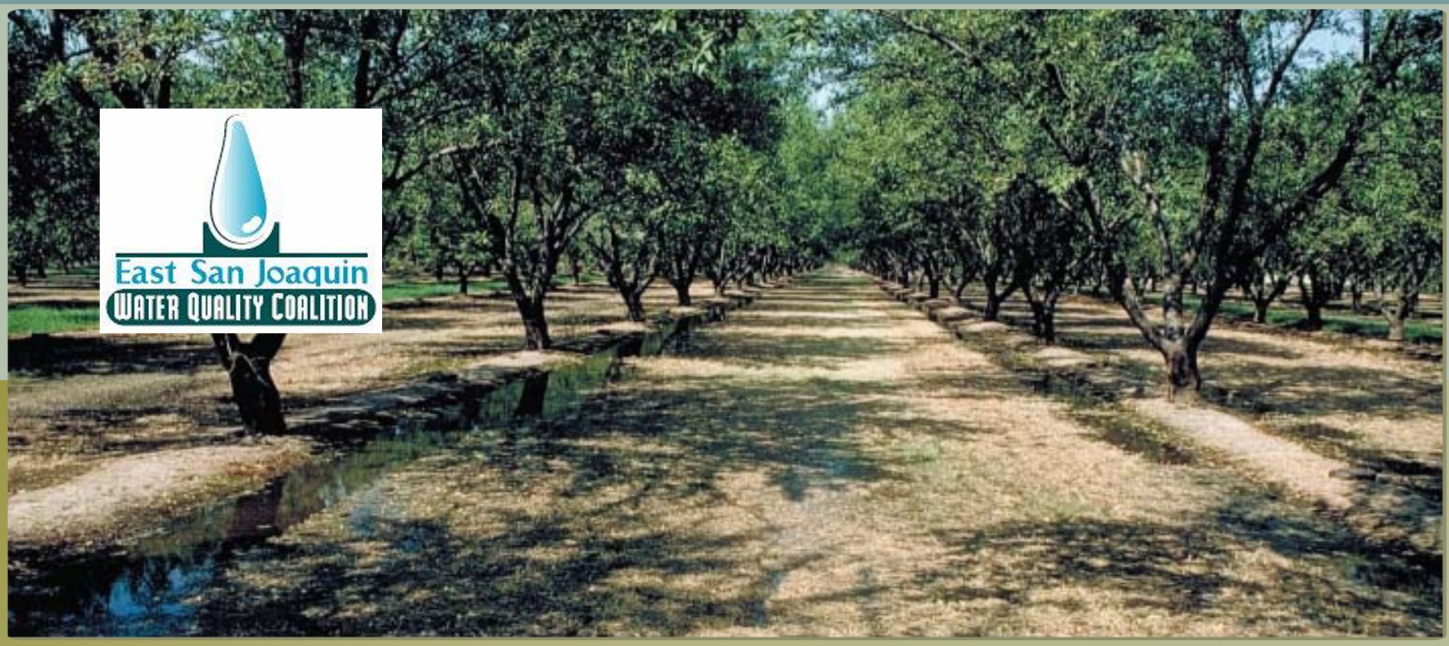

East San Joaquin Water Quality Coalition
Groundwater Quality Assessment Report

Addendum



November 2014

LUHDORFF & SCALMANINI
CONSULTING ENGINEERS

East San Joaquin Water Quality Coalition Groundwater Quality Assessment Report

Addendum

Prepared For
East San Joaquin Water Quality Coalition

Prepared By
Luhdorff and Scalmanini Consulting Engineers

LUHDORFF & SCALMANINI CONSULTING ENGINEERS

November 2014

This document is a companion to the East San Joaquin Water Quality Coalition Groundwater Quality Assessment Report dated January 2014

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Introduction

The East San Joaquin Water Quality Coalition (ESJWQC or Coalition) Groundwater Quality Assessment Report (GAR) was prepared in response to Waste Discharge Requirements (WDR), General Order R5-2012-0116 adopted by the Central Valley Regional Water Quality Control Board (RWQCB or Board) on December 4, 2012. This WDR is for the growers in the Eastern San Joaquin River Watershed that are members of the ESJWQC. The Coalition boundary generally coincides with the extent of the Eastern San Joaquin River Watershed.

The Notice of Applicability (NOA) for the ESJWQC was approved on January 11, 2013. The approval date associated with the NOA starts the timeline for several requirements in the WDR Order (Section IV. A.), including the requirement for submittal of an outline of the GAR within three months of receiving a NOA from the Board. Accordingly, the due date for submittal of the GAR outline was April 11, 2013. Additionally, the due date for the GAR is set at one calendar year after approval of the NOA, which for the ESJWQC is January 13, 2014 (the first working day after January 11, 2014). The ESJWQC submitted the GAR on January 13, 2014.

On June 4, 2014, the RWQCB provided a letter of conditional approval of the ESJWQC GAR and an accompanying staff comment letter (June 3rd). The letter of conditional approval specified that the Coalition must address the following items, along with comments in the staff letter, prior to issuance of the Executive Officer's final approval of the GAR.

1. Include map(s) that show the location of small disadvantaged communities reliant on groundwater through domestic well use or small water systems, where such information is available or can be inferred from existing information.
2. Revise the priorities within high vulnerability areas to ensure small disadvantaged communities reliant on groundwater are the highest priority for implementation of management plans.
3. Include map(s) that show the locations of wells with nitrate concentrations between 5 and 10 mg/L.
4. Include a discussion and rationale for excluding from the proposed East San Joaquin Water Quality Coalition High Vulnerability Area (ESJHVA) all wells with the observed nitrate concentration above 5 mg/L and below 10 mg/L, or include such wells in the methodology for designating the ESJHVA.

The following additional items were also noted in the letter of conditional approval:

- Compliance dates associated with the conditional approval (Table 1 in the June 4 letter).
- Inclusion of remaining items identified in the staff review in applicable workplans or in the 2019 GAR update (Table 2 in the June 4 letter).

The RWQCB's letter of conditional approval stated that the ESJWQC must submit a revised GAR or Addendum by August 11, 2014 to address the above items. On July 23rd, 2014, the

ESJWQC coordinated a meeting held with RWQCB staff and other agricultural coalition representatives to discuss comments received on the ESJWQC GAR. Shortly thereafter, on August 4 the ESJWQC requested a 90-day extension because the Coalition was unable to initiate revisions to the GAR until clarification of the requirements outlined in the conditional approval letter was provided by the RWQCB at the July 23 meeting. The extension was also requested to allow the ESJWQC sufficient time to complete any necessary analyses, reprioritization of high vulnerability areas, and coordination of the development of a Groundwater Quality Management Plan (GQMP) in light of the reprioritized areas.

This Addendum specifically addresses RWQCB requirements noted in the June 4, 2014 letter of conditional approval. Additionally, one other item noted in the RWQCB staff review (June 3 letter, Item 9.B.) requesting results from statistical analyses relating to land use control variables used in the East San Joaquin Hydrogeologic High Vulnerability Area (HHVA) modeling, is also addressed in this Addendum. This Addendum is intended as a complement to the GAR and provides additional details related to the methodology used in defining high vulnerability areas with a revised assessment of priority rankings performed in response to RWQCB comments.

1. Identification of Rural and Urban Communities Reliant on Groundwater

On July 23, 2014, the ESJWQC organized a meeting with RWQCB staff and other agricultural coalition representatives to discuss comments received on the ESJWQC GAR. A key issue discussed at that meeting related to identifying the location of small disadvantaged communities reliant on groundwater through domestic well use or small water systems, where such information is available or can be inferred from existing information. At the July 23 meeting, it was agreed that the locations of disadvantaged Census Designated Places (Disadvantaged Communities, or DACs) along with the Public Water Systems (PWS) reliant on groundwater as identified from the California Department of Public Health's (CDPH's) California Environmental Health Tracking Program (CEHTP) Environmental Health Investigations Branch (EHIB) Public Water Systems Boundary Tool would be used as the basis for defining communities reliant on groundwater.

The DACs were mapped according to locations of Census Designated Places (CDPs) meeting the criteria for disadvantaged or severely disadvantaged status [PRC §75005 (g)] using data for the 5-year median household income from the US Census Bureau 2012 American Community Survey and based on the 2012 statewide median household income (MHI). CDP data are available from the U.S. Census Bureau and have been through an extensive QA/QC process. The results of this mapping are shown on **Figure 1**.

PWS boundaries are available on CDPH's EHIB website (http://www.ehib.org/) and are uploaded by the water system operators. These have not been rigorously checked for errors prior to being made available to the public. Public water systems with a source code indicating reliance (to any degree) on groundwater were identified. The results of this mapping are also shown on **Figure 1**, based on available data from EHIB at the time of the GAR preparation in 2013.

