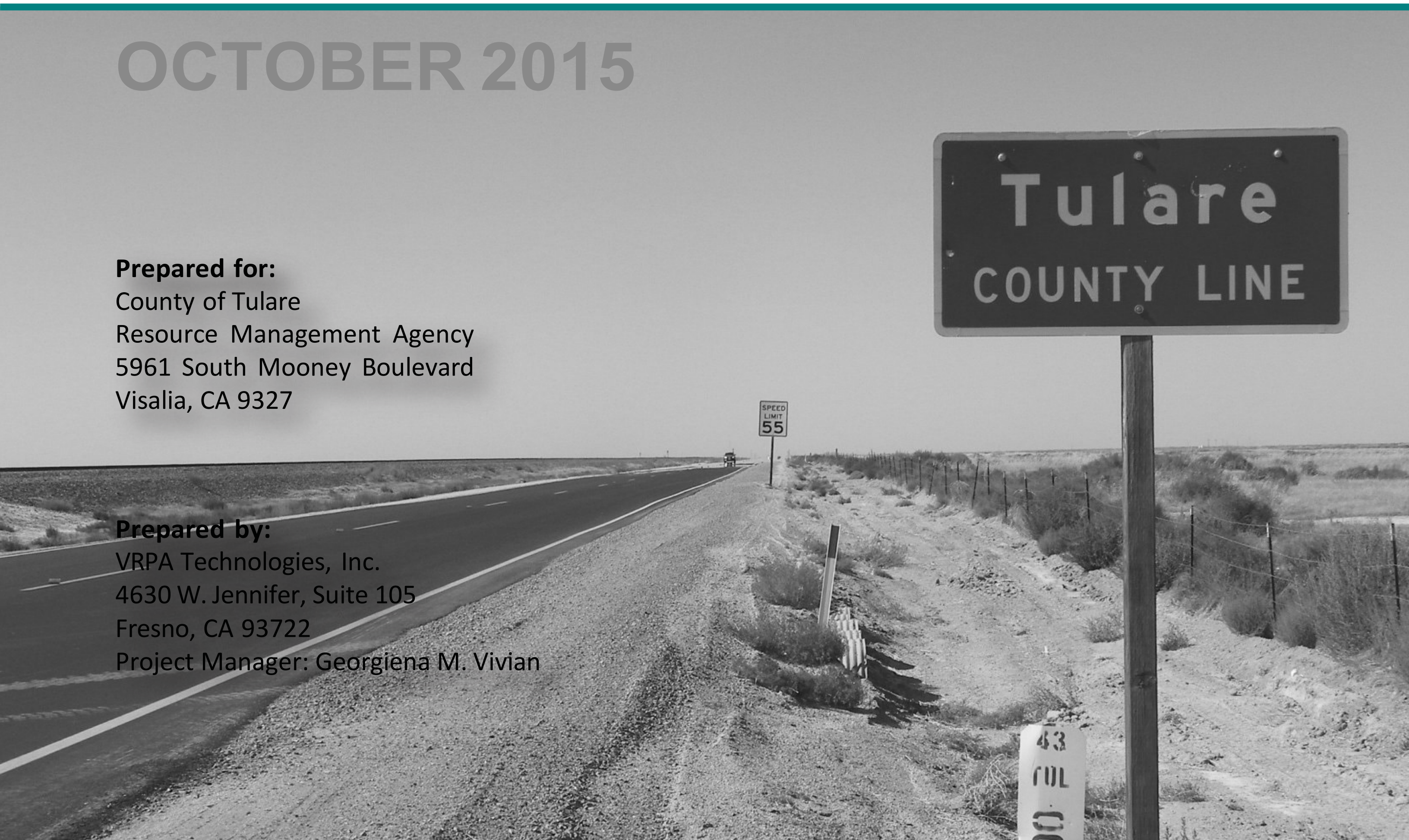
SENATE BILL 244: PART II

DISADVANTAGED UNINCORPORATED COMMUNITIES ASSESSMENT

OCTOBER 2015



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1. INTRODUCTION

1.1 Senate Bill 244

Senate Bill 244 (Wolk, 2011) (SB 244) was signed into law in October 2011 by Governor Jerry Brown and it affects Local Agency Formation Commissions (LAFCOs), cities, and counties in California. Disadvantaged unincorporated communities (DUCs) and their infrastructure needs and deficiencies (specifically water, wastewater, stormwater, and fire protection) are the focus of the legislation. As it pertains to a county's jurisdiction, a DUC is defined as a "legacy" community that meets the following criteria:

- ✓ An inhabited area[1] that contains 10 or more dwelling units in close proximity to each other
- ✓ Is geographically isolated and has existed for more than 50 years
- ✓ Has a median household income that is 80% or less than the statewide median household income

The purpose of SB 244 is to identify the infrastructure deficits that exist within DUCs and address the barriers to meeting the infrastructure needs.

