APPENDIX A: MERCED SUBBASIN GSAS MEMORANDUM OF UNDERSTANDING

MEMORANDUM OF UNDERSTANDING
BETWEEN THE MERCED SUBBASIN GROUNDWATER SUSTAINABILITY AGENCY, THE MERCED IRRIGATION URBAN GROUNDWATER SUSTAINABILITY AGENCY AND THE TURNER ISLAND WATER DISTRICT GROUNDWATER SUSTAINABILITY AGENCY

THIS Agreement is entered into to be effective October 13, 2017 by and among the Merced Subbasin Groundwater Sustainability Agency (GSA), the Merced Irrigation Urban GSA, and the Turner Island Water District GSA.

RECITALS

WHEREAS, on September 16, 2014 Governor Jerry Brown signed into law Senate Bills 1168 and 1319 and Assembly Bill 1739, known collectively as the Sustainable Groundwater Management Act; and

WHEREAS, the Act went into effect on January 1, 2015; and

WHEREAS, the Act seeks to provide sustainable management of groundwater basins, enhance local management of groundwater, establish minimum standards for sustainable groundwater management, and provide local groundwater agencies with the authority and the technical and financial assistance necessary to sustainably manage groundwater; and

WHEREAS, each of the Parties overlie the Merced Subbasin (Basin Number 5-22.04, Department of Water Resources Bulletin 118) within the San Joaquin Valley Groundwater Basin, which has been designated as a high-priority basin by DWR; and

WHEREAS, the Merced Subbasin GSA elected to manage the groundwater over the boundaries of its members and act as the GSA pursuant to SGMA and notified DWR on or about March 28, 2017; and

WHEREAS, the Merced Irrigation Urban GSA elected to manage the groundwater over the boundaries of its members and act as the GSA pursuant to SGMA and notified DWR on or about May 31, 2017; and

WHEREAS, the Turner Island Water District GSA elected to manage the groundwater over the boundaries of the water district and act as the GSA pursuant to SGMA and notified DWR on or about March 22, 2017; and

WHEREAS, the Parties have previously collaborated on groundwater management through membership in the Merced Area Groundwater Pool Interests (MAGPI); and

WHEREAS, collectively, the boundaries of the Parties include all lands overlying the Basin;

WHEREAS, the Parties desire, through this Agreement, to coordinate the work of the GSAs and the management of the Basin, in accordance with SGMA; and

WHEREAS, the Parties shall designate a point of contact for the Merced Subbasin Groundwater Sustainability Plan development, who shall communicate with all other Parties.

NOW, THEREFORE, in consideration of the mutual promises, covenants and conditions herein set forth, the Parties agree as follows:

ARTICLE 1: DEFINITIONS

As used in this Agreement, unless the context requires otherwise, the meaning of the terms hereinafter set forth shall be as follows:

1.1 "Agreement" shall mean this Memorandum of Understanding among the Merced Subbasin GSA, Merced Irrigation Urban GSA and Turner Island Water District GSA.

1.2 "Basin" shall mean Merced Groundwater Subbasin, California Department of Water Resources Basin No. 5-22.04 as its boundaries may be modified from time to time in accordance with Cal. Water Code Section 10722.2.

1.3 "Coordination Agreement" shall mean a legal agreement adopted between two or more GSAs that provides the basis for intra-basin coordination of multiple GSPs within that basin pursuant to SGMA.

1.4 "Coordination Committee" is defined in Article 4 of this Agreement.

1.5 "DWR" shall mean the California Department of Water Resources.

1.6 "Effective Date" shall mean the date on which the last Party executes this Agreement.

1.7 "Groundwater Sustainability Agency" or **"GSA"** shall mean an agency enabled by SGMA to regulate a portion of the Basin cooperatively with all other Groundwater Sustainability Agencies in the Basin, in compliance with the terms and provisions of SGMA.

1.8 "GSAs" - shall mean the three (3) GSAs in the Merced Subbasin, namely the Merced Subbasin GSA, the Merced Irrigation GSA, and the Turner Island Water District GSA.

1.9 Groundwater Sustainability Plan" or **"GSP"** shall have the definition set forth in SGMA.

1.10 "**MID**" shall mean the Merced Irrigation District.

1.11 "**Notice**" is defined in Section 4.2 of this Agreement.

1.12 "Party" shall mean any of the signatories to this Agreement and "**Parties**" shall mean all of the signatories to this Agreement.

1.13 "SGMA" or "**Act**" shall mean the Sustainable Groundwater Management Act of 2014 and all regulations adopted under the legislation (SB 1168, SB 1319 and AB 1739) that collectively comprise the Act, as that legislation and those regulations may be amended from time to time.

ARTICLE 2: KEY PRINCIPLES

2.1. The Parties intend to work together in mutual cooperation to develop one GSP in compliance with SGMA, for the sustainable management of groundwater for that portion of the Basin collectively underlying the boundaries of all of the Parties.

2.2. The Parties intend to mutually cooperate to the extent possible to jointly implement the GSP within the Basin.

2.3. To the extent the Parties are not successful at jointly implementing the GSP within the Basin, or to the extent that any Parties wishes to independently implement the GSP within its boundaries, a Party may implement the GSP within its boundaries, and agrees to work together with all Parties to coordinate such implementation in accordance with the requirements of SGMA.

2.4. The Parties expressly intend that this Agreement shall not limit or interfere with the right and authority of any Party over its own internal matters, including, but not limited to, a Party's legal rights to surface water supplies and assets, groundwater supplies and assets, facilities, operations, water management and water supply matters. The Parties make no commitments by entering into this Agreement to share or otherwise contribute their water supply assets as part of the development or implementation of a GSP.

2.5. Nothing in this Agreement is intended to modify or limit the Parties' police powers, land use authorities, or any other authority.

2.6. The Parties further intend through this Agreement to cooperate to obtain consulting, administrative and management services needed to efficiently develop a GSP, to conduct outreach to other basin agencies and private parties, and to identify mechanisms for the management reasonably anticipated to be necessary for the purposes of this Agreement.

2.7. Each of the Parties acknowledges that SGMA requires that the entire Basin must be managed under one or more GSPs for the basin to be deemed in compliance with SGMA, and that if multiple GSPs are adopted within the Basin the GSAs must coordinate, and are required to use the same data and consistent methodologies for certain required technical assumptions when developing a GSP.

ARTICLE 3: PURPOSE AND POWERS

3.1. Purpose of the Agreement. The purposes of this Agreement is to:

a. Cooperatively carry out the purposes of SGMA;

b. Provide for coordination among the Parties to develop and implement a GSP and/or facilitate a Coordination Agreement, to the extent necessary;

c. Develop, adopt and implement a legally sufficient GSP covering those portions of the Basin that are within the jurisdictional boundaries of the Parties, subject to the limitations set forth in this Agreement;

d. Satisfy the requirements of SGMA for coordination among GSAs.

3.2. Authority Under the Agreement. To the extent authorized by the Parties and subject to the limitations set forth in this Agreement and the limitations of all applicable laws, the Parties acting collectively shall have the following authority including, but not limited to, the power:

a. To coordinate the implementation of SGMA among the Parties in accordance with this Agreement;

b. To recommend the adoption of actions, rules, regulations, policies, and procedures related to the coordination of the Parties for purposes of implementation of SGMA;

c. To perform all acts necessary or proper to carry out fully the purposes of this Agreement; and to exercise all other powers necessary and incidental to the implementation of the powers set forth herein.

3.3. Powers Reserved to Parties. Each Party will retain the sole and absolute right, in its sole discretion, to:

a. Be a GSA individually or collectively within the Party's boundaries;

b. Approve any portion, section or chapter of the GSP adopted by the Parties as applicable within the Party's boundaries;

c. Exercise the authorities granted to each Party as a GSA under SGMA;

d. Implement SGMA and any GSP adopted pursuant to this Agreement within its boundaries;

Notwithstanding anything to the contrary in this Agreement, this Agreement does not provide any Party the authority to undertake any activities within the geographic or service area boundaries of any of other Party pursuant to the GSP developed or adopted hereunder, unless the Parties have formally and expressly consented and agreed in writing to the activity proposed.

3.4. Term. This Agreement shall be effective as of the Effective Date and shall remain in effect until terminated in accordance with Article 7.3 of this Agreement.

3.5. Role of Party Agencies. Each of the Parties agrees to undertake such additional proceedings or actions as may be necessary in order to carry out the terms and intent of this Agreement. The support of all Parties is required for the success of this Agreement. This support will involve the following types of actions:

a. The Parties will provide support to a Coordination Committee and any third party facilitating the development of the GSP by making available staff time, information and facilities within available resources;

b. Policy support shall be provided by the Parties to either approve, or respond quickly to, any recommendations made as to funding shares, operational decisions, and other policy areas;

c. Contributions of public funds and of personnel, services, equipment or property may be made by any Parties for any of the purposes of this Agreement provided that no repayment will be made for such contributions.

3.6. Other Officers and Employees. To the extent the Parties, or any third party facilitating the development of the GSP, need support from employees, officers, consultants or otherwise need to hire employees, the Parties may do the following:

a. Provide that any employee of any Party with the express approval of that Party, may work on behalf of the Parties under this Agreement, and shall perform, the same various duties under the direction of the Coordination Committee as for his or her other employer in order to carry out this Agreement. This work may be completed and funded under the existing employment with one of the Parties. In the alternative, the Coordination Committee may recommend that the Parties to this Agreement enter into agreements to compensate, off-set costs, or otherwise fund the cost of the employment for work performed under this Agreement;

b. The Parties shall collectively contract or hire consultants and/or employees to perform work under this Agreement. The Parties may designate one Party to administer the contract. For each contract that will require cost sharing amongst the parties, the proposed contract will be presented to the Coordination Committee for review, and each Party must approve the contract pursuant to that Party's approval requirements. Such contracts shall be drafted in a manner to reflect that consultants hired to perform work under this Agreement are working on behalf of all the Parties and will be expected to work with the Parties on a collective basis and with each Party on an individual basis. Such contracts shall be made to be enforceable by all applicable Parties. Additionally, the contracts must include appropriate indemnity, insurance, and non-disclosures to protect all Parties. Once approved, no expansion, addition, or change to an approved scope of work in a signed contract involving and increase or decrease in compensation under the contract can be made by the contract administrator until approved by each Party pursuant to that Party's approval requirements.

ARTICLE 4: GOVERNANCE

4.1 Coordination Committee. The activities under this Agreement will be guided by a Coordination Committee made up of up to four (4) representatives from each of the Parties. The Coordination Committee shall work collaboratively under the terms of this Agreement to develop recommendations for the technical and substantive Basin-wide issues. These recommendations shall be reached by unanimous vote of the Coordination Committee and submitted to each Party's governing board for final approval. The governing body of each Party must approve the recommendations of the Coordination Committee prior to them becoming effective.

The Coordination Committee shall develop, but not be limited to, the following actions:

a. budget(s) and appropriate cost sharing for any project or program that requires funding from the Parties;

b. Propose guidance and options for obtaining grant funding;

c. Recommend the adoption of rules, regulations, policies, and procedures related to the Agreement;

d. Recommend the approval of any contracts with consultants or subcontractors that would undertake work on behalf of the Parties and/or relate to Basin-wide issues and, if applicable, recommend the funding that each Party should contribute towards the costs of such contracts;

e. Report to the Parties respective governing boards when dispute resolution is needed to resolve an impasse or inability to make a consensus recommendation;

f. Recommend action and/or approval of a GSP.

4.2. Dispute Resolution. Should any controversy arise among or between the Parties concerning this Agreement, or the rights and duties of any Party under this Agreement, such a controversy shall be addressed as follows:

a. Any Party may trigger the dispute resolution process by delivering, in writing to all Parties, a notification of a dispute or controversy that contains a specific description of the actions alleged to be contrary to this Agreement, and a proposed solution ("**Notice**"). Within thirty (30) days after receipt of Notice, the Parties shall attempt in good faith to resolve the controversy through informal means. If the Parties cannot agree upon a resolution of the controversy within sixty (60) days from receipt of Notice, the dispute shall be submitted to mediation prior to the commencement of legal action.

b. Mediation shall be no less than a full day (unless otherwise agreed upon by the Parties) and the cost of mediation shall be paid in equal proportion among the Parties.

c. The mediator shall be either voluntarily agreed to, or, if the Parties cannot agree upon a mediator, selected by the method set forth in (i) or (ii) below:

    i. Each Party shall appoint one mediator in writing. At the next meeting of the Coordination Committee, one member shall select the name of one mediator from the three randomly from a container.

    ii. If the three Parties do not voluntarily agree to in writing to the randomly selected mediator, then the mediator shall be appointed by the Superior Court upon motion for appointment of a neutral mediator.

d. Should the mediation process described above not provide a final resolution to the controversy raised, any Party may pursue any judicial or administrative remedies otherwise available. However, notwithstanding this Section 4.2, a Party may seek a preliminary injunction or other interlocutory judicial relief prior to completion of the mediation if necessary to avoid irreparable damage or to preserve the status quo.

ARTICLE 5: EXCHANGE OF DATA AND INFORMATION

5.1. Exchange of Information. The Parties acknowledge and recognize pursuant to this Agreement and SGMA, the Parties will need to exchange information amongst and between the Parties and the Parties' consultants.

5.2. Procedure for Exchange of Information. The Parties may exchange information through collaboration and/or informal requests made at the Coordination Committee level or through working/stakeholder subcommittees designated by the Coordination Committee. To the extent it is necessary to make a written request for information to other Parties, the following protocols shall be followed: Each of the Parties shall designate a representative to respond to information requests and provide the name and contact information of the designee to the Coordination Committee. Requests may be communicated in writing and transmitted in person or by mail, facsimile machine or other electronic means to the appropriate representative as named in this agreement.

5.3. Non-Disclosure of Confidential Information.

a. The Parties acknowledge that, in connection with their mutual activities under this Agreement, each of them may share sensitive and/or confidential information with the other Parties. To the fullest extent permitted by law, including but not limited to the Public Records Act, California Government Code Section 6250 et seq., each of the Parties shall maintain any information, documents or materials shared by the other Parties or mutually developed pursuant this Agreement, in confidence, and shall not voluntarily provide or reveal such information, documents or materials to any third party. If any Party receives a request or order from a third party that the receiving Party believes requires it to disclose any such information, documents or materials, the receiving party shall (i) immediately notify the other Parties in writing and provide them with a copy of such request or order, (ii) defer any disclosure of such information, documents or material for as long as legally permitted and (iii) cooperate with any other Party that wishes to pursue an order preventing the disclosure of such information, documents or materials.

b. The Parties further acknowledge and agree that, unless otherwise required by law, any documents, data or material designed as "DRAFT" that is shared with other Parties to this Agreement (1) shall remain confidential (2) will not be made final or shared with third parties (other than employees or consultants of that Party with a need to know), and (3) shall be used only for the purposes set forth in this Agreement.

c. If there is a breach or threatened breach of any provision of this Section 5.3, it is agreed and understood that the non-breaching Party shall have no adequate remedy in money or other damages and accordingly shall be entitled to injunctive relief; provided however, no specification in this Agreement of any particular remedy shall be construed as a waiver or prohibition of any other remedies in the event of a breach or threatened breach of this Agreement.

5.4. Model(s). The Parties will collectively adopt a single water resources model for purposes of preparing the GSP. Any Party may utilize the model for investigative runs, however, only runs made with assumptions and changes approved by the Parties will be accepted as official for inclusion within the GSP. The approved model will be located at Merced Irrigation District ("**MID**") until a future location is agreed upon by the Parties. All Parties shall receive copies of the model and shall have access to the model at MID during normal business hours.

ARTICLE 6: FINANCIAL PROVISIONS

6.1. Contributions and Expenses. Each of the Parties shall be responsible to fund its participation in this Agreement. Funding outside costs, such as consultants, projects, or other Basin-wide activities shall be determined separately for each project. For any such Basin-wide project, the Coordination Committee shall develop a scope of work and recommended a cost allocation for each of the Parties that would need to be approved by a Party's governing board before it is binding on that Party. With respect to sharing costs for GSP development, the Parties agree to the cost share allocation in **EXHIBIT A**, GSP Cost Share Allocation dated October 13, 2017.

6.2. Funding Responsibilities. Each Party will be solely responsible for raising funds for payment of that Party's share of operating and administrative costs. The obligation of each of the Parties to make payments under the terms and provision of this Agreement is an individual and several obligation and not a joint obligation with those of the other Parties. Each of the Parties shall be individually responsible for its own covenants, obligations, and liabilities under this Agreement. No Party shall be precluded from independently pursuing any of the activities contemplated in this Agreement. No Party shall be the agent or have the right or power to bind any other Parties without such Party's express written consent, except as expressly provided in this Agreement.

6.3. Alternate Funding Sources. The Parties may secure contributions of grant funding, state, federal, or other funding as funding or a portion of funding for projects between the Parties.

ARTICLE 7: CHANGES IN PURPOSE, PARTICIPATION, WITHDRAWAL AND TERMINATION

7.1. Changes in Purpose. This Agreement shall remain in place and all applicable provisions shall remain in effect, in the event the Parties determine it is not possible to develop a single GSP pursuant to this Agreement. In that instance, the Parties may develop separate, multiple GSPs, but agree that they will work together to amend this Agreement and utilize this Agreement and the Coordination Committee to meet the requirements of SGMA to utilize the same data and consistent methodologies as required by SGMA, coordinate implementation of the GPSs, and work together as necessary to comply with SGMA. Under those circumstances, this Agreement, as amended, shall constitute the Coordination Agreement required by SGMA.

7.2. Noncompliance. In the event any Party (1) fails to comply with the terms of this Agreement, or (2) undertakes actions that conflict with or undermine the compliance with SGMA and/or achieving sustainable groundwater management, as determined through mediation or by the Coordination Committee, the Party or Parties alleging non-compliance shall provide written notice summarizing the nature of lacking compliance. Further, the non-compliant Party agree to make best efforts to resolve or remedy any such non-compliance. Such actions may include, for example, failure to pay its agreed upon contributions when due; refusal to participate in GSA activities or to provide required monitoring of sustainability indicators; refusal to enforce controls as required by the GSP; refusal to implement any necessary actions as outlined by the approved GSP minimum thresholds that are likely to lead to "undesirable results" under SGMA.

7.3. Withdrawal and Termination.

a. A Party may, in its sole discretion, unilaterally withdraw from this Agreement, effective upon ninety (90) days' prior written notice to the governing boards of the other Parties, provided that (1) the withdrawing Party will remain responsible for its proportionate share of any obligation or liability duly incurred while a Party to the Agreement and (2) the withdrawing Party agrees to take all actions after termination to remain in full compliance with SGMA. The withdrawing Parties will not be responsible for its proportional share of any future obligation or liability after the written notice of termination has been given to the governing boards of the other Parties. Thereafter, the withdrawing Party shall not be responsible for any obligations or liabilities incurred by the remaining Parties. In the event the withdrawing Parties have any rights in any property or have incurred obligations, the Parties may not sell, lease or transfer such rights or be relieved of its obligations, except in accordance with a written agreement executed by it and the Parties. This Agreement shall remain in effect for the non-withdrawing parties after the withdrawal of a party.

b. This Agreement may be terminated by unanimous written consent of all the Parties. Nothing in this Agreement shall prevent the Parties from entering into another coordination agreement. However, in the event of termination each of the Parties will remain responsible for its proportionate share of all debts, liabilities and obligations incurred prior to the effective date of termination.

7.4. Disposition of Property Upon Termination. Upon termination of this Agreement, the Coordination Committee shall recommend the Parties distribute the assets between the successor entity and the Parties in proportion to how the assets were provided.

7.5. Use of Data. Upon withdrawal, any Party shall be entitled to use any data or other information developed during its time as a Party to the Agreement. Further, should a Party withdraw after completion of the GSP, the withdrawing Party shall be entitled to rely on and utilize the GSP for future implementation of SGMA within its boundaries.

ARTICLE 8: MISCELLANEOUS PROVISIONS

8.1. Indemnification.

a. Each of the Parties shall hold harmless, defend and indemnify the other Parties, and their agents, officers and employees, from and against any liability, claims, actions, costs, damages or losses of any kind, including death or injury to any person and/or damage to property arising out of the activities of the Agreement to the extent of their respective cost share allocation (as set forth in Exhibit "A").

b. The indemnification obligation set forth in Section 8.1.a shall exclude actions or claims alleged to have occurred in full, or in part, as a result of active negligence by any indemnified Party, its officers, agents or employees and except for actions or claims alleging dangerous conditions of public property that arise out of the acts or failure to act by the indemnified Party, its officers, agents or employees which are not created by an indemnifying Party.

c. The indemnification provisions contain in this Section include, but are not limited to, violation of applicable law, ordinance, regulation or rule, including, where the claim, loss, damage, charge or expense was caused by deliberate, willful, or criminal acts of any Party, or any of their agents, officers, or employees or their performance under the terms of this Agreement.

d. It is the intent of the Parties that where negligence or responsibility for injury or damages is determined to have been shared, principles of comparative negligence will be followed and each Party shall bear the proportionate cost of any loss, damage, expense and liability attributable to that Party's negligence.

e. Each Party shall establish procedures to notify the other Parties, where appropriate, of any claims, administrative actions or legal actions with respect to any of the matters described in this Section. The Parties shall cooperate in the defense of such actions brought by others with respect to the matters covered in this Agreement.

f. These indemnification obligations of this Section shall continue beyond the Term of this Agreement as to any acts or omissions occurring during this Agreement. The duty to indemnify set forth herein shall extend only to that period of time prior to a Party's withdrawal.

8.2. Liability Coordination Committee. Each Party must defend, indemnify and hold harmless the other Parties from the actions of their employees or agents taken within the scope of the authority of this Agreement.

8.3. Amendments. This Agreement may be amended from time to time by a unanimous vote of the Parties' respective governing boards.

8.4. Binding on Successors. Except as otherwise provided in this Agreement, the rights and duties of the Parties may not be assigned or delegated without a unanimous vote by the Parties. Any approved assignment or delegation shall be consistent with the terms of any contracts, resolutions, indemnities and other obligations then in effect. This Agreement shall inure to the benefit of, and be binding upon, the successors and Assigns of the Parties hereto.

8.5. Notice. Any notice or instrument required to be given or delivered under this Agreement may be made by: (a) depositing the same in any United States Post Office, postage prepaid, and shall be deemed to have been received at the expiration of 72 hours after its deposit in the United States Post Office; (b) transmission by facsimile copy to the addressee; (c) transmission by electronic mail; or (d) personal delivery, as follows:

If to Merced Subbasin Groundwater Sustainability Agency:

Ms. Lacey Kiriakou
Merced County
2222 M Street
Merced, CA 95340
Phone: 209.385.7654
Email: LKiriakou@co.merced.ca.us

If to Merced Irrigation Urban GSA:

Mr. Hicham Eltal
Merced Irrigation District
744 W. 20th Street
Post Office Box 2288
Merced, CA 95344-0288
Phone: 209.722.5761

Email: heltal@mercedid.org

If to Turner Island Water District GSA:

Mr. Lawrence Scott Skinner
Turner Island Water District
1269 W. I Street
Los Banos, CA 93535
Phone: 209.827.7700
Email: sskinner@wolfseninc.com

8.6. Counterparts. This Agreement may be executed by the Parties in separate counterparts, each of which when so executed and delivered shall be an original. All such counterparts shall together constitute but one and the same instrument.

8.7. Choice of Law. This Agreement shall be governed by the laws of the State of California.

8.8. Severability. If one or more clauses, sentences, paragraphs or provisions of this Agreement are held to be unlawful, invalid or unenforceable, it is hereby agreed by the Parties that the remainder of the Agreement shall not be affected thereby. Such clauses, sentences, paragraphs or provisions shall be deemed reformed so as to be lawful, valid and enforced to the maximum extent possible.

8.9. Headings. The paragraph headings used in this Agreement are intended for convenience only and shall not be used in interpreting this Agreement or in determining any of the rights or obligations of the Parties to this Agreement.

8.10. Construction and Interpretation. This Agreement has been arrived at through negotiation and each of the Parties has had a full and fair opportunity to revise the terms of this Agreement. As a result, the normal rule of construction that any ambiguities are to be resolved against the drafting Parties shall not apply in the construction or interpretation of this Agreement.

8.11. Entire Agreement. This Agreement constitutes the entire agreement among the Parties and supersedes all prior agreements and understandings, written or oral. This Agreement may only be amended by written instrument executed by all Parties.

IN WITNESS WHEREOF, the Parties hereto execute this Agreement on the last date written beside each Party representative's signature.

Merced Subbasin Groundwater Sustainability Agency

By: Robert D Kelley   Date: 10/12/2017

Name: Robert D Kelley

Merced Irrigation Urban Groundwater Sustainability Agency

By: ____________________   Date: ____________________

Name: ____________________

Turner Island Water District Groundwater Sustainability Agency

By: ____________________   Date: ____________________

Name: ____________________

EXHIBIT A
GSP DEVELOPMENT COST SHARE ALLOCATION
October 13, 2017

GSA	COST ALLOCATION
Merced Irrigation Urban GSA	40%
Merced Subbasin GSA	58%
Turner Island Water District GSA	2%
	100%

The percentage are derived from a ratio between irrigated and urban areas and groundwater production for the last 10 years, as derived from the latest available sources.

APPENDIX B: COMBINED MEETING MINUTES FROM COORDINATING COMMITTEE, STAKEHOLDER ADVISORY COMMITTEE, AND PUBLIC MEETINGS

MEETING MINUTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: March 26, 2018 at 9:30 AM

LOCATION: Merced County Admin Building – 2222 M St, 3rd Floor Conference Room 310, Merced, CA

Coordinating Committee Members In Attendance:

	Representative	GSA
☐	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☐	Daniel Chaves	Merced Irrigation-Urban GSA
☐	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☒	Nic Marchini	Merced Subbasin GSA
☒	Rodrigo Espinoza	Merced Subbasin GSA
☐	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Overview of Sustainable Groundwater Management Act (SGMA) Groundwater Sustainability Plan (GSP) requirements
    - Woodard & Curran (consultant) provided a review of SGMA GSP requirements and discussed coordination with adjacent basins.
2. Overview of work completed to date and the scope of work for the Merced GSP development
    - Woodard & Curran provided an update on work completed to date, including modeling work that was completed as part of SGMA Readiness and Stressed Basins efforts. The basin groundwater model has been validated and calibrated.
    - DWR recommended full funding for Merced's GSP preparation and 3 Severely Disadvantaged Communities (SDAC) projects. Recommendations are currently out for public comment.
        i. Next Step: DWR expected to finalize recommendation soon and begin contracting.
3. GSP development process / timeline / roadmap
    - Woodard & Curran provided an overview of the GSP roadmap and timeline. The GSP needs to be finished in 18 months because the 3 GSAs need to adopt by Jan 31, 2020.

The meeting handout (Roadmap) and slides provide details on 13 scope tasks and anticipated process for plan development.

4. Discuss the stakeholder outreach approach
   - About 45 applications were received for the Stakeholder Committee. Draft committee list was formed by working with staff from each of GSAs.
   - ACTION: CC unanimous recommendation to approve the Stakeholder Committee; each GSA will take this list back to their board to approve.
5. Discuss DWR's SGMA Technical Support Services (TSS) opportunity
   - Woodard & Curran provided a summary of the TSS opportunity. The types and locations of monitoring will need to be identified to request services from DWR. The group discussed multiple options and criteria for potential well locations. The goal is to develop 2-3 ideas to discuss with DWR and move forward with the most appealing option.
   - ACTION: CC unanimous approval to pursue TSS funds with caveat team will come back to CC with specifics, time permitting.
6. Confirm Coordinating Committee schedule for in-person meetings and calls
   - The Committee agreed to set a standing meeting time for the fourth Monday of the month from 1:30pm to 3:30pm. The next meeting would be April 23, 1:30pm to 3:30pm (Note: the May meeting would be moved to May 29 from 1:30pm to 3:30pm due to the Memorial Day holiday).
7. Opportunity for public comment on items not on agenda
   - There was a request for information on the grant application for the 3 SDAC projects. Grant information is available through the DWR website and a link will be added to the Merced SGMA website (www.MercedSGMA.org)
8. Next steps and adjourn

MEETING MINUTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: April 23, 2018 at 1:30 PM

LOCATION: Sam Pipes Room, Civic Center/City Hall, 678 W 18th Street, 1st Floor, Merced, CA

Coordinating Committee Members In Attendance:

	Representative	GSA
☐	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☐	Daniel Chaves	Merced Irrigation-Urban GSA
☒	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☒	Nic Marchini	Merced Subbasin GSA
☐	Rodrigo Espinoza	Merced Subbasin GSA
☐	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Approval of minutes for March 26, 2018 meeting
   - Minutes were unanimously approved
2. Stakeholder Committee Progress and Update
   - First Stakeholder Committee Meeting will be 5/29/2018
3. Overview of work completed to date related to basin conditions
   - Woodard & Curran provided additional information on work completed to date as part of SGMA Readiness and Stressed Basins efforts:
     i. Merced Water Resources Model
     ii. Monitoring Plan – Merced County
4. Introduction to Terminology:
   - Woodard & Curran provided an overview of the key terminology for SGMA, including the relationships between Sustainability Indicators, Undesirable Results, Minimum Thresholds, Measurable Objectives, Interim Milestones, Margin of Operational Flexibility, and Monitoring Network
5. Preliminary Discussion on Undesirable Results

The group brought up the following potential undesirable effects to consider for each of the Sustainability Indicators:

- Chronic Lowering of Groundwater Levels
    i. Groundwater levels were noted to be an important indicator for several other Sustainability Indicators due to interconnectedness and easier visibility
    ii. Reduced specific pumping capacities at deeper wells
    iii. Question for technical team: how much emphasis will there be on recording or differentiating between static levels vs pumping levels?
- Reduction in Groundwater Storage
    i. Groundwater storage was noted to be less important due to a relatively large storage capacity – undesirable effects from reduced storage will be measured primarily in chronic lowering of groundwater levels
    ii. Might need to consider storage changes above vs below the Corcoran Clay separately
- Seawater Intrusion
    i. Does not apply to the Subbasin; salinity will be considered in degraded water quality
- Degraded Water Quality
    i. Crop impacts
    ii. Nonpoint sources, e.g. contaminant plumes in the cities
    iii. Water quality above vs below the Corcoran Clay
    iv. Groundwater pumping may be a positive action if trying to contain a specific localized groundwater quality concern
- Land Subsidence
    i. Increased conveyance costs of irrigation water
    ii. Possible changes in direction of flow in unconfined aquifer
    iii. Cost of injecting water as a tool to slow subsidence
    iv. Look into research on lagging effect of subsidence after groundwater pumping
- Depletion of Interconnected Surface Water
    i. CC members had no additions to list presented in slide

Other discussion points included:

- Substitute Environmental Document (SED) for Bay-Delta Plan unlikely to be finalized during GSP development; GSP will be developed according to current requirements but changes can be incorporated later if needed
- Shallow domestic wells are unlikely to be useful for groundwater level measurements
- The LeGrand area was identified as a key indicator region that has historically been more sensitive to groundwater level changes, but may have limited monitoring data available (additional investigation needed)

6. Discuss DWR's SGMA Technical Support Services (TSS) opportunity

    - Woodard & Curran provided an update on the TSS opportunity based on the 4/20/18 conference call with DWR

- Likely that Delta-Mendota Subbasin will site a monitoring well on their side of the Subbasin boundary which will be beneficial for Merced Subbasin as well, leaving Merced Subbasin with an opportunity to request a monitoring well in a different location in the Subbasin (potentially in the LeGrand region)

7. Discuss Leadership Counsel for Justice and Accountability Request for Letter of Support
    - Leadership Council for Justice & Accountability has applied for SGMA funding for DAC outreach in the San Joaquin Valley, and DWR has requested Leadership Counsel obtain letter of support from the GSPs in those areas (including Merced)
    - CC chose to take no action until additional information is provided by the group on their workplan and how it will be coordinated with the work Self Help Enterprises will conduct in the subbasin
8. Opportunity for public comment on items not on agenda
    - No questions
9. Next steps and adjourn
    - CC members were provided with maps of monitoring wells in 1992, 2015, and present for their respective GSA and given an assignment to indicate wells or regions of wells known to experience undesirable effects for each of the six Sustainability Indicators
    - Hicham ElTal provided an update on the first interbasin meeting between Turlock and Merced, with a next meeting tentatively June 18, 2018

MEETING MINUTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: May 29, 2018 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☐	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☒	Daniel Chavez	Merced Irrigation-Urban GSA
☒	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☒	Nic Marchini	Merced Subbasin GSA
☒	Rodrigo Espinoza	Merced Subbasin GSA
☐	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Approval of minutes for April 23, 2018 meeting
    - Minutes were unanimously approved
2. Stakeholder Committee (SC) Update
    - Unanimous approval to add City of Livingston representative Alex McCabe to the SC (was left off initial list due to administrative error)
    - Samantha Salvia provided an update on the first SC meeting, held earlier in the day.
        i. First SC Meeting was held morning of 5/29/2018, attended by 20 members.
        ii. SC members expressed interest in regular updates on interbasin coordination as well as meeting time allocated for educational topics including water quality related to SGMA and Bay Delta Plan. These items will be worked into future meetings on an ongoing basis.
        iii. SC members requested ability to designate alternates when they are unable to attend a meeting. CC members were open to alternates provided they represent the same interests as the SC member. Consultant team was directed to put together a

proposal for Stakeholder Committee procedures for attendance and designation of alternates.

- Hicham ElTal reported that UC Merced has offered to present on effective communication of water topics.
    i. CC group agreed to direct consultant team to schedule an optional "brown bag" lunchtime presentation for both SC and CC members in June or July.

3. Presentation by Woodard & Curran on GSP Development

- Charles Gardiner (Catalyst Group) provided an update on the Stakeholder Outreach Plan
    i. This is envisioned as a living document and will be updated roughly quarterly.
    ii. Any additional comments are requested from CC members by June 8.
- Dominick Amador (Woodard & Curran) gave a presentation on the Merced Water Resources Model (MercedWRM).
    i. The MercedWRM historical and existing conditions baseline was developed through the MAGPI group and is available to support GSP implementation.
    ii. W&C is currently incorporating additional data from Turner Island WD.
    iii. Additional discussion by the CC is needed to refine the assumptions required for development a projected conditions baseline.
    iv. Bob Kelley (Stevinson Water District) requested the committee consider extending the hydrologic period though the 2017 water year to capture the effects of drought recovery.
- Samantha Salvia (Woodard & Curran) provided a summary of feedback on the Undesirable Results Exercise from the CC members of all 3 GSAs

4. Update on DWR's SGMA Technical Support Services (TSS) opportunity

- Hicham ElTal (Merced Irrigation District) reported that discussions with Chris White (Central California Irrigation District) have continued re: installing a monitoring well in the southwest corner of the Subbasin. A landowner has volunteered a site but is requesting well characteristics information which Hicham is working on providing.
- Next steps include locating a site for the desired monitoring well in the Le Grand area.
- Amanda Peisch from DWR attended the 5/29/2018 SC meeting and indicated that limited funds are available in this first TSS round. More funds may be available in the future and will be dependent on state budget because source is the General Fund.

5. Discuss Leadership Counsel for Justice and Accountability Request for Letter of Support

- Amanda Monaco (Water Policy Coordinator at Leadership Counsel for Justice and Accountability) provided a description of her organization's work with Disadvantaged Communities and how it fits into GSP development in the Merced Subbasin.
- CC directed staff to write a letter of support for Leadership Counsel.

6. Opportunity for public comment on items not on agenda
    - No questions
7. Next steps and adjourn

MEETING MINUTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: June 25, 2018 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☐	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☒	Daniel Chavez	Merced Irrigation-Urban GSA
☒	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☒	Nic Marchini	Merced Subbasin GSA
☐	Rodrigo Espinoza	Merced Subbasin GSA
☐	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Approval of minutes for May 29, 2018 meeting.
    - Minutes were unanimously approved
2. Stakeholder Committee (SC) Update
    - Alyson Watson (Woodard & Curran) provided an update on the second SC meeting held earlier in the day. SC members were provided a background on sustainability terms and had open discussion about the definition of sustainability and how it applies to the Subbasin.
3. Plan Area and Authority
    - Alyson Watson provided an overview of what the Plan Area and Authority chapter includes, which will be provided for review by Coordinating Committee (CC) members at the end of June to return with comments by July 23 meeting.
4. Minimum Thresholds
    - MID likely has 1 well in area in eastern portion of the Subbasin that could be added to analysis., with 1 additional possibly near Fahrens Creek. Identified need to work with Planada CSD and others to get additional data in this eastern area.

- Some dry wells in 2015 were only 25 feet deep, but it may not be reasonable to say the threshold is 25 ft in these spots.

- Ron Meyers was identified as a pump tester who may have more detailed well completion information than some of the agencies for areas with private wells. Nic Marchini will provide Ron's contact info.

- Nic Marchini will look at static water level records back to 2012 and try to put together a summary spreadsheet to fill some data gaps.

- Hicham ElTal noted that in the McSwain area, some water is being produced from below a hardpan (not related to Corcoran Clay). In 2008, some wells dropped 40-50 feet. This one example out of several other special situations where shallow groundwater wells may not be useful for regional measurement and analysis.

- Hicham ElTal indicated that agencies in neighboring Subbasin may have more information about trucked water program and should be contacted.

- CC members discussed the definition of Groundwater Dependent Ecosystems (GDEs) and the need for ground-truthing the dataset provided by The Nature Conservancy (TNC)/DWR.

5. Current Conditions Baseline

- Ali Taghavi (Woodard & Curran) gave a presentation on current conditions baseline assumptions and results so far.

- Hicham ElTal and Ken Elwin indicated the possibility of using the latest 2012 MID dataset in the Water Resources Management Plan, prepared by CH2, for Merced and McSwain area to inform assumptions for parks, cemeteries, backyards, etc. within City of Merced boundary.

- Bob Kelley requested to rename "Change in Storage" to "Deficit" or "Overdraft" in Groundwater Budget graphics.

- A table summarizing average rainfall and example hydrologic years will be provided to CC members as a data request for suggested changes/updates.

	Average rainfall	Sample Years
Wet year		
Above normal		
Below normal		
Dry		
Critical		

6. Future Conditions

- Woodard & Curran shared that there is a need for additional information about future baseline assumptions from CC members.

- Bob Kelley shared that there is some information available about dairies, but it is not very detailed.

- Ken Elwin and Justin Vison will provide assumptions about other future conditions.
- Three assumption areas were identified for additional input:
    i. Urban: 2013 level of water usage (Will conservation measures last long-term? What can each municipality tolerate?)
    ii. Agriculture Surplus Water (Same cropping pattern with less water? What future cropping mix changes will increase or decrease water usage?)
    iii. Interbasin Coordination (How much water is escaping from Merced Subbasin to other subbasins?)
- CC members were requested to review and provide comments on projected water supply and demand information, agricultural land use, and industrial users on private wells.
- Woodard & Curran will summarize for Bob Kelley the historical information that has already been provided.

7. Coordination with Neighboring Basins Update
    - Staff have provided edits on Interbasin agreement back to Chowchilla Subbasin.
    - 2 meetings have been held so far with representatives from Turlock Subbasin to coordinate on GSP development status, data, etc.
    - Staff are trying to schedule a meeting with Delta-Mendota Subbasin, with preference to coordinate with GSAs preparing GSPs adjacent to Merced Subbasin.
    - CC members directed staff to represent them at the Interbasin Coordination meetings.
8. Update DWR's SGMA Technical Support Services (TSS) opportunity
    - Hicham ElTal (Merced Irrigation District) is still coordinating with CCID on federal and state funding for monitoring wells for subsidence. He is also still coordinating with a potential landowner to site an additional monitoring well south of LeGrand.
    - Amanda Peisch (Department of Water Resources) provided a brief update that four other TSS applications have been submitted so far. The $2-3M drilling contract is open, but DWR is hoping some other application requests outside of drilling would be handled through services provided by existing DWR staff. While funding is not exactly first-come first-serve, it is still limited and will be decreasing soon.
9. Opportunity for public comment on items not on agenda
    - A question was raised about whether GDEs will be included in future water budget projections:
        i. Not explicitly, but they are included in evapotranspiration (ET) from future land use.

- Water demand for for maintenance of natural spaces will be included through UWMPs (for city-supplied spaces) with some already in model. Refuge water release requirements from MID are already built into the model.

10. Next steps and adjourn

MEETING NOTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: July 23, 2018 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☐	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☒	Daniel Chavez	Merced Irrigation-Urban GSA
☒	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☒	Nic Marchini	Merced Subbasin GSA
☐	Rodrigo Espinoza	Merced Subbasin GSA
☒	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Approval of minutes for June 25, 2018 meeting.
    - Minutes were unanimously approved
2. Stakeholder Committee (SC) Update
    - Alyson Watson (Woodard & Curran) provided an update on the third SC meeting held earlier in the day. SC members had questions, discussion, and clarifications on assumptions for the groundwater model
    - The Coordinating Committee (CC) gave feedback on the Stakeholder Communication Workshop with UC Merced
        - Framing of the content was interesting, but how questions were posed could be improved
        - Good points were made by participants on key basin issues
3. Presentation by Woodard & Curran on GSP development
    - Plan area and authority
        - Some comments were received via email. CC members were asked to please let the Woodard & Curran team know if they plan to provide comments
    - Minimum thresholds

- Alyson Watson (Woodard & Curran) provided an overview. Technical work feeds into the policy decisions and informs what the basin will try to accomplish: identifying Undesirable Results (URs), Minimum Thresholds, and Measurable Objectives
- Groundwater Elevations
    - A list of the 6 sustainability indicators was provided. As previously discussed, seawater intrusion and storage are not considered relevant for the Merced Subbasin. Minimum thresholds are to be set where URs occur (e.g. lowest groundwater levels without UR)
    - Establishing what is undesirable/unreasonable is a policy decision. If a decision is made that an issue is significant and unreasonable that is occurring now, we can use as a 2015 data point
- Alyson Watson described the Minimum thresholds approach analysis for Corcoran clay. The approach is based on the information available for above, below, and outside the Corcoran clay. The consultant team's proposed approach looked at the CASGEM monitoring wells that are also located above the Corcoran clay and took into account the Tanked Water Program area. During the drought there were domestic wells that went dry in this area, which could be indicative of an undesirable result unless those wells have been deepened and the issues that occurred at those groundwater elevations have been addressed
- Alyson Watson also explained the minimum thresholds approach for outside the Tanked Water Program impacted area
    - An initial 20% buffer was established for the model to give an example of what this would look like in terms of thresholds. It is not suggested to have a threshold for every well, but to consider where the Tanked Water Program is and if there are some negative, undesirable results there
- Discussion and comments on the minimum thresholds approach were as follows:
    - Comment from Woodard & Curran (W&C): the question that must be asked is what undesirable results are occurring? For example, if all of the Tanked Water Program wells have been replaced, does this represent an undesirable result?
    - Comment from CC: there is not much data, nor many wells in the foothills of the Subbasin
    - Comment from CC: in selecting monitoring wells, it will be important to consider the age of the well and its anticipated additional life in terms of compliance
        - Comment from W&C: the CASGEM wells were selected because they have recorded dates that can be checked
    - Clarification given for question on adaptive management: a buffer is applied for operational flexibility. This process first considers well water for the lowest domestic wells and then looks at what happens when applying a 20% buffer
    - Comment from CC: there should be more substantiation behind the 20% buffer selection
    - Comment from W&C: the next step is to look at a 10% or 20% buffer, compare this to the data that the GSAs have, and figure out what is reasonable
- Water Quality

- Question was asked whether there are levels that could trigger issues with water quality. Response from W&C: this is very site-specific, and requires further work with staff from local agencies to understand this
- Alyson Watson (W&C) gave a brief introduction to the CV-SALTS (the Central Valley Salinity Alternatives for Long-Term Sustainability) initiative and the ILRP (Irrigated Lands Regulatory Program).
- Comment from CC: a data point on the TDS (Total Dissolved Solids) map "Average TDS Concentration BELOW Corcoran Clay (2000 – 2016)" was identified as surprising
- There was a brief discussion on salinity issues. Input from Alyson Watson (W&C): the challenge is that relatively few actions can be taken to address migration of salinity. The priority for the GSP is to identify undesirable results and how these are happening and prevent further impacts
- Input from Jim Blanke (W&C): there are some water quality issues that cannot be control (e.g. naturally occurring constituents). There are also existing programs that address some of these constituents

- Land subsidence
  - GW levels can be used as a proxy, or the GSP can use a rate of subsidence. However, even if all groundwater users in basin stopped pumping it is not known whether subsidence will continue. It is recommended by the consultant team to use this proxy and to ensure the GSP uses the same measurement approach as neighboring subbasins
  - Comment from CC: in the 1960s there was subsidence, but fewer wells and a high water table. The reasons for this are not well understood. Therefore, the GW level proxy might be a safer option
- Interconnected Surface Water
  - Alyson Watson and Dominick Amador (W&C) provided a brief overview of the interconnected surface water modelling
  - The model shows a segment north west of San Joaquin River and Merced River as an area of interest. The model will need to be adjusted to consider additional parameters for dry conditions
  - It is possible to look at how shallow wells have changed over time relative to stream losses. However, there are not many wells and there is fluctuation
  - The next step is to consider what are the undesirable results. Further work with be needed to determine GW conditions that are influencing low flows

a. Hydrogeologic conceptual model overview
   - This item was tabled to the next meeting due to lack of time

b. Current conditions baseline, projected water budget, and sustainable yield
   - Alyson Watson (Woodard & Curran) described how continued water use over 50 years will affect the water budget. The underlying assumptions are being refined
   - The sustainable yield is also being developed for discussion at the next meeting

4. Public Outreach update

- Plans for upcoming August 2 Public Meeting were discussed. Meeting materials are on the website

5. Coordination with Neighboring Basins
   - Hicham ElTal (Merced Irrigation District) reported there are upcoming meetings to sign agreements with Chowchilla and he is still working to set up a meeting with Delta-Mendota
6. Update DWR's SGMA Technical Support Services (TSS) opportunity
   - Hicham ElTal (Merced Irrigation District) provided an update. For Delta-Mendota, it might be possible to have two monitoring wells. He might be able to reach out to Chowchilla as well. Hicham also contacted DWR regarding Grant Agreement funding. DWR are not as concerned about whether the GSAs will receive funds, but that it might take longer for funds to be received
7. Public comment
8. Next steps and adjourn
   - Reminder given that Aug. 2nd is next Public meeting

Next Regular Meeting
August 27, 2018 at **1:30 p.m.**
Merced, CA – Castle Conference Center at Castle Airport (subject to change)
Information also available online at mercedsgma.org

Action may be taken on any item
Note: If you need disability-related modification or accommodation in order to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING NOTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: August 27, 2018 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☐	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☒	Daniel Chavez	Merced Irrigation-Urban GSA
☐	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☒	Nic Marchini	Merced Subbasin GSA
☐	Rodrigo Espinoza	Merced Subbasin GSA
☒	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Call to order

2. Approval of minutes for July 23, 2018 meeting.

   a) Minutes were unanimously approved

2. Stakeholder Committee (SC) update

   a) Alyson Watson (Woodard & Curran) provided an update on the fourth SC meeting held earlier in the day. SC members had questions, discussion, and clarifications on methodology for setting minimum thresholds, particularly for groundwater elevations.

3. Presentation by Woodard & Curran on GSP development

   a) Minimum Thresholds for Groundwater Elevations

      i. Alyson Watson (Woodard & Curran) presented the updated proposed methodology for calculating minimum thresholds for groundwater elevations at existing CASGEM wells.

      ii. Coordinating Committee members thought the updated methodology made sense. DWR data on domestic wells is likely to be poor, so using a 25th percentile shallow value sounds appropriate.

      iii. Public Comment: Timing of spring/fall measurement of CASGEM wells may not align with seasonal peak domestic well pumping (e.g. domestic wells may be temporarily dewatered in August, which wouldn't be caught by March/October monitoring).

iv. The “buffer”/”total range” for the elevation threshold analysis is including the impacts of seasonality and may want to consider fall to fall or spring to spring comparison.

v. Question: Should we use threshold setting results to directly identify additional monitoring locations? Answer: Our approach will be to determine storage changes through the sustainable yield process and then use the results to evaluate minimum thresholds and monitoring needs.

vi. In the gap area(s), Woodard & Curran will be evaluating other non-CASGEM wells in the database to identify any with (1) enough historical data and also that (2) meet requirements to be used (have completion depth, etc.). A separate challenge is that thresholds for newly constructed monitoring wells may take several years to determine a threshold (e.g. time needed to develop historical data).

1. Marco Bell (Merced Irrigation District [MID]) indicated that an update will be available in approximately 1-2 months about additional monitoring wells MID is working on adding or selecting from existing wells to fill CASGEM gap areas as identified in the Merced Subbasin CASGEM monitoring plan.

2. Request: Hicham ElTal (MID) requested standing agenda time to be added to future meetings to provide an update on CASGEM program status.

vii. Shallow school district wells were identified as a potential additional indicator for the groundwater threshold analysis. Woodard & Curran will start by contacting the Office of Education to obtain information about these wells for incorporation into the analysis.

b) Hydrogeologic Conceptual Model (HCM)

i. Alyson Watson (Woodard & Curran) provided an overview of the HCM section of the GSP and some example maps that will be included in the section writeup that will be provided for CC member review in the next few months.

ii. CC Comment: 3D renderings or cross sections need to include both a vertical and horizontal scale to distinguish vertical exaggeration or include a non-exaggerated version.

c) Projected Water Budget and Sustainable Yield

i. Alyson Watson (Woodard & Curran) provided an update to assumptions and results of the projected conditions baseline groundwater budget and sustainable yield groundwater budget.

ii. Question: On the projected conditions baseline budget, why does net deep percolation not change significantly? Answer: Right now, it doesn’t take into account efficiency changes since it is a baseline under projected conditions, but we would expect some decrease under other scenarios.

iii. Question: What are main assumptions in first 25 years (2015-2040) of the sustainable yield groundwater budget? Answer: No specific decisions on assumptions were made on how we will get to sustainable conditions in 2040, but for the purposes of modeling the end-result or goal, reducing agricultural land was used as a model input.

iv. Question: Under the 25-year projected sustainable yield, were assumed model condition changes modeled as front- or back-loaded in the timeline? Answer: This discussion and decision for implementation of projects and management actions will come later in the GSP process. Likely we will design it to be a smooth or back-loaded process to account for expected changes from SED or other factors.

d) Data Management Approach and DMS Demo

i. Jeanna Long (Woodard & Curran) provided a description of the data management system (Opti), including a short demo of the existing tool.

ii. Question: Will data be available to the public? Answer: The GSAs will decide, but the flexibility is there to make certain or all parts publicly available.

4. Public Outreach Update

   a. Alyson Watson (Woodard & Curran) provided a summary of discussion and comments recorded during the August 2 public workshop presentation.

5. Coordination with neighboring basins

   a) No update on Turlock right now, but meetings continue to coordinate on milestones. (Reminder: Turlock is on a different SGMA schedule that has a completion deadline 2 years after Merced).

   b) Debbie Liebersbach (Turlock Irrigation District) has met with Delta-Mendota representatives to start coordination efforts. Currently Turlock and Delta-Mendota Subbasin are discussing development of a resolution or similar document which will be shared with Merced when ready.

      i. Woodard & Curran will be setting up a meeting with Delta-Mendota soon to start coordination with the two GSPs adjoining the Merced Subbasin.

   c) A preliminary meeting was held with Chowchilla staff to begin coordination on modeling.

6. Update DWR's SGMA Technical Support Services (TSS) opportunity

   a) Hicham ElTal (MID) is waiting for a meeting to be set up by DWR to discuss timing of expected funding for Merced Subbasin project(s). Woodard & Curran continues to move the contract agreement forward with DWR and is currently waiting to hear back from DWR on the latest round of comments.

7. Public comment

   a) No comments.

8. Next steps and adjourn

Next Regular Meeting

September 24, 2018 at 1:30 p.m.

Merced, CA – Castle Conference Center at Castle Airport (subject to change)

Information also available online at mercedsgma.org

Action may be taken on any item

Note: If you need disability-related modification or accommodation in order to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING NOTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: September 24, 2018 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☒	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☒	Daniel Chavez	Merced Irrigation-Urban GSA
☒	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☒	Nic Marchini	Merced Subbasin GSA
☐	Rodrigo Espinoza	Merced Subbasin GSA
☐	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Call to order
2. Approval of minutes for August 27, 2018 meeting.
    a) Minutes were unanimously approved
3. Stakeholder Committee (SC) update
    b) Alyson Watson (Woodard & Curran) provided an update on the fifth SC meeting held earlier in the day. SC members had questions, discussion, and clarifications on updated methodology for groundwater elevation minimum elevations, plus projected water budget and sustainable yield.
4. Presentation by Woodard & Curran on GSP development
    a) Minimum Thresholds Update
        i. Groundwater Elevations
            1. Alyson Watson (Woodard & Curran) provided an update to the methodology of setting minimum thresholds for groundwater elevations (primarily the addition of CASGEM voluntary monitoring well locations and use of Merced County domestic well database related to undesirable results).
            2. Public question: What are the ranges of domestic well depths beyond the shallowest? Are there outliers for other domestic wells if the minimum threshold is the same as the shallowest domestic well? Answer: This is something we'll be

looking at more closely when we get farther into the process of selecting a smaller number of monitoring locations.

3. Question: How did you choose a 3-mile radius for domestic wells? Answer: This is a balance between being locally representative and capturing enough domestic wells per monitoring location to be statistically representative.

ii. Water Quality

1. Alyson Watson (Woodard & Curran) provided an overview of data analysis in progress for TDS and contaminated sites, demonstrating that there are large data gaps for TDS with depth.
2. Public comment: Try interviewing drillers in the area – they tend to have a good sense of at what depth high salinity is found.

b) Projected Water Budget and Sustainable Yield

i. Alyson Watson (Woodard & Curran) provided a reminder on the assumptions and results of the projected conditions baseline groundwater budget and update to the results of sustainable yield groundwater budget.

ii. Public question: Why was a 25 year implementation period used? Answer: The model's historical period is from 1995-2015 and SGMA compliance is required in 2040, so the implementation period ends up being 2015-2040 (25 years).

iii. Public question: What happens if there's a long-term drought immediately and something like 30% of domestic wells go dry (out of ordinary)? Answer: The Minimum Thresholds are generally set at levels where we do not expect this to occur. The regulations for violations are meant to be based on long-term average and we expect there to be an allowance for unusually dry year periods.

iv. Dominick Amador (Woodard & Curran) walked through GSA-specific water budget summary tables based on sustainable yield conditions.

v. Question: How was urban demand estimated outside of municipal service providers (e.g. domestic wells)? Answer: Urban demand was calculated based on population and per-person usage; outside of the cities, the population was based on census data.

vi. Alyson Watson (Woodard & Curran) provided a description of what water levels would look like under sustainable yield conditions in the subsidence area in the southern end of the Subbasin.

vii. Question: Have you considered using subsidence rates as an indicator? Answer: Yes, but this is more difficult to predict with high accuracy compared to groundwater levels. It is difficult to control subsidence rates directly, and we need to be ready to coordinate with neighboring subbasins on a similar methodology.

viii. Question: How can you go back to 2015 levels (per SGMA regulation) for subsidence if we decided to choose to use groundwater levels as a proxy for subsidence levels/rates? Answer: Probably only through an injection program or similar program designed to increase water levels.

c) Projects and Management Actions

i. Alyson Watson (Woodard & Curran) provided a description of projects and management actions and provided example categories that projects might fall into.

ii. Question: How do projects get credited to a particular GSA/landowner/etc.? Answer: It will largely depend who funds the project.

iii. The project team solicited initial project ideas from CC members and the following were brought up:

1. Reach out to the private growers for additional input.
2. Meter private irrigation wells.

5. CASGEM Update
   a. No updates provided – was tabled for next month.
6. Public Outreach Update
   a. Alyson Watson (Woodard & Curran) expressed the intention to hold a public workshop in first 1-2 weeks of December.
7. Coordination with neighboring basins
   a. Preliminary discussion was held with Delta-Mendota Subbasin: found that Delta-Mendota is slightly behind the Merced Subbasin in terms of data efforts and the project team will likely continue coordination efforts in early 2019.
8. Public comment
   a. Question: Do municipalities have overlying water rights? Answer: Individual landowners have overlying rights; rights of municipalities would be prescriptive.
   b. A request was made to post the PowerPoint slides before the next meeting in case printed copies run out.
9. Next steps and adjourn

Next Regular Meeting
October 22, 2018 at 1:30 p.m.
Merced, CA – Castle Conference Center at Castle Airport (subject to change)
Information also available online at mercedsgma.org

Action may be taken on any item
Note: If you need disability-related modification or accommodation in order to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING NOTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: October 22, 2018 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☐	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☒	Daniel Chavez	Merced Irrigation-Urban GSA
☒	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☒	Nic Marchini	Merced Subbasin GSA
☐	Rodrigo Espinoza	Merced Subbasin GSA
☒	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Call to order
2. Approval of minutes for September 24, 2018 meeting
    a. Meeting minutes were approved.
    b. A request was made and approved to have the Self-Help Enterprises and the Leadership Counsel for Justice and Accountability as the next agenda item.
3. Update from Self-Help Enterprises (SHE) and Leadership Counsel for Justice and Accountability (Leadership Counsel)
    a. Maria Herrera (SHE) and Amanda Monaco (Leadership Counsel) provided an overview of their organizations' outreach activities in the Merced Subbasin DACs and the funding received from DWR for reaching disadvantaged communities.
    b. Leadership Counsel works mostly within unincorporated communities and low-income communities that often lack basic infrastructure. Their work includes: outreach and education, GSP development assistance, identification of community water projects, and procurement of professional services.
    c. Funding for Leadership Counsel's SGMA-related work has come from the DWR Prop 1 grant and the Water Foundation.
    d. Leadership Counsel activities conducted in the Merced Subbasin included presentations to Neighbors United for a Better South Merced and to a community group in Delhi. Work has also included a GSP Workshop in April together with SHE and the Union of Concerned Scientists.

e. Maria Herrera (SHE) provided an overview of SHE activities. SHE works in outreach and education, direct community assistance, and GSP development assistance. Their work in the Merced Subbasin includes the SGMA Workshop held in August, outreach to 5 different communities, and support for development of workshop materials including translation.

    i. SHE's outreach also provides information on concerns voiced by local communities (e.g. including concerns for having large wells permitted near their communities).

    ii. SHE will continue to coordinate with Woodard & Curran and Catalyst in preparation for the upcoming public workshops.

4. Stakeholder Committee update

    a. Update from October 22 morning meeting was provided. There was a slightly smaller turn out than normal, but good discussion. Many questions were asked about groundwater rights. A CASGEM update was provided. There was a brief discussion of discuss projects and management actions.

5. Presentation by Woodard & Curran on GSP development

    a. Next Steps in GSP Development

        i. Alyson Watson (Woodard & Curran) gave an overview of the GSP development timeline.

        ii. The path for sustainability requires overcoming the challenge of reducing groundwater pumping while minimizing how much reduction has to be made in total use.

        iii. There are three steps to this process: 1) determine extent of groundwater pumping that is sustainable, 2) determine available surface water, and 3) identify potential deficit between demand and available resources.

        iv. Water budgets and modeling that has gone into these estimates are being refined. The initial estimates do not yet reflect changes to flow projections resulting from FERC relicensing.

        v. Two areas should be addressed to achieve sustainability: reducing groundwater pumping (e.g. though an allocation framework); and identifying projects and management actions (e.g. recharge groundwater, enhance surface water availability, and reduce demand).

        vi. Question asked by Alyson whether the information provided is understandable and provides committee members with enough and adequate information to be able to answer questions and talk about this issue with others. Members agree that content is understandable.

    b. Groundwater Rights Primer

        i. Brad Herrema (Brownstein Hyatt Farber Schreck) provided an informational presentation on groundwater rights and allocation frameworks. A brief list of key points is provided below (see full presentation on Merced SGMA website):

            1. In California, a water right is a usufructuary right in which there is a prohibition against waste and unreasonable use.

            2. California has a dual system of riparian rights and appropriative rights for both surface water and groundwater.

            3. Overlying rights: these rights have the highest priority and are analogous to riparian rights for surface water. All overlying land owners have the right to pump, but this is a correlative right (limited to reasonable use).

            4. Appropriative rights: non-overlying owners are allowed to extract surplus water not being used by overlying owners. It is a first in time, first in right use (whoever has

the right first, has priority over other appropriative right users). These can be subject to loss for non-use.

5. If water is imported into the basin this is covered by a "developed water" theory: those who develop means to import the water are entitled to use it.
6. Prescriptive rights: water right acquired through adverse possession of someone else's water right. There are several required elements. Often this is a result of someone taking someone else to court.
7. SGMA does not alter and is not determinative of water rights.
8. Brad Herrema recommends reviewing the Environmental Defense Fund paper on groundwater rights and the pros and cons for different allocation methods (link here).
    a. The comprehensive allocation method has the best chance of surviving judicial challenge but can be highly stakeholder engagement intensive.
    b. Allocation based on Fraction of Historic Pumping does not take into account the correlative nature of groundwater rights, and it can be difficult to get data for this.
9. Question: do you see much of the Central Valley undergoing adjudication in the future? Answer: Brad would not be surprised, but the GSP process does a lot of relevant work.
10. Clarification provided that water rights and allocation are two different things. Example provided by Alyson Waterson (W&C): your correlative water right is the straw (your ability to take water), how much you take (your allocation) is the amount you are using.

c. Projects and Management Actions

    i. Alyson Watson (W&C) gave a high-level overview for the projects and management actions section to enable adequate time for the CASGEM update. This will be revisited in the next meeting. An overview was given of what background work has been conducted and what projects information has been collected. The list presented provided information on projects the consultant team knows currently exist.
    ii. A request made to the committee to contact Woodard & Curran regarding any individuals or groups that should be contacted to collect information on more projects.
    iii. An example list of criteria was given for assessing projects.
    iv. Alyson Watson (W&C) asked the committee whether there are other criteria that should be considered. Several responses from the committee members were provided as follows:
        1. Have specific environmental benefits listed out individually.
        2. Question: if someone already has a project and it is completed how is this taken into account for allocation? Answer: will have to determine how to take this into account and determine if/how this will be credited.

d. Other Updates

    i. Groundwater Data templates and instructions for submitting data have been updated and are available on the MercedSGMA homepage.

6. CASGEM Update provided by Matt Beaman (MID)
    a. Merced Area Groundwater Pool Interests (MAGPI) collects data and submits this to the California Statewide Groundwater Elevation Monitoring program (CASGEM). CASGEM facilitates between DWR and the public.
    b. Data is used to established and create contour maps in groundwater elevations on a seasonal and long-term basis.
    c. DWR determines if Merced is in compliance with groundwater elevation reporting.
    d. CASGEM is still in effect and GSAs need to be in compliance with CASGEM to receive funding and loans. DWR provides monitoring guidelines (e.g. number of wells per area, how often monitoring, and what kind of wells). These guidelines are posted on the Merced SGMA website under the "Guidelines for Submitting Groundwater Data" on the homepage.
    e. The previous plan provided ways to minimize gap areas. Several maps are shown highlighting how wells have been filling gap areas. There are new wells from MID and 4 of the 5 wells are CASGEM wells.
    f. Stevinson Water District has some private wells that could be monitored. Hicham ElTal (MID) stated that these could be included within the datum created with upcoming grant funding for all public wells.
7. Public Outreach update
    a. Charles Gardiner (Catalyst) provided information on the two public workshops that will take place in December:
        i. Dec. 4th Community Workshop – Planada
        ii. Dec. 13th Community Workshop – Franklin-Beechwood
    b. Topics anticipated to include water budgets, where we are with the project, and a brainstorming of projects and management actions.
8. Coordination with neighboring basins
    a. Chowchilla and Delta-Mendota Subbasins will be ready early next year to continue coordination.
9. Public comment
    a. No public comments.
    b. Hicham ElTal offered that MID can provide a presentation on Flood-MAR during the next meeting.
10. Next steps and adjourn
    a. Several GSP development items anticipated to be discussed in the next meeting including: water budgets and documented assumptions, the Hydrogeological Conceptual Model (HCM) GSP section, sustainable yield analysis, and assessment of projects and management actions.

Next Regular Meeting
November 26, 2018 at 1:30 p.m.
Merced, CA – Castle Conference Center at Castle Airport (subject to change)
Information also available online at mercedsgma.org

Action may be taken on any item
Note: If you need disability-related modification or accommodation in order to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING NOTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: November 26, 2018 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☐	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☒	Daniel Chavez	Merced Irrigation-Urban GSA
☒	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☐	Nic Marchini	Merced Subbasin GSA
☐	Rodrigo Espinoza	Merced Subbasin GSA
☒	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Call to order
2. Approval of minutes for October 22, 2018 meeting
    a. Meeting minutes were approved.
3. Stakeholder Committee update
    a. Update from the November 26 morning meeting was provided. W&C staff gave a presentation on the Data Management System (DMS). Comments were requested on the draft Hydrogeologic Conceptual Model (HCM). Some SC members provided some verbal comments. Additional review time was requested and document was re-sent to SC with comments requested by Nov 30. SC comments on the Projects and Management Actions will be discussed during the discussion portion of the Coordinating Committee (CC) meeting.
4. Presentation by Woodard & Curran on GSP development
    a. Next Steps in GSP Development
        i. Alyson Watson (Woodard & Curran) provided a brief overview of the GSP development timeline and what will be covered during the meeting.
        ii. The HCM was sent out to the CC group in early November. This is part of a larger document (the GSP) with other sections. Deadline for comments is November 30th. However, if more time is needed to provide comments, CC members are asked to inform the W&C team.

iii. Water budgets have been updated with inclusion of FERC flows. Sustainable yield for the Merced Subbasin is estimated to be approximately 500,000 TAF per year. Projections that account for FERC flows indicate a need for about a 25% reduction in groundwater use for the subbasin. This percentage reduction is similar to previous estimated without updated FERC flows.

iv. Alyson Watson (W&C) explained the different inflows and outflows of the projected conditions groundwater budget and changes in cumulative storage.

b. Water Allocation Frameworks

i. Alyson Watson (W&C) described different water allocation frameworks possible under SGMA.

ii. The allocation framework chosen will also need to address and connect back to avoiding undesirable results. Projects and management actions will be revisited to address impacts to thresholds. When the GW allocation approach, projects and management actions, and consideration for impacts on thresholds and objectives are combined, the creation of management areas may be considered for specific issues.

iii. Alyson Watson (W&C) reviewed the proposed decision-making timeline for the GSP. November will focus on discussing allocation approaches as well as projects and management actions. Under SGMA, GSAs have broad authority to implement the allocations. In December the CC will discuss making a recommendation to the GSA Boards as to which allocation approach is best for the subbasin. The GSA Boards will consider the approach in January. The CC will review projects and management actions benefits along with the SC in January.

iv. Question: How will we know what impacts these different allocation approaches have? Answer from W&C: We will be doing the technical work to determine these impacts and will discuss this together.

v. Question: How will this impact thresholds? Answer from W&C: The thresholds are driven by undesirable results, which can be addressed by projects and management actions.

vi. Implementation of the GSP will be phased and include monitoring. Updates can be made to the thresholds and the allocation approach every 5 years.

vii. Question: When would we discuss management areas? Answer from W&C: This is planned for February.

viii. Alyson Watson (W&C) explained the different kinds of allocation methods.

1. Pro Rata Approach: Sustainable yield is divided total basin acreage. Advantages are that it is simple, and it recognizes the correlative (everyone has a right to access the basin) nature of groundwater rights. However, this does not account for appropriators/prescriptive rights, and does not differentiate between irrigated and unirrigated acres.
2. Pro Rata Irrigated Areas Approach: This divides the sustainable yield by irrigated and urban areas. It is simple and acknowledges existing pumping. However, the approach does not account for unexercised groundwater rights nor account for appropriators/prescriptive rights.
3. Historical Pumping Approach: This is based on historical use. This is less likely to result in conflict and accounts for appropriators and prescriptive rights. However, it requires more data and if unirrigated acres are excluded this also does not account for unexercised groundwater rights.

4. Comprehensive Approach: The advantages include less likelihood of conflict and an accounting of appropriative use and prescriptive rights. However, this approach requires data not that is currently available, and does not account for unexercised groundwater rights. The approach requires significant outreach and engagement.
5. Key differences between approaches were discussed. Some comments from the SC morning meeting were:
    a. Questions and comments on whether to have a water market.
    b. May need to limit water market access only to those who are in the basin.
    c. Maybe take a hybrid approach with different tiers (e.g. if you are not irrigating you may be in a different tier).
6. Comments from the CC group on allocation approaches:
    a. Prescriptive rights should be taken into account in calculations.
    b. It does not make sense to allocate groundwater where historically it was not used. However, people have the ability to exercise their rights to pump water.
    c. Input from Alyson Watson (W&C): Allocations can be adjusted as people exercise their rights.
    d. CC comment: Monitoring and enforcement will be important. How are we going to monitor what comes online?
    e. Input from Alyson Watson (W&C): GSAs have the authority to enforce.
    f. CC comment: If you allocate by acre, the surface water dependent folks will get less. In the commenter's experience working with surface water it is possible to prohibit the movement of water out of the basin.
    g. Comment: There is concern that people will buy useless land just for the water right.
    h. Question: Can you really do a pro rata allocation approach? Answer (W&C): GSAs cannot affect rights but can check that fees are fair.
    i. Comment: What are the enforcement actions available to GSAs? Answer (W&C): We will bring information to next meeting.
    j. Question: What if an irrigator comes online and decides to pump, but has not historically been pumping?
    k. Comment: With the County Ordinance that has been put into effect, there may likely be fewer new pumpers that will come online.
    l. Input from Alyson Watson (W&C): If there is not a question of substantial change from irrigated to non-irrigated lands, then the question is whether or not rights holders who are not irrigating (and do not intend to irrigate) will be able to sell their rights to others.
    m. Comment: It would not be a bad idea to look at other adjudicated basins and how this worked. Input from W&C: The example from the Mojave Adjudication which used a transferable allocations setup can be presented next meeting.

n. Comment: There will need to be significant outreach especially related to monitoring and data collection for the wells for people to understand this and what is needed.

o. It would be useful to have the per capita usage for the cities per day.

p. Request made to CC members from W&C: Consider the allocation approaches discussed for next meeting.

c. Projects and Management Actions

i. Alyson Watson (W&C) provided an update from the SC meeting discussion.

ii. Question asked about criteria to assess projects: What are they being assessed for? Answer (W&C): The subbasin should be able to show what projects and what potential funding avenues are in the implementation plan for the GSP.

iii. Comment: It could be useful to have a high-level cost/benefit ratio for projects.

iv. Input from Alyson Watson (W&C): The subbasin should determine what to target and identify areas of greatest need, and then determine projects that help best address these.

d. Other Updates

i. Monitoring Networks and the DMS sections of the GSP are underway.

5. Flood-MAR

a. This item was tabled to next meeting.

6. Public Outreach update

a. There are two upcoming Public Workshops: Dec. 4th in Planada, and Dec. 13th in Franklin.

7. Coordination with neighboring basins

a. Chowchilla and Delta-Mendota Subbasins will be ready early next year to continue coordination.

8. Public comment

a. Bill Nicholson from the Local Agency Formation Commission (LAFCo), which regulates boundary changes, gave in input on relevant boundary applications. There is an application for an Owen's Creek Water District, which is on the edge of the basin on the San Joaquin River. There is an annexation for Le Grand-Athelone Water District. This is currently in the sphere of influence for MID but will need to be removed. This might have some impacts to TIWD. Bill will send information out to individual districts and will be looking for input on these applications as they move forward.

9. Next steps and adjourn

a. Summary memo on the water budgets in progress.

b. Merced Subbasin GSA Board took place and the MIUGSA and TIWD Joint Meeting is upcoming.

Next Regular Meeting
December 17, 2018 at 1:30 p.m.
Merced, CA – Castle Conference Center at Castle Airport (subject to change)
Information also available online at mercedsgma.org

Action may be taken on any item

Note: If you need disability-related modification or accommodation in order to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING NOTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: December 17, 2018 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☐	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☒	Daniel Chavez	Merced Irrigation-Urban GSA
☒	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☐	Bob Kelley	Merced Subbasin GSA
☐	Nic Marchini	Merced Subbasin GSA
☐	Rodrigo Espinoza	Merced Subbasin GSA
☒	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Call to order
2. Approval of minutes for November 26, 2018 meeting
    a. Meeting minutes were approved.
3. Stakeholder Committee update
    a. Update from December 17 morning meeting was provided. Alyson Watson (Woodard & Curran) provided an update on what was discussed in the morning SC meeting.
4. Presentation by Woodard & Curran on GSP development
    a. Next Steps in GSP Development presented by Alyson Watson (W&C). The focus of the meeting is on water allocation frameworks.
    b. Water Allocation Frameworks
        i. Question: Does a violation have to be determined by the Superior Court? Answer (W&C): No, the GSAs have the authority to determine violations.
        ii. Alyson Watson (W&C) provided a brief review of the two different type of groundwater rights that will be discussed during the meeting: prescriptive and overlying (correlative) rights.
        iii. Alyson Watson (W&C) provided a recap of the different allocation methods discussed at the last meeting. The W&C team started from the comments received during the last meetings and worked these into different examples of allocation frameworks.

iv. The W&C team found and corrected a discrepancy in the sustainable yield analysis, which brings the sustainable total yield for the Subbasin to 530,000 acre feet per year.

v. Alyson Watson (W&C) explained that Water that is imported and seeps into the basin through unlined conveyance canals and distribution system belongs to the entity that developed the water. W&C team is working with entities in the basin (e.g. MID and others) to develop estimates of canal seepage.

vi. W&C provided an explanation for the breakdown of different historical use calculations presented over 10-year historical periods.

vii. The SC recommends using historical use rather than projected use as the basis for allocating sustainable yield.

viii. Comment: It would be good to have the baseline set on historical use from a city perspective and look at this in terms of per capita use.

ix. Comment: Cities are going to need to use alternatives, specifically conservation. Cities are also expected to further densify rather than spread, so a per capita use is a better estimation.

x. Alyson Watson (W&C) provided a brief overview of the input from the SC:

    1. There is concern for outside investors coming into water markets
    2. It is recommended to base allocations on historical use
    3. Will need to decide how to handle non-irrigated lands
    4. Several comments voiced a spirit of trying to be inclusive and work out solutions together in a fair way.

xi. Mojave Adjudication Example:

    1. There was a final judgement in 1996, for an area with 5 subbasins. Each year the Watermaster conducts a review and adjustment. This determines the amount that is allocated to each pumper
    2. Comment: Request made to look up how the amount pumpers can have is determined.

xii. A discussion was held on the general allocation approach. Comments and questions are summarized as follows:

    1. Question from W&C: Should there be an allocation for non-irrigated lands?
    2. Comment: They should have an allocation, although it is unclear what the most appropriate number for the allocation should be.
    3. There was a brief discussion on the amounts of irrigated and non-irrigated acres. About a third of the Subbasin's acres could be non-irrigated lands.
    4. Question: Why do we not have other appropriators in the prescriptive use estimates? Answer (W&C): It is a matter of time needed in putting together a more detailed example. If we choose to go this route, more information would be needed.
    5. Question from W&C: Does the Subbasin want to look at historical or projected or look at a hybrid? And should this consider a percentage reduction in GCPD?
    6. Comment: Look at projected use as a baseline.

7. Input from Charles Gardiner (Catalyst): The SC thought numbers for population expansion as stated in the plans (e.g. Urban Water Management Plans) might be too generous to be used for our estimates.
8. The SC wanted to see what the historical baseline would look like using different ranges of years. Question from W&C: Is there another way to do this? Potentially by using different years?
9. Comment (W&C): If a historical baseline is used, a range of years will need to be determined.
10. Comment: The allocation approach has to address overlying water rights.
11. Comment: A partial allocation could be determined for non-irrigated lands through the use of scenarios to see what that looks like.
12. Comment: A structure should be created and regulated for transferring allocations. It could be useful to have some examples of permutations to show what this would look like.

xiii. Alyson Watson (W&C) illustrated a timeline for the implementation of an allocation program from 2020 to 2040, with milestones for every 5-year period.

1. Feedback from CC:
    a. Comment: This seems to make sense, but there will need to be a lot of education.
    b. Comment: It is important to avoid having people think there is a lot of lead time and a general concern that the Subbasin will need to keep up momentum.
    c. Comment: The chosen approach will have to be reasonable and practical. Without metering implementation will be impossible.

c. Other Updates: The beta link requested for the Data Management System is still in progress with an estimated completion time in January.

5. Public Outreach update
    a. There were two public workshops held in December, both with good conversational input and good attendance. The next public workshop will be in late February.
6. Coordination with neighboring basins
    a. There is a memorandum of intent with six concepts with Turlock Basin. In December, the West Turlock GSA approved the MOI. This will go to the Merced Subbasin and East Turlock GSA.
7. Public comment
    a. There were no public comments.
8. Next steps and adjourn
    a. Water Budget Technical Memo and Water Allocation Framework development.

Next Regular Meeting
January 28, 2018 at 1:30 p.m.
Merced, CA – Castle Conference Center at Castle Airport (subject to change)
Information also available online at mercedsgma.org

Action may be taken on any item

Note: If you need disability-related modification or accommodation in order to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING NOTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: January 28, 2019 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☐	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☒	Daniel Chavez	Merced Irrigation-Urban GSA
☒	Ken Elwin (alternate)*	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☐	Nic Marchini	Merced Subbasin GSA
☐	Rodrigo Espinoza	Merced Subbasin GSA
☐	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1
	*Leah Brown attended for Ken Elwin	

Meeting Notes

1. Call to order
    a. Alyson Watson called the meeting to order and gave a brief overview of agenda items and content.
2. Approval of minutes for December 17, 2018 meeting
    a. Meeting minutes were approved.
3. Stakeholder Committee update
    a. Update from January 28 morning meeting
    b. SC meeting had good turnout with many different viewpoints. Big questions arose when discussing appropriative use and selection of historical period to use as baseline for allocation, and how to address overlying users not currently pumping. Comments ranged from 0% allocation for unirrigated lands to a partial allocation of either a 25 or a 50%. Several SC members stated there should be a process to address these lands in the future, especially if they start at a 0% allocation.
4. Flood-Managed Aquifer Recharge (Flood-MAR)
    a. Hicham ElTal (MID) provided an explanation of Flood-MAR activities in Merced Subbasin and why this is important for Merced. Benefits were identified.
    b. Hicham (MID) explained what must align to have a good Flood-MAR system including hydrology, land availability, recharge potential, and water rights.

c. Current plans and activities include work MID is conducting with DWR. This involves using the MID watershed model to look at precipitation, snowpack and snowmelt.

d. Hicham provided a map of soils where the land has high recharge potential. MID works with DWR on the GRAT (Groundwater Recharge Assessment Tool) which helps determine where recharge is best done, when, how much surface water can be captured, costs, and how much groundwater overdraft can be addressed through this recharge.

e. Hicham explained a good Flood-MAR system must consider water rights with knowledge of water sources and favorable land options. It also must make use of storms. The SWRCB allows taking water in Dec., Jan., and Feb., and only when capacity of the creek is at least 90% of flow that day. There are around 5 storms per year in California that we can try to use.

f. MID is trying to get funding from FEMA for a project on the Grand Canal that goes all the way down to Le Grand.

g. Question: What is the cost of the project? Answer from Hicham: Estimate is between $600,000-$700,000.

h. Hicham explained the configuration of custom analysis that relies on several models including some for irrigation systems, groundwater, upstream watershed, Merced River, etc.

i. MID will engage more with the Merced Streams group, especially in looking for funding.

j. It will be best for the GSAs to determine who is going to take the water when a storm comes.

k. Question: Does the GRAT assess the suitability of areas for recharge? Hicham: Yes. This helps determine what areas are best for recharge and compare areas to help GSAs determine where to prioritize recharge areas.

l. Comment: It would be good for individual landowners to follow this closely. Hicham: The landowners will have to look at it and decide for themselves if this works for them also economically. Yes, they should pay attention closely as information becomes available.

m. Question: It doesn't have to be on a crop area? Hicham: Correct, it can also be a fallowed area, or an area that does not have crops.

n. Question: During the winter times, could water be diverted to Livingston? Hicham: Yes, with some conveyance projects that could be put in place, water could be taken year-round.

o. Question: If there are farmers that have surface water and are in an area for recharge, could they apply? Hicham: Yes, you can buy the water (e.g. Livingston) even if you don't have a water right.

p. Question: Does the flooding affect the NPDES permitting? Hicham: The Irrigated lands Regulatory Program (ILRP) needs to be followed.

5. Temporary and long-term State Water Resources Control Board Permits for Flood Water

   a. Hicham ElTal introduced discussion and recommended the Merced Subbasin submit one long term permit to the SWRCB. One, collective permit assists more efficient flood flow decisions during a storm.

   b. Question: How would you figure out the fees? Don't they do this on a per acre basis? Hicham: This depends on how much water you want to pay for. You pay one fee for the water you take.

   c. Question & clarification: Hicham asked during the meeting for a single permit for all diversions in the subbasin. These do not have to be for a project that is already existing.

   d. Comment: One public audience member thinks this is a great idea.

   e. Comment: Committee member recommended GSA legal counsels investigate this and give advice.

f. Reply from Hicham: The SWRCB would rather have one permanent permit.

g. Clarification: Hicham states based on his past experience with discussions in Southern California recharge will never be considered for beneficial use.

h. Comment: Suggestion made permanent permit it preferred because it is harder to take this away as opposed to the temporary permit.

i. General consensus: Would like to bring this to the three GSAs and seek legal counsel and research.

j. Decision: GSAs to get legal counsel on board.

k. Question: What is the timeline for this permit? Hicham: Likely in 2020.

6. Presentation by Woodard & Curran on GSP development

   a. Next Steps in GSP Development

      i. Alyson Watson (Woodard & Curran) reviewed the decision-making timeline and focus of today. The main goal is to agree upon a recommendation for an allocation framework to determine allocation at the GSA level. A preliminary direction for the allocation framework is needed to meet the 2020 deadline. Additional information will refine modeling and allocations prior to implementation. Monitoring and reporting should be the focus for 2020-2025. This timeframe requires outreach on a broad level. There are five-year updates for the plan.

      ii. Hicham (MID) input: Thinks it makes sense not much is complete prior to 2025, but if we wait until 2030 some areas may be racing to hit their undesirable results thresholds. The Subbasin will have monitoring wells and will want to avoid hitting thresholds.

      iii. Comment: It is possible to can wait until 2030, but another 3-year drought occurs so do risks for undesirable results. Response from Alyson (W&C): Once framework is in place, we can determine specific actions be taken once certain thresholds reached. Focus is to determine an approach and use this to determine if there are areas that will have undesirable results.

      iv. Question: What is the guidance on timing for subsidence zones? Answer (W&C): There is no specific guidance in getting to 2015 conditions. Subsidence is what we will look at once we have a framework agreed upon.

   b. Water Allocation Framework

      i. Alyson Watson (W&C) presented the follow ups from the last meeting and the updated allocation framework development. She reviewed steps in determining the allocation methodology which include: determining sustainable yield, subtracting seepage and developed supply, and then allocating the sustainable native yield to overlying and appropriative users.

      ii. W&C did analyses to look at different historical averaging periods including spans of 20, 10, 15, and 5 years (and a 5, 10, and 15 year that exclude drought). Drought increases overlying users' usage.

      iii. The SC recommended using the 10-year period with the drought (2006-2015). There was a question of whether a 40-year period would be feasible. However, there is not adequate data to use 2040.

      iv. Question from Alyson (W&C): How does the CC feel about 10-year period? Answer from CC members: This time period is appropriate.

v. In addressing unirrigated lands at a minimum there should be a process outlined for how to bring in folks who have unirrigated lands into the allocation framework.

vi. Alyson (W&C) provided illustration for partial allocation estimations given to unirrigated lands. These were set up and estimated for 100%, 50%, or 25% or no allocation.

vii. There is a substantially higher number of unirrigated lands in Merced Subbasin GSA than the other GSAs. This can influence the total allocation to the GSAs depending on what partial allocation is given to unirrigated lands.

viii. Comments relayed from the SC meeting:

   1. 1.25 AF/A is difficult to have even for operating a dairy.
   2. However, folks who have pasture lands/unirrigated lands would like to be a part of the conversation.

ix. Comment: There is concern that the GSAs might not be aware of potential legal actions moving forward.

x. Question: Could we provide an example of what types of allocations would look like for the dry and wet years? Alyson (W&C): This is possible. We want to make sure that we are first getting a clear understanding and ensure the SC and CC have a clear understanding of the average year.

xi. General request: Concern about understanding the allocation framework expressed. W&C will set up separate calls to review and answer questions of content presented.

xii. Question: What about the seepage estimates, where do the numbers for this come from? Alyson (W&C): Seepage numbers come from estimates from MID and Stevinson Water District. W&C is still getting other information from other water conveyors.

xiii. Alyson explained the goal is to have a 2020 GSP that can be approved and is based on the information that we have, which is going to be updated and addresses data needs.

xiv. Question: What is the net loss flow to the Chowchilla? Dominick (W&C): The net value of loss is about 10,000 AF.

xv. Clarification: Numbers presented are to give an estimate based of the best data we have available with the knowledge that the numbers will change. What is presented is a proportional reduction.

xvi. Comment: What will be important is to consider the GSP as a living plan, so that as additional data come in and as questions are answered, these are integrated.

xvii. Comment from Hicham: Hicham asked MIDAC for an opinion, and MIDAC (growers) said they would like to go for a 0% allocation of unirrigated lands.

xviii. Alyson (W&C): With regard to legal challenges, we are not affecting GW rights. If someone wants to pump, we can avert some of this with a challenge process.

xix. W&C will schedule individual meetings with each GSA to discuss further and revisit this next month at CC meeting.

c. Data Management System

   i. Reminder that beta link for DMS has been created and sent out to the committees.

d. Other Updates

i. Projects are being reviewed. There are currently 40 in the draft list as of this meeting. These will be reviewed in more detail in the next meeting.

7. Public Outreach update
   a. Flyer for February public workshop was posted and sent out to committees.
8. Coordination with neighboring basins
9. Public comment
   a. None
10. Next steps and adjourn
    a. Water Budget TM – revise TM based on input from GSA staff
    b. Assessing projects and management actions

Next Regular Meeting
March 25, 2018 at 1:30 p.m.
Merced, CA – Castle Conference Center at Castle Airport (subject to change)
Information also available online at mercedsgma.org

Action may be taken on any item

Note: If you need disability-related modification or accommodation in order to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING NOTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: February 25, 2019 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☐	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☒	Daniel Chavez	Merced Irrigation-Urban GSA
☐	Ken Elwin (alternate)*	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☒	Nic Marchini	Merced Subbasin GSA
☐	Rodrigo Espinoza	Merced Subbasin GSA
☒	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Call to order
    a. Alyson Watson (Woodard & Curran) called the meeting to order.
2. Approval of minutes for January 28, 2019 meeting
    a. Meeting minutes approved with no changes.
3. Stakeholder Committee update
    a. Alyson Watson (W&C) provided an update from the February 25 morning meeting. The SC reviewed feedback received from the GSA discussions of allocation frameworks. The SC discussed priorities for projects and management actions to send to the CC. These will be summarized for next meeting for discussion.
4. Presentation by Woodard & Curran on GSP development
    a. Alyson reviewed the decision-making timeline and explained that the CC will be trying to reach an agreement on a framework recommendation to provide to the GSA boards.
    b. Question: Will the plan include the terms required to demonstrate the allocations are being demonstrated/adhered to? Answer: This is up to the GSAs. What would be in the plan is the framework including: the sustainable yield, how this is allocated to the GSAs, and what should be refined and considered in more detail.

c. Clarification: It is anticipated that plan will need to have a process for determining how to handle classification for duck clubs, refuge lands, etc.

d. Comment: It will be important that we have some clarity and a clear expectation of exactly what these allocations are and how they are estimated. Response (W&C): There will need to be a process for verification, especially for seepage.

e. Comment: The plan should include an expectation of how to quantify allocation based on existing water rights.

f. Alyson Watson (W&C) explained the Merced Subbasin Memorandum of Understanding (MOU) requires the CC have unanimous decision on a recommendation to the GSA Boards.

g. Alyson (W&C) provided a brief explanation on state intervention and what this mean in terms of potential fees. *De minimus* users (pumpers using 2AF/Y or less for domestic purposes) are subject to SGMA but not required to be metered.

h. Alyson reviewed the conceptual GSP implementation timeline. Within the first 5 years the GSAs may want to focus on metering and monitoring and implementing projects that already have funding. Outreach is another key component. By 2040 have planned projects online and allocation framework in place.

    i. Comment: The conceptual timeline should include a bullet for triggers for exceeding minimum thresholds up through 2025.

i. Water Allocation Frameworks

    i. Alyson (W&C) reviewed the framework steps 1-4 which include: 1) determining the sustainable yield, 2) estimating developed supply, 3) determine allocation of sustainable yield to appropriators and overlying users, 4) use as basis for allocations to GSA.

    ii. Alyson (W&C) summarized the comments from both the previous SC discussions on the allocation framework and from the GSA review meetings. SC points were:

        1. Important to consider drought years in historical baseline period.

        2. Having a 10-year period seems to make sense.

        3. In general, not in favor of 100% allocation unirrigated lands. Somewhere between 25-50% is a good starting point. Need direction on how this can be used and sold.

        4. Need mechanism to later include these lands if start at a 0% allocation.

        5. Metering is important but should also keep in mind *de minimus* users are not required to be metered under SGMA.

    iii. Alyson summarized feedback from individual GSA review meetings:

        1. Metering should be a priority in first 5 years.

        2. General consensus to review allocation annually, and review seepage potentially every 5 years.

        3. Cities are concerned about potential infill in the future. Keeping allocation at a fixed volume will lower the per capita per day. This needs to be reasonable.

        4. 2020-2030 should not be free-for-all to pump. People are not going to benefit from pumping more and might consequently end up needing to reduce pumping even more. Need to have clear triggers during this time to ensure we avoid any situations where we are in violation.

5. Need to ensure there is a verification method for seepage estimates.
6. Need to consider how to address rangeland, including partial allocations, and will need to be clear on rules for this in case of a water market. (e.g. who and how to sell/buy water in market).

iv. Summary of CC Water Allocation Framework Discussion:

1. Comment: We will have to be open and listen through this process to maintain the big picture of sustainability. We have a limited supply we are trying to allocate, and the allocation methodology is complex. To understand allocation, we must put this into context of water law. SGMA does not allow GSAs to alter water law, but GSAs can control groundwater by regulating it. Within description of sustainable yield, have seepage estimate off the top of the total sustainable yield. Question: is there a seepage credit for the applied surface water on the lands?
2. Answer from Hicham (MID): MID has gone through this situation with rice lands. The water applied to the lands is lost water in his opinion. This is different than seepage estimates which are decidedly directed as developed water.
3. Comment: This would depend on the crop types.
4. Comment from W&C: W&C can ask Brad Herrema, attorney from Brownstein, Hyatt, Farber, and Schreck about this question.
5. Comment from W&C: Accounting for applied water would reduce the 400K AF amount that is considered at the basin scale and is rolled back up to GSA level, but does not mean that it affects the general allocation framework. The question of applied water is something that can be refined later and allow us to still move forward.
6. Question: What about a break down by agencies for the appropriative and prescriptive water use? Answer: The only appropriative users in this group are the cities within MIUGSA.
7. Comment: Suggestion of a 75% allocation for unirrigated lands made by Merced Subbasin GSA (MSGSA).
8. Comment from Hicham (MID): There are no appropriators in MIDAC (MID Advisory Committee). This group is made up of growers. The decision on allocation for unirrigated lands has to consider that there is not an existing financial impact to grazing grounds, but there is a financial impact to those who are pumping now. Hicham will relay the MSGSA suggestion to MIDAC.
9. Comment: We do not know what it will be like in 2040. We do know that MID will be a significant surface water supplier. The lands that are in the MSGSA just have one source. We have the most unexercised (unirrigated) users in our GSA and must to consider them. We are still going to need preserve the ability to produce food.
10. Clarification from Hicham (MID): If we have a GW market, this will be more active in the MSGSA. There will be more financial impact on the growers.
11. Comment: If the subbasin has a water market, need an understanding that there should be no transfers outside the basin.
12. Comment from public: Need to look at permanent crops and how these areas are impacted in wet and dry years.

13. General consensus from CC: The subbasin should have a water market and have 5-year updates.

14. Question: How is this going to effect individual home owners? Answer: You would likely be a *de minimus* user who extracts 2AF/Y or less. The GSAs could charge a fee depending on how they try to fund the GSP implementation. Over time, the benefit is that the groundwater should stabilize.

v. Partial allocation for unirrigated lands discussion:

1. Comment: Need to start somewhere with partial allocation for unirrigated lands.
2. Comment: Reiterates suggestion for 75% allocation for unirrigated lands.
3. Hicham ElTal (MID) will bring the suggestion back to MIDAC.
4. Larry Harris (TIWD) will talk to folks at TIWD about the suggestion.
5. Bob Kelley (MSGSA) to look into how this 75% number could move depending on the response from other GSAs.
6. Question: have we looked at industrial use (e.g. commodity processing facilities) outside the cities? Answer (W&C): Not yet, but W&C can look into this.

vi. Consensus reached for the water allocation framework on the following:

1. Agreement on overall framework steps.
2. General support for developing a water market and addressing important considerations that should be included.
3. Agreement on historical averaging period of 10 years using 2006-2015.
4. Agreement on review of allocation every 5 years.

vii. Comment on applied water: There could be a credit for return flows using example of adjudications which have attributed these flows to the importing agency. If there’s a desire for that type of credit, it is possible to develop a process for determining flows.

viii. Comment from W&C: This could be added to a list of what needs to be refined and addressed in terms of seepage within GSP. Currently, this data is not available.

ix. Comment: People who have grazing land have not contributed to the problem and feel are being punished unfairly.

j. Next Steps in GSP Development

i. Alyson Watson (W&C) reviewed the overall timeline for draft GSP development.

ii. Hicham ElTal (MID) states that MID has talked internally about using groundwater elevation levels as a proxy for other indicators with DWR. They could set up a meeting within the next couple of months and talk about the overall methodology in how we are building our GSP.

k. Other Updates

i. Reminder that the beta test link is available for the Merced GSP data management system.

5. Public Outreach update

a. The public workshop is scheduled to take place this evening in Livingston.

6. Coordination with neighboring basins

a. Continuing communication with Turlock. More coordination in the next couple of months.

7. Long Term SWRCB Permits for Flood Water

    a. The Long Term Permits presentation is tabled to next month. Alyson confirmed with CC members that the meeting will extend to 4pm for March 25th.

8. Public comment

    a. None.

9. Next steps and adjourn

    a. Water Allocation Framework

    b. Review projects and management actions

Next Regular Meeting
March 25, 2019 at 1:30 p.m.
Atwater, CA – Castle Conference Center at Castle Airport (subject to change)
Information also available online at mercedsgma.org

Action may be taken on any item

Note: If you need disability-related modification or accommodation in order to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING NOTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: March 25, 2019 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☒	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☒	Daniel Chavez	Merced Irrigation-Urban GSA
☒	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☒	Nic Marchini	Merced Subbasin GSA
☐	Rodrigo Espinoza	Merced Subbasin GSA
☒	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Call to order
    a. Alyson Watson (Woodard & Curran) welcomed and called meeting to order.
2. Approval of minutes for February 25, 2019 meeting
    a. Meeting minutes from February 25th approved.
    b. CC members found no issue in having this meeting available for listen-in only in the future.
3. Stakeholder Committee update
    a. Update from March 25 morning meeting provided by Alyson Watson (W&C).
4. Presentation by Woodard & Curran on GSP development
    a. Water Allocation Frameworks
        i. Alyson Watson (W&C) reviewed what the group will try to accomplish today, the decision-making timeline, and the conceptual GSP timeline.
        ii. Comment: The Merced Subbasin should start to implement monitoring activities and have a countdown between 2020-2025.
        iii. Alyson (W&C) explained next month's meeting will return to Undesirable Results and Minimum Thresholds.

iv. Comment: If there are projects people can already implement, then they should start to implement or at least be able to implement.

v. Comment: It is important to understand what the loss of recharge water is in the Subbasin.

vi. Response and clarification (W&C): There may be recharge operations on a small scale that are already in place where someone should have an allocation credit that should be taken into account. There needs to be time for that process of reaching out and conducting public outreach.

vii. Comment: A recharge water loss estimation could be done for areas where projects would be implemented.

viii. Response (W&C): To conduct the loss estimation, need to gather enough information for the losses to determine whether an area is worth investing in for recharge. This could be done via scenarios as projects come up.

ix. Comment: This estimation should be done on a case by case basis.

x. Comment: The estimation could produce a map of contours of percentage loss.

xi. Response (W&C): W&C team to discuss internally potential approach for loss estimation.

xii. Comment: In looking at the previous Water Budget technical memo, it would be easier to understand the memo contents if we had the breakdown of the historical water budget numbers. For overlying use, it looks like there are federal lands and *de minimus* users. Where and how do both of these factor into the overlying use?

xiii. Response (W&C): We cannot force the federal lands to comply because they are exempt from SGMA. These acres and water use are pulled out of the analysis, the analysis is conducted, and then these lands and associated water use are put back. *De minimus* users are not exempt, they just cannot be required to meter under SGMA. The W&C team is also verifying the number of acres for federal lands.

xiv. Comment: Overlying user allocation is a critical part of the process going forward, especially with Merced Subbasin GSA being primarily overlying users. The MSGSA is concerned that overlying rights be considered and respected. The MSGSA has to manage the white areas and liability for their lack of surface water connection.

xv. Alyson (W&C): We would like to get to an agreement on a partial allocation during this meeting.

xvi. Comment: MSGSA would propose a geographic designation for the basin. Totals would be 327K AF for MSGSA, 151K AF for MIUGSA, and 12K AF for TIWD.

xvii. Alyson (W&C): To clarify, that proposal would reflect a 100% allocation for unirrigated lands.

xviii. Comment: MIUGSA recommends holding off on groundwater credits until we have the allocation finalized. Why not wait until we can fill those data gaps? We want to address the data gaps to better understand what the implications are of our allocation framework.

xix. Comment: MIUGSA is ok with a 100% allocation, as long as the Subbasin does not allow credits to be exchanged until the GSAs have more data.

xx. Comment: We need to clean up our assumptions before we make this kind of policy decision.

xxi. Both MSGSA and MIUGSA representatives reiterate that there is likely less water out there than we think there is.

xxii. Alyson (W&C): For GSP contents, we can have a preliminary framework, which includes how much water we have and how we are considering undeveloped and developed acres.

xxiii. General clarification and agreement on allocation framework: Agreement reached on a 100% allocation to unirrigated lands, but with the caveat that GSAs will not allow transfer of credits until all three GSAs agree on parameters for trading and fill in data gaps / finalize the allocations.

xxiv. Clarification: W&C can run sustainable yield scenario under this condition and see how that impacts undesirable results.

xxv. Water Allocation Framework Agreement:

1. Determine sustainable yield
2. Subtract groundwater originating from developed supply to obtain sustainable yield of native groundwater
3. Allocate sustainable yield of native groundwater to Overlying Users and Appropriative Users based on proportion of historical use
    a. Use 2006 through 2015 as the averaging period for historical use
    b. Appropriative user allocations based on fraction of historical use among appropriators
    c. Allocation to overliers will be based on acreage. All developed and undeveloped acreage (not including federal lands) to receive an allocation initially. GSAs agree that no water supply credits can be exchanged until and unless all three GSAs agree on parameters for trading and key data gaps are filled.
4. Use this framework to establish total allocations to each GSA. GSAs can modify implementation and allocations within their own boundaries.

xxvi. The above agreement was summarized as the Coordinating Committee recommendation and sent to GSA Board staff.

xxvii. Question: How long will it take for GSP approval?

xxviii. Response (MID and W&C): Estimate is that DWR may need to take the full time of two or more years. Review of only the critically overdrafted basins would take two years.

b. Projects and Management Actions

i. Review of revised project handout and current draft list of projects including short list provided by W&C team. Follow ups for gathering additional project information will be conducted in preparation for next meeting.

c. Climate Change Analysis

i. Alyson (W&C) explained W&C team is following the DWR guidance and moving forward on the climate change analysis. A section summary is anticipated for next meeting.

ii. Question: Do the climate change analyses seem to provide drier or wetter future conditions?

iii. Response (MID): From analysis conducted for DWR Flood-MAR, future conditions look slightly drier.

d. Next Steps in GSP Development

i. Alyson (W&C) reviewed the section schedule, including release dates for admin and SC & CC section drafts in preparation for GSP public draft.

e. Other Updates

i. Alyson Watson (W&C) provided overview of Undesirable Results including what these would be described as under a sustainable yield run. The W&C team is currently working on the implementation and the sustainable yield period for this analysis. Information on annual production numbers and relevant slides can be provided.

5. Public Outreach update

a. The next public workshop is anticipated to take place in May, and likely within the McSwain area.

6. Coordination with neighboring basins

a. W&C team will circle back with Chowchilla and Delta-Mendota and are also setting up a meeting with DWR to review methodology for sustainability indicators.

7. Long Term SWRCB Permits for Flood Water

a. Darren Cordova (MBK Engineers) provided a presentation on Groundwater Recharge/Extraction Permits. Topics for discussion included background & beneficial use, standard permit, temporary permit, potential alternative options. Purpose of presentation is to provide information on permitting from the state. MBK has worked previously with MID. For details, please see presentation which will be posted to the Merced SGMA website.

b. Standard Permit process includes preparation and submission of application to Appropriate Water and Underground Storage Supplement, which takes about a month or two to put this application together and submit. Submittal includes water availability analysis to demonstrate "reasonable likelihood" that water is available for appropriation. Also have to undergo environmental documentation needed for CEQA compliance. Cost for this estimated at $150K but would not include CEQA.

c. Question: What kind of information would be needed? Answer (MBK): Need to have information on the groundwater basin as a whole.

d. Comment: There will be a place in the GSP where we will talk about supplemental water.

e. Comment: For cost would need a couple more zeros for the estimates of associated cost if you are included in an Environmental Impact Report.

f. Question: If you get a temporary permit, when can you use it? Answer: Have to use the within the 180 days, otherwise can ask for extension.

g. Comment: If you file again, you will have to justify need for both permit requests.

h. Comment: The state board is starting to watch larger flows a little more closely and are starting to want permits for that in the future. The subbasin might need something to get the ball moving.

i. Alternative Options: SWRCB considering an expedited standard permit process for applicants diverting high flows for groundwater recharge/extraction. If you have an existing post 1914 water right, you can submit a Change Petition. Estimated to take between 3-5 years. Filing fees up to $6,710 per water right.

j. Comment: Have to prove that you are not initiating a new right.

k. Comment: When you do the flood control capture and recharge, you cannot count this as beneficial use under your water right, but you can put this in your GSP. You can put in a recharge basin to capture flood water and are therefore diverting/mitigating a nuisance for the entire basin.

l. Question: What about a permit for specific streams?

m. Answer (W&C): We have talked in this group about submitting a single long term permit for the subbasin.

n. Comment: We have to have the projects first to be able to have the diversion points you will need to identify in the application.

o. Comment: If we want to exercise pre-1914 rights, we should identify projects and people who are able to recharge.

p. Question: Who would hold the water right on someone else's land? Answer (MID): Good question, may need to investigate this.

q. Comment: All of the GSAs could hold the water right. Response from MID: That would be preferred.

r. Alyson (W&C): If the CC were to move forward with a recommendation on this, we would need to have a project put in the GSP.

s. Comment: We could say that for the GSP could have one recharging water right identified under one project.

t. Comment: It would be helpful if we show a map that provides all areas where we would like to be able to implement recharge.

u. Comment: Something similar was done in another subbasin using a site specific approach. In this case, had to get specific sites and provide this data to the state board.

v. Comment: We could look at getting a cost estimate on a programmatic EIR? And an estimate on the overall acreage that could benefit from this?

w. Comment: First task is to come up with a project, and work on the 90% permit establishing which streams are we talking about and where are we able to move the water.

x. Comment: This can be seen as two different things. There's the GSP – including the projects we are thinking about implementing for the basin. Second, is what streams and what waters can be used to pursue implementation.

y. Comment: We should try to pursue this permit process now, at least to set up a study.

z. Alyson (W&C): Would we need to have a fee and scope of work for this?

aa. Comment: We can come up with an add hoc committee to discuss this.

bb. Group agreement: Ad hoc committee will be established to determine a fee and scope for pursuing a Long Term Permit. Members of the committee will include Hicham ElTal, Larry Harris, and Nic Marchini

cc. Clarification: It is possible to include both surface water and groundwater within this permitting process. This does make it more complicated for the SWRCB folks. However, the process is similar.

8. Public comment

    a. None.

9. Next steps and adjourn

    a. Focus for April will be on Minimum Thresholds and Measurable Objectives

Next Regular Meeting
April 22, 2019 at 1:30 p.m.

Atwater, CA – Castle Conference Center at Castle Airport (subject to change)
Information also available online at mercedsgma.org
Action may be taken on any item
Note: If you need disability-related modification or accommodation in order to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING NOTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: April 22, 2019 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☐	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☐	Daniel Chavez	Merced Irrigation-Urban GSA
☒	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☒	Mike Gallo	Merced Subbasin GSA
☐	Nic Marchini	Merced Subbasin GSA
☐	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Call to order
    a. Alyson Watson (Woodard & Curran) called meeting to order. Members introduced themselves. A new member, Mike Gallo, for Merced Subbasin GSA has been added to the Coordinating Committee and replaced Rodrigo Espinoza.
2. Approval of minutes for March 25, 2019 meeting
    a. Meeting minutes from March 25th are approved with one abstention from Mike Gallo and one change. One sentence was added to include that the Water Allocation Framework Agreement was summarized as a Coordinating Committee recommendation and sent to GSA Board staff.
3. Stakeholder Committee update
    a. Update from April 22 morning meeting provided by Alyson Watson (W&C).
4. Presentation by Woodard & Curran on GSP development
    a. Climate Change Analysis
        i. Alyson Watson (W&C) described the regulations that apply for the climate change analysis and described the overall process used for Merced GSP.
        ii. The approach is consistent with the Department of Water Resources (DWR) recommended approach. A change factor from DWR is applied to the Projected Data Baseline to simulate the impact of climate change. This creates the Climate Change Baseline, which is put into the

Merced model. The output is the Climate Change Water Budget. The change (or perturbed) variables include streamflow, precipitation, and evapotranspiration (ET).

iii. Question: What are the modifications and how are they determined? Answer (W&C): We followed the DWR guidance, which provides the modifications (or change factors) and how they are determined.

iv. Alyson Watson (W&C) provided an example of precipitation using the Climate Change Analysis. The dark line is the regional average baseline. The blue line is the changed, or perturbed precipitation using factors from DWR. Generally, precipitation during a typical event is projected to be similar to the baseline conditions, but under climate change peak rain events are projected to be higher.

v. Similar DWR factors are used for ET. An example given from orchards shows a seasonal pattern of peaking in the summer months and a projected average increase in these months of 8%.

vi. Question: Is the climate change over 50 years, or over 1 year? Answer (W&C): We are applying a 2070 scenario and applying 50 years of hydrology.

vii. Question: Is this assuming the same cropping pattern? Answer (W&C): We met with GSAs to talk about changes to cropping pattern. We assumed 2040 conditions in urban build out. The projected water budget has many assumptions (e.g. assumptions on population change, etc.). We are doing the analysis to get an order of magnitude understanding of how potentially significant this can be for the basin, and see how we can adaptively manage.

viii. For surface water supplies, projections indicate that in wetter years (wetter season) there would be greater surface water, and in drier years (drier seasons) there would be less surface water.

ix. For groundwater production it is assumed there will be a change in groundwater pumping. The graph shows the difference in groundwater pumping with the climate change scenario. In general, there is an increase in groundwater demand as result of climate change conditions.

x. Summary of climate change scenario: Changed storage depletion is projected to increase from 82K AFY to 130K AFY. This analysis did not rerun the MIDH2O model to see how operations would change. The purpose of analysis was to get an order of magnitude understanding of how climate change might affect the basin.

xi. Clarification from W&C: This analysis does not include management actions and projects.

xii. Question: Is this going to be implemented in the plan? Will the budget reflect these climate changes? Or stay as it is? Answer (W&C): This is up to the group. It is not recommended to take and plan for this directly because there is so much uncertainty. However, we can revise our planning target if we find we are on this trajectory. We are going to do an update in 2025 and could update our targets then if needed.

b. Undesirable Results & Minimum Thresholds

   i. Alyson Watson (W&C) explained Undesirable Results (URs) and Minimum Thresholds (MTs), provided definitions and reviewed what was discussed in previous meetings.

   ii. The purpose is to try to bring the basin into balance. The GSP will need to define what is significant and unreasonable for URs. It is important to prevent these URs, because if they are violated there can be state intervention.

   iii. Sustainable Management Criteria Definitions: There may be a specific groundwater condition where wells went dry and enough wells went dry that we determine this should not happen again. This could be defined as an UR. An MT can be set at a depth at which this is not going to happen. Our Measurable Objective (MO) will be set at a shallower depth (this is a depth we are trying to reach). We want to work between these two (the MO and the MT) within the Margin of Operational Flexibility. There are no triggers for meeting the MOs. A violation occurs if URs occur. MTs are set to avoid URs. One well being in violation once is not significant and unreasonable, but a certain percentage going dry could be. Specifications can be established for dry years. The goal is to identify a way to prevent URs.

iv. Chronic Lowering of Groundwater Levels: This was discussed qualitatively for URs and needs to be quantified. Methods used for this include two levels of monitoring wells. This does not include the broader monitoring network, but is the subset used to establish MTs. CASGEM wells were used as a starting point for these monitoring wells because they follow closely to SGMA requirements. There should be monitoring wells in all three aquifers (above, below and outside Corcoran Clay). W&C looked at domestic wells and used the Merced County database. W&C looked at the depth of the shallowest domestic well and removed statistical outliers. The shallowest domestic well within a 2-mile radius buffer from each CASGEM well was compared against MTs. An example hydrograph was provided to show MTs, observed data, and a run from 2040 with 50 years of hydrology get to 2090 for Sustainable Yield.

v. Clarification: Other basins have used a method to say that if 25% of wells with MTs have surpassed MTs then this is UR. Individual wells may have different MTs.

vi. Alyson Watson (W&C) explained there is an area (identified by a red circle) on the slide with a high level of uncertainty for determining MTs. Some CASGEM wells are new, some do not have enough historical data to calibrate for the model. Alyson asks the group what are there issues in this area? Are you aware of areas where wells are not deep enough? Or have been dug deeper?

vii. W&C also looked at the distribution of domestic well depths. There are a significant number of 125 ft wells (about 70 at this depth). Are these wells still there, have they been replaced?

viii. Feedback from CC group:

   1. Comment: Have not seen any domestic wells that are dry but have seen trucked water going around.
   2. Comment (from public): In Meadowbrook area with California American Water Company they have a contract with a trucked water entity, which is required to stay within the company's jurisdiction.

ix. Alyson (W&C) explained there are a few options for moving forward including: identifying this area as a data gap and include in the GSP how this will be addressed, or establish this as an official Management Area.

x. Comment (MID): Interim thresholds and monitoring wells could be set up in that area.

xi. Alyson (W&C) asked group for input on how to approach URs. Should a certain percentage be used to determine what constitutes a UR?

xii. Comment (MID): SGMA allows room for flexibility in continuous drought. Establishing a percentage to determine URs is a good idea.

xiii. Comment (TIWD): In the SC meeting this morning, we discussed that we can set up mitigation plans in areas where we going to surpass meet MTs.

xiv. Comment (MID): Suggests to start with all of these ideas.

xv. Storage: Alyson (W&C) explained change in storage is about 0.3% per year. In terms of total water available, we do not anticipate significant and unreasonable URs occurring in the future. Therefore, no MTs are needed. Another approach is to take groundwater elevation (GWE) levels as a proxy and state that GWE levels are protective. A third approach is to say URs do not occur until a reduction by 10MAF is reached, and then report on this over time. W&C has suggested not to set thresholds and to provide an explanation for this. We are still waiting to hear back from DWR on this approach.

xvi. Seawater Intrusion: This indicator is not applicable for the Merced GSP, as it is not present and not likely to occur for the subbasin. Salinity is addressed as an MT under "Degraded Water Quality".

xvii. Degraded Water Quality: Thresholds should be based on our actions, where groundwater extractions effect groundwater quality. Existing cleanup sites have been previously mapped, which can ensure that new recharge sites are not put in these places and potentially cause water quality issues (e.g. extension of plumes). Where contaminants are regulated under existing programs, communication will be established with these programs. It is not necessary to take responsibility for these contaminants when they are regulated under existing mechanisms and frameworks. However, the Merced GSP will be addressing salinity.

xviii. Alyson (W&C) requested input from the group on proposed MTs for salinity. A current limit of 1000mg/L TDS is proposed for discussion. Does this sound reasonable? From a drinking water perspective as well as for agriculture?

xix. Feedback from CC group:

1. Comment (MID): There are some areas where it is already 1000mg/L. Response (W&C): In some areas where this is occurring we would not need to assign MTs if this is not posing an UR (e.g. blending, or use of salt-tolerant crops are currently employed as solutions).
2. Comment (MSGSA): They are receiving salinity intruding from the west, might be from the San Joaquin River.
3. Comment: There are sources of salinity. For example, upwelling brine. There could be trigger points where you can manage these primary sources like upwelling through saline sources and migration of water from the west. Options are to change the extraction process and take actions to prevent this.
4. Comment (public): Could look at a percentage change from ambient as one option. Or could look at difference from baseline number or use another indicator as a proxy such as acres of production affected as a proxy. Response (W&C): The only proxy allowed under SGMA is GWE.

xx. Question: What are risks are associated with a scenario where an investment fund purchases property and then violates their pumping allocation and violates an MT? Response (W&C): The GSA would be in charge of managing the extraction and enforcement through penalties (e.g. fines). MTs are not defined at every well in the basin. MTs are set on specific monitoring wells.

xxi. Land Subsidence: W&C is in communication with DWR regarding the current approach for the Merced Subbasin.

xxii. Depletion of Interconnected Surface Water: URs, MTs for this indicator are challenging. What can be measured or estimated in the modeling is streamlosses. The greatest losses actually occur in wet years because there is a lot more water in the stream channel. There is also not a clear UR. The consulting team has tried to come up with a threshold that would keep within the historical range of depletions. We have taken out wet years, looked at historical losses, and considered the 5-year average within this range. The goal is to not exceed historical losses.

xxiii. Question: How does the Supplemental Environmental Document play into this? Answer (W&C): This is not included in the analysis. It is assumed that the SED would impact the analysis but will not be included.

c. Approach and Timing For Implementing Allocations

i. Alyson (W&C) provided review of Conceptual GSP Implementation Timeline. The CC group discussed general ideas regarding the approach and timing for implementing allocations. No agreements or formal recommendations were reached.

d. Next Steps in GSP Development

i. Alyson (W&C) reviewed the section schedule, including release dates for admin and SC & CC section drafts in preparation for GSP public draft.

ii. Alyson also reviewed the proposed GSP review and submission timeline, which includes the public review period and proposed meetings prior to GSP approval and submittal. There is a 90-day requirement that goes effect after the notice of intent to adopt. The GSP may be adopted at 90 days after the notice of intent to adopt is made. The goal with release administrative drafts to GSA staff and sections to the SC and CC is to allow additional input and time to review content prior to the complete draft.

e. Other Updates

i. Alyson (W&C) gave an update on the status of several GSP sections sent or anticipated for administrative draft release.

5. Public Outreach update

a. The next public workshop will take place May 29th at the Atwater Community Center. Notices and additional information will be posted on the Merced SGMA website.

6. Coordination with neighboring basins

a. For interbasin agreements, W&C team has been reaching out to Delta-Mendota and has been looking at Chowchilla and the Turlock agreements as models for potential agreement structure and content.

7. Public comment

a. None.

8. Next steps and adjourn

a. Focus for May will be on Minimum Thresholds and Measurable Objectives and Implementation Planning.

Next Regular Meeting
May 29, 2019 at 1:30 p.m.
Atwater, CA – Castle Conference Center at Castle Airport (subject to change)
Information also available online at mercedsgma.org
Action may be taken on any item

Note: If you need disability-related modification or accommodation in order to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING NOTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: May 29, 2019 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☒	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☒	Daniel Chavez	Merced Irrigation-Urban GSA
☐	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☒	Mike Gallo	Merced Subbasin GSA
☒	Nic Marchini	Merced Subbasin GSA
☐	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Call to order
    a. Alyson Watson (Woodard & Curran) called meeting to order. Members introduced themselves.
2. Approval of minutes for April 22, 2019 meeting
    a. Meeting minutes from April 22th were approved.
3. Stakeholder Committee update
    a. Update from May 29 morning meeting provided by Alyson Watson (W&C).
4. Presentation by Woodard & Curran on GSP development
    a. Management Areas
        i. Alyson Watson (W&C) defined Management Areas and how and why they might be implemented.
        ii. Comment: Haven't come up with specific areas besides the subsidence area. Follow-up: may not need to call out a separate management area if there isn't subsidence in another part of the Subbasin – in this case, the same standards apply across the whole Subbasin.
    b. Sustainable Management Criteria
        i. Alyson Watson (W&C) walked through the sustainable management criteria for each of the sustainability indicators.

ii. Question: For purposes of setting thresholds for groundwater levels, what is the difference between CASGEM wells and domestic wells? Answer: CASGEM wells are used for representative monitoring as they meet strict SGMA monitoring requirements. Domestic wells were used to define location-specific minimum thresholds and undesirable results (e.g. finding the shallowest domestic well within a 2-mile radius of each CASGEM well).

iii. Comment: Need to come up with GWL threshold methodology for future additional monitoring wells where (1) there may not be domestic wells located within 2 miles or (2) there won't be historical groundwater record to help determine a minimum threshold since it is a new monitoring well.

iv. Question: Certain areas of the Subbasin (e.g. West side, near San Joaquin River) already have high salinity above minimum threshold. How do we bring this into the discussion? Answer: The proposed minimum threshold for degraded water quality is 1,000 mg/L TDS but in areas where it's already higher, it's not considered significant and unreasonable because high salinity is already being managed.

v. Lacey Kiriakou will check with Merced County Environmental Health for any feedback about constituents effected by groundwater pumping that we should consider setting thresholds beyond TDS.

vi. Feedback from Amanda Peisch-Derby (DWR): Suggestion provided to review example of Paso Robles Draft GSP which is publicly available. For degraded water quality, the GSP picked a set of common contaminants and used MCLs for setting Minimum Thresholds. Areas with existing exceedances of the MCLs were not selected for representative monitoring (e.g. MT was not developed for these areas). Elsewhere, the definition of undesirable results was set so that multiple wells had to exceed the MT.

vii. Comment: For about 10 years, Eric Swenson managed groundwater assessment and cleanup regulations for Merced County. Most of the concerns are in urban areas in domestic wells and large municipal wells. Practice was to carefully monitor constituents for exceedances of MCLs. Only 2 example wells where plume migration was observed.

viii. Question: How come we don't have specificity on the year type for definition of undesirable results for land subsidence, though we do for groundwater levels? Answer: In part, land subsidence doesn't respond as quickly as groundwater levels, but this also doesn't allow much flexibility in extended drought.

    1. CC group requested that consultant team update the definition of undesirable results for land subsidence to apply only in non-dry/critically dry years, similar to groundwater levels.

ix. Clarification on Interconnected Surface Waters: The MercedWRM model was used to determine what level of surface water flow reduction would be expected using the existing groundwater level minimum thresholds; the analysis did not determine a new set of minimum thresholds that meet known exact undesirable results for this sustainability indicator.

x. Comment: Moving forward, should consider whether there is an opportunity to directly measure stream depletions so when five year update comes we can re-evaluate. May need to involve additional monitoring wells along streams as well.

xi. Public question: Merced River floods ranch and water is seen as being wasted. Can the water be used to recharge aquifer and credited to the landowner? Answer: CC group has previously discussed possibility of having a permit for multiple diversion locations, identifying places of use, etc. that would mean ability to have credits would exist in the future.

c. Implementation Plan

i. Alyson Watson (W&C) gave a brief outline on implementation planning steps for the GSP that are currently underway, as well as a schedule for future implementation of the GSP.

1. Hicham ElTal (MIUGSA): Suggestion to invite Irrigation Training & Research Center (ITRC) from Cal Poly in to talk about one way we might implement one mechanism for incentives and groundwater tracking.

   a. CC interest was expressed from multiple members.

2. Suggestion: it would good to come up with other creative ideas for incentivizing better groundwater use, e.g. a funding mechanism establishing a dollar amount per year to incentivize people to fallow land.

   a. Eastside Water District has a program like this. Alternatively, a program could work to incentivize recharge, too. Could bring member of Eastside to present, too, in addition to ITRC above.

3. Hicham ElTal (MIUGSA) proposed writing a letter re: Prop 68 to DWR requesting that the previously funded projects for SDAC funding shouldn't be counted against the ~$2M funding cap.

   a. CC group approved a motion to direct Lacey and Hicham to write and submit a letter.

4. Hicham ElTal (MIUGSA) shared some proposed changes to DWR Technical Support Services (TSS) application, originally for monitoring well and extensometer funding for Merced/Delta-Mendota shared set of monitoring wells along southwest side. Since Subbasin is moving away from using groundwater levels as proxy for subsidence, proposal is to focus only on funding a continuous GPS station for subsidence monitoring which will be cheaper and easier to implement overall.

   a. CC members approved motion to submit TSS application based on this updated proposal.

5. Recommendation from SC to implement policy in GSP to limit/exclude exporting of water from the Subbasin (albeit maybe with little authority to enforce).

   a. CC response: legally complicated to include in the GSP, probably not necessary to include since the County has the existing Ordinance. Proposed allocation framework has measures for limiting export of water from the Subbasin.

d. Water Allocation Framework

i. Hicham ElTal (MIUGSA) shared a proposed clarification on Item #4 in 4/2/2019 water allocation framework update TM to GSA staff "Use framework above to establish total allocations to each GSA. GSAs can modify the implementation and allocations within their GSA Boundary."; To avoid a perverse incentive of groundwater mining prior to implementation, MIUGSA would like to modify text so that internal GSA management is allowed except transfer of groundwater from non-developed to developed lands. However, groundwater credit exchange for in-lieu recharge (recharge, surface water, FloodMAR, etc.) would still exist.

ii. Discussion ensued about various rules under this proposed scenario and other clarifications.

iii. Public Comment and Suggestion: What does this updated scenario mean for several different landowners? E.g. rangeland, 1000 acres owner, 5000 acres large property owner who wants to pipe 2 miles down road from allocations, etc.; Response: it is possible to come up with some examples for this in a future meeting.

iv. Public comment: Difficult to follow the overall conversation about framework modifications. Response: Team provided commitment to provide additional information in packet for next meeting with reference on framework memo discussion.

e. Next Steps in GSP Development

i. Included a summary of upcoming section review drafts to expect, as well as a review of steps for submission (e.g. notice of intent to adopt).

f. Other Updates

i. Included a summary of upcoming section review drafts to expect

5. Public Outreach update

a. The next public workshop will take place May 29th at the Atwater Community Center. Notices and additional information are posted on the Merced SGMA website.

6. Coordination with neighboring basins

a. A meeting with Turlock was just held. Also developing a draft agreement on how to coordinate in the future with Delta-Mendota (which is on a tight timeline and does not expect to be able to coordinate on data sharing unless there has been sufficient time for internal review).

7. Public comment

a. Question: Is Merced annexing property near UC Merced? Response: Not sure of details.

b. Question: Geologists say we are past due for a big earthquake. What would it do to our basin and is there any potential effect on sustainability of groundwater? Answer: See Hydrogeologic Conceptual Model for more information about the faults. We have not considered dam failure (while not required by SGMA, MID has been working on this separately).

c. Question: How many more meetings will be held? Answer: We will talk about this at the next meeting. Will be meeting in June and most likely in July as well. August we will likely spend discussing comments and how to support adoption as well as what additional meetings are required.

8. Next steps and adjourn

a. Focus for June will be on comments on draft sections and process for GSP Adoption and next steps.

Next Regular Meeting
June 24, 2019 at 1:30 p.m.
Atwater, CA – Castle Conference Center at Castle Airport (subject to change)
Information also available online at mercedsgma.org
Action may be taken on any item

Note: If you need disability-related modification or accommodation in order to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING NOTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Special Session

DATE/TIME: June 18, 2019 at 1:00 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance*:

	Representative	GSA
☐	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☒	Daniel Chavez	Merced Irrigation-Urban GSA
☐	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☐	Mike Gallo	Merced Subbasin GSA
☒	Nic Marchini	Merced Subbasin GSA
☒	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1
	Others:	
	Leah Brown (non-member)	MIUGSA, City of Merced
	Bryan Kelly	MIUGSA, MID
	Hicham ElTal	MIUGSA, MID

*Some attendees participated via phone.

Meeting Notes

1. Call to order
    a. Alyson Watson (Woodard & Curran) calls to order the Special Session of the Coordination Committee.
2. Discussion of Allocation Framework Issue
    a. Issue
        i. The Allocation Framework is discussed in the Projects and Management Actions section of the GSP. MIUGSA provided written comments on the administrative draft of this section,
        ii. The quantification of developed supply, included in the GSP for illustrative purposes, includes only seepage of surface water from unlined canals.
        iii. There are other potential sources of developed supply in groundwater that are not quantified in the current GSP, including deep percolation of applied surface water and leakage from piped conveyance.

iv. MIUGSA comments on GSP admin draft requested definition of "developed supply" in GSP text be expanded to include deep percolation of applied surface water.

b. Prior Discussions

i. Have discussed that sources other than seepage exist and may be refined later. A possible approach is that the GSP could state that there are other sources and that these could be investigated and the definition of "developed supply" could be refined moving forward.

c. Discussion:

i. Comment (MSGSA): We talked about deep percolation of applied surface waters. It is difficult to quantify, and difficult to ensure that this is not impacting the native groundwater.

ii. Comment (MIUGSA): Developed water is any water brought into the basin that is not natural. Scenario: If overirrigation occurs and this goes to groundwater for recharge. Developed water is something people should be able to bank on, it is not part of the allocation, it is outside of this. MIUGSA is not requesting to change the current Sustainable Yield estimated numbers.

iii. Comment (MSGSA): We have no issue with recharge. However, trend is not in the direction of overirrigating. The trend is to have less and less applied surface water.

iv. Comment (MIUGSA): People are using less water to irrigate their plants. There are two systems, one irrigation system in wet and one in dry years. Need to have a water balance. and we have to agree on the numbers. These are changing all the time, e.g., we have updates every 5 years. All that we are talking about today is the concept: developed water.

v. Comment (MSGSA): Could the number that came out of the MID Agricultural Water Management Plan used in the Water Budget Technical Memo be higher? (potential additional deep percolation).

vi. Comment (MIUGSA): This could increase, but we would need to do a water balance and have a good definition for developed water.

vii. Clarification (W&C): Yes, MIUGSA is asking to define "developed supply" and acknowledge that there are other sources of supply that can be investigated in the future.

viii. Comment (MSGSA): In defining "developed supply" is it the person who purchases the developed water the entity who receives credit for this water?

ix. Clarification (W&C): In adjudications in other basins, that water was considered the agency's property and not the person who purchased the water. We are not at the point of setting up a water credit system.

x. Comment (MSGSA): Would think that this should be the property of the person who purchased it.

xi. Clarification (W&C): For today what we are trying to clarify is whether this water would be part of the developed supply estimate.

xii. Comment (MSGSA): For continue progress of the GSP, we are going to need to hold out on additional details of the allocation framework. Do not see being able to get our boards to approve greater detail in the time that we have.

xiii. Comment (MIUGSA): In order to have an exchange system in the basin, we have to agree on how to account for the water. For today, we are discussing whether there are other sources that should be reviewed and investigated. We should have something now that encourages people to start thinking and working together to look into having a robust water exchange market, a monitoring network, and so on.

xiv. Comment (W&C): Once we estimate the amounts, we need to look at who has the right to this water.

xv. Comment (MSGSA): We would want to ensure that intent to recapture is documented.

xvi. Comment (MSGSA): How can we prevent people from overpumping?

xvii. Comment (MSGSA): We would like to make sure that not all applied surface water is pulled out of sustainable yield. The rights will need to be determined. A portion of that percolation would go to the overlying bucket, but that is either going to the agency or the person who purchased and applied it.

xviii. Clarification (W&C): Where we are with the definition: We are underscoring the importance of future work needed. We will use the conceptual definition that "developed supply" is supply that is brought into the basin. It would not be limited to the definition in the plan. We may be required to have documentation of intent to recapture and can have a description of future work that would be needed. This includes estimates from seepage, refining conveyance losses, addressing rights to developed supply, and documenting developed supplies. We currently do not specifically talk about managed recharge.

xix. Comment (MSGSA): It is hard to prove deep percolation.

xx. Comment (MIUGSA): Common law says that this is once the water passes the root zone it is lost to the grower. However, this has to be accepted by the GSAs.

xxi. Comment (MSGSA): We should have a certification process if there is going to be additional documentation of deep percolation of applied surface water. It should be approved with a public process.

3. Public comment

a. Question on the allocation: In April, GSAs agreed that all parcel's (including rangeland and undeveloped) would have equal allocation. Wasn't an agreement made that MSGSA would have full allocation.

b. Clarification (W&C): That is more related to the developed land. What we are talking about is developed water.

c. Comment (Public): Should do sooner rather than later, the subbasin should develop a credit system.

d. Comment (MSGSA): Agree, would like to see this developed in the first year.

e. Comment (MIUGSA): This should not be rushed. First should complete gaps in data, then complete metering, and then work on how we are going to move water and use the models to maximize how we use this.

f. Comment (Public): It seems legally ambiguous whether the water lost to the growers goes back to the agency.

g. Clarification (W&C): Developed supply includes supplies that are brought into the basin which would not otherwise reach the GW basin. Ownership would have to be determined. This definition would be included and not limited to definition in the plan. This could come online, with intent to recapture. This would include documenting, developing, and refining developed supply, and determining rights to this supply.

h. Comment (Public): We can add the caveat that the water should be put to beneficial use.

i. Comment (W&C): Is the group ok with the consultant team revising the definition and then sending this to GSA staff.

j. Comment (MIUGSA): Would be good to include Bryan Kelly while Hicham is out.

k. Question (Public): Do the Sustainable Yield buckets change?

l. Clarification (W&C): No, buckets stay the same. In the future if there's additional supply then it goes in that current developed supply bucket. It would be cleaner to have developed surface supply with an asterix that it will be refined later with future steps.

m. Comment (MSGSA): still some lack of clarity for how we are going to estimate deep percolation.

n. Comment (TIWD): The current definition is fine, but we also agree that it will be very difficult to come up with estimates for deep percolation.

o. Comment (MIUGSA): Estimates are based on as much information as we have. Everything has to be approved by the GSAs.

p. Comment (MSGSA): Each GSA should be able to manage its Sustainable Yield of GW within its boundaries. However, when we were talking about overlying and underlying users in the basin, we agreed we'd determine allocation by acreage. Transferring credits within GSAs respective basins should be enabled if it's transferring among developed acres.

q. Comment (MIUGSA): We would like to put a hold on creating a credit system until we ensure we fill data gaps. We are ok with developed acres moving water to developed acres.

r. Comment (MSGSA): We want dormant overlying users to be able to have credits, but need to have a system to enable that process. This can be done down the road.

s. Clarification (W&C): We have said both developed and undeveloped land are at full allocation. If undeveloped land starts using their water, it is not going to reduce allocation for developed lands. What Bob is suggesting that the GSA has X TAF that they can administer the full amount for developed or undeveloped lands.

t. Comment (MIUGSA): We have to see how the cities are going to survive in looking to work toward sustainability. At this point, we would like to have time to get a better understanding to resolve ambiguity. We're not saying that we will not agree to this, but that we need time and more information, and do not need to make a decision today.

u. Clarification (W&C): MIUGSA had some concerns initially. We all agree that the Sustainable Yield estimates will need to be refined. We need to hold off on issuing credits and establish credit system. MSGSA agrees but also states that MSGSA would allocate within their own boundaries.

v. Comment (MSGSA): We are saying that each GSA can determine how the allocation works within their area.

w. Clarification (W&C): We are not going to set up an allocation framework. Options are to go to the GSA level split and allow each GSA to administer their amount of water in their GSA in the interim, or this can be limited to developed land.

x. Comment (MIUGSA): We can see how we divvy up undeveloped land across the basin. We have no reason to reach a decision on that today. This is a GSA decision, not GSP decision.

y. Clarification (W&C): There was agreement to use 0.7 AF/acre to come up with the GSA allocation numbers. However, GSAs have the ability to use the full amount for their developed and undeveloped parcels. This was a good faith agreement, but there may have been some miscommunication. Both MSGSA and MIUGSA gave some compromise, but there may have been a misunderstanding. What we can do for the plans for now is state what has been estimated for the Sustainable Yield for the basin, this is how discussed, and how credits could be used and worked out at a later time.

z. Comment/ (Public): The 440K AF should be the native water. We do not need to talk about developed or undeveloped land for the purpose of GSP.

aa. Clarification (W&C): The assumption is that there are about 200K acres that could be using water but are not. From previous discussions, before we allow transferring, we need to get more information. For purpose of the GSP, we can take the suggestion not to discuss developed or undeveloped lands for the GSP.

bb. Comment (MIUGSA): Everything done on our side is done to avoid adjudication in the basin. (In these cases, grazing grounds do not often get anything, have to pay to put in a well, etc.). We want to have a fair system and be good example through our GSA and have good cooperation.

cc. Comment (MSGSA): Our GSA echoes those comments and feels very positively about ability to communicate and resolve issues. We think we have the ability to make a difference long term. Having this discussion and working through these issues is very positive.

4. Next steps and adjourn

    a. Adjourned to the next regular meeting.

Next Regular Meeting
June 24, 2019 at 1:30 p.m.
Atwater, CA – Castle Conference Center at Castle Airport (subject to change)
Information also available online at mercedsgma.org
Action may be taken on any item

Note: If you need disability-related modification or accommodation in order to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING NOTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: June 24, 2019 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☒	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☒	Daniel Chavez	Merced Irrigation-Urban GSA
☒	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☒	Mike Gallo	Merced Subbasin GSA
☐	Nic Marchini	Merced Subbasin GSA
☐	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Call to order
    a. Alyson Watson (Woodard & Curran) called meeting to order. Members introduced themselves.
2. Approval of minutes for May 29, 2019 meeting
    a. Meeting minutes from May 29th were approved.
3. Stakeholder Committee update
    a. Update from May 29 morning meeting provided by Alyson Watson (W&C). SC group would like to remain involved and be able to give input. The agenda for SC followed closely to content with CC's agenda. Input from the SC will be provided as each item is gone through during today's CC meeting.

    b. Leadership Counsel provided a comment and letter to the Merced Subbasin GSAs. Representatives attending CC meeting communicated some of the recommendations including recommendation to set minimum thresholds based on the anti-degradation policy at the state level (per Bill 1968), with level set at best water quality since 2015. Where minimum threshold exceeds public health goals, the GSP should include a policy to strive for water quality improvements to meet relevant public health goals.
4. Presentation by Woodard & Curran on GSP development
    a. Next Steps in GSP Development

i. Alyson (W&C): We are taking more time to get through the administrative reviews. However, should still be on schedule for July 19th estimated Public Draft release date. July 22nd CC meeting will go through contents/allow discussion for comments. Are looking at Aug./Sept. to provide review and comments on the draft GSP.

ii. Sustainable Management Criteria will be released to SC and CC June 28th, rest of chapters to be available for comment with Public Draft.

b. Sustainable Management Criteria

i. Alyson reviewed summary of sustainable management criteria MOs, URs, and MTs per sustainability indicator.

ii. For water quality, the takeaway from May 2019 from both forums and from LC and the public was to consider including more constituents. The GSAs circled back with Merced County Division of Environmental Health and received the feedback that SGMA does not specify constituents to be set with MTs, GSAs do not have tools, responsibility, or resources to monitor and clean up water quality contamination, or other programs are tasked with that. The Division support the proposed MT rationale.

iii. Comment: Public agencies already have to comply with water quality requirements.

iv. Clarification: Can usually find contamination sites on Geotracker.

v. Comment: There are not that many currently active monitoring wells. That's a concern because we've set an upper limit of 1000 mg/L, but we don't have more information. Response: General concentrations for those selected wells for the network are on order of 300 mg/L.

vi. Clarification: Need to confirm we know where these areas are that are already over this threshold[1]

vii. Alyson (W&C) explained the current minimum threshold methodology for declining groundwater levels and issues with areas in which the model does not fit well due to a shallow geological issue.

viii. Suggestion/clarification from MSGSA: Add third element to methodology for groundwater elevation Minimum Threshold— use simulated GWLs where historical data shows GWLs may have already dewatered shallowest domestic wells or where modeling shows GWL may drop below the 2015 level. Much discussion occurred over this suggestion and the complications of the two wells with a model fit issue. Ultimately the group decided:

1. Not to include these 2 wells as representative wells (what is included is the best representation for the Subbasin)

2. Acknowledge that GSAs will need to develop a methodology (like this third option suggested by MSGSA) in the next GSP update and model will need to be calibrated for this (new methodology to be developed once model calibrated).

c. Monitoring Networks & Addressing Data Gaps

i. Alyson Watson (W&C) reviewed the status of the monitoring networks and data gaps for each sustainability indicator.

[1] Information on TDS concentrations across the basin are provided in maps containing the average 2008-2018 TDS concentrations in the Current and Historical Conditions section of the Water Budget chapter of the Merced GSP.

ii. Comments regarding the metering program:

1. Heard from SC in morning session that they want a very flexible metering program. Received feedback that folks do not want to have to replace their meters (they are good to go out and continue gathering their own data). There are different types of set ups for metering, and different types of meters.
2. Question: Has that white paper on metering been released? A: No, it will be part of of projects and management actions chapter, which will be available for SC & CC around July 19th.[1]
3. Clarification: Telemetry is a method where you can get the metering information sent, e.g., to your cell phone.
4. Comment: Could get a few subbasins to work together to get satellite imagery in lieu of metering. If we could get the state to provide annual numbers – this could be huge.
5. Alyson: Hicham mentioned getting ITRC to attend a CC meeting. This is still in progress and will be revisited when Hicham comes back from vacation.

d. Plan Implementation

i. Request for input on assumptions:

1. We are assuming existing MOU will remain in place.
2. Interbasin coordination will continue.
3. We are reaching out to understand cost for GSA operating/administrative costs.
4. Much discussion was held about the role and frequency of the SC in the future during GSP implementation and CC consensus was reached:
    a. It is important to have continued input from the SC, particularly as the first few years of the GSP implementation will require crucial decisions for the Subbasin.
    b. SC and CC meetings would be staggered. (stagger can be a couple weeks, not a whole month, so as to have enough time for documentation of input from SC meeting to CC meeting and vice versa). These meetings would occur quarterly. It was agreed a liaison position for a member of the SC could be created by decision of the GSAs.
5. Also agreed that assumed 2 public outreach workshops per year.
6. Comment: Would be good to have public comment come as first agenda item.
7. CC agreed that if a GSA implements a project that they are expanding their allocation. Can start at the GSA level and be clear that there is a basinwide option.
8. People on the SC communicated they want to continue on the committee to provide input.

e. Water Allocation Framework

[1] Correction: this is a technical memorandum that will be added as an appendix to the Plan Implementation Chapter of the Merced Draft GSP.

i. Alyson (W&C) recounted the content and purpose of the Special Session of the CC.

    1. Purpose was to discuss language in the draft GSP on Developed Supply and Water Allocation Framework. General agreement that the numbers in draft GSP (allocation estimates) will remain for the Draft GSP. Miscommunication identified in agreement on whether GSAs can determine allocation within their own boundaries between developed and undeveloped lands.

ii. Recommendation and follow up from meeting:

    1. Include working definition of developed supply.
    2. Note that the full definition and ownership of developed water would need to be agreed upon by GSAs after adoption. Groundwater originating from developed supply could include seepage from unlined surface water conveyance, deep percolation of applied surface water, leakage from surface water infrastructure, and potentially other sources.
    3. Add footnote that developed supply in this GSP was calculated based on estimated seepage from unlined conveyance and will be refined and further documented in the future.
    4. Identify future work needed for GSP updates including: develop, refine, and document estimates of developed supply and determine rights to confirmed estimates of developed supply

iii. Clarification (W&C): Exchange system will not be discussed in the GSP.

iv. Question: The layout of steps would be in the GSP? Answer (W&C): The GSP is not going to document how GSAs are managing their allocation because we do not have that information yet.

v. Question: What are the management practices needed other than an exchange system if we want to agree on an estimated number that we want to use to actively manage? MSGSA Reply: All lands under each GSA receive water.

vi. MIUGSA: If we have not confirmed what the allocation is at a GSA level, what would MSGSA put into place to manage the allocation? We have mechanisms to manage this in a city and can document steps to achieve a concrete path to management. If MSGSA wants local control, everyone needs to know that there are mechanisms for management.

vii. MSGSA: We would manage this as a total, whatever the total allocation is for sustainable yield of overlying water – this is the “bucket” that would be managed.

viii. MIUGSA: To clarify, if MSGSA reaches that allocation number, folks would be asked to stop drawing water? MSGSA: Yes, by 2040.

ix. Clarification discussion:

    1. MSGSA: It is not our understanding that we would have undeveloped lands already transfer credits.
    2. Agreement: All GSAs agree that allocations to developed acres can be shared with other developed acres.
    3. Question: If the County has to issue the well permit, how are you going to adjust allocations each year based on the new permits? We want to prevent the type of management where land changing from not developed to developed gets an allocation without some kind of accounting system.

x. Clarification from W&C: The initial approach was developed with understanding that GSAs would have discretion to allocate within their boundaries. It is important to consider that, if we do not allow usage to undeveloped land, we are telling MSGSA that they have to reduce by half.

xi. MIUGSA: We gave on the 80% because this was requested by MSGSA, with agreement that there not be a credit system. We think we need to bring this back and establish whether and why some areas have not had historical use.

xii. Continued back and forth discussion with agreement that continued discussion is needed to clarify areas of disagreement and find solution. Request made to review past discussion and get everyone up to speed on development of allocation framework discussion.

xiii. Alyson (W&C): Continued discussion can also include how often these allocations should be updated, and how new wells come online each year.

5. Public Outreach update
   a. Public workshop summary is posted.
6. Coordination with neighboring basins
   a. Currently in process of scheduling a meeting with Delta-Mendota for late July.
7. Public comment
   a. Letter presented by Leadership Counsel. This letter has been attached as an appendix to the meeting minutes.
8. Next steps and adjourn
   a. Be on lookout for Sustainable Management Criteria draft on June 28th.
   b. Adjourn to next meeting on July 22.

Next Regular Meeting
July 22, 2019 at 1:30 p.m.
Atwater, CA – Castle Conference Center at Castle Airport (subject to change)
Information also available online at mercedsgma.org
Action may be taken on any item
Note: If you need disability-related modification or accommodation in order to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

Larry Harris, Turner Island Water District GSA #1
Mike Gallo, Merced Subbasin GSA
Nic Marchini, Merced Subbasin GSA
Bob Kelley, Merced Subbasin GSA
Daniel Chavez, Merced Irrigation-Urban GSA
Justin Vinson, Merced Irrigation-Urban GSA
Stephanie Dietz, Merced Irrigation-Urban GSA

June 21st, 2019

Re: Concerns and Recommendations to Ensure that Merced Subbasin GSP Protects Vulnerable Drinking Water Users

Dear Merced Groundwater Sub-basin Coordinating Committee members,

Our organization works alongside low income communities of color in the San Joaquin Valley and the Eastern Coachella Valley to advocate for local, regional and state government entities to address their communities' needs for the basic elements that make up a safe and healthy community, including clean, safe, reliable and affordable drinking water, affordable housing, effective and safe transportation, efficient and affordable energy, green spaces, clean air, and more. We have been engaged in the Sustainable Groundwater Management Act (SGMA) implementation process because many of the communities with whom we work are dependent on groundwater for their drinking water supplies, and often have already experienced groundwater quality and supply issues. Historically, communities we work with have not been included in decision-making about their previous water resources, and their needs have not been at the forefront of such decisions. In 2012, California recognized the Human Right to Drinking Water as a statewide goal. Now, because of SGMA's requirements for a transparent and inclusive process, groundwater management under the new law has the opportunity to include disadvantaged communities in decision-making and create groundwater management plans that understand their unique vulnerabilities and are sensitive to their drinking water needs.

We are concerned that drinking water impacts and disadvantaged community input have not been adequately analyzed and incorporated into the draft GSP, and recommend the following actions to ensure that drinking water is protected, especially for the communities whose drinking water is severely at risk from groundwater management activities, and who are the least able to pay for solutions for clean and reliable drinking water.

Development of Sustainable Management Criteria

In order to "consider the interests of"[1] disadvantaged communities in developing sustainable management criteria, GSAs must address the impacts of the six sustainability indicators, engage residents of disadvantaged communities to understand their groundwater issues and needs and get input on how to shape sustainable management criteria, and analyze the impact of preliminary minimum thresholds on drinking water users before establishing minimum thresholds.

Under SGMA, ***all sustainable management criteria must be based on the GSA's determination of what will cause a "significant and unreasonable" impact on each of the six sustainability indicators.*** [2] This determination of what is "significant and unreasonable" must be based on the needs of all beneficial users.[3] Without first consulting beneficial users, including disadvantaged communities, to understand what groundwater impacts those individuals and communities want to avoid, the GSA cannot make a valid determination of what is "significant and unreasonable", and thus cannot set valid sustainable management criteria.

In the Merced subbasin, GSAs and consultants had initial discussions at the first few stakeholder committee meetings about the general impacts that stakeholders on the committee wanted to avoid as they developed the GSP. On August 27th, 2018, consultants began more concrete conversations on the minimum thresholds, proposing groundwater levels minimum thresholds at the lowest historical elevation, plus a buffer, unless this would dewater no more than 25% or the shallowest nearby domestic wells. Consultants also proposed a second methodology that could protect more wells by establishing the minimum threshold at the level of the shallowest well, or the 25th percentile level, whichever was higher. For groundwater quality, consultants proposed only doing a minimum threshold for total dissolved solids and not other contaminants despite their knowledge that the subbasin has water quality issues from nitrates, DBCP, 123-TCP and other contaminants[4], and that their groundwater management activities could impact the concentration and location of those contaminants. Our organization and Self-Help Enterprises both voiced concerns with these thresholds, both in their substance and also because they were not based on a participatory determination of what stakeholders in the subbasin consider to be "significant and unreasonable" impacts from the sustainability indicators.

Subsequently, the Merced Subbasin GSAs hosted several workshops at which they asked the public for feedback on what they considered to be significant and unreasonable impacts. Our organization and Self-Help Enterprises worked with GSA consultants to ensure that workshops were accessible to disadvantaged communities, and that the presentations would go beyond presenting updates and be geared towards soliciting meaningful feedback. After the workshops and several more conversations with the Stakeholder Committee in April and May 2019, at which Leadership Counsel and Self-Help Enterprises stressed the importance of protecting drinking water for disadvantaged communities, consultants are now proposing that groundwater levels minimum thresholds be set at the depth of the shallowest well in the 2-mile radius around each monitoring well, or if the water levels are already below that level then setting

[1] Water Code sec. 10723.2
[2] CCR sec. 352.28(a), 354.30(b), 354.26(a)
[3] CCR sec. 352.28(b)(4)
[4] Merced Subbasin Groundwater Sustainability Plan Current and Historical Groundwater Conditions

the minimum threshold at 2015 levels. We believe public and stakeholder feedback on "significant and unreasonable" impacts to drinking water informed the improvements to the groundwater levels minimum threshold have come from, but it is still not clear what impact the 2015 levels will have on nearby drinking water users, or how many wells will not be taken into account that are outside the 2-mile radius around monitoring wells. For groundwater quality, despite our feedback that consultants look at addressing all contaminants, the GSAs still only propose a minimum threshold for total dissolved solids. There has been no meaningful discussion with the public or stakeholders about whether this will cause "significant and unreasonable" impacts to drinking water resources for beneficial users.

In order to effectively "consider the interests of" all beneficial users, GSA committees must analyze how preliminary sustainable management criteria will affect drinking water users before reaching proposed final sustainable management criteria.[5] Our experience demonstrates that once recommendations are made at the committee level, it is difficult to reassess those recommendations once they reach the governing board, so such a decision cannot overlook impacts on the most vulnerable groundwater users. Before asking committees to make recommendations to GSA staff, committees must be equipped with information about how potential minimum thresholds will impact access to drinking water for domestic well owners and communities on small community water systems. To date and to the best of our knowledge, the Merced subbasin GSAs have not conducted an analysis of how drinking water will be impacted by the groundwater quality and groundwater levels minimum thresholds proposed by consultants. Specifically, we request that the GSAs ensure that an analysis be done of the impact to domestic well users and small community water systems from the proposed minimum thresholds for groundwater quality and groundwater levels. With this drinking water impact analysis, the stakeholder committee can be equipped with the necessary information to determine whether impacts from these proposed minimum thresholds will be "significant and unreasonable."

The GSP development process must be representative of the interests of all beneficial users named in the Act. When board members do not come from disadvantaged communities or understand the unique groundwater needs of such communities, as is the case more often than not, ***it is imperative for the agency to reach out to disadvantaged community members for input*** before making key decisions such as recommending or proposing draft sustainable management criteria. The Merced GSAs' consultants have worked with Leadership Counsel and Self-Help to do outreach to disadvantaged communities for workshops, and have regular calls with our organizations to coordinate outreach to disadvantaged communities. At GSA meetings, to which community residents' schedules prevent them from coming, Leadership Counsel and Self-Help Enterprises helps provide feedback on GSP development on behalf of community residents. We are grateful that the GSA consultants actively reach out to us for suggestions on how to do such outreach, and hope that our organizations have been able to help the GSAs and

[5] California Department of Water Resources, Sustainable Management Criteria Best Management Practices, p. 9. The GSP must discuss how groundwater conditions at a selected minimum threshold could affect beneficial uses and users. This information should be supported by a description of the beneficial uses [of] groundwater and identification of beneficial uses, which should be developed through communication, outreach, and/or engagement with parties representing those beneficial uses and users, along with any additional information the GSA used when developing the minimum threshold.

consultants learn how to do more effective outreach to disadvantaged communities in the area. As the GSAs develop their sustainable management criteria and projects and management actions, they must ***show that they are meaningfully implementing the input*** that they are receiving from disadvantaged communities and disadvantaged community advocates regarding their drinking water needs.

Groundwater Quality Minimum Threshold Recommendation

Groundwater quality has been a particularly complex issue for GSAs. In determining how they will set their sustainable management criteria for groundwater quality, GSAs have considered many factors, including the state Maximum Contaminant Levels (MCLs), other agencies monitoring and regulating groundwater contaminants in the region, areas where MCLs are already exceeded, and ways that groundwater management could impact the concentration and movement of groundwater contaminants.

We understand the complexity of setting groundwater quality SMC that are accurate, attainable and measurable, and we are eager to work with the Merced subbasin GSAs to ensure that groundwater management does not increase groundwater contamination, especially where groundwater is being used as a drinking water source. Consultants for the Merced subbasin GSAs have stated they would only be monitoring for total dissolved solids. Given the need for a concrete minimum threshold that strongly protects the human right to drinking water, we recommend that the Merced subbasin GSAs instead implement the following minimum thresholds:

- Minimum thresholds for water quality should be set at the best water quality since 2015 for each constituent.
- Where the minimum threshold exceeds the public health goal for any constituent, the GSP should, at a minimum, include a policy to strive for improvements to water quality to the point of meeting the relevant public health goal(s).

The reasoning behind these minimum thresholds is that the GSA is tasked with avoiding any undesirable results, and contamination of groundwater and other drinking water sources is a “significant and unreasonable” impact to the resource that we all need to drink, cook, bathe, grow food, and more. Accordingly, minimum thresholds must ensure protection from and prevention of contamination of groundwater and other drinking water sources. DWR instructs GSAs to look to existing groundwater regulatory programs and water quality standards.[6] Many GSAs have proposed incorporating the existing MCLs into their minimum thresholds, however reliance on an MCL is not sufficiently protective of drinking water sources, and does not prevent contamination of our critical resources. An appropriate standard in the context of groundwater protections is the state’s anti-degradation policy, which is used by the SWRCB and regional water boards, and does not allow for further contamination of groundwater based on the best quality of the water since 1968.[7] In the SGMA context, it is key to prevent further

[6] California Department of Water Resources, Sustainable Management Criteria Best Management Practices, p. 15.
[7] *Asociacion de Gente Unida por el Agua v. Central Valley Regional Water Quality Control Bd.* (2012) 210 Cal.App.4th 1255, 1268.

degradation of groundwater quality to protect drinking water. We are asking the GSA to specifically look at protecting the highest quality of groundwater achieved since 2015, based on the year that SGMA was passed. Another rule commonly used in environmental law is the precautionary principle, which prohibits activities that could cause harm when the amount of potential harm is unknown. We urge the GSA to use these two rules, combined with seeking to remediate groundwater to the public health goal, as laid out above, to ensure that groundwater management does not cause degradation of groundwater quality.

GSAs should monitor all primary drinking water contaminants, as well as chrome-6[8], which is known has significant health effects but is undergoing a new process to set the MCL because of procedural flaws. It is widely known that the San Joaquin Valley experiences widespread water quality issues from nitrates[9], DBCP[10] [11], 123-TCP[12] and other contaminants, and the GSA's groundwater management activities could impact the concentration and location of those contaminants. Where relevant, GSAs should also consider monitoring for PFOA and PFOS as the EPA has established a Lifetime Health Advisory for them due to their potential impacts on drinking water systems.[13] This should especially be considered in the Merced Subbasin as they have they have identified these as emerging contaminants in their "Current and Historical Groundwater Conditions" Draft GSP Chapter. GSAs should also monitor contaminants that are proven to increase from groundwater management, such as arsenic and uranium,[14] increased contamination from recharge,[15] movement of contaminant plumes from groundwater pumping, and other groundwater management activities.[16]

Water Quality Considerations for Groundwater Management Actions

---

[8] Hausladen, Debra M., et al. "Hexavalent chromium sources and distribution in California groundwater." *Environmental science & technology* 52.15 (2018): 8242-8251.
[9] *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, 2012.
[10] Peoples, S. A., et al. "A study of samples of well water collected from selected areas in California to determine the presence of DBCP and certain other pesticide residues." *Bulletin of environmental contamination and toxicology* 24.1 (1980): 611-618.
[11] Loague, Keith, et al. "A case study simulation of DBCP groundwater contamination in Fresno County, California 2. Transport in the saturated subsurface." *Journal of Contaminant Hydrology* 29.2 (1998): 137-163.
[12] Burow, Karen R., Walter D. Floyd, and Matthew K. Landon. "Factors affecting 1, 2, 3-trichloropropane contamination in groundwater in California." *Science of The Total Environment* 672 (2019): 324-334.
[13] "Drinking Water Health Advisories for PFOA and PFOS." *EPA*, Environmental Protection Agency, www.epa.gov/ground-water-and-drinking-water/drinking-water-health-advisories-pfoa-and-pfos.
[14] Jurgens, Bryant C., et al. "Effects of groundwater development on uranium: Central Valley, California, USA." Groundwater48.6 (2010): 913-928.; *also see* "Groundwater Quality in the Sustainable Groundwater Management Act (SGMA): Scientific Factsheet on Arsenic, Uranium, and Chromium," found at https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328800/Groundwater_Quality_in_SGMA_Scientific_factsheet_on_arsenic__uranium__and_chromium.pdf?1559328800
[15] Ground Water Recharge Using Waters of Impaired Quality (1994) https://www.nap.edu/read/4780/chapter/3
[16] Moran, T., & Belin, A. (2019). *A GUIDE TO WATER QUALITY REQUIREMENTS UNDER THE SUSTAINABLE GROUNDWATER MANAGEMENT ACT*. Retrieved from https://purl.stanford.edu/dw122nb4780.

To establish causality between groundwater management activities and groundwater contamination, GSAs should look to (1) whether there has been a correlation in groundwater management activities and an increase in contamination that could result from groundwater management activities, (2) relevant scientific studies that show proven mechanisms by which causation can be established between groundwater management activities and groundwater contamination, and (3) data and samples collected showing a causal nexus in the case at hand.

Finally, in order to effectively protect drinking water resources, GSAs should establish Management Areas in areas that are more vulnerable to groundwater contamination, such as communities with many shallow wells and communities that cannot afford to install drinking water filters or treatment facilities.

Groundwater Levels Minimum Threshold Recommendation

GSAs must protect drinking water, and must consider the needs of disadvantaged communities and domestic well users in creating their GSPs. The California legislature has stated that the use of water for domestic purposes is the highest use of water,"[17] and passed the Human Right to Drinking Water in 2012.[18] After the passage of SGMA, GSAs now have the responsibility to protect drinking water through groundwater management. If they choose to allow individuals to keep pumping at the expense of severe drinking water impacts, that is a groundwater management decision that violates their obligation to protect drinking water resources. GSAs must therefore have strong minimum thresholds that protect all drinking water wells from dewatering.

Minimum thresholds are the most pivotal measure for how a GSA will prevent impacts from a sustainability indicator. This is the point that a GSA must avoid, and could necessitate state intervention. There is some flexibility, however; for groundwater levels, DWR shows in its Sustainable Management Criteria Best Management Practices guide that it will allow a GSA to dip below its minimum threshold for groundwater levels in some cases, as long as its GSP will ensure that it comes back up and towards its measurable objective. Therefore, GSAs should strive to set minimum thresholds at levels that they seek to avoid.

GSAs should set minimum thresholds for groundwater levels at the level of the shallowest existing wells in use, with a buffer above the depth depth of the top of the screen. If GSAs choose not to do so, they must take on the responsibility for the wells that do go dry from this policy choice. If proposed minimum thresholds allow wells to go dry, a GSA must conduct a drinking water impact analysis to evaluate how many drinking water wells will go dry, set management areas for shallower minimum thresholds where there are more concentrated shallow domestic wells, and ensure that drinking water is protected by implementing preventive actions such as digging deeper wells and assisting with

[17] Water Code sec. 106.

[18] Water Code sec. 106.3

consolidation projects. It is important to note that prevention, not mitigation, is the only way to effectively protect drinking water resources.

Consultants for the Merced subbasin GSAs are currently proposing that the groundwater levels minimum thresholds be set at the depth of the shallowest well within a 2-mile radius of monitoring wells, or if the water levels are already above that level then setting the minimum threshold at 2015 levels. We request that the GSAs set all minimum thresholds at a level to provide a buffer above the depth of the top of the screen of the shallowest well. The buffer must be adequate to ensure that the shallowest well does not go dry due to a short or medium-term exceedance of the minimum threshold. The GSAs should only disregard wells that they can prove are not in use.

In setting groundwater levels minimum thresholds, GSAs should also set minimum thresholds high enough as to avoid groundwater contamination from overpumping. They should also set minimum thresholds that ensure that rural communities have equitable access to groundwater resources, and have enough for current needs and future growth. GSAs must also factor in the increased costs of pumping and installing new wells if groundwater levels decrease, and avoid additional costs in groundwater access for low income communities dependent on groundwater for drinking water resources. GSAs should also set minimum thresholds for groundwater levels that will prevent subsidence from occurring and disrupting infrastructure that is critical to the health and safety of vulnerable communities, such as private wells, roads, and homes.

Monitoring Network

Broadly, the GSAs must develop actionable steps to fill data gaps and monitor groundwater levels and groundwater quality. In order to protect drinking water resources, monitoring networks should be closely monitoring impacts on drinking water. In particular to water quality, GSAs should monitor for contaminant concentrations quarterly, and increase monitoring to every month if a water quality test detects higher contamination concentration than the previous water quality test. Testing should also robustly monitor plume migration especially given the high number of water users in the Merced subbasin.

As a result, the GSP should fund a water quality testing program for strategically identified domestic wells to complement data from small water systems and disadvantaged communities in order to fill existing data gaps as well as begin to identify contaminant plumes. To track these concerns the GSA should place monitoring wells near DACs and clusters of domestic wells.

We look forward to providing further recommendations on the monitoring network in the future.

Transparency and Inclusivity

As public agencies, GSAs are subject to the requirements of the Ralph M. Brown Act, which requires transparency of public agencies through notice of meetings and prior posting of agendas, posting of meeting minutes after meetings, and public access to meeting materials upon request by a member of the public. In addition to Brown Act requirements, GSAs must also adhere to the specific public participation and inclusivity requirements for GSP development laid out in SGMA. SGMA expands the public participation requirements of GSAs to also "*encourage the active involvement of diverse social, cultural, and economic elements of the population within the groundwater basin prior to and during the development and implementation of the groundwater sustainability plan*." (Water Code sec. 10727.8) To assist in GSAs complying with this requirement, DWR has published guidance on public notice and engagement, highlighting good practices for effective engagement. Both the letter and spirit of SGMA communicate that GSAs must conduct GSP development in an open and inclusive way.

A best practice to ensure authentic, meaningful input as required by SGMA is to post meeting materials before the meeting, so that these materials are available to the public for feedback and engagement. The Brown Act requires these materials to be made available after the meeting upon written request of the public. Paired with SGMA's requirements for robust community engagement, the most effective way to ensure that the public is aware of what will be talked about at meetings, and to access critical GSP development information despite not being able to attend one meeting, is to post all meeting materials online before the meeting. The Merced Subbasin GSAs send out meeting notices with an agenda, and have an easily navigable website that contains meeting agendas, presentations and minutes for each meeting. However, the GSAs would facilitate more effective public engagement at the meetings if they were to post meeting presentations ahead of time, so that attendees could view the discussion items and data before the meeting.

GSAs should also ***dedicate sufficient funding to ensure meaningful, effective, and accessible engagement of the public***. We, along with Self-Help Enterprises, have worked with the Merced subbasin GSAs' consultants to improve outreach to disadvantaged communities. We have helped give input on several workshops, and have helped conduct outreach for those workshops. We have also kept community residents informed about GSP developments at community meetings. Self-Help has conducted translation and interpretation at meetings to ensure that Spanish-speaking residents can meaningfully engage at GSA workshops. However, we note that the Merced subbasin GSAs' consultants said that there was not enough funding for translation. Having food at evening meetings is also key to ensuring that residents who have worked all day can come to meetings, so the GSAs should allocate funding for food at public workshops. Given the type of outreach that is necessary in order to engage disadvantaged communities, the GSAs should also hire bilingual staff or consultants who can help conduct door-to-door outreach, attend community meetings, translate materials, and interpret at all GSA meetings. In creating annual operating budgets, GSAs should prioritize funding for these necessary outreach activities.

Projects and Management Actions

Projects and Management Actions are a crucial part of the GSP, since they demonstrate how the GSA plans on attaining the sustainability goals that they have set out. Therefore, GSAs should set specific timelines and triggers for projects.

We look forward to commenting further on recommendations for projects and management actions that will protect drinking water for the most vulnerable groundwater users.

Groundwater Markets

We have engaged in many discussions around the state about groundwater markets, and continue to warn against them. Commoditizing precious drinking water resources is dangerous and inequitable, since it lets those with more purchasing power have access to more water, and more likely than not will lead to concentrations of over-pumping by large agribusinesses, leaving nearby communities without drinking water. Furthermore, given all GSAs' severe lack of data on domestic wells and water use in their service areas, and our region's lack of understanding of how a market could impact groundwater use and subsurface groundwater flows, implementing groundwater markets now would be precipitous and reckless.

We know that Merced subbasin GSAs are considering doing a groundwater market, and consultants have communicated at meetings that they will be taking at least five years to collect the data and understand the impacts of a groundwater market for the Merced subbasin. We encourage the GSAs to take time to gather extensive data on existing groundwater resources and drinking water needs and analyze the potential impacts to drinking water before considering implementation of a groundwater market. We look forward to giving more feedback on the potential of developing a groundwater market in the Merced subbasin in the future if the subbasin decides to consider such an action.

~ ~ ~ ~ ~ ~ ~

We look forward to speaking more in depth with consultants and the coordinating committee about our recommendations. We hope that the Merced subbasin GSAs will consider the above recommendations, and hope to collaborate with the GSAs to ensure that the GSP protects the subbasin's most vulnerable drinking water users.

We are also in communication with the Department of Water Resources about current GSP development activities in the San Joaquin Valley, and hope to successfully work with GSAs, communities and DWR to ensure that groundwater management is equitable and sufficiently protective of vital drinking water resources.

Sincerely,

Leadership Counsel for Justice and Accountability

MEETING NOTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: August 26, 2019 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☐	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☐	Daniel Chavez	Merced Irrigation-Urban GSA
☒	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☒	Mike Gallo	Merced Subbasin GSA
☒	Nic Marchini	Merced Subbasin GSA
☐	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Call to order
    a. Alyson Watson (Woodard & Curran) called the meeting to order. Committee members introduced themselves.
2. Approval of minutes for July 22, 2019 meeting
    a. Minutes from July 22nd were approved.
3. Presentation by Woodard & Curran on GSP development
    a. Update on Public Comments Received on draft GSP
        i. Alyson (W&C) reviewed the GSP draft timeline.
    b. Plans for September 18 Joint GSA Boards Meeting
        i. Discussion will be focused on the Draft GSP comments and how to incorporate.
4. Prop 68 Funding Opportunity
    a. Alyson (W&C) presented a summary of the Prop 68 Funding Opportunity as well as a summary of the implementation activities that could be included in the funding application.
    b. Staff recommended assembling a small working group to decide what to include in grant application and requesting authorization from GSA Boards to fund preparation of the application itself.

c. CC members expressed concern that there may need to be additional meetings beyond September Joint Board Meeting to finish preparation and finalization of the GSP that would require use of the contingency, so it would be wise to request additional funding for the grant application preparation.

d. CC voted and unanimously approved that the consultants should start working on the Prop 68 grant application and bill to the contract contingency while the GSAs discuss with their boards to authorize an amendment by September 18.

e. Working group volunteers are: Hicham ElTal, Lacey Kiriakou, and Dena Traina (Provost & Pritchard)

5. Water Allocation Framework Discussion

   a. Alyson (W&C) provided a summary of previous discussions and provided some clarification and distinction between several sets of numbers that have been presented previously.

   b. Q: How do the sustainable yield values compare to what we've seen before? The current overall value doesn't appear to match some of the values presented previously in different regions. A: The number is 90,000 AFY for the entire Basin as a whole. Depending on where you are in the basin, it could be more or less compared to where your pumping is compared to the average.

   c. Q: Is the 2040 projected conditions the best baseline for comparison? A: It's based on SGMA compliance being needed by 2040, which would be the Projected Conditions. We should focus on the Sustainable Yield which is the same at all years.

   d. Q: Does 2040 projected conditions include implementation of GSP projects? A: No.

   e. Q: Is urban water use reduction included in the model of the 2040 projected conditions? A: It includes projected water use in 2040 which includes water use efficiency improvements but also population increases largely based on Urban Water Management Plan projections. Cropping patterns were generally based on current cropping patterns per direction from the GSAs.

   f. Q: How is the planned significant growth in UC Merced, City of Merced, etc. accounted for in the model? A: It's already included in the projected conditions scenario as part of the City's own projections for its water use.

   g. Alyson (W&C) summarized inter-GSA coordination efforts agreed on and what next steps are needed. Also shared that an ad-hoc committee is recommended to work in parallel with the GSP to develop.

   h. Q: What role do you see for the Stakeholder Committee in the ad-hoc allocation committee? A: This ad-hoc committee is intended to be more for GSA staff, but some items need to be put in the GSP vs others are too soon to discuss and won't be part of the GSP.

   i. CC supported development of an ad-hoc committee for development of an allocation framework, with the following members: Hicham ElTal, Ken Elwin, Mike Gallo, Larry Harris, and Bob Kelley.

6. Public Outreach update

   a. Charles (Catalyst) provided an update on public outreach activities, including community meetings put on by SHE and Leadership Council, the public September 18 Joint Board meeting, and the Adoption Hearings in Fall 2019.

   b. Comment: SHE and Leadership Council are spread thin and are concerned that the 30-day comment period was too short for full engagement with their communities and thus now encourage GSAs to consider ways to extend time and find ways to fund future additional DAC outreach. Also to consider expanding the Prop 68 working group to include a voice for DAC communities or to quantify benefits to DACs.

7. Coordination with neighboring basins

a. Hicham ElTal (MIUGSA) described a comment letter received from Delta-Mendota Subbasin representatives about subsidence and highlighted need to coordinate on objectives and thresholds between subbasins.

b. Comment: If we stopped pumping and everyone still farmed, the ground will still sink (subsidence continues), so setting a goal of 0 does not make sense.

8. Informational Item - Groundwater Tracking with Remote Sensing – Presentation by Dan Howes, ITRC
   a. Dan Howes was invited by the Coordinating Committee to talk about the technology for using remote sensing to measure groundwater use in lieu of metering which is potentially being considered for GSP implementation.
   b. (see separate PDF with PowerPoint slides)
   c. General costs of the remote sensing services would be $40,000/yr service for agencies with surface deliveries. More like $25,000/yr (due to simpler setup) if surface water deliveries are not used. Cost can vary with level of riparian areas that need more investigation/setup.

9. Public comment

   a. No comments.

10. Next steps and adjourn

   a. Next public meeting is September 18 @ 6PM Joint GSA Board Meeting to review and discuss public comments on draft GSP.

Next Regular Meeting
September 18 @ 6PM
Sam Pipes Meeting Room, Merced, CA (subject to change)
Information also available online at mercedsgma.org

Action may be taken on any item
Note: If you need disability-related modification or accommodation in order to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

DRAFT

MEETING NOTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: October 28, 2019 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☐	Stephanie Dietz	Merced Irrigation-Urban GSA
☐	Justin Vinson	Merced Irrigation-Urban GSA
☒	Daniel Chavez	Merced Irrigation-Urban GSA
☒	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☐	Mike Gallo	Merced Subbasin GSA
☒	Nic Marchini	Merced Subbasin GSA
☐	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Call to order
   a. Alyson Watson (Woodard & Curran) called the meeting to order.
   b. Minutes from previous meeting were approved.
2. Stakeholder Committee update
   a. Alyson (W&C) provided a summary from the October 28 Stakeholder Committee (SC) morning meeting. The meeting included discussion of the next steps in finalizing the GSP and the sustainable management criteria for water quality and subsidence. The SC also discussed the role of the SC during the implementation phase. The SC wants to continue to meet if their input will be used by the CC and suggested the schedule for future SC meetings be based on topics that need to be discussed. The group expressed an interest in potentially meeting jointly for some discussions or otherwise having an opportunity for direct input to the CC.
3. Finalizing Merced Subbasin GSP
   a. Alyson (W&C) reviewed the timeline for finalizing the GSP. The draft response to comments is posted on the MercedSGMA.org website. It includes a redline of the GSP showing edits based on comments and a master response to comments organized by 20 topics (see slide for full list). Master response and comment letters will be included as an Appendix to the GSP.
   b. Joint GSA Boards Meeting September 18, 2019

i. Alyson noted that SGMA does not require GSAs hold a public comment period. The Merced GSAs decided to hold the 30-day public comment period as a good faith effort to gather additional public input. Comments were also received at the Joint GSA Boards Meeting on Sept. 18th.This is an addition to the 60-day public comment period that DWR will hold once the GSP is submitted.

c. Concurrence with response to Public Comments Received on draft GSP

i. The responses to comments on the draft GSP come in a couple of forms: There is a redline version of the GSP that contains all of the suggested changes in redline. There is also a master response to comments by topic. The GSP Appendix will include all of the letters that were received. There were comments received on a wide range of topics for the draft GSP. The Master Response to Comments is up on the website. Two topics are the focus of today's meeting and discussion: the sustainable management criteria for subsidence and water quality.

ii. Subsidence:

1. Alyson provided some background information on subsidence in the basin: it is a gradual process that takes time to develop and time to halt. Subbasin may not be able to fully stop subsidence but can slow it and reduce impacts. She noted that despite wetter conditions 2017-2018, there was still between -0.17 ft/yr and -0.32 ft/yr observed in the portion of the subbasin.

2. Alyson compared the sustainable management criteria that are included in the Merced GSP and in the neighboring basins of Chowchilla and Delta-Mendota.

   a. Merced GSP management criteria based on historical subsidence rates observed.

   b. Chowchilla is using GWLs as a proxy for subsidence in the lower aquifer only (they are using this for both MT and MO). They are using an adaptive management approach with a trigger of -0.25 ft/yr for 3 years in Eastern main aquifer.

   c. In Delta-Mendota they have measurable objectives that vary by GSP and region, but most are between -0.01 to -0.1 ft/yr. For minimum threshold, they (again various by GSP) but have between -0.1 to -0.2 ft/yr. San Joaquin River Exchange Contractors: The MT is narrative: "that which doesn't reduce SJREC's conveyance capacity without appropriate mitigation."

3. Alyson further described Merced GSP approach. MT and MO set based on historical subsidence rates. Some level of future subsidence, likely at similar rates, likely to be underway already and will not be able to be prevented. GSAs will continue coordinate efforts with Chowchilla & Delta-Mendota to develop regional and local solutions to regional subsidence

4. The five-year update can look at options to utilize additional data sets including using DWR's Interferometric Synthetic Aperture Radar (InSAR) data.

5. Clarification (W&C): We don't expect zero subsidence. It may continue at rates that we've seen. We also know that we will have to continue coordination.

6. Question from CC member: Have we asked the state about the different guidance given to Chowchilla from DWR? Answer (W&C): We found out Chowchilla received different guidance than the Merced Subbasin received in our conversations with

DWR only today. There is nothing in SGMA that says each neighboring basin must use the same measure for subsidence.

7. Comment from CC member: We need to be coordinated with the neighboring basins. Different basins should not be taking different approaches. It appears we are allowing for more subsidence than D-M. In 2006, there was a very heavy flood year. In this year the lower SJ Flood District near highway 152 and north of this, was within 6 inches of breaking. Since that time, we've lost 5 feet, maybe more. With that levee system, if that fails, we'd be hard pressed to build it again, let alone the damage the water would do especially if it went out to the east sides (would decimate some of the earthen canal system in this location). Would like to see an arrest to subsidence as soon as possible. It is difficult to put a target minimal amount out there. However, we have to do something along those lines. What we would like to see is that there is a plan to get subsidence to a certain number.

8. Response from CC member: This means we would be watching levels below the Corcoran. We had a recommendation from a hydrogeologist for what they need to do to get an understanding of what is happening and is it stabilizing below the Corcoran. This might not be something we can put in the plan now but could be something for the plan update.

9. Alyson (W&C): The map provided on the slides shows the ranges of rates of subsidence. To give a little context, using data from USBR from 2011-2017 can see that Chowchilla has seen more subsidence. The MTs and MOs they have established are less than the historical subsidence shown on this map.

10. Input from member of Public: (Individual is involved with the Triangle T GSA in the Chowchilla Subbasin). There are two management areas in the Chowchilla Subbasin, including in Chowchilla Water District to the west. The way that it is being managed is above and below Corcoran. Above the Corcoran the MT is at the top of the Corcoran Clay. This is about managing the upper aquifer. The lower aquifer uses GWL from 2012 as a proxy unless it's already below that. Water levels cannot be taken any lower than they already are. There is going to quickly be an allocation system within that management area (within a year or two). In Chowchilla, Western below Corcoran areas will be managed via allocation. This involves the County GSA, and Triangle T GSA, and Clayton Water District (lattermost is not a GSA).

11. Alyson (W&C): Our options with respect to finalizing the GSP are to 1) leave SMC for subsidence as it is, 2) we could change the MT or MO if we thought there was a good reason to do this, or 3) we could follow the suggestion provided and focus on a management program without changing the numbers.

12. Feedback from CC members:

    a. Comment: It makes sense to coordinate the effort.

    b. Comment: For the GWLs to make sense for us, we need to tie it to our local issues. If we are doing what we are supposed to be doing, rather than pumping, the pumping below the Corcoran in some areas outside of the subsidence area will have less impact on areas where there is subsidence.

    c. Comment: What is your suggestion (asking consulting team), about whether to have both GWLs and surface measures?

i. Alyson (W&C): We are currently using both measures in the monitoring framework.

d. Comment: We as GSAs need to see what's happening around the subsidence area.

e. Alyson (W&C): In summary and in updating the draft GSP contents, we should at least update in the response to comments to be clearer that the GSAs intend to close the data gaps around subsidence and the subsidence area itself.

f. Comment: There's a need to coordinate. Response (W&C): Exactly, we need to get the plans out and then continue coordination. Because of current timeframe, will need to do further coordination with the other GSAs who are also (at the same time) trying to get their plans out.

g. Question: Did we have a buffer on the numbers used from historical data? Clarification from W&C: These numbers (for subsidence historical data) were rounded up slightly – no specific percentage buffer added.

h. Comment: We want to make sure that GWLs are not dropping because of neighboring basins.

i. Alyson (W&C): We can also note in the response to comments that the County has a project that would also streamline the process for environmental permitting to better enable conversion of wells from below to above Corcoran Clay.

j. Comment from CC: If we do not fully understand the extent of subsidence, and we set too low a threshold, this will not help us. Should not lower this threshold.

k. CC Recommendation: The CC recommended adding additional information about closing data gaps and the County project to the master response to comments and adding additional language around the GSAs intent to continue coordination with neighboring basins to the GSP. No change to the MTs or MOs.

13. Water Quality:

a. Alyson provided an explanation of Merced GSP water quality sustainable management criteria. The MT is set at 1,000mg/L for TDS (Total Dissolved Solids, measurement of salinity). This is drinking water standard. There are numerous other authorities governing and monitoring drinking WQ and contaminants. There is a summary of the response to comments for WQ on the Merced SGMA website.

b. Alyson provided summary of response to WQ comments. Salinity is selected as an indicator. GSAs recognize the importance of protecting drinking water quality. There is a desire to coordinate with agencies and their ongoing efforts to avoid duplication of efforts and efficiently use limited resources. Coordination activities include: (see list on PPT).

c. Comment/input from CC member: A CC member expressed concern that some areas of the subbasin already exceed the MT in part due to salinity migrating from marine soils underlying portions of the subbasin and wanted to ensure this would not cause a problem for these areas of the basin later.

d. Alyson (W&C) reply: The CC has discussed that some areas have salinity greater than 1000 mg/l TDS currently, but that this is not an Undesirable Result (UR). It is not related to GW extraction and is an existing condition that has been adapted to by agricultural users by blending with higher quality water.

e. Clarification from Alyson (W&C): The MTs are set for specific areas in the basin (not basinwide) and are well specific. Currently all wells with MTs are domestic wells.

f. Charles Gardiner (Catalyst): The SC was generally comfortable with this. However, it is important to pay attention to domestic well users.

g. CC Recommendation: No change to MTs or MOs for water quality.

d. Dates for Adoption Hearings for GSA Boards – still being scheduled. Tentative dates below:

   i. TIWD GSA-1 Nov. 19th

   ii. MSGSA is TBD

   iii. MIUGSA Dec. 11th

4. GSP Implementation Planning

   a. Prop 68 funding opportunity (deadline Nov. 1, 2019)

      i. Alyson (W&C) described the Prop 68 grant application. DWR has made development a higher priority for funding over GSP implementation for this funding round. DWR's priority is funding activities that help develop GSPs, including data gathering and addressing data gaps. The grant application contains three components. The first is grant administration portion of work, the second is work to address data gaps. This is focused on developing a data gaps plan and figuring out how to address those gaps. The third is to develop a remote sensing decision support tool to estimate groundwater use.

      ii. Comment from CC member: METRIC™ (evapotranspiration data) looks backwards – it looks at who is using water and understanding general use. Could use conventional processes to develop a tool to look to the future (there are other options and we may use different remote sensing methods to achieve our objectives).

      iii. Comment from CC member: It sounds like these are things we need to do anyway regardless of funding. We need them.

      iv. Comment from CC member: if we want to do GW credits, we need to have a good enough water budget and accounting system to do something like this.

      v. Comment from CC member: Please add that Lone Tree Mutual Water Co. has also provided a letter of support for the Prop 68 grant application.

   b. Annual report preparation proposal from Woodard & Curran

      i. The first annual report is due to DWR on April 1st. At staff request, W&C prepared a proposal to prepare the first annual report. The proposal includes optional tasks for program management, preparing stakeholder engagement plan update, and evaluation of the GDE pulse tool.

      ii. Alyson (W&C) asked if there is any input on this and on the optional tasks:

1. Comment from CC member: MID is working on a Prop 218 process to fund GSP related costs.

iii. Recommendation to authorize funding for W&C to prepare GSP First Annual Report consistent with consultant proposal is approved by the CC.

c. Water Allocation Framework discussion

i. There is an ad hoc group working on this and this work will continue.

1. Comment from CC member: The sustainable yield is the most important thing to come out of the GSP. Some items will have to be worked on at the GSA level.

5. Public Outreach update

a. Charles (Catalyst) reviewed input from the SC. The SC would like to have a roadmap of key implementation issues and get an understanding of the progress. We did not have the folks in the SC this morning who are normally more vocal about water quality issues. We received a suggestion from staff that a way to structure this is to organize topics as a workshop of the SC and CC together. That way we have everybody sitting around the table discussing the issues. The next step would be to flesh out the roadmap and the structure. We also have had a few resignations from the SC and we may want to re-evaluate the balance of interests we have represented on this committee. We may need to see if we need to replace some people. Any questions or comments?

b. Comment from CC member: Not sure about having workshops on regular basis, what is meant by this? Charles (Catalyst): This could be workshops on specific key topics – perhaps jointly at the beginning of a CC meeting with the SC and then after the joint discussion, the CC meeting would move onto its other business. We could also structure them as separate meetings as it is done now.

c. Comment from CC member: I think we are getting the information from the SC. Concern if this is too much.

d. Comment from CC member: For some of these topics, such as projects, this can be done in a workshop together. However, some issues that get very technical are not suited to a workshop format.

e. Comment from CC member: For certain issues, like subsidence, it will be important to have SC input.

6. Coordination with neighboring basins

a. The consulting team and GSA staff reached out to the three neighboring basins for letters of support for the Prop 68 grant application. All three basins provided letters of support to the Merced Subbasin Prop 68 application. The GSAs provided reciprocal letters of support to the neighboring basins in return.

b. Question from CC: Are we coordinating with all members of the GSAs in Delta-Mendota? Alyson (W&C): No, Delta-Mendota is coordinating with their members internally. We will be focused on working with Delta-Mendota GSAs on interbasin flows and subsidence.

c. Comment from CC member: We put together a plan and met with their consultants (from other GSAs). With Turlock we've had two big meetings and some small meetings.

i. Have not had a chance to do this in detail with Delta-Mendota and Chowchilla. We've had one call with Delta-Mendota, but not to the same level of formal review as with Turlock.

7. Public comment

a. None.

8. Next steps and adjourn

a. Prop 68 due Nov. 1st

b. GSA adoption hearings for the GSP are coming up. These will be published on website.

c. Adjourned and date for next meeting to be decided at later time and published accordingly.

Next Regular Meeting
TBD at 1:30 p.m.
Atwater, CA – Castle Conference Center at Castle Airport (subject to change)
Information also available online at mercedsgma.org
Action may be taken on any item

Note: If you need disability-related modification or accommodation in order to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING MINUTES – Merced GSP

SUBJECT: Merced GSP Stakeholder Committee Meeting

DATE/TIME: May 29, 2018 at 9:30 AM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Stakeholder Committee Members In Attendance:

	Representative	Community Aspect Representation
☐	Alex McCabe	City of Livingston
☒	Arlan Thomas	MIDAC, growers
☒	Ben Migliazzo	Live Oak Farms, growers
☒	Bill Spriggs	City of Merced, Merced Irrigation District
☒	Bob Salles	Leap Carpenter Kemps Insurance, insurance industry and natural resources
☒	Brad Robson	Buchanan Hollow Nut Co. Le Grand-Athlone Water District, growers
☒	Breanne Ramos	Merced County Farm Bureau
☒	Brian Carter	D&S Farms, growers
☒	Carol Bonin	Winton M.A.C.
☒	Daniel Machado	Machado Backhoe Inc., construction industry
☒	Frenchy Meissonnier	Rice Farmer, rice growers
☐	Galen Miyamoto	Miyamoto Farms
☒	Gino Pedretti III	Sandy Mush Mutual Water Company
☒	Greg Olzack	City of Atwater resident
☐	James (Jim) Marshall	City of Merced
☒	Joe Scoto	Scoto Bros Farms / McSwain Union School District
☒	Ladi Asgill	East Merced Resource Conservation District / Sustainable Conservation
☒	Maria Herrera	Self-Help Enterprises
☒	Mark Maxwell	University of California, Merced
☐	Maxwell Norton	Retired agricultural researcher
☒	Parry Klassen	East San Joaquin Water Quality Coalition, growers
☒	Rick Drayer	Drayer Ranch, Merced cattlemen
☒	Simon Vander Woude	Sandy Mush Mutual Water Company, dairies

Meeting Notes

1. Welcome, Introductions, and Agenda Review

- GSP outreach consultant Charles Gardiner (Catalyst Group) started the meeting
- Introductions were given for Charles, the GSP technical consultant Samantha Salvia with Woodard & Curran, and members of GSA leadership attending the meeting, as well as audience members
- Attending GSA leadership included: Larry Harris, Turner Island GSA, Governing Board; Hicham ElTal, Merced Irrigation-Urban Groundwater Sustainability Agency, Governing Board; Lacey Kiriakou, Merced Subbasin GSA, Water Resource Coordinator; Nic Marchini, Plainsburg Irrigation District and Merced Subbasin GSA, Vice Chair Governing Board

2. Stakeholder Outreach Approach and Committee Purpose

- Lacey Kiriakou (Merced Subbasin GSA) reviewed the requirements of GSP Outreach and provided information on approach and committee purpose
    i. The website is www.mercedsgma.org and information will be posted as it becomes available
    ii. Each of the GSAs will be the final decision makers and the Coordinating Committee (CC) is formed by agreement among all three GSAs
    iii. The role of the Stakeholder Committee (SC) is to provide community feedback to the Coordinating Committee
- Charles Gardiner (Catalyst Group) reviewed the SC Meeting Agreements and Guidelines for Successful Meetings
    i. The technical team will bring ideas to the SC to test ideas, see how they work, and seek input
    ii. SC members should bring information and input to meetings from their constituents and help educate constituents about SGMA and groundwater management
    iii. Discussion and recommendations from the SC will go to the CC and from there to the three GSAs

3. Overview of Sustainable Groundwater Management Act (SGMA) and Groundwater Sustainability Planning

- SGMA purpose and timeline
    i. Samantha Salvia (Woodard & Curran) reviewed: common language used, SMGA fundamentals, a map showing the high priority basin and critical overdrafted basins in California, and a map showing the Merced Subbasin as one of the high priority and critically overdrafted basins in California
    ii. Hicham ElTal (MIUGSA) reviewed that SGMA allows local management of groundwater basins with oversight from two agencies - DWR and State Water Resource Control Board and approval of a GSP by both agencies is needed to maintain local control
- Elements of a Groundwater Sustainability Plan

i. Samantha Salvia (Woodard & Curran) reviewed: GSP requirements; six undesirable results that are addressed during the development of the GSP; what the Basin Setting includes; what areas of the Merced Subbasin are either designated as a disadvantaged community or severely disadvantaged community; neighboring GSAs (Chowchilla, Delta-Mendota, and Turlock); options for the basin management approach and Merced Subbasin chosen approach (three GSAs to adopt one GSP for Merced Subbasin)

4. Pre-SGMA Groundwater Understanding

- Hicham ElTal (MIUGSA) reviewed what work has been done to date in the Merced Subbasin including data compilation and gaps, monitoring plans, model updates, and key findings

5. SGMA Grants, Scope, and Timeline of Planning Activities

- Lacey Kiriakou (Merced Subbasin GSA) reviewed where the funding was coming from to develop the GSP, with most of it coming from grant funding and reviewed grant funded projects that will assist Planada, El Nido, and Meadowbrook.

- Samantha Salvia (Woodard & Curran) reviewed the progress made on the GSP to date and Samantha and Charles (Catalyst Group) reviewed the GSP Roadmap

6. Stakeholder Committee Schedule and Decision-Making

- Charles Gardiner (Catalyst Group) reviewed the stakeholder committee decision-making options

- Charles suggested the SC develop consensus agreements or comments to share with the CC and three GSAs explained how the committee may want to define and reach consensus

- Samantha Salvia (Woodard & Curran) asked whether there was other feedback from the SC that can be presented to the CC in the afternoon meeting

- Lacey Kiriakou (Merced Subbasin GSA) asked if the meetings should be accessible by phone for members and the public to listen-in if these persons cannot participate

- The group discussed preferred meeting location and the Airdrome Conference Center was identified as comfortable and accessible

7. Public Comment on Items not on the Agenda

- No comments on public items not on the agenda.

8. Next Steps and Next Meeting

- The next two SC meeting are June 25th and July 23rd at 9:30 am.

- Items for Coordinating Committee:

  i. A request was made to receive regular updates from CC on interbasin coordination between the GSAs and for an alternate attend on a member's behalf be presented to CC for decision

- Topics for Future Discussions:

i. Water Quality and how it will be addressed in the Merced Subbasin GSP

ii. Bay Delta Plan impact on the water and the Merced Subbasin GSP

MEETING MINUTES – Merced GSP

SUBJECT: Merced GSP Stakeholder Committee Meeting

DATE/TIME: June 25, 2018 at 9:30 AM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Stakeholder Committee Members In Attendance:

	Representative	Community Aspect Representation
☒	Alex McCabe	City of Livingston
☒	Arlan Thomas	MIDAC, growers
☒	Ben Migliazzo	Live Oak Farms, growers
☒	Bill Spriggs	City of Merced, Merced Irrigation District
☒	Bob Salles	Leap Carpenter Kemps Insurance, insurance industry and natural resources
☒	Brad Robson	Buchanan Hollow Nut Co. Le Grand-Athlone Water District, growers
☒	Breanne Ramos	Merced County Farm Bureau
☒	Brian Carter	D&S Farms, growers
☒	Carol Bonin	Winton M.A.C.
☒	Daniel Machado	Machado Backhoe Inc., construction industry
☒	Darren Olguin	McSwain MAC
☒	Frenchy Meissonnier	Rice Farmer, rice growers
☒	Galen Miyamoto	Miyamoto Farms
☒	Gino Pedretti III	Sandy Mush Mutual Water Company
☒	Greg Olzack	City of Atwater resident
☐	James (Jim) Marshall	City of Merced
☒	Joe Scoto	Scoto Bros Farms / McSwain Union School District
☒	Ladi Asgill	East Merced Resource Conservation District / Sustainable Conservation
☒	Maria Herrera	Self-Help Enterprises
☒	Mark Maxwell	University of California, Merced
☒	Maxwell Norton	Retired agricultural researcher
☒	Parry Klassen	East San Joaquin Water Quality Coalition, growers
☒	Rick Drayer	Drayer Ranch, Merced cattlemen
☒	Simon Vander Woude	Sandy Mush Mutual Water Company, dairies

Meeting Notes

1. GSP Development Elements and Approach

    - Alyson Watson (Woodard & Curran) provided an overview of the schedule of components that will be used to develop the GSP, broken into three categories: Technical Work, Policy Decisions, and Management Actions

2. Stakeholder Outreach and Engagement Strategy

    - Charles Gardiner (Catalyst Group) provided an overview of Outreach and Engagement Activities, including targeting of the first week of August for first public workshop.

3. Merced Subbasin Overview

    - Plan Area Information

        i. Alyson provided an overview of the "Plan Area and Authority" chapter of the GSP.
        ii. A request was made to view the land use/crop map in greater detail, as well as a high-level, order of magnitude summary of total acreage by crop type. Maps are being prepared separately per GSA and the presentation slides will be posted online at www.mercedsgma.org

    - Historical Groundwater Conditions

        i. Alyson provided an overview of the six groundwater sustainability indicators, with some specific examples and maps that help explain each. Groundwater elevations are a good indicator of several sustainability indicators since they are all related.

4. Groundwater Sustainability Goals

    - Purpose and Overview

        i. Alyson introduced the sustainability terms: Undesirable Results, Minimum Thresholds, and Measurable Objectives.

    - Initial Committee Perspectives and Input on Sustainability

        i. The Committee was asked to provide input on their definition of sustainability. Below are the notes recorded on a flipchart during the conversation. Sustainability is:

            - The amount of groundwater depletion allowed during two, three, and four-year droughts.
            - Whatever the State Water Board wants to see for sustainability.
            - Stable groundwater levels.
            - Improving groundwater quality.
            - No adverse economic effects.
            - Not running out of water.
            - No restricted use that would affect the economy.
            - Enough water for the uses – agriculture, community, and environment – with a healthy reserve.
            - Significant water quality issues in the Valley improve over time.
            - Balancing surface and groundwater use.
            - Increased acreage in production and crop shift.

        - Maintain a balance of agriculture, human right to water, and safe drinking water.
        - Reduce the environmental impact (groundwater basin and water quality) while maintaining things of value.
        - Shared understanding of water budget so everyone knows how much water is used and replaced in every year.
        - Doing what needs to be done so you can keep doing what you are doing but better.
        - Need to plan for wet years – what to do with surplus water.
        - Storage would help fix the problem.
    - A DWR representative provided some background information about DWR and State Water Board roles in reviewing and approving GSPs as well as annual and five-year reporting.
        - A request was made to review the criteria that DWR will be using the evaluate the GSP. These criteria will be provided to SC members.

5. Stakeholder Committee Procedures

    - Based on feedback from the Coordinating Committee, Alternates for Stakeholder Committee members are allowed, but they need to represent the same interest as the SC member for whom they are substituting. Members of the SC are responsible for keeping their respective alternate current on the meeting topics.

    - The group reaffirmed their understanding that the Stakeholder Committee is subject to the Brown Act.

    - A suggestion made to flag in meeting agendas where Stakeholder Committee members are requested to make recommendations or achieve consensus on an item to help make the line of communication clearer with the Coordinating Committee.

    - The group reached consensus on Procedures and Commitments (see Attachment A).

6. Interbasin Coordination Update

    - Staff have provided edits on Interbasin agreement back to Chowchilla Subbasin.

    - 2 meetings have been held so far with representatives from Turlock Subbasin to coordinate on GSP development status, data, etc.

    - Staff are trying to schedule a meeting with Delta-Mendota Subbasin, with preference to coordinate with GSAs preparing GSPs adjacent to Merced Subbasin.

7. Public Comment on Items not on the Agenda

    - No comments on public items not on the agenda.

8. Next Steps and Adjourn

Attachment A – Stakeholder Committee Procedures and Commitments

Purpose

- Advise the Coordinating Committee and GSA Governing Bodies

Membership

- Diverse representation of interests in the Merced Subbasin
- Coordinating Committee identifies and appoints members, with GSA approval

Member Terms and Responsibilities

- Through development of GSP
- Participate, represent interests, and educate communities

Alternate Members

- Alternates selected by members
- Should represent the same interest/perspective as the member
- Member is responsible for keeping alternate current

Decision-making

- Consensus approach for joint recommendations

Meetings

- Brown Act compliance
- Consistent participation: don't miss 3 in a row or 5 in a year

Consensus

Polling the committee to assess and confirm consensus. Consensus is all members present voting in categories 1 through 4.

1. I can say an unqualified 'yes' to the decision. I am satisfied that the decision is an expression of the wisdom of the group.

2. I find the decision perfectly acceptable. It is the best of the real options we have available to us.

3. I can live with the decision. However, I'm not especially enthusiastic about it.

4. I do not fully agree with the decision and need to register my view about it. However, I do not choose to block the decision and will stand aside. I am willing to support the decision because I trust the wisdom of the group.

5. I do not agree with the decision and feel the need to block the decision being accepted as consensus.

6. I feel that we have no clear sense of unity in the group. We need to do more work before consensus can be achieved.

MERCED SGMA

MEETING MINUTES – Merced GSP

SUBJECT: Merced GSP Stakeholder Committee Meeting #3

DATE/TIME: July 23, 2018 at 9:30 AM

LOCATION: Castle Conference Center, 1900 Airdrome Entry, Atwater, CA

Stakeholder Committee Members In Attendance:

	Representative	Community Aspect Representation
☒	Alex McCabe	City of Livingston
☒	Arlan Thomas	MIDAC, growers
☐	Ben Migliazzo	Live Oak Farms, growers
☒	Bill Spriggs	City of Merced, Merced Irrigation District
☒	Bob Salles	Leap Carpenter Kemps Insurance, insurance industry and natural resources
☒	Brad Robson	Buchanan Hollow Nut Co. Le Grand-Athlone Water District, growers
☒	Breanne Ramos	Merced County Farm Bureau
☒	Brian Carter	D&S Farms, growers
☐	Carol Bonin	Winton M.A.C.
☒	Daniel Machado	Machado Backhoe Inc., construction industry
☒	Darren Olguin	McSwain MAC
☐	Frenchy Meissonnier	Rice Farmer, rice growers
☒	Galen Miyamoto	Miyamoto Farms
☒	Gino Pedretti III	Sandy Mush Mutual Water Company
☐	Greg Olzack	City of Atwater resident
☐	James (Jim) Marshall	City of Merced
☒	Joe Scoto	Scoto Bros Farms / McSwain Union School District
☐	Ladi Asgill	East Merced Resource Conservation District / Sustainable Conservation
☒	Maria Herrera	Self-Help Enterprises
☒	Mark Maxwell	University of California, Merced
☒	Maxwell Norton	Retired agricultural researcher
☒	Parry Klassen	East San Joaquin Water Quality Coalition, growers
☒	Rick Drayer	Drayer Ranch, Merced cattlemen
☒	Simon Vander Woude	Sandy Mush Mutual Water Company, dairies

Meeting Minutes

1. Welcome, Introductions, and Agenda Review

    a. Introduction and overview of agenda items given by Alyson Watson (Woodard & Curran)

    b. There were no comments for the past meeting minutes. Comments and questions from past meeting minutes and further input can be sent via email to Woodard & Curran

    c. Alyson Watson (Woodard & Curran) provided an explanation on GSP Development addressing what we are trying to do, what we are trying to avoid, and how to establish our management objectives

2. Merced Subbasin Water Resources Model and Water Budget

    - Baseline overview
        - Alyson Watson (Woodard & Curran) presented the most recent work on the groundwater modeling tool and talked about the model's progress. Input on clarifications and questions were given by Jim Blanke (Woodard & Curran) and Dominick Amador (Woodard & Curran)
        - The following points and questions were addressed:
            - How we intend to use the model: the model will help us talk about stream/aquifer interaction, water quality, subsidence, GW levels, etc. and how to quantify this
            - A clarification was given regarding that we are discussing the Merced Subbasin, which is part of the larger San Joaquin Basin
            - Alyson Watson (Woodard & Curran) explained the grid criteria for the model and that there are models the state has developed. However, we are developing a smaller scale model which is needed for the projects we would like to talk about implementing
        - Question: how many wells are we using? Answer: there are over 200 wells operated by various agencies.
        - Question: if we are light on the data in the Eastern part of the subbasin, could there be inaccuracies in the model? Answer: where we have more data, we are more confident that the data is simulating more accurately. Where we don't have data, we do the best we can
        - Question: what kind of wells were utilized for this? Answer: there are 200 calibration wells, and over 200,000 were taken into consideration including urban and agricultural wells

3. Undesirable Results

    a. Alyson Watson (Woodard & Curran) provided a review of SGMA requirements and guidelines, including that we have to use 50 years of hydrology and must consider three important baselines

    b. Alyson Watson (Woodard & Curran) clarified we used 2013 as a pre-drought starting point with good land use data

    c. Merced Subbasin conditions were explained by Alyson Watson (Woodard & Curran) with input by Jim Blanke (Woodard & Curran) and Dominick Amador (Woodard & Curran). Contents included an explanation of historic use and groundwater budget in the Merced Subbasin

    d. Several questions were asked and clarifications given as follows:

        i. Question: does the model show change in GW levels? Answer: where the change occurs varies from area to area and is very site specific. The model has capacity to show this change including the rate of decline across the basin

        ii. Comment from Stakeholder Committee member: nothing is going to look as bad as 2014 and 2015. Response: we are going to look at both historical and current conditions and are also looking at urban water use, land use, and river flows. From 2015-2060, we are simulating up to 2060 using the historical data

iii. Question: how do the three (2015-2018) years of actual data compare with what we are using? Answer: we are using the historical data in covering these years
iv. Comment: we should recharge in wet years, use our surface water, and rest the deep wells
v. Question: are updates made every 5 years? Answer: Per SGMA updates are every 5 years
vi. Question: are we going to account for population change? Answer: yes, this will be part of the projected budget
vii. Question: how are we checking the data? Answer: data is checked with each of the GSAs
viii. Question: is there a 600 AFY overdraft? (referring to slide) Answer: this is still a best estimate with the assumption that everything stays the same except hydrology. Eventually we will get to the projects we might want to implement and how these impact overdraft
ix. Comment: cities will (and have) projected higher population growth than actual growth, and this will make a huge difference on our water budget. Response: we are working with the GSAs to establish what they think will happen with land use change, population growth, etc.
x. Question: do we have a map with the projected changes throughout the basin? Answer: yes, we do have this can present next time
xi. Question: do we have a map with the 200 wells? Answer: this can be provided next meeting
xii. Question what well information do you need? Answer: Any well that has data, we can use
xiii. Question are you looking for more wells? Answer: Yes, especially in gap areas
xiv. Question: can you use data that the growers are keeping track of? Answer: we would take that information into consideration, although it might not go into the model
xv. Question: can we list what kind of well data we need on the website? Answer: yes
xvi. Comment: is a well with no historical data useful? Answer: we currently need historical data, but other data will be helpful going forward
xvii. Question: the Mariposa Basin is not included in the model? Answer: no, the other 3 directions have more complexity. However, at other boundaries we want to look at boundary interactions with the other basins
xviii. Question: when would we have a number for overdraft to plan with? Answer: there are many assumptions built into this number. However, using the projected baseline will be our best measure for future planning
xix. Question: does the Coordinating Committee make the decisions on this? Answer: the Coordinating Committee makes recommendations to the GSAs, who make decisions.
xx. Question: are we going to include the SED (Substitute Environmental Document) into the baseline? Answer: that will be a policy decision, and our recommendation is to not build it into the baseline until it is adopted

e. Alyson Watson (Woodard & Curran) explains for storage the challenge is in getting to the groundwater. The subbasin does not have a substantial issue in terms of total volume (storage)
f. Alyson Watson (Woodard & Curran) described what are significant and unreasonable undesirable results (types of negative impacts we want to avoid), minimum thresholds (what we are going to measure), and measurable objectives
g. Discussion was held focusing on undesirable results for the different sustainability indicators, addressing what members and attendees have seen, what is critical and most important based on their experience in the basin. Results of that discussion were put on a whiteboard as follows:
    i. Subsidence
        1. Loss of storage
        2. Infrastructure impacts
        3. Irreversible system impacts
        4. Flood flow impacts
        5. Planned projects impacts
    ii. Interconnected Surface Water
        1. SED impacts
        2. Environmental quality + habitat

iii. Degraded water quality
    1. Human consumption
    2. Reduced crop yields
    3. Soil impacts
    4. Public health + sanitation
iv. Groundwater Elevation
    1. Cost of pumping water
    2. Harder to recharge (with decline in levels)
    3. Energy requirements increasing
    4. Shallow wells going dry
    5. Well replacement costs
    6. Decline in yields

h. Economic impacts from groundwater issues impact everyone and span across all issues because everyone in the Subbasin is connected financially. This includes property value impacts and public health impacts

4. Stakeholder Outreach and Engagement Strategy

    a. The First Public Meeting will be August 2, 6:00pm to 8:30pm. Woodard & Curran will send out a notice. There will be Spanish translation provided. Committee members and attendees are encouraged to help get the word out about this event

5. Interbasin Coordination Update

    a. Hicham ElTal (MIUGSA) gave an update. We have met with Turlock and have an interbasin agreement with Chowchilla which is going to the GSAs for approval and signing. This is for agreeing to work together on the subsidence area and to share information and to agree on how we manage this area. There is a meeting with the technical staff in August to coordinate that information sharing. We are also setting up coordination the Delta-Mendota

    b. Question asked whether this means that one basin will adversely affecting another. Answer: There are different ways to develop goals and thresholds. We are going to coordinate now to avoid a position where one basin negatively affects another in the future

6. Public Comment on Items not on the Agenda

    a. Question was asked about what is the "SED". Answer: the "Substitute Environmental Document". This looks at in stream flow requirements for the Delta but has not been adopted yet

7. Next Steps and Next Meeting (will be Aug. 27th)

    a. Historical Water Budget
    b. Undesirable Results Continued (working toward sustainable thresholds)

Next Regular Meeting
August 27, 2018 at 9:30 a.m.
Castle Conference Center, 1900 Airdrome Entry, Atwater, CA
Information also available online at mercedsgma.org

Note: If you need disability-related modification or accommodation to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING MINUTES – Merced GSP

SUBJECT: Merced GSP Stakeholder Committee Meeting #4

DATE/TIME: August 27, 2018 at 9:30 AM

LOCATION: Castle Conference Center, 1900 Airdrome Entry, Atwater, CA

Stakeholder Committee Members In Attendance:

	Representative	Community Aspect Representation
☐	Alex McCabe	City of Livingston
☒	Arlan Thomas	MIDAC, growers
☒	Ben Migliazzo	Live Oak Farms, growers
☒	Bill Spriggs	City of Merced, Merced Irrigation District
☒	Bob Salles	Leap Carpenter Kemps Insurance, insurance industry and natural resources
☒	Brad Robson	Buchanan Hollow Nut Co. Le Grand-Athlone Water District, growers
☒	Breanne Ramos	Merced County Farm Bureau
☒	Brian Carter	D&S Farms, growers
☒	Carol Bonin	Winton M.A.C.
☐	Daniel Machado	Machado Backhoe Inc., construction industry
☒	Darren Olguin	McSwain MAC
☒	Frenchy Meissonnier	Rice Farmer, rice growers
☒	Galen Miyamoto	Miyamoto Farms
☒	Gino Pedretti III	Sandy Mush Mutual Water Company
☒	Greg Olzack	City of Atwater resident
☐	James (Jim) Marshall	City of Merced
☒	Joe Scoto	Scoto Bros Farms / McSwain Union School District
☐	Ladi Asgill	East Merced Resource Conservation District / Sustainable Conservation
☒	Maria Herrera	Self-Help Enterprises
☒	Mark Maxwell	University of California, Merced
☒	Maxwell Norton	Retired agricultural researcher
☒	Parry Klassen	East San Joaquin Water Quality Coalition, growers
☒	Rick Drayer	Drayer Ranch, Merced cattlemen
☐	Simon Vander Woude*	Sandy Mush Mutual Water Company, dairies

* Nate Ray (Sandy Mush Mutual Water Company) was present as an alternate for Simon Vander Woude

Meeting Minutes

1. Welcome, Introductions, and Agenda Review

    a. Introduction and overview of agenda items given by Charles Gardiner (Catalyst Group)

    b. There were no comments for the past meeting minutes. Comments and questions from past meeting minutes and further input can be sent via email to Woodard & Curran.

2. Minimum Thresholds

    a. Alyson Watson (Woodard & Curran) provided an overview of sustainability criteria, a summary of the comments provided last month on undesirable results related to each criteria, and a description of how setting minimum thresholds will be an iterative approach.

    b. Chronic Lowering of Groundwater Levels

        i. Question: How will the state evaluate the basin's minimum thresholds? Answer: The state doesn't have its own threshold methodology by which a comparison will be made. They will be evaluated based on the GSP's rationale of setting thresholds based on describing undesirable results.

        ii. Question: How will coordination of threshold-setting work with neighboring basins? Answer: Through our Interbasin coordination efforts with an understanding of different deadlines for SGMA for different basins.

        iii. Question: Is there a breakdown of location of all the CASGEM wells (to help identify which ones are under particular jurisdiction)? Answer: Yes, we can provide that information from DWR's CASGEM database and map with locations. This was sent out to all SC members on 9/5/2018.

        iv. Question: Have you taken into account historical cropping patterns in the basin? Answer: No, not explicitly, but whatever has been pumped at a particular location is most likely tied to crop history and is reflected in historical groundwater elevations.

        v. Question: How do you take into account previous droughts or future droughts? Answer: Droughts are seen in the historical groundwater levels and we're going to define violations to thresholds in the future (e.g. could be based on number of wells below threshold in a normal year, % of wells in a dry year, etc.)

        vi. Question: How far back does the DWR completion well database go back? Answer: In a review of the DWR database records for the Merced Subbasin, the "Date Work Ended" field (assumed to be well construction date) has entries as far back as 1941, though about 12% of all records have no date available.

        vii. Concern was expressed by several Stakeholder Committee (SC) members and the Leadership Council for Justice and Accountability that having a threshold near the shallowest domestic well depth (25^{th} percentile or higher) may not be protective enough.

            1. Members requested seeing the threshold analysis using the shallowest well instead of 25^{th} percentile for reference purposes.

viii. Question: Will thresholds be set for the whole basin vs areas of the basin? Answer: Thresholds are set at a specific monitoring well only but are meant to be representative of the entire basin in total.

ix. Question: Why aren't we using elevation thresholds to inform management areas? Answer: Thresholds are for measuring implementation of the plan and not a direct management tool.

x. Public Comment: Timing of spring/fall measurement of CASGEM wells may not align with seasonal peak domestic well pumping (e.g. domestic wells may be temporarily dewatered in August, which wouldn't be caught by March/October monitoring).

xi. Question: Does domestic well data show where the pumps are? Answer: No, it's not consistently part of the dataset.

xii. Question: Were disadvantaged communities overlaid or incorporated in the spatial portion of the analysis? Answer: No, we included <u>all</u> confirmed CASGEM wells, but disadvantaged community locations can be something we use when actually selecting the wells that will be used for regulatory purposes.

xiii. Marco Bell (Merced Irrigation District [MID]) noted that MID does record biannual measurements from production wells (e.g. not dedicated monitoring wells) as long as they're not actively running (e.g. static conditions) and meet other CASGEM program requirements.

c. Degraded Water Quality

i. Alyson Watson (Woodard & Curran) provided an overview of constraints on measuring and setting thresholds for groundwater quality constituents. SGMA will involve a focus on understanding issues and coordinating with other agencies who are managing water quality efforts.

ii. Questions: If GW elevations decline to a certain point, there may be drinking WQ issues, so how do we plan to handle this? Answer: This is going to be covered under setting minimum thresholds for groundwater elevations based on undesirable results.

iii. Comment: Growers require high quality water, so if growers encounter a saline well, it doesn't get used. Thus it's been somewhat of a self-regulating issue. Areas of high salinity will see crops that are salt-tolerant.

d. Land Subsidence

i. Question: Why don't we use actual subsidence values or rates (e.g. ft/yr) as a threshold? Answer: It is hard to accurately predict subsidence rates in order to develop our threshold and the Subbasin has no way to correct inelastic subsidence should a violation occur, but a related way to measure would be to use groundwater elevations as a surrogate with 1/1/2015 levels as a goal.

e. Depletion of Interconnected Surface Water

i. Comment: The areas where connectedness exists are very sandy and have a high salt content.

ii. Hicham ElTal (MID) noted that the Merced River is a gaining river (groundwater provides to the river) and when wells pump along the river, the river level goes down. Additionally, MID has recently added two groundwater elevation measuring points along the lower portion of the Merced River.

iii. Question: Can the Merced GSP emphasize that the San Joaquin River needs more water to help groundwater levels? Answer: Potentially yes, if we can link river flows to undesirable results for groundwater.

3. Projected Water Budget

   a. Multiple comments related to sustainable yield assumptions will change a lot of depending on State Water Board decision on the Substitute Environmental Document (SED) for Lower San Joaquin River and Southern Delta. (ability to manage flood flows and recharge as much as possible is important)

   b. Question: How much will we be including snowpack changes in future (different beyond historical hydrology)? Answer: We'll be including a climate change analysis, though it inherently considers a longer timescale beyond our 25 year regulatory horizon.

4. Public Outreach Update

   a. Charles Gardiner (Catalyst Group) provided a summary of discussion and comments recorded during the August 2 public workshop presentation.

   b. Comment: Having this workshop was valuable and important to inform the public about the process.

   c. Comment: We can bring more people to workshops by coordinating with Municipal Advisory Councils (MACs)

   d. Self-Help Enterprises will be using some of their DWR grant funding in Merced to continue door-to-door outreach before workshops as well as neighborhood meetings.

5. Interbasin Coordination Update

   a. A preliminary meeting was held with the Chowchilla Subbasin to facilitate information sharing.

   b. The Turlock Subbasin meeting series is ongoing but it was noted that Turlock has a SGMA deadline 2 years behind Merced.

   c. Preliminary Delta-Mendota Subbasin discussions have started and formal meetings will be scheduled soon.

6. Public Comment on Items not on the Agenda

   a. No comments were made.

7. Next Steps and Next Meeting

Next Regular Meeting
September 24, 2018 at 9:30 a.m.
Castle Conference Center, 1900 Airdrome Entry, Atwater, CA
Information also available online at mercedsgma.org

Note: If you need disability-related modification or accommodation to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING MINUTES – Merced GSP

SUBJECT: Merced GSP Stakeholder Committee Meeting #5

DATE/TIME: September 24, 2018 at 9:30 AM

LOCATION: Castle Conference Center, 1900 Airdrome Entry, Atwater, CA

Stakeholder Committee Members In Attendance:

	Representative	Community Aspect Representation
☐	Alex McCabe	City of Livingston
☒	Arlan Thomas	MIDAC, growers
☒	Ben Migliazzo	Live Oak Farms, growers
☒	Bill Spriggs	City of Merced, Merced Irrigation District
☒	Bob Salles	Leap Carpenter Kemps Insurance, insurance industry and natural resources
☒	Brad Robson	Buchanan Hollow Nut Co. Le Grand-Athlone Water District, growers
☒	Breanne Ramos	Merced County Farm Bureau
☒	Brian Carter	D&S Farms, growers
☐	Carol Bonin	Winton M.A.C.
☒	Daniel Machado	Machado Backhoe Inc., construction industry
☒	Darren Olguin	McSwain MAC
☐	Frenchy Meissonnier	Rice Farmer, rice growers
☒	Galen Miyamoto	Miyamoto Farms
☒	Gino Pedretti III	Sandy Mush Mutual Water Company
☒	Greg Olzack	City of Atwater resident
☐	James (Jim) Marshall	City of Merced
☒	Joe Scoto	Scoto Bros Farms / McSwain Union School District
☐	Ladi Asgill	East Merced Resource Conservation District / Sustainable Conservation
☒	Maria Herrera	Self-Help Enterprises
☒	Mark Maxwell	University of California, Merced
☒	Maxwell Norton	Retired agricultural researcher
☒	Parry Klassen	East San Joaquin Water Quality Coalition, growers
☒	Rick Drayer	Drayer Ranch, Merced cattlemen
☒	Simon Vander Woude	Sandy Mush Mutual Water Company, dairies

Meeting Minutes

1. Welcome, Introductions, and Agenda Review
    a. Introduction and overview of agenda items given by Charles Gardiner (Catalyst Group)
    b. There were no comments for the past meeting minutes. Comments and questions from past meeting minutes and further input can be sent via email to Woodard & Curran.
2. Minimum Thresholds Update
    a. Alyson Watson (Woodard & Curran) provided a review of the sustainability criteria and an update on the methodology used for developing minimum thresholds for groundwater levels.
    b. Clarifying questions were asked about the data source and characteristics of the Voluntary CASGEM wells and Domestic Wells from Merced County Database.
    c. Question: How does a well get populated in the Merced County Database? Answer: Well drilling requires a permit and has been required for several decades. The electronic version of the database includes all permitted domestic wells installed from the mid-1990s onward.
    d. Question: Are there a sufficient number of wells to set minimum thresholds around vulnerable communities? Answer: There are still gaps in certain areas, but if there isn't a history of monitoring in that area, then it is difficult to set thresholds there. There is good coverage overall but part of the GSP will involve developing additional monitoring locations in these types of areas.
    e. Question: Do minimum thresholds and a 3-mile radius around monitoring wells end up translating to individual management areas? Answer: The monitoring wells are meant to be indicative of the entire Subbasin. The 3-mile radius is used to select nearby domestic wells for analyzing undesirable results. We will be selecting a subset of monitoring wells to ultimately report long-term to the State for SGMA compliance.
    f. Question: Will SGMA compliance be determined based on seasonal measurements reported to CASGEM (e.g. March and October measurements influenced by seasonality)? Answer: Each GSP defines its compliance/violation standards and it will vary year-to-year as there are wet/dry cycles. Criteria will be developed that account for seasonal and year-to-year variations.
    g. A concern was raised that on the minimum thresholds map for groundwater elevations, the "white area" (unincorporated) on east side of Subbasin has no wells representation. Answer: At the next meeting, we can put together a map of all the wells used in the Merced Water Resources Model (MercedWRM) in that area.
    h. Question: Agricultural wells are much deeper than domestic wells (typically), so will they be included in the analysis? Answer: Because they're typically deeper, they're expected to be covered by this methodology which is protecting the shallowest wells.
    i. Public comment: Hitting thresholds may be economically infeasible and a future iteration may need to include ways to deliver water to shallow domestic users as a more efficient way of mitigating undesirable results.
    j. Question: How many monitoring wells are there in total and how many are driven by the domestic well depth for the minimum threshold? Answer: There are 65 monitoring wells total and 25 of them (38%) are driven by the shallowest domestic well to set the minimum threshold.

3. Hydrogeologic Conceptual Model
    a. Alyson Watson (Woodard & Curran) provided an overview of the HCM section of the GSP and some example maps that will be included in the section writeup that will be provided for SC member review in the next few months.
    b. Question: Will the plan be periodically updated to account for new information/data on water quality Constituents of Concern (COCs) in the future? Answer: Yes.
4. Projected Water Budget and Sustainable Yield
    a. Alyson Watson (Woodard & Curran) provided a reminder on the assumptions and results of the projected conditions baseline groundwater budget, as well as a presentation of the initial results of sustainable yield groundwater budget.
    b. Public Question: Has the City of Merced possible use of surface water for drinking water been included in projected water budget? Answer: No, but it may be considered as a future project and we'd need more details/parameters on that use.
    c. Question: Why does net deep percolation show as very similar across all 50 years (would expect to see large variation due to hydrology)? Answer: Net deep percolation comes primarily from agricultural use and not precipitation, since the sum of agriculture and precipitation will be roughly the same regardless of hydrology.
    d. Additional clarifying questions were asked about basin inflow from Sierra Nevada Mountains, which is largely seen in gain from streams (surface water) and less so from boundary inflow (long-term migration of groundwater from the eastern boundary).
    e. Public question: If you reduced pumping by an amount equal to the "Change in Storage" number, will we be in balance? Answer: Not exactly – there are a lot of interrelated complicating factors that respond to one another, such that reducing pumping has multiple different effects on other items in the balance.
    f. Question: Will the recent public trust doctrine court case (*Environmental Law Foundation vs. State Water Resources Control Board*) affect our "Gain from Streams" inflow value? Answer: No, because it's a natural system where inflow happens naturally. We will need to look at if pumping has a negative impact on stream level.
    g. Question: A localized project will help a localized area, but how do our geographically spaced projects help the whole Subbasin? Answer: A local project will still have an impact on the basin-wide water budget. It will also have localized impacts on groundwater elevations.
    h. Several clarifying questions were asked about what the basin-average sustainable yield allocation means and what it applies to (e.g. it is based on gross acres across the entire basin, since some landowners may have rights to pump even if they're not pumping now) and where the reductions in pumping occurred in the modeled scenario (across all uses on all acres). It was explained that the 1AF/ac is simply a calculation of the projected sustainable yield of the basin divided by gross acres and is not meant as a suggested management action allocation.
5. Public Outreach Update
    a. Charles Gardiner (Catalyst Group) provided an update to public outreach efforts, including planning for a public meeting in early December.

6. Interbasin Coordination Update

    a. The project team held an initial meeting with Delta-Mendota Subbasin representatives, but it looks like further coordination efforts won't begin until early 2019 as the Delta-Mendota Subbasin is farther behind Merced Subbasin's efforts due to a complex organizational structure of multiple GSAs and GSPs.

7. Substitute Environmental Document (SED) Update

    a. Hicham ElTal (Merced Irrigation District) provided an explanation of what SED is and some associated details about how it was developed and some potential impacts it may have on surface water flows to the San Joaquin River.

8. Public Comment on Items not on the Agenda

    a. No public comments were raised.

9. Next Steps and Next Meeting

Next Regular Meeting
October 22, 2018 at 9:00 a.m.
Please note the ½ hour earlier start time for special topics
Castle Conference Center, 1900 Airdrome Entry, Atwater, CA
Information also available online at mercedsgma.org

Note: If you need disability-related modification or accommodation to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING MINUTES – Merced GSP

SUBJECT: Merced GSP Stakeholder Committee Meeting #6

DATE/TIME: October 22, 2018 at 9:00 AM

LOCATION: Castle Conference Center, 1900 Airdrome Entry, Atwater, CA

Stakeholder Committee Members In Attendance:

	Representative	Community Aspect Representation
☐	Alex McCabe	City of Livingston
☒	Arlan Thomas	Merced Irrigation District Advisory Committee (MIDAC), growers
☒	Ben Migliazzo	Live Oak Farms, growers
☐	Bill Spriggs	City of Merced, Merced Irrigation District
☒	Bob Salles	Leap Carpenter Kemps Insurance, insurance industry and natural resources
☐	Brad Robson	Buchanan Hollow Nut Co. Le Grand-Athlone Water District, growers
☐	Breanne Ramos	Merced County Farm Bureau
☒	Brian Carter	D&S Farms, growers
☐	Carol Bonin	Winton M.A.C.
☒	Daniel Machado	Machado Backhoe Inc., construction industry
☐	Darren Olguin	McSwain MAC
☒	Frenchy Meissonnier	Rice Farmer, rice growers
☒	Galen Miyamoto	Miyamoto Farms
☐	Gino Pedretti III	Sandy Mush Mutual Water Company
☒	Greg Olzack	City of Atwater resident
☐	James (Jim) Marshall	City of Merced
☒	Joe Scoto	Scoto Bros Farms / McSwain Union School District
☐	Ladi Asgill	East Merced Resource Conservation District / Sustainable Conservation
☒	Maria Herrera	Self-Help Enterprises
☒	Mark Maxwell	University of California, Merced
☒	Maxwell Norton	Retired agricultural researcher
☐	Parry Klassen	East San Joaquin Water Quality Coalition, growers
☒	Rick Drayer	Drayer Ranch, Merced cattlemen
☐	Simon Vander Woude	Sandy Mush Mutual Water Company, dairies

Meeting Minutes

1. Welcome, Introductions, and Agenda Review
    a. Charles Gardiner (Catalyst) welcomed the group and gave an overview of the meeting agenda.
2. CASGEM Update
    a. Matt Beaman (MID) gave overview of the California Statewide Groundwater Elevation Monitoring program (CASGEM) and an introduction to the Merced Area Groundwater Pool Interests (MAGPI).
    b. CASGEM coordinates between DWR, the State Board, and the public. Elevation data is submitted to DWR, made public, and then DWR draws contours based on this data. DWR has created guidelines for CASGEM.
    c. Question: what does it mean to be in compliance? Answer: groundwater data is submitted to the satisfaction of DWR.
    d. Question: Could pumping above the Corcoran clay layer cause subsidence? What about water quality above this layer? Answer from Hicham ElTal (MID): recharge and pumping above the Corcoran clay layer are very unlikely to cause subsidence. Water quality above the Corcoran is generally not an issue, though there are some saline issues closer to the San Joaquin River.
    e. The CASGEM monitoring plan work from MID is nearly complete. Next steps include expanding coverage, continuing data compliance, instrumenting additional monitoring wells, and finalizing the updated monitoring plan.
3. Presentation by Woodard & Curran on GSP development
    a. Next Steps in GSP Development
        i. Alyson Watson (Woodard & Curran) provided an overview of the GSP Development overall timeline. Current focus is on sustainability goals and projects and management actions.
        ii. SGMA has two focus areas: to halt overdraft and to establish and monitor thresholds over time (i.e. avoid undesirable results). SGMA does not alter surface or groundwater rights.
        iii. The challenge for the Merced Subbasin is to reduce groundwater pumping while minimizing how much total water use must be reduced. Steps to reach sustainable yield are: 1) determine extent of groundwater pumping that is sustainable, 2) determine available surface water, and 3) identify potential deficit between demand and available resources.
        iv. Two areas should be addressed to achieve sustainability: reducing groundwater pumping (e.g. though an allocation framework); and identifying projects and management actions (e.g. that recharge groundwater, enhance surface water availability, and reduce demand).
        v. Question asked about what FERC (Federal Energy Regulatory Commission) flows are and how are these being accounted for. Answer: FERC is explained by Hicham ElTal (MID). This is a dam licensing and relicensing process. Every time a license is renewed considerations related to flows must be taken. With FERC relicensing MID will have to increase water released into the Merced River. MID is still waiting on a final answer for FERC flow. However, an estimate will be incorporated into GSP water budgets.
        vi. Discussion on Subbasin Sustainability:

1. A discussion was held on whether the problem framing and the approach to achieving sustainability is understood. A few key points from committee members are as follows:

    a. It would be good to have public meetings again in the eastern “white area” (gap areas) with a focus on communicating the current problem and creating a sense of urgency to start conserving now.

    b. Messages should be conducted continuously. Advertising can include via social media and media interviews. Simple talking points could be created to give to people and use in interviews. It would also be good to have a one-pager on SGMA and why people should get involved.

    c. People will be interested once we have rules set up for allocation.

    d. It would be good to have a further simplification of terms.

    e. Having a number to quantify how much overall use should be reduced is helpful in understanding the magnitude of the problem.

    f. There will always be demand, and solutions for achieving sustainability will need to consider surface water. Everyone seems to understand that the Subbasin needs groundwater recharge.

    g. UC Merced can also conduct further outreach.

b. Groundwater Rights Primer

    i. Water Rights Attorney Brad Herrema (Brownstein Hyatt Farber Schreck) gave an informational presentation on groundwater rights and potential allocation frameworks under SGMA. (see full presentation details on Merced SGMA website) Questions from group noted below:

    ii. Question regarding the recent Public Trust Doctrine case. Answer: Groundwater extractions can be regulated by SGMA if pumping is affecting neighboring streams. However, SGMA did not preempt the Public Trust Doctrine in applying to groundwater extractions.

    iii. Question asked about impacts to Pre-1914 rights. Answer: pre-1914 water rights only apply to surface water. There are no exemptions from SGMA except for some adjudicated basins. SGMA does not alter water rights.

    iv. Question: How does a basin become adjudicated? Answer: someone has to start the adjudication process. There are some streamlined adjudication processes, but some can last 20 years. What often starts as a one-one case becomes a full basin process.

    v. Clarification provided on dryland pastures and overlying water rights: There’s a concept of subordination where the overlying water right could be lost. In Antelope Valley, they were able to pump if they found water (e.g. they purchased a groundwater right or can lease out a right to use during a particular year).

    vi. Question: What have you seen regarding a water credit system? How does that work out? Answer: each basin is different, and this depends on the adjudication.

vii. Question: What about water markets? Answer: There are examples of a portal where people can see what water is available (e.g. water pricing, how much is available). In Chino Basin a portal was not needed because the basin was small.

viii. Question: how will changes in efficiencies of water use be taken into account, especially differences in return flows? Answer from Woodard & Curran: TBD, is something CC will need to consider.

c. Projects and Management Actions

i. Alyson Watson (Woodard & Curran) provided an introduction to projects and management actions. The goal is to implement projects to help achieve sustainability and minimize impacts to groundwater users.

ii. Woodard & Curran has looked through specific plans, contacted GSAs, and reached out to individual land owners as a starting point to gather information on existing projects for discussion. An initial list of these projects was provided.

iii. Committee members recommend looking into the list of grant reports from the Water Resources Control Board maintains for water quality projects.

iv. Committee members also recommended looking into past projects from the Army Corps of Engineers.

v. It is likely that several projects will develop in DAC areas.

vi. Alyson Watson (W&C) gave examples of criteria for assessing projects and invited discussion asking committee members what additional criteria should be considered. Responses included: benefits to DACs, eligibility for funding for DACs, and projects that help with CV-SALTs.

vii. Alyson Watson (W&C) asked committee members to think about whether there are projects we are missing in the initial list. She also asks what other criteria should be used to assess projects. This information should be brought to the next meeting.

viii. DWR representative states that Prob 68 will have funding for SGMA projects.

d. Other Updates

i. Groundwater Data templates and instructions for submitting data have been updated and are available on the MercedSGMA homepage.

4. Public Outreach Update

a. Charles Gardiner (Catalyst) reported that two public workshops will take place in December and will be in two different locations to make sure we are covering different areas of the Subbasin.

5. Interbasin Coordination Update

a. Hicham ElTal has been in contact with Chowchilla regarding subsidence discussions.

6. Public Comment on Items not on the Agenda

a. No public comments.

7. Next Steps and Next Meeting

    a. Several GSP development items anticipated to be discussed in the next meeting including: water budgets and documented assumptions, the data management system, the Hydrogeological Conceptual Model (HCM) GSP section, sustainable yield analysis, and assessment of projects and management actions.

Next Regular Meeting
November 26, 2018 at 9:30 a.m.
Castle Conference Center, 1900 Airdrome Entry, Atwater, CA
Information also available online at mercedsgma.org

Note: If you need disability-related modification or accommodation to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING MINUTES – Merced GSP

SUBJECT: Merced GSP Stakeholder Committee Meeting #7

DATE/TIME: November 26, 2018 at 9:30 AM

LOCATION: Castle Conference Center, 1900 Airdrome Entry, Atwater, CA

Stakeholder Committee Members In Attendance:

	Representative	Community Aspect Representation
☐	Alex McCabe	City of Livingston
☒	Arlan Thomas	Merced Irrigation District Advisory Committee (MIDAC), growers
☒	Ben Migliazzo	Live Oak Farms, growers
☒	Bill Spriggs	City of Merced, Merced Irrigation District
☒	Bob Salles	Leap Carpenter Kemps Insurance, insurance industry and natural resources
☒	Brad Robson	Buchanan Hollow Nut Co. Le Grand-Athlone Water District, growers
☒	Breanne Ramos	Merced County Farm Bureau
☐	Brian Carter	D&S Farms, growers
☐	Carol Bonin	Winton M.A.C.
☐	Daniel Machado	Machado Backhoe Inc., construction industry
☒	Darren Olguin	McSwain MAC
☒	Frenchy Meissonnier	Rice Farmer, rice growers
☒	Galen Miyamoto	Miyamoto Farms
☒	Gino Pedretti III	Sandy Mush Mutual Water Company
☒	Greg Olzack	City of Atwater resident
☐	James (Jim) Marshall	City of Merced
☐	Joe Scoto	Scoto Bros Farms / McSwain Union School District
☐	Ladi Asgill	East Merced Resource Conservation District / Sustainable Conservation
☒	Maria Herrera	Self-Help Enterprises
☒	Mark Maxwell	University of California, Merced
☒	Maxwell Norton	Retired agricultural researcher
☒	Parry Klassen	East San Joaquin Water Quality Coalition, growers
☒	Rick Drayer	Drayer Ranch, Merced cattlemen
☒	Simon Vander Woude	Sandy Mush Mutual Water Company, dairies

Meeting Minutes

1. Welcome, Introductions, and Agenda Review
   a. Charles Gardiner (Catalyst) welcomed the group and gave an overview of the meeting agenda.
   b. There were no changes nor comments to the past meeting minutes.
2. Presentation by Woodard & Curran on GSP development
   a. Jeanna Long (Woodard & Curran) presented on the Data Management System (DMS)
      i. Jeanna Long (Woodard & Curran) provided an introduction to what a DMS is and how this is used. Questions and discussion from the Stakeholder Committee (SC) were as follows:
         1. Question: How long has this system been used or has been in place? Answer (W&C): Since 2010. This has also been used in Sacramento to manage their water resources data. This tool has been customized for the SGMA program and helps enable collection of data from multiple agencies into one place.
         2. Question: Is there a program or effort in place to enable something statewide like this? Answer (W&C): No, not for this data. Comment from committee member: There is, however, statewide data used for emergency management. This may be something the state can pull together based on the information they have.
         3. Jeanna Long (W&C) demonstrated the different filters that can be viewed in the Opti tool, e.g. to zoom in on a well and see the data for that well.
         4. Question: Where is the data from that are currently in the system? Answer (W&C): Much of this is from the previous Integrated Water Resources Management Plan and from SGMA Readiness work for Merced and CASGEM data.
         5. Clarification on well information collected: This information is collected for monitoring and data reporting requirements according to SGMA.
         6. Question: Do we have a way to track where the data came from? Answer (W&C): Data source, importing, and modifications are tracked within the DMS.
         7. Question: How would this help with e.g. if I want to increase fire flows in the City of Atwater? Answer (W&C): it is a matter of scale. Comment from committee member: We did this before and it worked out well as a planning tool.
         8. Comment from Hicham ElTal (MID): Data collected for canals is water quality data.
         9. Jeanna Long (W&C) demonstrated the functionalities of the DMS. Data is still being imported. W&C will send you the link and a user guide for accessing and using the portal once this is complete.
         10. Jeanna (W&C) explained how this will be used for meeting SGMA requirements. It provides participating agencies and entities access to data collected. It enables tracking of thresholds and supports decision making for management actions.
   b. Next Steps in GSP Development

i. Alyson Watson (Woodard & Curran) provided an overview of the GSP Development overall timeline and roadmap plan.

ii. Several comments were provided on the Hydrogeologic Conceptual Model (HCM). However, the majority of SC committee members needed more time to review. Comments provided included:

1. On page 26 determine if fault line is significant for subsidence.
2. Do the maps on pages 38-39 need units?
3. On page 41 clarify what the depth means.
4. Comment for page 50: We have low recharge potential in the Eastern part of the basin.
5. There did not seem to have much information on land use and who depends on this water. Clarification from W&C given that this section is intended to provide the hydrogeologic basin settings. There are other sections that will address land use and water users.
6. Request made for a clarification on the losing and gaining streams interconnection section. This should be provided either via email or next meeting.
7. Request was made to resent the links to the HCM. These were resent during the meeting to the SC.

iii. Alyson Watson (W&C) provided an update on the water budgets and sustainable yields. This update shows the new water budgets that account for the FERC flows. Clarification was given that this is an estimate. The Subbasin will need to reduce pumping by approximately 25% according to the estimates. This is similar to the previous calculations that did not account for updated FERC flows.

c. Water Allocation Frameworks

i. Under SGMA, GSAs have authority to establish groundwater extraction allocations. SGMA and GSPs adopted under SGMA cannot alter water rights. Alyson Watson (W&C) gave a brief overview of the different allocation frameworks to allocate the basin's sustainable yield, their pros and cons, and potential implications for gw users in the basin.

ii. Question: what about management areas? Answer (W&C): GSAs can determine if management areas are needed.

iii. Alyson explained the proposed decision-making timeline. Potential allocation approaches and values to consider are discussed in November. This would continued in December, with a goal of recommending a preliminary allocation approach to the GSA Boards. In January, projects and management actions will be further discussed by the SC and CC.

iv. Question: Where are the undesirable results? And are these clearly defined? Answer (W&C): This is an iterative approach. These were discussed previously but have not been finalized or formalized. These were discussed by sustainability indicator in prior meetings, and they will need to be revisited, finalized, and written up in tandem with consideration of what allocation approaches and projects and management actions are available.

v. Pro Rata Approach: This divides sustainable yield by total basin acreage. Advantages are that this is simple and that it acknowledges existing pumping. Disadvantages include not explicitly accounting for appropriators/prescriptive rights and does not account for unexercised groundwater rights.

vi. Pro Rata Irrigated Areas Approach: Divides the sustainable yield by irrigated and urban areas. It is simple and acknowledges exiting pumping. However, it does not account for unexercised groundwater rights nor account for appropriators/prescriptive rights.

vii. Historical Pumping Approach: This is based on historical use. This is less likely to result in conflict and accounts for appropriators and prescriptive rights. However, it requires more data and if unirrigated acres are excluded this also does not account for unexercised groundwater rights.

1. Comment from CC: we will need to determine our historical reference point.
2. Question: this assumes everyone is metered? Answer (W&C): This would require having a way to measure and could result in extensive metering.

viii. Comprehensive Approach: The advantages include less likelihood of conflict and an accounting of appropriative use and prescriptive rights. However, this approach requires data not that are currently available, and does not account for unexercised groundwater rights. The approach requires significant outreach and engagement.

ix. Alyson Watson (W&C) provided key differences. Some approaches do not address prescriptive rights (e.g. pro-rata approach). Some do not consider all acres (pro-rata with irrigated acres, historical or comprehensive based on historical use).

x. SGMA and GSPs adopted under SGMA cannot alter water rights. The group discussed the types of groundwater rights in the basin – overlying users (correlative) rights, prescriptive rights, and developed/imported supplies.

xi. Comment: Can look at historical use to find the ratios of what is used by cities vs agriculture.

xii. Comment: Would be interesting to look into what we can do with a water credit system.

xiii. Discussion comments on allocation frameworks from SC members:

1. One consideration is to look at the estimates for allocations and see if they will impact cities' abilities to meet public health and safety needs. Water quality is also something that must be considered as some places have a single source.
2. Who can participate in the market and how this affects disadvantaged communities is also important.
3. We need to be aware of what happened in the Australian water rights credit system – external firms have come in and are driving up the price of water.
4. Question: What about management areas? Answer (W&C): Projects and management actions and undesirable results will be revisited to address whether management areas will be needed. This will occur in February next year.
5. If groundwater is not being banked, it should be possible to store this water and be able to use it later. If we can only use 500,000 TAF a year, can we bank it? I

would be best to save groundwater until it is absolutely needed. If someone doesn't want to credit it, they should be able to bank it. Should not be a use it or lose it.

6. Comment from Hicham ElTal (MID): We will also be making adjustments as we monitor. We can implement an allocations framework and then find later on that this needs to be adjusted.

7. If crop allocation or historical allocation is used, an equitable amount should be determined (e.g. how many acre feet does it take to grow almonds). However, this is not cut and dry, and depends on soil type and water quality.

8. When looking at historical use, the subbasin should avoid rewarding inefficient use.

9. Having numbers with allocation scenarios will help us to know which allocation frameworks are best.

d. Projects and Management Actions (Discussion)

i. Projects and Management Actions were discussed with a series of questions. The following are the general responses from the SC. Many of which were relevant for several questions:

1. Idea suggested of why not spend the first 5 years on enhancing supply (all supply) and then look at allocation frameworks?

2. Use of purple/recycled water can be increased.

3. There is funding from the United States Bureau of Recreation for recycled water projects that could be pursued.

4. General agreement that the supply side should be targeted more than demand.

5. However, demand must be reduced because the subbasin is in overdraft. Projects take a long time to achieve, and there are many variables and high uncertainty (e.g. climate change). There are still families relying on tanked water right now.

6. Improving water treatment especially in areas that do not have adequate clean water sources is an important consideration.

7. Quantifiable goals should be set. For example, "the subbasin will increase groundwater recharge by X% in the next 5 years".

8. Clarification on projects and criteria for assessment: It will be necessary to identify funding sources and pathways. The process started with a wide net for a range of projects. At a certain point, we will need to compare projects.

e. Other Updates

i. Monitoring Networks and the DMS sections of the GSP are underway.

3. Public Outreach Update

a. There are two upcoming Public Workshops: Dec. 4th in Planada, and Dec. 13th in Franklin.

4. Interbasin Coordination Update

a. Chowchilla and Delta-Mendota Subbasins will be ready early next year to continue coordination.

5. Public Comment on Items not on the Agenda

    a. Public comment given by Jeff Denham in printed form. This input will be scanned and sent out to the group.

    b. Question asked: Is there excess surface water available in a regular rain year or when we have extra rain? Answer from Hicham ElTal (MID): This depends on a number of factors, including inflows from streams that have to be taken into account.

6. Next Steps and Next Meeting

Next Regular Meeting
December 17, 2018 at 9:30 a.m.
Castle Conference Center, 1900 Airdrome Entry, Atwater, CA
Information also available online at mercedsgma.org

Note: If you need disability-related modification or accommodation to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING MINUTES – Merced GSP

SUBJECT: Merced GSP Stakeholder Committee Meeting #8

DATE/TIME: December 17, 2018 at 9:30 AM

LOCATION: Castle Conference Center, 1900 Airdrome Entry, Atwater, CA

Stakeholder Committee Members In Attendance:

	Representative	Community Aspect Representation
☐	Alex McCabe	City of Livingston
☒	Arlan Thomas	Merced Irrigation District Advisory Committee (MIDAC), growers
☒	Ben Migliazzo	Live Oak Farms, growers
☒	Bill Spriggs	City of Merced, Merced Irrigation District
☒	Bob Salles	Leap Carpenter Kemps Insurance, insurance industry and natural resources
☒	Brad Robson	Buchanan Hollow Nut Co. Le Grand-Athlone Water District, growers
☒	Breanne Ramos	Merced County Farm Bureau
☐	Brian Carter	D&S Farms, growers
☐	Carol Bonin	Winton M.A.C.
☐	Daniel Machado	Machado Backhoe Inc., construction industry
☒	Darren Olguin	McSwain MAC
☒	Frenchy Meissonnier	Rice Farmer, rice growers
☒	Galen Miyamoto	Miyamoto Farms
☒	Gino Pedretti III	Sandy Mush Mutual Water Company
☐	Greg Olzack	City of Atwater resident
☐	James (Jim) Marshall	City of Merced
☒	Joe Scoto	Scoto Bros Farms / McSwain Union School District
☐	Ladi Asgill	East Merced Resource Conservation District / Sustainable Conservation
☐	Maria Herrera	Self-Help Enterprises
☒	Mark Maxwell	University of California, Merced
☒	Maxwell Norton	Retired agricultural researcher
☐	Parry Klassen	East San Joaquin Water Quality Coalition, growers
☒	Rick Drayer	Drayer Ranch, Merced cattlemen
☒	Simon Vander Woude	Sandy Mush Mutual Water Company, dairies

Meeting Minutes

1. Welcome, Introductions, and Agenda Review
    a. Alyson Watson (Woodard & Curran) welcomed the group and went over ground rules.
2. Presentation by Woodard & Curran on GSP development
    a. Alyson Watson (W&C) discussed the GSP timeline and next steps in GSP development. The focus of the meeting is on the groundwater accounting framework and allocation. This will flow back into projects and management actions.
    b. Comments on the hydrogeologic conceptual model (HCM) were received and will be tracked with the GSP section drafts.
    c. Water Allocation Frameworks
        i. The goal will be to get the Coordinating Committee to the point where the Committee can make a preliminary recommendation to the GSA Boards. The goal for the Stakeholder Committee is to provide feedback and an input to the Coordinating Committee.
        ii. Key points from the previous CC meeting included: A need to address prescriptive rights, and an approach to how to bring in users that are not currently exercising rights but might in the future; agreement on a date range for historical and prescriptive periods; a timeline for implementation; and identification of remedies GSAs have for enforcing allocations.
        iii. Alyson Watson (W&C) provided a brief overview of what authority GSAs have under SGMA.
        iv. Question: Will implementation be monitored? How would GSAs be able to enforce allocations? Answer (W&C): Yes, there will be monitoring, and this is something we will be revisiting.
        v. Question: Where does the GSAs' authority come from? Answer (W&C): This comes from SGMA, which is state law.
        vi. Alyson Watson (W&C) provided an overview of prescriptive and overlying groundwater rights.
        vii. Question: What about those who are pumping water and taking this out of the basin? Answer (W&C): There is a Merced County Ordinance that prevents this. Lacey Kiriakou (County of Merced) confirmed there are no existing permits with the County to pump water out of the basin. A contract that previously permitted this has now expired.
        viii. Question: Will all GSAs be able to have the same enforcement mechanisms? Answer (W&C): Each GSA can determine individually how to enforce allocations, which must be approved by the GSA board (e.g. fees). Each GSA has the discretion to create their own rules.
        ix. Additional comments were provided and recorded via flipchart paper. These are summarized as follows:
            1. Comment: There should be a single structure in place to have a uniform fee structure across GSAs (should have consistency across GSAs).

2. Comment: Within the Merced Irrigation District (MID) area, there are those who pump and those who don't. Commentator does not see MID permitting a rate structure to some areas.

3. Revised previous comment: There should be a single structure as much as possible, but some areas may require a different structure.

4. Comment: Population projections seem a little high and might need to be adjusted.

5. Clarification (W&C): The money collected from fees established by the GSAs goes to the GSAs.

6. Comment (summary): Examples of potential different timeframes for allocation calculations include 2006-2015, 2006-2010, 1995-2015.

7. Clarification from MID: MID seepage is reserved for MID because this is developed water, and the rest is available for the allocation framework.

x. Rights to groundwater imported to a Subbasin:

1. Alyson Watson (W&C) clarifies that developed water is water that is imported into the Subbasin. This includes seepage of conveyed surface water that reaches the groundwater basin. It is the property of those who have brought that water into the basin.

2. Clarification (W&C): Seepage from developed water will have to be accounted for within sustainable yield/water budget calculations. This information will have to be monitored and the amounts agreed upon.

3. Question: This explanation is in existing state water law? Answer (W&C): Yes, this is consistent with CA groundwater law. The source of information from today's presentation and a good summary of CA groundwater rights law and SGMA is: *Groundwater Pumping and Allocations under California's Sustainable Groundwater Management Act*, Environmental Defense Fund, July 2018

xi. Alyson Watson (W&C) provided examples of allocation methods. The goal is to see how close the Subbasin can get to a comprehensive approach for allocation. There is not adequate time or data resources to do a full comprehensive approach.

xii. Alyson Watson (W&C) explained revisions made to the sustainable yield analysis. There were some discrepancies with the estimations of flows from the San Joaquin River. This has been recalculated and the outcome is updated estimate of basin sustainable yield is 530,000 af.

xiii. Alyson Watson (W&C) provided a review of the different potential allocation distributions and an example based on historical use is presented. Prescriptive use allocation tables are presented showing two 10-year historical periods and the projected demand in 2040.

1. Comment: Estimations should include a breakdown showing the individual CSDs and mutual water companies.

2. Clarification (W&C): the values shown for Prescriptive Use reflect water use and projected use with projected demand. These are based on Urban Water Management Plans.

3. Question: Where do the numbers for population come from? Answer (W&C): Population for projected conditions of Urban Water Use come from the 2040 projections of available Urban Water Management Plans.

4. Comment: We are going to have growth. It is normal to have an estimation of increased population. Cities as they grow need to have more rigorous conservation efforts. This will come down to household level.

xiv. Alyson Watson (W&C) gave an explanation of a modified application of the comprehensive allocation approach for Merced Subbasin.

1. Question: What about in a water market? If someone does not have an allocation, would they have no skin in the game? Answer (W&C): If there was a water market in place, then potentially yes. However, the GSAs would have to establish a water credit/trading system.

xv. Quantified and Transferable Rights

1. Alyson Watson (W&C) described some details of the Mojave Adjudication process.

2. Questions were asked that will be followed up by the W&C team as follows: What is the process for a new pumper to be added and what is the current status of the lawsuit on Mojave?

3. Comment: We do not want speculators coming into the subbasin.

4. Clarification (W&C): The CC in the last meeting did not say that we cannot do a water market or credit system. They were concerned with outside speculators purchasing land, not using the water on this land, and instead using it for profit elsewhere.

5. Comment: If the Subbasin does a credit system with irrigated lands that can trade back and forth, then this puts non-irrigated acres at a disadvantage.

6. Comment: If a trading system is developed then a discussion about dry range land will be needed.

7. Comment: Yes, if a credit system is pursued, then non-irrigated acres must be taken into account. A partial credit for the non-irrigated acres could be considered.

8. Comment: Non-irrigated lands should be able to have the opportunity to have a partial allocation. When this land is later changed to irrigated lands, allocation would change to a 100% allocation.

9. Comment: It will also be important to consider what happens if land is on more than one GSA.

xvi. Prescriptive based on Historical Use

1. Comment: Using historical data for calculating prescriptive use is more accurate, but the projected calculations will change. Response: This can be updated over time and a selected time period will be needed.

2. Comment: The historical period should use a 20-year time frame, and the Subbasin should consider looking at other adjudication examples.

3. Comment from W&C: The longer the time period, the greater potential change. We can look into shorter and longer timeframes, and can look at the full 95-2015, and 90-2010 periods as examples.

4. Question: Are we including the drought years? Answer (W&C): Yes.

5. Comment: Will have to keep in mind that the years after the drought tend to require more pumping because the water is lower.

6. Question: What does the State Water Regional Control Board decision for Substitute Environmental Document (SED) mean for the Merced Subbasin? Answer Hicham ElTal (MID): On Wednesday the SWRCB adopted the SED. Daniel Chavez found an article in the MercedSunstar that provides some information. This article was sent in electronic form to the committee members.

xvii. Alyson Waterson (W&C) reviewed the conceptual GSP implementation draft timeline and requested feedback from the SC. The feedback and discussion are summarized as follows:

1. Comment: The timeframe seems appropriate, especially considering that we will have to install and create the metering and monitoring networks we're going to use.

2. Comment: What do we need to show in the plan? Answer (W&C): We will need to show milestones into the plan and will need to put our allocation framework into the plan.

3. Question: How detailed should the plan be? Answer (W&C): Details should be included on how to implement the allocation. It is also possible to have a footnote with a "subject to change" clause that communicates the update process.

4. Clarification (W&C): Properties of under 2AF/year of domestic use are considered de minimus users and are not required to be metered according to SGMA.

5. General comment from the group: this is a reasonable timeframe, but we will need to eventually vet with thresholds.

6. Comment: What would be helpful in assisting the SC to think about and provide a recommendation is a quantification of acreages (pastures, etc.), and how many acres are in MID and other service areas.

7. Comment: It will be important to balance between the agricultural and urban users.

8. Question asked about status of projects and management actions. Answer (W&C): There is a current potential projects list. However, once the allocation is further along, this will enable us to identify which projects to target.

9. Question asked about funding mechanisms for projects. Answer (W&C): The W&C team has been looking into some preliminary options and will continue to identify these options as we get closer to our projects discussion.

10. Question: Could installing monitoring systems create opportunity to connect areas that are not currently connected to the system. Answer (W&C): Yes. Comment: Would like to see this put into the 20-year plan.

11. Question: Is there anything that mentions clean drinking water. Answer (W&C): Yes, there will be thresholds related to clean drinking water in the water quality thresholds.

d. Other Updates: A beta link for the Data Management System will be sent out in January.

3. Public Outreach Update

   a. Daniel Chavez asked Merced County to have Merced MACs help set up future public meetings.

   b. The next public workshop will likely occur in February.

4. Interbasin Coordination Update

   a. January and February are expected to have more interbasin coordination activities.

   b. There is an agreement with Turlock. They are on the 2022 timeline and are interested in keeping up with Merced.

5. Public Comment on Items not on the Agenda

   a. There were no comments.

6. Next Steps and Next Meeting

   a. Water Budgets memo to be provided to GSA staff for initial review.

   b. Provide follow-up on questions regarding allocation frameworks for next meeting.

Next Regular Meeting
January 28, 2019 at 9:30 a.m.
Castle Conference Center, 1900 Airdrome Entry, Atwater, CA
Information also available online at mercedsgma.org

Note: If you need disability-related modification or accommodation to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING MINUTES – Merced GSP

SUBJECT: Merced GSP Stakeholder Committee Meeting #9

DATE/TIME: January 28, 2019 at 9:30 AM

LOCATION: Castle Conference Center, 1900 Airdrome Entry, Atwater, CA

Stakeholder Committee Members In Attendance:

	Representative	Community Aspect Representation
☐	Alex McCabe	City of Livingston
☒	Arlan Thomas	Merced Irrigation District Advisory Committee (MIDAC), growers
☒	Ben Migliazzo	Live Oak Farms, growers
☒	Bill Spriggs	City of Merced, Merced Irrigation District
☒	Bob Salles	Leap Carpenter Kemps Insurance, insurance industry and natural resources
☒	Brad Robson	Buchanan Hollow Nut Co. Le Grand-Athlone Water District, growers
☒	Breanne Ramos	Merced County Farm Bureau
☐	Brian Carter	D&S Farms, growers
☐	Carol Bonin	Winton M.A.C.
☒	Daniel Machado	Machado Backhoe Inc., construction industry
☒	Darren Olguin	McSwain MAC
☒	Frenchy Meissonnier	Rice Farmer, rice growers
☒	Galen Miyamoto	Miyamoto Farms
☒	Gino Pedretti III	Sandy Mush Mutual Water Company
☐	Greg Olzack	City of Atwater resident
☐	James (Jim) Marshall	City of Merced
☒	Joe Scoto	Scoto Bros Farms / McSwain Union School District
☐	Ladi Asgill	East Merced Resource Conservation District / Sustainable Conservation
☐	Maria Herrera	Self-Help Enterprises
☐	Mark Maxwell	University of California, Merced
☒	Maxwell Norton	Retired agricultural researcher
☐	Parry Klassen	East San Joaquin Water Quality Coalition, growers
☒	Rick Drayer	Drayer Ranch, Merced cattlemen
☒	Simon Vander Woude	Sandy Mush Mutual Water Company, dairies

Meeting Minutes

1. Welcome, Introductions, and Agenda Review
    a. Alyson Watson (Woodard & Curran) welcomed the group and went over ground rules.
2. Flood-Managed Aquifer Recharge (Flood-MAR)
    a. Hicham ElTal (MID) gave a presentation on Flood-MAR. The presentation included an explanation of public benefits of Flood-MAR and what is required for Flood-MAR to be put into place. He explained current plans and activities for Flood-MAR.
        i. Hicham described the components of the MIDH2O Model (Res-SIM & RAS), as well as the analysis conducted to investigate favorable recharge areas. This analysis included consideration of hydrology and favorable soils. Many areas are already built as residential. Some favorable areas exist around Planada.
        ii. Hicham explained that MID is working with DWR on a tool that the GSAs could own that puts all of these components together. This is called a GRAT (Groundwater Recharge Assessment Tool). This is initially funded by DWR, and then maintained via funding through GSAs. The tool helps determine where are the best areas for recharge, when and how much surface water can be recharged, and costs.
        iii. Water Rights for both surface and groundwater must also be considered. Hicham explained that South of Bear Creek MID has licenses received with the annexation of El Nido, but this is restricted water. State regulation says you can take water if the flow is 90% range of the flow for that day. For example, if you have a creek with capacity of 1000 cfs, can only take water when this is above 900 cfs.
        iv. Hicham explained that there are difficulties including: 1) if water is put on someone's parcel it is difficult to determine whether water is it getting to the groundwater or not, and 2) it is difficult to forecast storm events. Having good forecasting is important because there are a limited number of strong storms during the year, and the Subbasin should use good forecasting to get best use of these storms.
        v. Question: How does Flood-MAR work in practice? Answer from Hicham (MID): The typical scenario is that a storm comes in, flood control dams are put to use, and there is a window of time to notify folks as the water backs up. MID contacts those who are part of Flood-MAR and asks who needs this water. This can be on a rotation basis. The GSAs would have to agree on the diversion. 800-900 cfs can happen often from a storm.
        vi. Question: how would this (Flood-MAR) work as a project on the GSP? Answer from Hicham (MID): this might be hard to quantify but looking at the Merced Study is a good start.
        vii. Question: Is there a Merced streams group now? Answer from Hicham: Yes, there is. However, it does not extend to Deadman and Dutchman, but does go to Sandy Mush.
        viii. Question: Is there a way to make the capacity higher during wet seasons and store water? Reply from Hicham: The Army Corps of Engineers owns the dams. The flood control dams are small. The Mariposa Flood Control Dam near Le Grand may be an option to forecast and store 5,000 AF. The cost of making the other dams larger might not be worth it.

ix. Question: What about the project like the Margarita Dam? Answer from Hicham: This was a very expensive project with very small acreage. More efficient projects should be sought.

3. Presentation by Woodard & Curran on GSP development

   a. Next Steps in GSP Development

      i. Alyson Watson (Woodard & Curran) reviewed the development and the decision-making timeline. Alyson explained that the goal is to discuss and determine an allocation framework and have the CC make a recommendation for the GSA boards. The SC should come up with recommendations to take to the CC group in the afternoon.

      ii. With the allocation framework, the Subbasin attempts to divide the sustainable yield amongst the GSAs. The GSAs will need to determine projects and management actions. The allocations are not likely to take place within the first 10 years of the GSP implementation because there are many technical analyses that will need to take place before the allocations are officially implemented.

      iii. Alyson (W&C) explained that within the first 5 years, the GSP will be focused mostly on monitoring and reporting. Alyson explained a further breakdown of potential activities including project implementation over time periods leading up to 2040.

      iv. Question: Has DWR seen this potential timeline breakdown? Answer from Alyson (W&C): No, this was brought to the CC last week. SGMA legislation allows GSAs to determine how to implement and over what timeframe.

      v. Question: How do we incentivize farmers to not aggressively pump? Answer (W&C): The GSAs will have to determine how to handle this. As allocations are discussed and drafted, there could be a maximum set for how much people are drafting to avoid aggressive pumping, but not penalize inappropriately.

   b. Water Allocation Frameworks

      i. Alyson (W&C) reviewed the list of requests and follow ups from the last meetings with respect to considerations for allocation. She also provided a brief overview of the definition of overlying and prescriptive water rights.

      ii. Question: Is prescriptive a stronger right? A: No, the prescriptive rights are junior to overlying rights.

      iii. Alyson (W&C) explained the meaning of developed water and that the entity that has created the canals to import water into the basin are the owners of that supply.

      iv. Water for the Subbasin comes from 3 buckets: overlying use, appropriation of groundwater, and recovery of seepage of developed surface water supply. These cannot be double-counted.

      v. Alyson (W&C) explained the process for the allocation framework. This includes determining the sustainable yield, subtracting developed supply, and allocating remaining sustainable yield to overlying and appropriative users. The end goal is to come up with a framework for basin-wide management.

      vi. Alyson (W&C) provided an illustration of the allocation framework using numbers estimated from the current analysis.

vii. Alyson explained potential allocation between overlying and appropriative allocations using an analysis of different historical averaging periods.

viii. Question: What are the implications for the GSAs? Answer (W&C): There are slides with this information. Choosing different historical averaging periods results in slightly different allocations between overlying and prescriptive users which would result in different allocations to GSAs depending on their proportion of types of users. This is a policy decision, there is no “right” answer.

ix. Several comments from the SC were provided and are summarized as follows:

1. The drought really influences the overlying more than the appropriative. If we have to pick one would this should be the 10-year period 2006-2015.

2. This is important for the cities as appropriators and for city planning. We will want to think about how this impacts growth of cities.

3. The farther out the time period, the less impact on the drought. A 40-year time frame would be possible. Response (W&C): Yes, but the issue is data, especially for land use change.

4. There should be have more than one drought in the calculation if we consider that these might become more frequent. Response (W&C): True, but again the issue is lack of data to support that analysis.

x. At the end of discussion, the general consensus was that a 10-year period 2006-2015 seems to make sense and will enable including the drought. This can be adjusted later.

xi. Question: For the seepage credit, what if the canal is over some else’s (not MID’s) property? Answer (W&C): The water itself is still MID’s property as the creator of the developed water, it does not matter where on the surface the seepage enters the basin.

xii. Alyson (W&C) explained that in addressing unirrigated lands there is no consistent legal precedent or formal guidance. These lands may have “sleeping” or dormant water rights.

xiii. Alyson (W&C) provided a brief follow up on the Mojave Adjudication example. An individual who was involved in the Chino adjudication stated that millions of dollars are spent on the adjudications. He does not recommend pursuing an adjudication. Suggests if possible, to avoid it.

xiv. Question: What about all of the landowners who have riparian rights? Is there seepage that should be taken into account? Answer (W&C): Not unless they have a developed supply that we can quantify. They are exercising their overlying right and are not an appropriative user. Follow up comment: They could give you what they have submitted to the state board? Answer (W&C): Yes, but the percolation for the conveyance would need to be accounted for as the losses.

xv. Comment: Diagrams would be helpful to better understand seepage and conveyance (how this works).

xvi. Previously, the group had requested an illustration of how partial allocations to currently unirrigated lands would affect overall allocations. W&C provided an illustration based on available data showing partial allocations of 0, 25%, 50%, and 100%. There are roughly 300,000 acres of developed/irrigated acres, and 200,000 acres of undeveloped in the basin.

Key questions are: should there be an allocation for acres that have not historically used groundwater? If so, what is appropriate for a partial allocation? And how can future pumpers be added at a later time?

xvii. Comment from Hicham (MID): The MID Advisory Committee (MIDAC) which is made up of growers is in favor of a 0% allocation for grazing/pasture lands.

xviii. Question: How do management areas work into this? Answer (W&C): We will be looking at these as a next step, after we are able to determine where to look for specific reasons such as avoiding undesirable results.

xix. Question: Are the CSDs included in these breakdowns? Answer (W&C): Some of the CSDs are included, but we are still gathering data for the remaining CSDs.

xx. Question: What about refuge land? Answer (W&C): They are counted within the undeveloped lands. If they have had historical use, they have prescriptive rights.

c. Question and Discussion for Water Allocation Framework recommendations to CC:

i. Clarification (W&C): We are trying to determine if there should be an allocation given to the acres that currently don't use groundwater.

ii. Comment: Some SC members in favor of not giving an allocation (following MIDAC's recommendation). But we should keep the conversation going.

iii. Question: If you own an irrigated acre and a non-irrigated acre – can you transfer this between your properties. Response (W&C): This is something needs to be considered.

iv. Comment: If you have non-irrigated water allocation, there should be language to direct how this water can be used (e.g. how this can be sold and used).

v. Question: How can overlying rights be taken away for undeveloped land? And how can these lands be added for allocation? Answer (W&C): There will need to be a process for how to add these lands. If there is a water market, the undeveloped land owner would stand to lose their ability to sell water allocation.

vi. Comment: Can see the undeveloped land as banking water for irrigated lands. If undeveloped lands don't use it or sell it, they can bank this for use later when irrigated users have greater need and have this be available on a transfer basis. Does not see 100% allocation as feasible but likes the 50%.

vii. Comment: The long term goal should be that we are not worried about allocation, because we have managed sustainably and have implemented projects.

viii. Question: Of the acreage within MID, how much of that acreage is farmed? Answer from Hicham (MID): There is very little undeveloped land left.

ix. Question: Irrigated and non-irrigated land has to be defined. Are drip systems with trees counting as irrigated? Answer from Hicham (MID): Yes. There are a lot of nuances with what is irrigated, or not. We will have to agree on definition of this.

x. Clarification: Fallowed acreage should maintain its allocation

xi. Comment: Along with allocation, we still need to know what we are actually pumping.

xii. Comment: We need to come up with a recommendation, an idea, but this is going to be changed. More importantly, we need meters.

xiii. Comment: 100% allocation is never going to be true for grasslands. It's going to have to be between 50% and 25%.

xiv. Comment: There are MID land owners that pump but could use surface water.

xv. Comment: There should be a starting point for non-irrigated in the middle, not 0%. There should also be language to add non-irrigated lands in the future.

xvi. Comment: Concern that the water for irrigators is a "live or die by water" situation. Should have a 1.25 AF/A amount allocation for irrigated lands.

4. Data Management System

   a. Alyson Watson (W&C) gave a brief introduction to the beta link for the DMS. This has been sent out to the group via email.

5. Other Updates

   a. Projects are being reviewed. There are currently 40 in the draft list as of this meeting. These will be reviewed in more detail in the next meeting.

6. Public Outreach Update

   a. Feedback provided from the SC that the summary of the workshops is done well.

7. Interbasin Coordination Update – none.

8. Public Comment on Items not on the Agenda

   i. Breanne Ramos gave information on the Water Symposium Hosted by the Merced County Farm Bureau.

9. Next Steps and Next Meeting

Next Regular Meeting
February 25, 2019 at 9:30 a.m.
Castle Conference Center, 1900 Airdrome Entry, Atwater, CA
Information also available online at mercedsgma.org

Note: If you need disability-related modification or accommodation to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING MINUTES – Merced GSP

SUBJECT: Merced GSP Stakeholder Committee Meeting #10

DATE/TIME: February 25, 2019 at 9:30 AM

LOCATION: Castle Conference Center, 1900 Airdrome Entry, Atwater, CA

Stakeholder Committee Members In Attendance:

	Representative	Community Aspect Representation
☐	Alex McCabe	City of Livingston
☐	Arlan Thomas	Merced Irrigation District Advisory Committee (MIDAC), growers
☒	Ben Migliazzo	Live Oak Farms, growers
☐	Bill Spriggs	City of Merced, Merced Irrigation District
☒	Bob Salles	Leap Carpenter Kemps Insurance, insurance industry and natural resources
☐	Brad Robson	Buchanan Hollow Nut Co. Le Grand-Athlone Water District, growers
☒	Breanne Ramos	Merced County Farm Bureau
☒	Brian Carter	D&S Farms, growers
☐	Carol Bonin	Winton M.A.C.
☒	Daniel Machado	Machado Backhoe Inc., construction industry
☒	Darren Olguin	McSwain MAC
☐	Frenchy Meissonnier	Rice Farmer, rice growers
☒	Galen Miyamoto	Miyamoto Farms
☒	Gino Pedretti III	Sandy Mush Mutual Water Company
☐	Greg Olzack	City of Atwater resident
☐	James (Jim) Marshall	City of Merced
☒	Joe Scoto	Scoto Bros Farms / McSwain Union School District
☒	Ladi Asgill*	East Merced Resource Conservation District / Sustainable Conservation
☒	Maria Herrera	Self-Help Enterprises
☒	Mark Maxwell	University of California, Merced
☒	Maxwell Norton	Retired agricultural researcher
☒	Parry Klassen	East San Joaquin Water Quality Coalition, growers
☒	Rick Drayer	Drayer Ranch, Merced cattlemen
☒	Simon Vander Woude	Sandy Mush Mutual Water Company, dairies
	*Jean Okuye attended as alternate for Ladi Asgill	

Meeting Minutes

1. Welcome, Introductions, and Agenda Review
   a. Charles Gardiner (Catalyst) welcomed the group and went over ground rules.
2. Presentation by Woodard & Curran on GSP development
   a. Alyson Watson (Woodard & Curran) communicated goal of SC meeting is to provide input to the CC on the draft list of projects for the first iteration of the 2020 GSP.
   b. Alyson Watson (W&C) briefly described the state intervention that would be triggered if there is no adopted GSP by the deadline. Several questions were asked as follows:
      i. Question: Will our GSP have a *de minimus* fee? Answer (W&C): This will need to be determined by the GSAs.
      ii. Question: What happens if we have something adopted and then 5 or 10 years down the road, we are not compliant? Answer (W&C): W&C will follow up on confirming specifics for this process.
      iii. Clarification on *de minimus* users (W&C): These users who extract 2 AF or less per year for domestic purposes are subject to SGMA but cannot be required to meter. These are generally private users.
   c. Water Allocation Framework
      i. Alyson Watson (W&C) briefly reviewed the water allocation framework under consideration by the CC and explained that it is a framework to allocate the sustainable yield of the basin to each of the GSAs. The GSAs have discretion to determine how they allocate to their users.
      ii. Alyson (W&C) provided a summary of feedback from the GSAs. Main points included: making metering a priority in the first 5 years, recommendation for a 10-year historical baseline, consider population growth and infill for cities, and establishing thresholds during period 2020-2030 to prevent over pumping.
      iii. Clarification given (W&C) that GSAs will have the ability to enforce allocations through fees.
      iv. Clarification given (W&C) that the water allocation framework will not go into effect immediately once the GSP is approved. There is a lead time including an outreach period to help ensure users are categorized correctly.
      v. Comment from SC member: Member disagreed with not metering residential acres. Stated this would be good for planning.
      vi. Clarification given on conceptual timeline for allocation framework: The allocation framework is established first, followed by consideration for projects. The goal is to investigate how both will avoid undesirable results.
      vii. Question: Will these results be made available to SC? Answer (W&C): Yes, but these are not complete yet.

viii. Question: Will the team run the project list through the model? Answer (W&C): Not all projects. The point of today is to look at priorities that help narrow the project list.

ix. Comment: We should consider areas like the ranches in Mcswain that have landscape that can use a lot of water. Specifically consider whether they will be metered.

x. Comment: A policy for *de minimus* users should be developed. Other basins have done this based on an analysis of what these users are extracting and on knowledge of the region.

xi. Input from W&C: Yes, and there will also need to be a mechanism for people to have an opportunity to contest this policy.

xii. Comment: The City of Merced is 100% metered. Residential usage is generally half an AF/Y. Agricultural use is significantly higher than urban use on a per acre basis.

xiii. Question: Are high density houses included in this estimate for City of Merced? Answer (commentator): Yes, and these use even less AF/Y.

xiv. Question: What is meant by determining partial allocations for rangeland? Answer (W&C): GSAs have to decide how to determine what this allocation should be and consider assumptions of what to do in the case of water market. For example, what must be considered in trying to prevent outside investment.

d. Projects and Management Actions

i. Alyson reviewed the conceptual implementation timeline with respect to projects. Outreach will be important throughout this process. Updates will be every 5 years.

ii. Comment: The allocation program should be phased in during the 2025-2030 time period.

iii. Comment: SC should and is ready to start groundwater recharge projects. Projects should be started as soon as possible. Everyone in the basin needs to contribute in some way. Cities can set up their projects individually. This has been explored for a long time – need temporary use of working farmland. Details will have to be worked out by the governing bodies once we get that point.

iv. Comment: Need to be working on securing grant funding to implement projects as soon as possible because this will take time.

v. Comment: Projects for demand management will be painful. Should focus on recharge and supply projects first.

vi. Alyson Watson (W&C) briefly explained the number of projects by GSA and their allocation.

vii. The group discussed the permitting constraints around storing riparian water and flood flows. MID has proposed applying for a single Long Term Permit for Flood flows from the SWRCB. MBK will be providing a presentation to the CC next month on this topic.

viii. Alyson Watson (W&C) asked the SC several questions including: What projects, programs, or actions do you see as the highest priority for the basin? What further questions or concerns do you have in considering projects? Which projects should be in a short list vs. a general running list of potential projects? Are there additional projects that can help the GSP address groundwater quality issues? Input from the SC discussion on projects & management actions is summarized as follows:

1. Projects that already have funding should be prioritized.

2. It is important to understand what permits or regulatory requirements are applicable for each project.

3. Projects that result in direct GW recharge should be prioritized.

4. Go BIG project would address basin issues.

5. Projects should help address areas where there is the greatest need.

6. The Environmental Quality Incentives Program (EQIP) is a USDA funding program that can be used to for meters. This is a very good program.

7. The subbasin should also consider water quality projects from the SWRCB.

8. GSAs will also have responsibility to ensure continued pumping and access for areas needing water. This should be tied to minimum thresholds and avoiding undesirable results. Creating a fund for mitigation will be important to address needs arising between now and next 10 years. The sooner revenue is collected for that the better the state of the subbasin.

9. There are water treatment facilities, e.g. ponds in the Franklin-Beechwood area, that are antiquated and need to be addressed.

10. Addressing water quality is a part of any recharge program.

11. Comment from Hicham (MID): Have to consider with in lieu recharge, you are saving groundwater so that you can pump it when you need it. States he is not in favor of recycled water recharge because there are risks in introducing pathogens or poor water quality. It is better to keep groundwater where it needs to be. We can look at conveyance facilities that have an issue moving the water currently. This has the best cost/benefit ratio.

12. The subbasin will need to address the subsidence issue because this is part of why we were identified as a critically overdrafted basin.

13. Comment from Hicham (MID): MID is doing a study now with the El Nido Canal improvement project. The intent is to move water to subsidence areas and assist monitoring.

14. The subbasin should have near-term actions when it comes to projects.

15. Groundwater recharge, whether in lieu or direct, is important. Understanding permitting and regulatory permitting process is critical. Everyone should participate in finding a solution, including e.g. school districts.

16. Suggestion to limit outdoor watering to two days as general policy.

17. If the governor declares a drought emergency, then a 2 days policy is enforced. Per current ordinance, existing policy is 3 days for City of Merced.

18. Everyone should contribute. However, the way in which they contribute (e.g. pay) also depends on the user (e.g. ability to pay). Some people are going to benefit more than others.

19. General consensus from SC group: If you are a groundwater user then you will have to pay or contribute somehow to the solution for the subbasin.

20. Priority should go to those projects which are in planning and funding stages.

21. The Go Big Super-Connect project would cover the most area with the most recharge potential.

22. Comment from Charles Gardiner (Catalyst): The subbasin could look at conveyance projects that are not as large and are near-term.

23. Comment from Hicham (MID): MID's Main Canal has been under the purview of Amy Corps Engineers for flood control. MID could move water outside of MID starting March onward, but no one wants it then (e.g. could move 2,000 cfs from Bear Creek). Automation and capacity would be the first things to target. These could be one of the projects. We know what is in MID and where we could recharge, but outside MID we need to work with folks in the basin and see how we can move that water.

24. Question: Could the SC suggest to the GSAs that constant drought conditions regulations be put in place? (e.g. in restaurants water given when requested) Answer (W&C): Municipalities have the authority to enforce conservation, but the GSAs could work with the cities to encourage this. GSAs could apply for funding for the cities to implement a conservation program.

25. Question: Are there areas within our basin we know have the greatest need – is there a way to determine where these areas are? Answer: There are areas where undesirable results have occurred in the past. The area serviced by the Trucked Water Program is an example.

26. Comment: The areas with potentially greatest need are located along the eastern side of the subbasin.

27. Comment from Hicham (MID): There may be $5-10M in funds for implementing projects. This is a rough estimate.

e. Next Steps in GSP Development

   i. Alyson Watson (W&C) reviewed the timeline for draft GSP development.

f. Other Updates

   i. Beta test link is available for the Merced GSP data management system.

3. Public Outreach Update

   a. The next public workshop takes place in Livingston this evening.

4. Interbasin Coordination Update

   a. None. Interbasin coordination is expected to pick up in the next couple of months.

5. Public Comment on Items not on the Agenda

   a. None.

6. Next Steps and Next Meeting

   a. Projects and Management Actions review

   b. Minimum Thresholds and Measurable Objectives

Next Regular Meeting
March 25, 2019 at 9:30 a.m.
Castle Conference Center, 1900 Airdrome Entry, Atwater, CA
Information also available online at mercedsgma.org

Note: If you need disability-related modification or accommodation to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING MINUTES – Merced GSP

SUBJECT: Merced GSP Stakeholder Committee Meeting #10

DATE/TIME: March 25, 2019 at 9:30 AM

LOCATION: Castle Conference Center, 1900 Airdrome Entry, Atwater, CA

Stakeholder Committee Members In Attendance:

	Representative	**Community Aspect Representation**
☐	Alex McCabe	City of Livingston
☒	Arlan Thomas	Merced Irrigation District Advisory Committee (MIDAC), growers
☒	Ben Migliazzo	Live Oak Farms, growers
☒	Bill Spriggs	City of Merced, Merced Irrigation District
☒	Bob Salles	Leap Carpenter Kemps Insurance, insurance industry and natural resources
☒	Brad Robson	Buchanan Hollow Nut Co. Le Grand-Athlone Water District, growers
☒	Breanne Ramos	Merced County Farm Bureau
☒	Brian Carter	D&S Farms, growers
☐	Carol Bonin	Winton M.A.C.
☒	Daniel Machado	Machado Backhoe Inc., construction industry
☒	Darren Olguin	McSwain MAC
☐	Frenchy Meissonnier	Rice Farmer, rice growers
☒	Galen Miyamoto	Miyamoto Farms
☒	Gino Pedretti III	Sandy Mush Mutual Water Company
☐	Greg Olzack	City of Atwater resident
☐	James (Jim) Marshall	City of Merced
☒	Joe Scoto	Scoto Bros Farms / McSwain Union School District
☒	Ladi Asgill*	East Merced Resource Conservation District / Sustainable Conservation
☐	Maria Herrera	Self-Help Enterprises
☒	Mark Maxwell	University of California, Merced
☒	Maxwell Norton	Retired agricultural researcher
☒	Parry Klassen	East San Joaquin Water Quality Coalition, growers
☒	Rick Drayer	Drayer Ranch, Merced cattlemen
☐	Simon Vander Woude	Sandy Mush Mutual Water Company, dairies
	*Jean Okuye attended as alternate for Ladi Asgill	

1. Welcome, Introductions, and Agenda Review
    a. Charles Gardiner (Catalyst) welcomed the group and reviewed the agenda items for the meeting.
2. Presentation by Woodard & Curran on GSP development
    a. Projects and Management Actions
        i. Alyson Watson (Woodard & Curran) provided a brief overview of the GSP Conceptual Timeline.
        ii. Tess Sprague (Woodard & Curran) gave description of the work to date on updating the Projects and Management Actions lists and reviewed the handout contents. Handouts contained the draft shortlist and running list of current potential projects for consideration in the GSP.
        iii. General input from Stakeholder Committee members and interested public:
            1. Water for habitat should be considered in the priorities for shortlisted projects.
            2. The importance of recharge and conveyance projects stressed, especially in the early phases of GSP implementation.
            3. Projects to be implemented in the first five years should include projects related to monitoring, reporting, data modeling, and studies that assist in gathering needed data.
            4. Priority should also be given for projects addressing subsidence.
            5. A "fatal flaw" filter should be applied, whereby a project should be removed from the list if the relevant implementing agency has already indicated it will not support the project.
            6. Drinking water should be a priority for shortlisted projects.
            7. Priority should also be given to projects that provide incentives to reduce pumping and to capture surface water, especially those that encourage capture of flood flows and purchasing of out of district water).
    b. Climate Change Analysis
        i. Alyson Watson (W&C) gave an introduction to the climate change analysis. Merced Subbasin GSA is using DWR provided climate change factors and is following the DWR approach.
        ii. Question: DWR has projected increase in evapotranspiration? Answer (W&C): Yes.
        iii. Question: Can you explain evapotranspiration? Answer (W&C): Evapotranspiration is essentially the water demand of the crop. This can also be influenced by precipitation.

iv. Question for follow up: Is DWR updating the climate change modeling? (Every 5 years?) Answer: We assume that this data is will not stay the same up until 2040. It is likely subject to change. There is a guidance document from DWR that provides further information. (Link to guidance document here)

v. Comment: With the 2020 deadline we should use the DWR data and hopefully get enough data after this point to make the output more locally relevant.

vi. Comment: There is no harm in including climate change in the GSP analyses, but there are more pressing issues until 2020.

vii. Question: What is the order of magnitude difference with the perturbation (change) factors? Answer: W&C to follow up and get this information from the analysis and DWR data.

c. Next Steps in GSP Development

i. Alyson Watson (W&C) reviewed the anticipated timeline and release of chapters for the Merced Subbasin GSP.

ii. Question: Where are the GSAs at with approving these parts? Answer (W&C): Major sections and particularly the water budget has been sent out to the GSA staff for review and comment as technical memos.

d. Other Updates

i. Alyson Watson (W&C) gave an overview of the preliminary work completed for Undesirable Results and addressed the Sustainability Goal. These will be revisited in the next meeting with greater focus on the Undesirable Results.

ii. Alyson explained what thresholds are in general and what does it mean to violate a threshold. Alyson gave a brief description for each sustainability indicator and what an Undesirable Result could be for each.

iii. Question: Are subsidence and loss storage the same thing? Answer (W&C): Storage is about whether there is sufficient storage to meet the needs of the users, whereas land subsidence is whether land subsidence is occurring because of a depleted aquifer and is causing changes to land elevation.

iv. For depletions of interconnected surface water, potential Undesirable Results may include effects on operations of upstream reservoirs and or reduction in viability of agriculture, fishery production, riparian habitat, and recreation usage.

v. Alyson provided an example of the approach that is in progress for next steps: To generate analysis under the sustainable yield scenario and consider groundwater elevations to set Minimum Thresholds.

vi. Question: Is this analysis done by your (W&C) modelers? Answer: Yes, we took the cumulative storage run, pulled the well data, and conducted the modelling analysis.

vii. Question: Are we confident that the Minimum Thresholds aren't too low? Answer: No, and this is the purpose of the continuing the analysis to get clarity on appropriate threshold levels.

viii. Question and clarification on what is in the example shown on slide 25: The example shows whether the well would be dewatered (a potential Undesirable Result) over time. It shows historical data, depth to ground water, and the projected levels with the Sustainable Yield scenario.

ix. The analysis helps determine what is an Undesirable Result, and where the Minimum Threshold should be. For example, a threshold can be set to the level at which you are up to the point of not dewatering the wells. The next step is to analyze how this works with sustainable yield and see if Undesirable Results still occur with Minimum Thresholds.

x. Question: Will there be a model run completed that includes projects? Answer (W&C): There are a few ways to do this. This is a later step in the analysis process.

xi. Question: What is the policy background for the Minimum Thresholds? Answer (W&C): The policy pursued is to take the historical variation, doubled this and check if dewatered wells occur within a three-mile radius of the CASGEM monitoring wells. We have to determine minimum thresholds and how these are violated.

xii. Question: Are there conceptual monitoring wells? Answer (W&C): CASGEM wells are used for monitoring and compliance. Wells outside of the CASGEM network generally do not have adequate historical data. If outside wells are used, it is important to consider wells that have sufficient data because these can be used for a regulatory trigger if their Minimum Thresholds are exceeded. Thresholds have to be representative of basin conditions.

xiii. Comment: What about the subsidence area? Do we have wells in these areas? Answer (W&C and MID): Additional monitoring wells will likely be needed for these areas.

xiv. Comment: Could the El Nido monitoring wells be used to address this issue? Answer (MID): This could be an option.

xv. Question: How do we deal with thresholds for wells above and below the Corcoran Clay? Answer (W&C): We need to look at Undesirable Results for the above, below and beside the Corcoran Clay layer. How this relates to the subsidence area is a complex issue.

xvi. Comment: Chowilla is having the same issue in the Triangle T area. They are paying, and their neighbors are pumping from the deep aquifer. They are basically already trading credits above and below within a water district.

xvii. Comment: In the example chart provided for Undesirable Results and Minimum Thresholds, it would be helpful to flip the left and right axis.

3. Public Outreach Update

   a. The February public workshop summary is available on the website. The next public workshop is anticipated to take place in May.

4. Interbasin Coordination Update

   a. The W&C team has been coordinating with the Chowchilla Madera and Turlock teams. Calls took place to exchange and coordinate on technical data needs. Additional meetings are planned in the next two months.

5. Public Comment on Items not on the Agenda

a. Comment: The policy in setting Minimum Thresholds is very interesting. What about the level of communication between consultants throughout the valley for different subbasins? The observation of the commentator is that policy approaches are very consultant driven. At the consultant level, to what extent is the Merced team coordinating with others. Kern and others seem to be setting very low thresholds that are likely not ever going to be exceeded.

b. Answer (W&C): The Merced team is following the BMPs from DWR. The folks at DWR who wrote the BMPs will be the people evaluating whether these have been followed and whether requirements have been met. Ethically, we would not support setting thresholds as low as we can go, but the threshold level is up to the basin. Interbasin flows are important, SGMA states you cannot impact interbasin flows. The challenge is that we are all on the same schedule. All basins are having to set up processes.

c. Comment: DWR should have a closed door, very highly recommended workshop on approach and methods for minimum thresholds with all of the hydrogeologists. It is not fair to have stakeholders sort this out.

d. Question: Have we looked at other places in the county, e.g. the Ogallala Aquifer area and see what they are doing? Answer: No, but we are modeling outside of the basin.

e. The W&C team is also reaching out to DWR to set up a discussion on Minimum Thresholds and Undesirable Result methods.

f. Question: Interbasin flows are taken into consideration in our analysis? Answer (W&C): Yes.

6. Next Steps and Next Meeting

a. The focus of the next meeting will be primarily on Undesirable Results and Minimum Thresholds.

b. W&C will send out a Doodle poll to find an alternate date for the May Stakeholder and Coordinating Committee meetings. These meetings are currently scheduled to take place on Memorial Day.

Next Regular Meeting
April 22, 2019 at 9:30 a.m.
Castle Conference Center, 1900 Airdrome Entry, Atwater, CA
Information also available online at mercedsgma.org

Note: If you need disability-related modification or accommodation to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING MINUTES – Merced GSP

SUBJECT: Merced GSP Stakeholder Committee Meeting #12

DATE/TIME: April 22, 2019 at 9:30 AM

LOCATION: Castle Conference Center, 1900 Airdrome Entry, Atwater, CA

Stakeholder Committee Members In Attendance:

	Representative	Community Aspect Representation
☐	Alex McCabe	City of Livingston
☐	Arlan Thomas	Merced Irrigation District Advisory Committee (MIDAC), growers
☐	Ben Migliazzo	Live Oak Farms, growers
☒	Bill Spriggs	City of Merced, Merced Irrigation District
☒	Bob Salles	Leap Carpenter Kemps Insurance, insurance industry and natural resources
☒	Brad Robson	Buchanan Hollow Nut Co. Le Grand-Athlone Water District, growers
☒	Breanne Ramos	Merced County Farm Bureau
☐	Brian Carter	D&S Farms, growers
☒	Carol Bonin	Winton M.A.C.
☒	Daniel Machado	Machado Backhoe Inc., construction industry
☒	Darren Olguin	McSwain MAC
☐	Frenchy Meissonnier	Rice Farmer, rice growers
☐	Galen Miyamoto	Miyamoto Farms
☒	Gino Pedretti III	Sandy Mush Mutual Water Company
☐	James (Jim) Marshall	City of Merced
☒	Joe Scoto	Scoto Bros Farms / McSwain Union School District
☒	Ladi Asgill*	East Merced Resource Conservation District / Sustainable Conservation
☐	Maria Herrera	Self-Help Enterprises
☐	Mark Maxwell	University of California, Merced
☒	Maxwell Norton	Retired agricultural researcher
☒	Parry Klassen	East San Joaquin Water Quality Coalition, growers
☒	Rick Drayer	Drayer Ranch, Merced cattlemen
☒	Simon Vander Woude	Sandy Mush Mutual Water Company, dairies
	*Jean Okuye attended as alternate for Ladi Asgill	

1. Welcome, Introductions, and Agenda Review
    a. Charles Gardiner (Catalyst) welcomed the group and reviewed the agenda items for the meeting.
2. Presentation by Woodard & Curran on GSP development
    a. Climate Change Analysis
        i. Alyson Watson (W&C) described the regulations that apply for the climate change analysis and described the overall process used for Merced GSP.
        ii. The approach is consistent with the Department of Water Resources (DWR) recommended approach. A change factor from DWR is applied to the Projected Data Baseline to simulate the impact of climate change. This creates the Climate Change Baseline, which is put into the Merced model. The output is the Climate Change Water Budget. The change (or perturbed) variables include streamflow, precipitation, and evapotranspiration (ET).
        iii. Alyson Watson (W&C) provided an example of precipitation using the Climate Change Analysis. The dark line is the regional average baseline. The blue line is the changed, or perturbed precipitation using factors from DWR. Generally, precipitation during a typical event is projected to be similar to the baseline conditions, but under climate change peak rain events are projected to be higher.
        iv. Similar DWR factors are used for ET. An example for orchards shows a seasonal pattern of peaking in the summer months and a projected average increase in these months of 8%.
        v. For surface water supplies, projections indicate that in wetter years (wetter season) there would be greater surface water, and in drier years (drier seasons) there would be less surface water.
        vi. For groundwater production, the graph shows the difference in groundwater pumping with the climate change scenario. In general, there is an increase in groundwater demand as result of climate change conditions.
        vii. Summary of climate change scenario: Changed storage reduction is projected to increase from 82K AFY to 130K AFY. This analysis did not rerun the MIDH2O model to see how operations would change. The purpose of analysis was to get an order of magnitude understanding of how climate change might affect the basin.
        viii. Comment: Suggestion to use the same units as some units for precipitation and ET are in mm and others are in inches.
        ix. Question: Regarding the precipitation example, is this the actual data and climate change is applied to this? Answer (W&C): We are taking the baseline and applying the DWR change (or perturbation) factors. What is visualized is a snapshot of 20 years. We have looked at the historical streamflow and actual deliveries to calibrate the model to gain an order of magnitude analysis for climate change. Analysis based on DWR guidance and DWR factors applied to see what this looks like for the basin and to help us understand in the future if the basin is trending a certain way.
    b. Undesirable Results & Minimum Thresholds
        i. Alyson Watson (W&C) explained Undesirable Results (URs) and Minimum Thresholds (MTs), provided definitions and reviewed what was discussed in previous meetings.

ii. The GSP goal is to try to bring the basin into balance. The GSP will need to define what is significant and unreasonable for URs. It is important to prevent these URs, because if they are violated there can be state intervention.

iii. Sustainable Management Criteria Definitions: There may be a specific groundwater condition where wells went dry and enough wells went dry that we determine this should not happen again. This could be defined as an UR. An MT can be set at a depth at which this is not going to happen. Our Measurable Objective (MO) will be set at a shallower depth (this is a depth we are trying to reach). We want to work between these two (the MO and the MT) within the Margin of Operational Flexibility. There are no triggers for meeting the MOs. A violation occurs if URs occur. MTs are set to avoid URs. One well being in violation once is not significant and unreasonable, but a certain percentage going dry could be. Specifications can be established for dry years. The goal is to identify a way to prevent URs.

iv. Alyson (W&C) explained each well has its own location and levels. There are 20 locations we are looking at for establishing wells with MTs, but when are there significant and unreasonable URs? Alyson asked the group for input on what is significant and unreasonable. Comments for this are provided after further presentation of slide content.

v. Chronic Lowering of Groundwater Levels: This was discussed qualitatively for URs and needs to be quantified. MTs will be established for a representative subset of wells that are part of the monitoring network. CASGEM wells were used as a starting point for these monitoring wells because they follow closely to SGMA requirements. There should be monitoring wells in all three aquifers (above, below and outside Corcoran Clay). W&C looked at domestic wells and used the Merced County database. W&C looked at the depth of the shallowest domestic well and removed statistical outliers. The shallowest domestic well within a 2-mile radius buffer from each CASGEM well was compared against MTs. An example hydrograph was provided to show MTs, observed data, and a run from 2040 with 50 years of hydrology get to 2090 for Sustainable Yield.

vi. Question: Was the process described conducted for all CASGEM wells? Answer (W&C): Yes.

vii. Question: The wells are all different. If some are dry, does that throw the entire basin out of compliance. Answer (W&C): Good question. The basin (GSAs) have to decide first how this should be approached. The basin can decide if one well goes dry that this is significant and unreasonable. If the basin violates whatever if has self-defined, then there can be state intervention. There is no trigger for violating Measurable Objectives. However, if URs are violated this triggers state intervention.

viii. Alyson Watson (W&C) explained there is an area (identified by a red circle) on the slide with a high level of uncertainty for determining MTs. Some CASGEM wells are new, some do not have enough historical data to calibrate for the model. Alyson asks the group what are there issues in this area? Are you aware of areas where wells are not deep enough? Or have been dug deeper?

ix. Comments from the SC group and public:

    1. Comment (MSGSA staff): The current status for the wells in the Trucked Water Program is uncertain. There are about six wells that did not have a solution for how to move forward at the end of the program. They are looking into what has happened in these cases.

    2. Comment (SC): Member is currently decommissioning a 300ft well, and is now punching through a 1000ft well.

3. Input from W&C: In looking at the distribution of the domestic well depths, the ones driving the issues are the 125ft depth wells.
4. Alyson (W&C) asks the group: Are there a significant number of wells in this area that are dry or cannot access groundwater? And is this significant and unreasonable?
5. Comment (SC): Member states in his area have had five wells that have gone dry and been replaced.
6. Comment (SC): There are many folks who are helping their neighbors and connecting to their neighbors water sources. Some areas to consider for this are Planada and Le Grand.
7. General response from SC group: Yes, there are wells that have gone dry. There are issues in the highlighted red area on the map.
8. Alyson (W&C) asks group: Are these issues described significant and unreasonable?
9. Comment (public): There could be a management area set up for this area. We could gather data now and get data from locals as we figure out who has gone dry and who is connected to their neighbors or Community Service Districts.
10. Comment (SC): We could identify the data gaps and what we are doing in lead up to our five year plan update.
11. Question: How flexible can this language be? Answer (W&C): We have seen flexibility with other basins. For example, with the use of a percentage of wells to indicate an URs. However, we need to be able to justify and make a case for why this is significant and unreasonable up to this point (or when this percentage of wells is reached). We have also seen exceptions for dry years from other basins.
12. Alyson (W&C) explained that this area could be carved out as a management area. However, there will still be similar challenges. It is possible to say that more monitoring is needed. Some basins use a twice a year frequency, which is a potential minimum because SGMA requires consideration of seasonal variability.
13. Comment (public): Some areas in the Subbasin will have potentially more, or easier, access to gravity flow source while other areas might require more pumping. This is something to consider in future planning and implementation.
14. General understanding from SC group: This area needs to be addressed and identified as a gap area in the GSP. More investigation is required, which will likely need to take place during GSP implementation due to current time constraints.
15. Alyson (W&C) suggested that the pathway forward is to still use the CASGEM wells, and to set thresholds for those that are appropriate (not all CASGEM wells would require setting MTs at this moment).
16. Comment (MID): There is a need for more monitoring wells on the ground. Response (W&C): We expect to have a broader monitoring network than the subset of wells we are currently focusing on.

x. Storage: Alyson (W&C) explained change in storage is about 0.3% per year. In terms of total water available, we do not anticipate significant and unreasonable URs occurring in the future. Therefore, no MTs are needed. Another approach is to take groundwater elevation (GWE) levels as a proxy and state that GWE levels are protective. A third approach is to say URs do not occur until a reduction by 10MAF is reached, and then report on this over time. W&C has suggested not to set thresholds and to provide an explanation for this. We are still waiting to hear back from DWR on this approach.

xi. Comment: Thinks that this approach might not be approved by DWR.

xii. Comment: If the science is sound, this approach should be fine.

xiii. Clarification (W&C): For each sustainability indicator, including storage, the basin has to determine if URs are not an issue.

xiv. Seawater Intrusion: Alyson (W&C) explained that this indicator is not applicable for the Merced GSP, as it is not present and not likely to occur for the subbasin. Salinity is addressed as an MT under “Degraded Water Quality”.

xv. Degraded Water Quality: Thresholds should be based on our actions, where groundwater extractions effect groundwater quality. Existing cleanup sites have been previously mapped, which can ensure that new recharge sites are not put in these places and potentially cause water quality issues (e.g. extension of plumes). Where contaminants are regulated under existing programs, communication will be established with these programs. It is not necessary to take responsibility for these contaminants when they are regulated under existing mechanisms and frameworks. However, the Merced GSP will be addressing salinity.

xvi. Alyson (W&C) requested input from the group on proposed MTs for salinity. A current limit of 1000mg/L TDS is proposed for discussion. Does this sound reasonable? From a crop perspective is using this limit appropriate?

1. Feedback from SC group:

    a. Comment: For pistachio’s this would be fine, but for peaches and almonds this could be an issue over a long time period.

    b. Question (MID): How is this managed currently for almonds? Response (SC): In the western parts of the Subbasin they use blending to manage salinity levels.

    c. Comment: Generally for 90% of the group this would not be a problem.

xvii. Subsidence: Alyson (W&C) explained the current approach for subsidence. The approach has been to not measure land subsidence directly, but to measure using groundwater levels as a proxy for future subsidence.

xviii. Comment: There is another basin who tried to use groundwater levels for all sustainability indicators, but have to change this after discussions with DWR. This basin also had more issues with subsidence than Merced Subbasin.

xix. Question: Why not have prevention of further subsidence as a goal? Answer (W&C): We would not want to set this as a goal because even if pumping stopped, there would still be further subsidence from prior pumping.

xx. Depletion of Interconnected Surface Water: URs, MTs for this indicator are challenging. What can be measured or estimated in the modeling is streamlosses. The greatest losses actually occur in wet years because there is a lot more water in the stream channel. There is also not a clear UR. The consulting team has tried to come up with a threshold that would keep within the historical range of depletions. We have taken out wet years, looked at historical losses, and considered the 5-year average within this range. The goal is to not exceed historical losses.

xxi. Comment: Commentator is hesitant to bring in rivers with fisheries with major reservoirs into the analysis.

c. Next Steps in GSP Development

i. Alyson Watson (W&C) reviewed the anticipated timeline and release of chapters for the Merced Subbasin GSP.

ii. Question: Where are the GSAs at with approving these parts? Answer (W&C): Major sections and particularly the water budget has been sent out to the GSA staff for review and comment as technical memos.

d. Other Updates

i. No additional updates at this time.

3. Public Outreach Update

a. The next public workshop will take place May 29th at the Atwater Community Center. Notices and additional information will be posted on the Merced SGMA website.

4. Interbasin Coordination Update

a. For interbasin agreements, W&C team has been reaching out to Delta-Mendota and has been looking at Chowchilla and the Turlock agreements as models for potential agreement structure and content.

5. Public Comment on Items not on the Agenda

a. Comment provided: There is still some money available for disadvantaged communities through government funds. These should be taken advantage of.

b. Comment from SC member: It would be good for the SC group to receive an update of what occurred in the most recent CC meetings to stay up to date.

6. Next Steps and Next Meeting

a. Focus for May will be on Minimum Thresholds and Measurable Objectives and Implementation Planning.

Next Regular Meeting
May 29, 2019 at 9:30 a.m.
Castle Conference Center, 1900 Airdrome Entry, Atwater, CA
Information also available online at mercedsgma.org

Note: If you need disability-related modification or accommodation to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING MINUTES – Merced GSP

SUBJECT: Merced GSP Stakeholder Committee Meeting #13

DATE/TIME: May 29, 2019 at 9:30 AM

LOCATION: Castle Conference Center, 1900 Airdrome Entry, Atwater, CA

Stakeholder Committee Members In Attendance:

	Representative	Community Aspect Representation
☐	Alex McCabe	City of Livingston
☒	Arlan Thomas	Merced Irrigation District Advisory Committee (MIDAC), growers
☒	Ben Migliazzo	Live Oak Farms, growers
☒	Bill Spriggs	City of Merced, Merced Irrigation District
☒	Bob Salles	Leap Carpenter Kemps Insurance, insurance industry and natural resources
☒	Brad Robson	Buchanan Hollow Nut Co. Le Grand-Athlone Water District, growers
☐	Breanne Ramos	Merced County Farm Bureau
☐	Brian Carter	D&S Farms, growers
☐	Carol Bonin	Winton M.A.C.
☒	Daniel Machado	Machado Backhoe Inc., construction industry
☒	Darren Olguin	McSwain MAC
☒	Frenchy Meissonnier	Rice Farmer, rice growers
☒	Galen Miyamoto	Miyamoto Farms
☒	Gino Pedretti III	Sandy Mush Mutual Water Company
☐	James (Jim) Marshall	City of Merced
☒	Joe Scoto	Scoto Bros Farms / McSwain Union School District
☒	Ladi Asgill	East Merced Resource Conservation District / Sustainable Conservation
☒	Maria Herrera	Self-Help Enterprises
☐	Mark Maxwell	University of California, Merced
☐	Maxwell Norton	Retired agricultural researcher
☒	Parry Klassen	East San Joaquin Water Quality Coalition, growers
☐	Rick Drayer	Drayer Ranch, Merced cattlemen
☐	Simon Vander Woude	Sandy Mush Mutual Water Company, dairies

*Jean Okuye attended as alternate for Ladi Asgill

Meeting Minutes

1. Welcome, Introductions, and Agenda Review
    a. Charles Gardiner (Catalyst) welcomed the group and reviewed the agenda items for the meeting.
2. Coordinating Committee Update
    a. Hicham ElTal (MIUGSA) provided an update on the Coordinating Committee meeting in April, including a summary of the climate change presentation, sustainable management criteria (broken down by individual sustainability indicator), as well as the implementation timeline.
    b. Hicham also provided a quick update on the Santa Clara Valley Water District proposal to buy 5,000 acres located in the Merced Subbasin to use as a water bank.
        i. Point was raised that Merced County would need to provide a permit to export groundwater per Ordinance. SCVWD would need to go through CEQA. An exemption for water districts does not apply as this exemption is only for water districts within the County.
        ii. SC reached consensus to provide recommendation to CC that GSP should incorporate a policy statement about intent of GSP to encourage land use ordinances, but noting that GSP doesn't necessarily have the authority to enforce. CC might be able to take that to their individual GSAs if it is groundwater being exported (not necessarily for surface water).
        iii. Comment: Concern that there is no surface water in this land region and poor percolation. Not sure how it can be used as a water bank. Might be information we're missing, so intent is to gather more information.
3. Presentation by Woodard & Curran on GSP development
    a. Management Areas
        i. Alyson Watson (W&C) defined Management Areas and how and why they might be implemented. Charles Gardiner (Catalyst) provided an example where faults located in the center of a different basin interrupt water flows and it was selected as a management area where conditions were different than other areas.
        ii. Question: Have management areas been defined in the Merced Subbasin? Answer: Not yet, the team has been focusing on building an understanding and framework for the whole Subbasin, and then evaluate the need for management areas. Now we're at that evaluation point, e.g. maybe the subsidence area is one example of a possible management area.
        iii. Question: Do we have a model of groundwater levels and flow directions? Answer: Yes, this is contained within the MercedWRM and also described in the Hydrogeologic Conceptual Model section of the GSP.
        iv. Question: Should we be looking at urban vs rural in terms of different thresholds, recharge and reuse of treated water, and converting to surface water? Answer: We can implement different projects in different areas of the Subbasin regardless of management areas.
        v. Comment: Management areas have been used in other Subbasins to focus on more stringent thresholds to protect vulnerable areas. Response: We have focused on shallow water areas via groundwater levels all over the Subbasin and set conservative thresholds based on shallow domestic wells; the limitation on setting more thresholds in these areas are that there are not wells in all these areas.

vi. Comment: Poorer water quality on the West side of the Subbasin may necessitate different management areas on the east vs west but not sure how to implement. Recharge in areas with lower water quality would help water quality. Response: A more restrictive threshold can still apply to the whole Subbasin even though it's developed based on just the lower water quality area.

b. Sustainable Management Criteria

i. Alyson Watson (W&C) walked through the sustainable management criteria for each of the sustainability indicators.

ii. Question: Is there science that quantifies the delay factor of subsidence due to previous pumping? 2 consecutive years used for the definition of undesirable results for land subsidence may not be sufficient or realistic. Answer: We've tried to address this by avoiding exceeding historical rates of subsidence by maintaining current rate or less. We are also not trying to achieve 0 subsidence because this is likely unreasonable.

iii. Comment/concern: Not sure if we have decided if Jan 1, 2015 is representative if historical groundwater levels indicate that the shallowest domestic well(s) may have been dewatered already. As-is, we might be restricting ourselves and need to select a deeper minimum threshold in these cases.

iv. Question: Why don't we have thresholds in the southern area of the Subbasin? Answer: No CASGEM wells currently available (data record limitations or no construction information: ultimately do not meet CASGEM monitoring requirements), but will be able to use the same methodology to implement new wells in future (as described in data gaps section of GSP). Goal to implement additional wells in the first five years of GSP implementation.

v. Question: How much funding do we have for monitoring wells? Answer: 2 monitoring wells in El Nido have been applied and received. The Subbasin is changing the request for Technical Support Services (TSS) from a monitoring well to a continuous GPS station for a number of reasons.

vi. Question: The GSAs are not establishing minimum threshold for contaminants besides salinity – why wouldn't we to set additional thresholds for these other contaminants and meet them by coordination with other agencies? Answer: The GSAs could choose to set minimum thresholds for other contaminants, but there are challenges for making any change or impact on the issue if a threshold was to be exceeded, for example due to natural arsenic increases or due to a commercial user with a toxic contaminant. It's difficult for GSAs to assume responsibility because there's no control over many of these contaminants. Salinity is an issue where changes in pumping can have an impact.

1. One thing to look at would be having an annual review process internal to look at other agency data. Ultimately, project implementation is where we have control.

vii. Question: What are the water quality challenges as of 2015? Answer: We've met with SC, CC, GSAs, and Merced County Environmental Health to identify these issues. They have been laid out in the Current and Historical Conditions section.

viii. Comment: CV-SALTS is about to go before the State in August to adopt new basin plan. Prioritization and optimization study with deep dive on data analysis to identify hotspots of salts, with results coming out over next 10 years. Nitrate control plans are already in place for ILRP, but additional nitrate control efforts have started in Chowchilla, Turlock, and Modesto Subbasins.

ix. Amanda Peisch-Derby (DWR): DWR cautions against an approach that simply references other water quality programs for addressing other water quality parameters. Amanda shared that she was not clear on how the GSP will become aware of issues and track. Additionally, exceedances of an MT don't have to mean undesirable results are immediately applicable.

x. Alyson framed that many of the suggestions provided for addressing additional contaminants are good basin management actions that should likely be implemented. However, this is different than self-imposed regulatory requirements (minimum thresholds) that include responsibility for managing the problem.

xi. Comment: Other GSAs appear to be doing a more thorough analysis of water quality constituents against MCL/SMCL levels and impacts of pumping on historical water quality and they are thinking about ways to deal with them. Response: Other subbasins are implementing thresholds but adding a disclaimer specifically "as impacted by groundwater pumping". The difference there is that they need to pay for monitoring wells that meet the standards and also back it up with analysis in every reporting cycle to prove whether it was or wasn't due to groundwater pumping on likely a regular basis.

xii. Lots of discussion ensued about what does a coordination program look like, what is enforceable, what does the Subbasin want.

xiii. Public Comment: Need to figure out how to reduce pumping so that total water volume increases and thus improves water quality. Water quality is a trigger.

c. Implementation Plan

i. Alyson Watson (W&C) gave a brief outline on implementation planning steps for the GSP that are currently underway, as well as a schedule for future implementation of the GSP.

ii. Comment: GSP needs to consider economics of the region in setting the implementation time period while balancing the need to avoid perverse incentives for single users to exploit supplies.

d. Next Steps in GSP Development

i. Included a summary of upcoming section review drafts to expect.

e. Other Updates

i. Included a summary of upcoming section review drafts to expect.

4. Public Outreach Update

a. The next public workshop will take place May 29th at the Atwater Community Center. Notices and additional information will be posted on the Merced SGMA website.

5. Interbasin Coordination Update

a. A meeting with Turlock was just held. Also developing a draft agreement on how to coordinate in the future with Delta-Mendota (which is on a tight timeline and does not expect to be able to coordinate on data sharing unless there has been sufficient time for internal review).

6. Public Comment on Items not on the Agenda
    a. Comment provided:
        i. What is the status of the Castle Air Force Base groundwater quality cleanup? Answer: Lots of progress has been made in recent decades, but it is ongoing.
7. Next Steps and Next Meeting
    a. Focus for June will be on comments on draft sections and process for GSP Adoption and next steps.

Next Regular Meeting
June 24, 2019 at 9:30 a.m.
Castle Conference Center, 1900 Airdrome Entry, Atwater, CA
Information also available online at mercedsgma.org

Note: If you need disability-related modification or accommodation to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING MINUTES – Merced GSP

SUBJECT: Merced GSP Stakeholder Committee Meeting #14

DATE/TIME: June 24, 2019 at 9:30 AM

LOCATION: Castle Conference Center, 1900 Airdrome Entry, Atwater, CA

Stakeholder Committee Members In Attendance:

	Representative	Community Aspect Representation
☐	Alex McCabe	City of Livingston
☐	Arlan Thomas	Merced Irrigation District Advisory Committee (MIDAC), growers
☒	Ben Migliazzo	Live Oak Farms, growers
☒	Bill Spriggs	City of Merced, Merced Irrigation District
☒	Bob Salles	Leap Carpenter Kemps Insurance, insurance industry and natural resources
☐	Brad Robson	Buchanan Hollow Nut Co. Le Grand-Athlone Water District, growers
☒	Breanne Ramos	Merced County Farm Bureau
☒	Brian Carter	D&S Farms, growers
☐	Carol Bonin	Winton M.A.C.
☒	Daniel Machado	Machado Backhoe Inc., construction industry
☐	Darren Olguin	McSwain MAC
☒	Frenchy Meissonnier	Rice Farmer, rice growers
☒	Galen Miyamoto	Miyamoto Farms
☒	Gino Pedretti III	Sandy Mush Mutual Water Company
☐	James (Jim) Marshall	City of Merced
☒	Joe Scoto	Scoto Bros Farms / McSwain Union School District
☐	Ladi Asgill	East Merced Resource Conservation District / Sustainable Conservation
☒	Jean Okuye (alternate to Ladi Asgill)	
☐	Maria Herrera	Self-Help Enterprises
☐	Mark Maxwell	University of California, Merced
☒	Maxwell Norton	Retired agricultural researcher
☒	Parry Klassen	East San Joaquin Water Quality Coalition, growers
☒	Rick Drayer	Drayer Ranch, Merced cattlemen
☒	Simon Vander Woude	Sandy Mush Mutual Water Company, dairies

Meeting Minutes

1. Welcome, Introductions, and Agenda Review

    a. Charles Gardiner (Catalyst) welcomed the group and reviewed the agenda items for the meeting.

2. Coordinating Committee Update

    a. Alyson Watson (Woodard & Curran) provided a summary of the previous Coordinating Committee (CC) meeting in May 2019:

        i. CC discussed and decided not to have management areas.

        ii. When looking to fill data gaps, identified that a new methodology to determine minimum thresholds may be needed for representative wells with limited or no historical data and/or no domestic wells within a 2-mile radius.

        iii. Discussed minimum threshold for salinity, such as in areas where TDS is higher, it is not currently considered an undesirable result due to blending and current management practices.

        iv. Discussion on water quality and additional constituents beyond TDS: decision was to circle back to Merced County Division of Environmental Health. The Sustainable Management Criteria chapter has been updated accordingly.

        v. For depletions of interconnected surface water, GSAs will be developing a methodology in the next few years before the 2025 update. In the interim, groundwater level thresholds will be used.

        vi. Discussed the management action in the water allocation framework section of the projects chapter and discovered a misunderstanding and a need for clarification on transferring water between developed and undeveloped land.

        vii. A Special Session of the CC was called to discuss the definition of developed supply. The estimate of canal seepage is the only item used in estimated developed supply. MIUGSA requested not to change the numbers, but consider other sources in the future, such as leaking pipes/canals. The CC agreed to update the working definition.

        viii. Question: Is recharge part of developed supply? Answer (W&C): It would be in the future, but this would be part of the other items to be investigated in the future.

        ix. Comment: SC wants to make sure can get comments and input. Response (W&C): Should have meetings in parallel. CC are looking to SC for input. Right now, need to look at what critical input is needed to get to a Plan. Some issues will have to be delay to get draft completed and approved.

        x. Question: For developed supply, if I overwater my almonds who does that water belong to? Answer (W&C): That is the question at hand. In some other basins undergoing adjudication, this has been determined in a way that recharge for beneficial use has been awarded back as developed supply. Otherwise, the questions are to whom (the agency or the person who purchased the water) does the credit go, how, and how to determine how much.

        xi. Question: Does that mean we need to look at a crop level? Answer (W&C): We could set up a documentation process that considers this for establishing credit.

xii. Comment: There's a lot more developed supply than Stevinson and MID; there are hundreds of riparian farmers from Merced creeks that are not being accounted for. Answer (W&C): What we have talked about is whether the supply can be measured. Will need to be able to measure this to count it.

   1. Question: What happens if a farmer has a riparian right and has a ditch and conveyance, and they have losses? Answer (W&C): This could be considered recharge, but there needs to be a mechanism to have participants estimate and document their losses.

xiii. Comment: SC will need to be involved in who gets the water that is lost to deep percolation.

xiv. Confirmation from group: The SC should continue meeting separately while CC is continuing planning. This will be especially important in the first few years of plan implementation as this period involves crucial decision-making topics.

3. Presentation by Woodard & Curran on GSP development

   a. Next Steps in GSP Development

      i. July 22nd for next meeting, will have a Notice of Intent (NOI) that says the GSAs will consider for adoption a GSP at least 90 days following NOI (will be publishing NOI around July 19).

      ii. Schedule plan:

         1. Aug/early Sept: walk through comments from public with the GSAs

         2. Oct: putting together final draft

         3. Nov/Dec: adoption hearings

            a. TIWD will adopt, MSGSA will adopt, and MIUGSA has an MOU (individual agencies will adopt)

         4. Jan: deadline for submitting GSP to DWR but have a small amount of buffer for this.

      iii. Question: Is the NOI a legal requirement? Answer (W&C): The GSAs do have to notify. This is similar to noticing public workshops. Each agency will also go through their notification processes in the fall.

      iv. Question: Are all GSAs about at this stage? Answer (W&C): Consultant team has only seen one GSP that is out and complete (Paso Robles).

   b. Sustainable Management Criteria

      i. Alyson Watson (Woodard & Curran) reviewed current summary of sustainable management criteria MOs, URs, and MTs per sustainability indicator.

      ii. Comment: Have heard from other basins about the subsidence and a consultant from Chowchilla-Madera thought the subsidence MT in Merced was too high. Answer (W&C): We have an agreement that we are on a parallel track and that we need to continue coordination with adjacent basins, but Delta-Mendota GSAs are still coordinating internally.

1. Comment: Another Subbasin is using groundwater level (GWL) as a proxy for subsidence. Response (W&C): DWR feedback provided to Merced team indicated the need for direct subsidence measure instead.

iii. Comment/question: Surprised that subsidence minimum threshold is not 0. Answer (W&C): The subsidence minimum threshold cannot be 0, as the Subbasin will continue to experience subsidence because this has already been set in motion (though it's expected to decrease over time).

iv. Water Quality: Comment was received to add minimum thresholds for more constituents. The GSAs can choose to add constituents but need feedback from SC group. GSAs circled back with Division of Environmental Health and got their feedback, which was consistent with the proposed minimum threshold approach. SGMA does not specify which WQ constituents must have MTs.

v. Question: Will other constituents be considered? Winton and Atwater have been identified as having water quality issues. Response (W&C): In the 2025 update, the GSAs will review all of the indicators and can update.

    1. Charles Gardiner (Catalyst): If there is an identified WQ problem, are you suggesting the GSAs take actions to manage this? Self-Help Enterprises (SHE): We would like GSAs to take this into account for indicators.

vi. Leadership Counsel comment: Wondering if would be important to take into account nitrates, etc. because recharge could increase contaminants.

    1. Comment: With new domestic well testing, now all new wells have to be tested for nitrates. This could answer that question.
    2. Comment: State Water Board and DWR are going to have to figure out if it's more valuable to put more water in the ground and potentially more (prev. existing) nitrates, which comes back to the impacts and benefits of recharge. Really this occurs at the level of the state. As for what the SC and GSAs can do, they can notify, can model and show what can happen. Not sure what you can do other than notify.
        a. Additional comment: If applicable, projects will have to go through CEQA.
    3. Comment: Who determines who gets to decide what the acceptable risk is for increased nitrates with groundwater recharge? Someone needs to figure out those policy issues. However, right now our only solution is to dilute our aquifers.

vii. Suggestion from MSGSA: Add third element to methodology for groundwater elevation Minimum Threshold OR remove wells that may have suspect data/conditions. Third element would be to use simulated GWLs where historical data shows GWLs may have already dewatered shallowest domestic wells or where modeling shows GWL may drop below the 2015 level.

    1. Alyson Watson explained the distribution of calibration wells.
    2. Clarification from MSGSA: Did not want to be limited to factors of shallowest domestic well in 2 mile radius or the 2015 level. A third element would give more flexibility, especially if we don't know what it's going to look like. MSGSA has talked about linear demand reduction. It could be that wells continue to drop and could drop below the 2015 level. Many of the wells are occurring in the MSGSA area.
        a. Comment: We need to include that third element, because we are limiting ourselves with the current method. Response (W&C): If there is concern

in using the model in these locations, we could instead remove these 2 wells.

3. Question and clarification from Marco at MID: MercedWRM is set up on quarter mile basis. Have already looked at existing data. Problem is that there are some stratigraphy issues in a particular area and the model results do not match some existing data. We have data analysis in the model, done in 3 dimensions, and have calibrated with adjacent wells. There are areas where we need some refinements. Funding is the issue, and we have not been allowed to charge to complete this refinement. We have done what we can for now. Model has the capacity, but we don't have the data to do that data analysis. Would be closer to a ~$100k effort to refine the model.
4. General consensus after discussion: Use the methodology as originally proposed but remove these two wells from representative wells and highlight need for future refinement.

c. Monitoring Networks & Addressing Data Gaps

   i. Alyson Watson (Woodard & Curran) reviewed the status of the monitoring networks and data gaps for each sustainability indicator.

   ii. Comment: The Rail Authority has some data/work for subsidence. We could refer to some of that.

   iii. Comment/clarification for follow up: We could look at whether additional SJRRP control points could be added.

   iv. Comments regarding the metering program:

      1. Comment: Should connect with ITRC to get input.
      2. Comment: Electric magnetic meters – not as expensive, have to get data myself and is accurate.
      3. Comment: Want to have flexibility in what meters can be used.
      4. Comment: Would be cheaper to be able to use existing meters and have folks go out to monitor, rather than replacing them with other meters.
      5. Comment: Always in favor of the lowest level of tech, and in favor of lowest maintenance cost.
      6. Comment: At minimum, have a minimum of "You have to have a meter. And if you don't have one, you need to get someone to go out there" (those are the people who should pay fines that pay for the staff to go out for meters).
      7. Comment: There are some subbasins down south that are not doing any metering but are using satellite data. Response: You are in that case estimating crop demand and not use, and it is not as accurate and is difficult to ground truth (have looked into and discussed).

   v. Other issues/comments:

      1. Comment: On depleted streamflow, it's a little more complicated. Answer (W&C): We're using GWLs as a proxy. Given the location of our wells, we recognize more work needs to be done.

d. Plan Implementation

i. Comment: The GSP Implementation costs should have a careful thought process.

ii. Assumptions made when estimating implementation costs:

    1. Consultant team is reaching out to GSAs on administrative costs.
    2. Assume CC would continue meeting quarterly and boards to meet bi-monthly.
    3. SC: Keep meeting? Quarterly? Term limits?

iii. Comment: Have SC meet every other month and on the "off" month without SC, have members attend a CC meeting.

iv. Question: What do the first few years look like? Answer (W&C): There are a lot of significant open items that will need to get refined right away.

v. Comment: These are huge decisions that may need input soon rather than next quarter. We may want to focus on setting recurring meetings based on important topics.

vi. Comment: Up to this point, we've tried to set the table and the important stuff and in the next 5 years you'll need folks that are on the ground to provide an opinion on whether things are working.

vii. Comments: If we meet quarterly, have to look at how many hours. Also, farmers cannot commit to an all-day meeting.

viii. Alyson (W&C): There has to be a commitment at the CC to take input from this meeting.

ix. Comment: Still think we're duplicating too much by having separate SC and CC meetings. Might be better to have full scope of what everyone is thinking/perspective.

