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 <u>Section 4.2</u>, 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

MERCED SGMA

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 22nd 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 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.

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 (25th percentile or higher) may not be protective enough.

            1. Members requested seeing the threshold analysis using the shallowest well instead of 25th 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.

MERCED SGMA

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	

Meeting Minutes

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	

Meeting Minutes

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.

MERCED SGMA

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.

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

LEADERSHIP COUNSEL FOR JUSTICE & ACCOUNTABILITY

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.

LEADERSHIP COUNSEL FOR JUSTICE & ACCOUNTABILITY

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.

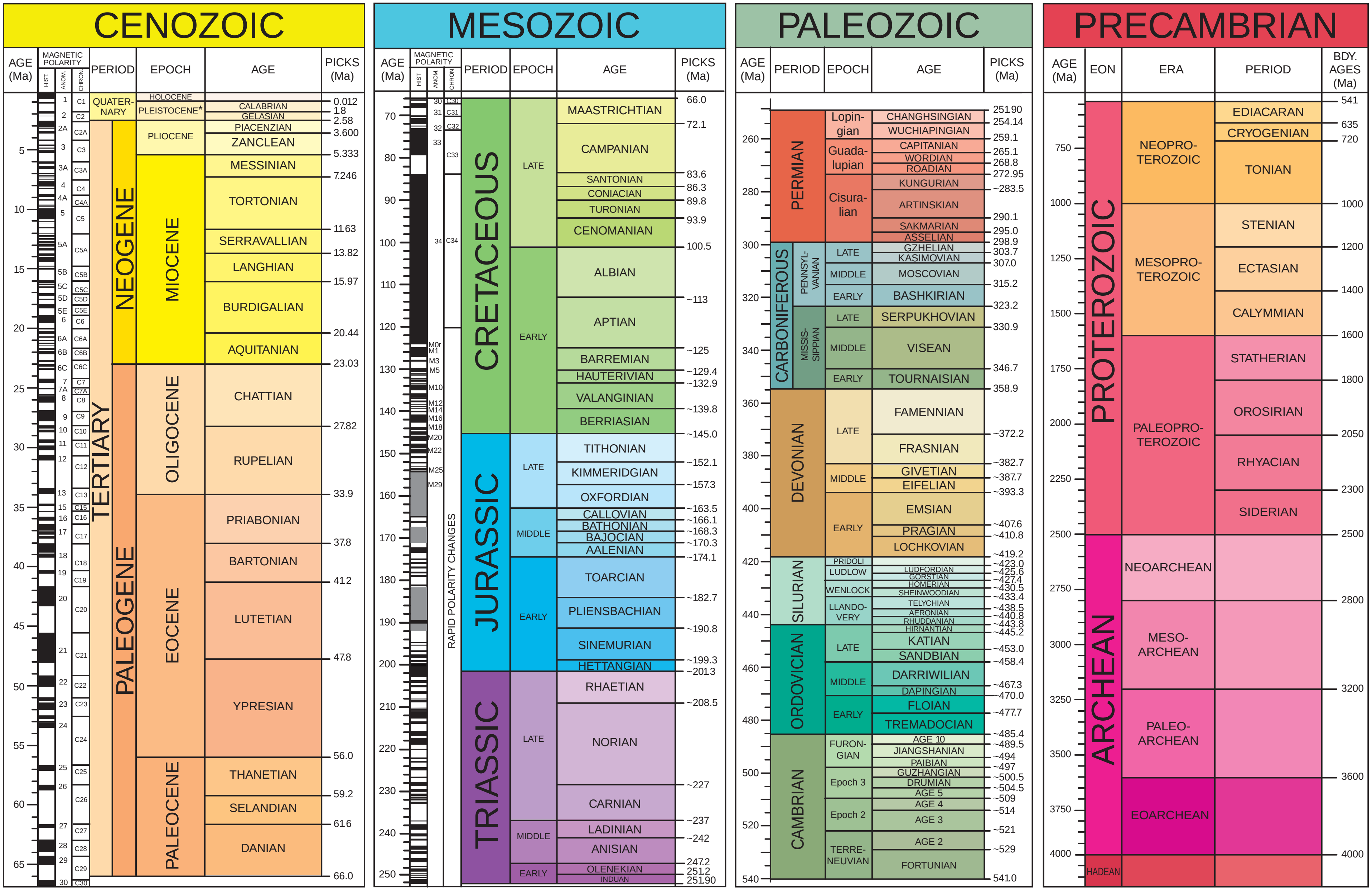
We are also in communication with the Department of Water Resources about current GSP development activities in the San Joaquin Valley, and hope to successfully work with GSAs, communities and DWR to ensure that groundwater management is equitable and sufficiently protective of vital drinking water resources.

Sincerely,

Leadership Counsel for Justice and Accountability

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).

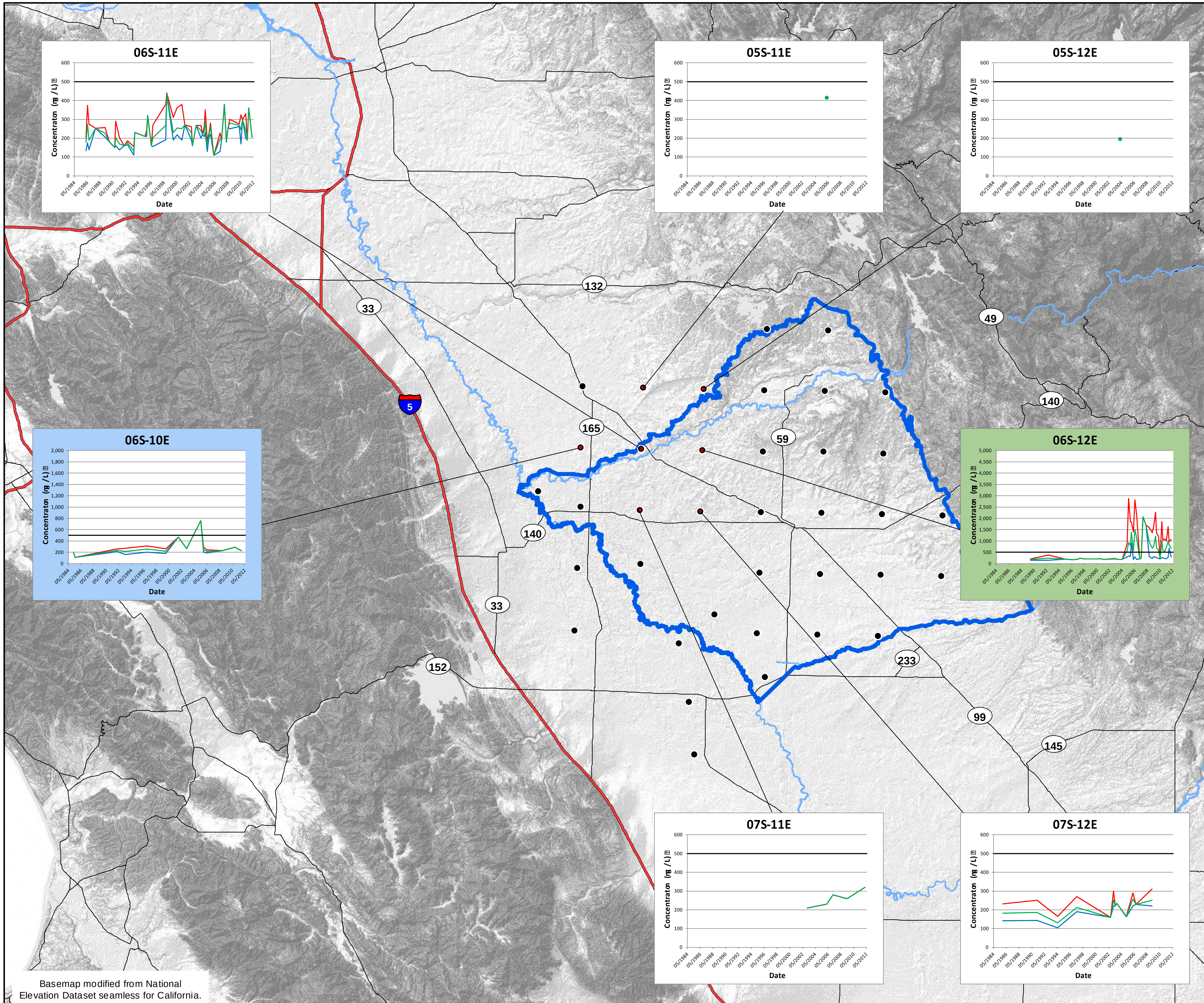
Gradstein, F.M, Ogg, J.G., Schmitz, M.D., et al., 2012, The Geologic Time Scale 2012: Boston, USA, Elsevier, https://doi.org/10.1016/B978-0-444-59425-9.00004-4.

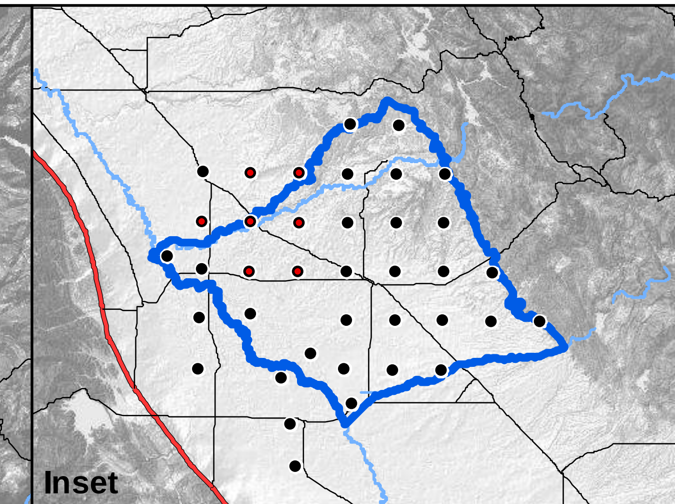
Previous versions of the time scale and previously published papers about the time scale and its evolution are posted to http://www.geosociety.org/timescale.

APPENDIX D: MERCEDWRM MODEL DOCUMENTATION

The MercedWRM documentation is still in draft form and will be finalized in the next published version of the Merced GSP.

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

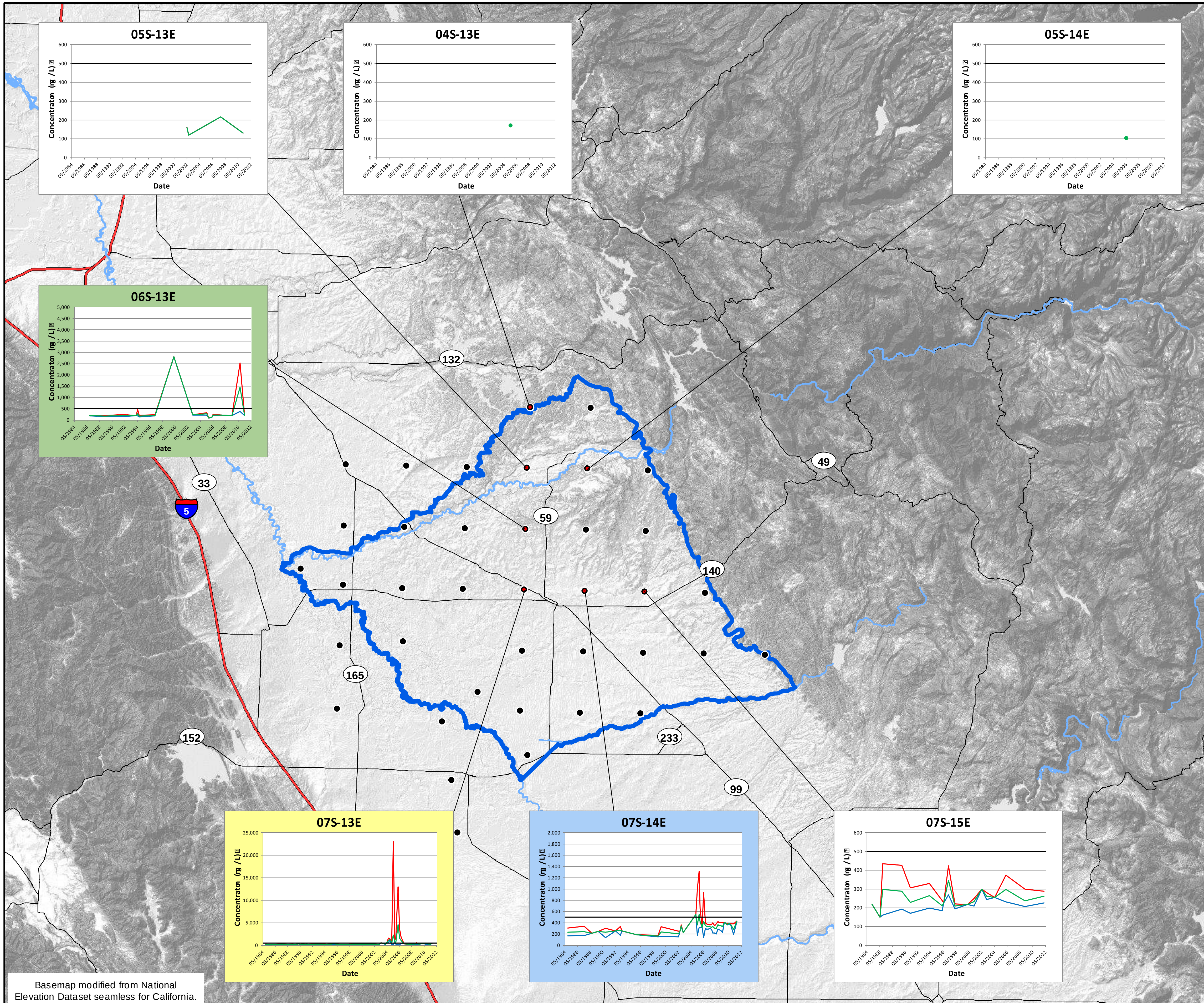
0 5 10

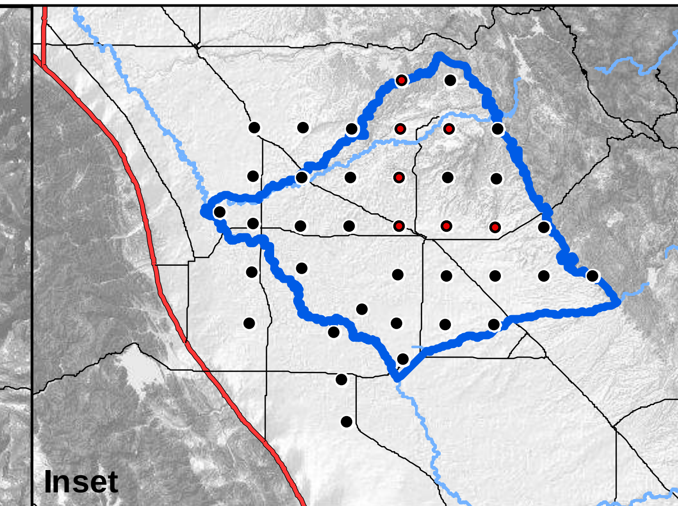
APPROXIMATE SCALE IN MILES

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

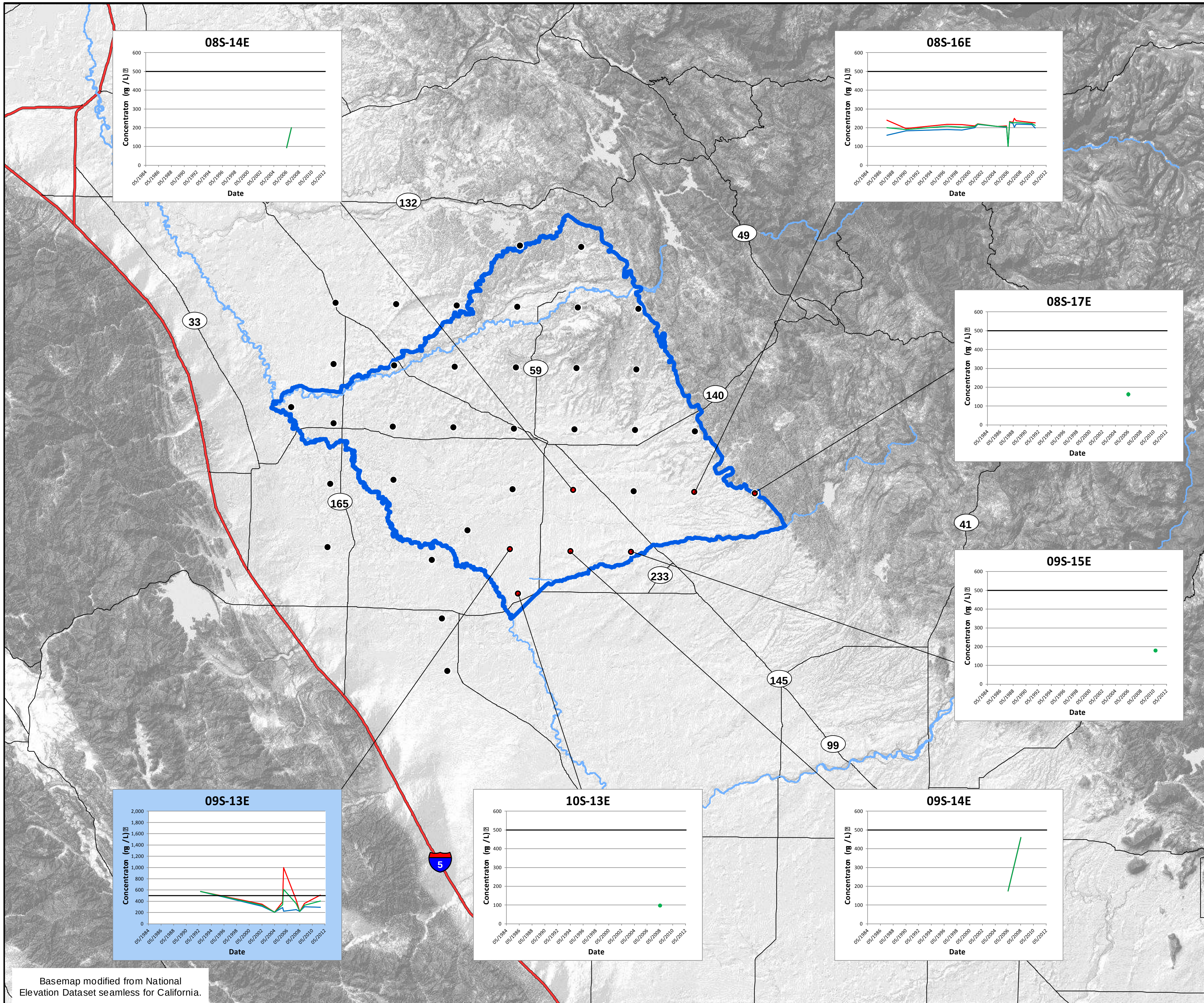
APPROXIMATE SCALE IN MILES

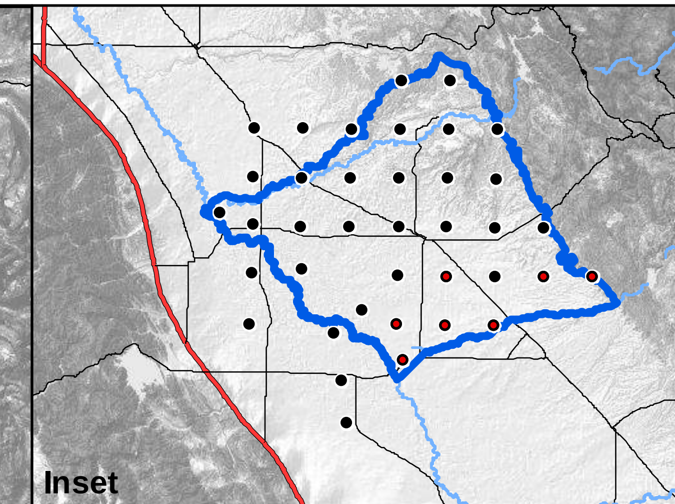
TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

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

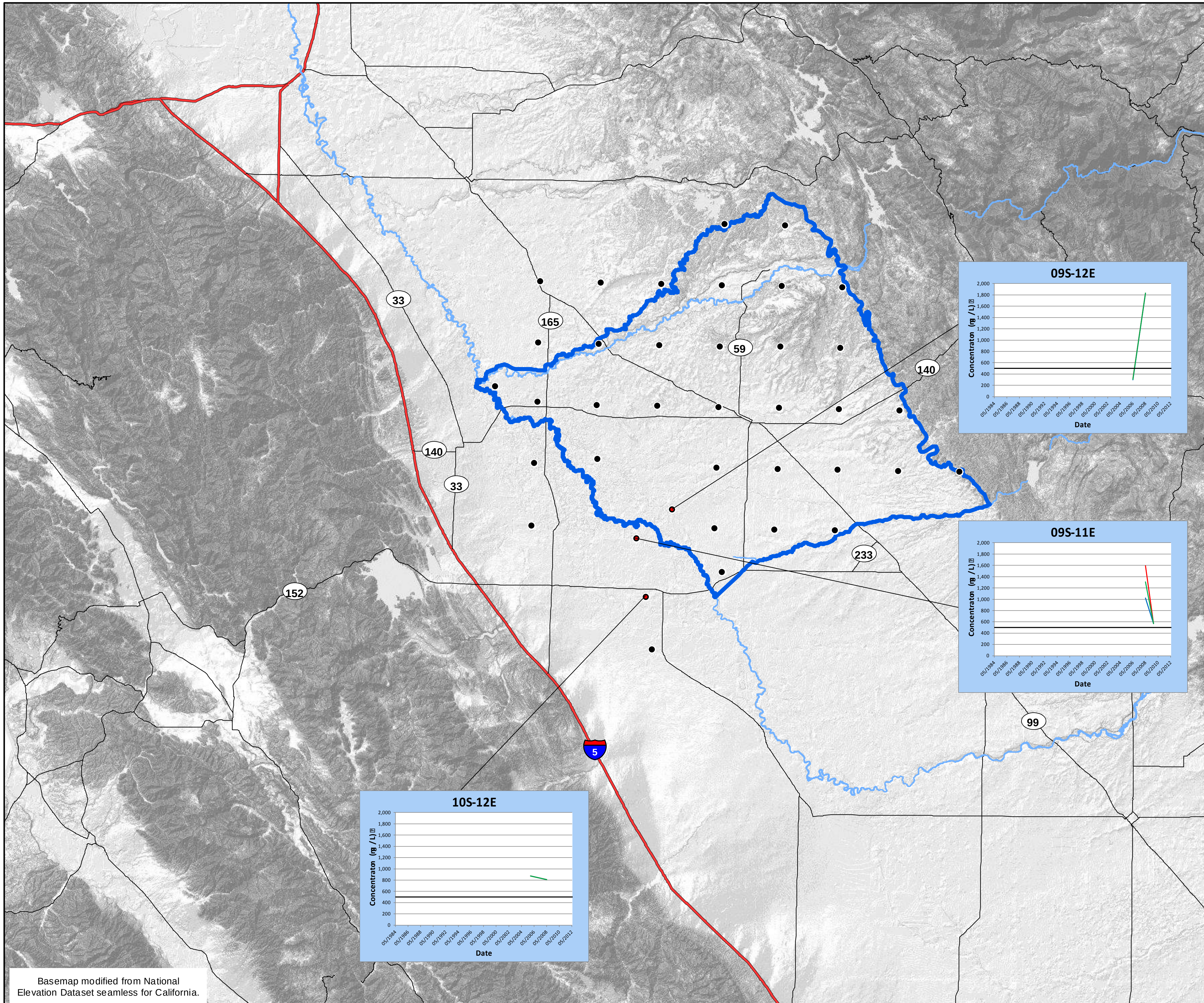
N

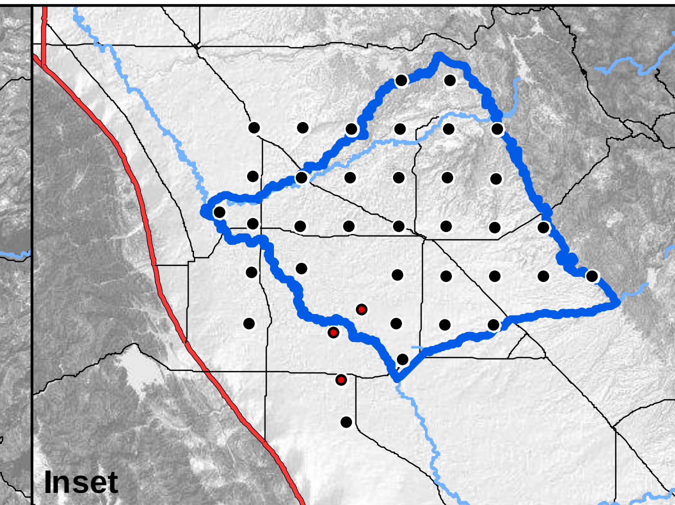
0 5 10
APPROXIMATE SCALE IN MILES

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

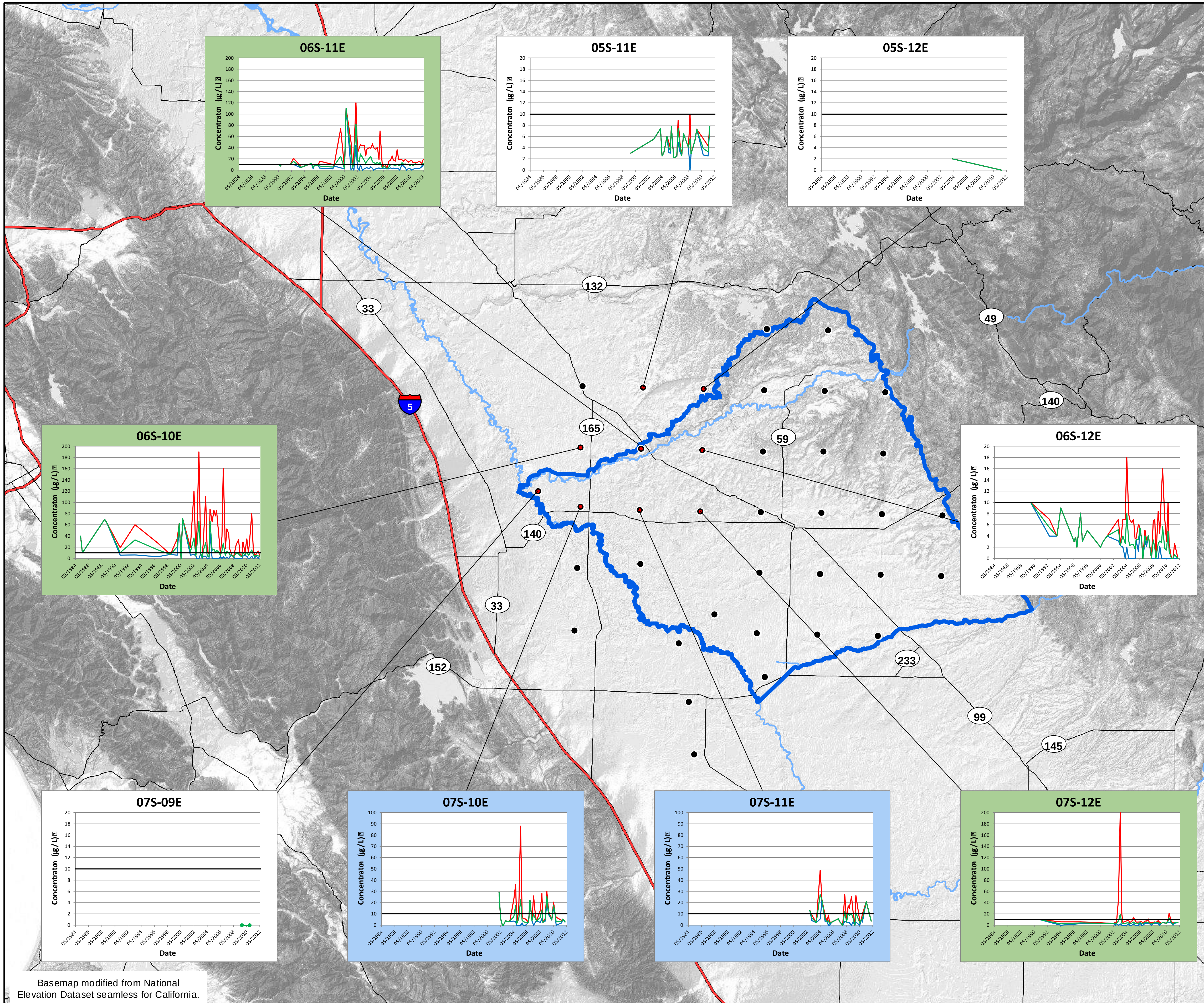
0 5 10

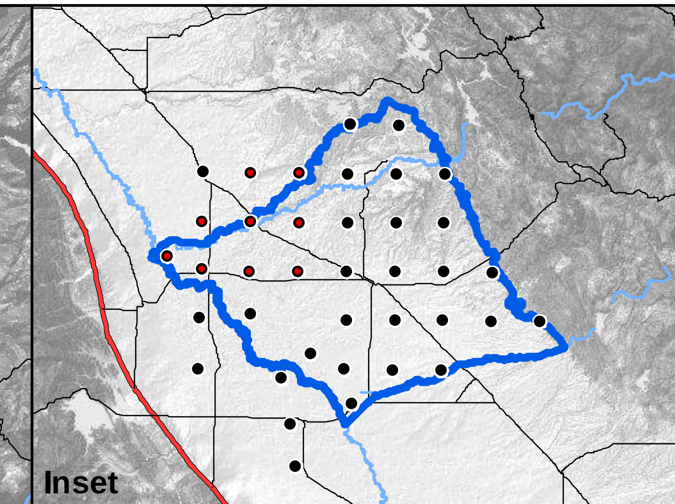
APPROXIMATE SCALE IN MILES

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

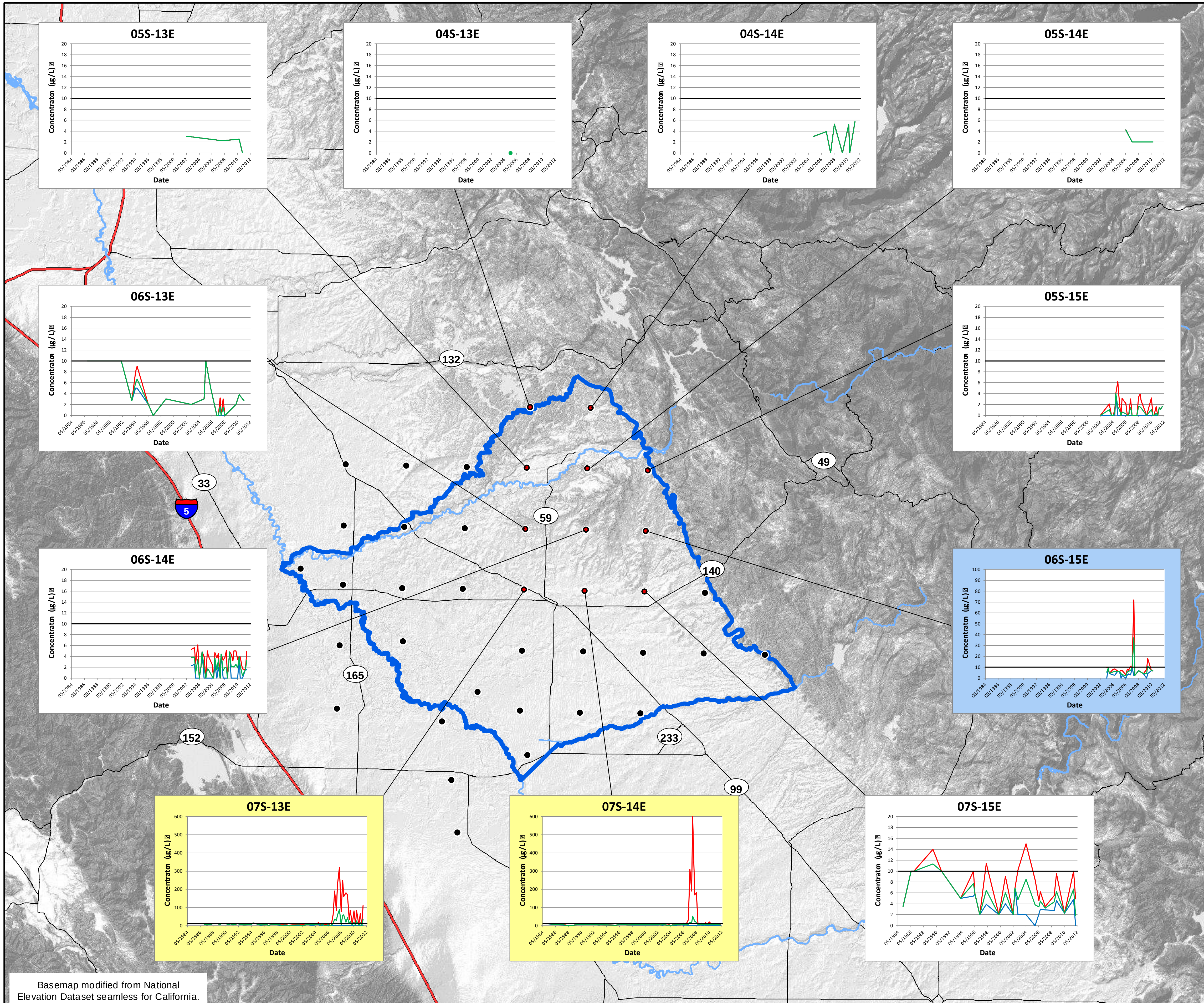
0 5 10

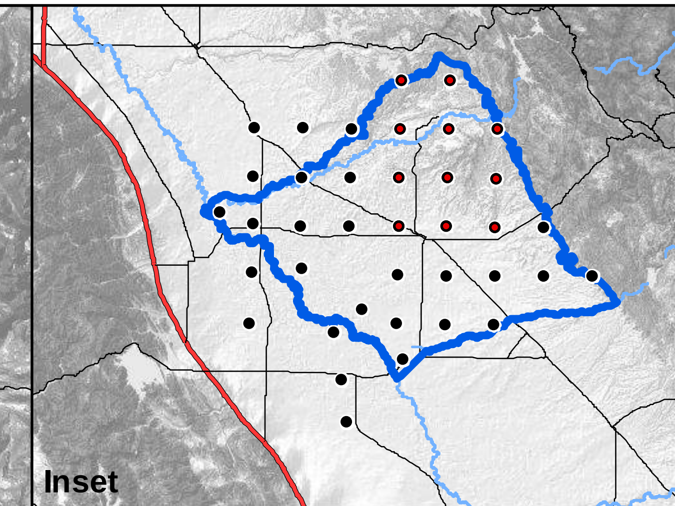
APPROXIMATE SCALE IN MILES

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





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

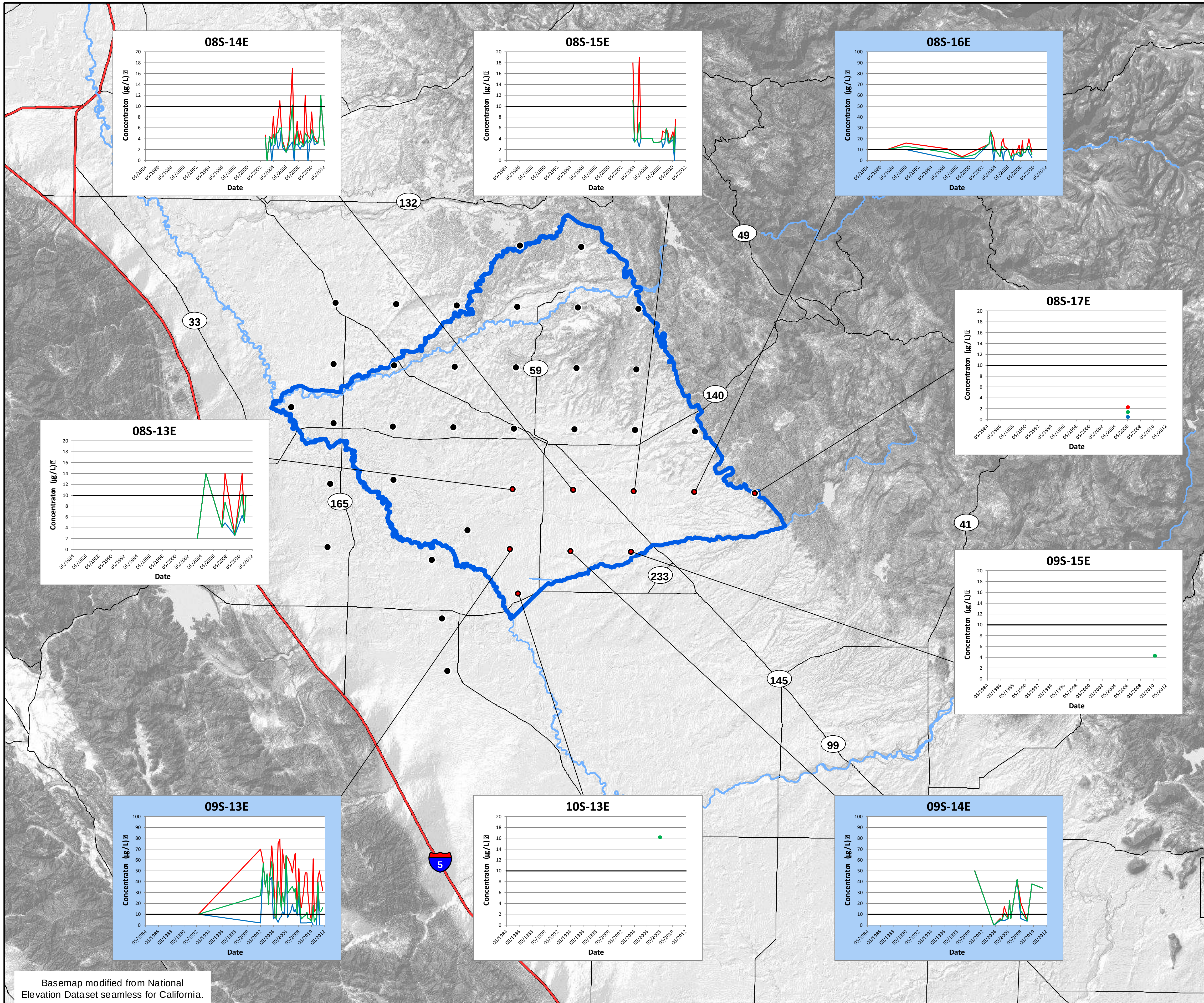
0 5 10

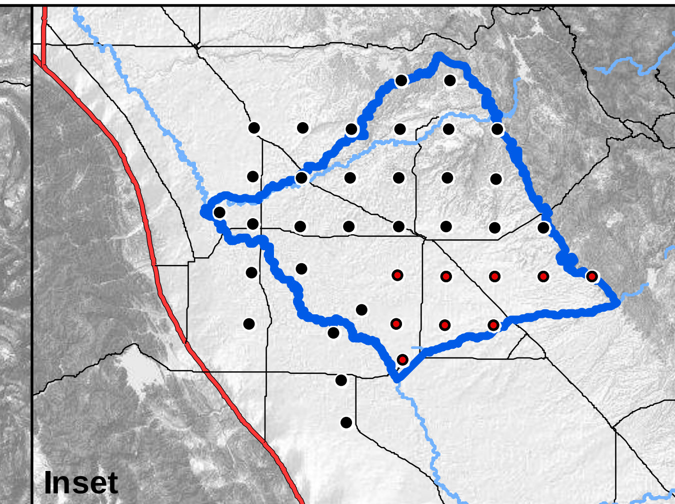
APPROXIMATE SCALE IN MILES

ARSENIC (As) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 3b

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

N

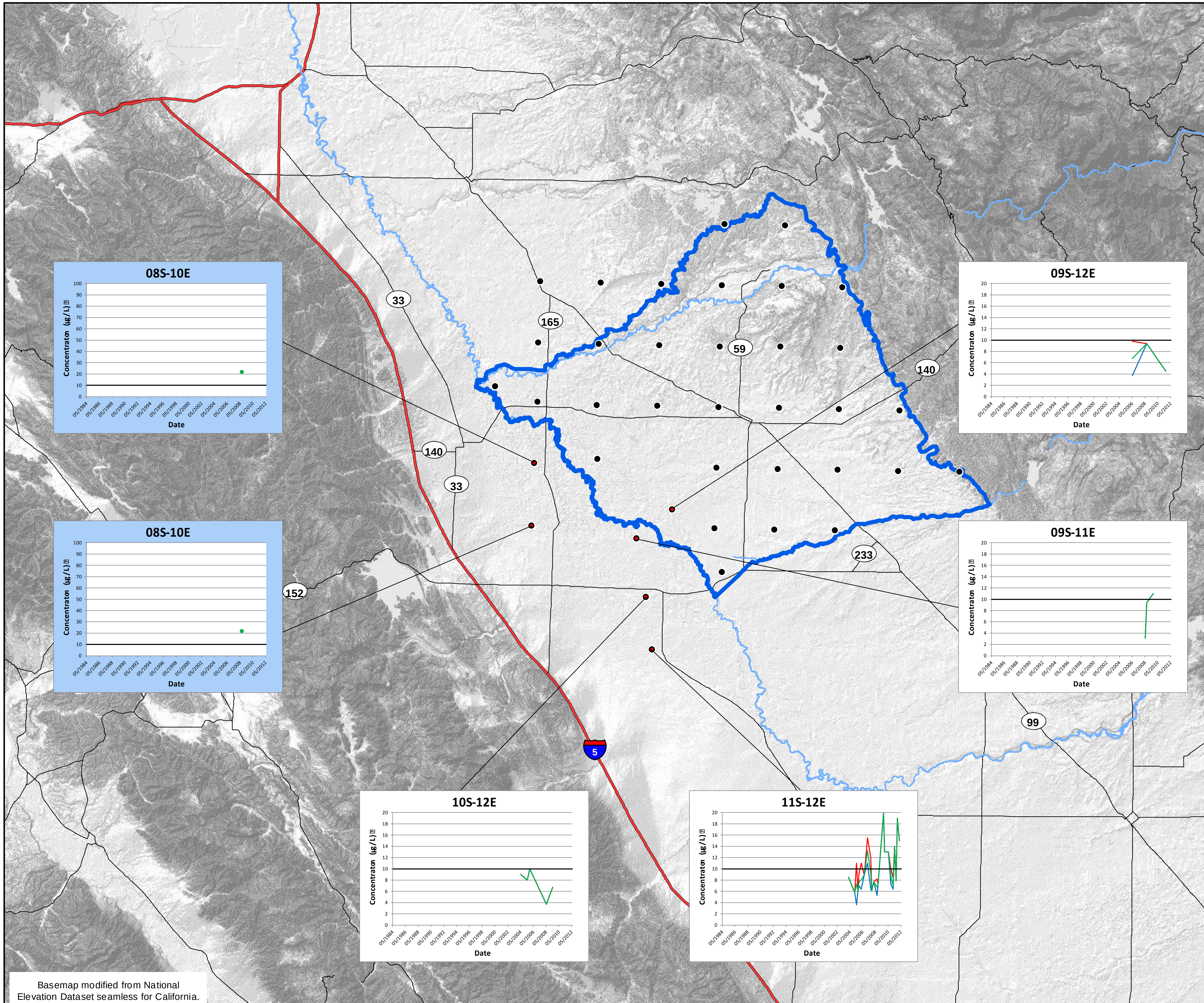
0 5 10

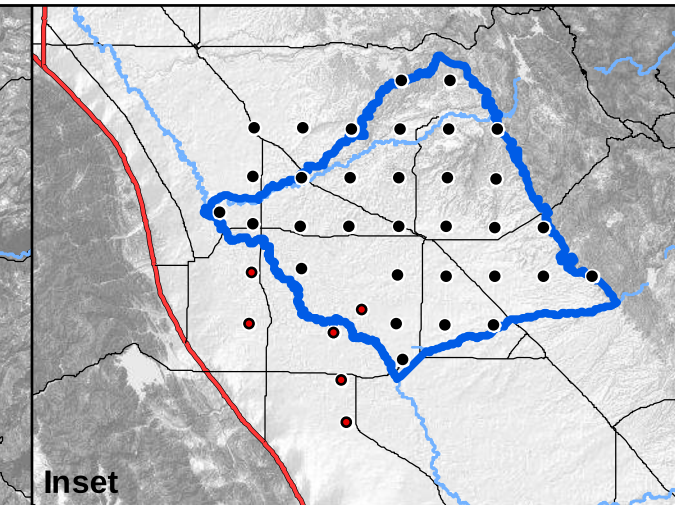
APPROXIMATE SCALE IN MILES

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

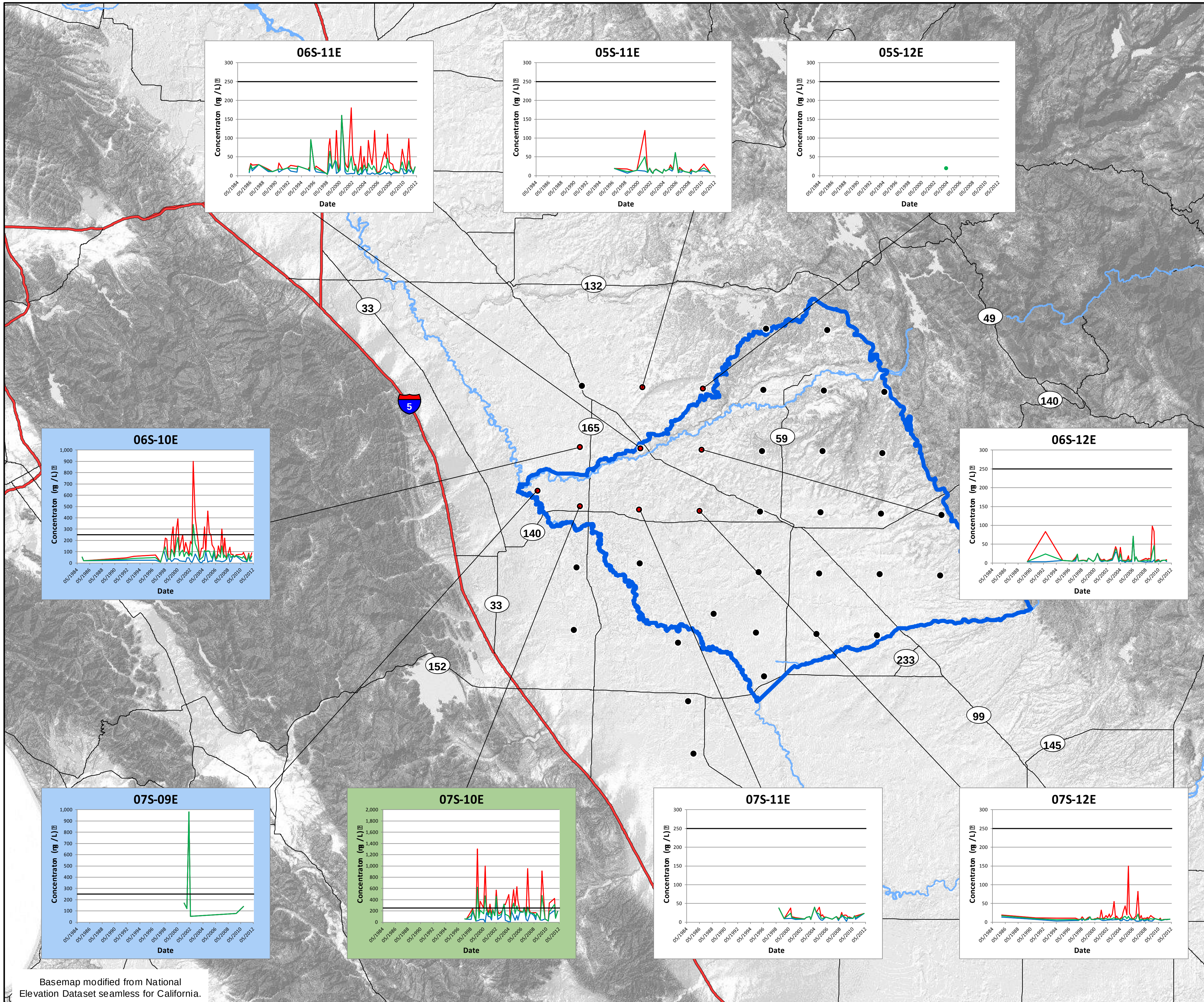
0 5 10

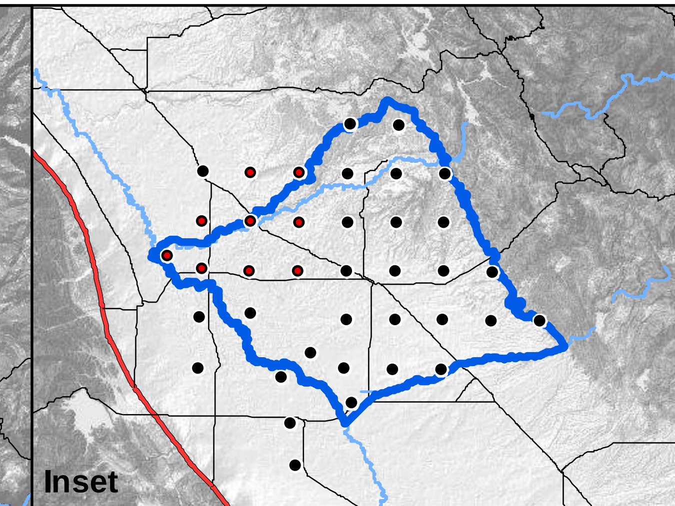
APPROXIMATE SCALE IN MILES

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





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

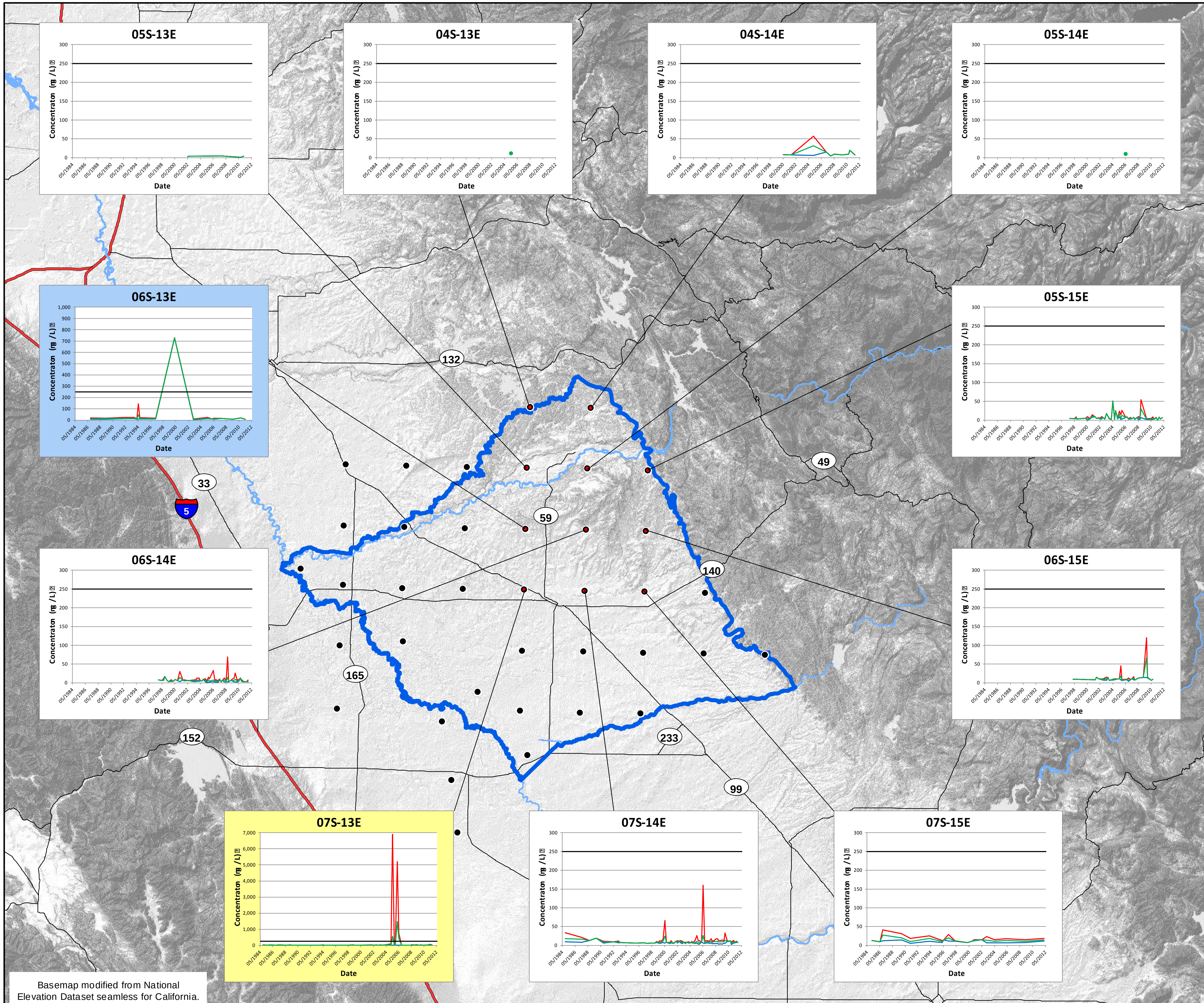
0 5 10

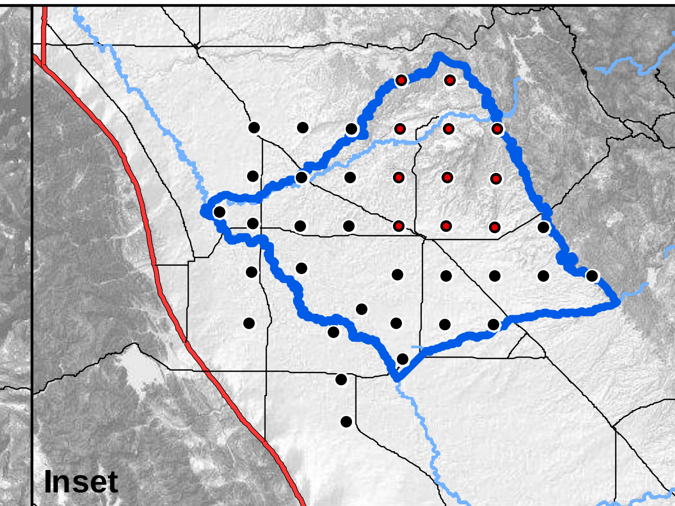
APPROXIMATE SCALE IN MILES

CHLORIDE (Cl) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 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

