SOMACH SIMMONS & DUNN
THERESA A. DUNHAM, ESQ. (SBN 187644)
500 Capitol Mall, Suite 1000
Sacramento, CA 95814
Telephone: (916) 446-7979
Facsimile: (916) 446-8199
Email: tdunham@somachlaw.com

Attorneys for Real Party in Interest East San Joaquin Water Quality Coalition

BEFORE THE STATE WATER RESOURCES CONTROL BOARD

In the Matter of Waste Discharge Requirements General Order No. R5-2012-0116 For Growers Within the Eastern San Joaquin River Watershed That Are Members of the Third-Party Group	SWRCB/OCC File Nos. A-2239(a)-(c) EAST SAN JOAQUIN WATER QUALITY COALITION'S RESPONSE TO STATE WATER RESOURCES CONTROL BOARD'S DRAFT ORDER

On February 8, 2016, the State Water Resources Control Board (State Board) released a public draft order pertaining to requirements adopted by the Central Valley Regional Water Quality Control Board (Central Valley Water Board) in Waste Discharge Requirements for the Growers Within the Eastern San Joaquin River Watershed that are Members of the Third Party Group (General Order No. R5-2012-0116).[1] The State Board's Draft Order and Draft Attachment A were developed in response to (1) petitions filed by various parties including Associacion de Gente unida por el Agua (AGUA), the California Sportfishing Protection Alliance (CSPA), and a joint petition filed by the San Joaquin County Resource Conservation District, California Farm Bureau Federation and Southern San Joaquin Water Quality Coalition (collectively "Agricultural Petitioners") and, (2) the State Board's action to take the matter up on Own Motion Review.[2]

[1] General Order No. R5-2012-0116 as adopted by the Central Valley Water Board will be referred to hereafter as the "General Order." The State Board's draft order consists of two parts: (1) the draft order, which consists of the State Board's proposed written order; and, (2) Attachment A, which consists of proposed changes to the General Order as adopted by the Central Valley Water Board. For the sake of clarity, we will refer to the State Board's proposed draft order as that "Draft Order" and its proposed changes as "Draft Attachment A."

[2] See Wat. Code, § 13320(a) and title 23, section 2050.5(c).

The East San Joaquin Water Quality Coalition (ESJ Coalition) is the third party approved by the Central Valley Water Board to assist in administering the requirements set forth in the General Order, and as such, is the real party in interest on behalf of its 3,800 members. The ESJ Coalition was formed in 2003 to assist in administering the surface water program, and was approved to be the third-party under the General Order on January 11, 2013. The ESJ Coalition boundaries extend from the crest of the Sierra Nevada mountain range to the east, the Stanislaus River Watershed to the north, the San Joaquin River to the west, and the San Joaquin River Basin boundary to the south. Just under 700,000 acres of irrigated farmland located in Madera, Merced, Stanislaus, Tuolumne and Mariposa counties are covered under the General Order, and 3,563 landowner/operators receive assistance from the ESJ Coalition to meet the requirements contained therein.

On behalf of its 3,563 members, the ESJ Coalition submits the attached response to the State Board's Draft Order and Draft Attachment A. Also attached is Draft Attachment A with recommended changes provided in track change mode.

SOMACH SIMMONS & DUNN
A Professional Corporation

DATED: June 1, 2016

By: Theresa A. Dunham
Theresa A. Dunham
Attorneys for Real Party in Interest East San Joaquin Water Quality Coalition

I. Introduction

Over the last 13 years, the East San Joaquin Water Quality Coalition (ESJ Coalition) has worked tirelessly to assist its landowner/operators with 698,354 acres – currently 3,563 members, to comply with water quality requirements adopted by the Central Valley Regional Water Quality Control Board (Central Valley Water Board). For the first 9 to 10 years, the ESJ Coalition focused on working with its members to improve surface waters within the coalition boundary areas, and to comply with what was then referred to as the Conditional Waiver for Irrigated Agriculture. These intensive surface water monitoring and outreach efforts, which included individual grower contact to assess management practices, have resulted in significant water quality improvements in area surface waters.

Beginning in early 2013, after adoption of the Waste Discharge Requirements General Order for Growers within the Eastern San Joaquin River Watershed that are Members of the Third Party Group (Order R5-2012-0116) (referred to hereafter as "General Order")[3], the ESJ Coalition greatly expanded its efforts to address member impacts to groundwaters within the coalition area. In compliance with the General Order, the ESJ Coalition has prepared a comprehensive Groundwater Assessment Report, Draft Groundwater Management Plan, and has conducted extensive outreach to its members on issues related to groundwater quality in the region. The ESJ Coalition has also, in cooperation with other third parties approved by the Central Valley Water Board (referred to hereinafter as "third parties" or "coalitions"), developed a Farm Evaluation template, Sediment and Erosion Control Plan template, nitrogen management plan and nitrogen summary reporting templates. The ESJ Coalition has also collected and aggregated three years of Farm Evaluation data and information, and is in the process of collecting its second year of nitrogen summary reporting data and information.

Although challenging, the ESJ Coalition has worked tirelessly to implement the General Order as adopted, and has worked closely with the Central Valley Water Board and others to

[3] Order No. R5-2012-0116 has been amended several times since its original adoption on December 7, 2012. The term "General Order" as used here refers to the original order and all of its subsequent amendments. All references and citations to the General Order are to Order R5-2012-01016, Revision 3, which is the final amended version.

adjust the program as determined appropriate based on lessons learned over the past 12 years. Further, the ESJ Coalition is an active participant in the Central Valley Salinity Alternatives Long-Term Sustainability (CV-SALTS) initiative. Through CV-SALTS, the ESJ Coalition is working cooperatively with the Central Valley Water Board, representatives from the Environmental Justice community, municipalities, others in agriculture, and many other stakeholders to develop a valley-wide Salt and Nitrate Management Plan that seeks to address many of the Central Valley's salt and nitrate challenges, including drinking water needs for communities that have groundwater impacted by nitrates.

Considering these significant efforts that are underway, and the past success that the ESJ Coalition has been able to achieve, the ESJ Coalition finds it necessary to oppose many of the revisions being proposed in the Draft Order WQ 2016, *In the matter of Review of Waste Discharge Requirements General Order No. R5-2012-0116 for Growers within the Eastern San Joaquin Watershed that are Members of the Third Party Group* (Draft Order) and in the related attachments (Draft Attachment) issued by the State Water Resources Control Board (State Board). Ultimately, if adopted as proposed, the Draft Order and its associated Draft Attachments would ruin the third party process, which would result in significant chaos, and more importantly, would *not* achieve the water quality improvements that we all desire.

II. The Draft Order Falls Short in Addressing Policy Challenges Associated with Agricultural Discharges

As is discussed in greater detail below, the Draft Order would dramatically shift the manner in which agricultural operations are regulated under the Porter-Cologne Water Quality Control Act (Porter-Cologne) in the Central Valley. Unfortunately, the change being proposed attempts to treat broad non-point source agricultural discharges in the same way that single facility (i.e., point source) discharges are regulated. This approach is not only untenable, but it fails to actually address many of the policy challenges that already exist because of the unique nature of agriculture as compared to other more traditional types of dischargers. This is particularly evident when looking at groundwater, and attempting to address groundwater quality impacts associated with agricultural operations.

A. Prior State Board Orders and Policies Fail to Recognize the Practical Realities Associated with Farming

Porter-Cologne sets the stage for regulating discharges of waste to waters of the state.[4] Generally, any person discharging waste, or proposing to discharge waste, that could affect water quality in a water of the state (defined to include both surface and groundwaters) must file a report of waste discharge with the appropriate regional water quality control board (regional board).[5] Upon receiving such a report (unless need for the report is waived), the applicable regional board is to prescribe waste discharge requirements, or a conditional waiver of waste discharge requirements.[6] Regardless of the legal permitting mechanism used (i.e., waste discharge requirements (WDRs) or Conditional Waiver), the regional board must consider applicable water quality control plans (Basin Plans), and the policies contained therein. For WDRs, the requirements imposed must implement the Basin Plan, and for Conditional Waivers, the waiver must be consistent with relevant Basin Plans and be in the public interest.[7] In general, this approach appears to be simple and straightforward. However, certain policies and prior precedential decisions adopted by the State Board eliminate flexibility in how this approach is applied to agricultural discharges.

Relevant Basin Plan policies at issue here include the State Board's Statement of Policy with Respect to Maintaining High Quality of Waters in California, Resolution No. 68-16 (hereafter referred to as "Resolution 68-16" or "Antidegradation Policy"), and the State Board's Policy for Nonpoint Source Pollution (Nonpoint Source Policy). These policies, combined with quasi-judicial and judicial decisions interpreting and applying these policies, have created significant challenges with respect to regulating agricultural discharges of waste[8] to waters of the state. These challenges are summarized here. Moreover, in light of these policy challenges, the

---

[4] Wat. Code, § 13000 et seq.

[5] Wat. Code, § 13260.

[6] Wat. Code, §§ 13263, 13269.

[7] *Ibid.*

[8] Notably, agricultural irrigation, and the act of irrigating agriculture, is not a discharge of waste.

ESJ Coalition is disappointed to see that the Draft Order fails to recognize that previous policy decisions are not directly applicable to agriculture, and fails to address these issues at this opportunity.

1. Antidegradation Policy

Resolution 68-16 was adopted prior to Porter-Cologne, the Federal Clean Water Act, and the Basin Plans to which it has now been incorporated. Its adoption was encouraged by the United States Department of the Interior. Notably, the United States Environmental Protection Agency was not yet in existence. According to Resolution 68-16, the State Board's intent and purpose in its adoption was "that such higher quality [waters] shall be maintained to the maximum extent possible consistent with the declaration of the Legislature."[9] Further, the Legislature's action in question was aimed towards surface water, as evidenced by the policy's additional statement that, "[w]hereas the California Legislature has declared that it is the policy of the state that the granting of permits and licenses for unappropriated water and the disposal of waste into the waters of the state shall be so regulated as to achieve highest water quality consistent with maximum benefit to the people of the state and shall be controlled so as to promote the peace, health, safety and welfare of the people of the state . . . ." The State Board has recognized this application to surface water in previously adopted orders.[10]

Nonetheless, the State Board applies Resolution 68-16 to groundwater, and has issued significant orders that currently control how Resolution 68-16 is applied to discharges to groundwater. Also, directly connected to Resolution 68-16 is how regional boards (and the State Board) are to permit discharges when the receiving water in question is not high quality, and thus Resolution 68-16 does not apply. Generally, the State Board has made clear that the antidegradation policy is *not* a "zero-discharge" policy.[11]

---

[9] Resolution 68-16, p. 1.

[10] See, e.g., *In the Matter of the Petitions of the County of Santa Clara, et al.*, Order No. WQ 86-8 (Order No. 86-8) ["Resolution No. 68-16 was adopted in response to a requirement by the federal government that all states adopt an antidegradation policy for surface waters . . . ."].

[11] See, e.g., Order No. 86-10, pp. 44-45 ["Resolution No. 68-16 is not a 'zero-discharge' standard but rather a policy statement that existing quality be maintained when it is reasonable to do so."]; see also, *id.*, p. 44 ["This policy does not absolutely require existing high water quality be maintained; rather, any change must be both consistent with maximum public benefit and not unreasonably affect beneficial uses."].

The State Board's general principles as they currently exist for setting permit limits to ensure compliance with applicable Basin Plan water quality standards are as follows:

- Where the groundwater already exceeds the objective in question (i.e., is not a high quality water), limitations must be set no higher than the Basin Plan objective.
- An exception may be granted where there is system mixing or removal of the constituent through percolation through the ground to the aquifer.
- In setting the limit, regional boards should set limitations more stringent than the objective if more stringent limits can be met by using "best efforts." Consideration of "best efforts" includes showing that the constituent is in need of control; discharger can meet the more stringent limitations using reasonable control efforts; consideration of the water supply available to the discharger; past effluent quality; effluent quality achieved by other similarly situated dischargers; good faith efforts to limit the discharge of that constituent; and measures necessary to achieve compliance with the more stringent limit.[12]
- Where compliance with the limits cannot be achieved by reasonable efforts, it may be appropriate to review the water quality objective.[13]
- Where the groundwater is of better quality than the Basin Plan objective (i.e., high quality water), the regional board may set limits, which are more *or* less stringent than the objective.
- Limits may be less stringent when there is available assimilative capacity. And, the regional board needs to ensure that the cumulative impact from all dischargers does not cause the Basin Plan objective to be exceeded.
- After considering available assimilative capacity, the regional board should then also apply the best efforts analysis to determine if a more stringent limitation is appropriate.[14]

[12] In the Matter of the Petition of the City of Lompoc, Order No. WQ-81-5 (Lompoc), pp. 6-7.

[13] Lompoc, p. 6; see also In the Matter of the Petition of Carol Ann Close; San Diego County Milk Producers Council, et al., Order No. WQ 88-12 (San Diego Milk Producers), p. 14.

[14] Lompoc, p. 7.

- If there is no assimilative capacity, and the discharger cannot show that the discharge will meet the objective, then the discharge should be prohibited.[15]

Critical components of these established principles are: (1) discharges must essentially equal objectives if there is no assimilative capacity; and, (2) if there is no assimilative capacity and the discharge cannot meet the objective, then the discharge is supposed to be prohibited. While this may have seemed appropriate and reasonable at the time that the State Board established these principles, application of such principles broadly to agriculture and related industries (i.e., food processors and wineries) can be exceedingly problematic.

Specifically, when it comes to salts and nitrates, it may be impossible for agriculture to be permitted under these principles. First, the practice of farming naturally concentrates salts. Second, fertilizers (commercial and organic) are necessary inputs for producing food and fiber. While there is much theorizing and speculation with respect to how much fertilizer may be necessary for any given crop, it is well understood that it is impossible to completely avoid nitrate from percolating through soil to groundwater.[16] Thus, while all agree that salt and nitrate management can (and must) be improved, it is unknown if improvements with currently known technology will be sufficient to ensure compliance with water quality standards.

2. Nonpoint Source Policy

Similar to Resolution 68-16, the state's Nonpoint Source Policy was developed with surface water in mind. It was first developed to bring the state into compliance with section 319 of the Clean Water Act, and section 6217 of the Coastal Zone Act Reauthorization Amendments of 1990. Notably, the Nonpoint Source Policy requires regional boards to find that any nonpoint source pollution implementation program have a "high likelihood" that the program will attain a regional board's stated water quality objectives. This finding needs to include consideration of management practices to be used and the process of ensuring proper implementation.[17] And, the implementation program must meet the key elements as set forth in the Nonpoint Source Policy.

[15] San Diego Milk Producers, p. 15.

[16] See *Conclusions of the Agricultural Expert Panel* (Sept. 9, 2014), p. iii, referred to hereafter as "Agricultural Expert Panel."

[17] Nonpoint Source Policy, p. 11.

Key element 1 requires regional board programs to control nonpoint source pollution in a manner that achieves and maintains water quality objectives. Key element 2 requires the program to describe management practices and other elements that are to be implemented to meet the program's stated purpose (i.e., meeting key element 1). Under key element 3, a regional board can provide a time schedule for achieving water quality objectives, and it must have quantifiable milestones to measure progress towards compliance. Key element 4 requires sufficient feedback mechanisms so that all stakeholders can determine if the program is achieving its stated purpose, and key element 5 requires the regional board to make clear the consequences for failing to comply.

While the key elements at first consideration appear reasonable, appropriate, and somewhat flexible, it has become exceedingly difficult to show how waste discharge requirements and conditional waivers adopted for irrigated agriculture meet these requirements. In particular, the key elements presume that irrigated agriculture can implement (and that there exist currently) management practices that achieve compliance with water quality objectives. This expectation has proven to be difficult to meet, especially in regard to groundwater and salts and nitrates.

For example, in *Monterey Coastkeeper v. California State Water Resources Control Bd.*, the court found that the State Board had failed to comply with its own Nonpoint Source Policy because it "failed to show a 'high likelihood' that implementation of the Modified Waiver will be successful in attaining the applicable water quality standards."[18] In reality, and as being interpreted by the court, it will be almost impossible for any regional board or the State Board to meet the "high likelihood" burden—especially with respect to salts and nitrates in groundwater. As stated previously, all agree improvements must be made. However, there are no clear answers as to how agriculture needs to adjust agronomic practices in order to comply with an ever increasing number of water quality standards and still produce food and fiber for the nation.

[18] *Monterey Coastkeeper v. California State Water Resources Control Bd.* (Superior Ct. Sacramento County, 2015, No. 34-2012-800013245), p. 38.

Because of these significant challenges, the ESJ Coalition recommends that the Draft Order be revised to distinguish the application of these policies to agricultural discharges, and in particular, to agricultural discharges to groundwater. Specifically, the Draft Order should reevaluate application of the Lompoc and San Diego Milk Producer orders to agricultural discharges, as well as the Nonpoint Source Policy's improper standard of requiring a "high likelihood" that agricultural discharges can meet water quality standards. While that standard may be appropriate for surface water discharges, which is the context in which it was developed, it is not an appropriate standard to apply to agricultural discharges of salts and nitrates to groundwater.

B. Draft Order Fails to Acknowledge Efforts Underway in CV-SALTS and Alternative Compliance Strategies

The ESJ Coalition is highly disappointed to see that the Draft Order makes little mention of the CV-SALTS initiatives underway. The only reference is in footnote 31.[19] The failure to recognize CV-SALTS is particularly troubling in that State Board staff participate in that effort, and the effort is attempting to address the many policy challenges as they pertain to salts and nitrates identified immediately above in section II.A. After extensive effort by the many stakeholders, CV-SALTS is close to competing its comprehensive Salt and Nitrate Management Plan (SNMP) for the Central Valley. Key management goals in the SNMP include: (1) Ensuring a Safe Drinking Water Supply, (2) Achieving Balanced Salt and Nitrate Loadings, and (3) Implementing Managed Aquifer Restoration programs.

Moreover, CV-SALTS seeks to address the challenges agriculture faces with respect to complying with water quality standards by recommending certain policy changes to be adopted in the Central Valley's two Basin Plans.[20] Specifically, the SNMP includes recommendations to authorize implementation of alternative compliance strategies. The framework for such strategies "focuses on ensuring safe drinking water, minimizing degradation, and implementing long-term

[19] Draft Order, p. 12.

[20] The Central Valley has two water quality control plans, otherwise referred to as Basin Plans: *Water Quality Control Plan for the Sacramento River and San Joaquin River Basins* and *Water Quality Control Plan for the Tulare Lake Basin.*

restoration when discharges cause salt and nitrate degradation in a receiving water."[21] The concept of alternative compliance strategies or options is not new to the State Board, and such strategies have been recently acknowledged in State Board Order WQ 2015-0075.[22] In general, in Order WQ 2015-0075, the State Board recognized challenges associated with meeting receiving water limitations for municipal storm water discharges. Because of these challenges, the State Board upheld development and implementation of comprehensive watershed management plans as an alternative to strict compliance with receiving water limitations.

The approach being proposed in CV-SALTS is similar in concept to that contained in the Los Angeles municipal separate storm sewer system permit, which is the permit at issue in Order WQ 2015-0075. With the CV-SALTS approach, a dischargers will not need be held to strict compliance with groundwater objectives for salts and nitrate as long as the discharger is complying with the SNMP, which includes ensuring safe drinking water where applicable. Considering these significant efforts to develop alternative compliance strategies, the ESJ Coalition believes it appropriate for the State Board's Draft Order to acknowledge and endorse the development of such strategies. While it is recognized that the Draft Order cannot "approve" actual alternative strategies until such time that they are before the State Board in the form of a Basin Plan amendment, the Draft Order can provide policy direction that recognizes the need for, and general acceptance of, alternative compliance strategies. For example, in Order WQ 2015-0075, the State Board specifically set forth principals for other stormwater related alternative compliance options.[23]

Accordingly, the ESJ Coalition recommends that the Draft Order be revised to recognize the challenges agricultural faces with respect to complying with water quality standards in the traditional manner. Further, the Draft Order should be revised to encourage the use of alternative

---

[21] See *SNMP Section 1, Executive Summary* at p. 1-19, attached as Exhibit 1 to East San Joaquin Water Quality Coalition Request for Consideration of Supplemental Evidence.

[22] *In the Matter of Review of Waste Discharge Requirements for Municipal Separate Storm Sewer System (MS4) Discharges within the Coastal Watersheds of Los Angeles County except for the City of Long Beach*, Order WQ 2015-0075 (Order WQ 2015-0075).

[23] Order WQ 2015-0075, at pp. 51-52.

compliance strategies like those that are being developed through the CV-SALTS stakeholder process.

C. Draft Order Improperly Ignores the Economic Impact of Its Mandates

Another broad policy issue of significant concern is how the Draft Order dismisses its economic impact. Without a doubt, the Draft Order substantially alters mandates as they currently exist in the General Order. For example, as is discussed in detail below, the Draft Order requires significant new reporting at all levels, which when implemented fully in the Central Valley, would result in all irrigated agricultural operations to report farm management practices and nitrogen application information at a field level. The Draft Order then directs the Central Valley Water Board to use the submitted data to verify accuracy and completeness of summaries submitted by coalitions, confirm third party follow up to members, and evaluate correlations between management practice implementation data and water quality monitoring data.[24] These are new requirements and the economic impact of such requirements have not been previously considered by the Central Valley Water Board.

However, in footnote 28, the Draft Order summarily dismisses the economic impact of these changes, and ignores the need for the State Board to consider such economic impacts. Specifically, the Draft Order dismisses consideration of costs by stating that "… the record does not establish the costs of complying with the requirements contained in the Eastern San Joaquin Agricultural General WDRs, including the insubstantial additional costs to comply with the requirements added by this order, would warrant relaxation of those requirements."[25] The Draft Order misses the point entirely.

That is, when adopting waste discharge requirements under Water Code section 13263, regional boards are required to consider the provisions of Water Code section 13241, which includes among other things economic considerations. Putting aside the issue of whether or not the Central Valley Water Board properly considered economics when it adopted the General

[24] Draft Order, pp. 55-56.

[25] Draft Order, pp. 11-12.

Order, the Draft Order proposes to substantially amend the General Order.[26] Due to these substantial amendments, which are to be adopted by the State Board, Water Code section 13263 is being invoked, which requires consideration of the provisions in Water Code section 13241.[27] In other words, by revising the General Order, the State Board is acting as the Regional Board, and thus the State Board must comply with relevant water code provisions, including Water Code section 13263. Thus, the State Board cannot ignore the obligation to consider section 13241 factors when it is substantially amending an order such as the General Order here.

Review of the Draft Order clearly shows that there has been no consideration of relevant factors articulated in Water Code section 13241, which includes consideration of all of the following:

(a) Past, present, and probable future beneficial uses of water.

(b) Environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto.

(c) Water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area.

(d) Economic considerations.

(e) The need for developing housing with the region.

(f) The need to develop and use recycled water.[28]

Accordingly, any move to adopt the Draft Order without considering these factors is a violation of law that should result in nullification of the State Board action. Thus, at the very least, the Draft Order needs to be revised to articulate how the actions proposed (i.e., revisions to the Draft Order) impact the factors specified in water code section 13241.

///

///

---

[26] See, e.g., Draft Attachment A and Attachment B.

[27] See, Wat. Code § 13320(c), ["Upon finding that the action of the regional board, …, was inappropriate or improper, the state board may … take the appropriate action itself, …. In taking any action, the state board is vested with all the powers of the regional boards under this division."].

[28] Wat. Code, §§ 13263, 13241.

III. Draft Order and Draft Attachments Improperly Remove Vulnerability Determinations from the General Order

The Draft Order significantly alters the General Order and its approach by removing vulnerability distinctions as they currently exist.[29] In rejecting the vulnerability distinctions, the Draft Order relies heavily on findings by the Agricultural Expert Panel, claiming that the definition of high vulnerability in the General Order was "vague, ambiguous, circular, and not supported by a sound technical rationale."[30] Further, the Draft Order relies on Agricultural Expert Panel statements to the effect that they found against vulnerability distinctions because they believed that good nitrogen management was essential in all areas.[31] The Draft Order's reliance on the Agricultural Expert Panel in this regard is misplaced for several reasons. First, determinations of vulnerability are possible, and in fact have already been completed. Second, the General Order requires good nitrogen management for all agricultural operations regardless of vulnerability: the primary difference between those in high and low vulnerability is the level of reporting required - not requirements for good nitrogen management.

A. The ESJ Coalition's Groundwater Assessment Report Is Technically Sound and Provides for Distinctions based on Vulnerability

At the time that the Agricultural Expert Panel convened, they did not have the benefit of a completed and final approved Groundwater Assessment Report (GAR) for the ESJ Coalition area. On December 24, 2014, after providing the Central Valley Water Board with an addendum to address deficiencies identified with the original submittal, the Central Valley Water Board provided Final Approval of the GAR.[32] Included in the GAR is a sound, technical methodology for identifying vulnerable areas within the ESJ coalition area, and a prioritization mechanism for

---

[29] Draft Order, pp. 21, et seq.

[30] Draft Order, p. 22.

[31] See, e.g., Agricultural Expert Panel Report, p. 26.

[32] Available as of May 30, 2016 at http://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/water_quality/coalitions/east_sanjoaquin/index.shtml#esjgar, and referred to as Exhibit 2 to Request for Consideration of Supplemental Evidence.

addressing groundwater quality issues in those highly vulnerable areas. The approach was developed by professional hydrogeologists, and ultimately approved by the Central Valley Water Board's staff of geologists and environmental engineers. In other words, it is *not* vague, ambiguous or circular. Thus, it is inappropriate for the Draft Order to rely on the Agricultural Expert Panel's opinion here, as it was developed in a vacuum without the benefit of actually seeing the ESJ Coalition's GAR.

B. The General Order Requires Good Nitrogen Management for All Members - Not Just Members in High Vulnerability Areas

Contrary to the Draft Order's arguments, the General Order requires good nitrogen management for all members of the third party and not just those in areas identified as high priority. For example, General Order provision IV.B.8 states: "All Members shall implement practices that minimize excess nutrient application relative to crop need. Members shall prepare and implement a farm-specific nitrogen management plan as required by Section VII.D. of this Order."[33] Provision VII.D further articulates the nitrogen management plan requirements for all members, including those in low vulnerability areas. Although the reporting requirements to the ESJ Coalition vary based on vulnerability, the requirement for a nitrogen management plan, and the need for it being updated annually applies universally.[34] Further, the nitrogen management plan must be maintained at the Member's farming operations headquarters, and be provided upon request as part of a Central Valley Water Board inspection.[35]

Besides the universal applicability of the nitrogen management plan requirement, all members are required to implement water quality management practices as necessary to protect water quality and achieve compliance with surface and groundwater receiving water limitations; implement water quality management practices that meet farm management performance standards; and, are required to submit a completed Farm Evaluation template to the ESJ

---

[33] General Order, p. 19.

[34] See, e.g., General Order, p. 27, Provision VII.D.2, ["By 1 March 2017, all Members within low vulnerability areas shall prepare, and update by 1 March annually thereafter, a Nitrogen Management Plan."].

[35] General Order, p. 26.

Coalition.[36] Moreover, as a practical matter, all ESJ Coalition members are subject to annual education and outreach requirements. While technically such requirements apply only to those in high vulnerability areas, the ESJ Coalition treats all of its members equally with respect to this requirement and requires all to members to participate annually in an outreach event. Over the past two years, the annual events featured presentations by Certified Crop Advisors on nitrogen management in crops, and presentations by irrigation specialists on the importance of proper water management in regard to nitrogen management. Members can also participate by viewing the meetings online.

Thus, the Draft Order's reasoning for eliminating vulnerability is not supported by the terms of the General Order, or implementation of the General Order through the GAR that evaluated local conditions and technically identified high and low vulnerability areas within the ESJ Coalition area. Accordingly, the Draft Order's elimination of vulnerability must be rejected.

C. Vulnerability Determinations in the General Order Distinguish Reporting Requirements - Not Management Requirements

On one level, the Draft Order appears to argue that vulnerability determinations must be deleted because it means that growers are treated differently. Along with this argument, the Draft Order attempts to compare vulnerability determinations with tiers that are contained in the Conditional Waiver for Irrigated Agriculture that applies to growers within the Central Coast region. These arguments must be dismissed as they fail to accurately understand that vulnerability determinations primarily control the level and frequency of reporting by growers - *not* the requirement to implement appropriate management practices for the protection of water quality.

Variable reporting requirements based on threat to water quality are legal, and in fact fundamental in Porter-Cologne. Reporting requirements in the General Order, like with all other types of waste discharge requirements, are issued under the regional board's authority as provided

[36] General Order at pp. 17-20, 24-25.

in water code section 13267.[37] Water code section 13267 specifically mandates that reports required by regional boards be commensurate with the threat to water quality. "The burden, including costs, of these reports shall bear a reasonable relationship to the need for the report and the benefits to be obtained from the reports."[38]

Under the General Order, more reporting is required by those in high vulnerability areas, in that they must update their Farm Evaluations annually, and when they are in a high vulnerability groundwater area, they must have their nitrogen management plan certified by a qualified professional for each crop year (or by the member after obtaining individual certification), and must submit an annual nitrogen management plan summary report to the third party. This is appropriate because there is a greater need in these areas because of the imminent threat to water quality. In comparison, however, for those areas determined to be of low vulnerability, the threat to water quality is not as great and thus the need and benefit for the information is far less. In fact, the burden and costs of additional reporting being imposed on those in low vulnerability areas, including a requirement for certification of a nitrogen management plan, runs counter to the mandates of water code section 13267 and cannot be supported. For this additional reason, the Draft Order's elimination of vulnerability determinations must be rejected by the State Board.

D. The ESJ Coalition Does Not Support Phasing of Reporting Requirements Based on the Size of Farm Operation

While the ESJ Coalition appreciates that the Draft Order was looking to provide for an appropriate phasing of requirements based on agricultural operation size, the ESJ Coalition does not support this approach. First, as discussed immediately above, reporting must bear a reasonable relationship to the need and benefit of the information, which suggests that it must be commensurate to the threat to water quality. Application of reporting requirements based on

---

[37] See, e.g., General Order, p. 6, Finding 22, ["Consistent with Water Code section 13267, this Order requires the implementation of a monitoring and reporting program (MRP) that is intended to determine the effects of Member waste discharges on water quality, to verify the adequacy and effectiveness of the Order's conditions and to evaluate Member compliance with the terms and conditions of this Order."].

[38] Water Code, § 13267(b)(1).

vulnerability addresses this element of water code section 13267. The size of an agricultural operation does not.

Further, as a practical matter, phasing reporting based on operation size creates additional administrative burdens on the ESJ Coalition, and is inconsistent with implementation of the ESJ Coalition's Comprehensive Groundwater Management Plan. With respect to the administrative burden, the ESJ Coalition is currently administering the General Order as it was adopted in 2012, and slightly modified thereafter. This includes the ESJ Coalition spending considerable resources on preparing the GAR, which has identified high and low vulnerability areas. After the GAR was approved in December of 2014, the ESJ Coalition then began to implement the General Order provisions for its members based on these determinations. This means that the ESJ Coalition conducted considerable outreach and education explaining the vulnerability areas, the various reporting requirements based on such determinations, and has now collected Farm Evaluation and Nitrogen Summary Report data and information based on these distinctions. At this time, the ESJ Coalition has collected three years of Farm Evaluation information from those in the identified high vulnerability areas, and at least one year of information from all members. The ESJ Coalition is also in the process of collecting Nitrogen Management Summary Reports from those in the high vulnerability areas. These efforts have been extensive, and costly.

The Draft Order would propose to eliminate this past approach and instead require the ESJ Coalition to revise its outreach and reporting approach based on agricultural operation size rather than vulnerability determination. This results in a checkerboard approach rather than focusing on broad geographic areas, which is inefficient and not logical considering threats to water quality.[39] It is also inconsistent with the ESJ Coalition's Comprehensive Groundwater Management Plan, which establishes performance goals and milestones for members and the ESJ Coalition based on vulnerability rather than size of member operations.[40]

[39] See Exhibits 3 and 4 to the Request for Consideration of Supplemental Evidence.

[40] See Groundwater Quality Management Plan (February 23, 2015), pp. 102-106, Exhibit 5 to Request for Consideration of Supplemental Evidence. The ESJ Coalition is still waiting for Central Valley Water Board approval of the Groundwater Quality Management Plan.

For all of these reasons, the Draft Order must be revised to recognize the validity and legality of vulnerability determinations within the General Order, and the imposition of reporting requirements based on such determinations.

IV. Draft Order Improperly Requires Submittal of Field-Specific Farm Evaluation and Nitrogen Summary Report Information

Along with eliminating vulnerability determinations, the Draft Order proposes to substantially alter the level of reporting for all members of the ESJ Coalition. Most significantly, the Draft Order would require all ESJ Coalition members to report Farm Evaluation and Nitrogen Summary Report information to the ESJ Coalition at a field-specific level, and would then require the ESJ Coalition to submit field-specific level information from both reports, with an identified location, to the Central Valley Water Board. By virtue of submitting this field-specific information to the Central Valley Water Board, the information would become public data and information. The Draft Order then goes even further to indicate that all field-specific information will then need to be uploaded into Geotracker at some time in the near future, which is a database available to the public through the internet.

Requiring the ESJ Coalition to turn over member field-specific data with specific location information is improper for a number of different reasons, including, most importantly, that it eliminates a key value that the ESJ Coalition provides to its members, which is privacy protection of sensitive grower information from mass public exposure. Elimination of this key value will seriously undermine the functionality of the ESJ Coalition, and threaten its very existence. Without the ESJ Coalition, and the other third-party groups which collectively represent more than 20,000 landowners/operators throughout the Central Valley, the Central Valley Water Board and the State Board will have an administrative nightmare in trying to implement any irrigated lands program across the Central Valley, let alone across the state, as is envisioned by the Draft Order. This alone should cause State Board members to reject the Draft Order's proposed changes regarding field specific reporting, and direct State Board staff to maintain the level of reporting as it currently exists in the General Order.

Moreover, there is no viable policy or legal justification for making this change. Rather, the Draft Order speculates that submittal of data in this manner is necessary to ensure proper oversight by the Central Valley Water Board, so that the Central Valley Water Board can directly evaluate "the correlation between management practice implementation data, A/R ratios, and water quality monitoring data."[41] For the many reasons explained below, such speculation is untenable and must be rejected. To address the Draft Order's issues with respect to accuracy and accountability, the ESJ Coalition provides for specific alternative recommendations to those as contained in the Draft Order. These alternatives are discussed in sections V and VI below. Here, we provide further detail as to why the Draft Order's proposal is completely improper.

A. Mandating Field Level Reporting to the Central Valley Water Board Will Eliminate Coalition Functionality

As already indicated, the ESJ Coalition believes that mandating coalition reporting of member field specific information to the Central Valley Water Board will eliminate the coalition's functional role. It would remove all incentive for being a member of a third party, due to direct individual reporting to the Central Valley Water Board.

For the last thirteen years, the third-party/coalition process has worked well in the Central Valley. It has allowed third parties (i.e., the ESJ Coalition and others) to work directly with their members to provide education and outreach, conduct monitoring, prepare and implement watershed management plans, and prepare comprehensive watershed based annual reports. Coalition activities are funded by members through per acre assessments, and members must remain in good standing to be part of the coalition. In exchange for participating in coalition and remaining as a member in good standing, growers do not have to report individual farming information directly to the Central Valley Water Board in a manner that provides for specific location and land ownership information. This avoids grower information from then being publically available through a simple Public Records Act (PRA) request, or from being displayed on a publically accessible website.

[41] Draft Order, pp. 39, 55-56.

For the ESJ Coalition, he approach has been successful because it results in direct communication between the Coalition and its grower members. For example, using surface water monitoring data collected, combined with other information such as pesticide use reporting data from the County Agricultural Commissioners, the ESJ Coalition contacts individual growers and assesses their management practices with respect to protecting surface water quality. From this outreach, growers then implement practices to better protect water quality. With the improvement of management practices, surface waters are better protected and no longer exceed water quality standards for parameters such as pesticides and toxicity. The ESJ Coalition intends to use this same iterative, direct grower contact approach for implementing the groundwater program, and in particular with respect to nitrogen management.

However, although the Draft Order would not preclude the ESJ Coalition from implementing the education/outreach approach described, the incentive to belong to a coalition is being removed. This means that landowners/operators will no longer find it necessary to be in a coalition (and pay coalition fees), and instead would likely decide that if their information is going to be provided directly to the Central Valley Water Board they may as well provide it on their own and forego the additional expense of coalition membership. With the loss of members, coalitions will no longer be able to function. Notably, being a member in a coalition is *voluntary*, and cannot be mandated since they have the option to be covered under an individual waste discharge requirement. Thus, to encourage coalition membership there must be some form of incentive as compared to being covered under an individual waste discharge requirement. To date, that has included some level of protection from private grower information being available publically. Without coalitions, there will be a tremendous void with respect to grower education and outreach efforts, as well as the loss of comprehensive watershed based water quality evaluations such as annual reports, GARs, and watershed management plans. The validity of current reporting is greatly enhanced by the near 100-percent participation of landowners/operators subject to the Irrigated Lands Program being part of a coalition. The ESJ Coalition sincerely hopes that the State Board does not take an action that eliminates this

exceedingly valuable and successful approach only to obtain millions of individual records that alone provide little value other than to expose private businesses to public scrutiny.

B. Public Availability of Grower Field Level Information Violates Rights to Privacy

With respect to public disclosure of the field level information, which contains private information of landowners and growers, it has been a critical concern of the ESJ Coalition and its members since the inception of the irrigated lands program since 2003. The irrigated lands program has been developed in a way that looks to balance privacy against the public's right to information. Indeed, one of the central tenants of the ESJ Coalition program includes not providing individual member information that specifically ties individual growers, companies, or landowners in a manner that would then be public. Contrary to the arguments set forth in the Draft Order, this is because the data and information being requested is proprietary business and/or private economic information.

For example, the Nitrogen Summary Report, as proposed to be revised in the Draft Order, would require reporting of post-production crop yields.[42] This means that without little effort, members of the public could calculate individual grower economic information. This runs directly counter to other statutes that protect individual crop yield data from public disclosure.[43] Further, public disclosure of management practices as well as amounts of nitrogen applied is proprietary business information that needs to be protected. The combination of such information is akin to a mechanical process and/or secret recipe that is protected for other industries. Agriculture should be afforded the same protections and such information should be shielded from public disclosure.

Moreover, unlike many industries, agricultural operations are often co-located with a farmer's home, or homes rented or made available to agricultural workers. Thus, field-specific information could be directly related to an individual residence—not a traditional place of business. This is important due to the potential that individuals residing in homes will be targeted

[42] Draft Attachment A, Appendix, MRP-4, p. 11.

[43] See, e.g., Food & Ag Code, section 58781.

or harassed by members of the public based on the availability of field-specific farming information.

C. Public Disclosure of Field Level Information Is not Necessary to Evaluate Water Quality and Effectiveness of Management Practices

According to the Draft Order, one of the reasons for requiring field level information is because it will allow for a more complete analysis of management practices in conjunction with water quality data and information.[44] This is simply not true. At the May 17, 2016 workshop, Dr. Thomas Harter from the University of California Davis (UCD) testified that due to the unique nature of groundwater, the aggregation of data to the township level is more than sufficient. "For that, the public data submitted to the Regional Water Board, if those are submitted, aggregated to the township level and include the total nitrogen applied per crop and total nitrogen removed by crop, the A over R ratio is completely sufficient to do an assessment of how much crops contribute relative to each other, to nitrate and groundwater, how farmers are doing relative to each other, and to give us a tool to do trend assessment and larger regional establishments."[45]

Moreover, there is no relationship between the public release of individual data and evaluation of water quality. It is very difficult, if not impossible, to associate groundwater quality at any point in the aquifer with practices employed at any point on the surface. For surface water quality problems, there is the potential for a single member to implement practices that can eliminate the water quality concern; however, improving groundwater quality requires effort by numerous growers across a wider geographic range and over a longer period of time. Therefore, reporting practices and nitrogen use across a larger area is sufficient to track the implementation of practices that will lead to improved groundwater quality. Further, the groundwater trend monitoring network will provide a comprehensive evaluation of groundwater quality across the coalition region and the Management Practices Evaluation Program will assist the ESJ Coalition in understanding the effectiveness of management practices implemented across the ESJ

---

[44] Draft Order, p. 29.

[45] Fresno Workshop Review of Eastern San Joaquin Agricultural WDRs Transcript of Proceedings, Tuesday, May 17, 2016, p. 28:14-22.

Coalition boundaries in different soil types and with different crops. The combination of regional monitoring of groundwater quality and the reporting of management practices and nitrogen applications on a regional scale are sufficient to allow the Central Valley Water Board to understand whether groundwater quality is improving, or is likely to improve.

Additionally, the Central Valley Water Board receives annually from the ESJ Coalition, individual records of management practices provided by members in their Farm Evaluation survey. The Farm Evaluation records are submitted with a geo-reference to a Township. The records from the Nitrogen Management Plan Summary Report are aggregated on a Township-Range (T-R) scale and include summary statistics by T-R and crop including the mean, maximum, minimum for amount of nitrogen applied and percentiles (90th, 75th, 50th, 25th, 10th) of nitrogen applied divided by the yield (A/Y ratios). The exact location of the management unit within that T-R is removed. Both the Farm Evaluation and NMP Summary Report records that are submitted to the Central Valley Water Board are available to the public. This collective level of information is more than sufficient to evaluate water management practices and water quality over time, thereby negating any need or value with reporting individual data records, with location, for public distribution

D. The Nitrogen Summary Report Information Is an Improper Proxy for Determining Impacts to Water Quality

Moreover, contrary to claims in the Draft Order, there currently exists significant uncertainty with respect to use of the applied versus removal ratio (A/R) as a proxy measurement for determining the amount of nitrogen that may leach to groundwater, and for using such ratios as a regulatory target. The Draft Order alleges that the A/R ratio is a reliable measurement for determining the amount of nitrogen left in the field.[46] However, the Draft Order also acknowledges that research is needed to determine crop removal values and to identify attainable multi-year A/R ratios for a range of crops and conditions.[47] To address this uncertainty, the Draft

[46] Draft Order, p. 35.

[47] Draft Order, p. 37.

Order allows reporting of crop yields as a proxy.[48] For the reasons stated above, direct field-level of reporting crop yield is inappropriate as it violates privacy and makes grower economic information public. From a technical perspective, the lack of reliable crop removal values is significant and that alone questions the viability of using A/R ratios as proper proxy for determining impacts to water quality. Further, while A/R ratios may be an appropriate management value, they do not predict the amount of nitrogen that may actually be available to leach to groundwater. A/R ratios do not account for soil conditions, precipitation, nitrogen transformation, and other environmental variables that determine how much nitrogen may be available to leach to groundwater.

In implementing the General Order, the coalitions identified other knowledge gaps that need to be addressed with respect to the A/R ratio. For example, the General Order requires the coalitions to submit "At a minimum, the statistical summary of nitrogen consumption ratios by crop or other equivalent reporting units and the estimated crop nitrogen needs for the different crop types and soil conditions will describe the range, percentiles (10th, 25th, 50th, 75th, 90th), and any outliers. A box and whisker plot or equivalent tabular or graphical presentation of the data approved by the Executive Officer may be used."[49] The nitrogen consumption ratio was interpreted to be the ratio of nitrogen applied to nitrogen removed at harvest. However, there was no guidance within the General Order for how to determine the amount of nitrogen applied from all potential sources, or the amount of nitrogen removed from the field.

To assist the coalitions, a Nitrogen Management Plan Technical Advisory Work Group (NMP TAWG) was convened to help understand the state of knowledge about nitrogen removed from crops in the Central Valley, and to help define methods for calculating nitrogen applied in various soil amendments such as compost and manure. A list of 13 questions was developed to guide the identification of knowledge gaps, and a series of meetings with the NMP TAWG was held. The NMP TAWG included experts from the University of California, state and federal agencies, and private industry, which met with stakeholders to develop the answers to those

[48] Id.

[49] General Order, Attachment B, p. 23.

questions. The information obtained during the NMP TAWG stakeholder meetings informed the Crop Nitrogen Knowledge Gap Study Plan (Study Plan) as well as Guidance Documents for growers; both documents were submitted to the Central Valley Water Board on December 18, 2015, and are available online. Guidance documents were also developed for growers to assist them with completing their Nitrogen Management Plans.

The discussions and information developed through the NMP TAWG process guided the coalitions' decision to propose yield as the metric growers will use for reporting nitrogen removed and it resulted in the approved NMP Summary Report template and associated instructions. The NMP TAWG provided input on the reliability of available nitrogen removed information that the coalitions could use to convert crop yield to the amount of nitrogen removed; this information is summarized within the Study Plan. As a response to Central Valley Water Board comments on the Study Plan, the coalitions revised their Y-to-R coefficients to include all 17 crops available on the California Department of Food and Agriculture (CDFA) Fertilizer Research and Education Program (FREP) website with the caveat that additional work needs to be done to review/refine these coefficients as they relate to Central Valley growing conditions. In addition, the coalitions proposed a timeline of milestones and deliverables for expanding/revising the Y-to-R conversion ratios. A Work Plan will be submitted in July 2016 further describing this process.

The NMP TAWG process identified the fact that there are still significant knowledge gaps with respect to nitrogen removal rates for Central Valley agriculture. Nitrogen removal rates are key to the development of A/R ratios, and thus the ESJ Coalition cautions against widespread use of such ratios as a proxy for determining impact to water quality.

Because of this scientific uncertainty, it is also wholly inappropriate to develop target ratios for use as regulatory metric. While the ESJ Coalition appreciates the Draft Order's attempts to not call out target ratios as a regulatory value at this time, it is difficult to see how development of such target values in the manner as suggested in the Draft Order would not be used for regulatory purposes.[50] First, the Draft Order directs the Central Valley Water Board to

[50] Draft Order, pp. 55-56.

develop target values for each crop within three years of coefficients being developed for that crop, and then directs the Central Valley Water Board to report its progress to the State Board. As many dischargers have experienced in the past, once a "target" value is developed, it ends up being used as a regulatory endpoint. Take, for example, draft water quality criteria. Although such criteria are not adopted water quality objectives, they are often used to interpret narrative water quality objectives. The ESJ Coalition is concerned that once target values are identified by the Central Valley Water Board, there will be significant pressure for them to be used as a method for determining if a grower is in compliance with the General Order – even though that is not the current intent of the Draft Order. Second, there is the practical reality that because grower A/R ratios will be public, they will be compared against Central Valley Water Board identified target values by litigious individuals, and such information may be used to allege that a grower not meeting a target is causing pollution or nuisance to groundwater.

Further, the Agricultural Expert Panel recommends use of A/R ratios as a management value, and for evaluating progress on source control.[51] The Panel does not suggest or recommend that such ratios become a regulatory metric. Thus, while A/R ratios may have value in assisting coalitions with their education and outreach efforts, it should not be used as a proxy for determining impacts to water quality, and A/R targets should not be used for regulatory purposes.

E. Field Level Reporting Is Not Necessary For the General Order To Comply With the Law

The Draft Order suggests that field level reporting is necessary to ensure that the General Order complies with the law, and the Nonpoint Source Policy in particular.[52] This is simply not true. Section II.A.2 above describes the challenges with application of the Nonpoint Source Policy to agricultural discharges to groundwater, and in particular its application with respect to salts and nitrates. Despite these challenges, field level reporting is *not* necessary to ensure compliance with the Nonpoint Source Policy.

[51] Agricultural Expert Panel report, p. 26.

[52] Draft Order, p. 20.

As the Draft Order acknowledges, the General Order relies on the ESJ Coalition to collect management practice information as well as surface and groundwater monitoring data and other information.[53] The ESJ Coalition then in turn reports the information to the Central Valley Water Board "with data identified or aggregated at a township level, without Member identification or location information." However, the Draft Order appears to question the validity of this approach because of concerns related to regulatory oversight and transparency in implementation of the program.[54] It appears that these concerns lead the Draft Order to find that field level reporting is necessary for the Central Valley Water Board to ensure that there is implementation of effective management practices, which is necessary to find compliance with the Nonpoint Source Policy.[55] The ESJ Coalition disagrees.

As discussed more fully in section V below, field level reporting is not necessary to provide for accountability, transparency and regulatory oversight. Rather, the Central Valley Water Board has sufficient legal authority to provide for regulatory oversight of the current program, making field level reporting unnecessary to achieve this purpose. Moreover, with the some additional enhancements to the ESJ Coalition's current outreach program, the ESJ Coalition believes that the General Order can ensure implementation of effective management practices, which in turn will ensure compliance with the Nonpoint Source Policy.

V. Central Valley Water Board Has Authority to Ensure Accuracy and Accountability

The ESJ Coalition has always believed that the Central Valley Water Board has the authority to inspect its records, as well as records of its individual members. In fact, the General Order clearly indicates that the Central Valley Water Board has the authority to request these records at anytime, and that such records shall be maintained for at least five years.[56] Further,

---

[53] Draft Order, pp. 17-18.

[54] Draft Order, p. 19.

[55] Draft Order, pp. 17-20.

[56] General Order, p. 36 ["The Member and the third-party shall maintain any reports or records required by this Order for five years. Records maintained by the third-party include reports and plans submitted by Members to the third-party include reports and plans submitted by Members to the third-party for purposes of complying with this Order. Individual Member information used by the third-party to prepare required reports must be maintained electronically

water code section 13267(c) provides the Central Valley Water Board with clear authority to inspect facilities of any person to ensure that the provisions of the General Order are being complied with. In fact, the Central Valley Water Board has, and continues, to inspect member facilities for such purposes. Thus, clearly the authority to ensure accuracy and accountability already exists.

However, to address the concerns expressed in the Draft Order, the ESJ Coalition recommends that the General Order be revised to better articulate the Central Valley Water Board's function with respect to auditing the ESJ Coalition records and grower operations. Also, the ESJ Coalition recommends that the General Order specify the frequency in which the Central Valley Water Board shall inspect the Coalition's records, at the Coalition's home office. Considering the number of coalitions generally, the ESJ Coalition recommends that Central Valley Water Board inspection of its records occur at least once every three years.

VI. ESJ Coalition Program Has a Rigorous Education and Outreach Program to Ensure Effective Implementation of Management Practices

As explained previously, the ESJ Coalition has developed a rigorous education and outreach program to ensure effective implementation of management practices. For the last 13 years, the ESJ Coalition has employed this program to address surface water issues of concern. This approach has consisted of taking surface water quality monitoring information, combined with other data and information such as that related to pesticide use information, to directly contact growers about their management practices. This direct contact consists of assessing grower current practices, and making recommendations about improved practices. There is then follow up to ensure that improved practices are being implemented, and subsequent surface water quality monitoring. To date, this program has been highly successful, and has resulted in improved surface water quality.

---

and associated with the Member submitting the information. The maintained reports or records, including electronic information, shall be made available to the Central Valley Water Board upon written request of the Executive Officer.].

The ESJ Coalition intends to implement a similar approach with respect to nitrogen management, which is a key issue of concern in the Draft Order and generally. First, the ESJ Coalition will use the nitrogen summary reporting information to calculate A/R ratios for all members, and will then aggregate this data on a crop basis for each township. This will be displayed through box and whisker plots, which identifies those growers that have A/R ratios that are outliers as compared to others. The ESJ Coalition will then directly contact those growers that are identified as outliers to better determine the reasons associated with their specific A/R ratio. This will include an assessment of nitrogen related management practices. The ESJ Coalition will monitor this individual annually to evaluate the A/R ratio from year to year, as well as through a multi-year average.

Second, the ESJ Coalition will provide *all* members with their A/R ratios prior to the next crop year. This will include letting the member know where they stand as compared to others growing the same crop. The ESJ Coalition will also use the aggregated township information to educate its members at its annual grower outreach meetings.

Through these combined efforts, along with implementation of the Groundwater Management Plan, trend monitoring, and the management practice effectiveness program (MPEP), the ESJ Coalition believes that effective management practices for nitrogen management will be implemented, and improved over time. No General Order changes are necessary to implement this program because it is part of the ESJ Coalition's Groundwater Management Plan approach.

VII. ESJ Coalition Recommends Development of a Coalition Performance Review and Improvement Plan for Nitrogen Management

In addition to the ESJ Coalition actions already required and being implemented under the General Order, the ESJ Coalition believes that it may be appropriate for the Coalition to develop a Performance Review and Improvement Plan for Nitrogen Management. The general purpose of this plan would be for the ESJ Coalition to develop performance metrics for ensuring improved nitrogen management across the coalition area. This may be a standalone plan, or part of the ESJ Coalition's Comprehensive Groundwater Management Plan. In general, a Performance Review

and Improvement Plan should use available CDFA information to identify appropriate targets (e.g., crop application rates), and use these identified targets in the member education and outreach program. This program would also take the information gained on nitrogen fertilizer management from the MPEP and build it into the education and outreach program. A large component of the Performance Review program will be for the ESJ Coalition to describe how it intends to evaluate and monitor the accuracy of information being provided to the Coalition by its members.

To implement this new proposed requirement, the ESJ Coalition recommends that the General Order be revised to require submittal of Performance Review and Improvement Plan to the Central Valley Water Board by December 31, 2017. This date is appropriate for the ESJ Coalition because by that time there will be several years of Farm Evaluation and Nitrogen Summary Report data, as well as information from the MPEP.

VIII. ESJ Coalition Surface Water Monitoring Program Has a Proven Record of Success and No Revisions Are Necessary

The Draft Order directs the Central Valley Water Board to review and modify the surface water monitoring program because "'we cannot find that it is, in fact, of sufficient density (spatially or temporally) to identify locations of possible pollution."[57] The ESJ Coalition adamantly disagrees with this statement, and disagrees with the findings in the Draft Order relevant to the ESJ Coalition's surface water monitoring program. For the reasons explained here, the Draft Order must be revised to recognize the adequacy of the existing surface water monitoring program.

A. Current Surface Water Monitoring Program Is Sufficiently Representative

The ESJ Coalition relies on the use of core monitoring sites to generate data, which are representative of other sites within a specific zone. For the ESJ Coalition, monitoring occurs in 31 different waterways in six (6) zones. The Draft Order's concern appears to be that with a zone based monitoring program that includes several watersheds, a grower in one portion of the zone

[57] Draft Order, p. 45.

could cause a problem that would go undetected because insufficient monitoring is occurring throughout the entirety of the zone.

Further, the Draft Order criticizes the current monitoring program for lacking sufficient density of sites both spatially and temporally, and directs the Central Valley Water Board to change the surface water monitoring program to be of sufficient spatial and temporal density.[58] The objective of such a design is "to pursue exceedances with increasingly focused monitoring in upstream channels designed to narrow down and identify the approximate area and sources of exceedances." Implicit in this objective is also the requirement to have a sufficient spatial and temporal monitoring density to detect exceedances in the first place.

To develop a "bigger" monitoring program, the primary question becomes what is sufficient spatial and temporal density of monitoring locations/timing? To absolutely guarantee that no chemical exceedances or toxicity goes undetected, it would be necessary to monitor all water, at all locations, continuously. Because this is not possible legally, logistically, or financially, any monitoring program necessarily involves sampling in space and time. Sampling is defined as the process of selecting individual items from among a larger population of those items. If the process of sampling is done correctly, the condition (e.g. water quality) of the items in the sample is representative of the condition in the entire population. Any monitoring program that involves "sampling" necessarily involves some risk that exceedances of Water Quality Trigger Limits for chemicals or toxicity may not be detected. Eliminating all risk of undetected exceedances is not possible. The goal of a representative sampling program is to reduce the risk of missing an exceedance to an acceptable level.

The Draft Order's assumption in the requirement to increase the density and frequency of monitoring is that the water quality in each waterbody is independent of the water quality in every other waterbody. With this assumption, the logical conclusion is that the only way to understand water quality across an entire coalition region is to sample everywhere, all the time. The fallacy of this logic can be seen using an analogy to sampling marbles in a closed box. Suppose there is a

[58] Draft Order, p. 47.

closed box containing black marbles and white marbles drawn from two different jars in some unknown proportion, one jar containing all black marbles, the other jar containing only white marbles. The question becomes how many marbles must be removed from the closed box to determine the color of every marble in the box. With only two colors, the probability of removing a black marble is 50% meaning that one can only be "half" certain of the color of each of the marbles in the box. If the color of each marble is independent of the color of the other marbles in the box, and one wants to know the color of every marble with absolute certainty, the answer is that every marble must be removed and its color determined. However, if we know that all of the marbles in the box are the same because we pulled them from the same jar (e.g., the jar of black marbles), we only need to pull a single marble out of the box to know the color of all the remaining marbles in the box.

The ESJ Coalition developed zones in which crops, soils, pesticide applications, weather, and other factors are similar, all leading to similar applications with a similar potential for exceedances. In other words, each zone is like a source jar of marbles. The analogy is that we sample a single waterbody in a zone ("Core sites") and determine if there is an exceedance of a Water Quality Limit Trigger. From this, we then assume that there could be the same exceedances at other waterbodies in the zone, and therefore we sample the other waterbodies (i.e., "Represented Sites") to confirm. The only difference between the marble analogy and the Core-Represented Site-Zone approach is that we are not absolutely certain that water quality is identical across the entire zone. Knowing that similar farming practices and environmental conditions in a zone are extremely likely to generate similar water quality gives us confidence that when water quality is good in the Core site, it is likely good everywhere in the zone, and conversely, when water quality is impaired at the Core site, it is likely to be impaired everywhere in the zone. However, to increase our confidence that this is in fact the case, the ESJ Coalition rotates the Core Sites every two years, and samples all Represented Sites when an exceedance occurs at the related Core Site.

This approach has been developed over the last 12 years, and is sufficiently representative. For this reason, no adjustments are necessary, and the Draft Order should be revised accordingly.

B. Surface Water Approach Has Been Proven to Be Successful

As indicated above, the ESJ Coalition currently conducts surface water sampling and analysis (i.e., monitoring) in 31 different waterways in 6 zones that encompass the irrigated lands of its members. This program monitors every watershed where access for sampling is possible, and where agriculture is the dominant land use. In addition to the monitoring at the certain sites that are identified as "Core" sites, additional sampling of waterways occurs across the entire ESJ Coalition region ("Represented Sites"). In general, monitoring occurs monthly at the Core sites (which are set up for each zone), and if an exceedance of a Water Quality Trigger Limit occurs, additional monitoring is extended to every other site within that zone ("Represented Site") and a management plan is triggered. As a result, management plans have been initiated in every watershed, with the exception of two that were recently added to the monitoring program. Once a management plan is initiated, even more monitoring is required for source identification, outreach to growers to educate them about the problem, identification of management practices for implementation that can help eliminate the problem, and monitoring to confirm that the problem has been eliminated. Through this iterative approach, a substantial number of surface water problems have been eliminated. Since 2012, the ESJ Coalition has completed 78 Management Plans, 49 of which are for pesticides and/or toxicity; the remaining 29 are for physical parameters (e.g. dissolved oxygen, pH), metals not applied by agriculture (e.g. lead), nutrients (ammonium), and bacteria.

Based on the ESJ Coalition's experience, additional sampling such as that being suggested by the Draft Order has not shown to improve the ability to identify sources of exceedances. For two years, the Coalition monitored upstream and downstream sites during the same sampling event in every waterbody in which an accessible upstream site was available. This extensive monitoring effort did not result in any significant improvement in the ability of the ESJ Coalition to identify growers that were discharging pollutants to surface water at a level that would cause and exceedance of a Water Quality Trigger Limit. Rather, after reviewing the data during numerous discussions with Central Valley Water Board staff, the Central Valley Water Board recommended that the ESJ Coalition discontinue upstream/downstream monitoring, and instead

focus on using alternative means to identify potential dischargers. Accordingly, the ESJ Coalition turned to Pesticide Use Reports filed with the County Agricultural Commissioner to identify all members who had the potential to discharge and/or cause exceedances of chemical Water Quality Trigger Limits or toxicity. With this information, the ESJ Coalition then determined that treating all upstream members equally was the most effective method of reducing exceedances rather than spending time to isolate one or a few members. Over the last several years, this approach has led to identification of numerous potential dischargers, increased outreach to those growers on management practices to protect surface water, and most importantly resulted in significant improvements in water quality. Accordingly, the surface water monitoring program is representative, and adequately leads to improvements in water quality.

IX. Domestic Well Monitoring Is a Landlord/Tenant Issue – Not an Irrigated Lands Issue

The ESJ Coalition agrees generally that domestic wells should be monitored to protect public health. The Irrigated Lands Program, which is implemented through the General Order, is a source control program that is designed to address "discharges of waste," as required under Porter-Cologne. Through the control of discharges, members subject to the General Order are then protecting beneficial uses, including the domestic and municipal drinking water beneficial use, referred to as MUN. The irrigated lands program is *not* a drinking water program per se, and thus, requiring members to monitor domestic wells and provide notification to those using the domestic wells of nitrate levels that exceed the drinking water standard is beyond the purposes of the Program. Rather, such requirements should be mandated of all domestic well owners by counties, or the Division of Drinking Water through other legal authorities.

As a practical matter, requiring such monitoring here only captures a small number of domestic wells as there are many more wells that exist outside of the irrigated lands program as compared to those that would be captured with the General Order. Further, many of the members subject to the General Order do not have access to domestic wells that may exist on leased properties. As such, these members will be unable to comply with the General Order if revised because they do not have access to or control of the domestic well. Accordingly, the ESJ

Coalition fails to see how requiring domestic well monitoring through the irrigated lands program provides for wide spread public health protection across the Central Valley.

Moreover, the ESJ Coalition does not support the Draft Order's suggestion that it be responsible for gathering domestic wells sample results from its members, and include such results in the ESJ Coalition's annual report. Such efforts would be excessive, costly and an administrative burden on the ESJ Coalition that it is not willing to undertake.

Accordingly, the ESJ Coalition recommends the following changes to the domestic well monitoring requirement:

- Extend the date of commencement of domestic well monitoring from December 31, 2016 to January 1, 2019. This will allow for other efforts to develop a comprehensive domestic well monitoring program through more appropriate legal authorities that are protective of public health.
- Include a provision that eliminates the requirement for domestic well monitoring if it is otherwise required through other legal means, such as a county ordinance, or state law.
- Remove the ESJ Coalition's role in gathering and being responsible for obtaining domestic well monitoring results from its members.

X. Draft Order Will Substantially Increase ESJ Coalition Program Costs

The ESJ Coalition has evaluated the impacts that the Draft Order will have on its program costs. Based on this evaluation, the ESJ Coalition finds that the Draft Order will lead to significant cost increases in personnel to assist members with understanding Draft Order requirements, obtaining self-certification for nitrogen management plans and answering questions and clearing up confusion about new program requirements. These increased costs are explained here.

The ESJ Coalition budget for 2016 is $3.1 million, which results in annual member cost of $3.75 per acre plus a $50 member fee. In addition to surface and ground water program costs, the budget includes administrative costs for personnel who are employed through the Stanislaus County Farm Bureau to assist with member and administrative responsibilities. There are also

consultant fees for managing the various ESJ Coalition databases. Overall, the ESJ Coalition estimates that the proposed changes in member requirements will result in a 27% increase in the ESJ Coalition budget, which will raise the dues from $3.75 to $5.25 an acre (assuming that the number of enrolled acres remains relatively the same as it exists now).

The additional member requirements translate into higher administrative costs due to the proposed requirements for all members to have Irrigation and Nitrogen Management Plans (INMPs) certified (requires more resources for self-certification), general confusion and understanding with respect to Draft Order revisions, and requirements related to field level reporting. These costs are substantial because the ESJ Coalition is a resource for its members, and it spends considerable time helping members understand requirements for complying with the General Order. A breakdown of the estimated cost increases and associated assumptions is included below, and are summarized in Table 1.[59]

- ESJ Coalition Staff / Director Increases

The ESJ Coalition expects that it will need to double the personnel time of its existing three part time staffers, which is estimated to result in an increase of $152,457.60 annually. In addition, the ESJ Coalition Executive Director's time is expected to increase by 30%. The total increase for additional Stanislaus County Farm Bureau staff time and the ESJ Coalition Executive Director's time is $182,457.60, which is an overall increase of 98% for personnel.

- Certified Crop Advisor Costs

Due the Draft Order's requirement that all members certify their INMP, the ESJ Coalition expects that it will need to hire a part time Certified Crop Advisor (CCA) to assist members with understanding the requirements, and to help with the additional self-certification needs. The annual CCA cost is a new cost, and is estimated to be $50,000 annually.

- Survey Data Management, Member Management and Field Level Data Reporting

The ESJ Coalition currently engages a consultant to manage various databases, including a membership database, a Farm Evaluation database, and a Nitrogen Management Plan database.

[59] Table 1 is included as Exhibit 6 to the Request for Consideration of Supplemental Evidence.

Due to the increase in requirements related to additional tracking of certifications and meeting attendances, it is estimated that the cost for these member management related services will increase by 25% annually. For survey data management, costs are estimated to increase by 45% due to the inclusion of additional required information on both the Farm Evaluation and the INMP Summary Report that will require database design updates. The increase in survey data management costs also reflects the need to track an additional 1,000 members with respect to an INMP Summary Report and data entry costs associated with this new requirement. The cost of uploading Farm Evaluation and INMP Summary Reports to GeoTracker is based on an estimated 4,000 members with one or more submitted reports and an estimated time of 15 minutes per member to load the data and track completeness ($100/hour rate). This is an additional cost of $100,000 that is not accounted for in the 2016 ESJ Coalition budget.

- Mailing Increase

The cost for mailing NMP Summary Reports is approximately $2.50 a member. In addition, the ESJ Coalition sends multiple follow up reminder post cards and sometimes has to re-mail surveys due to incorrect addresses or lost surveys. The ESJ Coalition estimates an additional $1.00 per member for the additional mailings (total mailing cost = $3.50 per member). It is estimated that the new INMP Summary Report requirements will result in an additional 1,000 members who will need to receive these mailings and an additional cost of $3,500. More significantly, the ESJ Coalition estimates that a $5 mailing will need to be sent to all members that describes the new requirements compelled by the Draft Order, and include an explanation of what members will need to do in order to stay in compliance with the Irrigated Lands Regulatory Program as revised; this mailing is estimated to be an additional $20,000 (total cost increase = $23,500).

- Individual Well Data Management

The Draft Order would require members to monitor for nitrate in domestic wells located on their property. It also requires that the data be uploaded in GeoTracker and included in annual reports submitted by the ESJ Coalition to the Central Valley Water Board. It is expected that the Coalition will have to assist members with the GeoTracker system (including obtaining a

GlobalID) as well as track the information (which member and APN is associated with what GlobalID) on GeoTracker in order to download the data and include the groundwater results in annual reports. Based on experience in working with growers on the Central Coast, the effort of tracking what GlobalIDs are associated with which member/parcel, is estimated to take at least an hour per member. The results in an estimated increase of $400,000 for Individual Well Data Management, which is based on an $100/hour rate multiplied by 4,000 members.

- 3rd Party Data Management System

The requirement to utilize a third party data management system (outside of what is already utilized by the ESJ Coalition) is estimated to be an additional $9,400 for the first year based on utilizing Barracuda and the cloud (initial purchase of hardware is $5,000, $1,000 per year for equipment warrantee, $900 per year for maintenance, $2,500 per year for storage space).

This results in a total overall increase of $834,737.60. This increase is just for the ESJ Coalition and does not include cost increases that will be borne by each individual member. Nor does this include an estimate of new fees that will need to be assessed by the State Board in order for the Central Valley Water Board to administer the new program requirements.

XI. Other Issues

A. Changes to Nitrogen Summary Report Are Improper

Draft Attachment A seeks to modify the Nitrogen Summary Report and would require growers to calculate the A/R ratio prior to submitting the Nitrogen Summary Report.[60] The existing approved Nitrogen Summary Report only requires growers to calculate and report A/Y. The ESJ Coalition then takes the A/Y provided information to calculate A/R for its members, and provides this information back to the members. Although it may appear that this is a relatively simple task, for a large number of growers the conversions/calculations required to generate the N removed value (R) from Yield, are formidable. A large number of growers in coalitions are older and not capable of making what appears to be relatively simple calculations. Further, review of Nitrogen Summary Report data provided to the ESJ Coalition by growers indicated that the

[60] Draft Attachment A, Appendix MRP-4, p. 11.

calculation of A/Y presented sufficient challenges and that significant follow up and correction was required.

Accordingly, the ESJ Coalition recommends that the Nitrogen Summary Report remain the same. Coalitions should continue to calculate A/R and A-R from the A and A/Y information that is provided and return those calculations to the grower. It allows the grower to see their A/R and A-R values in the context of other members who are growing the same crop in their region. The ratio and difference statistics are calculated to help the grower in planning. Given that there are no A/R or A-R values that have been established as reasonable targets (despite the insistence of some that A/R should be 1.0 and A-R should be 0), the grower would be performing an exercise that does not provide any positive input into the management of their operation.

Moreover, the current approach was agreed to be appropriate by the Central Valley Water Board, agronomic professionals and representatives of the environmental justice community, all of who were consulted when this approach was developed. All agreed that it was more appropriate for growers to calculate A/Y, thus ensuring a more accurate level of reporting.

B. Farm Evaluation Template Should Remain as Already Approved

As indicated previously, the ESJ Coalition has been collecting Farm Evaluation data from the already approved template for the last three years. Any effort to change the template now will cause confusion, and will make it more difficult to use the information already obtained. Thus, these changes should be rejected.

C. Changes to Nitrogen Management Plan Template Are Unnecessary and Duplicative

Draft Attachment Appendix MRP-4 proposes to change the currently approved Nitrogen Management Plan template. The proposed changes are unnecessary and duplicative. First, irrigation method information is already provided with the Farm Evaluation template. Second, crop evapotranspiration information is speculative in a planning document because it will vary based on weather and hydrogeologic conditions. Third, the ESJ Coalition has already conveyed and educated its members with respect to the existing approved template. Thus, collectively, the reasons for maintaining the existing template far outweigh the revisions proposed.

D. Use of Standard Deviation From the Mean Is Not a Proper Metric

The use of any arbitrary metric like the use of one standard deviation from the mean to identify outliers may be appealing on first glance but use of the same metric over time brings into question its utility. The main problem with a fixed metric like the one proposed in the Draft Order (e.g., 1 standard deviation above the mean, 90th percentile) is that it creates a disconnect between grower performance and the measurement of that performance. For example, an academic institution reports that it is possible to achieve an A/R of 1.5 taking into account losses to denitrification and volatilization. Growers implement practices that improve their performance and are able to bring their A/R to below 1.5. Using 1 standard deviation as the sole determinant of being out of compliance dictates that a fixed portion of the grower population will always be considered out of compliance regardless of their performance. Thus, growers with an A/R below what is considered possible to achieve will be flagged as managing their operation in a way that poses a risk to groundwater. This problem is exacerbated by our lack of understanding of what an appropriate A/R is for essentially all of the crops grown in the Central Valley.

F. Data Management and Record Retention

The Draft Order would require independent, offsite data storage. This requirement appears to be based on a concern that valuable data could be lost if it is all stored on a single computer that then suffers a malfunction. The requirement for backup/storage is reasonable; the requirement that the backup/storage be offsite is not reasonable. There are numerous options for storage that meet the intent of the requirement but reduce the cost of the backup/storage effort. ESJ Coalition data are backed up nightly whenever changes to the databases occur (e.g. the addition of new Nitrogen Summary Report data). If no changes occur, total system backup occurs every 7 days. The backup is made to tape, and the tape is stored offsite negating any possible loss of data due to a catastrophe such as a fire.

Offsite storage (the location is often referred to as a data farm) may appear to be more secure, but this is not necessarily the case. Recently, the State Board decided to store their water quality data kept in the California Environmental Data Exchange Network (CEDEN) in a data farm. After a short period of time, safety and security of the data were questioned and the State

Board removed its data from the data farm back into its own system. Thus, even the State Board recognizes that offsite storage does not guarantee safety and integrity of data.

