

**Kern River Watershed Coalition Authority**

# **Groundwater Trend Monitoring Work Plan – Phase II Monitoring Network Addendum 2.0**

Kern County, California  
January 23, 2019

Prepared for:



Prepared by:



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This Groundwater Trend Monitoring Work Plan - Phase II Addendum 2.0 is signed by the following certified professionals:

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# Table of Contents

List of Figures .....	ii
List of Tables .....	ii
1 Introduction .....	1-1
2 Groundwater Quality Trend Monitoring Work Plan Approach and Implementation.....	2-1
2.1 Groundwater Quality Trend Monitoring Work Plan Approach .....	2-1
2.2 Groundwater Quality Trend Monitoring Implementation .....	2-1
2.2.1 Initial Network Submission .....	2-2
2.2.2 Subsequent Network.....	2-3
2.2.3 Supplemental Network .....	2-4
2.3 Well Construction Details, Site Assessments, and Selection Criteria.....	2-5
2.4 Proposed Sampling Schedule .....	2-6
2.4.1 Initial Network Sampling Schedule .....	2-6
2.4.2 Subsequent Network Sampling Schedule .....	2-6
2.4.3 Supplemental Network Sampling Schedule .....	2-6



## List of Figures

Figure 1. Groundwater Trend Monitoring Well Network and Crops.....	2-7
Figure 2. Groundwater Trend Monitoring Well Network and Dairies.....	2-8

## List of Tables

Table 1. Wells Density Summary .....	2-9
Table 2. Initial Network Well Details.....	2-10
Table 3. Subsequent Network Well Details .....	2-11
Table 4. Supplemental Well Network Details .....	2-12
Table 5. Groundwater Sampling Analyses and Schedule.....	2-13



## 1 Introduction

This Groundwater Trend Monitoring Work Plan-Phase II Addendum 2.0 (**Addendum 2.0**) has been prepared on behalf of the Kern River Watershed Coalition Authority (**KRWCA** or **Coalition**), in response to the Waste Discharge Requirements (**WDR**) General Order R5-2013-0120 for Growers within the Tulare Lake Basin Area that are Members of a Third-Party Group (**General Order**), adopted by the Central Valley Regional Water Quality Control Board (**RWQCB** or **Regional Board**). This Addendum 2.0 was prepared in response to comments received in a letter dated September 25, 2018, regarding Regional Board staff’s review of the KRWCA’s Groundwater Trend Monitoring Work Plan-Phase II Addendum (**GTMW-II Addendum**), submitted on July 31, 2018. The GTMW-II Addendum was submitted to provide well network details not originally submitted with the Groundwater Trend Monitoring Work Plan Phase I (**GTMW**) or Groundwater Trend Monitoring Work Plan Phase II (**GTMW-II**). This Addendum 2.0 expands and builds upon the GTMW-II Addendum previously submitted and is intended to describe an expanded groundwater monitoring network.

The RWQCB staff’s review provided a conditional approval of the 32-well trend monitoring network proposed in the Coalition’s GTMW-II Addendum. The conditional approval was contingent on the KRWCA providing an updated rationale and trend monitoring network that meets trend monitoring objectives within 120 days of the review letter (January 23, 2019). In addition, the Regional Board requested a meeting with the KRWCA Coalition and technical staff prior to October 10, 2018. The KRWCA complied with this request and met with RWQCB staff on October 8, 2018.

This Addendum 2.0, in conjunction with the GTMW, the GTMW-II, and the GTMW-II Addendum, collectively address the Regional Board staff’s written and oral comments, and the requirements of Attachment B MRP Section IV.E of the General Order by providing:

- A subsequent network of trend monitoring wells;
- Location and construction details for wells composing the subsequent trend monitoring network; and
- A supplemental network consisting of municipal public supply wells and contiguous Irrigated Lands Regulatory Program (**ILRP**) coalition wells.



## 2 Groundwater Quality Trend Monitoring Work Plan Approach and Implementation

Attachment B, Section IV.C.2 of the General Order requires the Groundwater Trend Monitoring Work Plan to implement a groundwater monitoring network that consists of enough wells to adequately assess groundwater quality conditions. Additionally, the groundwater monitoring network must:

- Represent both high and low vulnerability areas;
- Employ relatively shallow wells or existing monitoring well networks; and
- Be representative of the regional effects of irrigated agriculture.