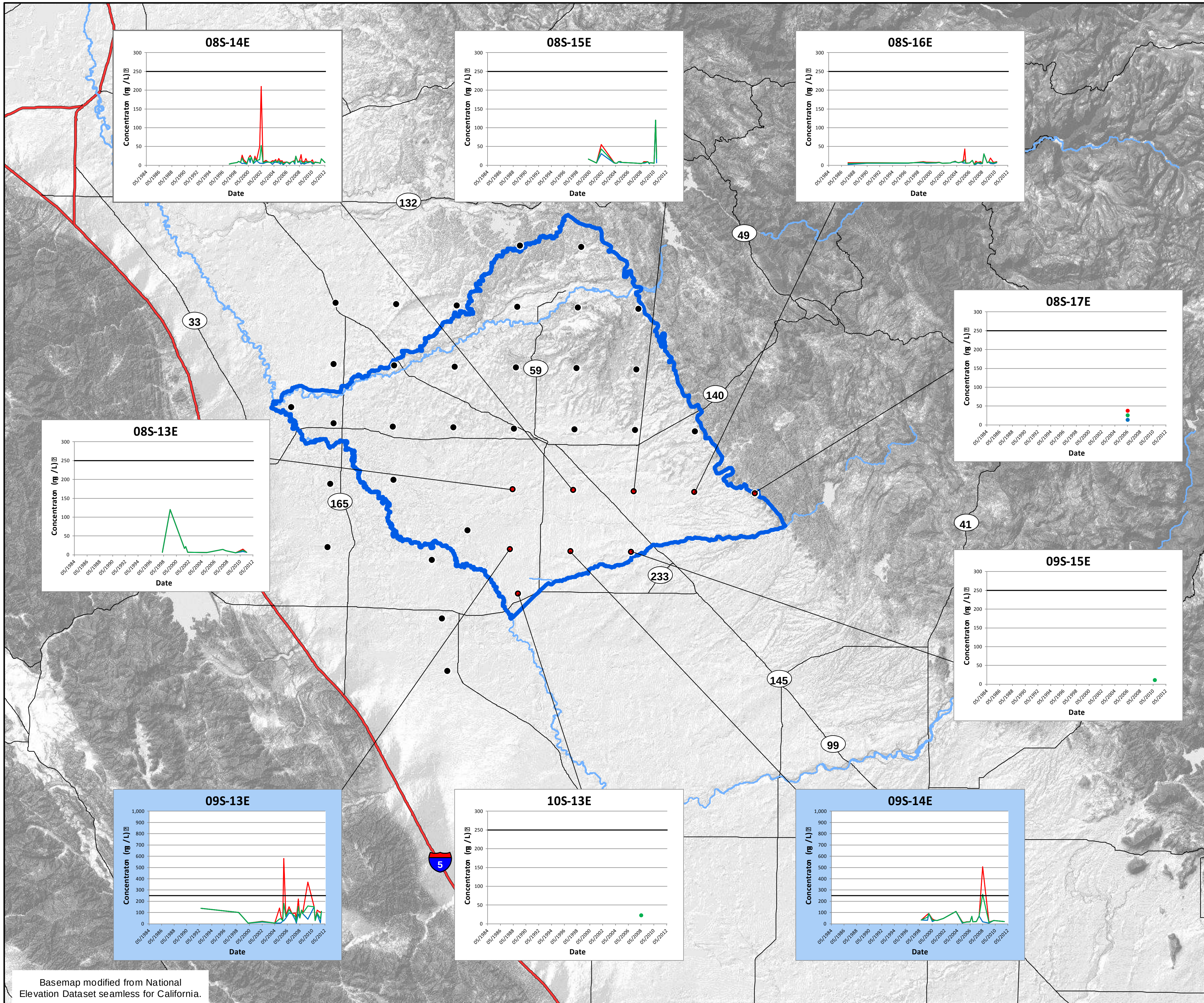
0 5 10

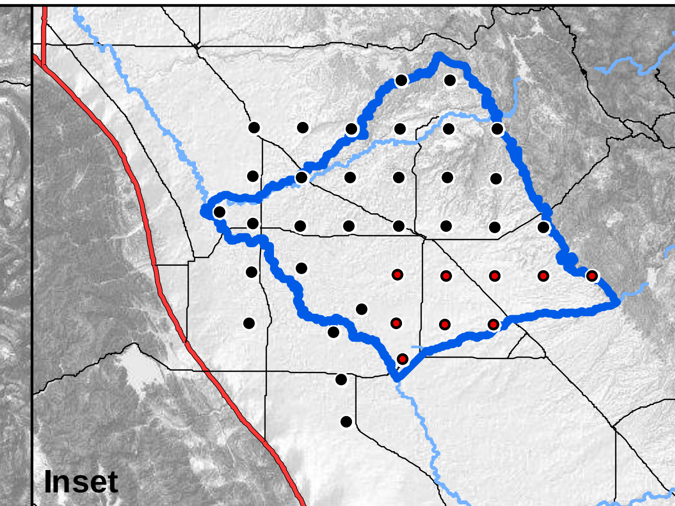
APPROXIMATE SCALE IN MILES

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





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

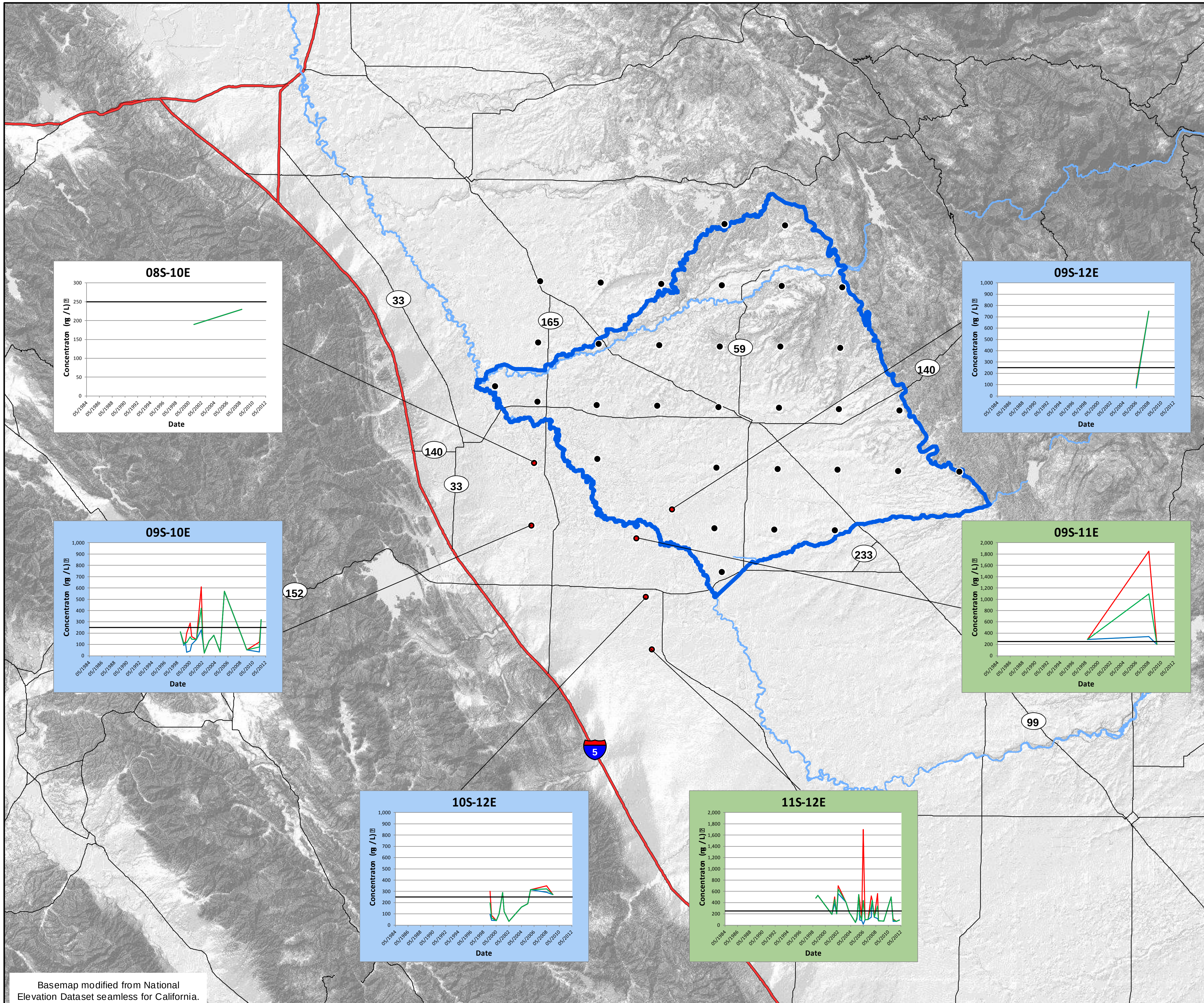
N

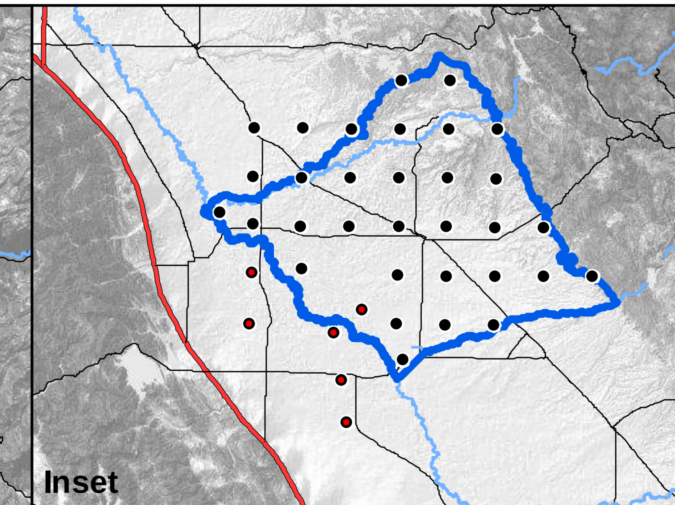
0 5 10
APPROXIMATE SCALE IN MILES

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

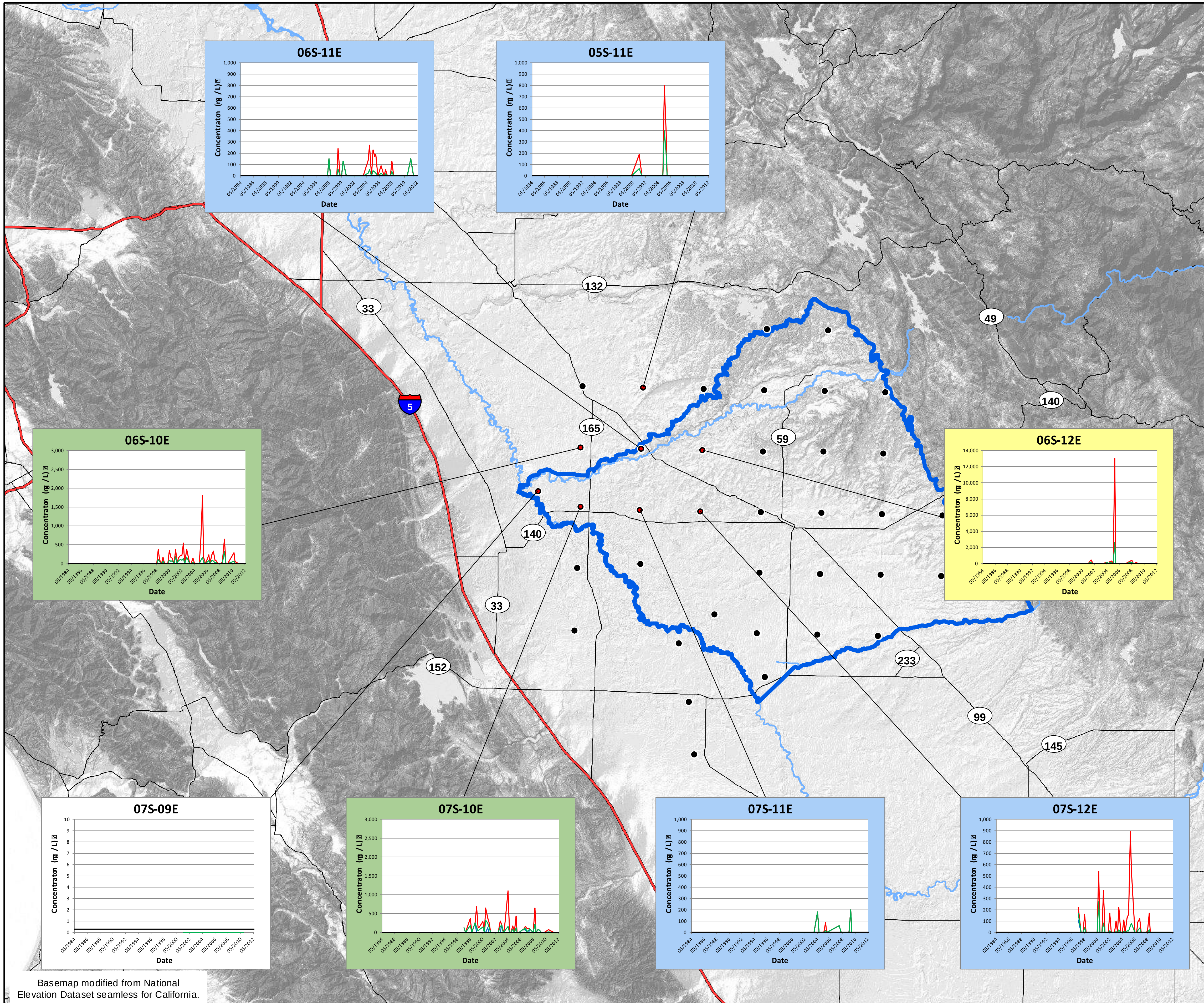
0 5 10

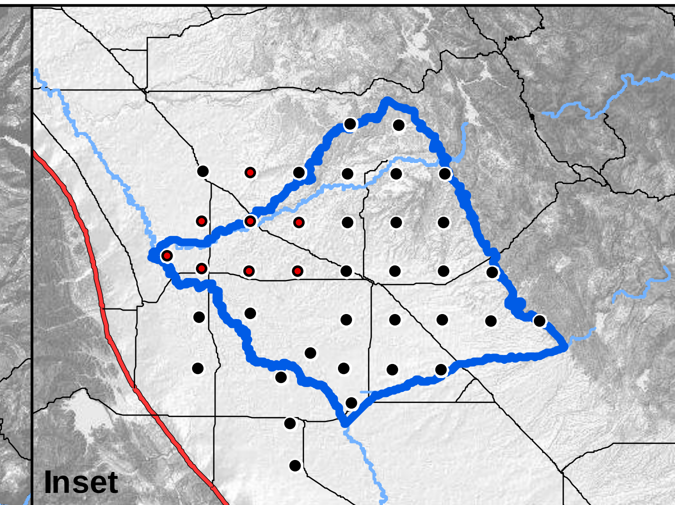
APPROXIMATE SCALE IN MILES

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

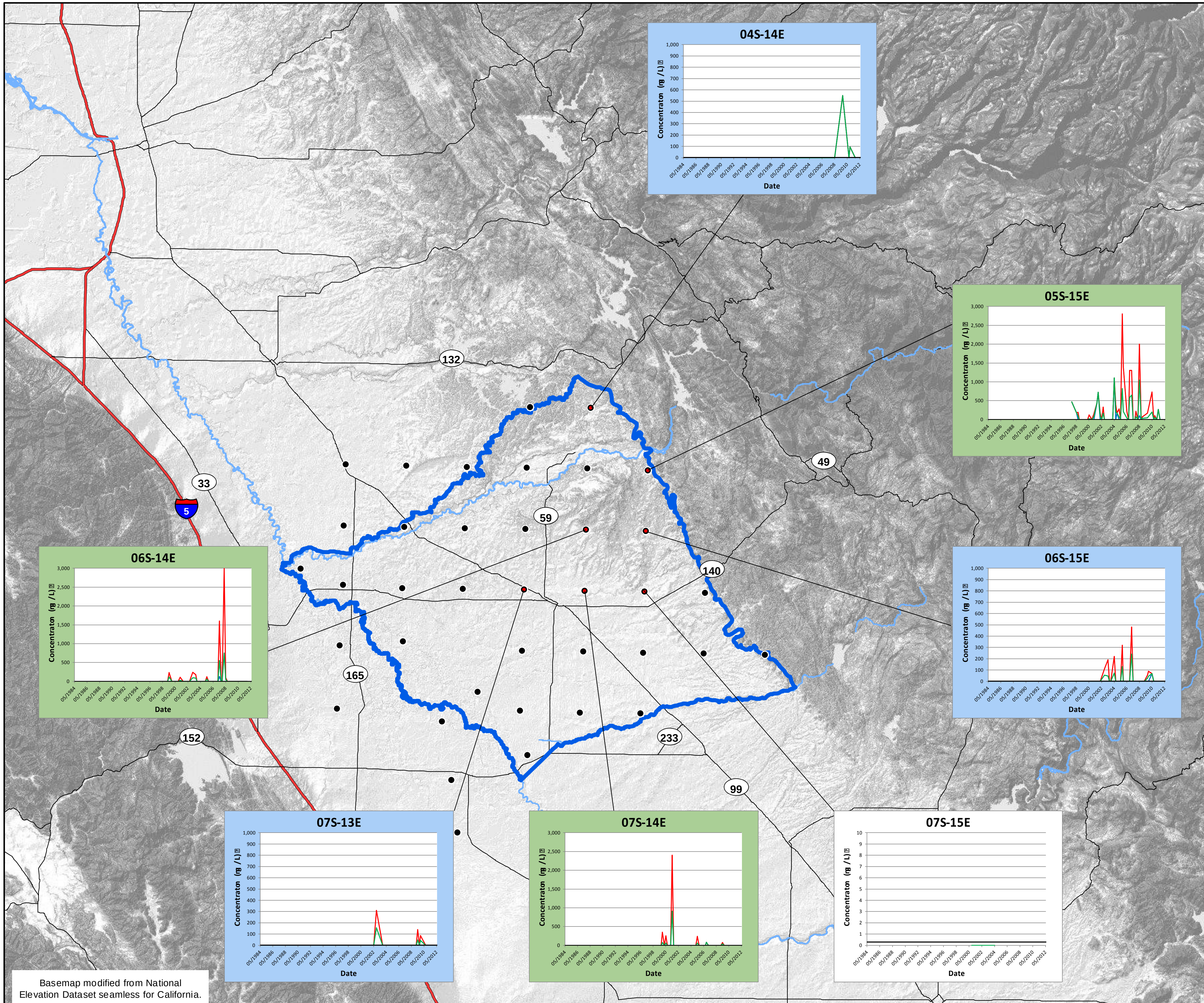
0 5 10

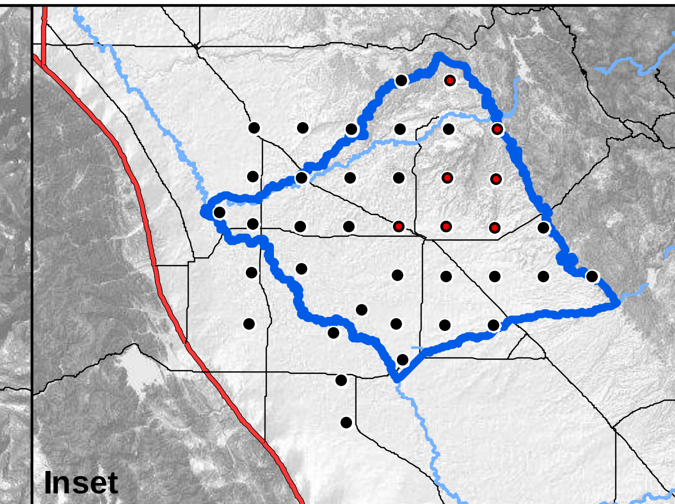
APPROXIMATE SCALE IN MILES

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_01ConcentrationMaps_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

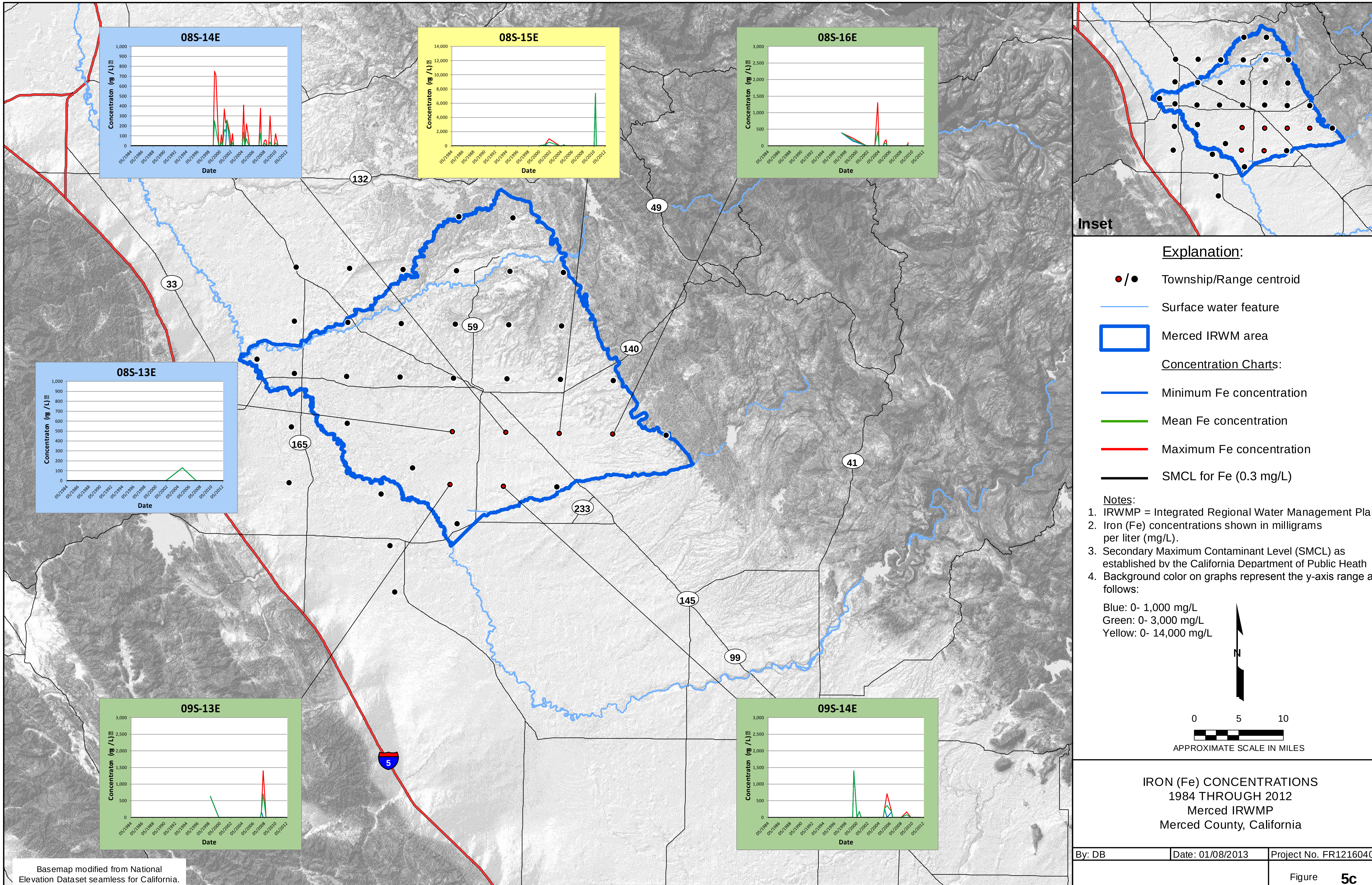
0 5 10

APPROXIMATE SCALE IN MILES

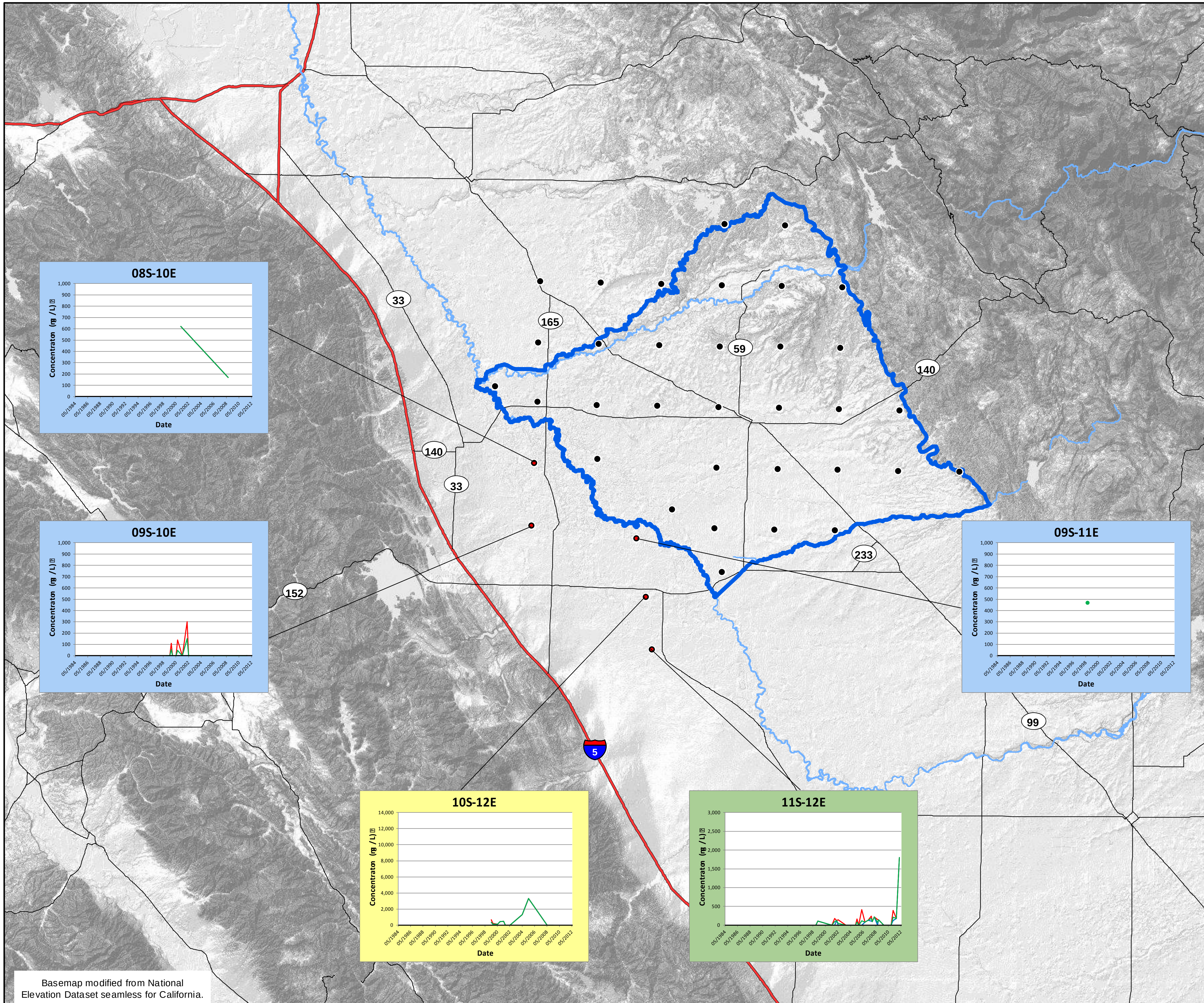
IRON (Fe) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 5b

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig05b_Fe.mxd



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

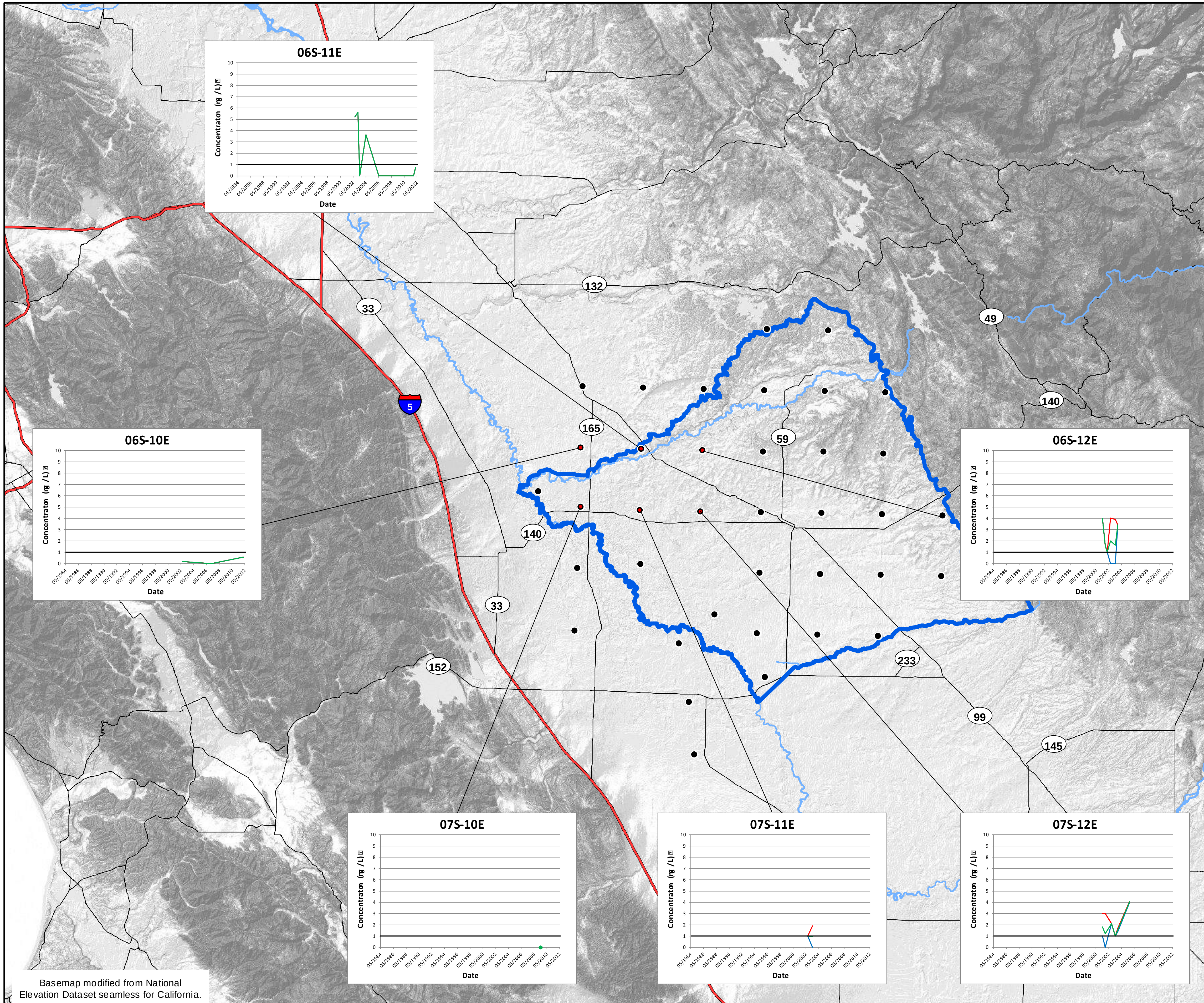
0 5 10

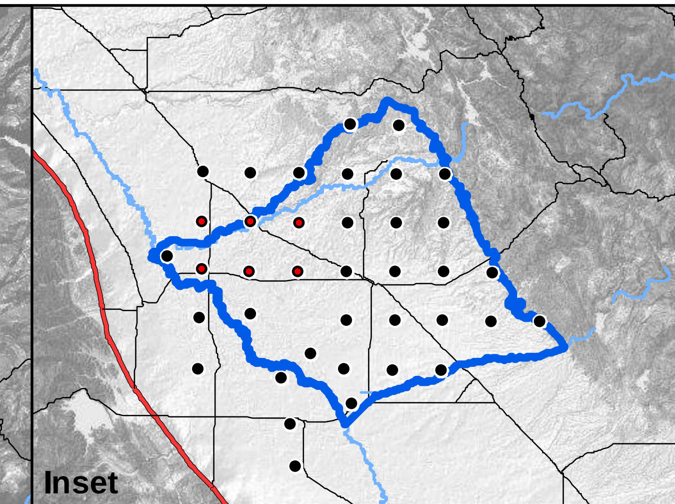
APPROXIMATE SCALE IN MILES

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

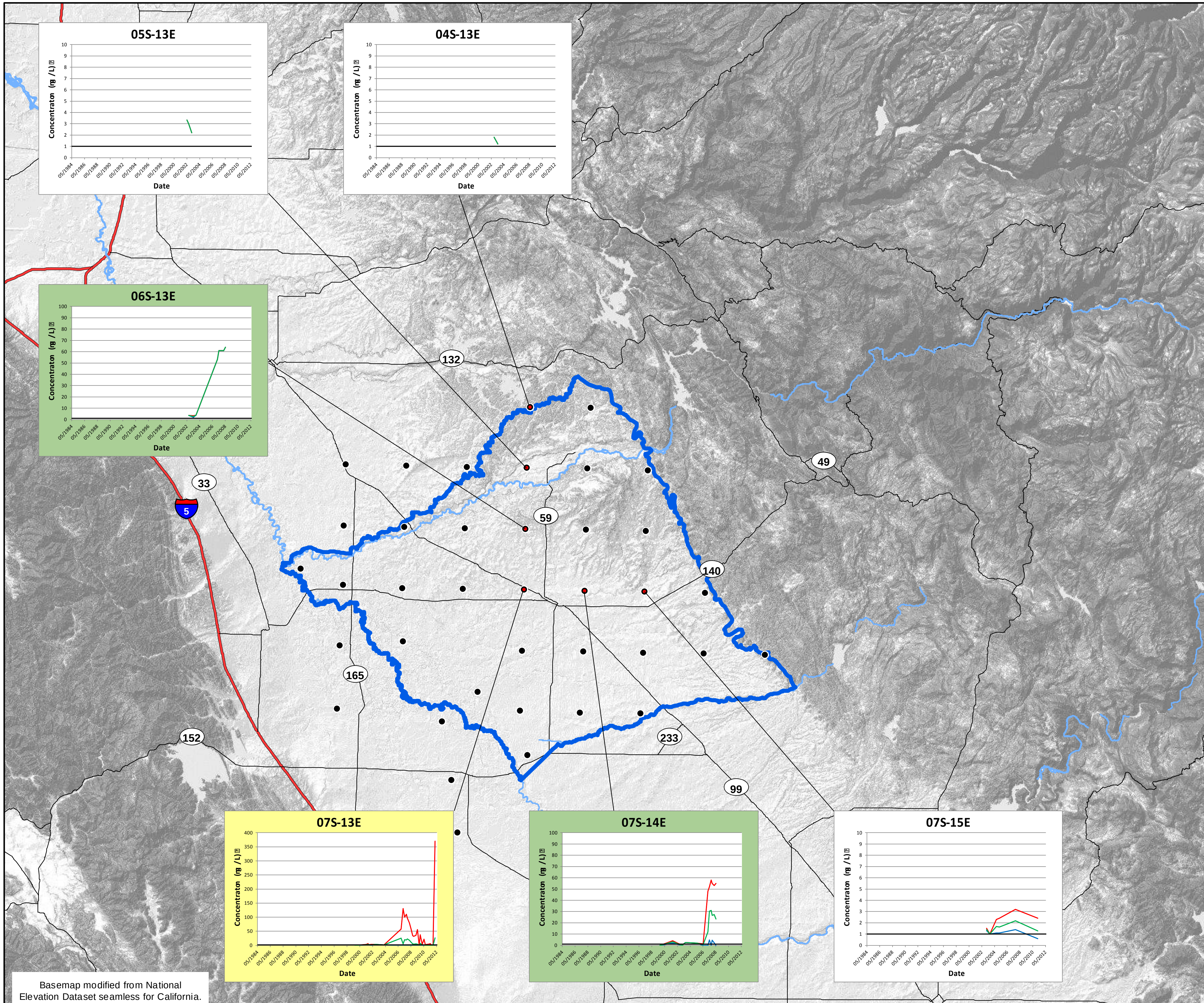
0 5 10

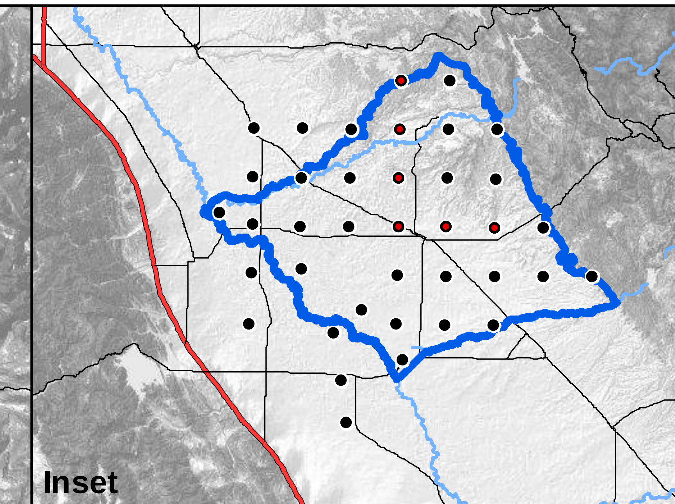
APPROXIMATE SCALE IN MILES

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

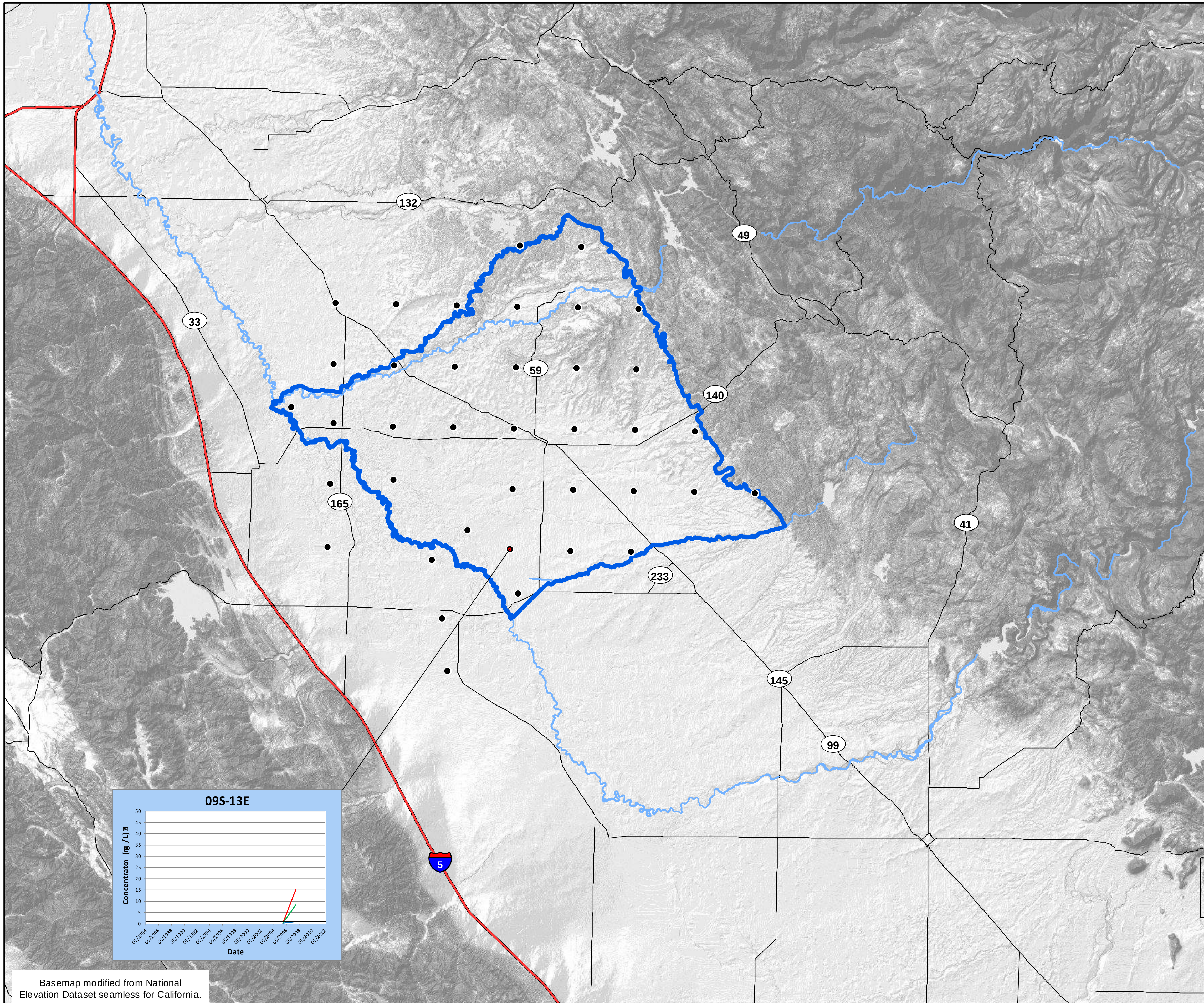
0 5 10

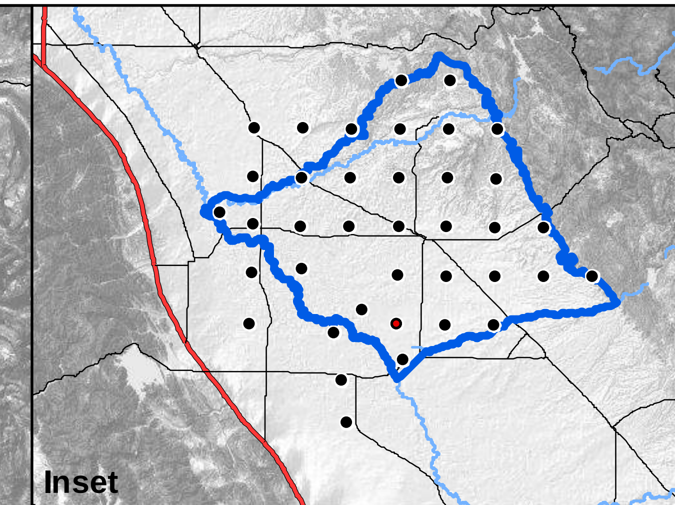
APPROXIMATE SCALE IN MILES

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

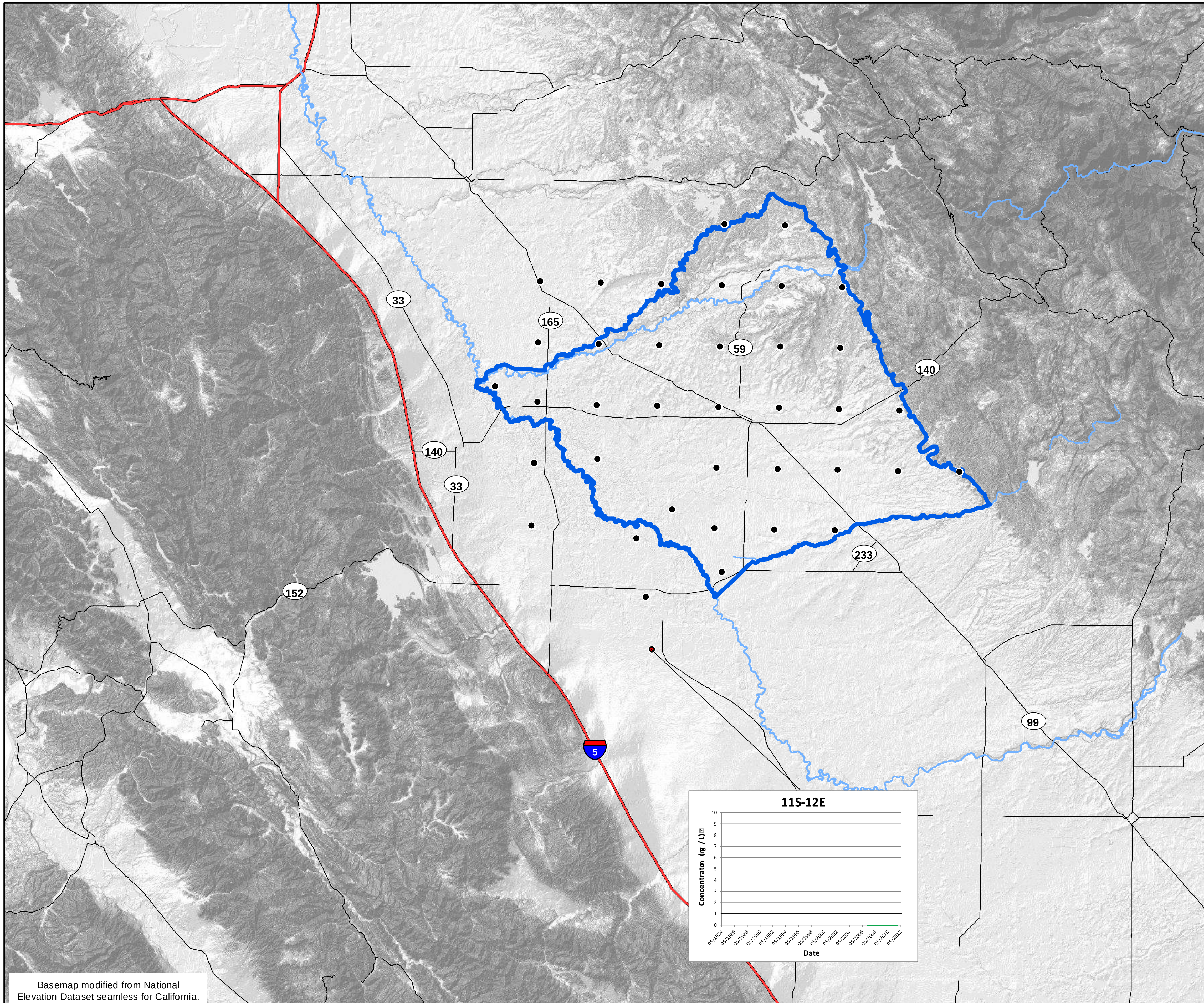
0 5 10

APPROXIMATE SCALE IN MILES

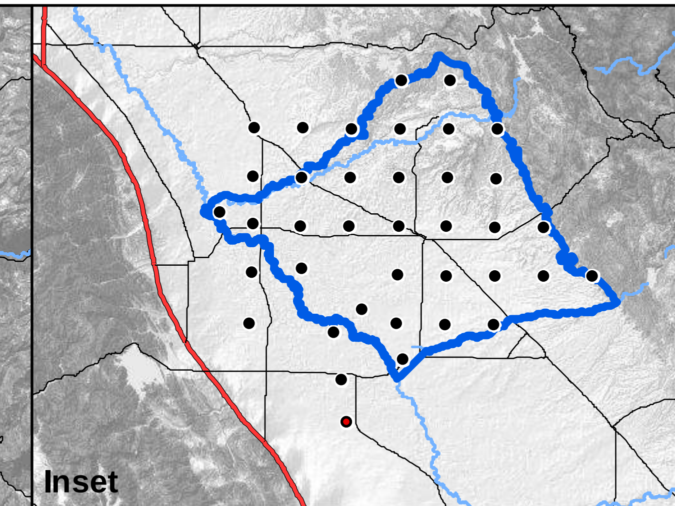
HEXAVALENT CHROMIUM (Cr6) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 6c

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig06c_Cr6.mxd



Basemap modified from National Elevation Dataset seamless for California.