    1. Clarification: the SC group is not set up as a voting body, but with intent to get broad range of input.

x. Feedback: What has been seen is that this feedback from the SC is presented well to the CC and is taken into consideration.

xi. Comment: Could have SC meeting staggered to occur with a few days in between SC and CC so that this provides a window to incorporate and make a more formal giving of feedback to the CC.

xii. Clarification from Alyson (W&C): For projects and management actions: If a GSA raises funds for a project this can increase their allocation. Assumption is that GSAs will have own financing plan.

    1. Clarification: MSGSA not implementing Prop 218 process for projects. Instead, it is a per-acre fee for GSP development, implementation, and GSA administration.

4. Public Outreach Update

    a. Charles Gardiner (Catalyst) provided a summary of the May 2019 public workshop: good discussions, not a large turnout, also provided local perspective of what was occurring in Atwater and Winton.

    b. Confirmed: Would not do a meeting in August, would have a combined GSAs meeting that we are currently scheduling with GSAs.

5. Interbasin Coordination Update

    a. Currently scheduling a meeting with Delta-Mendota for late July.

6. Public Comment on Items not on the Agenda

   a. Leadership Counsel provided a comment and letter to the Merced Subbasin GSAs. Representatives attending CC meeting communicated some of the recommendations including recommendation to set minimum thresholds based on the anti-degradation policy at the state level (per Bill 1968), with level set at best water quality since 2015. Where minimum threshold exceeds public health goals, the GSP should include a policy to strive for water quality improvements to meet relevant public health goals. This letter has been attached as an appendix to the meeting minutes.

   b. Public Comment: Need more public to show up and attend meetings. Fox26 had a program that featured the Friant Dam entities – camera panned to audience and there was no audience. No one was there. Has to be a means to get people to care.

      i. Leadership Counsel: Really good point to get more people to attend. Have heard from folks that should have more meetings in the evenings so working folks can attend.

   c. Additional comment/input from Breanne Ramos: Secretary Sonny Purdue from the USDA will be at the Los Banos Fairgrounds in the Germino Building Town Hall from 12:30-1:30pm, June 28th.

7. Next Steps and Next Meeting

   a. Sustainable Management Criteria draft chapter expected on the 28th to the SC group, everything else in Public Draft July 19th

   b. Shared focus of July meeting (see slide).

   c. Adjourn to next meeting.

Next Regular Meeting
July 22, 2019 at 9:30 a.m.
Castle Conference Center, 1900 Airdrome Entry, Atwater, CA
Information also available online at mercedsgma.org

Note: If you need disability-related modification or accommodation to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING MINUTES – Merced GSP

SUBJECT: Merced GSP Stakeholder Committee Meeting #15

DATE/TIME: July 22, 2019 at 9:30 AM

LOCATION: Castle Conference Center, 1900 Airdrome Entry, Atwater, CA

Stakeholder Committee Members In Attendance:

	Representative	Community Aspect Representation
☐	Alex McCabe	City of Livingston
☐	Arlan Thomas	Merced Irrigation District Advisory Committee (MIDAC), growers
☒	Ben Migliazzo	Live Oak Farms, growers
☐	Bill Spriggs	City of Merced, Merced Irrigation District
☒	Bob Salles	Leap Carpenter Kemps Insurance, insurance industry and natural resources
☒	Brad Robson	Buchanan Hollow Nut Co. Le Grand-Athlone Water District, growers
☒	Breanne Ramos	Merced County Farm Bureau
☐	Brian Carter	D&S Farms, growers
☐	Carol Bonin	Winton M.A.C.
☐	Daniel Machado	Machado Backhoe Inc., construction industry
☒	Darren Olguin	McSwain MAC
☐	Frenchy Meissonnier	Rice Farmer, rice growers
☒	Galen Miyamoto	Miyamoto Farms
☒	Gino Pedretti III	Sandy Mush Mutual Water Company
☐	James (Jim) Marshall	City of Merced
☒	Joe Scoto	Scoto Bros Farms / McSwain Union School District
☐	Ladi Asgill	East Merced Resource Conservation District / Sustainable Conservation
☒	Jean Okuye (alternate to Ladi Asgill)	
☒	Maria Herrera	Self-Help Enterprises
☐	Mark Maxwell	University of California, Merced
☒	Maxwell Norton	Retired agricultural researcher
☐	Parry Klassen	East San Joaquin Water Quality Coalition, growers
☒	Rick Drayer	Drayer Ranch, Merced cattlemen
☒	Simon Vander Woude	Sandy Mush Mutual Water Company, dairies

Meeting Minutes

1. Welcome, Introductions, and Agenda Review
    a. Charles Gardiner (Catalyst) welcomed the group and reviewed the meeting agenda content. There was a brief round of introductions of attendees.
    b. Alyson Watson (Woodard & Curran) reviewed and provided an update on the last Coordination Committee. The CC had a similar agenda to the SC meeting. Leadership Council (LC) provided a letter focused on water quality issues (please see June 2019 minutes). Last meeting reviewed how to address issues for monitoring and representative wells. Acknowledged that the GSP in the next update will address getting additional information. Decision was to remove two problem wells. Discussed data gaps and heard comments related to the metering program. Discussed role of SC and that this will continue to be important and CC will continue to provide input. Decision was made to have quarterly meetings that are staggered so that there is adequate time to summarize decisions and information from one meeting to the next (e.g. for SC to the CC and vice versa). The CC discussed the water allocation framework. The CC recommended to include in the GSP the working definition of developed supply, and that this will be further refined during Plan implementation. How allocation will be distributed will also need to be further refined.
2. Presentation by Woodard & Curran on GSP development
    a. Public Draft GSP
        i. Alyson (W&C) reviewed the GSP draft timeline and the availability of the public draft. The release of the Public Draft GSP was 19 July 2019. A Notice of Intent to Adopt is being sent to Cities and Counties on 22 July 2019.
        ii. There are 30 days for public review. A list of public locations for hard copies provided is provided in the slide handout (and on the Merced SGMA website) and was sent out to the email distribution lists.
    b. Highlights of key sections for review
        i. Alyson (W&C) reviewed the Sustainable Yield (SY), including the main components that went into calculating SY. This number also includes the items that need to be refined (e.g. the seepage and conveyance estimates).
        ii. Climate Change was reviewed. The climate change water budget starts with projected conditions baseline. A change factor (or perturbation factor) from DWR is applied to the Projected Data Baseline to simulate the impact of climate change. This creates the Climate Change Baseline, which is put into the Merced model. The output is the Climate Change Water Budget. This can be refined in the future to include the Merced Irrigation District (MID) operations model.
            1. Question: Where does the 4% on the slide come from? And are we using the 7% evapotranspiration (ET) forecast in our plan? Answer (W&C): The plan includes the study, but SY does not include climate change projections. We are using the 2070 information from DWR. The uncertainty is large, but the climate change analysis gives us a broader understanding of potential level of impact. DWR requires us to have an analysis. However, W&C recommends refining numbers to be more locally specific prior to using numbers to plan on local scale.
            2. Comment: We should get the plan done and submitted to the state, but the local governing bodies need to immediately insert climate change factors for planning.

3. Comment: For our projects, we also need to work toward the big number of what we need to reduce by in AFY overall for the Subbasin.
4. Agreement from SC: Need to stay aggressive on projects.
5. Comment/question: We should have a plan moving forward to include climate change into how we are managing the Subbasin.
6. Agreement from SC: In the update, we should identify that the plan should include the climate change analysis and a way to manage the Subbasin with this. Need to focus on recharge and consider climate change when working toward sustainability and meeting future demand needs.

iii. Sustainable Management Criteria

1. Alyson (W&C) reviewed what is in the draft GSP and each of the sustainability indicators including how Minimum Thresholds are determined. A summary slide containing information for all indicators was provided.
2. Question: What does this look like in dry years? Answer (W&C): Violations of MTs are not projected to occur during dry years according to model simulations.
3. Comment/question: For Depletions of Interconnected Surface Water, are we using groundwater levels as a proxy because measuring depletions directly is so difficult? Direct measurements are near impossible. Answer (W&C): Yes, but this is identified as something that can be refined.

iv. Water Level and Protecting Domestic Wells

1. Alyson (W&C) explained that groundwater level MTs are the depth of shallowest domestic well in a 2-mile radius of each representative well (24 representative wells), or the minimum level pre-January 2015 (1 representative well). There are 25 representative wells total. The domestic wells are usually shallower than agricultural wells. A single domestic well going dry is not considered an Undesirable Result (UR). An UR is triggered if > 25% of representative wells fall below MTs in two consecutive wet, above normal, or below normal years.
2. Alyson (W&C) asked the SC group for input on what we should be doing if a well is dewatered? And what do we do if an individual representative well reaches an MT but does not trigger an UR?
3. Alyson (W&C) reviewed hydrographs to show the results of 50 years of modelled hydrology. Two of the wells out of the 25% of representative wells would reach MTs during a 6-year drought condition. This does not trigger an UR, and consequential state intervention. However, there is a possibility that we could be dewatering domestic wells.
4. Question/comment: Need to define what we think are significant and unreasonable impacts and how to address these for disadvantaged communities. Concern is that we don't know what the impacts for the communities will be because we don't have representative wells in these areas.
5. Comment: The state is asking for a plan. We know it is not going to be perfect. There are some projects that try to address issue (e.g. El Nido). If we focus on recharge, this can address/mitigate these issues.
6. Comment: There should be a mitigation strategy given that it will take 5 years to get the data and install a monitoring well in these areas.

7. Clarification (W&C): The analysis does not project a potential reach of MTs to occur except once in a 50 year timeframe.
8. Comment: We could reach out to communities to see what kind of data they might have. Response (W&C): We can't establish MT wells now because there are currently no wells in those areas that meet reporting criteria. However, we could work toward this, including through projects.
9. Clarification (W&C): We have to wait until the 5 year update to adjust MTs.
10. Comment: We also have to consider the age of the wells. For example, if a well is 50+ years old, it might be nearing end of life use.
11. Question: What about monitoring in areas that currently have no monitoring wells? Answer (W&C): The CC can work on establishing new monitoring wells, but the approach for this needs to be agreed on. This is important for areas that do not have domestic wells, and especially wells with no historical data. Suggestions have been made at last CC but are not approved yet.
12. Water Quality
    a. Alyson (W&C) explained the MTs and what these are based on. Also received guidance from Merced County Division of Environmental Health. Leadership Counsel provided a letter and follow up letter to the GSAs.
    b. Comment: The Department of Pesticide Regulation already has several programs for the use of pesticides. We are not allowed to make changes that impact these programs. Response (W&C): We have focused on known areas where there are GW and salinity issues. However, we've heard concern over a variety of parameters. We are coordinating with existing programs to understand potential impacts. Depending on what is causing the issue, this may or may not fall within jurisdiction of SGMA.
    c. Comment: The recent approval of SB200, provides $200M per year fund that could be a potential resource for funding (e.g. for projects).
    d. Comment: If you are requesting funding, you need to show that the plan is working toward improving water quality. Otherwise, may have difficulty in getting funding.
    e. Comment: Coordination with DPR and DWR is the best avenue for water quality.
    f. Comment: Protecting water quality for drinking purposes has been discussed. Commentator would like to see more that can be done in the plan.
    g. Comment: It is good to look at coordinating with water quality monitoring groups and agencies.
13. Projects and Management Actions
    a. Alyson (W&C) reviewed the requirements from DWR for project information, the criteria used in the GSP as a filter to prioritize projects, and the list of 12 priority projects.
    b. Question: What are the funding sources for those that have funding: Project #10 is partially privately funded, Projects #1-3 are Prop1 DWR funded (the SDAC projects), Project #12 uses Merced County funding.

c. For Management Actions, there is a basin-wide allocation framework, and then the MSGSA allocation management action.

14. Plan Implementation

    a. Alyson (W&C) reviewed the timeline for the GSP implementation from 2020-2040, the components needed for first 5 years, and the estimated costs for plan implementation and projects.

    b. Comment: Report for the Prop 218 Landowner Fee pursued by MSGSA is available on the Merced County website (see link here: https://www.co.merced.ca.us/3253/Proposition-218-Landowner-Fee)

    c. Alyson (W&C) reviewed potential funding sources including what GSAs are enabled to do to raise funds through SGMA. This included funding authority given for extraction fees. Information included a brief review of options and process, with examples given of extraction fee and acreage-based assessment and fees.

    d. Question: How many wells are there for the Indian Wells Valley Groundwater Authority? Answer (W&C): Not certain but can look this up.

    e. Comment: Fee break out when looking at total costs to implement and total acreage would be around $4 or more per acre. Commentator thinks this is not bad.

    f. Comment: It was communicated in previous meetings that everyone who has a straw in the ground needs to contribute. Landowners should have a per acre fee, maybe for institutions or organization can use an extraction fee.

    g. Comment: There is not enough information to make a recommendation on which approach of fee to use, especially on behalf of disadvantaged communities.

3. Water Allocation Framework

    a. Alyson (W&C) reviewed the timeline of the initial discussions of the water allocation framework from Oct. 2018 to present. In summary: recently (in 2019) in March we discussed how allocate to overlying acres. In April there was a recommendation from the CC to the GSA boards. In May some disagreements in interpretation were identified. In June had Special CC session to discuss developed supply. For the Plan, the water allocation framework section is kept at a high level and further discussion with the CC is needed to agree on further detail.

    b. Alyson (W&C) went through an initial roadmap for continuing discussions. This included data gaps for allocation framework implementation, definition of developed supply, final allocation by GSA, procedure for new wells, and water credits & trading.

    c. Comment: Shouldn't it be that each GSA gets their allocation and should manage in a way that's tailored to their areas? Answer (W&C): The GSAs will have that discretion, it's just the process of getting there and agreeing on how.

    d. Question: Isn't there a project on streamlining well permitting? Answer from Merced County: This is a county project that is focused on above Corcoran wells. It involves an analysis of removing wells from below to above the Corcoran Clay layer, assists in removing the CEQA regulatory barrier, and should help protect against further subsidence.

4. Public Outreach Update

a. Charles explained the public review process. There is a 30-day public comment period, ending August 19th.

b. Public can provide comments also via Merced SGMA email address (see Contact Us page on Merced SGMA website).

c. A Joint GSA Board Public meeting to take place in September to review comments received. The location of the Joint GSA Board meeting will likely be the Merced County Building.

d. Adoption hearings to be held in Fall 2019.

5. Interbasin Coordination Update

   a. Merced Subbasin team have an Interbasin Coordination call with Delta-Mendota tomorrow, July 23rd.

6. Public Comment on Items not on the Agenda

   a. Comment: The GSAs' job is to address groundwater overdraft and related water quality needs. Response from SC member: To strengthen our communities, we should address and have GSAs take responsibility in addressing WQ issues.

   b. Comment: We could potentially have the SC and CC meet together to discuss this issue and reach decisions.

   c. Comment: 30 days for public review period is aggressive to try to reach communities. Are the GSAs going to have further public outreach? Also, to the point made about joining the two committees, we should consider how this will impact decision making and who is able to make decisions.

   d. Question/request from SC: Request to have the number of AFY the Subbasin needs to reduce by to reach sustainability on the first slide for future meetings.

7. Next Steps and Next Meeting

   a. Next meeting is currently to be determined. Once next regular or special meeting date confirmed, notices will be issued and outreach pursued.

Next Regular Meeting
TBD at 9:30 a.m.
Castle Conference Center, 1900 Airdrome Entry, Atwater, CA
Information also available online at mercedsgma.org

Note: If you need disability-related modification or accommodation to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MERCED SGMA

MEETING MINUTES – Merced GSP Stakeholder Committee

SUBJECT: Stakeholder Committee Meeting #16

DATE/TIME: October 28, 2019 at 9:30 AM

LOCATION: Castle Conference Center, 1900 Airdrome Entry, Atwater, CA

Stakeholder Committee Members In Attendance:

	Representative	Community Aspect Representation
☐	Alex McCabe	City of Livingston
☐	Arlan Thomas	Merced Irrigation District Advisory Committee (MIDAC), growers
☐	Ben Migliazzo	Live Oak Farms, growers
☐	Bill Spriggs	City of Merced, Merced Irrigation District
☐	Bob Salles	Leap Carpenter Kemps Insurance, insurance industry and natural resources
☐	Brad Robson	Buchanan Hollow Nut Co. Le Grand-Athlone Water District, growers
☒	Breanne Ramos	Merced County Farm Bureau
☐	Brian Carter	D&S Farms, growers
☐	Carol Bonin	Winton M.A.C.
☒	Daniel Machado	Machado Backhoe Inc., construction industry
☐	Darren Olguin	McSwain MAC
☐	Frenchy Meissonnier	Rice Farmer, rice growers
☒	Galen Miyamoto	Miyamoto Farms
☐	Gino Pedretti III	Sandy Mush Mutual Water Company
☐	James (Jim) Marshall	City of Merced
☒	Joe Scoto	Scoto Bros Farms / McSwain Union School District
☐	Ladi Asgill	East Merced Resource Conservation District / Sustainable Conservation
☐	Jean Okuye (alternate to Ladi Asgill)	
☐	Maria Herrera	Self-Help Enterprises
☐	Mark Maxwell	University of California, Merced
☐	Maxwell Norton	Retired agricultural researcher
☒	Parry Klassen	East San Joaquin Water Quality Coalition, growers
☐	Rick Drayer	Drayer Ranch, Merced cattlemen
☒	Simon Vander Woude	Sandy Mush Mutual Water Company, dairies

Meeting Minutes

1. Welcome, Introductions, and Agenda Review
    a. Charles Gardiners (Catalyst) welcomed the group. Attendees introduced themselves.
2. Finalizing Merced Subbasin GSP
    a. Alyson Watson (W&C) provided an update on the status of responding to comments and finalizing the GSP. The CC will discuss the revisions to the GSP this afternoon and adoption hearings are being scheduled for late November/early December.
    b. The consultant team worked with GSA staff on addressing comments that were received. The redline of the revised draft GSP and the master responses to comments are posted on the Merced SGMA website. The comment letters are also posted on the website. SGMA requires documenting public comments received.
    c. Master response to comments was organized by 20 topics (see slide for full list). Master response and comment letters will be included as an Appendix to the GSP.
    d. Alyson noted that SGMA does not require GSAs hold a public comment period. The Merced GSAs decided to hold the 30-day public comment period. This is an addition to the 60-day public comment period that DWR will hold once the GSP is submitted.
    e. Alyson highlighted two topics for more discussion today based on topics CC will also be discussing: subsidence sustainable management criteria and water quality sustainable management criteria.
        i. Subsidence discussion:
            1. Alyson provided some background information on subsidence in the basin: it is a gradual process that takes time to develop and time to halt. Subbasin may not be able to fully stop subsidence but can slow it and reduce impacts. She noted that despite wetter conditions 2017-2018, there was still between -0.17 ft/yr and -0.32 ft/yr observed in the portion of the subbasin.
            2. Alyson compared the sustainable management criteria that are included in the Merced GSP and in the neighboring basins of Chowchilla and Delta-Mendota.
                a. Merced GSP management criteria based on historical subsidence rates observed
                b. Chowchilla is using GWLs as a proxy for subsidence in the lower aquifer only (they are using this for both MT and MO). They are using an adaptive management approach with a trigger of -0.25 ft/yr for 3 years in Eastern main aquifer.
                c. In Delta-Mendota they have measurable objectives that vary by GSP and region but most are between -0.01 to -0.1 ft/yr. For minimum threshold, they (again various by GSP) but have between -0.1 to -0.2 ft/yr. San Joaquin River Exchange Contractors: The MT is narrative: "that which doesn't reduce SJREC's conveyance capacity without appropriate mitigation."
            3. Question from SC: Did Delta-Mendota use a different method for coming up with their numbers? Alyson: Yes, what was used to determine this is site specific. What they use cannot necessarily be used in Merced.

4. Clarification: we expect that DWR will expect that we have a continued coordination for subsidence. But we do not expect that they will require neighboring basins to have the exact same measurements.
    a. The consulting team and GSA staff were given direction by DWR that using groundwater level as proxy was not preferred. Neighboring subbasins got different input from DWR. (Chowchilla and Delta-Mendota).
    b. SGMA is very specific that the Subbasins will come up with their own approach to creating MTs and MOs. We are not allowed to impact our neighboring basins adversely. However, we do not have to have the same measurements/mechanisms for measurement in order to get our plan approved.
5. Question: DWR will see the response to comments and comments themselves? A: Yes, these are in GSP appendix and response to comments and comments are on the MercedSGMA.org website.
6. Alyson further described Merced GSP approach. MT and MO set based on historical subsidence rates. Some level of future subsidence, likely at similar rates, likely to be underway already and will not be able to be prevented. GSAs will continue coordinate efforts with Chowchilla & Delta-Mendota to develop regional and local solutions to regional subsidence
7. Alyson explained the subsidence map, showing varying degrees of subsidence in the southern part of the basin.
8. Question to the group: thoughts? Is Merced GSP approach reasonable?
    a. Comment: this is a good educated guess. The other basins are doing the same thing.
    b. Question: is there an overall system or data system that is watching this? A: the Bureau (USBR) is likely the best current data system for this. We are using this data.
    c. Hicham: DWR says they would like to see surface water stations used in our analysis. They were not as excited about using GWL, but we are in a good place to keep moving forward.
9. Question from public: what are you using for a standard measurement unit? Where are we right now and how are we compared to the other areas around us? Have to ask why how much is sinking over that time period in that particular location. A: When there’s groundwater pumping and you have permeable clay layers, you are creating these holes in the clay layers and these can compact and the ground can drop. And we can see this in the change in topography and that’s where the map is from (using data from USBR). We’re looking at directly how much the ground surface is changing. Moving forward we have to work with our neighbors to improve how we are managing this.
10. Comment from public: can you coordinate the GWL data and the subsidence (surface change) data together? A: That’s the plan. Think of this as step one. There will need to be more coordination and more data. More monitoring wells are being proposed for the future as well as more monitoring points for subsidence. There needs to be a consistency across the basins. Both sides have GWL and subsidence data, but will need to continued coordination. Next step is to look at

GSPs together and look at potentially regional plans and adjust. Confirmed: we are taking a big picture view.

11. Question: how much are we going to make specific points influence… is there going to be a blanket assessment? A: the MTs are location specific. You can have something greater or less than this at another location in the basin. However, the CC and the Boards can decide there is an issue somewhere and decide to do something there. Part of the reason for this is because of how site specific the issues might be.
12. Comment (Hicham Eltal MID): What we are saying is to look at the most drastic locations to ensure other areas also ok (measuring to the worst case in order to be protective).
13. Comment (Alyson Watson): we are using an approach that is protective of domestic wells in the subbasin.
14. Comment from public: when talking about El Nido, southeast side is very different than other areas. Drastic difference even within El Nido with difference of 3-5 miles.
15. Comment (Hicham): unless your areas become as bad as the other areas, will not be impacted by the restrictions.
16. Comment from public: worried about being lumped into another area and then having to be required to implement demand management actions/restrictions.
17. Clarification on whether GWL vs. subsidence surface measures as being more important: there is nothing in the plan that says there are demand management for areas of subsidence (e.g. for El Nido area). The plan will also be updated every 5 yrs.
18. Clarification from Hicham: you could still (according to discussion from DWR) have an increase in GWLs but still have subsidence.
19. Comment from public: basically, they don't (DWR) know what is going on with subsidence? A: right, we do not know the extent to which this will continue and severity.
20. Question: in the brown area of the map, is there a plan to put folks in that area (where subsidence is worst) on surface water?
    a. Response from SC: there are no cities in that area, and the farmers in that area have procured surface water supplies
    b. Clarification from Charles: we also have GWL objectives and thresholds in that area as well.
    c. Clarification from Alyson: MID has also been doing work to get SW to these areas.
    d. Hicham: folks in these areas have purchased meters. These folks are also getting water outside the district. MID Board has approved most of the time (not all the time) to move water outside the district. Previously has been the case 7 out of 10 years. In MID WRP also recognizes efforts outside the basin.
    e. Comment: Madera, Chowchilla, and others have all been trying to get SW out to these areas.

f. Question: is MID interested in that? Hicham: yes, depends on system capacity. The SW has to go through El Nido first. (El Nido is in district)

ii. Water Quality:

1. Alyson provided an explanation of Merced GSP water quality sustainable management criteria. The MT is set at 1,000mg/L for TDS (Total Dissolved Solids, measurement of salinity). This is drinking water standard. There are numerous other authorities governing and monitoring drinking WQ and contaminants. There is a summary of the response to comments for WQ on the Merced SGMA website.
2. Alyson provided summary of response to WQ comments. Salinity is selected as an indicator. GSAs recognize the importance of protecting drinking water quality. There is a desire to coordinate with agencies and their ongoing efforts to avoid duplication of efforts and efficiently use limited resources. Coordination activities include: (see list on PPT).
3. Comment from SC: we discussed previously that there are all of these other agencies who are doing this work.
4. Comment from Charles: there is some concern for residential users who might not be on these systems that are being monitored by existing agencies
5. Comment from SC: two weeks ago, State Board approved CVSALTS. (there will be data on nitrates becoming available.
6. Comment from Charles: the permittees develop together a collective nitrates program. The management zone is a collaborative effort kind of like a GSA. It might take a couple of years for this to develop and implement this kind of monitoring and planning.
7. Comment from SC: the program will be monitoring the domestic wells. Who is actually going to do the work will be determined by the regional board?
8. Comment: anything we could change in the plan to satisfy commenters?
9. Alyson: we could add more MTs, but there's not much else we can do with the plan. What SGMA requires sets a basin standard, you can have projects, but from a thresholds perspective this is not the most effective way to address these issues for these communities.
10. Charles: the groups who are advocating for these communities are in the process of conducting a study and assessment of the specific needs and issues in DACs throughout the basin
11. Comment: SB1 is going in this direction as well (targets disadvantaged communities and groundwater levels)
12. Clarification: will not have additional specific requirements to dairies, will be subbasin wide.
13. Comment from Charles: the program (CVSALTS) brought up earlier monitor and have regulations.
14. Comment from public: that's what we're hoping that if we are already adhering to the current regulations, that we are not creating a new agency we have to report to.

f. Dates for Adoption Hearings for GSA Boards – still being scheduled. Tentative dates below:

i. TIWD GSA-1 is anticipated for Nov. 19th

ii. MSGSA is TBD

iii. MIUGSA is anticipated Dec. 11th

3. GSP Implementation Planning

   a. Prop 68 funding opportunity (deadline Nov. 1, 2019)

      i. Alyson briefly summarized Prop 68 grant contents. These were developed by the ad-hoc working group.

      ii. We are submitting for the total amount we are eligible which is $500K. Expected to be competitive. DWR has indicated they are prioritizing GSP development activities over implementation projects.

      iii. Contents include three components, 1) grant administration, 2) Addressing GSP data gaps, and 3) Developing a remote sensing decision support tool

      iv. The objectives include: prioritizing data gaps, increasing the number of wells in the monitoring network, monitoring gw use, and stakeholder outreach.

      v. We are soliciting letters of support and currently have 14 letters from various groups in the basin. We have also received letters from all three neighboring subbasins and provided them with letters of support.

   b. Annual report preparation proposal from Woodard & Curran

      i. Alyson explained that W&C was asked by GSA staff to prepare a proposal for preparing the first annual report. The first annual report is due April 1, 2020 and must cover water years 2015-2019. The proposal includes optional tasks for project management, stakeholder engagement plan update, and evaluation of GDE Pulse Tool

   c. Water Allocation Framework update

      i. Alyson explained that the GSAs are continuing to discuss this issue. The GSP does not include an allocation. It states that GSAs intend to allocate water to each GSA but have not yet reached agreement on allocations or how they will be implemented. Estimates of basin-wide sustainable yield and developed supply are included in the GSP for illustrative purposes.

   d. Implementation and Stakeholder Committee Involvement

      i. Discussion: What topics are of most interest to the stakeholder committee?

         1. Funding: How and who will pay for this? MSGSA has done a Prop 218, MIUGSA is underway with this.

         2. Monitoring and reporting: SC members report hearing concerns in the community that someone will try to turn off their wells. Comment: Biggest question I get, who's turning my pump off? Nobody is going to tell me to turn off my wells.

         3. Allocation: What's the allocation and how is it enforced?

         4. Projects

         5. First 4 bullets (allocation framework, monitoring and reporting GW use, funding, and projects) are the key topics

         6. Water Quality – comment: there are 5 government agencies watching that. Do not think this plan needs to get specific about this.

ii. Composition of Stakeholder Committee

1. Charles suggested they may want to discuss who wants to stay on and whether have the right representation. He noted there have been two resignations from the committee during the course of GSP development and that we are at a natural milestone to confirm who wants to stay on committee and what committee's role moving forward will be.
2. Group discussed wanting to stay involved if input is used and valuable. Some members expressed desire to interact directly with the CC committee. Charles suggested possibility of holding joint discussions with CC around key topics.
3. Group wanted to meet no more than needed. Agreement that mapping out topics would be useful. Having summary of what was previously discussed also useful.

e. Integrated Regional Water Management Plan (IRWMP)

i. This effort is continuing and there was a second call for projects. These are all available online.

4. Public Outreach Update

a. GSA Adoption hearings will be coming up in late November/early December.

5. Interbasin Coordination Update

a. Coordination with neighboring basins will continue, especially for topics like subsidence.

6. Public Comment on Items not on the Agenda

a. Question: are we still trying to keep the water in the GSAs? Reply: the GSAs will need to agree together with how to split up the water allocation amongst the GSAs. Then there is also a requirement in SGMA to not adversely impact your neighboring basins. There is a general framework that has been laid out in the plan. However, the big question is how to allocate in a fair manner the water amongst the three GSAs.

b. Public comment submitted: member of public provided letter they received from Department of the Air Force concerning groundwater sampling for PFOS/PFOA. (attached)

7. Next Steps and Next Meeting

a. Will be submitting the Prop 68 grant application

b. Dates for adoption hearings will be posted on the website.

Next Regular Meeting
TBD at 9:30 a.m.
Castle Conference Center, 1900 Airdrome Entry, Atwater, CA
Information also available online at mercedsgma.org

Note: If you need disability-related modification or accommodation to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

DEPARTMENT OF THE AIR FORCE
AIR FORCE CIVIL ENGINEER CENTER

October 11, 2019

AFCEC/CIBE
2261 Hughes Avenue, Suite 155
JBSA Lackland TX 78236-9853

[redacted]

[redacted]

The Air Force is currently investigating whether perfluorooctane sulfonate (PFOS) and/or perfluorooctanoic acid (PFOA) is present in the groundwater near the former Castle Air Force Base (Castle AFB) in Atwater, California. Samples of groundwater on the former Castle AFB have confirmed the presence of PFOS and/or PFOA. The next steps in the Air Force investigation are to determine whether PFOS/PFOA are present in the water from private drinking water wells near Castle AFB.

While PFOS and PFOA are not regulated under the Safe Drinking Water Act, the United States Environmental Protection Agency (EPA) has issued Lifetime Health Advisories (LHA) and is continuing to study PFOS/PFOA to determine if regulation is needed. Please see the attached Fact Sheet for further information on these substances.

A review of the water well record databases maintained by the Air Force, the California Department of Water Resources, the City of Winton, and the City of Atwater indicates you may have drinking water wells on your property. If you do, the Air Force requests permission to take water samples from your drinking water wells. The Air Force will sample your wells at no cost to you and will share any information obtained from the well sampling.

To that end, we would very much appreciate it if you could take a few minutes to complete the enclosed Private Well Survey form and allow us to take samples from your wells at a mutually agreeable time. The Air Force, through its authorized agent, Wood Environment & Infrastructure Solutions, Inc. (Wood), will contact you soon to schedule the sampling and discuss the procedure and requirements. Please return the Private Well Survey form in the enclosed self addressed, postage paid envelope or email a copy to Ms. Mary Jo Heassler at maryjo.heassler@woodplc.com.

If you have any questions or concerns, please contact Roy Willis at 210-395-9452 or roy.willis@us.af.mil.

MERCED SGMA

Merced Irrigation-Urban GSA
Merced Subbasin GSA
Turner Island Water District GSA #1

Summary of Merced Subbasin Groundwater Sustainability Plan Community Workshop #1

Issued August 20, 2018

Overview

The first Merced Subbasin Community Workshop was held on August 2, 2018 in the Sam Pipes Room, 678 W. 18th Street, Merced, CA from 6 pm to 8:30 pm. The total attendance was approximately 35 of which 8 were members of the GSP Coordinating Committee, Stakeholder Committee, or staff from the County, City, or Merced Irrigation District (MID).

The workshop goals included the following:

1. Provide an introduction to:
    a. What are the requirements of the Sustainable Groundwater Management Act (SGMA),
    b. What are the roles of the three Groundwater Sustainability Agencies (GSAs), and
    c. What is the schedule and requirements for the Groundwater Sustainability Plan (GSP) being prepared for the Merced Subbasin.
2. Provide an overview of the Merced Subbasin conditions.
3. Encourage attendees to share their knowledge and experiences with groundwater in the Merced Subbasin and to talk about what groundwater sustainability means for them.

The workshop presentations covered the following topics:

1. What is SGMA -- what is required, who is responsible, and how will the GSP be developed?
2. Current Merced Subbasin groundwater conditions.
3. What are the undesirable effects of overuse of groundwater?
4. What does groundwater sustainability mean to people?

The workshop was publicized using a number of methods including:

1. <u>Press Release</u> was issued to the Merced Sun Times and posted on the GSP website.
2. <u>Display Advertisement/Notice</u> was placed in the Merced Sun Times.
3. <u>Workshop Notices</u> (in English and Spanish) were widely distributed by partner organizations to their email distribution lists and were posted on the three GSA websites as well as several partner websites.

4. SelfHelp Enterprises also distributed a workshop notice in several communities within the Merced Subbasin.

Questions about SGMA, GSAs, and the GSP

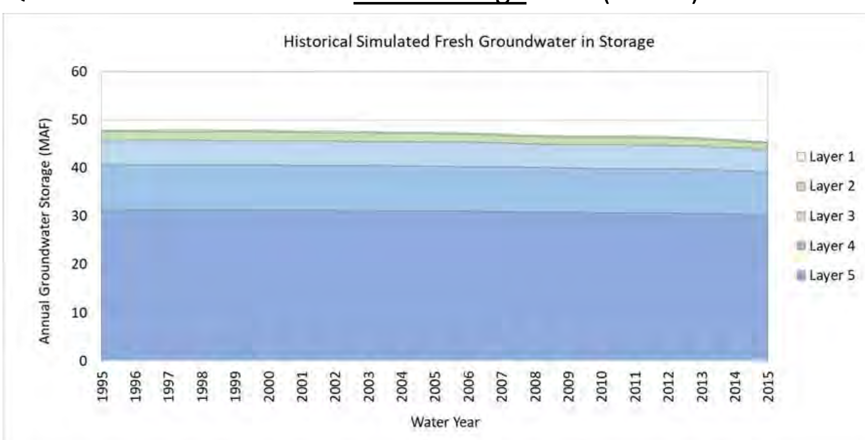
After a presentation about what is SGMA, the formation of the three GSAs and their roles, and the decision for all three GSAs to work together to develop one GSP for the Merced Subbasin, the following questions were asked:

1. What is the approval process from the State?
2. How many other GSPs are being prepared now in California?
3. Does the public get to review the draft GSP?
4. What will the process be for the public to get to review the draft GSP?
5. What is the website to go to for information about the Merced Subbasin GSP?
6. Who hired the consultants to prepare the GSP?

Questions about Current Merced Subbasin Groundwater Conditions

After a presentation about current Merced Subbasin groundwater conditions, the following questions were raised:

1. Is it possible to capture water from Bear Creek as the water flows to the ocean?
2. What is the definition of a Disadvantaged Community (DAC)?
3. Questions asked when the Total Storage slide (below) was discussed:



a) What is the significance of the "brackish water" layer?

b) Is there a correlation between the levels shown and depth in feet?

c) Is the lower water level from the High Sierras and the top level from recent events like rain?

d) Are there water quality differences in the levels shown?

4. When it comes to measuring well depths, will it be the responsibility of each individual to recharge their own well if the elevation drops? Are people going to have to track their individual well water usage?
5. Will there be a loss in storage in areas with land subsidence?
6. Is there a lot of data on interconnected surface water?
7. For the groundwater model being used, will there be "ground truthing" or validation of the model with real time well data? If so, how is it done?
8. Will there be any monitoring wells that can measure a number of different elements including groundwater levels, direction of flow, and flow rate?

Discussion about Undesirable Effects

In the initial workshop presentation, it was explained that under SGMA, sustainability is the management of groundwater to prevent significant and unreasonable undesirable results. There are six undesirable results defined under SGMA. They include: Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply; significant and unreasonable degraded water quality; significant and unreasonable reduction of groundwater storage; significant and unreasonable land subsidence; significant and unreasonable seawater intrusion; and depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.

Attendees were asked "What Do You See as the Undesirable Effects of Groundwater Use?" and the following responses were shared:

Responses Related to Land Use Planning and Groundwater Use

<u>Improved Land Use Planning is Important.</u> In the Merced General Plan, when new ground is broken for a project, water use parameters need to be established. A grading ordinance is needed when changing the function of the land use. Changes in land use when irrigation is added should be addressed or regulated in some way.

<u>Consider Using Recycled Water for Urban Use</u>. An example was provided that in Salt Lake City, a dual piping system is used where water goes to houses as two water supplies: one for recycled water used for lawns and other non-potable (non-drinking water) uses, and one for drinking water.

<u>Coordination of Private Well Groundwater Use</u> is needed between Suburban Areas and Agricultural Areas. What are the depth of the wells, and how can the water use be coordinated? When comparing water use between a subdivision and agricultural use, which uses more?

Responses about Educational Needs for Efficient Use of Water

<u>More Education about Water Use Efficiency is Needed.</u> An attendee asked about the allowable watering schedule in Merced County as he observed people watering their lawns during the day

and kids' pools overflowing, with no way to capture that water. Can the GSP include water efficiency actions and education? It was mentioned that some examples of efficiency and educational tools can be found and have been implemented in the City of Merced.

Responses Related to Surface and Ground Water Use

Land Subsidence Creates Loss of Water Storage. These areas are no longer able to be recharged as the soils will no longer hold water.

More Surface Water is Needed. The Proposed Temperance Flat Dam Project was voiced as a potential solution.

With Water Cutbacks, Water for Trees and Landscaping is Reduced. There needs to be a balanced approach.

Lower Groundwater Levels Negatively Affects Drinking Water Supplies for Rural Schools. There are areas around Merced where the elementary schools have come close to not having drinking water because of wells drying up.

No Water Transfers out of Merced

What prevents someone from buying land, putting in high capacity pumps, and pumping groundwater and selling it southern CA? This has happened. There should be no transfers out of the area but with surface water, water districts can transfer between water districts. There is, however, a County ordinance that prevents an individual from purchasing land, pumping the water, and selling it elsewhere.

Responses Related to Water Quality

Water Shortages Increase Contamination. In Planada, the contaminants from whatever is sprayed on the fields is getting into water that is available.

Monitoring Movement of Contaminant Plumes. With the groundwater modeling, can there be plumes of contaminants? How are they monitored? Plumes worsening or moving is the undesirable result.

Responses Related to Water and Economics

Smaller farmers are not able to afford deeper wells.

Responses Related to How Specific Items of Concern will be Addressed in the GSP

How will the GSP address groundwater being used at water bottling plants?

How will the GSP address population growth and crop changes?

Discussion about Sustainability

Following the discussion about undesirable results, attendees were asked for their thoughts and ideas about what sustainability means to them. They were asked to share about "What do you see as sustainability goals for you? What does sustainability mean to you, what does sustainability look like for you? The following input was received.

Responses Related to Sustainability Solutions

- Use conservation techniques.
- Water is required to be recharged, so increase recharge in wet years.
- Increase groundwater banking.
- Harvest water in urban areas.
- Use the groundwater model for land use decisions.
- Capture Merced River flood flows.
- Consider use of groundwater credits.
- Secure reliable surface water supply for recharge.
- In wet years, turn water into fields for recharge.
- Capture water from creeks in the Merced Subbasin for recharge.
- Provide equitable access to whatever the water resources are for all. If good, then good for everyone. If bad, then bad for everyone.
- Identify subsidence areas and focus recharge efforts there.
- Capture and retain storm water from Owens Creek.
- Merced Irrigation District (MID) Canal draining to recharge lands.

Responses Related to Economics and Sustainability

- Farming and economics -- need to keep the economy healthy, water is the driver of the whole area.
- What protects the value of the land?

Responses Related to Funding

- Is Department of Water Resources funding the GSP?
- What constraints on management actions or projects are anticipated such as funding? Are there others?

Responses Related to Other Ideas

- If more water retention is the only answer, how do we carry that message forward?
- Consider climate change factors.
- SED (the Substitute Environmental Document) if approved and implemented would be devastating as it will reduce San Joaquin River flows.

Discussion about Additional Concerns about Land Subsidence

1. Identify subsidence areas and have recharge areas put in.
2. Supply surface water to subsidence areas.
3. Capture urban runoff in subsidence areas.

4. Federal funding needed [for management actions and projects].
5. Appropriate monitoring of layers is needed to understand where subsidence occurs.
6. Flood benefits – flood and storm waters should be used for recharge.

Roles and Responsibilities for Developing the Merced Subbasin GSP

Governing Boards

Consistent with the requirements of SGMA, water management and land management agencies in Merced Subbasin formed three Groundwater Sustainability Agencies (GSAs): the Merced Irrigation-Urban Groundwater Sustainability Agency, the Merced Subbasin Groundwater Sustainability Agency, and the Turner Island Water District Groundwater Sustainability Agency. The three GSAs are collaborating on developing one Groundwater Sustainability Plan (GSP) for the entire Merced Groundwater Subbasin by January 2020. To develop the Plan, the GSAs will review groundwater conditions and identify means to ensure the long-term sustainability of the Merced Groundwater Subbasin.

Coordinating Committee

The three GSAs for the Merced Groundwater Subbasin have formed a Coordinating Committee of senior staff and governing board members to coordinate day-to-day planning activities and public outreach. Meetings of the Coordinating Committee will be noticed and open to the public and are held the fourth Monday of the month.

Stakeholder Committee

The three GSAs have also approved the formation of a Stakeholder Committee. The Stakeholder Committee serves as community representatives to advise the Coordinating Committee and the GSA governing boards on groundwater conditions, management issues and needs, and projects and management actions to improve sustainability in the basin. Meetings of the Stakeholder Committee are open to the public and are held on the fourth Monday of the month.

General Public, Landowners, Farmers, Ranchers in the Merced Subbasin

Your role is to provide input as the GSP is developed. You can submit comments through the GSP website: www.mercedsgma.org. Consider attending a Board meeting, Coordinating Committee meeting, or Stakeholder Committee meeting, or a Community Workshop to learn more, ask questions, and provide input.

Merced Irrigation-Urban GSA
Merced Subbasin GSA
Turner Island Water District GSA #1

Summary of Merced Subbasin Groundwater Sustainability Plan Community Workshops in Planada and Franklin

December 4 and 13, 2018

Overview

A second round of Merced Subbasin Community Workshops were held in Planada and Franklin in December 2018.

Tuesday, December 4, 2018
6 p.m. to 8 p.m.
Planada Community Center
Main Hall
9167 Stanford Ave., Planada, CA 95365

Thursday, December 13, 2018
6 p.m. to 8 p.m.
Franklin Elementary School
Multipurpose Room
2736 Franklin Rd, Merced, CA 95348

The goals for the public workshops included the following:

1. Provide information about options for sustainable management for the Merced Subbasin Groundwater and obtain participant feedback including input on preliminary ideas for projects and management actions.
2. Encourage attendees to share their knowledge and experiences with groundwater in the Merced Subbasin.

Both workshops were publicized using the following methods:

1. Press Release was issued to the Merced Sun-Star, Merced County Times, and posted on the GSP website. The workshops were mentioned by Mike Jenkins, Merced Irrigation District (MID) during a Merced radio station interview several days prior to the first workshop.
2. Workshop Notices (in English and Spanish) were widely distributed by partner organizations to their email distribution lists and were posted on the three GSA websites as well as several partner websites.
3. Self-Help Enterprises and The Leadership Counsel for Justice and Accountability assisted with outreach by distributing flyers and calling contacts that they have in Planada, South Merced, and Franklin.

The attendance at the December 4, 2018, Planada workshop included approximately 30 members of the public. The December 11, 2018 Franklin workshop was attended by approximately 24 members of the public. Self-Help Enterprises (SHE) provided a communications system at both workshops to support simultaneous Spanish translation. At the

Planada workshop two people took advantage of translation; no one utilized the translation option at the Franklin workshop.

The presentations for both workshops included the following topics with discussion questions (included below) asked of the participants after each presentation:

1. **Project Overview** – This presentation provided a review of the Sustainable Groundwater Management Act, the Groundwater Management Agencies involved and the Groundwater Sustainability Plan.
2. **Sustainable Management for the Merced Subbasin** – This presentation covered both reducing water use and allocating groundwater pumping as well as options for increasing water supplies and groundwater recharge.
3. **Groundwater Conditions –** This presentation was tailored for each workshop to include groundwater information relative to each area.

Presentation 1 - Project Overview

The following three questions were asked of the participants following the presentation.

1. Do you have any questions and discussion about what SGMA requires and the agencies preparing the Groundwater Sustainability Plan?
2. Do you have any questions and discussion about the Merced Subbasin groundwater conditions?
3. What thoughts do you have about current or future conditions?

There were no questions from the participants at the Planada workshop and at the Franklin workshop, two questions were asked:

Question: What is the projected acre-feet (amount of water) that will be allowed for pumping and will that vary across the Merced Subbasin?

> Answer: This question was answered during the second portion of the presentation. On average, a reduction of 25% in pumping is estimated as needed to achieve sustainability over time. The goal is to halt overdraft and get to a sustainable condition. The estimate of future pumping is 660 thousand acre feet (TAF) per year. The estimated amount of pumping for a sustainable groundwater basin is 500 TAF. The difference is what is needs to be reduced in pumping, which could be achieved looking at options for increasing supply, increasing groundwater recharge, or decreasing demand. The Coordinating Committee (CC) and the Stakeholder Committee (SC) are looking at possible approaches for allocating groundwater pumping. The team will be developing projects and management actions including options such as groundwater recharge projects and surface water projects for consideration by the CC and SC. The availability and benefits of these actions vary across the basin.

Question: What is the current status of connections at Meadowbrook?

> Answer: There are 3 groundwater wells that range from 300 to 500 feet deep to provide water to 1,730 connections.

Presentation 2 - Sustainable Management for Merced Subbasin Groundwater

Four questions were posed to participants at each workshop. The comments and questions received are summarized by workshop location.

1. What do you see as the most important issues related to groundwater pumping and water use? For residents and businesses? For agriculture?

Planada Workshop Questions and Comments

Question: Are there or will there be more projects beyond the Planada area? There must be other areas where there can be recharge projects.

> Answer: Yes. Merced Irrigation District (MID) is working with farmers on this now. Le Grand and Livingston have good soil for recharge. Recharge projects in the eastern side of the basin, such as LeGrand and Planada have the potential to benefit the entire basin (groundwater generally flows from east to west).

Question: Is the land subsidence in the El Nido area due to pumping? What can be done about it?

> Answer: There is land subsidence in the El Nido area. Generally, land subsidence is caused by pumping below the Corcoran clay layer (a layer of clay that separates upper and lower groundwater aquifers in the western portion of the basin). Pumping can lower groundwater levels, which dewaters the clay layer, which in turn compresses, lowering the ground levels. It cannot necessarily be reversed, but it can be slowed. If there is recharge in El Nido, it will take a long time to be able to raise the level of groundwater to reduce the subsidence.

Question: Will Planada recharge benefit Planada or flow to El Nido?

> Answer: This is the purpose of doing a feasibility study—to evaluate how much water can be infiltrated into the groundwater, how it moves, and where the benefits would be. There is an MID recharge basin in El Nido putting water into the ground to benefit that area.

Question: Can forest management (e.g., tree thinning) help with groundwater recharge and groundwater levels by allowing more water to flow into the groundwater?

Answer: UC Merced conducted studies of forest management in the foothills and headwaters areas. The studies had difficulties getting measurement equipment installed on federal lands (including concerns about impacts to endangered species in the area).

Franklin Workshop Questions and Comments

Question: How many acre feet of water can be stored in the ground? Is there a model that can tell us how much storage we have?

> Answer: In terms of total storage, the model estimates a capacity of 50 million acre-feet of water. The challenge is access. As the storage is depleted, groundwater levels decline, potentially dewatering wells, which is one of the undesirable results the plan seeks to avoid. The goal is to increase recharge and storage in wet years, when there is additional supply. The challenge is finding locations where flooding is occurring and where floodwaters can be stored to help the Merced Subbasin.

Question: What does recharge represent in terms of bringing the Merced Subbasin to sustainability?

> Answer: Recharge is one important component of management actions and projects that can be effective.

Question: There a number of dry creeks like Bear Creek, as well as canals that have dried up. Where is that water going?

> Answer: The creeks and canals provide recharge to the groundwater when there is water flowing in them. When the rain stops, there is not a constant flow of water in these areas. The flow of water depends on seasonal rainfall.

Question: Recharge projects involve a lot of time, available ground, planning, and approvals to put the infrastructure in place. The State requires a permit and that process is challenging. Will the State make the permit process easier?

> Answer: All water has to be used for beneficial use. Recharge by itself is not consider a beneficial by the State Water Resources Control Board (State Board). The State Water Board prefers projects that show additional benefits, such as reducing subsidence, assistance to Disadvantaged Communities (DACs), or improved water quality. Recharge projects should be combined with benefits to other uses. MID is working on Flood-MAR (using flood water for managed aquifer recharge) with the Department of Water Resources (DWR).

Question: The participant had recently purchased property with several 80-foot irrigation wells that have gone dry. They sought a permit for a new, deeper well, but they can't drill below the Corcoran Clay layer. How will the GSP development process take into account the Corcoran Clay layer when considering management actions and projects, e.g. recharge projects. We need to understand the Corcoran Clay layer.

> Answer: When drilling you can only go so deep until you hit the Corcoran Clay, then you would have to drill below the clay layer. However, additional pumping below the Corcoran Clay can increase land subsidence, therefore, the County restricts new wells

below the Corcoran Clay. The GSP will be looking at issues below, above, and outside of the Corcoran Clay. Some areas above Corcoran Clay layer have lower groundwater levels, but not all. The plan will consider approaches for getting groundwater in balance above and below the Corcoran Clay. Some other basins have abandoned the upper layer (above Corcoran), but we will not.

Comment: Corcoran Clay is located in the west and southwest portion of the basin.

Question: We should try to know where we can recharge. Can recharge go below the Corcoran Clay layer?

> Answer: There are two other types of possible recharge: (1) Dry wells can recharge below the Corcoran Clay, but this might not be in the best area for recharge; (2) Aquifer storage and recovery (ASR) wells are another possibility. ASR wells are used to recharge deep aquifers and form a "bubble" of recharged water. The approach is often used in areas where existing groundwater quality is poor.

Question: Will there be incentives offered for recharge projects including stormwater capture?

> Answer: If people want to self-recharge, this may be able to be worked into a credit system that provides an additional pumping allowance for those that recharge groundwater to the basin.

Question: Why is there more subsidence when pumping occurs below the Corcoran Clay layer?

> Answer: Below the Corcoran Clay layer, the water could be considered pressurized. If water is pumped out, the pressure is removed, and land subsides. The same process doesn't occur above the Corcoran Clay layer.

Question: When the GSP is implemented, can people purchase additional pumping allocations?

> Answer: It is likely that an allocation system would be implemented around 2030, but it is up to the three GSAs to adopt the GSP and implementation plan. Initial discussions by the Coordinating Committee have included ideas for a water market to allow people to purchase available groundwater pumping allocations from others in the basin.

Question: For MID recharge projects that exists now, what is their impact on the aquifers?

> Answer: Currently MID has 40 acres being used for recharge including areas in El Nido, in Winton). By current estimates, MID recharges approximately 100,000 acre-feet per year to the basin through the canals and recharge basins.

Question: What about the sustainable yield estimate? How do we have this projected until 2040?

> Answer: The sustainable yield estimate assumes that there is a transition period between now and 2040. Once we have identified projects and management actions and the timing for implementation (including pumping allocation), we can forecast the water budget more specifically for the period between now and 2040.

Comment: Hard decisions and investment will be needed going forward to reduce pumping.

Question: With a growing population, where will the water come from to reach sustainability unless we include more surface water storage? It doesn't seem solvable.

> Answer: Estimated population growth has been included in the model. Additional surface storage options will also be evaluated.

Question: Do we have any data on how the Fresno storage basins are working, and if this is a good example to follow for our subbasin?

> Answer: The storage basins in Fresno have experienced several issues and are using surface water.

Question: A participant's well is only at 65 feet, yet his neighbor has had to drill to 110 feet to get to water. Why is there a difference?

> Answer: This comes back to what undesirable results we want to avoid. We have about 40 CASGEM (California Statewide Groundwater Elevation Monitoring) wells. The plan will include groundwater level thresholds to prevent domestic wells within a 3-mile radius of these wells from going dry.

Question: When it comes to cutting back, how do you view cutting back groundwater use for agriculture versus targeting cuts in other uses?

> Answer: Groundwater pumping allocations would reduce water use for all users. For recharge and water supply projects, we are looking at all possible sources, stormwater recharge, recycled water, etc.

Question: Is climate change included in the modeling?

> Answer: Climate change will be factored into the GSP. For 2040, significant change is not expected but climate change analysis will continue and be a part of the GSP updates.

Question: Can urban stormwater recharge projects be considered?

> Answer: Yes.

Comment: We need to see more conservation in the urban/city areas. Municipalities have to educate residents more and come up with plans to limit the water use. It would be good to have incentives and rebates for dry landscape in communities.

Comment: Generally, people in cities do not understand how precious water is. There needs to be more education for people to understand this. Farmers are using a third less water now than they used to as they understand what a precious resource it is.

Question: Is there a way for the public to see/access the hydrogeologic model (HCM) online?

> Answer: There is a report on the hydrogeologic model available online at the Merced SGMA website.

2. How can groundwater pumping be allocated fairly across the basin for all users?

Planada Workshop Questions and Comments

Comment: Allocation cannot be historical. Certain trees take more water than others. The allocated amounts should be left to each grower as they know best what to do. Growers aren't wasting water.

Comment: Drip irrigation is good for trees but not as cost effective for crops such as tomatoes.

Comment: There is a stereotype that farmers want to use a lot of water. This is not true as most farmers put a lot of care into what they put on their plants.

Comment: We all have to take part in achieving groundwater sustainability, not just farmers. Every individual is going to have to take a part in recharging the Merced Subbasin. We need to work together to figure out a way to do this. Education is important. Doing little changes in every area might help (an example from Santa Barbara was cited).

Comment: Given the human right to drinking water (law in California), the GSP projects and management actions need to consider the effect on access to safe drinking water.

Comment: In 20 years, the water situation will get worse.

Comment: Climate is changing.

Franklin Workshop Questions and Comments

There were no comments on this question at the Franklin workshop.

3. How can the GSP help address groundwater quality issues?

Planada Workshop Questions and Comments

Comment: El Nido has a salinity problem in the water.

Comment: In Stevinson, there is potential for Aquifer Storage and Recovery (ASR) wells to allow both pumping and recharge.

Comment: South Merced is on domestic wells and some are contaminated. This area should be connected to the Merced municipal water system.

Comment: Shallow wells are accessing perched water with more contamination. In some areas, a solution may be to re-drill wells.

Franklin Workshop Questions and Comments

There were no comments on this question at the Franklin workshop.

4. What projects and actions could increase groundwater recharge and available water supplies?

Planada Workshop Questions and Comments

Comment: Farmers have spent millions of dollars putting in efficient irrigation systems. This could be part of the problem as flood irrigation used to help recharge the aquifer. In the past, flood irrigation was cheap and now it's expensive. Flood irrigation should be allowed again as it would help recharge the aquifers.

Question: Are injection wells being considered?

> Answer: Water has to be treated before injecting which makes this option too costly.

Comment: Another Merced Irrigation District (MID) big lake/reservoir and more canals are needed to address climate change impacts.

Comment: MID is doing some recharge in rice growing areas, which is resulting in limited recharge.

Comment: Explore further the benefits of forest management for improving recharge of the aquifers.

Franklin Workshop Questions and Comments

See the comments and questions under question #1 as there was significant input about recharge projects during the discussion of that question.

Additional Written Comments Received Via Comment Forms Available at the Workshops

Question: Do we know how much water Safeway/Lucerne Foods is bottling up from the Merced River? Is this information considered proprietary?

> Answer: The team can see if this information is available.

Comment: Have the State Water Resource Control Board (SWRCB) explain to the public how the public, undergoing sustainability actions to undertake recharge projects,…at least how to avoid being faced with restrictions to stormwater recharge.

Comment: I am going to retire, then I don't have to worry about water for farming.

Summary of Merced Subbasin Groundwater Sustainability Plan Community Workshop in Livingston, CA

February 25, 2019

Overview

The fourth Merced Subbasin Groundwater Sustainability Plan community workshop was held in Livingston, CA on Monday, February 25, 2019 in the City Hall Conference Room from 6 p.m. to 8 p.m. The workshop was attended by approximately 25 community members.

The goals for the workshop included the following:

1. Provide information about options for sustainable groundwater management for the Merced Subbasin
2. Obtain participant feedback, including input on the various projects and management actions under consideration.
3. Encourage attendees to share their knowledge and experiences with groundwater in the Merced Subbasin.

The workshop was publicized using the following methods:

1. Press Release was issued to the Merced Sun-Star, Merced County Times, and posted on www.mercedsgma.org.
2. Display Ad was published in the main news section of the Merced Sun-Star on February 22 and February 23.
3. Workshop Notices (English and Spanish) were widely distributed by partner organizations to their email distribution lists and were posted on the three GSA websites as well as several partner websites.
4. Self-Help Enterprises (SHE) and The Leadership Counsel for Justice and Accountability assisted with outreach by distributing workshop notices.

SHE provided a Spanish translator and communications system that supports simultaneous translation. No one utilized the translation option at this workshop.

Summary of Presentations and Discussions

Presentation 1 - Groundwater in the Livingston Area

Jose Ramirez, City Manager, Livingston, CA provided an overview of some of the challenges faced relative to water supply and water quality. He noted that there had been contaminants in Livingston wells causing them to be shut down. To meet the demand, the City was able to connect several wells and establish centralized treatment. He noted that Livingston is 100% metered and that the City is planning to diversify its water supply portfolio to include surface water from the Merced River. Questions included the following:

1. Question: The Merced River was noted as a source, are you talking about taking water from Merced River?

    Answer: Yes, but the permit process is very long. The plan includes installing horizontal wells below the river to access Merced River water.

2. Question: What is the per person water consumption in Livingston?

    Answer: An estimate is about half acre foot (AF) per household.

3. Question: Is Gallo on the Livingston water system?

    Answer: No, Gallo has asked to be connected to the water system, but it would require a large capital investment.

Presentation 2 – SGMA Overview and Current and Projected Groundwater Conditions

Alyson Watson, Woodward & Curran, provided a review of the Sustainable Groundwater Management Act (SGMA and the three Groundwater Management Agencies involved in the development of the Merced Subbasin Groundwater Sustainability Plan (GSP)). She also explained what a GSP is and what it includes. This presentation concluded with an overview of the current and projected groundwater conditions for the Merced Subbasin.

The following questions were asked by participants:

1. Question: Is the "critical overdraft" designation applied to entire Merced Subbasin; is any area excepted from this?

    Answer: This designation applies to entire basin, but there can be areas within the basin where recharge is occurring.

2. Question: Does the Merced Subbasin boundary complement or follow the groundwater aquifer boundaries?

    Answer: Loosely. Three of the four boundaries are generally located along rivers with one generally following the county boundary.

3. Question: Do minimum thresholds apply to private wells?

    Answer: Private wells will not have minimum thresholds. This also includes private businesses that have wells. There are specific criteria for establishing groundwater monitoring wells. Private wells often do not meet these criteria to capture what is needed for reporting.

4. Question: What is CASGEM?

    Answer: It is the California Statewide Groundwater Elevation Monitoring Program. It was established before SGMA to monitor groundwater levels across the state. For the GSP, we will use existing wells from the CASGEM network and add monitoring wells where needed.

5. Question: What is the status of the technical work? Where can we see the technical work?

    Answer: As draft GSP sections are prepared, they will be posted to the website for review in the Resources section. Currently, one chapter is available, Basin Settings - Hydrogeologic Conceptual Model (HCM).

6. Question: How do the new statewide domestic use goals (50 gallons per person per day by 2030) relate to SGMA?

   Answer: The urban water agencies will be working to achieve those goals for their service areas, which will help cities reduce their groundwater pumping. The goals do not apply to private domestic groundwater wells. These users are called de minimus users when they extract more than two acre feet per year. They are subject to SGMA, but the GSAs cannot require them to be metered.

7. Question: How does the GSP account for the SED (Substitute Environmental Document) for the Water Quality Control Plan for the San Francisco Bay/Sacramento–San Joaquin Delta Estuary? Would the state be charged for taking water from the Merced River?

   Answer: The groundwater modeling for the Merced Subbasin does not assume approval of the SED. If it is approved it would change surface water availability. It is not likely that the region could charge the state for water dedicated to instream flows.

8. Question/Comment: Referring to presentation slide titled "The Groundwater Model Estimates Flows Into and Out of the Groundwater Basin," this is all theory, right?

   Answer: The technical team is using the model to develop a projection for future groundwater use for the three GSAs.

9. Question: Who has to approve the GSP?

   Answer: The three GSAs have to approve the GSP. By January 31, 2020 the GSAs will submit the approved GSP to the Department of Water Resources (DWR). The DWR will then have to approve the GSP. If the DWR does not approve the GSP, the Merced Subbasin GSAs would be forwarded to the State Water Resources Control Board for enforcement or intervention.

10. Question: Is there no discussion with DWR after the GSP is submitted to them?

    Answer: DWR and the State Water Board have not fully described the process after submittal. However, we anticipate that there will be some back and forth if DWR identifies deficiencies in the GSP.

11. Question: When looking at the 50-year forecast, how would it change if there were more dams for water storage?

    Answer: A dam might not change the water budget (referring to the water projection graph presented) but it could increase seepage or change pumping depending on how it is used – for example, if more surface water were used instead of groundwater.

12. Question: What is the baseline for the model?

    Answer: The model uses a 50-year hydrology (rainfall and runoff from the last 50 years) and estimates of future population and land use in 2040.

13. Question/Comment: So the graph (referring to the graph of groundwater model estimates) is saying we need projects?

    Answer: Yes, projects to increase groundwater recharge and surface water supplies.

14. Clarification requested: Snowpack affects our groundwater. What is the impact to our groundwater from the snowpack in the Sierras?

Answer: Snowpack does affect the Merced Subbasin groundwater, but it is not more significant than the local pumping/use. We are using state estimates of future changes in snowpack.

15. Question: Are you doing isotope dating of the groundwater?

    Answer: UC Merced did some isotope dating. Previous pumping was estimated to be 1000-year water, and now it's 50- to 100-year water.

Presentation 3 – Sustainable Management for Merced Subbasin Groundwater

Alyson Watson, Woodward & Curran, explained that the goal of the GSP is to try to balance groundwater over the long term. The term "Sustainable Yield" was explained generally as how much groundwater can be pumped without causing undesirable results. The Sustainable Yield can be estimated using the model and then conditions can be modified to balance stored groundwater over time. Once the sustainable yield is developed, then the "Groundwater Allocation Framework" describes an approach for allocating the sustainable yield among the three GSAs within the Merced Subbasin. The Allocation Framework includes three "buckets" of water that are accounted for in the allocation: 1) overlying use, 2) appropriative use and 3) recovery of seepage of developed water. Alyson also discussed how to address unirrigated lands that may never have been pumped – should the allocation be the same? She explained the possibility of partial allocations and how that might relate to a water market.

1. Question: I'm an agricultural water user. I buy water from MID and then it seeps in on my land. Whose water is that?

    Answer: We are looking at an allocation of 400,000 AF and working now to sort out seepage considerations. Currently, this would not be considered seepage of a developed water supply.

2. Question: What about water banking?

    Answer: When we get to the discussion about projects and management actions, recharge projects (to bank water in the ground) are a type of project being considered.

3. Question: Shouldn't there be a credit for this (water recharge)?

    Answer: Yes, the owner of a recharge project would receive credit for developing the water supply.

4. Question: Say someone has a piece of land and they don't use it. If we have wet year, would they get credit for recharge on these lands?

    Answer: This gets to the practical implementation – you don't get credit for the water that falls on your land; the allocation is for the entire Merced Subbasin.

5. Question: Are there farmers in these groups (referring to the Coordinating Committee and Stakeholder Committee)?

    Answer: Yes.

6. Question: If you are only using part of your land, can you apply your full allocation to part of your land? You should also be able to carry over some part of what you have not used into the previous year.

    Answer: The GSAs have to determine how these types of situations will be handled.

7. Question: If a person hasn't used irrigation, they are paying the standby fee?

   Answer: In the case of Merced Irrigation District (MID), yes, and that allows you to contact MID whenever you want to start receiving the water again.

8. Question: What about farmers who have no access to surface water?

   Answer: In some cases, farmers may be able to purchase surface water (depending on location and water rights for the surface water rights holder). If you have been using surface water, you are not considered a dormant user.

9. Question: Do the allocation estimate numbers reflect sustainable yield?

   Answer: Yes, and these could be adjusted, for example the allocation could be increased if projects are implemented that are effective in increasing water supplies.

10. Question: What do you anticipate would be the relationship between an allocation for dormant users and the county process for issuing permits to drill a well.

    Answer: The process to permit a new well is cumbersome. The intent of the allocation process would be to avoid making the process more cumbersome by adding additional steps.

11. Comment: The consultant team and the GSAs will need to be very clear about what a dormant water right is. Also, when considering the allocation framework, it is important to consider the "climate" of the land (e.g., topography/geography).

12. Comment: You have growers on different types of soil. Some areas are very sandy, and others are not. The allocation should be done by soil type. Different soil types have different percolation rates and use different amounts of water to grow.

13. Comment: The trees (e.g., almonds) need a lot of water, the allocation could devastate people who grow trees. The allocation should take into consideration what people have already invested in developing their trees.

14. Comment: It would be helpful to have a crop map to see where you have permanent or seasonal crops.

15. Comment: It is really important to do a lot of public relations for people to not over pump before the allocation is implemented.

16. Comment: A lot of people in this basin feel like their water is being stolen by the state when it is their water, connected to their land and to their freedom as Americans.

Presentation 4 – Projects and Management Actions

Alyson Watson, Woodward & Curran, explained that there are 47 different projects being evaluated. There are three categories of projects: recharge projects, surface water projects, and actions to reduce water demand. Examples of projects in each category were provided.

1. Question: What about looking at the recharge efforts in Fresno?

   Answer: Hicham ElTal, MID, noted that there are a lot of opportunities for putting water on the ground for a few months (during the rainy season) and allowing recharge to happen. MID has two pilot recharge projects east and south of Planada underway now. MID also has landowners in El Nido who are interested in recharge projects. There are lots of opportunities, but the big question is funding, identifying lands that could be used, and timing.

2. Comment: One difficulty in implementing recharge projects is that many of the systems that deliver water to these areas are damaged or destroyed. This sounds good in concept, but it is difficult to implement because ability to get the water to the systems is difficult.

3. Question: Can the main MID canal be used for recharge?

   Answer: Hischam ElTal, MID, explained that there are liability exposures with potential flood flows for MID that have to be overcome before this could happen.

4. Question: What does MID do with reclaimed water?

   Answer: Hicham ElTal, MID, noted that reclaimed water is a possible source of supply, but it can be expensive and may not be acceptable for some crops (e.g., almonds). The reclaimed water goes to refuges and duck clubs. From a basin wide perspective, it does not account for a lot of water supply - about 3,000 AF from the City of Merced.

5. Comment: The commenter has heard that the state is going to declare that all of the water belongs to the state.

   Response: Hicham ElTal, MID clarified that, if the region is not successful in reaching sustainability by 2040, the state will come in and manage the water for the Subbasin.

Summary of Merced Subbasin Groundwater Sustainability Plan Community Workshop in Atwater, CA

May 29, 2019

Overview

The fifth Merced Subbasin Groundwater Sustainability Plan community workshop was held in Atwater, CA on Wednesday, May 29, 2019 at the Atwater Community Center from 6 p.m. to 8 p.m. The workshop was attended by 8 community members, a representative from the City of Atwater, a representative from the Winton Water and Sanitary District, and three staff from the Groundwater Sustainability Agencies.

The goals for the workshop included the following:

1. Provide information about the status the Groundwater Management Plan under development for the Merced Subbasin.
2. Obtain participant feedback.
3. Encourage attendees to share their knowledge and experiences with groundwater in the Merced Subbasin.

The workshop was publicized using the following methods:

1. Press Release was issued to the Merced Sun-Star, Merced County Times, and posted on www.mercedsgma.org.
2. Display Ad was published in the main news section of the Atwater Signal on May 18, 2019 and the Merced Sun-Star on May 22, 2019.
3. Workshop Notices (English and Spanish) were widely distributed by partner organizations to their email distribution lists and were posted on the three GSA websites and several partner websites.
4. Self-Help Enterprises (SHE) and The Leadership Counsel for Justice and Accountability assisted with outreach by distributing workshop notices.

SHE provided a Spanish translator and communications system that supports simultaneous translation. No one utilized the translation option at this workshop.

Summary of Presentations and Discussions

Presentation 1 - Sustainable Groundwater Management Act and Groundwater Sustainability Plan, and Current and Projected Groundwater Conditions

Alyson Watson, Woodard & Curran, provided a review of the Sustainable Groundwater Management Act (SGMA) and the three Groundwater Sustainability Agencies (GSAs) developing the Merced Subbasin Groundwater Sustainability Plan (GSP). She also explained what a GSP is and what it includes. Alyson presented an overview of the hydrologic water modeling for current and projected groundwater conditions in the Merced Subbasin.

Brenda Wey, Winton Water and Sanitary District, provided a brief overview of some of the water supply and water quality challenges in Winton. Winton currently has a moratorium on new water connections. Winton experienced a small drop in water levels during the most recent drought, but is situated near a shallow/high aquifer and has been relatively fortunate compared to surrounding communities.

Brian Shaw, City of Atwater, provided a brief overview of some of the water supply and water quality challenges in Atwater. He noted that public groundwater wells had to be deepened during the recent drought, but the City fared better than some other surrounding areas. Groundwater levels have continued to rebound during the recent wet years. The City has continued conservation restrictions since the drought. One of the City's wells is being treated for 1,2,3-TCP with carbon filters, and all wells are expected to need to be treated. Water quality in Atwater is good.

The following questions and comments were offered by participants:

1. Question: What hydrologic model are you using?

    Answer: A custom model developed on the IWFM (Integrated Water Flow Model) platform developed by the Department of Water Resources. It is the same platform as C2VSIM, more refined than the fine-grid C2VSIM that is being developed now.

2. Question: On Slide 17 titled "The Groundwater Model Estimates Flows Into and Out of the Groundwater Basin", what is the black line?

    Answer: Cumulative change in storage, a sum of all the net "ins" and "outs" from the Merced Subbasin storage over time.

3. Question: Does Slide 17 titled "The Groundwater Model Estimates Flows Into and Out of the Groundwater Basin" include projected land uses?

    Answer: Yes, it assumes 2040 water demands and General Plan buildout. It uses the latest crop type data with small minor updates based on specific feedback/projections from each of the three GSAs.

4. Question: Is the Merced Subbasin being drawn down more than is being replaced?

    Answer: Yes

5. Comment: Tree orchards are being planted now. These won't be able to be changed to a different crop that would use less water any time soon.

6. Comment: We need to conserve water and keep our neighbors in mind when using water. Water is a resource for everyone.

Presentation 2 – Sustainable Management for the Merced Subbasin Groundwater

Alyson Watson, Woodard & Curran, provided an overview of sustainable management criteria, what "sustainable yield" means, what an allocation framework is, what the allocation scheme for the Merced Subbasin is, how projects and management activities will provide additional water.

1. Question: How will the GSA handle groundwater users that can afford to pay and pump as much as they want to?

   Answer: An allocation plan is being developed that will address this possibility.

2. Question: How does agricultural water get allocated based on acreage; won't that continue the shortages that we have had in the past?

   Answer: The GSAs will be developing the allocation system in the first five years. The allocations will be based on the estimated sustainable yield of the basin. It is expected that some of the water could be traded in the future once a system is devised to be protective of the Subbasin.

3. Question: How will the allocation fee structure work for those that develop new water supplies or for those that decide they want to irrigate their land in the future?

   Answer: Pumping fees collected could be used to enable development of new supplies.

4. Question: How do de minimus users get included in allocation framework? How do you figure out their allocation?

   Answer: This is yet to be determined. GSAs can decide to include or exclude de minimus users from the allocation. GSAs cannot require monitoring of de minimus users.

5. Question: Community water systems may not be considered de minimus users, so how do they fit into the allocation framework?

   Answer: They generally are considered overlying users and would get an allocation per acre.

6. Question: Will cities be allocated based on historical uses and not future projections?

   Answer: Yes, and this is based on what is typically done for appropriative rights. The GSP team worked closely with the Coordinating Committee and Stakeholder Committee to look at several options for what historical period to use. There was only a small variation in amounts with different time periods. The current plan uses 1995 to 2015.

7. Question: How would City of Merced accommodate their planned growth and be allocated?

   Answer: Reduce per capita use or find new sources of supply to meet increased demand.

8. Question: Where can we find a description of the possible projects?

   Answer: The section of the GSP that includes the projects will be posted June 7. We'll post the draft project list on May 30.

9. Question: Where is the funding coming from?

   Answer: Current work is funded from Proposition 1. There are some funds available for future projects from Proposition 68.

10. Question: Is there a specific timeline for projects or triggers for implementation (e.g. allocation not being met)?

    Answer: At this point, the main management action is the allocation framework. Other projects have estimated timelines. Some are "more ready" (with timelines already), but implementation depends on funding. Projects that increase water supply would increase the allocations. The allocation will be phased in until 2040. As projects are implemented the allocations can be updated.

11. Question: Has there been discussion about replenishment beyond individuals to a regional basis?

Answer: The Coordinating Committee is applying for a long-term permit for stream diversion of flood flows. The permit would identify as many as possible diversion points along surface water conveyances so multiple landowners could opt to divert water to flood fields and manage recharge on a large scale. Currently, diversions are on an emergency basis and less reliable.

12. Question: Has the team or the GSAs talked to landowners about flooding for recharge purposes?

    Answer: Merced Irrigation District (MID) has done some flood management and recharge activities on rice fields. MID holds a water right off of Mariposa Creek that is designated for El Nido. There is a project included in the Integrated Regional Water Management Plan to automate an existing check structure on Mariposa Creek to move floodwater safely.

13. Question: Will the fee structure be used to pay for projects?

    Answer: Generally, the water users who benefit from a project will pay for the project.

14. Question: For groundwater levels (GWLs), with the minimum threshold set at 2015 levels, how many wells dewatered?

    Answer: The minimum threshold for GWLs is set at the shallowest domestic well within a 2-mile radius. Only a small number of wells where GWLs historically appear to be below shallowest domestic well have the 2015 GWL used as the minimum threshold. We haven't specifically analyzed the number of domestic wells dewatered by minimum threshold selections, but we can develop that information.

15. Question: For SGMA, GSAs are supposed to look at the full range of water quality contaminants that could be affected by groundwater management (pumping). Is the GSP doing this for contaminants other than salinity?

    Answer: There's a difference between monitoring and setting thresholds. Thresholds are set for salinity, which is the constituent where pumping could affect the movement of salinity. For other constituents, we don't have evidence that undesirable results are caused by pumping and will continue to monitor and review.

16. Comment: The GSAs should look at a number of constituents such as arsenic being released from the soil into the groundwater and monitor for more than salinity. Another Subbasin is looking at the percent change of the constituent as the minimum threshold rather than a set concentration of the contaminant.

17. Question: Are you working with other GSAs?

    Answer: Both Woodard & Curran and Catalyst are working with several other Subbasins in different capacities (outreach, modeling only, full planning, etc.).

18. Question: Are GSAs talking about uniform formats for data?

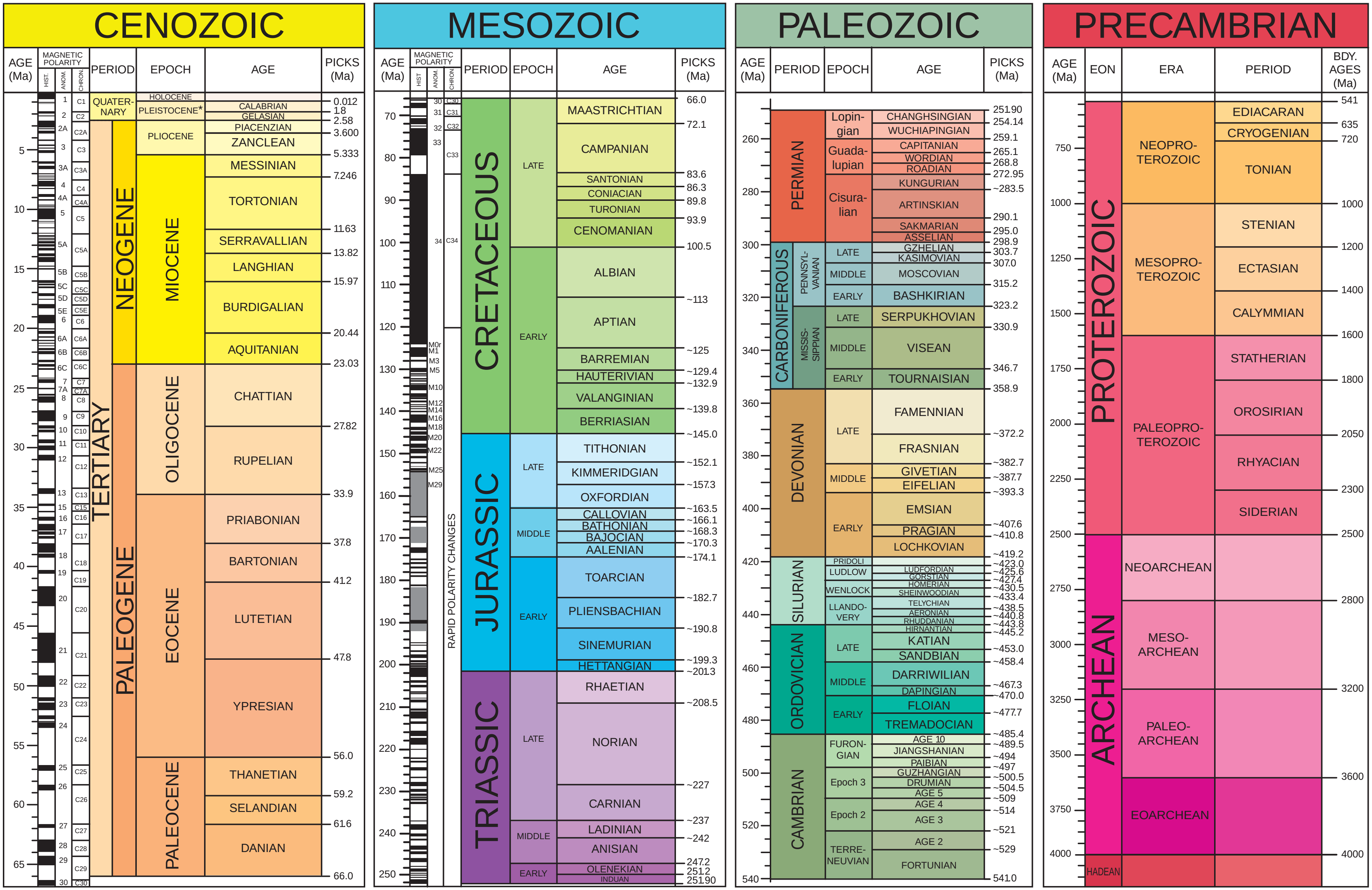
    Answer: Yes, we've developed a Data Management System specifically for the Merced Subbasin GSP. We'll tailor the DMS further to align with DWR standardized reporting when it is defined.

19. Question: Is data being coordinating throughout the Central Valley?

    Answer: This would be the responsibility of the Department of Water Resources.

APPENDIX C: GEOLOGIC TIME SCALE

GSA GEOLOGIC TIME SCALE v. 5.0



Walker, J.D., Geissman, J.W., Bowring, S.A., and Babcock, L.E., compilers, 2018, Geologic Time Scale v. 5.0: Geological Society of America, https://doi.org/10.1130/2018.CTS005R3C. ©2018 The Geological Society of America

*The Pleistocene is divided into four ages, but only two are shown here. What is shown as Calabrian is actually three ages—Calabrian from 1.80 to 0.781 Ma, Middle from 0.781 to 0.126 Ma, and Late from 0.126 to 0.0117 Ma.

The Cenozoic, Mesozoic, and Paleozoic are the Eras of the Phanerozoic Eon. Names of units and age boundaries usually follow the Gradstein et al. (2012), Cohen et al. (2012) , and Cohen et al. (2013, updated) compilations. Numerical age estimates and picks of boundaries usually follow the Cohen et al. (2013, updated) compilation. The numbered epochs and ages of the Cambrian are provisional. A "~" before a numerical age estimate typically indicates an associated error of ±0.4 to over 1.6 Ma.

THE GEOLOGICAL SOCIETY OF AMERICA®

REFERENCES CITED

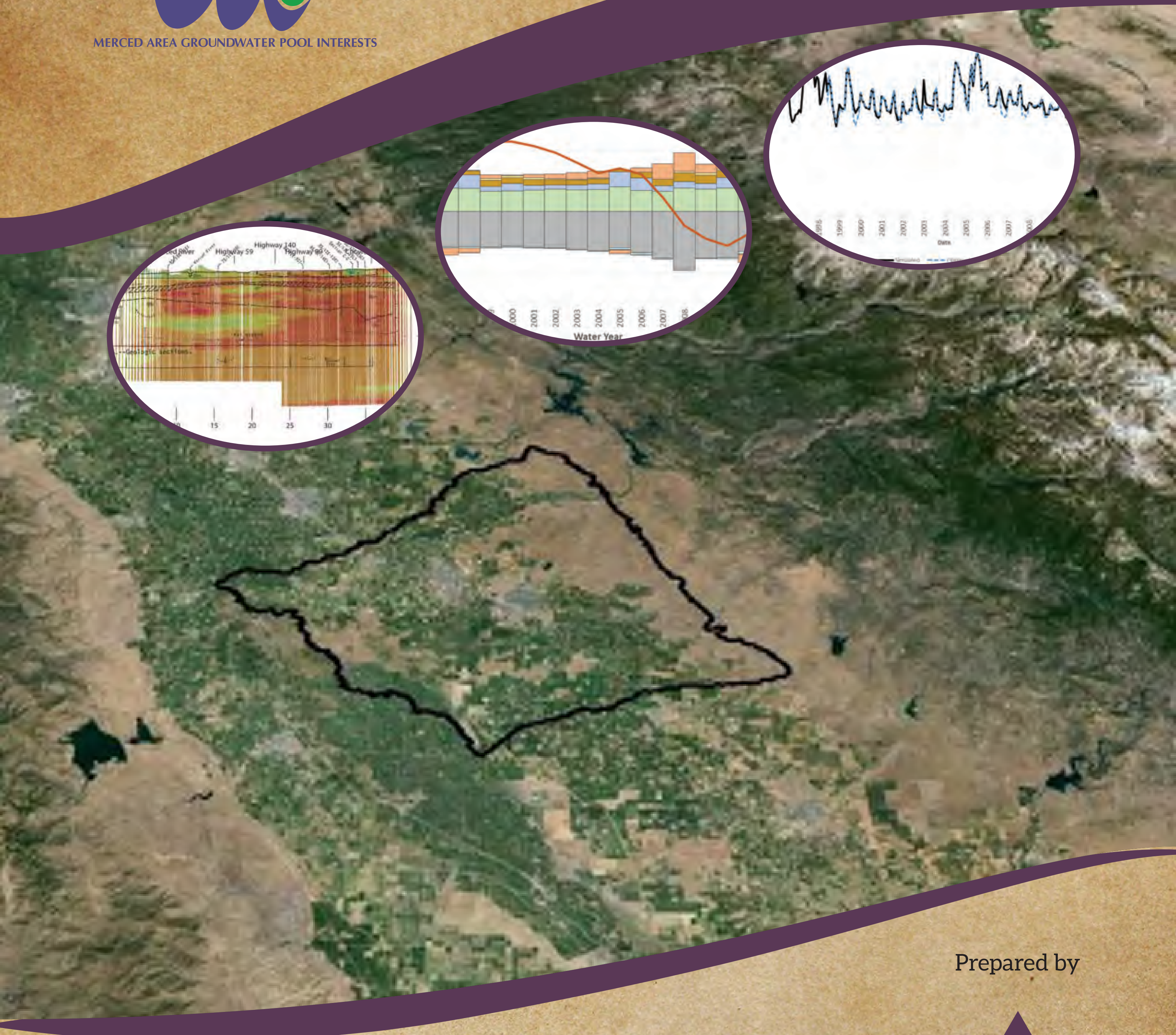
Cohen, K.M., Finney, S., and Gibbard, P.L., 2012, International Chronostratigraphic Chart: International Commission on Stratigraphy, www.stratigraphy.org (accessed May 2012). (Chart reproduced for the 34th International Geological Congress, Brisbane, Australia, 5–10 August 2012.)
Cohen, K.M., Finney, S.C., Gibbard, P.L., and Fan, J.-X., 2013, The ICS International Chronostratigraphic Chart: Episodes v. 36, no. 3, p. 199–204 (updated 2017, v. 2, http://www.stratigraphy.org/index.php/ics-chart-timescale; accessed May 2018).
Gradstein, F.M, Ogg, J.G., Schmitz, M.D., et al., 2012, The Geologic Time Scale 2012: Boston, USA, Elsevier, https://doi.org/10.1016/B978-0-444-59425-9.00004-4.

Previous versions of the time scale and previously published papers about the time scale and its evolution are posted to http://www.geosociety.org/timescale.

APPENDIX D: MERCEDWRM MODEL DOCUMENTATION

Merced Water Resources Model (Merced WRM)

MERCED AREA GROUNDWATER POOL INTERESTS



Prepared by

WOODARD & CURRAN

September 2019

MERCED AREA
GROUNDWATER POOL INTERESTS

Merced Water Resources Model (MercedWRM)

WOODARD
&CURRAN

1545 River Park Drive, Suite 425
Sacramento, CA 95815

September 2019

Table of Contents

List of Tables & Diagrams

List of Figures

Appendices

List of Abbreviations

AF	Acre-Feet
AFY	Acre-Feet per Year
C2VSim	California Central Valley Groundwater-Surface Water Simulation Model
CADs	Cowell Agreement Diverters
CALSIMETAW	California Simulation of Evapotranspiration of Applied Water
CDEC	California Data Exchange Center
CDL	Cropland Data Layers from US Department of Agriculture
CFS	Cubic Feet per Second
CVHM	Central Valley Hydrologic Model
CWD	Chowchilla Water District
DEM	Digital Elevation Model
DWR	Department of Water Resources, State of California
ET	Evapotranspiration
GWMP	Groundwater Management Plan
GSE	Ground Surface Elevation
GSP	Groundwater Sustainability Plan
GW	Ground Water
IDC	IWFM Demand Calculator
IGSM	Integrated Groundwater Surface Water Model
ITRC	Irrigation Training and Research Center
IWFM	Integrated Water Flow Model
IRWMP	Integrated Regional Water Management Plans
MAGPI	Merced Area Groundwater Pool Interests
MercedWRM	Merced Water Resources Model
METRIC	Mapping Evapotranspiration at High Resolution with Internalized Calibration
MID	Merced Irrigation District
MID-WBM	Merced Irrigation District Water Balance Model
NASS	National Agricultural Statistics Service
NRCS	Natural Resource Conservation Service
PRISM	Precipitation-Elevation Regressions on Independent Slopes Model
PSDI	Pore Size Distribution Index
SGMA	Sustainable Groundwater Management Act
SW	Surface Water
SWD	Stevenson Water District
TAF	Thousand Acre-Feet
TDS	Total Dissolved Solids
TWG	Technical Work Group
TID	Turlock Irrigation District
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WDL	Water Data Library

Acknowledgements

The Merced Water Resources Model (MercedWRM) was developed by Woodard & Curran with funding contributions and technical support from the Merced Area Groundwater Pool Interests (MAGPI) and the California Department of Water Resources (DWR).

A Technical Work Group (TWG) was formed to provide quality assurance and technical support throughout the project, resulting in a groundwater model widely accepted by local shareholders and public agencies. The workgroup consisted of representatives from the Department of Water Resources (DWR), the United States Geological Survey (USGS), and several of the MAGPI member agencies.

The Project Team included:

- **Merced Irrigation District**
    - Hicham ElTal, Project Manager
    - Marco Bell, Project Engineer
- **Merced County**
    - Ron Rowe
- **City of Merced**
    - Ken Elwin
- **Technical Work Group**
    - Tariq Kadir, DWR
    - Steven Phillips, USGS
    - Hicham ElTal, Merced Irrigation District
    - Marco Bell, Merced Irrigation District
    - Ron Rowe, Merced County
    - Ken Elwin[1], City of Merced
    - Bob Kelly, Stevenson Water District
- **Consultant: Woodard & Curran**
    - Ali Taghavi, Project Manager
    - Dominick Amador, Project Engineer
    - Jim Blanke, Project Hydrogeologist
- **Department of Water Resources Representative**
    - Jason Preece

[1] Prior to Ken Elwin's involvement, Mike Wegley represented the City of Merced in the Technical Work Group

Chapter 1 Introduction

The Merced Water Resources Model (MercedWRM or Model) is a fully integrated surface and groundwater flow model covering approximately 1,500 square miles of the Merced Groundwater Region (Region). The MercedWRM, a quasi-three-dimensional finite element model, was developed using the Integrated Water Flow Model (IWFM) 2015 software package to simulate the relevant hydrologic processes prevailing in the Region. The Model integrates groundwater aquifers with the surface hydrologic system, land surface processes, and water operations. Using data from Federal, State, and local resources, the MercedWRM is calibrated for the hydrologic period of October 1996 through September 2015, by comparing simulated evapotranspiration, groundwater levels, and streamflow records with historical observed records.

Development of the Model includes the study and analysis of technical data and information that have (a) assisted in the understanding the hydrologic, hydrogeologic, water demand, groundwater, and water supply conditions within the Region; and (b) provided the basis for development and analysis of alternative water management scenarios. The results of this study include groundwater analysis suitable to assist the Sustainable Groundwater Management Act (SGMA) program in the Merced groundwater basin. This analysis includes:

- Hydrogeologic conditions –This study was used in the establishment of the basin’s simulated conditions and to aid in model development. Information was collected from existing models, reports, and previous hydrogeologic studies that include, well logs, pump tests, and aquifer parameter data. The examination of this data led to the development of geologic cross sections, geologic zones, and water management subareas used to develop water budgets.
- Agricultural and urban water demands - Thorough analysis of the land and water use for the Region was completed using census data, land use surveys, historical crop acreage reports, and referenced standards for evapotranspiration and consumptive use fraction.
- Agricultural and urban water supplies - Detailed accounting of water sources for the Region were linked to the proper users. Extensive coordination between the local water purveyors was undertaken to collect and process available data. To this end, a detailed accounting of the various sources of water supplies (groundwater and surface water) for each user type and category was developed.
- Evaluation of regional water quality conditions – Water quality data for both Total Dissolved Solids (TDS) ad Nitrate (as NO3) was used to develop maps of TDS and NO3 distribution trends .Data collection efforts included loading of TDS and NO3 for various components such as applied water, irrigation canal water, and streamflow. .

1.1 Goals of Model Development

The goal of this project is to develop a comprehensive numerical integrated surface water and groundwater model that will help manage the water resources of the Merced Region at a localized scale. This model is to serve as a robust, defensible, established, publicly accepted analytical tool. This model would be used for analysis of water resources of the Region to evaluate the historical operations and hydrology of the Region, as well as support evaluation of water resources programs and water supply projects under baseline conditions reflecting the existing and future conditions in the Region.

As such, the model has been developed in an open and transparent process, with frequent workshops with the MAGPI members to review model data and assumptions, modeling process, as well as model results. In addition, a Technical Workgroup consistent of representatives of the Department of Water Resources, the US Geological Survey, and local agencies was formed to oversee the details of the model development and calibration process.

It is noteworthy that the Region is covered by the DWR's Central Valley Groundwater and Surface water Model (C2VSim), which can be used for simulation of the groundwater and surface water conditions at a much higher level, and evaluation of the interbasin flows across the model and the Region's boundaries. However, in order to evaluate the water resources conditions in the Region at a local scale, which reflects the details of the operations of the local Region, a detailed integrated hydrologic model is essential.

The specific objectives of development of the Merced Water Resources Model are:

Evaluate the Groundwater Region's Characteristics using the Model to:

- Assess historical and projected characteristics and behavior of the integrated SW & GW resources
- A robust and defensible analytical tool to support development of the Groundwater Sustainability Plan (GSP) for the basin
- Estimate historical water budgets for the basin
- Identify effects of historical operations of the basin on the groundwater resources and interaction of surface water and groundwater
- Estimate sustainable yield of the basin under historical, current, and projected land and water use conditions
- Evaluate interbasin flows across basin boundaries with the neighboring basins
- Evaluate the feasibility of conjunctive use management programs
- Assess natural recharge conditions
- Explore the nature of interaction of stream and aquifer system in various areas of the Region
- Estimate boundary flows between the Region and neighboring groundwater basins
- Assess the nature of operation of unlined canals and their interactions with the aquifer system
- Evaluate the effects of operation of upstream reservoir on the surface water supplies and groundwater system

Appraise Conditions of the Groundwater and Surface Water System Under Project Settings

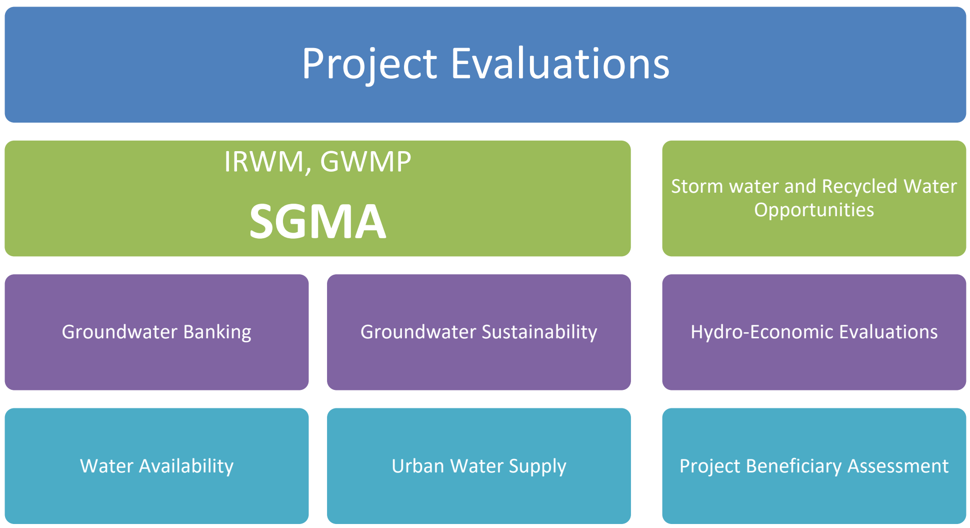
- Evaluate the basin operations under sustainable groundwater management conditions
- Estimate effects of demand side and supply side actions and plans for sustainable management of the basin
- Measures of assessing effects programs and projects considered under the Groundwater Sustainability Plan (GSP), Groundwater Management Plan (GWMP) and Integrated Regional Water Management Plans (IRWMP)
- Evaluate the effects of use of storm water and recycled water in the Region
- Assess effectiveness of groundwater storage and banking operations
- Estimate feasibility of surface water systems re-operations
- Evaluate GW & SW system responses to different pumping and recharge programs
- Estimate impacts of land use and water supply strategies on GW & SW systems
- Evaluate effects of urban growth on SW & GW systems
- Assess effect of basin operations on GW quality conditions
- Appraise benefits and costs for proposed project and programs
- Determine the effects of climate change on groundwater and surface water supplies and resources in the Region

Utilization of this model will provide MAGPI and other stakeholders with the ability to develop accurate analysis of the surface water and groundwater conditions in the Region. The model can evaluate the effects of changes in the land and water use, operations, irrigation practices, climate, water supply availability, conjunctive use, recharge, and other projects and operations on the groundwater and surface water resources in the Region.

It is anticipated the MercedWRM will be used in the evaluation of a variety of projects that include the evaluation of land and water use plans, water supply alternatives, recharge projects, conjunctive use options, water quality conditions, and many other surface and groundwater planning scenarios.

Although, the model development process began a few years prior to the 2014 passage of SGMA, the model, with some refinements and enhancements, is a well-established and defensible analytical tool to be used to support the development of the Groundwater Sustainability Plan (GSP) that will be undertaken in 2018-2019, due to the DWR by January 2020.

Diagram 1 Model Application Areas



1.2 Merced Groundwater Region

The Merced Groundwater Region (Figure 1) is primarily defined by the 491,000-acre Merced Groundwater Subbasin (Merced Subbasin), but it also includes portions of the Chowchilla Groundwater Subbasin to the south and the Turlock Groundwater Subbasin to the north, totaling approximately 608,000 acres. Its boundaries are defined to be the crystalline basement rock of the Sierra Nevada foothills on the east and the San Joaquin River to the west. The northern boundary is set at the northern edge of the Dry Creek Watershed and the southern boundary is formed by the Chowchilla River. The regional streams defining the north, west, and southern boundaries are recognized by the Department of Water Resources (DWR) through the Region Acceptance Process (RAP) as critical hydrological features distinguishing the Region from its neighbors.

Merced County is one of the top 5 agricultural producing counties in the state. In 2013, the County generated a gross of nearly 3.8 billion dollars[2] in commodities, much of which was produced on irrigated farmland. Land and water use in the Merced Region is dominated by agricultural uses, including animal confinement (dairy and poultry), grazing, forage, row crops, and fruit and nut trees. These uses rely heavily on surface water supply and private groundwater wells. Due to economic conditions and a strongly water-dependent

[2] 2013 Merced County Department of Agriculture Report on Agriculture

agricultural economy, water issues in the Region are well-understood and treated as high priority within the Region. Since the Merced Region plays a vital part in the economic future of California, managing the water resources of the Region is both a unique and challenging endeavor.

Furthermore, the Region is marked by a network of streams that are used for both conveyance and flood control. The Region's commitment to proper water resources management is evident by its long history of proactive management. In 1997, most of the Region's water agencies and purveyors formed the Merced Area Groundwater Pool Interests (MAGPI) to share technical data, encourage cooperative planning, and develop management strategies to improve the groundwater basin. Since then, MAGPI has played an active role in management of the groundwater resources in the Region.

1.3 Model Development Partners and the Technical Work Group

The development of the MercedWRM was overseen by the MAGPI board of directors and representative member agencies. The development environment was an open and transparent process, with public workshops during the project to review and reflect upon the data and assumptions used in the model, and to review the model results.

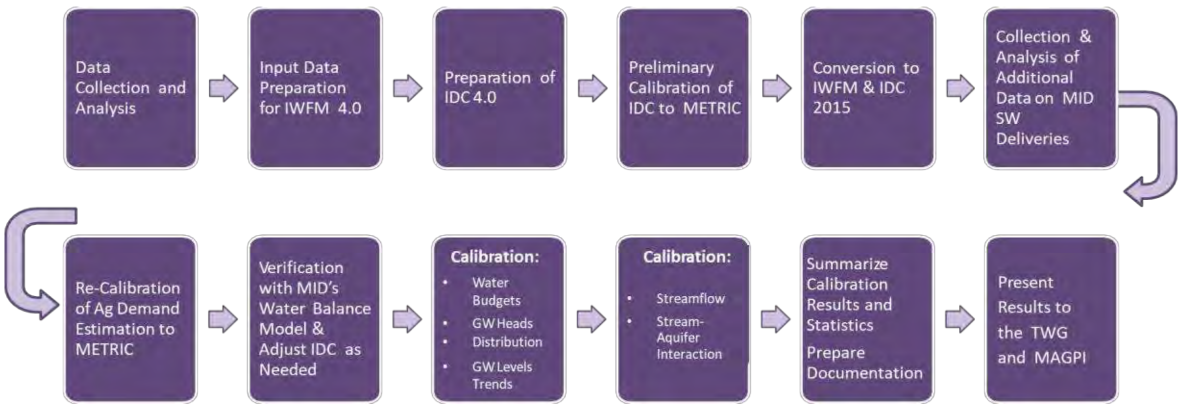
The Model was developed by financial contributions from the Merced Irrigation District, City of Merced, County of Merced, as well as a grant from the California Department of Water Resources.

A Technical Workgroup (TWG) was assigned to meet and oversee the details of the data, information and assumptions that are used in the Model development. This TWG consisted of representatives from the DWR, USGS, MID, Merced County, the City of Merced, and Stevinson Water District (SWD).

Chapter 2 Model Development

This section presents the data and analysis of input information undertaken during the development of the MercedWRM. It includes the spatial and temporal information regarding hydrologic and hydrogeologic data sets included in the model.

Diagram 2 - Model Development Process



2.1 Model Input Data

IWFM model files and associated Microsoft Excel worksheets are referenced below in Table 1.

Table 1: Merced Water Resources Model - Input Data

Major Data Category	Minor Data Category	Data Source	Report Section
Hydrogeological Data	Geologic Stratification	USGS Texture Model	2.8.2
		USGS Geospatial Database	2.8.2
		USGS Reports	2.8.2
	Aquifer Parameters	C2VSim	4.7
Hydrological Data	Stream Configuration	Merced Irrigation District	2.4
	Stream Inflow	USGS & CDEC Stream Gauges	2.4
	Calibration Gauges	USGS & CDEC Stream Gauges	4.3
	Precipitation	PRISM & CalSIMETAW	2.3
Agricultural Water Demand	Land Use	DWR	2.6
		CropScape	2.6
		Ag. Commissioner's Report	2.6
		MID-WBM	4.4.1
	Evapotranspiration	C2VSim	3.1
		METRIC	3.1
	Soil Properties	NASS Web Soil Survey	2.5
Agricultural Water Supply	Groundwater Pumping	Agency Well Locations	3.1.4
		Agency Well Production	3.1.4
		Private Well Production	3.1.5
	Surface Water Deliveries	Merced ID	3.1.3
		Stevinson WD	3.1.3
		Merquin County WD	3.1.3
		Turner Island WD	3.1.3
		Lone-Tree MWC	3.1.3
		Turlock ID	3.1.3
		Chowchilla WD	3.1.3
Urban Water Demand	Population	U.S. Census Bureau	3.2
	Per Capita Water Use	Merced UWMP	3.2
Urban Water Supply	Groundwater Pumping	Municipal Well Locations	3.2
		Municipal Well Production	3.2
Other	Boundary Conditions	DWR	2.10
	Initial Conditions	DWR	2.11
	Small Watersheds	MID	2.9
	Calibration Wells	Merced HydroDMS	4.5

2.2 Model Grid and Subregions

The MercedWRM is based around a two-dimensional finite element grid covering both the 950-square mile (608,000 acres) Region and a 550-square mile buffer zone (Figure 2). The grid consists of 17,696 nodes and 19,563 elements and is defined based on quarter mile discretization on all major hydrologic features while maintaining ½ mile discretization on district and city boundaries. Under this delineation, Model elements within the MAGPI subregions maintain an average area of 24 acres and follow the distribution shown in Figure 3. High grid resolution, along with the incorporation of fine data, makes it possible to provide detailed model results to support future hydrologic analysis of potential scenario runs.

The Region supports nine independently operating agricultural water purveyors and three major municipalities. Each of these agencies, in addition to the many unincorporated areas, have varying water resource practices and unique impacts on the groundwater hydrology. The MercedWRM is subdivided into 37 distinct subregions (Figure 4), 34 of which make up the Merced Groundwater Region, and 3 boundary zones. Delineating subregions help incorporate this variability and facilitate the zonal analysis of water budgets and hydrologic conditions.

2.3 Regional Hydrology

The development of the MercedWRM requires rainfall data for every model element. Rainfall data for the Region is derived from the PRISM (Precipitation-Elevation Regressions on Independent Slopes Model) dataset of the DWR's CALSIMETAW (California Simulation of Evapotranspiration of Applied Water) model. Daily precipitation data is available from October 1, 1921 on a 4-kilometer grid throughout the Region (Figure 5). The spatial distribution of precipitation data, to the model grid, was developed by mapping each of the model elements to the nearest of 621 available reference nodes, uniformly distributed across the model domain. The spatial intensity of the Region's precipitation is shown in Figure 8.

From the PRISM nodes within the Region, average annual rainfall and cumulative departure from the monthly mean is presented for the entire period of record in Figure 6 and for the current hydrological period (1970+) in Figure 7. Additional precipitation statistics are available in Table 2.

Table 2: PRISM Precipitation Statistics within the MercedWRM

	Long Term (1922-2015)		Hydrological Period (1970-2015)		Simulation Period (1996-2015)	
	Year	Precip (in)	Year	Precip (in)	Year	Precip (in)
Minimum	1977	4.90	1977	4.90	2007	6.29
Mean		11.94		11.95		12.52
Maximum	1958	25.59	1983	24.56	1998	23.16

2.4 Stream Configuration and Stream Flow Data

The surface water features of the MercedWRM, shown in Figure 9, include the 12 dynamically simulated streams (Table 3) divided into 71 distinct reaches for budgetary purposes. The streams and creeks listed below are represented in the model by 1548 stream nodes (Figure 10) on a quarter-mile interval. The high number of stream nodes and resolution provide increased accuracy when depicting the stream-groundwater interaction. Physical statistics, including the stream invert elevation, channel width, and a stream flow rating table, were provided by MID surveyed cross sections and USGS Digital Elevations Models (DEM).

Table 3 MercedWRM Simulated Streams

Major Streams within the Merced Region		
Merced River	Owens Creek	Dutchman Creek
Black Rascal Creek	Mariposa Creek	Chowchilla River
Bear Creek	Duck Slough	East Side Canal
Miles Creek	Deadman Creek	San Joaquin River

Metered streamflow data is available from 16 gauging stations that are reported by the USGS, the California Data Exchange Center (CDEC), and MID. Due to the availability of streamflow records, a few of the flow time series datasets were historically extrapolated to estimate flows in periods without recorded data. This process was completed by using the average monthly flow based on the DWR water year index. A detailed table of stream input data and a map of available stream gauge locations are found in Table 4 and Figure 11 respectively.

Table 4: Summary of MercedWRM Streamflow Data

Stream	Stream Node	Reporting Agency	Gauge Name	Period of Record
Merced River	1	USGS	Merced River at Northside Canal	October 1969 to September 2013
Merced River	35	CDEC	Merced River Near Snelling	March 1999 to September 2015
Merced River	85	USGS	Merced River at Shaffer Bridge	January 1970 to September 2015*
Merced River	103	CDEC	Merced River near Cressey	March 1999 to September 2015
Merced River	1127	USGS	Merced River at Stevinson	October 1969 to September 2015*
Bear Creek	225	CDEC	Bear Creek	October 1993 to September 2015
Owens Creek	450	CDEC	Owens Creek Dam	October 1993 to September 2015
Mariposa Creek	598	CDEC	Mariposa Creek Dam	July 1994 to September 2015
Chowchilla River	957	USGS	Chowchilla River at Buchanan	October 1969 to September 1990
San Joaquin River	1311	CDEC	San Joaquin River at Mendota Pool	December 1999 to September 2013

* Includes long periods without data.

2.5 Soils

IWFM, as an integrated surface water and groundwater model, simulates the interaction between surface features and the underlying aquifer system.

The soil types identified within the survey data are associated with one of four hydrological soil groups. Each soil group is categorized according to their runoff potential and infiltration characteristics. The Natural Resource Conservation Service (NRCS) defines these hydrological soil groups as follows:

> **Group A** – Soils in this group have low runoff potential when thoroughly wet. Water is transmitted freely through the soil. Group A soils typically have less than 10 percent clay and more than 90 percent sand or gravel and have gravelly or sandy textures. Some soils having loamy sand, sandy loam, loam or silt loam textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.
>
> **Group B** – Soils in this group have moderately low runoff potential when thoroughly wet. Water transmission through the soil is unimpeded. Group B soils typically have between 10 percent and 20 percent clay and 50 percent to 90 percent sand and have loamy sand or sandy loam textures. Some soils having loam, silt loam, silt, or sandy clay loam textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.

Group C – Soils in this group have moderately high runoff potential when thoroughly wet. Water transmission through the soil is somewhat restricted. Group C soils typically have between 20 percent and 40 percent clay and less than 50 percent sand and have loam, silt loam, sandy clay loam, clay loam, and silty clay loam textures. Some soils having clay, silty clay, or sandy clay textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.

Group D – Soils in this group have high runoff potential when thoroughly wet. Water movement through the soil is restricted or very restricted. Group D soils typically have greater than 40 percent clay, less than 50 percent sand, and have clayey textures. In some areas, they also have high shrink-swell potential.

Hydrologic data, collected from the Natural Resource Conservation Service's (NRCS) Web Soil Survey (WSS), was used to develop hydrologic soil types and root zone parameters for each element within the model area (Figure 12).

2.6 Land Use and Cropping Patterns

The MercedWRM uses annual land use distribution by element. The model divides all land use types into four classifications: native, non-ponded, ponded and urban. For each element, an aerial percentage ratio is given to each of 11 agricultural categories, and each of the non-agricultural categories, which are urban, native, riparian, or wetlands. The total of the ratios among categories for each individual element must add up to one.

Land use classifications stem from two primary sources, the DWR Land Use Survey and the USDA CropScape Program. DWR conducts land use surveys by county approximately every seven to ten years to estimate changing land and water use patterns. DWR's Merced County Land Use Survey data, available in 1995, 2002, and 2012, is available on a parcel level and has been mapped to the MercedWRM grid. In addition to DWR land use surveys, the United States Department of Agriculture's National Agricultural Statistics Service (NASS) provides geospatial satellite data, known as cropland data layers (CDL), on an annual basis since 2007. Each CDL has a ground resolution of 30 meters (Figure 13), and the USDA reports an 85% to 95% classification accuracy of the CropScape datasets for major crop-specific land cover categories.

Due to the nature of the CropScape datasets and remote sensing in general, there is some deviation in the total agricultural acreage across the district. In order to minimize error and ensure the quality of the data, the 2012 CropScape was compared to both the 2012 DWR Land Use Survey and the 2012 Merced County Ag Commissioner's report. While all datasets demonstrated some variance at high resolution, subregional aggregation offered a comparable distribution leading to the acceptance of the CropScape datasets and methodology. Accuracy was further enforced through a series of manual detailed analysis, where ground truthing was performed in hydrologically critical areas by inspection of historic areal imagery. These adjustments are further documented within the corresponding land use Excel file.

Due to the discontinuous nature of the available land use data, linear interpolation was completed to connect the 1995 to 2002 DWR Land Use Surveys, and again to connect the 2002 DWR Land Use Survey with the 2007 CropScape data. The annual distribution of crop categories and acreages across the entire Model is available in Figure 14.

Land use trends from 1995 through 2015 show significant increases in total and irrigated agricultural acreage, with 290,000 irrigated acres at the beginning of simulation and 325,000 acres in production by 2015. This change from native to agricultural area brings additional stresses on the hydrological system, particularly as the majority of this increase comes from the increased popularity of permanent crops, specifically vineyards, almonds, and walnuts.

2.7 Drainage

Surface drainage patterns define how runoff from rainfall and applied water is processed within the model framework. As a majority of the model area is either urban or developed agriculture, drainage within the system is largely a factor of infrastructure and does not rely specifically on ground surface elevation and natural flow patterns. Due to this, delineation of small drainage watersheds, as defined by MID (Figure 15), was integrated into the model. Each drainage watershed was assigned a stream node to discharge. All elements in the watershed were assign their specific watershed discharge stream node. As improved surface watershed models of the basin are developed, Merced WRM can spatially be re-delineated so that the watersheds match the updated sub-basin definitions.

2.8 Geologic Structure and Model Layering

The following section highlights the hydrogeologic analysis of the Merced Region and the resulting stratigraphic layering of the MercedWRM.

2.8.1 Conceptual Aquifer Systems

The Merced Groundwater Management Plan (MAGPI 2006) provided a basis for understanding of hydrogeologic conditions in the Merced area. This document identified six aquifer systems, as described below.

Fractured Bedrock - Along the eastern edge of the Merced Subbasin, wells have been completed within the Valley Springs and lone Formations (Page and Balding 1973, Page 1977). These wells appear to be completed in fractured bedrock with limited and variable yields. Because of the limited extent and poor yields of the fractured bedrock aquifer, the fractured aquifer is not a significant source of water in the Merced Subbasin.

The Mehrten Formation - The Mehrten Formation outcrops over a large area in the Merced Subbasin. Many water supply wells in the eastern portion of the Merced Subbasin penetrate the formation, and the formation is a significant source of groundwater. The Mehrten is considered a confined aquifer where it occurs beneath the Corcoran Clay. There is insufficient data to determine the degree of confinement of the formation where the Mehrten does not underlie the Corcoran Clay.

Confined Aquifer- The confined aquifer occurs in older alluvium (and Mehrten Formation) deposits that underlie the Corcoran Clay. Many water supply wells in the western portion of the MGWB penetrate the Corcoran Clay into the confined aquifer, and the confined aquifer is a significant source of groundwater.

Intermediate Leaky Aquifer - The intermediate leaky aquifer occurs in older alluvium deposits that overlie the Corcoran Clay or are east of the Corcoran Clay. Where the Corcoran Clay is absent, the intermediate aquifer extends to the Mehrten Formation. In the eastern portion of the Merced Subbasin the intermediate aquifer consists of a series of interbedded coarse-grained layers (gravel and sand) separated by fine-grained layers (silt and clay). The fine-grained layers inhibit, but do not prevent vertical groundwater flow between layers and thus form a leaky-aquifer system. Many water supply wells in the Merced Subbasin are completed in the intermediate leaky-aquifer and it is a significant source of groundwater.

The Intermediate leaky-aquifer is the most extensively developed aquifer in Merced Subbasin. Measured well yields within the Merced Subbasin range from 670 to 4000 gallons per minute (gpm) (Page and Balding, 1973). Estimates of specific capacity of supply wells throughout the Merced Subbasin range from about 20 to 40 gallons per minute per foot of drawdown and indicate that the specific capacity increases from east to west.

Shallow Unconfined Aquifer - The shallow unconfined aquifer occurs in older and younger alluvium deposited above the shallow clay bed. Because of its shallow depth, few water supply wells are completed in the shallow unconfined aquifer. Where water levels in the intermediate leaky aquifer fall below the base of the shallow clay bed, groundwater in the intermediate aquifer becomes unconfined and water in the overlying shallow aquifer becomes perched. (MAGPI 2006)

2.8.2 Data Sources

Model stratigraphy was developed through a thorough analysis of local and regional datasets, including published geological reports and existing models. The analysis utilized the conceptual understanding of the aquifer system described in the Merced Groundwater Management Plan (MAGPI 2006). This conceptualization was based in part on existing reports, notably by Page and Balding (1973) and Page (1977). The source documents and models were used to define the depth, thickness, and extent of the major geologic units associated with the aquifer systems described by in the Merced Groundwater Management Plan. More recent data was incorporated into the analysis by utilizing textural data from the USGS (2010), completed as part of the development of the Central Valley Hydrologic Model (CVHM). Localized data sets and regional surficial geology provided additional details to identify the extent of certain layers. A summary of hydrogeologic data used in the development of the MercedWRM layering is shown in Table 5.

Table 5: Model Hydrogeologic data

Data Source	Authors	Date
Geology and Quality of Water in the Modesto-Merced Area, San Joaquin, California	R.W. Page and G.O. Balding	1973
Appraisal of Groundwater Conditions in Merced California and Vicinity	R.W. Page	1977
Geologic Map of the San Francisco-San Jose Quadrangle, California	D.L. Wagner, E.J. Bortugno, and R.D. McJunkin	1991
Central California Valley Groundwater-Surface Water Simulation Model	California Department of Water Resources	2013
Central Valley Hydrologic Model Texture Model	United States Geological Survey	2010
Merced Groundwater Basin Groundwater Management Plan	AMEC Geomatrix	2008

Published Cross Sections – The basis for much of the definition of the aquifer systems in the Merced Groundwater Management Plan is Page and Balding (1973) and Page (1977). Among other information, these USGS source documents provide cross sections defining the major stratigraphic units, which allows for definition of the extent, depth, and thickness. Units include:

- Unconsolidated deposits
  - Flood basin deposits and younger alluvium
  - Older alluvium
  - Continental deposits
- Consolidated rocks

- o Mehrten Formation
- o Valley Springs Formation
- o Ione Formation
- o Basement complex

Locations of cross sections from Page and Balding (1973) are shown in Figure 16, with the associated cross sections in Figure 17. Similarly, locations of cross sections from Page (1977) are shown in Figure 18, with the associated cross sections in Figure 19. Page and Balding (1973) was used for cross section development as these sections are more regional in nature. Page (1977) contained some additional detail, notably the presence of a shallow clay, which was incorporated into the layering.

The cross sections show units dipping to the west-southwest with steeper dips in the older units and gently dipping recent units. The cross sections show the Corcoran Clay as a regionally extensive unit across the western portion of the model area and a shallower clay unit present in much of the central portion of the area.

USGS CVHM Texture Model – The USGS CVHM texture model of the Central Valley was used to augment the information contained in the published cross sections, as the published cross sections did not incorporate more recent boring log data and were not spaced closely enough to allow for suitable interpolation. The USGS CVHM texture model is a three-dimensional model of sedimentary texture deposited within California's Central Valley. Originally compiled in 2004, the model was developed by analyzing over 150,000 drillers' logs describing lithologies up to 950 meters deep. After a subset of 8,500 boreholes was selected, a form of kriging geostatistical analysis was performed to determine the percentage of coarse-grained deposits over each 15-meter composite interval. (Faunt, Belitz, and Hanson 2009). For use within the MercedWRM, coordination with USGS staff members provided refined textural data at each model node on a 10-foot vertical interval.

The CVHM texture model generally shows coarser materials near the Merced River and above the continental deposits, both above and below the Corcoran Clay. Materials generally become more fine-grained with depth and with distance to the south-southeast.

Additional Data Sources – Additional data sources were used to define the surficial extent of layers, the base of the model, and the extent of shallow clays.

- The ground surface elevation was defined by the USGS Digital Elevation Model was available on a 1/3 arc-second (approximately 33 feet) level of discretization and is shown in Figure 20. The horizontal data is in North American Datum of 1983 (NAD 83) and the vertical data is North American Vertical Datum of 1988 (NAVD 88).
- The location where layers are present at the surface (outcrop) was refined based on the surficial geologic map developed by Wagner, Bortugno, and McJunkin (1991). This map, shown in Figure 21, assisted in further refining the interpolation between cross sections and further improving correlation between texture information and stratigraphic units. Presence of Mehrten Formation, Valley Spring Formation, and alluvium were used to constrain the extent of the layers in the cross sections.
- The extent of shallow clays was established using records of historical perched aquifer conditions provided by Merced ID. Presence of perched aquifer conditions in the local data were combined with the extent of shallow clays shown in the spatially limited Page (1977) cross sections to define the extent of shallow clays.
- Regional extent, depth, and thickness of the Corcoran Clay Member of the Tulare Formation is available on the USGS Central Valley Spatial Database. This digital dataset, (Figure 22 and Figure

23) was directly implemented into the Model layer definition for Aquitard 2, as an extensive impermeable, lacustrine deposit.

- The base of fresh water as defined by the California Central Valley Groundwater-Surface Water Simulation Model (C2VSim-2015) as enhanced by the DWR in 2017, was used to define the maximum thickness of the fresh water aquifer, shown in in Figure 25.
-
- The extent of the MercedWRM is bounded in the vertical direction by the base of the continental deposit as defined by C2VSim-2015, whose elevation is shown in Figure 26.

2.8.3 Model Layer Development and Approach

The texture data was analyzed on a three-dimensional grid and incorporated into the layering analysis by developing cross sections aligned with published cross sections from the Page and Balding (1973) and Page (1977) reports and tying together with surficial geology information in Wagner, Bortugno, and McJunkin (1991). Texture model cross sections were developed at regular intervals aligned with the MercedWRM grid, as shown in Figure 24. This analysis allowed for refinement of the published cross sections with the newer textural data, with care taken to adjust for interpolation within the texture model that prefers the horizontal plane, rather than a dipping plane. The analysis also allowed for improved interpolation in areas without existing published cross sections, using the spatially continuous texture data. Geospatial overlays of the published reports with the texture model are available in Figure 27 though Figure 29, as listed in Table 6.

Table 6: Reference Table of the Hydrogeological Cross-Sectional Overlay

Figure	Page and Balding 1973	Texture Model
27	Cross Section B-B'	Cross Section A-A'
28	Cross Section C-C'	Cross Section F-F'
29	Cross Section D-D'	Cross Section J-J'

These overlays were combined with the other collected information to finalize the layers, as described below.

2.8.4 Model Layer Definition

The MercedWRM is divided into five distinct freshwater aquifers, one saline aquifer, and two confining units. Descriptions of each of the model layers are listed below, from top to bottom.

Layer 1 The ground surface elevation (GSE), or the top Layer 1, maintains an upper bound set by the USGS Digital Elevation Model (DEM) at a resolution of 1/3 arc-seconds, or approximately 33 feet. The layer thickness is limited by the greater of the two bounding factors subsequently listed. The primary element, from within the IWFM framework, maintains that localized stream invert constraints force the top layer to be no thinner than 25 feet thick. Additionally, within the Region, there is a shallow clay unit that covers the valley floor. This clay, described as Aquitard 1 below, is observed at ranges between 20 and 70 feet below the ground surface and, when present, defines the bottom of the first layer. Layer 1 is equivalent to the Shallow Unconfined Aquifer described in the Merced Groundwater Management Plan (http://magpi-gw.org/index.cfm/groundwater-management-plan/).

Aquitard 1 Throughout the central area of the Merced Groundwater Basin there is a shallow confining clay unit that ranges in thickness up to 20 feet thick and primarily lies at a depth of 1/3 of the distance between the ground surface and the top of the Corcoran clay.

Layer 2 Layer 2 is principally bounded by the previously defined confining shallow clay unit, Aquitard 1, and the Corcoran Clay deposit, Aquitard 2. Additionally, a minimum thickness of 25 feet is set wherever Layer 2 exists, to meet suggested convergence constraining factors within IWFM. Layer 2 is equivalent to the Intermediate Leaky aquifer system described in the Merced Groundwater Management Plan.

Aquitard 2 Equivalent to the Corcoran Clay or E Clay, Aquitard 2 within the MercedWRM is a regionally extensive confining unit. Digital shapefiles of the extent, thickness (Figure 22) and depth (Figure 23), of the Corcoran Clay are available from the CVHM Central Valley Spatial Database. The MercedWRM uses these shapefiles to define Aquitard 2.

Layer 3 Layer 3 consists of the older alluvium below the Corcoran Clay, as defined in Aquitard 2, to the top of the continental deposits in Layer 4, defined using cross sections from Page and Balding (1973) in combination with the USGS CVHM textural model, surficial geology, and a maximum depth defined by the C2VSim base of fresh water. Where the Corcoran Clay is present, Layer 3 and Layer 4 are equivalent to the Confined Aquifer described in the Merced Groundwater Management Plan.

Layer 4 Below the older alluvium, as defined in Layer 3, are continental deposits with a base defined in the same manner as above: cross sections from Page and Balding (1973) in combination with the USGS CVHM textural model, surficial geology, and a maximum depth defined by the C2VSim base of fresh water. Where below the Corcoran Clay, Layer 3 and Layer 4 are equivalent to the Confined Aquifer described in the Merced Groundwater Management Plan

Layer 5 The Mehrten Formation is composed of consolidated rock - sandstone, breccia, conglomerate, tuff, siltstone, and claystone - and is an important water supply aquifer. The bottom of the Mehrten, as with layers above, is defined through cross sections from Page and Balding (1973) in combination with the USGS CVHM textural model, surficial geology, and a maximum depth defined by the C2VSim base of fresh water. The Valley Springs Formation underlies the Mehrten on the eastern side of the Merced Groundwater Basin and is not considered a significant source of water due to a matrix of clay and fine ash. This layer is equivalent to the Mehrten Formation described in the Merced Groundwater Management Plan, with the underlying Valley Spring Formation part of the Fractured Bedrock aquifer system from the same document.

Layer 6 Layer 6 consists of the saline water ranging from the base of fresh water to the base of continental deposits as defined by the fourth layer of C2VSim-2015 (equivalent to the base of the Fractured Bedrock as defined in the Groundwater Management Plan). A non-production zone, this layer was implemented as a refinement to the water quality model and for the potential use of scenario development for the simulation of deep well production.

Finalized cross sections of the model layering, shown in v Figure 30 through Figure 42.

2.9 Small-Stream Watersheds

Watersheds defined by both the California Department of Conservation through the California Watershed Portal and the U.S. Geological Survey Watershed Boundary Dataset were reviewed in defining the watersheds of the Merced Region. The USGS Watershed Boundary Dataset classifications were selected as more representative of the Merced Region because its watershed boundaries are determined solely upon hydrologic principles and do not favor any administrative boundaries.

The spatial delineation of the watersheds within the MercedWRM is highlighted in Figure 44 and are listed from north to south in Table 7. The IWFM small watershed package is used to simulate both surface and subsurface flows entering the model's eastern boundary. Though this package, hydrologic conditions are simulated based on site-specific parameters and calculated flow rates are attributed to boundary nodes. Each intersecting groundwater node receives equivalent flow relating to its specific watershed. Since most of the streams entering the Basin are regulated, and IWFM simulates unimpaired flows, stream inflow is superseded whenever gauged inflow is available.

Table 7: Small Stream Watersheds

Small-Stream Watershed	Area (acres)
Bear Creek	46,097
Burns Creek	34,375
Deadman Creek	17,588
Dutchman Creek	10,998
Mariposa Creek	32,340
Merced River	50,762
Miles Creek	9,301
Owens Creek	17,462

2.10 Boundary Conditions

Time series general head boundary conditions were defined for the MercedWRM for all boundary nodes on the northern, western and southern limits (Figure 45), while the Model's eastern boundary is controlled by the small watersheds. These boundary conditions were developed using the DWR's Water Data Library (WDL) and annual groundwater level contours available from the DWR South-Central Region.

2.11 Initial Conditions

Similar to the boundary conditions, groundwater heads for each model node at the beginning of the simulation were developed using the DWR's WDL. As it is not possible to determine perforation interval of the observation wells, the heads were averaged across all layers. Because of this, the initial conditions for the MercedWRM were based on observed fall 1993 water level data (Figure 46), corresponding to a simulation beginning with the start of the 1994 water year. It should be noted that, while the simulation begins with the start of the 1994 water year, the calibration period begins in 1995 with the realization that an initial period is necessary for hydraulic stabilization across the model layering.

Chapter 3 Water Supply and Demand Data

The following sections describe the development process of the MercedWRM water demand and supply calculations.

3.1 Agricultural Water Demand

Agricultural water demand within the MercedWRM is dynamically calculated every month for each model element using consumptive use methodology. The consumptive use analysis within the Region was performed using the IWFM Demand Calculator (IDC) in conjunction with the remote sensing technology Mapping Evapotranspiration at High Resolution and Internalized Calibration (METRIC), which was used to verify the consumptive use demand by the IDC. The investigation of water demand under both methods offered distinct but parallel results, emphasized in the following sections.

3.1.1 Evapotranspiration (METRIC Remote Sensing)

Developed by the University of Idaho in 2000, METRIC is the process of using LandSAT Thematic Mapper data to directly compute the actual evapotranspiration (ET_C) of vegetation as a residual to the surface energy balance. For use in the MercedWRM, the Irrigation Training and Research Center (ITRC) used a modified METRIC procedure to develop the nine years of evapotranspiration data, distributed between 1989 and 2013, and shown in Table 8. The following years of analysis were selected to cover a variety of hydrological year types, cropping patters, and the availability of LandSAT images.

Table 8: METRIC Datasets within the MercedWRM

Available METRIC Data					
Calendar Year	Hydrologic Classification	Calendar Year	Hydrologic Classification	Calendar Year	Hydrologic Classification
1989	Critical	2000	Above Normal	2008	Critical
1997	Wet	2001	Dry	2010	Above Normal
1998	Wet	2002	Dry	2013	Critical

A detailed explanation of the METRIC process and how it was directly applied to the Merced Region is available in Appendix B of this report. The utilized data is a series of monthly rasters exhibiting actual ET_C on a 30-meter spatial discretization.

As remote sensing data is not available on a continuous basis, the dataset was employed as a calibration tool rather than a direct method of demand measurement. The analysis of this dataset, along with other observed parameters were used as a calibration tool for the IDC during Model development and are covered in further detail in the calibration section of this report.

For additional details on the implementation of the METRIC datasets, please reference Section 4.2, Calibration of the IDC and Root-Zone Parameters.

3.1.2 Evapotranspiration (IWFM Demand Calculator)

Agricultural water demand is the amount of irrigation water that is required to satisfy the crops potential evapotranspiration requirement. The IWFM Demand Calculator (IDC) is designed to estimate the agricultural water demand for each element within the model area through consumptive use methodology, based on historical crop acreage, soil moisture requirements, effective rainfall (the portion of rainfall available for crop consumptive use), potential evapotranspiration, and localized soil parameters.

The IDC applied to the MercedWRM is a soil moisture routing simulation integrated with the groundwater model. Figure 47, from the IDC user's manual, highlights the simulated flow processes applied to the Merced Region. Within this framework, a base demand, or the potential evapotranspiration (ET_P) shown in Figure 48, can be employed to either fixed or adjustable water consumption. Due to the nature of private groundwater production in the Central Valley, all elements with irrigated agriculture are set to pump groundwater to meet all demands not met by surface water deliveries.

3.1.3 Surface Water Diversions

Major water purveyors within the model domain provided surface water delivery data for study and model implementation. Figure 49 displays the elements receiving surface water for agricultural use within the Region and Table 9 highlights the spatial and temporal discretization of available data across the entire model. Since complete monthly records are not available for all water purveyors, an analysis of available data was preformed and refined as follows:

Period of Record - The MercedWRM simulation period begins in October 1993 and ends in September 2015. When unavailable, estimations are made to approximate the surface water deliveries applied within the unknown time period. This process is completed by using the average monthly value for that district, according to the respective water year index.

Spatial Discretization – Surface water deliveries within IWFM require the user to specify the surface water destination to be an element, a group of elements within a single subregion, or a specific subregion. As high-resolution delivery data may not be available, and data may span multiple subregions, district and service area deliveries may be divided based on the agriculture area within a sub-section. Since IWFM has the capability to apply surface water deliveries to the element level, future model updates can benefit from enhanced applied water data, including data spatial discretization, quantity and timing.

Time Step Adjustments – The MercedWRM is run on a monthly time step and requires monthly data as input. While monthly data is available from MID, records with such delineation were not presented for use from Stevinson, Merquin County, Turner Island, or Chowchilla Water Districts. Because of this, monthly delivery data is estimated by applying the fraction of monthly versus annual stream diversions by MID off the Merced River.

Table 9: MercedWRM Surface Water Delivery Data

Agency	Period of Record	Resolution	Time-Step
Merced Irrigation District	Oct 1993 - Sept 2015	Parcel / Element	Monthly
Stevinson Water District	Oct 2000 - Sept 2013	District Total	Annual
Merquin County	Oct 2000 - Sept 2013	District Total	Annual
Turner Island Water District	Oct 2003 - Sept 2015	District Total	Annual
Chowchilla Water District	Oct 1993 - Sept 2013	District Total	Annual
Merquin County	Oct 2000 - Sept 2013	District Total	Annual
Turlock Irrigation District	Jan 1991 - Dec 2012	Service Area	Monthly

In conjunction with surface water deliveries used to meet agricultural water demand, the Region benefits from significant recharge as a result of local management practices, particularly the 563 miles of unlined canals operated by MID. Recharge from these and other surface water purveyors provided approximately 114,000 AF per year during 1996-2005 and increased to approximately 141,000 AF per year during 2006-2015 decade to reflect the consolidation of El Nido Water District into the MID service area.

It should be noted that any limitations in available data may lead to relative weaknesses in calibration at both the local and regional level. Additional coordination efforts through the SGMA process will aid in future refinement of MercedWRM.

3.1.4 Agricultural Groundwater Production (Agencies)

Groundwater pumping within the MercedWRM is separated into well and element-based pumping, the former of which is primarily comprised of Merced Irrigation District operated wells that feed into the surface water supply network. District pumping is available annually throughout the simulation period, with well specific data available within the 2007-2012 calendar years. To estimate historical pumping on a per-well basis, prior to 2007 and after 2012, the monthly distribution of annual pumping was developed based on water year type. This index was applied on the monthly timestep for each operational well. Figure 50 and Figure 51 respectively demonstrate the spatial distribution of MID wells and the historical annual pumping used within the model.

In addition to MID, several local water districts, provided annual pumping volumes for implementation within the model. District pumping within Stevinson, Merquin County, and Turner Island Water Districts were accounted for using element pumping in conjunction with private pumping.

3.1.5 Agricultural Groundwater Production (Private)

Private agricultural pumping is estimated by the agricultural demand in each element minus any surface water deliveries. Since no site-specific information is known for private agricultural wells, IWFM averages pumping across the element nodes. Element pumping within the IWFM framework also requires the vertical distribution pumping to be defined in each layer. Estimations for this delineation were made through analysis of the over 5,000 well depth records digitally available within the Merced County Well Database (Figure 53).

The County's database includes maximum well depth, and from this we can see that the majority of wells in the Region are pumping from within the top 500 feet of the surface (Figure 52). Since perforation information is unavailable, assumptions must be made on where groundwater is being extracted from. Through analysis of the wells within this database, it is assumed that the layer pumping distribution is taken from between the 25th and 75th percentile of total well depth (Figure 54 and Figure 55, respectively).

3.2 Urban Water Use

Total urban water demand is the sum of municipal and rural domestic groundwater extraction within the Merced Groundwater Basin. The population, and subsequent water use characteristics, of Merced County are extremely diverse, with approximately half of its population operating private groundwater wells outside of the urban centers.

Municipal pumping data for MAGPI member agencies, which includes the location and monthly pumping rates were analyzed and implemented into the MercedWRM. Figure 56 shows the spatial location of the wells by operating agency.

Population and per capita consumption, the factors IWFM uses to calculate urban demand, are available from a mix of sources that include:

- Local Urban Water Management Plans
- Local Groundwater Pumping Records
- United States Census Bureau

Monthly pumping records from MAGPI member agencies are directly inputted as part of the time-series pumping file. To ensure these records are equal to demands of the system, reflect the historical trends, and are able to project water consumption, the data was compared to population values from the US Census Bureau and the reported values for per capita water use from local Urban Water Management Plans.

Surveyed population data from the US Census Bureau, available on the tract level, is taken every ten years, but annual estimates are also available from the agency and were implemented in the MercedWRM. Census tracts within the model boundaries were incorporated directly, whereas the tracts near the boundary, with only a fraction in the Merced Region, were adjusted according to the participating land use fraction. Summarized between major member agency and rural domestic users, the population of the Merced Region is represented in Figure 57.

Records of urban water consumption are available for municipalities within the Region (Table 10). To estimate the per capita water uses of rural domestic water users, an average of the three major municipalities were used and applied to the corresponding population. Additionally, as pumping data is only available post-1998, historic trends of GPCD were extrapolated from the existing records based on the most senior data available.

Since complete records are not available for all water purveyors, an analysis of available data was preformed and refined as follows:

Period of Record - The MercedWRM simulation period begins in October 1993 and ends in September 2015. When unavailable, estimations are made to approximate groundwater production within the unknown time period. This process is completed by using the average monthly value for that agency. When volumetric data is not available, the IWFM Demand Calculator (IDC) was utilized to estimate demand based on the regional average consumptive use.

Spatial Discretization – Municipal providers within the Region use groundwater wells as their source of supplied water. Due to the lack of well perforation data available, groundwater production is simulated with elemental pumping within estimated layers.

Table 10: MercedWRM Pumping Data

Agency	Period of Record	Resolution	Time-Step
Atwater	Jan 1998 – Feb 2012	Well location	Monthly
Black Rascal	Jan 1998 – Oct 2012	Well location	Monthly
Le Grand	Jan 1998 – Dec 2012	Well location	Monthly
Livingston	Feb 1998 – Dec 2013	Agency	Monthly
Meadowbrook	Jan 1998 – Nov 2012	Well location	Monthly
Merced	Jan 1998 – Jan 2014	Well location	Monthly
Planada	Jan 1998 – Dec 2013	Well location	Monthly
Winton	Jan 1998 – Jan 2014	Well location	Monthly

The City of Merced provided urban consumptive use data through 2015, which was used to calculate GPCD, that was incorporated into the model. Such data has not been provided to date by the cities of Livingston and Atwater and therefore only calculated estimates were incorporated into the model. These estimations are shown at the annual and monthly time scale, in Figure 58 and Figure 59 respectively, while total urban groundwater pumping within the model is shown in Figure 60.

Chapter 4 Model Calibration

The objectives of model calibration are (1) to achieve a reasonable water budget for each component of the hydrologic cycle modeled (i.e., land and water use, soil moisture, stream flow, and groundwater budgets) and (2) to maximize the agreement between simulated results and observed values for groundwater levels at selected well locations and (3) streamflow hydrographs at selected gauging stations. These objectives are achieved through careful review of the model input and adjusted model parameters. The model results also provide insight to key components of the groundwater basin including historical recharge, subsurface flows, and changes in groundwater storage.

The model calibration period for the MercedWRM is October 1996 through September 2015.

4.1 Model Calibration

Model calibration begins after the data analysis and input data file development is complete. The calibration effort can be broken down into subsets that align with multiple packages within the IWFM platform. As an integrated groundwater model, the results of each part of the simulation are dependent on one another. The model calibration can be considered a systematic process that includes the following activities:

- Calibrate hydrologic demand,
- Calibrate Surface Water Features,
- Calibrate overall water budgets for the model area,
- Calibrate simulated groundwater levels to observed groundwater levels,
- Compare calibration performance with the calibration targets, and
- Conduct additional refinements to model as necessary.

4.2 Calibration of the IDC and Root-Zone Parameters

The goal of the IDC calibration process is to align the multiple references for local ET, determine agricultural demand, and develop the corresponding components of a balanced root zone budget. Calibration of these surface features are the foundation of the greater model processes as they are the primary stresses on the groundwater system. This part of the calibration effort was primary focused on refining the following budget items while ensuring accuracy in and maintaining reasonable parameters.

Land Use – As the foundation of consumptive use analysis, land use across the model domain was extensively investigated and ground-truthed adjustments were made when necessary. Beyond the initial land use modifications mentioned in Section 2.6, Land Use and Cropping Patterns, MID cropping patterns underwent further analysis and the CropScape datasets were evaluated alongside the distribution developed as a part of the Merced Irrigation District Water Balance Model (MID-WBM), which uses land use data available through the MID accounting records. This comparison was performed across the MID subregions for 2010 and 2013, and results are shown in Table 11.

Table 11: Land use comparison between the MercedWRM and the MID-BWM (acres)

Land Use Classification	MID-WBM 2010	MID-WBM 2013	MercedWRM 2010	MercedWRM 2013
Orchards	45,914	51,685	40,167	50,189
Pasture	14,310	13,736	12,735	13,251
Alfalfa	17,416	7,985	25,227	13,556
Field Crops	20,003	23,307	15,408	17,485
Truck Crops	11,743	11,503	9,763	7,614
Grains	13,899	7,667	14,625	13,163
Vineyards	226	2,025	3,406	4,892
Rice	2,124	1,721	2,143	1,306
Cotton	0	0	6,074	4,525
Citrus	0	0	30	15
Idle	2,020	5,044	0	0
Total	**127,655**	**124,673**	**129,579**	**125,996**

The variance within the two models, while significant, is due to the differing model framework and consequent definition of the MID boundaries. These boundaries cause IWFM subregional budgets to include some acreage not within the bounds of MID, as IWFM regions must be contiguous and follow the finite element grid, while the WBM is founded on parcel level analysis. These areas of difference are highlighted in Figure 61.

Consumptive Use - IWFM recognizes monthly potential evapotranspiration (ET_P) as a model input for each defined crop category. Initial values were taken from the California Central Valley Groundwater-Surface Water Simulation Model (C2VSim) and were calibrated using the localized data available from the following three sources:

- ET_0 from the California Irrigation Management and Information System (CIMIS).
  - ET_0 is the grass-based reference evapotranspiration and is used as a standardized reflection of the energy available to transport the water vapor from the ground up into the lower atmosphere.
- ET_C from the Irrigation Training and Research Center (ITRC).
  - ET_C is the crop-specific evapotranspiration under standard growing conditions and assumes optimum growing conditions devoid of production limiters such as nutrient and moisture availability, crop diseases and pests.
- ET_A from Mapping Evapotranspiration at High Resolution and Internalized Calibration (METRIC) datasets.
  - ET_A is the actual evapotranspiration as measured from LandSAT images and is calculated as the residual of the difference between the net radiation to the land surface and a combination of sensible and ground heat fluxes.

Each of these sources were reviewed during the calibration process, at which point the original IDC referenced ET_P were adjusted to meet trends highlighted in the METRIC dataset for actual ET_C. Calibration results can be seen in the comparative charts, Figure 62 and Figure 63 , which show ET_C for the model domain and the MID subregions respectively. Post-Calibration ET_P values were calibrated to within an average of 5% of the referenced METRIC datasets.

Consumptive Use and Agricultural Demand – Whereas evapotranspiration makes up the majority of the agricultural demand, it is important to recognize and account for other water uses within a system. Non-consumptive uses including deep percolation, return flow, frost protection, leaching of the root zone, and other beneficial uses, can all add stress to the groundwater system by significantly increasing agricultural water demand. The ratio of evapotranspiration to the total applied water is known as the consumptive use fraction (CUF).

$$Consumptive\ Use\ Fraction\ (CUF) = \frac{Evapotranpiration\ of\ Applied\ Water}{Applied\ Water}$$

To determine the regional CUF, there was extensive coordination between the MercedWRM and the Merced Irrigation District Water Balance Model (MID-WBM) development teams. With data on elemental root zone parameters, research into published reports, and discussions with local growers on their irrigation practices, both models concluded that an average consumptive use fraction, considering all crop types and management practices, of 65% is representative of the Merced Region, with various subregions reaching the upper-70s.

To facilitate this relationship, evapotranspiration and root-zone parameters, particularly the soil hydraulic conductivity and the pore size distribution index, were adjusted in accordance with their hydrologic soil group and subregion. Spatial reference of these calibrated parameters is available from Figure 64 though Figure 68.

4.3 Calibration of Surface Water Features

The MercedWRM simulates streamflow in eight small-stream watersheds and several major rivers and creeks across the model domain. Streamflow calibration is performed by comparing the simulated streamflow with local data from the eight stream gauges in the Region (Figure 11).

Small Stream Watersheds – Calibration of small-stream watersheds was performed by comparing the simulated stream flow of the watersheds with the available gauged data from the Merced River, Bear Creek, Owens Creek, Duck Slough and the Chowchilla River. Since most of the larger, gauged streams are impaired with local reservoirs, their inflows overwritten with historical data. Prior to the flow adjustment, annual volumes were analyzed for potential refinement to the nearby, ungauged watersheds. Parameter adjustments, including watershed size and evapotranspiration, were implemented across the smaller watersheds without flow data.

Merced River – The Merced River is the only stream in the model area with detailed flow records for calibration analysis. The Merced River stream inflow into the model area is based on the USGS stream gauge located at Merced Falls near the Northside Canal and has an average flow of 1450 ft^3/second during the calibration period.

Merced River flowrates are measured at the following gauges:

- USGS – Merced Falls near the Northside Canal
- CDEC – Merced River near Snelling
- USGS – Merced River at Shaffer Bridge
- CDEC – Merced River near Cressey
- USGS – Merced River near Stevinson

Stream flow calibration included refinement of the stream bed hydraulic conductivity and simulated values were compared to observed records, results of which are available in Figure 69 through Figure 73.

4.4 Calibration of Water Budgets

Proper calibration of water budgets within the MercedWRM ensures that the hydrologic characteristics of the groundwater basin are accurately represented. The goal of the water budget analysis is to develop a balanced system between supply and demand, while summarizing the hydrologic flow within the Region, particularly including the movement of all primary sources of water such as rainfall, irrigation, streamflow, and subsurface flows. During the calibration process, model output is reviewed and summarized into monthly and annual budgets referred to as the groundwater budget and the land and water use budget. Key budget components for each of the calibrated water budgets are listed in Table 12.

Table 12: Major Components of Water Budgets

	Groundwater Budget	Land and Water Use Budget
Budget Component	Deep Percolation	Ag. Pumping
	Stream Recharge	Ag. Diversions
	Canal Recharge	Ag. Supply Requirement
	Pumping	Urban Supply Requirement
	Outflow to Root Zone	Urban Pumping
	Subsurface Flow	
	Change in Storage	
	Cumulative Change in Storage	

During this stage of the calibration, key model datasets and parameters have been adjusted. Root zone and aquifer parameters, as well as water use data, including the location, amount, and timing of surface water diversion and groundwater pumping, are particularly important during this stage of calibration.

The MercedWRM results are summarized in the following sections. The model budget tables can be generated in either monthly or annual time steps for the period of simulation.

4.4.1 Land and Water Use Budget

The land and water use budget balances water supply and water demand in the study area. Calculation of this balance ensures that the model is properly representing the key hydrologic components of the study area. This balance includes agricultural and urban land use, agricultural and urban water demand, and overall water supply, consisting of surface water deliveries and groundwater pumping.

The average annual water demand for the Region within the calibration period was 896,000 AF, consisting of 814,000 AF agricultural demand and 82,000 AF of municipal and domestic demand. This demand was met by 329,000 AF of surface water deliveries, and 711,000 AF of groundwater production, 629,000 AF of agricultural and 82,000 AF of municipal and domestic pumping. The annual land and water use budget for the calibration period (water years 1996-2015) are presented in Figure 74.

4.4.2 Groundwater Budget

The major hydrologic processes affecting groundwater flow in the model area are incorporated in the MercedWRM. The primary components of the groundwater budget are:

- Inflows:
  - Deep percolation from rainfall and irrigation-applied water,
  - Recharge due to stream seepage,
  - Recharge from other sources such as irrigation canals and recharge ponds,
  - Boundary inflows from outside the model area, and
  - Subsurface inflows from adjacent subregions.
- Outflows:
  - Groundwater pumping,
  - Outflow to streams and rivers,
  - Subsurface outflows to adjacent subregions, and
  - Boundary outflows.
  - Change in groundwater storage

The groundwater budget (Figure 75) shows that within the calibration period, the primary sources of aquifer recharge are deep percolation and seepage from the surface water features. During the 1996-2015 simulation period, groundwater storage was reduced by an average of 111,000 acre-feet per year. The primary cause for this reduction is the 750,000 acre-feet of pumping, offset by 367,000 acre-feet of deep percolation, a net gain from stream of 148,000 acre-feet, 127,000 acre-feet of canal recharge, and a net boundary flow of 10,000 acre-feet annually.

4.5 Groundwater Level Calibration

The goal of this stage of calibration is to achieve a reasonable agreement between the simulated and observed groundwater levels at the calibration wells. Within the Region, 176 groundwater observation wells were selected from the Merced HydroDMS database to be representative of both the local and regional groundwater trends. The selected calibration wells provide reliable historical data that has served as a fair representation of the long-term conditions of the Basin.

Aquifer parameters, such as hydraulic conductivity, specific storage, and specific yield were modified to achieve calibration targets. The groundwater level calibration is performed in two stages:

- The initial calibration effort is focused on the regional scale to verify hydrogeological assumptions made during development and confirm the accuracy of general groundwater flow vectors. During this iteration, simulated groundwater elevation trends, flow directions, and groundwater gradients generally match the measured data.
- The second stage of calibration of groundwater levels is to compare the simulated and observed groundwater level at each calibration well. This comparison provides information on the overall model performance during the simulation period. The simulated groundwater elevations at the 176 calibration wells (Figure 76) were compared with corresponding observed values for long-term trends as well as seasonal fluctuations.

The results of the groundwater level calibration indicate that the MercedWRM reasonably simulates the long-term hydrologic responses under various hydrologic conditions. Figure 77 and Figure 78 offer a cursory overview of the groundwater level calibration across the model domain, while Appendix A contains groundwater hydrographs at all calibration wells.

4.6 Measurement of Calibration Status

The MercedWRM calibration status was measured using two metrics: simulated and observed groundwater level matching statistics and groundwater trend matching. The statistics were evaluated to meet the

American Standard Testing Method (ATSM). In addition to quantifiable metrics, the MercedWRM calibration was evaluated by generating reasonable regional groundwater flow directions and producing realistic water budgets.

The "Standard Guide for Calibrating a Groundwater Flow Model Application" (ASTM D5981-96) states that "the acceptable residual should be a small fraction of the head difference between the highest and lowest heads across the site." The residual is defined as the simulated head minus the observed heads. An analysis of all calibration wells within the Region indicated the presence of 300+ feet of water level changes. Using 10 percent as the "small fraction", the acceptable residual level would be 30 feet. Calibration goals for the groundwater level residuals were set such that no more than 10 percent of the observed groundwater levels would exceed the acceptable residual level of 30 feet.

- 87.2% of observed groundwater levels are within +/- 20 feet of its respective simulated values
- 97.8% of observed groundwater levels are within +/- 30 feet of its respective simulated values

The residual histogram for the Merced Region is shown in Figure 79. Additionally, a scatter plot of simulated vs observed values is shown in Figure 80.

4.7 Final Calibration Parameters

The California Central Valley Groundwater-Surface Water Simulation Model (C2VSim) served as the basis aquifer parameters within the MercedWRM. These parameters were adjusted throughout the calibration process such that hydraulic head of the simulated model was best aligned with the observed data. The parameters resulting from the calibration process are listed in the subsection below.

Horizontal Hydraulic Conductivity – The hydraulic conductivity (K_H) in the MercedWRM varies across the horizontal direction and across model layers. The fully calibrated values remain descriptive of the initial hydrogeologic analysis, range from 4 ft/day to 100ft/day, and the spatial distribution is represented in Figure 81 through Figure 85.

Vertical Hydraulic Conductivity – Primarily a constraining factor across the Corcoran Clay (Aquitard 2), the Vertical Hydraulic Conductivity (K_V) shown in Figure 86 facilitates the separation between the unconfined and confined aquifers within the MercedWRM. The K_V values of the Corcoran aquitard is found to be less than one one-thousandth of the horizontal conductivity of the surrounding aquifer systems.

Specific Storage – Specific Storage (S_S) is used to represent the available storage at nodes in a confined aquifer, where the hydraulic head is above the top of the aquifer. Specific Storage is the unit volume of water released or taken into storage per unit change in head. Calibrated specific storage is shown in Figure 87.

Specific Yield – Specific Yield (S_Y) is representative of the available storage in an unconfined aquifer and defined as the unit volume of volume released from the aquifer per unit change in head due to gravity. Calibrated specific storage is shown in Figure 88.

4.8 Sensitivity Analysis

Sensitivity analysis is an important step in the model development process. It is defined as "the study of distribution of dependent variables (e.g., groundwater elevations in a groundwater model) in response to changes in the distribution of independent variables, initial conditions, boundary conditions, and physical parameters" (AWWA, 2001). In general, a sensitivity analysis of an integrated groundwater and surface water model is performed for the following purposes:

- To test the robustness and stability of the model by establishing tolerance within which the model parameters can vary without significantly changing the model results;
- To understand the impact of inaccuracies in input data on model results (e.g., how model results can change because of a 10% error in the estimation of agricultural pumping); and
- To develop an understanding of the relative sensitivity of the components of the hydrologic cycle and data, so that an effective data collection and monitoring plan can be developed.

4.8.1 Metrics of the Sensitivity Analysis

A sensitivity analysis was performed using the MercedWRM to assess the sensitivity of model results to specific model parameters and input data. Two different metrics were selected to measure the sensitivity of the MercedWRM. A sensitivity metric is a single number derived from the MercedWRM model results and has a unique value for each model run corresponding to a given set of data or parameter value. The sensitivity metrics used here:

- Average groundwater elevation in the study areas, and
- Average root mean square (RMS) error of groundwater elevation aggregated from selected calibration wells.

Average groundwater elevation in the study areas is defined as a three-way average of simulated groundwater elevations at model nodes. The average is taken over:

- Layers,
- Nodes, and
- Time.

This can be mathematically expressed by:

$$\overline{H} = \frac{1}{M}\sum_{K=1}^{M} H_k$$

Such that,

$$H_k = \frac{1}{N}\sum_{i=1}^{N}\left[\frac{1}{L}\sum_{j=1}^{L} h_j\right]_i^k$$

Where,

M	total number of simulation time steps,
H_k	average head in the model area at k-th time step,
N	number of model nodes,
L	number of model layers in aquifer,
H_j	groundwater elevation at layer j, and
i, j, k	are indices for node, layer, and time, respectively.

The average RMS error at selected calibration wells is defined as the average of individual RMS error at each calibration well. The RMS error at a calibration well is defined as follows:

$$RMS_w = \sqrt{\left\{\frac{1}{N}\sum_{k=1}^{N_0}\left[h_{k,w}^0 - h_{k,w}^s\right]^2\right\}}$$

where,

N_0 is the number of observations at well k,

$h_{k,w}^0$ is the observed groundwater elevation at time step k, at well w,

$h_{k,w}^s$ is the simulated groundwater elevation at time step k, at well w.

4.8.2 Results of the MercedWRM Sensitivity Analysis

Adjustments of aquifer parameters, and the analysis the resulting groundwater head, was performed at all groundwater nodes within the model domain. Sensitivity analyses were performed for the MercedWRM for the following parameters.

- Hydraulic Conductivity (Horizontal)
- Specific Yield
- Specific Storage
- Hydraulic Conductivity (Vertical) of the Corcoran Clay

4.8.3 Hydraulic Conductivity (Horizontal)

The sensitivity of the MercedWRM to changes in hydraulic conductivity are presented in Figure 89 and Figure 90. Reduction of hydraulic conductivity to one fourth of the calibrated value results in 10.31 feet lower groundwater levels in the model, whereas increases to hydraulic conductivity increase the average groundwater levels by 1.67 feet. Changes to hydraulic conductivity have significant impacts to RMS values.

4.8.4 Specific Yield

The sensitivity of the MercedWRM to changes in specific yield are presented in Figure 91 and Figure 92. Reduction of specific yield to one fourth of the calibrated value results in 14.61 feet lower groundwater levels in the model, whereas increases to specific yield increase the average groundwater levels by 7.90 feet. Changes to specific yield have significant impacts to RMS values.

4.8.5 Specific Storage

The sensitivity of the MercedWRM to changes in specific storage are presented in Figure 93 and Figure 94. Reduction of specific storage to one fourth of the calibrated value results in approximately 0.16 feet lower groundwater levels in the model, whereas increases to specific storage increase the average groundwater levels by 0.74 feet. Changes to specific storage have slight impacts to RMS values.

4.8.6 Hydraulic Conductivity (Vertical) of the Corcoran Clay

The sensitivity of the MercedWRM to changes in vertical hydraulic conductivity across the Corcoran Clay are presented in Figure 95 and Figure 96. Reduction of this parameter to one fourth of the calibrated value results in 1.91 feet lower groundwater levels in the model, whereas increases to the vertical hydraulic conductivity increase the average groundwater levels by 7.90 feet.

4.8.7 Summary of Sensitivity Analysis

The results of the sensitivity analysis for the MercedWRM indicate that the model is a stable model and the system responds in the expected manner because of changes in aquifer parameters and input data.

Chapter 5 The Merced Water Quality Model

The Merced Water Quality Model (MercedWQM) was developed to simulate total dissolved solids (TDS) and nitrogen within the Merced Groundwater Region. This module uses the groundwater flow field from the MercedWRM flow module to simulate the transport of water quality constituents in the soil and vadose zones, surface water features, and the groundwater basin aquifers. This chapter describes the assumptions made, calibration process, and hydrologic and water quality results during the calibration period.

5.1 IGSM Code Update

The foundation of the MercedWQM is the water quality module of the Integrated Groundwater Surface Water Model (IGSM). As IGSM is the predecessor of IWFM and an independent framework separate from IWFM, refinements were necessary to allow for cross-platform integration. Extensive collaboration with DWR staff was undertaken to update the IWFM code, verify parameters and water budget components, and ensure the alignment of flow vectors between the IWFM flow module and the IGSM water quality module.

Water quality modeling in IGSM includes simulation of soil zone biochemical processes, transport and decay processes in the vadose zone, and transport and decay processes in the saturated zone. Soil zone biochemical process simulation for nitrogen includes mineralization, immobilization, adsorption, desorption, denitrification and plant uptake. The transport process in the saturated and vadose zones is simulated by IGSM by solving the mathematical equations of transport that include advection, dispersion adsorption, desorption, and decay. Water quality simulation in the stream system is based on mass balance and first order linear decay rate.

5.2 IGSM Processes

The processes modeled for water quality simulation in surface and subsurface systems depend on the quality constituent and hydrologic unit. The water quality module has a separate water quality simulation procedure for each of the hydrologic units simulated in the MercedWRM flow module:

- Soil zone
- Stream system
- Vadose zone
- Groundwater zone

5.2.1 Soil Zone

The following discussion uses nitrogen as an example of constituent being simulated in the MercedWQM.

Nitrogen inflows to the soil zone are of three forms: as ammonia in fertilizers (adsorbed nitrogen); as organic nitrogen in fertilizers and in dairy wastes; and as nitrate (soluble nitrogen) in applied water.

These three forms of nitrogen interact with each other and transform from one form to another due to biochemical processes taking place in the soil zone. Soil physicists and agronomists have formulated differential equations with first order kinetic reaction rates to describe these processes. MercedWQM uses the Runge-Kutta method for solving these ordinary differential equations for nitrogen transformation processes in the soil zone. These equations are solved on an element by element basis at every time step of simulation. The numerical solution scheme used in the soil zone quality submodel of MercedWQM ensures numerical accuracy and stability by allowing for smaller time steps within the monthly time step.

The input data for the soil zone quality simulation includes:

- the time history of applied fertilizer;

- animal waste disposal data;
- concentration of imported water applied on the land;
- concentration of wastewater discharges;
- waste increment due to water use;
- concentration of stormflow recharge;
- concentration of agricultural and urban return flow;
- concentration of rainwater;
- plant uptake rate;
- mineralization/immobilization rates;
- adsorption/desorption rates; leaching fraction; and
- denitrification coefficients.

This submodel of MercedWQM generates the amount of leachate mass from each model element in the underlying vadose zone.

5.2.2 Stream System

Stream system quality is simulated in MercedWQM by solving the mass balance equation at each stream node. Each stream node in assumed to act like a continuous mixed reactor. A user specified loss rate in each stream element defines a first order loss rate for nitrogen losses in the stream system due to biological processes.

The mass balance components of stream quality simulation are:

- constituents mass inflow associated with water inflow at the upstream node of the stream element;
- mass associated with direct runoff and return flow;
- mass associated with wastewater discharges to stream;
- mass leaving with stream diversions;
- mass entering or leaving the stream system due to gain or loss to underlying aquifer; and
- mass loss due to biochemical processes.

The input data for stream quality simulation includes concentration of boundary stream inflows from:

- major streams and mountain watersheds;
- concentration of wastewater discharges to streams;
- concentration of rain runoff; concentration of return flow from urban and agricultural use; and
- nitrogen loss rate at each stream node.

The solution of constituent mass balance equation for a stream element provides the downstream mass outflow for that element. This outflow is used as upstream inflow for the stream element that is downstream of the current stream element.

5.2.3 Vadose Zone

The mass that leaches from the soil zone with percolation water travels through the vadose zone on its way to the saturated zone. For nitrogen simulation, the predominant form of nitrogen that percolates from the soil zone as leachate is nitrate. The vadose zone quality submodel of MercedWQM simulates water quality in the vadose zone by solving the one-dimensional vertical advection-dispersion equation with adsorption, desorption, and decay. The vadose zone quality submodel of MercedWQM has two mass pools to incorporate these process dynamics in the vadose zone. These two mass pools are mobile mass pool and immobile mass pool.

The mobile mass pool represents mass that is associated with mobile water phase; the immobile mass pool includes mass associated with immobile water phase and mass attached with soil particles by ionic bonds. The mass transfer between these two pools is governed by two model assumptions:

- the mobile and immobile phases of water are completely mixed; and
- concentration in both mass pools are equal at the end of each time step.

Decay coefficient defines the mass removal due to denitrification. The denitrification process removes nitrogen from the mobile and immobile pools. The numerical solution of the mathematical equation representing vadose zone quality is obtained by using the results of vadose zone flow simulation. The computations are performed node by node and layer by layer. In addition to a mass balance on water flow, a constituent mass balance is also performed for each layer. The mass exchange between the vadose zone and saturated zone due to water table rise and fall is included in MercedWQM by keeping track of depth to groundwater and corresponding concentrations in unsaturated and saturated zones at the previous time step. The mass outflow from the overlying vadose zone layer becomes the mass inflow to the layer beneath and so on. The mass outflow from the lowest vadose zone layer is the mass inflow to the saturated zone at the corresponding node.

The input data for vadose zone water quality simulation includes:

- thickness of vadose zone layers;
- hydraulic conductivity; dispersivity; distribution coefficient;
- specific retention; and
- denitrification coefficient for each unsaturated zone layer.

5.2.4 Groundwater Zone

Water quality in the groundwater zone is simulated by MercedWQM by solving two-dimensional advection-dispersion with adsorption, desorption, and decay. The flow field generated by the flow module is used to solve this mathematical equation by finite element method. The solution provides the concentration at each groundwater node at each layer. The vertical connection between the aquifer layers is simulated by considering mass exchanges associated with the vertical flow from one layer to another. A user specified decay coefficient accounts for mass removal due to denitrification.

The input data for groundwater zone water quality simulation includes:

- concentration of subsurface inflows at model boundary;
- concentration of injection water;
- longitudinal and transverse dispersivity;
- specific retention; and

- denitrification coefficient; etc.

The flow related parameters are provided in the flow module and are transferred to the water quality module of MercedWRM through the binary output from the flow module.

5.3 Model Input and Assumptions

This section describes the model inputs required to run the MercedWRM water quality module and key assumptions made. Water quality data sufficient to calibrate the MercedWRM water quality module is largely unavailable, and most values are sourced from local knowledge of the basin. Work associated with the development of the Groundwater Sustainability Plan for the Merced Subbasin will involve collection of water quality data and is expected to begin starting in 2018. Due to the lack of data available, a series of assumptions were developed and implemented based on known characteristics of the MercedWRM area.

5.3.1 Model Input

Previously, the focus of the MercedWRM has been on estimating the hydrologic components that drive the water resources of the study area. For water quality modeling, a water quality must be assigned to each hydrologic component. The input data for the MercedWQM can be summarized to include:

- Binary output file from geometry and flow module;
- time series of imported water quality
- the chemical concentration of rainfall, tributary flows, return flows, etc.;
- chemical concentration of subsurface inflow through the model boundary;
- time series of another surface loading features; and
- transport and rate parameters.

Base information was collected from the following sources, from which a series of assumptions were taken to fill in data gaps.

- The Merced Salt and Nutrient Management Plan
- GeoTracker GAMA Online Database
- Local knowledge of farming practices
- UC Davis Cooperative Extension

5.3.2 Model Assumptions

Initial concentrations for the water quality module, adopted from the Merced Subbasin Salt and Nutrient Management Plan (SNMP). This dataset, while maintaining the greatest spatial coverage, was developed without consideration of the vertical extent and is therefore is limited in its implementation though a lack of vertical discretization. These referenced values were applied at each groundwater node for both TDS and Nitrate as shown in Figure 97 and Figure 98.

For other loading parameters, a generalized survey of local knowledge was undertaken as there is a lack of quantifiable water quality data within the Merced Region. The following assumptions, listed in Table 13, were made based on the best available information.

Table 13: Merced Water Quality Model Assumptions

	TDS	Nitrate (as N)

	(mg/L)	(mg/L)
Boundary Conditions		
Northern Boundary	196	6.84
Western Boundary	1,500	1.14
Southern Boundary	209	0.70
Surface Loading		
Agricultural	1,000	1,000
Urban & Municipal	500	500
Stream Quality		
Simulated Streams	35	3.5
Canal System	50	5.0

5.4 Merced Water Quality Model Calibration

The MercedWQM calibration was performed through comparison of observed constituent levels with those of the simulated shallow and deep aquifers. Within the Region, water quality monitoring wells were selected from GeoTracker GAMA Online Database to be representative of both the local and regional water quality. Since perforation intervals of observed monitoring wells were not available, it is important to note that both an average of the shallow aquifers (layers 1-2) and the deeper aquifers (layers 3-5) were considered during calibration.

The goal of this stage of calibration is to achieve a reasonable agreement between the simulated and observed groundwater levels at the calibration wells. The results of the water quality calibration indicate that the MercedWQM reasonably simulates the long-term responses under various hydrologic and loading conditions. Figure 99 and Figure 100 offer a cursory overview of the water quality calibration across the model domain for TDS while Figure 101 and Figure 102 highlight a few of the calibration targets and simulated values for Nitrate.

Chapter 6 Recommendations

The Merced Water Resources Model, in its current state, is a defensible and well-established model for use in assessment of the water resources in the Region under historical and projected conditions. However, the following recommendations are to be considered for further refinement and enhancement of the Model:

- **Boundary Flows**
  - Interbasin boundary conditions - The current boundary flows between the Merced Region and neighboring groundwater basins are developed based on groundwater head simulations within the buffer model zone. It is recommended to use the latest version of the C2VSimFG, as being enhanced by the DWR for SGMA support, in comparing and verifying the groundwater flows across the boundaries with the neighboring basins.
  - Small Watershed - The boundary flows from the foothills have been calibrated with limited data available for the native conditions in the foothills. It is recommended to collect additional data and information on the nature of the grazing and native lands in the foothills and refine the simulation of the overland and groundwater flows from the foothills.
- **Refinement of Consumptive Use**
  - Variability of potential evapotranspiration - The current version of the IDC used for estimation of the consumptive use of crops in the Model uses monthly potential ET values that are the same for all simulation years. Given the annual variability of this data, and potential effects on the annual estimation of crop water demand, it is recommended to use more detailed data from the CIMIS stations to develop annual ETp values for use in the Model.
  - Drought Year ET Representation - The current set of ET maps used for calibration of the IDC ends in 2009. It is recommended to develop similar ET maps for the drought period of 2011-2015 and use the data to calibrate the performance of the IDC during the drought.
- **Implementation of updated datasets**
  - Land use and cropping patterns - The primary source of land use data in the model is the USDA's CropScape, available on the USDA's website. This data has been verified using the local land use and cropping pattern data from the local entities. Additionally, the DWR has recently published a detailed land use and cropping pattern map as developed based on the remote sensing, and verified at the field level, by LandIQ. This data represents the 2014 land use coverage. It is recommended to use this data in the next version of the model and continue using this data as it becomes available by LandIQ and the DWR for next updates to the Model.
  - Review and analysis of private well construction data
- **Linkage to Surface Model-** In order to be able to assess and evaluate effects of changes in operation of surface water resources and groundwater conditions in a dynamic and direct way, it is recommended to link the operations of the Merced River and Exchequer system to the Merced Water Resources Model.
- **C2VSimFG Update Based on MercedWRM for GSP Application-** C2VSimFG is developed to evaluate the integrated surface water and groundwater conditions at a regional scale, whereas, the MercedWRM is capable of evaluation of that integrated system at the local scale. As C2VsimFG may be used by the neighboring basins to evaluate the water resources conditions, and possibly the interbasin flows, it is recommended to work with the DWR to refine and update C2VSimFGto

reflect the local data in the Merced Region, so that the evaluations performed by the neighboring basins reflect the Merced operations properly.

- **Model update schedule-** In order to keep the Model up-to-date and current for analysis of the water resources in the area, it is recommended to update the model every 3-5 years and keep the Model current for evaluation of the GSP progress on path towards groundwater sustainability.

Model Figures

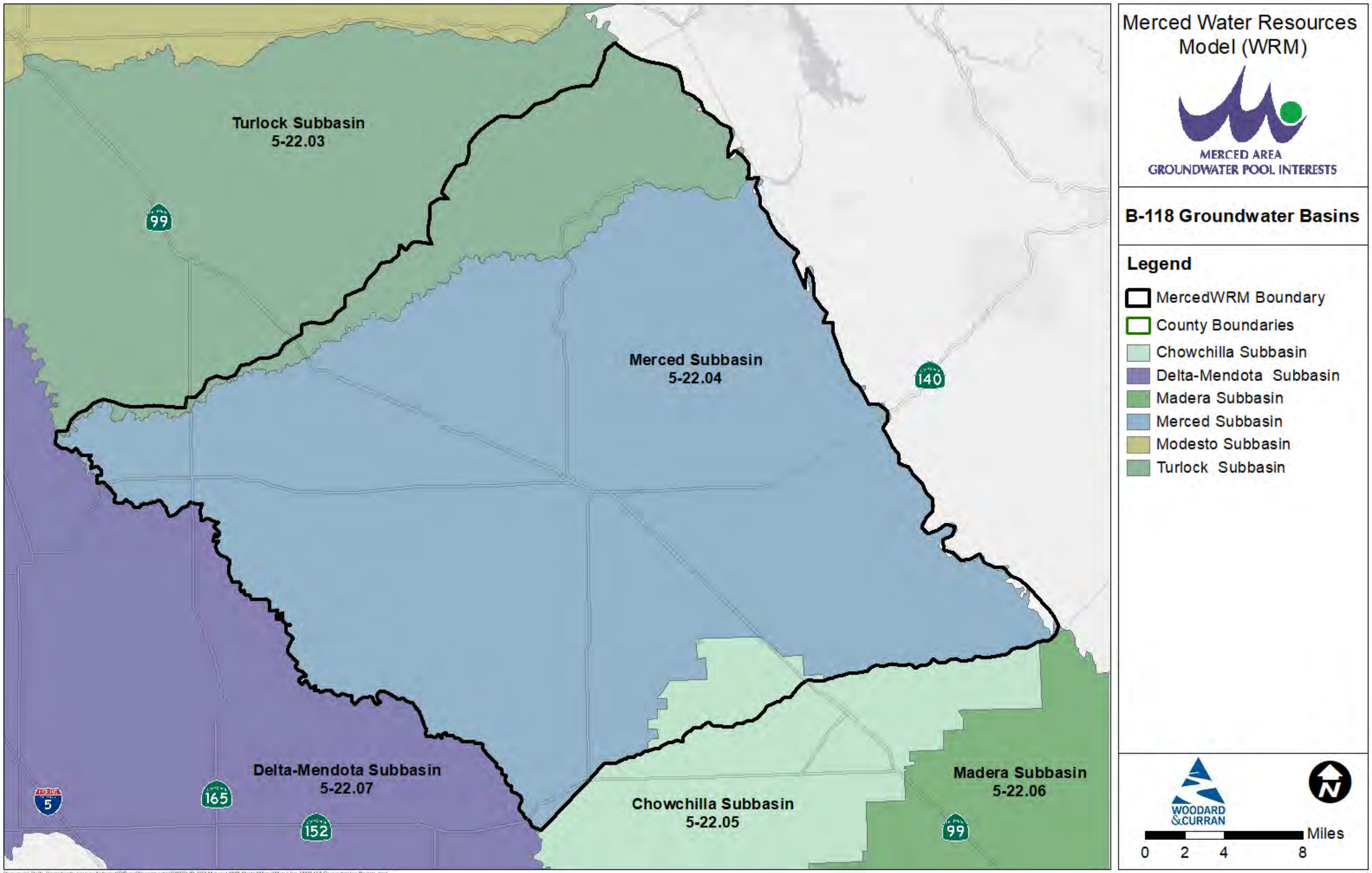


Figure 1: Bulletin 118 Groundwater Basins

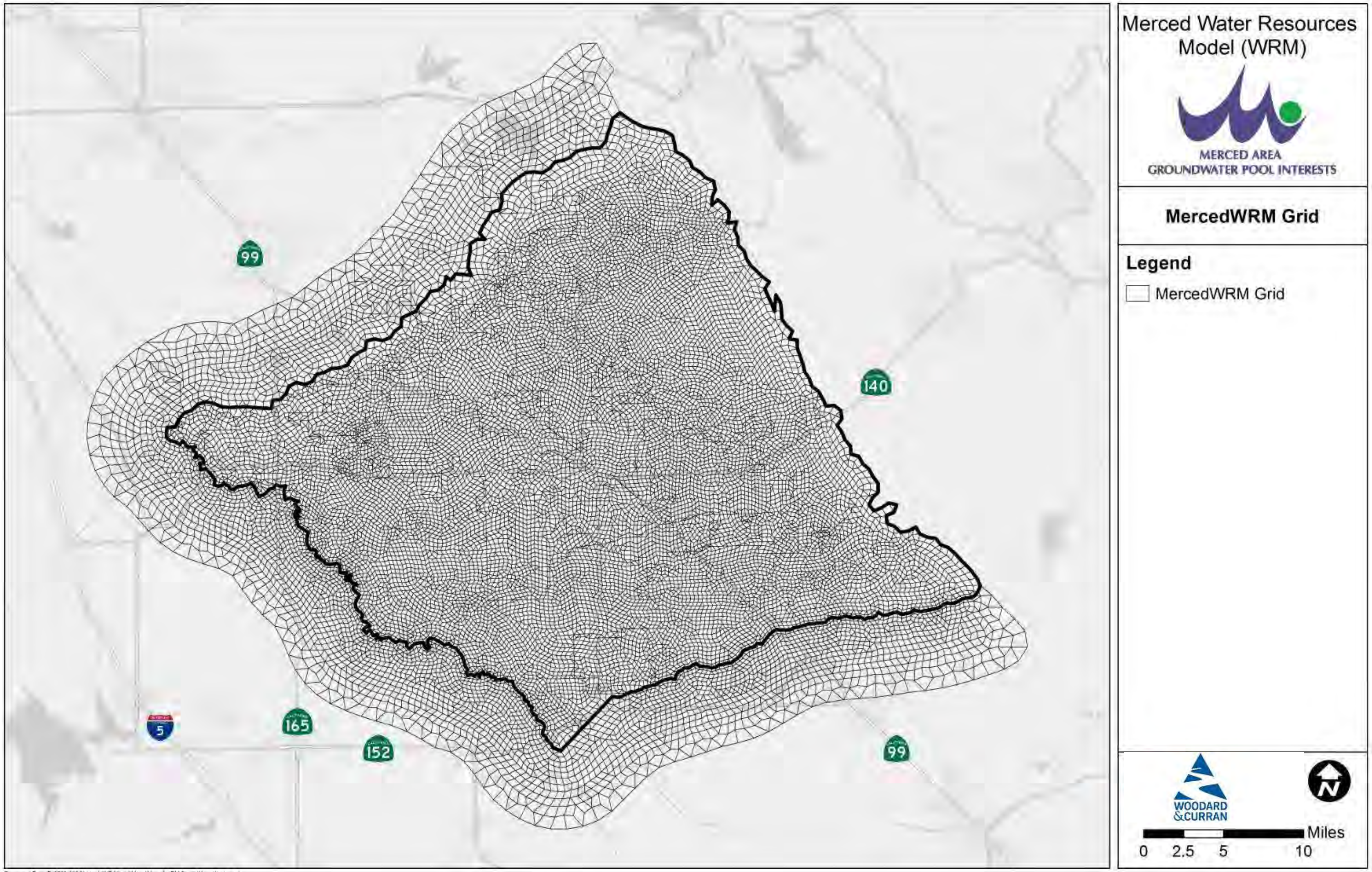


Figure 2: The Merced Water Resources Model Grid

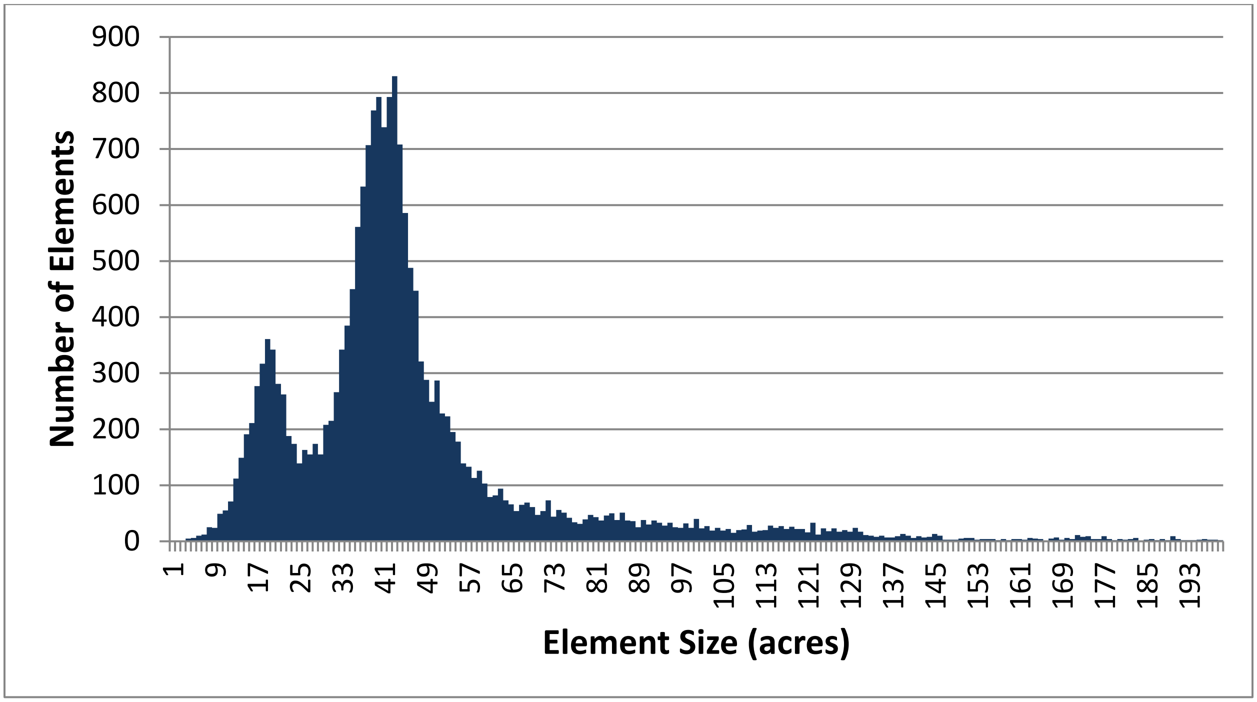


Figure 3: MercedWRM Element Size Distribution

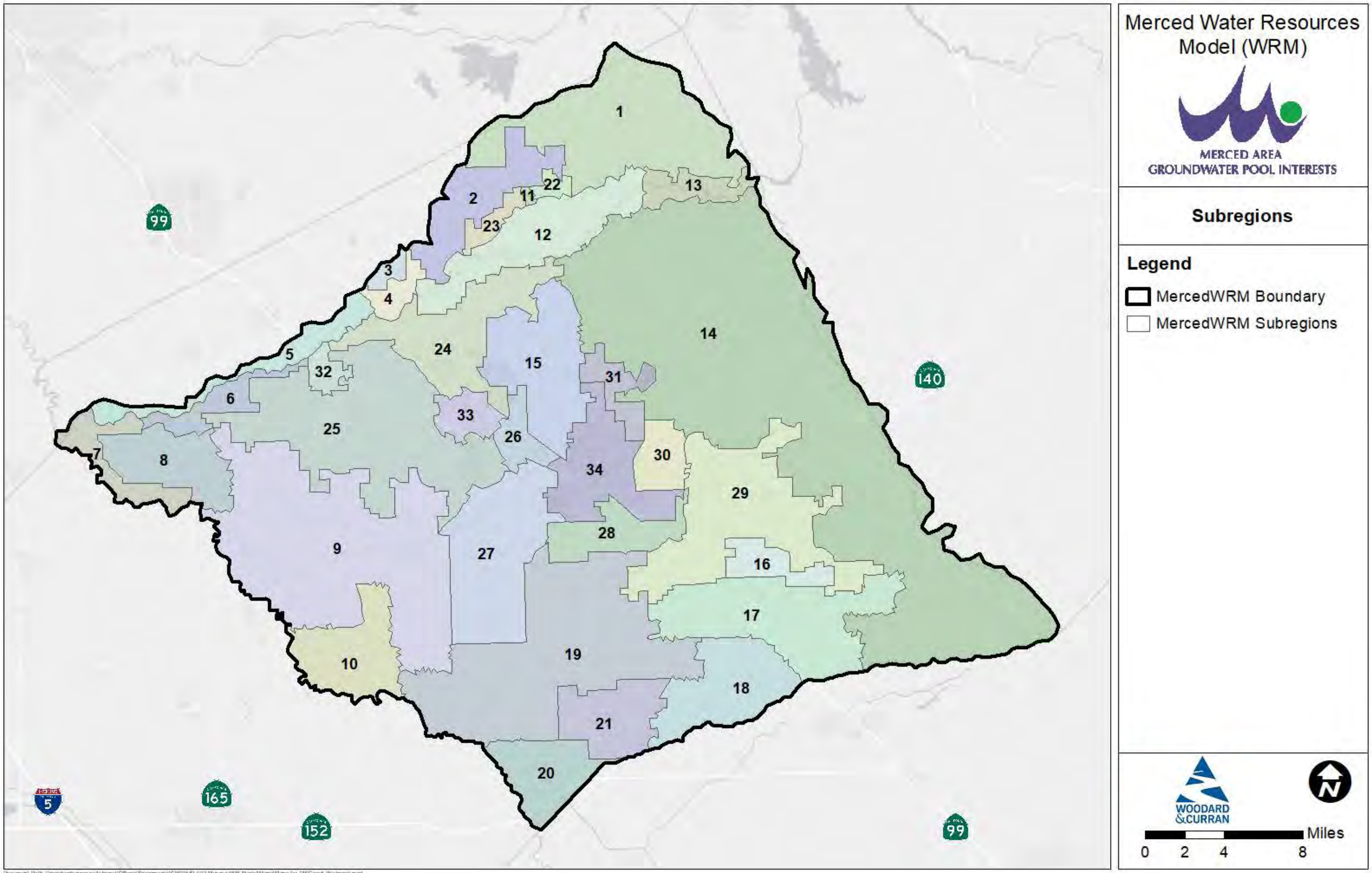


Figure 4: Merced Water Resources Model Subregions

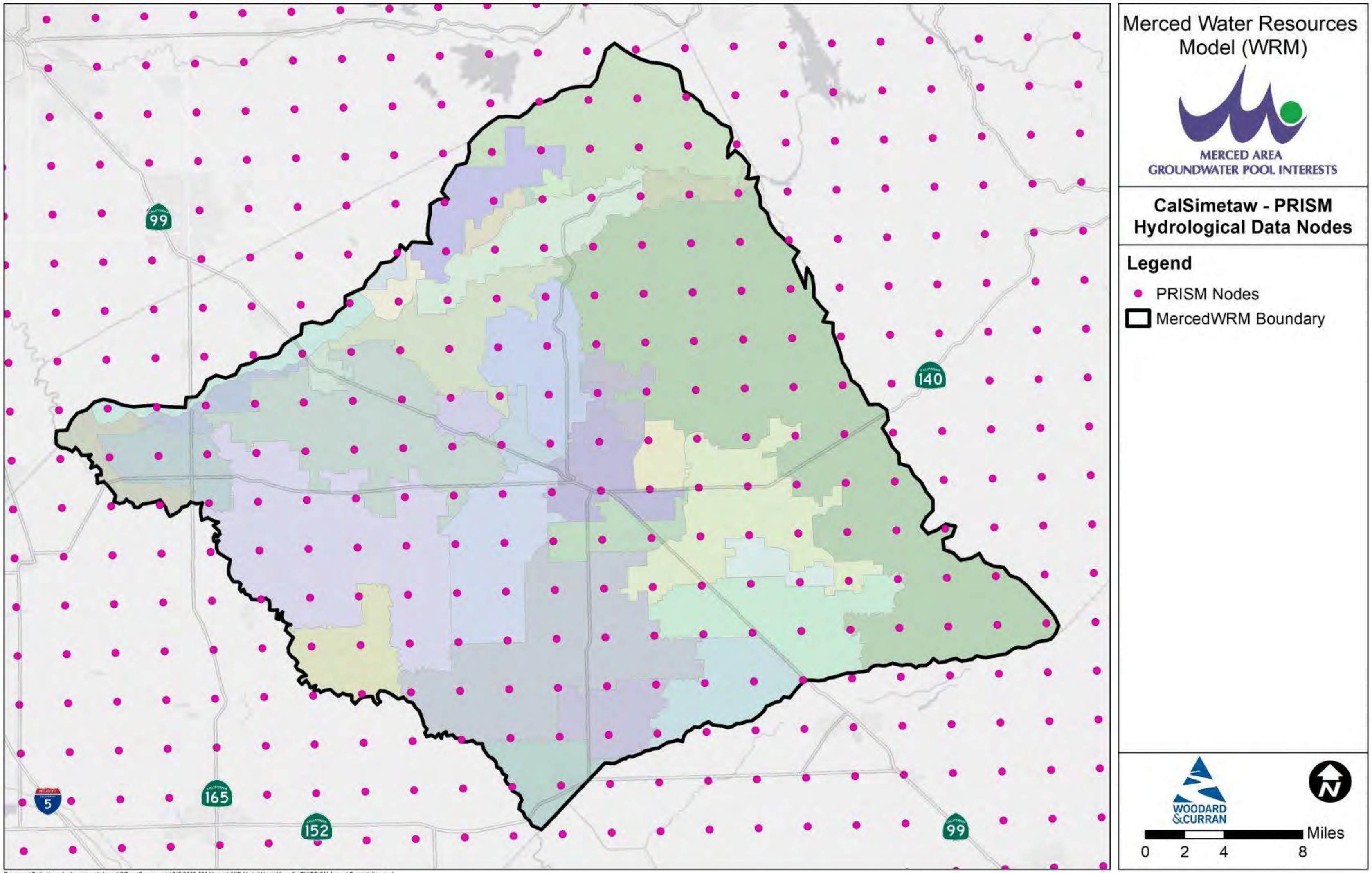


Figure 5: PRISM Grid

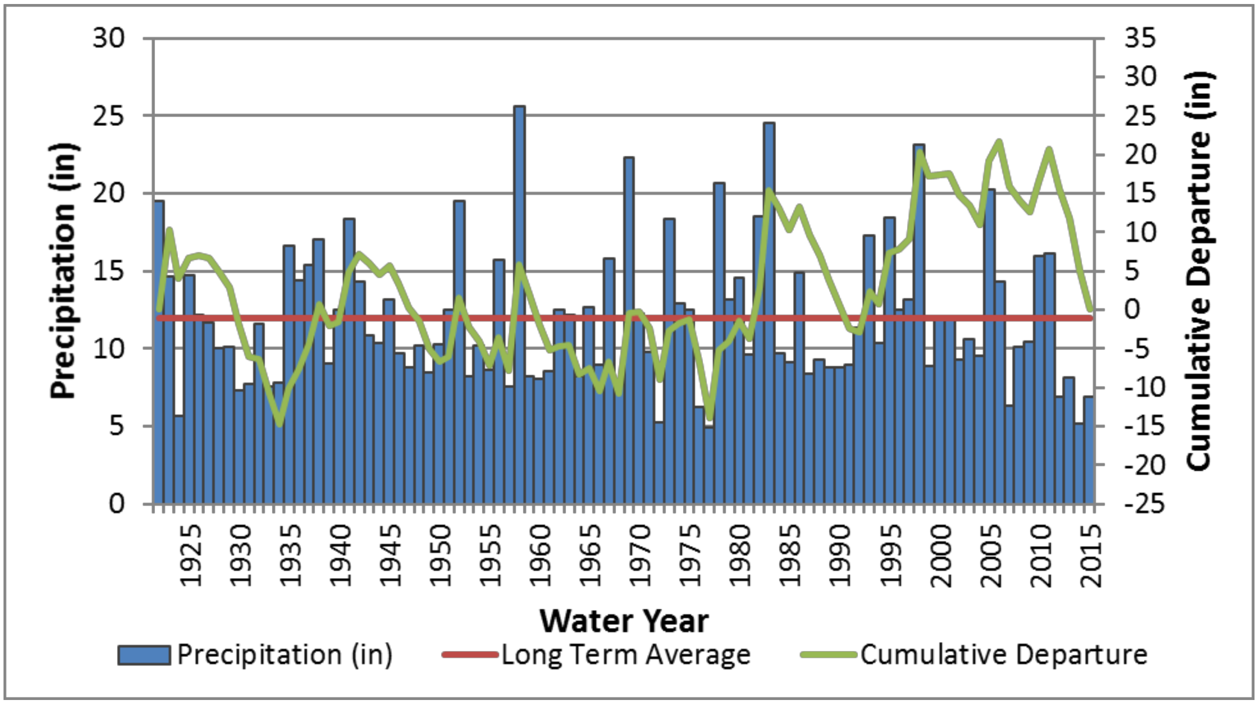


Figure 6: Monthly Precipitation and Cumulative Departure (Long Term: 1922-2015)

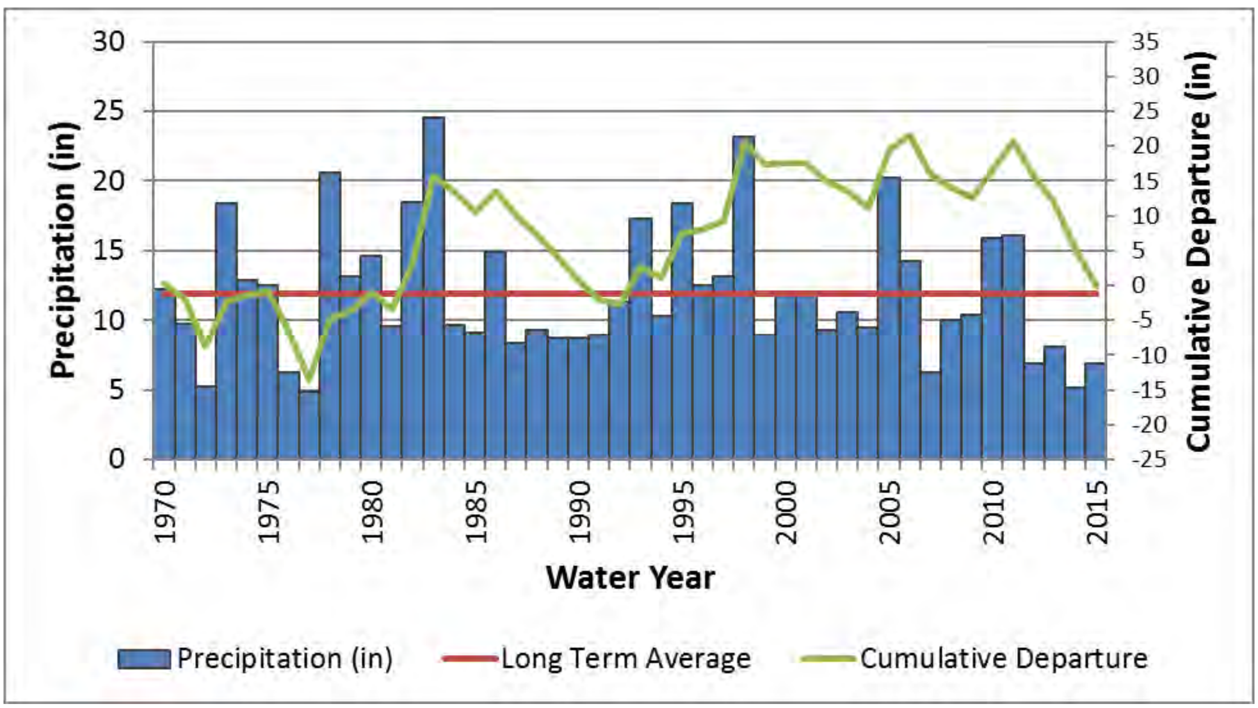


Figure 7: Monthly Precipitation and Cumulative Departure (Hydrologic Period: 1970-2015)

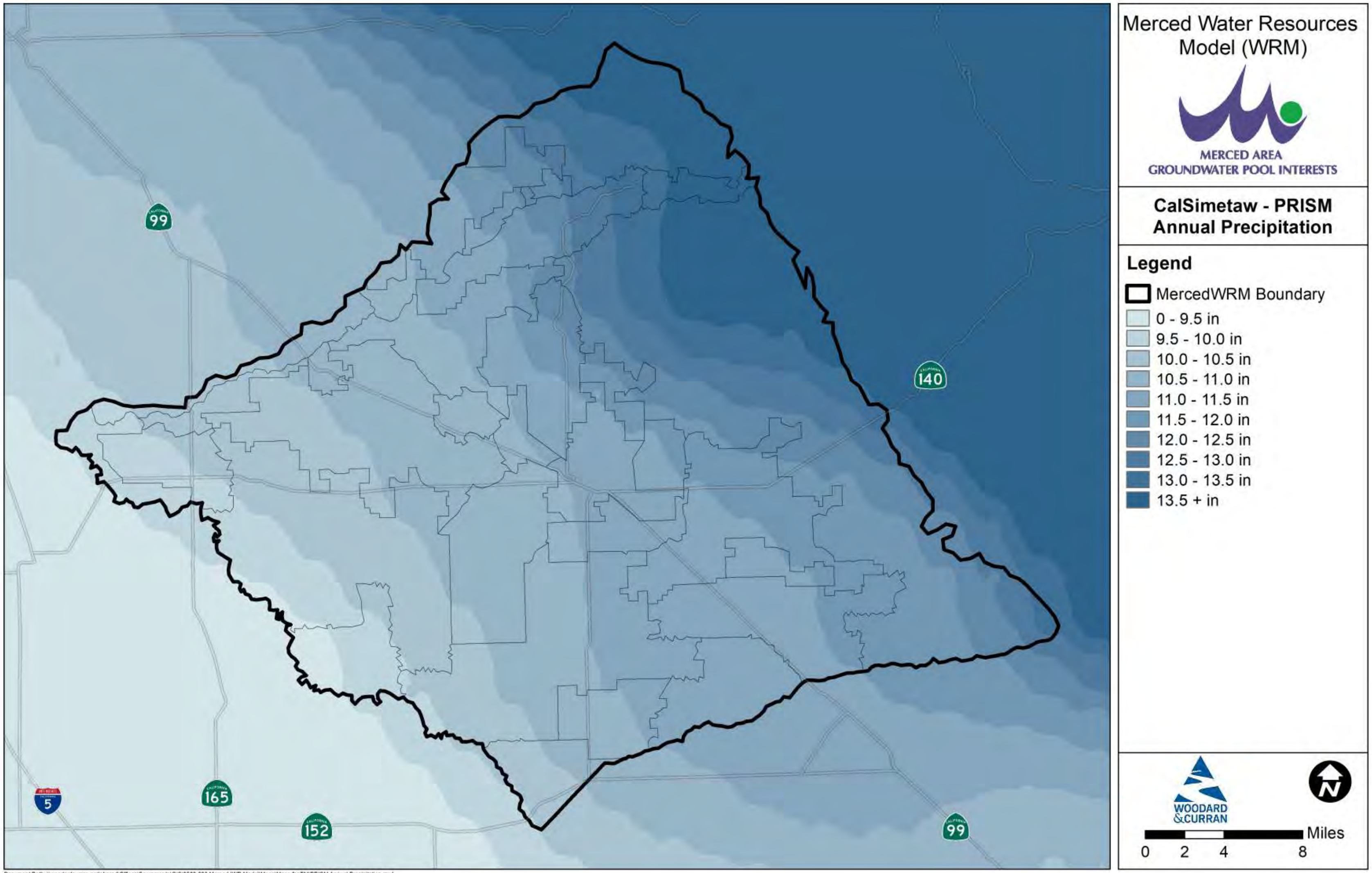


Figure 8: PRISM - Average Annual Rainfall (1970-2015)

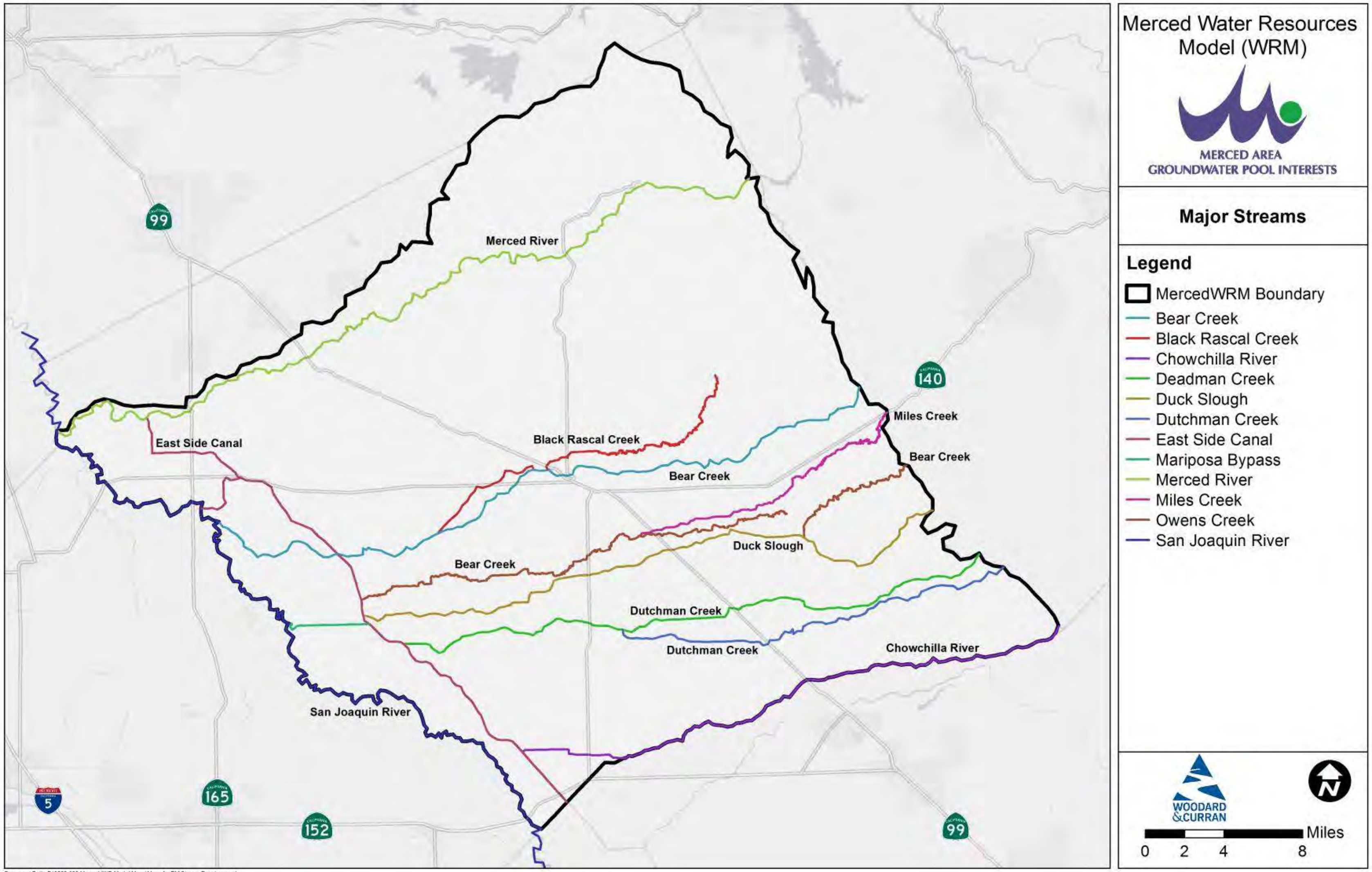


Figure 9: MercedWRM Stream Network

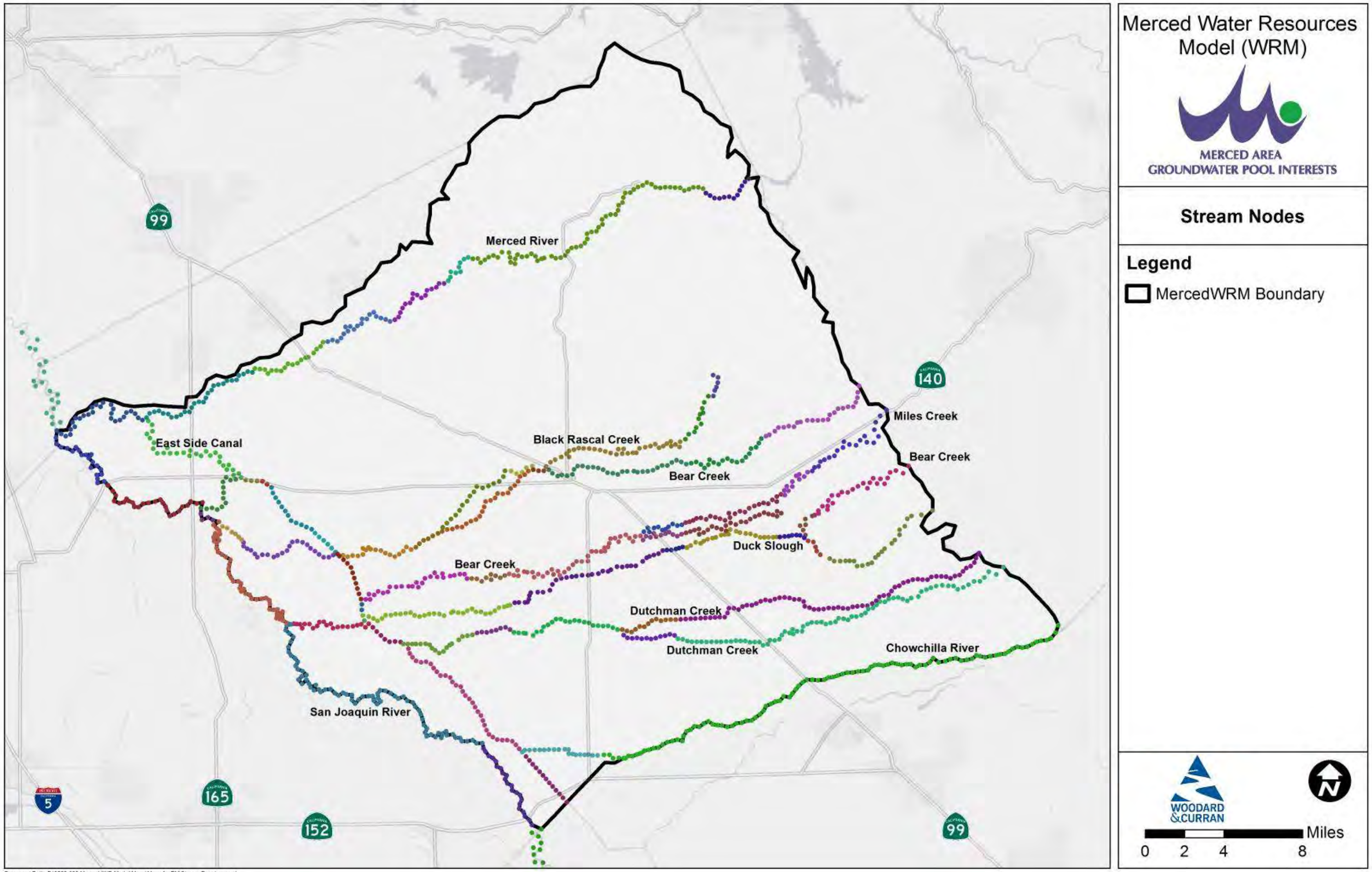


Figure 10: MercedWRM Stream Nodes and Stream Reach Configuration

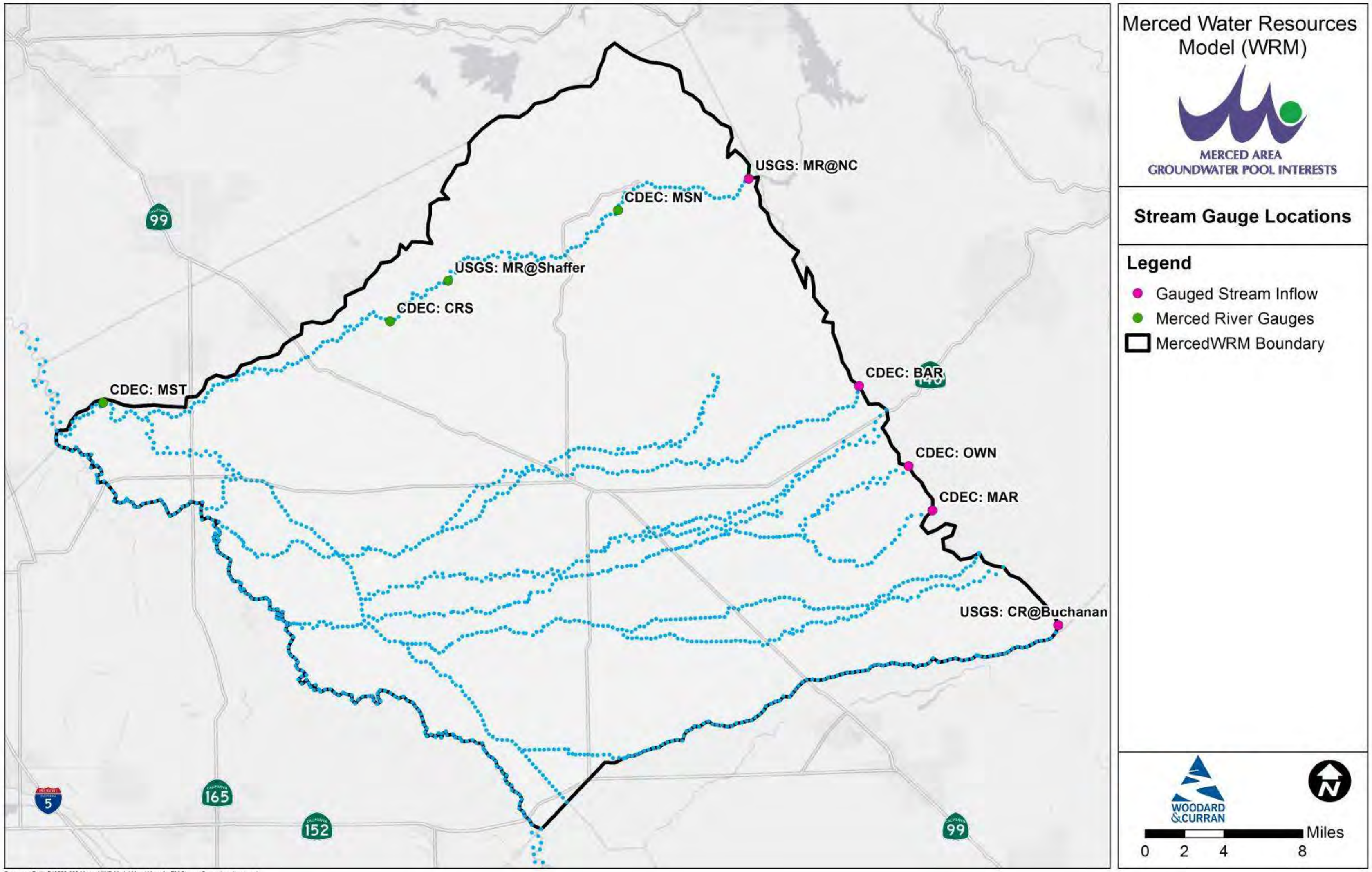


Figure 11: MercedWRM Stream Gauge Locations

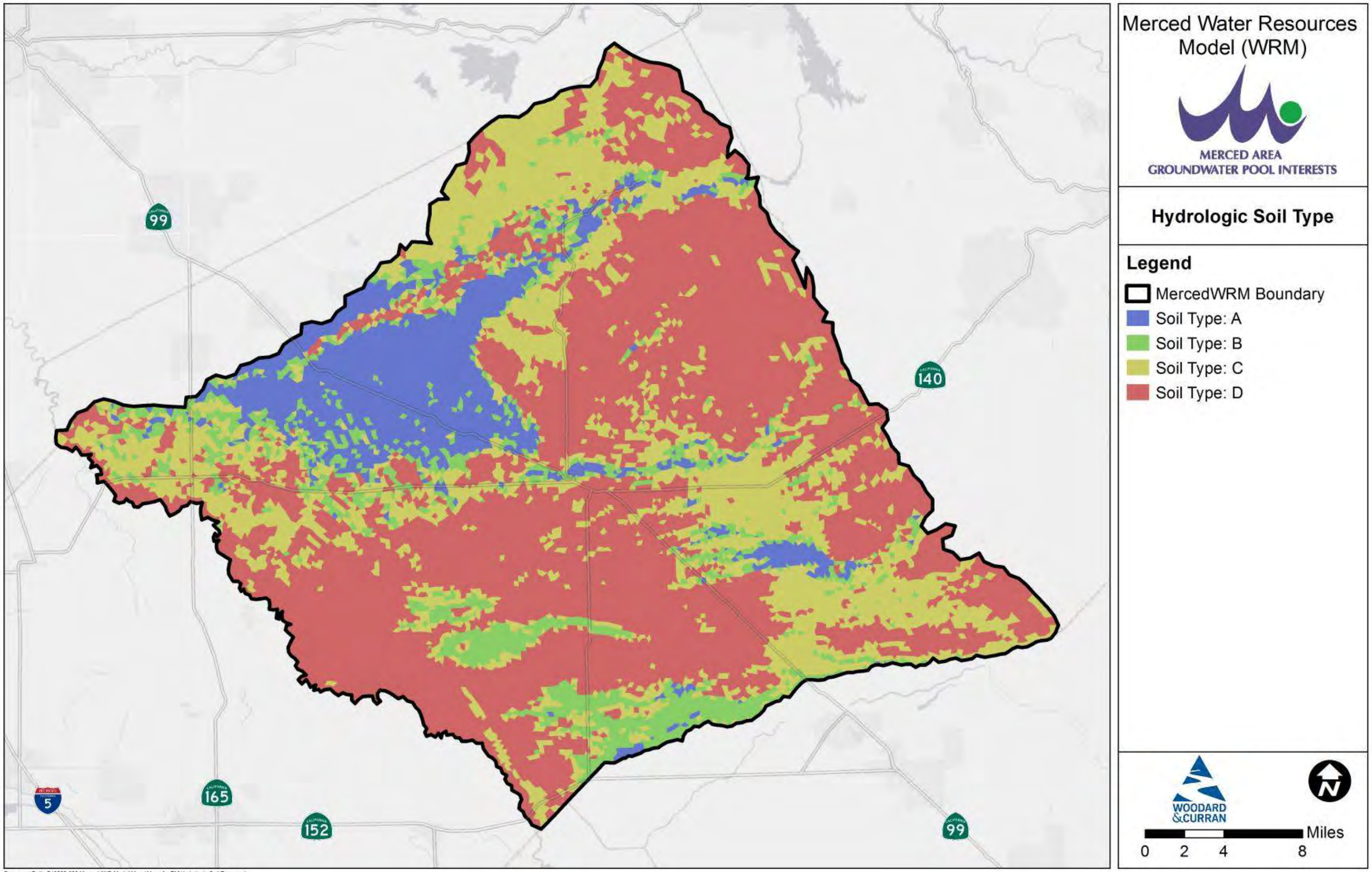


Figure 12: Soil Classifications

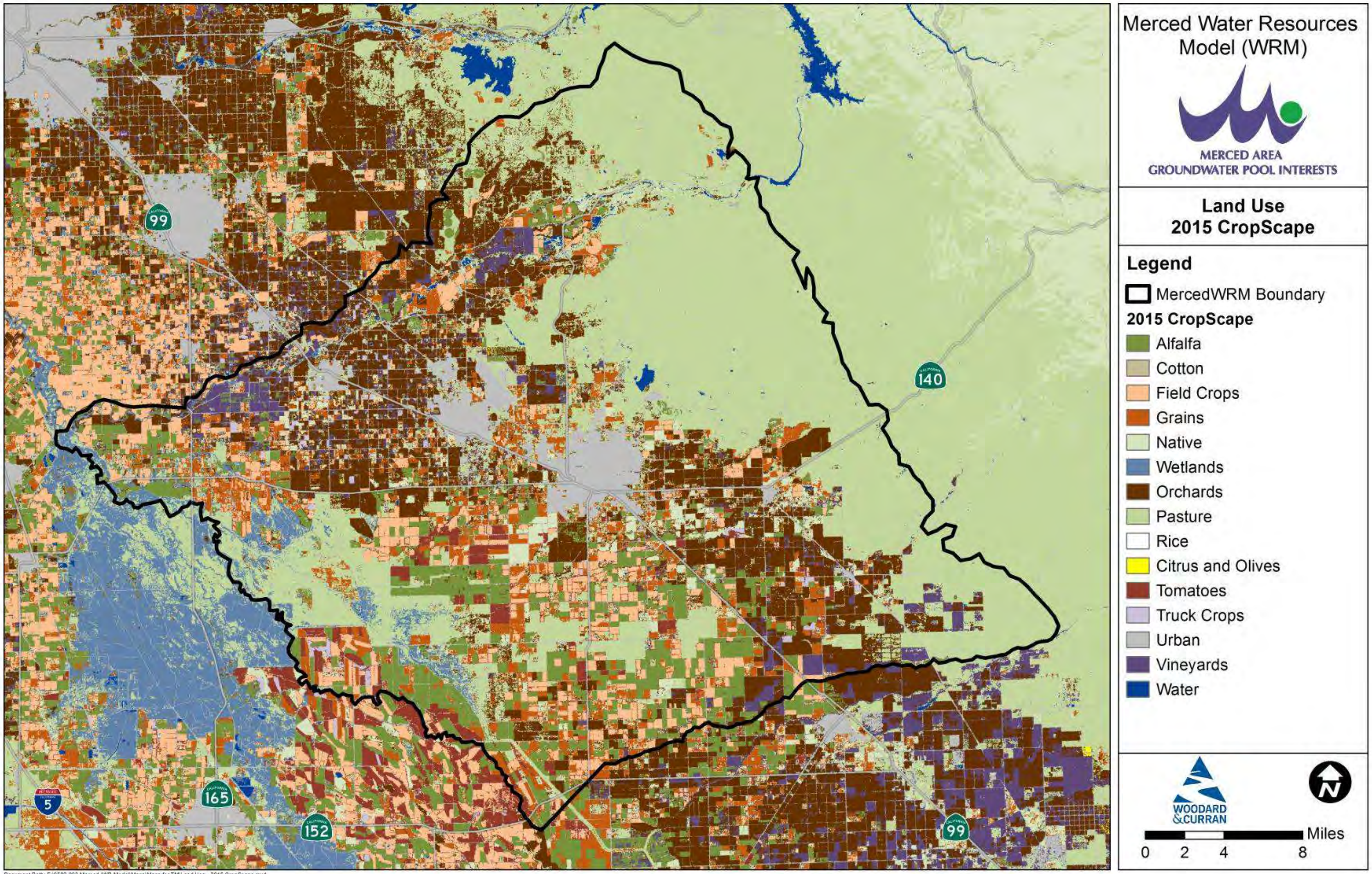


Figure 13: 2015 CropScape Land Use Data

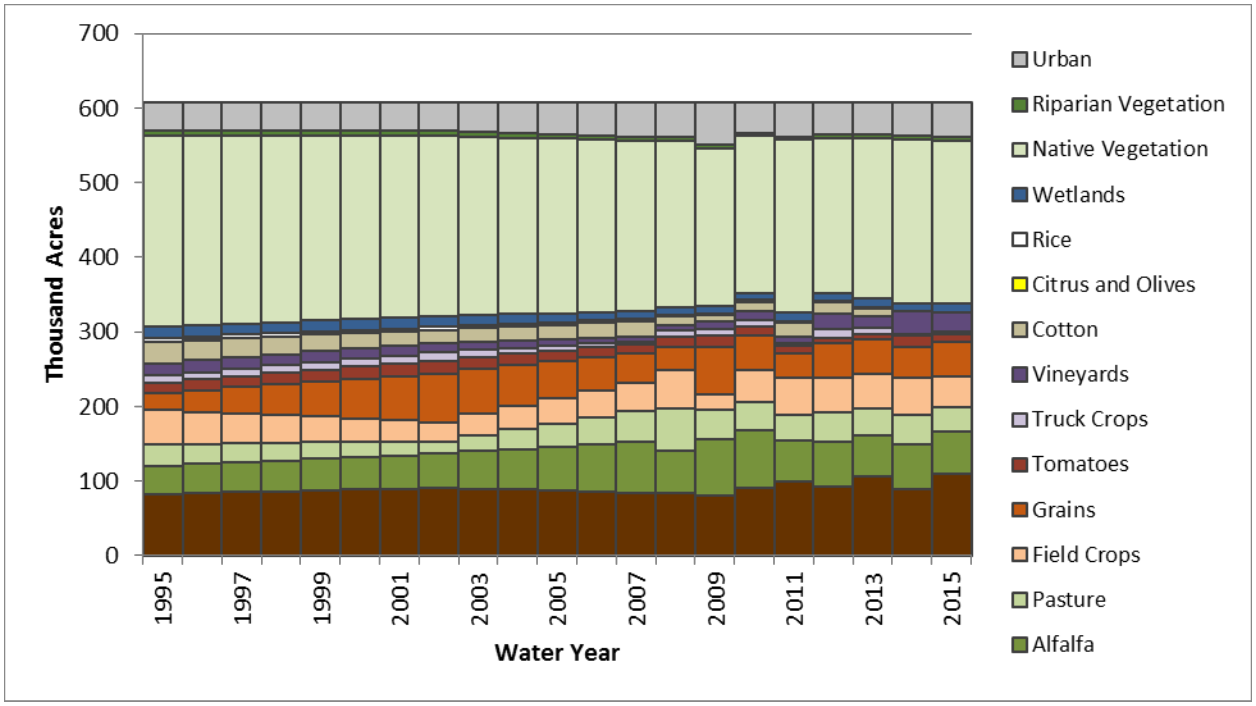


Figure 14: Merced Groundwater Region Annual Land Use Distribution

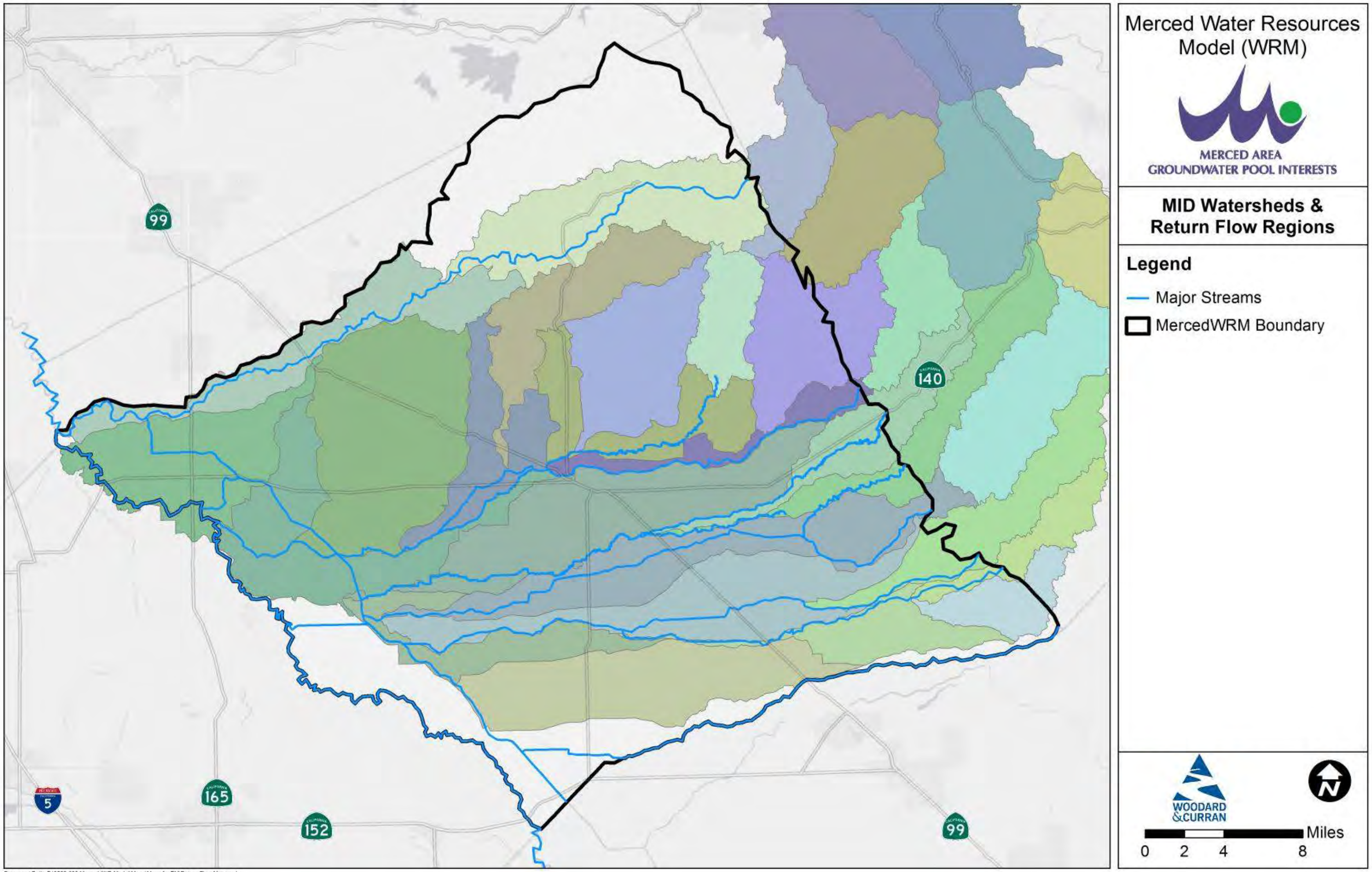


Figure 15: Merced Groundwater Basin Drainage Watersheds

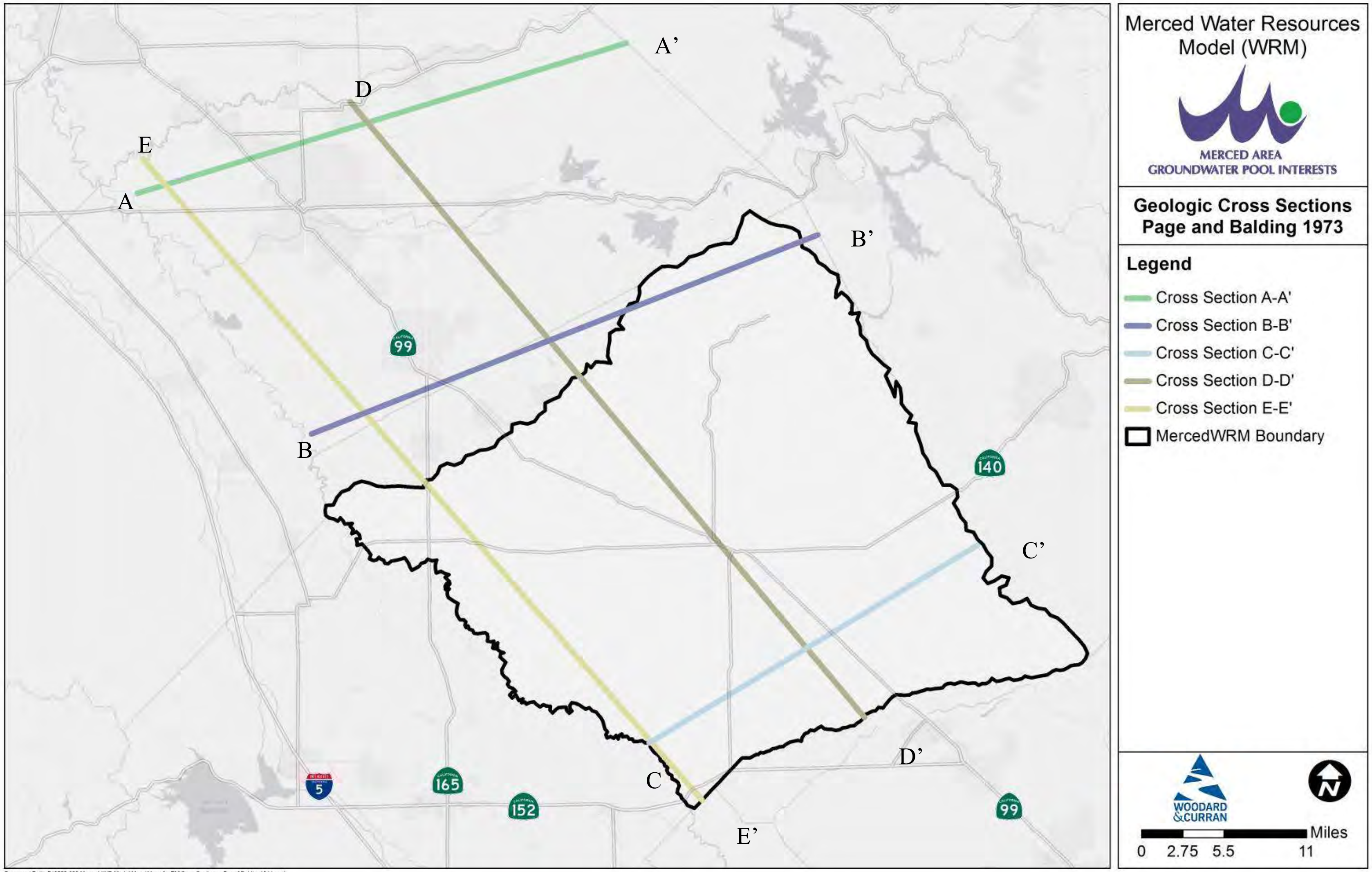


Figure 16: Location of Geologic Cross Sections - Page and Balding 1973

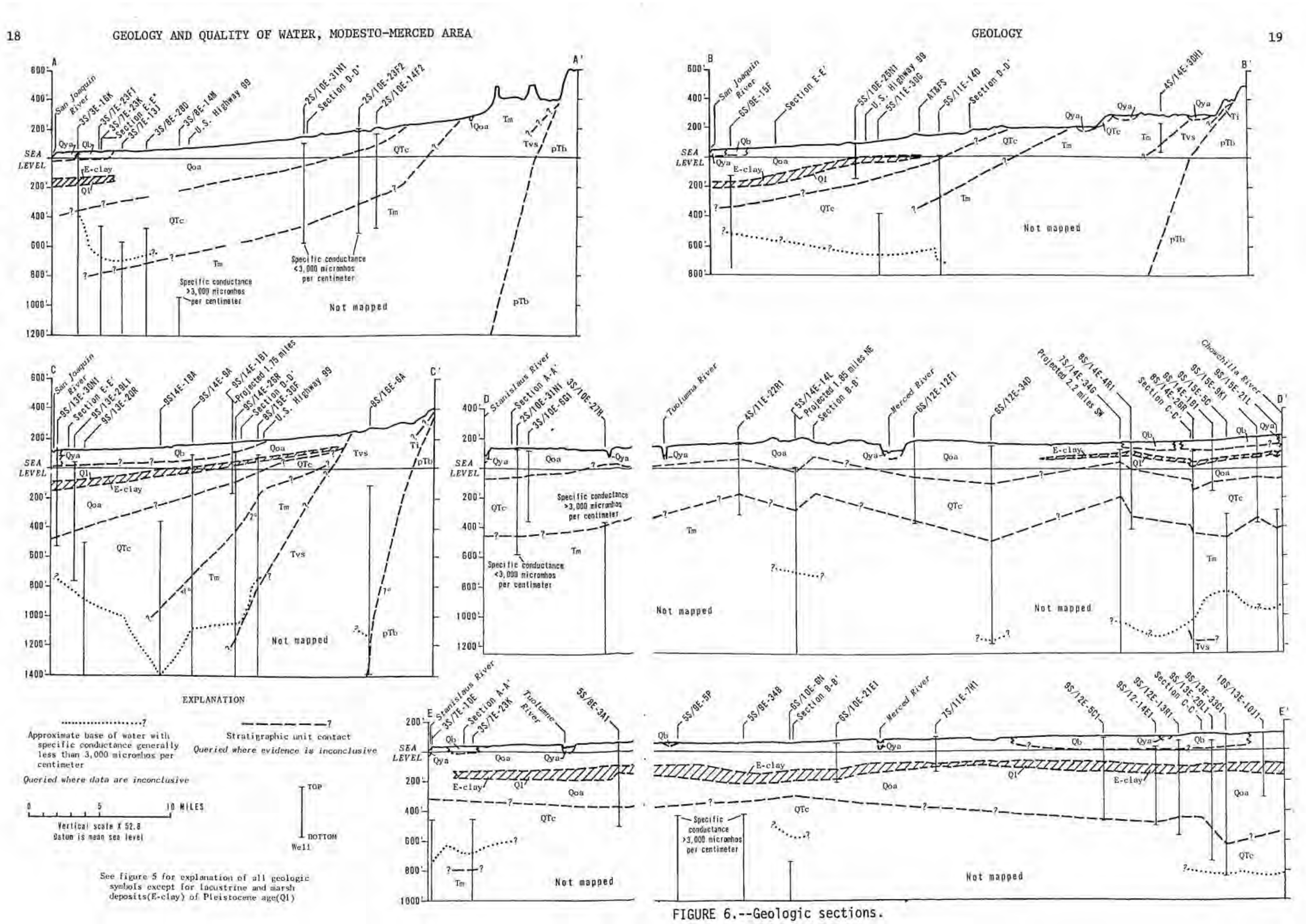


Figure 17: Referenced Cross Sections from Page and Balding 1973

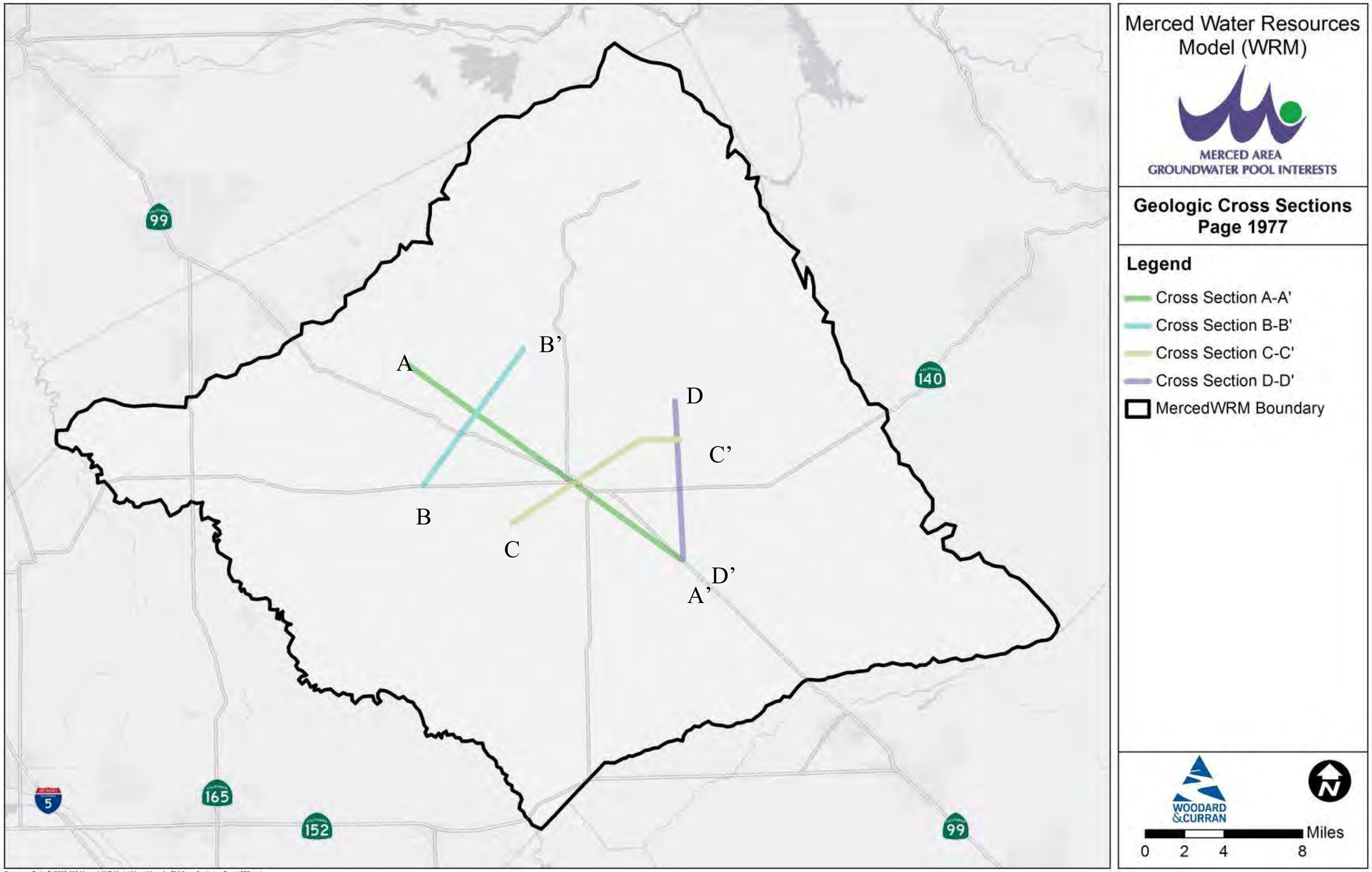


Figure 18: Location of Geologic Cross Sections - Page 1977

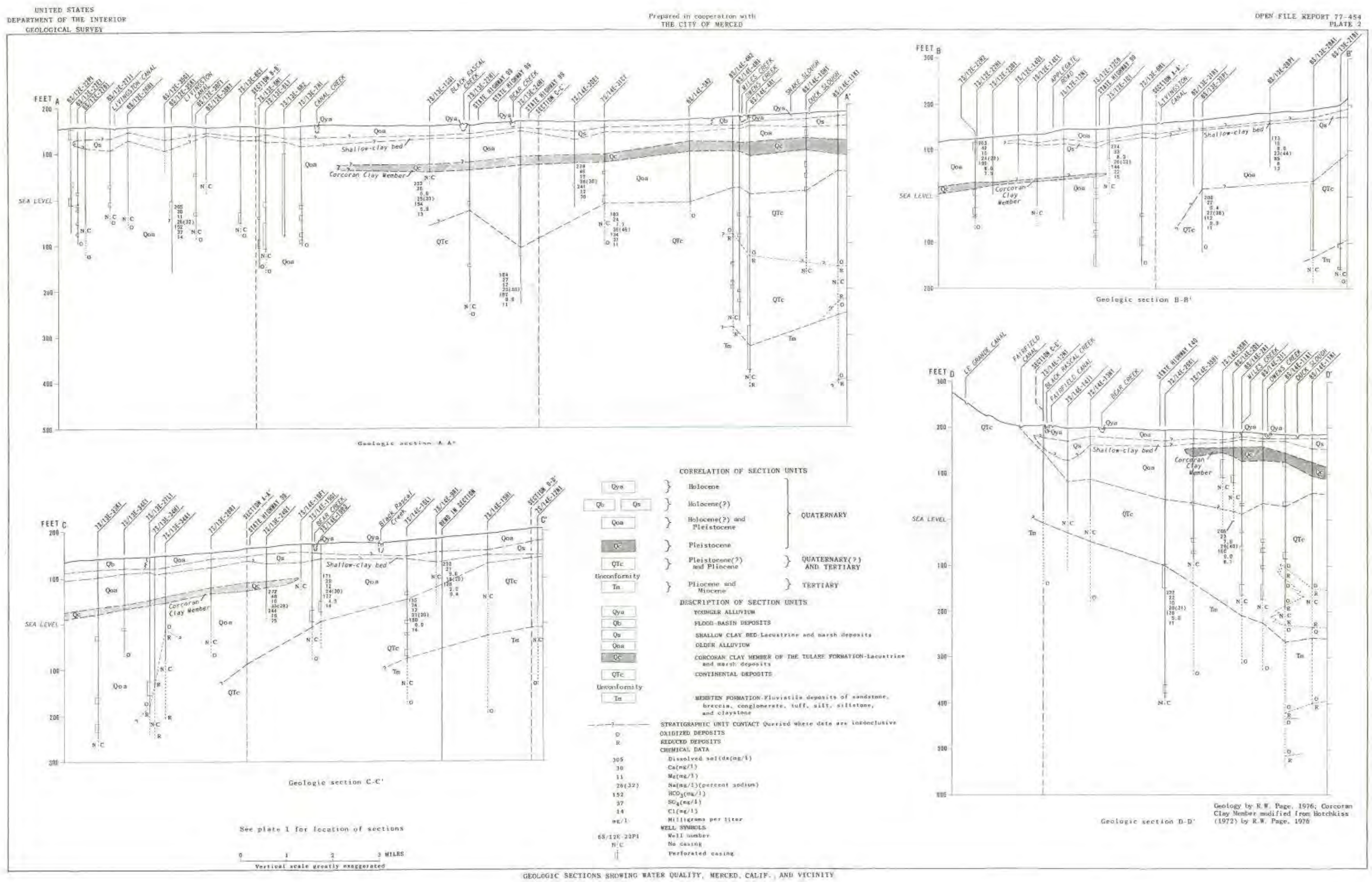


Figure 19: Referenced Cross Sections from Page 1977

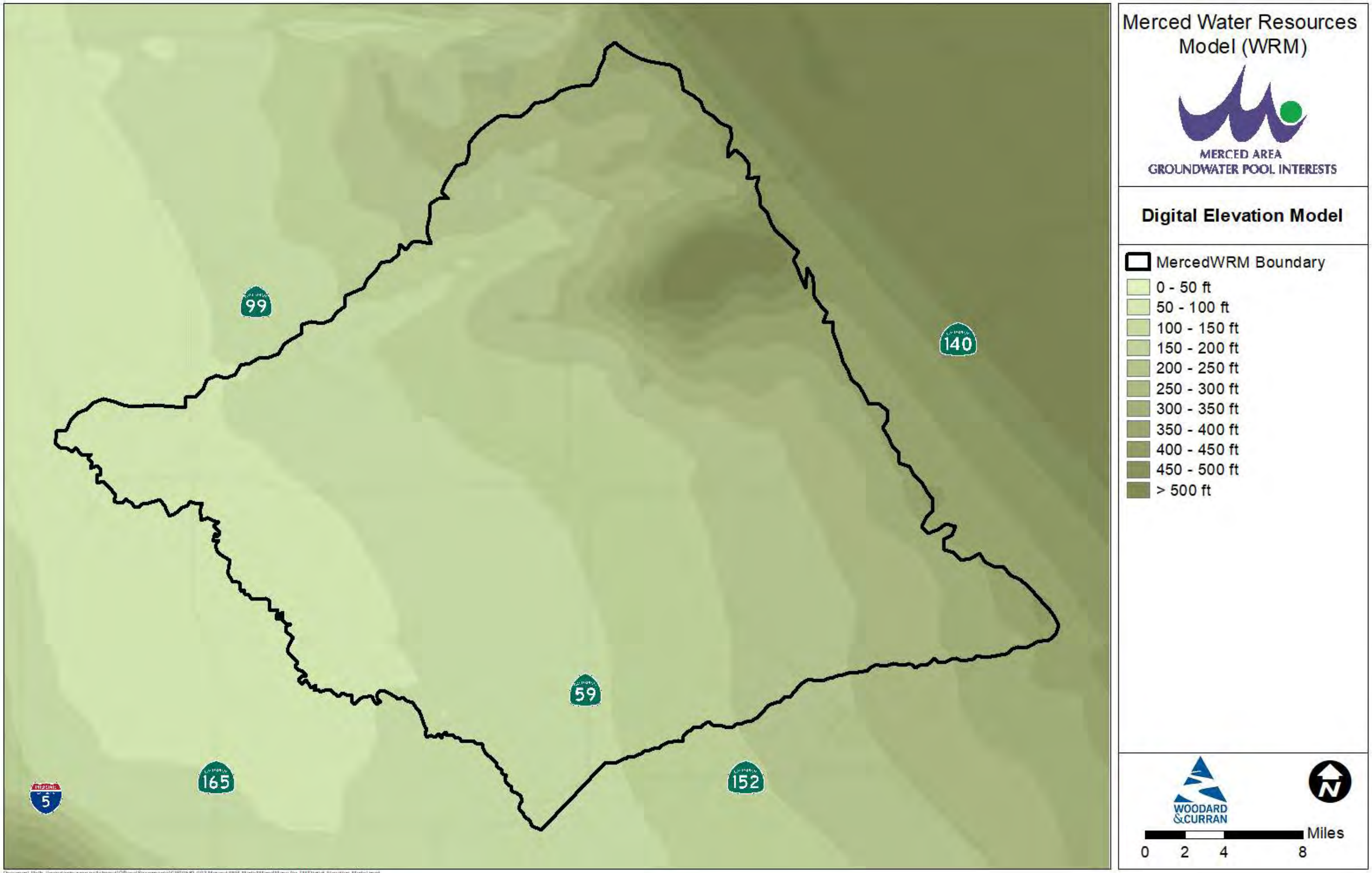


Figure 20: USGS Digital Elevation Model

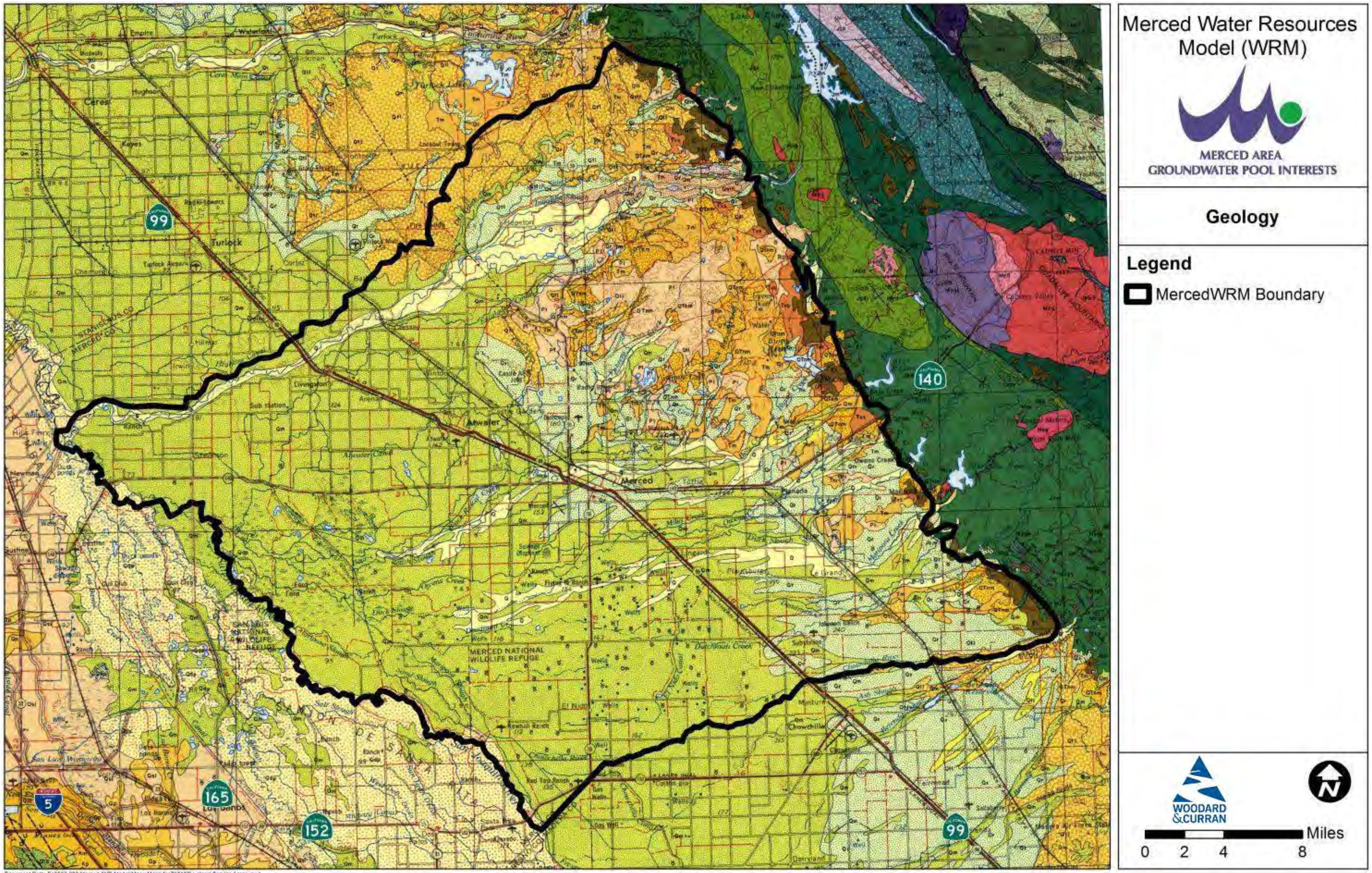


Figure 21: Surficial Geology - Wagner, Bortugno, and McJunkin (1991)

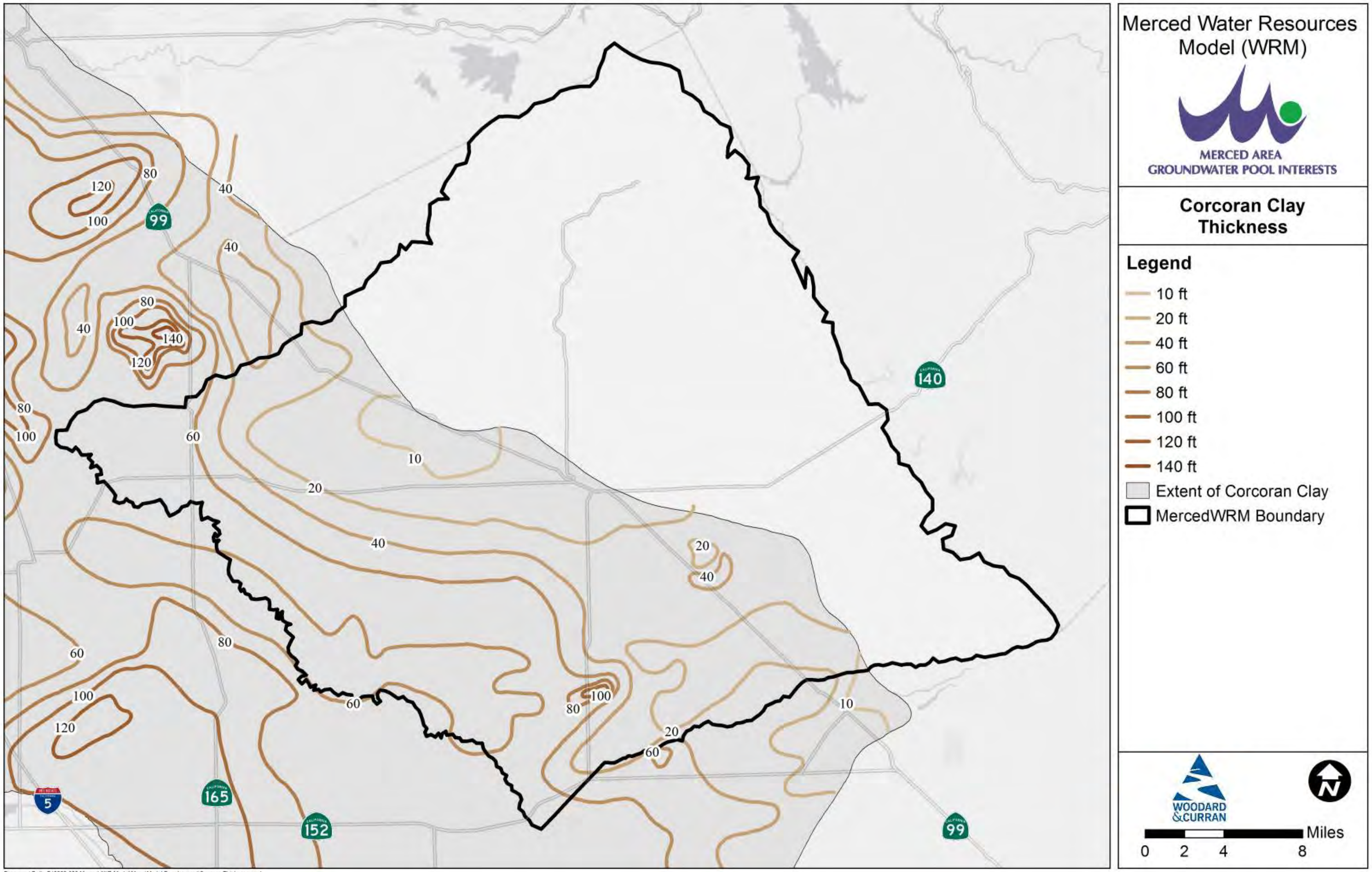


Figure 22: Corcoran Clay Thickness

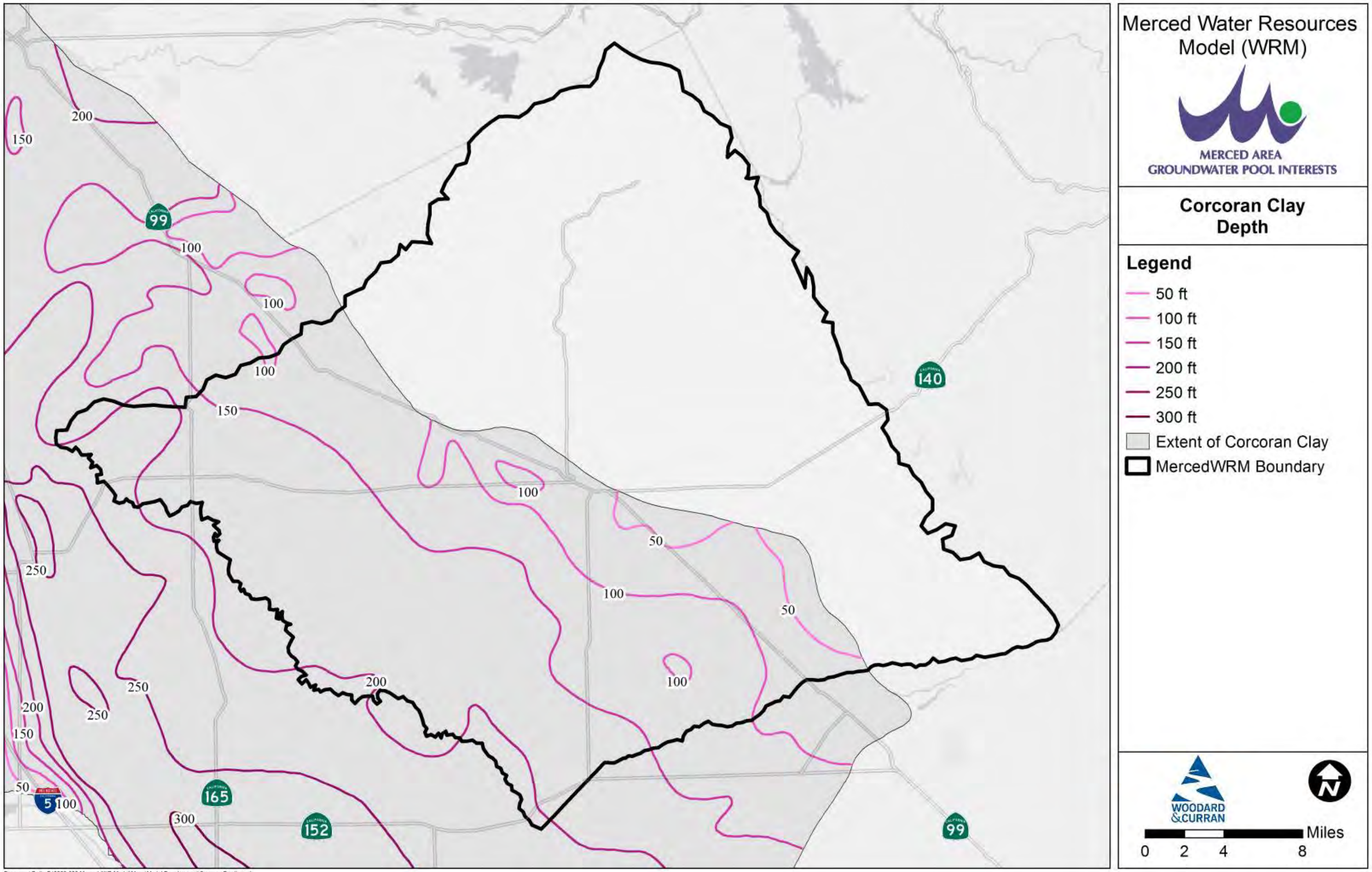


Figure 23: Corcoran Clay Depth

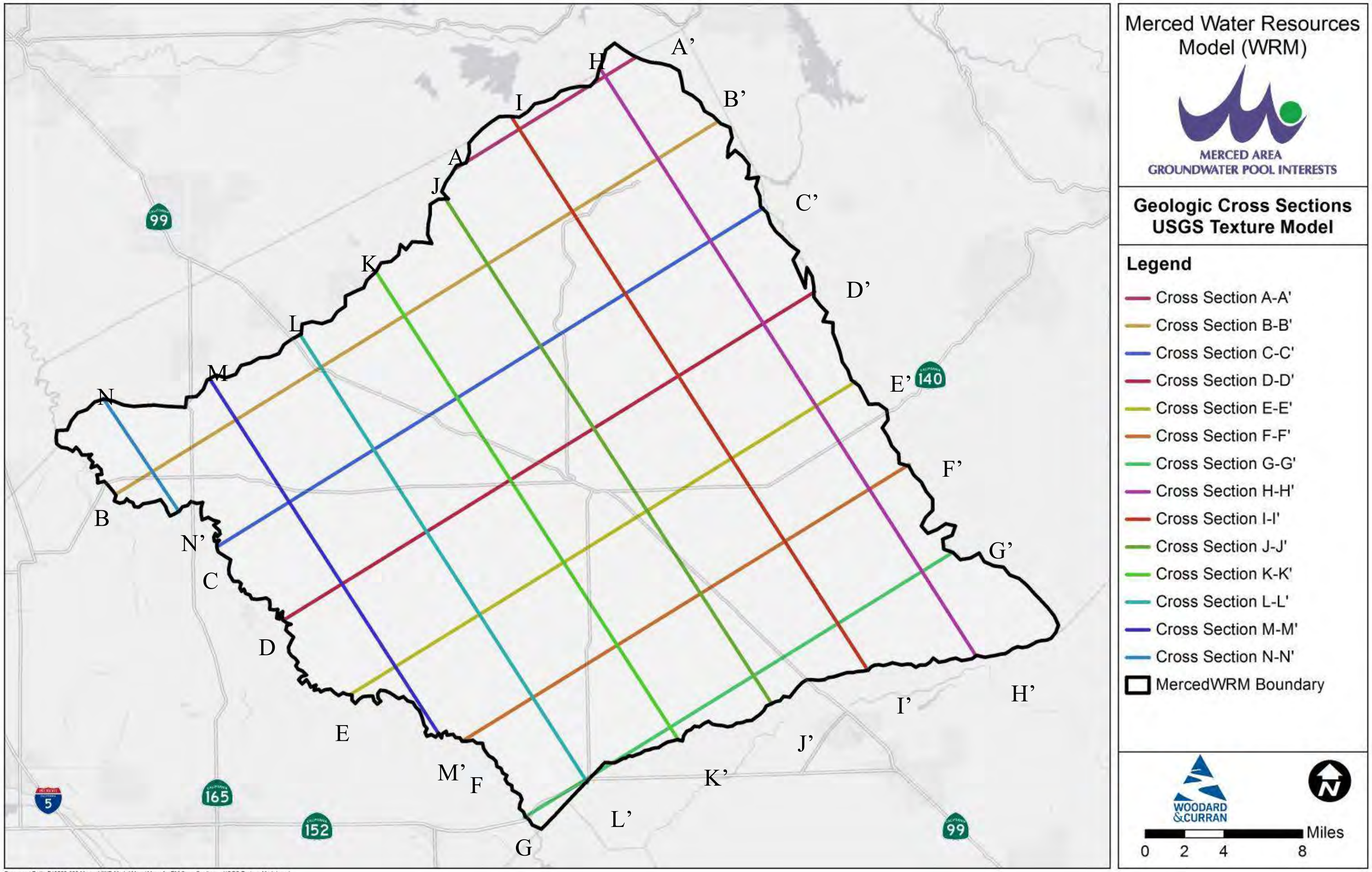


Figure 24: Location of Finalized Geologic Cross Sections

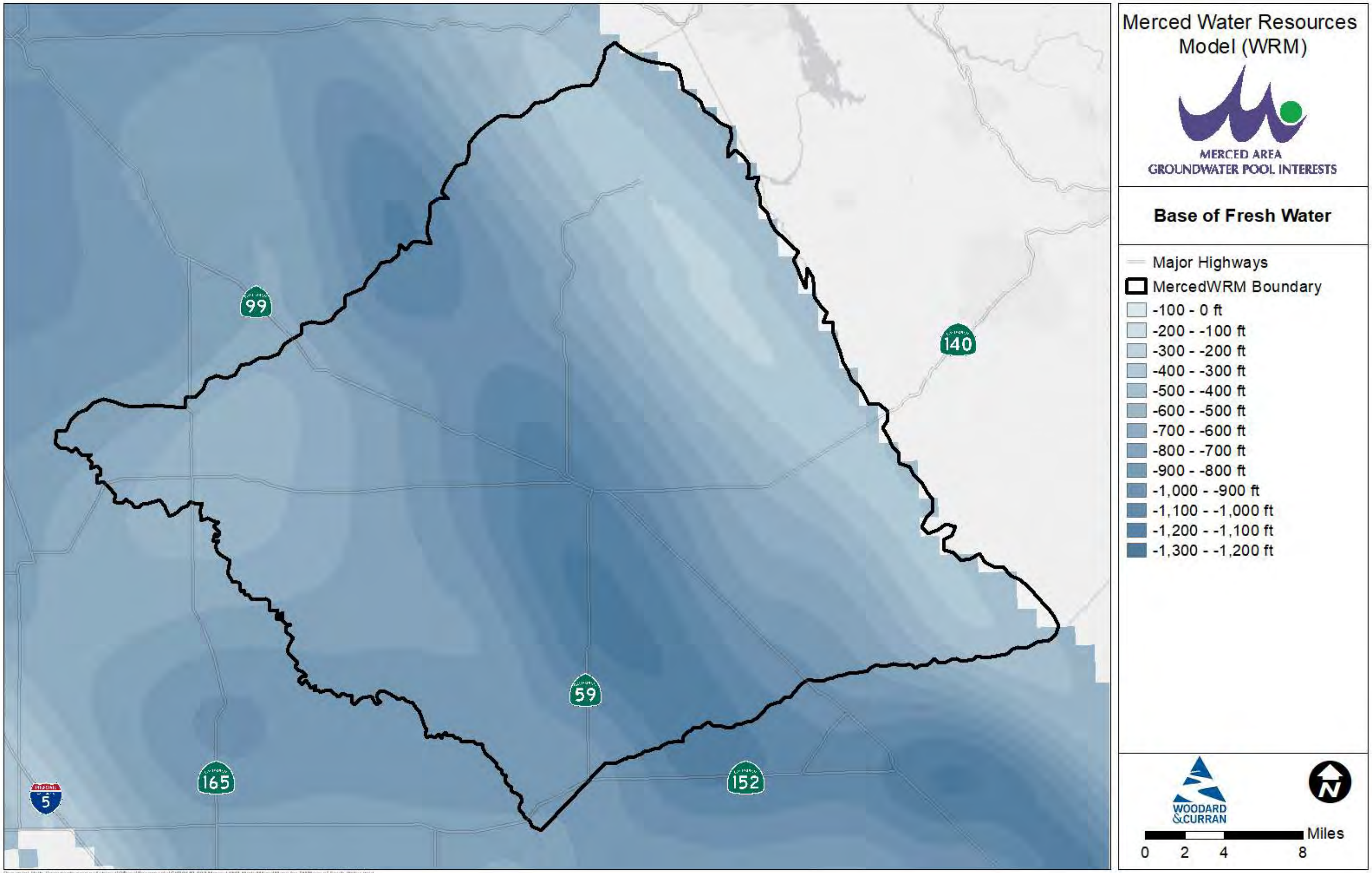


Figure 25: C2VSim Base of Fresh Water

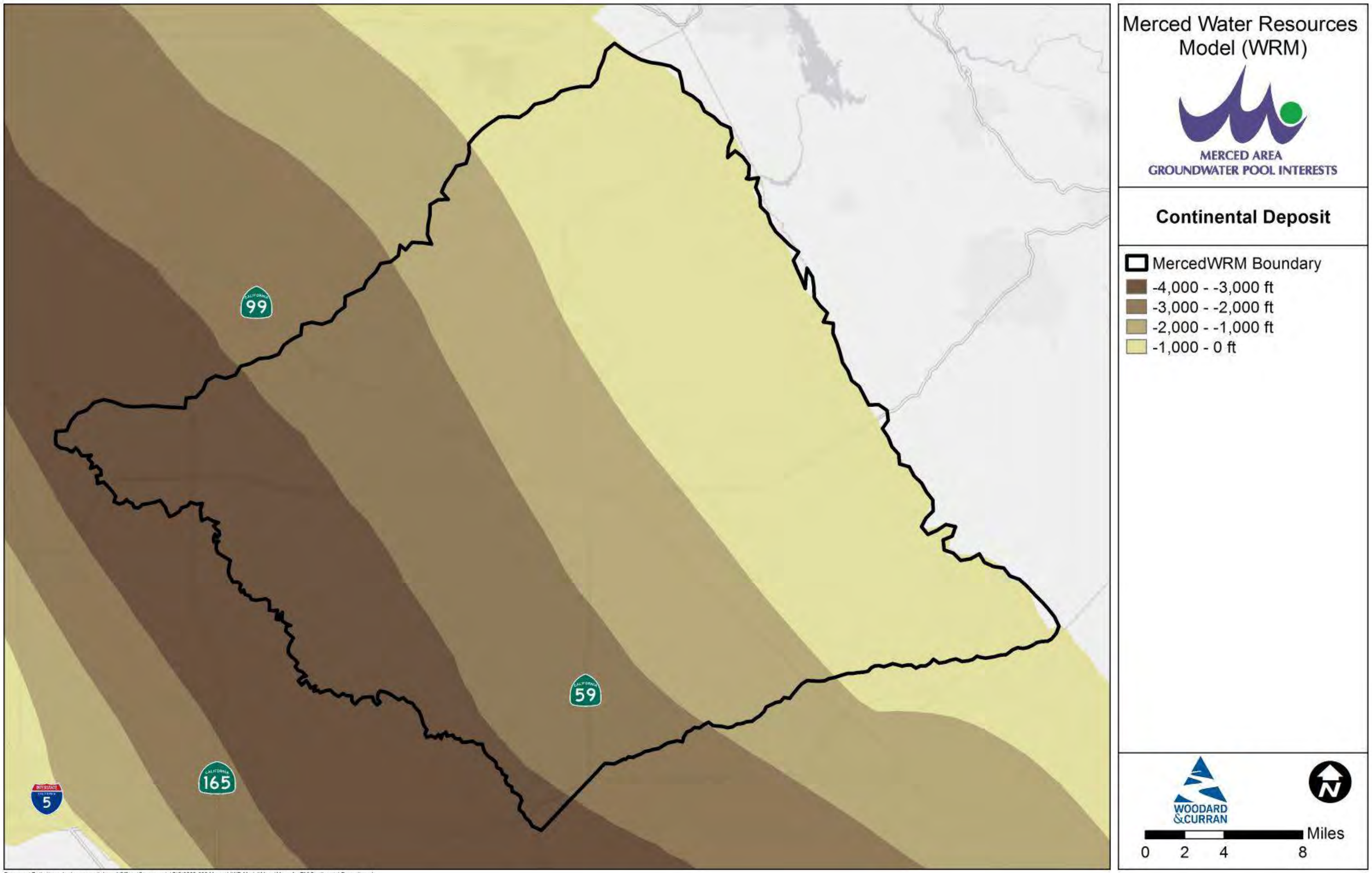


Figure 26: Continental Deposit

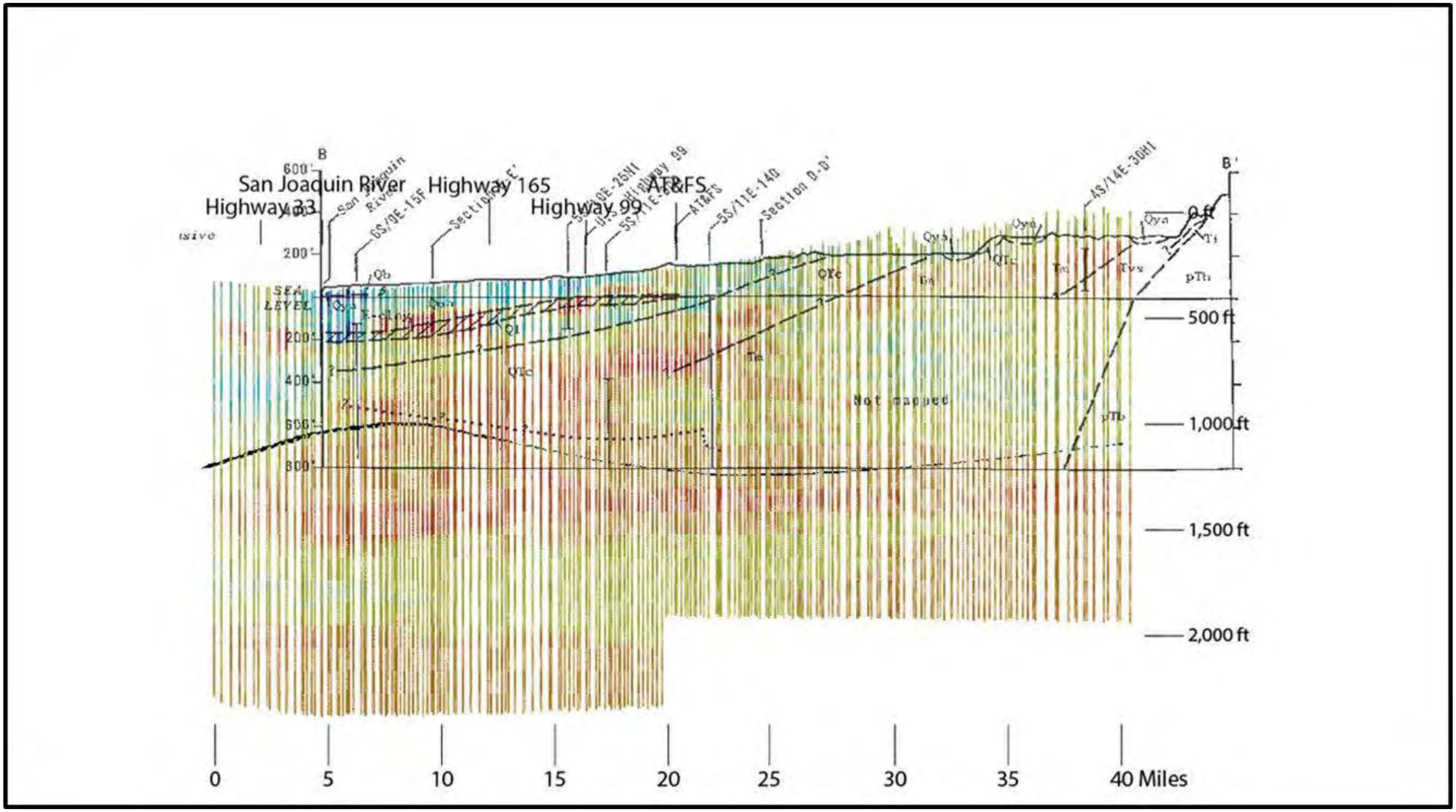


Figure 27: Page and Balding Cross Section B-B' Overlaying the USGS Texture Model Cross Section A-A'

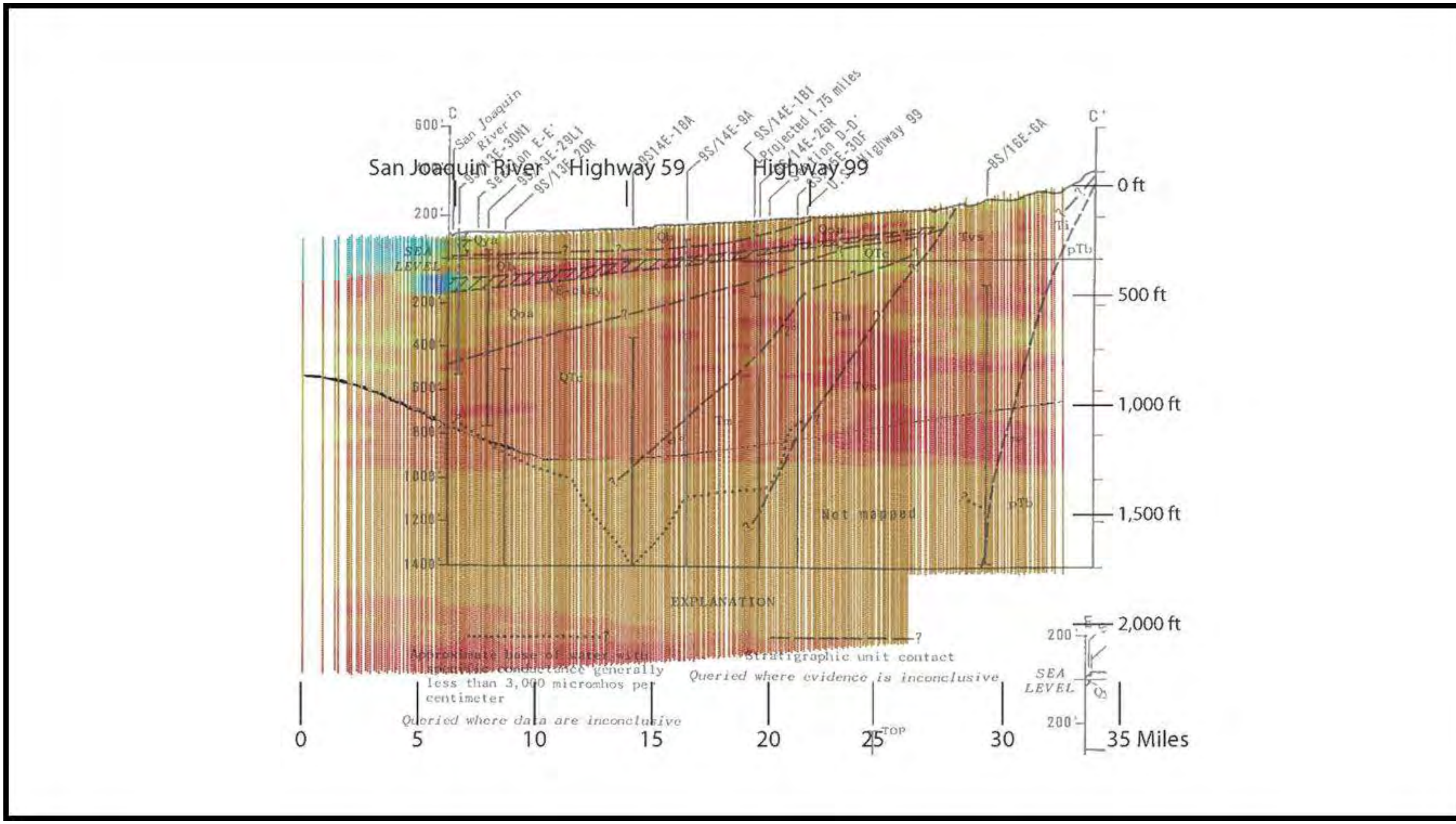


Figure 28: Page and Balding Cross Section C-C' Overlaying the USGS Texture Model Cross Section F-F'

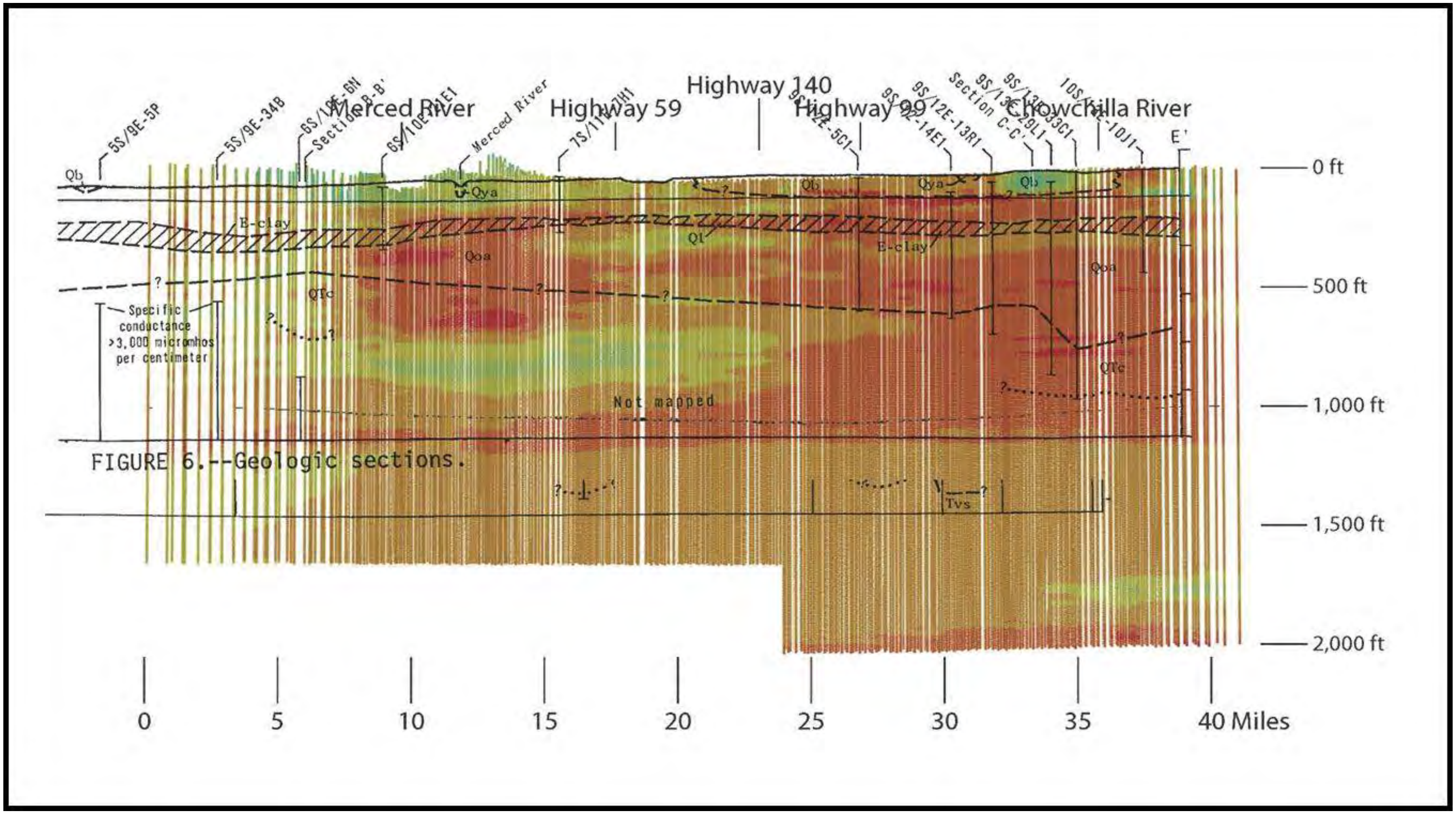


Figure 29: Page and Balding Cross Section D-D' Overlaying the USGS Texture Model Cross Section J-J'

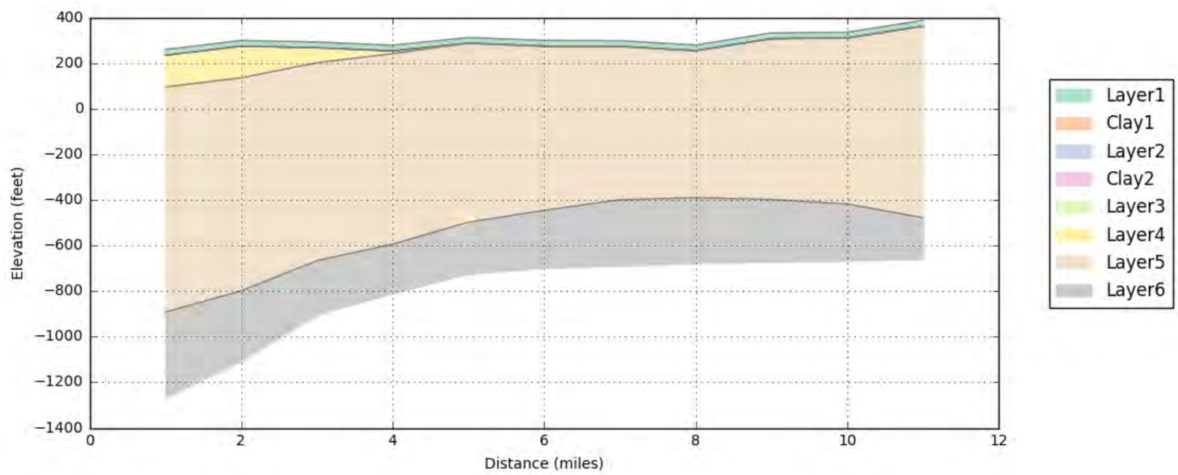


Figure 30: MercedWRM Geologic Cross Section A-A'

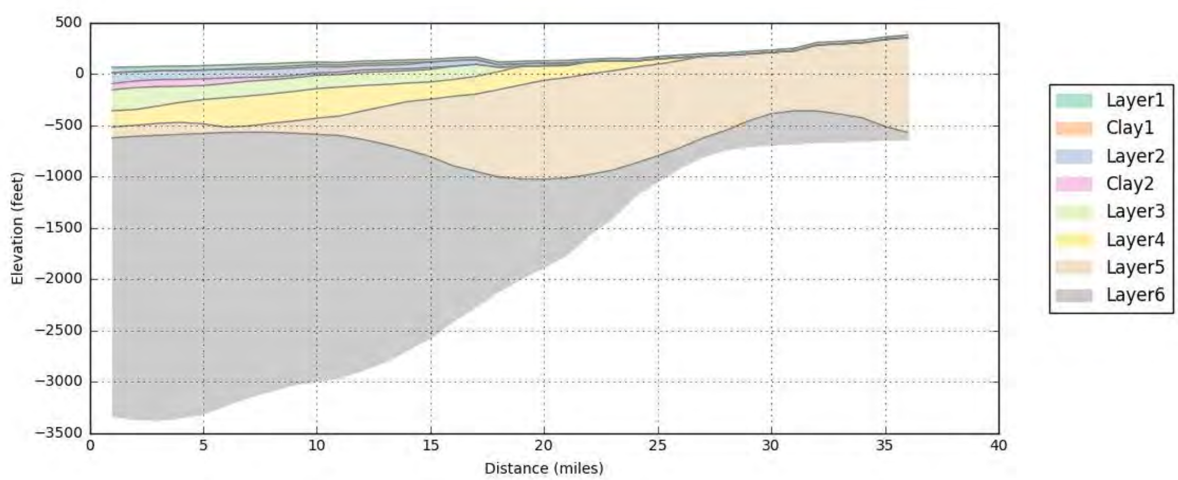


Figure 31: MercedWRM Geologic Cross Section B-B'

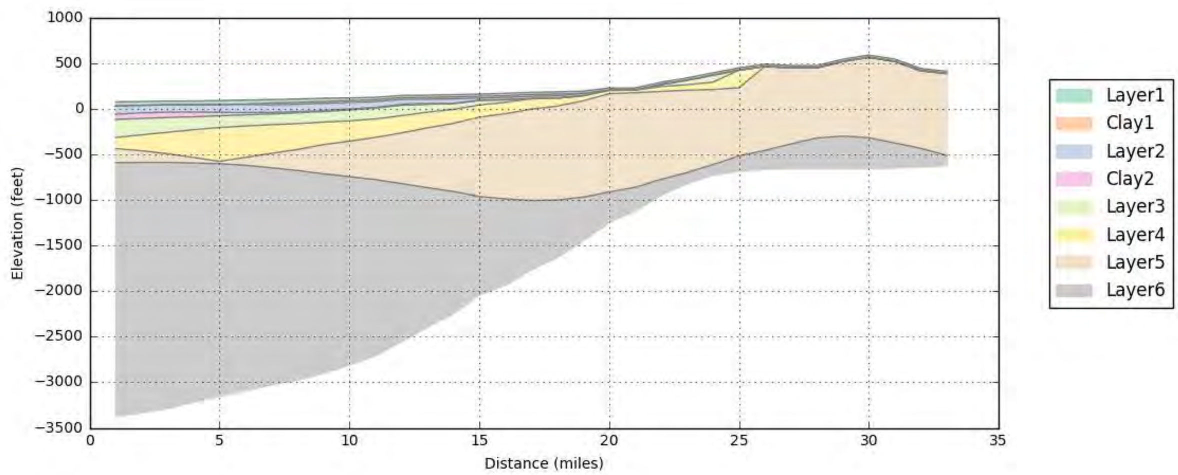


Figure 32: MercedWRM Geologic Cross Section C-C'

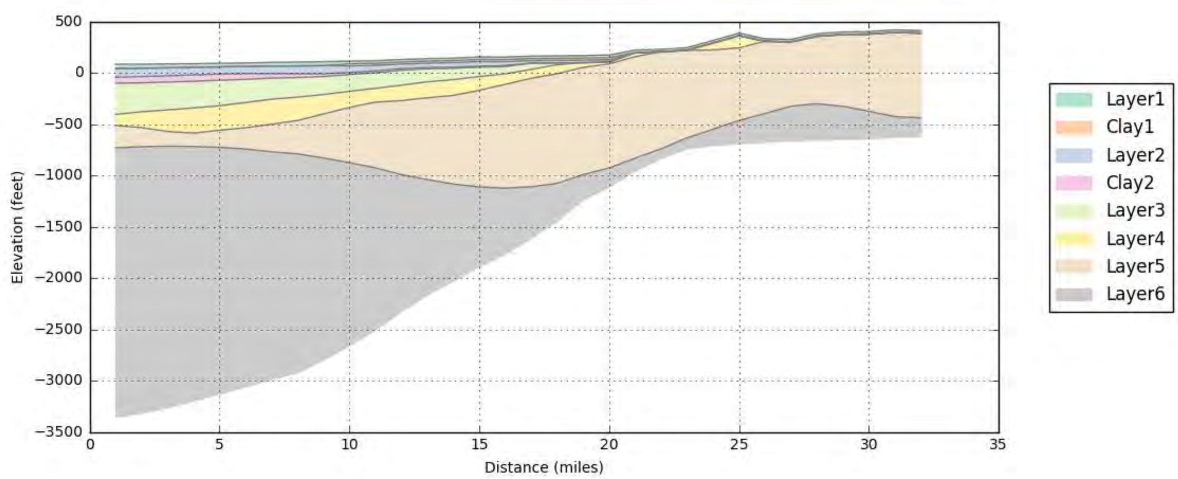


Figure 33: MercedWRM Geologic Cross Section D-D'

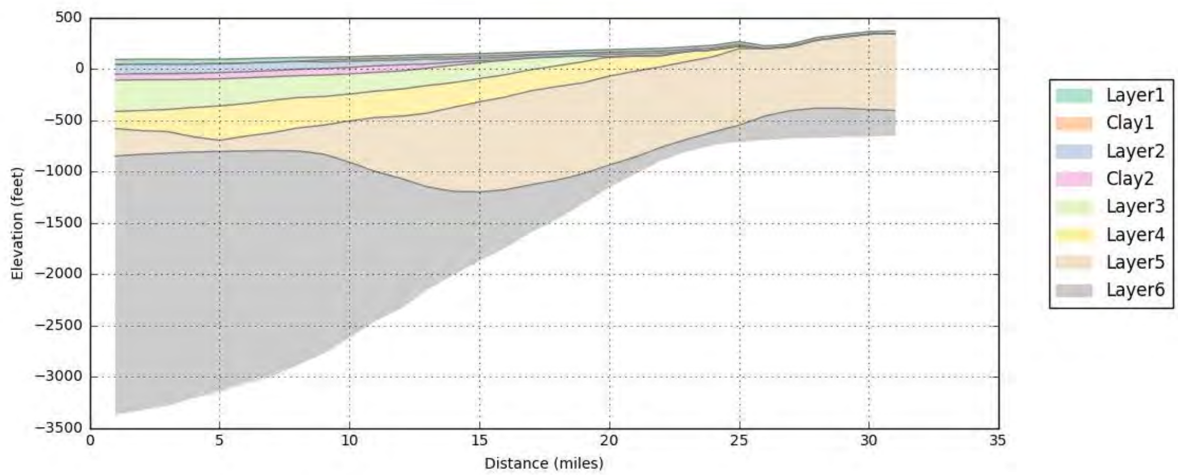


Figure 34: MercedWRM Geologic Cross Section E-E'

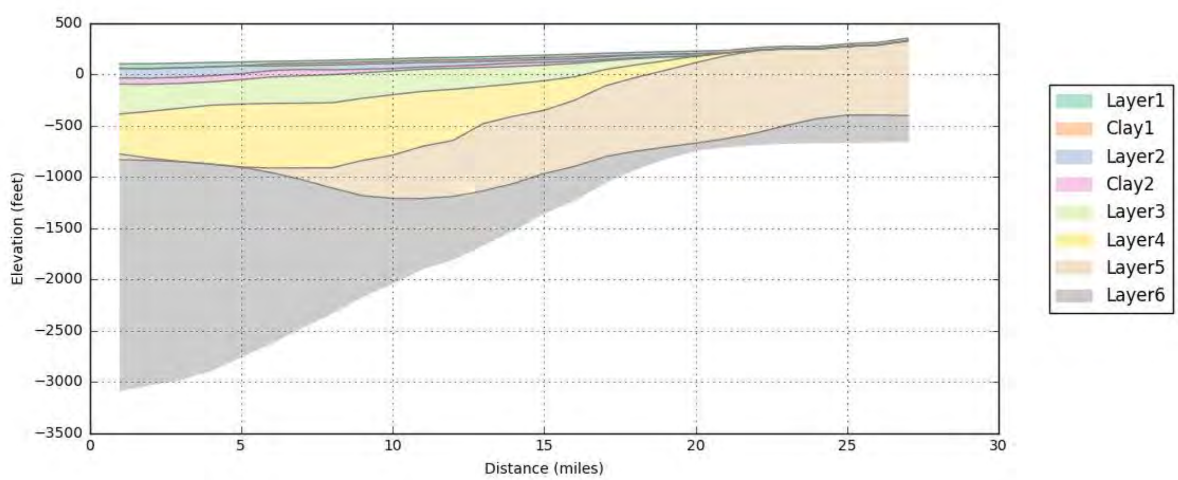


Figure 35: MercedWRM Geologic Cross Section F-F'

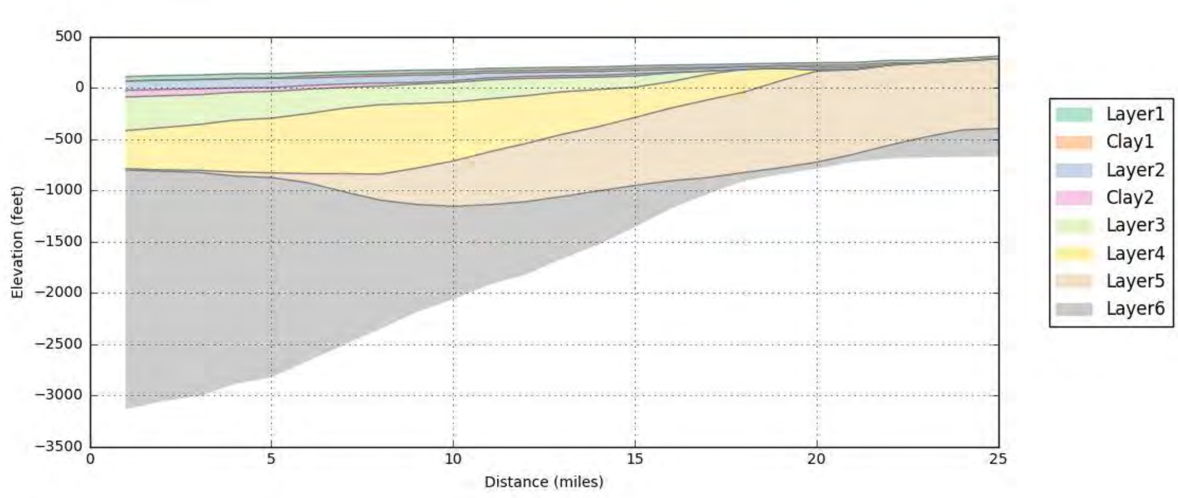


Figure 36: MercedWRM Geologic Cross Section G-G'

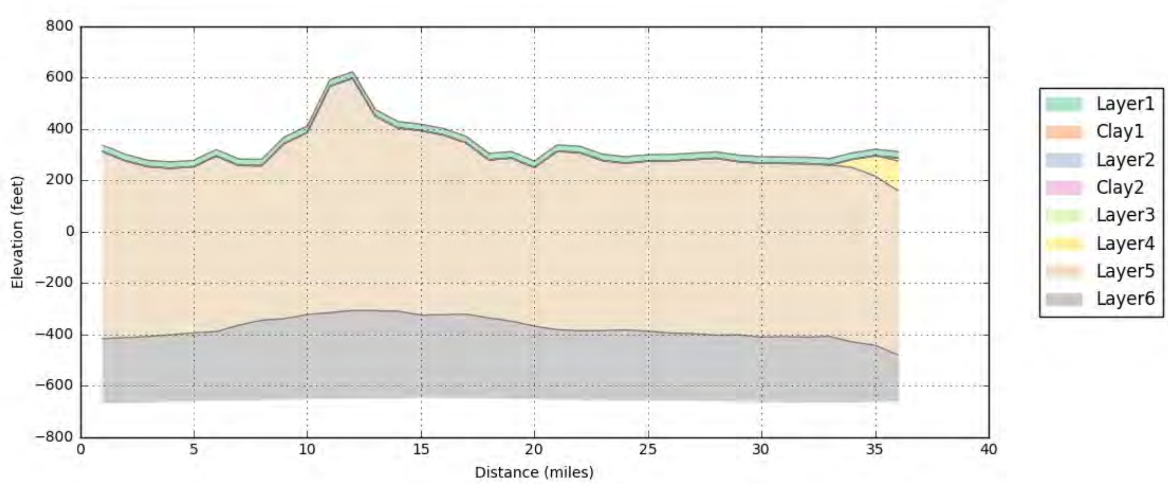


Figure 37: MercedWRM Geologic Cross Section H-H'

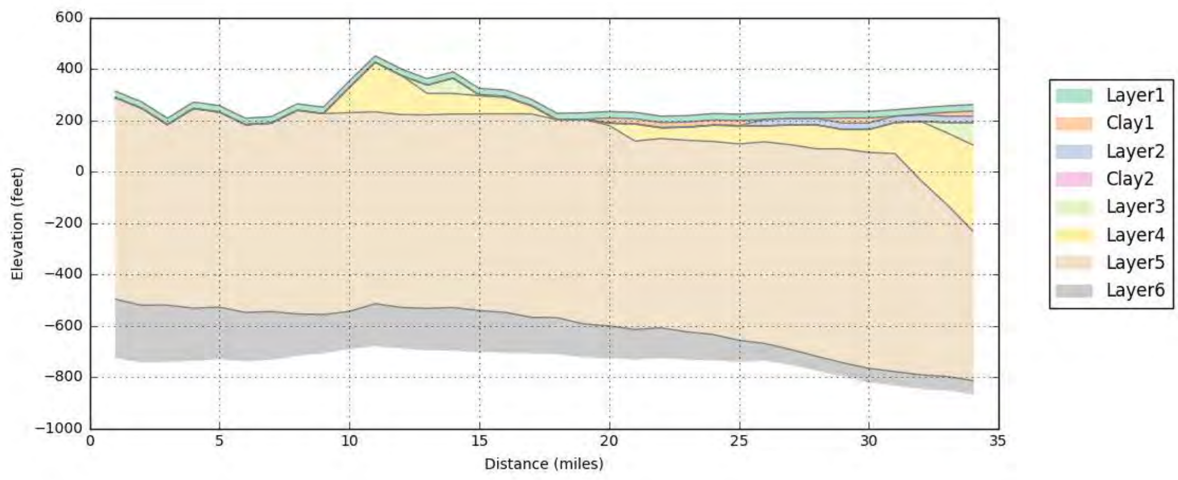


Figure 38: MercedWRM Geologic Cross Section I-I'

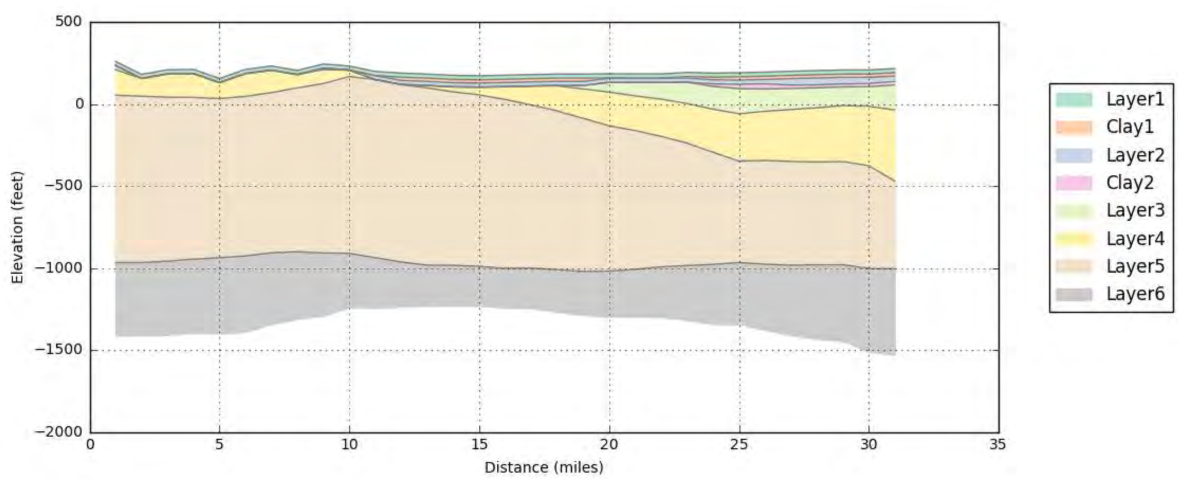


Figure 39: MercedWRM Geologic Cross Section J-J'

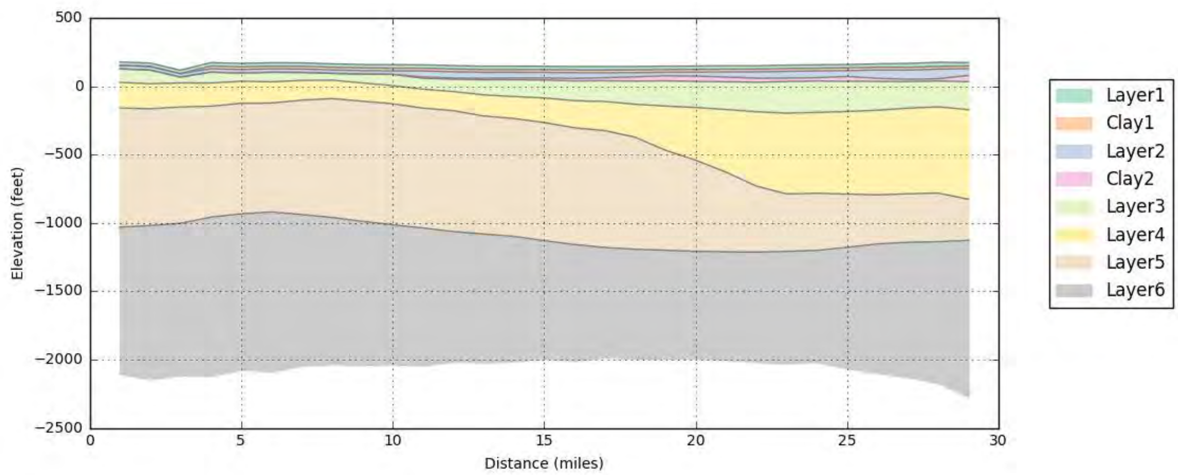


Figure 40: MercedWRM Geologic Cross Section K-K'

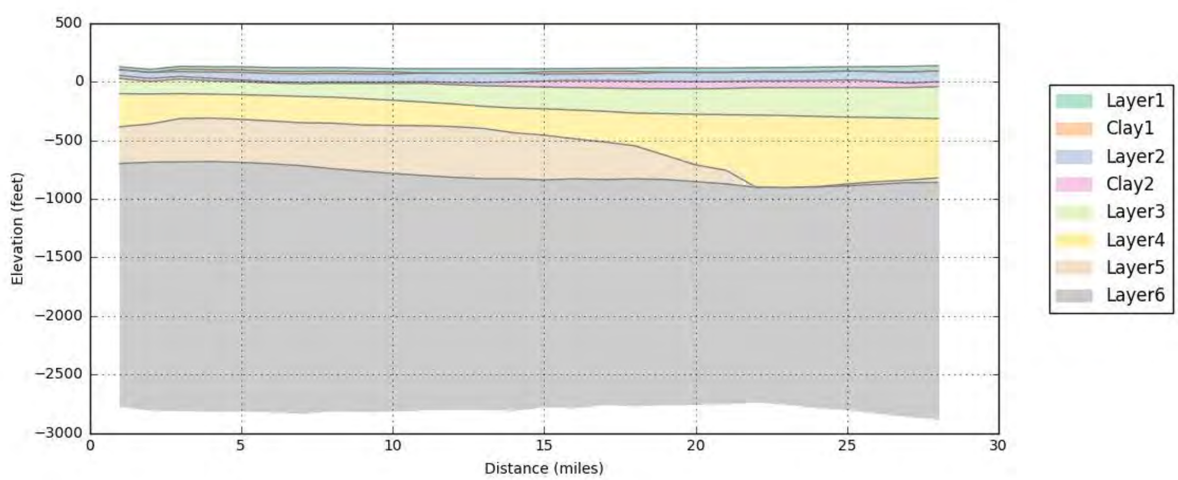


Figure 41: MercedWRM Geologic Cross Section L-L'

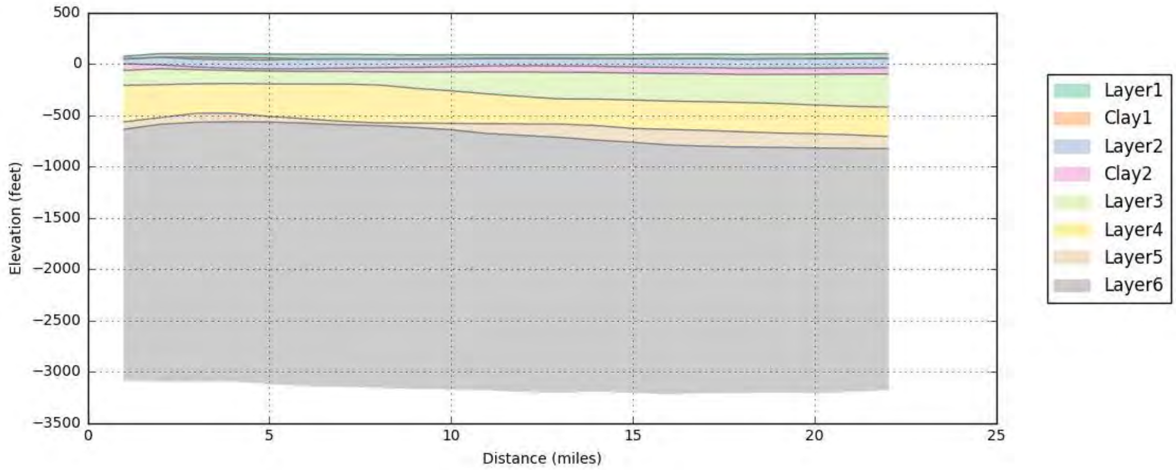


Figure 42: MercedWRM Geologic Cross Section M-M'

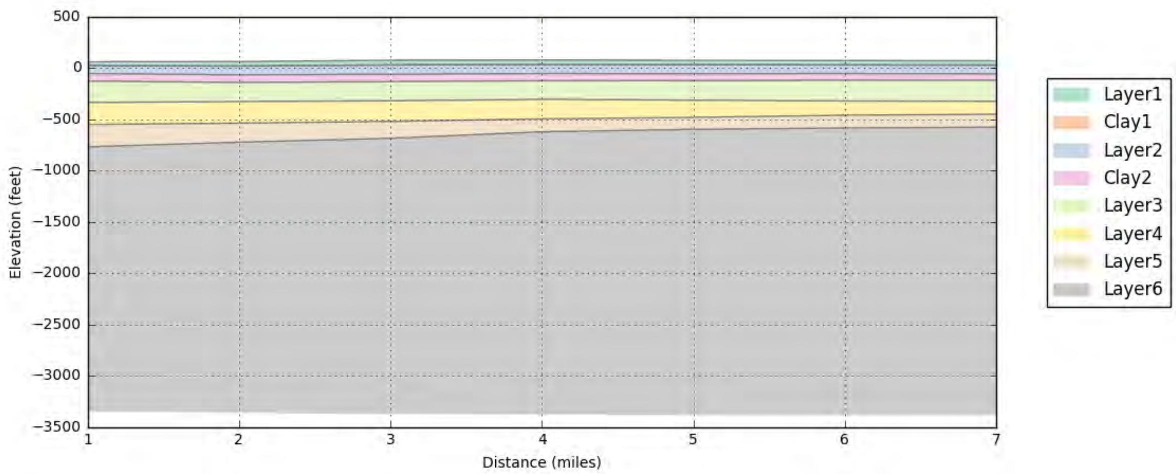


Figure 43: MercedWRM Geologic Cross Section N-N

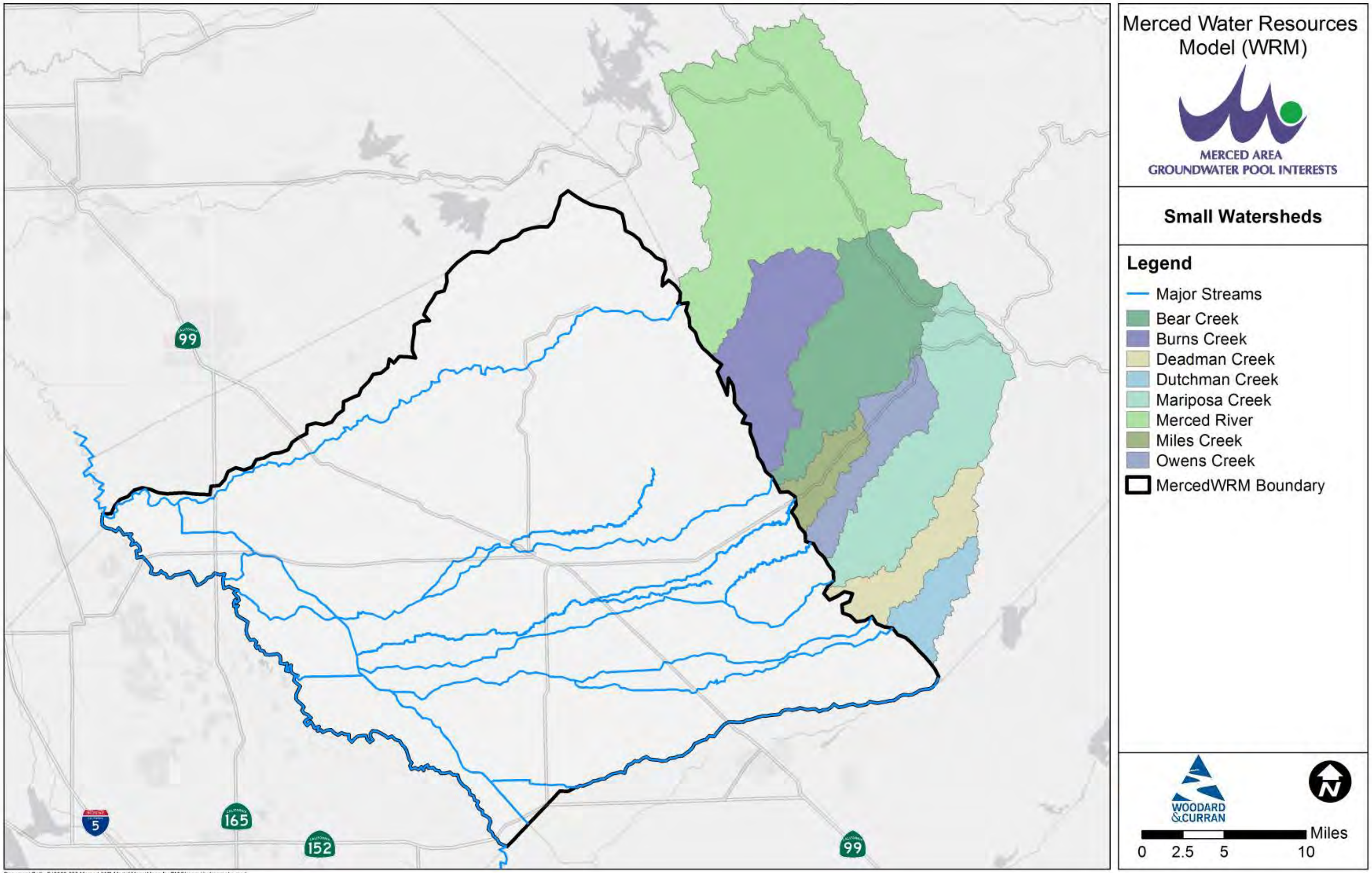


Figure 44: MercedWRM Small Watersheds

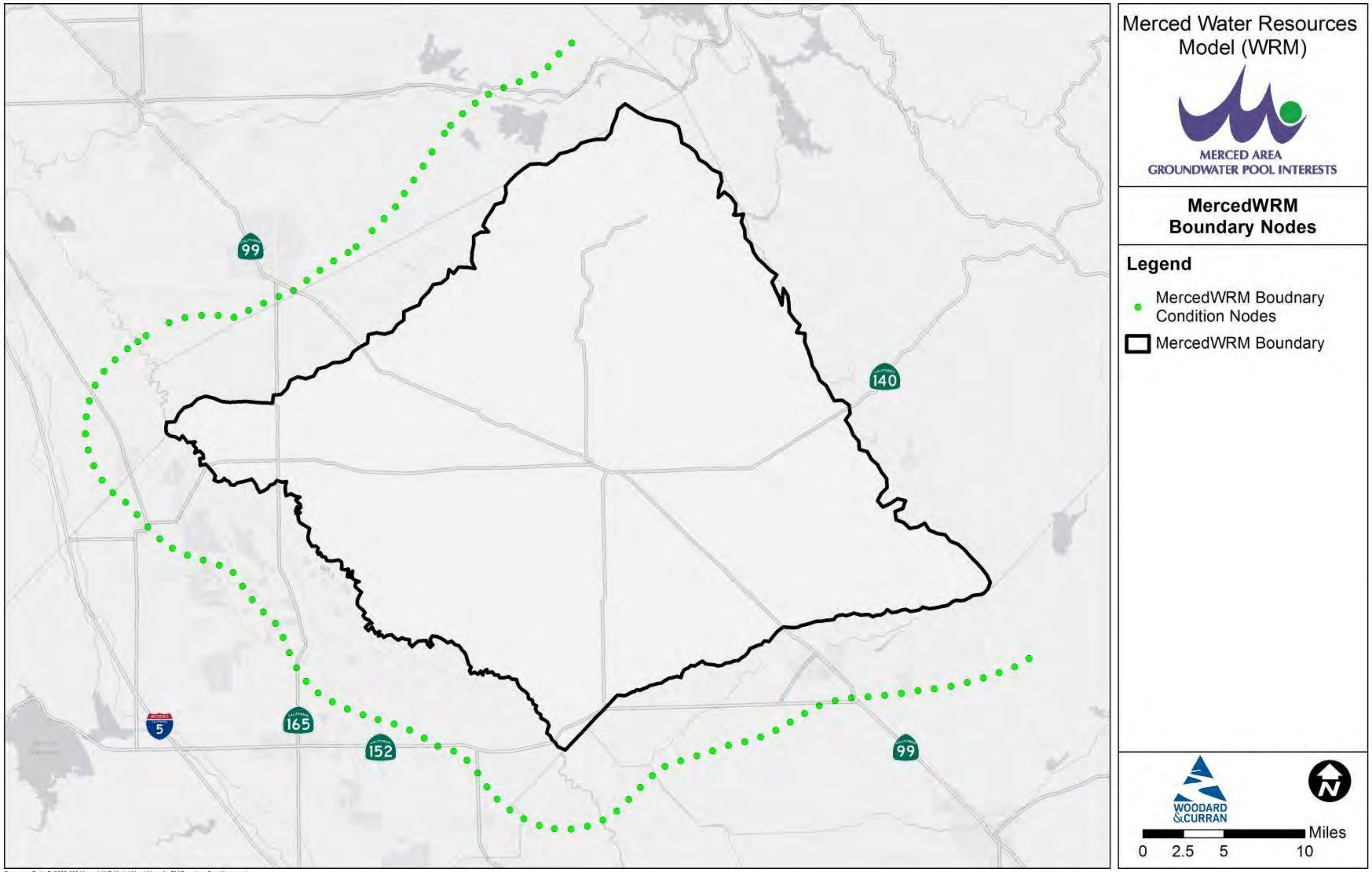


Figure 45: MercedWRM Boundary Nodes

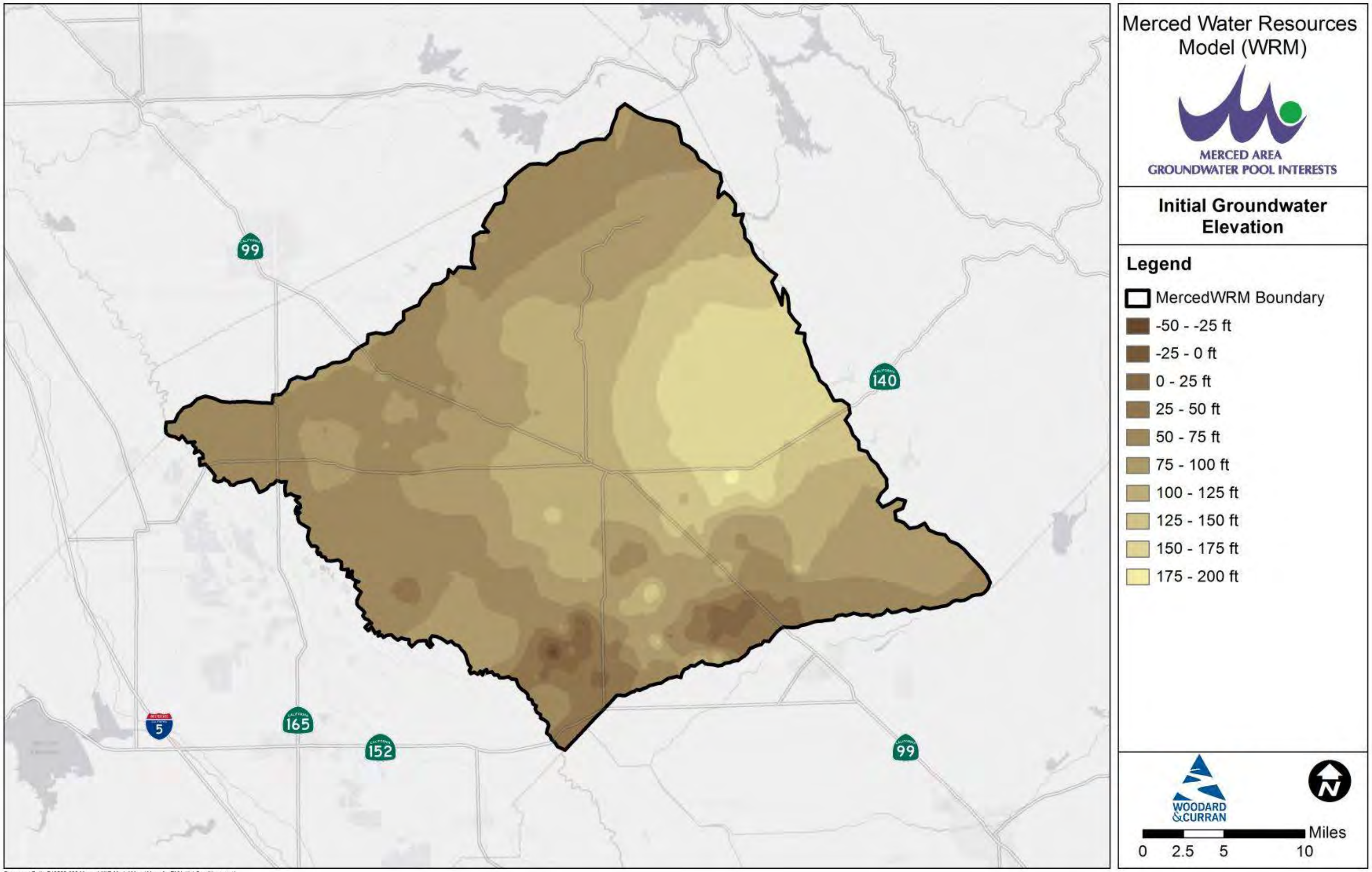


Figure 46: MercedWRM Initial Condition Groundwater Heads

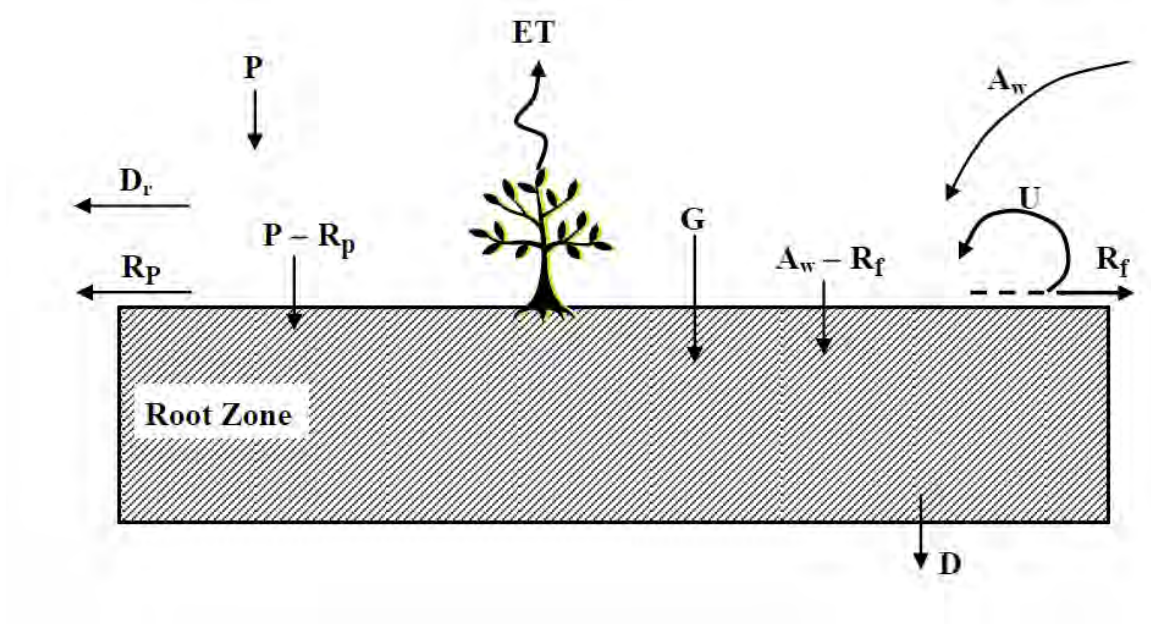


Figure 47: Schematic representation of root zone flow processes simulated by the IDC