Moreover, coalitions are required to provide an explanation of data management in their quality assurance protection plan (QAPP), which is appropriate. Thus, review and modification of the data management should be performed on a case by case basis in conjunction with QAPP preparation and renewal, rather than requiring all coalitions to universally spend additional resources on an unnecessary effort.

G. Changes to Groundwater Management Plan Triggers not Necessary

The trigger for a groundwater quality management plan (GQMP) includes any location designated as high vulnerability by the ESJ Coalition. Consequently, the question is whether the California Department of Pesticide Regulation Groundwater Protection Areas (CDPR GPAs) or the State Board's Hydrologically Vulnerable Areas (HVAs) capture the scientific rationale for designating high and low vulnerability, i.e., would they capture all areas that should be designated as high vulnerability without adding area that does not truly qualify as being high vulnerability. The DPR GPAs are sections of land (640 acres) in which wells contaminated with pesticides have been found. The location of GPAs (http://www.cdpr.ca.gov/docs/emon/grndwtr/gwp_id_gwpa.htm) includes sections that are at risk for runoff, leaching, or both, based on either pesticide detections or on certain soil types and a depth to groundwater shallower than 70 feet. The designations are a result of contamination by pesticides, not nitrate. Also, for those sections of the DPR GPAs that are the result of runoff, the runoff is defined as pesticide residues that are carried to more direct routes to groundwater such as dry wells or drainage wells, poorly sealed production wells, or soil cracks, or to areas where leaching can occur. Soil conditions on sections identified as having the potential for runoff problems does not mean that infiltration to groundwater would be a problem, and in fact, language on the DPR site indicates that there may be a hardpan layer and/or low infiltration rate on these sections. Consequently, the runoff groundwater protection areas are not measuring the same type of "risk" of contamination as the high vulnerability areas identified in the GARs developed by the Coalitions. And, the high vulnerability areas designated within the GAR do not

restrict the depth to groundwater to 70 feet making the determinations in the GARs more inclusive rather than less inclusive.

The State Board HVAs are the result of an analysis that is not technically or scientifically at the level of analysis performed by the ESJ Coalition. The maps in the HVA report were created by the State Board due to groundwater concerns over the release of MTBE from leaking underground storage tanks (http://www.waterboards.ca.gov/gama/docs/hva_map_table.pdf) and indicate where published information indicates soil or rock conditions may be more vulnerable (susceptible) to groundwater contamination. (The State Board underlines the term "may" in their description.) The State Board indicates that although the areas were designated over concerns about MTBE, these areas may also be vulnerable to other contaminants released at the surface. After the ESJ Coalition's high vulnerability areas were developed, they were compared to both the DPR GPAs and the State Board's HVAs. While there was a great deal of overlap, the ESJ Coalition's vulnerability areas encompass more area than the two state agency's high vulnerability designations, and are more inclusive of conditions that could lead to groundwater contamination. Where the ESJ Coalition's high vulnerability areas do not include some GPAs or State Board HVAs, the analyses performed by the ESJ Coalition is significantly more rigorous than either of the designations by the state. Requiring adherence to one or more less rigorously derived categorizations would not meet the level of groundwater quality protection found in the GAR vulnerability designations. Thus, the Draft Order's recommended changes with respect to DPR's GPAs and the State Board's HVAs need to be rejected.

XII. Conclusion

Based on the foregoing reasons, the ESJ Coalition finds that the Draft Order and Draft Attachments must all be significantly revised. The ESJ Coalition's recommended changes as presented above throughout this Response are summarized here:

- Revise the Draft Order to recognize that prior adopted orders and certain policies do not properly apply to irrigated agricultural discharges.
- Revise the Draft Order to acknowledge CV-SALTS initiatives and the need for alternative compliance strategies.

- Revise the Draft Order to be consistent with Water Code section 13263, and consider factors specified in Water Code Section 13241.
- Revise the Draft Order and Draft Attachments to reinstate vulnerability determinations/distinctions contained in the General Order, and remove phasing based on operation size.
- Revise the Draft Order and Draft Attachments to remove field-level and location-specific identification reporting requirements that go beyond those required in the General Order as originally adopted by the Central Valley Water Board.
- Revise the Draft Order to remove use of target A/R ratios – except for ESJ Coalition outreach efforts.
- Revise the General Order to require Central Valley Water Board inspection of all ESJ Coalition records, at the ESJ Coalition's headquarters, at least once every three years.
- Revise the General Order to require development and submittal of a Performance Review and Implementation Plan for Nitrogen Management, by December 31, 2017.
- Revise the Draft Order to recognize the adequacy of the ESJ Coalition's existing surface water monitoring program, and remove remand to the Central Valley Water Board.
- Revise the Draft Order and Draft Attachments to have domestic well sampling commence no sooner than January 1, 2019: include provisions to eliminate the requirement if it is otherwise required by other legal authorities.
- Revise the Draft Order and Draft Attachments to remove the ESJ Coalition's role with respect to gathering and reporting domestic well monitoring data and information.
- Revise the Draft Order and Draft Attachments to reinstate the Nitrogen Summary Report as it currently exists in the General Order.
- Reject changes to the Farm Evaluation and Nitrogen Management Plan templates that have already been approved, and are already in use.
- Revise the Draft Order to eliminate use of one standard above the mean as a performance metric.
- Revise the Draft Order to eliminate the requirement for offsite storage of data.

- Revise the Draft Order to eliminate changes associated with GWMP triggers.

For all of the above reasons, the Draft Order must be substantially revised.

SOMACH SIMMONS & DUNN
A Professional Corporation

DATED: June 1, 2016

By: Theresa A Dunham
Theresa A. Dunham
Attorneys for Real Party in Interest East San Joaquin Water Quality Coalition

Exhibit 1

Section 1
Executive Summary

California's Central Valley is one of the most productive agricultural regions in the world and is home to almost 20% of California's population (estimated at over 38 million in 2015). By 2030 the state population is expected to increase by more than 13% to over about 44 million people and by 2050 the population is expected to be close to 50 million people. This steady growth will put significant, increased demands on state and regional water resources.[1,2] Communities in the Central Valley rely on surface and groundwater to support many beneficial uses, including agriculture and drinking water supplies. However, elevated salt and nitrate concentrations in portions of the Central Valley impair, or threaten to impair, the region's water and soil quality. Such impairment, in turn, threatens agricultural productivity and/or the region's drinking water supplies. For example, a 2009 economic study, projected that if salt management did not change, direct economic costs could exceed $1.5 billion a year within the Central Valley by 2030.[3]

While the threats to the region's water supplies with respect to salts and nitrates is fairly well understood, the solutions for addressing such threats are complex and multi-faceted. As a result, to address these complex issues, a broad coalition of representatives from agriculture, cities, industry, state and federal regulatory agencies and the public (including Environmental Justice advocates on behalf of Disadvantaged Communities and populations) banned together, starting in 2006, to develop an environmentally and economically sustainable plan for the management of salts and nitrates in the Central Valley. This effort became known as the Central Valley Salinity Alternatives for Long-Term Sustainability initiative, or otherwise CV-SALTS. The overarching goals adopted by CV-SALTS include[4]:

- Sustain the Valley's lifestyle;
- Support regional economic growth;
- Retain a world-class agricultural economy;
- Maintain a reliable, high-quality urban water supply; and
- Protect and enhance the environment.

CV-SALTS was tasked with developing a Salt and Nitrate Management Plan (SNMP)[5] for the entirety of the Central Valley Regional Water Quality Control Board's (Central Valley Water

---

[1] *Groundwater Quality Protection Strategy A "Roadmap" for the Central Valley Region*, Central Valley Water Board, August 2010

[2] http://www.dof.ca.gov/research/demographic/reports/projections/P-1/

[3] *The Economic Impacts of Central Valley Salinity*. Final Report to the State Water Resources Control Board; prepared by Howitt et al., University of California Davis, March 20, 2009

[4] http://cvsalinity.org/

[5] Since salt and nitrate are of critical concern in Central Valley groundwater, the SNMP does not address constituents of emerging concern (CECs) or nutrients other than nitrate.

Board's) jurisdictional area (also referred to as "Central Valley" or "Region 5")[6] (**Figure ES-1**). The Central Valley SNMP builds on a range of water quality management policies and mechanisms already in existence, proposes additional policies and tools needed to provide the Central Valley Water Board with flexibility in addressing legacy and ongoing loading of salt and nitrate in the diverse region, and presents a comprehensive regulatory and programmatic approach for the sustainable management of salt and nitrate.

Although broader in overall scope, the SNMP was also developed to meet requirements set forth in the State Recycled Water Policy[7] (RWP), adopted in 2009 by the State Water Resources Control Board (State Board). The RWP provides statewide direction regarding the appropriate criteria to be used when issuing permits for recycled water projects. In addition, the RWP articulates the State Board's policy that every groundwater basin/sub-basin in California needs to have a consistent salt/nutrient management plan (i.e., SNMP). To ensure that such plans were developed in a timely manner, the RWP establishes criteria and timelines for their development. One of the overarching goals of the RWP is to develop salt and nutrient management plans (for groundwater basins or sub-basins) that are sustainable on a long-term basis and to provide the state with clean, abundant water. It is the intent of the RWP that local stakeholders work collaboratively to fund and develop locally driven SNMPs. Specific goals identified by the RWP include:

- Facilitate the development of local SNMPs that are consistent and/or integrated with the Central Valley SNMP;
- Support increased recycled water use in the region;
- Support the use of stormwater recharge as a water management measure;
- Maintain a reliable, high-quality water supply by protecting the beneficial uses of groundwater;
- Balance the use of assimilative capacity and the implementation of management measures within the region; and
- Monitor the implementation of SNMPs to determine if desired outcomes are being achieved.

Addressing the goals and requirements of the SNMP components of the RWP through the CV-SALTS initiative was a logical progression, and to that end, the State Board allocated $5-million of Clean-up and Abatement Account funds to facilitate the effort. Stakeholders have matched the $5-million with over $2-million directly related to the SNMP development, and several million directed to funding ongoing control and monitoring activities.

---

[6] The Central Valley Regional Water Quality Control Board is a state agency, organized under the Porter Cologne Water Quality Control Act at Water Code section 13200(g). The water code defines the Central Valley's jurisdictional area as "all basins, including Goose Lake Basin draining into the Sacramento River and San Joaquin Rivers to the easterly boundary of the San Francisco Bay region near Collinsville."

[7] State Water Resources Control Board Resolution No. 2009-0011, amended by Resolution No. 2013-0003 http://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2013/rs2013_0003_a.pdf

1.1 Management Goals & Priorities

Overall, to achieve desired outcomes for the management of salt and nitrate within the Central Valley, this Central Valley SNMP addresses the requirements of the RWP, and also addresses legacy and ongoing salt and nitrate accumulation issues. Further, the Central Valley SNMP looks to address both surface and groundwater issues with respect to salts and nitrates. However, the primary focus for early actions is on the need to address salt and nitrate issues in groundwater in a manner that leads to environmental and economic sustainability. The Central Valley SNMP is built on the following management goals:

Goal 1: Ensure a Safe Drinking Water Supply

The most important salt and nitrate management goal for the Central Valley Region is to ensure that a safe drinking water supply is available to all residents of the region. The need to ensure a safe drinking water supply is the highest priority for this SNMP and shall be addressed as quickly as possible in areas in the Central Valley Region where residents do not have drinking water that meets applicable drinking water standards.

Goal 2: Achieve Balanced Salt and Nitrate Loadings

Goal 2 seeks to establish a balance of the mass of salt and nitrate in groundwater underlying each permitted or managed area, meaning that achievement of this goal results in no additional degradation of the receiving water.

Goal 3: Implement Managed Aquifer Restoration Program

This goal seeks to restore salt and nitrate levels within groundwater basins/sub-basins, or locally managed areas, to concentrations that are at or below the applicable water quality objectives established for each constituent. Studies commissioned by CV-SALTS,[8], [9] as well as studies conducted by others in the Central Valley,[10] demonstrate that achieving applicable salt and nitrate objectives in already impaired waters represents a significant challenge. Given this challenge, this SNMP not only focuses on restoring water quality to meet the applicable objectives where possible, but it also seeks to minimize or prevent further degradation so that additional impairments do not occur.

In general, these goals recognize the need to focus limited resources first on health risks, and then focus on balancing salt and nitrate loading followed by restoring impacted water. Notably, however, activities (both regulated and unregulated) leading to salt and nitrate balance are ongoing now (e.g., preparation and implementation of nutrient management plans, improved

---

[8] *Nitrate Implementation Measures Study (NIMS) Final Report.* Report prepared by CDM Smith on behalf of CV-SALTS, March 31, 2016

[9] *Strategic Salt Accumulation Land and Transportation Study (SSALTS), Final Phase 2 Report: Development of Potential Salt Management Strategies.* Report prepared by CDM Smith on behalf of CV-SALTS. October 1, 2014; *SSALTS, Final Phase 1 Report: Identification and Characterization of Existing Salt Accumulation Areas.* Report prepared by CDM Smith on behalf of CV-SALTS. December 13, 2013.

[10] See for example: (a) King et al. 2012. Groundwater Remediation and Management for Nitrate. Technical Report 5 in: *Addressing Nitrate in California's Drinking Water with a Focus on Tulare Lake Basin and Salinas Valley Groundwater. Report for the State Water Resources Control Board Report to the Legislature.* Center for Watershed Sciences, University of California, Davis. (b) Harter et al. 2012. *Addressing Nitrate in California's Drinking Water with a Focus on Tulare Lake Basin and Salinas Valley Groundwater. Report for the State Water Resources Control Board Report to the Legislature.* Center for Watershed Sciences, University of California, Davis.

irrigation practices, real-time management of discharges, pilot studies, etc.) and are anticipated to continue and improve moving forward. With respect to the ultimate goal of restoring the region's groundwater basins, the SNMP recognizes that it will be a time and resource intensive effort. The SNMP provides a framework with milestones and timelines for undertaking such restoration efforts. The Central Valley SNMP also identifies a number of proposed policy changes that will support this effort, and recommends that the Central Valley Water Board take action to adopt these policy recommendations.

1.2 Central Valley SNMP

The Central Valley SNMP provides the over-arching framework, including default identification of current ambient water quality and available assimilative capacity in the Central Valley's groundwater basins, for the Central Valley. However, due to the diversity of the region, the SNMP also provides for local flexibility and encourages local-scale management plans to be developed and implemented by local and/or regional entities as local stakeholders deem appropriate. For the purposes of this SNMP, these locally developed management areas are referred to as Management Zones, which are discussed in detail in Attachment A of this SNMP.

The SNMP includes the required elements from the RWP and recommends new policies to be considered for adoption by the Central Valley Water Board. The Regional Board's water quality control policies/regulations are adopted into water quality control plans, as is required by law.[11], For the Central Valley, there are two such plans: *Water Quality Control Plan for the Sacramento River and San Joaquin River Basins* (SRSJR Basin Plan), and the *Water Quality Control Plan for the Tulare Lake Basin* (TLB Basin Plan) (collectively referred to as "Basin Plans"). Thus, to the extent that the SNMP includes recommended policies, or proposed changes/clarifications to existing Regional Board policies, such revisions would need to be adopted by the Central Valley Water Board as part of a process for amending the Basin Plans. Thus, the SNMP includes recommended policy/clarification changes to facilitate implementation of the SNMP; however, the Central Valley Water Board reserves the right and authority to adopt or reject the recommended changes. If adopted, the outcome would be a revised regulatory framework with the flexibility necessary to make salt and nitrate management decisions at the appropriate temporal, geographic and/or management scales.[12]

To better explain some of the proposed policy changes (and how they might work in reality), the SNMP is supported by archetype/prototype studies ("proofs of concept") that provide examples and/or guidelines for consideration when implementing various elements of this SNMP. Further, findings from technical studies provide the basis for SNMP recommendations for the short and long term management of salt and nitrate throughout the Central Valley.[13]

---

[11] California Water Code, §13240.

[12] See CV-SALTS Strategy and Framework at http://www.cvsalinity.org/index.php/docs/committee-document/executive-committee-docs/1411-cv-salts-program-work-plan-v-8-approved-3912pdf/file.html]

[13] http://www.cvsalinity.org/index.php/committees/technical-advisory/technical-projects-index.html

1.2.1 Implementation Framework

The Central Valley SNMP establishes the minimum or default expectations for the management of salt and nitrate in discharges to surface and groundwater in the Central Valley Region. Generally, and after the relevant recommendations are adopted into Basin Plans, the SNMP recommends that management measures identified in the SNMP be implemented through the Central Valley Water Board's issuance of Waste Discharge Requirements (WDRs) (individual or General Order) or Conditional Waivers (Waivers).[14] The SNMP recommends that incorporation of the management measures from the plan be phased-in across the Region to allow focus on the most significant water quality priorities first, and to allow for a reasonable allocation of resources. For some dischargers, current WDR and/or Conditional Waiver requirements may already be set at a level necessary to implement or meet the management measures recommended in the SNMP. For others, additional requirements may be necessary.

Where a group of dischargers desire to work collaboratively to comply with and implement this SNMP within a delineated area, these dischargers are encouraged to establish a Management Zone in accordance with the recommended Management Zone Policy, which is provided in section Attachment A of the SNMP. Once a Management Zone is established, WDRs and/or Conditional Waivers for multiple dischargers participating in the zone will likely need to be amended (individually or collectively) to incorporate the salt and nitrate management measures that are established specifically for that Management Zone.

1.2.2 Protection of Beneficial Uses

Groundwater basins in the Central Valley are considered suitable or potentially suitable for the following beneficial uses: Municipal and domestic water supply (MUN), agricultural water supply (AGR), industrial service supply (IND), and industrial process supply (PRO). Water quality objectives have not been established for IND or PRO. For MUN[15] and AGR,[16] the following nitrate or salinity water quality objectives provide the basis for the protection of these uses:

1.2.2.1 MUN Beneficial Use

Nitrate

The existing nitrate water quality objective for the protection of drinking water supplies in the Central Valley is 10 mg/L (nitrate measured as nitrogen). This SNMP reaffirms that objective for the protection of a waterbody used as a drinking water supply.

---

[14] All persons discharging wastes, or threatening to discharge wastes, to waters of the state are required to obtain authorization for such discharges from the Central Valley Water Board. The Central Valley Water Board's authorization is provided through the adoption of waste discharge requirements or adoption of a conditional waiver from waste discharge requirements, which are essentially permits that allow the discharge. See Wat. Code § 13260 et seq.

[15] The Basin Plans define MUN as "Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply."

[16] The SRSJR Basin Plan defines AGR as: "Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation (including leaching of salts), stock watering, or support of vegetation for range grazing"; the TLB Basin Plan defines AGR as: "Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing".

Salinity

Implementation of this SNMP is based on the protection of a range of total dissolved solids (TDS) or electrical conductivity (EC) concentrations established in 22 California Code of Regulations (CCR) Table 64449-B ("Secondary Maximum Contaminant Levels [SMCL] Ranges") and incorporated by reference into the Basin Plans (Chapter 3, Water Quality Objectives, Chemical Constituents). This SNMP recommends that the salinity water quality objective to protect the MUN beneficial use be 1,000 mg/L TDS or 1,600 µS/cm EC, consistent with the "Upper" level provided in 22 CCR Table 64449-B.

1.2.2.2 AGR Beneficial Use

Nitrate

No water quality objective has been established for nitrate to protect the AGR beneficial use.

Salinity

The Central Valley Basin Plans do not establish explicit numeric water quality objectives for salinity in groundwater for the protection of the AGR beneficial use. Instead, the Basin Plan relies on a narrative water quality objective to protect AGR. To support translation of the narrative water quality objective, this SNMP recommends the establishment of four AGR classes based on levels of protection required for crop irrigation and stock watering (see Policy: "Salinity Management to Provide Reasonable Protection of AGR Beneficial Uses in Groundwater", Attachment A):

- *AGR Class 1*: TDS < 1,000 mg/L (EC < 1,500 µS/cm).
- *AGR Class 2*: 1,000 mg/L < TDS < 2,000 mg/L (1,500 µS/cm < EC < 3,000 µS/cm).
- *AGR Class 3*: 2,000 mg/L < TDS < 5,000 mg/L (3,000 µS/cm < EC < 7,500 µS/cm).
- *AGR Class 4*: TDS > 5,000 mg/L (EC > 7,500 µS/cm).

These classes are assigned to groundwater basins/sub-basins based on existing ambient TDS water quality conditions determined for the production zone (see Section 4.2).

1.2.3 Existing Water Quality Conditions & Assimilative Capacity

The SNMP uses the groundwater basins/sub-basins established by the Department of Water Resources (DWR)[17] as the basic or default unit for the management of salt and nitrate in the Central Valley. The SNMP establishes existing water quality conditions and water quality trends within each of these basins and sub-basins for Upper, Lower, and Production Zones, where sufficient data are available.[18]

Table 1-1 summarizes the estimated average nitrate (mg/L) and TDS concentration (mg/L) in groundwater wells in the Upper Zone of groundwater basins/sub-basins in the valley floor of the Central Valley Region (**Figure 1-1**), where sufficient data are available. **Table 1-2** provides

[17] *California's Groundwater*, 2003. DWR Bulletin 118, Update 2003. October 2003. See Sacramento River, San Joaquin River and Tulare Lake Hydrological Regions

[18] See Section 4 of this SNMP for definitions of the upper, lower and production zones.

nitrate and TDS data for groundwater basins located outside the valley floor of the Central Valley Region, again where sufficient data are available. For these basins the water quality data represent the average of all available data, not just for the Upper Zone.

Table 1-1 also provides information regarding the volume-weighted nitrate and TDS concentrations in the Production Zone of groundwater basins/sub-basins in the valley floor of the Central Valley Region, where sufficient data are available. Water quality characteristics of the Production Zone as identified in Table 1-1 are expected to be used in the SNMP to establish the default amount of assimilative capacity that may be available on a sub-basin basis for the assimilation of salt and nitrate up to a certain level, and that would still be protective of beneficial uses.

Notably, the default values established in the SNMP for existing water quality conditions and assimilative capacity are applied broadly to an entire groundwater basin/sub-basin and do not consider variability in salt and nitrate concentrations at the local or sub-regional scale. For example, the broad default values presented in the SNMP do not evaluate existing water quality conditions or available assimilative capacity for Management Zone areas or for the specific zone of influence for a single discharge. To address concerns related to the creation of broad default values, the SNMP recommends that discharger(s) confirm available assimilative capacity for the defined Management Zone area, or for the area of influence associated with an individual (or collective individuals) that are covered by a single order. Use of assimilative capacity is further discussed in the Nitrate Permitting Strategy in Attachment A, and any permitted use of assimilative capacity must be consistent with Basin Plans and applicable State Policies.

1.2.4 Process for Implementing the SNMP in WDRs & Conditional Waivers

As indicated, the SNMP includes recommended management measures that will need to be addressed and/or incorporated into WDRs or Conditional Waivers. Thus, the SNMP anticipates that all existing dischargers covered by a WDR or Conditional Waiver will need to seek a revised WDR/Waiver so that the management measures established in the SNMP can be formally incorporated into their permit requirements. Or, at the very least, existing dischargers will need to provide the Central Valley Water Board with an appropriate level of information to demonstrate that their existing WDRs or Conditional Waiver sufficiently complies with the SNMP.

The SNMP recognizes that there are hundreds of existing dischargers in the Central Valley covered by individual WDRs, and thousands of individuals subject to General Orders. Accordingly, it is not feasible or possible for the Central Valley Water Board to amend all WDRs and General Orders at once to incorporate provisions from the SNMP. To address this simple reality, the SNMP will establish an orderly and priority process for reviewing existing WDRs and Conditional Waivers for the incorporation of applicable measures specified in the SNMP. In short, dischargers will be notified by the Central Valley Water Board when their WDRs/Waivers must be evaluated to determine if their applicable permit needs to be updated to incorporate elements from the SNMP. Notification by the Central Valley Water Board will be provided based on a priority scheme that focuses on the most significant water quality concerns first.

Table 1-1. Nitrate and Total Dissolved Solids Concentrations in Groundwater Basins/Sub-basins in the Central Valley Floor, as shown in Figure 1-1 (Upper Zone – arithmetic average of well data; Production Zone – volume-weighted average of upper and lower zones)

Region	Groundwater Basin Code[1]	Nitrate (mg/L)[2]		Total Dissolved Solids (mg/L)[2]	
		Upper Zone	Production Zone	Upper Zone	Production Zone
Northern Central Valley	5-6.01	2.17	1.05	164	172
	5-6.02	ND	1.16	ND	176
	5-6.03	0.83	1.12	169	168
	5-6.04	0.66	1.22	667	198
	5-6.05	0.65	1.28	ND	154
	5-6.06	ND	0.87	ND	176
	5-21.50	3.42	1.67	627	238
	5-21.51	2.25	2.16	343	272
	5-21.52	3.53	3.06	516	533
	5-21.53	ND	1.77	ND	250
	5-21.54	2.25	2.66	283	320
	5-21.55	2.87	1.80	323	224
	5-21.56	ND	1.67	ND	186
	5-21.57	3.76	2.28	216	195
	5-21.58	3.42	1.80	473	343
	5-21.59	1.69	1.31	339	320
	5-21.60	2.08	2.28	351	317
	5-21.61	4.22	2.30	529	391
	5-21.62	7.78	1.67	849	950
	5-21.64	13.83	2.37	957	353
	5-21.67	36.78	7.63	1,488	647
	5-21.68	ND	4.58	ND	823
Middle Central Valley	2-3	3.18	3.47	1,062	900
	2-4	ND	2.68	ND	1628
	5-21.65	3.35	1.78	646	270
	5-21.66	14.16	3.36	1,868	669
	5-22.01	22.43	4.72	2,418	385
	5-22.02	9.58	5.53	602	280
	5-22.03	17.87	7.74	506	322
	5-22.04	11.30	4.85	498	334
	5-22.05	9.78	8.21	625	774
	5-22.06	8.41	4.09	500	325
	5-22.07	13.67	5.01	1,234	1184
	5-22.15	7.43	3.04	1,714	1091
	5-22.16	3.85	1.87	380	220
Southern Central Valley	5-22.08	11.24	6.84	637	464
	5-22.09	0.91	1.80	1,305	1744
	5-22.10	1.15	1.37	4,056	2025
	5-22.11	18.20	12.64	936	465
	5-22.12	10.32	3.23	4,006	1173
	5-22.13	9.92	8.30	708	465
	5-22.14	9.79	3.76	2,418	1177

[1] Groundwater Basin Codes established by the California Department of Water Resources (DWR) in *California's Groundwater*, 2003. DWR Bulletin 118. October 2003.

[2] ND - Indicates insufficient data to calculate average or volume-weighted concentrations for nitrate or TDS.

Table 1-2. Nitrate and Total Dissolved Solids Concentrations in Groundwater Basins/Sub-basins Outside the Central Valley Floor, where Data Available (see Figure 1-2)

Region	Groundwater Basin Code[1]	Average Concentration[2, 3]	
		Nitrate (mg/L)	Total Dissolved Solids (mg/L)
North Central Valley	5-2.01	0.76	ND
	5-2.02	0.60	ND
	5-4	0.56	129
	5-5	1.08	107
	5-7	0.25	178
	5-9	0.32	207
	5-10	0.34	165
	5-11	0.67	394
	5-12.01	0.54	ND
	5-12.02	0.95	ND
	5-13	1.09	621
	5-14	0.87	327
	5-15	1.35	299
	5-16	0.23	1,084
	5-17	1.33	325
	5-18	1.76	381
	5-19	0.56	393
	5-30	1.58	252
	5-35	1.49	42
	5-46	0.23	112
	5-50	0.88	140
	5-56	0.38	258
	5-60	0.69	280
	5-62	0.34	568
	5-63	0.18	33
	5-66	0.27	325
	5-68	0.23	664
	5-87	0.22	93
Middle Central Valley	5-69	0.16	632
South Central Valley	5-25	3.16	577
	5-27	4.37	408
	5-28	6.10	254
	5-29	3.47	310
	5-80	2.74	470
	5-82	3.44	528
	5-83	3.00	167
	5-84	1.28	234
	5-85	0.85	184

[1] Groundwater Basin Codes established by the California Department of Water Resources (DWR) in *California's Groundwater*, 2003. DWR Bulletin 118. October 2003. If a Groundwater Basin is not included in the table; insufficient data available to calculate average nitrate or TDS concentrations

[3] Data for outside valley floor groundwater basins not separated into upper or lower zones.

[2] ND - Indicates insufficient data to calculate average or volume-weighted concentrations for nitrate or TDS.

Figure 1-1. Groundwater Basins/Sub-basins in the Valley Floor of the Central Valley Region (Source: California Department of Water Resources)

Newly proposed dischargers, or existing dischargers looking to substantially modify current discharges, will need to propose how they expect to comply with the SNMP when they submit their application for WDRs to the Central Valley Water Board (otherwise referred to as a "Report of Waste Discharge"). For these dischargers, the submittal schedule as well as Steps 1 and 2 of the implementation process described below in Section 1.2.4.2 do not apply. The remaining steps provide information regarding the requirements to comply with the SNMP.

1.2.4.1 Priority for Implementation

Implementation of this SNMP will be prioritized based on the findings of technical work conducted by CV-SALTS.[19] Prioritizing implementation is necessary so that Central Valley Water Board and discharger resources are focused on the most significant areas of water quality concern first, particularly with regards to nitrate levels and the protection of drinking water supplies. Prioritization is likely to be based on existing ambient water quality conditions in the Upper Zone of groundwater basins/sub-basins in the Central Valley Region.

Tables 1-1 and 1-2 summarize existing average water quality conditions for nitrate and TDS in the Central Valley Region. While this information provides a foundation for prioritizing SNMP implementation, additional factors may be considered to refine the prioritization process, including, but not limited to, the estimated number of public or domestic water supply wells at risk from elevated nitrate concentrations in the groundwater, spatial and temporal variability in the available water quality data, and the trend in nitrate concentrations, if known.

Ultimately, the Central Valley Board plans to establish four priority designations (Priority 1 through 4) to stagger the implementation of this SNMP, beginning with the areas with the most significant nitrate water quality concerns first. Groundwater basins/sub-basins in the valley floor, especially in the southern part of the Central Valley Region are expected to receive the highest priority for implementation. In contrast, given the generally lower nitrate and TDS concentrations in areas outside the valley floor, it is anticipated that these areas will receive the lowest priority for SNMP implementation. Although initial SNMP implementation will likely be based on nitrate water quality concerns, the SNMP recognizes the importance of salt issues and their potential impact to the Central Valley and the state. Prioritizing nitrates first is not meant to underscore the importance of addressing salts long-term, and where salt issues overlap with nitrate issues of concern, the SNMP recommends that these areas be considered as having a higher priority.

1.2.4.2 Compliance with the Central Valley SNMP[20]

Figure 1-2 illustrates the implementation process for complying with the Central Valley SNMP, and **Table 1-3** summarizes the SNMP's proposed compliance deadlines associated with this process. Below is an overview of the key requirements in the implementation process. For dischargers that decide to establish a Management Zone, a different process and time schedule is established in the Management Zone Policy. Moreover, the time lines presented below are intended to represent maximum timelines. The SNMP recommends that individuals and those

[19] Draft *Region 5: Updated Groundwater Quality Analysis and High Resolution Mapping for Central Valley Salt and Nitrate Management Plan*; prepared by Larry Walker Associates and Luhdorff & Scalmanini on behalf of CV-SALTS. May 2016

[20] For new dischargers or an existing discharger that has applied for permit renewal through the submittal of a Report of Waste Discharge, Steps 1 and 2 in Table 1-3 and Figure 1-2 do not apply.

seeking to comply through development of a Management Zone comply with the steps as outlined below as soon as possible, but no later than the number of days specified for each category.

- **Step 1** - The Central Valley Water Board must notify existing dischargers of their responsibility to comply with the SNMP. The notification shall occur in the Priority 1 areas no later than 90 days after the Basin Plan amendments to incorporate the SNMP become effective[21]. It is anticipated, however, that between the time that the SNMP is submitted to the Central Valley Water Board and while the Basin Plan amendments are going through the adoption/approval process, the Central Valley Water Board will be communicating directly with dischargers in the Priority 1 area to discuss and explain the SNMP, and the upcoming need to implement the SNMP. Table 1-3 summarizes notification dates for other priority areas.

- **Step 2** - No later than 270 days after the Basin Plan amendments become effective, dischargers (or an initial group of dischargers in a specified area) seeking to comply with the SNMP through development of a Management Zone shall submit a Preliminary Management Zone Proposal to the Central Valley Water Board. As part of development of the Preliminary Management Zone proposal, the initiating group of dischargers shall solicit other regulated dischargers to participate. To assist the initiating group of dischargers, the Central Valley Water Board staff will assist in identifying other regulated dischargers that should be approached with respect to participating in a Management Zone.

  To address Goal 1 of the SNMP as early as possible, it is imperative that there not be delay with respect to ensuring that residents within the proposed Preliminary Management Zone area have safe drinking water. Accordingly, the Preliminary Management Zone Proposal must include an initial identification of public supply wells, and/or domestic wells that exceed the drinking water standard for nitrate, to the extent that the information is readily available, for such wells within the Preliminary Management Zone boundaries. For purposes of developing a Preliminary Management Zone Proposal, it is anticipated that information regarding an initial identification of public supply and/or domestic wells will already be available and assembled by the Central Valley Water Board, State Board's Division of Drinking Water and/or others, and will be available to the those dischargers that are working to develop a Preliminary Management Zone Proposal.

  Along with identifying the initial public supply wells/and or domestic drinking water wells, the Preliminary Management Zone Proposal must include an Early Action Plan (EAP), which must include specific actions and a schedule of implementation, to address the immediate needs of those initially identified within the Preliminary Management Zone boundary that are drinking groundwater that exceeds nitrate standards.

[21] The SNMP will become effective after approvals are obtained from the Central Valley Water Board, State Board and the Office of Administrative Law.

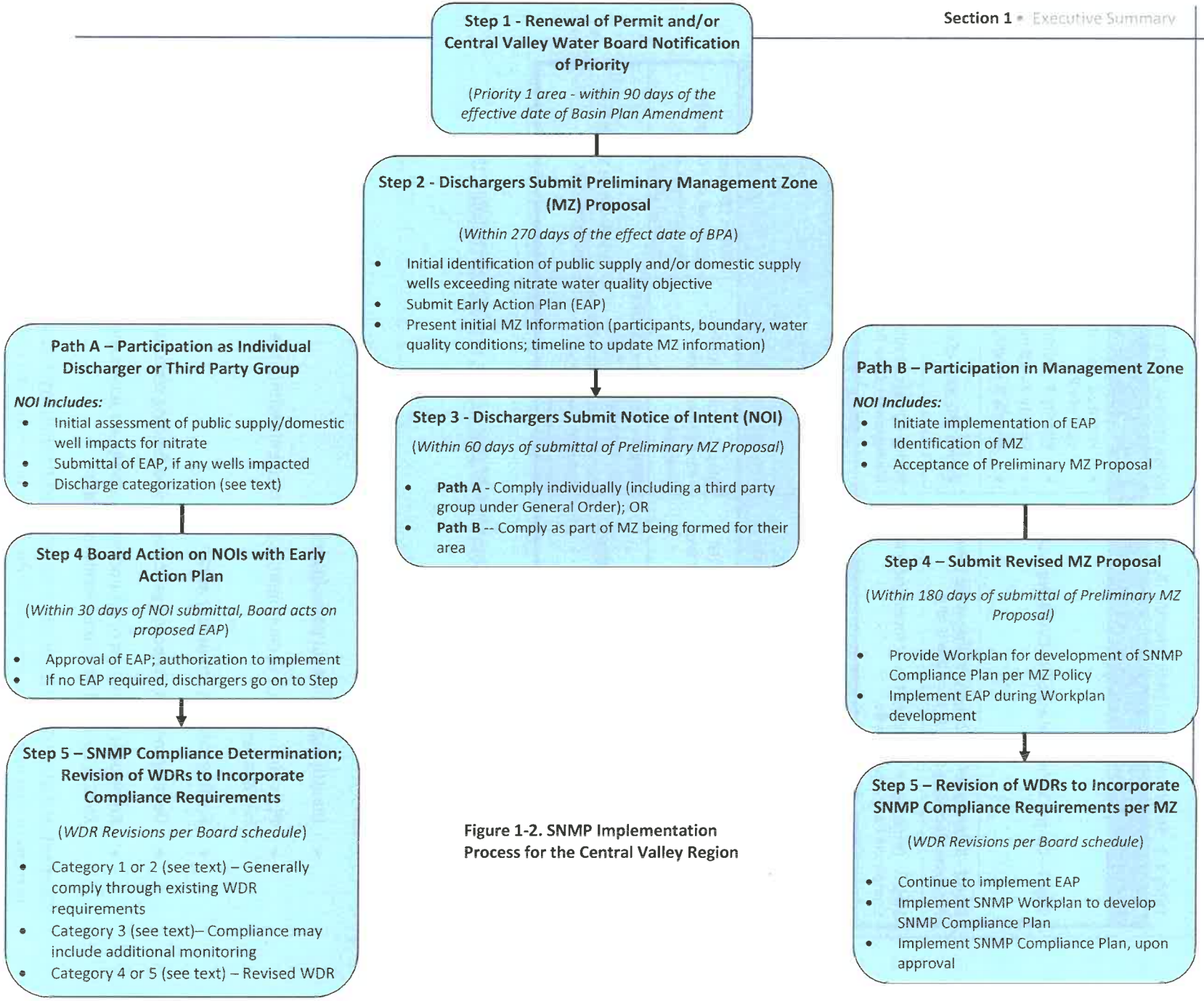


Figure 1-2. SNMP Implementation Process for the Central Valley Region

Table 1-3. SNMP Implementation Schedule (See text; stepwise process illustrated in Figure 1-3

Implementation Steps		Compliance Date	
Step 1 - Central Valley Water Board (CVWB) Notification		• Priority 1 - No later than 90 days of the effective date of BPA • Priority 2 – Within 1.5 years of adoption of BPA • Priority 3 – Within 3 years of adoption of BPA • Priority 4 – Within 5 years of adoption of BPA	
Step 2 - Submittal of Preliminary Management Zone Proposals (including Early Action Plan [EAP])		Within 270 days of the effective date of the BPA	
Step 3 - Dischargers Submit Notice of Intent (NOI) to Comply via **Path A** or **Path B.**		Within 60 days of submittal of the Preliminary Management Zone Proposal	
Path A - Comply individually (including a third party group under General Order)		**Path B** - Comply as part of a Management Zone being formed within discharger's area	
Implementation Step	**Compliance Date**	**Implementation Step**	**Compliance Date**
Step 4 - Board Action on NOIs with EAP (if no EAP, continue to Step 5)	Within 30 days of NOI submittal, Board acts on proposed EAP	**Step 4** – Submit Revised Management Zone Proposal	Within 180 days of submittal of Preliminary Management Zone Proposal (Step 2)
Step 5 – SNMP Compliance Determination and Revision of WDRs to Incorporate SNMP Compliance Requirements	CVWB revises WDRs in a timely manner	**Step 5** – Revision of WDRs of Management Zone Participants to Incorporate SNMP Compliance Requirements	CVWB revises WDRs in a timely manner

The Preliminary Management Zone Proposal should also include, to the extent feasible, the following information:

- Identification of initial participants;
- Proposed timeline for:
  - Identifying additional participants;
  - Plan for outreach to communities and residents within the management zone boundaries;
  - Further defining boundary areas;
  - Development of proposed governance and funding structure; and
  - Additional evaluation of groundwater conditions across the proposed Management Zone area, including consideration of salts.

The Central Valley Water Board will promptly post Preliminary Management Zone Proposals on its website, and make them available to the public for review and comment as they are received.

While Preliminary Management Zone Proposals are being developed, individual dischargers (or collective groups of dischargers covered by a single order) need to be conducting their own initial assessment of their discharge, and of receiving water conditions for both salts and nitrates. This information will be necessary for individuals to determine if they intend to comply with the SNMP as an individual, or be part of a Management Zone.

- **Step 3 - (Notice of Intent [NOI])** Within 60 days after Preliminary Management Zone Proposals are due to be submitted to the Central Valley Water Board (i.e., 330 days after the Basin Plan amendment becomes effective), dischargers in the priority area that received notice must notify the Central Valley Water Board of their intent to either comply with the components of the SNMP as an individual discharger, or as part of a Management Zone. For purposes of this notification, individual dischargers that are subject to General Orders that cover a specified geographic area and that are administered by a Third Party (e.g., Third Party Orders for Irrigated Agriculture), the Third Party may provide notice as required in this step on behalf of its members. For individual dischargers in the specified priority area that are subject to a General Order that is not administered by a Third Party (e.g., Dairy General Order), the individual must provide the necessary notice as indicated in this step.

    - **Individual Dischargers:** For those intending to comply with the SNMP as an individual discharger (or as a single Third Party group subject to a General Order), the Individual Discharger would follow the steps as identified below as ***PATH A***. Further, the NOI required here must include information as described under ***PATH A***.

    - **Management Zone Participants:** For those intending to participate in a Management Zone, they must identify the name of the Management Zone in which they intend to participate, and acknowledge that they have reviewed and understand the Preliminary Management Zone Proposal that applies to their area of discharge. For those intending to comply with the SNMP through participation in a Management Zone, the Management Zone (and thus its participants) would follow the steps further identified below as ***PATH B***.

PATH A - INDIVIDUAL DISCHARGER/THIRD PARTY GROUP SUBJECT TO GENERAL ORDER WISHING TO PROCEED AS AN INDIVIDUAL DISCHARGER

- **Step 3 - PATH A**

    - Individual/Third Parties seeking to comply with the SNMP under PATH A must include as part of their NOI an initial assessment of receiving water and/or discharge conditions. This includes an initial assessment to determine if the discharge (or collective discharges) are impacting any nearby public water supply or domestic wells for nitrates. If there are public water supply or domestic wells impacted by nitrates within the area of influence of discharges covered by the NOI, the initial assessment shall include an EAP, including specific actions and a schedule of implementation to address the immediate needs of those in that are drinking groundwater that exceeds the nitrate drinking water standard.

- The NOI must also indicate, based on the initial assessment, what category the discharge (or discharges) falls within with respect to nitrates:
  - *Category 1 - No Degradation Category*: Discharge[22] is equal to or less than the nitrate water quality objective of 10 mg/L, and the discharge is better than receiving water quality as measured in First Encountered Groundwater.
  - *Category 2 - De minimus Category*: Receiving water has assimilative capacity in First Encountered Groundwater (i.e., is better than the water quality objective). For this category, the discharge may be above the water quality objective as it enters First Encountered Groundwater, but the discharge will use less than 10% of the available assimilative capacity, and is thus considered *de minimus*.
  - *Category 3 - Degradation Below 75% of the Water Quality Objective Category*: Discharges will be considered as part of this category if they anticipate using available assimilative capacity in First Encountered Groundwater that is considered to be more than *de minimus* but will not cause First Encountered Groundwater to exceed a trigger of 75% of the water quality objective for nitrate over a 20 year planning horizon. To allow use of assimilative capacity in this circumstance, the Central Valley Water Board may find it necessary to include additional monitoring and trend evaluations as part of the WDRs in order to make appropriate findings consistent with Resolution 68-16 and the SNMP. (See Nitrate Permitting Strategy in Attachment A).
  - *Category 4 - Degradation Above 75% of the Water Quality Objective Category*: Discharges will be considered as part of this category if they anticipate using available assimilative capacity in First Encountered Groundwater, and use of assimilative capacity will cause First Encountered Groundwater to exceed the trigger of 75% of the water quality objective for nitrate over a 20 year planning horizon. To allow use of assimilative capacity in this circumstance, the Central Valley Water Board may find it necessary to include additional conditions as part of the WDRs in order to make appropriate findings consistent with Resolution 68-16 and the SNMP.
  - *Category 5 - Discharge Above Objective and No Available Assimilative Capacity*: Discharges that exceed the water quality objective for nitrate, and where First Encountered Groundwater has no available assimilative capacity, will be considered to be part of this category. Discharges in this category may need to seek an exception pursuant to the Exceptions Policy under the SNMP (see Attachment A).

[22] Discharge as used here is intended to mean the quality of the discharge as it enters first encountered groundwater. Thus, the quality of the discharge itself may exceed the standard but due to transformation and other variables, it meets or is better than the objective as it enters first encountered groundwater.

- The NOI must also provide a preliminary evaluation, based on the initial assessment, the impact that the discharge has (or does not have) with respect to salts in groundwater.

- **Step 4 - PATH A –Board Action on NOI with EAP**

  - *NOI That Includes EAP* - Within 30 days of receiving an Individual NOI that includes an EAP to address immediate drinking water needs, the Central Valley Water Board shall provide notice to the NOI applicant of its comments on the EAP, and indicate if the discharger may proceed forward with implementing the EAP.

  - *NOI and No EAP Necessary* - If there are no immediately identifiable drinking water needs in the area impacted by the discharge, then the discharger shall proceed forward under Step 5.

- **Step 5 - PATH A - Determination of Compliance with SNMP**

  Categorization of the discharge with respect to nitrates (as indicated in Step 3 - PATH A), as well as other information contained in the NOI, should provide the Central Valley Water Board with the information necessary for it to determine if the discharger can comply with the SNMP with no further action, or if the discharger will be required to submit additional information to indicate how the discharger proposes to comply with the SNMP. For example, discharges that fall within the No Degradation and *De Minimus* categories described above will be considered to comply with the SNMP for nitrates. Discharges that fall within the next two categories will require the Central Valley Water Board to make findings consistent with Resolution 68-16. Depending on the level of degradation for nitrates that will occur, or impacts to salts as identified in the NOI prepared under Step 3 of Path A, the Central Valley Water Board may require additional conditions in WDRs to implement the SNMP. The additional conditions should be commensurate with the level of degradation and the level of assimilative capacity that it intends to allocate. For the last category, the Central Valley Water Board will require the discharger to meet and comply with the exceptions policy (see Attachment A).

  As part of Step 5 - PATH A, it is anticipated that the Central Valley Water Board will revise WDRs for discharges of nitrate that fall within Categories 1,2 and 3 in a relatively short time frame, depending on available resources. For discharges that fall within Categories 4 and 5, the Central Valley Water Board will revise the WDRs for discharges of nitrate to require development and implementation of a plan that indicates how the discharger plans to comply with the nitrate elements of the SNMP (referred to as the SNMP Compliance Plan). To the extent that the discharge of salt is an issue within the permitted area, the Central Valley Water Board will take that into consideration as it revises the WDRs. The SNMP Compliance Plan shall include the following components to address the SNMP Management Goals as they apply to nitrates:

  - Identification of nitrate related drinking water supply issues in the area of influence of the discharge(s) (beyond those identified under an applicable EAP);

- A plan, with a proposed time schedule and milestones, for addressing newly-identified nitrate related drinking water supply issues that address in the area influenced by the discharge;
- Preliminary identification of steps that will be taken to evaluate actions necessary to meet Management Goals 2 and 3;
- Milestones related to implementation of steps required to meet Management Goals 2 and 3 may be phased in over time, and will likely require further evaluation and assessment to identify proposed long-term actions.

If salts are also an issue for the discharge(s) in question, the SNMP Compliance Plan shall also address compliance with SNMP Management Goals 2 and 3, as they pertain to salts. The time frame allowed by the Central Valley Water Board for development of the SNMP Compliance Plan for discharges within Categories 4 and 5 will vary depending on the complexity and size of the discharge, and the size of the area influenced by the discharge. The implementation time frame with actions and milestones will be included in the revised WDR. Implementation of the SNMP Compliance Plan will begin upon approval by the Executive Officer.

PATH B - COMPLIANCE THROUGH A MANAGEMENT ZONE

- **Step 4 - PATH B**

Within 180 days after submittal of the Preliminary Management Zone Proposal, the Management Zone shall submit a Revised Management Zone Proposal, which must include a Workplan for development of a SNMP Compliance Plan for the Management Zone. During development of the Workplan for the SNMP Compliance Plan, the Management Zone must implement the Early Action Plan, as provided in the Preliminary Management Zone Proposal. Implementation of the Early Action Plan as well as development of a Revised Management Zone Proposal must consider any comments provided by the Central Valley Water Board as well as comments submitted by the public. Requirements for the Revised Management Zone Proposal and SNMP Compliance Plan are provided in the Management Zone Policy (see Attachment A).

- **Step 5 - PATH B**

Upon receipt of the Revised Management Zone Proposal, it is anticipated that the Central Valley Water Board will revise WDRs for those discharger participants in the Management Zone. Revisions to WDRs may be made through a Resolution that revises specified WDRs to include requirements for development of the SNMP Compliance Plan, as well as requirements and milestones for implementing the SNMP Compliance Plan upon its approval by the Executive Officer of the Central Valley Water Board. The Central Valley Water Board will include EAP requirements into the WDRs as applicable. However, it is not the intent of the SNMP for implementation of the EAP to wait until after WDRs have been revised to include requirements associated with SNMP compliance.

1.2.5 Recommended New Policies, Regulatory Tools and Clarifications

Through the CV-SALTS process, stakeholders developed recommendations for clarifications to the Basin Plans, adoption of new or modified policies, and regulatory tools for incorporation into the Central Valley Basin Plans. These recommended clarifications, policies and tools are designed to facilitate implementation of the SNMP and efforts to achieve the Central Valley salt and nitrate management goals. Recommendations include:

- *Establish Default Management Areas* - Incorporate the DWR Bulletin 118 groundwater basin/sub-basin boundaries for use as default salt and nitrate management areas unless a group of dischargers elects to establish a Management Zone, which is a delineated area within groundwater basin/sub-basin (see below). The SNMP documents the existing salt and nitrate conditions in the upper, lower and production zones within each of these groundwater basins/sub-basins.

- *Provide Secondary Maximum Contaminant Level (SMCL) Guidance* - Incorporate guidance on appropriate use of 22 CCR §64449 SMCLs for the protection of the MUN beneficial use in surface waters and groundwater. In particular, provide guidance on the appropriate use of the "Recommended", "Upper", and "Short Term" consumer acceptance levels established for total dissolved solids and electrical conductivity in 22 CCR Table 64449-B.

- *Clarify Protection of the AGR Beneficial Use* - Incorporate guidance on interpretation of the existing narrative objective for chemical constituents for setting numeric salinity objectives for the protection of the AGR beneficial use. AGR covers both crop irrigation and stock watering protection. Salinity requirements to protect these uses vary widely depending on the crop or type of stock. This guidance will provide the basis for tailoring the protection of the AGR beneficial use to reflect local and regional differences in water use for agriculture and also identify triggers that will determine if additional action is needed to improve existing/trending water quality.

- *Authorize Implementation of Alternative Compliance Strategies* - Develop a framework for alternative compliance strategies that focuses on ensuring safe drinking water, minimizing degradation, and implementing long-term restoration when discharges cause salt and nitrate degradation in a receiving water. Strategies may include use of offsets, which provide an indirect approach to compliance with a WDR/Waiver requirement for a given pollutant by managing other sources and loads so that the net effect on receiving water quality from all known sources is functionally-equivalent to or better than that which would have occurred through direct compliance with the WDR at the point-of-discharge.

- *Clarify Factors to Support a Maximum Benefit Finding* – To authorize a discharge that is expected to lower water quality, the Central Valley Water Board must make a finding that authorizing the discharge is "consistent with maximum benefit to the people of the state". It is recommended that guidance be incorporated into the Basin Plan regarding factors to be considered when making a maximum benefit finding.

- *Support Establishment of Management Zones* - Amend the Basin Plans to allow and encourage management of salt and/or nitrate through the establishment of management zones. In general, a Management Zone consists of multiple dischargers working collectively

to manage salt and/or nitrate to first insure safe drinking water supplies, then create a balance within the defined Management Zone area, and then ultimately to develop a long-term plan for restoration of groundwater (where feasible) to meet applicable water quality objectives. The Basin Plans do not currently prevent the creation of a Management Zone to manage salt/nitrate; however, it is recommended that the Basin Plans be amended to clearly define requirements for establishment of a Management Zone and ensure that criteria for approval of a Management Zone by the Central Valley Water Board are properly established in regulation.

- *Clarify Allocation of Assimilative Capacity* – Establish guidance on the requirements for allocation of assimilative capacity in groundwater basins/sub-basins or Management Zones. Guidance will include the basis for calculating assimilative capacity within a managed area.

- *Revise the Exceptions Policy* – Revise requirements for granting exceptions in the Central Valley Region to facilitate efforts to achieve water quality objectives in impaired groundwater or to provide the time needed to revise an inappropriate water quality objective. Specifically, it is recommended that the following revisions be made to the current exceptions policy: (a) amend the existing policy to add nitrate to the list of chemical constituents for which the Central Valley Water Board may authorize an exception; (b) remove the existing sunset provision that prohibits the granting of exceptions beyond June 30, 2019; and (c) retain the existing provision that limits the term of an exception to no more than 10 years, but add a new provision stating that exceptions may be reauthorized for one or more additional 10-year periods and that a status report (summarizing compliance with the terms and conditions of the exception) must be presented to the Central Valley Water Board every 5 years.

- *Establish Drought and Water Conservation Policy* – Incorporate into the Basin Plan automatic triggers that may be used to implement a drought-based exception to salinity water quality objectives. Incorporation of such a trigger prevents the need for individual requests for an exception and ensures timely application when the specified conditions exist.

The recommendations are based on technical reviews, case studies, and extensive review and discussion by CV-SALTS stakeholders. Details on each are either included in this document or summarized here with the details referenced in supporting documents.

1.3 CEQA and Economics Analysis

To be developed:

- CEQA Scoping for the SNMP was completed in 2013

- Findings from the CEQA/Economic Analysis of the SNMP

1.4 SNMP Technical Support

To be developed: Executive Summary level discussion of technical findings that support this SNMP.

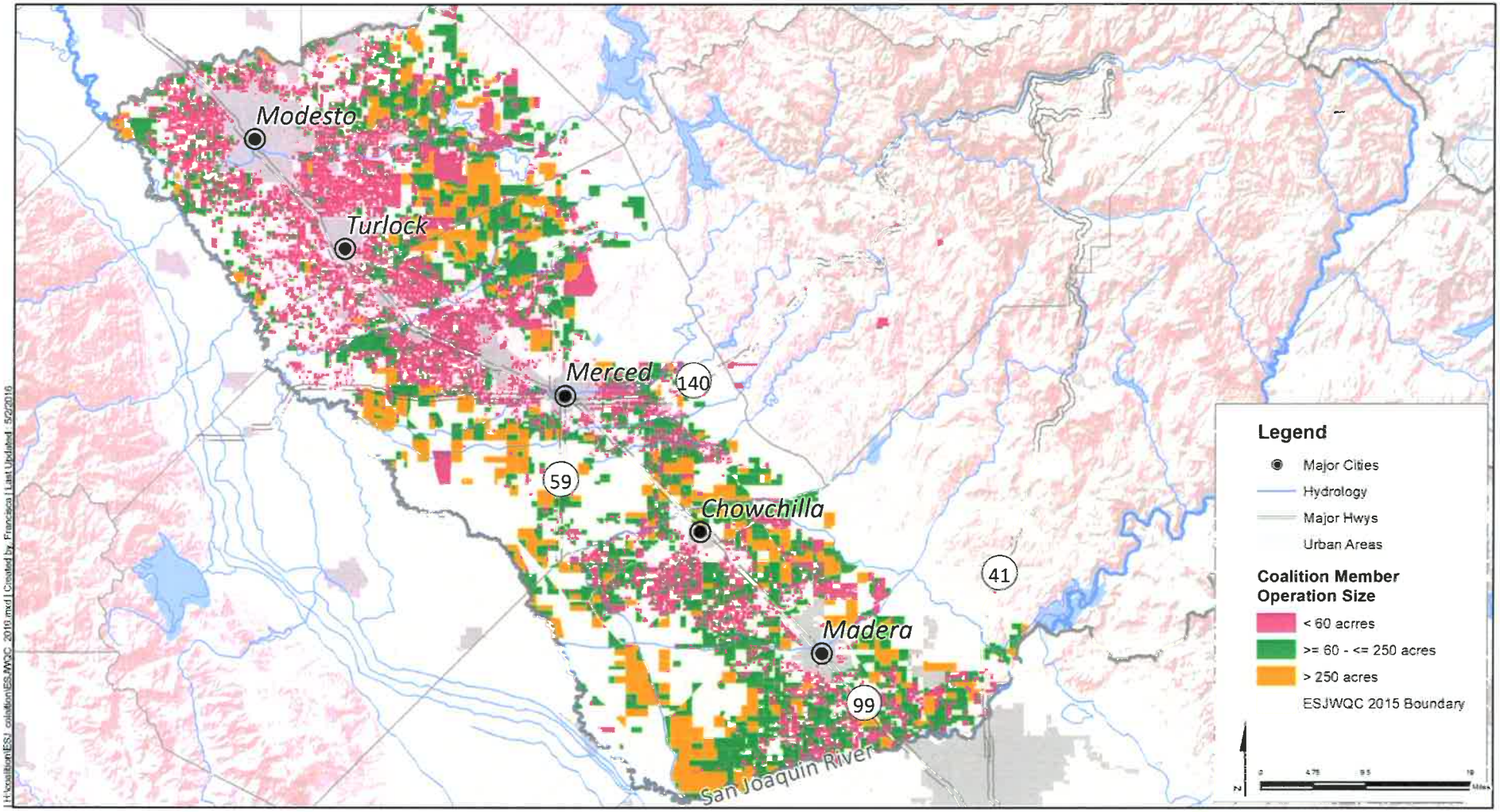
This page intentionally left blank.

Exhibit 2

Exhibit 2 is available at:

http://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/water_quality/coalitions/east_sanjoaquin/index.shtml#esjgar

Exhibit 3



H:\coalition\ESJ_coalition\ESJWQC_2016.mxd | Created by: Francisca | Last Updated: 5/2/2016

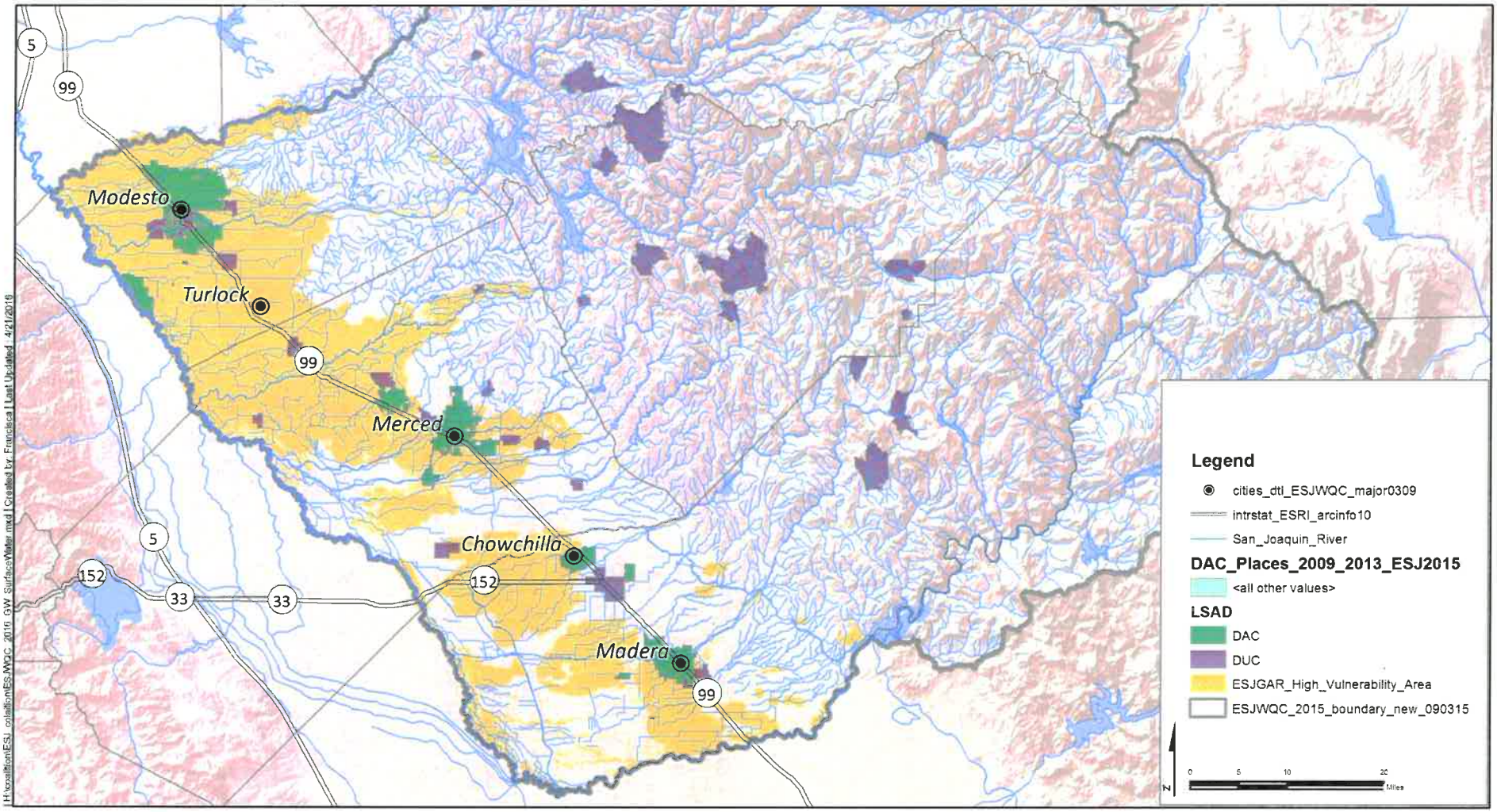
MICHAEL L. JOHNSON LLC
ECOSYSTEMS + CONSULTING

ESJWQC Map of Operation Size

ESJWQC

Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet
Projection: proparty=Lambert Conformal Conic
Units: Foot US

Exhibit 4



MICHAEL L. JOHNSON LLC
ECOSYSTEMS + CONSULTING

ESJWQC HighVulnerability Areas with DAC & DUC Areas

Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet
Projection: property=Lambert Conformal Conic
Units: Foot US

Exhibit 5

Groundwater Quality Management Plan

February 23, 2015

Irrigated Lands Regulatory Program

Central Valley Regional Water Quality Control Board

TABLE OF CONTENTS

Introduction and Background 12
Background 12
Coalition Boundaries 15
Groundwater Basin(s) within Coalition Region 15
Groundwater Quality Management Plan Area 18
Other Groundwater Management Plans within the ESJWQC Region 20
Physical Setting and Geographical Characteristics 25
Geology and Hydrogeology 30
General Hydrogeological Setting 34
Surface and Shallow Subsurface Sediments Characterization 34
Groundwater Hydrology 48
Groundwater Levels 48
General Groundwater Chemistry 60
Land Use 66
Irrigated Land 67
Existing Agricultural Management Practices 71
Irrigation Management Practices 73
Pesticide & Nutrient Management 74
Well Management Practices 75
Irrigation Wells 75
Abandoned Wells 77
Groundwater Constituents of Concern 78
Previous Work to Identify Constituents of Concern in Groundwater 79
Nitrate and TDS – Spatial Distribution 79
Pesticides – Spatial Distribution 80
ESJWQC High Vulnerability Area 87
Surface Water Data Indicating Constituents of Concern in Groundwater 91
Groundwater Beneficial Uses 91
Management Plan Strategy 92
Description of Approach 92
Identify COCs in the GQMP Zones 92
Identify Management Practices that are Protective of Groundwater 93
Management Plan Effectiveness 95
Tracking of Management Practices 96
Tracking of Groundwater Quality 97
Actions to Meet Goals and Objectives 97
Duties and Responsibilities 98
Strategies to Implement Management Plan Tasks 100
Agencies Contacted for Data and/or Assistance 100
Management Practices to Control COCs 100
Outreach Methods 101
Monitoring Methods 107
Monitoring design 107
Minimum Groundwater Monitoring Requirements 107
Groundwater Management Plan Zones 108

Modesto Subbasin Management Zone 108
Introduction and Background 108
Existing Groundwater Management Plans/Entities 108
Basin Boundaries and Surface Hydrology 110
Geology, Hydrogeology, and Groundwater Hydrology 110
Land Use/Irrigated Land 114
Constituents of Concern in Zone 115
Turlock Groundwater Management Zone 118
Introduction and Background 118
Existing Groundwater Management Plans/Entities 118
Basin Boundaries and Surface Water Hydrology 120
Geology, Hydrogeology, and Groundwater Hydrology 120
Land Use/Irrigated Land 122
Constituents of Concern in Zone 123
Merced Groundwater Management Zone 126
Introduction and Background 126
Existing Groundwater Management Plans/Entities 126
Basin Boundaries and Surface Water Hydrology 128
Geology, Hydrogeology, and Groundwater Hydrology 128
Land Use/Irrigated Land 130
Constituents of Concern in Zone 132
Chowchilla Groundwater Management Zone 134
Introduction and Background 134
Existing Groundwater Management Plans/Entities 134
Basin Boundaries and Surface Hydrology 137
Geology, Hydrogeology, and Groundwater Hydrology 137
Land Use/Irrigated Land 141
Constituents of Concern in Zone 142
Madera Groundwater Management Zone 144
Introduction and Background 144
Existing Groundwater Management Plans/Entities 144
Basin Boundaries and Surface Water Hydrology 144
Geology, Hydrogeology, and Groundwater Hydrology 144
Land Use/Irrigated Land 147
Constituents of Concern in Zone 148
Data Evaluation 150
Information needed to quantify program effectiveness 150
Records and reporting 150
References 151

LIST OF TABLES

Table 1. WDR requirements for groundwater quality monitoring plans and their corresponding sections within the ESJWQC GQMP. 14
Table 2. Basins and subbasins within the San Joaquin River Hydrologic Region located of the Coalition area. .. 18
Table 3. Water agencies and associated groundwater basin and subbasins (partial or entire) within the GQMP area. 20
Table 4. GQMP Zones, underlying subbasins (partial or entire), counties and Integrated Regional Water Management Plans (IRWMs) overlaying the Zone (partial or entire) within the irrigated land in ESJWQC. 23
Table 5. GQMP Zones, underlying subbasins (partial or entire), and counties overlaying the GQMP Monitoring Zones (partial or entire, in alphabetical order) within the irrigated land in ESJWQC..... 25
Table 6. Central Valley, California groundwater flow model layer thicknesses and depths listed by layers (Table. A3, Faunt, et. al., 2009). 35
Table 7. Land use acreage within the entire GQMP area. 66
Table 8. Approximate total acreages of GQMP Zones for the Coalition area..... 68
Table 9. ESJWQC land use acreage[1] of ESJHVA Priority 1-3 areas across the GQMP area. 68
Table 10. San Joaquin River Hydrologic Region (and Tulare Lake Hydrologic Region [Fresno County]) Average Annual Groundwater Supply by County and by Type of Use (2005-2010).[1] 69
Table 11. ESJWQC member management practices implemented in 2013; listed by Management Practice Category. 71
Table 12. Summary of Assembled Groundwater Quality Data for nitrate as N (all data since 1940; Table 5-1, GAR). 81
Table 13. Summary of Assembled Groundwater Quality Data for TDS (all data since 1940; Table 5-1, GAR). 81
Table 14. Summary of pesticide detections (Table 5-2, GAR)..... 82
Table 15. GQMP COC WQTLs. 93
Table 16. Performance Goals for the ESJWQC GQMP. 105
Table 17. Groundwater monitoring parameters (WDR, Attachment B, pg. 19). 107
Table 18. Land use acreage within the entire Modesto GQMP Zone1. 114
Table 19. Land use acreage as associated with irrigation data within the Modesto GQMP Zone by ESJHVA Priority 1-3 areas. 115
Table 20. Count of nitrate (NO3) detections from 5-10mg/L and exceedances >10mg/L by well from 2005-2013 for the Modesto GQMP Zone..... 115
Table 21. Number of individual wells with nitrate exceedances (greater than 10 mg/L) by well from 2005-2013 for the Modesto Groundwater Management Zone relative to ESJHVA Priority Areas 1, 2, or 3. 116
Table 22. Count of wells with detections of TDS (less than 450 mg/L) and exceedances of TDS (equal to or greater than 450 mg/L) by well from 2005-2013 within the Modesto GQMP Zone. 116
Table 23. Number of individual wells with TDS exceedances (greater than 450 mg/L) by well from 2005-2013 for the Modesto GQMP Zone relative to ESJHVA Priority Areas 1, 2, or 3. 116
Table 24. Summary of pesticide detections (below MCL threshold) and exceedances (at or above MCL threshold) for the Modesto GQMP Zone by individual well and TRS. COCs in this GQMP are bolded. 117
Table 25. Number of individual wells and TRS sections with pesticide exceedances for the Modesto GQMP Zone relative to ESJHVA Priority Areas 1, 2, or 3. 117
Table 26. Land use acreage within the entire Turlock GQMP Zone1..... 122
Table 27. Land use acreage associated with irrigation data within the Turlock GQMP Zone by ESJHVA Priority 1-3 areas. 123
Table 28. Count of nitrate (NO3) detections from 5-10mg/L and exceedances >10mg/L by well from 2005-2013 for the Turlock GQMP Zone. 123
Table 29. Number of individual wells with nitrate exceedances (greater than 10 mg/L) for the Turlock GQMP Zone relative to ESJHVA Priority Areas 1, 2, or 3. 124

Table 30. Count of wells with detections of TDS (less than 450 mg/L) and exceedances of TDS (equal to or greater than 450 mg/L) within the Turlock GQMP Zone. 124
Table 31. Number of individual wells with TDS exceedances (greater than 450 mg/L) by well from 2005-2013 for the Turlock GQMP Zone relative to ESJHVA Priority Areas 1, 2, or 3. 124
Table 32. Summary of pesticide detections (below MCL threshold) and exceedances (at or above MCL threshold) for the Turlock GQMP Zone. COCs in this GQMP Zone are bolded. 125
Table 33. Number of individual wells and TRS sections with pesticide exceedances for the Turlock GQMP Zone relative to ESJHVA Priority Areas 1, 2, or 3. Well, TRS, pesticide, and ESJHVA priority designation data used here are the same as those data compiled in the GAR. 125
Table 34. Land use acreage within the entire Merced GQMP Zone1. 130
Table 35. Land use acreage within the Merced GQMP Zone by ESJHVA Priority 1-3 areas. 131
Table 36. Count of nitrate (NO_3) detections from 5-10mg/L and exceedances >10mg/L by well from 2005-2013 for the Merced GQMP Zone. 132
Table 37. Number of individual wells with nitrate exceedances (greater than 10 mg/L) for the Merced GQMP Zone relative to ESJHVA Priority Areas 1, 2, or 3. 132
Table 38. Count of wells with detections of TDS (less than 450 mg/L) and exceedances of TDS (equal to or greater than 450 mg/L) within the Merced GQMP Zone. 132
Table 39. Number of individual wells with TDS exceedances (greater than 450 mg/L) by well from 2005-2013 for the Merced GQMP Zone relative to ESJHVA Priority Areas 1, 2, or 3. 132
Table 40. Summary of pesticide detections (below MCL threshold) and exceedances (at or above MCL threshold) for the Merced GQMP Zone. COCs in this GQMP Zone are bolded. 133
Table 41. Number of individual wells and TRS sections with pesticide exceedances for the Merced GQMP Zone relative to ESJHVA Priority Areas 1, 2, or 3. 133
Table 42. Land use acreage within the entire Chowchilla GQMP Zone1. 141
Table 43. Land use acreage within the Chowchilla GQMP Zone by ESJHVA Priority 1-3 areas. 141
Table 44. Count of nitrate (NO3) detections from 5-10mg/L and exceedances >10mg/L by well from 2005-2013 for the Chowchilla GQMP Zone. 142
Table 45. Number of individual wells with nitrate exceedances (greater than 10 mg/L) for the Chowchilla GQMP Zone relative to ESJHVA Priority Areas 1, 2, or 3. 142
Table 46. Count of wells with detections of TDS (less than 450 mg/L) and exceedances of TDS (equal to or greater than 450 mg/L) within the Chowchilla GQMP Zone. 143
Table 47. Number of individual wells with TDS exceedances (greater than 450 mg/L) by well from 2005-2013 for the Chowchilla GQMP Zone relative to ESJHVA Priority Areas 1, 2, or 3. Well, TDS, and ESJHVA priority designation data used here are the same as those data compiled in the GAR. 143
Table 48. Summary of pesticide detections (below MCL threshold) and exceedances (at or above MCL threshold) for the Chowchilla GQMP Zone. 143
Table 49. Number of individual wells and TRS sections with pesticide exceedances for the Chowchilla GQMP Zone relative to ESJHVA Priority Areas 1, 2, or 3. 143
Table 50. Land use acreage within the entire Madera GQMP Zone1. 147
Table 51. Land use acreage within the Madera GQMP Zone by ESJHVA Priority 1-3 areas. 147
Table 52. Count of nitrate (NO3) detections from 5-10mg/L and exceedances >10mg/L by well from 2005-2013 for the Madera GQMP Zone. 148
Table 53. Number of individual wells with nitrate exceedances (greater than 10 mg/L) for the Madera GQMP Zone relative to ESJHVA Priority Areas 1, 2, or 3. 148
Table 54. Count of wells with detections of TDS (less than 450 mg/L) and exceedances of TDS (equal to or greater than 450 mg/L) within the Madera Groundwater Management Zone. 148
Table 55. Number of individual wells with TDS exceedances (greater than 450 mg/L) by well from 2005-2013 for the Madera Groundwater Management Zone relative to ESJHVA Priority Areas 1, 2, or 3. 148

