consideration should be given to these datasets during the development and implementation of the MPEP.

Item 8. Groundwater Recharge

Section IV.A.2 of the Monitoring and Reporting Program requires that the GAR include information regarding groundwater recharge within the Coalition area, including the identification of areas contributing recharge to urban and rural communities where groundwater serves as a significant source of supply. Although the GAR did include some information on groundwater recharge, review of this material has identified issues with the approach used (detailed below) and additional information that is needed. The GAR should be revised to address these issues and provide the necessary additional information.

A. Section 4.1.4 of the GAR provides estimated diversions to canal distribution systems within the Coalition area. However, it does not appear that the influence of these distribution systems was incorporated into the groundwater vulnerability analysis. Section B.7 of Appendix B of the GAR details the process used to quantify the recharge rates of surface water bodies within the Coalition area. The process relies on the Kings Basin Integrated Groundwater and Surface Water Model (IGSM) to provide an estimation of flows and stream-aquifer interactions for two major rivers, nine creeks, and fourteen major canals. The model outputs provided in Figure B-28 and B-31 omit a large portion of the surface water conveyance canals that contribute significant recharge to urban and rural communities, and does not provide information for portions of Coalition area assessed by the GAR (e.g., most of Kings County falls outside the scope of the model). The Coalition should supplement the assessment by consulting other sources of information to identify areas of recharge, and incorporate the information during the development of groundwater monitoring work plans.

B. The GAR should be revised to include an evaluation of all recharge and flood control basins within the Coalition's area, and the effect these facilities have on urban and rural groundwater supply. Consideration should also be given to current and proposed on-farm flood flow capture projects, such as the Terranova Ranch groundwater recharge pilot study and the McMullin On-Farm Flood Capture and Recharge Project.

Item 10. Shallow Groundwater Constituent Concentrations from Existing Monitoring Networks

Section IV.A.2 of the Monitoring and Reporting Program requires that the GAR include information and data on shallow groundwater constituent concentrations that could be related to agricultural activities. As discussed in Item 1 above, the GAR omits a significant amount of readily available groundwater quality data, and consequently presents a partial assessment of shallow groundwater constituent concentrations within the Coalition area. Several examples of

readily available datasets are provided below. The Coalition should evaluate these and any other available sources of shallow groundwater quality data during the development of groundwater monitoring work plans.

A. The GAR utilized Nitrate and TDS results from the CV-SALTS dataset compiled as part of the Task 3 requirement of the Phase II Conceptual Model Work Plan. The dataset is a compilation of existing datasets from the Central Valley Dairy Representative Monitoring Program, California Department of Public Health, Department of Water Resources, United States Geological Survey, and Geotracker Groundwater Ambient Monitoring and Assessment program. The CV-SALTS dataset utilized the latest data available from these sources as of 2014, with the exception of the dairy data. More recent dairy data has been collected through the Waste Discharge Requirements General Order R5-2007-0035 for Existing Milk Cow Dairies (Dairy General Order), and includes a significant amount of shallow groundwater data. As stated in Item 1, these data should be evaluated in the GAR and incorporated into the vulnerability analysis.

B. Section 5.3.1 of the GAR states, “The GAMA-EDF portion of the dataset contains primarily monitoring data from environmental cleanup sites and other facilities regulated by the Water Boards. Monitoring at these facilities is likely to contain anomalously high values that are representative of localized contamination where the potentially responsible party is already identified.” As stated in Item 1.F, the provided rationale only applies to a specific constituent of concern or related group of constituents present at a monitoring site (e.g., constituents of gasoline). Additional constituents such as nitrate are often analyzed to provide supplemental information regarding groundwater quality beneath the sites. The GAMA-EDF data should be evaluated in the GAR and utilized during the development of groundwater monitoring work plans.

C. Section 5.3.2 of the GAR states that the GeoTracker GAMA dataset was filtered for constituents provided by DPR. It is unclear why the GAR would omit USGS data, including the GAMA studies, which contain pesticide detections and are publicly available. As stated in Section IV.A.1 of the MRP, the GAR must assess all available, applicable and relevant data and information.