The PWS/EHIB boundaries and DACs within the ESJWQC area were chosen as the basis to define the extent of communities reliant on groundwater in the GAR. Notably, most of these areas overlap to some extent; however, some PWS/EHIB boundaries are significantly different compared to the DAC boundaries. The results of overlaying the DAC dataset with the modified PWS/EHIB datasets are presented in **Figure 1**. The areas contributing recharge to these rural and urban communities were then re-evaluated for purposes of reprioritizing high vulnerability areas (HVAs).

2. High Vulnerability Areas and Priority Areas with Consideration of Disadvantaged Communities

The DACs, and areas contributing recharge to these communities, have been incorporated in the GAR prioritization matrix (see Section 6.3 of the GAR) and quantitative priority calculations used to inform prioritization in the high vulnerability areas have been updated. Based on recalculated priority values for all cells (30m x 30m) in the ESJHVA, the prioritization rankings (1-3) for areas have been revised (**Figure 2**). A generalized Priority 1 Area was delineated around cells with high computed priority values (**Figure 3**). Some cells with high computed priority values were not included in the generalized Priority 1 Area due to their lower density of high computed values.

Priority Areas and Relative Contribution from Prioritization Components

As discussed in the GAR, groundwater quality is one of 10 components factored into the geospatial prioritization matrix calculations (see Section 6.3 of the GAR). The contribution (out of a total potential value of 10) from each of the 10 prioritization matrix components is illustrated in **Figure 4**, by priority ranking (1-3). As illustrated in **Figure 4,** the highest contribution to priority values for calculated Priority 1 areas is attributed to the prioritization component relating to proximity to communities reliant on groundwater with slightly lesser, but still notably high, contributions also are from calculated groundwater vulnerability and observed groundwater quality. Typical nitrate application rates for crops and temporal trends in nitrate concentrations also represented relatively higher contributions to the calculated priority value for Priority 1 areas. The relative contributions from prioritization components can be used to inform future trend monitoring within identified priority areas. As an example, **Figure 5** is a map of the contribution from the observed groundwater quality component in the calculated prioritization results for the Priority 1 Area. In **Figure 5**, red indicates areas where groundwater quality contributes most to the calculated priority value whereas green indicates areas where the contribution from the groundwater quality component of the prioritization matrix is relatively lower. **Figure 5** illustrates how areas where groundwater quality factored more heavily in the priority calculations may be important for consideration when developing the trend monitoring program. Such information could be used in conjunction with the locations of potential trend monitoring candidate wells, as shown on **Figure 5**, to effectively design a trend monitoring program for the Coalition area.

Figure 6 shows the Priority 2 Area differentiated into subareas with relatively higher calculated priority values (2a) and relatively lower priority values (2b). This figure also shows the generalized Priority 1 Area and illustrates how the calculated priority value may also be an important consideration in designing and focusing trend monitoring within priority areas. As discussed for the Priority 1 Area, the relative contribution from each of the individual prioritization components can be used to inform the design of the trend monitoring program within priority areas. **Figure 7** shows the relative contribution from each of the prioritization

matrix components for the Priority 2 Area. Each component in the prioritization matrix and the respective weighting applied to the component in the matrix calculation (as described in Section 6.3 of the GAR) is shown along x-axis and the average contribution value (out of a total of 10) is indicated on the y-axis. As shown on the chart, groundwater vulnerability, observed groundwater quality, and the contributing recharge area (near PWS and DAC areas) have relatively higher contributions for the Priority 2 Area. Although predominant commodities represent a relatively low contribution to the calculated priority value, additional land use factors including typical nitrogen application rate and typical irrigation method also contribute to the calculated priority value (see Section 6.3 of the GAR). For the purposes of implementation of the Groundwater Quality Management Plan (GQMP), the top crops will be considered in conjunction with the Priority Area rankings for the ESJWQC area, as discussed below.

Predominant Crops in the ESJHVA

The top crop acreages associated with each of the priority areas, along with the greater Coalition area, portion of the top crops on the Central Valley Floor, and the ESJHVA (as delineated in the GAR) are summarized in **Table 1**. The three top crops in the Priority 1 Area include:

- Almonds (38,660 acres; 47.6% of the cropped area)
- Corn (6,804 acres; 8.4% of the cropped area)
- Grapes (4,901 acres; 6% of the cropped area)

The total acreage of these three crops comprises 62% (50,364 acres) of the cropped area and 39% of the total acreage in the generalized Priority 1 Area. The total area of these three crops makes up 361,811 acres of the ESJHVA and 591,998 acres of the Central Valley Floor portion of the Coalition. Within the Central Valley Floor portion of the Coalition area, these crops represent similar percentages of the cropped (61%) and total (35%) areas as they do within the generalized Priority 1 Area.

The prevalence of these three crops within the Priority 1 Area and also within the overall Coalition area make management of agricultural practices associated with these crops an important factor in the Coalition's GQMP approach. Notably, the top three acreage crops to be used in the GQMP do not affect the GAR prioritization approach discussed above. However, while the focus of the future GQMP will be on the top crops in the Coalition area, and especially the generalized Priority 1 Area, the proximity of these crops to the PWS and DAC areas representing communities reliant on groundwater is considered (**Figure 8)**.

Top Commodities and HVAs

The WDRs describe the approaches that may be considered by the third party when prioritizing HVAs, including consideration of "the largest acreage commodity types comprising up to at least 80% of the irrigated agricultural acreage in the high vulnerability areas…". The prioritization matrix in the GAR factors in all commodities in the Coalition area along with the associated typical irrigation method and nitrogen application rate. Therefore, the top commodities that cover

80% of the acreage in the ESJHVA are factored into the priority values calculated for each 30m x 30m cell.

Summary

The ESJHVA remains as delineated in the GAR (see Section 6.2.5 of the GAR). The prioritization approach also remained the same as in the GAR but was updated with the additional DACs and the corresponding groundwater recharge contribution areas. Priority values for all areas were recalculated based on this revision to the prioritization matrix. A revised Priority 1 Area was delineated. The priority ranking (1-3) of all areas will be considered for purposes of the trend monitoring network design.

Table 1: Summary of Top Crops within the East San Joaquin Water Quality Coalition Area

Crops Ranked by Percent within Area**		Entire ESJWQC Area	Central Valley Portion	High Vulnerability Area	Priority 1 Generalized	Priority 2 Modeled	Priority 3 Modeled
1	Crop	**Almonds**	**Almonds**	**Almonds**	**Almonds**	**Almonds**	**Almonds**
	Acreage	362,302	362,148	221,592	38,660	72,999	124,545
	Percent*	37.3%	37.3%	36.3%	47.6%	40.8%	35.1%
2	Crop	**Grapes**	**Grapes**	**Corn**	**Corn**	**Corn**	**Grapes**
	Acreage	136,409	135,758	74,395	6,804	28,542	53,652
	Percent*	14.1%	14.0%	12.2%	8.4%	16.0%	15.1%
3	Crop	**Corn**	**Corn**	**Grapes**	**Grapes**	**Walnuts**	**Corn**
	Acreage	94,095	94,093	65,824	4,901	7,944	37,233
	Percent*	9.7%	9.7%	10.8%	6.0%	4.4%	10.5%
4	Crop	**Other Hay/Non Alfalfa**	**Other Hay/Non Alfalfa**	**Other Hay/Non Alfalfa**	**Walnuts**	**Other Hay/Non Alfalfa**	**Other Hay/Non Alfalfa**
	Acreage	30,881	30,862	21,346	4,738	6,893	9,782
	Percent*	3.2%	3.2%	3.5%	5.8%	3.9%	2.8%
5	Crop	**Walnuts**	**Walnuts**	**Walnuts**	**Other Hay/Non Alfalfa**	**Grapes**	**Walnuts**
	Acreage	22,410	22,405	18,842	1,671	6,732	9,502
	Percent*	2.3%	2.3%	3.1%	2.1%	3.8%	2.7%
6	Crop	**Pistachios**	**Pistachios**	**Tomatoes**	**Sweet Potatoes**	**Sweet Potatoes**	**Tomatoes**
	Acreage	18,475	18,451	9,379	1,525	3,693	5,275
	Percent*	1.9%	1.9%	1.5%	1.9%	2.1%	1.5%

Table 1 (continued): Summary of Top Crops within the East San Joaquin Water Quality Coalition Area

Total Acreage Top 3 Crops	592,806	591,998	361,811	50,364	109,486	215,429
Percent of Cropped Area*	61%	61%	59%	62%	61%	61%
Percent of Entire Area	10%	35%	42%	39%	44%	43%
Total Acreage Top 6 Crops	664,572	663,716	411,378	58,298	126,804	239,988
Percent of Cropped Area*	68%	68%	67%	72%	71%	68%
Percent of Entire Area	12%	40%	48%	45%	51%	48%
Total Acreage All Crops	970,792	969,663	609,765	81,302	178,877	354,473
Total Acreage Entire Area***	5,710,906	1,667,844	854,552	129,890	248,449	501,222

* Percent of Cropped Area where cropped area includes all agricultural fields, whether active or not.