### 2.1 Groundwater Quality Trend Monitoring Work Plan Approach

Attachment B, Section IV.E.1 of the General Order requires that the Trend Monitoring Work Plan provide details regarding the rationale for the number of proposed wells to be monitored and their locations. The rationale must consider:

- The variety of agricultural commodities produced within the third party's boundaries;
- Conditions identified in the Groundwater Quality Assessment Report (GAR) related to the vulnerability prioritization within the coalition area; and
- Areas identified in the GAR that contribute significant recharge to urban and rural communities where groundwater serves as a significant source of supply.

Described within the KRWCA GTMW Section 4.2.1.6, these considerations were assigned a range of scores and a relative scale to develop the optimal density of wells per township/range within the KRWCA Coalition boundaries. A sum of the weighted scores yielded the maximum number of wells to be selected for monitoring in a township. Zero to three wells per township were selected as the optimum monitoring density based upon the assessed monitoring priority ranking.

Areas upgradient of communities reliant on groundwater were prioritized and weighted with respect to this classification. The scale defaulted all irrigated acreage upgradient of a disadvantaged community (DAC) to the highest HVA prioritization, Tier I, for selection. This prioritization was applied to all identified HVAs. Each township was assessed for the considerations and scored according to the given scale.

### 2.2 Groundwater Quality Trend Monitoring Implementation

The network well density and spatial distribution presented in the GTMW was proposed as the maximum ideal density to represent the regional impacts of irrigated agriculture within the KRWCA. Monitoring well details and spatial locations were provided in the GTMW-II Addendum. However, in many areas the maximum optimal number of wells were not available to achieve well densities proposed in the GTMW Phase I. Additional guidance and clarification were provided during the October 8, 2018, meeting between KRWCA and Regional Board staffs to facilitate network expansion. **Section 2.2.2** and **Section 2.2.3** of this Addendum 2.0 discuss the proposed subsequent monitoring network



## Section Two: Work Plan Approach and Implementation

### Groundwater Trend Monitoring Work Plan – Phase II Monitoring Network Addendum 2.0

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wells and supplemental network wells added to the KRWCA’s trend monitoring network. **Figure 1** shows the KRWCA’s proposed groundwater trend monitoring network in relation to crop areas.

**Figure 2** shows the KRWCA’s proposed GTM network in relation to dairy land areas. Existing milk cow dairies in Kern County are required to comply with the General Order for Existing Milk Cow Dairies Monitoring and Reporting Program (MRP) No. R5-2013-0122 (**Dairy Order**) or be covered by an individual discharge requirement or under a conditional waiver issued pursuant to Water Code Section 13269. According to the Dairy Order MRP Section 7, domestic and agricultural supply wells on dairy lands are required to be tested for groundwater quality annually. **Figure 2** provides a spatial representation of the KRWCA townships with a high density of dairy land in relation to the KRWCA’s proposed groundwater trend monitoring network.

The KRWCA supports the concept of a dynamic and evolving network presented in the Central Valley Groundwater Monitoring Collaborative (CVGMC) Technical Work Plan Section 3.6. The Coalition will continue to adjust spatial coverage and evaluate the adequacy of the monitoring network with respect to changes in the distribution of irrigated agriculture, groundwater quality monitoring results, and availability of appropriate wells. As described in the Regional Board’s conditional approval letter, any necessary changes to the monitoring network will be discussed with Regional Board staff at least 60 days before trend monitoring begins for the next water year (October 1 – September 30).

#### 2.2.1 Initial Network Submission

Within the GTMW-II Addendum, the KRWCA provided a trend monitoring plan that consisted of 32 wells (**initial network**). These 32 wells were conditionally approved by the Regional Board on September 25, 2018, for inclusion in the KRWCA’s trend monitoring network, contingent on the KRWCA providing an updated rationale and expansion of the trend monitoring network within 120 days. The initial monitoring network was selected using the following criteria:

1. Well located within a proposed monitoring area as defined by township/range;
2. Well use other than point source monitoring;
3. Well seal present to a minimum depth of 20 feet made of cement or bentonite;
4. Well depth within targeted upper water bearing zones;
5. Perforated interval within 50-150 feet below average groundwater level, where available, or perforated interval begins above significant confining subsurface material; and
6. Well is not located with ¼ mile of a significant point discharger.

The selection process for the initial network was intended to develop a monitoring network that was the most representative of groundwater trends potentially influenced by the regional impacts of irrigated agriculture. Thus, wells were only included if they withdrew water from the upper zone of the aquifer (selection criteria four and five), as defined in Section 3.3 of the CVGMC. A complete explanation of the methodology used for determining initial network well selection can be found within the GTMW-II Addendum Section 1.1, “Groundwater Quality Trend Monitoring Implementation and Work Plan Approach,” and was presented to the Regional Board on October 8, 2018.