Item 12. Existing Water Quality Impacts and Vulnerable Conditions

Section IV.A.3 of the Monitoring and Reporting Program requires that the GAR identify known groundwater quality impacts for which irrigated agricultural operations are a potential contributor or where conditions make groundwater more vulnerable to impacts from irrigated agricultural activities. Review of the GAR has identified the following concerns regarding existing groundwater quality impacts and data/information not included. The GAR should be revised to address these concerns.

A. As described above (see Items 1.A, 1.B, 1.D, 1.F, 6.A, 6.B, 10.A, 10.B, and 10.C), additional readily available data exist that has not been evaluated by the GAR. These data need to be reviewed and the GAR updated to reflect the new information.

B. If any readily available nitrite data are included in the data sets utilized by the GAR, this information should also be evaluated relative to the nitrite MCL (2 mg/l).

Item 15. Describe Pertinent Geologic and Hydrogeologic Information for the Third-party Area(s) and Utilize GIS Mapping Applications

Section 4.2.2.1 of the GAR provides a discussion of hydraulic conductivity and rates of infiltration using data from the Central Valley Hyrdologic Model. Percent course sediments values to a depth of 125 feet were converted to hydraulic conductivity based on a power mean average to estimate an average hydraulic conductivity for each CVHM grid cell.

It is unclear why the GAR uses a uniform depth of 125 feet to estimate vertical hydraulic conductivity for each CVHM grid cell, as actual depth to water in many parts of the Coalition can be much greater or less than this. The calculation should be based on soil properties above the water table and scaled to existing or historical groundwater elevation ranges to achieve the intended goal of generalizing hydraulic conductivity within a particular grid cell. It should also be noted that while the calculation provides a means of estimating relative differences in vertical hydraulic conductivity throughout the Coalition, it is not appropriate to use the values to estimate the rate of contaminant transport to the aquifer. Many studies have investigated the variation of hydraulic conductivity in the vadose zone and its comparative effects on the transport of constituents such as nitrate and pesticides (e.g., Onsoy et al. 2005). These studies have observed considerable spatial variation of constituents within the vadose zone, suggesting that flow within the zone can be highly heterogeneous, and that a uniform flow based approach may significantly underestimate the actual nitrogen leaching rate. Wherever possible, the GAR should attempt to validate the estimates based on the CVHM data with recorded observations or published studies.

Item 16. Groundwater Vulnerability Designations

The General Order requires that the GAR designate high/low vulnerability areas for groundwater 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. The vulnerability designations are to be made based on consideration of all constituents of concern associated with agriculture. Review of the vulnerability analysis Chapter 6 of the GAR has identified the following concerns that need to be addressed.

A. Although the high-vulnerability areas designated by the GAR include areas of high salinity and nitrate contamination, the WDR requires that the GAR designate high vulnerability areas "…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." The high vulnerability areas designated by the GAR should include all areas where nitrate and EC concentrations in groundwater are at 50% of the MCL or higher and have a trend indicating a statistically significant increasing concentration.

B. Figure 6-18 of the GAR highlights areas where two or more exceedances have been reported in a location estimated to be low risk in the GAR solution overlay. Section 6.5.3 explains these reported exceedances as due primarily to septic clusters, and the presence of food processing plants, dairies, and wastewater treatment plants. These areas were not included in the proposed high vulnerability area designations. The GAR has not provided definitive evidence that irrigated agriculture has not caused or contributed to these observed impacts, and removal of the referenced areas is not in compliance with the requirements of the WDR. These areas, in addition to all other areas where known water quality impacts exist where irrigated agriculture may be a causal or contributing source, must be designated as high vulnerability areas.