Located in the heart of the San Joaquin Valley, Tulare County (Figure 1-1) is home to over 400,000 residents with eight incorporated cities and a multitude of unincorporated communities. Tulare County's Planning Division is responsible for the County's long-range planning, including updating the County's General Plan and Housing Element. As part of the 2009 Update of the Tulare County Housing Element. The County's long-range planning includes goals and policies related to infrastructure concepts and the improvement and development of public facilities in urbanized and developing areas providing for adequate services to allow for function and growth. A major constraint to development of affordable housing for Tulare County is the lack of sufficient infrastructure and basic municipal services. Through Action Program 9: Housing Related Infrastructure Needs, the County continues to identify housing related infrastructure needs such as domestic water, wastewater, storm drainage, and street lights. In April 2014, Tulare County completed its inventory of existing infrastructure for the County's disadvantaged unincorporated communities and hamlets. The completed report, Tulare County Housing Element Action Program 9 Existing Infrastructure, is Part I of the County's response to SB 244 legislation. This report continues the County's commitment to Action Program 9 and SB 244 requirements.

1.2 Requirements

SB 244 legislation has found that hundreds of DUCs in California lack access to basic community infrastructure such as sidewalks, safe drinking water, and adequate waste water processing. These DUCs range from remote settlements throughout the State to neighborhoods that have been surrounded by, but are not part of, the State's fast-growing cities. Lack of investment in community infrastructure threatens residents health and safety and fosters economic, social, and educational inequality. Addressing the complex legal, financial, and political barriers that contribute to regional inequity and infrastructure deficits will result in a more efficient delivery system of services and infrastructure including, but not limited to sewer, water and structural fire protection. Investment in these infrastructure services will in turn result in the enhancement and protection of public health and safety for these DUCs.