## Section Two: Work Plan Approach and Implementation

### Groundwater Trend Monitoring Work Plan – Phase II Monitoring Network Addendum 2.0

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#### 2.2.2 Subsequent Network

The subsequent network was developed to expand the trend monitoring network after the KRWCA demonstrated, in GTMW-II Addendum Section 1.1.4, that the optimal number of monitoring wells could not be located using the initial selection criteria listed above. The wells proposed in the subsequent network submission are intended to be combined with the initial network submission to form one comprehensive KRWCA groundwater trend monitoring network.

On October 8, 2018, the Regional Board directed the KRWCA to remove the selection requirement that selected wells must have a perforated interval within 50-150 feet below average groundwater level. To broaden the geographic distribution of wells within the trend monitoring network, the well selection criteria was expanded to include unconfined wells that withdraw water from below the upper zone for the subsequent network. If possible, wells that withdraw water from the upper zone were prioritized for inclusion in the subsequent network submission.

##### 2.2.2.1 Candidate Well Identification

To develop the subsequent network submission, well records were collected from the Department of Water Resources (**DWR**) and Kern County Public Health (**KCPH**). The DWR Online System for Well Completion Reports (**OSWCR**) was used to download datasets and files of all Well Completion Reports publicly available for Kern County. Information requests were made to KCPH for data sets of all completed Well Permits and available Well Permit files were downloaded for review. Well completion datasets were searched for the KRWCA townships/ranges that required additional representation in the network.

Wells were identified as candidates for inclusion in the subsequent network, from the available records, based on the following criteria:

1. Well located within a proposed monitoring area, defined by township/range, that is not sufficiently covered by the initial network;
2. Well use other than point source monitoring;
3. Well seal present to a minimum depth of 20 feet made of cement or bentonite;
4. Well is not confined by any significant clay layers (Corcoran Clay); and,
5. Well is not within a  $\frac{1}{4}$  mile radius of any significant point source discharger.

The KRWCA reviewed 11,159 well records from the KCPH and DWR data sources. Of the 11,159 well records, only the 2,100 well records with a well status of “completed” advanced in the selection process. Well records with a status of “canceled permit”, “destroyed”, “expired permit”, or “in progress” were removed from consideration. The KRWCA considered agricultural, industrial, public supply, ambient monitoring, and domestic well types for inclusion in the subsequent network. Due to the possibility of data interference and lack of representativeness of irrigated agriculture, 237 wells were excluded due to their classification as cathode protection, point-source monitoring/testing, or vapor extraction wells. The remaining well records were filtered for wells located within the 24 townships/ranges that required additional representation in the trend monitoring network. An explanation of the density and distribution criteria the KRWCA used to develop the Groundwater Trend Monitoring Network design can be found in GTMW Section 4.2.1.6.



## Section Two: Work Plan Approach and Implementation

### Groundwater Trend Monitoring Work Plan – Phase II Monitoring Network Addendum 2.0

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A total of 193 well logs matched the subsequent network selection criteria and were identified as viable candidates for further assessment. Before a well could be included in the proposed subsequent network, it was necessary to obtain proper land access permissions. Access request letters were sent to all landowners or Coalition member contacts for parcels containing candidate wells. In total, the KRWCA sent out 121 access request letters. If a landowner or Coalition member owned multiple parcels with candidate wells, they only received one letter requesting access to multiple parcels.

Access request letters were returned to the Coalition for 51 parcels containing candidate wells. As a result of excellent member participation, 42 access request letters were returned for Coalition member parcels. The KRWCA received nine access request letters for non-member parcels. The majority of non-member landowners (89%) did not return the Coalition's request for access to their wells. After reviewing satellite imagery and conducting site-visits, 18 wells were removed from consideration due to being located within ¼ mile of a significant point discharger (e.g. dairy, wastewater treatment plant, food processor, septic tank, or confined animal feed operation). One well was removed due to it being abandoned. One well was not included because the well density target for its respective township/range had already been reached. On-site surveys were conducted for the remaining wells to record GPS coordinates, depth to static water measurements (if possible), and to ensure that the well has the capacity to operate.