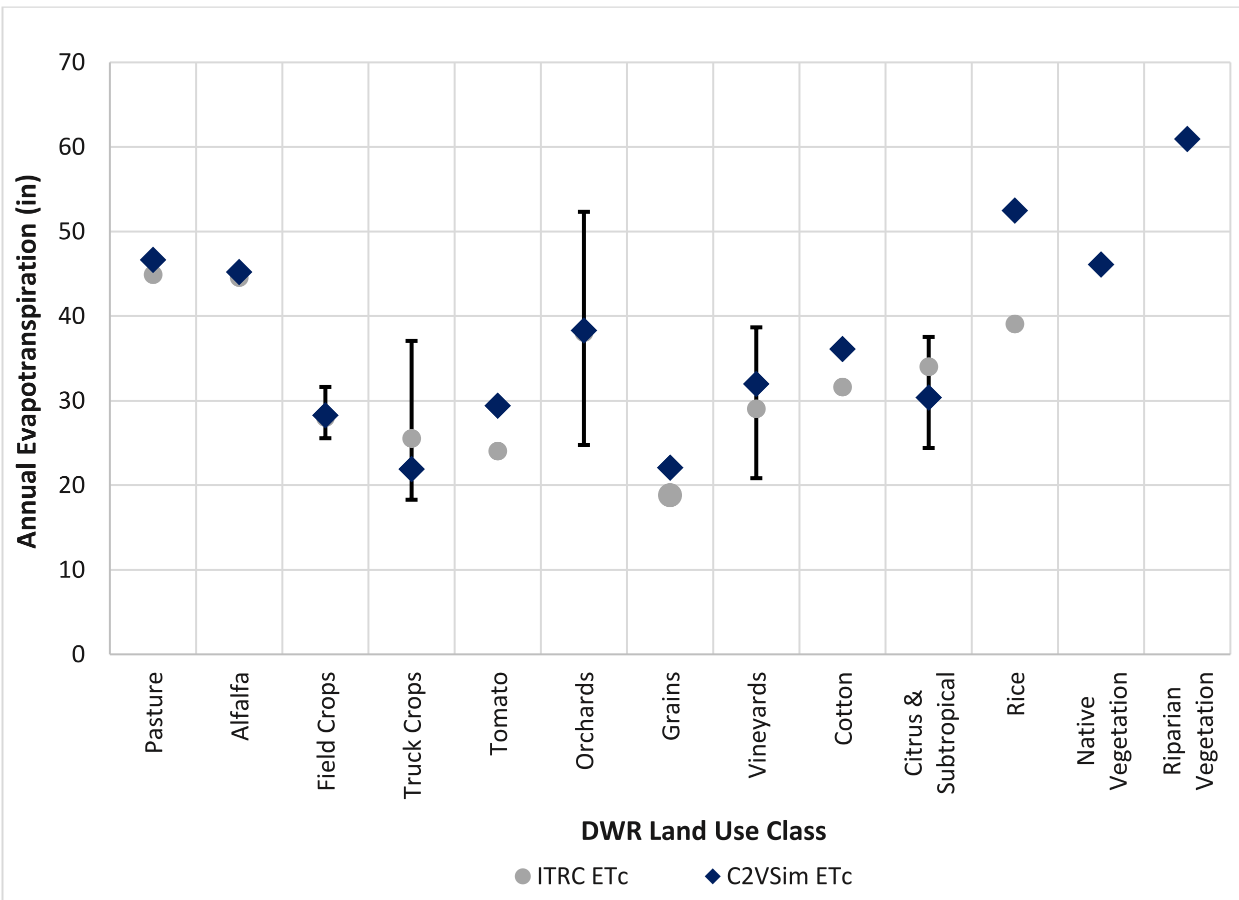


Figure 48: IWFM Demand Calculator Reference Potential Evapotranspiration

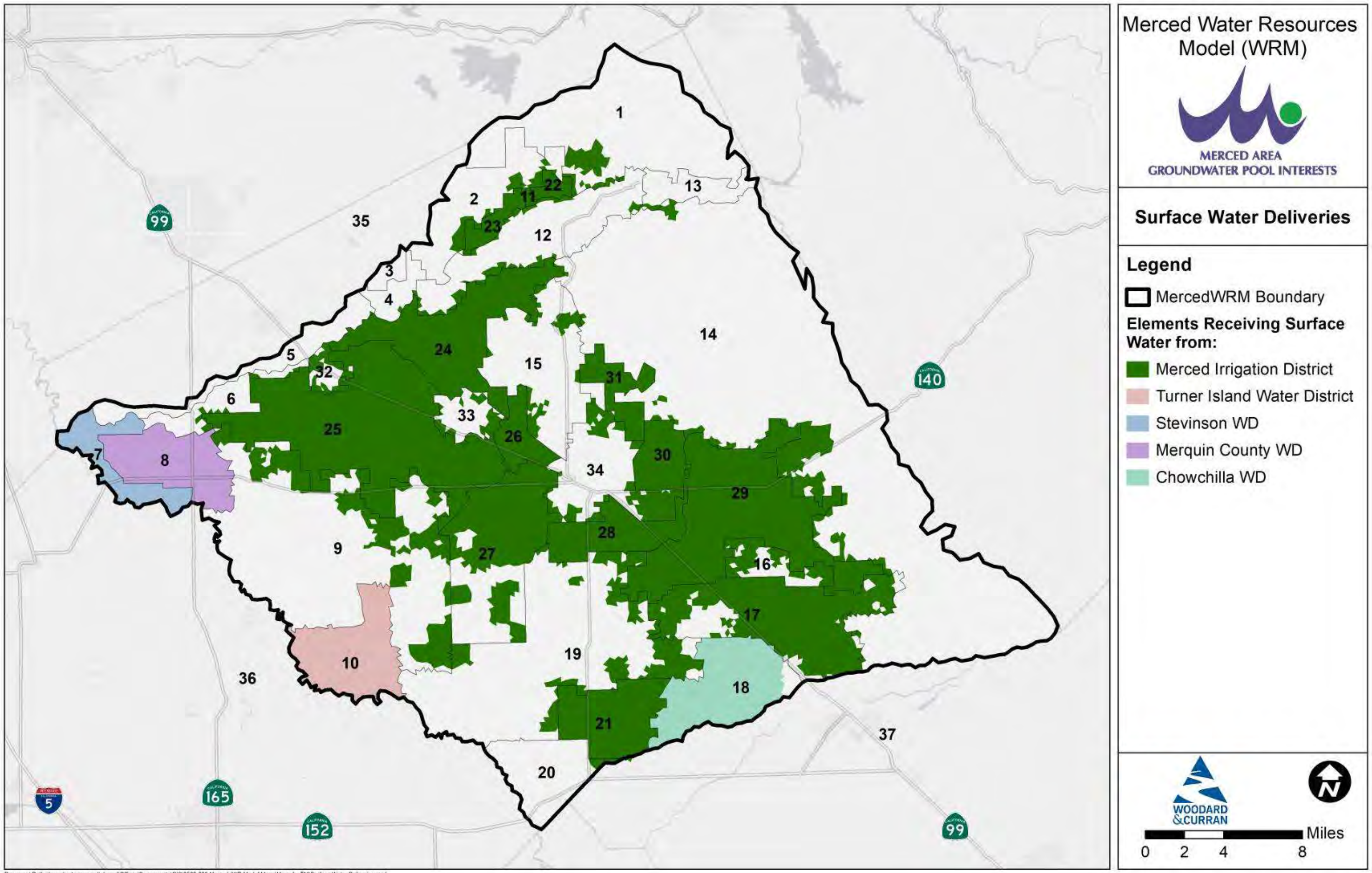


Figure 49: MercedWRM Surface Water Delivery Zones

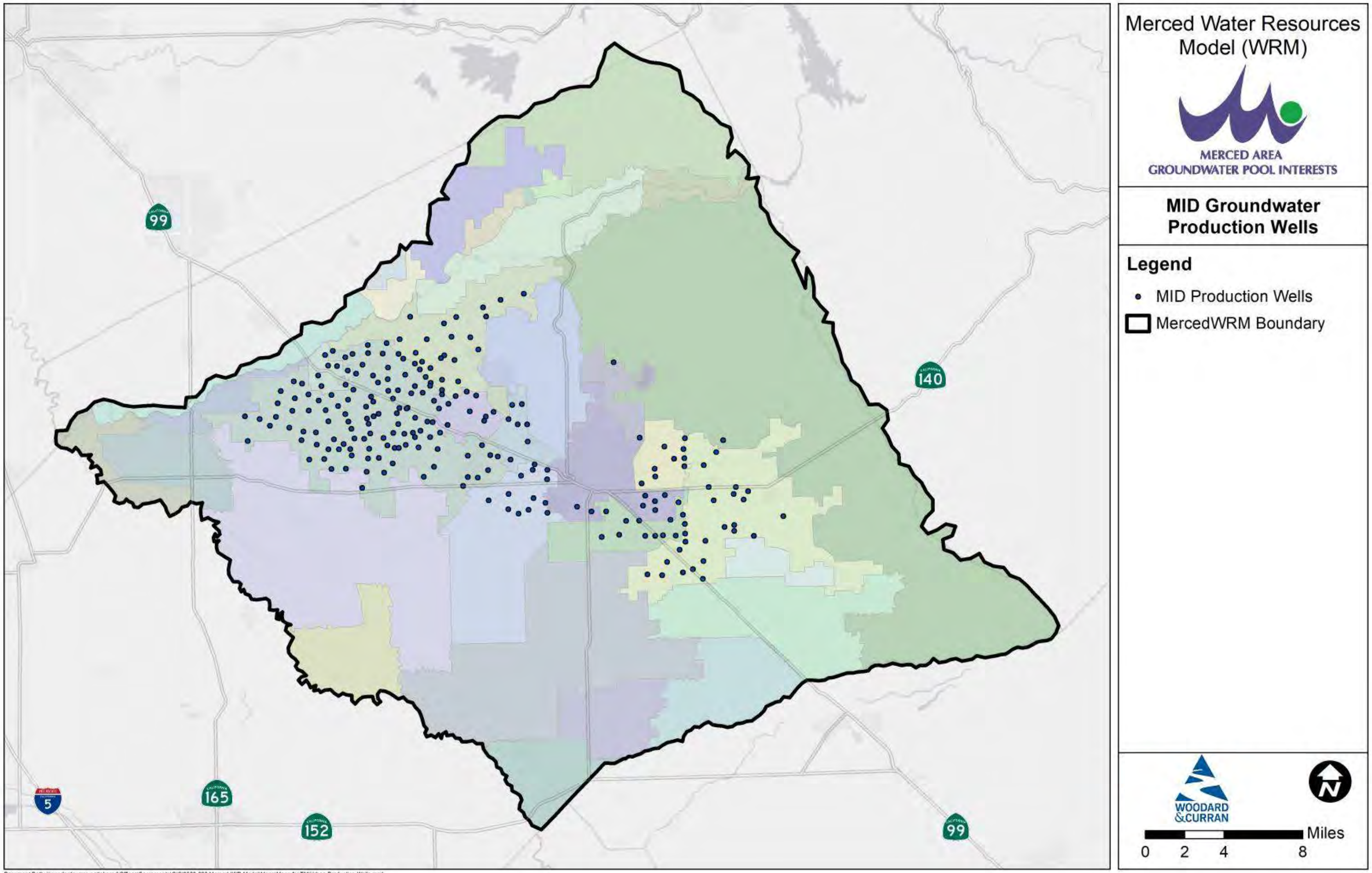


Figure 50: MID Groundwater Production Wells

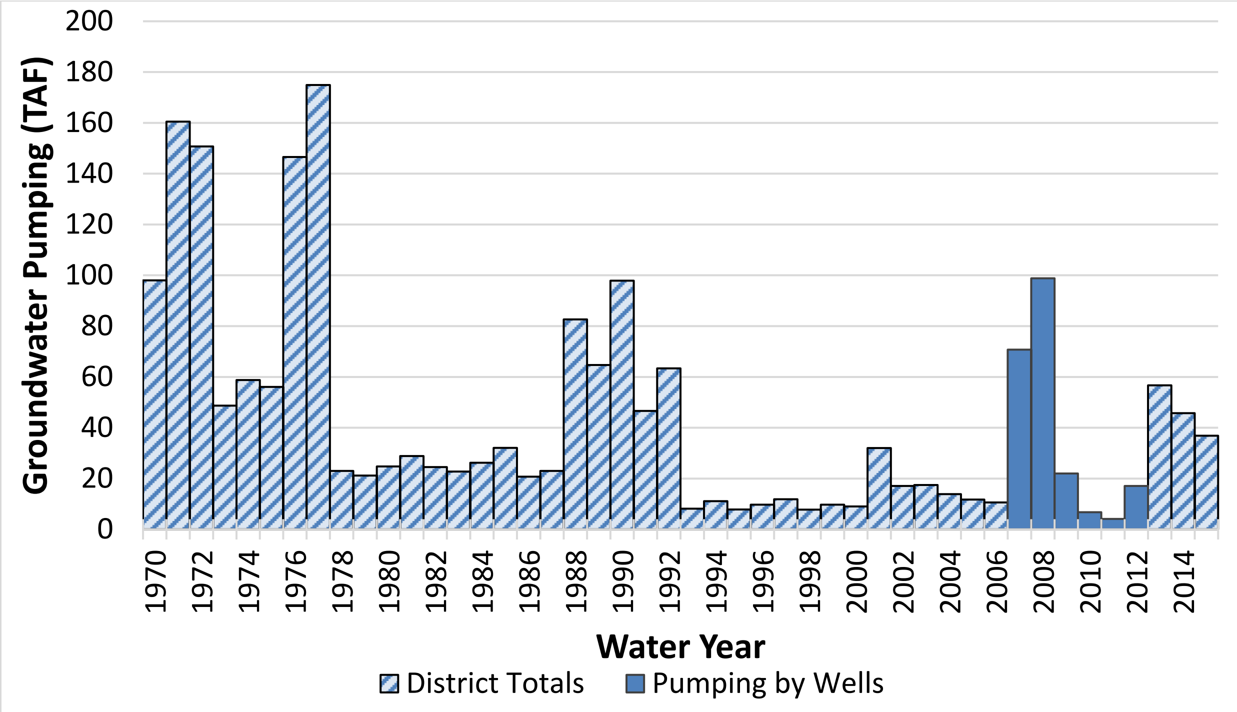


Figure 51: Merced Irrigation District Annual Groundwater Pumping

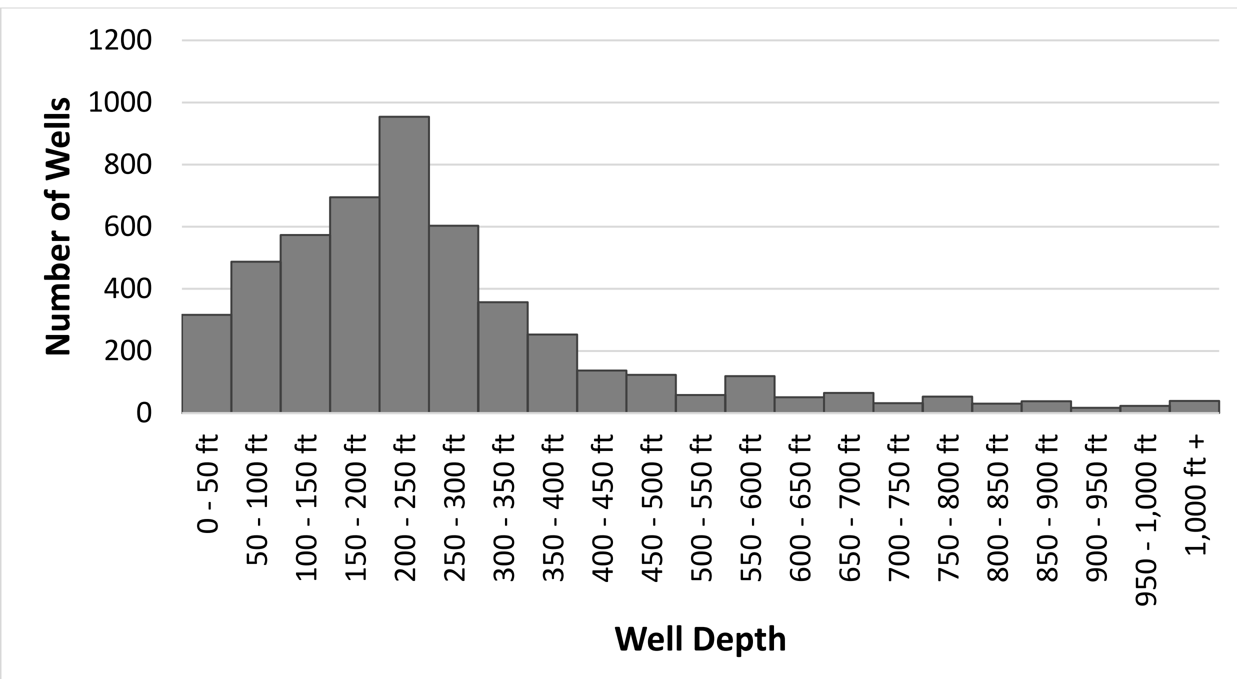


Figure 52: Merced County Database Groundwater Well Depth

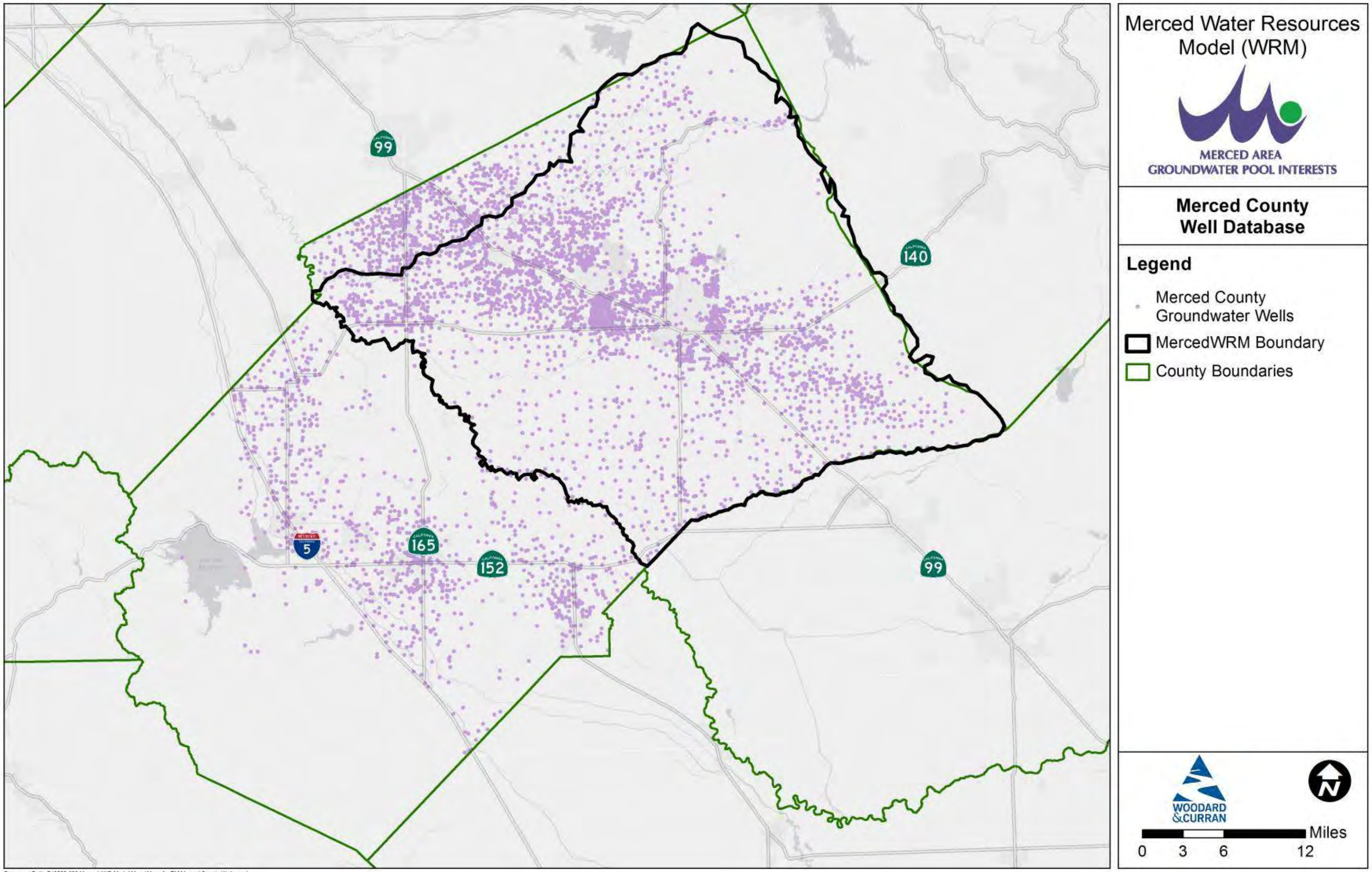


Figure 53: Merced County Groundwater Well Database

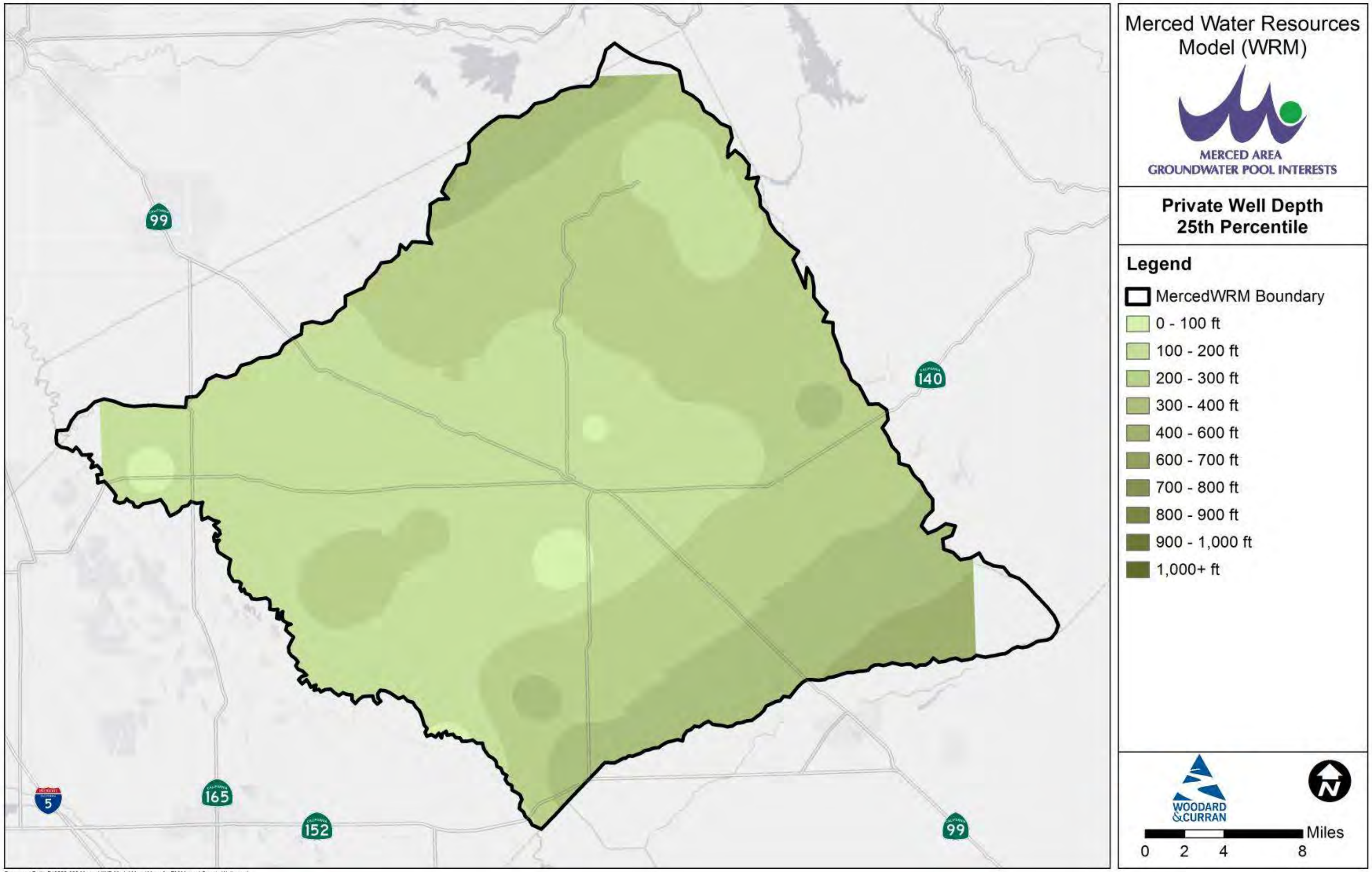


Figure 54: Private Well Depths - 25th Percentile

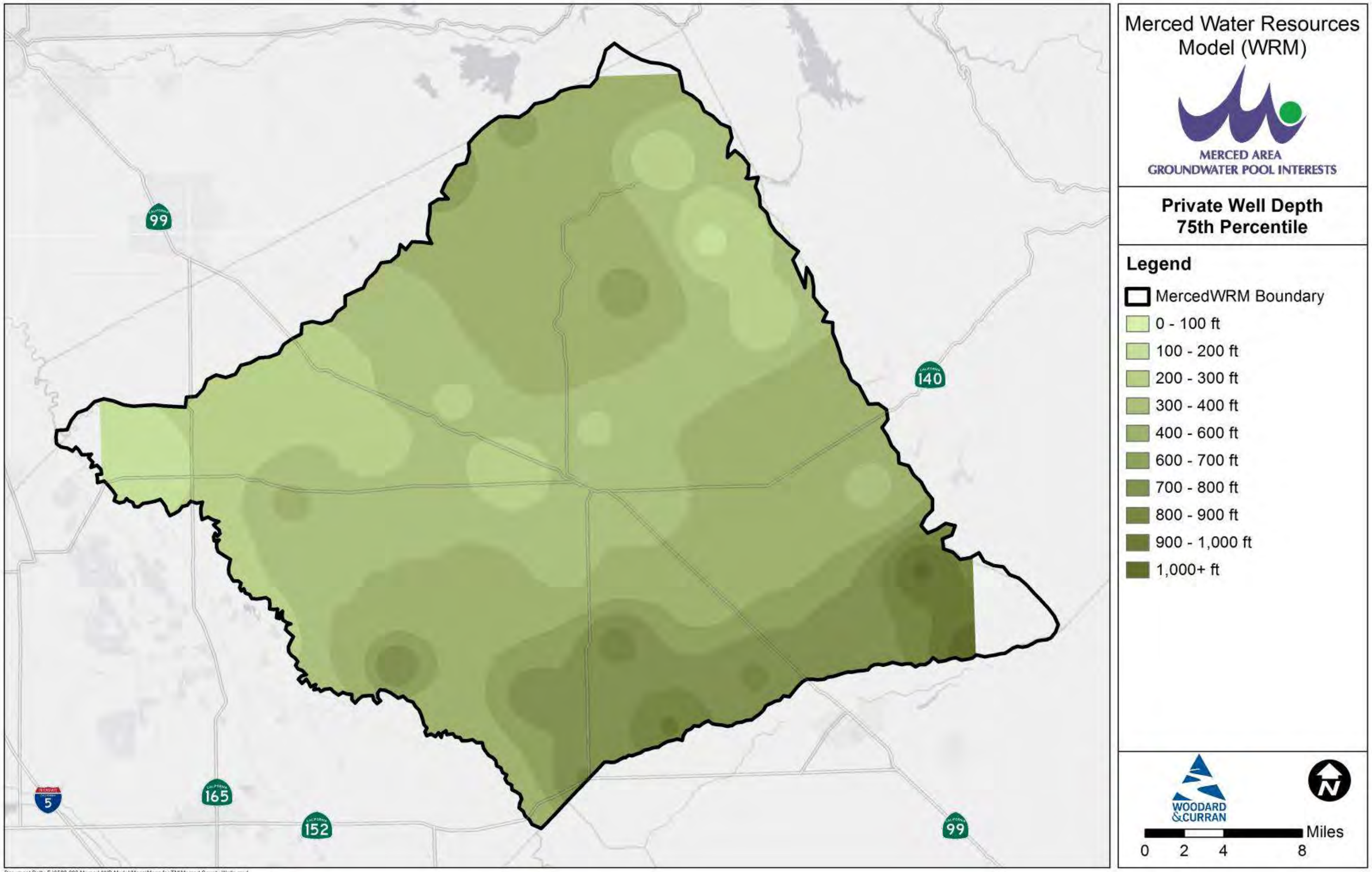


Figure 55: Private Well Depths - 75th Percentile

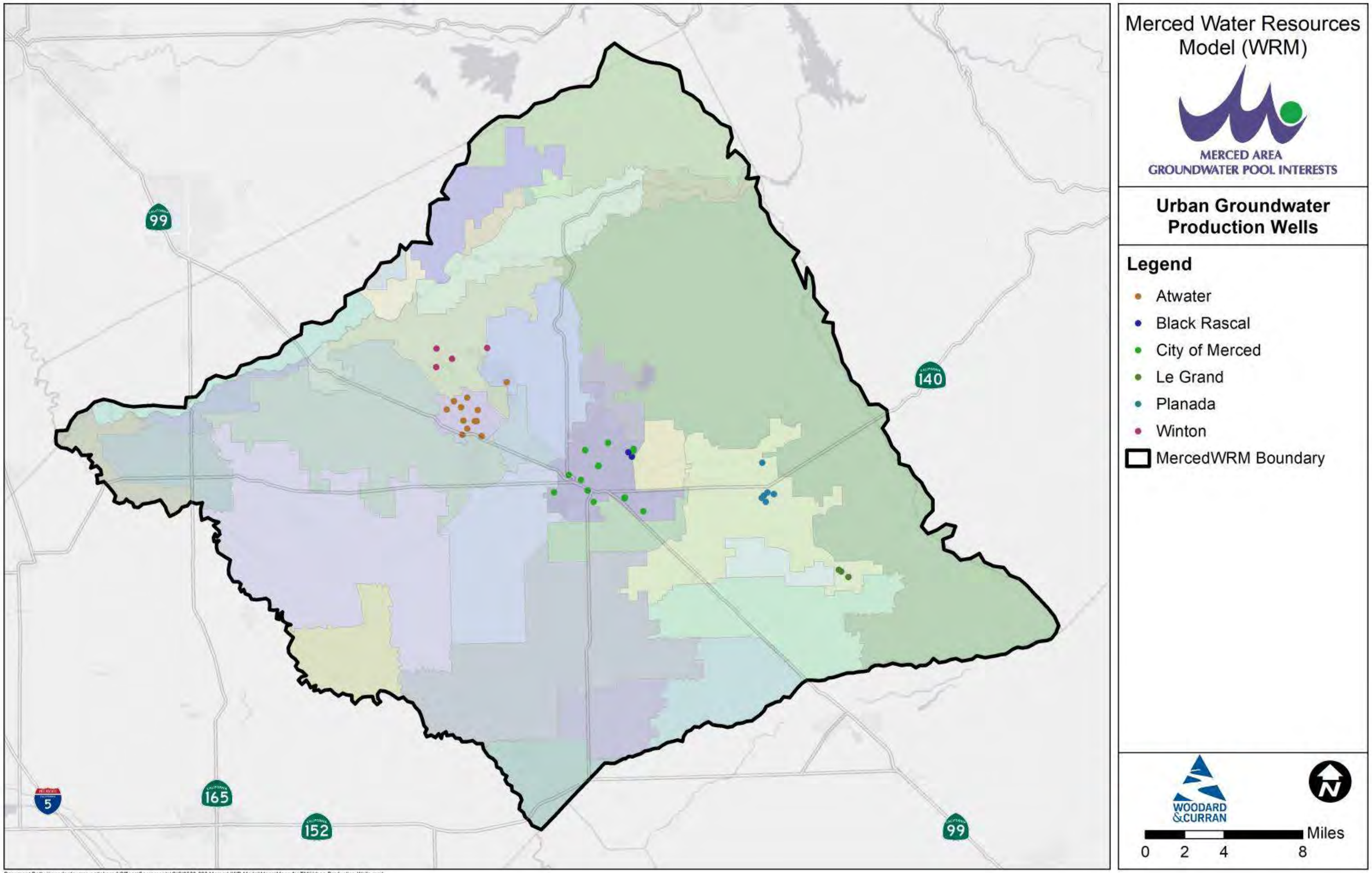
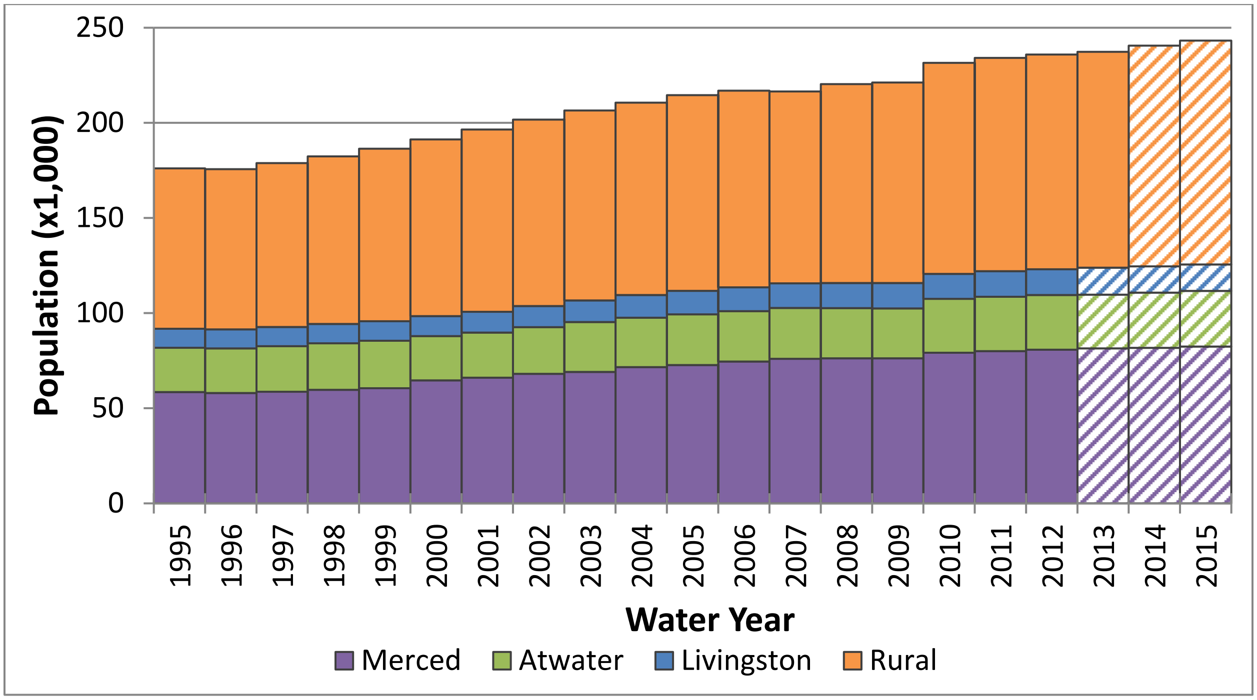
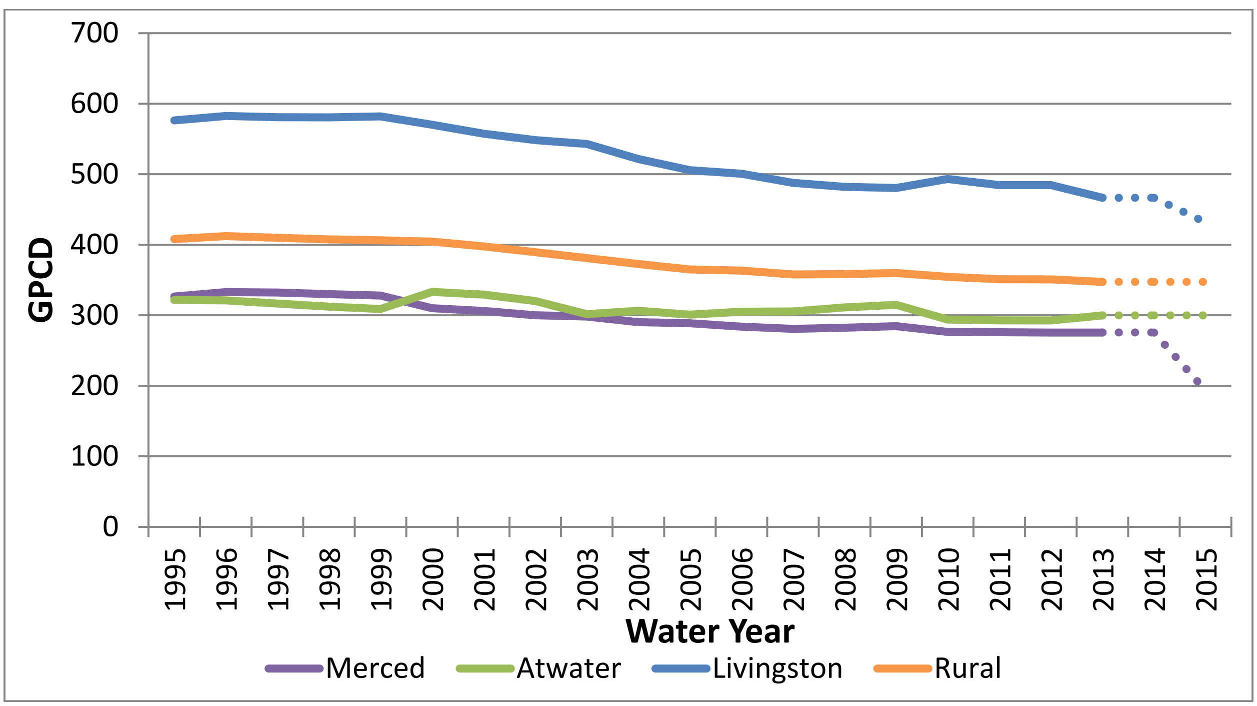


Figure 56: Location of Municipal Groundwater Production Well



*Hatched fill indicates estimated values

Figure 57: Merced Groundwater Region Urban Population Growth



*Dotted line indicates estimated values

Figure 58: Annual Average Urban Consumptive Use (Gallons per Capita per Day)

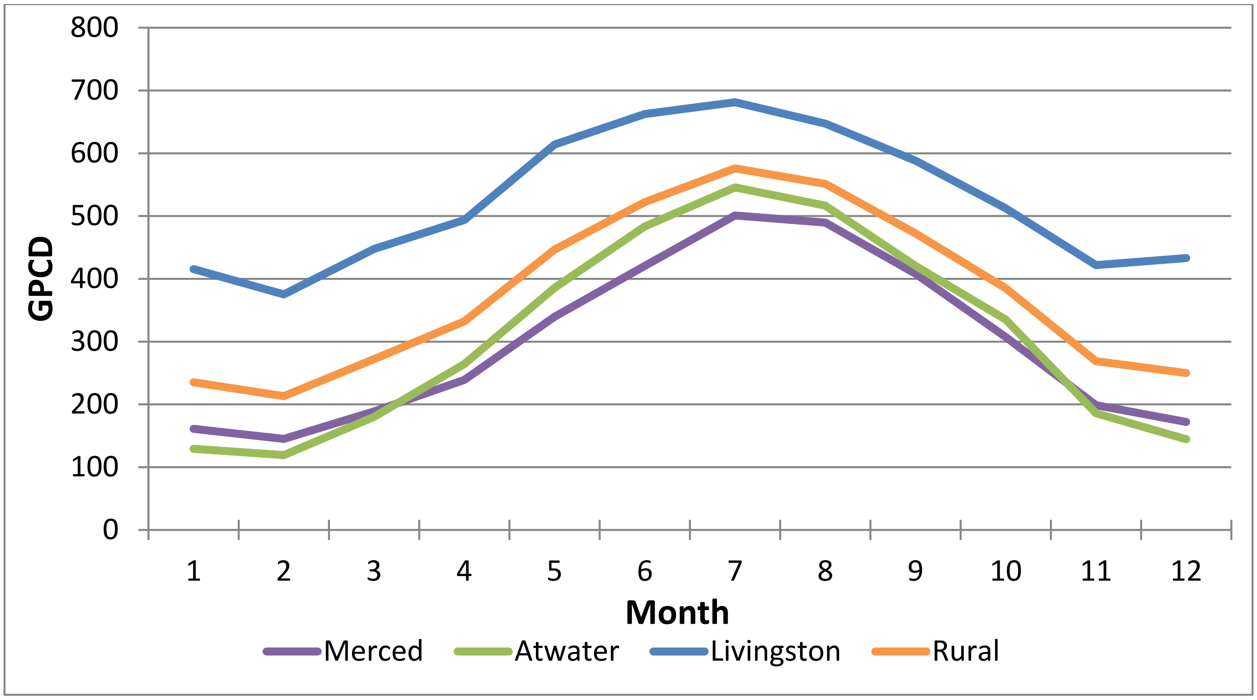
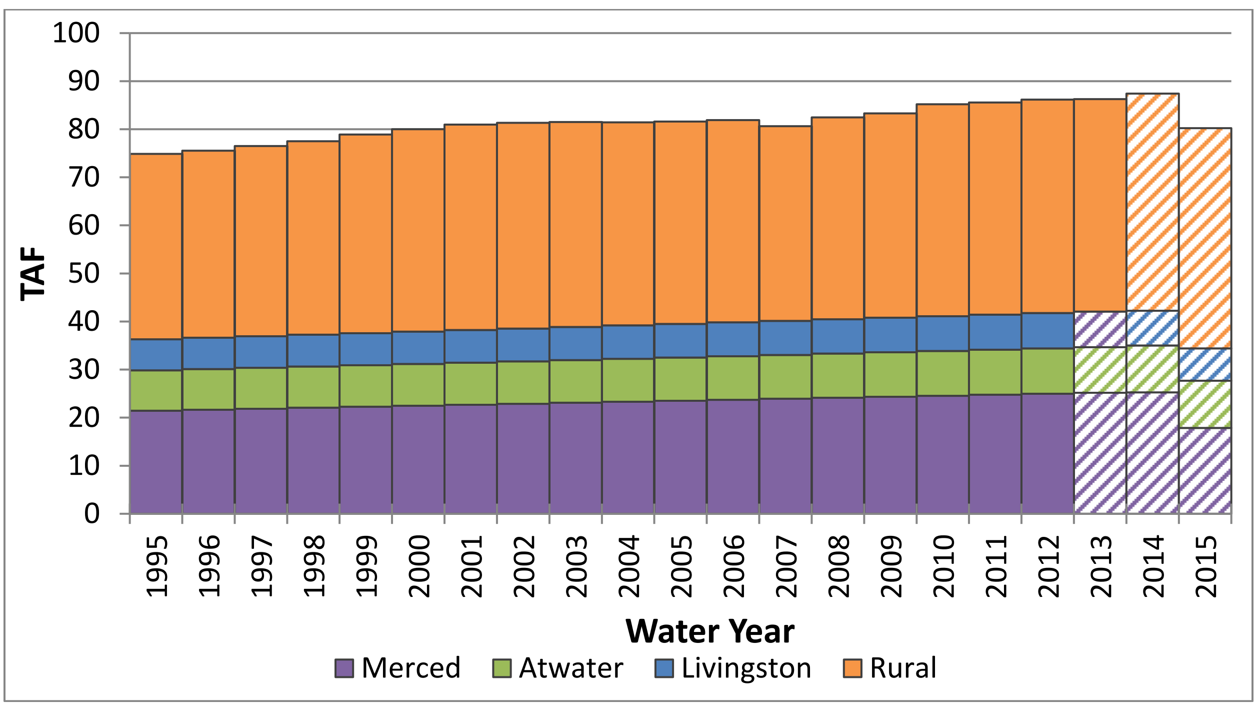


Figure 59: Monthly Average Urban Consumptive Use (Gallons per Capita per Day)



*Hatched fill indicates estimated values

Figure 60: Annual Urban Consumptive Use

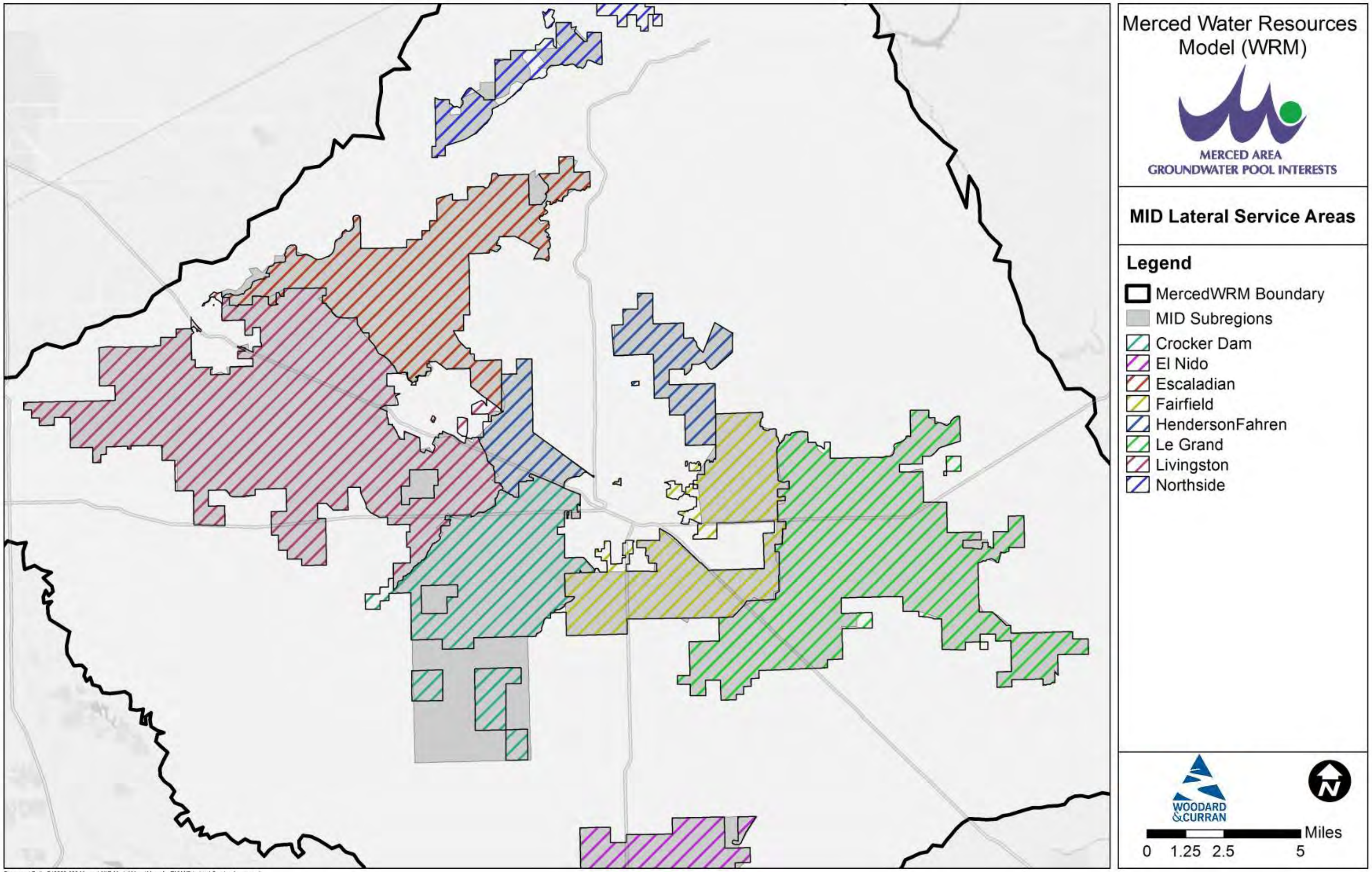


Figure 61: MercedWRM v MID-WBM Surface Budget Areas

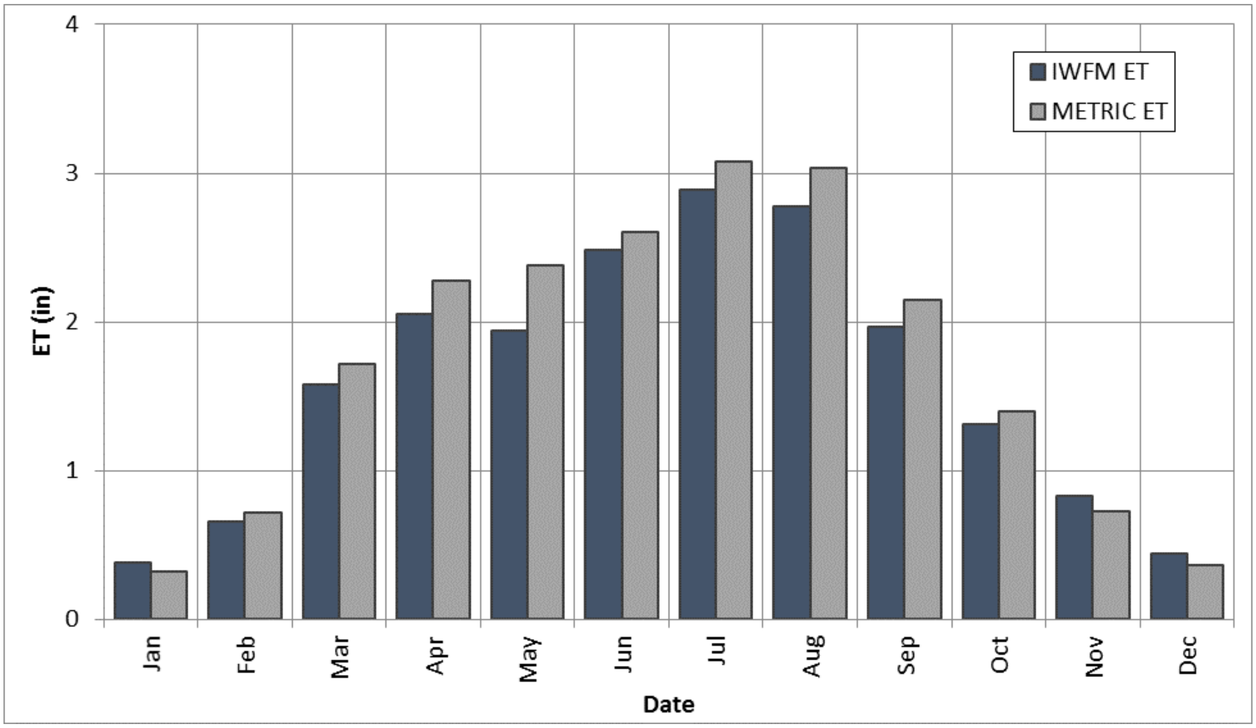


Figure 62: Monthly IWFM-METRIC ET of MercedWRM area during the calibration period

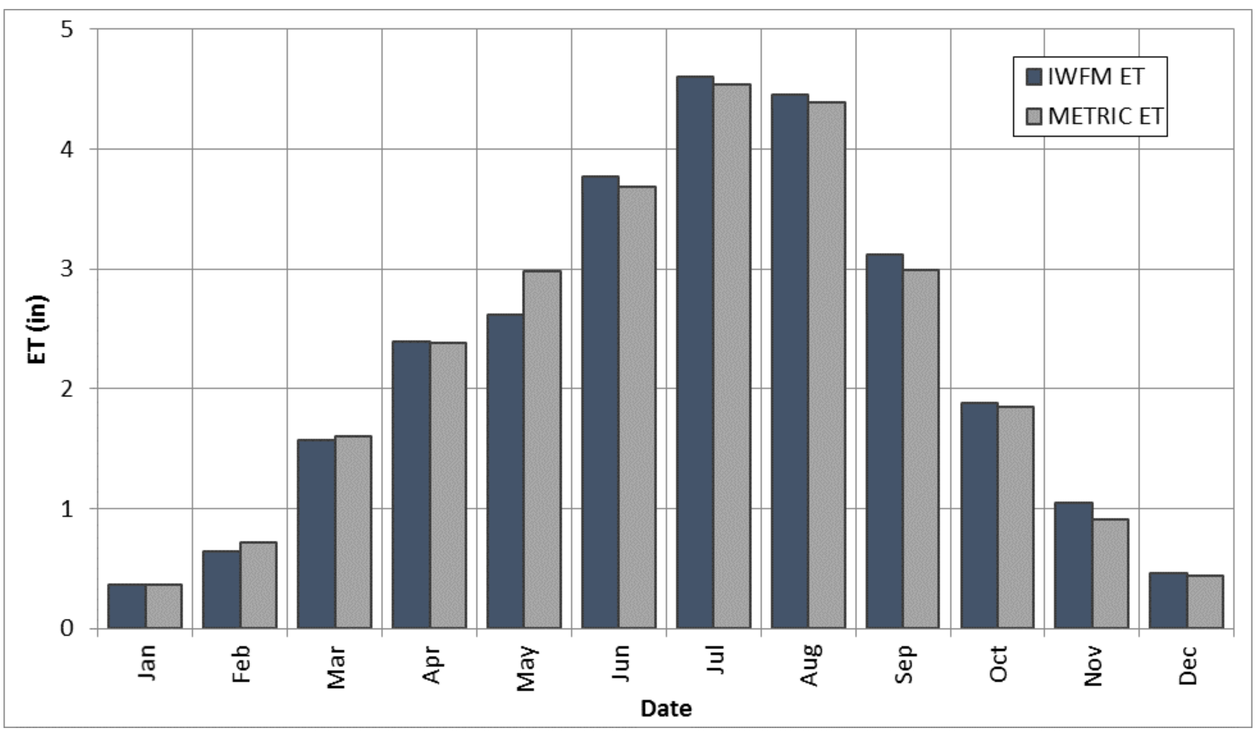


Figure 63: Monthly IWFM-METRIC ET of MID Subregions during the calibration period

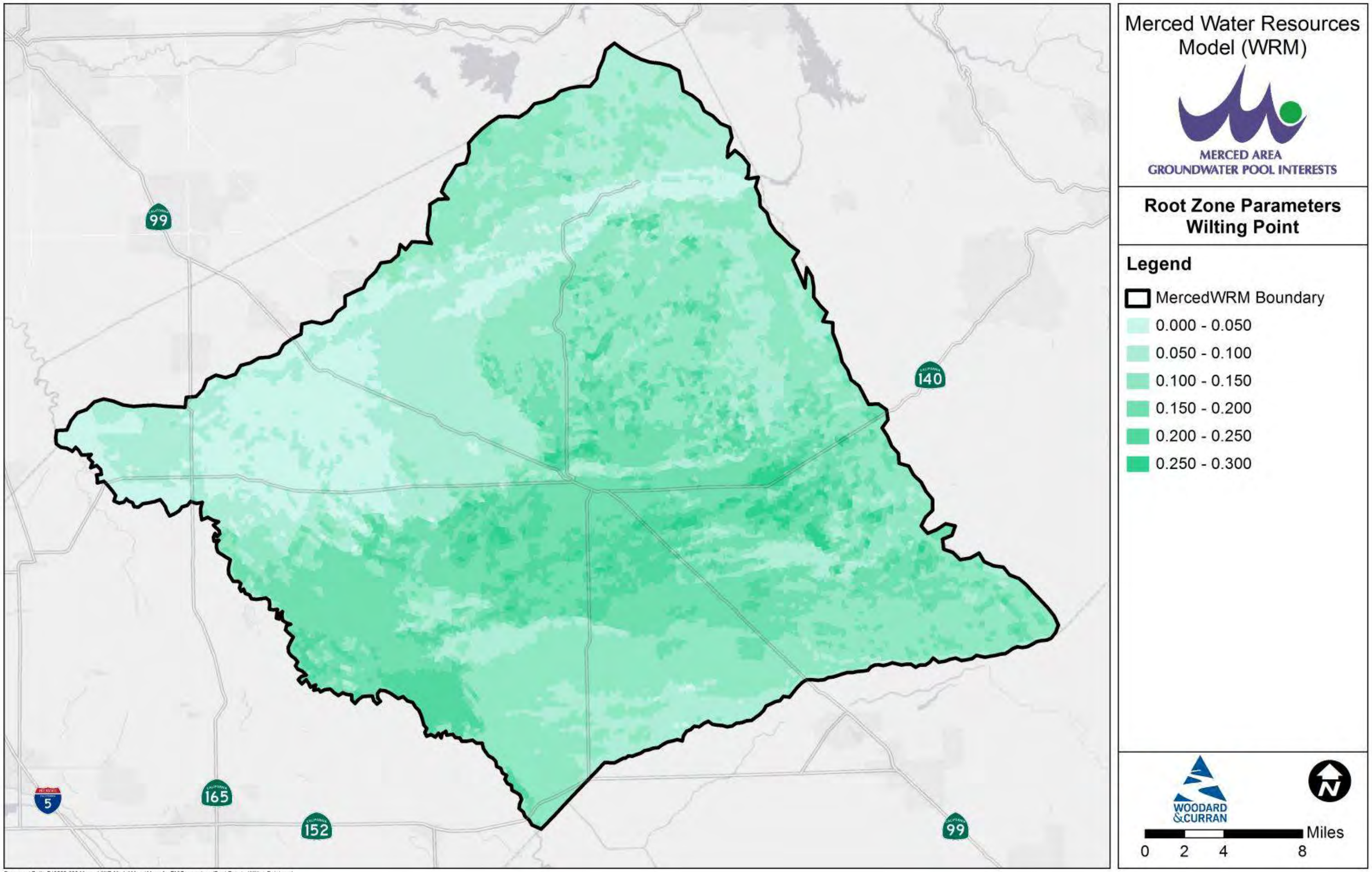


Figure 64: MercedWRM Root Zone Parameters - Wilting Point

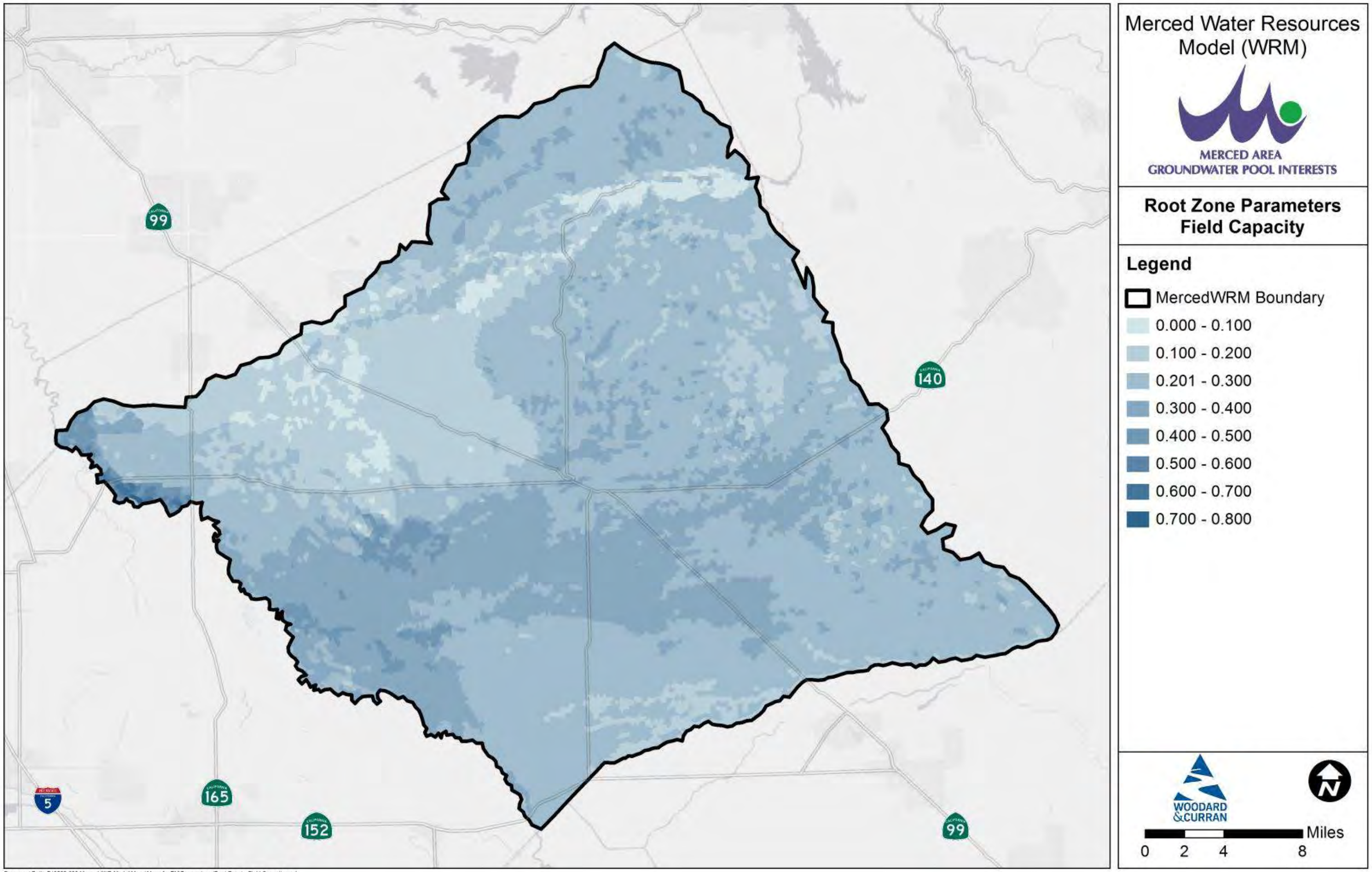


Figure 65: MercedWRM Root Zone Parameters - Field Capacity

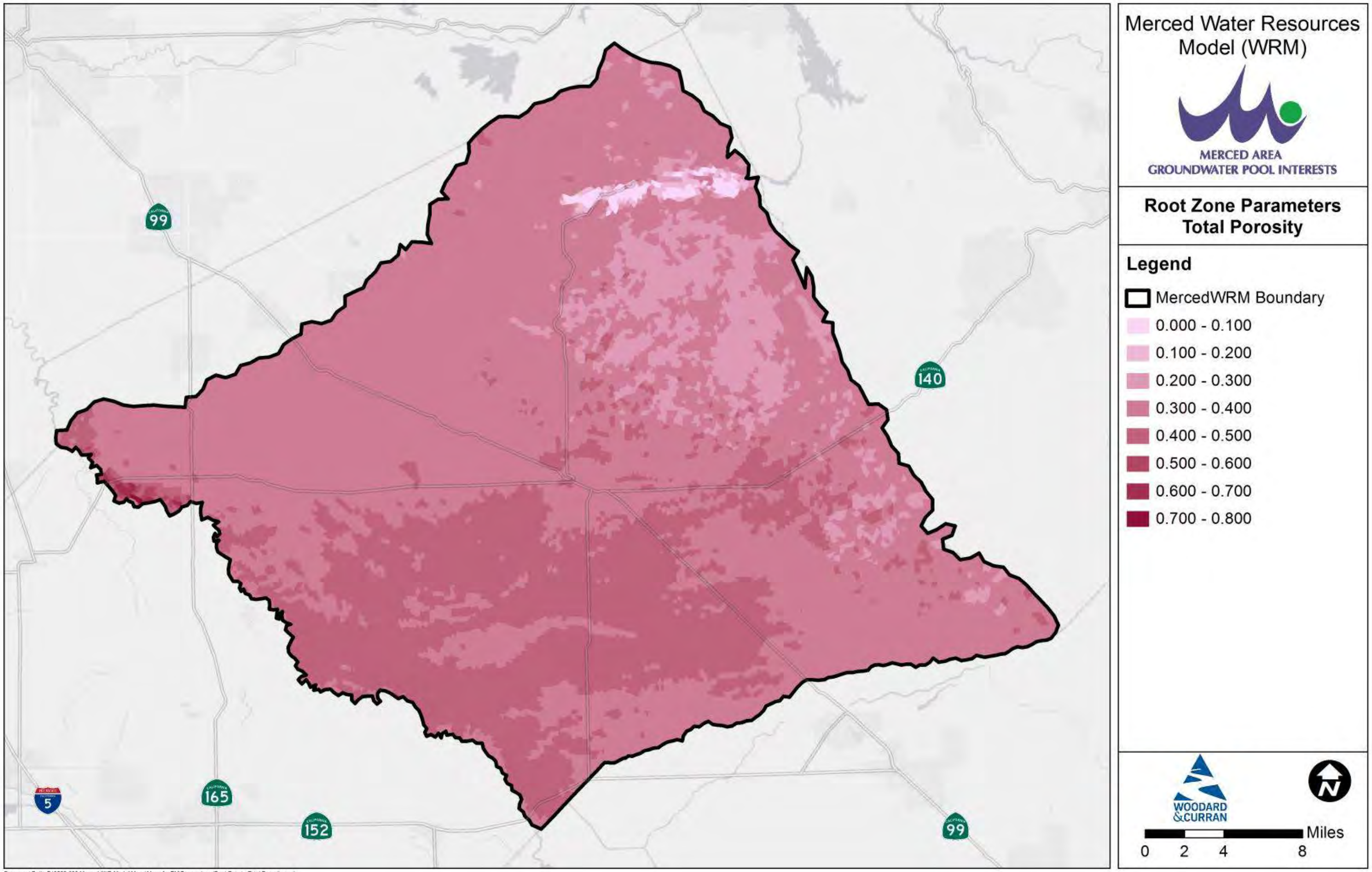


Figure 66: MercedWRM Root Zone Parameters - Total Porosity

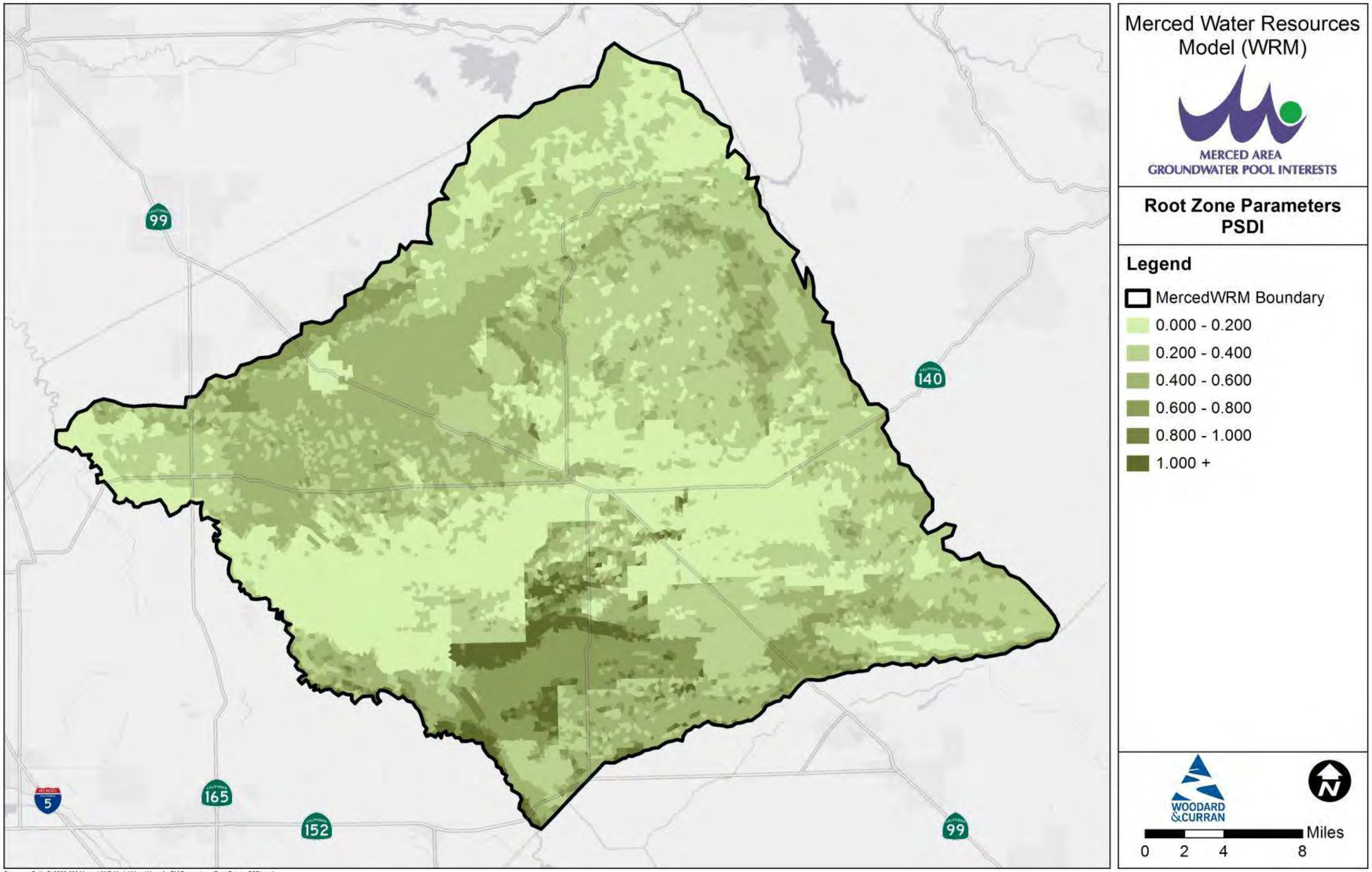


Figure 67: MercedWRM Root Zone Parameters - Pore Size Distribution Index

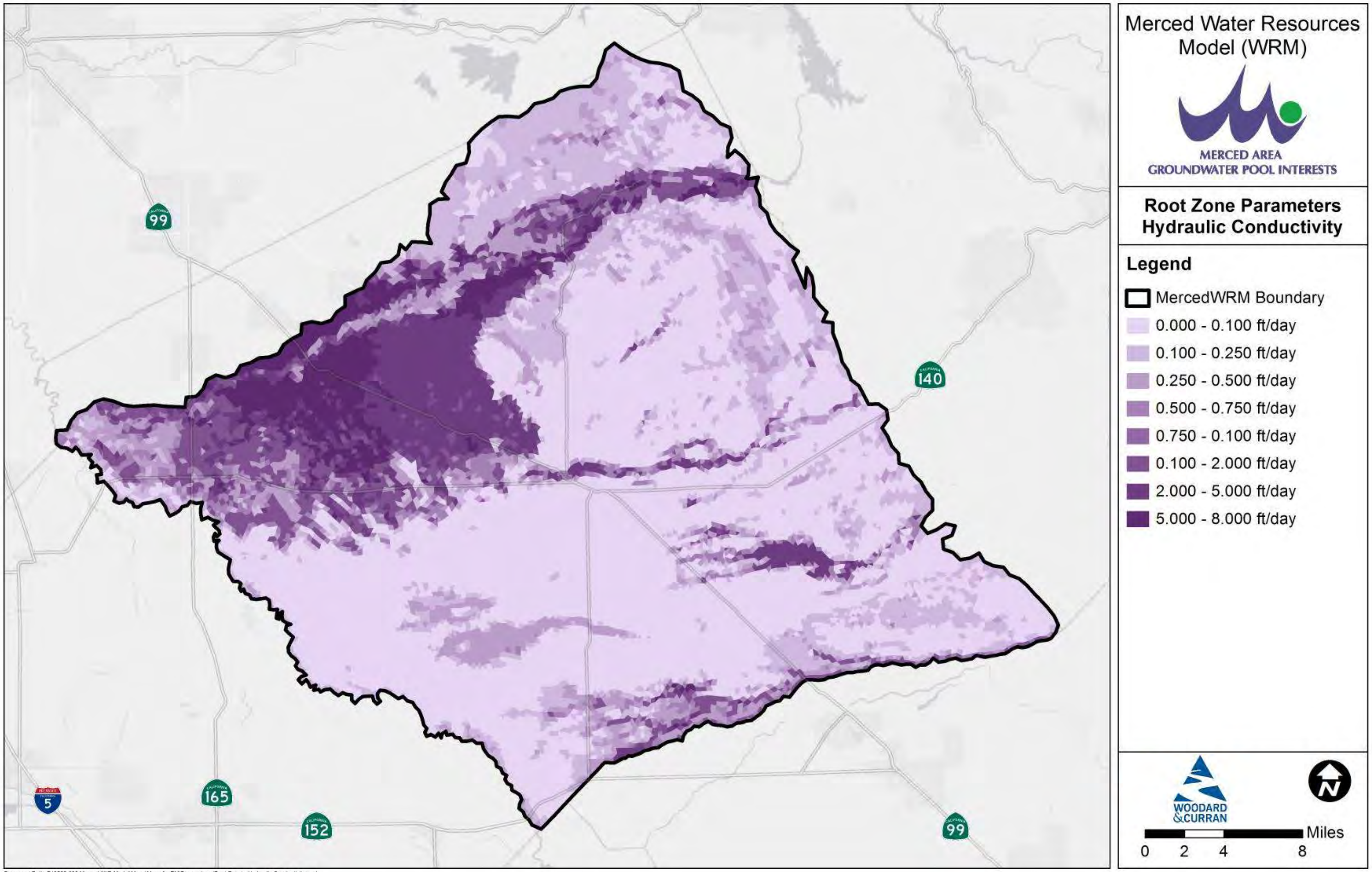


Figure 68: MercedWRM Root Zone Parameters - Hydraulic Conductivity

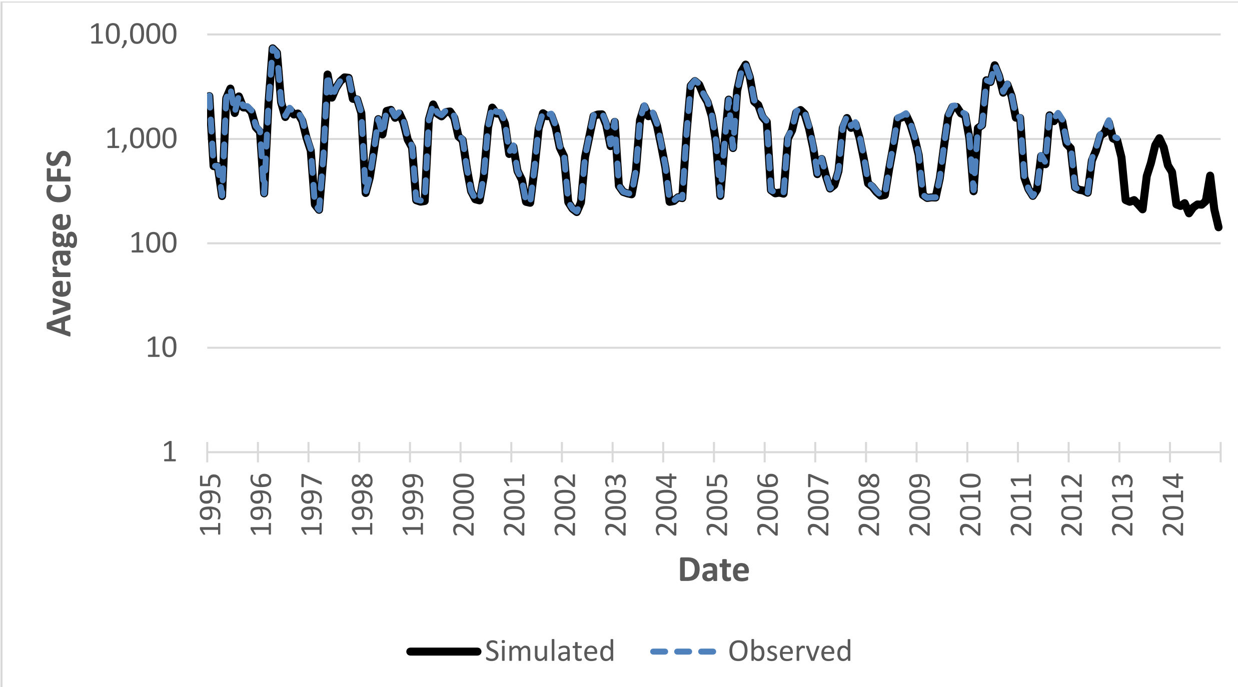


Figure 69: Observed vs Simulated Stream Flow (Merced Falls near the Northside Canal)

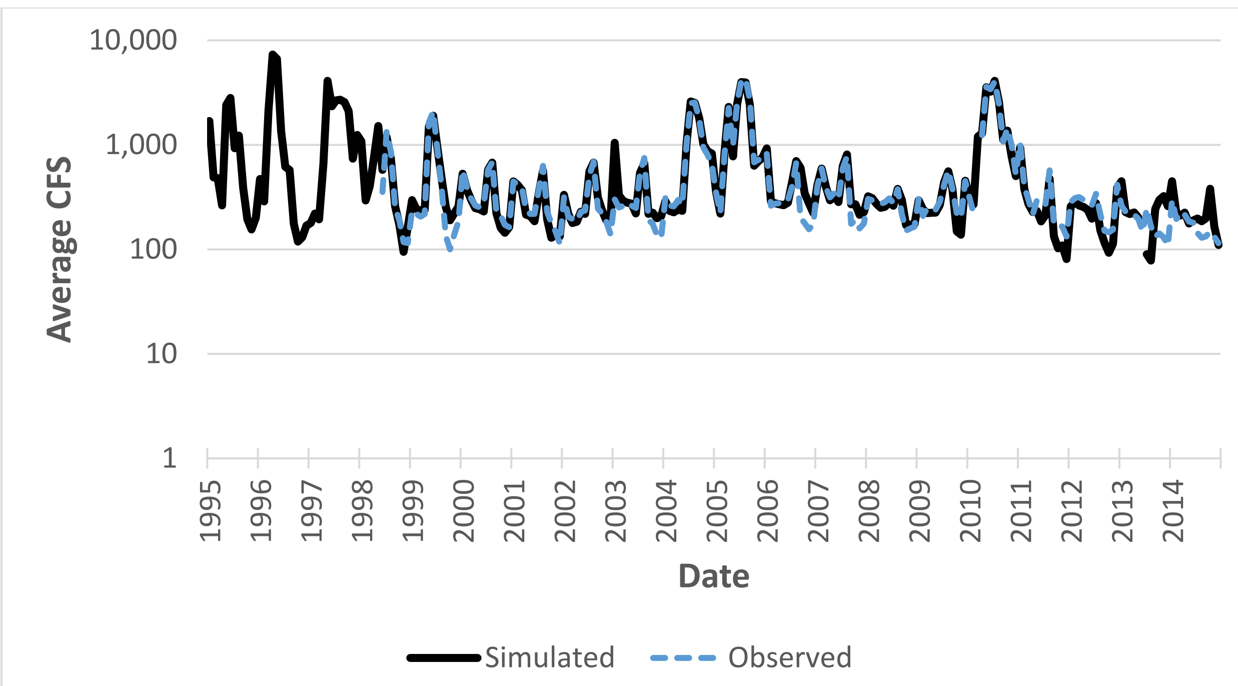


Figure 70: Observed vs Simulated Stream Flow (Merced River near Snelling)

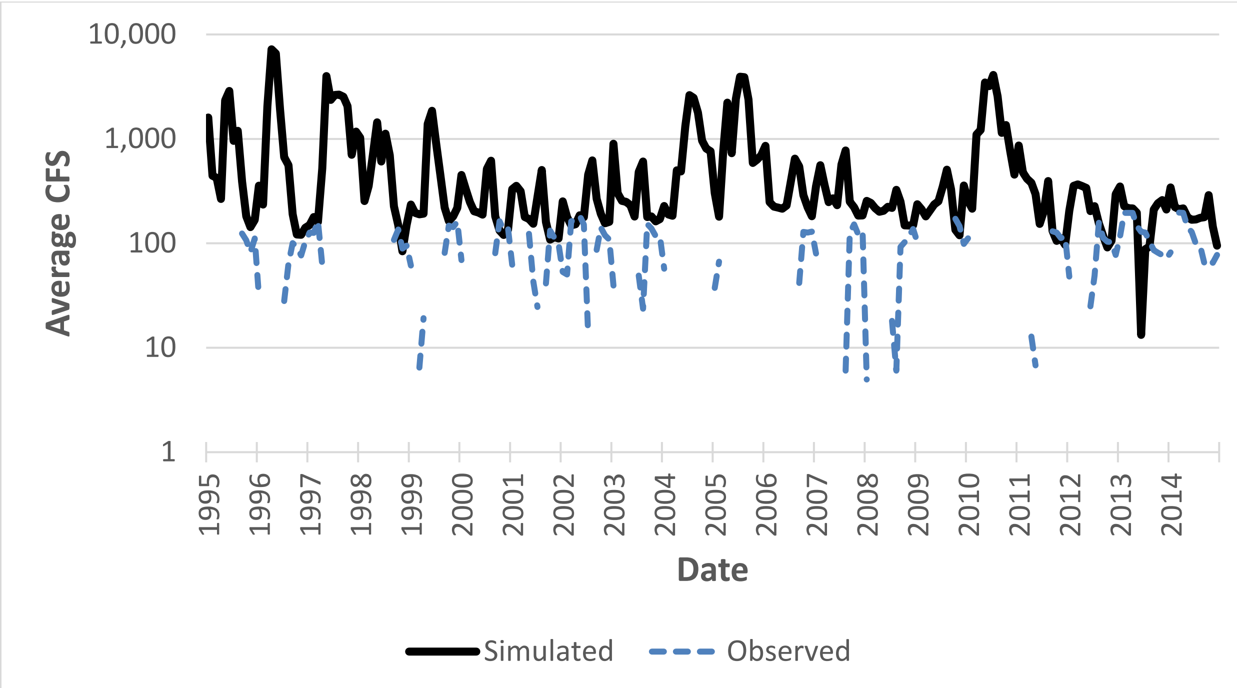


Figure 71: Observed vs Simulated Stream Flow (Merced River at Shaffer Bridge)

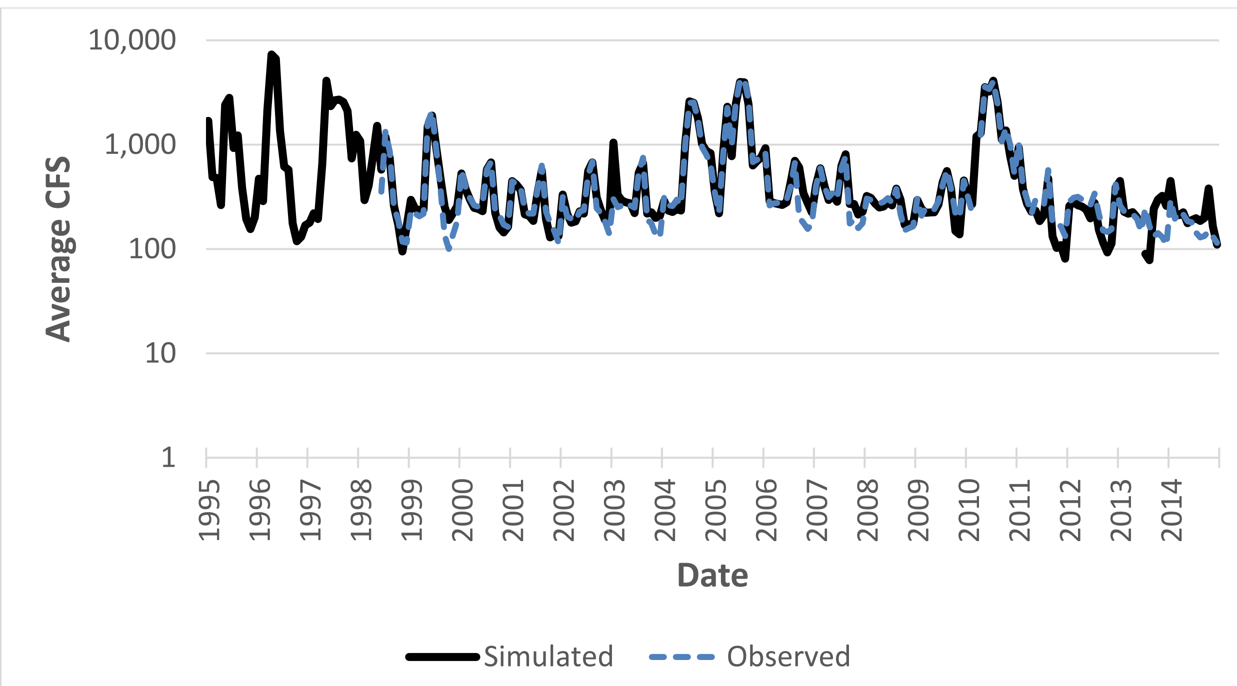


Figure 72: Observed vs Simulated Stream Flow (Merced River near Cressey)

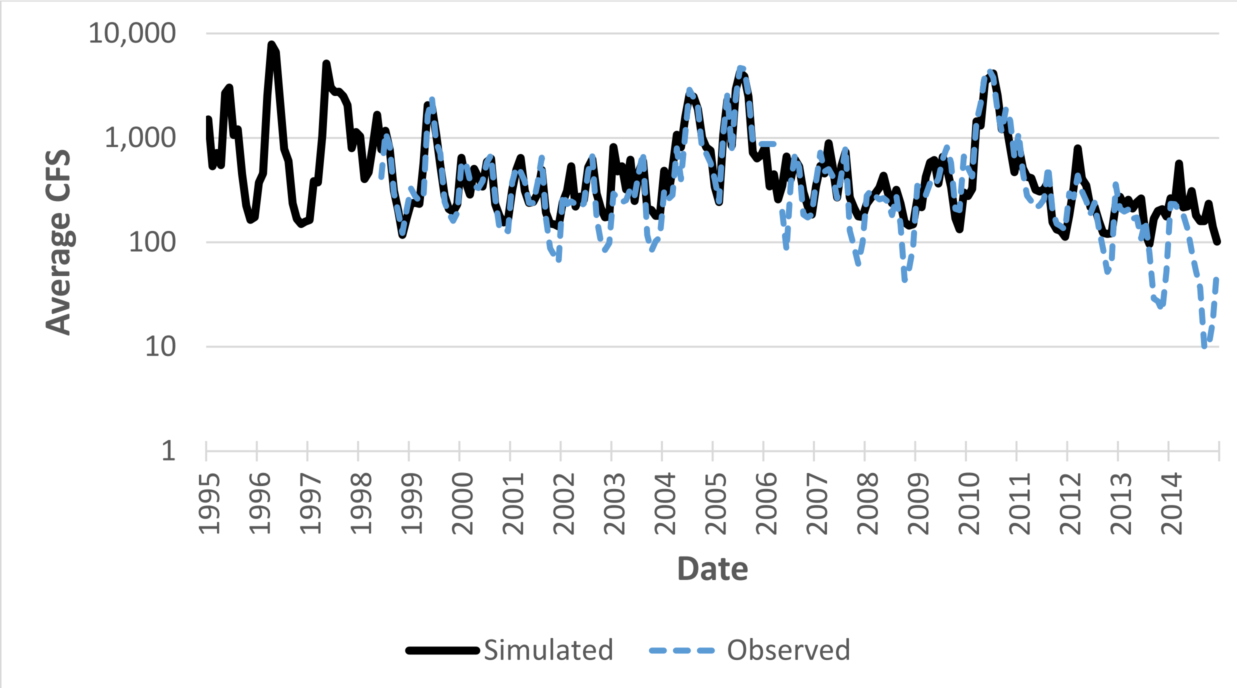


Figure 73: Observed vs Simulated Stream Flow (Merced River near Stevinson

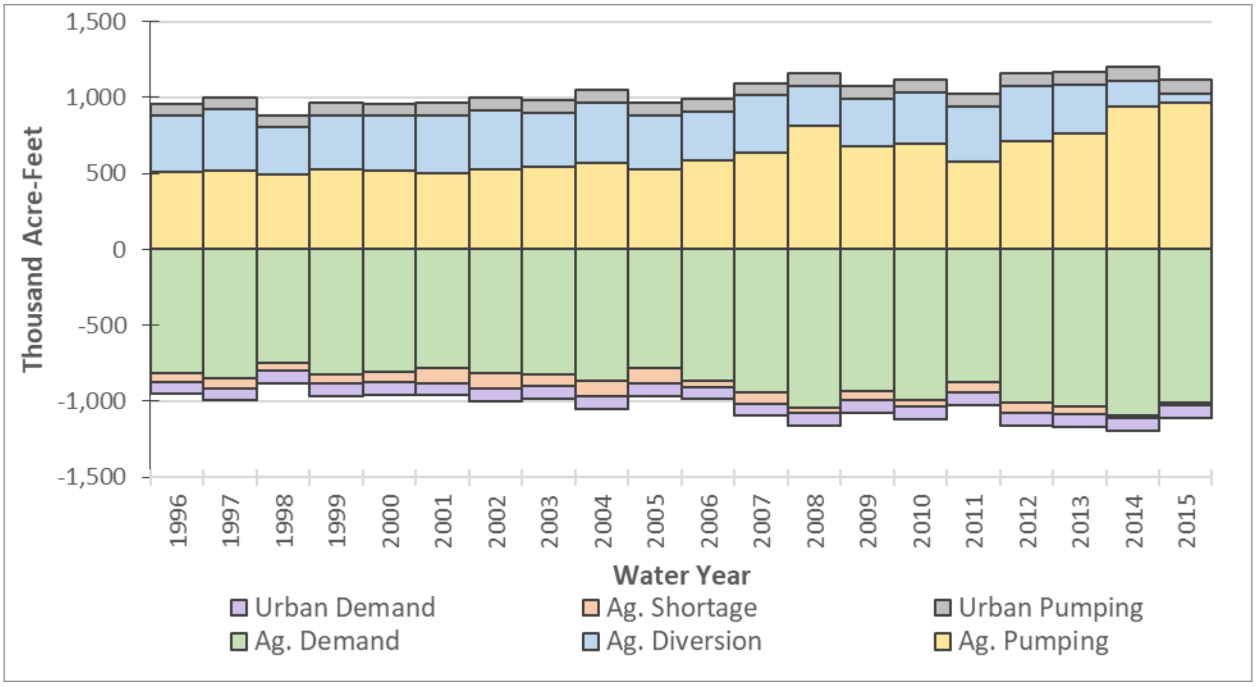


Figure 74: Land and Water Use - Merced Region

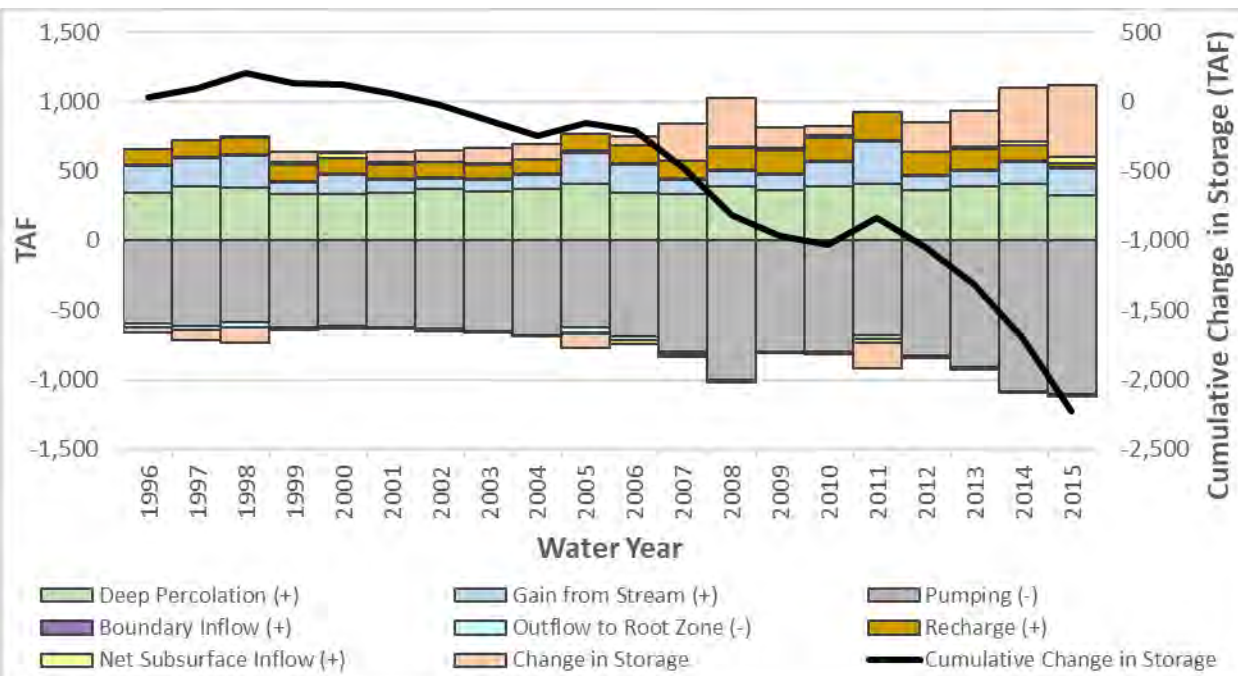


Figure 75: Groundwater Budget - Merced Region

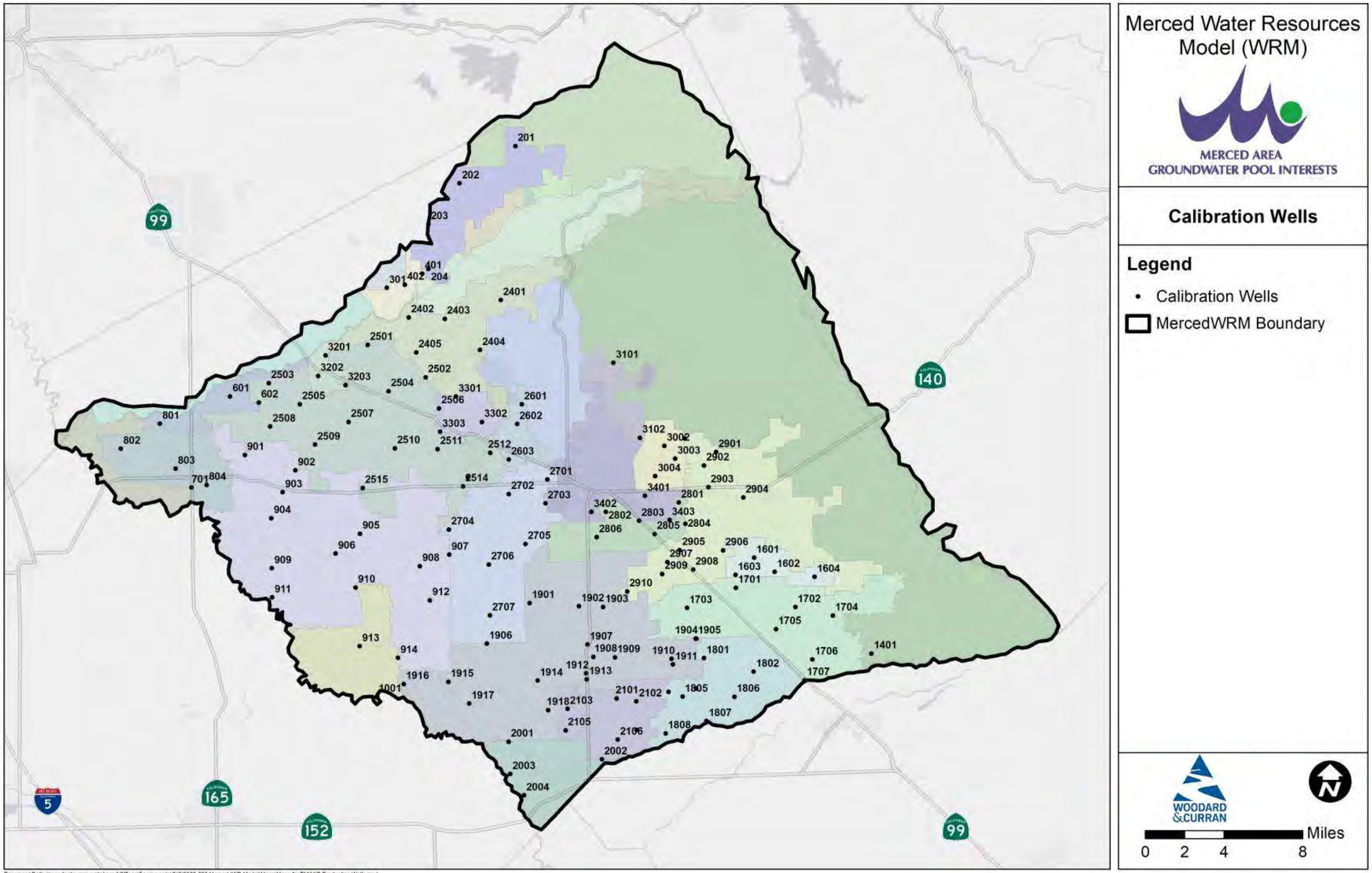


Figure 76: MercedWRM Groundwater Observation Wells

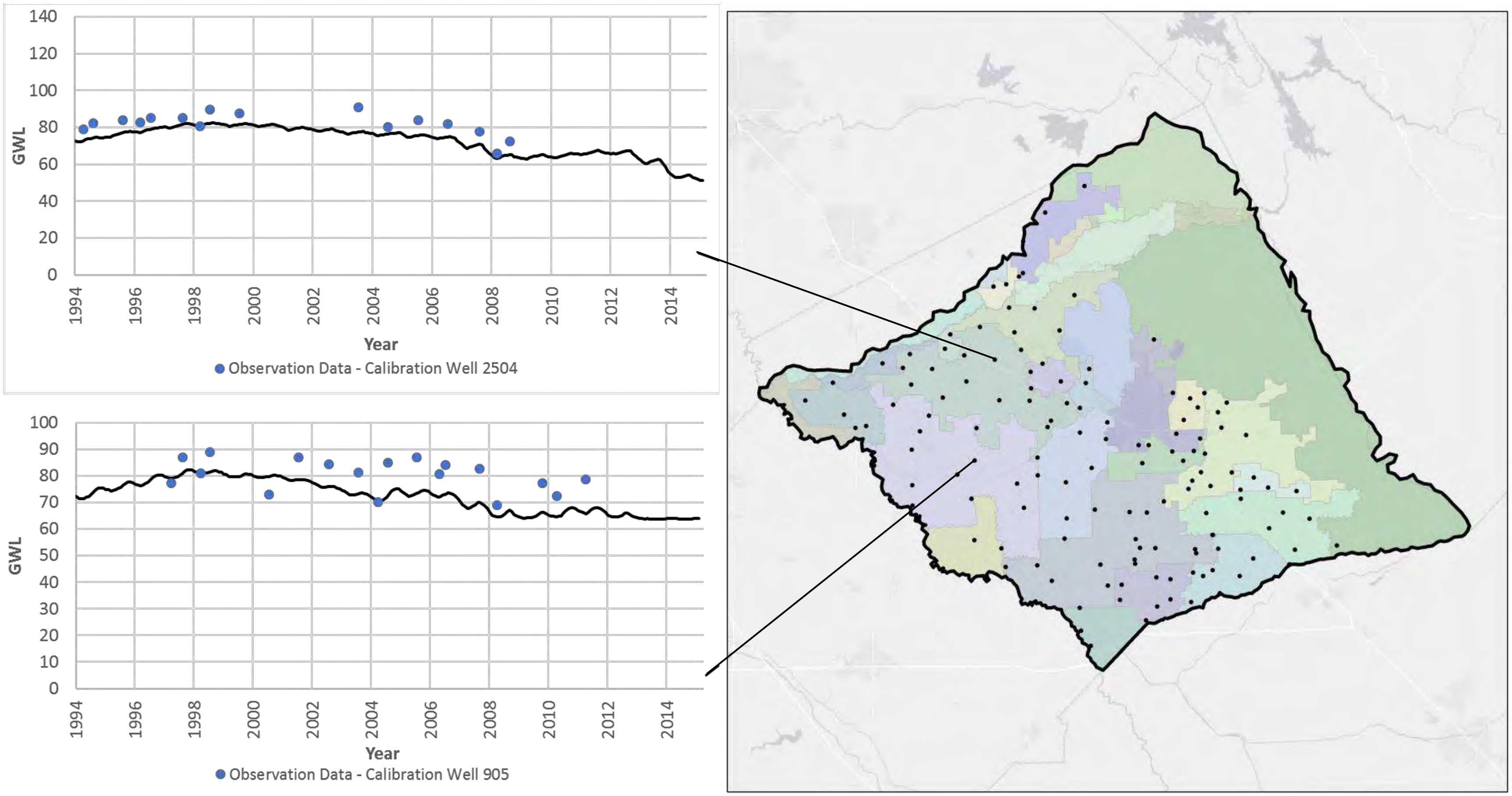


Figure 77: Sample Groundwater Calibration Hydrographs

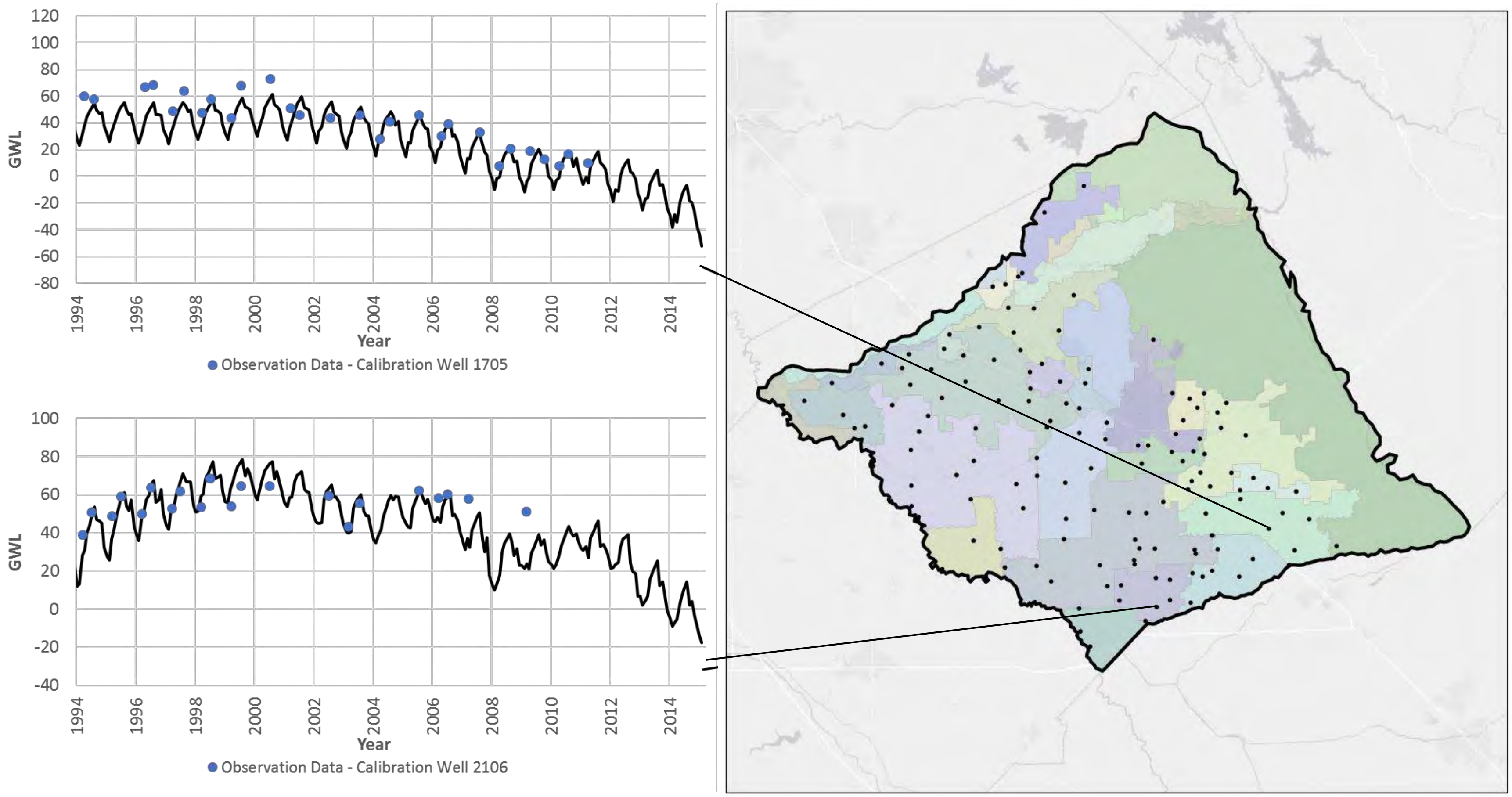


Figure 78: Sample Groundwater Calibration Hydrographs

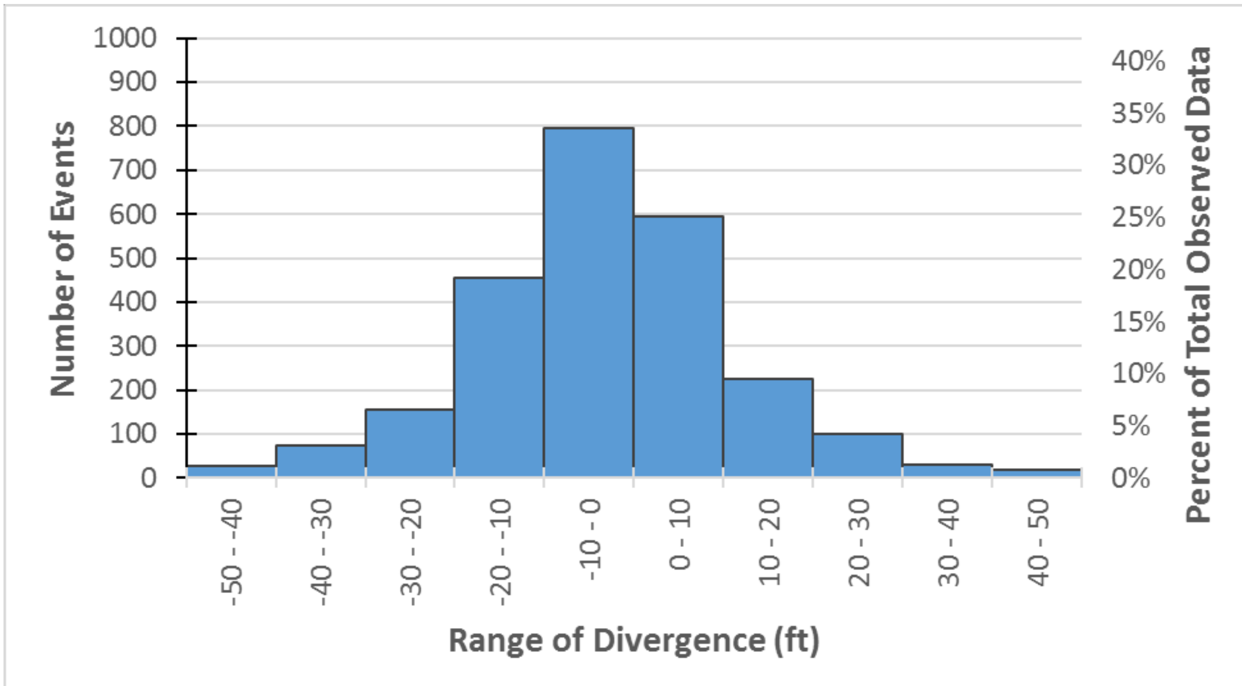


Figure 79: Residual Histogram - Merced Region

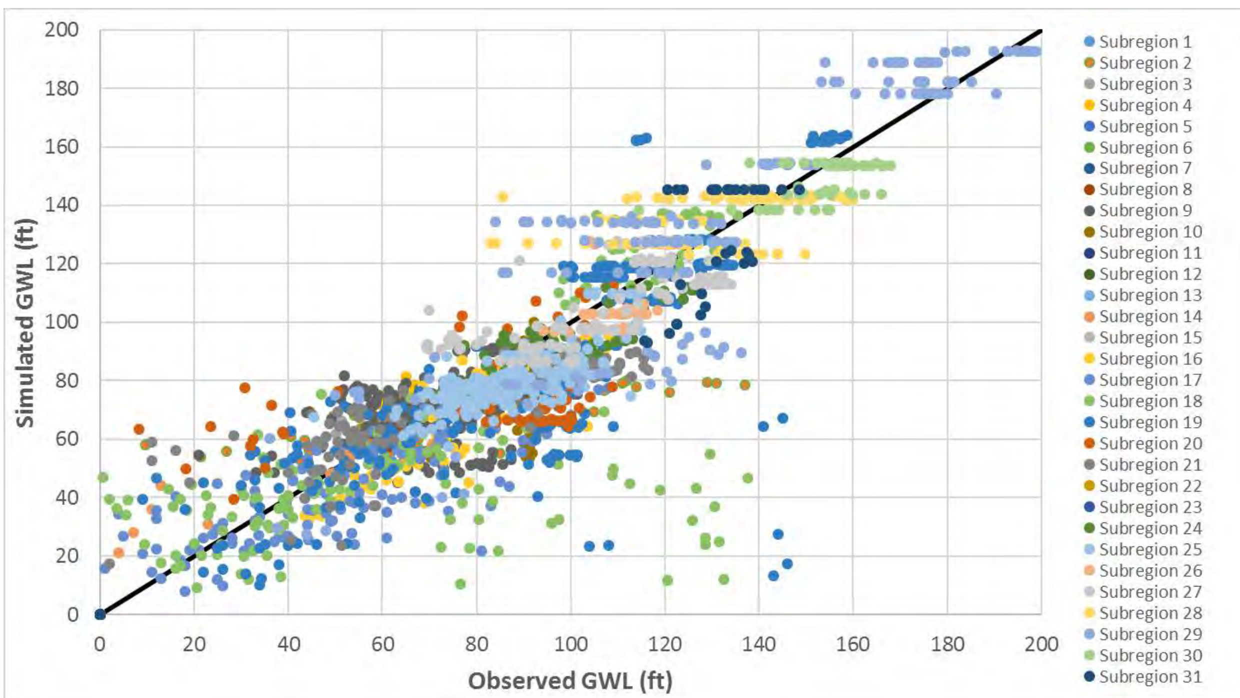


Figure 80: Simulated vs Observed Groundwater Levels By Subregion - Merced Region

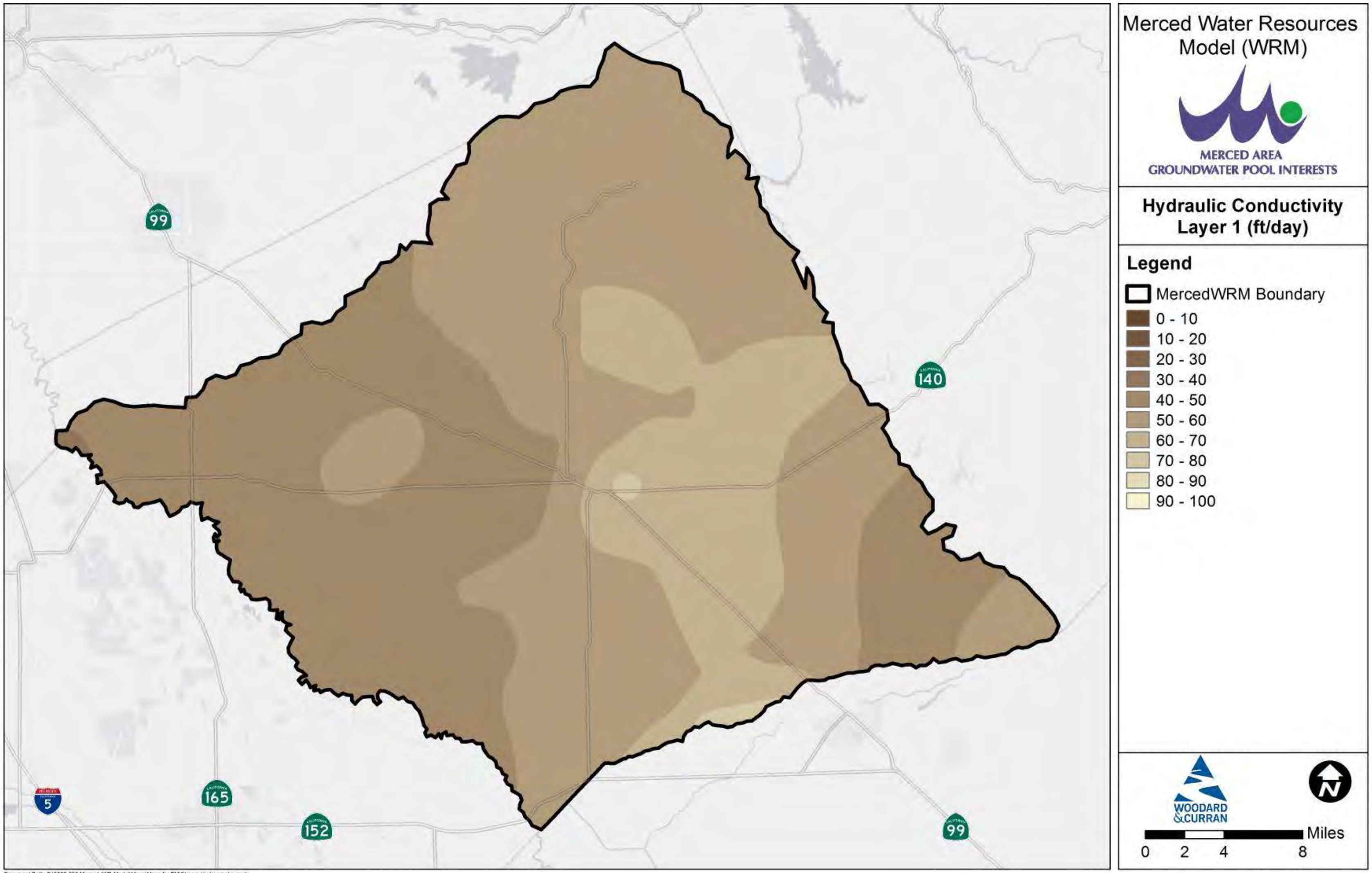


Figure 81: Aquifer Parameters - Hydraulic Conductivity (Layer 1)

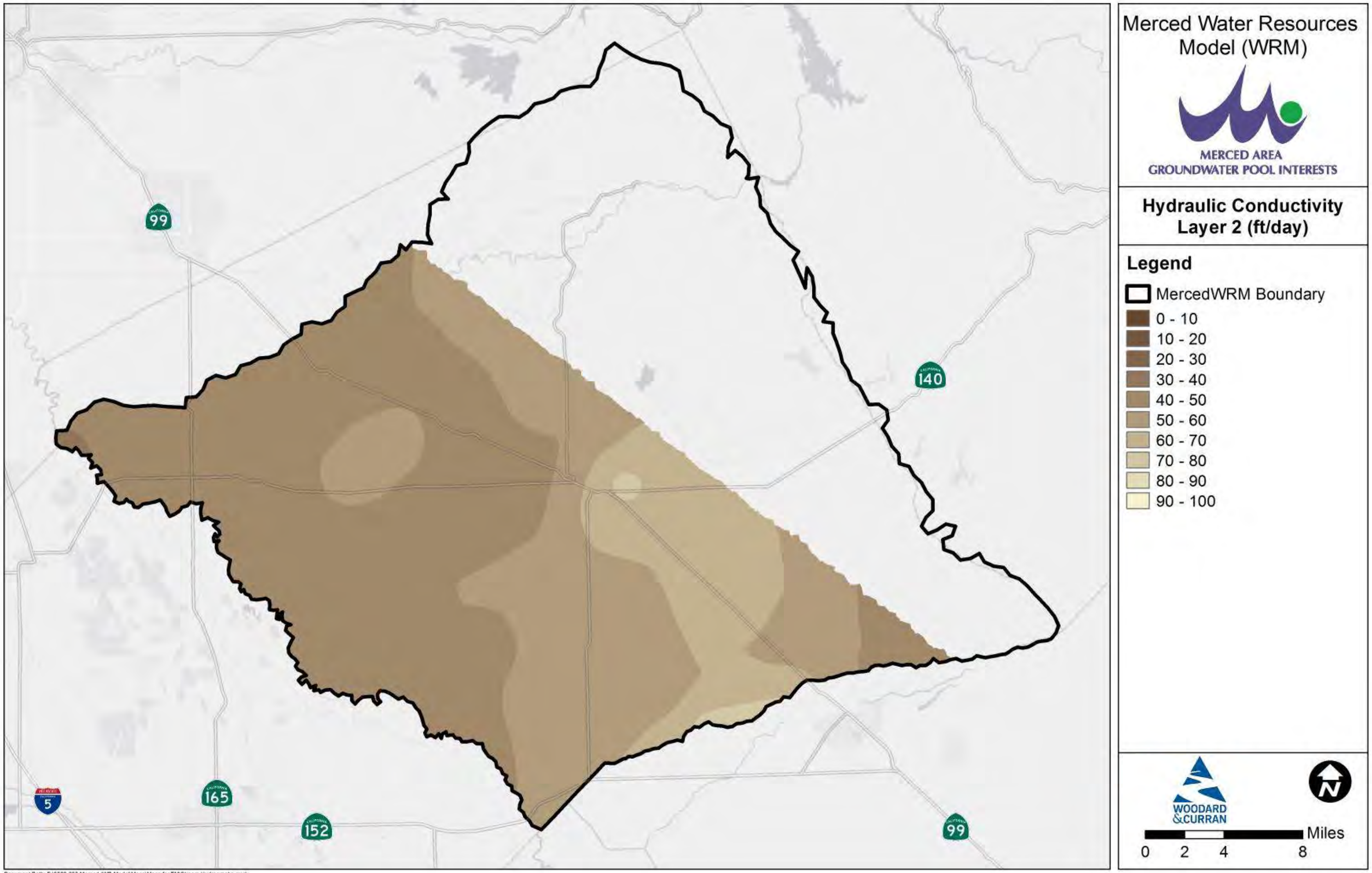


Figure 82: Aquifer Parameters - Hydraulic Conductivity (Layer 2)

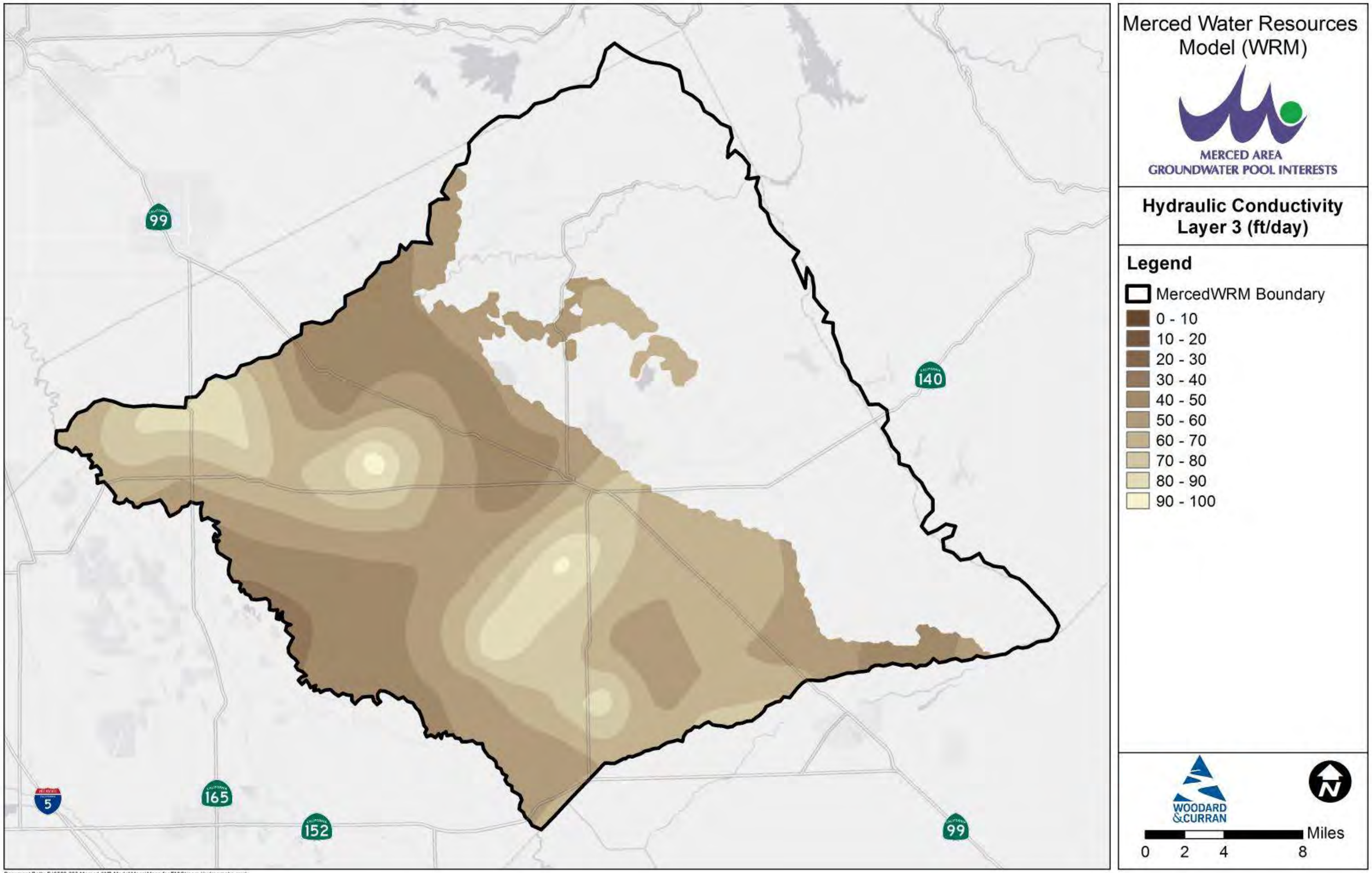


Figure 83: Aquifer Parameters - Hydraulic Conductivity (Layer 3)

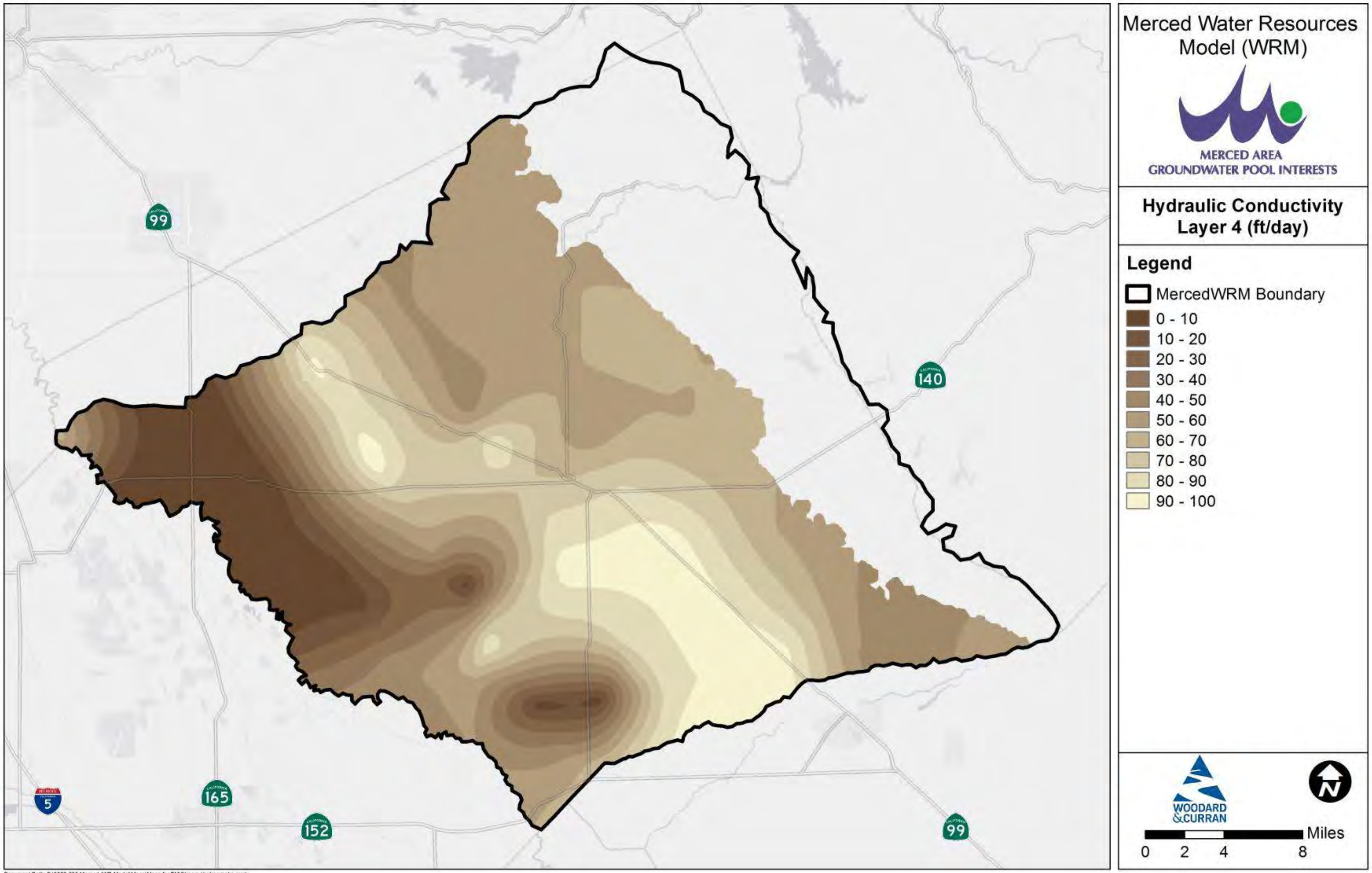


Figure 84: Aquifer Parameters - Hydraulic Conductivity (Layer 4)

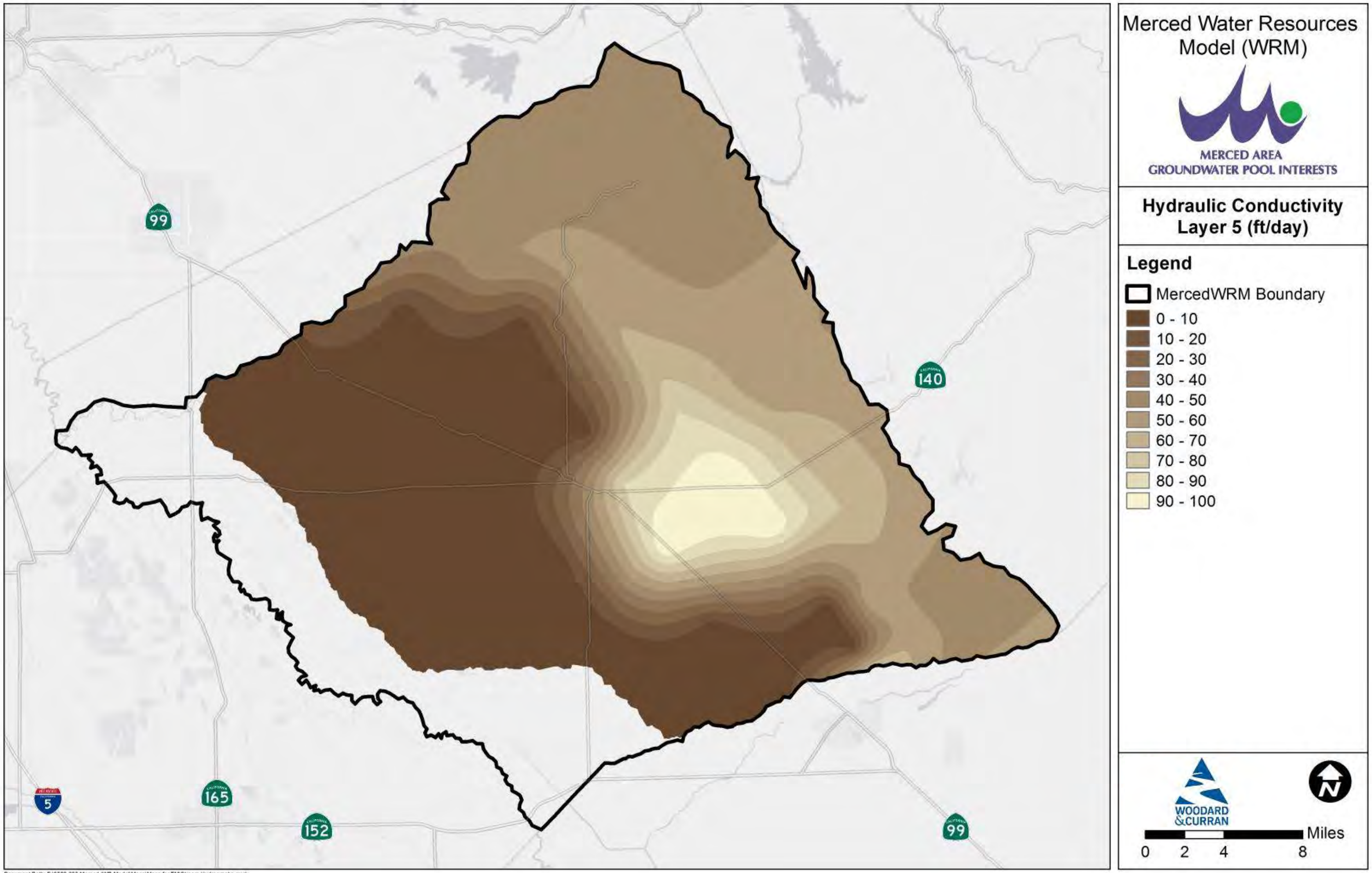


Figure 85: Aquifer Parameters - Hydraulic Conductivity (Layer 5)

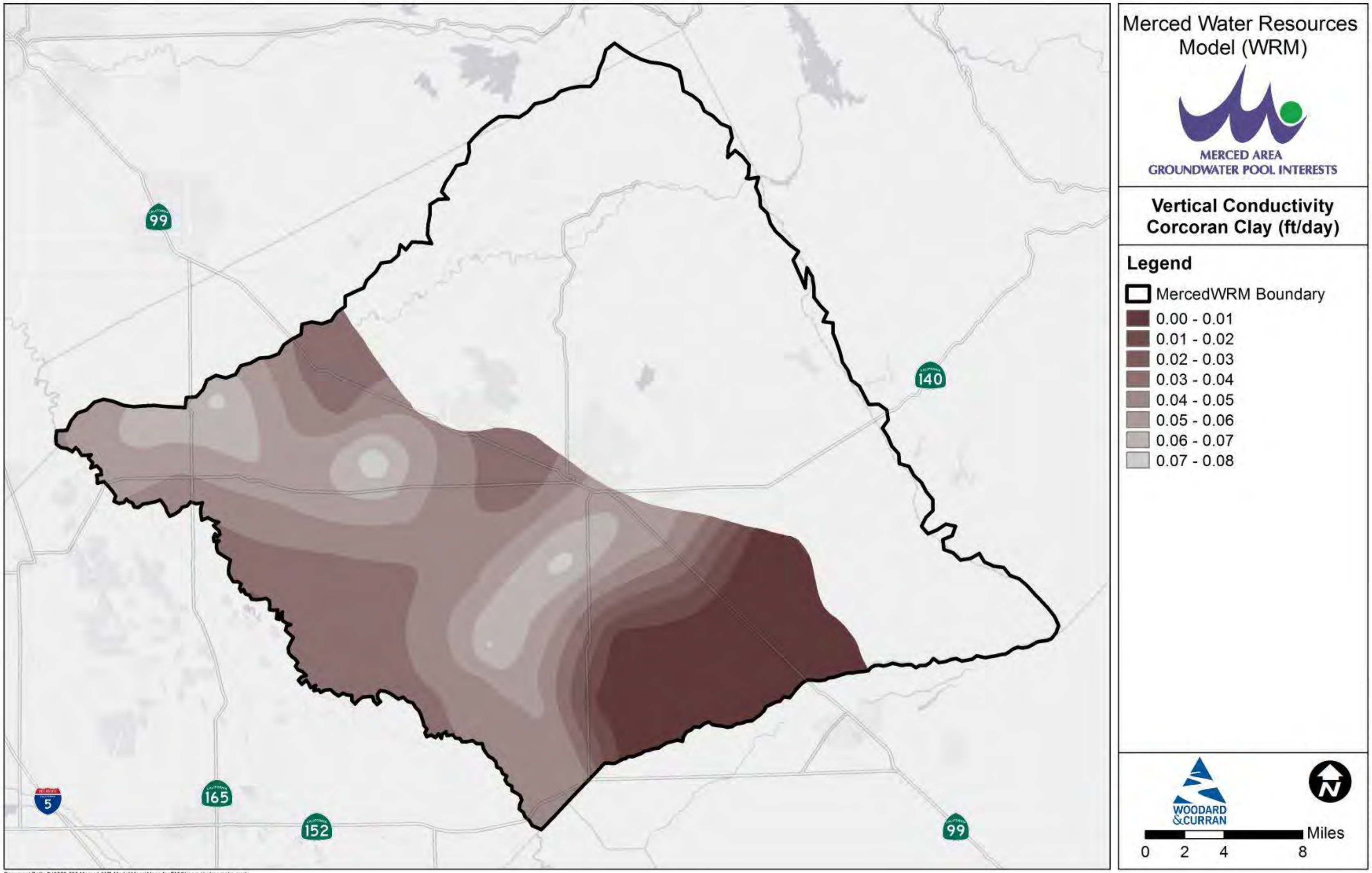


Figure 86: Aquifer Parameters - Vertical Hydraulic Conductivity of the Corcoran Clay

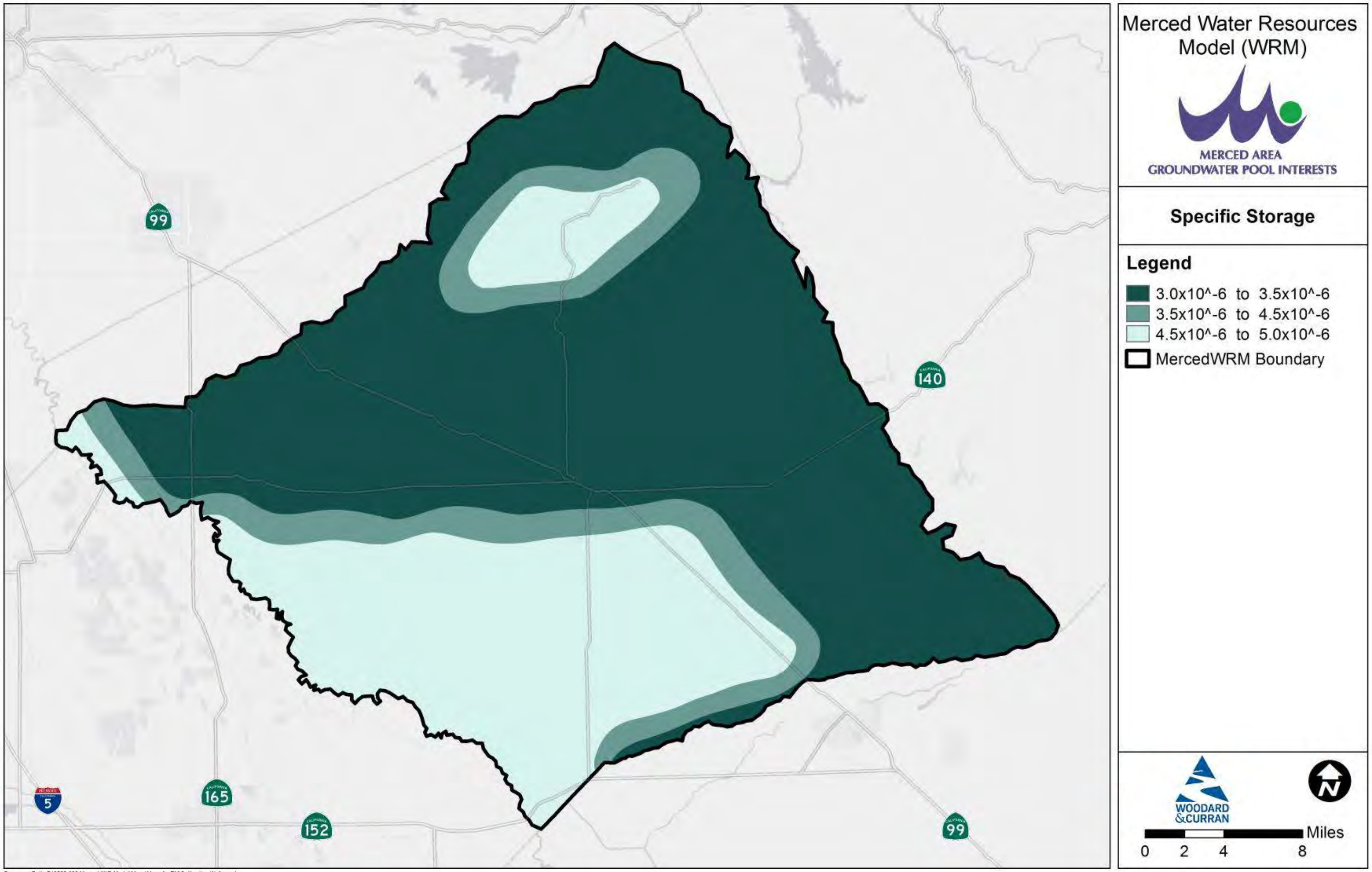


Figure 87: Aquifer Parameters - Specific Storage

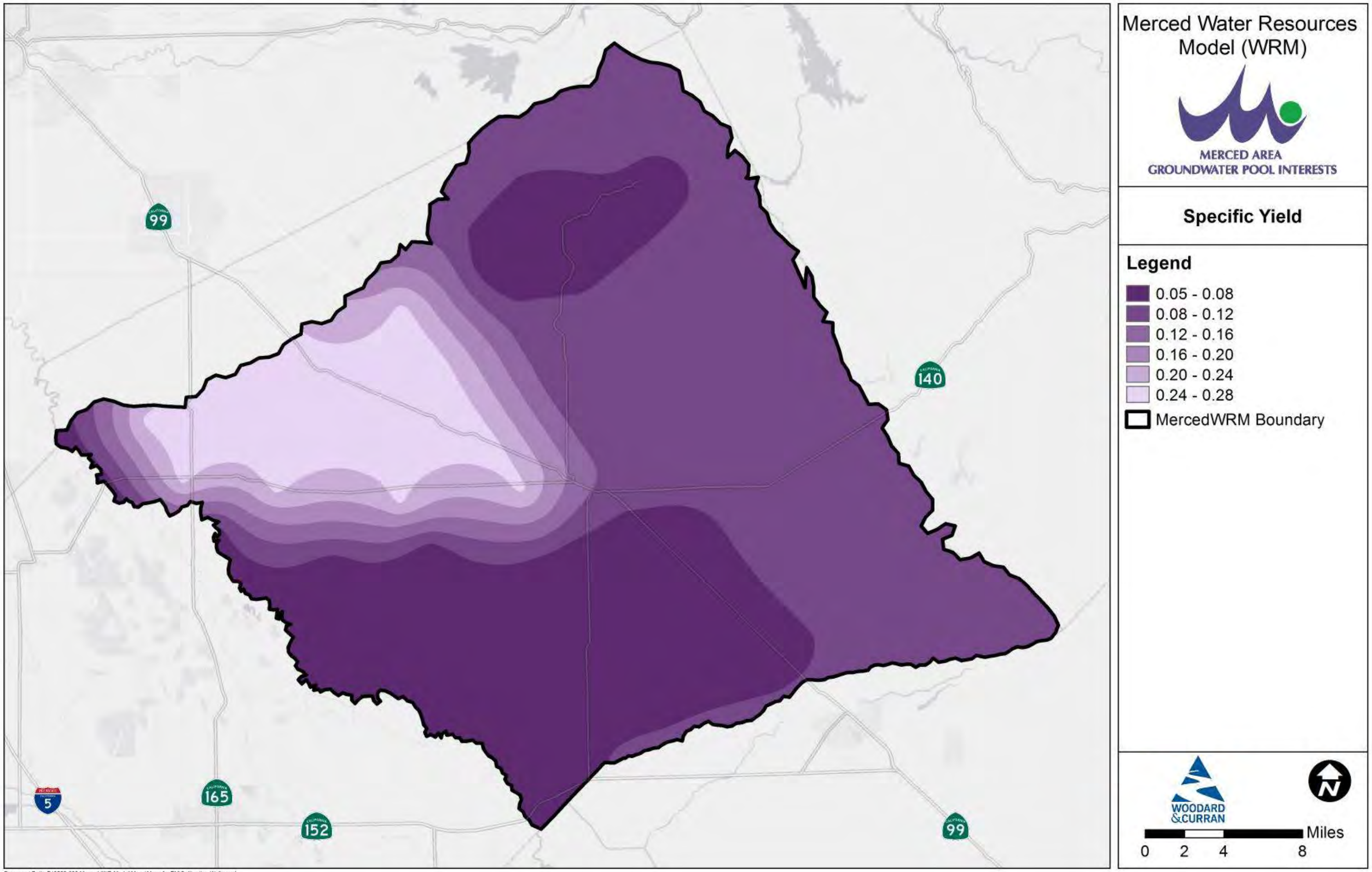


Figure 88: Aquifer Parameters - Specific Yield

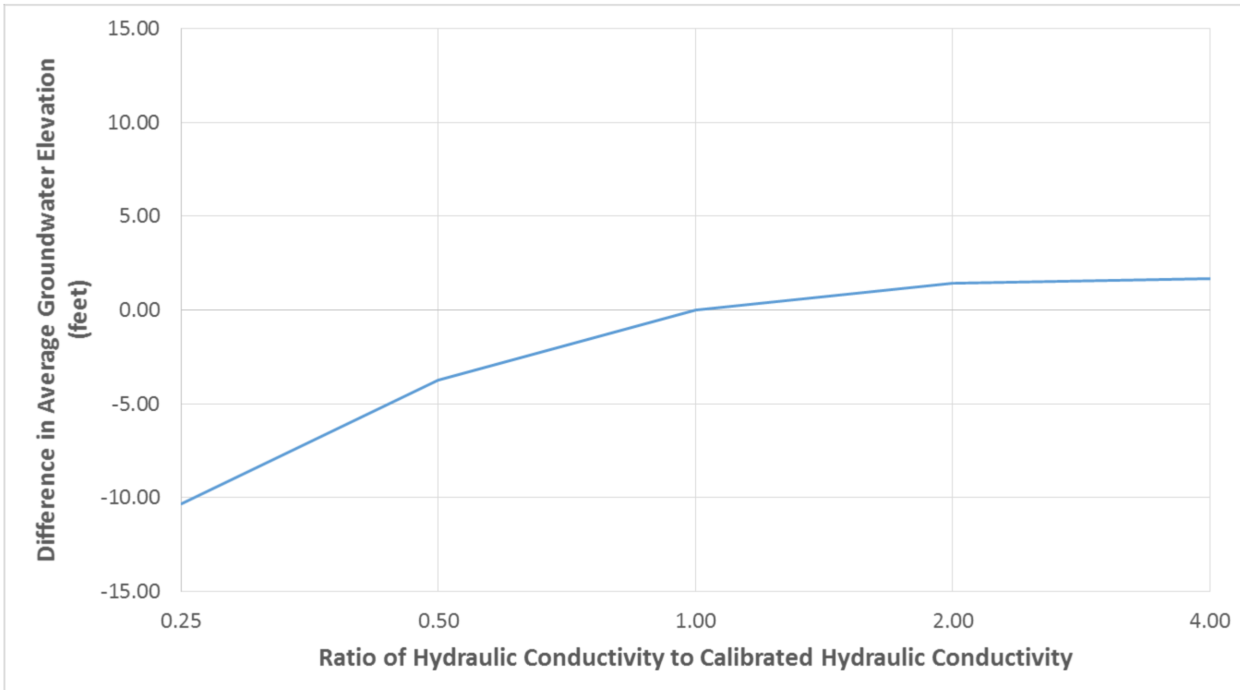


Figure 89: Sensitivity Analysis of Hydraulic Conductivity - Difference in Average Groundwater Elevation (feet)

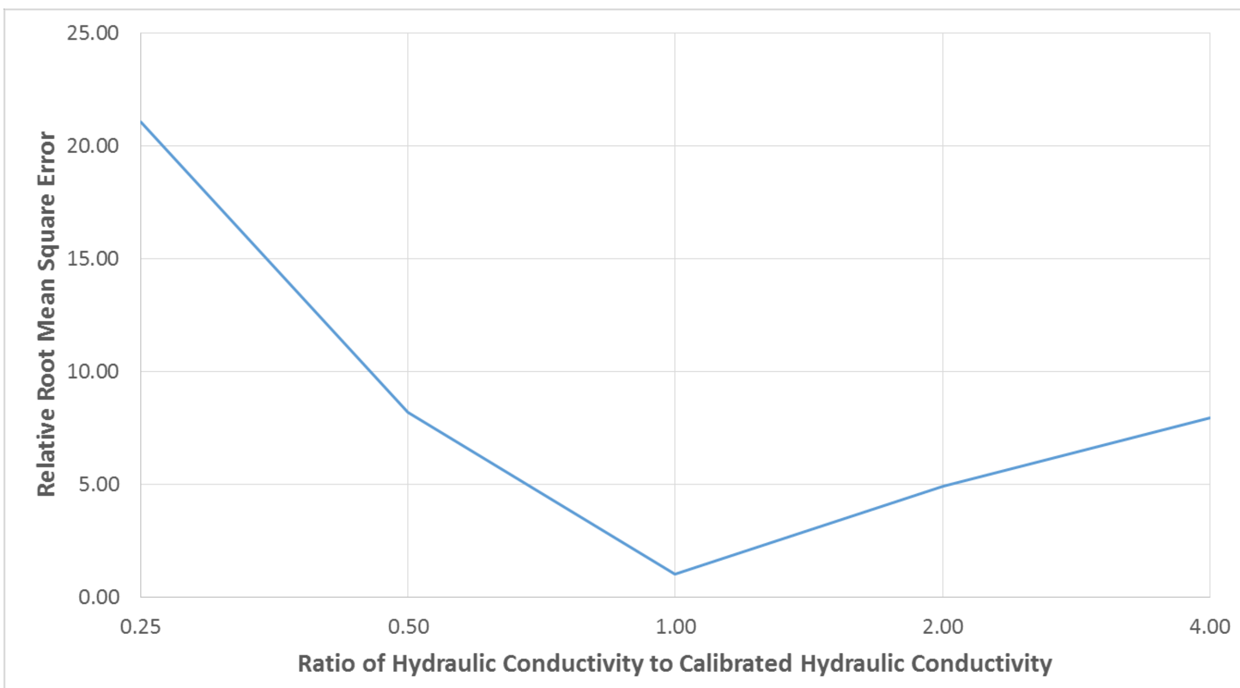


Figure 90: Sensitivity Analysis of Hydraulic Conductivity - Relative Root Mean Square Error

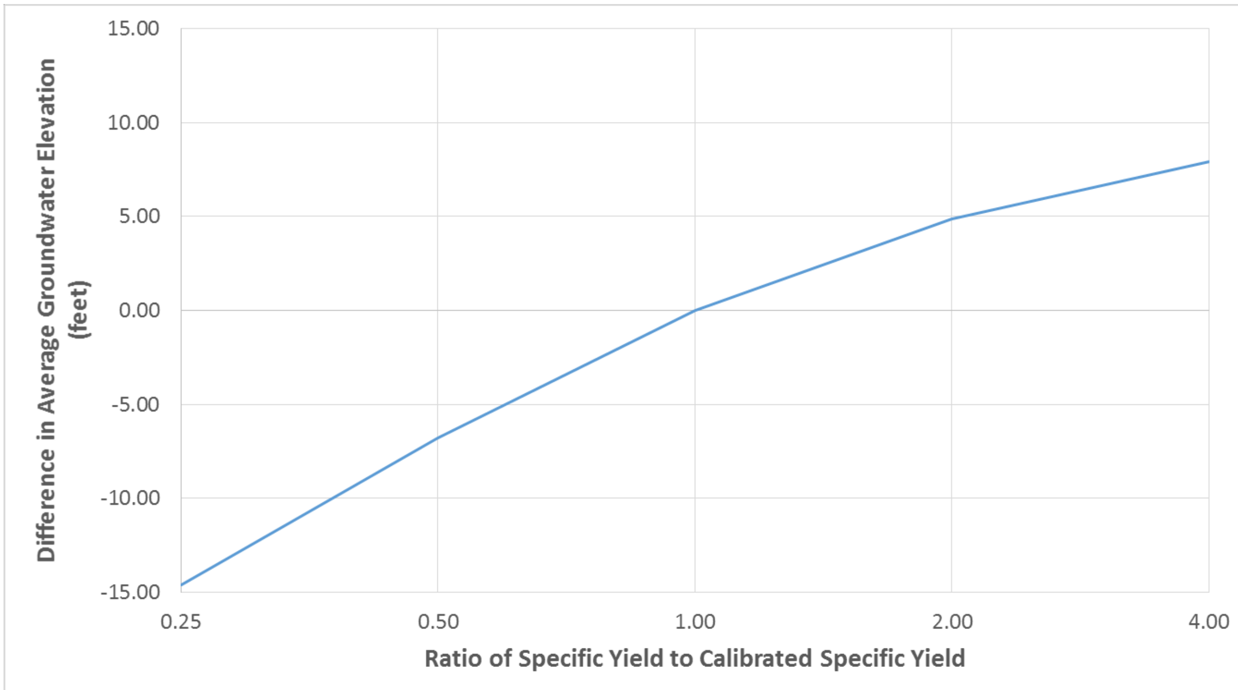


Figure 91: Sensitivity Analysis of Specific Yield - Difference in Average Groundwater Elevation (feet)

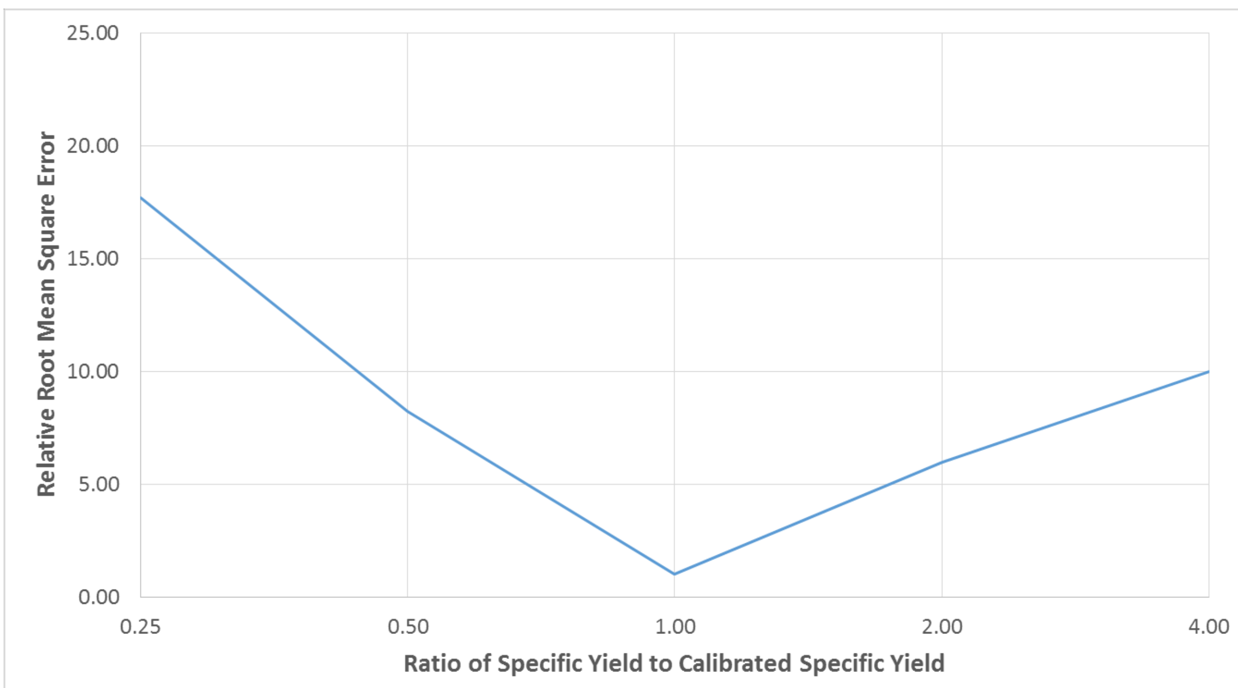


Figure 92: Sensitivity Analysis of Specific Yield - Relative Root Mean Square Error

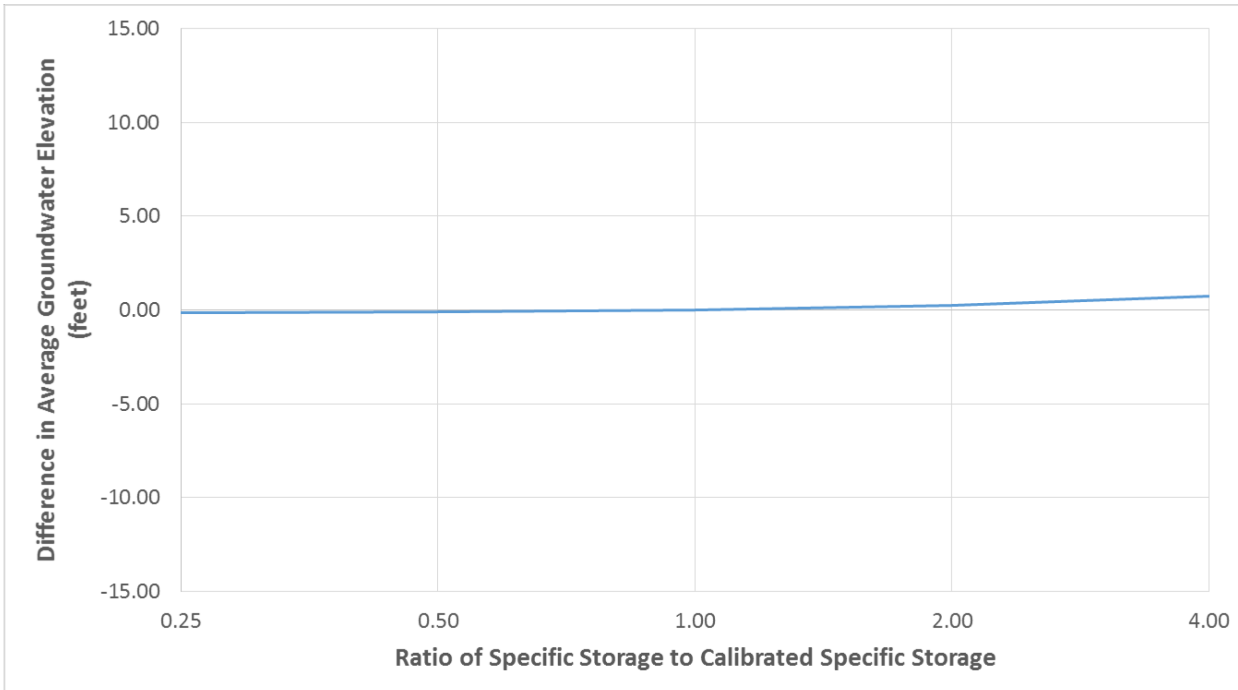


Figure 93: Sensitivity Analysis of Specific Storage - Difference in Average Groundwater Elevation (feet)

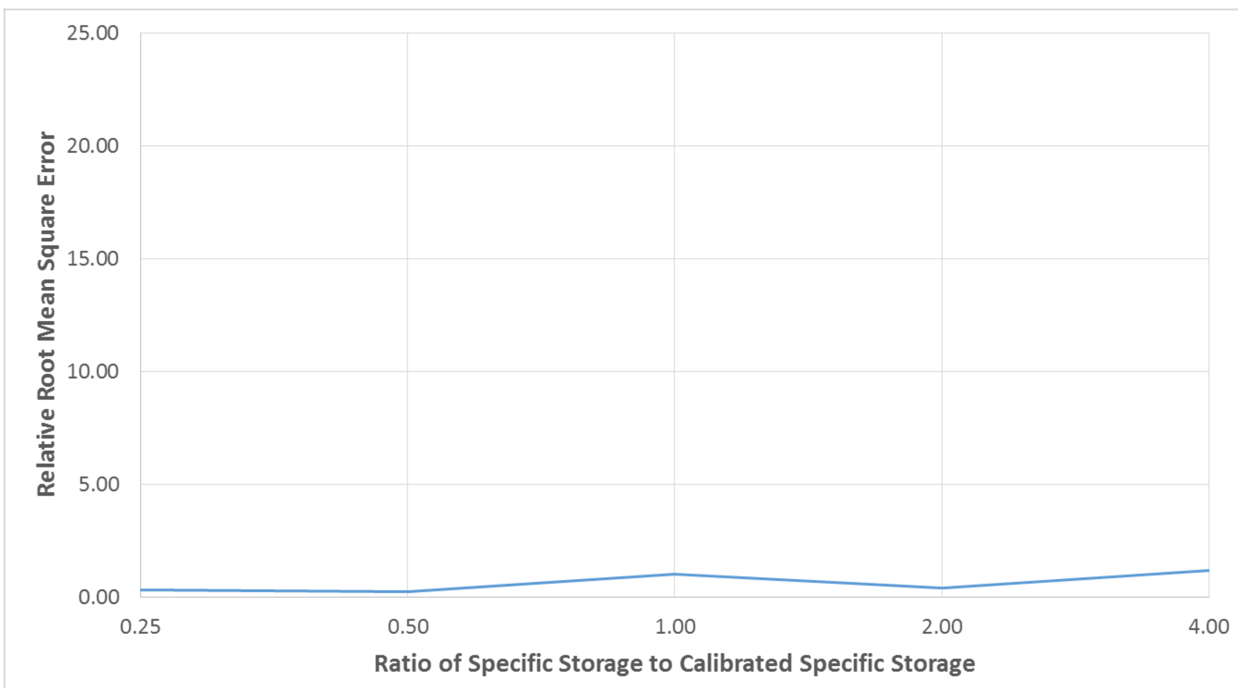


Figure 94: Sensitivity Analysis of Specific Storage - Relative Root Mean Square Error

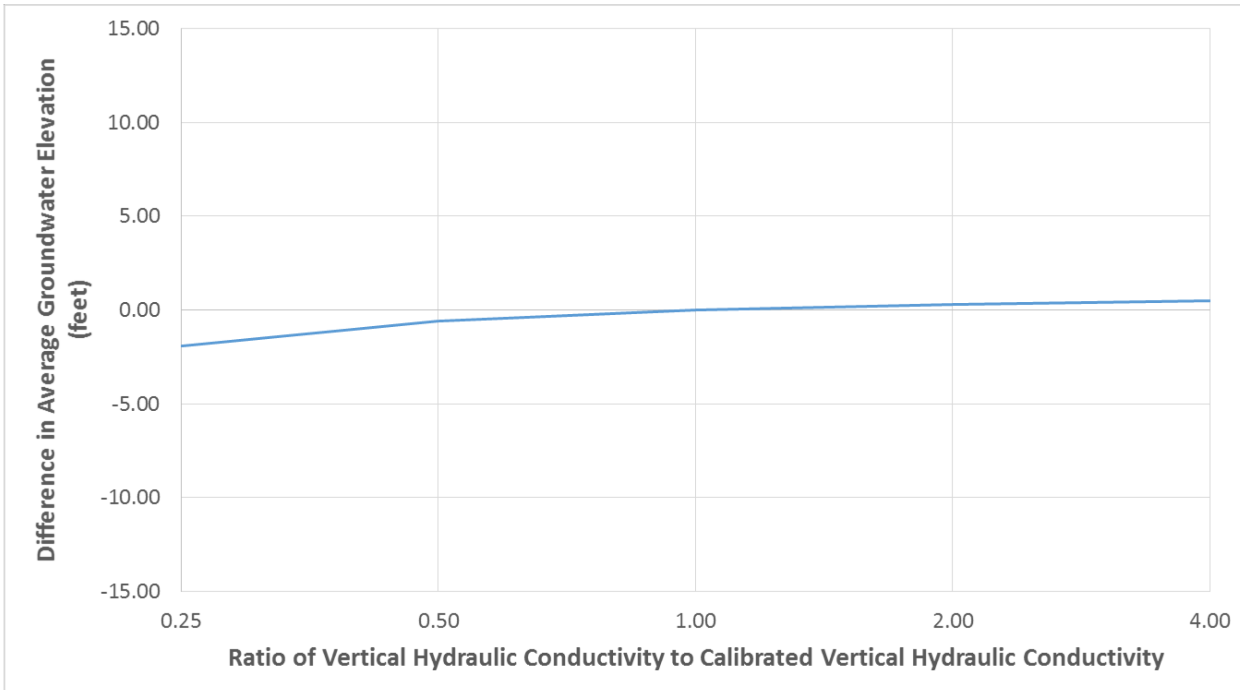


Figure 95: Sensitivity Analysis of Vertical Hydraulic Conductivity of the Corcoran Clay - Difference in Average Groundwater Elevation (feet)

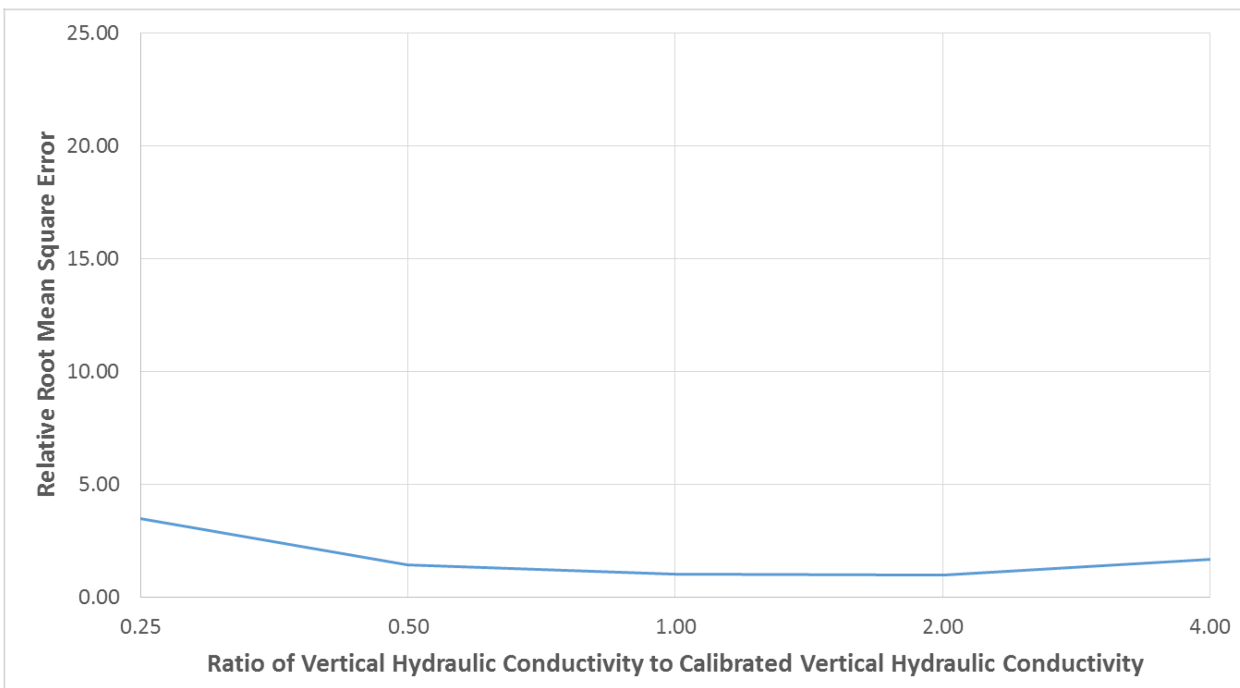


Figure 96: Sensitivity Analysis Vertical Hydraulic Conductivity of the Corcoran Clay - Relative Root Mean Square Error

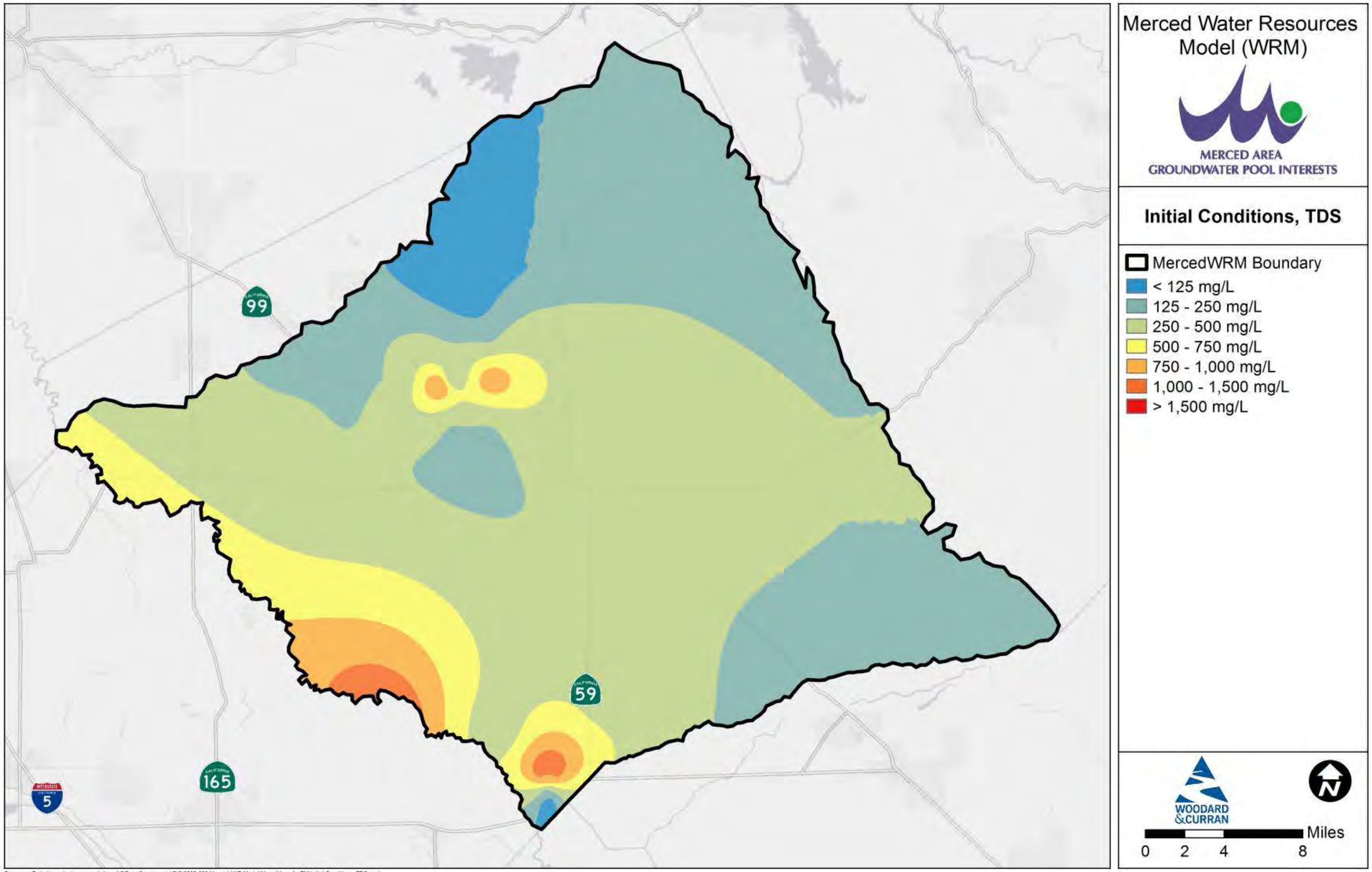


Figure 97: Initial Conditions, TDS

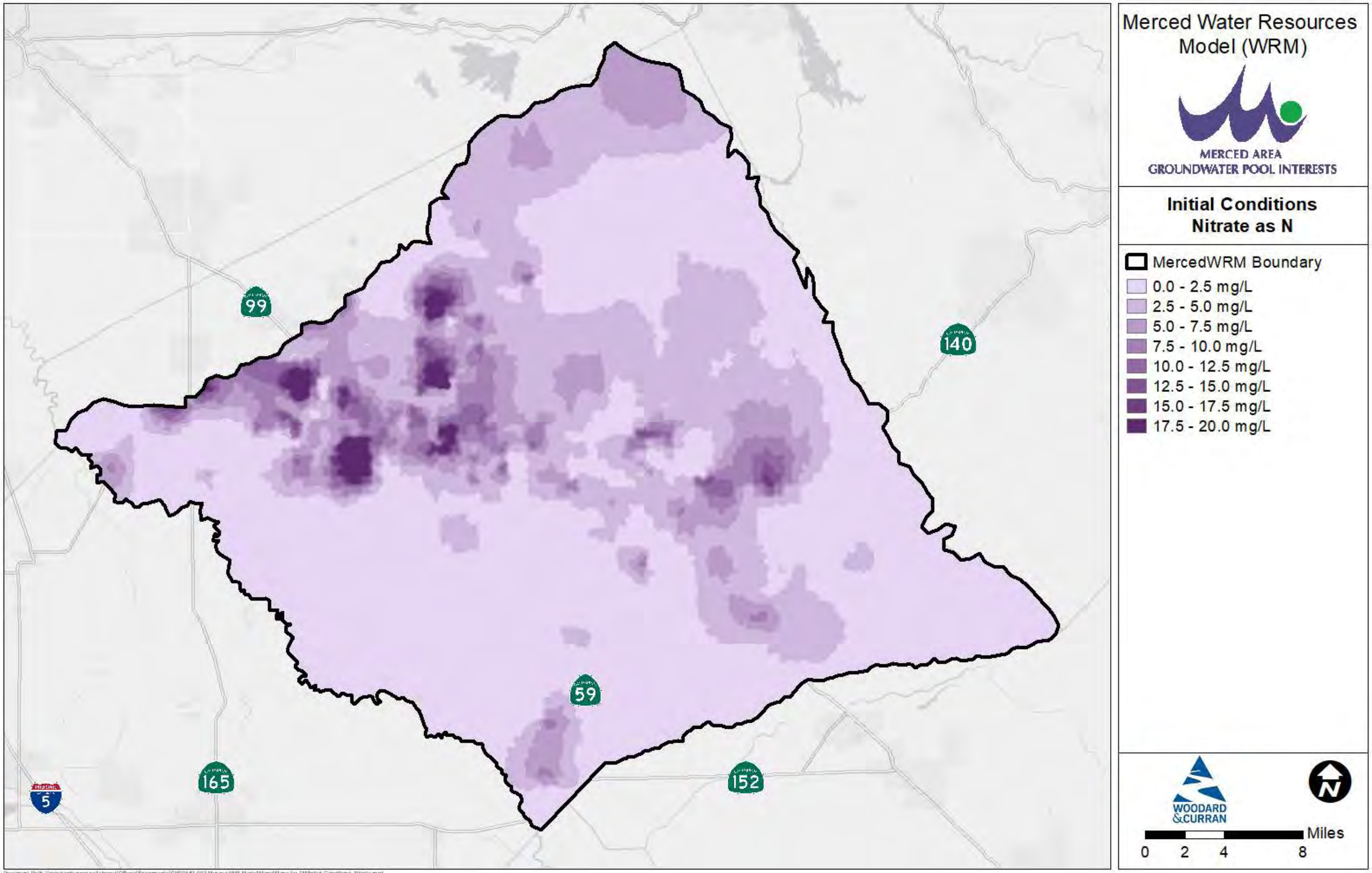


Figure 98: Initial Conditions, Nitrate as N

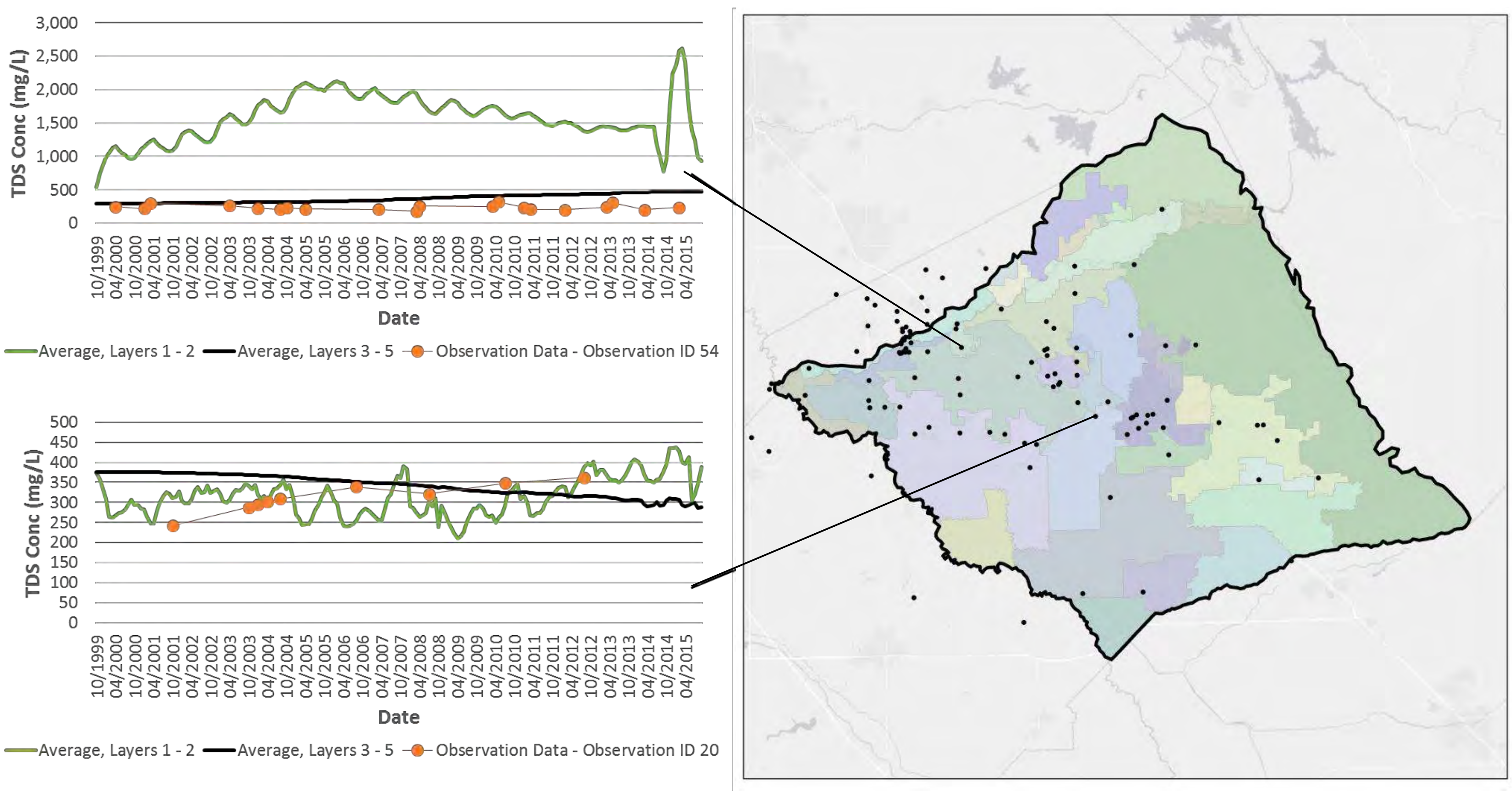


Figure 99: Sample TDS Concentration

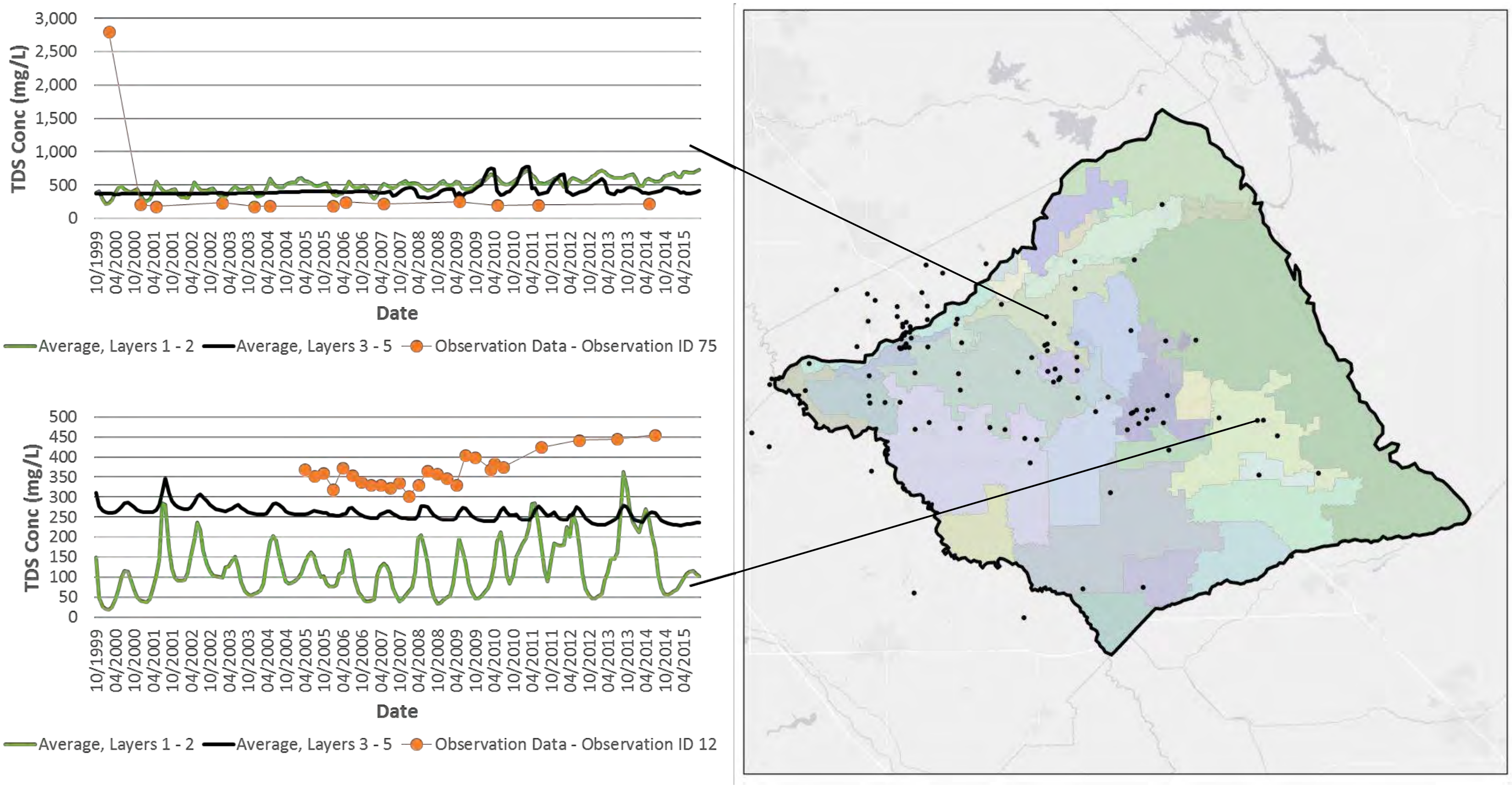


Figure 100: Sample TDS Concentration

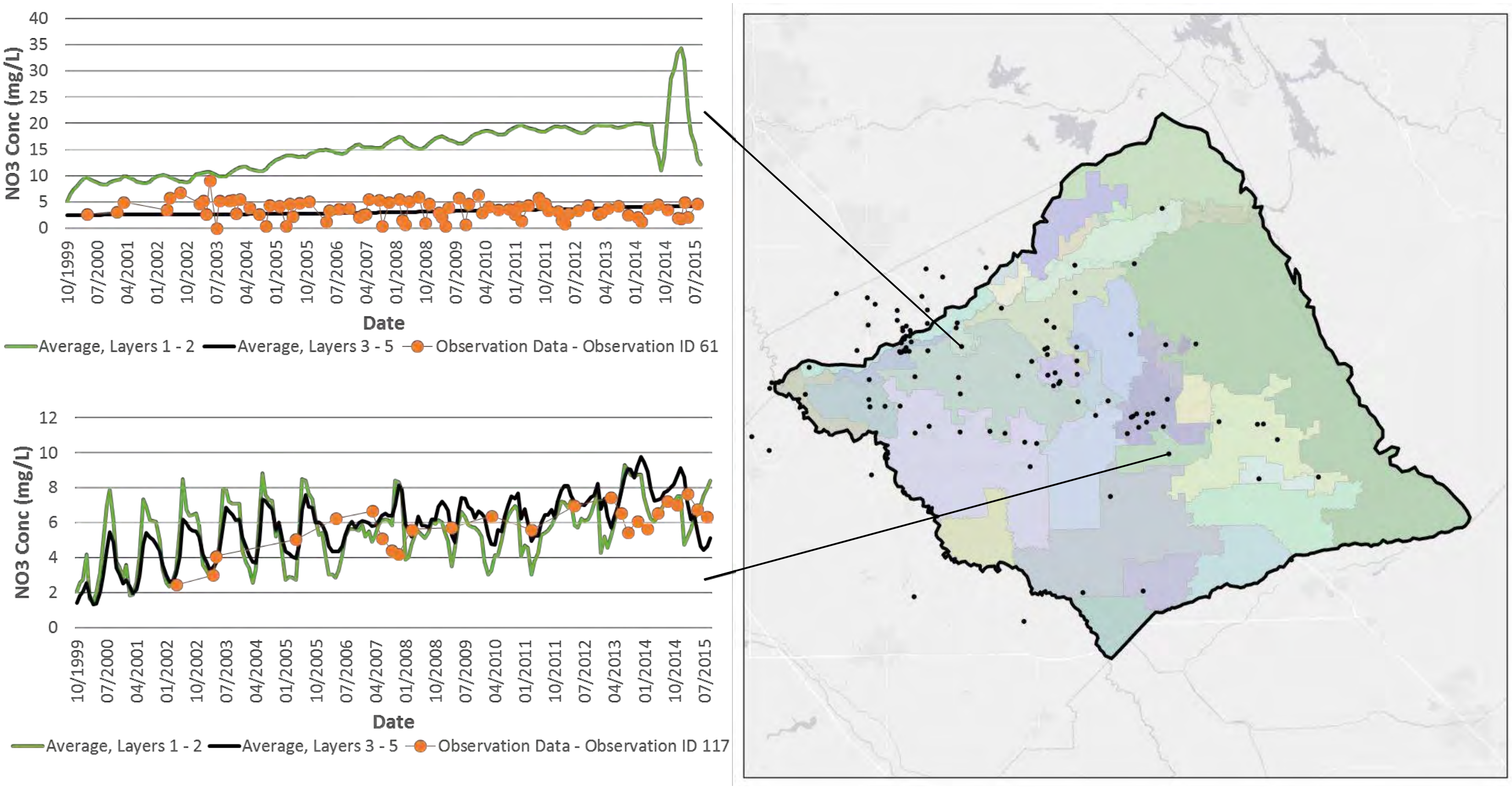


Figure 101: Sample Nitrate Concentration

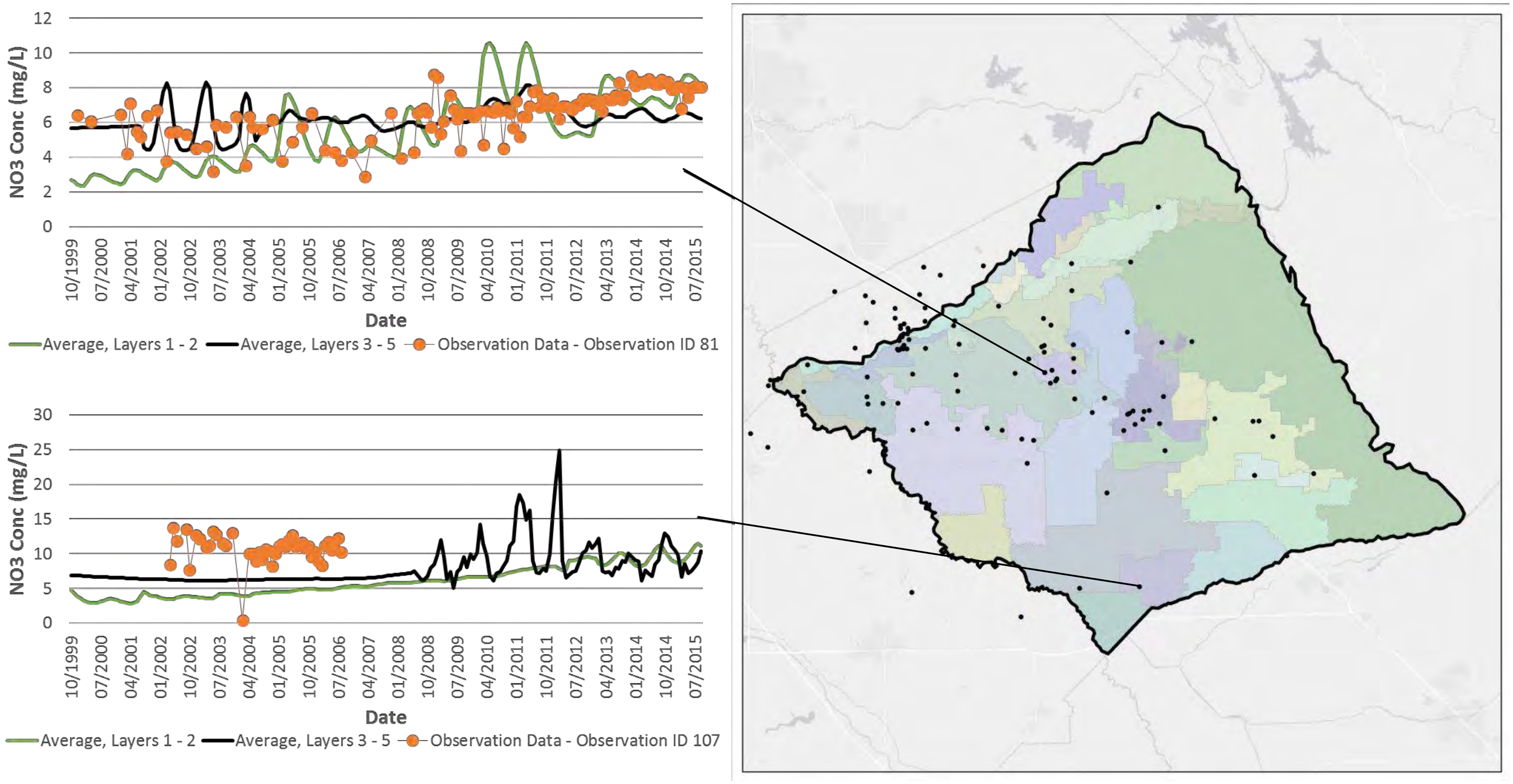
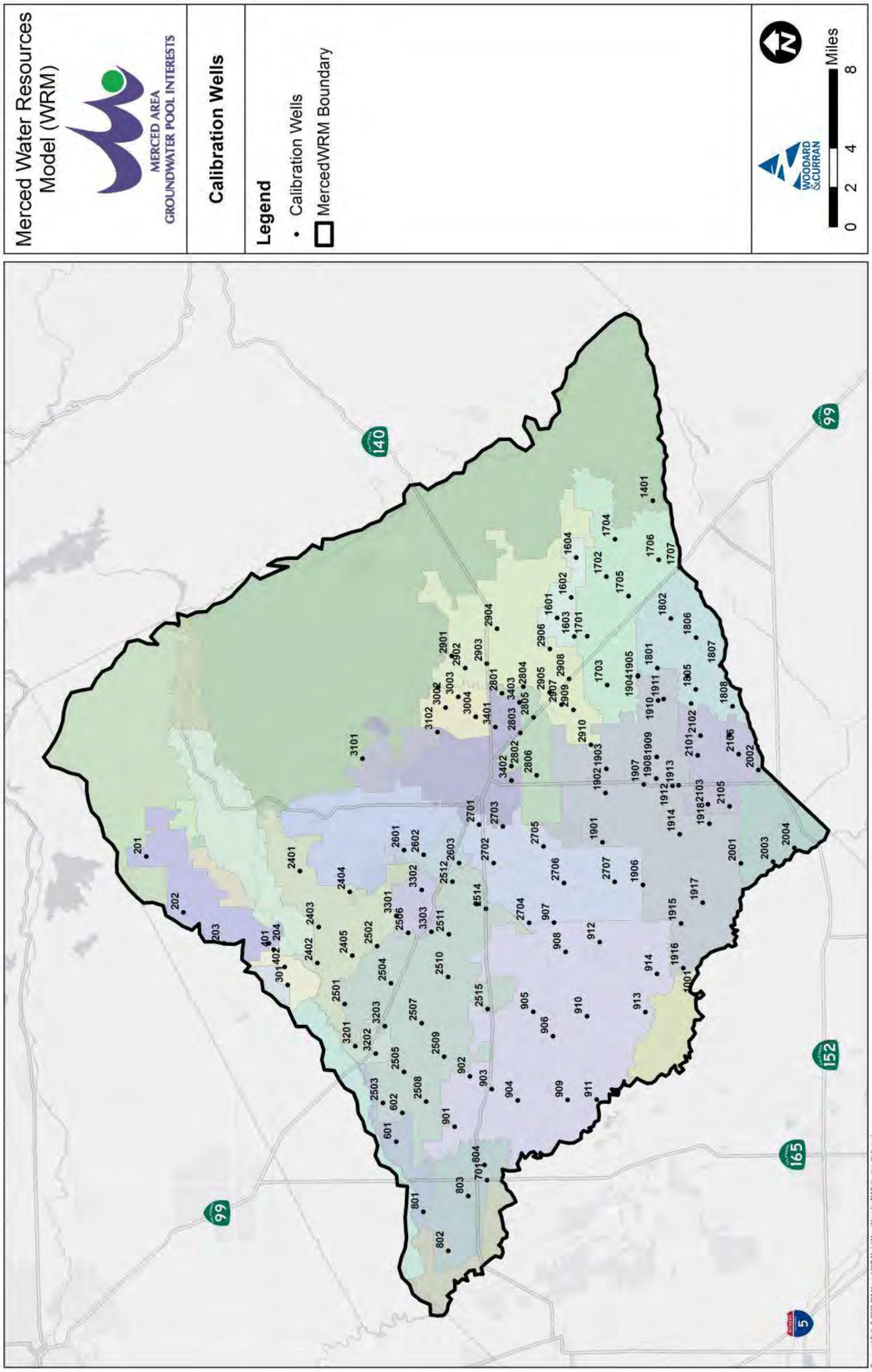


Figure 102: Sample Nitrate Concentration

Appendix A - Groundwater Hydrographs


Merced Water Resources Model (WRM)
MERCED AREA GROUNDWATER POOL INTERESTS
Calibration Wells
Legend
Calibration Wells
MercedWRM Boundary
WOODARD & CURRAN
0 2 4 8 Miles