** Land Cover types that are not treated with applied nutrients (such as Fallow/Idle, Winter Wheat, Alfalfa) are not ranked.

*** Total Acreages include all lands, irrigated and non-irrigated, including rural and urban landscapes.

Crop data calculations based on 2013 USDA National Agricultural Statistics Service Cropland Data Layer (Cropscape), downloaded July 2014.

3. Map with Locations of Wells with Nitrate Concentrations between 5 and 10 mg/L

Nitrate concentrations are displayed on several maps within the GAR (Figures 5-4, 5-5, 5-6 of the GAR); these maps show nitrate concentrations separately for shallow wells, deep wells, and wells in the peripheral area. The additionally requested map (**Figure 9**) further conveys this information showing all wells with a maximum historically observed nitrate concentration of 5 mg/L (as N) or greater.

4. Rationale for Not Including Wells with Nitrate Concentrations between 5 and 10 mg/L in ESJHVA

To the extent possible, the Coalition attempted to retain a scientific basis to the determination of the ESJHVA in the GAR (see Section 6.2 of the GAR). The scientific basis was founded on a conceptual model recognizing intrinsic physical attributes that likely affect vulnerability and further informed through use of statistical analyses as described in the GAR. The ESJHVA proposed in the GAR captures nearly all wells with known historical nitrate exceedances of the maximum contaminant level (MCL) and largely retains the scientific basis from which it originally evolved. However, during the determination of the ESJHVA, the Coalition extended the area to encapsulate all wells with historical exceedances of the MCL for nitrate, even if the physical attributes did not suggest high vulnerability, in order to recognize and incorporate areas where concentrations are above the groundwater quality objective.

Further extending the high vulnerability area to capture all wells with nitrate concentrations above 5 mg/L (as N), without regard for the intrinsic physical properties of the location, would greatly deviate from the scientific basis of the high vulnerability determination and is conceptually flawed. In the context of the conceptual model for groundwater vulnerability used in the GAR, it is believed that wells exhibiting nitrate concentrations between 5 and 10 mg/L are likely to be influenced by groundwater flow paths of greater distance when compared to wells with exceedance concentrations. Furthermore, the depth of wells is variable and commonly not known and locational accuracy, especially for CDPH wells used in the analysis, is uncertain. Consequently, the flow path for groundwater measured in a well is also uncertain. The ESJHVA area also captures a very high percentage (93%) of wells with maximum observed nitrate concentrations between 5 and 10 mg/L and clear spatial associations between the ESJHVA and wells with concentrations of 5 mg/L or greater are apparent, as shown in **Figure 9** and discussed in Section 6.2 of the GAR.

Table 2 summarizes the wells in which the most recent nitrate observation was between 5 and 10 mg/L and tallies their location in relationship to the ESJHVA and irrigated lands areas (from 2010 California Department of Conservation Farmland Mapping and Monitoring Program [FMMP]). The numbers in **Table 2** show that most of these wells are within or in close proximity to the ESJHVA. Of a total of 1,028 wells with a most recent nitrate observation of between 5 and 10 mg/L, only 46 (4.5%) wells are not in or within ¼ mile of the ESJHVA including the Tentative High Vulnerability Areas. Of the 46 wells that are not within ¼ mile of the ESJHVA, 13 of those wells are greater than ¼ mile from irrigated land area mapped in 2010 FMMP. This means that only 33 (3.2%) wells with concentrations between 5 and 10 mg/L are located on irrigated lands distant from areas designated as high vulnerability in the GAR. Because of the uncertainty associated with many well locations, most notably the obfuscation of all CDPH well locations by up to one mile, adding additional area to the ESJHVA to encompass well locations with concentrations above 5 mg/L would be arbitrary and would not necessarily

encompass real locations where nitrate concentration in groundwater are greater than 5 mg/L. Furthermore, this would stray from the physical basis used in the designation of the ESJHVA, as discussed above.

Table 2: Summary of Wells with Most Recent Nitrate Concentrations between 5 and 10 mg/L in Relation to the ESJHVA and Irrigated Lands within the Central Valley Floor

Data Source:	Inside ESJHVA?		Inside or Within 1/4 mile of ESJHVA?		Greater than ¼ mile from ESJHVA but within 1/4 mile of FMMP Irrigated Land?	
	Yes	No	Yes	No	Yes	No
Dairy	226	47	242	31	29	2
DPH	173	15	180	8	7	1
DWR	128	28	140	16	12	4
GAMA	270	29	280	19	16	3
MID	7	0	7	0	0	0
TID	3	0	3	0	0	0
USGS	89	13	91	11	8	3
Total (#)	**896**	**132**	**943**	**85**	**72**	**13**
Total (%)	**87.2%**	**12.8%**	**91.7%**	**8.3%**	**84.7%**	**15.3%**

Figure 10 shows the significant temporal trends in nitrate concentrations in wells with a maximum nitrate concentration of between 5 and 10 mg/L, based on analyses conducted as part of the GAR (see Section 5.3.2 of the GAR). This figure also illustrates that the locations where the greatest increasing trend in nitrate concentration occur are also located within or in close proximity to the ESJHVA. **Table 3** summarizes the wells with significantly increasing temporal trends in nitrate concentration and their spatial relationship to the ESJHVA. Of the wells with nitrate concentrations between 5 and 10 mg/L and exhibiting significantly increasing temporal trends, there are none that are located distant (>1/4 mile) from areas designated as high vulnerability in the GAR.

Table 3: Summary of Wells with Significant Temporal Trends in Nitrate Concentrations and Most Recent Concentration between 5 and 10 mg/L in Relation to the ESJHVA and Irrigated Lands within the Central Valley Floor

Nitrate Trend Category	Inside ESJHVA?		Inside or Within 1/4 mile of ESJHVA?		Greater than ¼ mile from ESJHVA but within 1/4 mile of FMMP Irrigated Land?	
	Yes	No	Yes	No	Yes	No
Decreasing	33	5	34	4	4	0
Increasing	96	2	98	0	0	0
Neutral (Low Rate of Change)	321	47	345	23	16	7
Total (#)	**450**	**54**	**477**	**27**	**20**	**7**

Summary

Table 4 compares the approach used by the Coalition for determining the ESJHVA with the comment by the RWQCB to include all wells with nitrate concentrations between 5 and 10 mg/L (as N) with respect to considerations to be used in defining high vulnerability areas as outlined in the WDR Order. The approach used in determining the ESJHVA considered factors including intrinsic physical properties, locations of historical exceedances of a concentration of 10 mg/L nitrate (as N) in groundwater, proximity to irrigated agriculture, and temporal trends in nitrate concentration. The ESJHVA encompasses 92% of well locations with a concentration of greater than 5 mg/L and nearly 97% of these locations that are also in proximity to irrigated agriculture are also within or in close proximity to the ESJHVA. Additionally, all wells with concentrations between 5 and 10 mg/L and with a significantly increasing temporal trend in nitrate concentration are within ¼ mile of the ESJHVA. As noted above, further extending the high vulnerability area to capture all wells with nitrate concentrations above 5 mg/L, without regard for the intrinsic physical properties of the location, would greatly deviate from the scientific basis of the high vulnerability determination and is conceptually flawed. Furthermore, using a threshold of 5 mg/L is also not consistent with the definition of an exceedance as outlined in the WDR Order.