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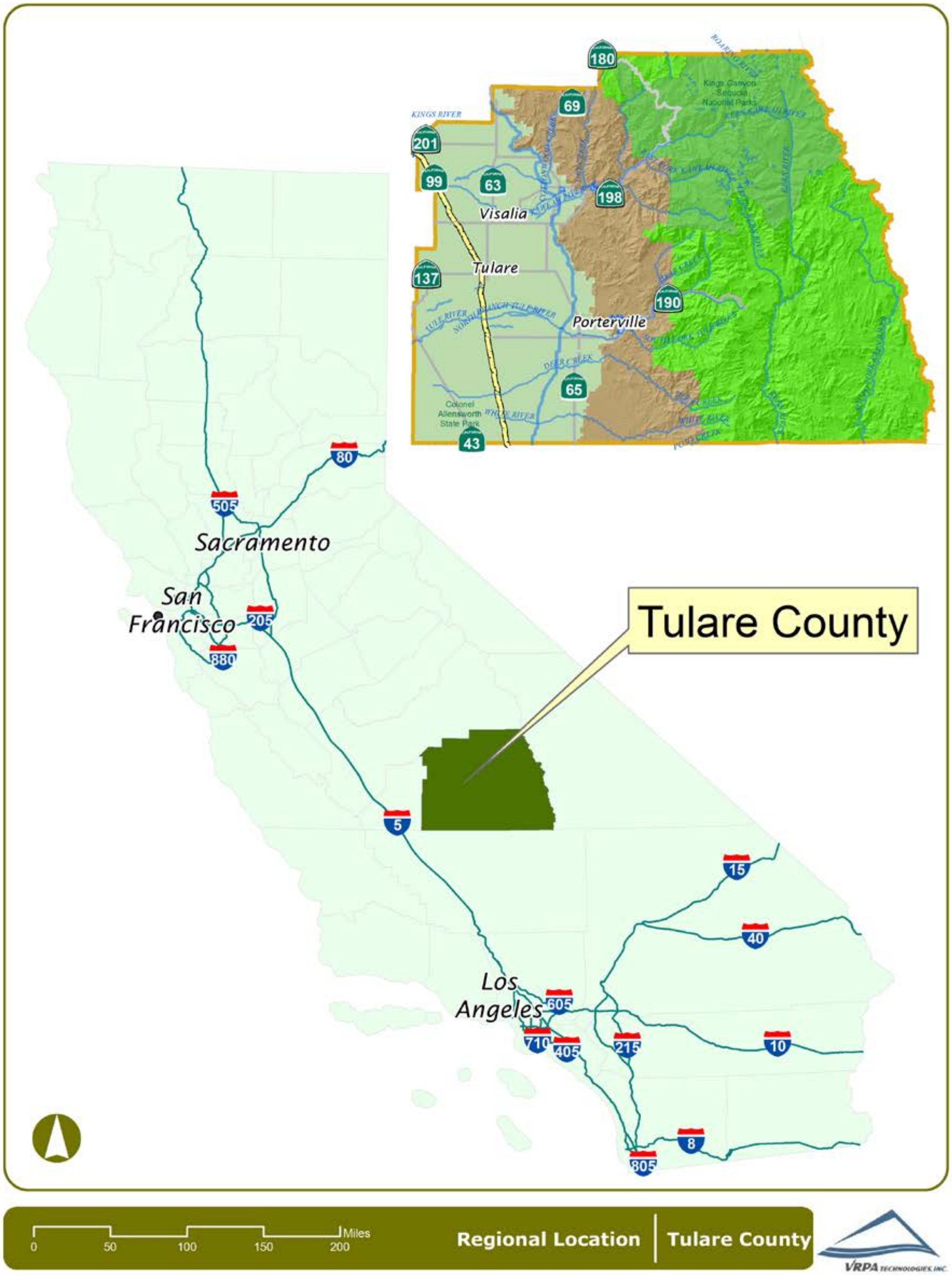
1 An inhabited area refers to a territory in which 12 or more registered voters reside.

Figure 1-1 Tulare County Regional Location



The specific requirements vary for LAFCOs, cities, and counties. LAFCOs are now required to consider DUCs when performing Municipal Service Reviews (MSRs). When cities are updating their spheres of influence (SOI), LAFCOs must also consider the existing infrastructure and needs of DUCs within the SOI. In addition, SB 244 places restrictions on LAFCOs' ability to approve city annexations greater than 10 acres when a DUC is adjacent to the area.

For cities, SB 244 requires they identify DUCs within their SOI and address their infrastructure needs. If the city approves an annexation greater than 10 acres and the area is adjacent to a DUC, the DUC must be annexed as well. Counties are also required to identify DUCs within their jurisdiction and address infrastructure needs. Both cities and counties are also now required to review and update the land use element of their general plans before the adoption of their next Housing Element. For each DUC, the city and county must provide a description and a map of each community. An analysis of the water, wastewater, stormwater, and fire protection infrastructure and needs must also be provided. Finally, the cities and counties must identify potential funding alternatives to extend these services to those DUCs that lack infrastructure.