Thirty-one wells were determined to meet the final criteria for inclusion in the subsequent network and the required details are listed in [Section 2.3](#), below. [Figure 1](#) provides a map of the spatial distribution of the combined initial and subsequent networks.

### 2.2.3 Supplemental Network

In addition to the initial network and proposed subsequent network, the KRWCA has identified a collection of supplemental wells to achieve the Coalition's monitoring objectives. The CVGMC Technical Work Plan Section 4 states that Coalitions may identify complementary wells to meet their monitoring objectives. These additional wells provide data to supplement the data collected from the Coalition's monitoring well network.

The KRWCA's supplemental network consists of public supply wells found using the State Water Board Groundwater Ambient Monitoring and Assessment Program (**GAMA**) groundwater information system (GeoTracker). In addition, via the CVGMC, the KRWCA will collaborate with two neighboring ILRP Coalitions, the Buena Vista Coalition (**BVC**) and the Cawelo Water District Coalition (**CWDC**), to utilize the data from their monitoring networks to provide representative coverage where Coalition borders are shared.

#### 2.2.3.1 Candidate Well Information

##### 2.2.3.1.1 ILRP Partner Coalition Candidate Well Information

The BVC well selection approach methodology can be found within the Buena Vista Coalition Groundwater Quality Trend Monitoring Plan (April 2018). The CWDC well selection approach methodology can be found within the Cawelo Water District Coalition Groundwater Quality Trend Monitoring Work Plan (May 14, 2018).



## Section Two: Work Plan Approach and Implementation

### Groundwater Trend Monitoring Work Plan – Phase II Monitoring Network Addendum 2.0

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#### 2.2.3.1.2 Public Supply Candidate Well Information

To form the supplemental network of public supply wells, the KRWCA completed a geographic assessment of the Coalition areas that required additional representation after selection of wells that met the initial and subsequent selection criteria.

Within each township/range requiring additional representation, the KRWCA used the State Water Board's GAMA GeoTracker database to locate well completion reports for active municipal systems utilizing groundwater as a drinking water source. If a well completion report could be located, and the well's construction details met the selection criteria discussed in **Section 2.2.2.1**, then the public supply well was included in the supplemental network. The KRWCA foresees adjusting the number of public supply wells from the network as needed to adequately represent the groundwater trend of irrigated agriculture within the region.

### 2.3 Well Construction Details, Site Assessments, and Selection Criteria

Attachment B, Section IV.E.2 requires details for wells proposed for trend monitoring, including:

- Global Positioning System (GPS) coordinates;
- California State Well Number (if known);
- DWR Well Completion Report/Driller's Log Number;
- Well depth;
- Top and bottom perforation depths;
- A copy of the well driller's log (if available);
- Depth of standing water (static water level), if available; and,
- Well seal information (type of material and length of seal).

Required well construction details were collected for the KRWCA initial and subsequent trend monitoring wells during the candidate identification process from well logs and on-site surveys. Well details for the KRWCA initial network are provided in **Table 2**. In the GTM-II Addendum, the KRWCA submitted 32 wells for inclusion in the network. During sampling, the Coalition discovered that two wells needed to be removed from the submitted network since they were located on non-member property and permission to access was refused. **Table 2** also provides updated well construction information for six wells within the initial network. Well details for the KRWCA subsequent network are provided in **Table 3**. Supplemental network well details for public supply wells were collected by reviewing available data within the GAMA database and are provided in **Table 4**. Supplemental network well details for the contiguous ILRP Coalition wells may be found in their respective groundwater trend monitoring work plans, as described in **Section 2.2.3.1.1**.



## 2.4 Proposed Sampling Schedule

### 2.4.1 Initial Network Sampling Schedule

As specified in Attachment B, MRP Section IV.E.3 of the General Order, trend monitoring wells must be sampled, at a minimum, annually at the same time of year. Sampling of the initial network was conducted in Fall 2018, in accordance with the terms provided in the Regional Board’s letter “Conditional Approval of the KRWCA Groundwater Trend Monitoring Work Plan and Phase II Monitoring Network Addendum” dated September 25, 2018. Moving forward, the KRWCA will continue to sample annually in coordination with the CVGMC, between the months of May and August. Sampling will include the constituents and timeframe listed in **Table 5** as required in Attachment B, MRP Section IV.E of the General Order.