Table 4: Rationale for Why ESJHVA Should Not Necessarily Include All Wells with Nitrate Concentrations of 5 mg/L or Greater

Considerations for High Vulnerability (Elements of RWQCB definition and ESJHVA emphasis for GAR)	**Comparison of Approaches**	
	ESJHVA Coalition Groundwater Vulnerability Method	**RWQCB Comment** Incude All Wells with Nitrate Concentrations between 5 and 10 mg/L
Intrinsic vulnerability: Physical properties and characteristics of the area (where conditions make groundwater more vulnerable to impacts)	ESJHVA geostatistical model incorporates physical properties	Blanket inclusion of all wells with nitrate concentrations between 5 and 10 mg/L does not directly consider physical conditions
Confirmed exceedance of Water Quality Objective	ESJHVA incorporates exceedances of nitrate Water Quality Objective (10 mg/L as N)	Approach using a threshold of 5 mg/L (½ the MCL) is not consistent with definition of an exceedance
Irrigated agriculture may cause or contribute to the exceedance	ESJHVA GAR considers whether or not the nitrate observation is associated with mapped irrigated agricultural lands, i.e., spatial analysis that considers potential causal mechanisms linking nitrate sources to water quality observations	Include wells with nitrate concentrations of ½ the MCL without consideration of sources and mechanisms may result in greater potential for sources of nitrates to be located more distant from wells, i.e., greater potential for regional impacts to be observed some distance along a flow path from one or more sources
Executive Officer determines that irrigated agriculture may be causing or contributing to a trend of groundwater degradation	All wells with nitrate concentrations between 5 and 10 mg/L with significantly increasing trends are captured by ESJHVA results	Blanket inclusion of all wells with nitrate concentrations between 5 and 10 mg/L does not directly consider trend

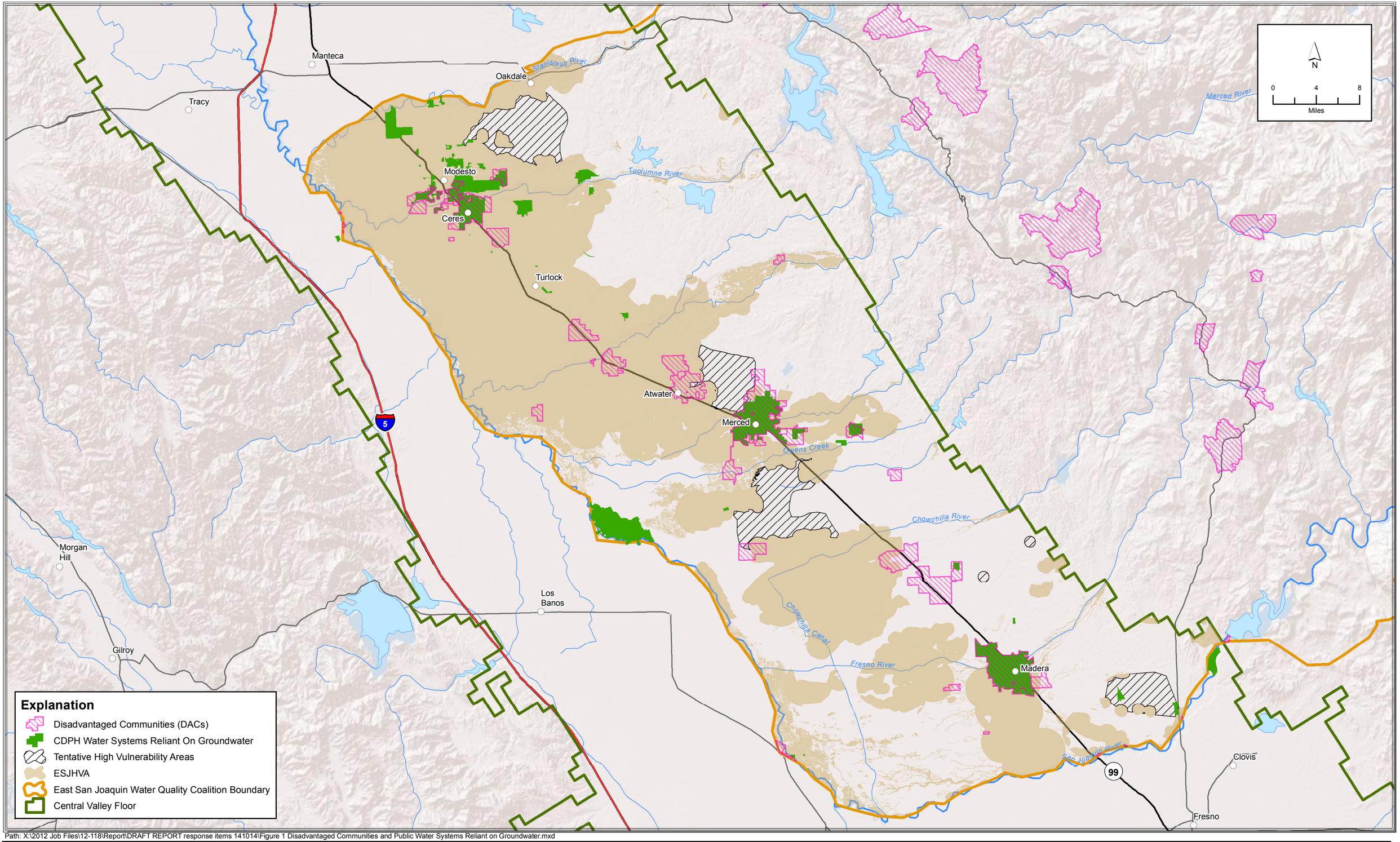
5. Results for the overlying land use control variable in East San Joaquin Hydrogeologic High Vulnerability Area (HHVA)

Table 5 presents some of the secondary statistical results from analyses conducted as part of the determination of groundwater vulnerability in the GAR (Section 6.2 of the GAR), as requested by the RWQCB in the staff review letter. In the statistical analyses conducted for the GAR, land use was used as a control variable in order to quantify statistical relationships between the intrinsic hydrogeologic properties and the observed groundwater quality (nitrate concentration). The results summarized in **Table 5** include the p-values and coefficients for each of the land use control variables used in the Shallow Wells Model, at two different snapshots in time (mid-1990s and early-2000s), as discussed in the GAR. A p-value of 0.1 or less was considered as significant in the GAR and only the coefficients for land uses with p-values of less than 0.1 are presented in **Table 5** (shaded green). The coefficients represent the mean predicted change in nitrate concentration for each land use category relative to a non-agricultural land use and holding all other variables constant.

Table 5: Summary of Results for Land Use Variables Used in the Groundwater Vulnerability Statistical Analysis

Land Use Category	Shallow Wells Model			
	Mid-1990s Land Use		Early-2000s Land Use	
	p-value	coefficient *	p-value	coefficient *
Citrus/Subtropics	0.523	N/A	0.271	N/A
Dairy/Livestock/Poultry	0.002	1.166	0.163	N/A
Fruit Trees	0.411	N/A	0.448	N/A
Grains/Cotton	0.742	N/A	0.177	N/A
Grapes	0.357	N/A	0.257	N/A
Grasses	0.049	0.434	<0.0005	0.800
Nut Trees	<0.0005	1.939	<0.0005	1.768
Rice	0.902	N/A	0.769	N/A
Seeds/Beans	0.001	-1.982	0.004	1.580
Vegetables	<0.0005	1.781	<0.0005	1.869

*The reported coefficients represent the increase/decrease in predicted mean nitrate concentration for each land use category relative to a non-agricultural land use, holding all other variables constant. N/A denotes that the relationship was not statistically significant at a p-value of less than 0.1.



Path: X:\2012 Job Files\12-118\Report\DRAFT REPORT response items 141014\Figure 1 Disadvantaged Communities and Public Water Systems Reliant on Groundwater.mxd