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

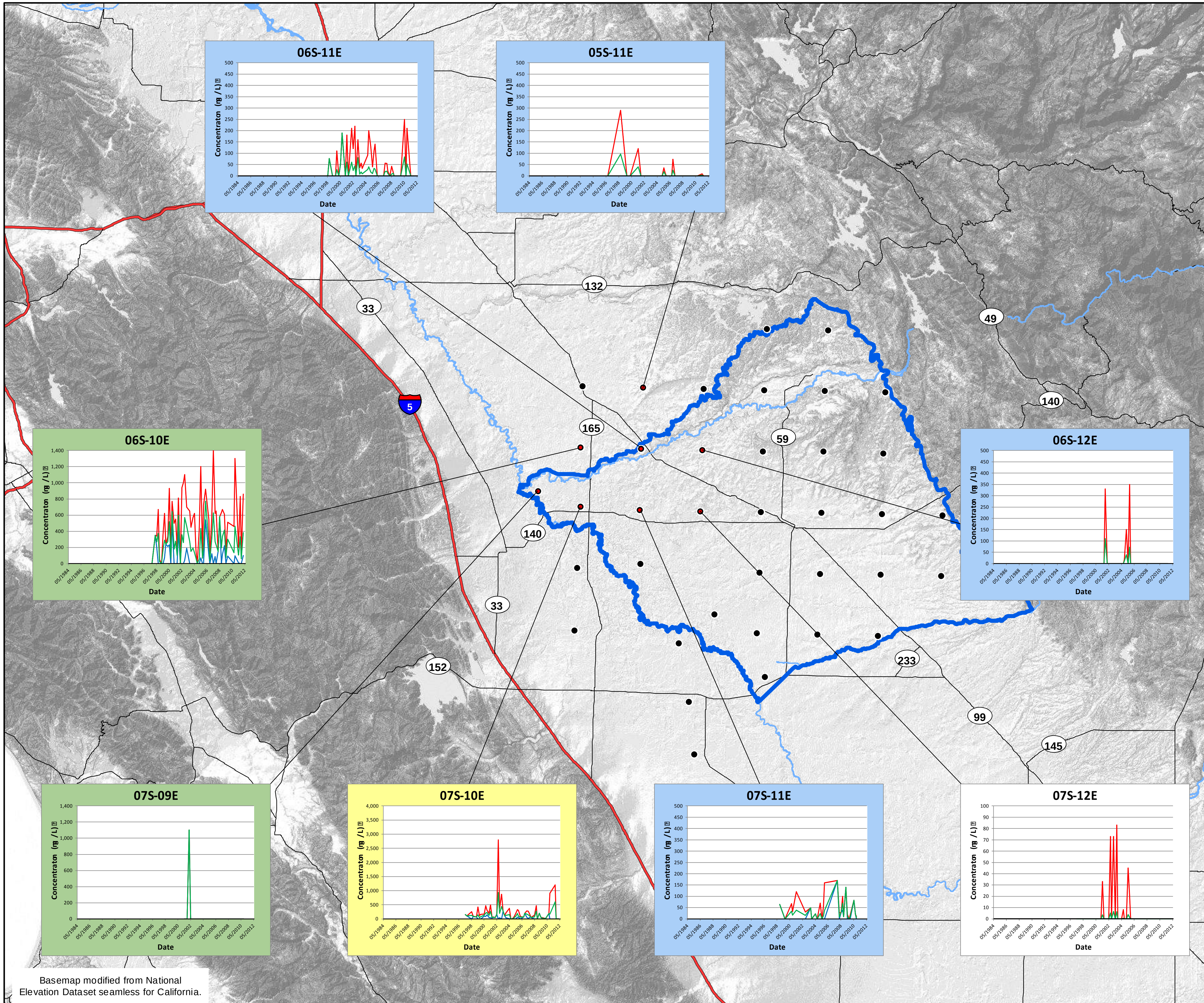
0 5 10

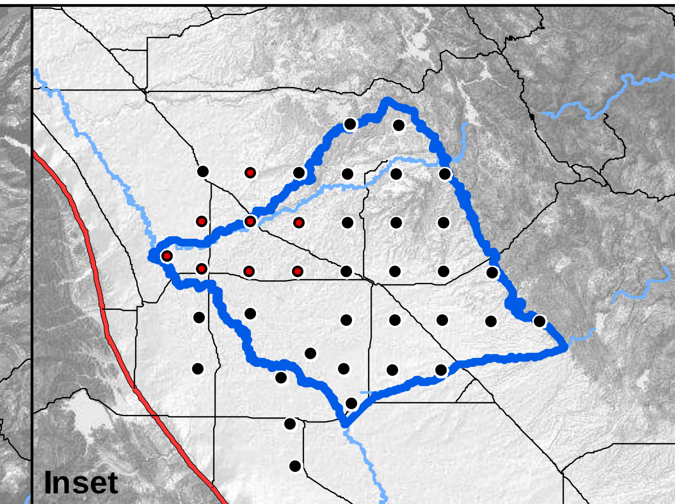
APPROXIMATE SCALE IN MILES

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

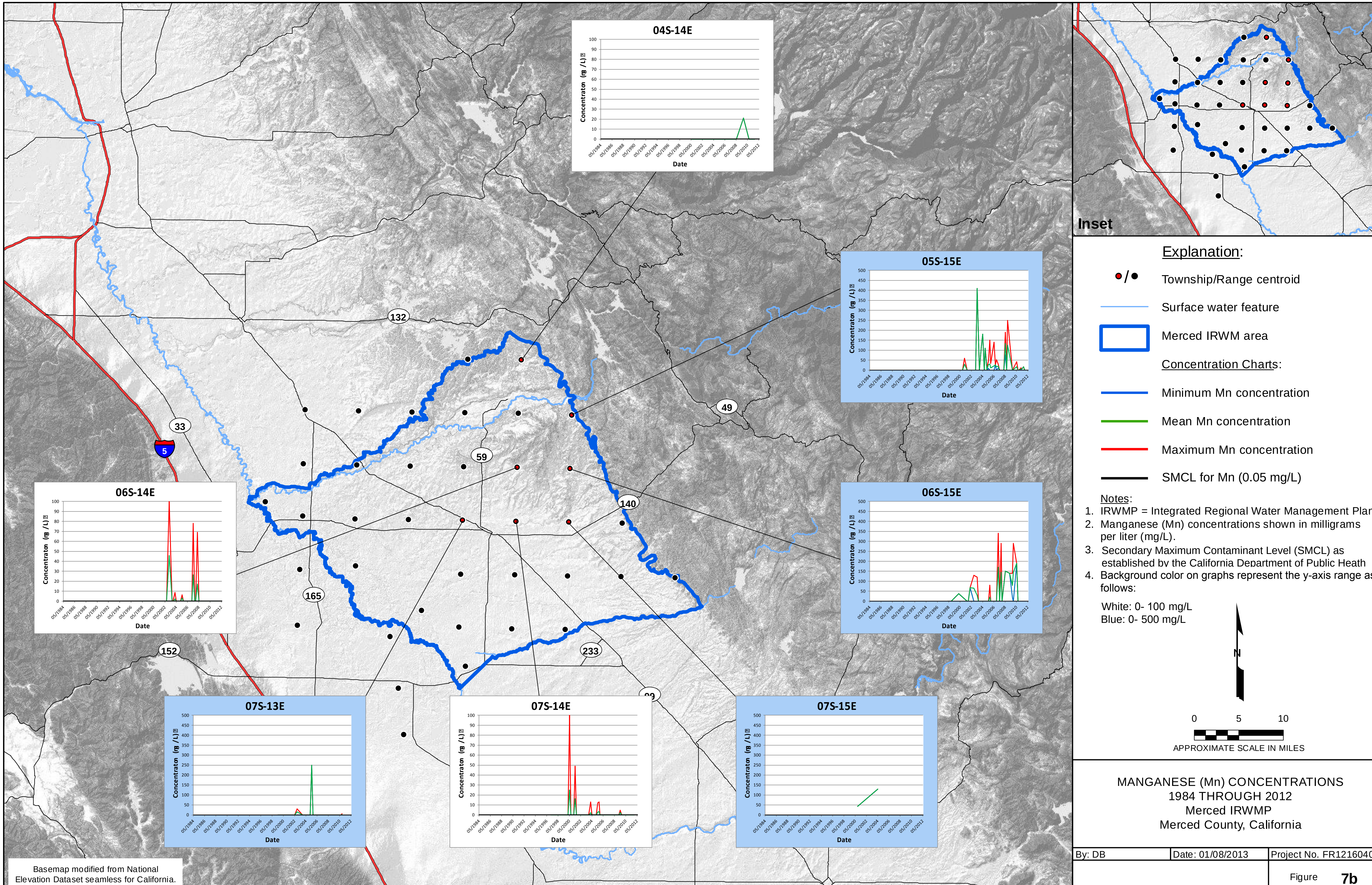
0 5 10

APPROXIMATE SCALE IN MILES

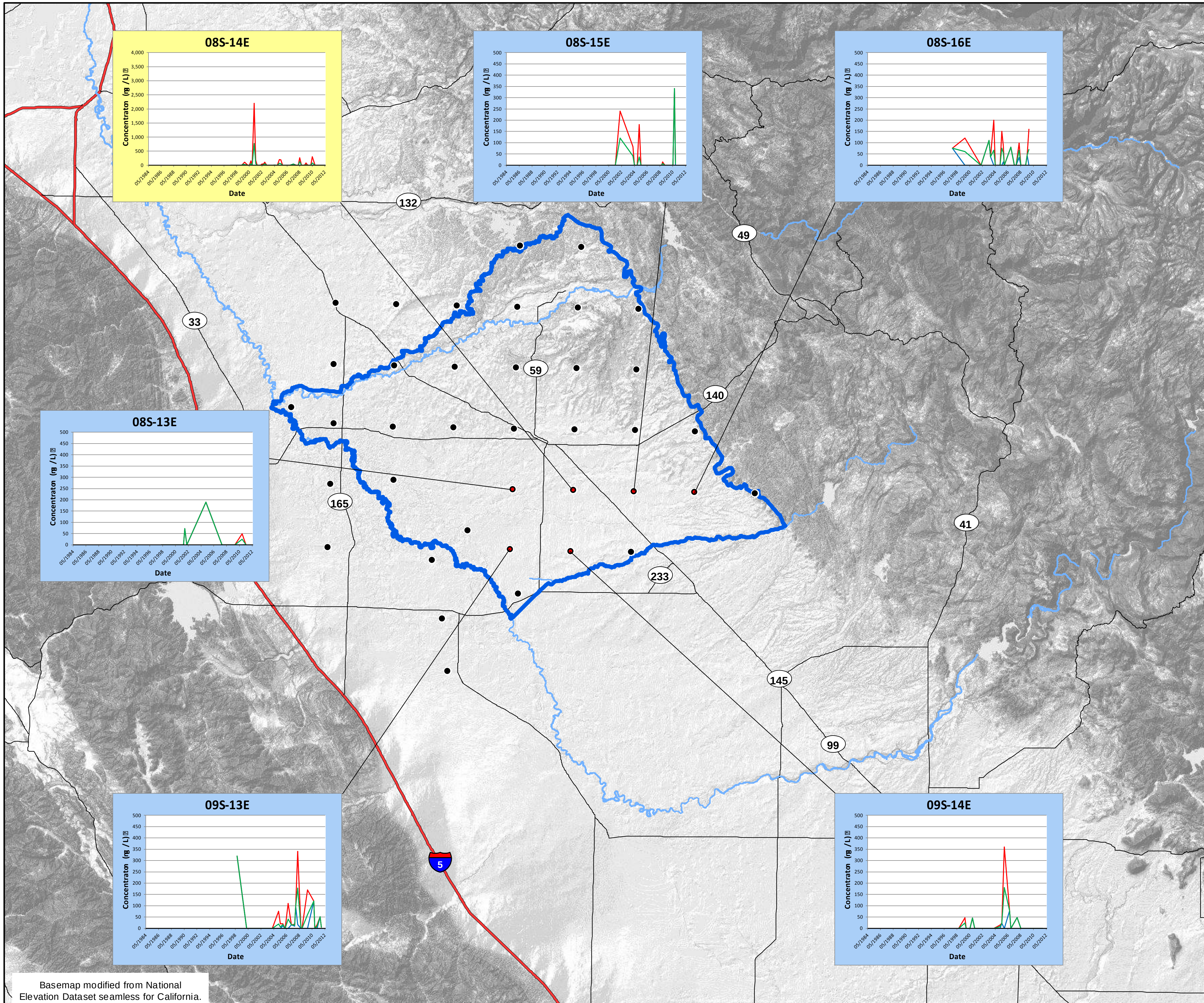
MANGANESE (Mn) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

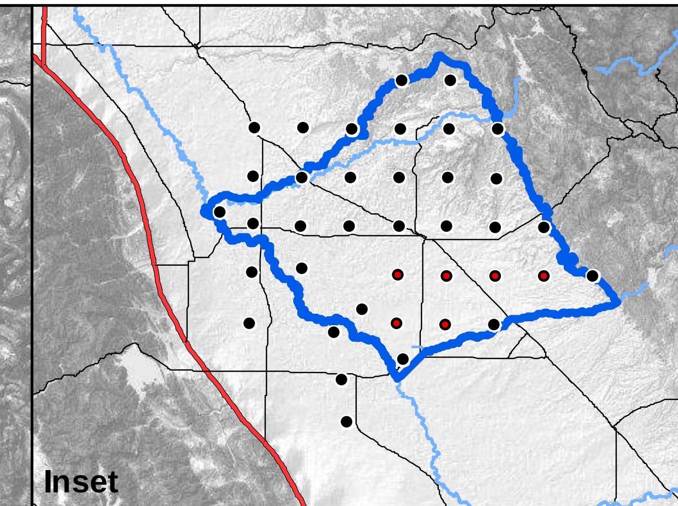
By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 7a

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig07a_Mn.mxd



N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig07b_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
Yellow: 0- 4,000 mg/L

N

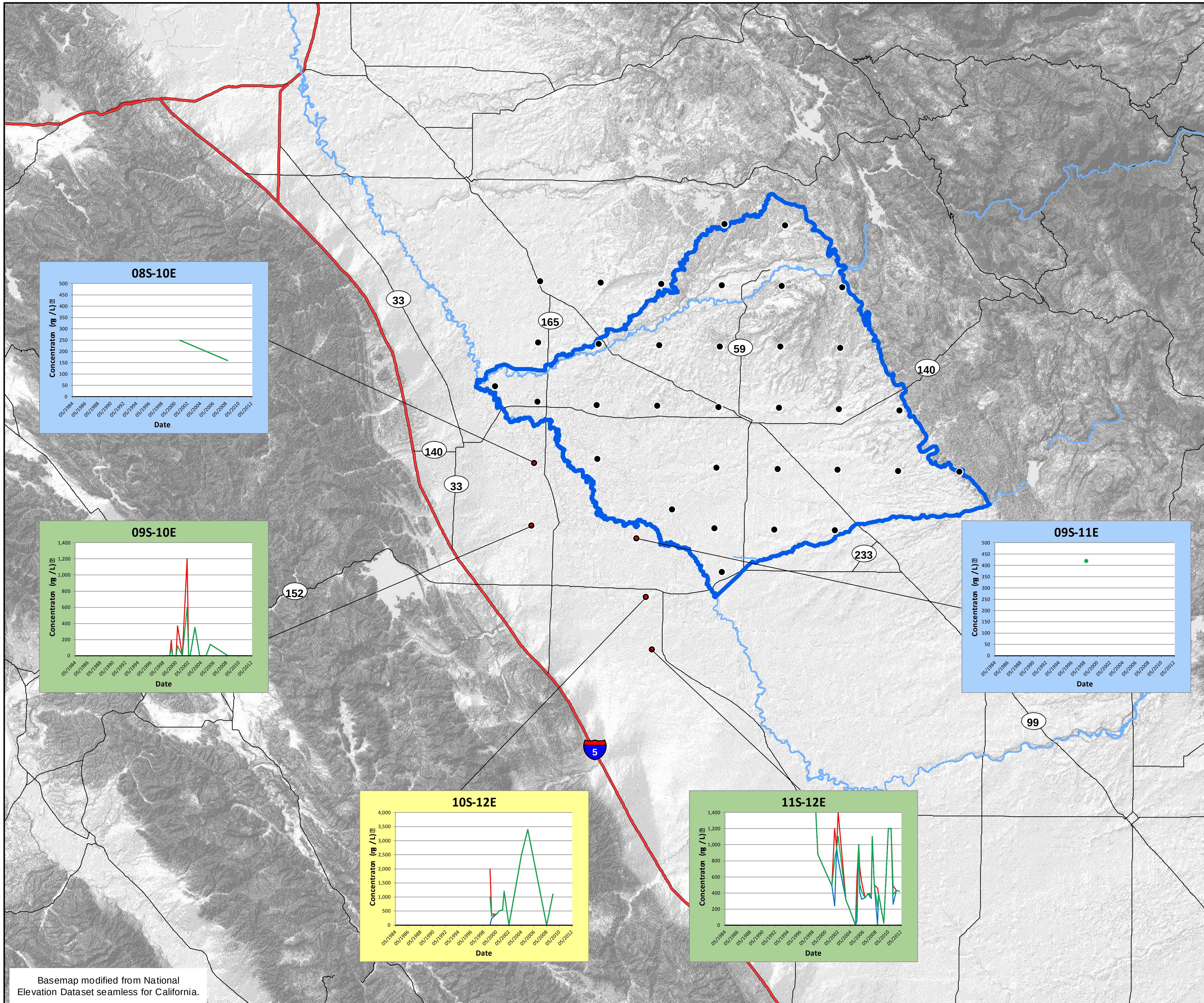
0 5 10

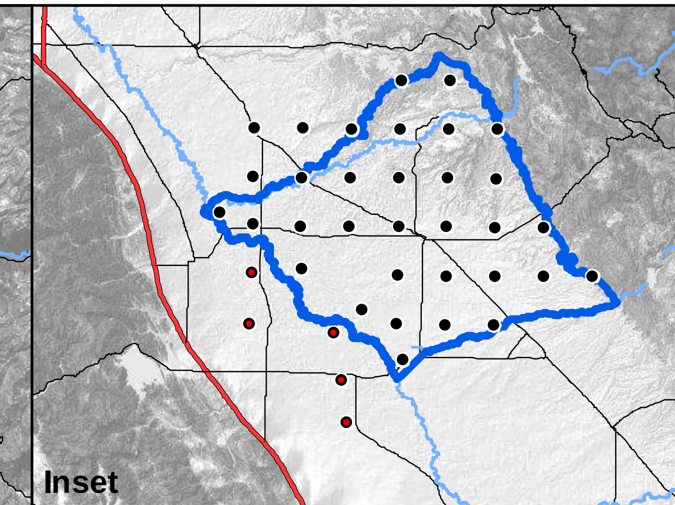
APPROXIMATE SCALE IN MILES

MANGANESE (Mn) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 7c

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig07c_Mn.mxd





<u>Explanation</u>:

Township/Range centroid

Surface water feature

Merced IRWM area

<u>Concentration Charts</u>:

Minimum Mn concentration

Mean Mn concentration

Maximum Mn concentration

SMCL for Mn (0.05 mg/L)

<u>Notes</u>:

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

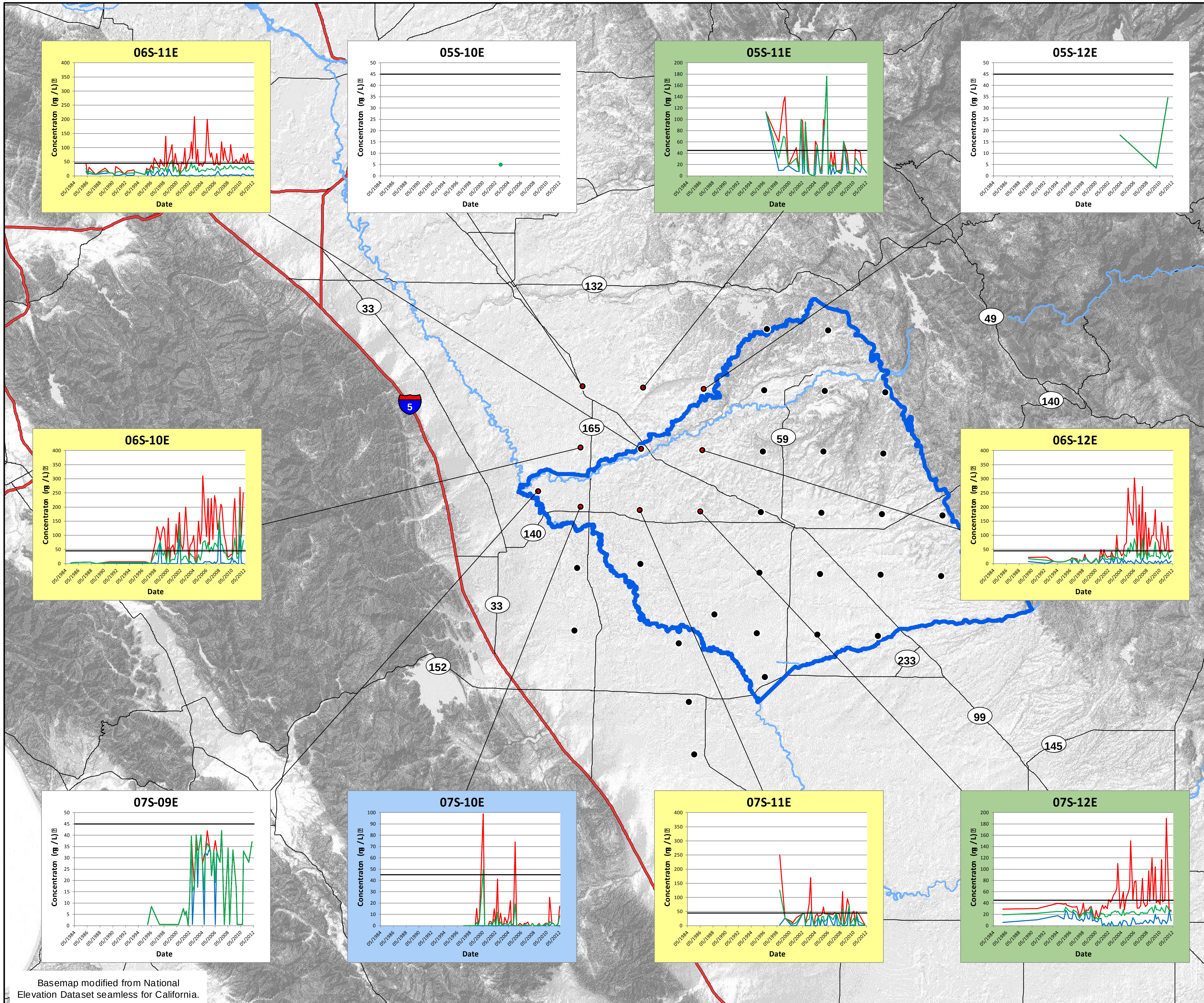
0 5 10

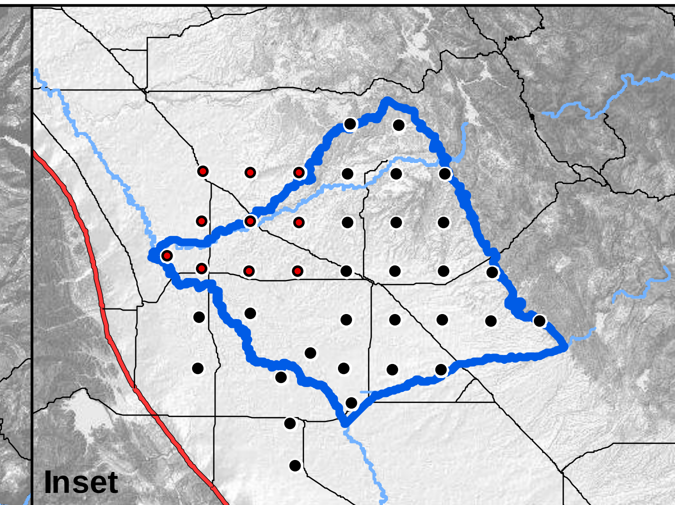
APPROXIMATE SCALE IN MILES

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

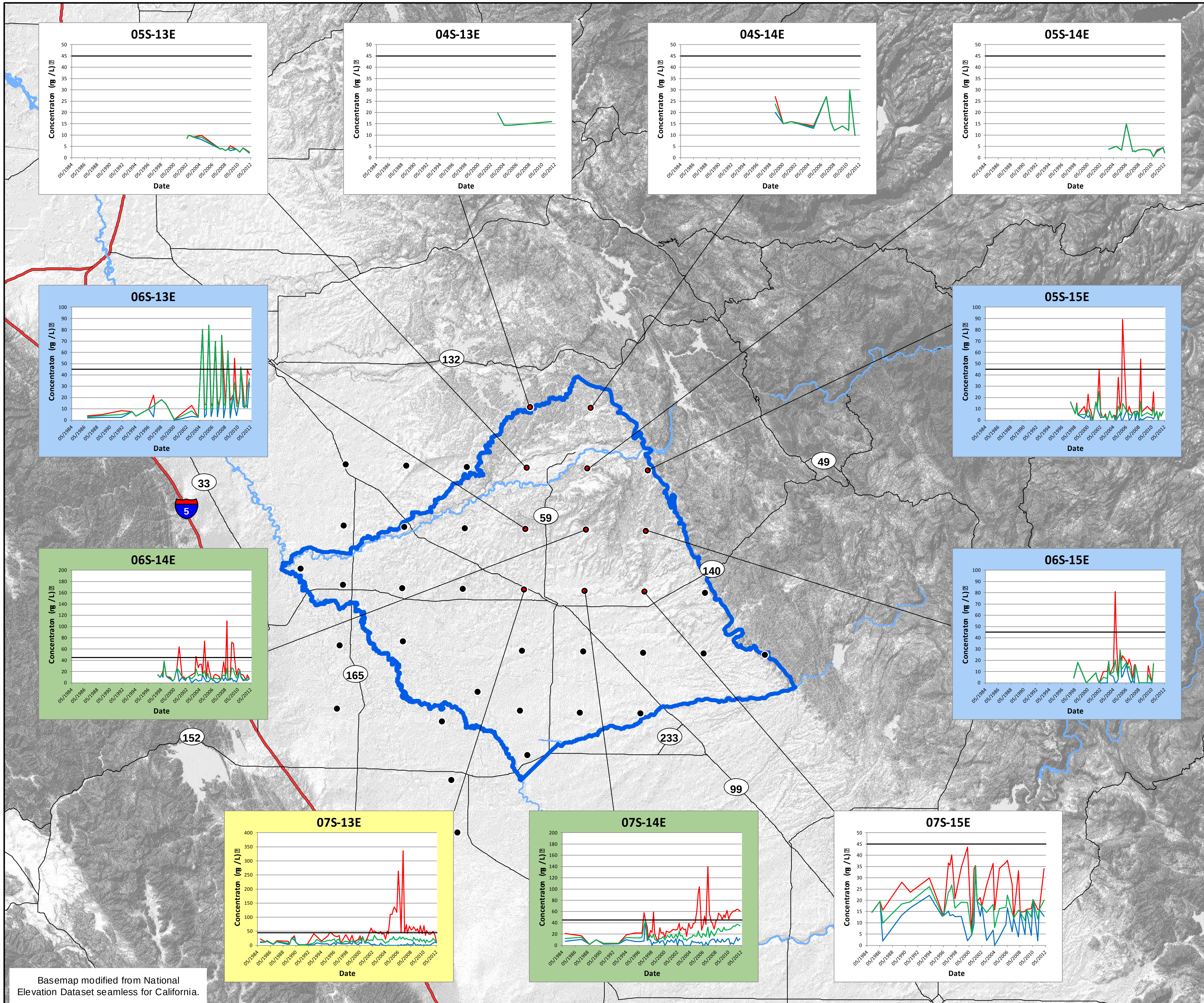
0 5 10

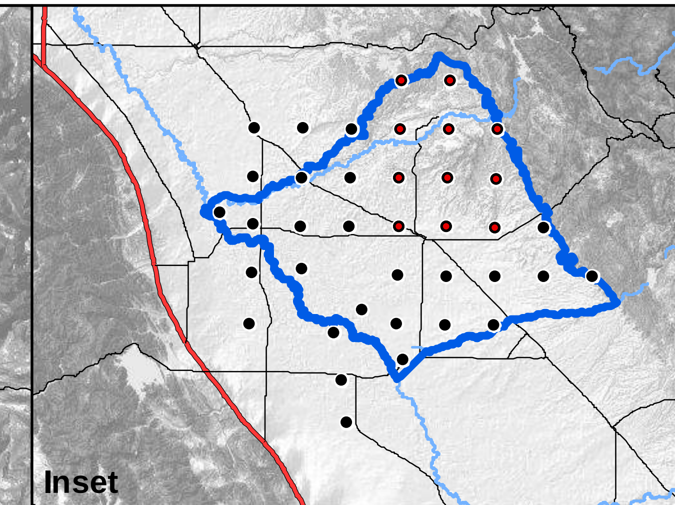
APPROXIMATE SCALE IN MILES

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

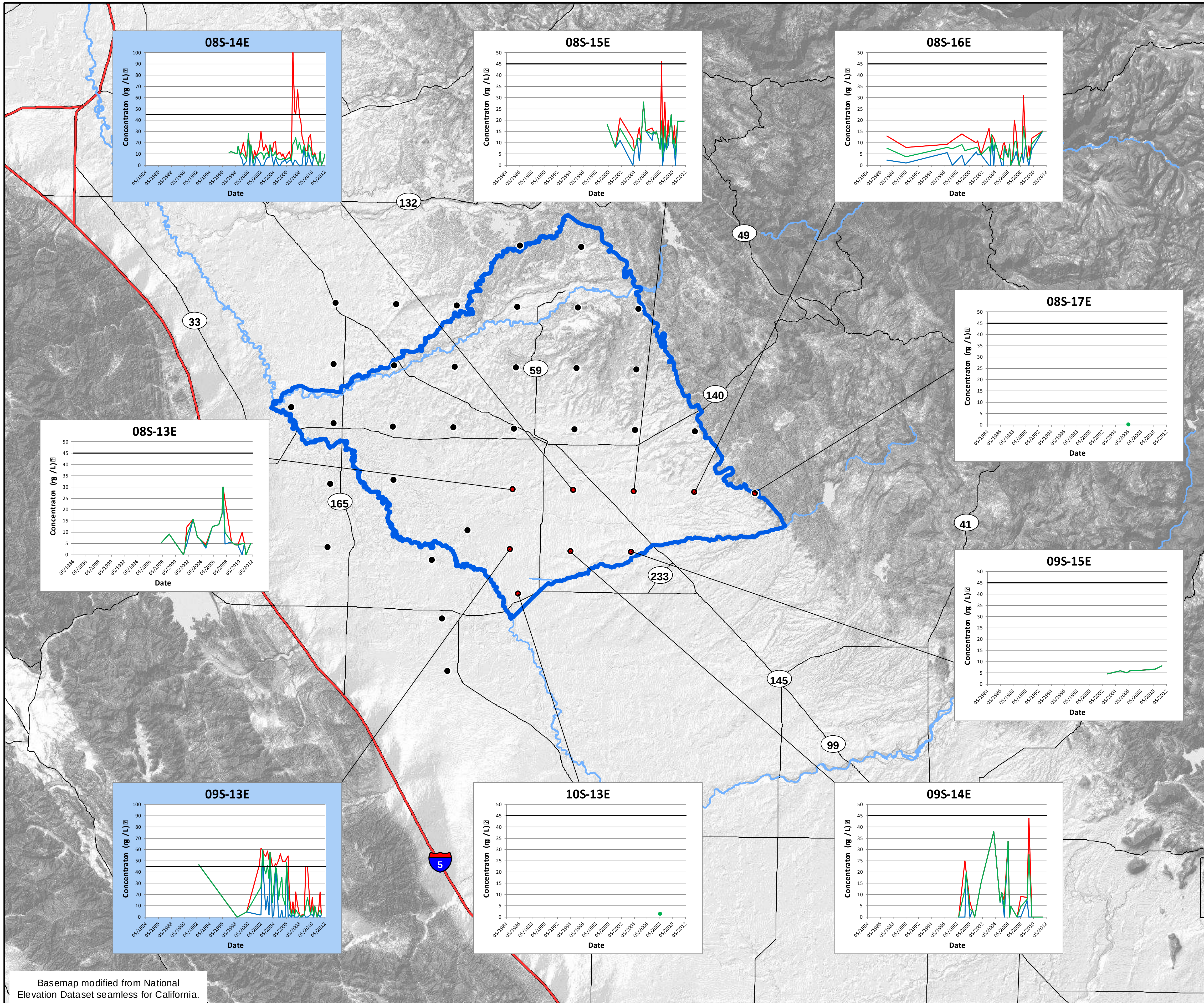
0 5 10

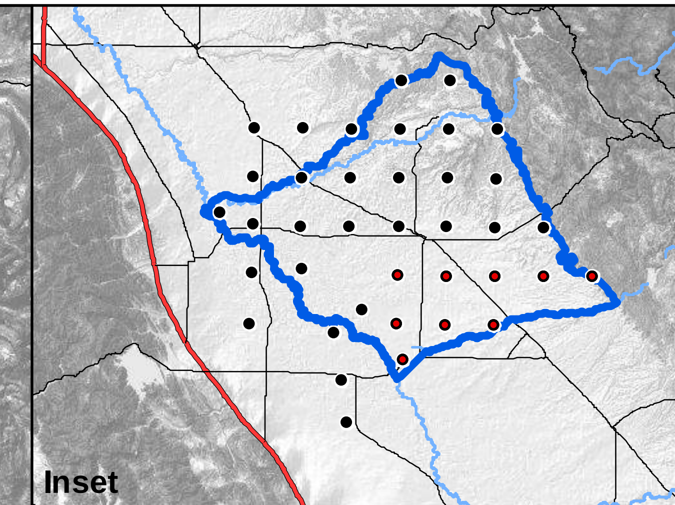
APPROXIMATE SCALE IN MILES

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_01ConcentrationMaps_fig08b_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

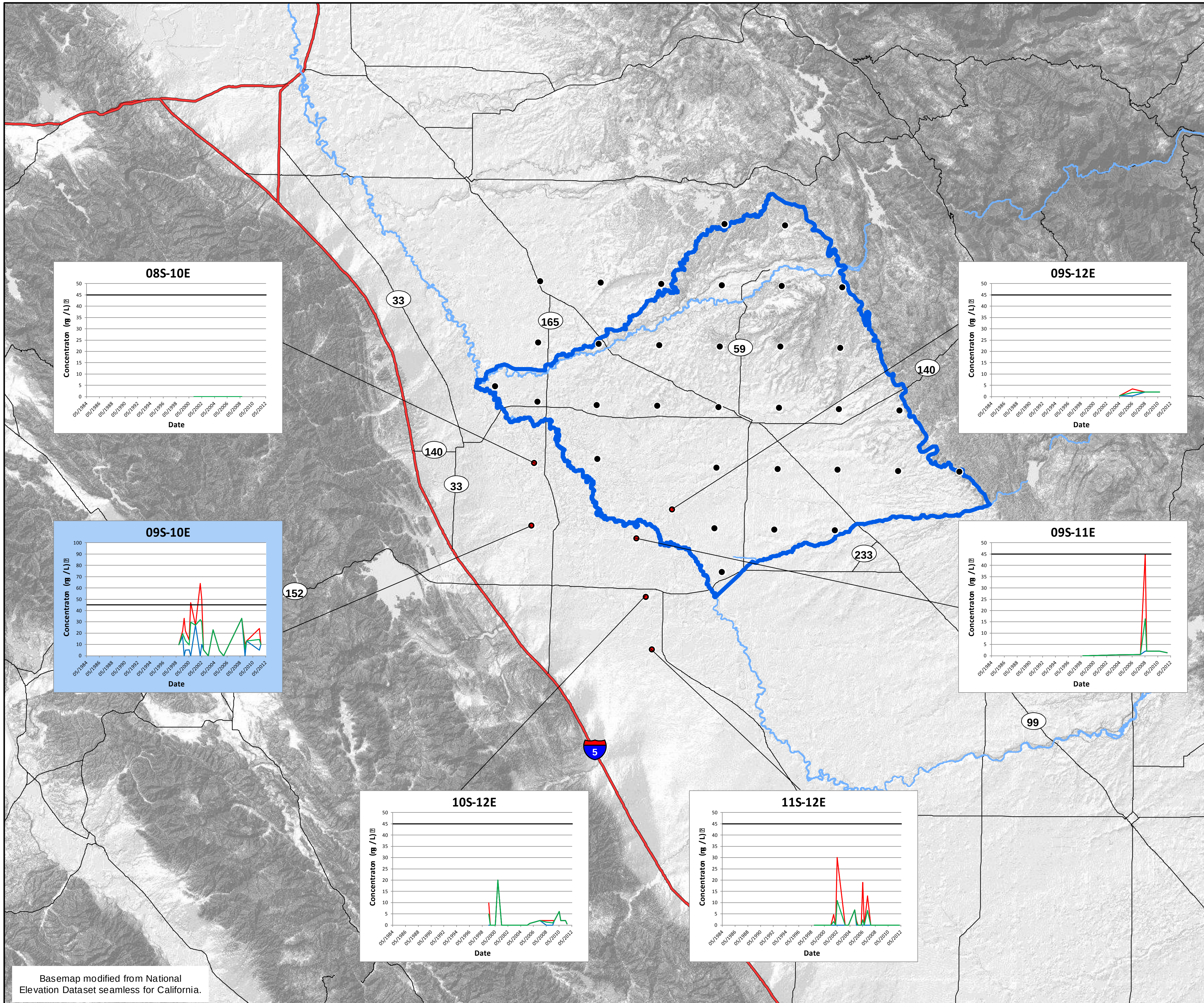
0 5 10

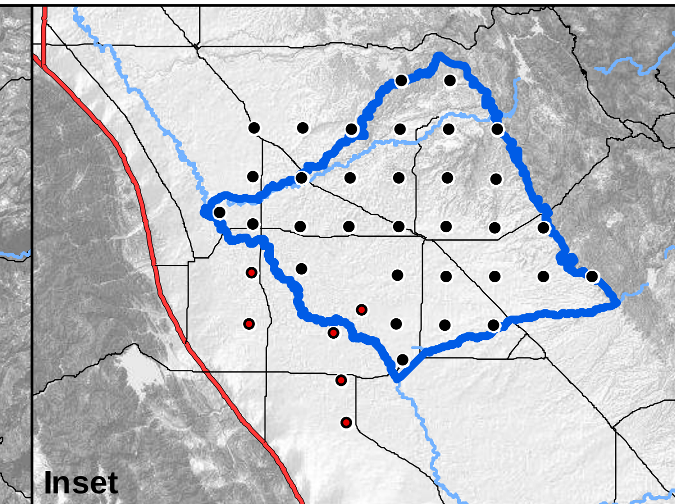
APPROXIMATE SCALE IN MILES

NITRATE (NO3) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 8c

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

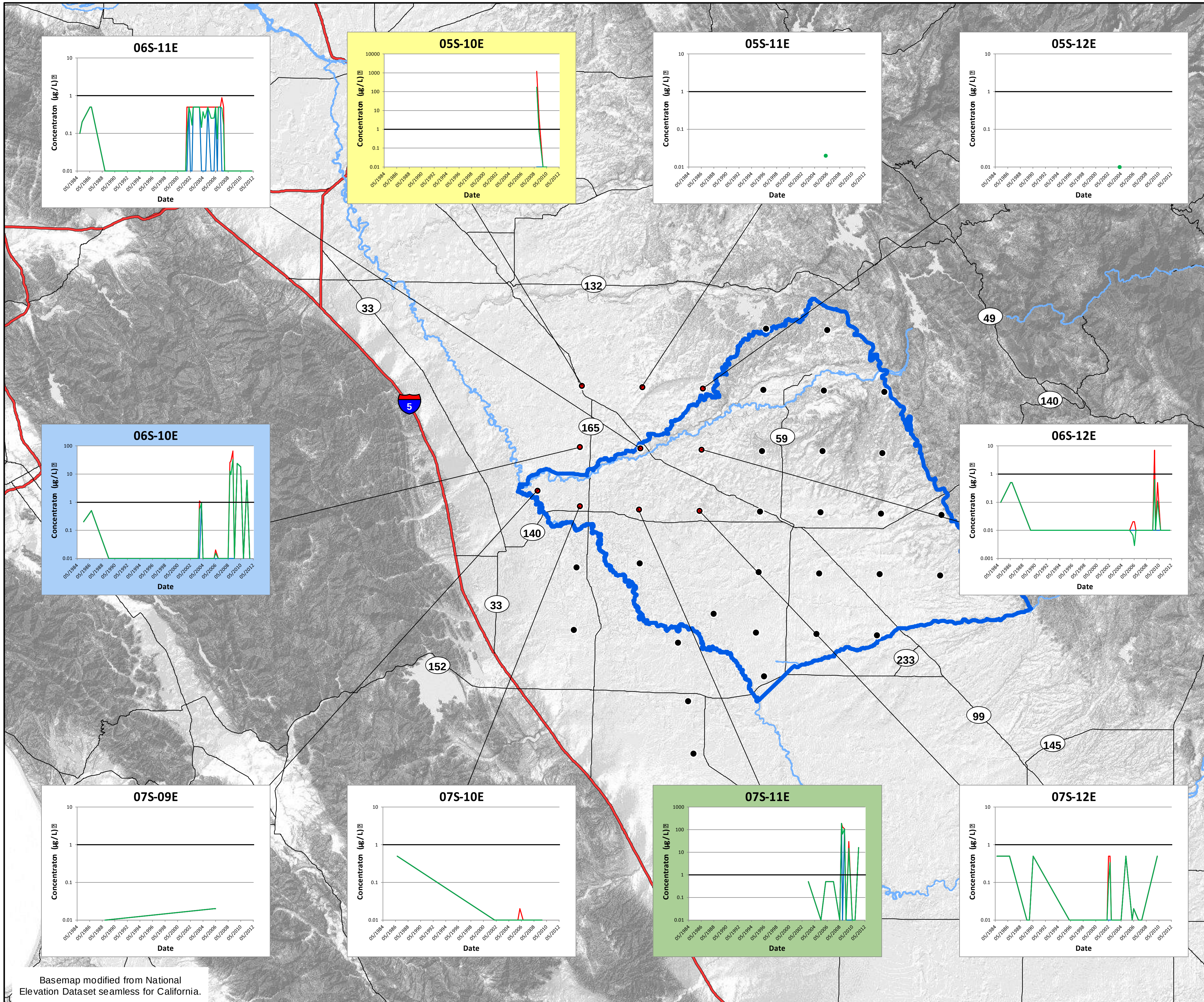
N

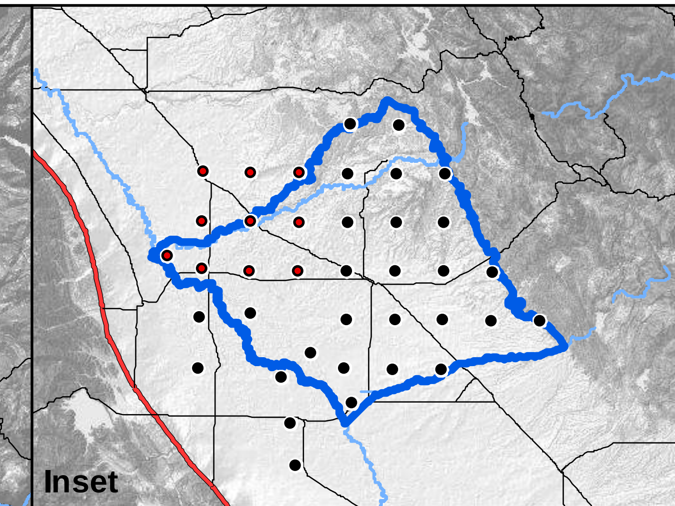
0 5 10
APPROXIMATE SCALE IN MILES

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

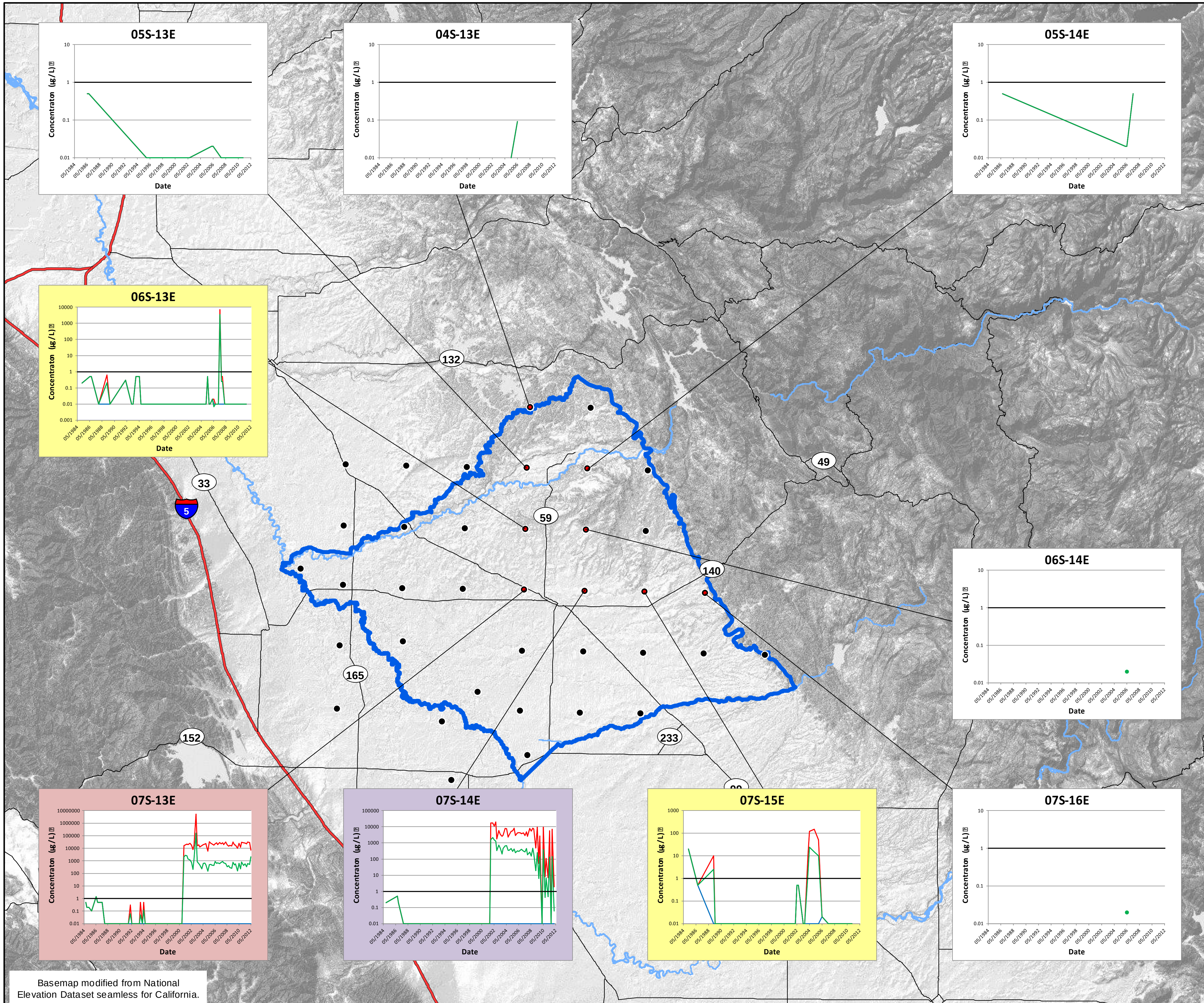
APPROXIMATE SCALE IN MILES

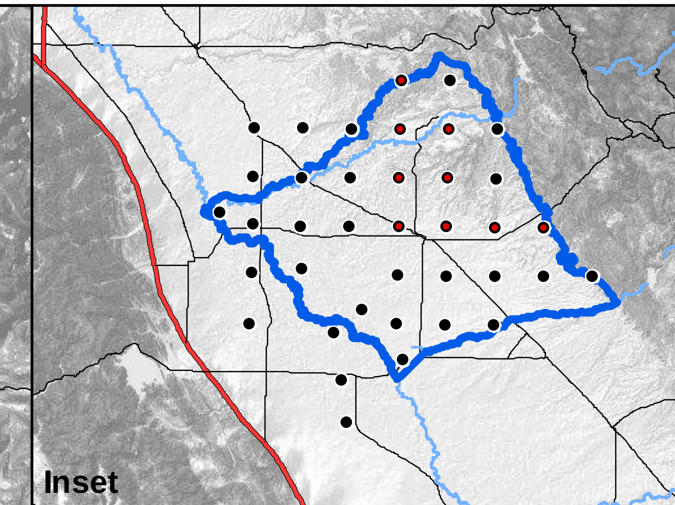
BENZENE CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A

Figure 10a

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig10a_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- 1,000 µg/L
Purple: 0.01- 100,000 µg/L
Pink: 0.01- 10,000,000 µg/L

N

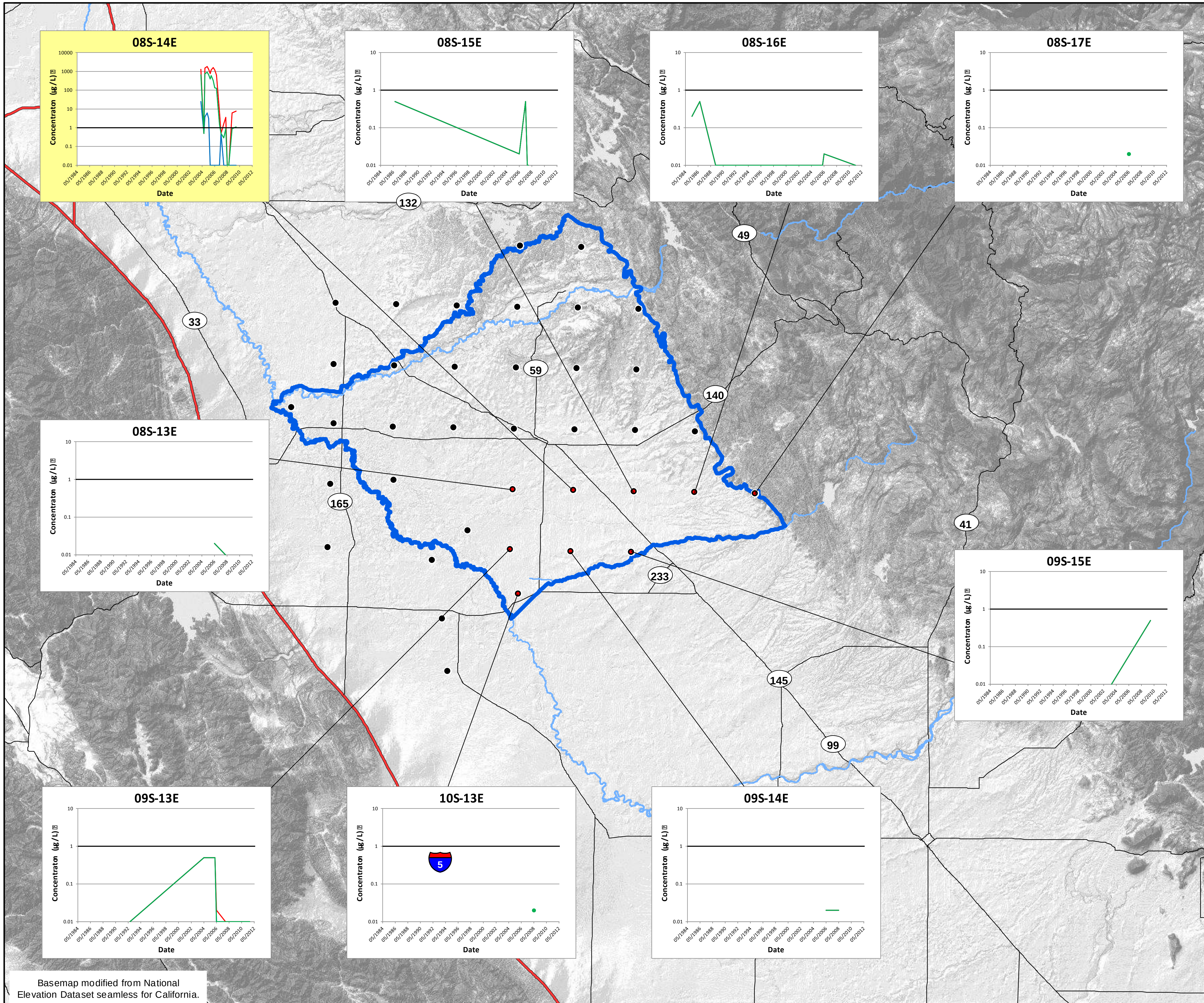
0 5 10

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



Basemap modified from National Elevation Dataset seamless for California.