### 2.4.2 Subsequent Network Sampling Schedule

Pending work plan approval, the KRWCA will follow the “initial sample frequency” constituent list displayed in **Table 5** for the 2019 sampling event for the added subsequent network wells. In 2019, the initial network will be sampled for the “annual frequency” constituents shown in **Table 5**. If the subsequent network is approved, the initial and subsequent networks will be combined to become one monitoring network. The KRWCA will follow the “annual frequency” sample schedule from **Table 5** for the 2020 through 2022 sampling events. For the 2023 sampling event, the KRWCA will sample the combined monitoring network following the “five-year frequency” constituent list displayed in **Table 5**.

The combined KRWCA Groundwater Trend Monitoring Network wells will be sampled annually in coordination with the CVGMC. The KRWCA did not receive direct permission to operate wells owned by Kern County water districts in order to take a sample. Therefore, water district wells will be sampled in coordination with an authorized party, Kern County Water Agency (**KCWA**). The KRWCA will collect an independent water sample during this coordinated sampling event and follow the same sampling schedule listed in **Table 5**. Water district wells will be sampled during the KCWA quarterly sampling event that is the closest to the CVGMC proposed sampling time frame of May-August.

### 2.4.3 Supplemental Network Sampling Schedule

Supplemental network wells that belong to associate member coalitions (Buena Vista Coalition and Cawelo Water District Coalition) will also be sampled by the associate member coalitions in accordance with the CVGMC Technical Work Plan. As described in the CVGMC Technical Work Plan Section 6, sample results acquired by all participating coalitions will be compiled and stored within the CVGMC Data Management System.

Similar to water district wells, public supply wells will be sampled in coordination with the owning agency. Permission to collect a coordinated sample is currently being sought for the public supply wells listed in **Table 4**. If permissions are obtained, the wells will be sampled at the owner-sanctioned sampling event closest to the CVGMC proposed sampling time frame of May-August.