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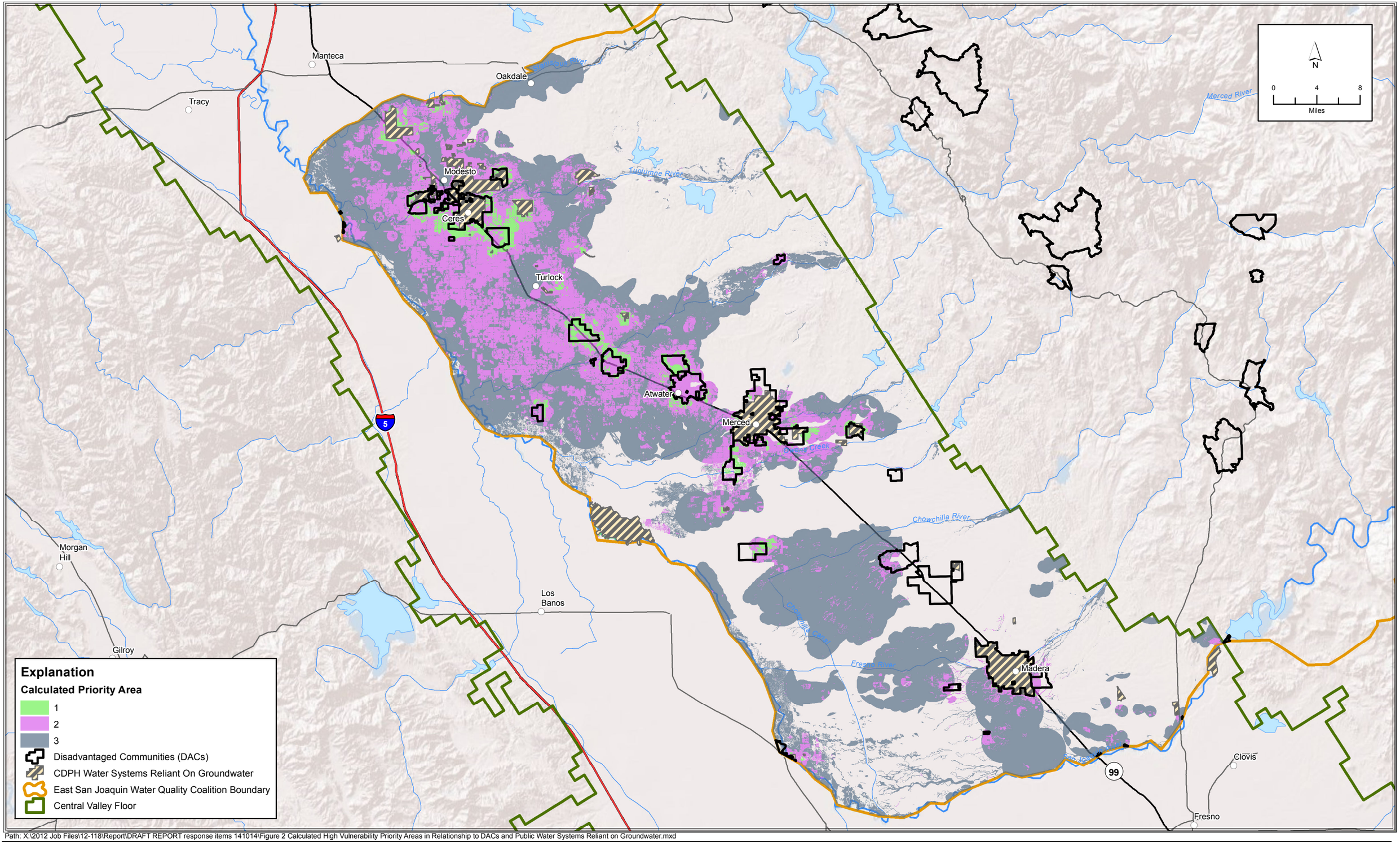
Figure 1
Disadvantaged Communities and Public Water Systems Reliant On Groundwater



Path: X:\2012 Job Files\12-118\Report\DRAFT REPORT response items 141014\Figure 2 Calculated High Vulnerability Priority Areas in Relationship to DACs and Public Water Systems Reliant on Groundwater.mxd