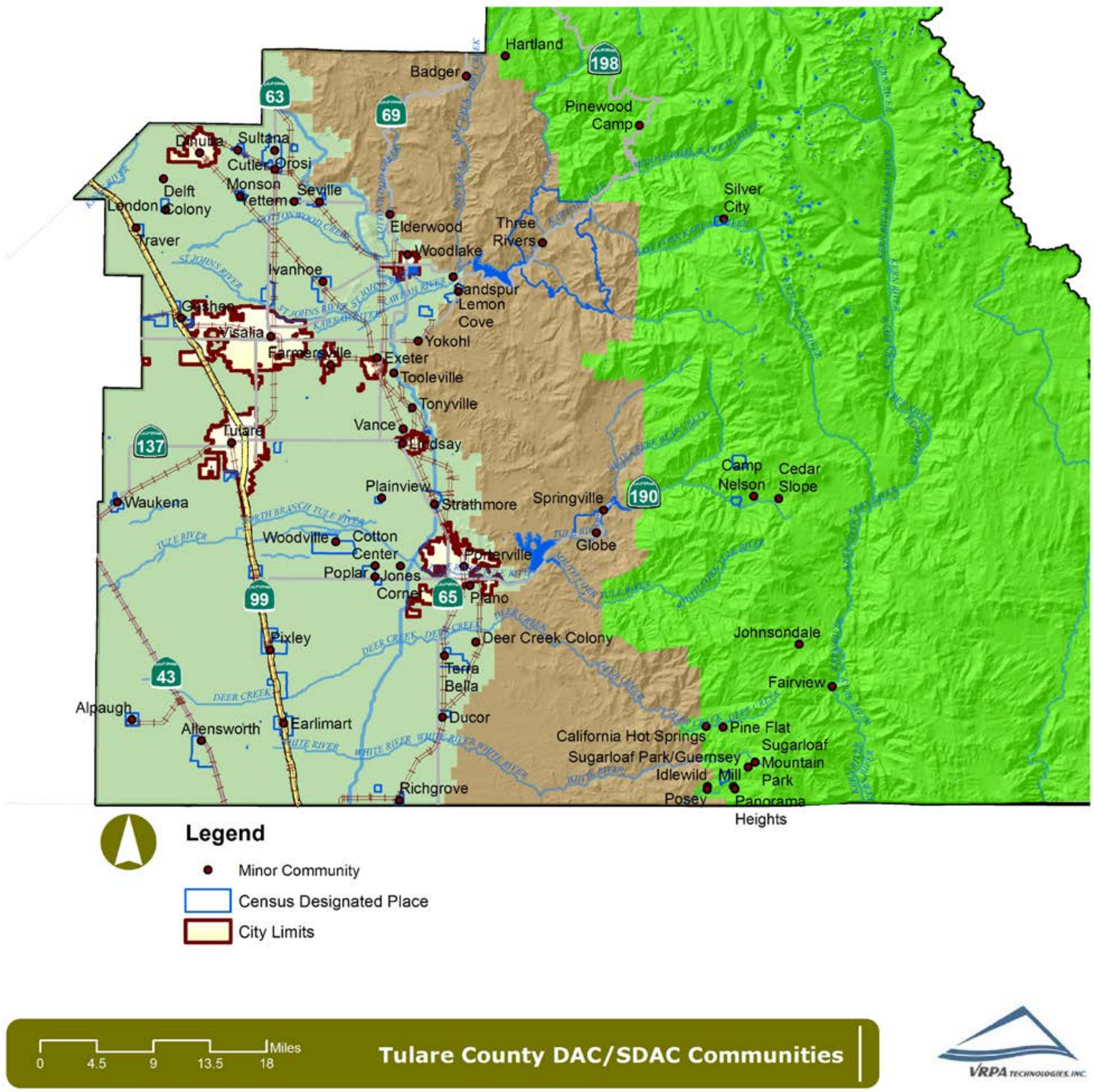
1.3 Tulare County's Approach

After review of the legislation, Tulare County has selected to exceed the minimum requirements imposed by SB 244. Chapter 2 of this report identifies the presence and location of existing infrastructure for each DUC. In addition to review of the water, wastewater, stormwater, and fire protection infrastructure, Tulare County reviewed the streetlight, sidewalk, and ADA curb ramp infrastructure. The location of streetlights, sidewalks, ADA curb ramps, and fire hydrants were mapped and listed in a matrix for each DUC. The emergency response times were calculated to each DUC from the nearest Tulare County fire station. All of the existing infrastructure work was performed in GIS software to assist the County in future mapping and analysis of the DUCs. Chapter 3 discusses the planned projects expected to provide new and/or enhanced infrastructure as well as the unmet infrastructure needs of each DUC. Chapter 4 identifies potential funding sources that could assist in providing needed infrastructure to the DUCs.

1.4 Identification of DUCs

The forty-five (45) DUCs analyzed in this report are listed below. There are an additional thirty-two (32) communities analyzed as part of Part 1: Housing Element Action Program 9 which are included in a separate report. Tulare County has three distinct planning area regions: valley, foothill, and mountain. The listing below separates the identified DUCs into the planning area region in which they are located. Figure 1-2 shows the planning area regions and the DUCs. The majority of Tulare County's DUCs and all of its cities can be found in the Valley planning area. The foothills and mountains form the eastern half of the County.