Table 56. Summary of pesticide detections (below MCL threshold) and exceedances (at or above MCL threshold) for the Madera GQMP Zone. 149
Table 57. Number of individual wells and TRS sections with pesticide exceedances for the Madera GQMP Zone relative to ESJHVA Priority Areas 1, 2, or 3. 149

LIST OF FIGURES

Figure 1. East San Joaquin Water Quality Coalition location within California. 16
Figure 2. DWR Designated Groundwater Basins and Subbasins within the Coalition region (reproduced from Figure 35 from Bulletin 118, DWR 2003). 17
Figure 3. GQMP Zones based on DWR Designated Groundwater Basins and Subbasins within the Central Valley portion of the Coalition. 19
Figure 4. Integrated Regional Water Management regions overlaying the GQMP Zones of the Coalition region. 24
Figure 5. Elevation map within the Coalition region (Figure 2-1, GAR). 26
Figure 6. Slope map of the irrigated lands within the Coalition region (Figure 2-2, GAR) 27
Figure 7. Annual average precipitation within the Coalition region (Figure 2-3, GAR). 28
Figure 8. Average monthly precipitation values in the cities of Modesto, Merced, and Madera, CA (Figure 2-4, GAR). 29
Figure 9. Generalized geologic map of the Coalition region (Figure 3-1, GAR). 31
Figure 10. Geologic Map of the Central Valley floor area (Figure 3-2, GAR). 32
Figure 11. Geologic Map of the Central Valley floor area (Figure 3-2 [Explanation], GAR). 33
Figure 12. Generalized hydrogeologic section of the Central Valley according the CVHM. Layers 1-10 indicate the discreet vertical layers described in the CVHM (Fig. A11, Faunt, et. al., 2009). 35
Figure 13. Groupings of basins and subbasins within the Central Valley used for textural soils analysis in the CVHM (Figure A10, Faunt, et. al., 2009). 36
Figure 14. Layer 1 of the CVHM depicting the percentage of coarse-grained material within the top 50 feet of the Central Valley. 37
Figure 15. Layer 3 of the CVHM depicting the percentage of coarse-grained material within the top 150 feet of the Central Valley. 38
Figure 16. Soil hydraulic conductivity in the Central Valley portion of the Coalition (Figure 3-3, GAR). 40
Figure 17. Soil salinity in the Central Valley portion of the Coalition (Figure 3-4, GAR). 41
Figure 18. Soil pH in the Central Valley portion of the Coalition (Figure 3-5, GAR). 42
Figure 19. Vertical hydraulic conductivity of the CVHM Layer 1within in the Central Valley portion of the Coalition (Figure 3-6, GAR). 44
Figure 20. Corcoran Clay characteristics (extent and depth) in the Central Valley portion of the Coalition (Figure 3-7a, GAR). 45
Figure 21. Corcoran Clay characteristics (thickness) in the Central Valley portion of the Coalition (Figure 3-7b, GAR). 46
Figure 22. Known tile drain locations in the Central Valley portion of the Coalition (Figure 3-8, GAR). 47
Figure 23. Spring depth to groundwater contours: Central Valley portion of the Coalition (Figure 3-11, GAR). . 50
Figure 24. Fall depth to groundwater contours: Central Valley portion of the Coalition (Figure 3-12, GAR). 51
Figure 25. DWR depth to groundwater contours of the Central Valley portion of the Coalition (Figure 3-13, GAR). 52
Figure 26. Potential groundwater discharge areas of the Central Valley portion of the Coalition (Figure 3-14, GAR). 53
Figure 27. Depth to groundwater measurements: Peripheral portion of the Coalition (Figure 3-15, GAR). 54
Figure 28. Spring groundwater elevation contours: Central Valley portion of the Coalition (Figure 3-16, GAR). 55
Figure 29. Fall groundwater elevation contours: Central Valley portion of the Coalition (Figure 3-16, GAR). 56
Figure 30. Groundwater recharge as simulated by the CVHM (Figure 3-20, GAR). 58
Figure 31. Areas with higher potential for groundwater recharge (Figure 3-21, GAR). 59

Figure 32. Piper diagram of ion balance for USGS grid and understanding wells and all wells in the CDPH database that have a charge imbalance of less than 10 percent, Central Eastside, California, USGS study unit. 61
Figure 33. USGS' Central–Eastside San Joaquin Basin Study Unit. 62
Figure 34. Distribution of groundwater types within the Merced groundwater basin (Geomatrix, Merced Groundwater Basin Groundwater Management Plan Update Merced County, CA, Figure 19, 2008). 63
Figure 35. Reproduced piper diagram for the Madera-Chowchilla study unit (USGS 2008). Well data are from the CDPH database using data from February 12, 2005 – February 12, 2008. 64
Figure 36. Stiff Diagram representing geochemical properties of both deep and shallow groundwater aquifers within Madera County (AB3030 Groundwater Management Plan, Madera County, 2002). 65
Figure 37. Land use by GQMP Zone within the Coalition based on DWR data. 70
Figure 38. Percent of acreage for irrigation management practices. 73
Figure 39. Acreage associated with pesticide application practices. 74
Figure 40. Acreage associated with nitrogen management methods. 75
Figure 41. Percent acreage associated with members who have irrigation wells and members implementing wellhead protection practices. 76
Figure 42. Percentage of acreage with abandoned wells and practices associated with those wells. 77
Figure 43. Distribution of nitrogen as nitrate at concentrations at or above 5 mg/L within the GQMP Zones of the Coalition region. 84
Figure 44. Distribution of TDS at concentrations at or above 450 mg/L within the GQMP Zones of the Coalition region. 85
Figure 45. Distribution of all pesticide concentrations (detection, exceedance, or non-detect) by TRS within the GQMP Zones of the Coalition region. 86
Figure 46. East San Joaquin Water Quality Coalition High Vulnerability Areas (ESJHVA) and Priority Areas (1-3) (GAR Addendum, 2014). 88
Figure 47. East San Joaquin Water Quality Coalition High Vulnerability Areas (ESJHVA) and Priority Areas (1-3) relative to GWMP Zones. 89
Figure 48. East San Joaquin Water Quality Coalition High Vulnerability Areas (ESJHVA), top 3 crops, and the Generalized Priority 1 Area (GAR, Figure 8). 90
Figure 49. Decision support system for managing nutrient inputs to irrigated crops. Taken from Fixen (2007). 94
Figure 50. Conceptual diagram of the GQMP strategy to evaluation effectiveness. 96
Figure 51. Identification key of responsible parties involved in major aspects of the GWMP. 99
Figure 52. Integrated Regional Groundwater Management Plan Area for the Modesto Subbasin and participating agencies. 109
Figure 53. Geologic setting of the Central-Eastside San Joaquin Basin study unit. 111
Figure 54. Locations of the various local water agencies and their respective political boundaries for the Turlock Subbasin. (Turlock Groundwater Basin Association, Turlock Groundwater basin, Groundwater Management Plan, Figure 2, 2008). 119
Figure 55. Locations of Merced Area Groundwater Pool Interests (MAGPI) agencies and their respective political boundaries for the Merced Subbasin (Geomatrix, Merced Groundwater Basin Groundwater Management Plan Update Merced County, CA, Figure 4, 2008). 127
Figure 56. Water agencies and groundwater subbasins (partial and entire) located within the Draft Madera Regional Groundwater Management Plan area. 135
Figure 57. Section of Madera County (that area within the Central Valley) covered in the Draft Madera Regional Groundwater Management Plan, the locations of participating agencies, and their respective political boundaries for the Chowchilla/Madera Subbasins. 136

Figure 58. Geologic setting of the Madera-Chowchilla study unit (DOI and USGS, Status and Understanding Groundwater Quality in the Madera-Chowchilla Study Unit, 2008: California GAMA Priority Basin Project, Fig. 3, pg. 7, 2008)..... 138

LIST OF ACRONYMS

AB	Assembly Bill
BOD	Board of Directors
CASGEM	California Statewide Groundwater Elevation Monitoring
CDPH	California Department of Public Health
COC	Constituent of Concern
CTR	California Toxics Rule
CURES	Coalition for Urban Rural Environmental Sterwardship
CVHM	Central Valley Hydrologic Model
CVRWQCB	Central Valley Regional Water Quality Control Board
CV-SALTS	Central Valley Salinity Alternatives for Long-Term Sustainability
DAC	Disadvantaged Community
DACT	Diaminochlorotriazine
DBCP	1,2-dibromo-3-chloropropane
DEA	Diethyl-atrazine
DEM	Digital Elevation Model
DOI	United States Department of the Interior
DPR	California Department of Pesticide Regulation
DWR	California Department of Water Resources
EC	Electrical Conductivity
EPA	U.S. Environmental Protection Agency
ESJHVA	East San Joaquin Water Quality Coalition High Vulnerability Area
ESJWQC	East San Joaquin Water Quality Coalition
ESRI	Environmental Systems Research Institute
FEP	Farm Evaluation Plan
GAR	Groundwater Assessment Report
GAMA	Geotracker database
GIS	Geographic Information System
GQMP	Groundwater Quality Management Plan
HHVA	Hydrogeologic High Vulnerability Area
I	Irrigated
ILP	Irrigated Lands Program
ILRP	Irrigated Land and Regulatory Program
IPNI	International Plan Nutrition Institute
IRWM	Integrated Regional Water Management Plan
LSCE	Luhdorff and Scalmanini Consulting Engineers
MAGPI	Merced Area Groundwater Pool Interests
MCL	Maximum Contaminant Level
MID	Merced (or Modesto) Irrigation District
MLJ-LLC	Michael L. Johnson, LLC
MPEP	Management Practice Evaluation Program

NA	Not Applicable
NI	Non-irrigated
NOA	Notice of Applicability
NMP	Nitrogen Management Plan
NRCS	Natural Resource Conservation Service
NWIS	National Water Information System
OID	Oakdale Irrigation District
PAM	Polyacrylamide
PCA	Pesticide Control Adviser
pH	Power of Hydrogen
PLSS	Public Land Survey System
SC	Specific Conductance
SJR	San Joaquin River
SNMP	Salt and Nitrate Management Plan
SWRCB	State Water Resources Control Board
TAF	Thousand Acre Feet
TDS	Total Dissolved Solids
TID	Turlock Irrigation District
TRS	Township Range Section, Public Land Survey System
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WDL	Water Data Library
WDR	Waste Discharge Requirements General Order r5-2012-0116-R2
WQO	Water Quality Objective
WQTL	Water Quality Trigger Limit

LIST OF UNITS

af	acre feet
°C	degrees Celcius
cm	centimeter
ft	foot
L	Liter
mg	milligram
µg	microgram
µmhos	microsiemens

INTRODUCTION AND BACKGROUND

The Comprehensive Groundwater Quality Management Plan (GQMP) outlined in this document, addresses the requirements of the Waste Discharge Requirements General Order for Growers within the Eastern San Joaquin River Watershed (No. R5-2012-0116-R2). The GQMP presents the Coalition's approach to eliminating/reducing impairments of beneficial uses of groundwater. The Management Plan approach involves three activities: 1) a broad spectrum method of identification of whether or not constituents of concern are related to agricultural practices, 2) outreach to all members whose parcels lay above groundwater identified as exceeding water quality parameters, providing recommendations of management practices with the potential to be effective in managing discharges, and 3) monitoring to evaluate the efficacy of those implemented management practices.

BACKGROUND

The Central Valley Regional Water Quality Control Board (the Regional Board or CVRWQCB) initiated the Irrigated Lands Program (ILP) in 2003 (and renewed in 2006) with the adoption of a Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands. The ILP, later the Irrigated Lands Regulatory program (ILRP), was developed to regulate discharges from irrigated agriculture to surface waters. The Waste Discharge Requirements General Order for Growers within the Eastern San Joaquin River Watershed (WDR or the Order; No. R5-2012-0116-R2), along with other orders to be adopted for the irrigated lands within the Central Valley, constitute the long-term ILRP, an expansion of the initial ILRP.

The East San Joaquin Water Quality Coalition (ESJWQC or Coalition) has been selected as the third-party group representing Coalition Members in the East San Joaquin River Watershed. The ESJWQC is one of the 13 coalition groups in the Central Valley of California. Members of the ESJWQC are those landowners and/or operators of irrigated lands who have enrolled an irrigated land parcel(s) under the Order within the area represented by the ESJWQC. By enrolling an irrigated land parcel under the Order, members obtain regulatory coverage for operational discharges and agree to comply with the terms and conditions of the Order.

Following the Regional Board's adoption of the WDR on December 7, 2012 (revised October 3, 2013 and March 14, 2014), the Notice of Applicability (NOA) was approved on January 11, 2013 for ESJWQC. The approval date associated with the NOA started the timeline for several requirements, including submittal of an NOI from entities wishing to join the Coalition and for the Coalition to submit an outline of the Groundwater Assessment Report (GAR) (The Order, Section IV. A). The GAR provides the basis for the Groundwater Quality Management Plan, the Groundwater Quality Trend Monitoring Program and the Management Practices Evaluation Program.

The GAR outline was submitted April 11, 2013 (approved May 6, 2013) and the GAR was submitted January 13, 2014. The Coalition's GAR was 'conditionally' approved by the Regional Board on June 6, 2014, with a revised GAR to be submitted by August 11, 2014. A request from ESJWQC for an extension to the submittal date of the revised GAR was approved by the Regional Board's Executive Director on August 8, 2014. An ESJWQC GAR Addendum was submitted November 5, 2014. The CVRWQCB gave final approval of the GAR in combination with the GAR Addendum on December 23, 2014. The CVRWQCB's final approval established the Comprehensive GQMP's

required submittal date to be February 23, 2015, 60 days after review and approval of the revised GAR and GAR Addendum.

The GQMP is developed following the requirements listed in the Order and using existing groundwater data and review of current regional management plans. The overarching goal of the GQMP is to improve the groundwater quality within the designated region of the Coalition in as timely a manner as possible and within the limitations set forth by the Order. Requirements of the Order and where they can be found within the GQMP are listed in Table 1.

Table 1. WDR requirements for groundwater quality monitoring plans and their corresponding sections within the ESJWQC GQMP.

Required Element (Appendix MRP-1)	Groundwater Quality Management Plan Sections
A. Introduction and Background	**Introduction and Background**
Previous work conducted to identify occurrence of COCs	
B. Physical Setting and Information	**Physical Setting and Geographical Characteristics**
B.1.a. Land use maps	Land Use
B.1.b. Identification of potential agricultural sources of COCs	Groundwater Constituents of Concern
B.1.c. Beneficial uses	Groundwater Beneficial Uses
B.1.d. Baseline of management practices	Existing Agricultural Management Practices
B.1.e. Summary, discussion, and compilation of surface water quality data	Previous Work to Identify Constituents of Concern in Groundwater
B.3. a. Soil information	Geology and Hydrology
B.3.b. Geology and hydrology	Geology and Hydrology
B.3.b.i. Regional geology	Geology and Hydrology
B.3.b.ii. Groundwater basins and sub-basins in area	Coalition Boundaries/Groundwater Hydrology
B.3.b.iii. Known water bearing zones	Groundwater Hydrology
B.3.b.iv. Identify water bearing zones used for domestic, irrigation, and municipal water	Geology and Hydrology
B.3.b.v. Aquifer characteristics	Geology and Hydrology
B.3.c. Identification of water chemistry	Geology and Hydrology
B.3.c. Identification of irrigation water sources	Irrigated Land
C. Management Plan Strategy	**Management Plan Strategy**
C.1. Description of approach	Description of Approach
C.2. Actions to meet goals and objectives	Actions to Meet Goals and Objectives
C.2.a. Compliance with receiving water limitations	Actions to Meet Goals and Objectives
C.2.b. Educate members	Outreach Methods
C.2.c. Identify, validate and implement management practices	Identify Management Practices that are Protective of Groundwater/Management Plan Effectiveness
C.3 Duties and responsibilities of individuals	Duties and Responsibilities
C.4. Strategies to implement the management plan tasks	Strategies to Implement Management Plan Tasks
C.4.a. ID entities or agencies	Agencies Contacted for Data and/or Assistance
C.4.b. ID management practices	Management Practices to Control COCs
C.4.c. ID outreach	Outreach Methods
C.4.d. Specific schedule and milestones	Specific Schedule and Milestones for Implementing Management Practices
C.4.e. Measurable performance goals with specific targets	Performance Goals and Performance Measures
D. Monitoring Methods	**Monitoring Methods**
D.3 Management Practice Evaluation Program and Groundwater Quality Trend Monitoring	Identify Management Practices that are Protective of Groundwater
E. Data Evaluation	**Data Evaluation**
F. Records and Reporting	**Records and Reporting**
G. Source Identification Study Requirements	**Strategies to Implement Management Plan Tasks**

COALITION BOUNDARIES

The East San Joaquin Water Quality Region encompasses an area of approximately 5.7 million acres (8,900 square miles), including approximately 1 million acres of irrigated land within the Eastern San Joaquin River Watershed. The Coalition region is bounded to the north by the Stanislaus River, to the south and west by the San Joaquin River, and to the east by the Sierra Nevada crest (Figure 1).

Groundwater Basin(s) within Coalition Region

Groundwater within the ESJWQC region lies within the San Joaquin Valley Groundwater Basin of the San Joaquin River Hydrologic Region as defined in Bulletin 118 from the Department of Water Resources (DWR) (Figure 2). From north to south, all or portions of seven groundwater subbasins lie within the Coalition region: Eastern San Joaquin, Modesto, Turlock, Merced, Chowchilla, Delta-Mendota, and Madera. The Modesto, Turlock, Merced, Chowchilla, and Madera subbasins are entirely within the Coalition boundaries while portions of the Eastern San Joaquin and Delta-Mendota subbasins lie to the north and southwest of the Coalition boundary, respectively. The Stanislaus River serves as the northern boundary of the Coalition with the exception of a relatively small sliver of land along the northern border which includes a portion of the Eastern San Joaquin subbasin north of and roughly parallel to the Stanislaus River. The San Joaquin River serves as the western and southern boundaries of the Coalition. The San Joaquin River is also the western boundary to the Modesto, Turlock, Merced, and Chowchilla subbasins. A portion of the Delta-Mendota subbasin extends from west to east across the San Joaquin River, bordering the Madera subbasin. The eastern portion of the San Joaquin Valley watershed and the Coalition is bounded by the crest of the Sierra Nevada. The groundwater subbasins within the Coalition, as defined by Bulletin 118, only reach the base of the foothills to the Sierra Nevada Mountains.

Figure 1. East San Joaquin Water Quality Coalition location within California.

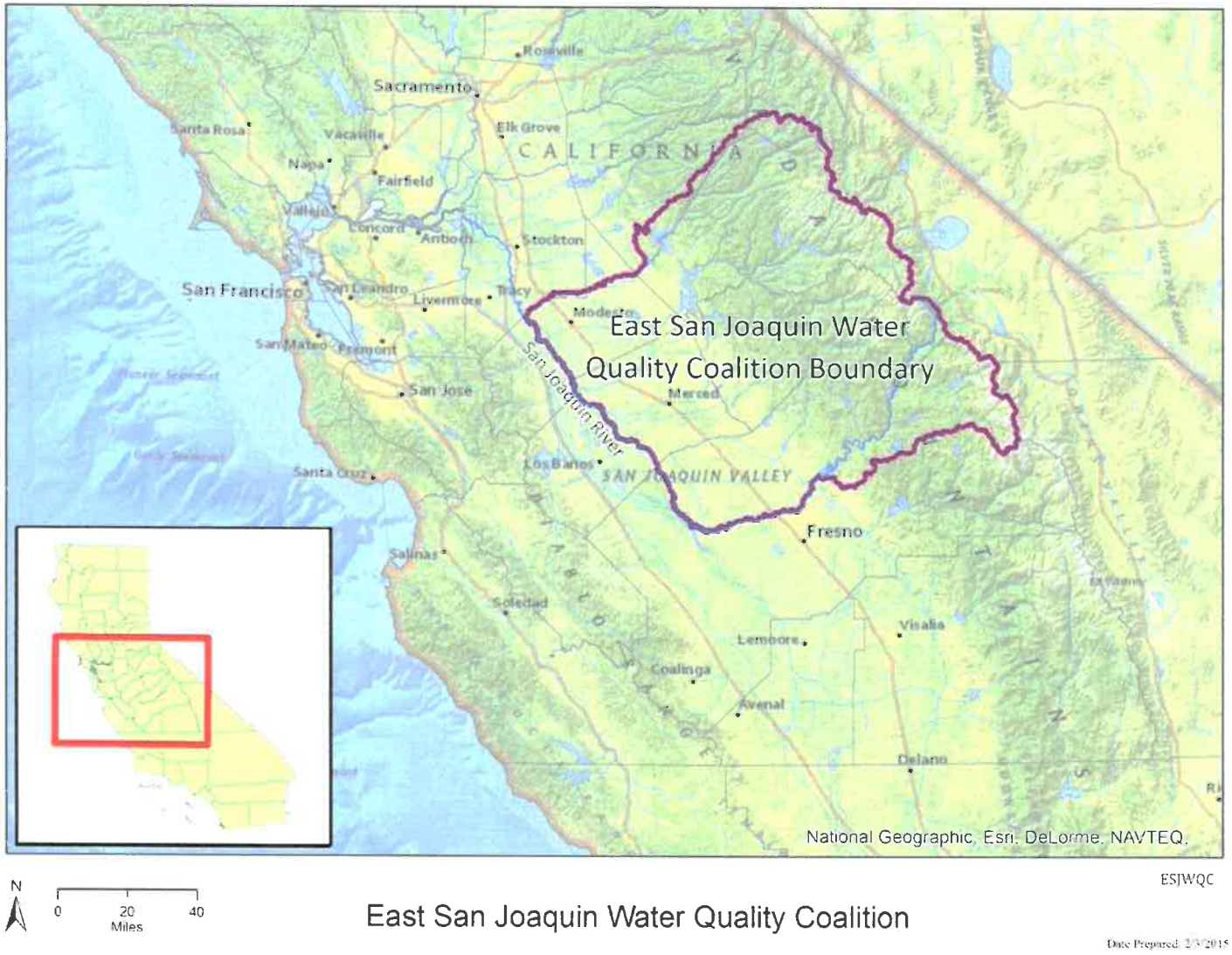
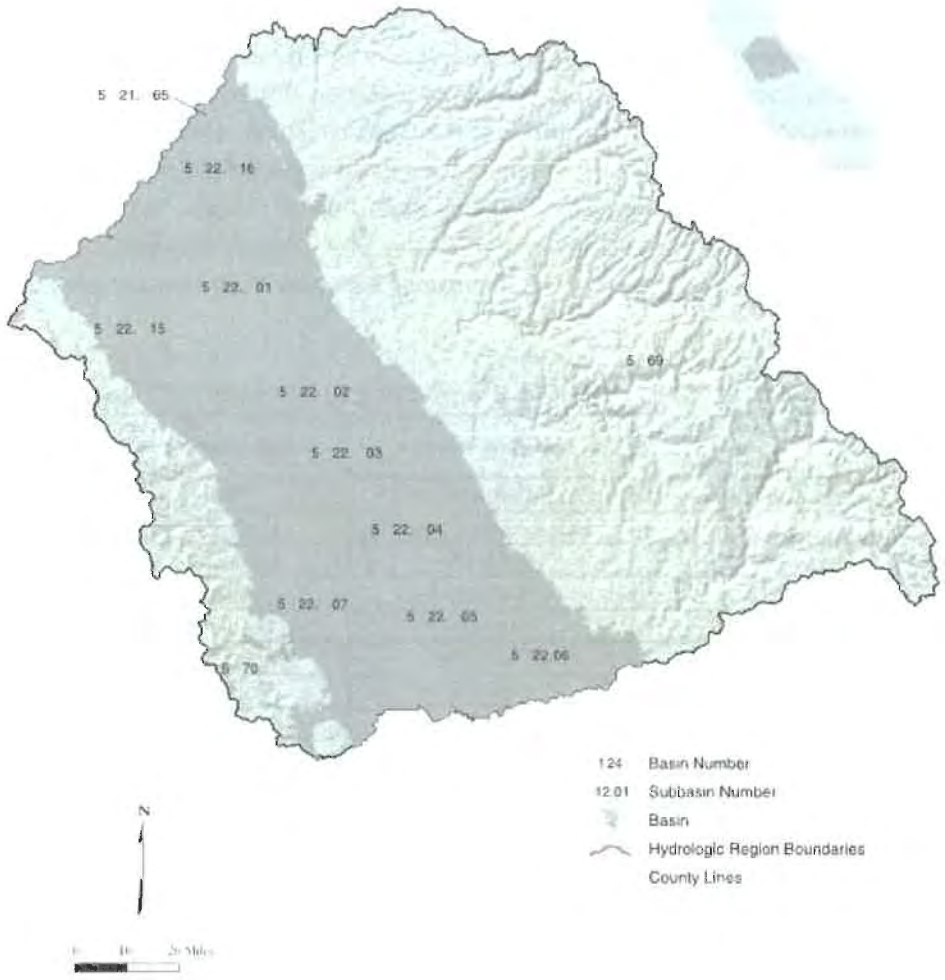


Figure 2. DWR Designated Groundwater Basins and Subbasins within the Coalition region (reproduced from Figure 35 from Bulletin 118, DWR 2003).



Groundwater Quality Management Plan Area

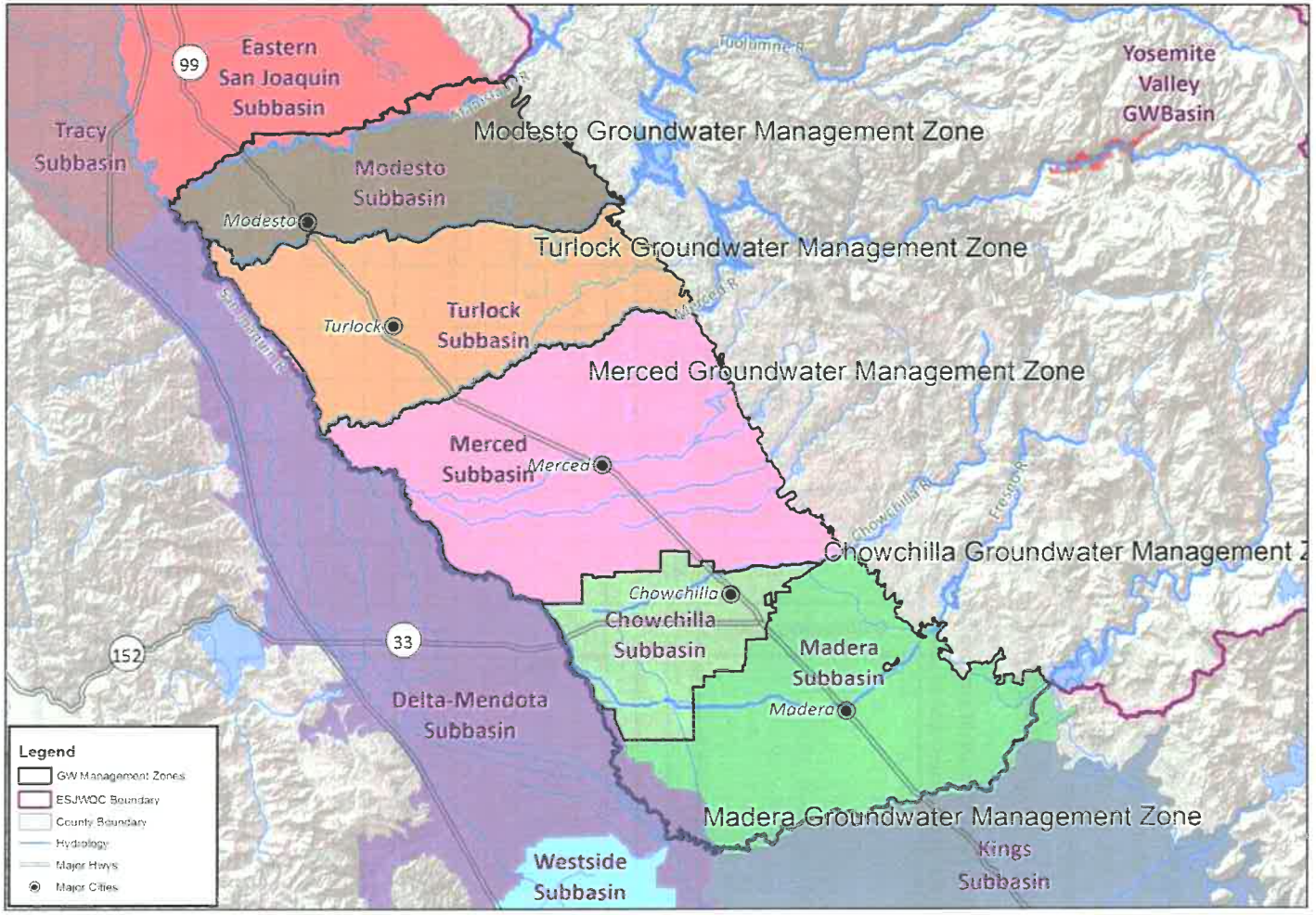
The Coalition area is divided into five groundwater management plan zones to facilitate the systematic monitoring of constituents of concern (COCs) and the implementation of an overall GQMP (Figure 3). The zone boundaries are based primarily on the underlying San Joaquin basin and subbasin boundaries within the San Joaquin River Hydrologic Region as estimated by Bulletin 118, page 168 (Figure 2). Zone names are based on the primary underlying subbasins from north to south: Modesto (including a portion of the Eastern San Joaquin subbasin), Turlock, Merced, Chowchilla, and Madera (including a portion of the Delta-Mendota subbasin; Table 2, Figure 3). The five zones overlay the western portion of the Coalition region, where the vast majority of agricultural land use occurs. Portions of the Delta-Mendota and Eastern San Joaquin subbasins are within the footprint of the Coalition boundaries and have been included within adjacent zones. The vast majority of agricultural activities (aside from ranching) occur within the Valley floor. Therefore, the GQMP Zones do not include the South American or Tracy subbasins of the San Joaquin Valley nor the Yosemite Valley or Los Banos Creek Valley basins (Table 2).

Table 2. Basins and subbasins within the San Joaquin River Hydrologic Region located of the Coalition area.

Basin	Basin-Subbasin Number	Subbasin Name	GQMP Zone	Within Coalition Region
San Joaquin Valley	5-21.65	South American	NA	NA
San Joaquin Valley	5-22.01	Eastern San Joaquin	Modesto	Partial
San Joaquin Valley	5-22.02	Modesto	Modesto	Entire
San Joaquin Valley	5-22.03	Turlock	Turlock	Entire
San Joaquin Valley	5-22.04	Merced	Merced	Entire
San Joaquin Valley	5-22.05	Chowchilla	Chowchilla	Entire
San Joaquin Valley	5-22.06	Madera	Madera	Entire
San Joaquin Valley	5-22.07	Delta-Mendota	Madera	Partial
San Joaquin Valley	5-22.15	Tracy	NA	NA
Yosemite Valley	5-69	NA	NA	NA
Los Banos Creek Valley	5-70	NA	NA	NA

NA – Not applicable

Figure 3. GQMP Zones based on DWR Designated Groundwater Basins and Subbasins within the Central Valley portion of the Coalition.



DWR Designated Subbasins and Groundwater Management Zones

ESJWQC

Date Prepared: 2/19/2015

Other Groundwater Management Plans within the ESJWQC Region

In 1992, the State Legislature provided structure for more formal groundwater management with the passage of Assembly Bill (AB) 3030, the Groundwater Management Act (Water Code §10750 et seq.). Groundwater management, as defined in DWR's Bulletin 118 Update 2003, is the planned and coordinated monitoring, operation, and administration of a groundwater basin, or portion of a basin, with the goal of long-term groundwater resource sustainability. Under AB 359, introduced in 2011, local agencies are required to provide a copy of their groundwater management plan to DWR and for DWR to provide public access to those plans.

Several entities (other than agricultural landowners/operators) whose management practices could affect groundwater quality are located within the Coalition area boundaries including portions of several irrigation districts, numerous federal and state water districts, municipal water companies, and sanitation districts. Oakdale, Modesto, Turlock, and Merced Irrigation Districts are now members of the ESJWQC. Table 3 lists the water agencies within the GQMP area, the subbasin(s) within which they fall and whether there is an existing groundwater management plan that is associated with the agency.

Table 3. Water agencies and associated groundwater basin and subbasins (partial or entire) within the GQMP area.
Subbasins are listed as they appear from north to south according the DWR's Bulletin 118.

Water Agencies	Eastern San Joaquin	Modesto	Turlock	Merced	Chowchilla	Madera	Delta-Mendota	Yosemite Valley[1]	Participating in an Existing Groundwater Management Plan[2]
River Junction Rec. Dist. #2064	X	X					X		
South Delta Water Agency	X	X					X		
City of Riverbank W.S.A.	X	X							X
Oakdale Irrigation District	X	X							X
South San Joaquin Irrigation District	X	X							
Turlock Irrigation District		X	X	X			X		X
Modesto Irrigation District		X	X						X
City of Ceres W.S.A.		X	X						X
Eastside Water District		X	X						X
Calaveras County Water District		X							X
City of Modesto		X							
City of Oakdale		X							
County of Stanislaus		X							
Del Este Water Company (acquired by the City of Modesto)		X							X
Stanislaus and Tuolumne Rivers' Groundwater Subbasin Association		X							
Tuolumne Utilities District		X							
Merced Irrigation District			X	X					
Ballico Community Service District			X						X
Ballico-Cortez Water District (inactive)			X						X

Water Agencies	Eastern San Joaquin	Modesto	Turlock	Merced	Chowchilla	Madera	Delta-Mendota	Yosemite Valley[1]	Participating in an Existing Groundwater Management Plan[2]
City of Turlock W.S.A.			X						X
Delhi County Water District			X						X
Denair Community Service District			X						X
Hilmar County Water District			X						X
Keyes Community Services District			X						X
Merced Area Groundwater Pool Interests				X	X		X		X
Sierra Water District (inactive)				X	X		X		
Chowchilla Water District				X	X	X			X
El Nido Irrigation District				X	X				X
Le Grand-Athlone Water District				X	X				X
San Luis Canal Co.				X			X		X
Mariposa County Water Agency				X		X			
Black Rascal Water Company				X					X
City of Atwater W.S.A.				X					X
City of Livingston				X					X
City of Merced Water District				X					X
County of Merced				X					
Eagle Field Water District				X					
East Merced Resource Conservtion District				X					
Le Grand Community Service District				X					X
Lone Tree Mutual Water Company				X					
Merquin County Water District				X					X
Plainsburg Irrigation District				X					
Planada Community Services District				X					X
Stevinson Irrigation Water District				X					
Turner Island Water District				X					X
Winton Water and Sanitation District				X					X
Columbia Canal Company					X	X	X		X
Central California Irrigation District					X		X		X
Clayton Water District					X		X		
Madera Irrigation District					X	X			X
California Water Service Company					X				
New Stone Water District					X				
Aliso Water District						X	X		X
Farmers Water District							X		
Patterson Water District							X		X
City of Fresno Service Area						X			
Fresno Irrigation District						X			X
Pinedale County Water District						X			
City of Madera W.S.A.						X			X[3]
County of Fresno Service Area						X			X
Fresno Co. Waterworks #18						X			

Water Agencies	Eastern San Joaquin	Modesto	Turlock	Merced	Chowchilla	Madera	Delta-Mendota	Yosemite Valley[1]	Participating in an Existing Groundwater Management Plan[2]
Gravelly Ford Water District						X			X
Madera Water District						X			X
Mesa Water District						X			
Root Creek Water District						X			X
Bear Valley Community Services District									
Chowchilla-Red Top Resource Conservation District									X
City of Angels Camp W.S.A.									
City of Hughson									
Coulterville WTR & SWR-CSA 1-M									
Fish Camp Mutual Water Company								X	
Groveland Community Service District								X	
Hidden Lake Estates								X	
Lake Don Pedro Community Services District								X	
Leland Meadows Water District								X	
Meadowbrook Water Company									X
Pacheco Water District									
Ponderosa Basin Mutual Water Company								X	
San Luis Water District									
Sierra Cedars Community Services District								X	
Tuolumne County Water District No. 1								X	
Yosemite Alpine Community Services District								X	

[1] Yosemite Valley groundwater basin is located east of and outside of the Central Valley and the Study area of this report.

[2] According to *California Water Plan Update 2013 (Draft)*, DWR; *Status of Groundwater Management in California, 2004*, DWR (http://www.water.ca.gov/pubs/groundwater/bulletin_118/california's_groundwater_bulletin_118_-_update_2003_/cagwmgmt10jan05-final.pdf); and DWR, *Bulletin 118*, updates.

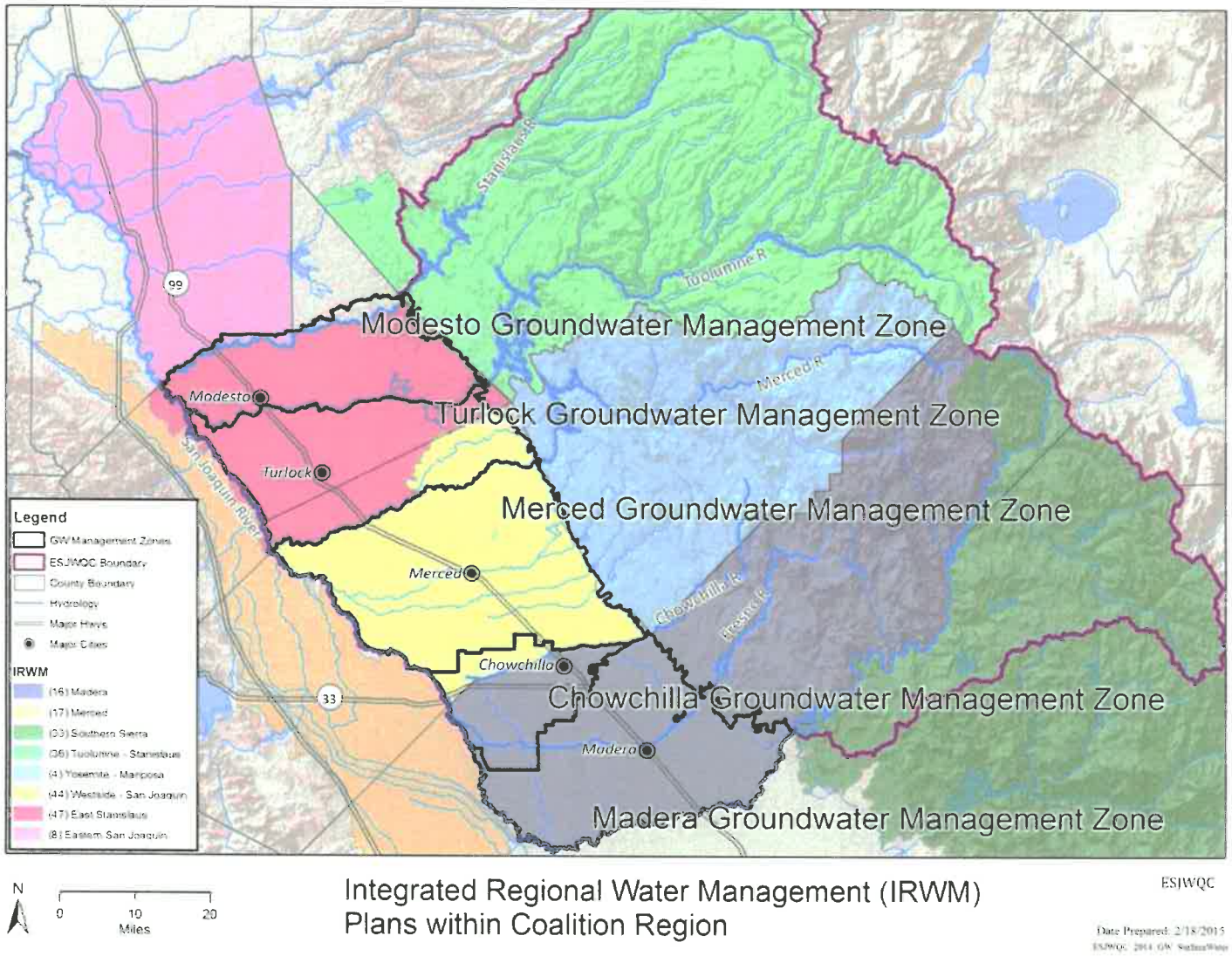
[3] With the exclusion of 800 acres, the City is included in the Madera ID AB3030.

In 2002, the Integrated Regional Water Management Act was created when Senate Bill 1672 was passed. With the passing of Proposition 50 in 2002 (the Water Security, Clean Drinking Water, Coastal and Beach Protection Act), funding for the preparation of Integrated Regional Water Management Plans (IRWMPs) was in place. IRWMPs define planning regions and identify strategies that allow for the regional management of water resources (supply, quality, management, and ecosystem restoration). The IRWM program is currently administered by DWR. IRWMs in the GQMP area are Madera, Merced, and East Stanislaus (Table 4, Figure 4).

Table 4. GQMP Zones, underlying subbasins (partial or entire), counties and Integrated Regional Water Management Plans (IRWMs) overlaying the Zone (partial or entire) within the irrigated land in ESJWQC.

GQMP Zones	Subbasins	Associated County(s)	Associated IRWM(s)
Modesto	Eastern San Joaquin	San Joaquin/Calaveras/Stanislaus	Eastern San Joaquin
	Modesto	Stanislaus	East Stanislaus
Turlock	Turlock	Merced/Stanislaus	East Stanislaus
Merced	Merced	Merced	Merced
Chowchilla	Chowchilla	Madera/Chowchilla	Madera
Madera	Madera	Madera	Madera
	Delta-Mendota	Fresno/Madera/Merced/Stanislaus	Madera

Figure 4. Integrated Regional Water Management regions overlaying the GQMP Zones of the Coalition region.



PHYSICAL SETTING AND GEOGRAPHICAL CHARACTERISTICS

The ESJWQC GQMP area includes the portions of Stanislaus and Merced counties east of the San Joaquin River, Madera County, the portion of Fresno County that drains directly into the San Joaquin River, and the portion of San Joaquin County that drains directly into the Stanislaus River (Table 5). The eastern counties within the boundary include Tuolumne, Mariposa, and the portions of Calaveras and Alpine Counties that drain into the Stanislaus River. Within the Coalition region, the major population centers include Madera, Merced, Modesto, and Turlock with smaller communities spread throughout the Central Valley Floor and in to the Sierra foothills. The ESJWQC consists of 3,971 Members who are landowners/growers of approximately 720,000 acres of land.

Table 5. GQMP Zones, underlying subbasins (partial or entire), and counties overlaying the GQMP Monitoring Zones (partial or entire, in alphabetical order) within the irrigated land in ESJWQC.

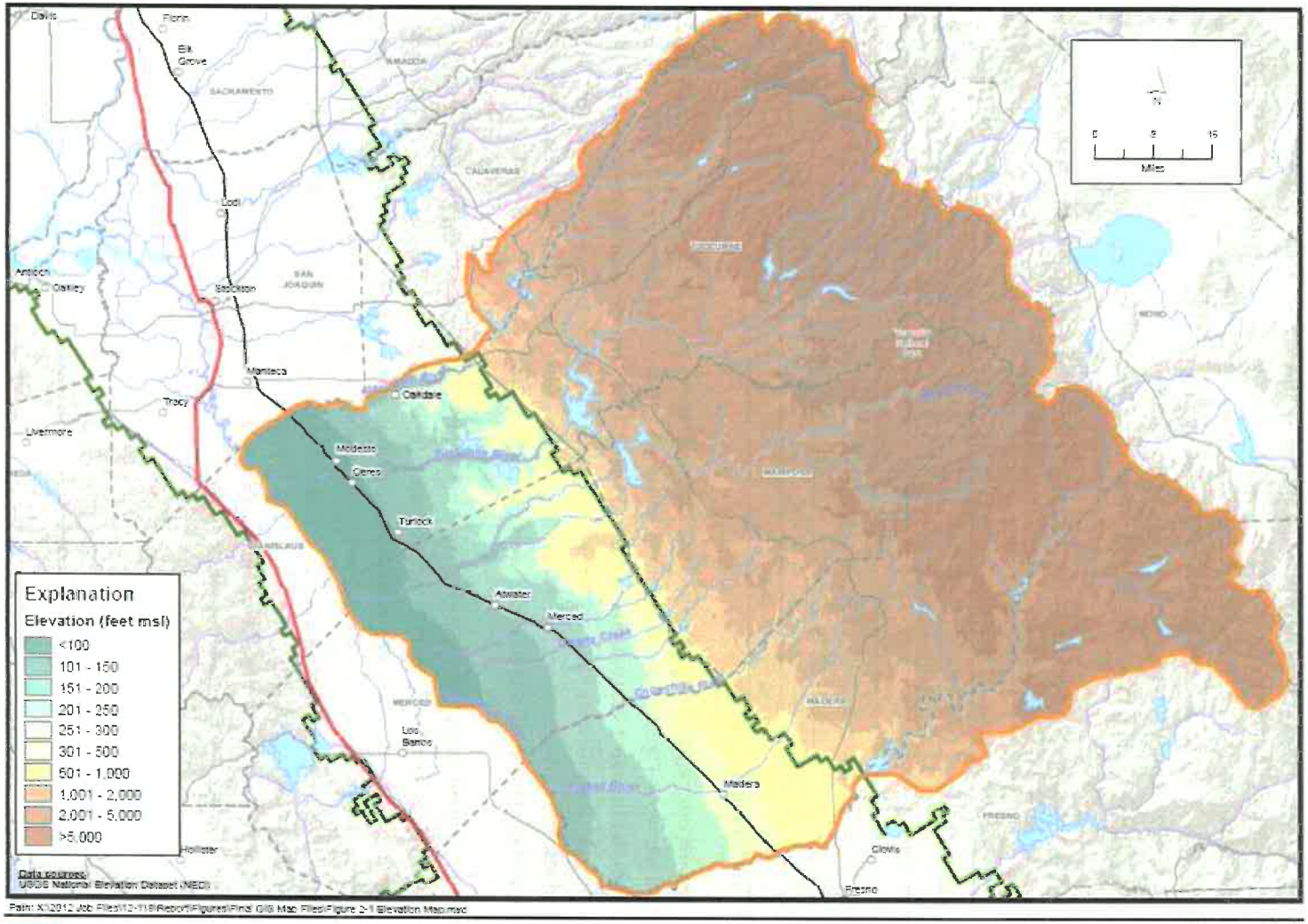
GQMP Zones	Subbasins	Associated County(s)
Modesto	Eastern San Joaquin	Calaveras/San Joaquin/Stanislaus
	Modesto	Stanislaus
Turlock	Turlock	Merced/Stanislaus
Merced	Merced	Merced
Chowchilla	Chowchilla	Madera/Merced
Madera	Madera	Madera
	Delta-Mendota	Fresno/Madera/Merced/Stanislaus

[1] Table contents from DWR's Bulletin 118

Elevations in the Coalition region range from less than 100 feet above mean sea level to over 10,000 feet along the Sierra crest as shown in Figure 5 in this document (Figure 2-1, GAR). The topography in the Coalition region ranges from flat to rolling land within the Central Valley Floor area to steep alpine terrain at higher elevations. Within the Central Valley Floor area, the topography flattens to the west with much of the area having a slope of less than 0.5 degrees (1 %). Topographic slope within the Central Valley Floor area of the Coalition region is shown in Figure 6 in this document (Figure 2-2, GAR).

The climate of the Coalition region ranges greatly from the Central Valley Floor to the higher elevations. Annual precipitation ranges from less than 10 inches in areas of the Central Valley Floor to more than 60 inches at high elevations. A map showing the spatial distribution of average annual precipitation in the Coalition area is included as Figure 7 (Figure 2-3, GAR). Most of the Central Valley Floor area receives less than 14 inches of annual precipitation with many areas having less than 12 inches of annual precipitation. Figure 8 (Figure 2-4, GAR) shows average monthly precipitation at Modesto, Merced, and Madera within the Central Valley Floor. Precipitation in the Central Valley Floor occurs mainly during winter months with almost 90 percent of precipitation occurring between November and April (GAR, page 5).

Figure 5. Elevation map within the Coalition region (Figure 2-1, GAR).

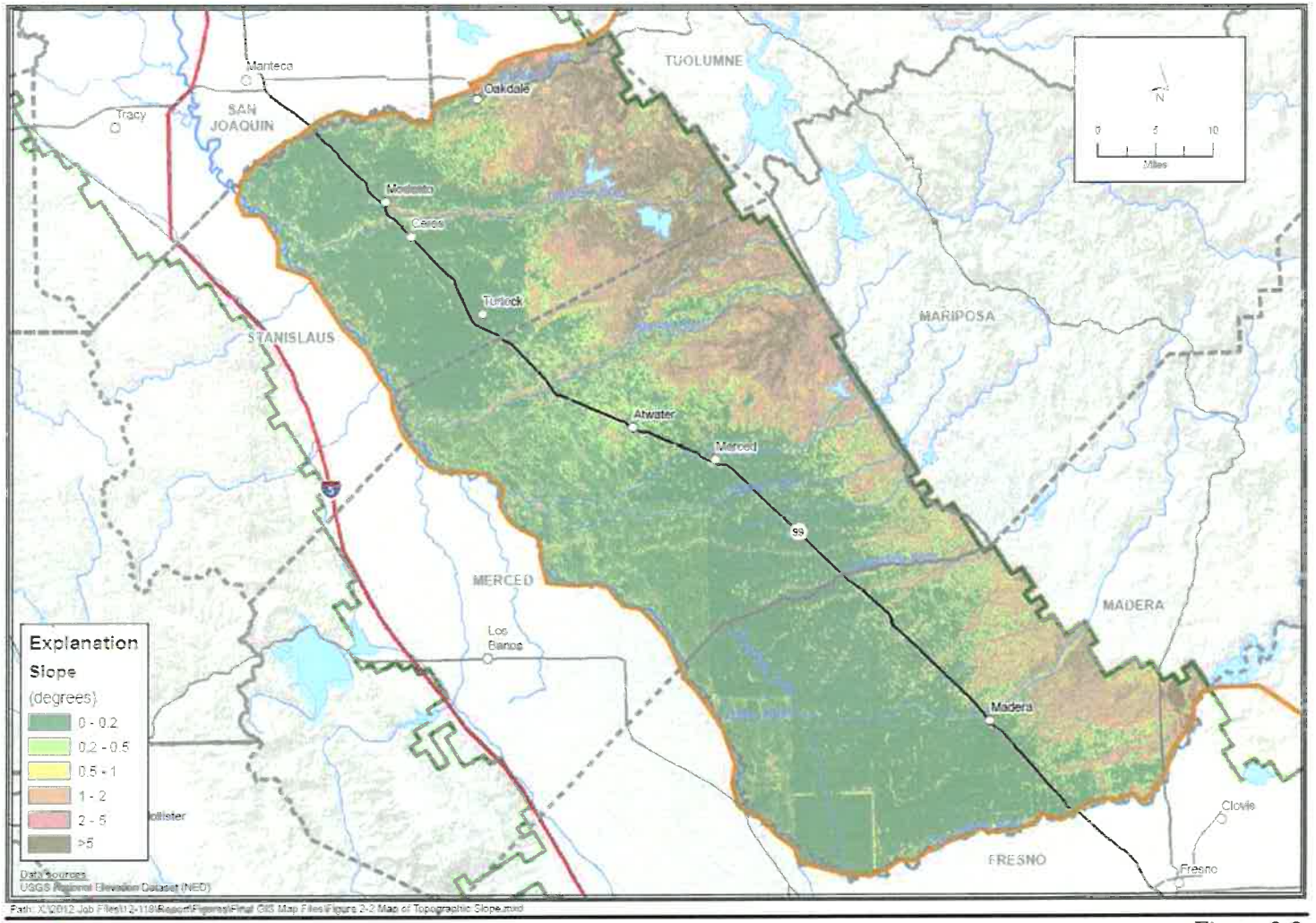


Path: X:\2012 Job Files\12-118\Report\Figures\Final GIS Map Files\Figure 2-1 Elevation Map.mxd

LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 2-1
Elevation Map

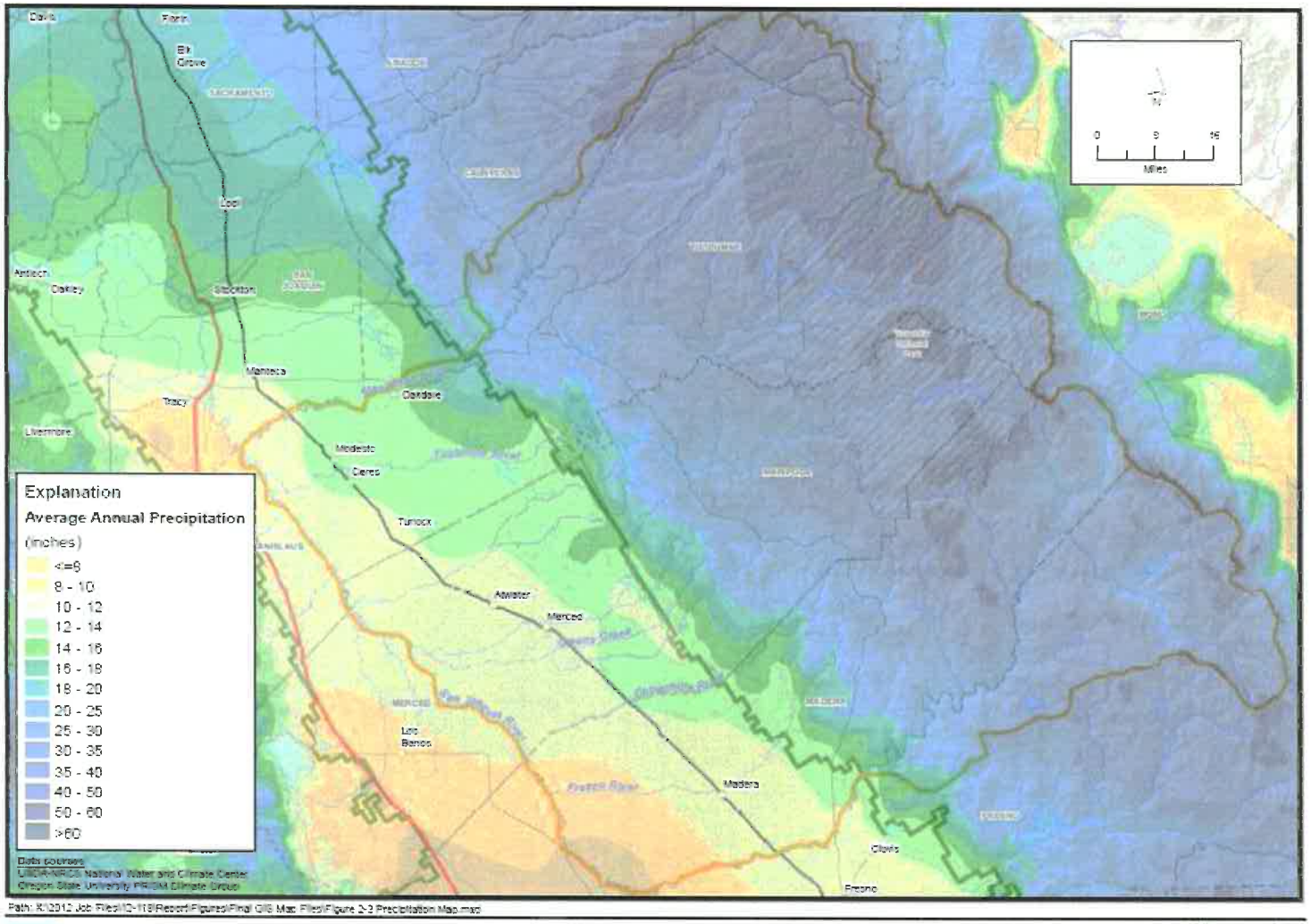
Figure 6. Slope map of the irrigated lands within the Coalition region (Figure 2-2, GAR).



LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 2-2
Slope Map

Figure 7. Annual average precipitation within the Coalition region (Figure 2-3, GAR).

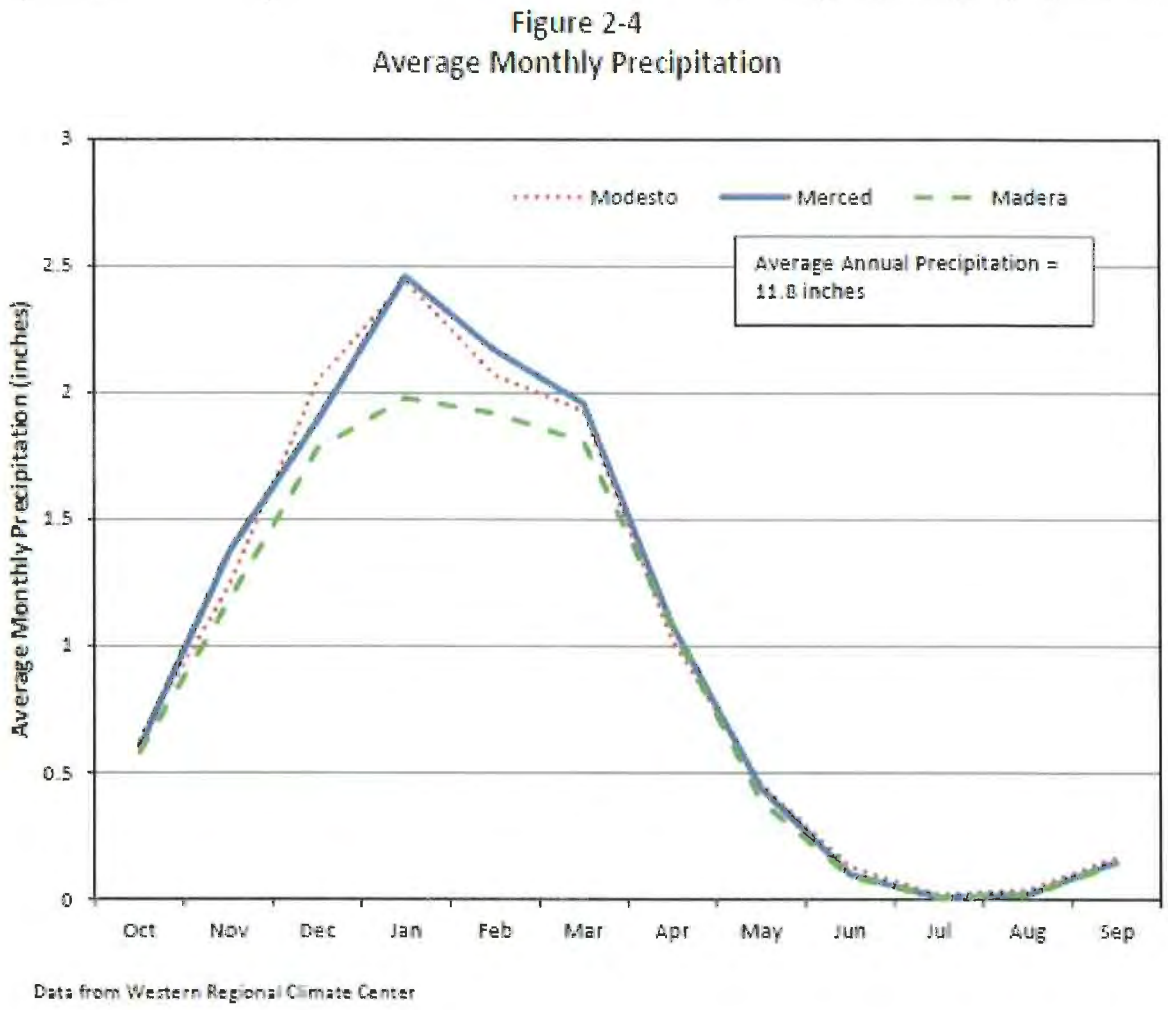


Path: R:\2012 Job Files\10-119\Report\Figures\Final GIS Mxd Files\Figure 2-3 Precipitation Map.mxd

LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 2-3
Precipitation Map

Figure 8. Average monthly precipitation values in the cities of Modesto, Merced, and Madera, CA (Figure 2-4, GAR).

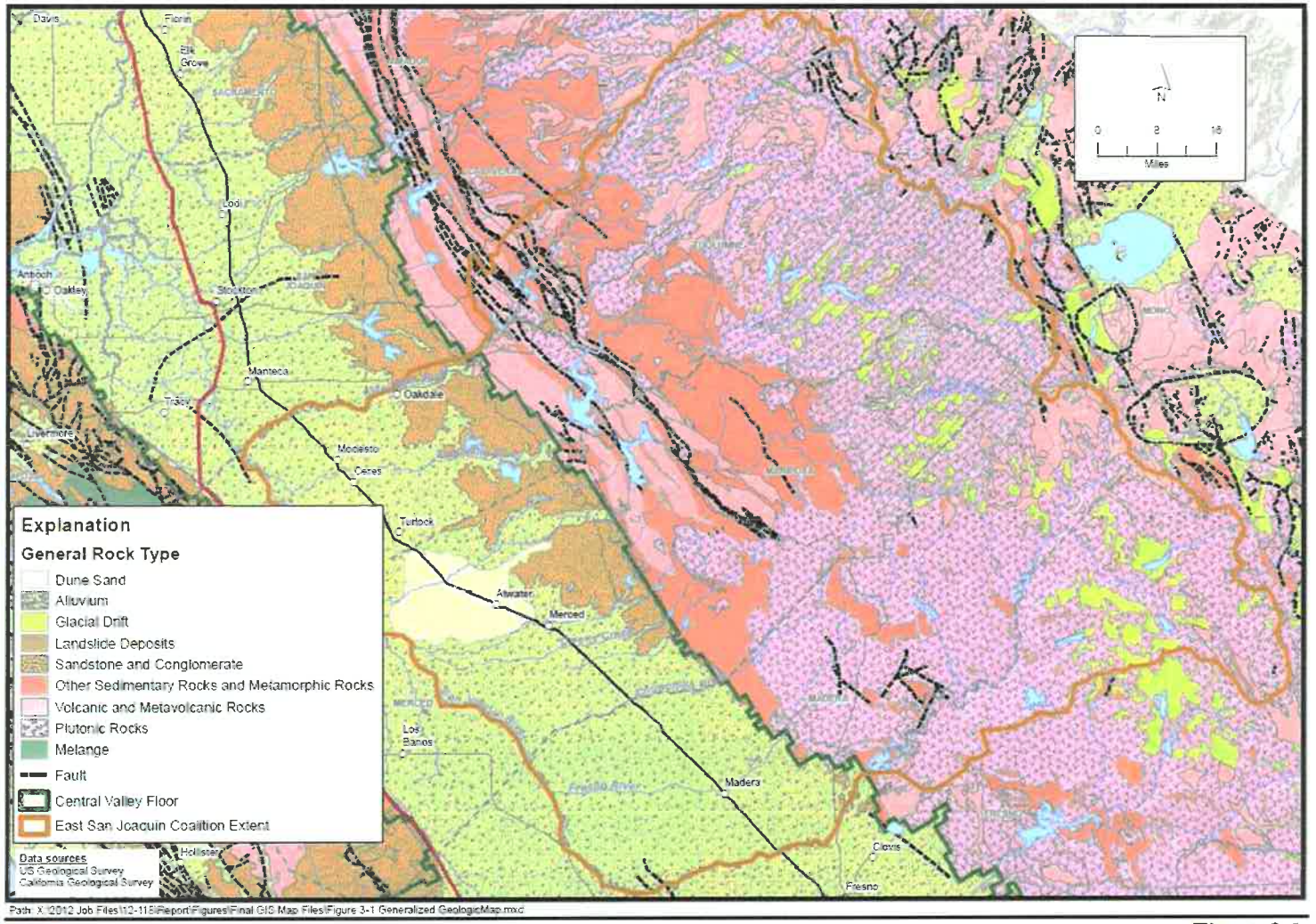


GEOLOGY AND HYDROGEOLOGY

Descriptions of GQMP Zone-specific soil characteristics, hydrology, and land use are included within the individual GQMP Zone sections. The general description of the geology, hydrogeology, and soils of the Central Valley Floor within the Coalition region is provided in the GAR (page 7 - 18) and summarized here.

The Coalition region is located within the San Joaquin Valley, near the southern end of the Central Valley of California in the Great Valley Geomorphic Province. The trough-shaped Central Valley has been filled with interlayered sediments of sand, gravel, silt, and clay derived from erosion of the Sierra Nevada and Coast Range mountains. Figure 9 (Figure 3-1, GAR) shows the geology within the Coalition region as generalized from Jennings (1977). Figures 10 and 11 (Figure 3-2, GAR) show more detailed geologic mapping focusing on the Central Valley Floor area of the Coalition region. The fill deposits mapped throughout much of the valley extend vertically for thousands of feet and the texture of sediments varies in the east-west direction across the valley. Coalescing alluvial fans have formed along the sides of the valley, primarily from the Sierra Nevada with a lesser extent coming from the Coastal Range. Alluvial fans with course textured material generally extend from the edges of the valley, gradually becoming finer towards the axis of the valley. Lacustrine and flood plain deposits also exist closer to the valley axis as thick silt and clay layers. Clay sediments referred to as the Corcoran Clay extend along parts of the San Joaquin Valley floor and generally are located along the western portion of the Coalition region. Resistant sedimentary, metamorphic, volcanic, and crystalline rocks define the foothills and mountains that border the eastern edge of the Central Valley Floor. The regional dip of strata is generally to the southwest.

Figure 9. Generalized geologic map of the Coalition region (Figure 3-1, GAR).



LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 3-1
Generalized Geologic Map

Figure 10. Geologic Map of the Central Valley floor area (Figure 3-2, GAR).

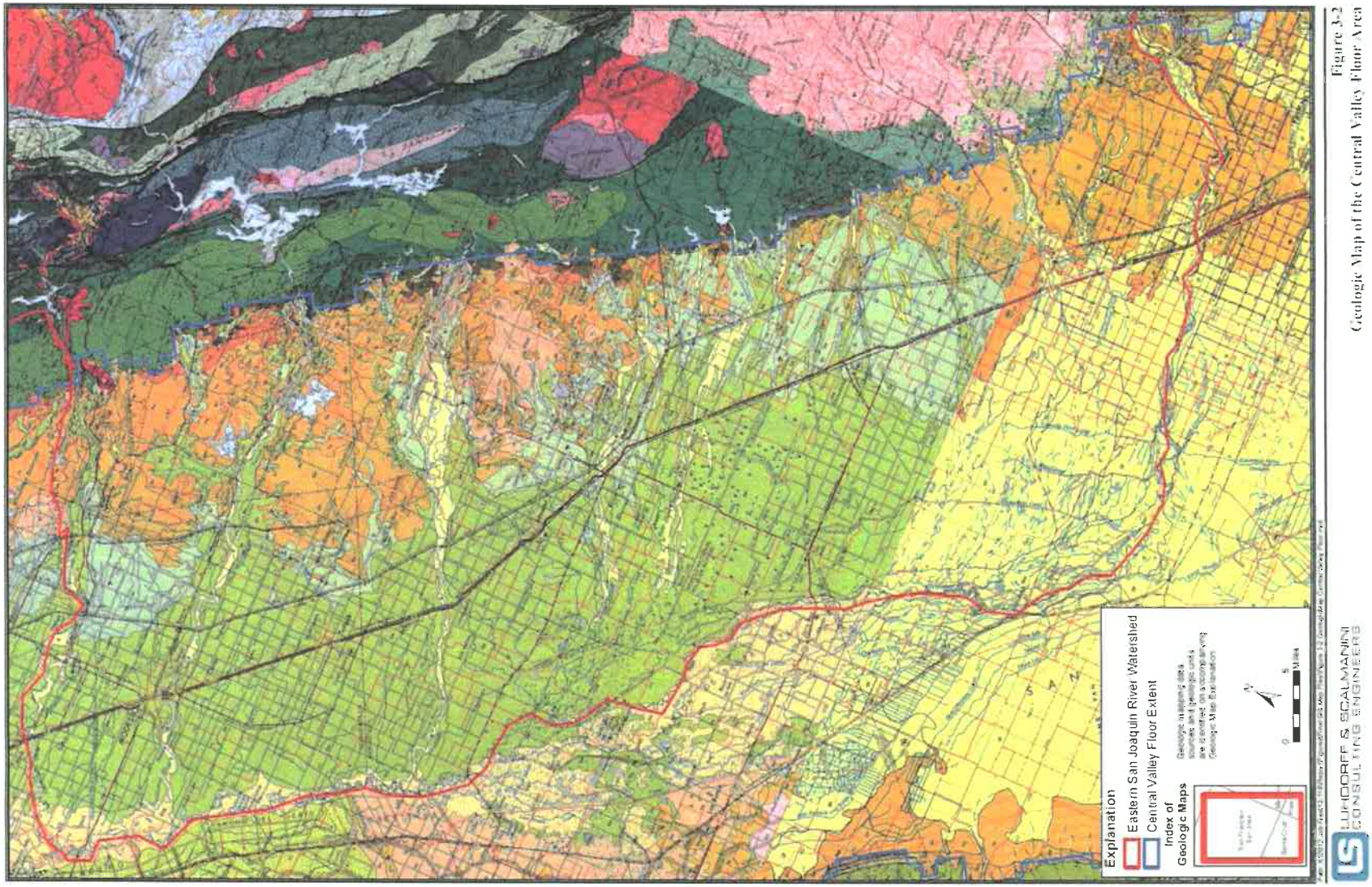


Figure 11. Geologic Map of the Central Valley floor area (Figure 3-2 [Explanation], GAR).

LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 3-2 (Explanation)
Geologic Map of the Central Valley Floor Area

General Hydrogeological Setting

Within the Central Valley Floor, the primary units consist of Quaternary-aged unconsolidated continental deposits and older alluvium that are present across most of the western portion of the Coalition region. The continental and older alluvial deposits consist of layers of sand, gravel, silt, and clay that increase in thickness away from the margins of the valley. The continental deposits are generally mapped as the Turlock Lake Formation, North Merced Gravel, and Pleistocene non-marine sedimentary units which occur along the eastern edge of the Central Valley Floor as shown in Figure 9 (Figure 3-1, GAR). The extent of the older alluvium is generally represented by geologic units mapped as alluvium, Riverbank Formation, Modesto Formation, and Great Valley deposits (Figures 9-11).

The Corcoran Clay is an extensive clay unit and prominent stratigraphic layer in parts of the Central Valley and is believed to separate shallow and deep groundwater systems where it is present. The Corcoran Clay is generally present only in the western portion of the Central Valley Floor area. Depth to the top of the Corcoran Clay generally increases towards the center of the valley.