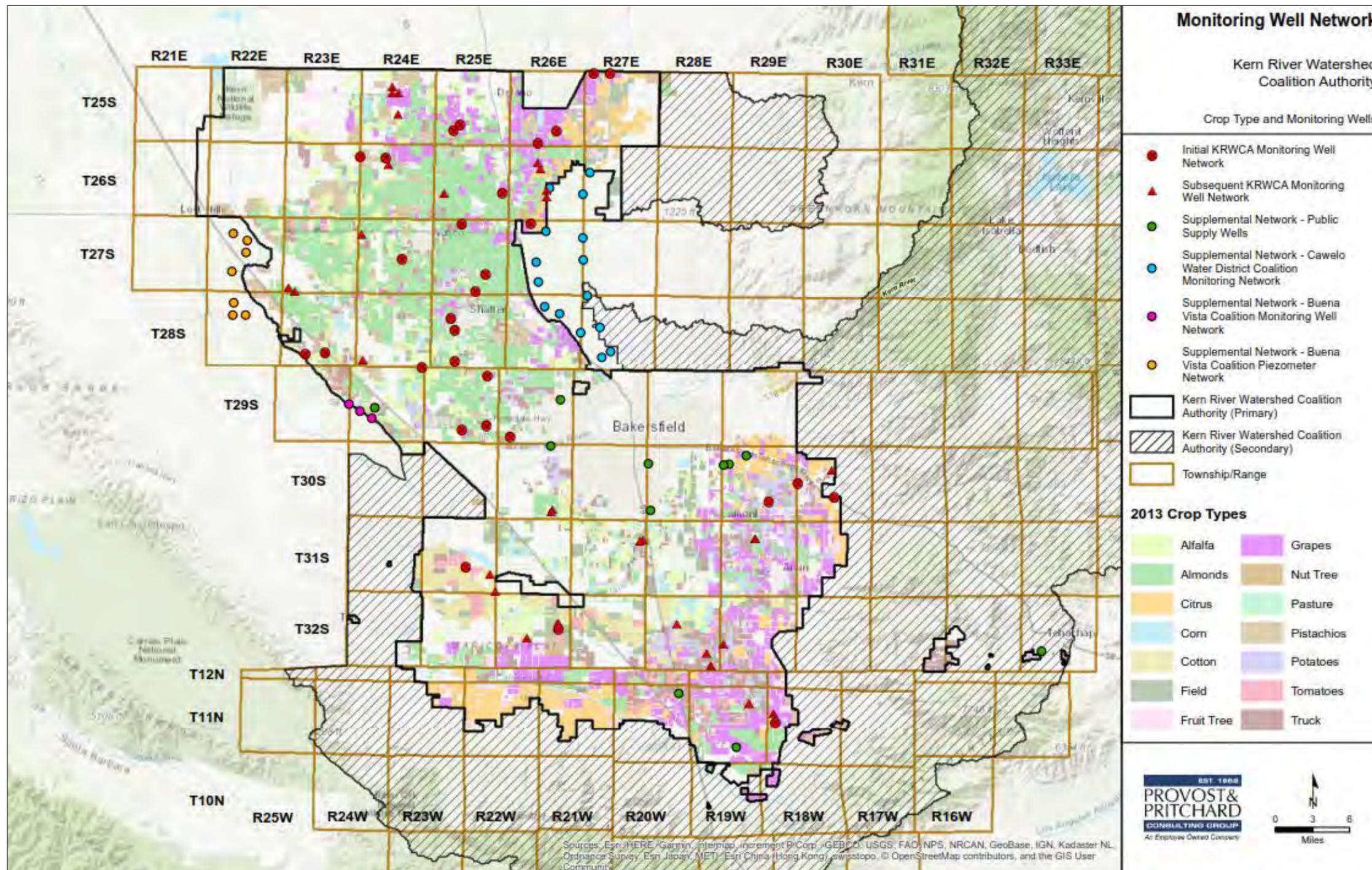


Figure 1. Groundwater Trend Monitoring Well Network and Crops

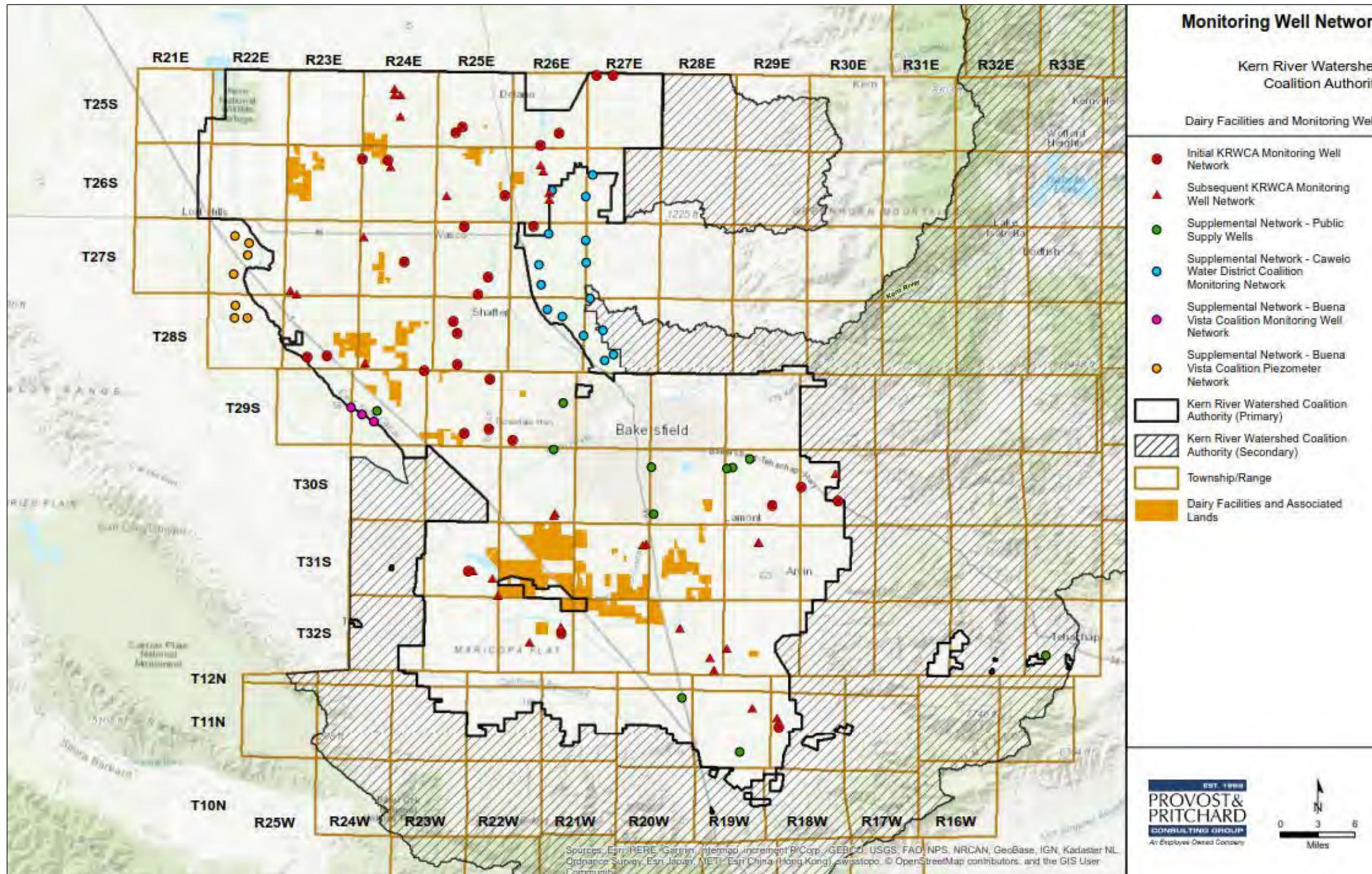


Figure 2. Groundwater Trend Monitoring Well Network and Dairies



## Section Two: Work Plan Approach and Implementation

Groundwater Trend Monitoring Work Plan – Phase II Monitoring Network Addendum 2.0

**Table 1. Wells Density Summary**

Proposed Number of Wells (from GTM-I Approach)	Initial Network Wells	Subsequent Network Wells	Contiguous ILRP Coalition Wells (Supplemental Network)	Public Supply Wells (Supplemental Network)	Total Number of Monitoring Wells
<b>107</b>	30	31	26	11	<b>98</b>



**Section Two: Work Plan Approach and Implementation**  
Groundwater Trend Monitoring Work Plan – Phase II Monitoring Network Addendum 2.0

**Table 2. Initial Network Well Details**

Latitude	Longitude	Well Depth (ft)	Top Perforations Depth (ft)	Bottom Perforations Depth (ft)	Well Drillers Log Number (if available)	Depth to Standing Water (ft) (if available)	Sanitary Seal Depth (ft)	Sanitary Seal Type
35.7193006	-119.1562225	600	400	600	508093	331	50	Cement
35.7045979	-119.1827062	440	340	440	508094	312	50	Cement
35.7872899	-119.0800907	800	400	800	e068721	429	50	Cement
35.7872450	-119.1035930	405	185	405	e012452	186	50	Cement
35.6865302	-119.4375743	400	200	400	e023106	-	50	Cement
35.6856420	-119.4006030	400	320	400	724867	323	100	Cement