Figure 1- 2 DUC Communities by Planning Area



Valley

The Valley area is geographical area located below the 600-foot elevation contour line and is bordered to the east by the foothills.

1) Calgro – Located in the northwestern part of Tulare County at the northeast corner of SR-63 and SR-201. Its name is an acronym for the California Growers Wineries. The nearest city is Dinuba to the northwest.

2) Citro – Located in the central part of Tulare County near the junction of SR-216 and SR-198. The nearest city is Woodlake to the west.

3) Deer Creek Colony – Located in the southern part of Tulare County on the valley floor. The nearest city is Porterville to the north.

4) East Porterville – CDP located in the south central part of Tulare County along SR-190. Its population was 7,331 at the 2010 Census. According to Census data, there were 1,637 households and the median age was 25.4 years. The nearest city is Porterville, directly to the west.

5) El Monte Mobile Home – Located in the northwest part of Tulare County on the valley floor. The nearest city is Dinuba, directly to the east.

6) Hawkins – Located in the central part of Tulare County on the valley floor. The nearest city is Lindsay, directly to the southwest.

7) Higby – Located in the western part of Tulare County on the valley floor. The nearest city is Visalia, directly to the north.

8) Hypericum – Located on the western part of Tulare County on the valley floor. The nearest city is Farmersville to the north.

9) Jones Corner – Located in the southern part of Tulare County on the valley floor. The nearest city is Porterville, directly to the east.

10) Jovista – Located in the southwestern part of Tulare County on the valley floor. The nearest city is Porterville to the north.

11) Lort – Located in the central part of Tulare County on the valley floor. The nearest city is Exeter to the south.

12) Naranjo – Located in the northwest part of Tulare County on the valley floor along SR-216. The nearest city is Woodlake to the west.

13) Paige – Located in the western part of Tulare County on the valley floor. The nearest city is Tulare to the east.

14) Peral – Located in the northwest part of Tulare County along SR-63. The nearest city is Visalia to the south.

15) Ponca – Located in the central part of Tulare County on the valley floor. The nearest city is Porterville, directly to the north.

16) Sandspur – Located in the central part of Tulare County near the junction of SR-198 and SR-216. The nearest city is Woodlake to the west.

17) Taurusa – Located in the northwest part of Tulare County on the valley floor. The nearest city is Visalia to the south.

18) Tooleville – CDP located in the central part of Tulare County on the valley floor. Its population was 339 at the 2010 Census. According to Census data, there were 78 households and the median age was 22.4 years. The nearest city is Exeter, directly to the west.

19) Vance – Located in the central part of Tulare County on the valley floor. The nearest city is Lindsay to the south.

20) Venida – Located in the central part of Tulare County along SR-65. The nearest city is Exeter to the south.

21) West Venida – Located in the central part of Tulare County along SR-65. The nearest city is Exeter to the south.

22) Worth – Located in the central part of Tulare County along SR-190. The nearest city is Porterville to the west.

23) Yokohl – Located in the central part of Tulare County along SR-198. The nearest city is Exeter to the southwest.

24) Zante – Located in the central part of Tulare County along SR-65. The nearest city is Porterville, directly to the south.

Foothill

The Foothill region includes geographical areas generally above the 600-foot elevation contour and is bounded on the east by the federally-owned parks in the Sierra Nevada Mountains and on the west by privately-owned lands of the San Joaquin Valley floor (Valley).

25) Badger – Located in the northern part of Tulare County along State Route (SR) 245 near the Sierra Nevadas. It has an estimated population of 140. The nearest city is Dinuba to the southwest. Most recently, the community is known for its religious groups (a Hindu school, Hare Krishna festival, and Subud spiritual group).

26) Elderwood – Located in the northwest part of Tulare County near the junction of SR-201 and SR-245. The nearest city is Woodlake to the south.

27) Globe – Located in the central part of Tulare County along SR-190. The nearest city is Porterville to the west.

Mountain

Located east of the Foothill region, the Mountain region generally coincides with the western boundary of the federal land jurisdictions of the National Park Service including Sequoia National Park, U.S. Forest Service including Giant Sequoia National Monument, and the Bureau of Land Management. Privately owned lands in the Mountain region are estimated at 40,000 acres.