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

Yellow: 0.01- 10,000 µg/L

N

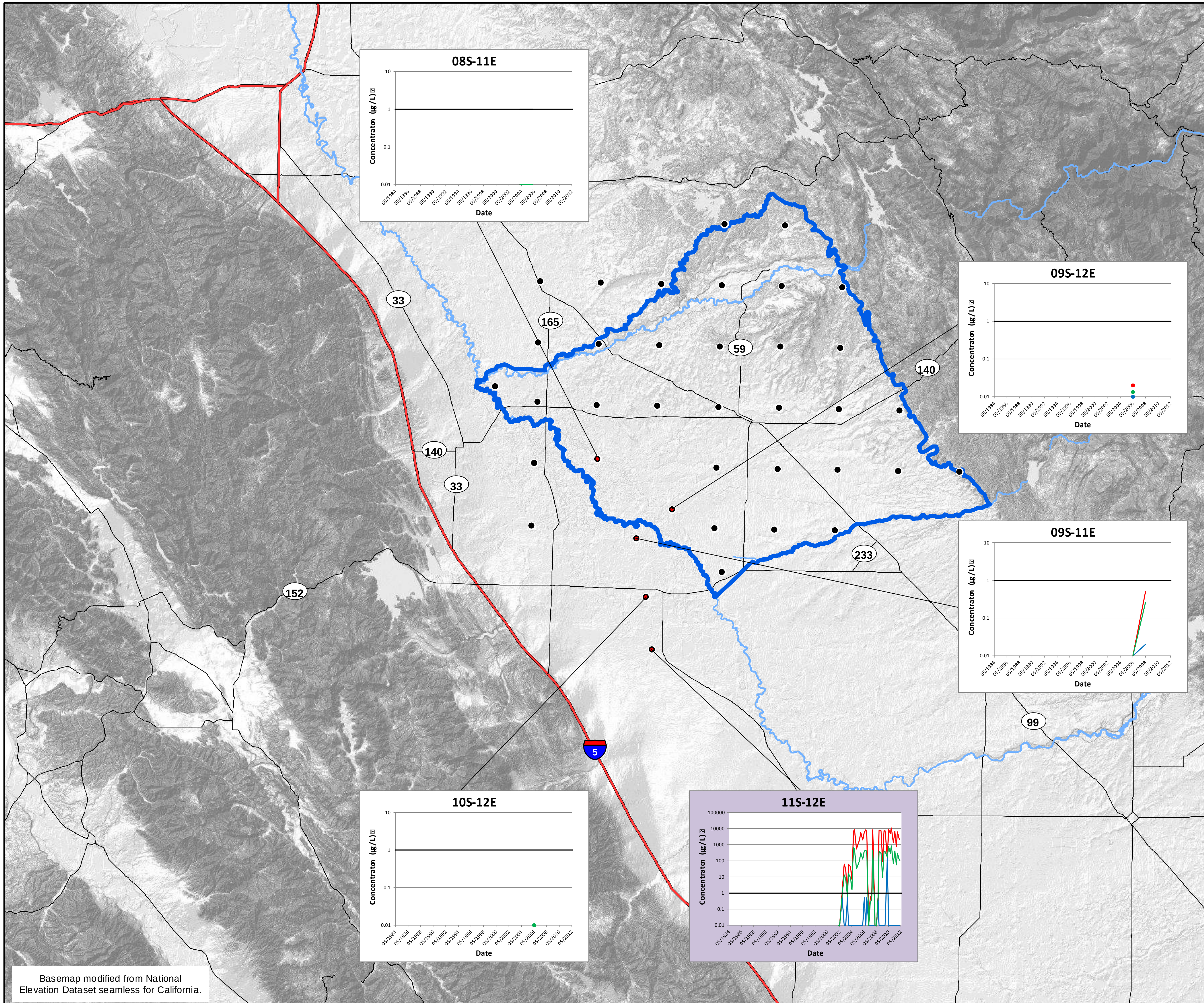
0 5 10

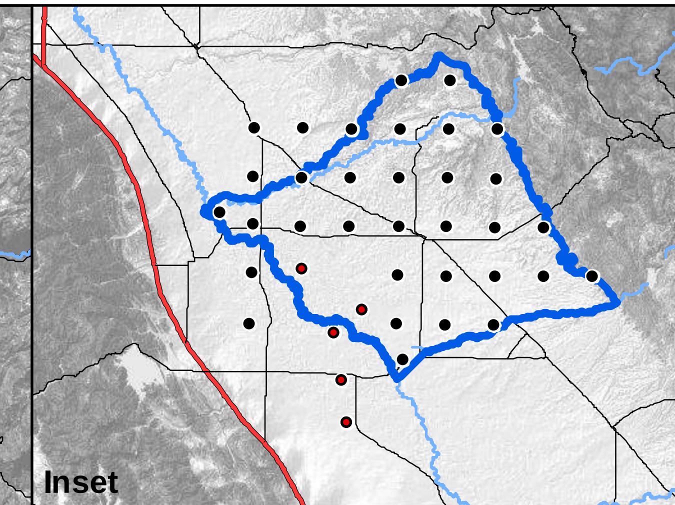
APPROXIMATE SCALE IN MILES

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_fig10d_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

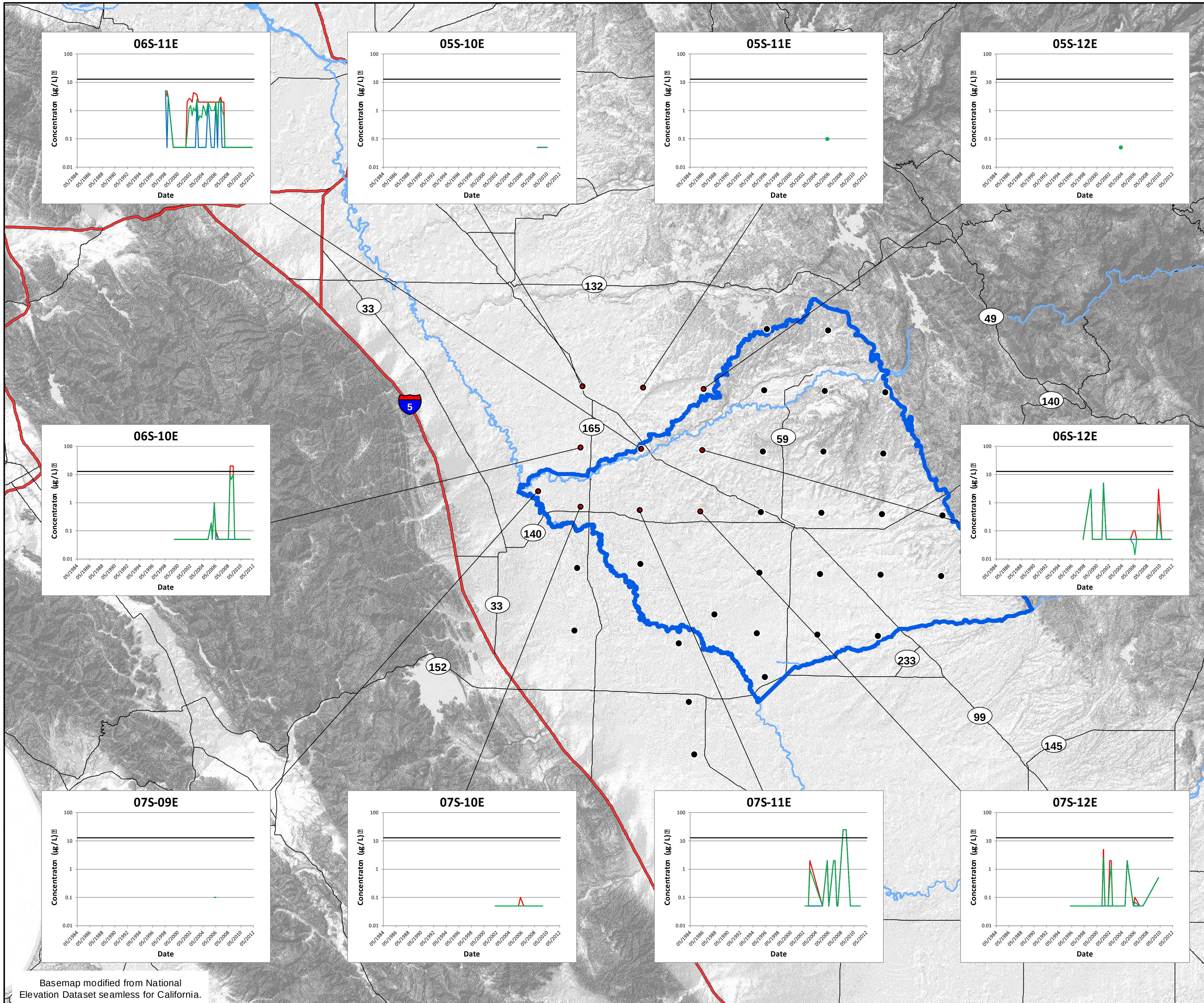
N

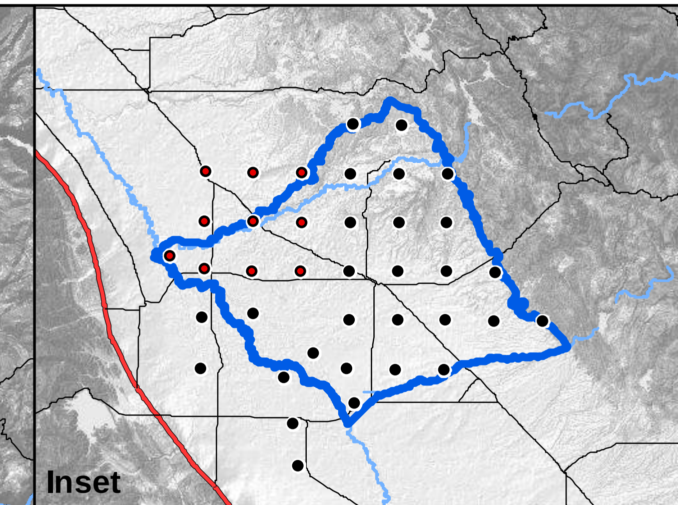
0 5 10

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





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

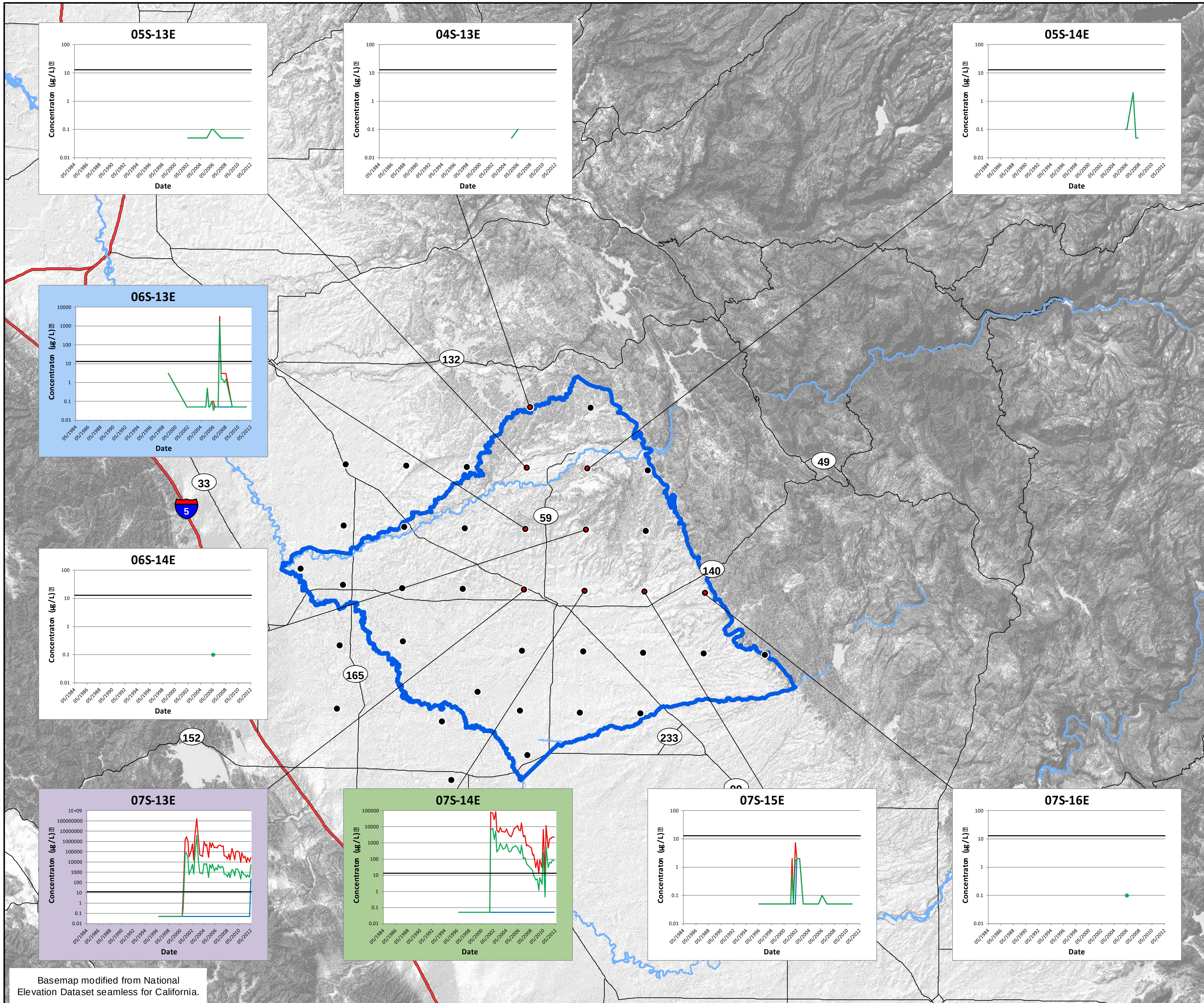
0 5 10

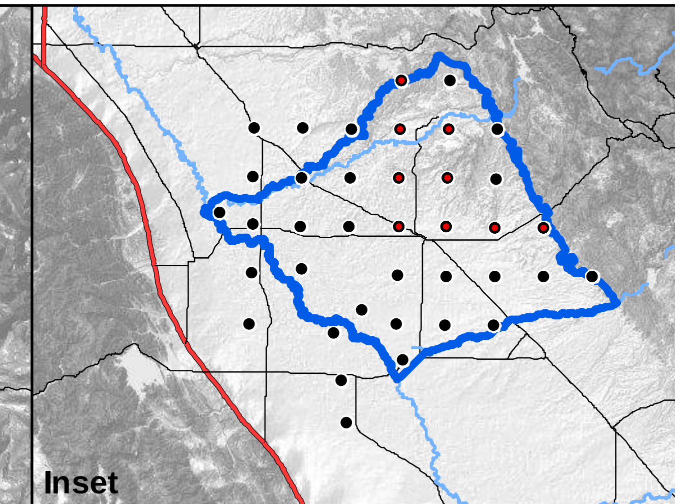
APPROXIMATE SCALE IN MILES

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

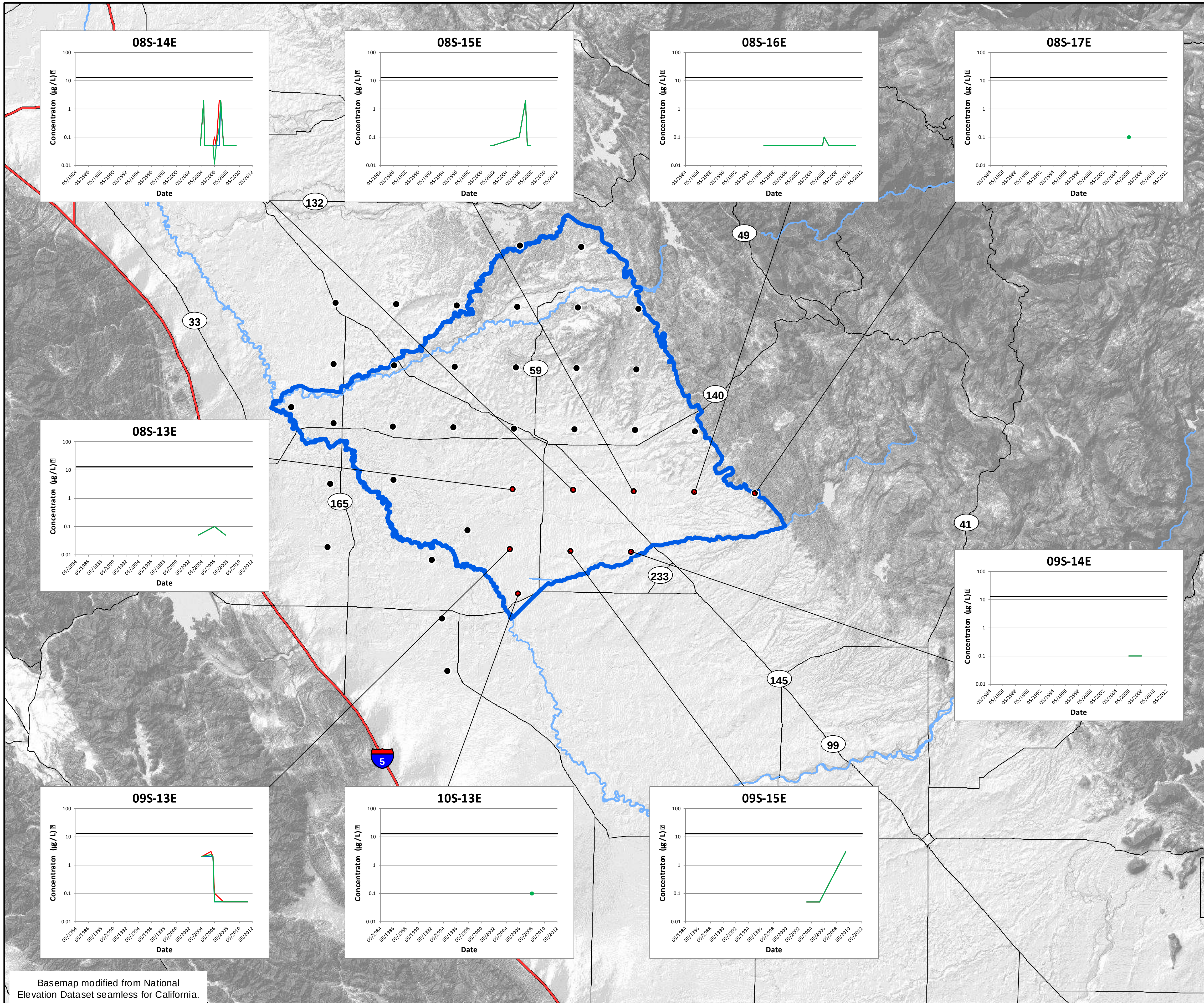
N

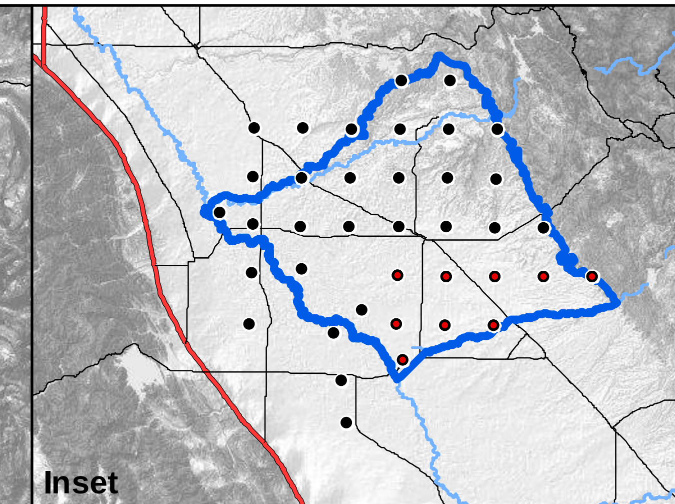
0 5 10
APPROXIMATE SCALE IN MILES

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

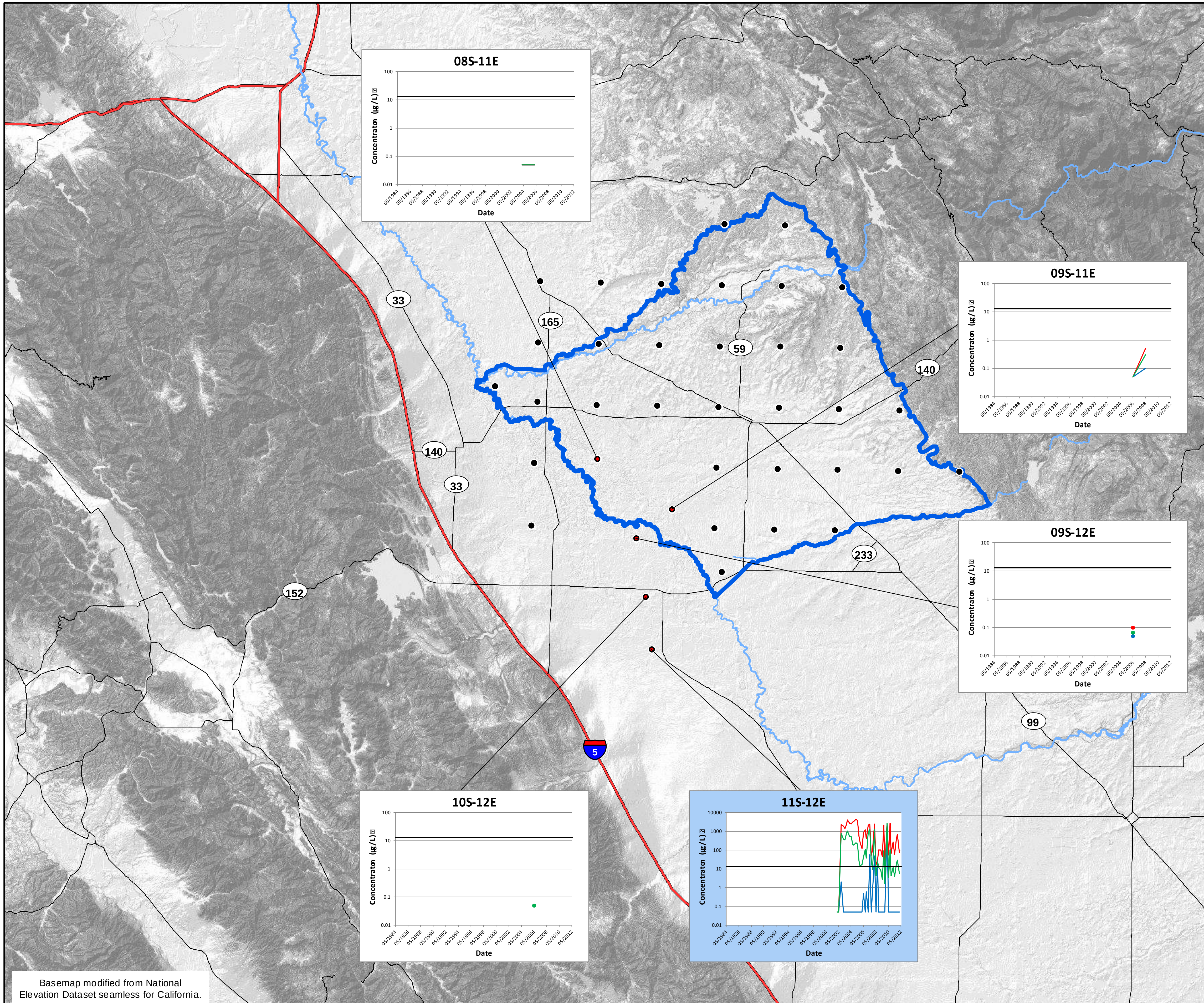
0 5 10

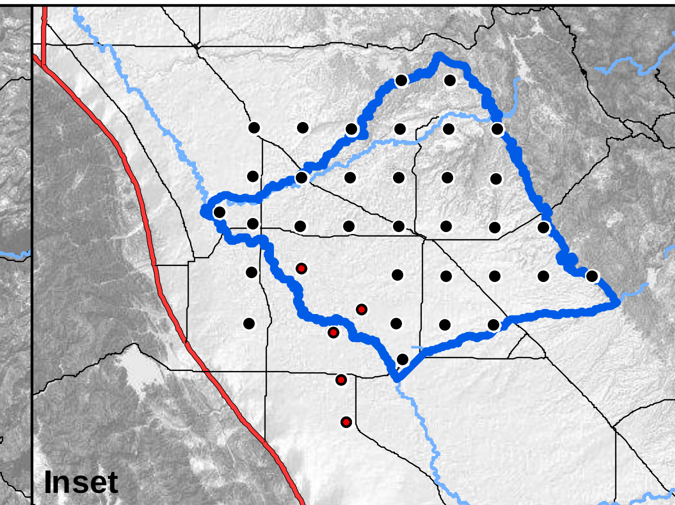
APPROXIMATE SCALE IN MILES

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

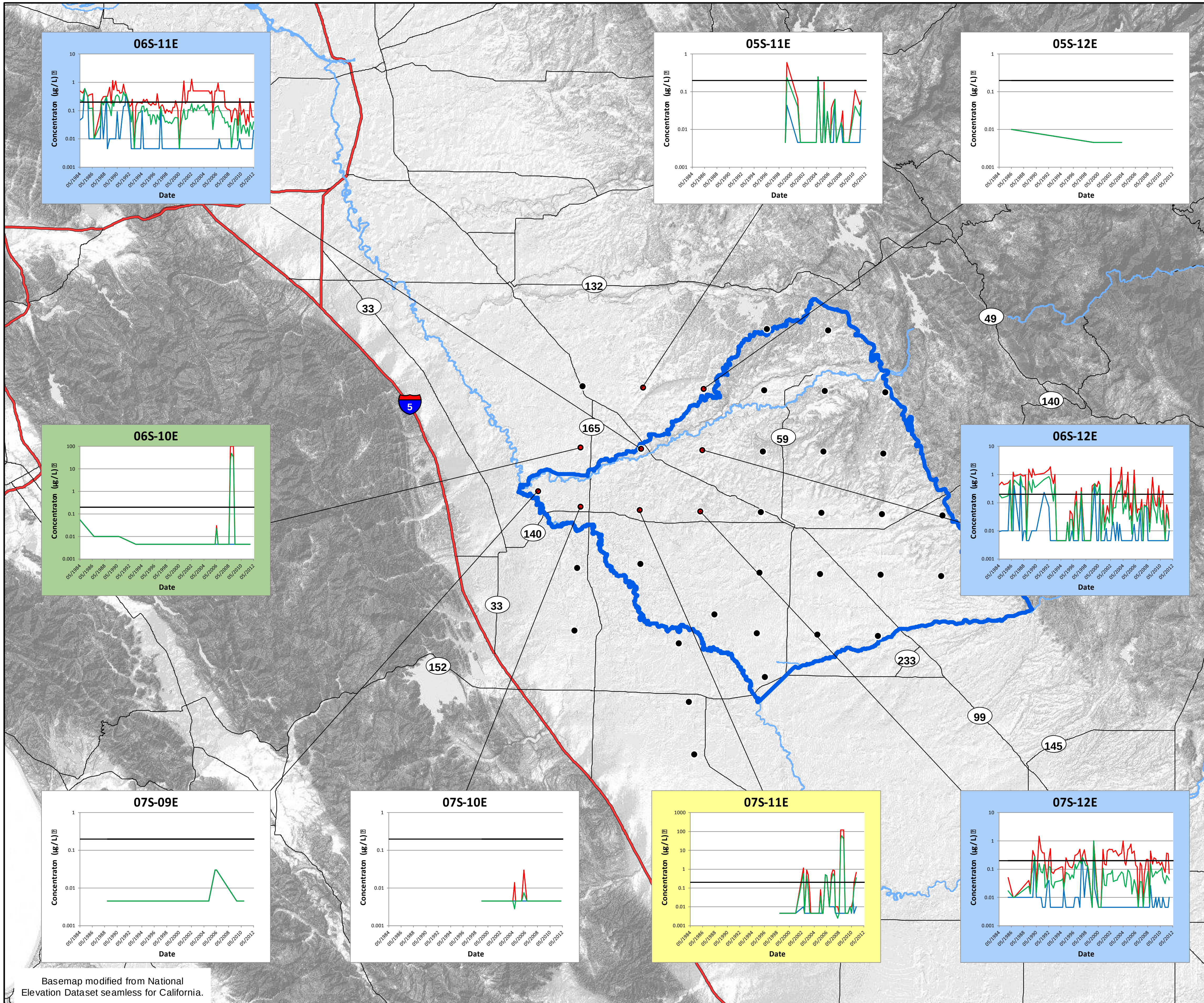
0 5 10

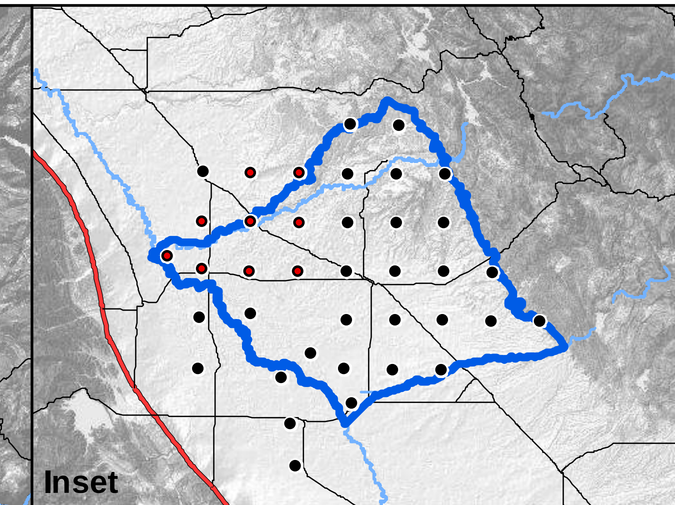
APPROXIMATE SCALE IN MILES

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

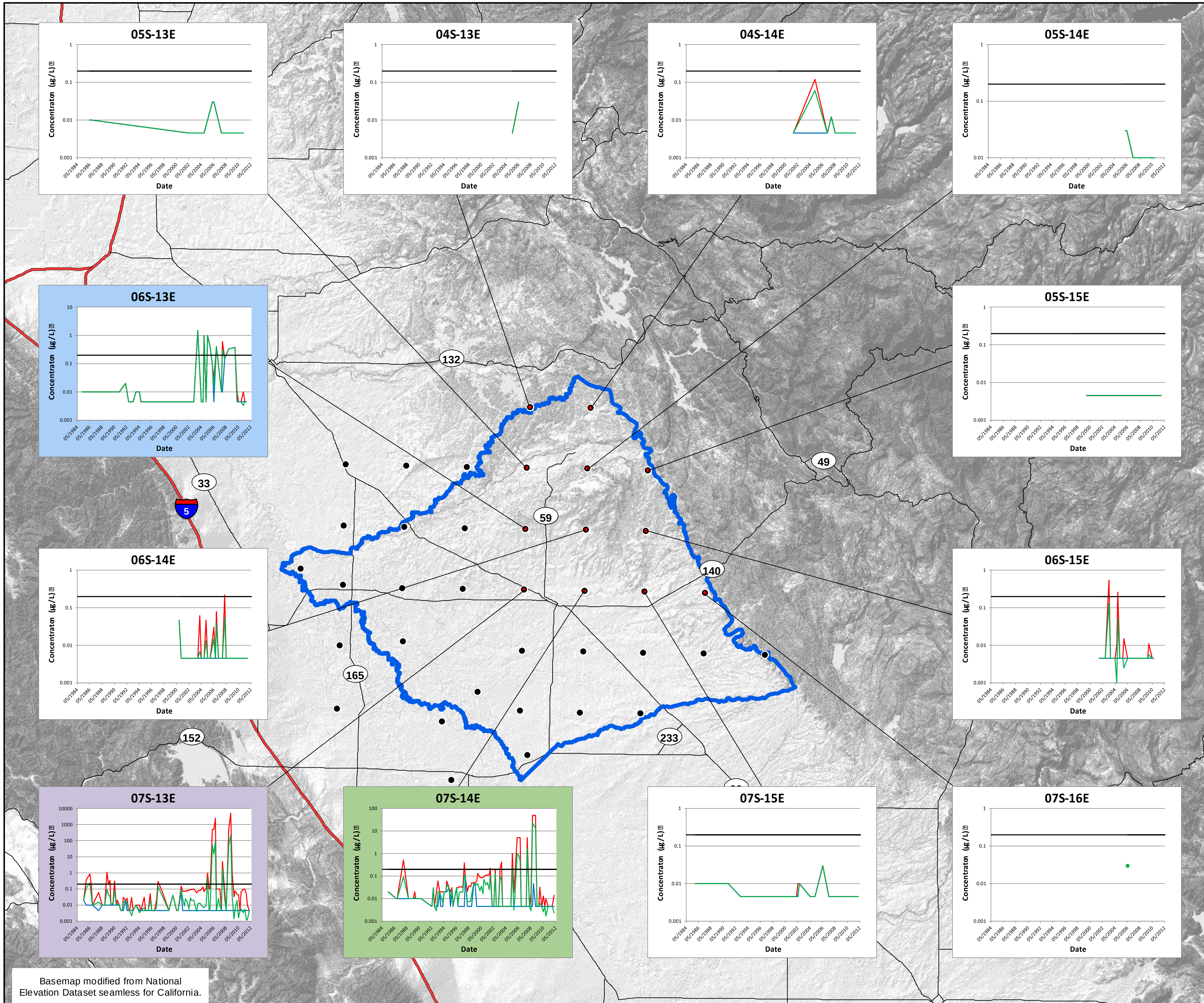
0 5 10

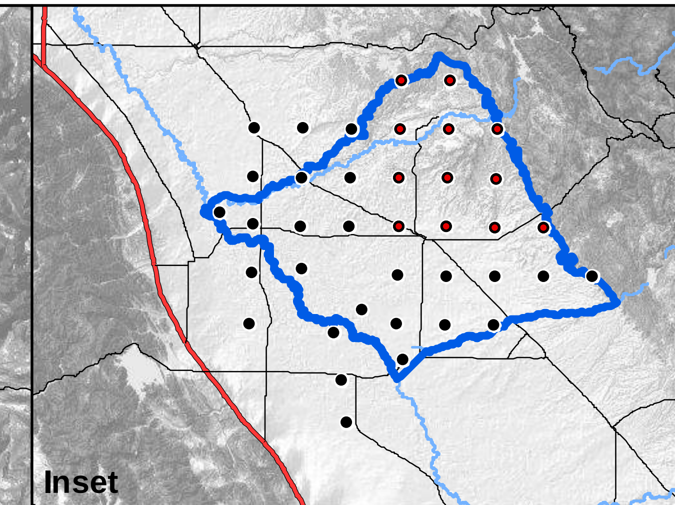
APPROXIMATE SCALE IN MILES

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

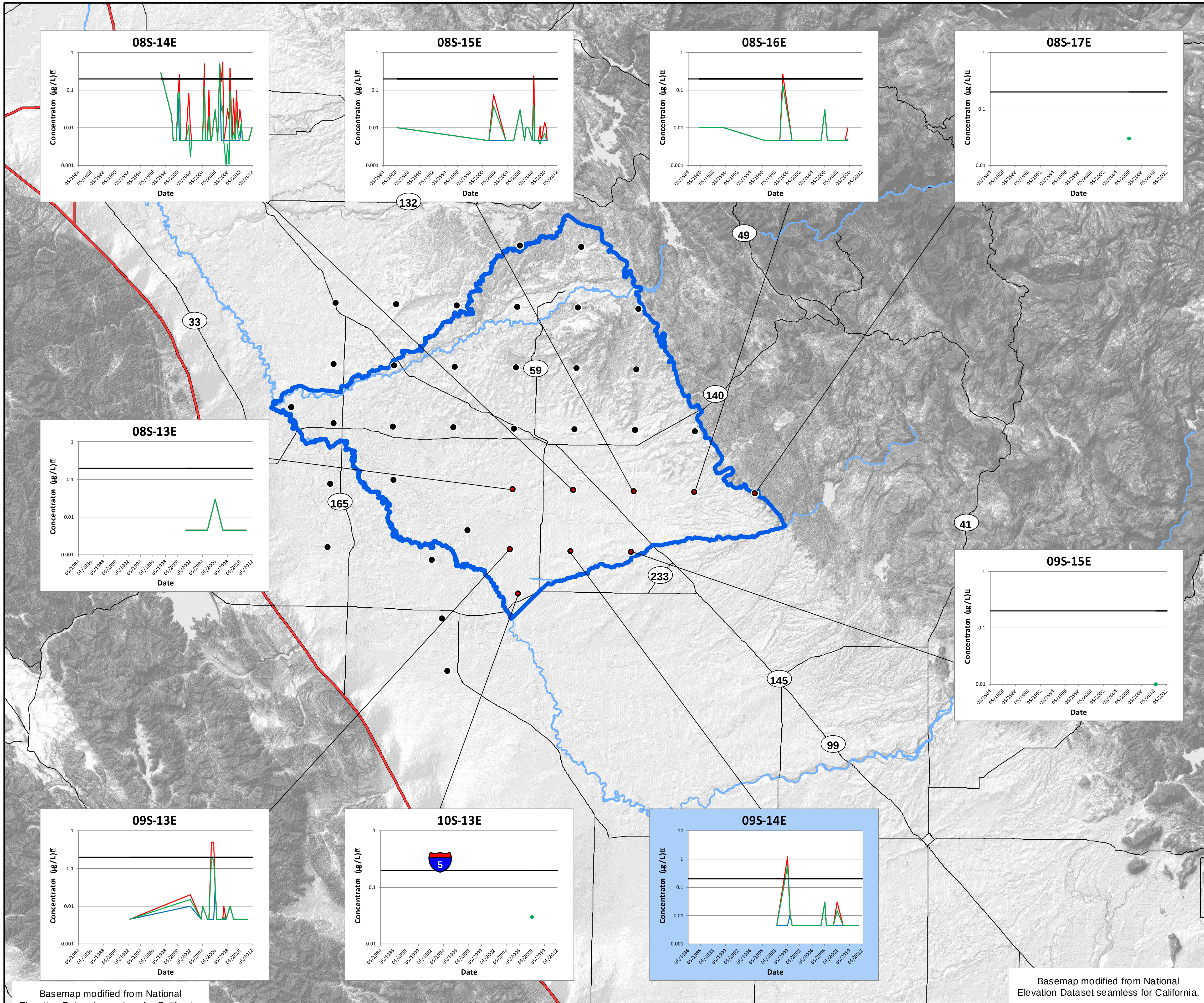
0 5 10

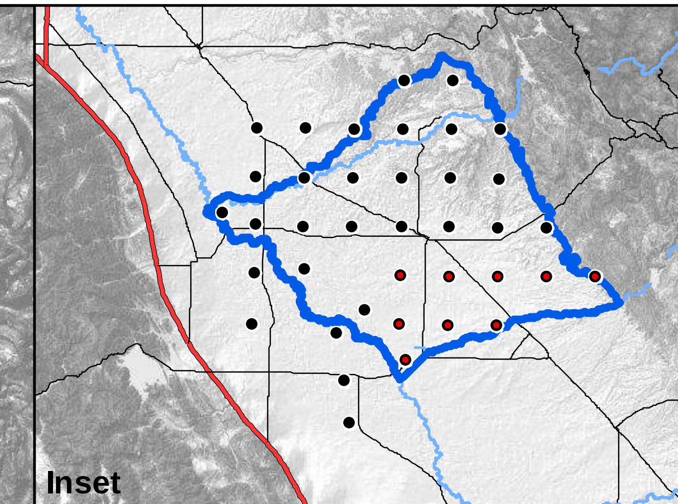
APPROXIMATE SCALE IN MILES

DIBROMOCHLOROPROPANE (DBCP) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 12b

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01ConcentrationMaps_fig12b_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

N

0 5 10

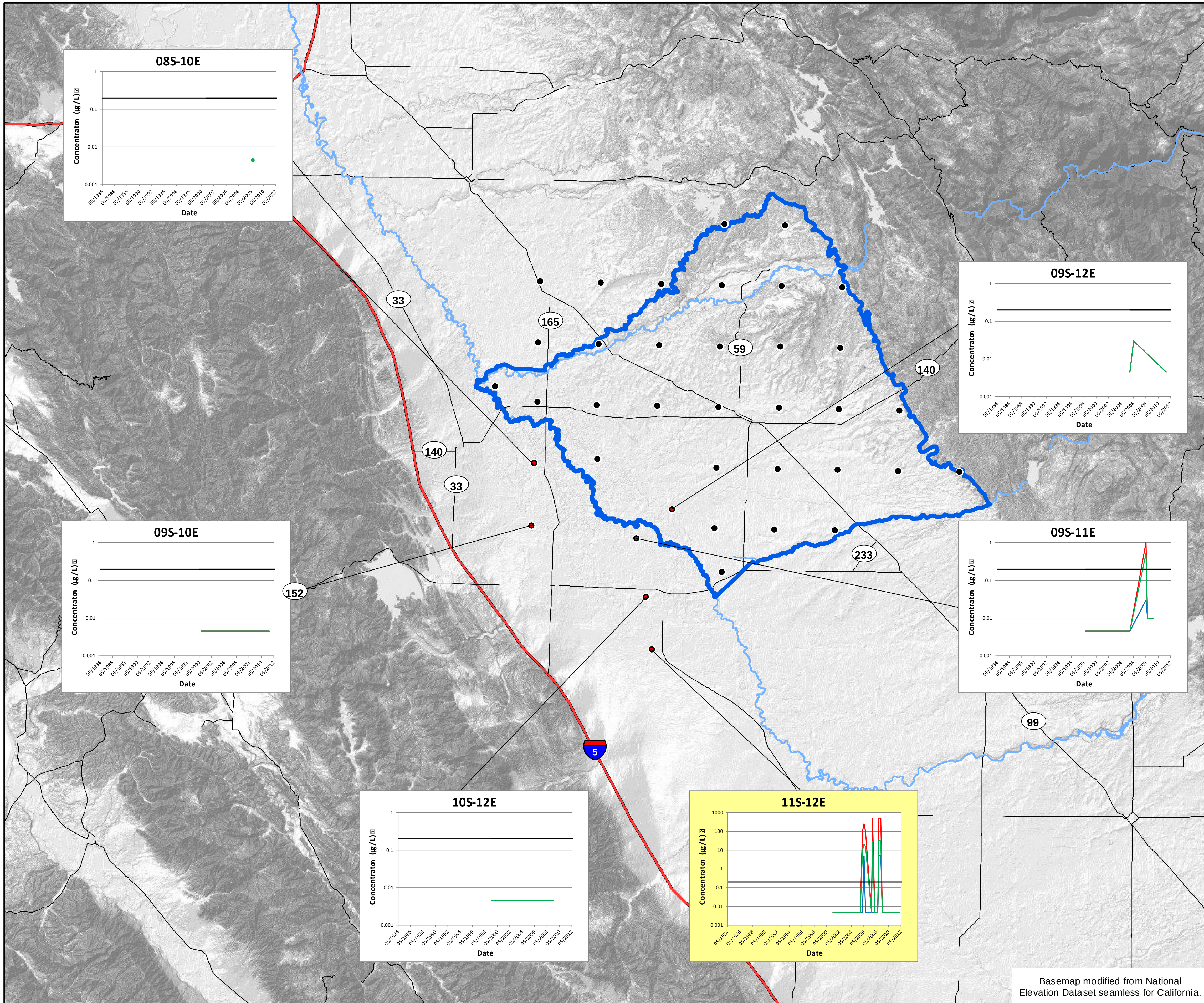
APPROXIMATE SCALE IN MILES

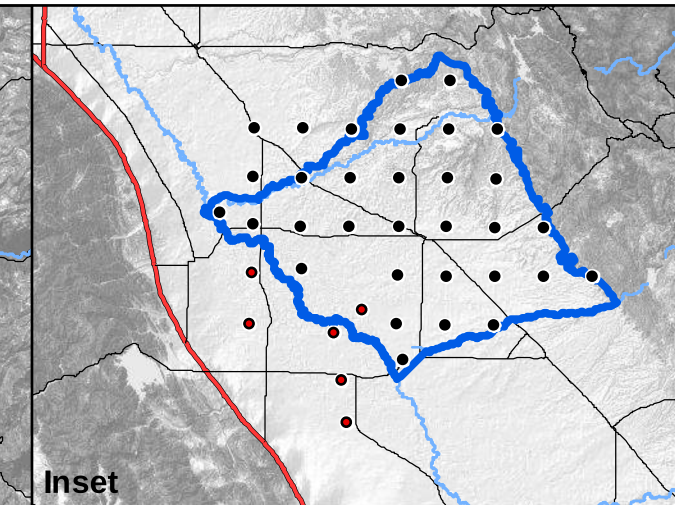
Basemap modified from National
Elevation Dataset seamless for California.

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

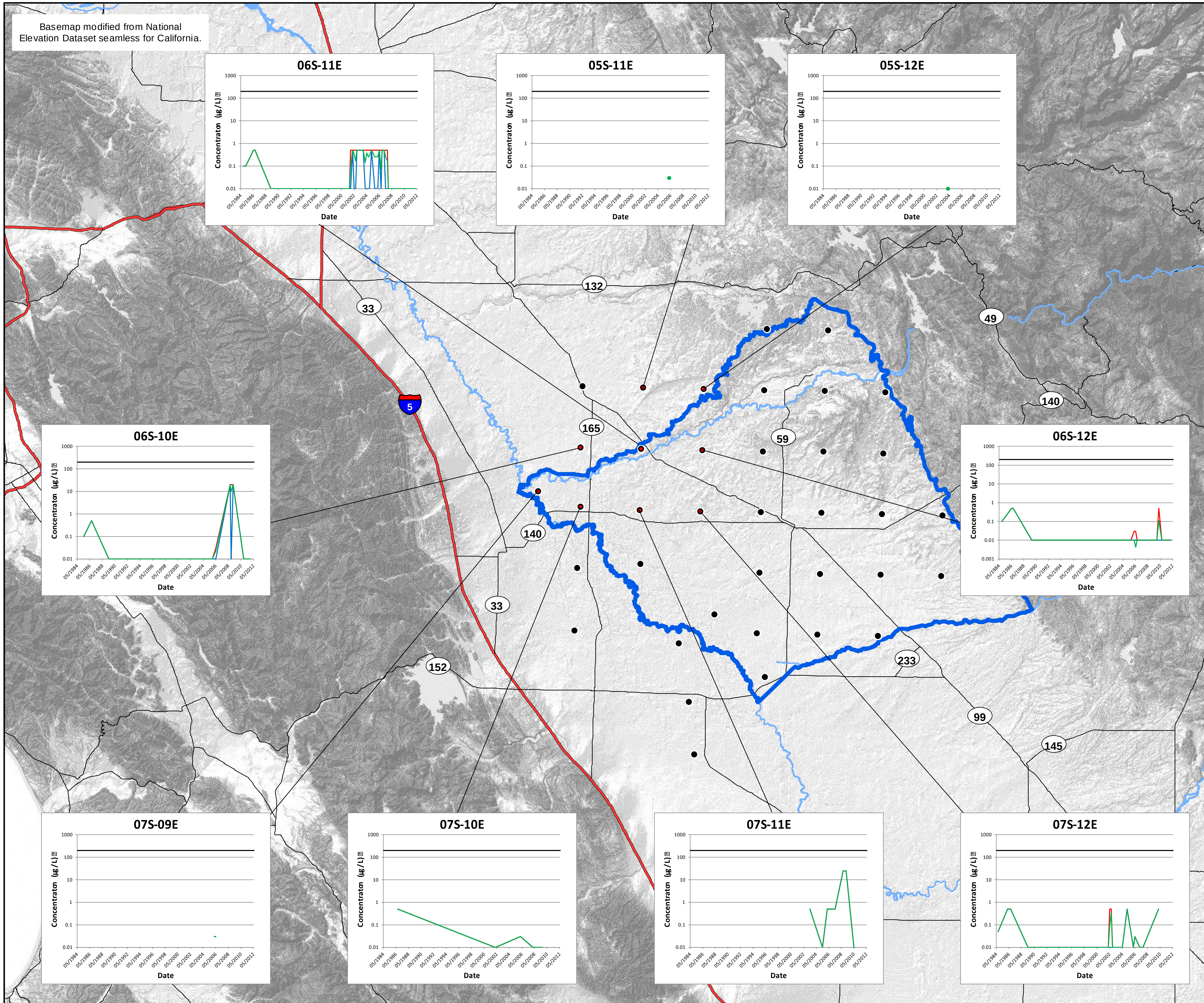
0 5 10

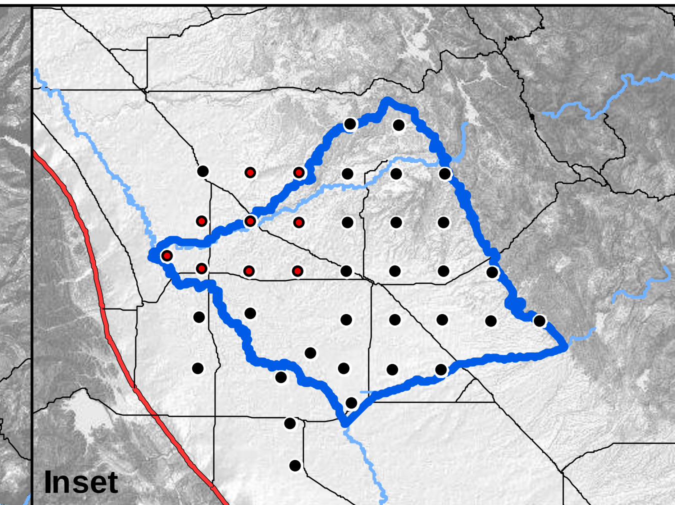
APPROXIMATE SCALE IN MILES

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





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

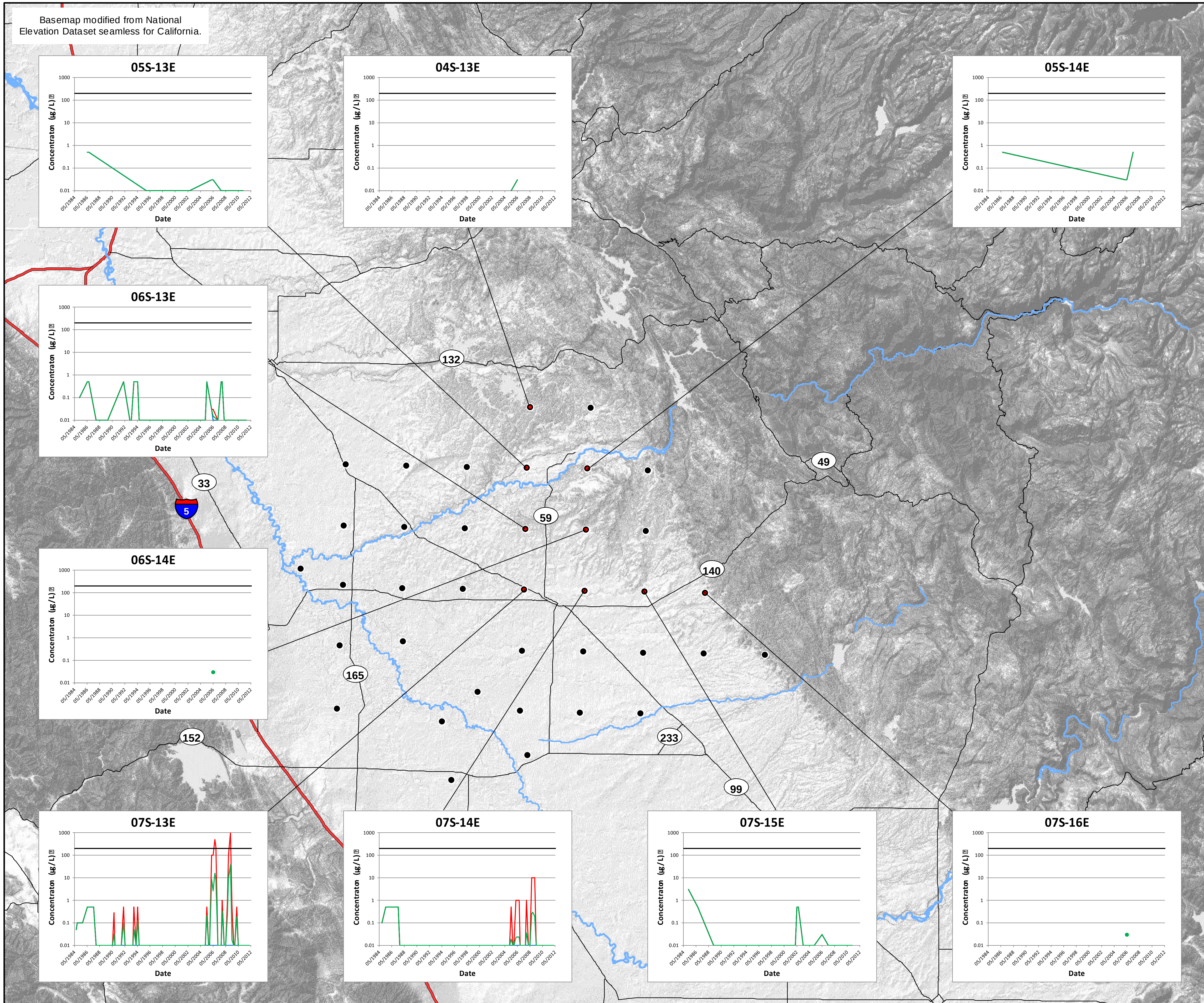
APPROXIMATE SCALE IN MILES

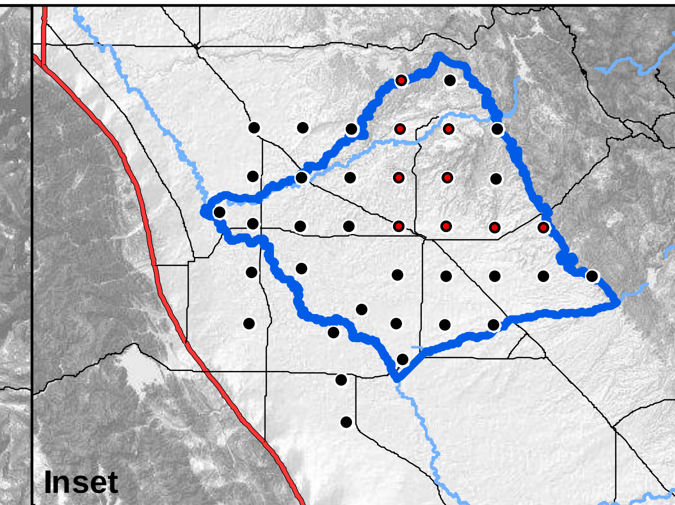
1,1,1-TRICHLOROETHANE (111TCA) CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A

Figure 13a

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01ConcentrationMaps_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