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Figure 2

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

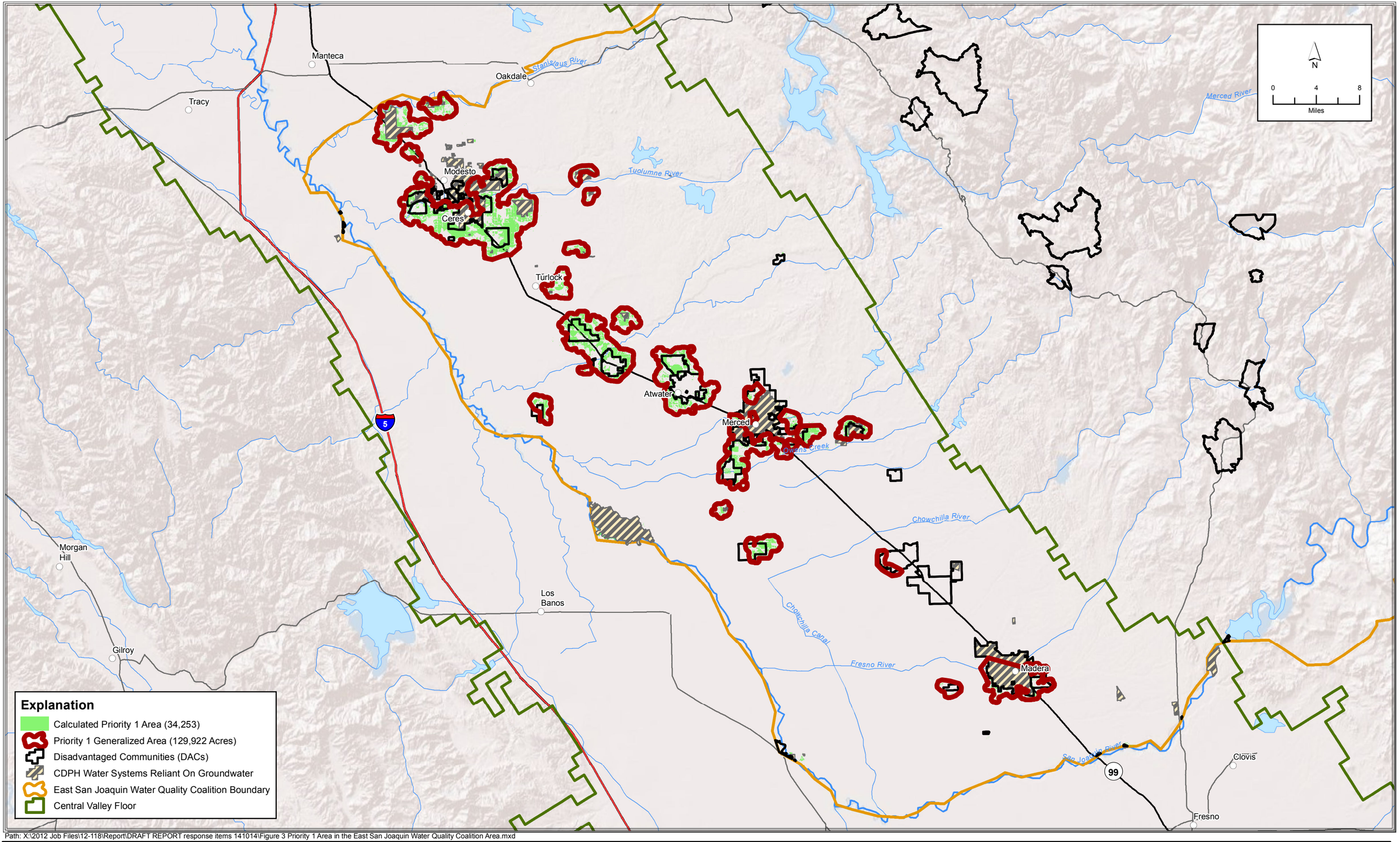

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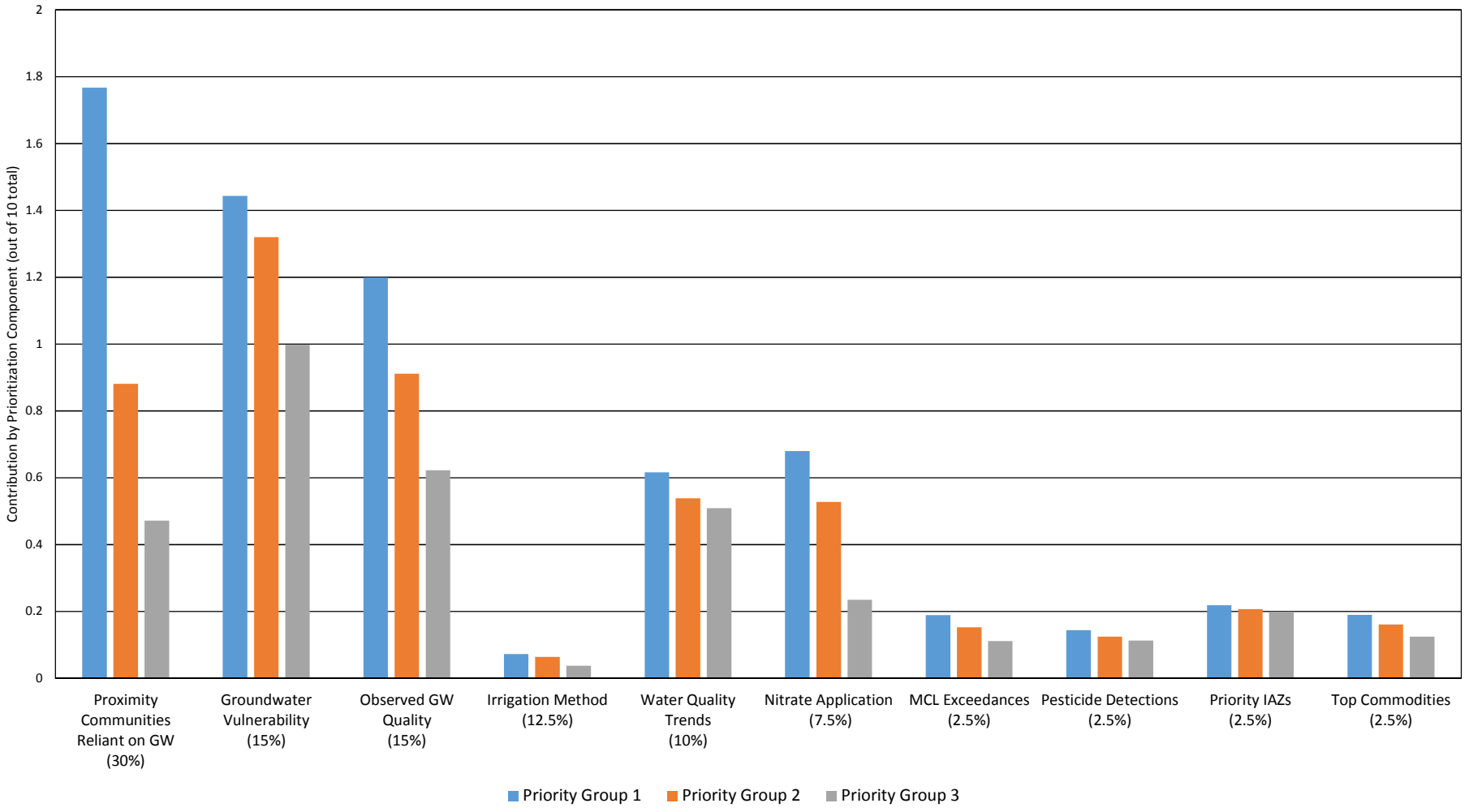
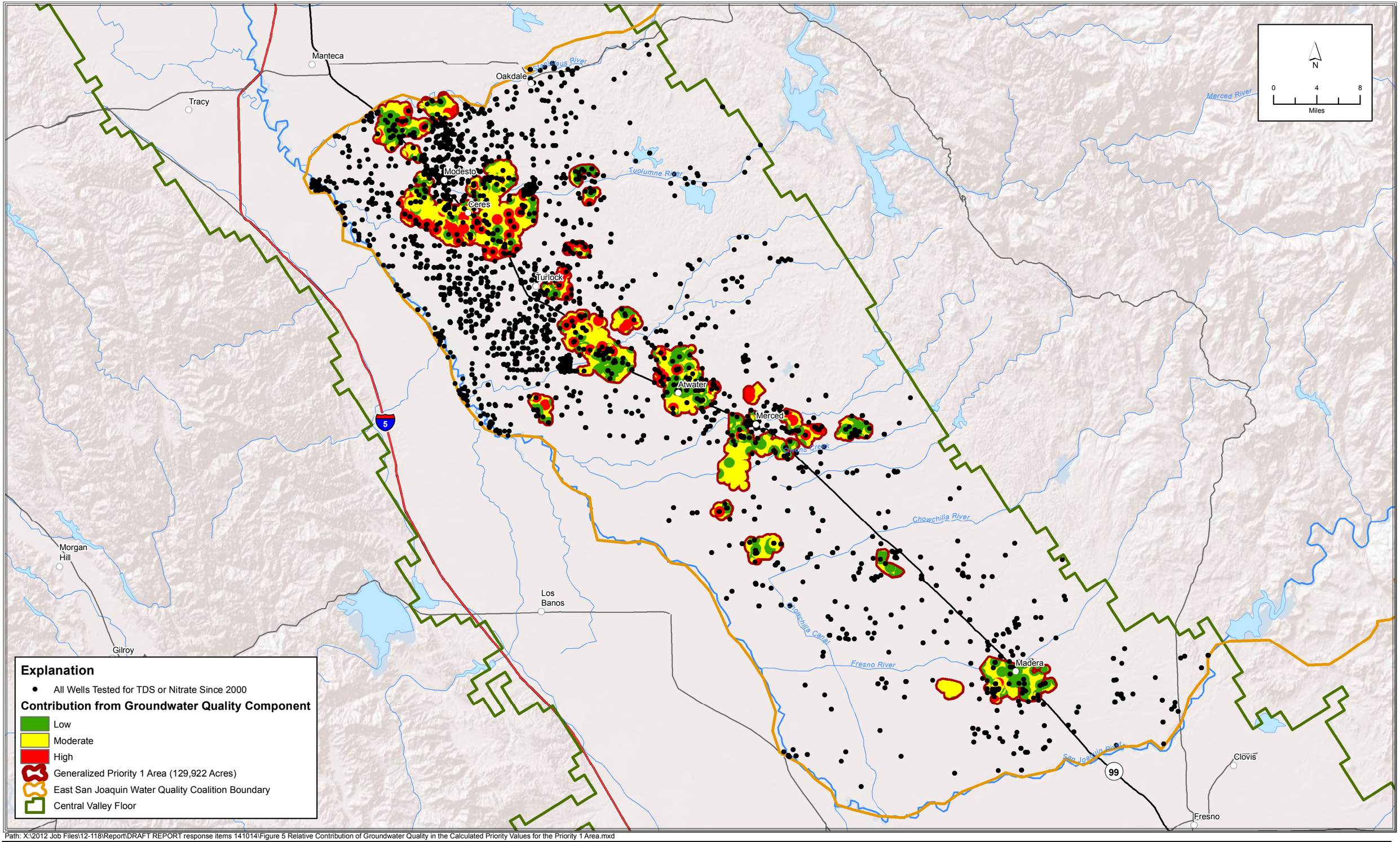
Figure 3
Priority 1 Area in the East San Joaquin Water Quality Coalition Area

Figure 4
Chart of Contribution from Prioritization Components in the Calculated Priority Areas





Path: X:\2012 Job Files\12-118\Report\DRAFT REPORT response items 141014\Figure 5 Relative Contribution of Groundwater Quality in the Calculated Priority Values for the Priority 1 Area.mxd

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Figure 5
Relative Contribution of Groundwater Quality in the Calculated Priority Values for the Priority 1 Area