28) Balance Rock – Located in the southern part of Tulare County near the Sierra Nevadas. It was named after Balance Rock, a geographic feature in the area. The nearest city is Porterville to the northwest.

29) California Hot Springs – Census designated place (CDP) located in the southern part of Tulare County in the Sierra Nevadas. Its population was 37 at the 2010 Census. According to Census data, there were 22 households and the median age was 60.5 years. The nearest city is Porterville to the northwest.

30) Camp Nelson – CDP located in the central part of Tulare County in the Sierra Nevadas. Its population was 97 at the 2010 Census. According to Census data, there were 55 households and the median age was 60.2 years. The nearest city is Porterville to the west.

31) Cedar Slope – CDP located in the central part of Tulare County along SR 190 in the Sierra Nevadas. The 2010 Census reported the community was uninhabited, however aerial imagery indicates the presence of residential structures. The nearest city is Porterville to the west.

32) Fairview – Located in the southern part of Tulare County in the Sierra Nevadas. The nearest city is Porterville to the northwest.

33) Hartland – CDP located in the northern part of Tulare County near the Sierra Nevadas. Its population was 30 at the 2010 Census. According to Census data, there were 14 households and the median age was 39.5 years. The nearest city is Woodlake to the southwest.

34) Idlewild – CDP located in the southern part of Tulare County near the Sierra Nevadas. Its population was 43 at the 2010 Census. According to Census data, there were 17 households and the median age was 50.4 years. The nearest city is Porterville to the northwest.

35) Johnsondale – Located in the southern part of Tulare County in the Sierra Nevadas. It was named after Walter Johnson of the Mount Whitney Lumber Company. The nearest city is Porterville to the northwest.

36) Kennedy Meadows – CDP located in the southeastern part of Tulare County in the Sierra Nevadas. Its population was 28 at the 2010 Census. According to Census data, there were 15 households and the median age was 61.0 years. It has become a major stopping point for northbound hikers on the Pacific Crest Trail. The nearest city is Porterville to the west.

37) Panorama Heights – CDP located in the southern part of Tulare County near the Sierra Nevadas. Its population was 41 at the 2010 Census. According to Census data, there were 22 households and the median age was 58.3 years. The nearest city is Porterville to the northwest.

38) Pine Flat – CDP located in the southeastern part of Tulare County in the Sierra Nevadas. Its population was 166 at the 2010 Census. According to Census data, there were 81 households and the median age was 54.3 years. The nearest city is Porterville to the northwest.

39) Ponderosa – CDP located in the central part of Tulare County in the Sierra Nevadas. Its population was 16 at the 2010 Census. According to Census data, there were 9 households and the median age was 65.3 years. The nearest city is Porterville to the west.

40) Posey – CDP located in the southern part of Tulare County near the Sierra Nevadas. Its population was 10 at the 2010 Census. According to Census data, there were 5 households and the median age was 52.0 years. The nearest city is Porterville to the northwest.

41) Silver City – CDP located in the central part of Tulare County in the Sierra Nevadas. The 2010 Census reported the community was uninhabited, however aerial imagery indicates the presence of residential structures. The nearest city is Woodlake to the west.

42) Sugarloaf Mountain Park – CDP located in the southern part of Tulare County in the Sierra Nevadas. The 2010 Census reported the community was uninhabited, however aerial imagery indicates the presence of residential structures. The nearest city is Porterville to the northwest.

43) Sugarloaf Park/Guernsey Mill – Located in the southern part of Tulare County in the Sierra Nevadas. The nearest city is Porterville to the northwest.

44) Sugarloaf Village – CDP located in the southern part of Tulare County in the Sierra Nevadas. Its population was 10 at the 2010 Census. According to Census data, there were 5 households and the median age was 71.0 years. The nearest city is Porterville to the northwest.

45) Wilsonia – CDP located in the northern part of Tulare County in the Kings Canyon National Park. Its population was 5 at the 2010 Census. According to Census data, there were 3 households and the median age was 56.5 years. The Wilsonia Historic District is a neighborhood of cabins listed on the National Register of Historic Places. The nearest city is Woodlake to the southwest.