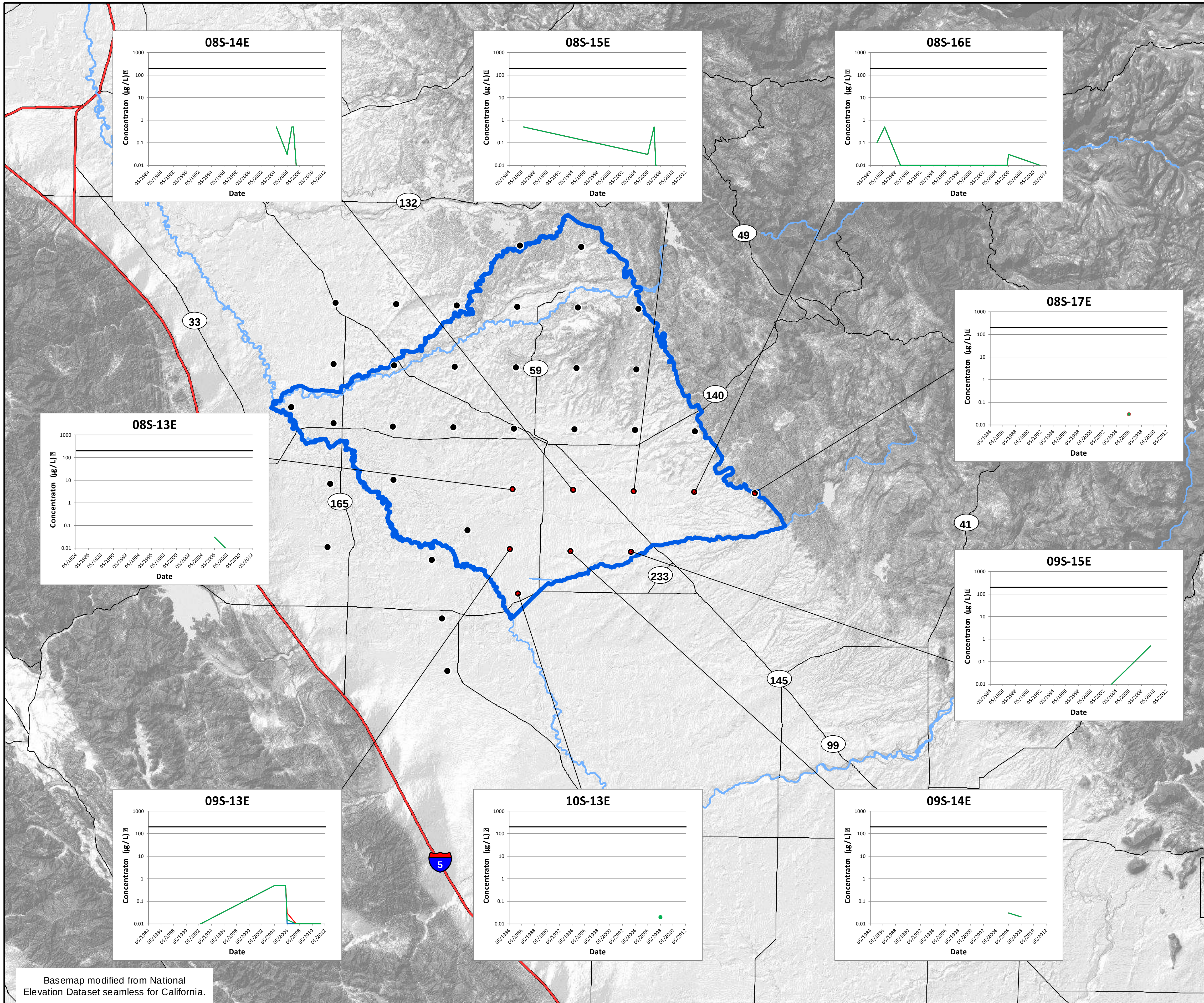
0 5 10

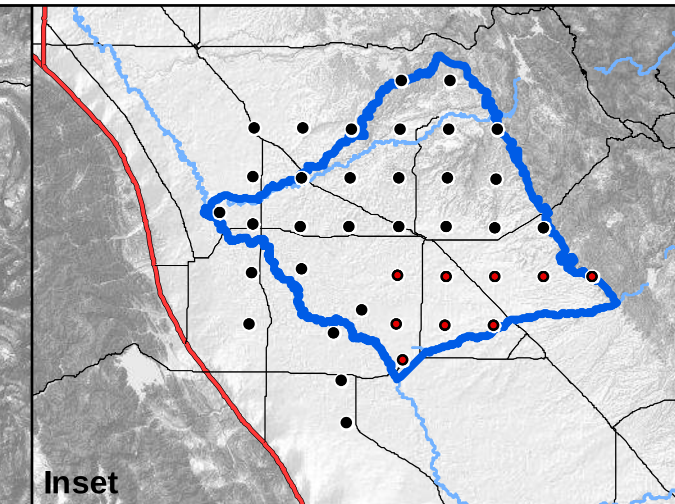
APPROXIMATE SCALE IN MILES

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

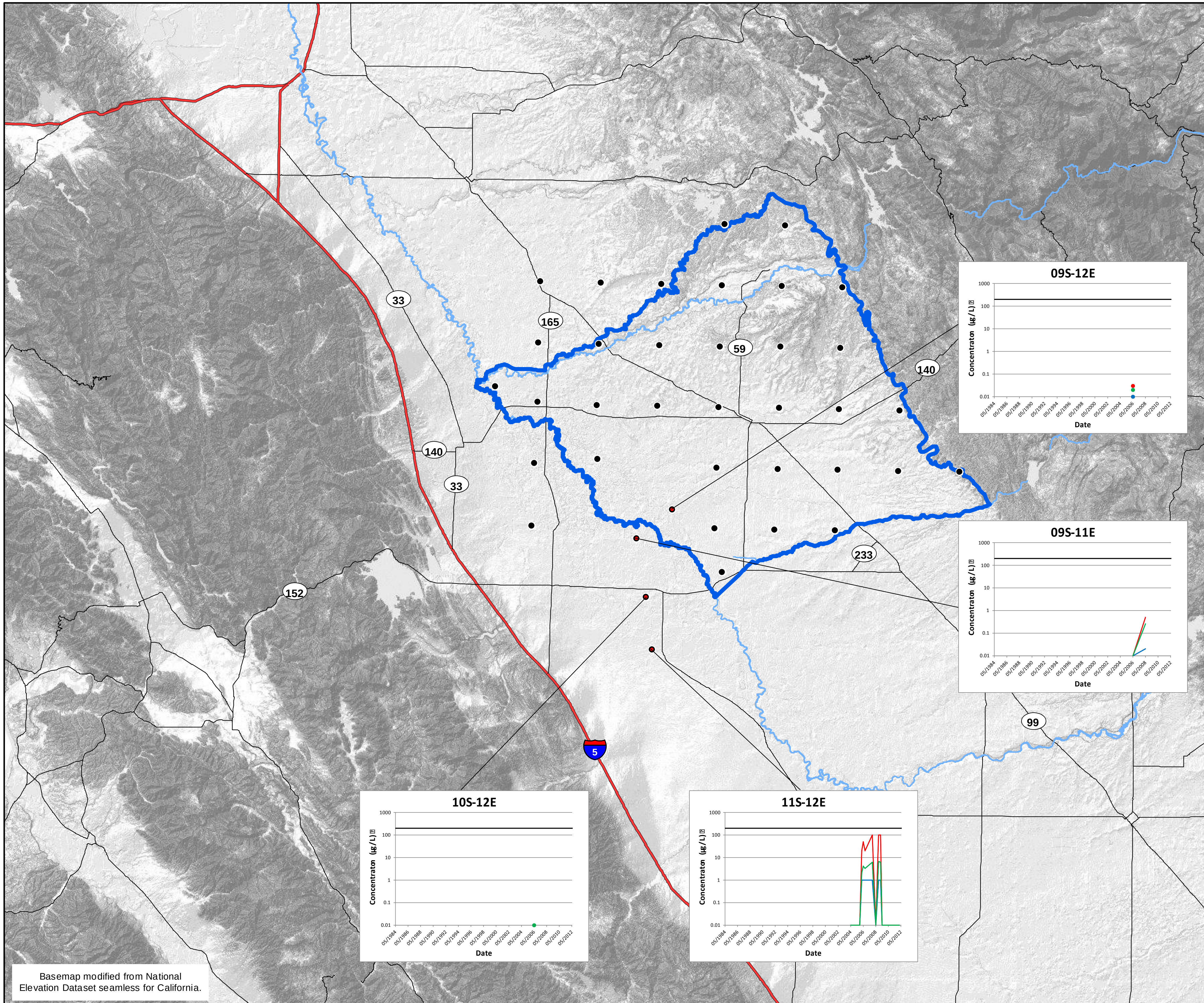
0 5 10

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_01ConcentrationMaps_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

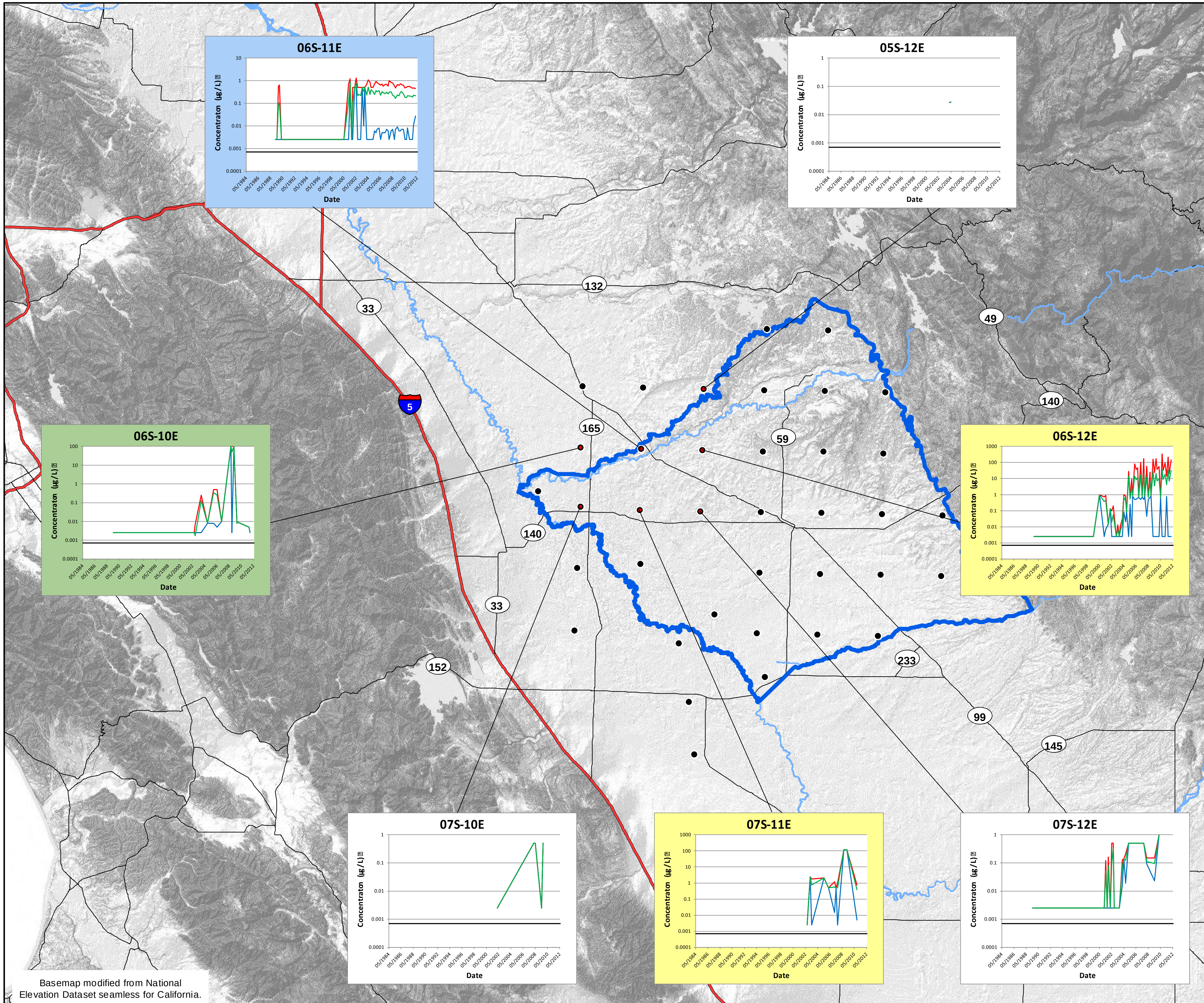
0 5 10

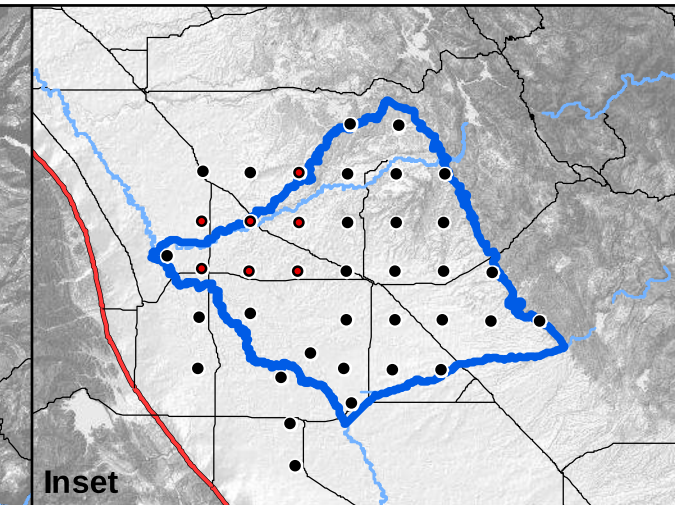
APPROXIMATE SCALE IN MILES

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

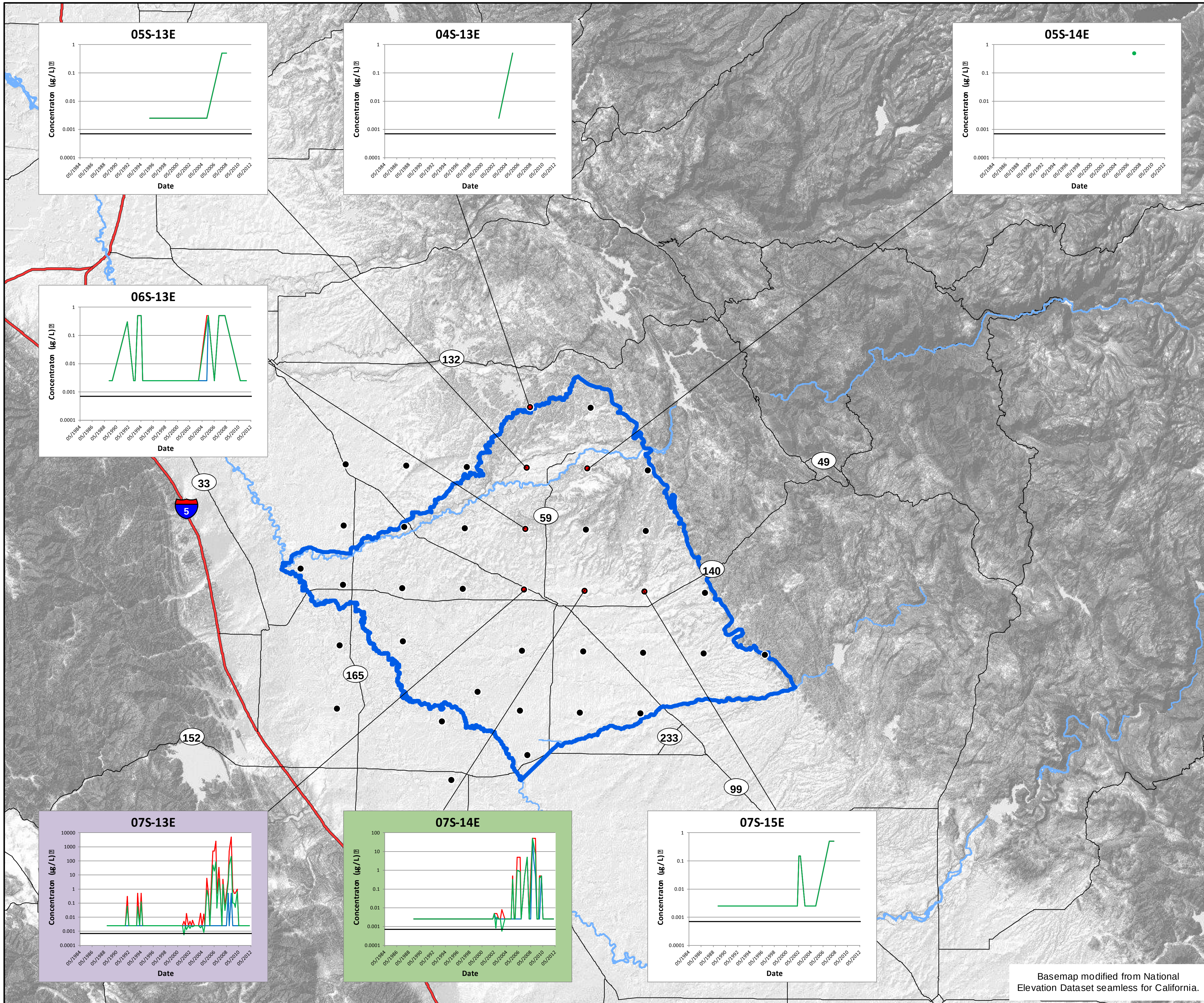
0 5 10

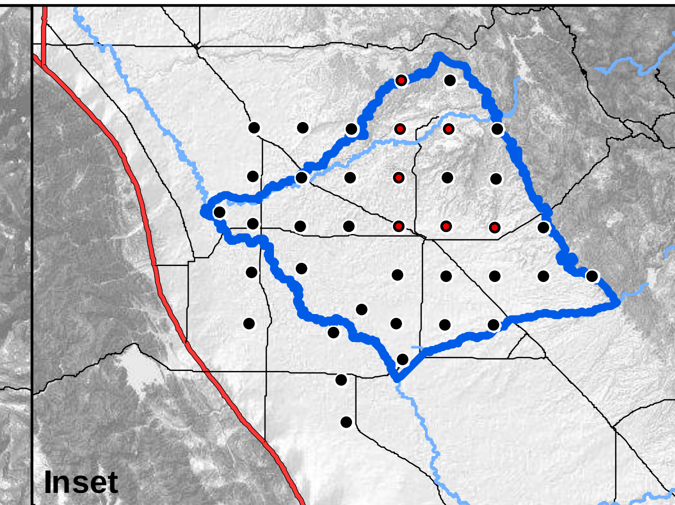
APPROXIMATE SCALE IN MILES

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

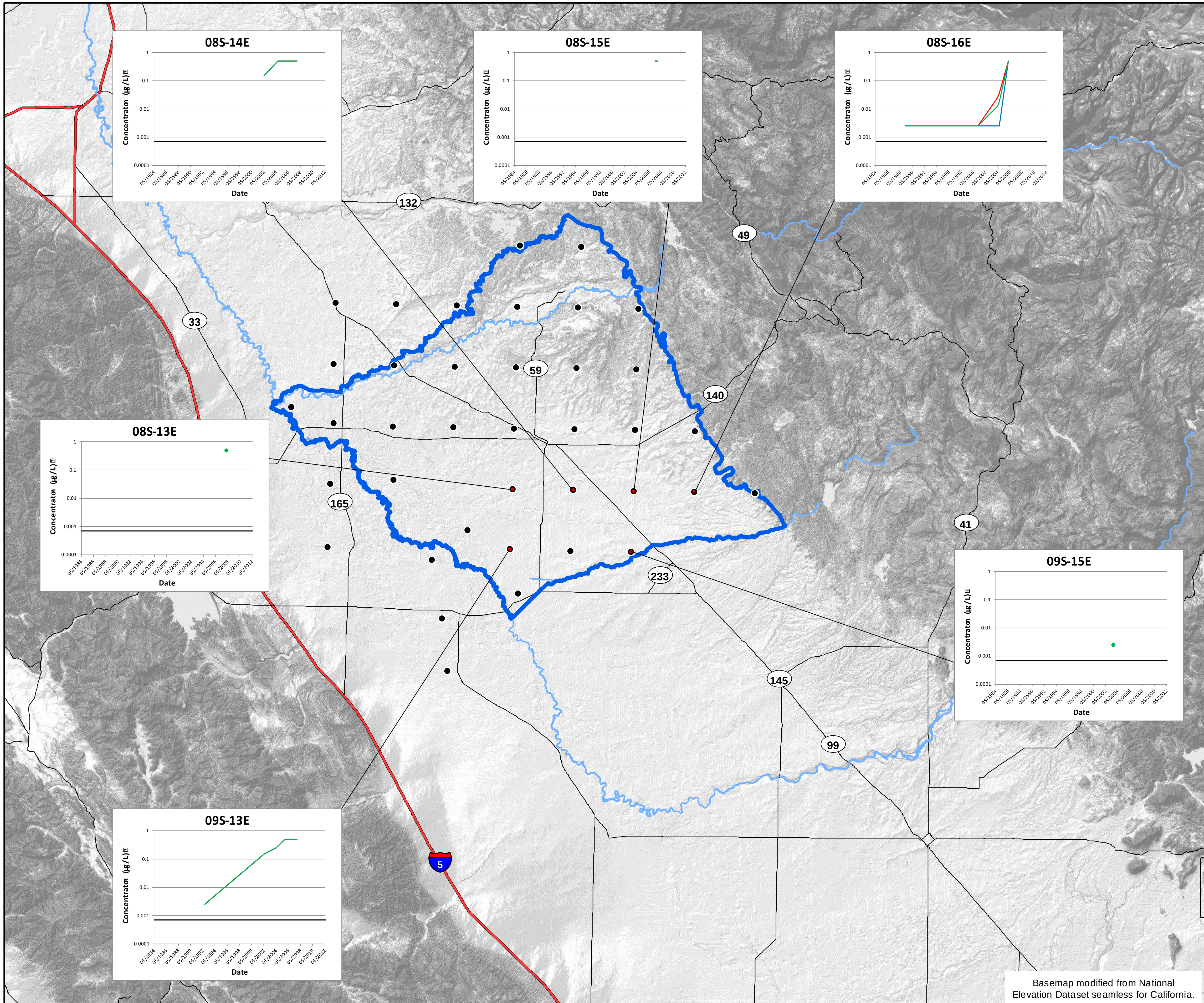
0 5 10

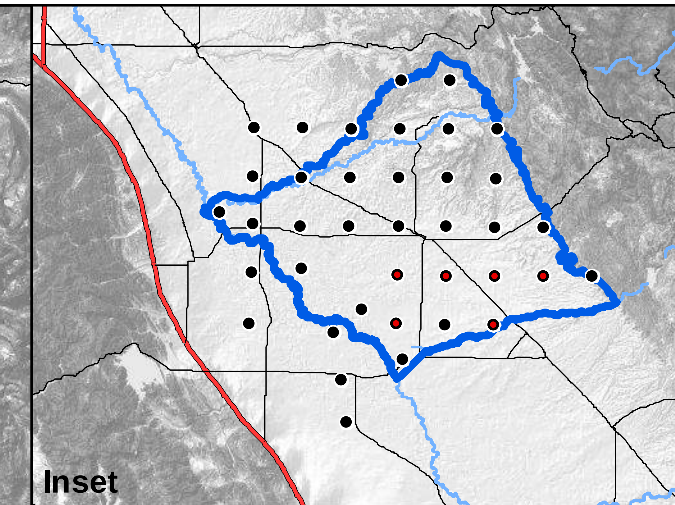
APPROXIMATE SCALE IN MILES

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

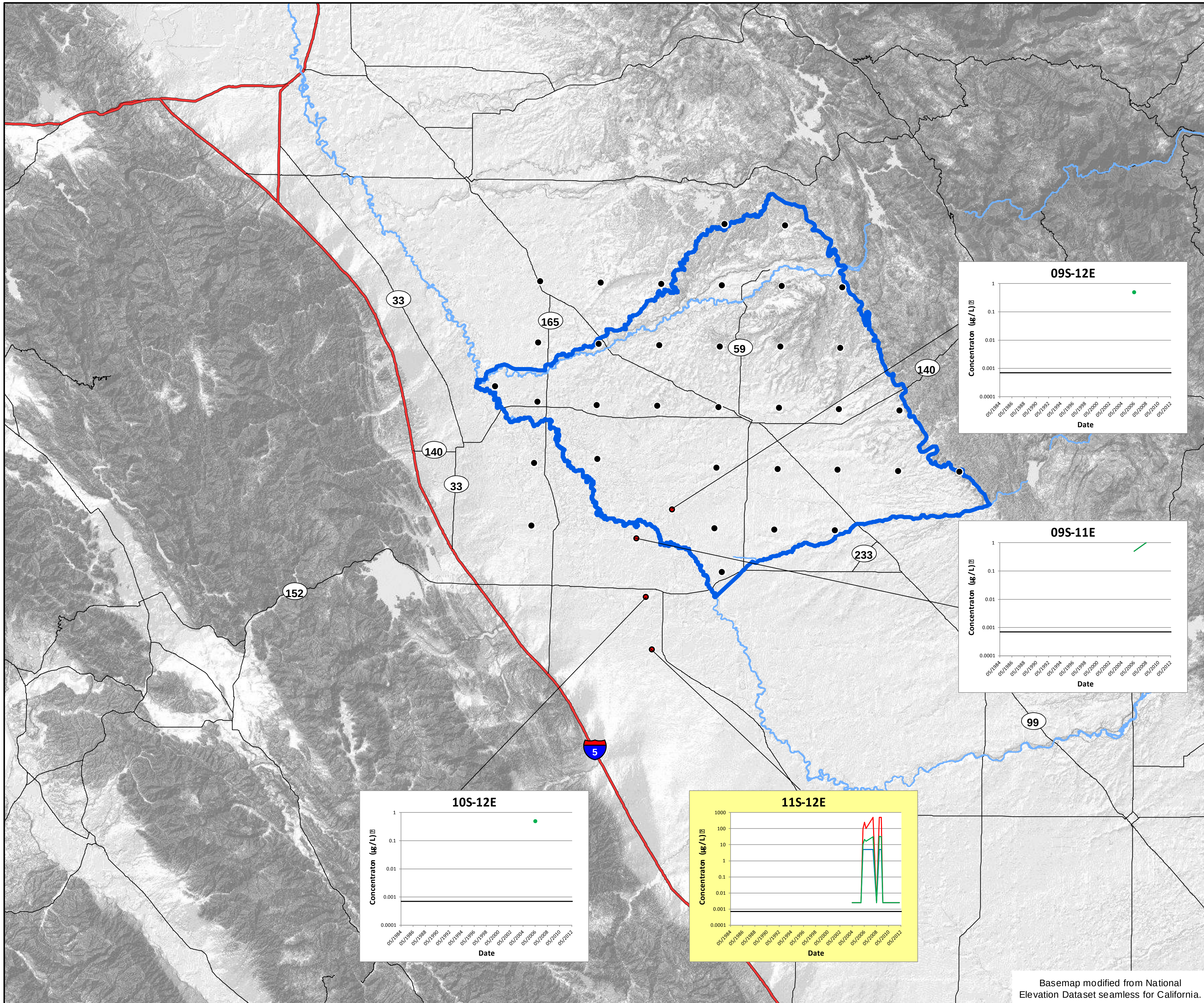
0 5 10

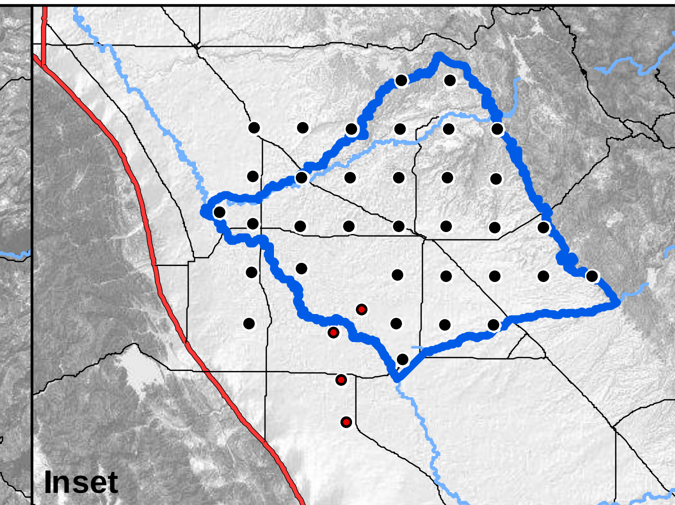
APPROXIMATE SCALE IN MILES

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





<u>Explanation</u>:

- Township/Range centroid
- Surface water feature
- Merced IRWM area

<u>Concentration Charts</u>:

- Minimum 123TCP concentration
- Mean 123TCP concentration
- Maximum 123TCP concentration
- PHG for 123TCP (0.0007 ug/L)

<u>Notes</u>:

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

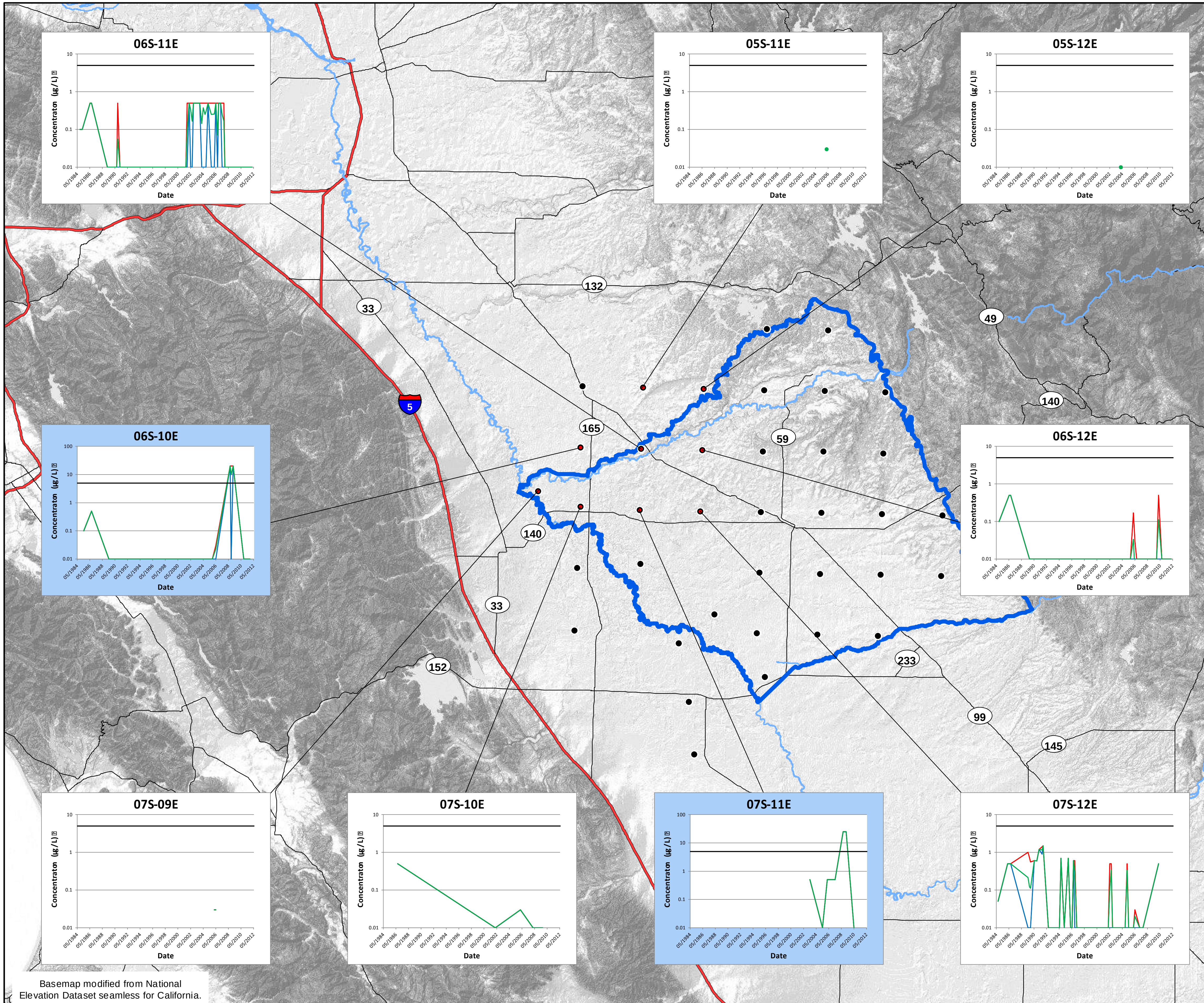
N

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



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:

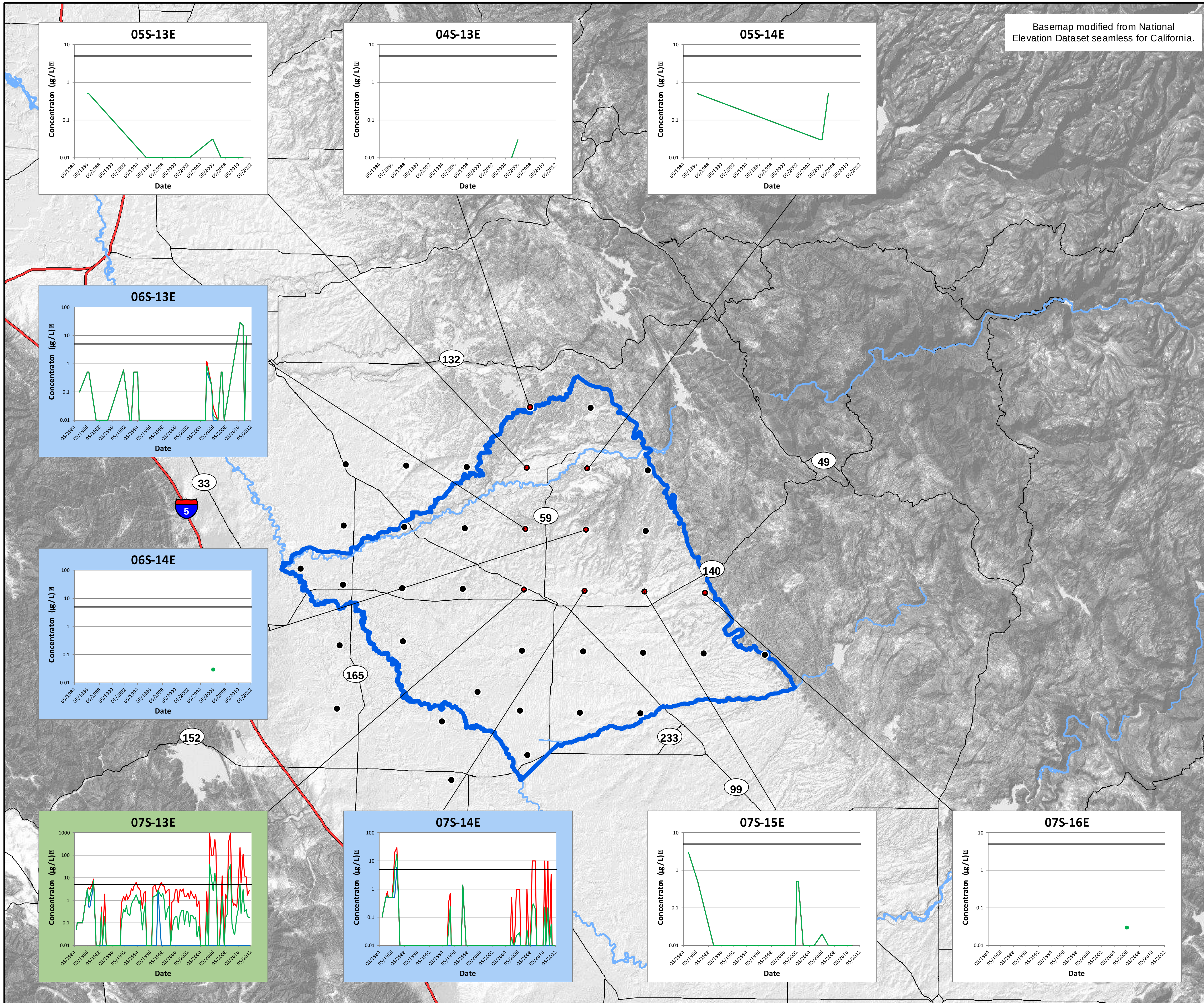
White: 0.01- 10 µg/L
Blue: 0.01- 100 µg/L

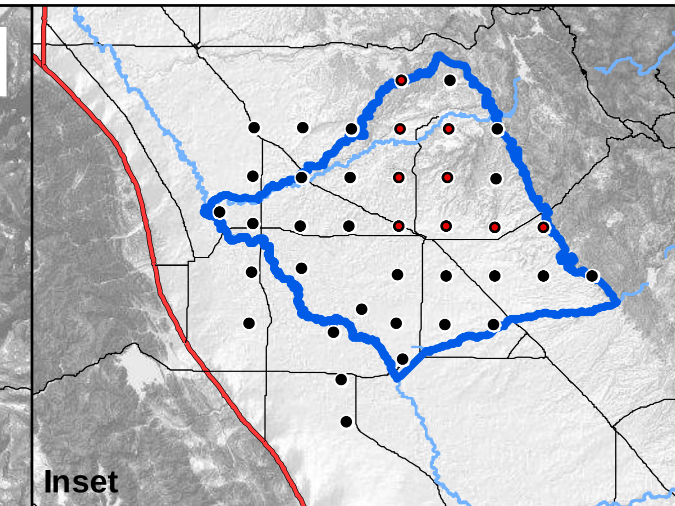
TETRACHLOROETHYLENE (PCE) CONCENTRATIONS 1984 THROUGH 2012
Merced IRWMP
Merced County, California

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

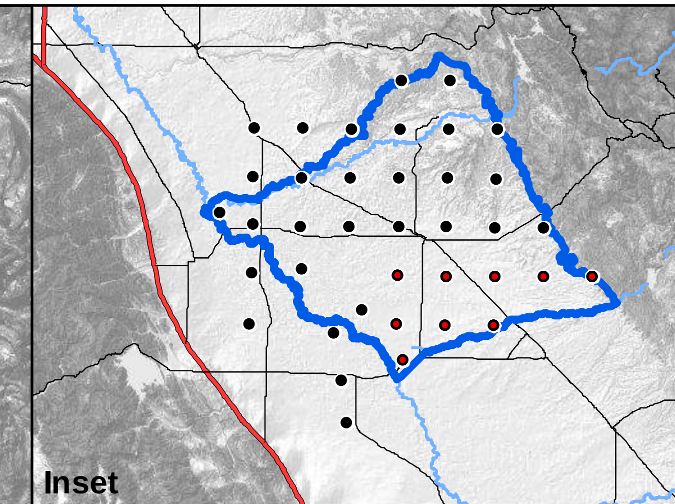
0 5 10

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

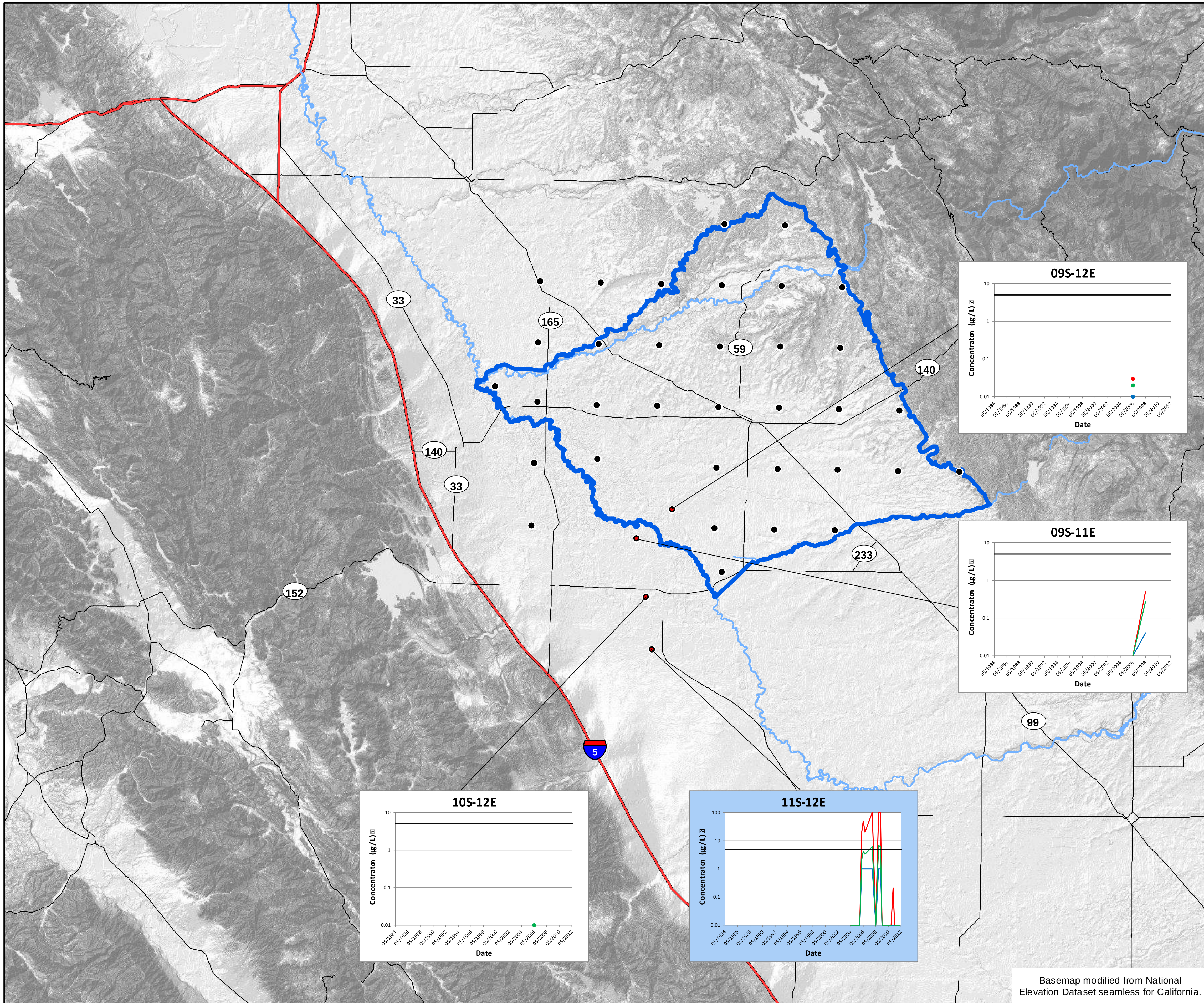
0 5 10

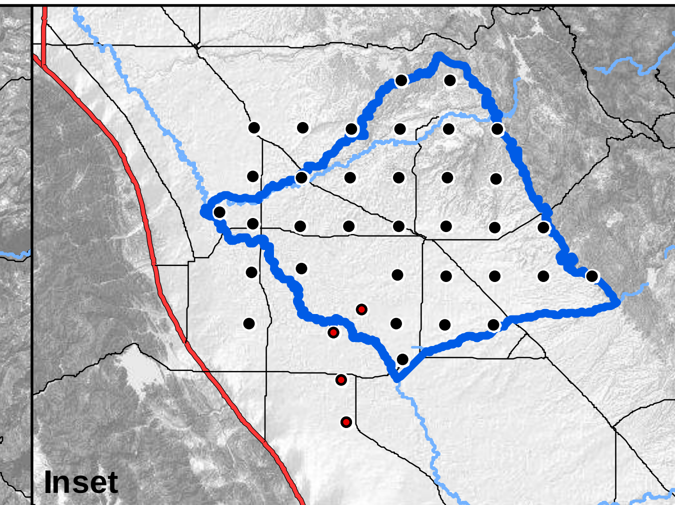
APPROXIMATE SCALE IN MILES

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

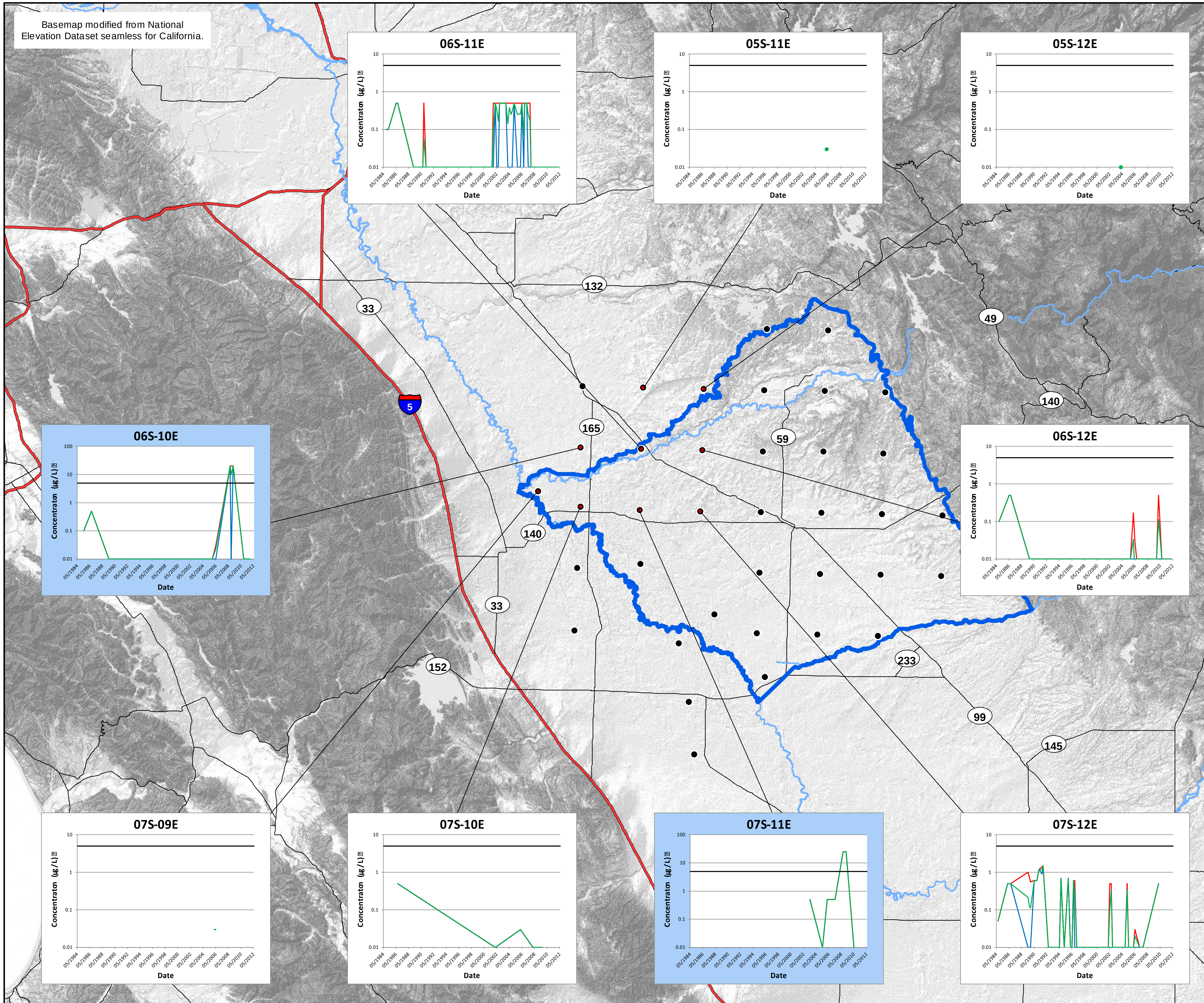
0 5 10

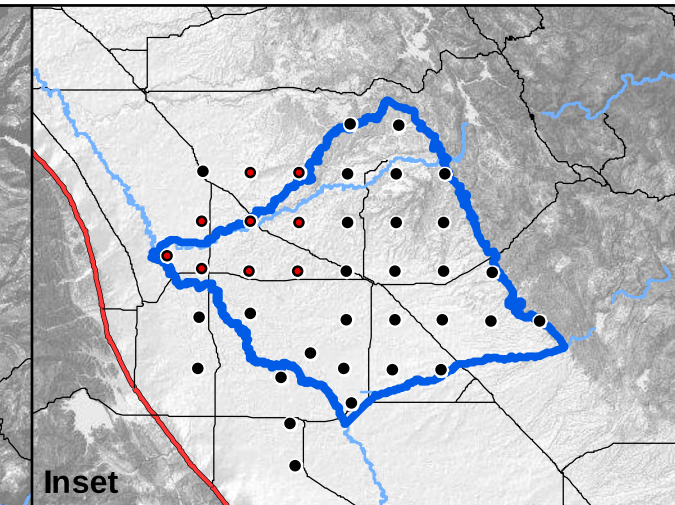
APPROXIMATE SCALE IN MILES

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





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

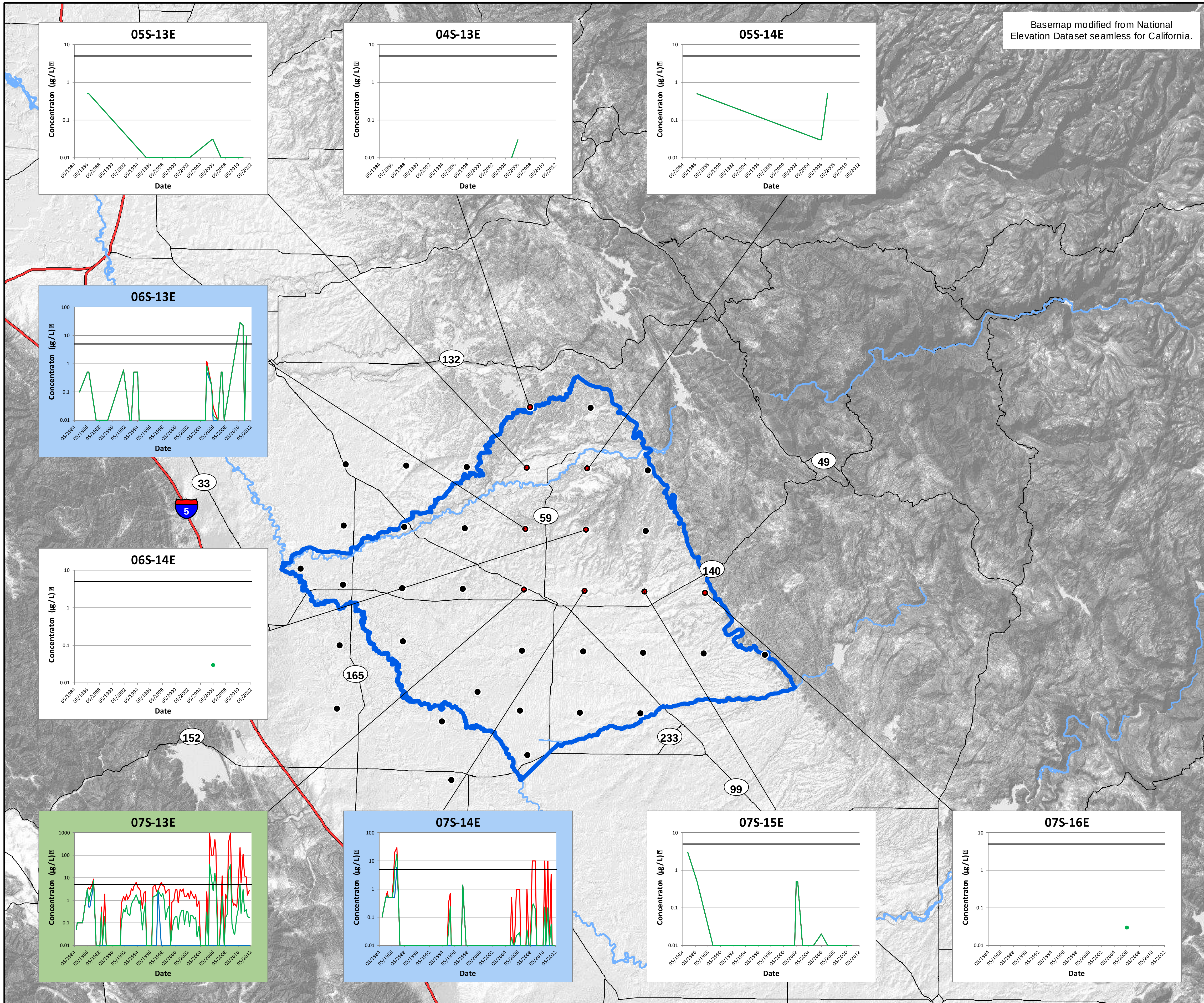
APPROXIMATE SCALE IN MILES

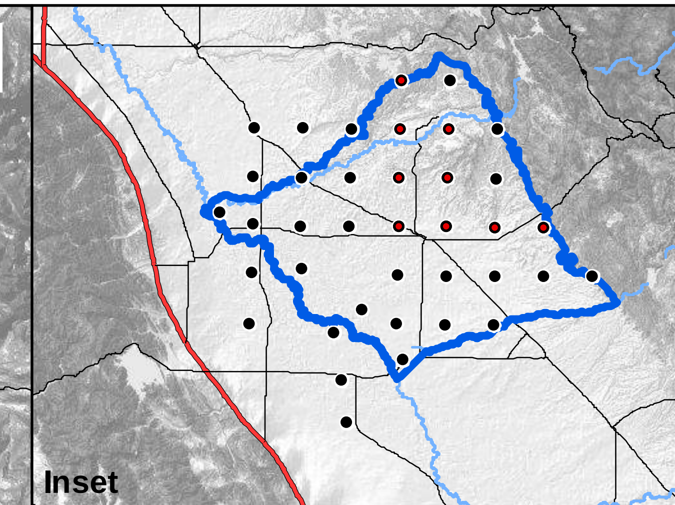
TRICHLOROETHYLENE (TCE)
CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A

Figure **16a**

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

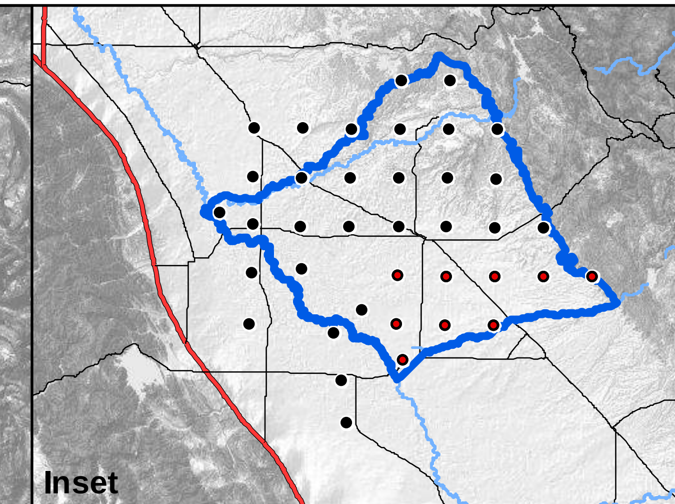
0 5 10

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

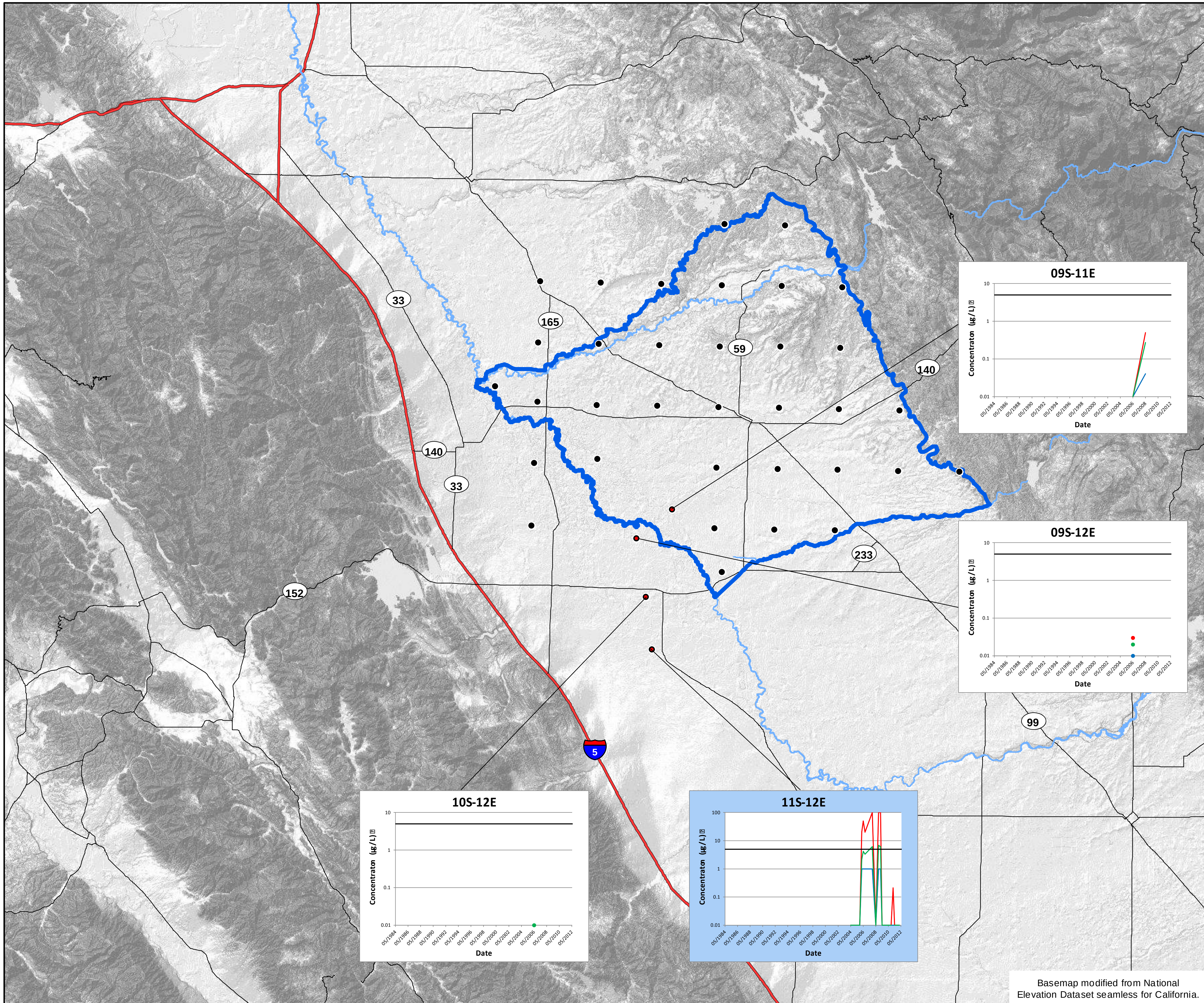
0 5 10

APPROXIMATE SCALE IN MILES

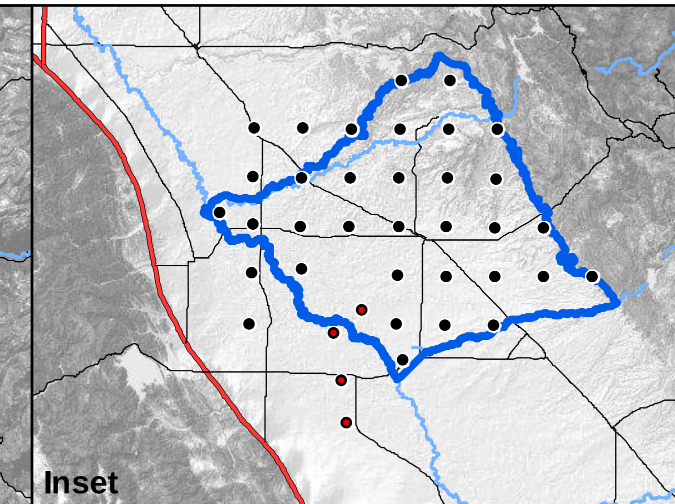
TRICHLOROETHYLENE (TCE)
CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 16c

N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig16c_TCE.mxd



Basemap modified from National Elevation Dataset seamless for California.