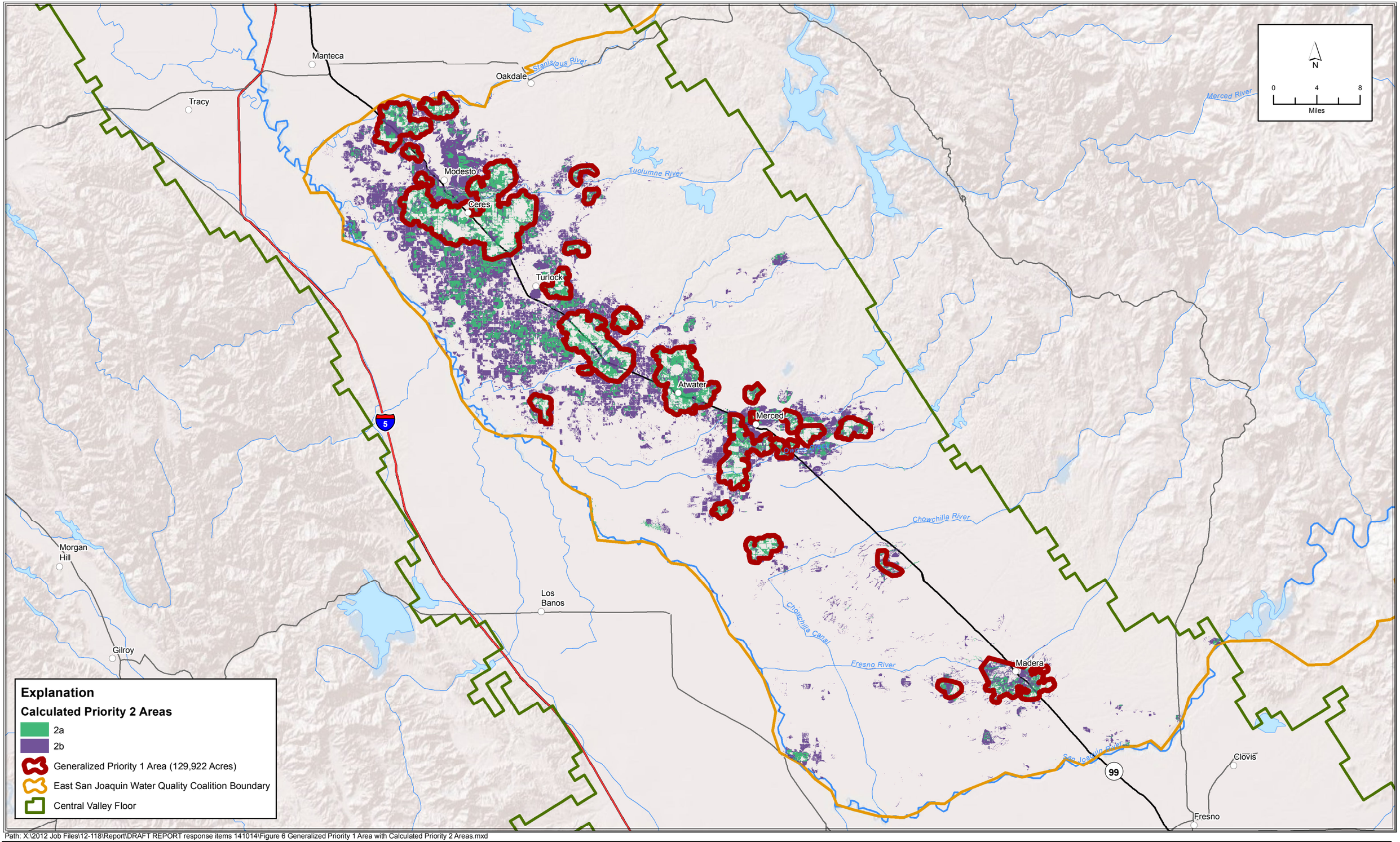

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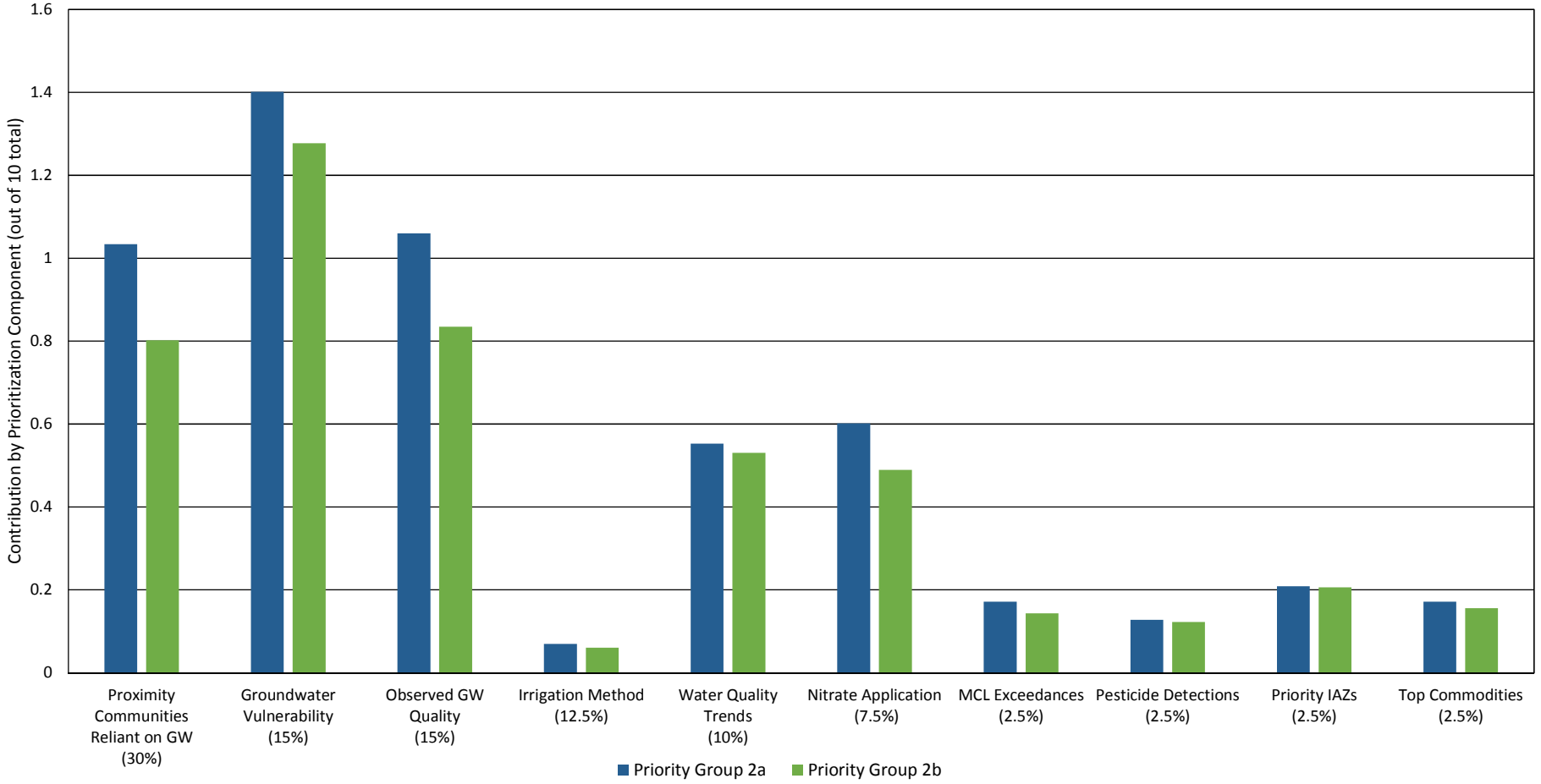
Figure 6
Generalized Priority 1 Area with Calculated Priority 2 Areas

Figure 7
Chart of Contribution from Prioritization Components in the Calculated Priority 2 Areas



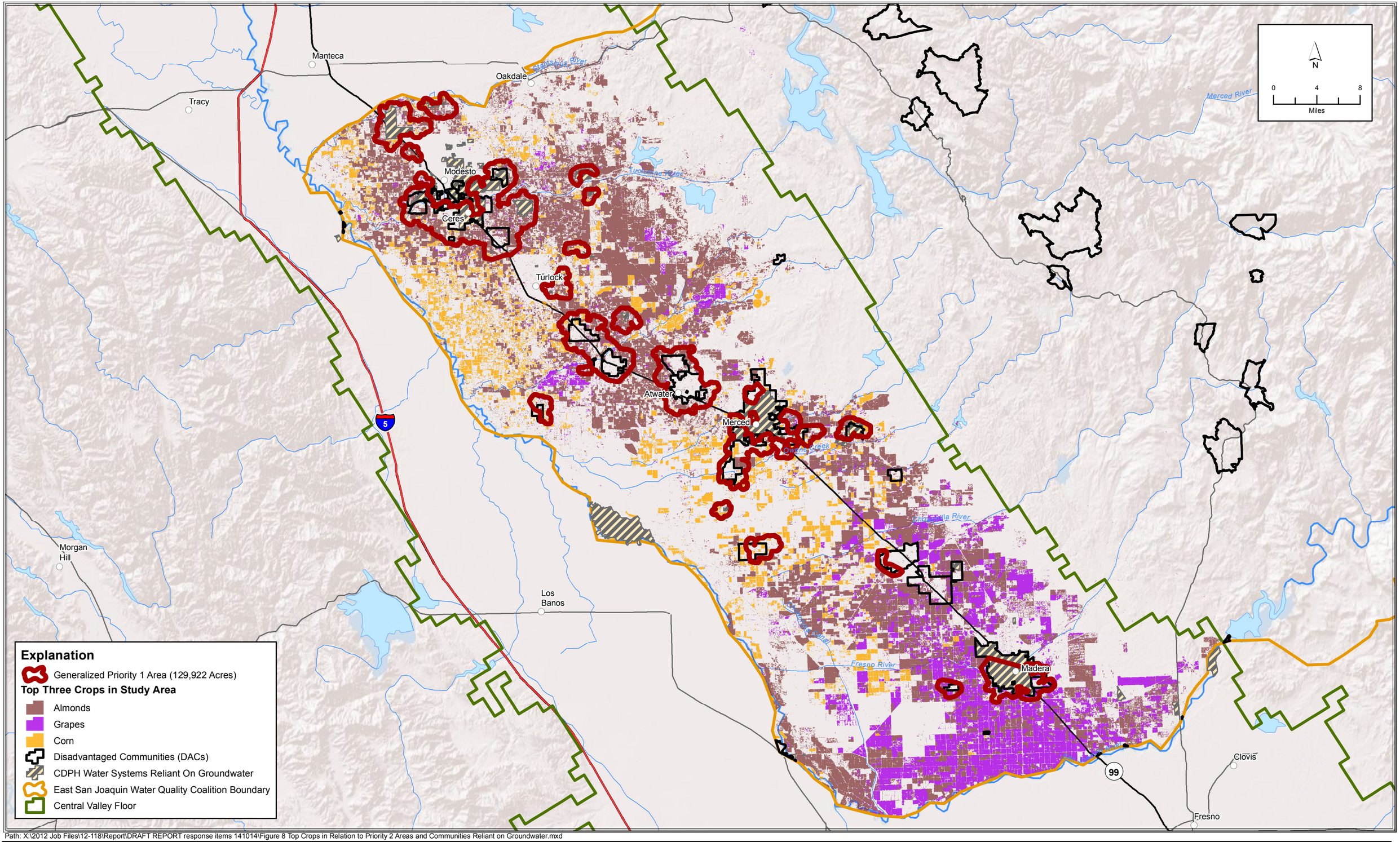


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Figure 8
Top Crops in Relation to Priority 2 Areas and Communities Reliant on Groundwater