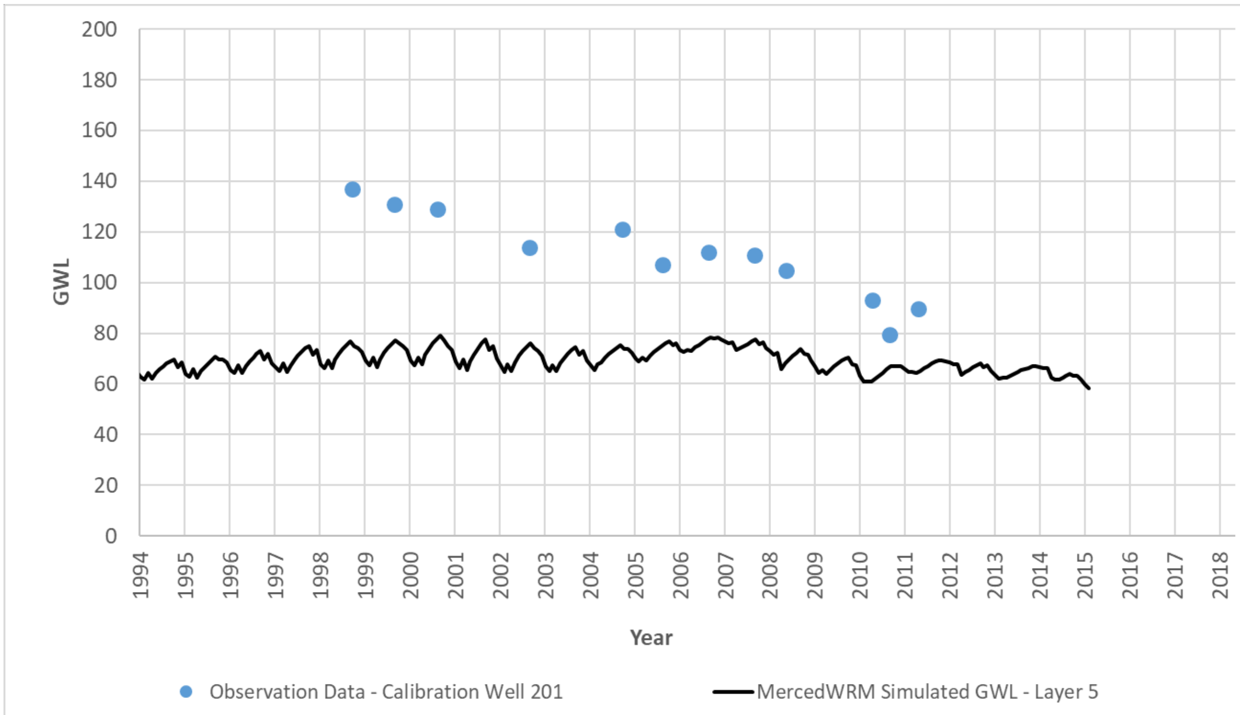


Figure A1: Calibration Well 201

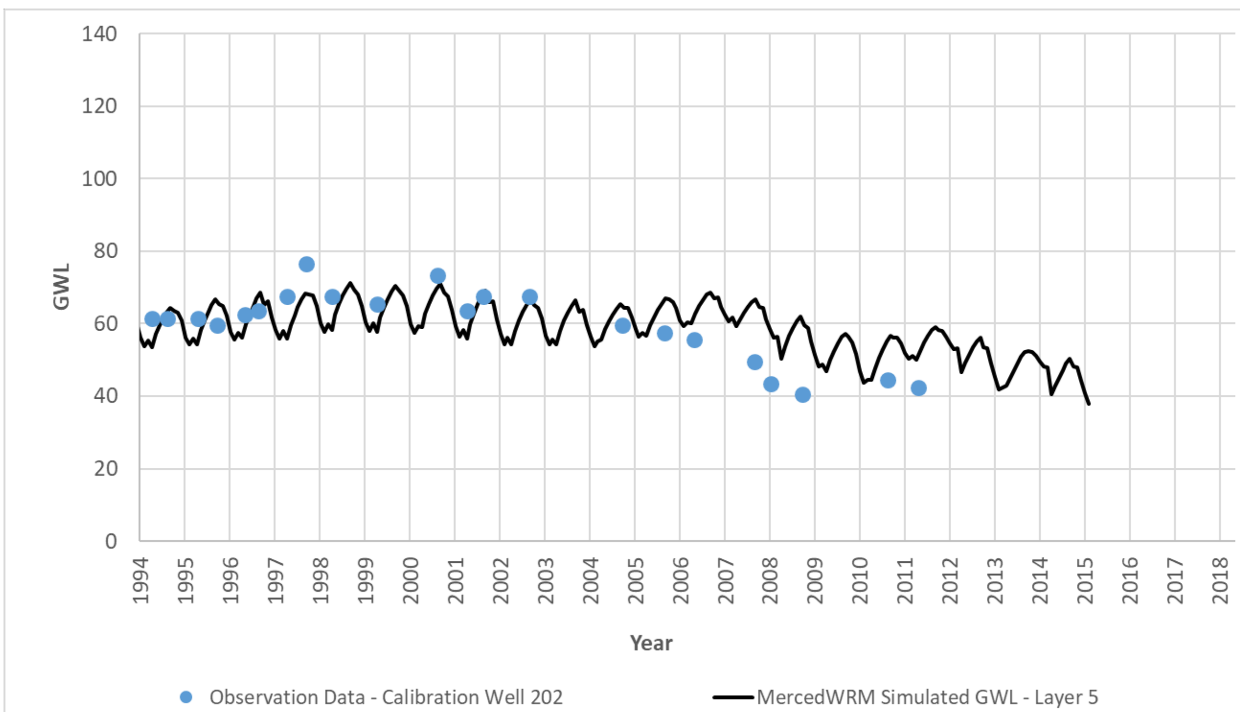


Figure A2: Calibration Well 202

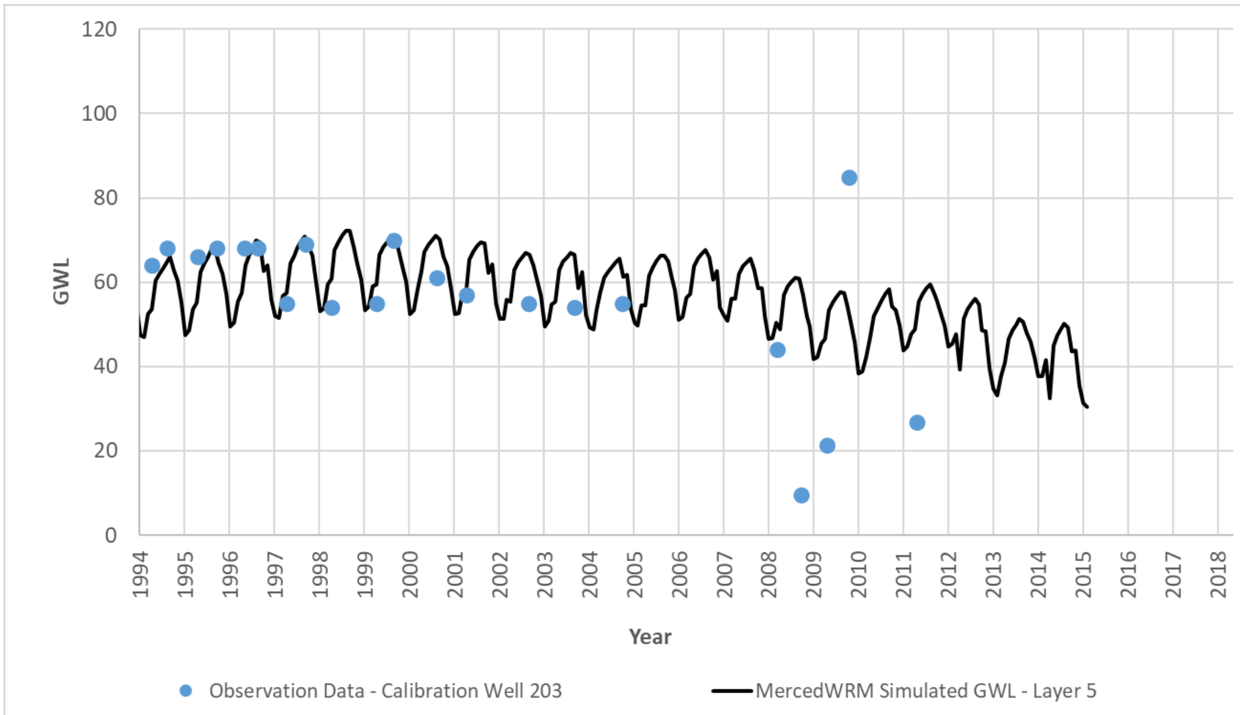


Figure A3: Calibration Well 203

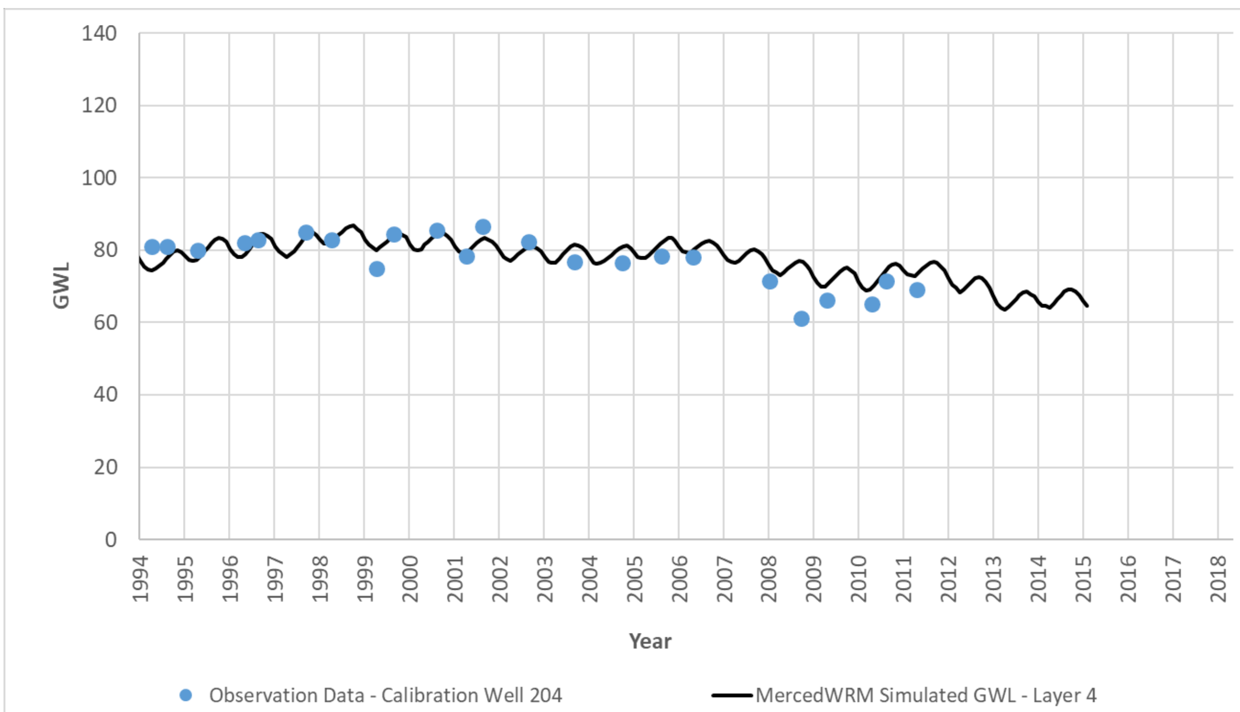


Figure A4: Calibration Well 204

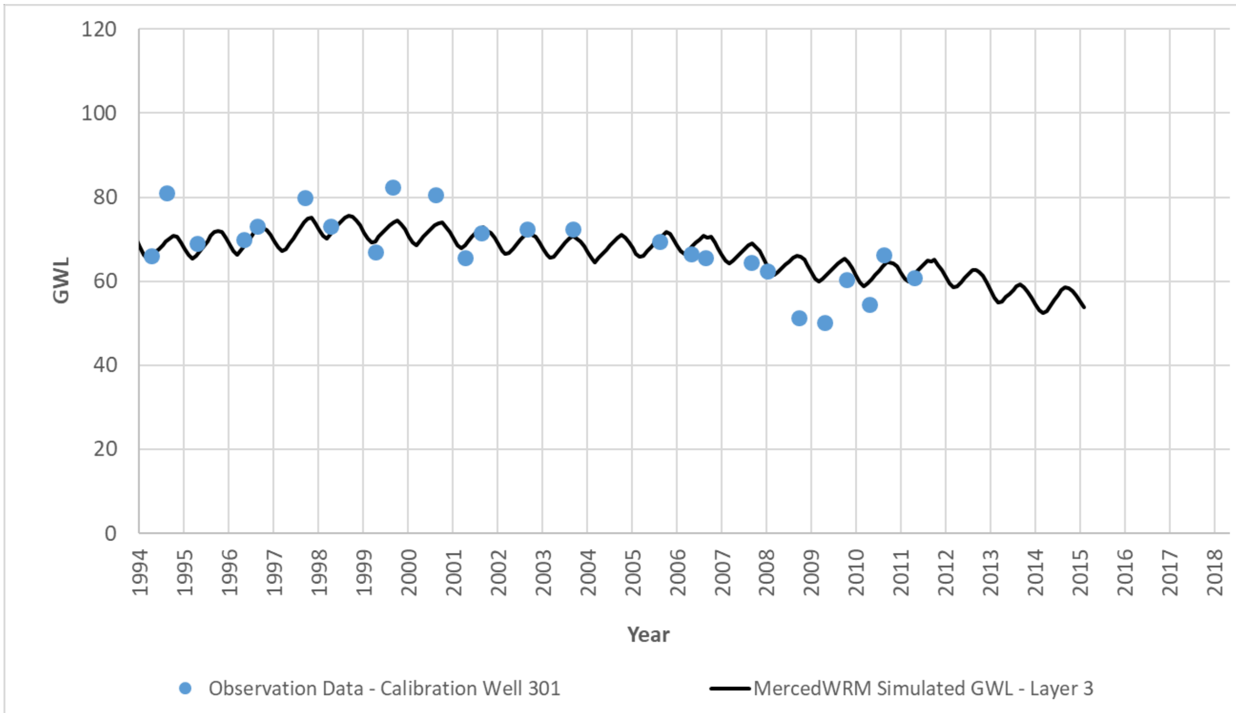


Figure A5: Calibration Well 301

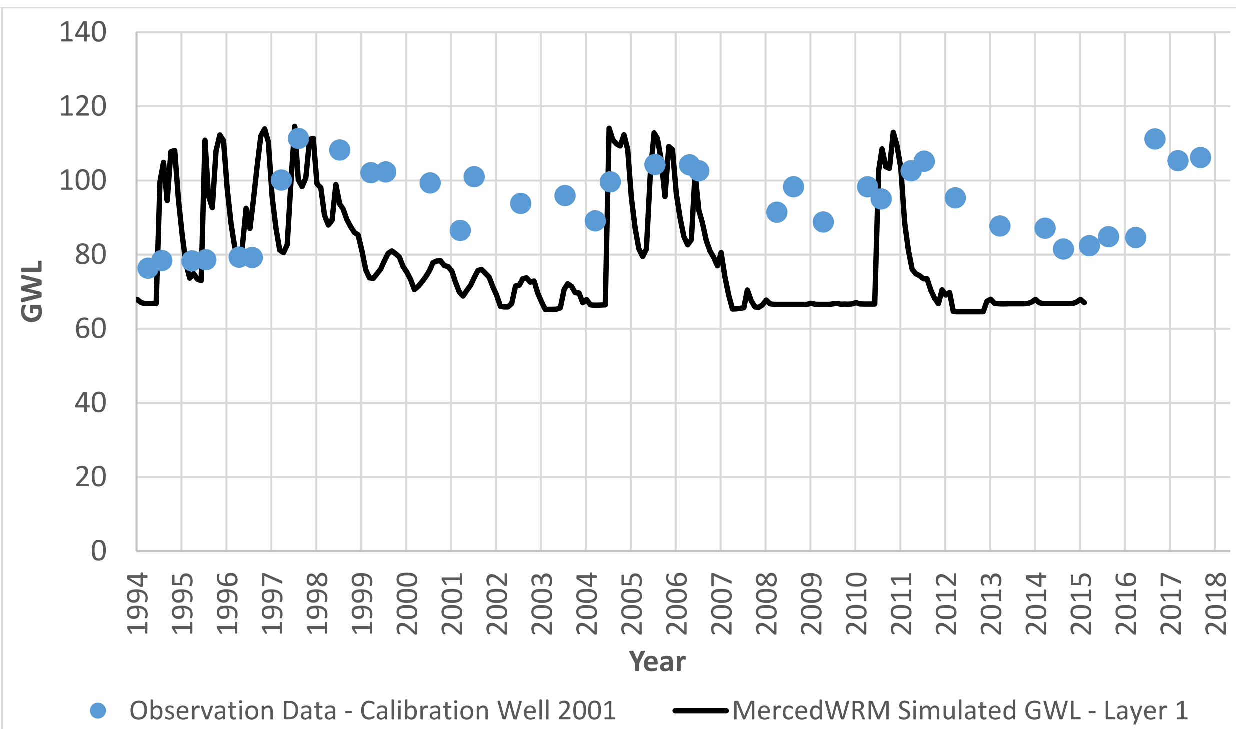


Figure A 6: Calibration Well 401

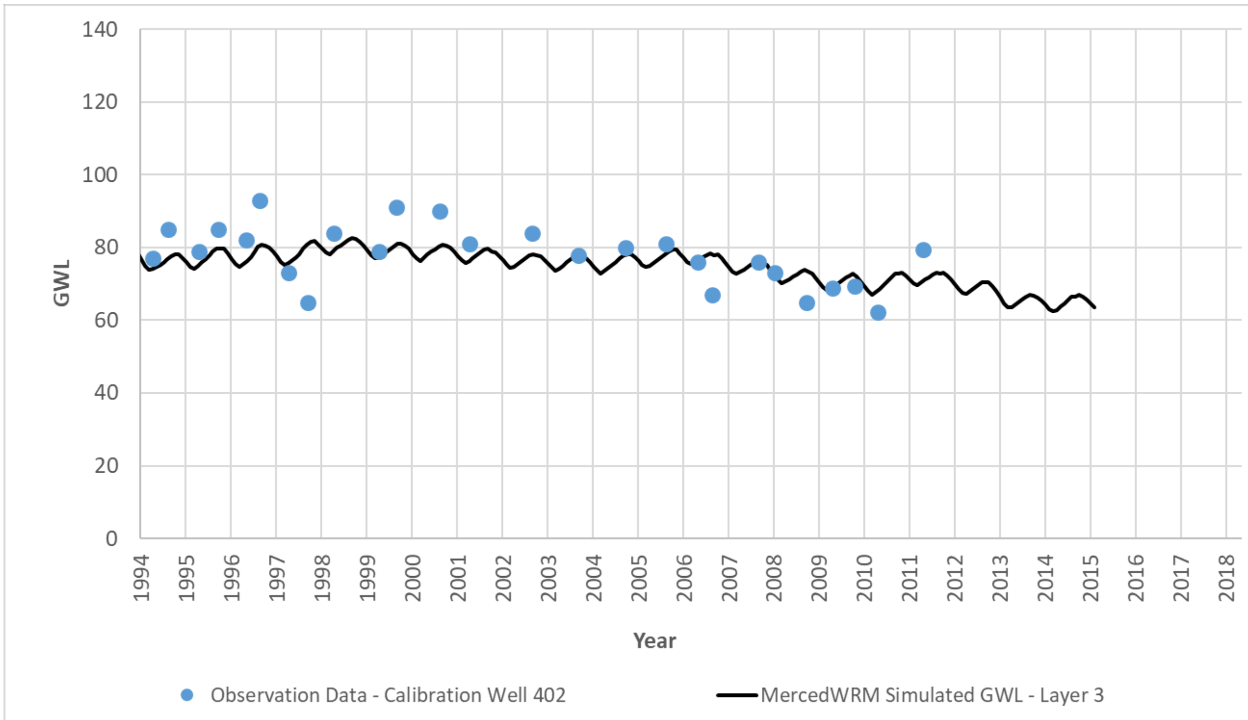


Figure A 7: Calibration Well 402

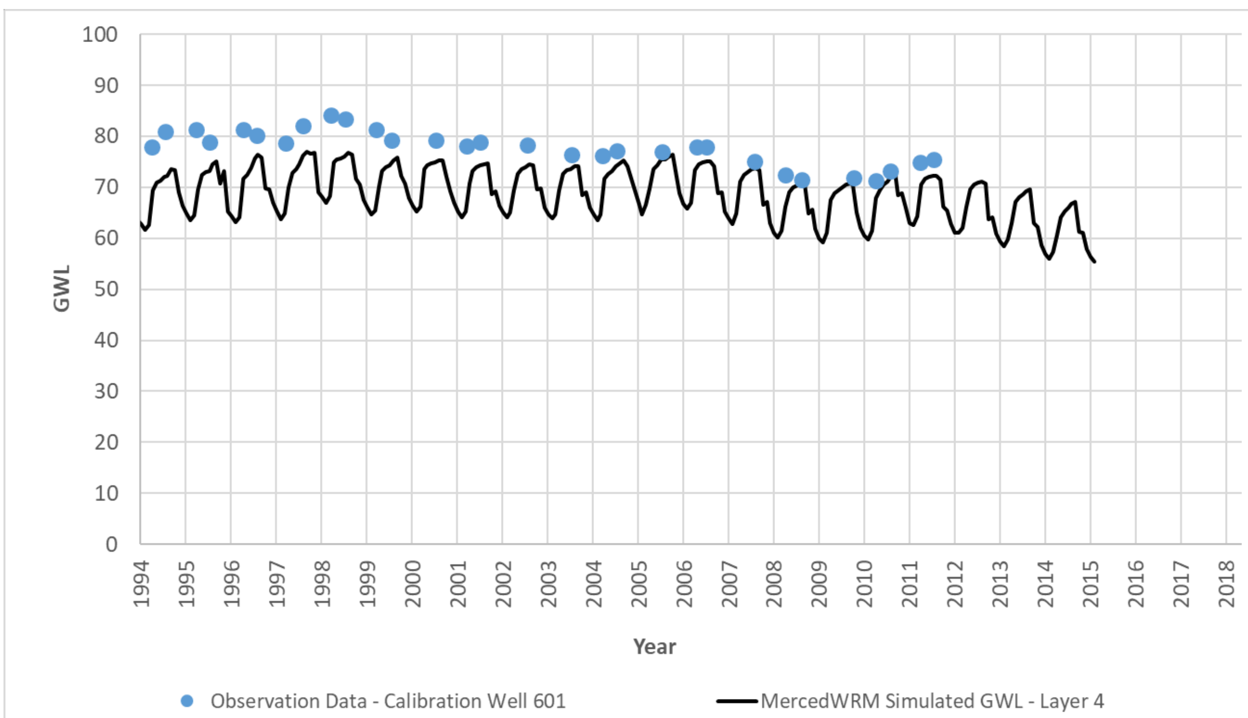


Figure A 8: Calibration Well 601

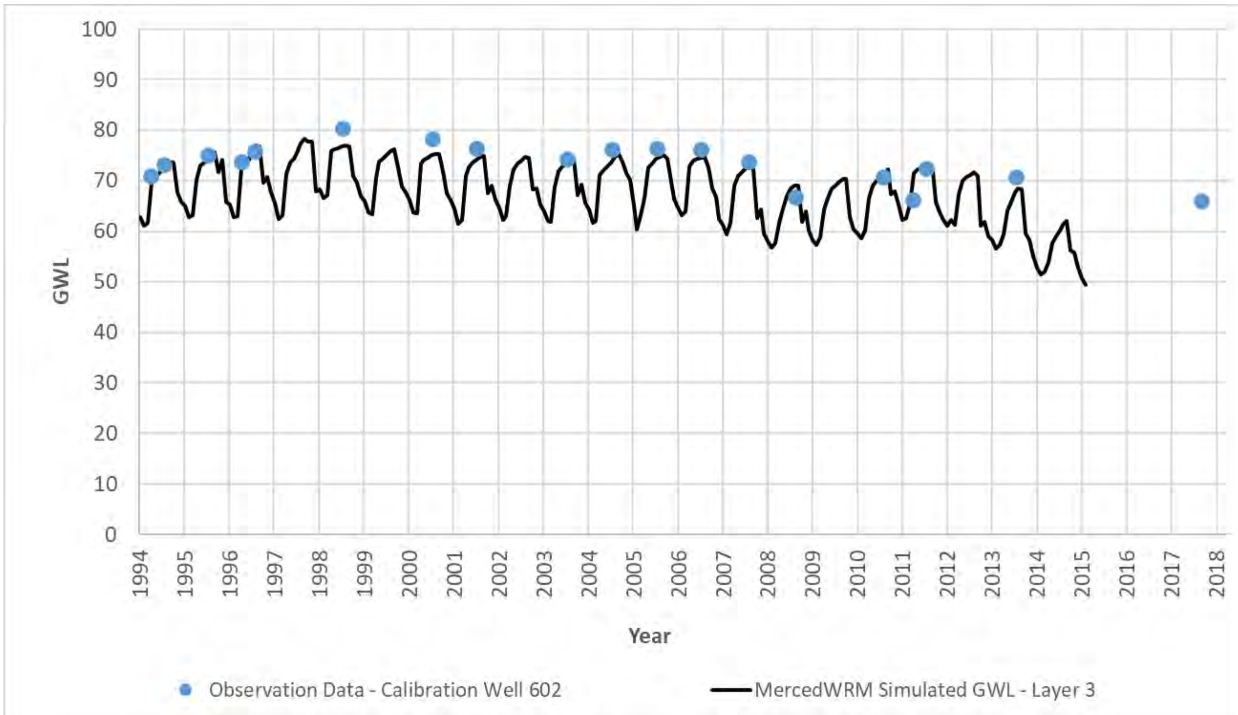


Figure A 9: Calibration Well 602

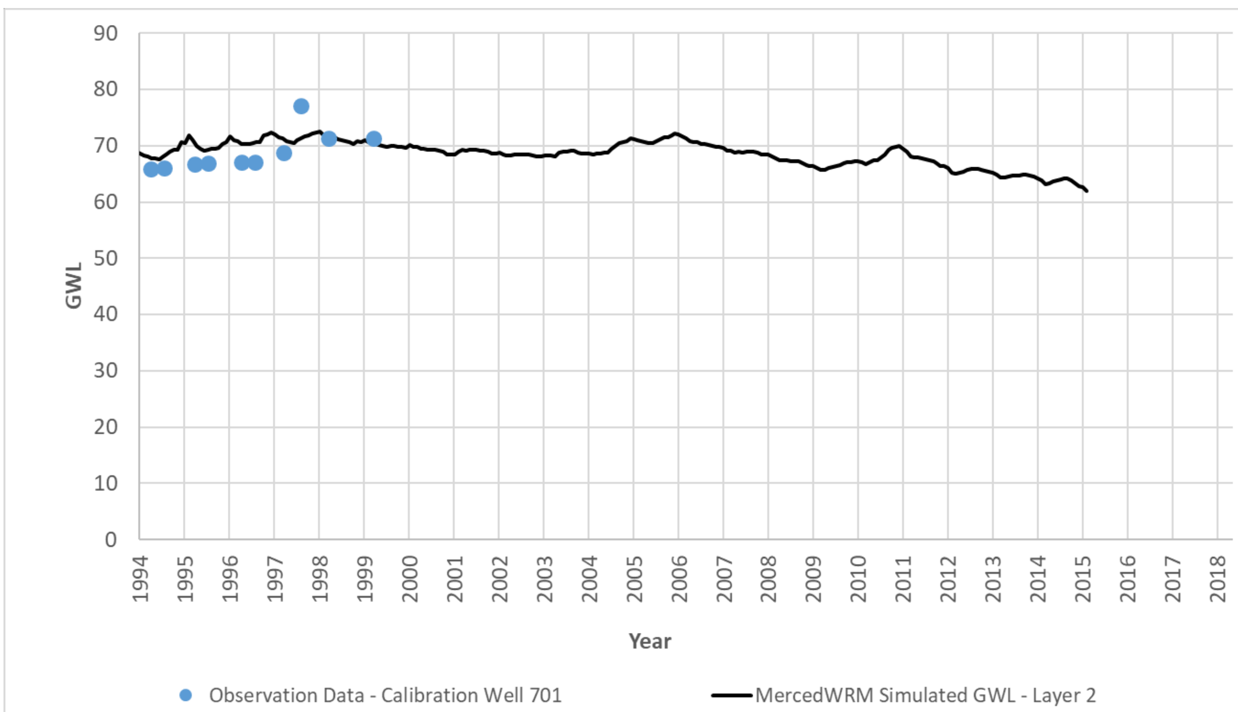


Figure A 10: Calibration Well 701

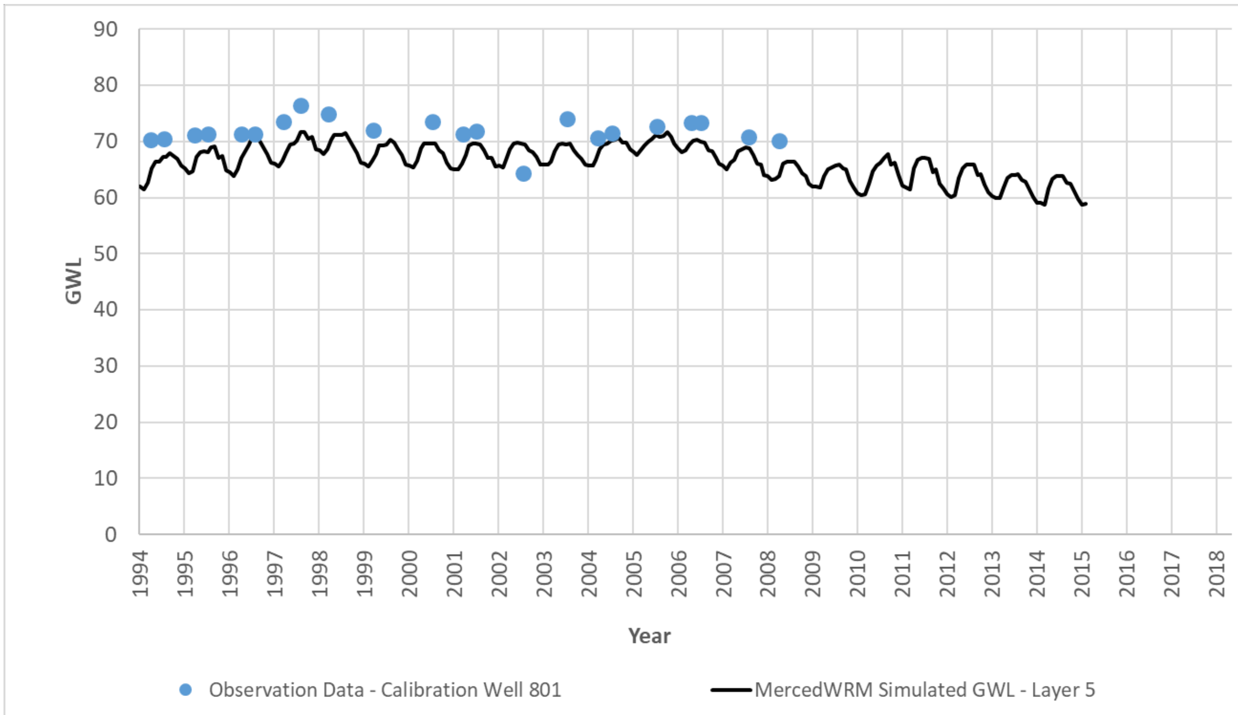


Figure A 11: Calibration Well 801

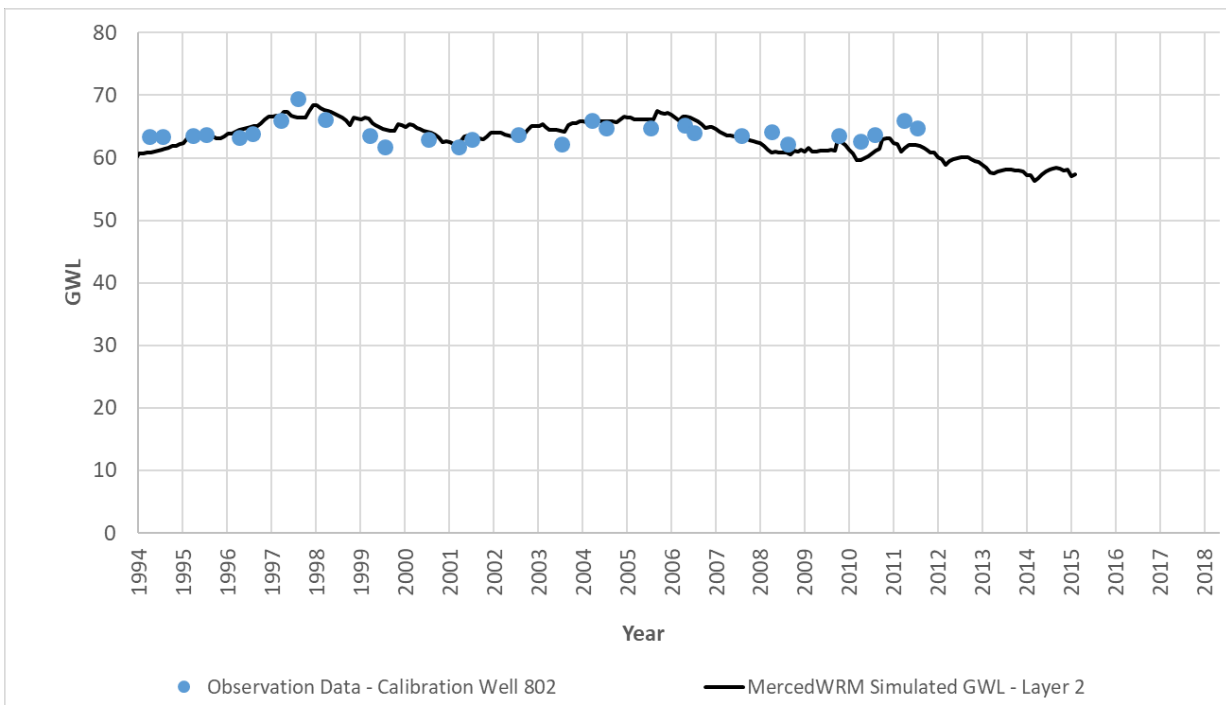


Figure A 12: Calibration Well 802

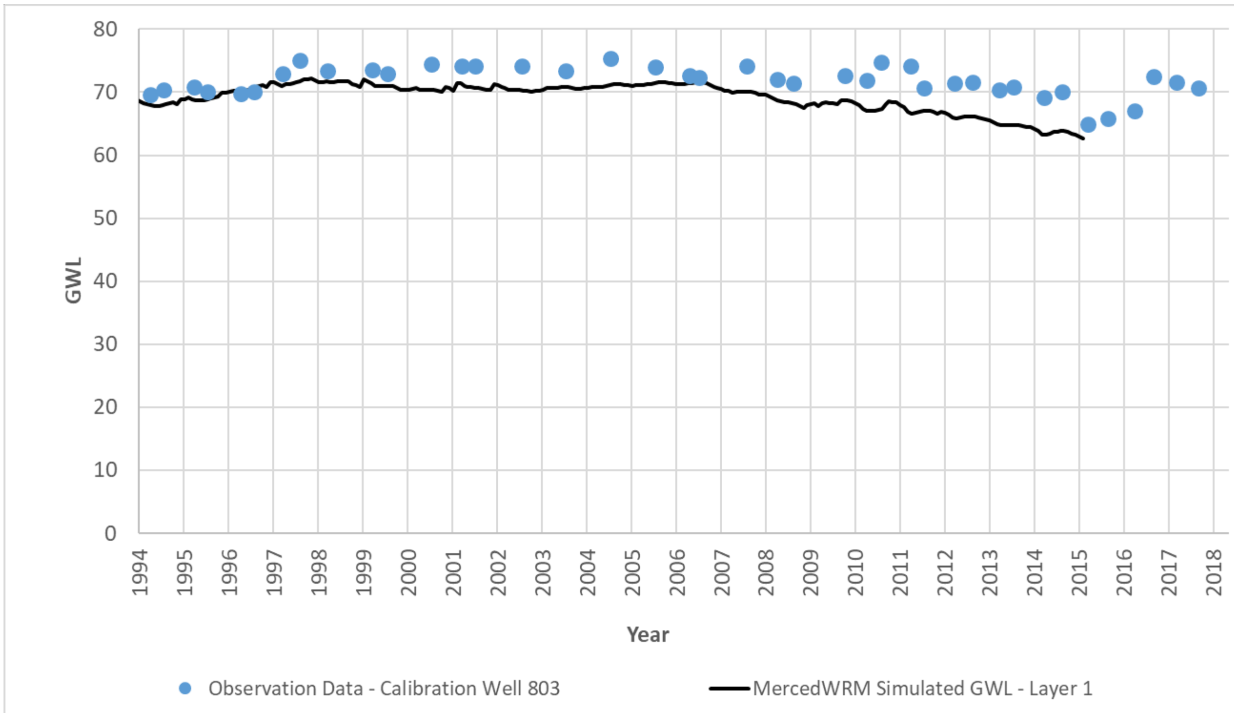


Figure A 13: Calibration Well 803

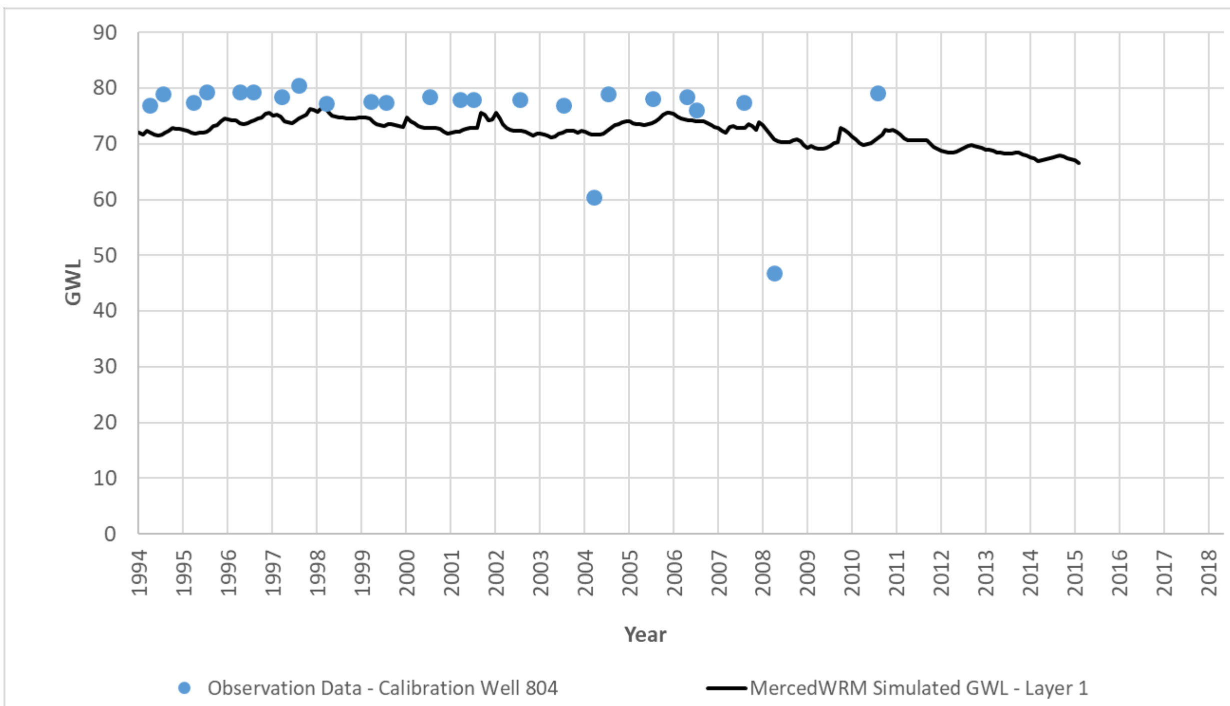


Figure A 14: Calibration Well 804

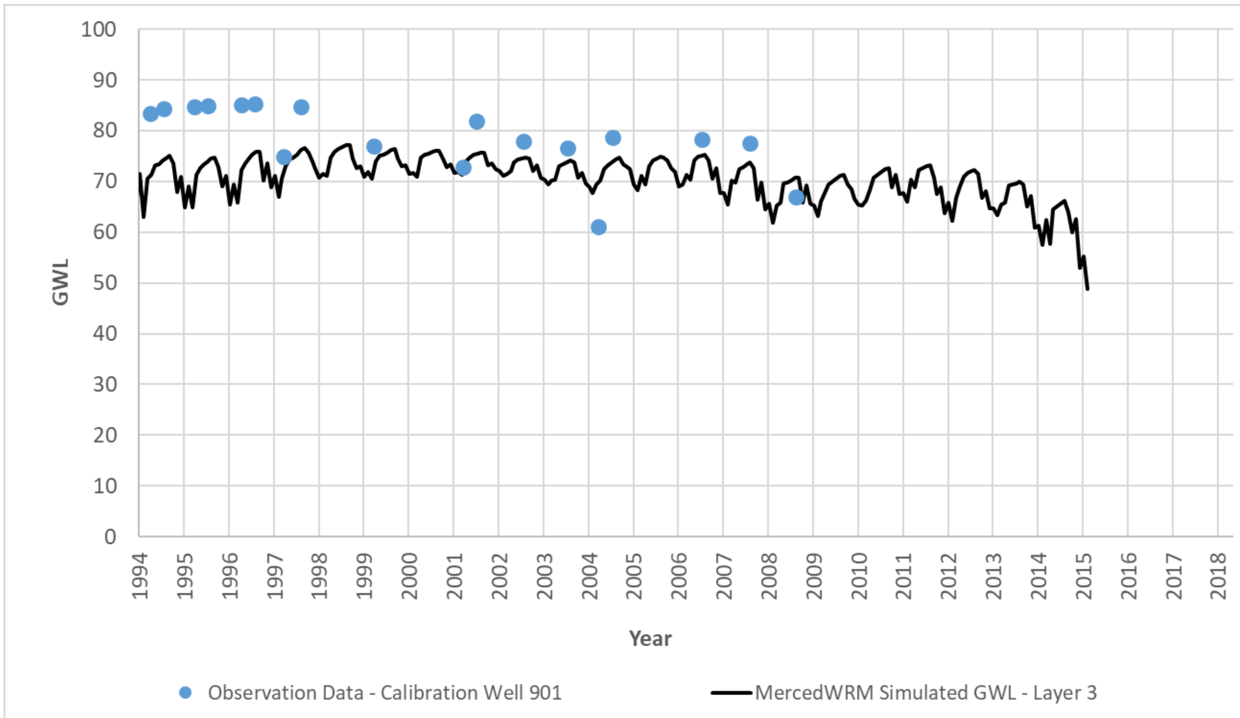


Figure A 15: Calibration Well 901

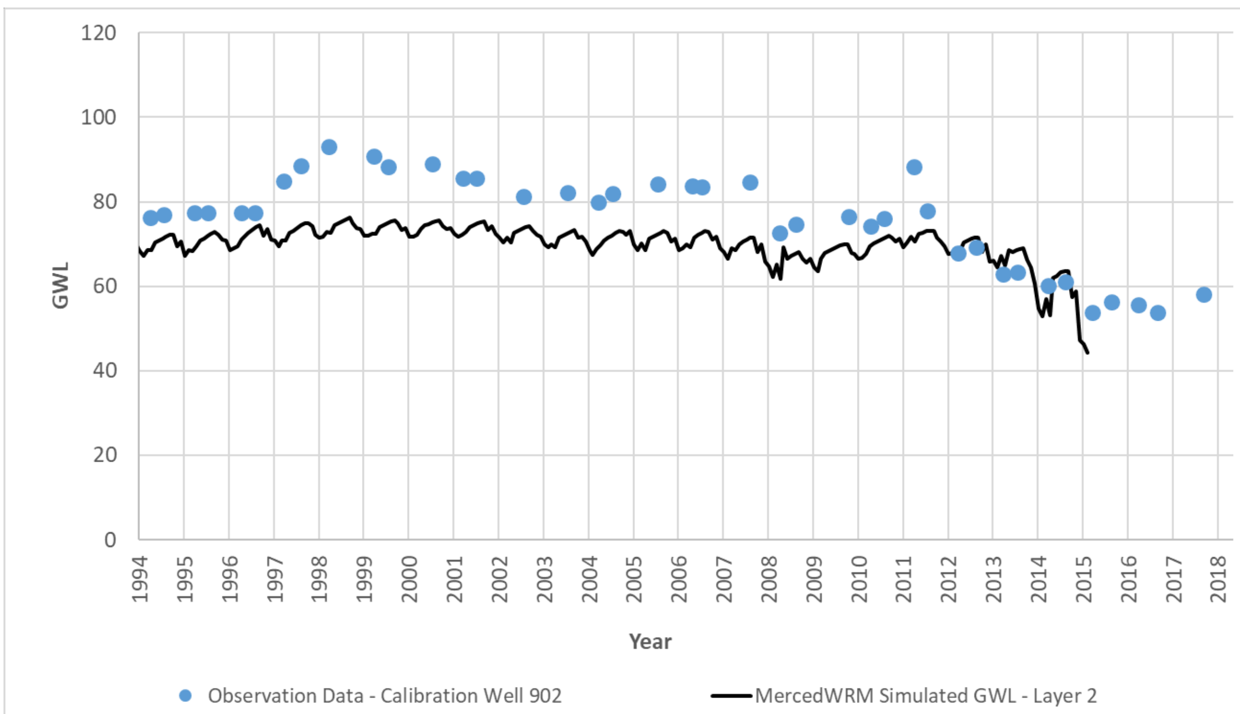


Figure A 16: Calibration Well 902

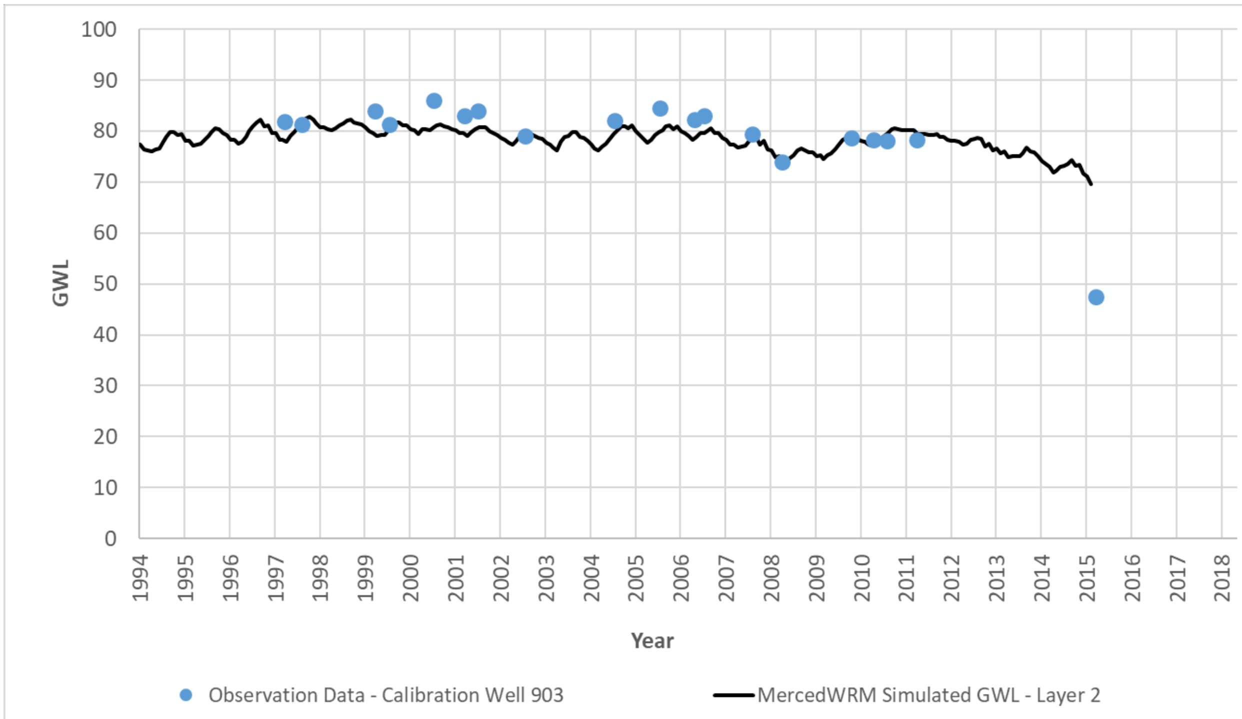


Figure A 17: Calibration Well 903

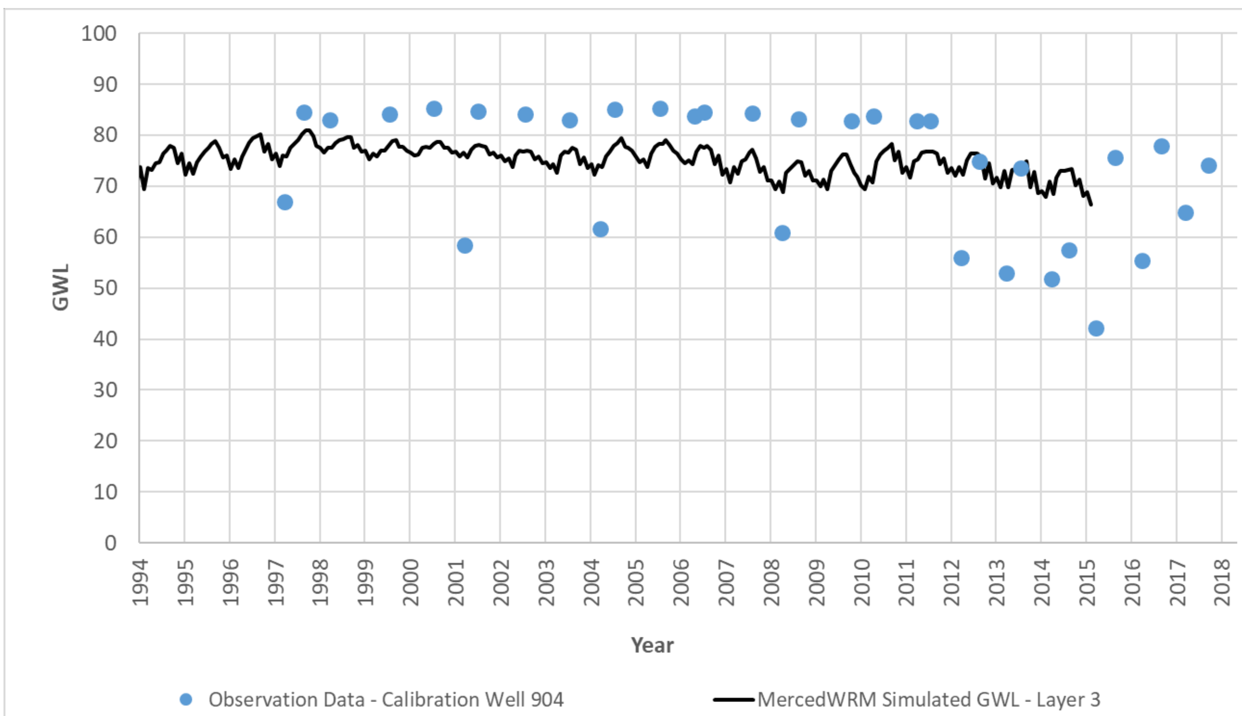


Figure A 18: Calibration Well 904

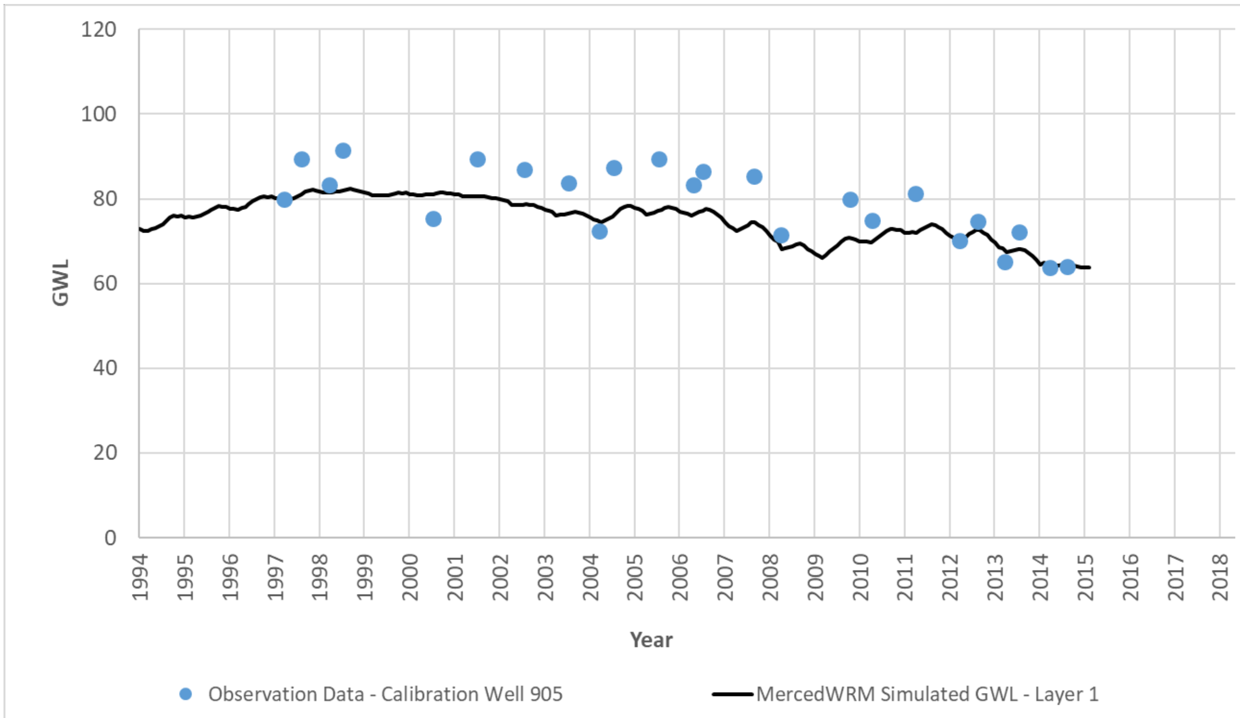


Figure A 19: Calibration Well 905

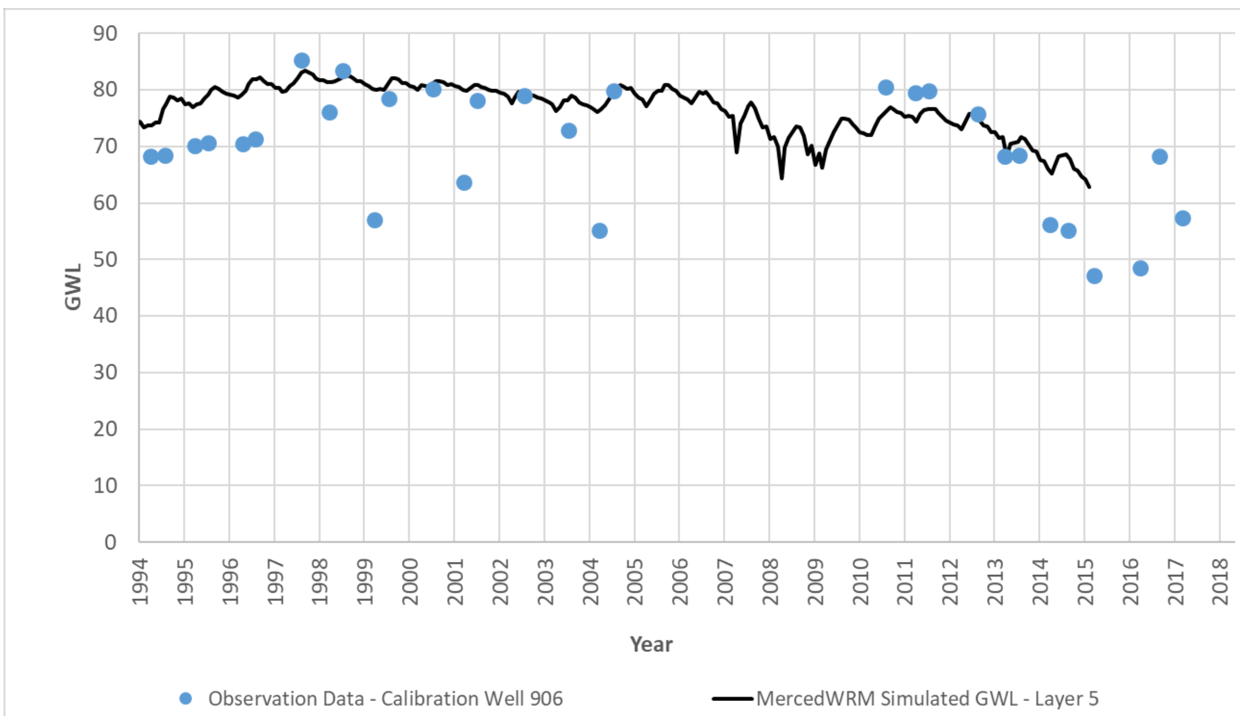


Figure A 20: Calibration Well 906

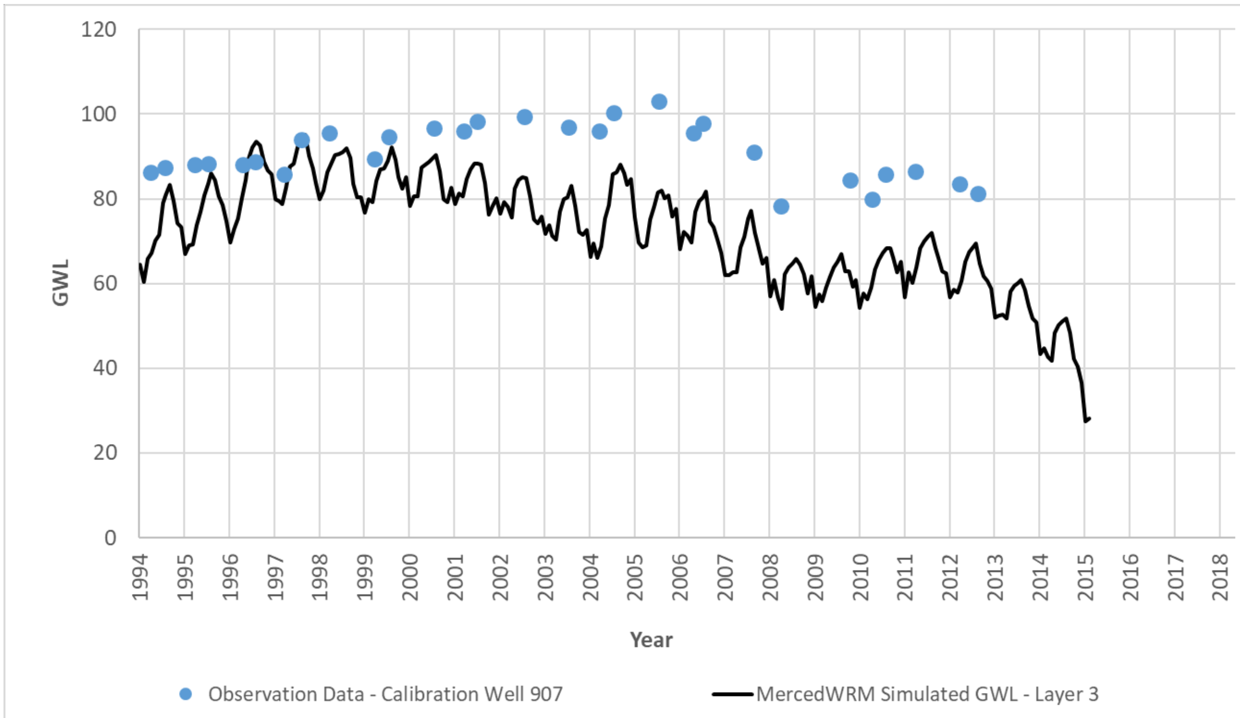


Figure A 21: Calibration Well 907

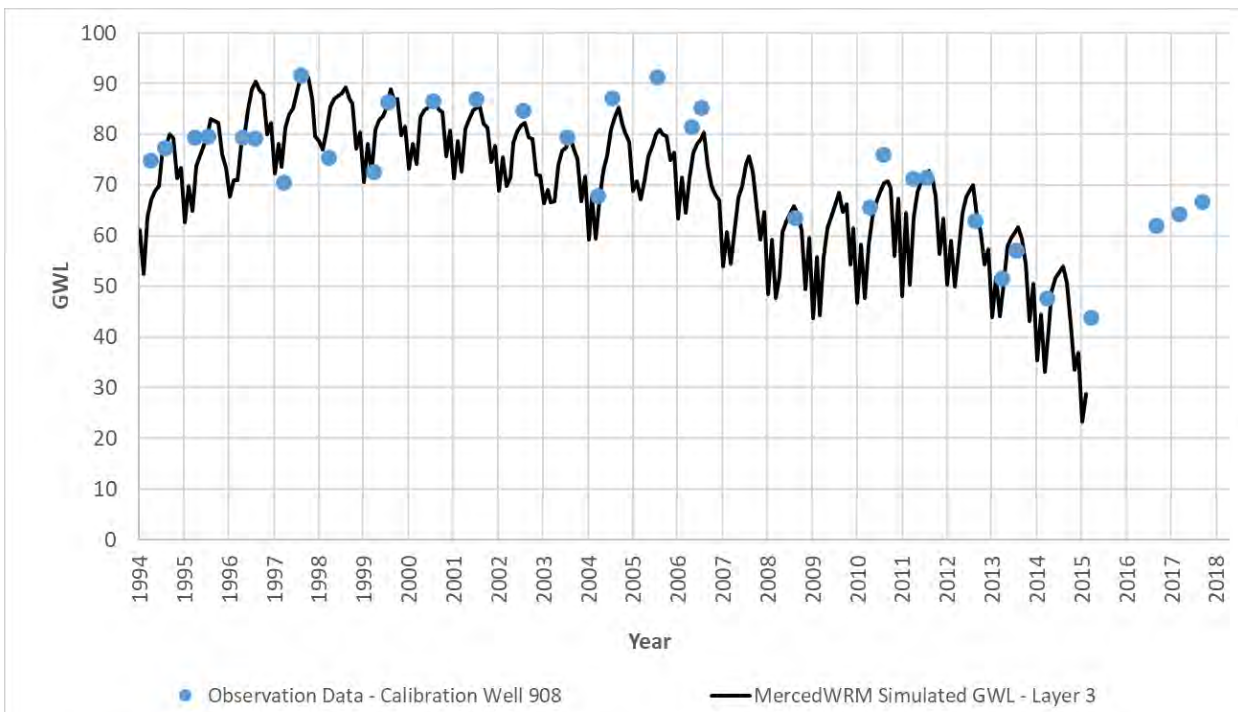


Figure A 22: Calibration Well 908

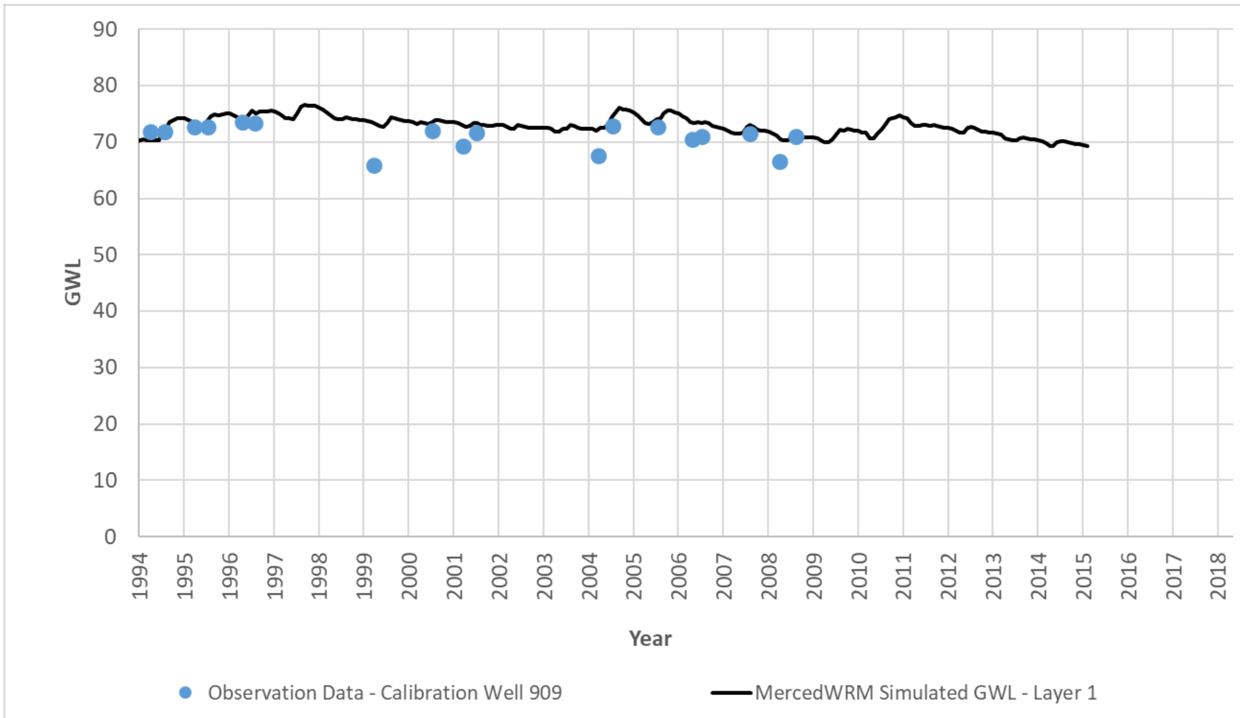


Figure A 23: Calibration Well 909

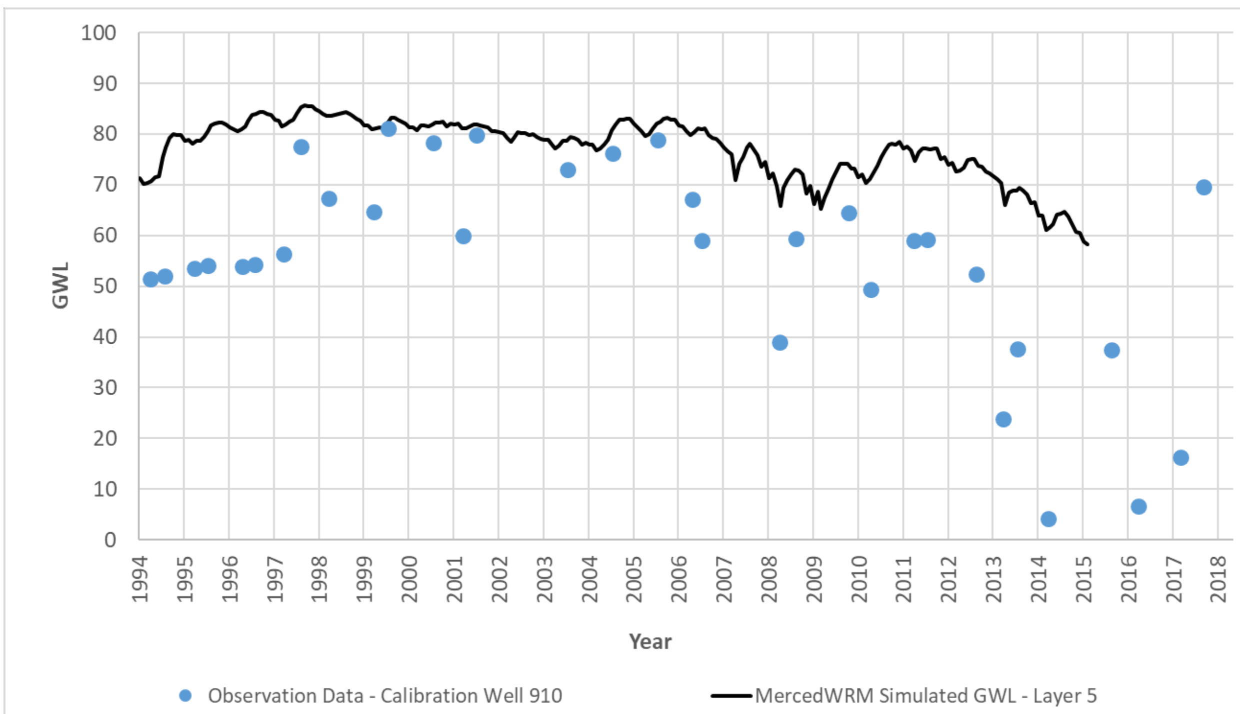


Figure A 24: Calibration Well 910

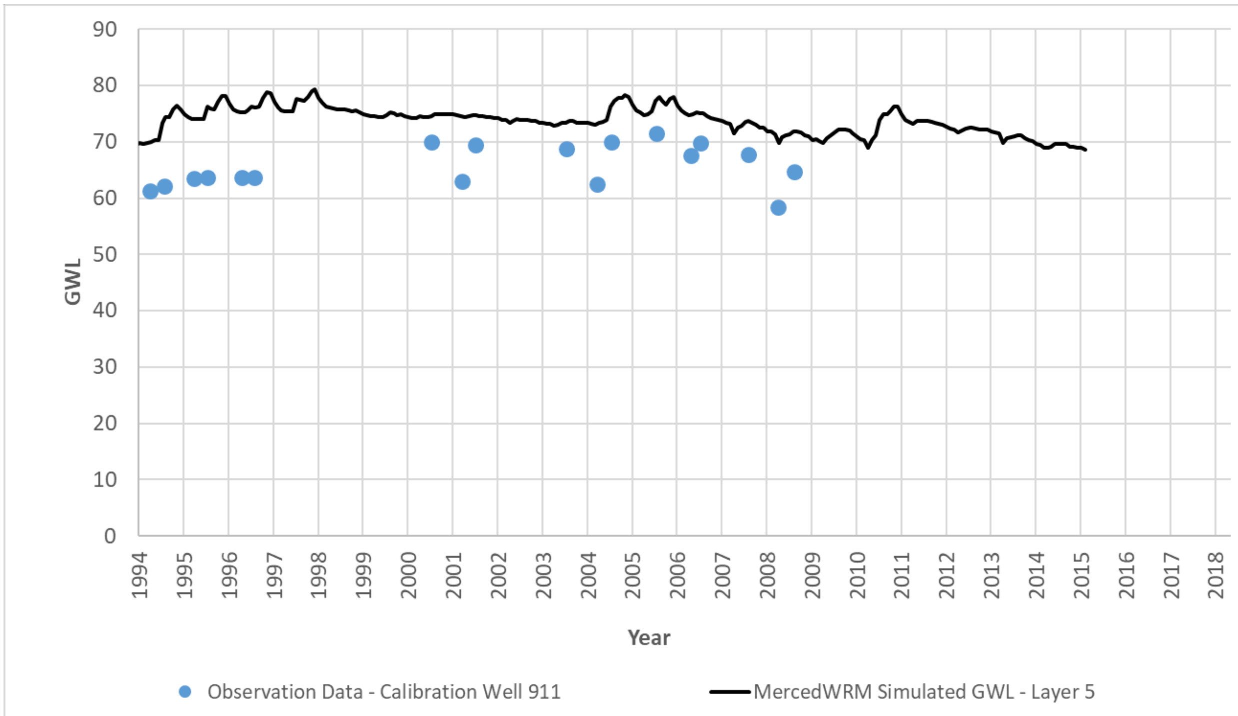


Figure A 25: Calibration Well 911

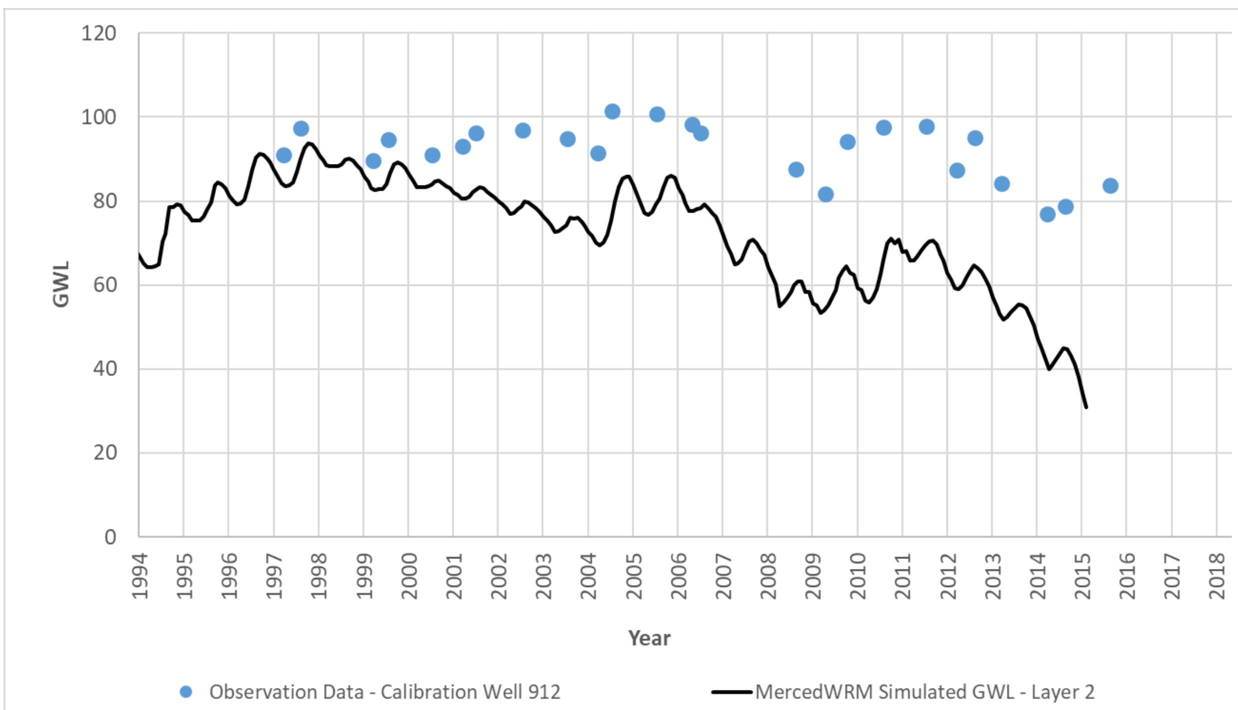


Figure A 26: Calibration Well 912

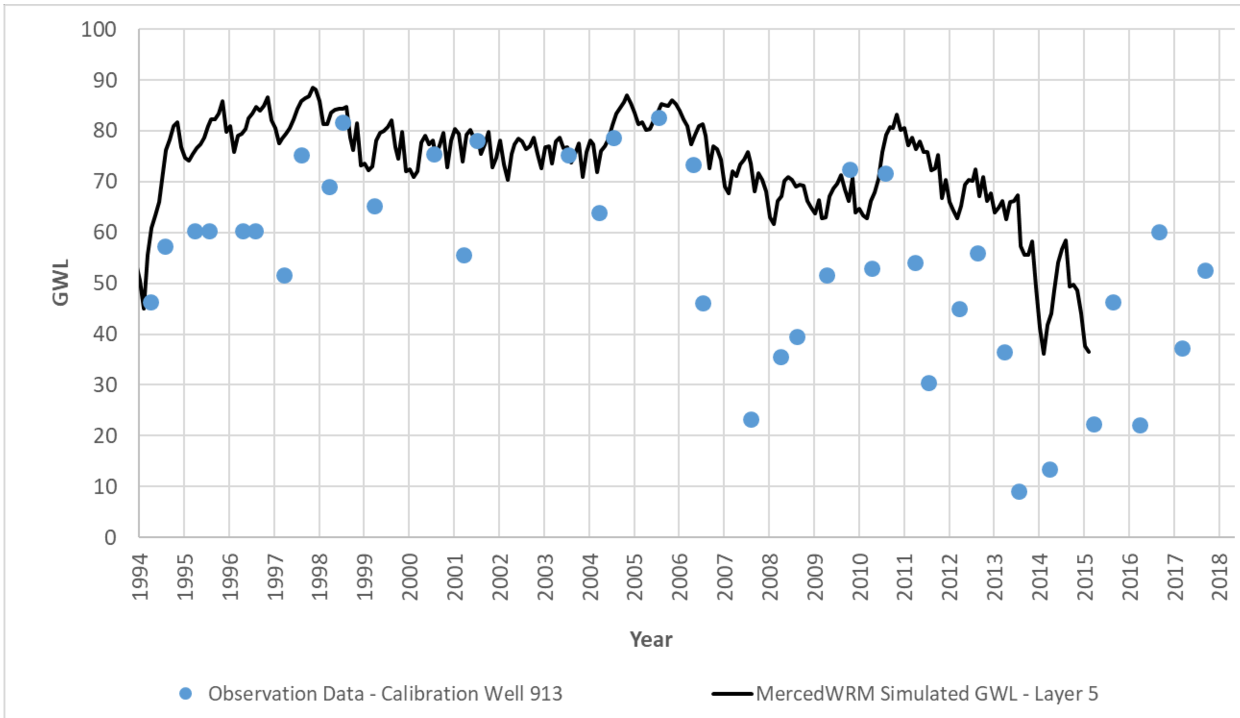


Figure A 27: Calibration Well 913

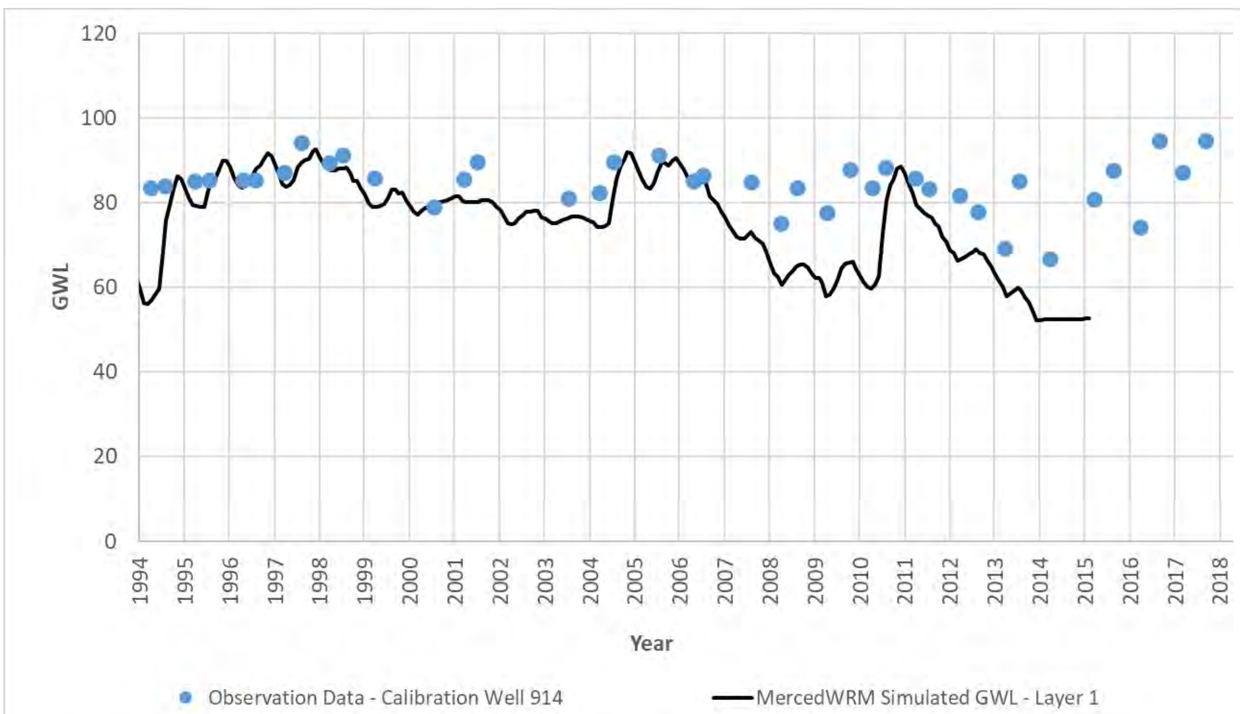


Figure A 28: Calibration Well 914

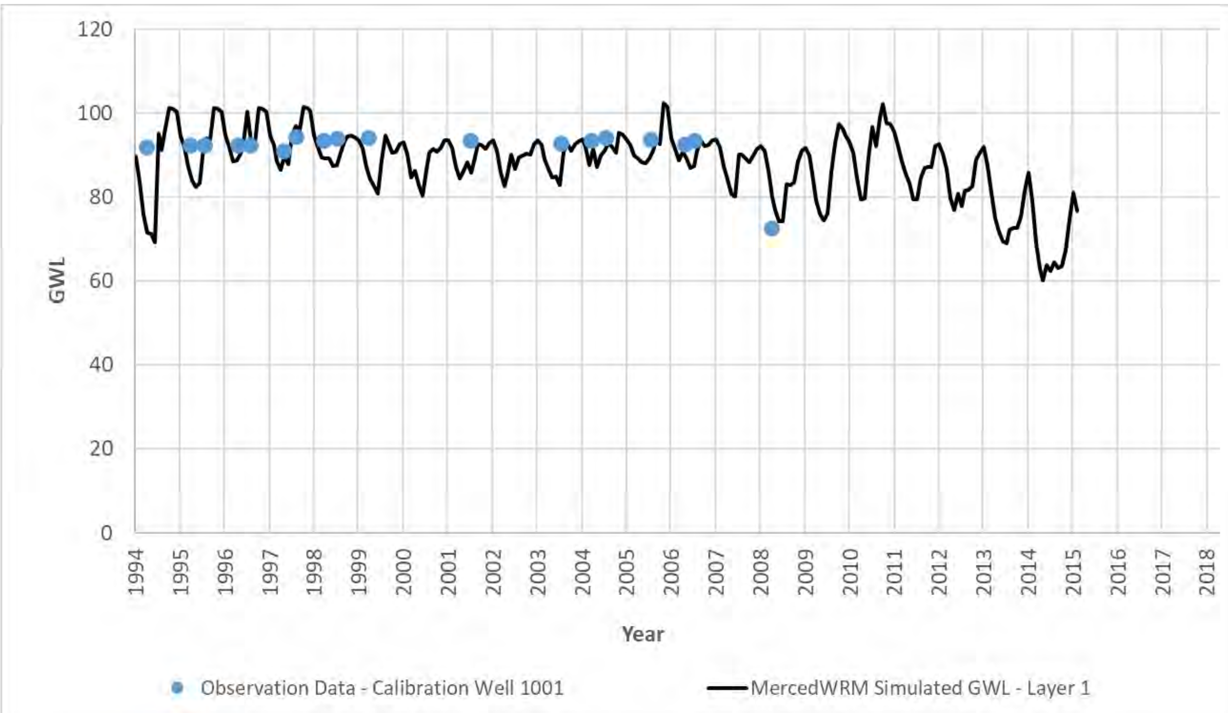


Figure A 29: Calibration Well 1001

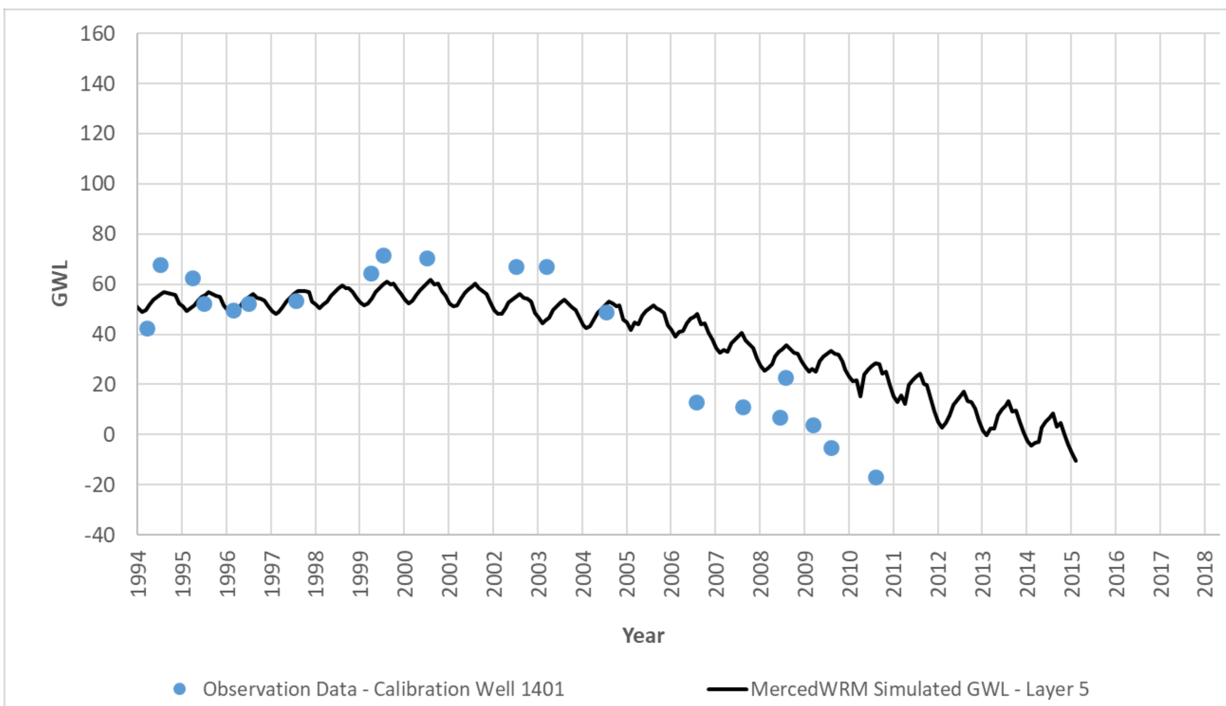


Figure A 30: Calibration Well 1401

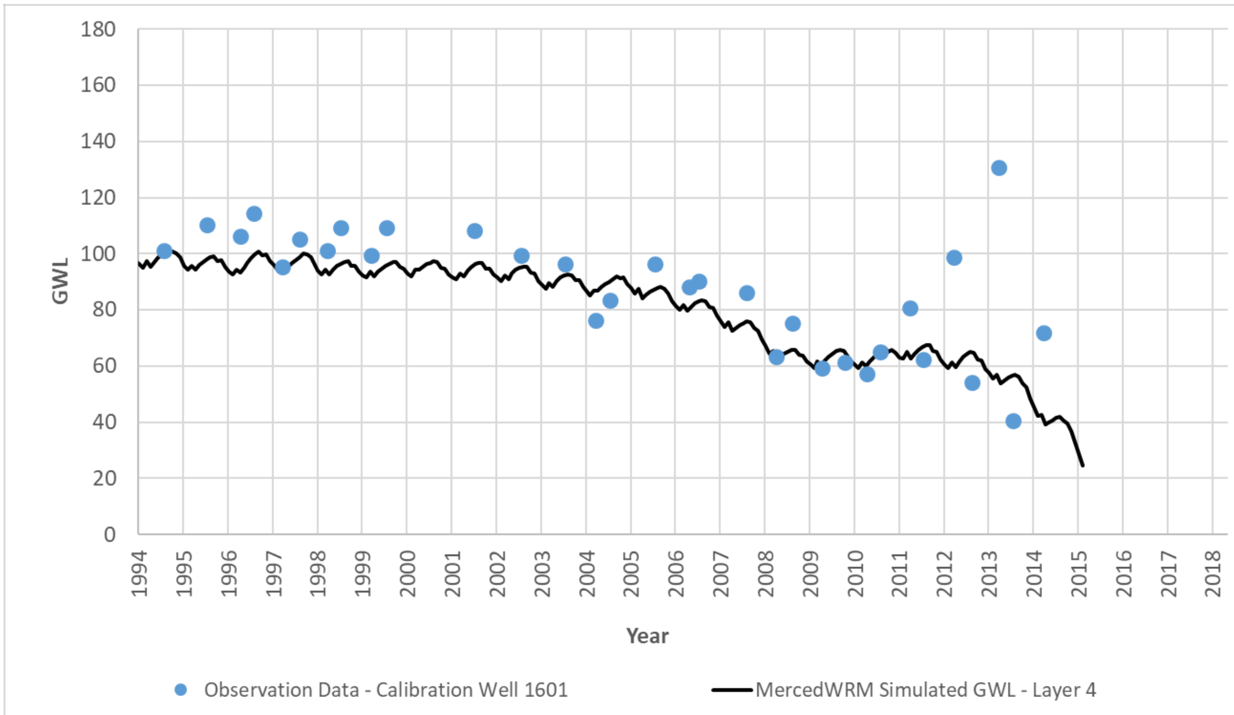


Figure A 31: Calibration Well 1601

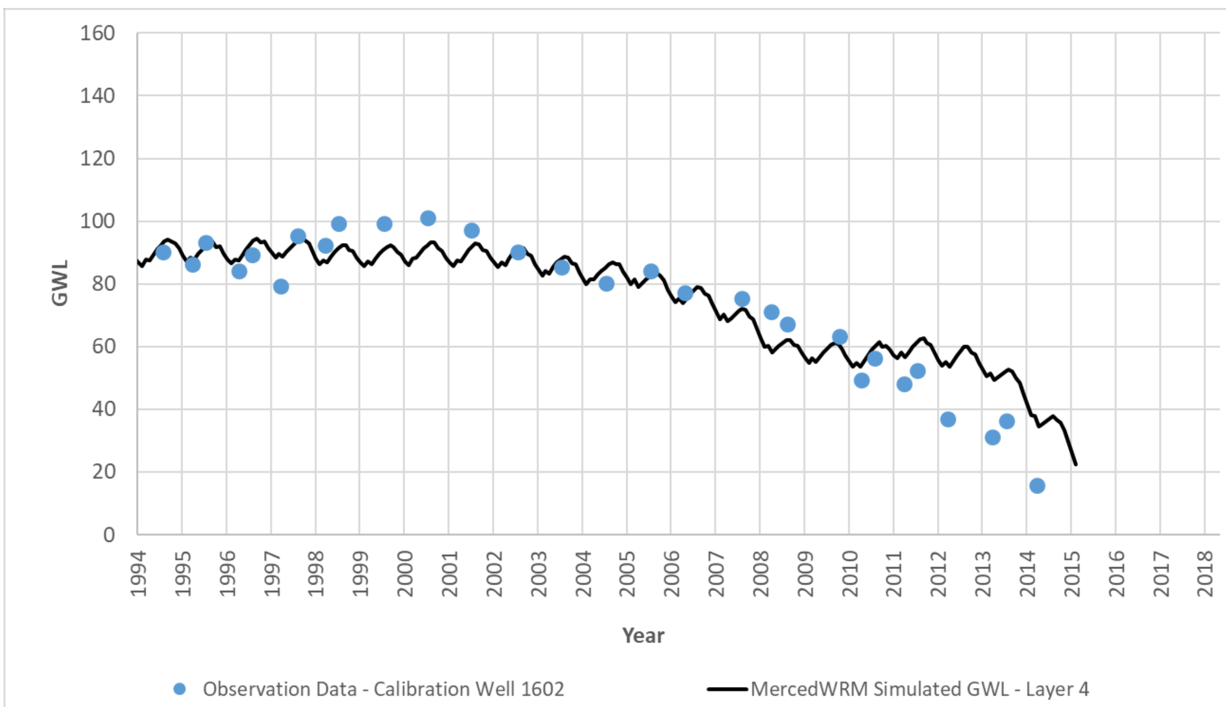


Figure A 32: Calibration Well 1602

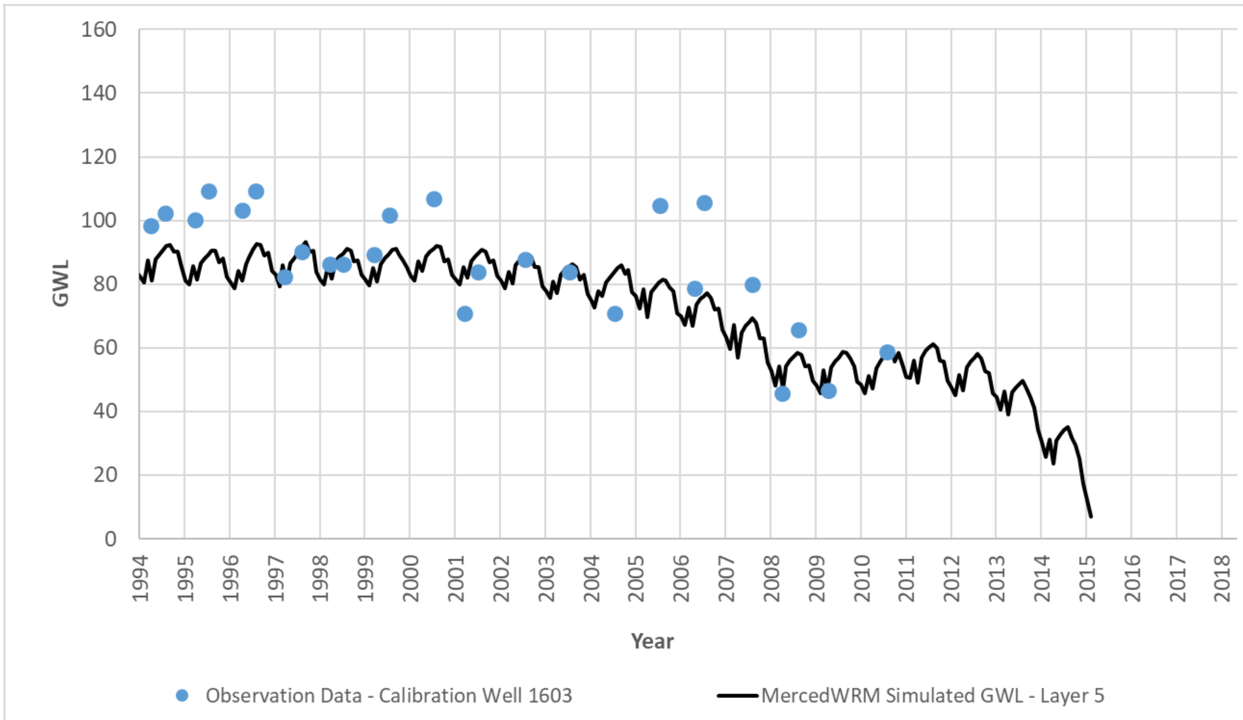


Figure A 33: Calibration Well 1603

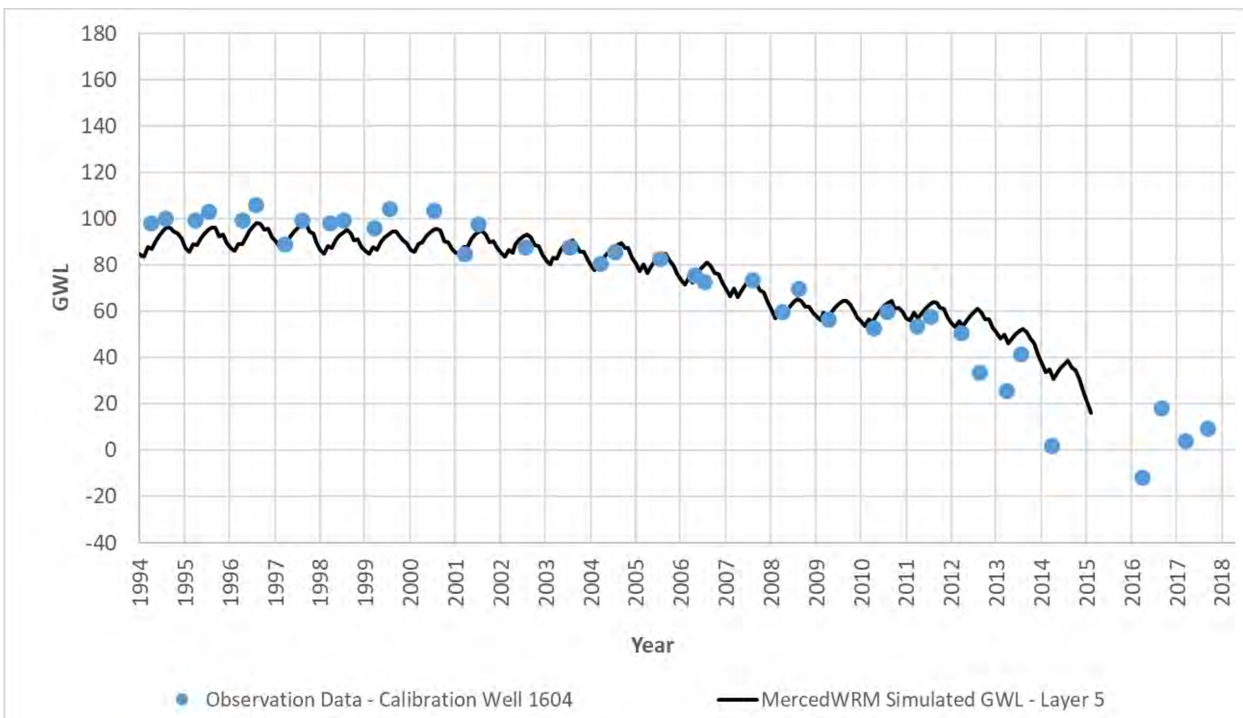


Figure A 34: Calibration Well 1604

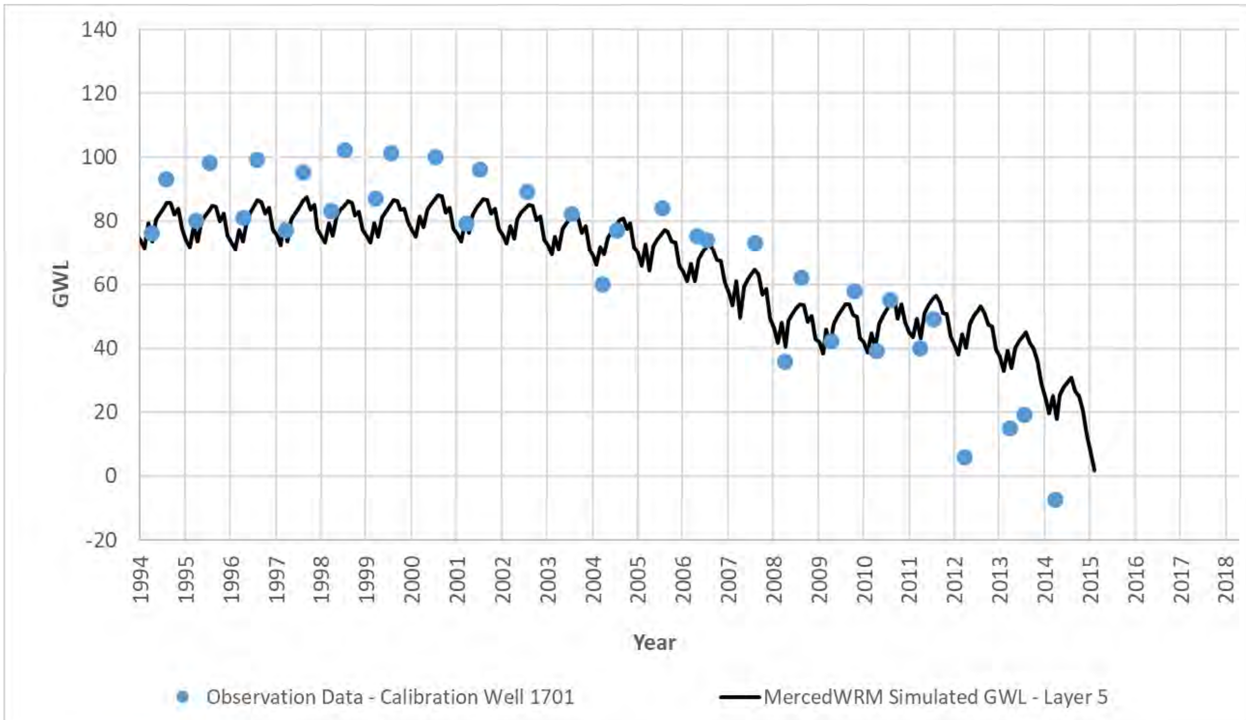


Figure A 35: Calibration Well 1701

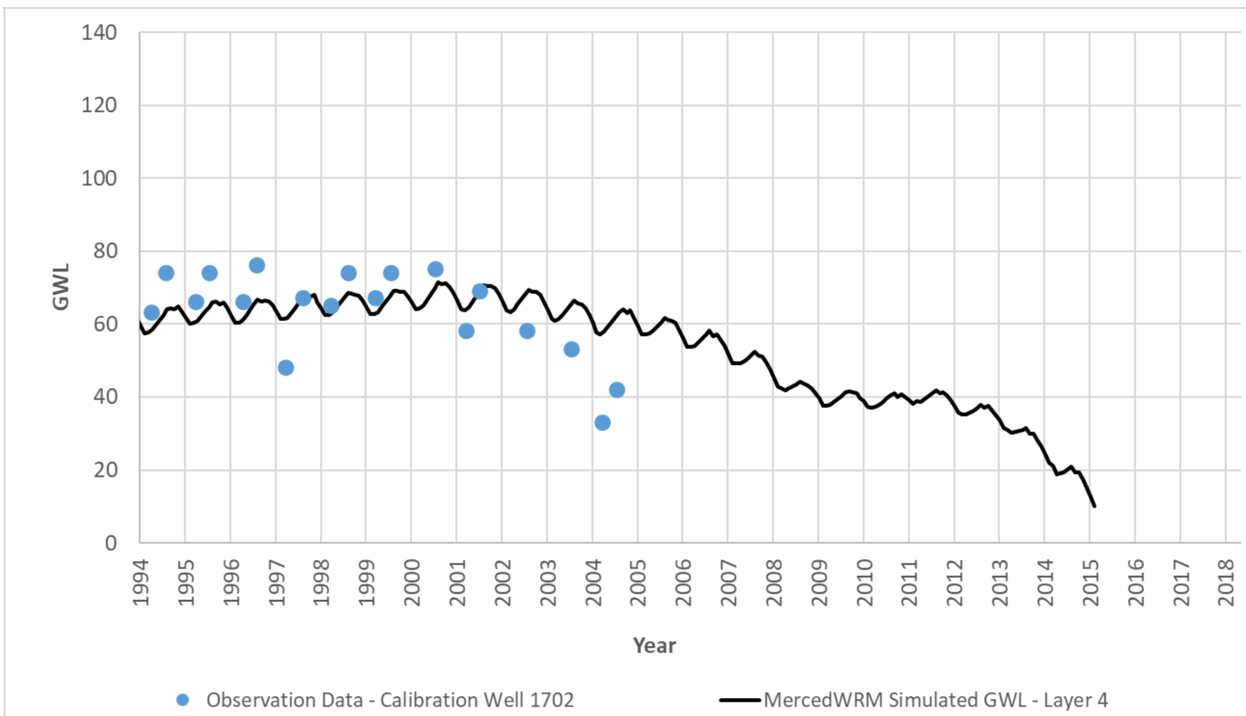


Figure A 36: Calibration Well 1702

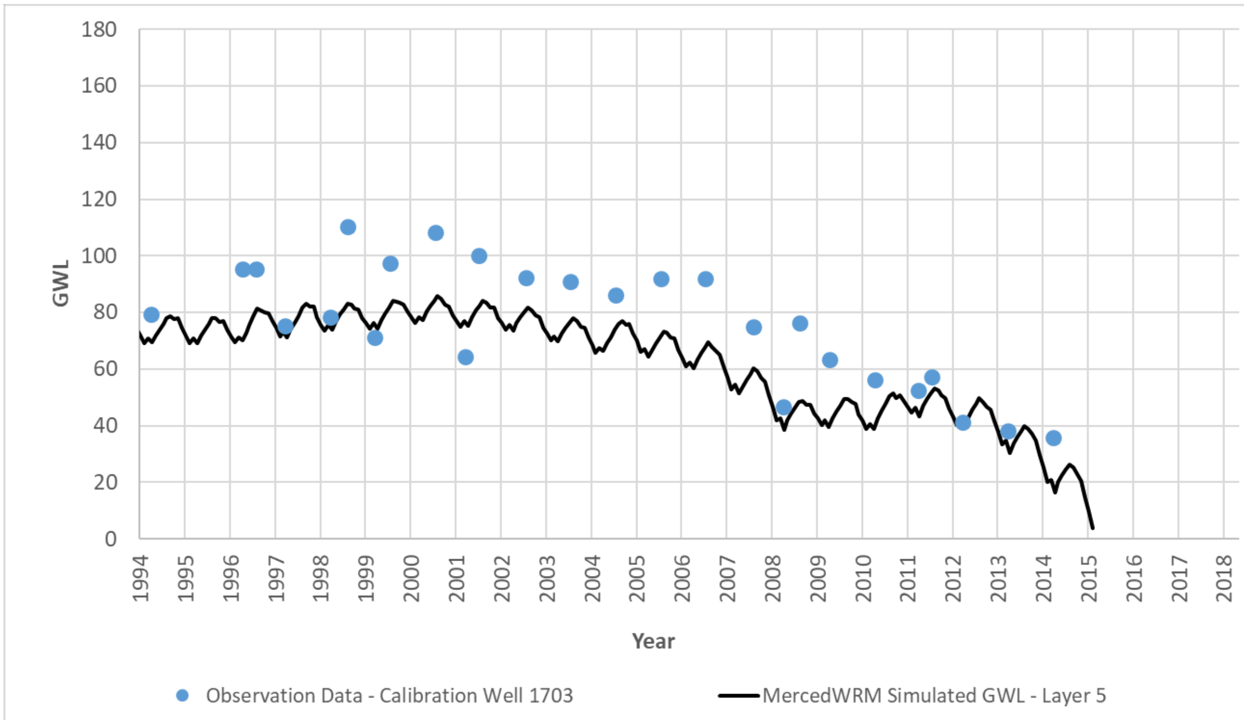


Figure A 37: Calibration Well 1703

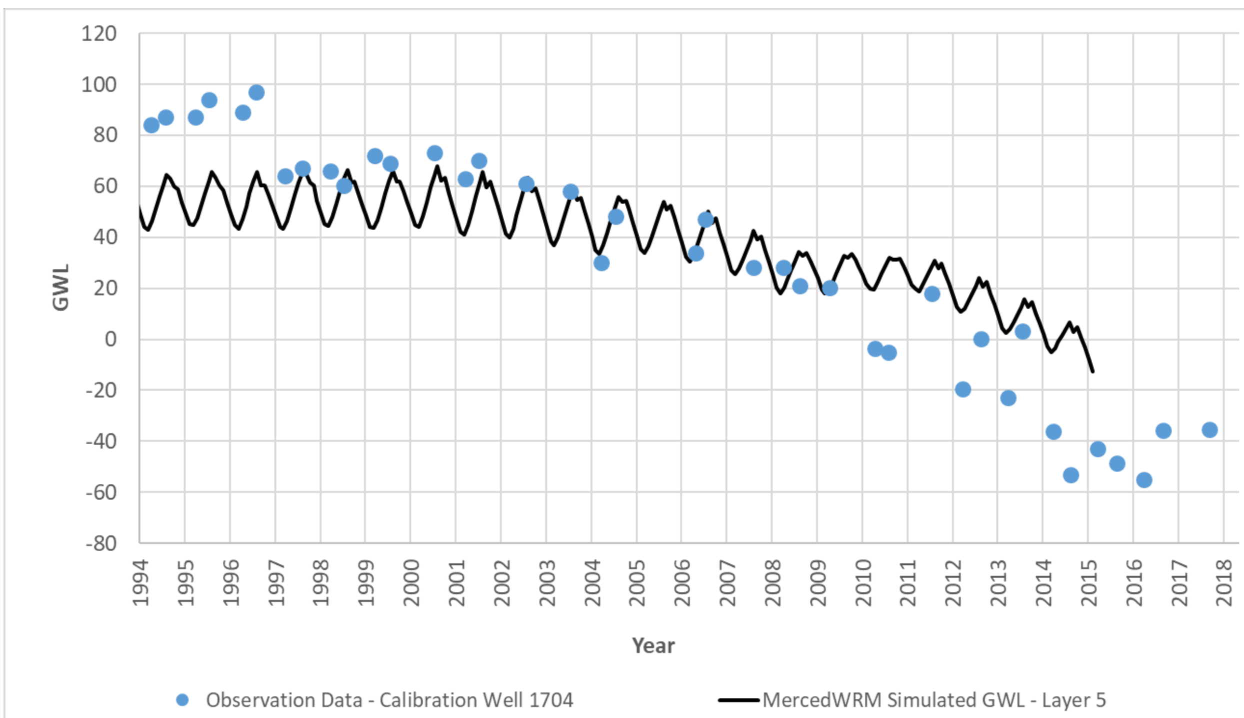


Figure A 38: Calibration Well 1704

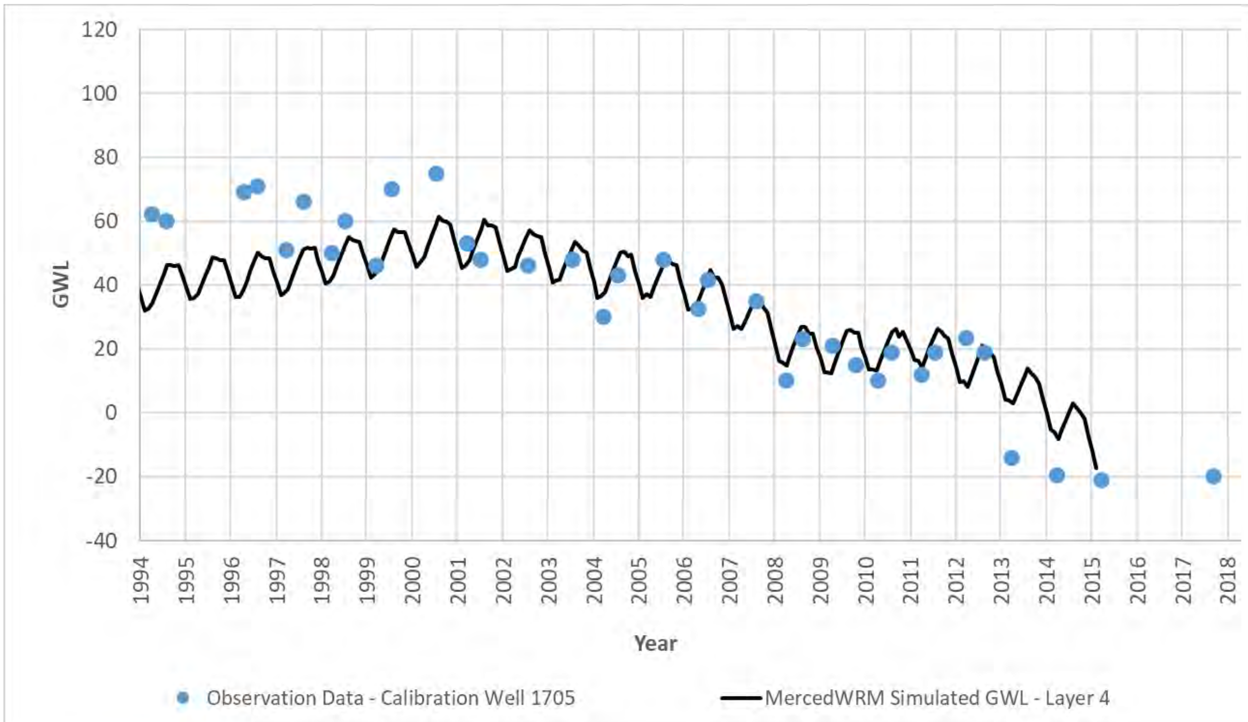


Figure A 39: Calibration Well 1705

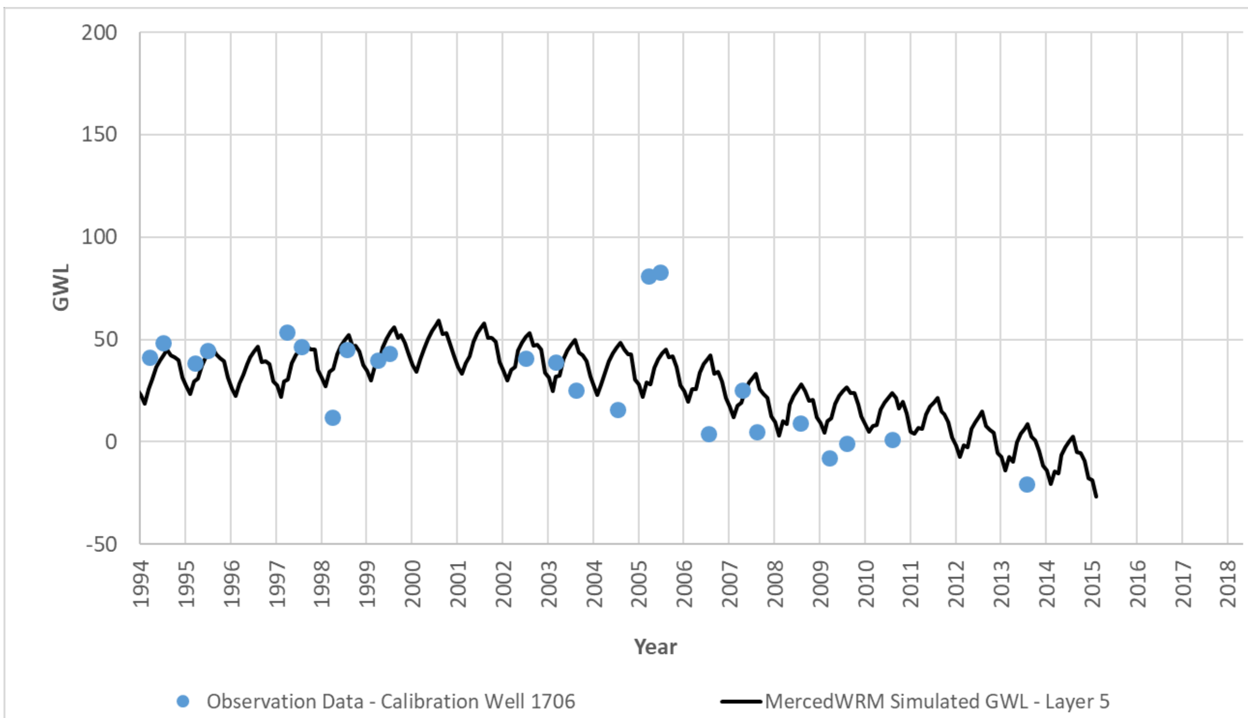


Figure A 40: Calibration Well 1706

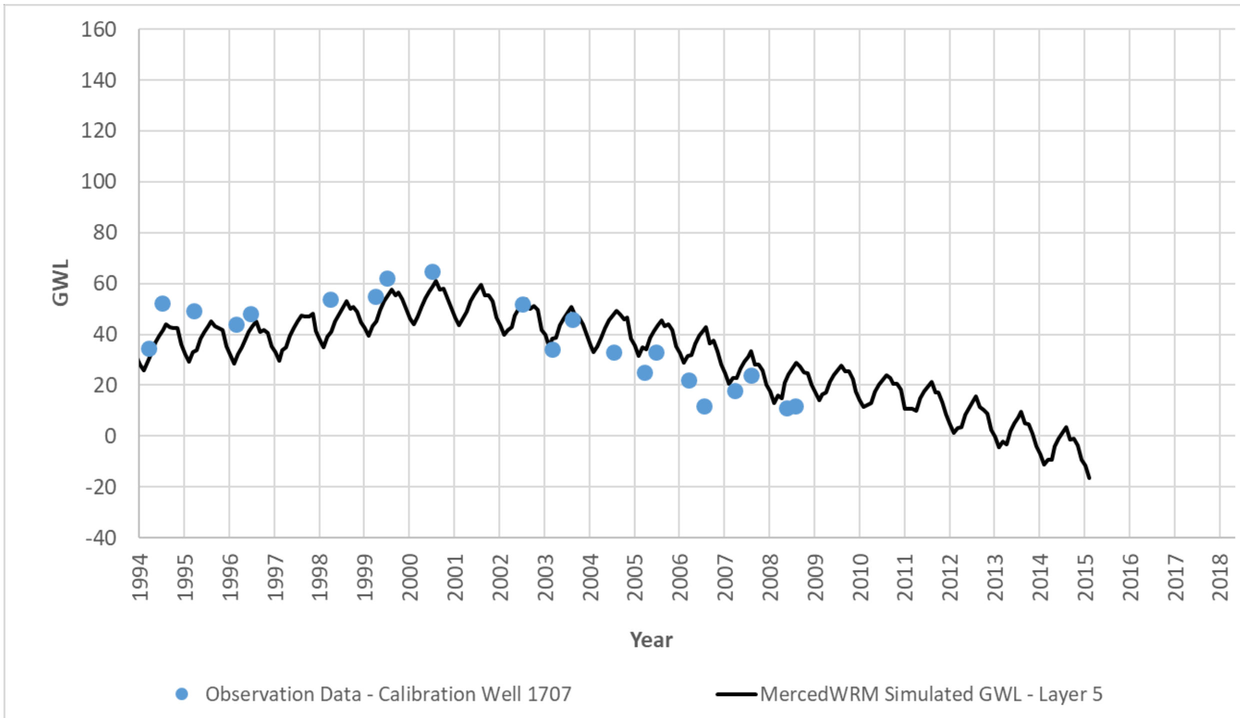


Figure A 41: Calibration Well 1707

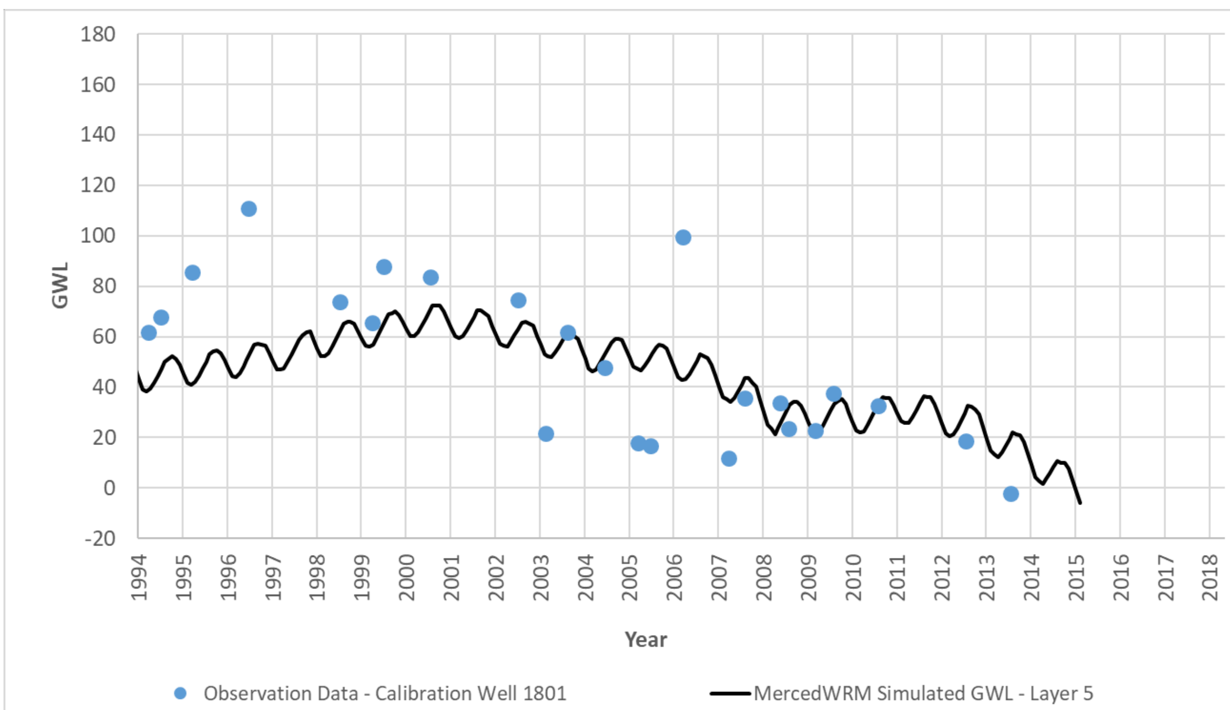


Figure A 42: Calibration Well 1801

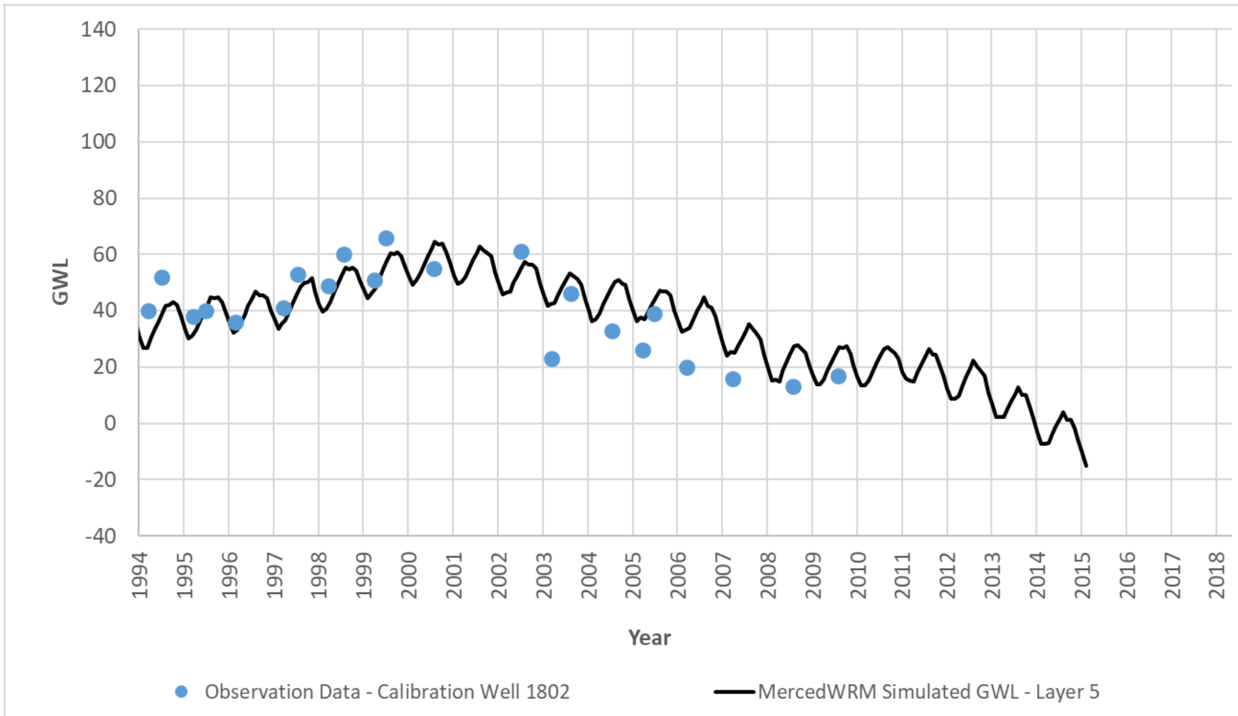


Figure A 43: Calibration Well 1802

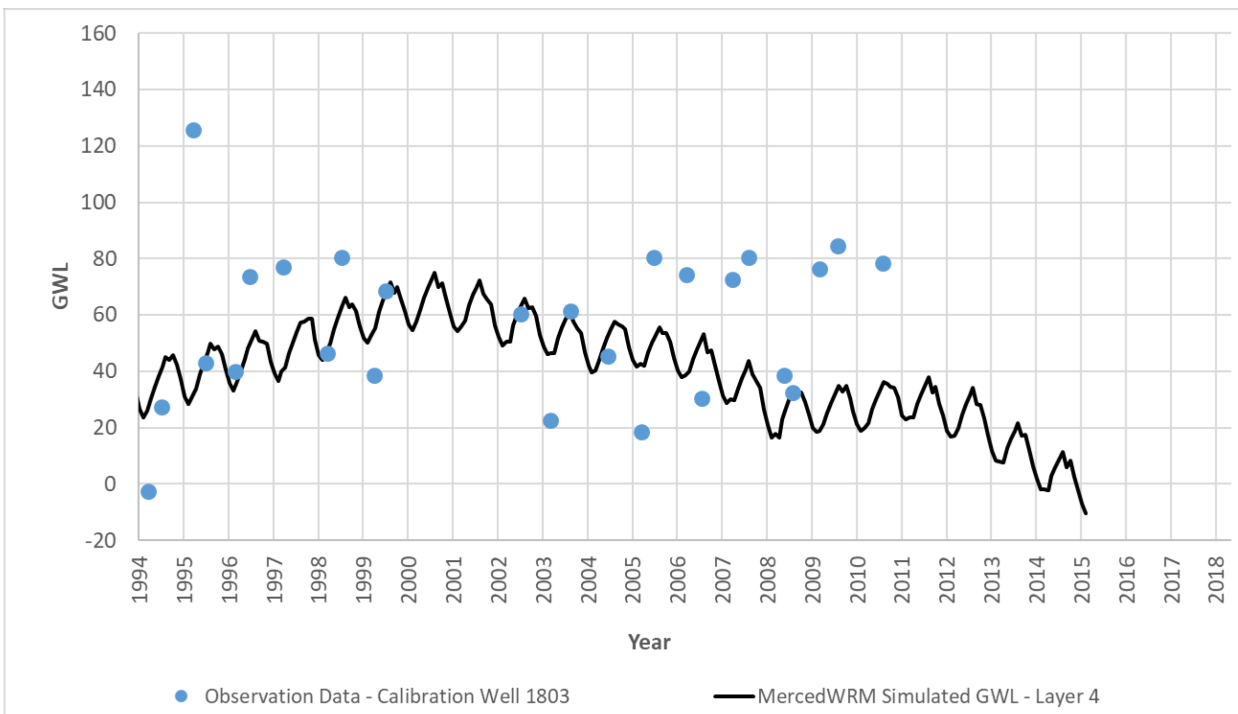


Figure A 44: Calibration Well 1803

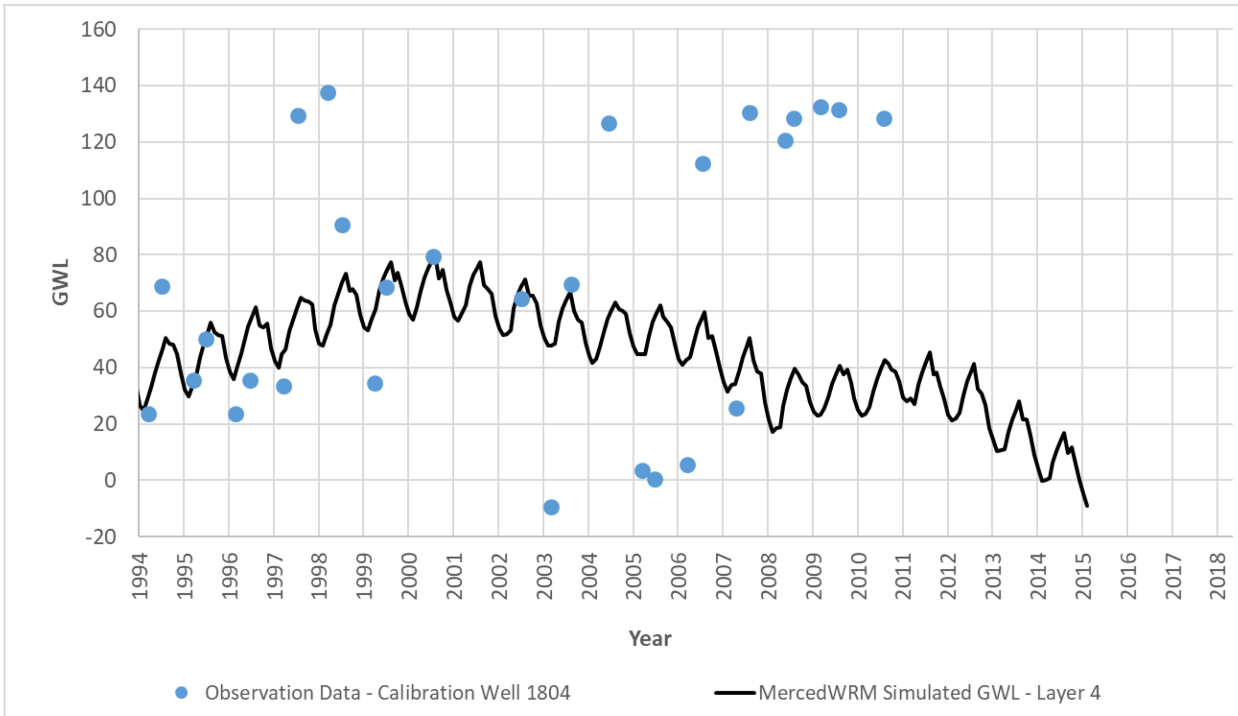


Figure A 45: Calibration Well 1804

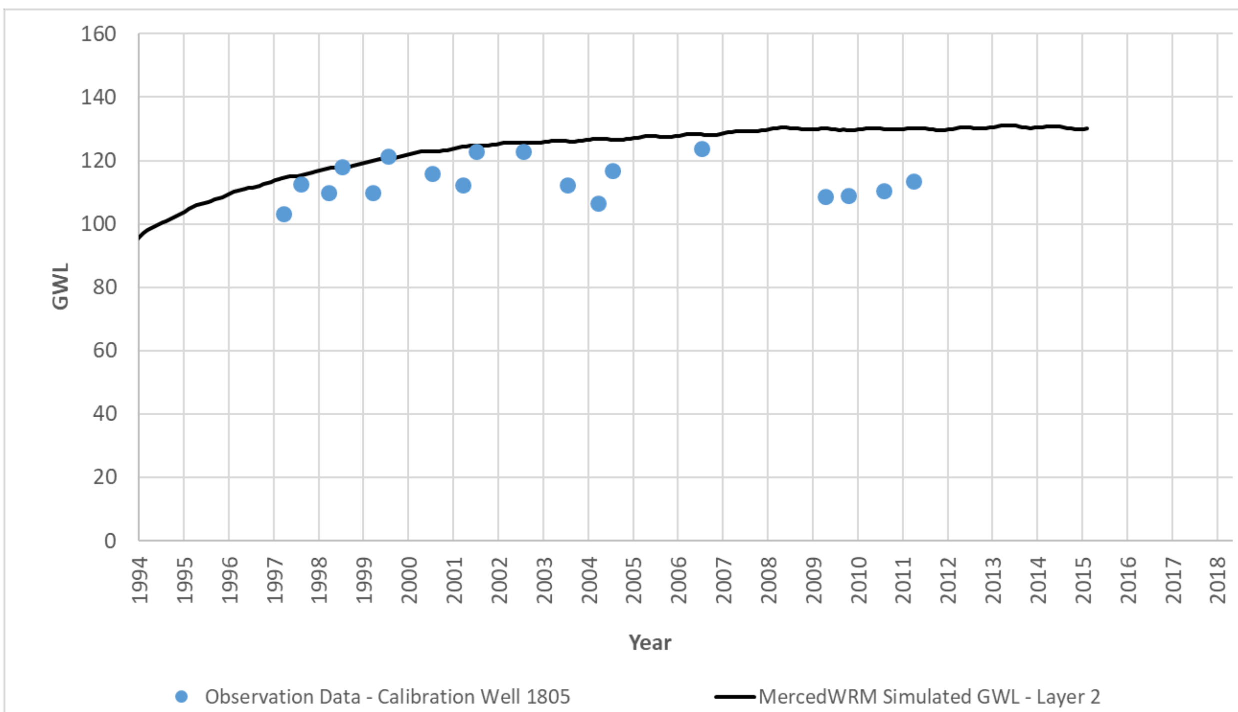


Figure A 46: Calibration Well 1805

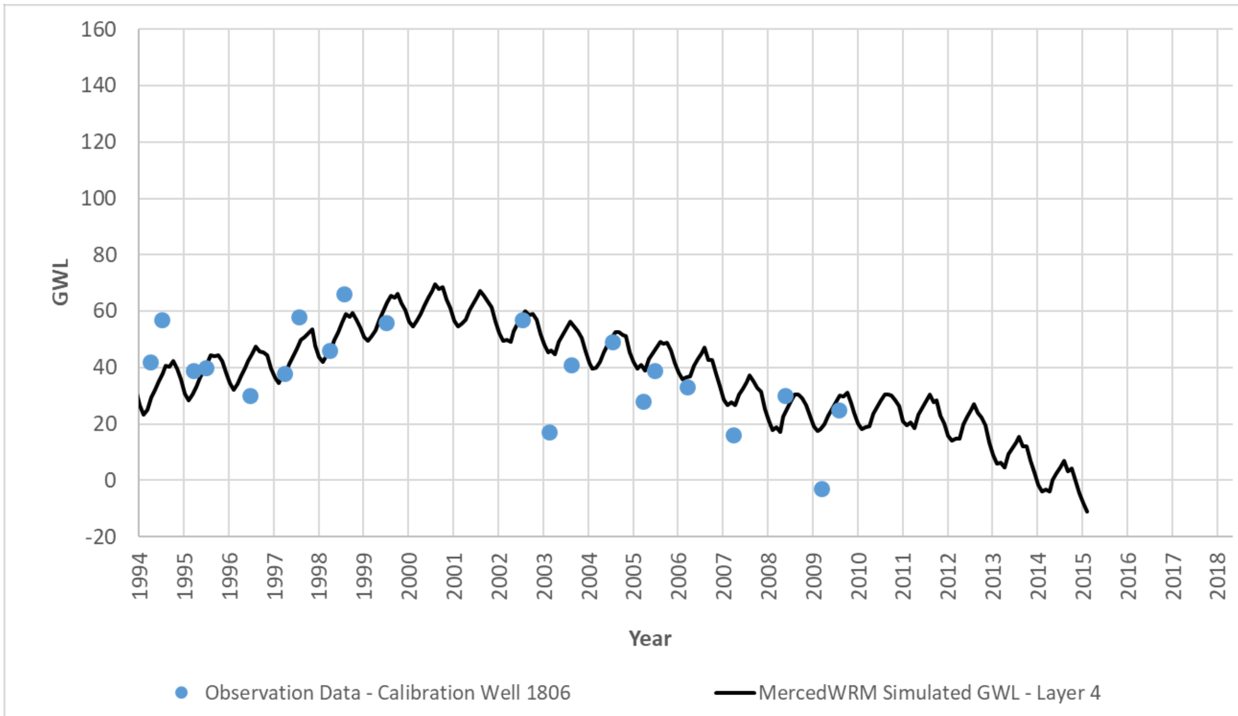


Figure A 47: Calibration Well 1806

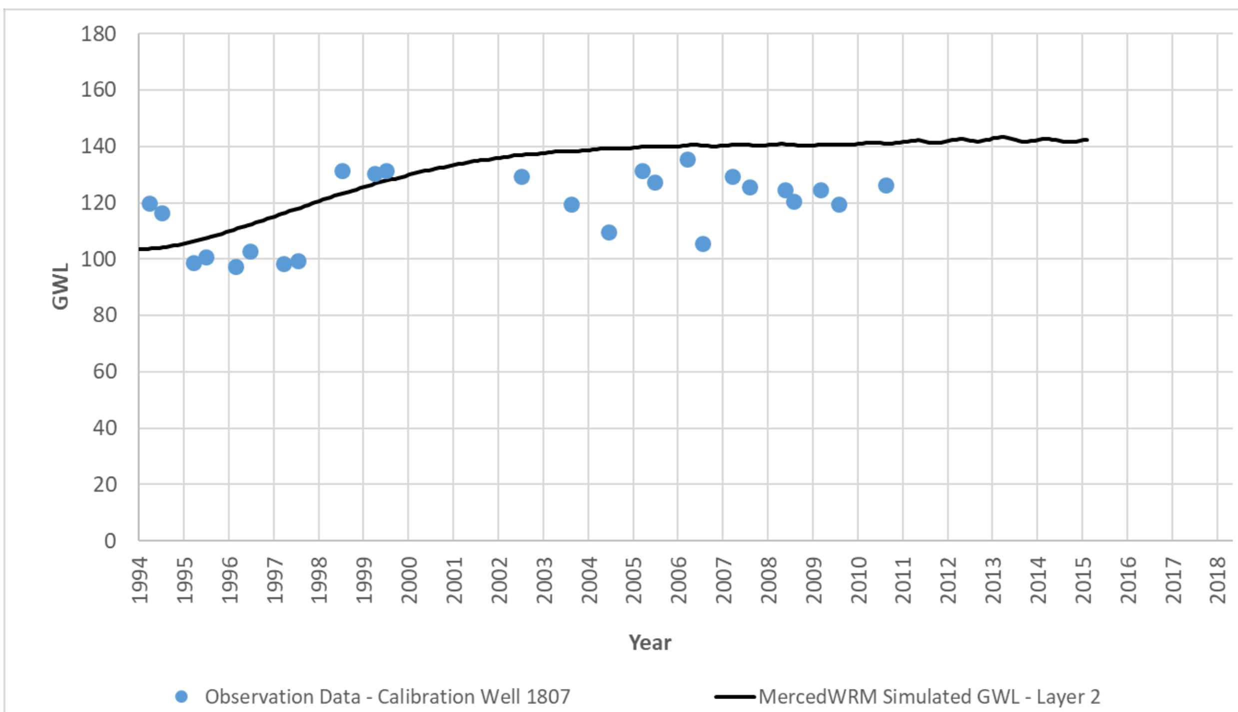


Figure A 48: Calibration Well 1807

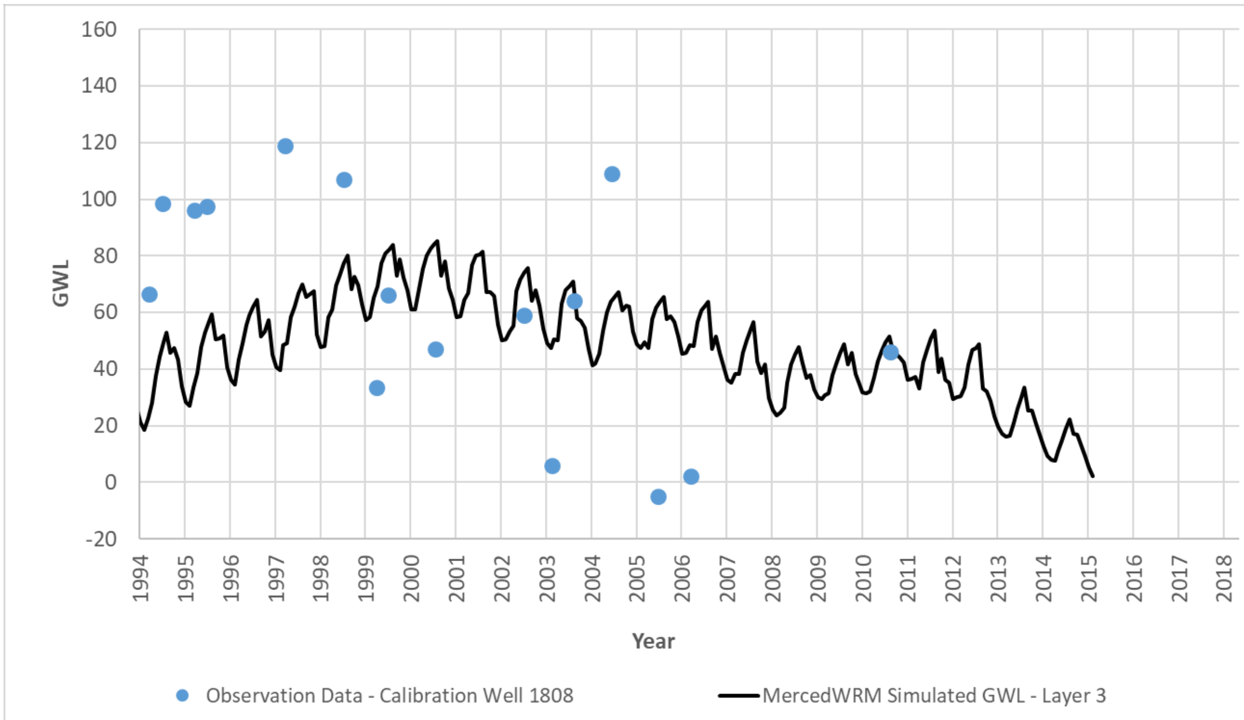


Figure A 49: Calibration Well 1808

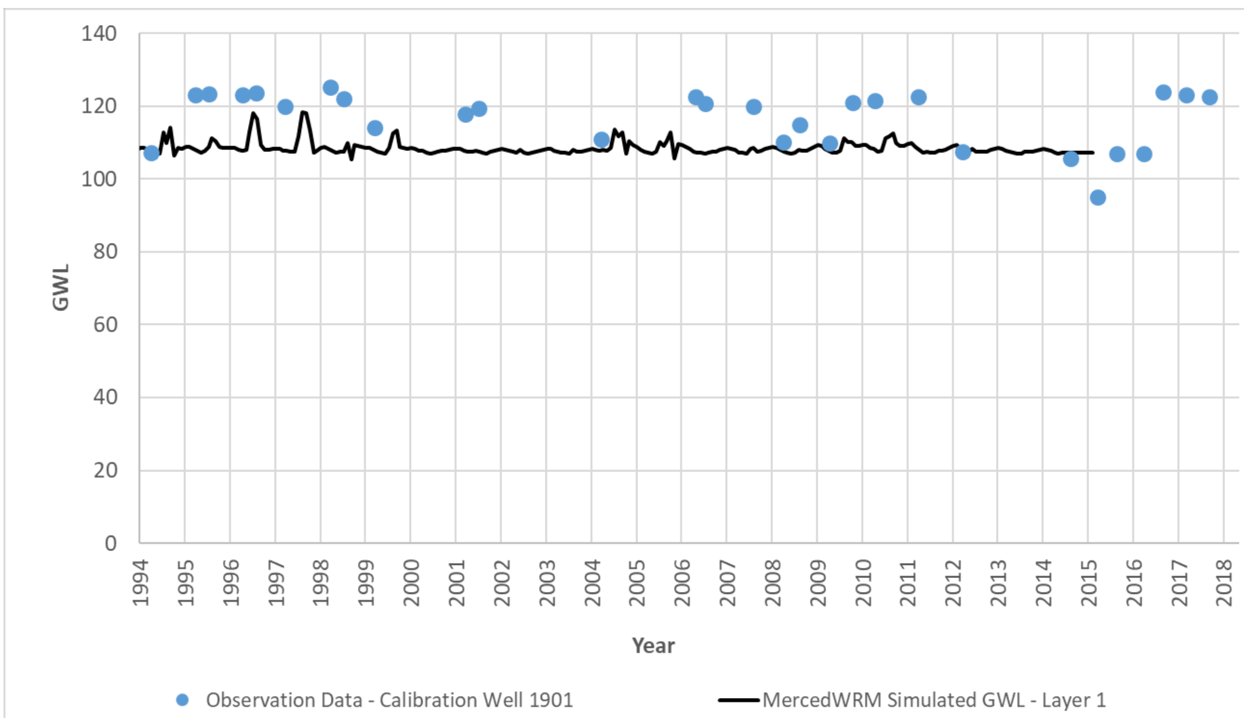


Figure A 50: Calibration Well 1901

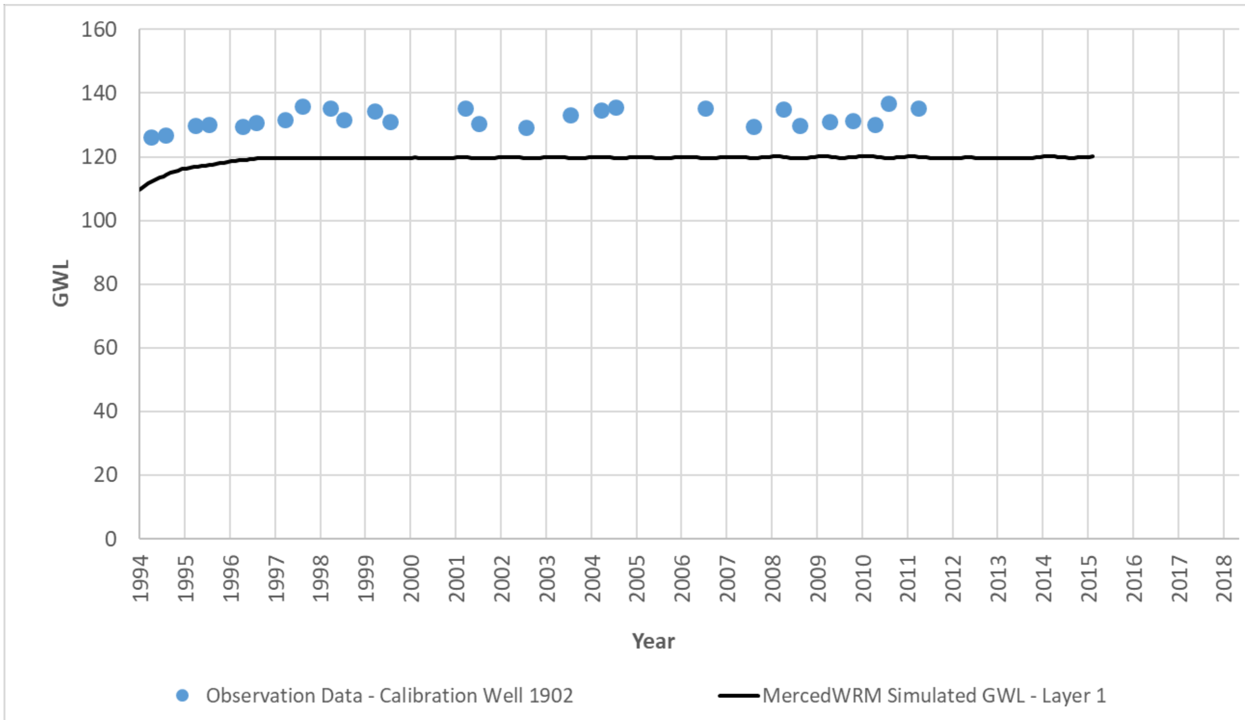


Figure A 51: Calibration Well 1902

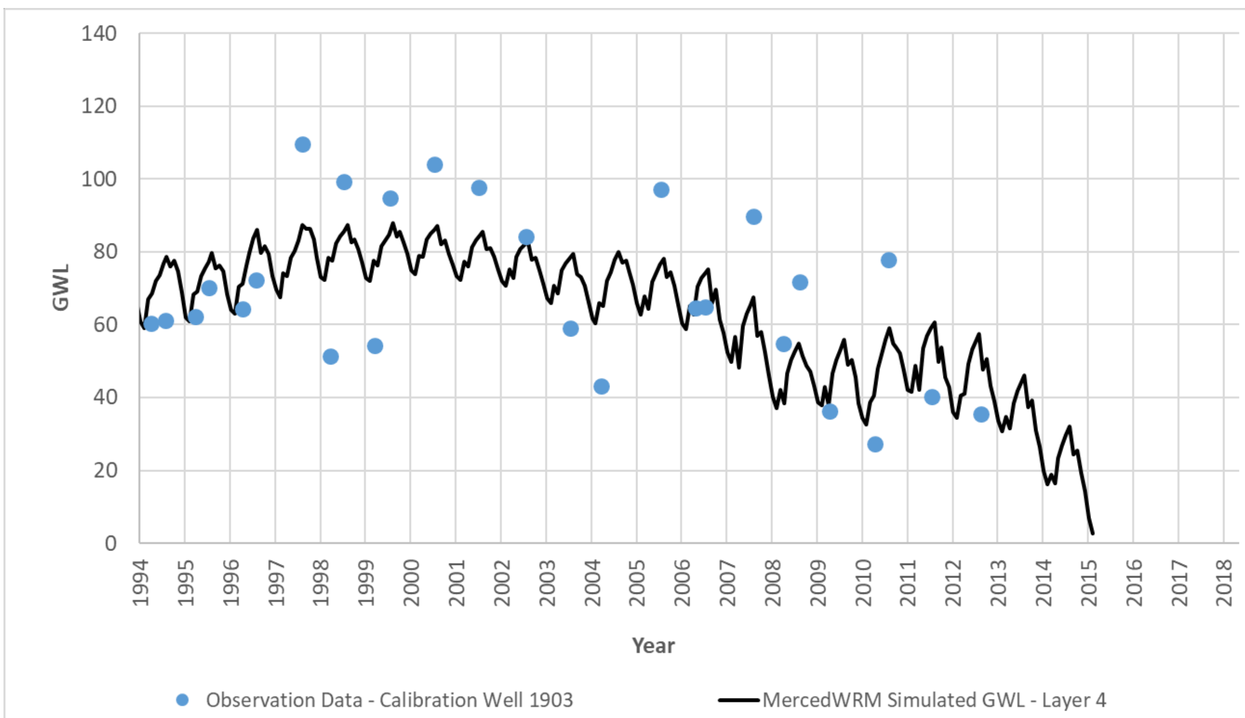


Figure A 52: Calibration Well 1903

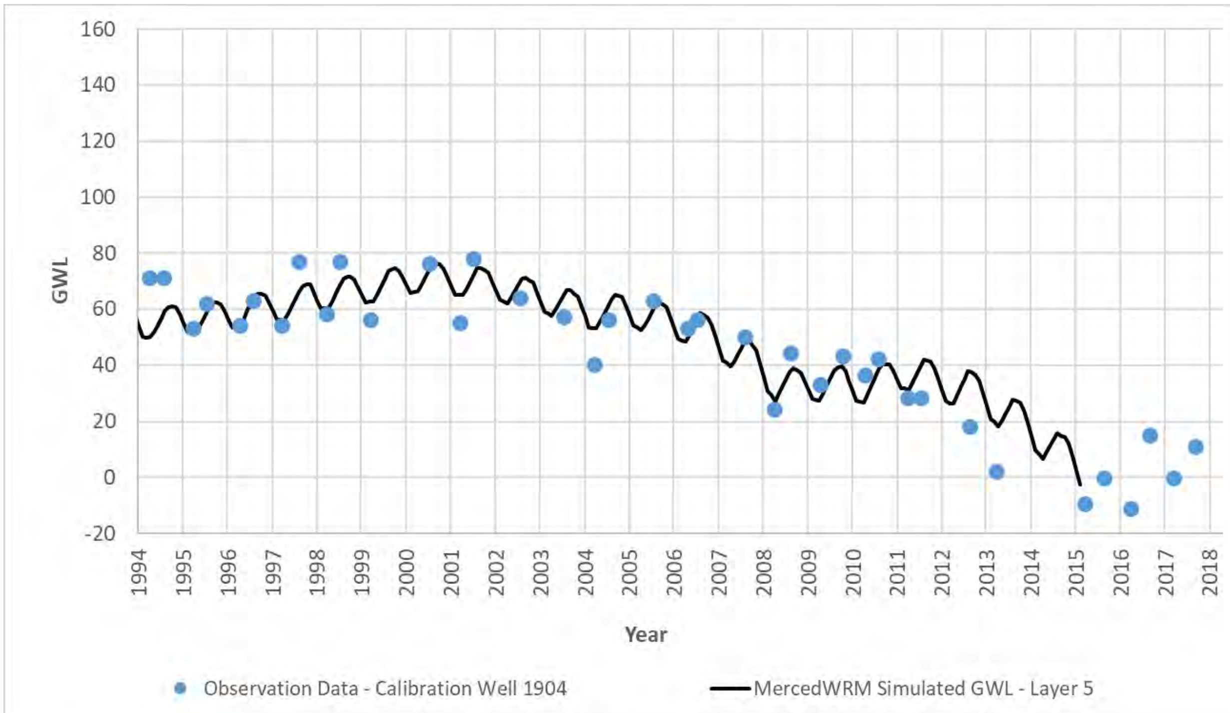


Figure A 53: Calibration Well 1904

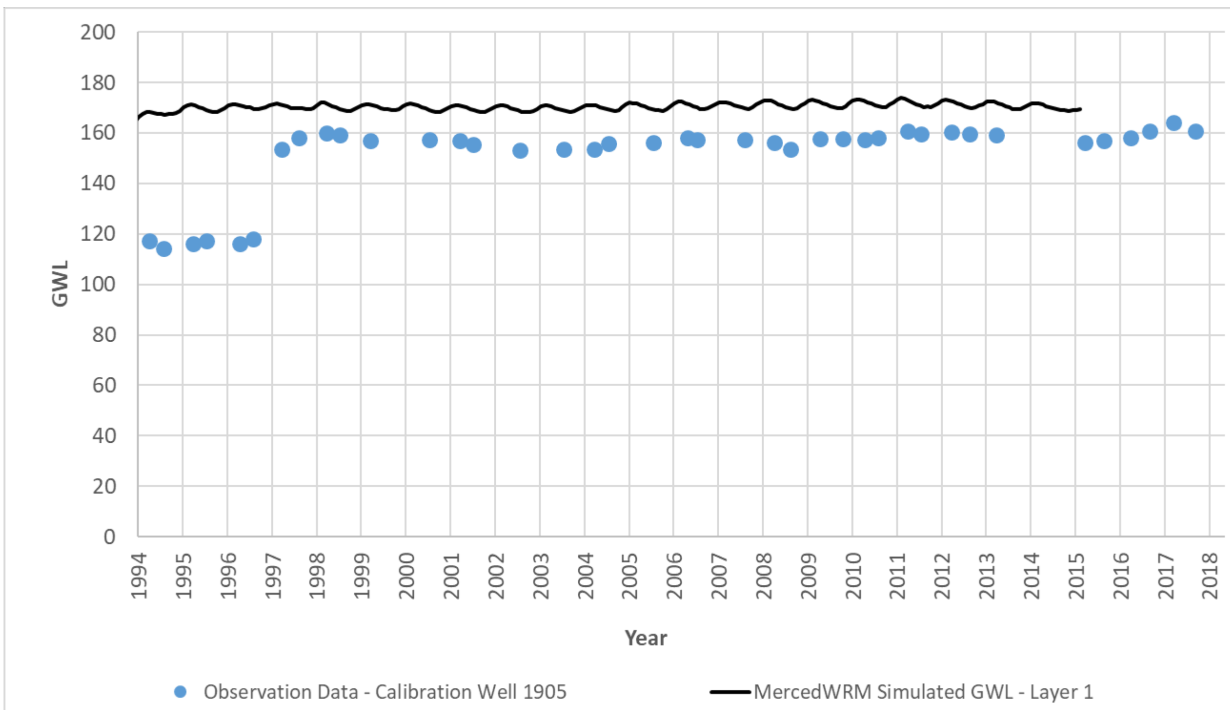


Figure A 54: Calibration Well 1905

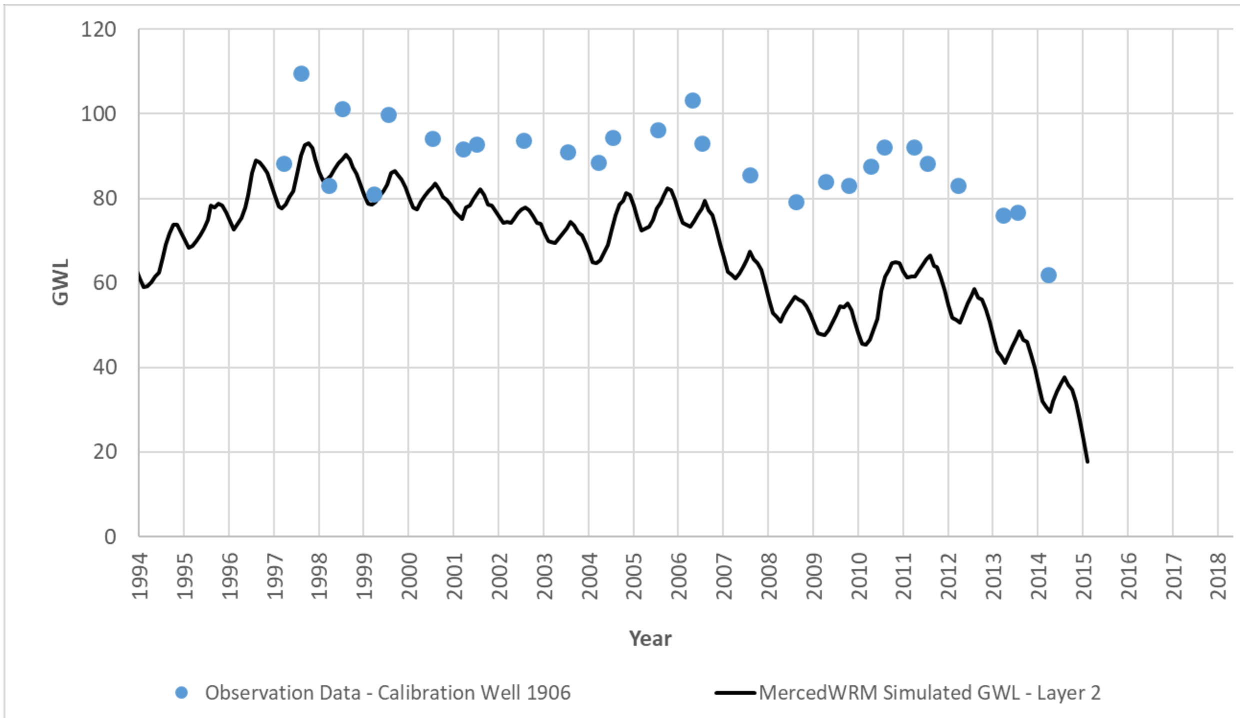


Figure A 55: Calibration Well 1906

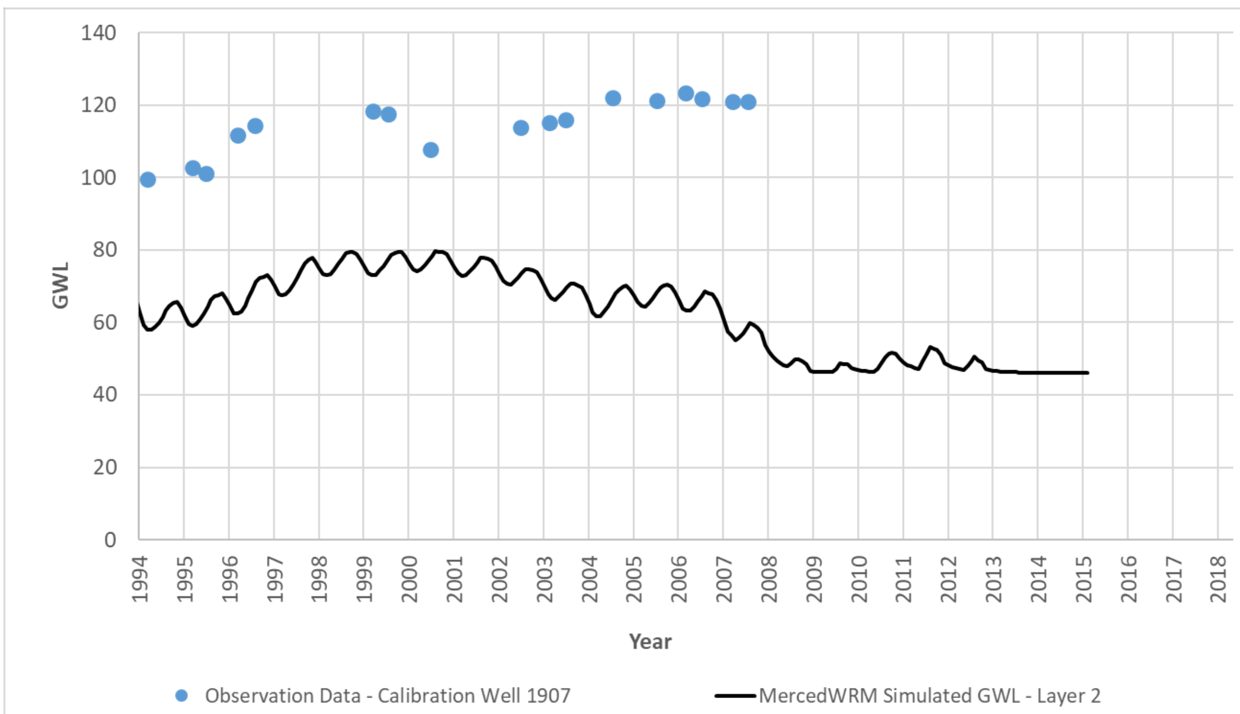


Figure A 56: Calibration Well 1907

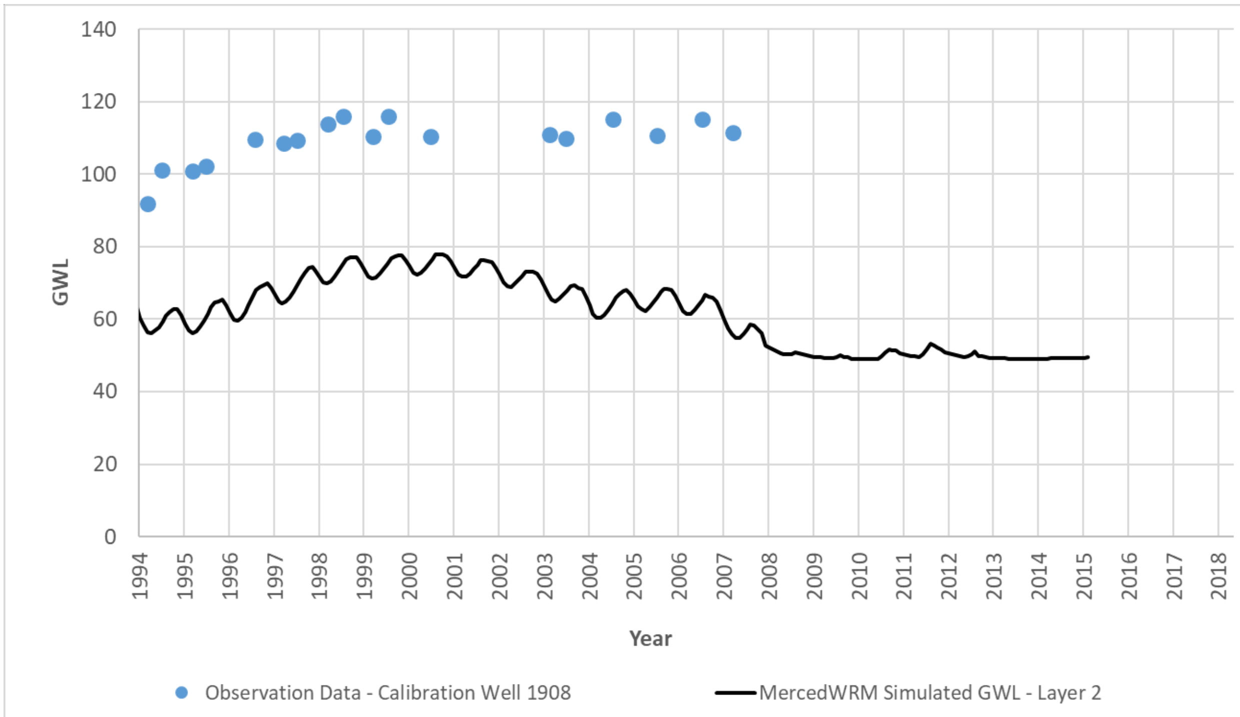


Figure A 57: Calibration Well 1908

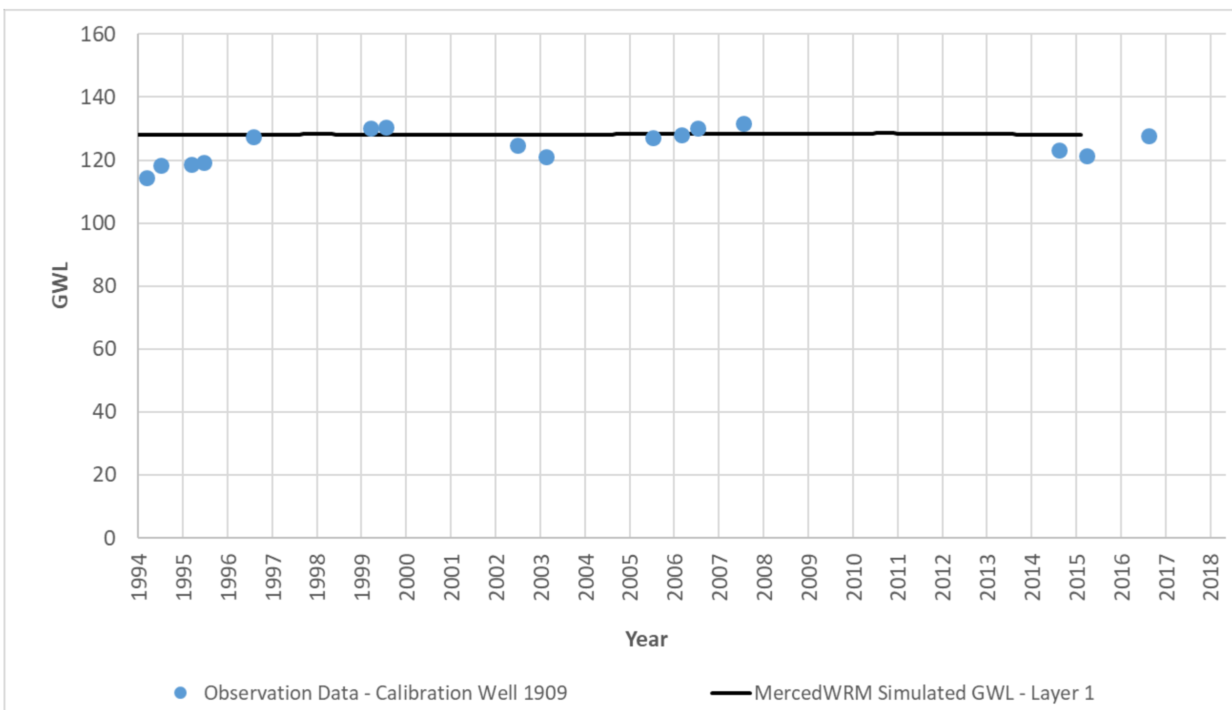


Figure A 58: Calibration Well 1909

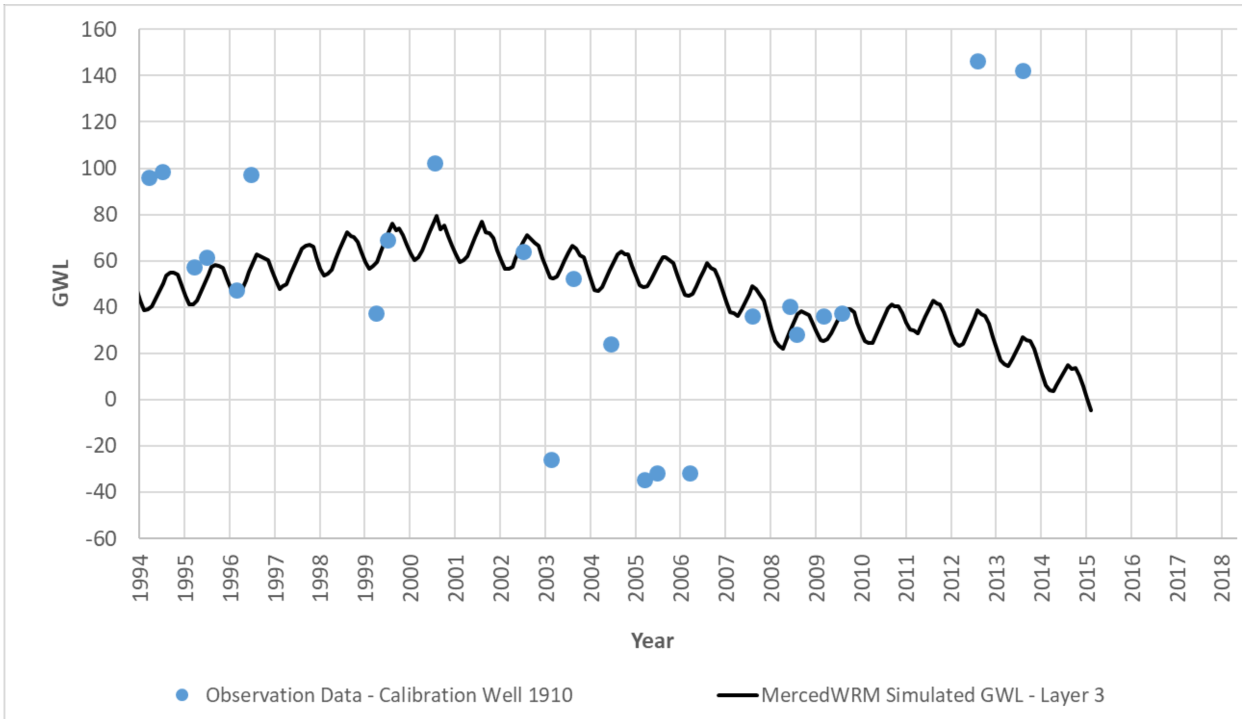


Figure A 59: Calibration Well 1910

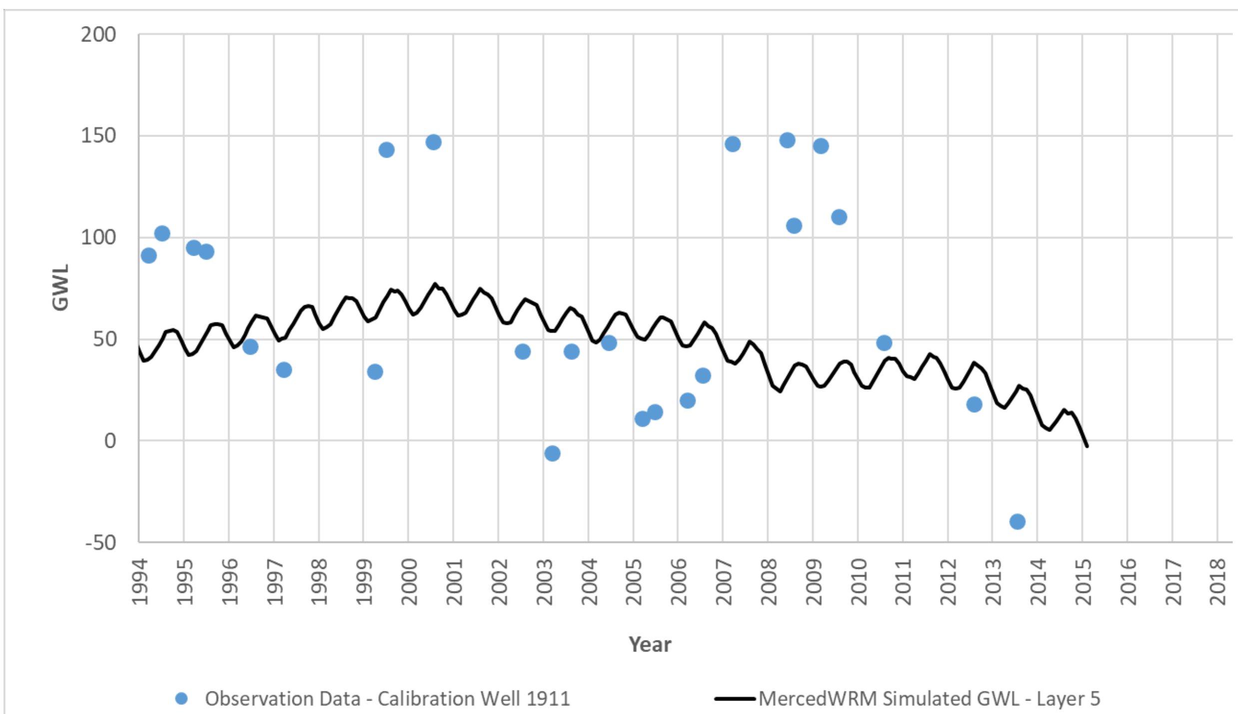


Figure A 60: Calibration Well 1911

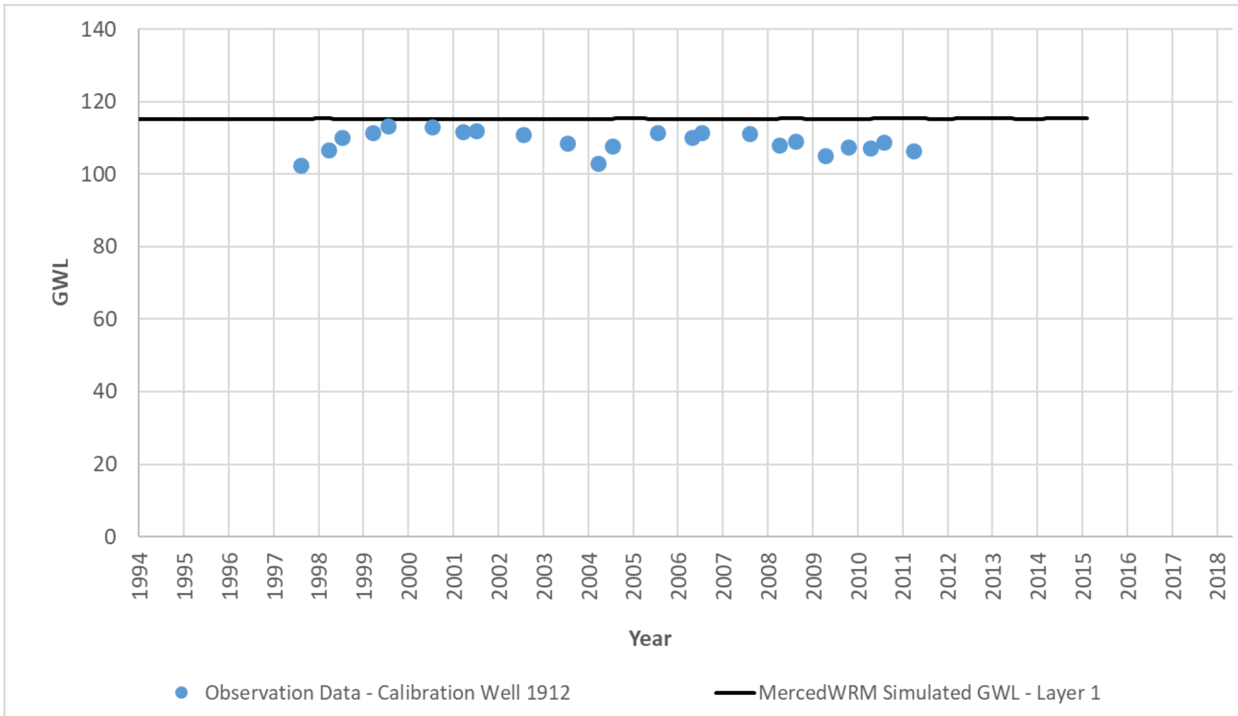


Figure A 61: Calibration Well 1912

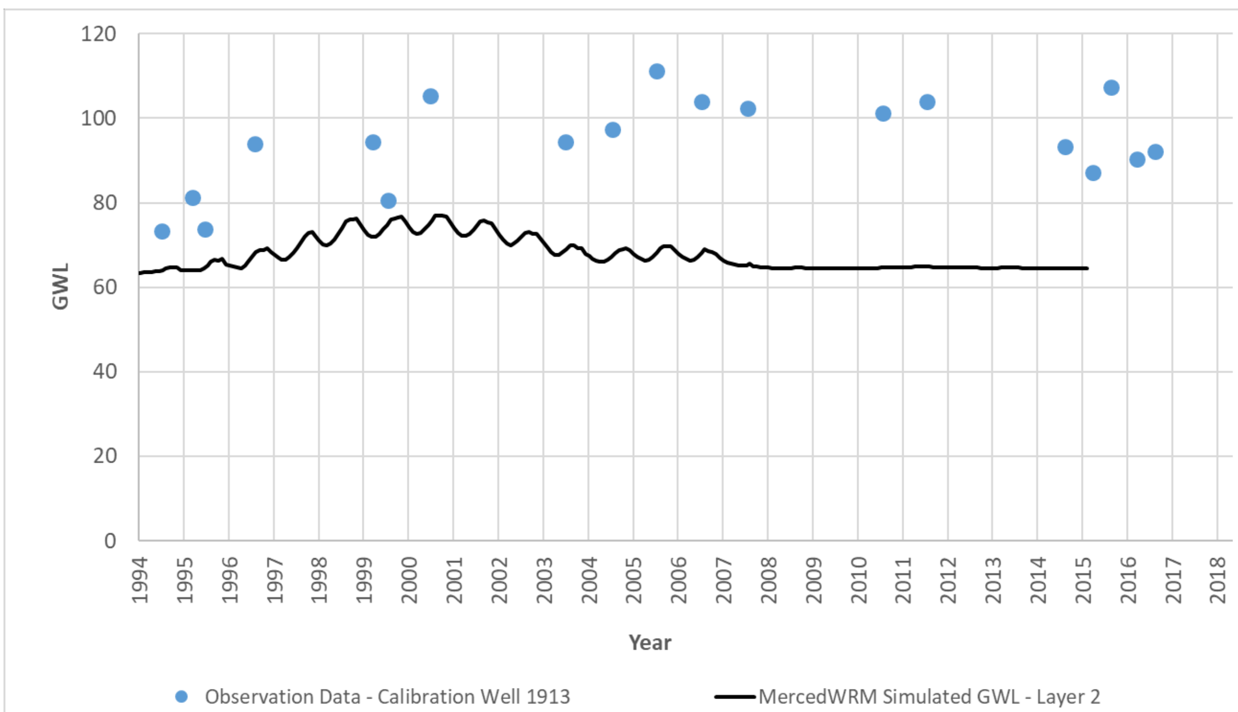


Figure A 62: Calibration Well 1913

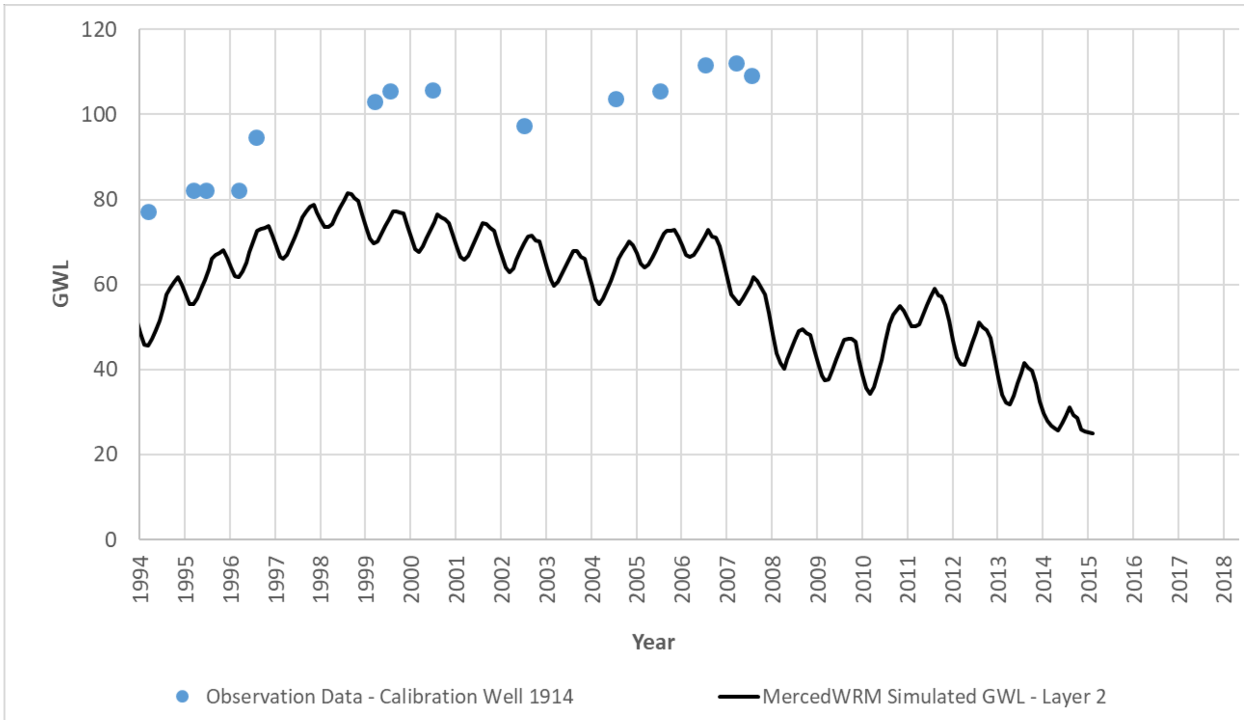


Figure A 63: Calibration Well 1914

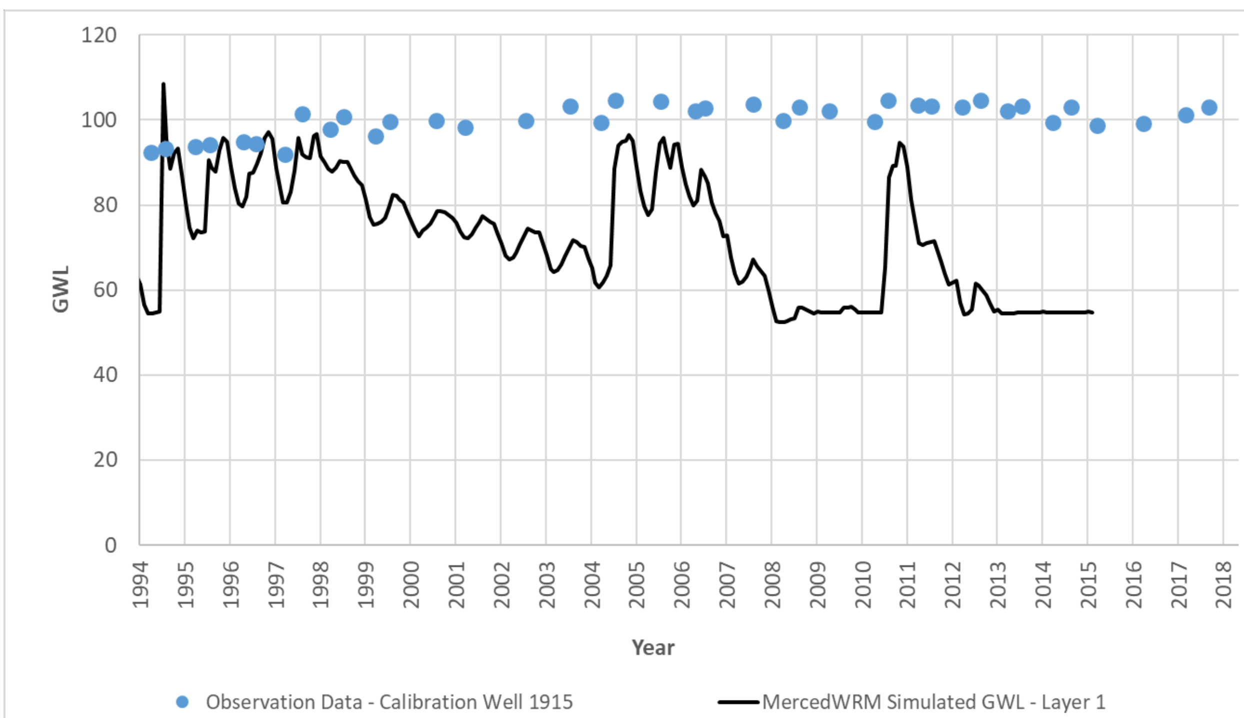


Figure A 64: Calibration Well 1915

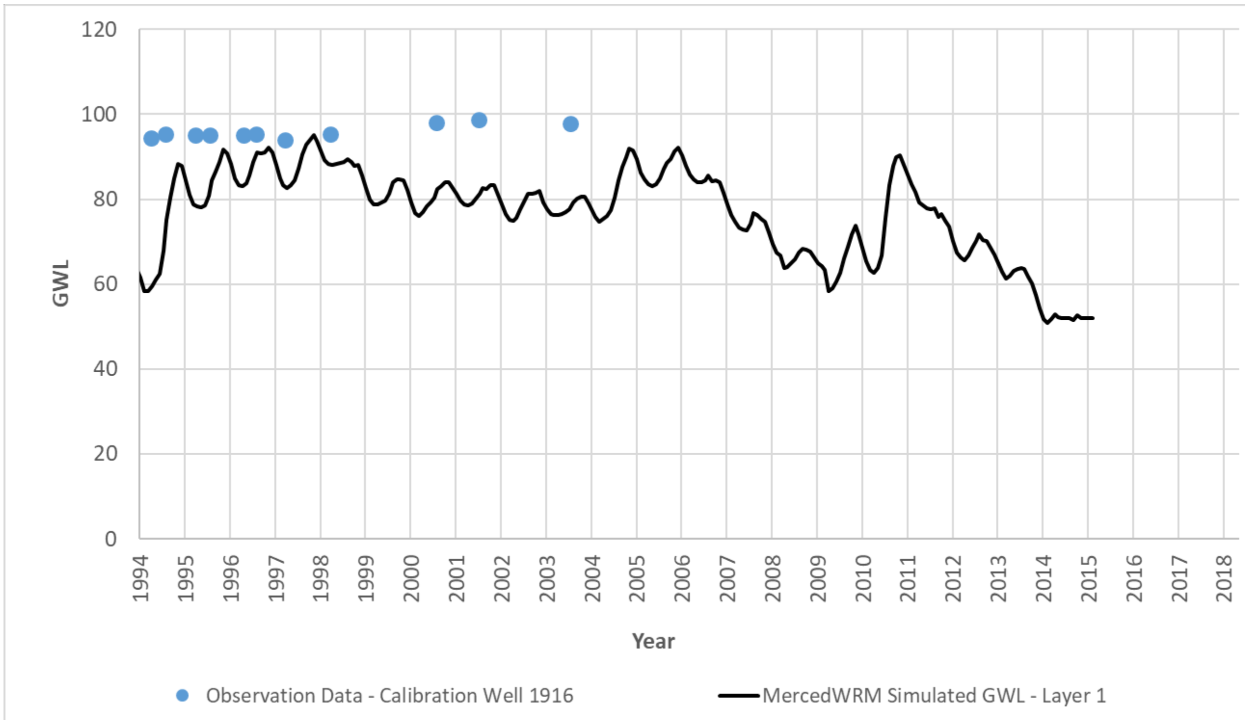


Figure A 65: Calibration Well 1916

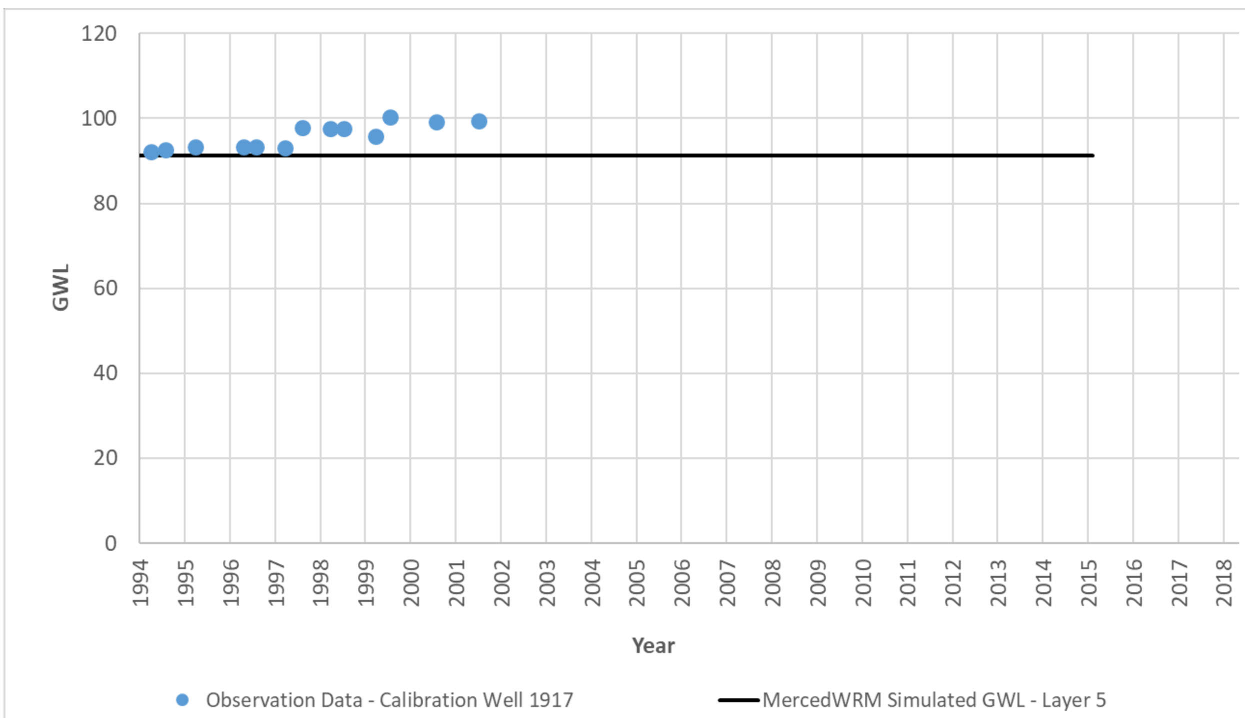


Figure A 66: Calibration Well 1917

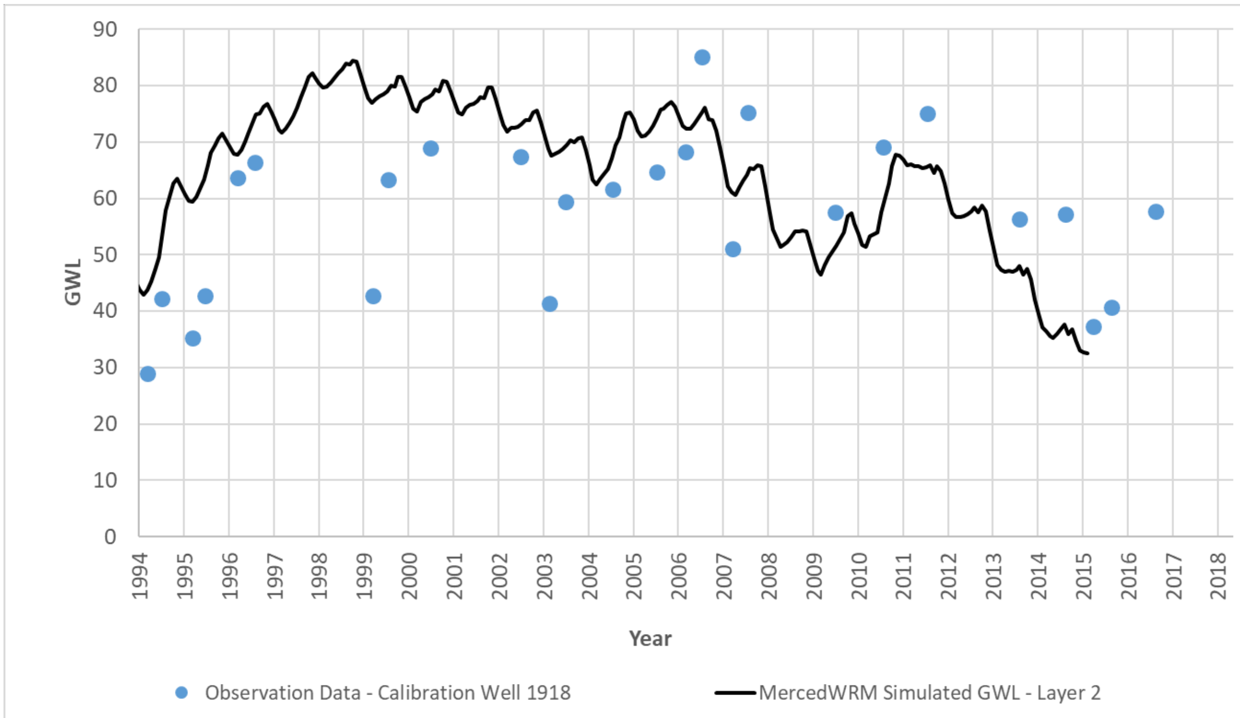


Figure A 67: Calibration Well 1918

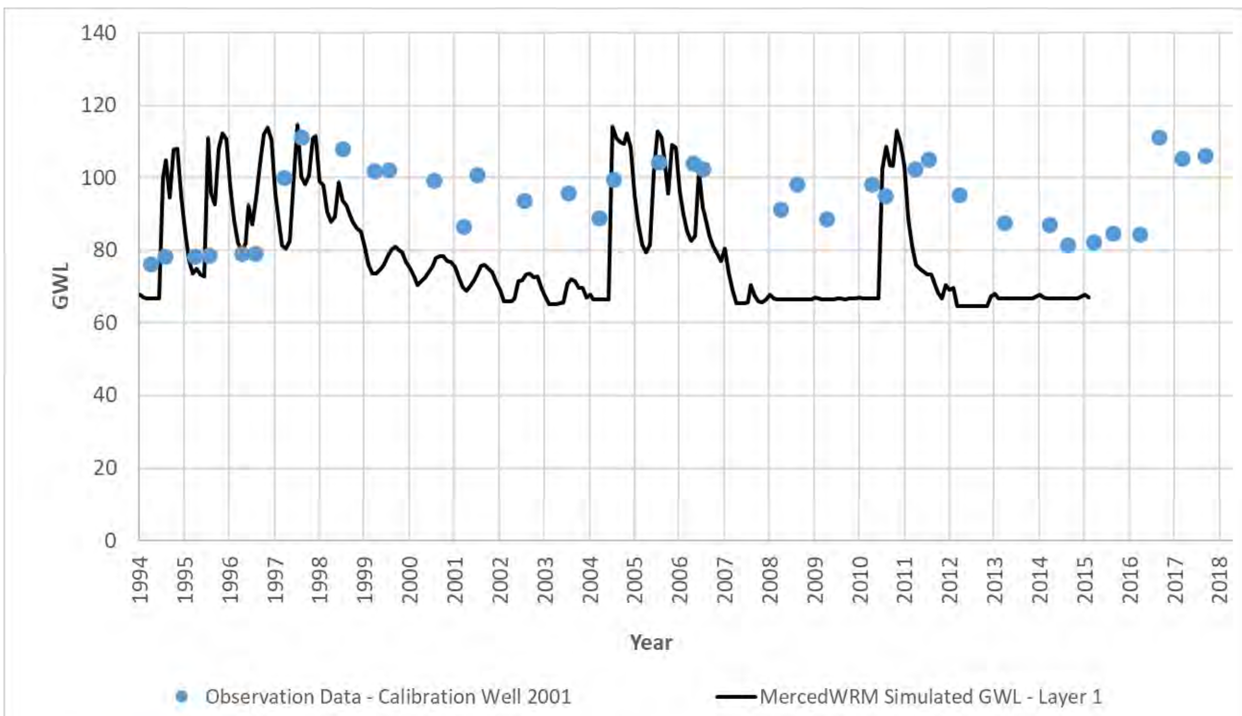


Figure A 68: Calibration Well 2001

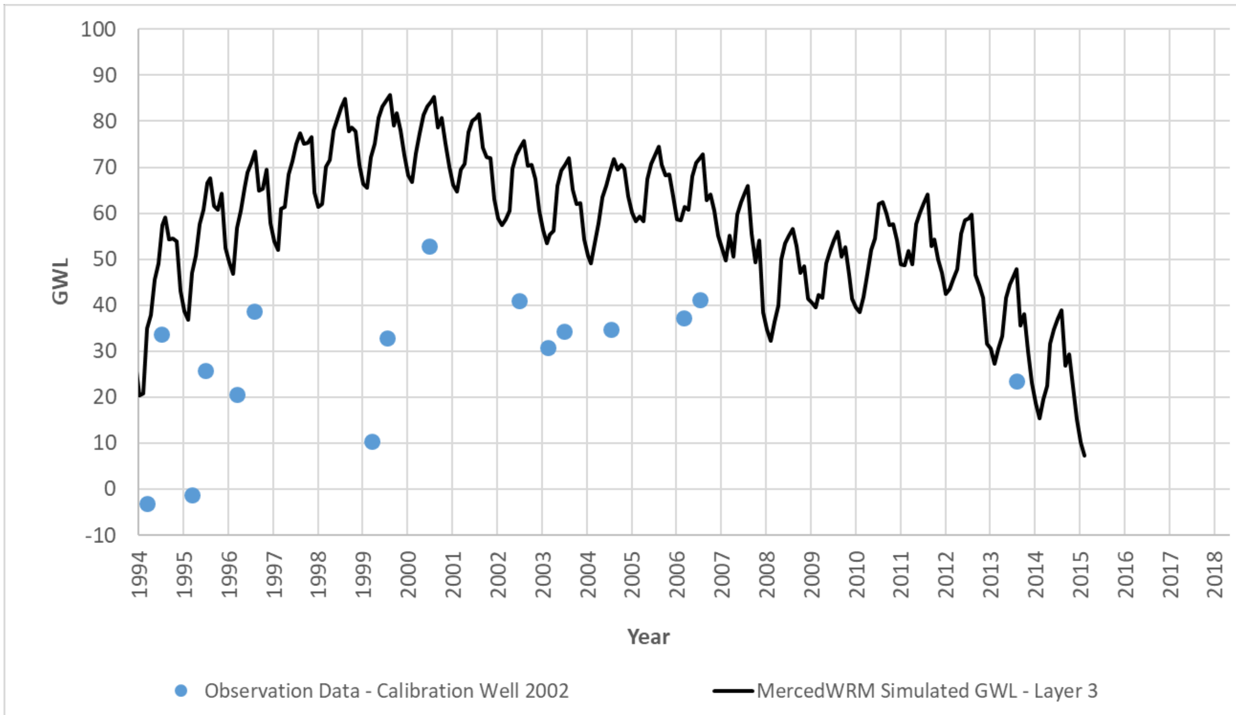


Figure A 69: Calibration Well 2002

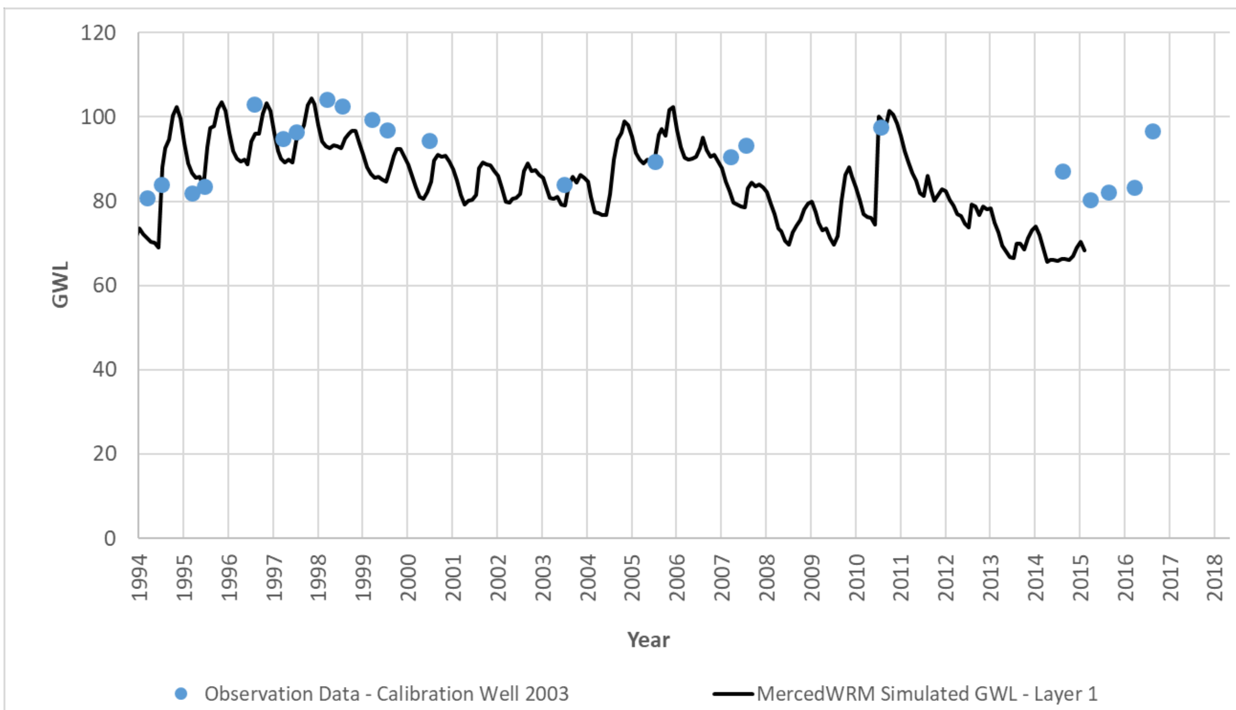


Figure A 70: Calibration Well 2003

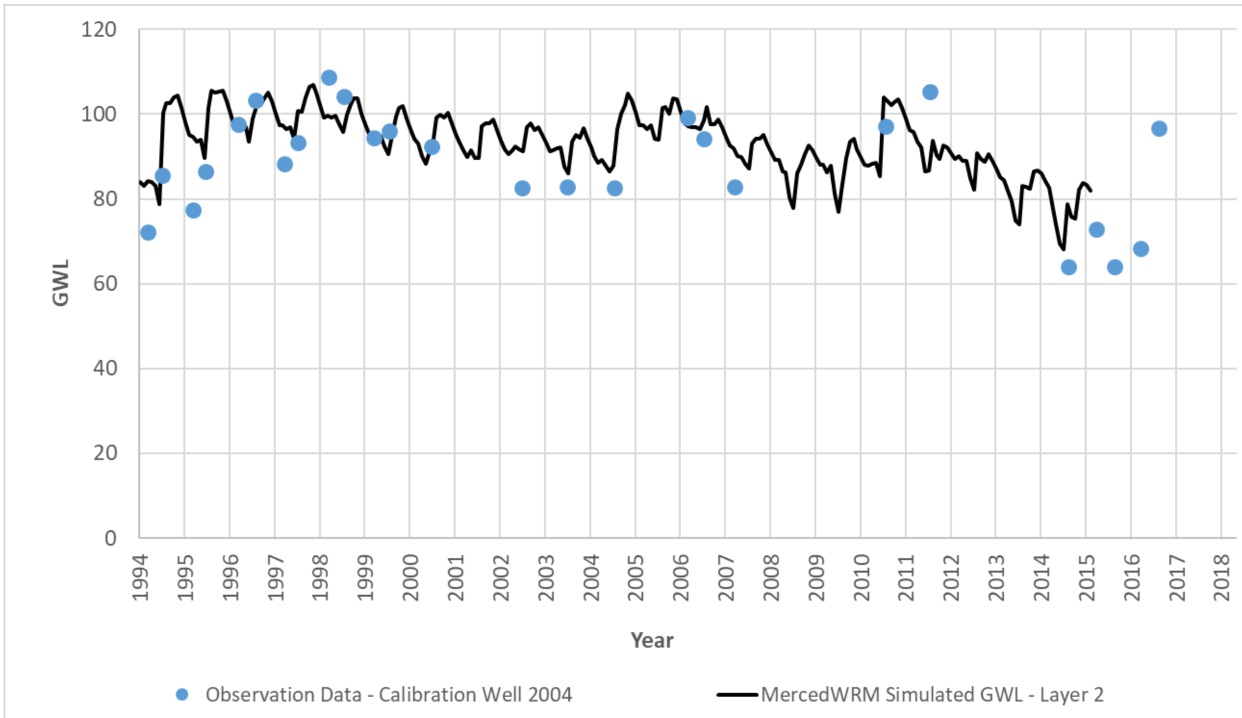


Figure A 71: Calibration Well 2004

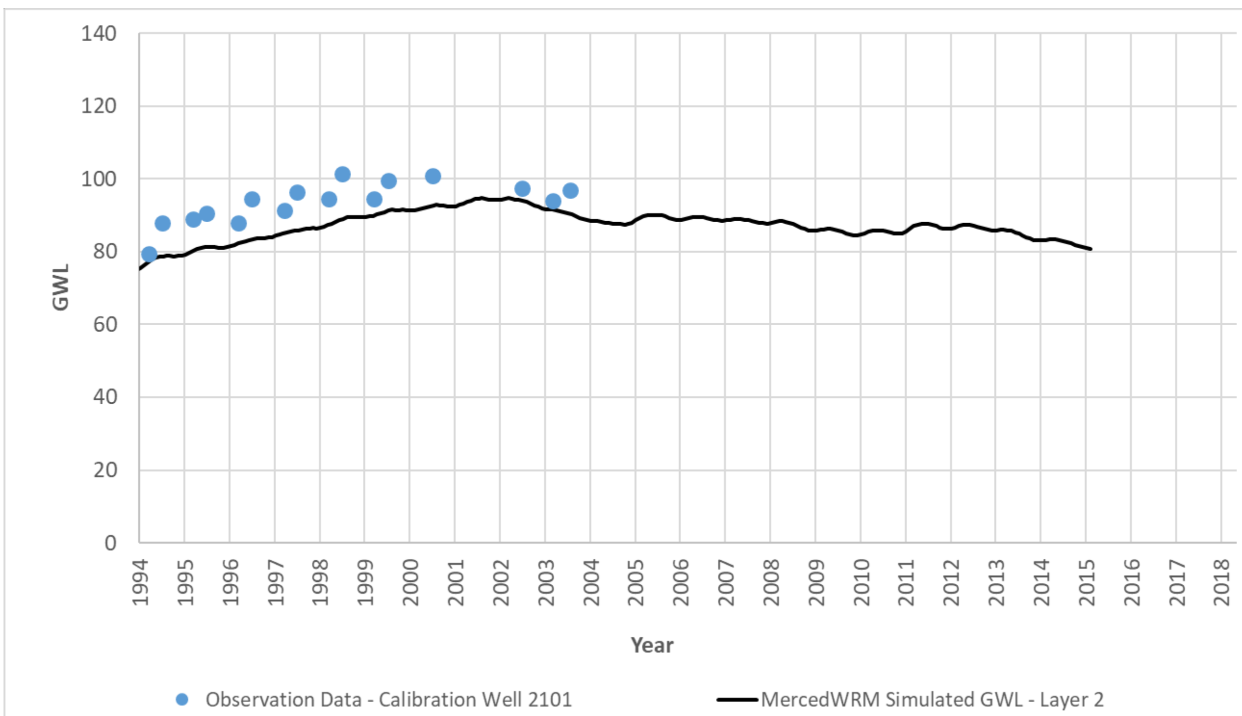


Figure A 72: Calibration Well 2101

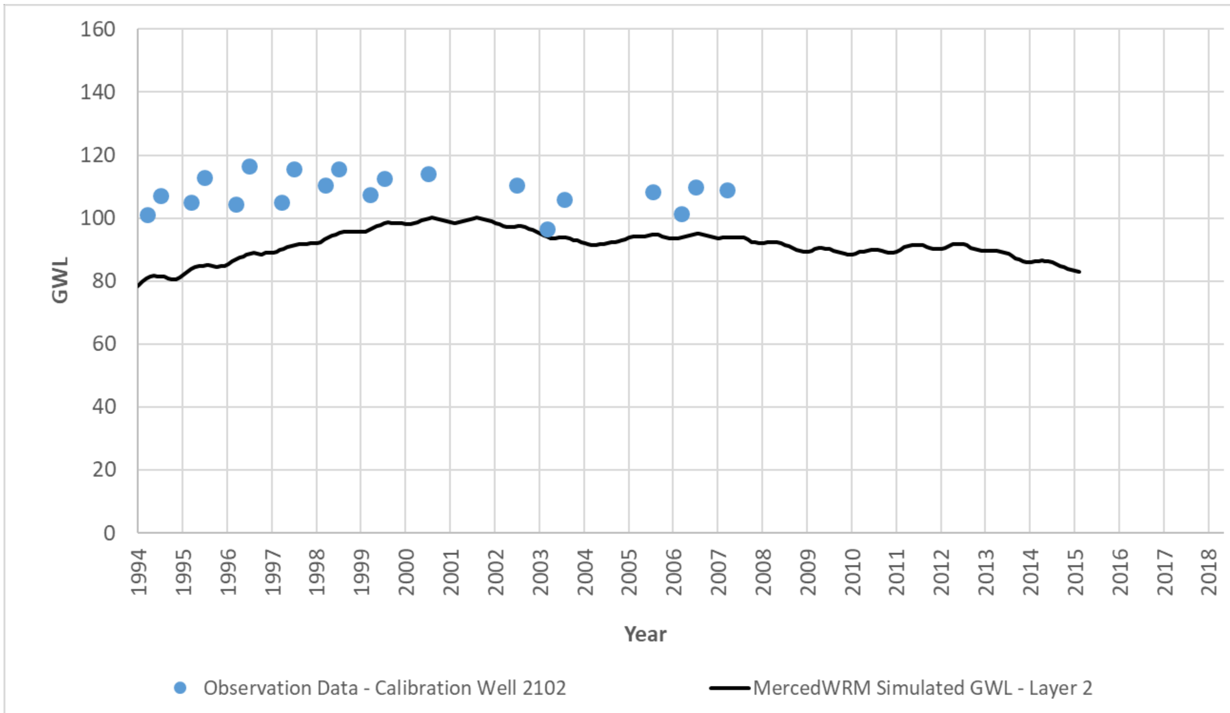


Figure A 73: Calibration Well 2102

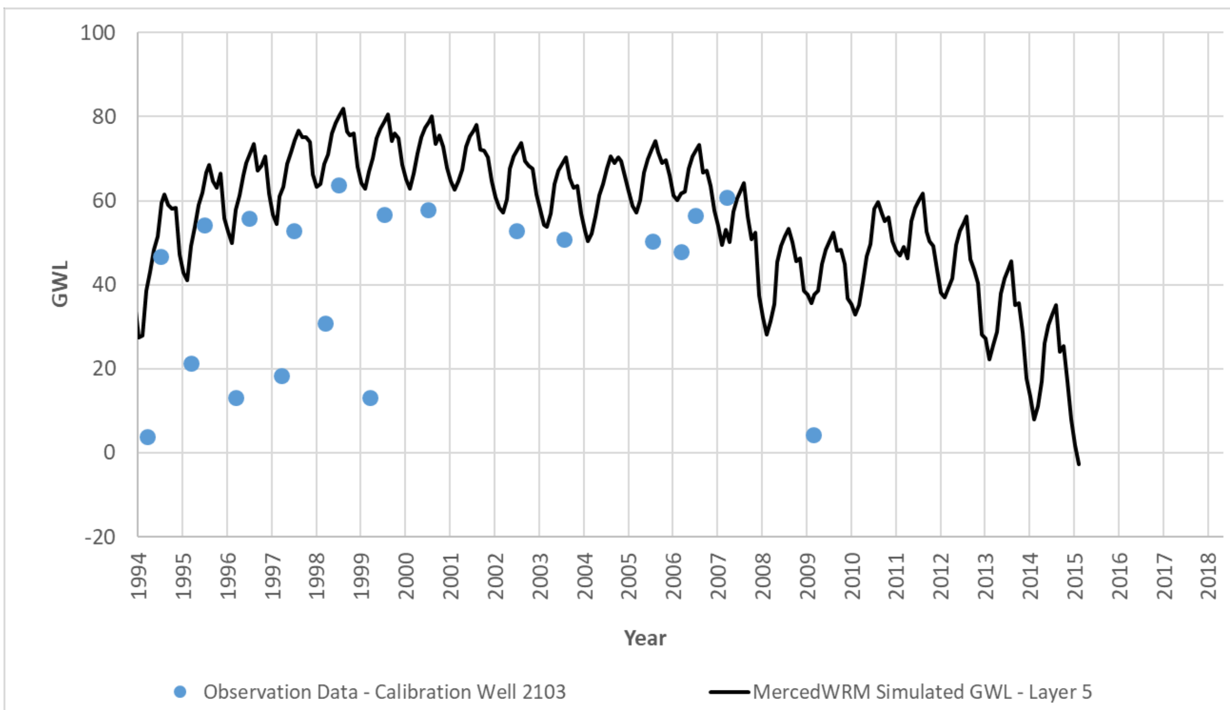


Figure A 74: Calibration Well 2103

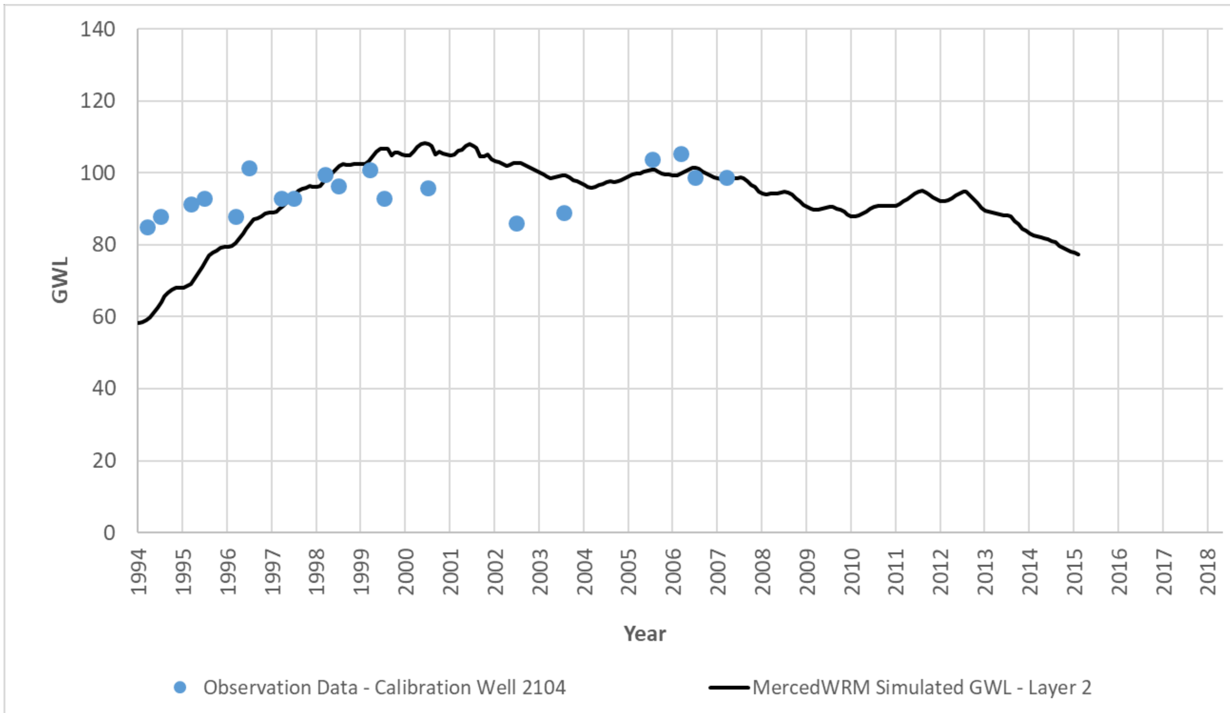


Figure A 75: Calibration Well 2104

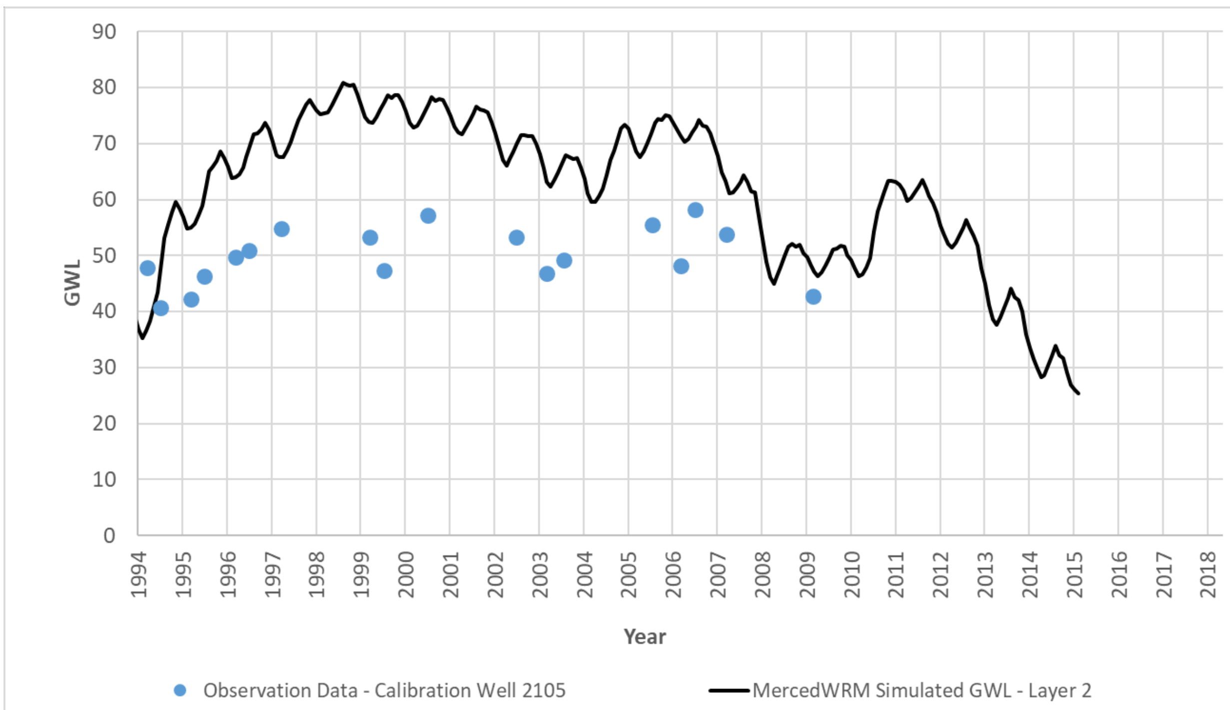


Figure A 76: Calibration Well 2105

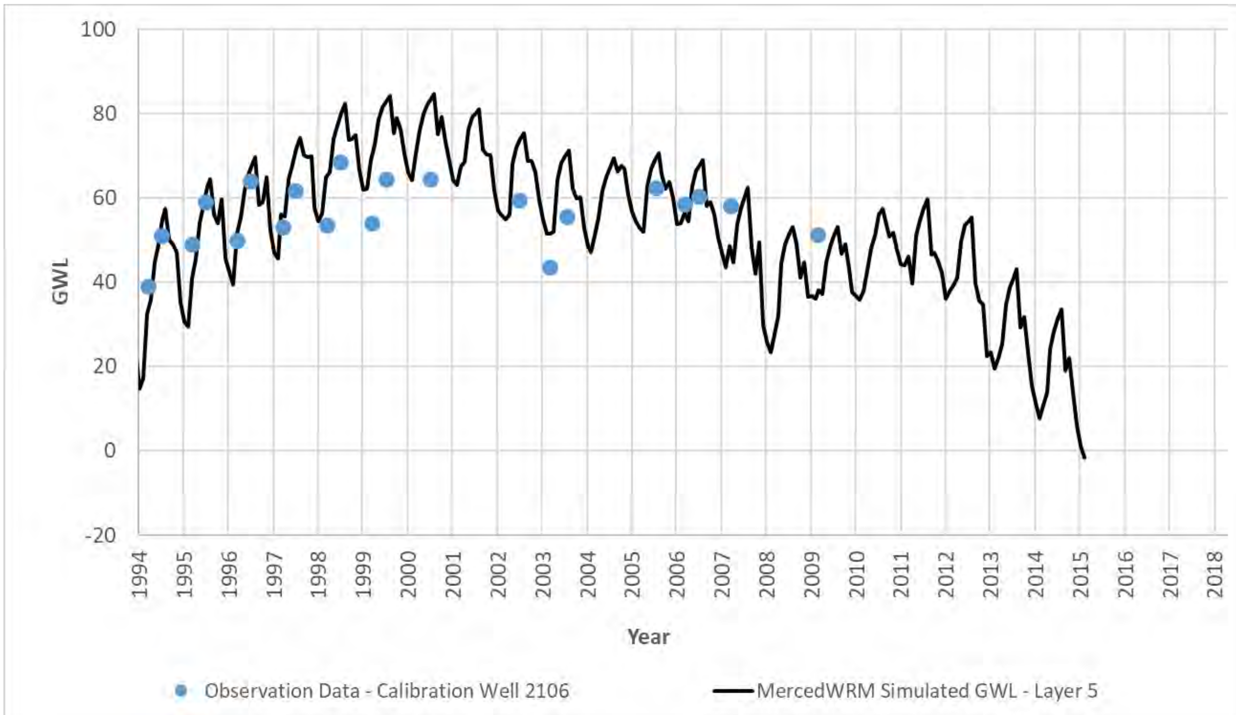


Figure A 77: Calibration Well 2106

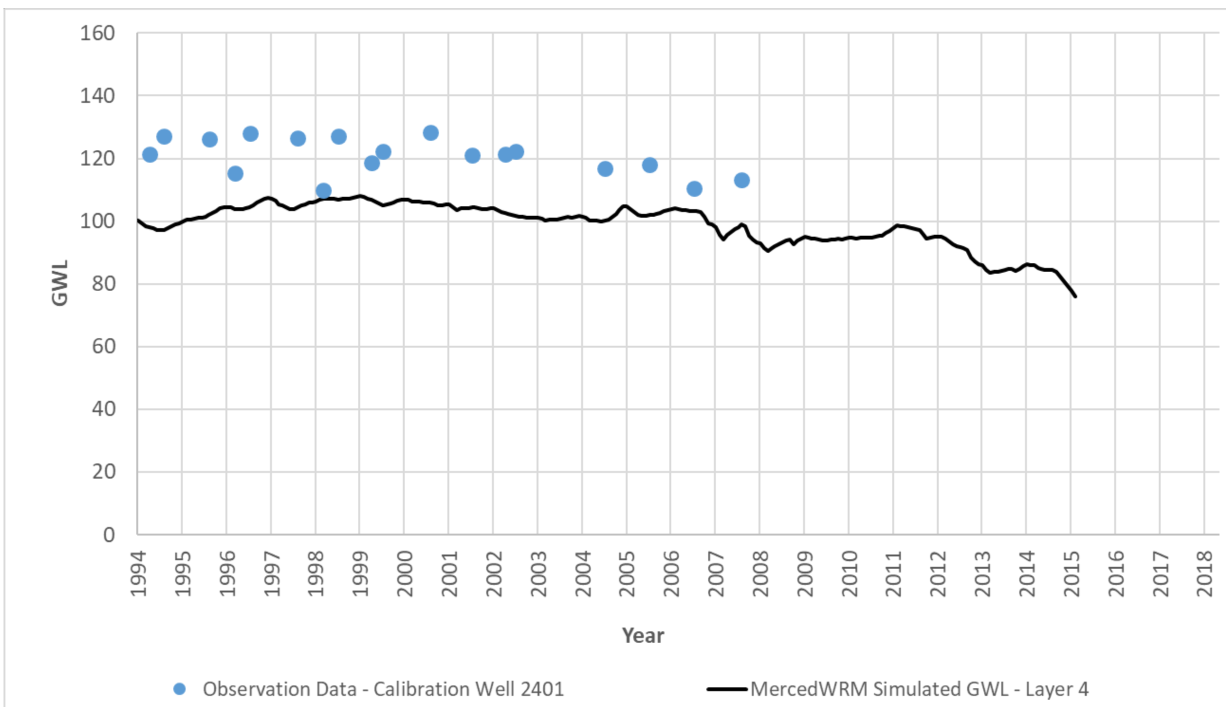


Figure A 78: Calibration Well 2401

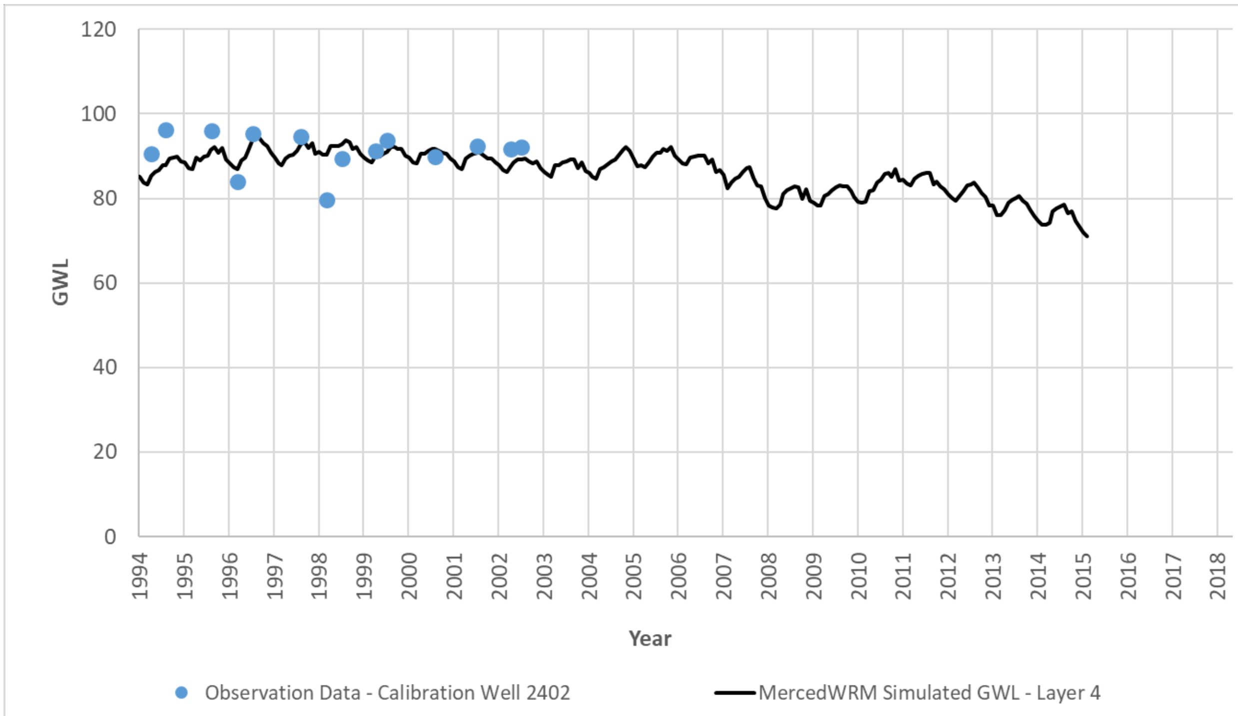


Figure A 79: Calibration Well 2402

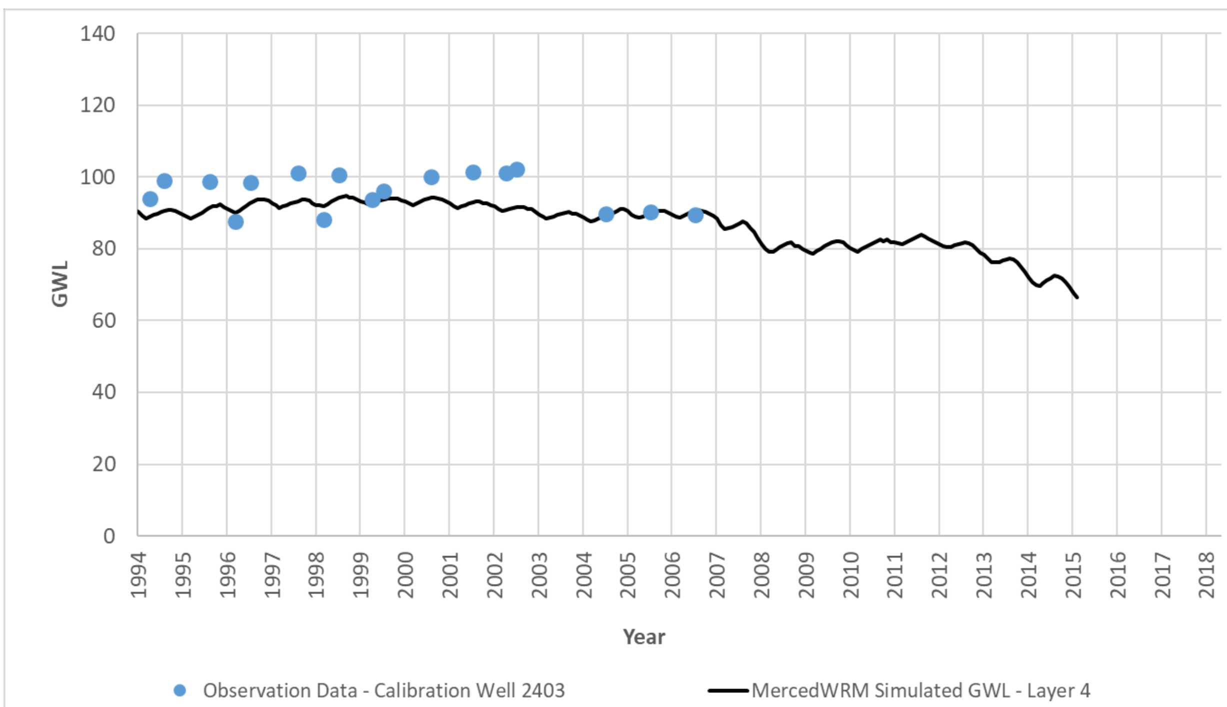


Figure A 80: Calibration Well 2403

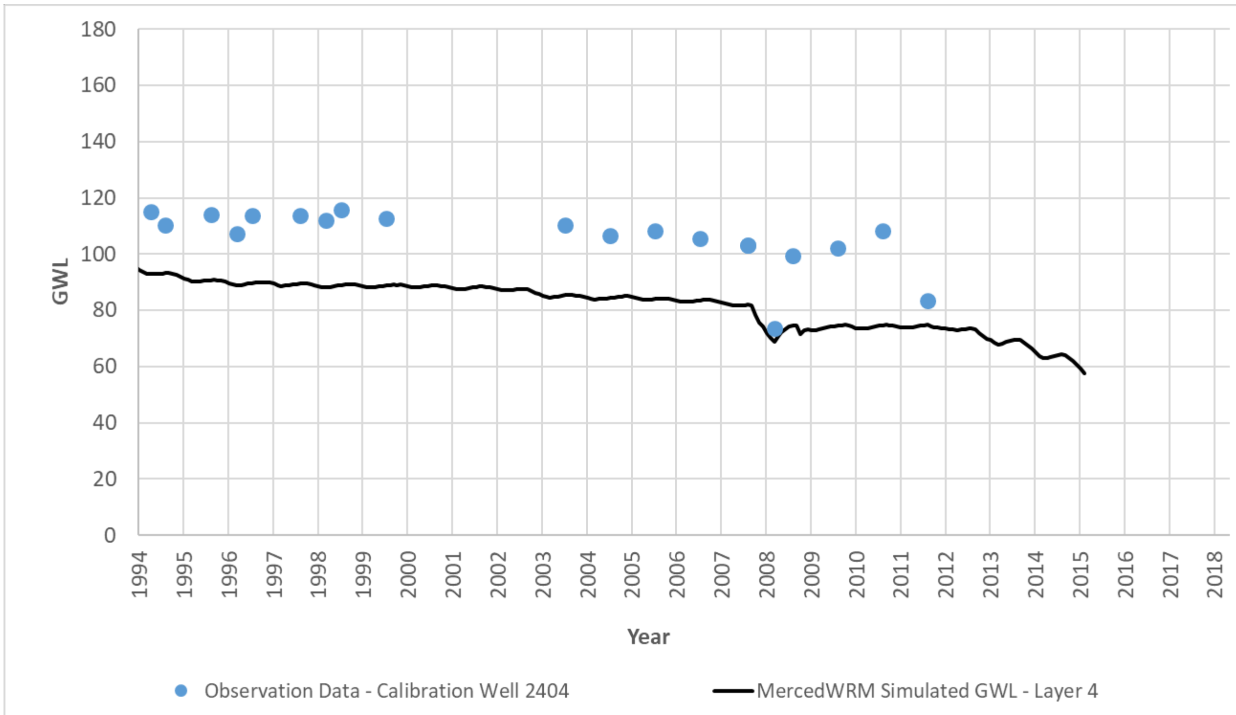


Figure A 81: Calibration Well 2404

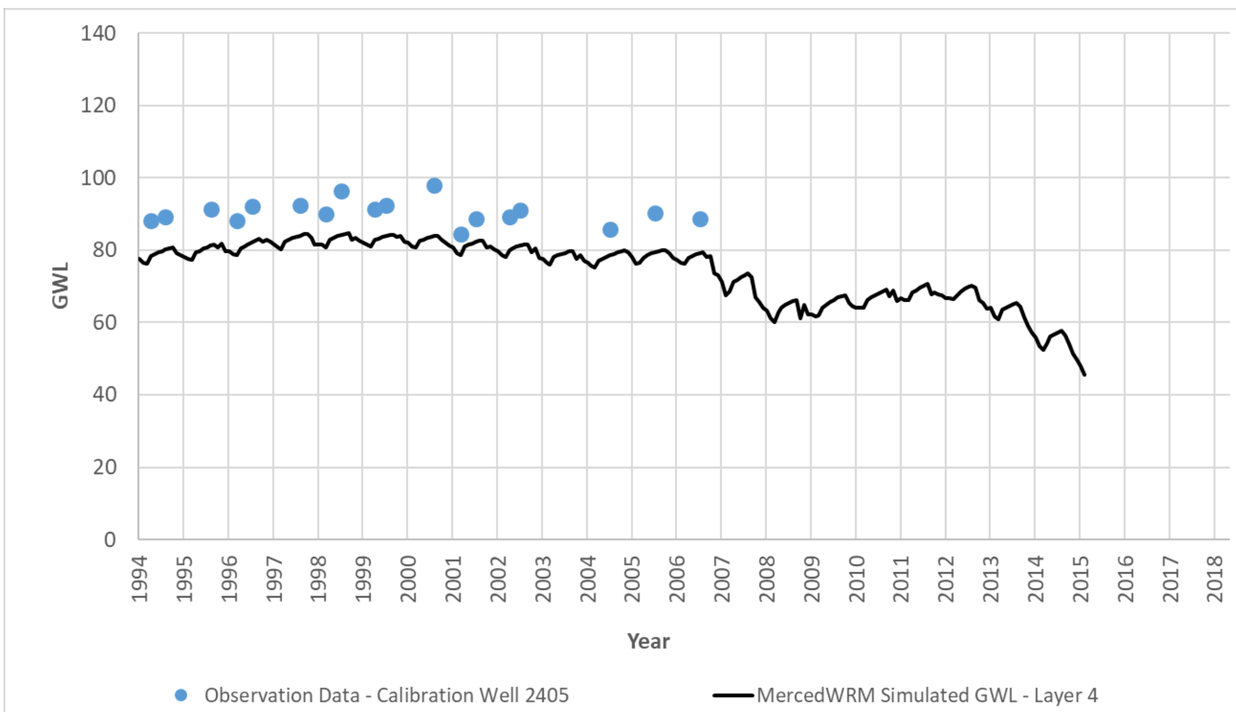


Figure A 82: Calibration Well 2405

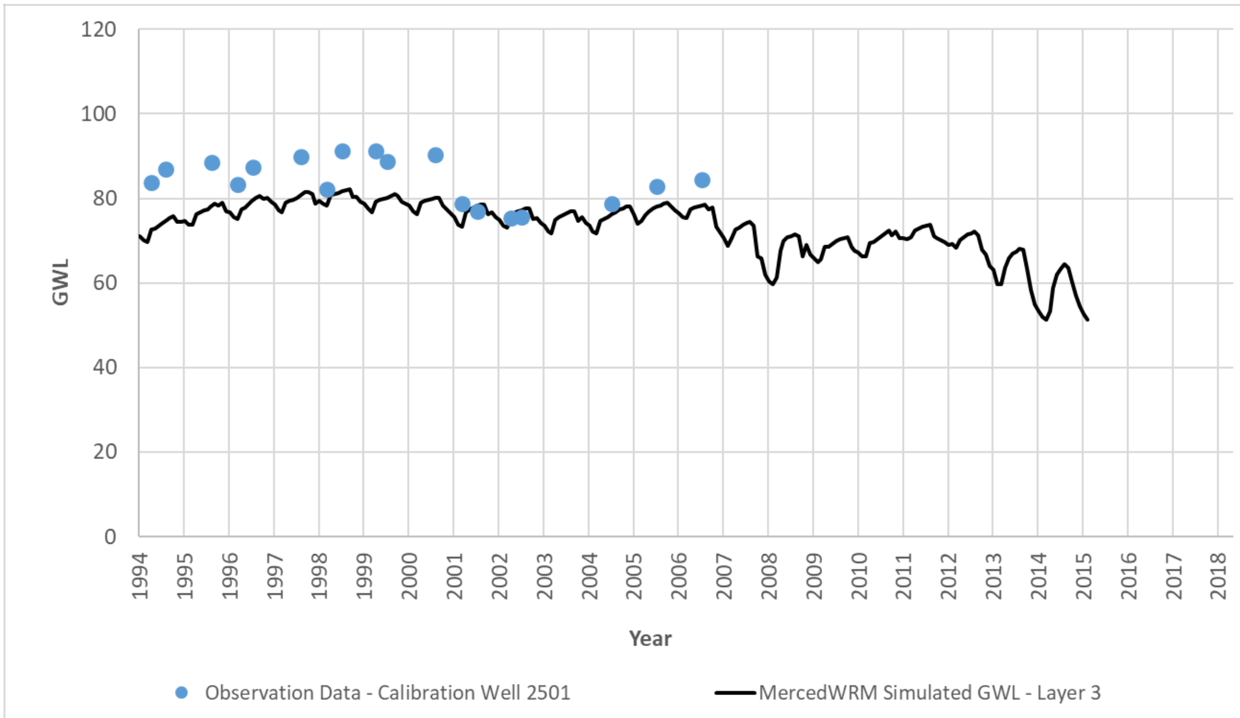


Figure A 83: Calibration Well 2501

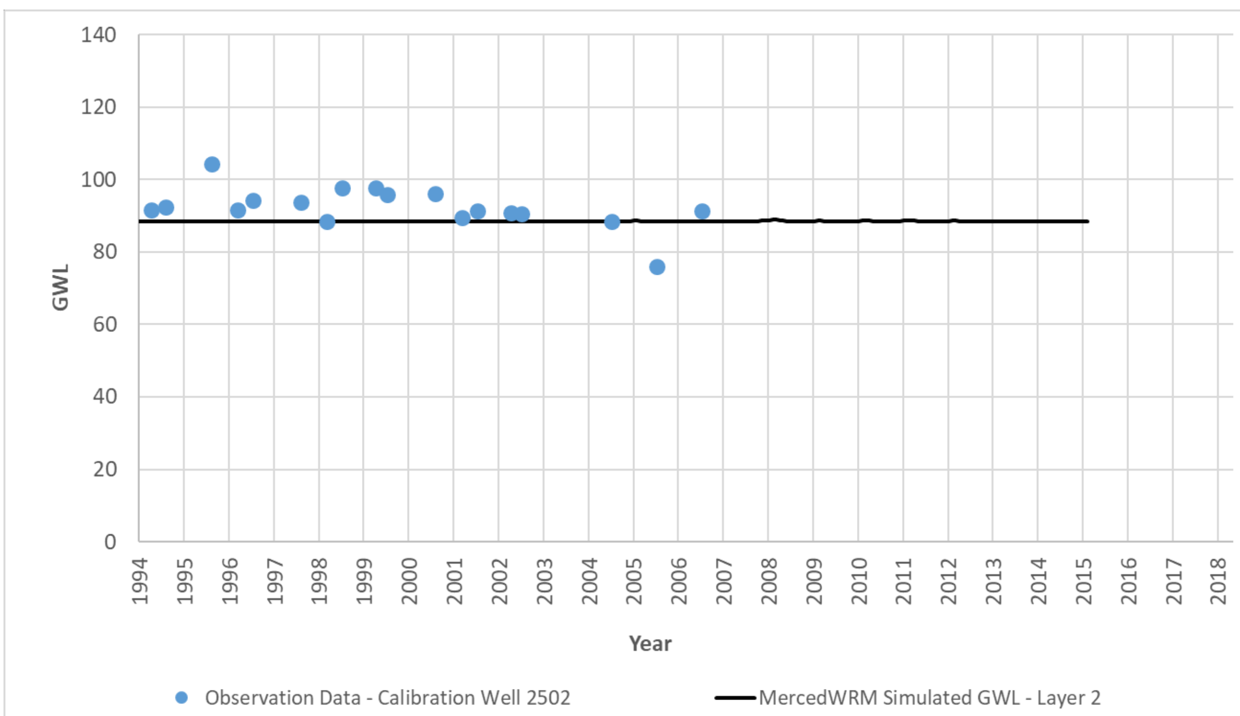


Figure A 84: Calibration Well 2502

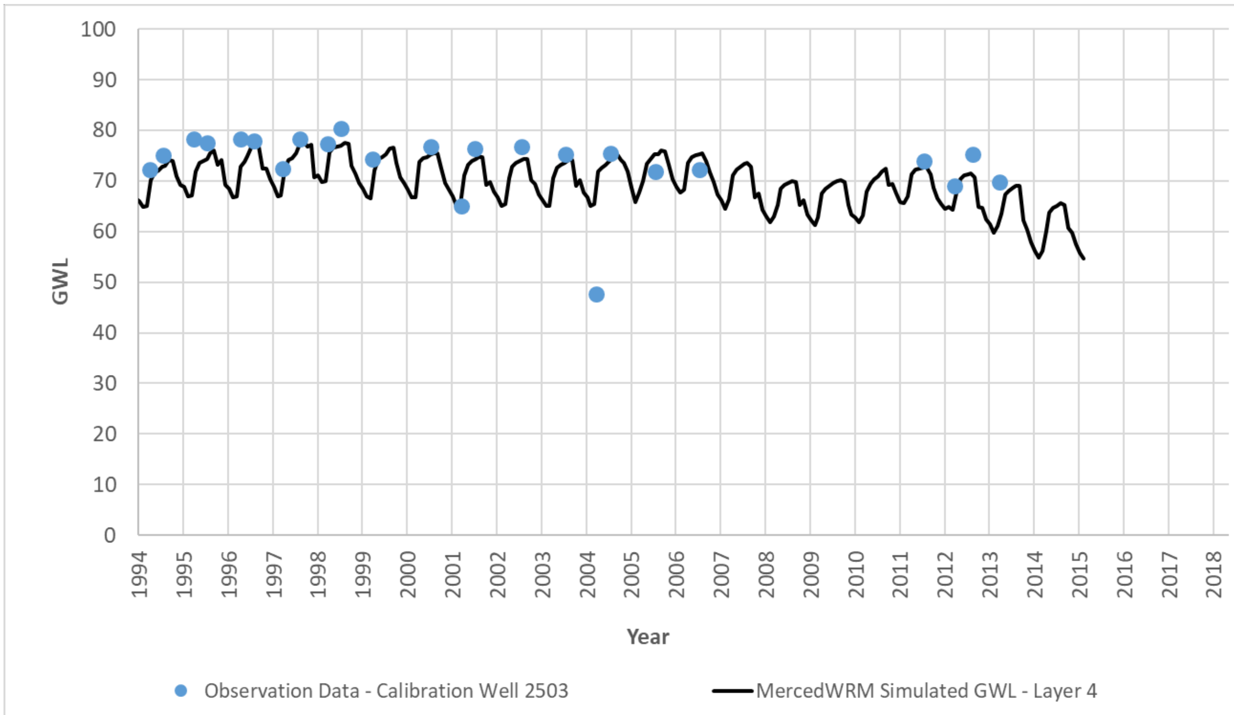


Figure A 85: Calibration Well 2503

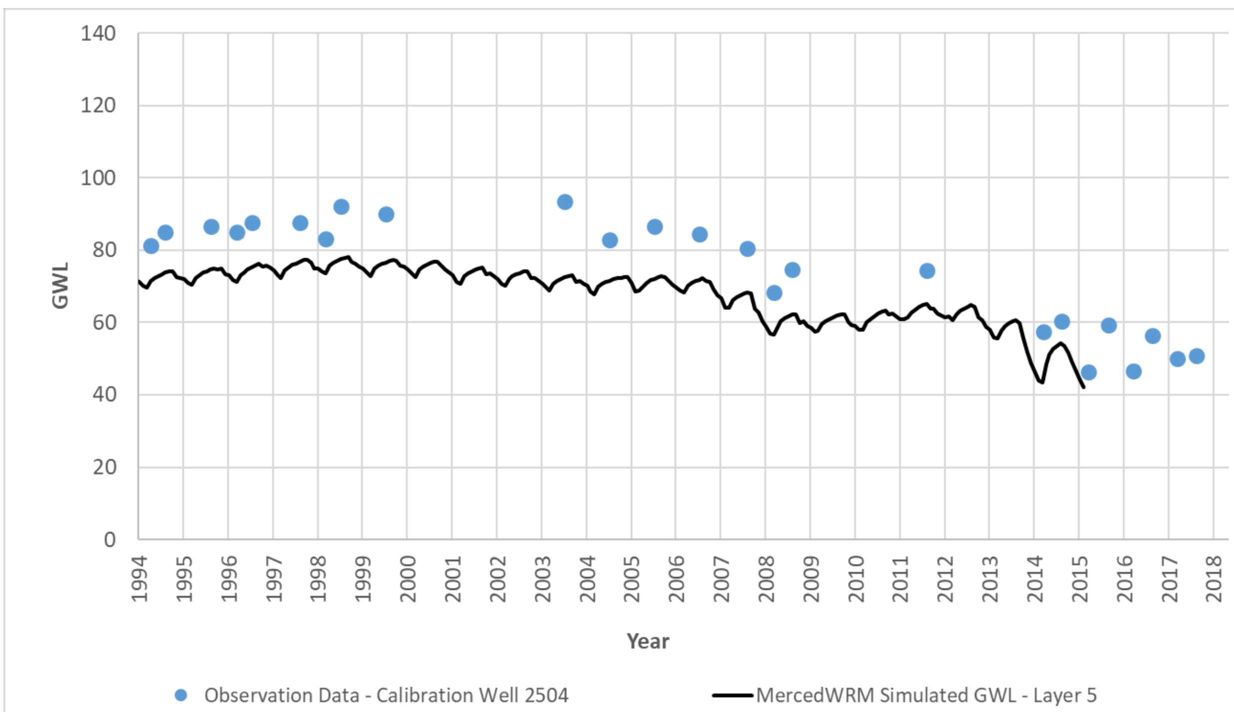


Figure A 86: Calibration Well 2504

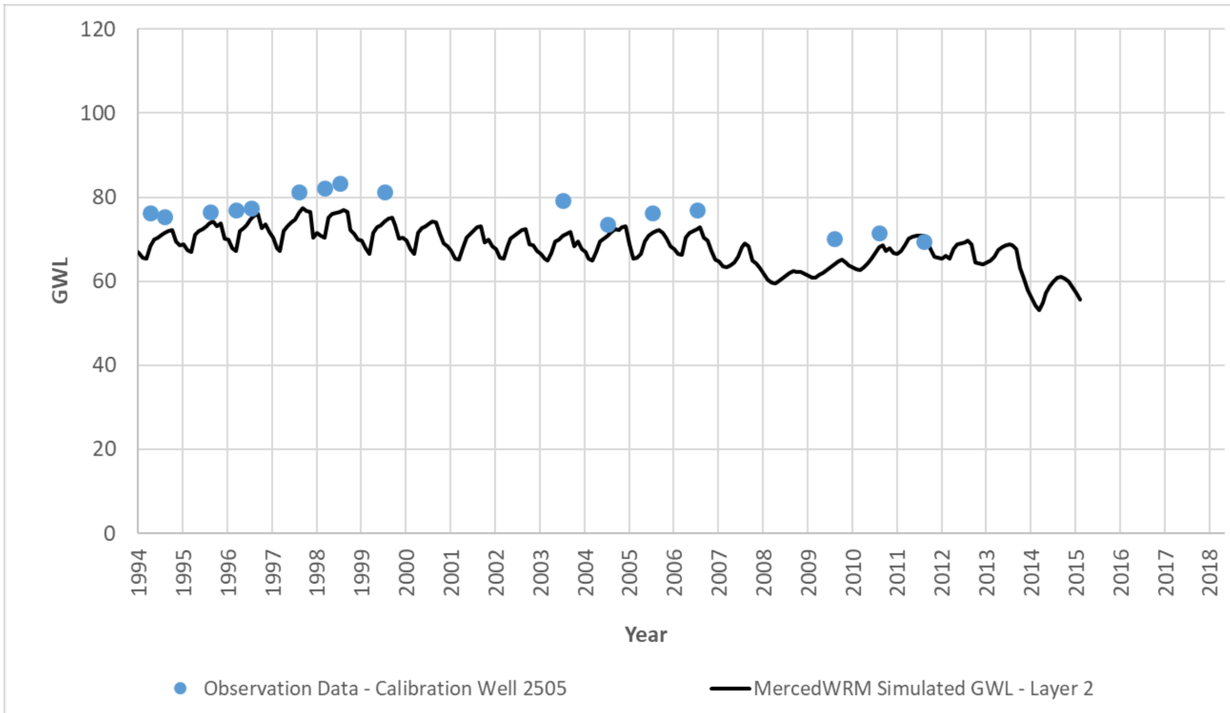


Figure A 87: Calibration Well 2505

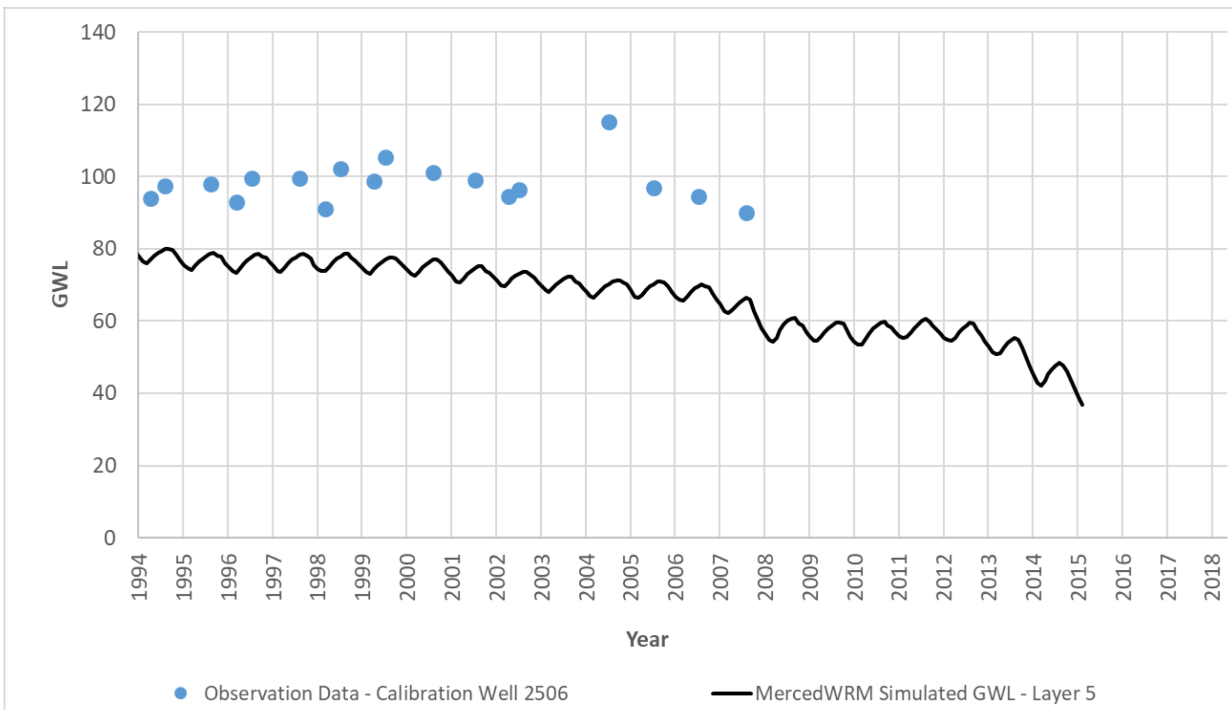


Figure A 88: Calibration Well 2506

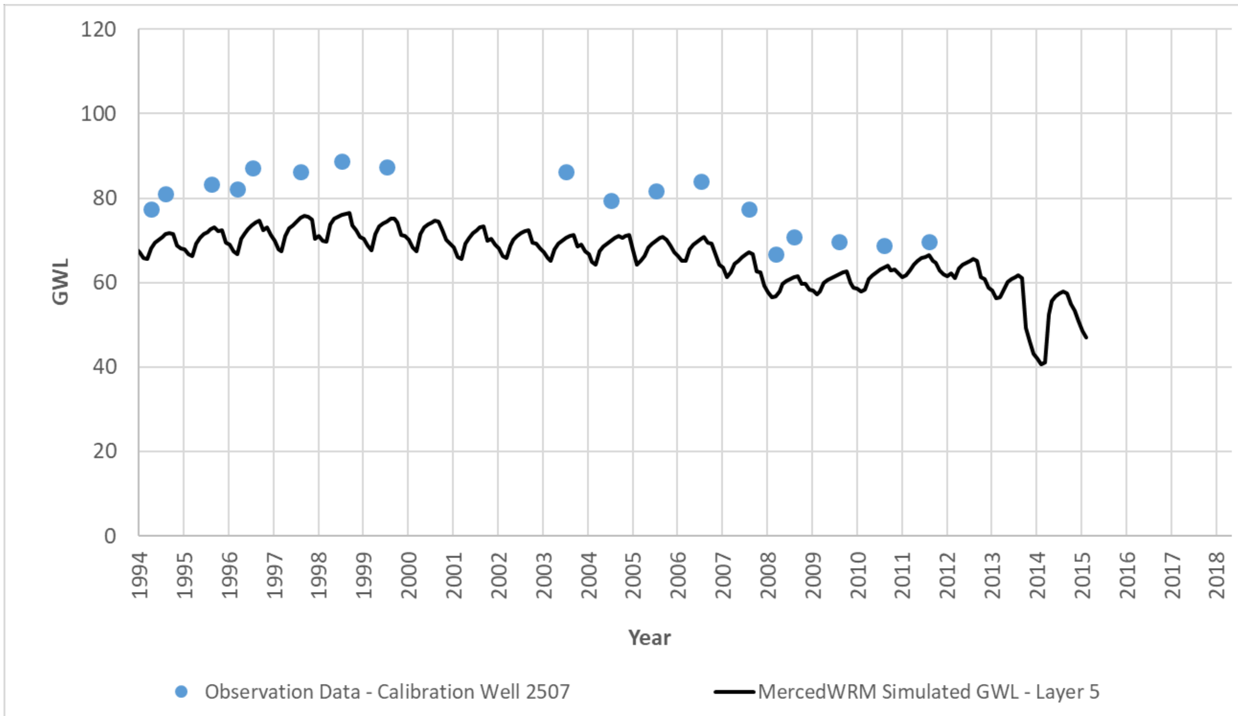


Figure A 89: Calibration Well 2507

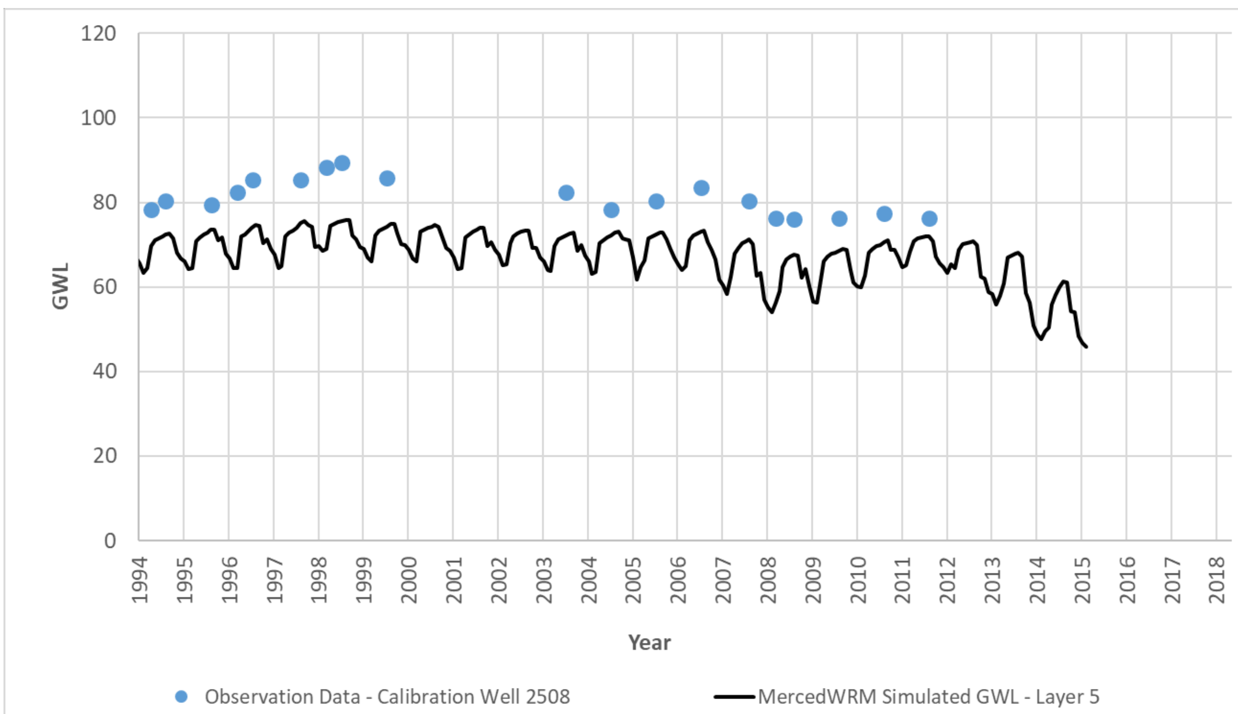


Figure A 90: Calibration Well 2508

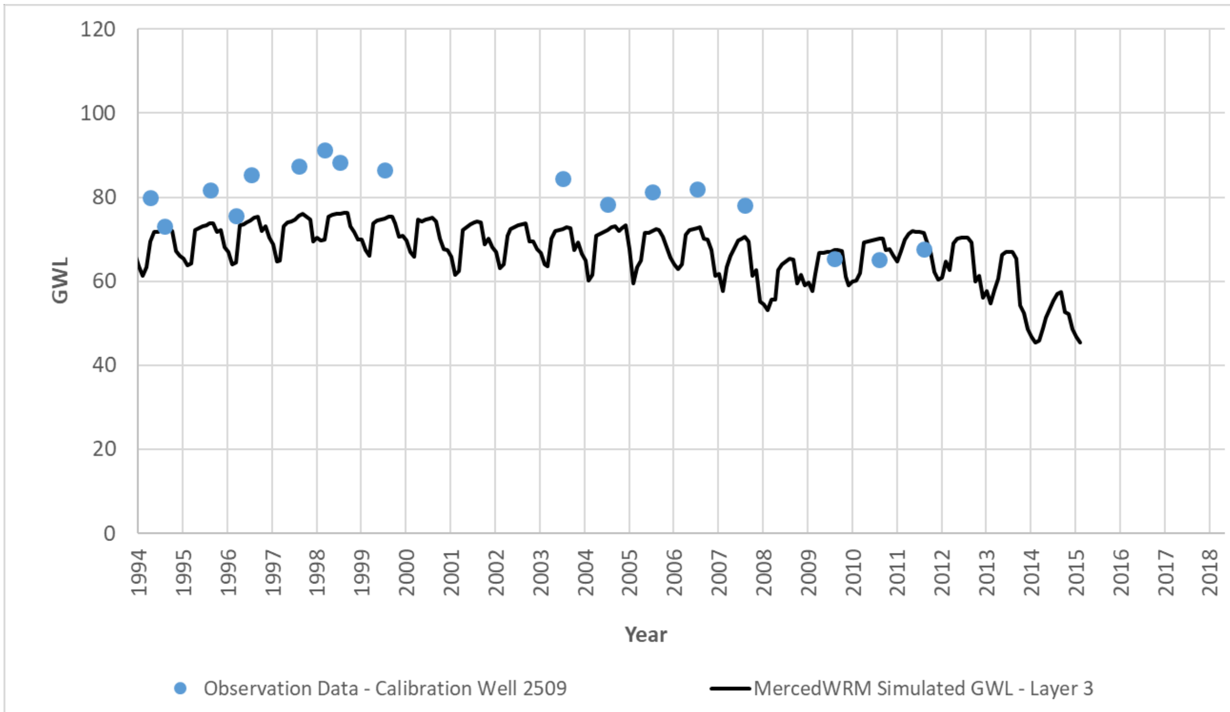


Figure A 91: Calibration Well 2509

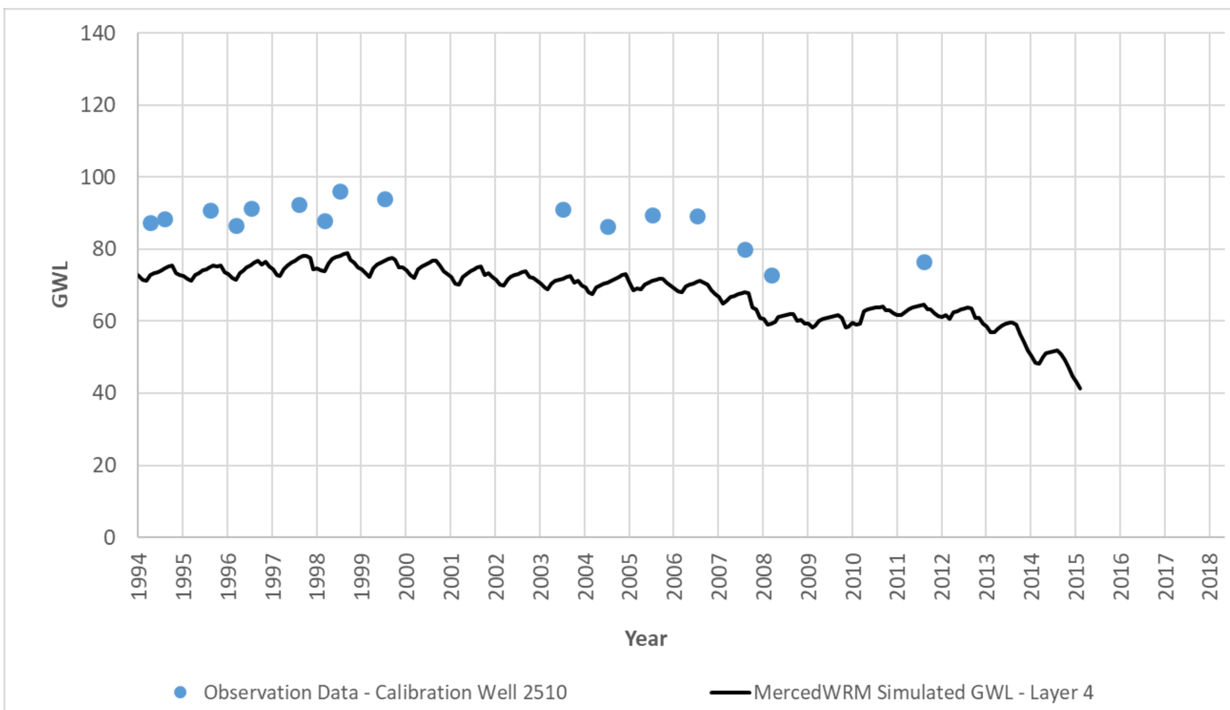


Figure A 92: Calibration Well 2510

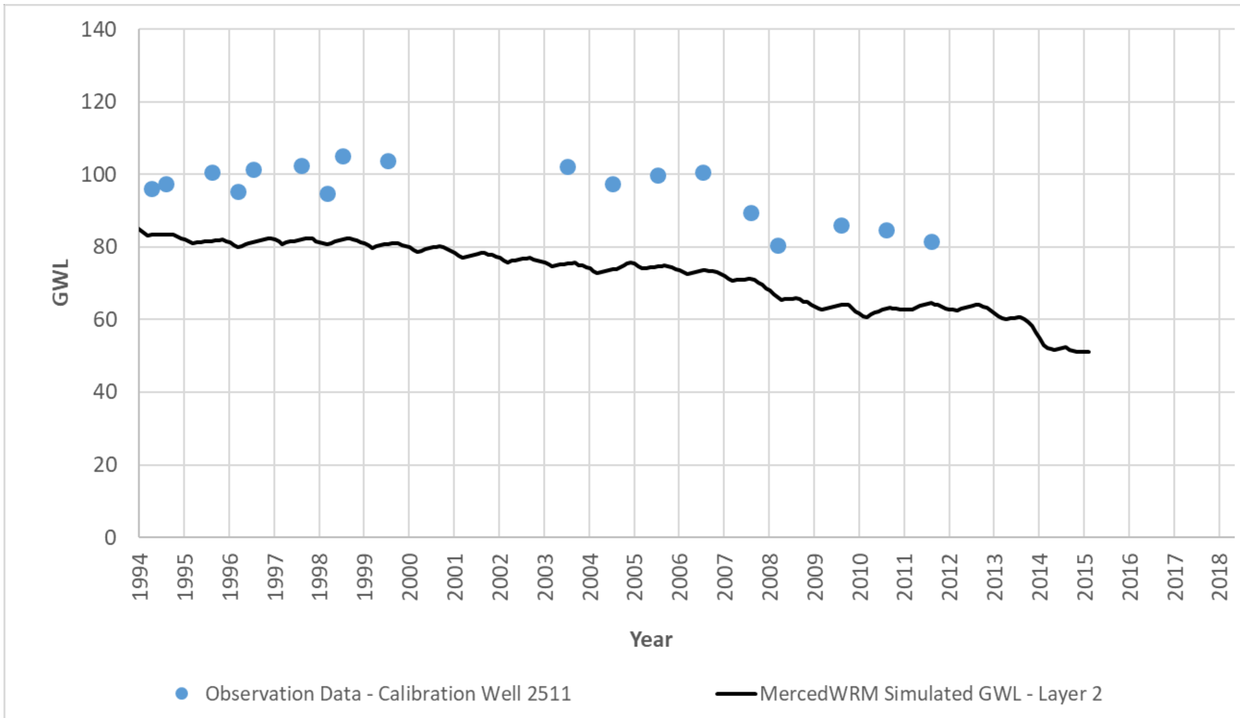


Figure A 93: Calibration Well 2511

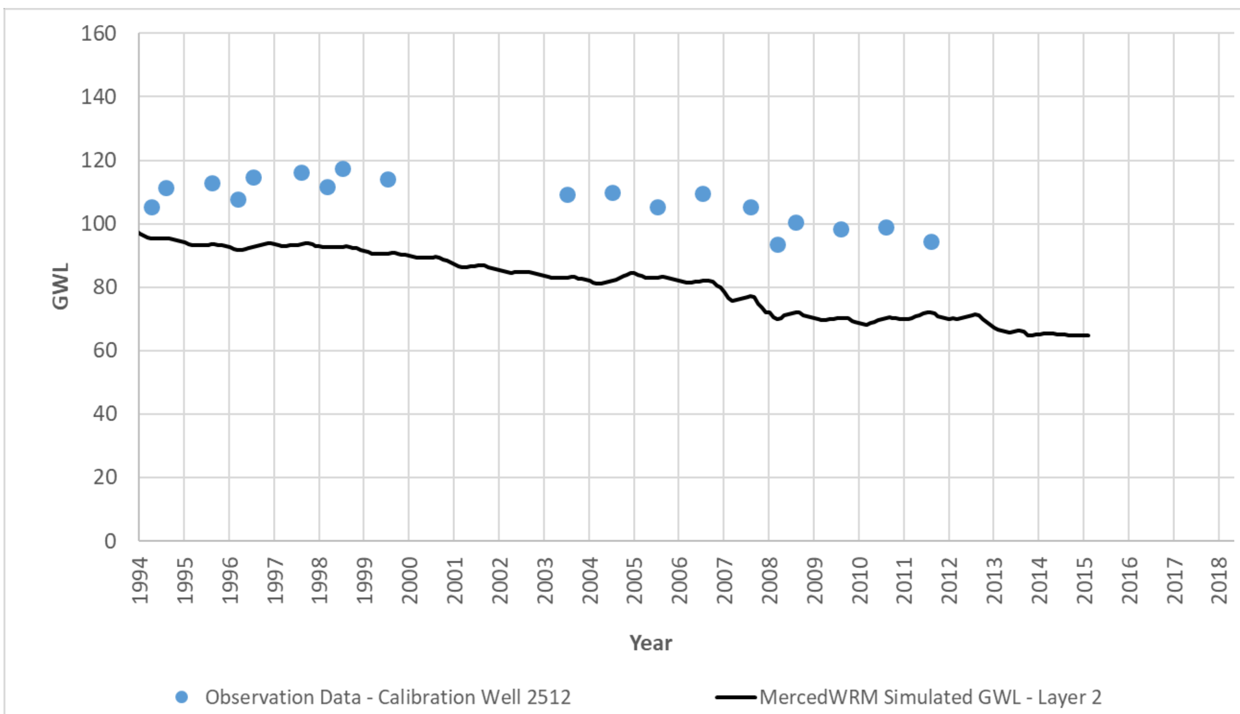


Figure A 94: Calibration Well 2512

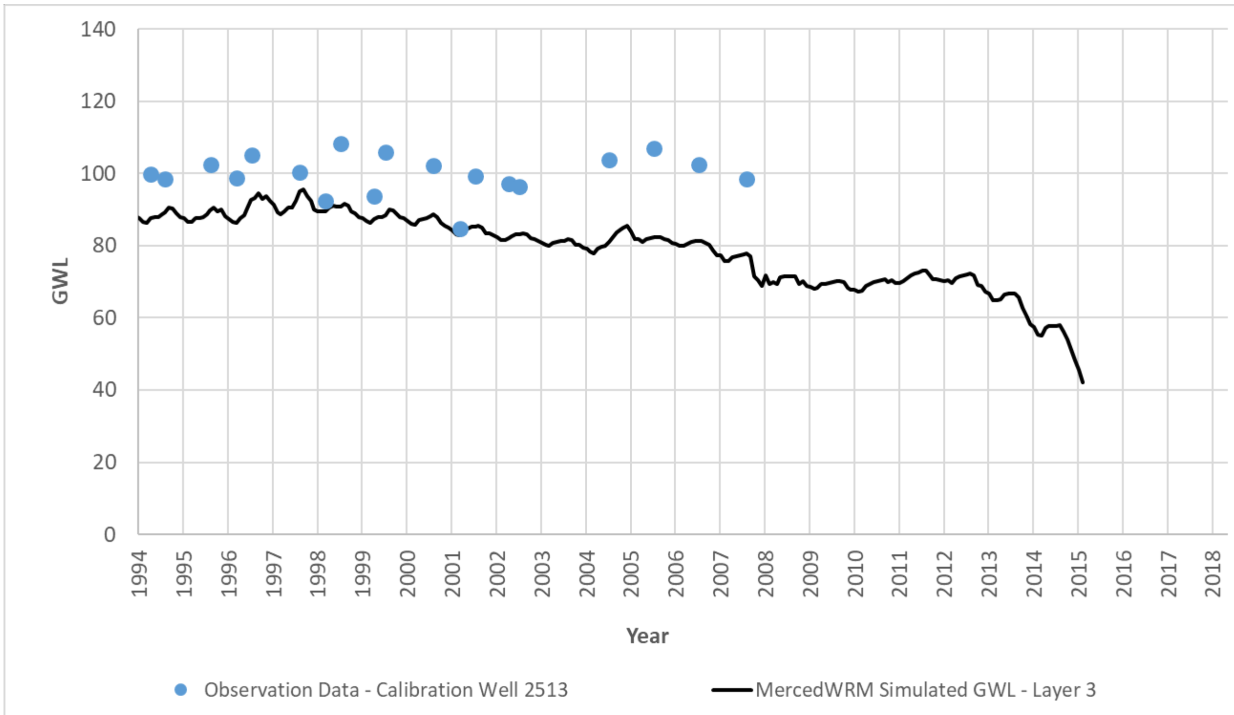


Figure A 95: Calibration Well 2513

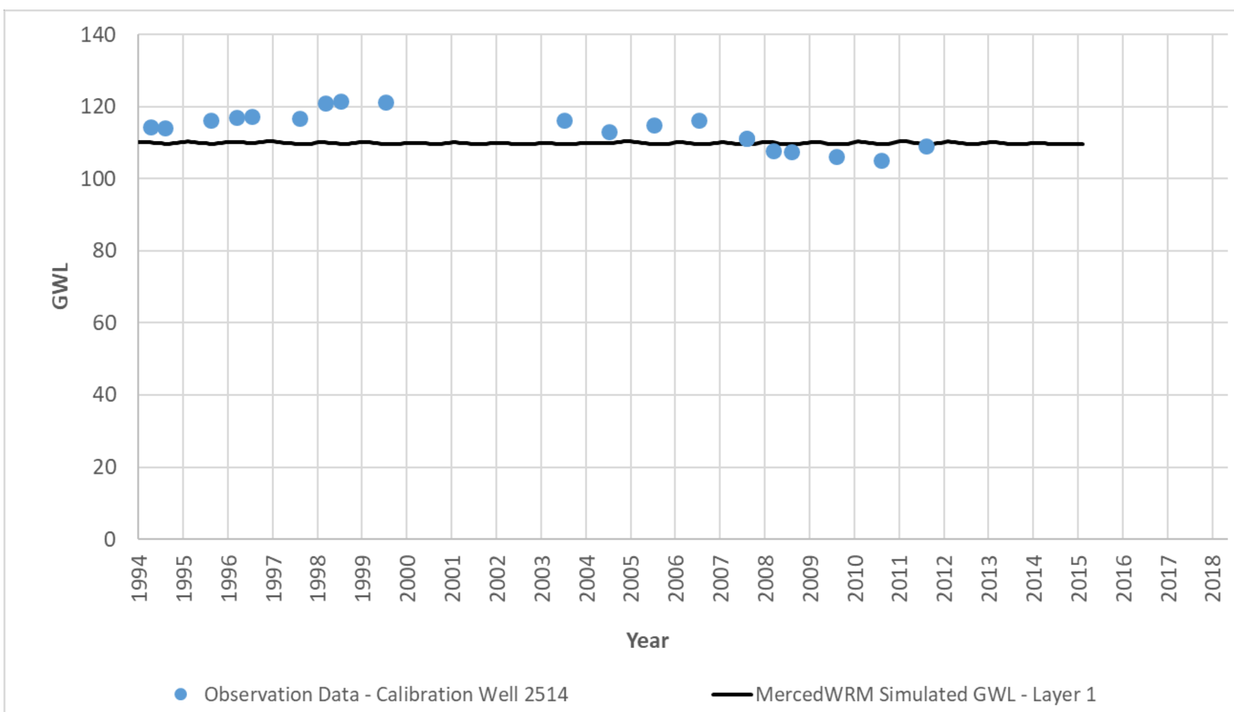


Figure A 96: Calibration Well 2514

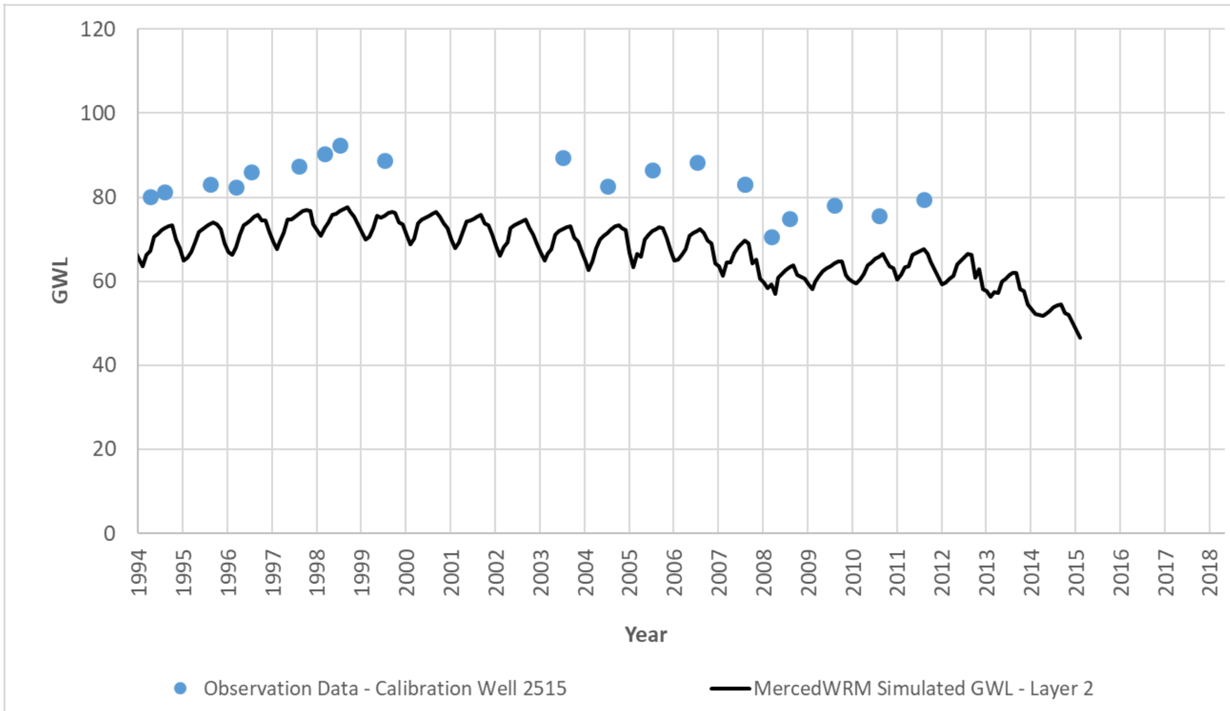


Figure A 97: Calibration Well 2515

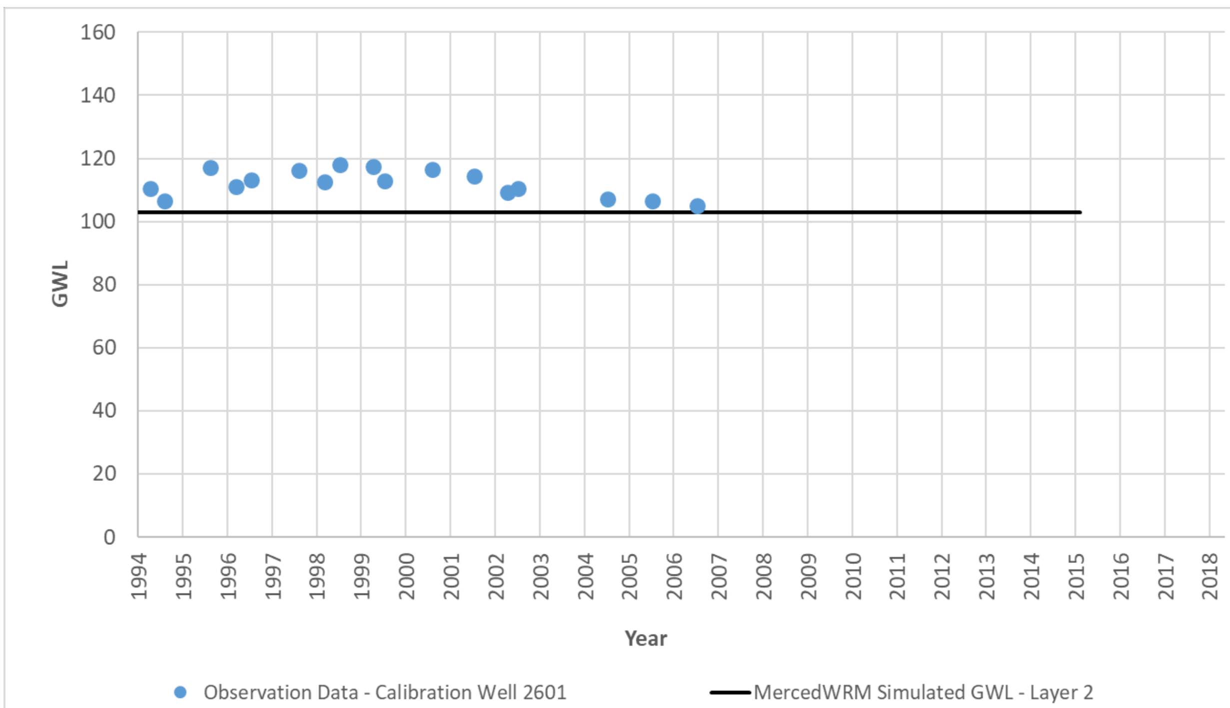


Figure A 98: Calibration Well 2601

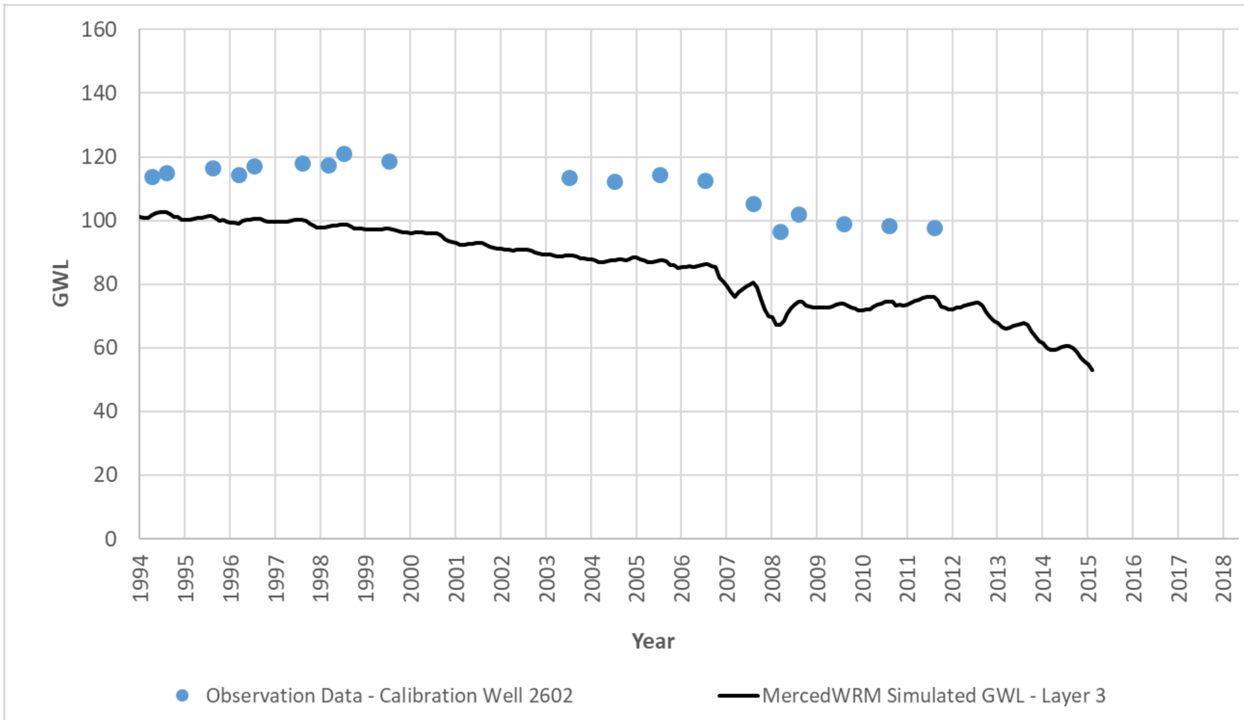


Figure A 99: Calibration Well 2602

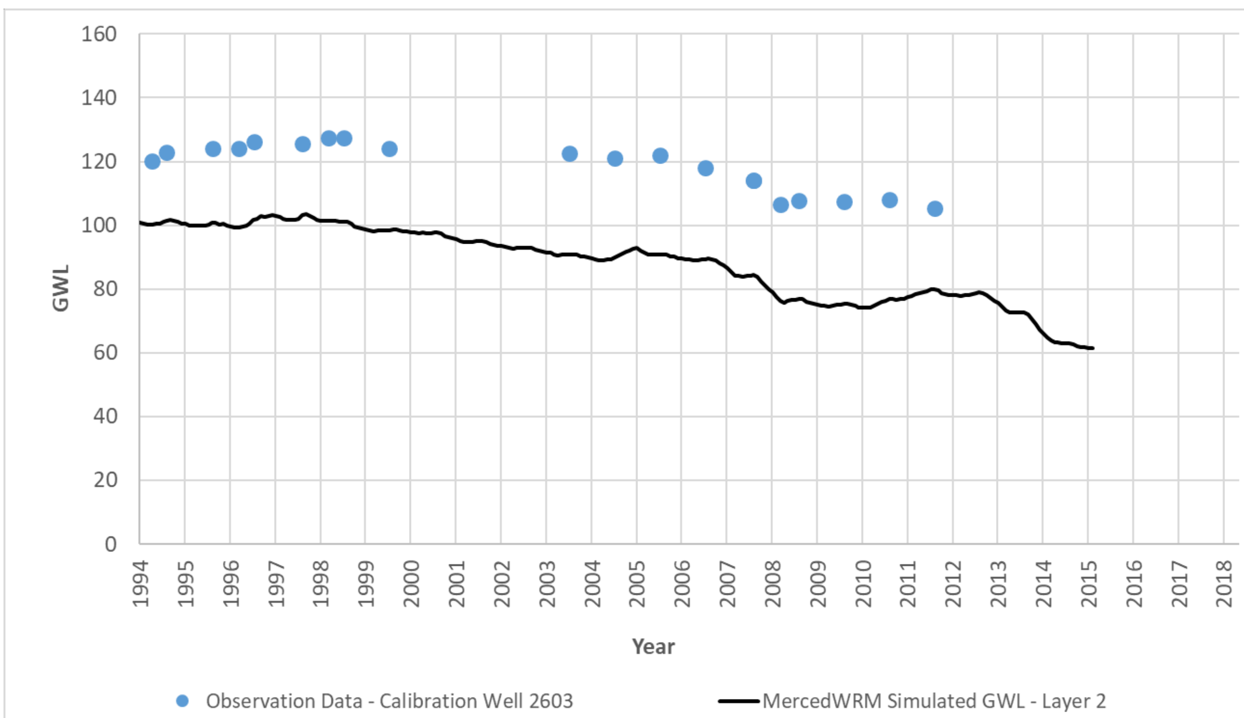


Figure A 100: Calibration Well 2603

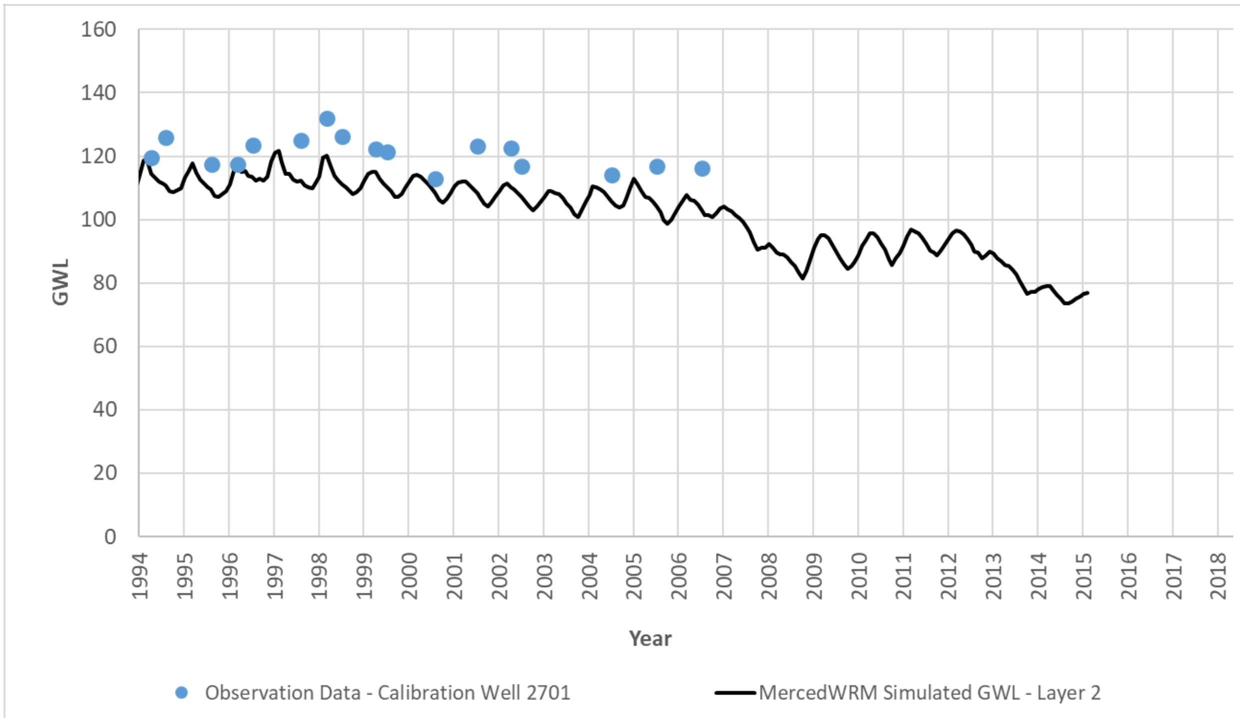


Figure A 101: Calibration Well 2701

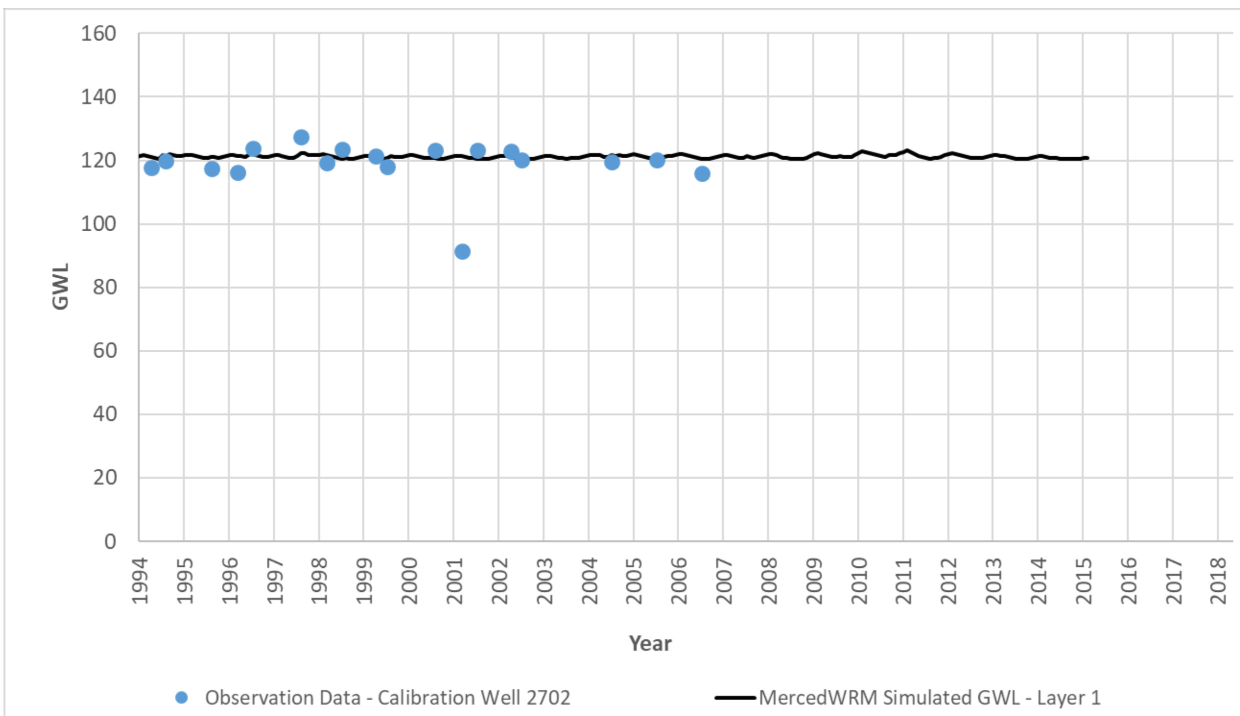


Figure A 102: Calibration Well 2702

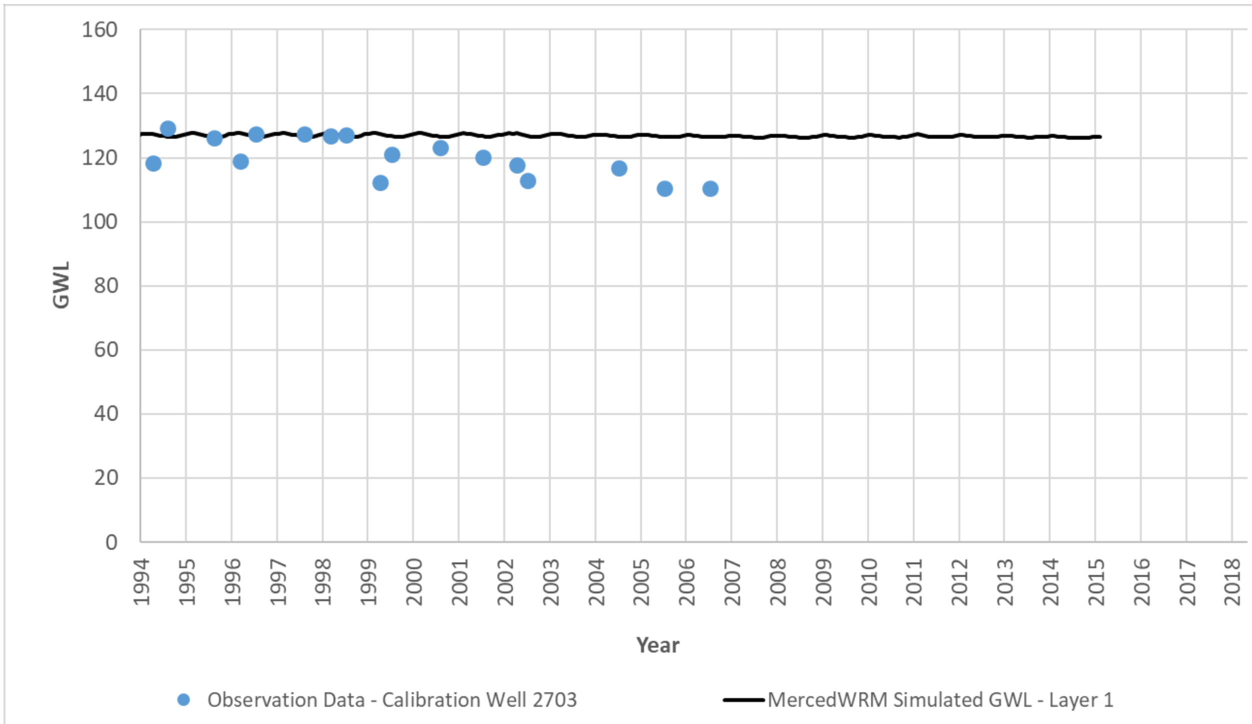


Figure A 103: Calibration Well 2703

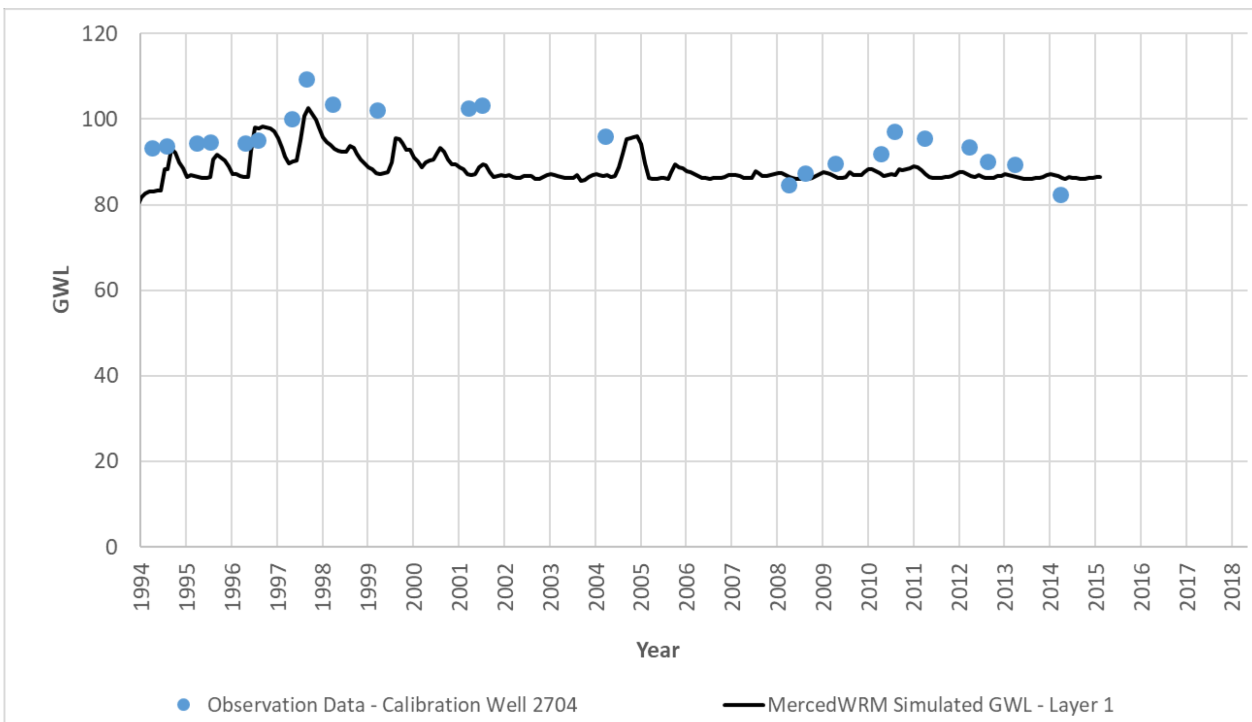


Figure A 104: Calibration Well 2704

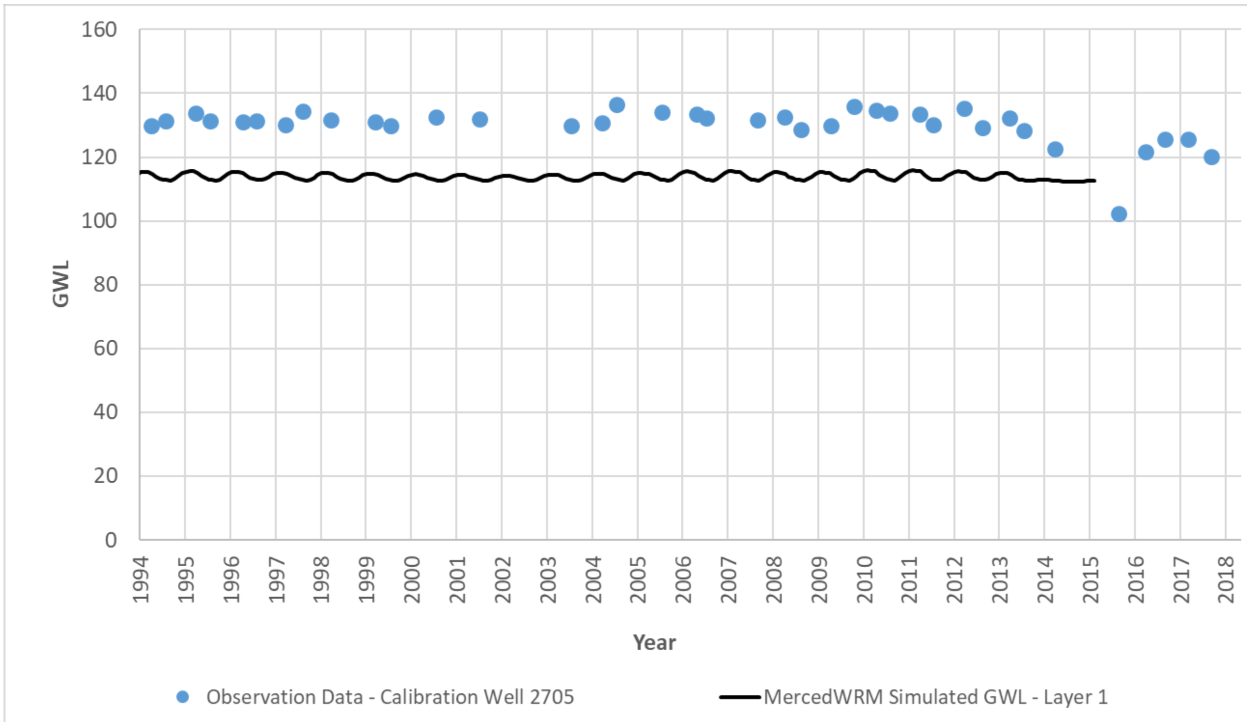


Figure A 105: Calibration Well 2705

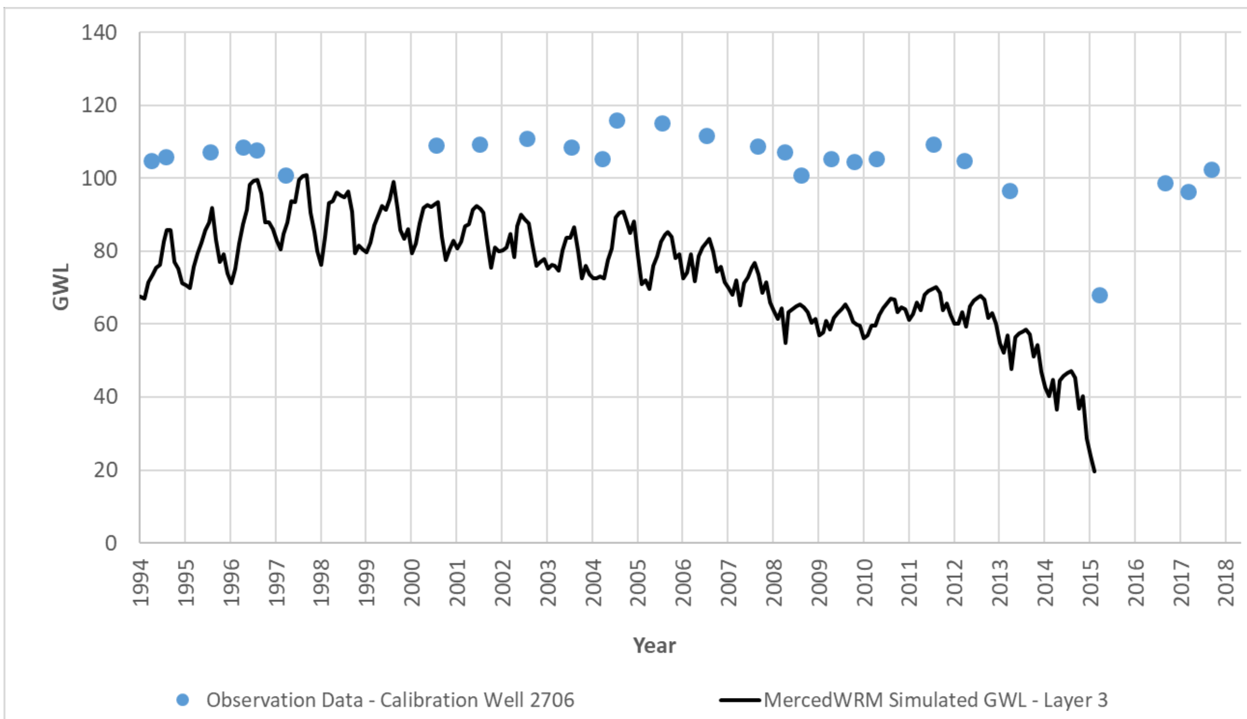


Figure A 106: Calibration Well 2706

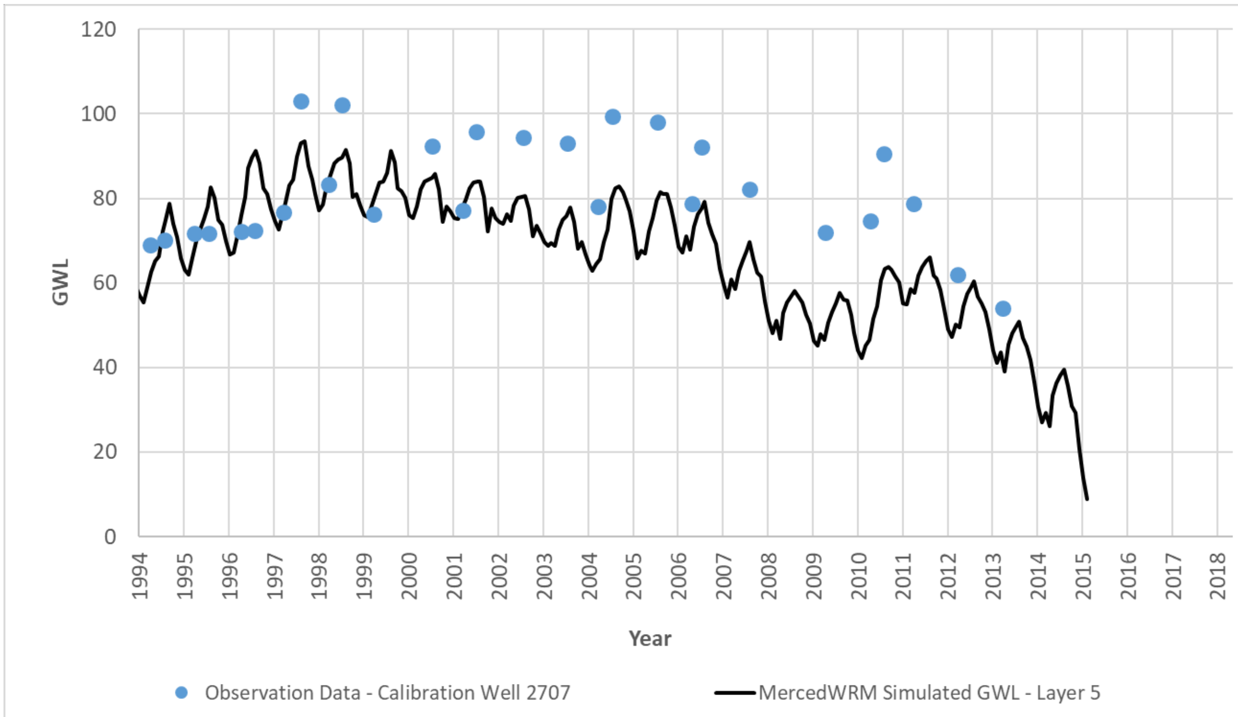


Figure A 107: Calibration Well 2707

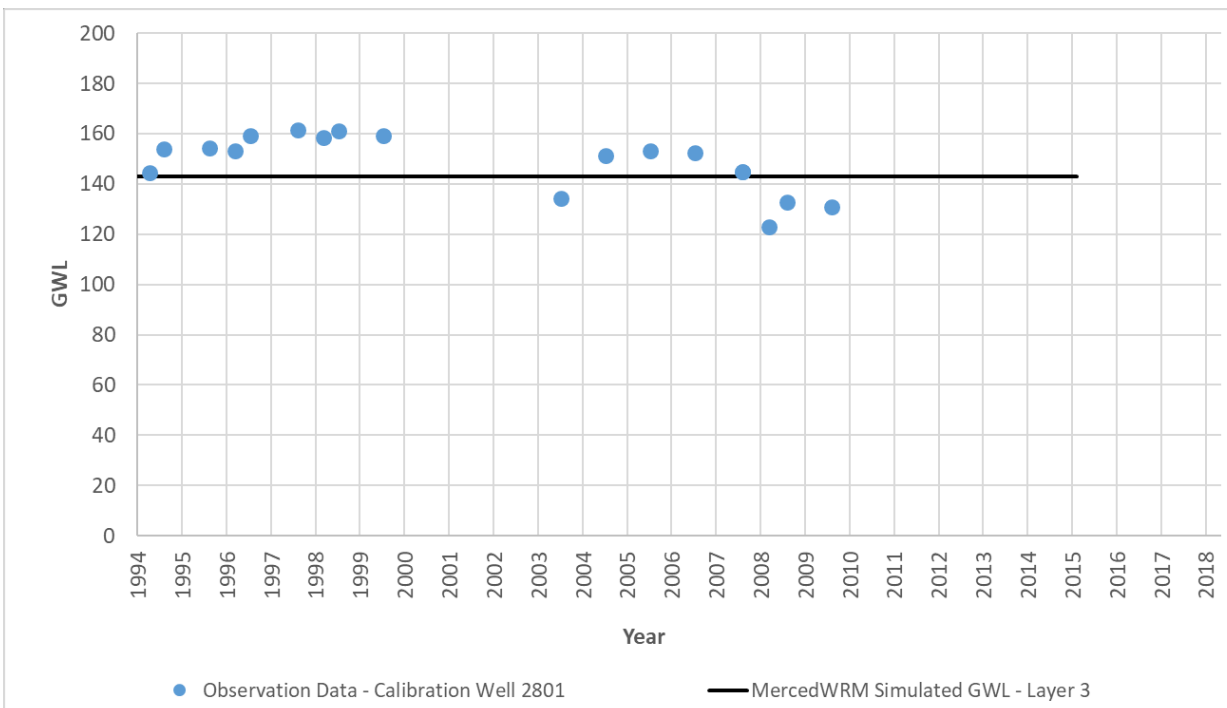


Figure A 108: Calibration Well 2801

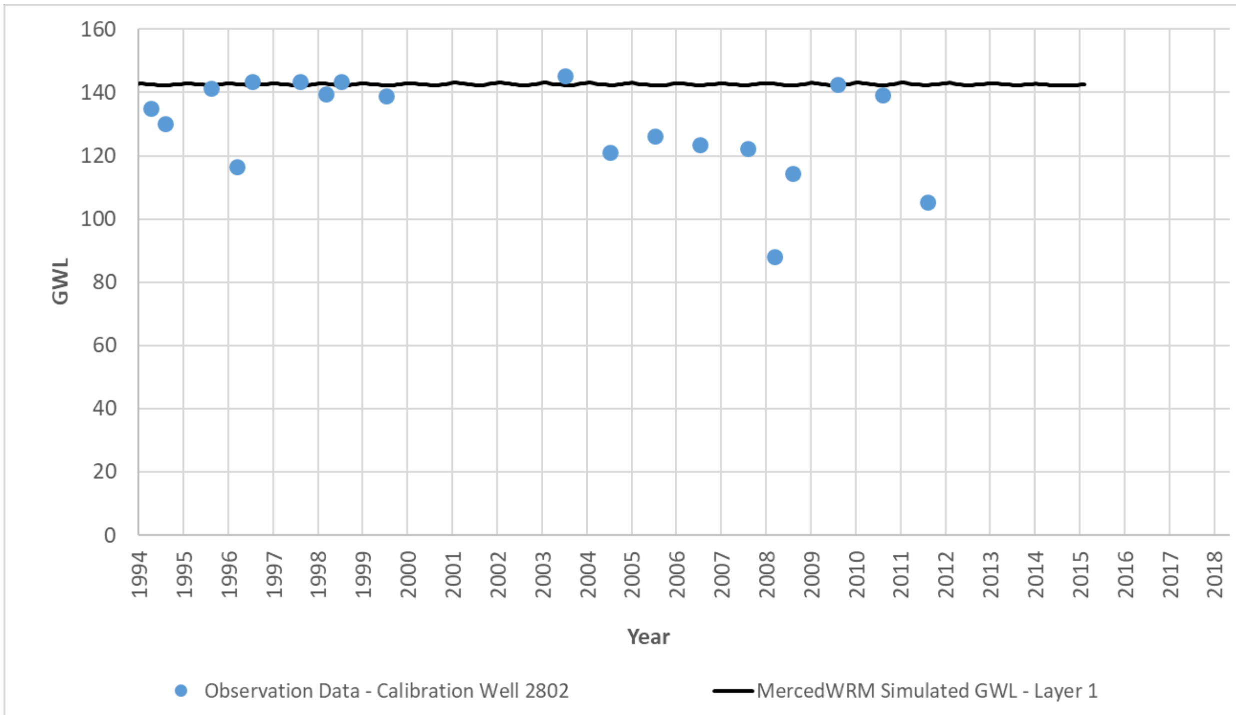


Figure A 109: Calibration Well 2802

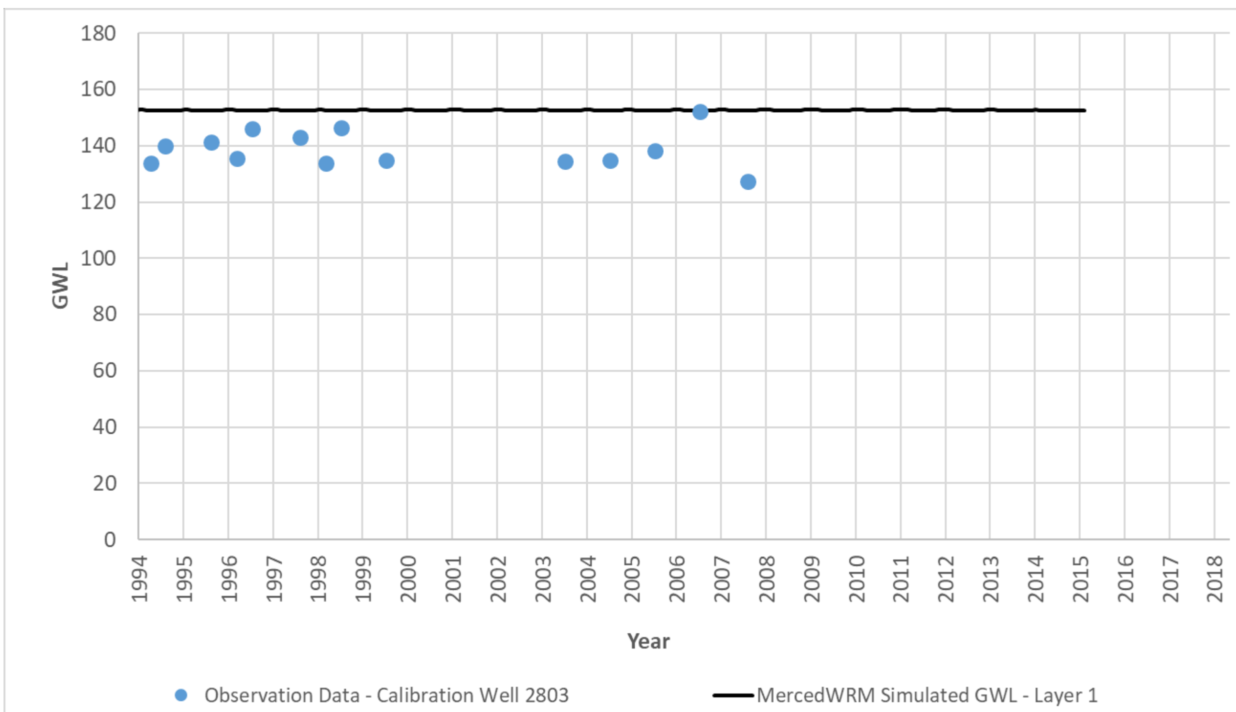


Figure A 110: Calibration Well 2803

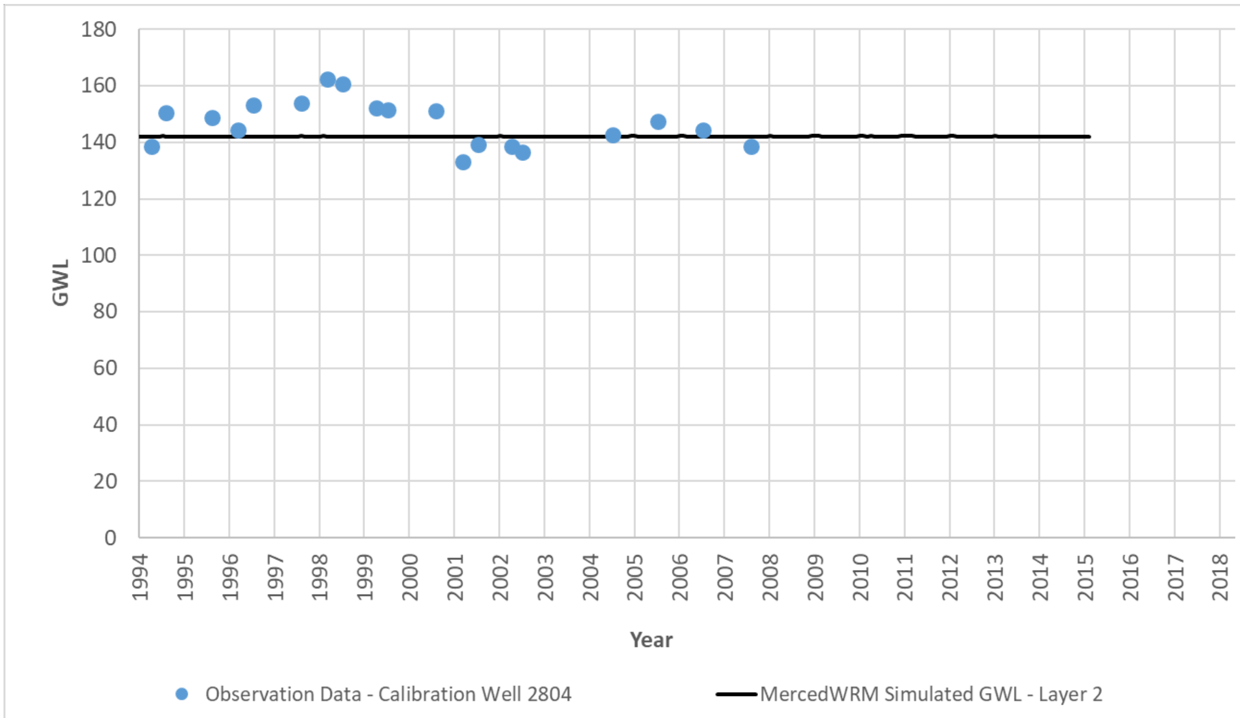


Figure A 111: Calibration Well 2804

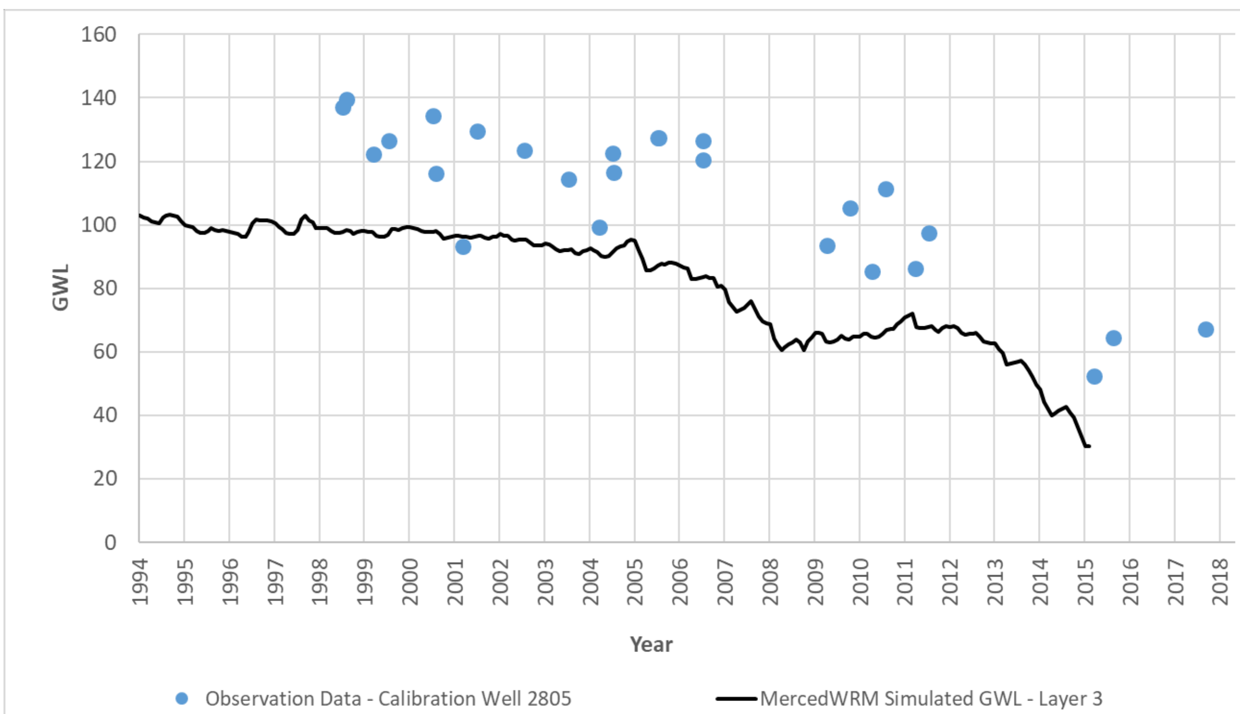


Figure A 112: Calibration Well 2805

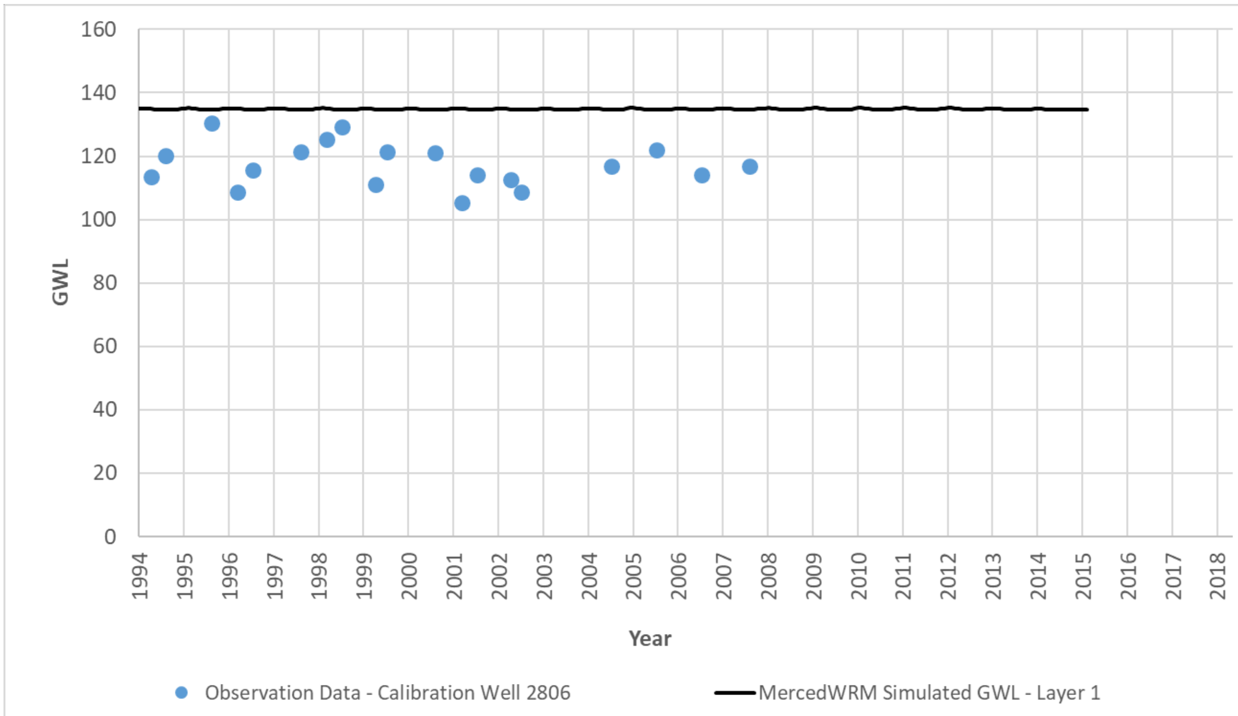


Figure A 113: Calibration Well 2806

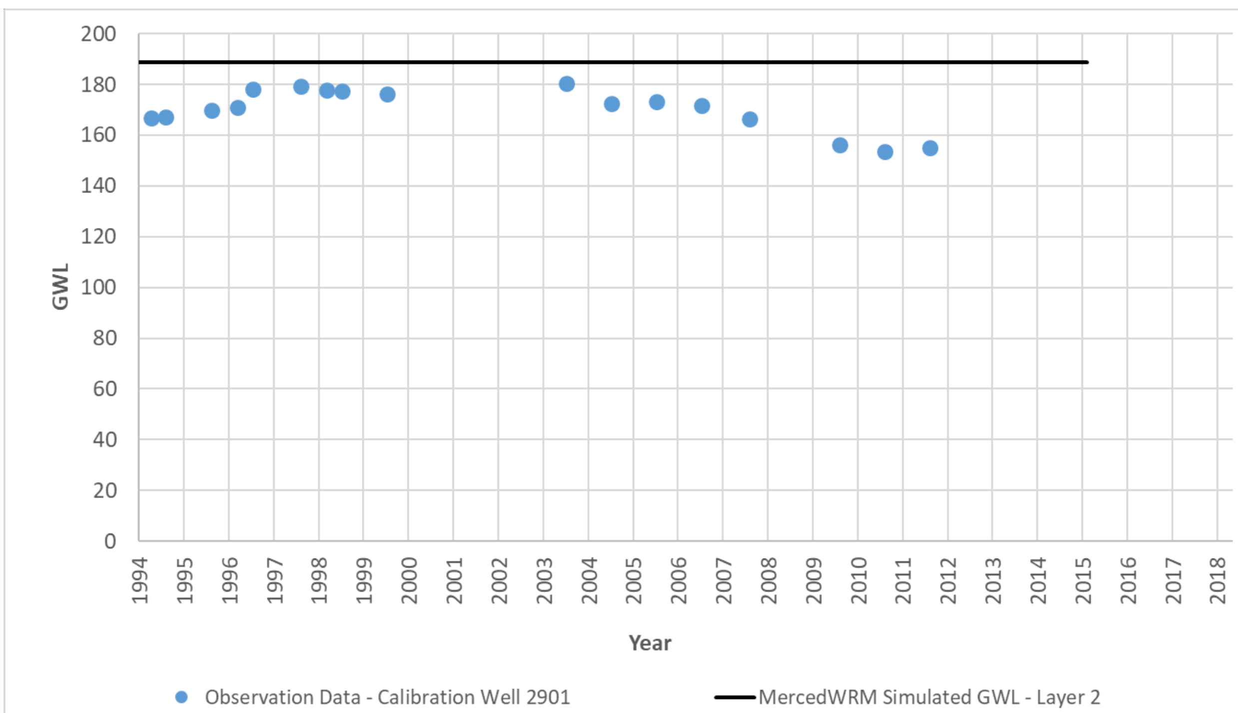


Figure A 114: Calibration Well 2901

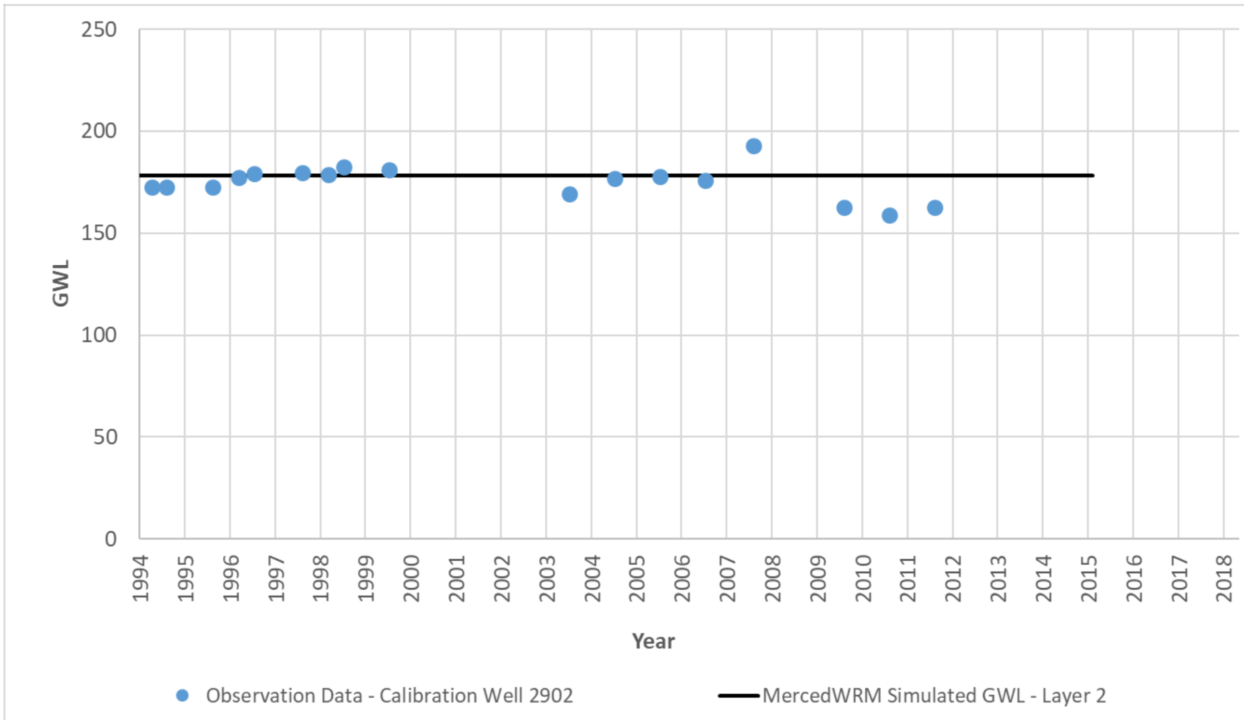


Figure A 115: Calibration Well 2902

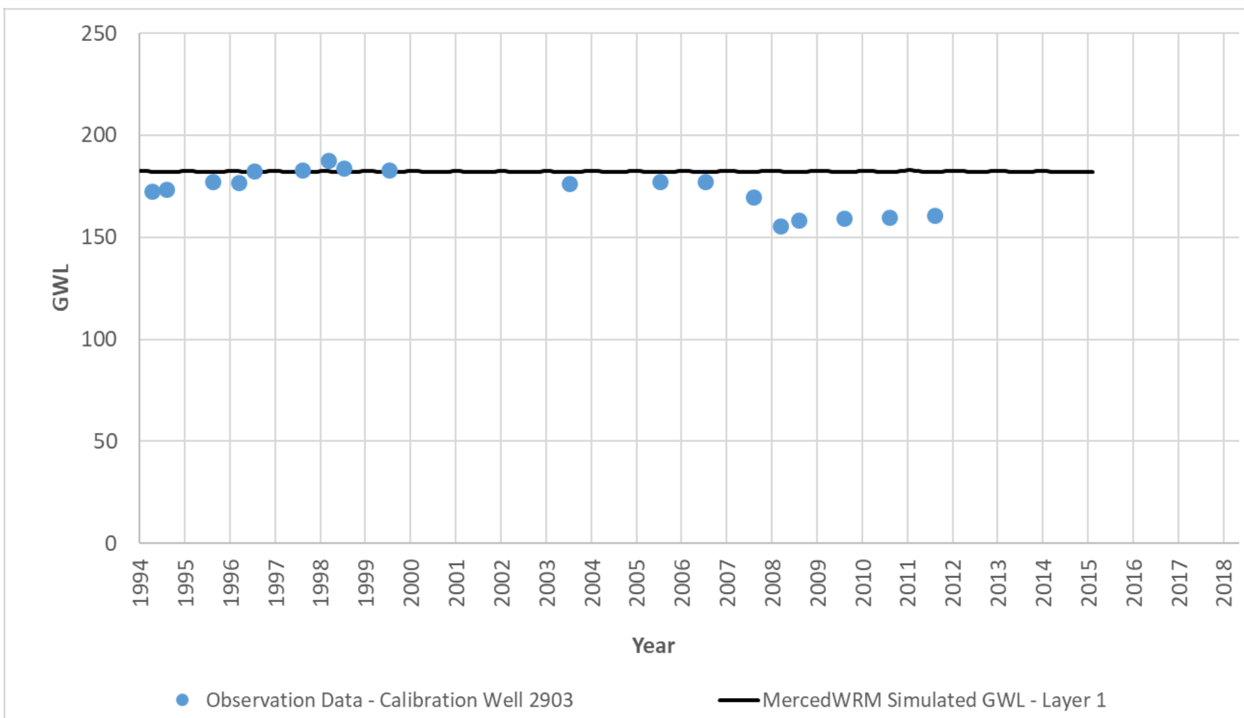


Figure A 116: Calibration Well 2903

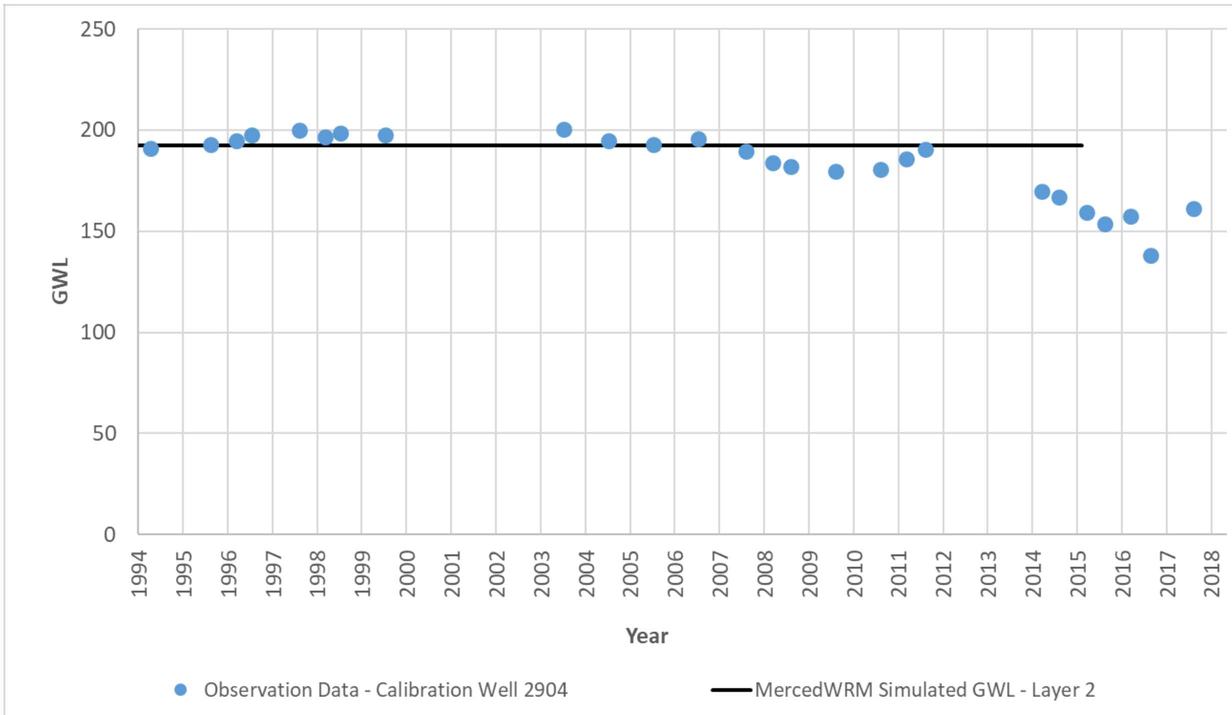


Figure A 117: Calibration Well 2904

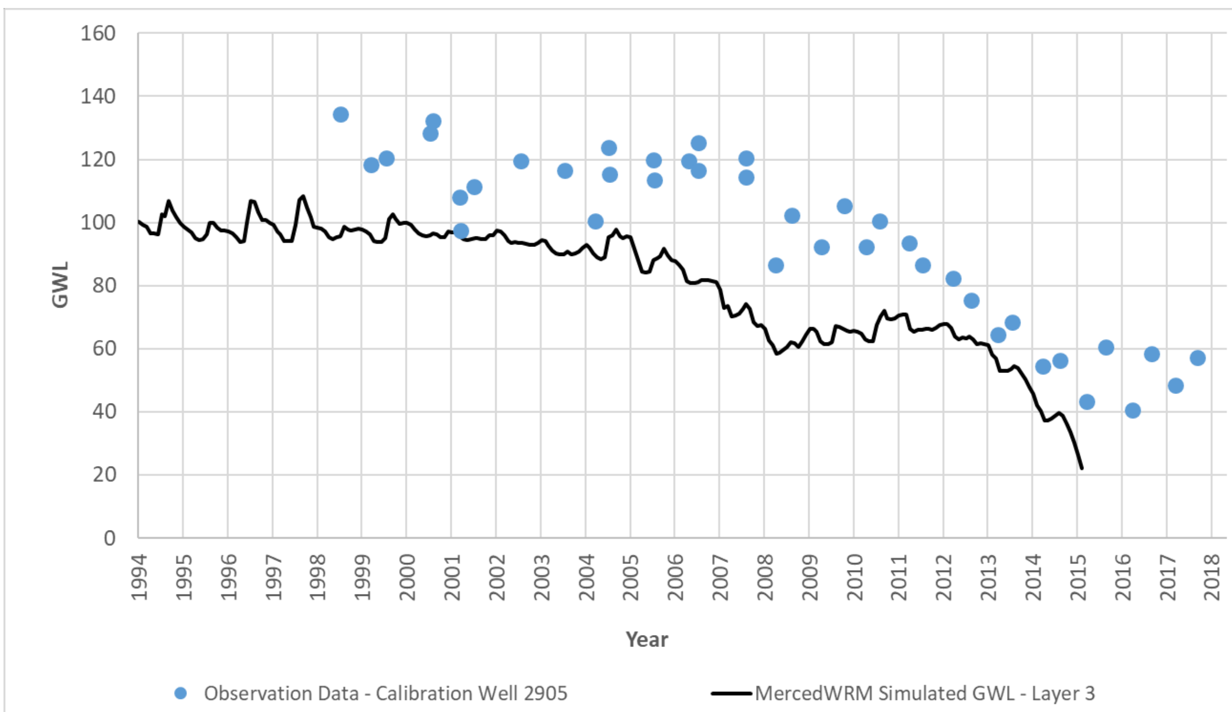


Figure A 118: Calibration Well 2905

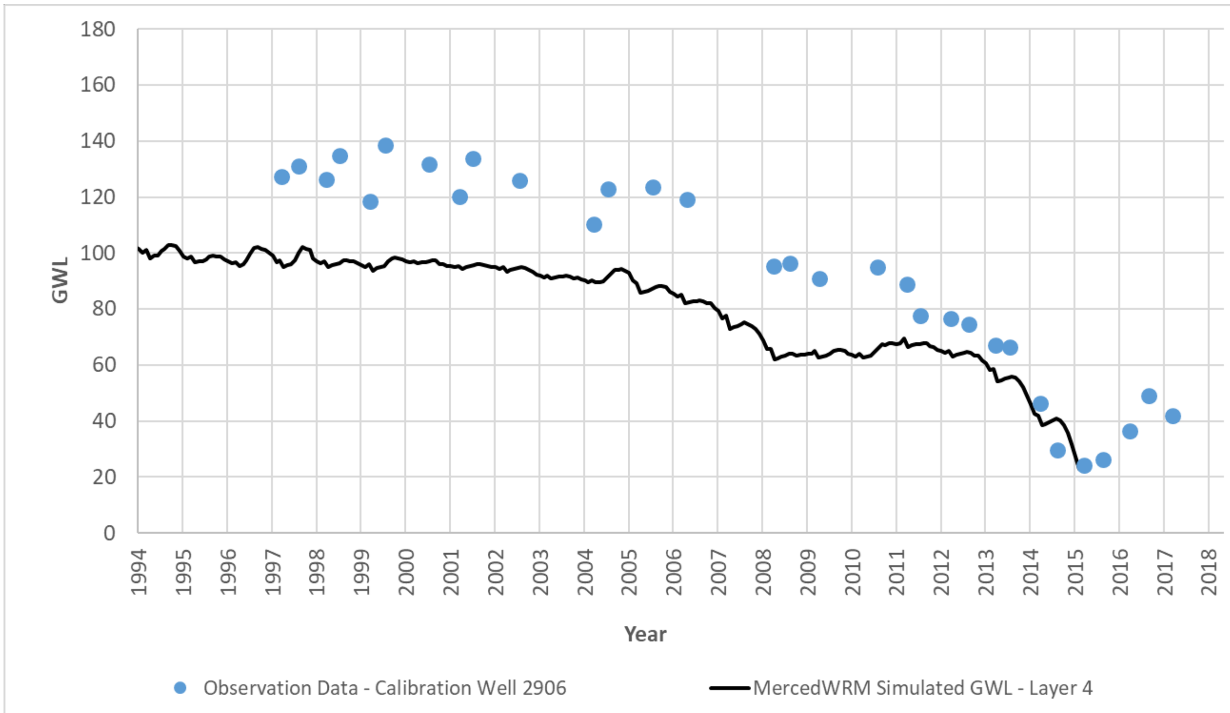


Figure A 119: Calibration Well 2906

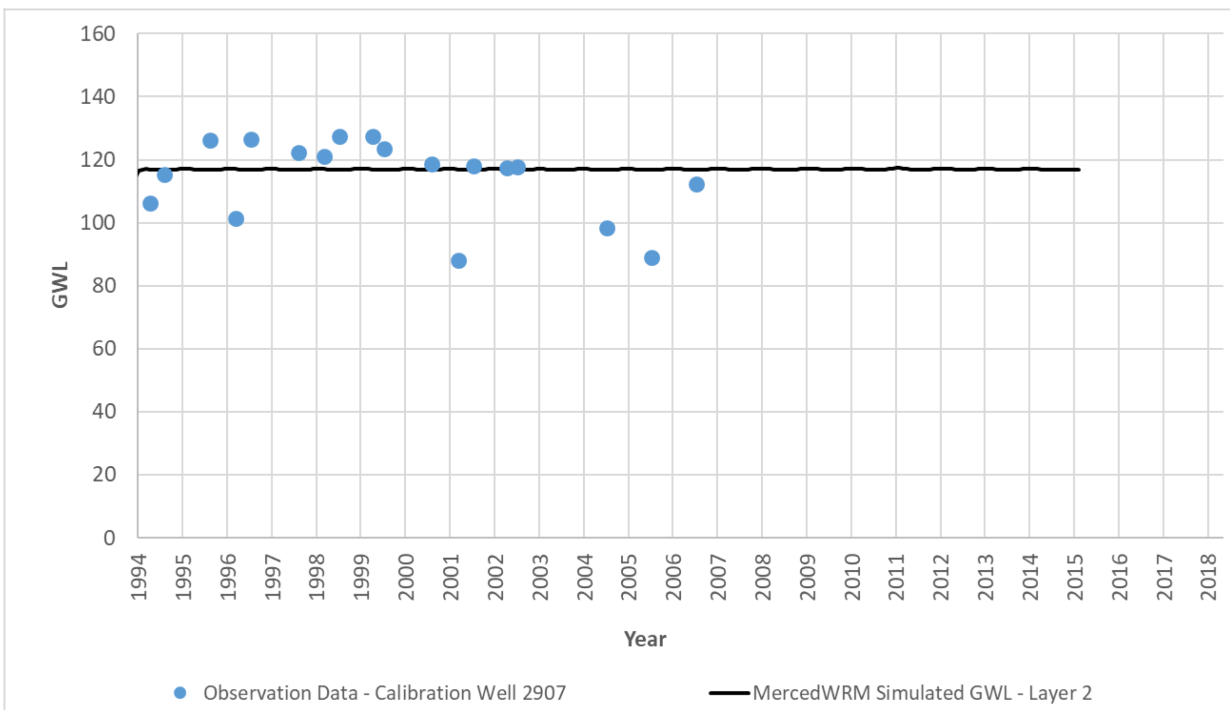


Figure A 120: Calibration Well 2907

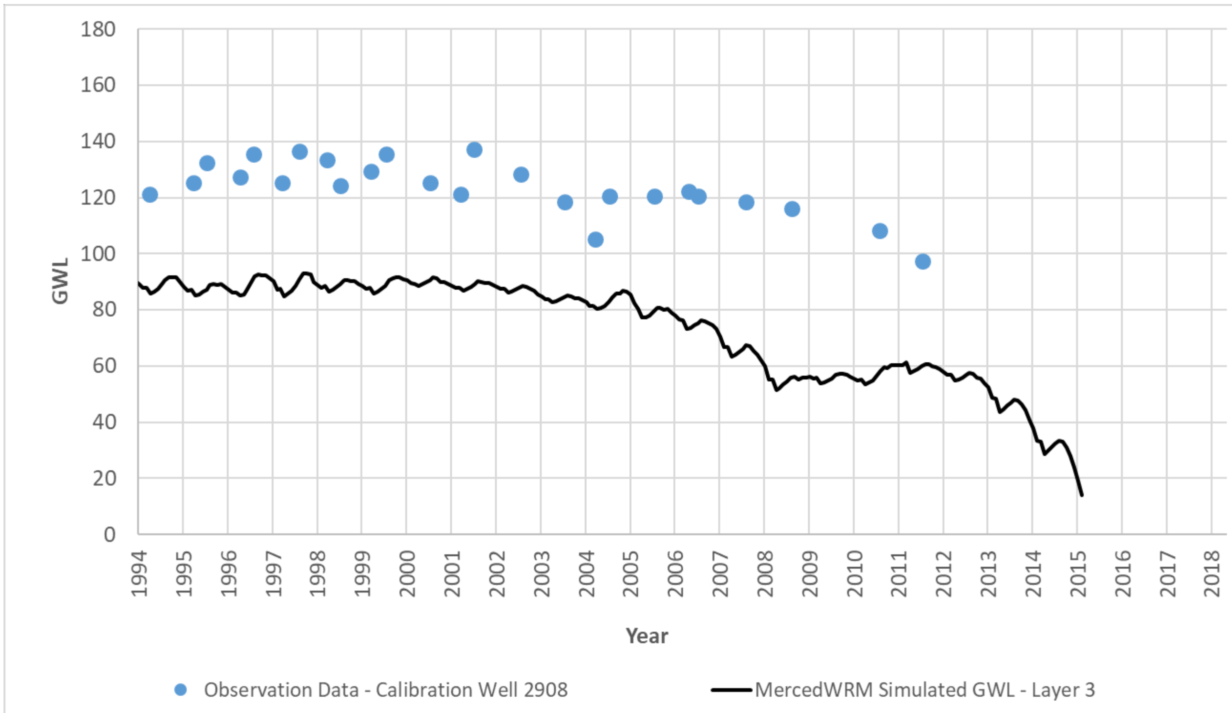


Figure A 121: Calibration Well 2908

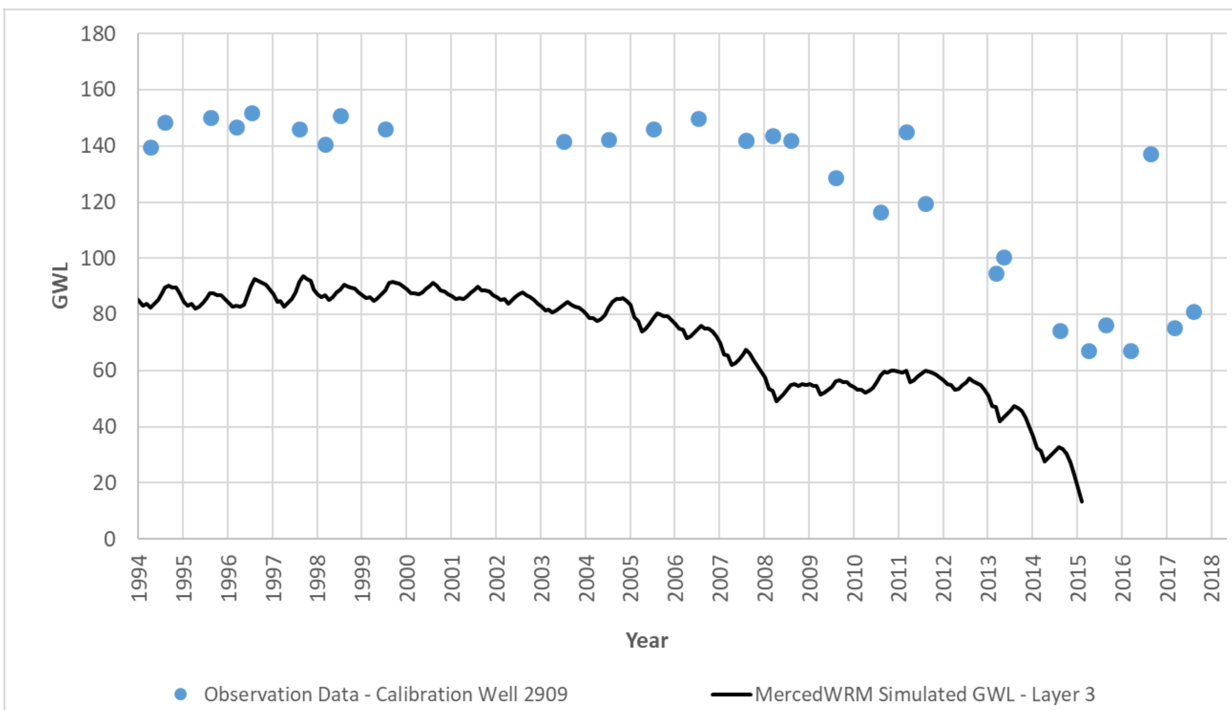


Figure A 122: Calibration Well 2909

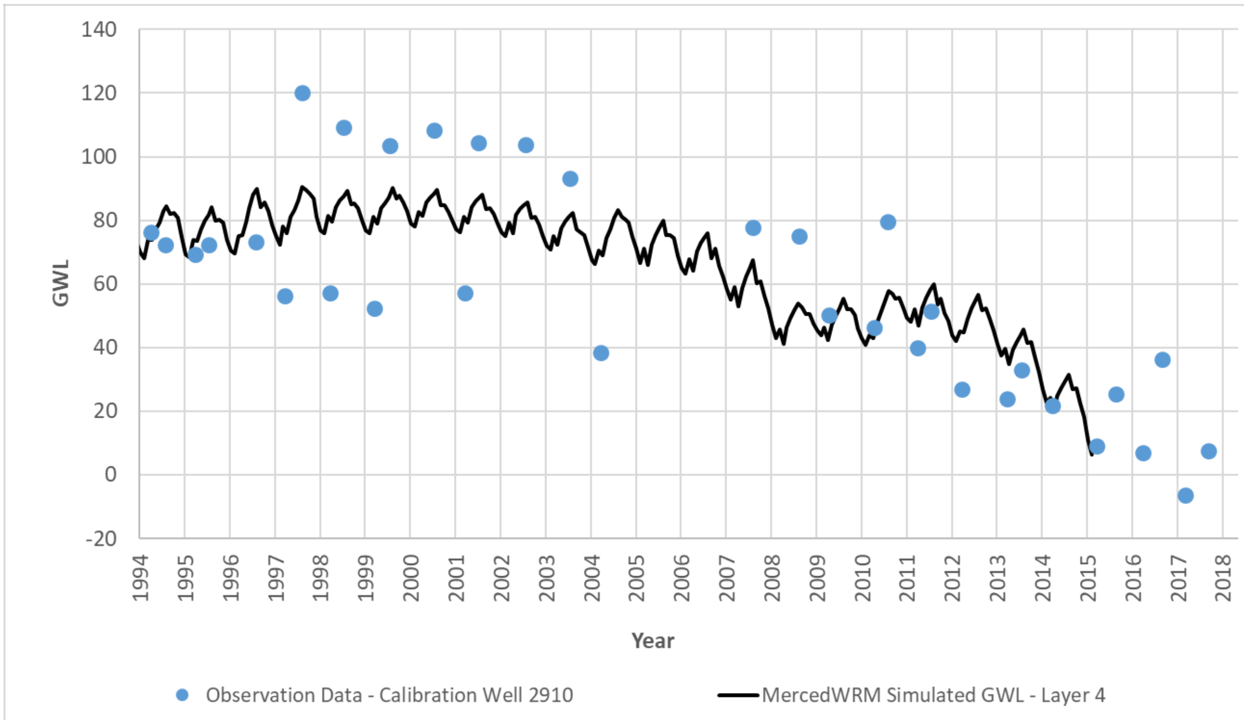


Figure A 123: Calibration Well 2910

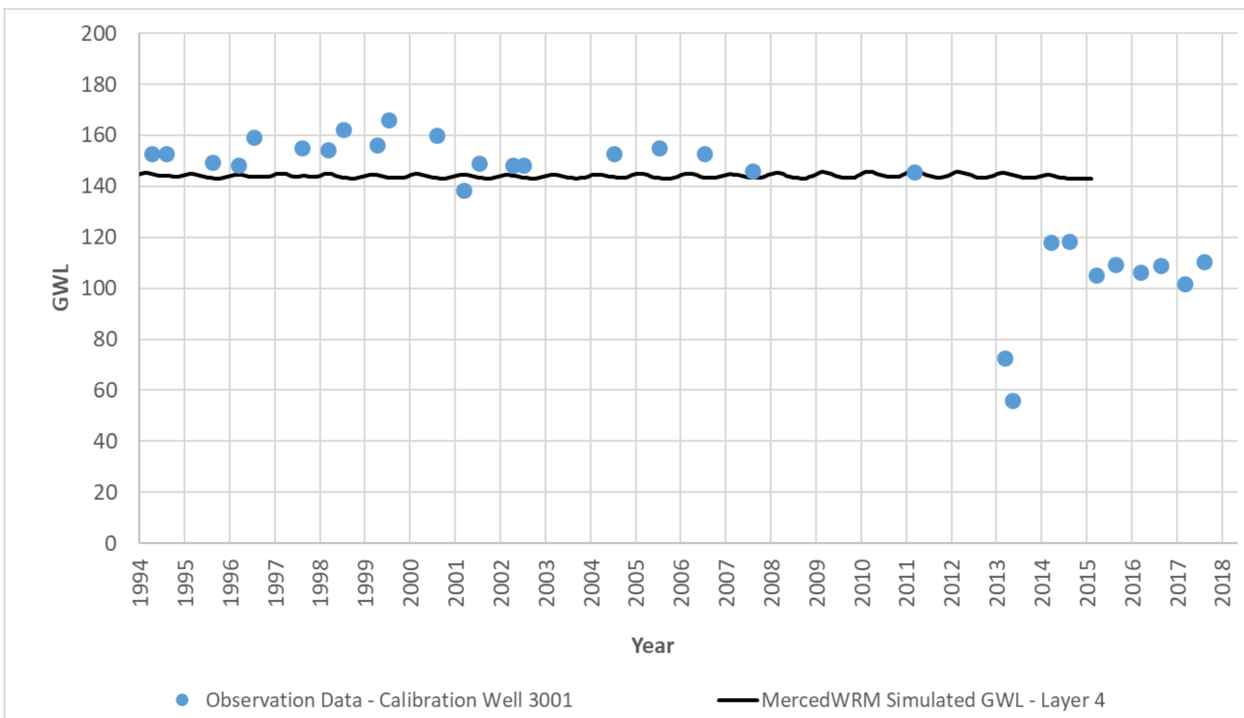


Figure A 124: Calibration Well 3001

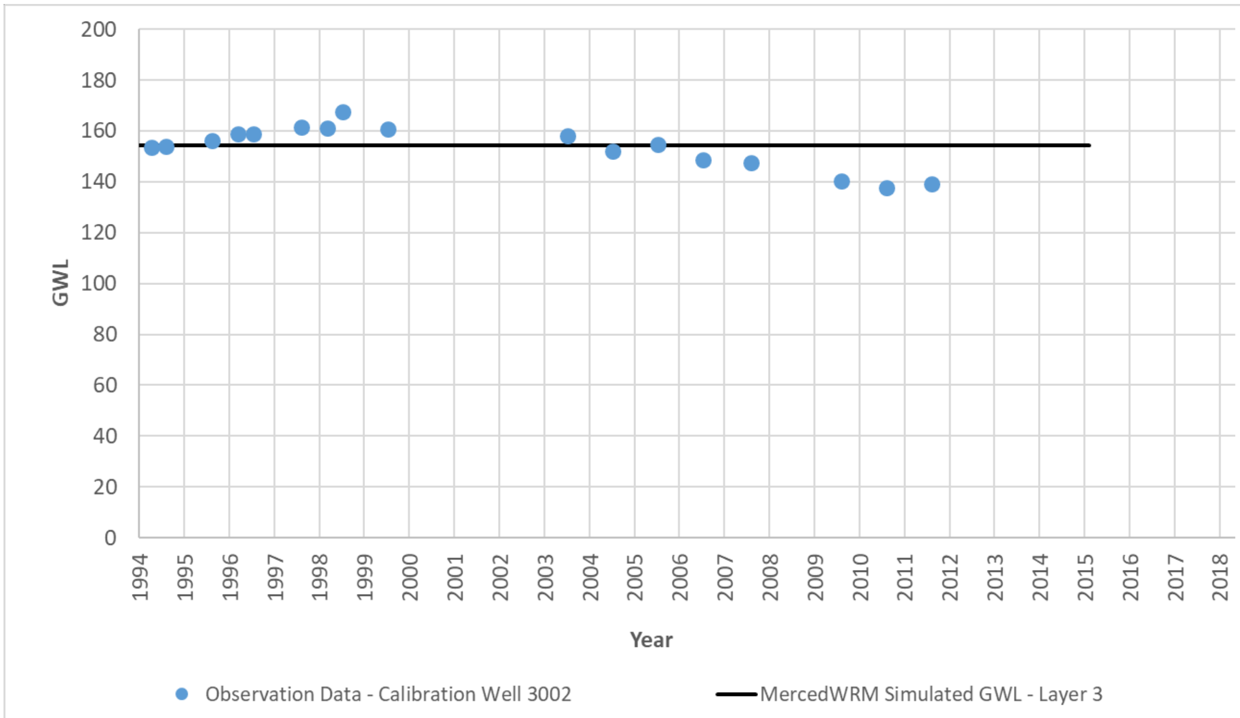


Figure A 125: Calibration Well 3002

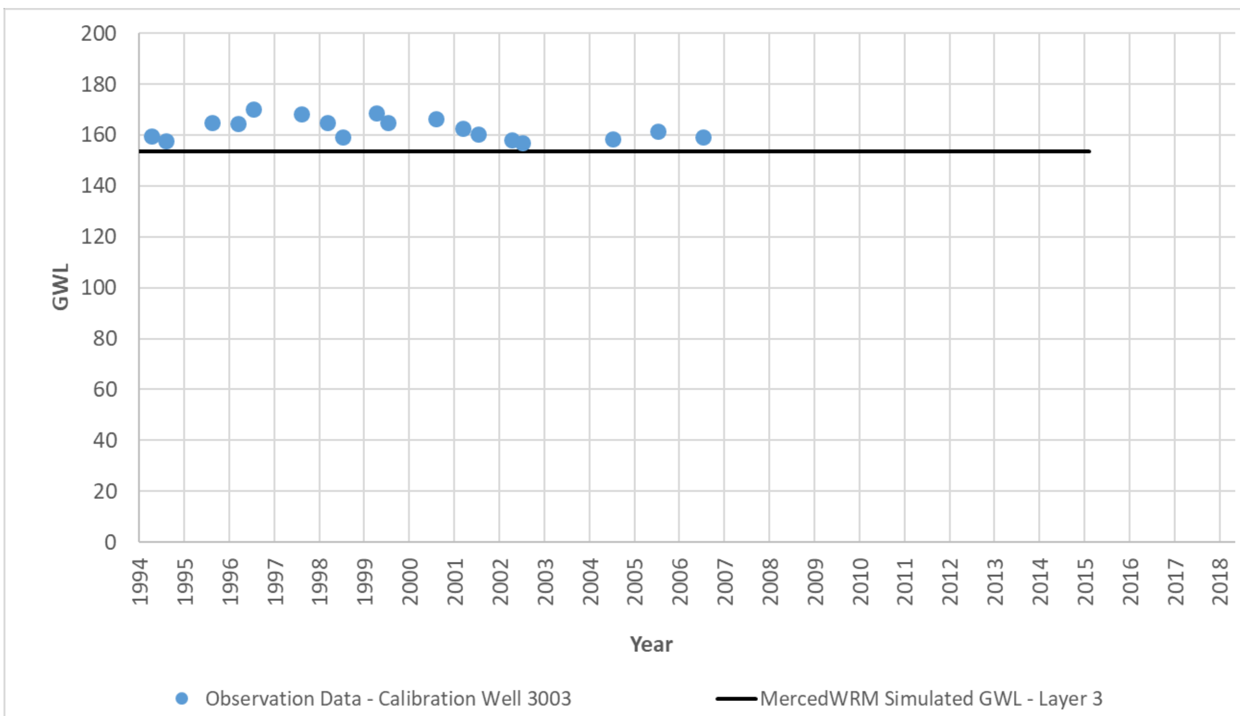


Figure A 126: Calibration Well 3003

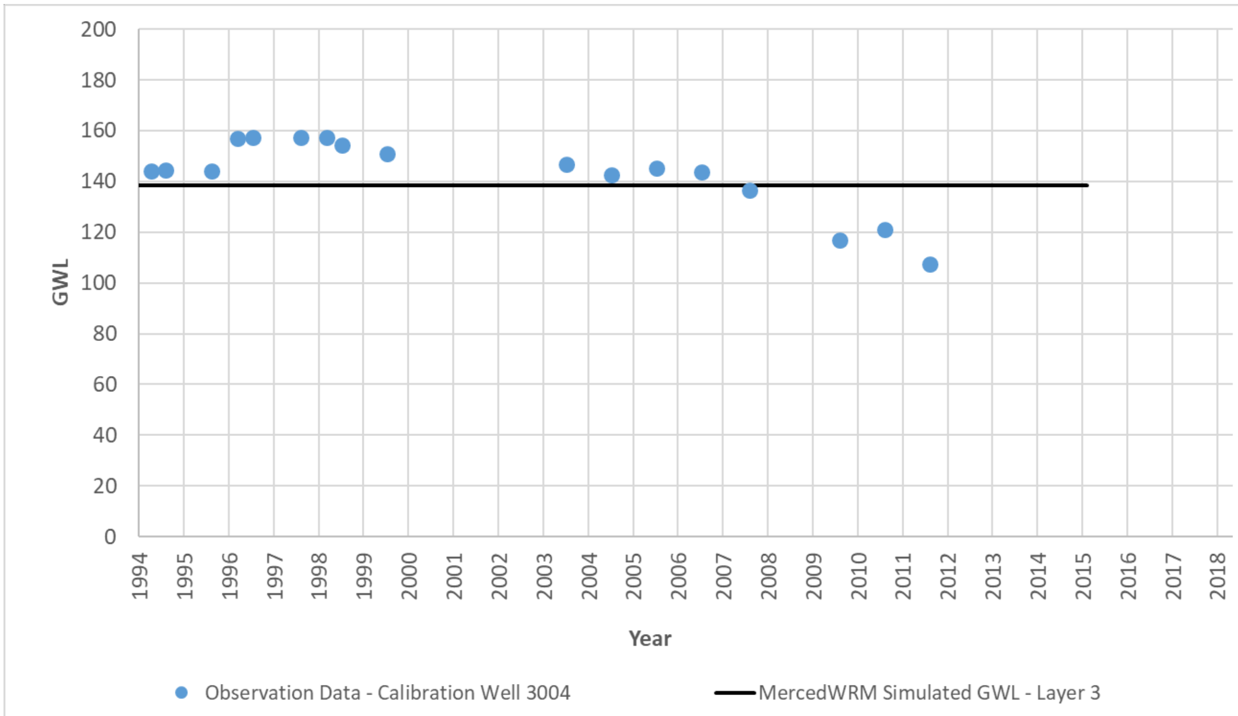


Figure A 127: Calibration Well 3004

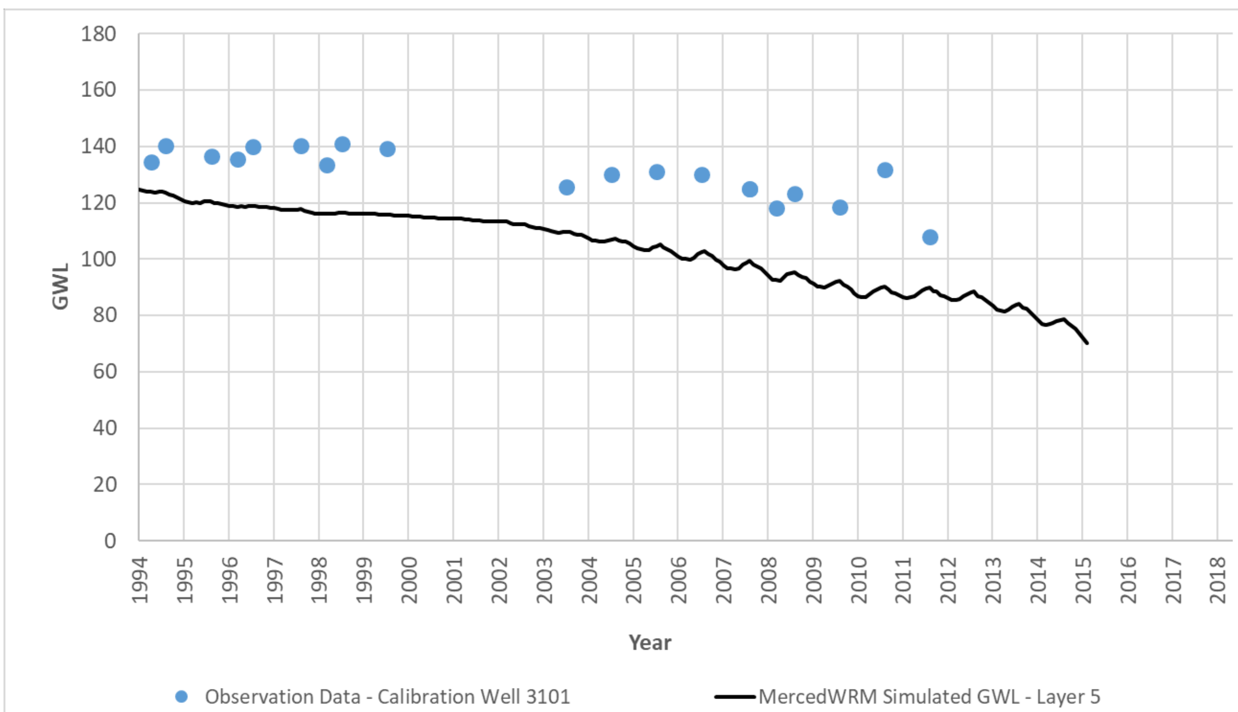


Figure A 128: Calibration Well 3101

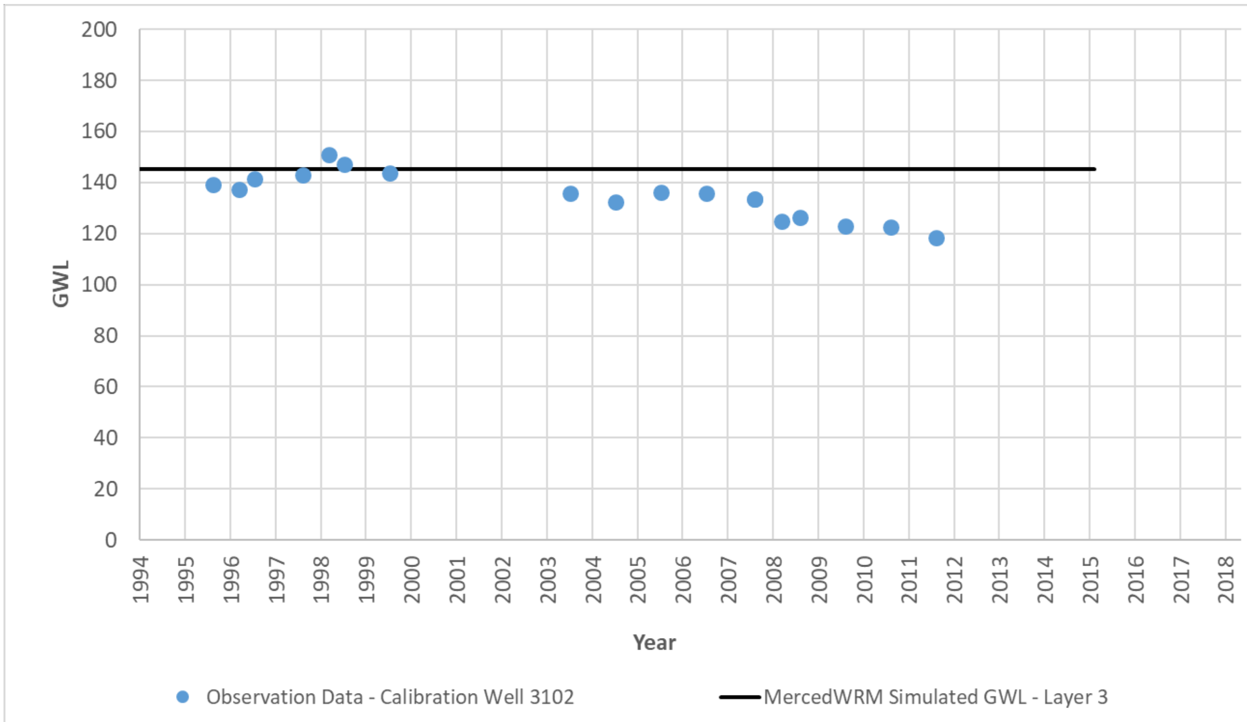


Figure A 129: Calibration Well 3102

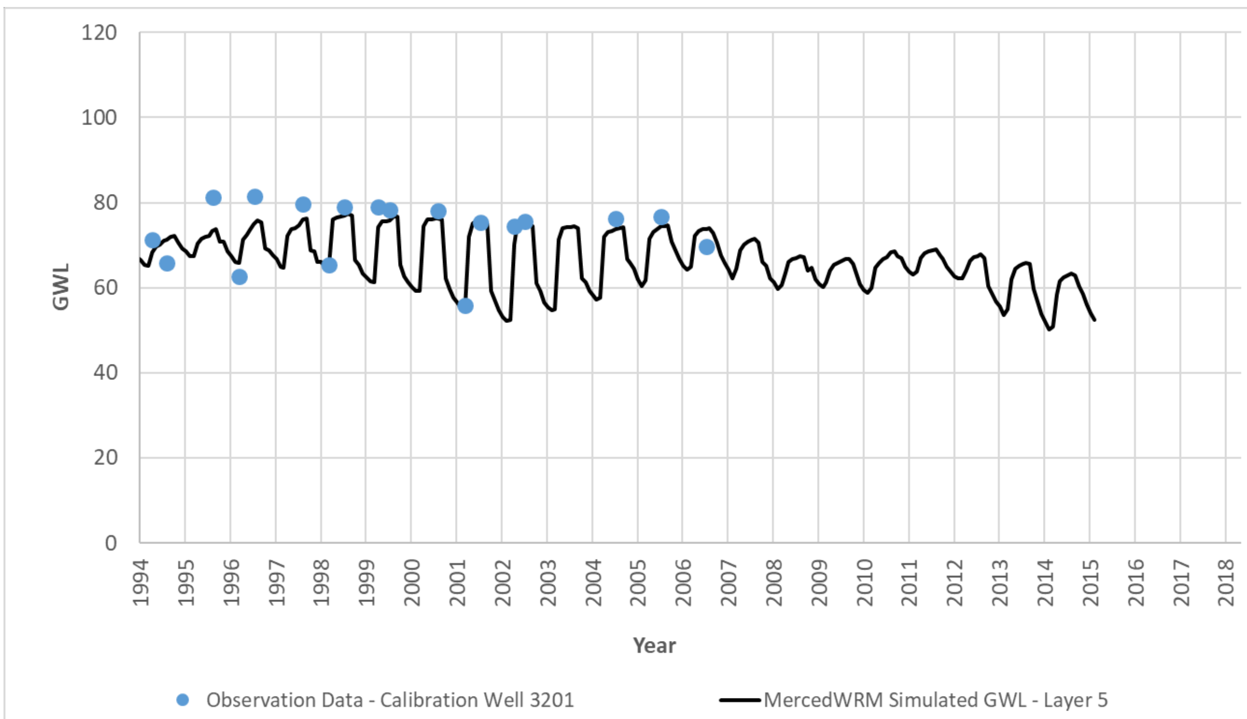


Figure A 130: Calibration Well 3201

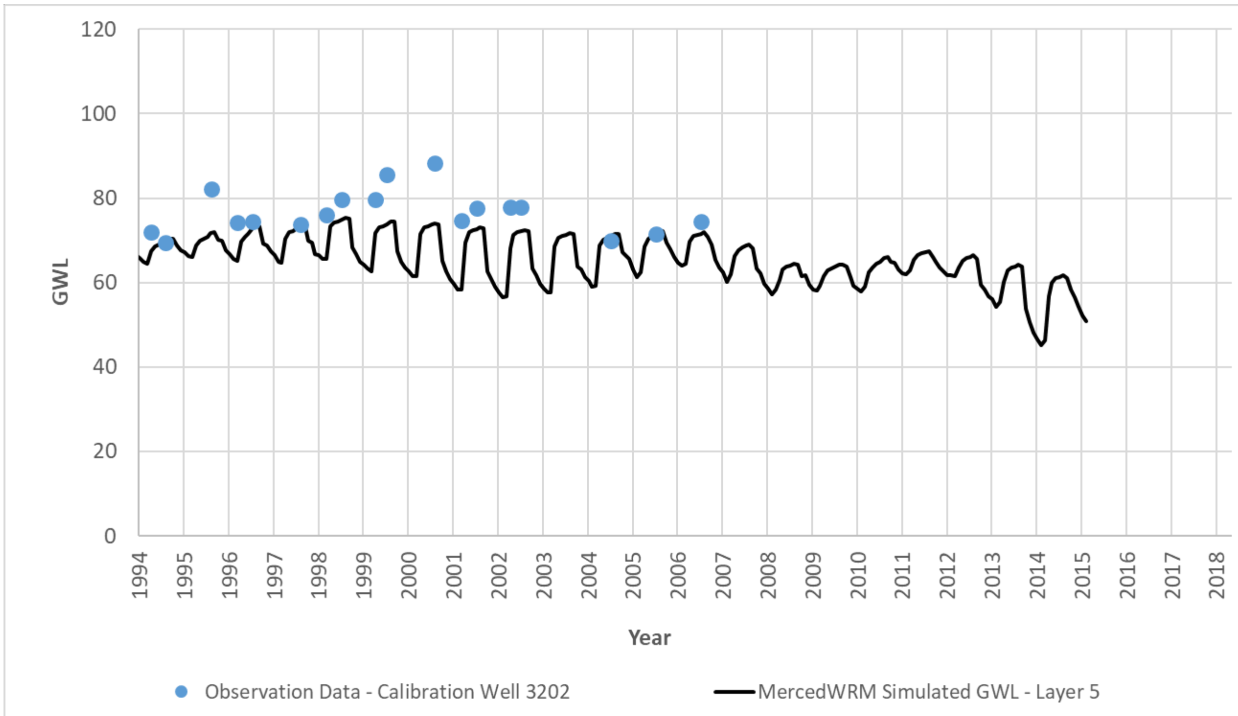


Figure A 131: Calibration Well 3202

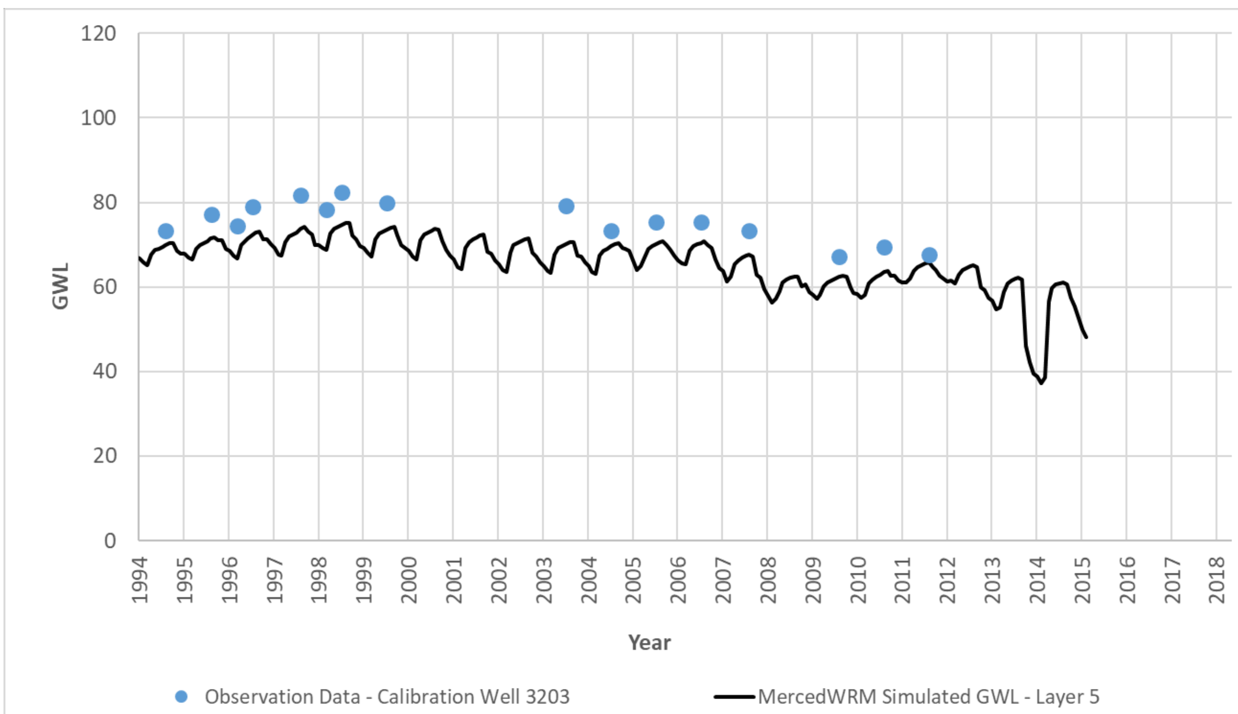


Figure A 132: Calibration Well 3203

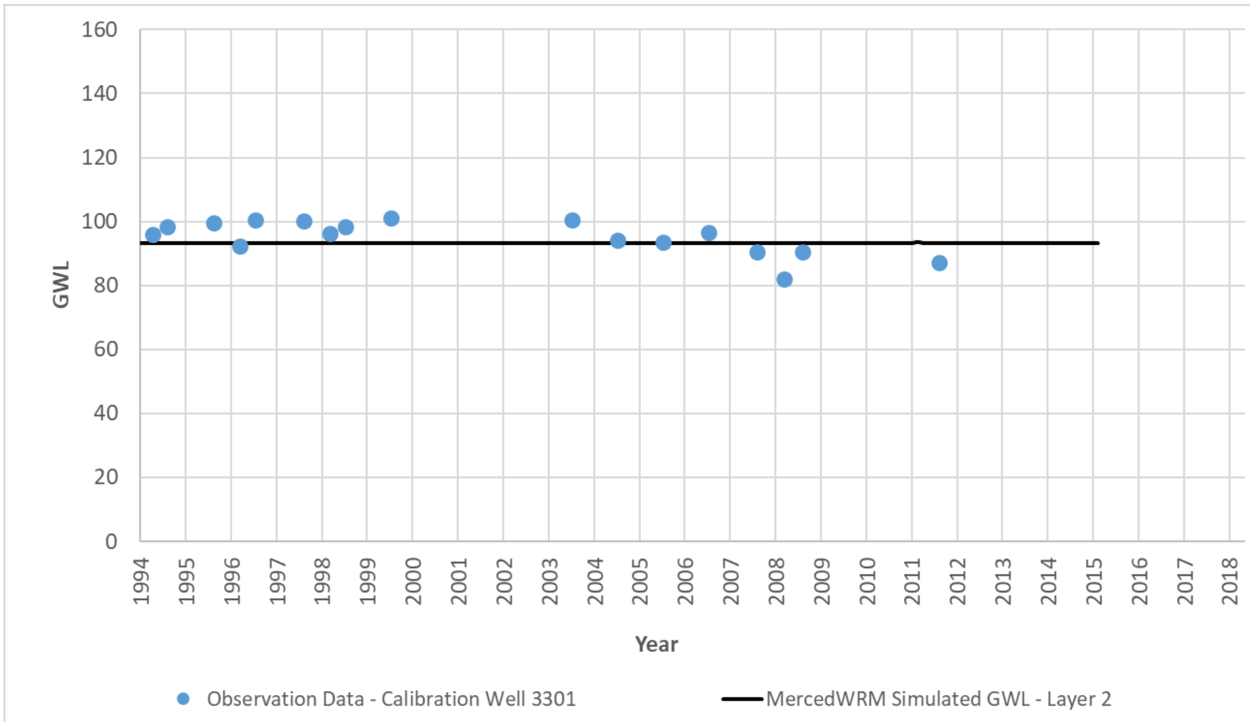


Figure A 133: Calibration Well 3301

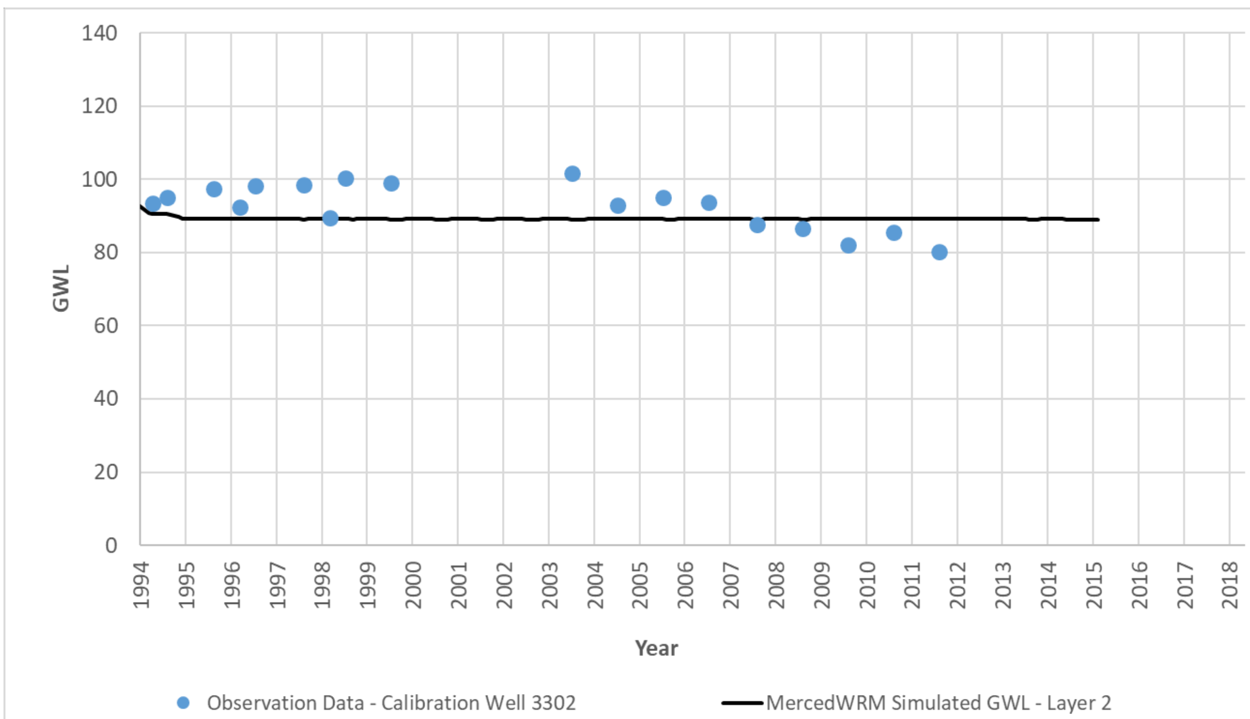


Figure A 134: Calibration Well 3302

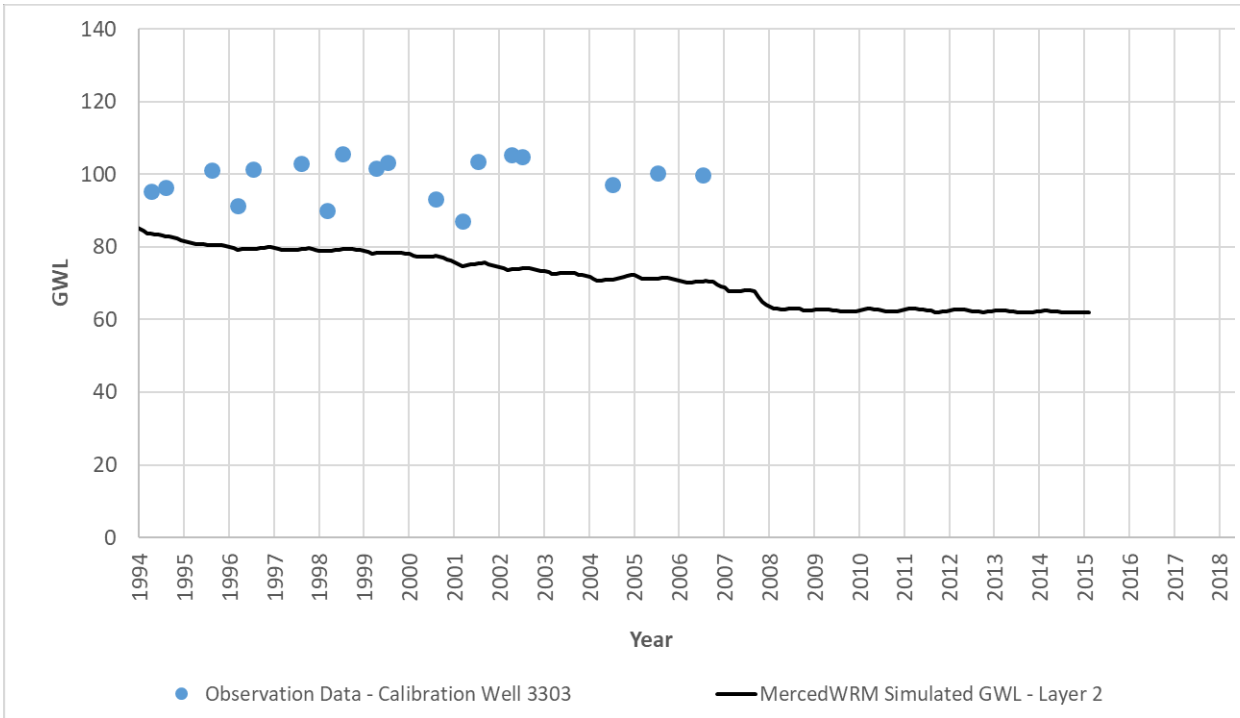


Figure A 135: Calibration Well 3303

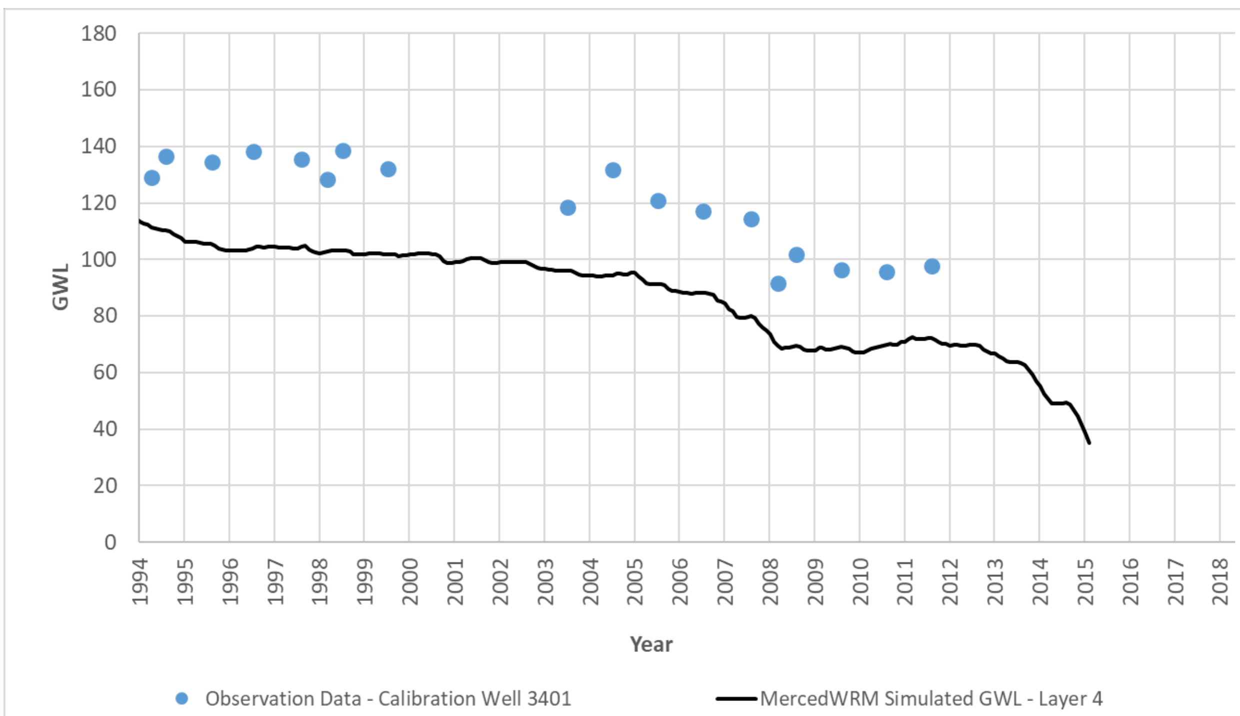


Figure A 136: Calibration Well 3401

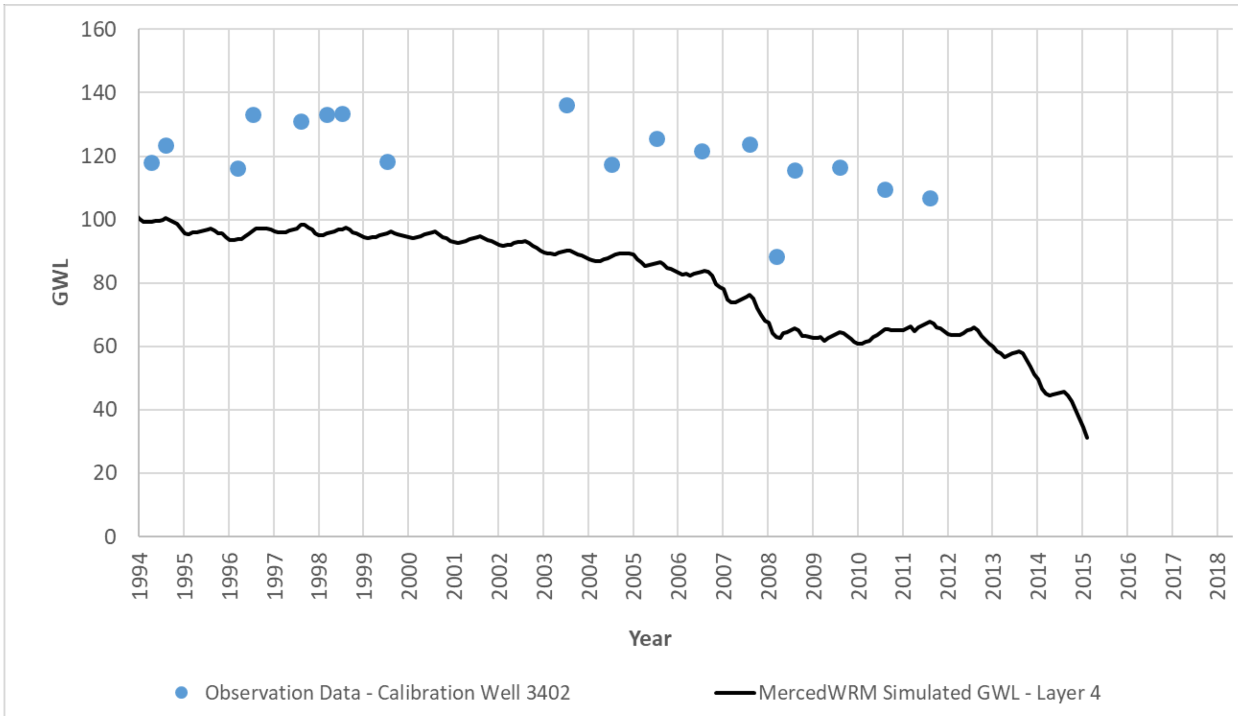


Figure A 137: Calibration Well 3402

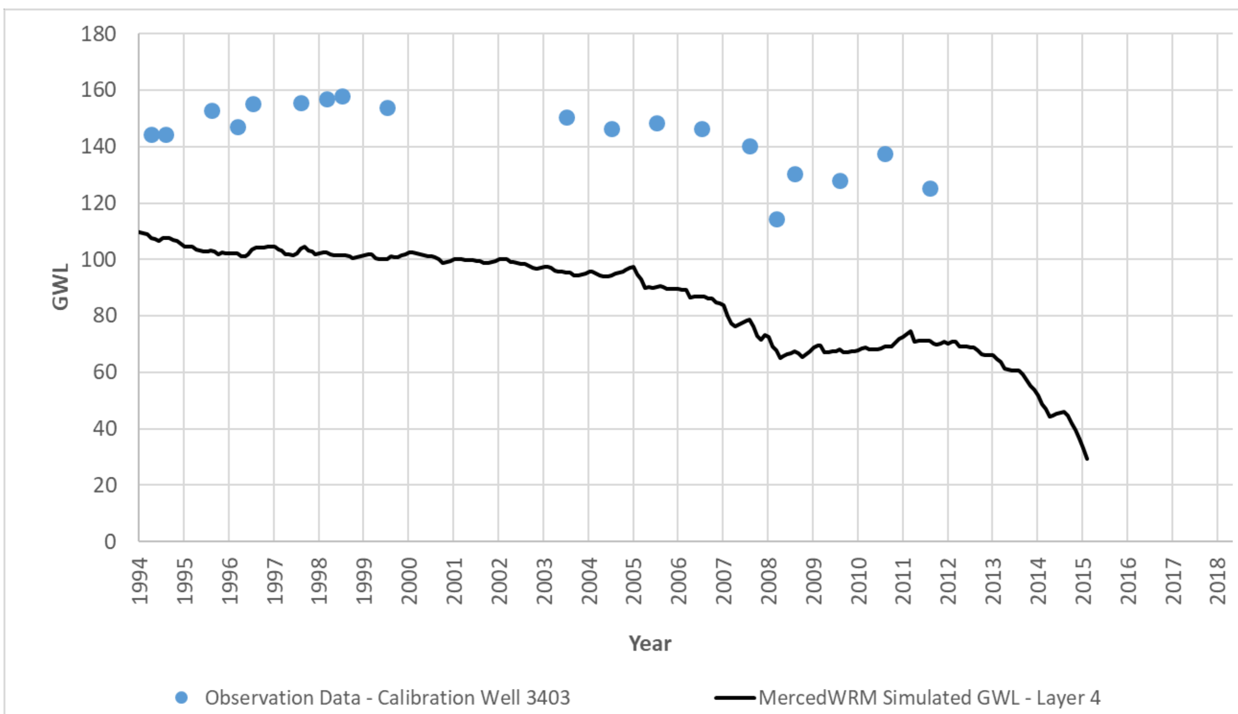


Figure A 138: Calibration Well 3403

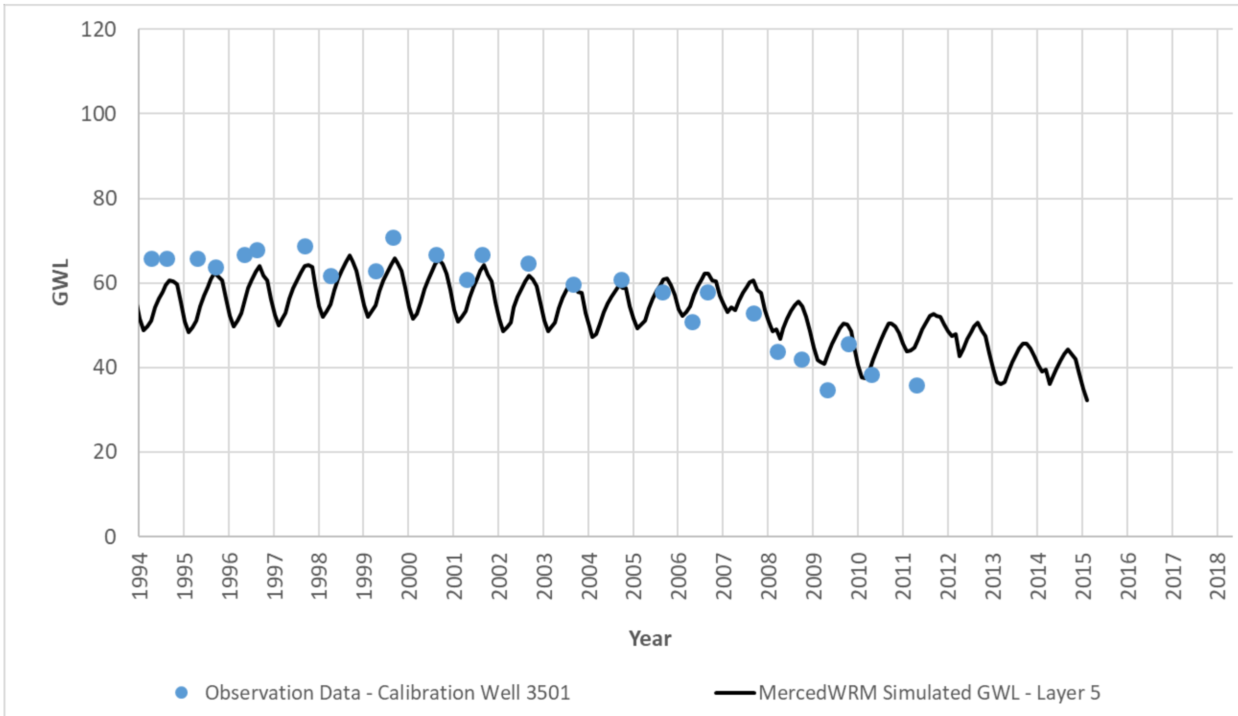


Figure A 139: Calibration Well 3501

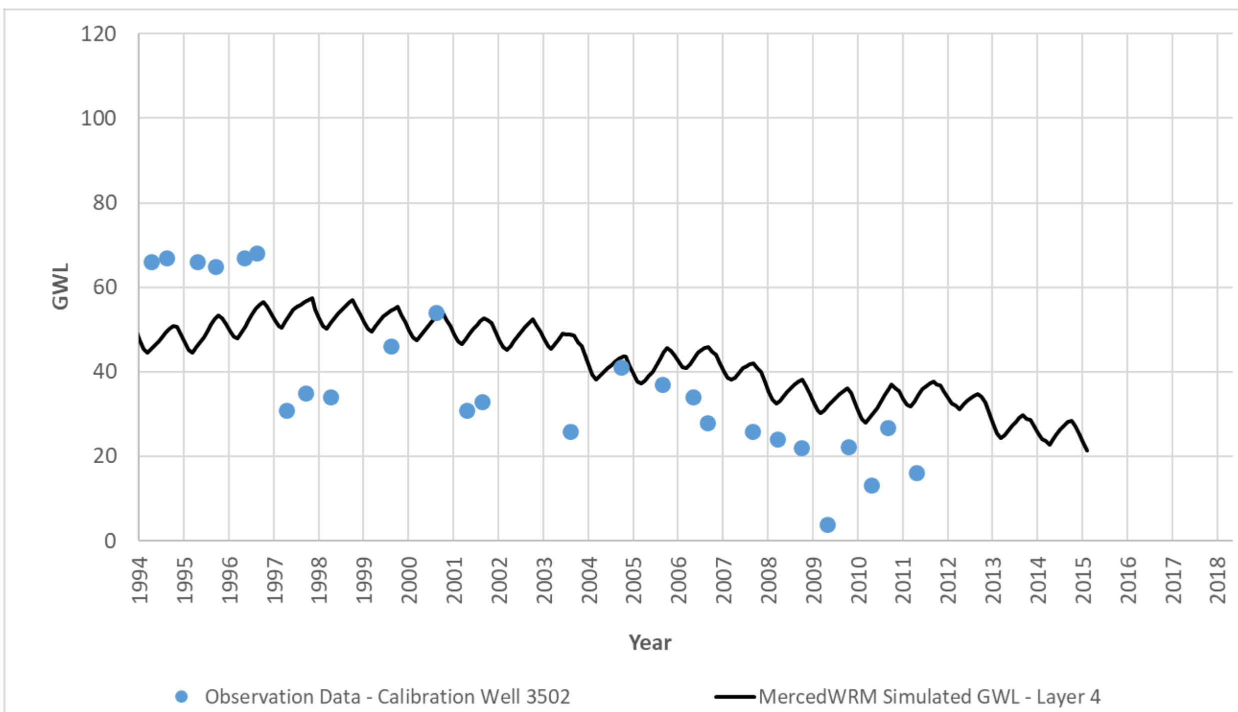


Figure A 140: Calibration Well 3502

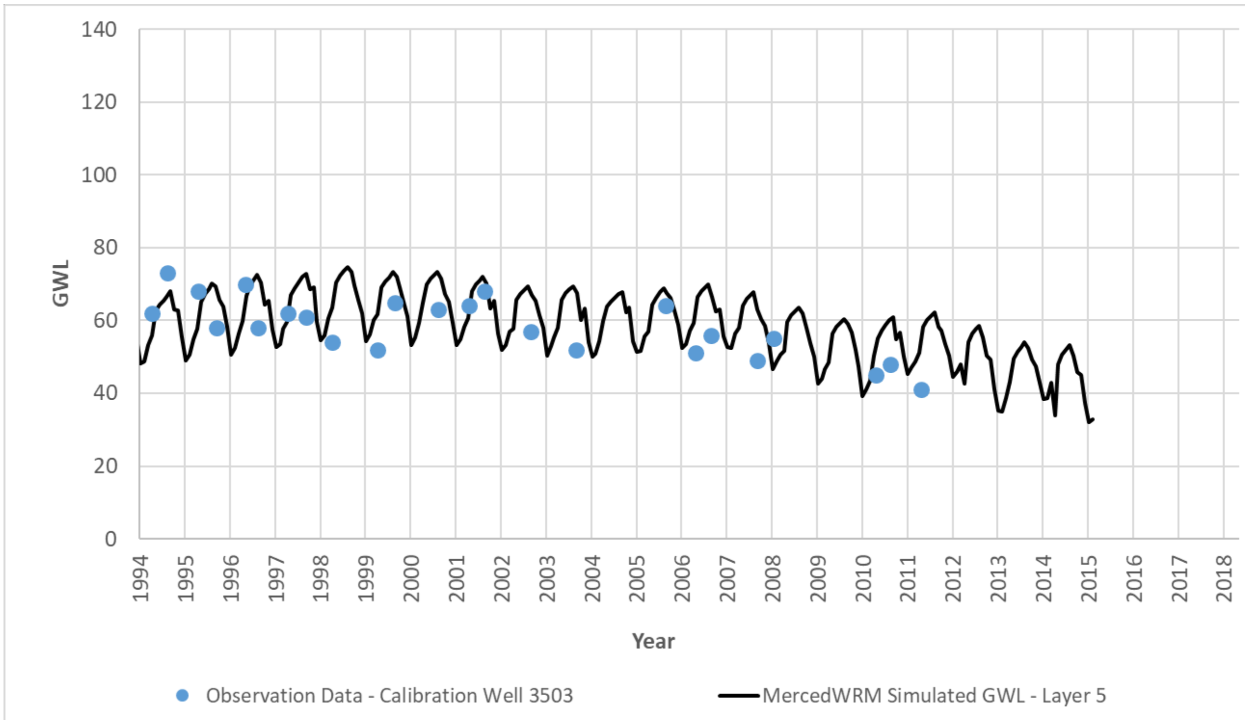


Figure A 141: Calibration Well 3503

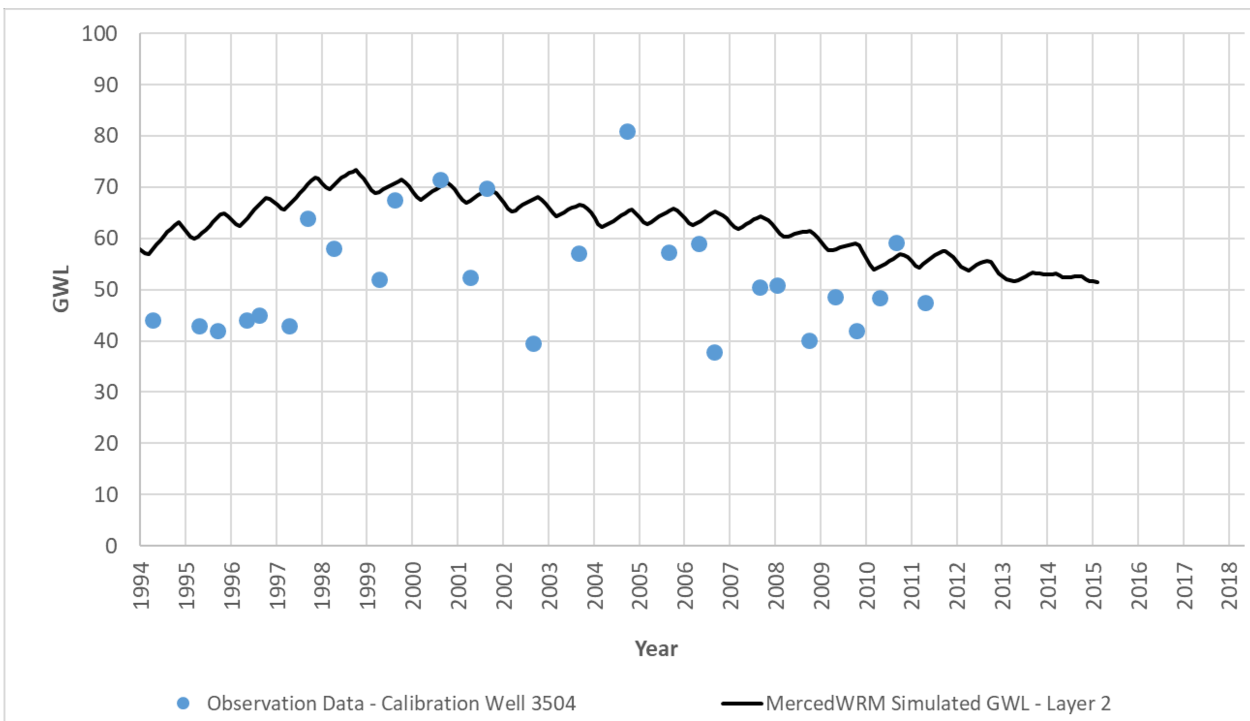


Figure A 142: Calibration Well 3504

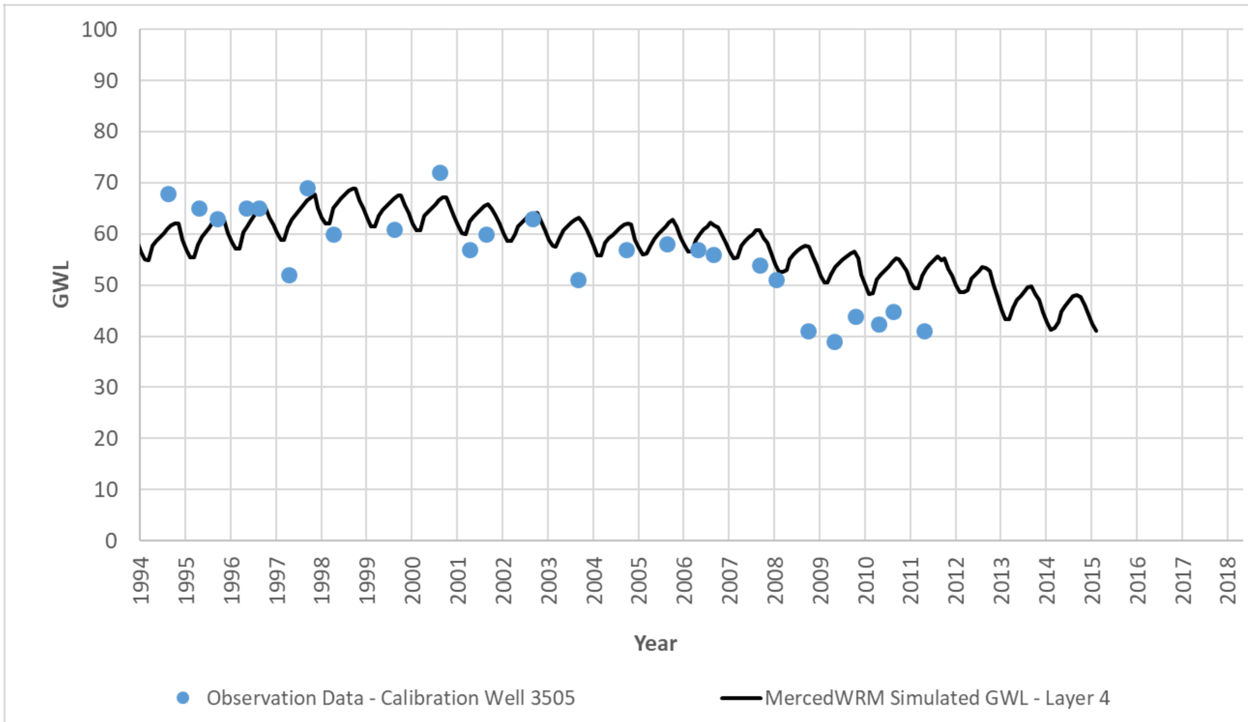


Figure A 143: Calibration Well 3505

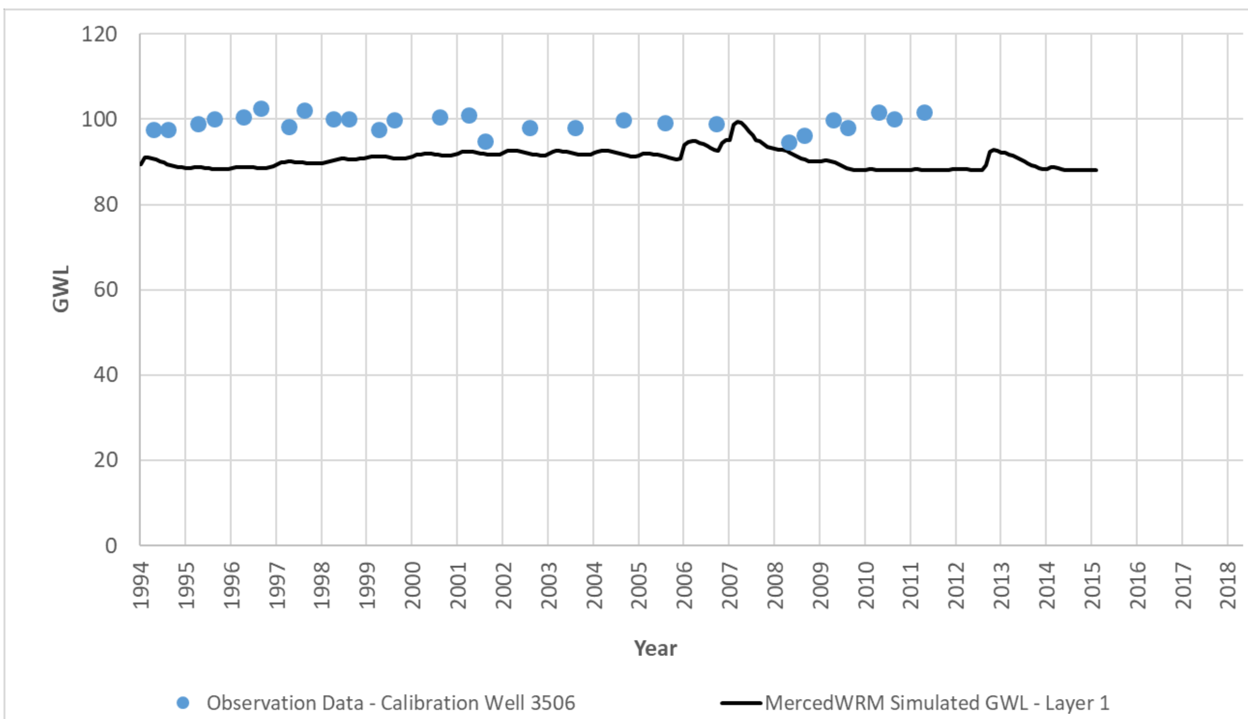


Figure A 144: Calibration Well 3506

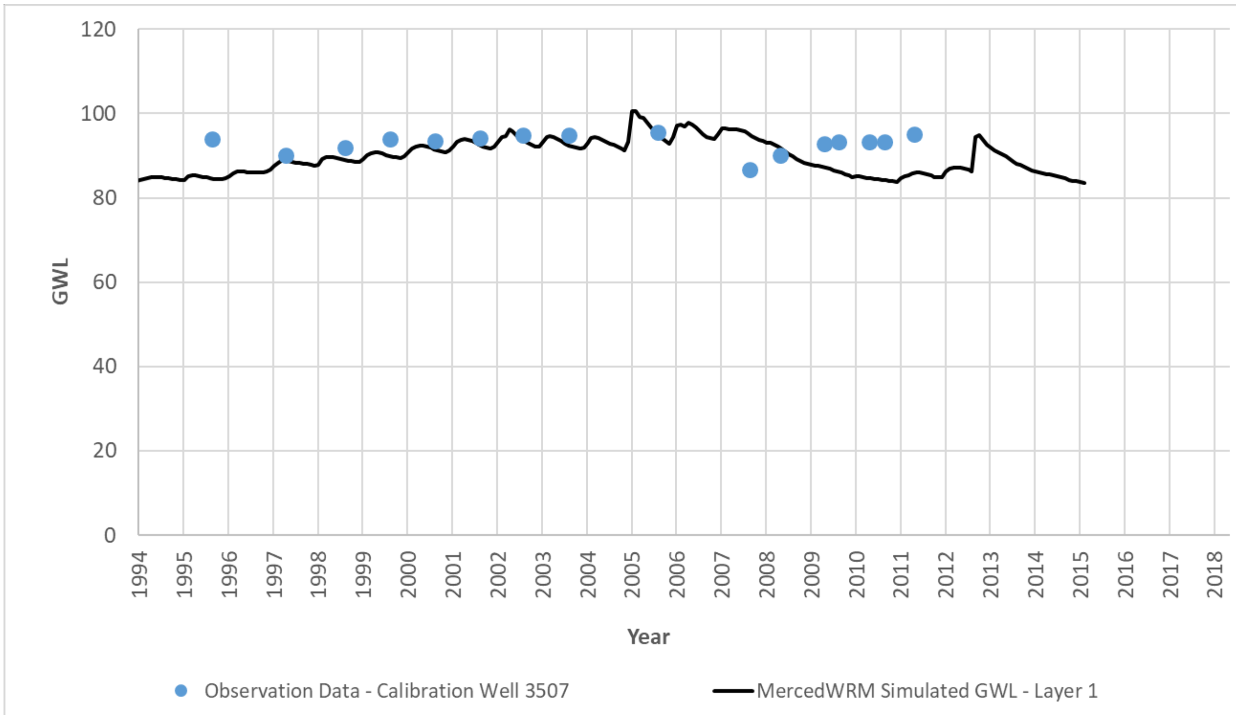


Figure A 145: Calibration Well 3507

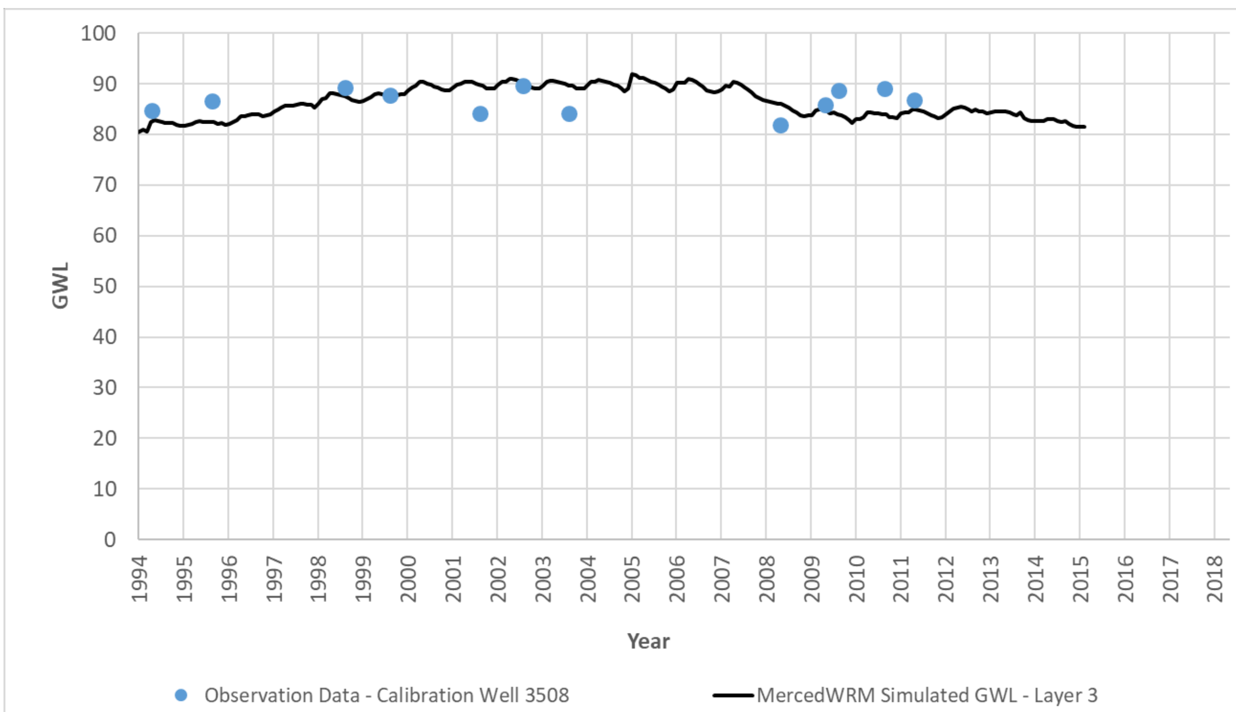


Figure A 146: Calibration Well 3508

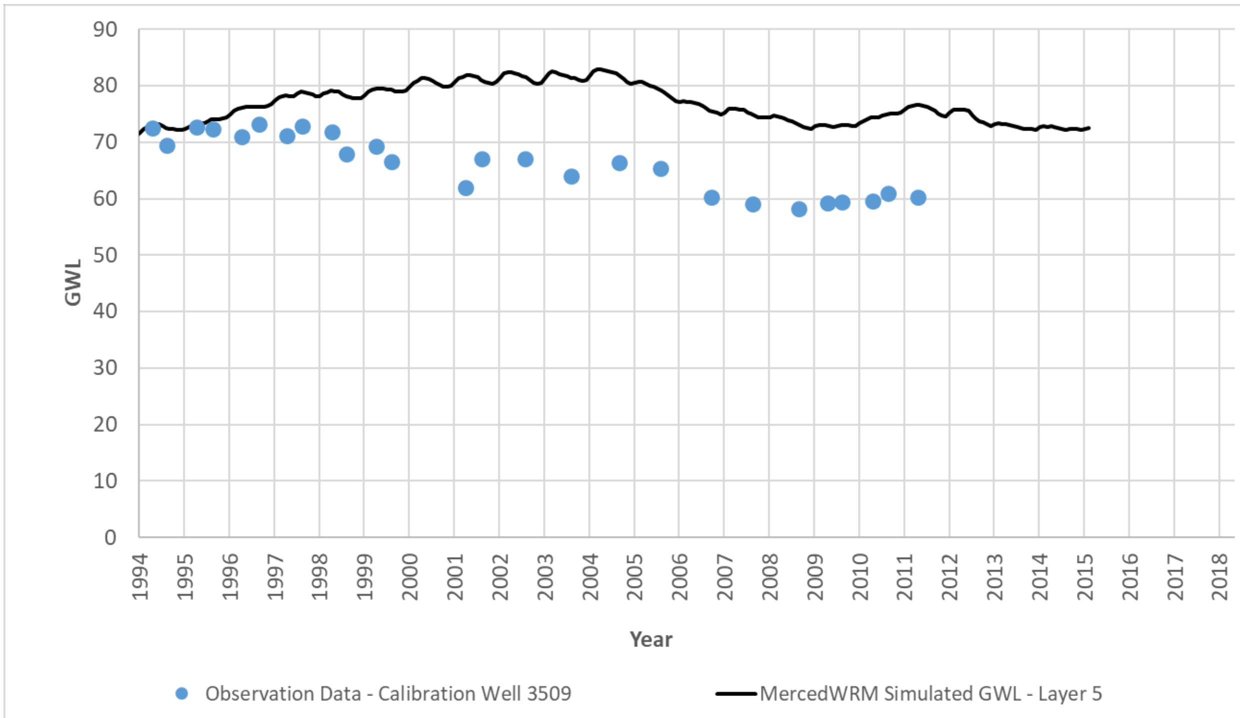


Figure A 147: Calibration Well 3509

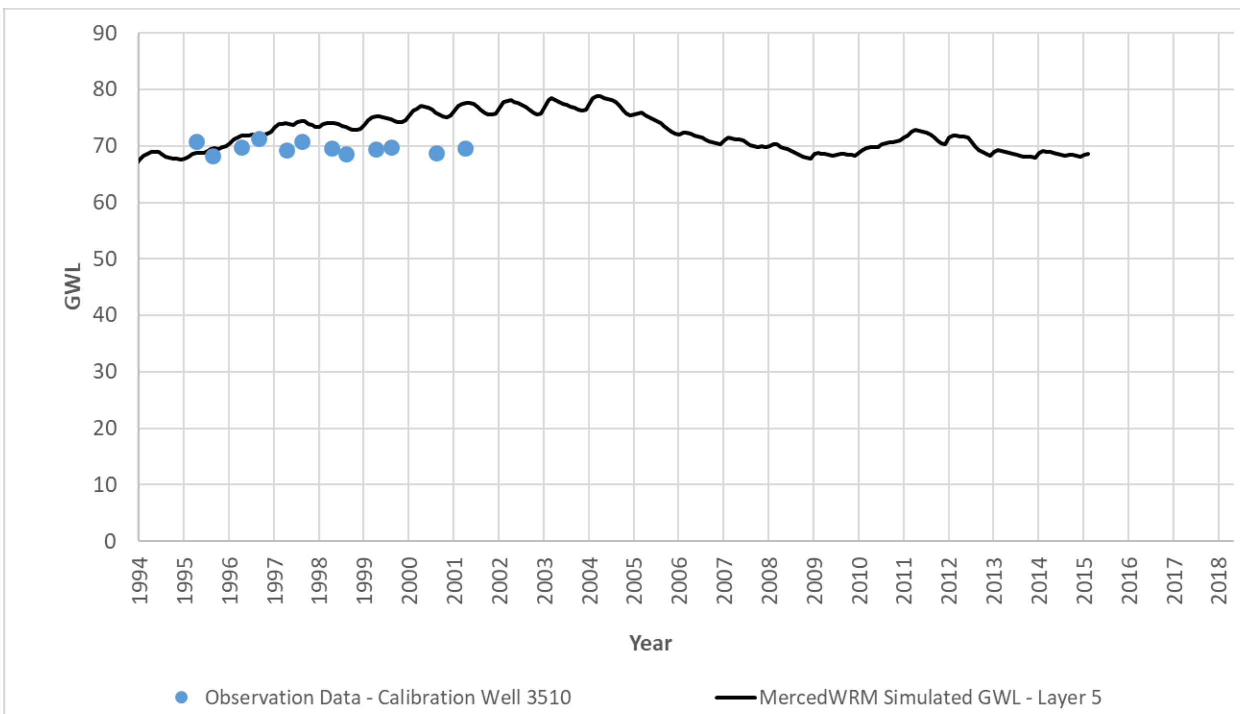


Figure A 148: Calibration Well 3510

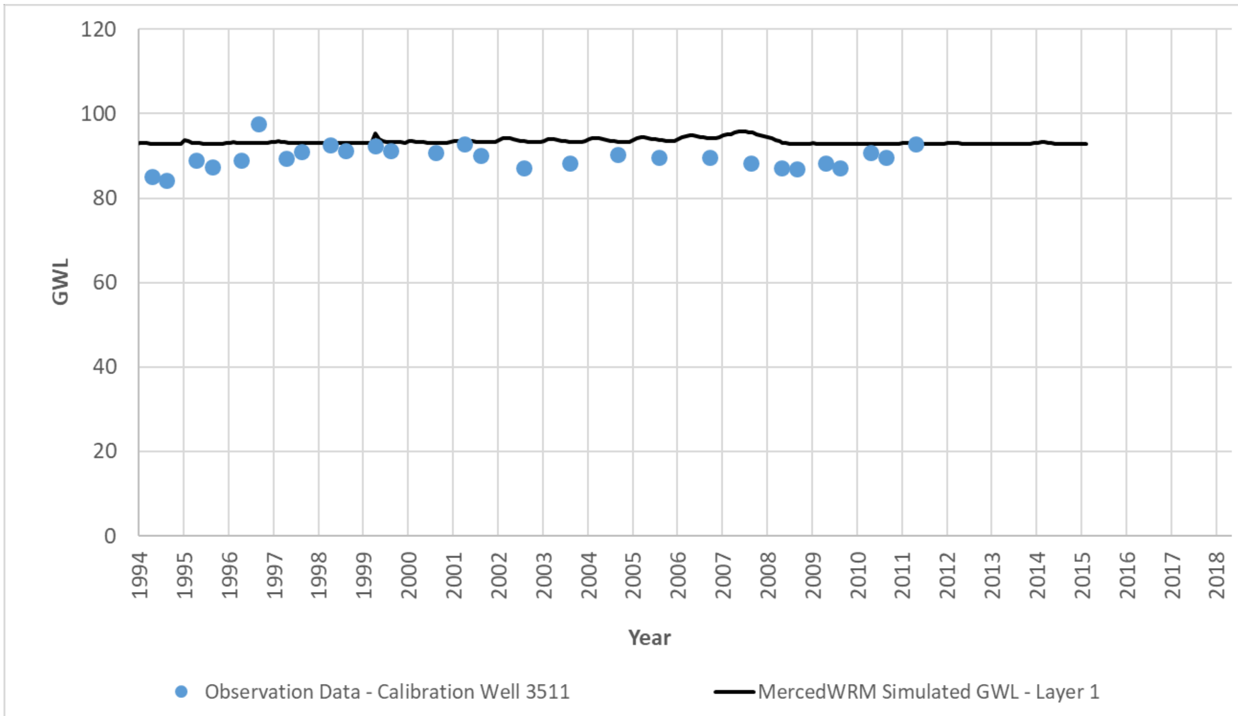


Figure A 149: Calibration Well 3511

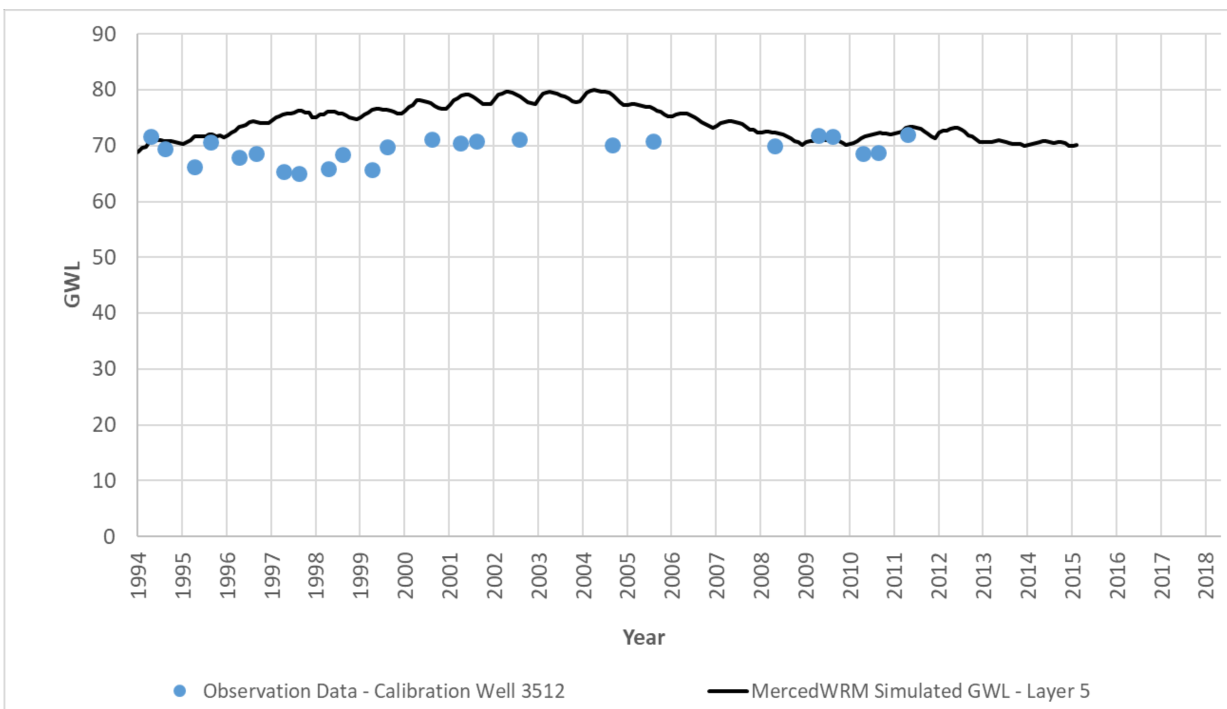


Figure A 150: Calibration Well 3512

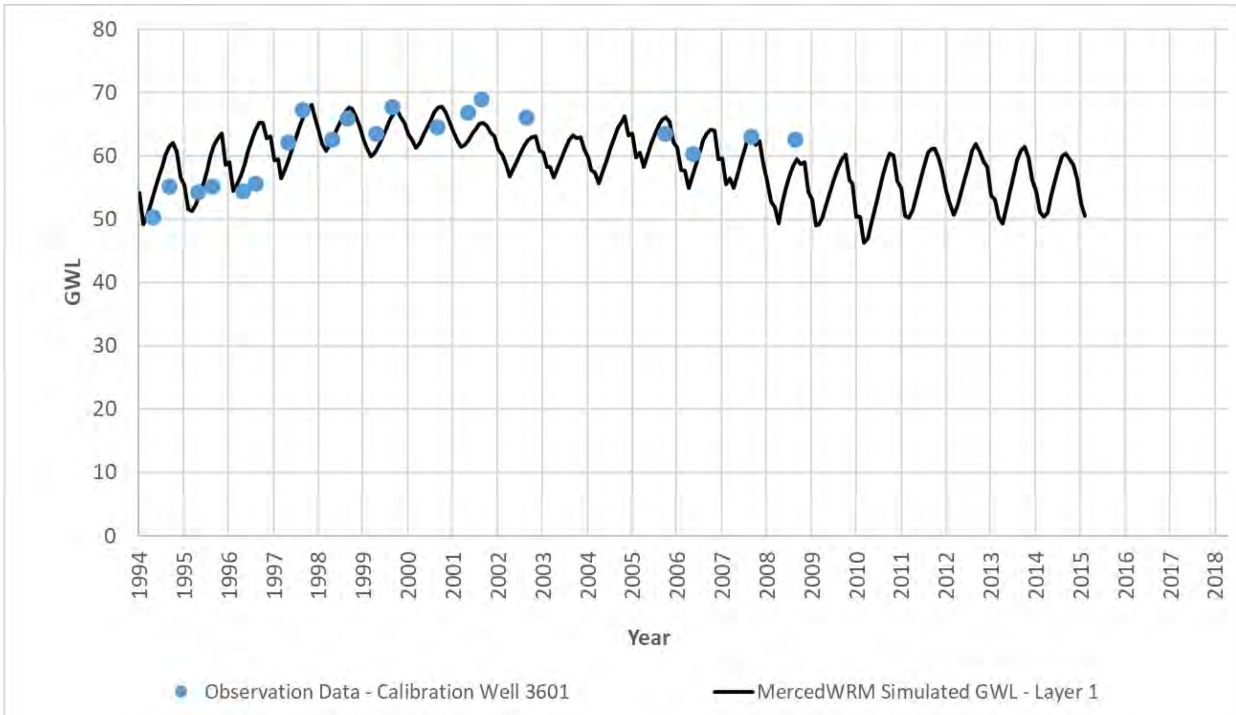


Figure A 151: Calibration Well 3601

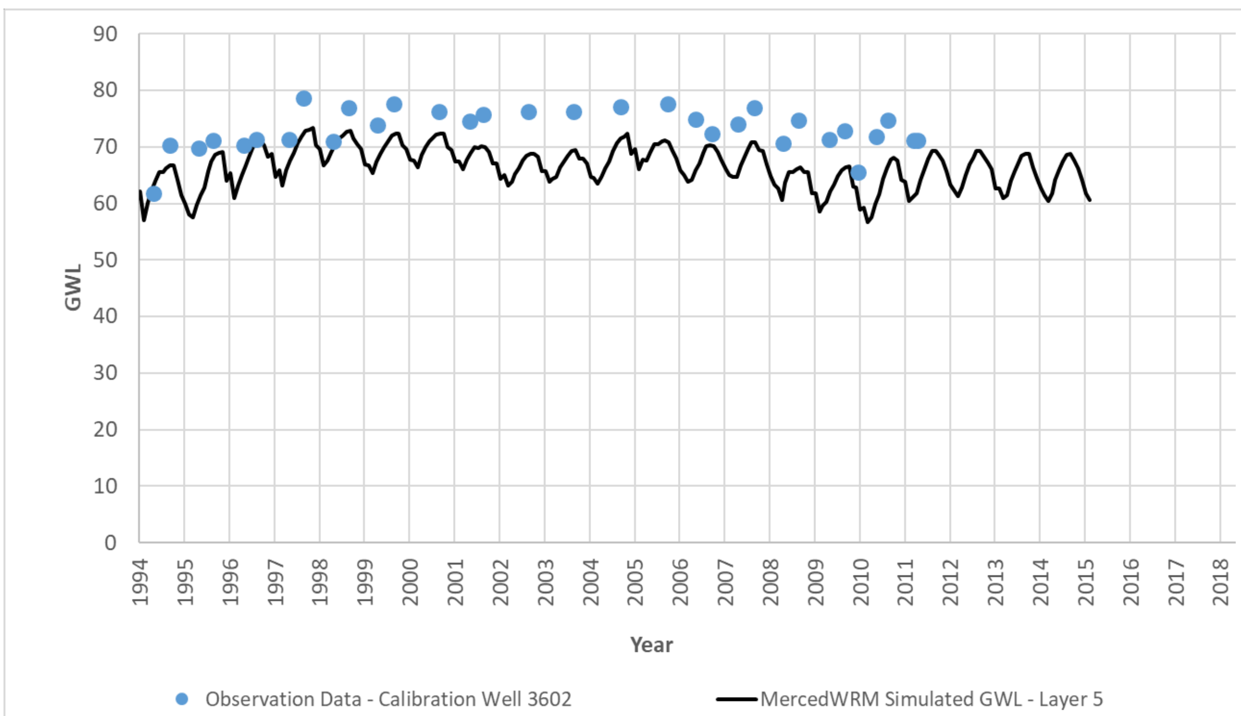


Figure A 152: Calibration Well 3602

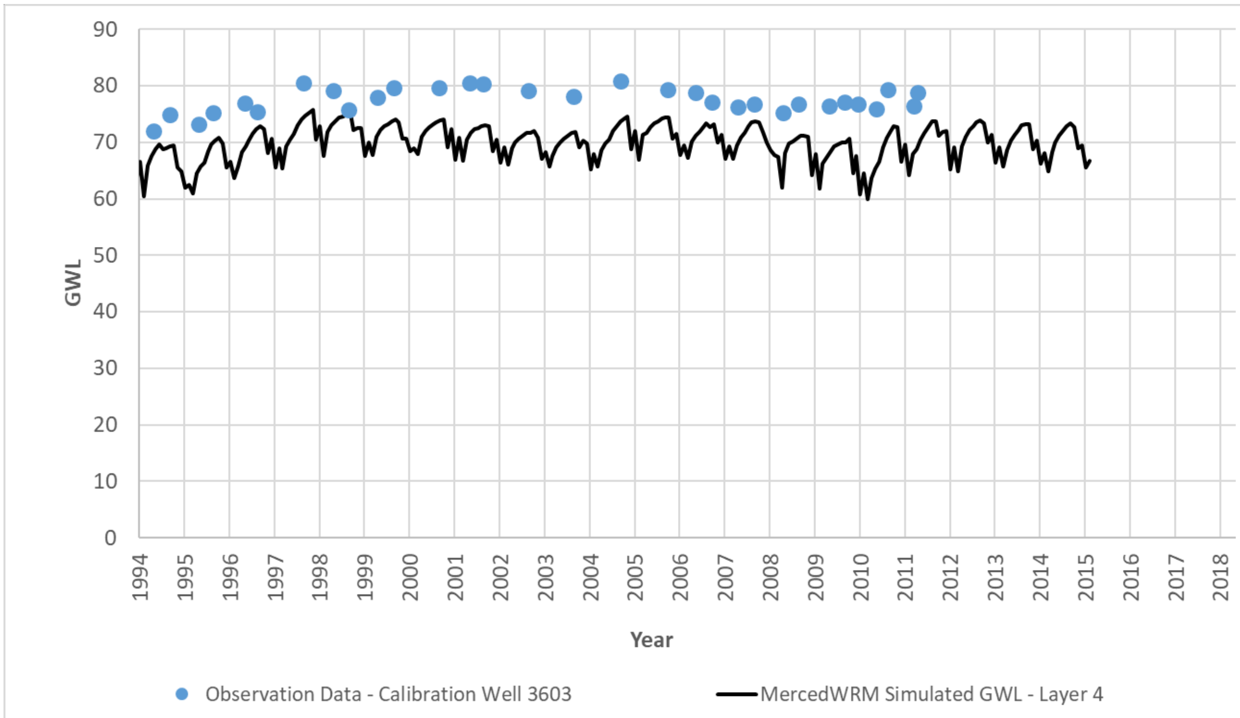


Figure A 153: Calibration Well 3603

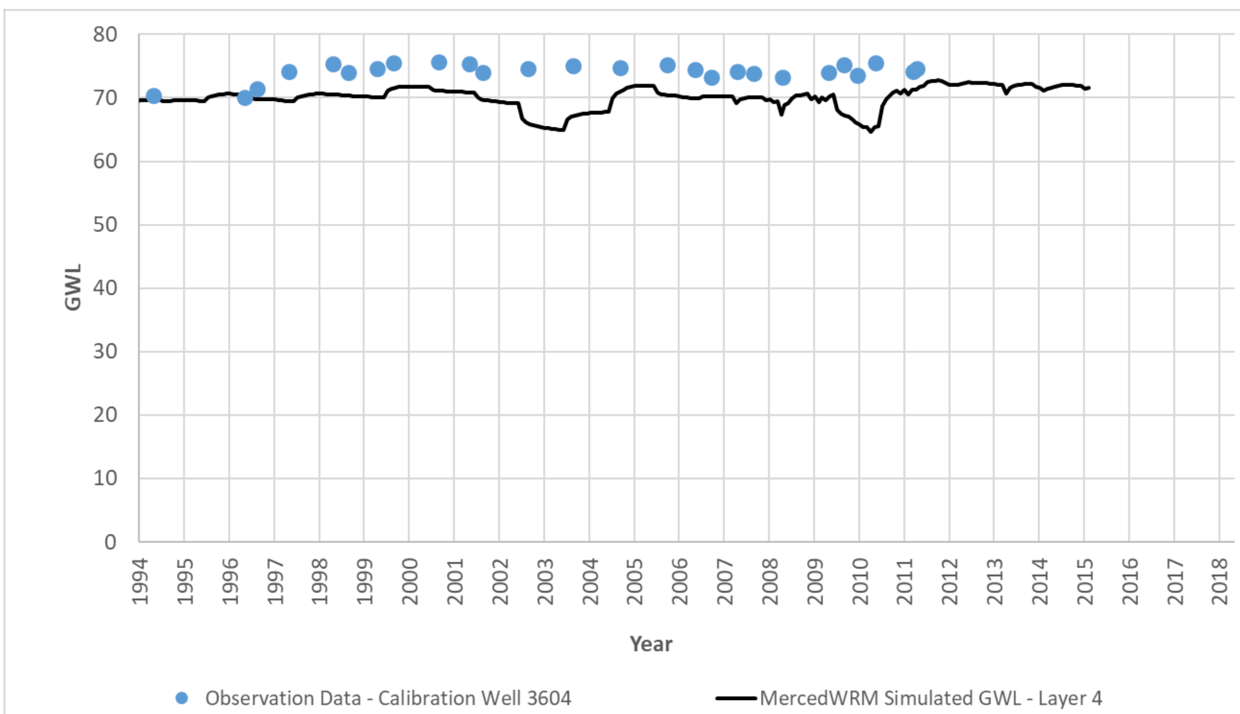


Figure A 154: Calibration Well 3604

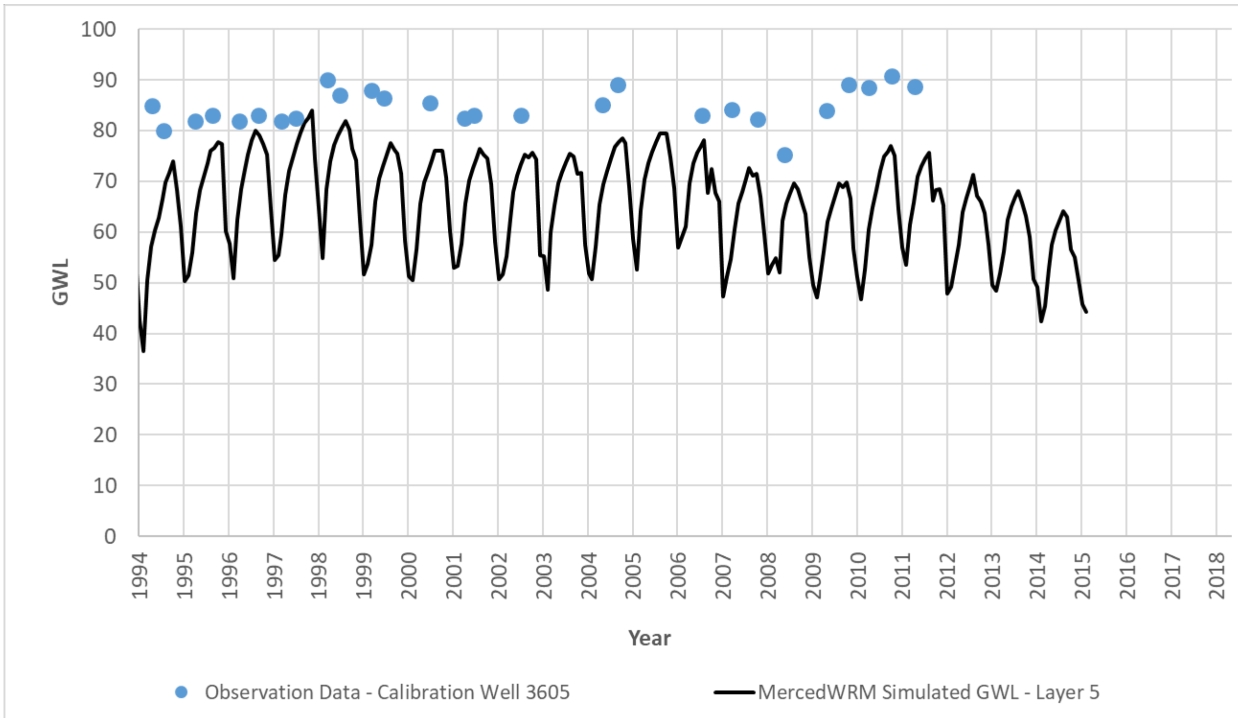


Figure A 155: Calibration Well 3605

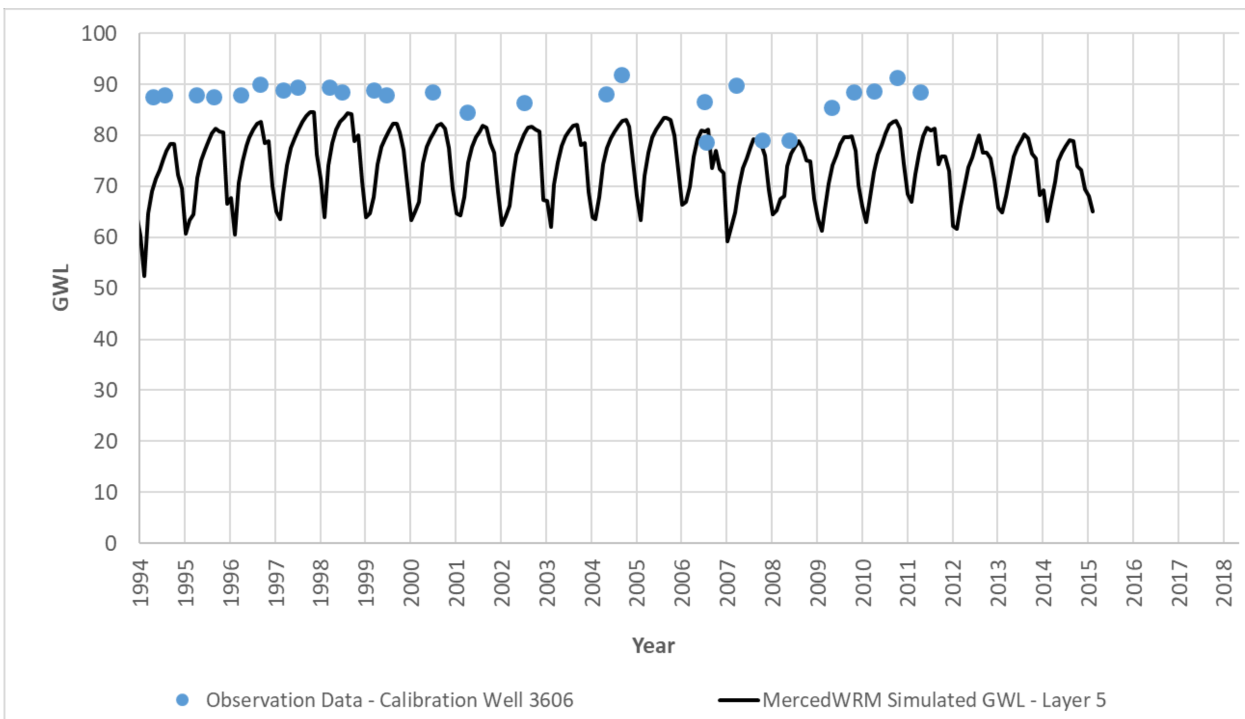


Figure A 156: Calibration Well 3606

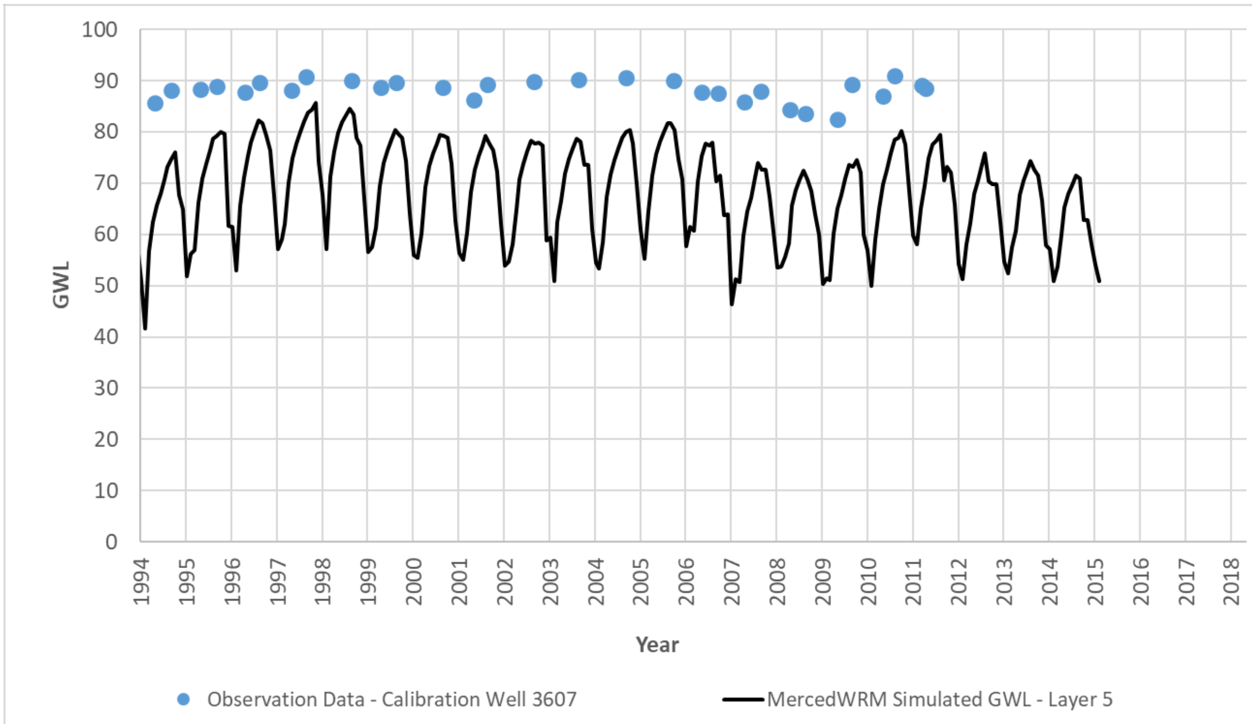


Figure A 157: Calibration Well 3607

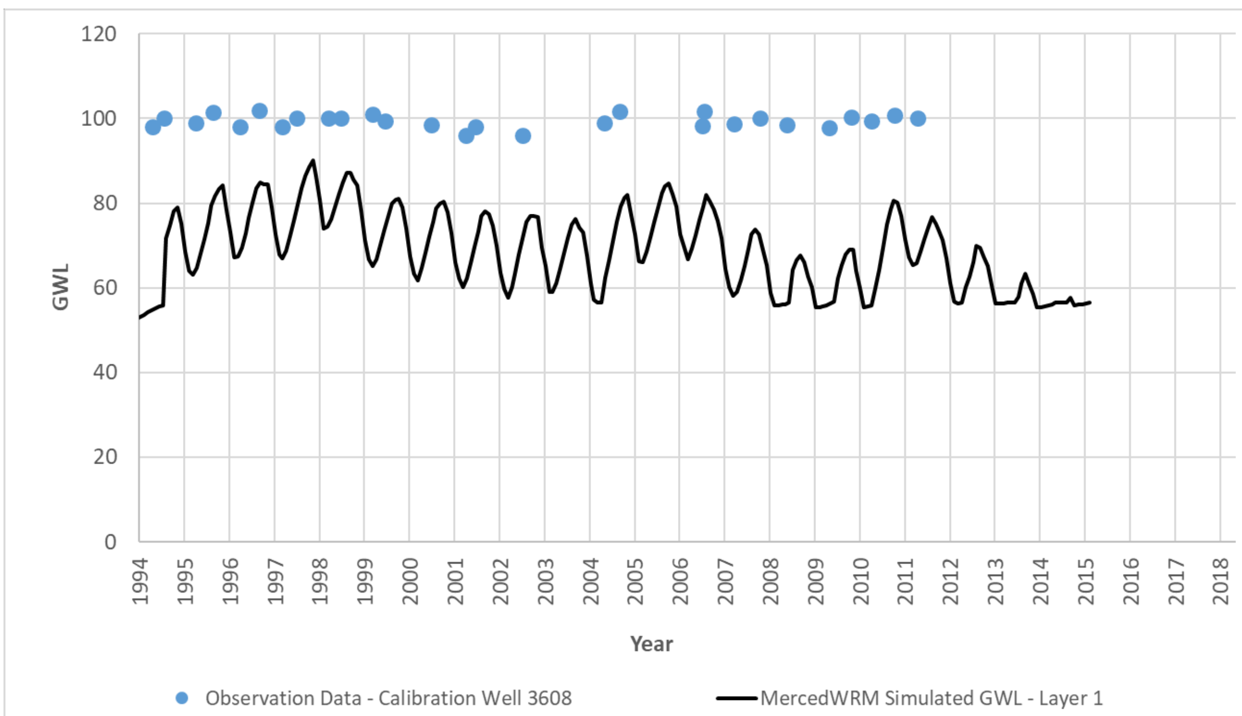


Figure A 158: Calibration Well 3608

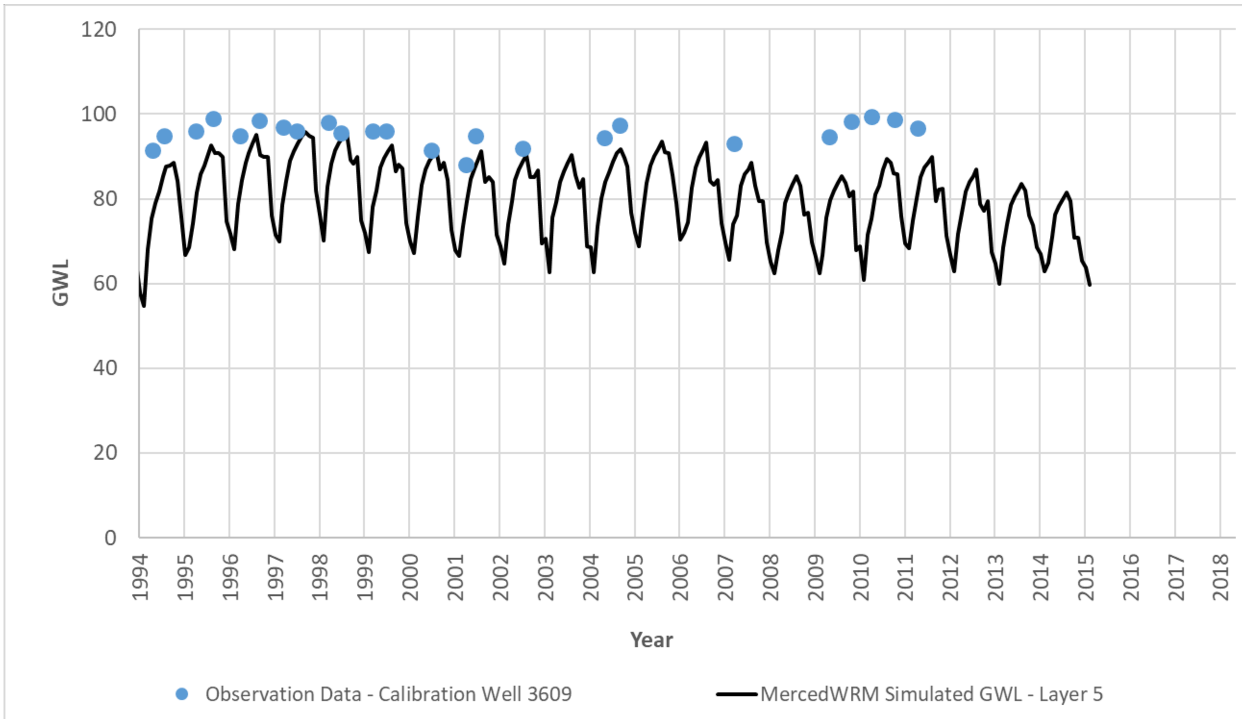


Figure A 159: Calibration Well 3609

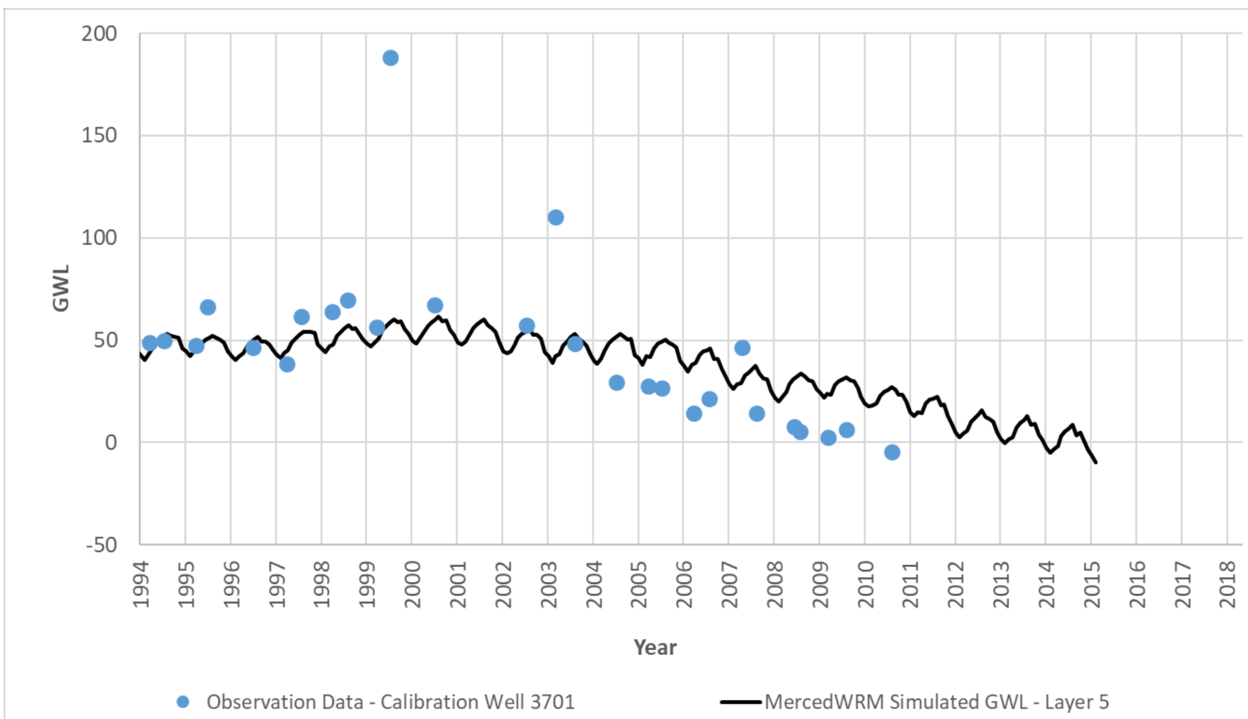


Figure A 160: Calibration Well 3701

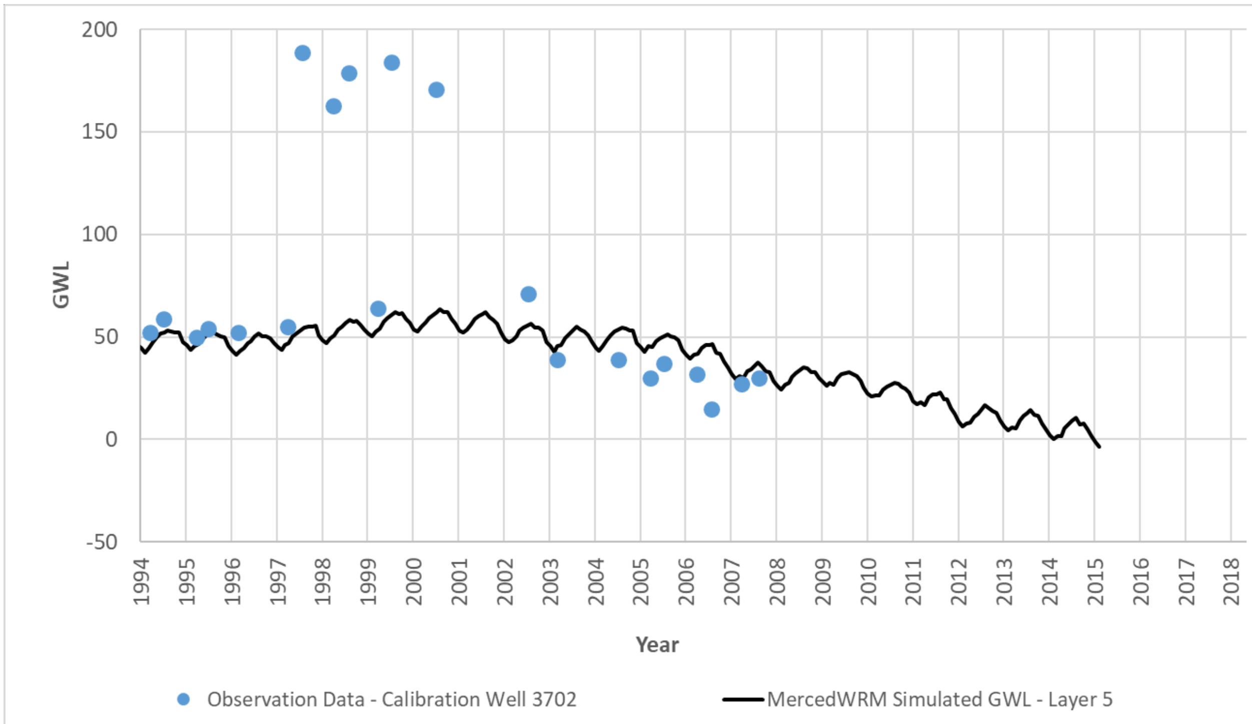


Figure A 161: Calibration Well 3702

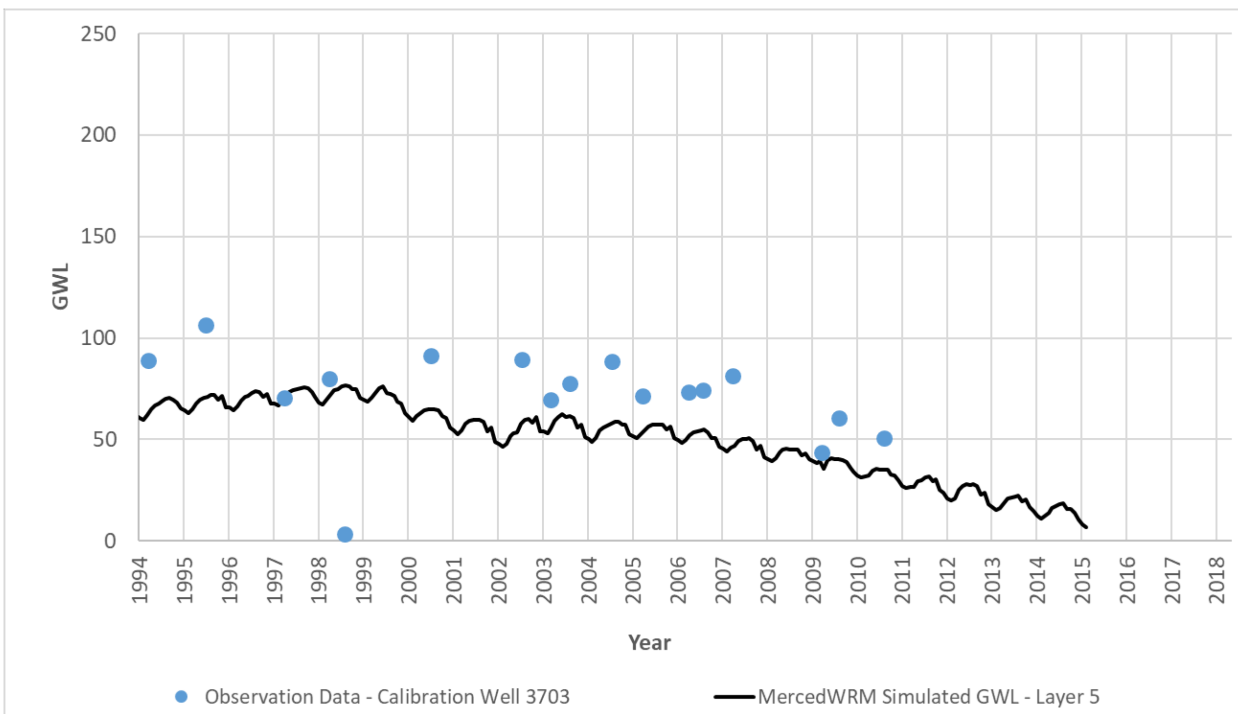


Figure A 162: Calibration Well 3703

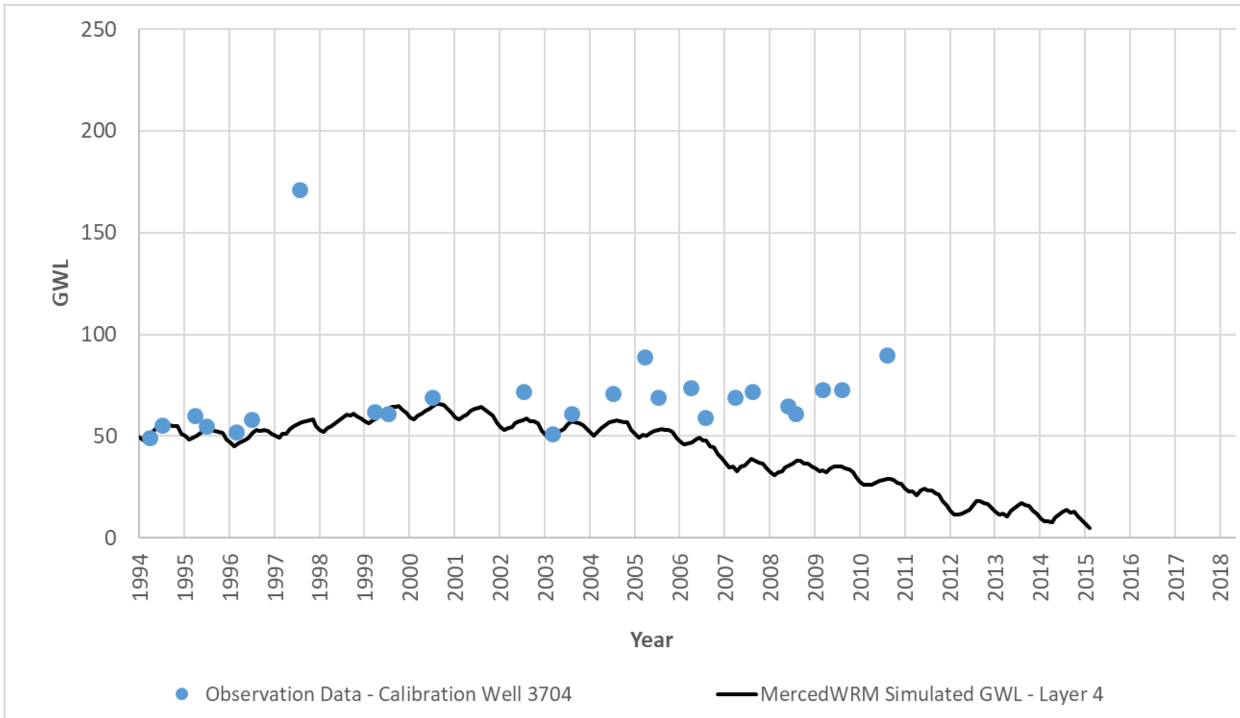


Figure A 163: Calibration Well 3704

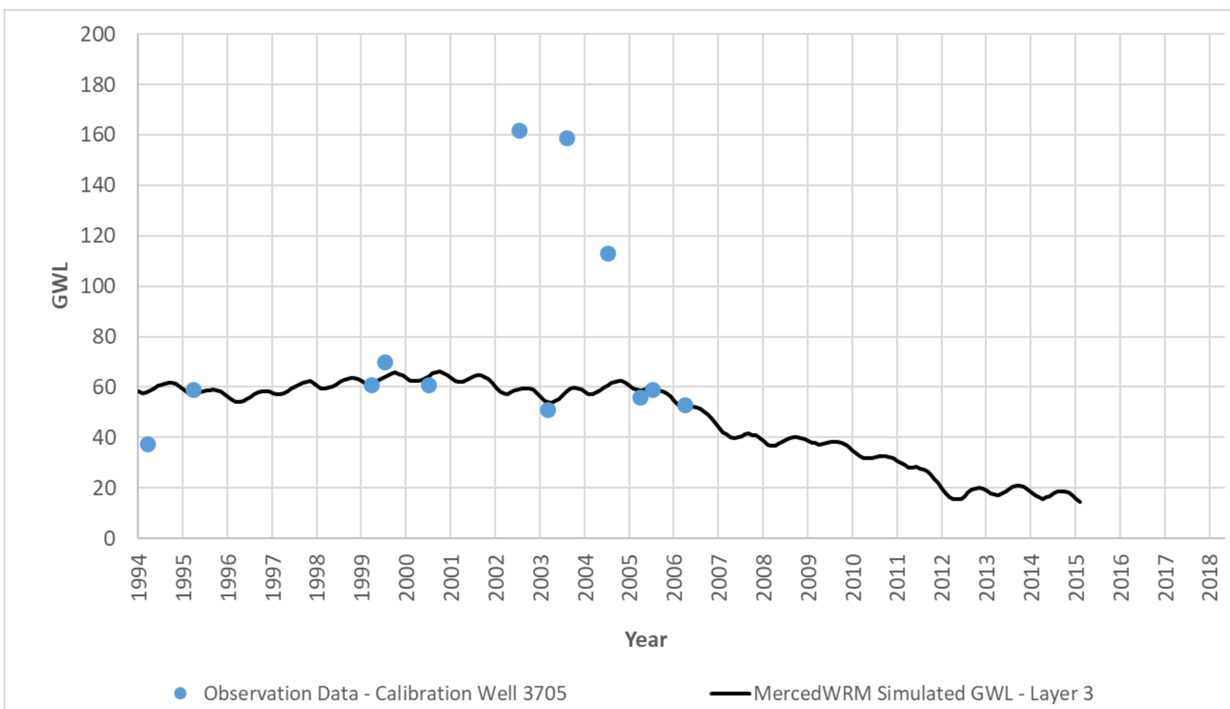


Figure A 164: Calibration Well 3705

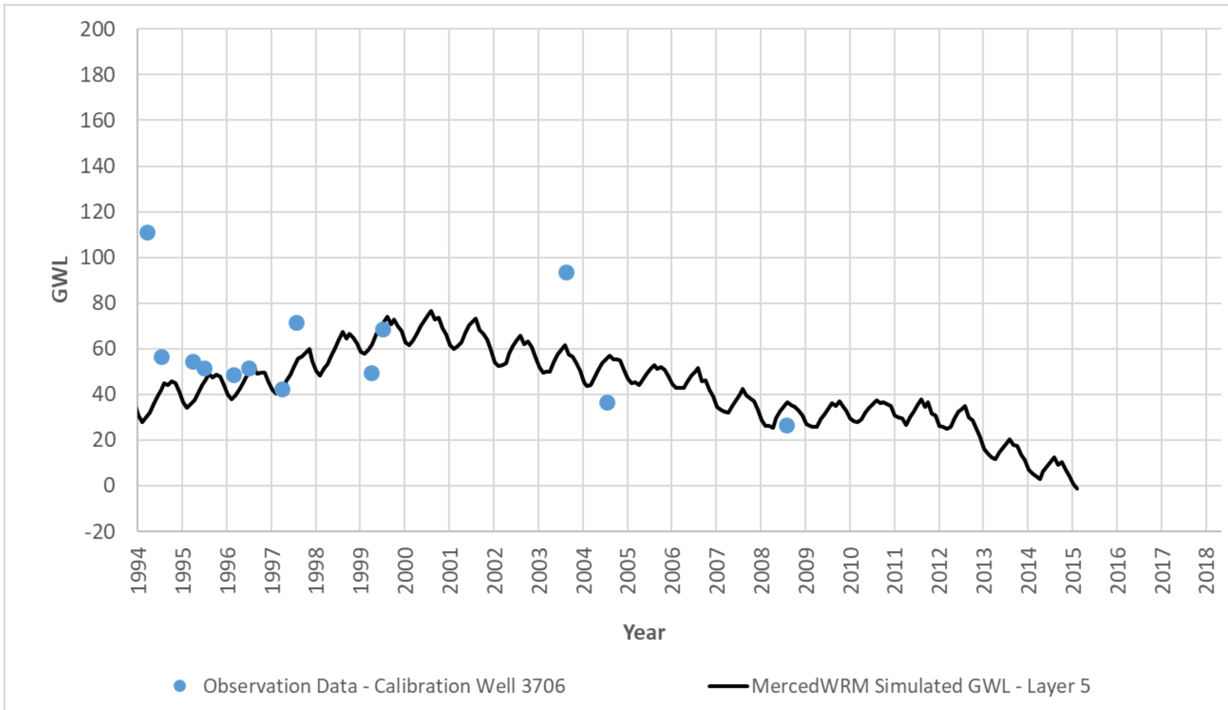


Figure A 165: Calibration Well 3706

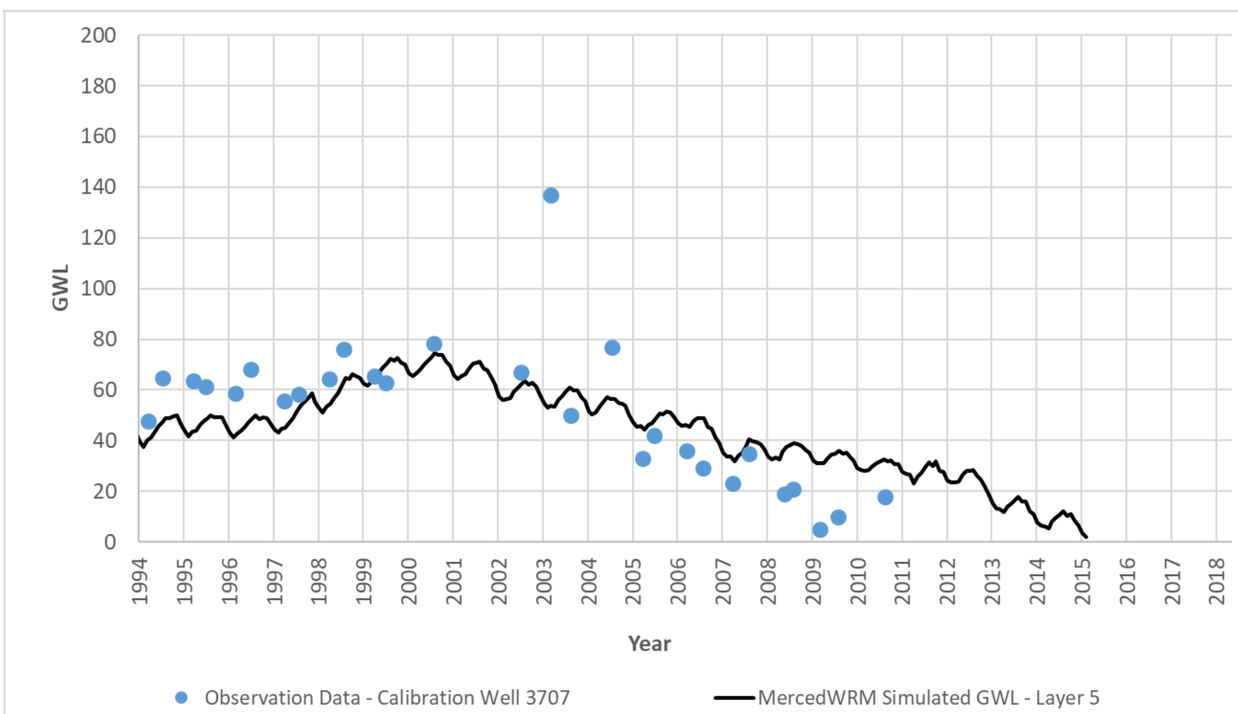


Figure A 166: Calibration Well 3707

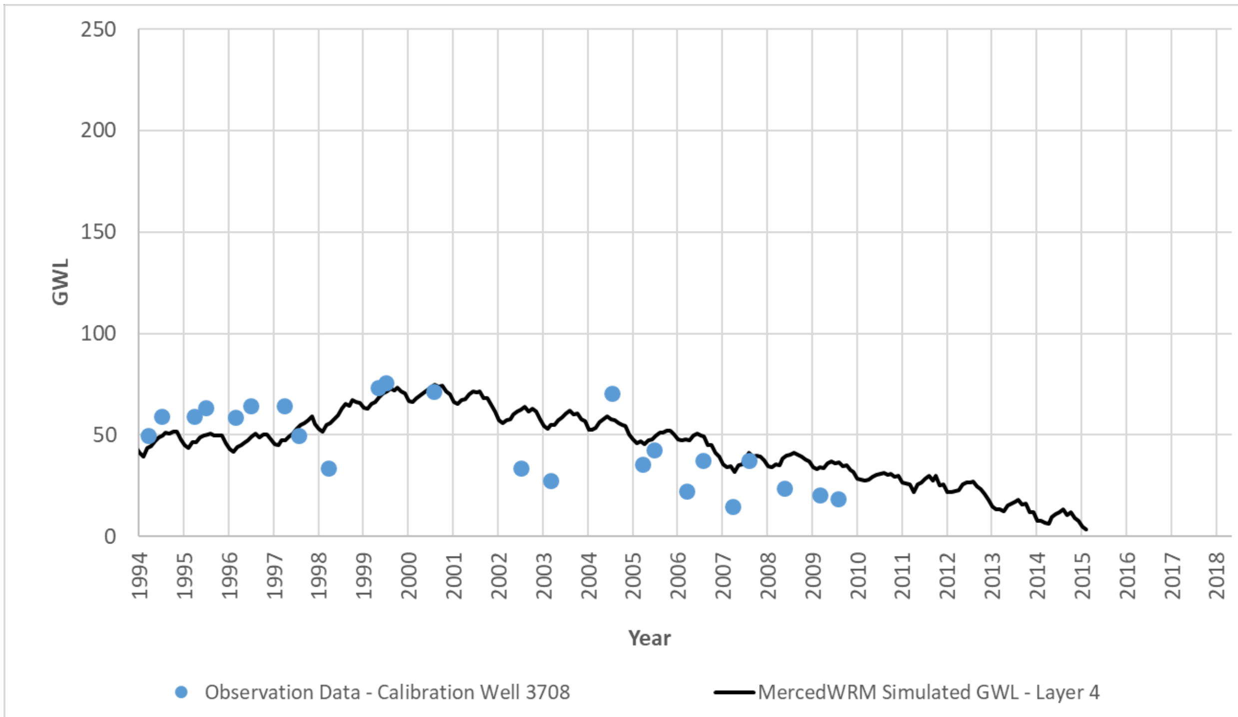


Figure A 167: Calibration Well 3708

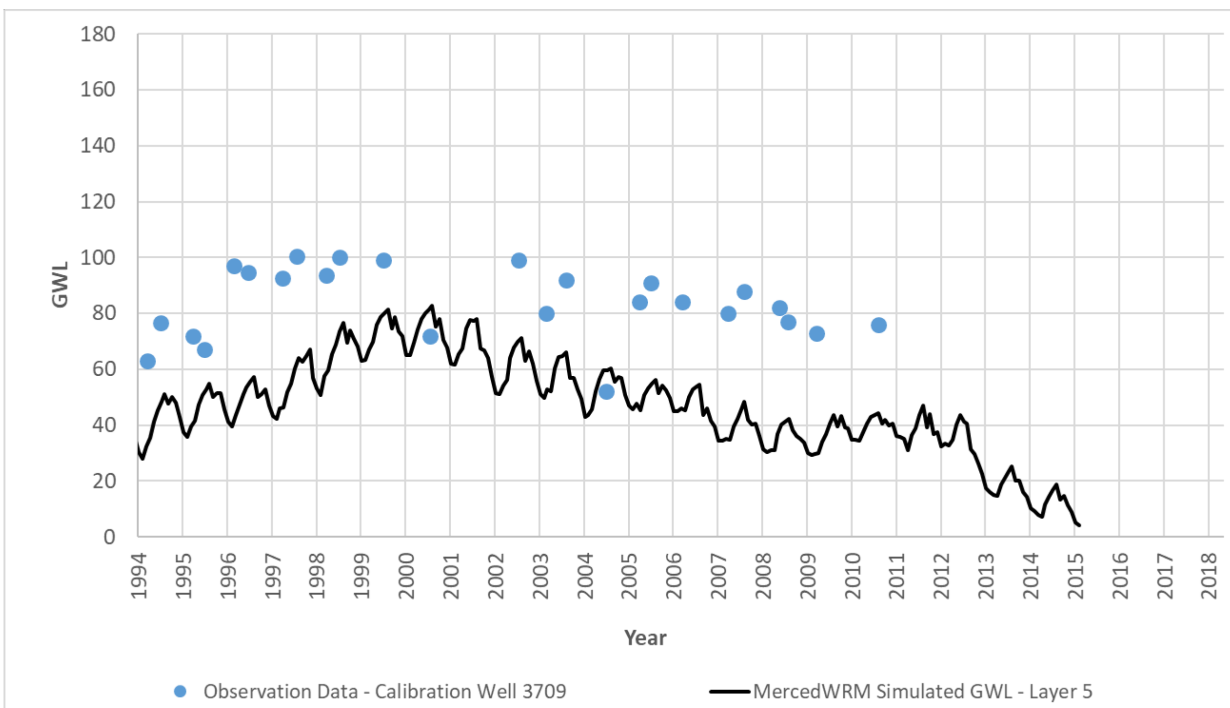


Figure A 168: Calibration Well 3709

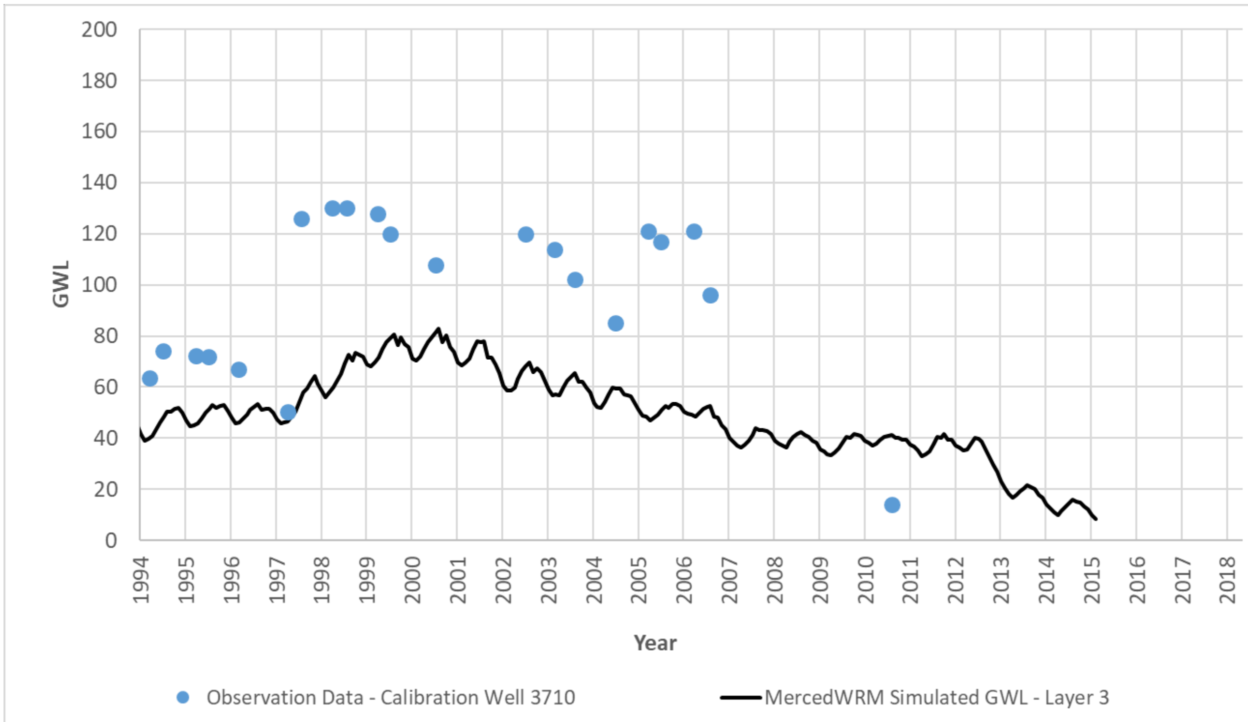


Figure A 169: Calibration Well 3710

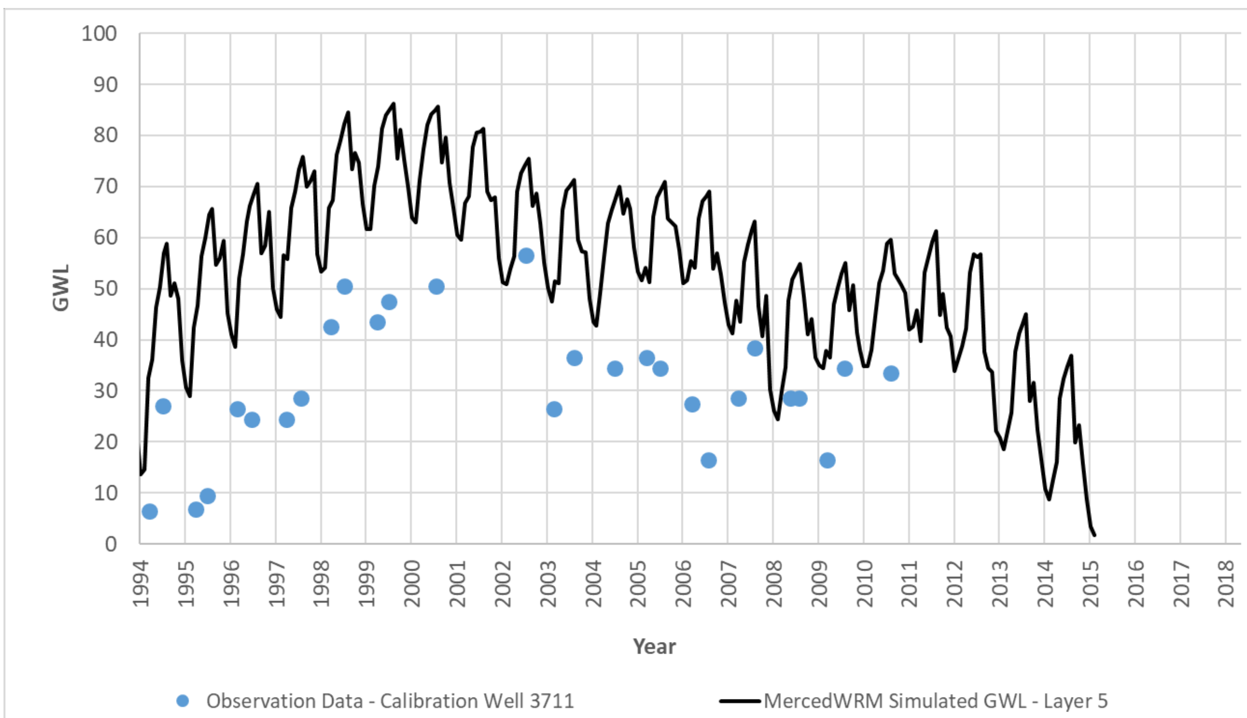


Figure A 170: Calibration Well 3711

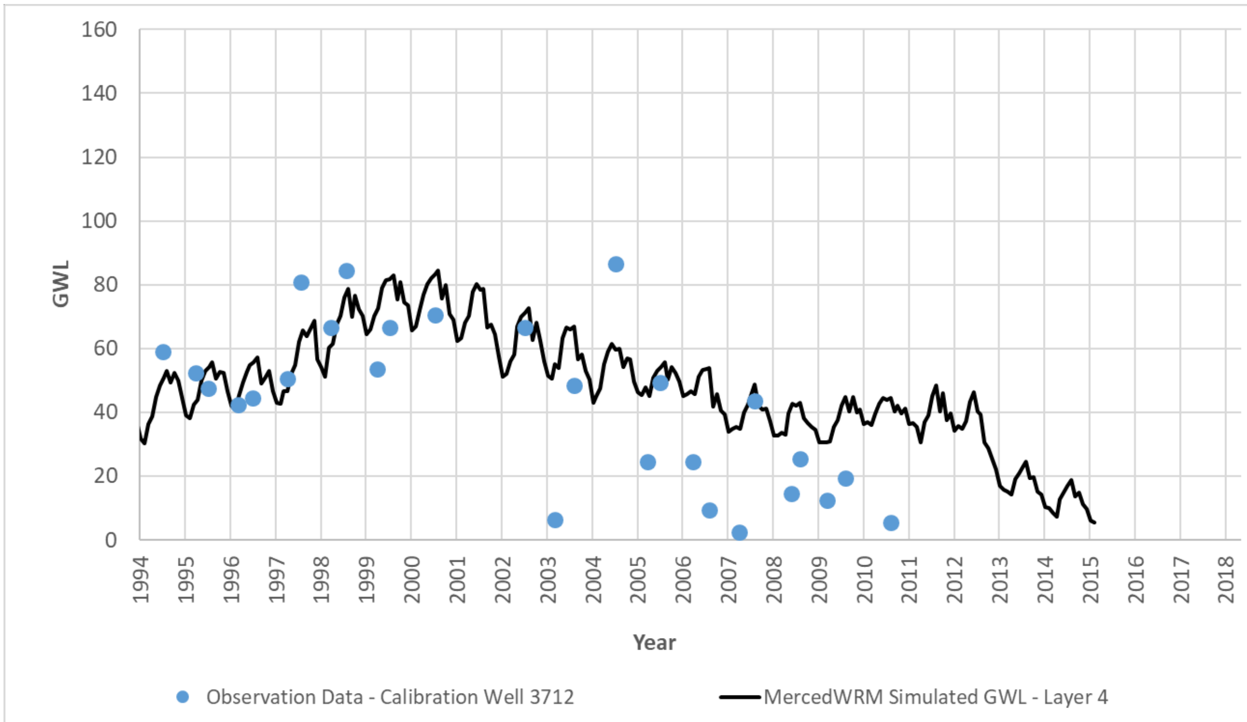


Figure A 171: Calibration Well 3712

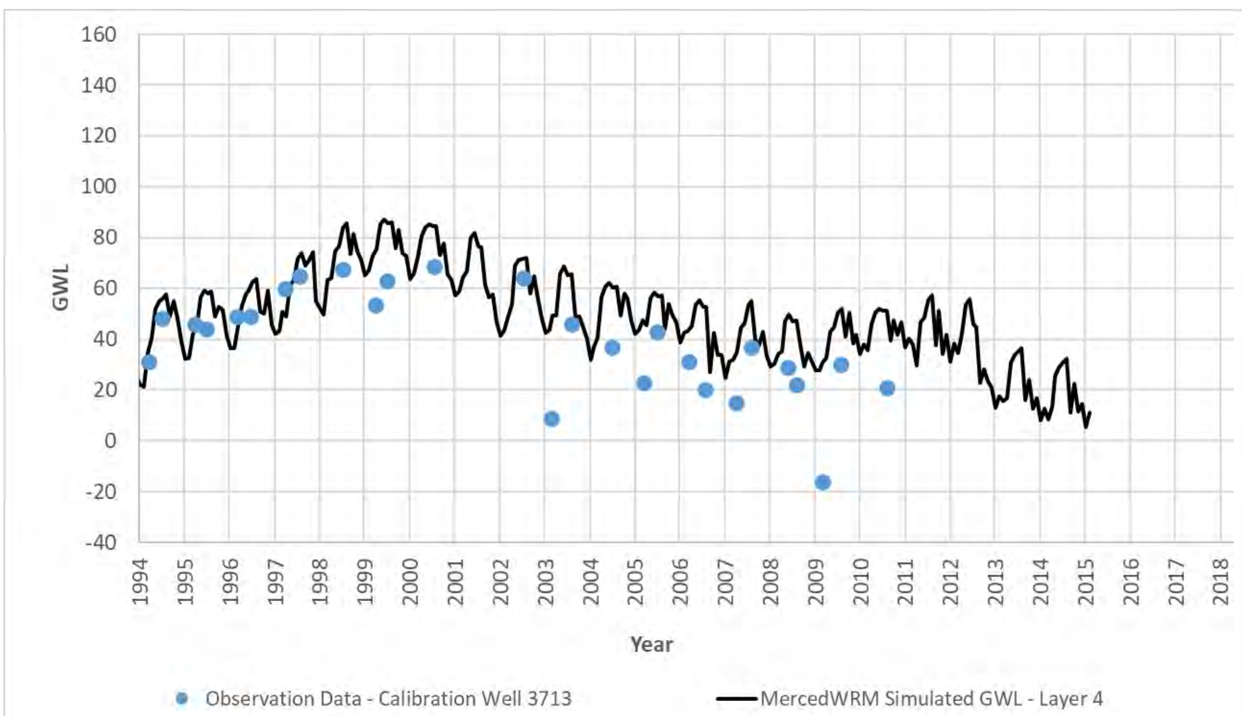


Figure A 172: Calibration Well 3713

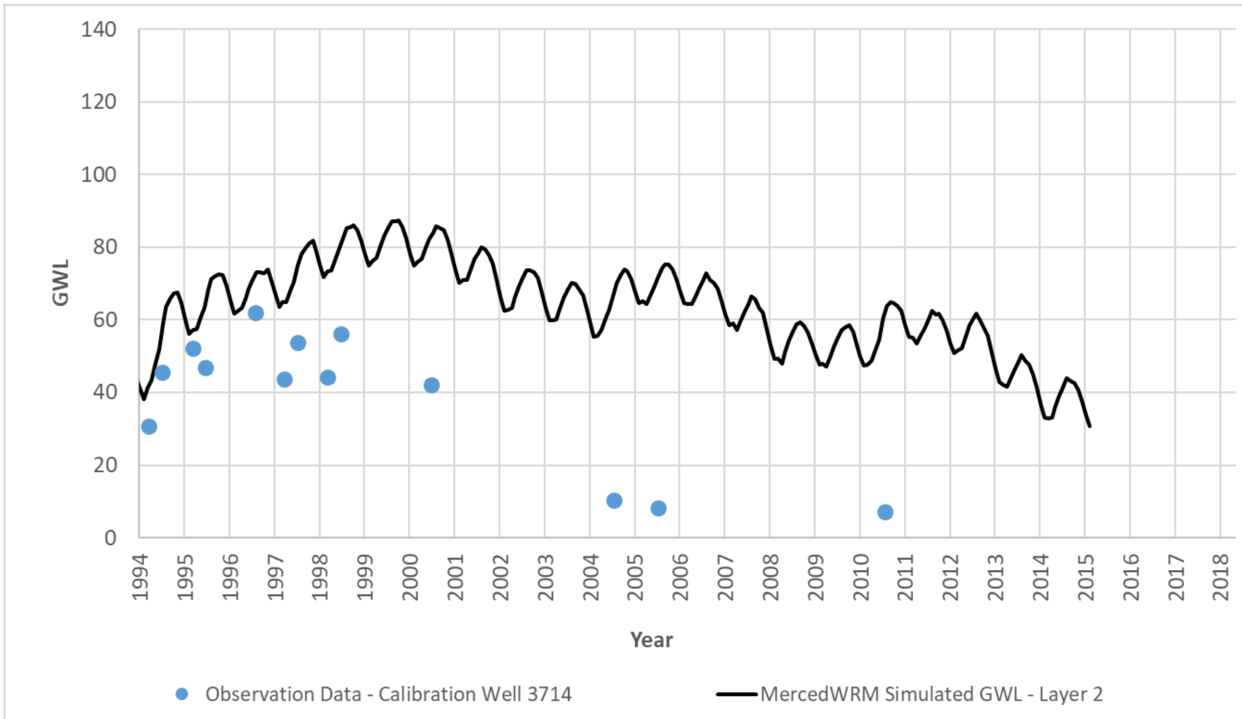


Figure A 173: Calibration Well 3714

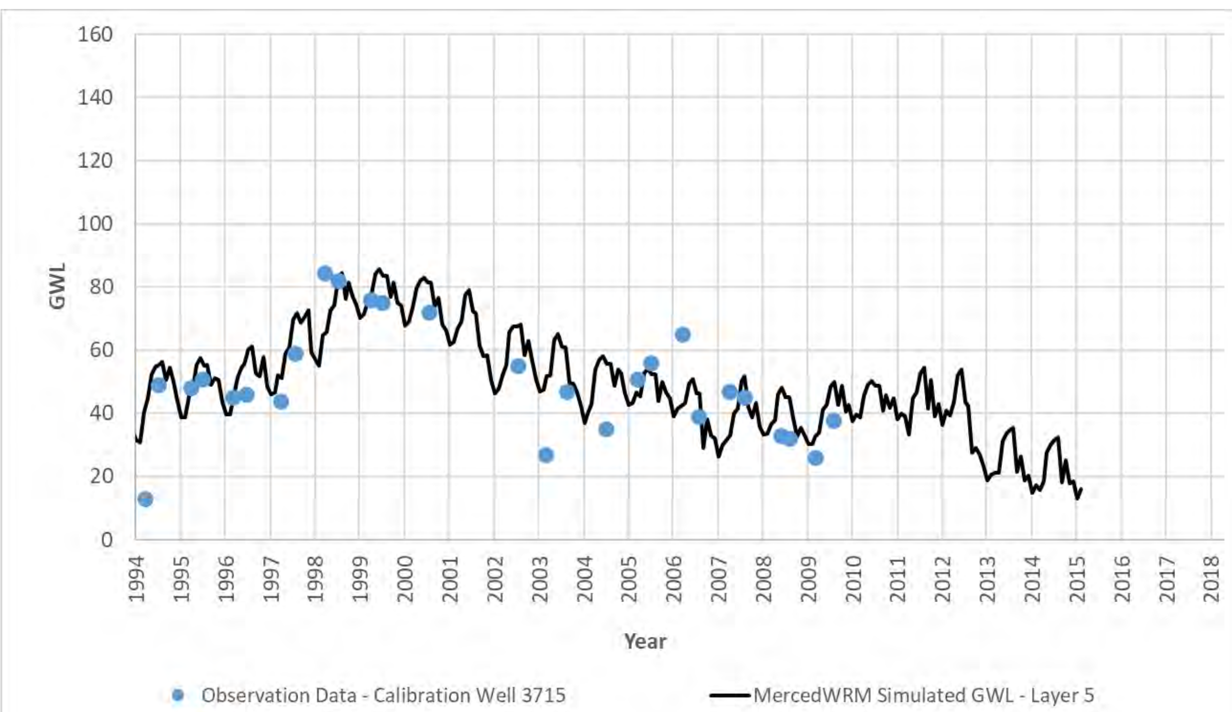


Figure A 174: Calibration Well 3715

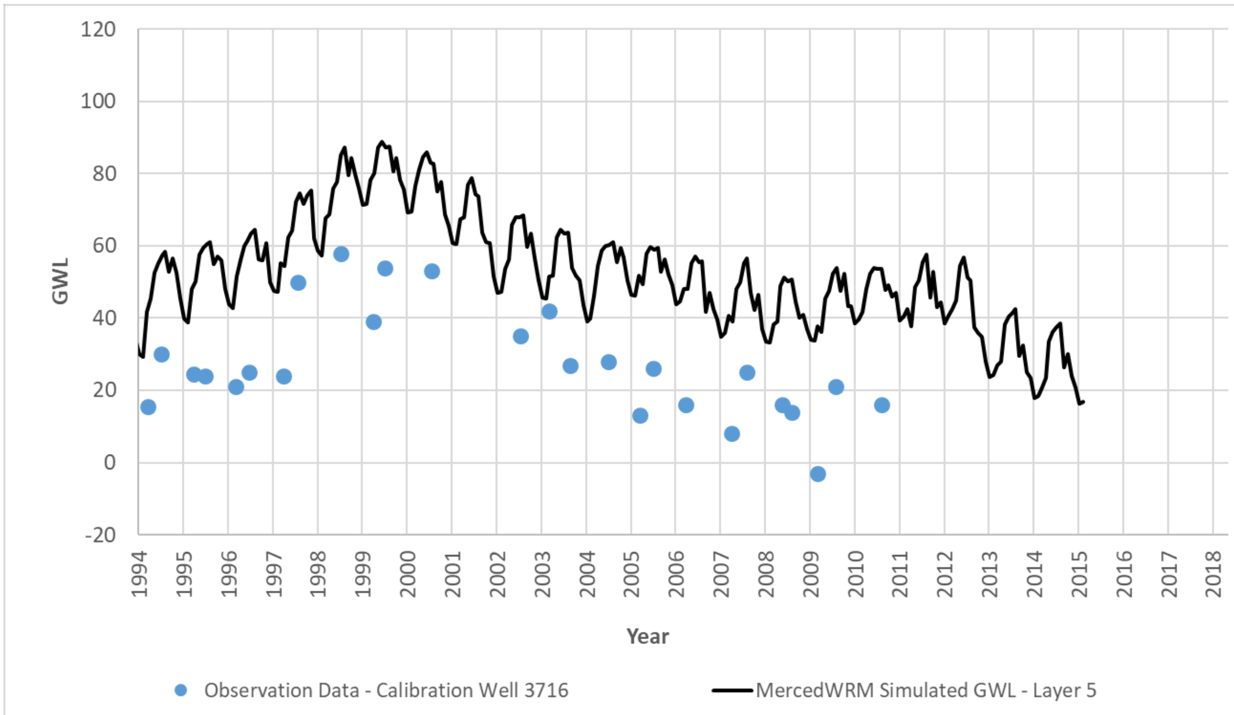


Figure A 175: Calibration Well 3716

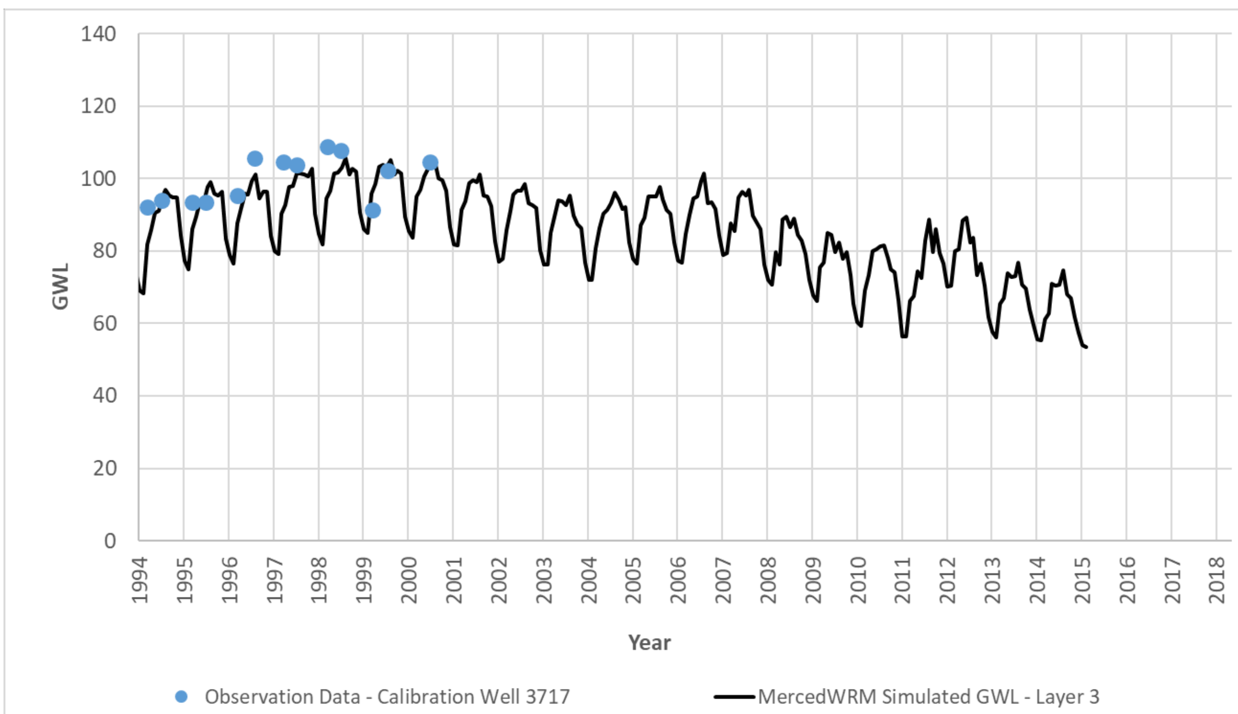


Figure A 176: Calibration Well 3717

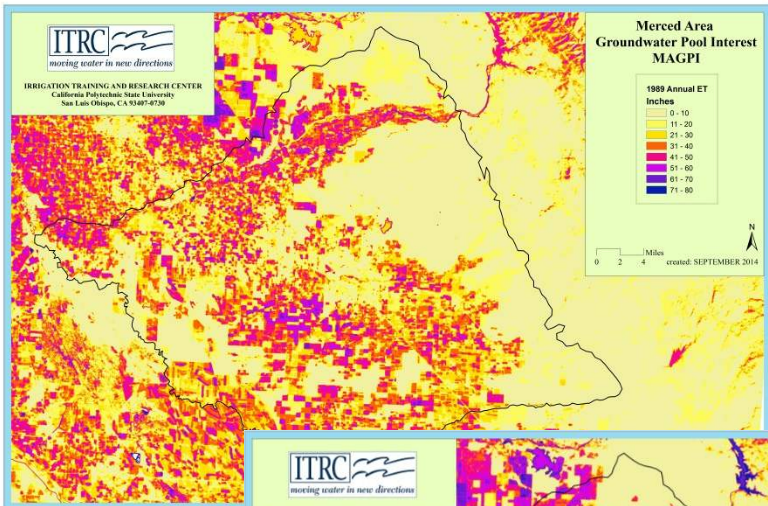
Appendix B - METRIC Project Report

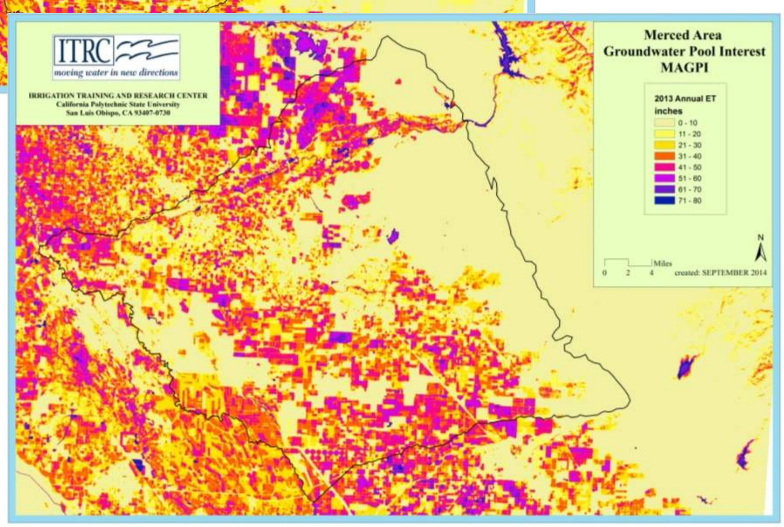
ITRC
moving water in new directions

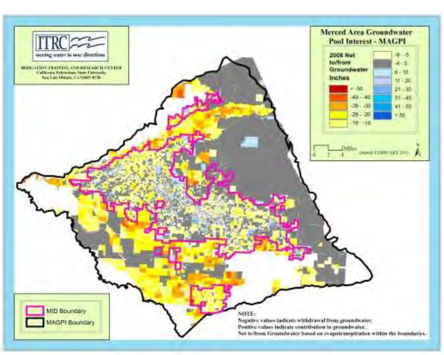
IRRIGATION TRAINING AND RESEARCH CENTER

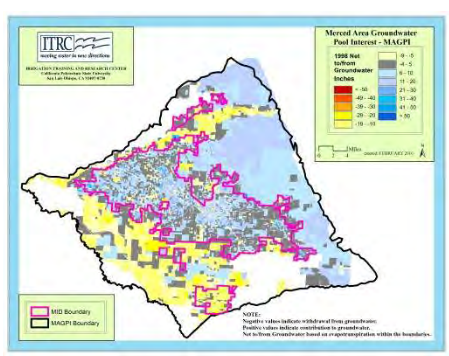
Remote Sensing of Actual Evapotranspiration and Net To and From Groundwater

DRAFT









DRAFT

Merced Area Groundwater Pool Interests (MAGPI)

Updated
February
2016

IRRIGATION
TRAINING AND
RESEARCH
CENTER

Prepared by

Daniel J. Howes, Ph.D., P.E.
Irrigation Training and Research Center (ITRC)
California Polytechnic State University
San Luis Obispo, CA 93407-0730
805.756.2434
www.itrc.org

Prepared for

Ali Taghavi, Ph.D., P.E.
Senior Water Resources Engineer
RMC Water and Environmental
1545 River Park Dr. Suite 425
Sacramento, CA 95815
Work: (916) 999-8760
Mobile (916) 806-3830
ataghavi@rmcwater.com

Disclaimer:

Reference to any specific process, product or service by manufacturer, trade name, trademark or otherwise does not necessarily imply endorsement or recommendation of use by either California Polytechnic State University, the Irrigation Training and Research Center, or any other party mentioned in this document. No party makes any warranty, express or implied and assumes no legal liability or responsibility for the accuracy or completeness of any apparatus, product, process or data described previously. This report was prepared by ITRC as an account of work done to date. All designs and estimates are subject to final confirmation.

Irrigation Training and Research Center
Original September 2014
Updated February 2016

EXECUTIVE SUMMARY

This project was conducted by the Irrigation Training and Research Center (ITRC) of California Polytechnic State University, San Luis Obispo, in cooperation with RMC Water & Environmental for the Merced Area Groundwater Pool Interests (MAGPI). The primary objective of this project was to provided actual spatial evapotranspiration information for the MAGPI region to support the groundwater modeling efforts by RMC. ITRC provided monthly ET information for 9 sample years from 1989 through 2013. These years were selected based on different precipitation levels and to account for crop shifts since the late 1980's. The ITRC-METRIC procedure was used to compute the actual evapotranspiration at a 30 meter pixel resolution throughout the study area using LandSAT TM data (LandSATs 5, 7, and 8 were used in this evaluation).

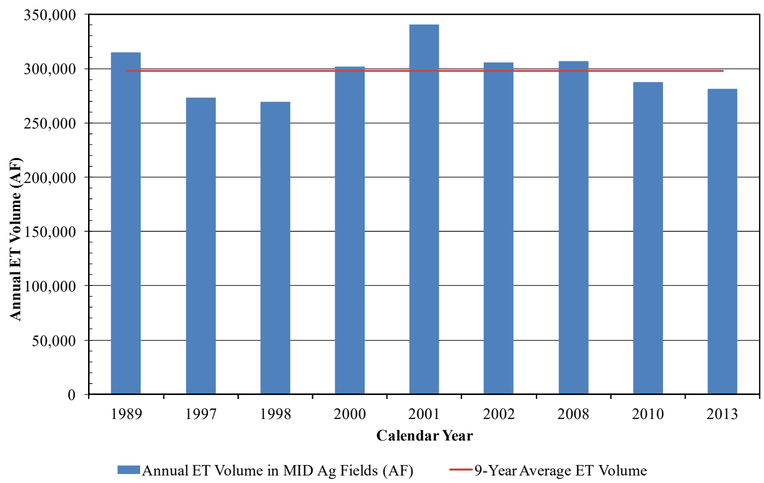


Figure ES-1. Annual volume of crop evapotranspiration within parcels in Merced ID boundaries.

A second objective was to evaluate net amount of water (precipitation and surface irrigation) that taken from or provided to the groundwater from fields throughout the study area. The Net To and From Groundwater (NTFGW) only accounted for water delivered to fields by MID and used in vegetative areas (not canal, drain, river, stream seepage) where surface water delivery information was known. This evaluation required inputs on surface water deliveries, precipitation, evapotranspiration, and estimated runoff (from irrigation and precipitation) spatially throughout the study area. Examples of the results are shown in the following figure for a average (10 inches), wet (19 inches), and a dry (4 inches) precipitation years.

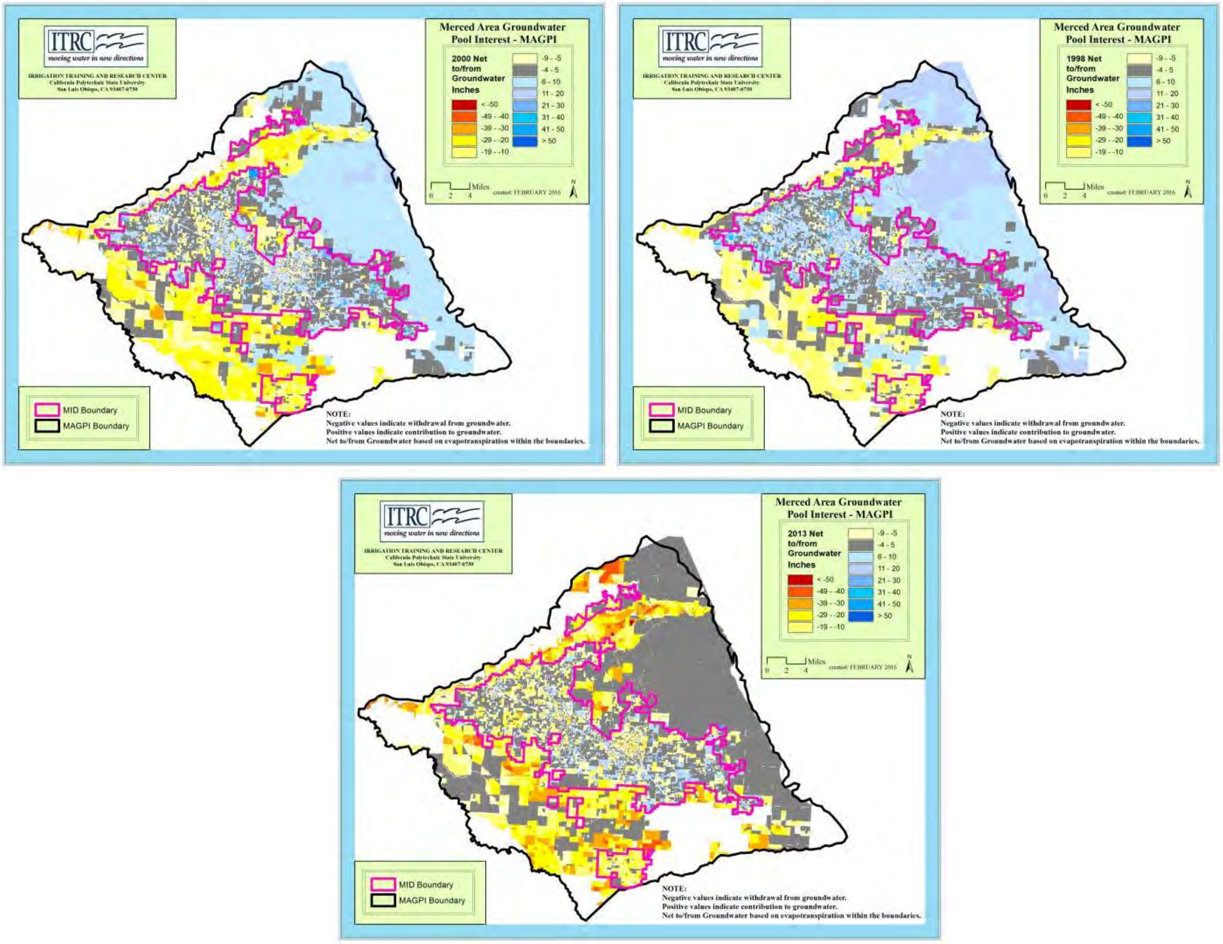


Figure ES-2. Annual net to and from groundwater for vegetative areas in MAGPI area during an AVERAGE (top left), WET (Top right), and DRY (bottom) precipitation year. Negative values (yellow to red) indicate a net from groundwater.

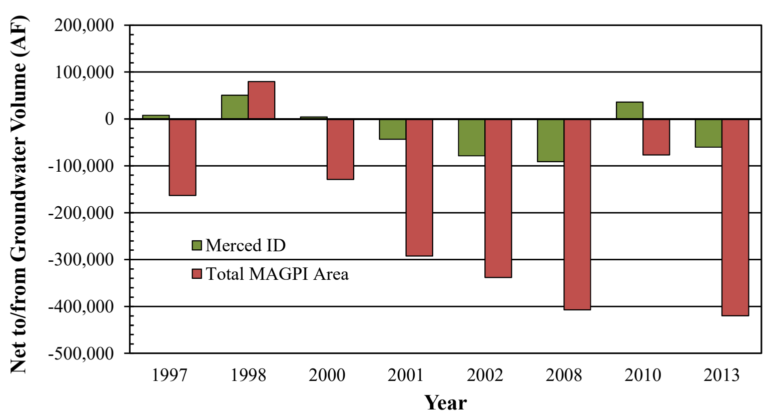


Figure ES-3. Net to/from Groundwater volumes in the Merced ID portion compared to the total MAGPI Area.

Figure ES-3 shows the estimated volume of net to and from groundwater for each year in the study. The volume of groundwater use or recharge is shown within MID boundaries and over the entire MAGPI boundary. It should be noted that surface water deliveries and diversions outside of MID control were requested but not provided as part of this analysis. Therefore the Total MAGPI NTFGW volume is slightly overestimated.

Key Findings

1) Of the years processed, 2001 had the highest ETc in the cropped areas within Merced ID.
2) In normal and wet years, MID users have a net contribution TO the groundwater. This occurs even though most MID users use both surface and groundwater during all years.
3) In dryer years, MID users rely more heavily on groundwater.
4) Except during extremely wet years, the overall MAGPI area has a net FROM (overdraft) which is mitigated by surface water deliveries in MID.

ITRC provided monthly and annual ITRC-METRIC actual ETc images (GIS format) to RMC for the groundwater modeling effort. NTFGW GIS images are also available for RMC to use. The NTFGW should help in the calibrations since one would expect the net groundwater use from the groundwater model to match.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

The Irrigation Training and Research Center (ITRC) at California Polytechnic State University, San Luis Obispo was subcontracted by RMC Water and Environmental to provide actual evapotranspiration (ETc) from vegetation throughout the Merced Area Groundwater Pool Interests (MAGPI) area for a select number of years. This ETc information will be used by RMC as part of a groundwater modeling study for the region that is being funded by MAGPI.

ITRC uses a modified Mapping of EvapoTranspiration with Internal Calibration (METRIC) procedure to compute actual evapotranspiration using LandSAT Thematic Mapper (LandSAT) data. Three LandSAT satellites were used for this study which covered a timeframe starting in 1985-2013 (several years or portions of years were missing in this timeframe). The MAGPI area is shown in Figure 1.

The second objective of this study was to evaluate the net amount of water that was contributed to or taken from the groundwater for crop use in the MAGPI area. ITRC felt that this information would help RMC calibrate the groundwater model for the years examined. This will be discussed in more detail in the body of this report.

ITRC-METRIC MODELING

Satellite Images

LandSAT 5, LandSAT 7, and LandSAT 8 images available from the United States Geological Survey (USGS) on sixteen-day intervals were used for the MAGPI METRIC process. **Table 1** below shows the time frame of available satellite images for each individual satellite.

Table 1. Time frame of available images for LandSAT 5, 7, and 8

LandSAT 5	LandSAT 7**	LandSAT 8
November 1982-October 2011	June 1999-May 2003	April 2013-Present

**After May 2003, LandSAT 7 began producing images with missing data because of a defective sensor

For all three satellites, the LandSAT image that encompassed the area of interest was located in Path 43 and in Row 34. The project area of interest can be seen in **Figure 1** with the July 30th 2013 LandSAT 8 "natural look" image in the background. **Figure 2** shows the infrared background for the same LandSAT 8 image date.

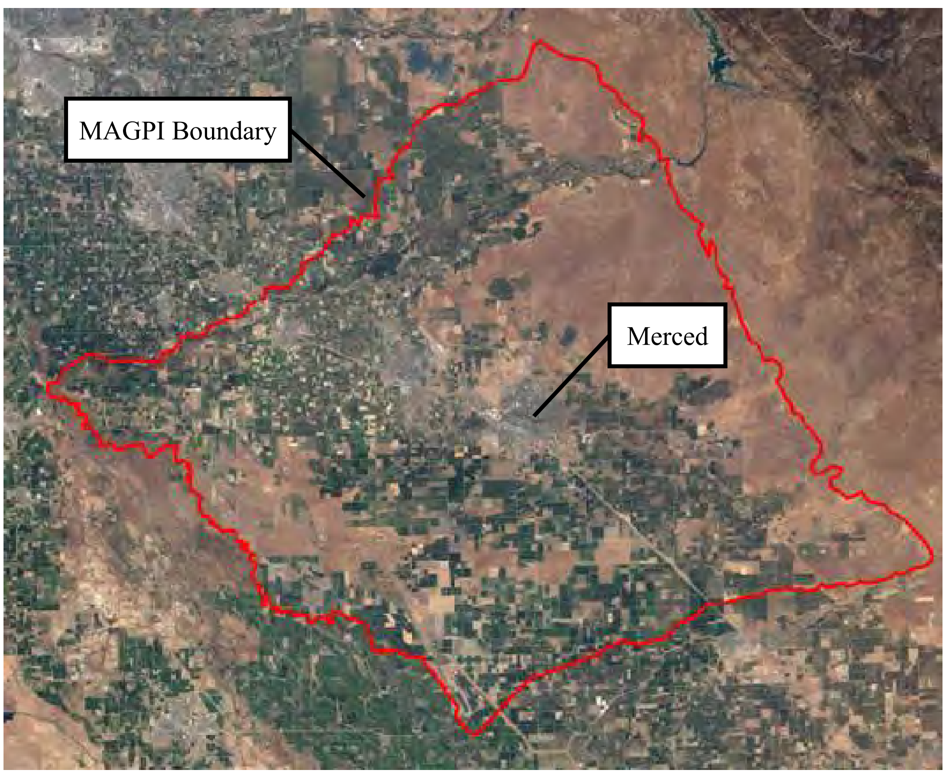


Figure 1. Area of interest with "natural color" image in the background

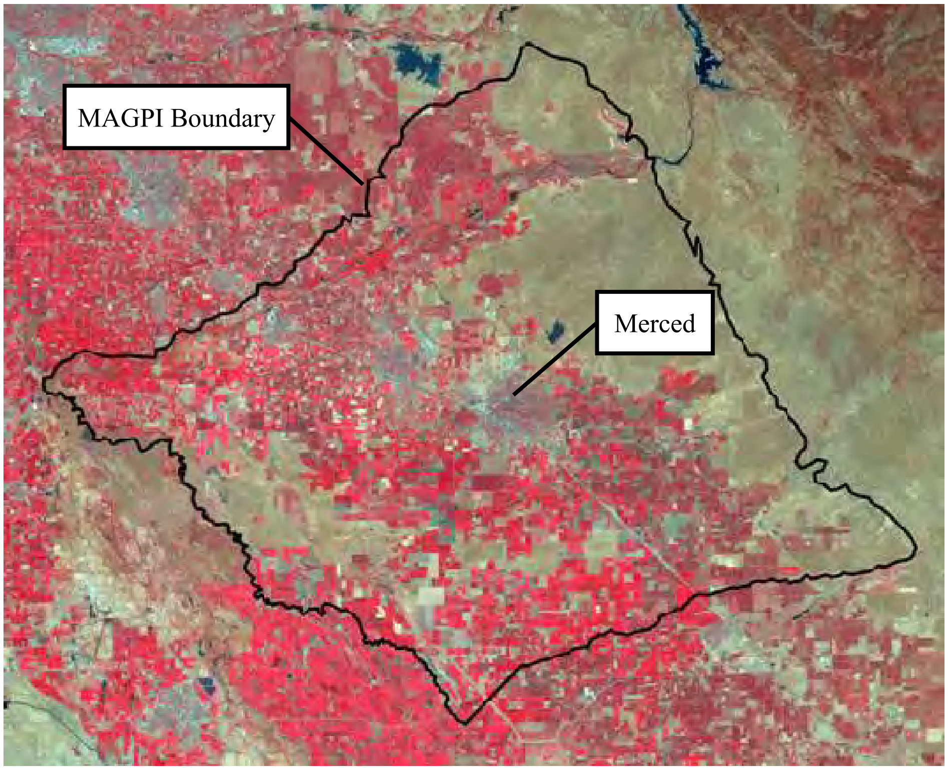


Figure 2. Area of interest with infrared image in the background

A total of nine years were analyzed for the METRIC modeling process. Years were selected so that they covered different precipitation year types (dry, average, or wet water year) and accounted for changes in crop types since the late 1980's. The following years were analyzed for this project:

1. 1989 (Dry water year)
2. 1997 (Average water year)
3. 1998 (Wet water year)
4. 2000 (Average water year)
5. 2001 (Average water year)
6. 2002 (Average/Dry water year)
7. 2008 (Average/Dry water year)
8. 2010 (Wet water year)
9. 2013 (Dry Water Year)

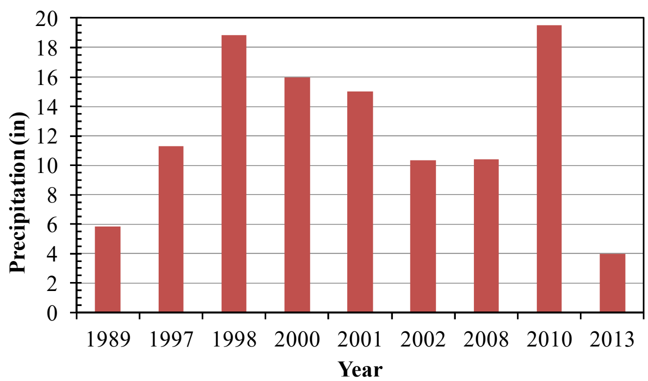
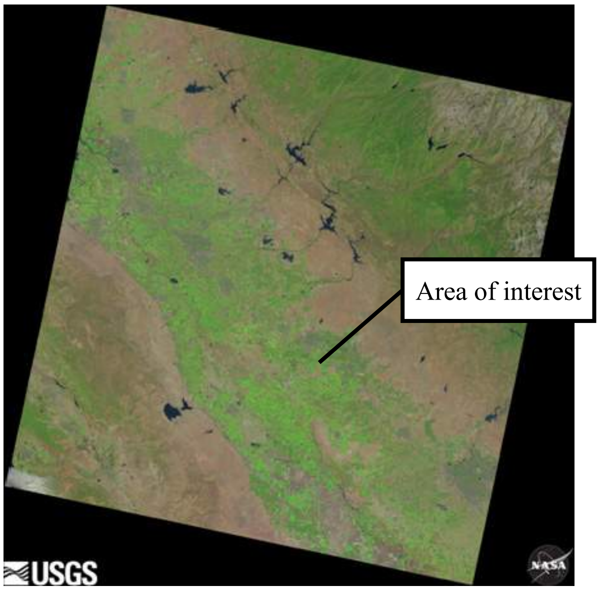


Figure 3. Approximate precipitation amounts in the MAGPI area for the years examined.

In order to obtain reliable results from the METRIC modeling process, daily images need to be free of cloud coverage in the area of interest. **Figure 4** shows the difference between a usable and unusable image for METRIC modeling.



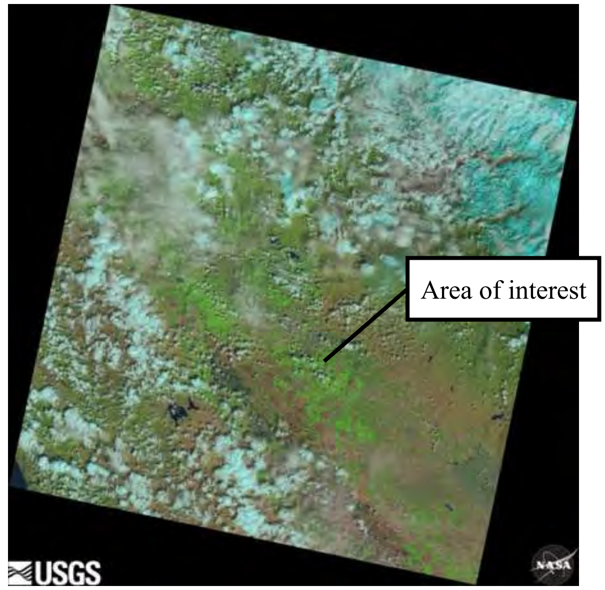


Figure 4. Usable LandSAT image (left image) and an unusable LandSAT image (right image)

All available cloud-free images were used for the modeling process as seen in **Table 2**. A total of 124 images were processed using METRIC.

Table 2. Chosen image dates for MAGPI METRIC Process

Year	1989	1997	1998	2000	2001	2002	2008	2010	2013**
Type	Dry	Average	Wet	Average	Average	Average	Dry	Wet	Dry
Image Dates	1/17 3/22 4/7 5/25 6/10 7/28 8/13 8/29 9/30 10/16 11/1 12/3	1/7 2/24 3/12 3/28 4/13 5/15 5/31 6/16 7/2 7/18 8/3 9/4 9/20 10/22 11/23	2/11 3/15 4/16 5/18 6/19 7/5 7/21 8/6 8/22 9/7 10/9 11/26 12/28	2/1 3/20 4/29* 5/31* 6/16* 6/24 7/2* 7/26 8/11 8/19* 9/20* 9/28 10/14 10/22* 11/17*	1/18 2/3 3/23 4/24 5/10 5/26 6/11 6/19* 7/13 7/29 8/14 8/30 9/15 10/1 11/26* 12/20	3/2* 4/3* 4/19* 5/5* 5/13 6/14 6/30 7/8* 7/24* 8/9* 8/25* 9/10* 9/26* 10/14 10/28*	2/7 3/26 4/11 4/27 5/13 5/29 6/14 6/30 7/16 8/1 8/17 9/2 9/18 10/20	2/12 4/1 5/35 5/19 6/20 7/6 7/22 8/7 8/23 9/24 10/10 11/11	4/25 5/11 6/12 6/28 7/14 7/30 8/15 8/31 9/16 10/18 12/25 12/21
Total	12	15	13	15	16	15	14	12	12

Notes: * indicates LandSAT 7 and ** indicates LandSAT 8

Weather Data

Daily and hourly weather data for the project time frame were collected from the California Irrigation Management Information System (CIMIS) weather stations located near the project area of interest as seen in **Figure 5**.

Figure 5. Location of agricultural weather stations considered for historical weather data

Two weather stations were considered for the METRIC modeling process:
1. Merced (Source: CIMIS – Station ID: #148 – Available 1/4/1999 to present)
2. Los Banos (Source: CIMIS – Station ID: #56 – Available 6/28/1988)

The Merced weather station data was used for the modeling years 2000 through 2013 because of its location in respect to the majority of the agricultural area within the MAGPI boundary. The Los Banos weather station data was used for the modeling years prior to the year 2000. The weather component data collected from both weather stations are:
1. Solar radiation (W/m^2)
2. Air temperature (ºC)
3. Wind speed (m/s)
4. Precipitation (mm)
5. Relative humidity (%)
6. Dew point temperature (ºC)

The collected weather data went through a quality control check based FAO procedures. A detailed procedure on the quality control conducted can be found in FAO Irrigation and Drainage paper No. 56 (Allen et al., 1998) along with correction procedures. The main correction needed to compute the hourly *ETo* is to the solar radiation. **Figure 6** contains a graph of the corrected solar radiation over the project time frame.

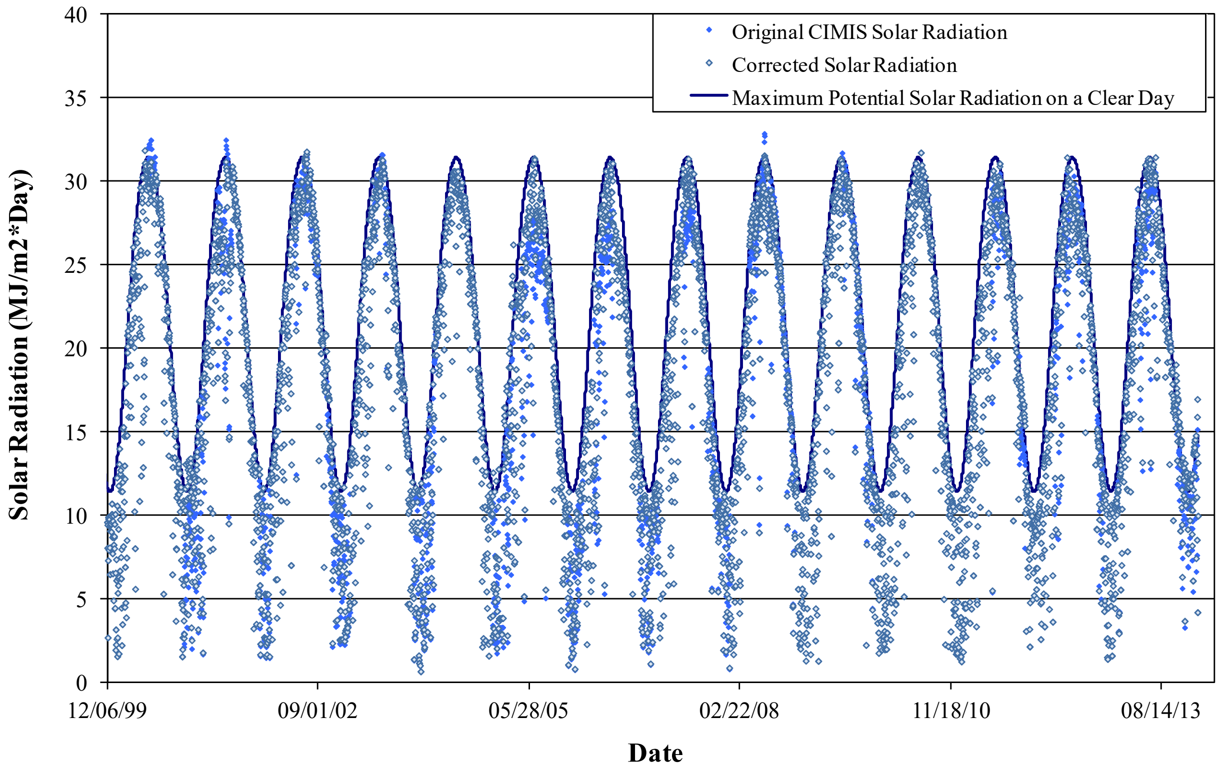


Figure 6. Adjusted solar radiation using FAO 56

Once the solar radiation and any other errors were corrected using the FAO procedures, the *ETo* was computed using the ASCE 2005 Standardized Penman Monteith *ETo* equation. **Figure 7** below shows a monthly comparison of the computed *ETo* for various years of the Merced weather data.

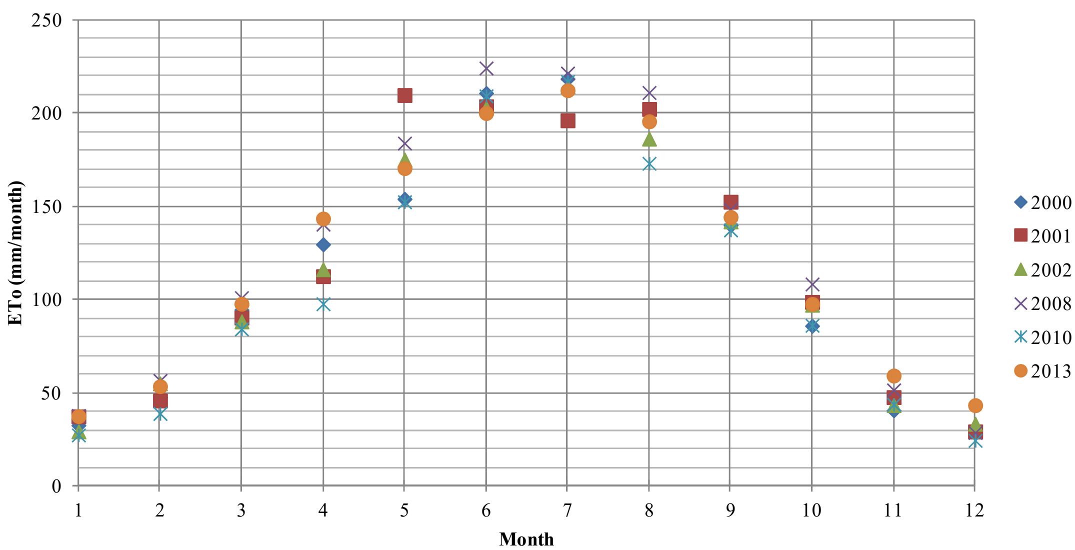


Figure 7. Comparison of monthly ETo computed from the ASCE 2005 Standardized Penman Monteith *ETo* equation using Merced historical weather data

ETo and individual weather data are used within the METRIC process to compute inputs into the software. METRIC computes the instantaneous *ETc* for every pixel within the LandSAT image at the instant the image is taken. Knowing the *ETo* at that instant from the local weather station, a **crop coefficient (*Kc*)** can be computed (*Kc = ETc/ETo*). It has been shown that this instantaneous *Kc* at the time of image acquisition (approximately 11 a.m.) is a very good representation of the *Kc* for that entire day.

Elevation Data

A Digital Elevation Model (DEM) provided by the USGS was used to adjust the model outputs based on the surface elevation through the area of interest. The DEM used had a resolution of 10m (1/3 arc second) which was then re-projected into a 30m x 30m pixel size to match the resolution of the LandSAT images.

Landuse Map

Landuse surveys conducted by the California Department of Water Resources (DWR) on a field by field basis for Merced County in 1995 and 2002 were used as the main source for landuse map in the METRIC modeling process. Additional landuse surveys provided by the DWR for the surrounding counties and annual landuse data provided by the National Agricultural Statistics Service (NASS – an extension of the U.S. Department of Agriculture – USDA) were used to compute the landuse characteristics in the outside areas of Merced County.

All of the landuse maps when through a quality control check to ensure that a single landue value was uniform across an entire field. **Figure 8** shows an example of the Landuse map used for processing the modeling year 2002.

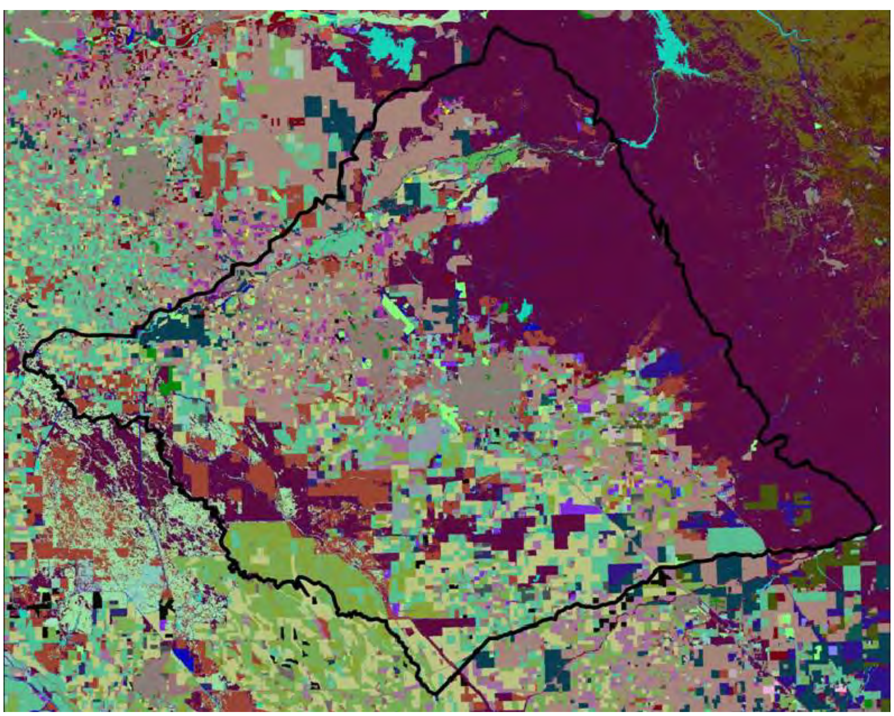


Figure 8. Example of landuse characteristic map used of the METRIC modeling process. Each color identifies a different landuse type (i.e. almonds, alfalfa, developed, etc.)

METRIC Kc Results

Figure 9, **Figure 10**, and **Figure 11** consist of *Kc* results from three different image dates and their ranges of *Kc* values. The lighter the pixel color, such as yellow, the lower the *Kc* value. Conversely, the darker the pixel color, such as blue, the higher the *Kc* value.

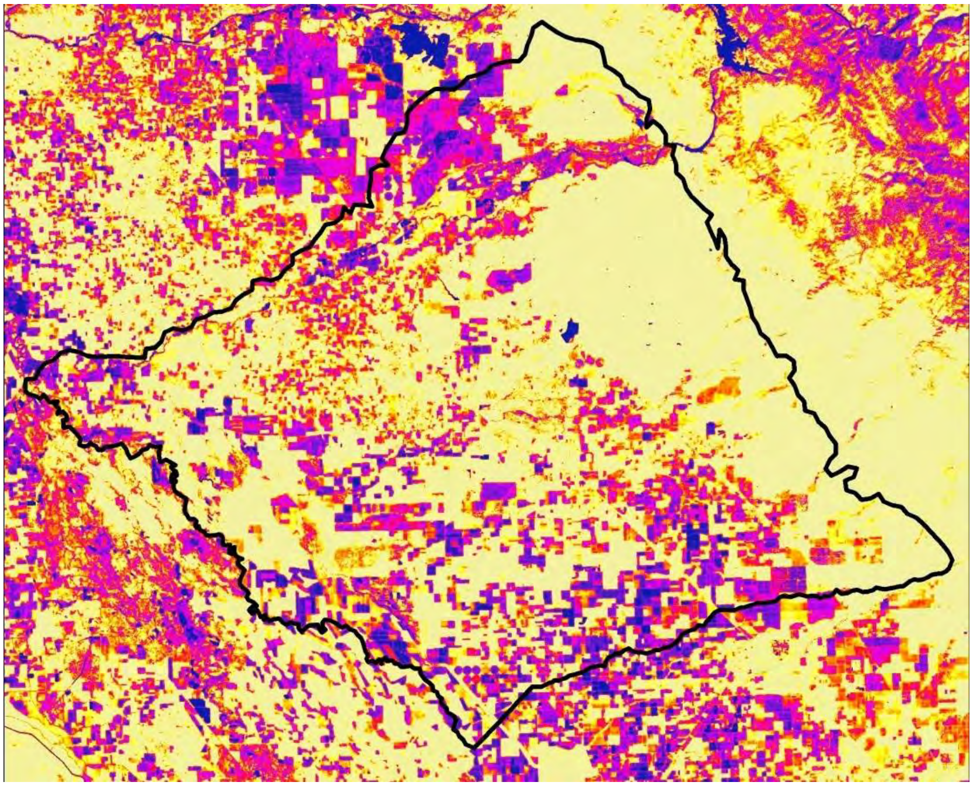


Figure 9. METRIC *Kc* Results for April 25th, 2013

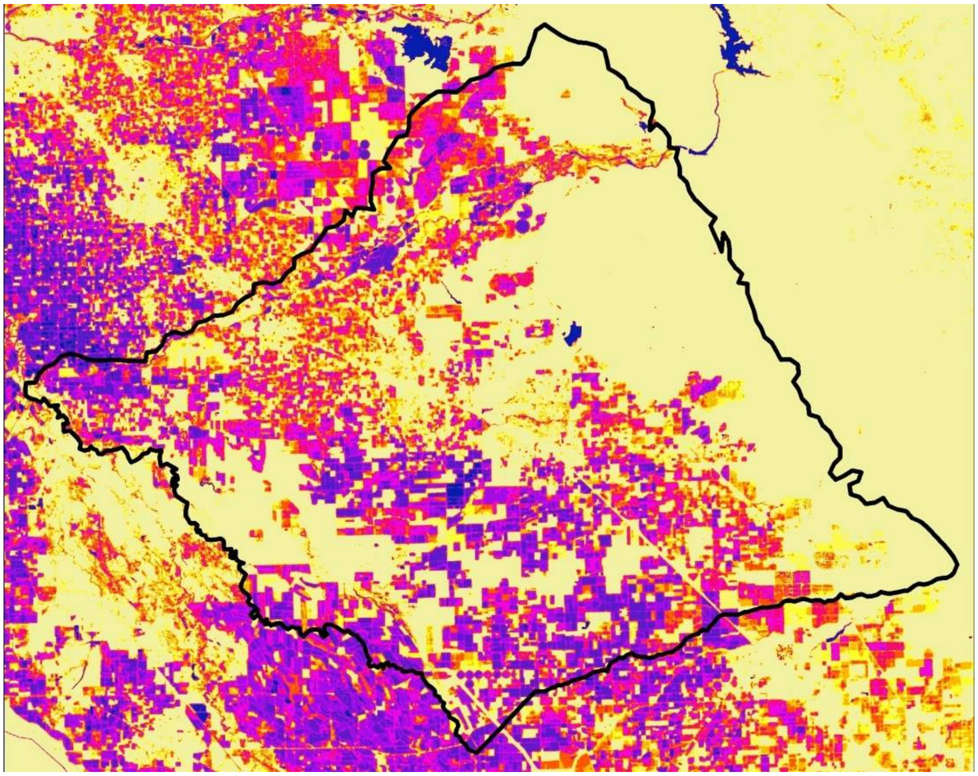


Figure 10. METRIC *Kc* Results for July 30nd, 2013

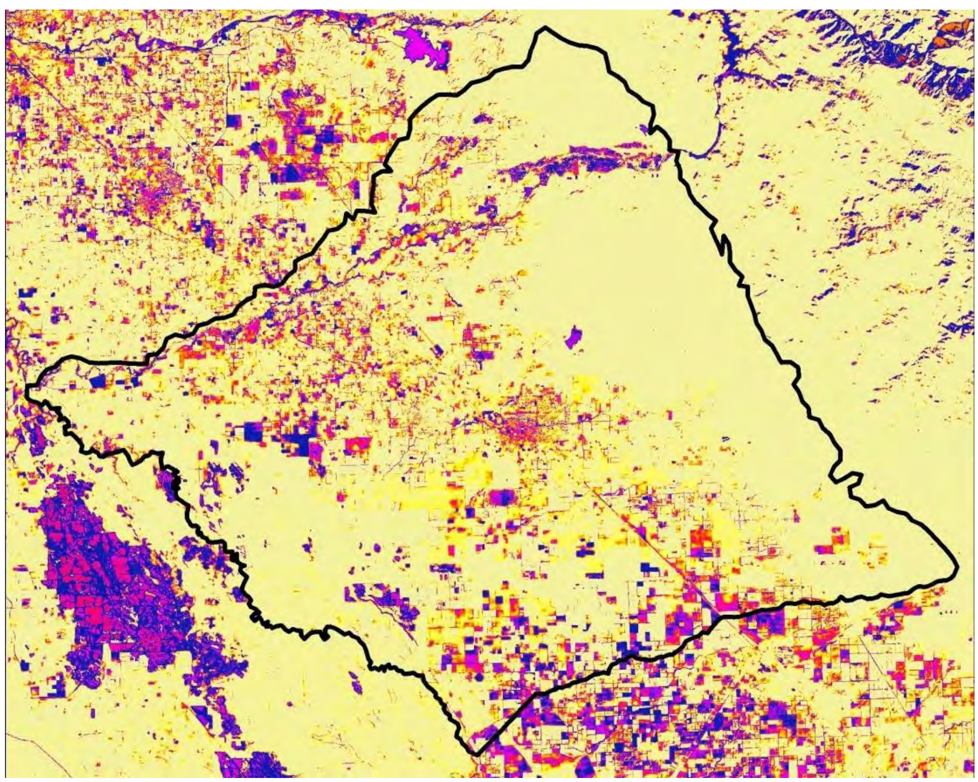


Figure 11. METRIC *Kc* Results for December 21st, 2013

Figure 12 compares the *Kc* values found in individual corn, almond, alfalfa, and peach fields for July 24th, 2002.

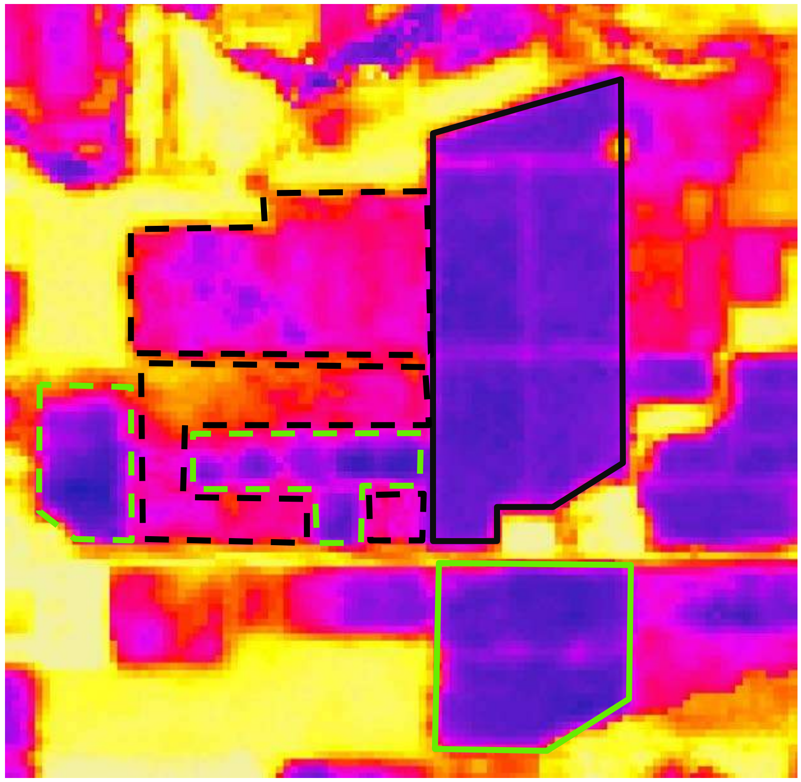


Figure 12. *Kc* color indexing for corn field (solid black border), almond field (dashed black border), alfalfa field (solid green border), and peach field (dashed green boarder) on July 24th, 2002

The *Kc* value ranges for the selected fields in **Figure 12** can be seen in **Table 3** below.

Table 3. Individual Field Kc Values for July 24th, 2002 image (refer to Figure 12)

Individual Field *Kc* Values for July 24th 2002 Image		
Crop	**Border Type/Color**	***Kc* Range**
Corn	Solid Black Line	1.05 – 1.15
Almonds	Dashed Black Line	0.75 – 0.95
Alfalfa	Solid Green Line	1.05 – 1.20
Peaches	Dashed Green Line	1.00 – 1.20

NET TO AND FROM GROUNDWATER MODELING

The other main objective of the ITRC for the MAGPI project besides determining ET for the area of interest was to make monthly estimates of the net amount of water to and from the groundwater for each project year. **Figure 13** shows a simple schematic of the individual components for estimating the *Net To and From Groundwater* (*NTFGW*).

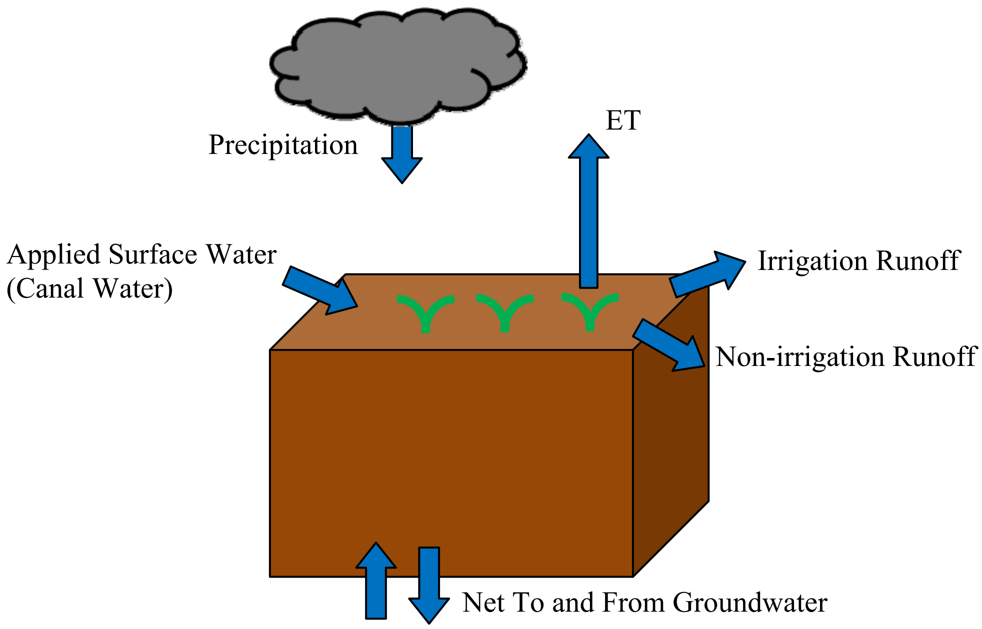


Figure 13. Schematic showing the components for computing the net to and from groundwater

The main components of NTFGW shown in **Figure 13** include:

1. Applied surface water (canal water)
2. Precipitation
3. Evapotranspiration (ET)
4. Irrigation Runoff
5. Non-Irrigation Runoff (precipitation runoff)

The *NTFGW* can be computed using to following equation:

$$NTFGW = Applied\ Water + Precipitation - ET - Irrigation\ Runoff - Non\_Irrigation\ Runoff$$

On a monthly time step, this equation must include the soil moisture depletion (SMD) at the beginning of the month. In order to determine SMD, the soil type and general crop type are needed to determine the soils available water holding capacity in the crops root zone. The initial SMD is estimated based on prior months' (November and December) precipitation amounts. The evaluation of monthly NTFGW requires several checks on Equation 1:

- If Eq. 1NTFGW is positive and is greater than the SMD, the end of the month SMD is assumed to be filled and any additional NTFGW must deep percolate below the root zone (Net to Groundwater).
- If Eq. 1 NTFGW is positive and is less than the SMD, the SMD at the end of the month is equal to the SMD at the beginning plus the Eq 1. NTFGW (no Net to Groundwater).

- If Eq. 1 NTFGW is negative and is less than the water remaining in the soil root zone at the end of the month, SMD at the end of the month is decreased by NTFGW (no Net from Groundwater).
- If Eq. 1 NTFGW is negative and is greater than the water remaining in the soil root zone at the end of the month, the SMD at the end of the month is decreased to the allowable depletion and the remaining NTFGW must be pumped from the groundwater (Net from Groundwater).

The sub-sections below discuss how each parameter of *NTFGW* was computed.

Merced County Parcels

A GIS file containing individual parcel locations in Merced County were obtained from the Merced County website. Output parameters such as ET, applied water, irrigation runoff, etc. were determined on a monthly basis for each individual parcel. **Figure 14** shows all the parcels located in eastern Merced County and within the MAGPI project boundary. **Figure 15** shows an example of an aerial image with individual parcels located just west of Merced.

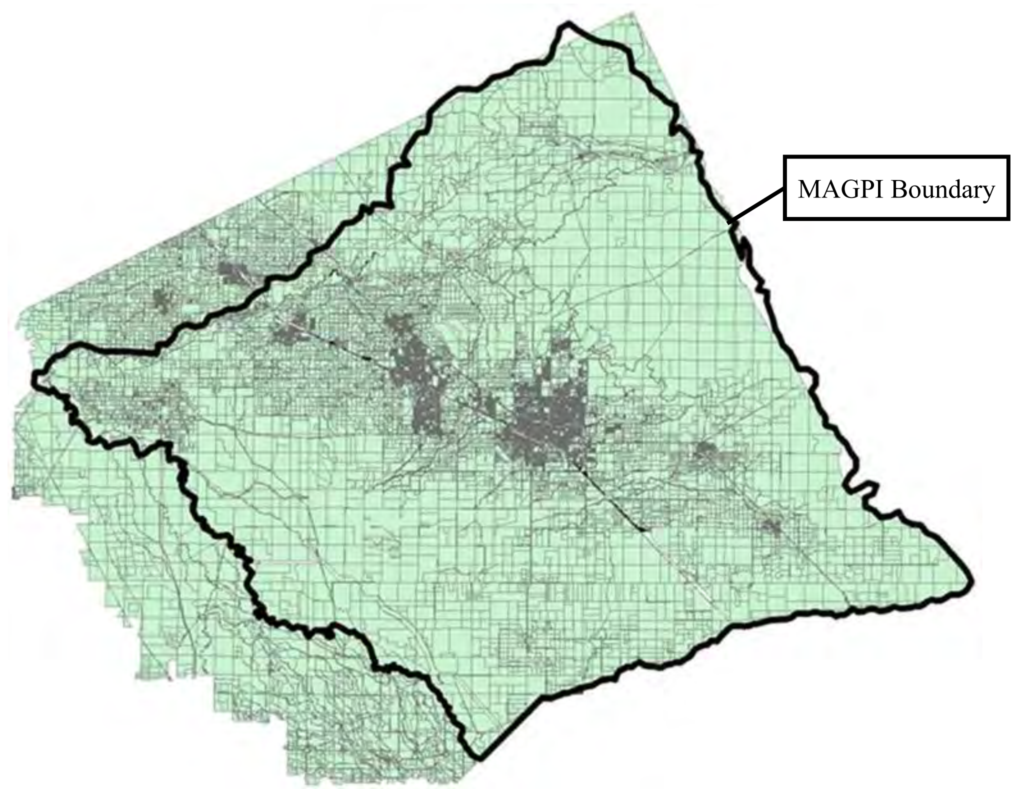


Figure 14. Individual parcels located in eastern Merced County and within the MAGPI project boundary

Figure 15. Aerial image shows individual parcels (outlined with black borders) west of Merced

Applied Surface Water

Surface water delivery events obtained from Merced Irrigation District (MID) from 1992 through 2013 were used to determine the applied water (in acre-feet) for individual water user accounts. The account number for individual surface water users in MID were compared to the known associated parcel numbers. The location of the associated parcel number was compared to the Merced County parcel GIS file to determine the approximate location of the applied water.

With the known approximate acreage of each parcel, the volume of applied water by parcel was converted to applied inches of water on a monthly basis. For simplicity, the applied inches of water were created to be uniform across the entire parcel. Some water accounts had multiple parcels for which the applied water was evenly distributed across all of the parcels under the single account number. A small amount of account numbers did not have an associated parcel number. In this case, the applied water for that account was ignored.

The applied surface water by parcel was averaged over one mile by one mile grid from the Merced County township and sections provided by the Public Land Survey System (PLSS). The reason for averaging the applied water over the quarter mile sub-section was to eliminate field outliers in such cases where small (only a few acres) irrigated fields applying an unrealistic amount of water in a single month. The field outliers were a result of missing parcel numbers for individual accounts that clearly have multiple parcels associated with that account.

An example of the applied water by parcel can be seen in the left image of **Figure 16**. The applied surface water averaged over the one mile grid sections for the same area can be seen in the right image of **Figure 16**. **Figure 17** shows the applied water (one mile resolution) for July 2002 for the entire MAGPI boundary area.

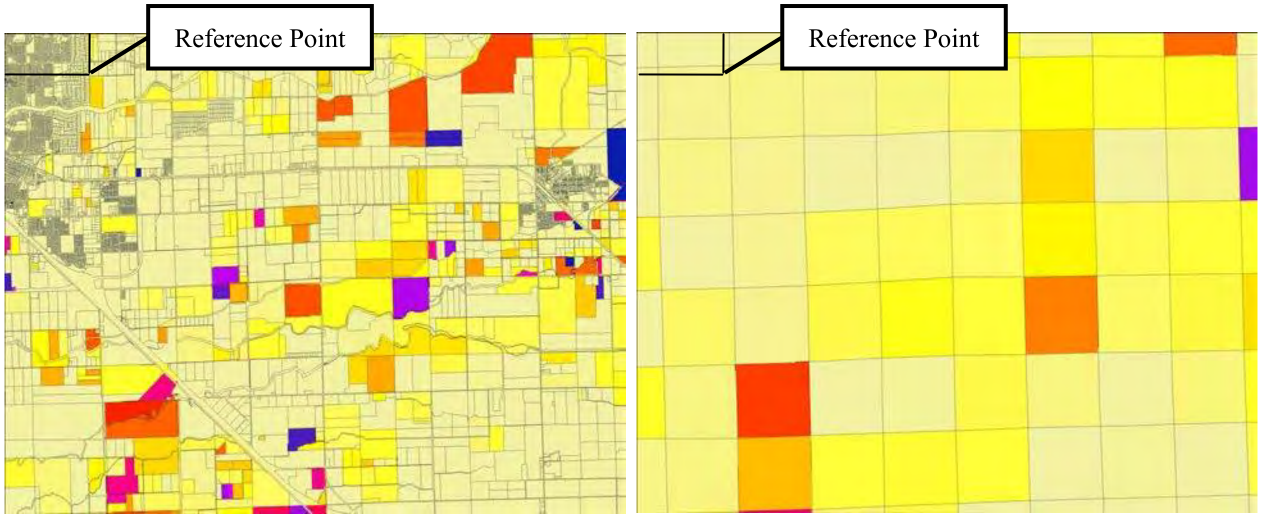


Figure 16. Example of applied water by parcel (left image) compared to applied water over one mile sections (right image) for July 2002. The darker the color the higher the applied surface water.

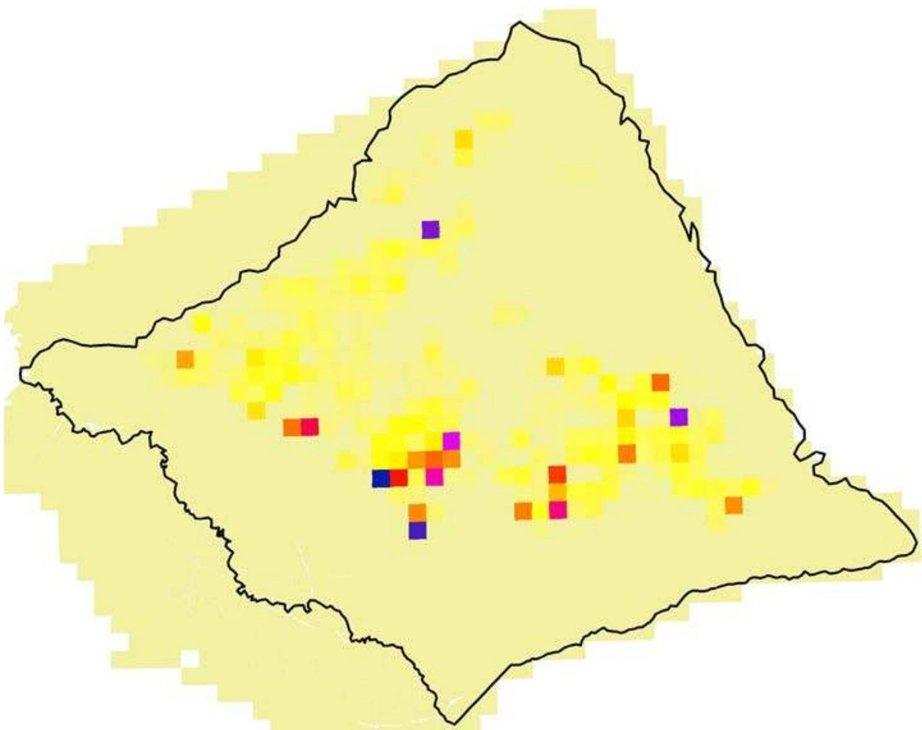


Figure 17. Example of applied surface water on a one mile resolution during July 2002 for the entire MAGPI boundary area

Precipitation

Spatially distributed precipitation maps were downloaded from the PRISM Climate Group of Oregon State University. The raster files displayed monthly precipitation data in millimeters for the entire United States on a 4 km by 4 km resolution.

A sub-set of the original monthly precipitation raster was extracted to be just larger that the project area of interest. The precipitation values of the sub-set precipitation raster were converted from millimeters to inches of precipitation. **Figure 18** shows an example of precipitation raster from PRISM for December 2002. The darker colors indicate a higher monthly total of precipitation.

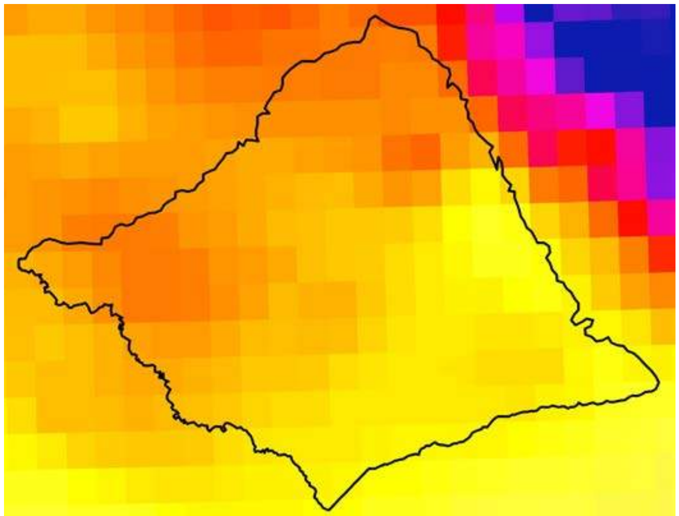


Figure 18. Example of monthly precipitation raster available from PRISM Climate Group for December 2002. The darker colors indicate higher monthly total of precipitation.

ET by Parcel

The average monthly ET per parcel rasters were created from the original 30m by 30 m resolution ET rasters calculated from METRIC. The average monthly ET (in inches) was applied to be uniform across the entire parcel. **Figure 19** shows an example of the average monthly ET by parcel for July 2002 where the dark the colors (blue) indicate a higher the ET value.

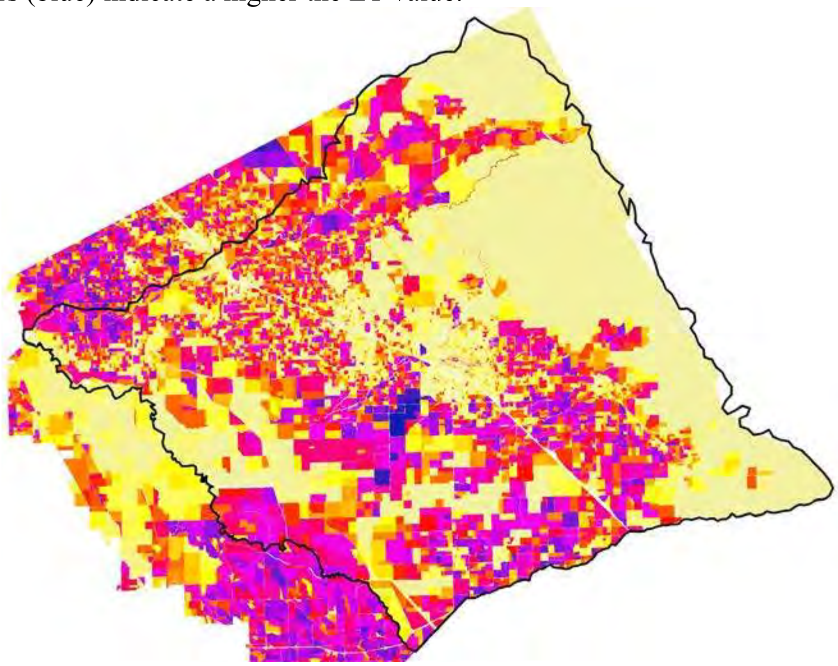


Figure 19. Example of average monthly ET by individual parcel for July 2002. The darker color (blue) indicates a higher ET amount.

Irrigation Runoff