2. EXISTING INFRASTRUCTURE

2.1 General Information

The Disadvantaged Unincorporated Communities (DUCs) are located all over Tulare County, with some residing in the remote areas of the mountainous eastern portion and others residing on the valley floor near the Cities, Hamlets, and larger unincorporated communities. Many of these DUCs lack infrastructure such as public sewer and water systems, storm drainage, ADA compliant curb ramps, sidewalks, and street lights. Table 2-1 identifies whether these types of infrastructure are present within each of the DUCs.

2.2 Domestic Water & Wastewater

The domestic water and sewer data presented on the maps in this chapter are based on a variety of sources. All of the community services districts (CSD's) and water companies within Tulare County were contacted to provide data on services within their boundaries. Data gaps were filled through review of aerial imagery, as well as contact with local businesses residing within each of the communities. Most of these communities were determined to lack domestic water and sanitary sewer systems. They receive drinking water from individual or community wells with wastewater services provided by septic systems.

Drinking water supplied by a public or municipal source is typically treated to ensure that the water is safe to drink. When a public or municipal source is not available, drinking water is most often obtained from a private domestic well with well owners responsible for testing the water quality to ensure that it is safe to drink. The State Water Resources Control Board (State Water Board) established in the Groundwater Ambient Monitoring and Assessment (GAMA) Program in 2000 to address public concerns over groundwater quality. As part of the GAMA Program, a voluntary groundwater monitoring project was established to provide water quality information to private (domestic) well owners. The Domestic Well Project sampled a total of 181 wells in Tulare County in 2006. Water Board staff completed testing on wells primarily located in the valley and foothill areas of the County at no cost to the well owner. The GAMA data report for the Tulare County Focus Area can be found in Appendix A. VRPA Technologies used the GeoTracker GAMA website, http://geotracker.waterboards.ca.gov/gama/gamamap/public, to obtain general information about domestic wells and their testing results for the DUCs. Additional details can be found in Section 3.3, Remaining Infrastructure Needs, of this report.

Table 2-1 Existing Infrastructure in DUCs

Disadvantaged Unincorporated Community (DUC)	Public Sewer Available	Public Water Available	Public Stormwater Available	Existing Streetlights	Existing Sidewalks	Existing ADA Curb Ramps	Existing Fire Hydrants
Valley							
Calgro	No	No	No	Yes	No	No	No
Citro	Yes	Yes	No	No	No	No	No
Deer Creek Colony	Yes	Yes	No	No	No	No	Yes
East Porterville, CDP	No	No	Yes	Yes	Yes	Yes	Yes
El Monte Mobile Home	No	Yes	No	Yes	No	No	No
Hawkins	No	Yes	No	No	No	No	No
Higby	Yes	Yes	No	No	No	No	No
Hypericum	No	No	No	No	No	No	No
Jones Corner	No	No	No	Yes	Yes	No	Yes
Jovista	No	No	No	No	No	No	No
Lort	No	No	No	No	No	No	No
Naranjo	No	Yes	Yes	Yes	No	No	No
Paige	No	No	No	Yes	No	No	No
Peral	No	No	No	No	No	No	No
Ponca	No	No	No	*Partial**	*Partial**	*Partial**	Yes
Sandspur	Yes	Yes	Yes	No	No	No	No
Taurusa	No	No	No	No	No	No	No
Tooleville, CDP	Yes	Yes	Yes	Yes	No	No	No
Vance	Yes	Yes	No	Yes	Yes	Yes	No
Venida	No	No	No	No	No	No	No
West Venida	No	No	No	No	No	No	No
Worth	No	No	No	No	No	No	No
Yokohl	No	No	No	No	No	No	No
Zante	No	No	No	No	No	No	No
Foothill							
Badger	No	No	No	No	No	No	No
Elderwood	No	No	No	No	No	No	No
Globe	No	*Partial**	No	No	No	No	No
Mountain							
Balance Rock	No	No	No	No	No	No	No
California Hot Springs, CDP	*Partial**	*Partial**	No	*Partial**	*Partial**	No	No
Camp Nelson, CDP	No	Yes	No	No	No	No	No
Cedar Slope, CDP	No	Yes	No	No	No	No	No
Fairview	No	No	No	No	No	No	No
Hartland, CDP	No	No	No	No	No	No	No
Idlewild, CDP	No	No	No	No	No	No	No
Johnsondale	No	Yes	No	Yes	No	No	No
Kennedy Meadows, CDP	No	No	No	No	No	No	No
Panorama Heights, CDP	No	No	No	No	No	No	No
Pine Flat, CDP	Yes	Yes	No	No	No	No	No
Ponderosa, CDP	No	Yes	No	No	No	No	No
Posey, CDP	No	No	No	No	No	No	No
Silver City	No	No	No	No	No	No	No
Sugarloaf Mountain Park, CDP	No	No	No	No	No	No	No
Sugarloaf Park/Guernsey Mill, CDP	No	No	No	No	No	No	No
Sugarloaf Village, CDP	No	No	No	No	No	No	No
Wilsonia	No	No	No	No	No	No	No