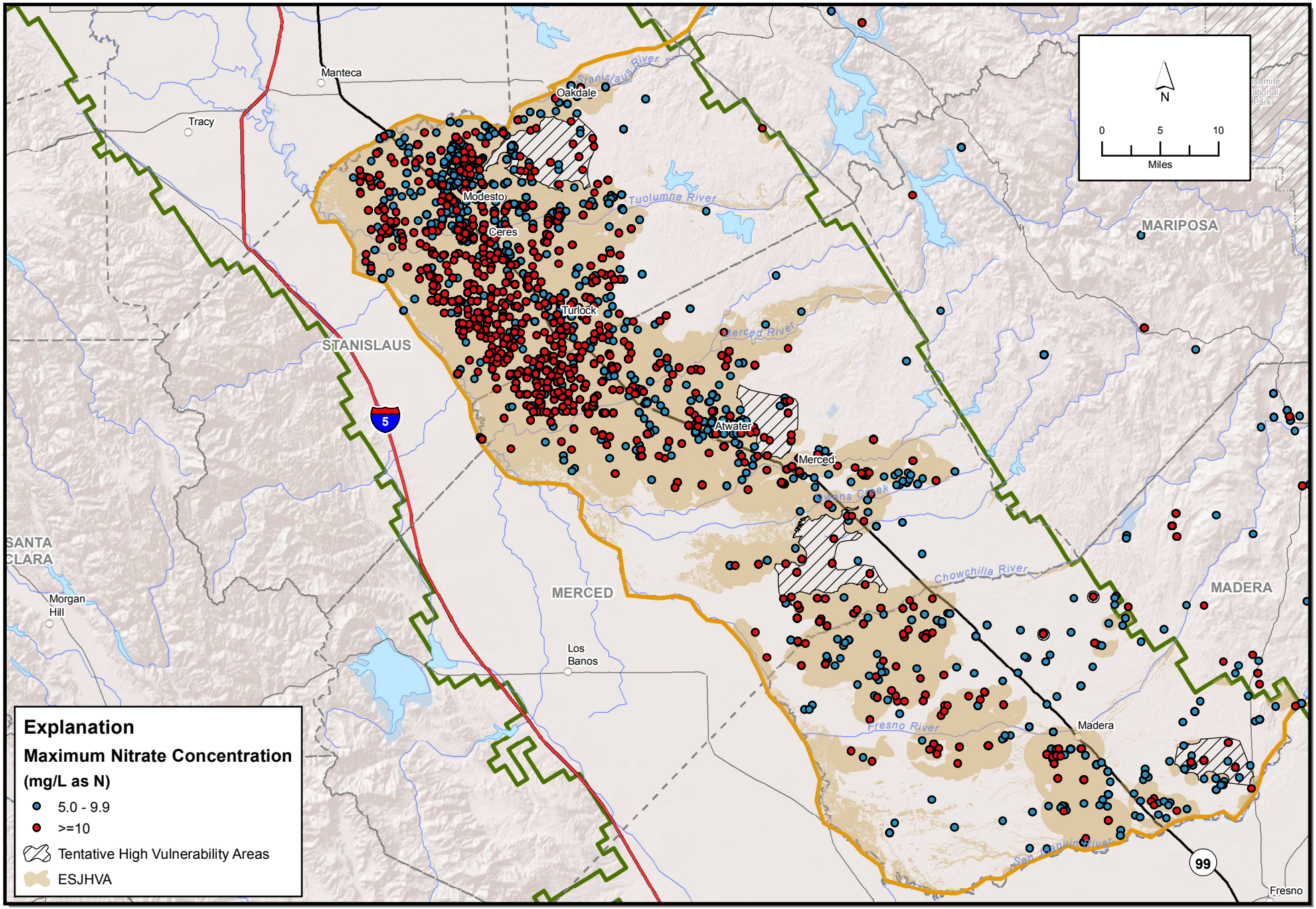

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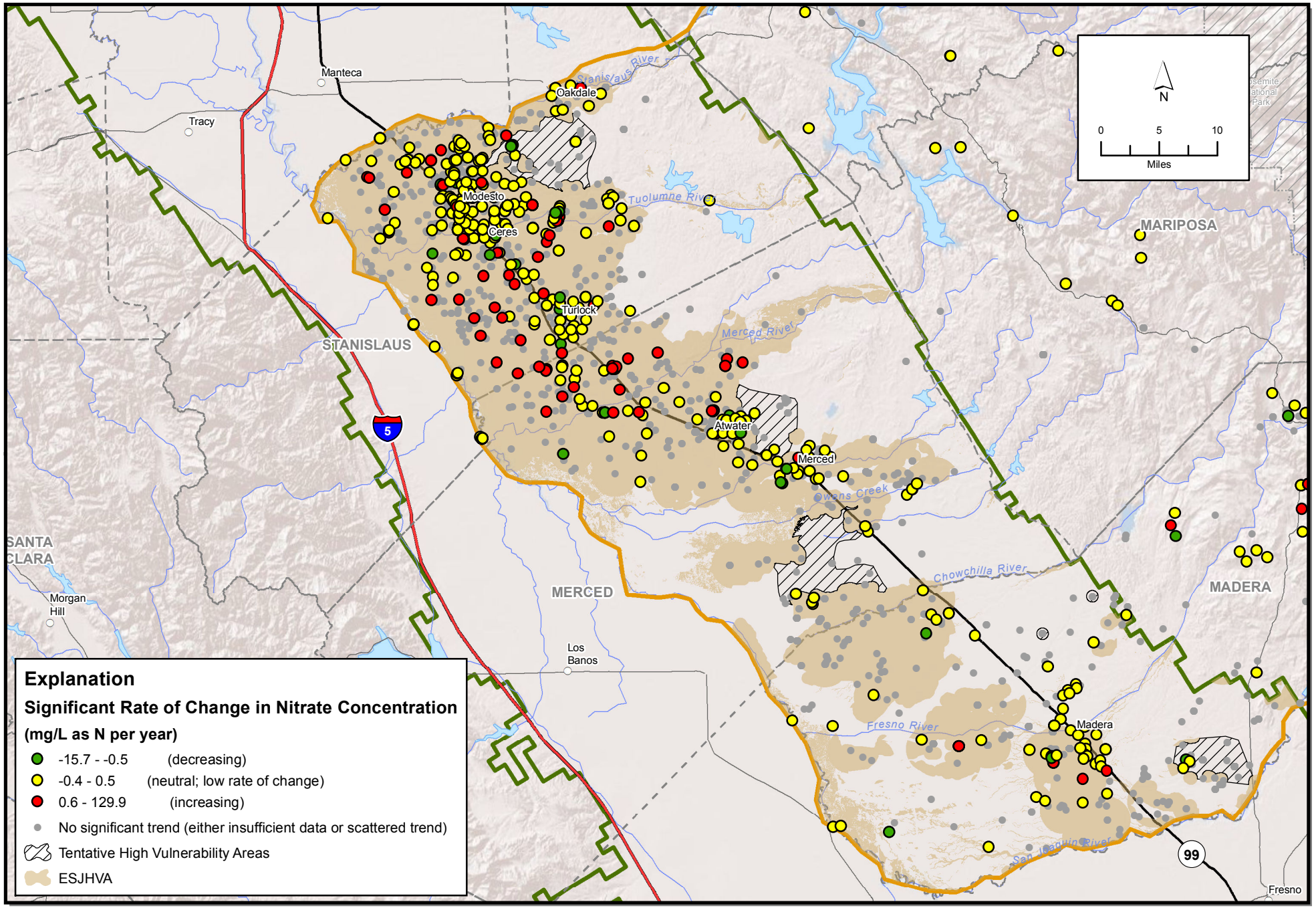
Figure 9

Wells with Maximum Nitrate Concentration of 5 mg/L or Greater



Path: X:\2012 Job Files\12-118\Report\DRAFT REPORT response items 141014\Figure 10 Significant Trends in Nitrate Concentration in Wells with Maximum Concentration Between 5 mgL and 10 mgL.mxd

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Figure 10
Significant Trends in Nitrate Concentration in Wells with Maximum Concentration Between 5 mg/L and 10 mg/L