Groundwater in the area generally occurs under confined, semi-confined, and unconfined conditions within primary water-yielding zones. Consolidated sedimentary rocks of lower water-bearing capacity include the Mehrten Formation, Valley Springs Formation, and Ione Formation which occur along the eastern edge of the Central Valley Floor and have lesser importance as a groundwater resource, although the Mehrten Formation, which consists primarily of sandstone, breccia, and conglomerate, is an important aquifer in the area (DWR, 2003).

Surface and Shallow Subsurface Sediments Characterization

For the purposes of completing the GAR, sources of data used to characterize the surface and subsurface sediments in the Coalition area consisted primarily of county soil surveys completed by the Natural Resource Conservation Service (NRCS), subsurface sediment texture model data from the USGS Central Valley Hydrologic Model (CVHM), and thickness and depth characteristics of the Corcoran Clay as represented in the CVHM (Faunt et al., 2009). The texture data of the CVHM was estimated using 50-foot-thick vertical increments. The model layers (1-10) range from 50-400 feet thick with the thickness of each layer 50 feet thicker than the layer above (Figure 12, Table 6).

Figure 13 depicts the groupings of basins and subbasins with the Central Valley used for the textural soils analysis in the CVHM. Modesto, Turlock, and Merced GQMP Zones are located in the southern half of the Northern San Joaquin spatial province and domain (22) of Figure 13. The Chowchilla and Madera GQMP Zones are located in Chowchilla-Madera spatial province and domain (23) of Figure 13. Layers 1-3 of the texture model are provided below (Figures 14-15) to represent the texture of soils surrounding wells typically defined as shallow (less than 200 feet deep) in the GAR.

Table 6. Central Valley, California groundwater flow model layer thicknesses and depths listed by layers (Table. A3, Faunt, et. al., 2009).

Layers 4 and 5 represent Corcoran Clay where it exists; elsewhere a 1 foot thick phantom layer; they are kept only to keep track of layer numbers.

Layer	Thickness (feet)	Depth to Base Outside Corcoran Clay (Feet)	Texture Figure
1	50	50	A9(a)
2	100	150	-
3	150	300	A9(b)
4	Variable	301	A9(c)
5	Variable	302	A9(c)
6	198	500	A9(d)
7	250	750	-
8	300	1050	-
9	350	1400	**A9(c)**
10	400	1800	-

Figure 12. Generalized hydrogeologic section of the Central Valley according the CVHM. Layers 1-10 indicate the discreet vertical layers described in the CVHM (Fig. A11, Faunt, et. al., 2009).

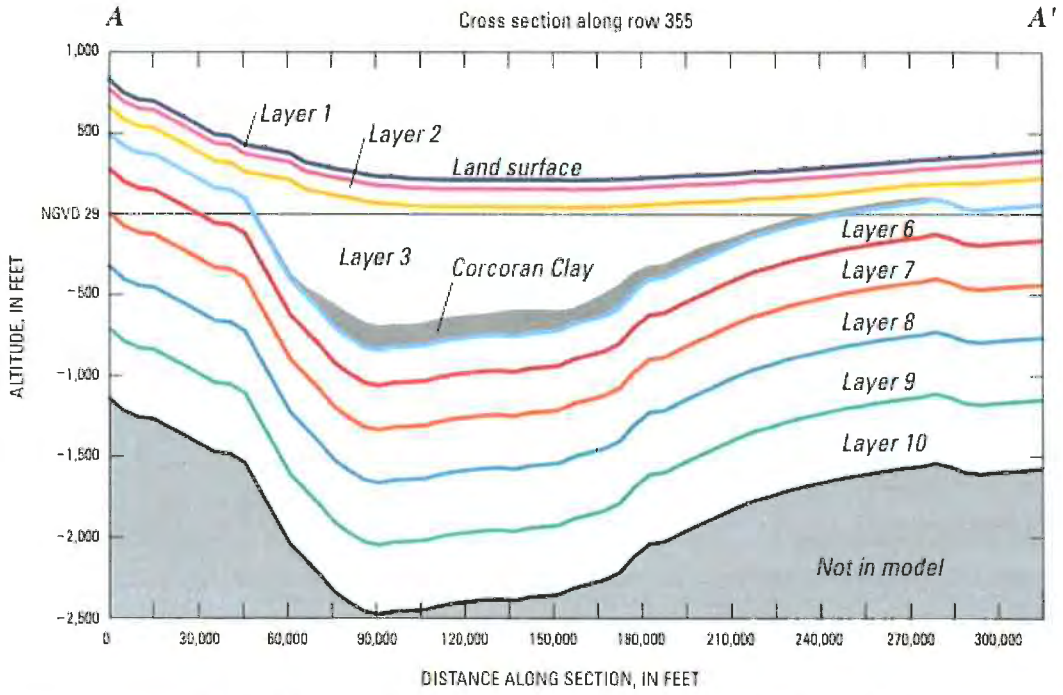


Figure A11. Generalized hydrogeologic section (*A–A'*) indicating the vertical discretization of the numerical model of the groundwater-flow system in the Central Valley, California. Line of section shown on *figure A1* (altitudes are along row 355; layer numbers indicate model layer).

Figure 13. Groupings of basins and subbasins within the Central Valley used for textural soils analysis in the CVHM (Figure A10, Faunt, et. al., 2009).

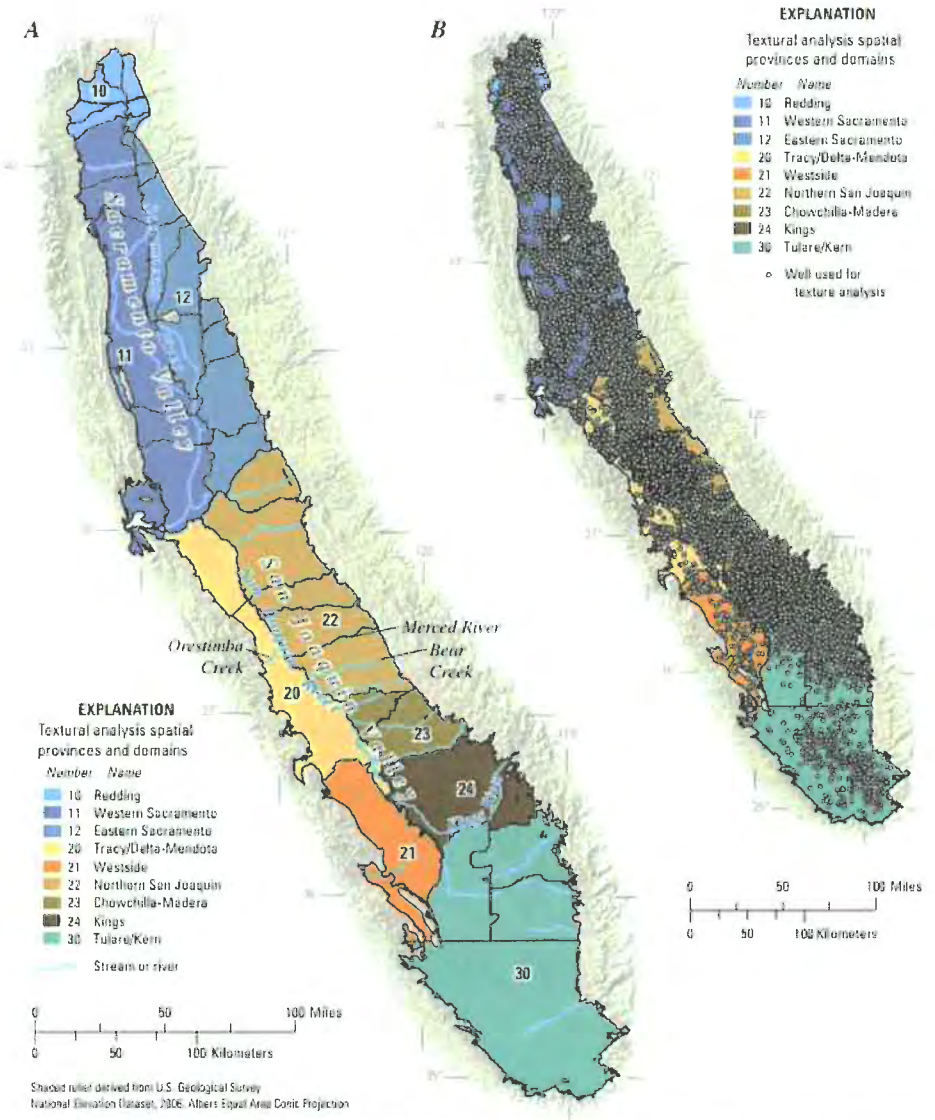


Figure A10. *A*, Central Valley showing groundwater basins and subbasins, groupings of basins and subbasins into spatial provinces and domains for textural analysis. *B*, Distribution of wells used for mapping texture. *C*, Count of wells for each depth increment by domains through 1,200 feet. Because less than 1 percent of the logs extend past 1,200 feet, increments below 1,200 feet were not shown. Detailed description of the spatial provinces and domains are in *table A2*.

Figure 14. Layer 1 of the CVHM depicting the percentage of coarse-grained material within the top 50 feet of the Central Valley.

Modesto, Turlock, and Merced GQMP Zones are located in the southern half of the Northern San Joaquin spatial province and domain (22). The Chowchilla and Madera GQMP Zones are located in Chowchilla-Madera spatial province and domain (23). (Fig. A12, Faunt, et. al., 2009).

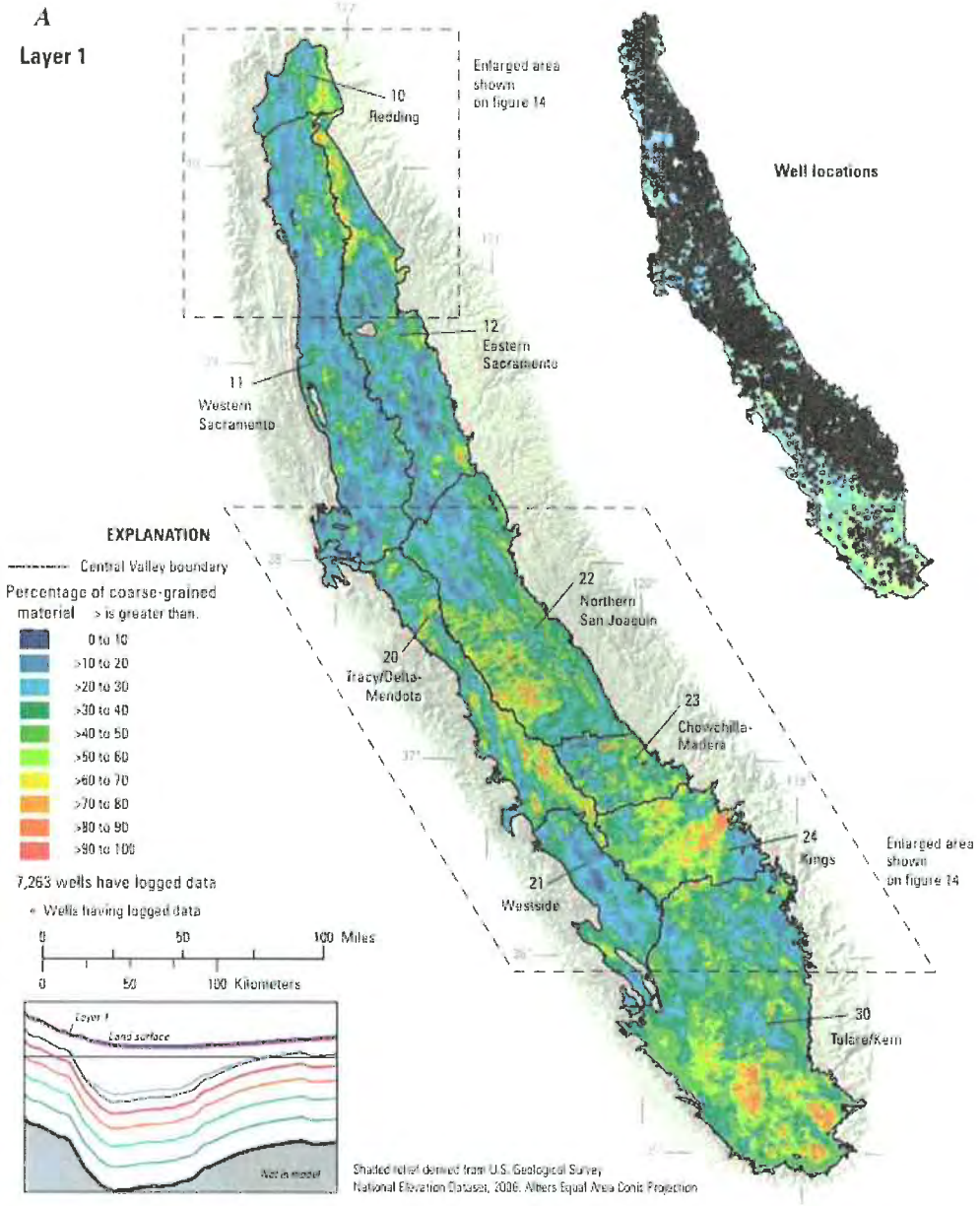
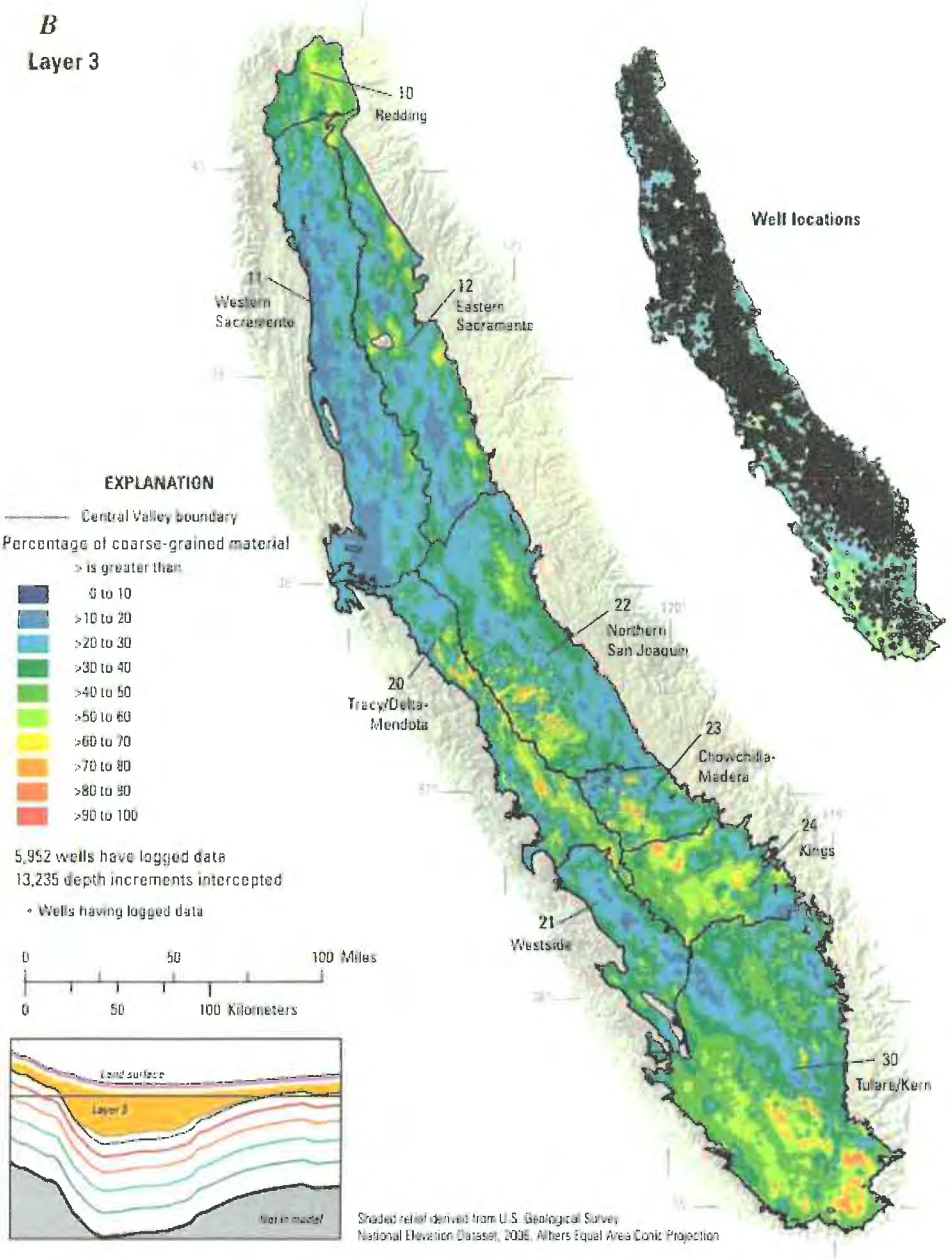


Figure 15. Layer 3 of the CVHM depicting the percentage of coarse-grained material within the top 150 feet of the Central Valley.

Modesto, Turlock, and Merced GQMP Zones are located in the southern half of the Northern San Joaquin spatial province and domain (22). The Chowchilla and Madera GQMP Zones are located in Chowchilla-Madera spatial province and domain (23). (Fig. A12 continued, Faunt, et. al., 2009).



Soil Hydraulic Conductivity

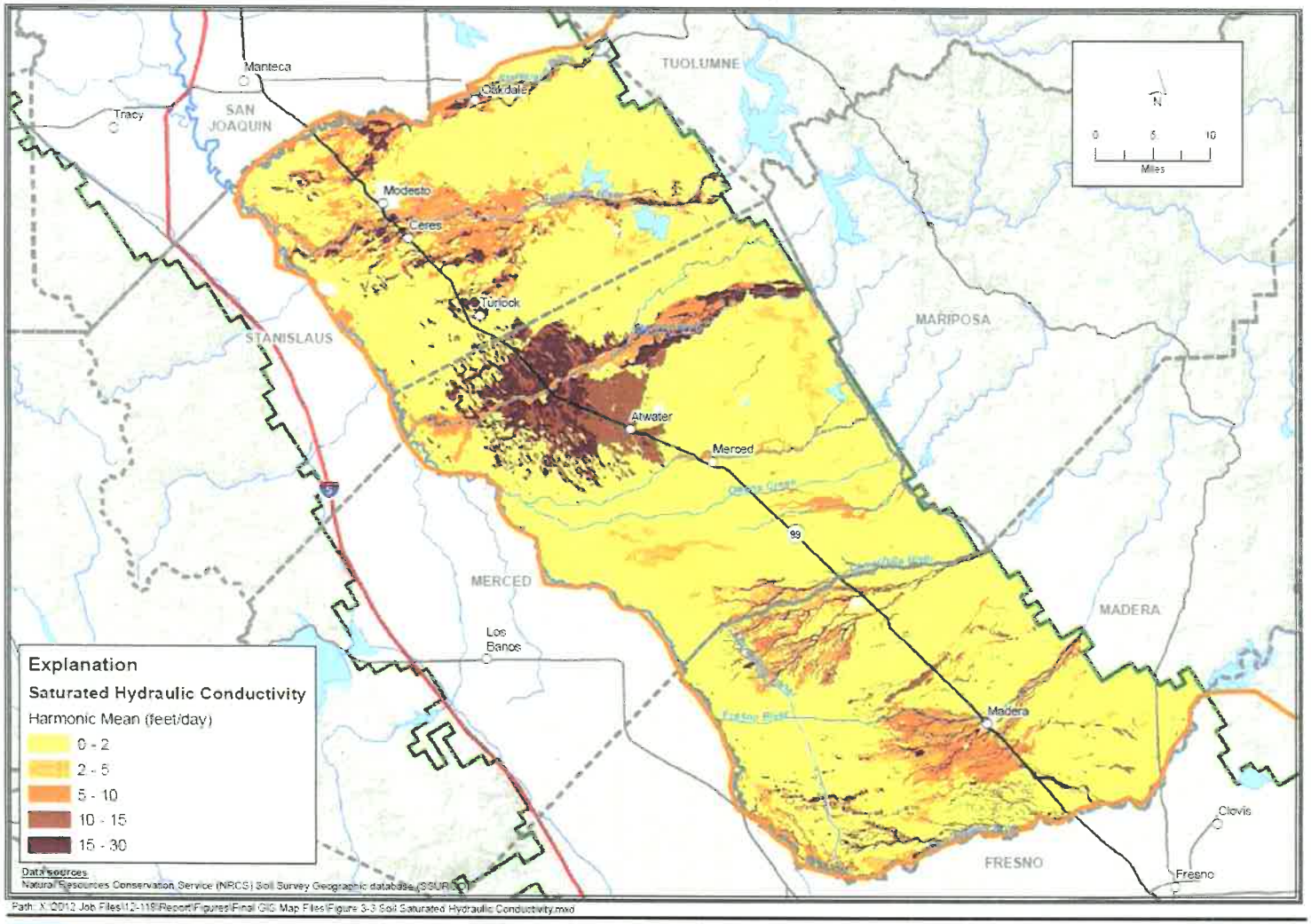
Hydraulic conductivity is a measure of the ability of a material to transmit water; the greater a material's hydraulic conductivity, the faster water moves through the matrix of the material. Figure 16 (Figure 3-3, GAR) shows the hydraulic conductivity of soils as derived from NRCS soil surveys within the Central Valley Floor area of the Coalition region. Notably, the NRCS soil survey data presented in Figure 16 show the presence of numerous long and narrow coarser-textured deposits of higher conductivity and the presence of alluvial channels which have formed large fans of high conductivity soils, particularly in those areas adjacent to the Merced, Tuolumne, Stanislaus, Chowchilla, and Fresno Rivers. Similar patterns of coarser textured material can also been seen within the Northern San Joaquin spatial province and domain (22) and Chowchilla-Madera spatial province and domain (23) in Layer 1 of the CVHM (Figure 14).

Soil Chemistry

The soil chemistry description below is taken almost exclusively from the GAR. Figure 17 (Figure 3-4, GAR) shows the spatial distribution of soil salinity within the Central Valley Floor area of the Coalition region, as derived from NRCS soil surveys. The GAR evaluates high salinity as electrical conductivity (EC) greater than 4 dS/m which may lead to an impact on crop productivity. Areas of soil salinity above 4 dS/m are largely limited to the western portion of the Central Valley Floor area of the Coalition region, and particularly in the southwest. Large areas of high salinity soils are also located south of Atwater and Merced, and to the west of Madera, while a smaller area of soils with high salinity is present west of Turlock.

The spatial distribution of soil pH, as derived from NRCS soil surveys, is shown in Figure 18 (Figure 3-5, GAR) for the Central Valley Floor area of the Coalition region. Highly alkaline soils (pH > 7.8) can affect plan health and appear to follow a similar spatial pattern as soils with high salinity. The western portion of the Central Valley Floor contains a majority of the alkaline soils, particularly to the south of Atwater and Merced and to the west of Madera. Throughout a large part of the Central Valley Floor of the Coalition region, soils are generally in the neutral pH range from 6.6 to 7.5. Crops vary in their ability to tolerate levels of soil pH; however, most crops grow best when the soil pH is slightly acidic at a value between 6 and 7. More acidic soils (lower pH) are generally located in the northern and eastern portions of the Central Valley Floor area of the Coalition region. Areas of greatest soil acidity exist to the northeast of Merced and along the eastern margins of the Central Valley Floor within the Coalition region.

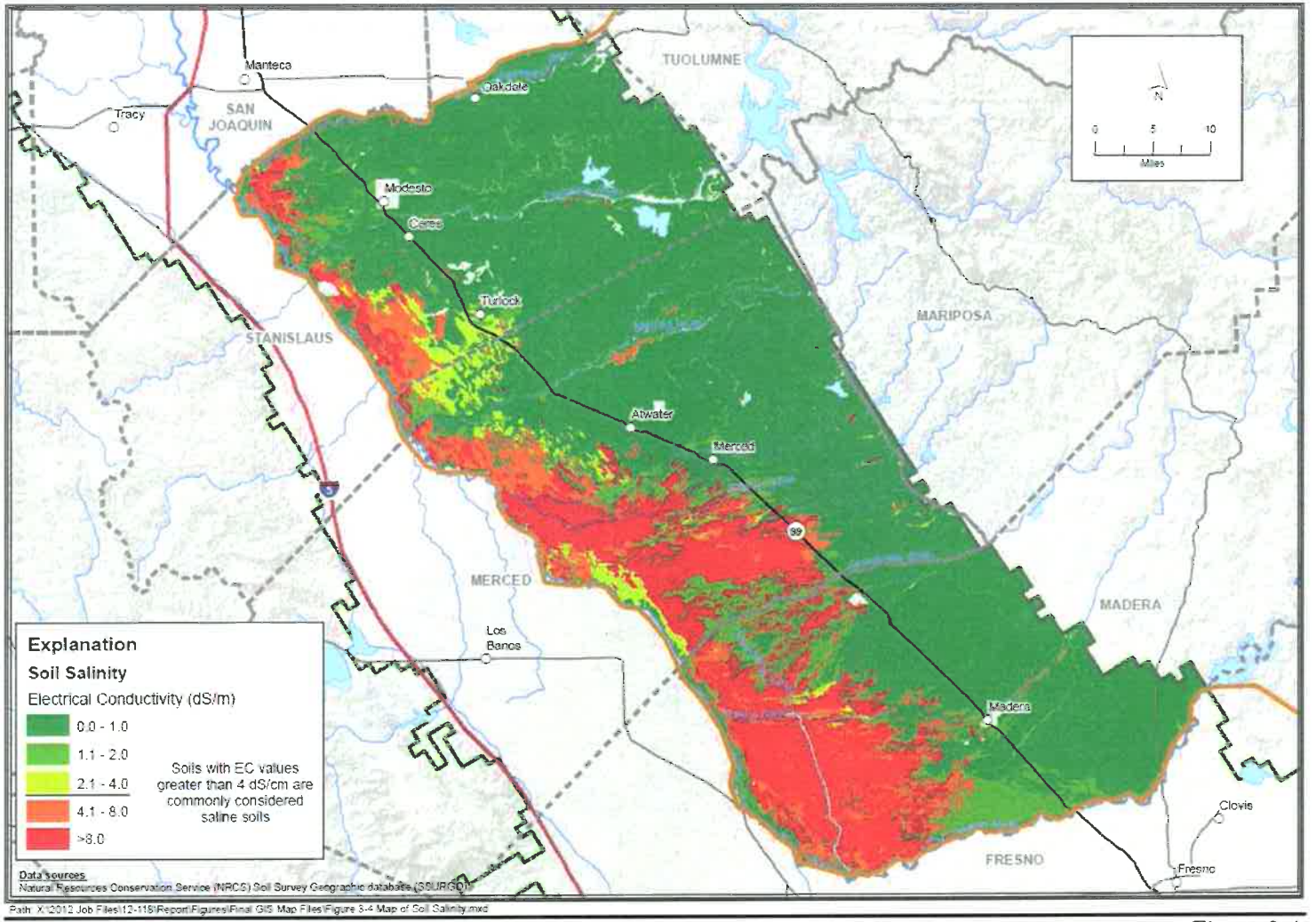
Figure 16. Soil hydraulic conductivity in the Central Valley portion of the Coalition (Figure 3-3, GAR).



LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 3-3
Soil Hydraulic Conductivity

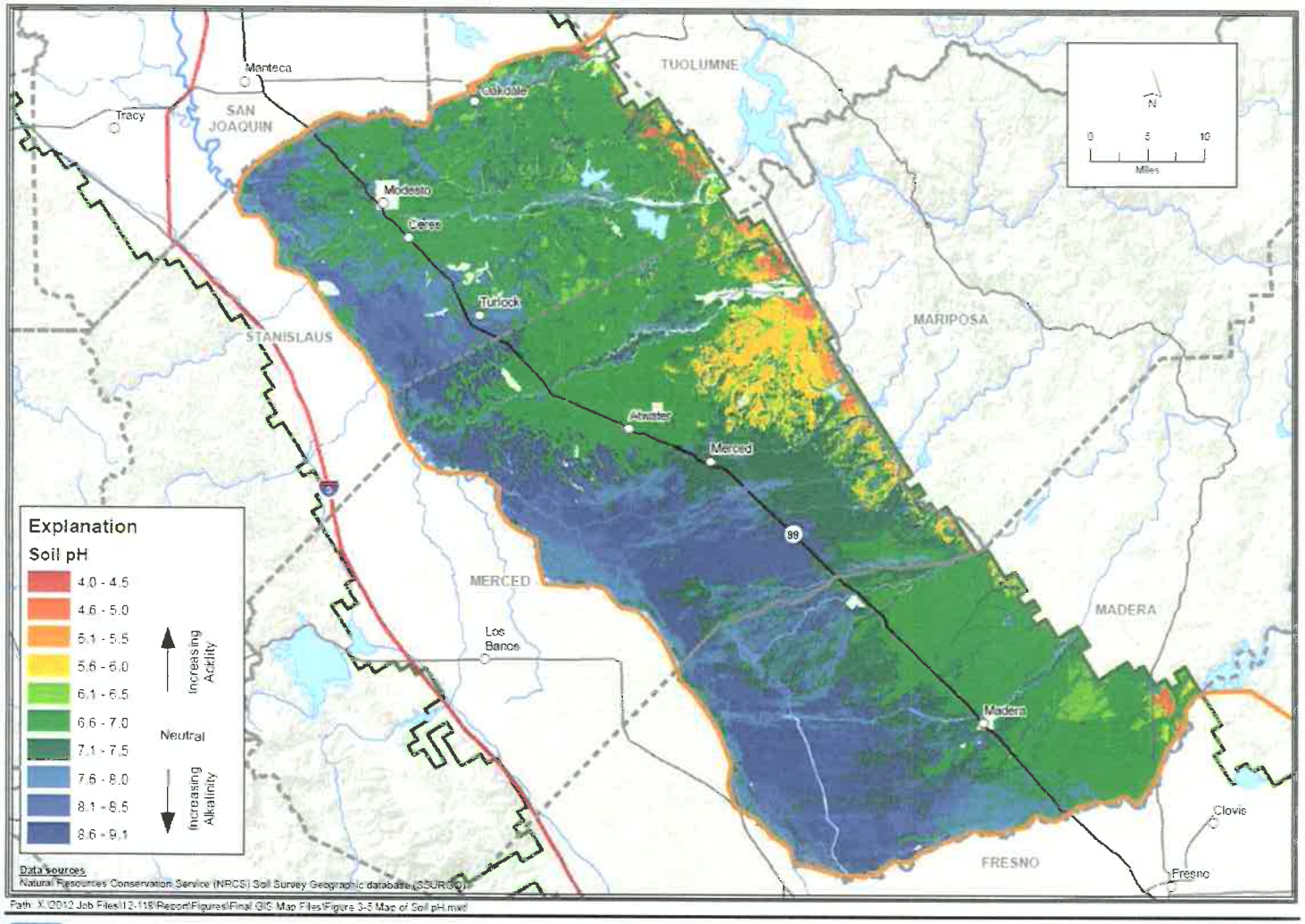
Figure 17. Soil salinity in the Central Valley portion of the Coalition (Figure 3-4, GAR).



LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 3-4
Soil Salinity

Figure 18. Soil pH in the Central Valley portion of the Coalition (Figure 3-5, GAR).



LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 3-5
Soil pH

The subsurface sediment description below is taken directly from the GAR. Reproductions of the figures presented in the GAR are included here for ease of reference.

CVHM Hydraulic Conductivity

The CVHM (Faunt et al., 2009) (Figures 14-15) incorporates available lithologic data from numerous well drillers' logs and other available data in a three-dimensional sediment texture model characterizing the valley-fill deposits within the Central Valley Floor area. The CVHM presents a layered spatial representation of subsurface hydraulic conductivity and texture at a horizontal grid scale of one-square mile and approximately 50-foot thickness intervals. For the purposes of understanding the relationship between irrigated agriculture management practices and groundwater quality, particularly in regards to the hydrogeologic vulnerability, the characteristics of the uppermost layer of the CVHM are of greatest interest (Figure 14). In the Coalition region, Layer 1 of the CVHM generally extends to a depth of 50 feet, and Figure 19 (Figure 3-6, GAR) shows the vertical hydraulic conductivity as represented in Layer 1 of the CVHM.

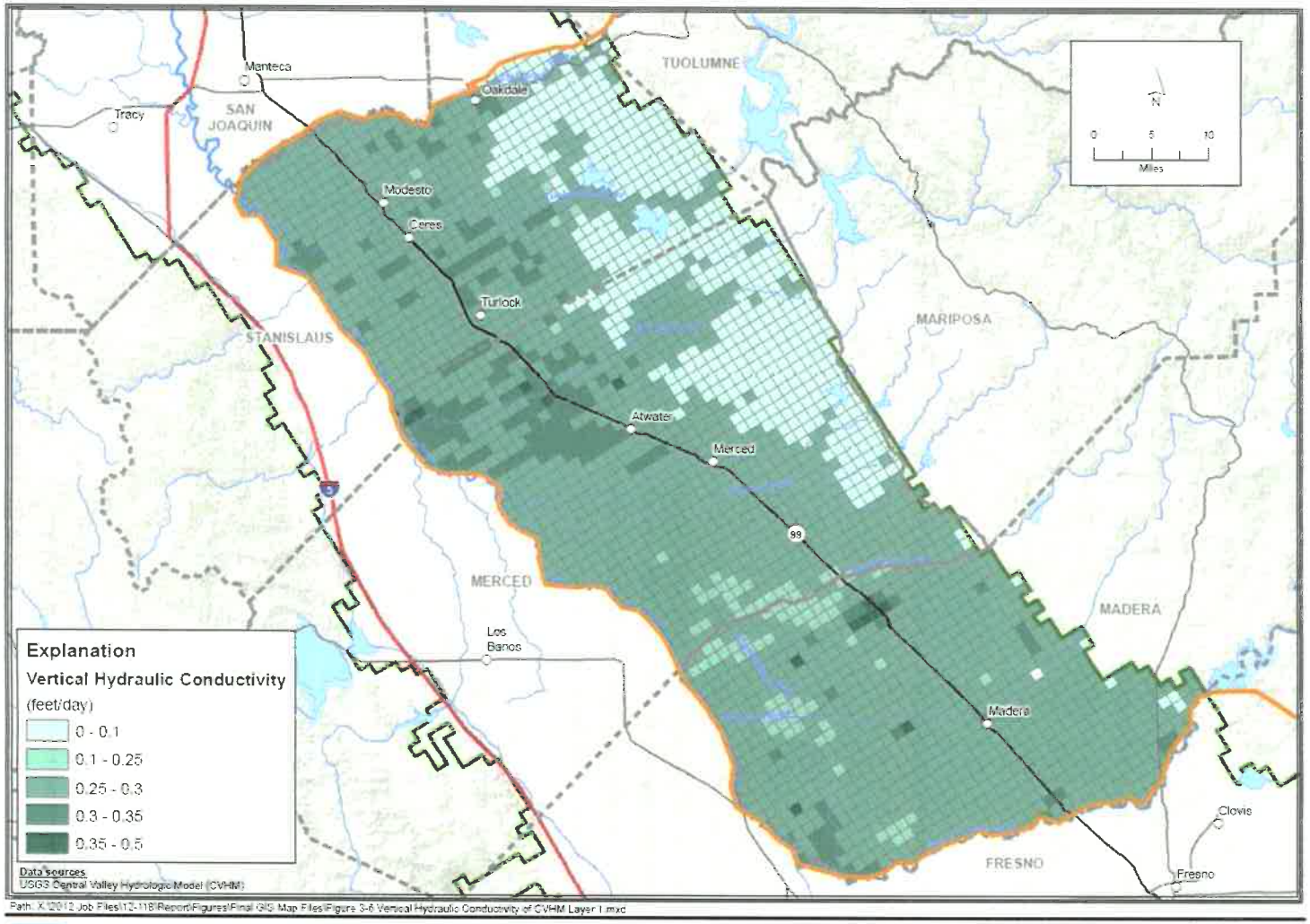
Corcoran Clay

The spatial extent, thickness, and depth to the top of the Corcoran Clay in the Coalition region, as depicted in the CVHM, are shown in Figures 20 and 21 (Figures 3-7a and 3-7b,GAR) and is generally present only in the western portion of the Central Valley Floor area, approximately west of Highway 99 as shown. Depth to the top of the Corcoran Clay generally increases towards the center of the valley and ranges from less than 50 feet along parts of its eastern extent to more than 300 feet below ground in the southwest portion of the Central Valley Floor area as illustrated in Figure 20 (Figure 3-7a, GAR). The thickness of the Corcoran Clay also increases towards the axis of the valley as shown in Figure 21 (Figure 3-7b, GAR). Two areas where the Corcoran Clay is thickest are located generally to the west of Turlock and also to the south of Turlock where the thickness is generally greater than 60 feet with some thicker areas of 100 feet or more. Although the lateral extent of the Corcoran Clay is generally greater farther south, the unit tends to thin with many areas of less than 40 feet thickness, particularly across most of the eastern part of its southern extent.

Known Tile Drains

The presence of shallow or perched groundwater in parts of the San Joaquin Valley has led to the installation of tile drains in some areas. In preparation of the GAR, readily available data sources were researched in an attempt to identify locations of known tile drains within the Coalition region. Figure 22 (Figure 3-8, GAR) shows the locations of identified tile drains based on DWR water quality sampling points. This map shows the presence of tile drains throughout much of the Sacramento Delta area and in areas west of the San Joaquin River. However, these data do not show the existence of any tile drains within the Coalition region, although the presence of shallow groundwater conditions and shallow wells used by irrigation districts to drain the shallow groundwater is discussed below as it relates to groundwater level data. Tile drains apparently exist along the western edge of the Coalition region, although specific locations for these features are not known.

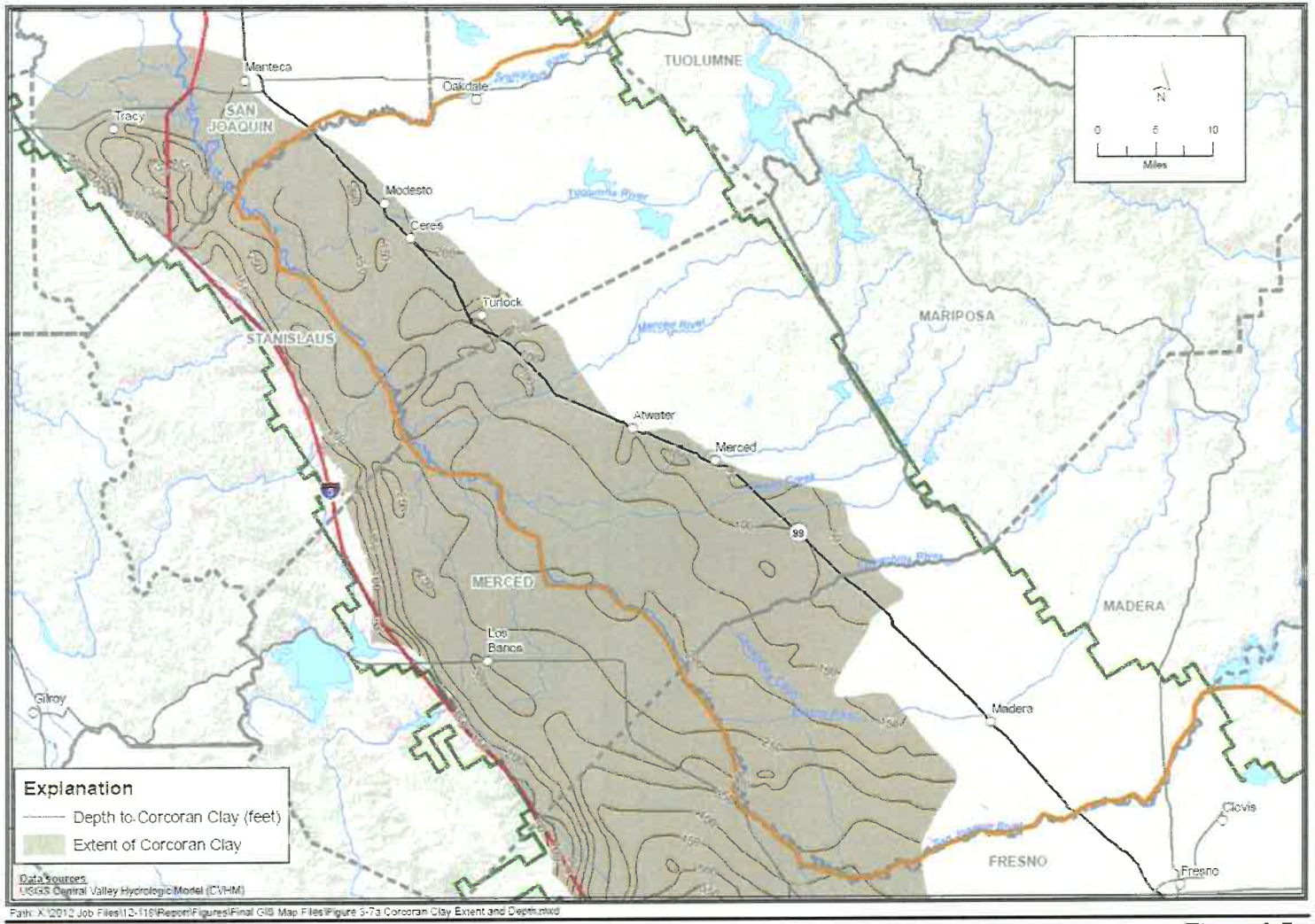
Figure 19. Vertical hydraulic conductivity of the CVHM Layer 1within in the Central Valley portion of the Coalition (Figure 3-6, GAR).



LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 3-6
Vertical Hydraulic Conductivity of CVHM Layer 1

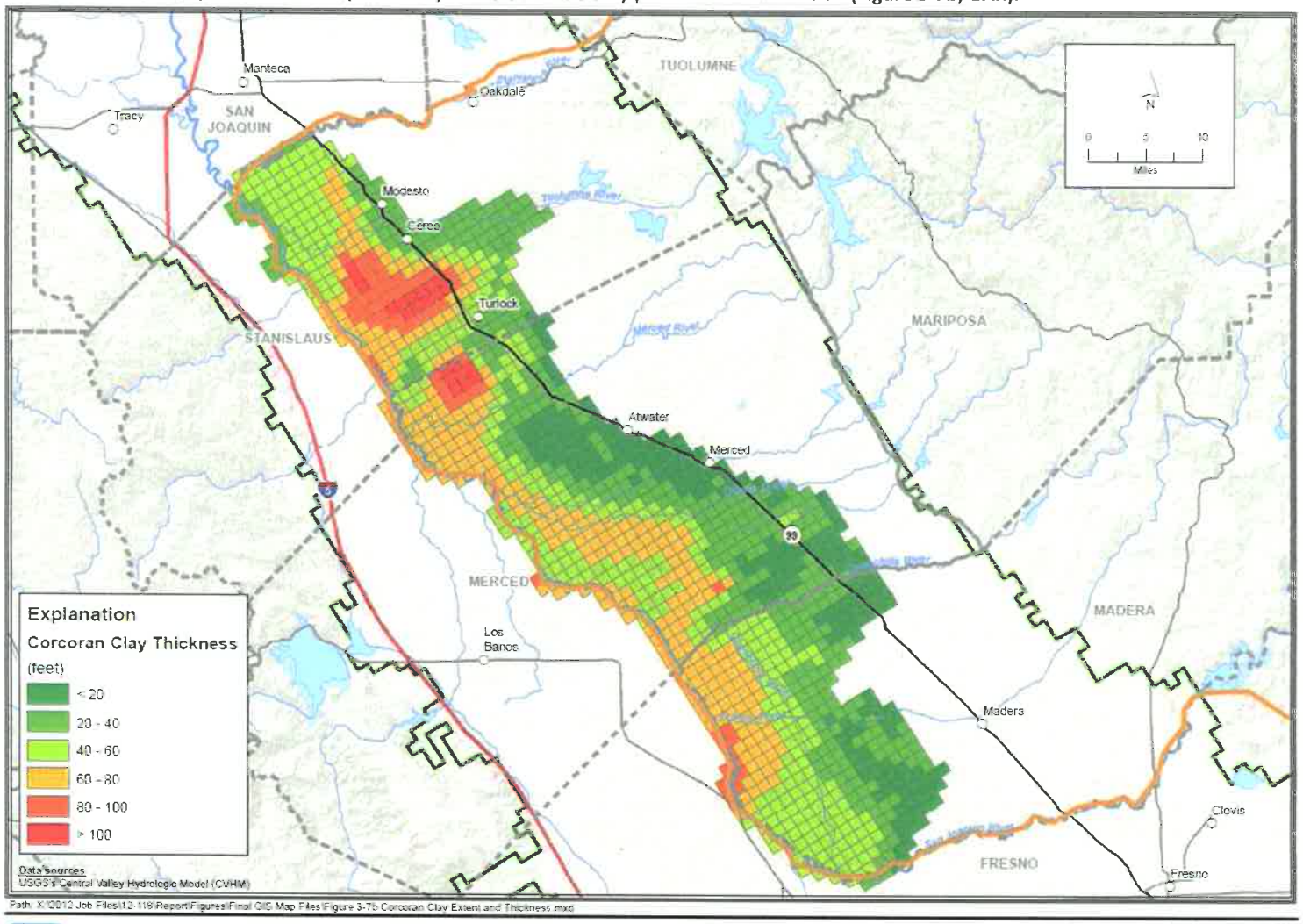
Figure 20. Corcoran Clay characteristics (extent and depth) in the Central Valley portion of the Coalition (Figure 3-7a, GAR).



LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 3-7a
Corcoran Clay Characteristics: Extent and Depth

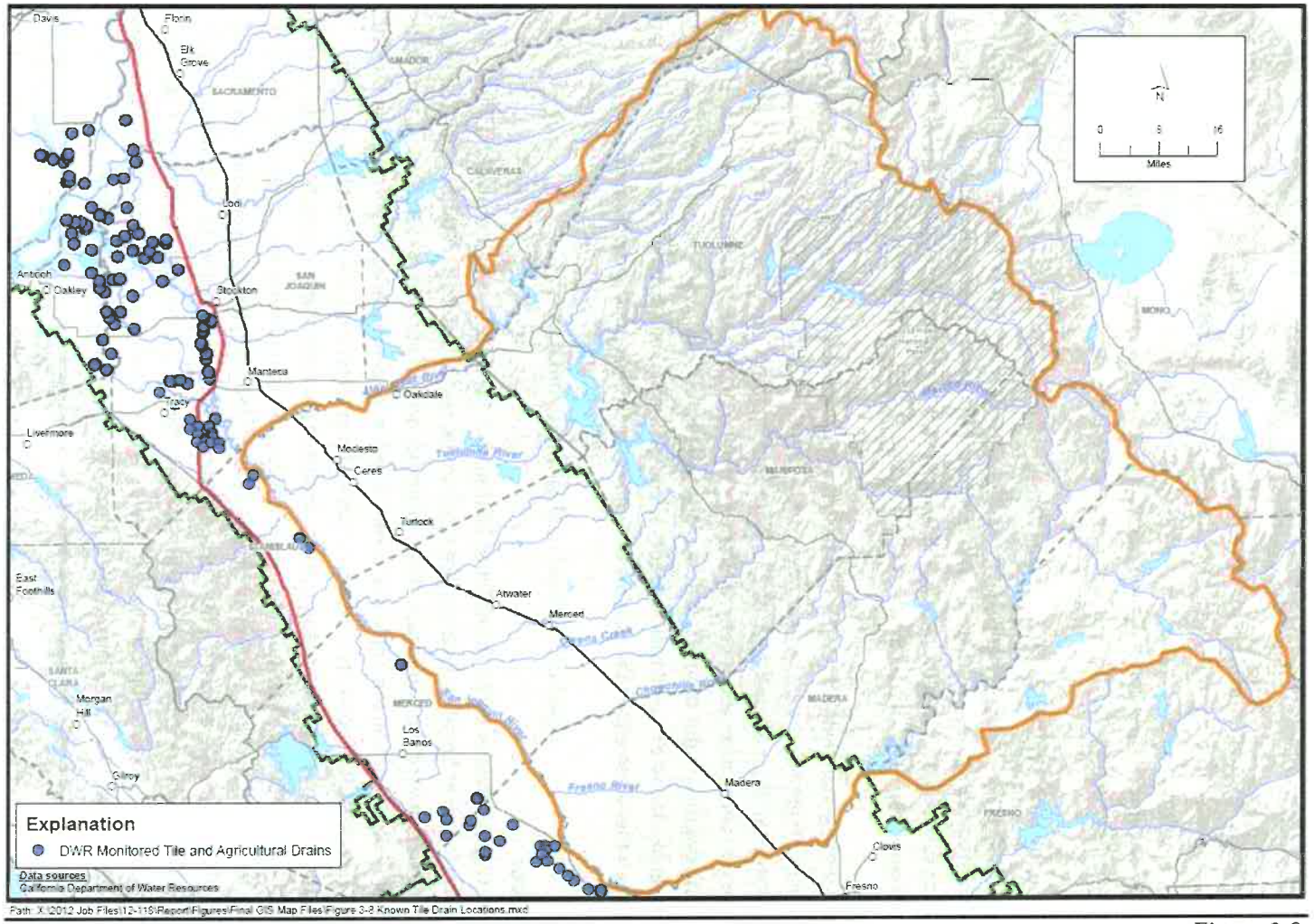
Figure 21. Corcoran Clay characteristics (thickness) in the Central Valley portion of the Coalition (Figure 3-7b, GAR).



LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 3-7b
Corcoran Clay Characteristics: Thickness

Figure 22. Known tile drain locations in the Central Valley portion of the Coalition (Figure 3-8, GAR).



GROUNDWATER HYDROLOGY

The groundwater hydrology description below is taken exclusively from the GAR. Reproduction of the figures presented in the GAR are included here for ease of reference. A discussion of the extent and various restrictions of the well data are presented at length in the GAR in Section 3.3.1.1.

Groundwater Levels

In order to characterize historical and present groundwater conditions for the GAR, groundwater level data for the Coalition region were gathered from available data sources including DWR's Water Data Library (WDL), California Statewide Groundwater Elevation Monitoring (CASGEM), United States Geological Survey (USGS's) National Water Information System (NWIS), the State Water Resources Control Board's (SWRCB) Geotracker database (GAMA), Merced Irrigation District and Turlock Irrigation District.

In addition to water level measurement data, spatial datasets representing groundwater levels as developed by the California Department of Pesticide Regulation (DPR), and DWR were also reviewed and evaluated. These included interpolated groundwater level data from the DPR Environmental Hazards Assessment Program, Depth to Groundwater Database (DPR, 2000) and from DWR contour maps for select areas of available data, primarily in the western part of the Central Valley Floor area within the Coalition region.

In the GAR, wells were grouped into three general well depth categories: shallow, deep, and unknown. Shallow wells were defined to be wells with known depths less than 200 feet and also included well use categories of domestic wells, monitoring wells, and Turlock Irrigation District (TID) drainage wells (because of anecdotally provided information about general well depth) when well depth was not provided. Deep wells included wells with depths greater than 200 feet and also municipal wells, irrigation wells, or other well uses indicating a greater likelihood of a well that is deeper than 200 feet. Wells without any further information with which to assign them into either the shallow or deep category were designated unknown.

Spatial Patterns in Depth to Groundwater

Central Valley Floor

The spring depth to groundwater contours in Figure 23 (Figure 3-11, GAR) show extensive shallow groundwater levels (<20 feet below ground surface [bgs]) in the northwestern part of the Coalition region near Turlock and westwards toward the San Joaquin River. Another area of considerable shallow groundwater exists in the general vicinity of Merced and along Owens Creek and its tributaries. Figure 23 also highlights other more localized areas of shallow groundwater evident along waterways, most notably along the Stanislaus River, Merced River, and San Joaquin River. Depth to groundwater tends to be deeper to the east and away from San Joaquin River. Two notable pockets of deeper groundwater are apparent to the east of Turlock, in the vicinity of Chowchilla, and between Merced and Madera in the more southerly portion of the area. Similar spatial patterns are evident in the contours of fall depth to groundwater as shown in Figure 24 (Figure 3-12, GAR). However, as expected, the depth to groundwater is generally greater in the fall than in the spring indicating seasonal lowering of groundwater levels. The depth to groundwater contour maps developed in the GAR show similar spatial patterns to those developed by DPR shown in Figure 25 (Figure 3-13, GAR).

Figure 26 (Figure 3-14, GAR) shows areas of potential groundwater discharge where the current depth to groundwater contours indicate shallow groundwater conditions (<10 feet bgs). Particularly notable areas where groundwater is within 10 feet of the ground surface are evident from Figure 26 in the vicinity of Turlock and along lower reach sections of many tributary rivers to the San Joaquin River, including the Stanislaus, Tuolumne, Merced, and Fresno Rivers. As a result, some of these tributary reaches may experience gaining conditions during some times. A number of sections of the San Joaquin River also have shallow groundwater conditions which may result in groundwater discharge areas along or near the river. These general patterns are similar to those depicted by DWR groundwater level contour maps (2010a; 2010b).

Peripheral Area

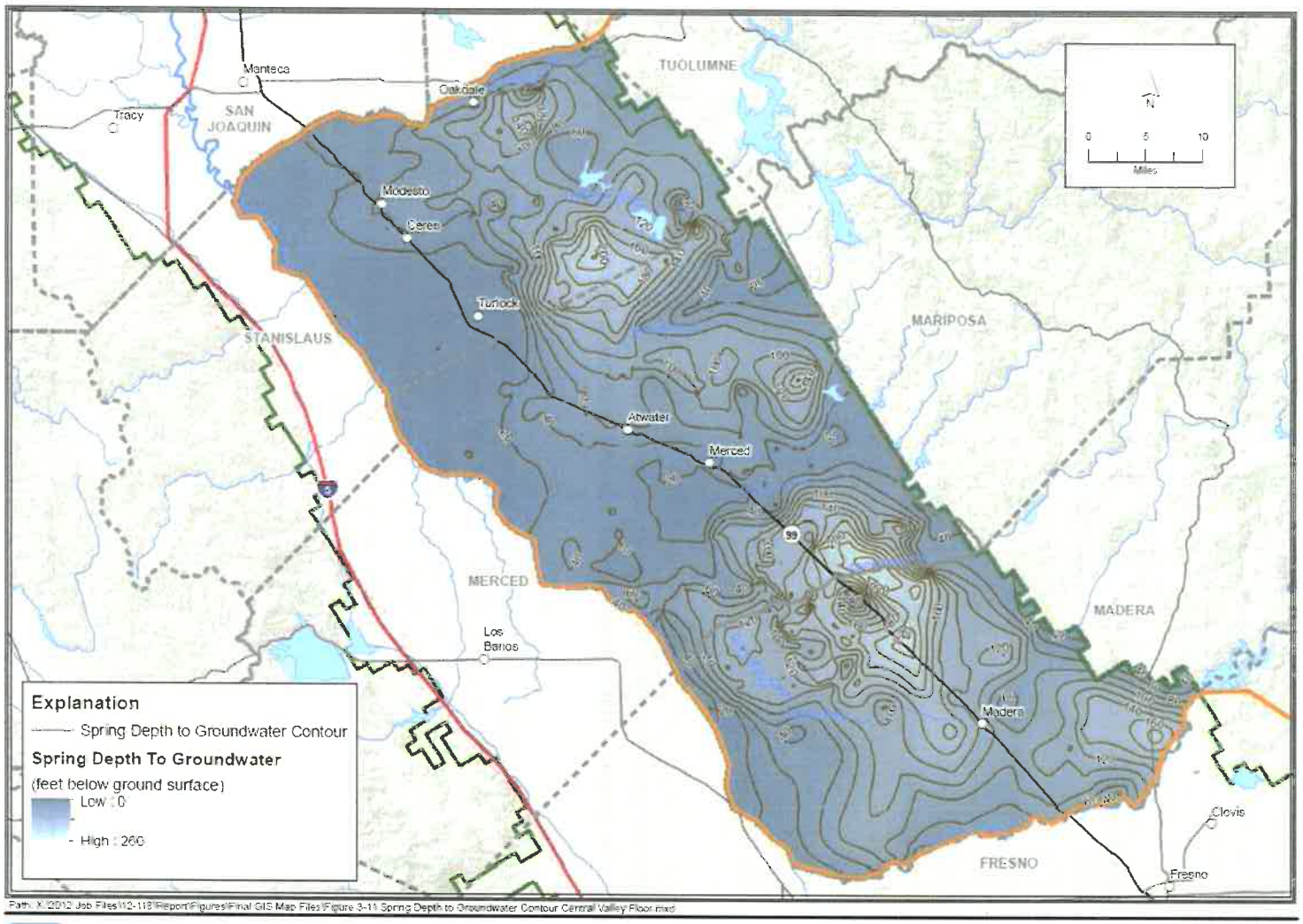
Because of the relatively sparse spatial distribution of available water level data, and the different hydrogeologic environment of the Peripheral Area in which groundwater commonly occurs in and moves through networks of fractures, interpreting spatial patterns can be challenging and misleading since groundwater conditions can be highly localized. Therefore, groundwater levels outside of the Central Valley Floor were not contoured. However, available recent water level data points in the Peripheral Area are shown in Figure 27 (Figure 3-15, GAR) to illustrate some of the general groundwater level conditions in the area. Because of the hydrogeologic environment of the Peripheral Area, differentiation of groundwater resources into shallow and deep zones is also not as meaningful. Figure 27 shows the average depth to groundwater value within the Peripheral Area for wells of all depth, regardless of time of year. This map shows a wide range of average depth to groundwater values ranging from shallow to greater than 700 feet below ground surface. The shallowest groundwater levels generally occur in valleys and deeper water levels are generally in upland areas away from waterways.

Groundwater Flow Directions

The continuous depth to groundwater spatial dataset and associated contours generated in the GAR were used to calculate groundwater elevations across the Central Valley Floor area and for estimating groundwater flow direction.

Figures 28 and 29 (Figures 3-16 and 3-17, GAR) show a steeper groundwater surface with greater hydraulic gradients in the eastern part of the Central Valley Floor area with the presence of some notable local groundwater depressions, particularly in the vicinity of Chowchilla, between Merced and Madera, and east of Turlock. The hydraulic gradient of the groundwater surface generally flattens to the west, particularly in the northern and western part of the Coalition region. Arrows on Figures 28 and 29 show the interpreted directions of groundwater flow under spring and fall conditions based off of the contour maps. Both spring and fall groundwater elevation contours indicate that groundwater generally flows in a southwestern direction away from the hills and mountains to the northeast.

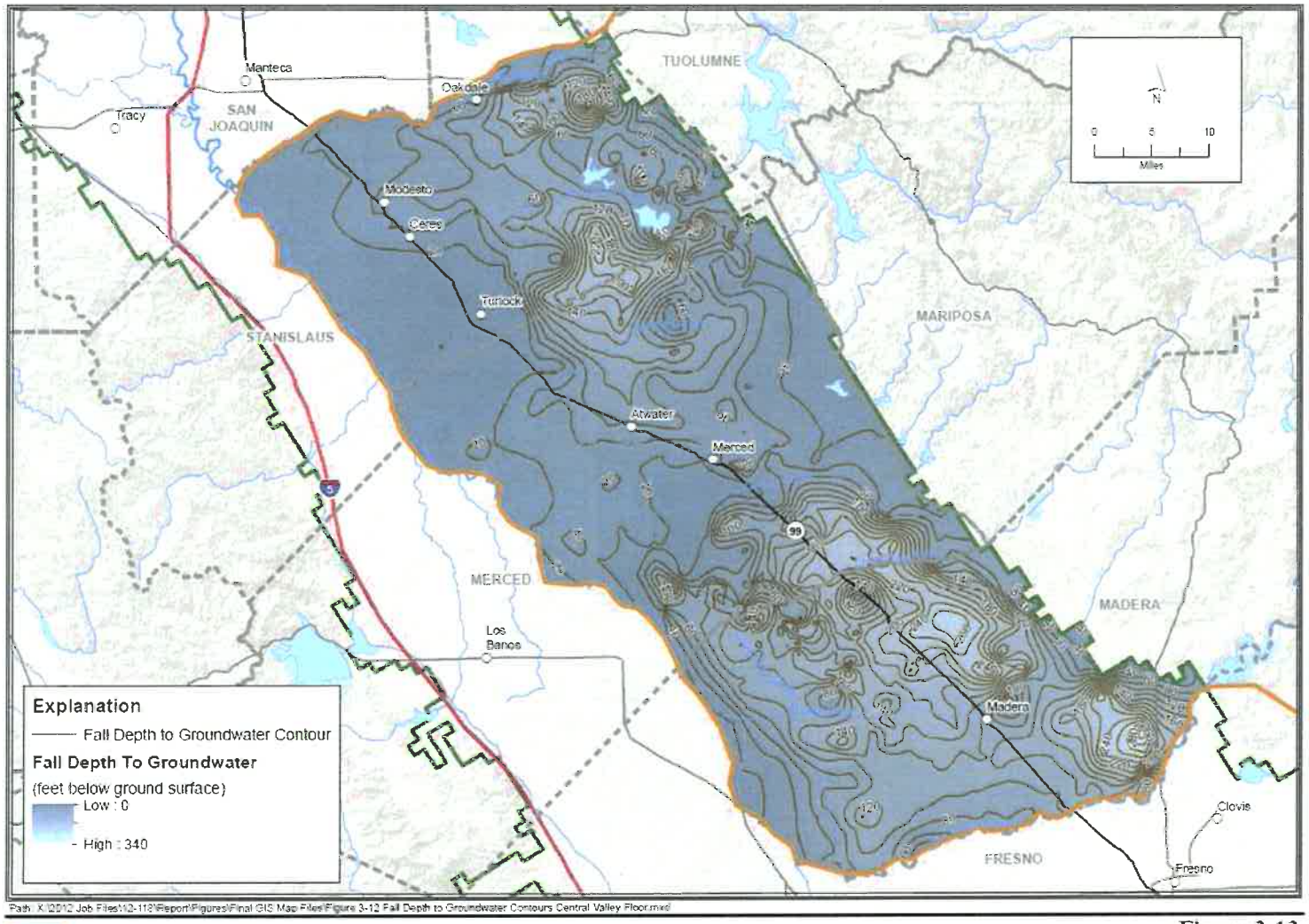
Figure 23. Spring depth to groundwater contours: Central Valley portion of the Coalition (Figure 3-11, GAR).



LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 3-11
Spring Depth to Groundwater Contours: Central Valley Floor

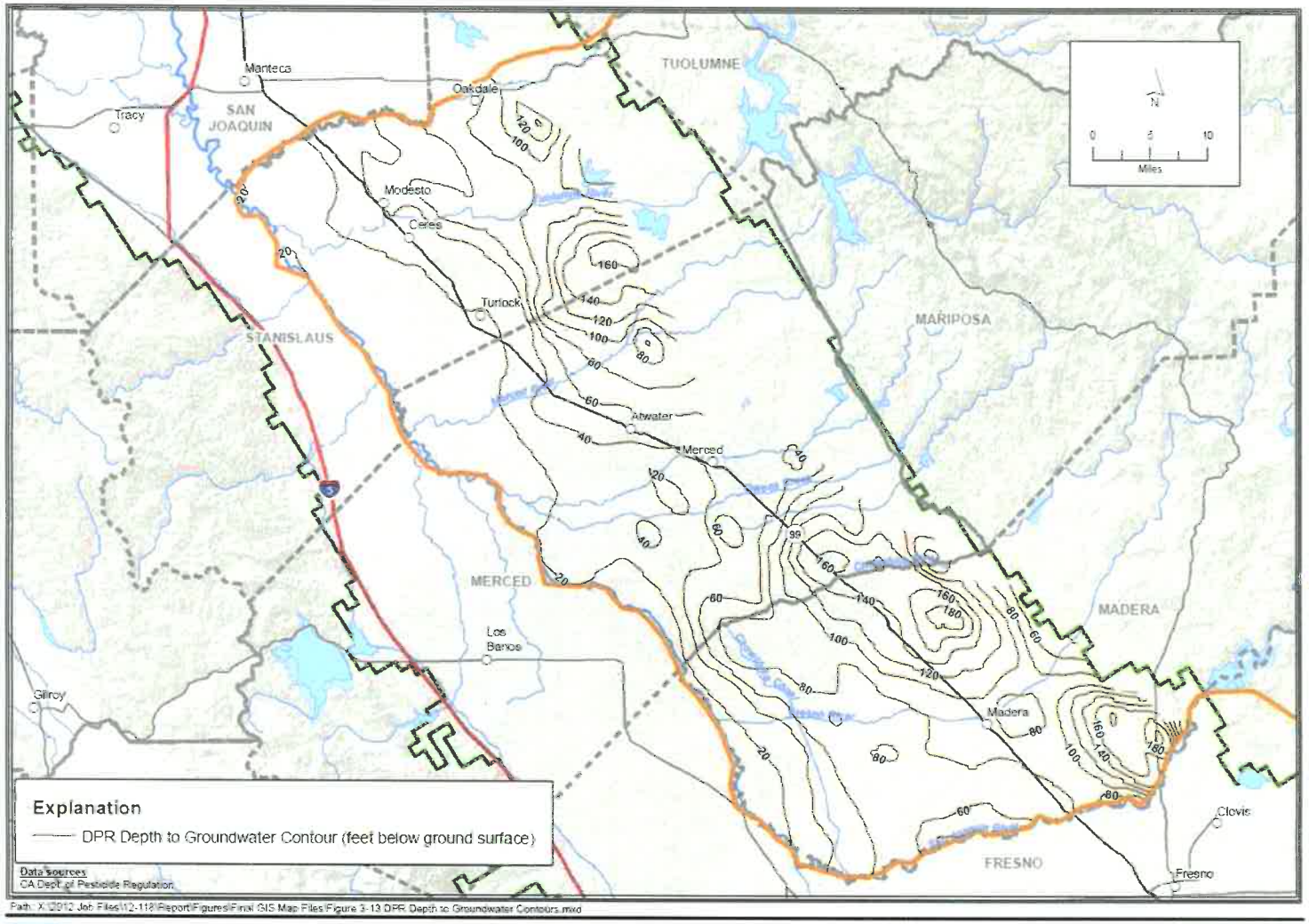
Figure 24. Fall depth to groundwater contours: Central Valley portion of the Coalition (Figure 3-12, GAR).



LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 3-12
Fall Depth to Groundwater Contours: Central Valley Floor

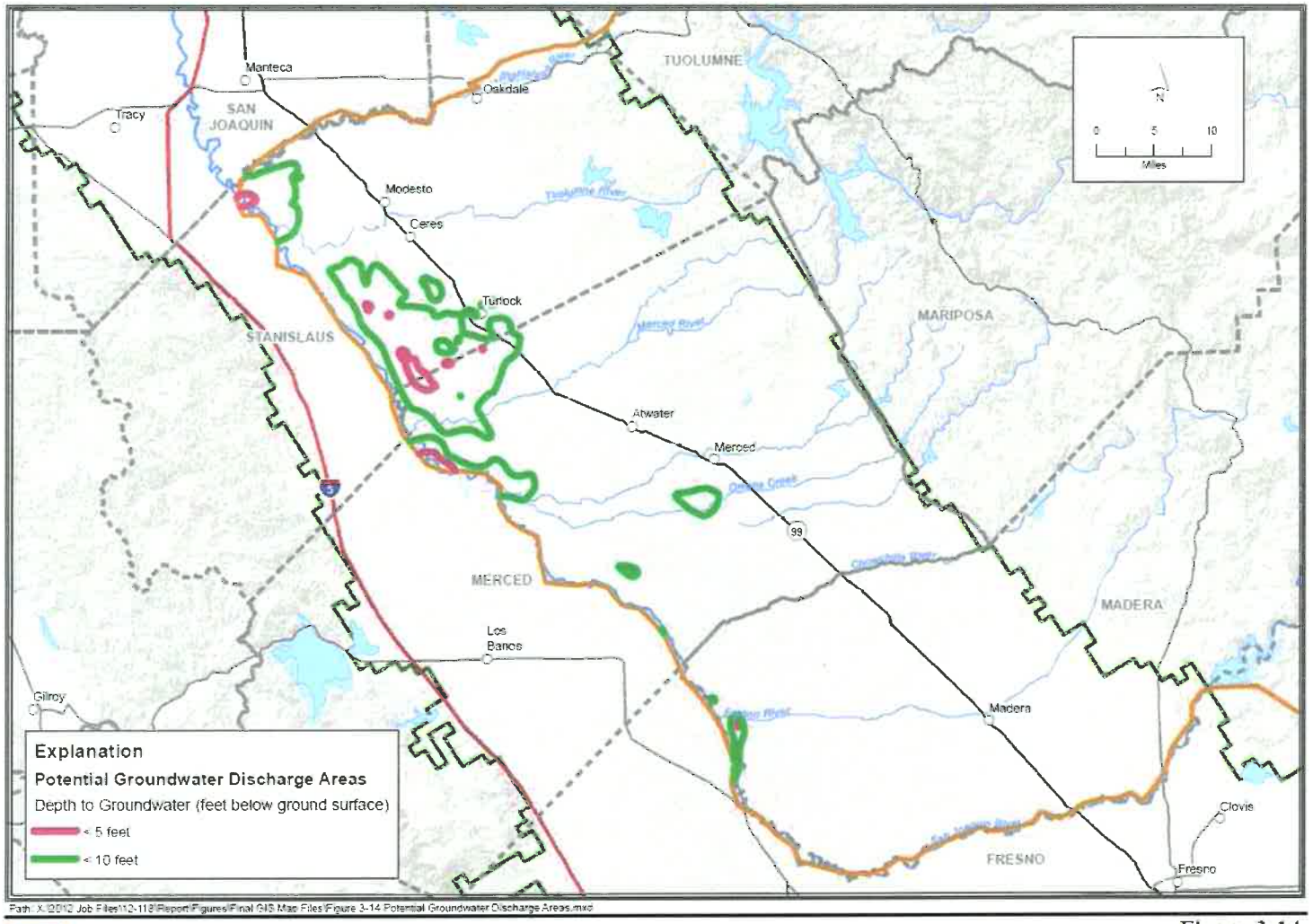
Figure 25. DWR depth to groundwater contours of the Central Valley portion of the Coalition (Figure 3-13, GAR).



LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 3-13
DPR Depth to Groundwater Contours

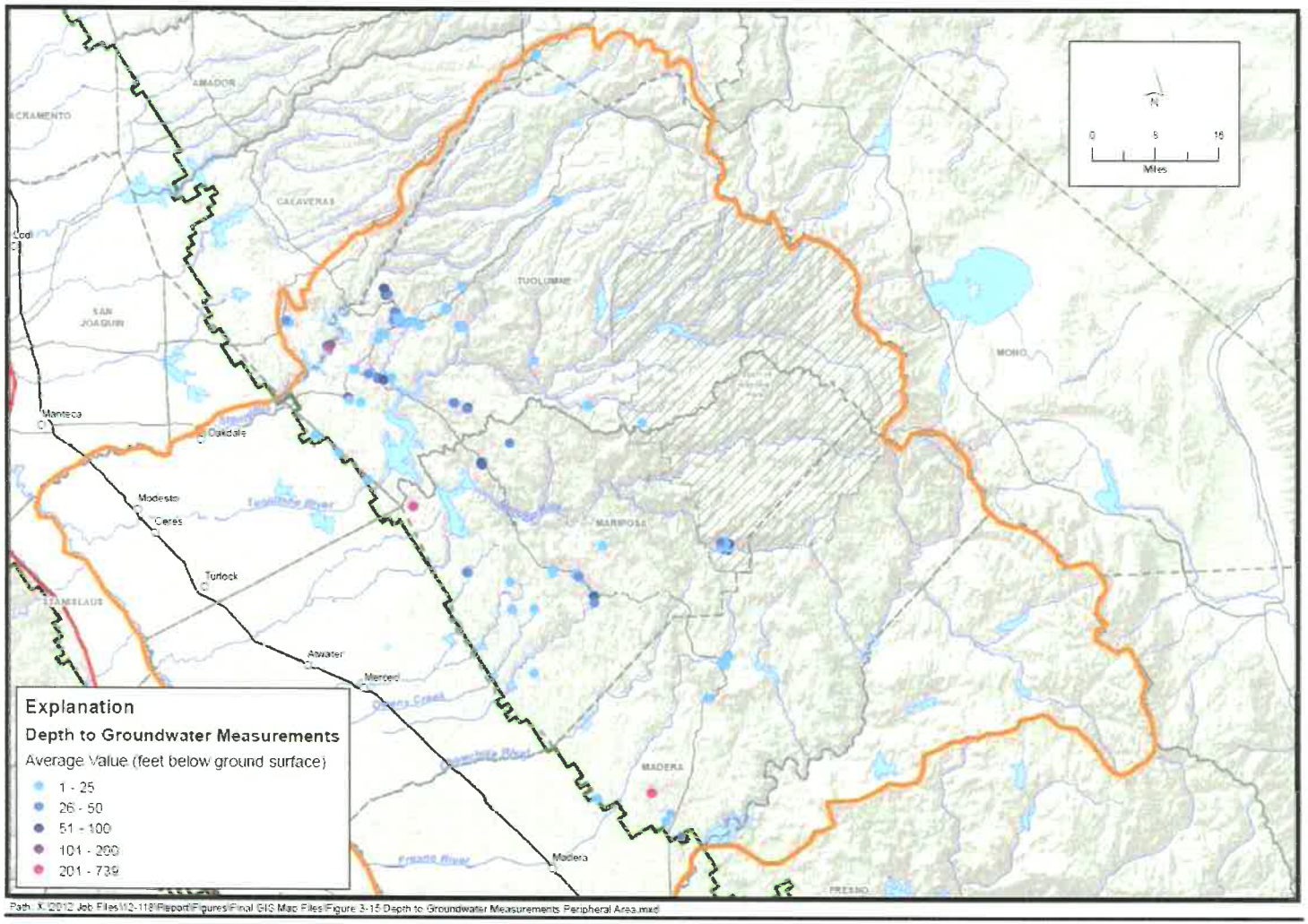
Figure 26. Potential groundwater discharge areas of the Central Valley portion of the Coalition (Figure 3-14, GAR).



LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 3-14
Potential Groundwater Discharge Areas

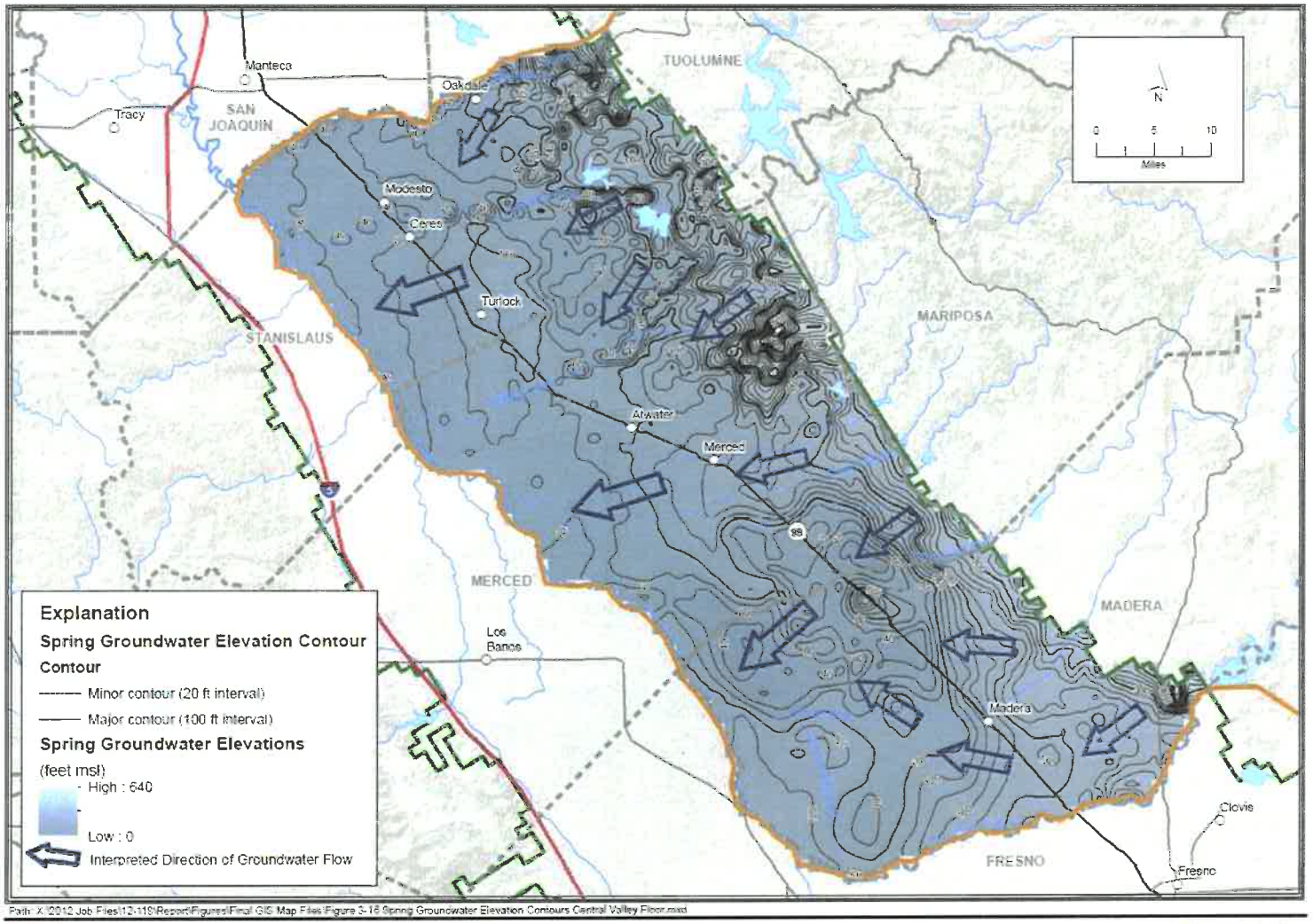
Figure 27. Depth to groundwater measurements: Peripheral portion of the Coalition (Figure 3-15, GAR).



LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 3-15
Depth to Groundwater Measurements: Peripheral Area

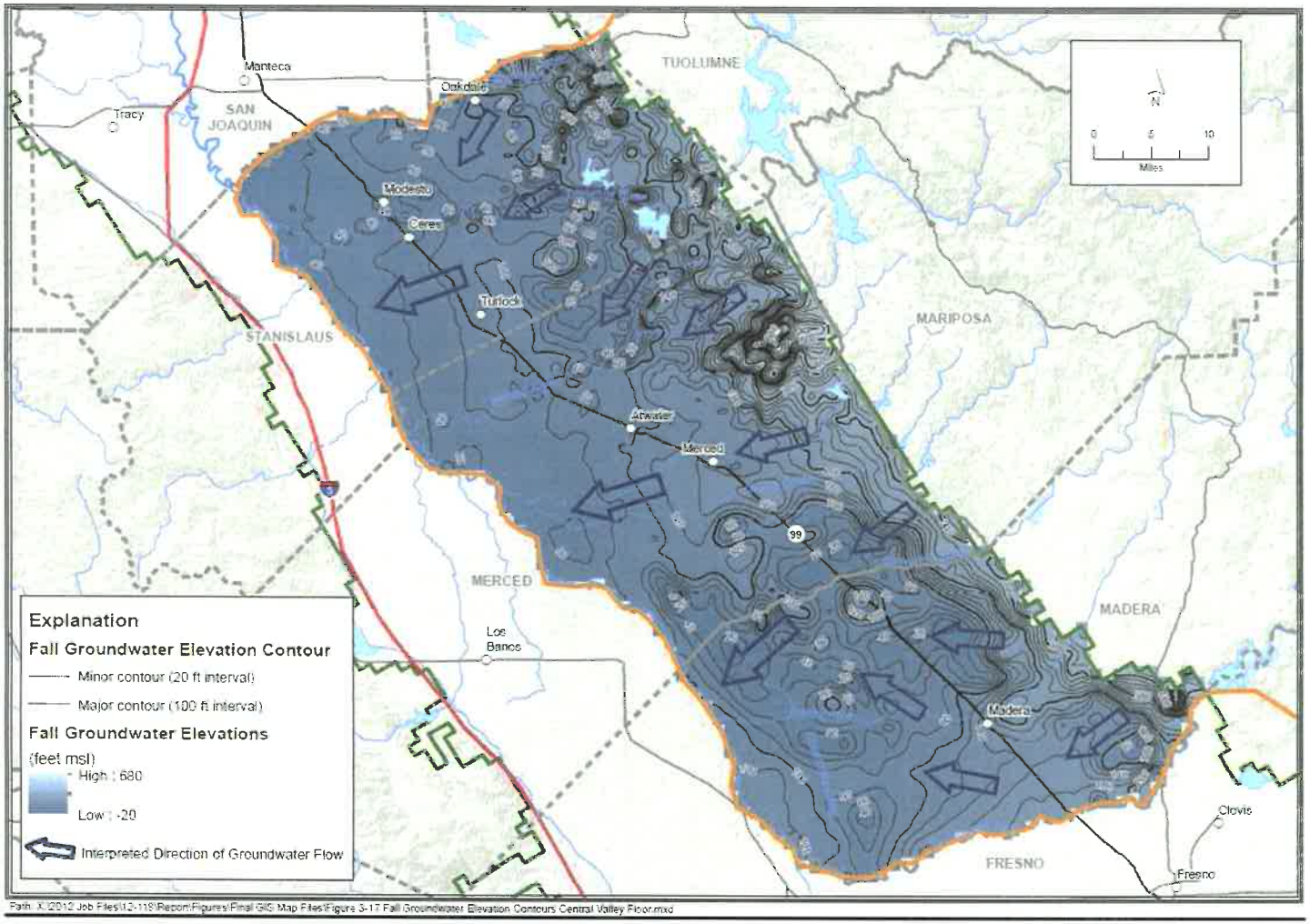
Figure 28. Spring groundwater elevation contours: Central Valley portion of the Coalition (Figure 3-16, GAR).



LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 3-16
Spring Groundwater Elevation Contours: Central Valley Floor

Figure 29. Fall groundwater elevation contours: Central Valley portion of the Coalition (Figure 3-16, GAR).



LUHDORFF & SCALMANINI CONSULTING ENGINEERS

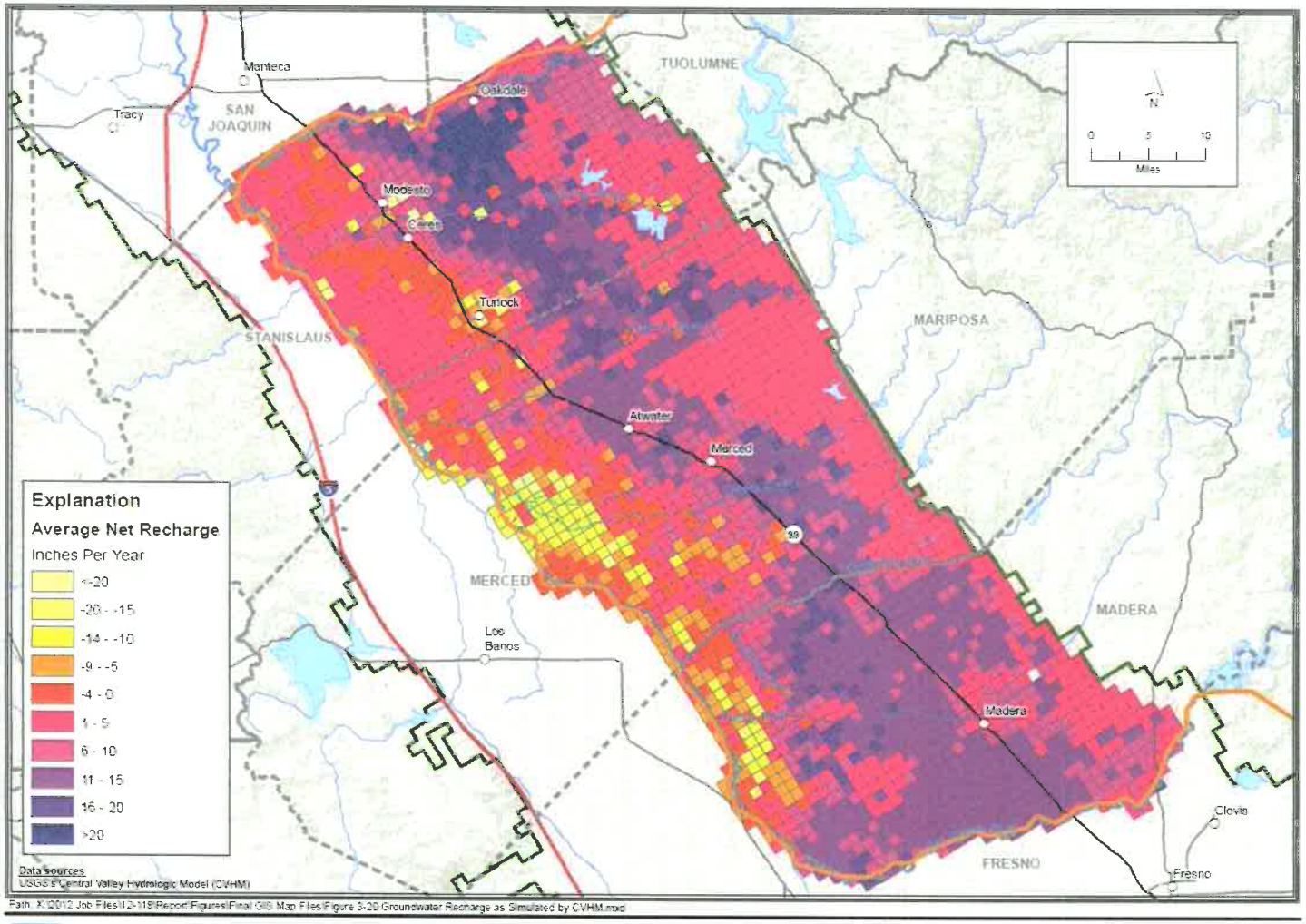
Figure 3-17
Fall Groundwater Elevation Contours: Central Valley Floor

The primary process for groundwater recharge within the Central Valley Floor area is from percolation of applied irrigation water. Groundwater recharge estimates made by DWR (2003) for each of the five main groundwater subbasins within the Coalition region indicate that natural groundwater recharge represents a relatively small fraction of total recharge when compared with estimates of recharge from applied water. Annual natural recharge estimates made by DWR for the five main groundwater subbasins within the Coalition region total 274,000 acre-feet (af) (Modesto: 86,000 af, Turlock: 33,000 af, Merced: 47,000 af, Chowchilla: 87,000 af, Madera: 21,000 af). In contrast, estimates of average annual recharge from applied water for these subbasins totals 1,231,000 af (Modesto: 92,000 af, Turlock: 313,000 af, Merced: 243,000 af, Chowchilla: 179,000 af, Madera: 404,000 af).

The modeled net recharge within the Central Valley Floor area from the CVHM output is shown in Figure 30 (Figure 3-20, GAR). This map depicts model-simulated annual net recharge in units of inches at a one square mile grid scale with values ranging from below negative 20 inches per year to greater than 20 inches per year. The areas of highest net recharge correspond with areas of high vertical hydraulic conductivity in CVHM model layers (as shown for CVHM Layer 1 on Figure 14) and also areas where depth to groundwater is generally deeper (as shown in Figures 23 and 24). Conversely, negative net recharge values are generally in areas where groundwater is shallow resulting in greater evapotranspiration of water within the root zone and potential discharging of groundwater.

Areas with high potential for groundwater recharge within the Central Valley Floor area of the Coalition region are shown in Figure 31 (Figure 3-21, GAR). The areas of potential groundwater recharge are based on mapped areas of high soil hydraulic conductivity (harmonic mean of saturated soil vertical hydraulic conductivity >2 feet/day) which overlie mapped unconsolidated geologic units, mainly alluvium. High conductivity soils are shown in blue in Figure 31 and occur along many of the main tributary river channels and as the result of distributary channel and fan deposition. The areas where the greatest potential for groundwater recharge exists are areas where these high conductivity soils overlie unconsolidated alluvium which functions as the primary aquifer system in the area. Where the Corcoran Clay exists, groundwater recharge is more likely to be limited to shallow groundwater zones (Figure 31). As a result, the areas with potential for deep groundwater recharge are more likely to be located in the eastern part of the Central Valley Floor where the Corcoran Clay is not present.

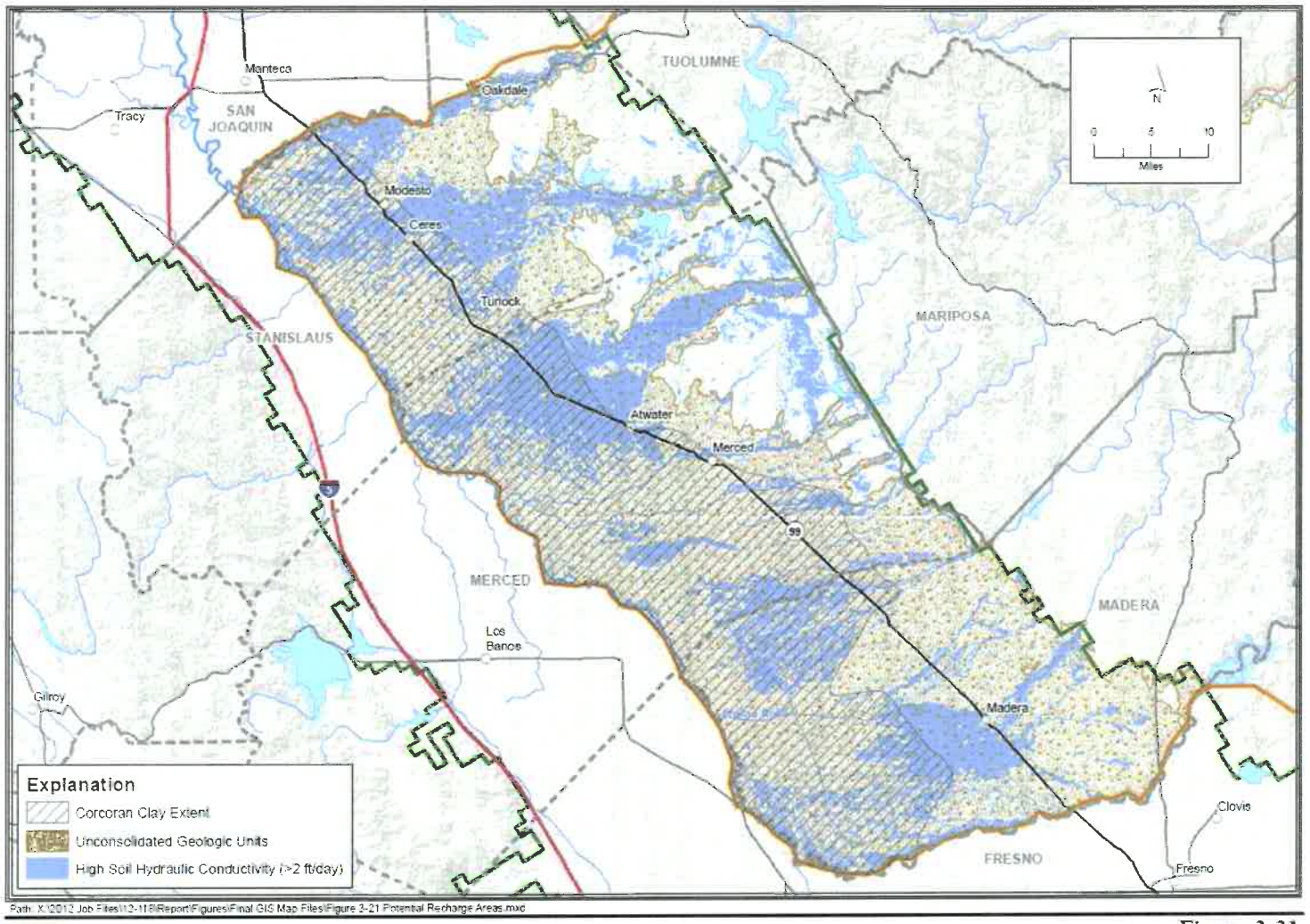
Figure 30. Groundwater recharge as simulated by the CVHM (Figure 3-20, GAR).



LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 3-20
Groundwater Recharge as Simulated by CVHM

Figure 31. Areas with higher potential for groundwater recharge (Figure 3-21, GAR).



LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 3-21
Areas with Higher Potential for Groundwater Recharge

The cation-anion balance of groundwater monitored in USGS' Central–Eastside San Joaquin Basin Study Unit is depicted in a Piper Diagram below (Figure 32). California Department of Public Health (CDPH) data used in the Piper diagram describes a charge imbalance of less than 10 percent. USGS' Central–Eastside San Joaquin Basin Study Unit is bounded by the San Joaquin River to the west, the Sierra Nevada Mountains to the east, the Stanislaus River to the north, and the Chowchilla groundwater subbasin to the south (USGS, *Status and Understanding of Groundwater Quality, Central–Eastside San Joaquin Basin, 2006: GAMA Priority Basin Project, Scientific Investigations Report 2009-5266*, page 5). For the purposes of the management units laid out in this GQMP, the USGS' Central–Eastside San Joaquin Basin Study Unit includes most of the Modesto GQMP Zone (excluding the northern most sliver along the Stanislaus River), part of the Eastern San Joaquin subbasin, and the entire Turlock and Merced GQMP Zones (Figure 33).

The Merced Area Groundwater Pool Interests (MAGPI) published a map of groundwater types (cation/anion) within the Merced groundwater subbasin in the Merced Groundwater Basin Groundwater Management Plan Update Merced County, CA, 2008 (Figure 34). "Groundwater with high concentrations of total dissolved solids is present beneath the entire Merced groundwater basin at depths from about 400 feet in the west to over 800 feet in the west. The shallowest high Total Dissolved Solids (TDS) groundwater occurs in zones five to six miles wide adjacent and parallel to the San Joaquin River and the lower part of the Merced River west of Hilmar, where high TDS groundwater is upwelling. The chemistry of groundwater in the Merced groundwater basin indicates that mixing is occurring between the shallow fresh groundwater and the brines, which produces the high TDS groundwater observed" (Merced Groundwater Basin Groundwater Management Plan Update Merced County, CA, 2008, page 15).

The cation-anion balance of groundwater monitored in USGS' Madera- Chowchilla Study Unit is depicted in a Piper Diagram below (Figure 35). USGS' Madera- Chowchilla Study Unit is bounded partially on the north by the Chowchilla River, approximately on the west and south by the San Joaquin River, and on the east by foothills of the Sierra Nevada (USGS, Status and Understanding of Groundwater Quality in the Madera-Chowchilla Study Unit, 2008: California GAMA Priority Basin Project, *Scientific Investigations Report 2012–5094*, page 5). For the purposes of the monitoring units laid out in this GQMP, the USGS' Madera- Chowchilla Study Unit includes the entire Chowchilla groundwater monitoring zone and most of the Madera groundwater monitoring zone, only excluding the eastern sliver of the Delta-Mendota subbasin as it follows the San Joaquin.

Madera County overlies most of the Madera subbasin and parts of the Chowchilla and Delta-Mendota subbasins. Madera County published a Stiff diagram in Figure 2-12 of their AB3030 Groundwater Management Plan Madera County Final Draft produced in January 2002 (Madera County, 2002). The Stiff diagram is reproduced in Figure 36. The Stiff diagram is a geochemical plot which allows for a visual comparison between water quality types based on concentrations of specific cations and anions in the water. The Madera County Stiff diagram indicates that the East and Central Basin are shallow with smaller concentrations of TDS. The Eastern Basin is considered deep with higher TDS concentrations and the presence of detectable metals and the Western Basin is shallow with a wide diagram dominated by sodium and chloride. According to the

Madera County Groundwater Management Plan, "the geochemical plot graphically illustrates the changes in water quality with depth and in particular the poorer water quality in the west" (Madera County, 2002).

Figure 32. Piper diagram of ion balance for USGS grid and understanding wells and all wells in the CDPH database that have a charge imbalance of less than 10 percent, Central Eastside, California, USGS study unit.

USGS, Status and Understanding of Groundwater Quality, Central–Eastside San Joaquin Basin, 2006: GAMA Priority Basin Project, Scientific Investigations Report 2009-5266, Figure B2, page 96.

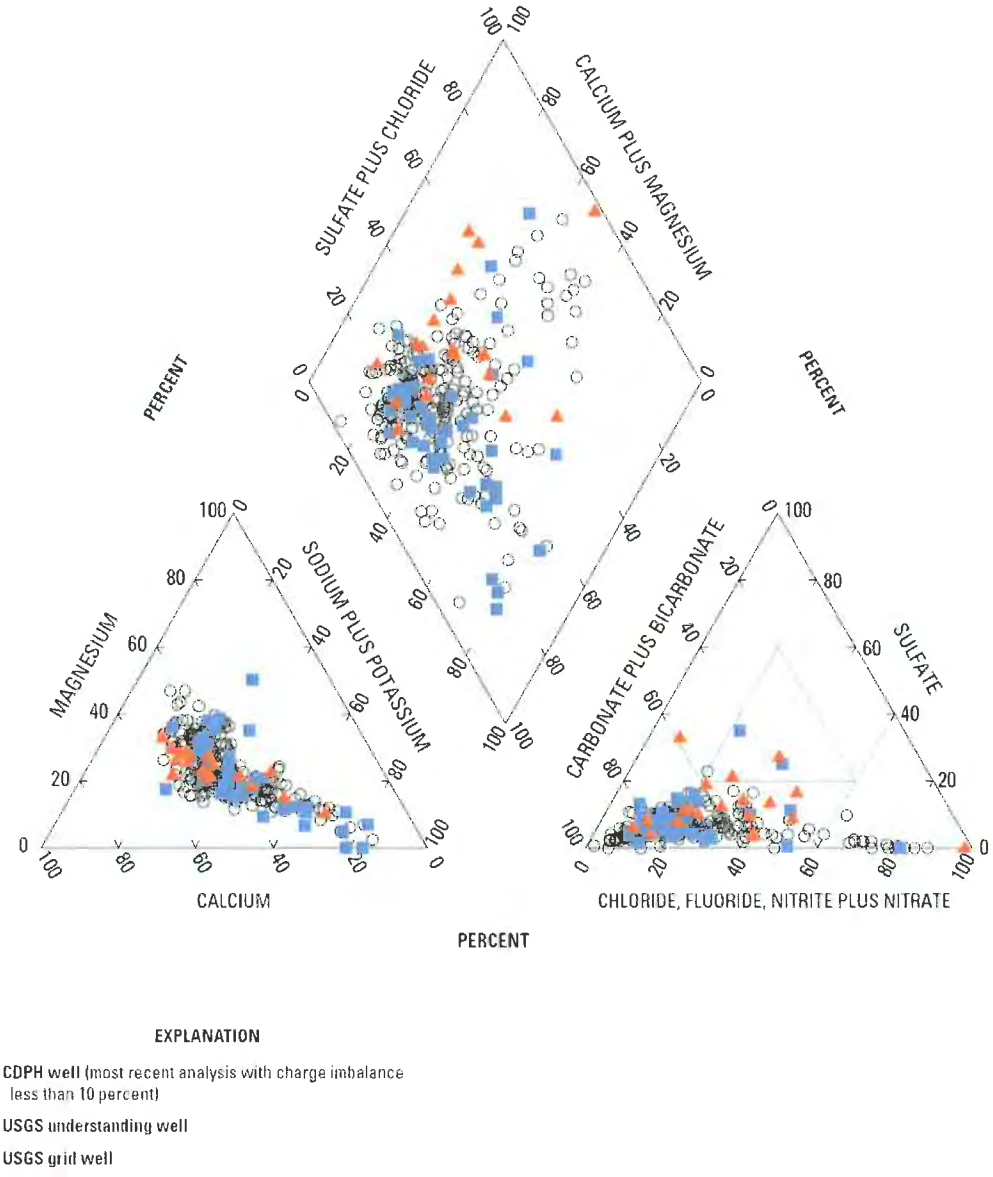


Figure 33. USGS' Central–Eastside San Joaquin Basin Study Unit.

USGS, Status and Understanding of Groundwater Quality, Central–Eastside San Joaquin Basin, 2006: GAMA Priority Basin Project, Scientific Investigations Report 2009-5266, page 5.

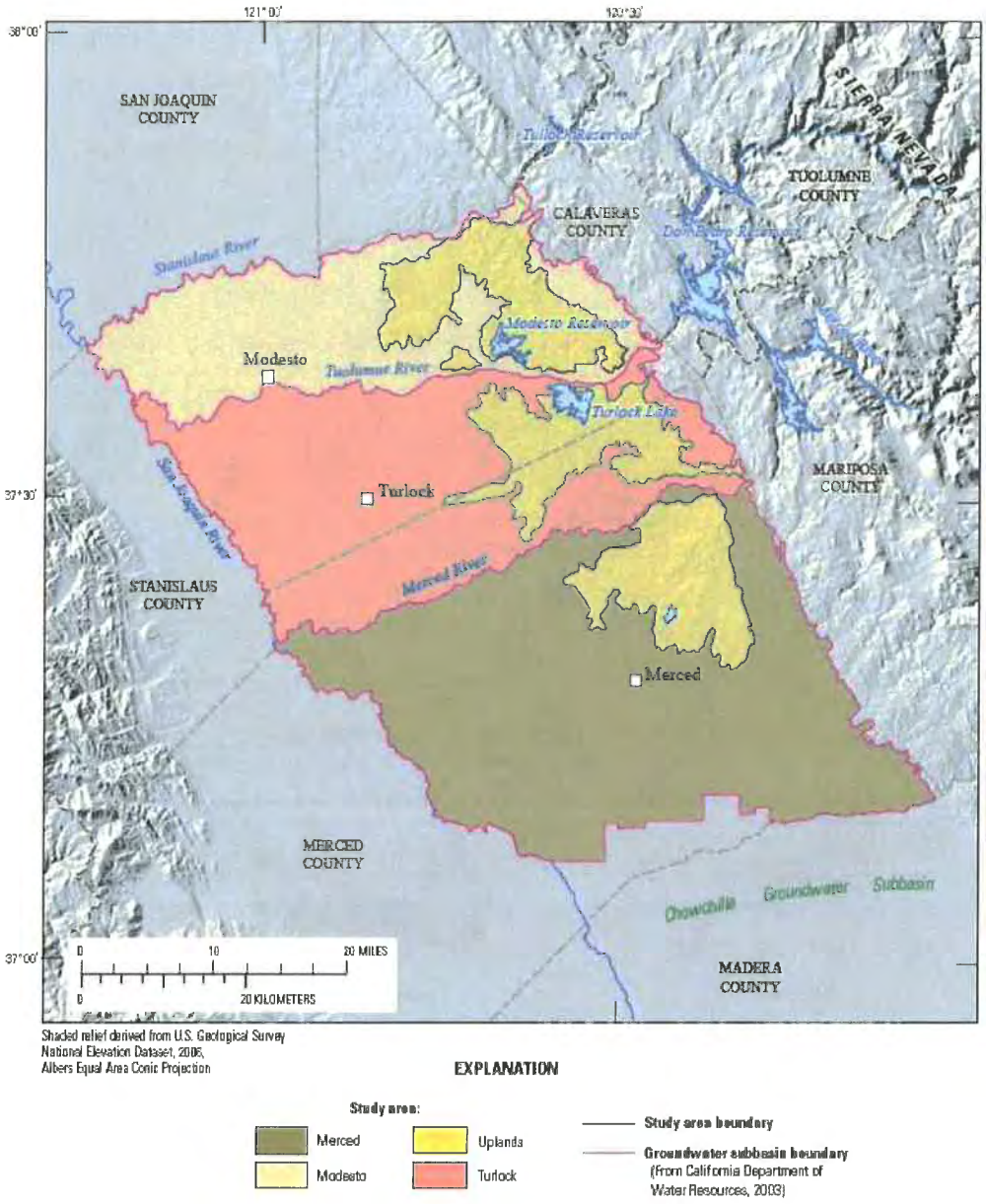


Figure 2. Geographic features of the Central Eastside, California, Groundwater Ambient Monitoring and Assessment (GAMA) study unit.

Figure 34. Distribution of groundwater types within the Merced groundwater basin (Geomatrix, Merced Groundwater Basin Groundwater Management Plan Update Merced County, CA, Figure 19, 2008).

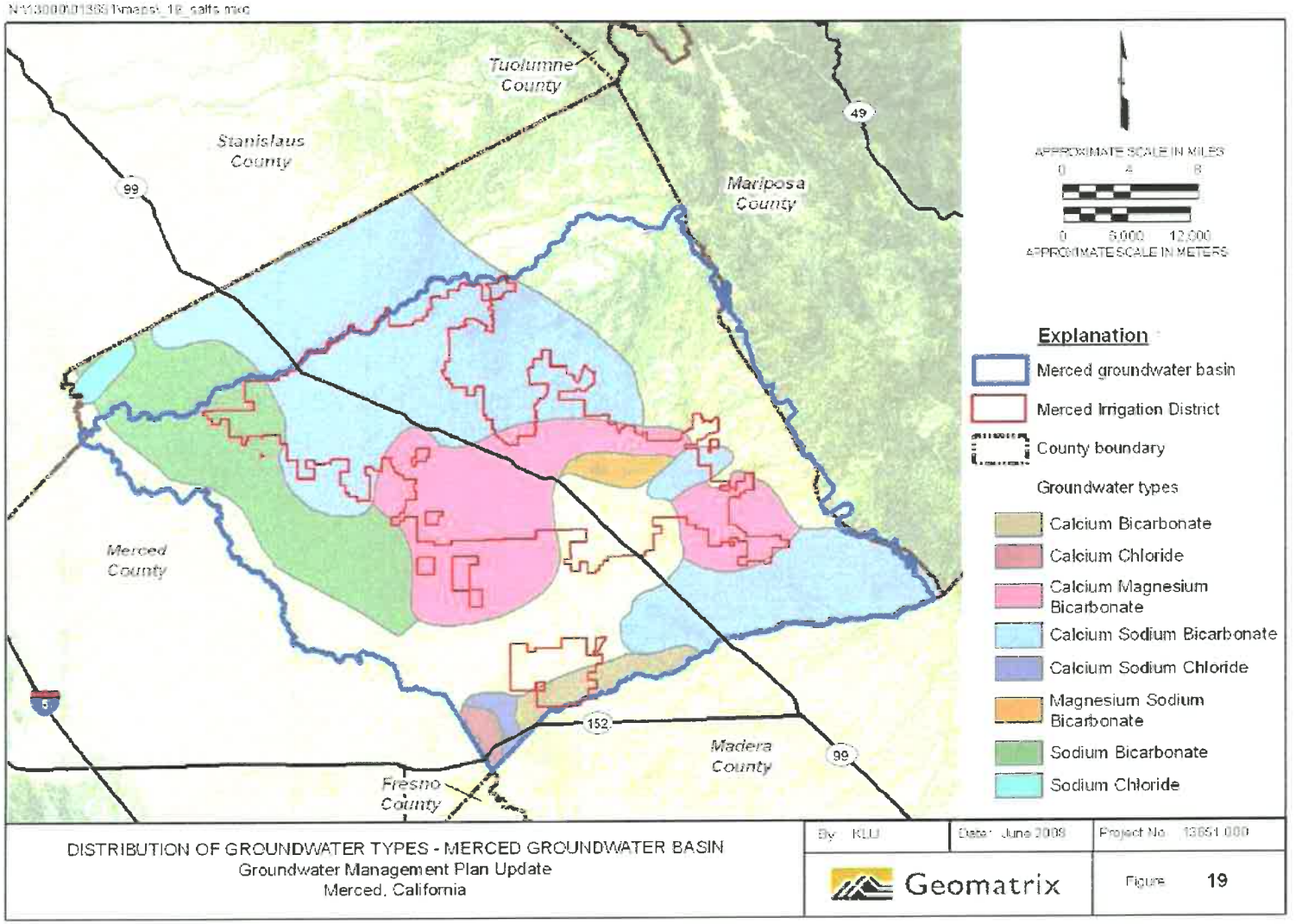


Figure 35. Reproduced piper diagram for the Madera-Chowchilla study unit (USGS 2008). Well data are from the CDPH database using data from February 12, 2005 – February 12, 2008.

USGS, Status and Understanding of Groundwater Quality in the Madera- Chowchilla Study Unit, 2008: California GAMA Priority Basin Project, Scientific Investigations Report 2012–5094, Figure B2, Appendix B, page 83.

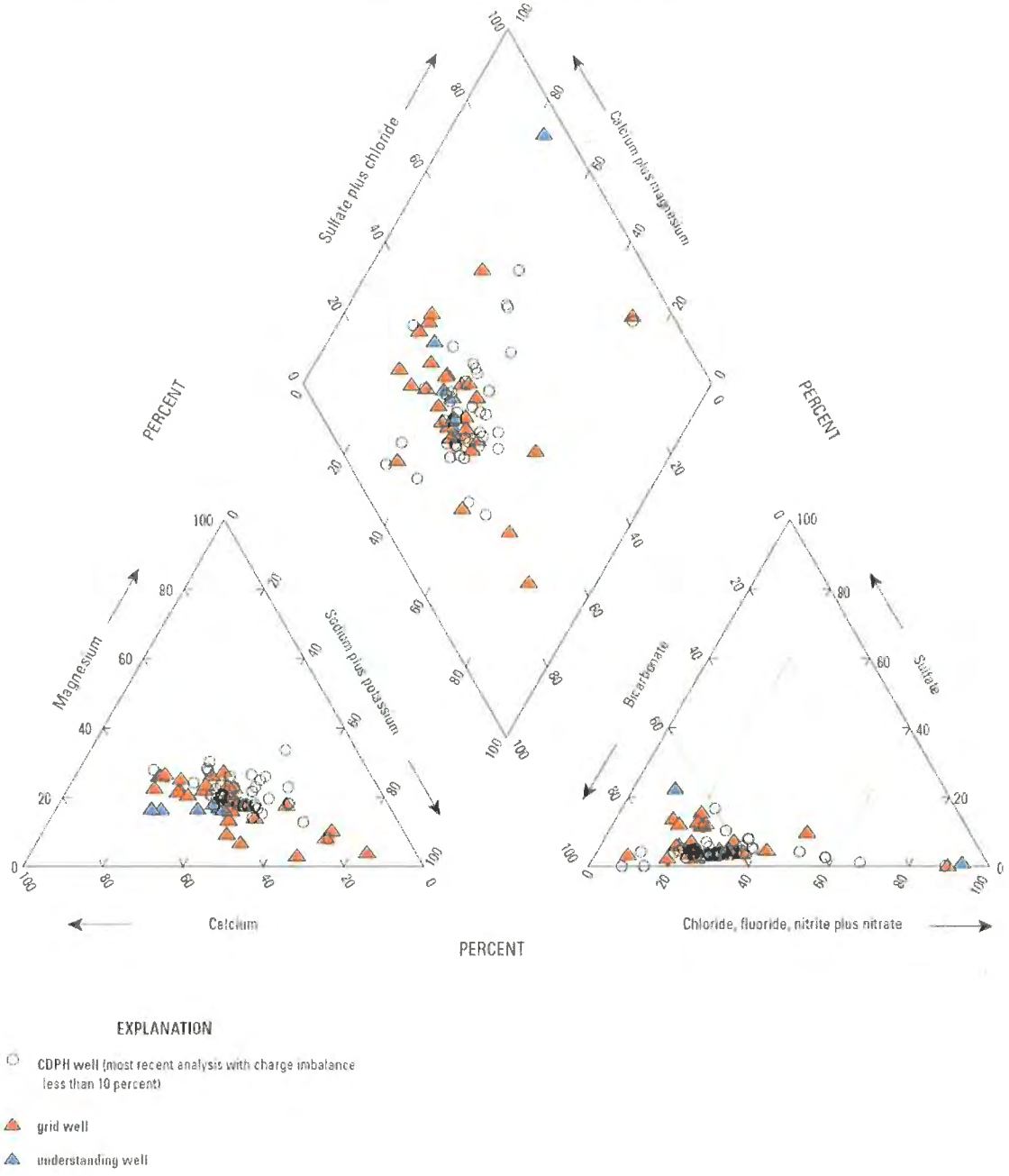
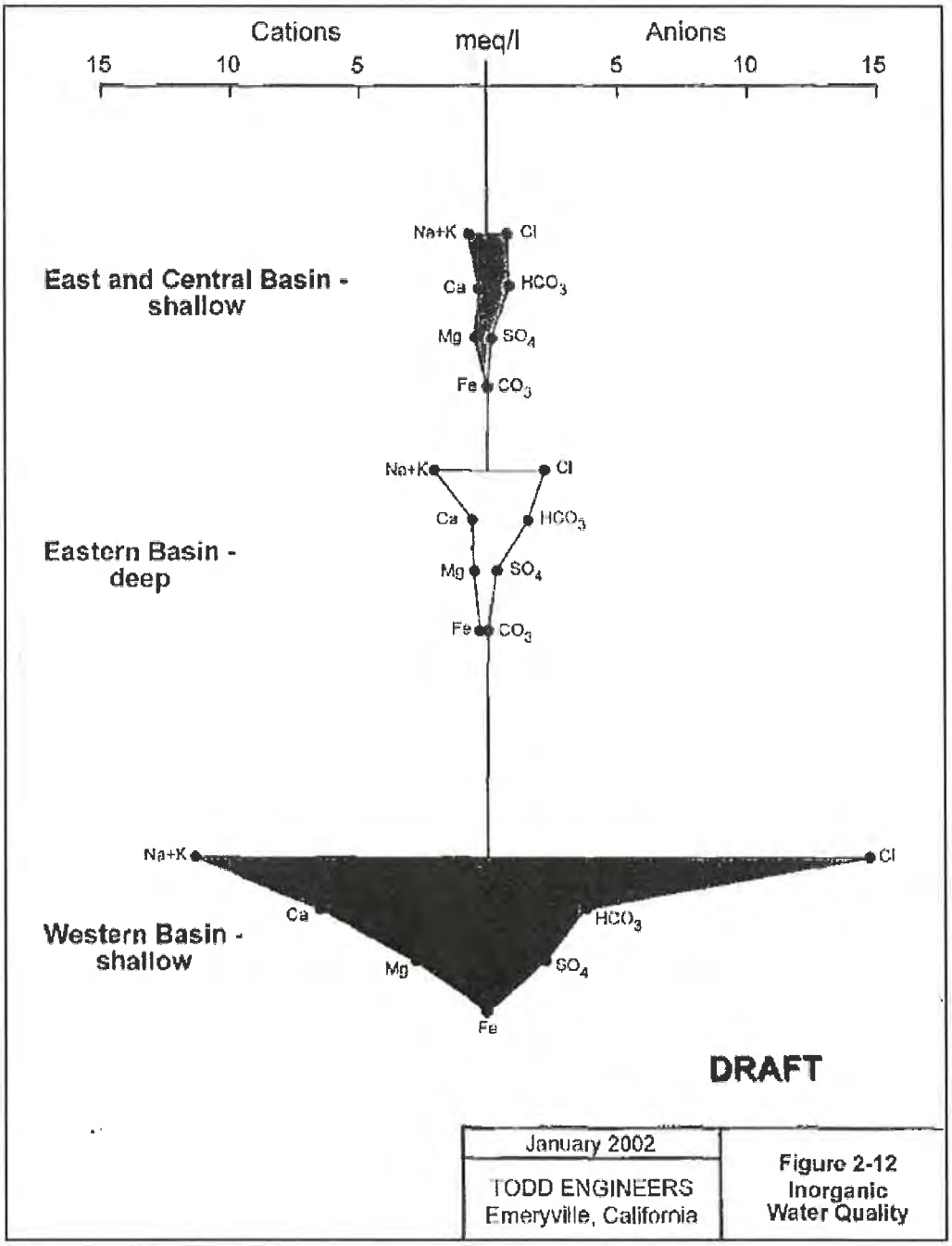


Figure 36. Stiff Diagram representing geochemical properties of both deep and shallow groundwater aquifers within Madera County (AB3030 Groundwater Management Plan, Madera County, 2002).



Irrigated agriculture is the predominant land use in the Coalition area although the growing urban areas in the Central Valley are also a significant land use. Other non-irrigated land uses include dairies with some acreage in feedlots. Land use analyses in the GAR reported the temporal change of crop and land use in the area using DWR land used data, from the mid-1990s to the early 2000s, and the United States Department of Agriculture (USDA) cropland data from 2012, to present the most recent data available. Based on the DWR land use data up until the early 2000s, the largest agricultural crop was nut trees. Based on the USDA data from 2012, the top agricultural crop categories within the GQMP area of the Coalition are almonds, alfalfa, winter wheat, grapes, and corn totaling over 75% of cropland according to the 2012 USDA data, when including values for double crops with corn (Table 7).

Table 7. Land use acreage within the entire GQMP area.

Land use information obtained from data provided by USDA, 2012 California Cropland Data Layer; http://www.nass.usda.gov/research/Cropland/SARS1a.htm. Land use in some areas of the ESJWQC may have changed since that time.

CROP TYPE	ACREAGE	PERCENT ACREAGE OF TOTAL GQMP*
Almonds	344690	36.18%
Alfalfa	120899	12.69%
Grapes	118449	12.43%
Winter Wheat	47705	5.01%
Double Crop Oats/Corn	42882	4.50%
Oats	42037	4.41%
Other Hay/Non Alfalfa	39727	4.17%
Fallow/Idle Cropland	30244	3.17%
Pistachios	28387	2.98%
Double Crop Winter Wheat/Corn	24990	2.62%
Corn	21796	2.29%
Walnuts	21168	2.22%
Cotton	16024	1.68%
Tomatoes	12245	1.29%
Sweet Potatoes	11506	1.21%
Grand Total for Agricultural Crops	922747	96.85%

*Percent of cropped area includes all agricultural fields, whether fallow or active. Land use categories such as barren, developed, and native or wetland vegetation were not included in acreage totals. Crops contributing 1% or more of the overall land use within the GQMP area were included.

Irrigated Land

Although exact acreage is difficult to estimate due to rapidly changing land use, the Coalition area contains approximately 5,743,147 acres. The acreage within the GQMP area is approximately 1,711,555 with a total irrigated acreage of 983,470 acres (57%), as provided by DWR (Table 8). To obtain irrigated acreages, the Coalition uses information from two DWR data sources: 1) DWR Agricultural Land and Water Use data, and 2) DWR Land Use Survey (Figure 37).

Agricultural Land and Water Use data (DWR, http://www.water.ca.gov/landwateruse/anaglwu.cfm) estimates the acreage of irrigated crops for the entirety of each county. Land Use Survey data (http://www.water.ca.gov/landwateruse/lusrvymain.cfm) includes more detailed information regarding specific crop uses (both irrigated and non-irrigated) than the Agricultural Land and Water Use data but is updated less often. Because Land Use Survey data are available in Geographic Information System (GIS) shape files, the information was mapped to the Coalition area and used for estimates of irrigated crop acreage. The data source used depends on: 1) whether or not the entire county is within the Coalition boundary, and 2) which data were developed most recently.

For San Joaquin, Stanislaus, Merced, Madera, Fresno, Alpine and Calaveras Counties, the Coalition utilized DWR Land Use Survey data to determine irrigated land area as only portions of these counties are included in the Coalition boundary or the data were more current. For Tuolumne and Mariposa Counties, data from Agricultural Land and Water Use were used since these counties are included in their entirety within the Coalition boundary. Although the entire county of Madera is represented by the Coalition, the DWR Land Use Survey is more current. For calculations of total acreage, measurements were made using ArcGIS.

As described in the GAR Addendum, the top acreage crops within the Coalition are almonds (362,302 acres), grapes (136,409 acres), and corn (94,095 acres). The GAR analysis of crop type for the ESJHVA prioritization is based on USDA 2012 cropland data (Table 7). The USDA data does not indicate if the land use is irrigated or not and therefore the DWR land use data (which includes irrigated vs. non-irrigated data) is evaluated in Table 9. DWR data was used for the purposes of the GQMP analysis because of the availability of irrigated versus non-irrigated land use information. There are over 200 land use categories assigned to DWR data, therefore, land use groupings were assigned based on generalized crop categories and urban versus agricultural land use. The DWR data reflect a similar pattern as the USDA data, with deciduous nut and fruit (including almond), field crop (including corn), and vineyard (including all grapes) as the top three agricultural categories. Based on DWR data, the top irrigated crops within the ESJHVA Priority 1 Areas are deciduous nut and fruit and field crops as the two largest irrigated crops, followed by truck, nursery, berry crops third. Agricultural water use met by groundwater for various counties in the GQMP area is listed in Table 10. Thousand acre foot (TAF) values are given by county and therefore are presented simply as an approximate reference to percentage of irrigation needs that are met by groundwater within any given Zone. GQMP Zones may or may not be included entirely within any given county. Table 3 lists the Zones in reference to the underlying subbasins and associated counties.

Table 8. Approximate total acreages of GQMP Zones for the Coalition area.

GQMP Zones	Total Acres[1] (from ArcGIS)
Modesto	273,477
Turlock	362,267
Merced	499,225
Chowchilla	160,963
Madera	415,623
Total	**1,711,555**

[1]Total zone acreages calculated using ArcGIS.

Table 9. ESJWQC land use acreage[1] of ESJHVA Priority 1-3 areas across the GQMP area.
Land uses designated as irrigated/non-irrigated (I/NI); numbers are rounded to nearest whole number.

LAND USE	I/NI	PRIORITY 1	PRIORITY 2	PRIORITY 3	NOT IN ESJHVA	TOTAL
Citrus	I	37	216	877	6,220	7,350
Citrus	NI	3	1	11	29	44
Deciduous nut and fruit	I	16,011	75,771	103,749	150,527	346,058
Deciduous nut and fruit	NI	7	-	-	95	102
Field crop	I	5,614	60,613	86,825	79,404	232,456
Field crop	NI	-	-	4	449	454
Grain and hay	I	1,105	5,597	12,774	16,741	36,218
Grain and hay	NI	100	682	2,695	12,938	16,414
Idle	I	247	1,646	4,414	6122	12,428
Idle	NI	-	-	154	495	648
Riparian Vegetation	NI	44	524	6,338	6219	13,124
Wild vegetation	NI	747	8,084	70,056	303,6925	3,115,811
Water surface	NI	225	1,612	6,091	61,601	69,529
Pasture	I	1,529	18,160	90,504	89,992	200,185
Pasture	NI	47	238	1,945	6,080	8,310
Rice	I	211	2,293	724	2,227	5,455
Feedlot, dairy, farmstead	NI	1,017	9,079	15,910	11,629	37,635
Truck, nursery, berry	I	1,758	9,162	10,185	18,172	39,277
Urban Landscape[1]	I/NI	155	3,651	4,723	5,339	13,867
Vineyard	I	932	7,666	54,865	67,656	131,118

[1] Land use data obtained from data provided by DWR, http://www.water.ca.gov/landwateruse/anaglwu.cfm. Data compiled in 2001, land use in some areas of the ESJWQC may have changed since that time.

[1]Urban Landscape irrigation versus non-irrigation data from DWR Land Use by county included irrigated labeled data within its non-irrigated category. Therefore, the values within the urban landscape category were assumed to be all "irrigated."

Table 10. San Joaquin River Hydrologic Region (and Tulare Lake Hydrologic Region [Fresno County]) Average Annual Groundwater Supply by County and by Type of Use (2005-2010).[1]

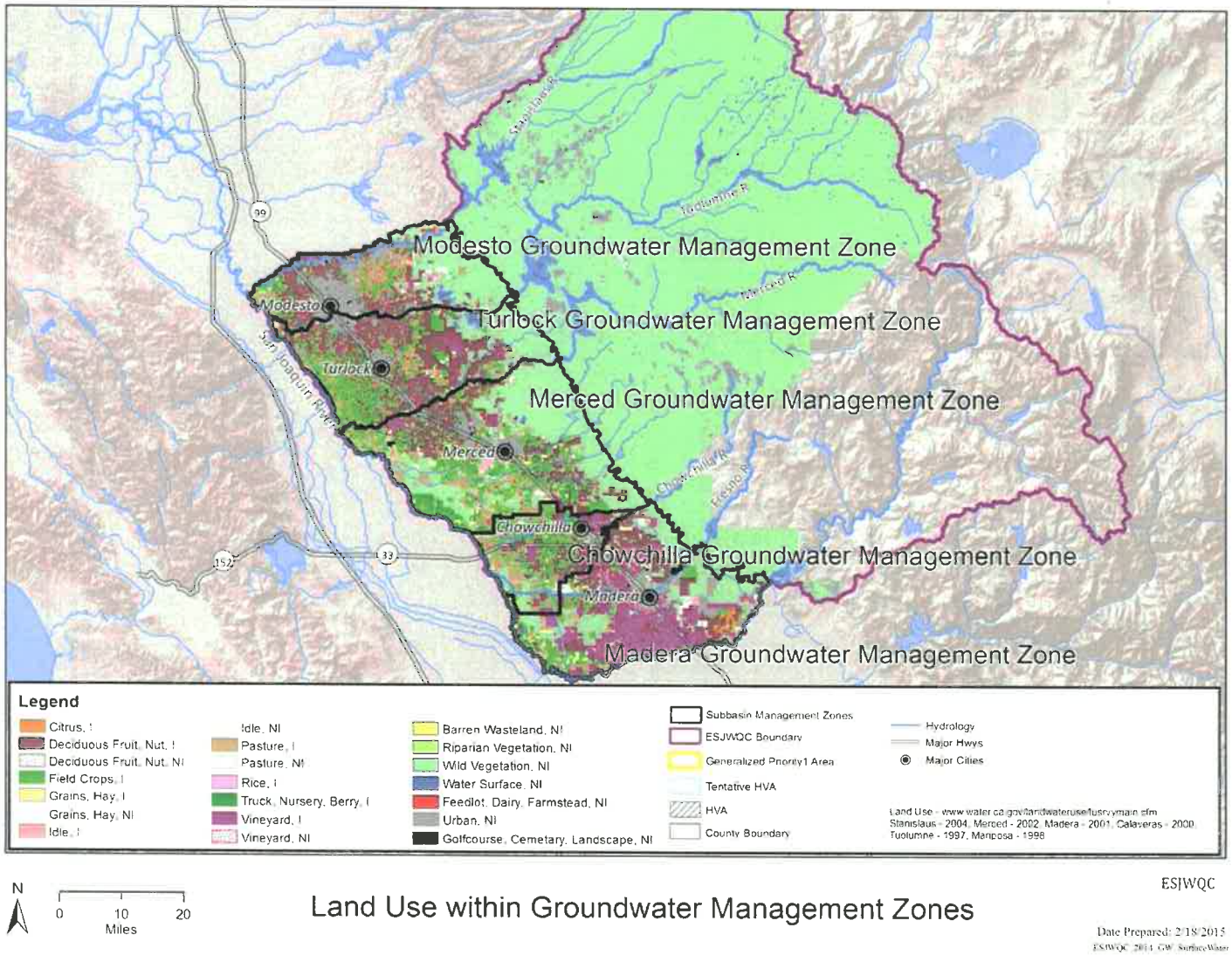
County	Water Use Type Met by Groundwater							
	Agriculture		Urban		Managed Wetlands		Total Water	
	TAF	%	TAF	%	TAF	%	TAF	%
Amador	3.0	20%	1.8	17%	0.0	0%	4.8	19%
Calaveras	1.3	16%	1.6	13%	0.0	0%	2.8	14%
Contra Costa	0.8	1%	25.0	9%	0.0	0%	25.8	6%
Fresno[2]	1,705.2	46%	272.4	80%	1.1	4%	1,978.6	48%
Madera[2]	673.1	66%	40.7	100%	0.0	0%	713.7	68%
Mariposa	3.1	0%	4.6	1%	0.0	0%	7.7	0%
Merced[2]	764.6	38%	84.6	97%	189.2	40%	1,038.3	40%
San Joaquin[2]	354.1	22%	79.9	42%	0.0	0%	434.0	24%
Stanislaus[2]	512.4	30%	162.8	85%	1.4	13%	676.6	36%
Tuolumne	0.4	7%	1.3	10%	0.0	0%	1.7	9%
2005-2010 Annual Average Total	**2,312.8**	**36%**	**402.1**	**48%**	**190.6**	**39%**	**2,905.5**	**37%**

[1] Table contents from DWR's Draft Water Plan, 2013 (Tables SJR-17 and Table TL-19)

[2] Counties in the GQMP area (partial or entire county)

Percent (%) use is the percentage of the total water supply (for the county) that is met by groundwater, by type of use.

Figure 37. Land use by GQMP Zone within the Coalition based on DWR data.



EXISTING AGRICULTURAL MANAGEMENT PRACTICES

Since 2007 the Coalition has surveyed its member grower/operators regarding their management practices. From 2008 to 2013 surveys were sent to landowners who were identified as having fields directly adjacent to or near any waterbody in a surface water management plan; the Coalition developed an inventory of surface water management practices of growers from these surveys including an assessment of irrigation management, pesticide application management and sediment management. Detailed results of the 2007 surveys can be found in the December 31, 2007 Semi Annual Monitoring Report. An inventory of management practices of growers with direct discharge to a management plan waterbody can be found in the Management Plan Update Reports submitted by the Coalition for each year between 2008 and 2013.

Starting in 2014, the Coalition has obtained additional management practice information from members within high vulnerability areas (surface or groundwater) based on the Farm Evaluation Plan surveys.

Farm Evaluations Plans are designed to collect the following information from each grower:

1. Crops grown and acreage of each crop,
2. Location of the member's farm,
3. Identification of on-farm management practices implemented to achieve the WDR farm management performance standards,
4. Potential for erosion during storm events and/or during irrigation (sediment and erosion risk areas) and a description of where within the property this occurs,
5. Identification of whether water leaves the property and is conveyed downstream and a description of where within the property this occurs,
6. Location of active wells and abandoned wells, and
7. Identification of whether wellhead protection and installation of backflow prevention devices have been implemented.

The Coalition includes an assessment of member management practices from the previous year in its Annual Report (submitted May 1 of each year). Table 11 and Figures 38-42 summarize the management practices implemented by members in 2013 to protect surface and groundwater quality.

Table 11. ESJWQC member management practices implemented in 2013; listed by Management Practice Category.

Management Practice Category		Management Practices
Irrigation Management Practices	Irrigation Efficiency Practices	Laser Leveling
		Pressure Bomb
		Soil Moisture Neutron Probe
		Use of ET in scheduling irrigations
		Use of moisture probe
		Water application scheduled to need
	Primary (and/or secondary) Irrigation Practices	Border Strip
		Drip

Management Practice Category		Management Practices
		Flood
		Furrow
		Sprinkler
		Micro Sprinkler
Sediment Management Practices	Cultural Practices to Manage Sediment and Erosion	Berms are constructed at low ends of fields to capture runoff and trap sediment.
		Cover crops or native vegetation are used to reduce erosion.
		Creek banks and stream banks have been stabilized.
		Crop rows are graded, directed and at a length that will optimize the use of rain and irrigation water.
		Field is lower than surrounding terrain.
		Hedgerows or trees are used to help stabilize soils and trap sediment movement.
		Minimum tillage incorporated to minimize erosion.
		Sediment basins / holding ponds are used to settle out sediment and hydrophobic pesticides such as pyrethroids from irrigation and storm runoff.
		Soil water penetration has been increased through the use of amendments, deep ripping and/or aeration.
		Storm water is captured using field borders.
		Subsurface pipelines are used to channel runoff water.
		Vegetated ditches are used to remove sediment as well as water soluble pesticides, phosphate fertilizers and some forms of nitrogen.
		Vegetative filter strips and buffers are used to capture flows.
	Irrigation Practices for Managing Sediment and Erosion	In-furrow dams are used to increase infiltration and settling out of sediment prior to entering the tail ditch.
		PAM (polyacrylamide) used in furrow and flood irrigated fields to help bind sediment and increase infiltration.
		Shorter irrigation runs are used with checks to manage and capture flows.
		Tailwater Return System.
		The time between pesticide applications and the next irrigation is lengthened as much as possible to mitigate runoff of pesticide residue.
		Use drip or micro-irrigation to eliminate irrigation drainage.
		Use of flow dissipaters to minimize erosion at discharge point.
Pesticide & Nutrient Management	Pesticide Application Practices	Avoid Surface Water When Spraying
		Chemigation
		End of Row Shutoff When Spraying
		Follow County Permit
		Follow Label Restrictions
		Monitor Rain Forecasts
		Monitor Wind Conditions
		Reapply Rinsate to Treated Field
		Sensitive Areas Mapped
		Target Sensing Sprayer used
		Use Appropriate Buffer Zones
		Use Drift Control Agents
		Use PCA Recommendations
		Use Vegetated Drain Ditches
	Nitrogen Management Methods to Minimize Leaching Past the Root Zone	Cover Crops
		Fertigation
		Foliar N Application
		Irrigation Water N Testing
		Soil Testing
		Split Fertilizer Applications
		Tissue/Petiole Testing

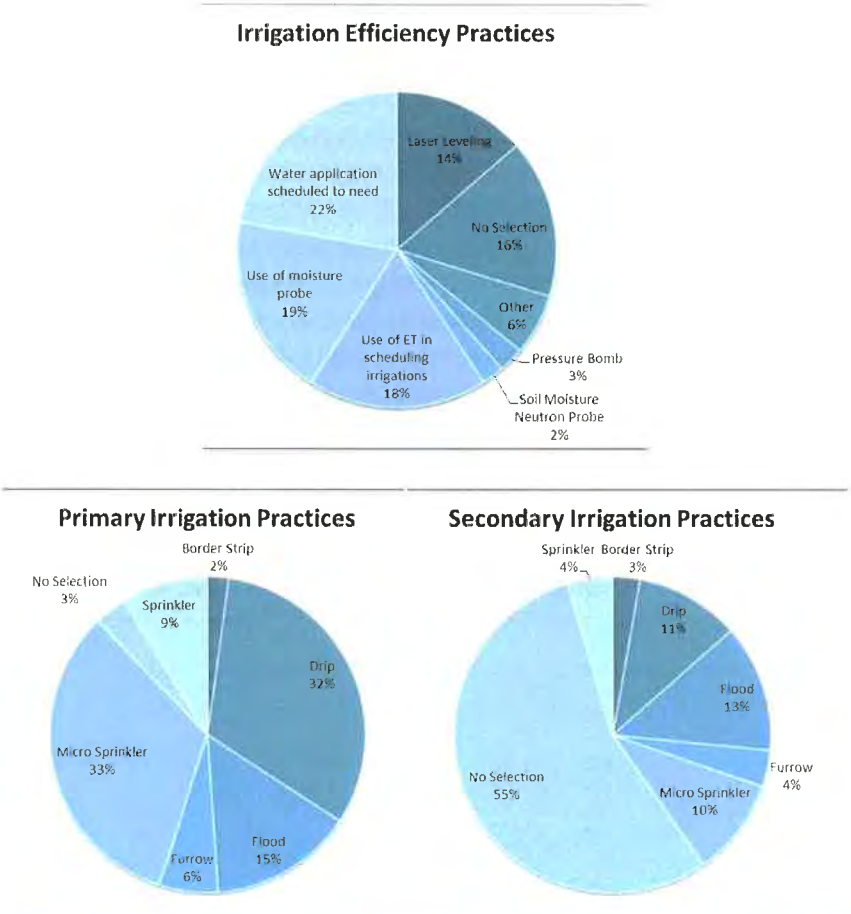
Management Practice Category		Management Practices
		Variable Rate Applications using GPS
Well Management Practices	Wellhead Protection Practices	Air Gap (for non-pressurized systems
		Backflow Preventive / Check Valve
		Good "Housekeeping" Practices*
		Ground Sloped Away from Wellhead
		Standing water avoided around wellhead
	Abandoned Wells Practices (if abandoned well is known to be present on site)	Destroyed – certified by county
		Destroyed - Unknown method
		Destroyed by licensed professional

*Good housekeeping practices include keeping the area surrounding the wellhead clean of trash, debris and any empty containers

IRRIGATION MANAGEMENT PRACTICES

A large portion of the Coalition region has parcels with implemented practices associated with the management of irrigation. The largest acreages were associated with pressurized irrigation. A combination of flood, furrow, and sprinkler irrigation was used on fewer acres than drip irrigation alone. Most members utilize only one irrigation method (Figure 38).

Figure 38. Percent of acreage for irrigation management practices.



Several management practices are associated with pesticide and nutrient management in order to reduce the movement of pesticides and nutrients to surface waters. Nutrient management practices target measures designed to achieve the desired crop yield, but prevent excess nutrients from passing through the root zone and enter groundwater. Pesticide management practices apply to groundwater by targeting the minimum amount of pesticide required to achieve the desired crop yield, preventing overspray from entering recharge areas, and by timing the application of the pesticide far enough in advance of irrigation to prevent pesticides from travelling beyond the targeted area through irrigation waters to recharge areas and entering the groundwater (Figures 39 and 40).

Figure 39. Acreage associated with pesticide application practices.

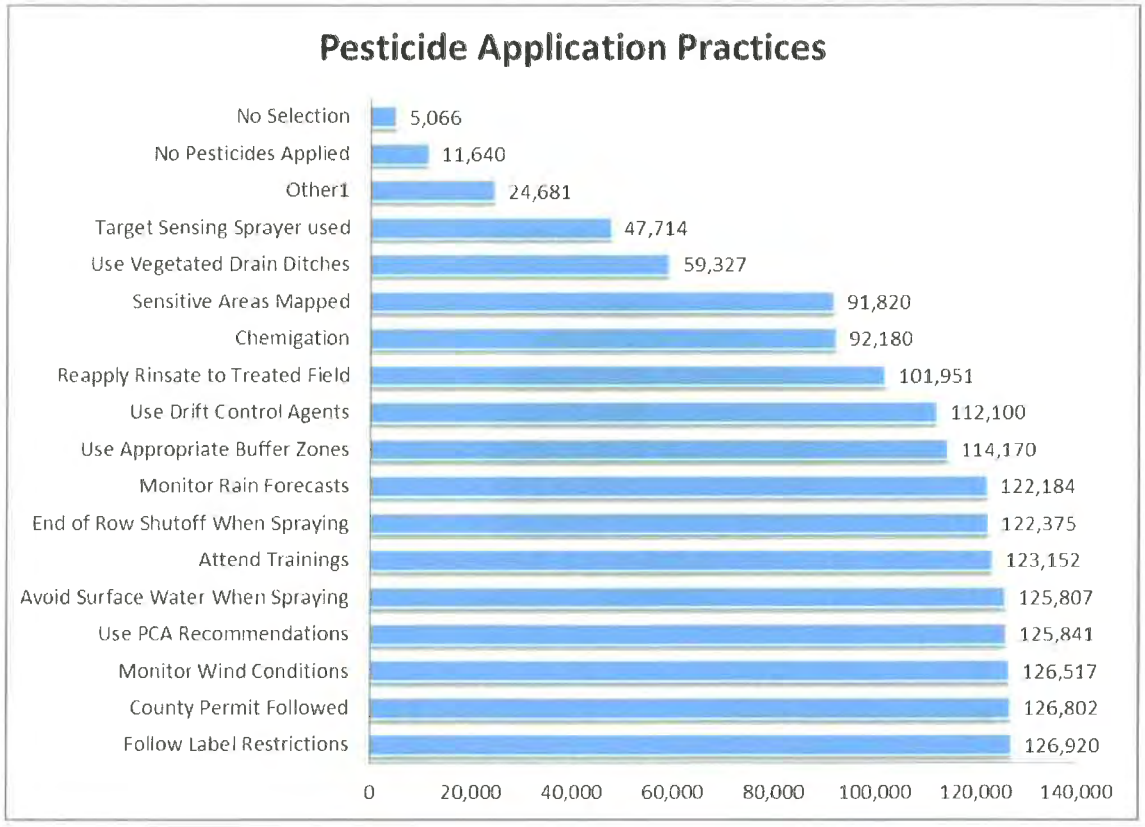
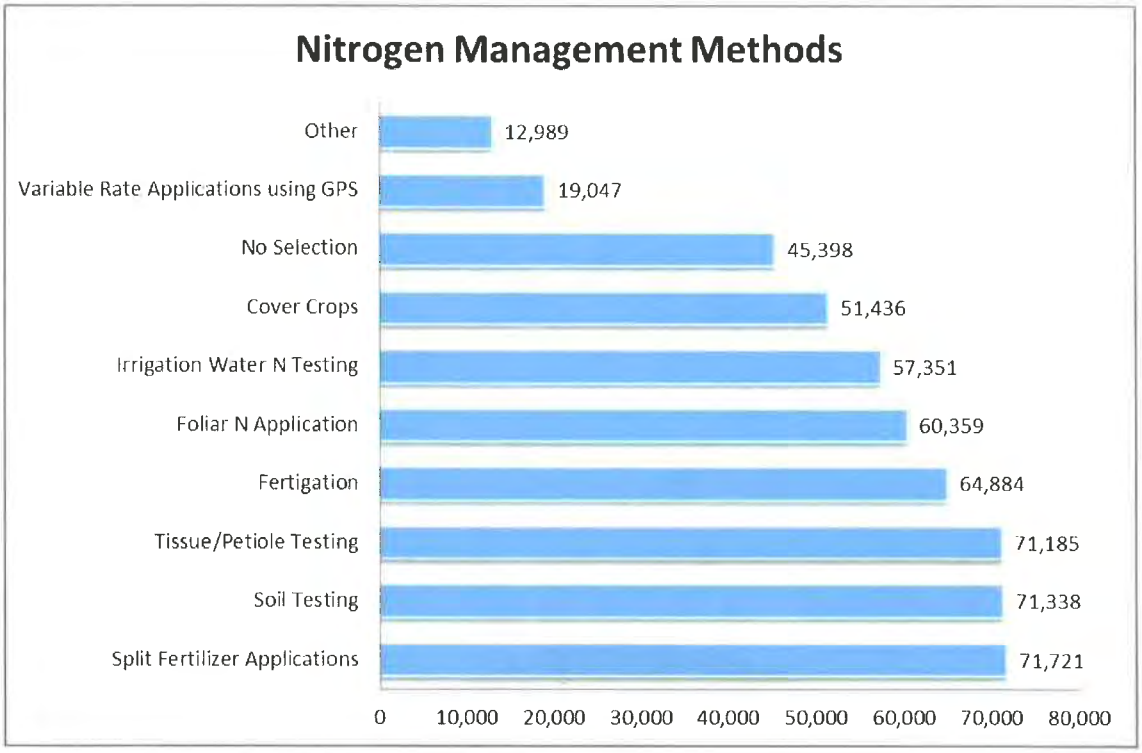


Figure 40. Acreage associated with nitrogen management methods.