The following process was used to estimate the amount of monthly irrigation runoff from agricultural fields inside the MAGPI project boundary area.

Landuse Type for Determining Irrigation Runoff

Landuse type for each individual parcel was determined using the landuse map created from the DWR land use survey as well as the NASS. Certain crops and landuse types were associated with having no irrigation runoff (refer to **Table 4**). For any orchard or vineyards, it is assumed that drip/microspray irrigation system as used to apply water to the crop and therefore produces no irrigation runoff.

Table 4. Landuse types associated with no irrigation runoff

Landuse Types Associated with No Irrigation Runoff		
Orchards/Vineyards	**Urban**	**Other**
Cherries	Developed – Open Space	Forest
Peaches	Developed – Low Intensity	Shrubland
Apples	Developed – Medium Intensity	Barren
Grapes	Developed – High Intensity	Non-Agriculture
Other Tree Crops		Deciduous Forest
Citrus		Evergreen Forest
Pecans		Mixed Forest
Almonds		Grassland Herbaceous
Walnuts		Fallow/Idle Cropland
Pears		Woody Wetlands
Pistachios		Herbaceous Wetlands
Prunes		
Oranges		
Pomegranates		

Irrigation Method for Determining Irrigation Runoff

The irrigation method for each individual parcel was determined from the DWR land use survey conducted in 2002 for Merced County. The following irrigation methods were assumed to have no irrigation runoff:

- Surface drip irrigation
- Buried drip irrigation (sub-surface drip irrigation)
- Microsprayer irrigation
- Center pivot sprinkler irrigation
- Linear mover sprinkler irrigation
- Non-irrigated fields

Estimated Irrigation Runoff

The following procedure was used to estimate the monthly irrigation runoff for each individual parcel:

1. If a single parcel had either a land use type **or** irrigation method associated with having no irrigation runoff (see previous sections), then it was assumed that no irrigation runoff would occur.

2. If the land use characteristic **or** irrigation method for an individual parcel did not match those stated in the previous sections, then it was assumed that irrigation runoff would occur. For example, a parcel irrigating corn using furrows would be assumed to have some amount of irrigation runoff.
3. For individual parcels assumed to have irrigation runoff occur, the runoff was estimated to be approximately 5% of the average monthly ET computed from METRIC for that specific parcel. For example, if the average monthly ET for a single parcel was 10 inches, the estimated irrigation runoff would be approximately 0.5 inches.

The reasoning behind the 5% of average monthly ET is based on the following reasons:

1. There is not an extensive drainage system throughout the MAGPI boundary to collect tail water runoff.
2. Farmers tend not to have any tail water runoff in their irrigation practices.
3. Some fields throughout the MAGPI boundary utilize tail water recovery systems.

Figure 20 below shows an example of the estimate July 2013 irrigation runoff for each individual parcel. The tan color indicated approximately zero irrigation runoff while the dark colored areas (blue being the darkest) indicating a higher amount of irrigation runoff (up to approximately 0.6 inches for this example).

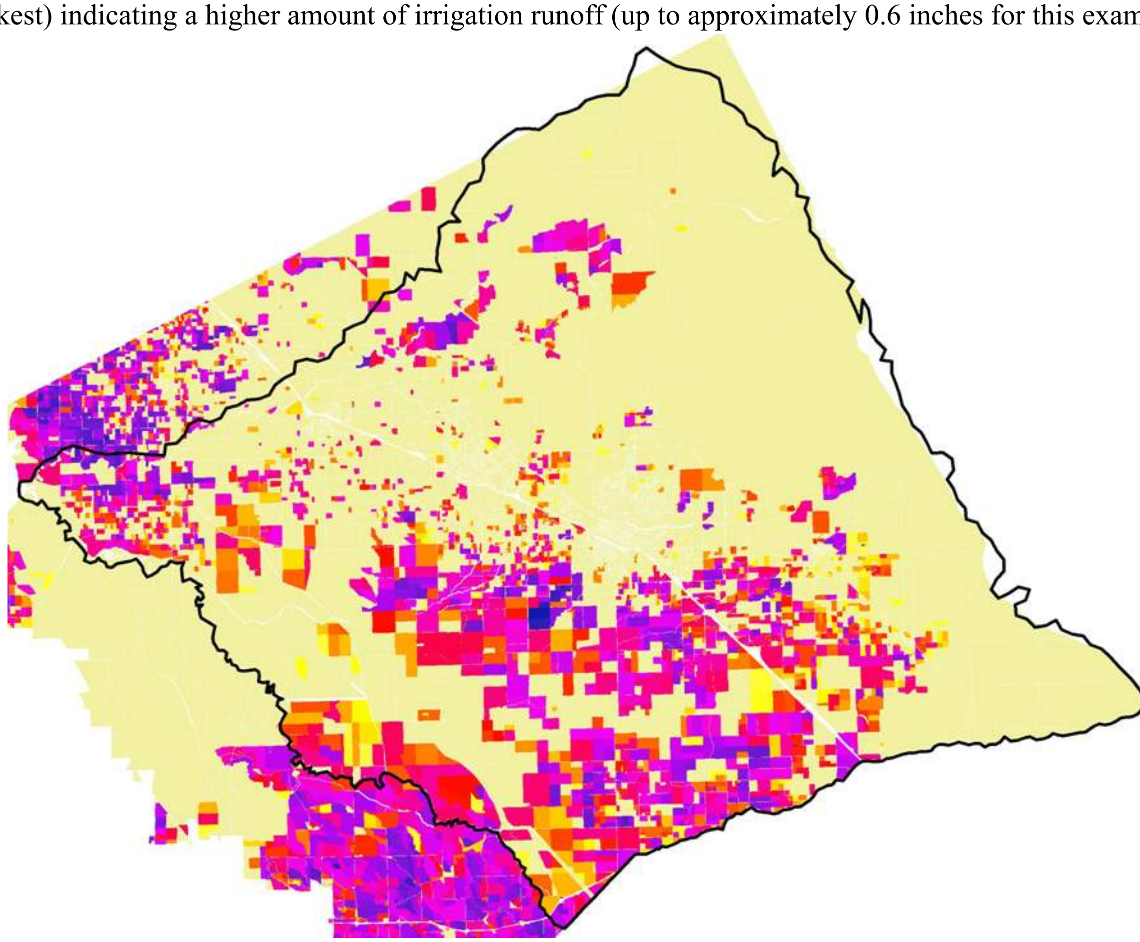


Figure 20. Example of estimate irrigation runoff for individual parcels in July 2013. The darker the color, the higher the irrigation runoff (up to approximately 0.6 inches of irrigation runoff for this example).

Non-Irrigation Runoff

The following procedure was used to estimate the non-irrigation runoff for individual parcels in the agricultural areas within the MAGPI boundary. Precipitation runoff in the urban areas was not considered for this study.

Soil Type Characterization for Individual Parcels

Soil characteristics for Merced County were obtained from the National Resources Conservation Service (NRCS) as seen in **Figure 21**.

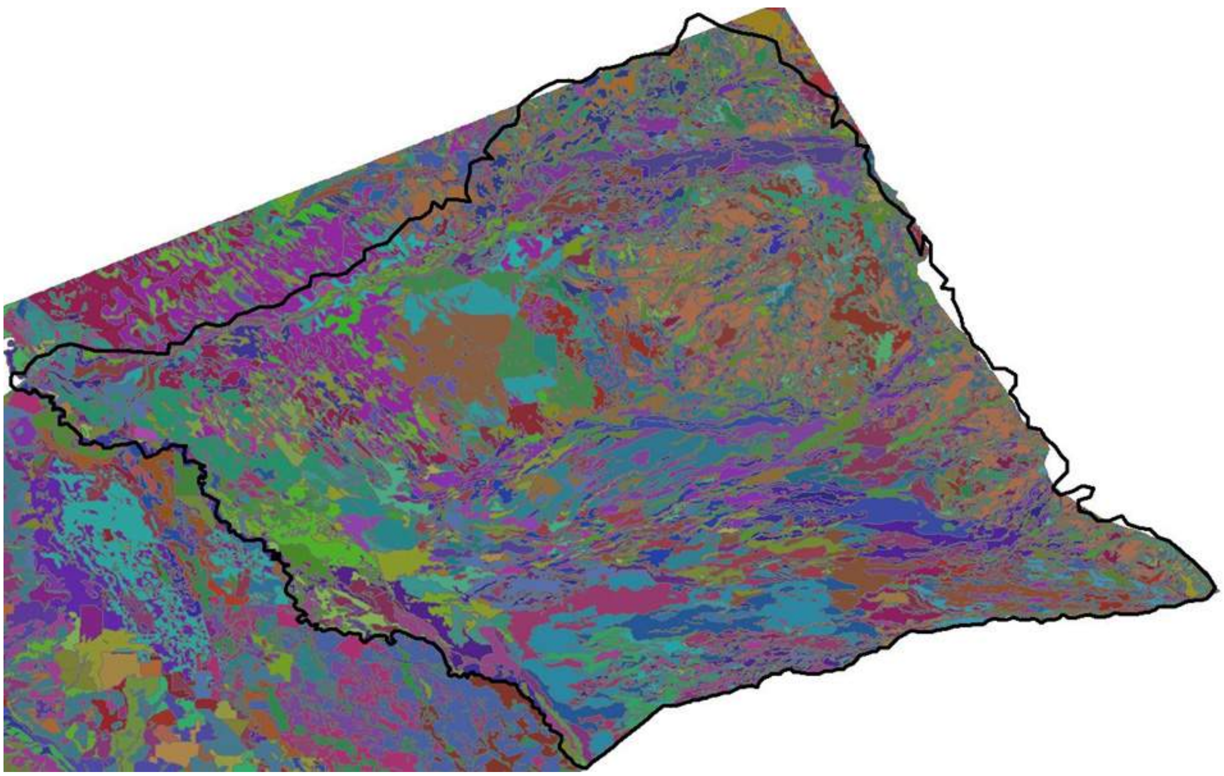


Figure 21. Example of Merced County soil types provided by the NRCS. Each color identifies a separate soil type.

The soil classification provide by the county were assigned a generic soil class types and soil group classification as following:

- Sand – Soil Group A
- Sandy Loam – Soil Group B
- Loam – Soil Group B
- Silt Loam – Soil Group C
- Clay Loam – Soil Group C
- Clay – Soil Group D

The soil types were reclassified for each individual parcel based on the majority of soil type located within each parcel. Each parcel was then assigned a uniform soil type. **Figure 22** shows the uniform soil types reclassified for each parcel to be used for the non-irrigation runoff estimates.

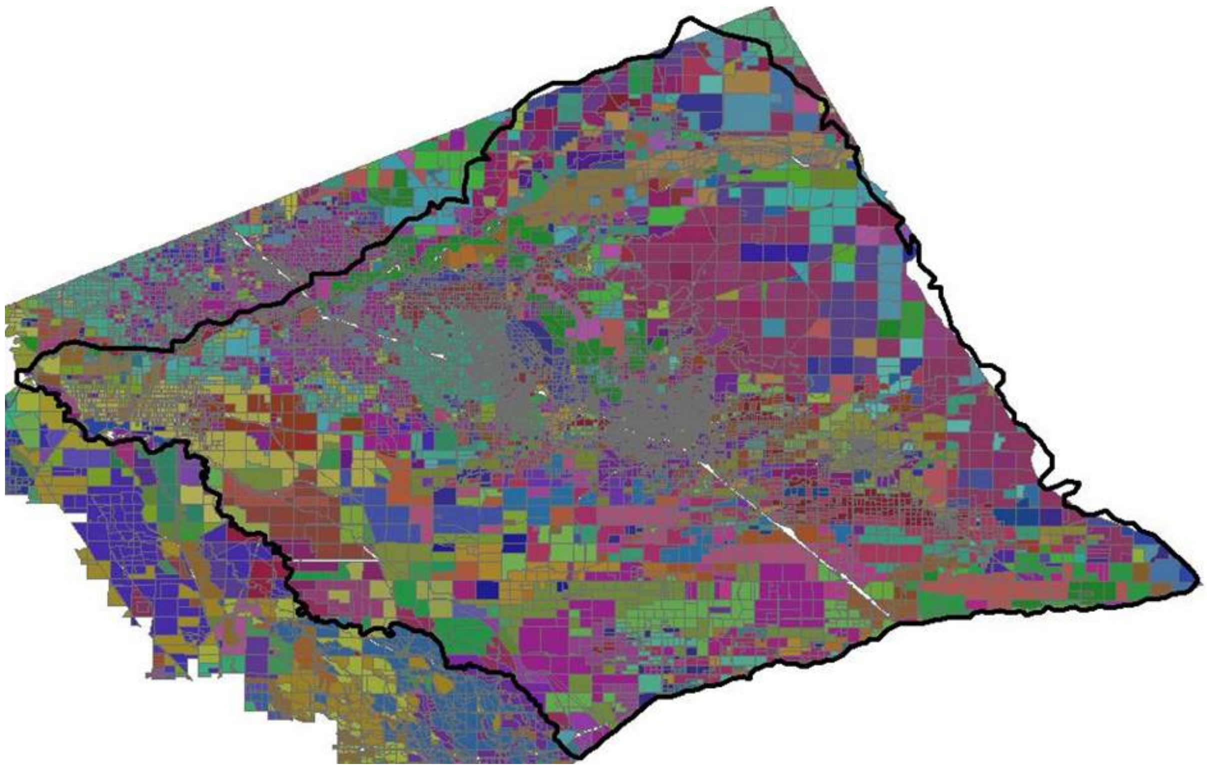


Figure 22. Reclassified soil type by parcel

NRCS (SCS) Rainfall Runoff Procedure for Non-Irrigation Runoff

The NRCS (SCS) rainfall runoff procedure was used to estimate the amount of monthly non-irrigation runoff from agricultural fields inside the MAGPI project boundary area due to precipitation.

Runoff due to precipitation can be estimated using the following equations:

$$P_e = \frac{(P - 0.2S)^2}{(P + 0.8S)}$$

$$S = \frac{1000}{CN} - 10$$

Where: P_e = direct runoff, inches
P = precipitation, inches
S = potential maximum retention
CN = runoff curve number

The precipitation input in the SCS runoff equation was based on daily precipitation totals from the two CIMIS weather stations. It was assumed that the precipitation totals were uniform across the entire project boundary. The curve number for each parcel was determined based on:

1. Assigned land use description (agricultural crop, fallow land, etc).
2. Hydrological soil group.

Table 5 shows the assigned SCS curve numbers used in the estimation of non-irrigation runoff of individual parcels. Runoff from urban areas was not considered in the estimates.

Table 5. Assigned SCS curve numbers for different land use and soil group descriptions

Assigned Curve Numbers for Different Land Use and Soil Group		
Land Use Description**	Soil Group	Curve Number
All agricultural crops – for cultivated agricultural land, row crops, straight rows, in good condition	A	67
	B	78
	C	85
	D	89
Fallow/idle cropland – for non-cultivated agricultural land, pasture or range, no mechanical treatment, in fair condition	A	49
	B	69
	C	79
	D	84
Grassland herbaceous – for non-cultivated agricultural land, forested, grass, in fair condition	A	44
	B	65
	C	76
	D	82
Shrubland – for non-cultivated land, forested, brush, in poor condition	A	48
	B	67
	C	77
	D	83

** Based on SCS Curve Number Descriptions

For small precipitation events, the SCS runoff equation would produce a runoff value greater than the amount of daily precipitation. The reason for this is because of the empirical characteristics for which the SCS runoff equation was produced. Therefore multiple quality control checks were performed on the calculated non-irrigation runoff estimates. The two quality control checks performed were as follows:

1. If the result of $\left[Precipitation - 0.2 \times \left(\frac{1000}{Curve\ No.} - 10\right)\right]$ is negative, then there is no runoff due to precipitation.
2. The amount of computed $Runoff\ must\ be \leq Precipitation.$

Only significant precipitation event with a total daily precipitation of approximately 0.4 inches or greater would produce any runoff amounts. The SCS runoff equation does take into account that a certain amount of precipitation must percolate into the soil before any runoff can occur. That is why only significant precipitation events produce runoff and account for the soil being fully saturated.

The daily runoff estimates were summarized into monthly runoff totals for each model year. **Figure 23** shows an example of the non-irrigation runoff computed for December 2002. The tan color indicated approximately zero non-irrigation runoff while the dark colored areas (blue being the darkest) indicating a higher amount of non-irrigation runoff (up to approximately 0.8 inches for this example).

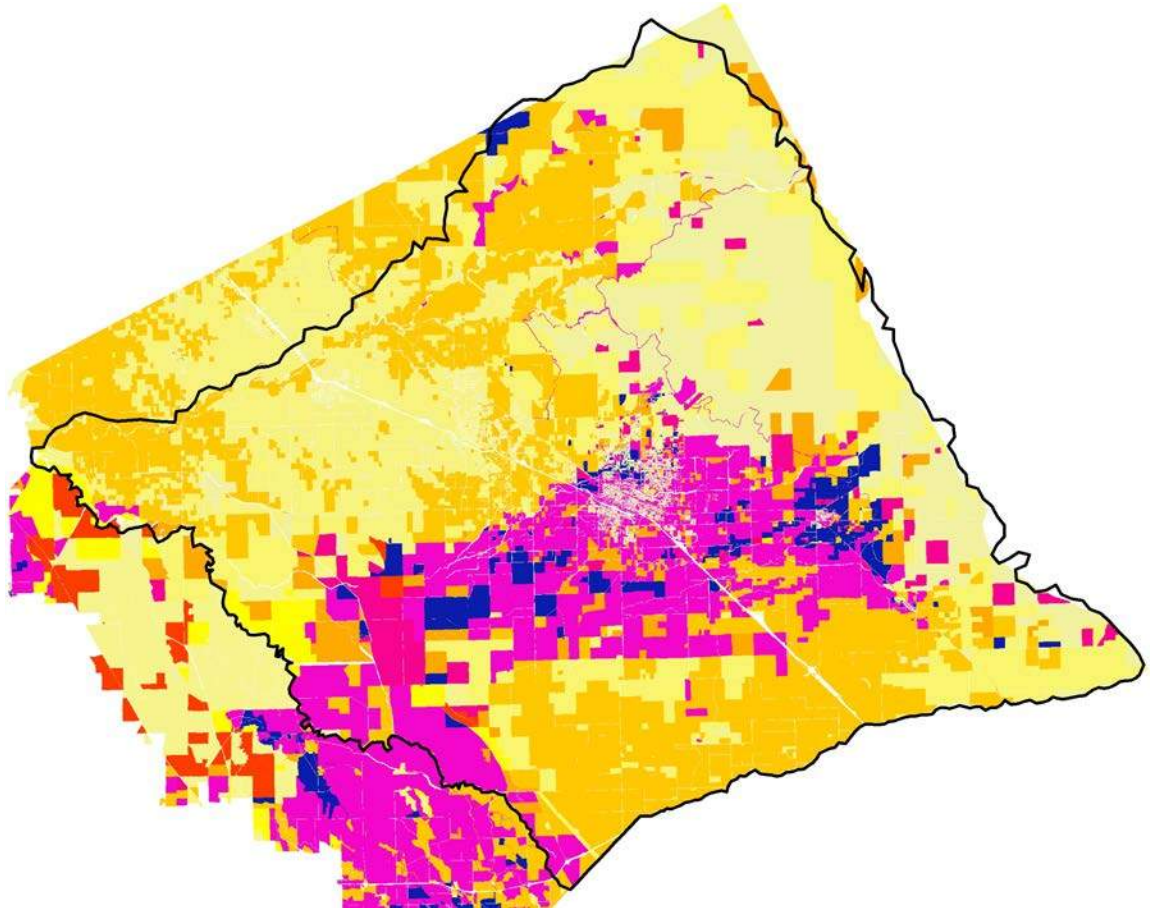


Figure 23. Example of estimate non-irrigation runoff for individual parcels in December 2002. The darker the color, the higher the non-irrigation runoff (up to approximately 0.8 inches of non-irrigation runoff for this example).

Soil Moisture Depletion

The soil's available water holding capacity (AWHC) in the crop root zone is needed to evaluate soil moisture depletion. The NRCS soils map for Merced County provides estimates of AWHC by soil type throughout the area of interest. The AWHC is provided as inches of water held at field capacity per inch of soil (inches/inch) for each soil horizon. A weighted average over the potential root zone was used to determine the root zone AWHC.

Root zones were assumed to be 5 feet for orchards, alfalfa, and vineyards, 3 feet for field crops, and 1.5 feet for natural vegetation. If an orchard or vineyard was irrigated using drip or microspray, the assumed wetted area was 60% of the total area, which reduces the AWHC by 40% for these irrigation methods. There was not a significant amount of buried row crop drip in the region during the analysis period.

The initial soil moisture depletions were estimated based on monthly rainfall in November and December prior to the year being analyzed. ET demand is low during these months and significant precipitation generally occurs in the area between November and February. If there was heavy rainfall during this period the SMD was assumed to be small. If there was little precipitation in the prior month the SMD was assumed to be large (approximately 50%-60% of the root zone AWHC). With average precipitation the SMD was assumed to be 20%-30% of the root zone AWHC.

The soil moisture depletion at the beginning of each month was applied to the procedure for estimating NTFGW as described.

Net To and From Groundwater Results

The resulting monthly *NTFGW* estimates (in inches) were created for each project years. **Figure 24** and **Figure 25** show examples of the computed *NTFGW* for February 2013 and July 2013 respectively.

From summer to fall, the applied water and ET are the driving factors for the *NTFGW* computations. Precipitation, irrigation runoff, and non-irrigation runoff have little to no impact during these months. On the contrary, during late fall through early spring months such as February 2013 (**Figure 24**), the precipitation and non-irrigation runoff become the driving factors. There is very little ET occurring during these months so depending on the monthly precipitation, there should be a slight to a significant contribution to the groundwater.

From the *NTFGW* result for July 2013, there is a apparent withdrawal from the ground water in the outside areas of the MAGPI boundary. No surface water is provided to those outside area and farmers are required to pump groundwater for irrigation. In the same image (**Figure 25**), there also appears to be a slight contribution to the groundwater from agricultural fields located within the MID boundary.

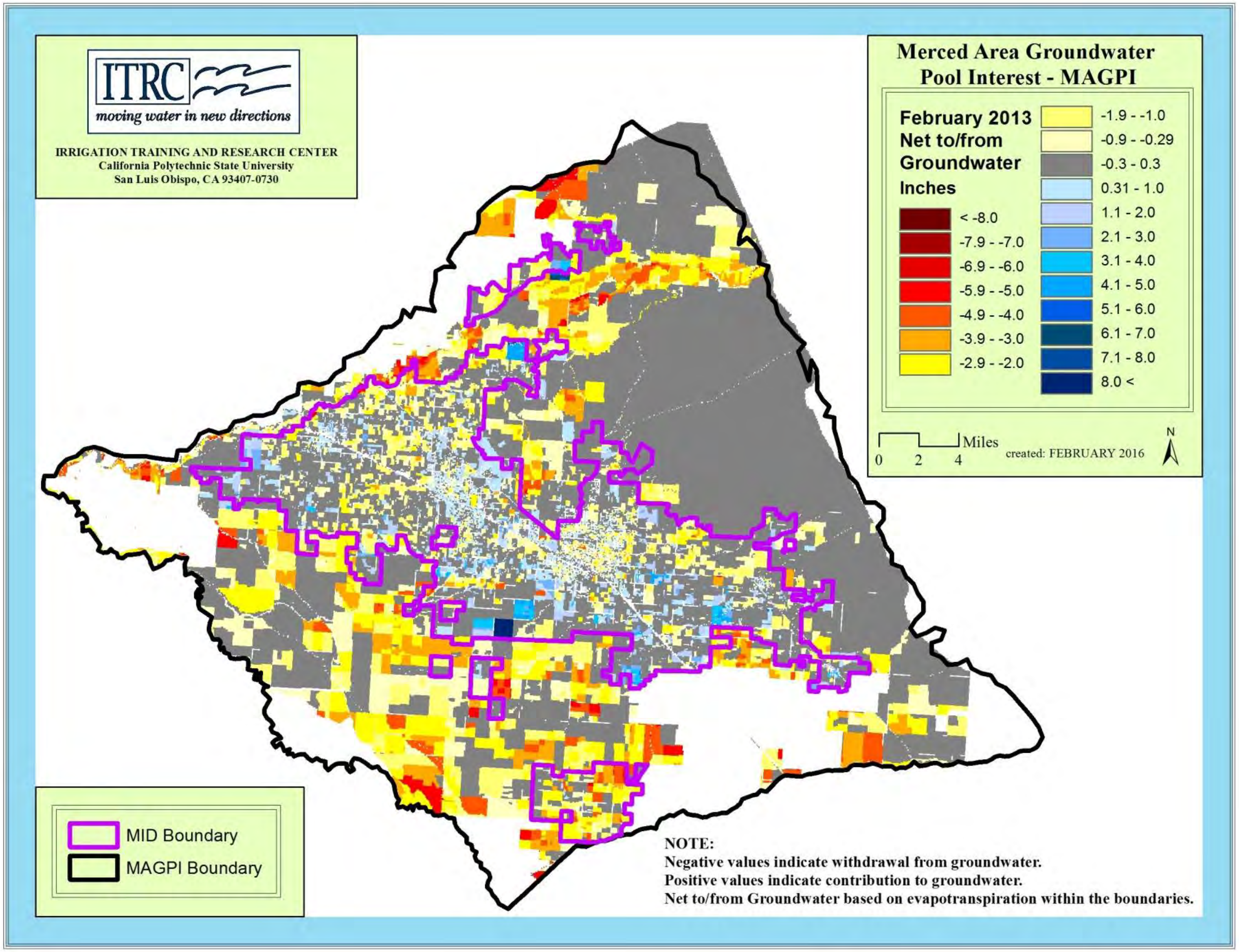


Figure 24. Estimated "Net To and From Groundwater" for February 2013

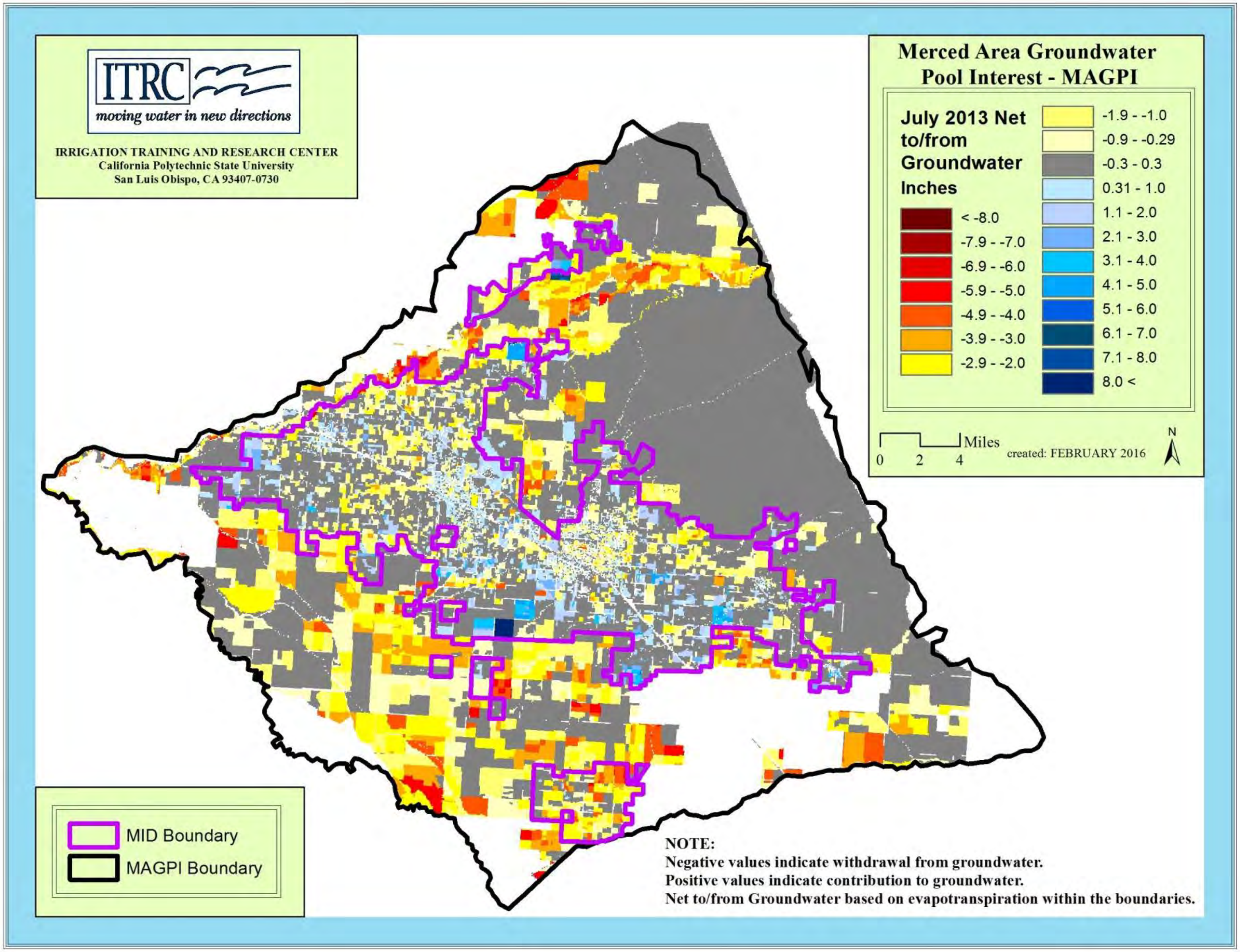


Figure 25. Estimated "Net To and From Groundwater" for July 2013

Missing Surface Water Data for Outside Areas

ITRC was not provided surface water deliveries data made by other irrigation and water districts such as Stevinson Water District or Turner Island Water District. Additionally, ITRC requested but did not receive water diversions from the Merced River north of Merced. Without knowing the amount of applied water in the other water purveyors, the *NTFGW* estimates would be inaccurate. For example, the *NTFGW* estimate would show a significant withdraw in groundwater in those areas when in reality there may only be a small amount of water withdrawn from the groundwater.

Therefore the boundary areas of other water purveyors (see **Figure 26**) were eliminated from the final *NTFGW* estimates.

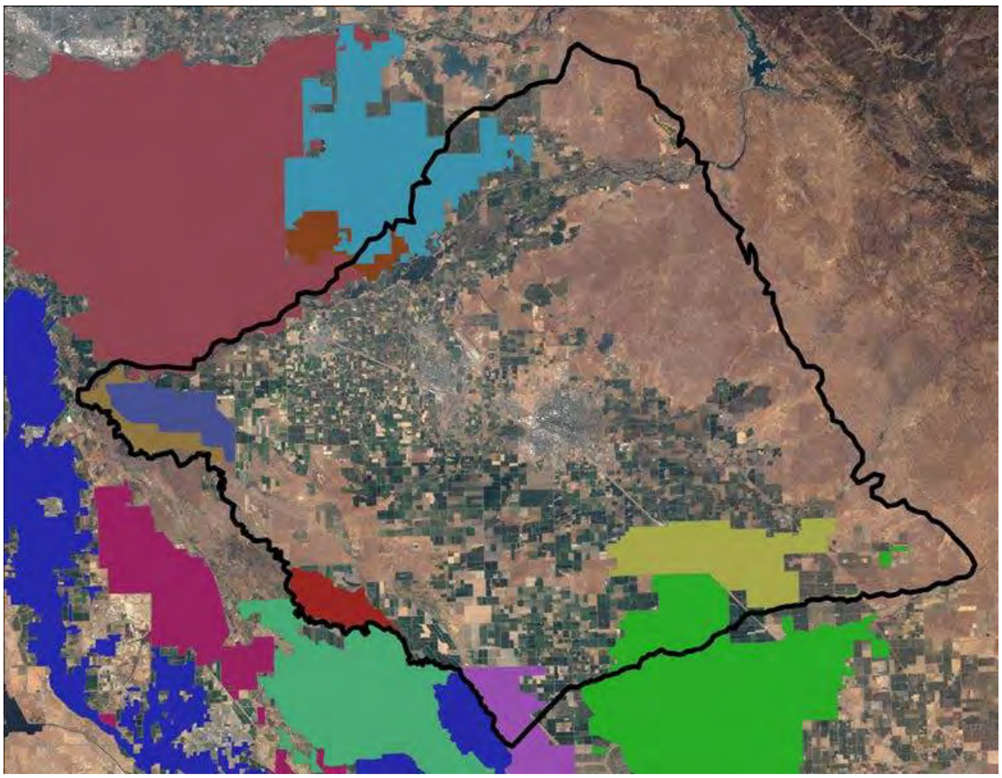
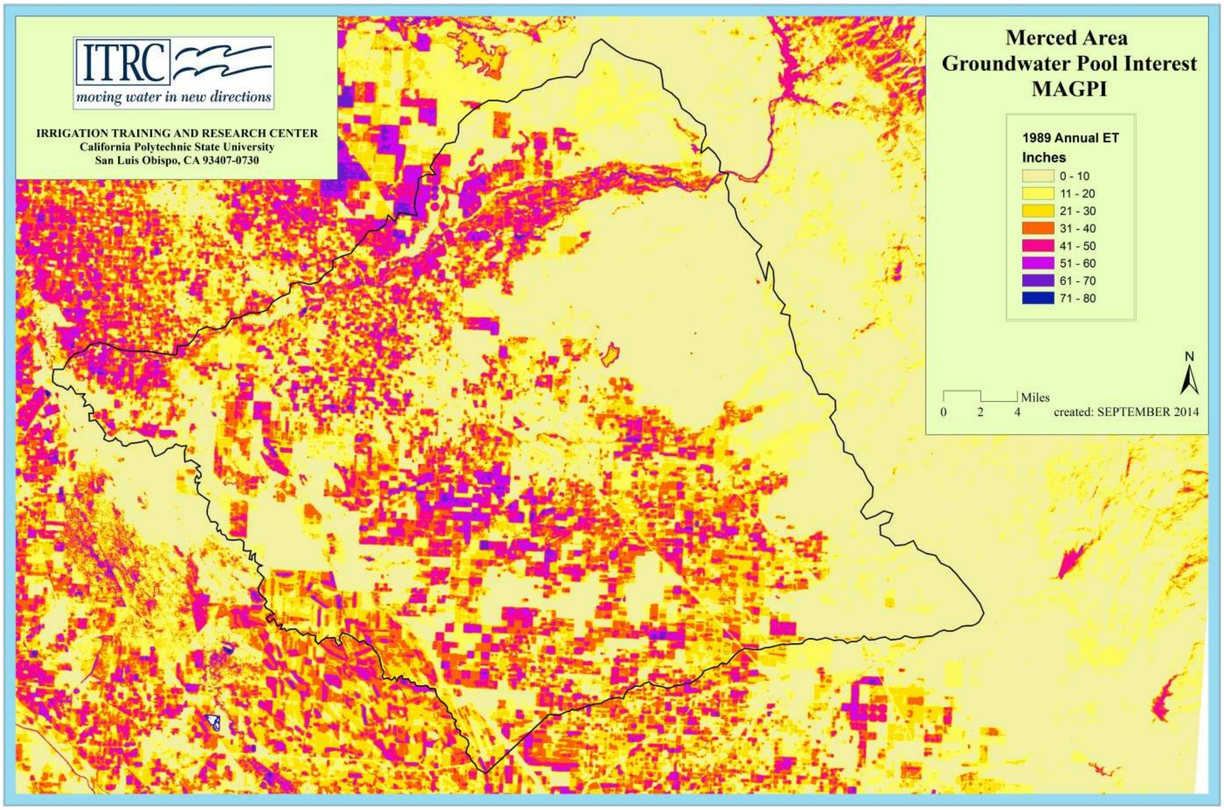
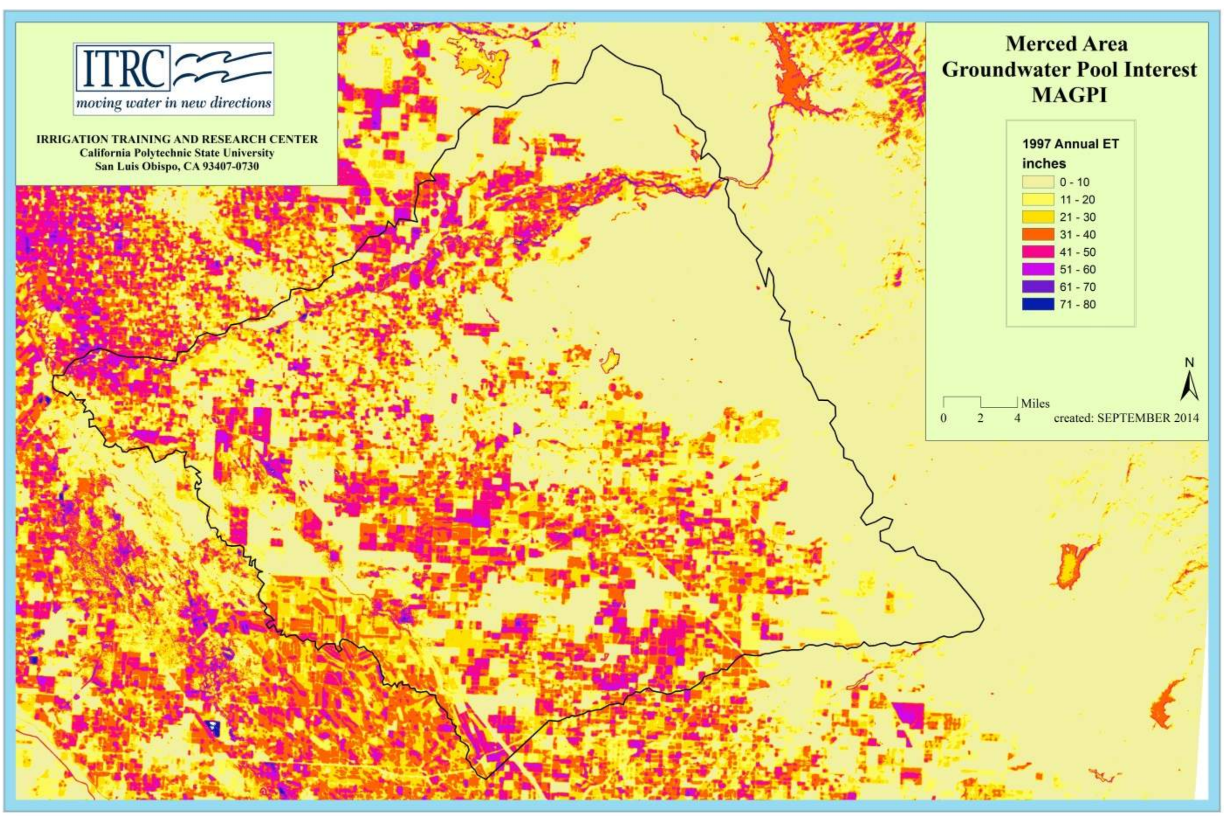
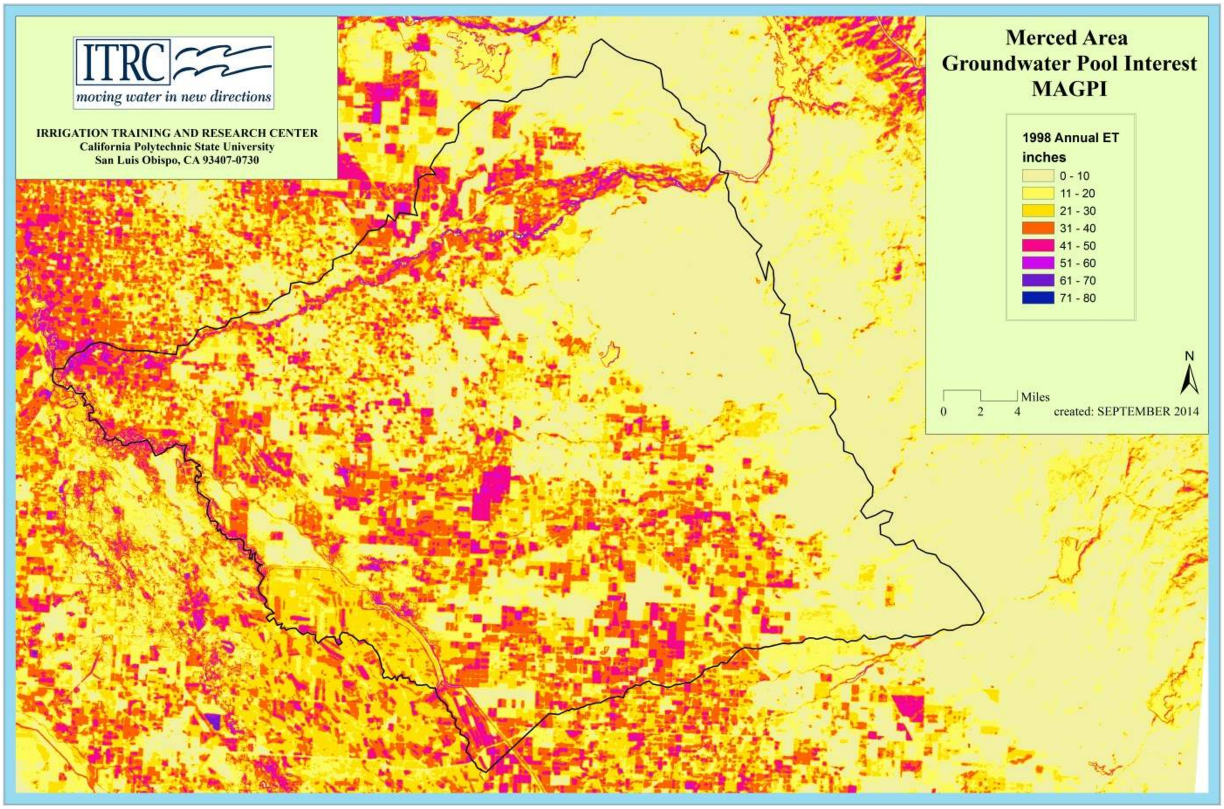


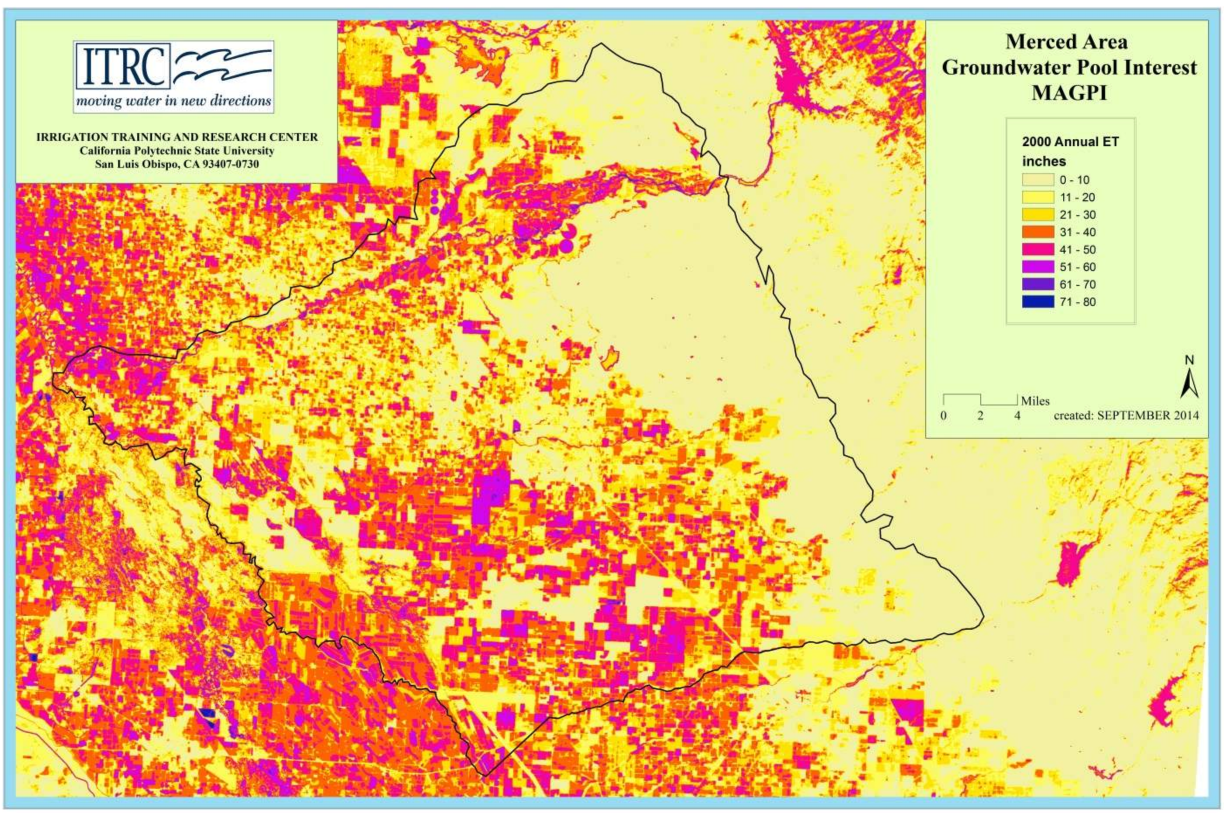
Figure 26. Additional water purveyors in and surrounding the MAGPI boundary for which no surface water data was provided

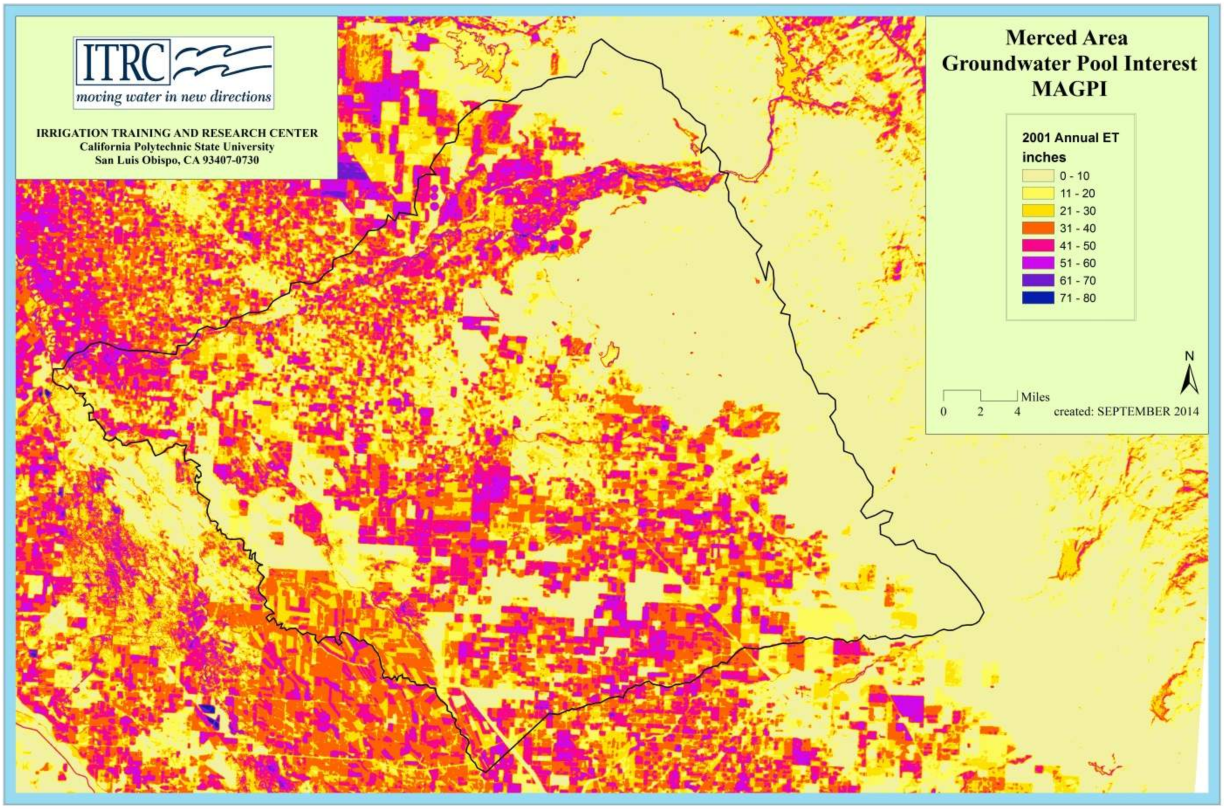
ATTACHMENT A
ITRC-METRIC Annual ETc Images

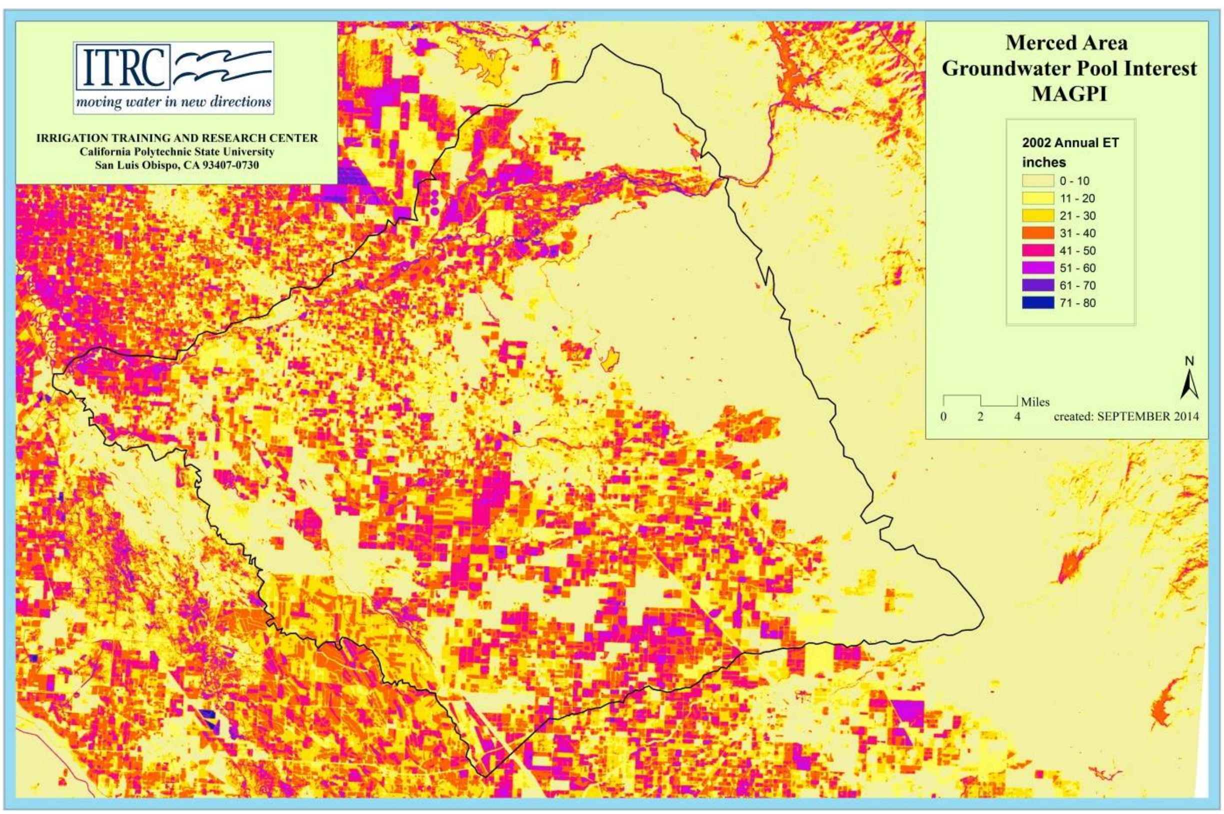

ITRC
moving water in new directions
IRRIGATION TRAINING AND RESEARCH CENTER
California Polytechnic State University
San Luis Obispo, CA 93407-0730
Merced Area
Groundwater Pool Interest
MAGPI
1989 Annual ET
Inches
0 - 10
11 - 20
21 - 30
31 - 40
41 - 50
51 - 60
61 - 70
71 - 80
N
Miles
0 2 4
created: SEPTEMBER 2014

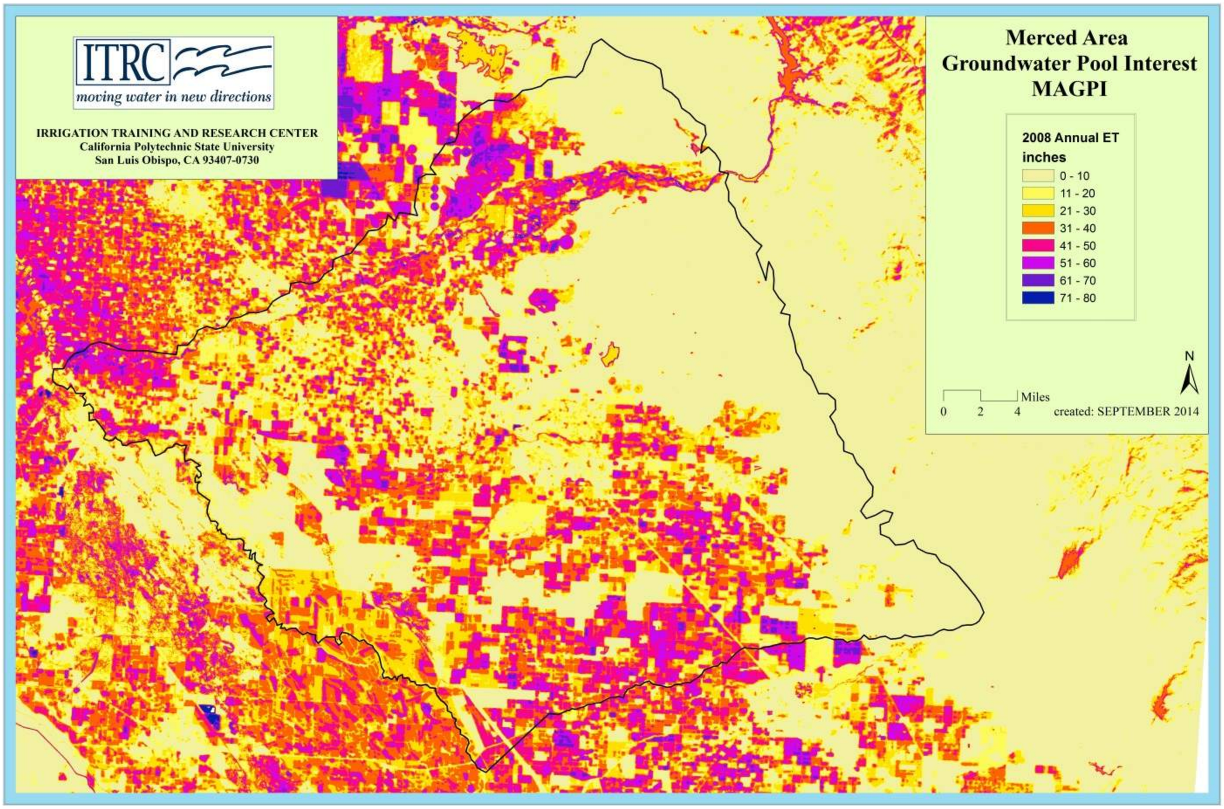

ITRC
moving water in new directions
IRRIGATION TRAINING AND RESEARCH CENTER
California Polytechnic State University
San Luis Obispo, CA 93407-0730
Merced Area
Groundwater Pool Interest
MAGPI
1997 Annual ET
inches
0 - 10
11 - 20
21 - 30
31 - 40
41 - 50
51 - 60
61 - 70
71 - 80
N
Miles
0 2 4
created: SEPTEMBER 2014

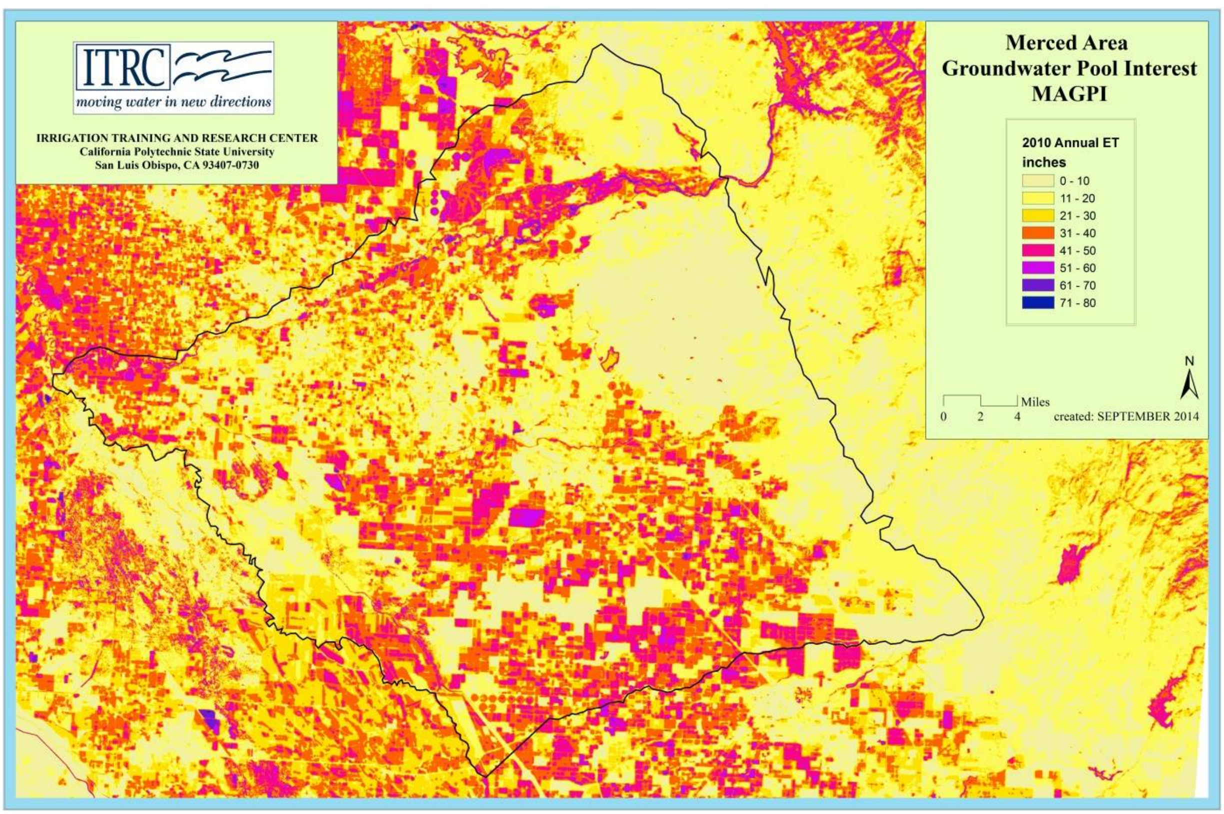

ITRC
moving water in new directions
IRRIGATION TRAINING AND RESEARCH CENTER
California Polytechnic State University
San Luis Obispo, CA 93407-0730
Merced Area
Groundwater Pool Interest
MAGPI
1998 Annual ET
inches
0 - 10
11 - 20
21 - 30
31 - 40
41 - 50
51 - 60
61 - 70
71 - 80
N
Miles
0 2 4
created: SEPTEMBER 2014

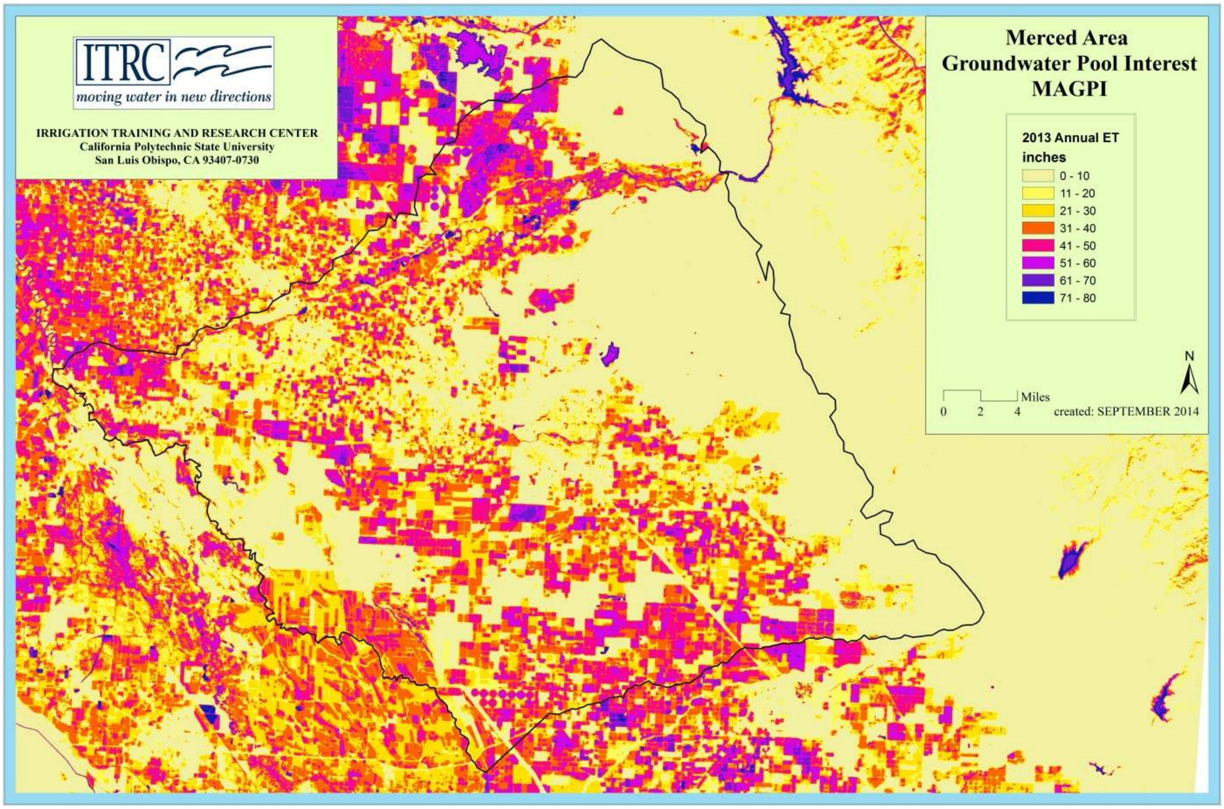

ITRC
moving water in new directions
IRRIGATION TRAINING AND RESEARCH CENTER
California Polytechnic State University
San Luis Obispo, CA 93407-0730
Merced Area
Groundwater Pool Interest
MAGPI
2000 Annual ET
inches
0 - 10
11 - 20
21 - 30
31 - 40
41 - 50
51 - 60
61 - 70
71 - 80
N
Miles
0 2 4
created: SEPTEMBER 2014


ITRC
moving water in new directions
IRRIGATION TRAINING AND RESEARCH CENTER
California Polytechnic State University
San Luis Obispo, CA 93407-0730
Merced Area
Groundwater Pool Interest
MAGPI
2001 Annual ET
inches
0 - 10
11 - 20
21 - 30
31 - 40
41 - 50
51 - 60
61 - 70
71 - 80
N
Miles
0 2 4
created: SEPTEMBER 2014

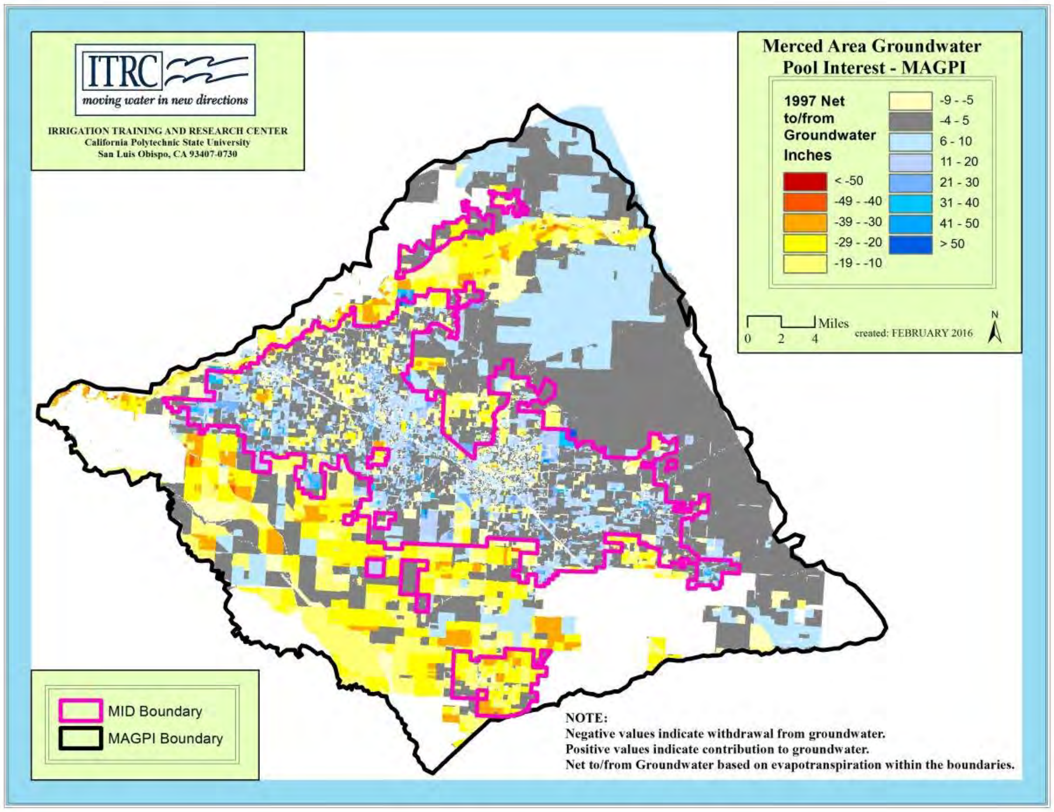

ITRC
moving water in new directions
IRRIGATION TRAINING AND RESEARCH CENTER
California Polytechnic State University
San Luis Obispo, CA 93407-0730
Merced Area
Groundwater Pool Interest
MAGPI
2002 Annual ET
inches
0 - 10
11 - 20
21 - 30
31 - 40
41 - 50
51 - 60
61 - 70
71 - 80
N
Miles
0 2 4
created: SEPTEMBER 2014

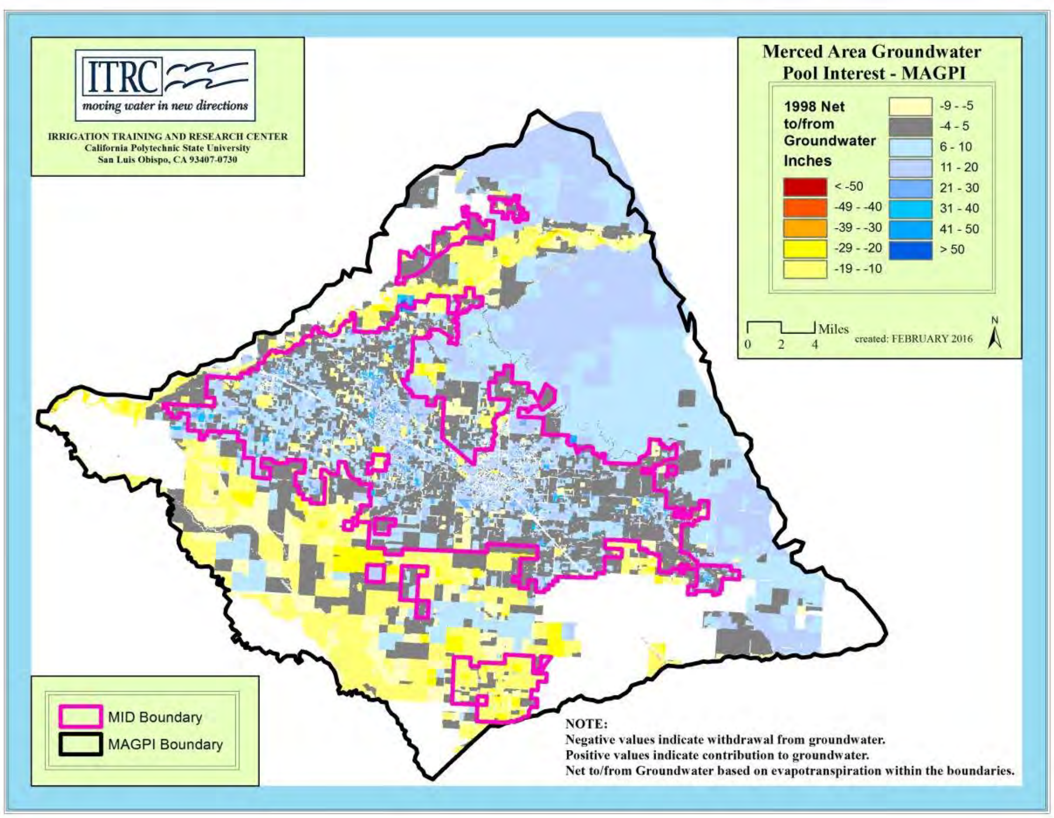

ITRC
moving water in new directions
IRRIGATION TRAINING AND RESEARCH CENTER
California Polytechnic State University
San Luis Obispo, CA 93407-0730
Merced Area
Groundwater Pool Interest
MAGPI
2008 Annual ET
inches
0 - 10
11 - 20
21 - 30
31 - 40
41 - 50
51 - 60
61 - 70
71 - 80
N
Miles
0 2 4
created: SEPTEMBER 2014

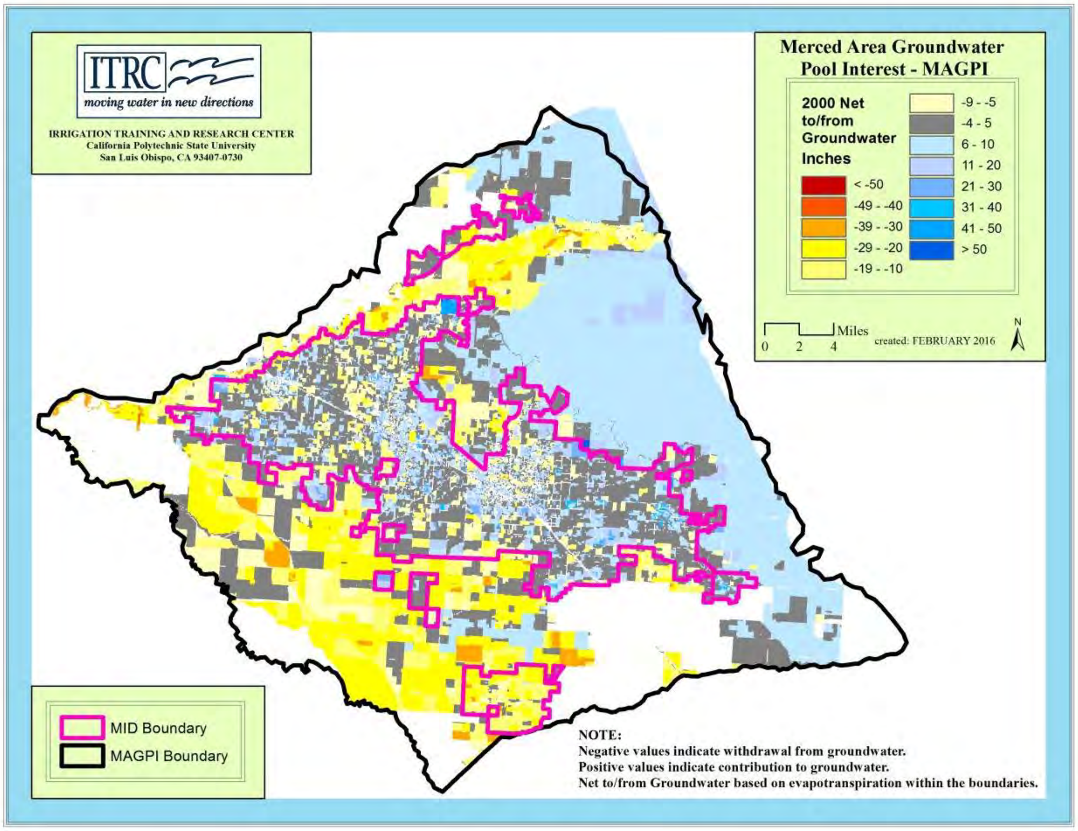

ITRC
moving water in new directions
IRRIGATION TRAINING AND RESEARCH CENTER
California Polytechnic State University
San Luis Obispo, CA 93407-0730
Merced Area
Groundwater Pool Interest
MAGPI
2010 Annual ET
inches
0 - 10
11 - 20
21 - 30
31 - 40
41 - 50
51 - 60
61 - 70
71 - 80
N
Miles
0 2 4
created: SEPTEMBER 2014

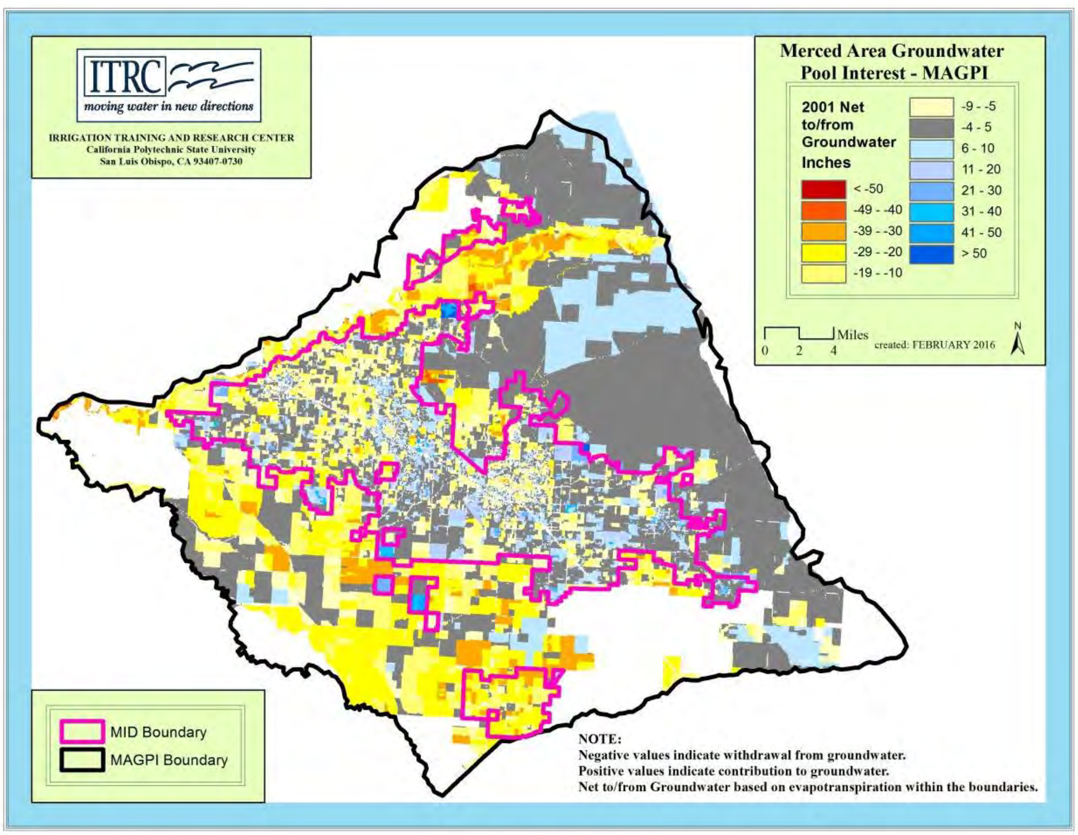

ITRC
moving water in new directions
IRRIGATION TRAINING AND RESEARCH CENTER
California Polytechnic State University
San Luis Obispo, CA 93407-0730
Merced Area
Groundwater Pool Interest
MAGPI
2013 Annual ET
inches
0 - 10
11 - 20
21 - 30
31 - 40
41 - 50
51 - 60
61 - 70
71 - 80
N
Miles
0 2 4
created: SEPTEMBER 2014

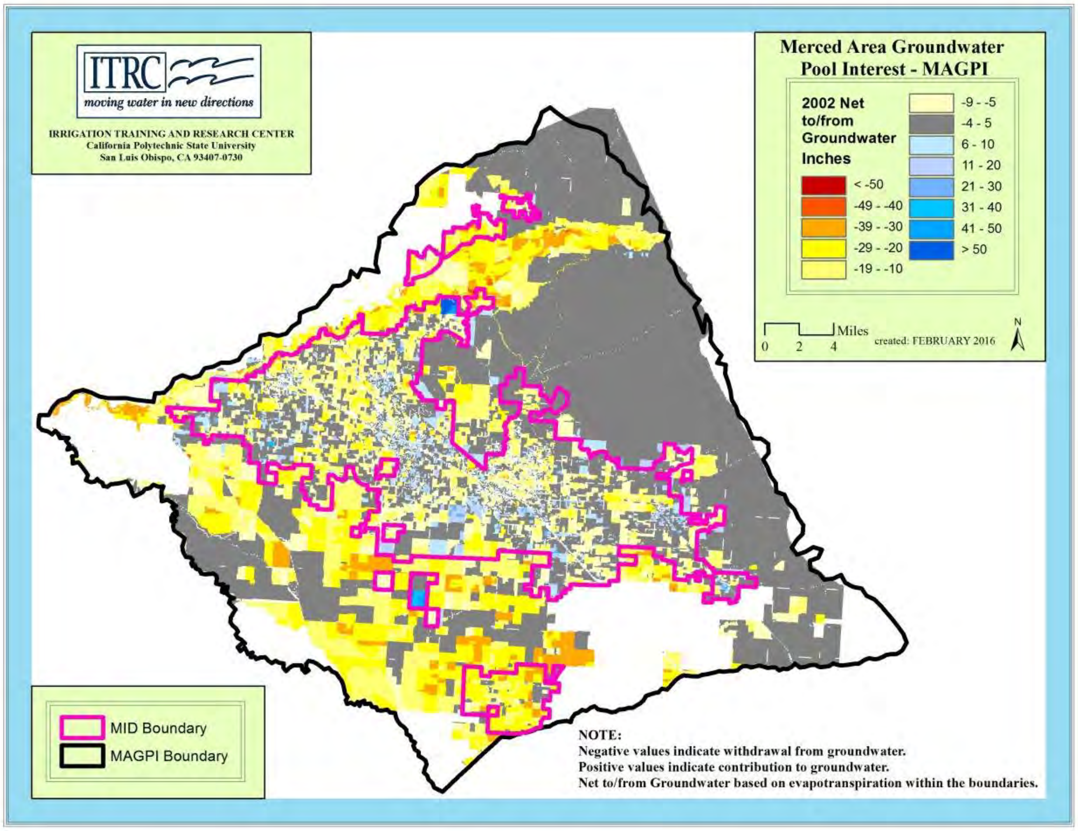
ATTACHMENT B
NTFGW Annual Maps

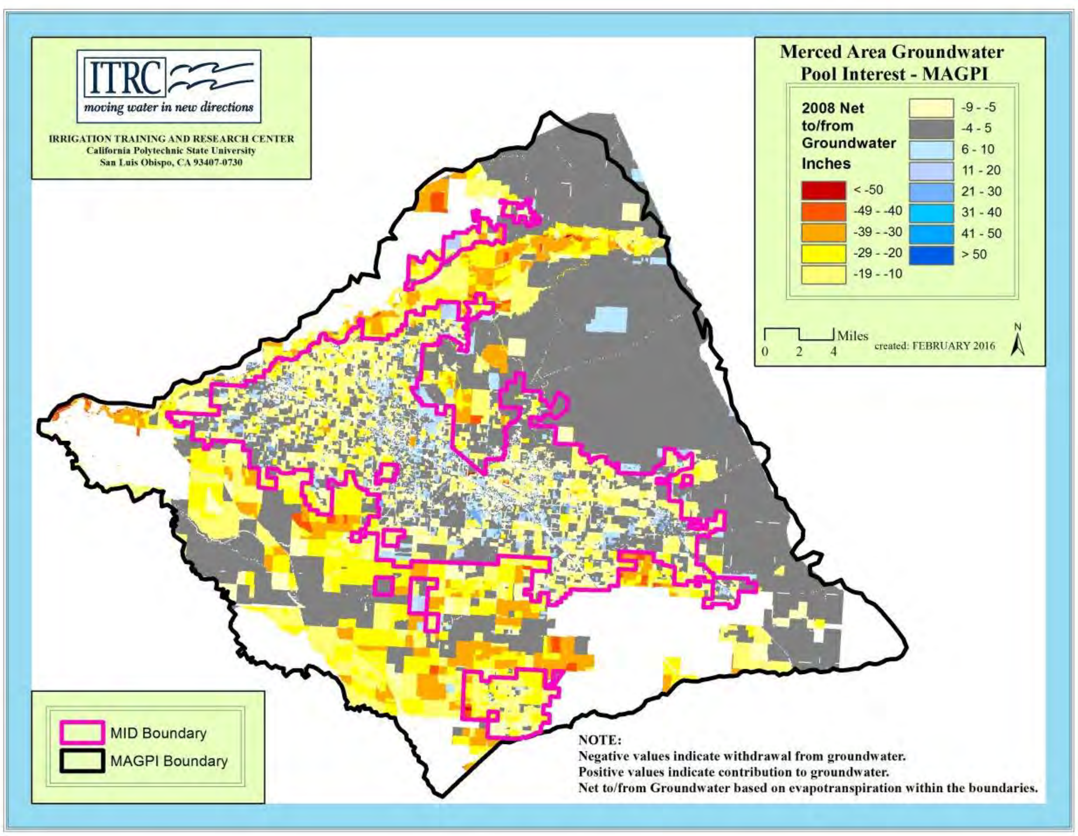

ITRC
moving water in new directions
IRRIGATION TRAINING AND RESEARCH CENTER
California Polytechnic State University
San Luis Obispo, CA 93407-0730
Merced Area Groundwater Pool Interest - MAGPI
1997 Net to/from Groundwater Inches
< -50
-49 - -40
-39 - -30
-29 - -20
-19 - -10
-9 - -5
-4 - 5
6 - 10
11 - 20
21 - 30
31 - 40
41 - 50
> 50
Miles
0 2 4
created: FEBRUARY 2016
N
MID Boundary
MAGPI Boundary
NOTE:
Negative values indicate withdrawal from groundwater.
Positive values indicate contribution to groundwater.
Net to/from Groundwater based on evapotranspiration within the boundaries.

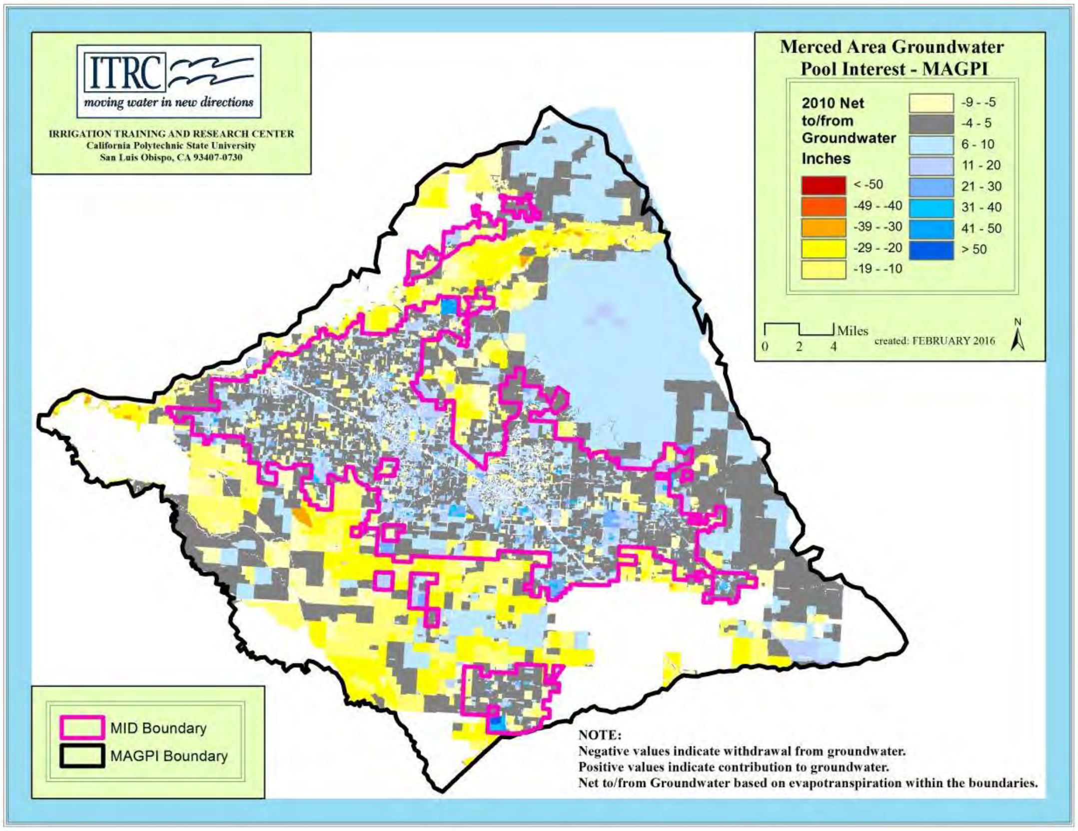

ITRC
moving water in new directions
IRRIGATION TRAINING AND RESEARCH CENTER
California Polytechnic State University
San Luis Obispo, CA 93407-0730
Merced Area Groundwater Pool Interest - MAGPI
1998 Net to/from Groundwater Inches
< -50
-49 - -40
-39 - -30
-29 - -20
-19 - -10
-9 - -5
-4 - 5
6 - 10
11 - 20
21 - 30
31 - 40
41 - 50
> 50
Miles
0 2 4
created: FEBRUARY 2016
N
MID Boundary
MAGPI Boundary
NOTE:
Negative values indicate withdrawal from groundwater.
Positive values indicate contribution to groundwater.
Net to/from Groundwater based on evapotranspiration within the boundaries.

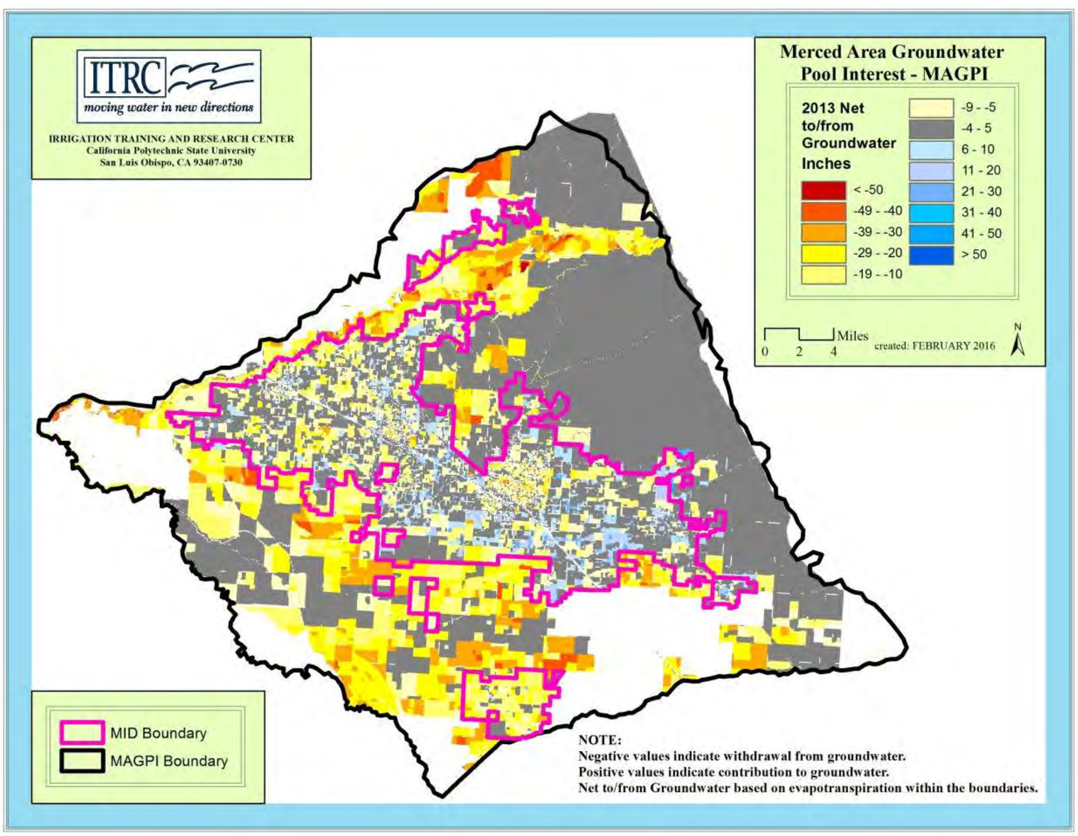

ITRC
moving water in new directions
IRRIGATION TRAINING AND RESEARCH CENTER
California Polytechnic State University
San Luis Obispo, CA 93407-0730
Merced Area Groundwater Pool Interest - MAGPI
2000 Net to/from Groundwater Inches
< -50
-49 - -40
-39 - -30
-29 - -20
-19 - -10
-9 - -5
-4 - 5
6 - 10
11 - 20
21 - 30
31 - 40
41 - 50
> 50
Miles
0 2 4
created: FEBRUARY 2016
N
MID Boundary
MAGPI Boundary
NOTE:
Negative values indicate withdrawal from groundwater.
Positive values indicate contribution to groundwater.
Net to/from Groundwater based on evapotranspiration within the boundaries.


ITRC
moving water in new directions
IRRIGATION TRAINING AND RESEARCH CENTER
California Polytechnic State University
San Luis Obispo, CA 93407-0730
Merced Area Groundwater Pool Interest - MAGPI
2001 Net to/from Groundwater Inches
< -50
-49 - -40
-39 - -30
-29 - -20
-19 - -10
-9 - -5
-4 - 5
6 - 10
11 - 20
21 - 30
31 - 40
41 - 50
> 50
Miles
0 2 4
created: FEBRUARY 2016
N
MID Boundary
MAGPI Boundary
NOTE:
Negative values indicate withdrawal from groundwater.
Positive values indicate contribution to groundwater.
Net to/from Groundwater based on evapotranspiration within the boundaries.


ITRC
moving water in new directions
IRRIGATION TRAINING AND RESEARCH CENTER
California Polytechnic State University
San Luis Obispo, CA 93407-0730
Merced Area Groundwater Pool Interest - MAGPI
2002 Net to/from Groundwater Inches
< -50
-49 - -40
-39 - -30
-29 - -20
-19 - -10
-9 - -5
-4 - 5
6 - 10
11 - 20
21 - 30
31 - 40
41 - 50
> 50
Miles
0 2 4
created: FEBRUARY 2016
N
MID Boundary
MAGPI Boundary
NOTE:
Negative values indicate withdrawal from groundwater.
Positive values indicate contribution to groundwater.
Net to/from Groundwater based on evapotranspiration within the boundaries.

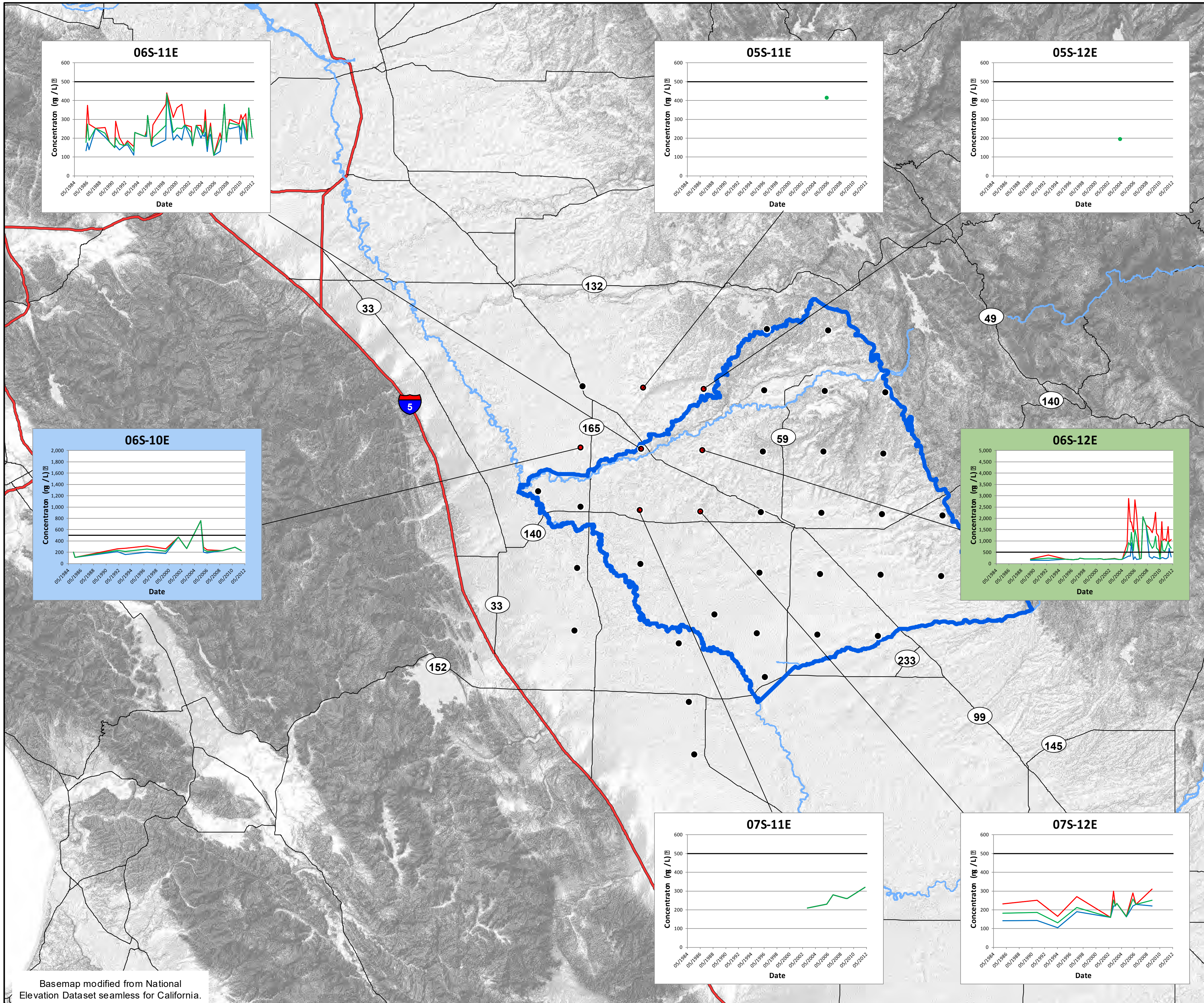

ITRC
moving water in new directions
IRRIGATION TRAINING AND RESEARCH CENTER
California Polytechnic State University
San Luis Obispo, CA 93407-0730
Merced Area Groundwater Pool Interest - MAGPI
2008 Net to/from Groundwater Inches
< -50
-49 - -40
-39 - -30
-29 - -20
-19 - -10
-9 - -5
-4 - 5
6 - 10
11 - 20
21 - 30
31 - 40
41 - 50
> 50
Miles
0 2 4
created: FEBRUARY 2016
N
MID Boundary
MAGPI Boundary
NOTE:
Negative values indicate withdrawal from groundwater.
Positive values indicate contribution to groundwater.
Net to/from Groundwater based on evapotranspiration within the boundaries.

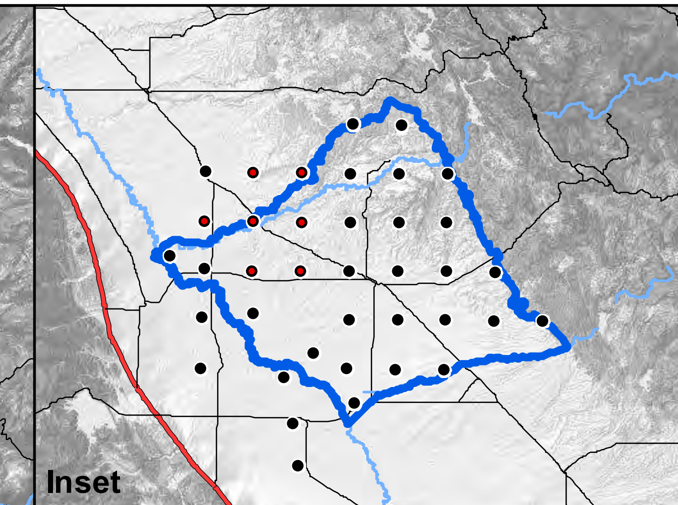

ITRC
moving water in new directions
IRRIGATION TRAINING AND RESEARCH CENTER
California Polytechnic State University
San Luis Obispo, CA 93407-0730
Merced Area Groundwater Pool Interest - MAGPI
2010 Net to/from Groundwater Inches
< -50
-49 - -40
-39 - -30
-29 - -20
-19 - -10
-9 - -5
-4 - 5
6 - 10
11 - 20
21 - 30
31 - 40
41 - 50
> 50
Miles
0 2 4
created: FEBRUARY 2016
N
MID Boundary
MAGPI Boundary
NOTE:
Negative values indicate withdrawal from groundwater.
Positive values indicate contribution to groundwater.
Net to/from Groundwater based on evapotranspiration within the boundaries.


ITRC
moving water in new directions
IRRIGATION TRAINING AND RESEARCH CENTER
California Polytechnic State University
San Luis Obispo, CA 93407-0730
Merced Area Groundwater Pool Interest - MAGPI
2013 Net to/from Groundwater Inches
< -50
-49 - -40
-39 - -30
-29 - -20
-19 - -10
-9 - -5
-4 - 5
6 - 10
11 - 20
21 - 30
31 - 40
41 - 50
> 50
Miles
0 2 4
created: FEBRUARY 2016
N
MID Boundary
MAGPI Boundary
NOTE:
Negative values indicate withdrawal from groundwater.
Positive values indicate contribution to groundwater.
Net to/from Groundwater based on evapotranspiration within the boundaries.

ATTACHMENT C

APPENDIX E: WATER QUALITY CONSTITUENT CONCENTRATION PLOTS





Explanation:

- Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum TDS concentration
- Mean TDS concentration
- Maximum TDS concentration
- Rec. SMCL for TDS (500 mg/l)

Notes:

1. IRWMP = Integrated Regional Water Management Plan
2. Total dissolved solids (TDS) concentrations shown in milligrams per liter (mg/L).
3. Secondary Maximum Contaminant Level (SMCL) as established by the California Department of Public Heath
4. Background color on graphs represent the y-axis range as follows:

White: 0- 600 mg/L
Blue: 0- 2,000 mg/L
Green: 0- 5,000 mg/L

N

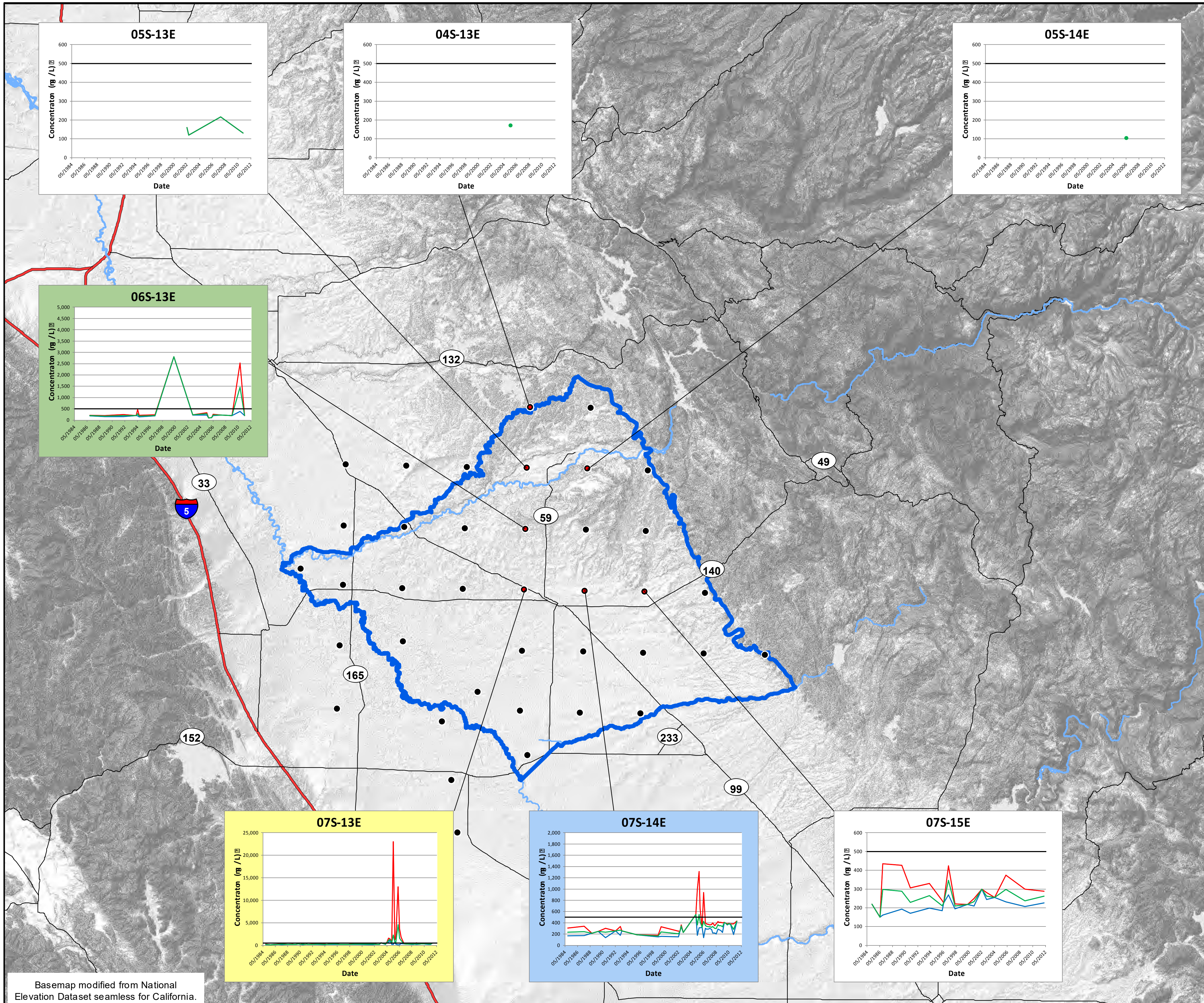
0 5 10

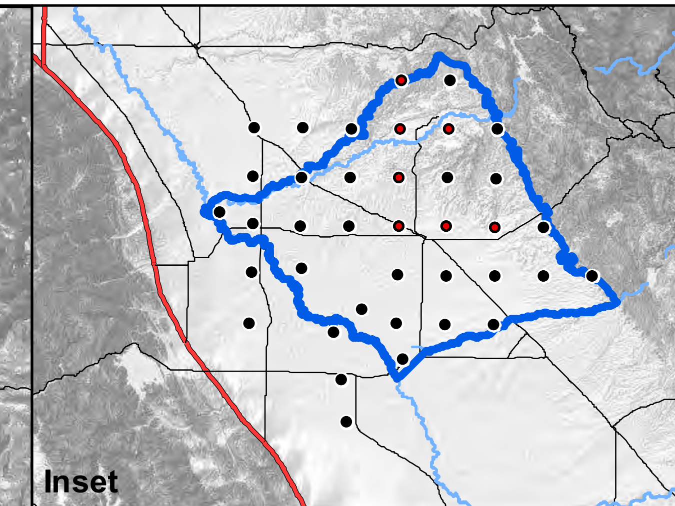
APPROXIMATE SCALE IN MILES

TOTAL DISSOLVED SOLIDS (TDS)
CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure **1a**

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig01a_TDS.mxd





Explanation:

- ●/● Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum TDS concentration
- Mean TDS concentration
- Maximum TDS concentration
- Rec. SMCL for TDS (500 mg/l)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Total dissolved solids (TDS) concentrations shown in milligrams per liter (mg/L).
3. Secondary Maximum Contaminant Level (SMCL) as established by the California Department of Public Heath
4. Background color on graphs represent the y-axis range as follows:

White: 0- 600 mg/L
Blue: 0- 2,000 mg/L
Green: 0- 5,000 mg/L
Yellow: 0- 25,000 mg/L

N

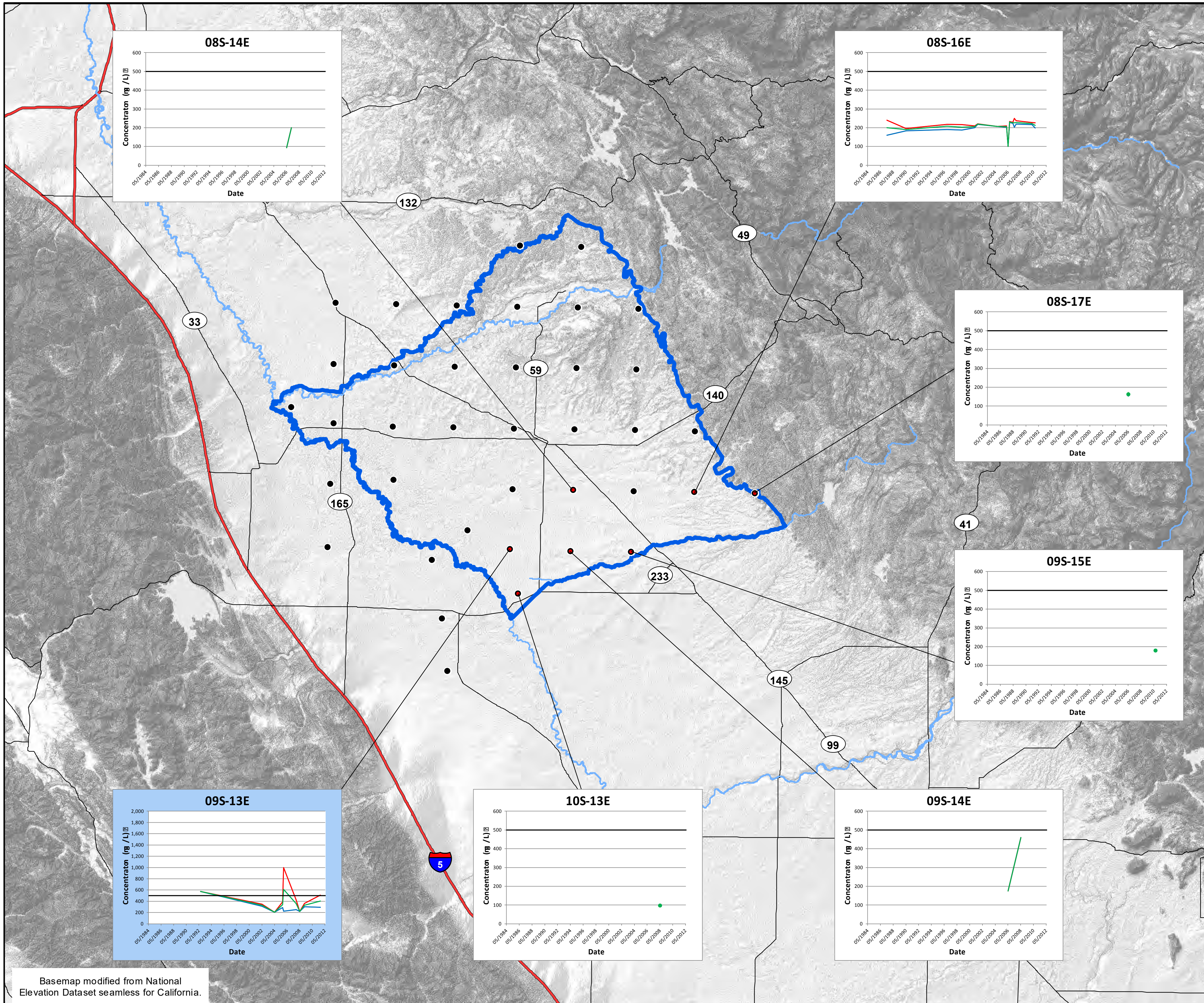
0 5 10

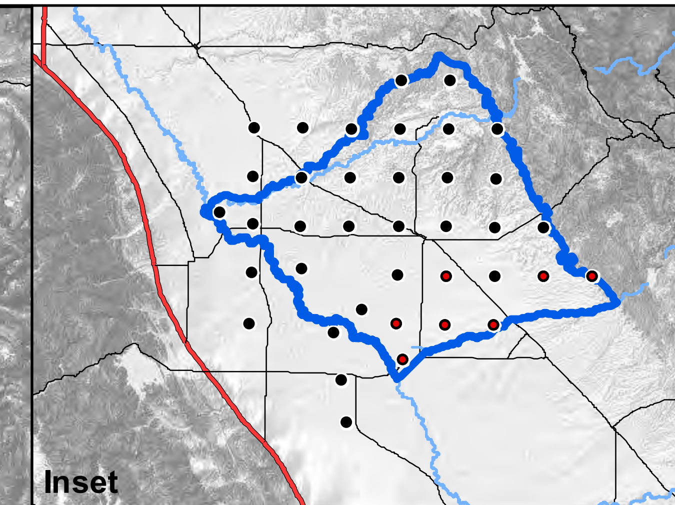
APPROXIMATE SCALE IN MILES

TOTAL DISSOLVED SOLIDS (TDS)
CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 1b

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig01b_TDS.mxd





Explanation:

- Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum TDS concentration
- Mean TDS concentration
- Maximum TDS concentration
- Rec. SMCL for TDS (500 mg/l)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Total dissolved solids (TDS) concentrations shown in milligrams per liter (mg/L).
3. Secondary Maximum Contaminant Level (SMCL) as established by the California Department of Public Heath
4. Background color on graphs represent the y-axis range as follows:

White: 0- 600 mg/L
Blue: 0- 2,000 mg/L

N

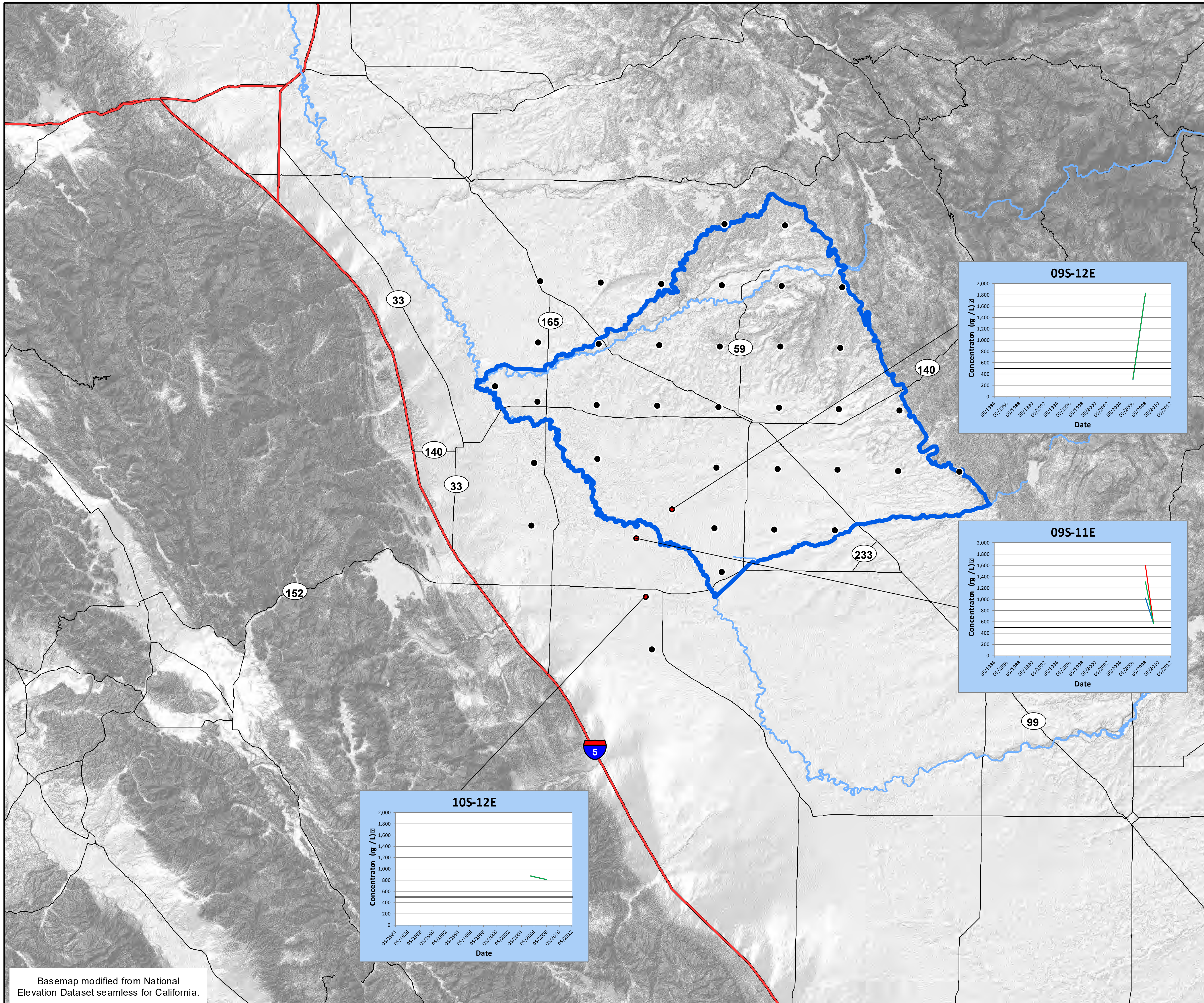
0 5 10

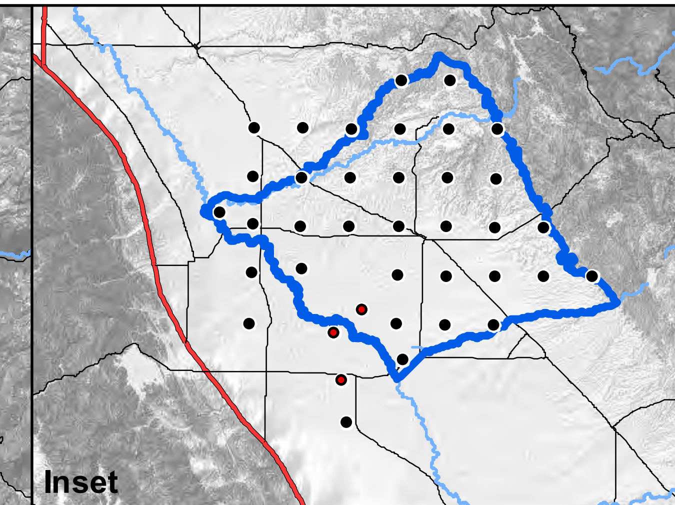
APPROXIMATE SCALE IN MILES

TOTAL DISSOLVED SOLIDS (TDS)
CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 1c

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig01c_TDS.mxd





Explanation:

- Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum TDS concentration
- Mean TDS concentration
- Maximum TDS concentration
- Rec. SMCL for TDS (500 mg/l)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Total dissolved solids (TDS) concentrations shown in milligrams per liter (mg/L).
3. Secondary Maximum Contaminant Level (SMCL) as established by the California Department of Public Heath

N

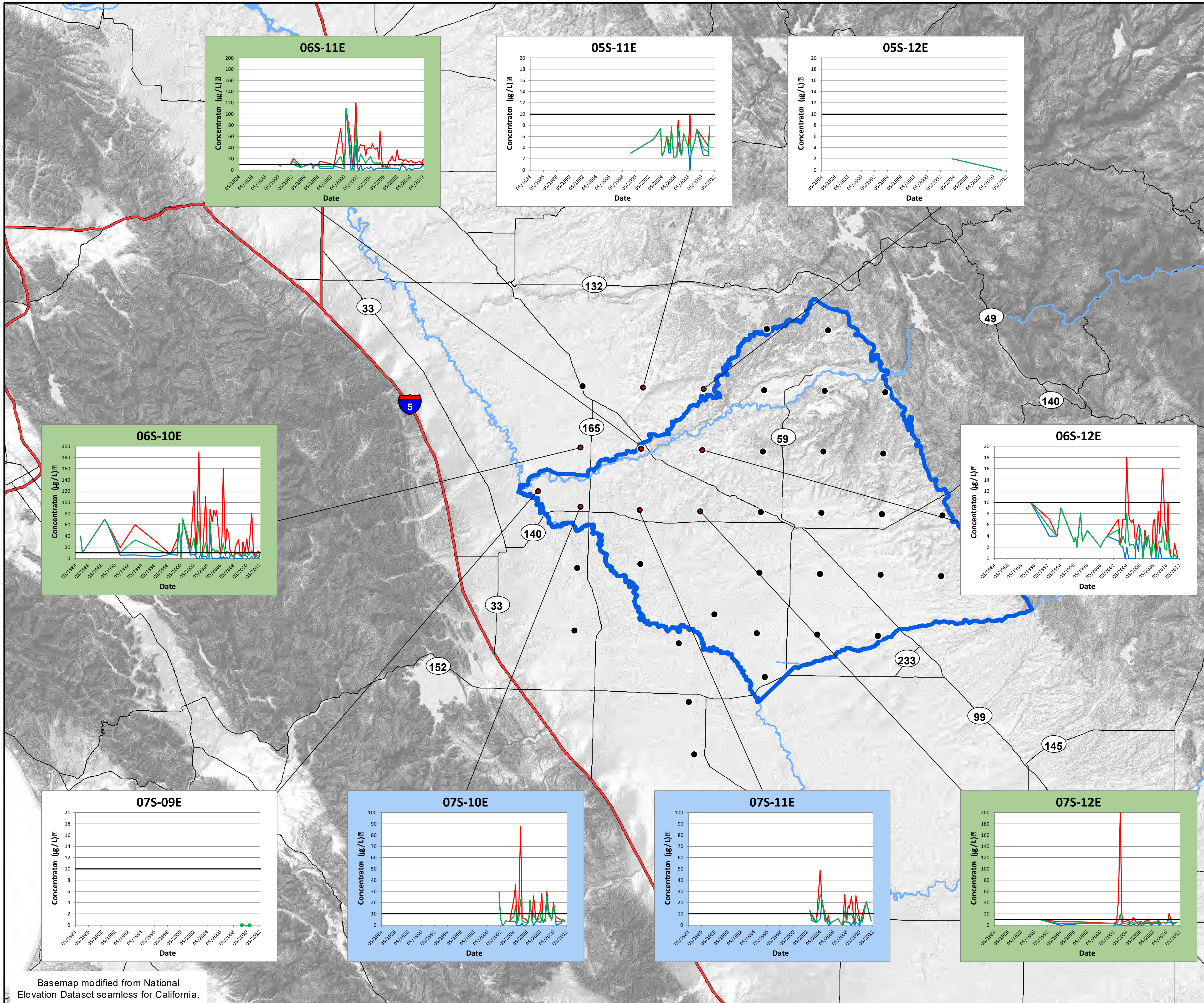
0 5 10

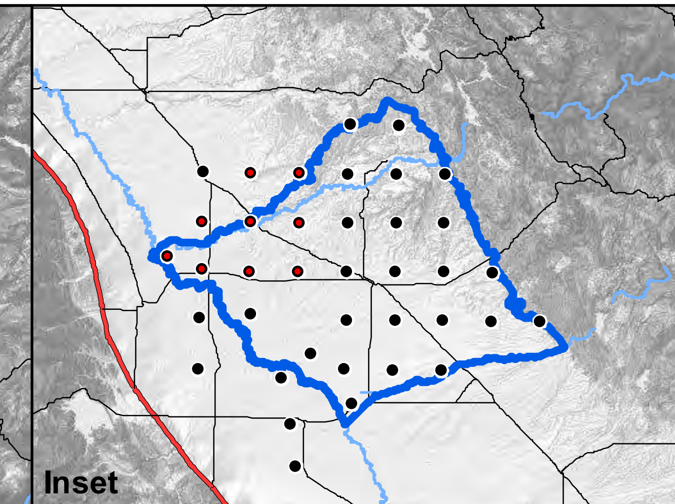
APPROXIMATE SCALE IN MILES

TOTAL DISSOLVED SOLIDS (TDS)
CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 12/05/2012	Project No. FR1216040A
		Figure 1d

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig01d_TDS.mxd





Explanation:

Township/Range centroid

Surface water feature

Merced IRWM area

Concentration Charts:

Minimum As concentration

Mean As concentration

Maximum As concentration

MCL for As (10 µg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Arsenic (As) concentrations shown in micrograms per liter (µg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.
4. Background color on graphs represent the y-axis range as follows:

White: 0- 20 µg/L
Blue: 0- 100 µg/L
Green: 0- 200 µg/L

N

0 5 10

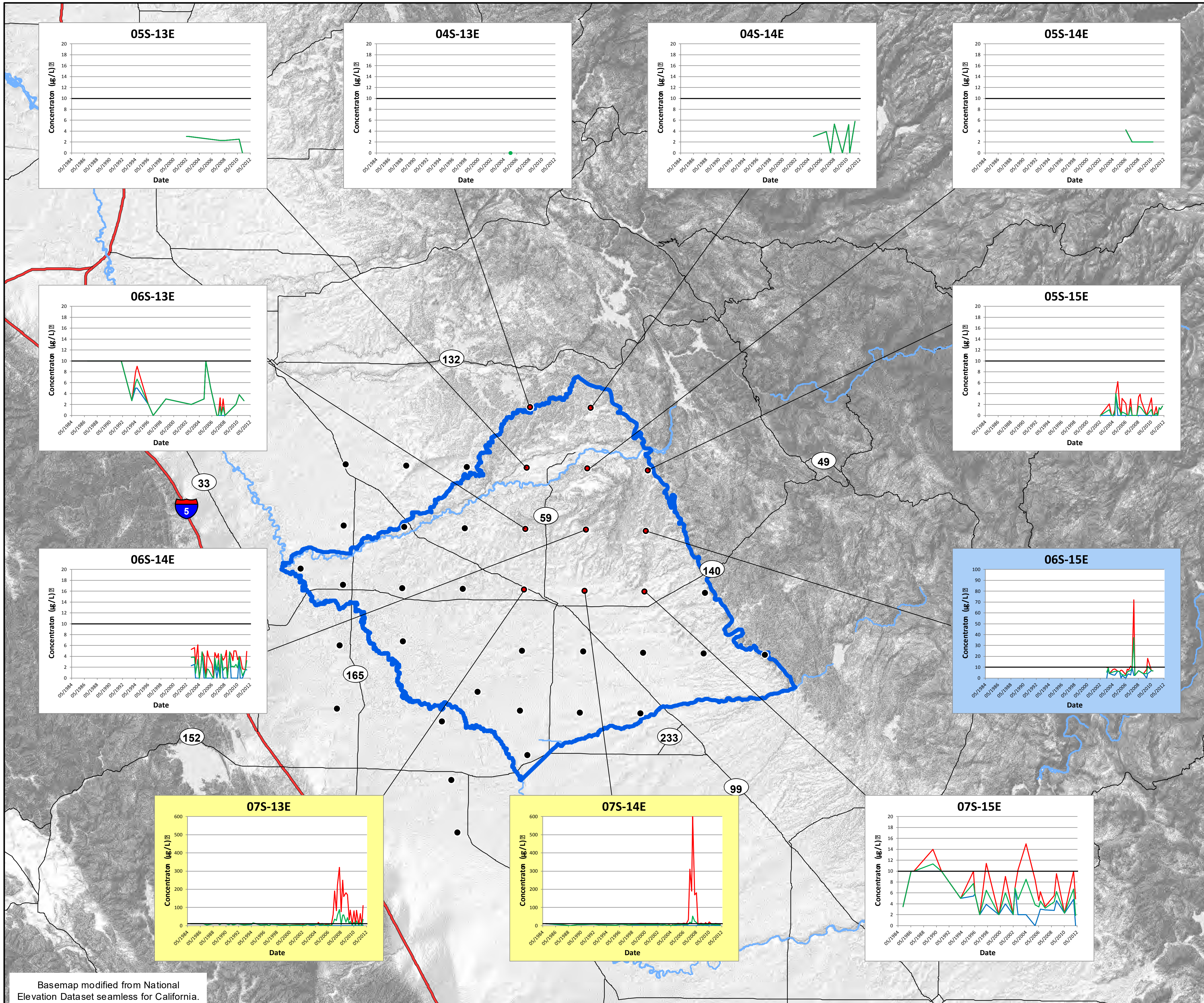
APPROXIMATE SCALE IN MILES

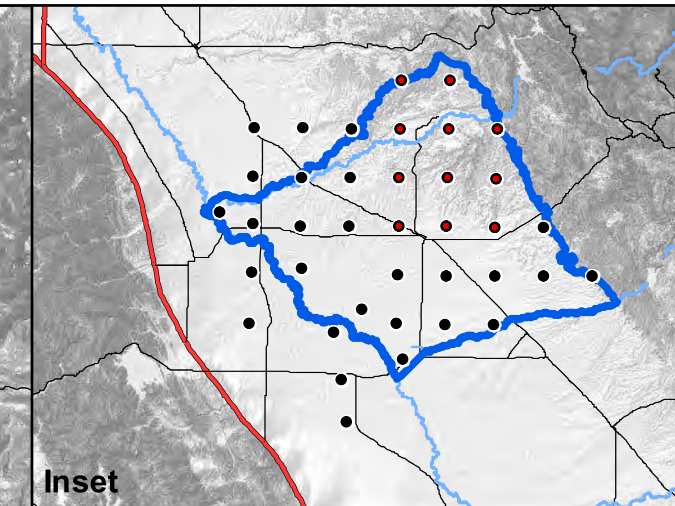
ARSENIC (As) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 3a

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig03a_As.mxd

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig03b_As.mxd





Explanation:

- Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum As concentration
- Mean As concentration
- Maximum As concentration
- MCL for As (10 µg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Arsenic (As) concentrations shown in micrograms per liter (µg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.
4. Background color on graphs represent the y-axis range as follows:

White: 0- 20 µg/L
Blue: 0- 100 µg/L
Yellow: 0- 600 µg/L

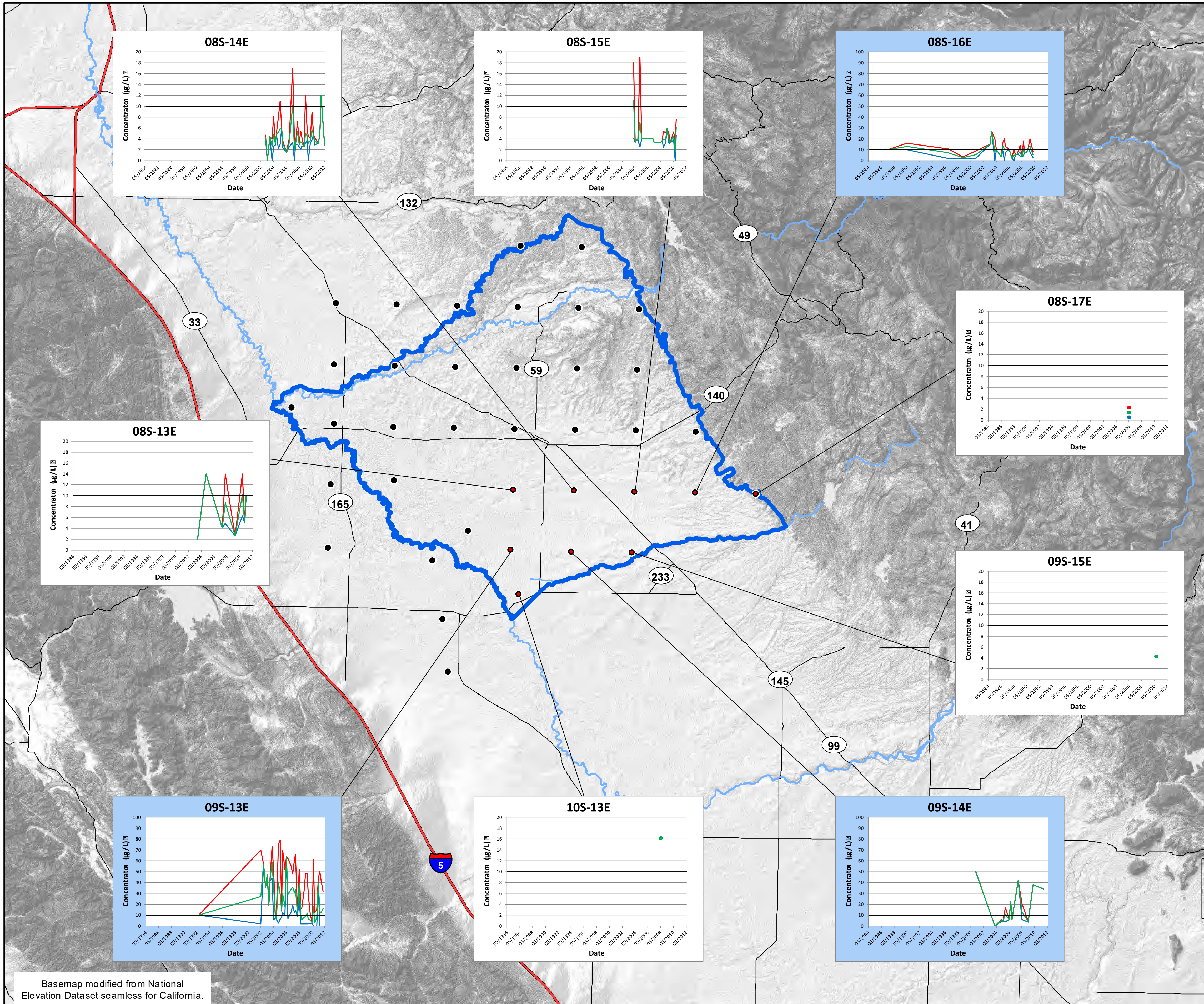
N

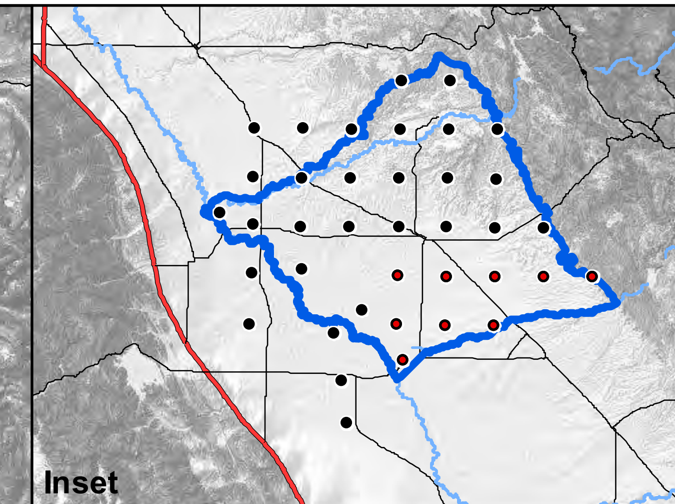
0 5 10

APPROXIMATE SCALE IN MILES

ARSENIC (As) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 3b





Explanation:

- Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum As concentration
- Mean As concentration
- Maximum As concentration
- MCL for As (10 µg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Arsenic (As) concentrations shown in micrograms per liter (µg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.
4. Background color on graphs represent the y-axis range as follows:

White: 0- 20 µg/L
Blue: 0- 100 µg/L

N

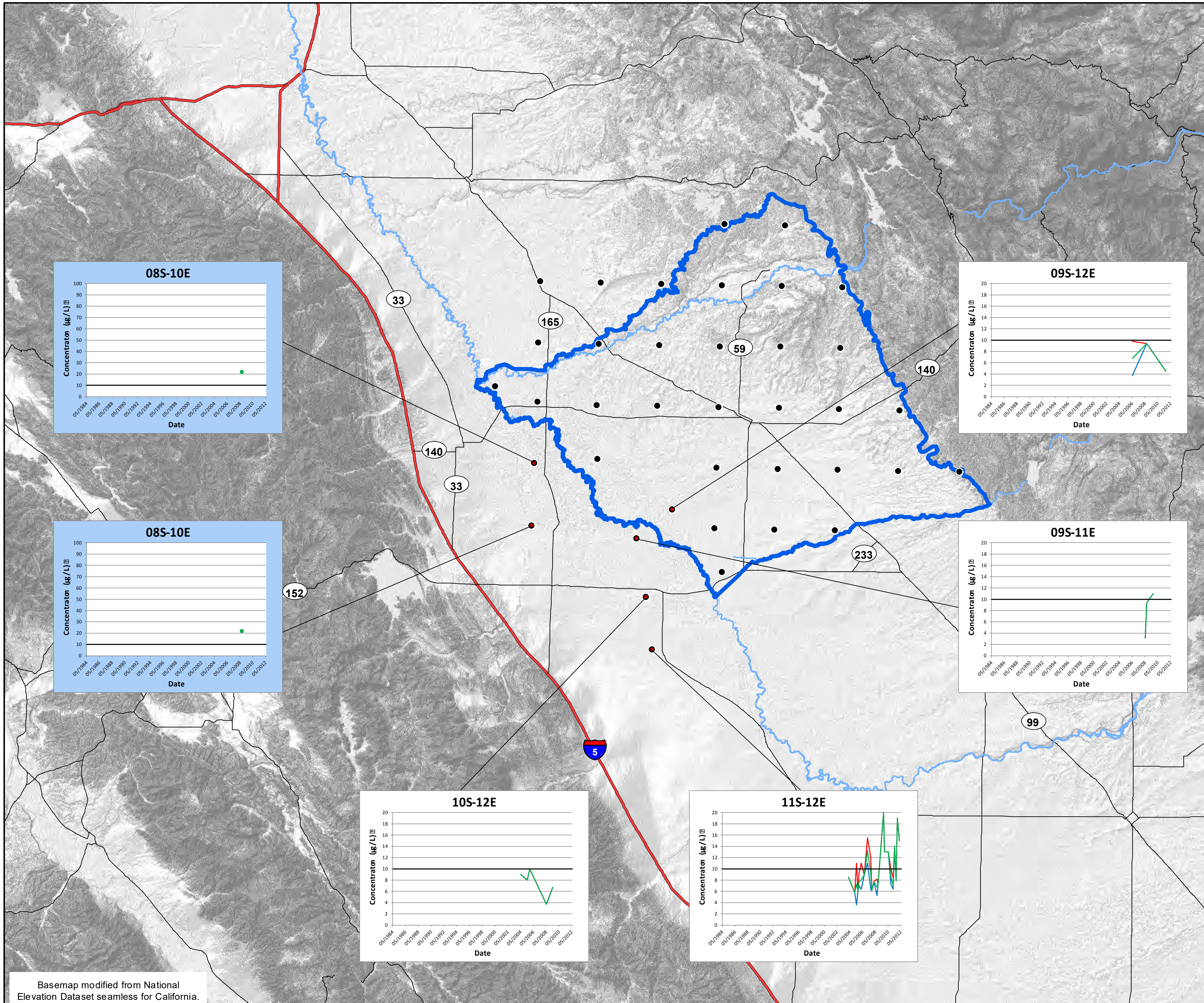
0 5 10

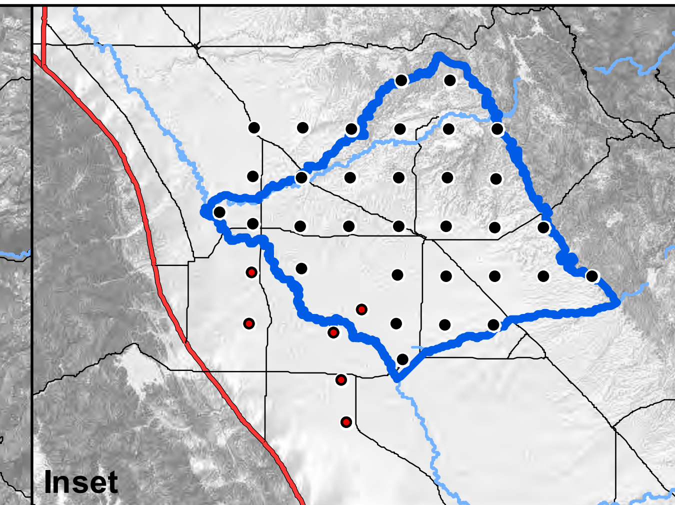
APPROXIMATE SCALE IN MILES

ARSENIC (As) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 3c

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig03c_As.mxd





Explanation:

- Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum As concentration
- Mean As concentration
- Maximum As concentration
- MCL for As (10 µg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Arsenic (As) concentrations shown in micrograms per liter (µg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.
4. Background color on graphs represent the y-axis range as follows:

White: 0- 20 µg/L
Blue: 0- 100 µg/L

N

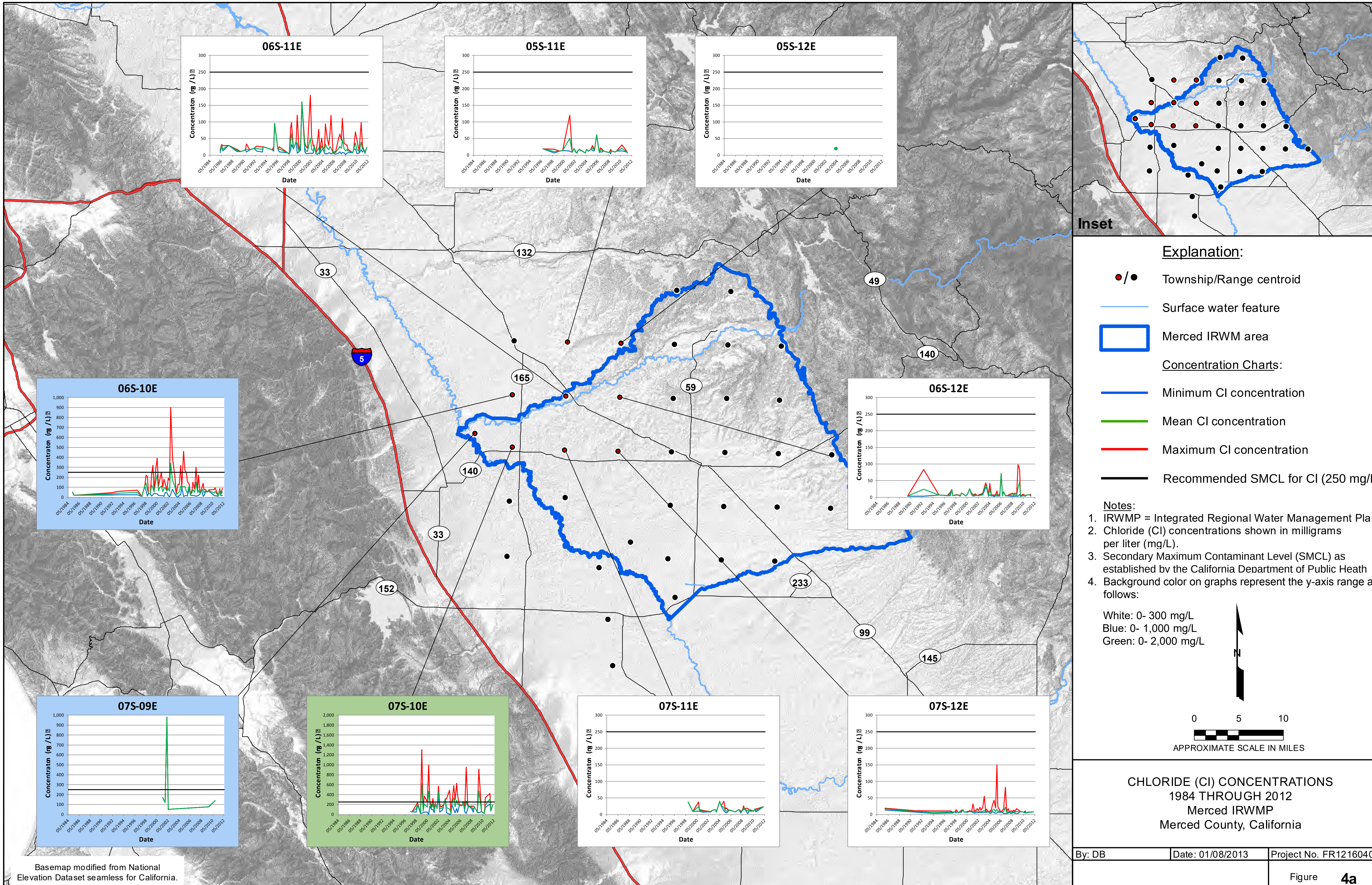
0 5 10

APPROXIMATE SCALE IN MILES

ARSENIC (As) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 3d

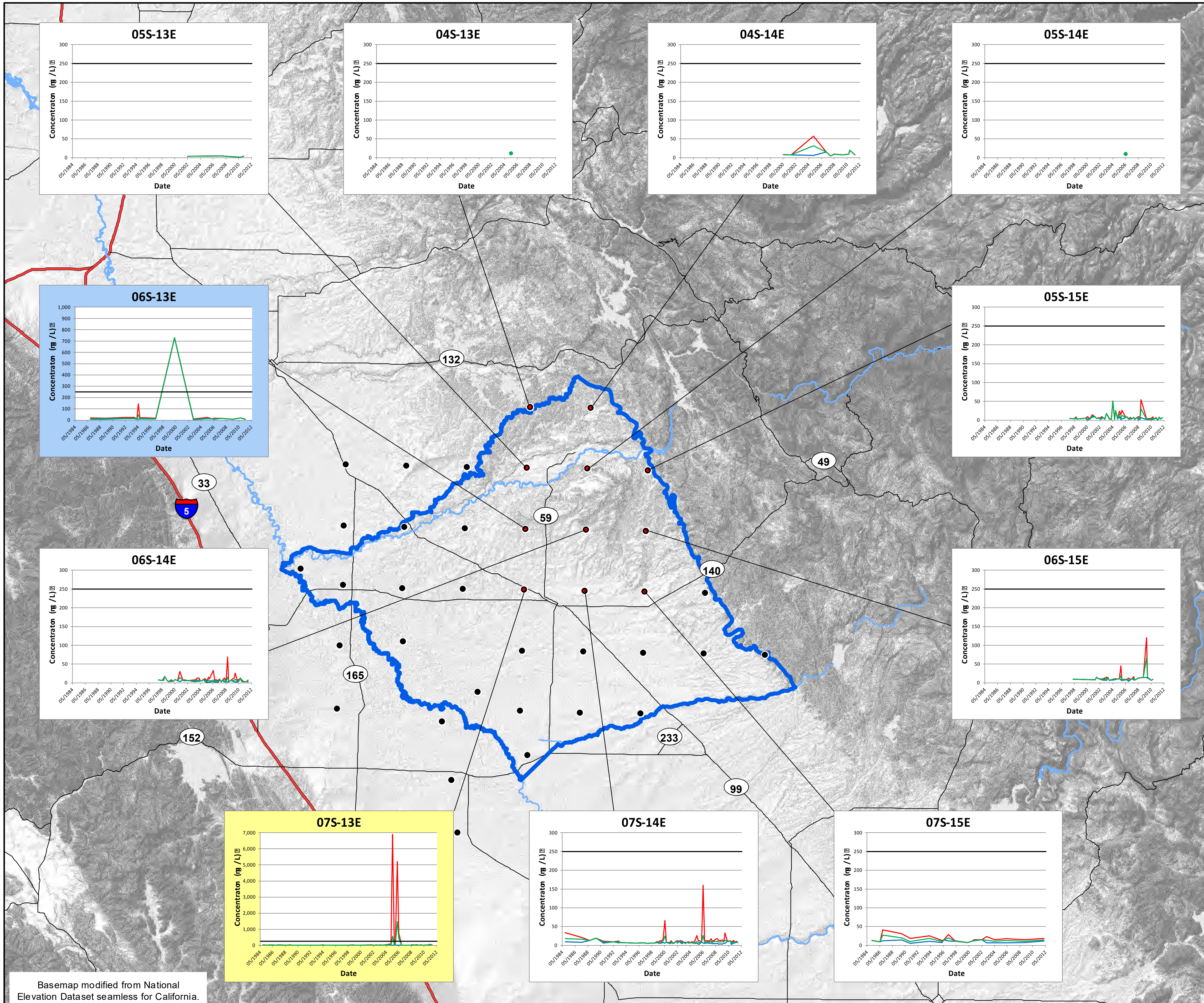
N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig03d_As.mxd

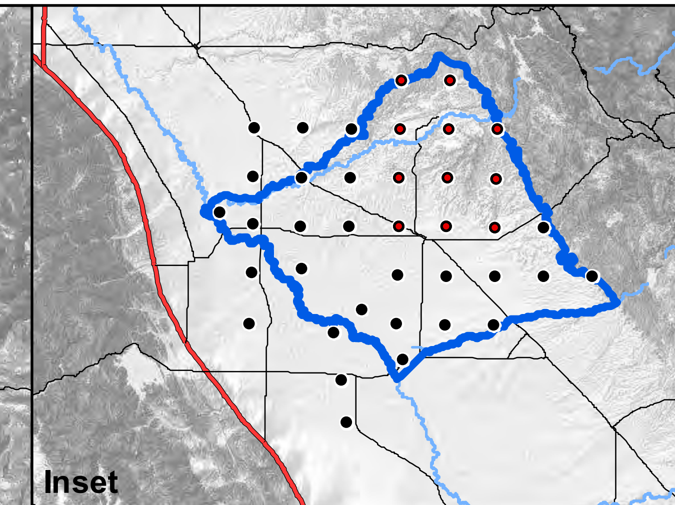


CHLORIDE (Cl) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 4a

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig04a_Cl.mxd





Explanation:

Township/Range centroid

Surface water feature

Merced IRWM area

Concentration Charts:

Minimum Cl concentration

Mean Cl concentration

Maximum Cl concentration

Recommended SMCL for Cl (250 mg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Chloride (Cl) concentrations shown in milligrams per liter (mg/L).
3. Secondary Maximum Contaminant Level (SMCL) as established by the California Department of Public Heath
4. Background color on graphs represent the y-axis range as follows:

White: 0- 300 mg/L
Blue: 0- 1,000 mg/L
Yellow: 0- 7,000 mg/L

N

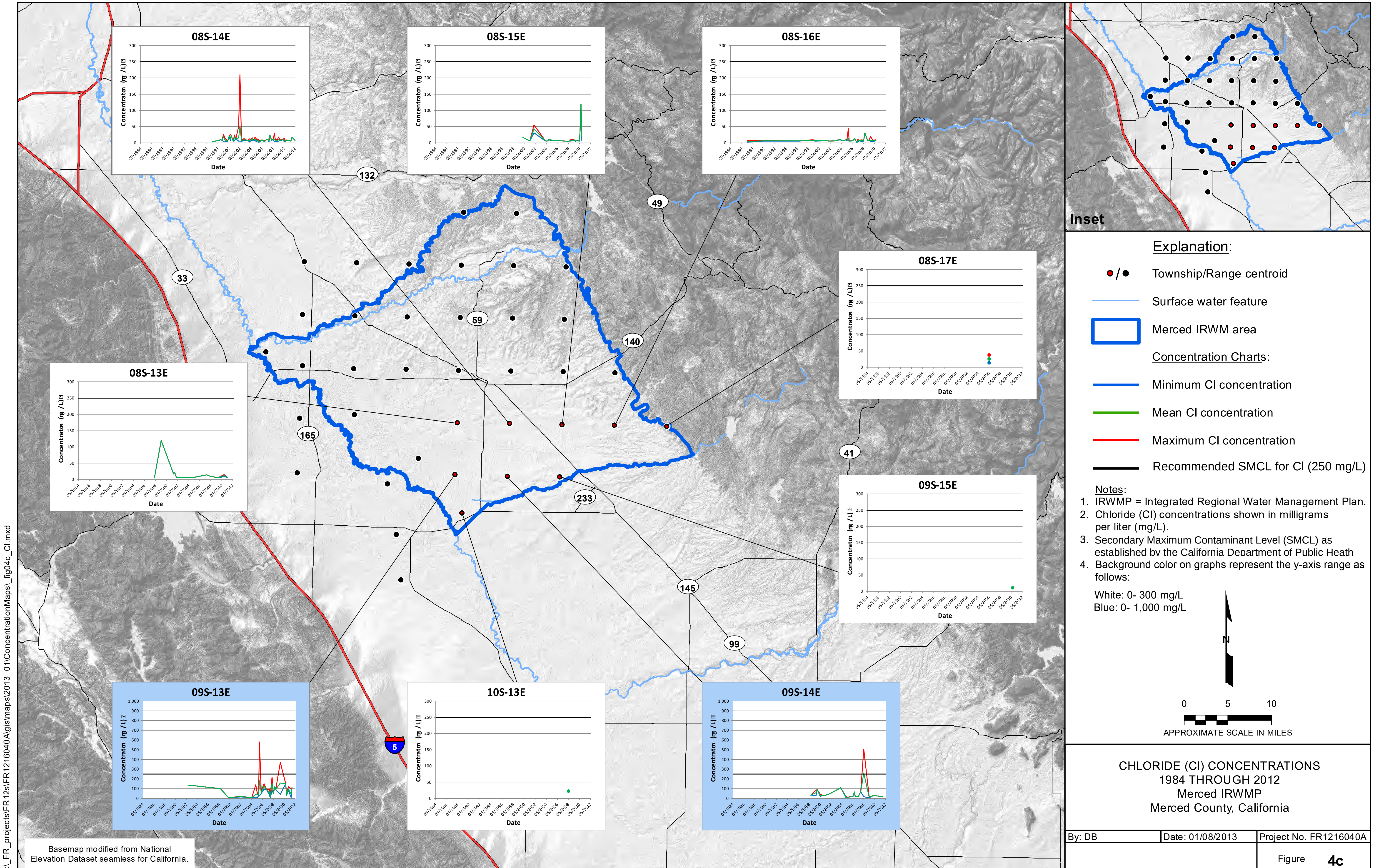
0 5 10

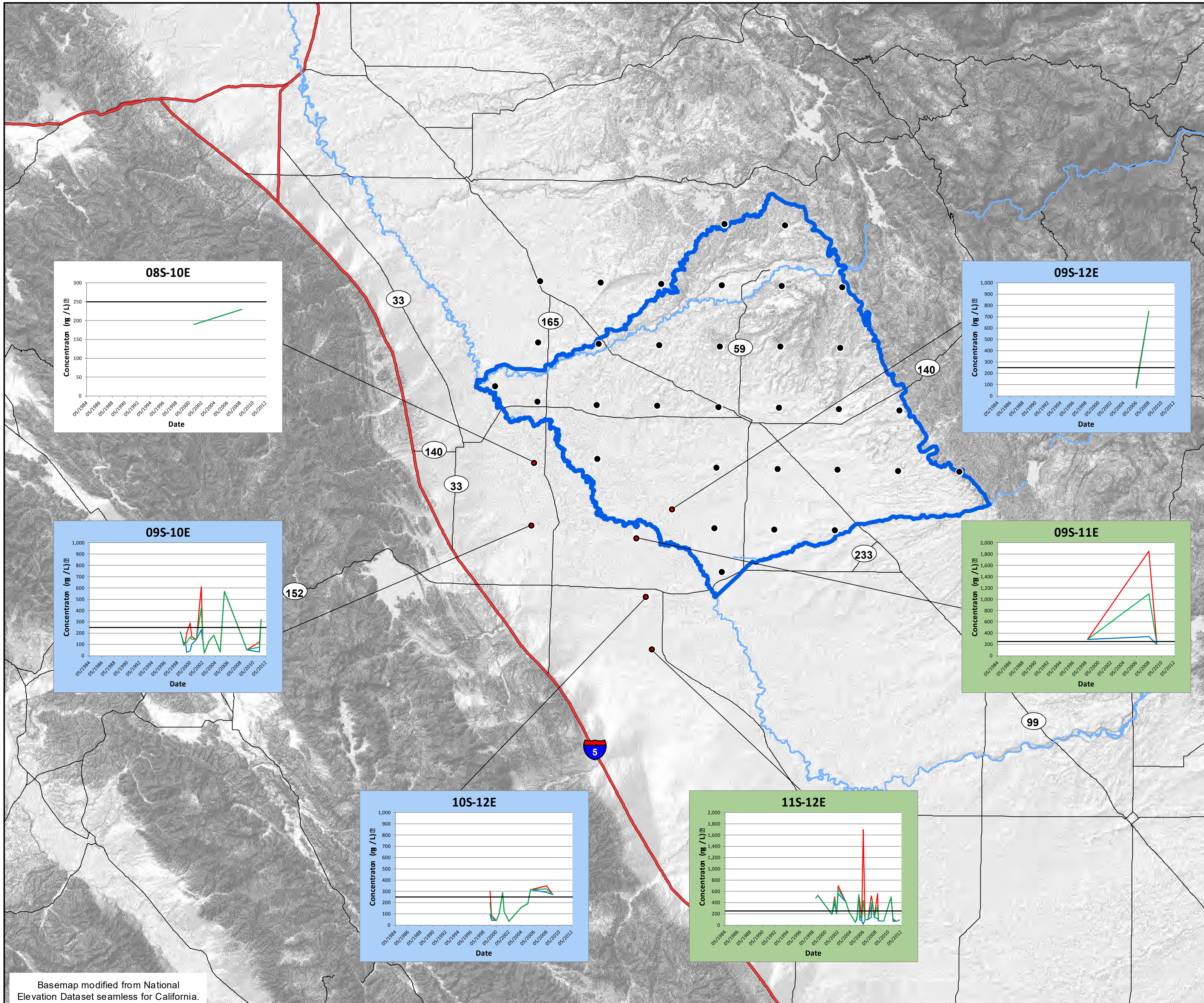
APPROXIMATE SCALE IN MILES

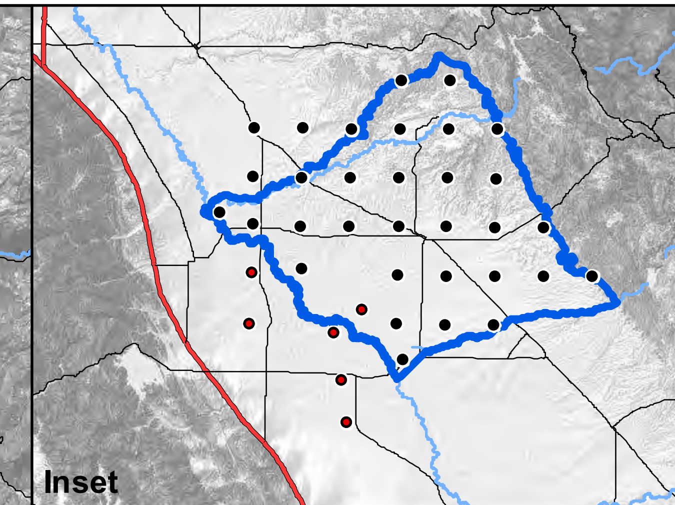
CHLORIDE (Cl) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 4b

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig04b_Cl.mxd


08S-14E
08S-15E
08S-16E
08S-17E
08S-13E
09S-15E
09S-13E
10S-13E
09S-14E
Concentraton (mg/L)
Date
Inset
132
49
33
59
140
165
41
233
145
99
5
Explanation:
Township/Range centroid
Surface water feature
Merced IRWM area
Concentration Charts:
Minimum Cl concentration
Mean Cl concentration
Maximum Cl concentration
Recommended SMCL for Cl (250 mg/L)
Notes:
1. IRWMP = Integrated Regional Water Management Plan.
2. Chloride (Cl) concentrations shown in milligrams per liter (mg/L).
3. Secondary Maximum Contaminant Level (SMCL) as established by the California Department of Public Heath
4. Background color on graphs represent the y-axis range as follows:
White: 0- 300 mg/L
Blue: 0- 1,000 mg/L
N
0 5 10
APPROXIMATE SCALE IN MILES
Basemap modified from National Elevation Dataset seamless for California.
CHLORIDE (Cl) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California
By: DB
Date: 01/08/2013
Project No. FR1216040A
Figure 4c
N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig04c_Cl.mxd





Explanation:

Township/Range centroid

Surface water feature

Merced IRWM area

Concentration Charts:

Minimum Cl concentration

Mean Cl concentration

Maximum Cl concentration

Recommended SMCL for Cl (250 mg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Chloride (Cl) concentrations shown in milligrams per liter (mg/L).
3. Secondary Maximum Contaminant Level (SMCL) as established by the California Department of Public Heath
4. Background color on graphs represent the y-axis range as follows:

White: 0- 300 mg/L
Blue: 0- 1,000 mg/L
Green: 0- 2,000 mg/L

N

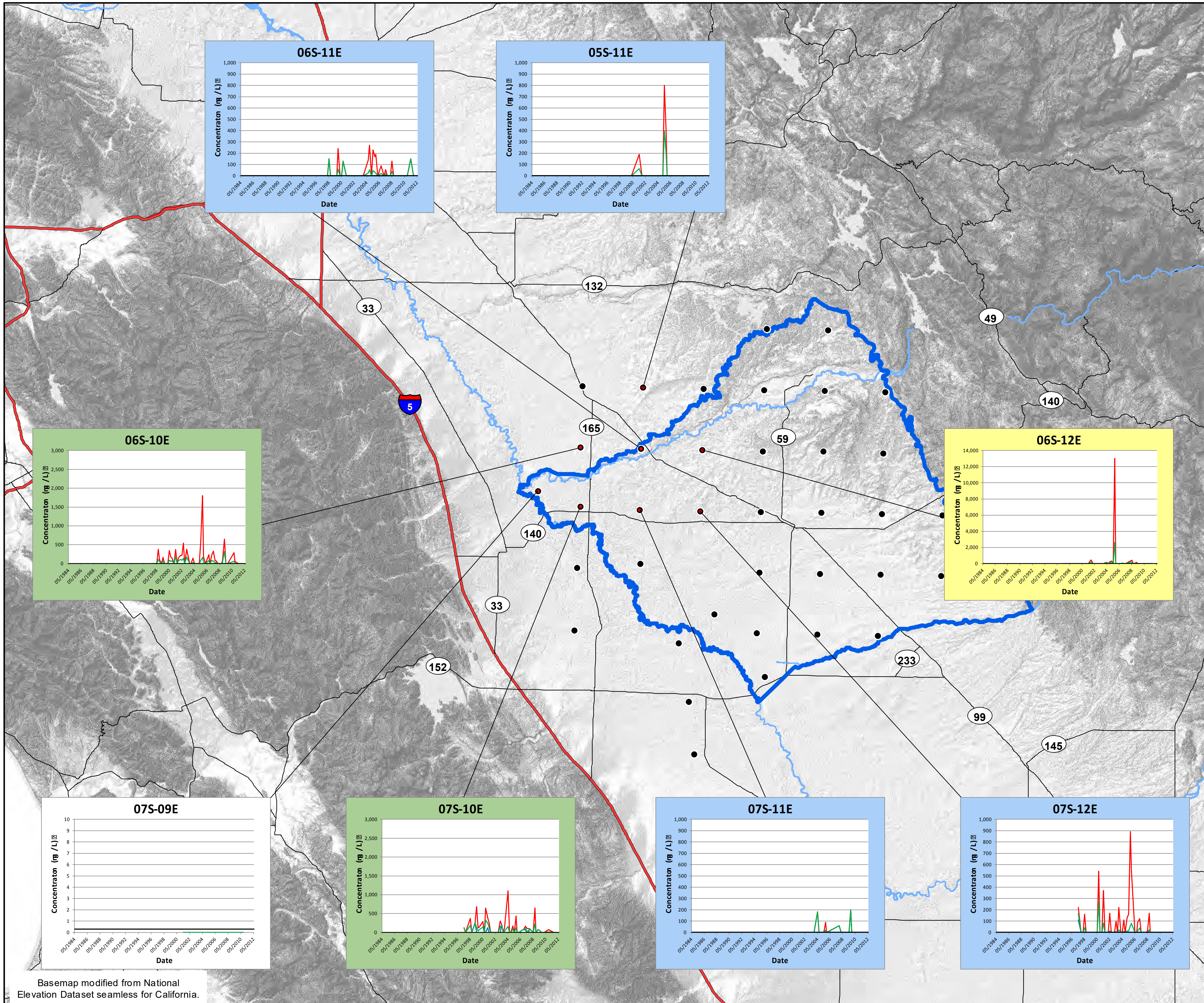
0 5 10

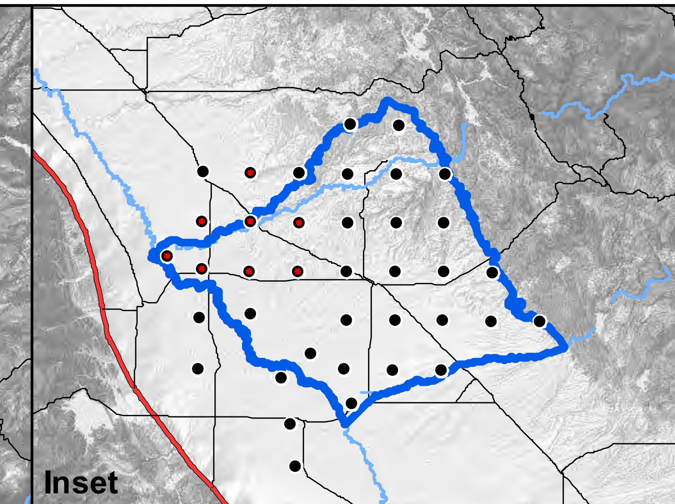
APPROXIMATE SCALE IN MILES

CHLORIDE (Cl) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 4d

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig04d_Cl.mxd





Explanation:

- Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum Fe concentration
- Mean Fe concentration
- Maximum Fe concentration
- SMCL for Fe (0.3 mg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Iron (Fe) concentrations shown in milligrams per liter (mg/L).
3. Secondary Maximum Contaminant Level (SMCL) as established by the California Department of Public Heath
4. Background color on graphs represent the y-axis range as follows:

White: 0- 10 mg/L
Blue: 0- 1,000 mg/L
Green: 0- 3,000 mg/L
Yellow: 0- 14,000 mg/L

N

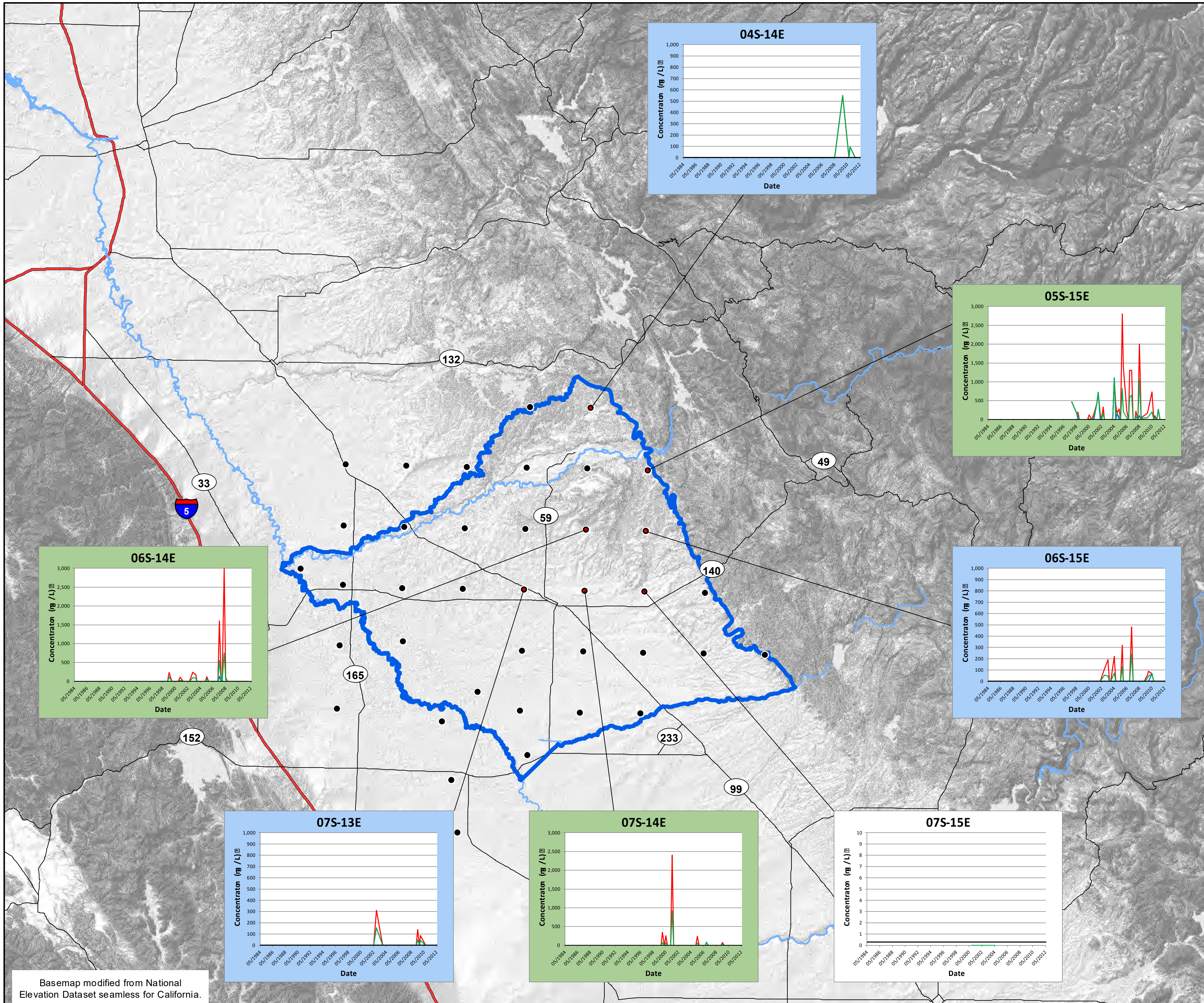
0 5 10

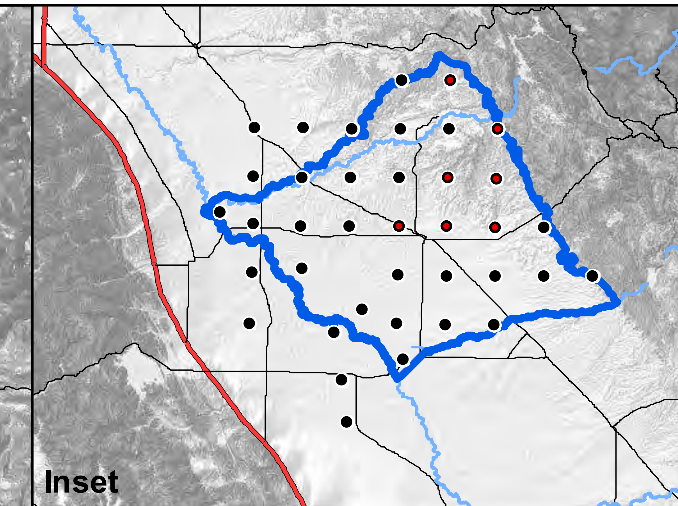
APPROXIMATE SCALE IN MILES

IRON (Fe) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 5a

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig05a_Fe.mxd





Explanation:

Township/Range centroid

Surface water feature

Merced IRWM area

Concentration Charts:

Minimum Fe concentration

Mean Fe concentration

Maximum Fe concentration

SMCL for Fe (0.3 mg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Iron (Fe) concentrations shown in milligrams per liter (mg/L).
3. Secondary Maximum Contaminant Level (SMCL) as established by the California Department of Public Heath
4. Background color on graphs represent the y-axis range as follows:

White: 0- 10 mg/L
Blue: 0- 1,000 mg/L
Green: 0- 3,000 mg/L

N

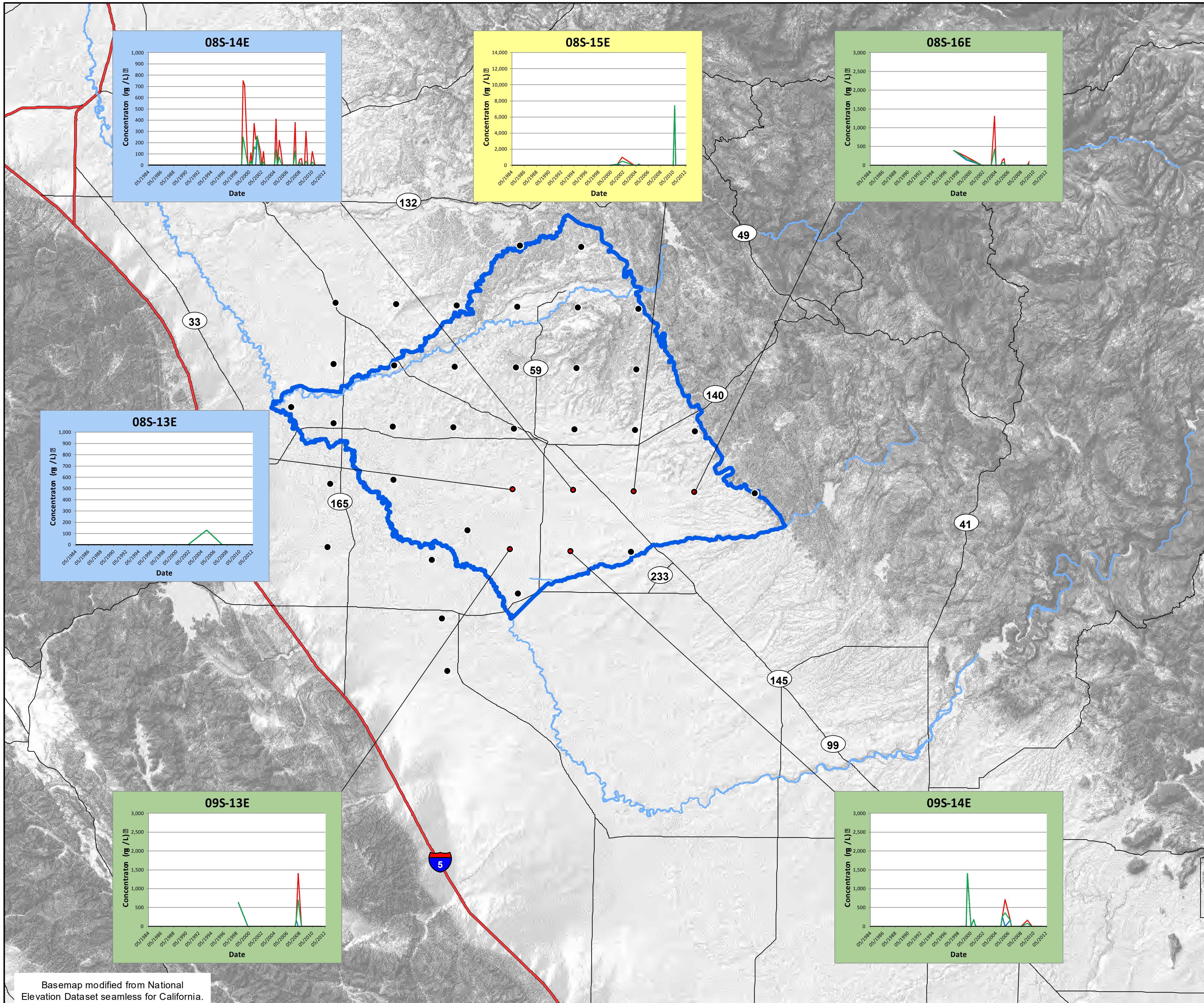
0 5 10

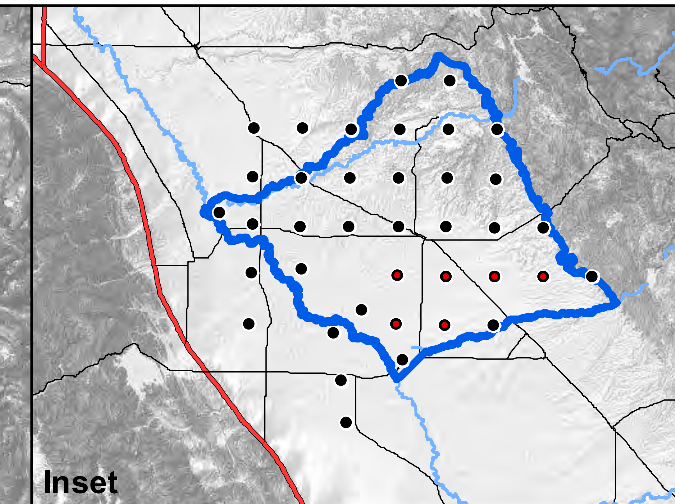
APPROXIMATE SCALE IN MILES

IRON (Fe) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 5b

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig05b_Fe.mxd





Explanation:

Township/Range centroid

Surface water feature

Merced IRWM area

Concentration Charts:

Minimum Fe concentration

Mean Fe concentration

Maximum Fe concentration

SMCL for Fe (0.3 mg/L)

Notes:
1. IRWMP = Integrated Regional Water Management Plan.
2. Iron (Fe) concentrations shown in milligrams per liter (mg/L).
3. Secondary Maximum Contaminant Level (SMCL) as established by the California Department of Public Heath
4. Background color on graphs represent the y-axis range as follows:

Blue: 0- 1,000 mg/L
Green: 0- 3,000 mg/L
Yellow: 0- 14,000 mg/L

N

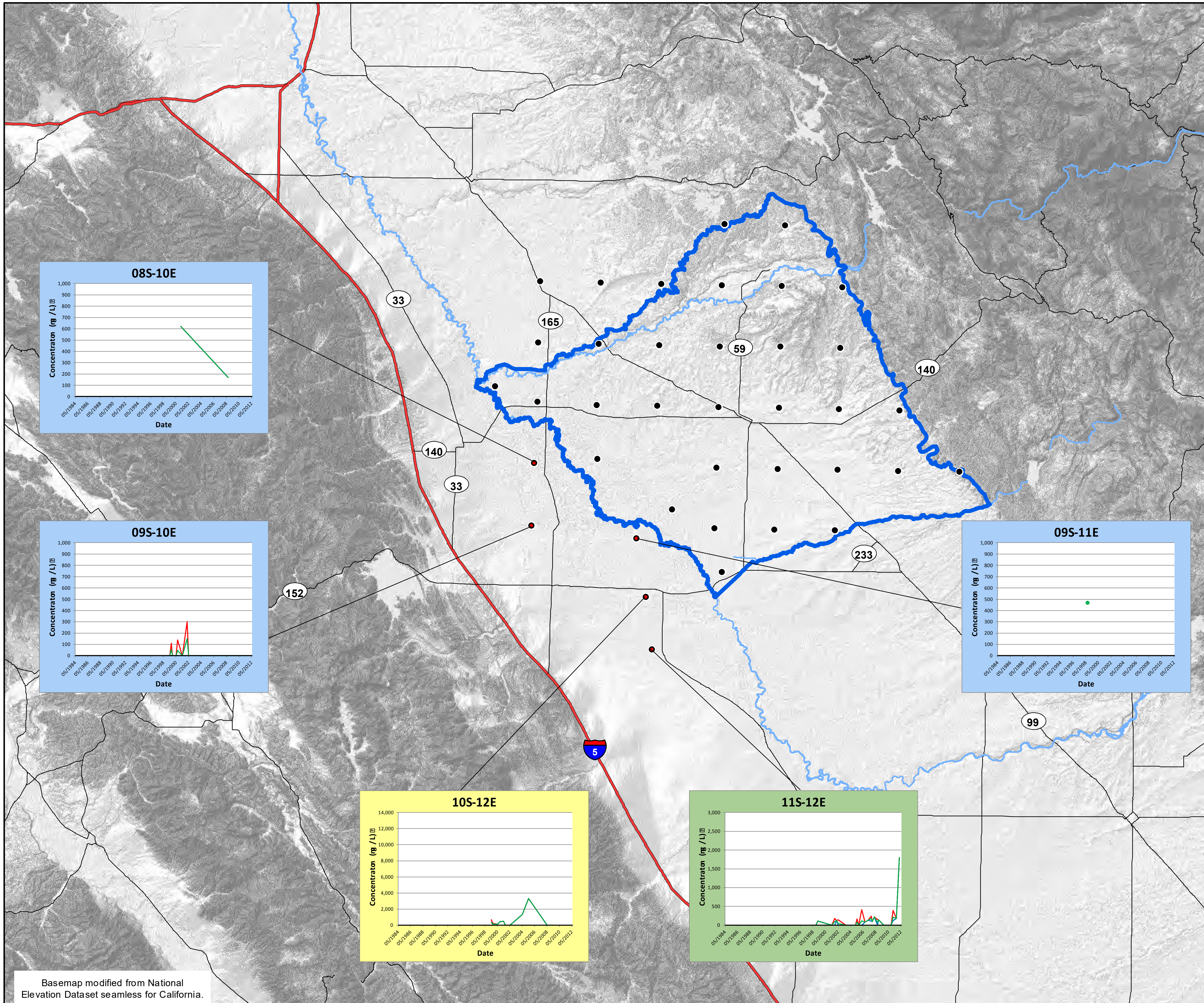
0 5 10

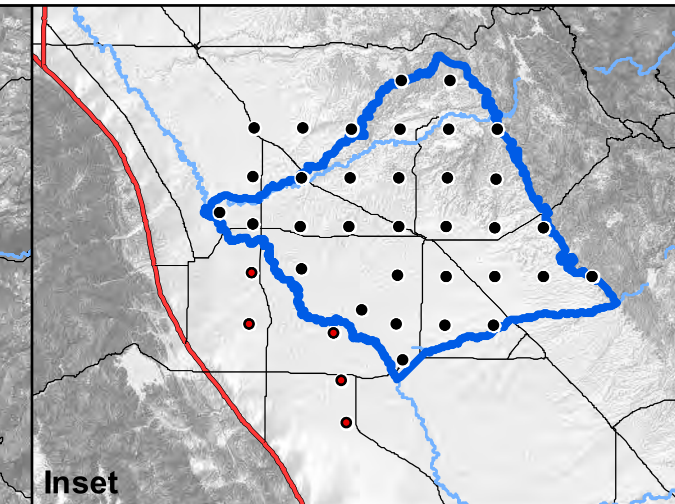
APPROXIMATE SCALE IN MILES

IRON (Fe) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 5c

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig05c_Fe.mxd





Explanation:

- Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum Fe concentration
- Mean Fe concentration
- Maximum Fe concentration
- SMCL for Fe (0.3 mg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Iron (Fe) concentrations shown in milligrams per liter (mg/L).
3. Secondary Maximum Contaminant Level (SMCL) as established by the California Department of Public Heath
4. Background color on graphs represent the y-axis range as follows:

Blue: 0- 1,000 mg/L
Green: 0- 3,000 mg/L
Yellow: 0- 14,000 mg/L

N

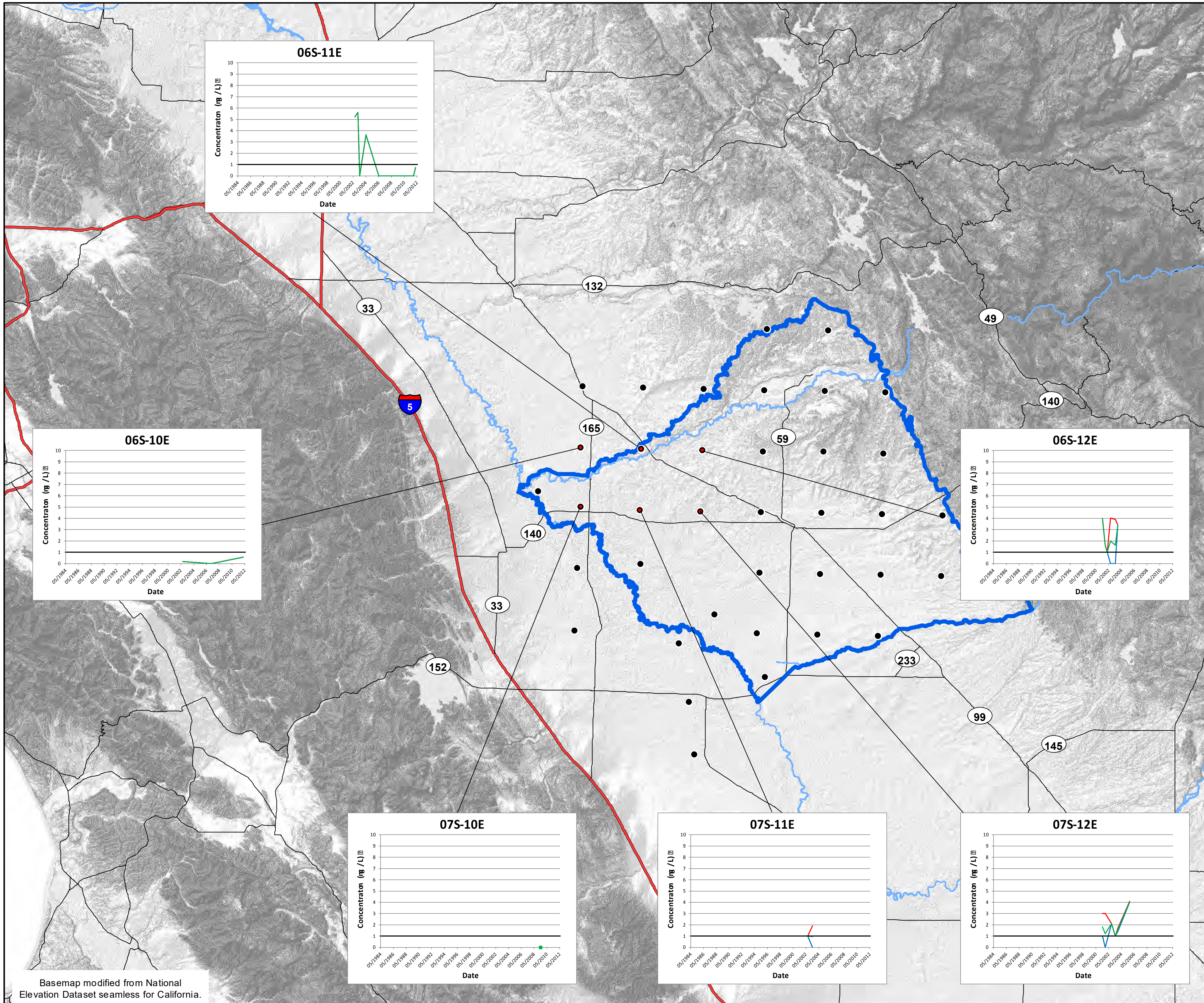
0 5 10

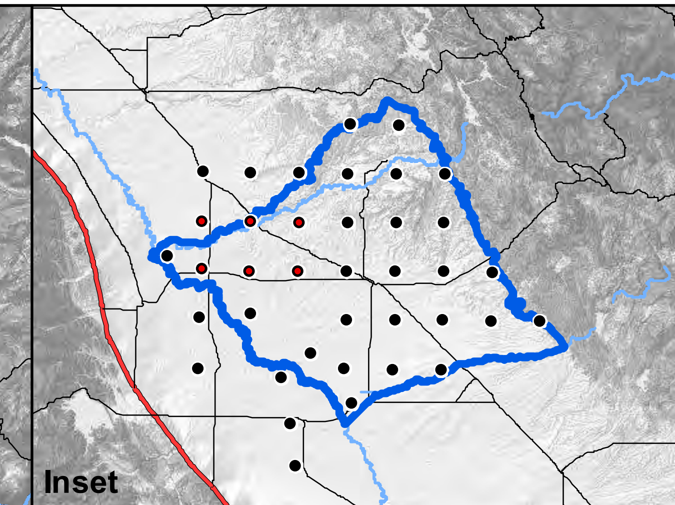
APPROXIMATE SCALE IN MILES

IRON (Fe) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 5d

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig05d_Fe.mxd





Explanation:

●/● Township/Range centroid

Surface water feature

Merced IRWM area

Concentration Charts:

Minimum Cr6 concentration

Mean Cr6 concentration

Maximum Cr6 concentration

MCL for Cr6 (1 mg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Hexavalent chromium (Cr6) concentrations shown in milligrams per liter (mg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.

N

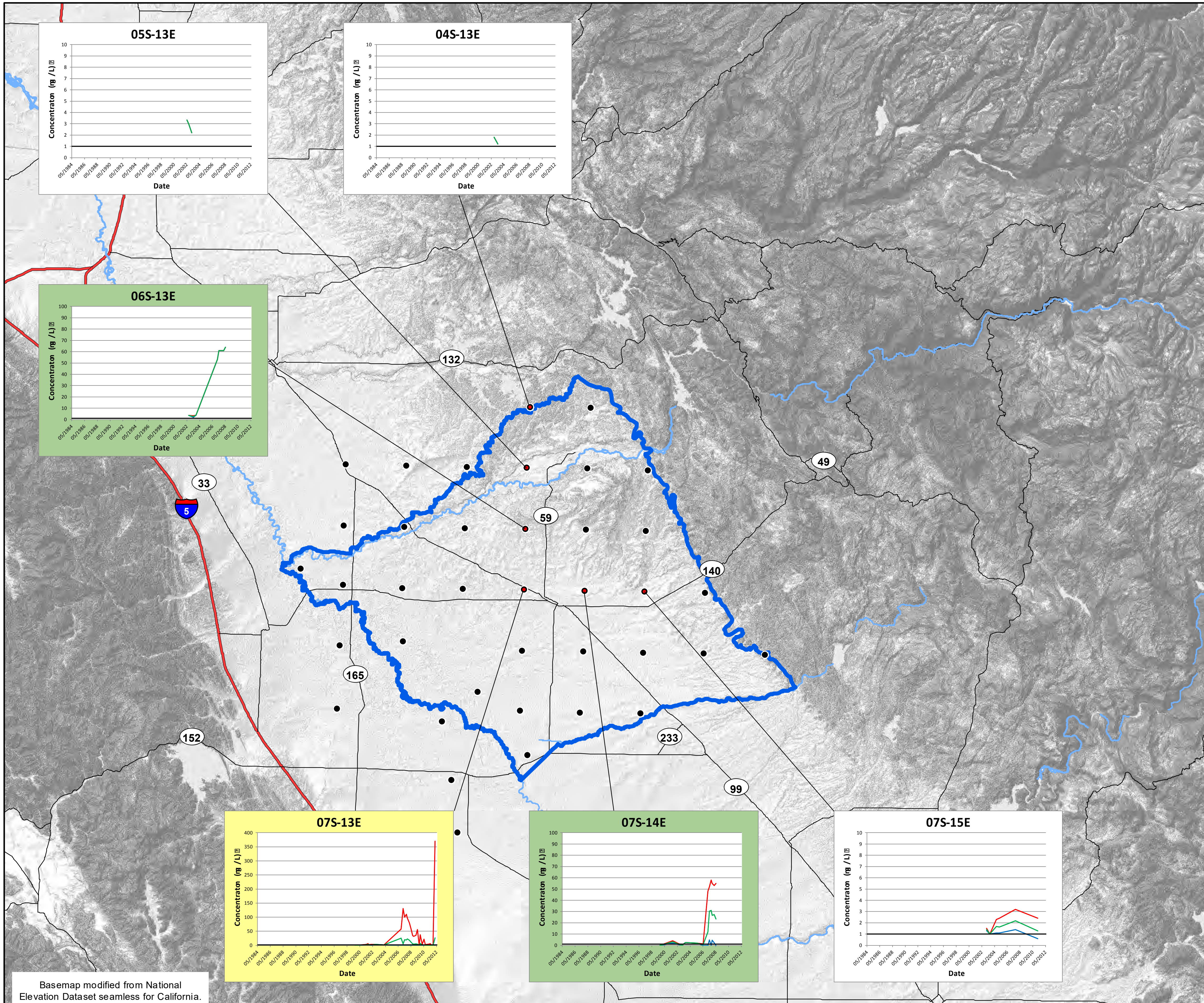
0 5 10

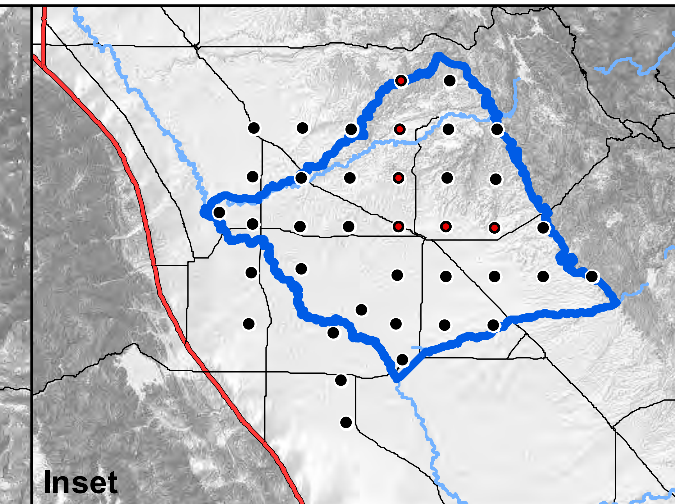
APPROXIMATE SCALE IN MILES

HEXAVALENT CHROMIUM (Cr6)
CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 6a

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig06a_Cr6.mxd





Explanation:

- Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum Cr6 concentration
- Mean Cr6 concentration
- Maximum Cr6 concentration
- MCL for Cr6 (1 mg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Hexavalent chromium (Cr6) concentrations shown in milligrams per liter (mg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.
4. Background color on graphs represent the y-axis range as follows:

White: 0 - 10 mg/L
Green: 0- 100 mg/L
Yellow: 0- 400 mg/L

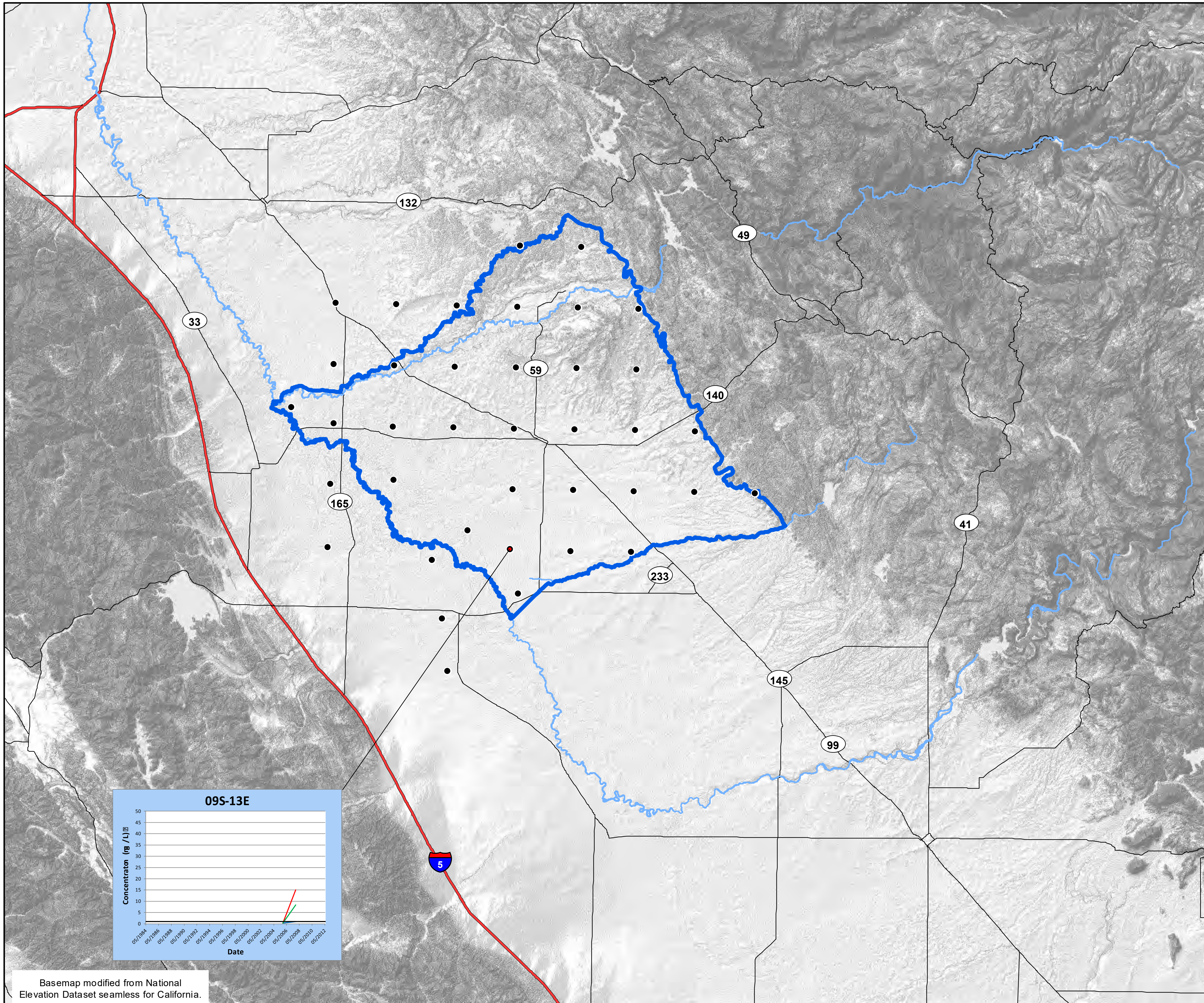
N

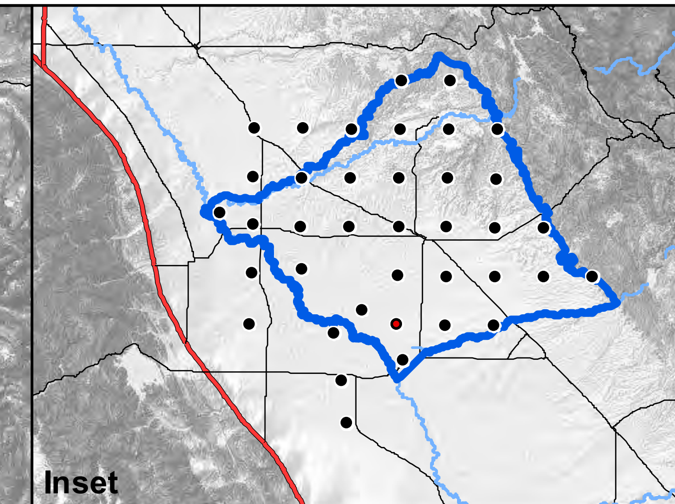
0 5 10
APPROXIMATE SCALE IN MILES

HEXAVALENT CHROMIUM (Cr6)
CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 6b

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig06b_Cr6.mxd





Explanation:

- Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum Cr6 concentration
- Mean Cr6 concentration
- Maximum Cr6 concentration
- MCL for Cr6 (1 mg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Hexavalent chromium (Cr6) concentrations shown in milligrams per liter (mg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.

N

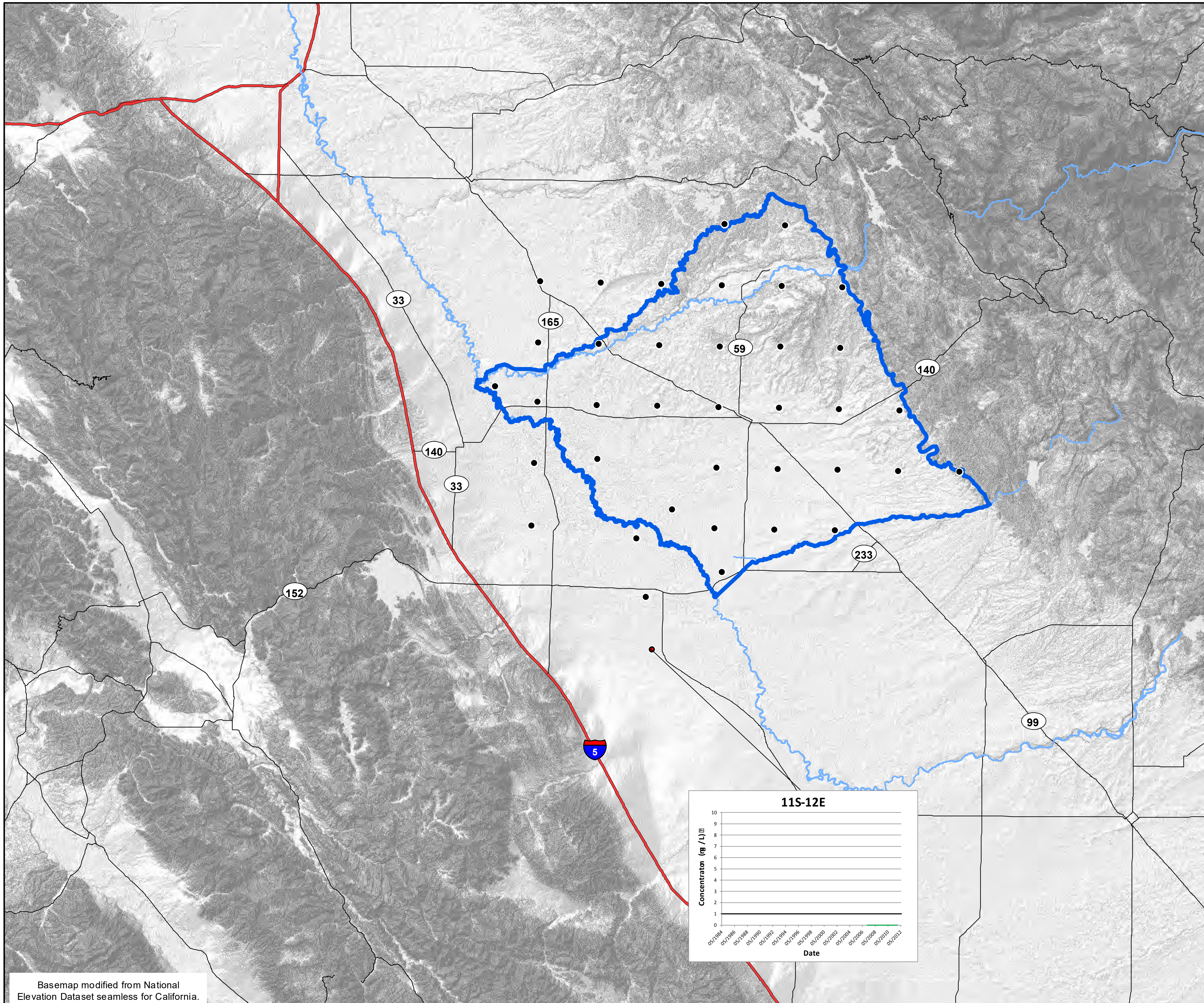
0 5 10

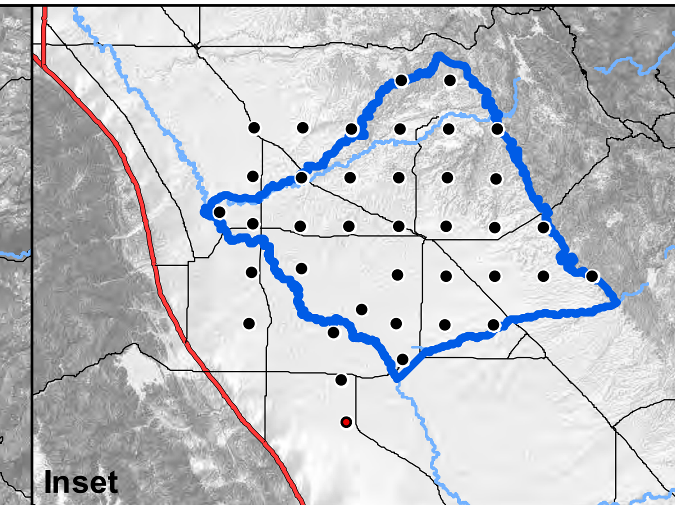
APPROXIMATE SCALE IN MILES

HEXAVALENT CHROMIUM (Cr6)
CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 6c

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig06c_Cr6.mxd





Explanation:

●/● Township/Range centroid

Surface water feature

Merced IRWM area

Concentration Charts:

Minimum Cr6 concentration

Mean Cr6 concentration

Maximum Cr6 concentration

MCL for Cr6 (1 mg/L)

Notes:
1. IRWMP = Integrated Regional Water Management Plan.
2. Hexavalent chromium (Cr6) concentrations shown in milligrams per liter (mg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.