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

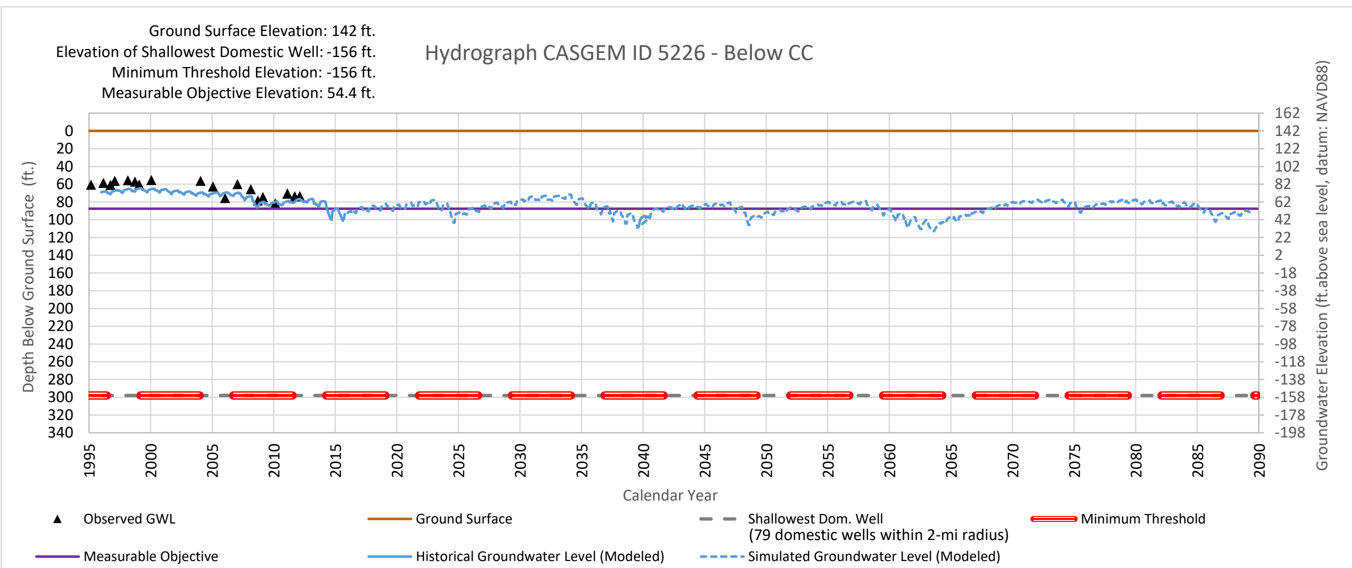
APPROXIMATE SCALE IN MILES

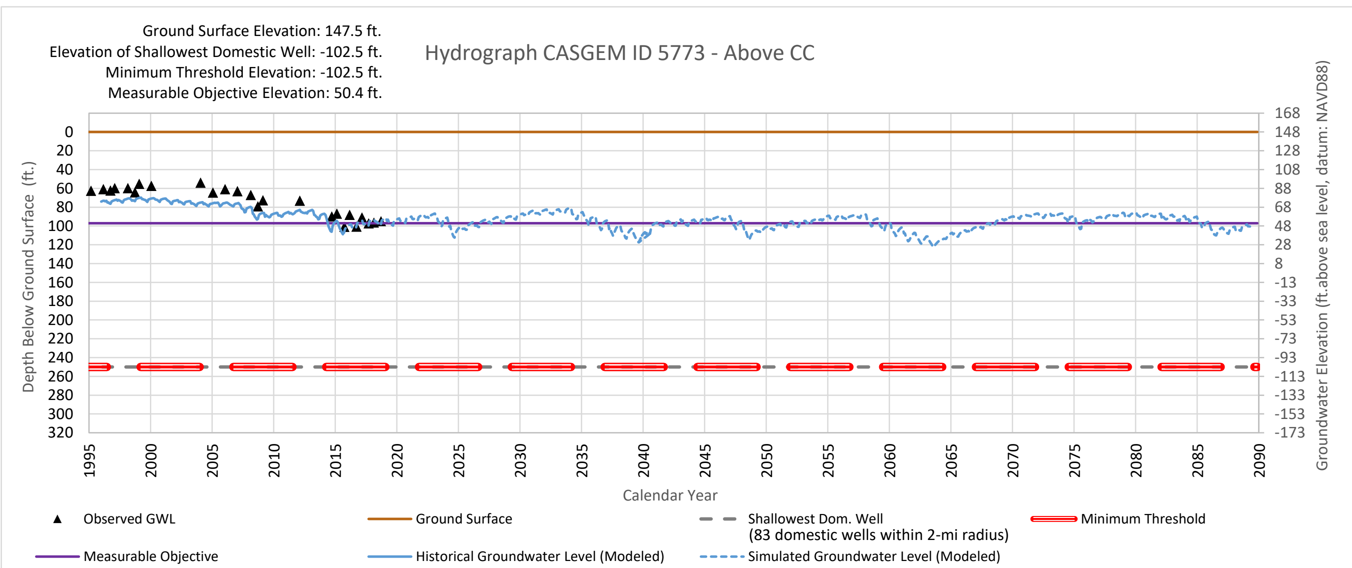
TRICHLOROETHYLENE (TCE)
CONCENTRATIONS
1984 THROUGH 2012
Merced IRWMP
Merced County, California

By: DB	Date: 01/08/2013	Project No. FR1216040A
		Figure 16d

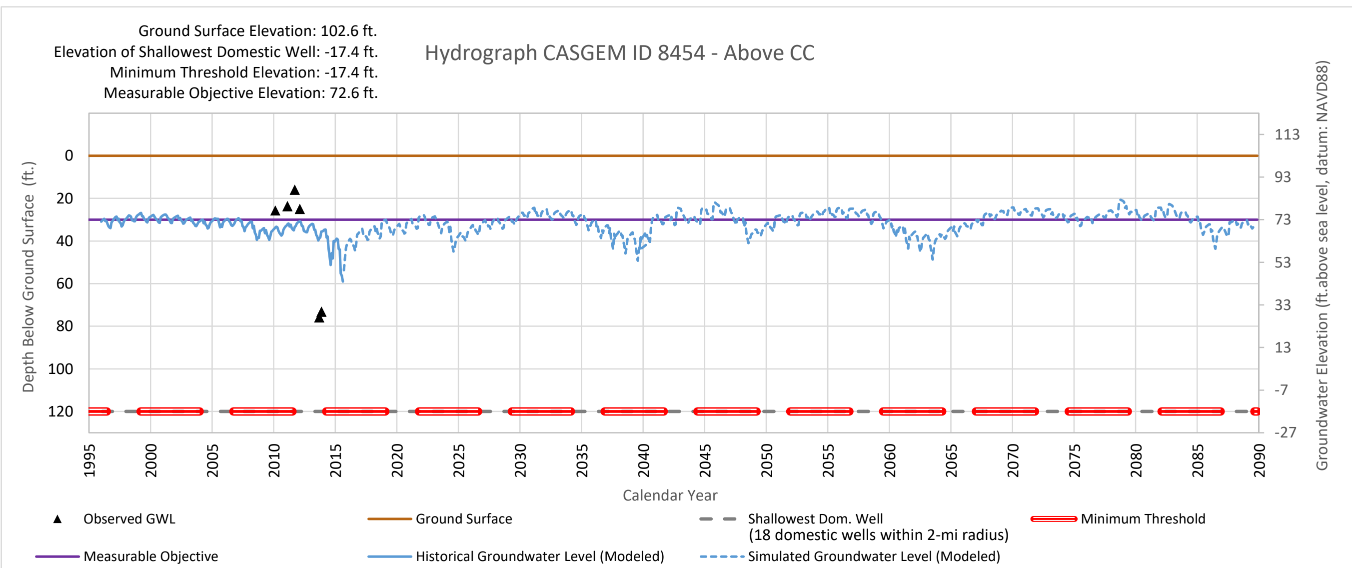
N:_FR_projects\FR12s\FR1216040A\gis\maps\2013_01\ConcentrationMaps_fig16d_TCE.mxd

APPENDIX F: SUSTAINABLE MANAGEMENT CRITERIA HYDROGRAPHS FOR DECLINING GROUNDWATER LEVELS

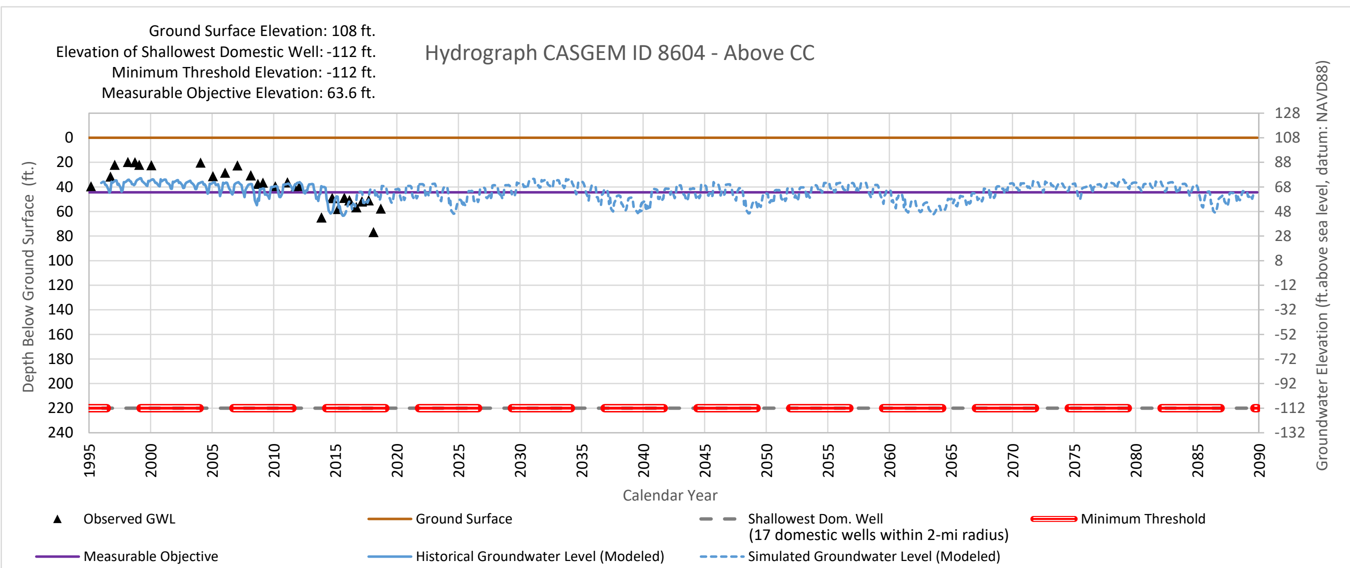

Ground Surface Elevation: 142 ft.
Elevation of Shallowest Domestic Well: -156 ft.
Minimum Threshold Elevation: -156 ft.
Measurable Objective Elevation: 54.4 ft.
Hydrograph CASGEM ID 5226 - Below CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
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)



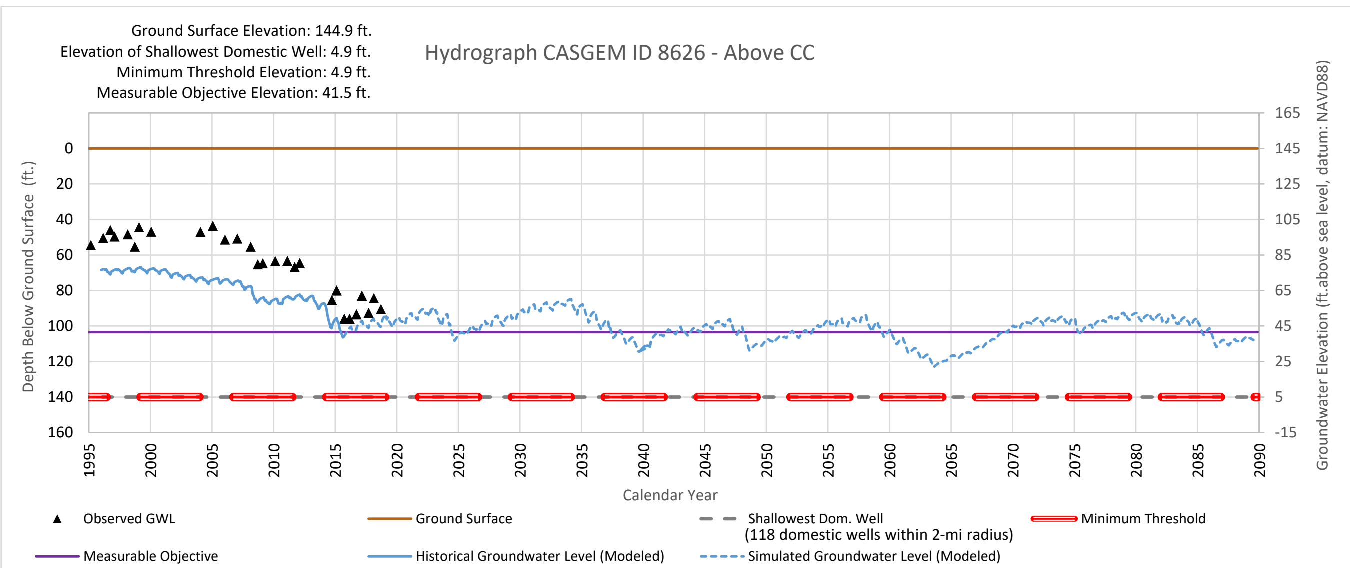
Ground Surface Elevation: 147.5 ft.
Elevation of Shallowest Domestic Well: -102.5 ft.
Minimum Threshold Elevation: -102.5 ft.
Measurable Objective Elevation: 50.4 ft.
Hydrograph CASGEM ID 5773 - Above CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar 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)



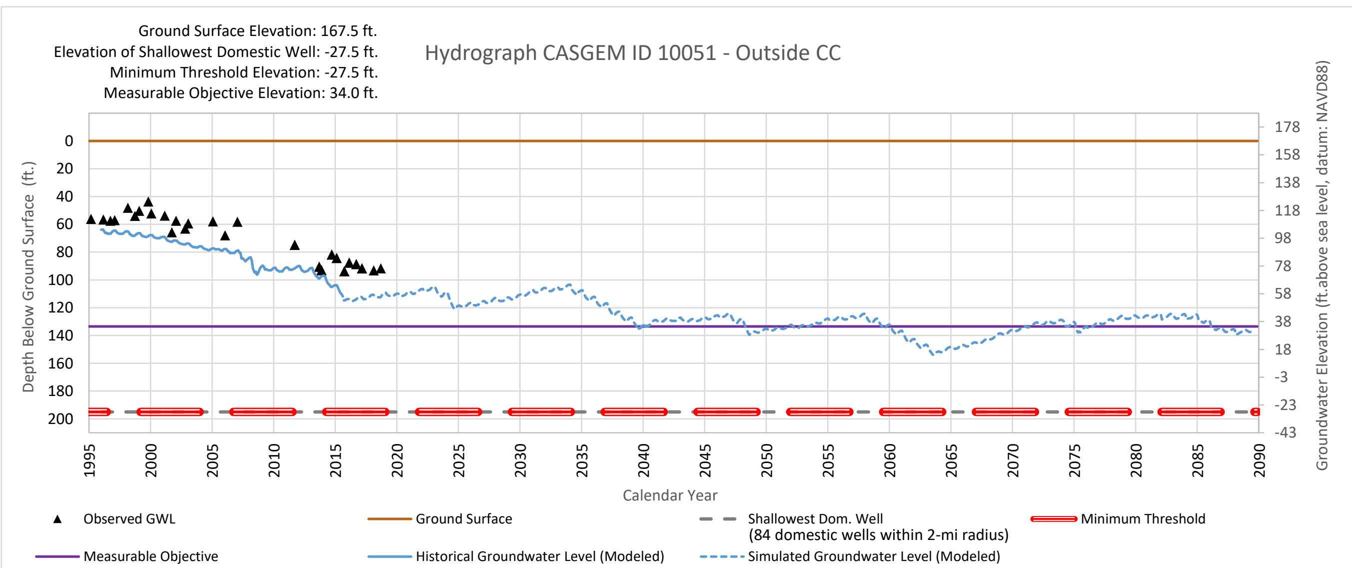
Ground Surface Elevation: 102.6 ft.
Elevation of Shallowest Domestic Well: -17.4 ft.
Minimum Threshold Elevation: -17.4 ft.
Measurable Objective Elevation: 72.6 ft.
Hydrograph CASGEM ID 8454 - Above CC
Depth Below Ground Surface (ft.)
0
20
40
60
80
100
120
113
93
73
53
33
13
-7
-27
Groundwater Elevation (ft.above sea level, datum: NAVD88)
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)



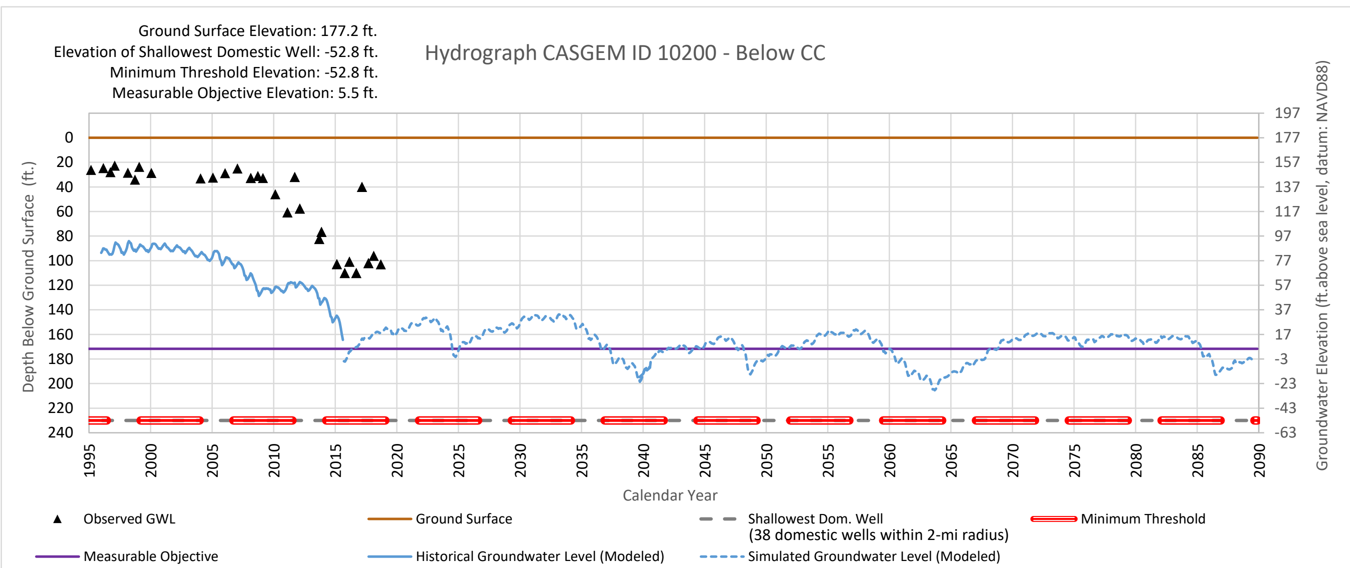
Ground Surface Elevation: 108 ft.
Elevation of Shallowest Domestic Well: -112 ft.
Minimum Threshold Elevation: -112 ft.
Measurable Objective Elevation: 63.6 ft.
Hydrograph CASGEM ID 8604 - Above CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
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)



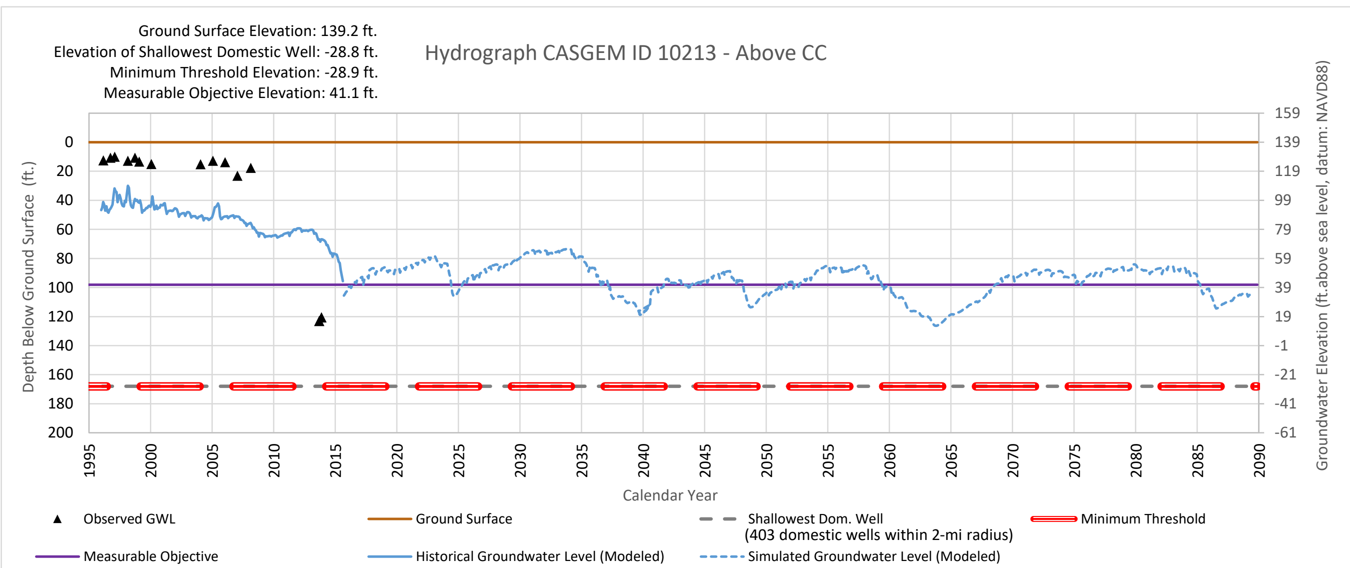
Ground Surface Elevation: 144.9 ft.
Elevation of Shallowest Domestic Well: 4.9 ft.
Minimum Threshold Elevation: 4.9 ft.
Measurable Objective Elevation: 41.5 ft.
Hydrograph CASGEM ID 8626 - Above CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
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)



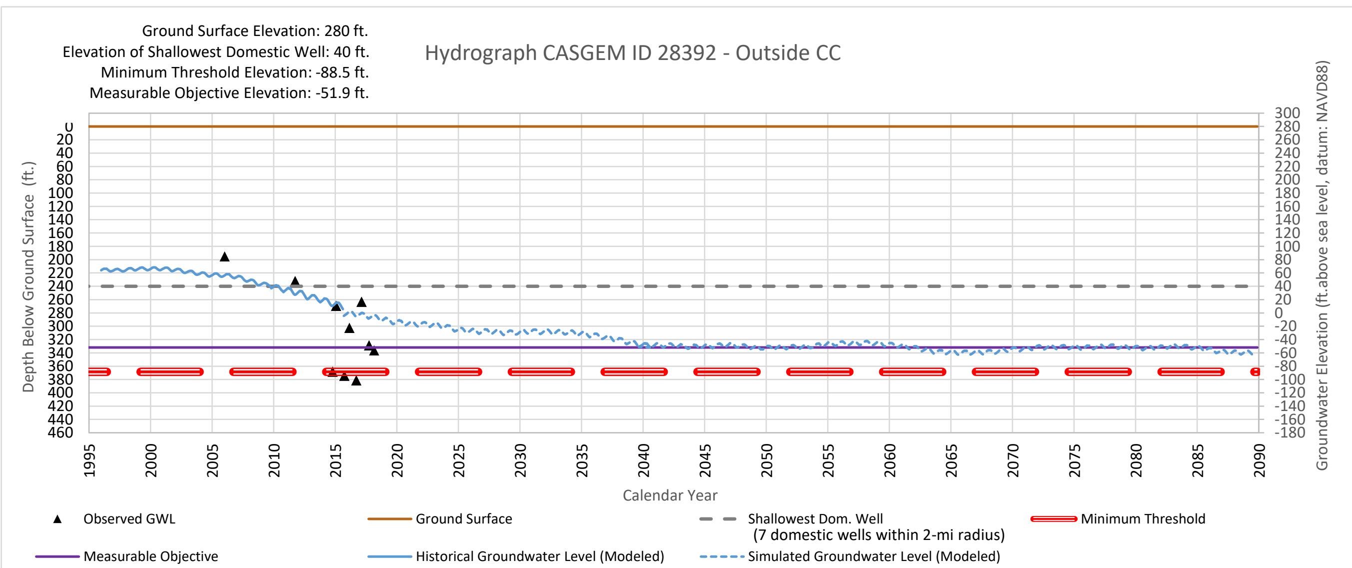
Ground Surface Elevation: 167.5 ft.
Elevation of Shallowest Domestic Well: -27.5 ft.
Minimum Threshold Elevation: -27.5 ft.
Measurable Objective Elevation: 34.0 ft.
Hydrograph CASGEM ID 10051 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar 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)



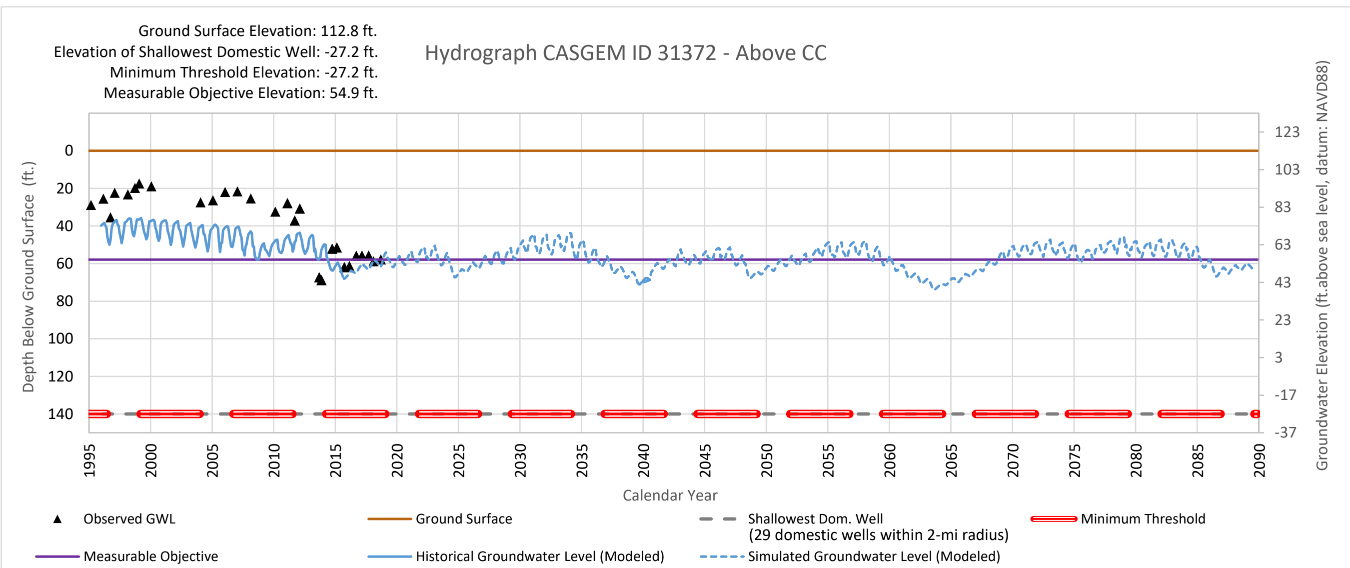
Ground Surface Elevation: 177.2 ft.
Elevation of Shallowest Domestic Well: -52.8 ft.
Minimum Threshold Elevation: -52.8 ft.
Measurable Objective Elevation: 5.5 ft.
Hydrograph CASGEM ID 10200 - Below CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar 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)

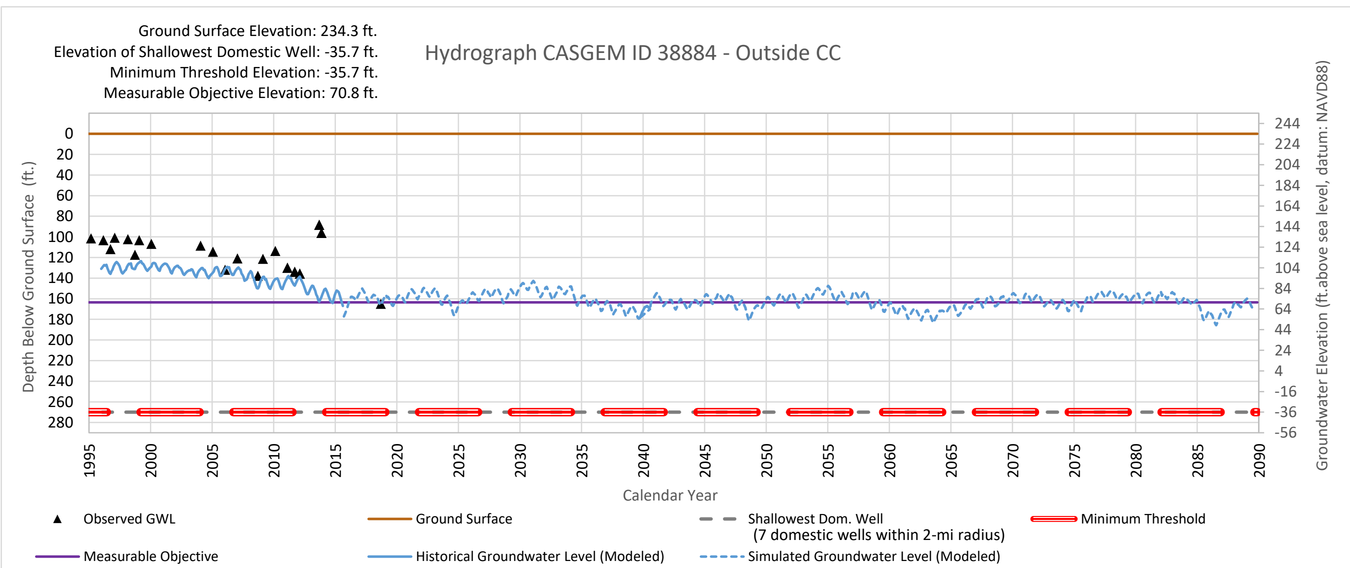


Ground Surface Elevation: 139.2 ft.
Elevation of Shallowest Domestic Well: -28.8 ft.
Minimum Threshold Elevation: -28.9 ft.
Measurable Objective Elevation: 41.1 ft.
Hydrograph CASGEM ID 10213 - Above CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
0
20
40
60
80
100
120
140
160
180
200
159
139
119
99
79
59
39
19
-1
-21
-41
-61
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
(403 domestic wells within 2-mi radius)
Minimum Threshold
Measurable Objective
Historical Groundwater Level (Modeled)
Simulated Groundwater Level (Modeled)

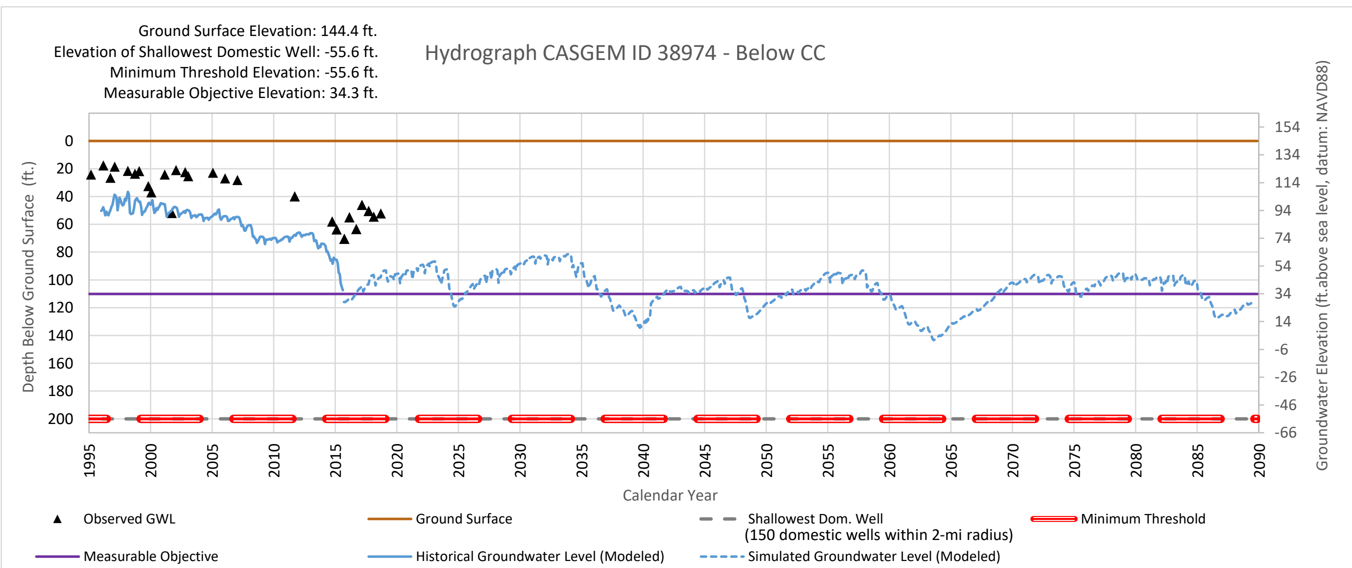


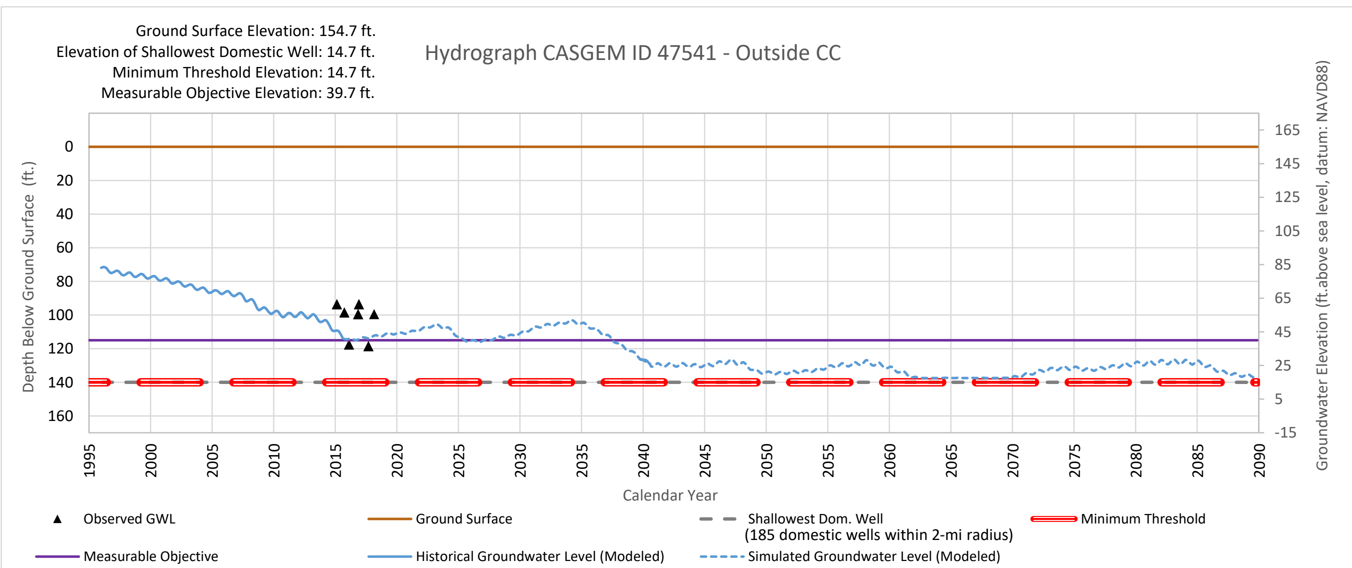
Ground Surface Elevation: 280 ft.
Elevation of Shallowest Domestic Well: 40 ft.
Minimum Threshold Elevation: -88.5 ft.
Measurable Objective Elevation: -51.9 ft.
Hydrograph CASGEM ID 28392 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar 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)


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)
0
20
40
60
80
100
120
140
123
103
83
63
43
23
3
-17
-37
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
(29 domestic wells within 2-mi radius)
Minimum Threshold
Measurable Objective
Historical Groundwater Level (Modeled)
Simulated Groundwater Level (Modeled)

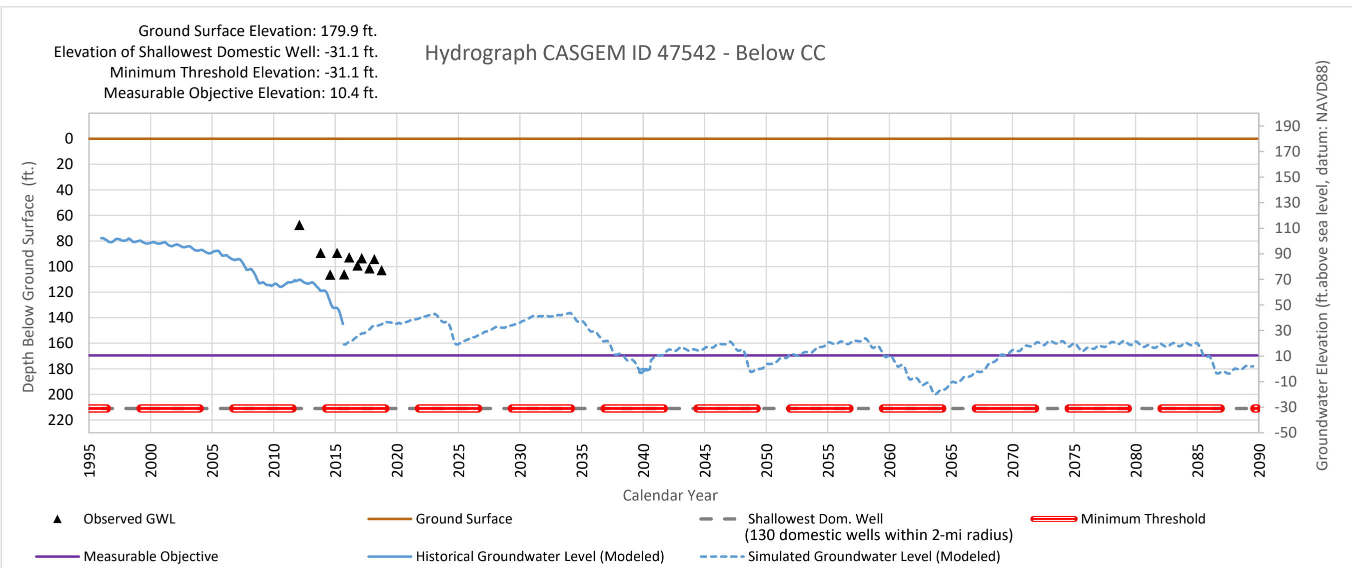


Ground Surface Elevation: 234.3 ft.
Elevation of Shallowest Domestic Well: -35.7 ft.
Minimum Threshold Elevation: -35.7 ft.
Measurable Objective Elevation: 70.8 ft.
Hydrograph CASGEM ID 38884 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar 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)

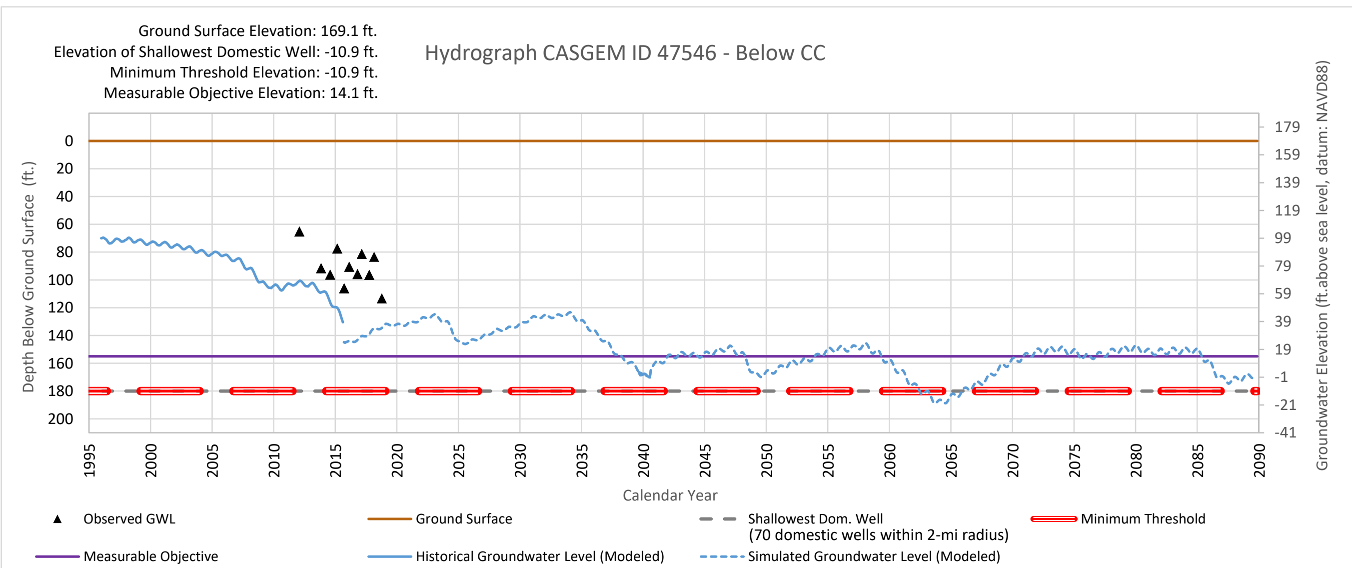

Ground Surface Elevation: 144.4 ft.
Elevation of Shallowest Domestic Well: -55.6 ft.
Minimum Threshold Elevation: -55.6 ft.
Measurable Objective Elevation: 34.3 ft.
Hydrograph CASGEM ID 38974 - Below CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar 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)

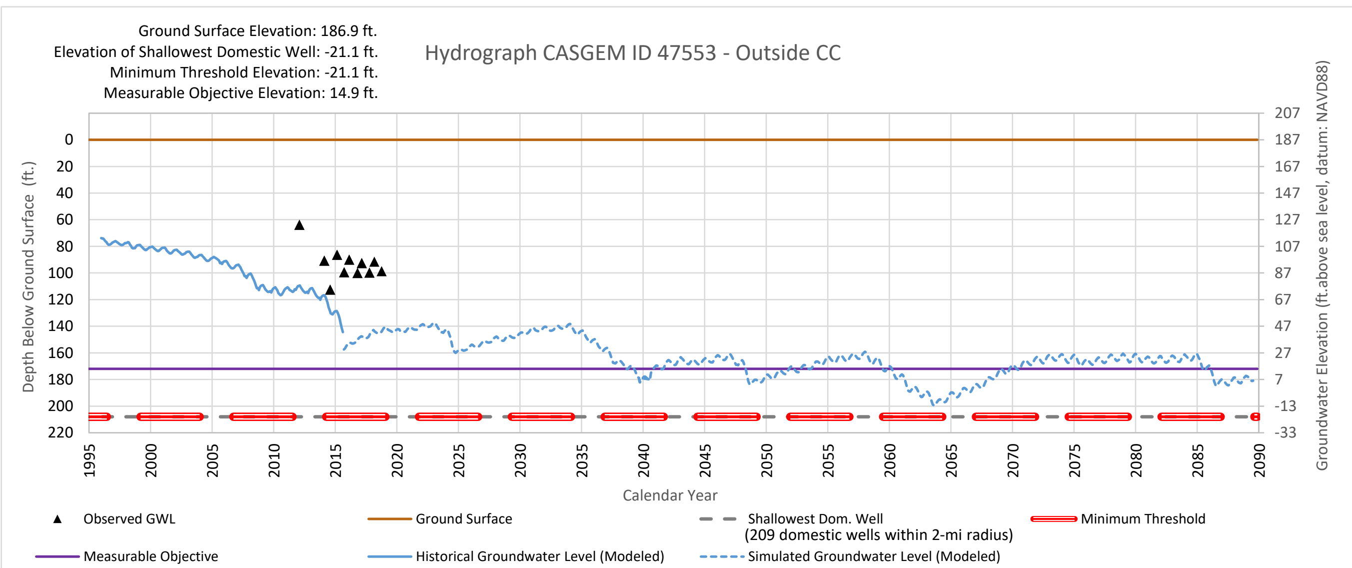


Ground Surface Elevation: 154.7 ft.
Elevation of Shallowest Domestic Well: 14.7 ft.
Minimum Threshold Elevation: 14.7 ft.
Measurable Objective Elevation: 39.7 ft.
Hydrograph CASGEM ID 47541 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar 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)