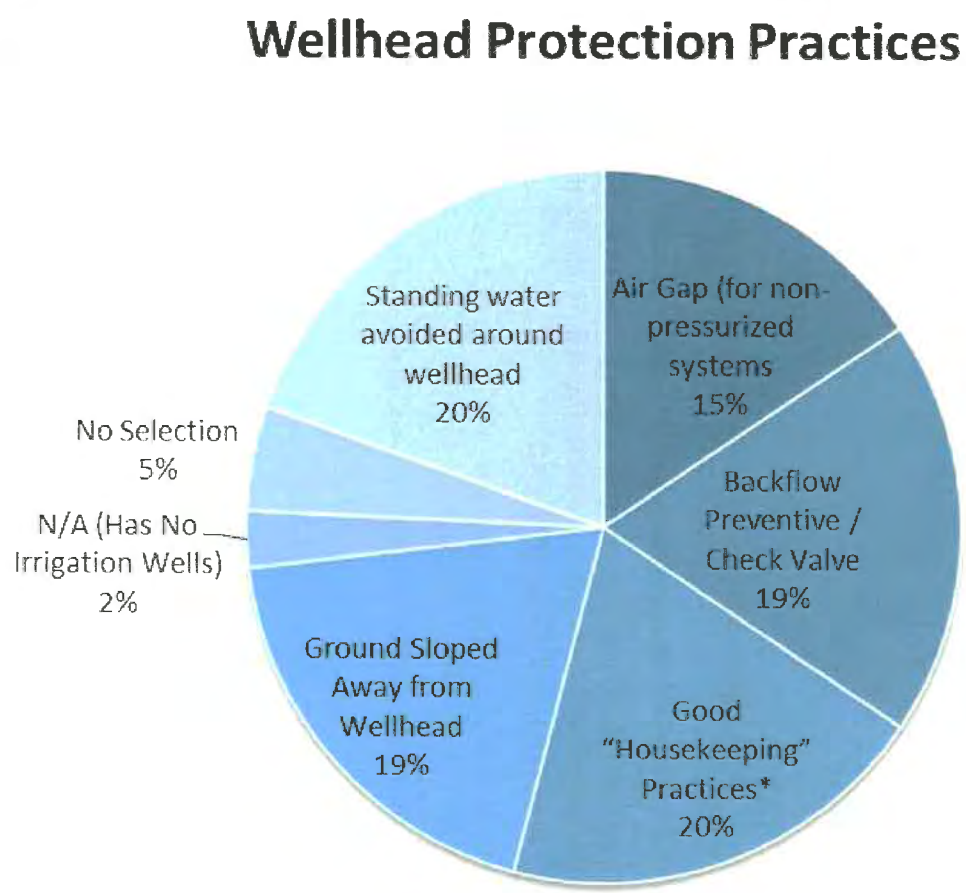


WELL MANAGEMENT PRACTICES

Irrigation Wells

Seventy eight percent of those owners/operators who returned a Farm Evaluation Survey indicated there was an irrigation well on the agricultural parcel(s). Of those owners/operators utilizing the irrigation well, various wellhead protection practices were employed (Figure 41).

Figure 41. Percent acreage associated with members who have irrigation wells and members implementing wellhead protection practices.

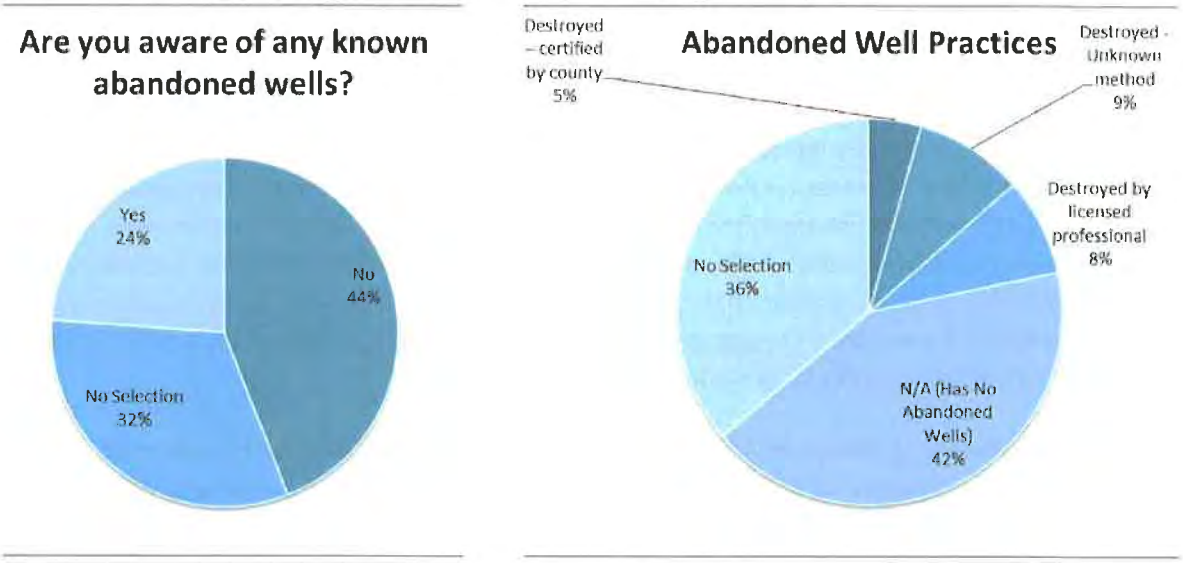


*Good housekeeping practices include keeping the area surrounding the wellhead clean of trash, debris and any empty containers

Abandoned Wells

The Coalition region contains abandoned wells, a large portion of these abandoned wells have been properly destroyed (Figures 42). The number of wells abandoned over the years has fluctuated and appears to bear no relationship to any environmental variable although a thorough analysis was not conducted.

Figure 42. Percentage of acreage with abandoned wells and practices associated with those wells.



GROUNDWATER CONSTITUENTS OF CONCERN

"...potential constituents of concern (in shallow groundwater) 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" (WDR, Attachment B, pg. 13).

Constituents of concern in groundwater are those materials that could impact beneficial uses and that have been applied during agricultural operations (including constituents in irrigation supply water (e.g., pesticides, fertilizers, soil amendments, etc.). Typically, shallow groundwater is that water most recently entering the groundwater recharge cycle and is representative of more recent overlaying land use activities. Due to the extended transport time of downward-moving irrigation return water (years) to even shallow groundwater aquifers, any management practice applied to land use during a given year could take years to result in improvements in groundwater quality. Because groundwater samples taken currently will in most cases include constituents applied several years in the past, identifying the source of a constituent in groundwater is impractical. Agricultural management practices recommended by this GQMP are designed to prevent future degradation of groundwater quality by agricultural operations.

The Groundwater Monitoring Advisory Workgroup for the Regional Board determined "that the most important constituents of concern related to agriculture's impacts to the beneficial uses of groundwater are nitrate (NO_3-N) and salinity" (WDR, Attachment A, page 16).

According to Bulletin 118 (DWR 2003), in general, the primary constituents present in the San Joaquin River Hydrologic Region with the potential to impact or cause degradation state waters are salts (TDS), nitrate, boron, chloride and organic compounds such as pesticides. High salts can be attributed to marine sediments in the Coast Range in the west side of the San Joaquin Valley and a culmination of evaporation and poor drainage resulting in increased salt concentrations within the Valley floor. Nitrates may occur naturally or as a result of anthropogenic sources such as human/animal waste or fertilizers, and boron/chloride are likely to be a result of evaporation leading to increased concentrations. As described in Bulletin 118, agricultural pesticides and herbicides have been detected in groundwater throughout the San Joaquin River Hydrologic Region especially where soil permeability is higher and depth to groundwater is shallower.

In the identification of constituents of concern (COCs) for the GQMP area, the Coalition relied on the findings of the GAR and GAR Addendum which presented previous work, studies, and monitoring programs conducted throughout GQMP area. Several sources were cited in the GAR for water quality data and COCs including: California Department of Public Health's (CDPH) Water Quality Analyses Database Files, DWR's Water Data Library (WDL), USGS's National Water Information System (NWIS), SWRCB's Geotracker database (GAMA), data from wells on dairy permitted lands acquired from the CVRWQCB, and the DPR pesticide sampling database. The following constituents are identified in the GAR as having exceeded a threshold for the Drinking Water Standards Maximum Contaminant Levels (MCLs): nitrate, TDS, and the pesticides aldicarb sulfone, DBCP

(dibromochloropropane), diazinon, ethylene dibromide, ethylene dichloride, naphthalene, simazine, and tetrachloroethane (Table 14). Per the GAR, selection of the threshold value to indicate an exceedance is based on a hierarchy consisting of the following order of preference: California Primary MCL, United States Environmental Protection Agency (EPA's) Federal Primary MCL, and California Notification Level (Tables 12-14). One notable exception is for TDS; in this document the threshold used to indicate an exceedance is based on the 450 mg/L limit for Agricultural Water Quality Goals (Food & Agriculture Organization of United Nations) versus the 500 mg/L threshold of the CDPH and EPA's Secondary MCLs. Only those constituents with concentrations above the MCLs or notification level or concentration of TDS above 450 mg/L were retained as potential COCs.

PREVIOUS WORK TO IDENTIFY CONSTITUENTS OF CONCERN IN GROUNDWATER

The Coalition's GAR summarizes current and historic groundwater quality data (dating back to 1910) in the Eastern San Joaquin River Watershed area using data from local, state, and federal agencies (CDPH Water Quality Analyses Database Files, DWR Water Data Library, USGS National Water Information System, GAMA, data acquired from the Regional Water Control Board from wells on dairy permitted lands, the DPR pesticide sampling database, MID, and TID). The GAR lists groundwater quality data relevant to irrigated agricultural practices (Tables 12-14), provides a spatial and temporal assessment of constituents in the groundwater, and serves as the survey of current, available groundwater quality data necessary to develop effective GQMPs for the Coalition region. According to groundwater quality data compiled from a variety of well depths throughout the Central Valley Coalition region, nitrogen concentrations were reported to be above both the 5 and 10 mg/L levels (Figure 43) and TDS concentrations exceeded the 450, 500 and 1,000 mg/L levels (Figure 44).

Nitrate and TDS – Spatial Distribution

According to the GAR, high concentrations of nitrate are found in shallow groundwater throughout much of the western part of the Central Valley Floor, with a large area of very high in nitrate levels in the northwestern part of the Coalition region, particularly in the vicinity and to the west of Turlock (Figure 43). Several shallow wells in the area west of Turlock exhibit nitrate concentrations above the drinking water MCL of 10 mg/L (nitrate as nitrogen). Nitrate concentrations in shallow groundwater within the southwestern portion of the Coalition region appear to be generally lower, however, much of the available data for this area date back to the 1970s and earlier.

Recent nitrate concentrations in deep wells show a somewhat similar spatial pattern as seen in shallow wells with higher nitrate concentrations occurring in the western part of the Central Valley Floor, again with a clustering of high nitrate concentrations around the Turlock area. Overall, nitrate concentrations in deep wells appear to be lower than those exhibited in the shallow wells and do not exhibit the same lateral spread as in shallow wells.

According to the GAR, some areas of locally high TDS concentrations exist in shallow wells, particularly in the vicinity of Modesto and also in some general locations west of Turlock. However, the most recent data indicate TDS concentrations in many shallow wells are below 500 mg/L, which represents the recommended MCL for Secondary Drinking Water Standards; agricultural beneficial use MCL is set at 450 mg/L. Figure 44 illustrates the distribution of wells exhibiting TDS concentrations above 450 mg/L in the Coalition region. The pattern of distribution appears to be similar to that of nitrates in Figure 43, with a cluster of wells with TDS concentrations above 450 mg/L between Turlock and the San Joaquin River. A number of wells with higher TDS concentrations are apparent in close proximity to the San Joaquin River along the western edge of the Coalition region where groundwater is generally very shallow. According to the GAR, the available data from deep wells show most TDS concentrations are below 500 mg/L although some deep wells with high concentrations are scattered throughout the Central Valley Floor area. Most the wells with the highest TDS concentrations (above 1,000 or 1,500 mg/L) are in the western part of the Coalition region.

Pesticides – Spatial Distribution

According to the GAR, data assembled to evaluate the distribution of pesticide detections in the Coalition region were from DPR. Corresponding well sampling location data are only available at the spatial resolution of the Public Land Survey System (PLSS) section in which the well is located. Overall, out of 2,732 unique wells sampled for pesticides, 872 had detectable concentrations of a pesticide and 369 wells had pesticide concentration exceedances of a water quality objective (Table 14, Figure 45). Of a total of 997 sections within which pesticide data archived by DPR are available, 375 sections have pesticide detections and 167 sections have exceedances. A total of 48 different pesticides have been detected within the Coalition region with exceedances reported for 8 different pesticides. The pesticides most often tested for were DBCP, atrazine, simazine, and 1,2-dichloropropane, and the most commonly detected pesticides were DBCP, simazine, DEA (diethyl-atrazine), and atrazine. Of those pesticides with reported exceedances, only diazinon, atrazine, and simazine are currently registered with DPR and/or are the only chemicals used in agricultural practice. Therefore, for the purposes of management of current agricultural practices in order to protect groundwater quality, only simazine and diazinon will be described in the GQMP Zone sections. Diazinon was detected in two wells within 442 sections, both wells had concentrations above the primary MCL of 1.2 µg/L. Simazine was detected in 75 wells within 62 sections, but only one well had a concentration above the primary MCL of 4 µg/L.

Table 12. Summary of Assembled Groundwater Quality Data for nitrate as N (all data since 1940; Table 5-1, GAR).

NITRATE DATA

Monitoring Entity	Number of wells	Number of samples	Number with known depth	Irrigation Wells	Monitoring Wells	Residential Wells	Public Supply Wells	Other Well Types	Unknown Well Type	Shallow Zone	Deep Zone	Unknown Depth Zone	Wells with results over 5 mg/L (as N)	Wells with results over 10 mg/L (as N)	Wells with results over 20 mg/L (as N)	Samples Pre-1970s	Samples in 1970s	Samples in 1980s	Samples in 1990s	Samples in 2000s	Samples in 2010s
Dairy	1,775	2,236	0	441	35	1,299	0	0	0	1,334	441	0	1,107	845	513	0	0	0	0	2,236	0
CDPH	1,235	27,404	0	0	0	0	1,235	0	0	0	1,235	0	438	146	21	0	0	754	3,388	16,910	6,352
DWR	836	1,651	0	0	0	0	29	11	796	0	29	807	240	56	5	1,246	278	127	0	0	0
GAMA	2,049	17,475	0	0	483	0	1,566	0	0	483	1,566	0	615	260	83	611	70	399	1,159	10,463	4,773
MID	29	32	0	0	0	0	0	0	29	0	0	29	16	9	2	0	0	0	0	32	0
TID	108	323	0	0	0	0	0	108	0	108	0	0	106	105	68	0	0	0	55	268	0
USGS	540	1,574	521	0	0	0	0	0	540	320	201	19	166	58	19	631	72	88	73	701	9
Total	**6,572**	**50,695**	**521**	**441**	**518**	**1,299**	**2,830**	**119**	**1,365**	**2,245**	**3,472**	**855**	**2,688**	**1,479**	**711**	**2,488**	**420**	**1,368**	**4,675**	**30,610**	**11,134**

Table 13. Summary of Assembled Groundwater Quality Data for TDS (all data since 1940; Table 5-1, GAR).

TOTAL DISSOLVED SOLIDS DATA

Monitoring Entity	Number of wells	Number of samples	Number with known depth	Irrigation Wells	Monitoring Wells	Residential Wells	Public Supply Wells	Other Well Types	Unknown Well Type	Shallow Zone	Deep Zone	Unknown Depth Zone	Wells with results over 500 mg/L	Wells with results over 1,000 mg/L	Wells with results over 1,500 mg/L	Samples Pre-1970s	Samples in 1970s	Samples in 1980s	Samples in 1990s	Samples in 2000s	Samples in 2010s
Dairy	34	156	0	0	34	0	0	0	0	34	0	0	25	8	0	0	0	0	0	156	0
CDPH	915	7,175	0	0	0	0	915	0	0	0	915	0	130	35	16	0	0	437	920	4,537	1,281
DWR	1,054	2,466	0	0	0	0	29	0	1,025	0	0	1,054	213	76	51	2,046	289	131	0	0	0
GAMA	1,654	6,555	0	0	254	0	1,400	0	0	254	0	1,400	466	183	122	1,400	124	262	406	3,467	896
MID	29	32	0	0	0	0	0	0	29	0	0	29	5	0	0	0	0	0	0	32	0
TID	108	323	0	0	0	0	0	108	0	108	0	0	102	18	1	0	0	0	55	268	0
USGS	722	3,215	696	0	0	0	0	0	722	429	267	26	167	61	43	842	74	454	364	1,464	17
Total	**4,516**	**19,922**	**696**	**0**	**288**	**0**	**2,344**	**108**	**1,776**	**825**	**1,182**	**2,509**	**1,108**	**381**	**233**	**4,288**	**487**	**1,284**	**1,745**	**9,924**	**2,194**

Table 14. Summary of pesticide detections (Table 5-2, GAR).

Pesticide	Wells Sampled	Wells with Detection	Wells with Exceedance	Sections Sampled	Sections with Detection	Sections with Exceedance	Concentration in Samples with Detections (µg/L)			Exceedance Threshold Used (µg/L)	Basis for Exceedance Threshold
							Average	Minimum	Maximum		
1,2-Dichloropropane (Propylene Dichloride)	1107	13	0	567	12	0	0.4	0.03	1.4	5	CA Primary MCL
2,4-DP (Isooctyl Ester)	40	2	0	31	2	0	0.01	0	0.01	-	Chemical not
3,4-Dichloro Aniline	160	12	0	146	12	0	0.005	0.004	0.01	-	Chemical not
ACET (Deisopropylatrazine)	233	41	0	185	37	0	0.14	0	0.53	-	Chemical not
Alachlor	832	1	0	488	1	0	0.1	0.1	0.1	2	CA Primary
Alachlor ESA	18	2	0	11	2	0	0.494	0.077	0.91	-	Chemical not
Aldicarb Sulfone	414	23	21	250	2	2	46	1	1281	3	EPA Primary
Aldicarb Sulfoxide	366	4	0	249	2	0	2.9	2.9	2.9	4	EPA Primary
Atrazine	1292	49	0	712	47	0	0.077	0.004	0.599	1	CA Primary
Bentazon, Sodium Salt	369	4	0	220	4	0	1.72	0.26	3.74	18	CA Primary
Bromacil	941	9	0	531	9	0	0.096	0.01	0.303	-	No value in
Carbon Disulfide	226	4	0	183	4	0	0.05	0.03	0.07	160	CA Notification
Chlorothalonil	348	1	0	239	1	0	0.02	0.02	0.02	-	No value in
Chlorthal-Dimethyl	241	2	0	205	1	0	0.46	0.37	0.54	-	No value in
Coumaphos	2	1	0	2	1	0	1	1	1	-	Chemical not
DBCP (Dibromochloropropane)	1786	632	331	675	250	154	0.831	0.001	166	0.2	CA Primary
Deethyl-Atrazine (DEA)	346	58	0	280	56	0	0.028	0.004	0.429	-	No value in
Demeton	128	1	0	89	1	0	1	1	1	-	No value in
Desmethylnorflurazon	79	15	0	65	13	0	0.36	0.066	1.86	-	Chemical not
Desulfinyl Fipronil	160	1	0	146	1	0	0.005	0.005	0.005	-	Chemical not
Diaminochlorotriazine (DACT)	126	46	0	93	38	0	0.243	0.051	1.23	-	Chemical not
Diazinon	732	2	2	442	2	2	127.5	0.1	507	1.2	CA Notification
Dicamba	331	1	0	228	1	0	0.01	0.01	0.01	-	No value in
Dinoseb	388	1	0	243	1	0	0.04	0.04	0.04	7	CA Primary
Diuron	618	32	0	394	29	0	0.16	0.01	1	-	No value in
Ethylene Dibromide	590	21	14	330	16	12	0.24	0.01	1	0.05	CA Primary
Ethylene Dichloride	29	1	1	29	1	1	2.9	2.9	2.9	0.5	CA Primary
Fipronil	160	1	0	146	1	0	0.011	0.011	0.011	-	Chemical not
Fipronil Sulfone	160	1	0	146	1	0	0.008	0.008	0.008	-	Chemical not
Hexazinone	429	12	0	328	10	0	0.078	0.008	0.27	-	No exceedance

Pesticide	Wells Sampled	Wells with Detection	Wells with Exceedance	Sections Sampled	Sections with Detection	Sections with Exceedance	Concentration in Samples with Detections (µg/L)			Exceedance Threshold Used (µg/L)	Basis for Exceedance Threshold
							Average	Minimum	Maximum		
Imazethapyr	47	1	0	45	1	0	0.01	0.01	0.01	-	Chemical not
Merphos	45	1	0	36	1	0	1	1	1	-	No value in
Methyl Bromide	1047	6	0	538	5	0	2.37	0.54	7.7	-	No value in
Metolachlor	637	11	0	382	11	0	0.011	0.004	0.036	-	No value in
Metolachlor ESA	18	9	0	11	7	0	0.527	0.06	1.155	-	Chemical not
Metolachlor OXA	18	4	0	11	4	0	0.14	0.072	0.279	-	Chemical not
Naled (Dibrom)	33	1	0	28	1	0	5	5	5	-	No value in
Naphthalene	684	6	1	398	5	1	6.4	0.4	29	17	CA Notification
Norflurazon	217	9	0	175	8	0	0.152	0.01	0.468	-	No value in
Ortho-Dichlorobenzene	848	2	0	454	2	0	0.69	0.56	1	-	No value in
Prometon	732	6	0	484	6	0	0.432	0.005	1.7	-	No value in
Propoxur	156	1	0	127	1	0	5	5	5	30	CA Notification
Simazine	1288	75	1	711	62	1	0.335	0.003	6.6	4	CA Primary
Tetrachloroethane	590	2	1	339	2	1	26.12	0.84	51.4	1	CA Primary
Tetrachloroethylene	30	2	0	30	2	0	0.2	0.2	0.2	5	CA Primary
Tetrachlorvinphos (Stirofos)	24	1	0	16	1	0	1	1	1	-	No value in
TPA (2,3,5,6-Tetrachloroterephthalic Acid)	7	3	0	4	2	0	0.817	0.419	1.5	3500	CA Notification
TOTAL UNIQUE LOCATIONS	**2732**	**872**	**369**	**997**	**375**	**167**					

Pesticide data are for the period 1979-2011 provided by DPR.

*Exceedance thresholds used are based on values reported in the SWRCB Water Quality Goals Online Database (http://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.shtml), when available. Selection of the threshold value for use to indicate an exceedance is based on a hierarchy consisting of the following order of preference: CA Primary MCL = California Primary MCL; EPA Primary MCL = EPA's Federal Primary MCL; CA Notification = California Notification Level. No value in database = Chemical is in the database but not possible threshold value reported, Chemical not in database = Chemical was not located in the SWRCB database.

Figure 43. Distribution of nitrogen as nitrate at concentrations at or above 5 mg/L within the GQMP Zones of the Coalition region.

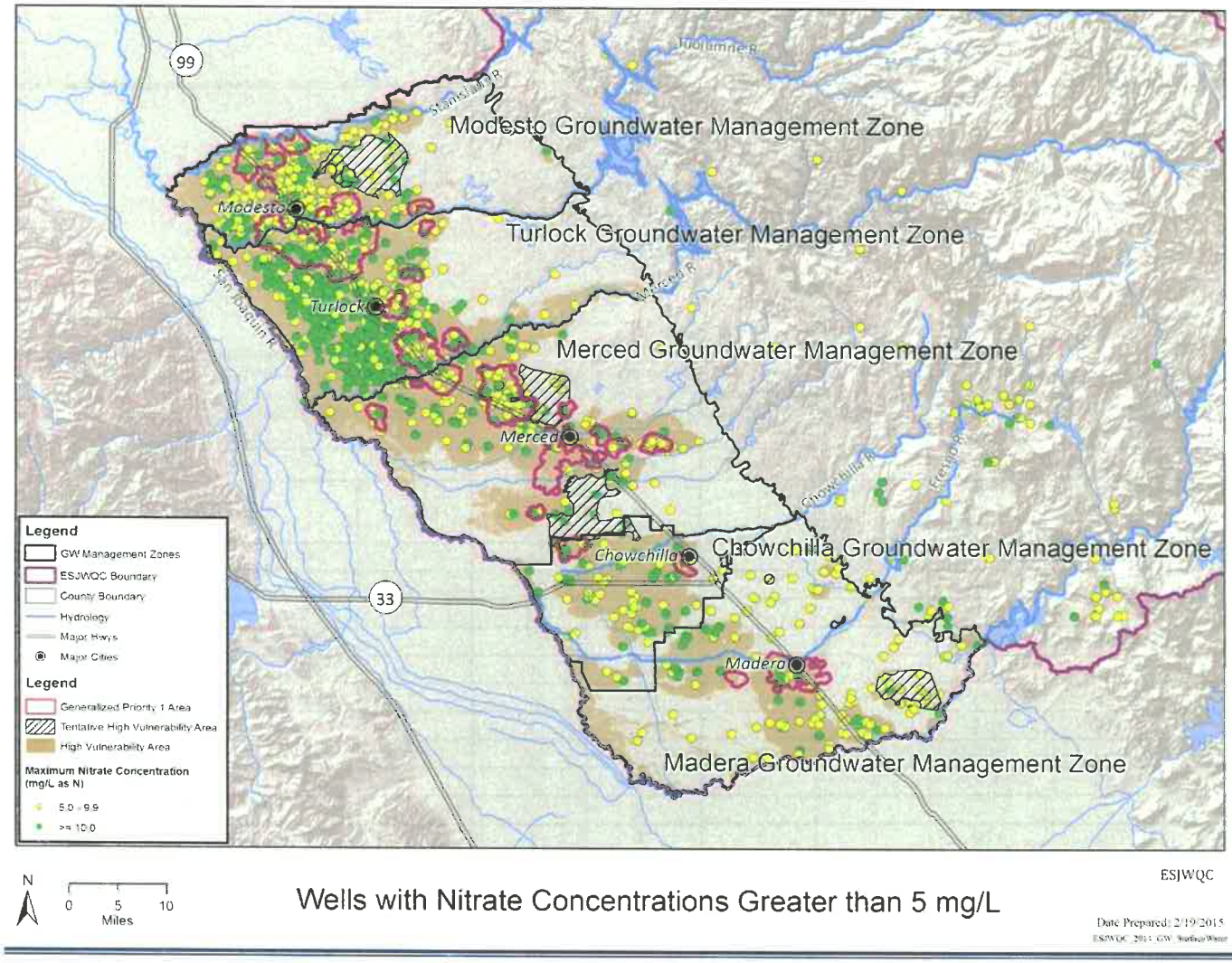


Figure 44. Distribution of TDS at concentrations at or above 450 mg/L within the GQMP Zones of the Coalition region.

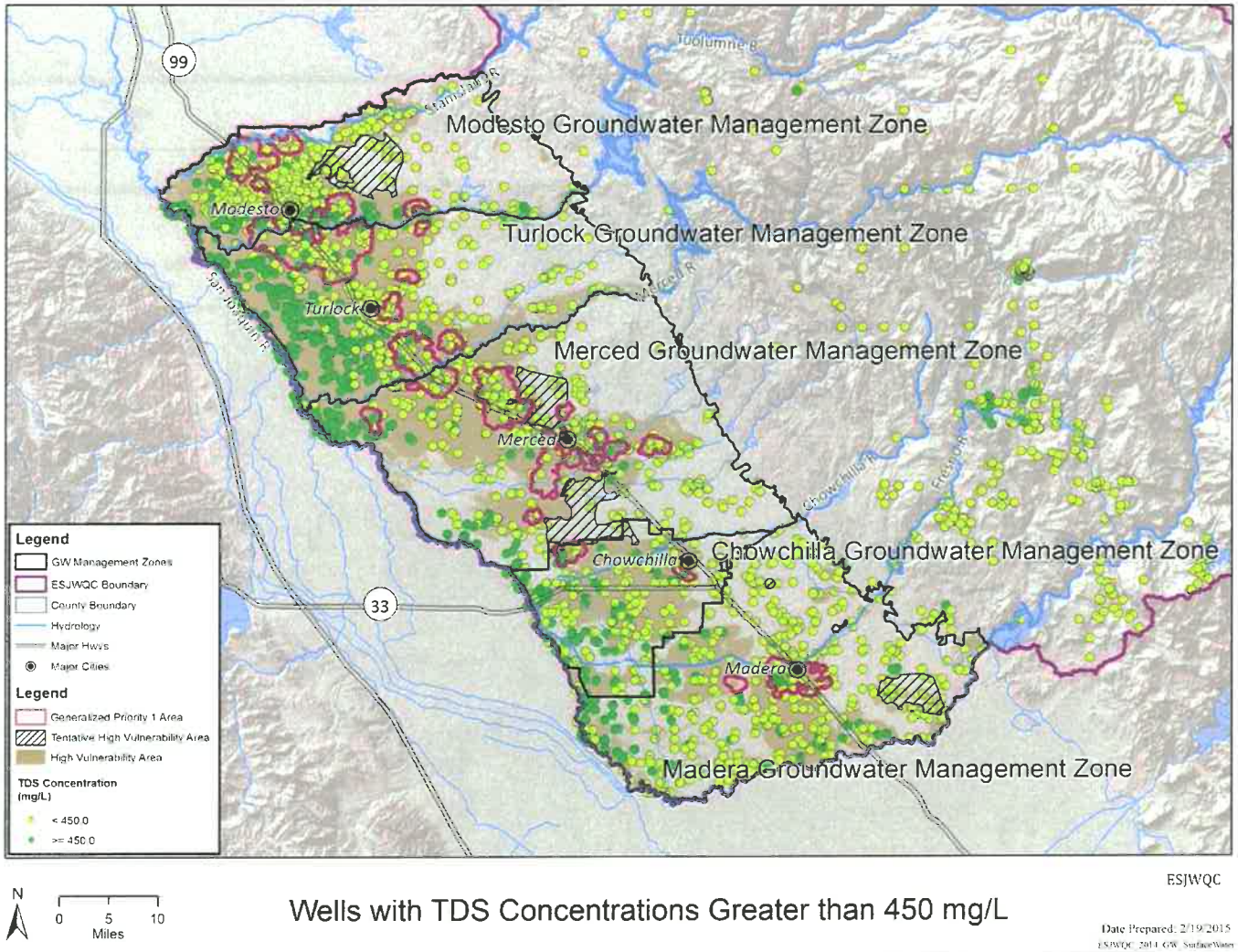
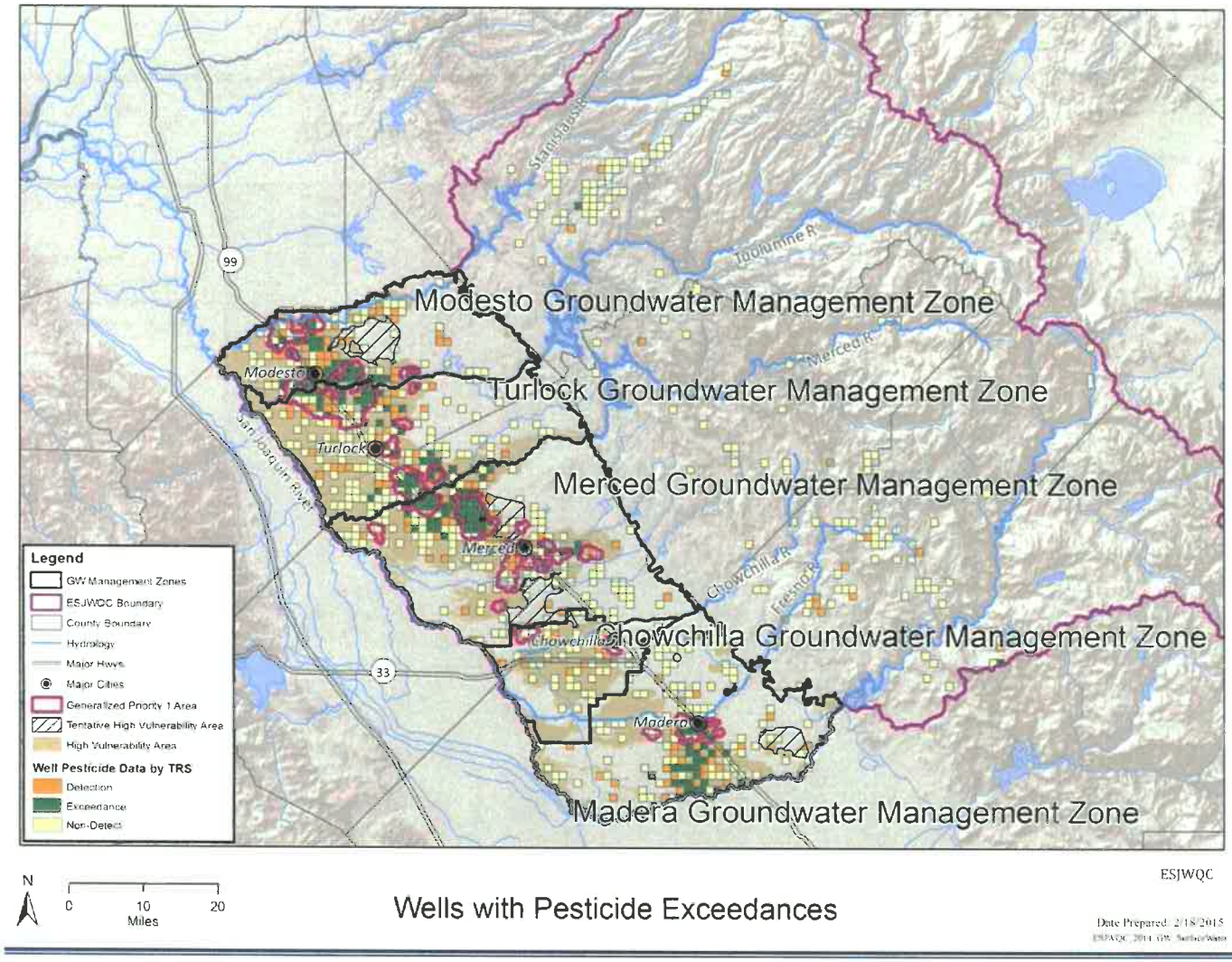


Figure 45. Distribution of all pesticide concentrations (detection, exceedance, or non-detect) by TRS within the GQMP Zones of the Coalition region.



ESJWQC High Vulnerability Area

"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" (WDR, Attachment B, pg. 13).

One of the objectives of the GAR was to "provide a basis for establishing groundwater quality management plans in high vulnerability areas and priorities for implementation of those plans" (WDR, Attachment B, page 13). As part of the focus on protection of regional groundwater quality, the relative vulnerability of groundwater to irrigated land practices was assessed in the GAR based on hydrogeologic sensitivity, overlying land uses and practices and groundwater quality data, historic and recent (Figure 46).

Determination of High Vulnerability Area

The Hydrogeologic High Vulnerability Area (HHVA) within the Coalition was determined utilizing a statistical model incorporating observed groundwater quality and hydrogeologic characteristics. The HHVA defines areas within the region where groundwater is most likely to be vulnerable to contamination based on current exceedances of the nitrate MCL, and select hydrogeologic characteristics identified in the groundwater vulnerability model laid out in the GAR. The HHVAs capture approximately 75 percent of the nitrate signals exceeding WQTLs observed across the Coalition region. A 0.5-mile buffer was added around the HHVA in the vicinity of wells where an observed nitrate exceedance occurred. With the addition of the 0.5 mile buffer around the HHVA, and a few additional, select areas (GAR, ES-15), 98 percent of the locations of nitrate exceedances observed in the surveyed well data are accounted for. The combined extents of the HHVA and buffer represent the East San Joaquin Water Quality Coalition High Vulnerability Area (ESJHVA) (Figure 46). The ESJHVA identified in the GAR covers approximately 55 percent of the area within the irrigated lands area and represents approximately 577,000 acres.

Determination of Prioritization of ESJHVAs

The WDR required several factors to be considered when prioritizing the high vulnerability areas of the ESJHVA:

- Identified exceedances of water quality objectives
- Proximity to areas contributing recharge to urban and rural communities that rely on groundwater as a source of supply
- Existing field and operational practices identified to be associated with irrigated agricultural waste discharges that are the cause or source of groundwater quality degradation
- The largest acreage commodity types comprising up to at least 80 percent of irrigated agriculture in the high vulnerability areas
- Legacy or ambient groundwater conditions
- Groundwater basins currently proposed to be under review by Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS)
- Identified constituents of concern

In addition, Disadvantaged Communities (DACs) and corresponding recharge areas were incorporated in the prioritization matrix and priority ranking (1-3) of the ESJHVA (Figure 46). Figure 47 illustrates the ESJHVA Priority Areas relative to the GQMP Zones. The top Priority 1 Area are almonds (38, 660 acres), corn (6,804 acres), and grapes (4,901 acres) (GAR Addendum, 2014) (Figure 48).

Figure 46. East San Joaquin Water Quality Coalition High Vulnerability Areas (ESJHVA) and Priority Areas (1-3) (GAR Addendum, 2014).

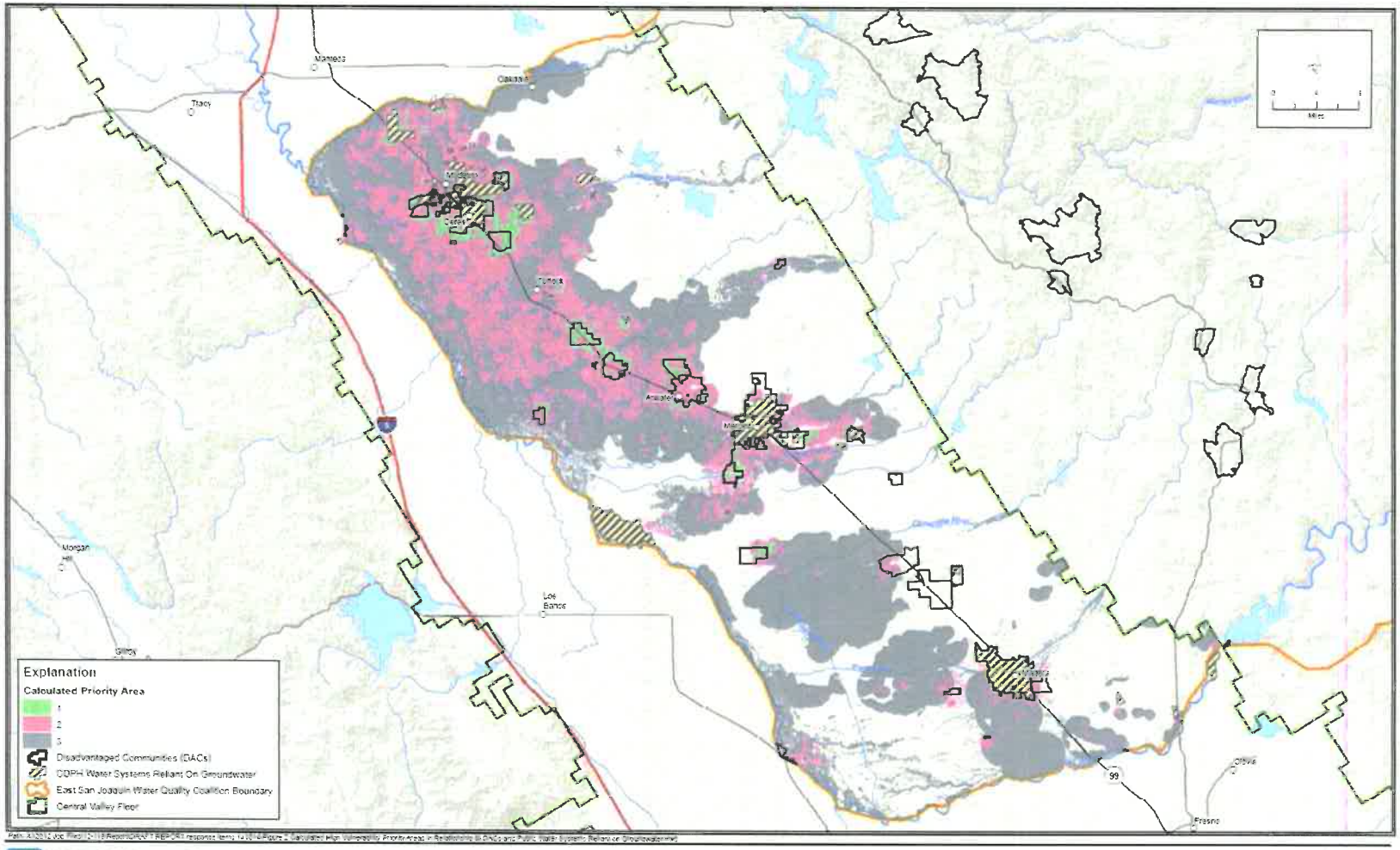


Figure 2
Calculated High Vulnerability Priority Areas in Relationship to DACs and Public Water Systems Reliant on Groundwater

Figure 47. East San Joaquin Water Quality Coalition High Vulnerability Areas (ESJHVA) and Priority Areas (1-3) relative to GWMP Zones.

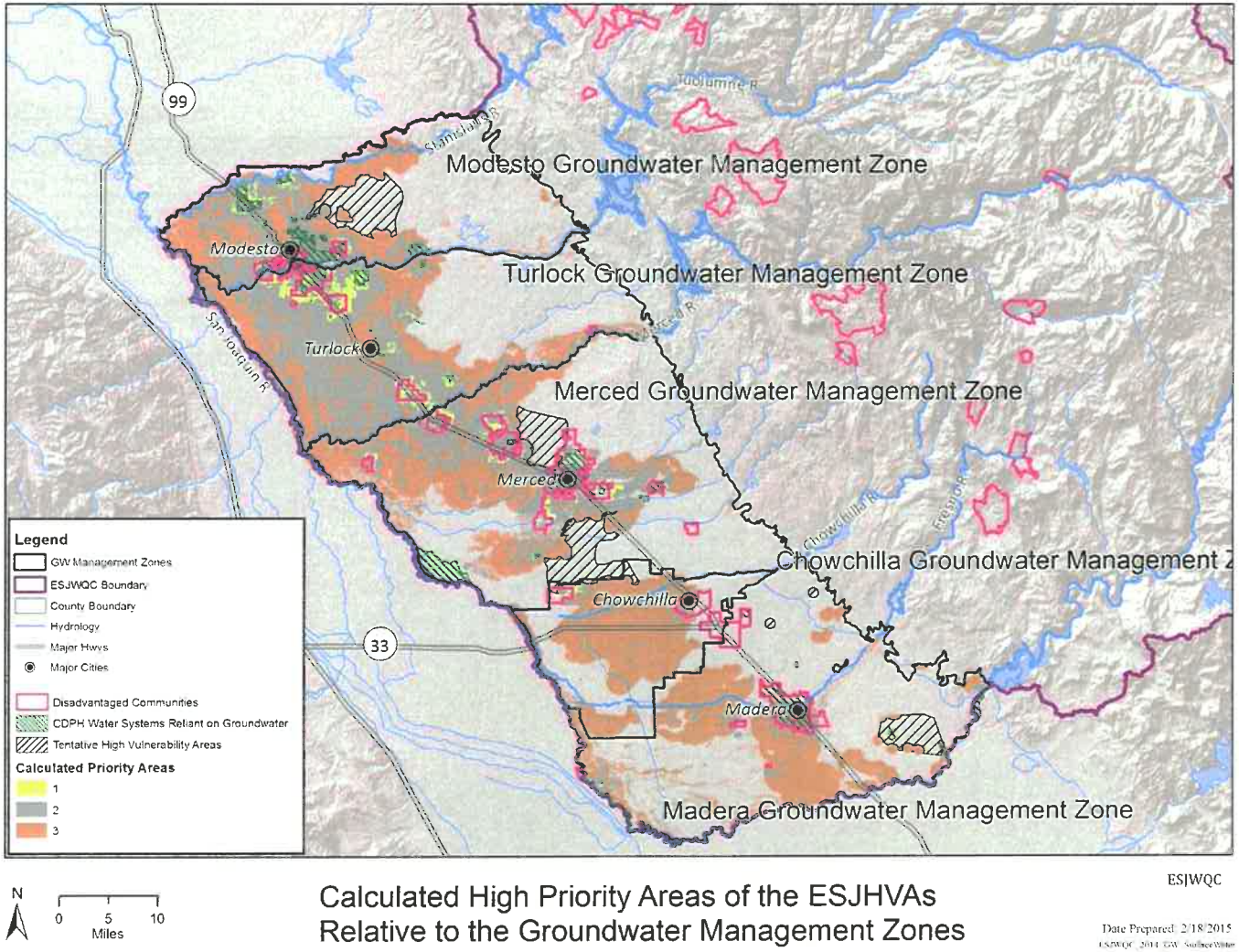
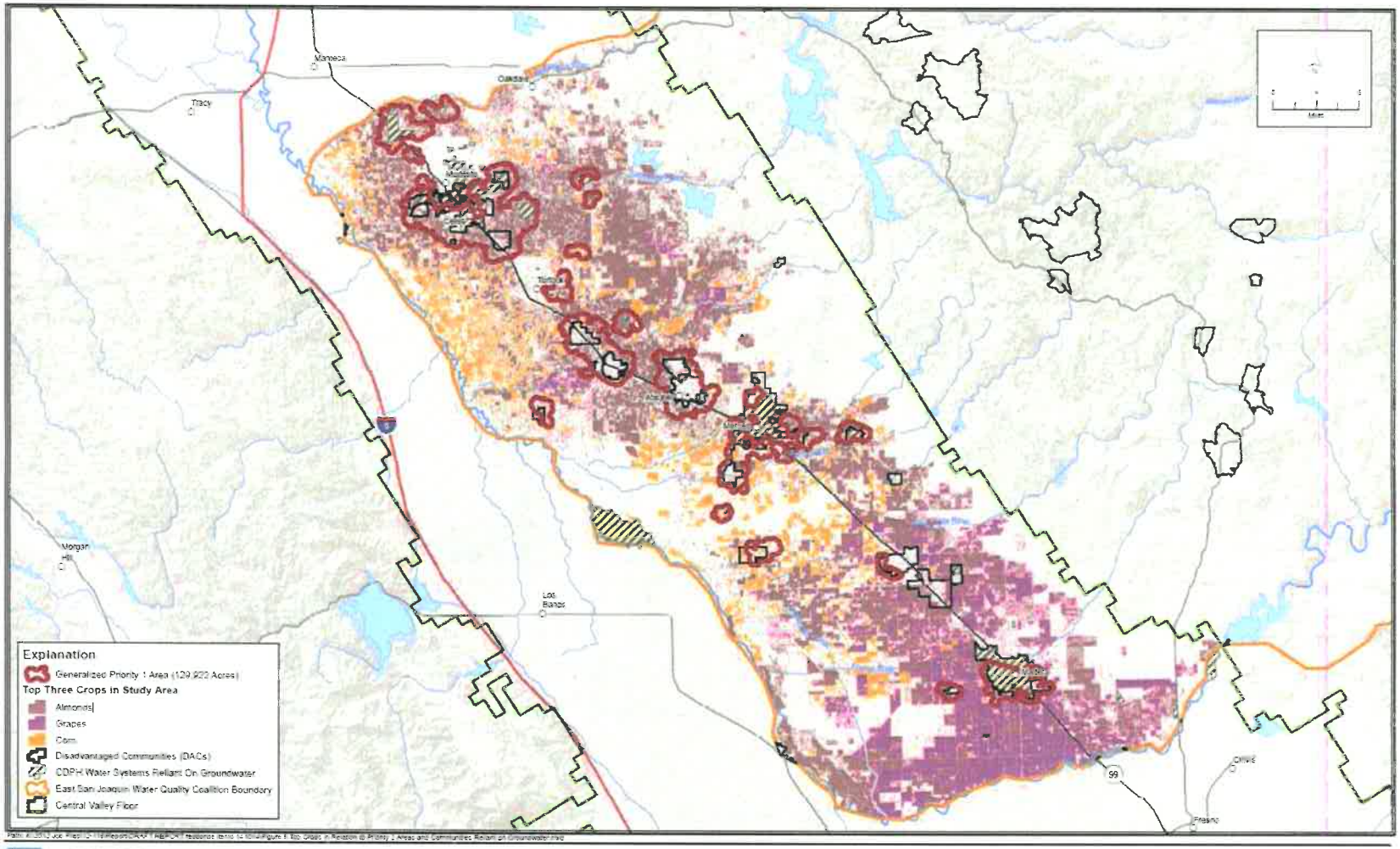


Figure 48. East San Joaquin Water Quality Coalition High Vulnerability Areas (ESJHVA), top 3 crops, and the Generalized Priority 1 Area (GAR, Figure 8).



LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 8
Top Crops in Relation to Priority 2 Areas and Communities Reliant on Groundwater

SURFACE WATER DATA INDICATING CONSTITUENTS OF CONCERN IN GROUNDWATER

The ESJWQC began surface water quality monitoring as part of the ILRP in 2004 and currently submits Annual Monitoring Reports of surface water quality monitoring and management for its Members to the Regional Board. In general terms, data collected from surface water monitoring will be used to evaluate current constituent applications in agricultural operations and to better advise specific management practices to protect future groundwater quality. It is beyond the scope of the GQMP to identify surface water sources of constituents of concern identified in groundwater samples collected over previous decades.

GROUNDWATER BENEFICIAL USES

The Water Quality Trigger Limits (WQTLs) in Table 12 are applied based on the protection of beneficial uses assigned to groundwater according to the Water Quality Control Plan for the Sacramento and San Joaquin River Basins (Basin Plan). According to the Basin Plan, "unless otherwise designated by the Regional Water Board, all ground waters in the Region are considered as suitable or potentially suitable, at a minimum, for municipal and domestic water supply, agricultural supply, industrial service supply, and industrial process supply" (Basin Plan, page II-3.00). These beneficial uses are described as:

- Municipal and Domestic Supply (MUN) – Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.
- Agricultural Supply (AGR) – Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.
- Industrial Service Supply (IND) – Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining cooling water supply, hydraulic conveyance, gravel washing, fire protection, and oil well repressurization.
- Industrial Process Supply (PRO) – Uses of water for industrial activities that depend primarily on water quality.

Groundwater provides almost the entire urban and rural water use and about 75 percent of the agricultural water use in the Central Valley Floor (Madera IRWMP 2008). Groundwater accounts for about 30 percent of the annual supply used for agricultural and urban purposes in the entire San Joaquin River Hydrologic Region (DWR YYYY). However, agricultural irrigation supplied by surface water and groundwater accounts for about 95 percent of the total water use in Modesto, Turlock and Merced subbasins (USGS 2006).

The irrigation demand in Madera County is unknown but estimated to be approximately 940,000 AFY. The average annual amount of surface water delivered in Madera County is approximately 300,000 AFY (1996-2006), leaving greater than a 600,000 AFY gap in water supply and irrigation demand (Madera IRWMP 2008).

MANAGEMENT PLAN STRATEGY

DESCRIPTION OF APPROACH

The goals of the ESJWQC GQMP process are to inform growers about management practices that are protective of groundwater quality, and have the growers implement those practices. To achieve those goals, the ESJWQC developed four objectives that will allow the Coalition to identify the specific constituents applied by agriculture that leach to groundwater and result in impaired water quality, identify management practices to prevent/reduce leaching, and identify a process for documenting the implementation of those practices and improvements in groundwater quality.

The objectives of the ESJWQC Groundwater Quality Management Plan Strategy are:

- Identify COCs in the GQMP Zones
- Identify management practices to be implemented that are protective groundwater quality
- Develop a management practice implementation evaluation process and schedule (based on priority)
- Develop management practice performance goals with a schedule (10 year compliance)

Identify COCs in the GQMP Zones

The ESJWQC identified COCs based on analyses for constituents known to have the potential to be found in groundwater. As identified in the GAR there have been exceedances of water quality objectives for nitrate, TDS, pesticides (aldicarb sulfone, DBCP [dibromochloropropane], diazinon, ethylene dibromide, ethylene dichloride, and simazine), and additional compounds (naphthalene and tetrachloroethane) (Table 14). Naphthalene is the active ingredient in moth balls and is used for indoor storage, not irrigated agriculture, and tetrachloroethane is a degreasing agent, again not used for crop production by irrigated agriculture. Because naphthalene and tetrachloroethane are not used by irrigated agriculture, and aldicarb sulfone, DBCP, ethylene dibromide, and ethylene dichloride are not registered for use in California, these compounds are not included as constituents of concern. Constituents of concern for the ESJWQC region include nitrate, TDS, diazinon, and simazine. Table 15 lists the WQTLs for the GQMP COCs.

Table 15. GQMP COC WQTLs.

Constituent	Water Quality Trigger Limit (WQTL)	Standard Type	Beneficial Use (BU) with most protective limit	Reference for the Trigger Limit	Category (see footnotes)
Total Dissolved Solids	450 mg/L	Narrative	Agricultural Supply	Water Quality for Agriculture (Ayers & Westcott)	3
Pesticides – Organophosphates					
Diazinon	0.1 µg/L	Numeric	Freshwater Habitat	Sacramento/San Joaquin Basin Plan: San Joaquin River & Delta numeric standard. Sacramento & Feather Rivers numeric standard	1
Pesticides – Herbicides					
Simazine	4.0 µg/L	Numeric	Municipal and Domestic Supply	Sacramento/San Joaquin Basin Plan Chemical Constituents Objective: California Primary MCL (MUN, human health)	1
Nutrients					
Nitrate as NO3 Nitrate as N	45 mg/L as NO3 10 mg/L as N	Numeric	Municipal and Domestic Supply	Sacramento/San Joaquin Basin Plan Chemical Constituents Objective: California Primary MCL	1

Category 1: Constituents that have numeric water quality objectives in the Sac-SJR Basin Plan or other WQO listed by reference such as MCLs (Page III-3.0)* , CTRs (Page III-10.1)*,
Category 3: Constituent does not have numeric WQO, and does not have a primary MCL. WQTL exceedance is based on implementation of narrative objective. All detections should be tracked. None are default exceedances.
MUN-Municipal and Domestic Supply
(*)-Water Quality Control Plan for the Sacramento and San Joaquin River Basins. Revised on October 2007.

Identify Management Practices that are Protective of Groundwater

The COCs are all soluble chemicals that are transported to groundwater with the downward movement of water. The sources of water resulting in leaching include: rainfall, irrigation, direct injection to operational wells lacking a proper backflow device, improperly abandoned or improperly cased wells, and surface water (rainfall and irrigation). Consequently the Coalition will focus on management practices that address all of these pathways to groundwater. Some of these transport pathways can be addressed immediately (transport through wells lacking backflow prevention, improperly abandoned wells); others will require additional research conducted through the MPEP to fully understand which management practices are most effective and under what conditions (movement to groundwater resulting from surface applications of nitrate).

The Coalition approach includes outreach about practices that can be implemented immediately and, through the MPEP, conducting studies that will provide crop-specific information on management practices. In the short term, the Coalition will initiate outreach on management practices that the Coalition knows can reduce the movement of nitrates and pesticides to groundwater through wells. In addition, there are numerous general management practices that can reduce leaching of nitrate from irrigated fields. The Coalition is currently communicating practices about wellhead protection and general practices to manage nitrogen applications to its members through outreach meetings. In the longer term, the emphasis in the Coalition's outreach will be expanded to include the outcome of the MPEP studies which will provide information that is specific to crops, soils, and climatic regions within the Coalition region.

Practices involving wellhead protection and prevention of contaminants moving down active or abandoned wells to groundwater include:

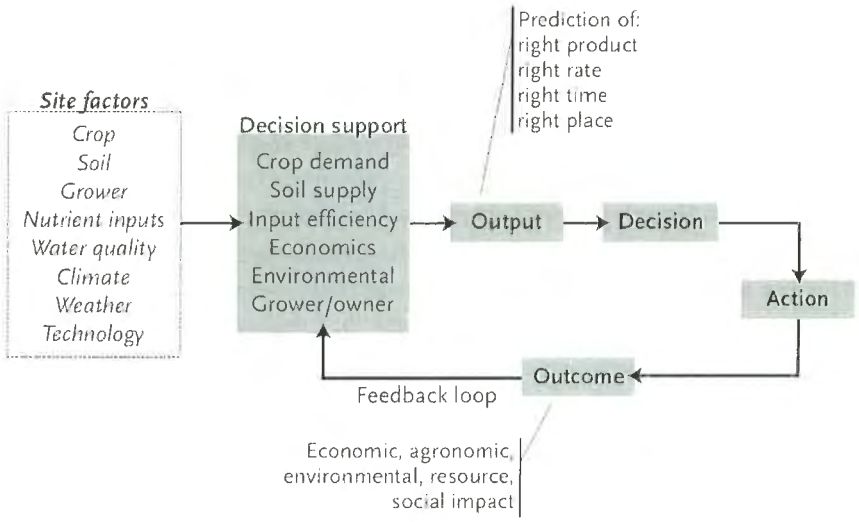
- Installation of proper backflow prevention devices

- Maintenance of area around wellhead including grading ground away from well
- Good housekeeping practices around wellhead
- Properly abandoning/destroying wells

The Coalition will utilize the 4Rs to guide its general approach for managing nutrients. The 4Rs (see below) were developed in the late 1980's at the Potash and Phosphate Institute, which is the predecessor of the International Plant Nutrition Institute. The original authors included a fertilizer industry agronomist and a university scientist who developed the concept to promote agricultural sustainability. Although developed specifically for fertilizers, these practices are also applicable to the management of other soluble constituents.

The International Plant Nutrition Institute (IPNI) is a leader in developing practices to optimize fertilizer applications and efficient use of nitrogen. The IPNI recognizes that there is not one set of universal fertilizer BMPs. By definition, BMPs are site and crop-specific and vary depending on soils, climate, cropping history, and management expertise. There are many uncontrollable factors such as light, temperature, moisture, soils, and cultivar. Controllable factors include fertilizer, soil amendments, pesticide applications, tillage, and other cultural practices. Uncontrollable factors introduce uncertainty into the system which can make management of nutrients difficult. Only when controllable factors are controlled and uncontrollable factors are measured can reliable information on the efficacy of management practices be generated. Once the information is developed, it can be used as part of a larger decision support system to guide the selection and implementation of appropriate management practices. An example of a DSS is provided in Figure 49 which is promoted by IPNI. The Coalition will use this general framework for communicating with growers about implementing fertilizer BMPs.

Figure 49. Decision support system for managing nutrient inputs to irrigated crops. Taken from Fixen (2007).



The 4Rs include right time, right place, right rate, and right source (product):

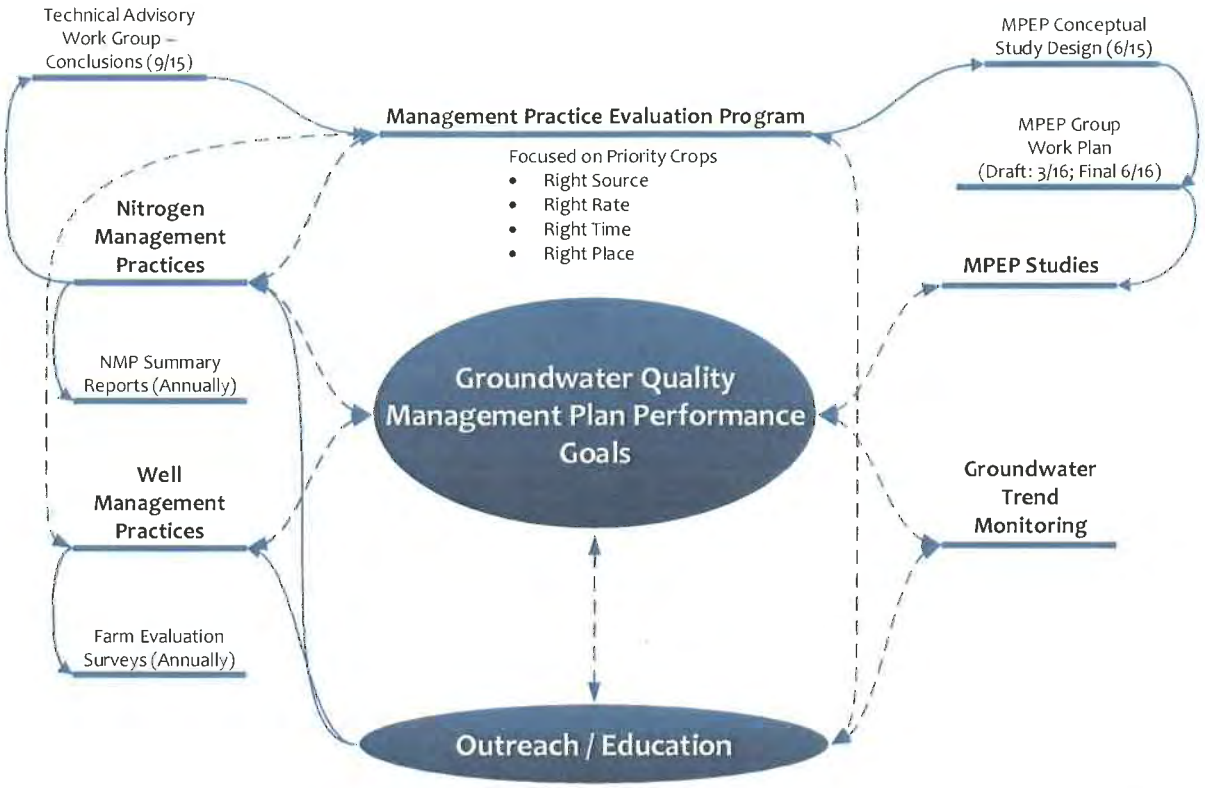
- Right time – nutrients are made available when the plant needs them, can be accomplished by providing when the plant needs them by synchronizing their application with crop demand, properly managing applications e.g. pre-plant or split applications, controlled release technologies, and product stabilizers
- Right rate – match the amount of fertilizer applied to the crop need to reduce losses to leaching or surface water runoff; BMPs include realistic yield goals, soil testing, crop nutrient budgets, tissue testing, plant analysis, applicator calibration, good record keeping and nutrient management plans
- Right place – keep nutrients where the crop can use them. Incorporation or fertigation are usually the best methods of doing this
- Right source (product) – match the fertilizer source and product to crop need and soil properties. Be aware of nutrient interactions and balance nitrogen, phosphorus, potassium, and other nutrients

Many of the basic properties of the 4Rs can be implemented without specific information about the individual crop including actions such as soil testing for residual N, tissue testing, testing of the concentration of nitrate in irrigation water, and developing a nitrogen management plan. However, for more specific management practices associated with the 4Rs, including the right timing of applications, right place (side dress), and right rate (100 lbs/acre vs. 200 lbs/acre), additional research needs to be conducted before the most efficient management practices, including the most optimal nitrogen fertilizer rate, are known for each crop. This research is the purpose of the MPEP.

MANAGEMENT PLAN EFFECTIVENESS

The Coalition will evaluate the effectiveness of the GQMP strategy by 1) documenting nitrate and well head management practices by members and 2) assessing groundwater quality improvements using monitoring data (Figure 50).

Figure 50. Conceptual diagram of the GQMP strategy to evaluation effectiveness.



Tracking of Management Practices

Farm Evaluation Plan surveys (FEPs) are required of members to report the management practices implemented on their farming operation. Completed yearly in HVAs, the FEPs address constituents of concern in both surface and groundwater. For groundwater, the FEPs provide information on wellhead protection, irrigation practices, and nitrogen applications. More specific information on nitrogen management is provided in the Nitrogen Management Plan (NMP) which will be completed yearly by members in HVAs starting in 2015. The NMP provides very specific information about the amount of nitrogen applied, the timing of the nitrogen additions, additional sources of nitrogen available (e.g. irrigation water) to the crop, and anticipated yield. Growers in HVAs will submit NMP summary reports annually starting in 2016 which will includes summary information based on the previous crop year's NMP. The Coalition will use a combination of the FEPs and NMP summary reports to track implementation of management practices in HVAs from year to year.

During 2015 the NMP Technical Advisory Work Group will convene to create a "Crop Nitrogen Knowledge Gap Study Plan" to determine the appropriate metric of nitrogen use to report to the CVRWQCB; it is anticipated that the metric will be some measure of nitrogen uptake and use by the crop. The recommended appropriate ratio of applied N to "consumed N" will be submitted to the Coalition by the members and these values will be tracked over time for each grower with the objective of reducing the potential for leaching nitrate to the groundwater. When the final reporting metric is developed, the Coalition will integrate the measure into the

MPEP studies to determine the appropriate range of target values for the major crops in the Coalition region starting with the priority crops identified in the GAR. Once these target values are known, members will be able to identify and implement practices that will allow them to evaluate their operation and practices (if needed) to minimize the potential for leaching of nitrate to groundwater.

Tracking of Groundwater Quality

Changes in groundwater quality, even first encountered groundwater which may be shallow, are very difficult to document for several reasons including infiltration rate, depth to groundwater, seasonal variation in groundwater quality and depth, yearly variation due to changes in weather (drought years vs. above normal rainfall years), volume of the aquifer, flow rate and path, and the spatial and temporal sample sizes (potentially years) needed to demonstrate a trend. However, the Coalition's Trend Monitoring Program will generate groundwater quality data that can be used to evaluate groundwater quality for COCs as tracked over an extended period of time. Even in shallow groundwater, reductions in nitrate leaching to groundwater may not be identifiable for many years. The nitrate in the vadose zone may take several years to reach groundwater, and the volume of groundwater and concentration of nitrate in that groundwater may make detection of any changes difficult to document. The extended drought in the Central Valley is also greatly delaying any movement of nitrates through the soil profile. Consequently, the first few years of monitoring will establish a baseline from which future trends can be determined and linked to implementation of management practices as reported in the FEPs and NMPs. The time needed to demonstrate improvements in groundwater quality is expected to vary across the Coalition region and therefore it is not known how long it will take to detect trends in groundwater quality.

ACTIONS TO MEET GOALS AND OBJECTIVES

The Coalition conducts outreach meetings regularly throughout the year at various locations in the Coalition region. At these meetings, Coalition monitoring results including exceedances of water quality objectives are discussed as well as management practices that can be implemented to reduce surface water runoff, sediment discharge, and leaching of COCs to groundwater. These practices include but are not limited to wellhead protection, irrigation system maintenance and calibration, and nitrogen management planning.

In addition to the outreach meetings, the Coalition presents information about management practices at individual meetings targeted to specific watersheds. The MPEP will provide substantial information about crop-specific management practices that can be provided to growers. The Coalition will provide information to growers of specific commodities at meetings in the Coalition region focused on conclusions from the MPEP studies. The Coalition will work with the MPEP Group to secure funding for studies on priority crops in HVAs as well as funds for creating additional outreach materials and tools that can be utilized by members to assist with nitrogen application planning relative to the 4Rs.

DUTIES AND RESPONSIBILITIES

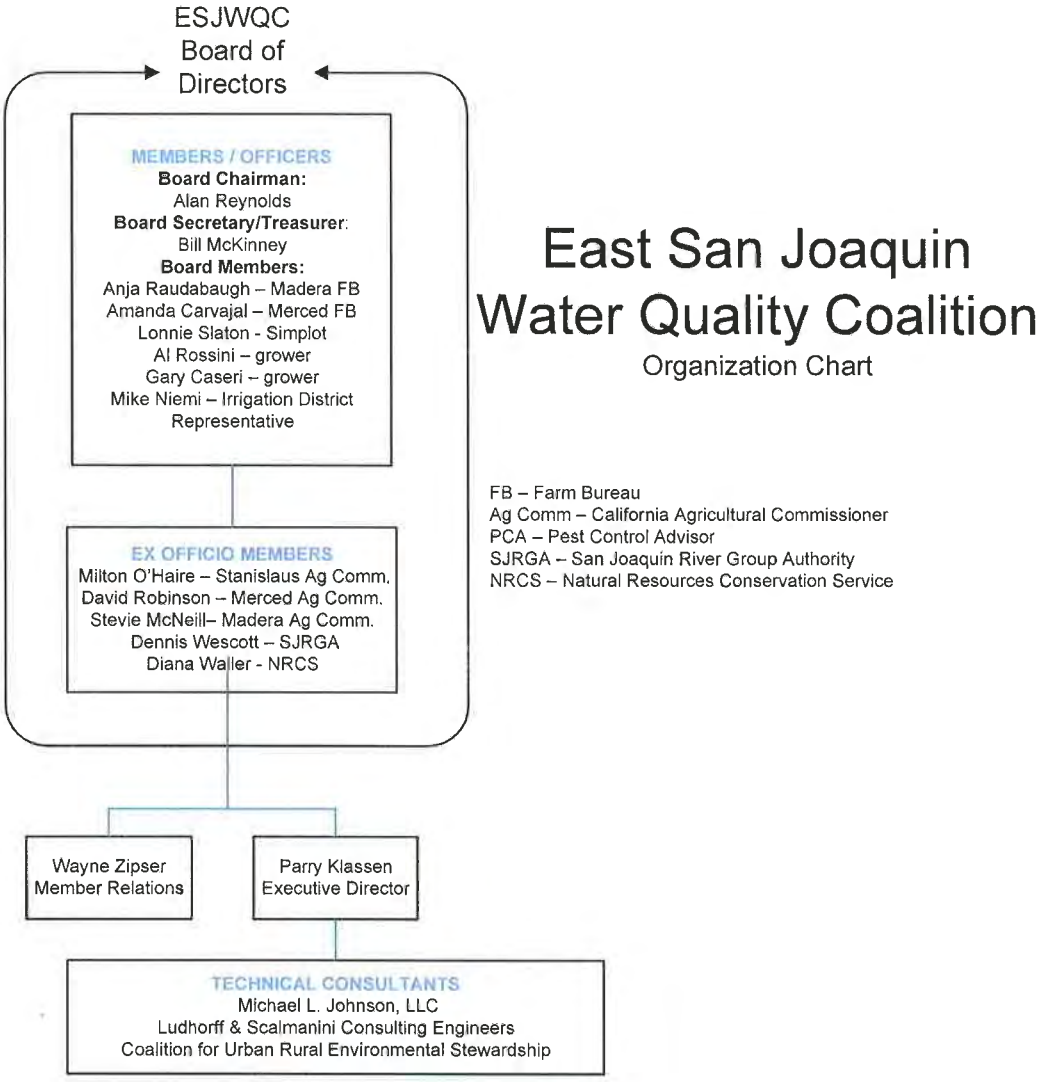
The responsible parties are provided in organizational chart provided below (Figure 51).

ESJWQC policy is determined by a Board of Directors. The ESJWQC Board of Directors (BOD) also oversees all Coalition business. The BOD works closely with the Executive Director to ensure effective management of Coalition activities. Parry Klassen is the Executive Director of the ESJWQC and the project lead for management plan activities. Mr. Klassen is responsible for implementing policy as directed by the Board of Directors including budgeting and financial management, management of the Coalition's membership, member outreach, oversight of consultant contracts, and management of consultant work products. Wayne Zipser is the Coalition Manager of Member Relations. Mr. Zipser is the lead for stakeholder involvement and is responsible for outreach to members, primarily in individual meetings with growers in management plan site subwatersheds. Technical consultants are contracted by the Coalition as needed to complete tasks and activities required by the Regional Water Board. Currently, the technical consultants to the ESJWQC are Michael L. Johnson, LLC; Luhdorff and Scalmanini Consulting Engineers (LSCE), and the Coalition for Urban Rural Environmental Stewardship (CURES). Michael L. Johnson, LLC (MLJ-LLC) will be responsible for conducting the groundwater monitoring and reporting program. LSCE is responsible for developing the Groundwater Trend Monitoring Report, updating the GAR every 5 years and providing technical support for groundwater issues. CURES assists in developing BMP literature and conducting member outreach events.

Coalition Contact Information

Parry Klassen
Executive Director
East San Joaquin Water Quality Coalition
559-288-8125
pklassen@unwiredbb.com

Figure 51. Identification key of responsible parties involved in major aspects of the GWMP.



STRATEGIES TO IMPLEMENT MANAGEMENT PLAN TASKS

Agencies Contacted for Data and/or Assistance

The Coalition utilizes data from DPR to assist with sources of applied pesticides that occur due to applied pesticides. The Coalition works with the each County Agricultural Commissioner office to obtain preliminary data approximately every quarter. These data are reviewed, analyzed and summarized in the Annual Report which includes the Management Plan Progress Report.

The Coalition receives input from NRCS in Modesto regarding county wide NRCS assistance to growers to implement new management practices is summarized in the Management Plan Progress Report. The Coalition encourages members to apply for NRCS funds to implement structural BMPs.

The Coalition is participating in a joint effort to conduct MPEP studies. Other coalitions participating are the Sacramento Valley Water Quality Coalition, San Joaquin County and Delta Water Quality Coalition, and the Westside Water Quality Coalition. The Coalitions have met and developed an administrative structure to manage the MPEP studies, and have convened a technical advisory group consisting of several representatives from UC Cooperative Extension, the fertilizer industry, and commodity groups. The Coalitions selected CURES as the administrative contractor, and have started developing grant proposals to fund MPEP studies.

In addition, several Coalitions are working with the CDFA to develop a nitrogen management curriculum that will allow members who successfully complete the course and certify their Nitrogen Management Plans. The MPEP participants are submitting a grant proposal to CDFA to fund the development of the curriculum of the self-certification course.