N

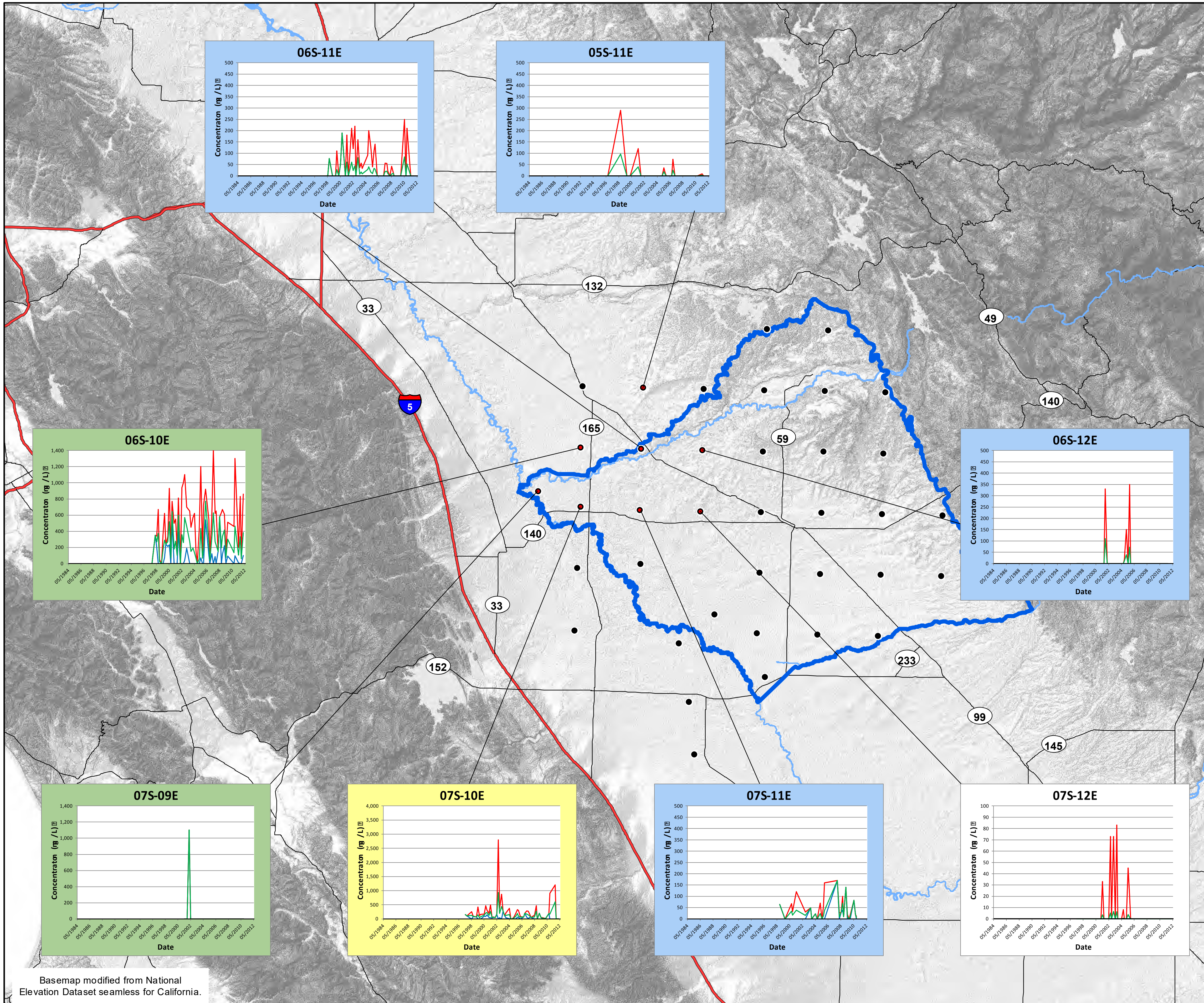
0 5 10

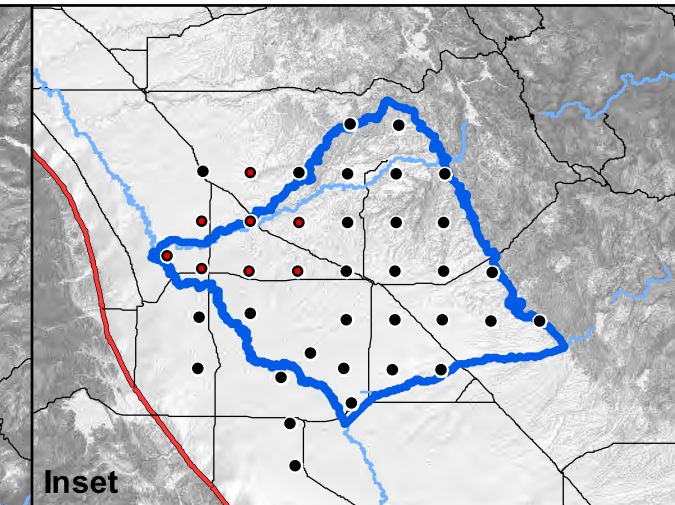
APPROXIMATE SCALE IN MILES

HEXAVALENT CHROMIUM (Cr6) CONCENTRATIONS 1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 6d

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig06d_Cr6.mxd





Explanation:

- Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum Mn concentration
- Mean Mn concentration
- Maximum Mn concentration
- SMCL for Mn (0.05 mg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Manganese (Mn) concentrations shown in milligrams per liter (mg/L).
3. Secondary Maximum Contaminant Level (SMCL) as established by the California Department of Public Heath
4. Background color on graphs represent the y-axis range as follows:

White: 0- 100 mg/L
Blue: 0- 500 mg/L
Green: 0- 1,400 mg/L
Yellow: 0- 4,000 mg/L

N

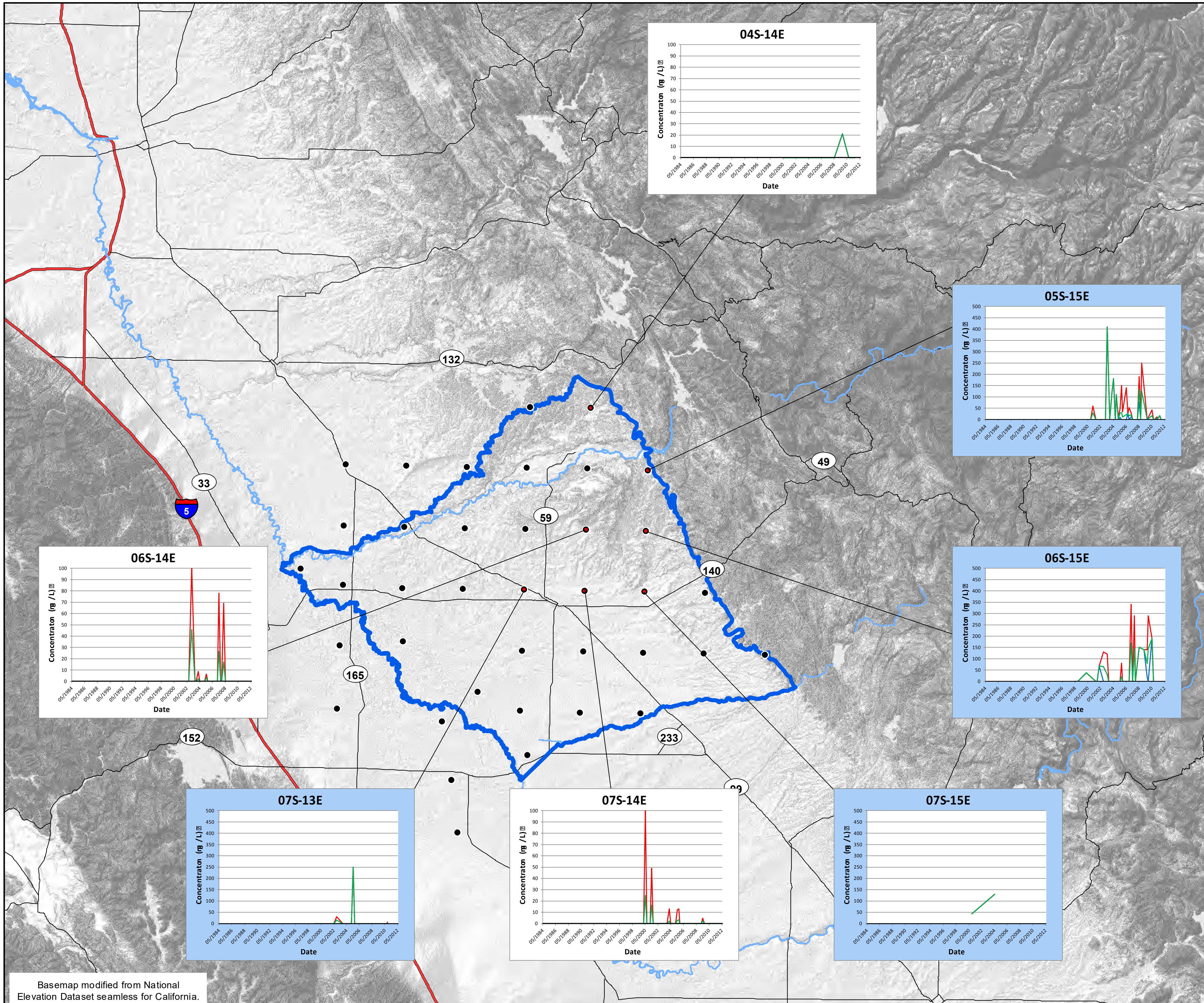
0 5 10

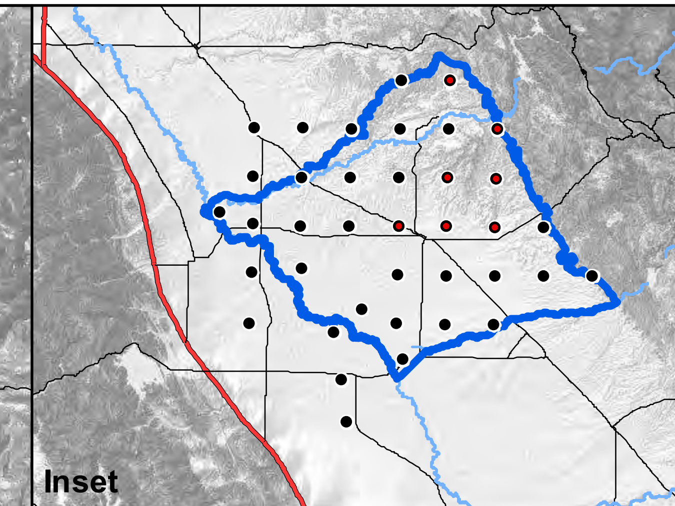
APPROXIMATE SCALE IN MILES

MANGANESE (Mn) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 7a

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig07a_Mn.mxd





Explanation:

- Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum Mn concentration
- Mean Mn concentration
- Maximum Mn concentration
- SMCL for Mn (0.05 mg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Manganese (Mn) concentrations shown in milligrams per liter (mg/L).
3. Secondary Maximum Contaminant Level (SMCL) as established by the California Department of Public Heath
4. Background color on graphs represent the y-axis range as follows:

White: 0- 100 mg/L
Blue: 0- 500 mg/L

N

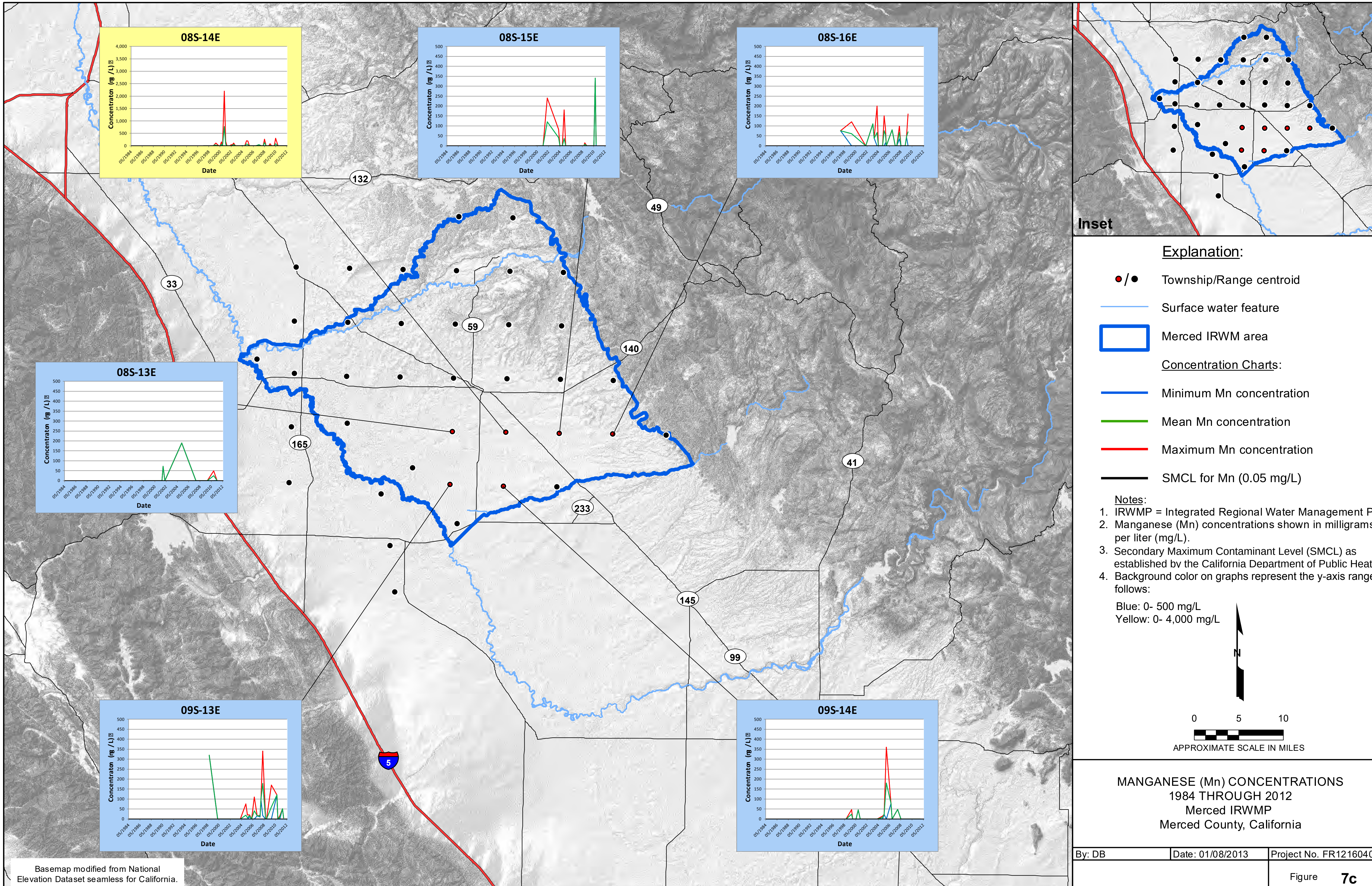
0 5 10

APPROXIMATE SCALE IN MILES

MANGANESE (Mn) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 7b

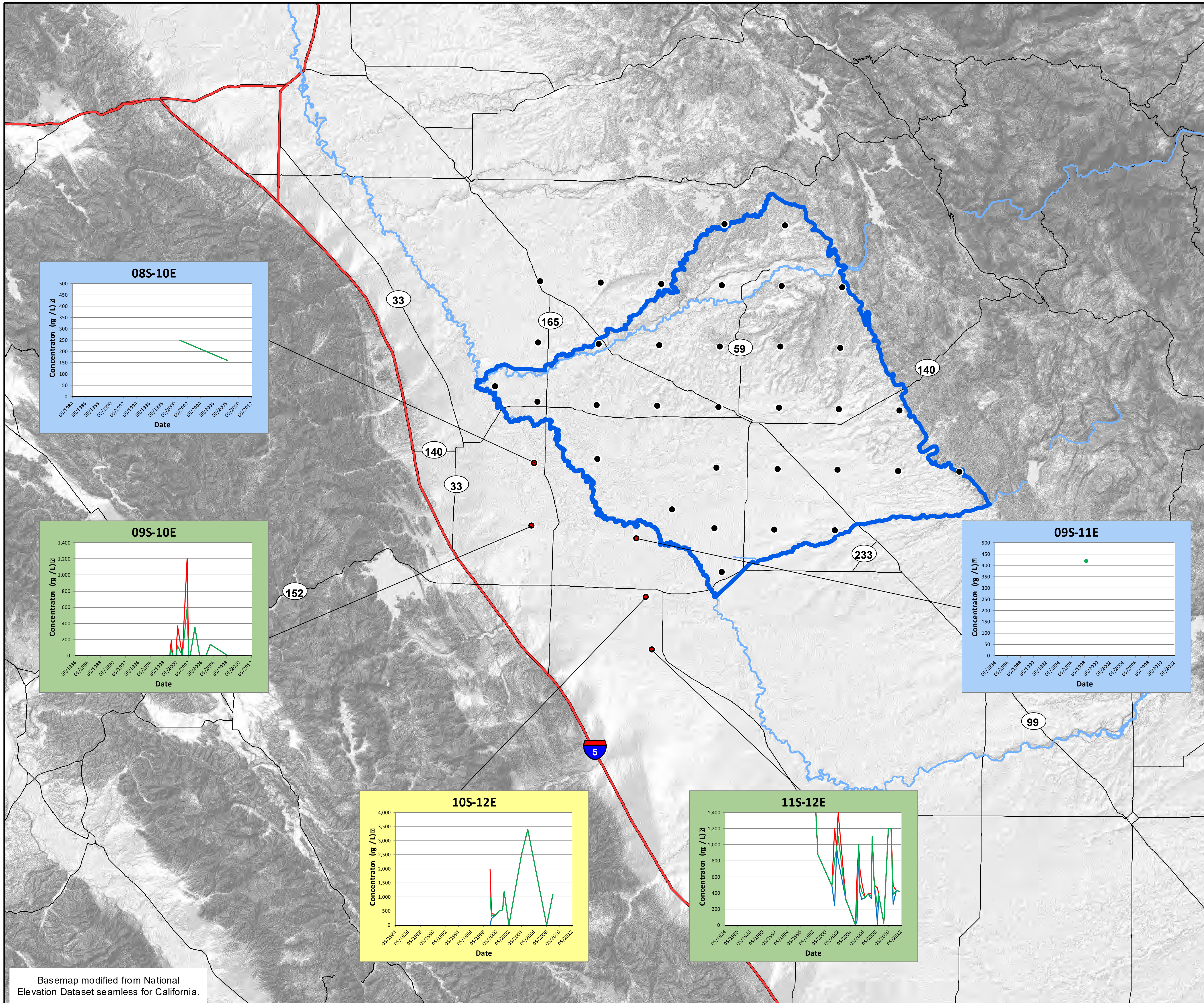
N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig07b_Mn.mxd

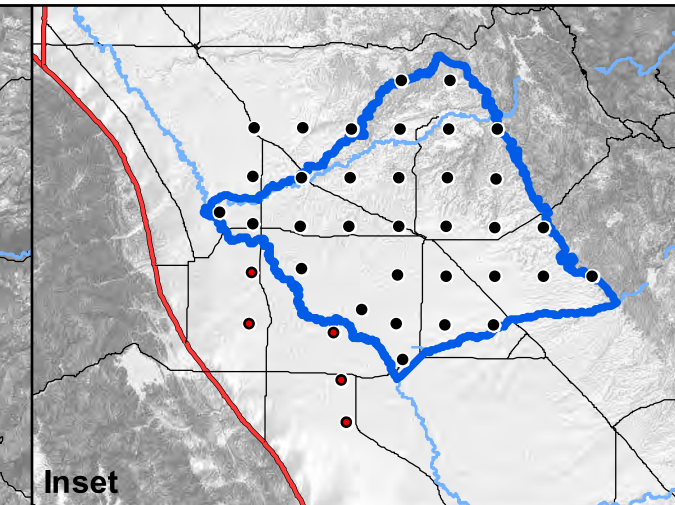


MANGANESE (Mn) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 7c

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig07c_Mn.mxd





Explanation:

●/● Township/Range centroid

Surface water feature

Merced IRWM area

Concentration Charts:

Minimum Mn concentration

Mean Mn concentration

Maximum Mn concentration

SMCL for Mn (0.05 mg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Manganese (Mn) concentrations shown in milligrams per liter (mg/L).
3. Secondary Maximum Contaminant Level (SMCL) as established by the California Department of Public Heath
4. Background color on graphs represent the y-axis range as follows:

Blue: 0- 500 mg/L
Green: 0- 1,400 mg/L
Yellow: 0- 4,000 mg/L

N

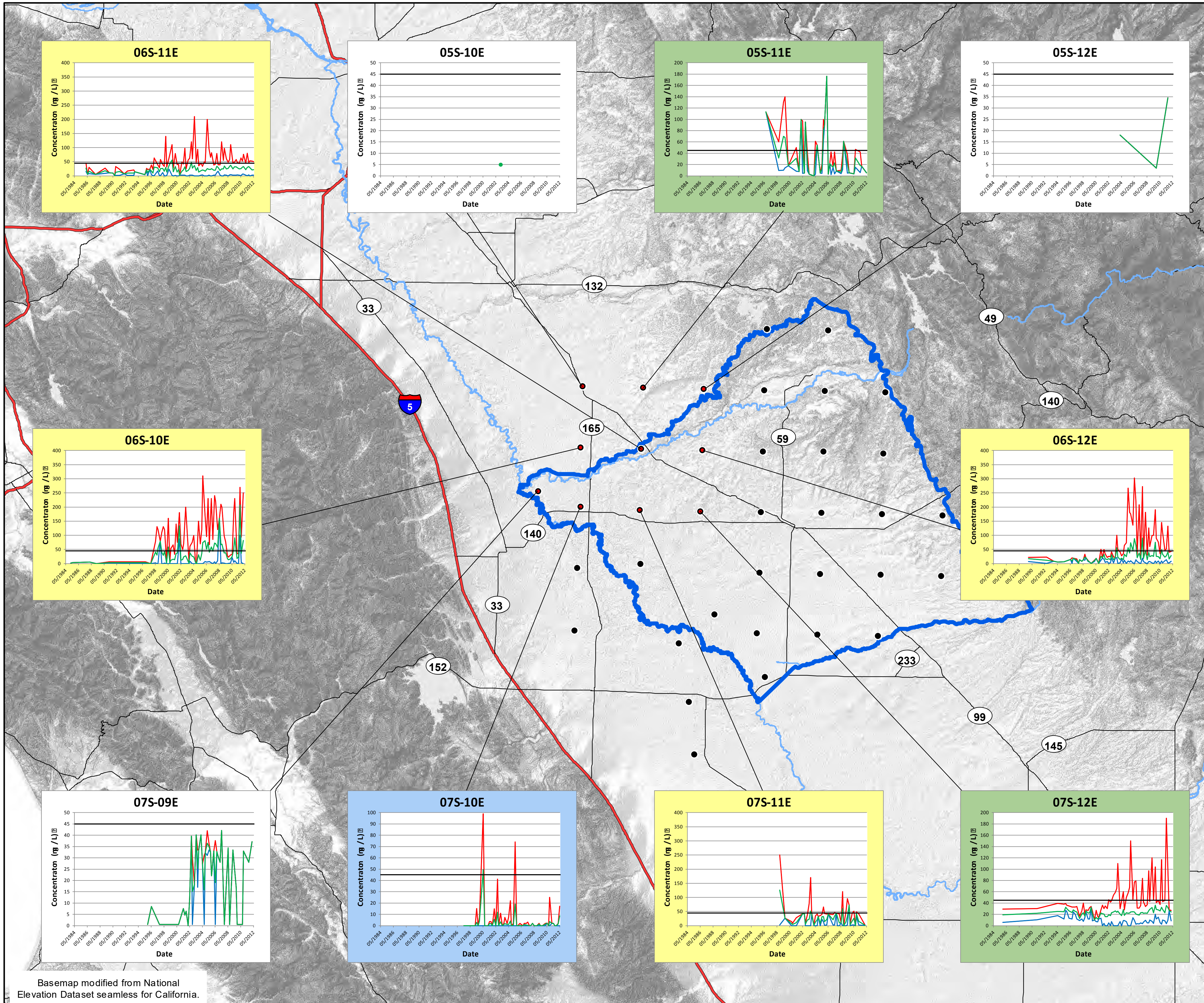
0 5 10

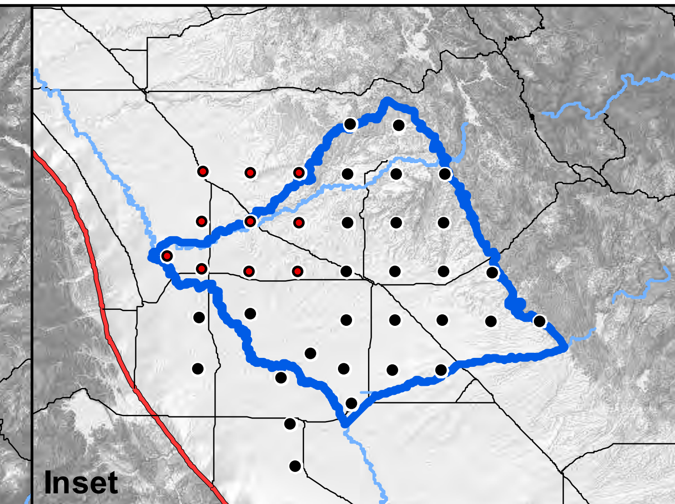
APPROXIMATE SCALE IN MILES

MANGANESE (Mn) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 7d

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig07d_Mn.mxd





<u>Explanation</u>:

●/● Township/Range centroid

Surface water feature

Merced IRWM area

<u>Concentration Charts</u>:

Minimum NO3 concentration

Mean NO3 concentration

Maximum NO3 concentration

MCL for NO3 (45 mg/L)

<u>Notes</u>:

1. IRWMP = Integrated Regional Water Management Plan.
2. Nitrate (NO3) concentrations shown in milligrams per liter (mg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.
4. Background color on graphs represent the y-axis range as follows:

White: 0- 50 mg/L
Blue: 0- 100 mg/L
Green: 0- 200 mg/L
Yellow: 0- 400 mg/L

N

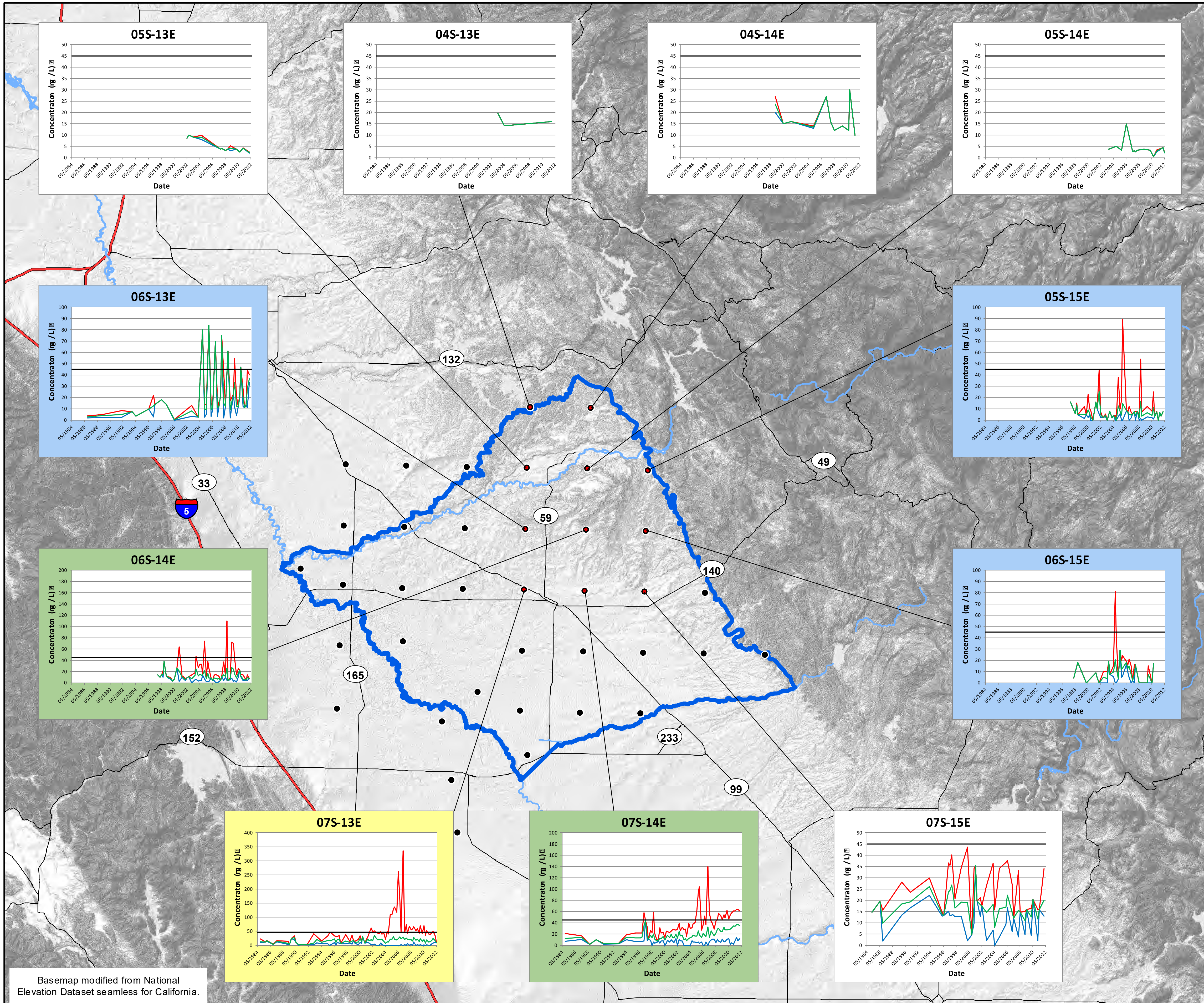
0 5 10

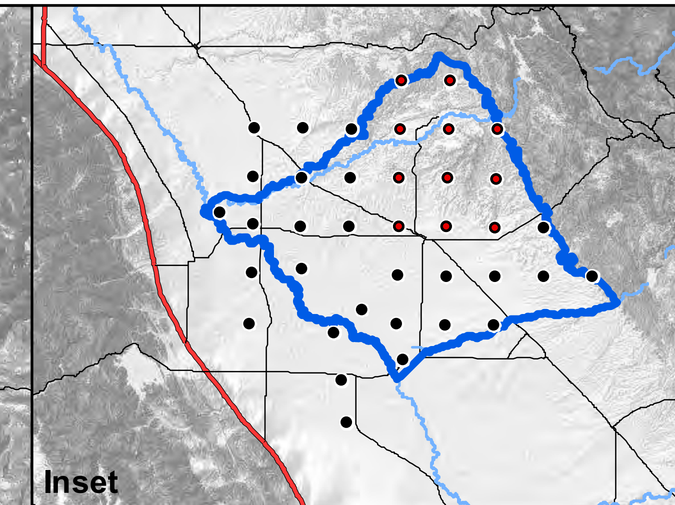
APPROXIMATE SCALE IN MILES

NITRATE (NO3) CONCENTRATIONS
1984 THROUGH 2012
Merced Salt and Nutrient Plan
Merced, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 8a

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig08a_NO3.mxd





Explanation:

Township/Range centroid

Surface water feature

Merced IRWM area

Concentration Charts:

Minimum NO3 concentration

Mean NO3 concentration

Maximum NO3 concentration

MCL for NO3 (45 mg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Nitrate (NO3) concentrations shown in milligrams per liter (mg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.
4. Background color on graphs represent the y-axis range as follows:

White: 0- 50 mg/L
Blue: 0- 100 mg/L
Green: 0- 200 mg/L
Yellow: 0- 400 mg/L

N

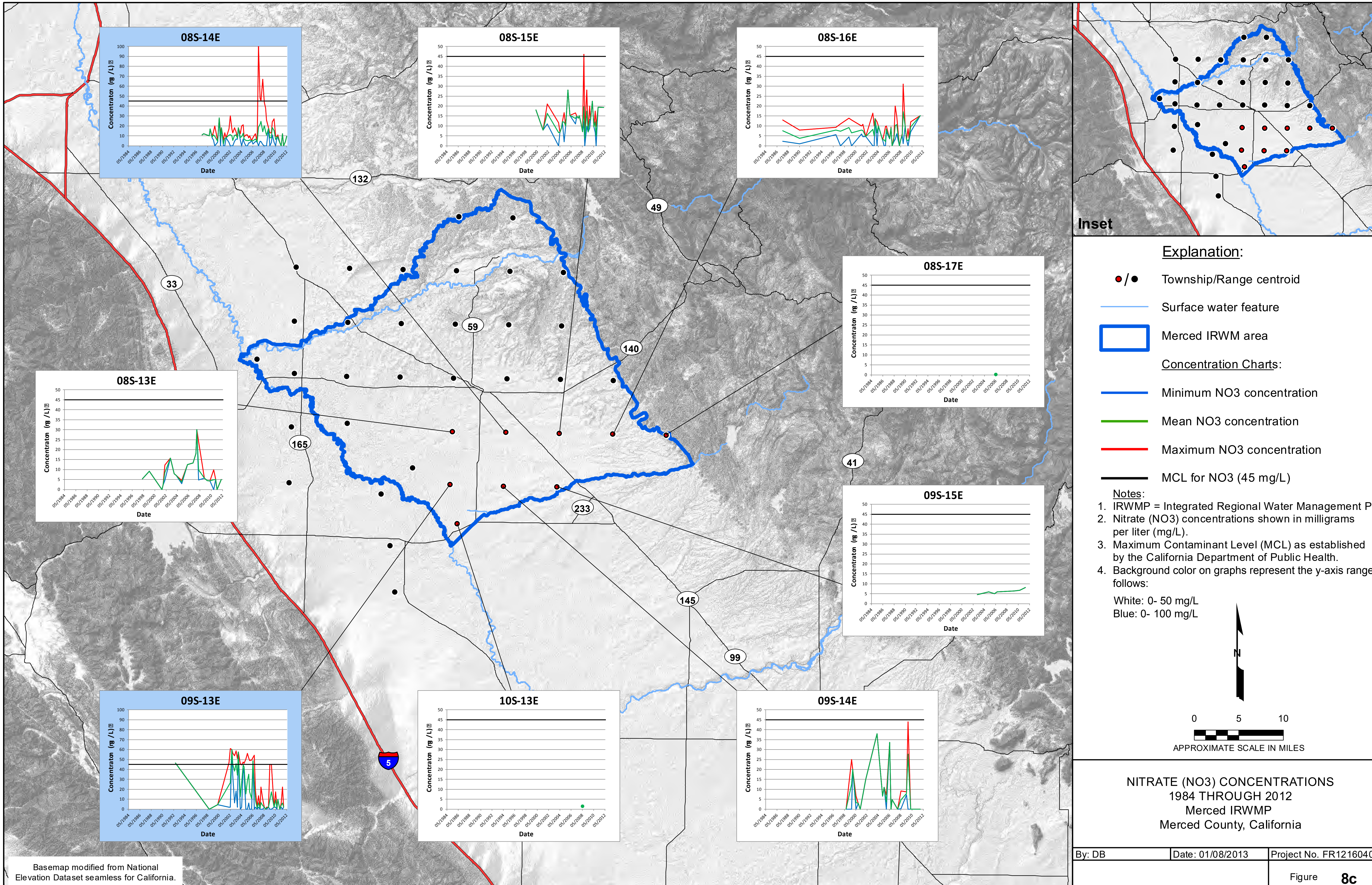
0 5 10

APPROXIMATE SCALE IN MILES

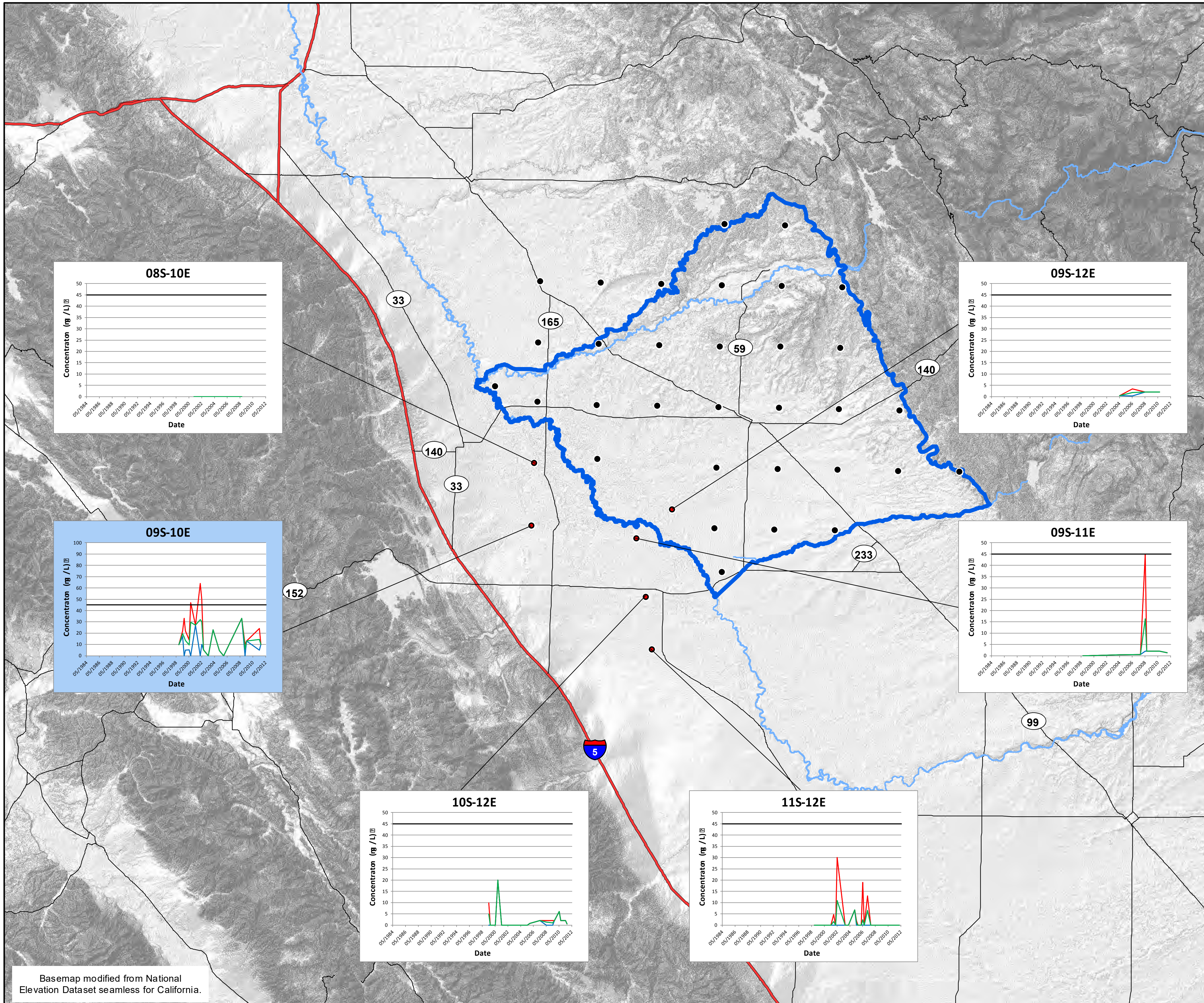
NITRATE (NO3) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

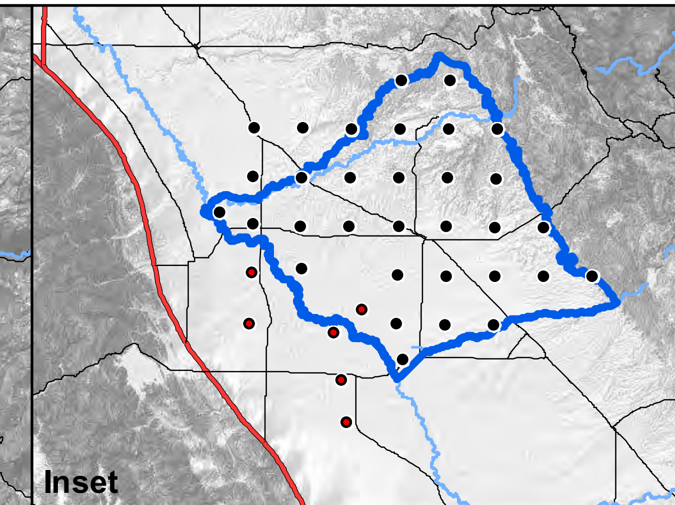
By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 8b

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig08b_NO3.mxd



N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig08c_NO3.mxd





Explanation:

- Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum NO3 concentration
- Mean NO3 concentration
- Maximum NO3 concentration
- MCL for NO3 (45 mg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Nitrate (NO3) concentrations shown in milligrams per liter (mg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.
4. Background color on graphs represent the y-axis range as follows:

White: 0- 50 mg/L
Blue: 0- 100 mg/L

N

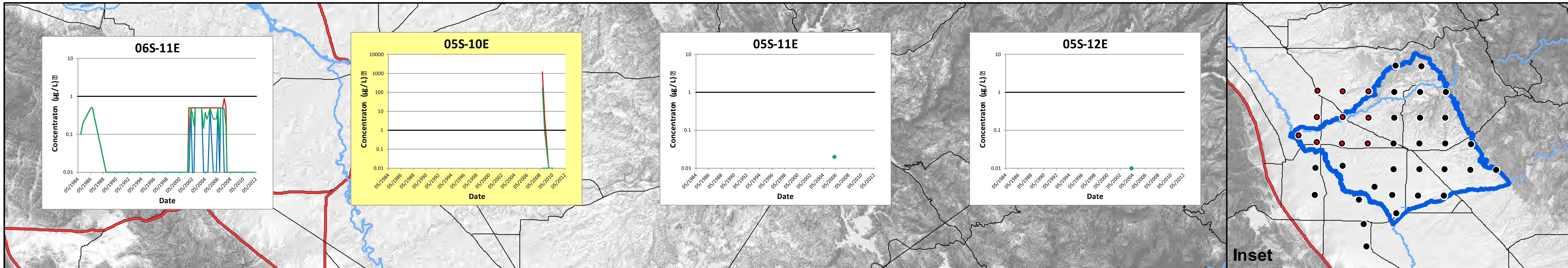
0 5 10

APPROXIMATE SCALE IN MILES

NITRATE (NO3) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 8d

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig08d_NO3.mxd



Explanation:

- Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum benzene concentration
- Mean benzene concentration
- Maximum benzene concentration
- MCL for benzene (1 µg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Benzene concentrations shown in micrograms per liter (µg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.
4. Background color on graphs represent the y-axis range as follows:

White: 0.01- 10 µg/L
Blue: 0.01- 100 µg/L
Green: 0.01- 1,000 µg/L
Yellow: 0.01- 10,000 µg/L

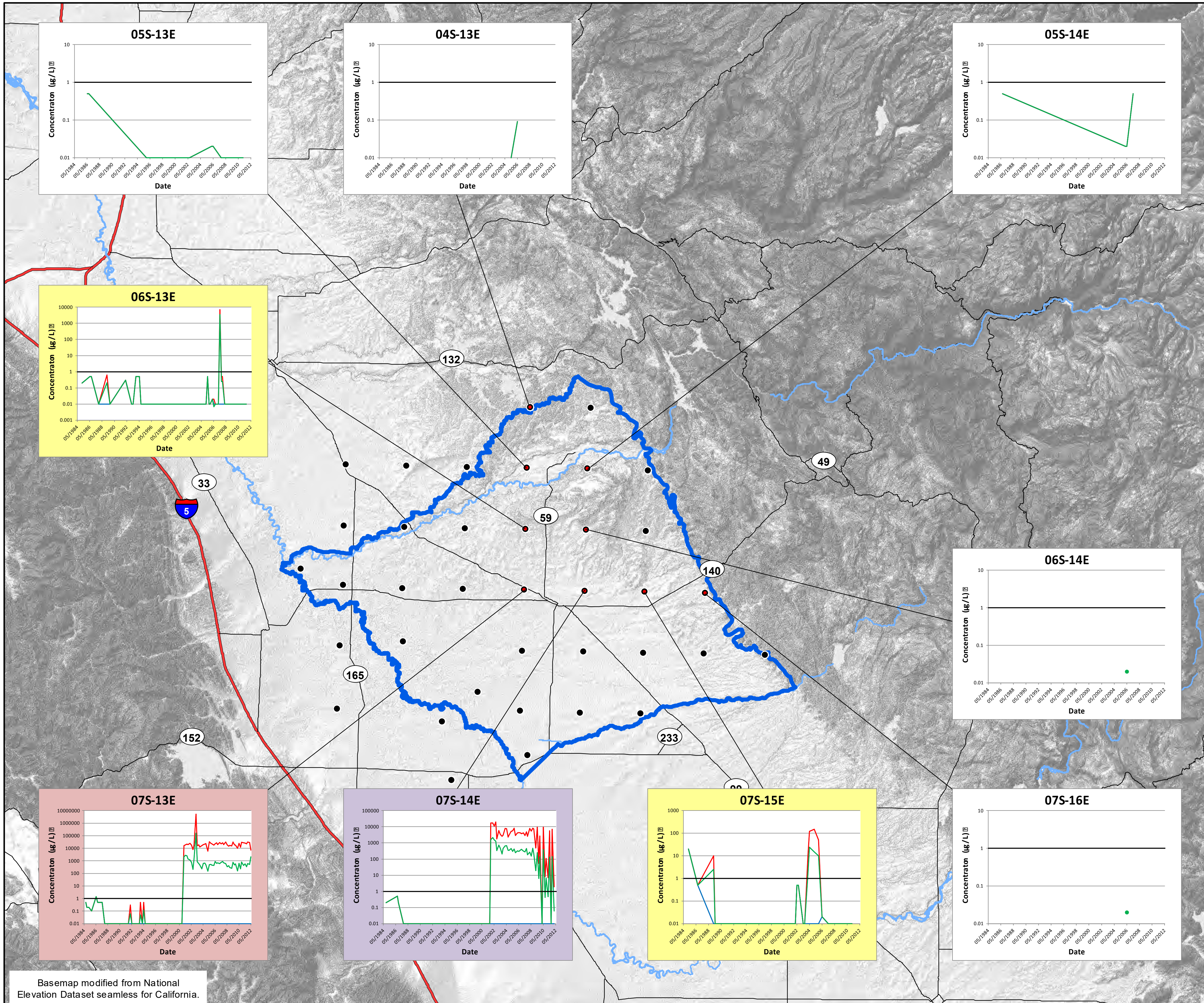
N

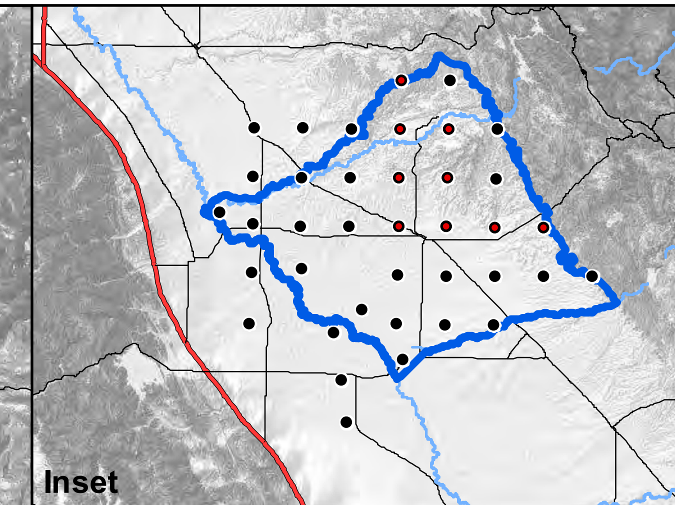
0 5 10

APPROXIMATE SCALE IN MILES

BENZENE CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure **10a**





Explanation:

- Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum benzene concentration
- Mean benzene concentration
- Maximum benzene concentration
- MCL for benzene (1 µg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Benzene concentrations shown in micrograms per liter (µg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.
4. Background color on graphs represent the y-axis range as follows:

White: 0.01- 10 µg/L
Yellow: 0.01- 1,000 µg/L
Purple: 0.01- 100,000 µg/L
Pink: 0.01- 10,000,000 µg/L

N

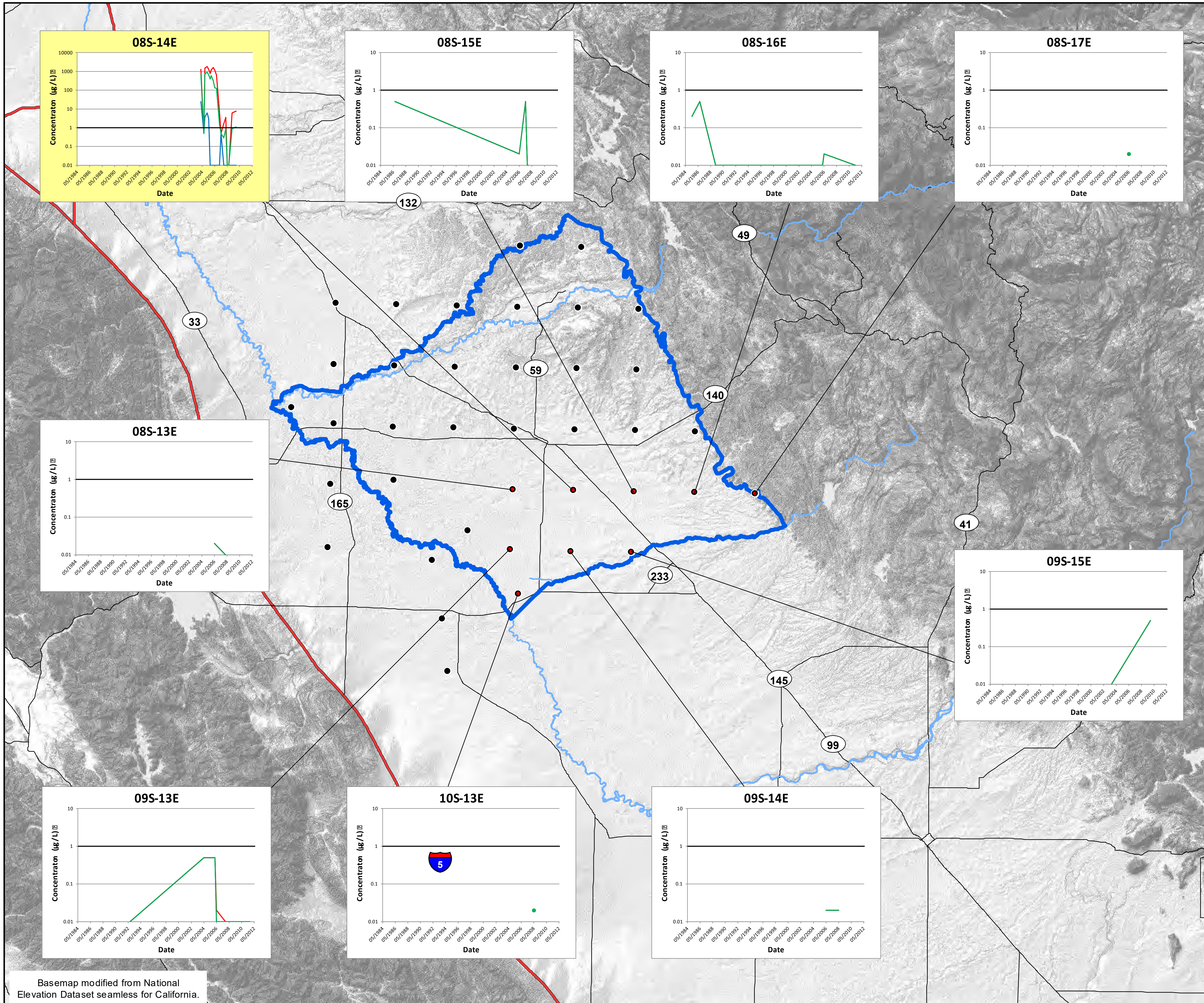
0 5 10

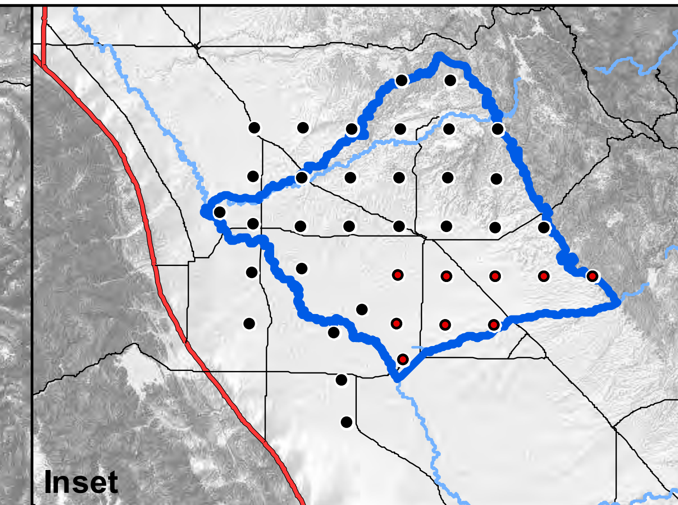
APPROXIMATE SCALE IN MILES

BENZENE CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 12/05/2012	Project No. FR1216040A
		Figure 10b

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig10b_Benzene.mxd





Explanation:

- ●/● Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum benzene concentration
- Mean benzene concentration
- Maximum benzene concentration
- MCL for benzene (1 µg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Benzene concentrations shown in micrograms per liter (µg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.
4. Background color on graphs represent the y-axis range as follows:
   White: 0.01- 10 µg/L
   Yellow: 0.01- 10,000 µg/L

N

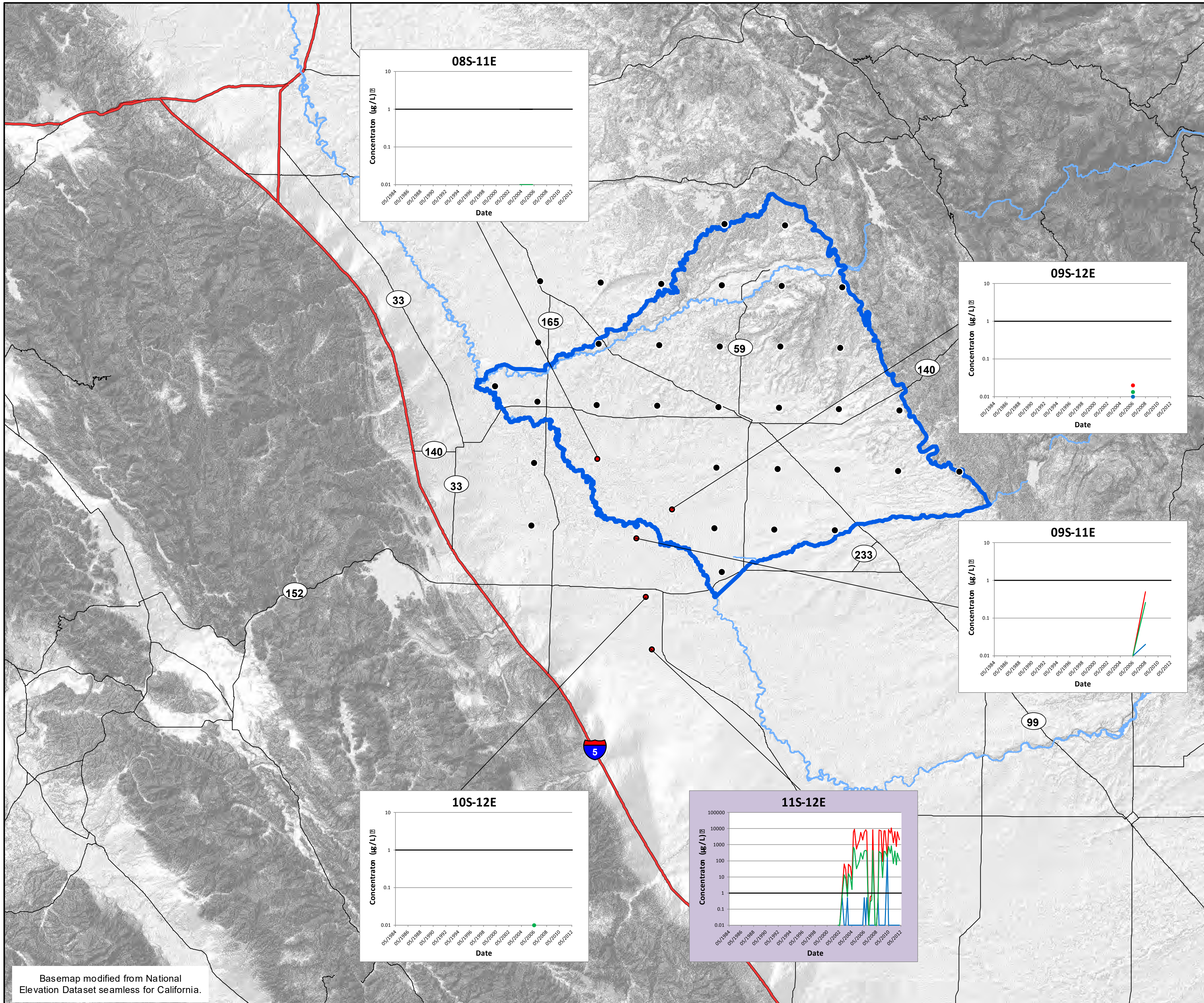
0 5 10

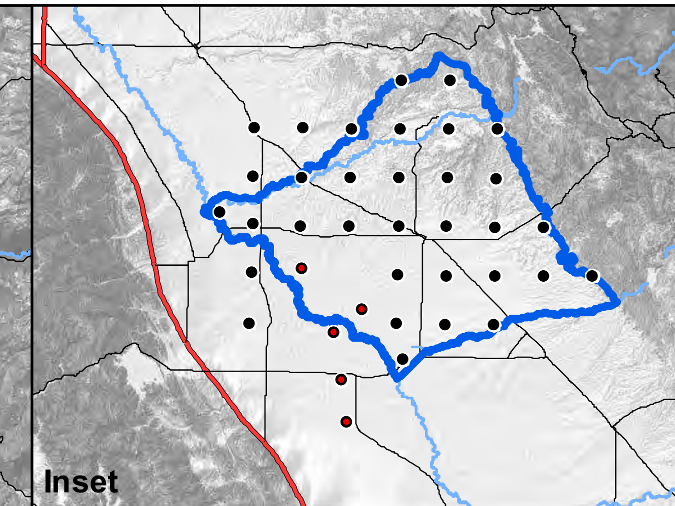
APPROXIMATE SCALE IN MILES

BENZENE CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 10c

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig10c_Benzene.mxd





Explanation:

- Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum benzene concentration
- Mean benzene concentration
- Maximum benzene concentration
- MCL for benzene (1 µg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Benzene concentrations shown in micrograms per liter (µg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.
4. Background color on graphs represent the y-axis range as follows:
   White: 0.01- 10 µg/L
   Purple: 0.01- 100,000 µg/L

N

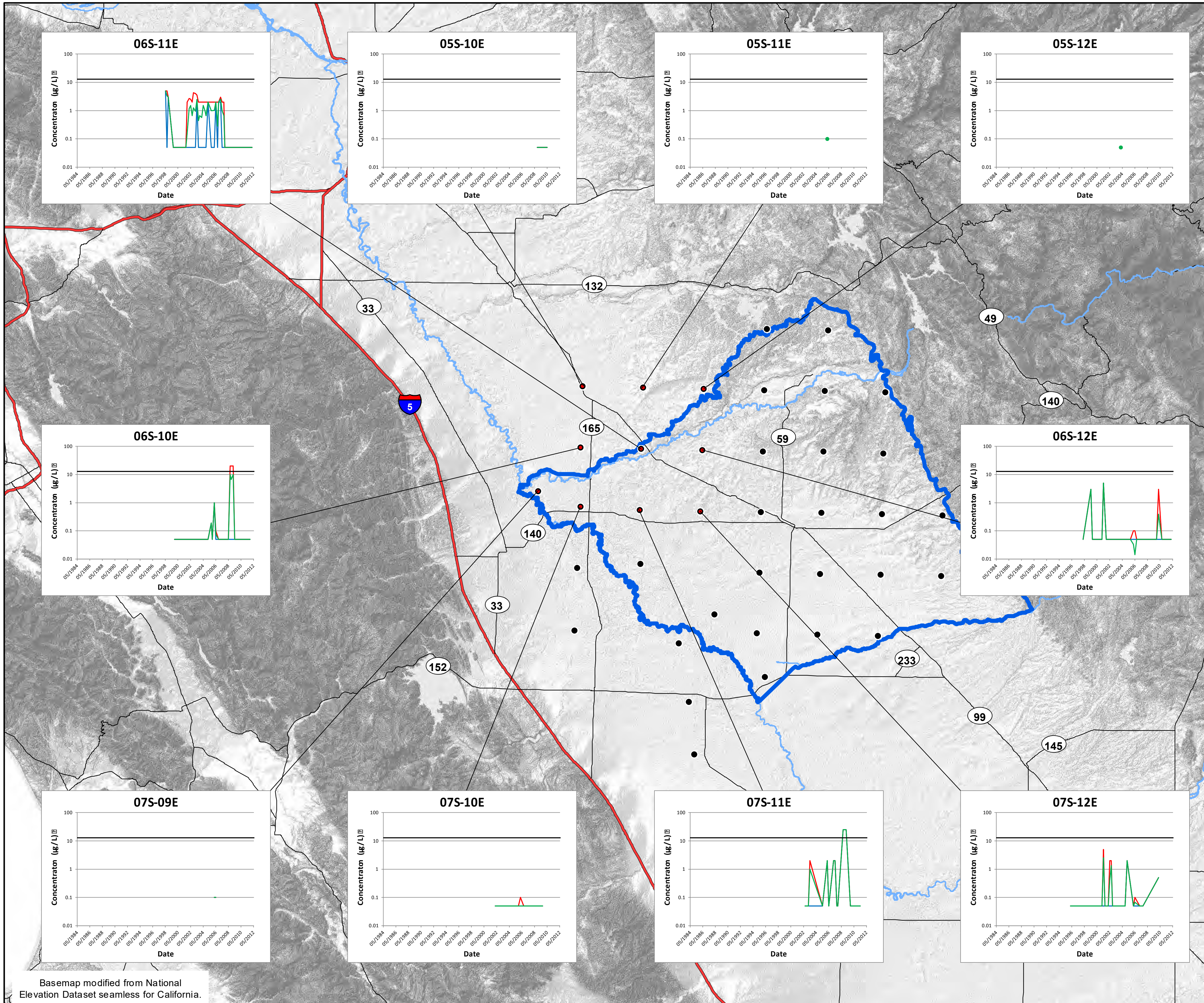
0 5 10

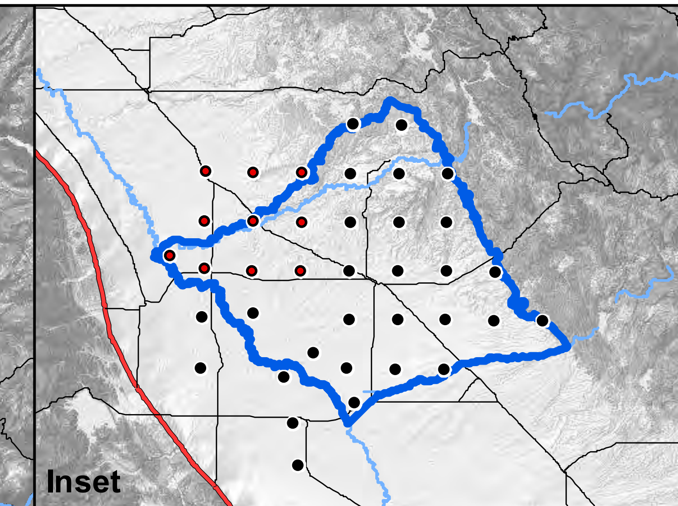
APPROXIMATE SCALE IN MILES

BENZENE CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure **10d**

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig10d_Benzene.mxd





Explanation:

- Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum MTBE concentration
- Mean MTBE concentration
- Maximum MTBE concentration
- MCL for MTBE (13 µg/L)

Notes:
1. IRWMP = Integrated Regional Water Management Plan.
2. Methyl Tertiary Butyl Ether (MTBE)concentrations shown in micrograms per liter (µg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.

N

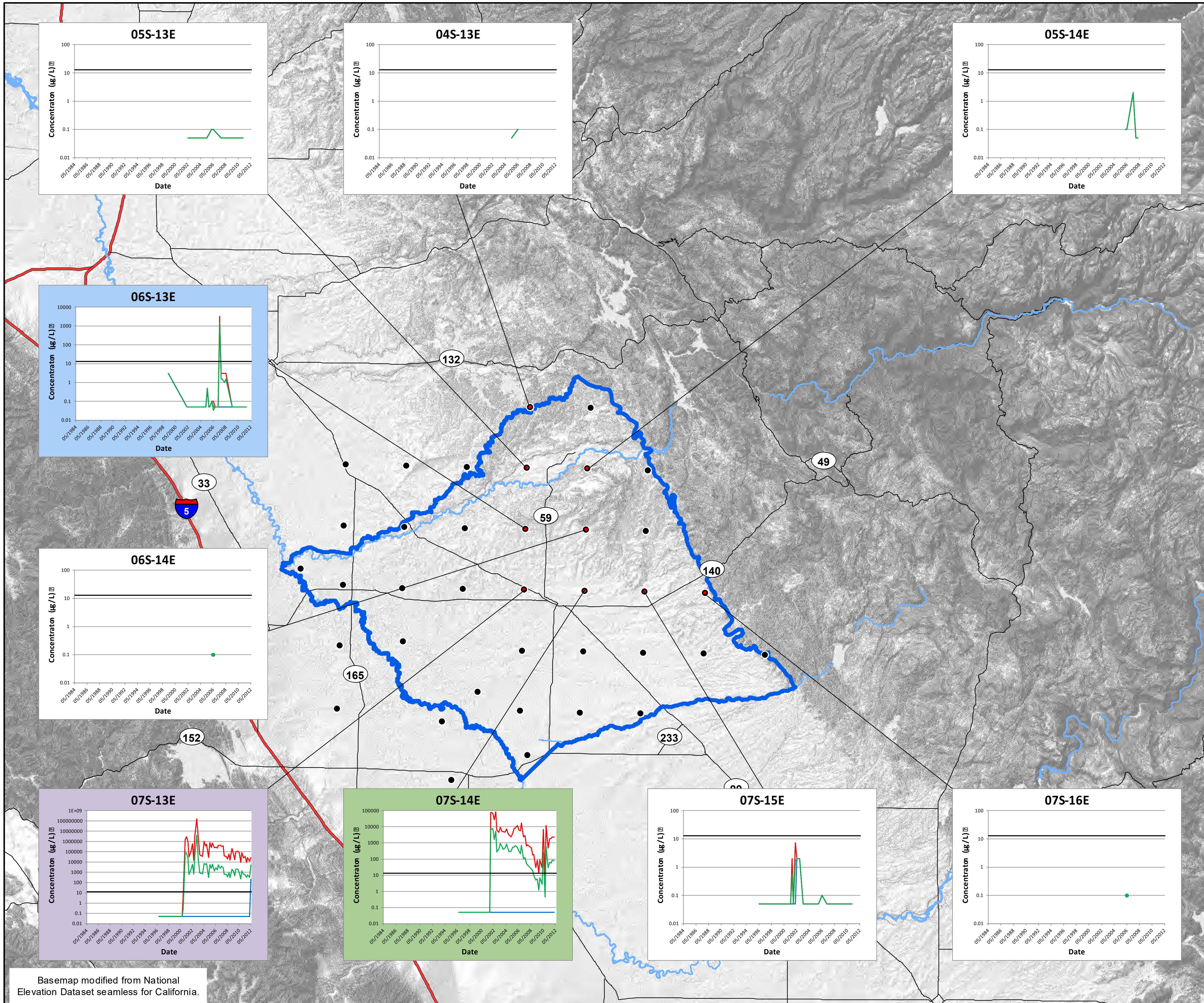
0 5 10

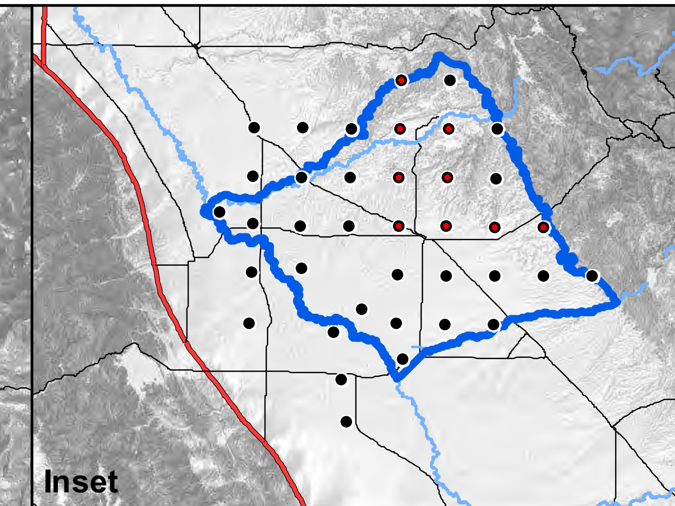
APPROXIMATE SCALE IN MILES

METHYL TERTIARY BUTYL ETHER (MTBE)
CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 11a

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig11a_MTBE.mxd





Explanation:

Township/Range centroid

Surface water feature

Merced IRWM area

Concentration Charts:

Minimum MTBE concentration

Mean MTBE concentration

Maximum MTBE concentration

MCL for MTBE (13 µg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Methyl Tertiary Butyl Ether (MTBE)concentrations shown in micrograms per liter (µg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.
4. Background color on graphs represent the y-axis range as follows:

White: 0.01- 100 µg/L
Blue: 0.01- 10,000 µg/L
Green: 0.01- 100,000 µg/L
Purple:0.01- 1,000,000,000 µg/L

N

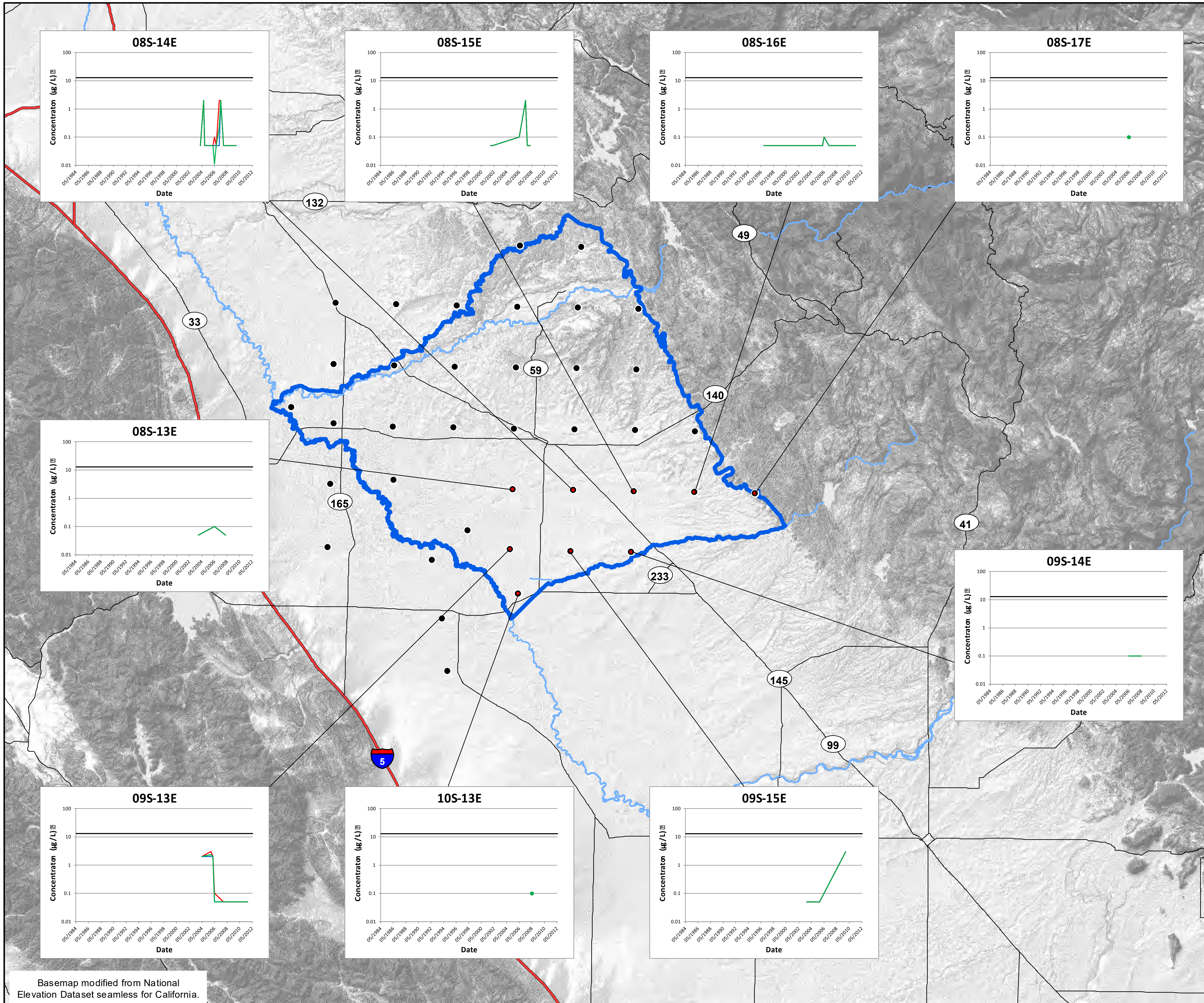
0 5 10

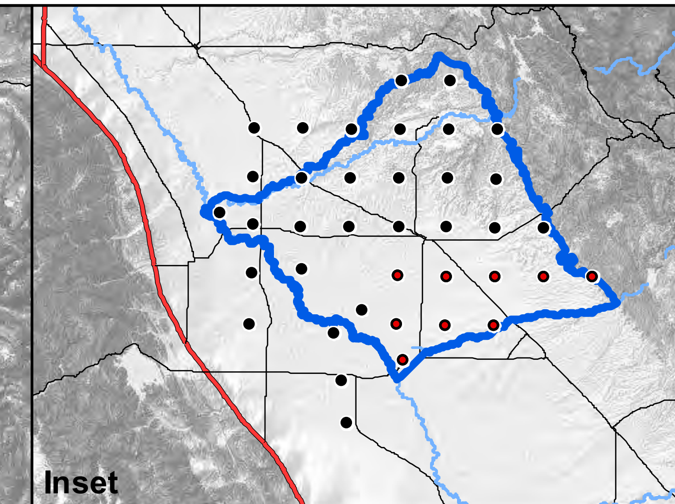
APPROXIMATE SCALE IN MILES

METHYL TERTIARY BUTYL ETHER (MTBE) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 12/05/2012	Project No. FR1216040A
		Figure **11b**

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig11b_MTBE.mxd





Explanation:

Township/Range centroid

Surface water feature

Merced IRWM area

Concentration Charts:

Minimum MTBE concentration

Mean MTBE concentration

Maximum MTBE concentration

MCL for MTBE (13 µg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Methyl Tertiary Butyl Ether (MTBE)concentrations shown in micrograms per liter (µg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.

N

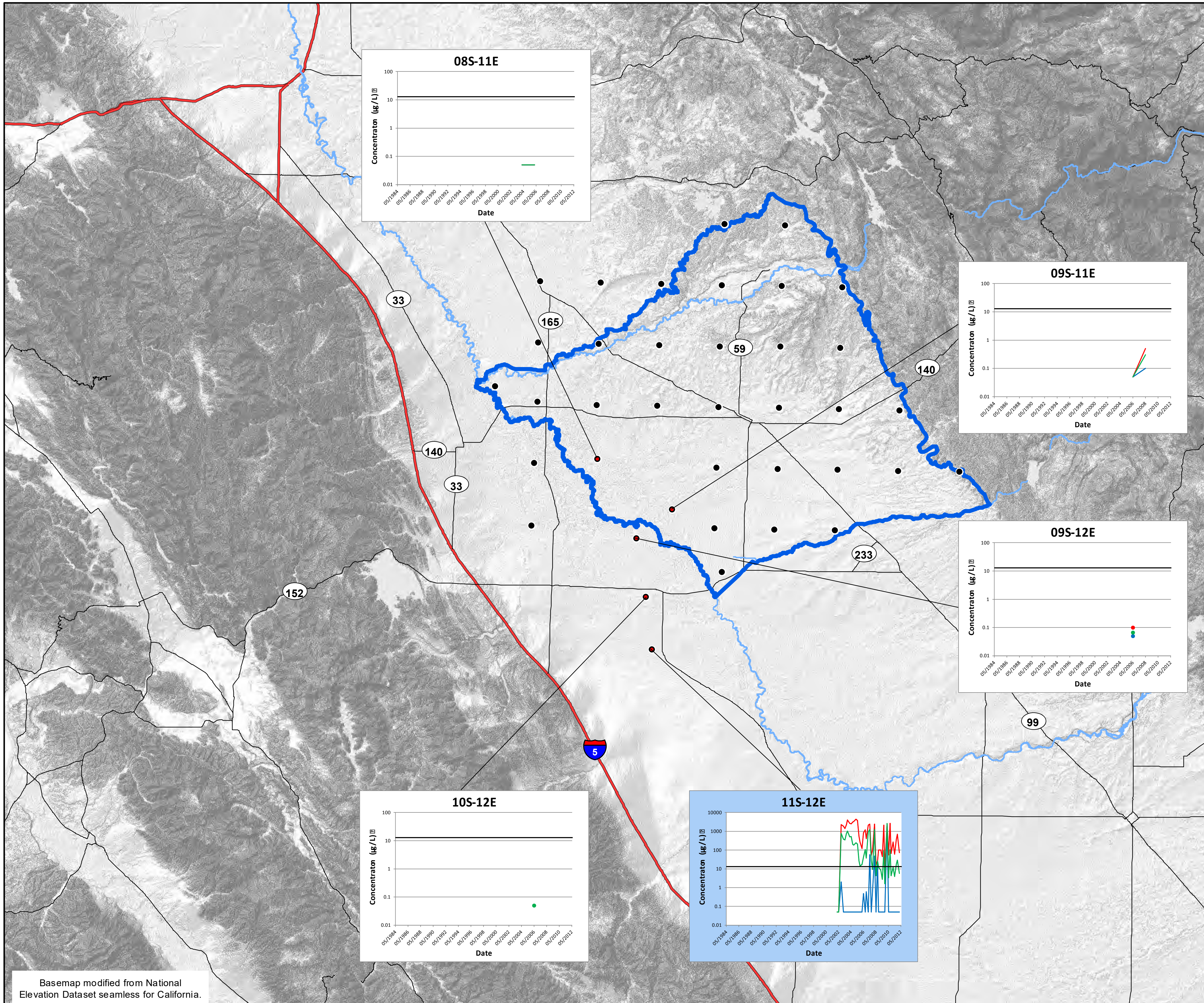
0 5 10

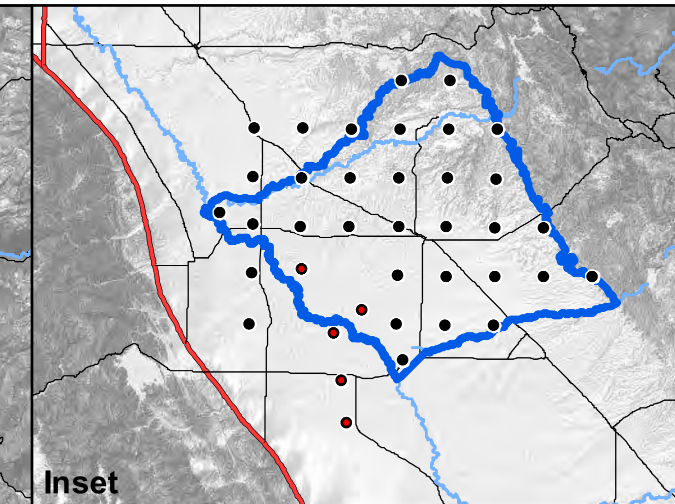
APPROXIMATE SCALE IN MILES

METHYL TERTIARY BUTYL ETHER (MTBE) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 11c

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig11c_MTBE.mxd





Explanation:

Township/Range centroid

Surface water feature

Merced IRWM area

Concentration Charts:

Minimum MTBE concentration

Mean MTBE concentration

Maximum MTBE concentration

MCL for MTBE (13 µg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Methyl Tertiary Butyl Ether (MTBE)concentrations shown in micrograms per liter (µg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.
4. Background color on graphs represents concentration

White: 0.01- 100 µg/L

Blue: 0.01-10,000 µg/L

N

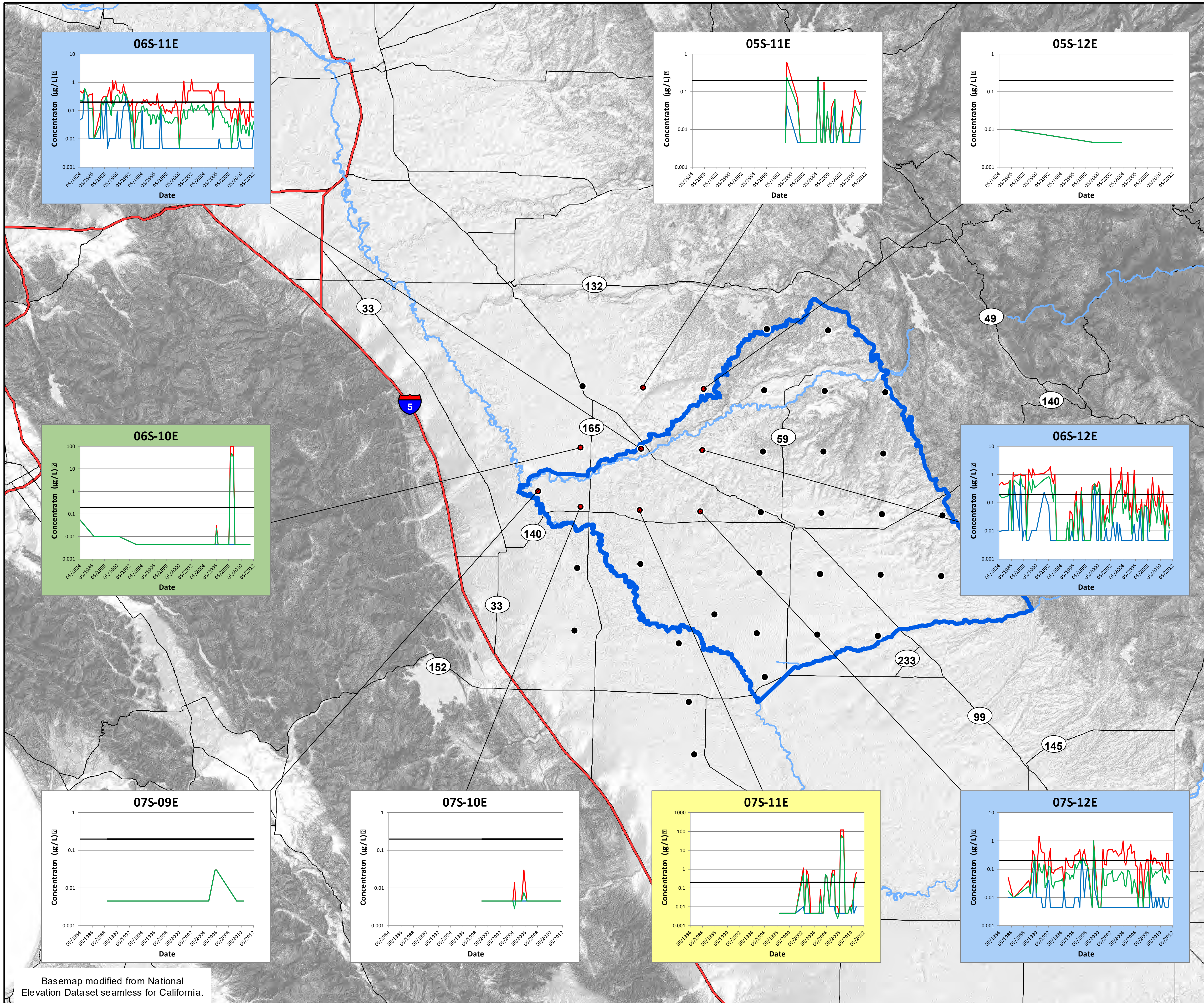
0 5 10

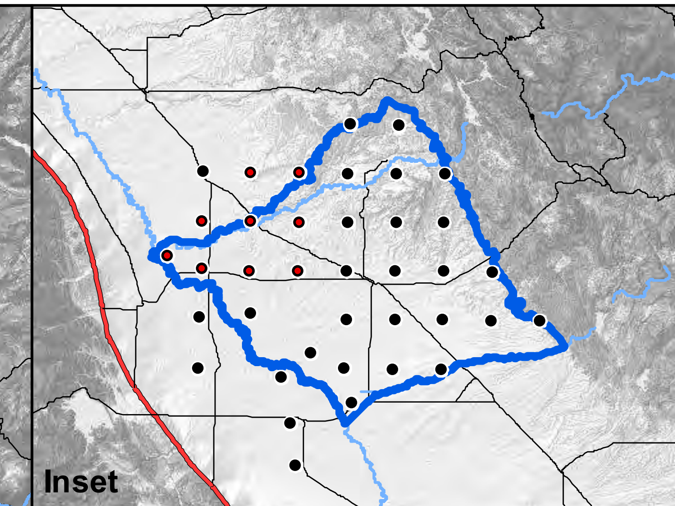
APPROXIMATE SCALE IN MILES

METHYL TERTIARY BUTYL ETHER (MTBE) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 12/05/2012	Project No. FR1216040A
		Figure 11d

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig11d_MTBE.mxd





Explanation:

Township/Range centroid

Surface water feature

Merced IRWM area

Concentration Charts:

Minimum DBCP concentration

Mean DBCP concentration

Maximum DBCP concentration

MCL for DBCP (0.2 µg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Dibromochloropropane (DBCP) concentrations shown in micrograms per liter (µg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.
4. Background color on graphs represent the y-axis range as follows:

White 0.001- 1 µg/L
Blue 0.001- 10 µg/L
Green 0.001- 100 µg/L
Yellow 0.001- 1,000 µg/L

N

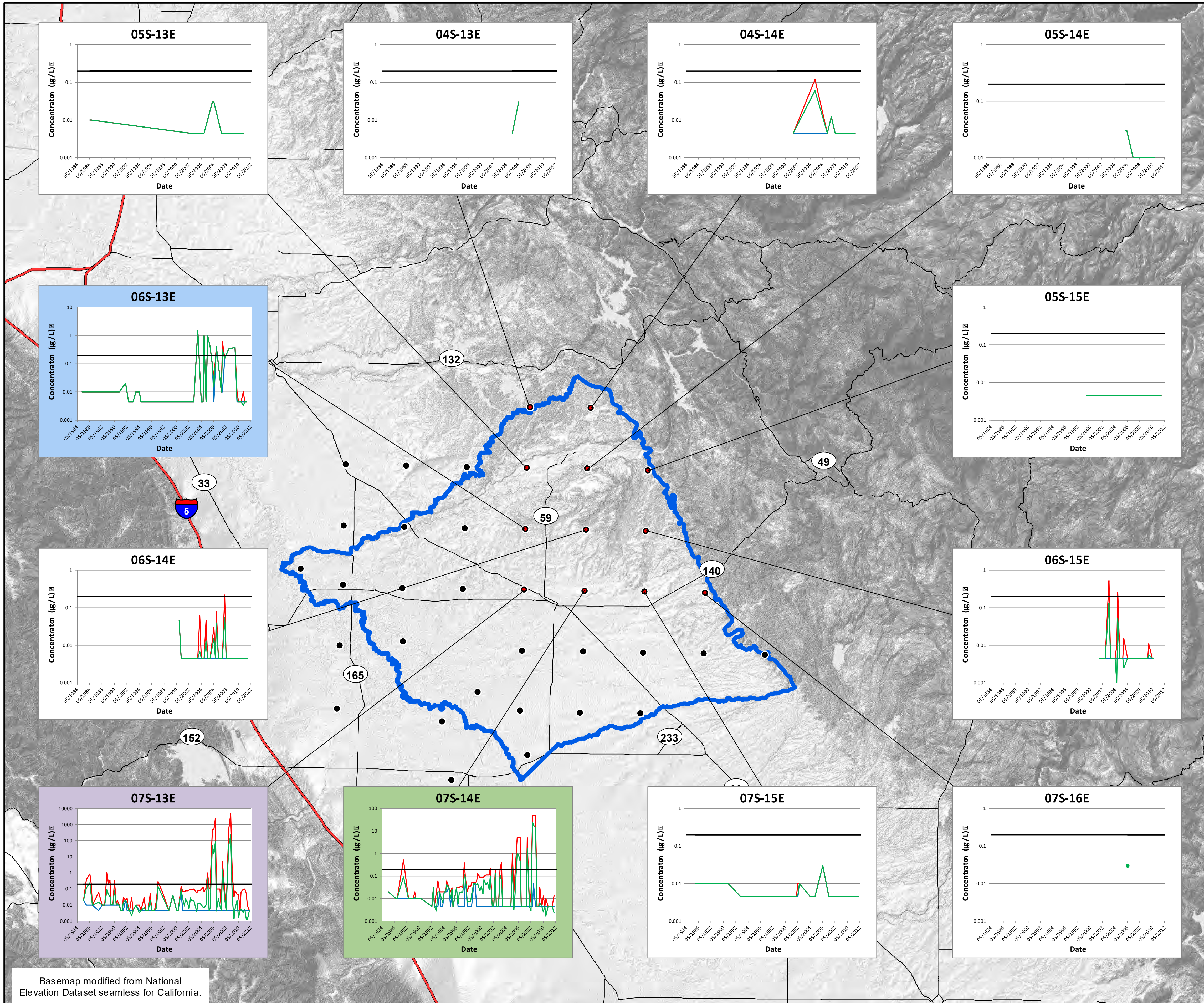
0 5 10

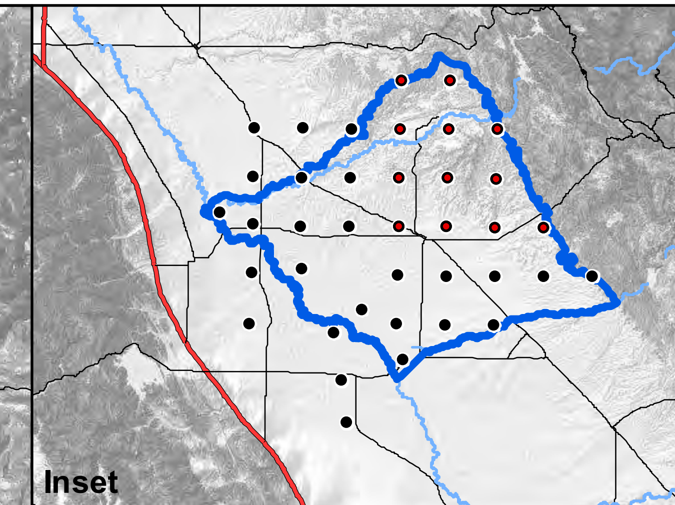
APPROXIMATE SCALE IN MILES

DIBROMOCHLOROPROPANE (DBCP)
CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 12a

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig12a_DBCP.mxd





Explanation:

- Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum DBCP concentration
- Mean DBCP concentration
- Maximum DBCP concentration
- MCL for DBCP (0.2 µg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Dibromochloropropane (DBCP) concentrations shown in micrograms per liter (µg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.
4. Background color on graphs represent the y-axis range as follows:

White: 0.001- 1 µg/L
Blue: 0.001- 10 µg/L
Green: 0.001- 100 µg/L
Purple: 0.001- 10,000 µg/L

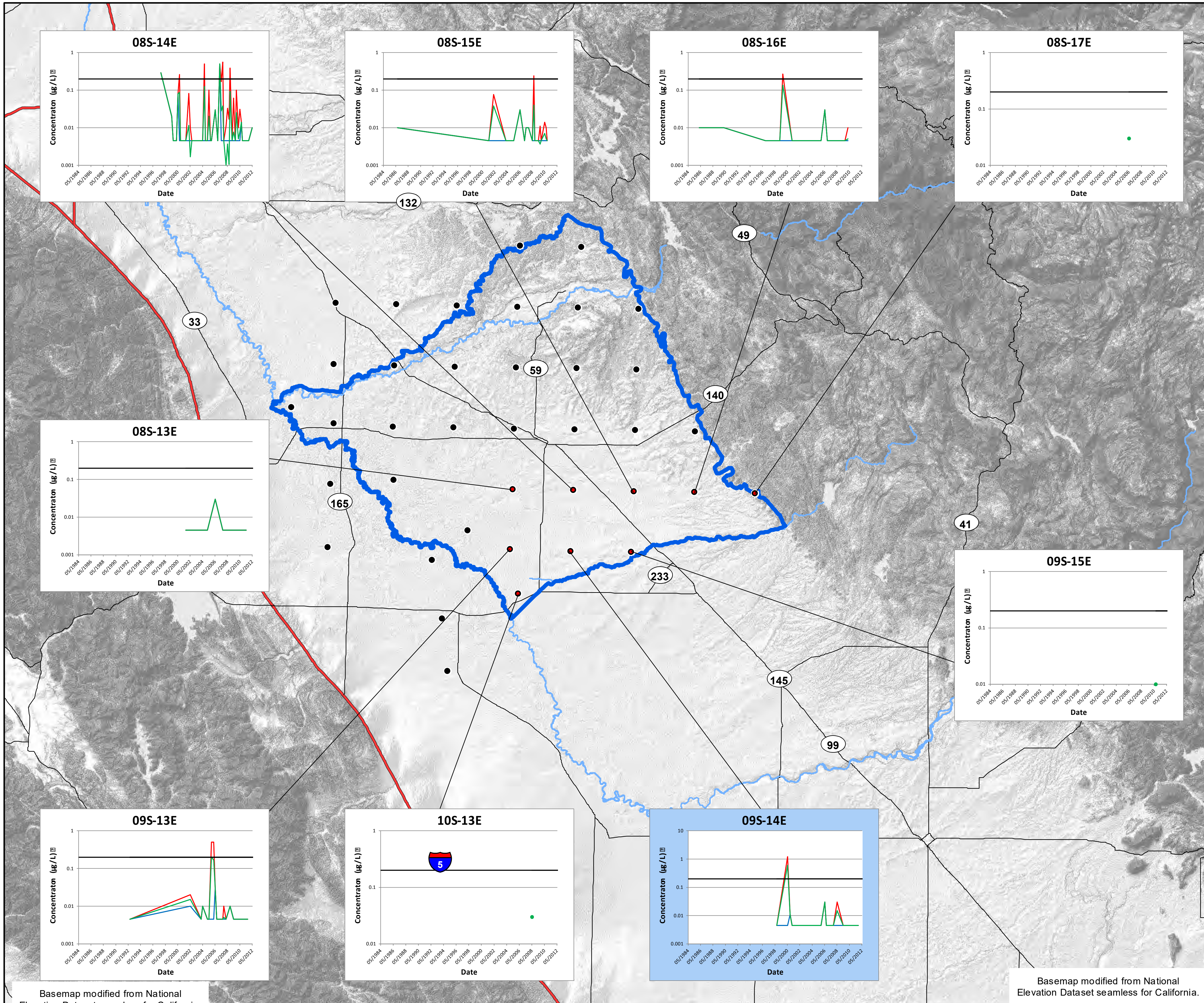
N

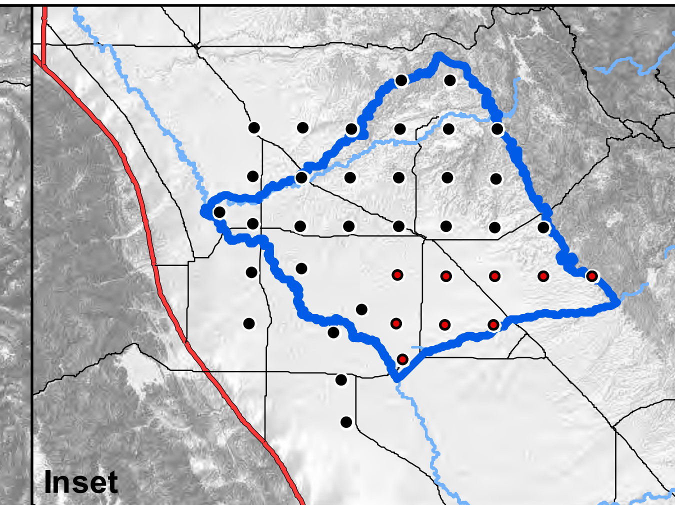
0 5 10

APPROXIMATE SCALE IN MILES

DIBROMOCHLOROPROPANE (DBCP)
CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 12b





Explanation:

- Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum DBCP concentration
- Mean DBCP concentration
- Maximum DBCP concentration
- MCL for DBCP (0.2 µg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Dibromochloropropane (DBCP) concentrations shown in micrograms per liter (µg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.
4. Background color on graphs represent the y-axis range as follows:

White: 0.001- 1 µg/L

Blue: 0.001- 10 µg/L

N

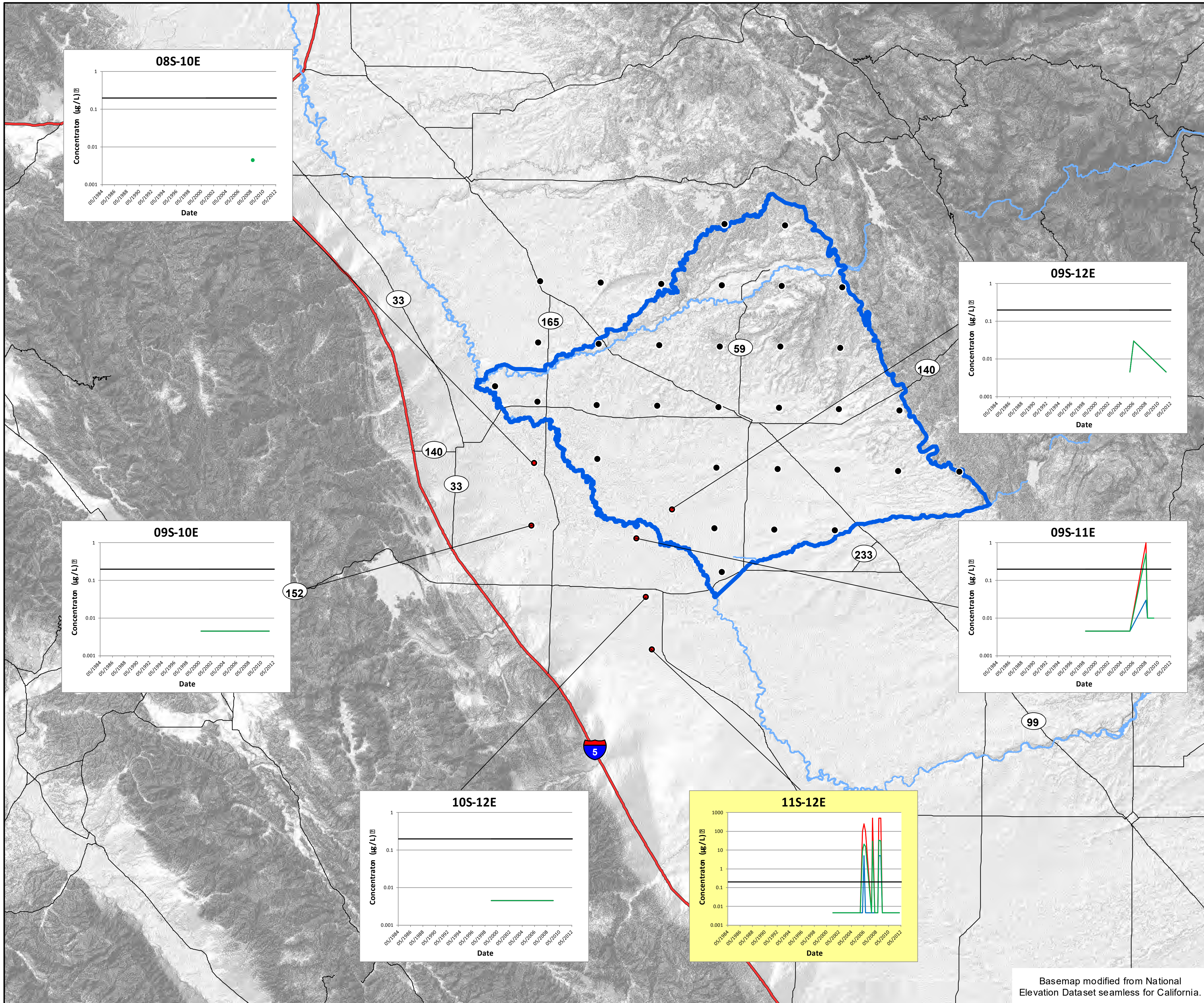
0 5 10

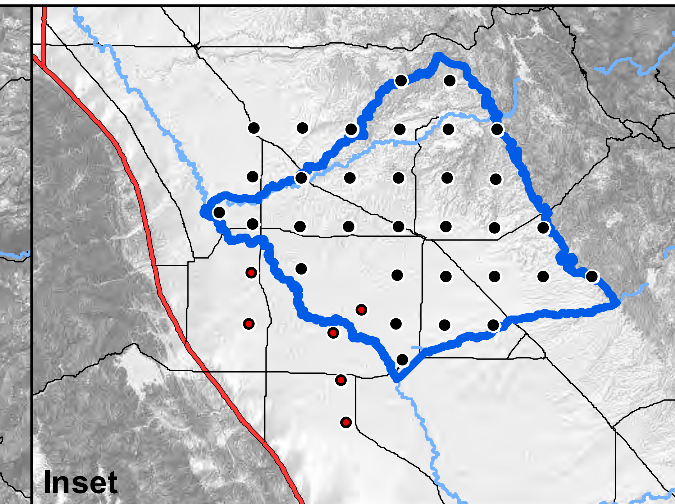
APPROXIMATE SCALE IN MILES

DIBROMOCHLOROPROPANE (DBCP)
CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 12c

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig12c_DBCP.mxd





Explanation:

Township/Range centroid

Surface water feature

Merced IRWM area

Concentration Charts:

Minimum DBCP concentration

Mean DBCP concentration

Maximum DBCP concentration

MCL for DBCP (0.2 µg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Dibromochloropropane (DBCP) concentrations shown in micrograms per liter (µg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.
4. Background color on graphs represent the y-axis range as follows:

White: 0.001- 1 µg/L
Yellow: 0.001- 1,000 µg/L

N

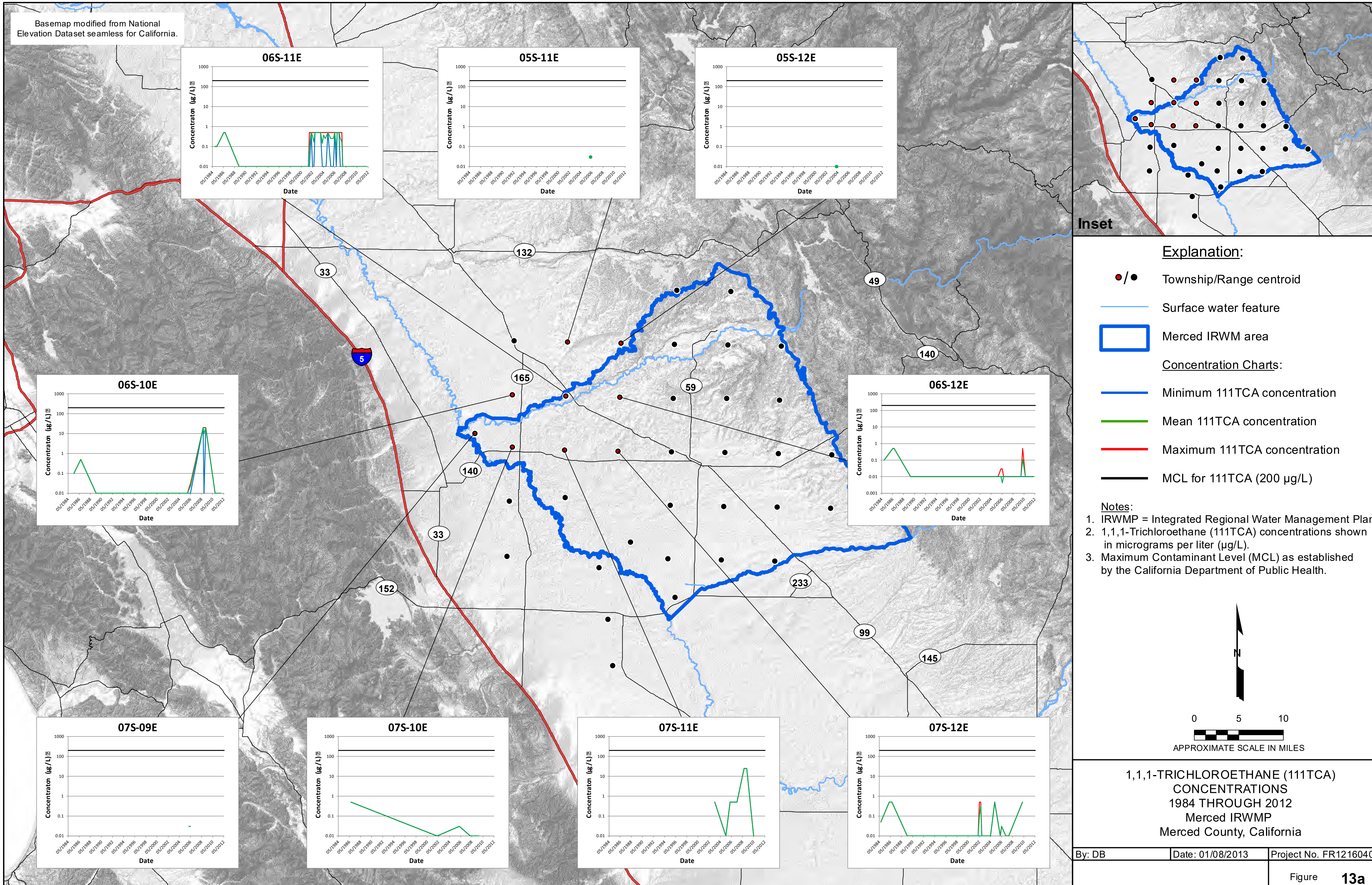
0 5 10

APPROXIMATE SCALE IN MILES

DIBROMOCHLOROPROPANE (DBCP)
CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 12d

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig12d_DBCP.mxd



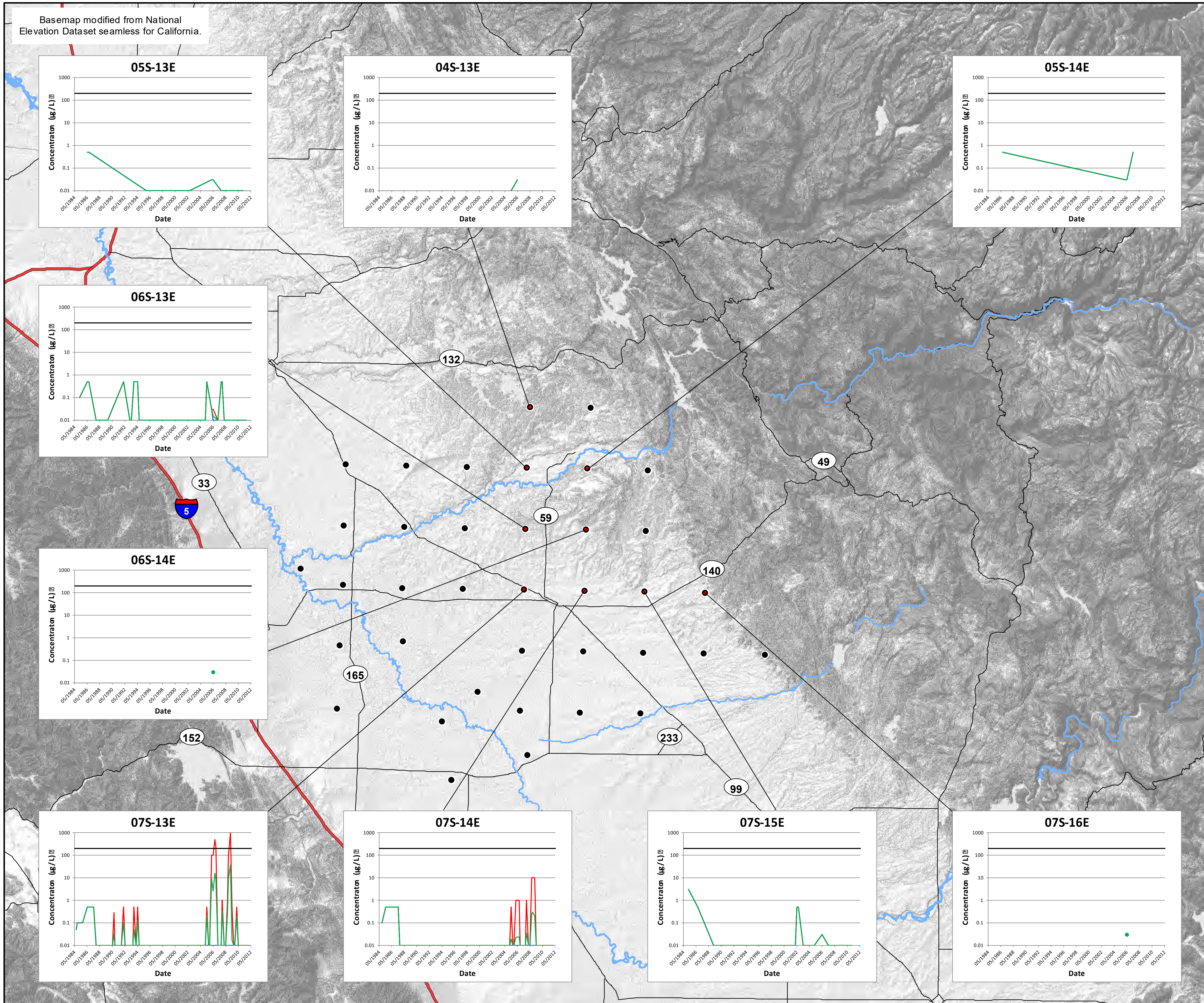
Notes:

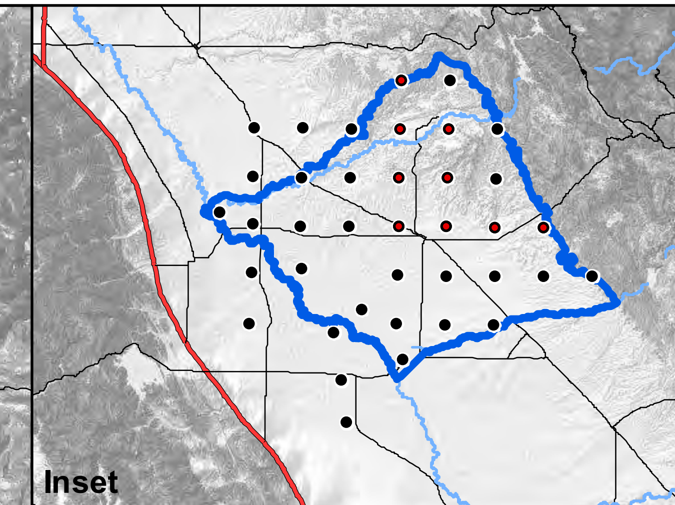
1. IRWMP = Integrated Regional Water Management Plan.
2. 1,1,1-Trichloroethane (111TCA) concentrations shown in micrograms per liter (µg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.

1,1,1-TRICHLOROETHANE (111TCA) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 13a

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig13a_111TCA.mxd





Explanation:

●/● Township/Range centroid

Surface water feature

Merced IRWM area

Concentration Charts:

Minimum 111TCA concentration

Mean 111TCA concentration

Maximum 111TCA concentration

MCL for 111TCA (200 µg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. 1,1,1-Trichloroethane (111TCA) concentrations shown in micrograms per liter (µg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.

N

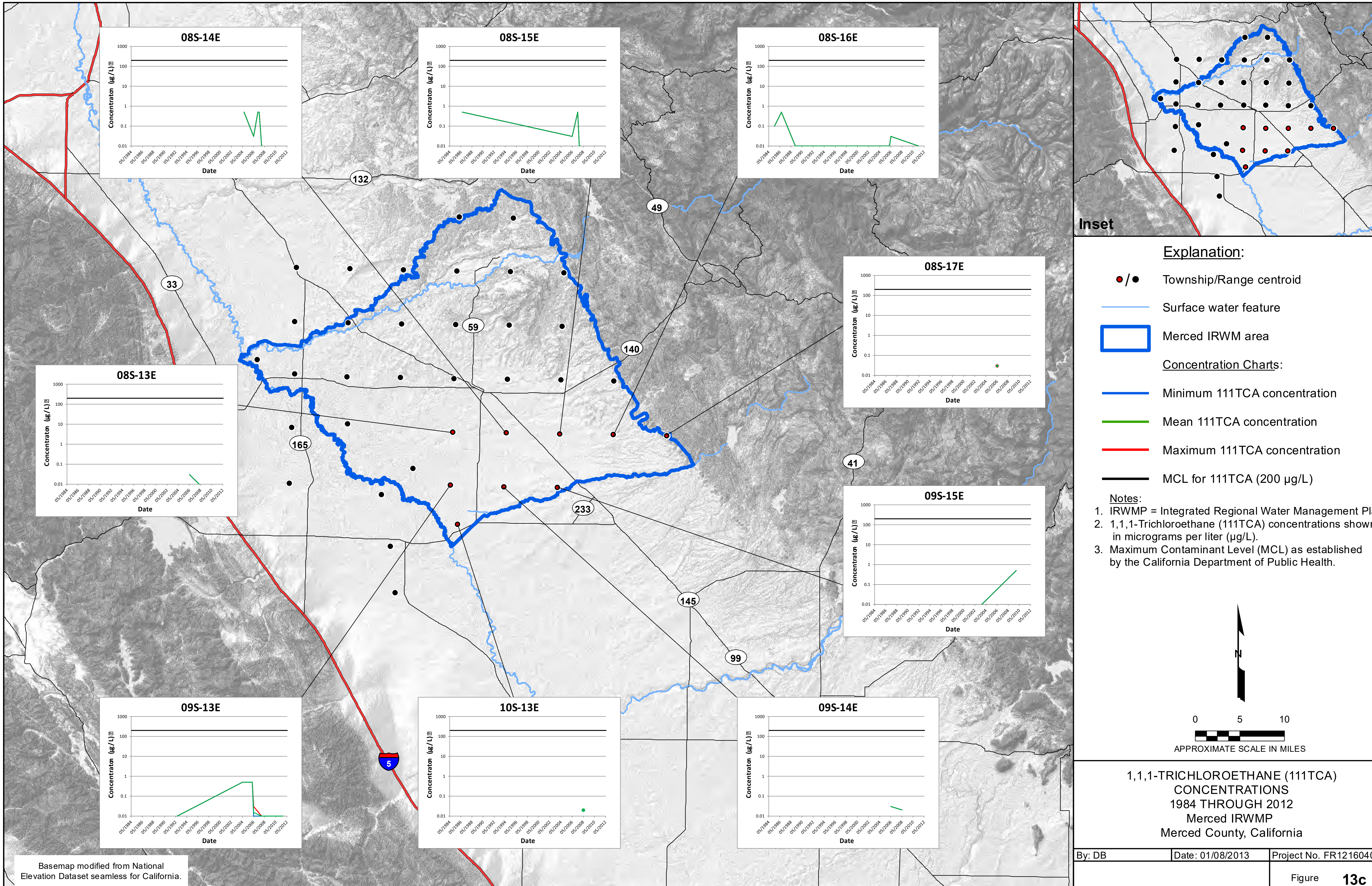
0 5 10

APPROXIMATE SCALE IN MILES

1,1,1-TRICHLOROETHANE (111TCA) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 13b

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig13b_111TCA.mxd



Explanation:

- Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum 111TCA concentration
- Mean 111TCA concentration
- Maximum 111TCA concentration
- MCL for 111TCA (200 µg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. 1,1,1-Trichloroethane (111TCA) concentrations shown in micrograms per liter (µg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.

N

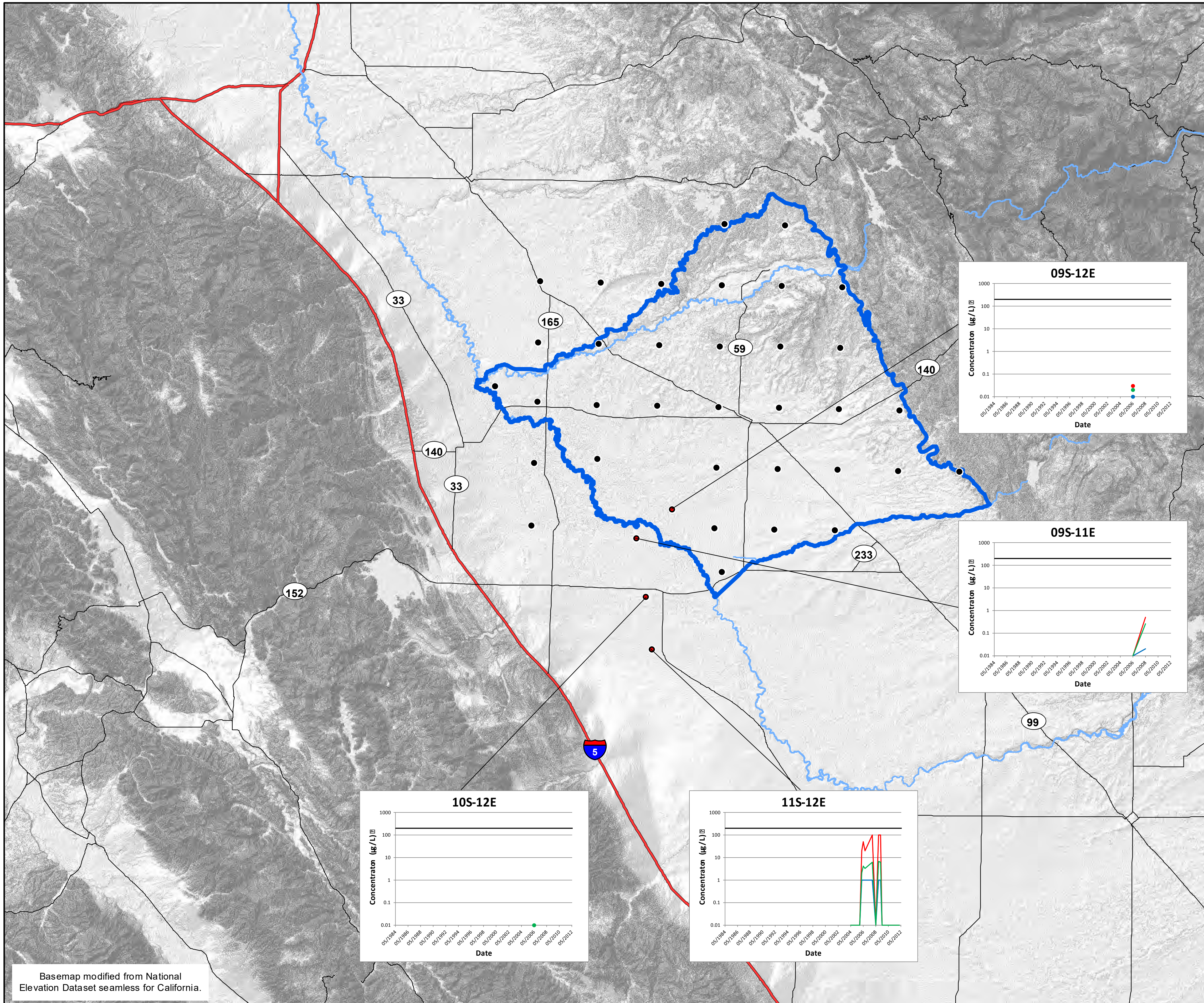
0 5 10

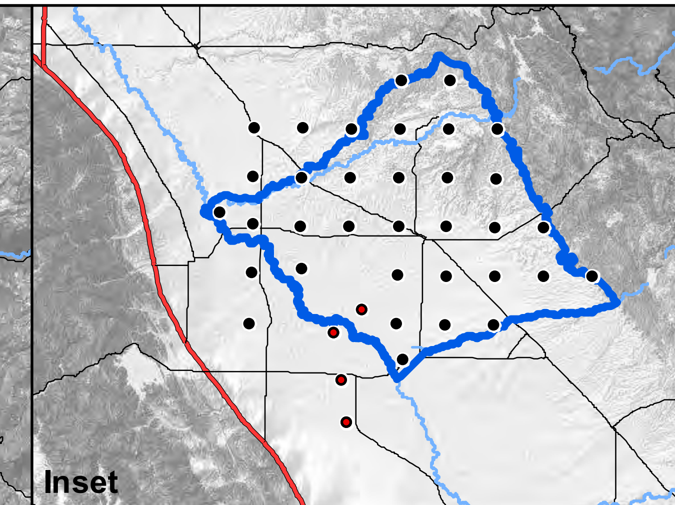
APPROXIMATE SCALE IN MILES

1,1,1-TRICHLOROETHANE (111TCA)
CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 13c

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig13c_111TCA.mxd





Explanation:

- ●/● Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum 111TCA concentration
- Mean 111TCA concentration
- Maximum 111TCA concentration
- MCL for 111TCA (200 µg/L)

Notes:
1. IRWMP = Integrated Regional Water Management Plan.
2. 1,1,1-Trichloroethane (111TCA) concentrations shown in micrograms per liter (µg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.

N

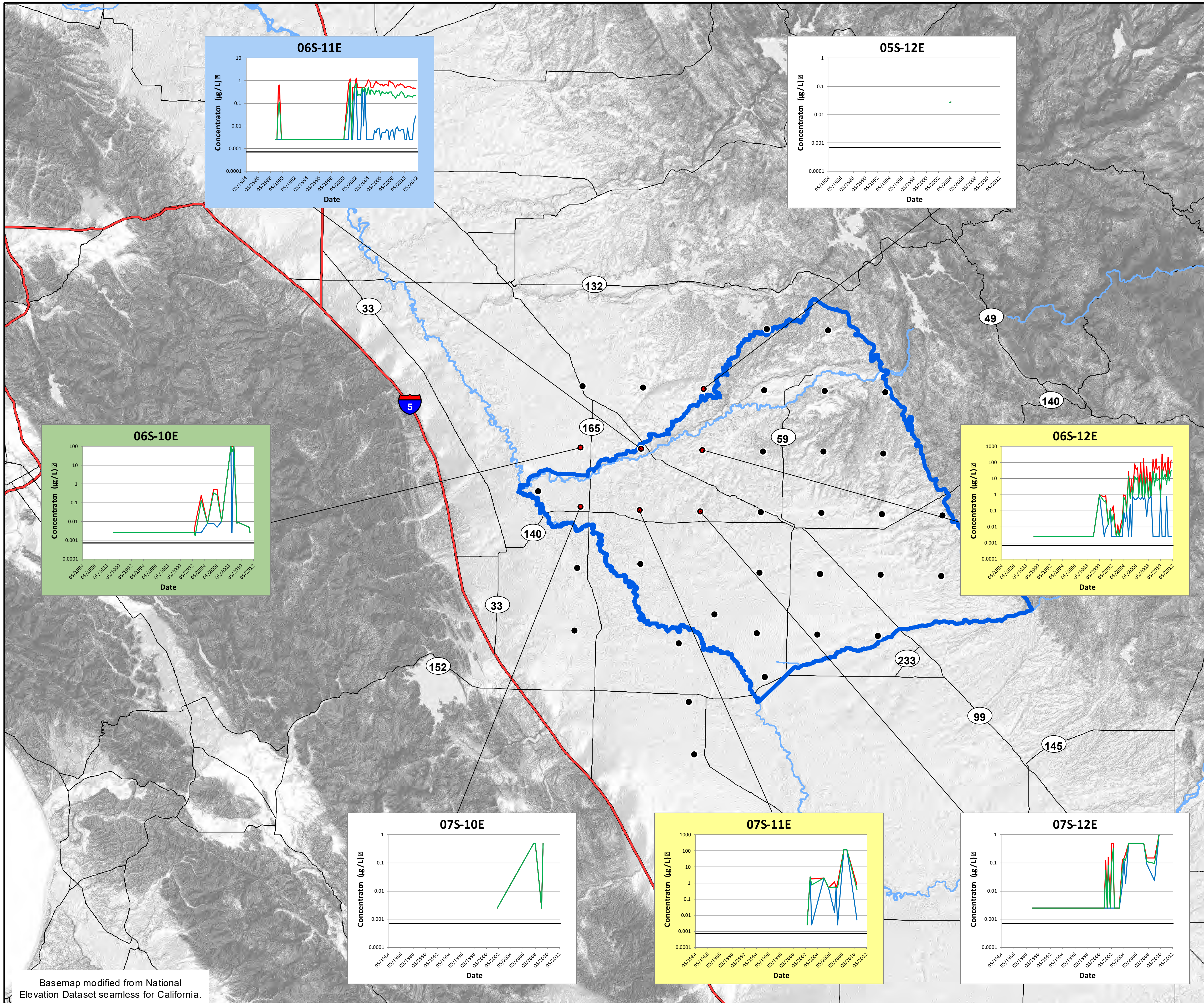
0 5 10

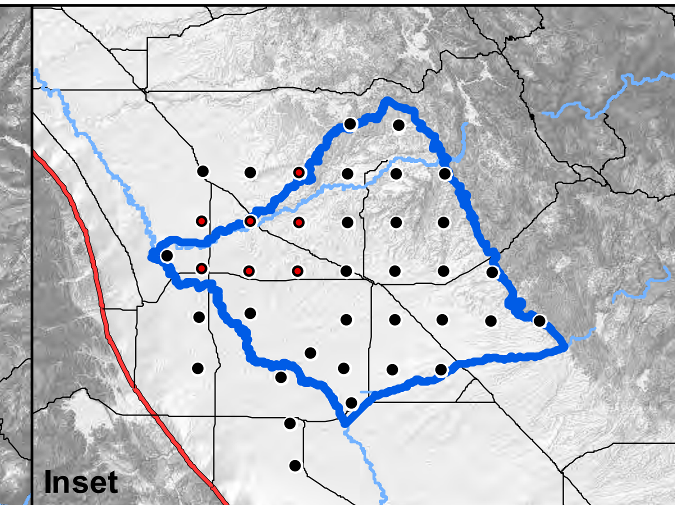
APPROXIMATE SCALE IN MILES

1,1,1-TRICHLOROETHANE (111TCA)
CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 13d

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig13d_111TCA.mxd





Explanation:

Township/Range centroid

Surface water feature

Merced IRWM area

Concentration Charts:

Minimum 123TCP concentration

Mean 123TCP concentration

Maximum 123TCP concentration

PHG for 123TCP (0.0007 ug/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. 1,2,3-Trichloropropane (123TCP) concentrations shown in micrograms per liter (µg/L).
3. Public Health Goal (PHG) as established by the California Office of Environmental Health Hazard Assessment
4. Background color on graphs represent the y-axis range as follows:

White: 0.0001- 1 µg/L
Blue: 0.0001- 10 µg/L
Green: 0.0001- 100 µg/L
Yellow: 0.0001- 1,000 µg/L

N

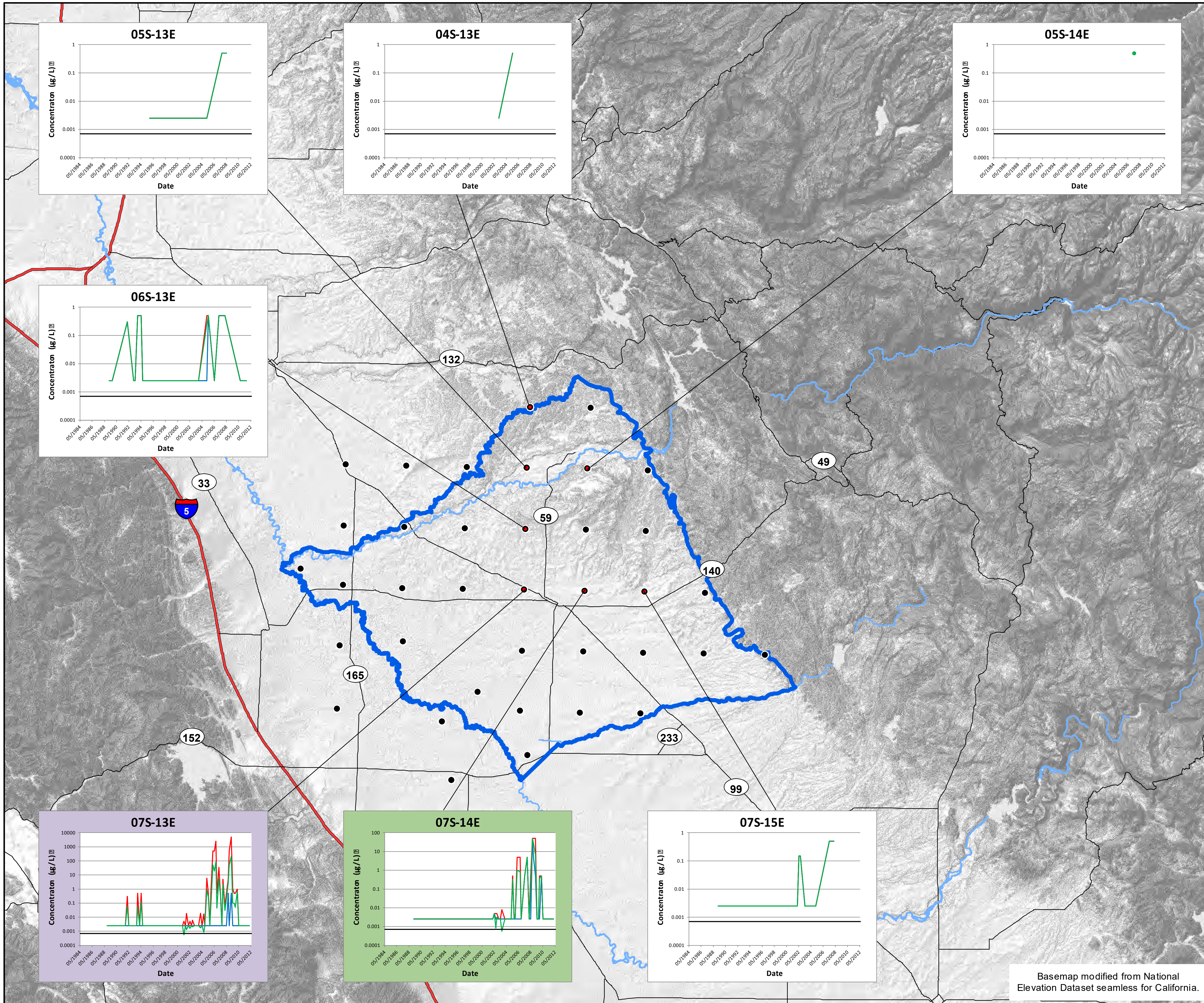
0 5 10

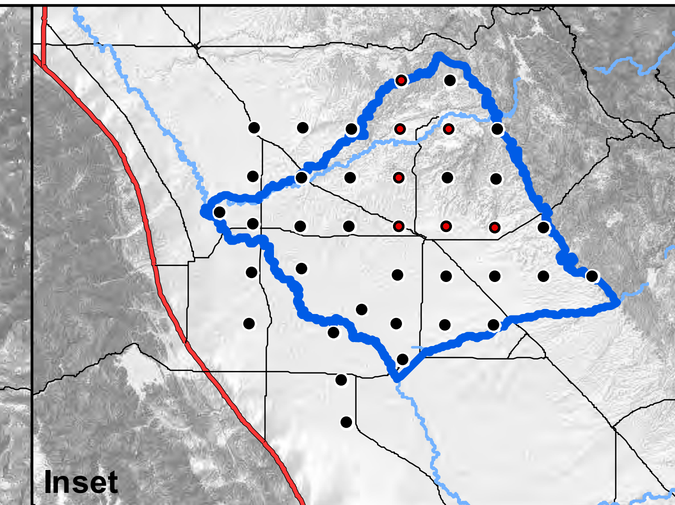
APPROXIMATE SCALE IN MILES

1,2,3-TRICHLOROPROPANE (123TCP)
CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure **14a**

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig14a_123TCP.mxd





Explanation:

●/● Township/Range centroid

Surface water feature

Merced IRWM area

Concentration Charts:

Minimum 123TCP concentration

Mean 123TCP concentration

Maximum 123TCP concentration

PHG for 123TCP (0.0007 ug/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. 1,2,3-Trichloropropane (123TCP) concentrations shown in micrograms per liter (µg/L).
3. Public Health Goal (PHG) as established by the California Office of Environmental Health Hazard Assessment
4. Background color on graphs represent the y-axis range as follows:

White: 0.0001- 1 µg/L
Green 0.0001- 100 µg/L
Purple: 0.0001- 10,000 µg/L

N

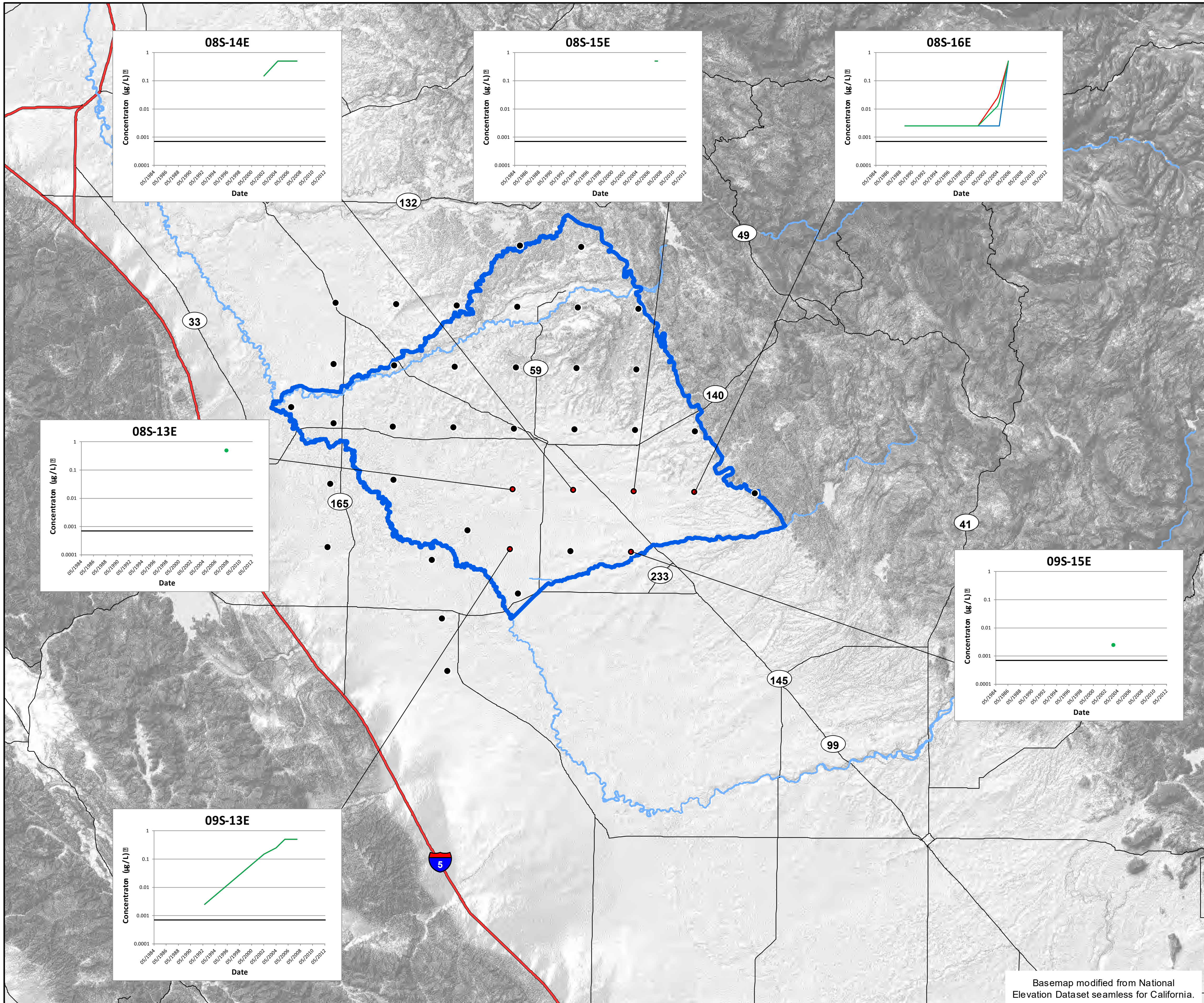
0 5 10

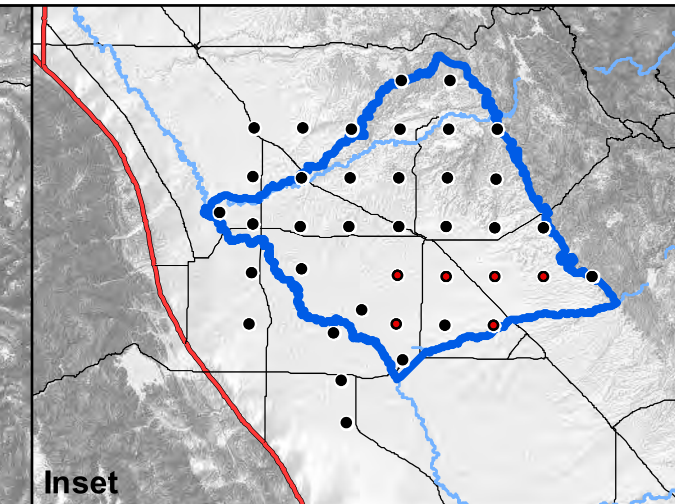
APPROXIMATE SCALE IN MILES

1,2,3-TRICHLOROPROPANE (123TCP) CONCENTRATIONS 1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 14b

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig14b_123TCP.mxd





Explanation:

- ●/● Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum 123TCP concentration
- Mean 123TCP concentration
- Maximum 123TCP concentration
- PHG for 123TCP (0.0007 ug/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. 1,2,3-Trichloropropane (123TCP) concentrations shown in micrograms per liter (µg/L).
3. Public Health Goal (PHG) as established by the California Office of Environmental Health Hazard Assessment

N

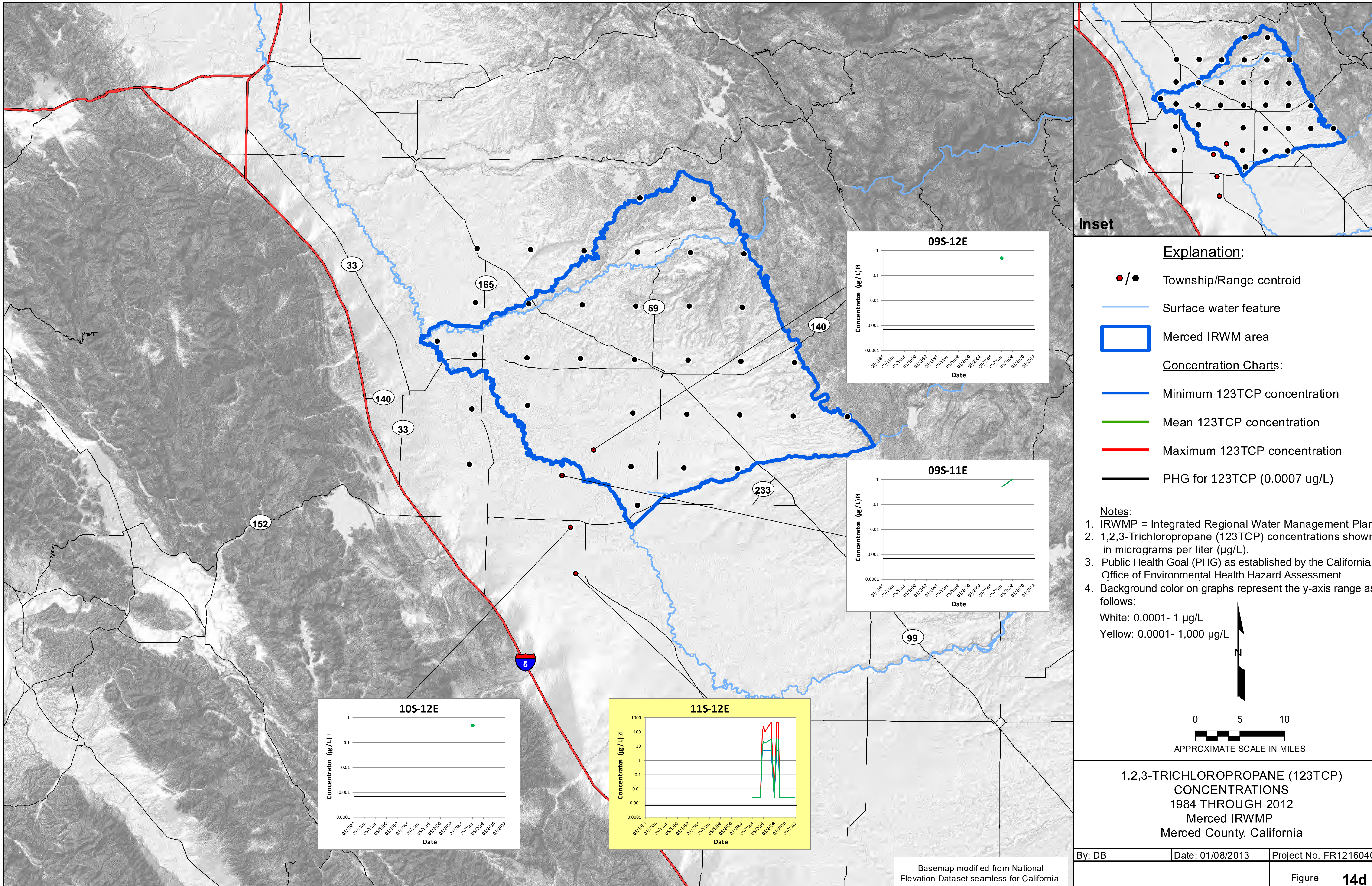
0 5 10

APPROXIMATE SCALE IN MILES

1,2,3-TRICHLOROPROPANE (123TCP)
CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure **14c**

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig14c_123TCP.mxd



Explanation:

●/● Township/Range centroid

Surface water feature

Merced IRWM area

Concentration Charts:

Minimum 123TCP concentration

Mean 123TCP concentration

Maximum 123TCP concentration

PHG for 123TCP (0.0007 ug/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. 1,2,3-Trichloropropane (123TCP) concentrations shown in micrograms per liter (µg/L).
3. Public Health Goal (PHG) as established by the California Office of Environmental Health Hazard Assessment
4. Background color on graphs represent the y-axis range as follows:

White: 0.0001- 1 µg/L

Yellow: 0.0001- 1,000 µg/L

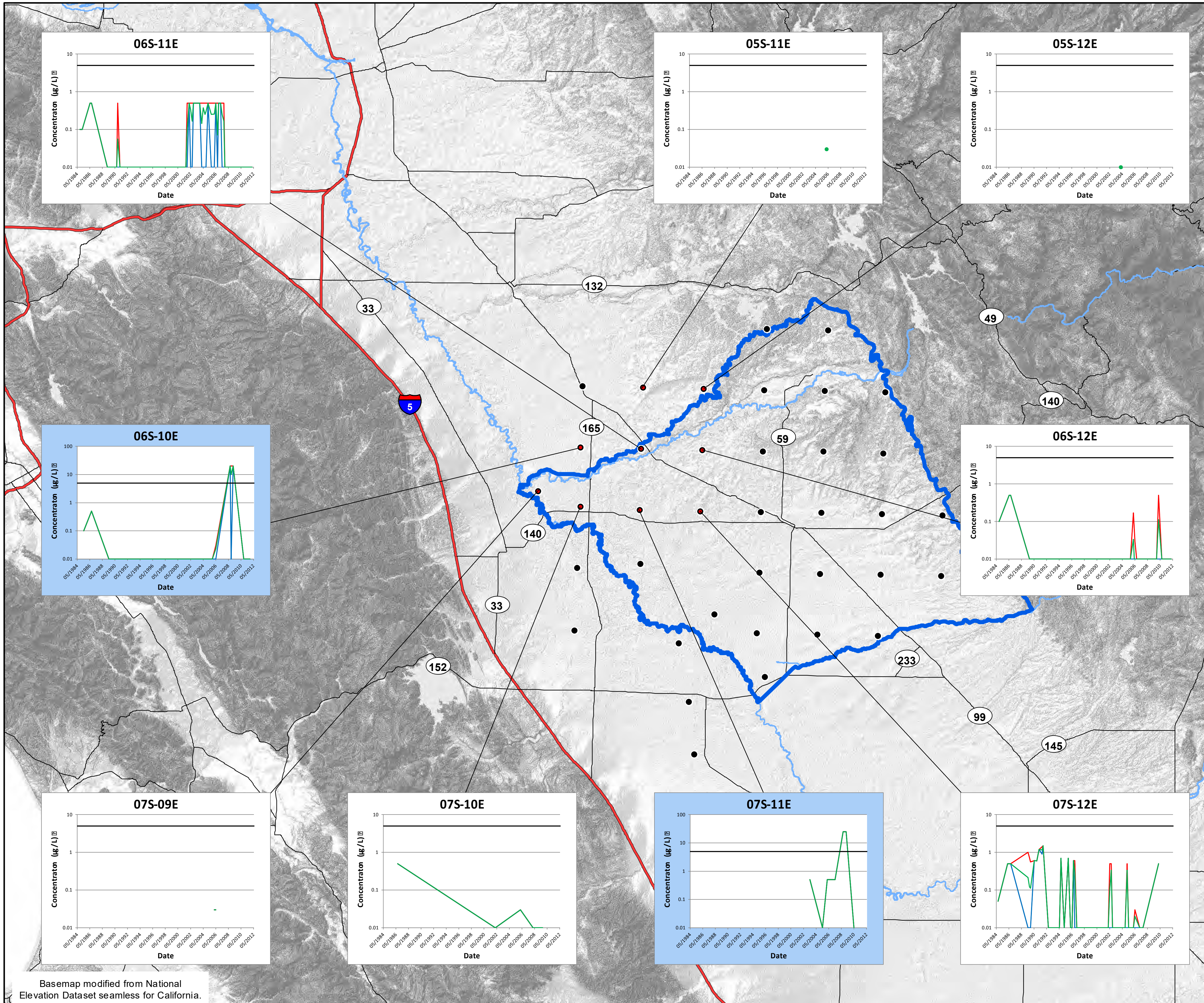
N

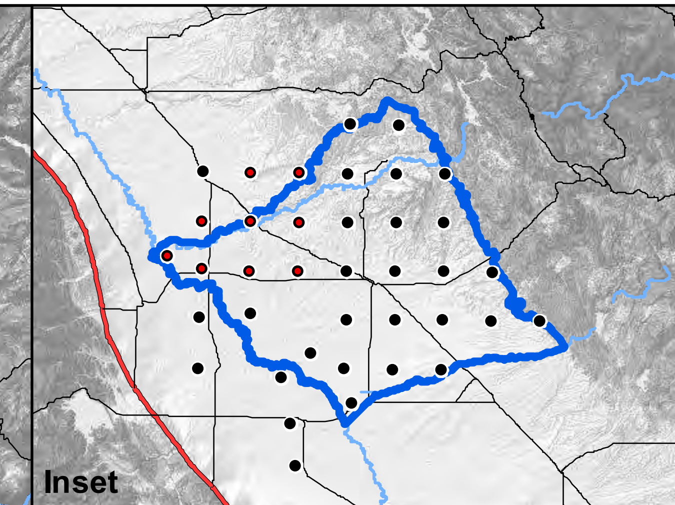
0 5 10

APPROXIMATE SCALE IN MILES

1,2,3-TRICHLOROPROPANE (123TCP)
CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 14d





Explanation:

●/●	Township/Range centroid
	Surface water feature
	Merced IRWM area
Concentration Charts:	
	Minimum PCE concentration
	Mean PCE concentration
	Maximum PCE concentration
	MCL for PCE (5 µg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Tetrachloroethylene (PCE) concentrations shown in micrograms per liter (µg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.
4. Background color on graphs represent the y-axis range as follows:

White: 0.01- 10 µg/L
Blue: 0.01- 100 µg/L

N

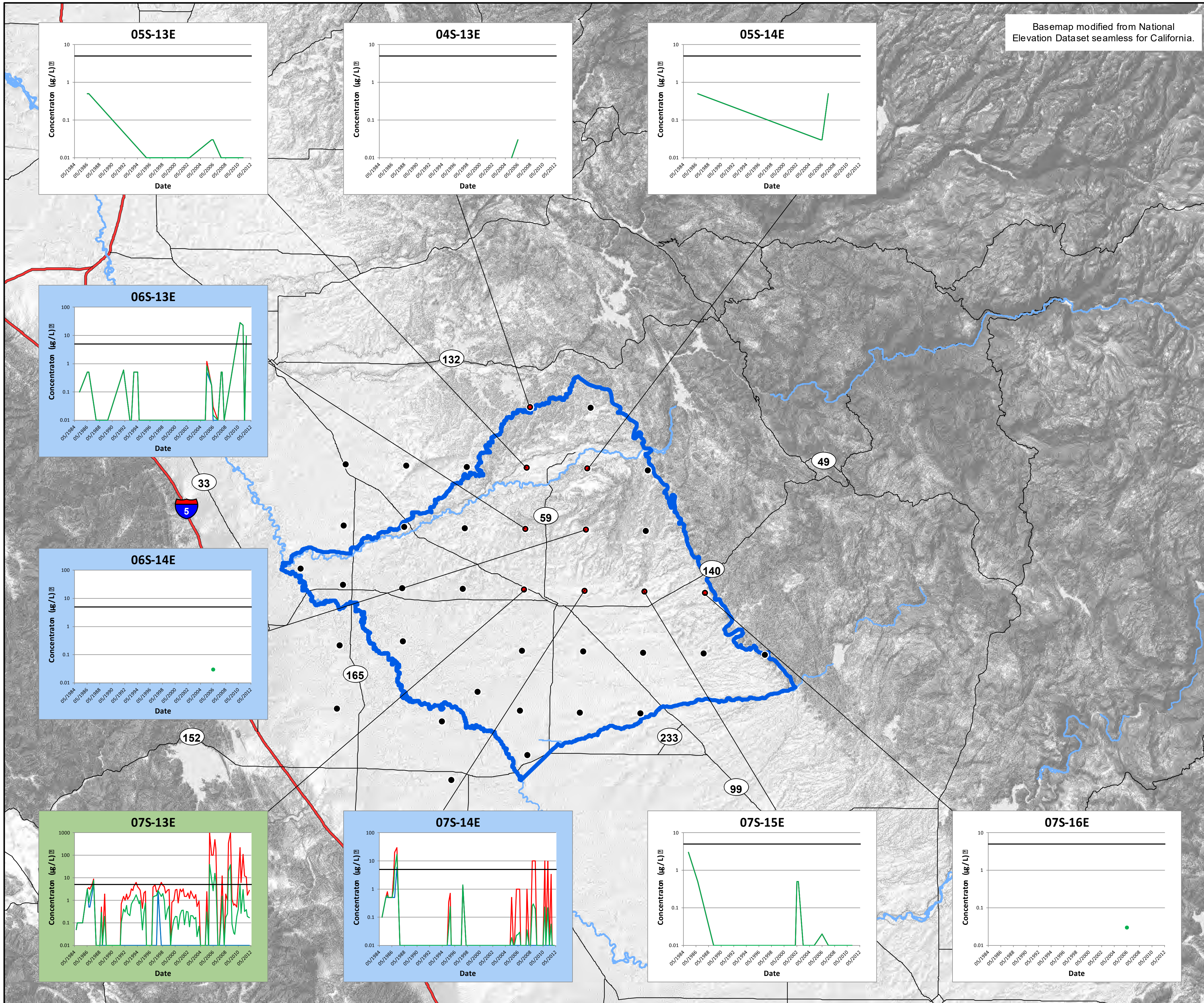
0 5 10

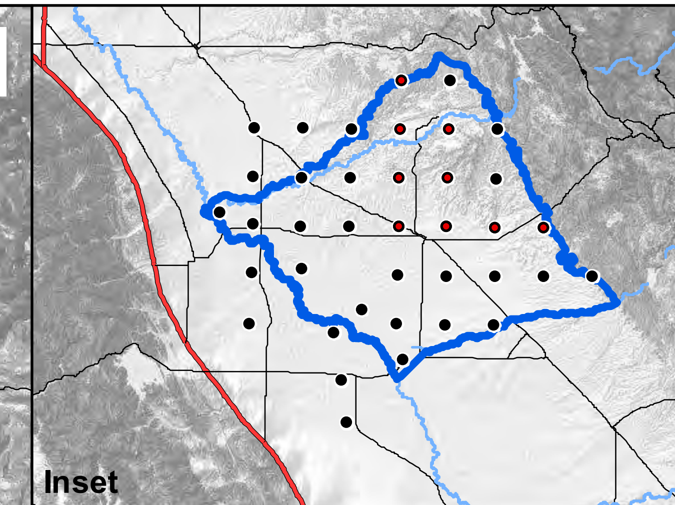
APPROXIMATE SCALE IN MILES

TETRACHLOROETHYLENE (PCE)
CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 15a

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig15a_PCE.mxd





Explanation:

- Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum PCE concentration
- Mean PCE concentration
- Maximum PCE concentration
- MCL for PCE (5 µg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Tetrachloroethylene (PCE) concentrations shown in micrograms per liter (µg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.
4. Background color on graphs represent the y-axis range as follows:

White: 0.01- 10 µg/L
Blue: 0.01- 100 µg/L
Green: 0.01- 1,000 µg/L

N

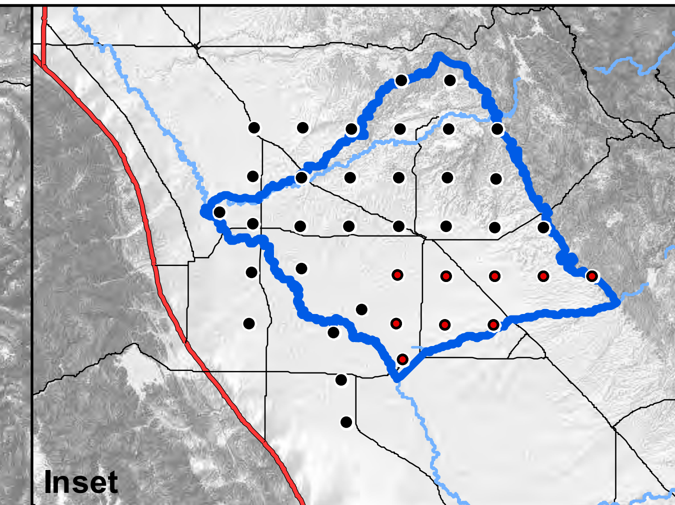
0 5 10

APPROXIMATE SCALE IN MILES

TETRACHLOROETHYLENE (PCE) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 15b

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig15b_PCE.mxd



Explanation:

- Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum PCE concentration
- Mean PCE concentration
- Maximum PCE concentration
- MCL for PCE (5 µg/L)

Notes:
1. IRWMP = Integrated Regional Water Management Plan.
2. Tetrachloroethylene (PCE) concentrations shown in micrograms per liter (µg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.

N

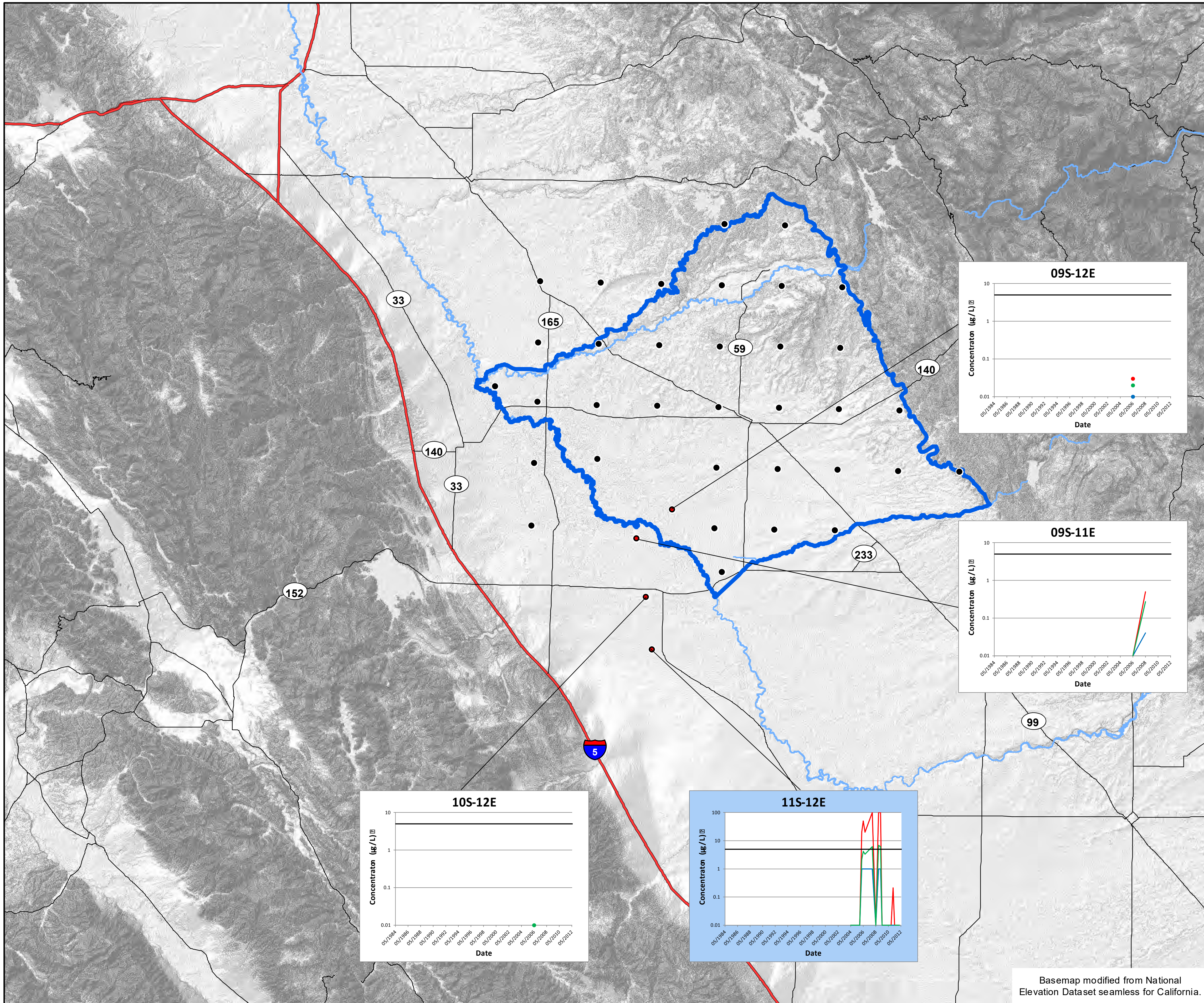
0 5 10

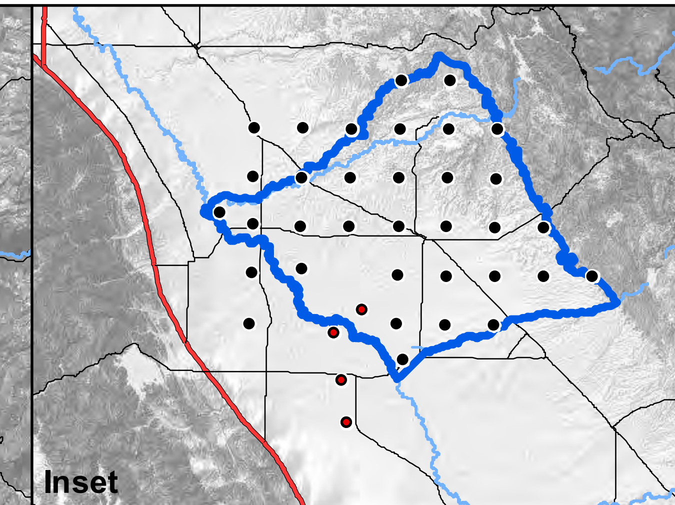
APPROXIMATE SCALE IN MILES

TETRACHLOROETHYLENE (PCE) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 15c

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig15c_PCE.mxd





Explanation:

- Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum PCE concentration
- Mean PCE concentration
- Maximum PCE concentration
- MCL for PCE (5 µg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Tetrachloroethylene (PCE) concentrations shown in micrograms per liter (µg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.
4. Background color on graphs represent the y-axis range as follows:

White: 0.01- 10 µg/L

Blue: 0.01- 100 µg/L

N

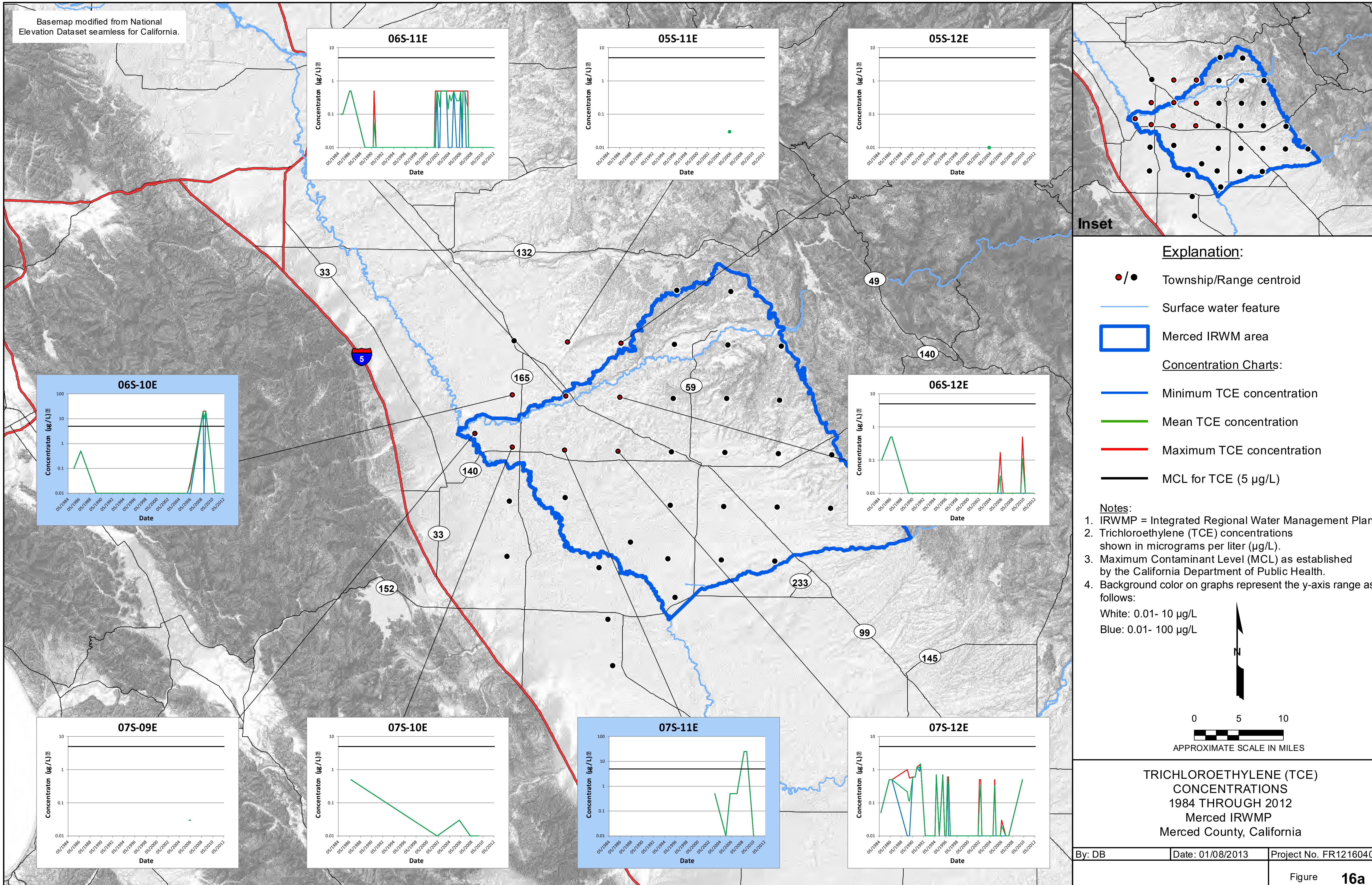
0 5 10

APPROXIMATE SCALE IN MILES

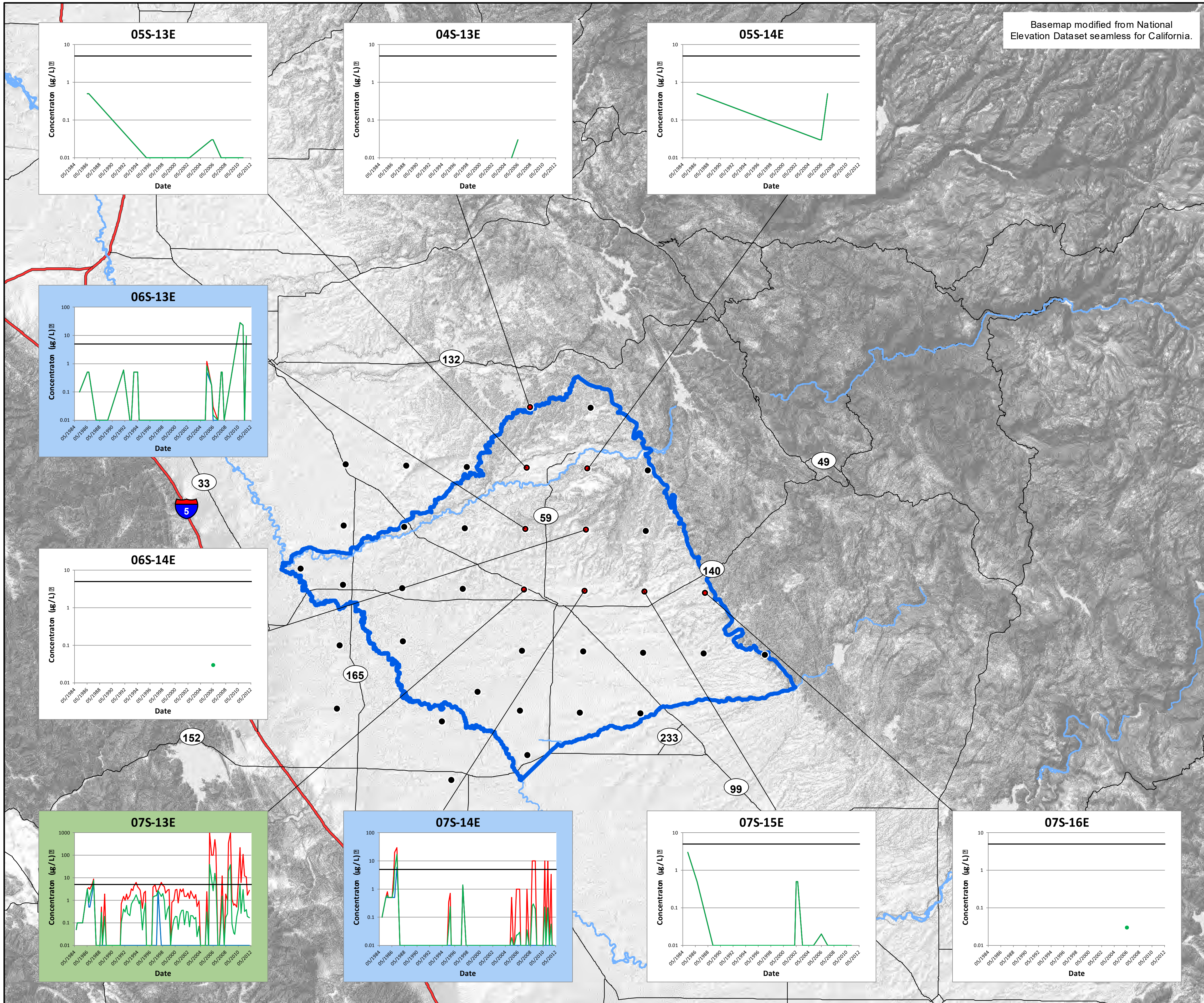
TETRACHLOROETHYLENE (PCE) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

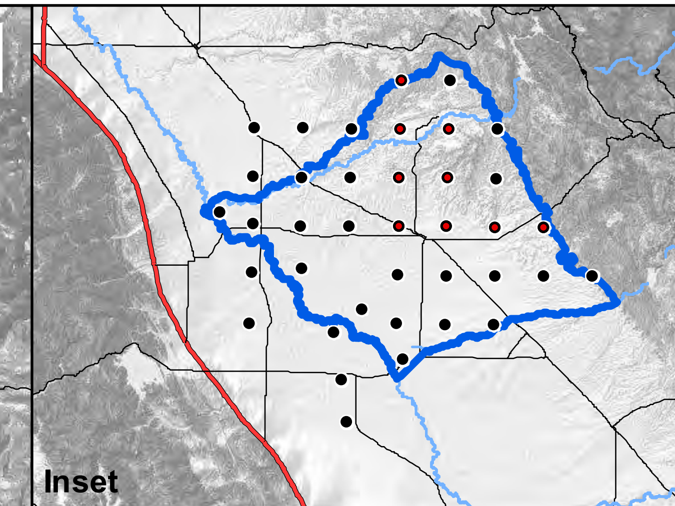
By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 15d

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig15d_PCE.mxd



N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig16a_TCE.mxd





Explanation:

Township/Range centroid

Surface water feature

Merced IRWM area

Concentration Charts:

Minimum TCE concentration

Mean TCE concentration

Maximum TCE concentration

MCL for TCE (5 µg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Trichloroethylene (TCE) concentrations shown in micrograms per liter (µg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.
4. Background color on graphs represent the y-axis range as follows:

White: 0.01- 10 µg/L
Blue: 0.01- 100 µg/L
Green: 0.01- 1,000 µg/L

N

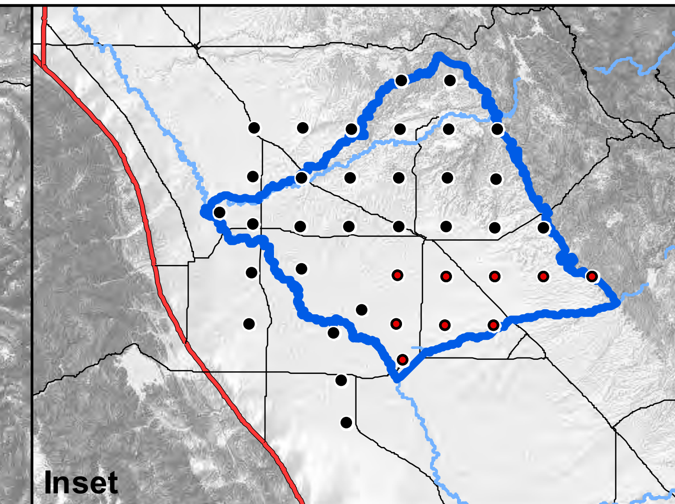
0 5 10

APPROXIMATE SCALE IN MILES

TRICHLOROETHYLENE (TCE)
CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 16b

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig16b_TCE.mxd



Explanation:

- Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum TCE concentration
- Mean TCE concentration
- Maximum TCE concentration
- MCL for TCE (5 µg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Trichloroethylene (TCE) concentrations shown in micrograms per liter (µg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.

N

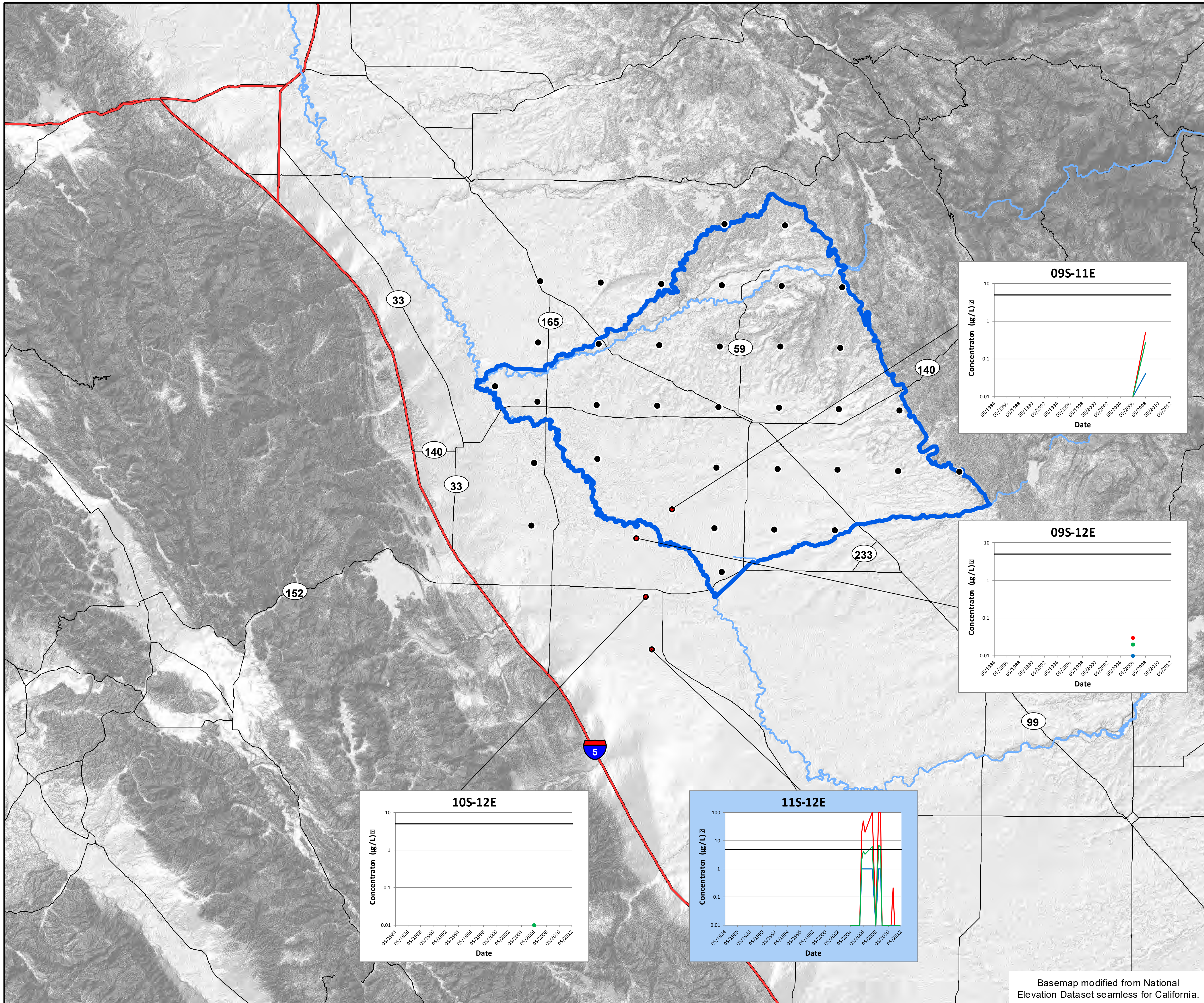
0 5 10

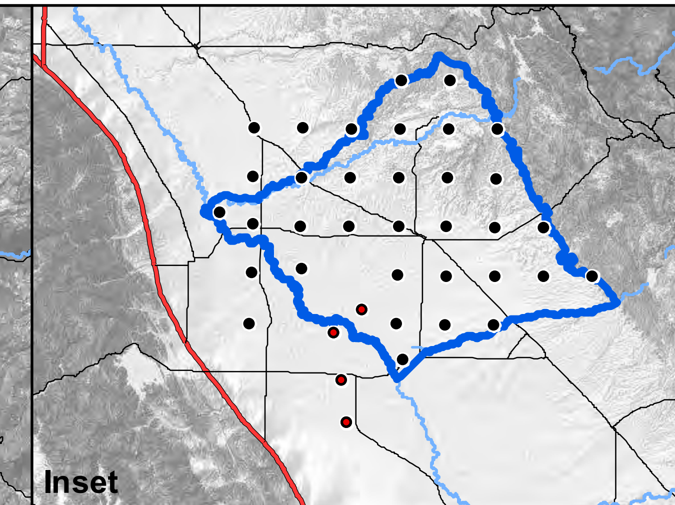
APPROXIMATE SCALE IN MILES

TRICHLOROETHYLENE (TCE) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 16c

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig16c_TCE.mxd





Explanation:

- Township/Range centroid
- Surface water feature
- Merced IRWM area

Concentration Charts:

- Minimum TCE concentration
- Mean TCE concentration
- Maximum TCE concentration
- MCL for TCE (5 µg/L)

Notes:

1. IRWMP = Integrated Regional Water Management Plan.
2. Trichloroethylene (TCE) concentrations shown in micrograms per liter (µg/L).
3. Maximum Contaminant Level (MCL) as established by the California Department of Public Health.
4. Background color on graphs represent the y-axis range as follows:

White: 0.01- 10 µg/L

Blue: 0.01- 100 µg/L

N

0 5 10

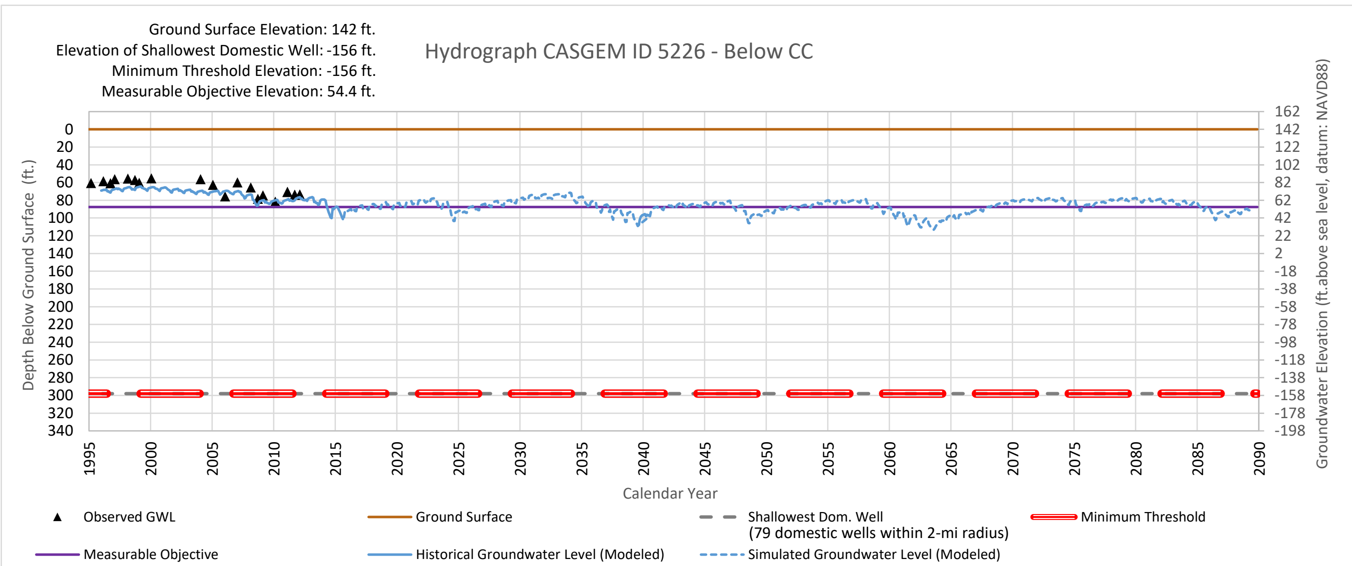
APPROXIMATE SCALE IN MILES

TRICHLOROETHYLENE (TCE)
CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

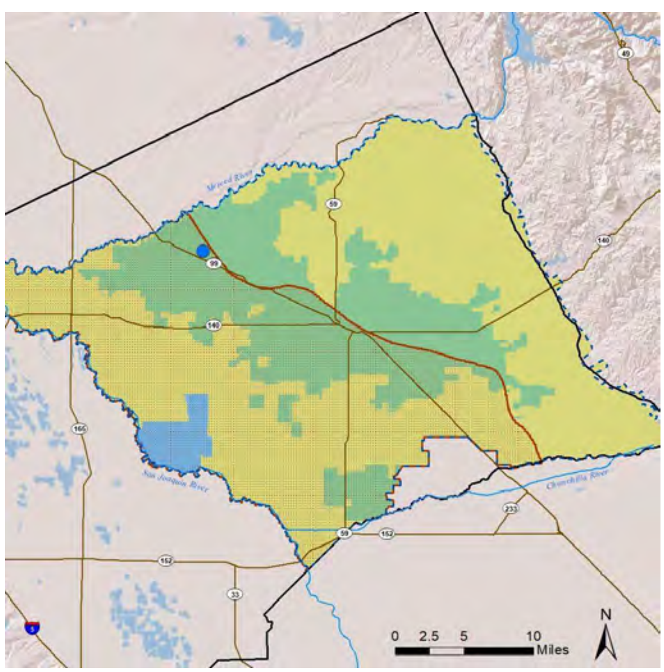
By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure **16d**

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig16d_TCE.mxd

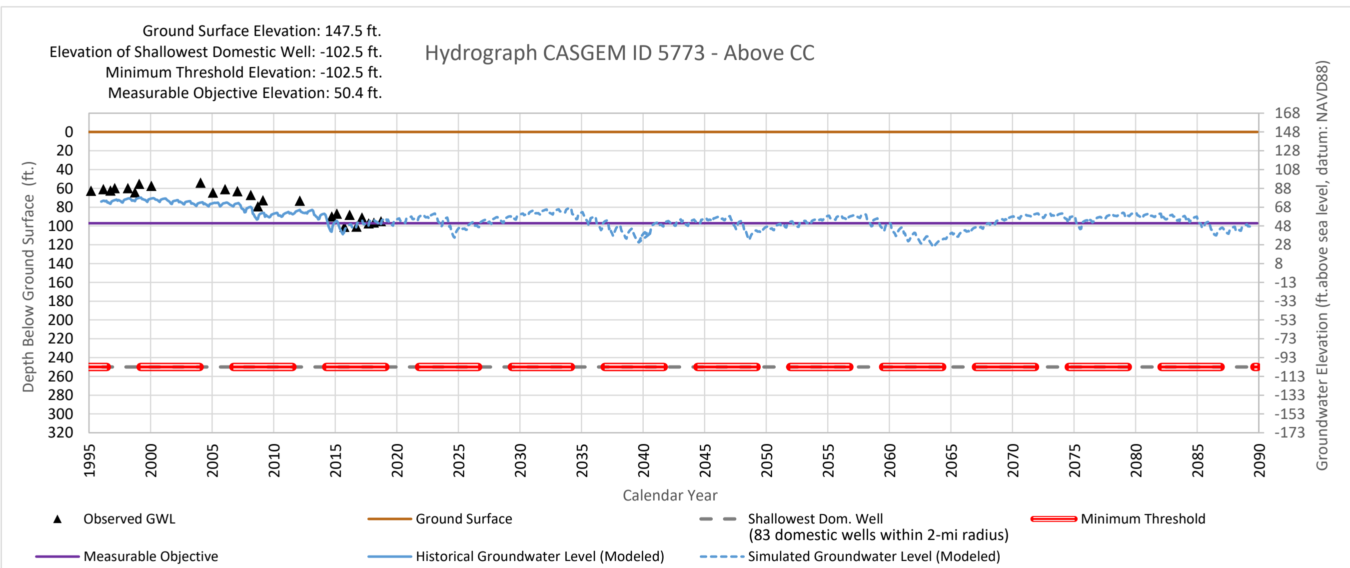
APPENDIX F: SUSTAINABLE MANAGEMENT CRITERIA HYDROGRAPHS FOR DECLINING GROUNDWATER LEVELS

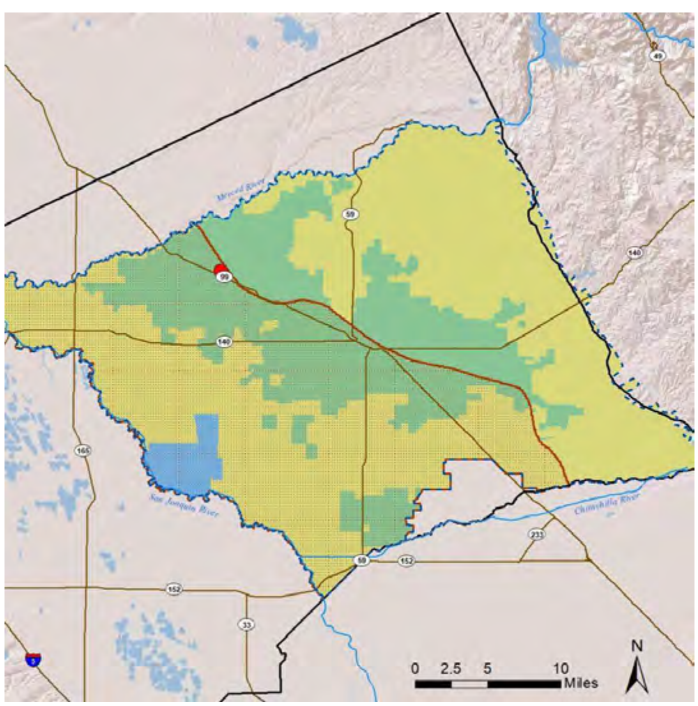


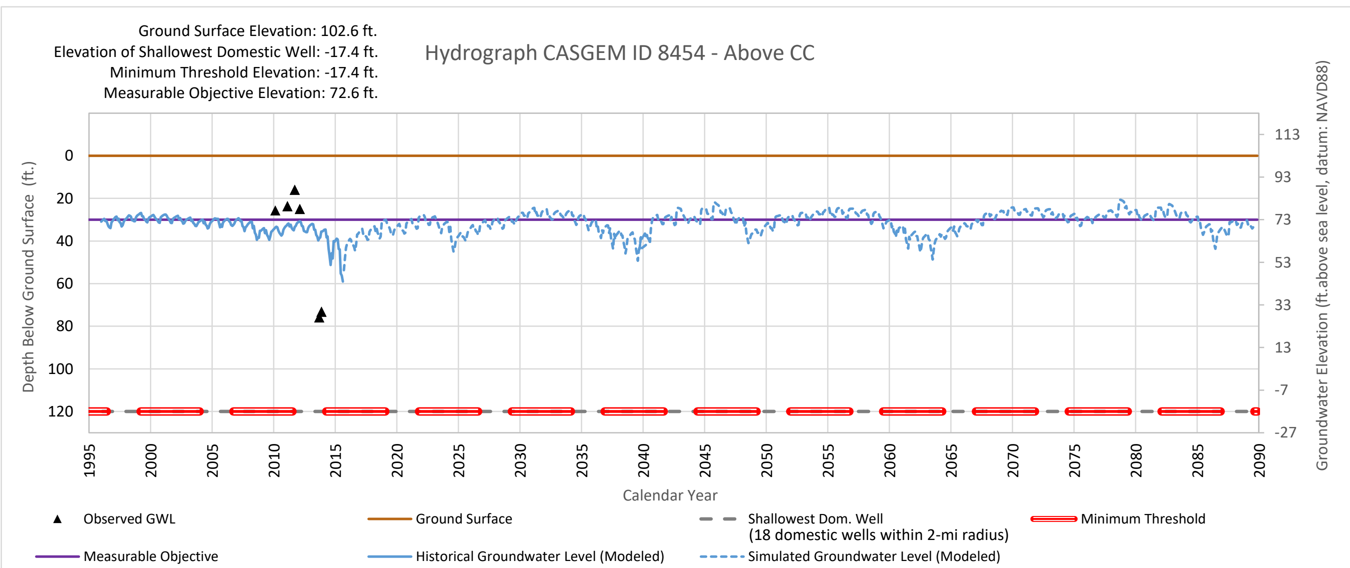
Ground Surface Elevation: 142 ft.
Elevation of Shallowest Domestic Well: -156 ft.
Minimum Threshold Elevation: -156 ft.
Measurable Objective Elevation: 54.4 ft.
Hydrograph CASGEM ID 5226 - Below CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Observed GWL
Ground Surface
Shallowest Dom. Well
(79 domestic wells within 2-mi radius)
Minimum Threshold
Measurable Objective
Historical Groundwater Level (Modeled)
Simulated Groundwater Level (Modeled)

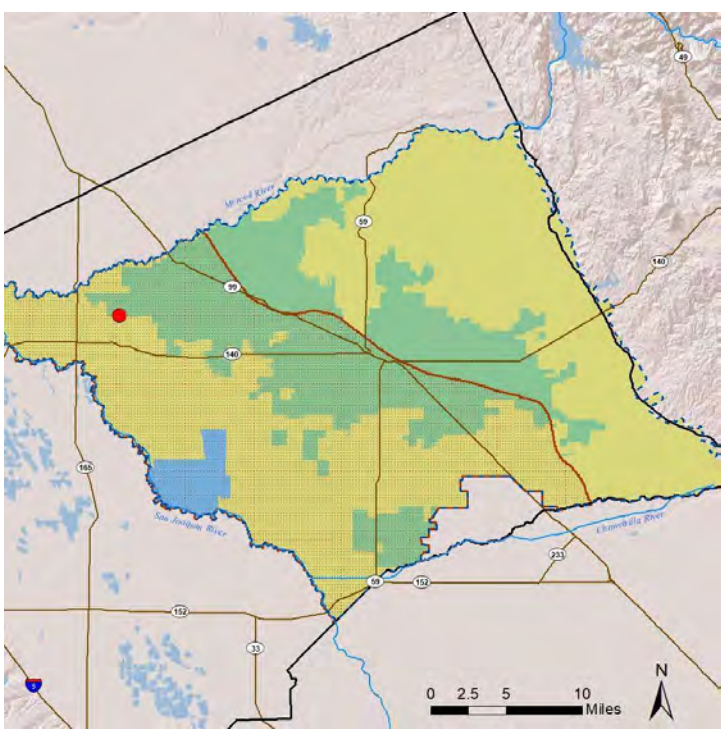


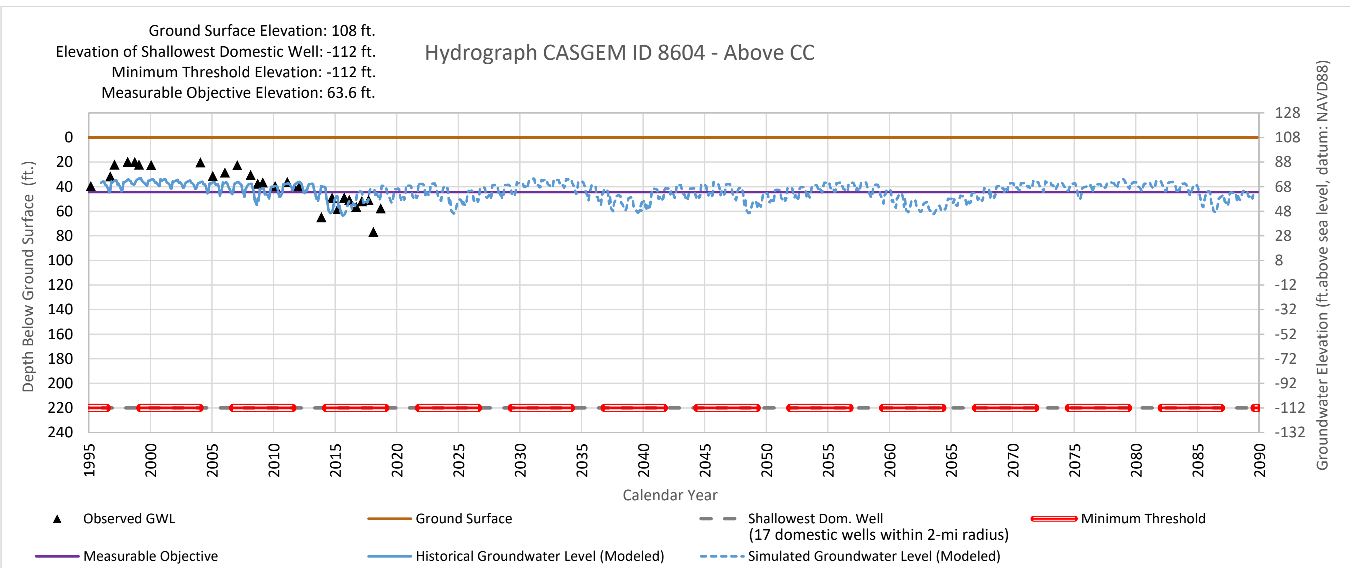
0 2.5 5 10
Miles
N

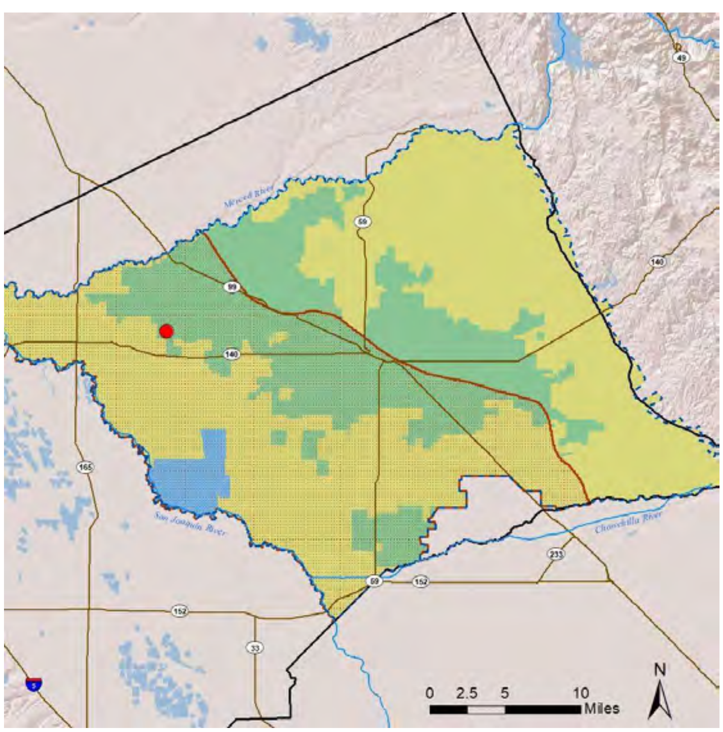

Ground Surface Elevation: 147.5 ft.
Elevation of Shallowest Domestic Well: -102.5 ft.
Minimum Threshold Elevation: -102.5 ft.
Measurable Objective Elevation: 50.4 ft.
Hydrograph CASGEM ID 5773 - Above CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Observed GWL
Ground Surface
Shallowest Dom. Well
(83 domestic wells within 2-mi radius)
Minimum Threshold
Measurable Objective
Historical Groundwater Level (Modeled)
Simulated Groundwater Level (Modeled)

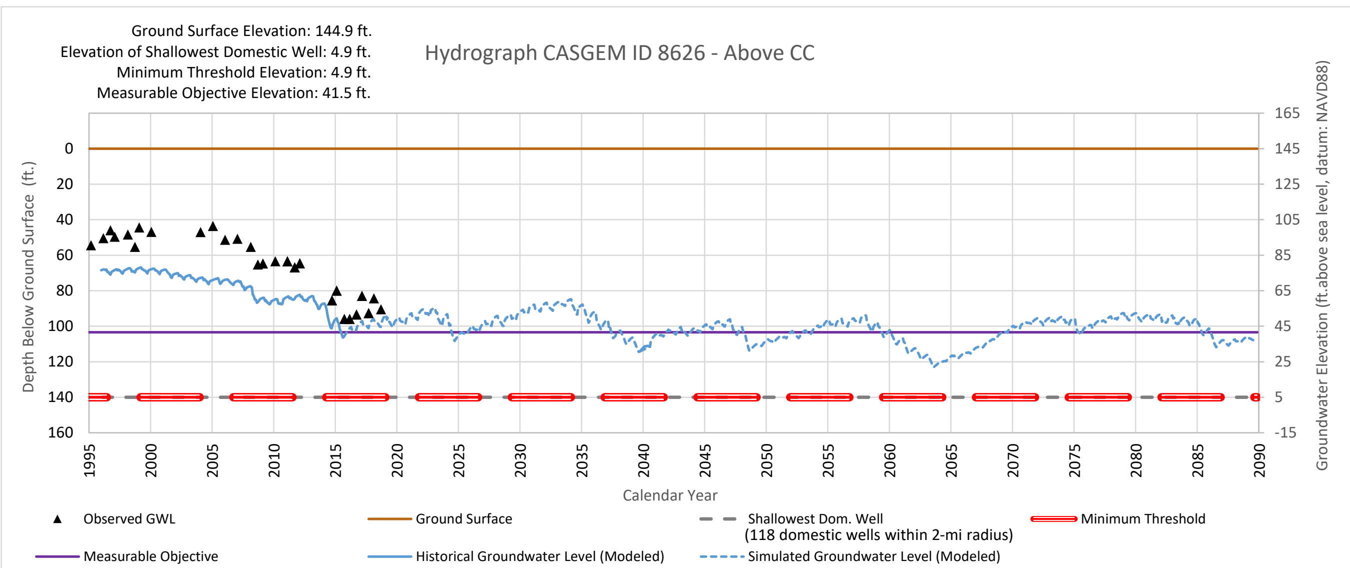

0 2.5 5 10
Miles
N

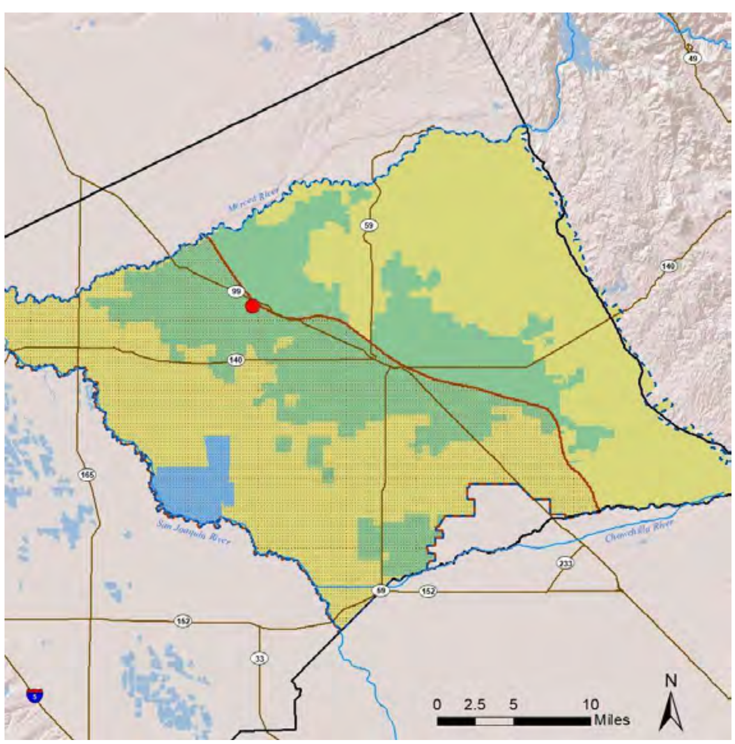

Ground Surface Elevation: 102.6 ft.
Elevation of Shallowest Domestic Well: -17.4 ft.
Minimum Threshold Elevation: -17.4 ft.
Measurable Objective Elevation: 72.6 ft.
Hydrograph CASGEM ID 8454 - Above CC
Depth Below Ground Surface (ft.)
0
20
40
60
80
100
120
Groundwater Elevation (ft.above sea level, datum: NAVD88)
113
93
73
53
33
13
-7
-27
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
2080
2085
2090
Calendar Year
Observed GWL
Ground Surface
Shallowest Dom. Well (18 domestic wells within 2-mi radius)
Minimum Threshold
Measurable Objective
Historical Groundwater Level (Modeled)
Simulated Groundwater Level (Modeled)

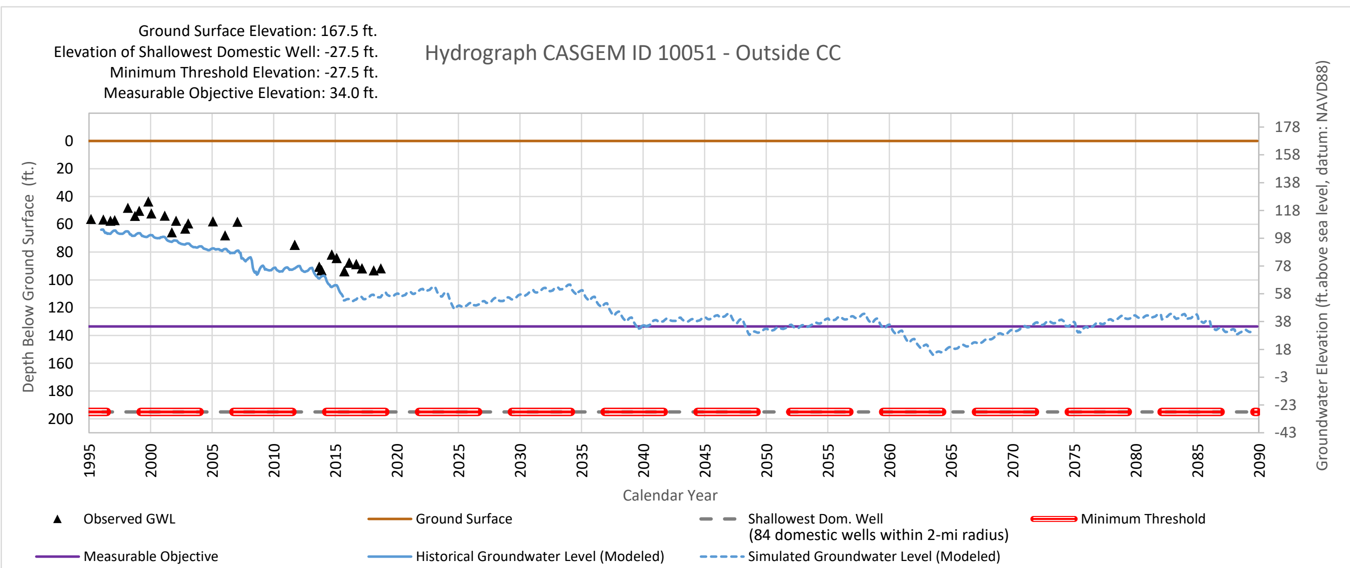

0
2.5
5
10
Miles
N


Ground Surface Elevation: 108 ft.
Elevation of Shallowest Domestic Well: -112 ft.
Minimum Threshold Elevation: -112 ft.
Measurable Objective Elevation: 63.6 ft.
Hydrograph CASGEM ID 8604 - Above CC
Depth Below Ground Surface (ft.)
0
20
40
60
80
100
120
140
160
180
200
220
240
Groundwater Elevation (ft.above sea level, datum: NAVD88)
128
108
88
68
48
28
8
-12
-32
-52
-72
-92
-112
-132
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
2080
2085
2090
Calendar Year
Observed GWL
Ground Surface
Shallowest Dom. Well
(17 domestic wells within 2-mi radius)
Minimum Threshold
Measurable Objective
Historical Groundwater Level (Modeled)
Simulated Groundwater Level (Modeled)

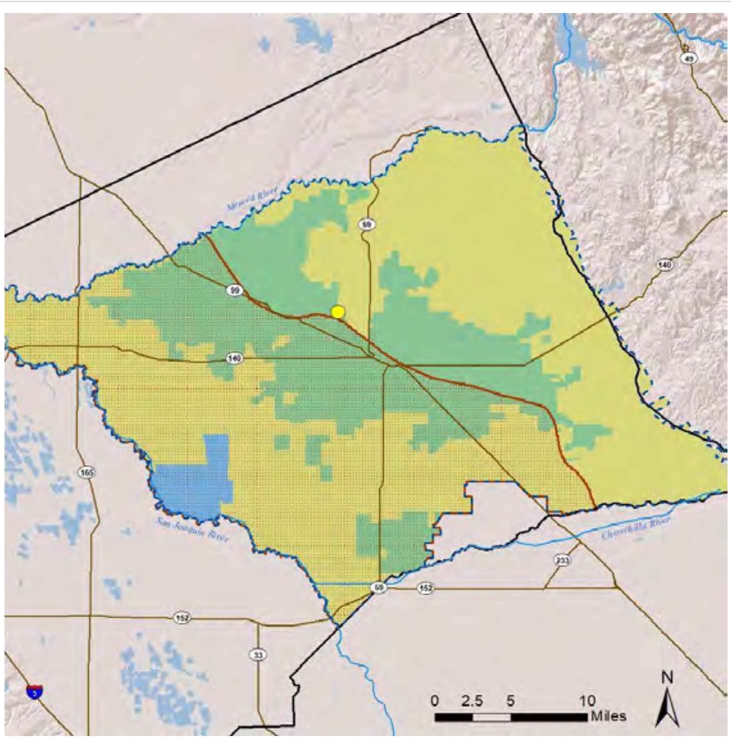

0 2.5 5 10
Miles
N


Ground Surface Elevation: 144.9 ft.
Elevation of Shallowest Domestic Well: 4.9 ft.
Minimum Threshold Elevation: 4.9 ft.
Measurable Objective Elevation: 41.5 ft.
Hydrograph CASGEM ID 8626 - Above CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Observed GWL
Ground Surface
Shallowest Dom. Well
(118 domestic wells within 2-mi radius)
Minimum Threshold
Measurable Objective
Historical Groundwater Level (Modeled)
Simulated Groundwater Level (Modeled)

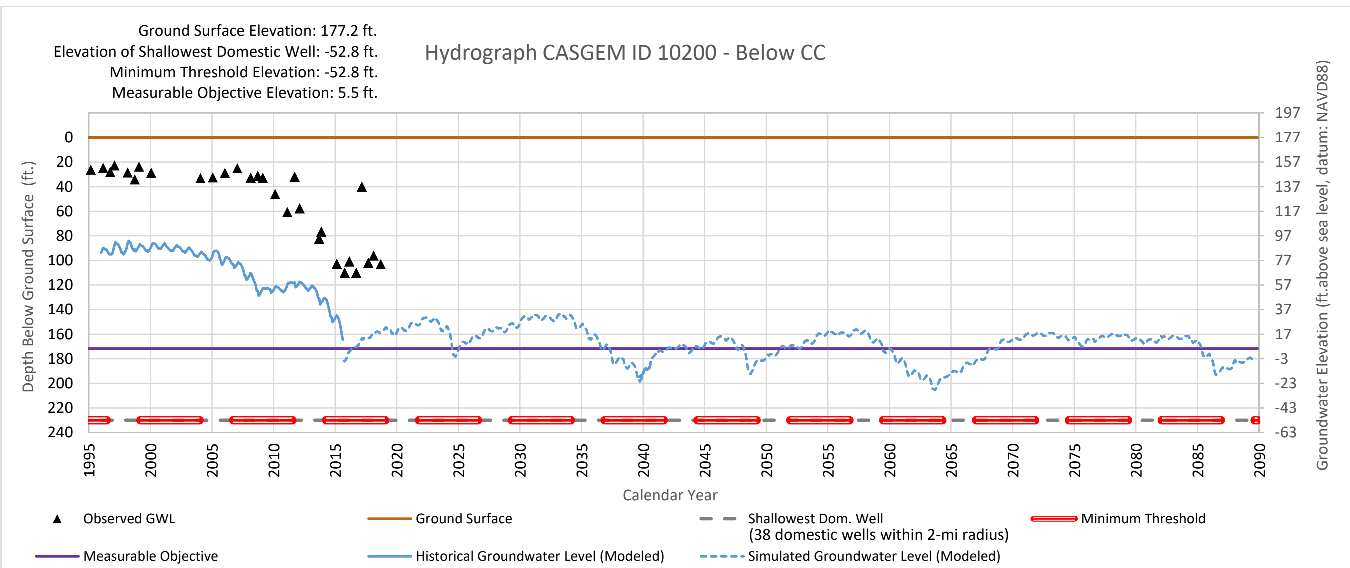

0 2.5 5 10
Miles
N

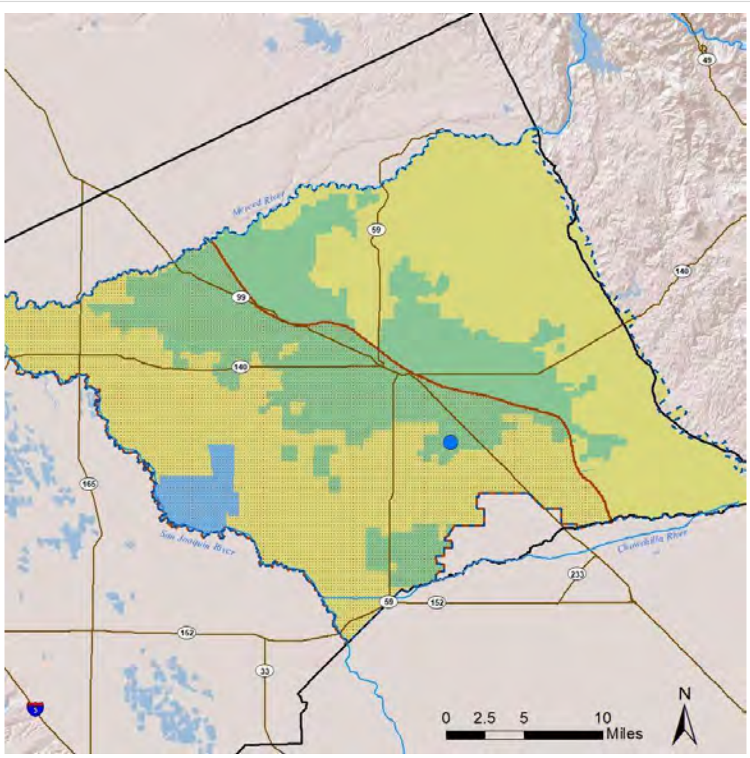


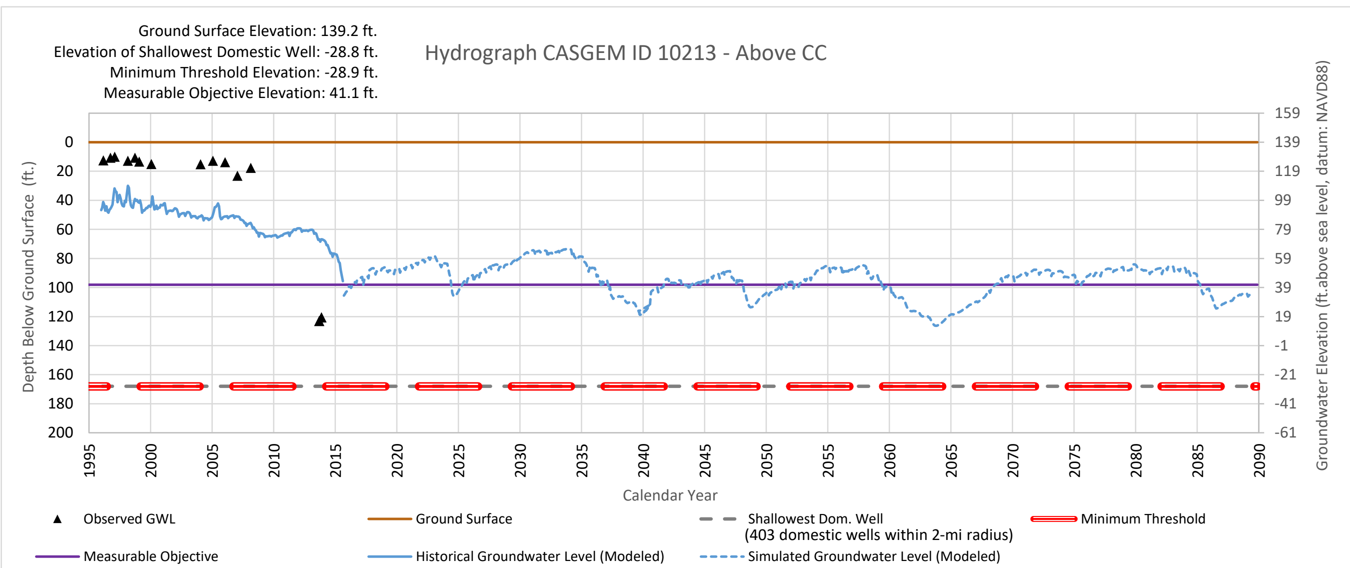
Ground Surface Elevation: 167.5 ft.
Elevation of Shallowest Domestic Well: -27.5 ft.
Minimum Threshold Elevation: -27.5 ft.
Measurable Objective Elevation: 34.0 ft.
Hydrograph CASGEM ID 10051 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Observed GWL
Ground Surface
Shallowest Dom. Well
(84 domestic wells within 2-mi radius)
Minimum Threshold
Measurable Objective
Historical Groundwater Level (Modeled)
Simulated Groundwater Level (Modeled)



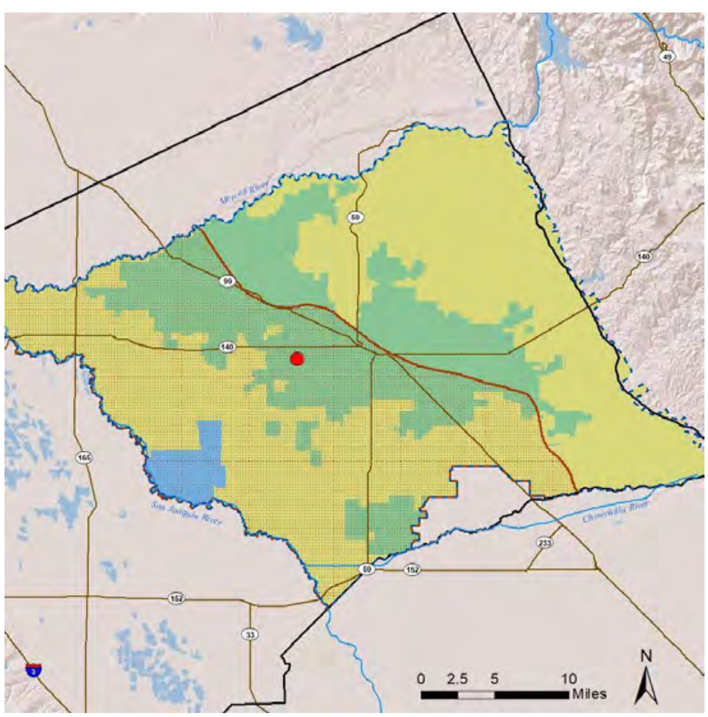
0 2.5 5 10
Miles
N


Ground Surface Elevation: 177.2 ft.
Elevation of Shallowest Domestic Well: -52.8 ft.
Minimum Threshold Elevation: -52.8 ft.
Measurable Objective Elevation: 5.5 ft.
Hydrograph CASGEM ID 10200 - Below CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Observed GWL
Ground Surface
Shallowest Dom. Well
(38 domestic wells within 2-mi radius)
Minimum Threshold
Measurable Objective
Historical Groundwater Level (Modeled)
Simulated Groundwater Level (Modeled)

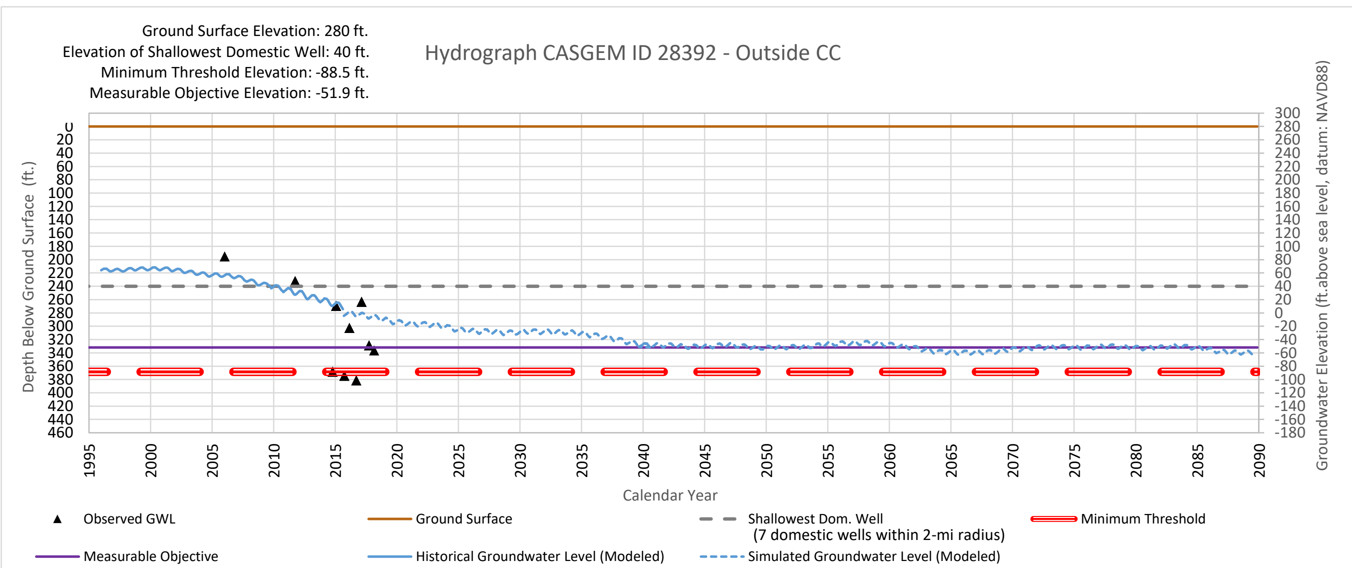

Merced River
San Joaquin River
Chowchilla River
0 2.5 5 10
Miles
N



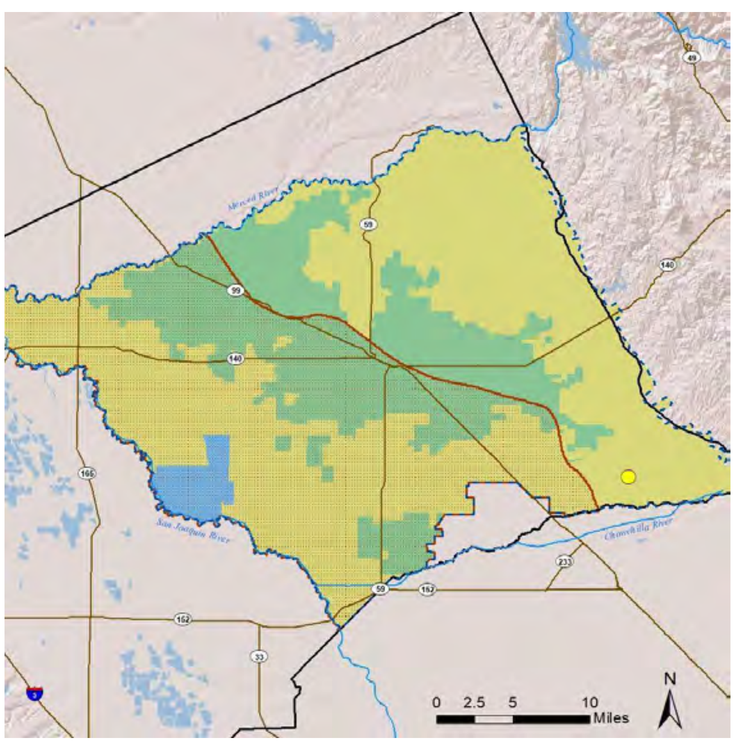
Ground Surface Elevation: 139.2 ft.
Elevation of Shallowest Domestic Well: -28.8 ft.
Minimum Threshold Elevation: -28.9 ft.
Measurable Objective Elevation: 41.1 ft.
Hydrograph CASGEM ID 10213 - Above CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Observed GWL
Ground Surface
Shallowest Dom. Well
(403 domestic wells within 2-mi radius)
Minimum Threshold
Measurable Objective
Historical Groundwater Level (Modeled)
Simulated Groundwater Level (Modeled)



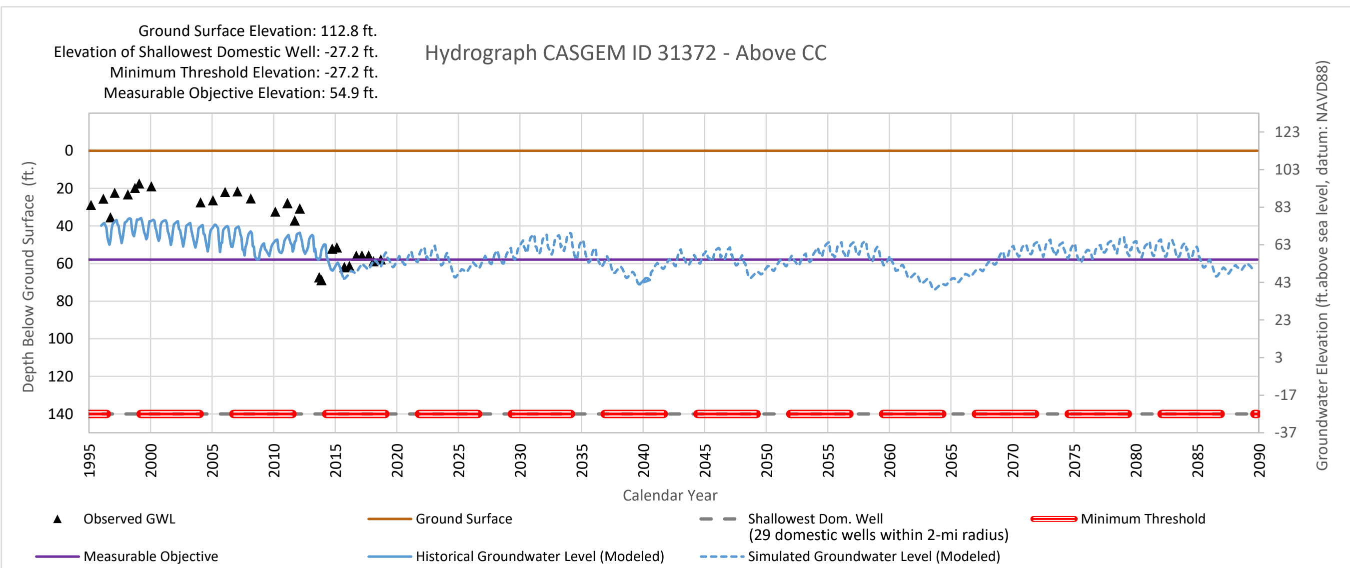
0 2.5 5 10
Miles
N

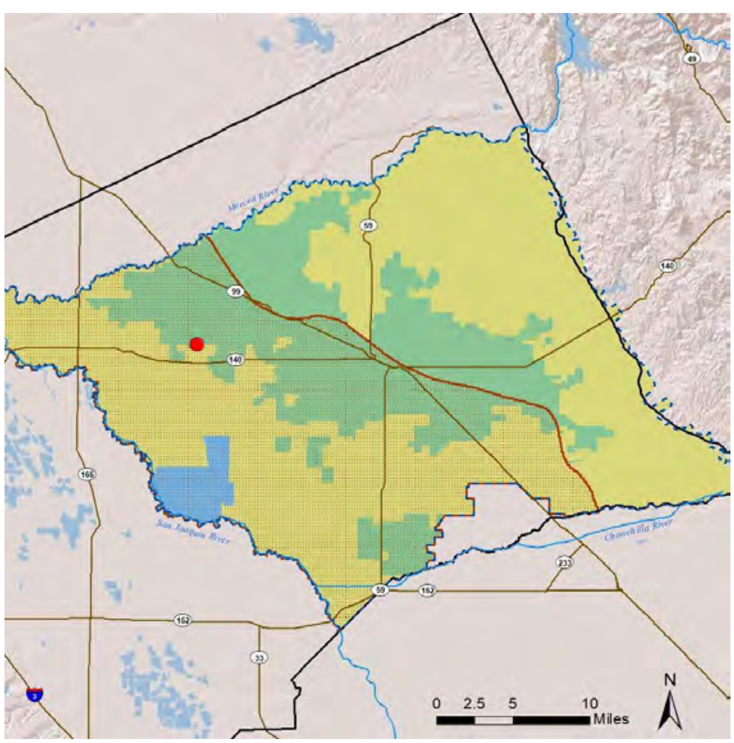


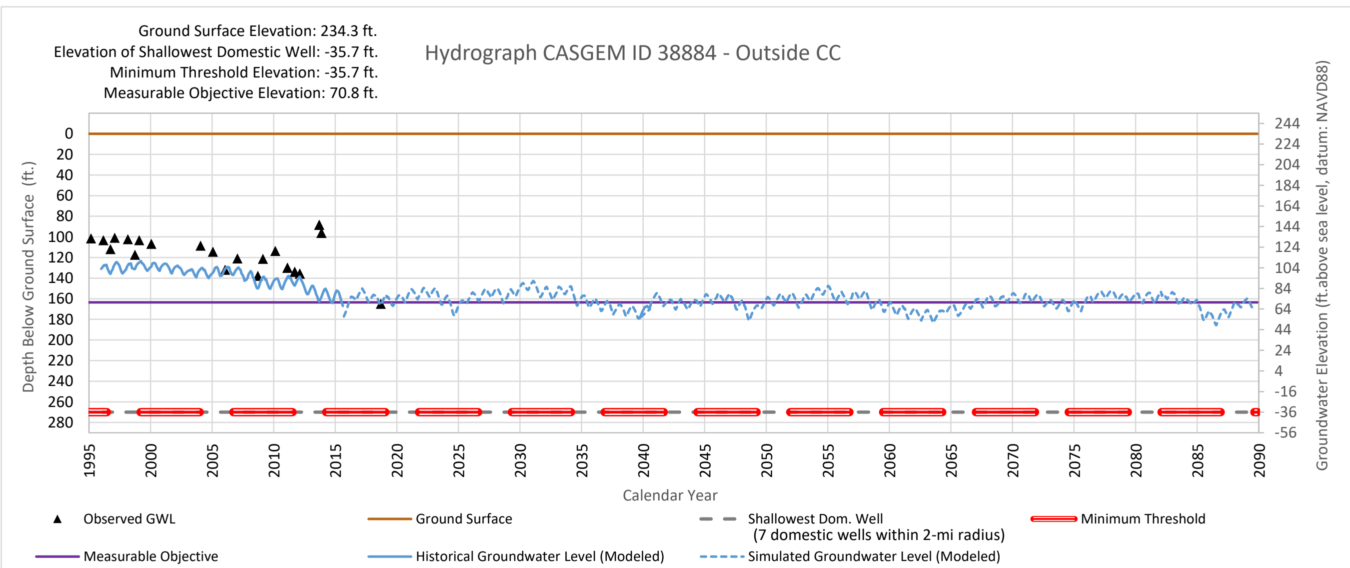
Ground Surface Elevation: 280 ft.
Elevation of Shallowest Domestic Well: 40 ft.
Minimum Threshold Elevation: -88.5 ft.
Measurable Objective Elevation: -51.9 ft.
Hydrograph CASGEM ID 28392 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Observed GWL
Ground Surface
Shallowest Dom. Well
(7 domestic wells within 2-mi radius)
Minimum Threshold
Measurable Objective
Historical Groundwater Level (Modeled)
Simulated Groundwater Level (Modeled)



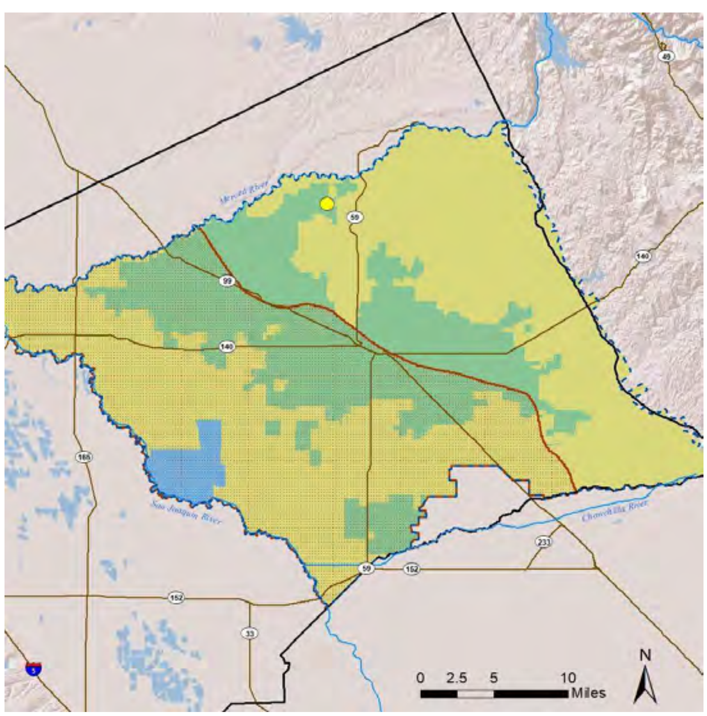
Merced River
San Joaquin River
Chowchilla River
0 2.5 5 10
Miles
N


Ground Surface Elevation: 112.8 ft.
Elevation of Shallowest Domestic Well: -27.2 ft.
Minimum Threshold Elevation: -27.2 ft.
Measurable Objective Elevation: 54.9 ft.
Hydrograph CASGEM ID 31372 - Above CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Observed GWL
Ground Surface
Shallowest Dom. Well
(29 domestic wells within 2-mi radius)
Minimum Threshold
Measurable Objective
Historical Groundwater Level (Modeled)
Simulated Groundwater Level (Modeled)

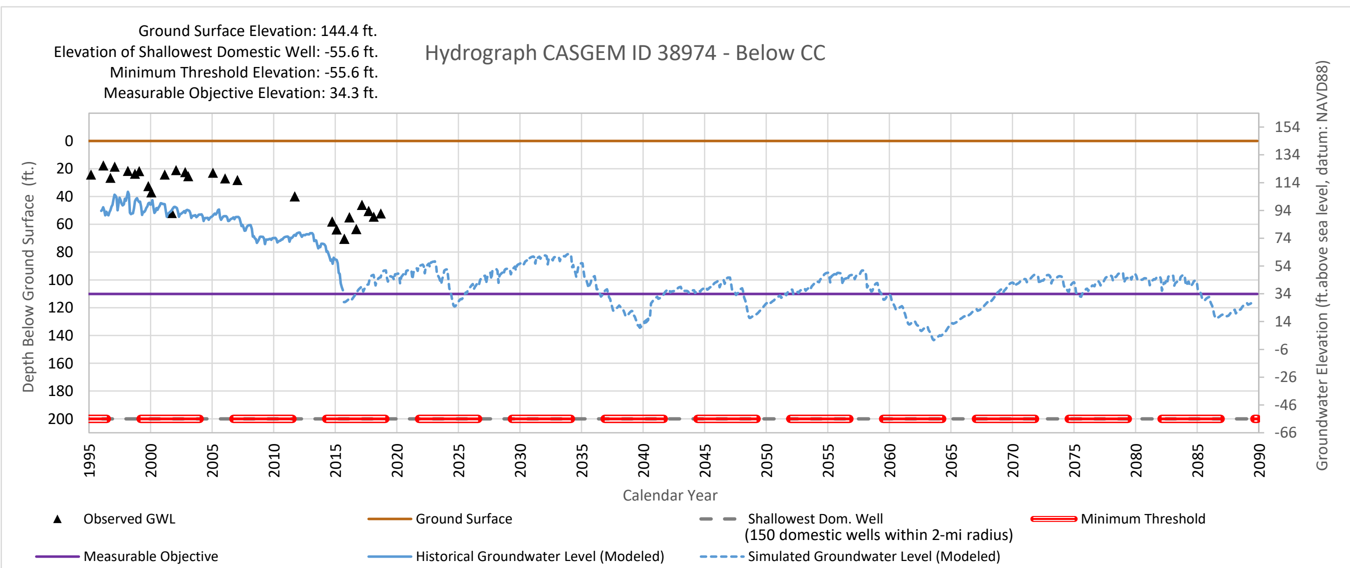

0 2.5 5 10
Miles
N

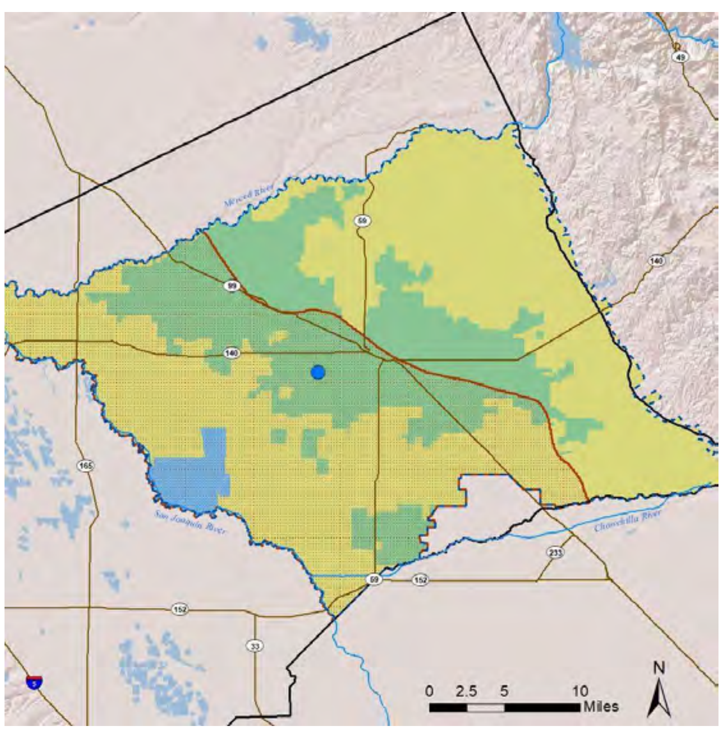


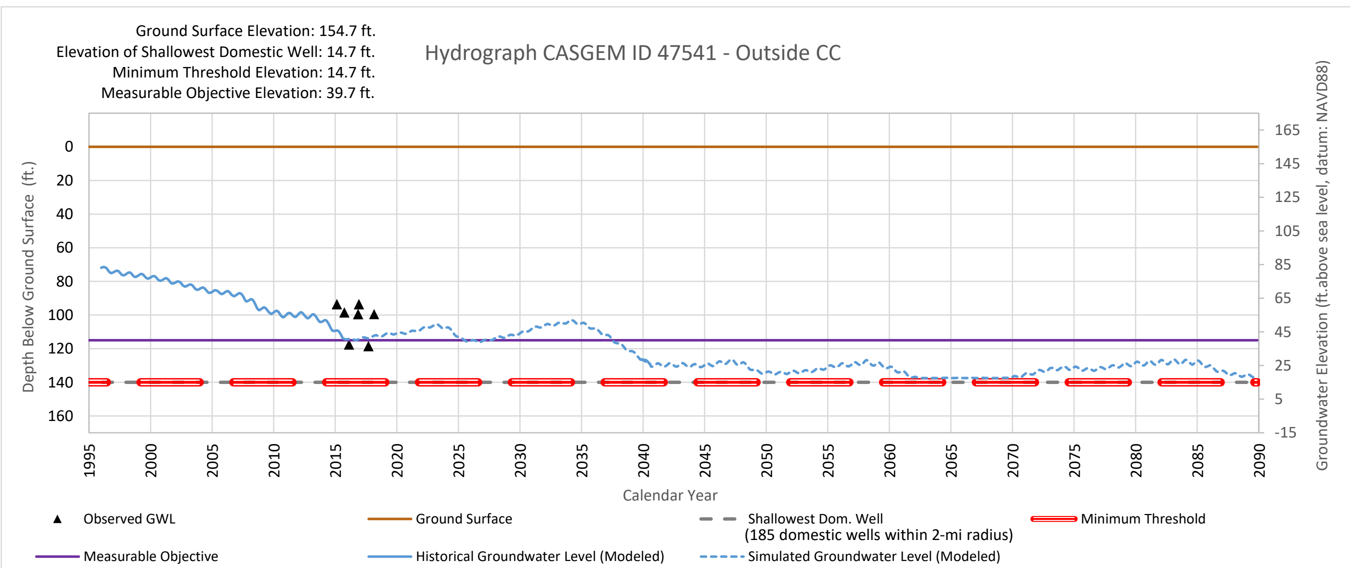
Ground Surface Elevation: 234.3 ft.
Elevation of Shallowest Domestic Well: -35.7 ft.
Minimum Threshold Elevation: -35.7 ft.
Measurable Objective Elevation: 70.8 ft.
Hydrograph CASGEM ID 38884 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Observed GWL
Ground Surface
Shallowest Dom. Well
(7 domestic wells within 2-mi radius)
Minimum Threshold
Measurable Objective
Historical Groundwater Level (Modeled)
Simulated Groundwater Level (Modeled)

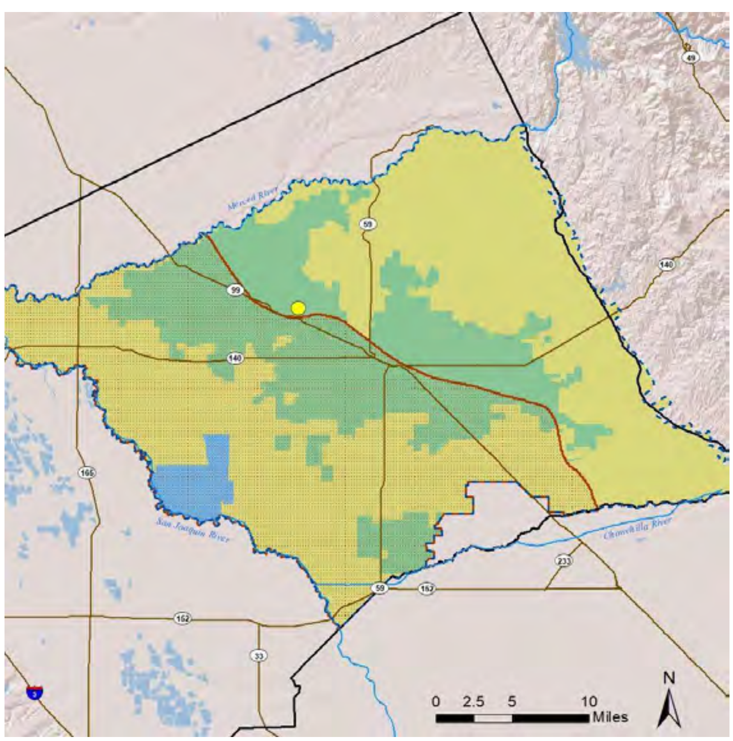


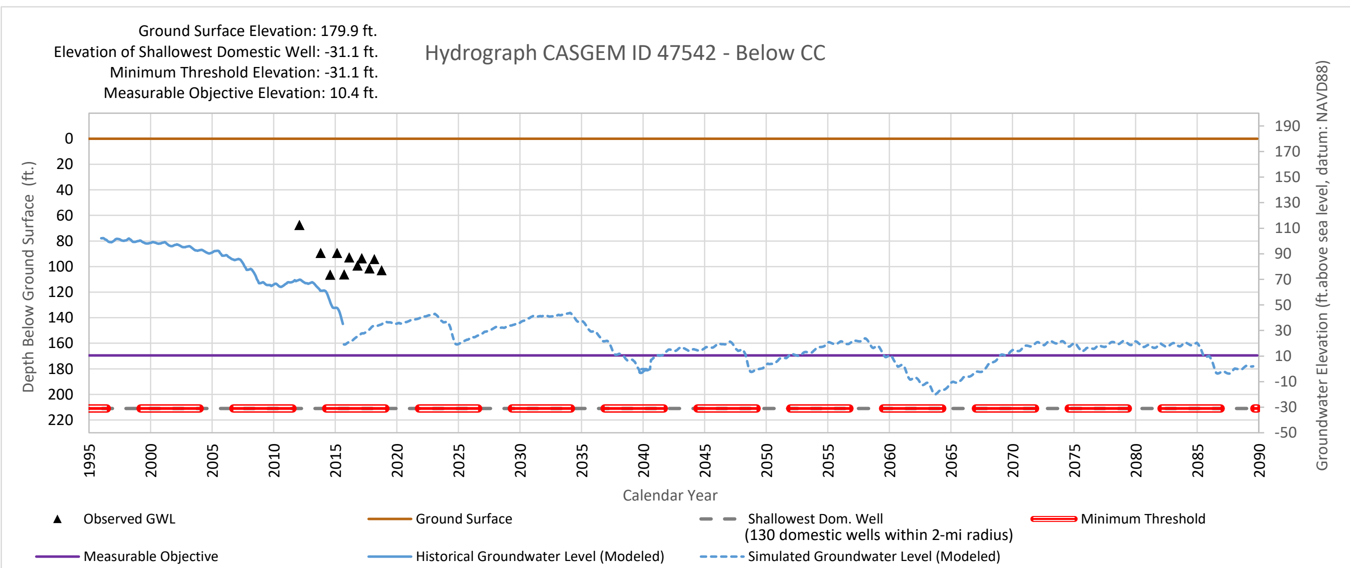
0 2.5 5 10
Miles
N

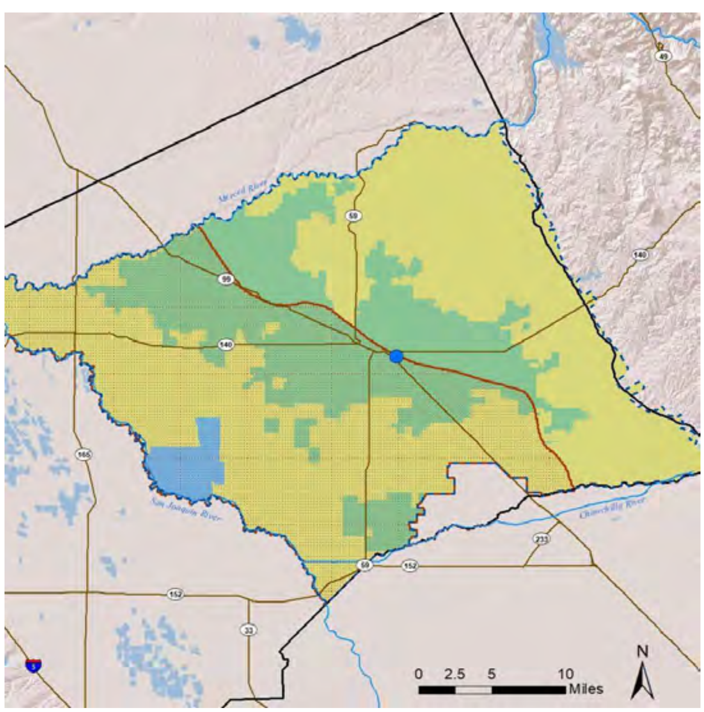

Ground Surface Elevation: 144.4 ft.
Elevation of Shallowest Domestic Well: -55.6 ft.
Minimum Threshold Elevation: -55.6 ft.
Measurable Objective Elevation: 34.3 ft.
Hydrograph CASGEM ID 38974 - Below CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Observed GWL
Ground Surface
Shallowest Dom. Well
(150 domestic wells within 2-mi radius)
Minimum Threshold
Measurable Objective
Historical Groundwater Level (Modeled)
Simulated Groundwater Level (Modeled)

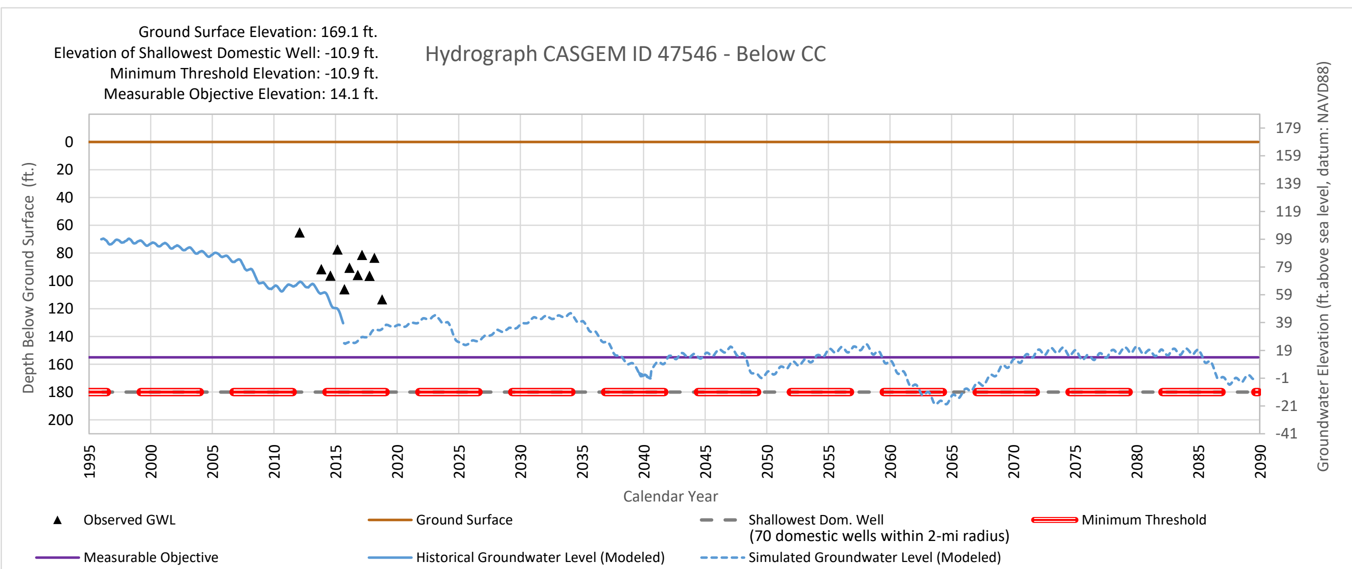

0 2.5 5 10
Miles
N

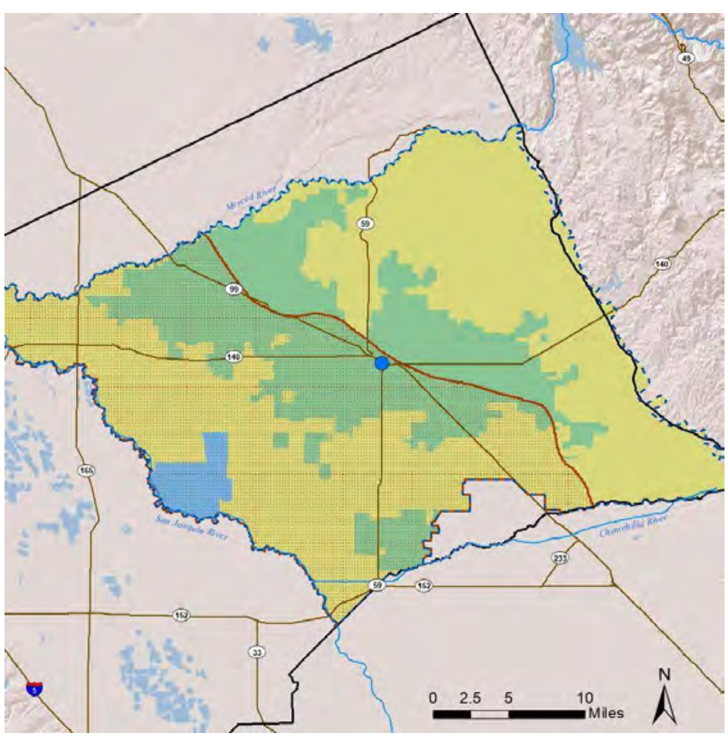

Ground Surface Elevation: 154.7 ft.
Elevation of Shallowest Domestic Well: 14.7 ft.
Minimum Threshold Elevation: 14.7 ft.
Measurable Objective Elevation: 39.7 ft.
Hydrograph CASGEM ID 47541 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Observed GWL
Ground Surface
Shallowest Dom. Well
(185 domestic wells within 2-mi radius)
Minimum Threshold
Measurable Objective
Historical Groundwater Level (Modeled)
Simulated Groundwater Level (Modeled)

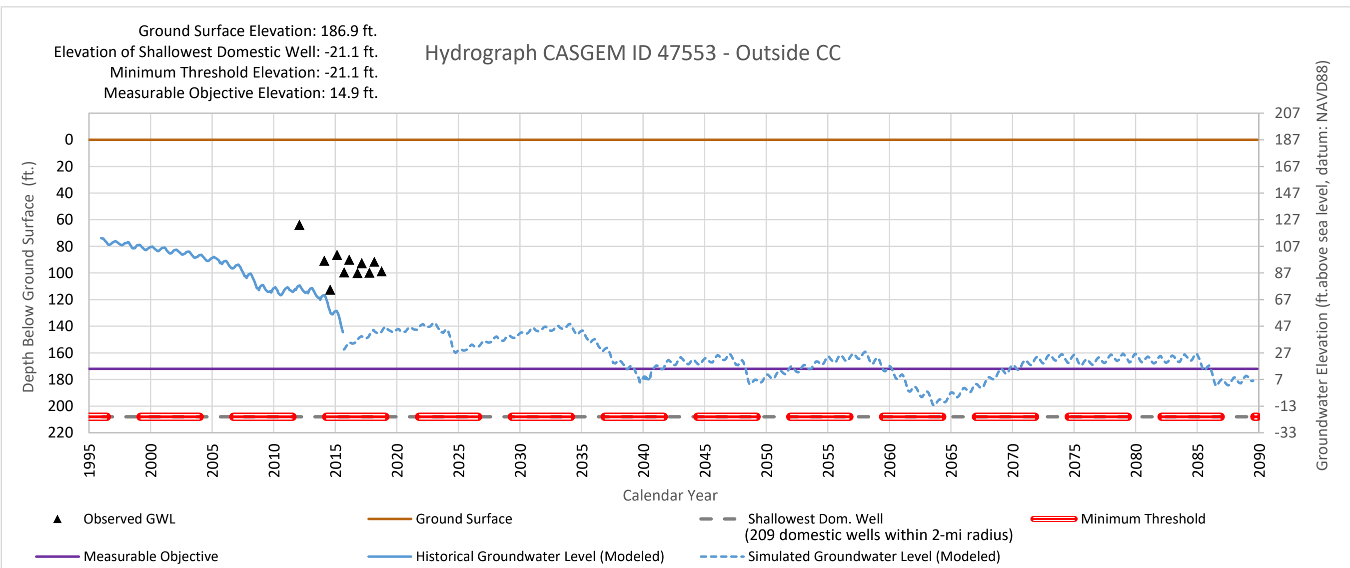

Merced River
San Joaquin River
Chowchilla River
0 2.5 5 10
Miles
N

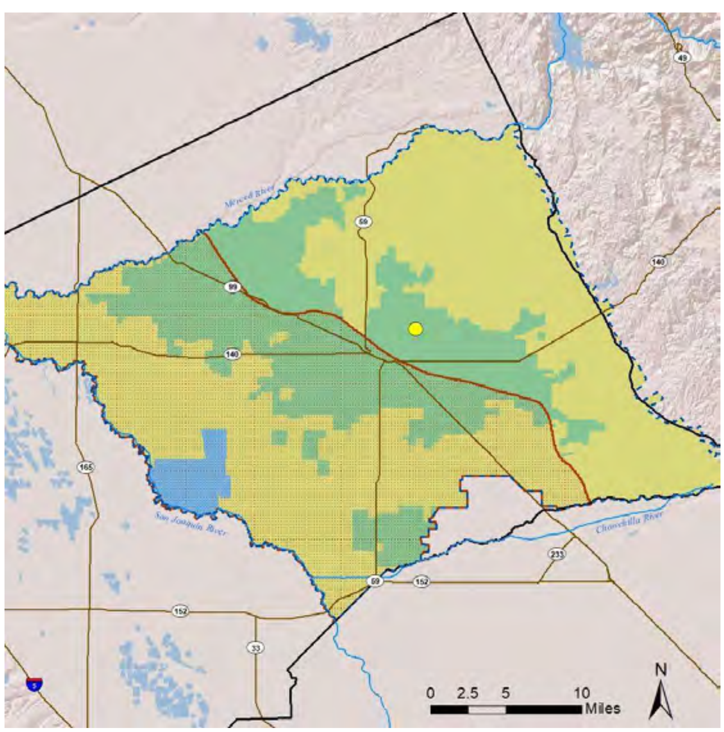

Ground Surface Elevation: 179.9 ft.
Elevation of Shallowest Domestic Well: -31.1 ft.
Minimum Threshold Elevation: -31.1 ft.
Measurable Objective Elevation: 10.4 ft.
Hydrograph CASGEM ID 47542 - Below CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Observed GWL
Ground Surface
Shallowest Dom. Well
(130 domestic wells within 2-mi radius)
Minimum Threshold
Measurable Objective
Historical Groundwater Level (Modeled)
Simulated Groundwater Level (Modeled)

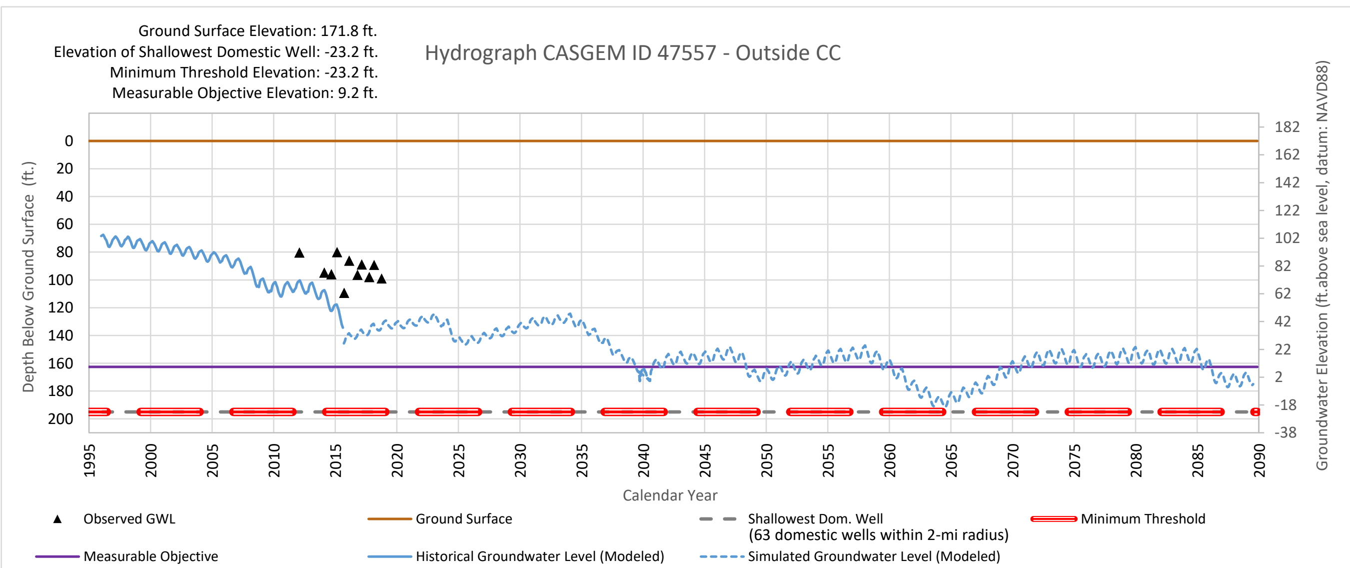

0 2.5 5 10
Miles
N

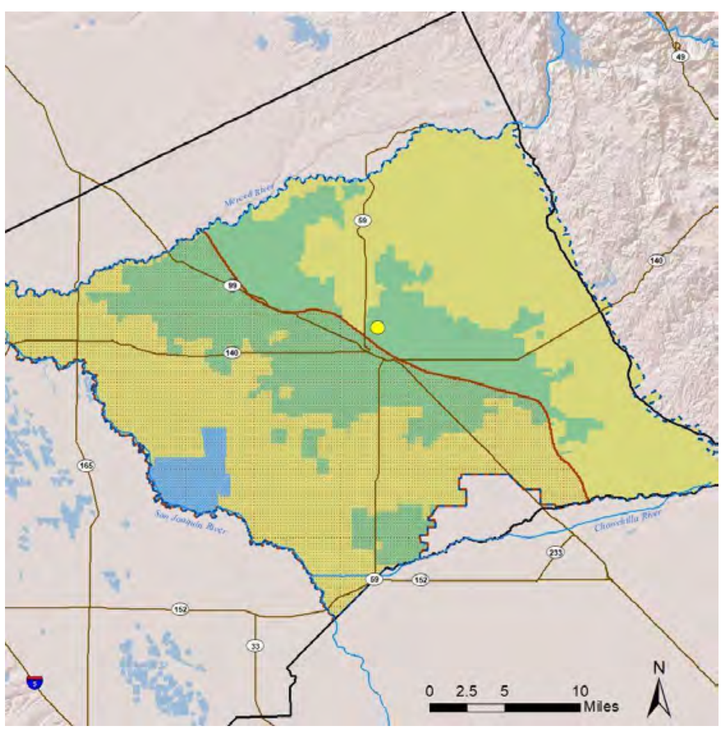

Ground Surface Elevation: 169.1 ft.
Elevation of Shallowest Domestic Well: -10.9 ft.
Minimum Threshold Elevation: -10.9 ft.
Measurable Objective Elevation: 14.1 ft.
Hydrograph CASGEM ID 47546 - Below CC
Depth Below Ground Surface (ft.)
0
20
40
60
80
100
120
140
160
180
200
Groundwater Elevation (ft.above sea level, datum: NAVD88)
179
159
139
119
99
79
59
39
19
-1
-21
-41
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
2080
2085
2090
Calendar Year
Observed GWL
Ground Surface
Shallowest Dom. Well
(70 domestic wells within 2-mi radius)
Minimum Threshold
Measurable Objective
Historical Groundwater Level (Modeled)
Simulated Groundwater Level (Modeled)

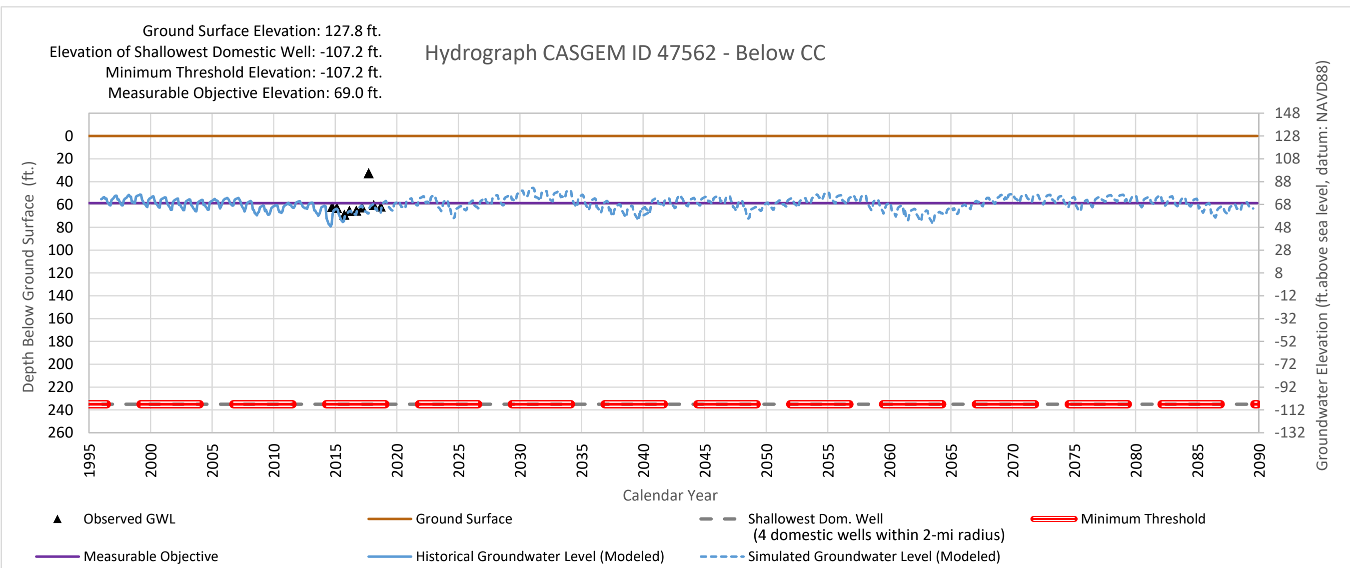

0
2.5
5
10
Miles
N

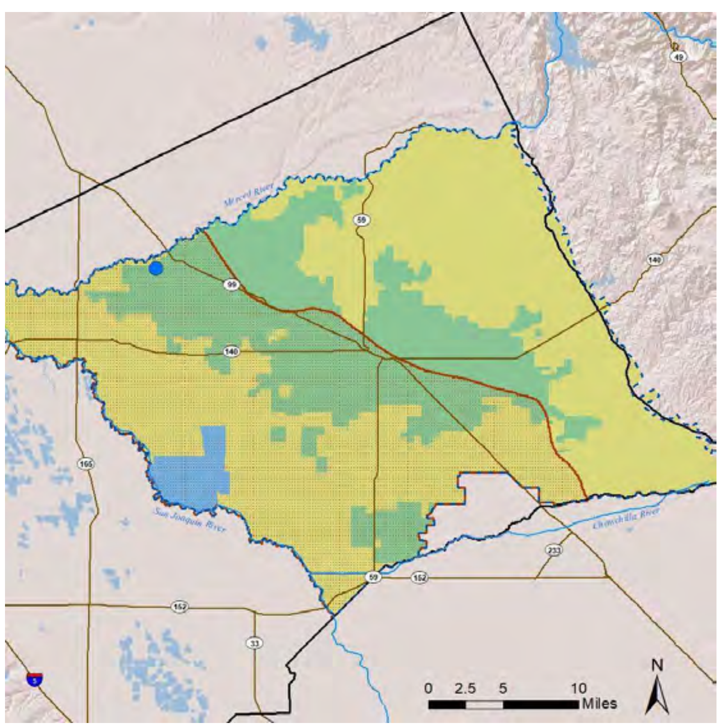

Ground Surface Elevation: 186.9 ft.
Elevation of Shallowest Domestic Well: -21.1 ft.
Minimum Threshold Elevation: -21.1 ft.
Measurable Objective Elevation: 14.9 ft.
Hydrograph CASGEM ID 47553 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Observed GWL
Ground Surface
Shallowest Dom. Well
(209 domestic wells within 2-mi radius)
Minimum Threshold
Measurable Objective
Historical Groundwater Level (Modeled)
Simulated Groundwater Level (Modeled)

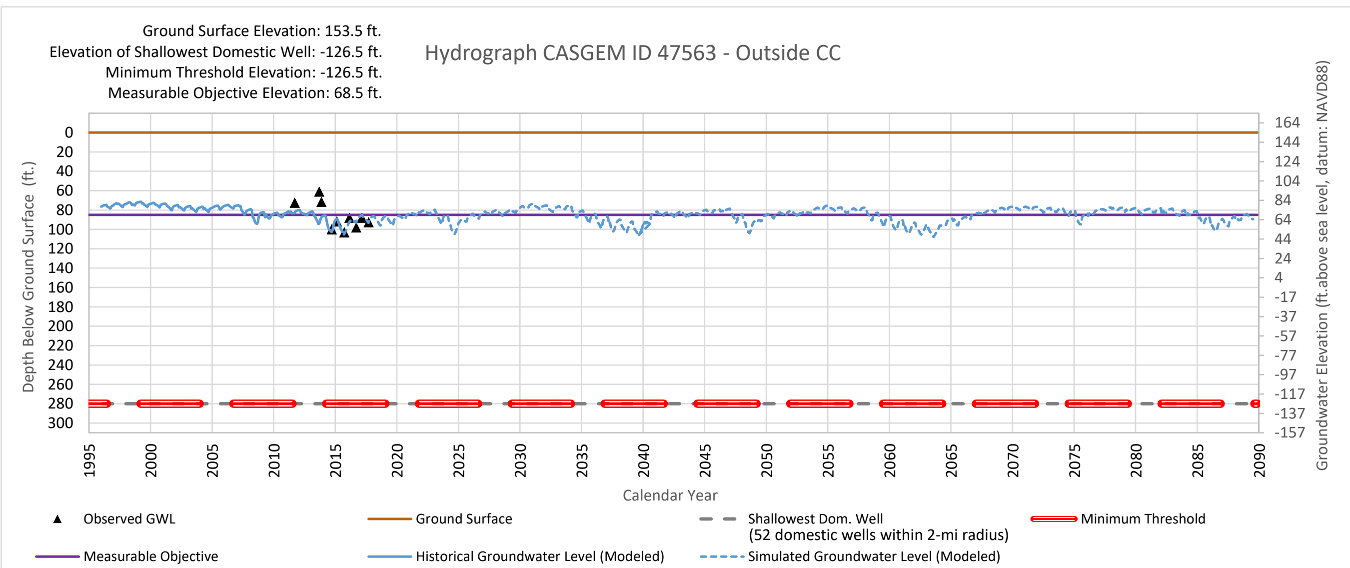

0 2.5 5 10
Miles
N

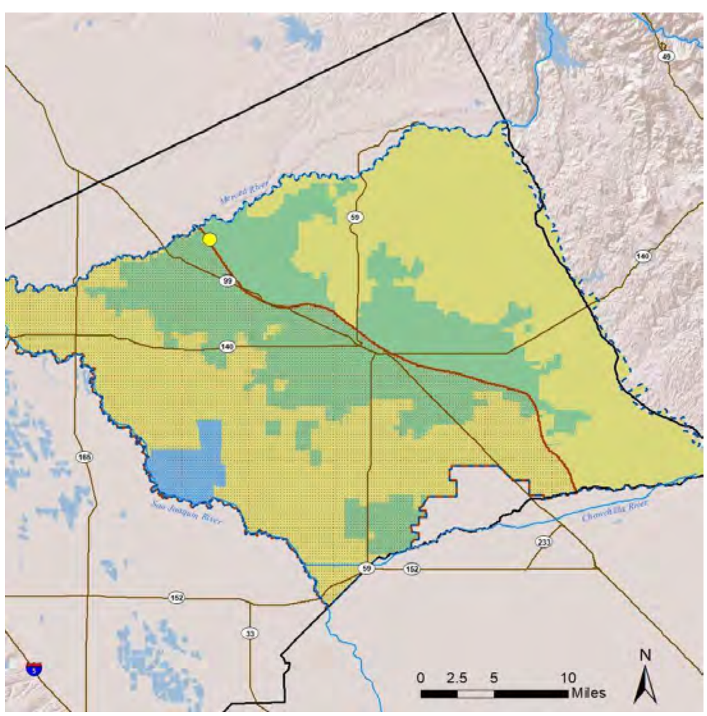

Ground Surface Elevation: 171.8 ft.
Elevation of Shallowest Domestic Well: -23.2 ft.
Minimum Threshold Elevation: -23.2 ft.
Measurable Objective Elevation: 9.2 ft.
Hydrograph CASGEM ID 47557 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Observed GWL
Ground Surface
Shallowest Dom. Well
(63 domestic wells within 2-mi radius)
Minimum Threshold
Measurable Objective
Historical Groundwater Level (Modeled)
Simulated Groundwater Level (Modeled)

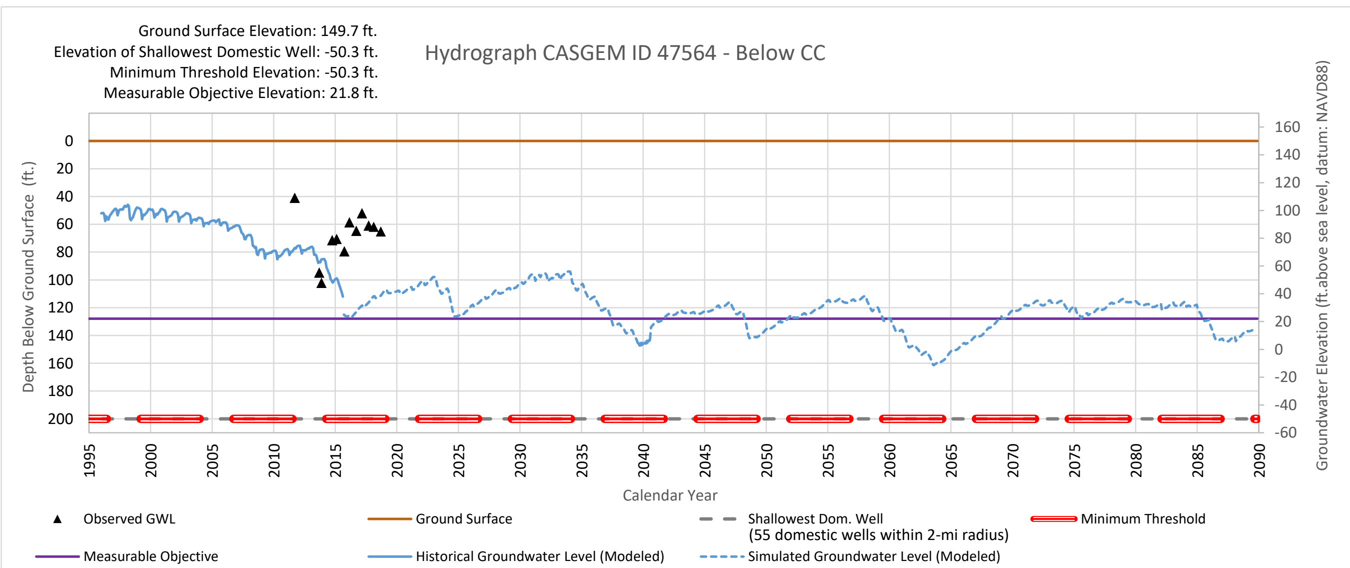

0 2.5 5 10
Miles
N

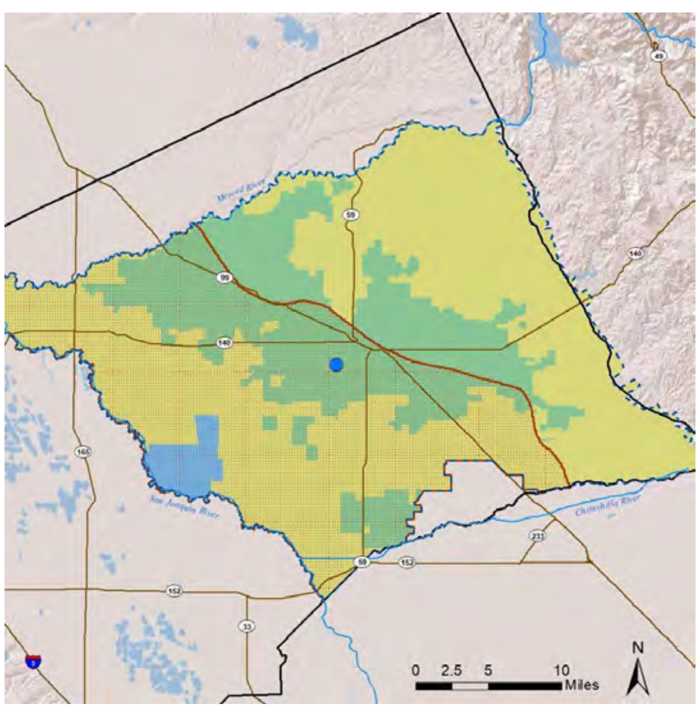

Ground Surface Elevation: 127.8 ft.
Elevation of Shallowest Domestic Well: -107.2 ft.
Minimum Threshold Elevation: -107.2 ft.
Measurable Objective Elevation: 69.0 ft.
Hydrograph CASGEM ID 47562 - Below CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Observed GWL
Ground Surface
Shallowest Dom. Well
(4 domestic wells within 2-mi radius)
Minimum Threshold
Measurable Objective
Historical Groundwater Level (Modeled)
Simulated Groundwater Level (Modeled)

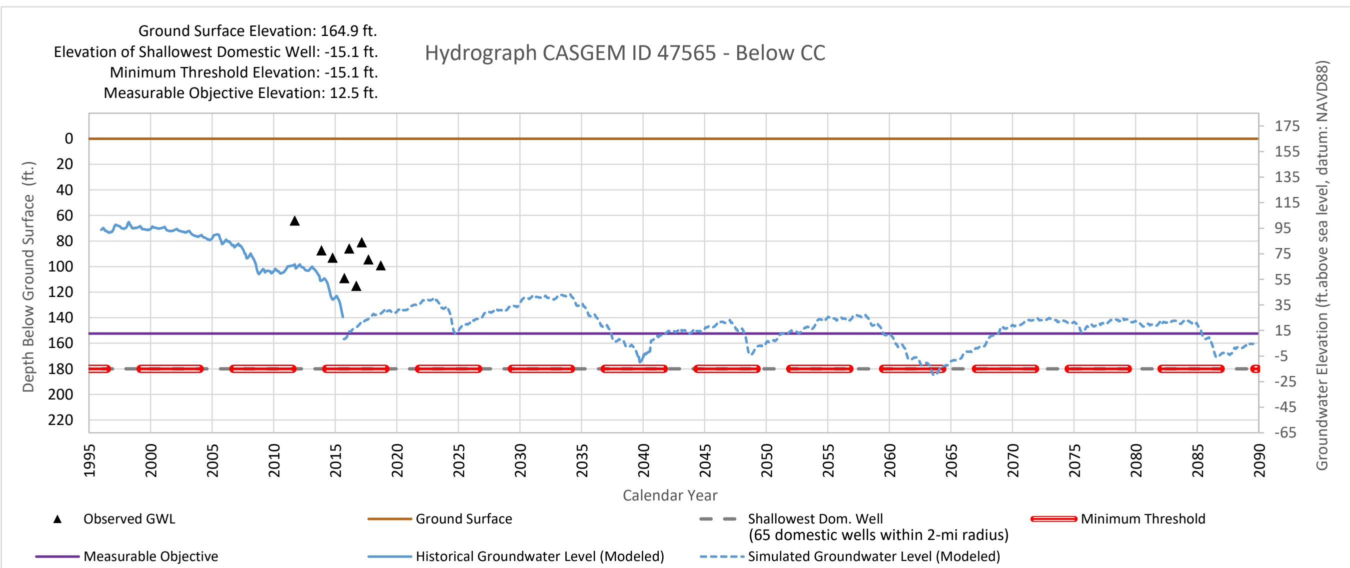

0 2.5 5 10
Miles
N

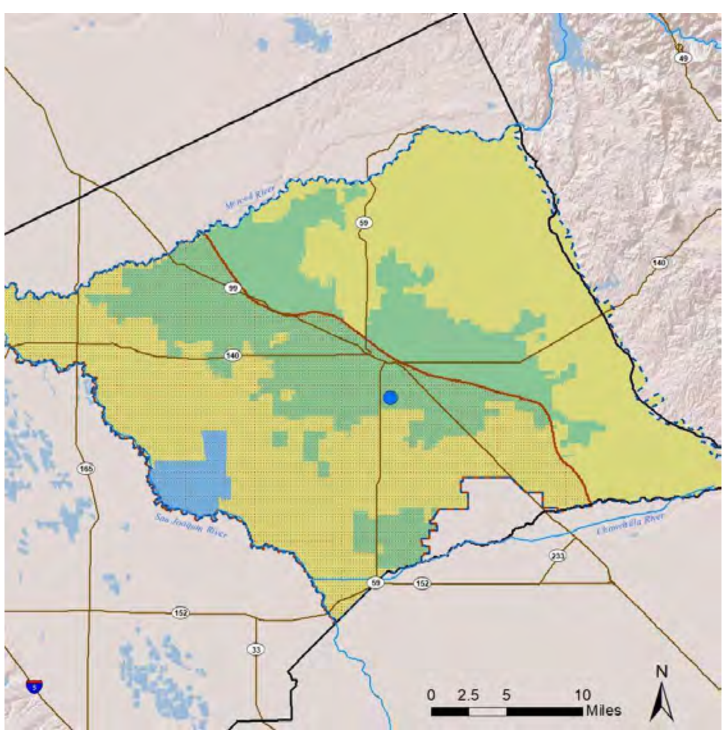

Ground Surface Elevation: 153.5 ft.
Elevation of Shallowest Domestic Well: -126.5 ft.
Minimum Threshold Elevation: -126.5 ft.
Measurable Objective Elevation: 68.5 ft.
Hydrograph CASGEM ID 47563 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Observed GWL
Ground Surface
Shallowest Dom. Well
(52 domestic wells within 2-mi radius)
Minimum Threshold
Measurable Objective
Historical Groundwater Level (Modeled)
Simulated Groundwater Level (Modeled)

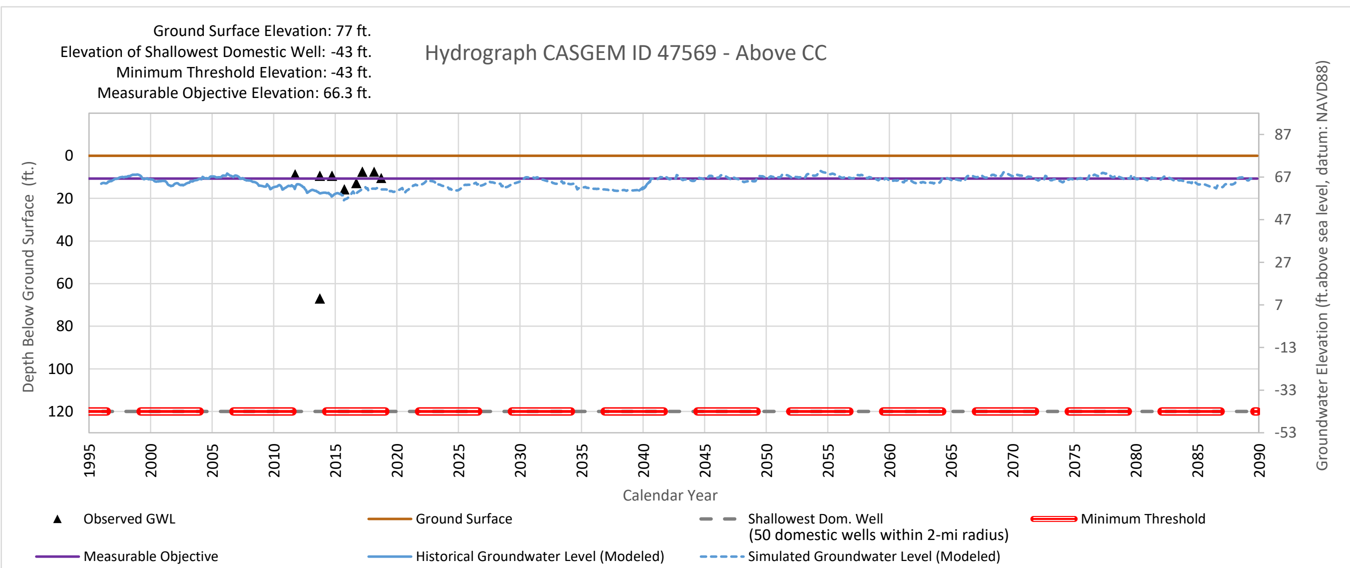

0 2.5 5 10
Miles
N

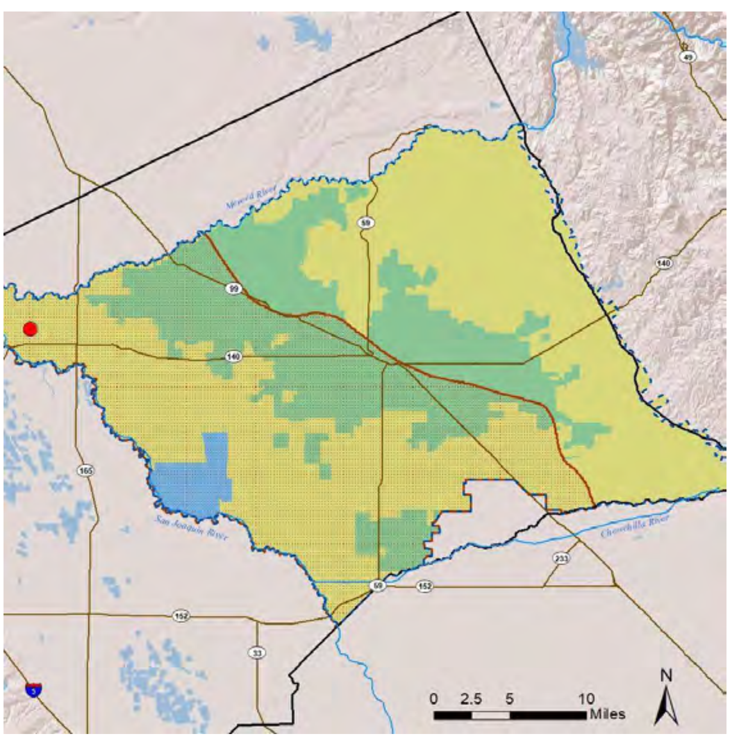

Ground Surface Elevation: 149.7 ft.
Elevation of Shallowest Domestic Well: -50.3 ft.
Minimum Threshold Elevation: -50.3 ft.
Measurable Objective Elevation: 21.8 ft.
Hydrograph CASGEM ID 47564 - Below CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Observed GWL
Ground Surface
Shallowest Dom. Well
(55 domestic wells within 2-mi radius)
Minimum Threshold
Measurable Objective
Historical Groundwater Level (Modeled)
Simulated Groundwater Level (Modeled)

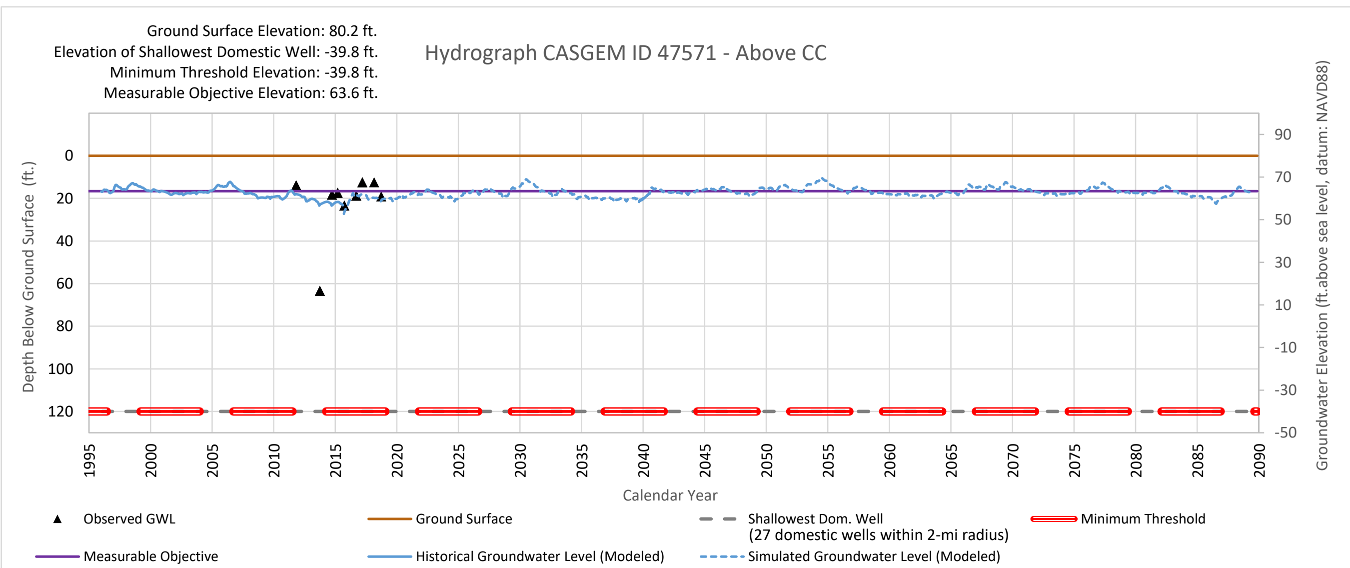

0 2.5 5 10
Miles
N


Ground Surface Elevation: 164.9 ft.
Elevation of Shallowest Domestic Well: -15.1 ft.
Minimum Threshold Elevation: -15.1 ft.
Measurable Objective Elevation: 12.5 ft.
Hydrograph CASGEM ID 47565 - Below CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Observed GWL
Ground Surface
Shallowest Dom. Well
(65 domestic wells within 2-mi radius)
Minimum Threshold
Measurable Objective
Historical Groundwater Level (Modeled)
Simulated Groundwater Level (Modeled)

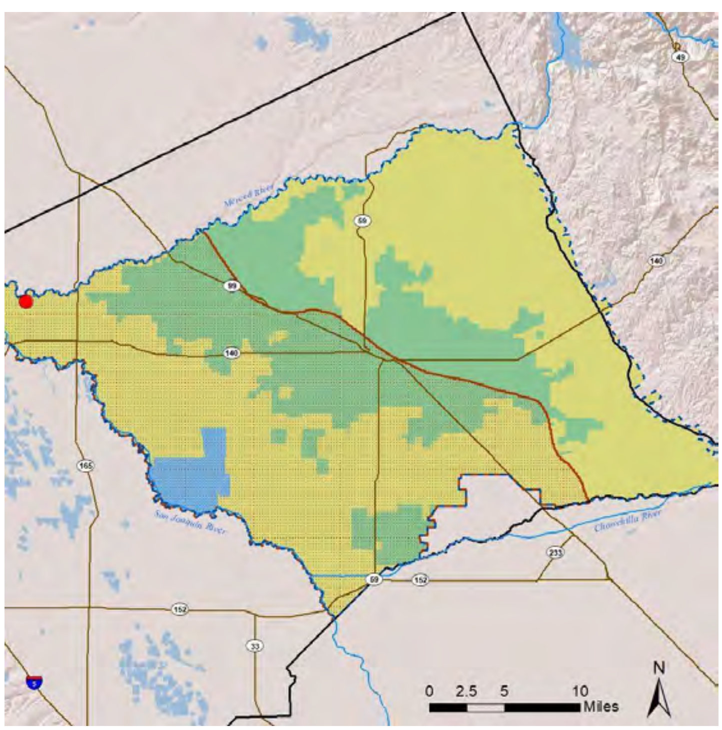

Merced River
San Joaquin River
Chowchilla River
0 2.5 5 10
Miles
N


Ground Surface Elevation: 77 ft.
Elevation of Shallowest Domestic Well: -43 ft.
Minimum Threshold Elevation: -43 ft.
Measurable Objective Elevation: 66.3 ft.
Hydrograph CASGEM ID 47569 - Above CC
Depth Below Ground Surface (ft.)
0
20
40
60
80
100
120
Groundwater Elevation (ft.above sea level, datum: NAVD88)
87
67
47
27
7
-13
-33
-53
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
2080
2085
2090
Calendar Year
Observed GWL
Ground Surface
Shallowest Dom. Well
(50 domestic wells within 2-mi radius)
Minimum Threshold
Measurable Objective
Historical Groundwater Level (Modeled)
Simulated Groundwater Level (Modeled)

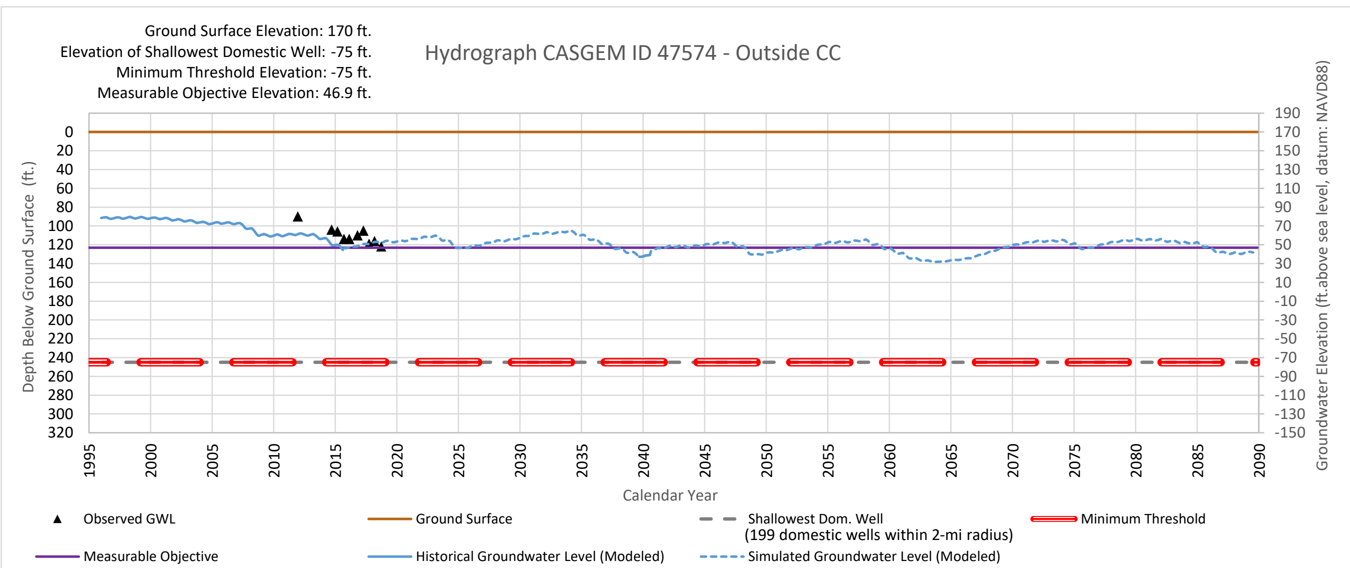

Merced River
San Joaquin River
Chowchilla River
0
2.5
5
10
Miles
N

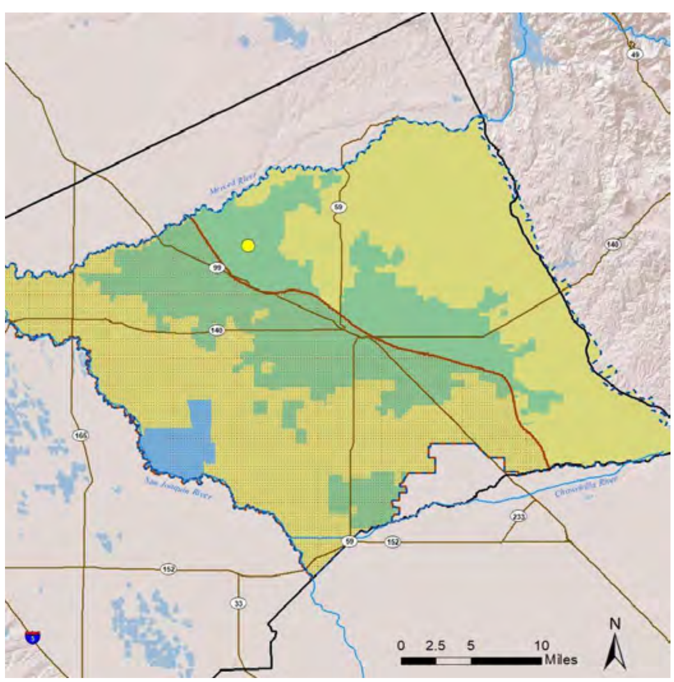


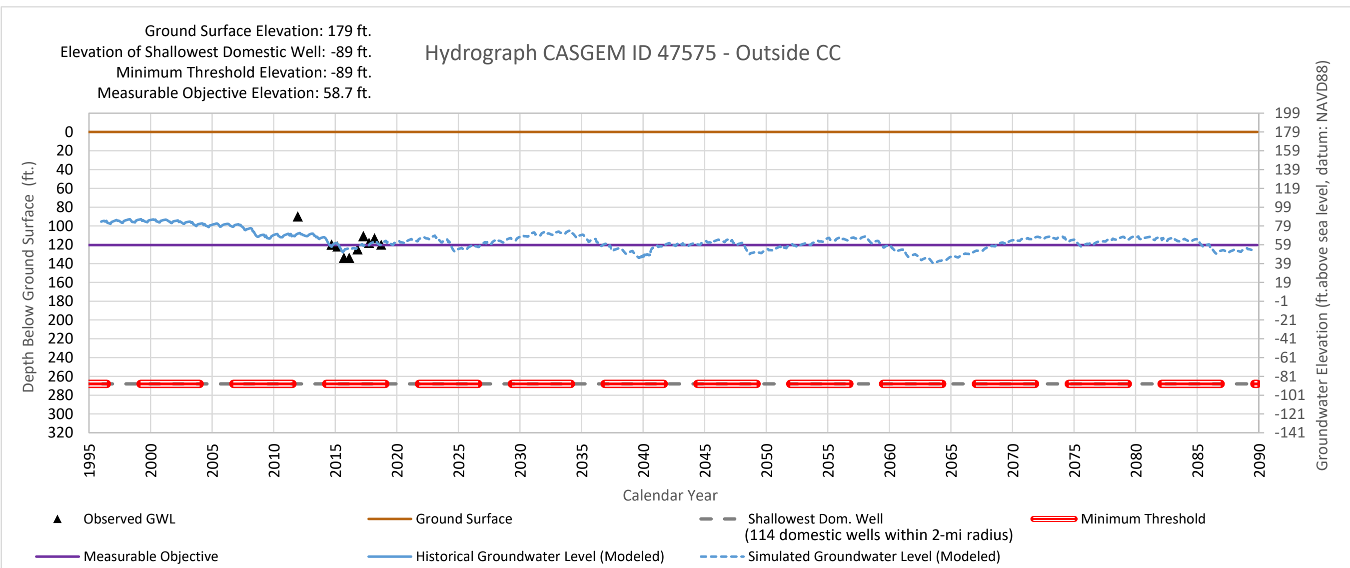
Ground Surface Elevation: 80.2 ft.
Elevation of Shallowest Domestic Well: -39.8 ft.
Minimum Threshold Elevation: -39.8 ft.
Measurable Objective Elevation: 63.6 ft.
Hydrograph CASGEM ID 47571 - Above CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Observed GWL
Ground Surface
Shallowest Dom. Well
(27 domestic wells within 2-mi radius)
Minimum Threshold
Measurable Objective
Historical Groundwater Level (Modeled)
Simulated Groundwater Level (Modeled)



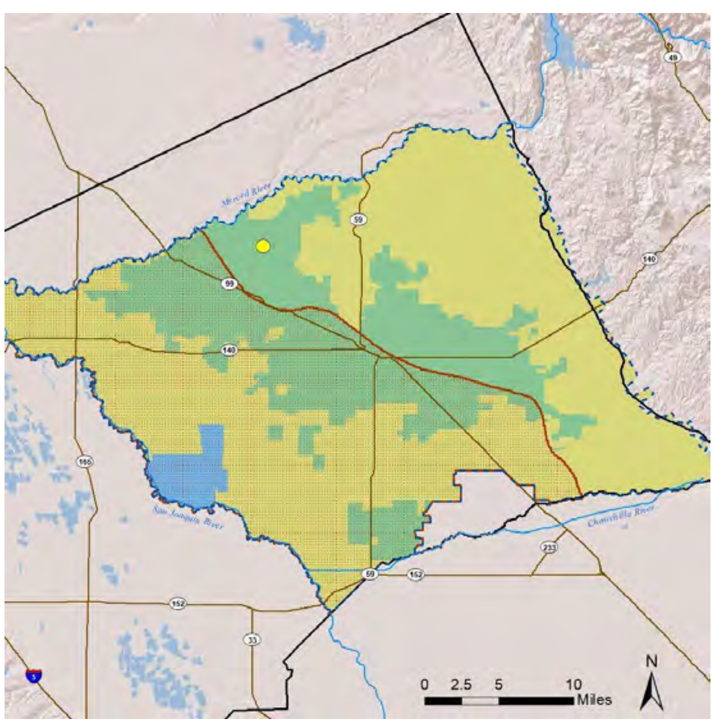
0 2.5 5 10
Miles
N


Ground Surface Elevation: 170 ft.
Elevation of Shallowest Domestic Well: -75 ft.
Minimum Threshold Elevation: -75 ft.
Measurable Objective Elevation: 46.9 ft.
Hydrograph CASGEM ID 47574 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Observed GWL
Ground Surface
Shallowest Dom. Well
(199 domestic wells within 2-mi radius)
Minimum Threshold
Measurable Objective
Historical Groundwater Level (Modeled)
Simulated Groundwater Level (Modeled)


0 2.5 5 10
Miles
N

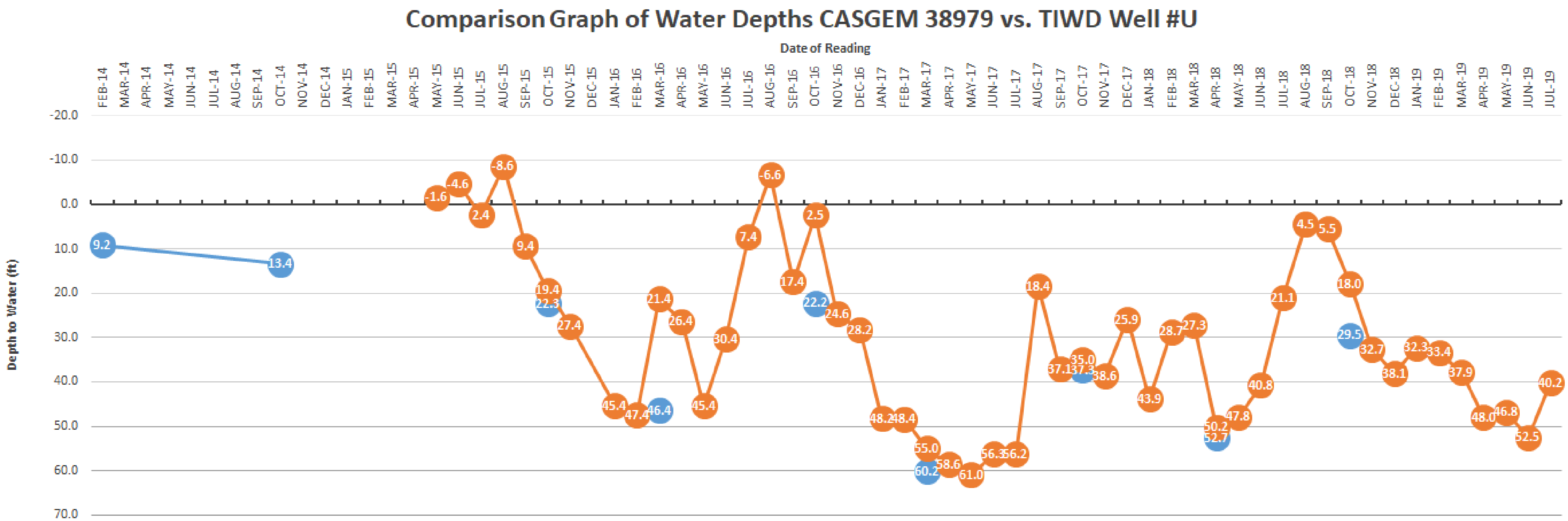


Ground Surface Elevation: 179 ft.
Elevation of Shallowest Domestic Well: -89 ft.
Minimum Threshold Elevation: -89 ft.
Measurable Objective Elevation: 58.7 ft.
Hydrograph CASGEM ID 47575 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Observed GWL
Ground Surface
Shallowest Dom. Well
(114 domestic wells within 2-mi radius)
Minimum Threshold
Measurable Objective
Historical Groundwater Level (Modeled)
Simulated Groundwater Level (Modeled)



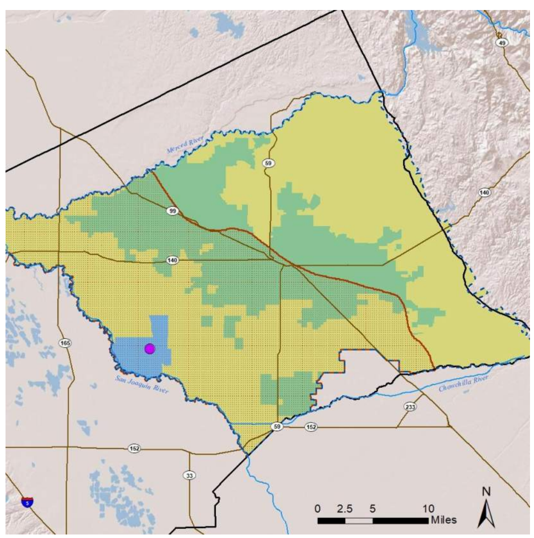
0 2.5 5 10
Miles
N

Additional data provided by TIWD GSA-1
comparing DWR CASGEM well measurements to measurements at same well by TIWD
(this is not a representative monitoring well)



	Feb-14	Oct-14	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17
CASGEM	9.2	13.4						22.3				46.4							22.2					60.2		
TIWD			-1.6	-4.6	2.4	-8.6	9.4	19.4	27.4	45.4	47.4	21.4	26.4	45.4	30.4	7.4	-6.6	17.4	2.5	24.6	28.2	48.2	48.4	55.0	58.6	61.0

	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19
CASGEM					37.3						52.7						29.5									
TIWD	56.3	56.2	18.4	37.1	35.0	38.6	25.9	43.9	28.7	27.3	50.2	47.8	40.8	21.1	4.5	5.5	18.0	32.7	38.1	32.3	33.4	37.9	48.0	46.8	52.5	40.2



APPENDIX G: MERCED CHOWCHILLA INTERBASIN AGREEMENT

INTERBASIN AGREEMENT

MERCED-CHOWCHILLA GROUNDWATER SUBBASINS

This Interbasin Agreement for the Merced-Chowchilla Groundwater Subbasins (this "Agreement") is made and effective as of July 31, 2018 ("Effective Date") by and among **Chowchilla Water District Groundwater Sustainability Agency, Merced Irrigation-Urban Groundwater Sustainability Agency, County of Madera Chowchilla Subbasin Groundwater Sustainability Agency, Merced Subbasin Groundwater Sustainability Agency, Triangle T Water District GSA** and **County of Merced Chowchilla Subbasin Groundwater Sustainability Agency**.

This Agreement is made with reference to the following facts and understandings:

A. On August 29, 2014, the California Legislature passed comprehensive groundwater legislation contained in SB 1168, SB 1319, and AB 1739, collectively known as the "Sustainable Groundwater Management Act" ("SGMA"). SGMA was signed into law on September 16, 2014 and it became effective on January 1, 2015. In adopting SGMA, the Legislature intended to provide local groundwater agencies with the authority and technical and financial assistance necessary to sustainably manage groundwater.

B. Under SGMA, each affected groundwater basin or subbasin will be regulated separately by one or more Groundwater Sustainability Agencies (each, a "GSA"). A local agency or combination of local agencies may elect to be the GSA for a basin or subbasin. Each of the parties to this Agreement ("Party(ies)") is a Groundwater Sustainability Agency (each, as "GSA") established by a local government entity with either water supply, water management, or land use responsibilities within the critically overdrafted Merced and Chowchilla groundwater subbasins of the San Joaquin Valley groundwater basin (the "Subbasins").

C. Groundwater sustainability under SGMA is to be achieved through Groundwater Sustainability Plans (each, a "GSP"). A GSP can be a single plan developed by one or more GSAs, or multiple coordinated plans within a basin or subbasin by multiple GSAs. SGMA requires that the GSPs for critically overdrafted subbasins be adopted by January 31, 2020. The regulations interpreting SGMA allow for GSAs with adjoining jurisdictions to enter into interbasin agreements to establish compatible sustainability goals and understanding regarding fundamental elements of the GSPs of each agency, and thereby promote the compatibility of GSPs where the actions in one subbasin may affect the groundwater of an adjoining subbasin.

D. In March of 2016 the Chowchilla Water District submitted a Basin Boundary Modification request to the California Department of Water Resources ("DWR") proposing that the Chowchilla groundwater subbasin boundary be modified under the Jurisdictional Modification criteria in the DWR Basin Boundary Modification Emergency Regulation, which requested changes do not alter the interactive hydrologic nature of the Subbasins. This Basin Boundary Modification resulted in moving a portion of the Chowchilla Subbasin (as defined by Bulletin 118- 2003) that is within the jurisdiction of Merced Irrigation District and Merced County into the Merced Subbasin. This area in Merced County, mainly around the community of El Nido, has experienced significant land subsidence over the recent years.

E. Merced Irrigation District initially submitted to DWR a letter opposing the Basin Boundary Modification due to concerns regarding inter-basin coordination. Merced County submitted a letter of support for the Basin Boundary Modification contingent upon the adoption of an interbasin agreement. Merced Irrigation District subsequently withdrew its opposition to the Basin Boundary Modification request based on agreement from the Chowchilla Subbasin GSAs to enter into this inter-basin agreement as defined in Section 357.2 of the Groundwater Sustainability Plan Emergency Regulations.

F. The Parties are entering into this Agreement to establish compatible sustainability goals and understandings for the Subbasins, with a focus on the areas where the activities occurring within one Party's jurisdiction may affect groundwater within another Party's jurisdiction, to resolve the comments and concerns of Merced Irrigation District and Merced County regarding the boundary modification request of the Chowchilla Water District, and to coordinate preparation of each agency's respective GSP in order to promote the compatibility thereof. The Parties intend that the GSPs will address the level of cooperation and coordination between the Parties.

G. The intent of the Parties under this Agreement is to provide each Party with the sole right and responsibility to implement SGMA within its respective boundaries, as defined herein, in a manner determined by the Party as a GSA. The Parties expressly intend that neither SGMA, nor this Agreement, nor any GSP shall be construed as authorizing another Party, or the other Parties acting together, or any dispute resolution process contained herein, to:

(i) Determine or alter surface water rights or groundwater rights (California Water Code Section 10720.5 (b));

(ii) Make binding determinations of the water rights of any person or entity (California Water Code Section 10726.8 (b)); or

(iii) Supersede the existing land use authority of cities or counties, including the city or county general plan, within the overlying basin (California Water Code Section 10726.8 (f)).

THEREFORE, in consideration of the mutual promises, covenants and provisions herein set forth, it is agreed by and among the Parties as follows:

1. Recitals Incorporated. The recitals set forth above are hereby incorporated into this Agreement as a statement of the intent and purposes of this Agreement.

2. General Information. Within 120 days from execution of this Agreement, each Party shall develop and share with the other Parties general information regarding the portion of the Subbasins in its jurisdiction, including:

a. Description and general information pertaining to groundwater resources;

b. List of public agencies and other entities with groundwater management responsibilities; and

c. List of groundwater management plans and other water resource management plans.

3. Exchange of Information. The Parties shall exchange relevant available technical information and groundwater data to quantify the level of interconnection between the Subbasins and the areas where the activities occurring within one Party's jurisdiction may affect groundwater within another Party's jurisdiction. The Parties will coordinate shared information and work on adjusting values to the same basis for all data and parameters to the best of their abilities, and within reasonable range of acceptable scientific practices to help all Parties reach sustainability within their respective GSA areas. The information exchanged shall include if feasible:

a. Model aquifer parameter values and other model inputs relevant to calculation of inter-basin groundwater flow (e.g. model layering, grid size vertical pumping distribution, etc.);

b. Model outputs including simulated heads (groundwater elevations) by model layer and model water budget components (including model-estimated flows across the Subbasin boundary);

c. Values for groundwater quality (primarily TDS and nitrate), quantity and land subsidence;

d. An estimate of groundwater flow across basin and jurisdictional boundaries, including consistent and coordinated data, methods and assumptions;

e. An estimate of stream-aquifer interactions at boundaries;

f. A common understanding of the hydrogeology and hydrology as it applies to the determination of groundwater flow across basin and jurisdictional boundaries;

g. Sustainable management criteria, including management goals and thresholds, and a monitoring network that would support confirmation that no adverse impacts result from the implementation of the GSPs;

h. Existing and proposed monitoring locations;

i. Plans, programs, and projects anticipated as options and/or alternatives for sustainable management of respective Subbasins;

j. The following parameters:

i. Groundwater elevation data;
ii. Groundwater extraction data or estimates;
iii. Groundwater quality information;
iv. Surface water supply;
v. Reports of cropping patters on parcels adjacent to the subbasin boundaries, with approximately a 5-mile buffer on both sides of the boundary;
vi. Total water use;
vii. Change in groundwater storage;
viii. Water budget for land surface, stream, and groundwater systems;
ix. Sustainable yield; and
x. Agricultural water demands (consumptive use and extraction).

g. The Parties will work in good faith to complete a preliminary exchange of available information set forth above in Section 3(a)-(j) by August 31, 2018, and a complete exchange of information by June 30, 2019. The Parties shall analyze hydrologic and hydrogeologic conditions, based on the detail and local information available within the Merced Water Resources Model and the model to be developed and used for the Chowchilla Subbasin GSP analyses. The Parties will exchange information for the area of model overlap and analyze hydrologic and hydrogeologic conditions in the area of overlap to the extent relevant to interbasin groundwater flow. Information from items "a" through "j" above will be utilized in the analyses. Field verification and results from GSP monitoring programs will generally be used to validate model results during GSP implementation.

4. Planning for the GSPs. The Parties shall develop compatible sustainability goals, minimum thresholds and measurable objectives for their respective GSPs. Compatible sustainability goals would include, but are not limited to, the following:

a. Targeted 2040 groundwater levels;
b. Measurable objectives and interim milestones; and
c. Volumes of groundwater extraction and managed recharge to ensure coordination of any GSP-established or State-recommended/mandated levels.

"Compatible" in the context of this section means that the sustainability goals developed would not impede the other Party's efforts to achieve sustainability

5. Development of the GSPs. Each Party shall be responsible for development of its own GSP for the lands within its GSA jurisdiction, or for joint development of a GSP for the lands within its GSA jurisdiction and the lands of one or more additional GSA. The contents and adoption of each GSP shall be the decision and responsibility of each Party, subject to the criteria set forth in SGMA and its implementing regulations. However, in developing its GSP, each Party shall utilize the information exchanged under this Agreement, and shall incorporate any agreed sustainability goals, minimum thresholds and measurable objectives into each GSP.

6. Implementation. Each Party, in implementing its GSP and managing its affairs, shall avoid actions that materially and adversely impact or impede the ability to achieve the

sustainability goals of each other Party. Disagreements regarding a Party's implementation of its GSP shall be subject to the dispute resolution process outlined in paragraph 9.

7. Meetings. Commencing within 30 days of execution of this Agreement, the Parties shall meet quarterly while the planning activities described in Paragraph 4 are being performed and while the Parties are developing their GSPs. After all GSPs are approved, the Parties shall meet as agreed to discuss implementation and ongoing issues.

8. Costs. Each Party shall bear its own costs for its direct participation in the activities contemplated by this Agreement, including staff time, administrative and overhead costs, office expenses, legal fees, and consultants that report directly and exclusively to that Party. Contracts for any additional studies, reports, and data development for the matters identified in Paragraphs 3 and 4 must be approved by the unanimous vote of the Parties. The Parties shall select one of their members to be the fiscal agent for implementation of this Agreement, which shall calculate the costs being incurred therefor, assess the Parties for contributions to common costs in a timely manner, and pay invoices for such services. No Party shall be bound, financially or otherwise, by any obligation, contract, or activity undertaken by the other Parties unless and except to the extent agreed upon by the Party.

9. Dispute Resolution. The Parties fully intend to comply with this Agreement in good faith. Should, however, any controversy arise among or between the Parties concerning this Agreement, or the rights and duties of any Party under this Agreement, such a controversy shall be addressed as follows:

a. Any Party may trigger the dispute resolution process by delivering, in writing to all Parties, a notification of a dispute or controversy that contains a specific description of the actions alleged to be contrary to this Agreement and a proposed solution. A dispute resolution group, consisting of one member of the elected or appointed governance of each Party, shall be established by the Parties to resolve disputes and/or controversies relating to this Agreement (the "Dispute Resolution Group"). The Dispute Resolution Group shall meet no later than 30 days following notification of the dispute or controversy. The Party alleged to be in violation shall prepare a written response delivered to all Parties prior to the meeting of the Dispute Resolution Group. Thereafter, the Dispute Resolution Group will have 90 days to issue a written, non-binding opinion on the matter in dispute, including a proposed resolution. Any Party, at its sole expense, may retain outside experts to assist in data development or discussion of the dispute. Upon unanimous approval by the Parties, the Dispute Resolution Group may retain independent experts to assist in mediating the dispute. The Parties shall equally share the cost to retain the experts the Dispute Resolution Group selects. The Dispute Resolution Group may also consult with the Department of Water Resources as necessary. Participation in the process established by the Dispute Resolution Group is mandatory and a condition precedent to resorting to litigation, or referring the dispute to the State Water Resources Control Board or Department of Water Resources for formal action.

b. Should the dispute resolution process described above not provide a final resolution to the controversy raised, any Party may pursue any judicial or administrative remedies otherwise available. However, notwithstanding this Paragraph 9, a Party may seek a preliminary injunction or other interlocutory judicial relief if necessary to avoid irreparable damage or to preserve the status quo.

10. General Provisions.

a. Term of Agreement. This Agreement shall expire on December 31, 2030 unless extended by all of the Parties.

b. Amendment. This Agreement may be amended only by a writing executed by all of the Parties.

c. Withdrawal. Any Party may withdraw from this Agreement starting six (6) months after approval of the GSP for all Parties by the DWR, and upon thirty (30) days prior written notice to all other Parties, provided that the withdrawing Party is cooperating through an approved GSP with other Parties and interests in the Basin, where the approved GSP fully meets and incorporates mutual promises, covenants and provisions 2, 3, 4, 5, and 6 of this agreement; and the written notice provided by the withdrawing party documents the basis for withdrawal and the way(s) in which the mutual promises, covenants and provisions 2, 3, 4, 5 have been addressed in the GSP to which it is a party. A withdrawing Party shall not be obligated for any financial obligations incurred after delivery of notice of its withdrawal, but shall remain liable for and shall pay upon demand all obligations of the Parties approved as provided herein prior to written notice of its withdrawal.

d. Severability. Should the participation of any Party to this Agreement, or any part, term or provision of this Agreement, be decided by any court to be illegal, in excess of that Party's authority, in conflict with any law of the State of California, or otherwise rendered unenforceable or ineffectual, the participation of the other Parties or the validity of the remaining portions, terms or provisions of this Agreement shall not be affected thereby and each Party hereby agrees it would have entered into this Agreement upon the remaining terms and provisions.

e. Counterparts and Facsimile. This Agreement may be executed in counterparts, each counterpart being an exact duplicate of all other counterparts, and all counterparts shall be considered as constituting one complete original and may be attached together when executed by the Parties hereto. Facsimile or electronic signatures shall be binding.

f. Notices. Notices authorized or required to be given pursuant to this Agreement shall be in writing and shall be deemed to have been given when mailed, postage prepaid, or delivered during working hours to the principal offices of the other Parties at the address indicated below, attention to the responsible person at each Party as identified, or to such other changed addresses communicated to the other Parties in writing.

Chowchilla Water District GSA
327 S. Chowchilla Blvd.
Chowchilla, CA 93610

County of Madera Chowchilla Subbasin GSA
Department of Water and Natural Resources
200 W. Fourth Street
Madera, CA 93637

Merced Subbasin Groundwater Sustainability Agency
Community and Economic Development Department
County of Merced
2222 M Street
Merced, CA 95340

County of Merced Chowchilla Subbasin GSA
Community and Economic Development Department
County of Merced
2222 M Street
Merced, CA 95340

Merced Irrigation-Urban Groundwater Sustainability Agency
744 West 20th Street
Merced, CA 95340

Triangle T Water District GSA
4400 Hays Drive
Chowchilla, CA 93610

IN WITNESS WHEREOF, the Parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or Board of Supervisors, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

CHOWCHILLA WATER DISTRICT GSA,
a California water district

By: Kole Upton

Name: Kole Upton

Title: Board President

Merced Subbasin Groundwater Sustainability Agency
Community and Economic Development Department
County of Merced
2222 M Street
Merced, CA 95340

County of Merced Chowchilla Subbasin GSA
Community and Economic Development Department
County of Merced
2222 M Street
Merced, CA 95340

Merced Irrigation-Urban Groundwater Sustainability Agency
744 West 20th Street
Merced, CA 95340

Triangle T Water District GSA
4400 Hays Drive
Chowchilla, CA 93610

IN WITNESS WHEREOF, the Parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or Board of Supervisors, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

CHOWCHILLA WATER DISTRICT GSA,
a California water district

By:____________________________

Name:__________________________

Title:___________________________

COUNTY OF MADERA CHOWCHILLA SUBBASIN GSA

By: 7-13-18
Michael R. Linden, Deputy County Counsel

COUNTY OF MADERA

Chairman, Board of Supervisors

COUNTY OF MADERA CHOWCHILLA SUBBASIN GSA,

By: ______________________________

Name: ______________________________

Title: ______________________________

COUNTY OF MERCED CHOWCHILLA SUBBASIN GSA,

By: Jerald R. O'Banion JUL 31 2018

Name: Jerald R. O'Banion

Title: Chairman, Board of Supervisors

MERCED SUBBASIN GSA

By: ______________________________

Name: ______________________________

Title: ______________________________

APPROVED AS TO LEGAL FORM

JAMES N. FINCHER
MERCED COUNTY COUNSEL

BY: ______________________________
Jeffrey B. Grant

MERCED IRRIGATION-URBAN GSA

By: ______________________________

Name: ______________________________

Title: ______________________________

COUNTY OF MADERA CHOWCHILLA SUBBASIN GSA,

By: ______________________________

Name: ______________________________

Title: ______________________________

COUNTY OF MERCED CHOWCHILLA SUBBASIN GSA,

By: ______________________________

Name: ______________________________

Title: ______________________________

MERCED SUBBASIN GSA

By: Robert D Kelley

Name: Robert D Kelley

Title: chairman

MERCED IRRIGATION-URBAN GSA

By: ______________________________

Name: ______________________________

Title: ______________________________

COUNTY OF MADERA CHOWCHILLA SUBBASIN GSA,

By: ______________________________

Name: ______________________________

Title: ______________________________

COUNTY OF MERCED CHOWCHILLA SUBBASIN GSA,

By: ______________________________

Name: ______________________________

Title: ______________________________

MERCED SUBBASIN GSA

By: ______________________________

Name: ______________________________

Title: ______________________________

MERCED IRRIGATION-URBAN GSA

By: Hicham EITal

Name: HICHAM ELTAL

Title: CHAIR

TRIANGLE T WATER DISTRICT GSA

By: ______________________

Name: Mmek Hutso

Title: President

APPENDIX H: MERCED TURLOCK INTERBASIN AGREEMENT

MEMORANDUM OF INTENT TO COORDINATE BETWEEN THE MERCED SUBBASIN AND TURLOCK SUBBASIN

WHEREAS, the Turlock Groundwater Subbasin (Subbasin No. 5-22.03) and the Merced Groundwater Subbasin (Subbasin No. 5-22.04) are adjacent subbasins that share a common boundary along the Merced River; and

WHEREAS, the Turlock Subbasin is a high-priority subbasin that is required to submit a Groundwater Sustainability Plan (GSP) to the Department of Water Resources (DWR) by January 31, 2022 and the Merced Subbasin is a high-priority, critically overdraft subbasin that must submit a GSP to DWR by January 31, 2020; and

WHEREAS, the West Turlock Subbasin Groundwater Sustainability Agency (WTSGSA) and the East Turlock Subbasin Groundwater Sustainability Agency (ETSGSA) are working to develop a single GSP in the Turlock Subbasin; and

WHEREAS, the Merced Subbasin Groundwater Sustainability Agency, the Merced Irrigation Urban Groundwater Sustainability Agency, and the Turner Island Water District Groundwater Sustainability Agency-1 are working to develop a single GSP in the Merced Subbasin; and

WHEREAS, the Sustainable Groundwater Management Act (SGMA) prohibits a GSP from adversely affecting an adjacent basin's ability to implement its GSP or impede the ability to achieve its sustainability goal (Water Code, § 10733(c)); and

WHEREAS, the parties to this Memorandum of Intent (MOI) (collectively "Party" or "Parties") desire to establish compatible sustainability goals and understanding regarding fundamental elements of the GSPs of each GSA as they relate to sustainable groundwater management.

NOW, THEREFORE BE IT RESOLVED that the Parties agree to coordinate in the following matter:

1. Each Party desires to comply with SGMA by assuring that its GSP actions do not negatively impact the adjacent GSA in complying with SGMA.

2. To assure this compliance, each Party commits to meeting as necessary to compare GSP development concepts and approaches to identify potential areas of concern that may negatively impact the other.

3. Each Party will commit to sharing data, analysis, methods, results, and any other information that is pertinent to the Parties' compliance with SGMA.

4. The Parties recognize that the development of the respective GSPs have different deadlines and may be developed using different timelines. Coordination is expected to continue, as needed, throughout GSP development and implementation.

5. The Parties recognize there may be data gaps that will need to be filled. Datasets will improve as the Parties develop and implement GSPs over time. The Parties agree to continue to work together to develop and refine understanding of the conditions over time. This common knowledge and understanding will be incorporated into future GSPs as data and information becomes available.

6. The Parties intend to coordinate messaging and outreach along the subbasin borders to maximize stakeholder outreach and understanding between the subbasins.

IN WITNESS WHEREOF, the parties have caused this Memorandum to be executed by and through their respective officers thereunto duly authorized.

WEST TURLOCK SUBBASIN GSA,
a Joint Powers Authority

By: ______________________
Joe Alamo, Chair

Date: 12/18/18

EAST TURLOCK SUBBASIN GSA,
a Joint Powers Authority

By: ______________________
Albert Rossini, Chair

Date: 01-28-19

MERCED IRRIGATION-URBAN GSA

By: ______________________
Chair

Date: 1/19/19

MERCED SUBBASIN GSA,
a Joint Powers Authority

By: [signature]
Chair

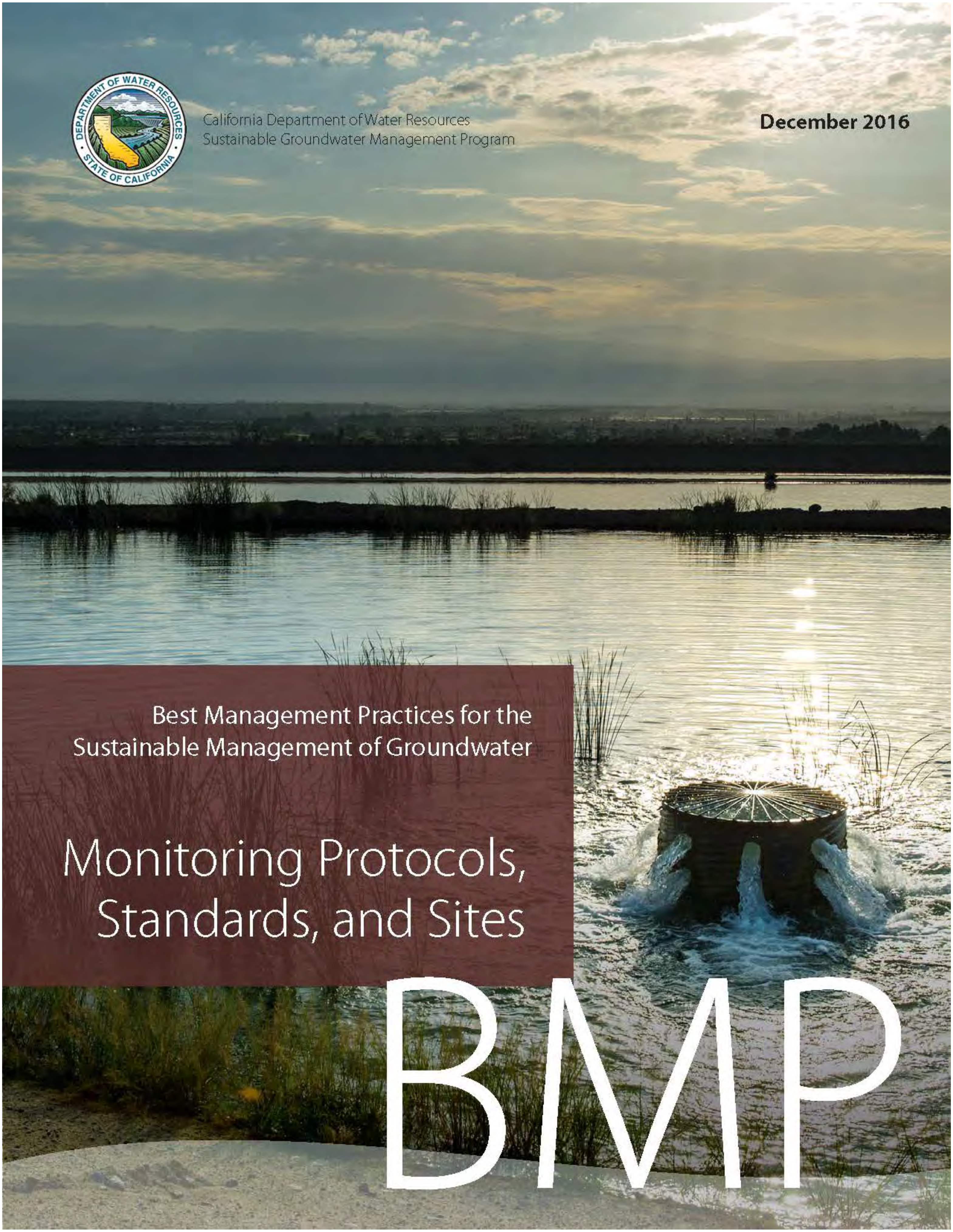
Date: 1/16/19

TURNER ISLAND WATER DISTRICT

By: ______________________
Chair

Date: 2-19-19

APPENDIX I: MONITORING PROTOCOLS – GROUNDWATER LEVELS (DWR BMP)



California Department of Water Resources
Sustainable Groundwater Management Program

December 2016

Best Management Practices for the Sustainable Management of Groundwater

Monitoring Protocols, Standards, and Sites

BMP

State of California
Edmund G. Brown Jr., Governor

California Natural Resources Agency
John Laird, Secretary for Natural Resources

Department of Water Resources
Mark W. Cowin, Director

Carl A. Torgersen, Chief Deputy Director

Office of the Chief Counsel
Spencer Kenner

Public Affairs Office
Ed Wilson

Government and Community Liaison
Anecita S. Agustinez

Office of Workforce Equality
Stephanie Varrelman

Policy Advisor
Waiman Yip

Legislative Affairs Office
Kasey Schimke, Ass't Dir.

Deputy Directors

Gary Bardini	**Integrated Water Management**
William Croyle	**Statewide Emergency Preparedness and Security**
Mark Anderson	**State Water Project**
John Pacheco (Acting)	**California Energy Resources Scheduling**
Kathie Kishaba	**Business Operations**
Taryn Ravazzini	**Special Initiatives**

Division of Integrated Regional Water Management

Arthur Hinojosa Jr., Chief

Prepared under the direction of:

David Gutierrez, Sustainable Groundwater Management Program Manager
Rich Juricich, Sustainable Groundwater Management Branch

Prepared by:

Trevor Joseph, BMP Project Manager

Timothy Godwin
Dan McManus
Mark Nordberg
Heather Shannon
Steven Springhorn

With assistance from:

DWR Region Office Staff

Groundwater Monitoring Protocols, Standards, and Sites Best Management Practice

1. OBJECTIVE

The objective of this *Best Management Practice* (BMP) is to assist in the development of Monitoring Protocols. The California Department of Water Resources (the Department or DWR) has developed this document as part of the obligation in the Technical Assistance chapter (Chapter 7) of the Sustainable Groundwater Management Act (SGMA) to support the long-term sustainability of California's groundwater *basins*. Information provided in this BMP provides technical assistance to Groundwater Sustainability Agencies (GSAs) and other stakeholders to aid in the establishment of consistent data collection processes and procedures. In addition, this BMP can be used by GSAs to adopt a set of sampling and measuring procedures that will yield similar data regardless of the monitoring personnel. Finally, this BMP identifies available resources to support the development of monitoring protocols.

This BMP includes the following sections:

1. Objective. A brief description of how and where monitoring protocols are required under SGMA and the overall objective of this BMP.
2. Use and Limitations. A brief description of the use and limitations of this BMP.
3. Monitoring Protocol Fundamentals. A description of the general approach and background of groundwater monitoring protocols.
4. Relationship of Monitoring Protocols to other BMPs. A description of how this BMP is connected with other BMPS.
5. Technical Assistance. Technical content providing guidance for regulatory sections.
6. Key Definitions. Descriptions of definitions identified in the GSP Regulations or SGMA.
7. Related Materials. References and other materials that provide supporting information related to the development of Groundwater Monitoring Protocols.