35.6465225	-119.2330533	900	400	900	e0316643	349	300	Cement
35.5678052	-119.3754850	400	320	400	569623	306	287	Cement
35.6091127	-119.2903921	828	468	828	151862	371	50	Cement
35.5511602	-119.2553406	800	440	800	1091572	397	50	Cement
35.5308929	-119.2697958	810	380	810	e0239535	370	350	Cement
35.6106927	-119.1911175	800	400	800	e068435	443	250	Cement
35.4572269	-119.4838263	440	120	440	e074073	69	100	Cement
35.4551024	-119.5124139	380	160	380	780438	291	150	Cement
35.4856394	-119.2982577	827	300	827	EO163192	499	40	Cement
35.4991640	-119.3046020	400	320	400	373298	338	50	Cement
35.4489443	-119.2980543	870	345	870	EO219847	316	40	Cement
35.4411870	-119.3449690	601	221	601	e0146271	234	140	Cement
35.4317941	-119.2513644	620	279	620	e0194674	292	50	Cement
35.3744290	-119.2517130	350	260	350	-	-	20	-
35.3693207	-119.2869671	310	210	310	-	-	20	-
35.2889455	-118.8469772	910	390	910	e0360864	396	50	Cement
35.3106598	-118.8054461	1220	560	1220	e0261310	393	50	Cement
35.2942040	-118.7533470	500	400	500	e0141238	289	350	Cement
35.2086061	-119.2782883	960	280	960	e070644	-	190	Cement
35.0311280	-118.8345720	720	540	700	e069441	582	50	Cement
35.1377369	-119.1453019	1020	540	1020	542931	248	50	Cement
35.3617083	-119.2170589	430	360	430	-	-	20	-
35.7184502	-119.3042325	340	200	340	0900615	132	100	Cement
35.7251160	-119.2948310	298	158	298	e073851	121	100	Cement