The Central Valley Salinity Alternatives for Long Term Solutions (CV-SALTS) process and the Central Valley Salinity Coalition are in the process of developing a Basin Plan Amendment for salt and nitrate that will involve the development of a Salt and Nitrate Management Plan (SNMP). This SNMP will include implementation options that may result in the use of specific management practices in some or the entire Coalition region. The CV SALTS process is anticipated to be completed by 2017 and when that BPA is finalized, the Coalition will re-evaluate its GQMP to determine its compatibility with the requirements of the BPA and the SNMP(s) developed for the Coalition region.

Management Practices to Control COCs

The Coalition uses the information provided by different state and federal agencies when making recommendations to growers about how to eliminate discharges from their farming operation. Recommended practices include a range of actions from reducing the amount of pesticide applied to installation of pressurized irrigation systems. Some of the management practices are not technically feasible on some crops. Some practices may be technically feasible but for some members, the practices may not be economically feasibility. For these members, the Coalition provides information about programs that provide a cost share of the purchase and installation improving the affordability of these systems.

Grower meetings

Meetings in each of the major counties (Stanislaus, Merced, and Madera Counties) in the Coalition region are typically the held three time each year. Additional meetings can be called at any time during the year if circumstances warrant. At these meetings, the Coalition discusses the water quality results for the year, new management plans that can improve water quality, and any changes in requirements due to updates of the WDR by the Regional Water Board.

Meetings within a smaller geographic area are held periodically. These meetings are arranged as needed and can involve the participation of individuals with specialized training, e.g. NRCS or UC Extension personnel. If the Coalition determines that meeting with a subgroup of members in the high priority areas within the HVAs will provide information that can lead to increased implementation of practices known to be protective of groundwater quality, the Coalition will organize a meeting with members who grow a specific crop such as almonds or operate of a groundwater basin of specific interest.

Other entities within the Coalition region hold meetings where water quality results and management practices are discussed. Meetings are conducted by the County Agricultural Commissioner to satisfy education requirements involved in receiving a pesticide application permit. Although not the focus of these meetings, presentations focusing on water quality and management practices are given specifically addressing pesticides and pesticide applications.

Outside of a formal meeting setting, the Coalition provides information to growers throughout the year through mailings, emails, newsletters and an annual member summary report. Through these media the Coalition presents information to members concerning the Coalition's progress in achieving water quality goals, monitoring results and management practices proven to be effective to reduce the discharge of nutrients and pesticides to groundwater. All outreach and education activities are reported in the ESJWQC Annual Report submitted by May 1 of each year.

The Coalition also hosts a website (http://www.esjcoalition.org/home.asp), which serves as a clearing house for Coalition activities and outreach on management practices. Information provided through the website is utilized as a supplement to regular grower contacts and meetings.

Pest Control Advisors, Agricultural Commissioners, Registrants, and Fertilizer Manufacturers

Agricultural Commissioners from Stanislaus, Merced, and Madera Counties are active participants as non-voting members of the ESJWQC Board of Directors. The Coalition collaborates with County Agricultural Commissioners, Pest Control Advisors (PCAs), and pesticide registrants to provide information on effective management practices to growers within the ESJWQC region. As the focus or water quality expands to groundwater, the Coalition has enlisted assistance from fertilizer manufacturers and their CCAs to work with members to optimize their nitrogen applications to achieve the maximum yield and eliminate discharge to groundwater.

The Coalition's Performance Goals are built on actions essential for successful completion of the Management Plan strategy. The Performance Goals reflect the steps necessary to guarantee that the objectives of the Management Plan program are met and that groundwater quality improves in the ESJWQC region.

The following section describes the Performance Measures associated with each Performance Goal (Table 16). These Performance Measures are the actions the Coalition will perform to meet the Performance Goals. Included in the table of Performance Goals and Performance Measures are the parties responsible for performing the actions described by the Performance Measures.

Performance Goal 1. Identify member parcels in areas requiring a GQMP.

Performance Measures

1.1 Map parcels of members in each GQMP Zone.

The ESJWQC will review member parcels in relation to the most recent groundwater high vulnerability areas and trend monitoring results (if applicable). This information will be used to identify member acreage within the ESJWQC GQMP area and will be reported on in the annual Management Plan Progress Report.

Performance Goal 2. Review the members' Farm Evaluation Plan survey (FEPs) to determine number/type of well management practices in place.

Performance Measures

2.1 Review FEP from 100% of member parcels in a GWMP for well management practices.
2.2 Identify members with abandoned wells where it is unknown how they were abandoned (e.g. unknown method, no selection on survey).
2.3 Identify well management practices not currently used by members that can be recommended to prevent discharges to groundwater.

The Farm Evaluation Plan survey (FEP) is completed by all members in high vulnerability regions annually. The Coalition will review these submissions to determine what practices are in place on member farming operations in regards to well management practices. The Coalition will conduct outreach to members who did not indicate a method for properly abandoning their wells on their Farm Evaluation. In addition, the Coalition will review well management practice responses and conduct outreach and education about additional practices that should be implemented to prevent discharges to groundwater. The Coalition will report on well management practices and additional recommended practices in the Management Plan Progress Report.

Performance Goal 3. Review the members' Farm Evaluation Plan survey (FEPs) to determine number/type of irrigation, pesticide and nitrate management practices in place.

Performance Measures

3.1 Review FEP from 100% of member parcels in GWMP for irrigation, pesticide and nitrate management practices.
3.2 Identify management practices not currently used by members that can be recommended to prevent discharges to groundwater based on MPEP study results.

Irrigation, pesticide and nitrate management practices will be recorded in an Access database annually to track changes in member management practices over time. As the MPEP studies are conducted, the results will be

communicated to members within the Coalition as effective management practices to reduce the potential for discharging nitrogen to the groundwater. The Management Plan Progress Report will identify management practices that have been identified by the Coalition (either through the MPEP or other resources) to be effective in reducing the potential for leaching of pesticides, nitrates and salts.

Performance Goal 4. Conduct outreach to inform members of water quality problems and recommend additional practices.

Performance Measures

4.1 Provide groundwater monitoring results at meetings with members and discuss practices that can be used to reduce leaching of COCs to groundwater.
4.2 When available and appropriate, provide information to members on the results of the MPEP.
4.3 Track attendance at meetings attended by the targeted members.

The Coalition conducts a series of Annual Meetings in addition to various meetings throughout the year. Results of groundwater monitoring will be discussed with members at Coalition meetings as well as the various management practices that can be implemented to reduce the leaching of COCs to groundwater. As results of the MPEP studies are available, the Coalition will present this information to its members in addition to having information available on its website. Attendance will be tracked at meetings to ensure that members within groundwater high vulnerability zones attend these meetings and are informed of current groundwater quality conditions.

Performance Goal 5. Improve understanding of effective management practices to reduce potential for leaching of COCs.

Performance Measures

5.1 Identify high priority crops and any data gaps through the NMP Technical Advisory Group.
5.2 Conduct studies through the MPEP to help fill data gaps regarding management practice effectiveness.
5.3 Create online resources regarding MPEP study results and information regarding the 4Rs.

The Coalition will work with the NMP Technical Advisory Group to identify high priority crops and data gaps that are necessary to resolve for better understanding the effectiveness of nitrogen application practices. The NMP Technical Advisory Group are expected to have conclusions regarding the data gaps and suggestions for what should be reported in the Nitrogen Summary Report. This information will be summarized in the Management Plan Progress Report and disseminated to members. The MPEP studies will assist with filling in data gaps identified through the NMP Technical Advisory Group as well as better understand the efficacy of many of the practices currently being implemented by ESJWQC members. The Coalition will participate in the MPEP planning process including study design implementation and working with participating members to conduct the studies as necessary. The Coalition anticipates that online resources will be necessary to disseminate the results of the NMP Technical Advisory Group, the MPEP studies, other nitrogen management studies, and various information regarding the 4Rs for specific crops. The ESJWQC will post resources on the ESJWQC website including links to existing webpages with pertinent information regarding nitrogen and irrigation management.

Performance Goal 6. Improve understanding of effective management practices to reduce potential for leaching of COCs.

Performance Measure

6.1 Evaluate monitoring results from the Groundwater Trend Monitoring Program for COCs.

Once the Groundwater Trend Monitoring Program is initiated, the Coalition will review the results annually in its Management Plan Progress Report and adjust the COCs in each GQMP Zone as needed. The results will be reviewed in relation to changes in management practices as documented in the FEPs as well as changes in nitrogen applications as recorded in the NMP Summary Reports.

Table 16. Performance Goals for the ESJWQC GQMP.

Performance Goal/Performance Measure	Outputs	Who
Performance Goal 1: Identify member parcels in areas requiring a GQMP.		
Performance Measure 1.1. – Map parcels of members in each GQMP Zone.	Report in Management Plan Progress Report the acreage represented by members in a GQMP area.	MLJ-LLC
Performance Goal 2: Review the member's Farm Evaluation Plan (FEP) to determine number/type of well management practices in place.		
Performance Measure 2.1 – Review FEP from 100% of member parcels in a GWMP for well management practices.	Completed individual management practice evaluations recorded in an Access database.	MLJ-LLC
Performance Measure 2.2 – Identify members with abandoned wells where it is unknown how they were abandoned (e.g. unknown method, no selection on survey).	Conduct outreach to members that have not properly abandoned a well or did not record an answer.	Parry Klassen/MLJ-LLC
Performance Measure 2.3 – Identify well management practices not currently used by members that can be recommended to prevent discharges to groundwater.	Summary in the Management Plan Progress Report of management practices recommended to members.	Parry Klassen
Performance Goal 3: Review the member's Farm Evaluation Plan (FEP) to determine number/type of irrigation, pesticide and nitrate management practices in place.		
Performance Measure 3.1 – Review FEP from 100% of member parcels in a GWMP for irrigation, pesticide and nitrate management practices.	Completed individual management practice evaluations recorded in an Access database.	MLJ-LLC
Performance Measure 3.2 – Identify management practices not currently used by members that can be recommended to prevent discharges to groundwater based on MPEP study results.	Summary in the Management Plan Progress Report of management practices identified as reducing the potential for leaching pesticides, nitrates and salts.	Parry Klassen/MLJ-LLC
Performance Goal 4: Conduct outreach to inform members of water quality problems and recommend additional practices.		
Performance Measure 4.1 – Provide groundwater monitoring results at meetings with members, and discuss practices that can be used to reduce leaching of COCs to groundwater.	Agendas and/or reports of all meetings with members.	Parry Klassen/MLJ-LLC
Performance Measure 4.2 – When available and appropriate, provide information to members on the results of the MPEP.	Provide reports from studies through meetings and the ESJWQC website.	Parry Klassen
Performance Measure 4.3 - Track attendance at meetings attended by the targeted members.	Report of members attending meetings provided in Management Plan Progress Report.	Parry Klassen/MLJ-LLC
Performance Goal 5: Improve understanding of effective management practices to reduce potential for leaching of COCs.		
Performance Measure 5.1 – Identify high priority crops and any data gaps through the NMP Technical Advisory Group.	Include conclusions from NMP TAC in Management Plan Progress Report.	MLJ-LLC
Performance Measure 5.2 – Conduct studies through the MPEP to help fill data gaps regarding management practice effectiveness.	Participate in the MPEP including study design implementation.	MLJ-LLC
Performance Measure 5.3 – Create online resources regarding MPEP study results and information regarding the 4Rs.	Post resources on the ESJWQC website.	MLJ-LLC
Performance Goal 6: Evaluate effectiveness of new management practices.		
Performance Measure 6.1 – Evaluate monitoring results from the Groundwater Trend Monitoring Program for COCs.	Assess results in Management Plan Progress Report.	MLJ-LLC
Performance Measure 6.2 – Compare annually changes in well, irrigation, pesticide and nitrate management practices recorded on FEPs.	Evaluate changes in Management Plan Progress Report.	MLJ-LLC
Performance Measure 6.3 – Evaluate trends in groundwater quality every 5 years in the GAR.	Trend analysis of COCs in GAR.	Luhdorff & Scalmanini

Each year the Coalition will evaluate and report on the management practices implemented the previous year by members within GQMP Zones. During the year the Coalition will conduct outreach and education to members regarding effective management practices that can be implemented to reduce the transport of COCs to groundwater. As data gaps regarding the 4Rs for specific crops are decreased, this information will be included in the Coalition's outreach and education efforts. The following milestones were developed based on this strategy and supplemented with target dates based on the objectives of this GQMP.

Milestone 1: Within 2 years of the approved GQMP, additional management practices will be implemented by members in high vulnerability areas especially regarding well management and nitrogen management (Target Date – 2018).

Milestone 2: Within 3 years of the initiation of the MPEP studies, identify a schedule for implementation of practices identified as effective by the MPEP (Target Date – 2020).

Milestone 3: Within 10 years of approved GQMP, all known abandoned wells will be properly abandoned (Target Date – 2026).

Milestone 4: Within 10 years of conducting Groundwater Trend Monitoring, show a reduction of the amount of nitrate being discharged to groundwater by irrigation agriculture for the priority crops almonds, walnuts and tomatoes through a combination of implemented management practices and monitoring data.

MONITORING METHODS

MONITORING DESIGN

The Coalition's groundwater monitoring strategy is currently being developed through the Groundwater Trend Monitoring Program and the Management Practices Evaluation Program. The Groundwater Trend Monitoring Program Work Plan will be submitted in June 2015 that will include a comprehensive monitoring program for groundwater quality. In addition, the MPEP will develop several studies of management practices to determine if they are protective of groundwater. A conceptual work plan will be submitted by June 4, 2015 and the final work plan will be submitted by June 4, 2016.

Minimum Groundwater Monitoring Requirements

According to the Order, "Trend monitoring wells will be sampled, at a minimum, annually at the same time of the year for the indicator parameters identified in Table 17 below."

Table 17. Groundwater monitoring parameters (WDR, Attachment B, pg. 19).

CONSTITUENTS, PARAMETERS, AND TESTS	
ANNUAL MONITORING	
Dissolved Oxygen* (mg/L)	Physical Parameters and General Chemistry
Electrical Conductivity* (µmhos/cm)	
pH* (in pH units)	
Temperature* (°C)	
Nitrate* as nitrogen (mg/L)	
TREND MONITORING	
Total Dissolved Solids (SC, field measure)	Physical Parameters and General Chemistry
Carbonate	Anions
Bicarbonate	
Chloride	
Sulfate	
Boron	Cations
Calcium	
Sodium	
Magnesium	
Potassium	

*Field parameters

GROUNDWATER MANAGEMENT PLAN ZONES

MODESTO SUBBASIN MANAGEMENT ZONE

Introduction and Background

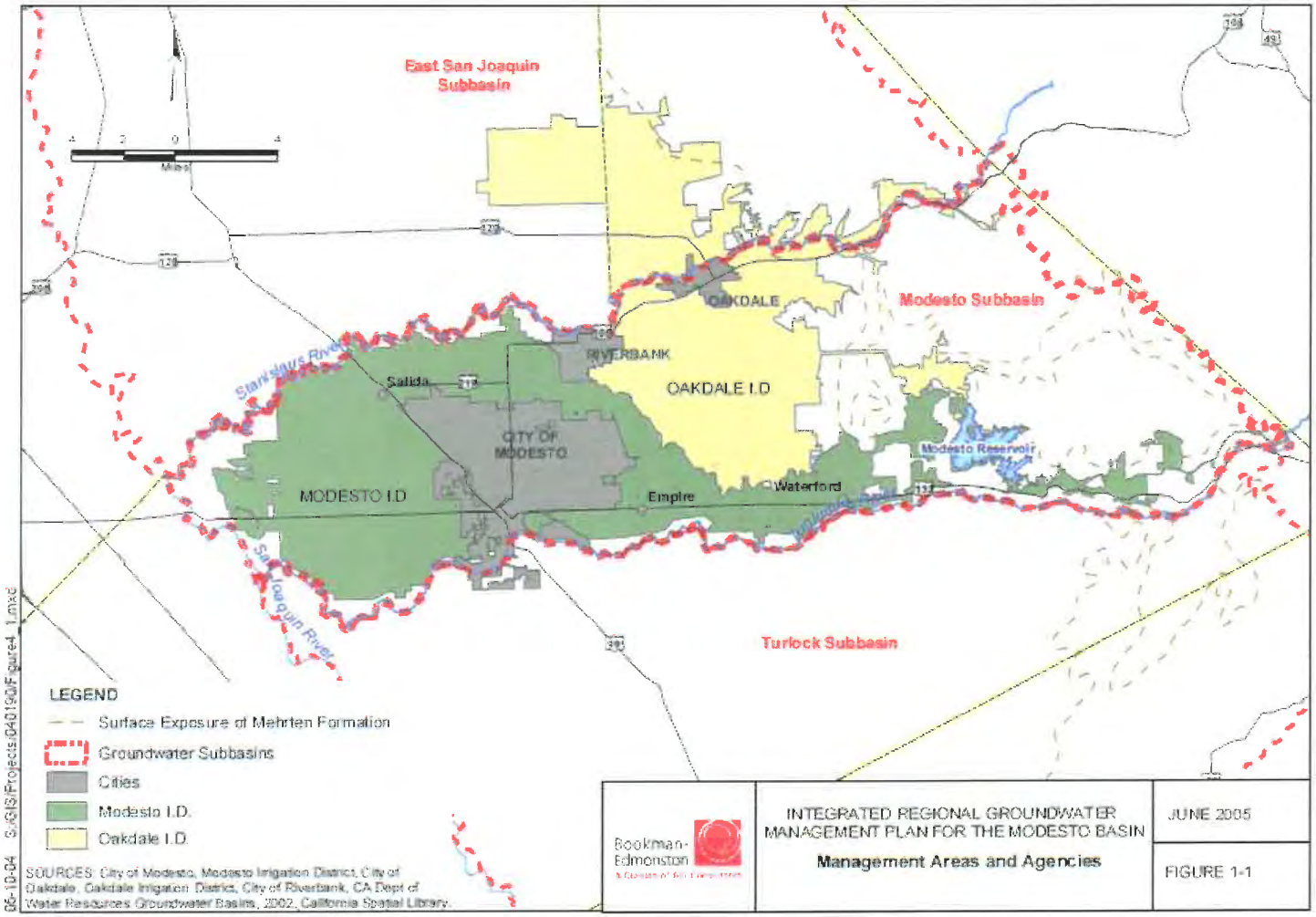
The Modesto GQMP Zone is the northern most zone within the Coalition including the entire Modesto Groundwater Subbasin and the southernmost border of the Eastern San Joaquin Groundwater Subbasin. The entire Modesto subbasin is within the Stanislaus County.

Existing Groundwater Management Plans/Entities

Figure 52 illustrates the six agencies covering the Modesto Groundwater Subbasin. These six agencies formed the Stanislaus and Tuolumne Rivers Groundwater Basin Association in 1994 to provide a forum for coordinated planning and management of the Subbasin. These six agencies are: the City of Modesto, the Modesto Irrigation District (MID), the City of Oakdale, The Oakdale Irrigation District (OID), the City of Riverbank, and Stanislaus County" (Bookman-Edmonston, 2005). The Integrated Regional Groundwater Management Plan for the Modesto Subbasin includes a table of "Current Level of Monitoring Efforts". This table lists a number of member agencies, including MID, OID, a number of small communities and also DWR and CDPH. "Altogether, the table shows a total of 113 wells monitored for water levels and 104 wells monitored annually for water quality" (Luhdorff and Scalmanini, 2014).

Figure 52. Integrated Regional Groundwater Management Plan Area for the Modesto Subbasin and participating agencies.

(Bookman-Edmonston, Integrated Regional Groundwater Management Plan for the Modesto Subbasin, Stanislaus & Tuolumne Rivers Groundwater Basin Association, Figure 1-1, 2005).



Basin Boundaries and Surface Hydrology

"The Modesto subbasin lies between the Stanislaus River to the north and Tuolumne River to the south and between the San Joaquin River on the west and crystalline basement rock of the Sierra Nevada foothills on the east. The northern, western, and southern boundaries are shared with the Eastern San Joaquin Valley, Delta-Mendota, and Turlock Groundwater Subbasins, respectively. The subbasin comprises land primarily in the Modesto Irrigation District (MID) and the southern two-thirds of the OID. The City of Modesto is in the southwestern portion of the subbasin. Average annual precipitation for this subbasin is 11 to 15 inches, increasing eastward" (DWR, Bulletin 118).

Geology, Hydrogeology, and Groundwater Hydrology

The characteristics of the Modesto, Turlock, and Merced groundwater subbasins which underlay the Modesto, Turlock, and Merced GQMP Zones are described as study areas within the Central Eastside Study Unit in the USGS' Status and Understanding Groundwater Quality in the Central-Eastside San Joaquin Basin Study Unit, 2006: California GAMA Priority Basin Project (Figure 53). The main water-bearing units of the Modesto, Turlock, and Merced study areas include the unconsolidated alluvial-fan deposits of the Pleistocene-age Riverbank Formation, the deeper unconsolidated Pleistocene-age Turlock Lake and Pliocene-age Laguna Formations, and the semi-consolidated Miocene-Pliocene-age Mehrten Formation.

Groundwater conditions are unconfined, semi-confined, and confined in different zones of the groundwater system in the Central Eastside study unit. The base of freshwater, where estimated, generally is more than 700 feet (ft) below land surface, but may be as shallow as 300 ft in parts of the study unit. Unconfined conditions are present in unconsolidated deposits above and east of the Corcoran Clay Member of the Turlock Lake Formation, which underlies the southwestern half of the study unit at depths ranging from 50 to 250 ft. Confined conditions are present below the Corcoran Clay. Semi-confined conditions are present at depth east of the Corcoran Clay, because of many discontinuous clay lenses (Landon, et al., 2010).

Figure 53. Geologic setting of the Central-Eastside San Joaquin Basin study unit.

(US Department of the Interior and US Geologic Survey, Status and Understanding Groundwater Quality in the Central-Eastside San Joaquin Basin Study Unit, 2006: California GAMA Priority Basin Project, Figure 5, pg. 10, 2006).

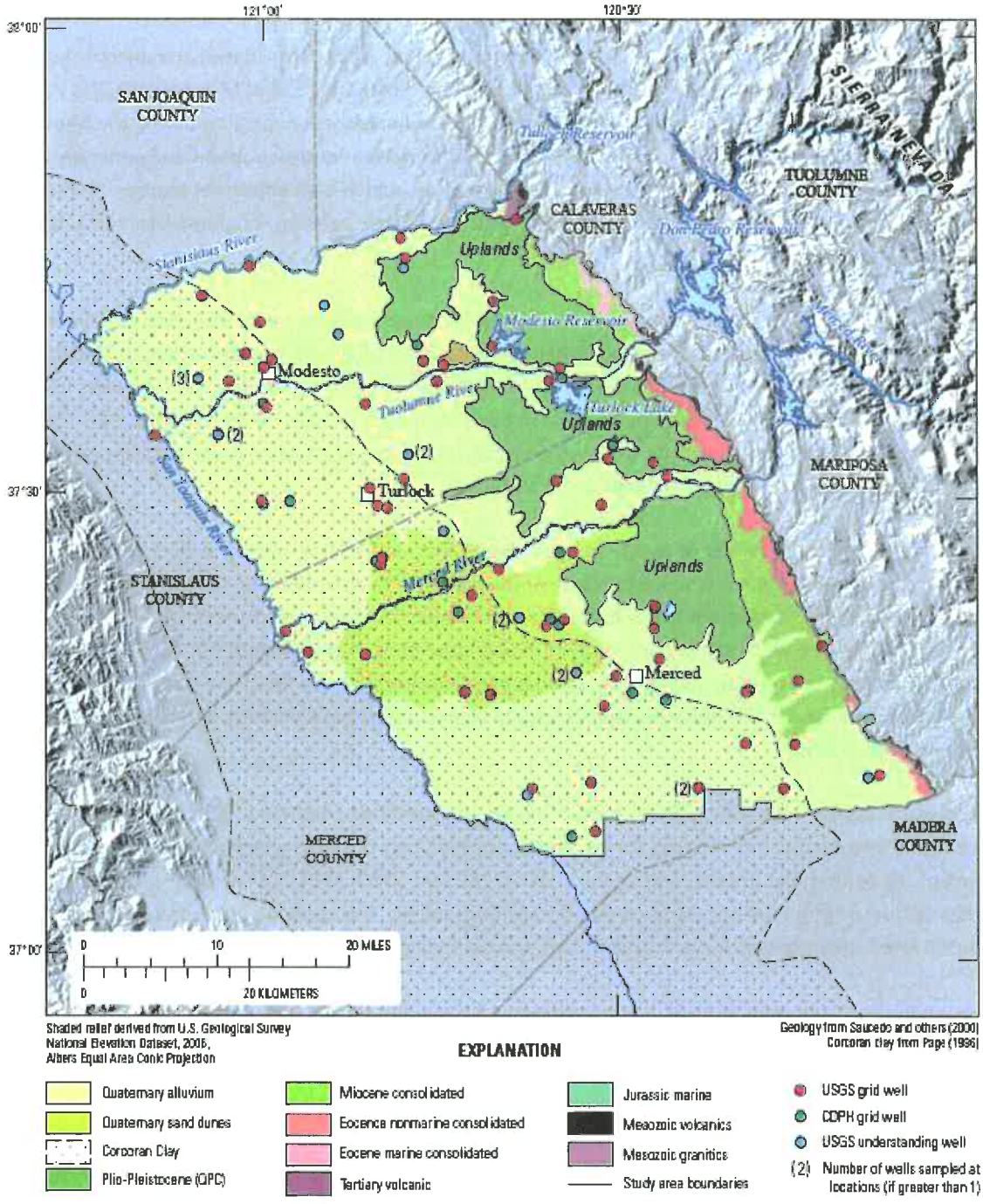


Figure 5. Geologic map of the Central Eastside, California, Groundwater Ambient Monitoring and Assessment (GAMA) study unit.

The geology, hydrogeology and groundwater hydrology description for the Modesto subbasin is taken almost exclusively from Bulletin 118 (DWR 2003).

Water Bearing Formations

The primary hydrogeologic units in the Modesto Subbasin include both consolidated and unconsolidated sedimentary deposits. The consolidated deposits include the lone Formation of Miocene age, the Valley Springs Formation of Eocene age, and the Mehrten Formation, which was deposited during the Miocene to Pliocene Epochs. The consolidated deposits lie in the eastern portion of the subbasin and generally yield small quantities of water to wells except for the Mehrten Formation, which is an important aquifer. In the Subbasin, the Mehrten Formation is composed of up to 300 feet of sandstone, breccia, conglomerate, tuff siltstone and claystone (Page 1973).

The unconsolidated deposits were laid down during the Pliocene to present and, from oldest to youngest, include continental deposits lacustrine and marsh deposits, older alluvium, younger alluvium, and flood-subbasin deposits. The continental deposits and older alluvium are the main water-yielding units in the unconsolidated deposits. The lacustrine and marsh deposits (which include the Corcoran, or "E-" Clay), and the flood-subbasin deposits yield little water to wells, and the younger alluvium in most places probably yields only moderate quantities of water to wells (page 1973).

The continental deposits consist of poorly sorted gravel, sand, silt and clay varying in thickness from 0 to 450 feet occurring at the surface on the eastern side of the subbasin to over 400 feet deep in the western portion. These deposits are the equivalent of the North Merced Gravels and the lower Turlock Lake Formation (Davis and others 1959). The older alluvium consists of intercalated beds of gravel sand, silt, and clay with some hardpan. This alluvium is up to 400 feet thick and is generally present near or at the surface of the western one-half of the subbasin. The older alluvium is largely equivalent to the Riverbank and Modesto Formations (Davis and others 1959).

Ground water occurs under unconfined, semi-confined, and confined conditions. The unconfined waterbody occurs in the unconsolidated deposits above and east of the Corcoran Clay, which underlies the southwestern portion of the subbasin at depths ranging from 150 to 250 feet (DWR 1981). Where clay lenses restrict the downward flow of groundwater, semi-confined conditions occur. The confined waterbody occurs in the unconsolidated deposits below the Corcoran Clay and extends downward to the base of fresh water.

The estimated average specific yield of this subbasin is 8.8 percent (based on DWR San Joaquin District internal data and Davis and others 1959).

Restrictive Structures

Groundwater flow is primarily to the southwest, following the regional dip of basement rock and sedimentary units. The lower to middle reaches of the Stanislaus and Tuolumne Rivers in the Subbasin appear to be gaining streams with groundwater flow into both, especially the Tuolumne River (DWR 2000). No faults have been identified that affect the movement of fresh groundwater (Page and Balding 1973).

Recharge Areas

Groundwater recharge is primarily from deep percolation of applied irrigation water and canal seepage from MID and OID facilities. Seepage from Modesto Reservoir is also significant (STRGBA 1995). Lesser recharge occurs as a result of subsurface flows originating in the mountains and foothills along the east side of the subbasin, losses from minor streams, and from percolation of direct precipitation.

'The irrigation supply is provided primarily by surface water draining from the Sierra Nevada, and stored in reservoirs. The surface-water supplies are managed by irrigation districts and delivered to agricultural users through hundreds of miles of lined canals. Primary sources of discharge are pumping withdrawals for irrigation and municipal water supply, evaporation from areas with a shallow depth to water, and discharge to streams. Agricultural irrigation supplied by surface water and groundwater accounts for about 95 percent of the total water use in the region' (Landon, et al., 2010).

Groundwater Level Trends

Changes in groundwater levels are based on annual water level measurements by DWR and cooperators. Water level changes were evaluated by quarter township and computed through a custom DWR computer program using geostatistics (kriging). On average, the subbasin water level has declined nearly 15 feet from 1970 through 2000. The period from 1970 through 1978 showed steep declines totaling about 12 feet. The six-year period from 1978 to 1984 saw stabilization and rebound of about 7 feet. 1984 through 1995 again showed steep declines, bottoming out in 1995 at nearly 20 feet below the 1970 level. Water levels then rose about 5 feet from 1996 to 2000. Water level declines have been more severe in the eastern portion of the subbasin, but have risen faster in the eastern subbasin between 1996 and 2000 than in any other portion of the subbasin.

Groundwater Storage

Estimations of the total storage capacity of the subbasin and the amount of water in storage as of 1995 were calculated using an estimated specific yield of 8.8 percent and water levels collected by DWR and cooperators. According to these calculations, the total storage capacity of this subbasin is estimated to be 6,500,000 af to a depth of 300 feet. According to published literature, the amount of stored groundwater in this subbasin as of 1961 is 14,000,000 af to a depth of < 1000 feet (Williamson 1989).

Groundwater Budget (Type B)

Although a detailed budget was not available for this subbasin, an estimate of groundwater demand was calculated based on the 1990 normalized year and data on land and water use. A subsequent analysis was done by a DWR water budget spreadsheet to estimate overall applied water demands, agricultural groundwater pumpage, urban pumping demand and other extraction data.

Natural recharge into the subbasin is estimated to be 86,000 af. Artificial recharge and subsurface inflow values are not determined. There is approximately 92,000 af of applied water recharge. Annual urban and agricultural extractions are estimated to be 81,000 and 145,000 af, respectively. There are no other extractions, and values for subsurface outflow are not determined.

Groundwater Quality Characterization

The groundwater in this basin is of a calcium bicarbonate type in the eastern subbasin to a calcium-magnesium bicarbonate or calcium-sodium bicarbonate type in the western portion. The TDS values range from 60 to 8,300 mg/L, with a typical range of 200 to 500 mg/L. The Department of Health Services, which monitors Title 22 water quality standards, reports TDS values in 88 wells ranging from 60 to 860 mg/L, with an average value of 295 mg/L.

Groundwater Quality Impairments

There are areas of hard groundwater and localized areas of high chloride, boron, DBCP, nitrate, iron, and manganese. Some sodium chloride waters of high TDS values are found along the east side of the subbasin. There are also some areas of shallow groundwater in the subbasin that require dewatering wells.

Land Use/Irrigated Land

Management Practices/Crops in Zone

Tables 18 and 19 describe land uses within the Modesto GQMP Zone from two different data sets, USDA (2012) and DWR (early 2000s), respectively. Table 18 indicates almonds, other-hay/non-alfalfa, walnut, alfalfa, clover/wildflower, and oats as the crops capturing over 85% of the land use in the Modesto GQMP Zone, regardless of irrigated or non-irrigated status. DWR data indicates the top irrigated crop as deciduous fruits and nuts, which also include almonds.

Table 18. Land use acreage within the entire Modesto GQMP Zone1.

Row Labels	Acreage	Percent acreage of Zone*
Almonds	40818	37.22%
Other Hay/Non Alfalfa	16316	14.88%
Walnuts	13391	12.21%
Alfalfa	11714	10.68%
Clover/Wildflowers	6115	5.58%
Oats	5589	5.10%
Double Crop Oats/Corn	3950	3.60%
Winter Wheat	2447	2.23%
Grapes	2184	1.99%
Double Crop Winter Wheat/Corn	1537	1.40%
Fallow/Idle Cropland	1229	1.12%
Grand Total for Agricultural Crops	105290	96.01%

[1]Land use information obtained from data provided by USDA, 2012 California Cropland Data Layer; http://www.nass.usda.gov/research/Cropland/SARS1a.htm. Land use in some areas of the ESJWQC may have changed since that time.
*Percent of cropped area includes all agricultural fields, whether fallow or active. Land use categories such as barren, developed, and native or wetland vegetation were not included in acreage totals. Crops contributing 1% or more of the overall land use within the GQMP area were included.

Table 19. Land use acreage as associated with irrigation data within the Modesto GQMP Zone by ESJHVA Priority 1-3 areas.

Land uses derived from DWR data in order to incorporate irrigation data designated as irrigated/non-irrigated (I/NI); numbers are rounded to nearest whole number.

Land Use	I/NI	Priority 1	Priority 2	Priority 3	Outside ESJHVA
Citrus & Sub-Tropical	I	0	5	33	0
Citrus & Sub-Tropical	N	0	0	1	29
Deciduous Fruits & Nuts	I	2898	16084	18416	16706
Field Crops	I	641	5944	6556	7245
Grain & Hay	I	161	368	501	186
Grain & Hay	N	2	23	76	2171
Idle	I	12	369	419	457
Native Riparian	N	36	288	4170	3135
Native Vegetation	N	103	801	4724	78791
Open Water	N	35	591	1650	2773
Pasture	I	264	1521	12806	19397
Pasture	N	17	63	147	1898
Rice	I	0	127	93	1465
Semi-agricultural	N	123	1375	2421	3759
Truck, Nursery, Berry	I	211	717	1104	268
Urban	N	528	19841	17996	3142
Vineyard	I	66	945	2458	1119

* Land use information obtained from data provided by DWR, http://www.water.ca.gov/landwateruse/anaglwu.cfm. Data compiled in 2001, land use in some areas of the ESJWQC may have changed since that time.

Constituents of Concern in Zone

Nitrates

Tables 20 and 21 describe nitrogen as nitrate within the Modesto GQMP Zone. Table 18 indicates that of those wells sampled in the Modesto GQMP Zone, approximately 24% exceeded the MCL of 10mg/L. Table 21 indicates that of those wells with nitrate exceedances from 2005-2013, the majority (107) are located in the Priority 3 area of the ESJHVA.

Table 20. Count of nitrate (NO3) detections from 5-10mg/L and exceedances >10mg/L by well from 2005-2013 for the Modesto GQMP Zone.

	Count of Wells			Percent of Wells		
	NO_3 <5 mg/L	NO_3 5-10 mg/L	NO_3 > =10 mg/L	NO_3 <5 mg/L	NO_3 5-10 mg/L	NO_3 > =10 mg/L
Modesto GQMP Zone	391	234	199	47%	28%	24%

Table 21. Number of individual wells with nitrate exceedances (greater than 10 mg/L) by well from 2005-2013 for the Modesto Groundwater Management Zone relative to ESJHVA Priority Areas 1, 2, or 3.

Well, nitrate, and ESJHVA priority designation data used here are the same as those data compiled in the GAR.

Zone	ESJHVA Priority Areas			
	Priority 1	Priority 2	Priority 3	Outside ESJHVA
Modesto GQMP Zone	4	81	107	7

TDS

Tables 22 and 23 describe TDS levels within the Modesto GQMP Zone. Table 22 indicates that of those wells sampled in the Modesto GQMP Zone, approximately 43% exceeded the agricultural MCL of 450 mg/L. Table 23 indicates that of those wells with TDS exceedances from 2005-2013, the majority (28) are located in the Priority 3 area of the ESJHVA.

Table 22. Count of wells with detections of TDS (less than 450 mg/L) and exceedances of TDS (equal to or greater than 450 mg/L) by well from 2005-2013 within the Modesto GQMP Zone.

Well and TDS data used here are the same as those data compiled in the GAR.

Zone	Count of Wells			% wells TDS>450
	TDS<450	TDS>=450	Total wells	
Modesto GQMP Zone	273	208	481	43%

Table 23. Number of individual wells with TDS exceedances (greater than 450 mg/L) by well from 2005-2013 for the Modesto GQMP Zone relative to ESJHVA Priority Areas 1, 2, or 3.

Well, TDS, and ESJHVA priority designation data used here are the same as those data compiled in the GAR.

Zone	ESJHVA Priority Areas			
	Priority 1	Priority 2	Priority 3	Outside ESJHVA
Modesto GQMP Zone	10	24	28	6

As stated in previous sections, of the eight pesticides recorded as having exceeded WQTLs in the GAR, only diazinon and simazine are currently registered for application and use with the DPR. Only diazinon and simazine are to be considered COCs for current groundwater quality management purposes. No exceedances of pesticide COCs occurred in the Modesto GQMP Zone. The below data (Tables 24 and 25) indicate detections only.

Table 24. Summary of pesticide detections (below MCL threshold) and exceedances (at or above MCL threshold) for the Modesto GQMP Zone by individual well and TRS. COCs in this GQMP are bolded.

Well and pesticide data used below are those data compiled in the GAR.

Pesticide	Individual Wells with Detections	Individual Wells with Exceedances	Individual TRS with Detections	Individual TRS with Exceedances	Concentration in Samples with Detections (µg/L)		Exceedance Threshold Used (µg/L)	Basis for Exceedance Threshold
					Minimum	Maximum		
DBCP	107	73	55	37	0.002	166.000	0.2	CA Primary MCL
Ethylene Dibromide	7	5	4	4	0.010	0.210	0.05	CA Primary MCL
Naphthalene	1	0	1	0	0.700	0.700	17	CA Notification
Simazine	**9**	**0**	**9**	**0**	**0.004**	**0.120**	**4**	**CA Primary MCL**
Tetrachloroethane	1	0	1	0	0.840	0.840	1	CA Primary MCL

Pesticide data are for the period 1979-2011 provided by the California Department of Pesticide Regulation (DPR)
TRS-Township Range Section
*Exceedance thresholds used are based on values reported in the SWRCB Water Quality Goals Online Database (http://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.shtml), when available. Selection of the threshold value for use to indicate an exceedance is based on a hierarchy consisting of the following order of preference: CA Primary MCL = California Primary MCL; EPA Primary MCL = EPA's Federal Primary MCL; CA Notification = California Notification Level. No value in database = Chemical is in the database but not possible threshold value reported, Chemical not in database = Chemical was not located in the SWRCB database

Table 25. Number of individual wells and TRS sections with pesticide exceedances for the Modesto GQMP Zone relative to ESJHVA Priority Areas 1, 2, or 3.

Well, TRS, pesticide, and ESJHVA priority designation data used here are the same as those data compiled in the GAR.

Pesticide	ESJHVA Priority Areas							
	Priority 1		Priority 2		Priority 3		Outside ESJHVA	
	Individual	Individual	Individual	Individual	Individual	Individual	Individual	Individual
DBCP	1	1	56	27	12	7	4	2
Ethylene Dibromide	0	0	4	3	1	1	0	0

TURLOCK GROUNDWATER MANAGEMENT ZONE

Introduction and Background

The Turlock GQMP Zone is south of the Modesto GQMP Zone and north of the Merced GQMP Zone within the Coalition. The Turlock GQMP Zone includes the entire Turlock Groundwater Subbasin. The Turlock subbasin is within the eastern portion of Stanislaus and Merced counties.

Existing Groundwater Management Plans/Entities

Figure 54 depicts the various water agencies within the footprint of the Turlock groundwater subbasin. Agencies eligible to participate in the Turlock Groundwater Basin Groundwater Management Plan for the include: the Turlock and Merced irrigation districts; the cities of Ceres, Turlock, Modesto and Hughson; the Hilmar and Delhi county water districts; the Keyes, Denair and Ballico community services districts; the Eastside and Ballico-Cortez water districts; as well as Stanislaus and Merced counties (Turlock Groundwater Basin Association, 2008).

The 2008 Turlock Groundwater Subbasin Groundwater Management Plan for the Turlock Subbasin includes a table of "Current Level of Monitoring Efforts". "The table shows a total of 68 wells monitored monthly for water levels (and also an additional 307 wells monitored for levels by DWR) and 69 wells sampled from monthly to triennially for water quality (and an additional 163 wells sampled to meet CDPH requirements for water quality)" (Luhdorff and Scalmanini, 2014).

Figure 54. Locations of the various local water agencies and their respective political boundaries for the Turlock Subbasin. (Turlock Groundwater Basin Association, Turlock Groundwater basin, Groundwater Management Plan, Figure 2, 2008).

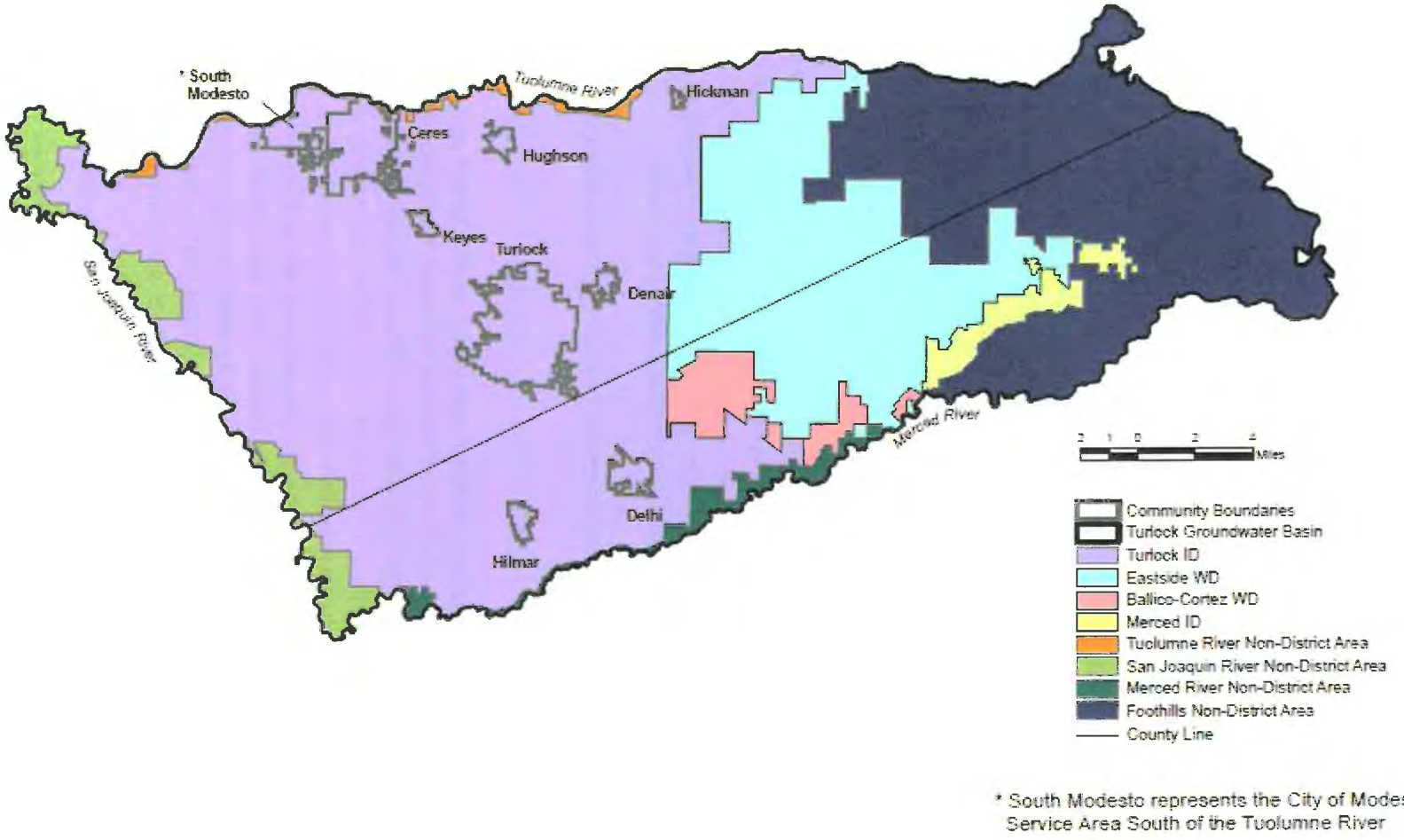


Figure 2. Urban Areas, Irrigation Districts, and Non-District Areas within the Turlock Groundwater Basin

Basin Boundaries and Surface Water Hydrology

"The Turlock Subbasin lies between the Tuolumne and Merced Rivers and is bounded on the west by the San Joaquin River and on the east by crystalline basement rock of the Sierra Nevada foothills. The northern, western, and southern boundaries are shared with the Modesto, Delta-Mendota, and Merced Groundwater Subbasins, respectively. The subbasin includes lands in the Turlock Irrigation District, the Ballico-Cortez Water District, the Eastside Water District, and a small portion of Merced I.D. Average annual precipitation is estimated as 11 to 13 inches, increasing eastward, with 15 inches in the Sierra foothills" (Bulletin 118).

Geology, Hydrogeology, and Groundwater Hydrology

As mentioned above, the characteristics of the Turlock groundwater subbasin is described as one of the study areas within the Central Eastside Study Unit in the USGS' Status and Understanding Groundwater Quality in the Central-Eastside San Joaquin Basin Study Unit, 2006: California GAMA Priority Basin Project (Figure 53). The main water-bearing units of the Modesto, Turlock, and Merced study areas include the unconsolidated alluvial-fan deposits of the Pleistocene-age Riverbank Formation, the deeper unconsolidated Pleistocene-age Turlock Lake and Pliocene-age Laguna Formations, and the semi-consolidated Miocene-Pliocene-age Mehrten Formation.

Groundwater conditions are unconfined, semi-confined, and confined in different zones of the groundwater system in the Central Eastside study unit. The base of freshwater, where estimated, generally is more than 700 ft below land surface, but may be as shallow as 300 ft in parts of the study unit. Unconfined conditions are present in unconsolidated deposits above and east of the Corcoran Clay Member of the Turlock Lake Formation, which underlies the southwestern half of the study unit at depths ranging from 50 to 250 ft. Confined conditions are present below the Corcoran Clay. Semi-confined conditions are present at depth east of the Corcoran Clay, because of many discontinuous clay lenses (Landon, et al., 2010).

The geology, hydrogeology and groundwater hydrology description for the Turlock subbasin is taken almost exclusively from Bulletin 118 (DWR 2003).

Water Bearing Formations

The primary hydrogeologic units in the Turlock Subbasin include both consolidated and unconsolidated sedimentary deposits. The consolidated deposits include the Ione Formation of Miocene age, the Valley Springs Formation of Eocene age, and the Mehrten Formation, which was deposited during the Miocene to Pliocene Epochs. The consolidated deposits lie in the eastern portion of the subbasin and generally yield small quantities of water to wells except for the Mehrten Formation, which is an important aquifer. The Mehrten Formation is composed of up to 800 feet of sandstone, breccia, conglomerate, tuff siltstone and claystone (Page 1973). Unconsolidated deposits include continental deposits, older alluvium, younger alluvium, and flood-basin deposits. Lacustrine and marsh deposits, which constitute the Corcoran or E-clay aquitard, underlie the western half of the subbasin at depths ranging between about 50 and 200 feet (DWR 1981). The continental deposits and older alluvium are the main water-yielding units in the unconsolidated deposits. The lacustrine and marsh deposits and the flood-subbasin deposits yield little water to wells. The younger alluvium, in most places, probably yields only moderate quantities of water. There are three groundwater

bodies in the Turlock Subbasin: the unconfined waterbody; the semi-confined and confined waterbody in the consolidated rocks; and the confined waterbody beneath the E-clay in the western Subbasin. The estimated average specific yield of the subbasin is 10.1 percent (based on DWR San Joaquin District internal data and Davis 1959).

Restrictive Structures

Groundwater flow is primarily to the southwest, following the regional dip of basement rock and sedimentary units. Based on recent groundwater measurements (DWR 2000), a paired groundwater mound and depression appear beneath the city of Turlock and to its east, respectively. The lower to middle reaches of the Tuolumne River and the reach of the San Joaquin River in the subbasin appear to be gaining streams during this period also. No faults have been identified that affect the movement of fresh groundwater (Page 1973).

Groundwater Level Trends

Changes in groundwater levels are based on annual water level measurements by DWR and cooperators. Water level changes were evaluated by quarter township and computed through a custom DWR computer program using geostatistics (kriging). On average the subbasin water level has declined nearly 7 feet from 1970 through 2000. The period from 1970 through 1992 showed a generally steep decline totaling about 15 feet. Between 1992 and 1994, water levels stayed near this low level. From 1994 to 2000, the water levels rebounded about 8 feet, bringing them to approximately 7 feet below the 1970 levels. Water level declines have been more severe in the eastern portion of the subbasin after 1982. From 1970 to 1982, water level declines were more severe in the western portion of the subbasin.

Groundwater Storage

Estimations of the total storage capacity of the subbasin and the amount of water in storage as of 1995 were calculated using an estimated specific yield of 10.1 percent and water levels collected by DWR and cooperators. According to these calculations, the total storage capacity of this subbasin is estimated to be 15,800,000 af to a depth of 300 feet and 30,000,000 af to the base of fresh groundwater. These same calculations give an estimate of 12,800,000 af of groundwater to a depth of 300 feet stored in this subbasin as of 1995 (DWR 1995). According to published literature, the amount of stored groundwater in this subbasin as of 1961 is 23,000,000 af to a depth of < 1000 feet (Williamson 1989).

Groundwater Budget (Type B)

Although a detailed budget was not available for this subbasin, an estimate of groundwater demand was calculated based on the 1990 normalized year and data on land and water use. A subsequent analysis was done by a DWR water budget spreadsheet to estimate overall applied water demands, agricultural groundwater pumpage, urban pumping demand and other extraction data. Natural recharge of the subbasin was estimated to be 33,000 af. Artificial recharge and subsurface inflow were not determined. Applied water recharge was calculated to be 313,000 af. Annual urban extraction and annual agricultural extraction were calculated at 65,000 and 387,000 af, respectively. Other extractions and subsurface inflow were not determined.

Groundwater Quality Characterization

The groundwater in this subbasin is predominately of the sodium-calcium bicarbonate type, with sodium bicarbonate and sodium chloride types at the western margin and a small area in the north-central portion. TDS values range from 100 to 8,300 mg/L, with a typical range of 200 to 500 mg/L. The Department of Health Services, which monitors Title 22 water quality standards, reports TDS values in 71 wells ranging from 100 to 930 mg/L, with an average value of 335 mg/L. EC values range from 168 to 1,000 µmhos/cm, with a typical range of 244 to 707 µmhos/cm.

Groundwater Quality Impairments

There are localized areas of hard groundwater, nitrate, chloride, boron, and DBCP. Some sodium chloride type water of high TDS is found along the west side of the subbasin. Two wells in the city of Turlock have been closed, one for nitrate and one for carbon tetrachloride (Dan Wilde 2001).

Land Use/Irrigated Land

Management Practices/Crops in Zone

Tables 26 and 27 describe land uses within the Turlock GQMP Zone from two different data sets, USDA (2012) and DWR (early 2000s), respectively. Table 26 indicates almonds, double crop oats/corn, alfalfa, oats, other hay/non alfalfa, and grapes as the crops capturing over 85% of the land use in the Modesto GQMP Zone, regardless of irrigated or non-irrigated status. DWR data indicates the top irrigated crop as deciduous fruits and nuts, which also include almonds.

Table 26. Land use acreage within the entire Turlock GQMP Zone1.

Row Labels	Acreage	Percent acreage of Zone
Almonds	78305	40.49%
Double Crop Oats/Corn	24289	12.56%
Alfalfa	21442	11.09%
Oats	15261	7.89%
Other Hay/Non Alfalfa	13949	7.21%
Grapes	8710	4.50%
Walnuts	6245	3.23%
Double Crop Winter Wheat/Corn	5996	3.10%
Corn	5095	2.63%
Winter Wheat	2408	1.24%
Fallow/Idle Cropland	1954	1.01%
Grand Total for Agricultural Crops	183654	95%

[1]Land use information obtained from data provided by USDA, 2012 California Cropland Data Layer; http://www.nass.usda.gov/research/Cropland/SARS1a.htm. Land use in some areas of the ESJWQC may have changed since that time.
*Percent of cropped area includes all agricultural fields, whether fallow or active. Land use categories such as barren, developed, and native or wetland vegetation were not included in acreage totals. Crops contributing 1% or more of the overall land use within the GQMP area were included.

Table 27. Land use acreage associated with irrigation data within the Turlock GQMP Zone by ESJHVA Priority 1-3 areas. Land uses derived from DWR data in order to incorporate irrigation data designated as irrigated/non-irrigated (I/NI); numbers are rounded to nearest whole number.

Land Use	I/NI	Priority 1	Priority 2	Priority 3	Not in ESJHVA
Citrus & Sub-Tropical	I	5	28	61	133
Citrus & Sub-Tropical	NI	0	1	10	0
Deciduous Fruits & Nuts	I	9558	36758	25499	41346
Deciduous Fruits & Nuts	NI	7	0	0	0
Field Crops	I	2105	34386	19235	10694
Field Crops	NI	0	0	0	139
Grain & Hay	I	42	818	1963	327
Grain & Hay	NI	14	97	252	808
Idle	I	80	632	895	138
Idle	NI	0	0	0	4
Native Riparian	NI	2	108	815	250
Native Vegetation	NI	176	1714	14766	52055
Open Water	NI	140	322	1806	3814
Pasture	I	666	9189	23871	5433
Pasture	NI	8	42	368	187
Semiagricultural	NI	732	5535	5515	1796
Truck, Nursery, Berry	I	310	1984	1378	688
Urban	NI	3824	13,553	12,081	79
Vineyard	I	622	2221	3184	5840

* Land use information obtained from data provided by DWR, http://www.water.ca.gov/landwateruse/anaglwu.cfm. Data compiled in 2001, land use in some areas of the ESJWQC may have changed since that time

Constituents of Concern in Zone

Nitrates

Tables 28 and 29 describe nitrogen as nitrate within the Turlock GQMP Zone. Table 28 indicates that of those wells sampled in the Turlock GQMP Zone, approximately 51% exceeded the MCL of 10mg/L. Table 29 indicates that of those wells with nitrate exceedances from 2005-2013, the majority of wells (428) are located in the Priority 2 area of the ESJHVA.

Table 28. Count of nitrate (NO3) detections from 5-10mg/L and exceedances >10mg/L by well from 2005-2013 for the Turlock GQMP Zone.

Zone	Count of Wells			Percent of Wells		
	NO_3 <5 mg/L	NO_3 5-10 mg/L	NO_3 > =10 mg/L	NO_3 <5 mg/L	NO_3 5-10 mg/L	NO_3 > =10 mg/L
Turlock GQMP Zone	475	220	712	34%	16%	51%

Table 29. Number of individual wells with nitrate exceedances (greater than 10 mg/L) for the Turlock GQMP Zone relative to ESJHVA Priority Areas 1, 2, or 3.

Well, nitrate, and ESJHVA priority designation data used here are the same as those data compiled in the GAR.

Zone	ESJHVA Priority Areas			
	Priority 1	Priority 2	Priority 3	Outside ESJHVA
Turlock GQMP Zone	27	428	257	0

TDS

Tables 30 and 31 describe TDS levels within the Turlock GQMP Zone. Table 30 indicates that of those wells sampled in the Turlock GQMP Zone, approximately 62% exceeded the agricultural MCL of 450 mg/L. Table 31 indicates that of those wells with TDS exceedances from 2005-2013, the majority of wells (107) are located in the Priority 3 area of the ESJHVA.

Table 30. Count of wells with detections of TDS (less than 450 mg/L) and exceedances of TDS (equal to or greater than 450 mg/L) within the Turlock GQMP Zone.

Well and TDS data used here are the same as those data compiled in the GAR.

Zone	Count of Wells			% Wells TDS>450
	TDS<450	TDS>=450	Total wells	
Turlock GQMP Zone	158	255	413	62%

Table 31. Number of individual wells with TDS exceedances (greater than 450 mg/L) by well from 2005-2013 for the Turlock GQMP Zone relative to ESJHVA Priority Areas 1, 2, or 3.

Well, TDS, and ESJHVA priority designation data used here are the same as those data compiled in the GAR.

Zone	ESJHVA Priority Areas			
	Priority 1	Priority 2	Priority 3	Outside ESJHVA
Turlock GQMP Zone	3	88	107	10

As stated in previous sections, of the eight pesticides recorded as having exceeded WQTLs in the GAR, only diazinon and simazine are currently registered for application and use with the DPR. Only diazinon and simazine are to be considered COCs for current groundwater quality management purposes. The below data (Tables 32 and 33) indicate exceedances of diazinon and simazine in one individual well each in the Turlock GQMP Zone.

Table 32. Summary of pesticide detections (below MCL threshold) and exceedances (at or above MCL threshold) for the Turlock GQMP Zone. COCs in this GQMP Zone are bolded.

Well and pesticide data used below are those data compiled in the GAR.

Pesticide	Individual Wells with Detections	Individual Wells with Exceedances	Individual TRS with Detections	Individual TRS with Exceedances	Concentration in Samples with Detections (µg/L)		Exceedance Threshold Used (µg/L)	Basis for Exceedance Threshold
					Minimum	Maximum		
Aldicarb Sulfone	3	9	1	1	1.000	1281.000	3	EPA Primary MCL
DBCP	86	79	46	42	0.001	31.900	0.2	CA Primary MCL
Diazinon	**1**	**1**	**1**	**1**	**0.100**	**2.600**	**1.2**	**CA Notification**
Ethylene Dibromide	2	3	2	1	0.020	0.070	0.05	CA Primary MCL
Ethylene Dichloride	0	1	0	1	2.900	2.900	0.5	CA Primary MCL
Naphthalene	1	0	1	0	0.400	0.400	17	CA Notification
Simazine	**26**	**1**	**19**	**1**	**0.004**	**6.600**	**4**	**CA Primary MCL**

Pesticide data are for the period 1979-2011 provided by the California Department of Pesticide Regulation (DPR)

*Exceedance thresholds used are based on values reported in the SWRCB Water Quality Goals Online Database (http://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.shtml), when available. Selection of the threshold value for use to indicate an exceedance is based on a hierarchy consisting of the following order of preference: CA Primary MCL = California Primary MCL; EPA Primary MCL = EPA's Federal Primary MCL; CA Notification = California Notification Level. No value in database = Chemical is in the database but not possible threshold value reported, Chemical not in database = Chemical was not located in the SWRCB database

Table 33. Number of individual wells and TRS sections with pesticide exceedances for the Turlock GQMP Zone relative to ESJHVA Priority Areas 1, 2, or 3. Well, TRS, pesticide, and ESJHVA priority designation data used here are the same as those data compiled in the GAR.

Pesticide	ESJHVA Priority Areas							
	Priority 1		Priority 2		Priority 3		Not in ESJHVA	
	Individual	TRS	Individual	TRS	Individual	TRS	Individual	TRS
Aldicarb Sulfone	0	0	0	0	9	1	0	0
DBCP	10	7	51	27	18	8	0	0
Diazinon	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**
Ethylene Dibromide	0	0	1	1	0	0	0	0
Ethylene Dichloride	0	0	1	1	0	0	0	0
Simazine	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**

MERCED GROUNDWATER MANAGEMENT ZONE

Introduction and Background

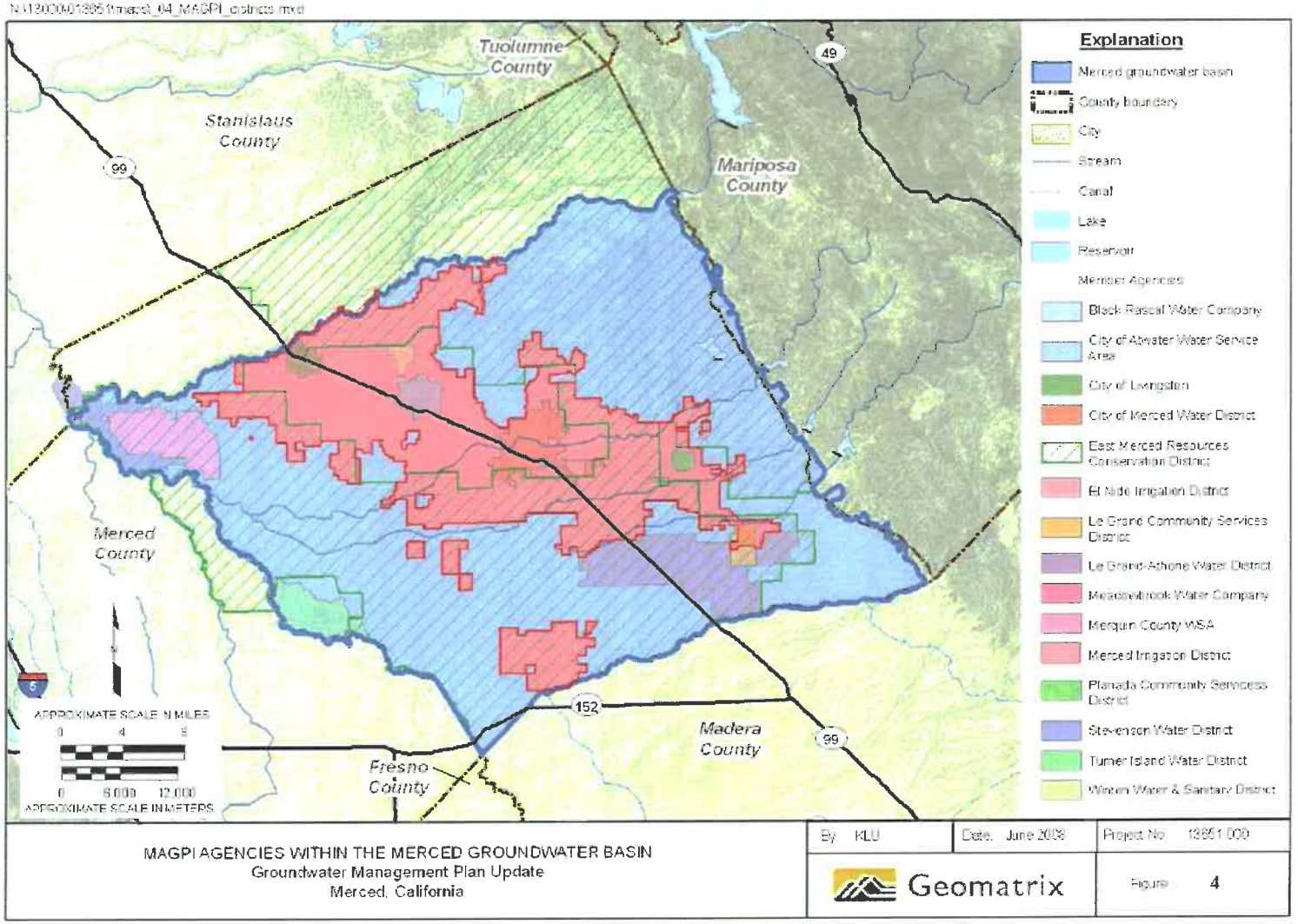
The Merced GQMP Zone is south of the Turlock GQMP Zone and north of the Chowchilla GQMP Zone within the Coalition. The Merced GQMP Zone includes the entire Merced Groundwater subbasin. The Merced subbasin is entirely within the Merced County.

Existing Groundwater Management Plans/Entities

Figure 26 depicts the various water agencies within the footprint of the Merced groundwater subbasin. Agencies eligible to participate in the Merced Groundwater Basin Groundwater Management Plan include: the City of Atwater, Black Rascal Water District, East Side Water District, Le Grand Community Service District, Le Grand-Athlone Water District, City of Livingston, Lone Tree Mutual Water Company, Meadowbrook Water Company, City of Merced, Merced County Environmental Health Department, Merced Irrigation District, Merquin County Water District, Planada Community Service District, Stevinson Water District, Turner Island Water District, Winton Water and Sanitary District (AMEC Geomatrix, 2008).

The 2008 Merced Groundwater Basin Groundwater Management Plan Update, Merced County, CA (AMEC Geomatrix, 2008) mentions other entities that monitor in the basin and the plan includes a figure (Figure 55) with a "Proposed Groundwater Monitoring Well Network, Merced Groundwater Basin"; there are 27 wells shown on the map with state well numbers (GAR, 2014).

Figure 55. Locations of Merced Area Groundwater Pool Interests (MAGPI) agencies and their respective political boundaries for the Merced Subbasin (Geomatrix, Merced Groundwater Basin Groundwater Management Plan Update Merced County, CA, Figure 4, 2008).



Basin Boundaries and Surface Water Hydrology

The Merced subbasin includes lands south of the Merced River between the San Joaquin River on the west and the crystalline basement rock of the Sierra Nevada foothills on the east. The subbasin boundary on the south stretches westerly along the Madera-Merced County line (Chowchilla River) and then between the boundary of the Le Grand-Athlone Water District and the Chowchilla Water District. The boundary continues west along the northern boundaries of Chowchilla Water District and El Nido Irrigation District. The southern boundary then follows the western boundary of El Nido I.D. south to the northern boundary of the Sierra Water District, which is followed westerly to the San Joaquin River. Average annual precipitation is 11 to 13 inches, increasing eastward (Bulletin 118).

Geology, Hydrogeology, and Groundwater Hydrology

As mentioned above, the characteristics of the Merced groundwater subbasin is described as one of the study areas within the Central Eastside Study Unit in the USGS' Status and Understanding Groundwater Quality in the Central-Eastside San Joaquin Basin Study Unit, 2006: California GAMA Priority Basin Project (Figure 53). The main water-bearing units of the Modesto, Turlock, and Merced study areas include the unconsolidated alluvial-fan deposits of the Pleistocene-age Riverbank Formation, the deeper unconsolidated Pleistocene-age Turlock Lake and Pliocene-age Laguna Formations, and the semi-consolidated Miocene-Pliocene-age Mehrten Formation.

Groundwater conditions are unconfined, semi-confined, and confined in different zones of the groundwater system in the Central Eastside study unit. The base of freshwater, where estimated, generally is more than 700 ft below land surface, but may be as shallow as 300 ft in parts of the study unit. Unconfined conditions are present in unconsolidated deposits above and east of the Corcoran Clay Member of the Turlock Lake Formation, which underlies the southwestern half of the study unit at depths ranging from 50 to 250 ft. Confined conditions are present below the Corcoran Clay. Semi-confined conditions are present at depth east of the Corcoran Clay, because of many discontinuous clay lenses (Landon, et al., 2010).

The geology, hydrogeology, and groundwater hydrology description for the Modesto subbasin is taken almost exclusively from Bulletin 118 (DWR 2003).

Water Bearing Formations

Geologic units in the Merced Subbasin consist of consolidated rocks and unconsolidated deposits. The consolidated rocks include the Ione Formation, the Valley Springs Formation, and the Mehrten Formation. In the eastern part of the area, the consolidated rocks generally yield small quantities of water to wells except for the Mehrten Formation, which is an important aquifer.

The unconsolidated deposits were laid down during the Pliocene to present. From oldest to youngest, these deposits include continental deposits, lacustrine and marsh deposits, older alluvium, younger alluvium, and flood basin deposits. The continental deposits and older alluvium are the main water-yielding units in the unconsolidated deposits. The lacustrine and marsh deposits (which include the Corcoran, or "E-" Clay), and the flood basin deposits yield little water to wells, and the younger alluvium in most places probably yields only moderate quantities of water to wells (page 1973.)

There are three groundwater bodies in the area: an unconfined waterbody, a confined waterbody, and the waterbody in consolidated rocks. The unconfined waterbody occurs in the unconsolidated deposits above and east of the Corcoran Clay, which underlies the western half of the subbasin at depths ranging between about 50 and 200 feet (DWR 1981), except in the western and southern parts of the area where clay lenses occur and semi-confined conditions exist. The confined waterbody occurs in the unconsolidated deposits below the Corcoran Clay and extends downward to the base of fresh water. The waterbody in consolidated rocks occurs under both unconfined and confined conditions. The estimated average specific yield of this subbasin is 9.0 percent (based on DWR, San Joaquin District internal data and that of Davis 1959).

Restrictive Structures

Groundwater flow is primarily to the southwest, following the regional dip of basement rock and sedimentary units. DWR (2000) data show two groundwater depressions south and southeast of the city of Merced during 1999.

Groundwater Level Trends

Changes in groundwater levels are based on annual water level measurements by DWR and cooperators. Water level changes were evaluated by quarter township and computed through a custom DWR computer program using geostatistics (kriging). On average, the subbasin water level has declined nearly 30 feet from 1970 through 2000. The period from 1970 through 1978 showed steep declines totaling about 15 feet. The ten-year period from 1978 to 1988 saw stabilization and a rebound of about 10 feet. 1988 through 1995 again showed steep declines, bottoming out in 1996 with water levels rising from 1996 to 2000. Water level declines have been more severe in the eastern portion of the subbasin.

Groundwater Storage

Estimations of the total storage capacity of the subbasin and the amount of water in storage as of 1995 were calculated using an estimated specific yield of 9.0 percent and water levels collected by DWR and cooperators. According to these calculations, the total storage capacity of this subbasin is estimated to be 21,100,000 af to a depth of 300 feet and 47,600,000 af to the base of fresh groundwater. These same calculations give an estimate of 15,700,000 af of groundwater to a depth of 300 feet stored in this subbasin as of 1995 (DWR 1995). According to published literature, the amount of stored groundwater in this subbasin as of 1961 is 37,000,000 af to a depth of < 1000 feet (Williamson 1989).

Groundwater Budget (Type B)

Although a detailed budget was not available for this subbasin, an estimate of groundwater demand was calculated based on the 1990 normalized year and data on land and water use. A subsequent analysis was done by a DWR water budget spreadsheet to estimate overall applied water demands, agricultural groundwater pumpage, urban pumping demand and other extraction data. Natural recharge into the subbasin is estimated to be 47,000 af. Values for artificial recharge and subsurface inflow are not determined. There is approximately 243,000 af of applied water recharge into the subbasin. Annual urban and agricultural extractions are 54,000 af and 492,000 af, respectively. Other extractions equal approximately 9,000 af. Subsurface inflow values are not determined.

Groundwater Quality Characterization

The groundwater in this subbasin is characterized by calcium-magnesium bicarbonate at the basin interior, sodium bicarbonate to the west, and calcium-sodium bicarbonate to the south. Small areas of sodium chloride and calcium-sodium chloride waters exist at the southwest corner of the basin (Page 1973). TDS values range from 100

to 3,600 mg/L, with a typical range of 200 to 400 mg/L. The Department of Health Services, which monitors Title 22 water quality standards, reports TDS values in 46 wells ranging from 150 to 424 mg/L, with an average value of 231 mg/L. For 10 wells, EC values range from 260 to 410 µmhos/cm, with an average value of 291 µmhos/cm.

Groundwater Quality Impairments

There are localized areas of high hardness, iron, nitrate, and chloride in this subbasin.

Land Use/Irrigated Land

Management Practices/Crops in Zone

Tables 34 and 35 describe land uses within the Merced GQMP Zone from two different data sets, USDA (2012) and DWR (early 2000s), respectively. USDA data in Table 34 indicate almonds, alfalfa, winter wheat, grapes, corn, cotton, double crop oats/corn, oats, sweet potatoes, and double crop winter wheat/corn as the crops capturing over 85% of the land use in the Merced GQMP Zone, regardless of irrigated or non-irrigated status. DWR data in Table 35 indicate the top irrigated crop as field crops, followed by deciduous fruits and nuts.