2. Use and Limitations

BMPs developed by the Department provide technical guidance to GSAs and other stakeholders. Practices described in these BMPs do not replace the GSP Regulations, nor do they create new requirements or obligations for GSAs or other stakeholders. In addition, using this BMP to develop a GSP does not equate to an approval determination by the Department. All references to GSP Regulations relate to Title 23 of the California Code of Regulations (CCR), Division 2, Chapter 1.5, and Subchapter 2. All references to SGMA relate to California Water Code sections in Division 6, Part 2.74.

3. Monitoring Protocol Fundamentals

Establishing data collection protocols that are based on best available scientific methods is essential. Protocols that can be applied consistently across all basins will likely yield comparable data. Consistency of data collection methods reduces uncertainty in the comparison of data and facilitates more accurate communication within basins as well as between basins.

Basic minimum technical standards of accuracy lead to quality data that will better support implementation of GSPs.

4. Relationship of Monitoring Protocol to other BMPs

Groundwater monitoring is a fundamental component of SGMA, as each GSP must include a sufficient network of data that demonstrates measured progress toward the achievement of the sustainability goal for each basin. For this reason, a standard set of protocols need to be developed and utilized.

It is important that data is developed in a manner consistent with the basin setting, planning, and projects/management actions steps identified on **Figure 1** and the GSP Regulations. The inclusion of monitoring protocols in the GSP Regulations also emphasizes the importance of quality empirical data to support GSPs and provide comparable information from basin to basin.

Figure 1 provides a logical progression for the development of a GSP and illustrates how monitoring protocols are linked to other related BMPs. This figure also shows the context of the BMPs as they relate to various steps to sustainability as outlined in the GSP Regulations. The monitoring protocol BMP is part of the Monitoring step identified in **Figure 1**.

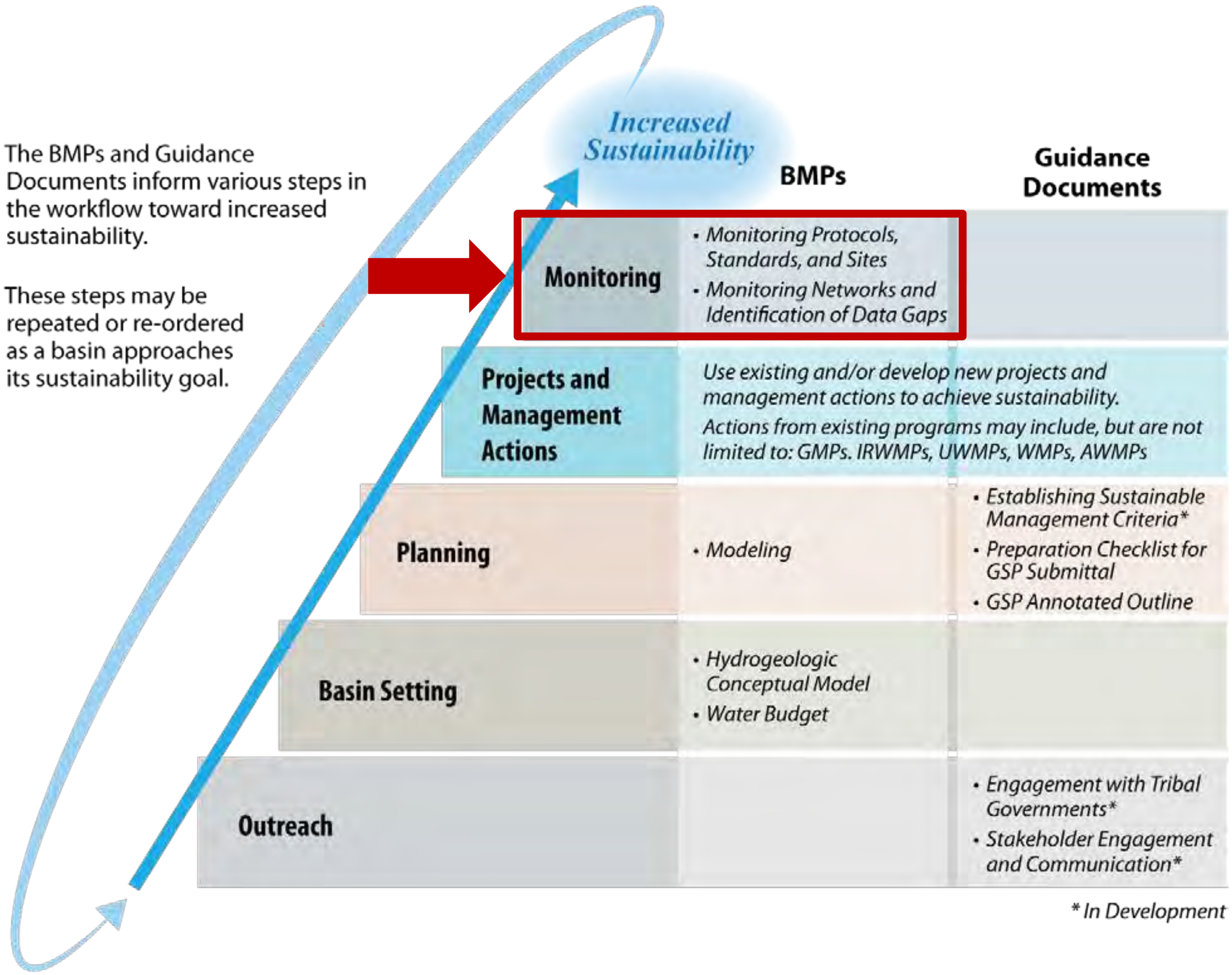


Figure 1 – Logical Progression of Basin Activities Needed to Increase Basin Sustainability

5. TECHNICAL ASSISTANCE

23 CCR §352.2. Monitoring Protocols. Each Plan shall include monitoring protocols adopted by the Agency for data collection and management, as follows:
(a) Monitoring protocols shall be developed according to best management practices.
(b) The Agency may rely on monitoring protocols included as part of the best management practices developed by the Department, or may adopt similar monitoring protocols that will yield comparable data.
(c) Monitoring protocols shall be reviewed at least every five years as part of the periodic evaluation of the Plan, and modified as necessary.

The GSP Regulations specifically call out the need to utilize protocols identified in this BMP, or develop similar protocols. The following technical protocols provide guidance based upon existing professional standards and are commonly adopted in various groundwater-related programs. They provide clear techniques that yield quality data for use in the various components of the GSP. They can be further elaborated on by individual GSAs in the form of standard operating procedures which reflect specific local requirements and conditions. While many methodologies are suggested in this BMP, it should be understood that qualified professional judgment should be used to meet the specific monitoring needs.

The following BMPs may be incorporated into a GSP's monitoring protocols section for collecting groundwater elevation data. A GSP that adopts protocols that deviate from these BMPs must demonstrate that they will yield comparable data.

PROTOCOLS FOR ESTABLISHING A MONITORING PROGRAM

The protocol for establishment of a monitoring program should be evaluated in conjunction with the *Monitoring Network and Identification of Data Gaps* BMP and other BMPs. Monitoring protocols must take into consideration the *Hydrogeologic Conceptual Model, Water Budget, and Modeling* BMPs when considering the data needs to meet GSP objectives and the sustainability goal.

It is suggested that each GSP incorporate the Data Quality Objective (DQO) process following the U.S. EPA *Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA, 2006). Although strict adherence to this method is not required, it does provide a robust approach to consider and assures that data is collected with a specific purpose in mind, and efforts for monitoring are as efficient as possible to achieve the objectives of the GSP and compliance with the GSP Regulations.

The DQO process presents a method that can be applied directly to the sustainability criteria quantitative requirements through the following steps.

1. State the problem – Define sustainability indicators and planning considerations of the GSP and sustainability goal.
2. Identify the goal – Describe the quantitative measurable objectives and minimum thresholds for each of the sustainability indicators.
3. Identify the inputs – Describe the data necessary to evaluate the sustainability indicators and other GSP requirements (i.e. water budget).
4. Define the boundaries of the study – This is commonly the extent of the Bulletin 118 groundwater basin or subbasin, unless multiple GSPs are prepared for a given basin. In that case, evaluation of the coordination plan and specifically how the monitoring will be comparable and meet the sustainability goals for the entire basin.
5. Develop an analytical approach – Determine how the quantitative sustainability indicators will be evaluated (i.e. are special analytical methods required that have specific data needs).
6. Specify performance or acceptance criteria – Determine what quality the data must have to achieve the objective and provide some assurance that the analysis is accurate and reliable.
7. Develop a plan for obtaining data – Once the objectives are known determine how these data should be collected. Existing data sources should be used to the greatest extent possible.

These steps of the DQO process should be used to guide GSAs to develop the most efficient monitoring process to meet the measurable objectives of the GSP and the sustainability goal. The DQO process is an iterative process and should be evaluated regularly to improve monitoring efficiencies and meet changing planning and project needs. Following the DQO process, GSAs should also include a data quality control and quality assurance plan to guide the collection of data.

Many monitoring programs already exist as part of ongoing groundwater management or other programs. To the extent possible, the use of existing monitoring data and programs should be utilized to meet the needs for characterization, historical record documentation, and continued monitoring for the SGMA program. However, an evaluation of the existing monitoring data should be performed to assure the data being collected meets the DQOs, regulatory requirements, and data collection protocol described in this BMP. While this BMP provides guidance for collection of various regulatory based requirements, there is flexibility among the various methodologies available to meet the DQOs based upon professional judgment (local conditions or project needs).

At a minimum, for each monitoring site, the following information or procedure should be collected and documented:

- Long-term access agreements. Access agreements should include year-round site access to allow for increased monitoring frequency.
- A unique identifier that includes a general written description of the site location, date established, access instructions and point of contact (if necessary), type of information to be collected, latitude, longitude, and elevation. Each monitoring location should also track all modifications to the site in a modification log.

PROTOCOLS FOR MEASURING GROUNDWATER LEVELS

This section presents considerations for the methodology of collection of groundwater level data such that it meets the requirements of the GSP Regulations and the DQOs of the specific GSP. Groundwater levels are a fundamental measure of the status of groundwater conditions within a basin. In many cases, relationships of the sustainability indicators may be able to be correlated with groundwater levels. The quality of this data must consider the specific aquifer being monitored and the methodology for collecting these levels.

The following considerations for groundwater level measuring protocols should ensure the following:

- Groundwater level data are taken from the correct location, well ID, and screen interval depth
- Groundwater level data are accurate and reproducible
- Groundwater level data represent conditions that inform appropriate basin management DQOs
- All salient information is recorded to correct, if necessary, and compare data
- Data are handled in a way that ensures data integrity

General Well Monitoring Information

The following presents considerations for collection of water level data that include regulatory required components as well as those which are recommended.

- Groundwater elevation data will form the basis of basin-wide water-table and piezometric maps, and should approximate conditions at a discrete period in time. Therefore, all groundwater levels in a basin should be collected within as short a time as possible, preferably within a 1 to 2 week period.
- Depth to groundwater must be measured relative to an established Reference Point (RP) on the well casing. The RP is usually identified with a permanent marker, paint spot, or a notch in the lip of the well casing. By convention in open casing monitoring wells, the RP reference point is located on the north side of the well casing. If no mark is apparent, the person performing the measurement should measure the depth to groundwater from the north side of the top of the well casing.
- The elevation of the RP of each well must be surveyed to the North American Vertical Datum of 1988 (NAVD88), or a local datum that can be converted to NAVD88. The elevation of the RP must be accurate to within 0.5 foot. It is preferable for the RP elevation to be accurate to 0.1 foot or less. Survey grade global navigation satellite system (GNSS) global positioning system (GPS) equipment can achieve similar vertical accuracy when corrected. Guidance for use of GPS can be found at USGS http://water.usgs.gov/osw/gps/. Hand-held GPS units likely will not produce reliable vertical elevation measurement accurate enough for the casing elevation consistent with the DQOs and regulatory requirements.
- The sampler should remove the appropriate cap, lid, or plug that covers the monitoring access point listening for pressure release. If a release is observed, the measurement should follow a period of time to allow the water level to equilibrate.
- Depth to groundwater must be measured to an accuracy of 0.1 foot below the RP. It is preferable to measure depth to groundwater to an accuracy of 0.01 foot. Air lines and acoustic sounders may not provide the required accuracy of 0.1 foot.
- The water level meter should be decontaminated after measuring each well.

Where existing wells do not meet the base standard as described in the GSP Regulations or the considerations provided above, new monitoring wells may need to be constructed to meet the DQOs of the GSP. The design, installation, and documentation of new monitoring wells must consider the following:

- Construction consistent with California Well Standards as described in Bulletins 74-81 and 74-90, and local permitting agency standards of practice.
- Logging of borehole cuttings under the supervision of a California Professional Geologist and described consistent with the Unified Soil Classification System methods according to ASTM standard D2487-11.
- Written criteria for logging of borehole cuttings for comparison to known geologic formations, principal aquifers and aquitards/aquicludes, or specific marker beds to aid in consistent stratigraphic correlation within and across basins.
- Geophysical surveys of boreholes to aid in consistency of logging practices. Methodologies should include resistivity, spontaneous potential, spectral gamma, or other methods as appropriate for the conditions. Selection of geophysical methods should be based upon the opinion of a professional geologist or professional engineer, and address the DQOs for the specific borehole and characterization needs.
- Prepare and submit State well completion reports according to the requirements of §13752. Well completion report documentation should include geophysical logs, detailed geologic log, and formation identification as attachments. An example well completion as-built log is illustrated in **Figure 2.** DWR well completion reports can be filed directly at the Online System for Well Completion Reports (OSWCR) http://water.ca.gov/oswcr/index.cfm.

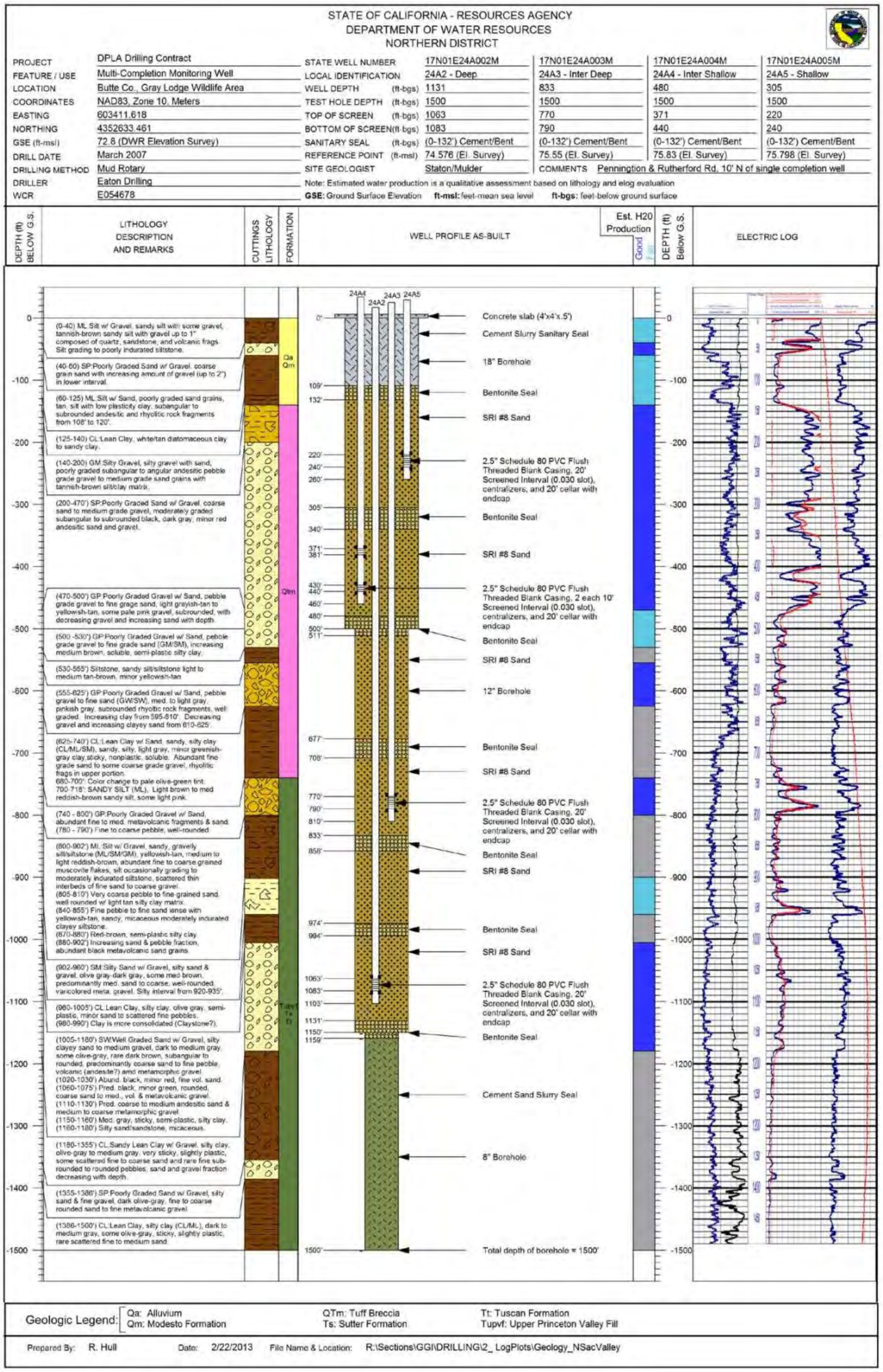


Figure 2 – Example As-Built Multi-Completion Monitoring Well Log

Measuring Groundwater Levels

Well construction, anticipated groundwater level, groundwater level measuring equipment, field conditions, and well operations should be considered prior collection of the groundwater level measurement. The USGS *Groundwater Technical Procedures* (Cunningham and Schalk, 2011) provide a thorough set of procedures which can be used to establish specific Standard Operating Procedures (SOPs) for a local agency. **Figure 3** illustrates a typical groundwater level measuring event and simultaneous pressure transducer download.

Figure 3 – Collection of Water Level Measurement and Pressure Transducer Download

The following points provide a general approach for collecting groundwater level measurements:

- Measure depth to water in the well using procedures appropriate for the measuring device. Equipment must be operated and maintained in accordance with manufacturer's instructions. Groundwater levels should be measured to the nearest 0.01 foot relative to the RP.
- For measuring wells that are under pressure, allow a period of time for the groundwater levels to stabilize. In these cases, multiple measurements should be collected to ensure the well has reached equilibrium such that no significant changes in water level are observed. Every effort should be made to ensure that a representative stable depth to groundwater is recorded. If a well does not stabilize, the quality of the value should be appropriately qualified as a

questionable measurement. In the event that a well is artesian, site specific procedures should be developed to collect accurate information and be protective of safety conditions associated with a pressurized well. In many cases, an extension pipe may be adequate to stabilize head in the well. Record the dimension of the extension and document measurements and configuration.

- The sampler should calculate the groundwater elevation as:

$$GWE = RPE - DTW$$

Where:

GWE = Groundwater Elevation
RPE = Reference Point Elevation
DTW = Depth to Water

The sampler must ensure that all measurements are in consistent units of feet, tenths of feet, and hundredths of feet. Measurements and RPEs should not be recorded in feet and inches.

<u>Recording Groundwater Levels</u>

- The sampler should record the well identifier, date, time (24-hour format), RPE, height of RP above or below ground surface, DTW, GWE, and comments regarding any factors that may influence the depth to water readings such as weather, nearby irrigation, flooding, potential for tidal influence, or well condition. If there is a questionable measurement or the measurement cannot be obtained, it should be noted. An example of a field sheet with the required information is shown in **Figure 4**. It includes questionable measurement and no measurement codes that should be noted. This field sheet is provided as an example. Standardized field forms should be used for all data collection. The aforementioned USGS *Groundwater Technical Procedures* offers a number of example forms.
- The sampler should replace any well caps or plugs, and lock any well buildings or covers.
- All data should be entered into the GSA data management system (DMS) as soon as possible. Care should be taken to avoid data entry mistakes and the entries should be checked by a second person for compliance with the DQOs.

STATE OF CALIFORNA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WELL DATA

STATE WELL NUMBER	COUNTY	REFERENCE POINT ELEV.	MEASURING AGENCY
			DWR

NO MEASUREMENT	QUESTIONABLE MEASUREMENT
0. Measurement discontinued	0. Caved or deepened
1. Pumping	1. Pumping
2. Pump house locked	2. Nearby pump operating
3. Tape hung up	3. Casing leaky or wet
4. Can't get tape in casing	4. Pumped recently
5. Unable to locate well	5. Air or pressure gauge measurement
6. Well has been destroyed	6. Other
7. Special	7. Recharge operation at or nearby well
8. Casing leaky or wet	8. Oil in casing
9. Temporarily inaccessible	

DATE	N M	Q M	TAPE AT RP	TAPE AT WS	RP to WS	OBSR VR	COMMENTS

DWR 1213

Figure 4 – Example of Water Level Well Data Field Collection Form

Pressure Transducers

Groundwater levels and/or calculated groundwater elevations may be recorded using pressure transducers equipped with data loggers installed in monitoring wells. When installing pressure transducers, care must be exercised to ensure that the data recorded by the transducers is confirmed with hand measurements.

The following general protocols must be followed when installing a pressure transducer in a monitoring well:

- The sampler must use an electronic sounder or chalked steel tape and follow the protocols listed above to measure the groundwater level and calculate the groundwater elevation in the monitoring well to properly program and reference the installation. It is recommended that transducers record measured groundwater level to conserve data capacity; groundwater elevations can be calculated at a later time after downloading.
- The sampler must note the well identifier, the associated transducer serial number, transducer range, transducer accuracy, and cable serial number.
- Transducers must be able to record groundwater levels with an accuracy of at least 0.1 foot. Professional judgment should be exercised to ensure that the data being collected is meeting the DQO and that the instrument is capable. Consideration of the battery life, data storage capacity, range of groundwater level fluctuations, and natural pressure drift of the transducers should be included in the evaluation.
- The sampler must note whether the pressure transducer uses a vented or non-vented cable for barometric compensation. Vented cables are preferred, but non-vented units provide accurate data if properly corrected for natural barometric pressure changes. This requires the consistent logging of barometric pressures to coincide with measurement intervals.
- Follow manufacturer specifications for installation, calibration, data logging intervals, battery life, correction procedure (if non-vented cables used), and anticipated life expectancy to assure that DQOs are being met for the GSP.
- Secure the cable to the well head with a well dock or another reliable method. Mark the cable at the elevation of the reference point with tape or an indelible marker. This will allow estimates of future cable slippage.
- The transducer data should periodically be checked against hand measured groundwater levels to monitor electronic drift or cable movement. This should happen during routine site visits, at least annually or as necessary to maintain data integrity.

- The data should be downloaded as necessary to ensure no data is lost and entered into the basin's DMS following the QA/QC program established for the GSP. Data collected with non-vented data logger cables should be corrected for atmospheric barometric pressure changes, as appropriate. After the sampler is confident that the transducer data have been safely downloaded and stored, the data should be deleted from the data logger to ensure that adequate data logger memory remains.

PROTOCOLS FOR SAMPLING GROUNDWATER QUALITY

The following protocols can be incorporated into a GSP's monitoring protocols for collecting groundwater quality data. More detailed sampling procedures and protocols are included in the standards and guidance documents listed at the end of this BMP. A GSP that adopts protocols that deviate from these BMPs must demonstrate that the adopted protocols will yield comparable data.

In general, the use of existing water quality data within the basin should be done to the greatest extent possible if it achieves the DQOs for the GSP. In some cases it may be necessary to collect additional water quality data to support monitoring programs or evaluate specific projects. The USGS *National Field Manual for the Collection of Water Quality Data* (Wilde, 2005) should be used to guide the collection of reliable data. **Figure 5** illustrates a typical groundwater quality sampling setup.

Figure 5 – Typical Groundwater Quality Sampling Event

All analyses should be performed by a laboratory certified under the State Environmental Laboratory Accreditation Program. The specific analytical methods are beyond the scope of this BMP, but should be commiserate with other programs evaluating water quality within the basin for comparative purposes.

Groundwater quality sampling protocols should ensure that:

- Groundwater quality data are taken from the correct location
- Groundwater quality data are accurate and reproducible
- Groundwater quality data represent conditions that inform appropriate basin management and are consistent with the DQOs
- All salient information is recorded to normalize, if necessary, and compare data
- Data are handled in a way that ensures data integrity

The following points are general guidance in addition to the techniques presented in the previously mentioned USGS *National Field Manual for the Collection of Water Quality Data.*

Standardized protocols include the following:

- Prior to sampling, the sampler must contact the laboratory to schedule laboratory time, obtain appropriate sample containers, and clarify any sample holding times or sample preservation requirements.
- Each well used for groundwater quality monitoring must have a unique identifier. This identifier must appear on the well housing or the well casing to avoid confusion.
- In the case of wells with dedicated pumps, samples should be collected at or near the wellhead. Samples should not be collected from storage tanks, at the end of long pipe runs, or after any water treatment.
- The sampler should clean the sampling port and/or sampling equipment and the sampling port and/or sampling equipment must be free of any contaminants. The sampler must decontaminate sampling equipment between sampling locations or wells to avoid cross-contamination between samples.
- The groundwater elevation in the well should be measured following appropriate protocols described above in the groundwater level measuring protocols.
- For any well not equipped with low-flow or passive sampling equipment, an adequate volume of water should be purged from the well to ensure that the groundwater sample is representative of ambient groundwater and not stagnant water in the well casing. Purging three well casing volumes is generally

considered adequate. Professional judgment should be used to determine the proper configuration of the sampling equipment with respect to well construction such that a representative ambient groundwater sample is collected. If pumping causes a well to be evacuated (go dry), document the condition and allow well to recover to within 90% of original level prior to sampling. Professional judgment should be exercised as to whether the sample will meet the DQOs and adjusted as necessary.

- Field parameters of pH, electrical conductivity, and temperature should be collected for each sample. Field parameters should be evaluated during the purging of the well and should stabilize prior to sampling. Measurements of pH should only be measured in the field, lab pH analysis are typically unachievable due to short hold times. Other parameters, such as oxidation-reduction potential (ORP), dissolved oxygen (DO) (in situ measurements preferable), or turbidity, may also be useful for meeting DQOs of GSP and assessing purge conditions. All field instruments should be calibrated daily and evaluated for drift throughout the day.
- Sample containers should be labeled prior to sample collection. The sample label must include: sample ID (often well ID), sample date and time, sample personnel, sample location, preservative used, and analytes and analytical method.
- Samples should be collected under laminar flow conditions. This may require reducing pumping rates prior to sample collection.
- Samples should be collected according to appropriate standards such as those listed in the *Standard Methods for the Examination of Water and Wastewater*, USGS *National Field Manual for the Collection of Water Quality Data,* or other appropriate guidance. The specific sample collection procedure should reflect the type of analysis to be performed and DQOs.
- All samples requiring preservation must be preserved as soon as practically possible, ideally at the time of sample collection. Ensure that samples are appropriately filtered as recommended for the specific analyte. Entrained solids can be dissolved by preservative leading to inconsistent results of dissolve analytes. Specifically, samples to be analyzed for metals should be field-filtered prior to preservation; do not collect an unfiltered sample in a preserved container.
- Samples should be chilled and maintained at 4 °C to prevent degradation of the sample. The laboratory’s Quality Assurance Management Plan should detail appropriate chilling and shipping requirements.

- Samples must be shipped under chain of custody documentation to the appropriate laboratory promptly to avoid violating holding time restrictions.
- Instruct the laboratory to use reporting limits that are equal to or less than the applicable DQOs or regional water quality objectives/screening levels.

Special protocols for low-flow sampling equipment

In addition to the protocols listed above, sampling using low-flow sample equipment should adopt the following protocols derived from EPA's *Low-flow (minimal drawdown) ground-water sampling procedures* (Puls and Barcelona, 1996). These protocols apply to low-flow sampling equipment that generally pumps between 0.1 and 0.5 liters per minute. These protocols are not intended for bailers.

Special protocols for passive sampling equipment

In addition to the protocols listed above, passive diffusion samplers should follow protocols set forth in USGS Fact Sheet 088-00.

PROTOCOLS FOR MONITORING SEAWATER INTRUSION

Monitoring seawater intrusion requires analysis of the chloride concentrations within groundwater of each principal aquifer subject to seawater intrusion. While no significant standardized approach exists, the methodologies described above for degraded water quality can be applied for the collection of groundwater samples. In addition to the protocol described above, the following protocols should be followed:

- Water quality samples should be collected and analyzed at least semi-annually. Samples will be analyzed for dissolved chloride at a minimum. It may be beneficial to include analyses of iodide and bromide to aid in determination of salinity source. More frequent sampling may be necessary to meet DQOs of GSP. The development of surrogate measures of chloride concentration may facilitate cost-effective means to monitor more frequently to observe the range of conditions and variability of the flow dynamics controlling seawater intrusion.
- Groundwater levels will be collected at a frequency adequate to characterize changes in head in the vicinity of the leading edge of degraded water quality in each principal aquifer. Frequency may need to be increased in areas of known preferential pathways, groundwater pumping, or efficacy evaluation of mitigation projects.
- The use of geophysical surveys, electrical resistivity, or other methods may provide for identification of preferential pathways and optimize monitoring well placement and evaluation of the seawater intrusion front. Professional judgment

should be exercised to determine the appropriate methodology and whether the DQOs for the GSP would be met.

PROTOCOLS FOR MEASURING STREAMFLOW

Monitoring of streamflow is necessary for incorporation into water budget analysis and for use in evaluation of stream depletions associated with groundwater extractions. The use of existing monitoring locations should be incorporated to the greatest extent possible. Many of these streamflow monitoring locations currently follow the protocol described below.

Establishment of new streamflow discharge sites should consider the existing network and the objectives of the new location. Professional judgment should be used to determine the appropriate permitting that may be necessary for the installation of any monitoring locations along surface water bodies. Regular frequent access will be necessary to these sites for the development of ratings curves and maintenance of equipment.

To establish a new streamflow monitoring station special consideration must be made in the field to select an appropriate location for measuring discharge. Once a site is selected, development of a relationship of stream stage to discharge will be necessary to provide continuous estimates of streamflow. Several measurements of discharge at a variety of stream stages will be necessary to develop the ratings curve correlating stage to discharge. The use of Acoustic Doppler Current Profilers (ADCPs) can provide accurate estimates of discharge in the correct settings. Professional judgment must be exercised to determine the appropriate methodology. Following development of the ratings curve a simple stilling well and pressure transducer with data logger can be used to evaluate stage on a frequent basis. A simple stilling well and staff gage is illustrated in **Figure 6**.

Streamflow measurements should be collected, analyzed, and reported in accordance with the procedures outlined in USGS Water Supply Paper 2175, *Volume 1. – Measurement of Stage Discharge* and *Volume 2. – Computation of Discharge.* This methodology is currently being used by both the USGS and DWR for existing streamflow monitoring throughout the State.

Figure 6 – Simple Stilling Well and Staff Gage Setup

PROTOCOLS FOR MEASURING SUBSIDENCE

Evaluating and monitoring inelastic land subsidence can utilize multiple data sources to evaluate the specific conditions and associated causes. To the extent possible, the use of existing data should be utilized. Subsidence can be estimated from numerous techniques, they include: level surveying tied to known stable benchmarks or benchmarks located outside the area being studied for possible subsidence; installing and tracking changes in borehole extensometers; obtaining data from continuous GPS (CGPS) locations, static GPS surveys or Real-Time-Kinematic (RTK) surveys; or analyzing Interferometric Synthetic Aperture Radar (InSAR) data. No standard procedures exist for collecting data from the potential subsidence monitoring approaches. However, an approach may include:

- Identification of land subsidence conditions.
    - Evaluate existing regional long-term leveling surveys of regional infrastructure, i.e. roadways, railroads, canals, and levees.
    - Inspect existing county and State well records where collapse has been noted for well repairs or replacement.
    - Determine if significant fine-grained layers are present such that the potential for collapse of the units could occur should there be significant depressurization of the aquifer system.

  - Inspect geologic logs and the hydrogeologic conceptual model to aid in identification of specific units of concern.
  - Collect regional remote-sensing information such as InSAR, commonly provided by USGS and NASA. Data availability is currently limited, but future resources are being developed.
- Monitor regions of suspected subsidence where potential exists.
  - Establish CGPS network to evaluate changes in land surface elevation.
  - Establish leveling surveys transects to observe changes in land surface elevation.
  - Establish extensometer network to observe land subsidence. An example of a typical extensometer design is illustrated in **Figure 7**. There are a variety of extensometer designs and they should be selected based on the specific DQOs.

Various standards and guidance documents for collecting data include:

- Leveling surveys must follow surveying standards set out in the California Department of Transportation's Caltrans Surveys Manual.
- GPS surveys must follow surveying standards set out in the California Department of Transportation's Caltrans Surveys Manual.
- USGS has been performing subsidence surveys within several areas of California. These studies are sound examples for appropriate methods and should be utilized to the extent possible and where available:
  - http://ca.water.usgs.gov/land_subsidence/california-subsidence-measuring.html
- Instruments installed in borehole extensometers must follow the manufacturer's instructions for installation, care, and calibration.
- Availability of InSAR data is improving and will increase as programs are developed. This method requires expertise in analysis of the raw data and will likely be made available as an interpretative report for specific regions.

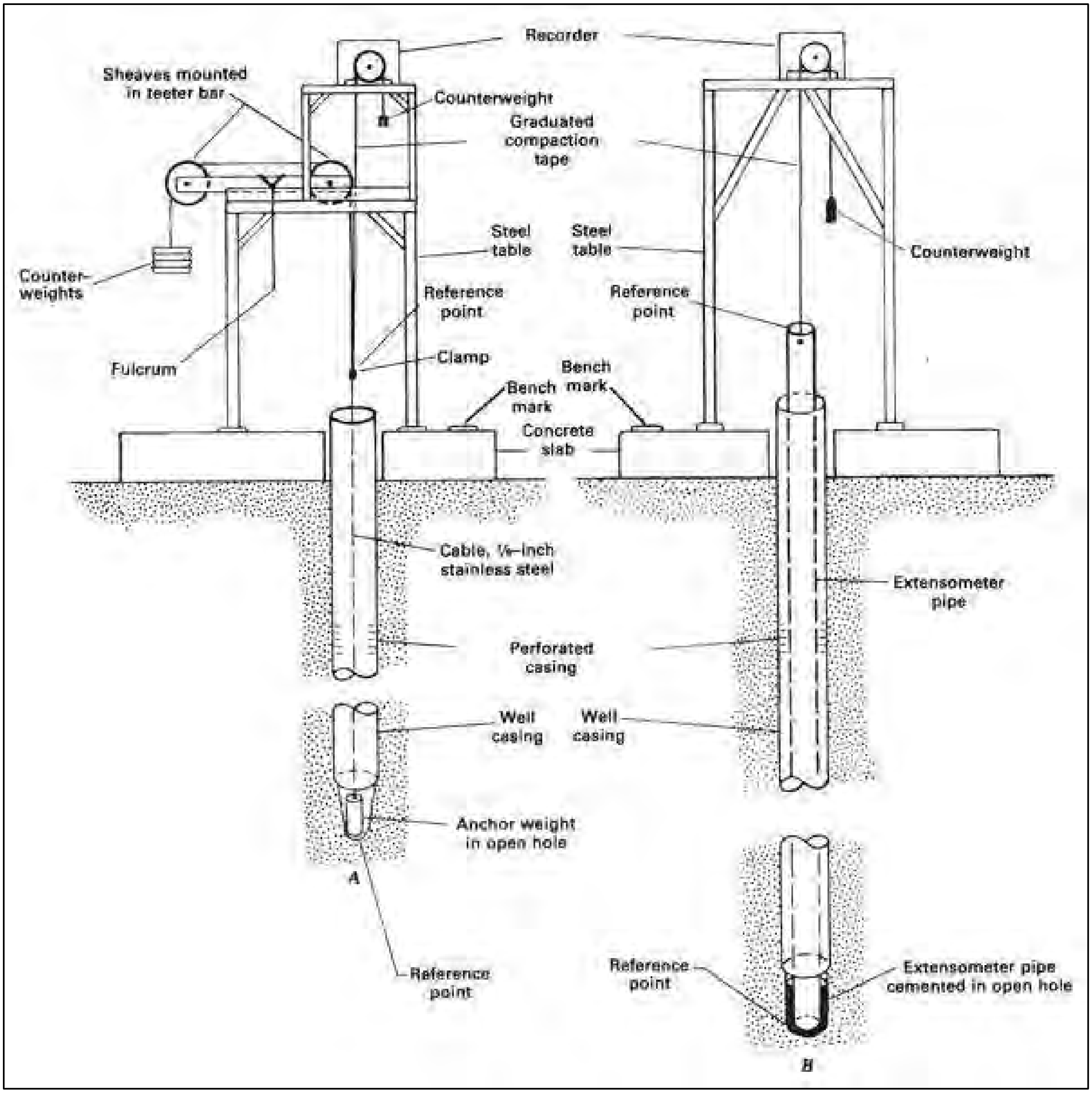


Figure 7 – Simplified Extensometer Diagram

6. KEY DEFINITIONS

The key definitions and sections related to Groundwater Monitoring Protocols, Standards, and Sites outlined in applicable SGMA code and regulations are provided below for reference.

Groundwater Sustainability Plan Regulations (California Code of Regulations §351)

- §351(h) "Best available science" refers to the use of sufficient and credible information and data, specific to the decision being made and the time frame available for making that decision, that is consistent with scientific and engineering professional standards of practice.
- §351(i) "Best management practice" refers to a practice, or combination of practices, that are designed to achieve sustainable groundwater management and have been determined to be technologically and economically effective, practicable, and based on best available science.

Monitoring Protocols Reference

§352.2. Monitoring Protocols

Each Plan shall include monitoring protocols adopted by the Agency for data collection and management, as follows:

(a) Monitoring protocols shall be developed according to best management practices.

(b) The Agency may rely on monitoring protocols included as part of the best management practices developed by the Department, or may adopt similar monitoring protocols that will yield comparable data.

(c) Monitoring protocols shall be reviewed at least every five years as part of the periodic evaluation of the Plan, and modified as necessary.

SGMA Reference

§10727.2. Required Plan Elements

(f) Monitoring protocols that are designed to detect changes in groundwater levels, groundwater quality, inelastic surface subsidence for basins for which subsidence has been identified as a potential problem, and flow and quality of surface water that directly affect groundwater levels or quality or are caused by groundwater extraction in the basin. The monitoring protocols shall be designed to generate information that promotes efficient and effective groundwater management.

7. RELATED MATERIALS

CASE STUDIES

Luhdorff & Scalmanini Consulting Engineers, J.W. Borchers, M. Carpenter. 2014. *Land Subsidence from Groundwater Use in California*. Full Report of Findings prepared for California Water Foundation. April 2014. 151 p. http://ca.water.usgs.gov/land_subsidence/california-subsidence-cause-effect.html

Faunt, C.C., M. Sneed, J. Traum, and J.T. Brandt, 2015. *Water availability and land subsidence in the Central Valley, California, USA*. Hydrogeol J (2016) 24: 675. doi:10.1007/s10040-015-1339-x.
https://pubs.er.usgs.gov/publication/701605

Poland, J.F., B.E. Lofgren, R.L. Ireland, and R.G. Pugh, 1975. *Land subsidence in the San Joaquin Valley, California, as of 1972*; US Geological Survey Professional Paper 437-H; prepared in cooperation with the California Department of Water Resources, 87 p.
http://pubs.usgs.gov/pp/0437h/report.pdf

Sneed, M., J.T. Brandt, and M. Solt, 2013. *Land subsidence along the Delta-Mendota Canal in the northern part of the San Joaquin Valley, California, 2003-10*; USGS Scientific Investigations Report 2013-5142, prepared in cooperation with U.S. Bureau of Reclamation and the San Luis and Delta-Mendota Water Authority.
https://pubs.er.usgs.gov/publication/sir20135142

Sneed, M., J.T. Brandt, and M. Solt, 2014. *Land subsidence, groundwater levels, and geology in the Coachella Valley, California, 1993–2010*: U.S. Geological Survey, Scientific Investigations Report 2014–5075, 62 p.
http://dx.doi.org/10.3133/sir20145075.

STANDARDS

California Department of Transportation, various dates. *Caltrans Surveys Manual*. http://www.dot.ca.gov/hq/row/landsurveys/SurveysManual/Manual_TOC.html

U.S. Environmental Protection Agency, 2006. Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4 https://www.epa.gov/sites/production/files/documents/guidance_systematic_planning_dqo_process.pdf

Rice, E.W., R.B. Baire, A.D. Eaton, and L.S. Clesceri ed. 2012. *Standard methods for the examination of water and wastewater*. Washington, DC: American Public Health Association, American Water Works Association, and Water Environment Federation.

GUIDANCE

Barcelona, M.J., J.P. Gibb, J.A. Helfrich, and E.E.Graske. 1985. *Practical Guide for Ground-Water Sampling*. Illinois State Water Survey, Champaign, Illinois, 103 pages. www.orau.org/ptp/PTP%20Library/library/epa/samplings/pracgw.pdf

Buchanan, T.J., and W.P. Somers, 1969. *Discharge measurements at gaging stations; techniques of water-resources investigations of the United States Geologic Survey chapter A8*, Washington D.C. http://pubs.usgs.gov/twri/twri3a8/html/pdf.html

Cunningham, W.L., and Schalk, C.W., comps., 2011, *Groundwater technical procedures of the U.S. Geological Survey*: U.S. Geological Survey Techniques and Methods 1–A1. https://pubs.usgs.gov/tm/1a1/pdf/tm1-a1.pdf

California Department of Water Resources, 2010. *Groundwater elevation monitoring guidelines*. http://www.water.ca.gov/groundwater/casgem/pdfs/CASGEM%20DWR%20GW%20Guidelines%20Final%20121510.pdf

Holmes, R.R. Jr., P.J. Terrio, M.A. Harris, and P.C. Mills, 2001. *Introduction to field methods for hydrologic and environmental studies*, open-file report 01-50, USGS, Urbana, Illinois, 241 p. https://pubs.er.usgs.gov/publication/ofr0150

Puls, R.W., and Barcelona, M.J., 1996, *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*; US EPA, Ground Water Issue EPA/540/S-95/504. https://www.epa.gov/sites/production/files/2015-06/documents/lwflw2a.pdf

Rantz, S.E., and others, 1982. *Measurement and computation of streamflow*; U.S. Geological Survey, Water Supply Paper 2175. http://pubs.usgs.gov/wsp/wsp2175/#table

Subcommittee on Ground Water of the Advisory Committee on Water Information, 2013. *A national framework for ground-water monitoring in the United States*. http://acwi.gov/sogw/ngwmn_framework_report_july2013.pdf

Vail, J., D. France, and B. Lewis. 2013. *Operating Procedure: Groundwater Sampling SESDPROC-301-R3*.

https://www.epa.gov/sites/production/files/2015-06/documents/Groundwater-Sampling.pdf

Wilde, F.D., January 2005. *Preparations for water sampling (ver. 2.0)*: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A1, http://water.usgs.gov/owq/FieldManual/compiled/NFM_complete.pdf

ONLINE RESOURCES

Online System for Well Completion Reports (OSWCR). California Department of Water Resources. http://water.ca.gov/oswcr/index.cfm

Measuring Land Subsidence web page. U.S. Geological Survey. http://ca.water.usgs.gov/land_subsidence/california-subsidence-measuring.html

USGS Global Positioning Application and Practice web page. U.S. Geological Survey. http://water.usgs.gov/osw/gps/

APPENDIX J: MONITORING PROTOCOLS – GROUNDWATER QUALITY (CVGM QAPRP & ESJWQC QAPP)

Quality Assurance Program Plan

For Groundwater Monitoring By The

Central Valley Groundwater Monitoring Collaborative

For The

Irrigated Lands Regulatory Program

Central Valley Regional Water Quality Control Board
11020 Sun Center Drive #200
Rancho Cordova, California 95670-6114

Submitted On

April 1, 2019

Prepared By

GROUP A. PROGRAM MANAGEMENT

1. APPROVAL SIGNATURES

Central Valley Regional Water Quality Control Board

Title:	Name:	Signature:	Date:
Senior Environmental Scientist	Susan Fregien		
Senior Engineering Geologist	David Sholes		
Water Resource Control Engineer	Ashley Peters		

State Water Resources Control Board

Title:	Name:	Signature:	Date:
SWRCB QA Officer	Rene Spears		

CVGMC Program Personnel

Title:	Name:	Signature:	Date:
Program Manager	David Cory		
Senior Hydrogeologist	Vicki Kretsinger		
Program QA Officer	Melisa Turner		

Coalition Project Personnel

Title/Project:	Name:	Signature:	Date:
Project Lead, Buena Vista Coalition	Tim Ashlock		
Project Manager, Buena Vista Coalition	Morgan Campbell		
Project QA Officer, Buena Vista Coalition	Sarah Rutherford		
Project Lead, Cawelo Water District Coalition	David Hampton		

Project Manager, Cawelo Water District Coalition	Dennis Pickin		
Project QA Officer, Cawelo Water District Coalition	David Ansolabehere		
Project Lead, East San Joaquin Water Quality Coalition	Parry Klassen		
Project Manager, East San Joaquin Water Quality Coalition	Ally Villalpando		
Project QA Officer, East San Joaquin Water Quality Coalition	Lisa McCrink		
Project Lead, Grassland Drainage Area Coalition	Joe McGahan		
Project Manager, Grassland Drainage Area Coalition	Nick Watterson		
Project QA Officer, Grassland Drainage Area Coalition	Aaron King		
Project Lead, Kaweah Basin Water Quality Association	Donald Ikemiya		
Project Manager, Kaweah Basin Water Quality Association	Jordan Muell		
Project QA Officer, Kaweah Basin Water Quality Association	Sarah Rutherford		
Project Lead, Kern River Watershed Authority	Nicole Bell		
Project Manager, Kern River Watershed Authority	Morgan Campbell		

Project QA Officer, Kern River Watershed Authority	Sarah Rutherford		
Project Lead, Kings River Water Quality Coalition	Charlotte Gallock		
Project Manager, Kings River Water Quality Coalition	Eric Athorp		
Project QA Officer, Kings River Water Quality Coalition	Laura Satterlee		
Project Lead, Westlands Water Quality Coalition	Debra Dunn		
Project Manager, Westlands Water Quality Coalition	Lindsay Nelson		
Project QA Officer, Westlands Water Quality Coalition	Lisa McCrink		
Project Lead, Westside San Joaquin River Watershed	Joe McGahan		
Project Manager, Westside San Joaquin River Watershed	Nick Watterson		
Project QA Officer, Westside San Joaquin River Watershed	Aaron King		
Project Lead, Westside Water Quality Coalition	Phil Nixon		
Project Manager, Westside Water Quality Coalition	Jill Ghelerter		
Project QA Officer, Westside Water Quality Coalition	Josh Spink		

Analytical Laboratory Personnel

Title/Laboratory:	Name:	Signature:	Date:
Laboratory Project Manager, BSK (Kern)	Stephane Maupas		
Laboratory Project Manager, BSK (Kings)	Heather S. White		
Laboratory Project Manager, BSK (Westside)	Adam Trevarrow		
Laboratory QA Officer, BSK	Michael Ng		
Laboratory Project Manager, Caltest	Eli Greenwald		
Laboratory QA Officer, Caltest	Nell Arguelles		
Laboratory Project Manager, Eurofins	Monica Van Natta		
Laboratory QA Officer, Eurofins	Nilda Cox		
Laboratory Project Manager, FGL	Stephanie Herron		
Laboratory QA Officer, FGL	David Terz		

2. TABLE OF CONTENTS

2.1. List of Tables

2.2. List of Figures

2.3. List of Appendices

Appendix I. Coalition Specific QAPP Forms

Appendix II. Data Management SOP

Appendix III. Field Sampling SOPs

Appendix IV. Laboratory SOPs

Index of Appendices

CVGMC Coalition	QAPP Appendix Reference	Data Management SOP Appendix Reference	Field Sampling SOP Appendix Reference	Laboratory SOPs Appendix Reference
Buena Vista Coalition	Appendix I-A	Appendix II	Appendix III-A	Appendix IV-A
Cawelo Water District Coalition	Appendix I-B	Appendix II	Appendix III-B	Appendix IV-D
East San Joaquin Water Quality Coalition	Appendix I-C	Appendix II	Appendix III-G	Appendix IV-B
Grassland Drainage Area Coalition	Appendix I-D	Appendix II	Appendix III-F	Appendix IV-C
Kaweah Basin Water Quality Association	Appendix I-E	Appendix II	Appendix III-C	Appendix IV-D
Kern River Watershed Coalition Authority	Appendix I-F	Appendix II	Appendix III-D	Appendix IV-A
Kings River Water Quality Coalition	Appendix I-G	Appendix II	Appendix III-E	Appendix IV-A
Westlands Water Quality Coalition	Appendix I-H	Appendix II	Appendix III-G	Appendix IV-B
Westside San Joaquin River Watershed Coalition	Appendix I-I	Appendix II	Appendix III-F	Appendix IV-C
Westside Water Quality Coalition	Appendix I-J	Appendix II	Appendix III-H	Appendix IV-A

2.4. List of Acronyms

AOAC	Association of Official Analytical Chemist	MDL	Method Detection Limit
ASTM	American Society of Testing Materials	MLJ-LLC	Michael L. Johnson, LLC
COC	Chain Of Custody	MOA	Memorandum of Agreement
CRM	Certified Reference Material	MQO	Measurement Quality Objective
CVGMC	Central Valley Groundwater Monitoring Collaborative	MS	Matrix Spike
CVRWQCB	Central Valley Regional Water Quality Control Board	MSD	Matrix Spike Duplicate
DDW	Division of Drinking Water	ORP	Oxidation Reduction Potential
DMS	Data Management System	PR	Percent Recovery
DO	Dissolved Oxygen	QA	Quality Assurance
DQI	Data Quality Indicators	QAPrP	Quality Assurance Project Plan
E	Environmental sample	QC	Quality Control
EC	Specific Conductance	RL	Reporting Limit
FB	Field Blank	RPD	Relative Percent Difference
FD	Field Duplicate	RS	Resample
GAR	Groundwater Quality Assessment Report	SOP	Standard Operating Procedure
GQTM	Groundwater Trend Monitoring	TDS	Total Dissolved Solids
ILRP	Irrigated Land and Regulatory Program	US EPA	United States Environmental Protection Agency
LCS	Laboratory Control Spike	USGS	United States Geological Survey
LCSD	Laboratory Control Spike Duplicate		

2.5. List of Units

cm	centimeter
L	liter
mg	milligram
mV	millivolts
NTU	Nephelometric Turbidity Units
pH	Power of Hydrogen
µg	microgram

3. DISTRIBUTION LIST

AFFILIATION	NAME	TITLE:	CONTACT
Central Valley Regional Water Quality Control Board	Susan Fregien	Senior Environmental Scientist	11020 Sun Center Drive, #200 Rancho Cordova, CA 95670
	David Sholes	Senior Engineering Geologist	
	Ashley Peters	Irrigated Lands Water Resource Control Engineer	
State Water Quality Control Board	Rene Spears	State Board QA Officer	1001 I Street Sacramento, CA 95814
CVGMC	David Cory	Program Manager	P.O. Box 2157 Los Banos, CA 93635
	Melissa Turner	Program QA Officer	1480 Drew Ave., Ste. 130 Davis, CA 95618
	Vicki Kretsinger	Senior Hydrogeologist	500 First Street Woodland, CA 95695
Buena Vista Coalition	Tim Ashlock	Project Lead	P.O. Box 756 Buttonwillow, CA 93206
	Morgan Campbell	Project Manager	130 N Garden Street Visalia, CA 93291
	Sarah Rutherford	Project QA Officer	
Cawelo Water District Coalition	David Hampton	Project Lead	17207 Industrial Farm Rd. Bakersfield, CA 93308
	Dennis Pickin	Project Manager	
	David Ansolabehere	Project QA Officer	
East San Joaquin Water Quality Coalition	Parry Klassen	Project Lead	1201 L Street Modesto, CA 95354
	Ally Villalpando	Project Manager	1480 Drew Ave., Ste. 130 Davis, CA 95618
	Lisa McCrink	Project QA Officer	
Grassland Drainage Area Coalition	Joe McGahan	Project Lead	P.O. Box 2157 Los Banos, CA 93635
	Nick Watterson	Project Manager	500 First Street Woodland, CA 95695
	Aaron King	Project QA Officer	
Kaweah Basin Water Quality Association	Donald Ikemiya	Project Lead	P.O. Box 2840 Visalia, CA 93279
	Jordan Muell	Project Manager	130 N Garden Street Visalia, CA 93291
	Sarah Rutherford	Project QA Officer	
Kern River Watershed Coalition Authority	Nicole Bell	Project Lead	P.O. Box 2840 Visalia, CA 93279
	Morgan Campbell	Project Manager	130 N Garden Street

Affiliation	Name	Title:	Contact
	Sarah Rutherford	Project QA Officer	Visalia, CA 93291
Kings River Water Quality Coalition	Charlotte Gallock	Project Lead	4886 E. Jensen Fresno, CA 93725
	Eric Athorp	Project Manager	
	Laura Satterlee	Project QA Officer	
Westlands Water Quality Coalition	Debra Dunn	Project Lead	3130 N. Fresno St. P.O. Box 6056 Fresno, CA 93703
	Lindsay Nelson	Project Manager	1480 Drew Ave., Ste. 130 Davis, CA 95618
	Lisa McCrink	Project QA Officer	
Westside San Joaquin River Watershed	Joe McGahan	Project Lead	P.O. Box 2157 Los Banos, CA 93635
	Nick Watterson	Project Manager	500 First Street Woodland, CA 95695
	Aaron King	Project QA Officer	
Westside Water Quality Coalition	Phil Nixon	Project Lead	21908 7th Standard Rd. McKittrick, CA 93251
	Jill Ghelerter	Project Manager	1281 East Alluvial Avenue, Suite 101, Fresno, CA 93720
	Josh Spink	Project QA Officer	
Central Valley Regional Water Quality Control Board	Susan Fregien	Senior Environmental Scientist	11020 Sun Center Drive, #200 Rancho Cordova, CA 95670
	David Sholes	Senior Engineering Geologist	
	Ashley Peters	Irrigated Lands Water Resource Control Engineer	
State Water Quality Control Board	Rene Spears	State Board QA Officer	1001 I Street Sacramento, CA 95814
BSK Associates	Michael Ng	Laboratory QA Officer	1414 Stanislaus Street Fresno, CA 93706
Caltest Laboratories	Nell Arguelles	Laboratory QA Officer	1885 North Kelly Road Napa, California 94558
Eurofins Eaton	Nilda Cox	Laboratory QA Officer	750 Royal Oaks Drive, Suite 100 Monrovia, CA 91016
Fruit Growers Laboratories	David Terz	Laboratory QA Officer	9415 W. Goshen Avenue Visalia, CA 93291

4. PROGRAM ROLES AND RESPONSIBILITIES

4.1. Involved Parties and Roles

The Central Valley Groundwater Monitoring Collaborative (CVGMC) is a monitoring program developed by various stakeholders across the Central Valley with the goal of characterizing groundwater quality and the potential impact of waste discharges on groundwater quality. The CVGMC has developed a Technical Workplan for long-term trend monitoring that will be implemented by the participating entities.

Ten Central Valley third-party groups comprise the initial group of Irrigated Lands Regulatory Program (ILRP) Coalitions taking part in the Collaborative. The participating agricultural Coalitions are:

- Buena Vista Coalition
- Cawelo Water District Coalition
- East San Joaquin Water Quality Coalition
- Grassland Drainage Area Coalition
- Kaweah Basin Water Quality Association
- Kern River Watershed Coalition Authority
- Kings River Water Quality Coalition
- Westlands Water Quality Coalition
- Westside San Joaquin River Watershed
- Westside Water Quality Coalition

Each of the participating agricultural Coalitions must meet their own groundwater monitoring requirements, outlined in their individual General Orders. However, each Order allows for the Coalitions to collaborate with other Central Valley third parties to monitor and report on groundwater quality trends on a regional basis. The role of the CVGMC is to establish common monitoring and reporting structure as it applies to the individual groundwater trend monitoring requirements established by each third-party group under their individual General Orders. The third-party groups will participate in a regional effort to collect and share groundwater monitoring data to be used for a broad geographical characterization of the potential effects of agricultural lands on groundwater aquifers, for regulatory compliance and decision making throughout the Central Valley.

The Quality Assurance Program Plan (QAPrP) establishes the quality assurance and quality control standards and requirements for useable data for individual projects contributing to this regional collaboration. It also establishes the requirements for a regional data management system, through which all useable data generated under the CVGMC can be stored and accessed by the participants and regulators.

4.2. Program Administration

The CVGMC participating Coalitions work collaboratively under a Memorandum of Agreement (MOA) signed on October 27, 2017. The Memorandum of Agreement outlines the purpose, organization, roles and responsibilities of the member Coalitions, administrative procedures, length of time the terms of the MOA remain in force, termination procedures, and rules of operation. In addition, there is a cost allocation schedule agreed upon by all member Coalitions.

4.3. Project Management and Coordination

The CVGMC activities are managed by a Coordination Committee which consists of a member from each of the Coalitions including a Chair and Vice Chair. The Coordination Committee is responsible for approving scope of work documents for any contractor and provides oversight for any work performed by outside contractors. The Chair serves as the Program Manager for the purpose of this QAPrP and works directly with the Program QA Officer and the Senior Hydrogeologist to assess data received from the individual Coalitions, compile and assess data, and evaluate data for inclusion in CVGMC analysis and reporting.

4.4. Quality Assurance and Data Management

Quality Assurance Officer Role

The Program QA Officer is responsible for developing the programmatic procedures and QA/QC guidelines for field sampling and analytical procedures conducted as part of the CVGMC Technical Workplan. The Program QA Officer will oversee and manage the assessment of accuracy, completeness and precision for samples collected as part of the CVGMC.

Persons Responsible for the Update and Maintenance of QAPrP

The Program QA Officer in coordination with the Program Manager and Senior Hydrogeologist will be responsible for creating, maintaining and updating the QAPrP including the submission of addendums to reflect updates based on project specific QAPP. The Program QA Officer will be responsible for making changes, submitting drafts for review, preparing a final copy and submitting the final version for signature.

4.5. Field, Laboratory, and Technical Services

Well sampling will be conducted by the member Coalitions as described in their project specific QAPP following quality assurance (QA) requirements found in this QAPrP. The individual entities will maintain and store records of data, field sheets, chain of custody (COC) forms, as well as all other forms of documentation.

Programmatic technical services are overseen by the Senior Hydrogeologist, who is responsible for overseeing the implementation of the Programmatic Workplan and development of five-year trend reports to the CVRWQCB. The Senior Hydrogeologist will review updates to the Workplan and assess how changes to workplans meet the technical requirements of the program.

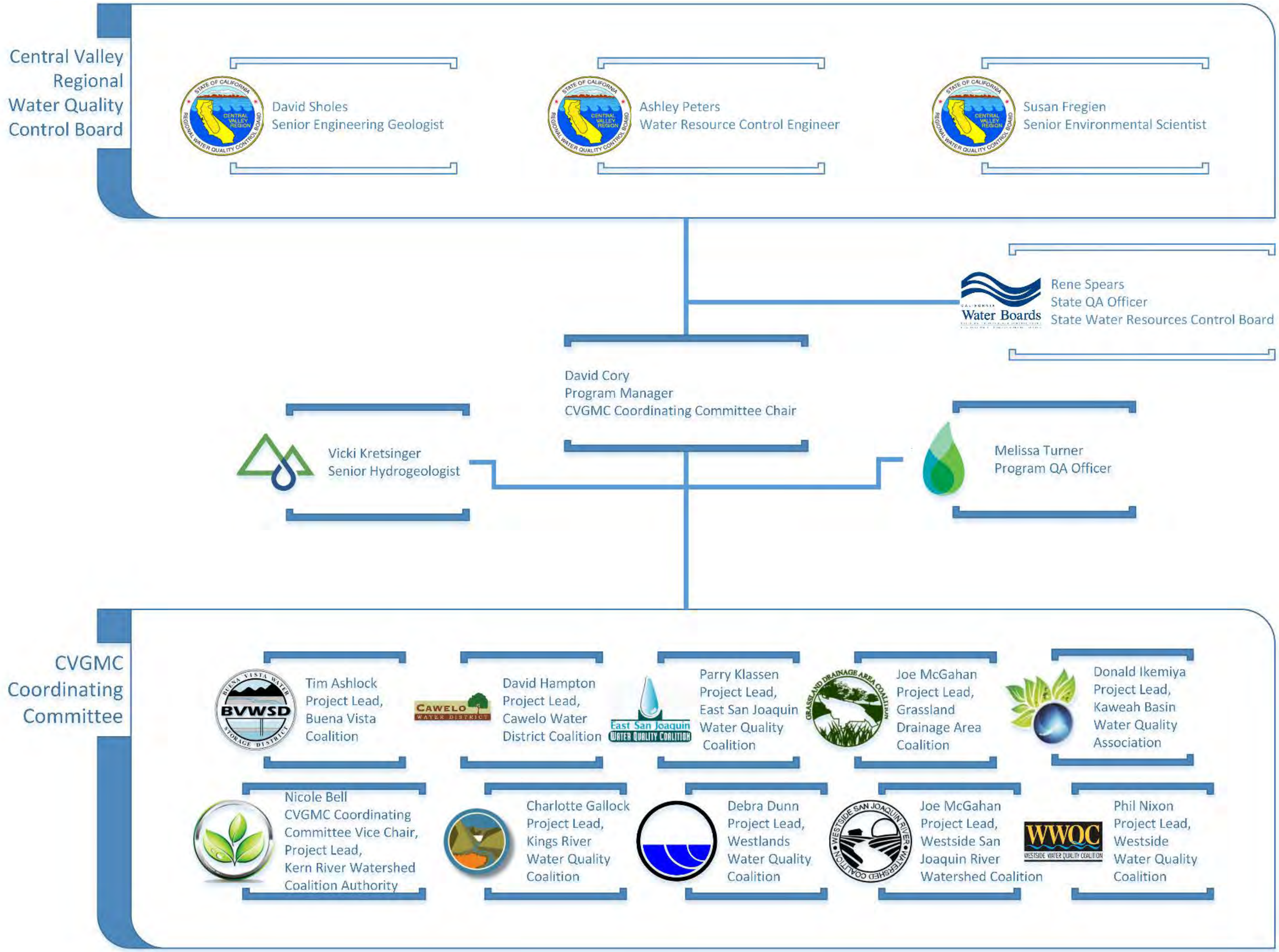
The laboratories contracted to analyze samples collected for the Program studies will provide analytical services for this project in accordance with all method and QA requirements found in this QAPrP. Individual contracts will be maintained by the third-party entities coordinating sampling efforts. All data deliverables generated by contract laboratories will be submitted to the Program Data Management System outlined in this QAPrP in **Section 19.**

All analytical issues will be resolved between the contract entities and covered under individual QAPPs. The laboratories will maintain contact with the individual Project Managers to resolve analytical issues or for notification of laboratory changes.

No individuals outside of the Program Team contribute to the CVGMC in an advisory role.

4.6. Organizational Chart and Responsibilities

Figure 1. Organizational chart - CVGMC.



Individual Project Organizational Charts Attached Below

Figure 2. Project Organizational Chart - Buena Vista Coalition.

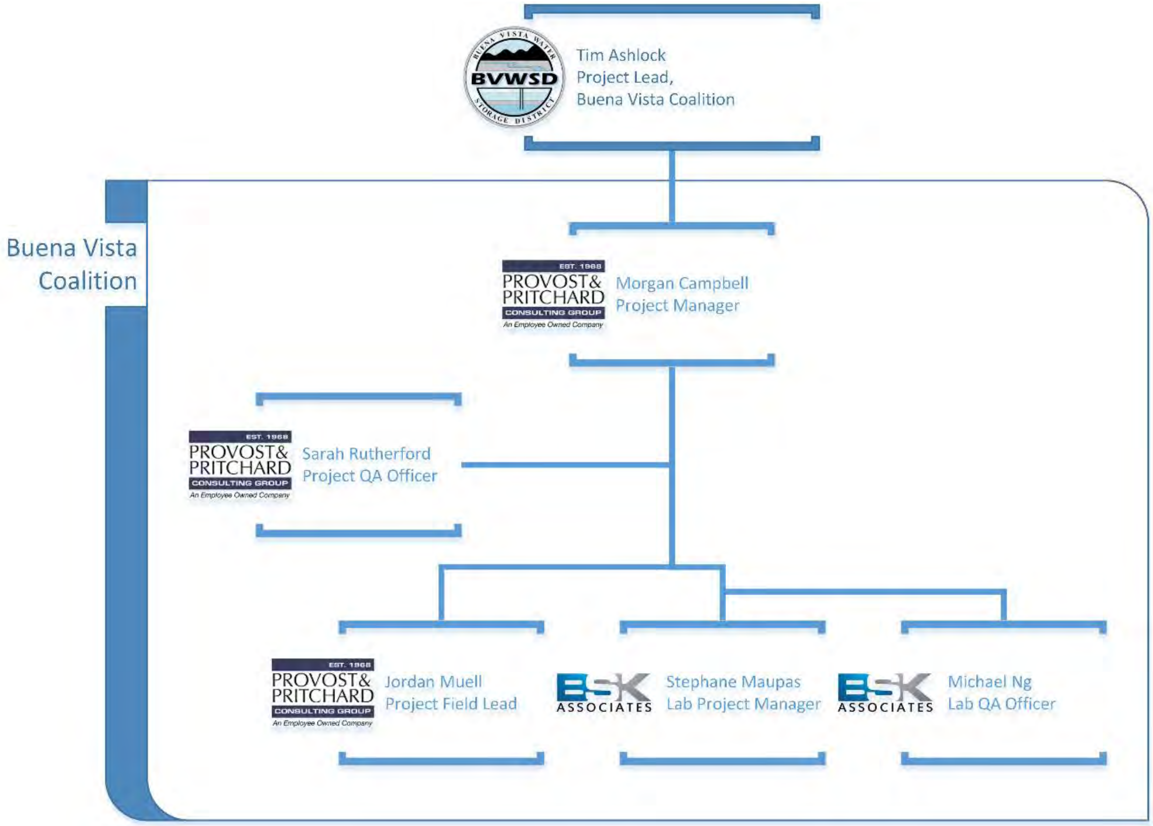


Figure 3. Project Organizational Chart - Cawelo Water District Coalition.

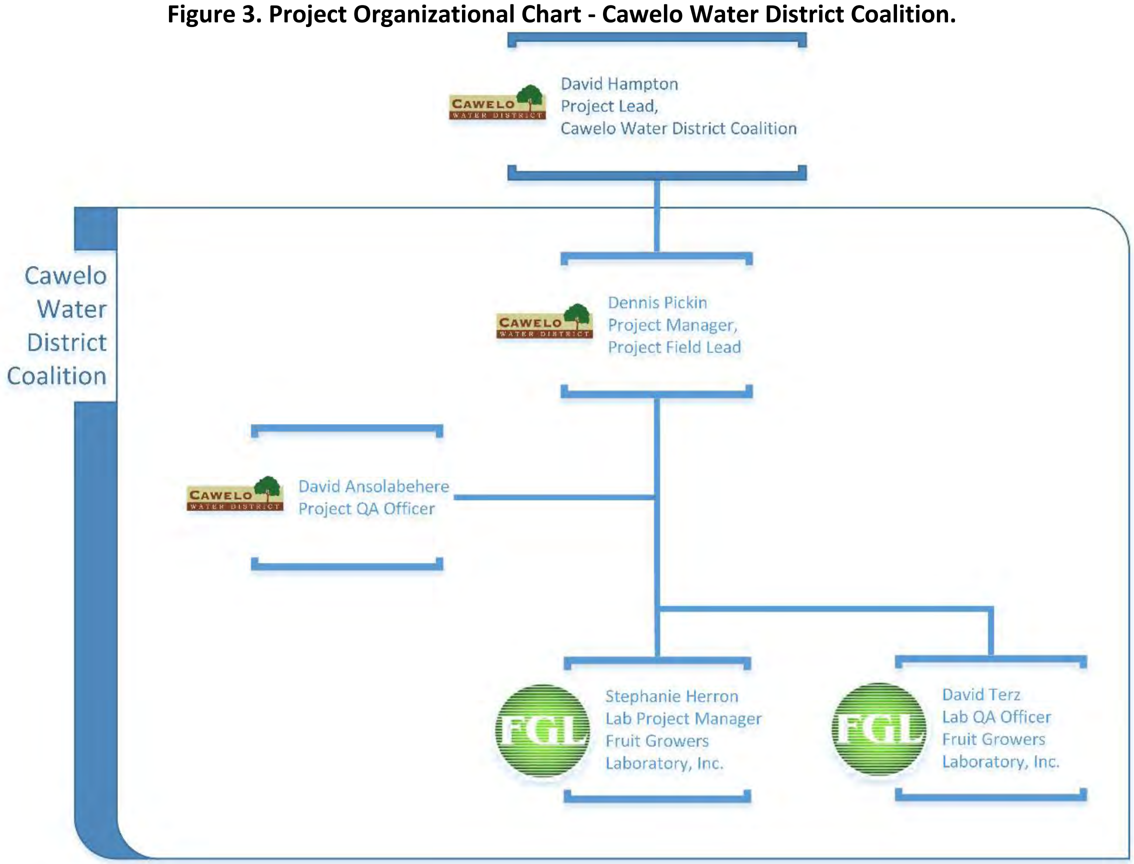


Figure 4. Project Organizational Chart - East San Joaquin Water Quality Coalition.

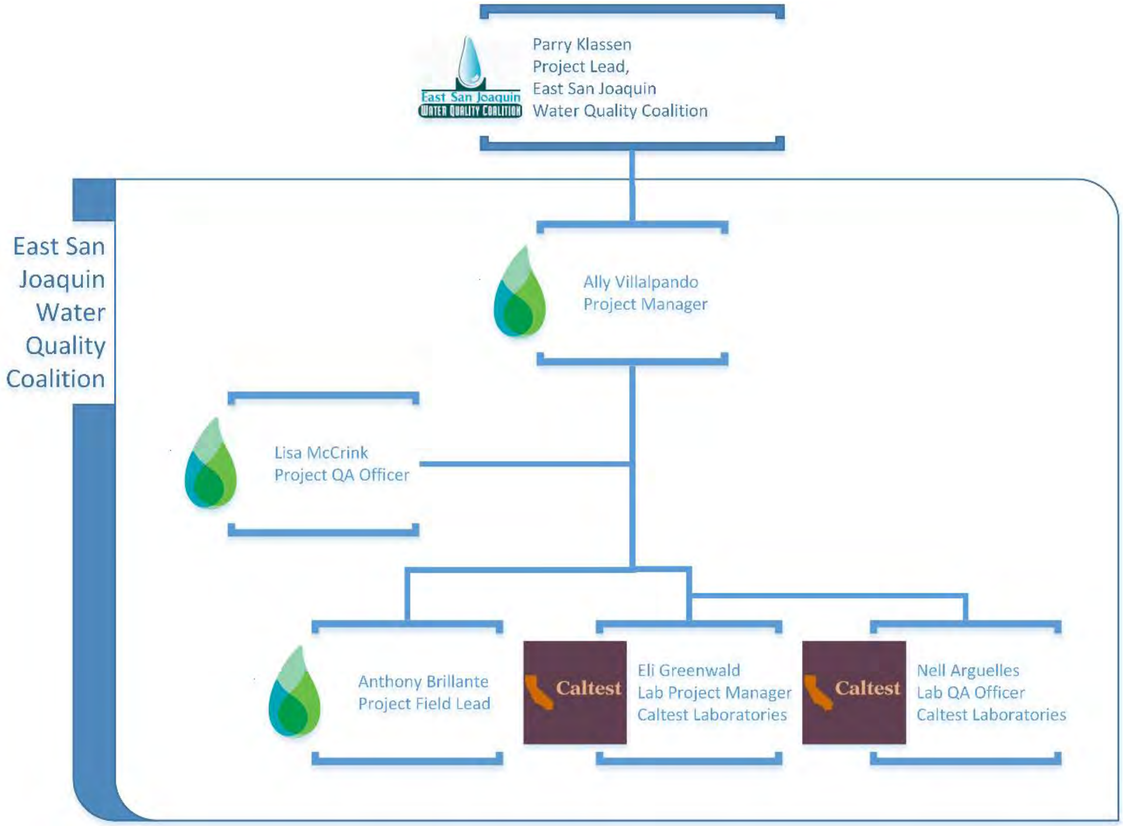


Figure 5. Project Organizational Chart - Grassland Drainage Area Coalition.

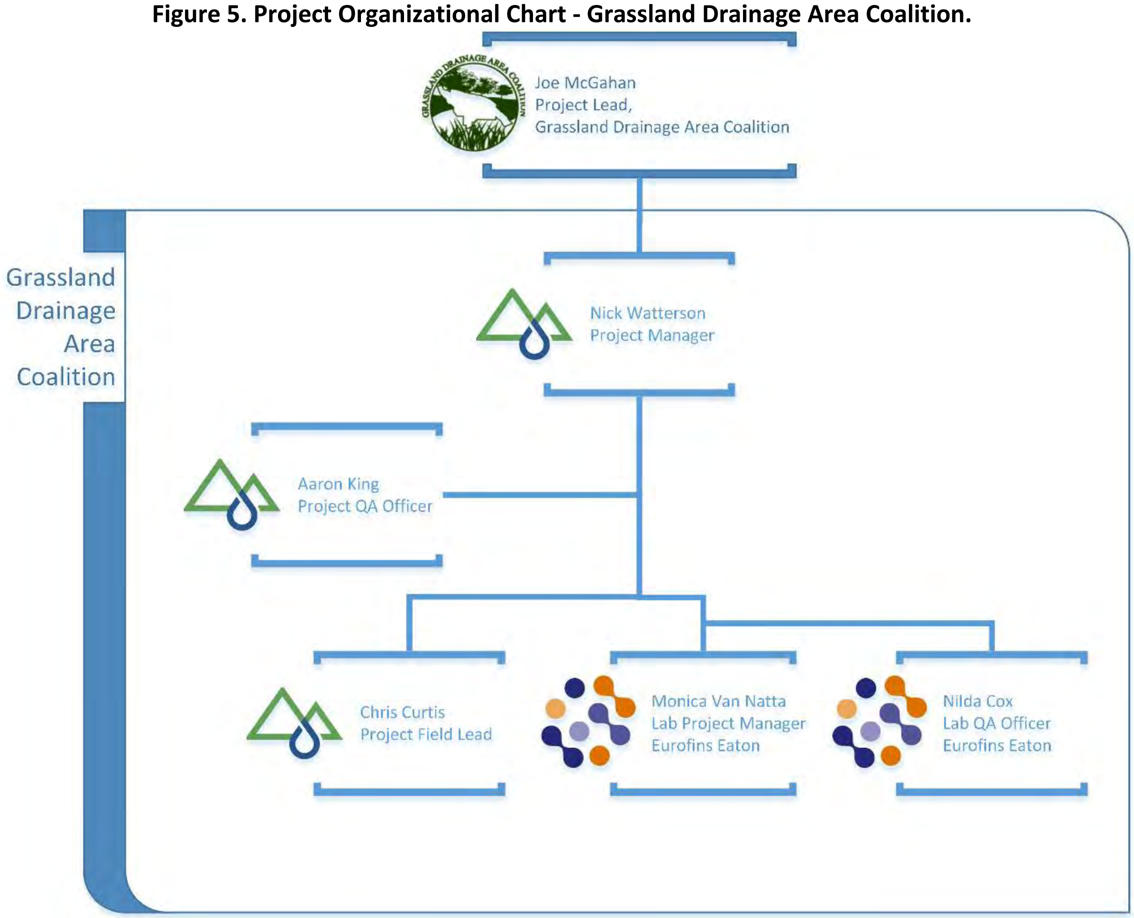


Figure 6. Project Organizational Chart - Kaweah Basin Water Quality Coalition.

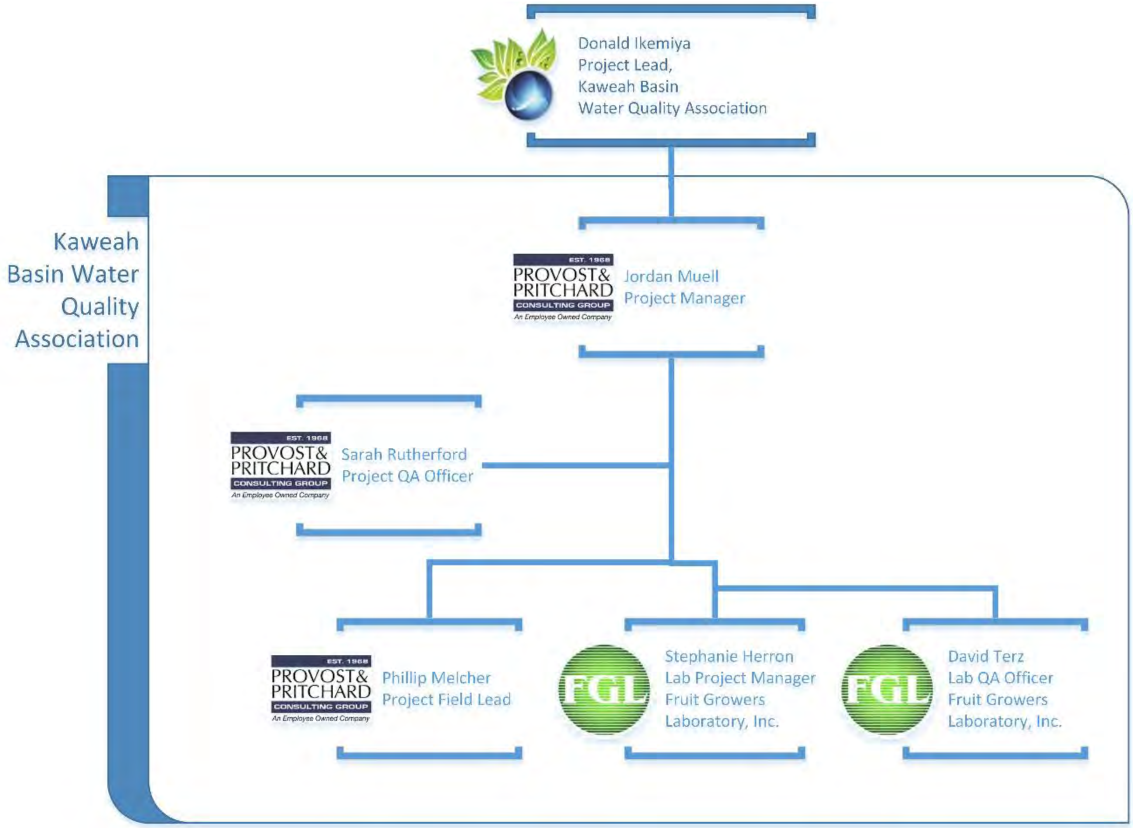


Figure 7. Project Organizational Chart - Kern River Watershed Coalition Authority.

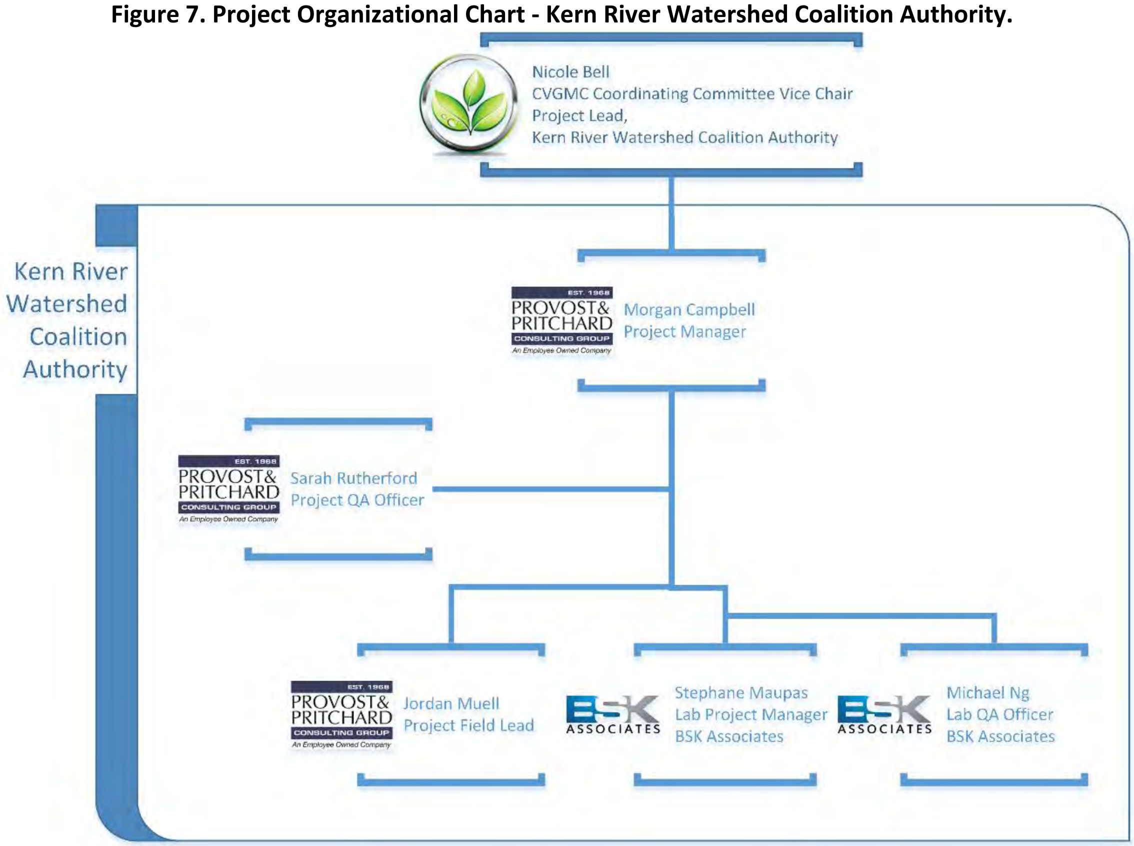


Figure 8. Project Organizational Chart - Kings River Water Quality Coalition.

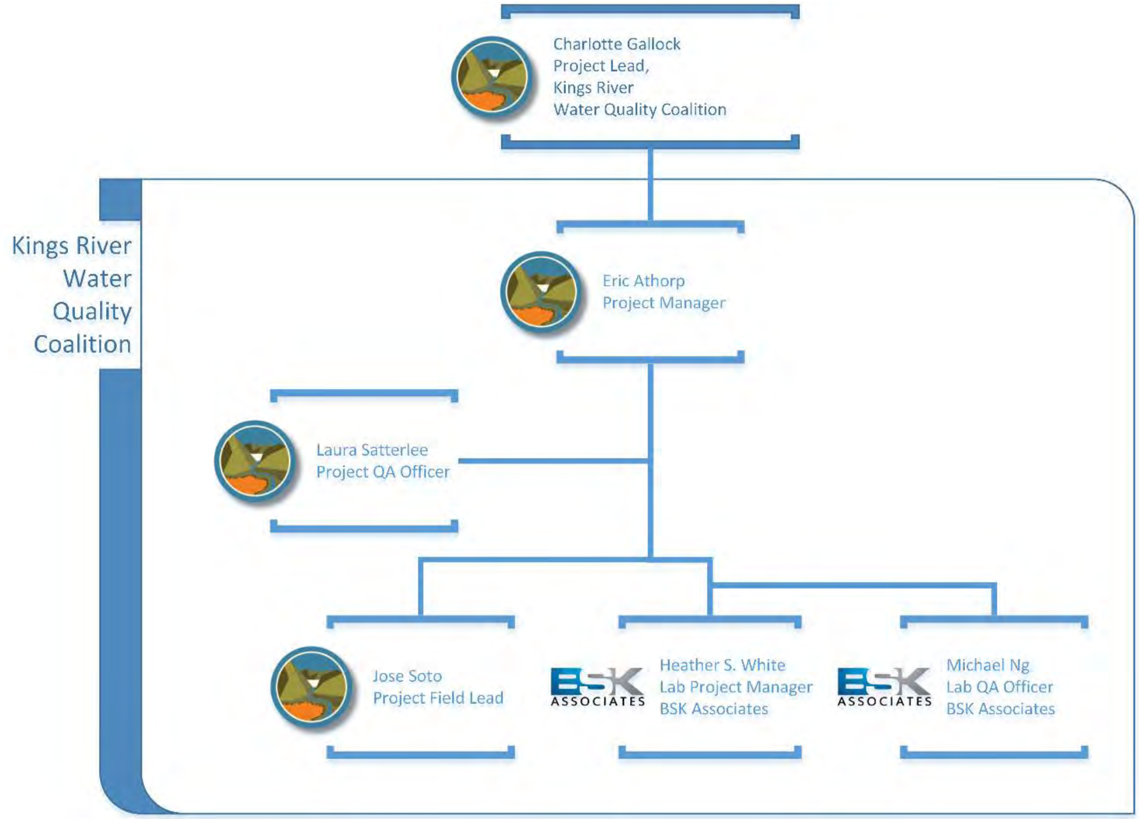


Figure 9. Project Organizational Chart - Westlands Water Quality Coalition.

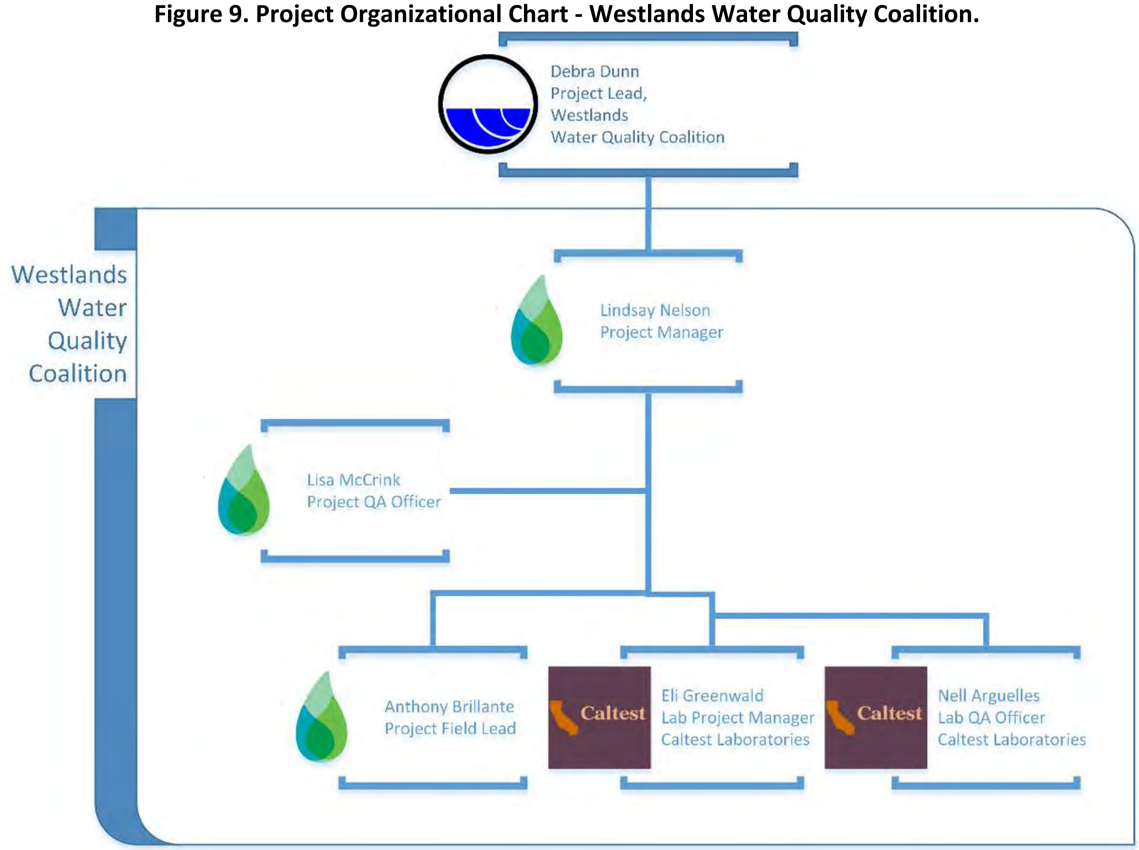


Figure 10. Project Organizational Chart - Westside San Joaquin River Watershed Coalition.

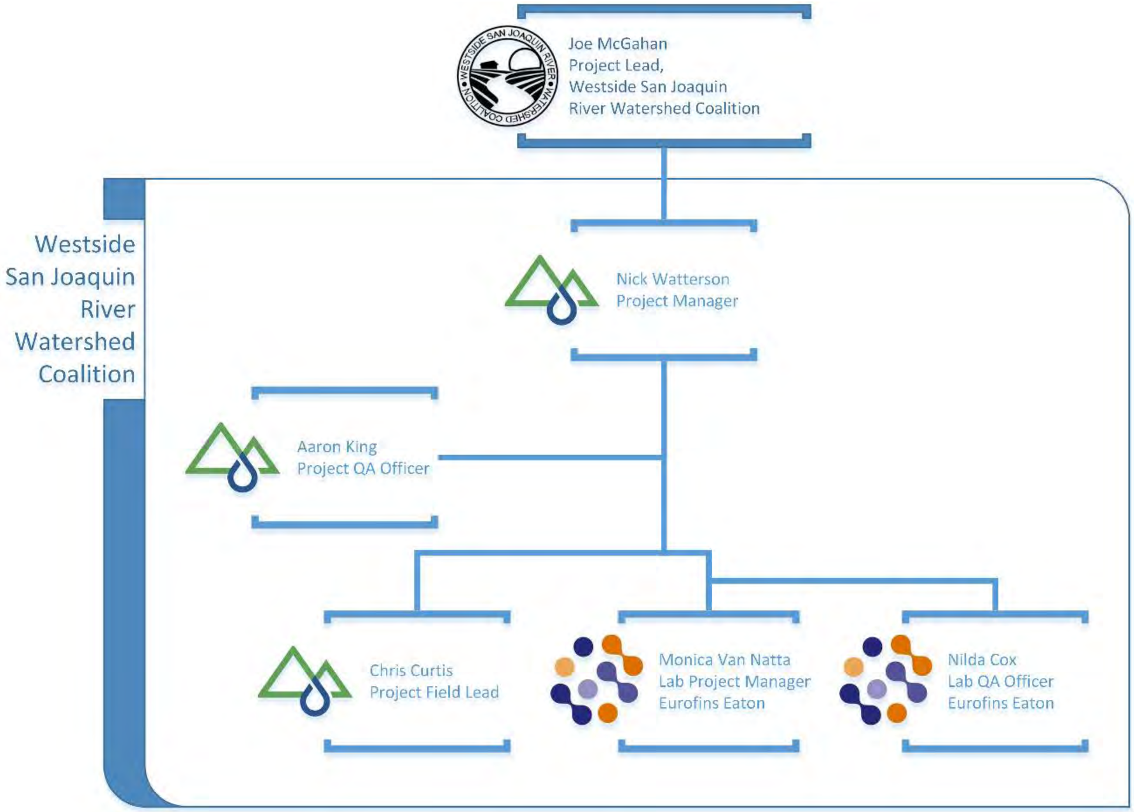
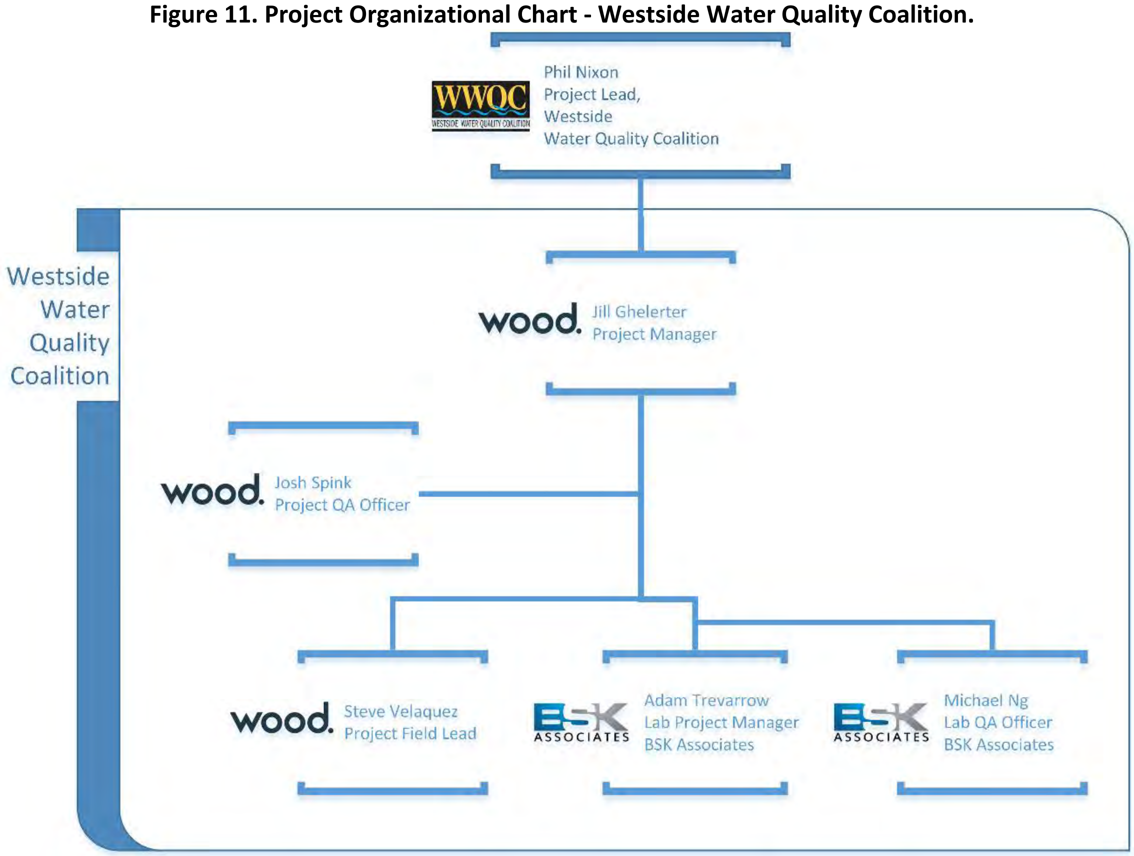


Figure 11. Project Organizational Chart - Westside Water Quality Coalition.



5. PROBLEM DEFINITION/BACKGROUND

The CVGMC was created to comply with the various Waste Discharge Requirements of the participating Central Valley ILRP Coalitions. Given the nature of groundwater trend monitoring and the challenges presented by accurately characterizing groundwater quality on a small geographical scale, groundwater quality trends can be more effectively and efficiently evaluated on a regional level. Furthermore, given the number of state and local regulatory programs with groundwater monitoring requirements, a regional collaboration allows for the individual stakeholders to avoid duplicating costs and effort for the use of the same data.

The Central Valley Regional Water Quality Control Board (CVRWQCB or Regional Board) has allowed the individual Coalitions to opt into a regional effort across the Central Valley to characterize groundwater quality trends and share resources to meet the groundwater monitoring requirements of each third party's individual General Orders. Ten ILRP Coalitions have founded the CVGMC in an effort to meet these requirements. Additionally, the program was created with the understanding that other state and regional programs with groundwater monitoring requirements may also participate in the Collaborative in the future, allowing shared resources across multiple dischargers and stakeholders throughout the Central Valley.

6. PROGRAM DESCRIPTION

6.1. Work Statement and Deliverables

The CVGMC program will be implemented in three phases:

Phase 1. ILRP Technical Workplan;

Phase 2. Coordination Among Existing Groundwater Monitoring Programs;

Phase 3. Future Groundwater Monitoring Coordination

Phase 1 was completed and submitted to the CVRWQCB on May 16, 2018. Upon Executive Officer approval of the Phase 1 Technical Workplan, monitoring of the well network established in the Workplan by the individual participating third parties will begin in Fall 2018.

Individual ILRP Coalitions will report on the data developed in their respective areas annually, in accordance with their individual Orders. All ILRP participants will contribute to a CVGMC 5-Year Report with additional methods to characterize groundwater quality conditions and trends.

Phase 2 and Phase 3 of the program will be implemented once the ILRP Technical Workplan and Data Management System are established.

6.2. Monitoring Projects

Each of the Central Valley ILRP Coalitions have developed a Groundwater Quality Assessment Report (GAR) that characterizes the existing state of groundwater quality within each region. Based on these characterizations, the individual Coalitions have developed, or are currently developing Groundwater

Trend Monitoring Workplans (GQTMs), with the goal of long-term characterization and overall protection and improvement of the groundwater conditions provided by each individual GAR.

By opting into the CVGMC, participating Coalitions will agree to the common approach to monitoring and reporting elements under the Technical Workplan to meet their individual GQTM requirements. The conclusions and existing data developed by each individual GQTM will inform and feed into the regional collaborative Technical Workplan.

Each participating Coalition is responsible for certain Coalition-specific responsibilities. These responsibilities include developing their own individual GQTM to meet specific Order requirements, conducting sampling within their own GQTM network, and preparing Annual Reports in accordance with the CVGMC format.

6.3. Constituents to Be Monitored

Table 1 lists the required constituents associated with CVGMC Technical Workplan and is consistent with the constituents to be monitored by each Coalition. The testing frequency reflects how often a constituent is measured at each well location. The table summarizes the parameter type (whether the result is derived from the field or the laboratory), methods, and analyses used to produce results for each constituent measured at each monitored well.

Table 1. Constituents and parameters.

Constituents and parameters measured are grouped by testing frequency, required or optional and parameter type.

Constituent	Reporting Units	Testing Frequency	Required or Optional	Parameter Type
Nitrate as Nitrogen (NO3-N) or Nitrate + Nitrite as Nitrogen (NO3-N)	mg/L (as N)	Annual	Required	Analytical
Dissolved Oxygen (DO)	mg/L	Annual	Required	Field Measure
Electrical Conductivity (EC) at 25 °C	µS/cm	Annual	Required	Field Measure
pH	pH units	Annual	Required	Field Measure
Temperature	°C	Annual	Required	Field Measure
Depth to standing water (static water level)	ft	Annual	Required[1]	Field Measure
Oxidation-reduction potential (ORP)	mV	Annual	Optional	Field Measure
Turbidity	NTU	Annual	Optional	Field Measure
Anions				
Carbonate	mg/L	Five Years	Required	Analytical
Chloride	mg/L	Five Years	Required	Analytical
Bicarbonate	mg/L	Five Years	Required	Analytical
Sulfate (SO4)	mg/L	Five Years	Required	Analytical
Cations				
Boron	mg/L	Five Years	Required	Analytical
Calcium	mg/L	Five Years	Required	Analytical
Magnesium	mg/L	Five Years	Required	Analytical
Potassium	mg/L	Five Years	Required	Analytical
Sodium	mg/L	Five Years	Required	Analytical
Total Dissolved Solids (TDS)	mg/L	Five Years	Required	Analytical

[1] Collected annually if available/accessible.

6.4. Program Schedule

The program will advance with the deliverable date outlined in **Table 2** below. Wells within the CVGMC network will be monitored starting in Fall 2018, pending Executive Officer approval of the Technical Workplan. Monitoring results will be reported on annually with the expectation that the Workplan will be approved prior to Fall 2018. Annual analysis and reporting of results related to the individual Coalition GQTMs will focus on visual and tabular presentation of data with limited representation of data interpretation. Additional interpretations and conclusions relating to trends and relationships in trends will be conducted as part of reporting every five years.

Table 2. Project deliverable schedule timeline.

DELIVERABLE	DESCRIPTION	DELIVERABLE DUE DATE
Individual Coalitions Annual Monitoring Reports	Coalition specific analysis and reporting of previous years monitoring results.	November 30, 2019 (Annually)
CVGMC 5-Year Report[1]	Reporting on all CVGMC network monitoring results from the previous 5 years including trends and interpretations.	November 30, 2023 (Every Five Years)

[1]First CVGMC 5-Year Report is shifted to 2023 to have the Coalitions align in their reporting periods coinciding with Groundwater Assessment Reports.

6.5. Geographical Setting

The CVGMC area is made up the groundwater monitoring networks developed by each of the member Coalitions. The area includes the geographic regions of the following Coalitions as part of Phase 1 of the CVGMC: Buena Vista Coalition, Cawelo Water District Coalition, East San Joaquin Water Quality Coalition, Grassland Drainage Area Coalition, Kaweah Basin Water Quality Association, Kern River Watershed Coalition Authority, Kings River Water Quality Coalition, , Westlands Water Quality Coalition, Westside San Joaquin River Watershed Coalition, and Westside Water Quality Coalition (**Figure 12**).

Each Coalition has developed its own network of wells for groundwater quality trend monitoring as described in the individual Coalition GQTMs. These networks include wells spatially distributed across high and low vulnerability areas of each Coalition region in accordance with Coalition-specified prioritization criteria. These well networks will be monitored by the Coalitions and incorporated into the CVGMC network for regional analysis and reporting.

6.6. Constraints

Any constraints that may disrupt the overall goals of the CVGMC are addressed in the Technical Workplan. Constraints associated with individual third-party sampling and data generation should be addressed in individual GQMPs and reported to the CVGMC. It is not anticipated that there will be any constraints that cannot be resolved or which will result in a compliance violation.

Figure 12. Geographical area covered by the CVGMC.

7. PROGRAM QUALITY OBJECTIVES

7.1. Data Quality Indicators

In order to account for the inherent level of uncertainty that can occur from the sampling design process through the result documentation, it is important for the program to have set limits of allowable error to ensure data are useable and supportive of the project goals.

Data Quality Indicators (DQIs) are the quantitative statistics and qualitative descriptors used to interpret the degree of acceptability or utility of data to the user (US EPA QA/G-5, 2002). The principal data quality indicators are precision, accuracy (bias), comparability, completeness, representativeness, and sensitivity.

Limits for error must be established for all applicable DQIs for every measurement conducted under the CVGMC program. Program definitions for each DQI are provided below. For minimum targets associated with each of the following DQIs, see **Section 14.** Project-specific limits for each DQI are provided in Table 5 of the individual QAPP for each participating member of the CVGMC and must at a minimum meet those laid out by this QAPrP.

Precision

Precision measures the agreement among repeated measurements of the same property under identical, or substantially similar, conditions. The closer two values that result from the same measurement under the same conditions are, the higher the degree of precision. The degree of precision can be a result of error and or the limits of the measurement system. A measurement quality objective (MQO) can be set for the allowable amount of variation between multiple measurements to account for limits of the measurement system and the inherent amount of user error associated with the measurement system. Program precision is monitored using duplicate quality control samples, including but not limited to field duplicates, laboratory duplicates, and matrix spike duplicates.

Accuracy (Bias)

Accuracy is a measure of the overall agreement of a measurement to a known value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations.

MQOs can be set to limit bias and to set an amount of error as compared to a true value achieved for a measurement. Contamination, measurement error, and matrix interference are all examples of causes of reduction in accuracy of a measurement.

Contamination that may be introduced during sample handling, preparation, or analysis can be monitored with the use of field blanks and laboratory blanks. If contamination is introduced, blank sample results can provide the degree of bias resulting from the error.

Measurement errors can be monitored through the analysis of a known concentration range and compared to measured results. This can be done using certified reference materials and laboratory control spike samples.

Bias introduced through interfering conditions present in the sample matrix can be monitored by duplicate environmental samples with a known concentration of target analytes prior to analytical process, known as matrix spike samples.

Sensitivity and Resolution

Analytical sensitivity is commonly defined as the lowest value an instrument or method can measure with reasonable degree of certainty. Resolution is the capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest. These limits are important to know when evaluating the appropriateness of a method or instrument for the requirements of a given study. Reporting limits represent the level at which a method or instrument can accurately measure a target compound. Reporting limits must be lower than the required project action limit to be appropriate for the project. At a minimum, the data collected under this QAPrP should meet the reporting limits outlined within **Section 13.**

Representativeness

Representativeness is the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness addresses the degree to which the samples collected represent the study and address the program objectives. Though not directly measurable, representativeness depends on appropriate study design and adherence to appropriate standard operating procedures. For groundwater sampling, representativeness can be affected by the measurement of stagnant water in well casings, which are not representative of the chemical conditions of the aquifer. As such, sufficient well purging is required to be addressed in all QAPPs and sampling procedures to ensure representativeness is properly addressed for all project data generated.

Various spatial considerations exist in designing the individual Coalition GQTM well networks and the CVGMC network. These considerations focus on where and how to representatively monitor groundwater quality relative to agricultural activities. Spatial factors relating to the CVGMC and GQTM network design include delineation of areas to monitor and specific sites (wells) suitable for use in monitoring. The approaches used in developing the Coalition GQTM well networks are based on consideration of the GQTM requirements in the WDRs and include consideration of agricultural commodities, conditions discussed/identified in the GARs related to vulnerability prioritization, and areas identified in the GAR as contributing significant recharge to urban and rural communities.

Comparability

Comparability is a measure of the confidence with which one data set or method can be compared to another. Project data are comparable when evaluated against similar quality objectives and when utilizing similar methodology and reporting requirements. Given the nature of the CVGMC requiring data generated from a wide geographical region being used in aggregate to make long term trend evaluations and broad regulatory decisions, comparability of contributing projects is crucial to the efficacy of the Collaborative. All projects contributing to the CVGMC Program must maintain comparability by following the provisions outlined in this QAPrP.

Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system. This assessment is typically expressed as a percentage of measurements reported within the prescribed limits associated with the respective DQOs, compared to those initially planned. Completeness evaluations ensure program requirements for data generation and reporting are met by contributing projects. Program completeness is assessed on three levels: field and transport, analytical, and batch completeness. Field and transport completeness is based on the number of samples successfully collected and transported to the appropriate laboratories. Analytical completeness is based on the number of samples successfully analyzed by the laboratory. Batch completeness is based on whether batches were processed with the appropriate QC samples, as prescribed by the method or defined by the laboratory. Minimum QC sample frequency requirements can be found in **Section 13** of this QAPrP.

8. SPECIAL TRAINING/CERTIFICATION

8.1. Specialized Training or Certifications

Field Crews

Specific training and certifications for field crews are the responsibility of the individual Project Managers and are addressed in Table 2 of the individual GQTM QAPPs. All field staff participating in the program must be properly trained on field collection protocols prior to sample collection. Training includes reviewing all sampling Standard Operating Procedures (SOPs), which detail procedures for collecting groundwater samples and associated QC samples. All personnel will be trained in proper calibration and deployment of equipment, sample handling and hold time requirements, and chain of custody procedures. To further safeguard against sampling error, all sampling by recently trained personnel should be done under the supervision of more experienced personnel who accompany sampling crews at least for the first time that they conduct sampling within the study fields. In addition to training for sampling, all sampling personnel should attend a field safety course.

Laboratories

All CVGMC laboratories must have an internal Quality Assurance Manual that is maintained and actively implemented in the day-to-day operations of the laboratory. Laboratory personnel should maintain current training in all relevant aspects of their role in the sample processing and data generation. Training records will be maintained by the laboratory Quality Assurance Officer and be available upon request.

8.2. Laboratory Certification Requirements

All laboratories processing program data will possess and maintain current Environmental Laboratory Accreditation Program (ELAP) certifications.

Participating laboratories will use the methodology specified by the individual QAPP and performed by qualified personnel in accordance with that accreditation.

9. PROGRAM DOCUMENTATION

9.1. CVGMC Planning Documents

ILRP Technical Workplan

The CVGMC has developed a Technical Workplan that identifies consistent approach(es) for monitoring and reporting among the Coalitions to meet requirements of the General Orders. This document outlines how monitoring and reporting will occur, and how quality assurance will be maintained as part of the CVGMC.

9.2. Quality Assurance Program Plan Distribution

Copies of this QAPrP will be distributed to all personnel and/parties involved in the project as outlined in the distribution list. If any parties associated with CVGMC data generation wish to update parts of the QAPrP, an amendment form should be completed to request an update. A signed amendment form must be submitted to the Program QA Officer for review. Once approved, the Project QA Officer will submit the amendment information to the CVRWQCB for final approval. When an amendment is approved, the QAPrP document will be updated and distributed to the all parties and personnel involved with the project.

Each individual QAPP submitted to the CVRWQCB will include details of when, where and how samples will be collected as well as which constituents will be measured. Field sampling and analytical SOPs will be included with each QAPP. These updates will not require an amendment to the QAPrP if the constituents and methods are already listed within **Table 1.** However, if the GQTM Workplan and associated QAPP requires the analysis of a constituent not already included in this QAPrP, a method not already identified, or proposes different DQOs that are less stringent than those listed, an amendment form must be submitted to the Program QA Officer for review once the GQTM is approved.

An alternative to a Coalition developing their own QAPP is to submit Addendum Forms under this QAPrP that will include information specific to their project for the following sections: 10. Sampling Process and Design, 11. Sampling Methods, 12. Sample Handling and Custody, 13. Analytical Methods, 14. Quality Control, 15. Instrument/Equipment Testing, Inspection and Maintenance, 16. Instrument/Equipment Calibration and Frequency, 17. Inspection/Acceptance of Supplies and Consumables.

If the Coalition chooses this option, all information within this QAPrP applies to their project in addition to the specifics outlined in the Addendum Form.

9.3. Standardized Forms

Field Sheets

Each individual QAPP will include the field sheet that will be used when samples are collected. An example field sheet is included in **Figure 13**. At a minimum field sheets must include the following:

- Project name
- Site name

- Site code
- Physical address of property on which well is situated
- State well number (if available)
- Sampling personnel
- GPS coordinates taken with each sampling event
- Sample type
- QC sample type
- Date and time of sample collection
- Results of field measurements
- Depth to standing water (static water level)
- Sampling conditions
- Constituents sampled
- Sample container
- Sample preservation

Chain of Custody

Each individual QAPP will include a Chain of Custody (COC) form that will be used when samples are collected. An example COC is included in **Figure 14**. At a minimum COC forms must include the following:

- Collection agency name and contact information
- Receipt agency name and contact information
- Sample Identification
- Date and time of sample collection
- Analyses requested
- Sample container type
- Number of sample containers
- Preservation
- Relinquished by name(s)
- Relinquished by date(s)
- Relinquished by signature(s)
- Received by name(s)
- Received by date(s)
- Received by signature(s)

Figure 13. Example field sheet.

Well Purging and Sampling

State Well #: ______ Site Code: ______

Site Name: ____________________

Property Address: ____________________

Target Lat/Long: / ________ Well Depth: ________

Date: ________ Field Lat.: ________ Depth to Water: ________

Weather: ________ Field Long.: ________ MP to LSE: ________

Personnel: ________ Acc.: ________ Casing Dia.: ________

Unit: ________

QC Site: Yes No

Blank pH: ________

Picture #(s): ________

Sample Point Description:

- At the wellhead
- After pressure tanks
- From a holding tank
- Spigot away from wellhead
- After filter
- Other: ________

Well Type: Domestic Irrigation Domestic/Irrigation

Meter Calibration Log

	pH	EC	DO	ORP
Standard Used				
Temperature				

Purge start time: **Purge Log**

Time	Volume	Temp	EC	DO	pH	ORP	Comments

Purge Method: submersible turbine pump other: ________

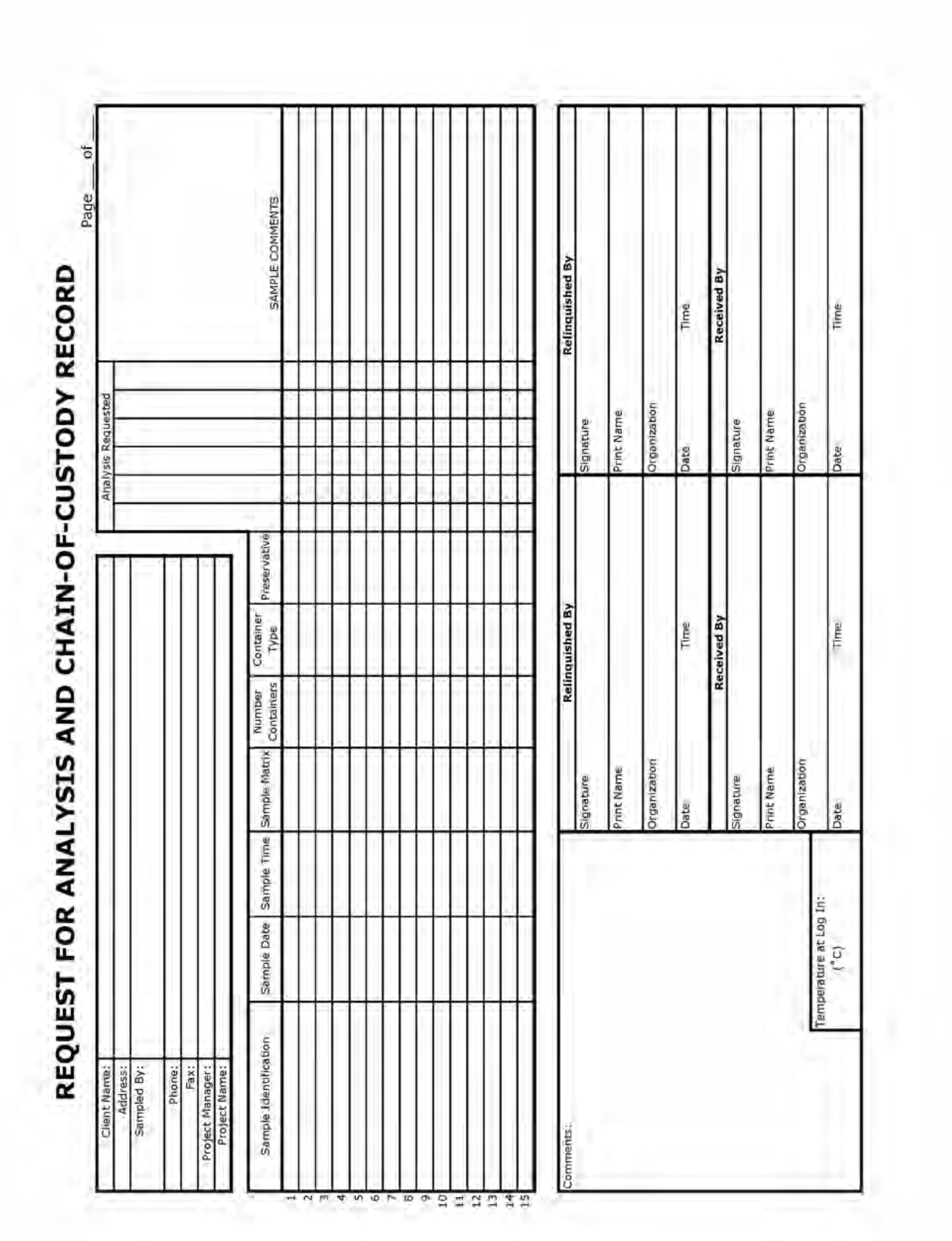
Sampling Method: submersible turbine pump other: ________

Sample Collection Log **Sample time:**

Analysis	**Container**	**Volume**	**Quantity**	**Filtered Y/N**	**Preservative**	**Lab**

Notes:

Figure 14. Example COC form.



REQUEST FOR ANALYSIS AND CHAIN-OF-CUSTODY RECORD

Page ___ of ___

Client Name:	
Address:	
Sampled By:	
Phone:	
Fax:	
Project Manager:	
Project Name:	

	Sample Identification	Sample Date	Sample Time	Sample Matrix	Number Containers	Container Type	Preservative	Analysis Requested						SAMPLE COMMENTS
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														

Comments:

Temperature at Log In: (°C)

Relinquished By		Relinquished By	
Signature		Signature	
Print Name		Print Name	
Organization		Organization	
Date	Time	Date	Time
Received By		**Received By**	
Signature		Signature	
Print Name		Print Name	
Organization		Organization	
Date	Time	Date	Time

9.4. Data Packages and Storage

All projects conducted as part of the CVGMC must maintain electronic records of field sheets, COCs, and laboratory data for all sampling events. Any original hard copy forms should be filed and kept at the Coalition's main office. Hard copies of laboratory reports may be archived as electronic files such as a PDF. Original GeoTracker EDFs must be saved electronically. GeoTracker EDFs must be uploaded to the GeoTracker and submitted to the CVGMC Data Management System (DMS). The CVGMC DMS will be housed on a third-party server with automatic backups performed nightly, at a minimum. Nightly backups will be replicated to at least one independent server to create redundancy and allow for instant replication if a failure occurs. All electronic files will be maintained for a minimum of 10 years.

A complete description of the data management process is described in this QAPrP in **Section 19.**

9.5. Additional Documents and Records

Additional documents may include photographic documentation, summary reports, meeting notes, presentations, and reports. All forms of documentation must be held on file where they are readily available if ever requested.

9.6. Retention of Documents

All data and/or other products created by the program will be retained by the participating entities and contract laboratories for a minimum of 10 years. The documents may be held for 10 years as electronic copies. Servers where the files reside will be backed up nightly.

9.7. Report Documents

Reporting will be accomplished using a common framework among the participating Coalitions. As required by the ILRP General Orders, each Coalition will provide an Annual Report describing groundwater monitoring in their region. The individual Coalition Annual Reports will be consistently formatted to include basic data tables, time series plots (when sufficient data are available), and figures to display the monitoring results of the current year and variation across years. Upon Executive Officer approval of the Phase 1 Technical Workplan, every five years, a coordinated report will be provided to the CVRWQCB that characterizes groundwater quality across the entire Central Valley (or the portions of the Central Valley participating in the CVGMC).

Annual Reports

Annual analysis and reporting of results related to the individual Coalition GQTMs will focus on visual and tabular presentation of data with limited representation of data interpretation. Annual reports will include a map or maps of the wells sampled and monitored as part of the GQTM network. Results from sampling will be provided in a tabulated format consisting of a summary of the results using statistics such as recent, minimum, maximum, and mean result, in addition to a table providing all field and analytical results.

CVGMC Five-Year Assessment Report

Reporting for the CVGMC will include more extensive analysis at five-year intervals. Every five years, a CVGMC Five-Year Assessment Report will be provided to the CVRWQCB that characterizes groundwater quality across the entire Central Valley (or the portions of the Central Valley participating in the CVGMC). The report will include separate chapters reporting on trends in groundwater quality in each Coalition region as well as a chapter(s) that characterizes groundwater quality across all participating regions. Each chapter will be consistently formatted with common maps, figures, and text to facilitate review by Regional Board staff and other interested parties.

GROUP B. DATA GENERATION AND ACQUISITION

10. SAMPLING DESIGN

10.1. Sampling Process Design Program Policy

An overview of the considerations and criteria for the design of the CVGMC trend monitoring network is detailed in the Technical Workplan focusing on the objectives of the program and requirements of the General Orders, including rationale for appropriate monitoring well distribution, encompassing agricultural regions of the Central Valley.

The primary objectives of the CVGMC GQTM are:

1) *Determine current water quality conditions of groundwater relevant to irrigated agriculture;*
2) *Develop long-term groundwater quality information that can be used to evaluate the regional effects of irrigated agricultural practices and changes in agricultural practices;*
3) *Understand long-term temporal trends in regional groundwater quality, particularly as they relate to effects from irrigated agriculture on potential sources of drinking water for communities;*
4) *Evaluate regional groundwater quality conditions in the CVGMC region, particularly in HVAs, and identify differences in groundwater quality laterally and vertically within the CVGMC region;*
5) *Distinguish groundwater quality changes associated with irrigated agriculture compared to other non-agricultural factors.*

For purposes of characterizing the relatively shallower part of the groundwater system, the CVGMC emphasizes monitoring in the Upper Zone within the upper part of the groundwater system. Wells selected for trend monitoring will be sampled and tested at an annual frequency for water quality parameters including nitrate as nitrogen (as N), electrical conductivity at 25 °C (EC), pH, dissolved oxygen (DO), and temperature. Electrical conductivity, pH, DO, and temperature will be measured in the field whereas nitrate concentration will be analyzed by a certified laboratory. In some Coalition regions, public water supply wells represent additional ongoing monitoring wells that are regularly tested. During the first monitoring event, wells selected for inclusion in the CVGMC GQTM will be sampled and tested for additional water quality constituents, including total dissolved solids (TDS), major anions (carbonate, bicarbonate, chloride, sulfate), and major cations (boron, calcium, sodium, magnesium, potassium). Wells will be tested for these additional constituents every 5 years.

Implementation of the CVGMC Technical Workplan will further the understanding of long-term temporal trends in regional groundwater quality. The regional-scale and long-term trend regional monitoring program involves establishing a system through which the groundwater quality within the CVGMC region will be monitored on a long-term basis to evaluate temporal trends and their relationship with irrigated agriculture. The approach to monitoring for long-term regional groundwater quality trends in the GQTM emphasizes evaluation of trends in wells that are believed to provide a representation of regional trends in areas dominated by irrigated agriculture. The spatial distribution of the monitoring network across the CVGMC region will be variable based on the prioritization of monitoring applied by individual Coalitions. Areas of generally higher priority, most commonly in the HVAs identified in the Coalition GARs, are a greater emphasis for long-term trend monitoring locations than areas of relatively lower priority, especially in lower vulnerability areas because hydrogeologic conditions suggest these areas are less vulnerable to contamination.

10.2. Deferral of Sampling Design Description

This QAPrP does not dictate the exact spatial distribution or prioritization of GQTM wells; the details of prioritization and final well selection are included in each Coalition's GQTM. Specific sample types, matrices, and volumes are outlined in Table 5 of the individual project QAPPs. Project activity schedule and the logistics of submitting samples to contract laboratories are outlined in individual field sampling SOPs. As part of individual Coalition GQTMs, a network of proposed wells exists for each Coalition region recognizing the applied prioritization and any associated delineation of targeted monitoring areas. A variety of factors were considered by individual Coalitions in prioritizing monitoring areas within their respective regions and these are summarized in the CVGMC Technical Workplan including high vulnerability areas, irrigated agriculture and commodities, groundwater quality trends, nitrate MCL exceedances, communities, and recharge areas relative to communities (including non ag sources).

11. SAMPLING METHODS

11.1. Sampling Method Program Policy

All samples collected for inclusion in the CVGMC GQTM analysis will be collected according to detailed SOPs included in the individual QAPPs. The SOPs contain instructions for collecting samples and cleaning equipment between samples. Below is a brief description of the minimal sampling method requirements.

Upon arrival at the well, an attempt will be made to measure the depth to water. Water levels can be measured using an electronic sounder or an air line; air lines have been installed on some agricultural supply wells and can be used to determine depth to water. When possible, it is preferred to use an electronic sounder and record the depth to water to the nearest 0.01 feet. Typically, all depth measurements should be made from the top (the highest point) of the inner well casing. The measuring point location is recorded on the field sheet and used in all subsequent measurements. If there is no measuring point or access to the inside of the well a note will made on the field data sheet.

Field parameters (pH, water temperature, EC, ORP and DO) are measured using field meters specified in the individual QAPPs. The meters will be calibrated for pH, ORP, and DO once in the morning prior to beginning sampling. For pH, a single 3-point calibration with be done using pH 4, 7, and 10 standards; exceptions are if the pH range is known and a calibration is conducted within that range. Conductivity will be calibrated in the morning prior to sampling, and then recalibrated to the nearest calibration solution whenever the conductivity of the well changes substantially. Calibration standards will be maintained at temperatures close to the temperature of the well water.

Except as noted below, purging should be performed for all groundwater monitoring wells prior to sample collection in order to remove stagnant water from within the well casing and ensure that a representative sample is obtained. In general, purging should be done to remove three casing volumes prior to sampling. The field sheet should include details for tracking the amount of volume purged relative to the depth of the well and well casing diameter. It may not be possible to purge three volume casings of water due to the volume of the casing which would result in considerable time and effort. In addition, it may not be necessary to purge three casing volumes for wells that are used daily and are not likely to have stagnant water in the well casing. Other methods for ensuring that the water collected is an adequate representation of the water quality in the groundwater is to monitor field parameters with a flow through system and wait to collect a sample until the measurements are steady, or to use a no-purge sampler such as a Hydrasleeve.

After samples are collected, they must be kept away from sunlight and kept at ≤ 6°C until extraction or analysis. Field personnel collect ten percent of the total samples for quality assurance purposes (5% field duplicate and 5% blank samples). Duplicate field parameter measurements are not necessary. The duplicate samples are submitted to the laboratory as semi-blind samples. Field QC samples are stored at ≤ 6°C alongside environmental samples until extraction or analysis. Field blank samples are processed in the field identically as the other samples using deionized water as sample water. The blank samples are submitted to the laboratory as semi-blind samples.

Any deviation from the written SOP requires notification of the Project QA Officer. All deviations or problems will be noted on the field sheet and corrective actions should be determined by the Project QA Officer. Deviations will also be reviewed by the CVGMC Program QA Officer to determine acceptability of data.

11.2. Deferral of Sampling Method Information

Individual QAPPs include the details for sample collection, including field calibration and sampling SOPs, and purging details. The QAPPs must give enough information to ensure that sampling methods will result in a sample that is void of contamination, representative of the groundwater, and is reproducible. Sample container, volume, and preservative requirements are specified in Table 5 of each individual QAPP. Project-level corrective actions in response to problems that occur during sample collection are the responsibility of the individual Project QA Officers. The Program QA Officer may be included, if necessary.

12. SAMPLE HANDLING AND CUSTODY

12.1. Sample Handling and Custody Program Policy

All sample containers should be clearly labeled with sample ID, collection date and time, collector, and requested analyses. All sampling SOPs must be followed while collecting samples. Custody of all samples is documented and traceable from collection time to submittal for analysis on a Chain of Custody (COC) form. COCs must be with samples during transport to the laboratory. The samples are considered in custody if:

- They are in actual possession;
- They are in view after being in physical possession;
- They are placed in a secure area (accessible by or under the scrutiny of authorized personnel only after in possession).

All samples and accompanying COCs are signed by the sampler in charge and submitted to analyzing laboratories by the samplers, by private overnight courier, or by overnight common parcel service. Once the laboratory has received the samples and COCs, they are responsible for maintaining custody logs sufficient to track each sample submitted and to analyze or preserve each sample within specified holding times.

Enough sample quantity should be collected to permit more than one analysis in case samples need to be re-analyzed. The contract laboratories may recommend sample quantities as well as types of containers for sample collection; most laboratories offer containers to use for analysis. All samples collected for use in the CVGMC GQTM must at a minimum follow program-defined QA requirements for sampling containers, holding time, and sample custody outlined in **Table 3** below. Holding times refer to the maximum time limit at which a laboratory must analyze a sample for the constituent listed. Any sample handling and custody information that deviates from the program sampling handling requirements will be described within the individual GQTMP QAPP and submitted to the CVGMC QA Officer as an amendment to the CVGMC QAPrP.

Table 3. Sample handling and custody.

Analyte	Recommended Container	Initial Preservation/Holding Requirements	Maximum Holding Time
Nitrate (as N)	Polyethylene	Cool to ≤ 6°C	48 hours
Nitrate + Nitrite (as N)	Polyethylene	Cool to ≤ 6°C; H_2SO_4 to pH ≤ 2	28 days
Carbonate	Polyethylene	Store at ≤ 6°C	14 days
Bicarbonate	Polyethylene	Store at ≤ 6°C	14 days
Chloride	Polyethylene	Store at ≤ 6°C	28 days
Sulfate (SO_4)	Polyethylene	Store at ≤ 6°C	28 days
Boron	Polyethylene	Preserve HNO_3 pH ≤2, store at ≤ 6°C	6 months
Calcium	Polyethylene	Preserve HNO_3 pH ≤2, store at ≤ 6°C	6 months

ANALYTE	RECOMMENDED CONTAINER	INITIAL PRESERVATION/HOLDING REQUIREMENTS	MAXIMUM HOLDING TIME
Magnesium	Polyethylene	Preserve HNO_3 pH ≤2, store at ≤ 6°C	6 months
Potassium	Polyethylene	Preserve HNO_3 pH ≤2, store at ≤ 6°C	6 months
Sodium	Polyethylene	Preserve HNO_3 pH ≤2, store at ≤ 6°C	6 months
Total Dissolved Solids	Polyethylene	Store at ≤ 6°C	7 days

13. ANALYTICAL METHODS

13.1. Analytical Methods Policy

Table 5 of the individual GQTM QAPPs identifies the specific analytical methods to be used. All analytical methods employed by a project must be identified within this QAPrP and will be subject to the requirements below.

13.2. QA Program-Defined Analytical Method Requirements

Standard Methodology

For the purposes of this QAPrP, standard methodology is defined as methods that follow a procedure approved by the US EPA or provided in *Standard Methods for the Examination of Water and Wastewater.* Additionally, methods developed or published by the US Geological Survey (USGS), American Society of Testing Materials (ASTM), and Association of Official Analytical Chemist (AOAC) may be used by accredited laboratories.

If a field crew or laboratory uses a method that is not listed in **Table 4**, the Project QA Officer must review the validity and comparability of the data generated following that method. The data validation process should consist of determining the sensitivity level (MDL and RL), accuracy of QC samples and standards, precision of duplicate data, and analytical bias associated with the new method. This information should be compared to the same components associated with the method in this QAPrP. If the Project QA Officer determines the achievability of the new method is comparable to the method listed in this QAPrP, justification for the new method and a copy of the method should be submitted as an amendment to this document and approved by the State Board QA Officer.

The Project QA Officer should be in communication with the Laboratory Project Manager to resolve analytical issues, when they arise. It is the responsibility of the Project QA Officer to determine the most appropriate course of action to resolve any problems and/or accept data. All corrective actions are overseen by the Project QA Officer and should be reported in the annual reports.

Laboratory Turnaround Time

Laboratory reports and electronic deliverables will be submitted to the individual Project Managers within 60 days of samples being submitted to the laboratory. The Program QA Officer will be notified when all samples have been collected and if the laboratory turnaround time has been exceeded.

Table 4. List of acceptable analytical methods for constituents and maximum sensitivity requirements.

Field equipment and laboratories must be able to achieve reporting limits that are equal to or less than those listed.

Constituent	Acceptable Methods	Reporting Limit	Reporting Unit
Field Parameters			
Dissolved Oxygen (DO)	EPA 360.1, EPA 360.2, SM 4500-O	0.1	mg/L
Electrical Conductivity (EC) at 25 °C	EPA 120.1, SM 2510B	2.5	µS/cm
pH	EPA 150.1, EPA 150.2, SM 4500-H+B	0.1	pH units
Temperature	SM 2550	0.1	°C
Turbidity	EPA 180.1, SM 2130B	1	NTU
Nutrients			
Nitrate (as N)	EPA 300.0, EPA 300.1, EPA 351.3, EPA 353.2, SM 4500-NO3, SM 4110 B,	0.1	mg/L (as N)
Nitrate + Nitrite (as N)		0.1	mg/L (as N)
Anions			
Carbonate	EPA 310.1. EPA 310.2, SM 2320B	10	mg/L
Bicarbonate		10	mg/L
Chloride	EPA 300.0, EPA 300.1, EPA 325.2, EPA 325.3, SM 4110B, SM 4110C, SM 4500-Cl	0.25	mg/L
Sulfate (SO4)	EPA 300.0, EPA 300.1, EPA 375.1, EPA 375.2, EPA 375.3, EPA 375.4, SM 4110B, SM 4110C, SM 4500-SO42-C	1	mg/L
Cations			
Boron	EPA 200.5, EPA 200.7, EPA 212.3, SM 3120 B, SM4500-B-B	0.1	mg/L
Calcium	EPA 200.5, EPA 200.7, EPA 215.1, EPA 215.2, SM 3111B, SM 3120 B, SM 3500-Ca B	0.5	mg/L
Magnesium	EPA 200.5, EPA 200.7, EPA 242.1, SM 3111B, SM 3120 B	0.06	mg/L
Potassium	EPA 200.7, EPA 258.1, SM 3111B, SM 3120 B, SM 3500-K B	1	mg/L
Sodium	EPA 200.5, EPA 200.7, EPA 273.1, SM 3111B, SM 3120 B, SM 3500-Na B	0.01	mg/L
Solids			
Total Dissolved Solids	EPA 160.1, SM 2540C	10	mg/L

14. QUALITY CONTROL

14.1. Program Policy

Samples analyzed as part of the CVGMC will be subjected to laboratory and method-specific guidelines to maintain comparability across multiple projects. All projects must utilize the minimum analytical QC outlined below to address the DQIs outlined in this QAPrP within **Section 7.1.**

14.2. CVGMC Programmatic MQOs

Measurement quality objectives are the individual performance or acceptance goals for the individual DQIs. All projects must adhere to the minimum QAPrP MQOs; approved QAPPs may have more stringent MQOs.

Field Quality Control

Field QC results must adhere to the limits of error and frequency requirements detailed in **Table 5**. Field QC frequencies are calculated to ensure that a minimum of 5% of all analyses are for QC purposes (both field duplicate and field blanks).

Table 5. Field Sampling QC.

Sample Type	Frequency	Acceptable Limits	Corrective Action
Field Duplicate	5% annual total	RPD ≤ 25%	Determine cause, take appropriate corrective action.
Field Blank	5% annual total	Detectable substance contamination <RL or < sample/5	Determine cause of problem, remove sources of contamination.

Analytical Quality Control

Analytical QC results must adhere to the minimum limits of error and frequency requirements detailed in **Table 6**. All analytical QCs must be analyzed at a frequency of 1 every 20 samples, minimum of 1 per batch.

Table 6. Analytical measurement quality objectives.

Sample Type	Frequency	Acceptable Limits	Corrective Action
Nutrients			
Lab Blanks (method, reagent, instrument)	1 per 20 samples, minimum 1 per batch	Detectable substance contamination <RL	Determine cause of problem, remove sources of contamination, reanalyze suspect samples or flag all suspect data.
Lab Duplicate*	1 per 20 samples, minimum 1 per batch	RPD < 25%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.
Matrix Spike	1 per 20 samples, minimum 1 per batch	80-120%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.
Lab Control Spike, CRM, or SRM	1 per 20 samples, minimum 1 per batch	90-110%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.
Anions			
Lab Blanks (method, reagent, instrument)	1 per 20 samples, minimum 1 per batch	Detectable substance contamination <RL	Determine cause of problem, remove sources of contamination, reanalyze suspect samples or flag all suspect data.
Lab Duplicate*	1 per 20 samples, minimum 1 per batch	RPD < 25%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.
Lab Control Spike, CRM, or SRM	1 per 20 samples, minimum 1 per batch	75-125%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.
Cations			
Lab Blanks (method, reagent, instrument)	1 per 20 samples, minimum 1 per batch	Detectable substance contamination <RL	Determine cause of problem, remove sources of contamination, reanalyze suspect samples or flag all suspect data.
Lab Duplicate*	1 per 20 samples, minimum 1 per batch	RPD < 25%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.
Matrix Spike*	1 per 20 samples, minimum 1 per batch	75-125%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.

Sample Type	Frequency	Acceptable Limits	Corrective Action
Lab Control Spike, CRM, or SRM	1 per 20 samples, minimum 1 per batch	75-125%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.
Total Dissolved Solids			
Lab Blanks (method, reagent, instrument)	1 per 20 samples, minimum 1 per batch	Detectable substance contamination <RL	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.
Lab Duplicate*	1 per 20 samples, minimum 1 per batch	RPD < 25%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.
Lab Control Spike, CRM, or SRM	1 per 20 samples, minimum 1 per batch	80-120%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.

*For the purposes of this program it is acceptable for the matrix spike duplicate or the laboratory control duplicate to stand in for the lab duplicate as a measure of the precision of the analytical method.

Precision will be assessed through a combination of field duplicate samples and laboratory duplicate samples. Precision of a pair of samples is measured as the relative percent difference (RPD) between a sample and its duplicate—a laboratory control sample (LCS) and its duplicate (LCSD), a matrix spike (MS) and matrix spike duplicate (MSD), an environmental sample (E) and field duplicate (FD), or an environmental sample and its associated lab duplicate. It is calculated as follows:

$$RPD\ (\%) = \left| \frac{2(V_i - V_D)}{V_i + V_D} \right| \times 100$$

V_i = The measured concentration of the initial sample
V_D = The measured concentration of the sample duplicate

For precision assessment purposes, any lab duplicate, including a matrix spike duplicate or a lab control spike duplicate, may function as the lab duplicate in any batch.

Accuracy is assessed using either an LCS or MS. For an LCS, lab water is spiked with a known concentration of a target analyte and the percent recovery (PR) is reported. PR in an LCS is calculated as follows:

$$\%\ Recovery = \left(\frac{V_{LCS}}{V_{Spike}} \right) \times 100$$

V_{LCS} = The measured concentration of the spiked control sample
V_{Spike} = The expected spike concentration

A MS can also be used to assess accuracy. For a MS, environmental water is spiked with a known concentration of a target analyte and the PR is reported. PR in and MS is calculated as follows:

$$\%\ Recovery = \left(\frac{V_{MS} - V_E}{V_{Spike}} \right) x\ 100$$

V_{MS} = The measured concentration of the spiked matrix sample
V_{Spike} = The concentration of the spike added
V_E = The measured concentration of the original (unspiked) matrix sample

The MS should not be used solely to assess accuracy due to the likelihood of matrix interference; however, if an LCS does not fall within acceptance criteria an MS may be used to validate a batch if the MS is within acceptance criteria. Some constituents are difficult to spike (e.g., Total Dissolved Solids); therefore, a laboratory may choose to analyze a certified reference material (CRM). A CRM analysis may be used in place of an LCS analysis.

14.3. Field and Laboratory Corrective Actions

Batches should be reanalyzed if a single QC sample did not meet an MQO due to an identifiable laboratory error and/or MQOs are not met for more than 50% of analytes analyzed in a QC sample. When batches are reanalyzed, the laboratory should provide both results to the third party. If DQOs fail, but neither of the above scenarios is applicable, the laboratory should follow the corrective actions prescribed in **Table 5** and **Table 6**. Overall, all data failing to meet MQOs should be flagged; re-analysis may occur to confirm improvements in accuracy, precision or contamination measures. The laboratory Project Manager and the Project QA Officer may further discuss additional corrective actions on a case by case basis.

Field crews and contract laboratories are responsible for responding to failures in their measurement systems. If sampling or analytical equipment fails, personnel must record the problem according to their documentation protocols.

15. INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

15.1. Programmatic Policies

Field Equipment

All field equipment must be inspected and repaired as necessary prior to each sampling event. Routine maintenance and repair of field equipment should follow manufacturer instructions and guidelines. Records of field equipment maintenance and repairs should be maintained for each instrument and are summarized in Table 8 of the individual project QAPPs and outlined in attached sampling SOPs. Project Field Leads are responsible for ensuring that inspection and maintenance activities are completed in accordance with project requirements. Project QA officers oversee all maintenance records generated by project personnel. These records will be available to the Program Manager upon request.

Laboratory Equipment

Routine laboratory instrument testing, inspection, and maintenance should be carried out by a qualified technician. Laboratories are responsible for testing, inspecting, and maintaining all laboratory equipment according to manufacturer specifications. Frequency and procedures for maintenance of analytical equipment used by each laboratory are documented in the Quality Assurance Manual for each laboratory, which will be available to Program Managers from any contract laboratory on request. Laboratory instrument inspection and maintenance activities are outlined in Table 8 of the individual project QAPPs. Any instrument deficiencies that are not resolved prior to data generation will be reviewed by the Project QA Officer. Corrective actions for any deficiencies are the responsibility of the Project QA Officer.

16. INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

16.1. Programmatic Policies

Field Equipment

Field probes and sensors used to measure field parameters are essential to data generated by the program. Sensors must be calibrated properly prior to any deployment to ensure precision and accuracy of measurement of field parameters. Calibration is performed by measuring the sensors' responses to known conditions and adjusting accordingly to ensure accurate measurements. Calibration procedures should follow manufacturer specifications for the equipment used and are outlined in Table 9 of the individual project QAPPs.

Records of field equipment calibration will be maintained for each instrument. These records will be available to Program Managers upon request.

Laboratory Equipment

Routine laboratory instrument calibration should be carried out by a qualified technician. Laboratories are responsible for calibrating all laboratory equipment according to manufacturer specifications. Frequency and procedures for calibration of analytical equipment used by each laboratory are documented in the Quality Assurance Manual for each laboratory, which will be available to Program Managers from any contract laboratory on request.

17. INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

17.1. Programmatic Policies

Acceptance criteria for supplies and consumables are outlined in the Laboratory Quality Assurance Manual and in Table 10 of the individual project QAPPs. Laboratory personnel and field crews are responsible for ensuring that all supplies and consumables meet these criteria prior to analysis of sample collection. Inspecting and testing records will be maintained by the laboratories and field crews, and available to Program Managers on request.

18. NON-DIRECT MEASUREMENTS (EXISTING DATA)

Public supply wells may be included in some CVGMC GQTM networks (see description in Technical Workplan); procedures described herein apply to these wells. Continued monitoring of these wells will also be performed by the water supply system operators in accordance with Division of Drinking Water (DDW) requirements. While the annual sampling of the GQTM network wells conducted by each Coalition will include collection of the field parameters identified above, monitoring of additional wells by other monitoring entities may not include testing of all the identified field parameters. Groundwater quality testing in additional wells monitored by others may not align exactly with the frequency of testing for all water quality parameters specified in the WDRs, although coordination efforts with cooperating monitoring entities will focus on establishing a testing program that is consistent and compatible with the monitoring objectives for the GQTM.

All pre-existing data will be assembled within the DMS to facilitate organization, analysis, and display of the acquired data. Well construction information will also be obtained and stored within the database.

Data collected by outside entities will be associated with their individual projects (e.g. PSW_DDS) and clearly identified in any reports or analysis as described in the CVGMC Data Management SOP.

18.1. Existing Data – Meets QAPrP Requirements

If a public supply well is listed as a principal well within the monitoring network, existing data will be reviewed according to the procedures outlined within the CVGMC Data Management SOP and flagged accordingly within the CVGMC DMS. Existing data for principal wells may come directly from the laboratory and/or the agency collecting the samples. The Coalition is responsible for ensuring that these data are loaded to GeoTracker as well as to the CVGMC DMS.

18.2. Existing Data – Does Not Meet QAPrP Requirements

Existing data collected by other entities that do not adhere to the minimum QAPrP requirements may be used for general basin characterization. At a minimum this information must include the location of the well, date of sampling, identification of the agency who collected the sample, original source, method, analyte, concentration, units and reporting limit. Sources of existing data may include GeoTracker and water supply system operators.

19. DATA MANAGEMENT

The CVGMC will use a coordinated data management system that will be centrally maintained for the purpose of implementing the CVGMC. Each Coalition may elect to maintain their own data separately in their own database, if desired, but a coordinated data management system (DMS) will be used to facilitate analyses and reporting of regional groundwater quality data across the CVGMC area and submittal of CVGMC data.

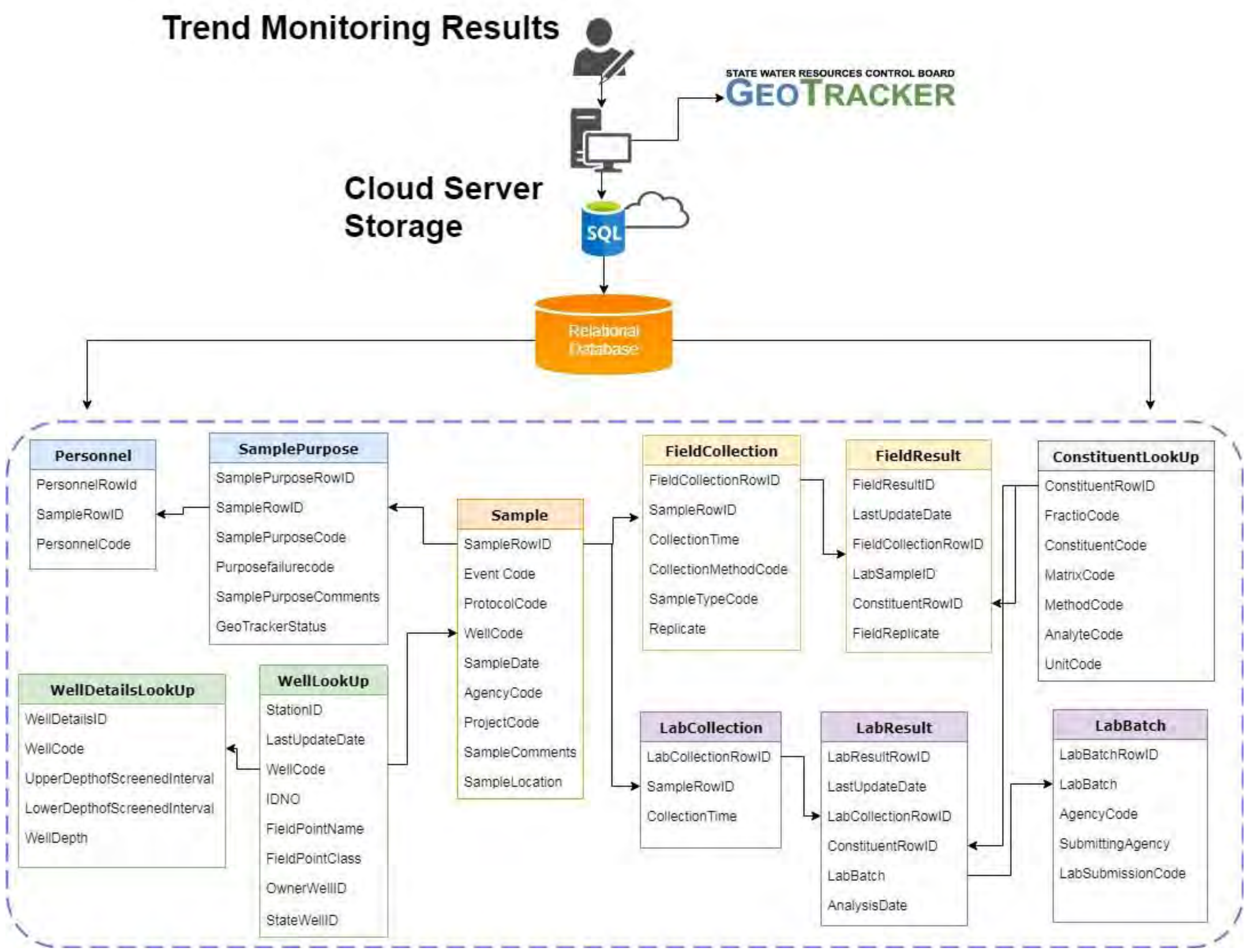
The DMS will be a relational database allowing for efficient storage of well monitoring information, including project information (Coalition-specific project codes and protocols), sample collection information (sample date, time, and location of sample collection), well-related information and monitoring results and associated information. The relational database structure will ensure the integrity of the database with one to many relationships facilitating the analysis of water quality results used for trend analysis, graphing, and visualization. The database will house well location, well construction information, environmental results and quality control data.

Figure 15 includes a conceptual diagram of how data will be collected by individual Coalitions, submitted to GeoTracker and the CVGMC, and stored within the CVGMC DMS. The depiction of the relational database design is not meant to capture all components of the CVGMC DMS but highlights the critical elements of the database and required information. Additional tables not shown include valid value requirements for the various tables to ensure comparability of data sets and assignment of quality assurance codes.

All field data is entered into the CVGMC DMS after it has been reviewed and qualified. All data transcribed or transformed, electronically and otherwise, is double checked for accuracy by project staff; records of this double check are maintained by each Coalition. All field sheets and COCs are scanned and an electronic copy is saved on a secure server which can be accessed by the Program QA Officer upon request.

Transfer of data from laboratories to the Coalitions is done through electronic submittals. Laboratory reports are received as PDFs and in a GeoTracker EDF; both types of files are stored on the Coalition's secure server and can be accessed by the Program QA Officer upon request. EDFs are loaded into the CVGMC DMS as outlined within the Data Management SOP.

Figure 15. CVGMC DMS Relational Database Design Conceptual Diagram.



GROUP C. ASSESSMENT AND OVERSIGHT

20. ASSESSMENTS & RESPONSE ACTIONS

All reviews of QA data will be made by the Project QA Officer according to the data verification and validation procedures outlined in the CVGMC Data Management SOP. Reviews may include the Program QA Officer, if necessary. Contract laboratories are responsible for self-assessment and oversight of finalized data submitted in laboratory reports and GeoTracker files, although data are audited for compliance with each Coalition's QA/QC program. Well data will be loaded directly to GeoTracker by the laboratory. Once data are received by the CVGMC, the data will be reviewed, flagged as necessary and uploaded to the DMS. Individual Project Managers are responsible for notifying the Program QA Officer once data have been reviewed and uploaded into the DMS. The Program QA Officer is responsible for flagging all data that does not meet established QA/QC criteria.

If a discrepancy is discovered during a review, the Program QA Officer will discuss the discrepancy with the Coalition responsible for the activity. The discussion will include the accuracy of the information, potential cause(s) leading to the deviation, how the deviation might impact data quality and the corrective actions that might be considered. Should impacts on data quality be determined to be of substantial concern, the Program QA Officer may issue a stop work order to an individual project, effective until data quality can be assessed and brought within program requirements.

The quality of data will routinely be reviewed as a whole and assessed to determine procedural (field and analytical) changes are necessary for improved data quality. The QA officer may request to visit the laboratory to discuss the review and data quality. Laboratory visits may occur as frequently as once a year or less depending on the need. Other assessments that occur periodically will be oral or electronic via email correspondences; if no discrepancies are noted and corrective action is not required, additional records are neither maintained nor reported. If discrepancies are observed, the details of the discrepancy and any corrective action will be reported in the quarterly and final monitoring report.

Corrective action may correct an unauthorized deviation from the QA/QC procedures or SOPs, or it may remedy a systematic failure in the established QA/QC procedures or SOPs. The Project QA Officer will be responsible for addressing all corrective actions.

21. REPORTS TO MANAGEMENT

The Project Manager is responsible for notifying the Program QA Officer that sampling has been completed and that results are reviewed and loaded into the DMS.

Personnel involved in project tasks may encounter unforeseen issues/concerns at any time. It is important that staff report issues/concerns to managers when they are identified. Individual Project Managers are responsible for project resolutions. If the resolution requires changes to approved workplans or QAPPs, the ILRP CVRQWCB will be contacted and the appropriate actions will be taken to have changes approved.

Project results and an assessment of data quality will be submitted annually to the CVRWQCB. Programmatic data quality assessments will be reported to the CVRWQCB with programmatic trend reports, submitted every five years.

GROUP D. DATA VALIDATION AND USABILITY

22. DATA REVIEW, VERIFICATION, AND VALIDATION REQUIREMENTS

Project QA Officers will review data collected under a Coalition specific GQTM according to the data quality objectives and QA/QC practices outlined within the Data Management SOP. Data utilized by the CVGMC will be reviewed against the data quality objectives cited in **Section 7** of this document, and of each attached individual QAPPs, as well as the QA/QC practices cited in Sections 14 , 15 , 16 , and 17. The Program QA Officer will review any data that fails any stated quality objectives to decide whether to accept or reject the data for use in the CVGMC. The decision to accept or reject the data will be based on an assessment of the impact of the data quality failure. Data collected by other monitoring agencies will go through a more general review as stated within **Section 18.**

23. VERIFICATION AND VALIDATION METHODS

Data will be QC'd by each Coalition according to the data review procedures outlined in the Data Management SOP. The Project's QA Officer or a delegate of the QA Officer will do all reviews of 100% of the reports. Each contract laboratory's QA Officer will perform checks of all of its records at a frequency that the lab determines sufficient. The Program QA Officer is responsible for conducting programmatic reviews of all data for consistency and comparability. Data utilized for the CVGMC will undergo review and checks based on the CVGMC Data Management SOP.

24. RECONCILIATION WITH USER REQUIREMENTS

Procedures to review, verify and validate project data are included in the Data Management SOP. The Program Quality Objectives section describes the role of the DQO process and identifies the program's objectives. Reconciliation with the DQOs involves reviewing the data to determine whether the DQOs have been attained and that the data are adequate for their intended use. At the project level, reconciliation occurs during the data quality assessment.

Limitations in data use will be reported to the CVRWQCB in the Annual Reports and CVGMC Five-Year Assessment Reports.

Quality Assurance Project Plan

For Groundwater Monitoring By The

East San Joaquin Water Quality Coalition

In Compliance With The

Central Vally Groundwater Monitoring Collaborative QAPrP

For The

Irrigated Lands Regulatory Program

Central Valley Regional Water Quality Control Board
11020 Sun Center Drive #200
Rancho Cordova, California 95670-6114

Submitted On

April 1, 2019

Prepared By:

MLJ ENVIRONMENTAL

GROUP A. PROJECT MANAGEMENT

INTRODUCTION

Each of the participating CVGMC agricultural Coalitions must meet their own groundwater monitoring requirements, outlined in their individual General Orders. The role of the CVGMC is to establish common monitoring and reporting structure as it applies to the individual groundwater trend monitoring requirements established by each third-party group under their individual General Orders. The third-party groups will participate in a regional effort to collect and share groundwater monitoring data to be used for a broad geographical characterization of the potential effects of agricultural lands on groundwater aquifers, for and regulatory compliance and decision making throughout the Central Valley.

The Quality Assurance Program Plan (QAPrP) establishes the quality assurance and quality control standards and requirements for useable data for individual projects contributing to this regional collaboration. It also establishes the structure and requirements for a regional data management system, through which all useable data generated under the CVGMC can be stored and accessed by the participants and regulators.

In addition to the programmatic requirements address in the CVGMC QAPrP, the East San Joaquin Water quality Coalition (ESJWQC) will adhere to the following project-specific requirements established in this QAPP.

3. DISTRIBUTION LIST

Table 1. Project Personnel.

Title	Name	Organizational Affiliation	Contact Information (Telephone number, fax number, email address.)
Project Lead	Parry Klassen	ESJWQC	(209) 846-6112 klassenparry@gmail.com
Project Manager	Ally Villalpando	MLJ Environmental	(530) 756-5200 avillalpando@mljenvironmental
Project QA Officer	Lisa McCrink	MLJ Environmental	(530) 756-5200 lmccrink@mljenvironmental
Project Field Lead	Anthony Brillante	MLJ Environmental	(530) 756-5200 abrillante@mljenvironmental.com
Contract Laboratory Project Manager	Eli Greenwald	Caltest Laboraories	(707) 258-4000 eli_greenwald@caltestlabs.com
Contract Laboratory QA Officer	Nell Arguelles	Caltest Laboraories	(707) 258-4000 nell_arguelles@caltestlabs.com

4. PROJECT ROLES AND RESPONSIBILITIES

Project Lead Role

The Project Lead will oversee the project specific groundwater monitoring program and budget. The Project Lead will work with the Project Manager to ensure all protocols as outlined in this QAPP are followed. The Project Lead will be informed regarding any deviations from protocols and/or analytical issues. The Project Lead is responsible for ensuring that the Groundwater Quality Trend Monitoring (GQTM) Workplan is implemented and any deviations to the Workplan are documented.

Project Manager Role

The Project Manager facilitates the implementation of the GQTM Workplan under the guidance of the Project Lead. The Project Manager is responsible for the the coordination of well sampling, laboratory analysis and data reporting. Prior to monitoring, the Project Manager is responsible for ensuring that all parties involved with collecting and analyzing groundwater samples are awre of both field and laboratory roles and responsibilities. The Project Manager is responsible for ensuring communication with Laboratory and Project QA Officers to resolve analytical issues and maintain communication between all parties in regard to laboratory and/or sampling changes.

Project Quality Assurance Officer Role

The Project QA Officer is responsible for establishing QA/QC guidelines for field sampling and analytical procedures conducted as part of the GQTM Workplan. The Project QA Officer will oversee and manage the assessment of accuracy, completeness, and precision for samples collected as part of the GQTM and ensure that project QA/QC guidelines adhere to the QA/QC guidelines set forth in the CVGMC QAPrP.

Project Field Lead

The Project Field Lead is responsible for performing the sample collection and field measurement activities. The Project Field Lead is also responsible for all communications with the analytical laboratory regarding sample shipment, schedule and ensuring that COCs and Field Sheets are completed accurately.

Persons Responsible for the Update and Maintenance of QAPP

The Project QA Officer in coordination with the Project Lead will be responsible for creating, maintaining and updating the QAPP template. The Project QA Officer will be responsible for making changes and submitting the final version to the CVGMC and individuals identified in Section 3 of the QAPP for signature.

5. PROBLEM DEFINITION/BACKGROUND

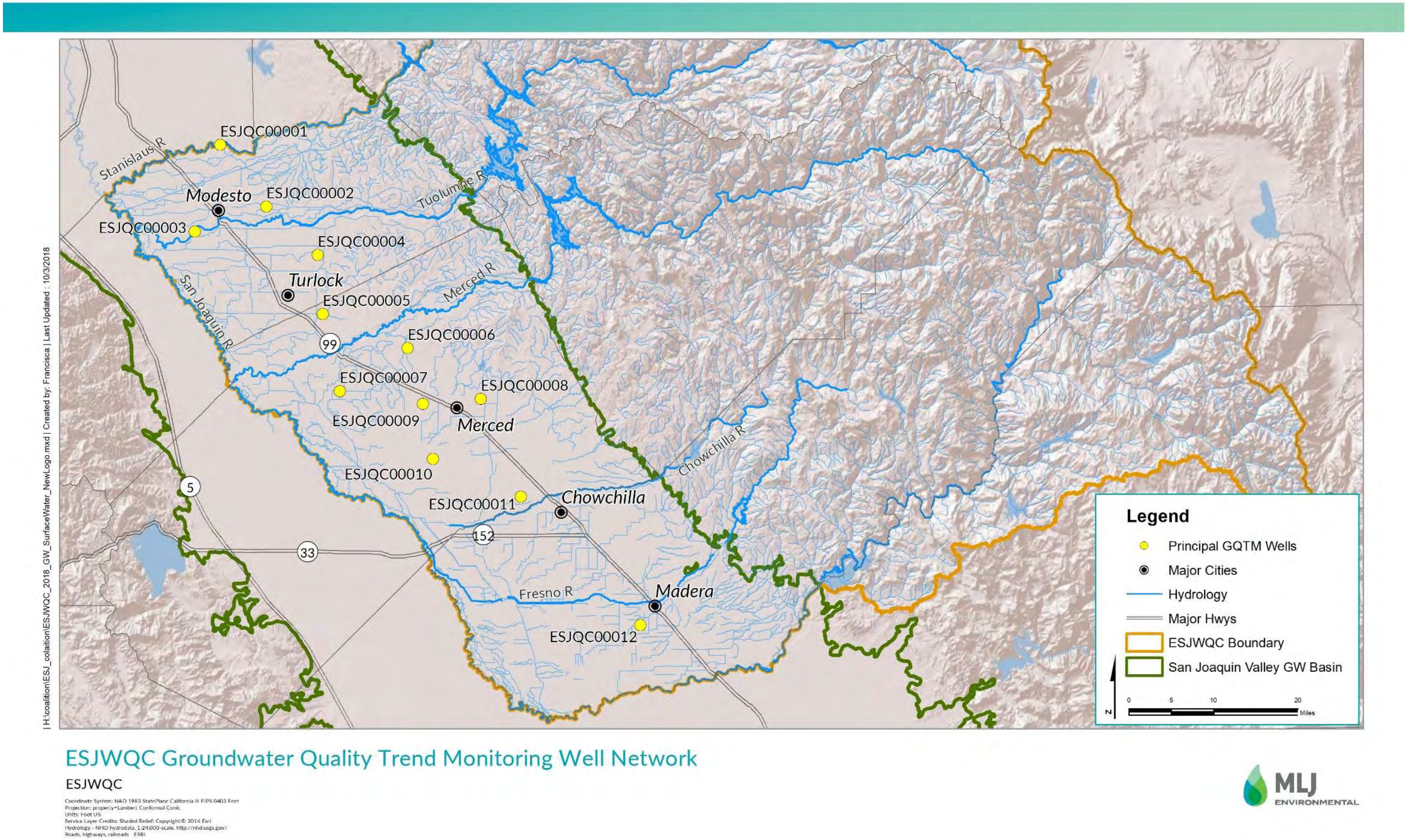
This QAPP includes project-specific information pertaining to the groundwater monitoring to be performed by the ESJWQC as described within the GQTM Workplan submitted on March 1, 2018. The Coalition is a member of the CVGMC and has developed a GQTM Workplan and QAPP in adherence with the CVGMC Technical Workplan and Programmatic QAPP (QAPrP) submitted to the Central Valley Regional Water Quality Control Board on May 16, 2018.

6. PROJECT DESCRIPTION

6.1. Geographical Setting

The Coalition has developed its own network of wells for groundwater quality trend monitoring as described in the GQTM Workplan. These networks include wells spatially distributed across high and low vulnerability areas the Coalition region in accordance with Coalition-specified prioritization criteria. This well network will be monitored and incorporated into the CVGMC network for regional analysis and reporting.

Figure 1. Map of ESJWQC well network.



7. PROJECT QUALITY OBJECTIVES

7.1. Data Quality Indicators

The minimum requirements for Data Quality Indicators (DQIs) (precision, accuracy, comparability, completeness, representativeness and sensitivity) are addressed in the CVGMC QAPrP. Project specific measurement quality objectives (MQOs) are included in **Section 14** are established to ensure that the Coalition is meeting the minimum requirements as outlined in the QAPrP.

8. SPECIAL TRAINING/CERTIFICATION

8.1. Specialized Training or Certifications

The Project Lead is responsible for ensuring that all field crews receive proper training and certifications as outlined in the QAPrP. The Contract Laboratory Project Manager is responsible for ensuring that all laboratory staff maintain current training in all relevant aspects of their role in the sample processing and data generation. Training records must be maintained and available upon request.

Table 2. Specialized training or certifications.

Specializaed Training	Description of Training	Training Provider	Personnel Receiving Training	Location of Records & Certificates
Field Sampling	Procedures and techniques for collecting groundwater samples.	MLJ Environmental	All sampling personnel	MLJ Environmental Offices
Field and Office Safety	Overview of saftey concerns and procedures for field sampling and office work.	MLJ Environmental	All sampling personnel	MLJ Environmental Offices

9. PROJECT DOCUMENTATION

Copies of this QAPP will be distributed to all personnel and/parties involved in the project as outlined in the distribution list. If the Coalition's GQTM and associated QAPP requires the analysis of a constituent not already included in this QAPrP, a method not already identified, or proposes different DQOs that are less stringent than those listed, an amendment form must be submitted to the Program QA Officer for review once the GQTM is approved. The Coalition's GQTM does not required an amendment to the QAPrP.

This Coalition's QAPP Adppendix Form includes project-specific information for the following sections: 10. Sampling Process and Design, 11. Sampling Methods, 12. Sample Handling and Custody, 13. Analytical Methods, 14. Quality Control, 15. Instrument/Equipment Testing, Inspection and Maintenance, 16. Instrument/Equipment Calibration and Frequency, 17. Inspection/Acceptance of Supplies and Consumables.

Field Sheets

The Coalition's field sheet is included in **Figure 2**. At a minimum field sheets must include the following:

- Project name
- Site name
- Site code
- Physical address of property on which well is situated
- State well number (if available)
- Sampling personnel
- GPS coordinates taken with each sampling event
- Sample type
- QC sample type
- Date and time of sample collection
- Results of field measurements
- Depth to standing water (static water level)
- Sampling conditions
- Constituents sampled
- Sample container
- Sample preservation

Chain of Custody

The Coalition's Chain of Custody (COC) form is included in **Figure 3**. At a minimum COC forms must include the following:

- Collection agency name and contact information
- Receipt agency name and contact information
- Sample Identification
- Date and time of sample collection
- Analyses requested
- Sample container type
- Number of sample containers
- Preservation
- Relinquished by name(s)
- Relinquished by date(s)
- Relinquished by signature(s)
- Received by name(s)
- Received by date(s)
- Received by signature(s)

Figure 2. ESJWQC field sheet.

Well Purging and Sampling Log

State Well #: ____ QTMP Well ID: ____ Sample ID: ____ Field Point: ____

Member Name: ____

Physical Address: ____

Date: ____ Target Lat/Long: ____ Well Depth: ____

Sky Code (Circle one): Field Lat.: ____ Depth to Water: ____

Clear, Cloudy, Partly Cloudy, Rain Field Long.: ____ MP to LSE: ____

Wind: Calm, Light wind, Gusty Accuracy: ____ Casing Dia.: ____

Unit: ____

QC Site: Yes No

Blank pH: ____

Personnel: ____

Picture # (s): ____

Well Type: Domestic Irrigation Public Water Supply

Sampling Point Description:

At the wellhead

After pressure tanks

From a holding tank

Spigot away from wellhead

After Filter

Other: ____

Well Diameter Multiplier			Purge Volume Calculations
Diameter	L	Gal	**DTW (Depth to water); WD (well depth); CV (casing vol)**
2"	0.6	0.16	1CV= (TD-DTW)* Multiplier; 3CV= 1CV*3
4"	2.4	0.65	

Purge start time: **Purge Log** **Purge end time:**

Time	Volume	Temp	EC	DO	pH	ORP	DTW	Turbidity	Comments

Purge Method: Submersible Turbine pump other: ____

Sampling Method: Submersible Turbine pump other: ____

Sample Collection Log **Sample time:**

Analysis	Container	Volume	Quantity	Filtered	Preservative	Lab
Nitrate + Nitrite as N	Poly	500 mL	1	Yes / No	H_2SO_4	
B, Ca, K, Mg, Na	Poly	500 mL	1	Yes / No	HNO_3	
TDS/ Alk/ Cl/ SO_4	Poly	500 mL	1	Yes / No		

Notes:

Figure 3. ESJWQC Chain of Custody form.

MLJ ENVIRONMENTAL

Caltest CHAIN-OF-CUSTODY RECORD

Client Name:	MLJ-LLC
Address:	1480 Drew Ave. Suite #130, Davis, CA 95618
Sampled By:	
Phone:	(530) 756-5200
Fax:	(530) 756-5225
Project Manager:	Michael Johnson
Project Name:	East San Joaquin Water Quality Coalition

	Sample Identification	Field Point Name	Global ID	Sample Date	Sample Time	Number	Type	Total Alkalinity as CaCO3 (SM 2320B)	Total Dissolved Solids (SM2540C)	Chloride, Sulfate SO4 (EPA 300)	Boron, Calcium, Magnesium, Sodium, Potassium	Nitrate as N (EPA300)	Field pH	LAB ID
1						1	500-mL Poly							
						1	500-mL Poly							
						1	500-mL Poly							
2						1	500-mL Poly							
						1	500-mL Poly							
						1	500-mL Poly							
3						1	500-mL Poly							
						1	500-mL Poly							
						1	500-mL Poly							
4						1	500-mL Poly							
						1	500-mL Poly							
						1	500-mL Poly							
5						1	500-mL Poly							
						1	500-mL Poly							
						1	500-mL Poly							
6						1	500-mL Poly							
						1	500-mL Poly							
						1	500-mL Poly							
7						1	500-mL Poly							
						1	500-mL Poly							
						1	500-mL Poly							

Comments:

Please fax signed and completed COC to MLJ LLC: (530) 756-5225, or email to abrillante@mlj-llc.com

If samples are collected for individual monitoring please write the individual Global ID in the sample comments.

Temperature at Log In: (°C)

Relinquished By		Relinquished By	
Signature		Signature	
Print Name		Print Name	
Organization		Organization	
Date	Time	Date	Time
Received By		**Received By**	
Signature		Signature	
Print Name		Print Name	
Organization		Organization	
Date	Time	Date	Time

Full; pg ____ of ____

Sample Matrix: ☐ Sediment ☐ Freshwater ☐ Wastewater ☐ Stormwater ☒ Groundwater

GROUP B. DATA GENERATION AND ACQUISITION

10. SAMPLING DESIGN

For purposes of characterizing the relatively shallower part of the groundwater system, the CVGMC emphasizes monitoring in the Upper Zone within the upper part of the groundwater system. Wells selected for trend monitoring will be sampled and tested at an annual frequency for water quality parameters including nitrate as nitrogen (as N), electrical conductivity at 25 °C (EC), pH, dissolved oxygen (DO), and temperature. Electrical conductivity, pH, DO, and temperature will be measured in the field whereas nitrate concentration will be analyzed by a certified laboratory. In most Coalition regions, public water supply wells represent additional ongoing monitoring wells that are regularly tested. Public water supply wells and any associated external sampling agencies are identified in **Table 4**. Non-direct measurements and analytical data collected by external agencies are processed according to Section 18 of the QAPrP. During the first monitoring event, wells selected for inclusion in the CVGMC GQTM will be sampled and tested for additional water quality constituents, including total dissolved solids (TDS), major anions (carbonate, bicarbonate, chloride, sulfate), and major cations (boron, calcium, sodium, magnesium, potassium). Wells will be tested for these additional constituents every 5 years.

Sample collection will occur during the seasonal window specified in the Workplan. Seasonal sampling reduces variability in groundwater aquifers accross the wet and irrigation seasons. Attempts will be made to sample every well within the network during this time. Inaccesibile wells should be re-sampled whenever possible. If inaccessibility is permanent or resampling cannot occur during the specified sampling period, then the well may need to be removed from the well network. The Project Manager and Project Lead must be notified so that a suitiable replacement well can be located and submitted to Regional Board staff for approval.

All samples collected will be submitted to the contract laboratory with enough time for analysis to occur within the holding times prescribed in **Table 5**. Sample submittals shall occur according to the procedures outlined in the Field Sampling SOP.

Table 3. Well information.

GQTM Well Name	Well ID	GeoTracker Global ID	State Well Number	Well Completion Report Number	Well Type	Well Depth	Well Depth Unit	Year Drilled	Latitude	Longitude	Datum
P01_2a_McHenry	ESJQC00001	AGC100012331		190887	Domestic	135	Feet	1987	37.7522	-120.994	NAD83
P02_1b_Root	ESJQC00002	AGC100012331		290694	Domestic	180	Feet	1988	37.6467	-120.894	NAD83
P03_1q_Vivian	ESJQC00003	AGC100012331		64838	Domestic	105	Feet	1987	37.6031	-121.048	NAD83
P04_1e_Swanson	ESJQC00004	AGC100012331		22701	Domestic	136	Feet	1977	37.5641	-120.783	NAD83
P05_2f_Harding	ESJQC00005	AGC100012331		81-152-D	Domestic	180	Feet	1981	37.4629	-120.772	NAD83
P06_3g_Eucalyptus	ESJQC00006	AGC100012331		465203	Domestic	236	Feet	1993	37.4048	-120.589	NAD83
P07_2g_Atwater	ESJQC00007	AGC100012331	07S11E14	803853	Domestic	230	Feet	2003	37.3308	-120.735	NAD83
P08_1k_East	ESJQC00008	AGC100012331		359701	Domestic	180	Feet	1990	37.3178	-120.432	NAD83
P09_2h_Rodgers	ESJQC00009	AGC100012331		334471	Domestic	180	Feet	1989	37.3092	-120.556	NAD83
P10_2j_Rahilly	ESJQC00010	AGC100012331		Not Found	Domestic	180	Feet	1965	37.2144	-120.535	NAD83
P11_3y_Road11	ESJQC00011	AGC100012331		Not Found	Domestic				37.1497	-120.347	NAD83
P12_1p_Road25	ESJQC00012	AGC100012331		242495	Domestic	276	Feet	1985	36.9287	-120.092	NAD83

Table 4. Well ownership type and sampling agency.

GQTM Well Name	Well ID	Owner Type	Sampling Agency	Sampling SOP
P01_2a_McHenry	ESJQC00001	Member	MLJ Environmental	Standard Operating Procedures for Groundwater Sampling
P02_1b_Root	ESJQC00002	Member	MLJ Environmental	Standard Operating Procedures for Groundwater Sampling
P03_1q_Vivian	ESJQC00003	Member	MLJ Environmental	Standard Operating Procedures for Groundwater Sampling
P04_1e_Swanson	ESJQC00004	Member	MLJ Environmental	Standard Operating Procedures for Groundwater Sampling
P05_2f_Harding	ESJQC00005	Member	MLJ Environmental	Standard Operating Procedures for Groundwater Sampling
P06_3g_Eucalyptus	ESJQC00006	Member	MLJ Environmental	Standard Operating Procedures for Groundwater Sampling
P07_2g_Atwater	ESJQC00007	Member	MLJ Environmental	Standard Operating Procedures for Groundwater Sampling
P08_1k_East	ESJQC00008	Member	MLJ Environmental	Standard Operating Procedures for Groundwater Sampling
P09_2h_Rodgers	ESJQC00009	Member	MLJ Environmental	Standard Operating Procedures for Groundwater Sampling
P10_2j_Rahilly	ESJQC00010	Member	MLJ Environmental	Standard Operating Procedures for Groundwater Sampling
P11_3y_Road11	ESJQC00011	Member	MLJ Environmental	Standard Operating Procedures for Groundwater Sampling
P12_1p_Road25	ESJQC00012	Member	MLJ Environmental	Standard Operating Procedures for Groundwater Sampling

11. SAMPLING METHODS

All samples will be collected according to the attached Standard Opertating Procedures for Groundwater Sampling which includes instructions for collecting samples and cleaning equipment between samples. The field SOP meets the minimal sampling method requirements as described in the QAPrP including details regarding field meter calibration, sampling and purging details. By following the field sampling SOP, samples will be void of contamination, representative of the groundwater, and reproducible.

Any deviation from the written SOP requires notification of the Project QA Officer. All deviation or problems will be noted both on the field sheet and corrective actions should be determined by the Project QA Officer. Deviations will also be reviewed by the CVGMC Program QA Officer to determine acceptability of data.

12. SAMPLE HANDLING AND CUSTODY

All sample containers should be clearly labeled with sample ID, collection date and time, collector, and requested analyses. Chain of Custody forms will be completed and remain with samples during transport to the laboratory as described in the QAPrP. All samples will meet the requirements for sampling containers, holding time, and sample custody outlined in **Table 5** below. Holding times refer to the maximum time limit at which a laboratory must analyze a sample for the constituent listed.

13. ANALYTICAL METHODS

The Project QA Officer should be in communication with the Laboratory Project Manager to resolve analytical issues, when they arise. It is the responsibility of the Project QA Officer to determine the most appropriate course of action to resolve any problems and/or accept data. All corrective actions should be reported in the annual reports.

Table 5. Sample handling and analytical information.

Constituent	Lab-oratory	Analytical Method	Matrix	Fraction	Sample Volume	Sample Container	Preparation	Preservative	Maximum Hold Time	Method Detection Limit (MDL)	Reporting Limit (RL)	Reporting Unit
Field Parameters												
Dissolved Oxygen (DO)	MLJ	SM 4500-O	Groundwater	Unfiltered	NA	NA	None	None	NA	NA	0.01	mg/L
Electrical Conductivity (EC) at 25 °C	MLJ	EPA 120.1	Groundwater	Unfiltered	NA	NA	None	None	NA	NA	2.5	µS/cm
pH	MLJ	EPA 150.1	Groundwater	Unfiltered	NA	NA	None	None	15 minutes	NA	0.1	pH units
Temperature	MLJ	SM 2550	Groundwater	Unfiltered	NA	NA	None	None	NA	NA	0.1	°C
Depth to standing water (static water level)	MLJ	NA	Groundwater	Unfiltered	NA	NA	None	None	NA	NA	NA	ft
Oxidation-reduction potential (ORP)	MLJ	NA	Groundwater	Unfiltered	NA	NA	None	None	NA	NA	NA	mV
Turbidity	MLJ	EPA 180.1	Groundwater	Unfiltered	10 mL	NA	None	None	NA	NA	1	NTU
Nutrients												
Nitrate + Nitrite as N	Caltest	EPA 353.2	Groundwater	Unfiltered*	500 mL	Polyethylene	Field Acidified	H_2SO_4	28 days	0.07	0.1	mg/L (as N)
Anions												
Bicarbonate	Caltest	SM 2320B	Groundwater	Unfiltered*	500 mL	Polyethylene	None	None	14 days	1.2	10	mg/L
Carbonate	Caltest	SM 2320B	Groundwater	Unfiltered*	500 mL	Polyethylene	None	None	14 days	1.2	10	mg/L
Chloride	Caltest	EPA 300.0	Groundwater	Unfiltered*	500 mL	Polyethylene	None	None	28 days	0.2	1	mg/L
Sulfate (SO_4)	Caltest	EPA 300.0	Groundwater	Unfiltered*	500 mL	Polyethylene	None	None	28 days	0.1	0.5	mg/L
Cations												
Boron	Caltest	EPA 200.8	Groundwater	Unfiltered*	500 mL	Polyethylene	Field Acidified	HNO_3	6 months	0.002	.01	mg/L
Calcium	Caltest	EPA 200.8	Groundwater	Unfiltered*	500 mL	Polyethylene	Field Acidified	HNO_3	6 months	0.02	0.05	mg/L
Magnesium	Caltest	EPA 200.8	Groundwater	Unfiltered*	500 mL	Polyethylene	Field Acidified	HNO_3	6 months	0.005	0.05	mg/L
Potassium	Caltest	EPA 200.8	Groundwater	Unfiltered*	500 mL	Polyethylene	Field Acidified	HNO_3	6 months	0.02	0.05	mg/L
Sodium	Caltest	EPA 200.8	Groundwater	Unfiltered*	500 mL	Polyethylene	Field Acidified	HNO_3	6 months	0.02	0.05	mg/L
Solids												
Total Dissolved Solids (TDS)	Caltest	SM 2540 C	Groundwater	Unfiltered*	500 mL	Polyethylene	None	None	7 days	4	10	mg/L

*Samples with a final turbididty measurement > 10 NTU will be filtered in the field.

14. QUALITY CONTROL

Field Quality Control

Field QC results must adhere to the limits of error and frequency requirements detailed in **Table 6**. Field QC frequencies are calculated to ensure that a minimum of 5% of all analyses are for QC purposes (both field duplicate and field blanks).

Table 6. Field Sampling QC.

Sample Type	Frequency	Acceptable Limits	Corrective Action
Field Duplicate	5% annual total	RPD ≤ 25%	Determine cause, take appropriate corrective action.
Field Blank	5% annual total	Detectable substance contamination <RL or < sample/5	Determine cause of problem, remove sources of contamination.

Analytical Quality Control

Analytical QC results must adhere to the minimum limits of error and frequency requirements detailed in **Table 7**. All analytical QCs must be analyzed at a frequency of 1 every 20 samples, minimum of 1 per batch.

Table 7. Analytical measurement quality objectives.

Sample Type	Frequency	Acceptable Limits	Corrective Action
Nutrients			
Lab Blanks (method, reagent, instrument)	1 per 20 samples, minimum 1 per batch	Detectable substance contamination <RL	Determine cause of problem, remove sources of contamination, reanalyze suspect samples or flag all suspect data.
Lab Duplicate*	1 per 20 samples, minimum 1 per batch	RPD < 25%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.
Matrix Spike	1 per 20 samples, minimum 1 per batch	80-120%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.
Lab Control Spike, CRM, or SRM	1 per 20 samples, minimum 1 per batch	90-110%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.
Anions			
Lab Blanks (method, reagent, instrument)	1 per 20 samples, minimum 1 per batch	Detectable substance contamination <RL	Determine cause of problem, remove sources of contamination, reanalyze suspect samples or flag all suspect data.

Sample Type	Frequency	Acceptable Limits	Corrective Action
Lab Duplicate*	1 per 20 samples, minimum 1 per batch	RPD < 25%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.
Lab Control Spike, CRM, or SRM	1 per 20 samples, minimum 1 per batch	75-125%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.
Cations			
Lab Blanks (method, reagent, instrument)	1 per 20 samples, minimum 1 per batch	Detectable substance contamination <RL	Determine cause of problem, remove sources of contamination, reanalyze suspect samples or flag all suspect data.
Lab Duplicate*	1 per 20 samples, minimum 1 per batch	RPD < 25%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.
Matrix Spike*	1 per 20 samples, minimum 1 per batch	75-125%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.
Lab Control Spike, CRM, or SRM	1 per 20 samples, minimum 1 per batch	75-125%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.
Total Dissolved Solids			
Lab Blanks (method, reagent, instrument)	1 per 20 samples, minimum 1 per batch	Detectable substance contamination <RL	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.
Lab Duplicate*	1 per 20 samples, minimum 1 per batch	RPD < 25%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.
Lab Control Spike, CRM, or SRM	1 per 20 samples, minimum 1 per batch	80-120%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.

*For the purposes of this project it is acceptable for the matrix spike duplicate or the laboratory control duplicate to stand in for the lab duplicate as a measure of the precision of the analytical method.

Precision will be assessed through a combination of field duplicate samples and laboratory duplicate samples utilizing the formulas described in the QAPrP. Accuracy is assessed using either an LCS or MS using the formulas described in the QAPrP. Corrective actions shall occur as described in the QAPrP including communication between the laboratory, Project Lead, and Project QA Officer to discuss additional corrective actions on a case by case basis. Field crews and contract laboratories are responsible for responding to failures in their measurement systems. If sampling or analytical equipment fails, personnel must record the problem according to their documentation protocols.

15. INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

Field equipment and laboratory instruments must be inspected, repaired and maintained as described in the QAPrP. Records of maintenance will be available to the CVGMC Program Manager upon request.

16. INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

Field calibration procedures will follow manufacturer specifications for the equipment used and are outlined within the attached Standard Operating Procedures for Groundwater Sampling. Records of field equipment calibration should be maintained for each instrument. These records will be available to the CVGMC Program Managers upon request. Calibration of laboratory instruments will be documented in the Quality Assurance Manual for each laboratory which will be available to the CVGMC Program Manager upon request.

Table 8. Instrument/Equipment Testing, Inspection, and Maintenance.

Equipment / Instrument	Maintenance Activity, Testing Activity or Inspection Activity	Frequency	Responsible Person
YSI Pro Plus - Glass Electrode pH Sensor	Clean glass bulb and visually inspect	<24 hours before sampling	Field Lead
YSI Pro Plus - Polarographic DO Sensor	Change membrane and KCl solution	Every 30 days	Field Lead
YSI Pro Plus - Electrode Cell EC and Thermistor Temperature Probe	Clean electrodes	<24 hours before sampling	Field Lead
YSI Pro Plus - Platinum Band ORP Sensor	Clean sensor	<24 hours before sampling	Field Lead
Hanna Instruments Portable Turbidimeter	Battery check; visually inspect and clean samples cuvets	<24 hours before sampling	Field Lead
DGSI Water Level Indicator	Clean cable and check batteries.	<24 hours before sampling	Field Lead
SEAL AQ2 Discrete Analyzer	Clean cells, check all tubing, regenerate cadimum coil	According to manufacturer specifications	Lab QA Officer
Man-Sci Titrasip	Clean titration cup, check tubing	According to manufacturer specifications	Lab QA Officer
Ion Chromatograph (DX 320)	Clean column, check bed supports, replace regenerant, replace suppressor	According to manufacturer specifications	Lab QA Officer
ICP-MS	Check pump tubing, check pump oil, clean cones, clean torch, replace nebulizer, replace torch	According to manufacturer specifications	Lab QA Officer
Balance	Clean pan and check if level, check range of mass used	According to manufacturer specifications	Lab QA Officer

Table 9. Instrument/Equipment Calibration and Frequency.

Equipment / Instrument	Calibration Description and Criteria	Frequency of Calibration	Responsible Person
YSI Pro Plus - Glass Electrode pH Sensor	3 Point calibration at pH 4, 7, and 10; calibration must be accepted by YSI meter	Daily before first measurement	Field Lead
YSI Pro Plus - Polarographic DO Sensor	H20 Saturated air calibration (%O2) at default 760mm Hg	Before each measurement	Field Lead
YSI Pro Plus - Electrode Cell EC and Thermistor Temperature Probe	Calibration to 1413 µS/cm; calibration must be accepted by YSI meter. Temperature calibration is factory set and does not require user calibration	Daily before first measurement and when EC changes substantially between wells	Field Lead
YSI Pro Plus - Platinum Band ORP Sensor	Calibration using ZoBell solution to proper value based on temperature	Daily before first measurement	Field Lead
Hanna Instruments Portable Turbidimeter	2 point calibration at < 0.10 and 15 NTUs	<24 hours before sampling event	Field Lead
SEAL AQ2 Discrete Analyzer	Linear, r≥0.995	Daily, before analysis	Lab QA Officer
Man-Sci Titrasip	pH calibration before use,	Daily, before analysis	Lab QA Officer
Ion Chromatograph (DX 320)	Mixed-standard curve calibration, r≥0.995	Daily, before analysis	Lab QA Officer
ICP-MS	Three calibration standards per linear range, MDL determination, ICV, CCV	When analyst observes calibration is necessary, MDL determined annually, ICV immediately after calibration, CCV after every 10 samples and at end of sample run	Lab QA Officer
Balance	Mass within 0.5%	Daily, before analysis	Lab QA Officer

17. INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

Acceptance criteria for supplies and consumables are outlined in the Laboratory Quality Assurance Manual and field sampling SOPs. Laboratory personnel and field crews are responsible for ensuring that all supplies and consumables meet these criteria prior to analysis of sample collection. Inspecting and testing records will be maintained by the laboratories and field crews, and available to Program Managers on request.

Table 10. Inspection/Acceptance of Supplies and Consumables.

Consumable	Acceptance Criteria	Frequency	Responsible Person
pH standard calibrating solutions (Fisher Scientific)	Manufacturer's seal intact, measurements within ±0.2 of prior standard measurement	Upon opening a fresh standard solution	Field Lead
EC standard calibrating solutions (Fisher Scientific)	Manufacturer's seal intact, measurements within ±0.5% or 1µS/cm of prior standard measurement	Upon opening a fresh standard solution	Field Lead
Certified pre-cleaned bottles (from laboratory)	Bottles and caps intact	At receipt date of shipment	Field Lead
Pre-preserved containers (from laboratory)	Proper preservative volume present, bottles and caps intact	At receipt date of shipment	Field Lead
Nitrile Gloves (Fisher Scientific)	Carton is intact and gloves within are clean and intact	At receipt date of shipment	Field Lead

18. NON-DIRECT MEASUREMENTS (EXISTING DATA)

Review and assembly of data collected by other entities will follow the procedures described in the QAPrP.

19. DATA MANAGEMENT

The CVGMC will use a coordinated data management system that will be centrally maintained for the purpose of implementing the CVGMC. A coordinated data management system (DMS) will be used to facilitate analyses and reporting of regional groundwater quality data across the CVGMC area and submittal of CVGMC data; the DMS is described in the QAPrP. The Data Management SOP for the CVGMC DMS will be submitted as an amendment to the QAPrP.

GROUP C. ASSESSMENT AND OVERSIGHT

20. ASSESSMENTS & RESPONSE ACTIONS

All reviews of QA data will be made by the Project QA Officer including an assessment of precision, accuracy and completeness as outlined in the Data Management SOP. Reviews may include the Program QA Officer, if necessary. Contract laboratories are responsible for self-assessment and oversight of finalized data submitted in laboratory reports and GeoTracker files, although data are audited for compliance as part of the Coalition's QA/QC program. The Project QA Officer is responsible for ensuring that all data that do not meet the established MQOs are flagged.

If a discrepancy is discovered during the review, the Project QA office will discuss the discrepancy with the personnel responsible for the activity. The discussion will include the accuracy of the information, potentials cause(s) leading to the deviation, how the deviation might impact data quality and the corrective actions that might be considered. If discrepancies are observed, the details of the discrepancy and any corrective action will be reported in the final monitoring report. The Project QA Officer will be responsible for addressing all corrective actions.

21. REPORTS TO MANAGEMENT

Personnel involved in project tasks may encounter unforeseen issues/concerns at any time. It is important that staff report issues/concerns to managers when they are identified. Managers are responsible for project resolutions. If the resolution requires changes to approved documents, the CVRQWCB will be contacted and the appropriate actions will be taken to have changes approved.

GROUP D. DATA VALIDATION AND USABILITY

22. DATA REVIEW, VERIFICATION, AND VALIDATION REQUIREMENTS

The Project QA Officer will review data collected as part of the GQTM according to the data quality objectives and QA/QC practices outlined in the CVGMC Data Management SOP. The decision to accept or reject the data will be based on an assessment of the impact of the data quality failure. Data collected by other monitoring agencies will go through a more general review as stated within **Section 18.**

23. VERIFICATION AND VALIDATION METHODS

The Project's QA Officer or a delegate of the QA Officer will do all reviews of 100% of the reports as outlined in the Data Management SOP. Each contract laboratory's QA Officer will perform checks of all of its records at a frequency that the lab determines sufficient.

24. RECONCILIATION WITH USER REQUIREMENTS

Procedures to review, verify and validate project data is included in the Data Management SOP. The Program Quality Objectives section describes the role of the DQO process and identifies the program's objectives. Reconciliation with the DQOs involves reviewing the data to determine whether the DQOs have been attained and that the data are adequate for their intended use. At the project level, reconciliation occurs during the data quality assessment.

Limitations in data use will be reported to the CVRWQCB in the Annual Reports and CVGMC Five-Year Assessment Reports.

ADDITIONAL REQUIRED DOCUMENTS

The following attached documents are associated with this project.

Table 11. Standard Operating Procedures

Responsible Agency	Method	SOP Title	Revision	Revision Date
MLJ	NA	Standard Operating Procedures for Groundwater Sampling	2.0	Mar-19
Caltest	EPA Method 353.2 / SM 4500NO3F	Nitrate + Nitrite as N	W-NNO3-rev9a	Sep-17
Caltest	SM 2540 C & E / EPA 160.1, 160.4	Total Dissolved Solids, Fixed & Volatile Dissolved Solids	W-TDS-rev10a	Nov-13
Caltest	SM 2320B	TitraSip Automated Water Quality Testing Equipment	W-TitraSip-rev2b	Sep-13
Caltest	EPA 160.1	Total and Volatile Solids, Total and Volatile Solids in Solid Samples	W-RESIDUE-rev9a	Jan-14
Caltest	EPA 300.0	The Determination of Inorganic Anions by Ion Chromatography	W-Dioxex-rev10a	Nov-14
Caltest	EPA 200.8	Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma-Mass Spectrometry (3 Modes)	M-2008-3mode-rev3a	Sep-13

APPENDIX K: MONITORING PROTOCOLS – SUBSIDENCE (USBR SJRPP)

RECLAMATION
Managing Water in the West

San Joaquin River Restoration Project – Geodetic Network

GPS Survey Report

U.S. Department of the Interior
Bureau of Reclamation
Mid-Pacific Region
Surveys and Mapping Branch, MP-220

December 2011

GPS SURVEY REPORT

San Joaquin River Restoration Project

Geodetic Network

December 2011

Prepared for: Bureau of Reclamation
Mid–Pacific Region
San Joaquin River Restoration Program
2800 Cottage Way
Sacramento, CA 95825

Katrina Harrison
Hydraulic Engineer
Phone: (916) 978-5465

Prepared by: Bureau of Reclamation
Mid–Pacific Region
Division of Design & Construction
Surveys & Mapping Branch, MP-220
2800 Cottage Way
Sacramento, CA 95825

Gerald Davis, PLS
Phone: (916) 978-5538

PROFESSIONAL LAND SURVEYOR
GERALD T. DAVIS
No. 8545
Exp. 12-31-12
STATE OF CALIFORNIA

MAY 4, 2012

I. INTRODUCTION

This report details survey work completed by the Bureau of Reclamation, Mid–Pacific Region, Division of Design and Construction, Surveys and Mapping Branch (MP Surveys) for the San Joaquin River Restoration Project (SJRRP). This survey network was undertaken to provide consistent control on which to base the horizontal and vertical locations of SJRRP maintained staff gages. Recent surveys by RBF Consulting and the California Department of Water Resources (DWR) made us aware of subsidence issues in the project area. Due to these issues, the network was expanded to reach across the entire central valley to allow for the location of stable control stations. Certain control stations from these recent surveys were also selected as a part of our network to provide a direct link to any historic subsidence data. The expanded network also serves as a passive system for future monitoring of subsidence in the San Joaquin River valley. The survey work described in the following report was accomplished with the use of Global Positioning System (GPS), digital optical level and total station technology.

The survey conducted by MP Surveys included:

GPS observation of approximately 63 stations
Least Squares adjustment
Digital Level observation of approximately 195 stations
Digital Level data adjustment
Coordinate Listing
Control Point Data Sheets
Survey Report

The GPS observations incorporated in this survey report were accomplished in November and December 2011. The achieved horizontal accuracy for this network is +\- 1 centimeter based upon the Fully Constrained Network Adjustment – Adjusted Grid Coordinates – Northing Error and Easting Error, which exceeded the horizontal accuracy goal of +\- 2 centimeters. The achieved vertical accuracy for this network is +\- 2.5 centimeters based upon the Fully Constrained Network Adjustment – Adjusted Grid Coordinates – Elevation Error, which exceeded the vertical accuracy goal of +\- 3 centimeters. Ties to the existing control were made to determine the rotational biases. Elevations depicted in this report were determined by static GPS and digital level methods.

MP Surveys provided all GPS, digital level and total station equipment, associated hardware, and all software used during the field phase of the project. MP Surveys was responsible for preparing the final adjustment and this report.

This report details the personnel and equipment used on the project followed by a section detailing the chronology, the method of observing and computational procedures. All pertinent adjustments, coordinate listings and diagrams are included in the attached Appendices.

II. PERSONNEL AND EQUIPMENT

A. Personnel

MP Surveys supplied the following personnel during the field operation:

Gerald Davis, PLS	Project Manager (California PLS #8545)
Mark Morberg, PLS	GPS Supervisor (California PLS #8213)
Adrian VerHagen, LSIT	GPS Observer
John Harrison, LSIT	GPS Observer
Robert Keller	GPS Observer

As Project Manager, Mr. Gerald Davis, PLS was the responsible person in charge of the survey. Mr. Davis reviewed the daily work plans concerning GPS observations and was in direct charge of all the computations, adjustments and the preparation of the final GPS report.

Additional MP Surveys office personnel involved:

Matt Perigny	Graphic/Computer Support
Jillian Baber	Graphic/Computer Support

B. Field Equipment

MP Surveys supplied all computers, printers, software and office products. MP Surveys also supplied the following equipment:

3 – Trimble R8 GNSS GPS receivers

4 – Trimble TSC2 Data Collectors with Trimble Survey Controller software (Ver. 12.43, 12.44, and 12.45)

1 – Trimble 5601 Total Station (1")

1 – Leica DNA03 Digital Level (0.3mm)

1 – Leica Invar Level Rod (barcode read)

Klamath Basin Area Office supplied the following equipment:

2 – Trimble R8 GNSS GPS receivers

1 – Trimble TSC2 Data Collector with Trimble Survey Controller software (Ver. 12.43)

C. Adjustment Software:

Trimble Business Center: Database and Baseline processing program, (Ver. 2.40.3)

III. CHRONOLOGY

November 28, 2011 (332)
Mobilization and Project Management / Strategy meeting
Begin Static GPS Observation
Session 1 (station observed)
143, 120, 111, 112, 142
Session 2
134, 120, 113, 112, 145

November 29, 2011 (333)
Continue Static GPS Observation
Session 1
134, 142, 165, 141, 140
Session 2
154, 102, 163, 141, 140
Session 3
154, 139, 163, 114, 115
Session 4
104, 105, 114, 115
Session 5
125, 128, 105, 122, 153
Session 6
125, 128, 144, 147

November 30, 2011 (334)
Continue Static GPS Observations
Session 1
157, 146, 144, 147, 137
Session 2
108, 146, 167, 152, 137
Session 3
138, 146, 167, 110, 150
Session 4
138, 109, 119, 110, 166
Session 5
108, 109, 119, 148, 126

November 31, 2011 (335)
Continue Static GPS Observations
Session 1
109, 110, 167, 130
Session 2
108, 106, 107, 155, 126

December 1, 2011 (335), Con't.
Session 3
124, 106, 131, 135, 126
Session 4
157, 106, 162, 156, 133
Session 5
157, 124, 162, 161, 132
Session 6
121, 124, 135, 123, 132

December 2, 2011 (336)
Continue Static GPS Observations
Session 1
121, 147, 101, 123, 129
Session 2
158, 153, 159, 123, 129
Session 3
105, 153, 127, 116, 159
Session 4
114, 163, 127, 160, 103
Session 5
127, 143, 131, 135, 141

December 3, 2011 (337)
Complete Static GPS observations of Primary Control Network
Session 1
128, 139
Session 2
140, 145
Session 3
123, 168
Session 4
137, 155

December 5 – 9, 2011
Begin total station and digital level observations
Gage stations observed
CTK, MIL, LDC, H41, SJF, DNB, SKAGGS, GRF, JBP

December 19 – 23, 2011
Continue total station and digital level observations
Gage stations observed
CBP, SJB, SJN, MEN, SDP, SWA, ELN, EBM, SSH, SJS, MSG, FFB, NEW

January 10 – 11, 2012
Complete total station and digital level observations
Gage stations observed
SMN, NEW

February 2012
Final adjustment of static GPS network, total station, and digital level data completed.

March 2012
GPS report and appendices completed.

April 2012
GPS report and appendices QA/QC'd and peer review completed.

May 2012
Peer review comments incorporated into report. Final report issued.

IV. METHODS

All primary control survey work on the San Joaquin River Restoration Project Geodetic Network was accomplished by static GPS methods. Approximately 61 control points were surveyed as a part of the primary control network. The horizontal datum for this project is the California Coordinate System of 1983, Zone 4, based upon NAD 1983 (epoch 2007), and the vertical datum is NAVD 1988. All coordinates and elevations are reported in U.S. Survey Feet.

Static Survey

GPS observations were made during the daytime hours, with sessions typically averaging 30 minutes in duration. There was an acceptable satellite visibility window from approximately 7 AM to 5 PM. Communication between observers was maintained through the use of cellular phones, which allowed for adjustment of the pre-planned observation schedule due to unforeseen circumstances. Observation start and stop times, antenna height measurements, station descriptions and other pertinent details were recorded on session log sheets. Transportation between control points was achieved through the use of 4 wheel drive government vehicles.

Data processing was performed on a daily basis by the Project Manager and GPS Supervisor. Each evening following the observation sessions, the collected data was downloaded from the internal memory of each data collector and processed using Trimble Business Center (TBC). This processing resulted in a fixed and / or float solution for each baseline. Float solutions were not used in the final constrained adjustment, as fixed solutions represent the most accurate solution. The statistical output generated from the data processing provided the first quality control indicators. These indicators showed acceptable results.

After the baselines were processed and reviewed for statistical integrity, a minimally constrained least squares adjustment was run on a daily basis using TBC. This software adjusts GPS vectors in three dimensions and was designed for network densification using GPS observations. The maximum post processed GPS vector residuals resulting from the least squares adjustment are +\- 1.8 centimeters in the horizontal plane and +\- 6.4 centimeters in the vertical plane. All free adjustments computed in the field were in NAD 83.

RTK GPS and Total Station Surveys

Secondary project control and site features were located in the horizontal dimension using RTK GPS through either the use of a conventional base station setup or Virtual Reference Stations, as dictated by cell coverage, and / or a conventional total station. These features include gage houses, local benchmarks and project monitored staff gages.

Redundant control checks were performed from each base station, virtual or actual, each day to prevent blunders and enable the localization of virtual base collected data. At least two control stations being part of the geodetic network were surveyed at the beginning and completion of each RTK session. This enabled the RTK data to be adjusted to the static control station values, which were held “fixed” for all RTK surveys. This allowed all GPS data to be put on the same datum / epoch and provided “sanity checks” for the data gathered using virtual base stations.

Staff gages and features which were not able to be surveyed using RTK, due to vegetation or proximity to standing water, were surveyed using the Trimble 5601 total station's reflectorless capabilities. All measurements were made in "standard" mode, which averages seven EDM returns for each measured point. Staff gages lying within the waterway of the San Joaquin River were also surveyed for elevations using this same method. A minimum of two individual measurements in both the Direct and Reverse faces were made for each "elevated point" to help prevent blunders, systematic and random errors. The splits of all measured angle sets were verified to be within project tolerances of 5" Horizontal and 10" Vertical maximum.

Digital Level Surveys

NAVD 88 elevations for project monitored staff gages, local benchmarks and secondary control points were established through digital leveling techniques utilizing a Leica DNA03 digital level, rated to .3mm/Km, reading barcodes on Leica Invar Level Rods.

Physical field notes were kept alongside electronic field notes as an independent verification of each digital level observation. All observations were made as a part of closed level loops, with a maximum closure of 0.006' per √Mile.

V. ADJUSTMENTS

Minimally Constrained Adjustment
A primary network was surveyed as part of this project. This network was comprised of existing and new stations and ties into existing National Geodetic Survey (NGS) control stations.

The minimally constrained adjustment computes the network independent of multiple fixed controls and is an indicator of the quality of the GPS measurements. The minimally constrained adjustment held one point (NGS control station K 361) fixed horizontally and vertically, which produced the following results:

Number of Stations	61	Minimum Vector Length	4,821 usft
Degrees of Freedom	501	Maximum Vector Length	176,017 usft
Number of Observations	236	Largest residual (Hz)	0.060 usft
Reference Factor	1.00	Largest residual (Vt)	0.211 usft

*More specific information regarding this adjustment is contained in Appendix 2.

Fully Constrained Adjustment
The constrained adjustment holds the position of specified horizontal and vertical control and scales and rotates the GPS network to fit the control held fixed. For this project the five control stations were held fixed either horizontally or vertically to determine the rotational biases. These five stations were selected based upon their overall agreement with the minimally constrained network adjustment result and their geographic location. Due to the previously mentioned subsidence issues in the San Joaquin River valley we had no confidence in the vertical accuracy of control stations situated within the valley. For this reason, the points selected to constrain the network are spaced around the outside perimeter and are located at the edges of the San Joaquin River valley. These points should provide stable control locations for any future re-observation or network densification. Geoid03 was utilized to achieve orthometric elevations.

Stations held fixed in the primary network constrained adjustment:

Pt	Designation	Northing (usft)	Easting (usft)	Elevation
119	109.28			111.276’
128	F 928			619.257’
138	HPGN CA 10 04	2423374.062	5929562.855	
139	HPGN D CA 06 NF	2099649.706	6250234.978	
145	J 1233	2199134.508	6397420.403	494.094’
146	K 361	2275034.315	5961519.299	285.344’

Network Statistics:

Number of Stations	61	Minimum Baseline Length	4,821 usft
Degrees of Freedom	506	Maximum Baseline Length	176,017 usft
Number of Observations	236	Largest residual (Hz)	0.060 usft
Reference Factor:	1.05	Largest Residual (Vt)	0.211 usft

Deflection in Latitude: 0.107 sec **(95%)** 0.030 sec
Deflection in Longitude: 0.068 sec **(95%)** 0.037 sec
Azimuth Rotation: -0.052 sec **(95%)** 0.010 sec
Scale Factor: 1.00000012**(95%)** 0.00000005

The horizontal datum is NAD 1983 (2007), California Coordinate System of 1983, Zone 4, U. S. Survey Feet.

The vertical datum is NAVD 1988. Geoid model *Geoid03* was selected for use to determine orthometric elevations in the final adjustment. Geoid09 was originally planned for use in the final adjustment. However, after comparing orthometric elevations determined using Geoid09 with the record elevations of our "fixed" control we came to the conclusion that Geoid03 produced elevations more consistent with the record data. As our selected control to be held "fixed" is located in the foothills of the Sierra and Coastal ranges, we have a high degree of confidence that these stations are not subject to the subsidence issues observed in portions of the central valley. The larger elevation differences, as determined by Geoid09, may be caused by stations constrained in the creation of Geoid09 having subsided since their last observation, forcing inaccuracies into the geoid model.

Coordinate differences at known control as reported by the fully constrained adjustment (Negative elevations denote observed elevations lower than record NGS elevations).

Pt. #	PID	Designation	Northing (usft)	Easting (usft)	Elev. Diff.	Yrs since rec. obs.[1]	Comments
101	GU0753	X 989	-0.049	-0.014	-0.98'	4	
119	HS4510	109.28	-83.116	49.791	FIXED	23	NGS Hz Co-ords scaled (+/- 6")
121	GU0762	375 USE	-0.111	-0.122	-1.38'	3	
122	DH6668	ALEX 5	-0.002	0.012	-0.57'	3	
124	HS1103	D 158 RESET	0.004	0.017	-0.76'	3	
125	DH6676	DWIGHT	0.015	-0.059	-0.40'	8	
126	HS4523	E 1420	0.088	-0.012	0.10'	23	
128	GU0588	F 928	0.025	-0.078	FIXED	7	
129	GU4281	FIREPORT	-0.024	-0.054	-0.72'	3	
130	HS1919	FREMONT	0.030	-0.088	-0.15'	2	
131	HS1204	G 706 RESET 1962	-5.578	-4.193	0.21'	46	NGS Hz Co-ords per Hand Held

Pt. #	PID	Designation	Northing (usft)	Easting (usft)	Elev. Diff.	Yrs since rec. obs.[1]	Comments
132	GU0763	G 990 (SDP)	-26.98	775.368	-5.90’	46	NGS Hz Co-ords scaled (+/- 6")[2]
133	AB5019	H 1235 RESET	27.229	111.161	-1.62’	4	NGS Hz Co-ords scaled (+/- 6")
134	DG9695	H1 1941	-0.058	0.066	0.01’	7	
135	HS5409	HPGN CA 06 03	0.011	-0.036	-0.78’	7	
137	HS5410	HPGN CA 10 01	0.042	-0.038	-0.34’	19	
138	HS5412	HPGN CA 10 04	FIXED	FIXED	-0.39’	19	
139	AC6109	HPGN CA 06 NF	FIXED	FIXED	-1.30’	2	
140	AC6102	HPGN CA 06 QF	-0.058	0.095	-0.05’	7	
141	AC6103	HPGN CA 06 RF	-0.044	0.021	-0.19’	7	
142	AC6105	HPGN CA 06 RG	0.000	-0.001	-0.05’	11	
143	AC6106	HPGN CA 06 SG	0.062	-0.041	-0.09’	18	
144	AA4253	HPGN CA 10 BK	0.053	-0.137	-0.17’	7	
145	GT1583	J 1233	FIXED	FIXED	FIXED	3	
146	HS2341	K 361	FIXED	FIXED	FIXED	23	
147	DH6674	KELLIE	0.014	-0.069	-0.69’	8	
148	HS5446	LIVINGSTON RESET	0.043	0.058	0.16’	17	
150	HS2391	NEWMAN NW BASE	0.274	0.300	0.05’	68	
152	HS1827	SALT RM 1	-0.028	0.079	-0.62’	24	
153	DH6679	SHAWN	-0.013	-0.013	-0.43’	8	
154	GU3389	SPEAK AZ MK CADH	-0.010	0.035	-0.31’	18	
155	HS1894	T 987 CADWR	5.147	-375.83	-1.36’	46	NGS Hz Co-ords scaled (+/- 6")
156	HS1953	W 990 CADWR (SWA)	-130.00	-88.276	-6.15’	46	NGS Hz Co-ords scaled (+/- 6")
157	DH6673	WILLIAM 3	-0.010	-0.067	-0.93’	8	

[1]Year of observation for record values is based upon best information available on NGS datasheet; this year has been subtracted from December 2011 to calculate the approximate total elapsed years.
[2]Large differences in Easting value of point 132 exposes a possible datasheet coordinate error, being transcribed numbers in the seconds’ position of the Longitude on the NGS datasheet. Point was recovered as described on NGS datasheet.

The primary network adjustments, both minimal and fully constrained, along with all coordinate listings are included in the following appendices. Please be aware, TBC refers to Ellipsoid Heights as “Height” and Orthometric Elevations as “Elevation”.

VI. SUMMARY

Subsidence is a known issue and our survey has hopefully provided more data for analysis and future monitoring. Our computations show approximately 1.38 feet of subsidence in almost three years at station 375 USE (PID GU0762), affirming subsidence rates noted by RBF Consulting and the U.S. Geological Survey. Additionally, our survey has exposed significant, nearly 6 feet since 1965, subsidence at station G 990 (PID GU0763). While in other areas we show subsidence as low as a couple tenths of a foot over nearly half a century. Furthermore, our survey seems to have exposed a related issue with Geoid09 in this locale. Based upon our observations and data analysis, along with conversations with representatives of the National Geodetic Survey, it appears the validity of Geoid09 in this region has been degraded by subsidence of local passive control stations. The rate of subsidence in areas of the San Joaquin River valley has caused orthometric elevations on known passive control to change more rapidly than published control data can be updated. Due to this, stations were constrained during the creation of Geoid09 which in actuality differed (sometimes greatly) from their published values. In conclusion, this survey provides the start of a stable means for passive monitoring of future subsidence in the San Joaquin River valley.

VII. APPENDICES

Section 1	Control Diagram
Section 2	Minimally Constrained GPS Adjustment
Section 3	Fully Constrained GPS Adjustment
Section 4	Total Station Observation Data
Section 5	Raw Digital Level Data
Section 6	Digital Level Adjustment
Section 7	Adjusted Coordinate Table
Section 8	Control Point Data Sheets

APPENDIX L: MERCED OPTI DATA USER GUIDE

Merced Subbasin Data Management System

optiDATA

Public User Guide

MERCED SGMA

WOODARD & CURRAN

Opti Public User Guide

Opti is a one-stop-shop for transparent data management and analysis that enables integrated performance tracking to support sustainable water management. This Public User Guide has been developed to assist you with navigation and usage of the Merced Subbasin Data Management System (DMS). Please see the Appendix for specific data types and quality codes configured in this implementation.

The DMS may be accessed at: http://opti.woodardcurran.com/merced

Please click on Guest Login to access the DMS as a guest user. If you would like to gain additional access to the DMS for data updates and management, please contact: Tess Sprague (TSprague@woodardcurran.com).

Public usage of the DMS is explained in the following modules:

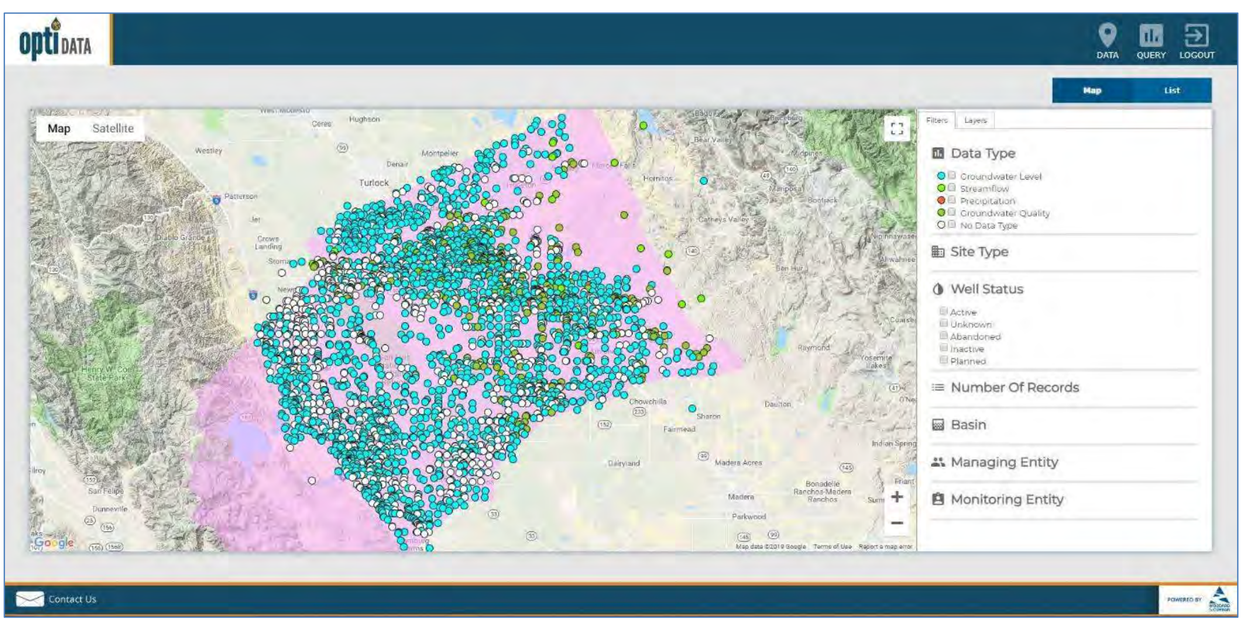
- Data
- Query

Module: Data (Top)

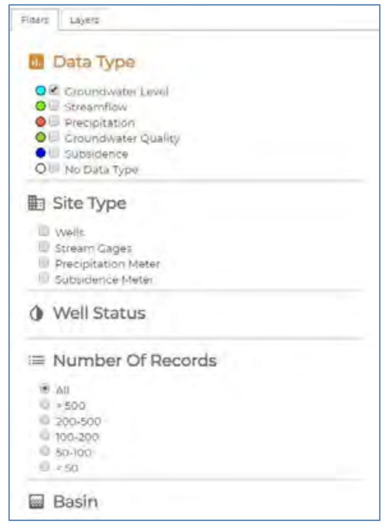
The Data module contains two available submodules that allow you to view water resources data and their associated site information: Map and List.

Submodule: Map

The Map submodule displays the sites (wells, stream gages, facilities, etc.) as point locations on the map.



Feature: Change the Google Map display



- To move the location or extent of the map display, use the "+" and "-" icons in the lower right-hand corner of the map. You may use the pan tool to move the focal location of the display.
- To change the base layer of the map display, select an option from the upper l eft-hand side of the map display (Map or Satellite).

Feature: Filter the results displayed on the map

- On the Filters tab on the right-hand panel, select the checkboxes for the options for which you would like to filter the results.
- Select sites based on:
    - o data type associated with the site,
    - o site type,
    - o number of data records,
    - o entity, or
    - o a combination of any filter.

Please note that sites may have more than one data type associated with them, e.g., groundwater level and groundwater quality.

Feature: Change the layers displayed on the map

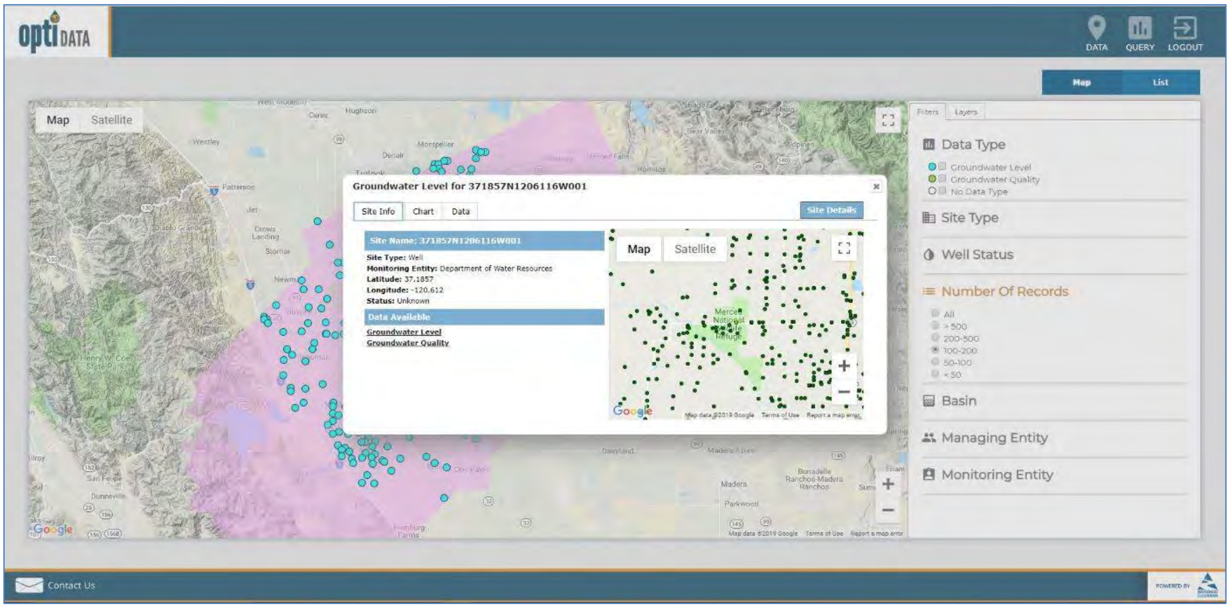
- Click on the Layers tab on the right-hand panel.
- Select the layers that you wish to have displayed. Upon selection, the map will be updated to show the selected layers.
- You may click on features on the layer to view information on that feature.

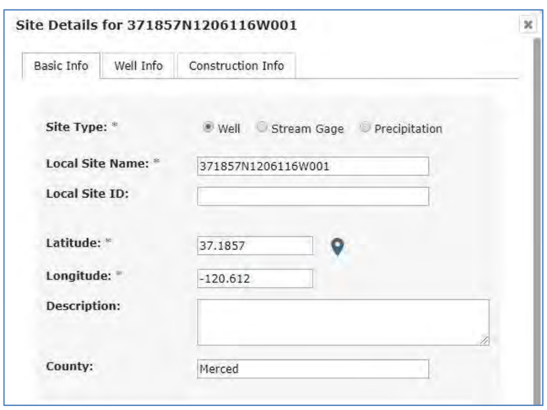
Feature: View site information on the map

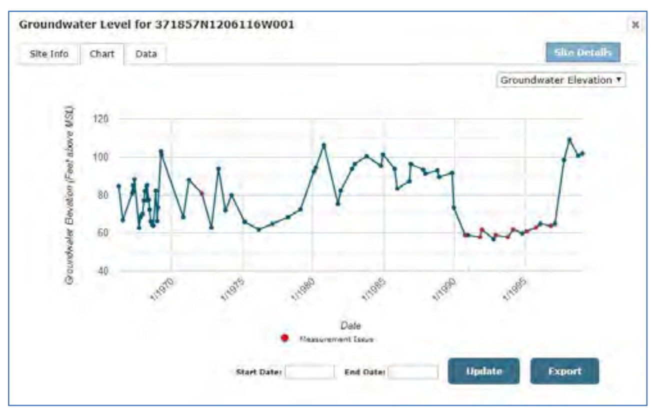
- Click on a site on the map. The site information will be displayed with tabs for Site Info, Chart, and Data.
- To view site detailed information, click on the Details link. The Site Details page will open.
- To view a chart of the data, click on the Chart tab. You may change the parameter by selecting a parameter from the drop-down list in the upper right-hand corner. You may update the chart timeline by selecting the Start Date and End Date and clicking Update. You may export the data to Excel by clicking Export.
- To view a table of the data, click on the Data tab. You may change the parameter by selecting a parameter from the drop-down list in the upper right-hand corner. You may narrow the tabular

list by selecting the Start Date and End Date and clicking Update. You may export the data by clicking Export.

- To select a different data type for the site, click on the data type available under “Data Available” on the Site Info tab.

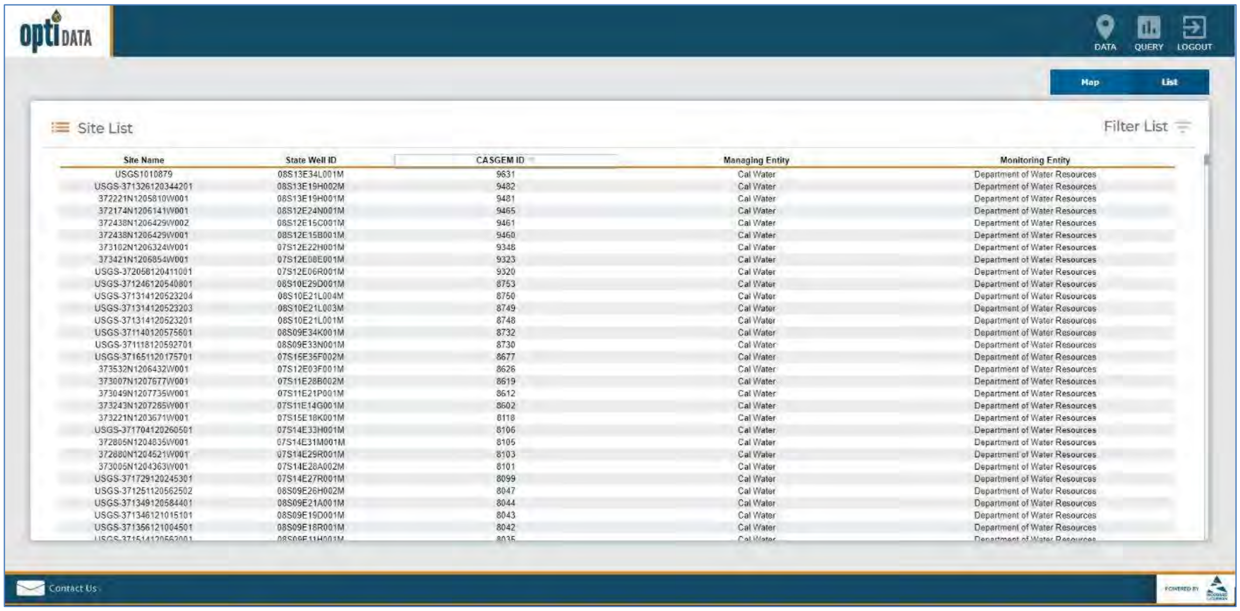






Submodule: List

The List submodule contains a list of sites in a sortable, tabular format.



Feature: Filter and/or sort sites

- Select data type, site type, number of records, or entity from the drop-down menu at the top of the table to filter sites.
- Click on the table headers to alphabetically or numerically sort the selected column.

Feature: View site information from list

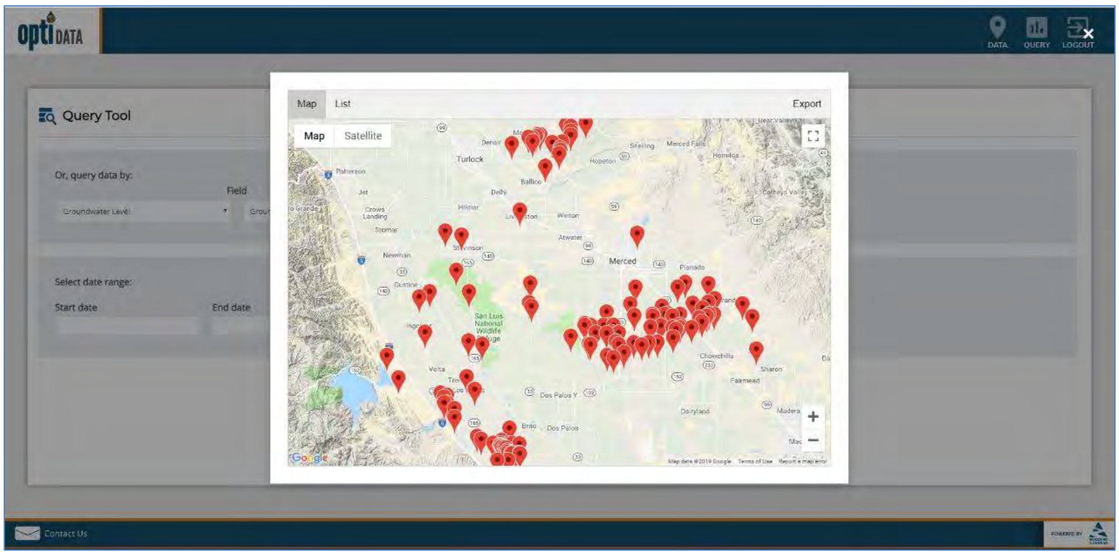
- Click on the selected site name in the list. The site information will be displayed with tabs for Site Info, Chart, and Data. The Site Details page is available through this dialogue box. The following information may be available:

Basic Info	Well Info	Construction Info
Site Type	State Well ID	Total Well Depth
Local Site Name	CASGEM ID	Borehole Depth
Local Site ID	Ground Surface Elevation	Casing Perforations
Latitude/Longitude	Reference Point	Casing Diameter
Description	Reference Point Elevation	Casing Modifications
County	Reference Point Location	Well Capacity
Managing Entity	Reference Point Description	Well Completion Report Number
Monitoring Entity	Well Use	Comments
Type of Monitoring	Well Status	
Type of Measurement	Well Type	
Monitoring Frequency	Aquifers Monitored	

Basic Info	Well Info	Construction Info
	Groundwater Basin Name/Code Comments Upload File	

Module: Query (Top)

The Query module allows users to search for sites and data using different parameters and values.



Feature: Create new query

- Click on the Query icon in the menu.
- To create a new query:
    - Select the following options from the drop-down menu under "Or, query data by:":
        - Entity
        - Site Name
        - Groundwater Level
        - Streamflow
        - Precipitation
        - Groundwater Quality
        - Surface Water Quality
    - If the selected option has associated parameters, select a parameter in the second drop-down menu.
    - Select an Operator. Please note that for text searches, you may use the "Like" option with wildcards (%).
    - To add additional rows to the query, click on the blue "+" button and complete.
    - To remove rows from the query, click on the red "-" button.
- To select data within a particular date range, complete the Start date and End date fields.

- Click Run. A window will open with a map view of the results.
    - Click on the site in the map to view the data for the site.
    - Click on the List tab to view the data in a list format. You may click on a site to view the data.
    - Click on Export to export the data to Excel.
- To clear the query, click the Clear button at the bottom of the page.

Appendix – Merced Subbasin Specific Implementation Information

Data Types

The following data types are currently configured in the DMS. Please note that this list may change as more data becomes available.

Data Type	Parameter	Units	Currently Has Data in DMS
Groundwater Elevation	Depth to Groundwater	Feet	Yes
	Groundwater Elevation	Feet above MSL	Yes
Groundwater Quality	1,1,1-Trichloroethane	ug/L	Yes
	1,1,2,2-Tetrachloroethane	ug/L	Yes
	1,1,2-Trichloroethane	ug/L	Yes
	1,1-Dichloroethylene	ug/L	Yes
	1,2-Dibromo-3-chloropropane	ug/L	Yes
	1,2-Dichloroethane	ug/L	Yes
	1,2-Dichloropropane	ug/L	Yes
	Alachlor	ug/L	Yes
	Aluminum	mg/L	Yes
	Antimony	ug/L	Yes
	Arsenic	ug/L	Yes
	Atrazine	ug/L	Yes
	Barium	mg/L	Yes
	Barium	ug/ L	Yes
	Benzene	ug/ L	Yes
	Beryllium	ug/ L	Yes
	Bicarbonate	mg/ L	Yes
	Cadmium	ug/ L	Yes
	Calcium	mg/ L	Yes
	Carbofuran	ug/ L	Yes
	Carbon tetrachloride	ug/ L	Yes
	Chloride	mg/ L	Yes
	Dicamba	ug/ L	Yes
	Dinoseb	ug/ L	Yes
	Endrin	ug/ L	Yes
	Fluoride	mg/ L	Yes
	Glyphosate	ug/ L	Yes
	Heptachlor	ug/ L	Yes
	Heptachlor epoxide	ug/ L	Yes
	Magnesium	mg/ L	Yes

Data Type	Parameter	Units	Currently Has Data in DMS
Groundwater Quality (*continued*)	Manganese	ug/ L	Yes
	MBAS	mg/ L	Yes
	Methoxychlor	ug/ L	Yes
	Molinate	ug/ L	Yes
	Nitrate	mg/ L	Yes
	Pentachlorophenol	ug/ L	Yes
	Picloram	ug/ L	Yes
	Potassium	mg/ L	Yes
	Sodium	mg/ L	Yes
	Sulfate	mg/ L	Yes
	Thiobencarb	ug/ L	Yes
	Toxaphene	ug/ L	Yes
	Dissolved Nitrate	mg/ L as N	Yes
	Dissolved Nitrate	mg/ L as NO3	Yes
	1,1-Dichloroethane	TON	Yes
	1,2,4-Trichlorobenzene	ug/L	Yes
	1,2-Dibromoethane (EDB)	ug/L	Yes
	1,3-Dichloropropene (Total)	mg/L	Yes
	1,4-Dichlorobenzene	ug/L	Yes
	2,4,5-TP (Silvex)	ug/L	Yes
	2,4'-D	ug/L	Yes
	Aluminum - Total	ug/L	Yes
	Antimony - Total	ug/L	Yes
	Apparent Color		Yes
	Arsenic - Total	ug/L	Yes
	Atrazine (Aatrex)	ug/L	Yes
	Barium - Total	ug/L	Yes
	Bentazon	ug/L	Yes
	Benzo(a)pyrene	ug/L	Yes
	Beryllium - Total	ug/L	Yes
	Bicarbonate Alkalinity	ug/L	Yes
	Boron - Total	ug/L	Yes
	Cadmium - Total	ug/L	Yes
	Calcium	NTU	Yes
	Calcium - Total	mg/L	Yes
	Carbonate Alkalinity	ug/L	Yes
	Chloride	ug/L	Yes
	Chromium - Total	ug/L	Yes

Data Type	Parameter	Units	Currently Has Data in DMS
Groundwater Quality (*continued*)	Chromium (Total)	pCi/L	Yes
	Chromium (VI)	ug/L	Yes
	cis-1,2-Dichloroethylene	pCi/L	Yes
	Copper - Total	ug/L	Yes
	Cyanide, Total	ug/L	Yes
	Dalapon	ug/L	Yes
	DBCP	ug/L	Yes
	Di(2-ethylhexyl)adipate	ug/L	Yes
	Di(2-Ethylhexyl)phthalate	ug/L	Yes
	Diquat	ug/L	Yes
	EDB	ug/L	Yes
	Endothall	ug/L	Yes
	gamma-BHC (Lindane)	ug/L	Yes
	Hexachlorobenzene	ug/L	Yes
	Hexachlorocyclopentadiene	ug/L	Yes
	Iron - Total	ug/L	Yes
	Lab Turbidity	NTU	Yes
	Lead - Total	ug/L	Yes
	Magnesium - Total	mg/L	Yes
	Manganese - Total	ug/L	Yes
	Mercury - Total	ug/L	Yes
	Nickel - Total	ug/L	Yes
	Nitrate - N	mg/L	Yes
	Nitrate (as N)	mg/L	Yes
	Nitrate (as N)	ug/L	Yes
	Odor Threshold	TON	Yes
	Oxamyl (Vydate)	ug/L	Yes
	pH		Yes
	Potassium - Total	mg/L	Yes
	Radium 228	mg/L	Yes
	Selenium - Total	ug/L	Yes
	Silica - Total	mg/L	Yes
	Silver - Total	ug/L	Yes
	Simazine (Princep)	ug/L	Yes
	Sodium - Total	mg/L	Yes
	Specific Conductance	umhos/cm	Yes
	Specific Conductance	mg/L	Yes
	Strontium - Total	ug/L	Yes

Data Type	Parameter	Units	Currently Has Data in DMS
Groundwater Quality (*continued*)	TDS	mg/L	Yes
	Technical Chlordane	ug/L	Yes
	Thallium - Total	ug/L	Yes
	Total Alkalinity	mg/L	Yes
	Total Hardness	mg/L	Yes
	Total PCBs	ug/L	Yes
	Uranium - Total	ug/L	Yes
	Vanadium - Total	ug/L	Yes
	Zinc - Total	ug/L	Yes
	TDS	tons/acre-foot	Yes
	NO3N	mg/L	Yes
	NO3-N	mg/L	Yes
	Total Nitrate	mg/L as NO3	Yes
	Total Nitrate	mg/L as N	Yes
	1,2-Dichlorobenzene	ug/L	Yes
	Dissolved Nitrate	mg/L	Yes
	Various Parameters	Various	
Surface Water Quality	Various Parameters	Various	
Streamflow	Streamflow	cfs	Yes
Precipitation	Precipitation	inches	Yes
	Reference Evapotranspiration (ETo)	inches	Yes
	Average Air Temperature	Degrees F	Yes

Quality Flags for Measurement Data

The following quality flags are currently configured in the DMS. Please note that this list may change as more data becomes available.

ID	Quality Flag	Associated Data Type
1	Caved or deepened	Groundwater Level
2	Pumping	Groundwater Level
3	Nearby pump operating	Groundwater Level
4	Casing leaking or wet	Groundwater Level
5	Pumped recently	Groundwater Level
6	Air or pressure gauge measurement	Groundwater Level
7	Other	Groundwater Level
8	Recharge or surface water effects near well	Groundwater Level

ID	Quality Flag	Associated Data Type
9	Oil or foreign substance in casing	Groundwater Level
10	Acoustical sounder	Groundwater Level
11	Recently flowing	Groundwater Level
12	Flowing	Groundwater Level
13	Nearby flowing	Groundwater Level
14	Nearby recently flowing	Groundwater Level
15	Measurement Discontinued	Groundwater Level
16	Pump house locked	Groundwater Level
17	Tape hung up	Groundwater Level
18	Can't get tape in casing	Groundwater Level
19	Unable to locate well	Groundwater Level
20	Well has been destroyed	Groundwater Level
21	Special/Other	Groundwater Level
22	Casing leaking or wet	Groundwater Level
23	Temporarily inaccessible	Groundwater Level
24	Dry well	Groundwater Level
25	Flowing artesian well	Groundwater Level
26	Questionable measurement	Groundwater Level
27	No measurement	Groundwater Level
28	Equal to	Groundwater Quality
29	Less than	Groundwater Quality
30	No data	Groundwater Quality
31	Presence verified but not quantified	Groundwater Quality
32	Analyzed for but not detected	Groundwater Quality
33	Approved for publication	Streamflow
34	Value has been estimated	Streamflow
35	Provisional data subject to revision	Streamflow
36	Unspecified	Streamflow
37	Missing	Precipitation
38	Missing or a comparative sensor is severe or sensor is out of service or data is out of sensor threshold	Precipitation
39	Data is far out of historical limits	Precipitation
40	Quality test pending	Precipitation
41	Data is moderately out of historical limits	Precipitation
42	Historical average	Precipitation
43	Special/other	Precipitation
44	Temporarily inaccessible	Precipitation

APPENDIX M: METERING AND TELEMETRY TECHNICAL MEMORANDUM

TECHNICAL MEMORANDUM

PREPARED BY: Kyle Tracy

REVIEWED BY: Mike Matson and Samantha Salvia

DATE: May 9, 2019

RE: GSP Metering

The intent of this technical memorandum is to provide a data collection and network communications framework that can be applied to GSP projects. GSP metering presents multiple challenges that range from access to private property, meter tampering or bypass to access power and communication utilities; all while implementing a metering program that may have high initial establishment costs and recurring operational and maintenance costs. The metering approach described here will address the common issues that will be associated with most GSP data collection sites. In addition, the alternative approaches presented herein will provide flexibility in implementation, while still achieving the goal of collecting the required data.

1. WELL SITE ALTERNATIVES

1.1 Metering Alternatives

A variety of meters are available to measure water flow. However, the type of meter selected will impact on one or more of the following: cost, pressure loss, rangeability, and accuracy. Installation of the meter must also be considered in the selection process. In many cases the meters will be installed on privately owned wells. Each well will have a unique configuration that will present installation challenges. Well site challenges may include:

- Remote location – many wells are located in farming communities and can be located well away from public roadways
- Limited available straight segments of pipe – In many cases the pipe leaving the well head will almost immediately angle back down into the ground leaving very little straight section of pipe to install a flow meter.
- Pipe diameter different between sites – Well sites will have different pipe diameters, which may impact meter type selection.
- Availability of power – Well sites will of course have power available, but that metered power is paid for by the well owner. Therefore, additional metered power service may be required, or an alternative power source (renewable) may be used.

1.2 Meter Selection

The inconsistency between well sites prevents the establishment of a single standard specification for selecting a meter. Therefore, a set of specifications that provides flexibility in the selection of an appropriate meter for the various well configurations is required. The specification must address the variety of pipe diameters, the variety of piping configurations, turndown (rangeability), calibration requirements, other maintenance requirements, and power demand.

In addition to the meter specifications, the installation requirements must also be considered. The following sections illustrate the installation options, categized as either intrusive or passive.

1.2.1 Invasive Installations

An invasive installation is generally defined as an installation process that requires the pipe be breached. These types of meters require that the pipe be cut, and flanges welded to the pipe. Other meters types require a hole drilled into the pipe with a threaded o-let or hot tap welded onto the pipe. Both types require that the well be shutdown for a period of time while the meter is installed.

Beyond the shutdown time, the downside to this type of installation is the requirement to cut into a pipe that is privately owned. In addition, once the pipe has been cut it may move and cause alignment issues.

1.2.2 Passive Installations

A passive installation is defined as an installation that does not require modification to the existing pipe. These types of meters strap onto the outside of the pipe. The meter uses ultrasonic waves transmitted through the water between sensors to calculate the flow rate. However, since the fluid being measured is clean water, an ultrasonic transit time meter is the only type of meter available

An additional passive method for measuring flow may be achieved by monitoring how long the well pump is running. The pump characteristics must be known along with the pump motor operational characteristics. With the pump curve and motor rpm the flow can be interpolated. The accuracy of this method is low and will continue to deteriorate as the pump & motor ages. Additionally, if the motor is controlled by a VFD, the rpm will need to be measured and recorded in addition to the run state of the pump.

1.2.3 Meter Characteristic Matrix

A variety meters are available to measure clean water flow. The characteristics and installation requirements of each meter have a practical impact on its application. For example, a typical orifice plate requires a long straight run of pipe both upstream and downstream. Other characteristics to consider is the pressure loss and installation orientation – some meters work best mounted vertically. The cost can also vary widely, which is driven by accuracy and the type of material used in its construction.

The following matrix provides a quick look at the various characteristics associated with each meter type. The characteristics included in this table are typical for each type of meter. Actual characteristics vary by manufacturer. The cells highlighted with red text indicate a negative factor that could eliminate the meter type from further consideration.

Table 1: Meter Characteristics Matrix

Meter Type	Installation Type	Rangeability* (typ)	Permanent Pressure Loss **	Pipe Diameter Range (in)	Pipe Diameters (Up / Down)	Calibration / Maintenance ***	Cost$
Orifice	Invasive	4:1	Medium	0.5 - 72	22 / 8	Low	Low
Target	Invasive	10:1	Medium	>= 0.5	1 / 1	High	Low
Venturi	Invasive	4:1	Low	>= 2	Spool	Low	High
Pitot (Annubar)	Invasive	3:1	Very Low	>= 1	8 / 1	Low	Medium
Elbow	Invasive	3:1 (low accuracy)	Very Low	>= 2	N/A	Low	Medium
Magmeter	Invasive	40:1	None	0.1 – 72	5 / 2	Low	High

Meter Type	Installation Type	Rangeability* (typ)	Permanent Pressure Loss **	Pipe Diameter Range (in)	Pipe Diameters (Up / Down)	Calibration / Maintenance ***	Cost$
Insertion Magmeter	Invasive	100:1	Very Low	2 – 120	5 / 2	Low	High
Turbine	Invasive	10:1	High	0.25 - 24	10 / 5	High	Medium
Ultrasonic Time of Flight	Passive	20:1	None	>= 0.5	1 / 1	Low	High
Rotameter	Invasive	10:1	Medium	<= 3	Vertical	Low	Medium
PD Meter	Invasive	10:1	Very High	< 12	1 / 1	High	High
Vortex	Invasive	10:1	Medium	1.5 – 16	15 / 5	Low	Very High
Mass Coriolis	Invasive	10:1	Low	0.25 – 6	Vertical	Low	Very High
Mass Thermal	Invasive	10:1	Low	>= 0.5	N/A	Low	High

Matrix data obtained from multiple sources and is intended to show relative values on a macro level. Actual values will vary by manufacture.

* The Rangeability (or Turndown) value presented is typical for the type of instrument. Actual Rangeability will vary by manufacturer.

** Relative Permanent Pressure can range from very low <0.1 psi to very high >14 psi and can vary by manufacturer

*** Calibration and Maintenance: Low – Requires little to no maintenance and/or infrequent calibration; High – Requires frequent calibration and/or mechanical components may create additional maintenance.

$ Cost: Low – $600 to $2000, Medium – $2,000 to $4,000, High – $5000 to $10,000, Very High – $10,000+

The ideal meter for this type of installation would be the ultrasonic time of flight flow meter. Installation of the meter does not involve breaching the pipe, the meter is highly accurate, and requires relatively short lengths of pipe for installation. In addition, the meter is capable of storing flow data and internally totalizing the flow, and can communicate that information to an external device. It should be noted that older piping with scaling, pitting, or heavy corrosion may create issues for this technology. Additionally, external coatings and internal liners may also be challenging for this technology. However, a handheld meter can be easily strapped onto the pipe and tested during the initial site investigation to aid in making a final meter type selection for the specific installation.

Alternative meter types include the traditional magmeter, insertion magmeter, turbine meter, and target flow meter. However, these meters all require breaching the pipe for installation.

- Like the ultrasonic flow meter, the magmeter has no permanent pressure loss and is highly accurate. The meters require little maintenance, but can be expensive, particularly for larger meters.
- The insertion magmeter is less invasive as its installation involves a hot tap and strap-on components, rather than cutting out a segment the pipe. Like the traditional magmeter it is highly accurate, but does have a mild permanent pressure drop.
- Typical revenue water meters are either turbine or positive displacement meters. Turbine meters are used for larger flows and larger diameter pipes, while positive displacement meters are used on residential applications. Turbine meters are accurate, but will introduce a permanent pressure loss and typically require a long straight run of pipe.

- The target meter is a low-cost alternative that is fairly accurate. However, the meter requires onsite calibration and has an average permanent pressure loss.

1.3 Well site data buffer

The electronics associated with most flow meters are capable of totalizing flow and storing the data internally. The data is shared through various means including: 4-20mA signal, pulse, and bus communication (DNP3, MODBUS, etc.). The amount of data that can be buffered in the meter electronics varies by manufacturer.

If the meter electronics are not capable of buffering the flow data, then a Remote Terminal Unit (RTU) or similar device will be required to collect the flow information and store it for forwarding to centralized data storage.

1.4 Well site data transmitter

The data transmitter implemented at the well site will depend on the Network Communications Architecture selected for the system. The data transmitter may be privately operated licensed frequency or public domain frequency radios, cellular data radio, or a landline connection.

Regardless of the communication medium, the radios will be capable of transmitting data using standard communication protocols. Several open standard and proprietary protocols are available. However, the protocols commonly used in the water industry to transmit data between devices include:

- MODBUS – The most common open standard used in the industry. RTU (Serial Communication) and TCP (Ethernet Communication) variants are available.
- DNP3 – A protocol first adopted by the power industry has become widely recognized as a protocol that operates efficiently over wireless connections.

Proprietary protocols may offer performance improvements or additional levels of security, but selecting a proprietary protocol will also require specific hardware that is typically only available from a single manufacture.

2. NETWORK COMMUNICATIONS

Getting the data from the remote well sites can be achieved through multiple methods, and may involve combinations of methods. The methods of communication include:

- Landline (telephone, cable, fiber optic)
- Cellular WVLAN
- Radio Licensed Frequency
- Radio Public Domain Frequency

In rural areas and farming communities the availability of Landline connections will likely be scarce. The infrastructure may be available close to main roadways, but would be expensive to extend to a well site that is more than 100 yards from the Landline infrastructure. Trenching and conduit are the major contributors to the cost of extending the infrastructure. Likewise, Cellular coverage may also be an issue in these remote areas and communities. However, Landline and Cellular communication methods may still be part of the total communications architecture required to move the data from the wells to central data storage.

Privately operated data radios operate either on a radio frequency licensed for use with the FCC, or on a public domain frequency. In either case the data being transmitted will be encrypted for protection from theft. The primary difference is that in the public domain frequencies there is a risk that another user can broadcast on the same frequency, which will degrade the communication throughput or completely disrupt communications. The same interference is possible with a licensed frequency, but since it is licensed the offender can be ordered to stop communicating on that frequency.

2.1 Architecture Alternatives

While each systems network architecture will be unique, the systems will each use components of two general approaches. The Area Collectors approach collects data from nearby wells at a network node that is still remotely in the overall system, but near to more established infrastructure. That Area Collector Node would then transmit the aggregated data to central data storage. The Peer to Central Host approach has the wells reporting directly back to a centralized host that aggregates the data and forwards it to central data storage.

2.1.1 Area Collectors (Private Radio to Cellular/Landline)

The Area Collectors architecture situates private radios at each well site that communicate with a master radio located within line of site of the well at an Area Node. The Area Node will collect data from multiple well sites and locally buffer the data. The buffered data is then periodically transmitted back to the central host via a cellular or landline connection. The Area Collectors method allows data to be collected from remotely located sites that may not have communication infrastructure available. Additionally, this method allows data transmissions to be managed, thereby reducing costs associated with data usage.

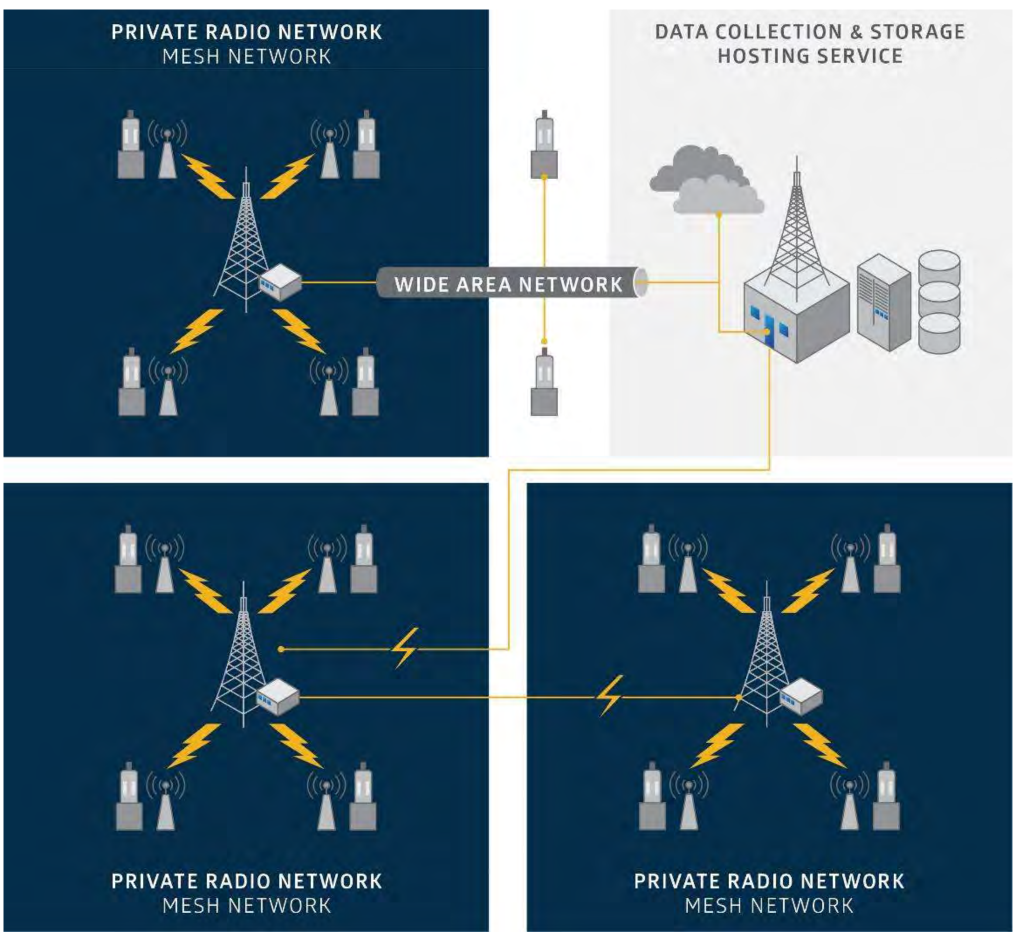


Figure 1 Area Collectors architecture

2.1.2 Peer to Central Host (Private Radio and/or Cellular/Landline to Central Host)

The Peer to Central Host architecture encompasses multiple communication method all reporting to a central host. Since the central host collects data from multiple sources, a more powerful communication processing engine will be required to manage multiple connections. Additionally, data communications will need to be managed at each remote site, and there will be a greater reliance on local data buffering at the remote sites.

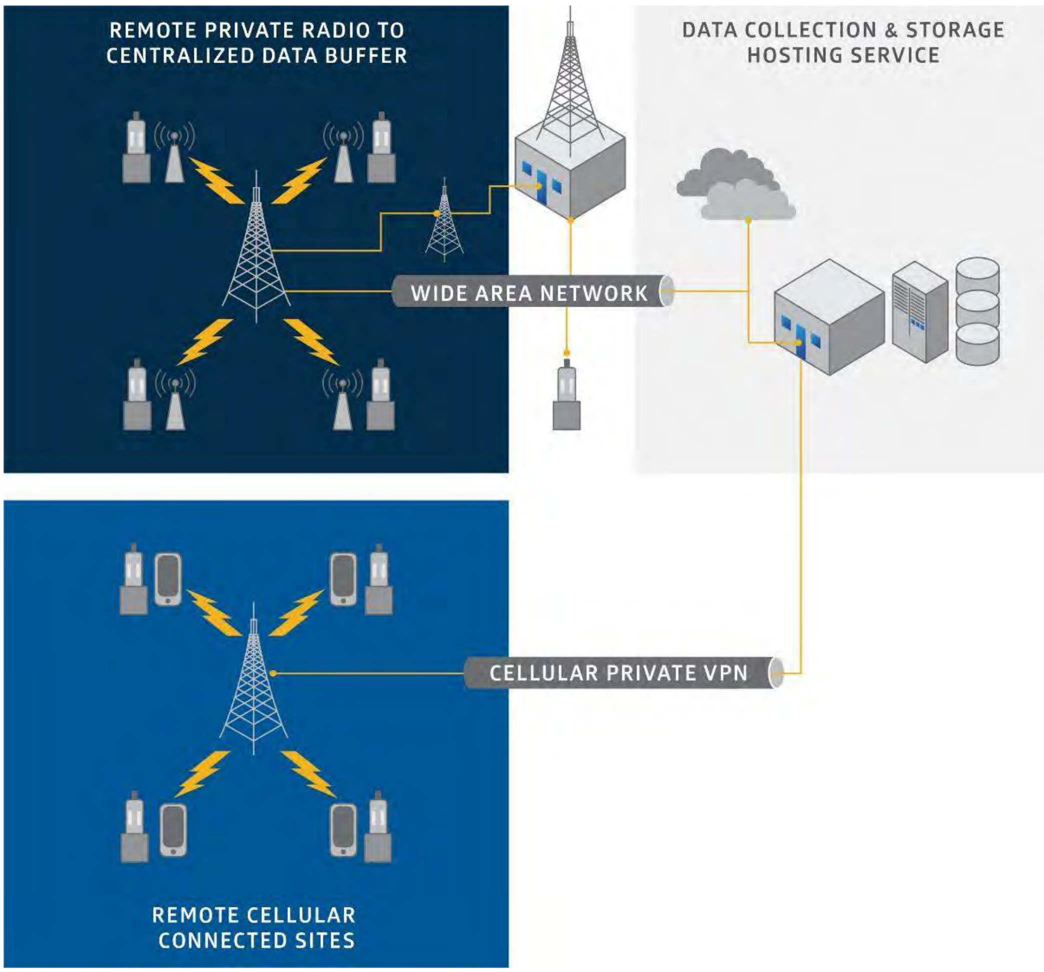


Figure 2 Peer to Central Host architecture

2.1.3 Combined Architecture

The ideal configuration will use a combination of both methods. Geography will be a major factor in the design of the communication architecture, along with the availability of existing communication infrastructure. The selection of a standard communication protocol will also influence the design of the network architecture. MODBUS is a polling communication protocol, which requires sequential managed communication. Whereas DNP3 is capable of both polling and report by exception, which can provide more flexibility in the network architecture, but also requires greater bandwidth.

3. DATA COLLECTION, STORAGE, AND ACCESS

3.1 Central Collection

The data will be received from the remote sites (either directly from the well or from an area node) at a central server. The server, typically a virtual machine with a redundant partner, will translate the received protocol (MODBUS or DNP3) using a software package like Kepware. The Kepware Server is then attached to a SQL server, where the data is collected and stored. At this point the data is available to be moved from the SQL server database to hosted long-term storage where ownership and privacy is managed, while also making the data available for reporting.

The Central Collection may be located either at a District or Interagency headquarters, or may reside in a hosted environment in the cloud. The details of the hosting services are beyond the scope of this technical memo.

4. ESTIMATED COST

A preliminary design will be required in order to establish a reasonable estimate of installation and annual operating costs. Multiple factors contribute to the cost at both the well sites and the overall network communications architecture. The following presents the contributing factors and a range of potential costs:

Well Site Factors:

- Pipe cutting and welding ($800 - $1,600 per well)
- Utility power availability / feasibility of solar or another renewable source
- Access to the well site
- Security, tampering and vandalism prevention
- High-level estimate per well site: $6,000 - $10,000
    - Ultrasonic Time of Travel Flow Meter -- $4,000
    - RTU -- $800
    - Radio -- $1,000
    - Labor -- $1,600

Network Communication Factors:

- Communication infrastructure
- Radio repeater stations
- Cellular data contracts
- Cybersecurity
- High-level network communications estimate (not a hosted service): $3,000 -- $15,000
    - Radio / Network Connectivity -- $3,000
    - Hardware Firewall -- $5,000
    - Labor -- $,5000

Data Collection, Storage, and Access Factors:

- Secure server environment
- Hosting service
- High-level central collection host estimate (not a hosted service): $20,000 -- $27,000
    - Redundant Server Hardware and Virtual Machines -- $10,000
    - Server Software -- $3,000
    - Labor -- $12,000

APPENDIX N: MERCED BASIN GROUNDWATER SUSTAINABILITY STAKEHOLDER ENGAGEMENT STRATEGY

Merced Basin Groundwater Sustainability Stakeholder Engagement Strategy

Prepared for

Merced Irrigation-Urban Groundwater Sustainability Agency

Merced Subbasin Groundwater Sustainability Agency

Turner Island Water District Groundwater Sustainability Agency #1

May 22, 2018 – Updated September 27, 2019

Prepared by

Woodard & Curran

Catalyst

Table of Contents

List of Acronyms

DAC	Disadvantaged Community
DWR	California Department of Water Resources
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
IRWM	Integrated Regional Water Management
MID	Merced Irrigation District
MIUGSA	Merced Irrigation-Urban Groundwater Sustainability Agency
RCD	Resource Conservation District
SDAC	Severely Disadvantaged Community
SGMA	Sustainable Groundwater Management Act
TCP	Trichloropropane
USGS	United States Geological Survey

Merced Subbasin Groundwater Sustainability Stakeholder Engagement Strategy

Overview

California's Groundwater Sustainability Management Act (SGMA) requires that Groundwater Sustainability Plans (GSP) be adopted for the most critical groundwater basins in California. The Merced Groundwater Subbasin was identified by the California Department of Water Resources (DWR) as one of 21 basins in California identified as "critically overdrafted" and one of 48 basins considered high priority.

In accordance with SGMA, water management and land management agencies in Merced Subbasin formed three Groundwater Sustainability Agencies (GSAs):

- Merced Irrigation-Urban Groundwater Sustainability Agency
- Merced Subbasin Groundwater Sustainability Agency
- Turner Island Water District Groundwater Sustainability Agency #1, Turner Island Water District, 1269 W. I Street, Los Banos, CA 93635. (209) 827-7700. GSA Formation Documentation

The GSAs have agreed to develop one GSP for the entire Merced Groundwater Subbasin to be submitted to DWR by January 31, 2020. To develop and implement the GSP, the governing boards of the three GSAs will work together to make decisions necessary to review existing groundwater conditions and develop a plan that supports the long-term sustainability of the Merced Groundwater Subbasin.

Merced Groundwater Subbasin

The Merced Groundwater Subbasin includes the cities of Merced, Atwater, and Livingston, and unincorporated portions of Merced County, including a number of smaller communities, some of which are considered disadvantaged or severely disadvantaged communities (DACs).[1]

The City of Merced serves as the county seat for Merced County and has a population of nearly 80,000. The population is mostly white and Hispanic or Latino, with a mix of African American, Native American, Pacific Islander and an Asian community that includes Hmong, Chinese, Vietnamese, Laotian, Cambodian, Filipino, Thai, Korean, and Asian Indian. The City of Merced is considered a disadvantaged community[2]. Other disadvantaged communities within the Merced Subbasin include Atwater, Bear Creek (Celeste), El Nido, Franklin, Le Grand, Planada, The Grove, Stevinson, Tuttle, and Winton. El Nido, Franklin, and Planada are considered severely disadvantaged.[3]

The Merced Irrigation District (MID) supplies water for agricultural irrigation systems that begin at Lake McClure and divert water to more than 2,000 growers that farm more than 100,000 acres across eastern

---

[1] DWR developed a DAC mapping tool, which is here: https://gis.water.ca.gov/app/dacs/. The County of Merced has also identified disadvantaged communities in the unincorporated portions on the Merced Subbasin.

[2] Disadvantaged Communities are considered those whose median household income less than 80 percent of the Statewide average

[3] Severely Disadvantaged Communities are considered those whose median household income less than 60 percent of the Statewide average.

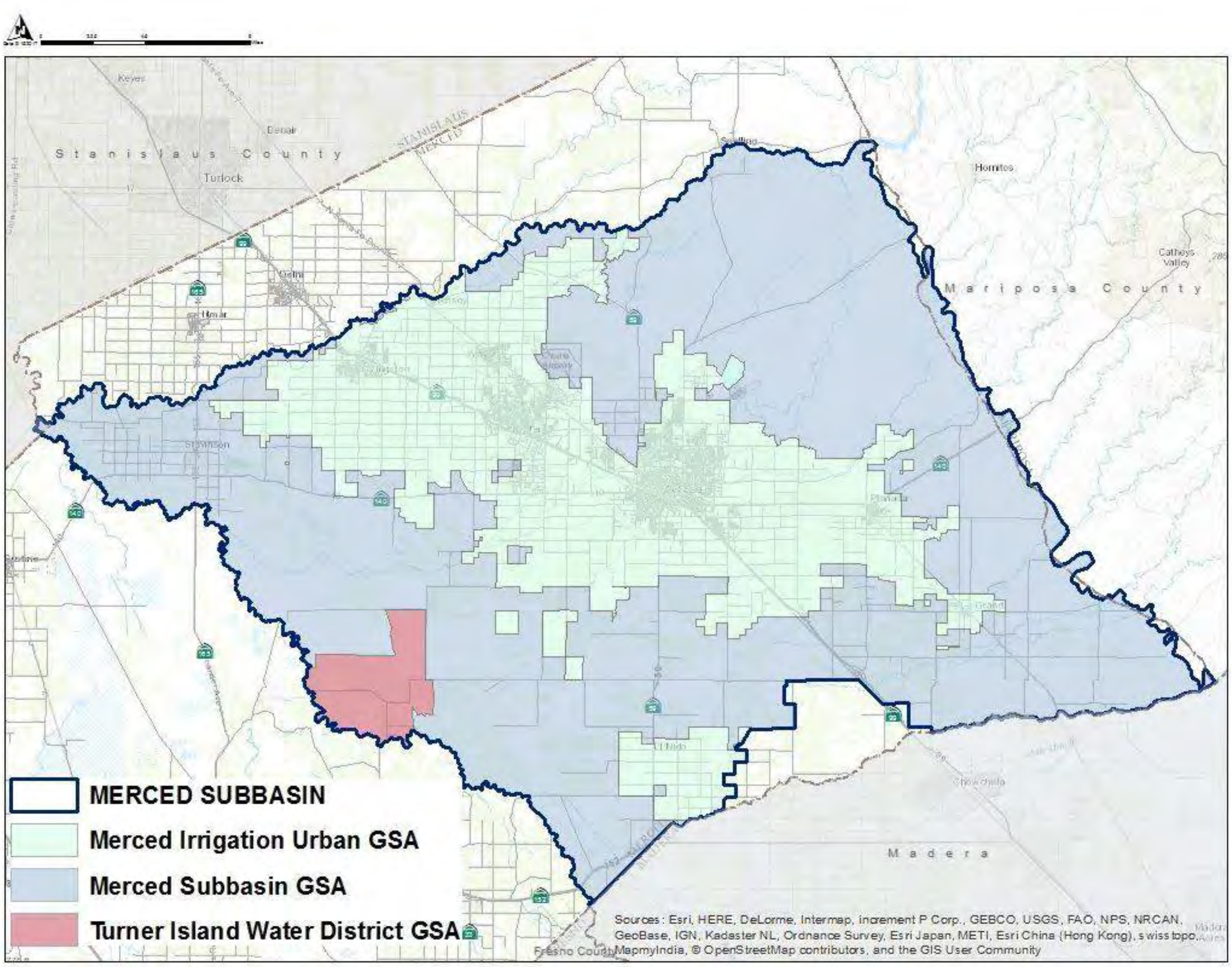
Merced County. The water originates from the Merced River, is stored behind the New Exchequer and McSwain Dams. More than 725 miles of canals and sections of several creeks and sloughs, bring the water to MID customers. MID owns and operates 185 active wells in years of surface water shortage.

The cities of Merced, Livingston, and Atwater pump groundwater and distribute it to residential and business customers in their service areas. Other water districts and companies operating in the Merced Subbasin include:

- Le Grand-Athlone Water District
- Merquin County Water District
- Plainsburg Irrigation District
- Stevinson Water District
- Lone Tree Mutual Water Company
- Sandy Mush Mutual Water Company
- Planada Community Services District
- Le Grande Community Services District

In 2010 in Merced County, U.S. Geological Survey (USGS) data shows that 69% of the water used was surface water and 31% was groundwater. Most of the surface and groundwater was used for agriculture.

Figure 1 Merced Subbasin and Groundwater Sustainability Agencies



Engagement Strategy Goals

The Merced Subbasin Stakeholder Engagement Strategy has been developed to achieve the following goals:

- **Conduct an inclusive outreach and education** process that best supports the success of a well-prepared GSP and that meets SGMA requirements.
- **Offer a comprehensive, transparent outreach and education** process that builds understanding and trust among the various stakeholders.
- **Create a clear, concise, transparent, reliable information flow** with opportunities for public and stakeholder input.
- **Use a *Planning Roadmap*** to align the public engagement opportunities with the development of technical information at key points throughout the project.
- **Evaluate engagement methods** throughout the GSP development and modify as needed.
- **Facilitate effective engagement and communication** to build trust between the various stakeholders and the GSAs.

Key Elements of the Engagement Strategy

Given the importance of groundwater to the continuing economic vitality and public health of the areas served by the Merced Groundwater Subbasin, stakeholder education and input throughout the GSP planning process is essential. This Stakeholder Engagement Strategy has been developed to support the preparation and implementation of a well-informed GSP. The engagement strategy is designed to be flexible and will generally follow the *Planning Roadmap* (See Figure 2, page 8) that aligns public engagement opportunities with the development of technical information throughout the GSP development process.

Roles and Responsibilities

Governing Boards of the Three Groundwater Sustainability Agencies

The governing boards of the three **Groundwater Sustainability Agencies**[4] will work together to oversee the development of the GSP for the entire Merced Subbasin, including overall direction, funding and approval of the GSP. The GSP will be adopted by the governing bodies of the three GSAs. Information about the actions by the governing boards related to the GSP will be posted on the GSP website, at www.mercedsgma.org.

The three GSA governing boards, member agencies, and staff contacts for each of three GSAs are provided in **Appendix A**.

GSP Coordinating Committee

The three GSAs have formed a **Coordinating Committee** comprised of senior staff and governing board members to coordinate GSP planning activities and public outreach. The Coordinating Committee meets the 4th Monday of every month starting at 1:30 pm. Meetings will be noticed at least 48 hours prior to

[4] Merced Irrigation-Urban Groundwater Sustainability Agency, Merced Subbasin Groundwater Sustainability Agency, and Turner Island Water District Groundwater Sustainability Agency #1.

each meeting at www.mercedsgma.org. Meetings are open to the public and include public comment period. Minutes will also be available online.

The Coordinating Committee members are listed in **Appendix A**.

GSP Stakeholder Committee

The **Stakeholder Committee** will be the primary body for providing community input to each of the three GSA Governing Boards and the Coordinating Committee regarding the development of the GSP. The Committee will serve as community representatives to review groundwater conditions, management issues and needs, and projects and management actions to improve groundwater sustainability in the Merced Subbasin. Members also serve as a conduit for engaging stakeholders in the Merced Subbasin and will be invited to participate in GSP outreach activities. The Stakeholder Committee is advisory to the GSA governing boards and is not a decision-making body.

Stakeholder Committee meets the 4th Monday of every month starting at 9:30 am. Meetings will be noticed at www.mercedsgma.org, are open to the public, and include time for public input. Meeting minutes will also be available online.

The Stakeholder Committee members were solicited through a public application process and were approved by the GSA governing boards. The members are listed in **Appendix A**.

Data and Evaluation

The Groundwater Sustainability Plan will be based on data, modeling, and evaluation regarding surface water and groundwater conditions, water uses, and water management options. Public outreach and engagement will be an important element of efforts to collect, review, validate, and refine the data and evaluation that will form the basis of the GSP and future management actions. Throughout the GSP development process, technical information and data will be summarized, simplified, and presented at workshops, online, via email, and in newsletters.

Public Outreach, Education, and Engagement

The GSP planning process includes activities to reach out to organizations and individuals involved in and affected by water management in the Subbasin; to inform and educate them about SGMA, groundwater management, and the GSP planning process; and to solicit and address issues and opportunities to improve groundwater management for the Subbasin.

The three GSA governing bodies will consider stakeholder and public input throughout the GSP development and implementation. The Coordinating Committee will plan and implement the following activities:

- **Develop and maintain notification lists** for the diverse social, cultural, and economic elements of the Merced Subbasin population (see Target Audiences, below). Notification about the GSP process and for public meetings and workshops will be provided through notices (in English and Spanish) available online and emailed to Merced GSP email list, as well as through newspaper display ads and press releases. The notification process will be supported by partner organizations sharing meeting notices with their constituent lists. (see Appendix D).
- **Develop and provide information** regarding SGMA and GSP planning, groundwater management, and Subbasin conditions, and make it available at www.mercedsgma.org
- **Solicit stakeholder and public input** on groundwater analysis and modeling, sustainability goals, project and management actions, and implementation plans.

- **Provide and summarize stakeholder and public input** for the Stakeholder Committee and the three GSA governing bodies throughout the GSP development and implementation.

Project Schedule

The final GSP must be submitted to the California Department of Water Resources in January 31, 2020. The project schedule is designed to solicit, consider, and address public and stakeholder input regarding the important planning elements, including basin conditions, groundwater modeling, sustainability goals, management actions, implementation plan, and draft and final GSP.

Figure 2, page 8, the **GSP Planning Roadmap**, shows a generalized depiction of the schedule for these planning elements and public and stakeholder engagement.

Initial Topics for Stakeholder Input

To support a fair and balanced outreach process and provide inclusive, open pathways for public education and input, it is helpful to identify the key issues of interest to stakeholders as the planning process commences.

Key topics of interest identified to-date include the following:

Planning Process

- With the various involved agencies, including the State, how will surface and groundwater use be accurately depicted for modeling as there are data gaps?
- Identify and plan for the important decision and guidance points in the planning process so that technical analysis, public review comments, and Coordinating Committee recommendations can be provided in timely manner to each of the GSA governing bodies.
- Clarify and plan for how management areas will be defined within the Merced Subbasin, to what degree each management area can define goals and criteria, and how the management areas will be coordinated.
- Establish a common base of understanding about SGMA and the purpose of the GSP.
- Consider how the GSP will relate to, or establish a need to change, the existing county groundwater ordinance.
- How will the GSP address community water supply reliability and quality?
- Consider potential statewide solutions, including improved water trading markets.

Analysis and Evaluation

- There are data gaps regarding groundwater use. Data collection and transparency will be a concern to many landowners. Consider mechanisms for managing private well data.
- Consider and agree on a modeling approach and tool for the Subbasin. There is a lot of variability in groundwater conditions across the Subbasin. The model needs to work for all three GSAs and coordinate with adjacent basins.
- What will the costs (water and financial) for implementation be for communities and farmers?
- How will allocation and management options be developed to reflect differences in surface and ground water access across the Subbasin?

- The monitoring well plan will be important for understanding current conditions and measuring future changes. How will monitoring well locations be identified to be effective for gathering the needed data? How will they be managed?

Education and Outreach

- Contacting and including the interested and affected landowners, groundwater pumpers, and communities in the unincorporated areas outside the boundaries of the Merced Irrigation District will be challenging. The outreach effort should begin immediately to reach out in western, southern, and eastern portions of the Subbasin.
- Use existing forums to inform and engage Municipal Advisory Councils, agriculture and business associations.
- Encourage participation by any persons whose rights may be affected by the GSP development and implementation including but not limited to property rights, surface water and overlying groundwater rights, and the human right to drinking water.
- Translate materials (into languages including but not limited to Spanish) to ensure meaningful participation by stakeholders whose dominant language is not English. Coordinate with Self Help Enterprises to have interpretation services at public meetings.
- Consider informational/educational topics for outreach including:
    - What is SGMA and a GSP?
    - What is a water budget and how does the water modeling work?
    - What is the decision-making process for the GSP?
    - What is the difference between SGMA and IRWM?
    - What is surface water, what is groundwater, how does the subbasin hydrology work?

Outreach Methods

Communication strategies are generally most effective when they are tailored to specific audience-type(s). Targeted materials will be translated into Spanish. Education and outreach will occur throughout the development of the GSP, refer to the **GSP Planning Roadmap** section below.

Here are the general outreach methods and tools envisioned for this project:

1. **Meetings of each of the GSA governing boards** provide an opportunity for formal public comment at decision milestones throughout the GSP planning process.
2. **Coordinating Committee** meetings are also open to the public for questions and input throughout the GSP planning process. Visit http://www.mercedsgma.org for meeting times, agenda, materials, and minutes.
3. Meetings of the **Stakeholder Committee** provide community representatives and other members of the public an opportunity to review and provide input on the elements of the GSP. Meeting are open to the public. Visit http://www.mercedsgma.org for meeting times, agenda, materials, and minutes.
4. **Community Workshops** will provide opportunities for community members and interest groups to learn about, discuss, and comment on the GSP planning process before major decision milestones. Interpretation/translation services at in-person meetings (into languages including but not limited to Spanish) will be provided in communities with substantial non-English speaking populations. Hold workshops in different geographic locations within the Subbasin.

5. The **GSA Website** (www.mercedsgma.org) will house information about SGMA, the GSP process, GSA Governing Boards, Coordinating Committee, Stakeholder Committee, and public meetings, project reports and studies, and groundwater data and information. **Presentation materials** will be posted online. Select Spanish-language information will be included.
6. **Short Articles** will be distributed to local and regional organizations and partners to inform stakeholders about GSP planning, technical issues, and opportunities for participation and review in a simple, clear manner. Organizations may include Merced County Farm Bureau, Merced Chamber of Commerce, and East Merced Resource Conservation District.
7. To share timely information with affected and interested parties, the Coordinating Committee will **engage local and regional organizations and partners** to assist in noticing public meetings and sharing project information. Entities could include Merced County, City of Merced, participating water and irrigation districts, Merced Farm Bureau, Merced Chamber of Commerce, Merced-Mariposa Cattlemen's Association, and others.
8. **Translation of written materials** and interpretation services at in-person meetings (into languages including but not limited to Spanish).
9. Use existing **social media channels** such as Facebook Pages: e.g., Merced County, City of Merced, City of Livingston, and Merced Irrigation District.
10. Engage **news media** representatives at milestones in the GSP process to inform the public and announce opportunities for participation and review.
11. **Key messages** will be developed for use in outreach and education, using compelling, simple, clear **visuals and graphics** to best explain complex technical data.

GSP Planning Roadmap

Using established GSP planning activities, the planning roadmap for stakeholder engagement depicts the relationship of technical studies, decision milestones, and outreach and engagement activities. Figure 2, page 8, the GSP Planning Roadmap shows:

1. Suggested timeline of stakeholder education regarding SGMA and groundwater management issues.
2. Sequencing of education topics and key issues for discussion with GSA Stakeholder Committee, Coordinating Committee, and the three GSA governing boards.

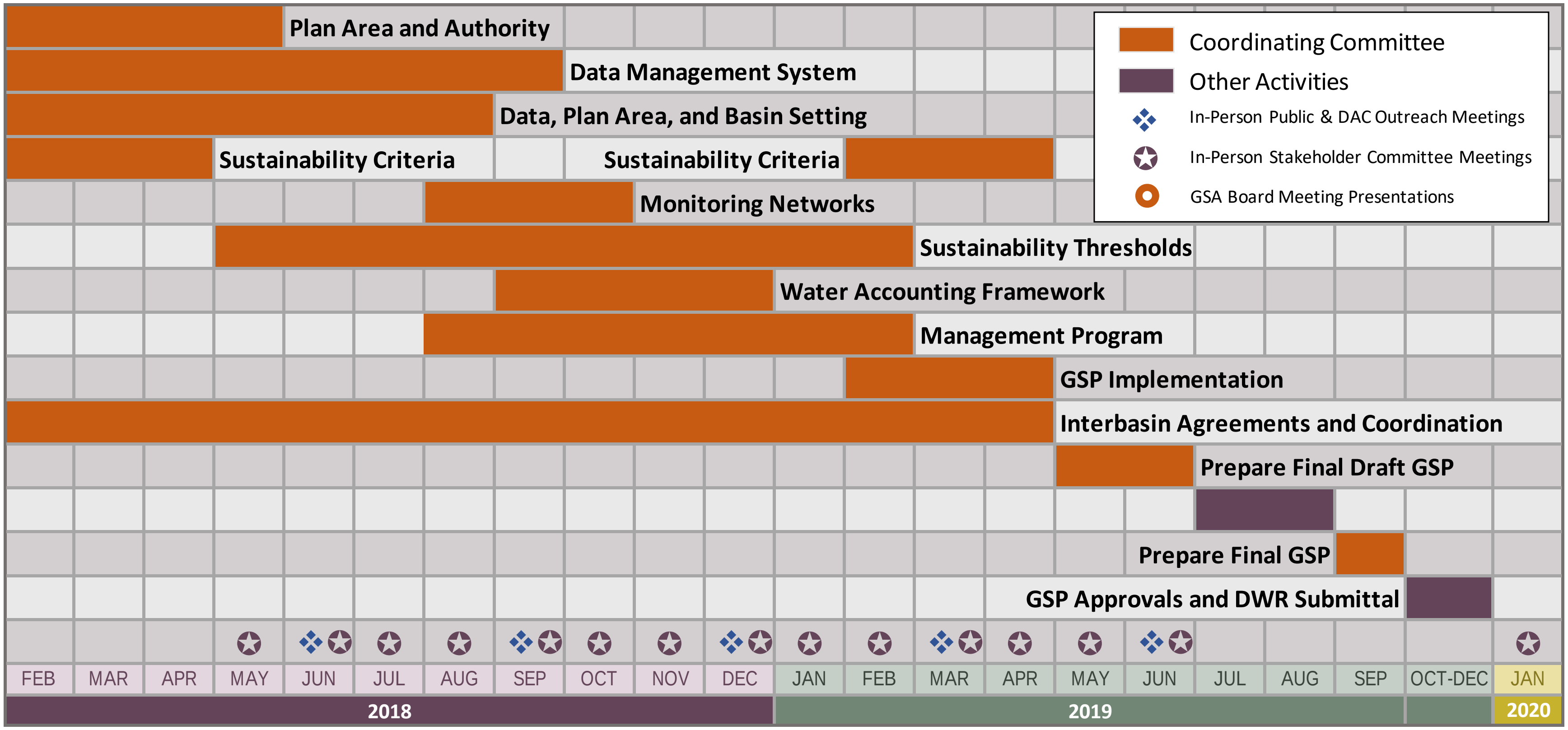
Key Audiences

Knowing the various interested audiences is key to setting a solid course for stakeholder engagement throughout the GSP process. The various interested parties and stakeholders identified to date are listed in **Appendix B**.

According to Water Code section 10723.3, the GSP development process will consider the interests of holders of overlying groundwater rights (including agricultural users and domestic well owners), municipal well operators, public water systems, local land use planning agencies, environmental users of groundwater, surface water users (if there is a connection between surface and groundwater), the federal government, Native American tribes, disadvantaged communities, and other local agencies that were monitoring and managing groundwater usage in the GSP area. Additional relevant stakeholders have also been included.

The Engagement Strategy relies on GSA governing boards, stakeholder committee, and the public to expand the list of interested and affected audiences as the GSP process unfolds.

Figure 2, GSP Planning Roadmap



Attachment A
Merced Subbasin Groundwater Sustainability Agencies

Merced Irrigation-Urban Groundwater Sustainability Agency (MIUGSA)

Member Agencies

- City of Atwater (Municipal)
- City of Livingston (Municipal)
- City of Merced (Municipal)
- Merced Irrigation District (Agriculture and Municipal)
- LeGrand Community Services District (Municipal)
- Planada Community Services District (Municipal)
- Winton Water and Sanitary District (Municipal)

Governing Board

Chair - Hicham Eltal, Merced Irrigation District
Vice Chair – Stephanie Dietz, City of Merced

Staff Contact

Hicham ElTal, heltal@mercedid.org, www.mercedid.org

Merced Subbasin Groundwater Sustainability Agency

Member Agencies

- County of Merced
- County of Mariposa
- Le Grand-Athlone Water District
- Merquin County Water District
- Plainsburg Irrigation District
- Stevinson Water District
- Lone Tree Mutual Water Company
- Sandy Mush Mutual Water Company

Governing Board

- Bob Kelley, Stevinson Water District - Chair
- Nic Marchini, Western White Area Representative - Vice Chair
- Michael Gallo, Eastern White Area Representative
- George Park, Lone Tree Mutual Water Company
- Kole Upton, Le Grand Athlone Water District
- Lloyd Pareira, County of Merced

Staff Contact

Lacey Kiriakou, Merced County, Water Resources Coordinator, lkiriakou@countyofmerced.com.
www.countyofmerced.com/MercedSubbasinGSA

Turner Island Water District Groundwater Sustainability Agency #1

Governing Board

Donald C. Skinner, Chair

Staff Contact

Larry Harris, LHarris@murdoc.com

GSP Coordinating Committee Members

1. Stephanie Dietz, Merced Irrigation-Urban GSA
2. Justin Vinson, Merced Irrigation-Urban GSA
3. Daniel Chavez, Merced Irrigation-Urban GSA
4. Ken Elwin (alternate), Merced Irrigation-Urban GSA
5. Bob Kelley, Merced Subbasin GSA
6. Nic Marchini, Merced Subbasin GSA
7. Mike Gallo, Merced Subbasin GSA
8. George Park (alternate), Merced Subbasin GSA
9. Larry Harris, Turner Island Water District GSA #1
10. Scott Skinner (alternate), Turner Island Water District GSA #1

GSP Stakeholder Committee Members

1. Arlan Thomas, MIDAC
2. Ben Migliazzo, Live Oak Farms
3. Bill Spriggs, City of Merced resident
4. Bob Salles, Leap Carpenter Kemps Insurance
5. Brad Robson, Buchanan Hollow Nut Co. Le Grand-Athlone Water District
6. Breanne Ramos, Executive Director, Merced County Farm Bureau
7. Brian Carter, D&S Farms
8. Carol Bonin, Winton M.A.C.
9. Daniel Machado, Machado Backhoe Inc.
10. Darren Olgwin, McSwain MAC
11. Frenchie Meissonnier, Rice Farmer
12. Galen Miyamoto, Miyamoto Farms
13. Gino Pedretti III, Sandy Mush Mutual Water Company
14. Joe Scoto, Scoto Bros Farms / McSwain Union School District
15. Jean Okuye, East Merced Resource Conservation District
16. Maria Herrera, Self-Help Enterprises
17. Mark Maxwell, University of California, Merced
18. Maxwell Norton, Retired agricultural researcher
19. Parry Klassen, East San Joaquin Water Quality Coalition
20. Rick Drayer, Drayer Ranch
21. Simon Vander Woude, Sandy Mush Mutual Water Company
22. Vacant, City of Livingston resident
23. Vacant, City of Atwater resident

Attachment B - Key Audiences

California Water Code Section 10723.3 Stakeholders

Agricultural Users and Domestic Well Owners

- Groundwater users
- De minimus groundwater users
- Others

Municipal Well Operators and Public Water System Operators

- Le Grand-Athlone Water District
- Merquin County Water District
- Plainsburg Irrigation District
- Stevinson Water District
- Lone Tree Mutual Water Company
- Sandy Mush Mutual Water Company
- California American Water, Meadowbrook District
- Merced Area Groundwater Pool Interests (monitors and reports groundwater elevations in the Merced Subbasin)
- Le Grand Community Services District
- Planada Community Services District

Local Land Use Planning Agencies

- Merced County staff
- Mariposa County staff
- Merced, Atwater, and Livingston town staff
- Neighboring GSA staff

Environmental Groundwater Users

- Merced National Wildlife Refuge, within the San Luis National Wildlife Refuge Complex
- Great Valley Grasslands State Park

Surface Water Users

- Merced Irrigation District (largest agency in the Subbasin with surface water rights)
- Stevinson Water District
- Merquin County Water District

Federal Government Agencies

- U.S. Fish and Wildlife, Merced National Wildlife Refuge
- USDA Natural Resource Conservation Service, Fresno
- USDA, Farm Service Agency
- U.S. Geological Survey, California Water Science Center, Sacramento

Native American Tribes

- None

Disadvantaged and Severely Disadvantaged Communities

- Atwater
- Bear Creek
- Delhi
- El Nido (severely disadvantaged)
- Franklin (severely disadvantaged)
- Hilmar
- Le Grand
- McSwain
- Planada (severely disadvantaged)
- South Merced
- Stevinson
- The Grove
- Tuttle
- Winton

Other State and Local Agencies that Monitor and Manage Groundwater Usage

- Department of Water Resources
- State Water Resources Control Board
- California Department of Fish and Wildlife

Additional Stakeholders

Elected Officials

- Merced County Board of Supervisors
- City Councils: Merced, Atwater, Livingston
- Jim Costa, U.S. Representative, California's Congressional District 16
- Anthony Cannella, California Senate District 12
- Adam Gray, California Assembly District 21

Agricultural Organizations

- Merced County Farm Bureau
- Merced-Mariposa Cattlemen's Association

Municipal Advisory Councils

- McSwain Municipal Advisory Council
- Le Grand Municipal Advisory Council
- Planada Municipal Advisory Council
- Winton Municipal Advisory Council
- Franklin Beachwood Municipal Advisory Council

Colleges and Universities

- University of California Merced

Disadvantaged Community Organizations

- Community Water Center, Laurel Firestone and Debbie Ores
- Clean Water Action, Jennifer Clary
- Leadership Council for Justice and Accountability, Amanda Monaco
- Self Help Enterprises, Maria Herrera and Ilse Lopez-Narvaez
- Neighbors United for a Better South Merced

Business and Community Interests

- Merced Chamber of Commerce
- Merced County Hispanic Chamber of Commerce

Natural Resources Interests/Organizations

- East Merced Resource Conservation District
- Audubon
- River Partners

News Media

- Newspapers: Merced-Sun Star, Atwater Signal,
- Radio: Radio Merced
- TV: Channel 30, Univision based in Fresno

Attachment C
Links to SGMA and Groundwater Information

Department of Water Resources, SGMA: http://www.water.ca.gov/groundwater/sgm/

Department of Water Resources Critically Overdrafted Basins:
http://www.water.ca.gov/groundwater/sgm/cod.cfm

Department of Water Resources, Draft Guidance for GSP Stakeholder Communication and Engagement
http://www.water.ca.gov/groundwater/sgm/pdfs/GD_C&E_Final_2017-06-29.pdf

Department of Water Resources, Stakeholder Communication and Engagement Digital Toolkit
http://www.water.ca.gov/groundwater/sgm/digital_toolkit.cfm

UC Davis Resources re: SGMA: http://groundwater.ucdavis.edu/SGMA/

Union of Concerned Scientists, A Guide to California's Groundwater Sustainability Plans, in English and Spanish: https://www.ucsusa.org/global-warming/ca-and-western-states/groundwater-toolkit#.WnSt5KinFPY

Union of Concerned Scientist, SMGA information: https://www.ucsusa.org/global-warming/regional-information/california-and-western-states/sustainable-groundwater-management-act#.Wne0ga2ZPq0

Community Water Center, Union of Concerned Scientists, Clean Water Fund, Stakeholder Guide for Sustainable Groundwater Management Act Implementation:
https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/52/attachments/original/1438102537/SGMA_Stakeholder_Engagement_White_Paper.pdf?1438102537

USGS, California Water Use: https://ca.water.usgs.gov/water_use/2010-california-water-use.html

Attachment D
Partner Opportunities for GSP Outreach

To assist in best leveraging engagement and educational opportunities for interested parties in the Merced Subbasin area, partnering with local organizations can be very effective. By developing a list of activities and opportunities for outreach occurring in the Merced, Livingston, Atwater areas, we can dovetail these with the Merced Subbasin *Planning Roadmap*. Here are some of the partnership opportunities identified to date.

Greater Merced Chamber of Commerce

http://www.mercedchamber.com

Share Public Workshop notices (English and Spanish) for distribution to members.

Merced County Hispanic Chamber of Commerce

http://www.mercedhcc.com

Share Public Workshop notices (English and Spanish) for distribution to members.

Merced Farm Bureau

https://www.mercedfarmbureau.org

- Share articles and Public Workshop notices (English and Spanish) for distribution to members.

Cattlemen's Association – California and Merced/Mariposa

- Share articles and Public Workshop notices (English and Spanish) for distribution to members.

East Merced Resource Conservation District (RCD)

https://www.eastmercedrcd.org

- Share articles and Public Workshop notices (English and Spanish) for distribution to members.

Merced Irrigation District (MID)

http://www.mercedid.com

- Share press releases and Public Workshop notices (English and Spanish) for distribution to news media and members.

County of Merced

https://www.co.merced.ca.us

- Share press releases and Public Workshop notices (English and Spanish) for distribution to news media and interested party list.

City of Merced

https://www.cityofmerced.org

- Share Public Workshop notices (English and Spanish) for distribution to interested party list.

City of Livingston

- Share Public Workshop notices (English and Spanish) for distribution to interested party list.

City of Atwater

- Share Public Workshop notices (English and Spanish) for distribution to interested party list.

Self Help Enterprises & Leadership Counsel for Justice & Accountability

DWR has contracts with these two organizations to assist GSAs with outreach and engagement with disadvantaged communities in the region. The Coordinating Committee will work with both organizations to expand the outreach to disadvantaged communities in the Merced Subbasin for the GSP.

Attachment E
Stakeholder Committee Application

Merced Groundwater Sustainability

Overview

The Merced Groundwater Subbasin is one of 21 basins in the State of California identified by the California Department of Water Resources as critically overdrafted and one of 48 basins considered high priority. Consistent with the requirements of the Sustainable Groundwater Management Act (SGMA), water management and land management agencies in Merced Subbasin have formed three Groundwater Sustainability Agencies (GSAs): the Merced Irrigation-Urban Groundwater Sustainability Agency, the Merced Subbasin Groundwater Sustainability Agency, and the Turner Island Water District Groundwater Sustainability Agency. The three GSAs are collaborating on developing one Groundwater Sustainability Plan for the entire Merced Groundwater Subbasin by January 2020. To develop the Plan, the GSAs will review groundwater conditions and identify means to ensure the long-term sustainability of the Merced Groundwater Subbasin.

Public Outreach and Engagement

As part of developing the Groundwater Sustainability Plan, the Groundwater Sustainability Agencies will inform and involve interested and affected individuals and organizations (stakeholders) and the general public.

- **Groundwater Sustainability Agencies (GSAs)** - Overall direction, funding, and approval for the groundwater sustainability planning process and work products is provided by the governing boards of the three Groundwater Sustainability Agencies. The final Groundwater Sustainability Plan will be adopted by the elected governing bodies of each these organizations. The GSAs have formed a Coordinating Committee of senior staff and board members to coordinate day-to-day project activities and public outreach.
- **Stakeholder Committee** - The GSAs are seeking community representatives to participate in a Stakeholder Committee to review groundwater conditions, management issues and needs, and projects and management actions to improve sustainability of the groundwater basin. The Stakeholder Committee will advise the GSAs and the governing bodies on these topics. Meetings of the Stakeholder Committee will be noticed and open to the public.

- **Members of the Public** - Public outreach and engagement will consist primarily of open Stakeholder Committee meetings, information and updates to the project website, and public workshops held at important stages of the groundwater sustainability planning process. The GSAs will also provide information briefings to elected officials (City Councils, County Board of Supervisors, and Merced Irrigation District Board of Directors), community organizations, neighborhoods, and others as needed to keep them informed and participating.

Appointing the Stakeholder Committee

The GSAs will appoint individuals representing the broad interests and perspectives in the region to participate on the Stakeholder Committee. Candidates who can work together to help the GSAs and staff develop the Groundwater Sustainability Plan (GSP) will be identified through an application process, which will be publicly announced at meetings of the GSA boards and the member agencies. Stakeholder Committee participants are expected to represent the broad interests and geography of the region. The GSP Coordinating Committee will select the members and alternates for the Stakeholder Committee. The intended makeup of the Stakeholder Committee is 10 to 15 members who represent one or more of the following interests:

- **Groundwater Users**
- **Community / Neighborhood Interests**
- **Flood Management Interests**
- **Agricultural Interests**
- **Other Business Interests (non-agriculture)**
- **Environmental Interests**
- **Other Institutional Interests (e.g. UC Merced, Board of Education)**
- **Disadvantaged Community and Environmental Justice Interests**

The GSAs are seeking individuals who have a demonstrated commitment to community service and civic leadership, prior experience participating constructively on similar task forces and advisory committees, and an understanding of water issues.

Participation in the Stakeholder Committee will require a significant commitment of time and attention. The Stakeholder Committee is expected to meet approximately monthly beginning in April 2018 and complete its work in 2019.

The Stakeholder Committee application is attached.

Merced Groundwater Sustainability Plan (GSP)
Stakeholder Committee
Application for Volunteers

The Groundwater Sustainability Agencies for the Merced Groundwater Subbasin are seeking volunteers to participate on the Stakeholder Committee. Ideal candidates will have a demonstrated commitment to community service and civic leadership, prior experience participating constructively on similar task forces or advisory committees, and an understanding of water issues. Volunteers are expected to make a firm commitment to participate in monthly meetings and review groundwater planning documents and other information during groundwater sustainability planning through 2019. The Stakeholder Committee will be appointed from the pool of applications received. Applications are due by **February 12, 2018** and should be submitted via email to the Merced Subbasin GSAs c/o Samantha Salvia, Woodard & Curran, ssalvia@woodardcurran.com, 415-321-3423.

Name: ____

Organization: ____

Mailing Address: ____

Preferred Phone: (Mobile/Work/Home) ____

Email Address: ____

Disciplines/Perspectives: (check all that apply)

☐ Groundwater Users
☐ Community / Neighborhood Interests
☐ Flood Management Interests
☐ Agricultural Interests
☐ Other Business Interests (non-agricultural)
☐ Environmental Interests
☐ Other Institutional Interests
☐ Disadvantaged Community and Environmental Justice Interests

Relevant Prior Experience (Task Forces, Advisory Committees, water issues):

Additional Comments:

APPENDIX O: PUBLIC COMMENTS AND RESPONSE

Merced GSP Response to Public Comments

The Merced GSP Public Draft was published July 19, 2019 and written comments were collected for a 30-day period ending August 19, 2019. Additional comments were also received at a joint meeting of the three GSA Boards held on September 18, 2019. Comments from the joint boards meeting are documented in the meeting minutes which are included with the comment letters in this Appendix. Individual comments from all letters and the public were reviewed, categorized, and addressed in one of three ways:

Response Type	Response Approach
Minor Corrections/Clarifications	Direct edits to text in GSP
Substantive comments on Draft GSP	Categorized by topic, master response developed for each topic
Comments on future considerations for GSP Implementation	Categorized and compiled for GSA Board consideration and future Coordinating Committee meeting discussion.

For comments that were substantive (not considered "Minor Corrections/Clarifications" or "Comments on future considerations for GSP Implementation"), master responses have been developed and are presented below the summary table below.

Commenter	Corresponding Master Responses
Amsterdam Water District	Demand Management
Audubon California	Stakeholder Outreach, GDEs, Water Budget Development, Allocation Framework, New Project Recommendations, Project-specific recommendations, Project prioritization criteria
Billy Grissom	Management Area, Allocation Framework, Demand Management
California Department of Fish and Wildlife	GDEs, Water Budget Development, GWQ MT/MO Methodology, Justification for using GWLs as proxy for depletion of interconnected surface waters, Allocation Framework
California Poultry Federation	Allocation Framework, Demand Management
Clayton Water District	GWQ MT/MO Methodology
East Turlock Subbasin and West Turlock Subbasin GSA Joint Technical Advisory Committee	(no comments)
Joint Letter from Environmental Organizations: Union of Concerned Scientists, Audubon California, American Rivers, Clean Water Action/Clean Water Fund, The Nature Conservancy	Stakeholder Outreach, Basin Settings, GDEs, Water Budget Development, Water Budget Documentation, Climate Change, Management Area, GWL MT/MO Methodology, GWQ MT/MO Methodology, Depletions of Interconnected Surface Waters, Justification for using GWLs as proxy for depletion of interconnected surface waters, Project prioritization criteria
Joint Self-Help Enterprises and Leadership Counsel Focused Technical Review	Water Budget Development, Water Budget Documentation, GWL MT/MO Methodology, GWQ MT/MO Methodology, New Project Recommendations
Lanny E Seliger	New Project Recommendations

Leadership Counsel for Justice and Accountability	Stakeholder Outreach, Water Budget Development, Water Budget Documentation, GWL MT/MO Methodology, Groundwater storage MT/MO Methodology, GWQ MT/MO Methodology, Subsidence, Depletions of Interconnected Surface Waters, Allocation Framework, New Project Recommendations
Marsha Burch (Valley Land Alliance)	Climate Change, Subsidence, Allocation Framework, New Project Recommendations
Merquin County Water District	Management Area
Nickel Family LLC	Subsidence
Olam Edible Nuts	Allocation Framework, Demand Management
San Joaquin River Exchange Contractors GSA	Water Budget Development, GWL MT/MO Methodology, Groundwater storage MT/MO Methodology, Subsidence
Sandy Mush Mutual Water Co.	Demand Management, Project-specific recommendations
Self-Help Enterprises	Stakeholder Outreach, Basin Settings, Water Budget Documentation, Sustainability Goal, Management Area, GWL MT/MO Methodology, GWQ MT/MO Methodology, Subsidence, Allocation Framework, Demand Management, New Project Recommendations, Project-specific recommendations
The Nature Conservancy	Stakeholder Outreach, Basin Settings, GDEs, Water Budget Documentation, Justification for using GWLs as proxy for depletion of interconnected surface waters, Project-specific recommendations,
US Fish and Wildlife Service	Project-specific recommendations

STAKEHOLDER OUTREACH

Several comments asserted that the outreach efforts for developing the GSP were not sufficient, particularly to environmental interests and disadvantaged communities. Outreach to stakeholders was a priority for the GSAs and was guided by a Stakeholder Engagement Strategy (see Appendix N) developed early in the GSP process and reviewed by the Coordinating and Stakeholder Committees.

Stakeholder and community outreach was conducted throughout the GSP development, primarily through a Stakeholder Committee and community workshops. The Stakeholder Committee consisted of 21 (initially 23) community members representing the diverse groundwater users in the basin including urban, agricultural, and community water systems, disadvantaged communities, individual users, and environmental organizations (see sidebar). The Stakeholder Committee met 16 times, beginning in May 2018, to review the analysis and content of each section of the GSP and provide recommendations to the Coordinating Committee.

Several comments raised concerns about the balance of the Stakeholder Committee representation and inclusion of small communities, drinking water users, and environmental interests.

The composition of the stakeholder committee was determined by the Coordinating Committee with approval of the GSA governing boards. The GSAs conducted a public application process in early 2018 during initiation of the GSP development process. The GSAs sought participants to represent local knowledge of the broad interests and geography of the basin. Specifically the application stated the GSAs were seeking:

- Groundwater Users
- Community / Neighborhood Interests
- Flood Management Interests
- Agricultural Interests
- Other Business Interests (non-agriculture)
- Environmental Interests
- Other Institutional Interests (e.g. UC Merced, Board of Education)
- Disadvantaged Community and Environmental Justice Interests

Stakeholder Committee

1. Arlan Thomas, MIDAC
2. Ben Migliazzo, Live Oak Farms
3. Bill Spriggs, resident (formal mayor, City of Merced
4. Bob Salles, Leap Carpenter Kemps Insurance
5. Brad Robson, Buchanan Hollow Nut Co. and Le Grand-Athlone Water District
6. Breanne Ramos, Merced County Farm Bureau
7. Brian Carter, D&S Farms
8. Carol Bonin, Winton M.A.C.
9. Daniel Machado, Machado Backhoe Inc.
10. Darren Olgwin, McSwain MAC
11. Frenchie Meissonnier, Rice Farmer
12. Galen Miyamoto, Miyamoto Farms
13. Gino Pedretti III, Sandy Mush Mutual Water Company
14. Jean Okuye, East Merced Resource Conservation District
15. Joe Scoto, Scoto Bros Farms / McSwain Union School District
16. Maria Herrera, Self-Help Enterprises
17. Mark Maxwell, UC Merced
18. Maxwell Norton, Retired agricultural researcher
19. Parry Klassen, East San Joaquin Water Quality Coalition
20. Rick Drayer, Drayer Ranch
21. Simon Vander Woude, Sandy Mush Mutual

The Coordinating Committee reviewed applications and selected a 23-member committee intended to include:

- A majority of full and part-time residents in the Merced Subbasin.
- Representation the geographic regions of the Merced Subbasin.
- Representation of the diverse demographics of the Merced Subbasin including both urban and rural groundwater users, varied farming and ranching interests, disadvantaged community representatives, environmental interests, and other representatives of the diversity of the beneficial uses and users of groundwater in the Subbasin.

Self Help Enterprises (SHE) was included on the Stakeholder Committee to represent underrepresented small communities and to identify additional representatives from small, underrepresented communities. To date, no additional representatives have been identified. The community representatives for Atwater and Livingston resigned during GSP development and replacements have not been identified. Atwater is represented on the Coordinating Committee and both cities are parties to the MIUGSA Memorandum of Understanding (as is the City of Merced). Environmental interests were represented through the East Merced RCD. Note that some stakeholders represent multiple interests given their roles in the community. The Stakeholder Committee operated on a consensus basis for discussion and recommendations. This process is appropriate for a committee where some participants may feel they could be out voted by other members. The GSAs will review Stakeholder Committee participation and fill vacancies for the implementation phase.

The GSAs hosted five community workshops through GSP development. These workshops were conducted in communities across the basin in the evening to maximize accessibility for community members (Merced, Planada, Franklin, Livingston, and Atwater). Workshop locations and content were planned in partnership with SHE and Leadership Counsel for Justice and Accountability (LC), both of which have contracts with DWR to assist with outreach for disadvantaged communities. Simultaneous Spanish translation was provided at each workshop by Woodard & Curran or SHE. Each workshop provided background on SGMA, the GSAs, and GSP timeline, as well as specific content on water budget, sustainability criteria, projects and management actions, and implementation, as it was available. In addition, SHE and LC conducted additional workshops in several disadvantaged communities to provide background on SGMA, how to engage with the GSAs, and the GSP issues as they were identified.

Community workshop notices in English and Spanish and news items were distributed to the project contact list, posted on the GSP website, distributed through local government (e.g., City of Livingston and Planada Community Services District) and local organizations (e.g., Merced County Farm Bureau, Chamber of Commerce, and East Merced RCD). In addition, SHE and LC posted and distributed flyers by hand in the communities before workshops. Newspaper ads and press releases also announced community workshops and opportunities to comment on the draft GSP. All information about community workshops and Stakeholder Committee and Coordinating Committee meetings is posted on the GSP website, www.mercedsgma.org. The Stakeholder Engagement Plan provides additional detail on the outreach and communications strategies (see Appendix N).

Several comments suggested continued community outreach during implementation, revisions to the Stakeholder Committee process, and additional representation on the Stakeholder Committee and GSA Boards. The Stakeholder Committee has expressed an explicit interest to continue its review and advice on critical GSP implementation issues. The GSAs are considering Stakeholder Committee representation, timing, and relationship to Coordinating Committee and GSA board decision-making. The GSAs are also considering the outreach activities to be conducted during implementation and are committed to continued stakeholder engagement.

BASIN SETTINGS

Comments on Basin Settings requested more description of shallow groundwater conditions including groundwater level conditions in and around disadvantaged communities and severely disadvantaged communities

(DACs/SDACs). The GSP reflects the information the GSAs currently have on water quality in DAC/SDAC areas. The GSAs understand that a DAC water needs assessment is being conducted under the Integrated Regional Water Management (IRWM) program. The San Joaquin River Funding Area Disadvantaged Community Needs Assessment Report is in draft and the GSAs will incorporate information from the report in their GSP update when it is publicly available.

Comments also included requests for more information about conditions during the drought and the County's tanked water program. The GSP has been revised to include additional information provided by the County on the tanked water program.

Additional information was also requested describing water quality conditions for uranium, a naturally occurring constituent in the Subbasin. The GSP reflects the available data on uranium. The reason spatial and temporal analyses of uranium are not included in the GSP is due to data limitations – there are not enough data points to meaningfully characterize current or historical conditions. While commenters noted that uranium is listed as present in the Data Management System (DMS), there are only 2 data points at 2 locations for uranium. These data were collected by the United States Geological Survey as part of California's Groundwater Ambient Monitoring and Assessment (GAMA) Program, a program created by the State Water Resources Control Board in 2000. The uranium data were collected as part a one-time USGS sampling effort to characterize water quality in California basins. Uranium is not a regularly monitored constituent in the Subbasin.

Additional information was also requested describing the water quality analysis conducted for arsenic. Like all other water quality constituents presented in the Current and Historical Conditions (with the exception of nitrate and salinity), available data through 2012 was analyzed in detail as part of the 2013 Salt and Nutrient Study compiled as part of the Merced Integrated Regional Water Management Plan (IRWMP). Additional information about the source of data and the analysis methodology has been added to the GSP. Data limitations, particularly with respect to depth, are identified as part of the GSP and additional water quality monitoring will be developed to inform the understanding of current water quality conditions, particularly as they pertain to depth and the characterization of the three Principal Aquifers.

The information in Basin Settings reflects the available information for these constituents. Plans for addressing water quality data gaps moving forward are discussed in more detail in the Monitoring and Implementation sections of the GSP. The GSAs plan to request additional state grant funding to address data gaps.

There was also a general comment that applies to a few GSP chapters, requesting that maps be overlaid with the location of DACs, domestic wells, community water system boundaries, city boundaries, and/or other sensitive beneficial users. This comment was considered and it was decided that the additional detail would obscure the information presented. For example, the publicly available locations for domestic wells published by DWR are aligned by township and range and end up creating a matrix of what appear to be evenly spaced dots. This would potentially obscure the information presented in many of the maps. In response to the comment, additional detail was added to Figures 1-8 and 1-9 Non-Domestic and Domestic Wells to show city and community boundaries to provide more context to the reader.

GROUNDWATER DEPENDENT ECOSYSTEMS

Comments on groundwater dependent ecosystems (GDEs) expressed concern that further declines in water level could negatively impact GDEs in the basin. The letters included lengthy comments critical of the methodology used to identify areas likely to be GDEs and suggested changing the methodology to increase the extent of areas assumed to be GDEs and stating that this would make the GSP more protective of GDEs. Specifically, some commenters proposed assuming all Natural Communities Commonly Associated with Groundwater (NCCAGs) are likely GDEs until the GSAs have collected data to prove otherwise.

DWR provides guidance on use of the NCCAG dataset in GSP development, stating that "[t]he Natural Communities dataset is provided by DWR as a reference dataset and potential starting point for the identification of GDEs in groundwater basins. The Natural Communities dataset and its source data can be reviewed by GSAs, stakeholders, and their consultants using local information and experience related to the validity of mapped features and understanding of local surface water hydrology, groundwater conditions, and geology..."[1]

This DWR guidance resulted in the methodology used for this GSP which was to identify likely GDEs in the subbasin by combining the NCCAG database with additional local data and knowledge. The database was a starting point to identify areas dependent on groundwater.

The GSAs considered all beneficial uses in establishing sustainable management criteria including the beneficial use of water for the environment. The relationship between groundwater level, particularly in shallower aquifers, and groundwater dependent ecosystems, is not well understood in the basin. The GDEs in the Subbasin are located within the area of the Corcoran Clay. The Corcoran Clay provides a significant barrier to vertical flow, resulting in pumping below the Corcoran Clay having a limited impact to the open aquifer above the Corcoran Clay including shallow or perched groundwater, and thus a limited impact on GDEs. There is limited information on the relationship between pumping above the Corcoran Clay and groundwater conditions at depth ranges accessed by GDEs. However, the two primary areas where likely GDEs were identified in the basin are areas near surface water where most groundwater is pumped from a deeper aquifer. The vertical separation between the portion of the aquifer being pumped and the shallow groundwater accessed by GDEs limits the impact of pumping on the GDEs. In contrast, many domestic wells are screened at depths similar to, or somewhat shallower than, nearby domestic, agricultural, or municipal wells. Thus, shallow domestic well users were considered the beneficial use most sensitive to groundwater level changes caused by overpumping and were the basis for setting minimum thresholds for groundwater levels. The GSP Implementation chapter identifies additional monitoring of very shallow groundwater conditions near both GDEs and deeper monitoring wells to improve the ability to evaluate these conditions in GSP updates.

Commenters suggested using the GDE Pulse Tool to identify likely GDEs in the basin. The GDE Pulse Tool is a new, free online tool developed by The Nature Conservancy that is designed to enable GSAs to assess changes in GDE health using satellite (35 years of Landsat data), rainfall, and groundwater data. This tool was released in mid-2019 and SGMA deadlines did not allow for the tool to be considered for incorporation into the Merced GSP. The GSP Implementation chapter has been revised to identify the GDE Pulse Tool as a tool to be evaluated for use in the GSP updates.

Shallow groundwater monitoring, particularly in the El Nido area and near the San Joaquin River, is identified as a critical data gap in the GSP. The GSP implementation section has been revised to indicate that new monitoring well sites in areas near likely GDEs should include a very shallow well at the same location, to the extent funding and logistics allow. The GSAs are also requesting additional funding from the state to aid in addressing data gaps through a grant program established by the California Drought, Water, Parks, Climate, Coastal Protection, and Outdoor Access for All Act of 2018 (Proposition 68). A multi-level monitoring well is already planned for installation at the fire station in

[1] DWR, 2018, *Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer.* accessed online at https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf.

El Nido as a result of Sustainable Groundwater Planning Grant Program Round 2 funding by the Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Proposition 1).

Commenters also suggested that the new monitoring well being constructed in El Nido be included as a representative well in the GSP. This is the intent of the GSAs. As additional wells are added to the monitoring network, they will be considered for inclusion as representative monitoring wells based on their ability to contribute to characterization and management of groundwater conditions in the Subbasin. The GSAs are planning to develop a methodology for establishing sustainable management criteria for new wells with no data available for pre-2015 groundwater levels.

WATER BUDGET DEVELOPMENT

Several comments requested clarification of how wetlands/habitat areas were classified and how water demands were developed. Clarifying information has been added to the GSP section on water budgets to describe how applied surface water and applied groundwater, as well as deep percolation, in wetland/habitat areas are aggregated into the other categories already shown in summary tables. It is difficult to disaggregate it because information for demands from private wetlands/habitat areas were not readily available. However, the model was calibrated and validated for consumptive use using remote sensing of evapotranspiration data (METRIC) which is expected to result in a net accurate model result for these aggregated categories, even if the individual wetland components couldn't be tabulated separately. Clarifying information has also been added to the same section describing that the water budget values for urban water demands are based on the best information available provided by water agencies serving the regions. In the three city regions (Atwater, Merced, and Livingston), water demands for all scenarios were based on their respective most recent (2015) Urban Water Management Plans (UWMPs). Water demands for the remaining areas were based on population data (by census tract) multiplied by a per capita usage averaged from the UWMP regions. The projected population growth for non-city regions was also based on an average population growth projected in the UWMPs. It is anticipated that the projected water budget will be refined and updated in future GSPs.

To address model uncertainty, additional information has been added to the water budget section and has been summarized here. All groundwater models contain assumptions and some level of uncertainty. They are decision support tools used to better understand complex interactive systems. Sources of model uncertainty include heterogeneity in hydrogeologic properties and stratigraphy, quality of historical data, projections of future land use, hydrology, and climate. The MercedWRM model has been calibrated and validated. Inputs for GSP related modeling runs used the best available data and science. Projections of future land use and water demands were based on the most recent planning documents prepared by agencies in the basin. The model in its current form represents the best available representation of the basin. As additional information is collected during GSP implementation, the model will be updated to reflect the newly available data. Efforts to address basin data gaps will improve information available for the model. Specific assumptions implemented when modeling future conditions are discussed in Section 2.3.3.3 - Projected Water Budget.

WATER BUDGET DOCUMENTATION

Several commenters noted that MercedWRM (model) documentation was not completed in time for publishing with the Draft GSP. The model documentation was uploaded to the MercedSGMA website on September 17, 2019. The MercedWRM model has been developed for use in the basin over the last five years (since 2014), with additional coordination occurring well beforehand, through an open and transparent process consisting of frequent workshops with Merced Area Groundwater Pool Interests (MAGPI) members and a Technical Workgroup consisting of representatives of the Department of Water Resources, the US Geological Survey, and local agencies.

The model was thoroughly reviewed and calibrated prior to initiating the process of developing the GSP. Additionally, model assumptions and inputs were discussed in the Coordinating Committee and Stakeholder Committee meetings in summer 2018, and stakeholders were able to provide input at that time. In addition, as modeling results were used to inform sustainable management criteria during the development of the GSP, uncertainties in model results were discussed in multiple committee meetings. The GSAs would have preferred to have the full model documentation available, but did not want to delay publishing the draft GSP document while the documentation was being finalized, and believe that the information provided in the GSP itself is sufficient for reviewing the water budgets and the GSP as a whole.

The GSP section on Water Budgets summarizes the major assumptions and data sources for the inputs to each scenario (under historical, current, and projected conditions). The appendix for model documentation largely provides additional technical information used to develop the model (such as aquifer layer definition and boundary conditions) as well as model calibration procedures and results. The majority of the underlying geology and aquifer layer definition is already included in the hydrogeologic conceptual model (HCM) section of the GSP.

Commenters requested additional detail on how urban demands were calculated in general and also how they were reduced for the sustainable yield analysis. To address these requests, additional information has been added to the water budgets section to describe the methodology by which urban demands were calculated, with some example water use rates (in GPCD) added in the list of baseline assumptions. Clarifying text has also been added to explain how urban demands were reduced in conjunction with agricultural demands for the sustainable yield scenario. The methodology for reducing basinwide pumping to estimate sustainable yield was developed solely for the purpose of estimating basinwide sustainable yield and is not intended to prescribe or describe how pumping would actually be reduced in the basin during GSP implementation to achieve sustainability. The implementation of pumping reductions to achieve sustainability will be done by the GSAs and take into account multiple considerations including water right and beneficial uses including the human right to water. The status of plans for implementing management actions related to pumping reductions is further discussed in Projects and Management Actions.

A comment suggested that acres of each land use type should be presented, particularly how historical land use varies over the historical water budget period. This information is presented for historical conditions in the Merced WRM Model Documentation (Appendix D to the GSP) in Figures 13 & 14.

A comment requested time series graphs of water budget results by year. In response to this comment, graphs were added to the GSP section for Water Budgets.

CLIMATE CHANGE

Comments on climate change requested more information on how climate change affects specific elements of the water budget and also expressed support for accounting for climate change in the planning process. As described in Section 2.4 of the GSP, the climate change sensitivity analysis was conducted (per DWR guidance) for 2070 conditions, versus the GSP planning horizon goal of 2040. The results of the climate change sensitivity analysis were used to better understand expected climate change trends and to inform planning. However, the Projected Conditions 2040 baseline was deemed most appropriate for use in analyzing the GSP implementation time period.

In addition to figures already in the GSP that show the results of the climate change water budget, several tables have been added to Section 2.4 in a format similar to the presentation of other water budget results. These tables provide additional detail on how climate change may affect elements of the water budget.

SUSTAINABILITY GOAL

One commenter suggested that degradation of groundwater quality specifically be called out in the text of the sustainability goal and that stakeholder feedback and vision be integrated into an expanded sustainability goal. The Merced Subbasin Sustainability Goal was developed with direction from the Coordinating Committee and succinctly states a goal of “sustainable groundwater management on a long-term average basis” while “avoiding undesirable results", which are defined more specifically in the subsections of the Sustainable Management Criteria chapter for each of the sustainability indicators, including water quality. The Coordinating Committee chose to develop a sustainability goal that was brief and inclusive, rather than to prioritize specific sustainability indicators. The GSAs reviewed the goal as part of considering the public comments and have decided to keep the goal as written and agreed upon by the Coordinating Committee.

MANAGEMENT AREAS

Some comments expressed a desire to create management areas for various regions of the Subbasin, such as the Stevinson area or area near the Bear Creek confluence with San Joaquin River (due to higher groundwater elevations and/or lack of subsidence concerns) or for drinking water systems and communities relying on private wells (e.g. more protective thresholds due to potential community vulnerability).

The GSAs have considered management areas and have concluded that management areas *as defined by SGMA* are not needed in the Merced Subbasin at this time. A management area is defined in SGMA as an "*area within a basin for which the [GSP] may identify different minimum thresholds, measurable objectives, monitoring, or projects and management actions based on differences in water use sector, water source type, geology, aquifer characteristics, or other factors*" [CCR Title 23, Division 2, §351(r)]. The GSAs recognize that the implementation of management actions for the basin may entail identifying different regions with different implementation requirements, but do not believe that formal management areas, as defined by SGMA, with different sustainable management criteria and additional reporting requirements are needed at this time. The GSAs can consider establishing management areas in the future if during the course of GSP implementation it becomes apparent that some areas require a significantly different management approach.

GROUNDWATER LEVEL SUSTAINABLE MANAGEMENT CRITIERIA

Comments on the sustainable management criteria for groundwater levels raised several concerns which are addressed in the paragraphs below.

First, several comments assert that the existing groundwater level minimum thresholds are not adequately protective of drinking water for disadvantaged communities and that there was inadequate consideration of all beneficial uses (such as small community water systems serving DACs or GDEs). Additionally, it was suggested that a single well going dry should be considered significant and unreasonable.

Under the proposed GSP, the basin will be managed to a measurable objective which is based on the groundwater levels needed to achieve the long-term sustainability goal. The minimum threshold is used to define undesirable results and is also the threshold at which state intervention may be triggered if the basin is unable to correct the issue causing undesirable results. The GSAs intend to manage the Subbasin to the measurable objective by monitoring conditions and taking actions if progress toward the measurable objectives is not occurring.

In setting sustainable management criteria for water levels, the GSAs sought to be protective of the most sensitive beneficial users. Because domestic wells are often more shallow than agricultural, industrial, or municipal wells, domestic well users were considered the beneficial use most sensitive to changes in groundwater levels caused by pumping. The minimum threshold for groundwater levels was based on shallowest domestic well depths.

Comments from Self-Help Enterprises and Leadership Counsel incorrectly assert that nearly one-third of all domestic wells in the subbasin were not considered in the establishment of a minimum threshold for chronic lowering of groundwater levels. This appears to be a misinterpretation of the methodology used to set the minimum threshold. The

GSAs intend for the sustainable management criteria for groundwater levels to be protective of all beneficial users in the basin. The first step in setting sustainable management criteria for groundwater levels was to establish a representative well network based on existing wells in the basin that meet the SGMA-defined requirements to be used for monitoring wells (CASGEM status, screening information, etc.). As noted in comments, the well density of the groundwater level monitoring network is within DWR's recommended range and could be improved. The GSAs share a desire to increase basin monitoring (see additional discussion of Monitoring Network in GSP and in master response). The representative network selected for groundwater levels in this GSP is intended to be representative of water level conditions in the basin. The purpose of the monitoring network is not to monitor every unique use or user, but instead to identify a number of representative sites that assist in evaluating the effects and effectiveness of Plan implementation. Therefore, the GSAs do not plan to identify specific users associated with each representative monitoring well, but will continue to work on filling data gaps to make sure the monitoring network achieves its objectives.

Once the representative wells were selected, the elevation of the minimum threshold was determined at each well based on the shallowest depth of nearby domestic wells (nearby defined as a two-mile radius). This two-mile radius was used to set the elevation of the minimum threshold at each representative well. It is not an indication of the limits of which wells are "protected" within the basin. The representative wells are intended to represent groundwater level conditions beyond the two-mile radius. The GSAs believe the sustainable management criteria selected for groundwater levels are protective of beneficial uses, including domestic use, throughout the basin based on available information and existing wells, and acknowledge that additional monitoring wells are desirable. The GSAs are pursuing funding to address data gaps and will develop a methodology to establish sustainable management criteria at new monitoring wells that lack historical data.

In response to comments about presentation of domestic well data used for establishing the minimum threshold, the depth and location of individual domestic wells contained within the Merced County well database are confidential and cannot be published in detail in the GSP.

In response to comments about increasing the elevation of the minimum threshold from the bottom of total construction depth to a value related to the screened interval: there is limited information available on the depths of screened intervals and pump placement within wells. While it is recognized that there may be impacts on pumping if groundwater levels were to approach the bottom of the shallowest well, the impacts are not expected to be significant and unreasonable. Using the constructed depth of the shallowest domestic well for this analysis is considered the best source of data for setting the minimum threshold.

Commenters suggested that any well going dry should be considered an undesirable result. Other comments suggested that the sustainable management criteria for water level should not exclude dry and critically dry years in its definition of undesirable results. DWR guidance states:

> "Undesirable results are one or more of the following effects: Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon. Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods…."[1]

[1] *Best Management Practices for the Sustainable Management of Groundwater, DWR, 2017, page 4.*

The GSAs do not consider a single well going dry an undesirable result that should trigger state intervention in the subbasin. A domestic well going dry would trigger further investigation and efforts to provide drinking water. The GSAs are open to developing a mitigation program for domestic wells that go dry due to lowering groundwater levels during implementation. The GSP states that the GSAs will evaluate development of a mitigation program within the first five years of implementation.

Some commenters questioned the definition of undesirable result requiring a hydrological condition of two consecutive wet, above normal, or below normal years. DWR's guidance states that overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels. Extended dry periods are not reflective of long term average basin conditions and thus the water year type condition was included in the definition of undesirable result. The GSAs intend to manage the Subbasin to the measurable objective by monitoring conditions and taking actions if progress toward the measurable objectives is not occurring. The GSAs reviewed the definition of undesirable result and, based on the State guidance, no changes were made to the definition of undesirable results.

Some commenters questioned whether the sustainable management criteria were protective of environmental beneficial uses. The GSAs intend the measurable objective and minimum threshold to be protective of all beneficial uses, including environmental uses. Areas deemed likely groundwater dependent ecosystems (GDEs) in the basin are in areas of relatively high groundwater levels. More information is needed to develop a comprehensive understanding of the relationship between groundwater levels, deep aquifer pumping, and GDEs in the Subbasin (see more explanation in master response for Groundwater Dependent Ecosystems).

GROUNDWATER STORAGE SUSTAINABLE MANAGEMENT CRITIERIA

Comments were received about the lack of a sustainable management criteria for groundwater storage. The GSAs maintain that due to the volume of water available in storage and the relatively small changes in storage under historical pumping in comparison to the total stored volume, there are no significant and unreasonable effects due to reduced groundwater storage. There are other basins where groundwater storage is a concern separate and distinct from groundwater level. For example, this would include shallow basins where groundwater wells are typically screened to the bottom of the aquifer. In such shallow basins, managing for storage is important as extraction facilities are sensitive to the presence of water, not the depth of water.

This is not the case for the Merced Subbasin. The significant and unreasonable effects in the Merced Subbasin have been related to changes in groundwater level. Concerns about *accessing* groundwater are most appropriately addressed by the groundwater level sustainability indicator.