**Table 3. Subsequent Network Well Details**

Latitude	Longitude	Well Depth (ft)	Top Perforations Depth (ft)	Bottom Perforations Depth (ft)	Well Drillers Log Number <i>(if available)</i>	Depth to Standing Water (ft) <i>(if available)</i>	Sanitary Seal Depth (ft)	Sanitary Seal Type
35.76129	-119.38377	930	360	930	f168212	304	465	Cement
35.76822	-119.39262	1200	340	1200	e057090	298	340	Cement
35.76133	-119.39262	945	340	945	e057063	-	472	Cement
35.73679	-119.38430	947	392	912	e0105552	302	320	Cement
35.67760	-119.39702	800	420	760	e072256	-	400	Cement
35.64534	-119.31651	800	310	800	e072643	340	270	Cement
35.67488	-119.17845	1240	520	1220	e0089573	305	150	Cement
35.68179	-119.18251	805	386	805	780415	-	50	Cement
35.65040	-119.16936	1105	653	1104	1095418	282	50	-
35.64225	-119.16942	1000	600	1000	e0083772	268	150	Cement
35.24583	-118.86579	680	400	680	780424	276	390	Cement
35.53275	-119.53745	500	300	500	801174	-	50	-
35.5304	-119.33923	620	420	620	780436	-	50	Bentonite
35.52782	-119.52839	500	300	500	e041479	-	50	Cement
35.44934	-119.42926	700	340	700	-	285	340	Cement
35.32700	-118.75735	600	260	600	EO-38690	140	50	Cement
35.18113	-119.23581	1000	300	1000	e066238	200	300	Cement
35.20154	-119.24418	1000	300	1000	e066233	176	300	Cement
35.24320	-119.02585	710	200	700	e0079091	143	155	Cement
35.24142	-119.03004	710	200	697	e0079092	142	155	Cement
35.05301	-118.87280	1000	500	1000	e0081187	183	50	Cement
35.04184	-118.83734	1080	560	1080	e0083811	191	50	Cement
35.14492	-119.14610	1002	496	1002	-	-	150	Cement
35.12665	-119.18995	1050	907	1050	e070637	-	150	Cement
35.14533	-118.97646	1002	438	1002	EO172071	235	40	Cement
35.11112	-118.93358	1200	560	1200	785641	304	50	Cement
35.09670	-118.92792	1200	520	1200	783349	397	50	Cement
35.12235	-118.90996	920	314	920	e007896	314	150	Cement
35.59588	-119.43375	681	440	681	1095425	340	310	Cement
35.27810	-119.15558	610	230	600	e0092295	186	160	Cement
35.27417	-119.15775	810	200	800	e0092275	185	160	Cement



**Table 4. Supplemental Well Network Details**

Latitude	Longitude	Well Depth (ft)	Top Perforations Depth (ft)	Bottom Perforations Depth (ft)	Well Drillers Log Number <i>(if available)</i>	Depth to Standing Water (ft) <i>(if available)</i>	Sanitary Seal Depth (ft)	Sanitary Seal Type
35.001967	-118.889406	1447	767	-	-	-	50	Cement
35.064358	-118.972453	880	730	870	e0155328	-	50	Cement
35.393894	-119.410803	640	320	635	503236	-	50	-
35.405942	-119.145914	1170	730	1170	1086172	-	680	Cement
35.351600	-119.158917	651	352	632	173562	-	300	Cement
35.332400	-119.018961	600	192	600	-	-	100	Cement
35.277569	-119.014858	675	300	675	17964	-	60	Cement
35.342697	-118.878828	603	362	603	259278	-	300	Cement
35.332417	-118.903194	600	400	600	097839	-	50	Cement
35.331719	-118.911236	845	440	835	1084900	-	400	Cement
35.116642	-118.456019	604	400	590	344466	-	300	Cement



## Section Two: Work Plan Approach and Implementation

### Groundwater Trend Monitoring Work Plan – Phase II Monitoring Network Addendum 2.0

**Table 5. Groundwater Sampling Analyses and Schedule**

Frequency		Indicator Parameter	Reporting Units	Field Measurement	Laboratory Analysis	Analysis Method	
Initial Sample	5-Year	Annual	Electrical Conductivity (EC)	µmhos/cm	•		Field Instrument
			pH	pH units	•		Field Instrument
			Dissolved Oxygen (DO)	mg/L	•		Field Instrument
			Temperature	°C	•		Field Instrument
			Nitrate as Nitrogen	mg/L		•	Method 300.0
		Total Dissolved Solids (TDS)	mg/L		•	Method 2540C	
		General Minerals - Anions (carbonate, bicarbonate, chloride, sulfate)	mg/L		•	Method 2320B	
		General Minerals - Cations (boron, calcium, sodium, magnesium, potassium)	mg/L		•	Method 200.7	