Item 17. Compliance with Sections 6735(a) and 7835 of the California Business and Professions Code

Section 7835 of the California Business and Professions Code states that *"All geologic plans, specifications, reports, or documents shall be prepared by a professional geologist or registered certified specialty geologist, or by a subordinate employee under his or her direction. In addition, they shall be signed by the professional geologist or registered certified specialty geologist or stamped with his or her seal, either of which shall indicate his or her responsibility for them."*

Section 6735(a) of the California Business and Professions Code states that "All civil (including structural and geotechnical) engineering plans, calculations, specifications, and reports (hereinafter referred to as "documents") shall be prepared by, or under the responsible charge of, a licensed civil engineer and shall include his or her name and license number. Interim documents shall include a notation as to the intended purpose of the document, such as "preliminary," "not for construction," "for plan check only," "for review only." All civil engineering plans and specifications that are permitted or that are to be released for construction shall bear the signature and seal or stamp of the licensee and the date of signing and sealing or stamping. All final civil engineering calculations and reports shall bear the signature and seal or stamp of the licensee and the date of signing and sealing or stamping. If civil engineering plans are required to be signed and sealed or stamped and have multiple sheets, the signature, seal or stamp, and date of signing and sealing or stamping shall appear on each sheet of the plans. If civil engineering specifications, calculations, and reports are required to be signed and sealed or stamped and have multiple pages, the signature, seal or stamp, and date of signing and sealing or stamping shall appear at a minimum on the title sheet, cover sheet, or signature sheet."

The GAR contains information that is consistent with the requirement of the aforementioned sections of the California Business and Professions Code, and, therefore, the appropriate signature or stamp needs to be included.

Table 1. Components of the Groundwater Assessment Report

Item No.	Required Component	Location in GAR
GAR Objectives – MRP section		
1	Provide an assessment of all readily 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.	Partial Throughout
2	Establish priorities for implementation of monitoring and studies within high vulnerability or data gap areas.	Chapter 6
3	Provide a basis for establishing Monitoring Work plans developed to assess groundwater quality trends.	Partial Throughout
4	Provide a basis for establishing Management Practices Evaluation Program (MPEP) Work plans and priorities developed to evaluate the effectiveness of agricultural management practices to protect groundwater quality.	Partial Throughout
5	Provide a basis for establishing groundwater quality management plans in high vulnerability areas and priorities for implementation of those plans.	Throughout
Required GAR Components – MRP section		
6	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. If the third-party manages the area through sub-watershed groups, the GAR information should be developed for each sub-watershed.	Partial Chapter 4
7	Information regarding depth to groundwater, provided as a contour map(s), if readily available. Tabulated and/or graphical data from discrete sampling events may be submitted if limited data precludes producing a contour map.	Section 4.2.3
8	Groundwater recharge information, if readily available, including identification of areas contributing recharge to urban and rural communities where groundwater serves as a significant source of supply.	Partial Section 4.1, Section 6.6, Appendix B
9	Soil survey information, including significant areas of high salinity, alkalinity and acidity.	Section 4.2.1
10	Shallow groundwater constituent concentrations from existing monitoring networks (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).	Partial Chapter 5
11	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 all readily accessible information relevant 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.	Chapter 3, Chapter 7

GAR Data Review and Analysis – MRP section		
12	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.	Partial Chapter 5, Chapter 6
13	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.	Chapter 7
14	Prepare a ranking of high vulnerability areas to provide a basis for prioritization of work plan activities.	Chapter 6
15	Describe 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.	Partial Chapter 4, Chapter 6, Appendix A and B
Groundwater Vulnerability Designations – MRP section		
16	The GAR shall designate high/low vulnerability areas for groundwater in consideration of high and low vulnerability definitions provided in Attachment E of the Order. The vulnerability designations will be made using a combination of physical properties (soil type, depth to groundwater, known agricultural impacts to beneficial uses, etc.) and management practices (e.g., irrigation method, crop type, nitrogen application and removal rates, extent of implementation, etc.). The third-party shall provide the rationale for proposed vulnerability determinations.	Partial Chapter 6, Appendix B
Other		
17	Section 7835 of the California Geologist and Geophysicist Act states that **“**All geologic plans, specifications, reports, or documents shall be prepared by a professional geologist or registered certified specialty geologist, or by a subordinate employee under his or her direction. In addition, they shall be signed by the professional geologist or registered certified specialty geologist or stamped with his or her seal, either of which shall indicate his or her responsibility for them.”	Missing

Attachment B
Additional References

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