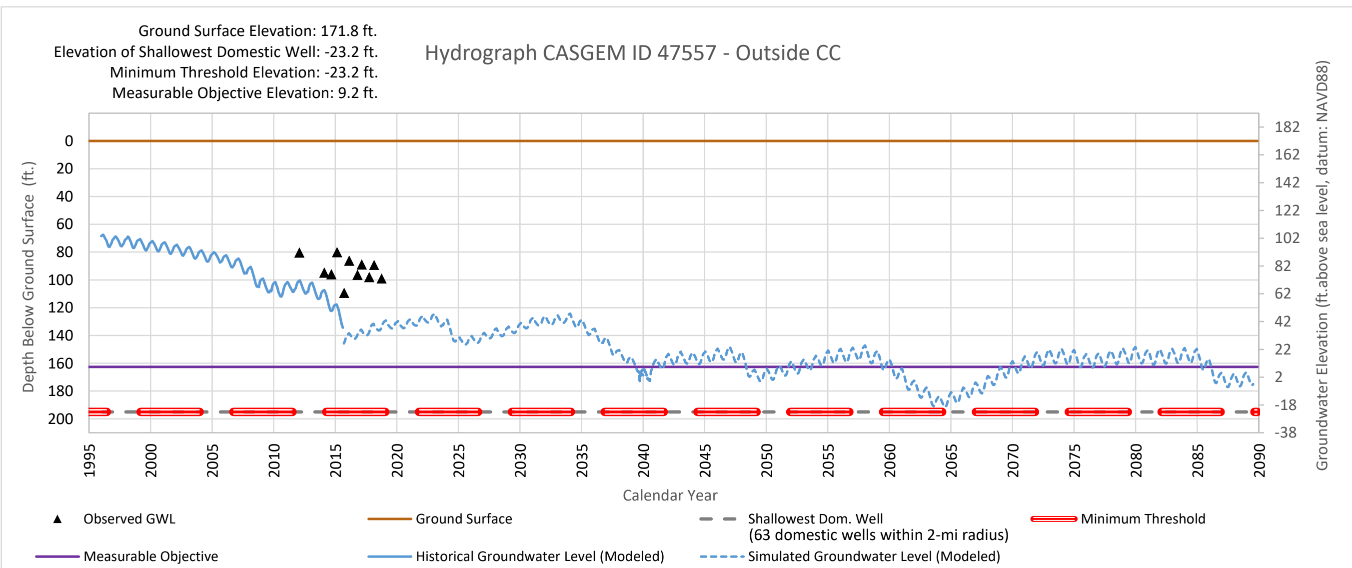


Ground Surface Elevation: 179.9 ft.
Elevation of Shallowest Domestic Well: -31.1 ft.
Minimum Threshold Elevation: -31.1 ft.
Measurable Objective Elevation: 10.4 ft.
Hydrograph CASGEM ID 47542 - Below CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar 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)

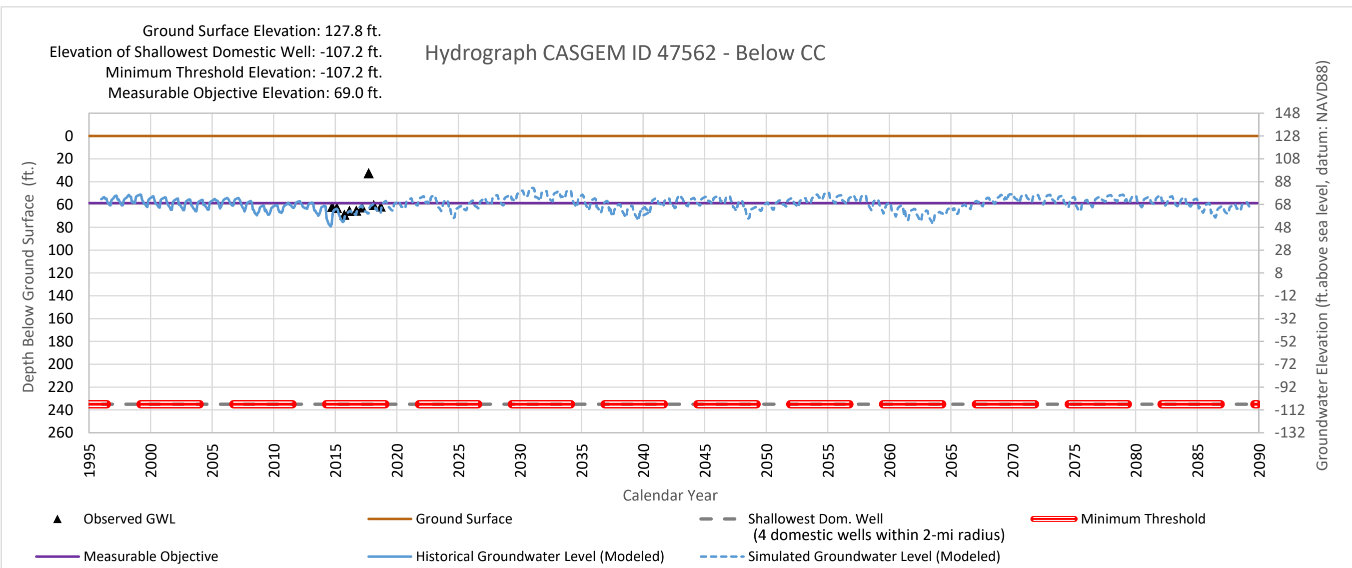

Ground Surface Elevation: 169.1 ft.
Elevation of Shallowest Domestic Well: -10.9 ft.
Minimum Threshold Elevation: -10.9 ft.
Measurable Objective Elevation: 14.1 ft.
Hydrograph CASGEM ID 47546 - Below CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
0
20
40
60
80
100
120
140
160
180
200
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
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)



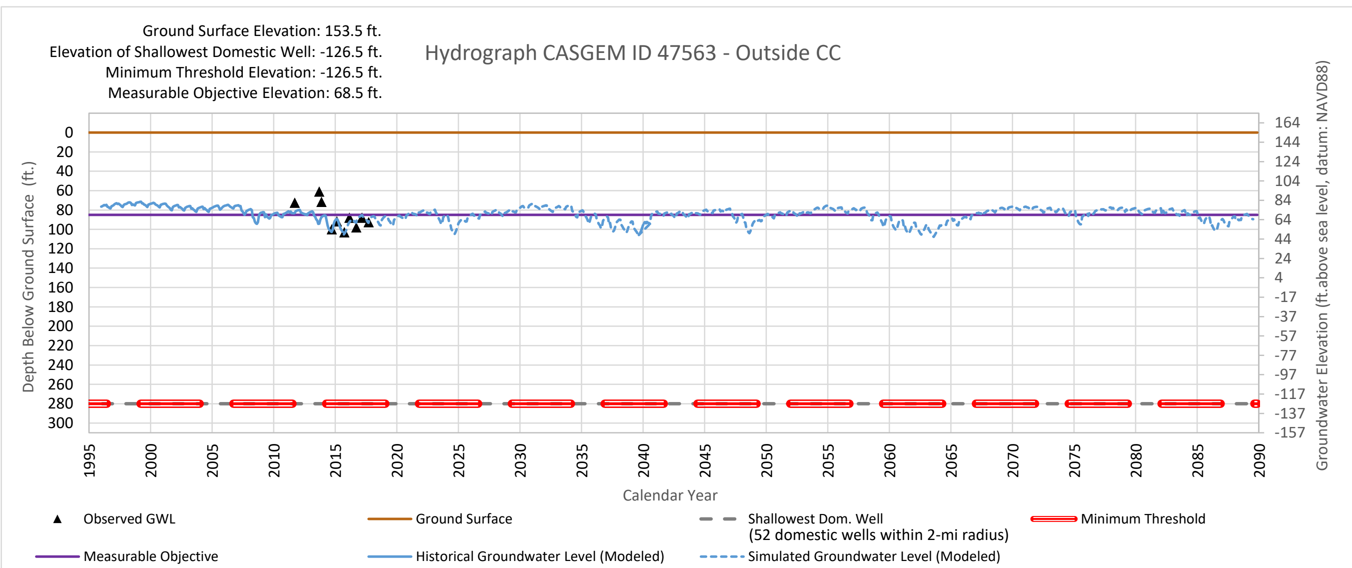
Ground Surface Elevation: 186.9 ft.
Elevation of Shallowest Domestic Well: -21.1 ft.
Minimum Threshold Elevation: -21.1 ft.
Measurable Objective Elevation: 14.9 ft.
Hydrograph CASGEM ID 47553 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar 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)



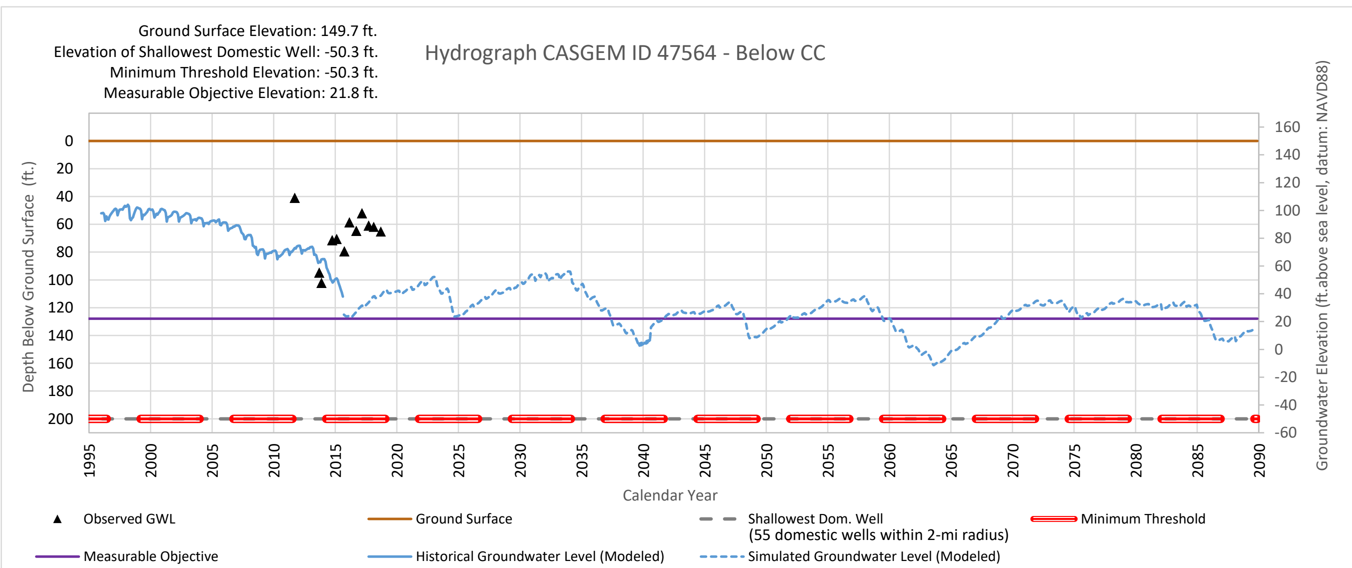
Ground Surface Elevation: 171.8 ft.
Elevation of Shallowest Domestic Well: -23.2 ft.
Minimum Threshold Elevation: -23.2 ft.
Measurable Objective Elevation: 9.2 ft.
Hydrograph CASGEM ID 47557 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar 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)



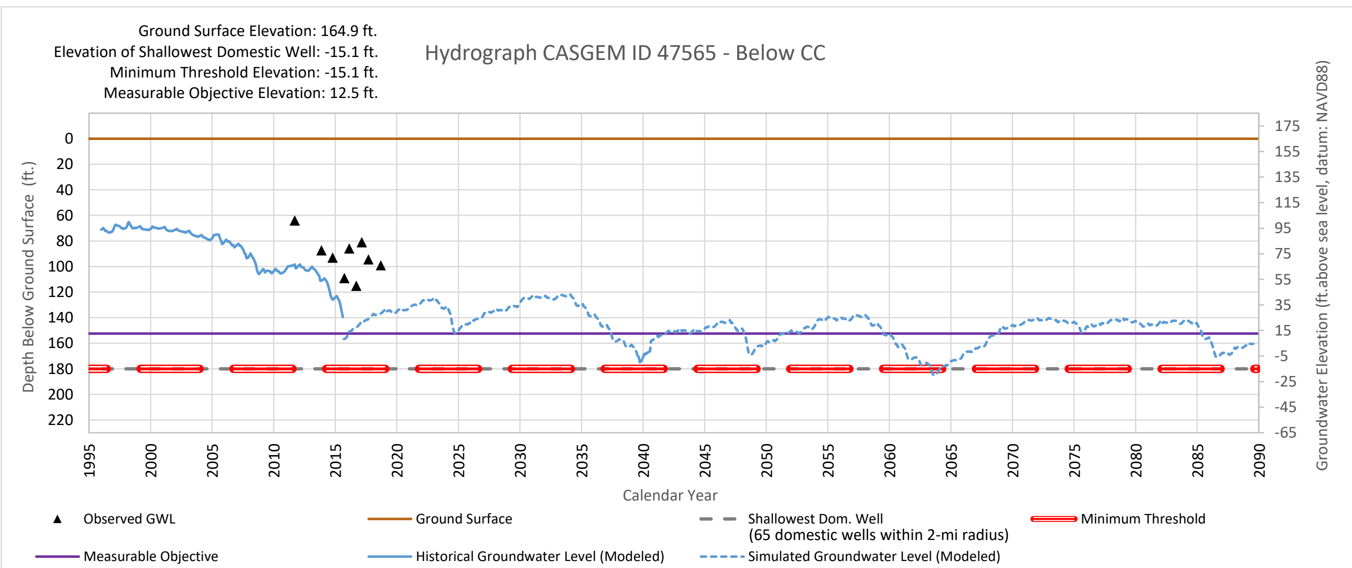
Ground Surface Elevation: 127.8 ft.
Elevation of Shallowest Domestic Well: -107.2 ft.
Minimum Threshold Elevation: -107.2 ft.
Measurable Objective Elevation: 69.0 ft.
Hydrograph CASGEM ID 47562 - Below CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar 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)



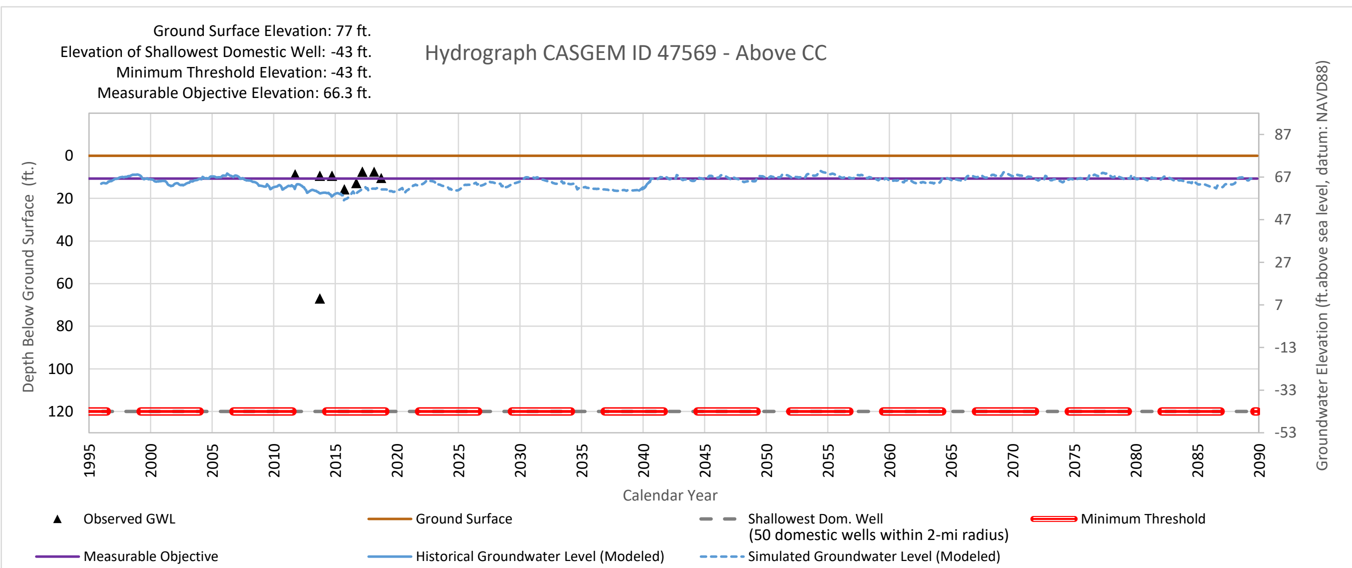
Ground Surface Elevation: 153.5 ft.
Elevation of Shallowest Domestic Well: -126.5 ft.
Minimum Threshold Elevation: -126.5 ft.
Measurable Objective Elevation: 68.5 ft.
Hydrograph CASGEM ID 47563 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar 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)



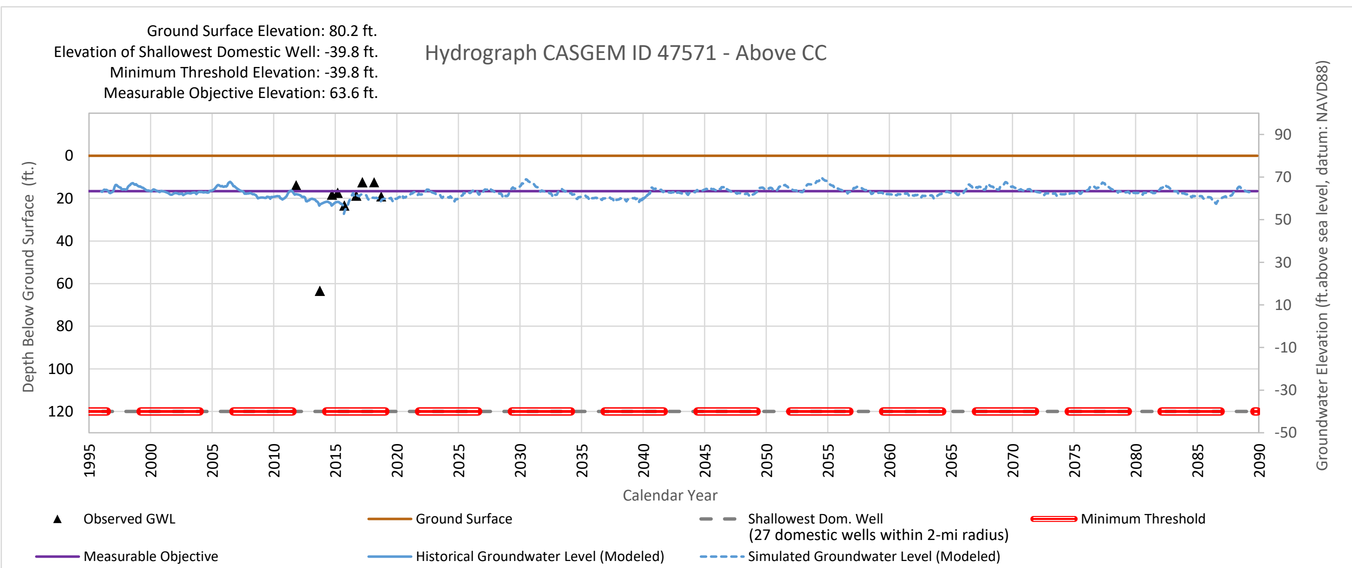
Ground Surface Elevation: 149.7 ft.
Elevation of Shallowest Domestic Well: -50.3 ft.
Minimum Threshold Elevation: -50.3 ft.
Measurable Objective Elevation: 21.8 ft.
Hydrograph CASGEM ID 47564 - Below CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar 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)



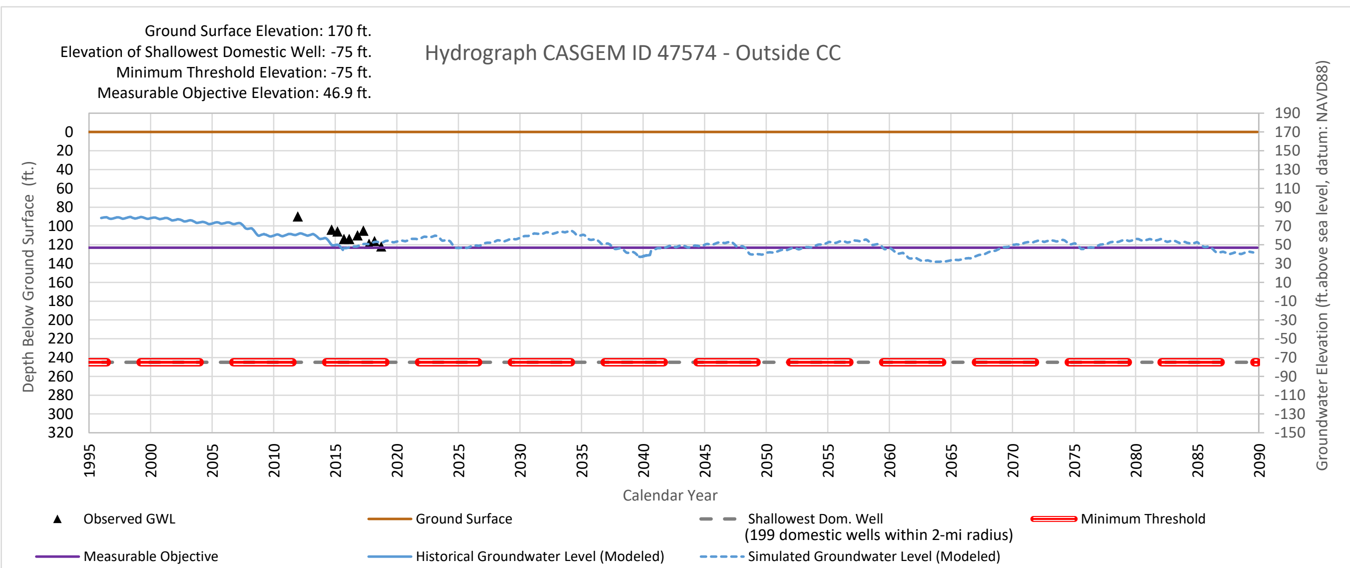
Ground Surface Elevation: 164.9 ft.
Elevation of Shallowest Domestic Well: -15.1 ft.
Minimum Threshold Elevation: -15.1 ft.
Measurable Objective Elevation: 12.5 ft.
Hydrograph CASGEM ID 47565 - Below CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar 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)



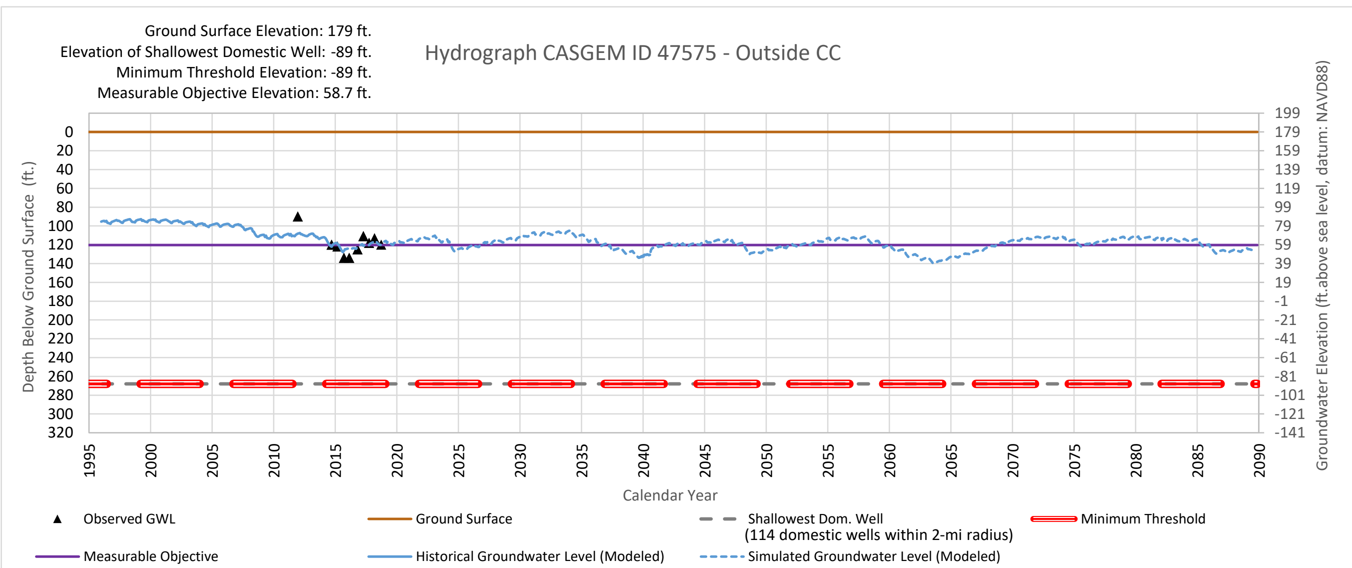
Ground Surface Elevation: 77 ft.
Elevation of Shallowest Domestic Well: -43 ft.
Minimum Threshold Elevation: -43 ft.
Measurable Objective Elevation: 66.3 ft.
Hydrograph CASGEM ID 47569 - Above CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
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)



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)



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)


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)

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. <u>Recitals Incorporated</u>. The recitals set forth above are hereby incorporated into this Agreement as a statement of the intent and purposes of this Agreement.

2. <u>General Information</u>. 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	COUNTY OF MADERA
By: 7-13-18	
Michael R. Linden, Deputy County Counsel	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 3 1 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: [signature]

Name: HICHAM ELTAL

Title: CHAIR

TRIANGLE T WATER DISTRICT GSA

By: ______________________

Name: Mark Hutson

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
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: ______________________
Chair

Date: 1/16/19

TURNER ISLAND WATER DISTRICT

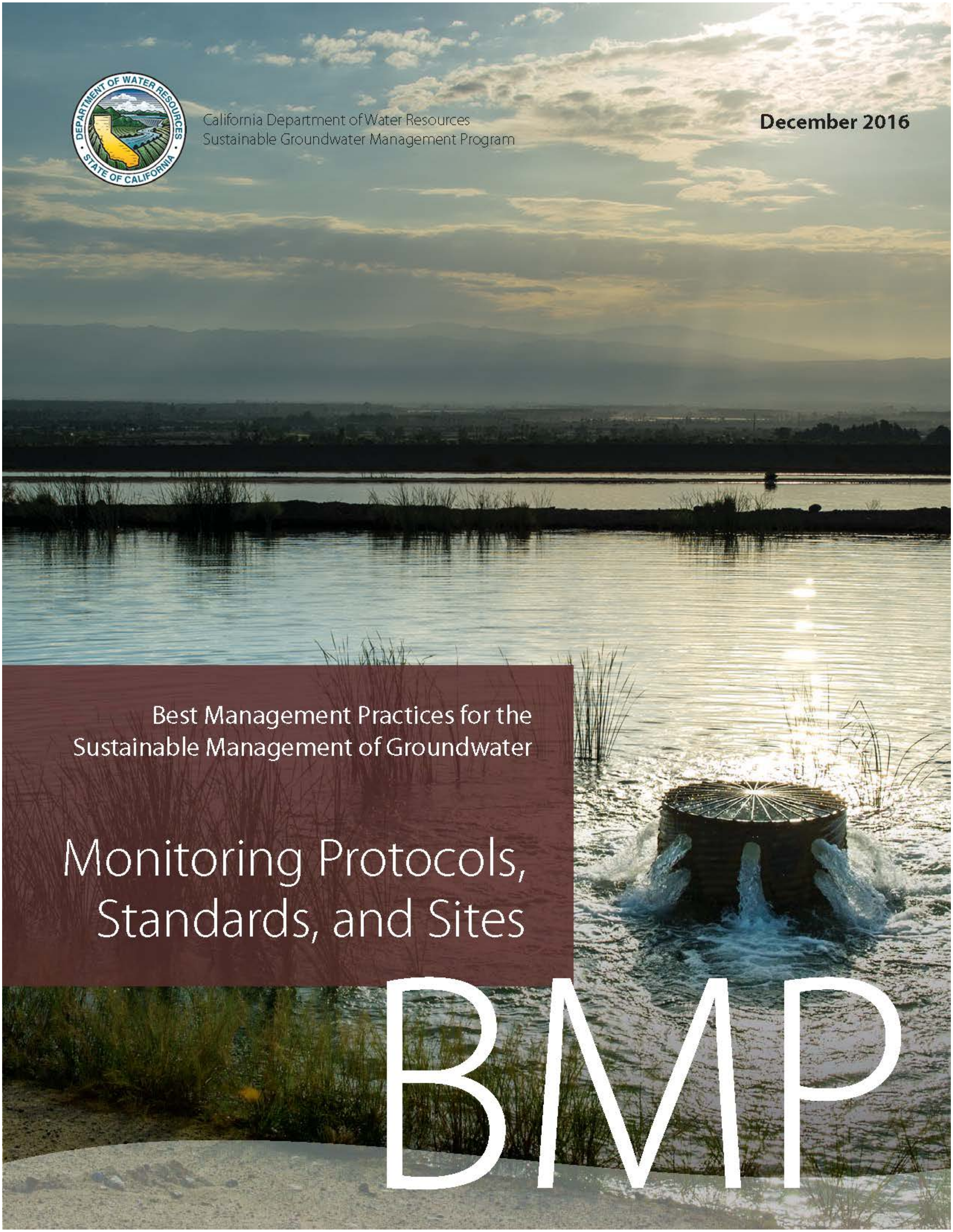
By: ______________________
Chair

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

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**.

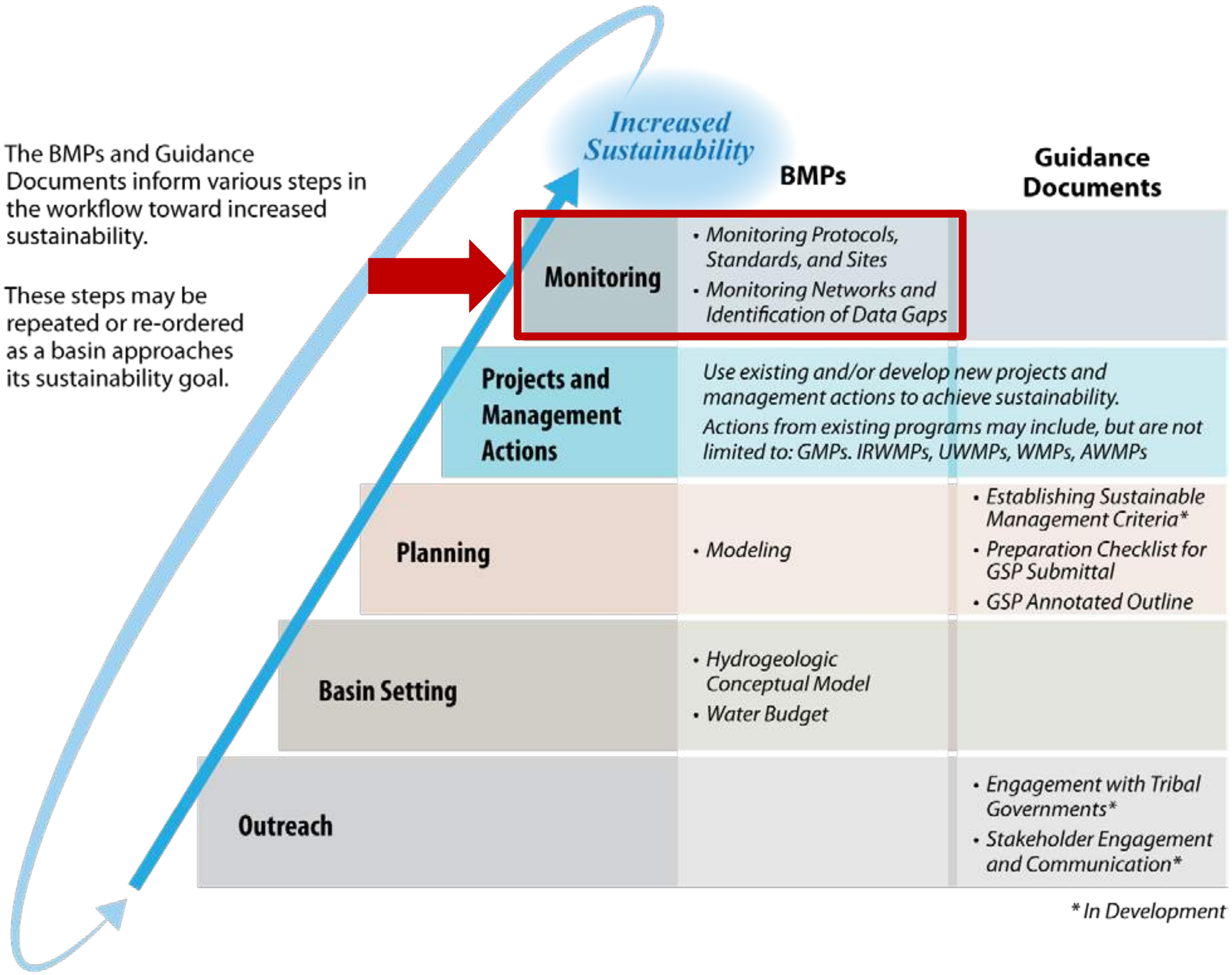


Figure 1 – Logical Progression of Basin Activities Needed to Increase Basin Sustainability

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.

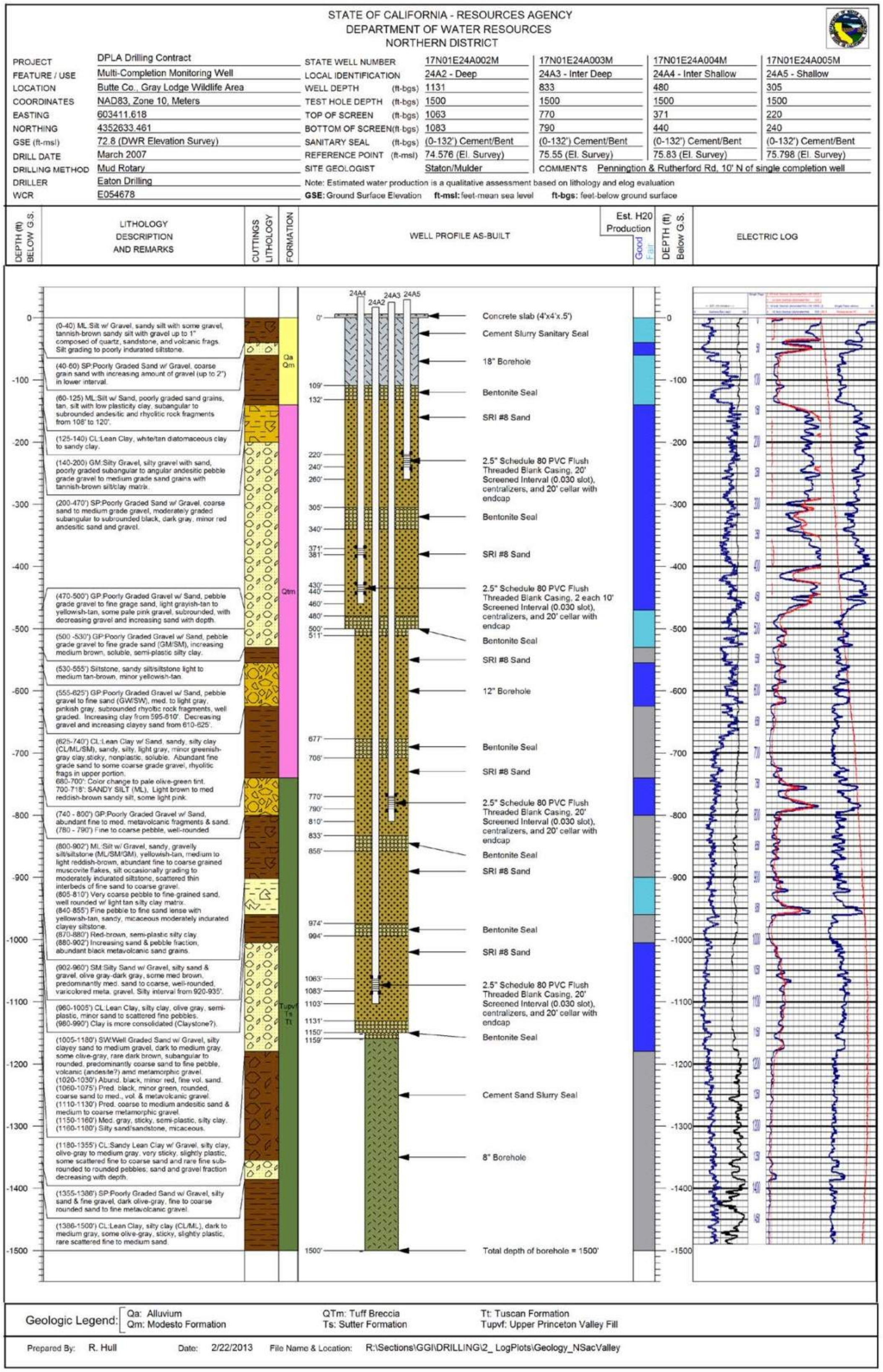


Figure 2 – Example As-Built Multi-Completion Monitoring Well Log

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.

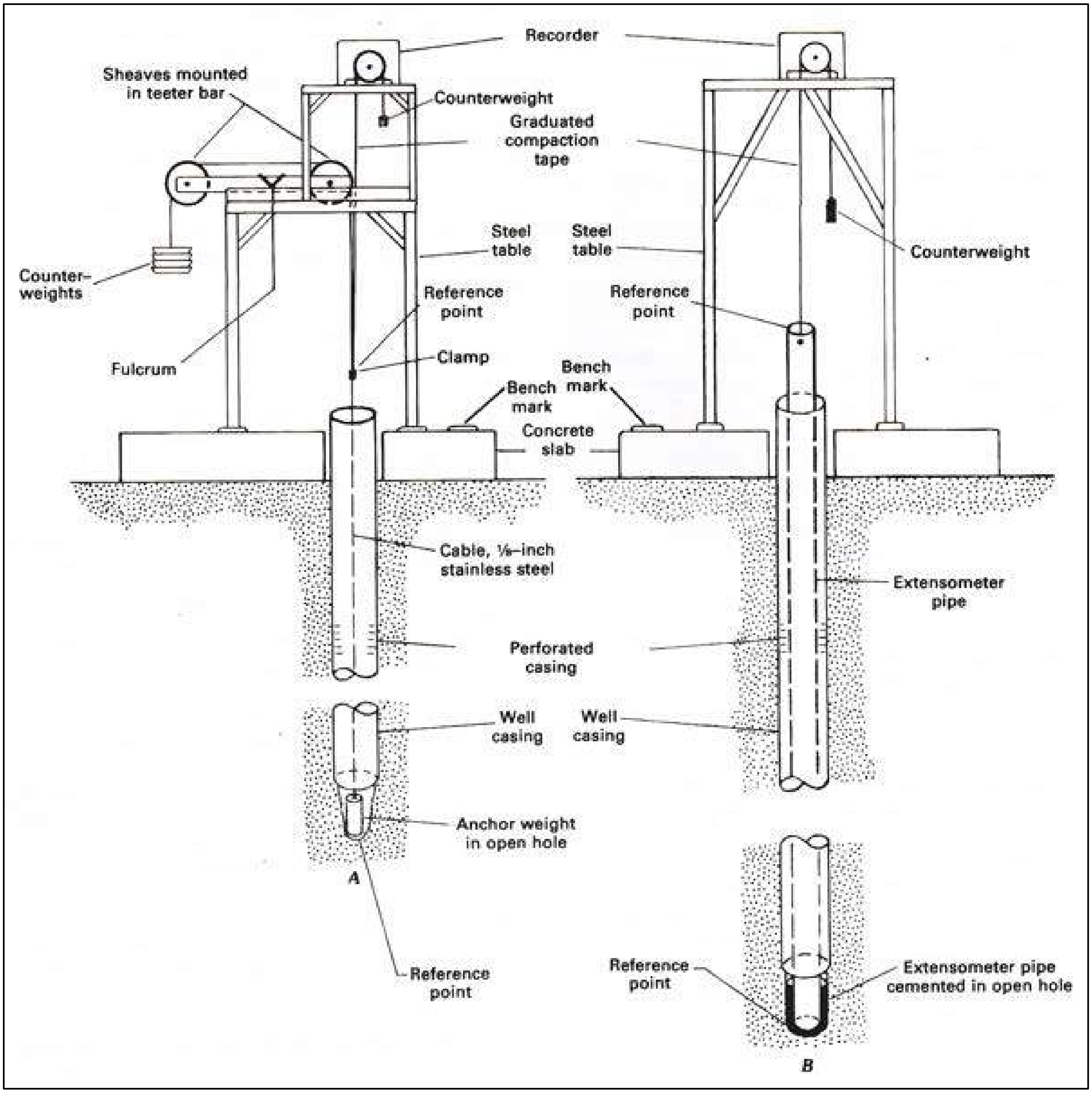


Figure 7 – Simplified Extensometer Diagram

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

LUHDORFF & SCALMANINI CONSULTING ENGINEERS

MLJ ENVIRONMENTAL

PROVOST & PRITCHARD CONSULTING GROUP

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.

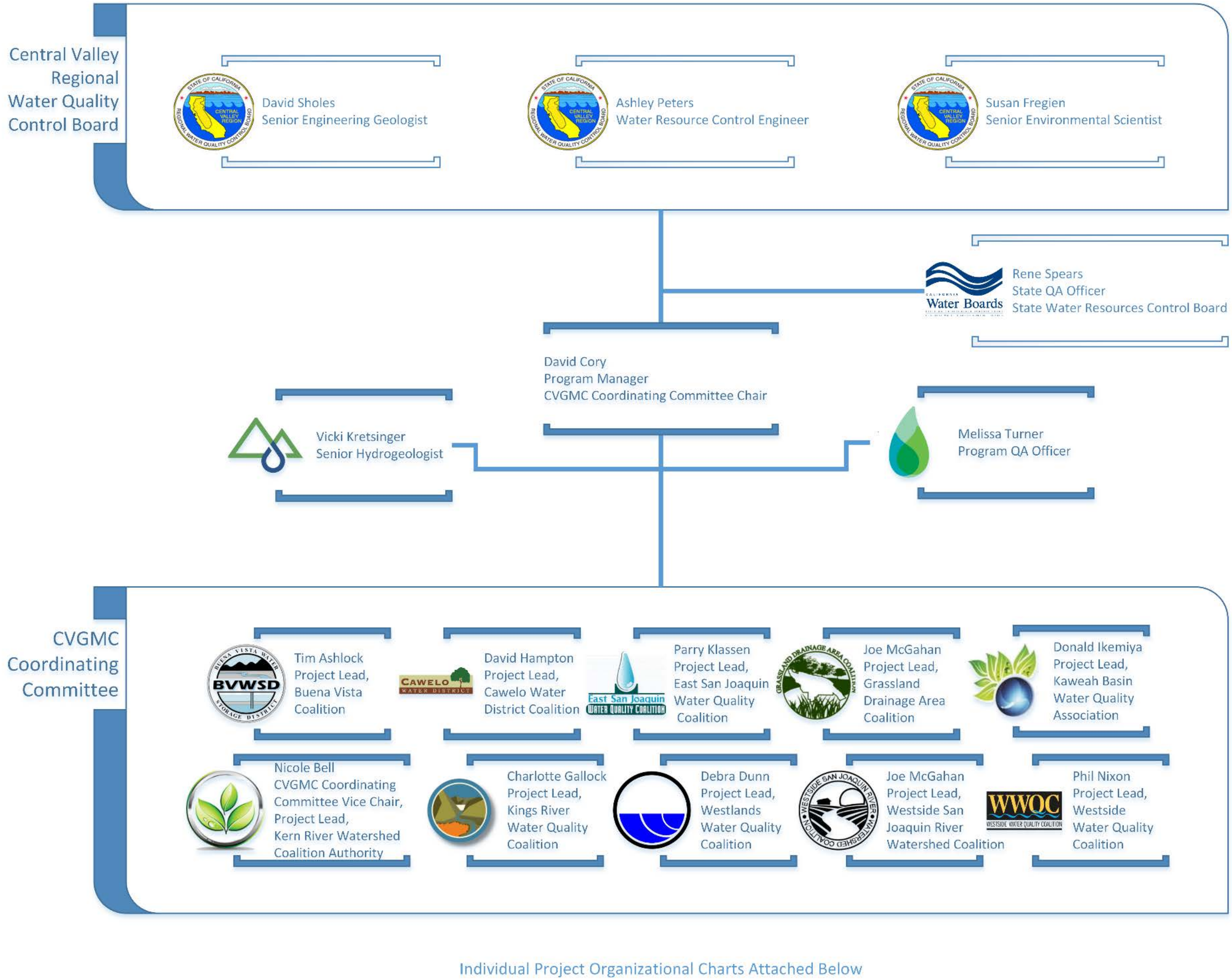


Figure 2. Project Organizational Chart - Buena Vista Coalition.

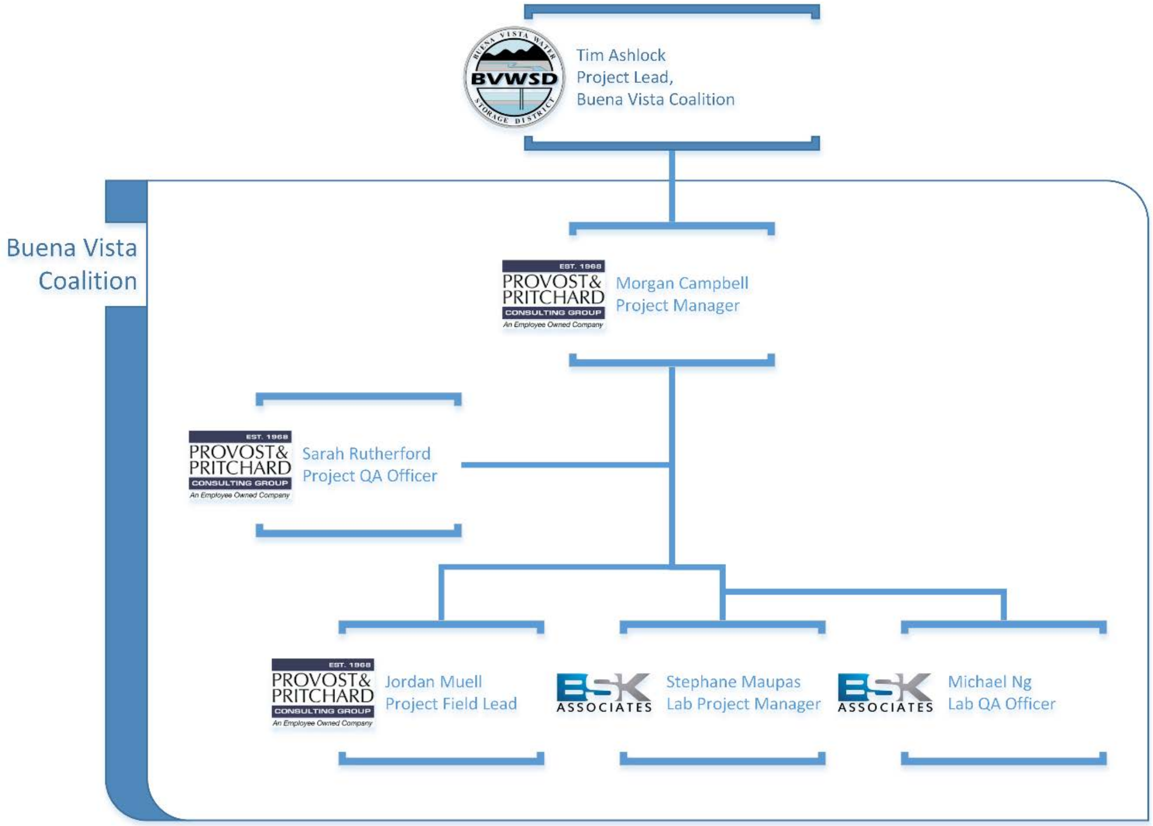


Figure 3. Project Organizational Chart - Cawelo Water District Coalition.

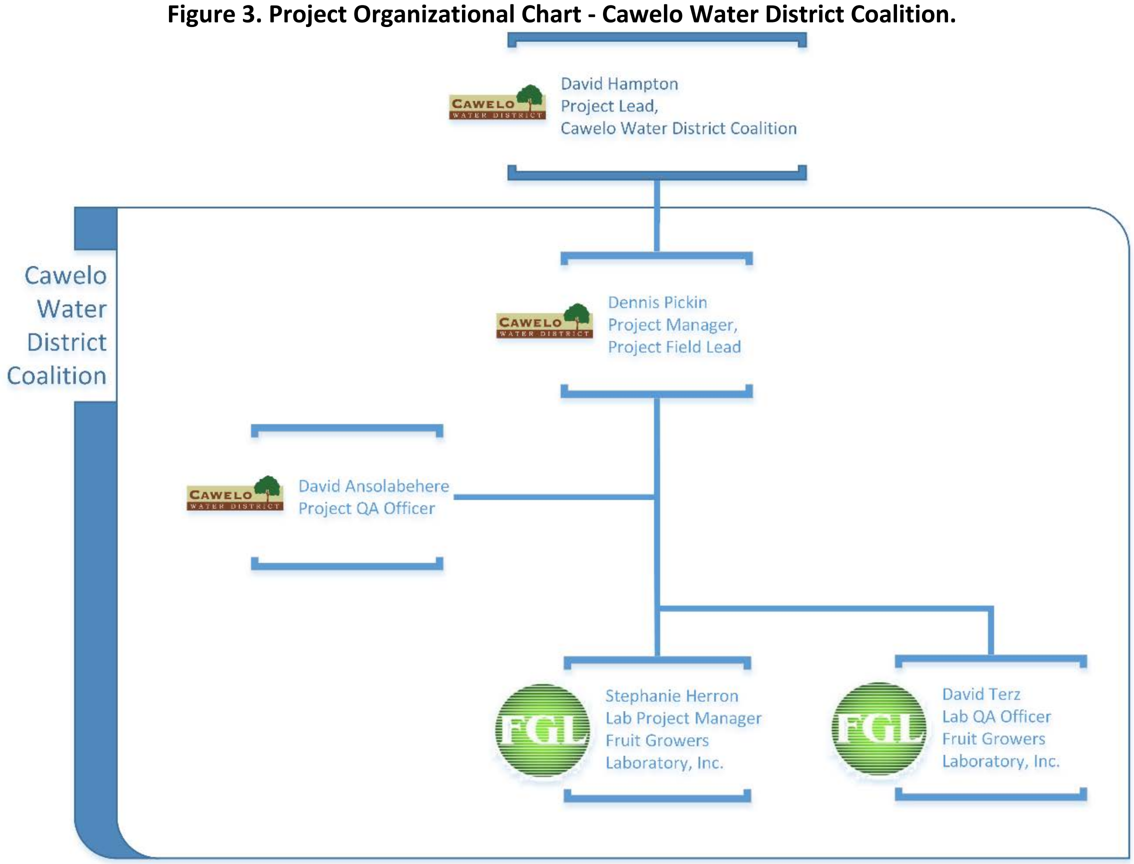


Figure 4. Project Organizational Chart - East San Joaquin Water Quality Coalition.

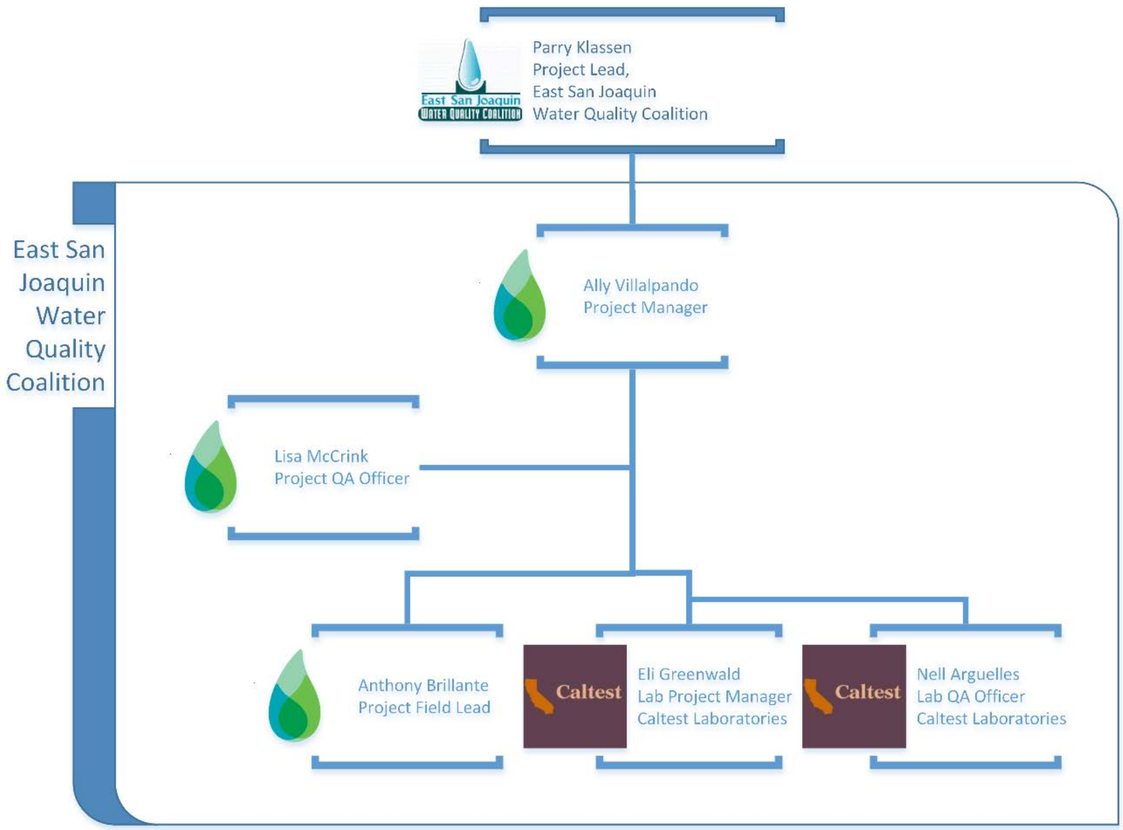


Figure 5. Project Organizational Chart - Grassland Drainage Area Coalition.