Further, minimum thresholds and measurable objectives for groundwater storage would need to be measured by groundwater levels as a proxy and would not change the GSP approach because ability to access groundwater and meeting measurable objectives for groundwater levels will still drive basin management. For these reasons, the GSAs find that there is not a need to set separate sustainable management criteria for the groundwater storage sustainability indicator.

GROUNDWATER QUALITY SUSTAINABLE MANAGEMENT CRITIERIA

Comments asserted that the existing sustainable management criteria do not adequately protect drinking water quality, additional minimum thresholds should be established for constituents in addition to salinity, and that there are not enough representative or general water quality monitoring wells.

Salinity was selected by the GSAs based on stakeholder input and the recommendation of the Merced County Division of Environmental Health as the only constituent for which to develop a minimum threshold in the GSP because the causal nexus between salinity concentrations and groundwater management activities has been established. Relatively high salinity groundwater in the basin has been shown to migrate due to groundwater extraction activities. Groundwater management is the only mechanism available to GSAs to implement SGMA, including water quality. Establishing minimum thresholds for constituents that cannot be managed by changing pumping or recharge was deemed inappropriate by the GSAs.

This does not mean that there are not important water quality concerns for the Subbasin. The GSAs recognize importance of protecting drinking water quality. The GSAs also recognize that water quality in the Merced Subbasin is being addressed through various water quality programs (e.g., CV-SALTS and ILRP) and agencies (e.g., RWQCB, EPA) that have the authority and responsibility to address them. The GSAs desire to coordinate with these agencies and their ongoing efforts to avoid duplication of efforts and efficiently use limited resources. The GSAs will abide by any future local restrictions that may be implemented by the agencies or coalitions managing these programs.

The monitoring of water quality constituents is included in ongoing monitoring efforts listed below and will be summarized in future GSP updates. The GSAs have laid out several activities that will be used to coordinate on water quality, including:

- Monthly review of data submitted to the Department of Pesticide Regulation (DPR), Division of Drinking Water (DDW), Department of Toxic Substances Control (EnviroStor), and GeoTracker as part of the Groundwater Ambient Monitoring and Assessment (GAMA) database.
- Quarterly check-ins with existing monitoring programs, such as CV-SALTS and ESJWQC GQTM.
- Annual review of annual monitoring reports prepared by other programs (such as CV-SALTS and ILRP)
- GSAs will invite representative(s) from the Regional Water Quality Control Board, Merced County Division of Environmental Health, and ESJWQC to attend an annual meeting of the GSAs to discuss constituent trends and concerns in the Subbasin in relation to groundwater pumping.
- GSAs will consider potential beneficial and adverse effects on groundwater quality in siting groundwater recharge projects and other management actions.

The purpose of these reviews will be to monitor and summarize the status of constituent concentrations throughout the Subbasin with respect to typical indicators such as applicable MCLs or SMCLs. The Merced Subbasin GSP Annual Report and 5-Year Update will include a summary of the coordination and associated analyses of conditions. The GSP 5-year updates can include evaluation of whether minimum thresholds for additional constituents are needed.

Some comments specifically requested additional monitoring in the communities of Planada, El Nido, and Le Grand. Planada and Le Grand are served by Community Services Districts (CSDs) that conduct regular monitoring of their wells. In fact, when comparing existing monitoring throughout the Merced Groundwater Subbasin, there is disproportionate representation in the DAC areas compared to the surrounding "White" areas. Increased monitoring within the "White" areas could provide a larger benefit to DACs in forecasting water quality trends than installing additional wells directly in a DAC area. This will be evaluated as part of the Data Gap Plan that will be developed in the first year of GSP implementation.

The Planada and Le Grand CSDs conduct routine testing of their groundwater wells as required by state and federal regulations. The 2018 Consumer Confidence Report for the Planada Community Services District indicated the water met state and federal standards for drinking water.

One comment suggested setting a higher salinity minimum threshold for agricultural wells, particularly in the El Nido area where some shallow groundwater exceeds 1,000 mg/l TDS. The GSAs have set minimum thresholds at representative wells in the basin, all of which at this time are domestic wells. In pockets of the Subbasin with elevated TDS (greater than 1,000 mg/L), water use behaviors have already shifted to accommodate these concentrations. For example, agriculture has focused on more salt-tolerant crops, and more saline water supplies are blended with less saline water supplies. As a result, TDS concentrations in excess of 1,000 mg/L where currently experienced are not considered to be undesirable. There is, however, a desire on the part of Subbasin stakeholders to limit increases in salinity in parts of the Subbasin where TDS is below 1,000 mg/L to prevent undesirable results such as requirements to change cropping, blending supplies, etc. Therefore, the GSAs did not make changes to the sustainable management criteria for water quality, but will re-assess sustainable management criteria for water quality in future GSP updates.

The GSAs have identified data gaps in water quality monitoring, specifically with relatively few monitoring wells closer to the San Joaquin River and Mariposa County, as well as many wells used for monitoring not having construction information (for distinguishing below or above the Corcoran Clay).

The plan to fill this data gap includes coordination with Eastern San Joaquin Water Quality Coalition on existing plans to add new wells to the Groundwater Quality Trend Monitoring Plan, as well as a separate effort to obtain additional construction information for at least 20 public water system wells. In addition to the coordination efforts outlined above, the GSAs intend to fill all data gaps and will start by requesting funding to address water quality data gaps through Prop 68.

The GSAs understand that a DAC water needs assessment is being conducted under the IRWM program. The San Joaquin River Funding Area Disadvantaged Community Needs Assessment Report is in draft and the GSAs will incorporate information from the report in their GSP update when it is publicly available.

The GSP's Plan Implementation chapter has been revised to state that projects considered for implementation will be evaluated for potential water quality impacts during the selection and implementation process.

SUBSIDENCE SUSTAINABLE MANAGEMENT CRITIERIA

Comments expressed concern that historical and ongoing subsidence is significant and there have been adverse impacts on infrastructure. Some comments called for defining a measurable objective of zero subsidence, while others called for reducing pumping below the Corcoran Clay or otherwise implementing a more aggressive approach to reducing land subsidence.

The GSAs recognize that subsidence is an area of concern. However, subsidence is a gradual process that takes time to develop and time to halt. Even despite wetter conditions, subsidence in the Merced Subbasin between December 2017 and December 2018 was approximately -0.17 ft/yr and -0.32 ft/yr, depending on the location. Due to the thickness and low permeability of clayey units responsible for subsidence, subsidence may take years or decades to be fully realized after groundwater levels decline. As a result, some level of future subsidence, likely at rates similar to those currently experienced, is likely to be underway already and will not be able to be prevented.

Further, the GSAs recognize the importance of managing pumping volumes below the Corcoran Clay, as this is the depth range believed to be causing subsidence. The understanding of the depth at which subsidence is occurring is identified as a data gap in the GSP. The County of Merced is currently funding a project designed to study the potential impacts of moving pumping from below the Corcoran Clay to above the Corcoran Clay which includes streamlining the process of environmental permitting that is required during this change in pumping. This analysis is intended to facilitate moving pumping while meeting the requirements of Merced County's Groundwater Ordinance and is described further in the Projects and Management Acts section. The Projects and Management Actions section also discusses installation of extensometers or other ground surface monitoring stations to better characterize the magnitude, extent, and depth of subsidence (and help fill identified data gaps) and the relationship of subsidence to groundwater pumping activities. The Merced GSP will continue to coordinate efforts with surrounding subbasins to develop regional or local solutions to subsidence occurring in the Merced, Chowchilla, and Delta-Mendota Subbasins.

The GSAs reviewed the proposed sustainable management criteria for subsidence in response to these comments and are not revising them at this time. The GSAs will reevaluate the sustainable management criteria for subsidence within the next five years. In the meantime, the GSAs intend to continue coordination with neighboring basins on subsidence to better understand subsidence and develop regional and local solutions to help address it. Interferometric Synthetic Aperture Radar (InSAR) data was recently (May 2019) published as part of DWR's SGMA technical assistance program. This satellite data provides high resolution subsidence information for the whole Subbasin. This data will be potentially useful in Annual Reporting in conjunction with existing USBR control points and will be evaluated more thoroughly as part of the GSP 5-year update.

Additionally, one comment requested considering adding El Nido community infrastructure as an example of infrastructure that has the potential to be damaged due to subsidence. This was added to the GSP.

DEPLETIONS OF INTERCONNECTED SURFACE WATERS SUSTAINABLE MANAGEMENT CRITIERIA

Commenters requested documenting the methodology used to determine gaining/losing streams in more detail and also stated that the GSP does not go far enough in considering avoiding or minimizing harm to public resources (e.g. where there is a hydrologic connection between groundwater and a navigable surface water body).

The methodology for determining gaining/losing streams is contained within Section 2.1.3.5.2 – Natural Groundwater Recharge and Discharge. It describes how a MercedWRM historical simulation was used to identify median monthly stream gains and losses to designate gaining or losing streams. Additional text has been added to further clarify the methodology.

As described in the GSP and acknowledged in the GSP regulations, there are significant challenges associated with directly measuring streamflow depletions. Additionally, managing depletions is difficult without direct measurements. The MercedWRM is a fully integrated surface and groundwater flow model developed and calibrated specifically for the Subbasin. The MercedWRM is a necessary and valuable tool for quantifying stream depletions. The GSAs have identified information on depletions of interconnected surface waters as a data gap that can be substantially filled by additional depth-discrete groundwater elevation data near selected rivers and streams. Data from these locations will be used to refine the MercedWRM in the future, resulting in improved estimates of depletions.

USING GROUNDWATER LEVELS AS PROXY FOR DEPLETION OF INTERCONNECTED SURFACE WATERS

Some commenters expressed concern that the justification for using groundwater levels as a proxy for depletion of interconnected surface waters was inadequate. The GSP section on the justification has been updated with additional results from the analysis used to support the justification. Additional information has been added on the level of data certainties related to smaller creeks which are primarily used for conveyance of irrigation water. There are significant challenges associated with directly measuring streamflow depletions. Based on the best information currently available through the use of the MercedWRM, the GSAs have determined that depletions occurring under groundwater level conditions that would cause undesirable results for groundwater levels would not be considered undesirable. Thus, the existing minimum thresholds for groundwater levels can be considered a protective proxy for depletions of interconnected surface waters. This represents the best available information. The GSAs have identified information on depletions of interconnected surface waters as a data gap that can be substantially filled by additional depth-discrete groundwater elevation data near selected rivers and streams.

MONITORING NETWORKS

Several comments raised the issue that there are not enough monitoring locations for any of the sustainability indicators, particularly near vulnerable communities and other groundwater stakeholders. Additional comments suggested considering identification of beneficial users that are associated with each of the existing monitoring wells.

The GSAs agree that the basin would benefit from additional monitoring data. The GSP identifies key data gaps and the GSAs are seeking funding to begin addressing them.

In Chapter 4 (Monitoring Networks), the subsections for each sustainability indicator contain information on Data Gaps and Plan to Fill Data Gaps. These gaps and plans have been summarized below:

- Groundwater Levels
    - Three specific data gaps identified from previous CASGEM planning efforts, plus acknowledgement of general data gap along western edge of Subbasin.
    - The plan to fill data gaps includes adding representative wells in the Above & Below Corcoran Clay Principal Aquifers in the southwesterly portion of the Subbasin, as well as along the northwestern portion of the Subbasin.
- Groundwater Quality
    - Two significant data gaps identified for (1) near San Joaquin River and close to Mariposa County and (2) limited or no well construction information.
    - The plan to fill data gaps includes coordinating with ESJWQC on existing specific plans to add additional wells and obtaining construction information for other wells.
- Subsidence
    - Data gaps include understanding the depth at which subsidence is occurring which will help characterize the relationship between subsidence and groundwater pumping activities.
    - The GSAs will develop a plan to fill identified data gaps through interbasin coordination on additional subsidence monitoring that may include installation of extensometers or other measurement methods to help characterize the magnitude, extent, and depth of subsidence.

Regarding identification of beneficial users per monitoring location: the intent of the SGMA-compliant monitoring network is to demonstrate short-term, seasonal, and long-term trends of the Subbasin as a whole. The intent of the monitoring network is not to monitor every unique use or user, but instead to select a number of representative sites that evaluate the effects and effectiveness of Plan implementation. Therefore, the GSAs do not plan to identify specific users associated with each representative monitoring well, and will continue to work on filling data gaps to make sure the monitoring network achieves its objectives.

ALLOCATION FRAMEWORK

The allocation framework refers to the way in which the sustainable yield of the basin will be shared among users. The GSAs have agreed on some elements of a framework and are continuing to discuss other important aspects of the allocation and how it would be implemented. The allocation framework has been a topic of discussion at the monthly Coordinating Committee and Stakeholder Committee meetings since October 2018. This is one of the most important and challenging aspects of the GSP and it is taking time to develop and reach agreement.

There were numerous comments received on the allocation framework. Comments included the need to consider allocation to non-irrigated lands, fairness of allocation, economics, adaptive management of the allocation in response to undesirable results and droughts, and incentives. There were comments highlighting the need to consider all beneficial users in the basin including managed habitats and environmental uses, domestic users in disadvantaged areas, de minimus users, and range lands. Comments expressed a desire for more information and the opportunity to engage and comment.

The GSP states that the GSAs intend to allocate water to each GSA but have not yet reached agreement on allocations or how they will be implemented. The GSP includes estimates of basin-wide sustainable yield and developed supply for illustrative purposes. The GSP also identifies the following steps in the first five years of the GSP to develop allocations:

- Agreeing upon details of how allocations to each GSA will be established
- Developing, refining, and documenting estimates of developed supply and determining rights to confirmed estimates of developed supply
- Determining how pumping will be measured through metering program or equivalent
- Implementation schedule and timing
- Conducting outreach and communications
- Establishing sustainable allocation trading and crediting rules

The GSP reflects the current state of understanding and agreement between the GSAs. This topic is the subject of ongoing discussions among the GSAs through the Coordinating Committee. The GSAs intend to continue discussion and reach agreement on an allocation framework for the Basin with public input and transparency.

DEMAND MANAGEMENT

Because the basin is in overdraft, there is a recognition that pumping in the basin must be reduced. The GSP includes a specific management action that the Merced Subbasin GSA is planning to implement to reduce pumping within its area. Many of the comments received on demand management were about managing pumping reductions in general and not necessarily specific to Merced's proposed action. Comments included recommendations on timing of implementation – including multiple commenters recommending using the full 20 year implementation period and a commenter recommending implementation be accelerated in the first 10 years. Some comments suggested considerations regarding fee and demand reductions excluding some users (e.g. DAC and SDAC community water systems, de minimus users, etc.) There were comments seeking information about how demand reduction would be implemented during droughts. There were comments encouraging public participation in demand management decisions.

Demand reduction and the allocation framework are related and both are areas of active development for the GSPs. The specifics of demand management are the subject of ongoing discussions by the Coordinating Committee. The information in the GSP reflects the current state of information about the GSAs' plans. The GSAs intend to continue discussion and refinement of each GSA's program with public input and transparency.

NEW PROJECT RECOMMENDATIONS

Several comments recommended new projects for consideration. The projects on the existing list in the GSP were identified through a several month process involving Stakeholder and Coordinating Committees and the general public. This included a public project solicitation. A template for project submission was posted online for the public in September 2018 and provided to the Stakeholder and Coordinating Committees. This project submission template was also advertised during several committee meetings and remains online for public download on the Merced SGMA website. Project information was received from committee members and interested members of the public. This list was discussed and presented during the January and February 2019 committee meetings. Input received from committee members and members of the public was integrated and used to refine the project list into a shortlist of projects for inclusion in the GSP. This shortlist was created based on priorities identified by the public and committee members (see Section 6.3 of the GSP for a detailed list).

Implementation of projects will be an ongoing and live aspect of the GSP and the GSAs are committed to working with both urban and agricultural communities to pursue various tools to achieve sustainability through projects and management actions. The recommended new projects have been documented and will be taken into future consideration during the implementation phase. The GSAs will also continue to work with interested parties and agencies to pursue funding for projects.

PROJECT-SPECIFIC RECOMMENDATIONS

Comments were received on a several specific projects outlined in Chapter 6 of the GSP (Projects and Management Actions). The comments and response to comments are summarized in the table below. In general, the shortlisted projects (coming out of the project prioritization process described in the GSP) are still in the planning phase, with much more work needed to better define them and evaluate potential benefits, costs, and impacts.

Comment	Response
USFWS: Projects 5 and 9 will contribute to increase in groundwater withdrawal at Merced NWR and loss of wetlands in Central Valley	The GSP does not relieve any agency of its commitments. MID responded to USFWS' comment letter specifically regarding these projects with a written response dated 9/4/2019.
Sandy Mush Mutual Water Co: El Nido Improvement Canal project should be reinstated; Merced Subbasin GSA should cost-share with MID on improvements to increase peak capacity downstream of Mariposa Creek	While MID is a member of MIUGSA, MID has discretion over funding and projects allocated for its facilities. GSAs will re-evaluate this project during GSP implementation
Audubon: Evaluate Project 1: Planada Groundwater Recharge Basin Pilot Project, Project 4: Merquin County Water District Recharge Basin, and Project 10: Vander Woude Dairy Offstream Temporary Storage for "water for habitat" benefits	See master response for "Project Prioritization" below.
Self-Help Enterprises: Comments and recommendations pertaining to water quality for recharge and storage projects 4 & 10	These projects are in the planning phase. The GSP Plan Implementation chapter has been updated to state that projects selected for implementation will be evaluated for water quality impacts. CEQA compliance for most projects would also include analysis of water quality and water supply benefits/impacts
Self-Help Enterprises: Confirm that wells associated with Planada GW Recharge Basin Pilot Project and El Nido GW Monitoring Well will be established as representative monitoring wells for GWL and GWQ MTs	This is the intent of the GSAs and part of why funding was sought for these wells. As additional wells are added to the monitoring network, they will be considered for inclusion as representative monitoring wells based on their ability to contribute to characterization and management of groundwater conditions in the Subbasin. The GSAs will be developing a methodology for establishing minimum thresholds at new wells which lack pre-2015 historical data.

PROJECT PRIORITIZATION

One commenter suggested expanding criteria for "project addresses and or prioritizes water for habitat" to read "project addresses and or prioritizes water for habitat and or creates new or sustains existing managed habitat benefits". The existing prioritization criteria was intended to encompass and is consistent with the suggested revision of prioritization description. This change to the text would not alter the results of current or future project prioritization.

A second commenter requested explaining how groundwater recharge projects (#1, #4, and #10) could benefit GDEs and how they will be evaluated. There is limited information at this time to be able to evaluate how those projects could benefit GDEs. As described in the GSP and in earlier comment responses regarding GDEs and depletions of interconnected surface waters, there is uncertainty about identifying and confirming GDEs in the Subbasin. Shallow groundwater monitoring, particularly in the El Nido area and near the San Joaquin River, is identified as a critical data gap in the GSP. It is expected that as more information becomes available and depletions of interconnected surface waters are more understood, then GDEs will be more thoroughly evaluated as part of project prioritization and evaluation. Further, the Projects and Management Actions include evaluation of the GDE Pulse application as a method of assessing GDE or NCCAG health. Future GSP updates may consider this tool or other available information to evaluate project benefits.

PLAN IMPLEMENTATION

Leadership Counsel and Self-Help Enterprises provided comments on the Plan Implementation section of the GSP. The comments requested that the GSP consider using adaptive management to reconsider GSP elements as-needed and not necessarily be tied to the five-year update as required by DWR. The GSAs plan to utilize adaptive management. A full GSP update is a significant undertaking and not something that the GSAs plan to conduct on a rolling or as-needed basis. However, the GSP does envision that water levels, water quality, and subsidence will be monitored and evaluated regularly. The values reported by monitoring do not need to reach minimum thresholds in order to for the GSAs to act. The GSAs will be actively managing to reach the measurable objectives that have been set based on sustainable conditions and drinking water standards. Additionally, the GSAs will have outreach activities and meetings during the implementation phase at which there will be opportunities for seeking and incorporating feedback from the public on an ongoing basis.

Attachments:

1. Comment letters received
2. Meeting Minutes from September 18, 2019 joint board meeting of the three GSA Boards

AMSTERDAM WATER DISTRICT
2941 South State Hwy 59 - Merced, CA 95341
209-829-9914

August 15, 2019

Merced Irrigation District
Attention: Mr. Hicham Eltal
GSP Contact
744 W. 20th St.
Merced, CA 95340
mercedsgma@woodardcurran.com

Dear Mr. Eltal,

Thank you for the opportunity to provide comments on the Draft Merced Subbasin Groundwater Sustainability Plan (GSP) dated July 19, 2019. Implementation of the Sustainable Groundwater Management Act (SGMA) in the Merced Subbasin is of upmost important to Amsterdam Water District (AWD), and the agricultural community in whole. We appreciate the effort your team as put forth.

The landowners within the Amsterdam Water District have been preparing for the implementation of SGMA by: 1) organizing; 2) purchasing out-of-district Merced Irrigation District (MID) surface water when available; 3) conducting a Water Supply Study; and 4) creating a data management plan. In the near future, we would like to partner with MID on a groundwater recharge project.

The GSP describes several demand management tools, including allocations, water markets, fallowing programs, and groundwater extraction fees. We understand there is overdraft and SGMA requires a change in farming practices. Changes in farming practices can't happen overnight so any demand management program that is considered must fully utilize the 20-year transition period from 2020 to 2040.

Once again, we appreciate your efforts thus far and are willing partners moving forward. Please don't hesitate to contact me if you have any questions or comments.

Sincerely,

Bert Crane, Jr.
President, Amsterdam Water District

August 16, 2019

Merced Irrigation District
Attention: Mr. Hicham Eltal
GSP Contact
744 W. 20th St.
Merced, CA 95340
mercedsgma@woodardcurran.com

Dear Mr. Eltal,

I am a landowner in the "White Area" of the Merced Subbasin and have a diversified agricultural operation, including a soil amendment business, beef cattle, and row crop farming. Thank you for the opportunity to provide comments on the Draft Merced Subbasin Groundwater Sustainability Plan (GSP) dated July 19, 2019.

Most of my land is in the southwest corner of the Merced Subbasin, near Grasslands Wildlife Management Area, where Bear Creek and other creeks, sloughs, and other drainages merge with the San Joaquin River. Much of this land floods every year and declining groundwater levels and/or subsidence are not a concern. As such, I believe the Merced Subbasin GSP must create Management Areas.

There are unique groundwater settings throughout the Subbasin, such as a) land subsidence in the El Nido area, b) a cone of depression in the Le Grand area, and c) shallow groundwater in the Stevinson area. These and potentially other concerns, should be managed independently since each is susceptible to unique Undesirable Results and require different management actions. For example, land subsidence is best avoided by reducing pumping below the Corcoran Clay layer. As such, the El Nido area should be managed to encourage recharge and withdrawal from of the upper aquifer and avoidance of deep aquifer pumping. This situation is unique to the El Nido area and it should be managed accordingly. Because of this situation, draft GSPs recently released in adjacent subbasins have created Management Areas with unique Sustainability Management Criteria.

The Draft GSP describes a potential groundwater allocation system where the "sustainable yield" is allocated to landowners. I want to emphasize that *non-irrigated* land receive the same allocation as currently *irrigated* farmland. Owners of non-irrigated land did not create the overdraft situation and their land values shouldn't suffer as a consequence.

The Merced Subbasin is in overdraft by approximately 150,000 AF/Y with the SGMA expectation that the Subbasin will reach sustainability by 2040. As such, any sort of demand management program should recognize the need to slowly transition from overdraft to sustainability during the 20-year implementation period. Hard and fast pumping restrictions would unnecessarily devastate the local economy by not allowing farmers to thoughtfully adjust their practices.

I plan to continue to stay engaged during the preparation of the GSP so please contact me if you would like clarification of my comments.

Sincerely,

Billy Grissom

Billy Grissom
PO Box 951
Hilmar, CA 95324
(209) 723-632-6055

State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Central Region
1234 East Shaw Avenue
Fresno, California 93710
(559) 243-4593
www.wildlife.ca.gov

GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director

August 16, 2019

Via Mail and Electronic Mail

Hicham Eltal
Merced GSP Contact
Merced Subbasin Groundwater Sustainability Agency
744 West 20th Street
Merced, California 95340
mercedsgma@woodardcurran.com

Subject: Comments on the Merced Subbasin Draft Groundwater Sustainability Plan

Dear Mr. Eltal:

The California Department of Fish and Wildlife (Department) Central Region is providing comments on the Merced Subbasin Draft Groundwater Sustainability Plan (GSP) prepared by Merced Subbasin Groundwater Sustainability Agency (Merced Subbasin GSA, MSGSA), Turner Island Water District GSA, and Merced Irrigation-Urban GSA pursuant to the Sustainable Groundwater Management Act (SGMA). As trustee agency for the State's fish and wildlife resources, the Department has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and the habitat necessary for biologically sustainable populations of such species (Fish & Game Code §§ 711.7 and 1802).

Development and implementation of GSPs under SGMA represents a new era of California groundwater management. The Department has an interest in the sustainable management of groundwater, as many sensitive ecosystems and species depend on groundwater and interconnected surface waters. SGMA and its implementing regulations afford ecosystems and species specific statutory and regulatory consideration, including the following as pertinent to Groundwater Sustainability Plans:

- Groundwater Sustainability Plans should identify and consider impacts to groundwater dependent ecosystems pursuant to 23 CCR § 354.16(g) and Water Code § 10727.4(l);

- Groundwater Sustainability Agencies should consider all beneficial uses and users of groundwater, including environmental users of groundwater pursuant to Water Code §10723.2 (e); and Groundwater Sustainability Plans should identify and consider potential effects on all beneficial uses and users of groundwater pursuant to 23 CCR §§ 354.10(a), 354.26(b)(3), 354.28(b)(4), 354.34(b)(2), and 354.34(f)(3);

- Groundwater Sustainability Plans should establish sustainable management criteria that avoid undesirable results within 20 years of the applicable statutory deadline, including depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water pursuant to 23 CCR § 354.22 *et seq.* and Water Code §§ 10721(x)(6) and 10727.2(b) and describe monitoring networks that can identify adverse impacts to beneficial uses of interconnected surface waters pursuant to 23 CCR § 354.34(c)(6)(D); and

- Groundwater Sustainability Plans should account for groundwater extraction for all Water Use Sectors including managed wetlands, managed recharge, and native vegetation pursuant to 23 CCR §§ 351(al) and 354.18(b)(3).

Accordingly, the Department values SGMA groundwater planning that carefully considers and protects groundwater dependent ecosystems and fish and wildlife beneficial uses and users of groundwater and interconnected surface waters.

COMMENT OVERVIEW

The Department supports ecosystem preservation in compliance with SGMA and its implementing regulations based on Department expertise and best available information and science.

The Department recommends the GSP provide additional information and analysis that considers all environmental beneficial uses and users of groundwater in its sustainability management criteria and better characterize or consider surface water-groundwater connectivity. In addition, the Department is providing additional comments and recommendations below.

COMMENTS AND RECOMMENDATIONS

The Department comments are as follows:

1. **Comment #1** (Basin Setting, 2.2.7 Groundwater-Dependent Ecosystems, pp 2-110): GDE identification, pursuant to 23 CCR § 354.16 (g), is based on a limited data set to demonstrate exclusion of risk to ecosystems that may depend on groundwater.

    a. *Issue*: Methods applied to the Natural Communities Commonly Associated with Groundwater (NCCAG) dataset to eliminate potential GDEs are not robust.

i. Depth to Groundwater: The removal of 'areas with a depth to groundwater greater than 30 feet in Spring 2015' relies on a single-point-in-time baseline hydrology, specifically a point in time that is several years into a historic drought when groundwater levels were trending significantly lower due to reduced surface water availability. Exclusion of potential GDEs based on this singular groundwater elevation measurement is questionable because it does not consider representative climate conditions (i.e. seasons and a range of water type years) and it does not account for GDEs that can survive a finite period of time without groundwater access (Naumburg et al. 2005), but that rely on groundwater table recovery periods for long term survival.

ii. Adjacent to Irrigation or Surface Water: The removal of potential GDEs that are 'adjacent to irrigated fields' or 'depending on adjacent losing surface water bodies' does not consider GDE's adaptability and opportunistic nature in accessing water supply.[1] The GSP assumes that these potential GDEs are accessing and primarily dependent on irrigation water or surface water discharges based on proximity to a surface water source, but this assumption is poorly justified and there is no acknowledgement of the potential for shifting reliance between surface and ground water. Additionally, GDEs that are near an *interconnected* surface water bodies may depend on sustained groundwater elevations that stabilize the gradient or rate of loss of surface water; meaning ecosystems near interconnected surface waters may depend on sustainable groundwater elevations. Therefore, it is possible that any of these potential GDEs rely on groundwater during specific seasons or water year types.

b. *Recommendations*:

i. Depth to Groundwater: Develop a hydrologically robust baseline from which to remove 'areas with a depth to groundwater greater than 30 feet' that relies on multiple, climatically representative years of groundwater elevation and that accounts for the inter-seasonal and inter-annual variability of GDE water demand.

---

[1] The Department assumes that potential GDEs removed under this step overlie shallow groundwater, otherwise they would have already been removed during the step of excluding potential GDEs that overlie a depth to groundwater of 30+ feet.

ii. Adjacent to Irrigation or Surface Water: Reevaluate potential GDEs previously removed due to proximity to irrigated lands or a losing surface water body. The Department recommends the GSP be more conservative and all-inclusive until there is evidence that the overlying ecosystem has no significant dependence on groundwater across seasons and water year types. The Department advises that these riparian GDE beneficial users of groundwater and surface water are carefully considered in the analysis of undesirable results and minimum thresholds for depletions of interconnected surface waters.

iii. Include additional references for evaluation: The Department recognizes that NCCAG (Klausmeyer et al. 2018) provided by Department of Water Resources (DWR) is a good starting reference for GDE's; however, the Department recommends the GSP included additional resources for evaluating GDE locations. The Department recommends consulting other references, including but not limited to: California Department of Fish and Wildlife (CDFW) (2019) VegCAMP, CDFW (2019) CNDDB, California Native Plant Society (CNPS) (2019A and 2019B), Klausmeyer et al. (2019), Rohde et al. (2018), The Nature Conservancy (TNC) (2014), U.S. Forest Service (USFS) (2019) CalVeg, U.S. Fish and Wildlife Service (USFWS) (2018) NWI, USFWS (2019), and Witham et al. (2014).

2. **Comment #2** (Basin Setting, 2.3.3.3 Projected Water Budget, starting pp 2-117): The Department is concerned the projected water budget assumptions risk overestimating water availability by not relying on best available information pursuant to 23 CCR § 354.18(e).

   a. *Issue*: Key water budget assumptions, which potentially underscores sustainable yield estimates, risk overestimating water availability. Overestimation of water availability could result in the overallocation of both surface and groundwater water resources, potentially impacting environmental beneficial users. It is recommended the three water budget assumptions include additional best available information that improves sustainable yield allocation. Specifically, the Department is concerned that: 1) the first 25 years of the 'Projected Conditions Baseline' assumes static basin conditions and only considers expected population, land use, and water demand/supply projections starting in 2040, discounting the first 25 years of change; 2) the climate change analysis that predicts a net depletion of aquifer storage is not reflected in the projected water budget; and 3) projected surface water deliveries appear to not reflect anticipated regulatory reductions of surface water deliveries such as those codified in the State Water Resources Control Board Water Quality Control Plan for the Bay Delta: San Joaquin River Flows and Southern Delta Water Quality.

b. *Recommendation*: The Department recommends amending the water budget and sustainable yield to reflect: 1) a refined understanding of changing water demands over the next 25 years; 2) application of climate change estimates; and 3) adjusted, regulatorily-compliant surface water delivery estimates. These adjustments should improve projected water availability and provide a more realistic sustainable yield.

3. **Comment #3** (Sustainable Management Criteria, starting pp 3-1): Sustainable Management Criteria does not appear to protect against undesirable results for fish and wildlife beneficial uses and users of groundwater and interconnected surface waters.

   a. *Issues*:

      i. Proxy Metrics: Before addressing the individual sustainability criteria that are applied to both Groundwater Levels and Depletions of Interconnected Surface Water, the Department does not concur with the use of groundwater elevations as a proxy metric for Depletions of Interconnected Surface Water. The GSP does not provide adequate documentation that a "significant correlation exists between groundwater elevations" [23 CCR § 354.36(b)(1)] and Depletions of Interconnected Surface Water. Instead, the GSP seems to use a circular reference to get to the proxy metric by associating the proposed Groundwater Level minimum threshold with the absence of significant and unreasonable surface water depletions and by claiming that "historical depletions of interconnected surface water in the Subbasin are not considered significant and unreasonable" (GSP pp 3-19, 4th paragraph under Justification of Groundwater Levels a Proxy). The GSP offers few details to substantiate this claim and does not share specifics on the modeling exercise used to determine the insignificance of surface water depletions. Considering the status of surface water allocations and aquatic ecosystems on the Merced River, the Department believes that any surface water depletions attributable to groundwater pumping are likely significant, particularly when contrasted with the benchmark year of 2015, which was the third documented consecutive critical dry year in a drought cycle.

      If a significant correlation is lacking between Groundwater Elevations and Depletions of Interconnected Surface Waters, particularly at the representative monitoring well locations used to track groundwater elevations, then groundwater elevations used as a proxy for surface water depletions may misinform groundwater management activities and poorly predict instream habitat conditions for fish and wildlife species. Accordingly, the Department does not concur that the subsequent application of Groundwater Level sustainable management criteria to Depletions of Interconnected Surface Water is appropriate, as it is not grounded in a quantifiable and site-specific understanding of surface water-groundwater connectivity pursuant to 23 CCR § 354.28 (c)(6)(A).

ii. Undesirable Results: Current Groundwater Level undesirable results do not mention impacts to environmental beneficial users (pp 3-3). Additionally, the method used to identify undesirable results for Groundwater Levels (i.e., minimum threshold exceedances in groundwater elevation) does not account for dry or critically dry years and is applied to the identification of undesirable results for the Depletions of Interconnected Surface Water. The measure of 25% of monitoring wells falling below their minimum thresholds for two consecutive (non-dry) years may have little relevance to accurately identifying undesirable results for Depletions of Interconnected Surface Water. Firstly, the GSP does not provide data that a relationship between representative monitoring wells and depletions of surface waters exists. Secondly, the indicators of undesirable results are tolerant of exceeding minimum thresholds and do not take into account dry water years suggesting undesirable results may be well underway and impacting ecosystems, before they are identified. Effectively, the GSP does not connect identification of undesirable results for Depletions of Interconnected Surface Waters to impacts on surface water beneficial users. Finally, the GSP notes that groundwater levels that fall below the minimum threshold during hydrologically dry or critical years are not considered to be an undesirable result (pp 3-4), which results in no groundwater management actions to mitigate impacts in the most challenging of times for water resources management.

iii. Minimum Thresholds and Measurable Objectives: Minimum thresholds and measurable objectives for Groundwater Levels, and by proxy, for Depletions of Interconnected Surface Waters, are not protective of environmental beneficial uses and users of groundwater. Minimum thresholds allow for a significant decrease of groundwater elevation from 2015 for almost all representative monitoring sites, and measurable objectives are set at projected future average groundwater levels as predicted by the Merced Water Resources Model sustainable yield simulation. These sustainability criteria suggest that: 1) groundwater elevations at representative wells can continue to decrease for the next 20 years from a benchmark date derived several years into a historic drought in a basin already designated *Critically Overdrafted* without witnessing undesirable results (pp 3-9); and 2) measurable objectives for groundwater levels match average groundwater levels necessary to meet sustainable yield (pp 3-7). The Department is concerned that the decline in terrestrial and aquatic groundwater dependent ecosystem health around the 2015 benchmark has already been demonstrated to have impacts to beneficial uses and further groundwater decline will undoubtedly lead to significant impacts for fish and wildlife beneficial uses and users of groundwater and interconnected surface waters under these sustainability criteria. In addition, groundwater levels above the minimum threshold and below the measurable objective (in the margin of operational flexibility), which are acceptable according to the GSP, will not allow the basin to achieve sustainability in the long run.

b. *Recommendation*:

   i. <u>Proxy Metrics</u>: To justify use of groundwater elevations as a proxy metric for Depletions of Interconnected Surface Water, the Department recommends the GSP specify how groundwater elevations are significantly correlated to surface water depletions; and define an expeditious path to identifying the location, quantity, and timing of surface water depletions caused by groundwater use, pursuant to 23 CCR § 354.28(c)(6)(A), to better inform sustainability criteria for Depletions of Interconnected Surface Water.

   ii. <u>Undesirable Results</u>**:** The Department recommends a discussion of Groundwater Level undesirable results for environmental beneficial users of groundwater during dry and critical water years and provide measurable undesirable result indicators for Depletions of Interconnected Surface Waters that are relevant to beneficial users of surface water.

   iii. <u>Minimum Thresholds and Measurable Objectives</u>: Reconsider minimum thresholds and measurable objectives, accounting for undesirable results for fish and wildlife beneficial uses and users of groundwater and interconnected surface water.

4. **Comment #4** (Sustainability Criteria, 3.6 Degraded Water Quality, starting pp 3-10): The Department does not concur that GSP abdicates responsibility for some

constituents by incorrectly claiming no nexus between some contaminants and "increasing or decreasing pumping" (GSP pp 3-12).

a. *Issue*: The GSP states that "GSAs do not have control over the presence of [naturally occurring constituents such as arsenic, uranium, iron, and manganese] in aquifer materials," (GSP pp 3-12) and therefore, the GSP does not set threshold for these constituents claiming "there is no demonstrated local correlation between fluctuations in groundwater elevations and/or flow direction and concentrations of these constituents at wells." Conversely, over-pumping of aquifers has the potential for clay layers to compress and release dissolved arsenic, as well as high rates of pumping in deep wells drawdown shallow water, resulting in an increase of dissolved uranium in extracted water (Fendor et al. 2019). Thus, pumping actions can affect the presence, movement, and concentration of naturally occurring constituents in groundwater. The GSP cites arsenic and uranium as the primary naturally occurring constituents of concern (GSP pp 2-76).

b. *Recommendation*: Establish a plan to investigate the relationship between groundwater pumping and the presence, movement, and concentration of arsenic and uranium in the Merced Subbasin and develop sustainability criteria accordingly for these constituents by the first 5-year plan update in 2025.

5. **Comment #5** (Monitoring Networks, starting pp 4-1): Shallow groundwater monitoring wells are lacking.

    a. *Issue*: The current monitoring network lacks a representative distribution of shallow groundwater monitoring wells sufficient to monitor impacts to environmental beneficial uses and users of groundwater pursuant to 23 CCR § 354.34(2). Few monitoring wells are near interconnected surface waters or concentrated GDEs; and therefore, there are few data points on shallow groundwater level trends that are important to understanding groundwater management impacts on fish and wildlife beneficial uses and users of groundwater, including GDEs and interconnected surface water habitats.

    b. *Recommendation*: The Department recommends a plan to install additional shallow groundwater monitoring wells near GDEs and interconnected surface waters, potentially to be paired with streamflow gauges for improved understanding of surface water-groundwater interconnectivity.

6. **Comment #6** (Project and Management Actions, 6.2.2 Merced Subbasin GSA Groundwater Demand Reduction Management Actions, starting pp 6-5): Demand reduction management actions lack specificity critical to timely implementation and sustainability goal achievement.

   a. *Issue*: The Department understands development of sustainable yield allocations within 5 years of implementation will result in the quantification of demand reduction requirements for distinct responsible parties. However, in contrast to supply augmentation project and management actions, demand reduction management actions lack implementation details. This lack of specificity on how demand will be managed may lead to deprioritization or delayed implementation of demand management actions, which can undermine a basin's ability to achieve sustainably goals.

   b. *Recommendation*: The Department recommends including specific measures for initiating demand reduction on an earlier timeline in the Merced Subbasin to account for groundwater pumping lag impacts, implementation challenges, and scaled ramping-down of groundwater use that is a necessary ingredient in San Joaquin Valley long-term groundwater sustainability.

CONCLUSION

In conclusion, the Merced Subbasin Draft GSP needs to address all SGMA statutes and regulations, and the Department recommends the GSP seriously consider fish and wildlife beneficial uses and interconnected surface waters. The Department recommends that the MSGSA consider the above comments before the GSP is submitted to the Department of Water Resources (DWR). The Department appreciates the opportunity to provide comments on the Merced Subbasin Draft GSP. If you have any further questions, please contact Dr. Andrew Gordus at Andy.Gordus@wildlife.ca.gov or (559) 243-4014 x 239.

Sincerely,

Julie A. Vance
Regional Manager, Central Region

Enclosures (Literature Cited)

ec: **California Department of Fish and Wildlife**

Joshua Grover, Branch Chief
Water Branch
Joshua.Grover@wildlife.ca.gov

Robert Holmes, Environmental Program Manager
Statewide Water Planning Program
Robert.Holmes@wildlife.ca.gov

Briana Seapy, Statewide SGMA Coordinator
Groundwater Program
Briana.Seapy@wildlife.ca.gov

Annee Ferranti, Environmental Program Manager
Central Region
Annee.Ferranti@wildlife.ca.gov

Andy Gordus, Staff Toxicologist
Central Region
Andy.Gordus@wildlife.ca.gov

Annette Tenneboe, Senior Environmental Scientist
Central Region
Annette.Tenneboe@wildlife.ca.gov

California Department of Water Resources

Craig Altare, Supervising Engineering Geologist
Sustainable Groundwater Management Program
Craig.Altare@water.ca.gov

Amanda Peisch-Derby, Merced Subbasin SGMA Point of Contact
South Central Region Office
Amanda.Peisch@water.ca.gov

National Marine Fisheries Service

Rick Rogers, Fish Biologist
West Coast Region
Rick.Rogers@noaa.gov

Erin Strange, San Joaquin River Branch Lead
West Coast Region
Erin.Strange@noaa.gov

U.S. Fish and Wildlife Service
San Luis National Wildlife Refuge Complex

Kim Forrest, Refuge Manager
kim_forrest@fws.gov

State Water Resources Control Board

James Nachbaur, Director
Office of Research, Planning & Performance
James.Nachbaur@waterboards.ca.gov

Literature Cited

California Department of Fish and Wildlife (CDFW). 2019. Vegetation Classification and Mapping Program. Available from https://www.wildlife.ca.gov/Data/VegCAMP

California Department of Fish and Wildlife. 2019. CNDDB (California Natural Diversity Database). Rarefind Version 5. Internet Application. CDFW, Sacramento, California. https://www.wildlife.ca.gov/Data/CNDDB/Maps-and-Data

California Native Plant Society (CNPS). 2019A. A Manual of California Vegetation, online edition. http://www.cnps.org/cnps/vegetation/.

California Native Plant Society (CNPS). 2019B. California Protected Areas Database. (CPAD). Sacramento, California. https://www.calands.org/cpad/

Fendor, S., A. Sherris, A. Hamann, and A. Wells. 2019. Groundwater quality in the Sustainable Groundwater Management Act (SGMA). Community Water Center. Sacramento, California. www.communitywatercenter.org.

Naumburg E, R. Mata-Gonzalez, R.G. Hunter, T. McLendon and D. Martin. 2005. Phreatophytic vegetation and groundwater fluctuations: a review of current research and application of ecosystem response modeling with an emphasis on great basin vegetation. *Environmental Management.* 35(6):726-40.

Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, and A. Lyons. 2018. Mapping indicators of groundwater dependent ecosystems in California. https://data.ca.gov/dataset/natural-communities-commonly-associated-groundwater

Klausmeyer, K. R., T. Biswas, M. M. Rohde, F. Schuetzenmeister, N. Rindlaub, and J. K. Howard. 2019. GDE pulse: taking the pulse of groundwater dependent ecosystems with satellite data. San Francisco, California. Available at https://gde.codefornature.org (Same as:TNC. 2019. GDE pulse. Interactive map. Website. https://gde.codefornature.org/#/home

Rohde, M. M., S. Matsumoto, J. Howard, S. Liu, L. Riege, and E. J. Remson. 2018. Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans. The Nature Conservancy, San Francisco, California.

TNC (The Nature Conservancy). 2014. Groundwater and stream interaction in California's Central Valley: insights for sustainable groundwater management. Prepared by RMC Water and Environment.

U. S. Forest Service. 2019. Landsat-based classification and assessment of visible ecological groupings, USDA Forest Service (March 2007). https://www.fs.fed.us/r5/rsl/projects/classification/system.shtml

USFWS (U.S. Fish and Wildlife Service). 2018. National Wetlands Inventory website. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. http://www.fws.gov/wetlands/

USFWS. 2019. Threatened & Endangered Species Active Critical Habitat Report: online mapping tool. https://fws.maps.arcgis.com/home/webmap/viewer.html?webmap=9d8de5e265ad4fe09893cf75b8dbfb77

Witham, C. W., R. F. Holland, and J. E. Vollmar. 2014. Changes in the Distribution of Great Valley Vernal Pool Habitats from 2005 to 2012. Prepared for CVPIA Habitat Restoration Program, U.S. Fish and Wildlife Service, Sacramento, CA. USFWS Grant Agreement No.F11AP00169 with Vollmar Natural Lands Consulting. October 14.

California Poultry FEDERATION
4640 Spyres Way, Suite 4 | Modesto, CA 95356 | Phone: (209) 576-6355 | Fax: (209) 576-6119 | www.cpif.org

VIA E-MAIL

August 15, 2019

Hicham Eltal
Merced GSP Contact
Merced Irrigation District
744 W. 20th Street
Merced, California 95340
c/o mercedsgma@woodardcurran.com

Dear Mr. Eltal:

The California Poultry Federation ("CPF") is pleased to submit these comments on the draft Merced Groundwater Subbasin Groundwater Sustainability Plan (hereinafter the "Draft GSP"). CPF represents all parts of the poultry industry, including growers, hatchers, breeders, and processors working with chickens, turkeys, ducks, and game birds. For all those segments, water is essential for nutrition as well as maintaining safe and sanitary conditions. CPF therefore encourages effective measures to assure reliable water supplies.

In this regard, CPF supports the emphasis in the Draft GSP on augmenting yield and increasing recharge. Such measures are essential for avoiding the undesirable result of groundwater elevations being too low to satisfy beneficial uses. We believe the Merced Subbasin's Groundwater Sustainability Agencies ("GSAs") must continue identifying and implementing additional measures to increase water supplies.

We appreciate the burden to GSAs of developing sustainability plans that address the many requirements of the Sustainable Groundwater Management Act. But at the same time, CPF is concerned about those facets of the Draft GSP that have been deferred to a later date. These include the allocation among the GSAs and plans for any specific demand reduction measure to be taken. The Draft GSP does not assess the pros and cons of the various alternatives under consideration for these important additions. It is critical for the GSAs to do so, giving particular attention to the likely success of measures to increase water supplies as well as the costs that demand reduction measures would impose on all beneficial users and surrounding communities. Particularly concerning is the Draft GSP text (at 6-6) that "[t]he development of the demand reduction program *may* include outreach and feedback from stakeholders and MSGSA member agencies." Public participation is indispensable to the GSP process, and the public must be given adequate time to review and submit written comments on any proposed demand reduction measures. CPF looks forward to those opportunities.

CPF appreciates your consideration of these comments. Please contact me if you need any additional information.

Very truly yours,

Bill Mattos

Bill Mattos
President

Clayton Water District
Comments on GSP

<u>Merced GSP Comments</u>

1. Water Quality thresholds – Threshold is set at 1,000mg/L, which is lower than the current actual water quality for many ag wells in the El Nido area. Many of the shallow wells in this area have been out of compliance for dozens of years using this standard, approximately at 1,500 mg/L. Obviously, drinking water quality needs to be at a much higher standard, but domestic wells in the area are in the lower aquifer, where the 1000 mg/L threshold is achievable.

   If the language could be changed to state that the water quality threshold is 1,000 mg/L, or the current level + 20% for ag wells, this is more realistic. By the way, this is what is stated in the Chowchilla Subbasin GSP.

Contact: Julia Berry
Juliaberry@sbcglobal.net

TURLOCK GROUNDWATER

August 19, 2019

Electronic Submittal via E-Mail

Mr. Hicham Eltal
Merced Irrigation District
744 W. 20th Street
Merced CA 95340

Subject: Comments on the Merced Subbasin's Draft Groundwater Sustainability Plan

Dear Mr. Eltal:

The East Turlock Subbasin and West Turlock Subbasin groundwater sustainability agencies (GSA) Joint Technical Advisory Committee (TAC) thanks you for the opportunity to comment on the Merced Subbasin Draft Groundwater Sustainability Plan (GSP).

We offer no specific comments at this time. We understand there remains opportunity to comment on the GSP before fall adoption hearings, and there remains potential for more coordination and refined comments until such time.

As an adjacent Subbasin to the Merced Subbasin, we look forward to continuing to coordinate with the Merced Subbasin GSAs as we continue to build upon our knowledge and understanding of the Subbasins while we continue to develop, refine and implement our GSPs to achieve sustainability within the region. Interbasin coordination will continue to be a vital part of the groundwater planning and implementation process.

Generally, the Turlock Subbasin GSAs are supportive of the current and historical efforts of the Merced Subbasin GSAs to reach groundwater sustainability and achieve stakeholder participation. As we continue to coordinate with the Merced Subbasin, we would expect to work together to address various data gaps and other opportunities for continued interbasin coordination to present themselves as our combined knowledge of our Subbasins increases and information is developed by our technical teams.

Thank you again for the opportunity to review and comment on the Merced Subbasin Draft GSP. We look forward to continued coordination as both Subbasins continue to move forward toward groundwater sustainability.

Sincerely,

Kevin Kauffman
Chair, East Turlock Subbasin GSA TAC

Michael Cooke
Chair, West Turlock Subbasin GSA TAC

August 19, 2019

Hicham Eltal, Merced GSP Contact
Merced Irrigation District
744 W 20th Street
Merced, CA 95340

Sent via email to mercedsgma@woodardcurran.com

Re: Comments on Draft Groundwater Sustainability Plan for Merced Subbasin

Dear Mr. Eltal,

On behalf of the above-listed organizations, we would like to offer the attached comments on the draft Groundwater Sustainability Plan for the Merced Subbasin. Our organizations are deeply engaged in and committed to the successful implementation of the Sustainable Groundwater Management Act (SGMA) because we understand that groundwater is a critical piece of a resilient California water portfolio, particularly in light of our changing climate. Because California's water and economy are interconnected, the sustainable management of each basin is of interest to both local communities and the state as a whole.

Our organizations have significant expertise in the environmental needs of groundwater and the needs of disadvantaged communities.

- The Nature Conservancy, in collaboration with state agencies, has developed several tools[1] for identifying groundwater dependent ecosystems in every SGMA groundwater basin and has made that tool available to each Groundwater Sustainability Agency.
- Audubon California is an expert in understanding wetlands and their role in groundwater recharge and the provision of ecosystem services.
- Clean Water Action and Clean Water Fund are sister organizations that have deep expertise in the provision of safe drinking water, particularly in California's small disadvantaged communities, and co-authored a report on public and stakeholder engagement in SGMA[2].

[1] https://groundwaterresourcehub.org/

[2] https://www.cleanwater.org/publications/collaborating-success-stakeholder-engagement-sustainable-groundwater-management-act

- The Union of Concerned Scientists has been working to ensure that future water supply meets demand and withstands climate change impacts by supporting stakeholder education and integration, and the creation and implementation of science-based Groundwater Sustainability Plans.
- American Rivers is committed to restoring damaged rivers and conserving clean water for people and nature.

Because of the number of draft plans being released and our interest in reviewing every plan, we have identified key plan elements that are necessary to ensure that each plan adequately addresses essential requirements of SGMA. A summary review of your plan using our evaluation framework is attached to this letter as Appendix A. Our hope is that you can use our feedback to improve your plan before it is submitted in January 2020.

This review does not look at data quality but instead looks at how data was presented and used to identify and address the needs of disadvantaged communities (DACs), drinking water and the environment. In addition to informing individual groundwater sustainability agencies of our analysis, we plan to aggregate the results of our reviews to identify trends in GSP development, compare plans and determine which basins may require greater attention from our organizations.

Key Indicators

Appendix A provides a list of the questions we posed, how the draft plan responds to those questions and an evaluation by element of major issues with the plan. Below is a summary by element of the questions used to evaluate the plan.

1. Identification of Beneficial Users. This element is meant to ascertain whether and how DACs and groundwater-dependent ecosystems (GDEs) were identified, what standards and guidance were used to determine groundwater quality conditions and establish minimum thresholds for groundwater quality, and how environmental beneficial users and stakeholders were engaged through the development of the draft plan.
2. Communications plan. This element looks at the sufficiency of the communications plan in identifying ongoing stakeholder engagement during plan implementation, explicit information about how DACs were engaged in the planning process and how stakeholder input was incorporated into the GSP process and decision-making.
3. Maps related to Key Beneficial Uses. This element looks for maps related to drinking water users, including the density, location and depths of public supply and domestic wells; maps of GDE and interconnected surface waters with gaining and losing reaches; and monitoring networks.
4. Water Budgets. This element looks at how climate change is explicitly incorporated into current and future water budgets; how demands from urban and domestic water users were incorporated; and whether the historic, current and future water demands of native vegetation and wetlands are included in the budget.
5. Management areas and Monitoring Network. This element looks at where, why and how management areas are established, as well what data gaps have been identified and how the plan addresses those gaps.
6. Measurable Objectives and Undesirable Results. This element evaluates whether the plan explicitly consider the impacts on DACs, GDEs and environmental beneficial users in the development of Undesirable Results and Measurable Objectives. In addition, it examines whether stakeholder input was solicited from these beneficial users during the development of those metrics.

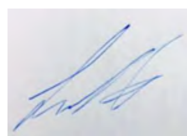
7. Management Actions and Costs. This element looks at how identified management actions impact DACs, GDEs and interconnected surface water bodies; whether mitigation for impacts to DACs is discussed or funded; and what efforts will be made to fill identified data gaps in the first five years of the plan. Additionally, this element asks whether any changes to local ordinances or land use plans are included as management actions.

Conclusion

We know that SGMA plan development and implementation is a major undertaking, and we want every basin to be successful. We would be happy to meet with you to discuss our evaluation as you finalize your Plan for submittal to DWR. Feel free to contact Suzannah Sosman at suzannah@aginnovations.org for more information or to schedule a conversation.

Sincerely,

Jennifer Clary
Water Program Manager
Clean Water Action/Clean Water Fund



Lisa Hunt
Director of California River Restoration Science
American Rivers

Samantha Arthur
Working Lands Program Director
Audubon California

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Appendix A
Review of Public Draft GSP

Groundwater Basin/Subbasin: Merced Subbasin (DWR # 5-022.04)
GSA: Merced Irrigation-Urban Groundwater Sustainability Agency (MIUGSA), Merced Subbasin Groundwater Sustainability Agency (MSGSA), and Turner Island Water District Groundwater Sustainability Agency #1 (TIWD GSA-1)
GSP Date: July 22, 2019 Public Review Draft

1. Identification of Beneficial Users

Were key beneficial users identified and engaged?

Selected relevant requirements and guidance:
GSP Element 2.1.5, "Notice & Communication" (§354.10):
(a) A description of the beneficial uses and users of groundwater in the basin, including the land uses and property interests potentially affected by the use of groundwater in the basin, the types of parties representing those interests, and the nature of consultation with those parties.
GSP Element 2.2.2, "Groundwater Conditions" (§354.16):
(d) Groundwater quality issues that may affect the supply and beneficial uses of groundwater, including a description and map of the location of known groundwater contamination sites and plumes.
(f) Identification of interconnected surface water systems within the basin and an estimate of the quantity and timing of depletions of those systems, utilizing data available from the Department, as specified in Section 353.2, or the best available information.
(g) Identification of groundwater dependent ecosystems within the basin, utilizing data available from the Department, as specified in Section 353.2, or the best available information.
GSP Element 3.3, "Minimum Thresholds" (§354.28):
(4) How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.

Review Criteria		Yes	No	N/A	Relevant Info per GSP	Location (Section, Page[1])
1. Do identified beneficial users (BUs) include:	a. Disadvantaged Communities (DACs)	X			"Additional interests (as listed in CWC §10723.2) include…Disadvantaged communities (DAC), combined list based on DWR's DAC Mapping Tool and Merced County's SB244 Analysis: o Disadvantaged: Atwater City, Le Grand CDP, Merced City, Stevinson CDP, The Grove, Tuttle CDP, Winton CDP o Severely Disadvantaged: Bear Creek CDP (Celeste), El Nido CDP, Franklin CDP, Planada CDP"	1.2.5.1, page 68
	b. Tribes		X		"Potential interests (listed in CWC §10723.2) that are not present in the Merced Subbasin include: California Native American tribes"	1.2.5.1, page 68
	c. Small community public water systems (<3,300 connections)	X			"Additional interests (as listed in CWC §10723.2) include: Public water systems/municipal well operators: o Le Grand-Athlone Water District o Merquin County Water District o Plainsburg Irrigation District o Stevinson Water District o Lone Tree Mutual Water Company o Sandy Mush Mutual Water Company o California American Water, Meadowbrook District o Merced Area Groundwater Pool Interests (monitors and reports	1.2.5.1, page 67-68

Review Criteria		Yes	No	N/A	Relevant Info per GSP	Location (Section, Page[1])
					groundwater elevations in the Merced Subbasin) o Le Grand Community Services District o Planada Community Services District" The size of the water systems is not clearly identified.	
2. What data were used to identify presence or absence of DACs?	a. DWR DAC Mapping Tool[2]	X			"DWR DAC Mapping tool: https://gis.water.ca.gov/app/dacs/. Data is based on US Census ACS 2010-2014."	1.2.5.1 footnote 3, page 68
	i. Census Places	X				
	ii. Census Block Groups		X		Not specified	
	iii. Census Tracts		X		Not specified	
	b. Other data source	X			"Merced County SB244 report: http://www.co.merced.ca.us/DocumentCenter/View/12199. Report is dated May 2016, based on 2000 Census data."	1.2.5.1 footnote 4, page 68
3. Groundwater Conditions section includes discussion of:	a. Drinking Water Quality	X			"Data are available for active and inactive drinking water sources for water systems that serve the public ... Wells are monitored for Title 22 requirements, including pH, alkalinity, bicarbonate, calcium, magnesium, potassium, sulfate, barium, copper, iron, zinc, and nitrate." "The primary water quality constituents of concern related to human activity include salinity, nitrate, hexavalent chromium, petroleum hydrocarbons (such as benzene and MTBE), pesticides (such as DBCP, EDB, 1,2,3 TCP), solvents (such as PCE, TCE), and emerging contaminants (such as PFOA, PFOS). Of these issues, nitrate is the most widespread issue with a direct impact on public health. Salinity is also an issue due to the widespread nature of the problem and difficulty of management given increases in salinity as a result of both urban and agricultural use. The Merced County Department of Public Health, Division of Environmental Health maintains a list of areas of known adverse water quality in the County, shown below in Table 2-8."	1.2.2.2.1.3, page 52; 2.2.4, page 148-173
	b. California Maximum Contaminant Levels (CA MCLs)[3] (or Public Health Goals where MCL does not exist, e.g. Chromium VI)	X			"Salinity levels within the Merced Subbasin range from less than 90 to greater than 3,000 mg/L as measured by TDS. The recommended drinking water secondary MCL for TDS is 500 mg/L, with an upper limit of 1,000 mg/L and a short-term limit[5] of 1,500 mg/l (SWRCB, 2006)." "Within the Merced Subbasin area, chloride concentrations range from non-detect (typically less than 2 mg/L) to as much as 1,850 mg/L. The recommended secondary MCL for Cl is 250 mg/L and the upper secondary MCL is 500 mg/L (SWRCB, 2006)." Other constituent concentrations compared to MCLs are: metals (arsenic, iron, manganese, hexavalent chromium), pesticides (DBCP and 123-TCP), petroleum hydrocarbons (benzene, MTBE), solvents (111-TCA, PCE, and TCE)	2.2.4, page 155-173
4. What local, state, and	a. Office of Environmental Health		X			

Review Criteria		Yes	No	N/A	Relevant Info per GSP	Location (Section, Page[1])
federal standards or plans were used to assess drinking water BUs in the development of Minimum Thresholds (MTs)?	Hazard Assessment Public Health Goal (OEHHA PHGs)[4]					
	b. CA MCLs[3]	X			"The minimum threshold for salinity is defined based on the potential impact of salinity on drinking water and agricultural beneficial uses, as aligned with state and federal regulations. The recommended drinking water secondary MCL for TDS is 500 mg/L with an upper limit of 1,000 mg/L and a short-term limit[11] of 1,500 mg/L (SWRCB, 2006)." No MTs defined for other water quality constituents, based on input from Stakeholder Advisory Committee.	3.6.2, page 239 page 238-239
	c. Data Quality Objectives (DQOs) in Regional Water Quality Control Plans		X			
	d. Sustainable Communities Strategies/ Regional Transportation Plans[5]		X			
	e. County and/or City General Plans, Zoning Codes and Ordinances[6]		X			
5. Does the GSP identify how environmental BUs and environmental stakeholders were engaged throughout the development of the GSP?			X		The environment is listed as one of the beneficial users of groundwater in the Subbasin, but few details are given. The US Fish and Wildlife is listed as operating several wildlife refuges supported by groundwater, as shown in Figure 1-7 (p. 1-20), along with state parks. A statement is made that there are other wetlands and GDEs that exist mostly in the western part of the subbasin, but they are not specified. The types and locations of environmental uses, species and habitats supported, and the designated beneficial environmental uses of surface waters that may be affected by groundwater extraction in the Subbasin should be specified. The stakeholder outreach process is described, and include outreach to federal, state, and local agencies, but did not appear to engage environmental groups.	1.2.5

Summary / Comments

Based on our review of the draft GSP, it does not appear that that PHGs or Regional Water Quality Control Plan DQOs, were considered in the assessment of drinking water users. It is suggested that the number of connections for each public water system be provided, as this is valuable information regarding the scale of the population dependent on these systems.

Review Criteria	Yes	No	N/A	Relevant Info per GSP	Location (Section, Page[1])

Groundwater quality discussion must include potential impacts to drinking water sources.[1]

The GSP makes a statement that there are other wetlands and GDEs that exist mostly in the western part of the subbasin; these should be specified in the document.

The types and locations of environmental uses, species and habitats supported, and the designated beneficial environmental uses of surface waters that may be affected by groundwater extraction in the Subbasin should be specified. To identify environmental users, please refer to the following:

- Natural Communities Commonly Associated with Groundwater dataset (NC Dataset) - https://gis.water.ca.gov/app/NCDatasetViewer/
- The list of freshwater species located in the Merced Subbasin in available here: https://groundwaterresourcehub.org/sgma-tools/environmental-surface-water-beneficiaries/. Please take particular note of the species with protected status.
- Lands that are protected as open space preserves, habitat reserves, wildlife refuges, etc. or other lands protected in perpetuity and supported by groundwater or interconnected surface waters should be identified and acknowledged.

The stakeholder outreach process is described, and includes outreach to federal, state, and local agencies, but did not appear to engage environmental groups.

[1] Community Water Center and Stanford School of Earth, Energy, and the Environmental Sciences, *Groundwater Quality in the Sustainable Groundwater Management Act (SGMA): Scientific Factsheet on Arsenic, Uranium, and Chromium*, https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1560371896/CWC_FS_GrndwtrQual_06.03.19a.pdf?1560371896; Community Water Center, *Guide to Protecting Drinking Water Quality Under the Sustainable Groundwater Management Act*, https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

2. Communications Plan

How were key beneficial users engaged and how was their input incorporated into the GSP process and decisions?

Selected relevant requirements and guidance:
GSP Element 2.1.5, "Notice & Communication" (§354.10):

Each Plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following:

(c) Comments regarding the Plan received by the Agency and a summary of any responses by the Agency.
(d) A communication section of the Plan that includes the following:
(1) An explanation of the Agency's decision-making process.
(2) Identification of opportunities for public engagement and a discussion of how public input and response will be used.
(3) A description of how the Agency encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin.
(4) The method the Agency shall follow to inform the public about progress implementing the Plan, including the status of projects and actions.

DWR Guidance Document for GSP Stakeholder Communication and Engagement[7]

Review Criteria	Yes	No	N/A	Relevant Info per GSP	Location (Section, Page)
1. Is a Stakeholder Communication and Engagement Plan (SCEP) included?		X		A Stakeholder Engagement Strategy document is referenced, but is not included as part of the GSP.	
2. Does the SCEP or GSP identify that ongoing engagement will be conducted during GSP implementation?	X			"Activities under GSP Implementation Program Management also include stakeholder engagement through the Stakeholder Advisory Committee (SC)." "The GSAs intend to continue public outreach and provide opportunities for engagement during GSP implementation. This will include providing opportunities for public participation, especially from beneficial users, at public meetings, providing access to GSP information online, and continued coordination with entities conducting outreach to DAC communities in the Basin. Announcements will continue to be distributed via email prior to public meetings (e.g., Stakeholder Committee meetings, Coordinating Committee meetings, public workshops, and GSA Board meetings). Emails will also be distributed as specific deliverables are finalized, when opportunities are available for stakeholder input and when this input is requested, or when items of interest to the stakeholder group arise, such as relevant funding opportunities. The Merced SGMA website, managed as part of GSP Administration, will be updated a minimum of monthly, and will house meeting agendas and materials, reports, and other program information. The website may be updated to add new pages as the program continues and additional activities are implemented. Additionally, public workshops will be held semi-annually, or more frequently if necessary, to provide an opportunity for stakeholders and members of the public to learn about, discuss, and provide input on GSP activities, progress towards meeting the Sustainability Goals of this GSP, and the SGMA program."	1.2.5.5.2, page 71; 7.2, page 323; 7.4, page 324

Review Criteria	Yes	No	N/A	Relevant Info per GSP	Location (Section, Page)
3. Does the SCEP or GSP specifically identify how DAC beneficial users were engaged in the planning process?	X			"Active public participation was encouraged through the following opportunities for public engagement: • Accepting public comment at GSA Board Meetings of all three GSAs. • Accepting public comments at Coordinating Committee Meetings and Stakeholder Advisory Committee Meetings. • Forming the Stakeholder Advisory Committee that includes community representatives of the diverse interests in the Subbasin to review and provide input on the elements of the GSP through monthly meetings open to the public. • Conducting briefings and Public Workshops to provide opportunities for community members and interests groups to learn about, discuss, and comment on the GSP planning process before major decision milestones. • Coordinating with Leadership Counsel and Self-Help Enterprises in their DAC outreach efforts. • Developing a robust website with timely, pertinent information, opportunity to make comments, and sign-up for email notifications. The website houses information about SGMA, the GSP process, the Merced Subbasin GSA Boards, Coordinating Committee, Stakeholder Advisory Committee, Public Workshops, and draft GSP sections. • Issuing news releases announcing public participation opportunities at Public Workshops. • Providing translation services at Public Workshops. Coordinating with Leadership Counsel and Self-Help Enterprises in their DAC outreach efforts."	1.2.5.2, page 69;

Review Criteria	Yes	No	N/A	Relevant Info per GSP	Location (Section, Page)
4. Does the SCEP or GSP explicitly describe how stakeholder input was incorporated into the GSP process and decisions?	X			"The GSAs were also informed by a 23-member Stakeholder Advisory Committee which consisted of community representatives who reviewed groundwater conditions, management issues and needs, and projects and management actions to improve sustainability in the basin. The committee met monthly starting in May 2018 in sessions open to the public, providing a forum for testing ideas as well as providing information and feedback from members' respective constituencies." The GSP does not identify who the members of the Stakeholder Advisory Committee were or what interests and/or organizations they represent were. "Salinity was selected by the GSAs based on stakeholder input and the recommendation of the Merced County Division of Environmental Health as the only constituent to monitor in the GSP because the causal nexus between salinity concentrations and groundwater management activities has been established (see Section 3.6.2 – Minimum Thresholds)." "During GSP development, the Merced GSP Program used multiple forms of outreach to communicate SGMA-related information and solicit input."	1.2.5.5.1, page 71; 3.6.1, page 237; 7.4, page 324

Summary / Comments

The GSP does not include a copy of the SCEP. The SCEP must be included in the GSP as an appendix or attachment.

We understand that Leadership Counsel and Self-Help Enterprises received funding from DWR to support their engagement efforts in this basin. Additional funding will be needed to support this outreach through GSP implementation.

The GSP does not identify who the members of the Stakeholder Advisory Committee were or what interests and/or organizations they represent. This information is important for the reader to be able to understand just who was involved in the process and what interests provided input in the process.

Stakeholder outreach notification appears to have been done primarily through email. This approach is inadequate, because not everyone has consistent access to the internet. Thus, major decisions and development as well as engagement opportunities need to be posted in key public locations as well.

3. Maps Related to Key Beneficial Uses

Were best available data sources used for information related to key beneficial users?

<u>Selected relevant requirements and guidance:</u>
GSP Element 2.1.4 "Additional GSP Elements" (§354.8):

Each Plan shall include a description of the geographic areas covered, including the following information:

(a) One or more maps of the basin that depict the following, as applicable:

(5) The density of wells per square mile, by dasymetric or similar mapping techniques, showing the general distribution of agricultural, industrial, and domestic water supply wells in the basin, including de minimis extractors, and the location and extent of communities dependent upon groundwater, utilizing data provided by the Department, as specified in Section 353.2, or the best available information.

<u>GSP Element 3.5 Monitoring Network (§354.34)</u>

(b) Each Plan shall include a description of the monitoring network objectives for the basin, including an explanation of how the network will be developed and implemented to monitor
groundwater and related surface conditions, and the interconnection of surface water and groundwater, with sufficient temporal frequency and spatial density to evaluate the affects and effectiveness of Plan implementation. The monitoring network objectives shall be implemented to accomplish the following:

(c) Each monitoring network shall be designed to accomplish the following for each sustainability indicator:

(1) Chronic Lowering of Groundwater Levels. Demonstrate groundwater occurrence, flow directions, and hydraulic gradients between principal aquifers and surface water features by the following methods:

(A) A sufficient density of monitoring wells to collect representative measurements through depth-discrete perforated intervals to characterize the groundwater table or potentiometric surface for each principal aquifer.

(4) Degraded Water Quality. Collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues.

(6) Depletions of Interconnected Surface Water. Monitor surface water and groundwater, where interconnected surface water conditions exist, to characterize the spatial and temporal exchanges between surface water and groundwater, and to calibrate and apply the tools and methods necessary to calculate depletions of surface water caused by groundwater extractions. The monitoring network shall be able to characterize the following:

(A) Flow conditions including surface water discharge, surface water head, and baseflow contribution.

(B) Identifying the approximate date and location where ephemeral or intermittent flowing streams and rivers cease to flow, if applicable.

(C) Temporal change in conditions due to variations in stream discharge and regional groundwater extraction.

(D) Other factors that may be necessary to identify adverse impacts on beneficial uses of the surface water.

(f) The Agency shall determine the density of monitoring sites and frequency of measurements required to demonstrate short-term, seasonal, and long-term trends based upon the following factors:

(3) Impacts to beneficial uses and users of groundwater and land uses and property interests affected by groundwater production, and adjacent basins that could affect the ability of that basin to meet the sustainability goal.

Review Criteria		Yes	No	N/A	Relevant Info per GSP	Location (Section, Page)
1. Does the GSP Include Maps Related to Drinking Water Users?	a. Well Density	X			"Figure 1-8 shows the density of non-domestic wells per square mile in the Merced Subbasin." It is not clear if non-domestic wells include public drinking water supply wells. "Figure 1-9 shows the density of domestic wells per square mile in the Merced Subbasin." "Figure 2-39 contains a series of maps showing the density per square mile of irrigation and domestic wells per principal aquifer."	Figure 1-8, page 48; Figure 1-9, page 49; Figure 2-39, page 128
	b. Domestic and Public Supply Well Locations & Depths		X		No map is provided.	
	i. Based on DWR Well Completion Report Map Application[8]?			X		
	ii. Based on Other Source(s)?			X		
2. Does the GSP include maps related to Groundwater Dependent Ecosystem (GDE) locations?	a. Map of GDE Locations		X		A map was included of NCCAG units that might be classified as GDEs (Figure 2-85 p. 2-109). The units were then screened using the following categories: areas with groundwater depth greater than 30 feet, habitat areas with supplemental water sources, areas adjacent to irrigated fields, areas dependent on losing surface waters, and areas of vernal pool complexes. The areas that were not screened out are shown in Figures 2-87 and 2-88 (p. 2-112 and 2-113). No information was given on the historical or current groundwater conditions in the GDEs or the ecological conditions present. The vegetation species were not ranked as having a high, moderate or low value and no inventory of the vegetation types or habitat types were provided.	2.2.7
	b. Map of Interconnected Surface Waters (ISWs)	X			A map showing gaining and losing streams was provided in Figure 2-9 (p. 2-15) as determined using the Merced Water Resources Model (MercedWRM). The report stated that no field studies have been conducted to confirm the designations and the documentation of the model was not provided in the GSP (Appendix D). Therefore, no estimates of surface water depletions by water year type were made.	2.1.3.5.2; 2.2.6
	i. Does it identify which reaches are gaining and which are losing?	X				
	ii. Depletions to ISWs are quantified by stream segments.		X			
	iii. Depletions to ISWs are quantified seasonally.		X			
3. Does the GSP include maps of monitoring networks?	a. Existing Monitoring Wells		X		No map provided. "The existing monitoring and management landscape within the Merced Subbasin is a patchwork of local, regional, state, and federal programs, each serving its own specific function. ... This patchwork of programs also creates redundancies, inconsistent protocols, and inconsistent timing of monitoring that will need to be improved under SGMA."	1.2.2, page 49

Review Criteria			Yes	No	N/A	Relevant Info per GSP	Location (Section, Page)
	b. Existing Monitoring Well Data sources:	i. California Statewide Groundwater Elevation Monitoring (CASGEM)	X			"Groundwater elevations are measured biannually, in the spring and fall, by local monitoring agencies as part of the California Statewide Groundwater Elevation Monitoring Program (CASGEM) program."	1.2.2.1.3, page51
		ii. Water Board Regulated monitoring sites		X			
		iii. Department of Pesticide Regulation (DPR) monitoring wells	X			"Exact locations are not known, but based on estimation of coordinates via county, township, range, and section, there are 951 wells are monitored within the Merced Subbasin with groundwater quality measurements on pesticides, such as DBCP and xylene, sampled between 1979 through 2015. " "In the Merced Subbasin, CDPR reported groundwater quality measurements for 170 wells with water quality data from 1981 through 2012. CDPR only monitors for pesticides and therefore does not have results on water quality constituents such as nitrates and TDS."	1.2.2.2.1.2, page 52; 1.2.2.2.1.3, page 52
	c. SGMA-Compliance Monitoring Network		X			Figure 4-1: Merced Subbasin GSP Groundwater Level Monitoring Network Wells Figure 4-5: Merced Subbasin GSP Groundwater Level Monitoring Network Monitoring and Representative Wells Figure 4-7: Merced Subbasin GSP Groundwater Quality Monitoring Network Wells	Figure 4-1, page 249; Figure 4-5, page 255; Figure 4-7, page 263
	i. SGMA Monitoring Network map includes identified DACs?			X		Figure 6-1 (Location of Proposed Monitoring Well Clusters) for identified project 2 (El Nido Groundwater Monitoring Wells) shows severely DAC areas, but the SGMA Monitoring Network maps do not include DACs.	
	ii. SGMA Monitoring Network map includes identified GDEs?			X			

Summary / Comments

Detailed information regarding the location and depths of domestic wells and existing monitoring networks is currently lacking in the GSP. Because the measurement of the undesirable result and MTs of groundwater levels are based upon the depth of domestic wells in proximity to representative monitoring wells, this lack of information in the draft makes it impossible to understand: (1) how many domestic wells are considered within the representative monitoring network, (2) whether specific areas or communities are excluded from the monitoring plan, and (3) whether undesirable result may be exacerbated by a lack of representative monitoring wells proximate to areas of shallow domestic wells.

Providing maps of the monitoring network overlaid with location of DACs, domestic wells, community water systems, GDEs, and any other sensitive beneficial users will allow the reader to evaluate the adequacy of the network to monitor conditions near these beneficial users.

A map was included of NCCAG units that might be classified as GDEs (Figure 2-85 p. 2-109). The units were then screened using the following categories: areas with groundwater depth greater than 30 feet, habitat areas with supplemental water sources, areas adjacent to irrigated fields, areas dependent on losing surface waters, and areas

Review Criteria	Yes	No	N/A	Relevant Info per GSP	Location (Section, Page)
of vernal pool complexes. The areas that were not screened out are shown in Figures 2-87 and 2-88 (p. 2-112 and 2-113). Areas with depth to groundwater greater than 30 feet can serve as a water source to some plants, e.g. oak trees, in the dry part of the year. Areas within 300 feet of losing streams identified by the model, MERCEDWRM, were eliminated. The distance of 300 feet seems excessive and may have eliminated some areas prematurely. The documentation of the model was not included in the draft report, Appendix D, so this information could not be verified. The potential GDEs were not grouped into larger units. Please check that potential GDEs were not excluded by the screening process. No information was given on the historical or current groundwater conditions in the GDEs or the ecological conditions present. The vegetation species were not ranked as having a high, moderate or low value and no inventory of the vegetation types or habitat types were provided. Please identify whether any endangered or threatened freshwater species of animals and plants or areas with critical habitat were found in any of the potential GDEs. The list of freshwater species located in the Merced Subbasin is located here: https://groundwaterresourcehub.org/sgma-tools/environmental-surface-water-beneficiaries/. Please provide groundwater data for historical and current conditions near the GDEs or identify as a data gap. According to the GSP, no field studies have been conducted to confirm the designations of streams as gaining or losing, and the associated documentation of the model was not provided in the GSP (i.e., Appendix D is missing). Therefore, the document does not include any estimates of surface water depletions by water year type were made. Please provide the documentation for the model and how the gaining and losing streams were determined.					

4. Water Budgets

How were climate change projections incorporated into projected/future water budget and how were key beneficial users addressed?

Selected relevant requirements and guidance:
GSP Element 2.2.3 “Water Budget Information” (Reg. § 354.18)

> *Each Plan shall include a water budget for the basin that provides an accounting and assessment of the total annual volume of groundwater and surface water entering and leaving the basin, including historical, current and projected water budget conditions, and the change in the volume of water stored. Water budget information shall be reported in tabular and graphical form.*
>
> *Projected water budgets shall be used to estimate future baseline conditions of supply, **demand**, and aquifer response to Plan implementation, and to identify the uncertainties of these projected water budget components. The projected water budget shall utilize the following methodologies and assumptions to estimate future baseline conditions concerning hydrology, water demand and surface water supply availability or reliability over the planning and implementation horizon:*
>
> *(b) The water budget shall quantify the following, either through direct measurements or estimates based on data:*
>
> *(5) If overdraft conditions occur, as defined in Bulletin 118, the water budget shall include a quantification of overdraft over a period of years during which water year and water supply conditions approximate average conditions.*
>
> *(6) The water year type associated with the annual supply, demand, and change in groundwater stored.*
>
> *(c) Each Plan shall quantify the current, historical, and projected water budget for the basin as follows:*
>
> *(1) Current water budget information shall quantify current inflows and outflows for the basin using the most recent hydrology, water supply, **water demand**, and land use information.*

DWR Water Budget BMP[9]
DWR Guidance for Climate Change Data Use During GSP Development and Resource Guide[10]

Review Criteria	Yes	No	N/A	Relevant Info per GSP	Location (Section, Page)
1. Are climate change projections explicitly incorporated in future/ projected water budget scenario(s)?	**X**			“Consistent with §354.18(d)(3) and §354.18(e) of the SGMA Regulations, analyses for the Merced GSP evaluated the projected water budget with and without climate change conditions.”	2.4.1, page 209
2. Is there a description of the methodology used to include climate change?	**X**			“The approach developed for this GSP is based on the methodology in DWR’s guidance document (DWR, 2018). Similarly, the “best available information” related to climate change in the Merced Subbasin was deemed to be the information provided by DWR combined with basin specific modeling tools. The following resources from DWR were used in the climate change analysis: • SGMA Data Viewer • Guidance for Climate Change Data Use During Sustainability Plan Development and Appendices (Guidance Document) • Water Budget BMP • Desktop IWFM Tools … The methods suggested by DWR in the above resources were used, with modifications where needed, to ensure the resolution would be	2.4.2, page 210;

Review Criteria		Yes	No	N/A	Relevant Info per GSP	Location (Section, Page)
					reasonable for the Merced Subbasin and align with the assumptions of the Merced Water Resources Model (MercedWRM). Figure 2-101 shows the overall process developed for the Merced GSP consistent with the Climate Change Resource Guide (DWR, 2018) and describes workflow beginning with baseline projected conditions to perturbed 2070 conditions for the projected model run." "For climate change impacts on groundwater, accepted methods are based on the assessment of impacts on the individual water resource system elements that directly link to groundwater. These elements include precipitation, streamflow, evapotranspiration and, for coastal aquifers, sea level rise as a boundary condition. The method for perturbing the streamflow, precipitation, and evapotranspiration input files is described in the following sections. A future scenario in 2070 was evaluated in this analysis, consistent with DWR guidance (DWR, 2018). DWR combined 10 global climate models (GCMs) for two different representative climate pathways (RCPs) to generate the central tendency scenarios in the datasets used in this analysis. The "local analogs" method (LOCA) was used to downscale these 20 different climate projections to a scale usable for California (DWR, 2018). The 2070 central tendency among these projections serves to assess impacts of climate change over the long-term planning and implementation period."	2.4.3, page 212
3. What is used as the basis for climate change assumptions?	a. DWR-Provided Climate Change Data and Guidance[11]	X			"The methods suggested by DWR in the above resources were used, with modifications where needed, to ensure the resolution would be reasonable for the Merced Subbasin and align with the assumptions of the Merced Water Resources Model (MercedWRM)."	2.4.2, page 210
	b. Other		X		From the descriptions above, the relevant assumptions of MercedWRM model are not clearly identified.	
4. Does the GSP use multiple climate scenarios?			X		"A future scenario in 2070 was evaluated in this analysis, consistent with DWR guidance (DWR, 2018)." Only one climate scenario was used in this GSP.	2.4.3, page 212
5. Does the GSP quantitatively incorporate climate change projections?		X			"The analysis was based on the projected conditions baseline with climate change perturbed inputs for streamflow, precipitation, and ET. Under the climate change scenario, the average annual volume of evapotranspiration is seven percent higher than the projected baseline, increasing to 916,000 AFY from 853,000 AFY. Due to changes to local hydrology, the average	2.4.3.3, page 223

Review Criteria			Yes	No	N/A	Relevant Info per GSP	Location (Section, Page)
						annual surface water availability was projected to increase 4 percent from 274,000 AFY to 286,000 AFY.8 The simulated increase in surface water supply is not enough to meet the increased water demands under the climate change scenario. As a result, private groundwater production is simulated to increase approximately 7 percent, from 536,000 AFY to 565,000 AFY. Under climate change conditions, depletion in aquifer storage is expected to increase by about 60 percent to an average annual rate of 130,000 AFY, from 82,000 AFY in the projected conditions baseline. A graphical representation of simulated changes to evapotranspiration, surface deliveries, and groundwater pumping are presented in Figure 2-116 though Figure 2-118 below and complete water budgets for the climate change scenario are shown in Figure 2-119 and Figure 2-120."	
6. Does the GSP explicitly account for climate change in the following elements of the water budget?	a. Inflows:	i. Precipitation	X			"DWR change factors were multiplied by projected baseline precipitation to generate projected precipitation under the 2070 central tendency future scenario using the Desktop IWFM GIS tool (DWR, 2018)."	2.4.3.2.1, page 220
		ii. Surface Water	X			"While river flows and surface water diversions in the Merced, Chowchilla, and San Joaquin rivers are simulated in CalSim II, there are significant variations when compared to local historical data. Due to the uncertainty in reservoir operations, flows from CalSim II provided by the state are not used directly in the Merced GSP. Instead, as explained later in this section, relative perturbation factors were used to derive surface water inflows and diversions for analysis with the MercedWRM. Local tributaries and smaller streams within Merced Subbasin are not simulated in CalSim II and must be simulated using adjustment factors developed by DWR for unregulated stream systems. While not all of these local tributaries are completely unregulated, most control structures are minor in operation, do not significantly impair natural flow when simulated on a monthly timestep, and are considered unimpaired for this analysis. Resolution of these perturbation factors are available at the HUC 8 watershed scale and include Bear Creek, Owens Creek, and Mariposa Creek. The remaining streams simulated in the MercedWRM utilize the IWFM small-watershed package, whose climate change impacts are calculated internally dependent on both precipitation and evapotranspiration refinement."	2.4.3.1, page 212
		iii. Imported Water		X		"The analysis was based on the projected conditions baseline with climate change perturbed inputs for streamflow, precipitation, and ET." No climate change impacts on imported water were discussed in the GSP.	
		iv. Subsurface Inflow		X		"The analysis was based on the projected conditions baseline with climate	

Review Criteria			Yes	No	N/A	Relevant Info per GSP	Location (Section, Page)
						change perturbed inputs for streamflow, precipitation, and ET." No climate change impacts on subsurface inflow were discussed in the GSP.	
	b. Outflows:	i. Evapotranspiration	X			"Potential ET is in the Merced Subbasin is aggregated to one of seventeen land use categories but does not vary spatially. DWR provides change factors for ET in the same spatially distributed manner as precipitation, as described above. However, to match the level of discretization with the Merced model, an average ET change factor was calculated across all VIC grid cells within the Merced Subbasin boundary. Therefore, the tool to process ET provided by DWR was not needed or used. Change factors provided by DWR for November 1, 1964 through December 1, 2011 were averaged. This average ET change factor was then applied to the baseline ET time series for each crop type."	2.4.3.2.2, page 220
		ii. Surface Water Outflows (incl. Exports)		X		"The analysis was based on the projected conditions baseline with climate change perturbed inputs for streamflow, precipitation, and ET." No climate change impacts on surface water outflows were discussed in the GSP.	
		iii. Groundwater Outflows (incl. Exports)		X		"The analysis was based on the projected conditions baseline with climate change perturbed inputs for streamflow, precipitation, and ET." No climate change impacts on groundwater outflows were discussed in the GSP.	
7. Are demands by these sectors explicitly included in the future/projected water budget?	a. Domestic Well users (<5 connections)			X		"Development of the projected water demand is based on the population growth trends reported in the 2015 UWMP, and land use, evapotranspiration, and crop coefficient information from the 2015 AWMP. This data has been adjusted based on projected growth identified in general, agricultural, and urban water management plans to evaluate future scenarios of water demand uncertainty associated with projected changes in local land use planning, population growth, and climate." But projected demands by sectors are not described explicitly.	2.3.4.3, page 205-209
	b. State Small Water systems (5-14 connections)			X		Projected demands by sectors are not explicitly stated.	2.3.4.3, page 205-209
	c. Small community water systems (<3,300 connections)			X		Projected demands by sectors are not explicitly stated.	2.3.4.3, page 205-209
	d. Medium and Large community water systems (> 3,300 connections)			X		Projected demands by sectors are not explicitly stated.	2.3.4.3, page 205-209
	e. Non-community water systems			X		Projected demands by sectors are not explicitly stated.	2.3.4.3, page 205-209
8. Are water uses for native vegetation and/or wetlands explicitly				X		The water budget for the surface water components did not include an explicit evapotranspiration term, but the following footnote was included	2.3

Review Criteria	Yes	No	N/A	Relevant Info per GSP	Location (Section, Page)
included in the current and historical water budgets?				as an explanation to Table 2-14 (p. 2-121 to 2-122). "Other flows is a closure term that captures the stream and canal system include gains and losses not directly measured or simulated within IWFM. Some of these features include but may not be limited to direct precipitation, evaporation, unmeasured riparian diversions and return flow, temporary storage in local lakes and regulating reservoirs, and inflow discrepancies resulting from simulating impaired flows." Riparian uptake from streams and evapotranspiration was included in the Land System Budget Table 2-15 (p. 2-123 to 2-124). The groundwater budget (Table 2-16 p. 2-125 and 2-126) did not include an explicit evapotranspiration term but included the following footnote "Other flows within the groundwater system including temporary storage in the vadose zone, and root water uptake from the aquifer system." The water budgets were calculated by the model, MercedWRM, and without the documentation the water budget is uncertain.	

Summary / Comments

Given the uncertainties of climate change, it is appropriate to analyze the impacts of climate change for a range of scenarios (e.g., a mild effects scenario and a high (worst case) effects scenario).

Based on the data presented, it is not clear how climate change is expected to affect specific elements of the water budget (i.e., imported water, subsurface flows, surface water and groundwater outflows, including exports).

The GSP also does not provide specifics on drinking water demands included for large urban water systems, domestic well users, or community water systems in the historical, current or future water budgets. This information should be provided for full transparency of the assumptions, data, and results of the water budgets.

The GSP does not provide summaries of land use type by acreages, so the accuracy of the land use types used in the water budget cannot be reviewed by the public.

The GSP is incomplete because Appendix D - MercedWRM Model Documentation was not provided in the public review draft. This appendix is necessary for understanding the assumptions and methodologies inherent in the model used for this GSP.

Managed habitats that use applied water (e.g., Merced NWR) are not listed in the water budget. These managed habitats should be listed alongside ag and urban throughout the water budget (Table 2-15 and 2-16) as both groundwater pumpers and as supplying deep percolation.

It is also not clear how climate change is anticipated to change the demands of domestic users and public water systems and how these demands were accounted for in the projected water budget.

Based on the information presented in the GSP, the water budget for the surface water components and groundwater budget do not include explicit evapotranspiration terms.

Review Criteria	Yes	No	N/A	Relevant Info per GSP	Location (Section, Page)
The water budgets were calculated by the model, MercedWRM, and the appendix detailing the model methodology and assumptions was omitted from the document. Please provide a more complete description of the budget and Appendix D (full model documentation).					

5. Management Areas and Monitoring Network

How were key beneficial users considered in the selection and monitoring of Management Areas and was the monitoring network designed appropriately to identify impacts on DACs and GDEs?

Selected relevant requirements and guidance:
GSP Element 3.3, "Management Areas" (§354.20):

(b) A basin that includes one or more management areas shall describe the following in the Plan:

(2) The minimum thresholds and measurable objectives established for each management area, and an explanation of the rationale for selecting those values, if different from the basin at large.

(3) The level of monitoring and analysis appropriate for each management area.

(4) An explanation of how the management area can operate under different minimum thresholds and measurable objectives without causing undesirable results outside the management area, if applicable.

(c) If a Plan includes one or more management areas, the Plan shall include descriptions, maps, and other information required by this Subarticle sufficient to describe conditions in those areas.

CWC Guide to Protecting Drinking Water Quality under the SGMA[12]
TNC's Groundwater Dependent Ecosystems under the SGMA, Guidance for Preparing GSPs[13]

Review Criteria	Yes	No	N/A	Relevant Info per GSP	Location (Section, Page)
1. Does the GSP define one or more Management Area?		X		"Management Areas have been discussed in the Merced GSP Stakeholder and Coordinating Committee Meetings, as well as GSA Board Meetings. At this time, there are no management areas established for the purposes of defining sustainability criteria for the Subbasin."	3.2, page 229
2. Were the management areas defined specifically to manage GDEs?			X		
3. Were the management areas defined specifically to manage DACs?			X		
a. If yes, are the Measurable Objectives (MOs) and MTs for GDE/DAC management areas more restrictive than for the basin as a whole?			X		
b. If yes, are the proposed management actions for GDE/DAC management areas more restrictive/ aggressive than for the basin as a whole?			X		
4. Does the GSP include maps or descriptions indicating what DACs are located in each Management Area(s)?			X		
5. Does the GSP include maps or descriptions indicating what GDEs are located in each Management Area(s)?			X		
6. Does the plan identify gaps in the monitoring network for DACs and/or GDEs?		X			
a. If yes, are plans included to address the identified deficiencies?			X		

Summary / Comments

Review Criteria	Yes	No	N/A	Relevant Info per GSP	Location (Section, Page)

If management areas are defined in the future, care should be taken so that they and the associated monitoring network are designed to adequately assess and protect against impacts to all beneficial users, including GDEs and DACs.

The monitoring network for water quality consists of 5 representative monitoring wells. This amounts to 0.65 wells per 100 square miles, which is at the very low end of DWR guidance for monitoring well densities of between 0.2 and 10 wells per 100 square miles.[2] Given the complexity of this subbasin, the volume of groundwater use this representative monitoring well density is insufficient for the protection of beneficial users.

[2] DWR, 2016. Best Management Practices for the Sustainable Management of Groundwater, Monitoring Networks and Identification of Data Gaps (BMP #2), December 2018.

6. <u>Measurable Objectives and Undesirable Results</u>

How were DAC and GDE beneficial uses and users considered in the establishment of Sustainable Management Criteria?

<u>Selected relevant requirements and guidance:</u>
GSP Element 3.4 "Undesirable Results" (§ 354.26):
(b) The description of undesirable results shall include the following:
(3) Potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results
GSP Element 3.2 "Measurable Objectives" (§ 354.30)
(a) Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin within 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon.

Review Criteria	Yes	No	N/A	Relevant Info per GSP	Location (Section, Page)
1. Are DAC impacts considered in the development of Undesirable Results (URs), MOs, and MTs for groundwater levels and groundwater quality?		X		DACs are not explicitly identified, but domestic well users are discussed in terms of URs, MOs, and MTs. "If groundwater were to reach levels that cause undesirable results, effects could include: de-watering of a subset of the existing groundwater infrastructure, starting with the shallowest wells (which are generally domestic wells) and adverse effects on groundwater dependent ecosystems." "If groundwater quality were degraded to levels causing undesirable results, the effect could potentially cause a reduction in usable supply to groundwater users, with domestic wells being most vulnerable as treatment or access to alternate supplies may be unavailable or at a high cost for small users. Water quality degradation could cause potential changes in irrigation practices, crops grown, crop productivity, adverse effects to property values, and other economic effects. Degraded water quality could have impacts on native vegetation or managed wetlands. Additionally, reaching undesirable results levels for groundwater quality could adversely affect current and projected municipal uses, and users could have to install wellhead treatment systems or seek alternate supplies." "The measurable objective is a TDS concentration of 500 mg/L, which aligns with the Secondary MCL for TDS. The margin of operational flexibility (MoOF) is 500 mg/L TDS, the difference between the measurable objective of 500 mg/L and the minimum threshold of 1,000 mg/L." "The minimum threshold for groundwater levels was defined as the construction depth of the shallowest domestic well within a 2-mile radius. Based on the undesirable results described in Section 3.3.1, dewatering of domestic wells is considered the most protective indicator, since domestic	 3.3.1, page 230; 3.3.2, page 231; 3.6.1, page 237 3.6.3, page 240; Page 231

Review Criteria	Yes	No	N/A	Relevant Info per GSP	Location (Section, Page)
				wells are expected to be the most shallow groundwater accessing infrastructure." Water level MOs are set above this threshold.	
2. Does the GSP explicitly discuss how stakeholder input from DAC community members was considered in the development of URs, MOs, and MTs?	X			"The undesirable result for chronic lowering of groundwater levels in the Merced Subbasin is sustained groundwater elevations that are too low to satisfy beneficial uses within the basin over the planning and implementation horizon of this GSP. During development of the GSP, potential undesirable results identified by stakeholders included: • Significant and unreasonable unusable and stranded groundwater extraction infrastructure •Significant and unreasonable reduced groundwater production •Significant and unreasonable increased pumping costs due to greater lift and deeper installation or construction of new wells •Significant and unreasonable number of shallow domestic wells going dry" "In identifying undesirable results for the Subbasin, the GSAs sought input from beneficial users through multiple venues including the stakeholder advisory committee and public workshops held in locations specifically selected to provide access to disadvantaged communities. The protection of water quality for drinking and for agricultural use was identified as a priority for users in the basin. … The GSAs also sought input from the Merced County Division of Environmental Health as to which constituents of concern in the Subbasin could be tied to groundwater management activities and therefore managed through SGMA. While the Division of Environmental Health has identified several constituents of concern in the Subbasin (see Section 2.2.4 – Groundwater Quality in Current and Historical Groundwater Conditions), this GSP focuses on only those constituents where groundwater management activities have the potential to cause undesirable results."	3.3.1, page 229; 3.6.1, page 236
3. Does the GSP explicitly consider impacts to GDEs and environmental BUs of surface water in the development of MOs and/or MTs for groundwater levels and depletions of ISWs?		X		The measurable objectives addressed only the representative monitoring wells and was set at 25 feet above the minimum threshold. GDEs were not considered. The minimum threshold was set at each of the representative monitoring wells. The level was defined as "The minimum threshold for groundwater levels was defined as the construction depth of the shallowest domestic well within a 2-mile radius." Thus, GDEs were not considered. Chronic lowering of groundwater levels were considered by proxy only for the Merced River and San Joaquin River, not for the other creeks in the Merced Subbasin.	 3.3.3 3.3.2
4. Does the GSP explicitly consider impacts GDEs and environmental BUs of surface water and recreational lands in the discussion and development of Undesirable Results?		X		Undesirable results are defined as follows: "For the Merced Subbasin, an undesirable result for declining groundwater levels is considered to occur during GSP implementation when November groundwater levels at greater	3.3.1

Review Criteria	Yes	No	N/A	Relevant Info per GSP	Location (Section, Page)
				than 25% of representative monitoring wells (at least 7 of 25) fall below their minimum thresholds for two consecutive years where both years are categorized hydrologically as below normal, above normal, or wet". GDEs are not specifically addressed. No hydrologic or biological data are compiled for the GDEs and data gaps are not described. Potential impacts on the GDEs are not described.	

Summary / Comments

Based on the presented information, domestic well uses are considered under URs and for the development of water level MOS and MTs, but DAC members are not explicitly considered. More detail and specifics regarding DAC members, including those that rely on smaller community drinking water systems, not only domestic wells, is necessary to demonstrate that these beneficial users were adequately considered.[3]

The GSP includes insufficient data on the proximity of DACs to the representative monitoring wells that will be used to measure undesirable results.

Water level MTs are established based on the minimum of: (1) the construction depth of the shallowest well in a two-mile radius of each representative monitoring well and (2) the minimum pre-January 2015 elevation. However, the GSP does not include any analysis or data showing what wells and well depths were considered and how many domestic wells fall outside of these 2-mile radius zones. This data is necessary for understanding how sensitive drinking water users may be impacted or protected by the proposed MTs.

The water level MTs are set relative to the *bottom* of the total well construction depth. A water supply well becomes unusable or subject to decreased performance and longevity as water levels fall within the screened interval, which will occur before water levels reach the bottom of the well. Therefore, many domestic wells within the 2-mile radius may be significantly impacted before this MT is exceeded or undesirable results are triggered.

The measurable objectives addressed only the representative monitoring wells and was set at 25 feet above the minimum threshold. GDEs were not considered. Please expand the Measurable Objectives to include protection of the environmental health of GDEs and ISWs.

The minimum threshold was set at each of the representative monitoring wells. The level was defined as "The minimum threshold for groundwater levels was defined as the construction depth of the shallowest domestic well within a 2-mile radius." Thus, GDEs were not considered. Please explain whether any adverse impacts to GDEs are expected and if changes to the minimum threshold should be made.

Chronic lowering of groundwater was considered by proxy only for the Merced River and San Joaquin River, not for the other creeks in the Merced Subbasin. Please identify areas on rivers or creeks where depletions are expected and if the minimum threshold should be changed.

---

[3] Community Water Center and Stanford School of Earth, Energy, and the Environmental Sciences, *Groundwater Quality in the Sustainable Groundwater Management Act (SGMA): Scientific Factsheet on Arsenic, Uranium, and Chromium,* https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1560371896/CWC_FS_GrndwtrQual_06.03.19a.pdf?1560371896; Community Water Center, *Guide to Protecting Drinking Water Quality Under the Sustainable Groundwater Management Act,* https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

Review Criteria	Yes	No	N/A	Relevant Info per GSP	Location (Section, Page)
Undesirable results are defined as follows: “For the Merced Subbasin, an undesirable result for declining groundwater levels is considered to occur during GSP implementation when November groundwater levels at greater than 25% of representative monitoring wells (at least 7 of 25) fall below their minimum thresholds for two consecutive years where both years are categorized hydrologically as below normal, above normal, or wet”. GDEs are not specifically addressed. No hydrologic or biological data are compiled for the GDEs and data gaps are not described. Potential impacts on the GDEs are not described. For existing GDEs, please provide hydrologic and biological data for current conditions and describe how susceptible they are to future impacts.					

7. Management Actions and Costs

What does the GSP identify as specific actions to achieve the MOs, particularly those that affect the key BUs, including actions triggered by failure to meet MOs? What funding mechanisms and processes are identified that will ensure that the proposed projects and management actions are achievable and implementable?

Selected relevant requirements and guidance
GSP Element 4.0 Projects and Management Actions to Achieve Sustainability Goal (§ 354.44)

(a) Each Plan shall include a description of the projects and management actions the Agency has determined will achieve the sustainability goal for the basin, including projects and management actions to respond to changing conditions in the basin.

(b) Each Plan shall include a description of the projects and management actions that include the following:

(1) A list of projects and management actions proposed in the Plan with a description of the measurable objective that is expected to benefit from the project or management action.

Review Criteria			Yes	No	N/A	Relevant Info per GSP	Location (Section, Page)
1.	Does the GSP identify benefits or impacts to DACs as a result of identified management actions?		X			Table 6-3 (Projects Shortlist for Merced Subbasin Groundwater Sustainability Plan) identifies projects anticipated to have benefits to DACs. The subsequent sections detail the benefits by project. For example: "The Planada Groundwater Recharge Basin Pilot Project is a three-year pilot project to construct a groundwater recharge basin in the Planada area, an SDAC that is completely reliant on groundwater. The project addresses a demonstrated need for greater groundwater monitoring and data collection for potential recharge projects, particularly within this SDAC area. …. Groundwater basin recharge will be an important component of the GSP; this pilot program will provide information critical to establishing long-term Basin sustainability, while directly benefitting an SDAC that needs a sustainable groundwater supply."	Table 6-3, page 299; 6.4 Project 1, page 300
2.	If yes:	a. Is a plan to mitigate impacts on DAC drinking water users included in the proposed Projects and Management Actions?		X		Within each project description section, the "Expected Benefits and Evaluation" part describes how the project will benefit DACs and "How Project Will Be Accomplished" includes a general project plan. A plan to specifically mitigate impacts to DAC drinking water users, such as a well replacement program or program to connect well users to a public water system is not clearly specified. The emergency tanked water program implemented during the drought is identified, but the program ended in 2018 and the GSP does not identify implementing this or a similar program in the future, if necessary to protect shallow domestic well users.	6.4, page 300-310
		b. Does the GSP identify costs to fund a mitigation program?	X			Table 6-3 (Projects Shortlist for Merced Subbasin Groundwater Sustainability Plan) summarizes the project costs and described again under each project section.	Table 6-3, page 299; 6.4, page 300-310
		c. Does the GSP include a funding mechanism to support the mitigation program?	X			"Estimated Costs and Plans to Meet Costs" under project sections include the funding resources.	6.4, page 300-310;

Review Criteria	Yes	No	N/A	Relevant Info per GSP	Location (Section, Page)
				"The range of applicable projects, per SWRCB Funding Opportunities fact sheet and per Water Code §10727.4(h), include recharge projects, groundwater contamination remediation, water recycling projects, in-lieu use, diversions to storage, conservation, conveyance, and extraction projects. Additional Projects or Management Actions outside of this list that a GSA determines will help achieve the sustainability goal for the Basin may also be applicable (see GSP Regulations §354.44). Many of the available funding mechanisms accept applications on a continuing basis. Table 6-7 provides a brief overview of the project types and available funding and programs as well as important dates to consider for implementation."	6.6, page 319
3. Does the GSP identify specific management actions and funding mechanisms to meet the identified MOs for groundwater quality and groundwater levels?	X			Table 6-3 provides a summary of the MOs Expected to Benefit by each project. According to the table, projects 1-5 and 9-12 are identified to mitigate the chronic lowering groundwater levels; and projects 2-4 and project 7 are expected to improve groundwater quality. The funding mechanisms are included in the detailed description of each project following the table. For example: "Description: The El Nido Groundwater Monitoring Wells project is comprised of installing monitoring wells in and near the community of El Nido that will improve the understanding of stratigraphy and groundwater conditions in the area and improve ongoing monitoring of water elevation and water quality. … Measurable Objective: The project addresses measurable objectives for water level and subsidence by enhancing monitoring efforts, especially for areas prone to subsidence. To the extent the project improves understanding of groundwater movement three-dimensionally in the Basin, it will also help address measurable objectives for water quality. "Estimated Costs and Plans to Meet Costs: The estimated cost for this project is $395,000. Costs for this project are met through Proposition 1 Funding through DWR."	Table 6-3, page 299; 6.4 Project 1-5, page 300-306; 6.4 Project 9-12, page 309-312
4. Does the GSP include plans to fill identified data gaps by the first five-year report?		X		"Creating a Data Gaps Plan It is anticipated that within one year of the acceptance of the GSP by DWR, the GSAs will develop a plan to address identified data gaps with a timeline for implementation based on priority. Within two years after the acceptance of GSP by DWR, the GSAs will provide a plan to fill in identified gaps, with a timeline for priorities of implementation."	7.8, page 330

Review Criteria	Yes	No	N/A	Relevant Info per GSP	Location (Section, Page)
5. Do proposed management actions include any changes to local ordinances or land use planning?		X		Proposed projects include construction of new infrastructure, which will have a limited change to land use, including conversion of 50-acres field to a storage reservoir. No changes to ordinances or land use planning are proposed. "The Merced Subbasin, the Merced Region Water Use Efficiency Program will be implemented by multiple water purveyors in the Region to increase the level of water conservation & ensure long-term water use efficiency by the regions urban and agricultural users."	6.4 Project 7, page 307
6. Does the GSP identify additional/contingent actions and funding mechanisms in the event that MOs are not met by the identified actions?		X			
7. Does the GSP provide a plan to study the interconnectedness of surface water bodies?		X			
8. If yes: a. Does the GSP identify costs to study the interconnectedness of surface water bodies?			X		
b. Does the GSP include a funding mechanism to support the study of interconnectedness surface water bodies?			X		
9. Does the GSP explicitly evaluate potential impacts of projects and management actions on groundwater levels near surface water bodies?				A process was conducted by the three GSAs and stakeholders to select 12 projects. The projects are listed in Table 6-3. Only a general way of evaluating each project is given. Up to 50 future potential projects, listed in Table 6-6 Projects Running List for Reference, and may be implemented as priorities and funding change. None of the 12 selected projects are expected to directly benefit GDEs. Please explain how the groundwater recharge projects (Project #1, #4, and #10) could benefit GDEs or a location near the GDEs and how the projects will be evaluated.	6.3

Summary / Comments

The GSP does not appear to include any plans to address impacts to domestic well users if domestic wells do go dry in the future. While many of the identified projects are intended to benefit and protect DACs and domestic well users, no program is provided as a contingency in case: 1) groundwater conditions decline before the projects are fully implemented, or 2) implementation of such projects does not have the desired effects. A plan to mitigate impacts to DAC drinking water users could include a program to replace wells, connect well users to a public water system, reinstatement of the emergency tanked water program, etc. Of these, connecting well users to a public water systems would be most preferable as this will result in a more sustainable water supply for these users over the long-term.

A process was conducted by the three GSAs and stakeholders to select 12 projects, but based on the information presented in the GSP, none of the 12 selected projects are expected to directly benefit GDEs. Please explain how the groundwater recharge projects (Project #1, #4, and #10) could benefit GDEs or a location near the GDEs and how the projects will be evaluated.

---

[1] Page numbers refer to the page of the PDF.
[2] DWR DAC Mapping Tool: https://gis.water.ca.gov/app/dacs/
[3] CA MCLs: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/MCLsandPHGs.html
[4] OEHHA PHGs: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/MCLsandPHGs.html
[5] CARB: https://ww2.arb.ca.gov/resources/documents/scs-evaluation-resources
[6] OPR General Plan Guidelines: http://www.opr.ca.gov/planning/general-plan/
[7] DWR Guidance Document for GSP Stakeholder Communication and Engagement https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Document-for-Groundwater-Sustainability-Plan---Stakeholder-Communication-and-Engagement.pdf
[8] DWR Well Completion Report Map Application: https://www.arcgis.com/apps/webappviewer/index.html?id=181078580a214c0986e2da28f8623b37
[9] DWR BMP for the Sustainable <management of Groundwater Water Budget: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-4-Water-Budget.pdf
[10]DWR Guidance Document for the Sustainable Management of Groundwater Guidance for Climate Change Data Use During GSP Development: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Climate-Change-Guidance_Final.pdf
[11] DWR Guidance Document for the Sustainable Management of Groundwater Guidance for Climate Change Data Use During GSP Development: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Climate-Change-Guidance_Final.pdf
DWR Resource Guide DWR-Provided Climate Change Data and Guidance for Use During GSP Development: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Resource-Guide-Climate-Change-Guidance_v8.pdf
[12] CWC Guide to Protecting Drinking Water Quality under the SGMA:
https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858
[13] TNC's Groundwater Dependent Ecosystems under the SGMA, Guidance for Preparing GSPs: https://www.scienceforconservation.org/assets/downloads/GDEsUnderSGMA.pdf

From:	LANNY E SELIGER
To:	mercedsgma
Subject:	GSP Draft comments
Date:	Sunday, August 4, 2019 8:41:28 PM

The steep decline in groundwater storage during the drought should be of concern as with climate change another 5 year drought is probable more likely to occur than not before 2040. With another 5 year drought either the valley turns into a desert or we have surface water stored to handle the dry period, or the ground water levels drop and the GSA fails.

The GSA should protect itself by again requesting an additional reservoir as part of a successful GSP at any location found acceptable by the Army Corp. The climate in Sacramento regarding fresh water has changed. Ask for more storage.

Audubon | CALIFORNIA

August 19, 2019

Hicham Eltal, Merced GSP Contact
Merced Irrigation District
744 W 20th Street
Merced, CA 95340

Sent via email to mercedsgma@woodardcurran.com

Re: Comments on Draft Groundwater Sustainability Plan for Merced Subbasin

Dear Mr. Eltal,

Audubon California appreciates the opportunity to provide public comment on the draft Groundwater Sustainability Plan for the Merced Groundwater Subbasin.

Audubon California is a statewide nonprofit organization with a mission to protect birds and the places they need. Our organization has a long history of solutions-focused work in the Central Valley in collaboration with state and federal agencies, water districts, non-profits, and industry. We are commenting on draft Groundwater Sustainability Plans (GSPs) to provide technical information that may be missing or misrepresented and to identify areas of opportunity to partner with landowners or Groundwater Sustainability Agencies to provide groundwater and wildlife habitat benefits.

Audubon California is reviewing GSPs as a stakeholder for the environment with a particular focus on wetlands. Over 95 percent of historic wetlands in the Central Valley have been replaced with agriculture or urban development. The remaining wetlands are a critical component of the Pacific Flyway, supporting millions of migratory waterfowl and hundreds of thousands of shorebirds. Wetlands in the Central Valley are highly managed, operating similar to agriculture in that they utilize delivered surface water or pumped groundwater to grow food resources and habitat for waterbirds.

Our comments on the Merced Subbasin draft GSP are detailed below. We welcome any follow up questions and look forward to seeing the issues raised below addressed in the final GSP submittal in January 2020.

P. 1-19: 1.2.1 Summary of Jurisdictional Areas and Other Features. Figure 1-6 and the accompanying text represent four land use categories in the Merced Subbasin, cropland, rangeland, undeveloped, and urban. This map classifies areas as either rangeland or undeveloped that are actually managed wetland habitat for migratory birds, which rely on applied water. Figure 1-7 shows US Fish and Wildlife Service (USFWS) Refuges in the Merced Subbasin, including Merced National Wildlife Refuge, Grasslands Wildlife Management Area, and San Luis National Wildlife Refuge, which are managed for migratory birds and other species through surface and groundwater use. Private landowners in this western portion of the Merced subbasin also apply surface or groundwater for managed wetlands. Additional land use categories should be added to accurately reflect the managed wetland habitat in the western portion of the Merced Subbasin and to distinguish this land use from rangeland in the eastern portion of the Subbasin.

P. 1-20: 1.2.1 Summary of Jurisdictional Areas and Other Features. Figure 1-7 is missing California Department of Fish and Wildlife fee and easement interests. Additionally, the introduction to this section reads, "Figure 1-7 shows a map with boundaries of federal and state parks within the Merced Subbasin." The federal lands are not parks, but are wildlife refuges that use applied surface water and pumped groundwater to produce food resources and habitat for migratory birds.

P. 1-20: 1.2.1 Summary of Jurisdictional Areas and Other Features. Figure 1-7 does not accurately represent the USFWS properties in the Merced Subbasin, which could have consequences for water budget development later in the draft GSP and future allocations under the proposed framework. See the below map of the San Luis National Wildlife Refuge Complex for a representation of the USFWS fee and easement boundaries. The detailed map below labels each management unit within the Grasslands Ecological Area, which straddles both the Merced Subbasin and the Delta-Mendota Subbasin. Within the Merced Subbasin, the Merced, Lone Tree, Arena Plains, and Snobird units comprise Merced National Wildlife Refuge, which is owned in fee title by USFWS. The East Bear Creek unit is a part of San Luis National Wildlife Refuge, also owned in fee title by USFWS. The remaining units in the Merced Subbasin are USFWS easements (marked in blue), referenced in other maps as Grasslands Wildlife Management Area. As we detail below in reviewing the water budget in the draft GSP, Merced National Wildlife Refuge uses pumped groundwater and delivered surface water, East Bear Creek unit of San Luis National Wildlife Refuge receives delivered surface water, and private wetlands in the Grasslands Wildlife Management Area pump groundwater to produce habitat.

P. 1-40: 1.2.5.1 Beneficial Uses and Users in the Basin. This section inaccurately states 15,000 acre-feet per year (AFY) as the surface water use at Merced NWR. Annual surface water deliveries from Merced Irrigation District to Merced NWR have dropped from an average of approximately 11,000 AFY from 2009 to 2013 to 3,234 AF in 2017 (a flood year) and 4,502 AF in 2018 (a normal rain year). As surface water deliveries to Merced NWR have dropped, Merced NWR has been forced to rely on groundwater to provide the habitat needed by thousands of migratory birds, including listed species like the Tricolored Blackbird and Greater Sandhill Crane. In the non-drought years of 2017 and 2018, 11,475 AF and 11,219 AF, respectively, were pumped from wells to meet the water demands of important habitat. Additionally, under the 1992 Central Valley Project Improvement Act, Congress mandated that Merced NWR receive 16,000 AFY to meet necessary habitat benefits. Merced Irrigation District is required to deliver up to 15,000 AFY to Merced NWR as mitigation for the Merced River Hydroelectric Project.

P. 1-40: 1.2.5.1 Beneficial Uses and Users in the Basin. State interests should be included as additional interests in this section, including Great Valley Grasslands State Park and California Department of Fish and Wildlife.

P. 2-110: 2.2.7 Groundwater-Dependent Ecosystems. The section includes explanation of the areas not identified as Groundwater Dependent Ecosystems (GDEs) from the Natural Communities Commonly Associated with Groundwater (NCCAG) dataset. The second bullet describes that habitat areas that are supported by supplemental water were removed from GDE consideration, but it should be noted here that these managed wetlands heavily rely on <u>pumped</u> groundwater. Additionally, the amount of surface water referenced as delivered to Merced NWR does not match earlier references (p. 1-40) and does not include recent, non-drought years. The inaccurate reference to 15,000 AFY on p. 1-40 should be updated and p. 2-110 should reference the surface water deliveries in 2017 and 2018 (3,234 and 4,502 AF, respectively), which clearly indicate that the ongoing low surface water deliveries to Merced NWR are not a result of drought conditions. In order to meet water demands for wetland habitat needs, Merced NWR relies heavily on groundwater, pumping an average of 9,220 AFY from 2009-2018, 11,698 AFY from 2015-2018, and 11,347 AFY from 2017-2018, which were notably wet and normal rain years.

P. 2-109 and 2-111: 2.2.7 Groundwater-Dependent Ecosystems. The representation of the variance between Figures 2-85 and 2-86 is unclear and there should be more detailed representation of actual acreage suggested for removal from the NCCAG map. The spatial data input to generate Figure 2-86 appears to be inaccurate because it does not show known managed wetlands in the Merced Subbasin.

P. 2-117: 2.3.3.2 Current Water Budget. The land use information listed in the Current Conditions Baseline developed to apply current land and water use conditions to historical hydrology appears to be inadequate to classify managed wetlands and habitat areas. Please clarify the local ground truthing and refinement conducted to accurately represent habitat areas that are not included in 2013 United States Department of Agriculture's CropScape Cropland Data Layer.

P. 2-117: 2.3.3.2 Current Water Budget. It is unclear whether the water demand information used in the Current Conditions Baseline includes the water demands of managed wetlands. Please clarify whether this land use and water demand is included in the Current Conditions Baseline. Habitat water demands need to be recognized as an existing user, similar to other overlying groundwater users, particularly as the GSAs may move towards allocation systems that reflect current or past groundwater use.

P. 2-118: 2.3.3.3 Projected Water Budget. It is unclear whether land use and water demand information in the Projected Conditions Baseline reflects the managed wetlands land use type and associated water demands. See our above comments regarding the Current Water Budget.

P. 2-123: Table 2-15 Average Annual Water Budget – Land Surface System, Merced Subbasin. The water budget should add managed habitats, which use both delivered surface water and pumped groundwater, to the following components in Table 2-15: Inflows – surface water supply and groundwater supply; Outflows – deep percolation from surface water and deep percolation from groundwater. Table 2-15 currently includes a component for evapotranspiration of "Refuge, Native, and Riparian," but it is unclear if this includes evapotranspiration of applied water to managed habitat (refuges) and if it includes the full acreage extent of managed habitats, including federal, state, and private, given the errors earlier in the document, detailed above.

P. 2-123: Table 2-16 Average Annual Water Budget – Groundwater System, Merced Subbasin. Similar to the previous comment above, Table 2-16 should include managed habitats in the following components: Inflows – deep percolation from surface water and deep percolation from groundwater; Outflows – groundwater production.

P. 2-130: Table 2-17 Average Annual Values for Key Components of Water Budget by Year Type. Managed habitats should be included in the water demand and water supply summary components of Table 2-17. These habitats are federal, state, and private and utilize delivered surface water and pumped groundwater and contribute to deep percolation.

P. 4-14. 4.5.6 Data Gaps. We encourage the quick resolution of data gap #2, which is an area of "virtually no known wells" on the western edge of the Subbasin. This represents critical habitat for migratory birds on the Pacific Flyway and other listed species.

P. 6-1. 6.2.1 Initial Groundwater Allocation Framework. This section should include managed habitats throughout the groundwater allocation framework. Specifically, deep percolation from managed habitats should be accounted for in the "Developed Supply" in step 2 because surface water is imported from outside the basin to manage wetlands. This surface water amount should be treated on par with surface water imported for agricultural lands under the proposed framework. East Bear Creek Unit, which is the portion of San Luis National Wildlife Refuge within the Merced Subbasin received 8,200 AF last year of imported surface water. Merced National Wildlife Refuge is mandated 16,000 AFY by the Central Valley Project Improvement Act, receiving an average of 7,164 AFY of surface water between 2009 and 2018.

P. 6-2. 6.2.1 Initial Groundwater Allocation Framework. We recommend the allocation framework account for the benefits that seepage from unlined canals provides to important habitats in any future estimates of "Developed Supply" and "Sustainable Yield of Native Groundwater." Also, because a portion of managed habitat water needs are met with developed supplies, any removal of such designated supply must remain with the managed habitat interests (ownership), along with any benefits from seepage or deep percolation that may be determined. Managed habitat lands that apply water need to be addressed in the same manner as agricultural lands.

P. 6-4. 6.2.1 Initial Groundwater Allocation Framework. This section outlines the next steps to begin implementation of allocations in the first five years of the GSP. Representatives of private, state, and federal wildlife areas should be included in the development of allocation methods to ensure accurate identification of land area, developed supply, and historical use. These habitat areas are vitally important to the Pacific Flyway and provide local recreational benefits.

P. 6-7: 6.3 Projects. Many priorities across a wide stakeholder group need to be addressed in order to effectively develop and implement projects. We are enthusiastic about the inclusion of the priority "*Project addresses and or prioritizes water for habitat,*" but suggest it be expanded to include the importance of maintaining and improving existing habitat in the Subbasin. We recommend that this priority include more general benefits to wildlife and habitat, and should be amended to read "*Project addresses and or prioritizes water for habitat and or creates new or sustains existing managed habitat benefits*". Expanding priorities that have added benefit, such as habitat and wildlife value, can also lead to non-target benefits (e.g. water filtration or recreation opportunities). This may open the door to additional funding sources that otherwise would not have been there if these benefits were not part of a project.

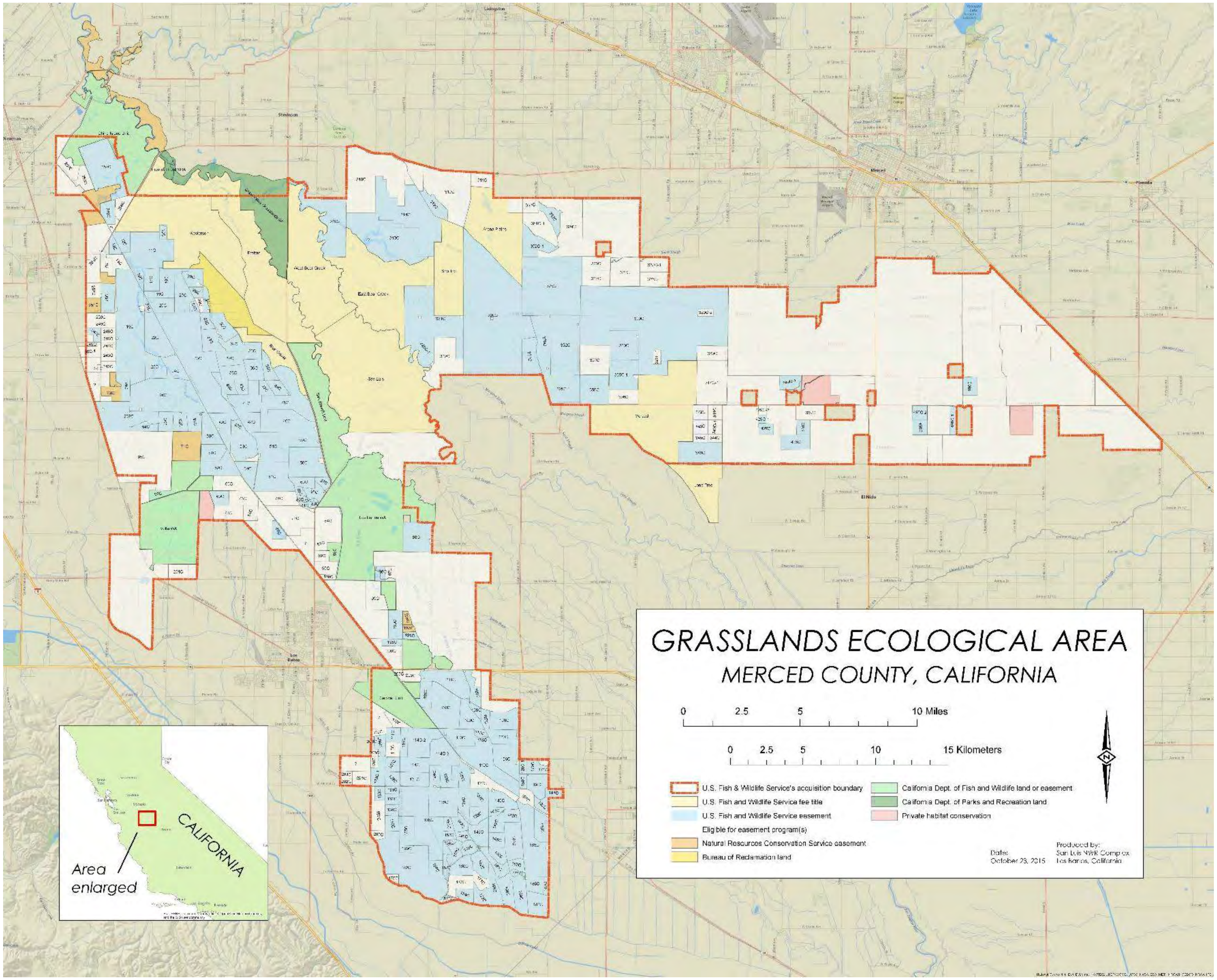
P. 6-8: 6.4 Projects Shortlist. As specific projects become further developed, managed habitat areas may offer ideal opportunities for recharge or temporary storage of water during high flow events. Projects that utilize habitat lands may lessen negative impacts to cultivated lands from flooding or intentional recharge. We recommend that the GSAs investigate opportunities that can allow habitat areas to function both for habitat and to provide recharge or temporary storage. Knowing that water for recharge likely comes in large quantities over short timeframes, the existing configurations of managed habitat areas can make for useful retention areas, without risking the flooding on irrigated crops such as trees and vines. Audubon is interested in helping the GSAs investigate these potential opportunities.

P. 6-9: Table 6-3 – Projects Shortlist. Of the 12 projects on the short list only one has identified "water for habitat" as an expected benefit. However, recharge and temporary storage projects can also provide habitat benefits through low-effort design and management actions targeting wildlife needs. We recommend evaluating the opportunities for the following three projects to provide "water for habitat": *Project 1: Planada Groundwater Recharge Basin Pilot Project*, *Project 4*: *Merquin County Water District Recharge Basin*, and *Project 10: Vander Woude Dairy Offstream Temporary Storage*. We would like to continue bringing forward project ideas that can benefit groundwater and habitat, and work with you in the future to develop and identify funding for these multiple benefit projects.

Thank you for your consideration of Audubon California's comments. If you would like to discuss this matter further, please do not hesitate to contact me at (916) 737-5707 or via email at sarthur@audubon.org.

Sincerely,

Samantha Arthur
Working Lands Program Director
Audubon California


GRASSLANDS ECOLOGICAL AREA
MERCED COUNTY, CALIFORNIA
0 2.5 5 10 Miles
0 2.5 5 10 15 Kilometers
U.S. Fish & Wildlife Service's acquisition boundary
U.S. Fish and Wildlife Service fee title
U.S. Fish and Wildlife Service easement
Eligible for easement program(s)
Natural Resources Conservation Service easement
Bureau of Reclamation land
California Dept. of Fish and Wildlife land or easement
California Dept. of Parks and Recreation land
Private habitat conservation
Date:
October 23, 2015
Produced by:
San Luis NWR Complex
Los Banos, California
N
CALIFORNIA
Area enlarged

August 19th, 2019

[sent via email]

Hicham Eltal, Merced GSP Contact
744 W 20th St., Merced, CA 95340
mercedsgma@woodardcurran.com

Re: Comments on Draft Merced Subbasin Groundwater Sustainability Plan

Dear Merced Groundwater Sub-basin GSAs:

Leadership Counsel for Justice and Accountability works alongside low income communities of color in the San Joaquin Valley and the Eastern Coachella Valley. We work in partnership with community leaders in the communities of Planada and South Merced to advocate for local, regional and state government entities to address their communities' needs for the basic elements that make up a safe and healthy community: clean, safe, reliable and affordable drinking water, affordable housing, effective and safe transportation, efficient and affordable energy, green spaces, clean air, and more.

We have been engaged in the Sustainable Groundwater Management Act (SGMA) implementation process because many of the communities with whom we work are dependent on groundwater for their drinking water supplies, and have already experienced groundwater quality and supply issues. Historically, communities we work with have not been included in decision-making about their precious water resources, and their needs have not been at the forefront of such decisions. In 2012, California recognized the Human Right to Drinking Water as a statewide goal. Additionally, state law requires that GSAs avoid disparate impacts on protected classes. Now, because of SGMA's requirements for a transparent and inclusive process, groundwater management under the new law has the opportunity to include disadvantaged communities in decision-making and create groundwater management plans that understand their unique vulnerabilities, are sensitive to their drinking water needs, and avoid causing a disparate impact on low income communities of color.

We submit these comments to elevate our concerns that the Merced Subbasin's (GSAs) Draft Groundwater Sustainability Plan (Draft GSP) provide for public review is incomplete, does not adequately analyze drinking water impacts and does not incorporate drinking water impacts into the management plan. Additionally, the Draft GSP neither adequately analyzes nor incorporates input from disadvantaged communities, and will create a disparate impact on protected classes unless modified to protect drinking water resources for disadvantaged communities. We include herein our comments with respect to deficiencies in the Draft GSP and as well as recommendations for improvements.

Draft GSP is Incomplete

The Draft GSP omits critical data regarding the water budget, drinking water impacts, projects and management actions. For example, there has been no analysis of how many wells will go dry or become potentially contaminated from the policies proposed in the Draft GSP, including the proposed sustainable management criteria. Additionally, as explored below the GSP's description of the water budgets lacks the necessary data, assumptions and approaches used to determine the water budgets. The GSP also lacks information on the impact of and timelines for key projects and management actions.

The GSP cannot be adopted until all information on data and assumptions used in the development of the water budget, drinking water impacts from all sustainable management criteria, and details about projects and management actions, are made available to the public for public review during a new review period. In re circulating the GSP for public review, the GSA must analyze the drinking water impacts of setting sustainable management criteria, follow a concrete methodology for considering those impacts in creating new sustainable management criteria, and include that impacts analysis and methodology in the revised Draft GSP.

Inadequate Transparency, Public Process, Consideration of Public Input and Representation Undermine the Value and Efficacy of the Draft GSP

SGMA requires that a GSA "shall consider the interests of all beneficial uses and users of groundwater," which expressly includes "[h]olders of overlying rights" and "[d]isadvantaged communities, including, but not limited to, those served by private domestic wells or small community water systems."[1] The emergency regulations similarly require that a Draft GSP summarize and identify "opportunities for public engagement and a discussion of how public input and response will be used."[2] The GSA thus must engage "diverse social, cultural, and economic elements of the population within the basin."[3]

We dispute the Draft GSP's statement that the Stakeholder Committee represented "the broad interests and geography of the region."[4] The Stakeholder Committee was composed mainly of members representing agricultural interests. With only one disadvantaged community (DAC) and one Urban Water District representative on the Committee, it was often difficult for our organization's and others' advocacy for drinking water concerns to be fully considered and incorporated into the Plan. Because of the disproportionate number of agricultural representatives on the committee, the Stakeholder Committee cannot be considered to be adequately representative of all beneficial user groups in the subbasin. Given this unbalanced representation of Stakeholders in the Committee and lack of other avenues for representatives of other beneficial uses to provide input throughout the development of the Draft GSP, the GSAs have not fulfilled their requirements under SGMA to seek out and fully consider all beneficial users' interests in the Draft GSP formation process. Accordingly, the GSAs should conduct a fully accessible public workshop on

[1] Water Code § 10723.2.
[2] 23 CCR 354.10(d).
[3] Guidance Document for Groundwater Sustainability Plan; Stakeholder Communication and Engagement, p. 1.
[4] Draft Merced Subbasin GSP pg. 1-12, dated July 2019.

the Draft GSP during a public comment period wherein community feedback can be received, addressed, and incorporated into the final Plan.

To our knowledge, the GSAs have no plans to hold public workshops to explain the Draft GSP to the public and allow for questions, answers and public feedback in real time. Upon releasing the 339 page Draft GSP with 416 pages of appendices on July 19th, 2019, the GSAs made the decision to only allow 30 days for the public to submit comments on the GSP. Of the 12 GSP development processes in which we are engaged, this GSP is the only one with a public comment period shorter than 45 days. While the GSAs plan to have a joint meeting to review written comments with the other basin GSAs, a separate public workshop or hearing focused on discussing the Draft GSP would have allowed for the GSAs to inform the public about the contents of Draft GSP, answer stakeholder questions about the Draft GSP, and facilitate informed comments and feedback on the Draft GSP. The short review period further inhibits input from all beneficial users. Furthermore, the Draft GSP is not complete as released and should therefore be taken back to the public for more time with complete information regarding drinking water impacts.

To address concerns over public engagement, transparency, and inclusivity, the GSAs must:

- Release to the public information about drinking water impacts and the methodology used to consider those impacts in the creation of sustainable management criteria and other policy decisions.
- Hold a robust public comment period by re-opening the comment period for at least 60 days before a public hearing to adopt the Draft GSP.
- Hold at least one public workshop to discuss the Draft GSP prior to GSP adoption, and incorporate public input received at that workshop into an updated GSP.
- Accurately describe the stakeholder interests represented on the Stakeholder Committee by listing each representative and which beneficial user group they represented.
- Plan to obtain and meaningfully consider public input from all beneficial user groups in the implementation of the GSP. The GSAs should host public workshops and present at meetings with all types of beneficial user groups before decisions are made regarding GSP updates or projects and management actions. To reach disadvantaged groups, GSA staff and consultants should present relevant information and solicit feedback at meetings in disadvantaged communities regularly. Public workshops must provide interpretation in any languages needed, and should follow robust and effective community outreach to ensure that the most vulnerable drinking water users are informed and included. Public engagement may be funded through SGMA-related fees and/ or state grants if necessary.

The Data and Assumptions Underlying the Water Budgets are Unclear, Inadequate and Incomplete

SGMA defines the term "water budget" to mean "an accounting of the total groundwater and surface water entering and leaving a basin including the changes in the amount of water stored."[5]The SGMA emergency regulations similarly require that every GSP include a water budget "that provides an accounting and assessment of the total annual volume of groundwater

[5] Water Code Section 10721(y).

and surface water entering and leaving the basin, including historical, current and projected water budget conditions, and the change in the volume of water stored."[6] In developing a water budget, the GSP must utilize the "best available information and best available science."[7]

In calculating the current water budget, the GSP must "quantify current inflows and outflows for the basin *using the most recent hydrology, water supply, water demand, and land use information*."[8] In contrast to this requirement, the data utilized to estimate the projected water budget is out-of-date, incomplete and inaccurate.

First, the Draft GSP does not accurately explain or include all urban water users, or rely on the most recent information. According to the Draft GSP, urban water demand is based on the 2015 Urban Water Management Plan (UWMP) and municipal pumping records. However, no information is provided on the magnitude of the urban demand, population information, or per capita water use specified in the model. The Draft GSP does not identify which municipal water providers provided data and which required estimation of water demand. Nor does it discuss how estimated water use from rural domestic water users or small community water systems was represented in the model or the magnitude of these values.

Second, the Draft GSP does not adequately factor in population growth and expanded development in cities and communities in the subbasin. SGMA requires that a "groundwater sustainability plan shall take into account the most recent planning assumptions stated in local general plans of jurisdictions overlying the basin."[9] The regulations also require that projected water demand must take into account, among other things, population growth.[10] Accounting for future growth within the water budget must also include accounting for reasonable growth in DACs. This information is critical to incorporated into the water budget to ensure that communities have a stable source of water when the GSP is implemented. The GSAs must look to General Plans, Community Plans, Specific Plans, Regional Transportation Plans, LAFCO Municipal Service Reports, Regional Housing Needs Assessments, and Department of Finance population estimates to accurately assess future drinking water needs in disadvantaged communities in the subbasin. If such documents do not contain information about population projections in DACs, the GSAs should communicate directly with residents of DACs and community-based nonprofits working with local communities to estimate future population growth.

To form its projected land use conditions baseline, the GSAs list direct communication on future projections with local agencies and farmers.[11] Because SGMA requires that the interests of all beneficial users and uses to be considered in developing GSPs,[12] there must be direct communication with all relevant stakeholders and representatives of all beneficial uses, including

[6] 23 CCR 354.18(a).
[7] 23 CCR 354.18(e).
[8] 23 CCR 354.18(c)(1) [emphasis added].
[9] Water Code § 10726.9.
[10] 23 CCR 354.18(c)(3)(B).
[11] Draft Merced Subbasin GSP pg. 2-118, dated July 2019.
[12] Water Code section 10723.2.

people reliant on domestic wells. This communication should be through meetings held in communities, facilitated where possible by collaboration with community-based nonprofits.

Lastly, it is unclear why the GSAs chose the historical baselines that they did. The methodology that the GSAs used to choose the historical baseline of 1969 to 2018 should be clarified.[13] It should also be explained why the GSAs chose a different period as their baseline for their current and projected water budget.[14]

As the attached technical report highlights other deficiencies with the water budgets, and development thereof:

- The Draft GSP presents only a brief listing of the data sources used to specify conditions for the model periods used to develop the water budgets. There is very little discussion on how the model input relative to the water budget was developed from the listed sources. It is noted in the text that additional data used for model development is included in Appendix D (MercedWRM Model Documentation), but Appendix D is still under development and was not included in the Draft GSP. Therefore, any additional data related to the water budget could not be reviewed by the public during this comment period. The Draft GSP made available to the public is incomplete, and a full evaluation of the model and assumptions cannot be made.
- According to the Draft GSP, urban water demand is based on the 2015 Urban Water Management Plan (UWMP) and municipal pumping records.[15] However, no information is provided on the magnitude of the urban demand, population information, or per capita water use specified in the model. The Draft GSP does not identify which municipal water providers provided data and which required estimation of water demand. Nor does it discuss how estimated water use from rural domestic water users or small community water systems was represented in the model or the magnitude of these values. Therefore, based on the limited data provided in the Draft GSP, the public cannot review the drinking water demand estimates for domestic users, community water systems, or large urban water suppliers and make an assessment as to the appropriateness of the demands considered in the historical, current, or future water budgets.
- There is no specific information included in the Draft GSP on how historical land use was determined or how it varies over the historical water budget period. According to the Draft GSP, the current water budget uses 2013 CropScape data and the projected water budget uses the 2013 CropScape data, 2015 agricultural water management plan projections, and information from local agencies and farmers. No summary of acreages by land use type is provided so the accuracy of the representation of urban and agricultural areas cannot be assessed by the public. Without this information the public cannot assess how domestic well users and small community water systems are represented in the land use data.
- The majority of the Draft GSP section discussing the water budget focuses on the results of the water budget. These results are presented as average annual values for the entire subbasin which limit the ability for the public to evaluate and understand the impacts to DACs and small community water systems. Time series graphs of the water budget results

[13] Draft Merced Subbasin GSP pg. 2-136, dated July 2019
[14] Draft Merced Subbasin GSP Table 2-3 pg. 2-119, dated July 2019
[15]

are needed to evaluate if the water budget adequately represents the temporal variability and trends in drinking water demand. By presenting only subbasin-level water budget results and only as average annual values, the presented results are opaque with respect to drinking water use by DACs, as well as demands by other types of beneficial users.

- The Draft GSP does not include any discussion of the uncertainty in the data used for the model and its potential effects on the water budget results. The GSP should include an uncertainty analysis to identify the plausible range in water budget results and an indication of the magnitude of the effects these inherent uncertainties may have on the water budget results.
- The estimate of sustainable yield for the subbasin was determined using the Projected Conditions Baseline scenario. According to the Draft GSP, in this scenario, agricultural and urban demand is reduced across the model domain to achieve a net storage change of zero. Agricultural demand was reduced by reducing agricultural land use. Urban demand was reduced by reducing the per capita water use. However, the Draft GSP does not present information on how per capita water use reductions were determined or if they were applied equally to all drinking water users (municipal users, rural domestic users, small community waters systems, etc.). The document also does not include a discussion of how these reductions would affect domestic water users or small community water systems. Therefore, based on this, it is not clear how demands by drinking water users were considered in the sustainable yield calculation.

The Monitoring Network Is Inadequate With Respect to Groundwater Levels and Groundwater Quality.

The GSA's Monitoring Network is insufficient because its representative monitoring wells do not cover the entirety of the Subbasin. The GSAs must consider the interests of beneficial users including domestic well owners and disadvantaged communities,[16] and must avoid disparate impacts on protected groups pursuant to state law.[17] The Draft GSP lacks representative monitoring wells in areas of the subbasin where drinking water users may be particularly vulnerable to groundwater supply and quality issues, leaving the GSAs with no ability to measure and avoid significant and unreasonable impacts to those users. The GSAs must prioritize measures to address these data gaps and add more representative monitoring wells. The insufficiency of the

[16] Water Code sec. 10723.2.
[17] Gov. Code § 11135 ["No person in the State of California shall, on the basis of sex, race, color, religion, ancestry, national origin, ethnic group identification, age, mental disability, physical disability, medical condition, genetic information, marital status, or sexual orientation, be unlawfully denied full and equal access to the benefits of, or be unlawfully subjected to discrimination under, any program or activity that is conducted, operated, or administered by the state or by any state agency, is funded directly by the state, or receives any financial assistance from the state."]; Gov. Code § 65008 [Any discriminatory action taken "pursuant to this title by any city, county, city and county, or other local governmental agency in this state is null and void if it denies to any individual or group of individuals the enjoyment of residence, land ownership, tenancy, or any other land use in this state…"]; Government Code §§ 12955, subd. (l) [unlawful to discriminate through public or private land use practices, decisions or authorizations].

representative monitoring network poses a significant threat to the validity of the Plan at large, and therefore must be addressed immediately.

Representative Monitoring Wells

The GSAs have proposed a monitoring network of 50 wells, out of which only 25 have been designated as representative wells.[18] As the attached technical report notes, this represents only one well for over 153 square miles of groundwater subbasin, or 0.65 wells per 100 square miles. This monitoring well density is just barely within the established DWR guidance for monitoring well densities of between 0.2 and 10 wells per 100 square miles.[19] In addition, representative wells are generally located in the center of the subbasin, while domestic wells are distributed widely across the subbasin;[20] this results in approximately 1,100 out of approximately 3,600 domestic wells in the subbasin being located outside of the two-mile radius areas used to establish the Draft GSP's minimum thresholds as highlighted in the attached technical report. In particular, the domestic wells located in and around the DACs of El Nido, Planada, Le Grand, and south of the City of Merced are located outside of the areas being monitored for water levels. As such, there are no representative wells for groundwater levels or groundwater quality in the vicinity of these beneficial users. Furthermore, the areas not covered by the monitoring network are where the subbasin's shallowest wells are located, as indicated by the Merced County tanked water program, which tanked water out to many communities in the areas without monitoring wells.[21]

Consultants for the GSAs have cited this lack of data to justify why it cannot protect drinking water users from wells going dry at several subbasin meetings.[22] This stance is alarming, given that state law recognizes drinking water as the "highest use of water."[23] As such, it is imperative for the GSAs to include a plan for a robust monitoring network to fill those data gaps. In their Draft GSP, the GSAs have only proposed to install four more representative wells to fill in data gaps in groundwater levels in the three large data gap regions they have identified,[24] and plans to wait until a year after GSP approval by DWR (which may not be for another two years) to create a plan to fill data gaps.[25] Additionally, the GSA proposes to fill two of their data gap areas by relying on monitoring wells and data from existing programs such as the East San Joaquin Water Quality Coalition Groundwater Quality Trend Monitoring and Public Water System,[26] which is concerning as ESJWQC is still phasing in their groundwater trend monitoring network.[27] It is also unclear whether the additional wells will be at the correct groundwater depth to detect impacts to domestic wells.

---

[18] Draft Merced Subbasin GSP pg. 4-8, dated July 2019.
[19] DWR, 2016. Best Management Practices for the Sustainable Management of Groundwater, Monitoring Networks and Identification of Data Gaps (BMP #2), December 2018.
[20] Draft Merced Subbasin GSP pg. 4-3, dated July 2019.
[21] Draft Merced Subbasin GSP pg. 3-5, dated July 2019.
[22] Merced Subbasin Stakeholder Committee meeting, July 22, 2019, in which consultants stated that data is limited in some SDAC areas so they cannot include them in representative wells.
[23] Water Code § 106.
[24] Draft Merced Subbasin GSP pg. 4-15, dated July 2019.
[25] Draft Merced Subbasin GSP pg. 4-26, dated July 2019.
[26] Draft Merced Subbasin GSP pg. 4-26, dated July 2019.
[27] East San Joaquin Water Quality Coalition Groundwater Quality Trend Monitoring Workplan: Phase III.

To ensure that the representative wells within the monitoring network accurately monitor impacts to groundwater management for drinking water beneficial users, and does not create a disparate impact on protected groups, we make the following recommendations:

- Include all MAGPI wells in the representative monitoring network in order to include DACs such as Planada and Winton, so that those wells can measure compliance with goals for groundwater quality and quantity.
- Include a plan in the GSP to fill data gaps, and include an aggressive timeline to ensure prompt implementation of the plan. This plan should include installation of representative monitoring wells measuring groundwater quality and levels in DAC areas not currently covered by the monitoring network. These representative monitoring wells should also be designed to measure impacts at the level of community water system wells and domestic wells. In particular, new representative monitoring wells should be installed in or near the DACs of Planada, El Nido, and Le Grand to detect groundwater quality and supply impacts to those communities.
- All 50 wells in the monitoring network must be properly retrofitted as representative monitoring wells. Currently, only 25 of the 50 existing wells in the monitoring network are representative.
- Add the monitoring well proposed to be installed in El Nido to the representative monitoring well network by ensuring that it meets the requirements of being a representative monitoring well.

The Draft GSP Sustainable Management Criteria for Groundwater Levels are not Adequate

The Draft GSP's proposed minimum thresholds and undesirable results with respect to groundwater levels are not tied to sufficient information and criteria about their impact on beneficial users including drinking water users, and its measurable objective does not comply with its sustainability goals. The GSAs have not shown how they have considered the interests of beneficial users including domestic well owners and disadvantaged communities.[28] The resulting impact from the proposed sustainable management criteria will likely lead to disparate impacts on protected groups pursuant to state and federal law.[29]

The Proposed Minimum Threshold is not Sufficiently Protective

[28] Water Code sec. 10723.2.

[29] Gov. Code § 11135 ["No person in the State of California shall, on the basis of sex, race, color, religion, ancestry, national origin, ethnic group identification, age, mental disability, physical disability, medical condition, genetic information, marital status, or sexual orientation, be unlawfully denied full and equal access to the benefits of, or be unlawfully subjected to discrimination under, any program or activity that is conducted, operated, or administered by the state or by any state agency, is funded directly by the state, or receives any financial assistance from the state."]; Gov. Code § 65008 [Any discriminatory action taken "pursuant to this title by any city, county, city and county, or other local governmental agency in this state is null and void if it denies to any individual or group of individuals the enjoyment of residence, land ownership, tenancy, or any other land use in this state…"]; Government Code §§ 12955, subd. (l) [unlawful to discriminate through public or private land use practices, decisions or authorizations].

The Draft GSP does not set forth a clear methodology by which the GSAs arrived at the decision to set the minimum threshold for groundwater levels at the level of the shallowest well in a 2-mile radius around each representative monitoring well, or at 2015 levels if the shallowest well has been dewatered. The groundwater levels sustainable management criteria set by the GSAs must have the purpose of avoiding "significant and unreasonable" impacts on beneficial users caused by declining groundwater levels. The Draft GSP states that stakeholders identified "significant and unreasonable number of shallow domestic wells going dry" as an undesirable results.[30] However, the GSAs make no determination as to how many dry wells constitute a "significant and unreasonable" number, and this determination was not made at any public meetings.

Under the SGMA regulations, the GSAs should provide "the information and criteria relied upon to establish minimum thresholds," an explanation of how the proposed minimum thresholds will "avoid undesirable results," and "how minimum thresholds may affect the interests of beneficial uses and users of groundwater."[31] The only type of "information and criteria" that will show whether a proposed minimum threshold will cause dry wells is an analysis of how many wells will go dry throughout the subbasin, based on the best available data. We were able to commission a quick analysis comparing proposed minimum thresholds with domestic well depths using available data. However, such an explanation was not written in the Draft GSP, and was not taken into account in creating the proposed minimum thresholds.

Once such an analysis has been conducted, the GSAs should consider that drinking water use has been recognized as the "highest use of water" by the California legislature, and should consult with stakeholders to ensure that the minimum threshold is set is such a way as to guarantee the human right to drinking water to all individuals in the subbasin.

Additionally, the attached technical report notes that nearly one-third of all domestic wells in the subbasin were not considered in the establishment of minimum thresholds: given the limited spatial distribution of the 25 representative monitoring wells, as described above, approximately 1,100 out of approximately 3,600 domestic wells in the subbasin are located outside of the two-mile radius areas used to establish these minimum thresholds. Therefore, even if all representative monitoring wells were to set the minimum threshold at the level of the shallowest well, this still puts a third of the subbasin's domestic wells at risk of going dry. Additionally, there are no information or criteria justifying why 2015 levels were chosen as the alternative minimum threshold in cases where shallow wells have gone dry in a 2-mile radius around representative monitoring wells, or why a radius of 2 miles was chosen.[32]

The minimum thresholds further do not avoid the significant and unreasonable impact of dry wells, because they are set at the level of the bottom of the total well construction depth. A water supply well becomes unusable or subject to decreased performance and longevity as water levels fall within the screened interval, which will occur before water levels reach the bottom of the well, as highlighted in the attached technical report. Therefore, many domestic wells within the two-mile

[30] Draft Merced Subbasin GSP pg. 3-4, dated July 2019
[31] 23 CCR § 354.28.
[32] Draft Merced Subbasin GSP pg. 3-6, dated July 2019

radius of each representative monitoring well may be impacted before the minimum threshold is exceeded.

Therefore, the GSAs must do the following:

- Conduct a drinking water impacts analysis that clearly shows the impact of the proposed minimum thresholds on drinking water users
- Modify the minimum threshold to avoid the significant and unreasonable impact of dry wells. In order to protect drinking water users, the GSAs should place the minimum threshold at a level above where the shallowest domestic well is *screened*.
- Provide a full explanation of the information and criteria that was used to set the minimum threshold.

The Proposed Measurable Objectives for Groundwater Levels is Inadequate

The Draft GSP sets measurable objectives at levels that do not protect against the significant and unreasonable impact of wells going dry. In areas where the minimum threshold is set at the level of the shallowest well, the minimum threshold should be at a buffer of 25 feet above where the shallowest domestic well is *screened*.

The same problem of lack of representative monitoring well coverage also means that, even where the proposed measurable objective is 25 feet above the shallowest well, there are still many domestic wells at risk of dewatering in areas without representative monitoring wells. This does not comply with the obligations under the SGMA regulations to set measurable objectives and interim milestones that "achieve the sustainability goal for the basin within 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon." Subbasin stakeholders identified a significant and unreasonable number of wells going dry as an undesirable result, and this measurable objective will not achieve that goal.[33]

The Proposed Undesirable Result for Groundwater Levels is Inadequate

The GSAs propose to wait until 25% of representative wells fall below the minimum threshold for two consecutive wet, above normal, or below normal years, before an UR is triggered. The SGMA regulations require GSAs to justify their undesirable results by including the "[p]otential effects on the beneficial uses and users of groundwater."[34] The GSAs have included no information or criteria to explain how many shallow domestic wells will go dry if this undesirable result is reached, and therefore does not set forth adequate information to justify this decision. Given the amount of wells outside of the representative monitoring well 2-mile radius zone, and the wells that are screened above the minimum threshold, this could put thousands of domestic users' drinking water access at severe risk. 25% percent of the subbain seems too high to protect drinking water users, and the GSAs should consult with stakeholders to determine whether the number of wells that will go dry is "significant and unreasonable." Lastly, adding a hydrological condition of

[33] 23 CCR § 354.30.
[34] 23 CCR § 354.26.

two consecutive wet, above normal or below normal years to the undesirable result adds an unnecessary and unfair constraint considering California's highly variable regional climate.[35]

Recommendations for Modifying the Sustainable Management Criteria for Groundwater Levels

To ensure that drinking water users are protected from impacts to groundwater level declines:

- At minimum, the Merced GSAs must do a drinking water impact analysis with a focus on identifying how many wells are at risk of dewatering from the proposed minimum threshold and the proposed undesirable result. This analysis needs to be considered by stakeholders and the GSAs as part of decision-making about sustainable management criteria, included in the GSP, and all data and methodology for this analysis should be made available to the public. This request has been made several times at various community meetings, as well as our previous comment letter.
- The Merced GSAs must consider the dewatering of *any* well that is currently in use to be a significant and unreasonable result. It should therefore place minimum thresholds at a level that protect all drinking water wells from going dry or becoming contaminated in the subbasin. If the Merced subbasin GSAs decide to define and reach their sustainability goal in a way that allows for the dewatering of drinking water wells, they must provide a robust drinking water protection program to prevent impacts to drinking water users and mitigate drinking water impacts that occur.
- The Merced GSAs must show how its measurable objectives and interim milestones for groundwater levels will avoid a significant and unreasonable number of shallow domestic wells going dry. Once the GSAs have conducted an analysis of how the proposed levels will affect shallow domestic wells, they can determine alongside stakeholders whether the number of wells is significant and unreasonable, and modify their measurable objective accordingly. Additionally, the requirement for minimum threshold violations for two similar consecutive hydrological years need to be removed and replaced with much more aspirational criteria and objectives that better protect drinking water access.

The GSAs Should Set Sustainable Management Criteria for Groundwater Storage

The GSAs did not set any sustainable management criteria for groundwater storage based on the premise that "unreasonable depletions of groundwater storage are not present and not expected to occur in the Subbasin".[36] However, the GSAs use an incorrect standard to assess the impact of this sustainability indicator on beneficial users. The GSAs state that there will not be a significant *percent* change in storage, citing to the vast depths of the aquifer in the Subbasin. However, the GSAs should instead focus on beneficial users' ability to *access* stored groundwater. Should groundwater storage be depleted to the extent that the aquifer is no longer accessible to the beneficial users in the Subbasin, then beneficial users will see significant and unreasonable impacts from not being able to access the stored groundwater. This inability to access stored groundwater may be the result of technological and/or economic barriers relating to loss of groundwater storage,

[35] Bell, Jason L., Lisa C. Sloan, and Mark A. Snyder. "Regional changes in extreme climatic events: a future climate scenario." *Journal of Climate* 17.1 (2004): 81-87.
[36] Draft Merced Subbasin GSP pg. 3-10, dated July 2019.

among other challenges.[37] Therefore the GSAs have not shown how they have considered the interests of beneficial users including domestic well owners and disadvantaged communities,[38] and the resulting impact from the proposed sustainable management criteria will likely lead to disparate impacts on protected groups pursuant to state and federal law.[39]

We strongly urge the GSAs to do the following:

- Set sustainable management criteria for groundwater storage.
- In setting sustainable management criteria for groundwater storage, the GSAs must consider the impacts that loss in access to groundwater storage will have on drinking water users, specifically around increased costs in accessing lower groundwater.

The Draft GSP Fails to Adequately Address Groundwater Quality

The Draft GSP leaves drinking water users in the subbasin vulnerable to increased drinking water contamination from the GSAs' groundwater management activities or from the lack of adequate groundwater management in the subbasin. The GSAs have not shown how they have considered the interests of beneficial users including domestic well owners and disadvantaged communities in shaping groundwater quality sustainable management criteria.[40] Instead of fully incorporating protection of all drinking water quality standards into the Draft GSP, the GSAs limit their goals for groundwater quality to Total Dissolved Solids (TDS), a constituent far less harmful to human health than many others identified in the Draft GSP including nitrates, arsenic, 123-TCP, and

---

[37] McGuire VL, Johnson MR, Schieffer RL, Stanton JS, Sebree SK, Verstraeten IM (2003) Water in storage and approaches to groundwater management, High Plains aquifer, 2000. US Geol Surv Circ 1243.
Konikow, Leonard F., and Eloise Kendy. "Groundwater depletion: A global problem." *Hydrogeology Journal* 13.1 (2005): 317-320.
Handa, Divya, et al. "The Efficiencies, Environmental Impacts and Economics of Energy Consumption for Groundwater-Based Irrigation in Oklahoma." *Agriculture* 9.2 (2019): 27.
Wilkinson, Robert, and W. Kost. "An analysis of the energy intensity of water in California: providing a basis for quantification of energy savings from water system improvements." *California Institute for Energy Efficiency, California* (2006).
[38] Water Code sec. 10723.2.
[39] Gov. Code § 11135 ["No person in the State of California shall, on the basis of sex, race, color, religion, ancestry, national origin, ethnic group identification, age, mental disability, physical disability, medical condition, genetic information, marital status, or sexual orientation, be unlawfully denied full and equal access to the benefits of, or be unlawfully subjected to discrimination under, any program or activity that is conducted, operated, or administered by the state or by any state agency, is funded directly by the state, or receives any financial assistance from the state."]; Gov. Code § 65008 [Any discriminatory action taken "pursuant to this title by any city, county, city and county, or other local governmental agency in this state is null and void if it denies to any individual or group of individuals the enjoyment of residence, land ownership, tenancy, or any other land use in this state…"]; Government Code §§ 12955, subd. (l) [unlawful to discriminate through public or private land use practices, decisions or authorizations].
[40] Water Code sec. 10723.2.

hexavalent chromium. The resulting impact from the proposed sustainable management criteria will likely lead to disparate impacts on protected groups, in conflict with state and federal law.[41]

The California legislature has stated that the use of water for domestic purposes is the highest use of water[42] and SGMA charged GSAs with the responsibility to protect water quality through groundwater management.[43] Despite several mentions of the importance of protecting drinking water resources in the draft GSP, the minimum threshold, measurable objective, and undesirable result are wholly inadequate.

The GSAs only proposed to establish sustainable management criteria for water quality that consider, measure, and protect against increasing salinity levels.[44] They further assert that they do not need to establish minimum thresholds for other constituents because there is no demonstrated correlation between water quality and water elevations.[45] They do not, however, present the data or analysis to support this claim. The water quality trend data presented in Appendix E only provides data through 2012 for selected water quality constituents (TDS, arsenic, nitrate, hexavalent chromium, DBCP, 1,2,3-TCP, etc.) and therefore does not present temporal trend data that would be associated with the lowered groundwater levels during the drought. In fact, there is almost no post-2012 drinking water quality data included in the Draft GSP. This represents an incomplete analysis of groundwater conditions that could have significant impacts to the sustainability and usability of the groundwater resource by drinking water users. The Draft GSP makes a key conclusion relevant to the long term management of water quality in the subbasin based on a conclusion that is unsupported by the analysis presented in the Draft GSP.

The Draft GSP also states that "[t]he primary water quality constituents of concern related to human activity include salinity, nitrate, hexavalent chromium, petroleum hydrocarbons (such as benzene and MTBE), pesticides (such as DBCP, EDB, 1,2,3 TCP), solvents (such as PCE, TCE), and emerging contaminants (such as PFOA, PFOS)."[46] Of these constituents, nitrates are the most widespread contaminant with a direct impact on public health. The Merced County Department of Public Health considers nitrate to be an adverse groundwater quality parameter for most regions in the subbasin.[47] Despite its impacts to human health and prevalence in the area, the Draft GSP

[41] Gov. Code § 11135 ["No person in the State of California shall, on the basis of sex, race, color, religion, ancestry, national origin, ethnic group identification, age, mental disability, physical disability, medical condition, genetic information, marital status, or sexual orientation, be unlawfully denied full and equal access to the benefits of, or be unlawfully subjected to discrimination under, any program or activity that is conducted, operated, or administered by the state or by any state agency, is funded directly by the state, or receives any financial assistance from the state."]; Gov. Code § 65008 [Any discriminatory action taken "pursuant to this title by any city, county, city and county, or other local governmental agency in this state is null and void if it denies to any individual or group of individuals the enjoyment of residence, land ownership, tenancy, or any other land use in this state…"]; Government Code §§ 12955, subd. (l) [unlawful to discriminate through public or private land use practices, decisions or authorizations].
[42] Water Code § 106.
[43] Water Code sec. 10721(w)(4); 23 CCR sec. 354.28(c)(4).
[44] Draft Merced Subbasin GSP pg. 3-11, dated July 2019.
[45] Draft Merced Subbasin GSP pg. 3-10, 3-11, dated July 2019.
[46] Draft Merced Subbasin GSP pg. 2-76, dated July 2019
[47] Draft Merced Subbasin GSP pg. 2-77, dated July 2019.

does not set minimum thresholds for nitrate, or for any water quality constituent other than TDS. The GSAs attempt to justify this decision, explaining that "[t]hresholds are not set for these constituents as the GSAs have no authority to limit the loading of nutrients or agrochemicals."[48] This justification is flawed as groundwater management actions will have a direct and indirect impact on the transport of nitrates, for example through groundwater recharge activities, groundwater pumping and management can impact the migration of contaminant plumes, and decreased water resources can increase concentrations of contaminants.

Groundwater quality protection is a requirement of SGMA.[49] This Draft GSP fails to incorporate performance measures and management criteria with respect to contaminants that impact human health including those contaminants with established primary drinking water standards, and in so, fails to conform with the requirements of SGMA. Furthermore, the minimum threshold for TDS itself is inadequate. A minimum threshold will only be triggered after seven representative wells show increasing levels of salinity consecutively for two years.[50] This is an unreasonably lax contamination threshold, especially given the sparseness of the monitoring network. In other words, since there are significant geographic gaps in the Merced Subbasin monitoring network (as discussed above), by the time seven of the 25 representative wells show increases in salinity for two consecutive years, it is more than likely that a high percentage of vulnerable drinking water users will be experiencing severe, long-term drinking water contamination problems before a minimum threshold is triggered. Therefore, this minimum threshold does not protect access to safe drinking water.

In order to set the minimum threshold, measurable objectives, and undesirable result, that are protective of groundwater quality for all beneficial users in the basin, the GSP must include the following:

- All representative monitoring wells must monitor constituents with established primary drinking water standards, hexavalent chromium, and PFOSs/PFOAs which has been identified as emerging contaminants in the basin.[51] We have raised this point at several committee meetings and through written correspondence.
- Set a protective minimum threshold, measurable objective, and undesirable result for all constituents with primary drinking water standards,hexavalent chromium, and PFOSs/PFOAs that may be impacted by groundwater management activities, or failure to manage groundwater in a way that does not negatively impact groundwater quality.
- A detailed explanation as to how the groundwater quality minimum threshold will result in the protection of groundwater for DACs and other drinking water users in the subbasin.

The GSP Should Ensure No Further Land Subsidence

The GSP should establish the measurable objective for land subsidence as zero change in subsidence resulting from groundwater management actions. While we are aware land subsidence happens naturally, the increase in pumping during the recent drought has led to an acceleration in

[48] Draft Merced Subbasin GSP pg. 3-12, dated July 2019.
[49] Water Code §§ 10727.2(d)(2); 10721(x)(4)
[50] Draft Merced Subbasin GSP Executive Summary, Table ES-1.
[51] Draft Merced Subbasin GSP pg. 2-76, dated July 2019.

land subsidence.[52] Because the basin is in critical overdraft, the GSAs should aim to prevent any subsidence as a result of groundwater management activities, or from failure to manage groundwater in a way that does not aggravate land subsidence.

One concern that has not been taken into consideration while setting the minimum thresholds, measurable objectives, and undesirable result, has been the impact of land subsidence on critical infrastructure, including roads, homes, piping, and wells. The only infrastructure that the Merced GSA considered to be of relevance for land subsidence in the Draft GSP is the Eastside Bypass.[53] While it is important to consider impacts of land subsidence on the Eastside Bypass, it is not the only critical infrastructure in the basin. In many parts of the world land subsidence due to groundwater extraction has caused surface deformation resulting in disturbances to water distribution networks and sewer systems.[54] We want to make sure we avoid such potential harms by making sure the minimum threshold, measurable objectives, and undesirable result, take into consideration the impacts of land subsidence on roads, homes, piping, and wells.

Projects and Management Actions are Inadequate

The projects and management actions set forth in the Draft GSP does not demonstrate a path towards achieving the sustainability goals in the plan, as significant management actions will not be fully implemented until five years before the GSAs must achieve their sustainability goals. Projects and Management Actions are also insufficient because they disproportionately benefit agricultural water users over other users, and disadvantaged communities will be benefited disproportionately less than other users. The GSAs have not shown how they have considered the interests of beneficial users including domestic well owners and disadvantaged communities.[55] The resulting impact from the proposed sustainable management criteria will likely lead to disparate impacts on protected groups pursuant to state and federal law.[56] Additionally, the Projects

[52] Faunt, Claudia C., et al. "Water availability and land subsidence in the Central Valley, California, USA." *Hydrogeology Journal* 24.3 (2016): 675-684.
[53] Draft Merced Subbasin GSP pg. 3-15, dated July 2019.
[54] Pacheco-Martínez, Jesús, et al. "Land subsidence and ground failure associated to groundwater exploitation in the Aguascalientes Valley, México." Engineering Geology 164 (2013): 172-186; Abidin, H. Z., et al. "Land subsidence in coastal city of Semarang (Indonesia): characteristics, impacts and causes." Geomatics, Natural Hazards and Risk 4.3 (2013): 226-240; Hernández-Espriú, Antonio, et al. "The DRASTIC-Sg model: an extension to the DRASTIC approach for mapping groundwater vulnerability in aquifers subject to differential land subsidence, with application to Mexico City." Hydrogeology Journal 22.6 (2014): 1469-1485; Zektser, S., Hugo A. Loáiciga, and J. T. Wolf. "Environmental impacts of groundwater overdraft: selected case studies in the southwestern United States." Environmental Geology 47.3 (2005): 396-404.
[55] Water Code sec. 10723.2.
[56] Gov. Code § 11135 ["No person in the State of California shall, on the basis of sex, race, color, religion, ancestry, national origin, ethnic group identification, age, mental disability, physical disability, medical condition, genetic information, marital status, or sexual orientation, be unlawfully denied full and equal access to the benefits of, or be unlawfully subjected to discrimination under, any program or activity that is conducted, operated, or administered by the state or by any state agency, is funded directly by the state, or receives any financial assistance from the state."]; Gov. Code § 65008 [Any discriminatory action taken "pursuant to this title by any city, county, city and county, or other local governmental agency in this state is null and void if it denies to any individual or group of individuals the

and Management Actions section does not describe clear timelines and commitments for projects that specifically benefit disadvantaged communities.

Management Actions

The GSAs selected two management actions to achieve sustainability: an initial groundwater allocation framework and groundwater demand reduction. These two actions will be pivotal to reaching basin wide sustainability by 2040. However, the Draft GSP does not set a clear timeline for implementation of an allocation framework. The Draft GSP states that the GSAs will only implement the demand reduction strategy "as needed," that demand reduction does not begin until 2025, and will not be fully implemented until 2035. We are concerned that the GSAs will not achieve their sustainability goals if water use is not limited through both an allocation framework (established within one year of GSP adoption) and a fully implemented demand reduction requirements within ten years of plan adoption.

In order to protect drinking water resources and avoid a disparate impact on protected groups, the GSAs must:

- Implement a demand reduction strategy immediately in order to avoid impacts to drinking water users, and define a concrete timeline for implementation of the strategy.
- Define an allocation framework within a year of submittal of the GSP, ensure that the allocation framework adequately protects groundwater to meet the drinking water needs of domestic well owners and disadvantaged communities in the subbasin, and implement the allocation framework proactively to avoid wells going dry.

Projects

The GSAs should prioritize more projects geared towards water efficiency in the agricultural sector and reduction in agricultural water use, since irrigation is the primary cause of overdraft in the Subbasin. Several of the projects in both the shortlist and on the projects running list focus more on increasing import of water supplies and water efficiency in urban water use. However, water efficiency in the urban sector, while important, only makes up a small portion of water use in the basin. Vastly less groundwater usage would be gained from water efficiency in urban water use than can be achieved through water conservation in irrigation.[57]

Basin-wide metering, with a focus on agricultural metering, should be prioritized under "Projects and Management Actions." With data available from basin wide-metering the GSAs will be better equipped to create an equitable allocation framework, as well as have stronger data to help understand what a sustainable yield in the basin should be and the amount of demand reduction that should be enforced each year in order to achieve sustainability. Without metering, the GSAs will not have accurate information about groundwater use.

---

enjoyment of residence, land ownership, tenancy, or any other land use in this state…"]; Government Code §§ 12955, subd. (l) [unlawful to discriminate through public or private land use practices, decisions or authorizations].

[57] Ward, Frank A., and Manuel Pulido-Velazquez. "Water conservation in irrigation can increase water use." Proceedings of the National Academy of Sciences 105.47 (2008): 18215-18220.

The Merced subbasin GSAs must avoid creating a disparate impact on low-income communities of color. As written, only one of the proposed projects protects a disadvantaged community's drinking water supply, while the majority of the projects in the Draft GSP benefit agricultural users. The lack of projects that protect disadvantaged communities' drinking water supplies, combined with the sustainable management criteria that will allow for many domestic wells to go dry and become contaminated, will cause a disparate impact to low income communities of color that live in disadvantaged communities in the subbasin. The GSAs should therefore include more projects and management actions specifically geared towards protecting drinking water resources in disadvantaged communities.

The GSAs should use their operational budget to pay for these DAC projects, instead of relying on other state drinking water programs or grants. State drinking water programs like the Safe and Affordable Drinking Water Fund are not meant to substitute GSA investments in drinking water sustainability pursuant to their responsibilities under SGMA.

The following must be incorporated into the Projects and Management Actions section of the GSP in order to avoid a disparate impact on low income communities of color in the Merced subbasin:

- Projects benefiting disadvantaged communities such as the Planada recharge basin must contain specific timelines and commitments to ensure achievement of sustainability and protection of drinking water resources for disadvantaged communities.
- Detailed information on projects must be available to the public online, as appendices to the GSP, and in a public workshop during a public comment period. In reading the shortlist projects descriptions, we had several questions about project details, which could be easily answered by providing more information on the projects. In order to better inform stakeholders on these projects and why they are being prioritized over others, more information on these projects needs to be made available, both in the plan and through more opportunities for in-person public comment.
- Establish basin wide metering to accurately assess the amount of groundwater being pumped in the basin, and where such pumping is occurring.
- Improvements in the representative monitoring well network must be prioritized, particularly for currently uncovered areas where DACs are located
- Implement projects to benefit disadvantaged communities in a reasonably timely manner, and concurrently with projects that benefit other beneficial users, so as to avoid disparate impacts on low income communities of color.
- More projects must be included that specifically benefit DACs. These projects and management should include:
    - Management areas that set more protective sustainable management criteria in areas where vulnerable communities and DACs are located, particularly where data gaps and no representative monitoring wells are located. Such areas should contain a buffer around communities to avoid localized impacts.
    - Implementing a warning system so that the GSAs are aware of when wells are going dry, or when wells are going to become contaminated from groundwater management activities, so it can take action to prevent drinking water impacts. If drinking water wells are at risk of impacts, the GSAs should help connect communities and individual homes to nearby reliable water systems. If

consolidation is not possible, the GSAs should deepen wells, install treatment facilities or POE/POU treatment in homes. In the interim, the GSA should provide emergency bottled water.

- Incentives for demand reduction strategies.
- A mitigation fund for increased cost of accessing safe and reliable drinking water for low income families. We will gladly speak with you more in detail about how such a program could be structured, financed and how residents would qualify.
- Implement more recharge basins in and around DACs, with clear implementation timelines and a clear plan for community leadership of the project
- Stormwater drainage ponds that would eliminate flooding and increase groundwater recharge in DACs
- Funds for private well testing for low income families

Plan Implementation Must Include Robust Public Participation, Allow Amendments to the GSP Upon Availability of New Information, and Implement Drinking Water Protection Programs

We have several concerns regarding plan implementation, specifically concerns over public outreach, the potential to make amendments to the GSP, metering requirements, and future mitigation strategies.

In the public outreach section for plan implementation, the GSA did not include translation services for DACs in which the predominant language is not English. The Merced basin is home to a large Latino population, many of whose first language is Spanish.[58] In order to be able to include all beneficial users in the GSP implementation process, material needs to be made available in the appropriate language. Additionally, GSA should not rely on email as the primary mode of relaying information and conducting outreach since many of the most vulnerable drinking water users may not have access to internet services.

As the draft plan is currently written, it is unclear if reconsidering elements of the GSP is only possible at the 5-year update or if reconsiderations can be proposed and made at any other time. Through its GSP, the GSA must establish processes by which it will seek and incorporate feedback from the public on an ongoing basis through direct outreach to disadvantaged communities and public workshops that are held at convenient locations and times and accessible in multiple languages. Additionally, proposed reconsiderations must be publicly noticed and circulated for public review and comment prior to final adoption.

Under the “Establishing Metering Program” section, the GSA states that on advisement from the stakeholders and coordination committees, the GSA should take a “flexible approach” to metering. Without full metering across the basin we will not have an accurate view of how much water is entering and exiting the aquifer. As stated above, basin-wide metering, with a focus on agricultural metering, should be prioritized under “Projects and Management Actions.”

[58] United States Census Bureau. "QuickFacts, Merced County, California" census.gov. 16 Aug. 2019. Web https://www.census.gov/quickfacts/mercedcountycalifornia#qf-headnote-b.

Last, at the end of this chapter the Merced GSA briefly discusses mitigation for possible future domestic well dewatering.[59] As has been stated previously in this letter, the California legislature has stated that the use of water for domestic purposes is the highest use of water[60], as such, a single domestic shallow well being dewatered should be considered significant and unreasonable. The attached technical report highlights that a significant proportion of domestic wells have the potential to be partially or fully dewatered if water levels reach the proposed minimum threshold levels. Establishing mitigation for shallow domestic wells that might be dewatered by declining water levels during the GSP implementation period should be of the highest priority.

To ensure that the GSP is implemented properly, the GSA must do the following:

- The GSA should include translation services as part of their public outreach plan in order to meaningfully consult with and consider the interest of all beneficial users. Workshops and meetings must be at an accessible time and locations for all stakeholders. Additionally, notifications should also be sent out via mail to those who have limited or no access to internet services.
- Clarify in the GSP that the plan may be modified as data becomes available, and that the GSA will seek and accept feedback from the public on an ongoing basis throughout plan implementation.
- Clarify that any modification to the GSP must be in writing, noticed and provide sufficient time for public review and feedback.
- Establish a plan for drinking water protection and a plan for improving the representative well monitoring network within this GSP.

The Draft GSP Threatens to Infringe on Water Rights

In enacting SGMA, the legislature found and declared that "[f]ailure to manage groundwater to prevent long-term overdraft infringes on groundwater rights."[61] The test of SGMA further notes that "[n]othing in this part, or in any groundwater management plan adopted pursuant to this part, determines or alters surface water rights or groundwater rights under common law or any provision of law that determines or grants surface water rights."[62] As discussed in detail above, the Draft GSP allows continued overdraft above the safe yield of the basin, such that drinking water wells (especially domestic wells) will continue to go dry, infringing on the rights of overlying users of groundwater. The Draft GSP must be revised to protect the rights of residents of disadvantaged communities and/or low-income households who hold water rights to groundwater.

The Draft GSP Conflicts with the Reasonable And Beneficial Use Doctrine

The "reasonable and beneficial use" doctrine, to which SGMA expressly must comply,[63] is codified in the California Constitution. It requires that "the water resources of the State be put to

---

[59] Draft Merced Subbasin GSP pg. 7-11, dated July 2019.
[60] Water Code § 106.
[61] AB 1739 (2014).
[62] Water Code § 10720.5(b).
[63] Water Code § 10720.1(a).

beneficial use to the fullest extent of which they are capable, and that the waste or unreasonable use or unreasonable method of use of water be prevented, and that the conservation of such waters is to be exercised with a view to the reasonable and beneficial use thereof in the interest of the people and for the public welfare." (Cal Const, Art. X § 2; *see also United States v. State Water Resources Control Bd.* (1986) 182 Cal.App.3d 82, 105 ["…superimposed on those basic principles defining water rights is the overriding constitutional limitation that the water be used as reasonably required for the beneficial use to be served."].)

The reasonable and beneficial use doctrine applies here given the negative impacts of the draft GSP on groundwater supply and quality, which are likely to unreasonably interfere with the use of groundwater for drinking water and other domestic uses. As the Draft GSP authorizes waste and unreasonable use, it conflicts with the reasonable and beneficial use doctrine and the California Constitution.

The Draft GSP Conflicts with the Public Trust Doctrine

The "public trust" doctrine applies to the waters of the State, and establishes that "the state, as trustee, has a duty to preserve this trust property from harmful diversions by water rights holders" and that thus "no one has a vested right to use water in a manner harmful to the state's waters."[64]

The "public trust" doctrine has recently been applied to groundwater where there is a hydrological connection between the groundwater and a navigable surface water body.[65] In *Environmental Law Foundation*, the court held that the public trust doctrine applies to "the extraction of groundwater that adversely impacts a navigable waterway" and that the government has an affirmative duty to take the public trust into account in the planning and allocation of water resources.[66] The court also specifically held that SGMA does not supplant the requirements of the common law public trust doctrine.[67]

The Draft GSP proposes to use groundwater levels as a proxy for depletion of interconnected surface water "due to the challenges associated with directly measuring streamflow depletions and because of the significant correlation between groundwater levels and depletions.[68] The Draft GSP further notes interaction between surface water and groundwater in discussing the losing and gaining streams that will be impacted.[69] The draft GSP thus concedes that there is a hydrological connection between groundwater and surface water in the regulated area. As such, *Audobon* and its progeny require the GSAs to consider the impacts of the draft GSP on public trust resources and to attempt, so far as feasible, to avoid or minimize any harm to those interests.

---

64 *United States v. State Water Resources Control Bd.* (1986) 182 Cal.App.3d 82, 106; *see also Nat'l Audubon Soc'y v. Superior Court* (1983) 33 Cal.3d 419, 426 ["before state courts and agencies approve water diversions they should consider the effect of such diversions upon interests protected by the public trust, and attempt, so far as feasible, to avoid or minimize any harm to those interests."].
65 *Environmental Law Foundation v. State Water Resources Control Bd.* (2018) 26 Cal.App.5th 844, 844.
66 *Id.* at 856-62.
67 *Id.* at 862-870.
68 Draft Merced Subbasin GSP, p. ES-6, dated July 2019.
69 GSP, p. 2-14, 2-15.

In contrast to these requirements, the Draft GSP does not consider impacts on public trust resources, or attempt to avoid insofar as feasible harm to the public's interest in those resources.

The Draft Groundwater Sustainability Plan Will Have Disparate Negative Impacts On Protected Classes.

State law provides that no person shall, on the basis of race, national origin, ethnic group identification, and other protected classes, be unlawfully denied full and equal access to the benefits of, or be unlawfully subjected to discrimination under, any program or activity that is conducted, operated, or administered by the state.[70] Furthermore, the state's Fair Employment and Housing Act guarantees all Californians the right to hold and enjoy housing without discrimination based on race, color, or national origin.[71]

Small disadvantaged communities of color within the San Joaquin Valley are disproportionately impacted by unsustainable groundwater use, falling groundwater tables, dry drinking water wells, subsidence, and water quality degradation.[72] The negative impacts discussed in this letter, which will be allowed by the GSP, will be disproportionately felt by communities of color, and are thus discriminatory on the basis of race, color, ancestry, and national origin.

~ ~ ~ ~ ~ ~ ~ ~ ~

The GSP must protect subbasin's most vulnerable drinking water users. We welcome the opportunity to discuss our recommendations to ensure compliance with state law. We are also in communication with the Department of Water Resources about current GSP development activities in the San Joaquin Valley, and hope to successfully work with GSAs, communities and DWR to ensure that groundwater management is equitable and sufficiently protective of vital drinking water resources.

[70] Gov. Code § 11135 ["No person in the State of California shall, on the basis of sex, race, color, religion, ancestry, national origin, ethnic group identification, age, mental disability, physical disability, medical condition, genetic information, marital status, or sexual orientation, be unlawfully denied full and equal access to the benefits of, or be unlawfully subjected to discrimination under, any program or activity that is conducted, operated, or administered by the state or by any state agency, is funded directly by the state, or receives any financial assistance from the state."]; Gov. Code § 65008 [Any discriminatory action taken "pursuant to this title by any city, county, city and county, or other local governmental agency in this state is null and void if it denies to any individual or group of individuals the enjoyment of residence, land ownership, tenancy, or any other land use in this state…"]; Government Code §§ 12955, subd. (l) [unlawful to discriminate through public or private land use practices, decisions or authorizations].

[71] Gov. Code § 12900 et seq.

[72] Feinstein et al., "Drought and Equity in California" (January 2019); Balazs et al., "Social Disparities in Nitrate Contaminated Drinking Water in California's San Joaquin Valley," Environmental Health Perspectives, 19:9 (September 2011); Balazs et al., "Environmental Justice Implications of Arsenic Contamination in California's San Joaquin Valley," Environmental Health Perspectives, 11:84 (November 2012); Flegel et al., "California Unincorporated: Mapping Disadvantaged Communities in the San Joaquin Valley" (2013).

Sincerely,

/s/
Amanda Monaco
Leadership Counsel for Justice and Accountability

CC:

Amanda Peisch-Derby
Senior Engineer
Department of Water Resources

Encl:

Technical Review, July 2019 Merced Subbasin Draft Groundwater Sustainability Plan (GSP)

Self-Help ENTERPRISES

LEADERSHIP COUNSEL FOR JUSTICE & ACCOUNTABILITY

Focused Technical Review:
July 2019 Merced Subbasin Draft Groundwater Sustainability Plan (GSP)

Water Levels

The draft GSP sets the minimum thresholds (MTs) for groundwater levels as the shallower of: (1) the construction depth of the shallowest well in a two-mile radius of each representative monitoring well, or (2) the minimum pre-January 2015 elevation. The GSP further defines the undesirable result (UR) as being when greater than 25% of the representative monitoring wells (RMWs) are below their respective MT for two consecutive years. This approach to setting water level MTs leaves key beneficial users in the subbasin, specifically domestic well users and in particular members of disadvantaged communities (DACs), potentially vulnerable to impacts.

- The water level MTs are set relative to the <u>bottom</u> of the total well construction depth. A water supply well becomes unusable or subject to decreased performance and longevity as water levels fall within the screened interval, which will occur before water levels reach the bottom of the well. **Therefore, many domestic wells within the two-mile radius may be impacted before this MT is exceeded or URs are triggered**.
- Given the limited spatial distribution of the RMW network, a substantial proportion of domestic wells within the subbasin appear to have not been considered in the development of these MTs. **Figure 1** shows the location of domestic wells within the subbasin. Each dot is scaled to represent the number of wells located within a given PLSS Section (i.e., approximately a 1-square mile grid cell). Based on this assessment, approximately 1,100 out of approximately 3,600 domestic wells in the subbasin are located outside of the two-mile radius areas used to establish these MTs. **Nearly one-third of all domestic wells in the subbasin were therefore not considered in the establishment of MTs.**
- The RMWs are generally located in the center of the subbasin, while domestic wells are distributed widely across the subbasin. In particular, as shown in **Figure 1**, the domestic wells located in and around the DACs of El Nido, Planada, Le Grand, and south of the City of Merced are located outside of the areas being monitored for water levels. **As such, there are no water level RMWs, or SGMA compliance points, for water levels in the vicinity of these beneficial users.**
- **Figure 1** also shows the location of community water systems in the subbasin. As you can see in this figure, the **RMW network does not provide adequate coverage for the Planada Community Services District (CSD), Planada Elementary School, or Le Grand CSD; combined, these systems serve a population of over 6,800 people.**
- In order to improve the RMW network, we recommend that additional *representative* monitoring wells (with MTs) be established to be protective of the DACs of Planada, El Nido, and Le Grand.
- **Figure 2** shows the approximate elevations of the domestic well depths (as estimated elevations) with an inset of Figure 3-3 from the draft GSP, which presents the groundwater levels at the proposed MTs for the RMW network. Domestic well depths are shown using the same color

scheme as in the GSP figure, with red representing the shallowest wells and blue representing the deepest wells. Based on this assessment, it appears that many domestic wells are completed to shallower depths than the proximate water level MTs. We acknowledge that this assessment is a "quick and dirty" assessment of well elevations; however, the GSP does not clearly and transparently present the domestic well data used for the establishment of these MTs, nor does it present an assessment of how many and which domestic wells are expected to go dry if the MTs are reached. **Per 23 CCR § 354.28, these assessments should be included in the GSP in order for the public and DWR to able to fully evaluate the ability of the proposed sustainable management criteria and monitoring program to protect beneficial users within the subbasin.**

Water Quality

The draft GSP includes limited analysis of water quality constituents and defines URs for water quality as a "reduction in the long-term viability of domestic, agricultural, municipal, or environmental uses over the planning and implementation horizon of this GSP." For the reasons identified below, the water quality monitoring network and analysis presented in the draft GSP appears to be inadequate, and the sustainable management criteria do not appear to be sufficient to ensure that the stated water quality UR of impacting the long-term viability of the groundwater resource, particularly for domestic water users including DACs, will be avoided.

- The draft GSP sets MTs for groundwater quality for only five *representative* monitoring wells within the subbasin.[1] This represents only one well for over 153 square miles of groundwater subbasin, or 0.65 wells per 100 square miles. This monitoring well density is just barely within the established DWR guidance for monitoring well densities of between 0.2 and 10 wells per 100 square miles.[2] Further, the DWR guidance provides a range of recommended monitoring density and notes that the frequency of monitoring wells depends on local geology, extent of groundwater use, and how the GSP defines undesirable results. **Given the complexity of this subbasin and the geographic distribution of sensitive beneficial users, this proposed network of water quality RMWs appears to be insufficient to monitor impacts to groundwater for drinking water beneficial users, particularly domestic well users and DACs.**
- **Figure 3** shows the location of domestic wells within the subbasin. Each dot is scaled to represent the number of wells located within a given PLSS Section (i.e., approximately a 1-square mile grid cell). **Figure 3** also shows the location of the five water quality RMWs. Over 2,600 out of 3,600 domestic wells in the subbasin are located outside of a two-mile radius of these RMWs. **Over 70% of all domestic wells in the subbasin are therefore located more than two miles from RMW locations where water quality sustainability will be evaluated against MTs.**
- As shown in **Figure 3**, nearly 70 community water systems are located in the subbasin, most of which are located far from the water quality RMWs, including Planada CSD, Le Grand CSD, and many systems supplying schools in the area. The proposed water quality representative monitoring network appears to be inadequate for measuring and quantifying the sustainability of

[1] It is noted that the GSP acknowledges that water quality data from additional wells will be included for annual reporting purposes, but not compliance purposes under SGMA.
[2] DWR, 2016. *Best Management Practices for the Sustainable Management of Groundwater, Monitoring Networks and Identification of Data Gaps (BMP #2),* December 2018.

the groundwater resource for these systems. The GSP explains that community water systems are required to conduct periodic water quality monitoring on their systems; however, this does not prevent the systems from being impacted by degraded water quality resulting from groundwater use and management actions in the subbasin. **At a minimum, the draft GSP should explain how the data from the community water systems will be incorporated into subsequent GSP evaluations and decisions. Further, the draft GSP should describe how the proposed RMWs will ensure that the groundwater used by these community water systems will be managed to avoid significant and unreasonable negative water quality impacts to these beneficial users.**

- In order to improve the monitoring network for water quality, we recommend that additional *representative* monitoring wells (with MTs) be established to be protective of the DACs of Planada, El Nido, and Le Grand, as well as in the western portion of the subbasin.
- The draft GSP states that "The primary naturally-occurring water quality constituents are arsenic and uranium." However, despite being a primary water quality constituent, uranium data are not reviewed and included in the document. Based on data listed as available in Data Management System (DMS; described in Appendix E), uranium data are available to the GSAs for review and analysis. **In order to characterize the water quality conditions in the subbasin and evaluate sustainability management criteria, uranium concentrations, including temporal and spatial trends, should be analyzed, in particular with respect to use of groundwater by drinking water users.**[3,4]
- Arsenic is also identified in the draft GSP as a primary water quality constituent. The draft GSP presents a five-year average of arsenic concentrations (2007-2012) as a contoured map, with no explanation as to the methodology used to contour the map. This methodology of presenting the data has the potential to obscure "hot spots" and localized trends. Appendix E presents time plots of arsenic concentrations from 1984 – 2012, and based on the data presented, areas of higher arsenic concentrations are present in the subbasin. The draft GSP also does not present any analysis comparing the change in arsenic concentrations to the change in water levels. Further, the draft GSP does not include any arsenic data post 2012, which is an omission of the evaluation of possible change in water quality as a result of the lowered water levels experienced during the recent drought. In addition, arsenic concentrations haven been shown in some areas to have a relationship to the dewatering of the Corcoran Clay.[5] This spatial trend should also be evaluated, with data presented clearly with respect to the presence of the clay. **The analysis of arsenic concentrations in groundwater are therefore incomplete with respect to 1) recent data, 2) correlation to changing water levels, and 3) relationship to the presence of the Corcoran Clay.**[3,4]
- The draft GSP provides the following justification for not establishing MTs for naturally occurring constituents, including arsenic and uranium: "Thresholds are not set for these constituents as there is no demonstrated local correlation between fluctuations in groundwater elevations

[3] DWR, 2017. *Best Management Practices for the Sustainable Management of Groundwater, Sustainable Management Criteria (BMP #6),* Draft November 2017.
[4] Stanford, 2019. *A Guide to Water Quality Requirements Under the Sustainable Groundwater Management Act,* Spring 2019.
[5] Smith, Ryan et al. "Overpumping leads to California groundwater arsenic threat." *Nature communications* vol. 9,1 2089. 5 Jun. 2018, doi:10.1038/s41467-018-04475-3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5988660/

and/or flow direction and concentrations of these constituents at wells."(Section 3.6.2). The draft GSP makes the conclusion that there is no demonstrated correlation between water quality and water elevations, but does not present the data or analysis to support this claim. In particular, the draft GSP omits all water quality data collected after 2012 for arsenic. The water quality trend data presented in Appendix E only provides data through 2012 for selected water quality constituents (TDS, arsenic, nitrate, hexavalent chromium, DBCP, 1,2,3-TCP, etc.) and therefore does not present temporal trend data that would be associated with the lowered groundwater levels during the drought. This is an incomplete analysis of groundwater conditions that could have a significant impact to sustainability and the usability of the groundwater resource by drinking water users. [3,4] **The draft GSP makes a key conclusion relevant to the long term management of water quality in the subbasin based on a conclusion that is unsupported by the analysis presented in the draft GSP.**

- The draft GSP also states that "The primary water quality constituents of concern related to human activity include salinity, nitrate, hexavalent chromium, petroleum hydrocarbons (such as benzene and MTBE), pesticides (such as DBCP, EDB, 1,2,3 TCP), solvents (such as PCE, TCE), and emerging contaminants (such as PFOA, PFOS). *Of these issues, nitrate is the most widespread issue with a direct impact on public health. [Emphasis added.*] Salinity is also an issue due to the widespread nature of the problem and difficulty of management given increases in salinity as a result of both urban and agricultural use." Table 2-8 indicates that the Merced County Department of Public Health considers nitrate to be an adverse groundwater quality parameter for most regions in the subbasin. Despite its widespread importance and impacts to drinking water the GSP does not set MTs for nitrate, or for any water quality constituent other than TDS. The justification given for this is that "Thresholds are not set for these constituents as the GSAs have no authority to limit the loading of nutrients or agrochemicals." Per 23 CCR § 354.28**, the draft GSP should provide a detailed explanation as to how this approach will result in protection of groundwater for DACs and other drinking water beneficial users in the subbasin.**

Other Monitoring Network Comments

- The GSP proposes a project to install two monitoring well clusters in and near the community of El Nido, a severely disadvantaged community (SDAC) for the purposes of "understanding of stratigraphy and groundwater conditions in the area and improve ongoing monitoring of water elevation and water quality" primarily to "understand water movement and causes of land subsidence in this area." The GSP also purports that this project "also directly benefits a SDAC." However, the GSP makes no mention that these new wells will be come *representative* monitoring wells or that MTs will be established for these wells. **To ensure that these new wells will provide a benefit to the community of El Nido, these should be established as RMWs with established water level and water quality MTs, as quantifiable measurements of sustainability. Setting these as RMWs will better support the GSAs to manage groundwater sustainably in this area and thus protect these beneficial users.**

Well Mitigation Program

Based on our assessment of the water levels, a significant proportion of domestic wells have the potential to be partially or fully dewatered if water levels reach the proposed MT levels. However, the draft GSP does not include or describe any plans to develop a well impact mitigation program. Such a program could include a combination of replacing impacted wells with new, deeper wells and/or connecting domestic users to a public water system. A plan to reestablish the emergency tanked water program may be an appropriate short-term solution, but would not be a good long-term solution for community members. Key considerations for establishing such a program should include:

- A strong preference for connecting current domestic well users to a public water system, whenever possible. Public water systems have an obligation to test water quality for water served, and although the public water systems in this area typically have limited resources, they do have a greater ability to install treatment systems to address water quality impacts, recoup funds for litigated contamination such as 1,2,3-TCP, and apply for and receive grant funding for beneficial projects. Because of this, public water systems, including small community water systems, provide a more reliable drinking water source than privately-owned domestic wells.
- A secure and reliable funding source and mechanism for implementation of such a mitigation program needs to be identified. While grant or emergency funding could potentially be available for such a program when needed, the availability of these funds is not certain. A more secure funding mechanism could be the establishment of a reserve fund that is paid into on an annual basis and accrues funds that would then available as water levels drop in the future.
- The implementation of a mitigation program should be triggered before wells begin to become unusable, so that funding will be available, and the necessary planning and contracting will be completed such that the necessary construction will be implemented without unnecessarily leaving community members without access to drinking water. Thus, the program should be designed to be proactive, rather than reactive.
- A well mitigation program should not be established only in case of emergency, such as the tanked water program during the last drought. Droughts are said to be becoming more and more frequent and severe, and as such should be included as part of the long-term sustainability planning for the subbasin.

Water Budget

The Water Budget section (2.3) and Climate Change Analysis section (2.4) of the draft GSP were reviewed to identify approaches and assumptions used in the water budget development that may not be protective of domestic water users and small community water systems. Water budgets for the subbasin were developed for historic, current, and projected conditions using the Merced Water Resources Model (MercedWRM). The MercedWRM produces water budgets for the Stream & Canal System, Land Surface System, and Groundwater System. Comments regarding the adequacy of the assessment and projections of conditions relevant to DACs are provided below.

- The draft GSP presents only a brief listing of the data sources used to specify conditions for the model periods used to develop the water budgets. There is very little discussion on how the model input relative to the water budget was developed from the listed sources. It is noted in the text that additional data used for model development is included in Appendix D (MercedWRM Model Documentation), but Appendix D is still under development and was not included in the draft GSP. Therefore, any additional data related to the water budget could not be reviewed at this time.

The draft GSP made available to the public is incomplete, and a full evaluation of the model and assumptions cannot be made at this time.

- According to the draft GSP, urban water demand is based on the 2015 Urban Water Management Plan (UWMP)[6] and municipal pumping records. However, no information is provided on the magnitude of the urban demand, population information, or per capita water use specified in the model. The draft GSP does not identify which municipal water providers provided data and which required estimation of water demand. Nor does it discuss how estimated water use from rural domestic water users or small community water systems was represented in the model or the magnitude of these values. **Therefore, based on the limited data provided in the draft GSP, the public cannot review the drinking water demand estimates for domestic users, community water systems, or large urban water suppliers and make an assessment as to the appropriateness of the demands considered in the historical, current, or future water budgets.**
- There is no specific information included in the draft GSP on how historical land use was determined from available data or how it varies over the historical water budget period. According to the draft GSP, the current water budget uses 2013 CropScape data and the projected water budget uses the 2013 CropScape data, 2015 agricultural water management plan projections, and information from local agencies and farmers. No summary of acreages by land use type is provided so the accuracy of the representation of urban and agricultural areas cannot be assessed by the public. **Without this information the public cannot assess how domestic well users and small community water systems are represented in the land use data.**
- The majority of the draft GSP section discussing the water budget focuses on the results of the water budget. These results are presented as average annual values for the entire subbasin which limit the ability for the public to evaluate and understand the impacts to DACs and small community water systems. Time series graphs of the water budget results are needed to evaluate if the water budget adequately represents the temporal variability and trends in drinking water demand. **By presenting only subbasin-level water budget results and only as average annual values, the presented results are opaque with respect to drinking water use by DACs, as well as demands by other types of beneficial users.**
- The draft GSP does not include any discussion of the uncertainty in the data used for the model and its potential effects on the water budget results. **The GSP should include an uncertainty analysis to identify the plausible range in water budget results and an indication of the magnitude of the effects these inherent uncertainties may have on the water budget results.[7]**
- The estimate of sustainable yield for the subbasin was determined using the Projected Conditions Baseline scenario. According to the draft GSP, in this scenario, agricultural and urban demand is reduced across the model domain to achieve a net storage change of zero. Agricultural demand was reduced by reducing agricultural land use. Urban demand was reduced by reducing the per capita water use. However, the draft GSP does not present information on how per capita water

[6] The water budget section of the GSP refers to a singular UWMP – but does not specify if the UWMP used was for the City of Merced, City of Livingston, or both.

[7] DWR, 2016. *Best Management Practices for the Sustainable Management of Groundwater, Modeling (BMP #5),* December 2016.

use reductions were determined or if they were applied equally to all drinking water users (municipal users, rural domestic users, small community waters systems, etc.). The document also does not include a discussion of how these reductions would affect domestic water users or small community water systems. **Therefore, based on this, it is not clear how demands by drinking water users were considered in the sustainable yield calculation.**

Attachments

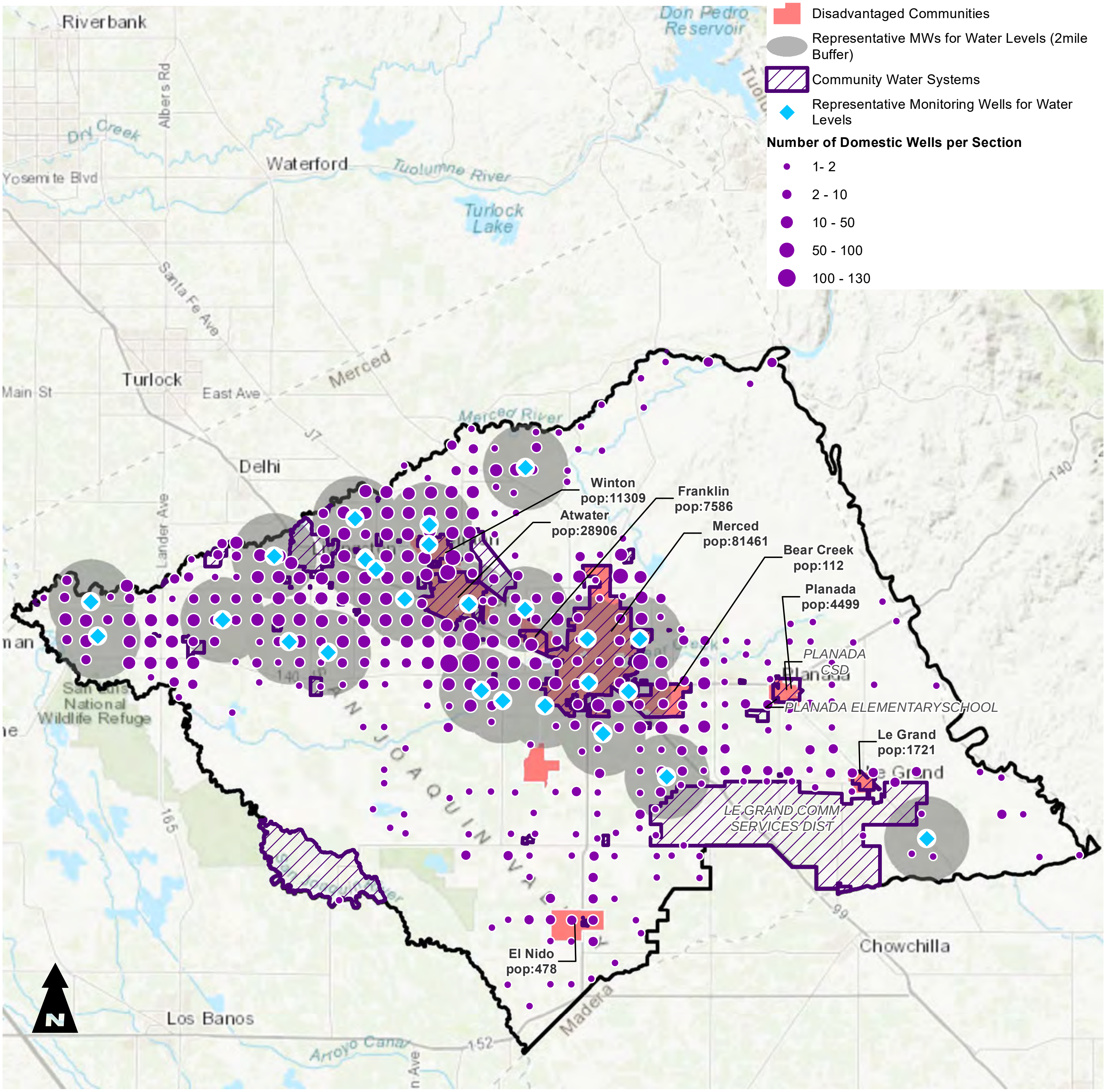
Figure 1 - Representative Monitoring Network for GW Levels Relative to Domestic Wells, DACs, and Community Water Systems

Figure 2 - Water Level MTs and Domestic Wells

Figure 3 - Representative Monitoring Network for Water Quality Relative to Domestic Wells, DACs, and Community Water Systems

Figure 1 - Representative Monitoring Network for GW Levels Relative to Domestic Wells, DACs, and Community Water Systems

Merced Subbasin



0 4 8 16 Miles

Notes
1. All locations are approximate.

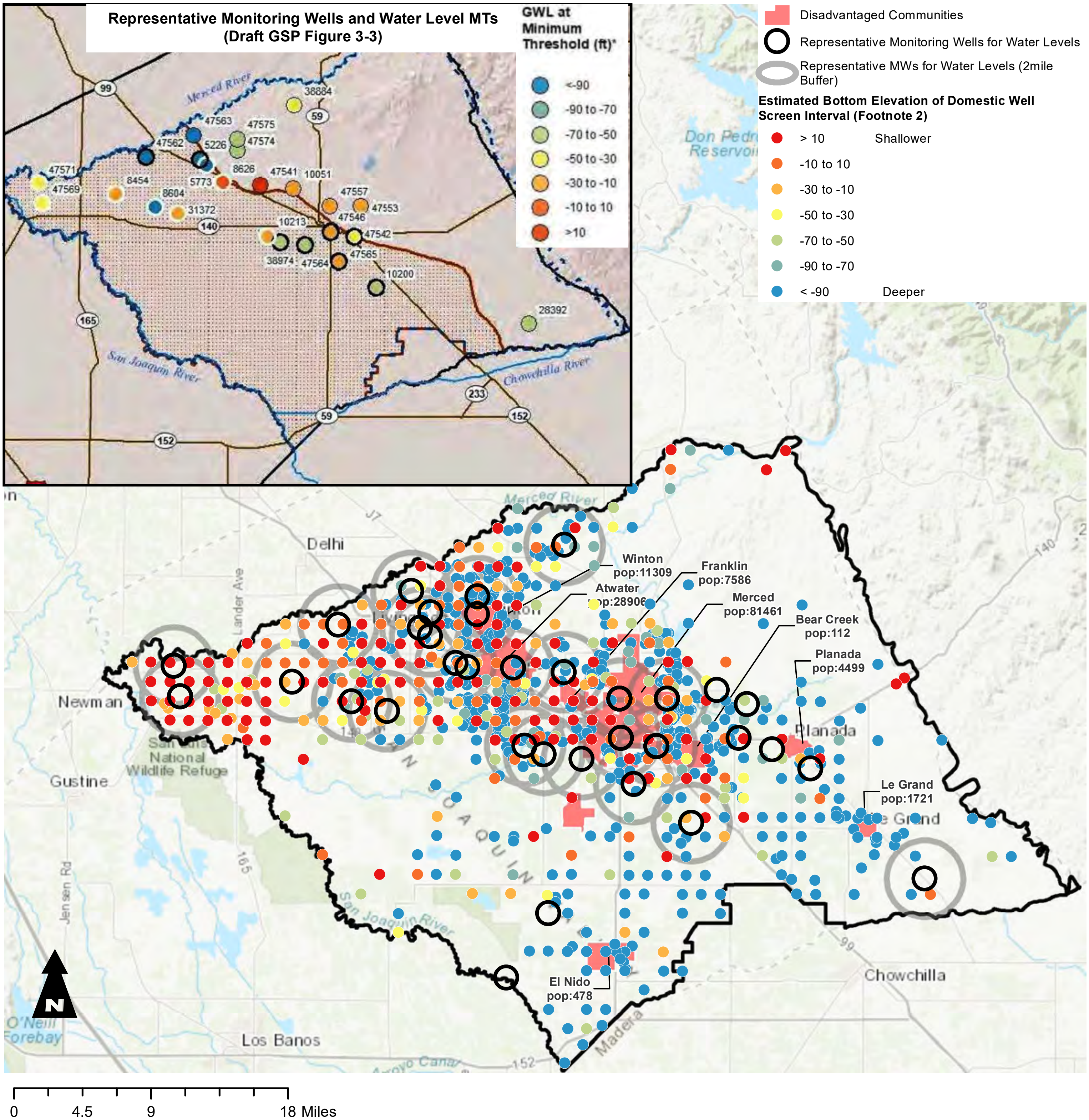
References
1. Domestic Well Densities: CWC draft Vulnerability Tool as of August 6, 2019.
2. Disadvantaged community data: downloaded on August 6, 2019 from the DAC Mapping Tool: https://gis.water.ca.gov/app/dacs/.
3. Community Water System data: downloaded on August 6, 2019 from Tracking California: https://trackingcalifornia.org/water/map-viewer.
3. Groundwater level monitoring well information are from Draft Merced Subbasin GSP dated July 2019.

Self-Help ENTERPRISES

LEADERSHIP COUNSEL FOR JUSTICE & ACCOUNTABILITY

Figure 2 - Water Level MTs and Domestic Wells

Merced Subbasin



<u>Notes</u>

1. All locations are approximate.
2. In order to estimate the domestic well elevations, the depth of domestic wells is subtracted from the ground surface elevation. For purposes of this assessment, the ground surface elevation is assumed to be 100 ft above sea level for the entire Merced Subbasin area. Where available, bottom of screen interval was used for this assessment, and bottom of well depth was used for the remaining wells.

<u>References</u>

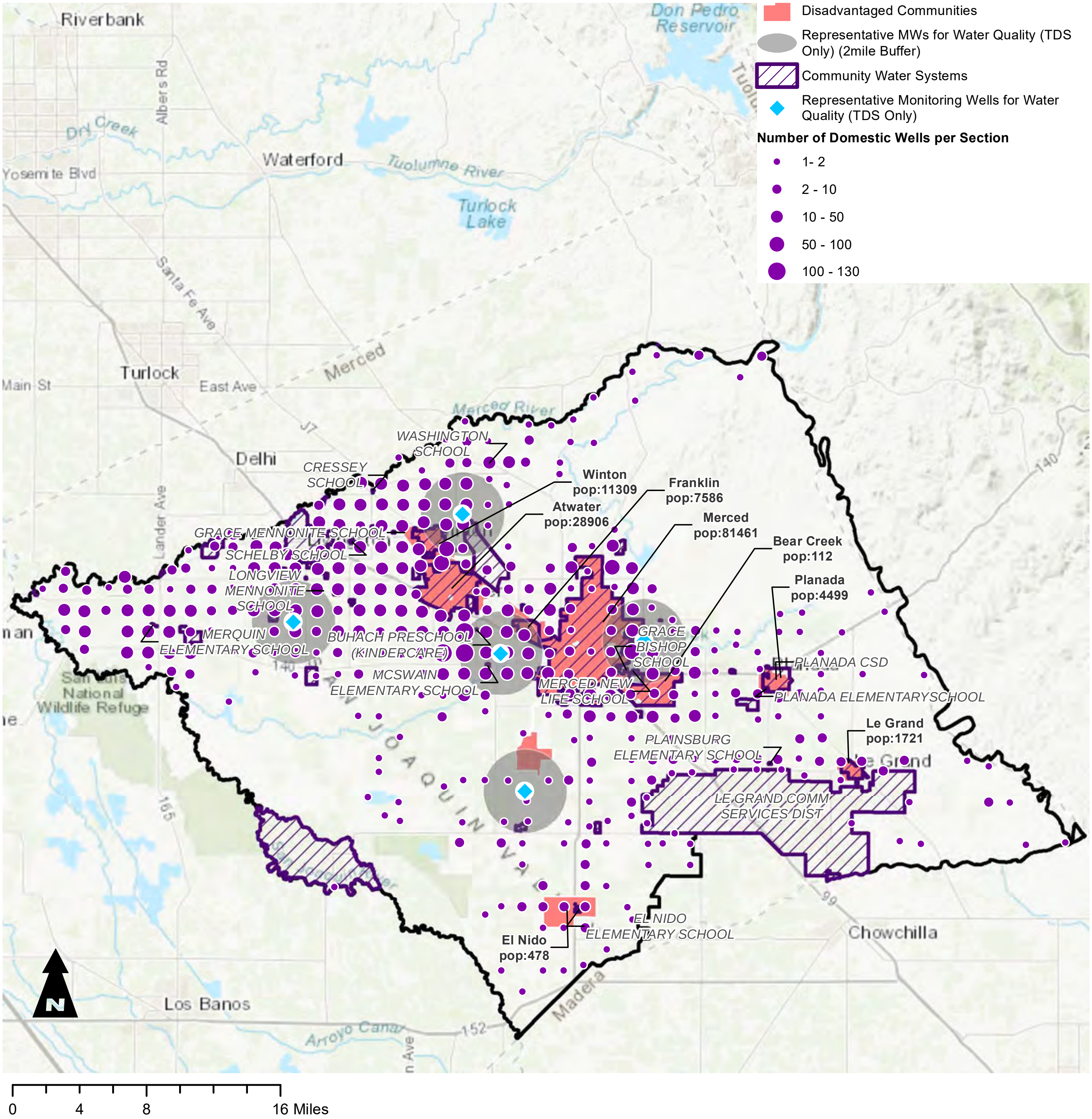
1. Domestic Well data: CWC draft Vulnerability Tool as of May 16, 2019.
2. Disadvantaged community data: downloaded on August 6, 2019 from the DAC Mapping Tool: https://gis.water.ca.gov/app/dacs/. Last updated in 2016.
3. Groundwater monitoring well information are from Draft Merced Subbasin GSP, dated July 2019.

Self-Help ENTERPRISES

LEADERSHIP COUNSEL FOR JUSTICE & ACCOUNTABILITY

Figure 3 - Representative Monitoring Network for Water Quality Relative to Domestic Wells, DACs, and Community Water Systems

Merced Subbasin



Notes
1. All locations are approximate.

References
1. Domestic Well Densities: CWC draft Vulnerability Tool as of August 6, 2019.
2. Disadvantaged community data: downloaded on August 6, 2019 from the DAC Mapping Tool: https://gis.water.ca.gov/app/dacs/.
3. Community Water System data: downloaded on August 6, 2019 from Tracking California: https://trackingcalifornia.org/water/map-viewer.
3. Groundwater level monitoring well information are from Draft Merced Subbasin GSP dated July 2019.

Self-Help ENTERPRISES

LEADERSHIP COUNSEL FOR JUSTICE & ACCOUNTABILITY

NICKEL FAMILY LLC

August 19, 2019

Mr. Hicham Eltal
Merced CSP Contact
Merced Irrigation District
744 W 20th Street
Merced, CA 95340

RE: Groundwater Sustainability Plan

Dear Sirs:

As a landowner located just west of your Merced Sub Basin GSA, along the San Joaquin River, we strongly object to your Sustainable Management criteria for land subsidence of a minimum threshold of minus 0.75 feet per year. It is ludicrous to state, as your GSP does, that ".....while land subsidence has been recognized by the GSA's as an area of concern, it is not considered to have caused a significant and unreasonable reduction in the viability of the use of infrastructure." The subsidence we have experienced in our area over the past 10 years has accelerated at an ever-increasing rate over what we experienced in the prior 100 years. The capacity of the Eastside Bypass as well as the capacity of the San Joaquin River has been reduced by over 40%, which will result in flooding of our properties in high runoff years. The capacity of our irrigation canals has been greatly reduced as well. There can be no question that the infrastructure has been adversely affected.

The solution your GSP proposes: "ongoing monitoring and management in the Merced Sub Basin", is not a solution. The only solution is to immediately reduce pumping below the Corcoran Clay to a sustainable level, which we estimate to be no more than 0.15 acre feet per acre.

Sincerely,

James L. Nickel
President

15701 Highway 178 • P.O. Box 60679 • Bakersfield, CA 93386-0679
Phone: 661-872-5050 • Fax: 661-872-7141

Olam
Edible Nuts

205 E. Riverpark Circle Suite 310
Fresno, CA 93720

August 19, 2019

Merced Irrigation District
Attention: Mr. Hicham Eltal
GSP Contact
744 W. 20th St.
Merced, CA 95340
mercedsgma@woodardcurran.com

Dear Mr. Eltal,

Thank you for the opportunity to provide comments on the Draft Merced Subbasin Groundwater Sustainability Plan (GSP) dated July 19, 2019. Our Nevada Ranch is 1,000-acres and is located at the northeast corner of Santa Fe Ave. and White Rock Road and is considered "White Area". We want to thank you for the opportunity to provide these comments and show our appreciation for the hard work the various Board members, staff, consultants, and the general public have put into this State mandated document.

We understand that the Merced Subbasin is in overdraft by approximately 150,000 AF/Y and that agricultural must step up to the plate to close the gap. We are encouraged that several of the projects listed in the GSP would provide infrastructure so that surface water supplies to the White Areas of the Subbasin could be augmented. We are a willing partner for these sorts of projects so please contact me during the scoping of any of the projects near our ranch if you have any financing, engineering, and/or right-of-way acquisition needs.

In addition to the list of projects, the GSP describes several demand management options that are being considered by the Groundwater Sustainability Agencies, including groundwater allocations, water credit market, fallowing, and/or groundwater extraction fees. Olam believes a tiered groundwater extraction fee program where the first volume of water is cheaper than the last is the least bureaucratic and quickest way to begin to incentivize farmers to pump less groundwater. A groundwater fee program also avoids the contentious matters involved with allocating groundwater, such as irrigated vs. non-irrigated, deep percolation from developed water, water market framework, etc. The money generated from the program could be used to fund projects and/or retire marginal farm ground.

I also want to emphasize that all demand management programs need to recognize the need to slowly transition from overdraft to sustainability during the 20-year implementation period. Any sort of hard and fast pumping restrictions would unnecessarily devastate the local economy by not allowing farmers to thoughtfully adjust their practices.

Olam Edible Nuts

Thank you again for your hard work and please don't hesitate to contact me if you have any questions or comments. Your consideration is greatly appreciated.

Best Regards,

Mike Richardson
General Manager Farm Operations
Olam Farming Inc.

(559) 633-0946

Sandy Mush Mutual Water Co.
P.O. Box 1232 · Merced, CA 95341
209.723.3001

August 19, 2019

Merced Irrigation District
Attention: Mr. Hicham Eltal
GSP Contact
744 W. 20th St.
Merced, CA 95340
mercedsgma@woodardcurran.com

Dear Mr. Eltal,

Thank you for the opportunity to provide comments on the Draft Merced Subbasin Groundwater Sustainability Plan (GSP) dated July 19, 2019. As a Representative Agency within the Merced Subbasin Groundwater Sustainability Agency (MSGSA), as well as active participants in the Stakeholder Advisory and Coordinating Committees, we appreciate the hard work the various Board members, staff, consultants, and the general public have put into this document.

Our comments are limited at this time and we anticipate a more detailed review of the GSP during the upcoming Public Comment period provided by Department of Water Resources (DWR). We would appreciate the opportunity to meet with you and the GSP consultant team to discuss the GSP.

The GSP states that the Merced Subbasin is in overdraft by approximately 150,000 AFY. In order to preserve our regions' economy, the agricultural community must fully utilize all available surface water for both direct irrigation and groundwater recharge. Merced Irrigation District (MID) has out-of-district surface water available in most years and there needs to be an incentive for both MID and Merced Subbasin out-of-district growers to purchase this water. Sandy Mush Mutual Water Company (SMMWC) is committed to entering into a long-term transfer agreement to purchase this water, even in the shoulder season, and will build the necessary infrastructure to convey it.

We have been participating in the Stakeholder Committee for many months and had become comfortable with the project list in previous iterations of Chapter 6. We were surprised that the El Nido Improvement Canal project was removed. The El Nido Canal is the main artery to bring MID water to the El Nido area, where subsidence is a very real concern. Although MID owns and operates the El Nido Canal, they did not cause the subsidence, and should not necessarily have to pay for the needed improvements. The El Nido Canal Improvement Project should be re-instated into the GSP and the Merced Subbasin GSA should cost-share with MID on improvements to increase the peak capacity downstream of Mariposa Creek.

Sandy Mush Mutual Water Co.
P.O. Box 1232 · Merced, CA 95341
209.723.3001

There are many Demand Management programs described in the GSP, including groundwater allocations, water market, metering, and fallowing programs. These types of programs will have long lasting impacts on our members, as well as our community. We encourage the GSAs to conduct a thorough hydrogeological AND economic evaluation of all demand management programs considered. It is imperative that SMMWC and the public be informed of all future discussions regarding demand management in the Merced Subbasin.

SMMWC has begun establishing an internal demand management program and would like to have the opportunity to opt-out of any demand management program established by the GSAs.

Thank you for the opportunity to participate in the GSP process and provide these comments. As stated above, we would appreciate the opportunity to meet at your earliest convenience.

Sincerely,

Simon Vander Woude
President

August 19, 2019

Merced Groundwater Sustainability Agencies
Merced Irrigation District
744 W. 20th Street
Merced, CA 95340

Re: Comments/Recommendations on the July 2019 Merced Subbasin Draft Groundwater Sustainability Plan (GSP)

Sent via email: mercedsgma@woodardcurran.com

In response to the July 2019 Merced Subbasin Draft Groundwater Sustainability Plan (GSP) released for a 30-day public comment period on July 19, 2019, Self-Help Enterprises (SHE) would like to offer several comments and recommendations.

Detailed comments on various sections of the GSP are included in a more detailed comment letter/attachment titled SHE Comments – July 2019 Merced Subbasin GSP. Moreover, SHE partnered with Leadership Counsel for Justice and Accountability (LCJA) to conduct a focused technical review of certain sections of the GSP. Findings of this review are included as Appendix 1. Appendix 1 includes three Figures: Figure 1 - Representative Monitoring Network for GW Levels Relative to Domestic Wells, DACs, and Community Water Systems, Figure 2 - Water Level MTs and Domestic Wells and Figure 3 - Representative Monitoring Network for Water Quality Relative to Domestic Wells, DACs, and Community Water Systems. Please note that some of these findings have been incorporated and/or referenced in our detailed comment letter. Lastly, our comments and recommendations also reflect comments, concerns and suggestions provided by groundwater users that attended our August 2019 community GSP review workshops in Planada and El Nido.

Comments and recommendations are provided in an effort to protect the drinking water sources of the vulnerable and often underrepresented groundwater users that SHE works with and in order to assist the Merced Subbasin Groundwater Sustainability Agencies (GSAs) in better achieving the objectives ascribed by the GSP regulations and increase the chances of GSP approval by the Department of Water Resources (DWR).

Given that our comments are long and detailed, we have summarized a few key comments and recommendations below:

Short 30-Day Public Comment Period and lack of Community Outreach and Public Workshops

We would like to express concern with the short public comment period of just 30 days for such a technical, lengthy, yet important plan and lack of public workshops to present the draft GSP. While a 30-day comment period is allowed under the Sustainable Groundwater Management Act (SGMA), it is important to recognize that this short public comment period and lack of community outreach/public workshops is not conducive for effective public engagement and does not meet the specific engagement needs of vulnerable and often underrepresented groundwater stakeholders, e.g. Severely, Disadvantaged and Communities (S/DACs), low income water system users and households relying on shallow domestic wells. Most other GSAs within the San Joaquin Valley are providing or are planning to provide longer comment review periods (a minimum 45 days and most of them 90 days). Please make sure to properly consider the needs of underrepresented stakeholders as you move into GSP adoption and implementation.

Upon release of the draft GSP, SHE staff cumulatively held two (2) community GSP review workshops in Planada (residents from Le Grand were invited) and El Nido. At these workshops, participants were provided information about SGMA, their local GSA and presented general information about the draft GSP. The workshops also included small and large group discussions. During these group discussions, participants were asked to identify when, how often and how they would like to be notified and engaged during GSP implementation. Recommendations offered by these participants include but are not limited to: utilizing existing community venues, e.g. community board meetings, workshops and events to provide information, identifying community social media (Facebook,

8445 W. Elowin Court • P.O. Box 6520 • Visalia, CA 93290
Phone (559) 651-1000 • Fax (559) 651-3634 • info@selfhelpenterprises.org • www.selfhelpenterprises.org

Instagram, etc.) groups, pages and websites and post information, conducting site visits, door-to-door outreach. Recommendations also included identifying and working with key community leaders and trusted messengers to distribute information /encourage community participation. In addition, the importance of providing bilingual (English and Spanish) information and materials on the website, via email and inserting short notices (notices must include key messages, visuals and information that is relevant to the average water user in water bills was noted. Attendees also expressed interest in obtaining information during key GSP milestones and prior to the approval of important decisions, e.g. during public comment periods, plan updates and during the development and approval of the Merced Groundwater Allocation Framework and Merced Groundwater Reduction Plan.

Water Budget

We believe the draft GSP made available to the public is incomplete, and a full evaluation of the model and assumptions cannot be made at this time. Without a complete GSP draft that thoroughly explains the assumptions and methods used for the development of the Water Budget, the public is unable to provide meaningful comments and recommendations. The majority of the draft GSP section discussing the water budget focuses on the results of the water budget. These results are presented as average annual values for the entire subbasin, which limits the public's ability to evaluate and understand the impacts to DACs and small community water systems in a particular GSA. Time series graphs of the water budget results are needed to evaluate if the water budget adequately represents the temporal variability and trends in drinking water demand. By presenting only subbasin-level water budget results and only as average annual values, the presented results are hard to interpret with respect to drinking water use by DACs, as well as demands by other types of beneficial users. The draft GSP does not include any discussion of the uncertainty in the data used for the model and its potential effects on the water budget results. The GSP should include an uncertainty analysis to identify the plausible range in water budget results and an indication of the magnitude of the effects these inherent uncertainties may have on the water budget results.

Sustainable Management Criteria

Sustainability Goal

We are concerned that degradation of groundwater quality has not been incorporated into the Merced Subbasin Sustainability Goal. This is particularly concerning given that the protection of water quality for drinking and for agricultural uses has been identified as a priority for users in the basin as mentioned in subsection 3.6, and documented in several meeting minutes of the Merced GSP Stakeholder Advisory Committee. During the previously mentioned community GSP review workshops, participants were asked to share their vision for sustainability and provide recommendations for what should be included in the subbasin's sustainability goal. Feedback provided at these workshops included preserving drinking water supplies, promoting water conservation and identifying equitable solutions for all groundwater users. Based on participant's feedback, we recommend consideration of revising the current sustainability goal in order to fully integrate stakeholders' vision for groundwater management.

Minimum Thresholds (MTs) for groundwater levels

The current approach to setting water level Minimum Thresholds (MTs) leaves key beneficial users in the subbasin, specifically domestic well users and in particular members of DACs potentially vulnerable to impacts. Based on the findings of the focused technical review conducted by SHE and LCJA of the water level sustainable management criteria and representative monitoring wells, nearly one-third of all domestic wells in the subbasin and important disadvantaged communities such as Planada, Le Grand, and El Nido, were not considered in the establishment of minimum thresholds. As a result, a significant proportion of drinking water wells have the potential to be partially or fully dewatered if water levels reach the proposed minimum thresholds levels.

For these reasons, the proposed approach for setting sustainable management criteria for groundwater levels appears to be inadequate, and does not sufficiently consider the groundwater issues that may affect the supply and beneficial uses of groundwater as required by GSP Regulations Section 354.16. To avoid the risk of having DWR deem the Plan incomplete or inadequate, we are recommending the following:

- Reconsider the proposed approach to setting water level MTs that leave key beneficial users in the subbasin, specifically domestic well users and in particular members of disadvantaged communities (DACs), potentially vulnerable to impacts.
- Expand the current representative monitoring well (RMW) network to include additional RMWs, particularity near vulnerable communities and groundwater stakeholders. Incorporate the new wells planned for El Nido and Planada as RMWs with established water level and water quality minimum thresholds, as quantifiable measurements of sustainability, as soon as they are constructed.

- Conduct an assessment of how many and which domestic wells are expected to go dry if the MTs are reached and the number of wells that could go dry outside of the 2-mile radius of the proposed RMW. The analysis should also provide an estimate of how many well could go dry with the undesirable result definition proposal of when greater than 25% of the RMWs are below their respective MT for two consecutive years. Per 23 CCR § 354.28, these assessments should be included in the GSP in order for the public and DWR to able to fully evaluate the ability of the proposed sustainable management criteria and monitoring program to protect beneficial users within the subbasin.

Minimum Thresholds (MTs) for groundwater quality

The current proposal of only defining sustainable management criteria for salinity is not protective of the human right to safe and affordable water, does not properly reflects input provided by stakeholders, and is dissonant with the groundwater quality conditions presented in the GSP Basin Setting Chapter.

The draft GSP includes limited analysis of water quality constituents and defines Undesirable Results (URs) for water quality as a "reduction in the long-term viability of domestic, agricultural, municipal, or environmental uses over the planning and implementation horizon of this GSP." The water quality monitoring network and analysis presented in the draft GSP appears to be inadequate, and the sustainable management criteria do not appear to be sufficient to ensure that the stated water quality UR of impacting the long-term viability of the groundwater resource, particularly for domestic water users including DACs, will be avoided. We strongly believe that the proposed approach will not be allowed under SGMA and could lead DWR to deem the Plan incomplete or inadequate. To avoid this risk, Merced GSAs should reconsider their approach to set sustainable management criteria for groundwater quality. All drinking water contaminants of concern as identified in the GSP Basin Setting section should be consider (e.g. nitrate, hexavalent chromium, arsenic, uranium, perchlorate, petroleum hydrocarbons, pesticides, solvents, and emerging contaminants).

Projects and Management Actions - Well Impact Mitigation Program

The draft GSP does not include a well impact mitigation program but rather only mentions that GSAs will evaluate during the first five years if a mitigation for shallow domestic wells that might be dewatered by declining water levels during the GSP implementation is needed. We suggest that the Merced GSAs not delay such an evaluation given that a significant proportion of domestic wells have the potential to be partially or fully dewatered if water levels reach the proposed minimum thresholds levels. That is particularly important considering the significant gaps in the groundwater levels sustainable management criteria and the proposal of postponing to after 2025 the implementation of any actions regarding groundwater allocation and pumping reduction. It is also suggested that a mitigation program be considered that could include a combination of replacing impacted wells with new, deeper wells and/or connecting domestic users to a public water system. A plan to reestablish the emergency tanked water program may also be an appropriate short-term solution, but would not be a good long-term solution for community members. Such a program is important especially if the region faces another drought.

Lastly, it is important to acknowledge that DWR, as one of the relevant state agencies identified in AB 685 - Human Right to Water of 2012, will be considering this policy when reviewing and approving GSPs. Consequently, GSPs that do not support access to sufficient and affordable quantities of quality drinking water may require costly and time-consuming revisions prior to approval from DWR.

Thank you for the opportunity to review and provide comments on the draft GSP. We look forward to working with all three GSAs in the Merced Subbasin to ensure that the GSP is protective of the drinking water sources of vulnerable and often underrepresented groundwater stakeholders. Feel free to contact our Community Development Manager for Community Engagement and Planning Maria Herrera or myself regarding any questions or comments you may have.

Sincerely,

Thomas J. Collishaw
President/CEO

Enclosure

SAN JOAQUIN RIVER EXCHANGE CONTRACTORS GROUNDWATER SUSTAINABILITY AGENCY

Post Office Box 2115
Los Banos, CA 93635
(209) 827-8616

August 16, 2019

Mr. Hicham Eltal
Merced Subbasin GSP
Merced Irrigation District
744 W 20th Street
Merced, CA 95340

RE: ***Comments on the Draft Merced Subbasin Groundwater Sustainability Plan***

Dear Mr. Eltal:

The San Joaquin River Exchange Contractors Groundwater Sustainability Agency (SJREC GSA) participated in a joint workshop between the Delta-Mendota Subbasin and the Merced Subbasin. The purpose of the meeting was to review groundwater conditions along the adjoining basin boundary and evaluate the draft proposed Sustainable Management Criteria and the potential impacts to the adjacent subbasin.

During this workshop, the Merced Subbasin presented an executive summary of the proposed SMC. The proposed SMC has the potential to directly impact the ability of the Delta-Mendota Subbasin to achieve its sustainability goal. We raised concerns in this meeting about the potential impacts to the SJREC GSA and the Delta-Mendota Subbasin. This letter serves as a formal response to the issues raised during the workshop. The following is a summary of the areas of concern.

1. The proposed SMC for land subsidence is unacceptable to the SJREC GSA. The land subsidence Minimum Threshold (MT) is defined as -0.75 ft/year. An Undesirable Result (UR) is defined as exceeding a MT at 3 or more representative sites for 2 consecutive years. The representative sites were presented during the workshop and located proximal to the Delta-Mendota Subbasin in a known area of significant inelastic land subsidence. Land subsidence in this area has proven to reduce the ability to convey flood flows through the area and also reducing the capacity of irrigation delivery facilities.

2. An UR for groundwater levels is defined as "greater than 25% of representative wells fall below MT in 2 consecutive wet, above normal, or below normal years." Chronic lowering of groundwater levels is most likely to occur during dry periods. Additional information would be helpful on why the Merced Subbasin has decided to ignore groundwater level during dry and critically dry water year types.

3. The Merced Subbasin has determined that a change in groundwater storage is "not present and not expected to occur in the subbasin due to the significant volumes of freshwater in storage". We anticipate that managing groundwater levels and groundwater storage in the upper aquifer (above the Corcoran clay) would follow similar procedures where a significant and unreasonable change in groundwater storage would not occur so long as water levels are managed appropriately. Additional information on how water levels will remain at/above historic levels is requested particularly in regard to our comment #2 above. Additionally, any land subsidence in the area will directly reduce the groundwater storage in the lower aquifer (below the Corcoran Clay) and should be monitored and managed accordingly. If there is predicted loss of storage due to subsidence, additional information is necessary to define whether or not that loss is significant and unreasonable. The SJREC GSA does not agree that depletion of groundwater storage will not occur solely because there is "significant volumes of freshwater in storage".

4. During the workshop the SJREC GSA provided the Merced Subbasin with lateral groundwater flows for both the upper and lower aquifers. We request the lateral groundwater flow information used in the historical/current/projected water budgets.

This letter serves as a continuation of the regional coordination the SJREC GSA has pursued with neighboring subbasins and GSP's adjacent to the Delta-Mendota Subbasin. Please feel free to contact us with any questions or concerns you have so we can collectively and collaboratively manage our groundwater sustainability in the future.

Yours truly,

Chris White

Chris White,
Executive Director

The Nature Conservancy
Protecting nature. Preserving life.

CALIFORNIA WATER | GROUNDWATER

555 Capitol Mall, Suite 1290
Sacramento, California 95814
[916] 449-2850

nature.org
GroundwaterResourceHub.org

August 19, 2019

Woodard Curran
101 Montgomery Street | Suite 1850
San Francisco, California 94104

Submitted via Email at mercedsgma@woodardcurran.com

Re: Merced Groundwater Subbasin Groundwater Sustainability Plan

Dear Basin Representatives,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the Merced Subbasin Groundwater Sustainability Plan being prepared under the Sustainable Groundwater Management Act (SGMA).

TNC as a Stakeholder Representative for the Environment

TNC is a global, nonprofit organization dedicated to conserving the lands and waters on which all life depends. We seek to achieve our mission through science-based planning and implementation of conservation strategies. For decades, we have dedicated resources to establishing diverse partnerships and developing foundational science products for achieving positive outcomes for people and nature in California. TNC was part of a stakeholder group formed by the Water Foundation in early 2014 to develop recommendations for groundwater reform and actively worked to shape and pass SGMA.

Our reason for engaging is simple: California's freshwater biodiversity is highly imperiled. We have lost more than 90 percent of our native wetland and river habitats, leading to precipitous declines in native plants and the populations of animals that call these places home. These natural resources are intricately connected to California's economy providing direct benefits through industries such as fisheries, timber and hunting, as well as indirect benefits such as clean water supplies. SGMA must be successful for us to achieve a sustainable future, in which people and nature can thrive within Merced Subbasin region and California.

We believe that the success of SGMA depends on bringing the best available science to the table, engaging all stakeholders in robust dialog, providing strong incentives for beneficial outcomes and rigorous enforcement by the State of California.

Given our mission, we are particularly concerned about the inclusion of nature, as required, in GSPs. The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Addressing Nature's Water Needs in GSPs

SGMA requires that all beneficial uses and users, including environmental users of groundwater, be considered in the development and implementation of GSPs (Water Code § 10723.2).

The GSP Regulations include specific requirements to identify and consider groundwater dependent ecosystems [23 CCR §354.16(g)] when determining whether groundwater conditions are having potential effects on beneficial uses and users. GSAs must also assess whether sustainable management criteria may cause adverse impacts to beneficial uses, which include environmental uses, such as plants and animals. The Nature Conservancy has identified each part of the GSP where consideration of beneficial uses and users are required. That list is available here: https://groundwaterresourcehub.org/importance-of-gdes/provisions-related-to-groundwater-dependent-ecosystems-in-the-groundwater-s. Please ensure that environmental beneficial users are addressed accordingly throughout the GSP. Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decision, and using data collected through monitoring to revise decisions in the future. Over time, GSPs should improve as data gaps are reduced and uncertainties addressed.

To help ensure that GSPs adequately address nature as required under SGMA, The Nature Conservancy has prepared a checklist (Attachment A) for GSAs and their consultants to use. The Nature Conservancy believes the following elements are foundational for 2020 GSP submittals. For detailed guidance on how to address the checklist items, please also see our publication, *GDEs under SGMA: Guidance for Preparing GSPs*[1].

1. Environmental Representation

SGMA requires that groundwater sustainability agencies (GSAs) consider the interests of all beneficial uses and users of groundwater. To meet this requirement, we recommend actively engaging environmental stakeholders by including environmental representation on the GSA board, technical advisory group, and/or working groups. This could include local staff from state and federal resource agencies, nonprofit organizations and other environmental interests. By engaging these stakeholders, GSAs will benefit from access to additional data and resources, as well as a more robust and inclusive GSP.

2. Basin GDE and ISW Maps

SGMA requires that groundwater dependent ecosystems (GDEs) and interconnected surface waters (ISWs) be identified in the GSP. We recommend using the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) provided online[2] by the Department of Water Resources (DWR) as a starting point for the GDE map. The NC Dataset was developed through a collaboration between DWR, the Department of Fish and Wildlife and TNC.

3. Potential Effects on Environmental Beneficial Users

SGMA requires that potential effects on GDEs and environmental surface water users be described when defining undesirable results. In addition to identifying GDEs in the basin, The

[1]GDEs under SGMA: Guidance for Preparing GSPs is available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf

[2] The Department of Water Resources' Natural Communities Commonly Associated with Groundwater dataset is available at: *https://gis.water.ca.gov/app/NCDatasetViewer/*

Nature Conservancy recommends identifying beneficial users of surface water, which include environmental users. This is a critical step, as it is impossible to define “significant and unreasonable adverse impacts” without knowing *what* is being impacted. For your convenience, we’ve provided a list of freshwater species within the boundary of the Merced Subbasin in Attachment C. Our hope is that this information will help your GSA better evaluate the impacts of groundwater management on environmental beneficial users of surface water. We recommend that after identifying which freshwater species exist in your basin, especially federal and state listed species, that you contact staff at the Department of Fish and Wildlife (DFW), United States Fish and Wildlife Service (USFWS) and/or National Marine Fisheries Services (NMFS) to obtain their input on the groundwater and surface water needs of the organisms on the GSA’s freshwater species list. Because effects to plants and animals are difficult and sometimes impossible to reverse, we recommend erring on the side of caution to preserve sufficient groundwater conditions to sustain GDEs and ISWs.

4. Biological and Hydrological Monitoring
If sufficient hydrological and biological data in and around GDEs is not available in time for the 2020/2022 plan, data gaps should be identified along with actions to reconcile the gaps in the monitoring network.

The Nature Conservancy has thoroughly reviewed the Merced Subbasin Draft GSP, and considers it to be incomplete under SGMA since beneficial uses and users are not adequately identified and considered.

Our specific comments related to the Merced Subbasin Draft GSP are provided in detail in Attachment B and are in reference to the numbered items in Attachment A. Attachment C provides a list of the freshwater species located in the Merced Subbasin. Attachment D describes six best practices that GSAs and their consultants can apply when using local groundwater data to confirm a connection to groundwater for DWR’s Natural Communities Commonly Associated with Groundwater Dataset[2]. Attachment E provides an overview of a new, free online tool that allows GSAs to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

Thank you for fully considering our comments as you develop your GSP.

Best Regards,

Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

Attachment A

Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

GSP Plan Element*		GDE Inclusion in GSPs: Identification and Consideration Elements	Check Box
Admin Info	2.1.5 Notice & Communication *23 CCR §354.10*	Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.	1
Planning Framework	2.1.2 to 2.1.4 Description of Plan Area *23 CCR §354.8*	Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.	2
		Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.	3
		Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs	4
Basin Setting	2.2.1 Hydrogeologic Conceptual Model *23 CCR §354.14*	Basin Bottom Boundary: Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions?	5
		Principal aquifers and aquitards: Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized?	6
		Basin cross sections: Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers?	7
	2.2.2 Current & Historical Groundwater Conditions *23 CCR §354.16*	Interconnected surface waters:	8
		Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal).	9
		Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type.	10
		Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal).	11

		If NC Dataset *was* used:	Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0).	12
			The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).	13
			GDEs polygons are consolidated into larger units and named for easier identification throughout GSP.	14
		If NC Dataset *was not* used:	Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information.	15
		Description of GDEs included:		16
		Historical and current groundwater conditions and variability are described in each GDE unit.		17
		Historical and current ecological conditions and variability are described in each GDE unit.		18
		Each GDE unit has been characterized as having high, moderate, or low ecological value.		19
		Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0).		20
	2.2.3 Water Budget *23 CCR §354.18*	Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget.		21
		Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget.		22
Sustainable Management Criteria	3.1 Sustainability Goal *23 CCR §354.24*	Environmental stakeholders/representatives were consulted.		23
		Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest.		24
		Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest.		25
	3.2 Measurable Objectives *23 CCR §354.30*	Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.		26
	3.3 Minimum Thresholds *23 CCR §354.28*	Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:		27
		Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds?		28
		Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters?		29
	3.4 Undesirable Results *23 CCR §354.26*	For GDEs, hydrological data are compiled and synthesized for each GDE unit:		30
		If hydrological data *are available* within/nearby the GDE	Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0).	31
			Baseline period in the hydrologic data is defined.	32

			GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater.	33
			Cause-and-effect relationships between groundwater changes and GDEs are explored.	34
		If hydrological data *are not available* within/nearby the GDE	Data gaps/insufficiencies are described.	35
			Plans to reconcile data gaps in the monitoring network are stated.	36
		For GDEs, biological data are compiled and synthesized for each GDE unit:		37
		Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability.		38
		Data gaps/insufficiencies are described.		39
		Plans to reconcile data gaps in the monitoring network are stated.		40
		Description of potential effects on GDEs, land uses and property interests:		41
		Cause-and-effect relationships between GDE and groundwater conditions are described.		42
		Impacts to GDEs that are considered to be "significant and unreasonable" are described.		43
		Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported.		44
		Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating).		45
		Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.		46
Sustainable Management Criteria	3.5 Monitoring Network *23 CCR §354.34*	Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit.		47
		Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network.		48
		Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions.		49
Projects & Mgmt Actions	4.0. Projects & Mgmt Actions to Achieve Sustainability Goal *23 CCR §354.44*	Description of how GDEs will benefit from relevant project or management actions.		50
		Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented.		51

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

Attachment B

TNC Evaluation of the
Merced Subbasin Groundwater sustainability Plan

A complete draft of the Merced Subbasin GSP has been provided for public review. The following comments are in order of the Checklist given in Attachment A.

Section 1.2.5 Beneficial Uses and Users p. 1-40
(Checklist Item 1)

The environment is listed as one of the beneficial users of groundwater in the Subbasin, but few details are given. The US Fish and Wildlife is listed as operating several wildlife refuges supported by groundwater, as shown in Figure 1-7 (p. 1-20), along with state parks. A statement is made that there are other wetlands and GDEs that exist mostly in the western part of the subbasin, but they are not specified.

The types and locations of environmental uses, species and habitats supported, and the designated beneficial environmental uses of surface waters that may be affected by groundwater extraction in the Subbasin should be specified. To identify environmental users, please refer to the following:

- Natural Communities Commonly Associated with Groundwater dataset (NC Dataset) - https://gis.water.ca.gov/app/NCDatasetViewer/
- The list of freshwater species located in the Merced. Subbasin in Attachment C of this letter. Please take particular note of the species with protected status.
- Lands that are protected as open space preserves, habitat reserves, wildlife refuges, etc. or other lands protected in perpetuity and supported by groundwater or interconnected surface waters should be identified and acknowledged.

The stakeholder outreach process is described, and include outreach to federal, state, and local agencies, but did not appear to engage environmental groups. Please note if any environmental groups were contacted and were enlisted in the GSP development process.

Section 1.2 Plan Areas p. 1-13 through 1-38
(Checklist Item 2)

The jurisdictional boundaries and water use management and existing monitoring programs are adequately described. The land use designations do not show types of crops. Only federal and state parks are shown on Figure 1-7 (p. 1-20). The general and land use plans are adequately described. Surface water gauging is described for the three major creeks; a map showing the locations would be helpful. Habitat Conservation Plans (HCPs) or Natural Community Conservation Plans (NCCPs) within the Subbasin should be added and noted if they are associated with critical, GDE and/or ISW habitats.

Section 2.1.3.3 Surface Water p. 2-9 through 2-12
(Checklist Item 3)

The regulation of surface waters by dams and reservoirs is described for each of the major rivers in Section 2.1.3.3 Surface Waters. Past examples of in-stream flows are given on page 1-40 for the Merced River, by the Merced Irrigation District. In-stream flow requirements in each of the rivers/streams including the amount, time of year when the flow minimum is specified, the duration, the freshwater fish species for which it applies, associated permits that set forth the requirements, and the regulating agency setting forth the compliance requirements. Please provide a list of the current in-stream flow requirements for chinook salmon and other threatened and endangered fish species and other requirements to protect habitat on the Merced and San Joaquin Rivers and the other creeks.

Section 1.2.3.3 Well Permitting p.138
Checklist Item 4

Merced County established a well permitting system for new, replacement, back-up, and De Minimus wells in 2015. It is not clear if this requirement covers monitoring wells, unless they are classified as De Minimus wells. The permit includes property setback distances, which may apply to surface water. The City of Merced also enforces well standards that apply to all new and existing water wells, monitoring wells, cathodic protection wells, test wells and those exploratory holes deeper than twenty feet within the jurisdictional boundaries of the city. The City of Merced directs permittees to DWR standards for wells. Please clarify the permitting requirements for monitoring wells and how they will be coordinated with the GSP.

Section 2.1.6.2 Bottom of the Merced Basin p. 2-39
(Checklist Item #5)

The base of freshwater, defined as specific conductance > 3,000 micromhos/cm, is used as the bottom of the basin. Because the depth varies with location, a map is provided as Figure 2-28 (p. 2-40). The depth of this boundary is provided in some areas of the geologic cross-sections, but not others. As noted on page 9 of DWR's Hydrogeologic Conceptual Model BMP (https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf) "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions". Thus, groundwater extraction well depth data should also be included in the definition of the basin bottom. This will prevent the possibility of extractors with wells deeper than the basin boundary (defined by the base of freshwater) from claiming exemption from SGMA due to a well residing outside the vertical extent of the basin boundary. Please check that active wells used for domestic or public water supply or agricultural wells are not deeper than the base of freshwater.

Section 2.2.1.2 Current Groundwater Conditions p. 2-63 through 2-29
(Checklist Item #6)

The number of wells used to describe the groundwater elevations for each aquifer is sparse. For example, there were only eight wells used for the spring 2017 elevation measurements (Figure 2-44 p. 2-64) for the Above the Corcoran Clay aquifer and six for fall 2017 elevation for the Above the Corcoran Clay aquifer (Figure 2-47 p. 2-67). Additional wells have been included in the GSP Monitoring Program, as stated on p. 4-2, "The Merced Subbasin GSP groundwater level monitoring network totals 50 wells from the CASGEM program. This includes 13 wells in the Above Corcoran Clay Principal Aquifer, 16 wells in the Below Corcoran, and 21 wells in the Outside Corcoran. Additional monitoring wells with appropriate screened intervals should be installed and added as the funding allows.

<u>Section 2.1.7.2 Principal Aquifers and Aquitards</u>
(Checklist Item 6)

The three principal aquifers have been combined from the original five designations. The three aquifers are shown in a schematic diagram (Figure 2-36 p. 52) and the general characteristics are discussed (p. 2-52 and 2-53). The shallow aquifers are not described in sufficient detail to show where GDEs are likely and the places with interconnected surface water. Please expand the discussion of shallow groundwater and discuss any information regarding vertical groundwater gradients across the principal aquifers.

<u>Section 2.1.4 Geologic Formations and Stratigraphy</u>
<u>(Checklist Item 7)</u>

The geologic cross-sections, Figures 2-13 through 2-17 and Figure 2-19 through 2-22 (p. 2-24 and 2-27 and 2-29 and 2-32, respectively), show the full depth of the basin and do not highlight the shallow aquifers. Cross-sections along the San Joaquin and Merced Rivers showing the relationship between the rivers and the shallow aquifers would be helpful. The near-surface cross sections should provide details that depict the conceptual understanding of shallow groundwater and stream interactions at different locations, including perched aquifers.

<u>Section 2.2.6 Interconnected Surface Waters p. 108</u>
<u>(Checklist Items 8, 9 and 10)</u>

A map showing gaining and losing streams was provided in Figure 2-9 (p. 2-15) as determined using the Merced Water Resources Model (MercedWRM). The report stated that no field studies had been conducted to confirm the designations and the documentation of the model was not provided in this report (Appendix D). Therefore, no estimates of surface water depletions by water year type were made. Please provide the documentation for the model and how the gaining and losing streams were determined.

<u>Section 2.2.7 GDEs p. 2-109</u>
<u>(Checklist Item 10-15)</u>

SGMA requires that all beneficial uses and users, including GDEs, be considered in the development and implementation of GSPs (Water Code §10723.2). The GSP Regulations include specific requirements to identify (map) GDEs and consider them when determining whether groundwater conditions are having potential effects on beneficial uses and users. SGMA also requires an assessment of whether sustainable management criteria (including minimum thresholds and measurable objectives) may cause adverse impacts to beneficial uses, including GDEs, and that monitoring networks are designed to detect such impacts. Therefore, mapping GDEs is a critical first step for incorporating environmental considerations into GSPs.

- It appears that the preliminary desktop analysis, completed by Woodard & Curran and documented in the draft GSP, resulted an excessive elimination of the NC dataset polygons mapped in the Merced Subbasin. In particular, the methods used to confirm whether or not polygons in the NC Dataset are connected to groundwater in the Merced Subbasin are highly flawed. Here we debunk the scientific insufficiencies in the methodology used:
    1. *Areas with depth to groundwater greater than 30 feet in Spring 2015.*
        a. While depth to groundwater levels within 30 feet are generally accepted as being a proxy for confirming that polygons in the NC dataset are connected to groundwater, it is highly advised that seasonal and interannual groundwater fluctuations in the groundwater regime are taken into consideration. Utilizing groundwater data from <u>one point in time</u> (e.g., Spring 2015) can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Based on a study we recently submitted to Frontiers in Environmental Science Journal, we've observed riparian forests along the Cosumnes River to experience a range in groundwater levels between 1.5 and 75 feet over seasonal and interannual timescales. Seasonal fluctuations in the regional water table can support perched groundwater near an intermittent river that seasonally runs dry due to large seasonal fluctuations in the regional water table. While perched groundwater itself cannot directly be managed due to its position in the vadose zone, the water table position within the regional aquifer (via pumping rate restrictions, restricted pumping at certain depths, restricted pumping around GDEs, well density rules) and its interactions with surface water (e.g., timing and duration) can be managed to prevent adverse impacts to ecosystems due to changes in groundwater quality and quantity under SGMA. We highly recommend using depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled in the monitoring network.
        b. Please confirm that wells screened in the Shallow and Leaky intermittent principal aquifers located <u>above the Corocoran Clay Layer</u> are being used to verify whether NCCAGs are actual GDEs. According to Figure 2-39, the majority of wells in the

area in between Route 140, Route 59, and the San Joaquin River where NCCAGs were not identified as GDEs due to "depth to water" (Figure 2-86); however the wells located in this area are predominantly irrigation and domestic wells screened in the principal aquifers BELOW the Corocoran Clay Layer. Using "depth to groundwater" measurements from confined aquifers is mapping piezometric head of the confined aquifer and not detecting groundwater conditions in the principal aquifers of the unconfined aquifer that are supporting the ecosystem. If there is insufficient groundwater level data in the principal aquifers above the Corocoran Clay layers, then the NCCAGs in these areas should be included as GDEs in the GSP <u>until</u> data gaps are reconciled in the monitoring network.

c. Please provide more details on how depth to groundwater contour maps were developed:
   i. Are the wells used for interpolating depth to groundwater sufficiently close (<5km) to NC Dataset polygons to reflect local conditions relevant to ecosystems?
   ii. Are the wells used for interpolating depth to groundwater screened within the surficial unconfined aquifer and capable of measuring the true water table? (see comment b above)
   iii. Is depth to groundwater contoured using groundwater elevations at monitoring wells to get groundwater elevation contours across the landscape? This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[3] to estimate depth-to-groundwater contours across the landscape. This will provide much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found. Depth to groundwater contours developed from depth to groundwater measurements at wells assumes that the land surface is constant, which is a poor assumption to make. It is better to assume that water surface elevations are constant in between wells, and then calculate depth to groundwater using a DEM of the land surface to contour depth to groundwater.

d. Spring 2015 is <u>after</u> the SGMA benchmark date of January 1, 2015. Please rely on groundwater condition data prior to the SGMA benchmark date.

e. Please use care when considering rooting depths of vegetation. While Valley Oak (*Quercus lobata*) have been observed to have a max rooting depth of ~24 feet (https://groundwaterresourcehub.org/gde-tools/gde-rooting-

[3] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

depths-database-for-gdes/), rooting depths are likely to spatially vary based on the local hydrologic conditions available to the plant. Also, max rooting depths do not take capillary action into consideration, which will vary with soil type and is an important consideration since woody phreatophytes generally do not like to have their roots submerged in groundwater for extended periods of time, and hence can access groundwater at deeper depths. In addition, while it is likely to be true that shallow water availability is necessary to support the recruitment of saplings, hydraulic lift of groundwater to shallow depths has been observed in *Quercus* spp. Research on the symbiotic relationships between species and offspring is still emerging, but the assumption that a groundwater depth of 25 feet is "unlikely to support recruitment of new oak seedlings" is an unsubstantiated claim and falsely considered to be "conservative". This approach is not "conservative" and results in the elimiination of more NC polygons because it negates the fact that there may be mature tree species that are likely connected to groundwater. Regardless of life stage, if any plant or animal species in the NC polygons are connected to groundwater, then it needs to be mapped as a GDE. The evaluation of potential effects on GDEs (e.g., the likelihood that regeneration is not occuring in the GDE due to groundwater levels being to deep for saplings) is to be performed when defining undesirable results in the Sustainable Management Criteria section of GSP, not the Basin Setting section.

2. *Habitat areas with supplemental water*
    a. The application of supplemental water to managed wetlands <u>does not preclude</u> the possibility that NC polygons could be accessing groundwater in addition to the supplied water. In the scientific literature, it is generally acknowledged that GDEs can rely on groundwater for <u>some or all</u> of its requirements. GDEs can rely on multiple water sources simultaneously and at different temporal/spatial scales (e.g., precipitation, river water, reservoir water, soil moisture in the vadose zone, groundwater, applied water, treated wastewater effluent, urban stormwater, irrigated return flow). SGMA defines GDEs as "ecological communities and species that depend on groundwater <u>emerging from aquifers</u> or on groundwater <u>occurring near</u> the ground surface". Hence, we recommend that depth to groundwater contour maps are used to identify whether a connection to groundwater exists for the Managed Wetlands in the Merced Subbasin. Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.
3. *Areas adjacent to irrigated fields*
    a. SGMA defines GDEs as "ecological communities and species that depend on groundwater <u>emerging from aquifers</u> or on groundwater

occurring near the ground surface". We recommend that depth to groundwater contour maps are used to identify whether a connection to groundwater exists for the NC Dataset polygons adjacent to irrigated fields in the Merced Subbasin. Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

   b. GDEs can rely on multiple water sources – including shallow groundwater receiving inputs from irrigation return flow from nearby irrigated fields - simultaneously and at different temporal/spatial scales. Groundwater basins can be comprised of one continuous aquifer or multiple aquifers stacked on top of each other. Basins with a stacked series of aquifers may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow principal aquifers, that support springs, surface water, and groundwater dependent ecosystems. NC polygons adjacent to irrigated land can still potentially be reliant on shallow groundwater aquifers, thus excluding them based on their proximity to irrigated fields is inadequate.

4. *Areas depending on adjacent losing surface water bodies*
   a. While losing conditions occur when groundwater levels are lower than the stage in the stream, the degree to which losing conditions occur will depend on the groundwater level gradient between them. Losing conditions also vary in time, especially over different seasons. Even if a stream or river reach is losing, the riparian vegetation may still be accessing groundwater, and hence be identified as a GDE. We highly recommend that depth to groundwater levels under the NC polygons be used as the evaluation criteria, since access to groundwater could be be occuring in/near losing reaches. Please refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer. If riparian vegetation in losing reaches are 100% of the time using surface water (especially if the groundwater is consistantly deep), it is not a GDE.
   b. Areas within 300 feet of losing streams identified by the model, MERCEDWRM, were eliminated. The distance of 300 feet seems excessive and may have eliminated some areas prematurely. The documentation of the model was not included in the draft report, Appendix D, so this information could not be verified.
5. *Areas of vernal pool complexes*

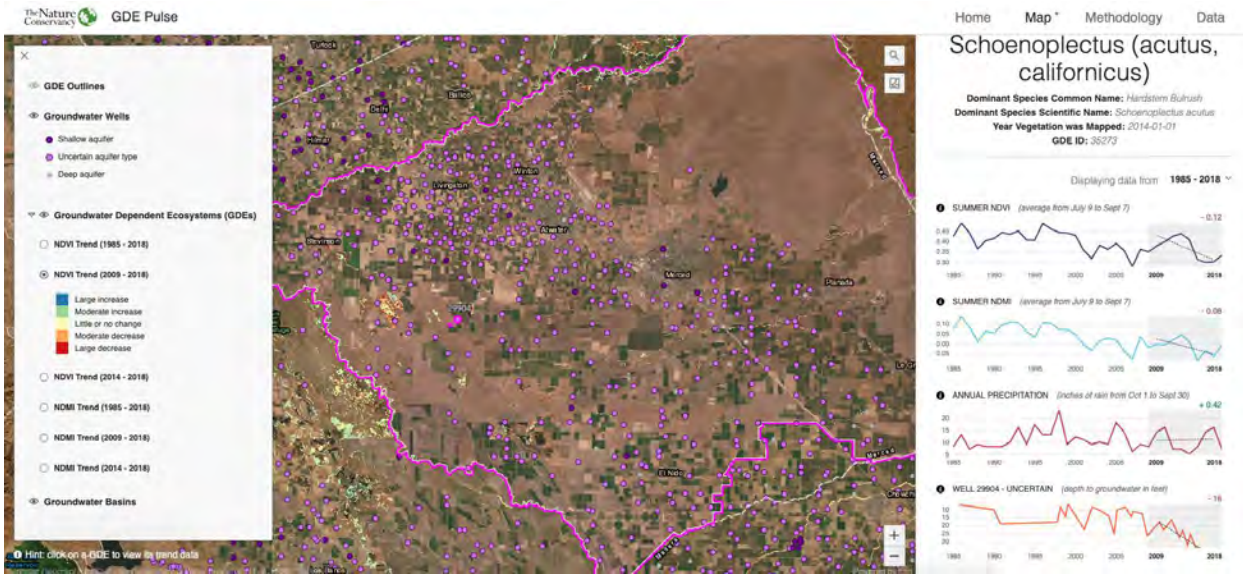
a. While we generally agree that vernal pools are shallow pockets of groundwater that are not directly connected or associated with principal aquifers, please included a short description on whether or not the vernal pool complexes mapped in the DFW 1989-1998 dataset are consistent with information collected in the HCM and groundwater conditions in the surficial aquifers (e.g., shallow and intermittent leaky aquifers above the Corocoran Clay Layer).

- The NC dataset is a starting point for GSAs to identify GDEs in their basin. Please map the original NC dataset on Figures 2-86, 2-87, and 2-88 (p. 2-111, 2-112, and 2-113) and document which polygons were added (and what local sources were used to identify them), removed (and the removal reason), and kept (from the original NC dataset). The basin's GDE shapefile, which is submitted via the SGMA Portal, should also include two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed).

Section 3.37 GDE p. 2-109 through 2-112

Checklist Items 16-20)

- No information was given on the historical or current groundwater conditions in the GDEs or the ecological conditions present. Please provide groundwater data for historical and current conditions near the GDEs or identify as a data gap. Refer to GDE Pulse (https://gde.codefornature.org; See Attachment E of this letter for more details) or any other locally available data to describe depth to groundwater trends in and around GDE areas, as well as trends in plant growth (e.g., NDVI) and plant moisture (e.g., NDMI). Below is a screenshot example of data available in GDE Pulse for NC dataset polygons found in Merced Subbasin:



- The vegetation species were not ranked as having a high, moderate or low value and no inventory of the vegetation types or habitat types were provided. Please identify whether any endangered or threatened freshwater species of animals and plants or areas with critical habitat were found in any of the GDEs. The list of freshwater species located in the Merced Subbasin in Attachment C of this letter.

<u>Section 2.3 Water Budget Information p. 2-113</u>
<u>(Checklist Item 21-22)</u>

The water budget for the surface water components did not include an explicit evapotranspiration term, but the following footnote was included as an explanation to Table 2-14 (p. 2-121 to 2-122). “Other flows is a closure term that captures the stream and canal system include gains and losses not directly measured or simulated within IWFM. Some of these features include but may not be limited to direct precipitation, evaporation, unmeasured riparian diversions and return flow, temporary storage in local lakes and regulating reservoirs, and inflow discrepancies resulting from simulating impaired flows.” Riparian uptake from streams and evapotranspiration was included in the Land System Budget Table 2-15 (p. 2-123 to 2-124). The groundwater budget (Table 2-16 p. 2-125 and 2-126) did not include an explicit evapotranspiration term but included the following footnote “Other flows within the groundwater system including temporary storage in the vadose zone, and root water uptake from the aquifer system.” The water budgets were calculated by the model, MercedWRM, and without the documentation the water budget is uncertain. Please provide a more complete description of the budget and the full model documentation in Appendix D.

<u>Section 3.1 Sustainability Goal p, 3-1</u>
<u>(checklist Items 23-25)</u>

The sustainability goal is stated as “Achieve sustainable groundwater management on a long-term average basis by increasing recharge and / or reducing groundwater pumping, while avoiding undesirable results" (p. 3-1). The report does not provide details on stakeholders involved in the goal selection process. The statement refers to "undesirable results" but does not mention GDEs, specifically. The goal appears to be directed toward reducing the groundwater overdraft and reducing the chance of wells going dry. The goal does not make a distinction between the pre-SGMA period and later years. Please clarify the sustainability goal and expand it to pertain to protection of GDE, ISWs and critical habitats.

Section 3.3.3 Measurable Objectives and Interim Milestones p, 3-4
(Checklist Item 26)

The measurable objectives addressed only the representative monitoring wells and was set at 25 feet above the minimum threshold. GDEs were not considered. Please expand the Measurable Objectives to include protection of the environmental health of GDEs and ISWs.

Section 3.3.2 Minimum Thresholds p. 3-4
(Checklist Item 27-29)

The minimum threshold was set at each of the representative monitoring wells. The level was defined as "The minimum threshold for groundwater levels was defined as the construction depth of the shallowest domestic well within a 2-mile radius." p. 3-5 Thus, GDEs were not considered. Please explain whether any adverse impacts to GDEs are expected and if changes to the minimum threshold should be made.

Chronic lowering of groundwater was considered by proxy only for the Merced River and San Joaquin River, not for the other creeks in the Merced Subbasin. Please identify areas on rivers or creeks where depletions are expected and if the minimum threshold should be changed.

Section 3.3.1 Undesirable Results p. 3-3
(Checklist Items (30-46)

- Undesirable results are defined as follows: "For the Merced Subbasin, an undesirable result for declining groundwater levels is considered to occur during GSP implementation when November groundwater levels at greater than 25% of representative monitoring wells (at least 7 of 25) fall below their minimum thresholds for two consecutive years where both years are categorized hydrologically as below normal, above normal, or wet" (p.3-3). GDEs are not specifically addressed. No hydrologic or biological data are compiled for the GDEs and data gaps are not described. Potential impacts on the GDEs are not described. For existing GDEs, please provide hydrologic and biological data for current conditions and describe how susceptible they are to future impacts.
- Please provide more specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. The definition of 'significant and unreasonable' is a qualitative statement that is used to describe when undesirable results would occur in the basin, such that a minimum threshold can be quantified. Potential effects on all beneficial users of groundwater in the basin need to be taken into consideration.

According to the California Constitution Article X, §2, water resources in California must be "put to beneficial use to the fullest extent of which they are capable". Please identify appropriate biological indicators that can be used to monitor potential impacts to environmental beneficial users due to groundwater conditions. Refer to Appendix E of this letter for an overview of a free, new online tool for monitoring the health of GDEs over time.

Section 4.5.6 Data Gaps p. 4-13
(Checklist Item #47)

Three regions where monitoring wells are missing or scarce are shown in Figure 4-6 (p. 4-14). These areas include:

> "1. Data Gap #1: Located northwest of Merced and northeast of Atwater, this area contains relatively fewer existing wells, which often have limited construction information, and the wells are generally privately owned and require coordination with well owners to obtain permission and data.
> 2. Data Gap #2: Located along the western edge of the Subbasin, this area has virtually no known wells; overall well coverage needs to be enhanced through outreach to well owners to identify wells that can be used for monitoring purposes.
> 3. Data Gap #3: Located along the southern portion of the Subbasin just east of Data Gap #2, there are known potential wells to monitor but acquiring data from these wells is associated with technical or funding issues. These wells are primarily located within a federal wildlife refuge."

Aside from these areas, there are limited wells close to the Merced and San Joaquin Rivers to track conditions near potential GDEs. Greater effort should be directed toward obtaining full well construction information in all areas, but especially in the areas with GDEs and then selecting appropriate wells for monitoring.

Section 4.10 Depletions of Interconnected Surface Water Monitoring Network p, 4-30
(Checklist Item 48)

The stream gauges used to support interconnected stream monitoring are listed in Table 4-10 and shown in Figure 4-9 (p. 4-32 and 4-33, respectively). The GSP states on page 4-35 that "The understanding of depletions of interconnected surface water could be improved through additional depth-discrete groundwater elevation data near some rivers and streams and some NCCAGs." The addition of clusters of multi-depth wells near the known interconnected surface waters should be given a high priority.

Section 4.1 Monitoring Network Objectives p, 4-1
(Checklist Item 49)

One of the stated objectives of the monitoring program is "Monitoring impacts to the beneficial uses or users of groundwater." (p. 4-1) There is no reference to use of biological data for monitoring potential impacts to the GDEs or to the combined use of hydrologic and biological data. Hydrologic and biological data should be obtained around existing GDEs. Remote imaging can provide a useful tool for monitoring ecosystem health of GDEs and ISWs. Please clarify the potential use of imagery as a monitoring tool and expand it to monitoring surface indicators of ISW and GDE ecosystem health. Please describe how GDEs will be monitored to avoid or minimize impacts from both a hydrologic and biological standpoint.

Section 6.3 Projects p. 6.6
(Checklist Item #50-51)

A process was conducted by the three GSAs and stakeholders to select 12 projects. The projects are listed in Table 6-3. Only a general way of evaluating each project is given. Up to 50 future potential projects, listed in Table 6-6 Projects Running List for Reference, and may be implemented as priorities and funding change. None of the 12 selected projects are expected to directly benefit GDEs. Please explain how the groundwater recharge projects (Project #1, #4, and #10) could benefit GDEs or a location near the GDEs and how the projects will be evaluated.

Attachment C

Freshwater Species Located in the Merced Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Merced Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the GSA's boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[4]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[5] as well as on The Nature Conservancy's science website[6].

Scientific Name	mmon Name	Legally Protected Species		
		Federal	State	Other
Birds				
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Ixobrychus exilis hesperis	Western Least Bittern		Special Concern	BSSC - Second priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pandion haliaetus	Osprey		Watch list	
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority

[4] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710
[5] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[6] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Vireo bellii	Bell's Vireo			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
		Crustaceans		
Branchinecta conservatio	Conservancy Fairy Shrimp	Endangered	Special	IUCN - Endangered
Branchinecta lindahli	Versatile Fairy Shrimp			
Branchinecta longiantenna	Longhorn Fairy Shrimp	Endangered	Special	IUCN - Endangered
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Branchinecta mesovallensis	Midvalley Fairy Shrimp		Special	
Cyzicus californicus	California Clam Shrimp			
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	Special	IUCN - Endangered
Linderiella occidentalis	California Fairy Shrimp		Special	IUCN - Near Threatened
		Fishes		
Mylopharodon conocephalus	Hardhead		Special Concern	Near-Threatened - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	Special	Vulnerable - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	Special Concern	Endangered - Moyle 2013
Acipenser transmontanus	White sturgeon		Special	Vulnerable - Moyle 2013

Catostomus occidentalis occidentalis	Sacramento sucker			Least Concern - Moyle 2013
Cottus asper ssp. 1	Prickly sculpin			Least Concern - Moyle 2013
Cottus gulosus	Riffle sculpin		Special	Near-Threatened - Moyle 2013
Entosphenus tridentata ssp. 1	Pacific lamprey		Special	Near-Threatened - Moyle 2013
Gasterosteus aculeatus microcephalus	Inland threespine stickleback		Special	Least Concern - Moyle 2013
Lampetra hubbsi	Kern brook lamprey		Special Concern	Vulnerable - Moyle 2013
Lavinia exilicauda exilicauda	Sacramento hitch		Special	Near-Threatened - Moyle 2013
Lavinia symmetricus symmetricus	Central California roach		Special Concern	Near-Threatened - Moyle 2013
Mylopharodon conocephalus	Hardhead		Special Concern	Near-Threatened - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	Special	Vulnerable - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus tshawytscha - CV fall	Central Valley fall Chinook salmon	Species of Special Concern	Special Concern	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV late fall	Central Valley late fall Chinook salmon	Species of Special Concern		Endangered - Moyle 2013
Orthodon microlepidotus	Sacramento blackfish			Least Concern - Moyle 2013
Pogonichthys macrolepidotus	Sacramento splittail		Special Concern	Vulnerable - Moyle 2013
Ptychocheilus grandis	Sacramento pikeminnow			Least Concern - Moyle 2013
Herps				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Pseudacris regilla	Northern Pacific Chorus Frog			
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC

Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis sirtalis sirtalis	Common Gartersnake			
Insects and Other Invertebrates				
Ablabesmyia spp.	Ablabesmyia spp.			
Berosus spp.	Berosus spp.			
Centroptilum spp.	Centroptilum spp.			
Cladotanytarsus spp.	Cladotanytarsus spp.			
Corixidae fam.	Corixidae fam.			
Cricotopus spp.	Cricotopus spp.			
Cryptochironomus spp.	Cryptochironomus spp.			
Enallagma carunculatum	Tule Bluet			
Microtendipes spp.	Microtendipes spp.			
Mideopsis spp.	Mideopsis spp.			
Nanocladius spp.	Nanocladius spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Polypedilum spp.	Polypedilum spp.			
Procladius spp.	Procladius spp.			
Psychodidae fam.	Psychodidae fam.			
Sigara spp.	Sigara spp.			
Stylurus olivaceus	Olive Clubtail			
Tanytarsus spp.	Tanytarsus spp.			
Trichocorixa spp.	Trichocorixa spp.			
Mammals				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
Mollusks				
Anodonta californiensis	California Floater		Special	
Ferrissia spp.	Ferrissia spp.			
Helisoma anceps	Two-ridge Rams-horn			CS
Margaritifera falcata	Western Pearlshell		Special	
Menetus opercularis	Button Sprite			CS
Physa spp.	Physa spp.			

Plants				
Alopecurus saccatus	Pacific Foxtail			
Ammannia coccinea	Scarlet Ammannia			
Arundo donax	NA			
Azolla filiculoides	NA			
Bacopa eisenii	Gila River Water-hyssop			
Bacopa rotundifolia	NA			
Brodiaea nana				Not on any status lists
Callitriche longipedunculata	Longstock Water-starwort			
Callitriche marginata	Winged Water-starwort			
Castilleja campestris succulenta	Fleshy Owl's-clover	Threatened	Endangered	CRPR - 1B.2
Cephalanthus occidentalis	Common Buttonbush			
Cicendia quadrangularis	Oregon Microcala			
Crassula aquatica	Water Pygmyweed			
Cyperus erythrorhizos	Red-root Flatsedge			
Cyperus squarrosus	Awned Cyperus			
Damasonium californicum				Not on any status lists
Downingia bella	Hoover's Downingia			
Downingia cuspidata	Toothed Calicoflower			
Downingia pulchella	Flat-face Downingia			
Downingia pusilla	Dwarf Downingia		Special	CRPR - 2B.2
Elatine brachysperma	Shortseed Waterwort			
Elatine californica	California Waterwort			
Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis quadrangulata	NA			
Elodea canadensis	Broad Waterweed			
Epilobium campestre	NA			Not on any status lists
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eryngium castrense	Great Valley Eryngo			
Eryngium racemosum	Delta Coyote-thistle		Endangered	CRPR - 1B.1
Eryngium spinosepalum	Spiny Sepaled Coyote-thistle		Special	CRPR - 1B.2

Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Gratiola ebracteata	Bractless Hedge-hyssop			
Gratiola heterosepala	Boggs Lake Hedge-hyssop		Endangered	CRPR - 1B.2
Hydrocotyle ranunculoides	Floating Marsh-pennywort			
Isoetes howellii	NA			
Isoetes nuttallii	NA			
Isoetes orcuttii	NA			
Juncus exiguus				Not on any status lists
Juncus uncialis	Inch-high Rush			
Juncus usitatus	NA			Not on any status lists
Lasthenia ferrisiae	Ferris' Goldfields		Special	CRPR - 4.2
Lasthenia fremontii	Fremont's Goldfields			
Lemna gibba	Inflated Duckweed			
Lemna minuta	Least Duckweed			
Limnanthes douglasii nivea	Douglas' Meadowfoam			
Limnanthes douglasii rosea	Douglas' Meadowfoam			
Ludwigia peploides peploides	NA			Not on any status lists
Lycopus americanus	American Bugleweed			
Marsilea vestita vestita	NA			Not on any status lists
Mimulus guttatus	Common Large Monkeyflower			
Mimulus latidens	Broad-tooth Monkeyflower			
Mimulus tricolor	Tricolor Monkeyflower			
Myosurus minimus	NA			
Myosurus sessilis	Sessile Mousetail			
Myriophyllum aquaticum	NA			
Navarretia leucocephala leucocephala	White-flower Navarretia			
Navarretia myersii myersii	Pincushion Navarretia		Special	CRPR - 1B.1
Navarretia prostrata	Prostrate Navarretia		Special	CRPR - 1B.1
Neostapfia colusana	Colusa Grass	Threatened	Endangered	CRPR - 1B.1

Orcuttia inaequalis	San Joaquin Valley Orcutt Grass	Threatened	Endangered	CRPR - 1B.1
Orcuttia pilosa	Hairy Orcutt Grass	Endangered	Endangered	CRPR - 1B.1
Panicum dichotomiflorum	NA			
Paspalum distichum	Joint Paspalum			
Persicaria amphibia				Not on any status lists
Persicaria hydropiper	NA			Not on any status lists
Persicaria hydropiperoides				Not on any status lists
Persicaria lapathifolia				Not on any status lists
Persicaria maculosa	NA			Not on any status lists
Phyla nodiflora	Common Frog-fruit			
Pilularia americana	NA			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys austiniae	Austin's Popcorn-flower			
Plagiobothrys distantiflorus	California Popcorn-flower			
Plagiobothrys greenei	Greene's Popcorn-flower			
Plagiobothrys humistratus	Dwarf Popcorn-flower			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Plagiobothrys undulatus	NA			Not on any status lists
Plantago elongata elongata	Slender Plantain			
Pogogyne douglasii	NA			
Pogogyne zizyphoroides				Not on any status lists
Potamogeton nodosus	Longleaf Pondweed			
Potamogeton pusillus pusillus	Slender Pondweed			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus oregonus	Oregon Woolly-heads			
Psilocarphus tenellus	NA			
Ranunculus aquatilis aquatilis	White Water Buttercup			
Ranunculus bonariensis	NA			
Ranunculus sceleratus	NA			

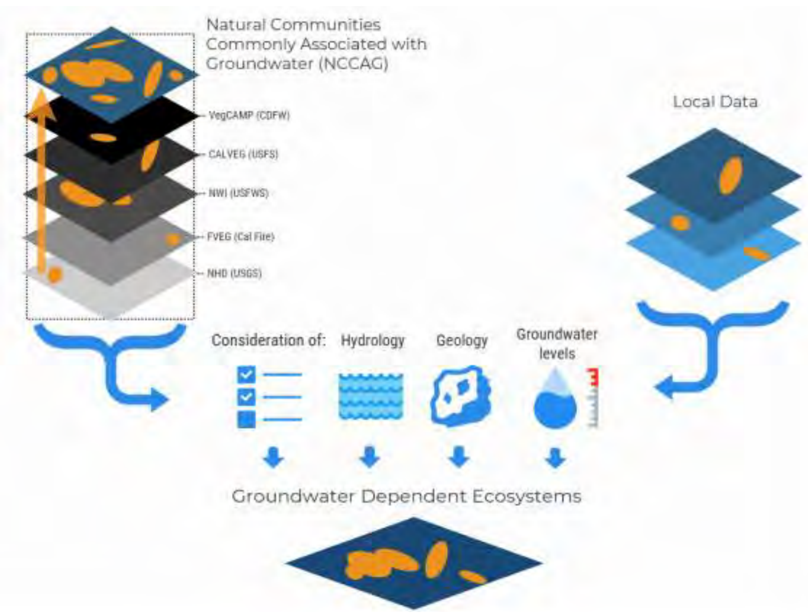
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Rorippa palustris palustris	Bog Yellowcress			
Rumex stenophyllus	NA			
Sagittaria sanfordii	Sanford's Arrowhead		Special	CRPR - 1B.2
Salix exigua exigua	Narrowleaf Willow			
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus californicus	California Bulrush			
Sidalcea calycosa calycosa	Annual Checker-mallow			
Sidalcea hirsuta	Hairy Checker-mallow			
Sparganium eurycarpum eurycarpum				
Spirodela polyrhiza	NA			
Stachys albens	White-stem Hedge-nettle			
Stuckenia striata				Not on any status lists
Triglochin scilloides	NA			Not on any status lists
Tuctoria greenei	Green's Awnless Orcutt Grass	Endangered	Rare	CRPR - 1B.1
Typha domingensis	Southern Cattail			
Zannichellia palustris	Horned Pondweed			

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA
Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[7] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[8]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.



[7] *NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/*

[8] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[9]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[10] on the Groundwater Resource Hub[11], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

---

[9] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

[10] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[11] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

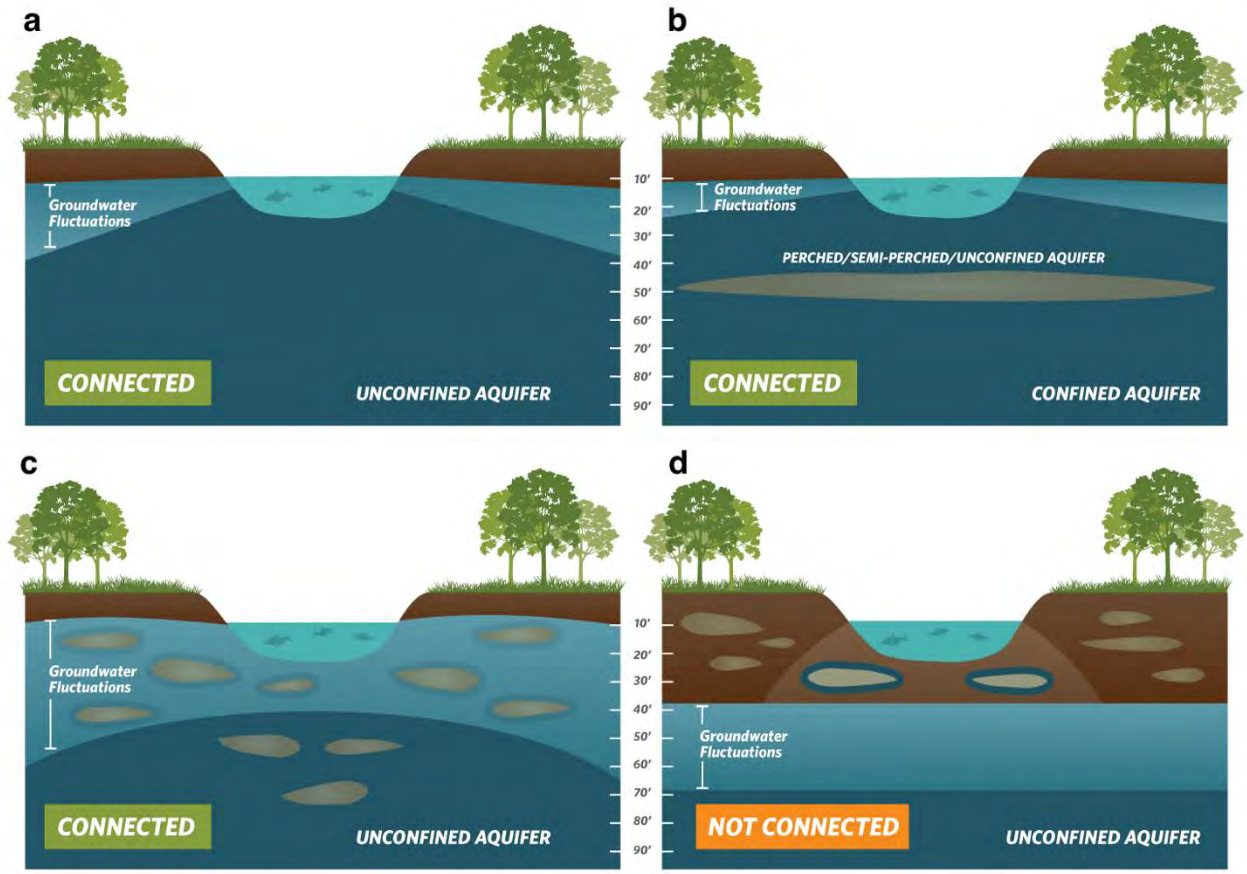


Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. (b) Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. Bottom: (c) Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. (d) Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[12] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[13] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[14] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[15]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

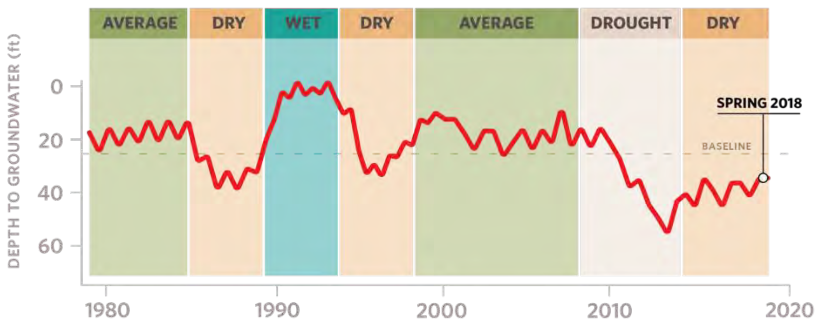


Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

---

[12] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[13] *Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]*

[14] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[15] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[16], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

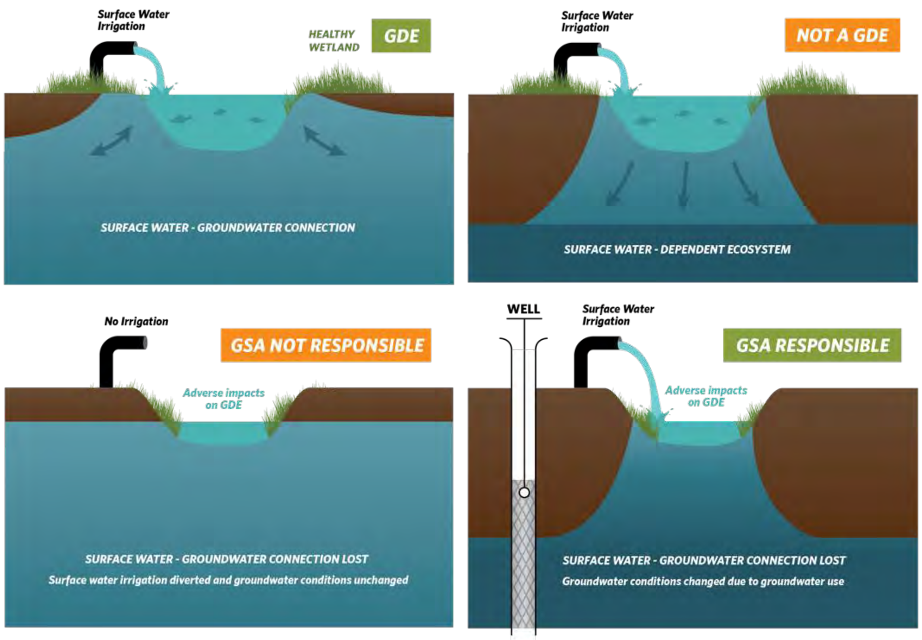


Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. (Right) Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. Bottom: (Left) An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. (Right) Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[16] *For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/*

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

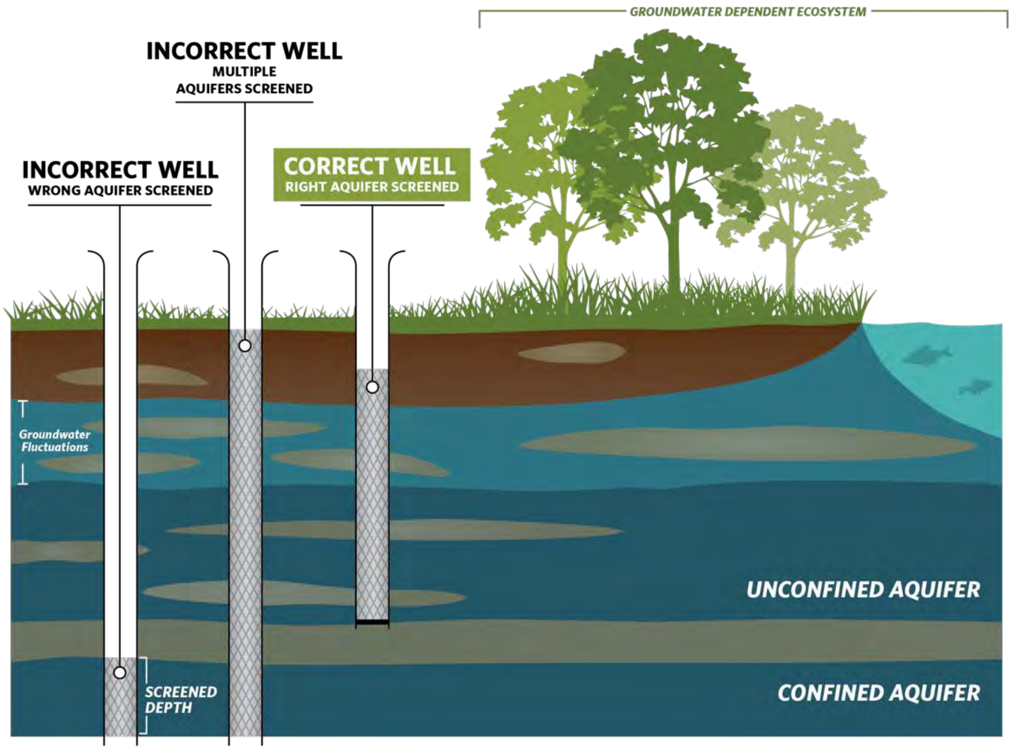


Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate groundwater elevations at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[17] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

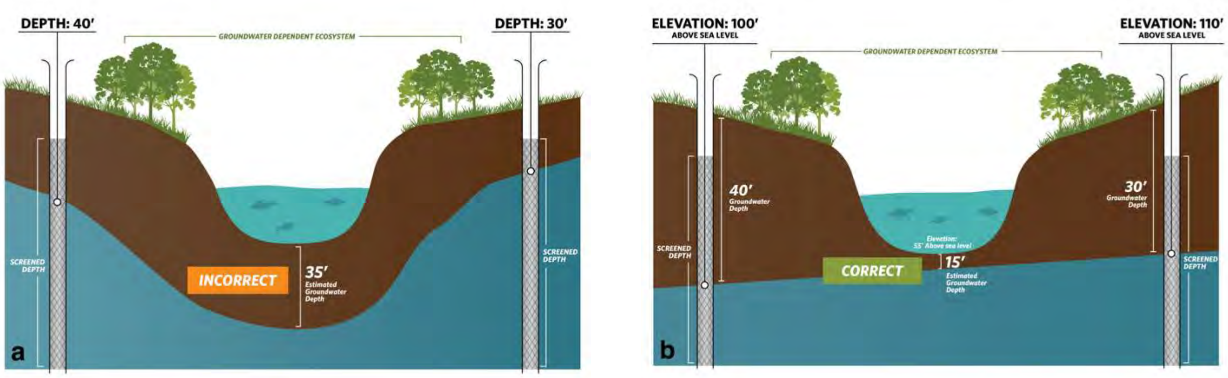


Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. (b) Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

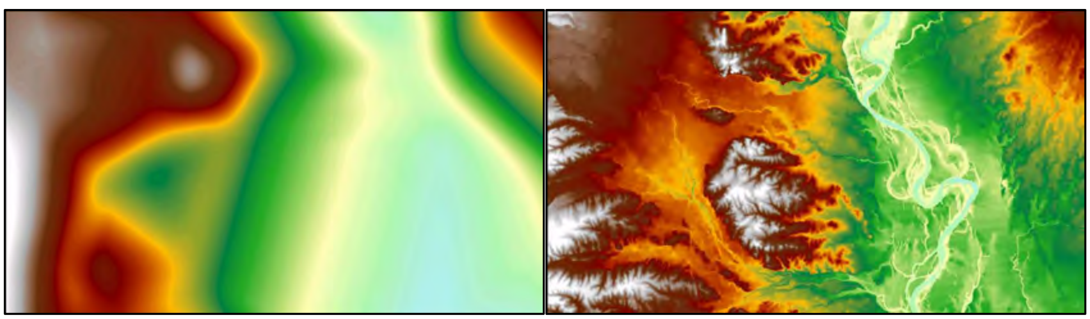


Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. (Right) Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[17] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network. Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

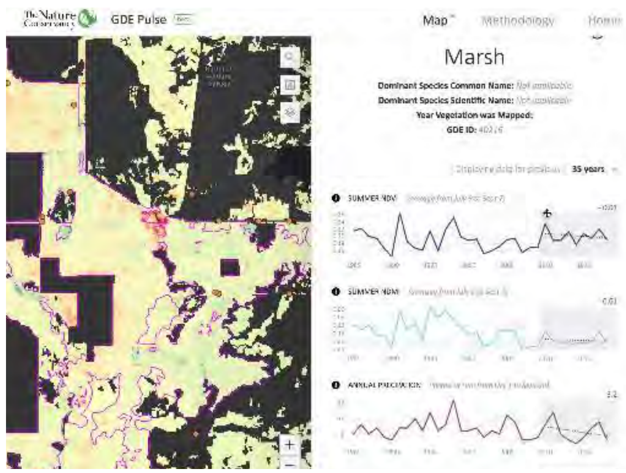
The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Attachment E

GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

Visit https://gde.codefornature.org/



Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset[18]. The following datasets are included:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset[19]. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

[18] *The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#*

[19] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

United States Department of the Interior

FISH AND WILDLIFE SERVICE

San Luis National Wildlife Refuge Complex
Post Office Box 2176
7376 South Wolfsen Road
Los Banos, California 93635

01 August 2019

Via mail and email

Mr. Hicham Eltal, Merced GSP Contact
Merced Irrigation District
744 W 20th Street
Merced, CA 95340
Email: mercedsgma@woodardcurran.com

Re: Comments on Draft Groundwater Sustainability Plan for Merced Groundwater Sub-basin July 2019 Draft Report

Dear Mr. Eltal:

There are some discrepancies in the *Draft Groundwater Sustainability Plan for the Merced Sub-basin*, and the U.S. Fish & Wildlife Service has serious concerns regarding two proposed projects:

- **Pg. 1-24: "1.2.2.1.5 San Luis National Wildlife Refuge Complex** -- The San Luis NWR Complex records monthly groundwater elevation data for 25 wells in the Merced National Wildlife Refuge."
  - **Correction:** Groundwater elevation is rarely recorded for the Merced NWR wells; it is generally recorded only when well tests are performed by a contractor, which occurs less than once per decade on each well.
- **Pg. 1-40: "1.2.5.1 Beneficial Uses and Users in the Basin** -- Approximately **15,000 AFY** of water for environmental surface water flows are used at the Merced National Wildlife Refuge. "
  - **Correction:** This is inaccurate. The FERC-mandated quantity of water intended to mitigate for the loss of habitat caused by MID's operations is up to 15,000 AFY. However, annual quantities of water have been diminishing from an average of 11,000 AFY to 3,234 AF in WY2017 (a flood year) and 4,502 in WY2018 (a normal year); for an average post-drought supply of **3,868 AF.** In WY2017, the 3,234 AF delivered by MID was 22% of the water used, and 11,475 AF (78%) was pumped from wells. In WY2018, the 4,502 AF delivered by MID was 29% of the water used, and 11,219 AF (71%) was pumped from wells. Thus, post-drought, an average of only 25% of the water needed by the Refuge was surface water flows, causing the Refuge to rely on wells for the remaining 75%; the opposite of pre-drought proportions.
- **Pg. 2-110: "2.2.7 Groundwater-Dependent Ecosystems - 2. Habitat areas with supplemental water** – ... A substantial portion of this area overlaps with the Merced National

Wildlife Refuge which receives an average 11,000 AFY of surface water (2009-2013), with reduced deliveries during drought (100 to 4,000 AFY during 2014-2016)."

- **Correction:** However, post-drought deliveries have averaged only **3,868 AFY.**

- **Pg. 6-15: "Project 5: Merced Irrigation District to Lone Tree Mutual Water Company Conveyance Canal Description** -- LTMWC is seeking to establish a new 2.25 mile long canal connection from an existing MID canal to an existing canal within the LTMWC system. The capacity of the canal to be constructed would be 60 cubic feet per second (cfs) and the potential delivery would be 20-24,000 AFY. The project would benefit 1020 acres in the Sandy Mush Mutual Water Company service area that are entirely dependent on ground water by providing access to surface water from the canal which would cross the acreage in route to LTMWC. LTMWC has 11,574 acres which are significantly dependent on groundwater in all but above average rainfall years. In addition, LTMWC is situated on the northern border of acreage being annexed into the Clayton Water District and said acreage is entirely dependent upon groundwater. Given these circumstances, LTMWC could implement the project to wheel surface water into Clayton Water District for usage in lieu of groundwater use, or for groundwater recharge. The project addresses management of groundwater extraction and recharge through in lieu recharge by switching groundwater demand to surface water in a white area of the Subbasin. Measurable Objective: The project supports mitigation of chronic lowering of groundwater levels through in lieu recharge, and also benefits reduction of subsidence through reduced groundwater pumping. **Time-Table for Initiation and Completion**: The project is anticipated to run from May 2019 through November 2020. The project will be in planning and design phase from May through mid summer 2019 with the preliminary engineering of two potential routes and subsequent selection of one route. This is followed by negotiation with landowners for easements, which is expected to be complete before end of 2019. Construction is anticipated to be complete by November 2020. **Expected Benefits and Evaluation**: This project has several benefits including supporting reduction of groundwater pumping by providing in lieu recharge opportunities. Note from MID: Local project sponsors (e.g., LTMWC, LGAWD, etc.) anticipate that surface water sourced from the Merced Irrigation District may be available through temporary water purchase and sale agreements and may serve as a water supply for the project(s). It is understood that the Board of Directors for the MID has and shall retain full and absolute discretion regarding whether and when it will enter into temporary water purchase and sale agreement(s), if any, and further, nothing contained in this document creates in any party or parties any right to water controlled by the MID whether it be surface water or groundwater. Any transferred water made available by MID shall be limited by the terms and conditions contained in any respective temporary water purchase and sale agreement. **Legal Authority**: The Merced Subbasin GSA has authority per SGMA to develop and support projects for conveyance and potential in lieu recharge, as well as projects which reduce subsidence in the Subbasin. **Estimated Costs and Plans to Meet Costs**: The estimated costs for this project are between \$3,000,000 - \$6,000,000. Costs for this project are expected to be met through pursuit of further grant funding, private funding, and funding raised through MSGSA."

    - **Major Issue:** This action will actually contribute to the ***increase in groundwater withdrawal*** at Merced NWR, and the ***loss of wetlands*** in the Central Valley. MID has reduced deliveries to Merced NWR from approximately 11,000 AFY to 4,000 AFY, causing groundwater withdrawal by the Refuge to increase by 7,000 AFY. Spending \$3 million to \$6 million on this proposed project to build a canal, acquisition of easements, and establishing water purchase agreements will tend to make more permanent that loss of surface water delivery to the Refuge. ***It is simply shifting groundwater withdrawal eight miles westward.*** In addition, those well costs are paid by the U.S. Department of the Interior's Restoration Fund; diminishing funding available for creating wetlands elsewhere in the Central Valley, which in turn causes the overall loss of 250 to 2,000 acres of seasonal wetlands elsewhere, depending on the cost of water.

- **Pg. 6-19: "Project 9: Study for Potential Water System Intertie Facilities from MID to LGAWD and CWD Description:** Under this project MID, LGAWD and Chowchilla Water District (CWD) would investigate the feasibility of improving and constructing water conveyance facilities to allow the temporary transfer of water from MID to LGAWD and CWD."
    - **Major Issue:** As with Project 5, Project 9 is also likely to aggravate groundwater withdrawal at Merced NWR and wetland loss overall.

Please don't hesitate to contact me if you have any questions or concerns (Kim_Forrest@fws.gov, 209/826-3508).

Sincerely,

Kim Forrest
Refuge Manager

Cc: Stacy Armitage, Refuge Supervisor; USFWS
Dale Garrison, CVPIA Coordinator; USFWS
Dan Welsh, Dan Welsh, Deputy Field Supervisor; USFWS
Alison Willy, Senior Fish and Wildlife Biologist; USFWS
Lacey Kiriakou, Water Resources Coordinator; Merced County
Ric Ortega, General Manager; Grassland Water District / Grassland GSA
Andy Gordus, Toxicologist; California Department of Fish & Wildlife
Amanda Peisch-Derby, Regional Coordinator; California Department of Water Resources
Amber Villalobos, Environmental Scientist; California State Water Resources Control Board
Matt Buhyoff, Ken Yu, Alan Mitchnick, Annie Jones; Federal Energy Regulatory Commission
Mark Biddlecomb, Director of Operations - Western Regional Office; Ducks Unlimited
Meghan Hertel, Director - Land and Water Conservation; Audubon California

MARSHA A. BURCH
ATTORNEY AT LAW

131 South Auburn Street
GRASS VALLEY, CA 95945

Telephone:
(530) 272-8411

mburchlaw@gmail.com

August 19, 2019

Via electronic mail:
mercedsgma@woodardcurran.com

Hicham Eltal, Merced GSP Contact
Merced Irrigation District
744 W 20th Street
Merced, CA 95340

Re: Draft Merced Subbasin Groundwater Sustainability Plan

Dear Mr. Eltal:

This office represents the Valley Land Alliance ("VLA") with respect to the above-referenced Draft Groundwater Sustainability Plan ("GSP"). We appreciate the opportunity to comment on the GSP at this stage of its development.

While the critical steps of developing allocation procedures and determining initial allocations will occur next year, there are aspects of the Draft GSP that should be emphasized and clarified at this stage.

The replacement of sub-Corcoran wells must be prioritized. The Draft GSP understates the severity and importance of land subsidence in the subbasin. It is noted as an "area of concern" but this is a rather tepid description of a grave, ongoing problem. One of the stated purposes of the GSP is to prevent "significant and unreasonable land subsidence," and yet the GSP does not include a robust analysis of this issue. VLA encourages a clearer and more aggressive approach to reducing land subsidence within the subbasin area.

The GSP planning process must also continue to take into account the evolving science and information regarding climate change. Development of the GSP will necessarily occur over a period of many years, and the rapid development of climate change science will inform the GSP in a dynamic way.

We anticipate that the GSP will include, among other things, the following: identification of optimum locations for effective recharge projects; limits on the reach of the GSP into only areas and activities that impact groundwater; and a continued focus on projects and management actions that will either increase surface water supplies to augment the sustainable groundwater yield or will increase groundwater recharge.

We also encourage vigilant resistance to any approach that results in the unreasonable or unfair allocation of water based upon the relative power of the water users involved. The hard lessons learned in California regarding "moving" water from one area to another without deep analysis of the potential consequences should not be forgotten.

VLA looks forward to continued participation in the process, and to providing input as the GSP is developed. Thank you for considering our comments.

Very truly yours,

Marsha A. Burch
Attorney

cc: Valley Land Alliance

MEETING NOTES

Joint Meeting of the Boards of Directors of the Merced Groundwater Subbasin Groundwater Sustainability Agencies:

Merced Subbasin Groundwater Sustainability Agency (MSGSA), Merced Irrigation-Urban Groundwater Sustainability Agency (MIUGSA), and Turner Island Water District Groundwater Sustainability Agency #1 (TIWD-1)

DATE/TIME: September 18, 2019 at 6:00 PM

LOCATION: Sam Pipes Room, Merced Civic Center, 678 West 18th Street Merced, CA 95340

GSA Board Members In Attendance:

Board Members Attending	GSA
Hicham Eltal	Merced Irrigation-Urban GSA
Justin Vinson	Merced Irrigation-Urban GSA
Daniel Chavez	Merced Irrigation-Urban GSA
Leah Brown (as alternate for Ken Elwin)	Merced Irrigation-Urban GSA
Brenda Wey	Merced Irrigation-Urban GSA
Carlos Gudino	Merced Irrigation-Urban GSA
Cynthia Benavidez	Merced Irrigation-Urban GSA
Dave Nervino (as alternate for Bob Kelley)	Merced Subbasin GSA
Mike Gallo	Merced Subbasin GSA
Nic Marchini	Merced Subbasin GSA
George Park	Merced Subbasin GSA
Kole Upton	Merced Subbasin GSA
Lloyd Pareira	Merced Subbasin GSA
Lawrence S. Skinner	Turner Island Water District GSA #1
Donald C. Skinner	Turner Island Water District GSA #1
Thomas C. Skinner	Turner Island Water District GSA #1

Meeting Notes

1. Call to order
    a. Alyson Watson (Woodard & Curran) invited the chair of each board to call their meeting to order.
    b. Each board member introduced themselves.
    c. Each chair confirmed they had a quorum.
    d. Alyson (W&C) reviewed the agenda.

2. Report Items

   a. Overview of GSP Development to Date

      i. Alyson Watson (W&C) reviewed GSP development to date. This included a brief review of the 6 sustainability indicators. She described two objectives: bringing the basin into balance and doing this in a way that prevent Undesirable Results.
      ii. She also reviewed the overall GSP Development timeline and highlighted the technical foundation items including the groundwater model, hydrogeologic analysis, historical current and projected water budget, and the data management system (creating a database for existing data and to store and manage data collected in the future). She explained the process of understanding undesirable results and establishing sustainable management criteria (e.g. establishing a minimum threshold to prevent domestic wells going dry), as well as establishing a monitoring network. Projects and Management Actions are used to get us to where we need to go, and we are looking into how to fund these actions.
      iii. Question: Is this information (what is presented at the meeting) available online? A: Yes. All information including the written comments received on the draft GSP are available online at www.mercedsgma.org

   b. Public Engagement Process

      i. Charles Gardiner (Catalyst) reviewed the Public Engagement Process. Outreach was guided by a Stakeholder Engagement Strategy developed early in the GSP process. Public workshops addressed elements of the plan and were conducted around the basin in different locations. Public meetings included 19 Coordinating Committee meetings, 15 Stakeholder Committee meetings, and 5 Public Workshops coordinated with Self-Help Enterprises (SHE) and Leadership Counsel. Spanish translation was made available for the public workshops and for tonight's meeting in coordination with SHE.
      ii. Charles explained that the regulatory timeline drives the plan. The plan is due by 2020, the deadline for implementation is 2040. This GSP should be considered a first effort at what is needed for sustainable groundwater management in this basin and there will be regular updates. All of this is subject to update as we understand how the basin responds to actions that are taken.
      iii. Charles explained the purpose of the Joint Board Meeting, and that the meeting provides the opportunity for the public to provide additional, supplemental comments. The consultant team will provide an overview of the comments received on major topics, provide an opportunity for additional public comments on the GSP, and provide an opportunity for a joint Board discussion and input to GSA staff who will guide the consultant team in revising the GSP for adoption. The meeting also includes a status update on the Prop 1 funded SDAC projects and consideration of authorization of funds for preparation of a Prop 68 grant application on behalf of the basin.

   c. Summary of Public Comments Received (Opportunity for public comment following each topic)

      i. Samantha Salvia (Woodard & Curran) provided a summary of the public comment process. She noted that SGMA does not require that GSAs hold a public comment period on the draft GSP, in part because DWR will hold a 60-day public comment period during their review process. However, the coordinating and stakeholder committees felt this was important and so time was built into the schedule for a 30-day review. She described how the public draft GSA was made available. She reviewed the list of NGOs, water agencies, State and Federal Agencies, and other entities who provided public comment to the draft GSP. All comments are available on the mercedsgma.org website. All comments were provided to each Board member in advance of tonight's meeting. She explained the approach to responding to comments will involve placing the comments into 3 groups:: minor corrections/clarifications will be addressed directly by edits within the GSP), substantive comments will be responded to with a master responses and edits to GSP under direction from GSAs, and comments on future considerations for GSP implementation will be noted for GSA Board consideration and future Coordinating Committee meeting discussions).

ii. Comments were received on many parts of GSP. Given time constraints, for tonight's meeting, discussion will be focused on the following seven areas of comments: water level, subsidence, demand management, water allocation, water quality, groundwater dependent ecosystems, and stakeholder outreach. Samantha described the meeting format for the review of public comments: she will describe the relevant GSP section, background on the approach taken in the GSP, who commented, key concerns raised, and the potential response. Readers are encouraged to see presentation slides available on the mercedsgma.org website for full summary details (link to Meetings page: http://www.mercedsgma.org/meetings). After each comment the public will be invited to comment, with a limit of 3 minutes per person, per topic. This will be followed by an opportunity for Board discussion and/or comment.

iii. Water Level: Samantha (W&C) explained the approach in the GSP. The GSP took the approach of setting sustainable management criteria to be protective of the most sensitive beneficial use – shallow domestic wells. The GSAs will manage the basin to measurable objectives. The minimum thresholds are not the threshold for action, they are used to define undesirable conditions and they are the trigger for state intervention. Samantha reported that the GSP team has heard both from stakeholders and the coordinating committee a strong desire to manage groundwater locally and avoid state intervention. The representative monitoring network was developed based on previous CASGEM (California Statewide Groundwater Elevation Monitoring) monitoring. (Since 2009, the CASGEM Program has tracked seasonal and long-term groundwater elevation trends in groundwater basins statewide.) Included in the implementation plan is action to develop a Data Gaps Plan in first year. Data gaps are largely within southwestern portion of basin and to lesser degree in Northeastern area.

- Written comments were received from environmental organizations and organizations representing disadvantaged areas.

    1. Public Comments:

        a. Keith Ensminger (Merced resident, small business owner): Keith is glad we have finally come to the point where we are starting to regulate our aquifers. We are the last western state to do this. Keith attended a farm show and folks there were surprised that it took until now for CA to regulate groundwater. Keith has been involved in the technical committee late in the process, used to be a farmer, had teaching as second career, translation now as the third (he and his wife have a local translation business). Explained that surface water (SW) has been a strong influence on groundwater (GW), a strong approach with will need to be taken with SW/GW interaction. The folks using irrigation systems with SW should use the SW first before pumping the GW. Keith also stated that Prop 68 funding should be used to bring SW into areas that are fallow or would have to go out of operation. He has talked to a few folks in the irrigation districts but there needs to be money to do this activity. Keith thinks it's important that those in the irrigation districts should use all of the SW rights first before using GW. He stated all the pumps today need to be regulated whether that's through GSP, meters, or other means.

b. Nataly Garcia (Leadership Counsel): Nataly asked that the groundwater level comments provided by Leadership Counsel in their letter be considered, as they do not see this on the summary. They want to make sure that this has been documented and considered.

2. Board Comments:

a. Dave Nervino (MSGSA): In response to the comments, Dave stated that with the Minimum Thresholds (MTs) there was a comment that the MTs should be based on the best water quality and not just the level. Dave agrees with this comment and commented: what's the point if the water quality is not good.

iv. Subsidence: Samantha (W&C) explained the approach for subsidence. The measurable objectives for subsidence were based on recent measured subsidence levels. The coordinating committee considered using groundwater level as a proxy and decided it was most appropriate to set targets based on direct measurements of subsidence. She reiterated that the minimum thresholds are not where the basin wants to be. The GSP acknowledges that there has been subsidence and some loss of flood capacity, but the CC did not consider those significant and unreasonable. The objectives were set with the objectives of balancing the desire to reduce subsidence, avoid state intervention, and focus on ways to reduce stress on the deep aquifer while allowing some economic activity and beneficial use to continue.

v. Samantha identified who submitted written comments and summarized them: concerns raised on whether adequate protection is provided, acknowledgement of undesirable results related to subsidence, and request for immediate reduction in sub-Corcoran pumping. A potential response including clarifying and adding information for the El Nido area and continued coordination with neighboring basins was described.

1. Public Comments:

a. Keith Ensminger (Merced resident, small business owner): Keith stated the key issue to discuss is the water trading. There are essentially three key aquifers in the basin, and sometimes these flow in different directions. First, our water should not be traded outside of this district at all. When it comes to trading, this should be done and limited to trade amongst adjacent properties as much as possible. It does not make sense for folks in Stevinson to be trading with folks in Planada because they are in a different environment. This relates to subsidence. This could create problems for the irrigation districts, the canals and different entities. Mr. Ensminger stated that water trading is an important part of managing the aquifers

2. Board Comments:

a. Kole Upton (MSGSA): SW is the key to GW sustainability. There needs to be trade, but like Keith said, this needs to be done with one land next to another.

b. Dave Nervino (MSGSA): Stated we should not waste time trading outside the basin or discussing this.

vi. Demand Management: Samantha explained that because the basin is in overdraft, there is a recognition that pumping in the basin must be reduced. Demand management is discussed in the Projects and Management Actions section of the GSP both generally and as a specific action proposed by Merced Subbasin GSA. Many of the comments were about managing pumping reductions in general and not necessarily specific to Merced's proposed action. Comments were provided by water districts, NGOs, individuals, and businesses and the CA Poultry Federation. Conflicting comments on timing of implementation were submitted. Concerns also included encouraging public participation in decisions potentially excluding some users from reductions. This topic is still a work in progress with GSAs, more detail and refinement may be added prior to adoption as information becomes available.

1. Question from SHE: Is this (the potential response) what is going to be put forward? Answer (W&C): The potential response is a starting point. The consultant team will be working with the Board and the GSA staff on in developing the responses to comments.

2. Public Comments:

    a. David Hobbs (Merquin County Water District): Appreciates the work that has gone into creating the GSP. He was surprised that at the first stakeholder meeting residents of areas of subsidence said they recognized they were responsible for the issue. Merquin County Water District is asking for consideration that the resolution be equitable. If the decision upon implementation is that every pumper gets the same reduction, this is not equitable. That is subsidizing sustainability. Merquin is located in the Stevinson area. Stevinson has historically had high GW in part because they are the bathtub of basin and in part because of surface water they import. Merquin brings in over 14,000 AF annually, and asks that when the implementation decisions be made that this be taken into account. They also want to look into enacting management zones and not have a one-size-fits-all approach to the basin. There is a joke in Stevinson that there are some parts of year that you can't dig a posthole. It is not equitable or fair to cut pumping back the same for everyone in the basin as someone who has overpumped.

    b. Keith Ensminger (Merced resident, small business owner): Keith stated that we are overdrafting over 175K AF/yr and we need to deal with this. As far as land use goes, we need to cut back on the amount of farm land that's there and one way to do that is to fallow land, and another way to do that is to pay farmers to fallow land from time to time and make this part of their rotational schedule with their crops. Perhaps with Prop 68 and other legal structures we have we can support this and also help the irrigation districts to run water through their canals on those fallow lands in order to recharge those basins. There are differences in places like Stevinson and Planada. Pasture land on the east side of the Santa Fe railroad should probably remain pasture land and once orchards that are out there have reached end of useful life, they should go back to pasture land. The key is to create a water storage program that helps everyone.

3. Board Comments:

a. George Park (MSGSA): General discussions have been in the MSGSA that we would like to see some form of demand management and that this will be the subject of some of the next meetings.
b. Dave Nervino (MSGSA): In implementing demand management, we need to have an adequate time considered how to implement infrastructure needed for this.

vii. Allocation Framework: Samantha (W&C) explained that the allocation framework refers to the way that the GSAs are going to determine how much water to allocate throughout the basin. The coordinating and stakeholder committees have been discussing this topic since last October. This is one of the most challenging part of the GSP and it is understandable that it is taking time to develop. The draft document includes estimates of sustainable yield and developed supply for illustrative purposes. Comments received included the need to consider non-irrigated lands, economics, equity, and incentives. There was a comment to include habitats in the framework and a request to have more information in the GSP and opportunity to comment. More specifics may be added to the GSP prior to adoption. It is likely the full details of the allocation will be finalized after the GSP is submitted to DWR.

1. Public Comments:

   a. Eric Swenson (Shannon Pump, on behalf of Merquin Water District): Requested and strongly encouraged that the MSGSA area establish a minimum of 3 management zones for the 2020-2025 update. Believes that there are risks faced by DACs, natural habitats, and others. The first zone could be a subsidence zone centered around El Nido. The second zone, which would be east of subsidence zone, is significantly different than the other two zones. Natural GW recharge rates appear to be significantly different in this area. There is greater potential for domestic and small water wells to go dry, and not adequate water for nut production. The third zone has different habitats with significantly greater recharge occurring in this area. He would like to also request that GW recharge from canals be included in the model developed by W&C. Mr. Swenson stated that he has maps of the three zones that can and has provided those to officials in the past.

2. Board Comments:

   a. Nic Marchini (MSGSA): Agrees with comments from Eric. The zones will inevitably and likely be more than 3, but generally agrees with the comments.
   b. Dave Nervino (MSGSA): Stated we could also consider that these are priority zones and could move resources from wet areas to where this they are needed.

viii. Water Quality: Samantha (W&C) provided a summary of the GSP approach, reiterating that drinking water is an important issue and has been the subject of discussions during Stakeholder and Coordinating Committee meetings. The GSP developed sustainable management criteria for water quality constituents where there is a clear causal nexus between groundwater activities and water quality - salinity. The GSAs sought input from the Merced County Environmental Health Division and set management criteria for salinity based on drinking water standards. The other key part of the GSP approach is coordination with agencies already tasked with monitoring water quality. Board members strongly agreed that the GSAs should avoid duplicating efforts with programs already underway by agencies tasked with protecting drinking water quality. Comments were received from SHE, LC, and environmental organizations with main concerns including: MTs do not adequately address drinking water quality, need more regulation and monitoring of wider range of constituents, and not enough monitoring wells. The potential response includes clarifying and better defining coordination with other monitoring programs, ensuring GSP related projects evaluate water quality impacts, and incorporating the under development IRWM DAC Water Needs Assessment when available.

1. Public Comments:
    a. Nataly Garcia (LC): Believes the responses do not address what Leadership Counsel provided in the comment letters.
    b. Maria Herrera (SHE and SC member): Wants to encourage the board to consider the comments they have submitted because the current plan does not address drinking water for communities. She is concerned that there is not enough content connected to constituents with the MTs section and is concerned that the plan is at risk of not being deemed adequate by DWR. She also reminded Board members that SGMA requires input and participation from stakeholders in this region. States that the GSP as written would not respect the human right to drinking water.
    c. Keith Ensminger (Merced resident, small business owner): Used to live in Southeastern Montana, where lot of wells were non-potable. His wells were not potable, and neither were his neighbors' wells. Nearest potable well was 5 miles away. Maybe one way to find a solution is to provide potable water to folks now to ensure that they have what they need if they currently do not have potable water from their wells. This could be a potential solution.
2. Board Comments:
    a. Kole Upton (MSGSA): Is also concerned with water quality and testing and thinks we could expand coordination with the existing agencies and make use of the data that is out there.
    b. Lloyd Pareira (MSGSA): We should coordinate with existing agencies.
    c. Hicham Eltal (MIUGSA): This is our first cut of the GSP, a lot is not known. His concern is unless you have information that leads the way, effort is made in vain. There are pumpers where there are no monitoring wells. It is difficult to know what the implications will be in making things stricter or not stricter for pumping. He does not disagree with anything that has been said, but states that the Subbasin will need to proceed with caution. All of these things have to be vetted, especially when there is missing data.

ix. Groundwater Dependent Ecosystems: Samantha (W&C) explained that the approach assessed Natural Communities Commonly Associated with Groundwater (NCCAG) dataset against groundwater depth, supplemental water, irrigated fields, losing streams, and vernal pools to identify potential GDEs in subbasin. GDEs were considered as beneficial users of groundwater. She noted that the relationship between groundwater levels and GDEs is not well understood. Most of the areas that were identified as potential GDEs are near the San Joaquin River and in areas with clay layers – how, if at all, deep aquifer pumping affects them is not well understood. All comments received were from environmental organizations. Concerns raised were expanding areas considered GDEs and making the GSP more protective of GDEs. Potential responses include considering

GDE locations in developing plan to fill data gaps for shallow groundwater monitoring and evaluating incorporation of The Nature Conservancy's GDE Pulse Tool into GSP annual report process.

1. Public Comments: None.
2. Board Comments: None.

x. Stakeholder Outreach: Samantha (W&C) explained the consulting team believes the approach made good use of time and resources available. Because Charles Gardiner (Catalyst) described the outreach approach in detail earlier in the meeting, she focused on plans for future outreach. The implementation plan describes the current plan for ongoing outreach and involvement. Comments were received from environmental orgs, LC, and SHE. Concerns included inadequate outreach to disadvantaged communities and environmental interests and a lack of balance on SC of all stakeholders especially for environmental representation. Potential response includes adding SC membership and who they represent in GSP and including the Stakeholder Engagement Strategy in appendix, as well as updating the Stakeholder Engagement Strategy for the implementation phase.

1. Public Comments:
    a. Maria Herrera (SHE and SC member): Maria thanked the Boards members and said that the letter of support from the GSAs enabled her organization to access state funding to cover translation services at this and other key meetings. It also paid for SHE in translating documents and conducting outreach in the basin. The State funding for their services is coming to an end early next year. She encouraged the boards to consider including funding in their operating budgets for translation services. She also encouraged using consultants with connection to local communities and providing adequate time for comments (30 days was not enough).
    b. Nataly Garcia (LC): Nataly states that it is great that there is a joint meeting, but there should have been a public workshop where the GSP was walked through with the public. This should have taken place prior to this meeting.
2. Board Comments:
    a. Dave Nervino (MSGSA): In getting the public involved, we also have the farm bureaus and other groups who will and have circulated information.

d. Next Steps in GSP Adoption Process

i. Alyson Watson (W&C) described the next steps and timeline for review & submission of the GSP to DWR. W&C will be working with GSA staff on revising the GSP in response to comments, including those received this evening.). The earliest the GSP can be adopted is late October, because the adoption hearings cannot begin until 90 days after filing a Notice of Intent to adopt (filed in July). Hearings are anticipated to take place Nov./Dec. Submission in January 2020 to DWR.

e. Update on progress of the Severely Disadvantaged Community grant projects.

i. Hicham Eltal (MIUGSA) described the funding source for the DAC projects and provided an overview of the locations of the projects (see slides for map of projects). The updates were as follows:

1. Planada Groundwater Recharge Pilot Basin & Monitoring Well: We have secured a parcel of land and are moving forward with experimenting with certain soils in this area. We are honing in on the best soils. The location is not far from Mariposa Creek.
2. El Nido Groundwater Monitoring Wells: The other project is supposed to have two wells, the first well we are still working on. We are still working with the owner of the land. The other monitoring well likely be at the fire station. The County has given the approval to install the well.
3. Meadowbrook Intertie Feasibility Study: This project looks into providing a connection to the Franklin-Beechwood area. We are hoping in the next few months to have the results of the study.
4. Questions from Dave Nervino (MSGSA): How deep are the monitoring wells. Answer (Hicham): each of these are deep wells. They will be multiple completion wells. They will go to almost 600 ft.

3. Action Item

a. Prop 68 Funding Opportunity – Consider authorization of funding of $50,000 for consultant support to prepare Prop 68 Grant Application

i. Alyson (W&C) explained that the funding used for the SDAC projects and the GSP development were under Proposition 1. There is a new Proposition 68 and the basin is eligible for up to $500K and should qualify for a DAC wavier meaning no local match. The application is due on November 1, 2019. The Planning Grants Proposal Solicitation Package (PSP) and final guidelines have now been released by DWR. The updated timeline was also provided by DWR. The final review and funding award are anticipated in the March 2020 timeframe.
ii. In their last meeting the CC recommended that the Boards authorize up to $50K for W&C to prepare the application for Prop 68 funding.
iii. MSGSA motions and approves of the action.
iv. TIWD GSA-1 makes a motion, the motion is seconded, and approved.
v. MIUGSA makes a motion, the motion is seconded, and approved.

4. Public Comments

a. Question from Maria Herrera (SHE and SC member): Has the working group for Prop 68 content started? When are those meetings? Answer (W&C): They are just starting this process. We understand SHE (Maria) has expressed interest in this and she will be included in working group.
b. Nataly Garcia (LC): Will the updated GSP also be provided to the public? Answer (Catalyst): Yes, it will go to each GSA board and they will do their own public process. It will also be available on the website.

5. Meeting Adjournment

a. Meeting is adjourned by the GSA chairs in accordance with their boards' protocols.

WOODARD
&CURRAN

woodardcurran.com
COMMITMENT & INTEGRITY DRIVE RESULTS