Table 34. Land use acreage within the entire Merced GQMP Zone1.

Row Labels	Percent Acreage of Zone	Acreage
Almonds	66544	26.96%
Alfalfa	45711	18.52%
Winter Wheat	18341	7.43%
Grapes	14051	5.69%
Corn	12843	5.20%
Cotton	12702	5.15%
Double Crop Oats/Corn	12023	4.87%
Oats	11612	4.70%
Sweet Potatoes	9748	3.95%
Double Crop Winter Wheat/Corn	8649	3.50%
Fallow/Idle Cropland	8341	3.38%
Tomatoes	6873	2.78%
Pistachios	5777	2.34%
Other Hay/Non Alfalfa	4978	2.02%
Barley	2470	1.00%
Grand Total for Agricultural Crops	240663	97.5%

[1]Land use information obtained from data provided by USDA, 2012 California Cropland Data Layer; http://www.nass.usda.gov/research/Cropland/SARS1a.htm. Land use in some areas of the ESJWQC may have changed since that time.

*Percent of cropped area includes all agricultural fields, whether fallow or active. Land use categories such as barren, developed, and native or wetland vegetation were not included in acreage totals. Crops contributing 1% or more of the overall land use within the GQMP area were included.

Table 35. Land use acreage within the Merced GQMP Zone by ESJHVA Priority 1-3 areas.

Land uses derived from DWR data in order to incorporate irrigation data designated as irrigated/non-irrigated (I/NI); numbers are rounded to nearest whole number.

LAND USE	I/NI	PRIORITY 1	PRIORITY 2	PRIORITY 3	NOT IN ESJHVA
Citrus & Sub-Tropical	I	6	29	19	79
Citrus & Sub-Tropical	NI	3	1	0	0
Deciduous Fruits & Nuts	I	3457	19538	20533	23934
Field Crops	I	1994	14465	19917	29628
Grain & Hay	I	641	3084	3102	6594
Grain & Hay	NI	73	404	898	2000
Idle	I	154	573	1866	1719
Idle	NI		0	152	490
Native Riparian	NI	5	32	43	363
Native Vegetation	NI	438	4391	30271	168241
Open Water	NI	17	290	627	962
Pasture	I	440	5137	23725	31987
Pasture	NI	21	130	1429	680
Rice	I	209	2051	629	750
Semi-agricultural	NI	115	1545	3658	2333
Truck, Nursery, Berry	I	1231	6189	5753	14806
Urban	NI	993	14728	4178	8181
Vineyard	I	30	881	4203	2522

* Land use information obtained from data provided by DWR, http://www.water.ca.gov/landwateruse/anaglwu.cfm. Data compiled in 2001, land use in some areas of the ESJWQC may have changed since that time.

Constituents of Concern in Zone

Nitrates

Tables 36 and 37 describe nitrogen as nitrate within the Merced GQMP Zone. Table 36 indicates that of those wells sampled in the Merced GQMP Zone, approximately 26% exceeded the MCL of 10mg/L. Table 37 indicates that of those wells with nitrate exceedances from 2005-2013, the highest number of wells with nitrate exceedances greater than 10 mg/L are located in the Priority 2 and 3 areas (both with 68 wells) of the ESJHVA.

Table 36. Count of nitrate (NO_3) detections from 5-10mg/L and exceedances >10mg/L by well from 2005-2013 for the Merced GQMP Zone.

	Count of Wells			Percent of Wells		
	NO_3 <5 mg/L	NO_3 5-10 mg/L	NO_3 > =10 mg/L	NO_3 <5 mg/L	NO_3 5-10 mg/L	NO_3 > =10 mg/L
Merced GQMP Zone	366	137	178	54%	20%	26%

Table 37. Number of individual wells with nitrate exceedances (greater than 10 mg/L) for the Merced GQMP Zone relative to ESJHVA Priority Areas 1, 2, or 3.

Well, nitrate, and ESJHVA priority designation data used here are the same as those data compiled in the GAR.

Zone	ESJHVA Priority Areas			
	Priority 1	Priority 2	Priority 3	Outside ESJHVA
Merced GQMP Zone	27	68	68	15

TDS

Tables 38 and 39 describe TDS levels within the Merced GQMP Zone. Table 38 indicates that of those wells sampled in the Merced GQMP Zone, approximately 31% exceeded the agricultural MCL of 450 mg/L. Table 39 indicates that of those wells with TDS exceedances from 2005-2013, the majority of wells (13) are located in the Priority 3 area of the ESJHVA.

Table 38. Count of wells with detections of TDS (less than 450 mg/L) and exceedances of TDS (equal to or greater than 450 mg/L) within the Merced GQMP Zone.

Well and TDS data used here are the same as those data compiled in the GAR.

Zone	Count of Wells			% wells TDS>450
	TDS<450	TDS>=450	Total wells	
Merced GQMP Zone	153	68	221	31%

Table 39. Number of individual wells with TDS exceedances (greater than 450 mg/L) by well from 2005-2013 for the Merced GQMP Zone relative to ESJHVA Priority Areas 1, 2, or 3.

Well, TDS, and ESJHVA priority designation data used here are the same as those data compiled in the GAR.

Zone	ESJHVA Priority Areas			
	Priority 1	Priority 2	Priority 3	Outside ESJHVA
Merced GQMP Zone	0	10	13	9

As stated in previous sections, of the eight pesticides recorded as having exceeded WQTLs in the GAR, only diazinon and simazine are currently registered for application and use with the DPR. Only diazinon and simazine are to be considered COCs for current groundwater quality management purposes. No exceedances of pesticide COC occurred in the Merced GQMP Zone; Tables 40 and 41 indicate detections only.

Table 40. Summary of pesticide detections (below MCL threshold) and exceedances (at or above MCL threshold) for the Merced GQMP Zone. COCs in this GQMP Zone are bolded.

Well and pesticide data used below are those data compiled in the GAR.

Pesticide	Individual Wells with Detections	Individual Wells with Exceedances	TRS Sections with Detections	TRS Sections with Exceedances	Concentration in Samples with Detections (µg/L)		Exceedance Threshold Used (µg/L)	Basis for Exceedance Threshold
					Minimum	Maximum		
Aldicarb Sulfone	7	12	1	1	1.000	78.000	3	EPA Primary MCL
DBCP	136	143	53	51	0.001	32.000	0.2	CA Primary MCL
Ethylene Dibromide	4	7	3	6	0.020	0.320	0.05	CA Primary MCL
Naphthalene	3	1	3	1	2.000	29.000	17	CA Notification
Simazine	**22**	**0**	**19**	**0**	**0.003**	**1.140**	**4**	**CA Primary MCL**

Pesticide data are for the period 1979-2011 provided by the California Department of Pesticide Regulation (DPR)

*Exceedance thresholds used are based on values reported in the SWRCB Water Quality Goals Online Database (http://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.shtml), when available. Selection of the threshold value for use to indicate an exceedance is based on a hierarchy consisting of the following order of preference: CA Primary MCL = California Primary MCL; EPA Primary MCL = EPA's Federal Primary MCL; CA Notification = California Notification Level. No value in database = Chemical is in the database but not possible threshold value reported, Chemical not in database = Chemical was not located in the SWRCB database

Table 41. Number of individual wells and TRS sections with pesticide exceedances for the Merced GQMP Zone relative to ESJHVA Priority Areas 1, 2, or 3.

Well, TRS, pesticide, and ESJHVA priority designation data used here are the same as those data compiled in the GAR.

Pesticide	ESJHVA Priority Areas							
	Priority 1		Priority 2		Priority 3		Not in ESJHVA	
	Individual	TRS	Individual	TRS	Individual	TRS	Individual	TRS
Aldicarb Sulfone	0	0	12	1	0	0	0	0
DBCP	21	5	110	37	12	0	0	0
Ethylene Dibromide	1	1	5	4	1	1	0	0
Naphthalene	0	0	1	1	0	0	0	0

CHOWCHILLA GROUNDWATER MANAGEMENT ZONE

Introduction and Background

The Chowchilla GQMP Zone is the south of the Merced GQMP Zone and northwest of the Madera GQMP Zone within the Coalition. The entire Chowchilla Groundwater subbasin is included within the Chowchilla GQMP Zone. The Chowchilla subbasin is underlays portions of both the Madera and Merced Counties.

Existing Groundwater Management Plans/Entities

The Chowchilla groundwater subbasin is largely, although not entirely, located within Madera County (Figure 56). Those agencies located within Madera County are eligible to participate in the Madera Regional Groundwater Management Plan. The Madera Regional Groundwater Management Plan (Provost and Pritchard, 2014) lists several entities within the plan's boundaries which perform mostly groundwater level monitoring (Figure 57). These groundwater entities include the City of Chowchilla, City of Madera, Chowchilla Water District, Gravelly Ford Water District (not as a participant of the Madera Regional Groundwater Management Plan but as a member of the California State Groundwater Elevation Monitoring Program), Madera Irrigation District, and Madera County. The total number of wells monitored for groundwater elevation listed within the Madera Regional Groundwater Management Plan approximately 415. The Madera Regional Groundwater Management Plan mentions the water quality data collected by DWR and the CDPH, and local city and county water agencies were used to analyze water quality trends for the Madera 2008 Integrated Regional Water Management Plan but the Madera Regional Groundwater Management Plan does not list other local monitoring agencies or any monitoring schedule.

In 2010, DWR approved the Madera-Chowchilla Basin Groundwater Monitoring Group as the local monitoring entity including: Madera Irrigation District, Chowchilla Water District, Gravelly Ford Water District, and Madera County, Madera Water District, and Root Creek Water District. The total monitoring area covers 789 square miles and includes all of the Madera sub-basin and most of the Chowchilla sub-basin. The Group submits groundwater level data each spring and fall to the DWR describes a variety of groundwater monitoring programs that exist throughout the county and suggests a meeting of all parties currently collecting groundwater data (Provost and Pritchard, 2014).

Figure 56. Water agencies and groundwater subbasins (partial and entire) located within the Draft Madera Regional Groundwater Management Plan area.

Provost & Pritchard, Draft Madera Regional Groundwater Management Plan, Figure 2.1, 2014.

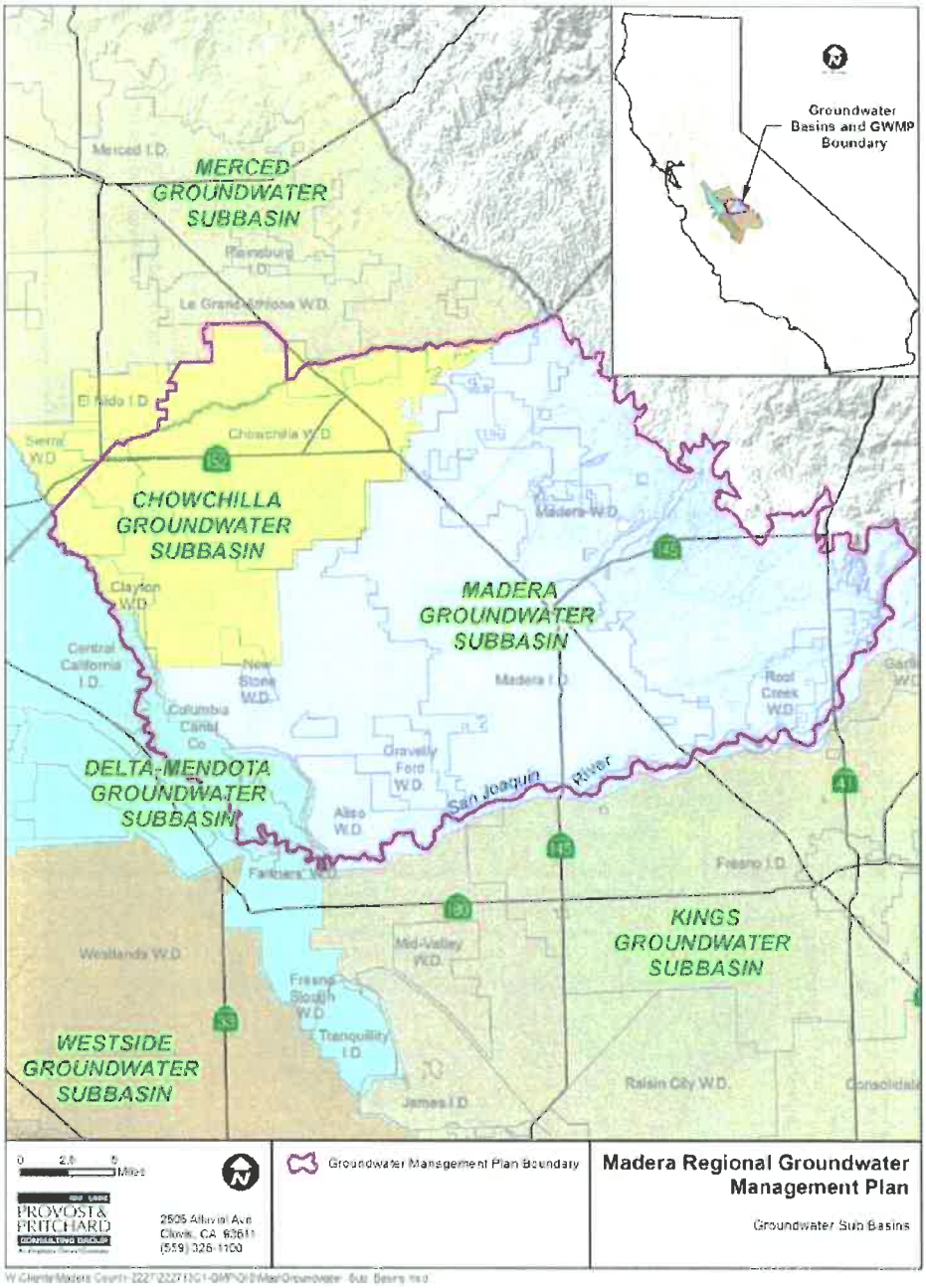


Figure 2.1 – Groundwater Sub-basins

\\PINEFLAT\dwg_dgn\Clients\Madera County of - 2227\222713C1 - GWMP_DOCUMENTS\Reports\Madera Regional GMP-4th Revised Draft 2014.11.06.doc

Figure 57. Section of Madera County (that area within the Central Valley) covered in the Draft Madera Regional Groundwater Management Plan, the locations of participating agencies, and their respective political boundaries for the Chowchilla/Madera Subbasins.

The Draft Madera Regional Groundwater Management Plan area excludes those cities and irrigation/water districts with previously adopted groundwater management plans (Provost & Pritchard, Draft Madera Regional Groundwater Management Plan, Figure 1.1, 2014).

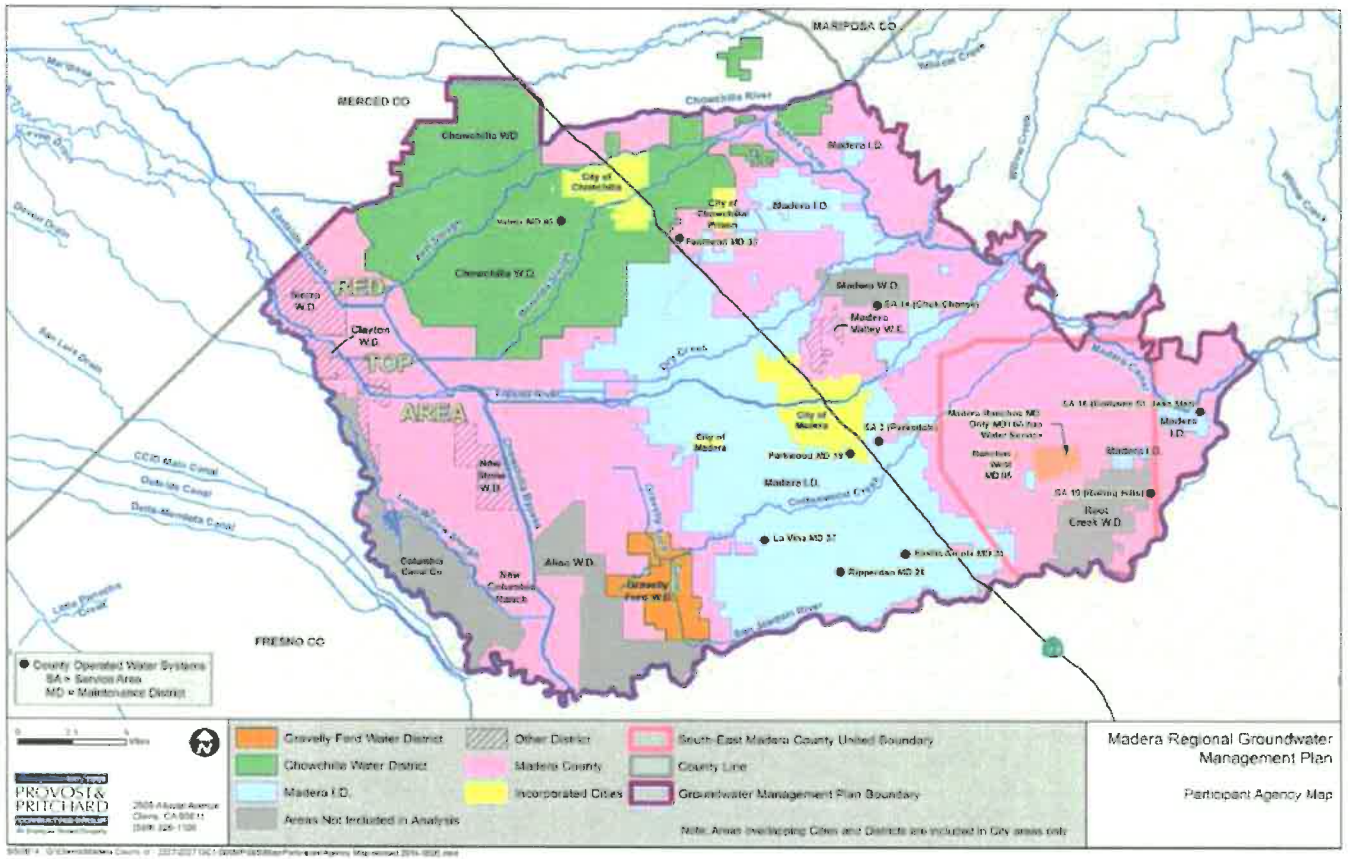


Figure 1.1 – Participating Agency Map

Basin Boundaries and Surface Hydrology

The basin boundaries, surface hydrology, geology, hydrogeology, and groundwater hydrology description for the Chowchilla subbasin is taken almost exclusively from Bulletin 118 (DWR 2003).

The Chowchilla subbasin includes lands in Madera and Merced Counties. The subbasin is bounded on the west by the San Joaquin River and the eastern boundary of the Columbia Canal Company Service Area and on the north by the southern boundary of the Merced Subbasin. The southern boundary from the west to its connection with the northern boundary runs along the southern boundary of Township 11 South, Ranges 14 East and 15 East, northerly along the eastern boundaries of sections 9, 20, 27, and 33 of Township 11S, Range 15 East, and northeasterly along the southern and eastern boundaries of Chowchilla Water District, then northeasterly following Berenda Slough and Ash Slough to the Chowchilla River. Major rivers in the subbasin are the Fresno and Chowchilla Rivers. Average annual precipitation is estimated to be 11 inches.

Geology, Hydrogeology, and Groundwater Hydrology

The characteristics of the Chowchilla and Madera groundwater subbasins which underlay the Chowchilla and Madera GQMP Zones are described as study areas within the Madera- Chowchilla Study Unit in the USGS' Status and Understanding of Groundwater Quality in the Madera- Chowchilla Study Unit, 2008: California GAMA Priority Basin Project. The study unit is bounded partially on the north by the Chowchilla River, approximately on the west and south by the San Joaquin River, and on the east by foothills of the Sierra Nevada (Figure 58; Shelton, et. al., 2008). In general, the Late Tertiary and Quaternary continental deposits increase in thickness from north to south and are up to 3,000 ft thick in the Madera-Chowchilla study unit. The Madera-Chowchilla study unit includes eastern alluvial fan, with derivatives from the Sierra Nevada, and basin areas. The Corcoran Clay Member of the Tulare Formation, underlies large parts of the basin and the distal end of parts of the eastern alluvial fans at depths dipping from 50 ft on the eastern edge of the Clay to 300 ft along the margin of the Coast Ranges and divides the San Joaquin Valley freshwater aquifer systems into an unconfined to semi-confined upper system and a largely confined lower system.

Figure 58. Geologic setting of the Madera-Chowchilla study unit (DOI and USGS, Status and Understanding Groundwater Quality in the Madera-Chowchilla Study Unit, 2008: California GAMA Priority Basin Project, Fig. 3, pg. 7, 2008).

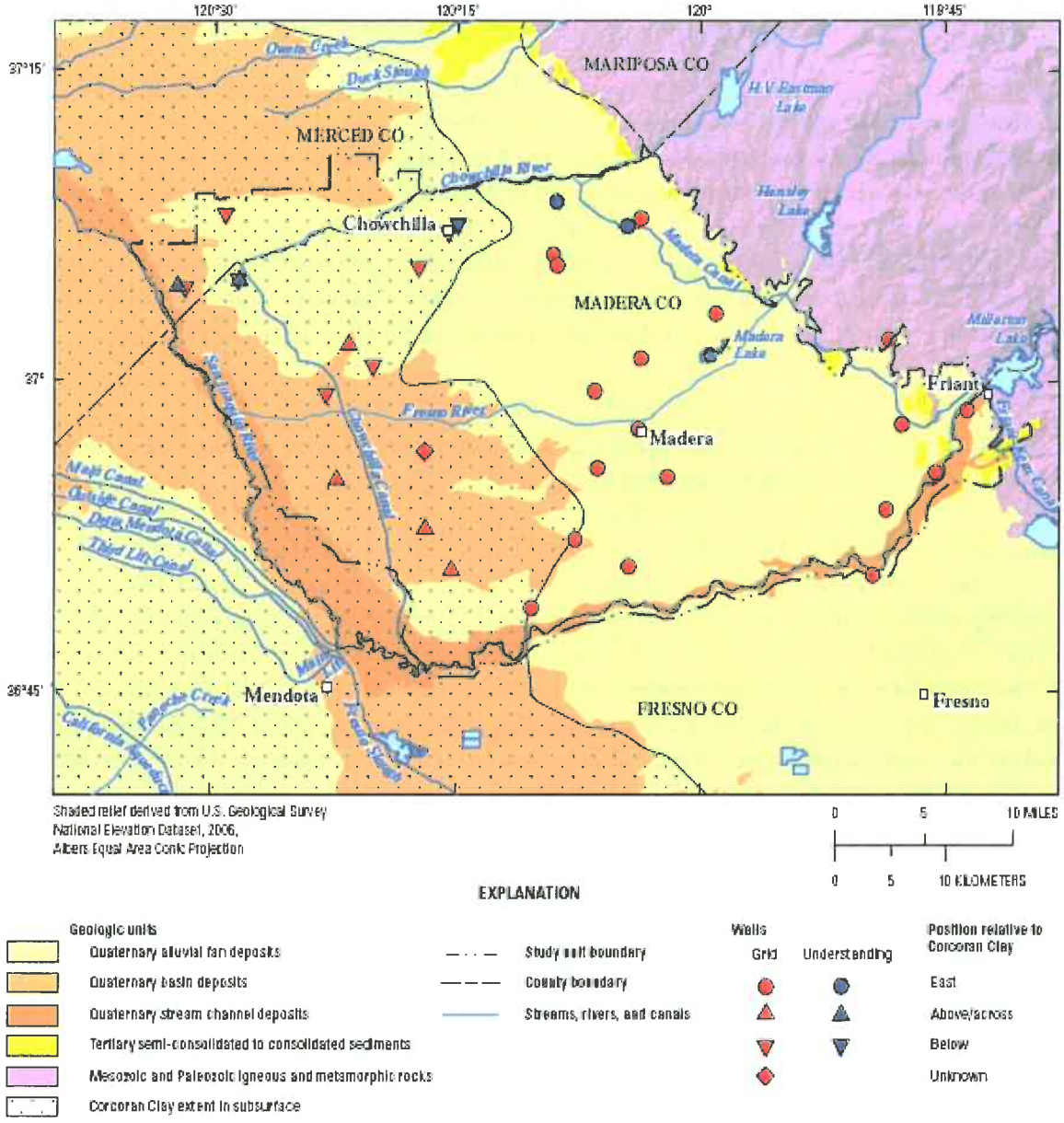


Figure 3. Madera-Chowchilla study unit, California GAMA Priority Basin Project.

Water Bearing Formations

Hydrogeologic units in the Chowchilla Subbasin consist of unconsolidated deposits of Pleistocene and Holocene age. These deposits are divided into continental deposit of Tertiary and Quaternary age, and continental deposits of Quaternary age. Continental deposits of Quaternary age include older alluvium, lacustrine and marsh deposits and younger alluvium. The continental deposits of Quaternary age crop out over most of the area and yield probably more than 95 percent of the water pumped from wells. Although younger alluvium and flood-basin deposits yield small quantities of water to wells, the most important aquifer in the area is the older alluvium. It consists mostly of intercalated lenses of clay, silt, sand, and some gravel. The Corcoran Clay or E-Clay (a lacustrine and marsh deposit), which underlies most of the subbasin at depths ranging between 50 and 250 feet (DWR 1981), restricts the vertical movement of groundwater and divides the water bearing deposits into confined and unconfined aquifers. The estimated average specific yield of this subbasin is 8.6 percent (based on DWR San Joaquin District internal data and that of Davis 1959).

Restrictive Structures

Groundwater flow is generally southwestward but with groundwater mounds occurring at the subbasin center and pumping depressions in the western portion during 1999 (DWR 2000). Based on current and historical groundwater elevation maps, groundwater barriers do not appear to exist in the subbasin.

Recharge Areas

Groundwater recharge is primarily from deep percolation of applied irrigation water (DWR 1995).

Groundwater Level Trends

Changes in groundwater levels are based on annual water level measurements by DWR and cooperators. Water level changes were evaluated by quarter township and computed through a custom DWR computer program using geostatistics (kriging). On average, the subbasin water level has declined nearly 40 feet from 1970 through 2000. The period from 1970 through 1978 showed steep declines totaling about 30 feet. The nine-year period from 1978 to 1987 saw stabilization and rebound of about 25 feet, taking the water levels close to where they were in 1970. 1987 through 1996 again showed steep declines, bottoming out in 1996 at about 45 feet below 1970 levels. Water levels rose about 8 feet from 1996 to 2000. Water level declines have been more severe in the eastern portion of the subbasin from 1980 to the present, but the western basin showed the strongest declines before this time period.

Groundwater Storage

Estimations of the total storage capacity of the subbasin and the amount of water in storage as of 1995 were calculated using an estimated specific yield of 8.6 percent and water levels collected by DWR and cooperators. According to these calculations, the total storage capacity of this subbasin is estimated to be 8,000,000 af to a depth of 300 feet and 13,900,000 af to the base of fresh groundwater. These same calculations give an estimate of 5,500,000 af of groundwater to a depth of 300 feet stored in this subbasin as of 1995 (DWR 1995). According to published literature, the amount of stored groundwater in this subbasin as of 1961 is 15,000,000 af to a depth of < 1000 feet (Williamson 1989).

Groundwater Budget (Type B)

Although a detailed budget was not available for this subbasin, an estimate of groundwater demand was calculated based on the 1990 normalized year and data on land and water use. A subsequent analysis was done by a DWR water budget spreadsheet to estimate overall applied water demands, agricultural groundwater pumpage, urban pumping demand and other extraction data. Natural recharge of the subbasin is estimated to be 87,000 af. Artificial recharge and subsurface inflow are not determined. There is approximately 179,000 af of applied water recharge. Annual urban and agricultural extractions are 6,000 af and 249,000 af, respectively. There are no other extractions, and subsurface outflow has not been determined.

Groundwater Quality Characterization

The water in this subbasin is of a calcium-sodium bicarbonate type in the eastern part of the subbasin. This turns into calcium bicarbonate, sodium-calcium bicarbonate, and sodium chloride water types towards the western part of the subbasin (Mitten 1970). TDS values range from 120 to 6,400 mg/L, with a typical range of 200 to 500 mg/L. The Department of Health Services, which monitors Title 22 water quality standards, reports TDS values in eight wells ranging from 120 to 390 mg/L, with an average value of 228 mg/L. EC values range from 150 to 3,380 µmhos/cm, with an average value of 508 µmhos/cm.

Groundwater Quality Impairments

There are local areas of high nitrate, hardness, iron, and chloride in the subbasin.

Management Practices/Crops in Zone

Tables 42 and 43 describe land uses within the Chowchilla GQMP Zone from two different data sets, USDA (2012) and DWR (early 2000s), respectively. USDA data in Table 18 indicate almonds, alfalfa, winter wheat, grapes, double crop winter wheat/corn, fallow/Idle cropland, and pistachios as the crops capturing over 85% of the land use in the Chowchilla GQMP Zone, regardless of irrigated or non-irrigated status. DWR data (Table 43) indicate the top irrigated crop as field crops followed by deciduous fruits and nuts.

Table 42. Land use acreage within the entire Chowchilla GQMP Zone1.

Row Labels	Acreages	Percent of Acreage in Zone
Almonds	46814	34.10%
Alfalfa	30472	22.19%
Winter Wheat	15032	10.95%
Grapes	10015	7.29%
Double Crop Winter Wheat/Corn	8173	5.95%
Fallow/Idle Cropland	6143	4.47%
Pistachios	4824	3.51%
Other Hay/Non Alfalfa	3705	2.70%
Cotton	2671	1.95%
Double Crop Oats/Corn	2152	1.57%
Oats	1760	1.28%
Tomatoes	1695	1.23%
Corn	1654	1.20%
Barley	1382	1.01%
Grand Total for Agricultural Crops	136493	99.4%

[1]Land use information obtained from data provided by USDA, 2012 California Cropland Data Layer: http://www.nass.usda.gov/research/Cropland/SARS1a.htm. Land use in some areas of the ESJWQC may have changed since that time.
*Percent of cropped area includes all agricultural fields, whether fallow or active. Land use categories such as barren, developed, and native or wetland vegetation were not included in acreage totals. Crops contributing 1% or more of the overall land use within the GQMP area were included.

Table 43. Land use acreage within the Chowchilla GQMP Zone by ESJHVA Priority 1-3 areas.

Land uses derived from DWR data in order to incorporate irrigation data designated as irrigated/non-irrigated (I/NI); numbers are rounded to nearest whole number.

Land Use	I/NI	Priority 1	Priority 2	Priority 3	Not in ESJHVA
Citrus & Sub-Tropical	I	0	4	3	12
Deciduous Fruits & Nuts	I	31	600	18230	9825
Field Crops	I	698	2608	26492	11187
Grain & Hay	I	215	271	2992	2618
Grain & Hay	NI	11	109	424	1110
Idle	I	1	64	319	522
Native Riparian	NI	0	0	255	176
Native Vegetation	NI	7	293	7271	12691
Open Water	NI	4	2	403	279

Land Use	I/NI	Priority 1	Priority 2	Priority 3	Not in ESJHVA
Pasture	I	70	1067	20754	17344
Pasture	NI	0	4	1	0
Semi-agricultural	NI	40	326	2514	989
Truck, Nursery, Berry	I	0	44	900	105
Urban	NI	39	801	1274	1949
Vineyard	I	0	85	5213	6827

* Land use information obtained from data provided by DWR, http://www.water.ca.gov/landwateruse/anaglwu.cfm. Data compiled in 2001, land use in some areas of the ESJWQC may have changed since that time.

Constituents of Concern in Zone

Nitrates

Tables 44 and 45 describe nitrogen as nitrate within the Chowchilla GQMP Zone. Table 44 indicates that of those wells sampled in the Chowchilla GQMP Zone, approximately 36% exceeded the MCL of 10mg/L. Table 45 indicates that of those wells with nitrate exceedances from 2005-2013, the highest number of wells with nitrate exceedances greater than 10 mg/L are located in the Priority 3 area (69 wells) of the ESJHVA.

Table 44. Count of nitrate (NO3) detections from 5-10mg/L and exceedances >10mg/L by well from 2005-2013 for the Chowchilla GQMP Zone.

	Count of Wells			Percent of Wells		
	NO_3 <5 mg/L	NO_3 5-10 mg/L	NO_3 > =10 mg/L	NO_3 <5 mg/L	NO_3 5-10 mg/L	NO_3 > =10 mg/L
Chowchilla GQMP Zone	108	55	92	42%	22%	36%

Table 45. Number of individual wells with nitrate exceedances (greater than 10 mg/L) for the Chowchilla GQMP Zone relative to ESJHVA Priority Areas 1, 2, or 3.

Well, nitrate, and ESJHVA priority designation data used here are the same as those data compiled in the GAR.

Zone	ESJHVA Priority Areas			
	Priority 1	Priority 2	Priority 3	Outside ESJHVA
Chowchilla GQMP Zone	0	19	69	4

TDS

Tables 46 and 47 describe TDS levels within the Chowchilla GQMP Zone. Table 46 indicates that of those wells sampled in the Chowchilla GQMP Zone, approximately 34% exceeded the agricultural MCL of 450 mg/L. Table 47 indicates that of those wells with TDS exceedances from 2005-2013, the majority of wells (17) are located in the Priority 3 area of the ESJHVA.

Table 46. Count of wells with detections of TDS (less than 450 mg/L) and exceedances of TDS (equal to or greater than 450 mg/L) within the Chowchilla GQMP Zone.

Well and TDS data used here are the same as those data compiled in the GAR.

Zone	Count of Wells			% wells TDS>450
	TDS<450	TDS>=450	Total wells	
Chowchilla GQMP Zone	35	18	53	34%

Table 47. Number of individual wells with TDS exceedances (greater than 450 mg/L) by well from 2005-2013 for the Chowchilla GQMP Zone relative to ESJHVA Priority Areas 1, 2, or 3. Well, TDS, and ESJHVA priority designation data used here are the same as those data compiled in the GAR.

Zone	ESJHVA Priority Areas			
	Priority 1	Priority 2	Priority 3	Outside ESJHVA
Chowchilla GQMP Zone	0	1	17	0

Pesticides

As stated in previous sections, of the eight pesticides recorded as having exceeded WQTLs in the GAR, only diazinon and simazine are currently registered for application and use with the DPR. Only diazinon and simazine are to be considered COCs for current groundwater quality management purposes. No exceedances of pesticide COCs occurred in the Chowchilla GQMP Zone. The below data (Tables 48 and 49) indicate detections only.

Table 48. Summary of pesticide detections (below MCL threshold) and exceedances (at or above MCL threshold) for the Chowchilla GQMP Zone.

The TRS, well, and pesticide data used below are those data compiled in the GAR.

Pesticide	Individual Wells with Detections	Individual Wells with Exceedances	TRS Sections with Detections	TRS Sections with Exceedances	Concentration in Samples with Detections (µg/L)		Exceedance Threshold Used (µg/L)	Basis for Exceedance Threshold
					Minimum	Maximum		
DBCP	2	0	2	0	0.003	0.003	0.2	CA Primary MCL
Simazine	2	0	2	0	0.006	0.062	4	CA Primary MCL

Pesticide data are for the period 1979-2011 provided by the California Department of Pesticide Regulation (DPR)

*Exceedance thresholds used are based on values reported in the SWRCB Water Quality Goals Online Database (http://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.shtml), when available. Selection of the threshold value for use to indicate an exceedance is based on a hierarchy consisting of the following order of preference: CA Primary MCL = California Primary MCL; EPA Primary MCL = EPA's Federal Primary MCL; CA Notification = California Notification Level. No value in database = Chemical is in the database but not possible threshold value reported, Chemical not in database = Chemical was not located in the SWRCB database

Table 49. Number of individual wells and TRS sections with pesticide exceedances for the Chowchilla GQMP Zone relative to ESJHVA Priority Areas 1, 2, or 3.

Well, TRS, pesticide, and ESJHVA priority designation data used here are the same as those data compiled in the GAR.

Pesticide	ESJHVA Priority Areas							
	Priority 1		Priority 2		Priority 3		Not in ESJHVA	
	Individual	TRS	Individual	TRS	Individual	TRS	Individual	TRS
DBCP	0	0	0	0	0	0	0	0
Simazine	0	0	0	0	0	0	0	0

MADERA GROUNDWATER MANAGEMENT ZONE

Introduction and Background

The Madera GQMP Zone is the southernmost GQMP Zone, south of the Chowchilla GQMP Zone. The entire Madera Groundwater subbasin and a portion of the Delta-Mendota groundwater subbasin are included within the Madera GQMP Zone. The Madera subbasin in entire included within Madera County. The eastern portion of the Delta-Mendota subbasin within the Madera GQMP Zone is located within Madera County.

Existing Groundwater Management Plans/Entities

As stated previously, the Madera Regional Groundwater Management Plan (Provost and Pritchard, 2014) lists several entities within the plan's boundaries (Figure 31) which perform mostly groundwater level monitoring. These groundwater entities include the City of Chowchilla, City of Madera, Chowchilla Water District, Gravelly Ford Water District (not as a participant of the Madera Regional Groundwater Management Plan but as a member of the California State Groundwater Elevation Monitoring Program), Madera Irrigation District, and Madera County. The total number of wells monitored for groundwater elevation listed within the Madera Regional Groundwater Management Plan approximately 415. The Madera Regional Groundwater Management Plan mentions the water quality data collected by DWR and the CDPH, and local City and County water agencies were used to analyze water quality trends for the Madera 2008 Integrated Regional Water Management Plan but the Madera Regional Groundwater Management Plan does not list other local monitoring agencies or any monitoring schedule.

In 2010, DWR approved the Madera-Chowchilla Basin Groundwater Monitoring Group as the local monitoring entity including: Madera Irrigation District, Chowchilla Water District, Gravelly Ford Water District, and Madera County, Madera Water District, and Root Creek Water District. The total monitoring area covers 789 square miles and includes all of the Madera sub-basin and most of the Chowchilla sub-basin. The Group submits groundwater level data each spring and fall to the DWR describes a variety of groundwater monitoring programs that exist throughout the county and suggests a meeting of all parties currently collecting groundwater data. (Provost and Pritchard, 2014)

Basin Boundaries and Surface Water Hydrology

"The Madera subbasin consists of lands overlying the alluvium in Madera County. The subbasin is bounded on the south by the San Joaquin River, on the west by the eastern boundary of the Columbia Canal Service area, on the north by the south boundary of the Chowchilla Subbasin, and on the east by the crystalline bedrock of the Sierra Nevada foothills. Major streams in the area include the San Joaquin and Fresno Rivers. Average annual precipitation is 11 inches throughout the majority of the subbasin and 15 inches in the Sierra foothills" (DWR, Bulletin 118).

Geology, Hydrogeology, and Groundwater Hydrology

As stated previously, the characteristics of the Chowchilla and Madera groundwater subbasins which underlay the Chowchilla and Madera GQMP Zones are described as study areas within the Madera-Chowchilla Study Unit in the USGS' Status and Understanding of Groundwater Quality in the Madera-Chowchilla Study Unit, 2008: California GAMA Priority Basin Project. The study unit is bounded partially on the north by the Chowchilla River, approximately on the west and south by the San Joaquin River, and on the east by foothills of the Sierra Nevada (Figure 58; Shelton, et. al., 2008). In general, the Late Tertiary and Quaternary continental deposits increase in

thickness from north to south and are up to 3,000 ft thick in the Madera-Chowchilla study unit. The Madera-Chowchilla study unit includes eastern alluvial fan, with derivatives from the Sierra Nevada, and basin areas. The Corcoran Clay Member of the Tulare Formation, underlies large parts of the basin and the distal end of parts of the eastern alluvial fans at depths dipping from 50 ft on the eastern edge of the Clay to 300 ft along the margin of the Coast Ranges and divides the San Joaquin Valley freshwater aquifer systems into an unconfined to semi-confined upper system and a largely confined lower system.

The geology, hydrogeology and groundwater hydrology description for the Madera subbasin is taken almost exclusively from Bulletin 118 (DWR 2003).

Water Bearing Formations

Hydrogeologic units in the Madera Subbasin consist of unconsolidated deposits of Pleistocene and Holocene age. These deposits are divided into continental deposit of Tertiary and Quaternary age, and continental deposits of Quaternary age. Continental deposits of Quaternary age include older alluvium, lacustrine and marsh deposits and younger alluvium. The continental deposits of Quaternary age crop out over most of the area and yield probably more than 95 percent of the water pumped from wells. Although younger alluvium and flood-basin deposits yield small quantities of water to wells, the most important aquifer in the area is the older alluvium. It consists mostly of intercalated lenses of clay, silt, sand, and some gravel. The lacustrine and marsh deposits (which contain the E-clay) do not crop out in the area but occur within the older alluvium and underlie the western portion of the subbasin at depths ranging between 150 and 300 feet (DWR 1981). These deposits restrict the vertical movement of groundwater and divide the water-bearing deposits into confined and unconfined aquifers. Continental deposits of Tertiary and Quaternary age include the Ione Formation which outcrops on the Subbasin's eastern margin. This unit may yield small quantities of water to wells but is not an important aquifer. The estimated average specific yield of this groundwater subbasin is 10.4 percent (based on DWR San Joaquin District internal data and that of Davis 1959).

Restrictive Structures

Groundwater flow is generally southwestward in the eastern part of the subbasin and to the northwest in the southern portion, away from the recharge area along the San Joaquin River. During 1999, a groundwater mound occurred in the northwest portion of the subbasin with accompanying depressions to the north and south, and a large depression in the subbasin's southeast corner (DWR 2000). Based on current and historical groundwater elevation maps, groundwater barriers do not appear to exist in the subbasin.

Groundwater Level Trends

Changes in groundwater levels are based on annual water level measurements by DWR and cooperators. Water level changes were evaluated by quarter township and computed through a custom DWR computer program using geostatistics (kriging). On average, the subbasin water level has declined nearly 40 feet from 1970 through 2000. The period from 1970 through 1978 showed steep declines totaling about 30 feet. The nine-year period from 1978 to 1987 saw stabilization and rebound of about 25 feet, taking the water levels close to where they were in 1970. 1987 through 1996 again showed steep declines, bottoming out in 1996 at about 45 feet below 1970 levels. Water levels rose about 8 feet from 1996 to 2000. Water levels declines have been more severe in the eastern portion of the subbasin from 1980 to the present, but the western subbasin showed the strongest declines before this time period.

Groundwater Storage

Estimations of the total storage capacity of the subbasin and the amount of water in storage as of 1995 were calculated using an estimated specific yield of 10.4 percent and water levels collected by DWR and cooperators. According to these calculations, the total storage capacity of this subbasin is estimated to be 18,500,000 af to a depth of 300 feet and 40,900,000 af to the base of fresh groundwater. These same calculations give an estimate of 12,600,000 af of groundwater to a depth of 300 feet stored in this subbasin as of 1995 (DWR 1995). According to published literature, the amount of stored groundwater in this subbasin as of 1961 is 24,000,000 af to a depth of < 1000 feet (Williamson 1989).

Groundwater Budget (Type B)

Although a detailed budget was not available for this subbasin, an estimate of groundwater demand was calculated based on the 1990 normalized year and data on land and water use. A subsequent analysis was done by a DWR water budget spreadsheet to estimate overall applied water demands, agricultural groundwater pumpage, urban pumping demand and other extraction data. Natural recharge was estimated to be 21,000 af. Artificial recharge and subsurface inflow were not determined. Applied water recharge was calculated to be 404,000 af. Annual urban extraction and annual agricultural extraction were estimated as 15,000 af and 551,000 af, respectively. There were no other extractions, and subsurface outflow was not determined.

Groundwater Quality Characterization

The majority of this subbasin is generally a calcium sodium bicarbonate type, with sodium bicarbonate and sodium chloride at the western margin of the subbasin along the San Joaquin River (Mitten 1970). TDS values range from 100 to 6,400 mg/L, with a typical range of 200 to 400 mg/L. The Department of Health Services, which monitors Title 22 water quality standards, reports TDS values in 40 wells ranging from 100 to 400 mg/L, with an average value of 215 mg/L. EC values range from 180 to 600 µmhos/cm, with an average value of 251 µmhos/cm (based on 15 wells).

Groundwater Quality Impairments

There are localized areas of high hardness, iron, nitrate, and chloride. One well is currently undergoing GAC filtration for the removal of EDB/DBCP (Glos 2001).

Land Use/Irrigated Land

Tables 50 and 51 describe land uses within the Madera GQMP Zone from two different data sets, USDA (2012) and DWR (early 2000s), respectively. USDA data in Table 50 indicate almonds, grapes, pistachios, and fallow/idle cropland as the crops capturing over 85% of the land use in the Madera GQMP Zone, regardless of irrigated or non-irrigated status. DWR data in Table 51 indicate the top irrigated crop as deciduous fruits and nuts followed closely by vineyards.

Table 50. Land use acreage within the entire Madera GQMP Zone1.

Row Labels	Acreage	Percent acreage of Zone
Almonds	112208	42.27%
Grapes	83488	31.45%
Pistachios	17638	6.64%
Fallow/Idle Cropland	12576	4.74%
Alfalfa	11560	4.35%
Winter Wheat	9477	3.57%
Oats	7814	2.94%
Grand Total for Agricultural Crops	254763	96%

[1]Land use information obtained from data provided by USDA, 2012 California Cropland Data Layer: http://www.nass.usda.gov/research/Cropland/SARS1a.htm. Land use in some areas of the ESJWQC may have changed since that time.
*Percent of cropped area includes all agricultural fields, whether fallow or active. Land use categories such as barren, developed, and native or wetland vegetation were not included in acreage totals. Crops contributing 1% or more of the overall land use within the GQMP area were included.

Table 51. Land use acreage within the Madera GQMP Zone by ESJHVA Priority 1-3 areas.

Land uses derived from DWR data in order to incorporate irrigation data designated as irrigated/non-irrigated (I/NI); numbers are rounded to nearest whole number.

Land Use	I/NI	Priority 1	Priority 2	Priority 3	Not in ESJHVA
Citrus & Sub-Tropical	I	26	151	761	5979
Deciduous Fruits & Nuts	I	67	2791	21070	58409
Field Crops	I	176	3209	14625	20649
Field Crops	NI	0	0	4	311
Grain & Hay	I	45	1056	4216	7017
Grain & Hay	NI	0	49	1045	6812
Idle	I	0	8	915	3238
Idle	NI	0	0	1	0
Native Riparian	NI	1	96	1055	972
Native Vegetation	NI	23	885	12612	88805
Pasture	I	88	1245	9348	14204
Pasture	NI	0	0	0	28
Rice	I	1	115	2	12
Semi-agricultural	NI	7	299	1800	1897
Truck, Nursery, Berry	I	6	228	1051	2280
Urban	NI	160	3619	4331	18629
Vineyard	I	214	3534	39807	50762

* Land use information obtained from data provided by DWR, http://www.water.ca.gov/landwateruse/anaglwu.cfm. Data compiled in 2001, land use in some areas of the ESJWQC may have changed since that time.

Constituents of Concern in Zone

Nitrates

Tables 52 and 53 describe nitrogen as nitrate within the Madera GQMP Zone. Table 52 indicates that of those wells sampled in the Madera GQMP Zone, approximately 13% exceeded the MCL of 10mg/L. Table 53 indicates that of those wells with nitrate exceedances from 2005-2013, the highest number of wells with nitrate exceedances greater than 10 mg/L are located in the Priority 3 area (21 wells) of the ESJHVA.

Table 52. Count of nitrate (NO3) detections from 5-10mg/L and exceedances >10mg/L by well from 2005-2013 for the Madera GQMP Zone.

	Count of Wells			Percent of Wells		
	NO_3 <5 mg/L	NO_3 5-10 mg/L	NO_3 > =10 mg/L	NO_3 <5 mg/L	NO_3 5-10 mg/L	NO_3 > =10 mg/L
Madera GQMP Zone	174	49	32	68%	19%	13%

Table 53. Number of individual wells with nitrate exceedances (greater than 10 mg/L) for the Madera GQMP Zone relative to ESJHVA Priority Areas 1, 2, or 3.

Well, nitrate, and ESJHVA priority designation data used here are the same as those data compiled in the GAR.

Zone	ESJHVA Priority Areas			
	Priority 1	Priority 2	Priority 3	Outside ESJHVA
Madera GQMP Zone	0	7	21	4

TDS

Tables 54 and 55 describe TDS levels within the Madera GQMP Zone. Table 54 indicates that of those wells sampled in the Madera GQMP Zone, approximately 19% exceeded the agricultural MCL of 450 mg/L. Table 55 indicates that of those wells with TDS exceedances from 2005-2013, the majority (17) are located in the Priority 3 area of the ESJHVA.

Table 54. Count of wells with detections of TDS (less than 450 mg/L) and exceedances of TDS (equal to or greater than 450 mg/L) within the Madera Groundwater Management Zone.

Well and TDS data used here are the same as those data compiled in the GAR.

Zone	Count of Wells			% wells TDS>450
	TDS<450	TDS>=450	Total wells	
Madera GQMP Zone	136	32	168	19%

Table 55. Number of individual wells with TDS exceedances (greater than 450 mg/L) by well from 2005-2013 for the Madera Groundwater Management Zone relative to ESJHVA Priority Areas 1, 2, or 3.

Well, TDS, and ESJHVA priority designation data used here are the same as those data compiled in the GAR.

Zone	ESJHVA Priority Areas			
	Priority 1	Priority 2	Priority 3	Outside ESJHVA
Madera GQMP Zone	0	1	17	0

Pesticides

As stated in previous sections, of the eight pesticides recorded as having exceeded WQTLs in the GAR, only diazinon and simazine are currently registered for application and use with the DPR. Only diazinon and simazine are to be considered COCs for current groundwater quality management purposes. No exceedances of pesticide COCs occurred in the Madera GQMP Zone. The below data (Tables 56 and 57) indicate detections only.

Table 56. Summary of pesticide detections (below MCL threshold) and exceedances (at or above MCL threshold) for the Madera GQMP Zone.

COCs in this GQMP Zone are bolded. Well and pesticide data used below are those data compiled in the GAR.

Pesticide	Individual Wells with Detections	Individual Wells with Exceedances	TRS Sections with Detections	TRS Sections with Exceedances	Concentration in Samples with Detections (µg/L)		Exceedance Threshold Used (µg/L)	Basis for Exceedance Threshold
					Minimum	Maximum		
DBCP	57	49	40	32	0.003	60.000	0.2	CA Primary MCL
Ethylene Dibromide	1	1	1	1	0.010	1.000	0.05	CA Primary MCL
Simazine	**5**	**0**	**5**	**0**	**0.006**	**0.200**	**4**	**CA Primary MCL**

Pesticide data are for the period 1979-2011 provided by the California Department of Pesticide Regulation (DPR)

*Exceedance thresholds used are based on values reported in the SWRCB Water Quality Goals Online Database (http://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.shtml), when available. Selection of the threshold value for use to indicate an exceedance is based on a hierarchy consisting of the following order of preference: CA Primary MCL = California Primary MCL; EPA Primary MCL = EPA's Federal Primary MCL; CA Notification = California Notification Level. No value in database = Chemical is in the database but not possible threshold value reported, Chemical not in database = Chemical was not located in the SWRCB database

Table 57. Number of individual wells and TRS sections with pesticide exceedances for the Madera GQMP Zone relative to ESJHVA Priority Areas 1, 2, or 3.

Well, TRS, pesticide, and ESJHVA priority designation data used here are the same as those data compiled in the GAR.

Pesticide	ESJHVA Priority Areas							
	Priority 1		Priority 2		Priority 3		Not in ESJHVA	
	Individual	TRS	Individual	TRS	Individual	TRS	Individual	TRS
DBCP	0	0	9	7	32	20	8	5
Ethylene Dibromide	0	0	1	1	0	0	0	0

DATA EVALUATION

INFORMATION NEEDED TO QUANTIFY PROGRAM EFFECTIVENESS

To quantify management plan program effectiveness, there are several types of data that will be collected by the Coalition over the next year including:

- Management practices used by members in high vulnerability regions,
- Management practices recommended to growers for implementation in the future, and
- Recommended management practices actually implemented by members.

The Coalition currently maintains independent relational databases for water quality monitoring data, management practices reported in the Farm Evaluation Reports, practices recommended by Coalition representatives, and pesticide use information received from the office of the County Agricultural Commissioners. In addition, the Coalition maintains a database of pesticides applied in the Coalition region including physical, chemical, and toxicological information that is used to identify applications that have the potential to cause toxicity.

RECORDS AND REPORTING

The Coalition will submit each year by May 1 in a Management Practice Progress Report as part of the Annual Monitoring Report, also submitted by May 1. The report will contain the 13 components listed in Appendix MRP-1 of the WDR. All reports are submitted electronically and shapefiles are either submitted with the reports, or available upon request.

REFERENCES

AMEC Geomatrix. (2008). *Merced Groundwater Basin Groundwater Management Plan Update, Merced County, CA*. Available at: http://www.water.ca.gov/groundwater/docs/GWMP/SJ-8_MAGPI_GWMP_2008.pdf.

Bookman-Edmonston. (2005). *Integrated Regional Groundwater Management Plan for the Modesto Subbasin*. Available at: http://www.water.ca.gov/urbanwatermanagement/2005uwmps/Modesto/GWMP/app-h.pdf.

Boyle Engineering Corporation. (2008). *Integrated Regional Water Management Plan, Volume 1, Madera County*.

Burow, K.R., Shelton, J.L., Hevesi, J.A., and Weissmann, G.S. (2004). *Hydrogeologic Characterization of the Modesto Area, San Joaquin Valley, California: U.S. Geological Survey Scientific Investigations Report 2004-5232*. Available at: http://pubs.usgs.gov/sir/2004/5232/.

California Department of Water Resources, County Land Use Survey Data by Individual County, http://www.water.ca.gov/landwateruse/lusrvymain.cfm.

California Department of Water Resources. (1997). *Groundwater Management in California, A Report to the Legislature Pursuant to Senate Bill 1245 (1997)*.

California Department of Water Resources. (2003). *Bulletin 118*. Available at: http://www.water.ca.gov/groundwater/bulletin118/index.cfm.

California Department of Water Resources. (2005). Irrigated Crop Acres and Water Use. Currently using 2005 Data. Available at: http://www.water.ca.gov/landwateruse/anaglwu.cf

California Department of Water Resources. (2013). *California Water Plan, Investing in Innovation and Infrastructure, San Joaquin River Hydrologic Region, Volume 2, Regional Reports*. Available at: http://www.waterplan.water.ca.gov/docs/cwpu2013/Final/Vol2_SanJoaquinRiverRR.pdf.

California Regional Water Quality Control Board Central Valley Region. (2006). *Irrigated Lands Discharge Program Draft Existing Conditions Report*. Available at: http://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/new_waste_discharge_requirements/exist_cond_rpt/draft_existing_conditions_rpt/ch04_pt3.pdf.

California Regional Water Quality Control Board Central Valley Region. (2012). *California Regional Water Quality Control Board Central Valley Region Order R5-2012-0116, Revision 2, Waste Discharge Requirements General Order for Growers within the Eastern San Joaquin River Watershed that are Members of the Third-Party Group*. Available at: http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/general_orders/r5-2012-0116-r2.pdf.

California State Water Resources Control Board. (2013a). Water Quality Goals Online Database. Available at: http://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.shtml.

CWD-Red Top RCD Joint Powers Authority. (1997). *Groundwater Management Plan in Accordance with AB3030*. Available at: http://www.water.ca.gov/groundwater/docs/GWMP/SJ-2_ChowchillaWD-RedTopRCD_GWMP_1997.pdf.

East San Joaquin Water Quality Coalition. (2014). *East San Joaquin Water Quality Coalition Groundwater Quality Assessment Report*.

East Stanislaus Regional Water Management Partnership. (2013). *East Stanislaus Region Integrated Regional Water Management Plan*.

Faunt, C., R.T. Hanson, K. Belitz, W. Schmid, S. Predmore, D. L. Rewis, and K. McPherson. (2009) *Groundwater Availability of the Central Valley Aquifer, California. USGS Professional Paper 1766*. Available at: http://pubs.usgs.gov/pp/1766/.

GEI Consultants, Inc. (2014). *Draft 2014 Eastern San Joaquin Integrated Regional Water Management Plan*. Available at: http://www.water.ca.gov/irwm/grants/docs/PlanReviewProcess/Eastern_San_Joaquin_IRWMP/Eastern%20San%20Joaquin%202014%20IRWMP%20Update%20140605%20rev21%20%28FINAL%29.pdf.

Landon, M.K., Belitz, Kenneth, Jurgens, B.C., Kulongoski, J.T., and Johnson, T.D. (2010). *Status and Understanding of Groundwater Quality in the Central-Eastside San Joaquin Basin, 2006: California GAMA Program Priority Basin Project: U.S. Geological Survey Scientific Investigations Report 2009-5266*.

Provost and Pritchard Consulting Group. (2014). *Draft Madera Regional Groundwater Management Plan*, http://co.madera.ca.gov/index.php/county-forms/category/633-groundwater-management-plan.

RMC. (2013). *Merced Integrated Regional Water Management Plan*. Available at: http://www.mercedirwmp.org/files/MIRWMP%20Revised%20Final.pdf.

Shelton, J.L., Fram, M.S., Belitz, K., and Jurgens, B.C. (2012). *Status and Understanding of Groundwater Quality in the Madera-Chowchilla study unit, 2008: U.S. Geological Survey Scientific Investigations Report 2012-5094*.

Roberts, T. L. (2007). Right product, right rate, tight time and right place... the foundation of best management practices for fertilizer. Fertilizer Best Management Practices. First Edition, IFA, Paris, France. p. 1-32. Available at: (http://www.ipni.net/ipniweb/portal.nsf/0/55C6FA392D96B89885257A8C0057EDAA/$FILE/Fixen_2007_Global_BMP_Framework.pdf).

Madera County. (2002). *AB3030 Groundwater Management Plan Madera County (Final Draft)*.

Turlock Groundwater Basin Association. (2008). *Turlock Groundwater Basin, Draft Groundwater Management Plan*. Available at: http://www.water.ca.gov/urbanwatermanagement/2010uwmps/Turlock,%20City%20of/Turlock_Groundwater_Management_Plan+Appendices.pdf.

U.S. Department of Agriculture. (2012) USDA, National Agricultural Statistics Service, 2012 California Cropland Data Layer. 2007-2012. Available at: http://www.nass.usda.gov/research/Cropland/SARS1a.htm

Exhibit 6

Table 1. Breakdown of estimated ESJWQC administrative cost increases based on 2016 budget and current proposed State Board WDR revisions.

Description	Expected Increase	Percent Increase	Justification
ESJWQC Staff / Director Increase	$182,457.60	98%	Doubling of existing Farm Bureau staff (3 part time personnel). Increase in Director's time.
CCA Part time	$50,000.00	NA	Addition of CCA to assist members with self-certification and INMP requirements.
Survey Data Management Increase	$45,405.00	45%	Increase in survey database management (additional 1,000 members with INMP requirement) and changes to database design to store additional information.
Member Management Increase	$23,975.00	25%	Increase in member data management due to additional grower requirement tracking.
Field Level Data on GeoTracker	$100,000.00	NA	Addition of time to load data to GeoTracker - estimates 4,000 members and 15 minutes each member for FE and INMP surveys (rate of $100 per hour).
Mailing Increase	$23,500.00	31%	Estimates additional mailings for INMPs at $3.50 each for 1,000 additional members (including follow up mailings). In addition, estimates additional mailings for 4,000 members at $5.00 each describing new Order requirements.
Individual Well Data Management	$400,000.00	NA	Estimates an hour each member (4,000) to assist with GeoTracker information (rate of $100 per hour).
3rd Party Data Management System	$9,400.00	NA	Based on first year cost estimates utilizing Barracuda and cloud storage.
Overall Increase (Estimated)	**$834,737.60**		
Total 2016 Budget	**$3,100,00.00**		
New Order Budget (Estimated)	$3,934,737.60	27%	

NA – Not Applicable due to new requirement and no corresponding amount budgeted in 2016.

SOMACH SIMMONS & DUNN
THERESA A. DUNHAM, ESQ. (SBN 187644)
500 Capitol Mall, Suite 1000
Sacramento, CA 95814
Telephone: (916) 446-7979
Facsimile: (916) 446-8199
Email: tdunham@somachlaw.com

Attorneys for Real Party in Interest East San Joaquin Water Quality Coalition

BEFORE THE STATE WATER RESOURCES CONTROL BOARD

In the Matter of Waste Discharge Requirements General Order No. R5-2012-0116 For Growers Within the Eastern San Joaquin River Watershed That Are Members of the Third-Party Group	SWRCB/OCC File Nos. A-2239(a)-(c) EAST SAN JOAQUIN WATER QUALITY COALITION'S REQUEST FOR CONSIDERATION OF SUPPLEMENTAL EVIDENCE

Pursuant to section 2050.6 of title 23 of the California Code of Regulations, the East San Joaquin Water Quality Coalition (ESJ Coalition) hereby requests that the State Water Resources Control Board (State Board) add the following supplemental evidence to the administrative record for the above-captioned matter and consider the following documents:

- Exhibit 1 – Central Valley Salt and Nitrate Management Plan, Section 1, Executive Summary (SNMP Executive Summary).
- Exhibit 2 – ESJ Coalition's January 13, 2014 Groundwater Assessment Report and the November 5, 2014 Addendum to the Groundwater Assessment Report, available at http://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/water_quality/coalitions/east_sanjoaquin/index.shtml#esjgar.
- Exhibit 3 – ESJ Coalition Map of Operation Size (Operation Size Map).
- Exhibit 4 – ESJ Coalition Map of High Vulnerability Area (Vulnerability Map).

- Exhibit 5 - ESJ Coalition's February 23, 2015 Comprehensive Groundwater Management Plan.
- Exhibit 6 – Breakdown of Estimated ESJ Coalition Administrative Cost Increases Based on 2016 Budget and Current Proposed State Board WDR Revisions (Table of Estimated Cost Increases).

The ESJ Coalition makes this request because admission of the aforementioned documents is necessary and appropriate in light of and to respond to new evidence and/or permit revisions or statements introduced in the State Board's proposed order on its review of Waste Discharge Requirements for Growers Within the Eastern San Joaquin River Watershed that are Members of the Third Party Group (General Order No. R5-2012-0116) (Draft Order). This request is consistent with the State Board's Second Revised Notice of Public Workshops and Notice of Written Comment Period that provides: "Supplemental Evidence will not be permitted except under limited circumstances described in California Code of Regulations, title 23, section 2050.6."

ARGUMENT

Pertinent to the matter, section 2050.6 requires any person requesting State Board to consider extra-record evidence to provide a reason why the documents were unavailable for presentation to the regional board, a detailed statement of the nature of the evidence and facts to be proved and detailed explanation of why the evidence could not previously have been submitted. Justifications for admission of Supplemental Evidence are provided for the documents in question here.

Exhibits 1 through 6 as identified above were not presented to the Central Valley Regional Water Quality Control Board (Central Valley Water Board) during the administrative process related to consideration and adoption of Waste Discharge Requirements for the Growers Within the Eastern San Joaquin River Watershed that are Members of the Third Party Group (General Order No. R5-2012-0116) (General Order). The reason is that the documents identified did not exist at the time that the General Order was adopted in 2012.

Specifically, the exhibits became available as follows: (1) Exhibit 1 became publically available on Monday, May 23, 2016, when the Central Valley Water Board noticed its public workshop on the Central Valley Salt and Nitrate Management Plan; (2) Exhibit 2 was submitted to the Central Valley Water Board by the ESJ Coalition in several parts in compliance with the General Order, with the original ESJ Groundwater Assessment Report being submitted on January 13, 2014, and an addendum to the ESJ Groundwater Assessment Report being submitted on November 5, 2014; Exhibit 3 was created in response to the State Board's Draft Order issued *In the Matter of Waste Discharge Requirements General Order No. R5-2012-0116 for Growers within the Eastern San Joaquin River Watershed that are Members of the Third-Party Group* (Draft Order), and was shown as part of the ESJ Coalition's power point presentation to the State Board at its May 4, 2016 workshop; Exhibit 4 was created in response to the State Board's Draft Order issued *In the Matter of Waste Discharge Requirements General Order No. R5-2012-0116 for Growers within the Eastern San Joaquin River Watershed that are Members of the Third-Party Group* (Draft Order), and was shown as part of the ESJ Coalition's PowerPoint presentation to the State Board at its May 4, 2016 workshop; Exhibit 5 was submitted to the Central Valley Water Board by the ESJ Coalition on February 23, 2015 in compliance with the General Order; and, Exhibit 6 was prepared by the ESJ Coalition's consultant to provide relevant cost information in response to the Draft Order.

A. Request for Supplemental Evidence Is Timely Made

The ESJ Coalition is submitting this request for Supplemental Evidence in conjunction with its responses to the Draft Order. This is as soon as it was reasonable to determine that supplemental evidence was appropriate and proper. First, at the time of the Central Valley Water Board hearing process, the ESJ Coalition could not know or speculate with respect to any Draft Order or its proposed revisions that the State Board may decide to issue in response to petitions filed challenging the Central Valley Water Board's adoption of the General Order. Thus, it was impossible for the ESJ Coalition to develop or provide the supplemental evidence at that time. Second, although some of the exhibits have been available for sometime, again, the ESJ Coalition could not anticipate that the information would be relevant to the State Board's proceedings with

respect to the Draft Order, or that it would be relevant to the ESJ Coalition's comments that were prepared in response to the State Board's Draft Order. Accordingly, the ESJ Coalition timely submits this Request for Supplemental Evidence at the designated time and date set for submittal of responses to the State Board's Draft Order.

B. Nature of the Evidence

As already indicated above, the evidence being provided here was not available at the time of the Central Valley Water Board's consideration and adoption of the General Order. That process took place over four (4) years ago, and the State Board has just now issued a very detailed and comprehensive proposal in response to petitions, and on its own motion, challenging the General Order. It is appropriate for the State Board to supplement the record with the requested evidence because it is being offered directly in response to proposed revisions that the State Board potentially seeks to make with respect to the General Order. The proposed changes in the Draft Order are far reaching and have a significant impact on the ESJ Coalition's General Order. Because of these significant changes, it is appropriate to allow the ESJ Coalition to submit additional evidence in response to such changes. The documents being proposed as supplemental evidence are being provided to support the ESJ Coalition's arguments in response to proposed changes in the Draft Order , or are evidence of resulting impacts that the proposed changes in the Draft Order will have on the administration of the ESJ Coalition's third party program under the General Order as.

C. Additional Evidence Provided in Writing

With this request, the ESJ Coalition provides the additional evidence in writing, with the exception of the ESJ Coalition Groundwater Assessment Report, and the Addendum to the ESJ Coalition Groundwater Assessment Report, which are readily available on the Central Valley Water Board's website. A direct link is provided to identify the location of the ESJ Coalition Groundwater Assessment Report and the Addendum to the ESJ Coalition Groundwater Assessment Report. These documents are not being provided directly because of the size of the documents, and because they are readily available on the Central Valley Water Board's website.

///

CONCLUSION

For the reasons provided above, the ESJ Coalition respectfully requests that the State Board grant the requests. .

SOMACH SIMMONS & DUNN
A Professional Corporation

DATED: June 1, 2016

By: _____
Theresa A. Dunham
Attorneys for Real Party in Interest East San Joaquin Water Quality Coalition

SOMACH SIMMONS & DUNN
THERESA A. DUNHAM, ESQ. (SBN 187644)
500 Capitol Mall, Suite 1000
Sacramento, CA 95814
Telephone: (916) 446-7979
Facsimile: (916) 446-8199
Email: tdunham@somachlaw.com

Attorneys for Real Party in Interest East San Joaquin Water Quality Coalition

BEFORE THE STATE WATER RESOURCES CONTROL BOARD

In the Matter of Waste Discharge Requirements General Order No. R5-2012-0116 For Growers Within the Eastern San Joaquin River Watershed That Are Members of the Third-Party Group	SWRCB/OCC File Nos. A-2239(a)-(c) DECLARATION OF THERESA A. DUNHAM IN SUPPORT OF EAST SAN JOAQUIN WATER QUALITY COALITION'S REQUEST FOR CONSIDERATION OF SUPPLEMENTAL EVIDENCE

I, Theresa A. Dunham, declare:

1. I am an attorney and shareholder with the law firm of Somach Simmons & Dunn. Somach Simmons & Dunn represents Real Party in Interest East San Joaquin Water Quality Coalition, in the above-captioned matter.

2. Exhibit 1 attached to the East San Joaquin Water Quality Coalition's Request for Consideration of Supplemental Evidence (ESJ Coalition's Request) is a true and correct copy of the May 23, 2016 Central Valley Salt and Nitrate Management Plan, Section 1, Executive Summary.

3. Exhibit 2, which is available at http://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/water_quality/coalitions/east_sanjoaquin/index.shtml#esjgar, is a a true and correct copy of the January 13, 2014 East San Joaquin Groundwater Assessment Report, and November 5, 2014 Addendum to the East San Joaquin Groundwater Assessment Report.

4. Exhibit 5 attached o the ESJ Coalition's Request is a true and correct copy of the February 23, 2015 East San Joaquin Comprehensive Groundwater Management Report.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct. Executed this 1st day of June 2016, at Sacramento, California.

Theresa A. Dunham

SOMACH SIMMONS & DUNN
THERESA A. DUNHAM, ESQ. (SBN 187644)
500 Capitol Mall, Suite 1000
Sacramento, CA 95814
Telephone: (916) 446-7979
Facsimile: (916) 446-8199
Email: tdunham@somachlaw.com

Attorneys for Real Party in Interest East San Joaquin Water Quality Coalition

BEFORE THE STATE WATER RESOURCES CONTROL BOARD

In the Matter of Waste Discharge Requirements General Order No. R5-2012-0116 For Growers Within the Eastern San Joaquin River Watershed That Are Members of the Third-Party Group	SWRCB/OCC File Nos. A-2239(a)-(c) DECLARATION OF MELISSA TURNER IN SUPPORT OF EAST SAN JOAQUIN WATER QUALITY COALITION'S REQUEST FOR CONSIDERATION OF SUPPLEMENTAL EVIDENCE

I, Melissa Turner, declare:

1. I am a Vice President and Senior Environmental Scientist in the consulting firm of Michael L. Johnson LLC (MLJ LLC). MLJ LLC is a consulting firm with expertise in ecology, toxicology, water quality, field study design, monitoring strategies, statistics, water quality regulatory compliance, geospatial analysis, database development and agricultural coalition based outreach and education. MLJ LLC provides various consulting services to the East San Joaquin Water Quality Coalition (ESJ Coalition), including but not limited to, geospatial analysis, database management and member management services. I provide direct oversight of MLJ LLC services to the ESJ Coalition, and assist the ESJ Coalition in preparing annual budgets with respect to the services and personnel needed from MLJ LLC and others.

2. Exhibit 3 attached to the East San Joaquin Water Quality Coalition's Request for Consideration of Supplemental Evidence (ESJ Coalition Request) is a true and correct copy of a

May 2, 2016 map developed by MLJ LLC for the ESJ Coalition. The map shows the ESJ Coalition area with farming operation sizes based on categories depicted on the map.

3. Exhibit 4 attached to the ESJ Coalition Request is a true and correct copy of a April 21, 2016 map developed by MLJ LLC for the ESJ Coalition. The map shows the ESJ Coalition area with high vulnerability areas identified in the ESJ Coalition Groundwater Assessment Report and its Addendum depicted on the map in relationship to disadvantaged communities.

4. Exhibit 6 attached to the ESJ Coalition Request is a true and correct copy of a May 31, 2016 Table that includes the Breakdown of Estimated ESJ Coalition Administrative Cost Increases Based on a 2016 Budget and Current Proposed State Board WDR Revisions, which I prepared based on my 12 years of experience and knowledge in managing day-to-day the ESJ Coalition activities and budgets to comply with Central Valley Regional Water Quality Control Board requirements imposed on the ESJ Coalition and its members.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct. Executed this 1 day of June 2016, at Davis, California.

Melissa Turner

Melissa Turner