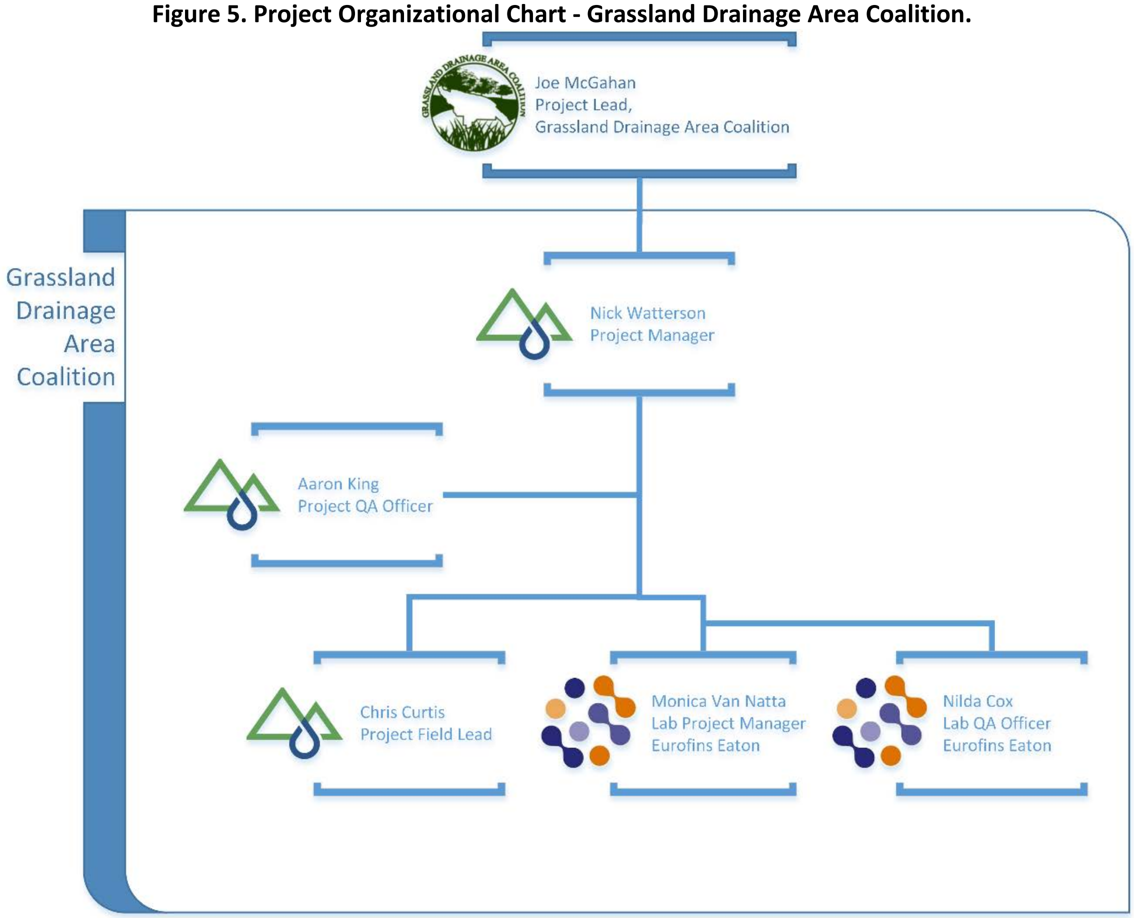


Figure 6. Project Organizational Chart - Kaweah Basin Water Quality Coalition.

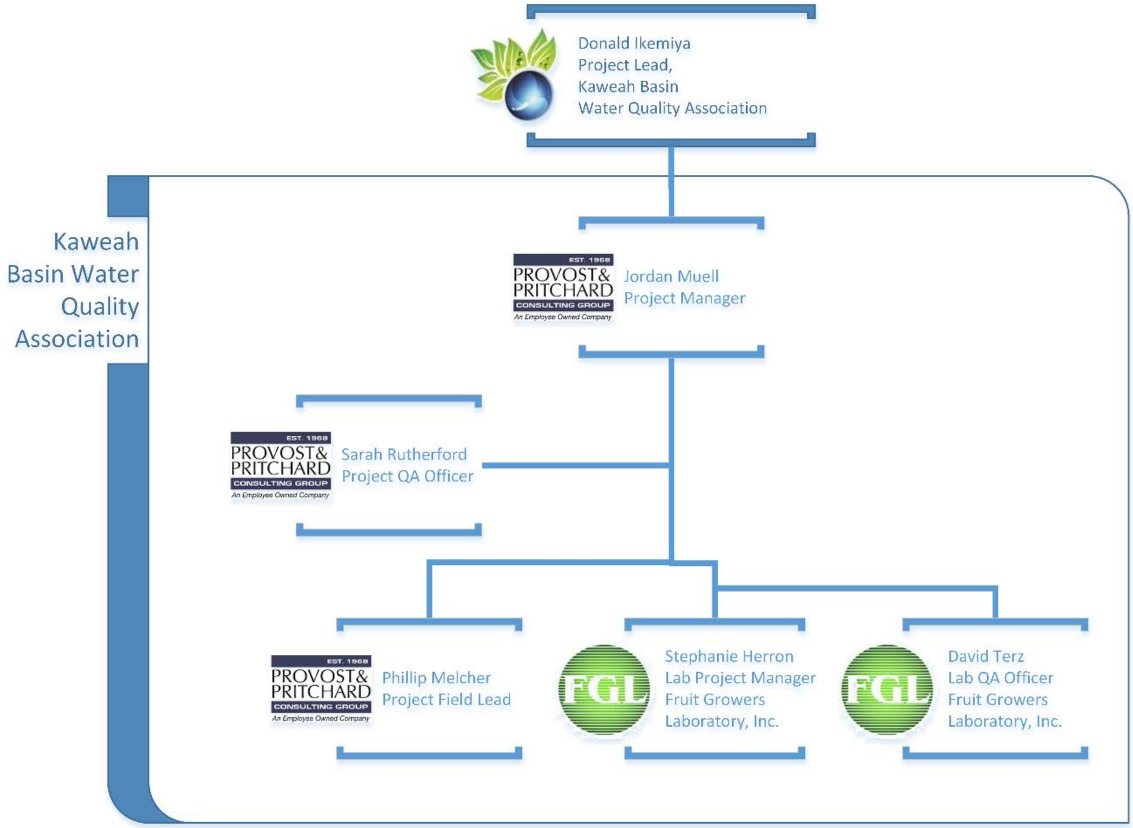


Figure 7. Project Organizational Chart - Kern River Watershed Coalition Authority.

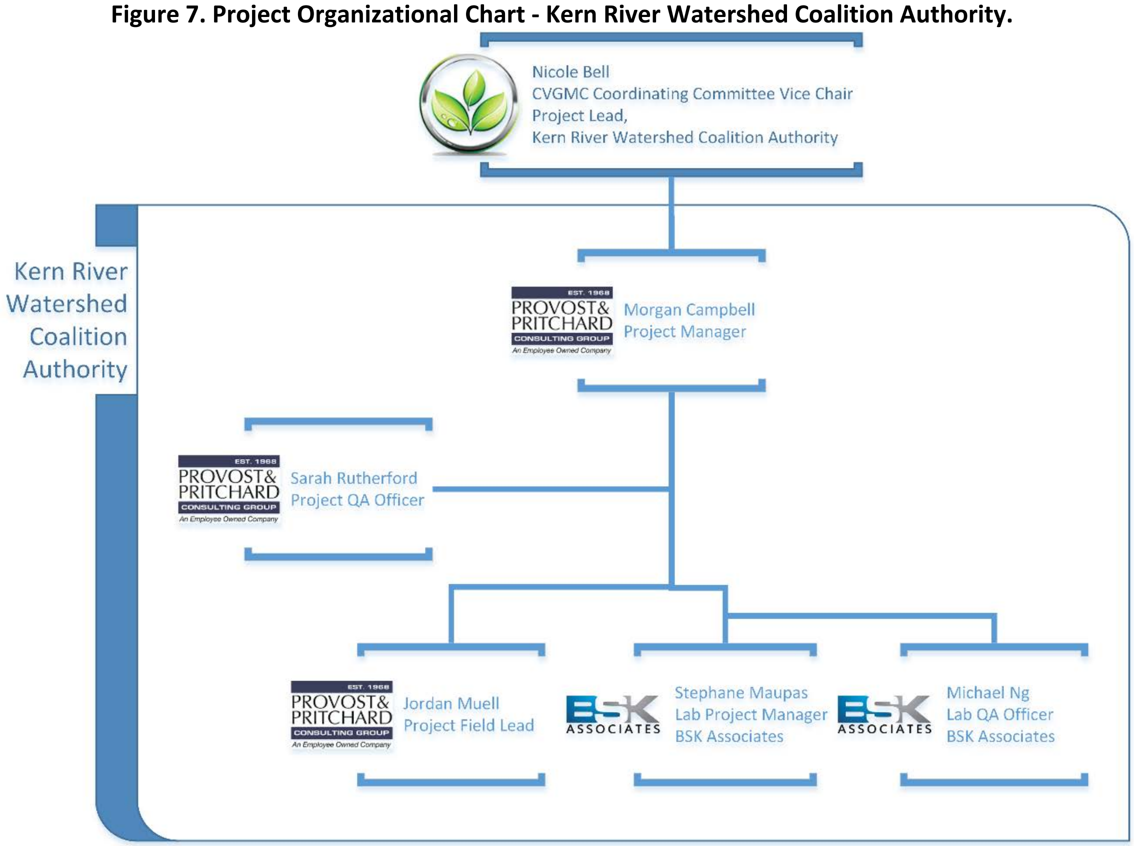


Figure 8. Project Organizational Chart - Kings River Water Quality Coalition.

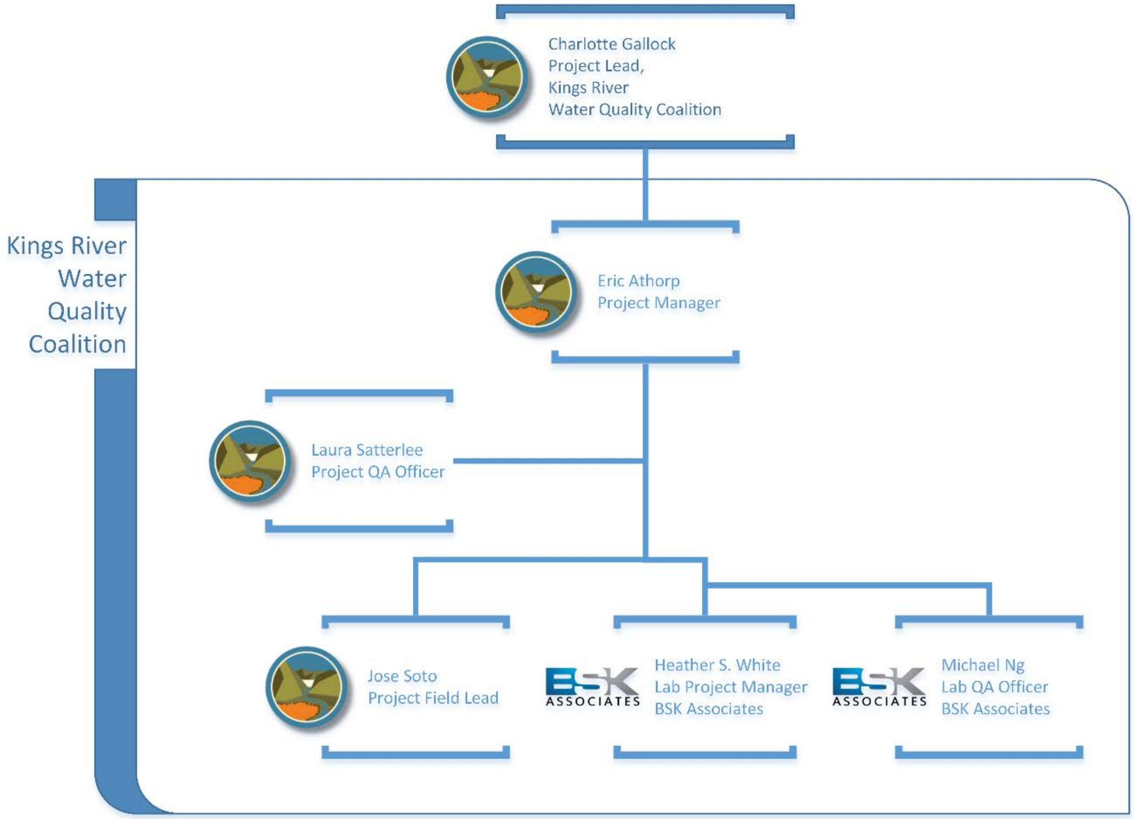


Figure 9. Project Organizational Chart - Westlands Water Quality Coalition.

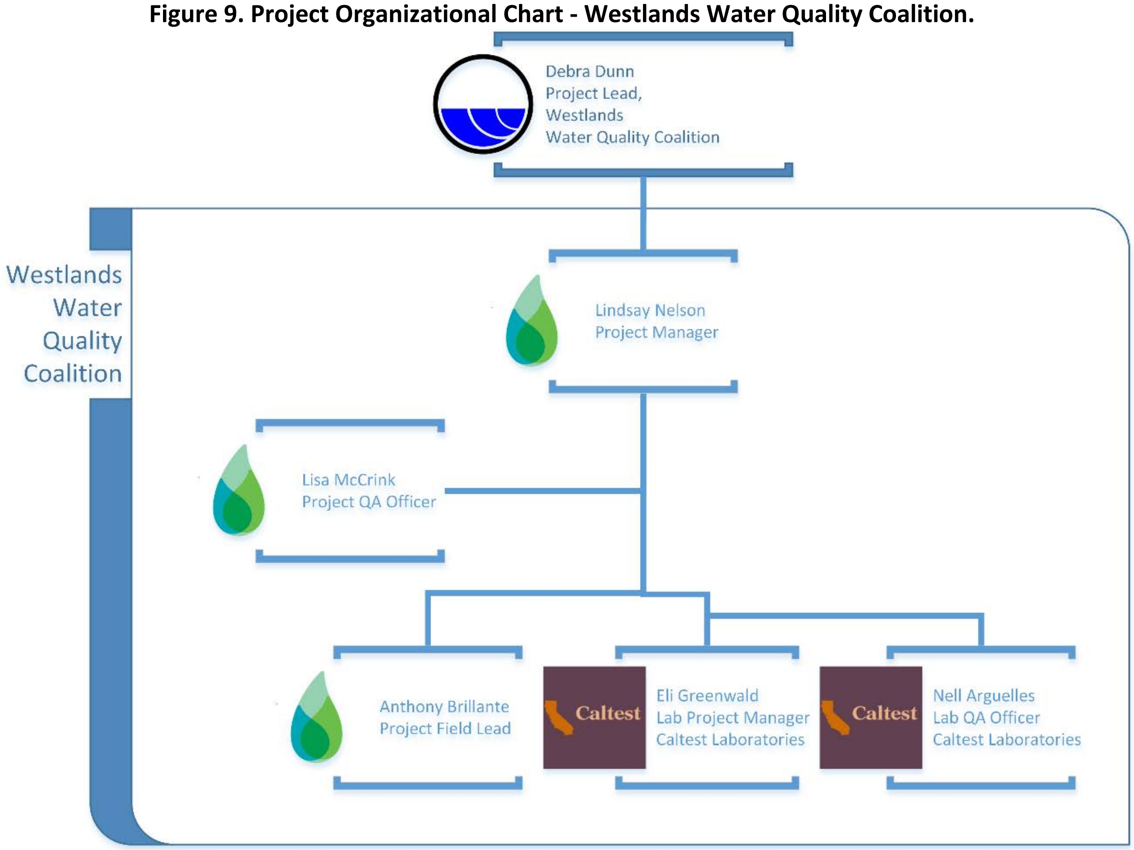


Figure 10. Project Organizational Chart - Westside San Joaquin River Watershed Coalition.

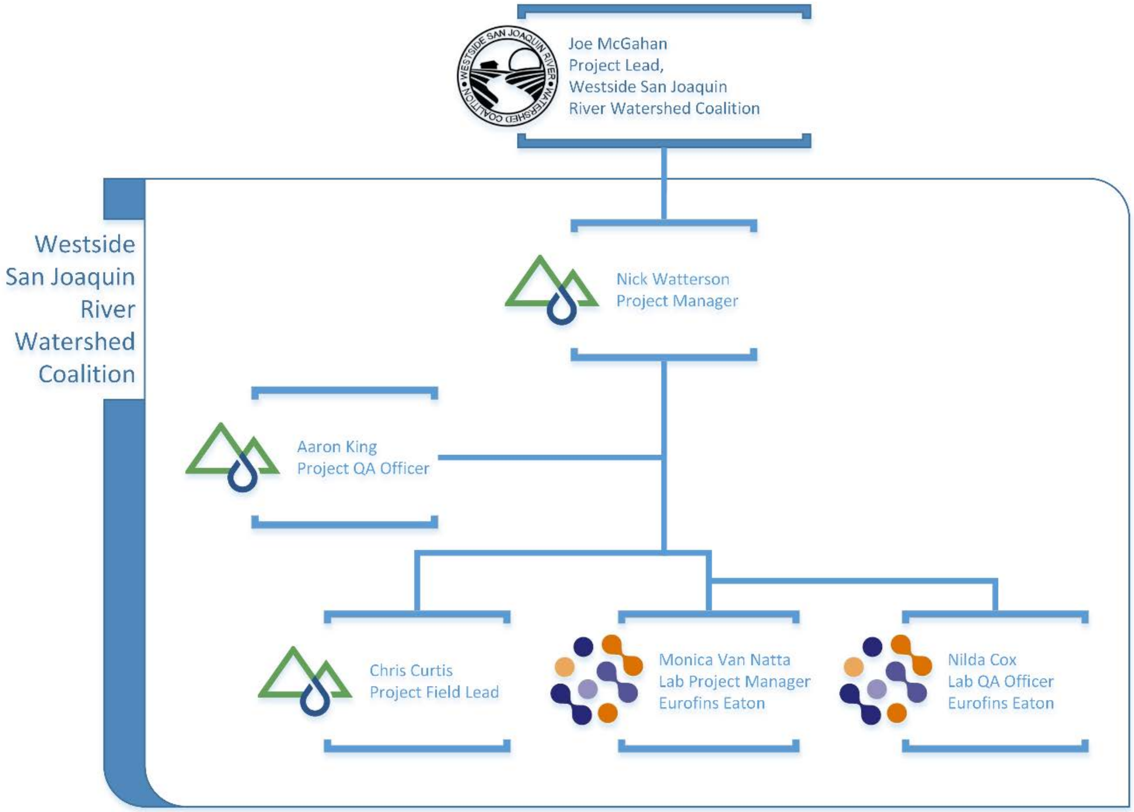
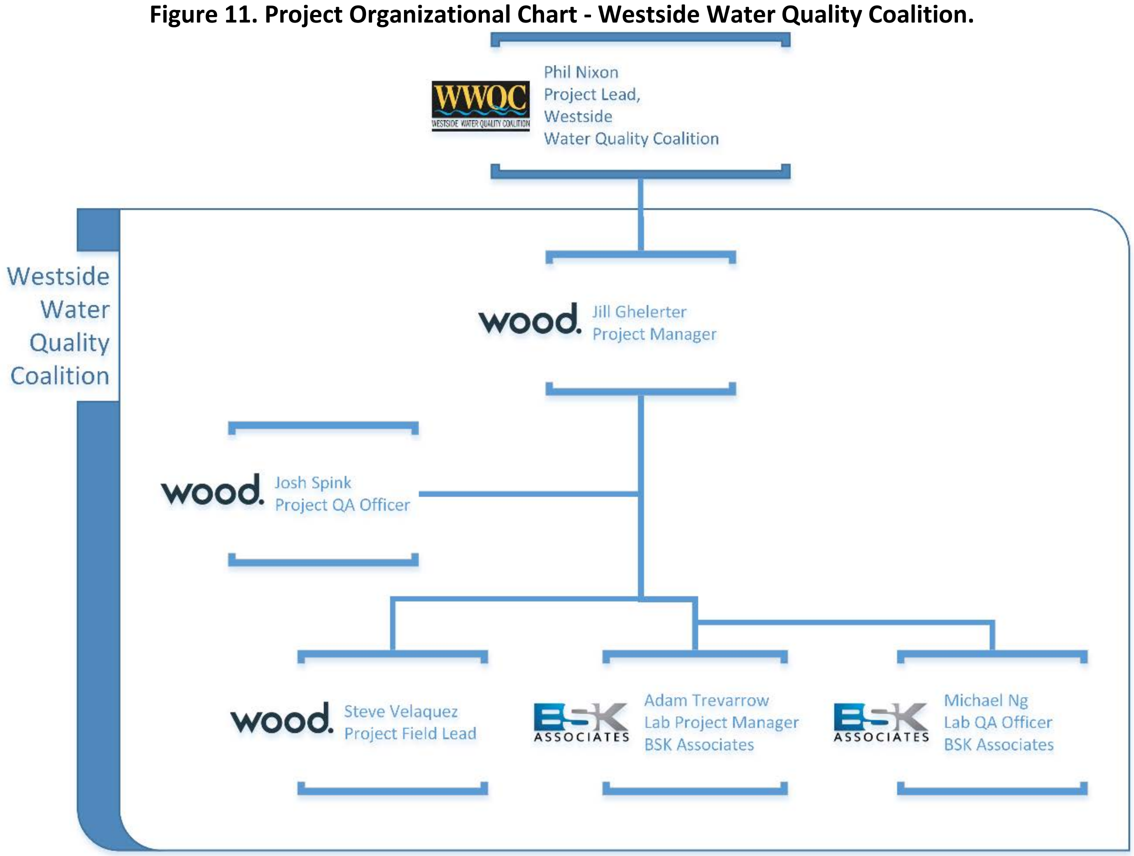


Figure 11. Project Organizational Chart - Westside Water Quality Coalition.



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: ______

Picture #(s): ______

QC Site: Yes No

Blank pH: ______

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:	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	
Temperature at Log In: (°C)	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.

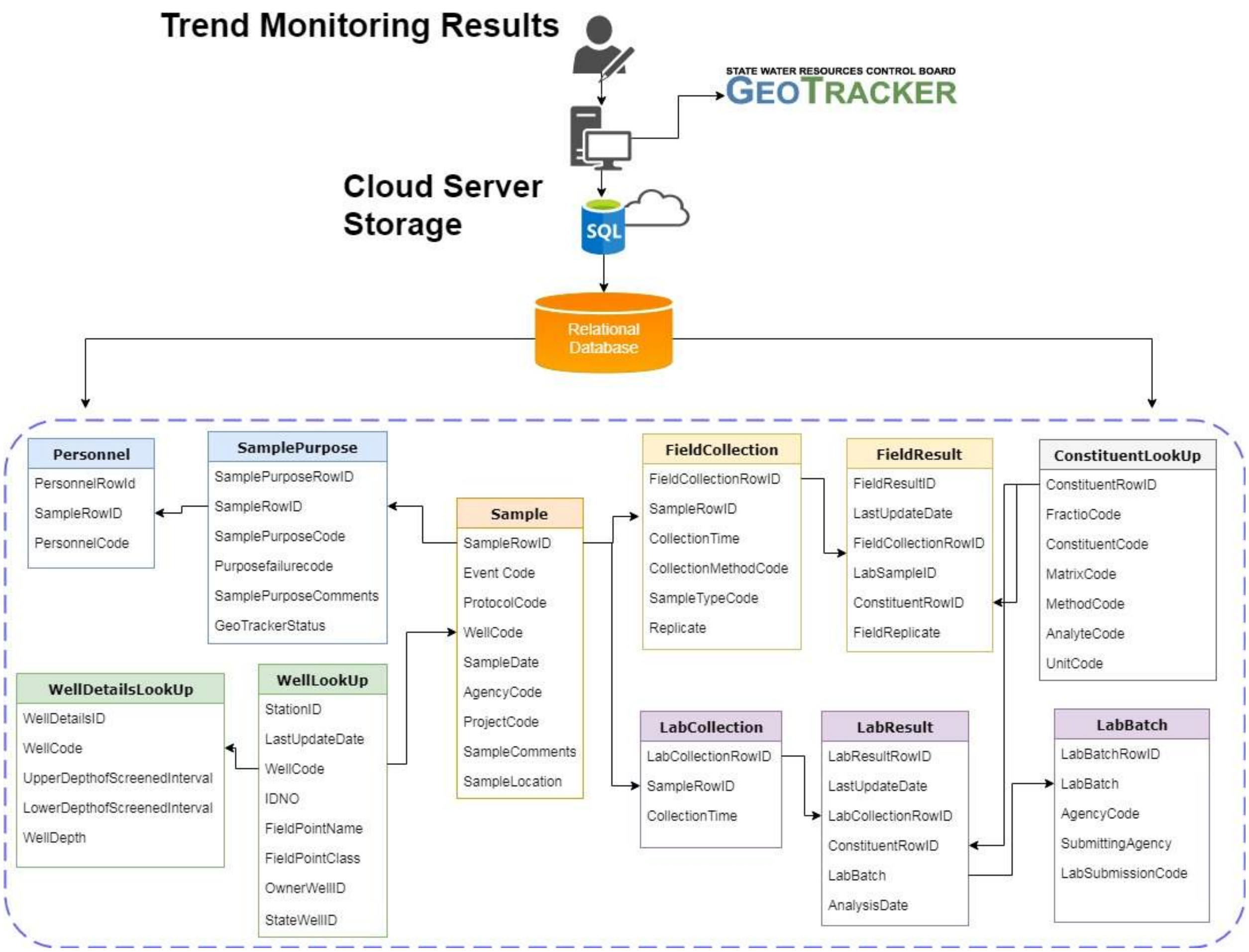
The DMS will be a relational database allowing for efficient storage of well monitoring information, including project information (Coalition-specific project codes and protocols), sample collection information (sample date, time, and location of sample collection), well-related information and monitoring 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

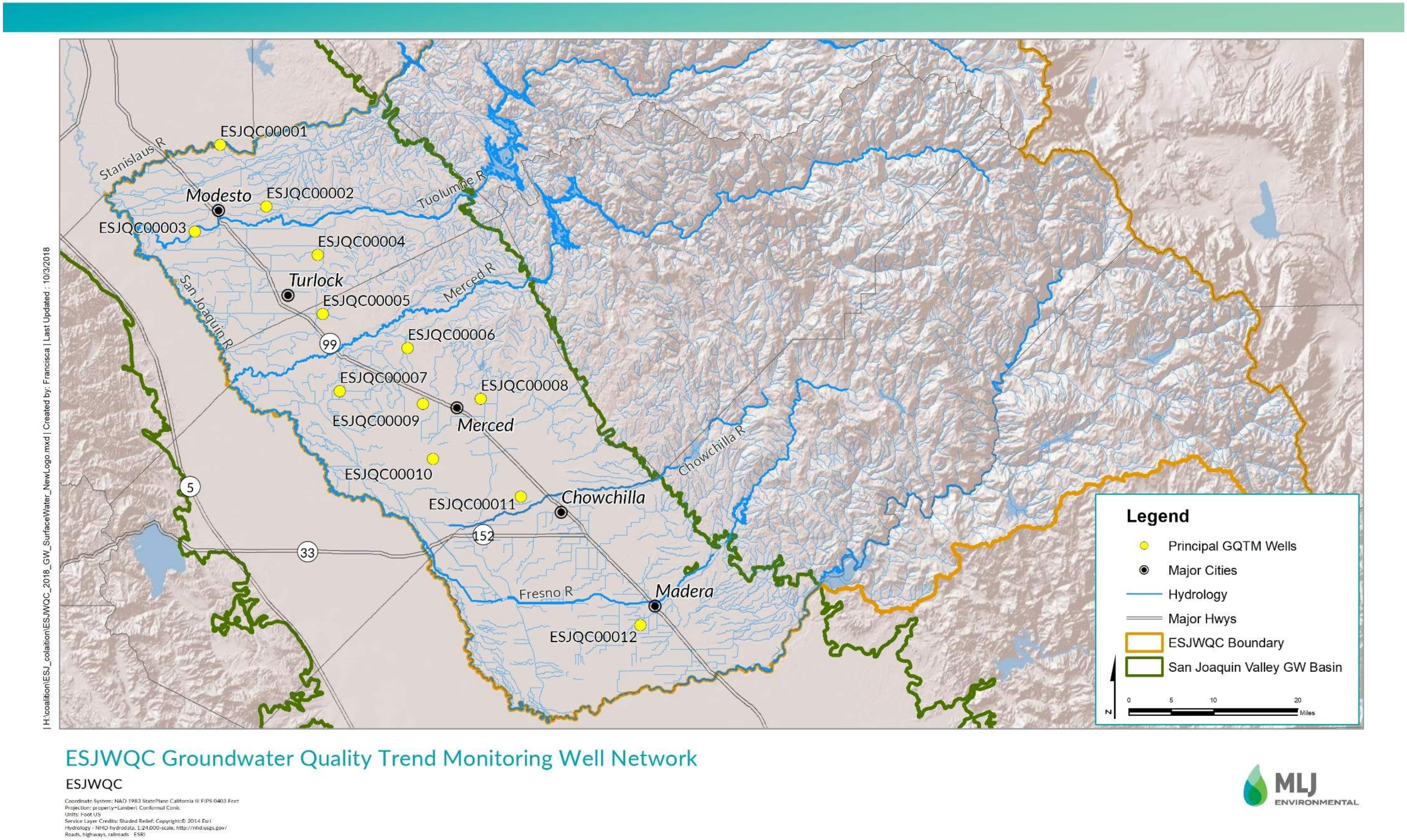
This QAPP includes project-specific information pertaining to the groundwater monitoring to be performed by the ESJWQC as described within the GQTM Workplan submitted on March 1, 2018. The Coalition is a member of the CVGMC and has developed a GQTM Workplan and QAPP in adherence with the CVGMC Technical 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:	Relinquished By	Relinquished By
	Signature	Signature
Please fax signed and completed COC to MLJ LLC: (530) 756-5225, or email to abrillante@mlj-llc.com	Print Name	Print Name
	Organization	Organization
	Date Time	Date Time
If samples are collected for individual monitoring please write the individual Global ID in the sample comments.	**Received By**	**Received By**
	Signature	Signature
	Print Name	Print Name
	Organization	Organization
Temperature at Log In: (°C)	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	Longitu de	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	H2SO4	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 (SO4)	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	HNO3	6 months	0.002	.01	mg/L
Calcium	Caltest	EPA 200.8	Groundwater	Unfiltered*	500 mL	Polyethylene	Field Acidified	HNO3	6 months	0.02	0.05	mg/L
Magnesium	Caltest	EPA 200.8	Groundwater	Unfiltered*	500 mL	Polyethylene	Field Acidified	HNO3	6 months	0.005	0.05	mg/L
Potassium	Caltest	EPA 200.8	Groundwater	Unfiltered*	500 mL	Polyethylene	Field Acidified	HNO3	6 months	0.02	0.05	mg/L
Sodium	Caltest	EPA 200.8	Groundwater	Unfiltered*	500 mL	Polyethylene	Field Acidified	HNO3	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.
<u>Session 3</u>
124, 106, 131, 135, 126
<u>Session 4</u>
157, 106, 162, 156, 133
<u>Session 5</u>
157, 124, 162, 161, 132
<u>Session 6</u>
121, 124, 135, 123, 132

December 2, 2011 (336)
Continue Static GPS Observations
<u>Session 1</u>
121, 147, 101, 123, 129
<u>Session 2</u>
158, 153, 159, 123, 129
<u>Session 3</u>
105, 153, 127, 116, 159
<u>Session 4</u>
114, 163, 127, 160, 103
<u>Session 5</u>
127, 143, 131, 135, 141

December 3, 2011 (337)
Complete Static GPS observations of Primary Control Network
<u>Session 1</u>
128, 139
<u>Session 2</u>
140, 145
<u>Session 3</u>
123, 168
<u>Session 4</u>
137, 155

December 5 – 9, 2011
Begin total station and digital level observations
<u>Gage stations observed</u>
CTK, MIL, LDC, H41, SJF, DNB, SKAGGS, GRF, JBP

December 19 – 23, 2011
Continue total station and digital level observations
<u>Gage stations observed</u>
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:

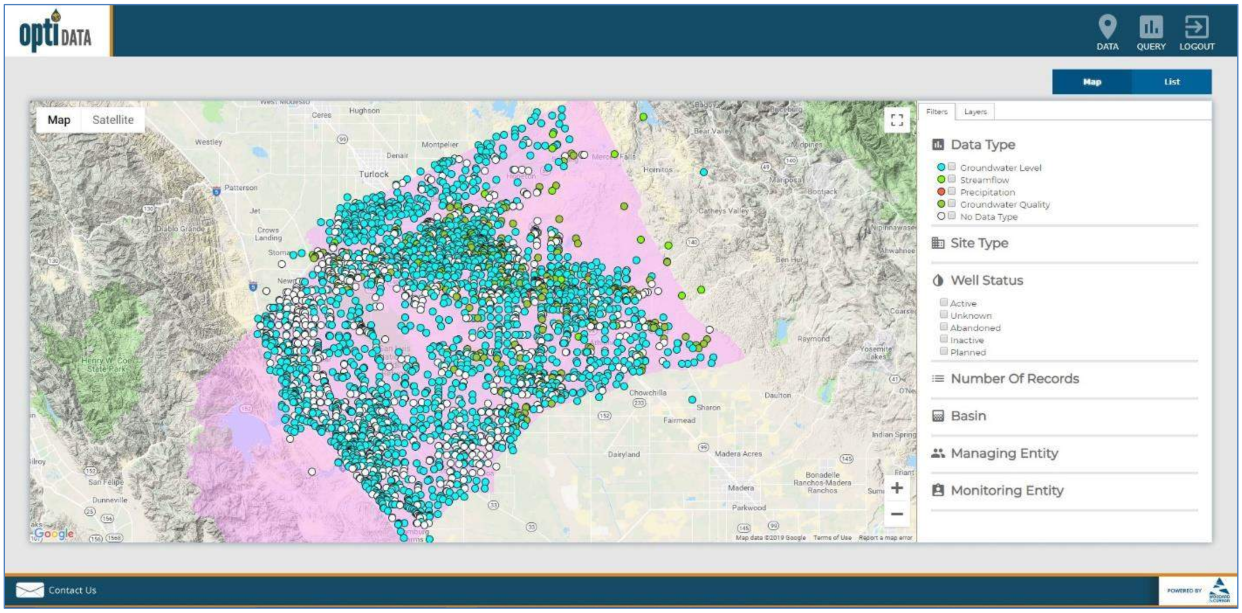
- Data
- Query

Module: Data (Top)

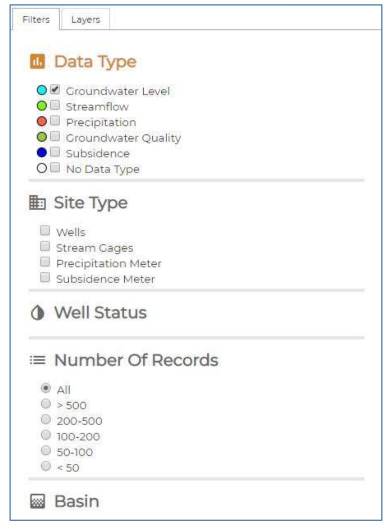
The Data module contains two available submodules that allow you to view water resources data and their associated site information: Map and List.

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



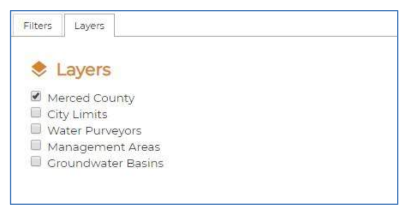
- To move the location or extent of the map display, use the "+" and "-" icons in the lower right-hand corner of the map. You may use the pan tool to move the focal location of the display.
- To change the base layer of the map display, select an option from the upper l eft-hand side of the map display (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:
    - data type associated with the site,
    - site type,
    - number of data records,
    - entity, or
    - 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



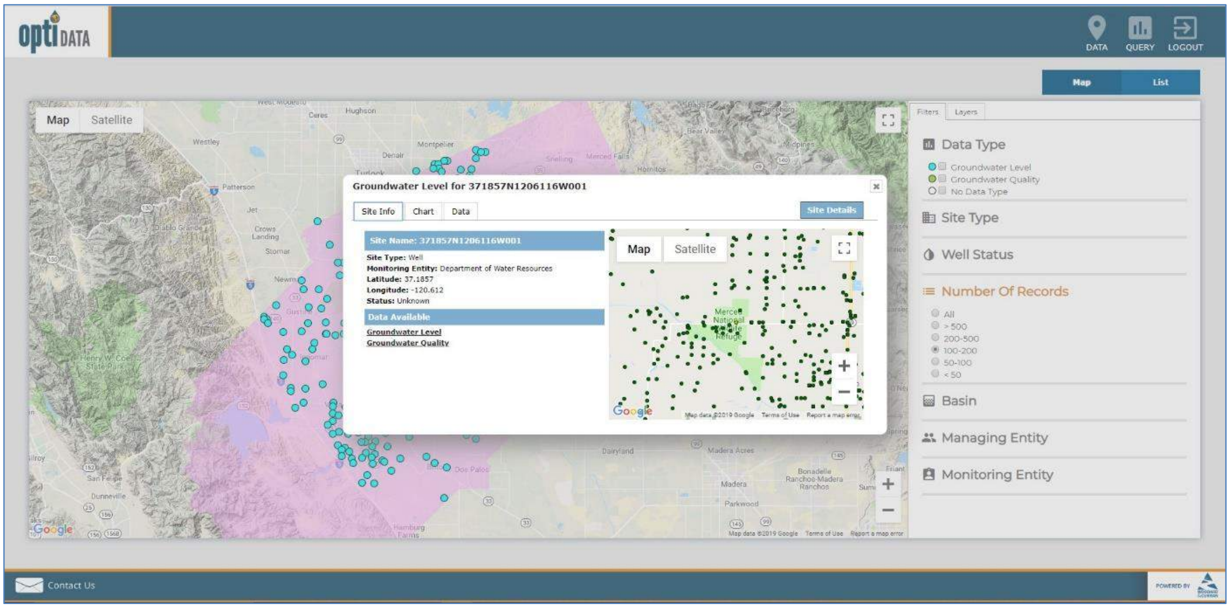
- Click on the Layers tab on the right-hand panel.
- Select the layers that you wish to have displayed. Upon selection, the map will be updated to show the selected layers.
- You may click on features on the layer to view information on that feature.

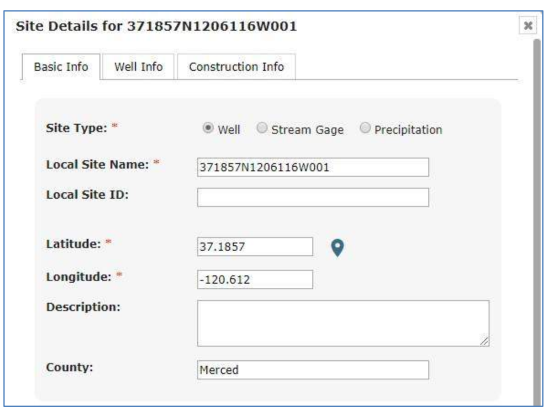
Feature: View site information on the map

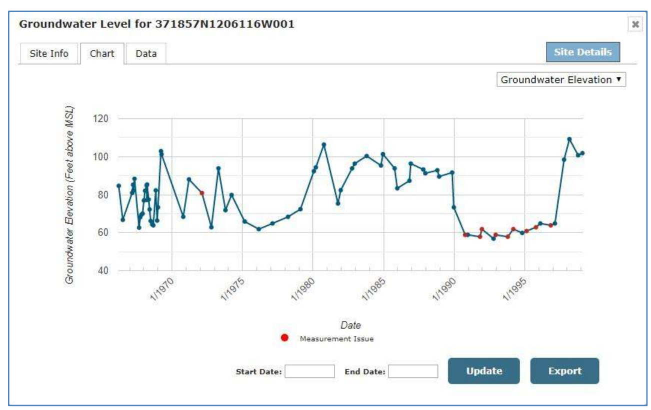
- Click on a site on the map. The site information will be displayed with tabs for Site Info, Chart, and Data.
- To view site detailed information, click on the Details link. The Site Details page will open.
- To view a chart of the data, click on the Chart tab. You may change the parameter by selecting 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.

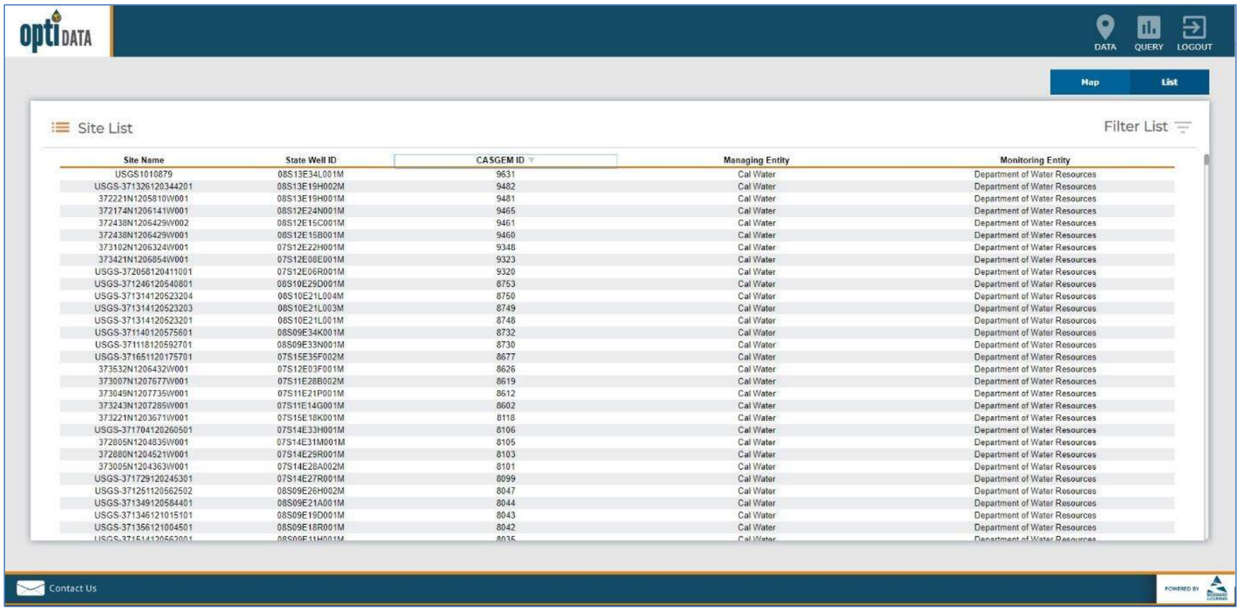






Submodule: List

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

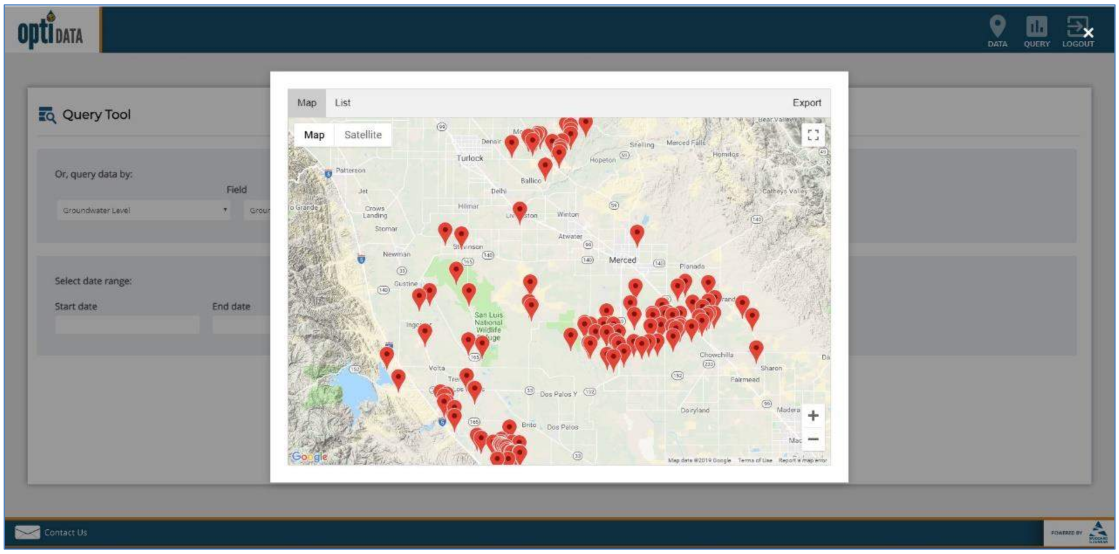
- Click on the selected site name in the list. The site information will be displayed with tabs for Site Info, Chart, and Data. The Site Details page is available through this dialogue box. The following information may be available:

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.

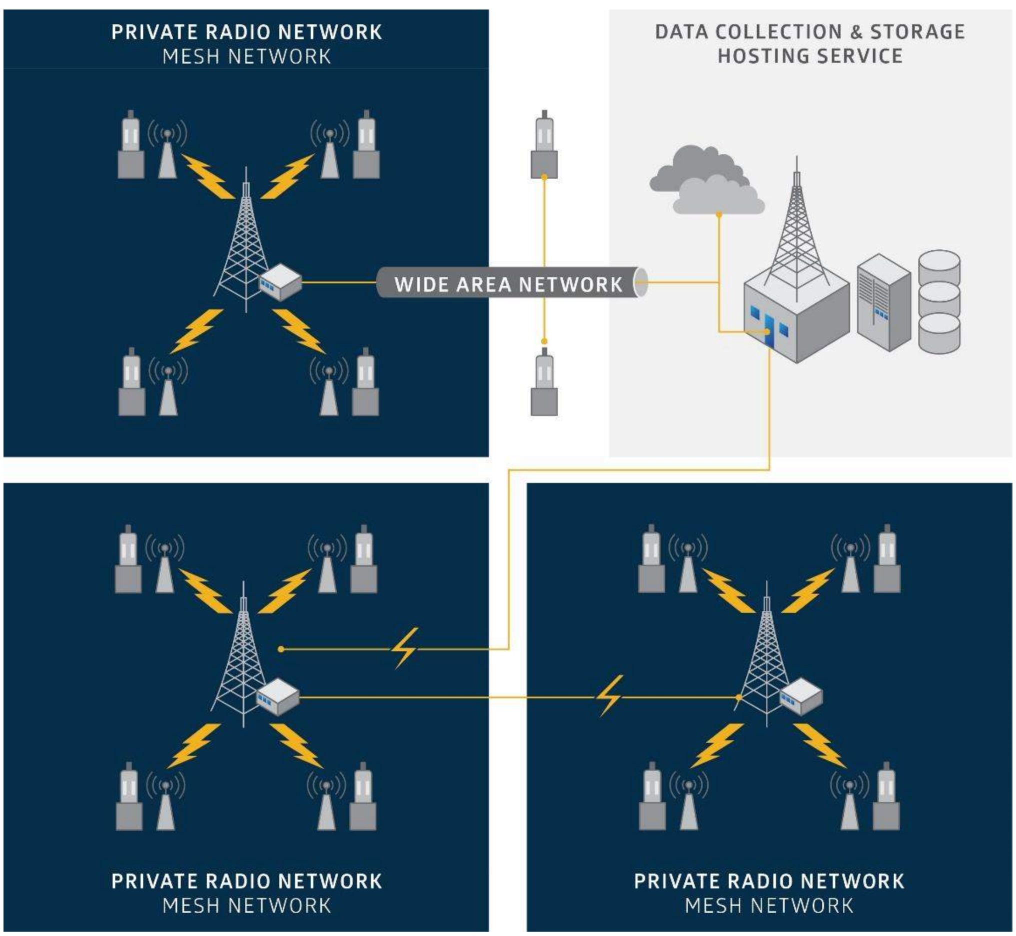


Figure 1 Area Collectors architecture

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.

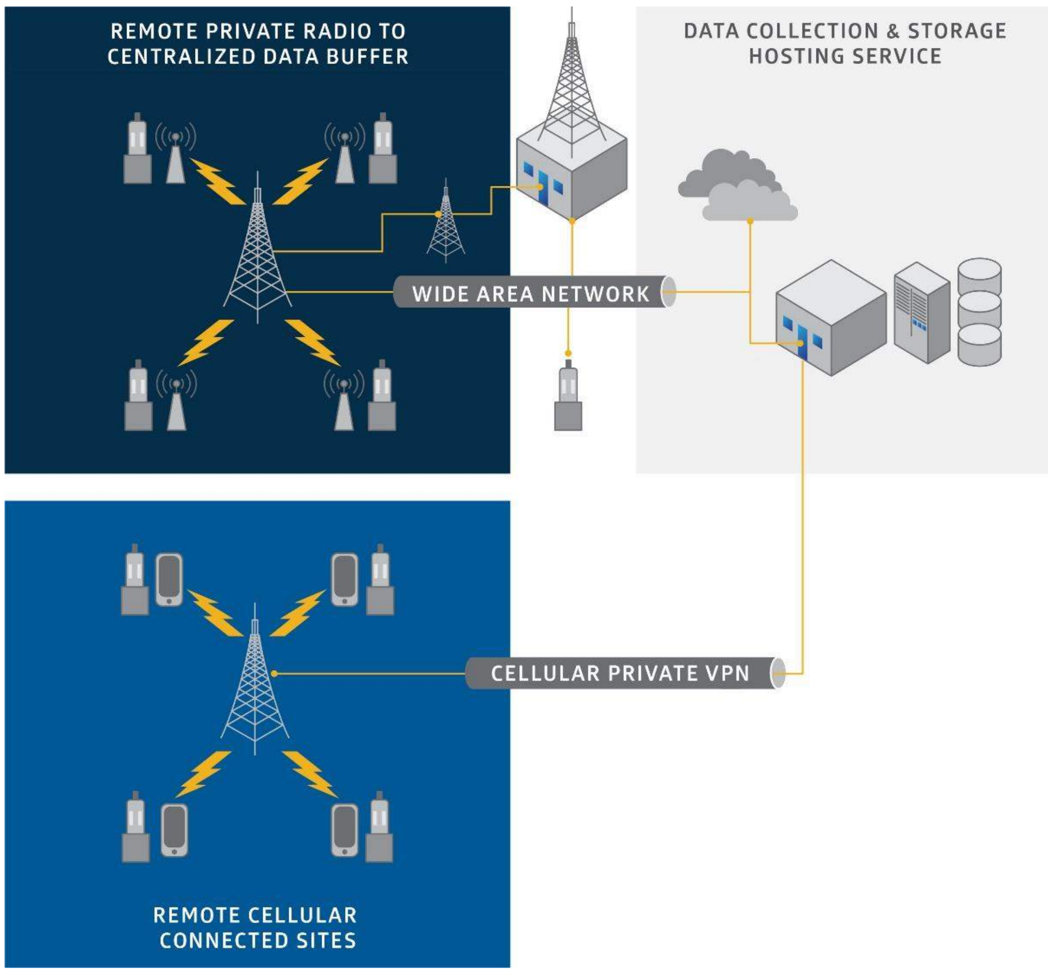


Figure 2 Peer to Central Host architecture

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