**Partial - Infrastructure is available in some areas of the community, but lacking in others, deficiencies are noted. Refer to Section 3.3 of this report for additional, detailed information for each community.*

2.3 Storm Drainage

A storm drainage system is designed to drain excess rain and groundwater (from roads, sidewalks, etc.) to some point where it is discharged into a channel, ponding basin, or piped system. The system itself typically consists of pipes connecting inlets and is facilitated by curbs and gutters, manholes, and sumps. The operation of the system consists of runoff being collected in the inlets and transported by pipes to a discharge location. Manholes provide access to storm drain pipes for inspection and cleanout. A sump is a shallow, artificial pond designed to infiltrate storm water through permeable soils into the groundwater aquifer. It does not typically discharge to a detention basin.

Storm drainage systems should be designed so they have adequate capacity to accommodate runoff that enters the system for the design frequency and should also be designed considering future development. An inadequate roadway drainage system could result in the following:

- ✓ Water overflowing the curb and entering adjacent property leading to damage
- ✓ Accelerated roadway deterioration and public safety concerns may occur due to excessive water accumulation on roadways
- ✓ Over saturation of the roadway structural section due to immersion will lead to pavement deterioration

VRPA Technologies surveyed existing storm drainage systems within each community. Most of the communities lack a storm drainage system and several of them located on the valley floor are prone to flooding periodically. Communities located in the eastern part of Tulare County where the terrain is not flat also lack storm drainage systems, however these systems are rarely necessary given the natural flow of water runoff.

2.4 ADA Curb Ramps

The Americans with Disabilities Act (ADA) of 1990 included design requirements for persons with disabilities in the public rights-of-way. Curb ramps are an important part of making sidewalks and street crossings accessible to people with disabilities (especially those who use wheelchairs). An ADA compliant curb ramp is a short ramp cutting through or built up to a curb. It consists of the ramp itself which is sloped to allow wheelchair access from the street to the sidewalk and flared sides that bring the curb to the level of the street.

Curb ramps are most typically found at intersections, but can also be located near on-street parking, transit stations and stops, and midblock crossings. Title II regulations require curb ramps at existing and new facilities.

VRPA Technologies surveyed existing ADA curb ramps within each community. Most of the communities lack ADA compliant curb ramps.

2.5 Sidewalks

Sidewalks are typically separated from a roadway by a curb and accommodate pedestrian travel. They improve mobility for those with disabilities and are also an important part of walking routes to schools. They provide the space for pedestrians to travel within the public right-of-way while being separated from vehicles and bicycles.

The 2010 California Building Code identifies a clear width minimum of 48 inches for sidewalks. This clear width minimum is the walkway width that is completely free of obstacles and not necessarily the sidewalk width. However, the 48 inch minimum does not provide sufficient passing space or space for two-way travel. Therefore, the guidelines state that for sidewalks less than 5 feet in clear width, passing lanes (wide enough for wheelchairs) shall be provided at 200-foot intervals. However, the clear width may be reduced to 3 feet if the enforcing agency determines that compliance with the 4-foot clear sidewalk width would create an unreasonable hardship due to right-of-way restrictions, natural barriers, or other existing conditions.

VRPA Technologies surveyed existing sidewalks within each community but did not distinguish between those that were ADA compliant and noncompliant. The majority of sidewalks were constructed prior to current ADA guidelines and are assumed to be non ADA compliant facilities. Such noncompliant facilities would require complete reconstruction to be considered ADA compliant.

2.6 Street Lights

Street lights are typically located at the edge of roadways on top of utility poles. They are illuminated at night and improve the visibility and safety of the roadway and sidewalk by increasing motorist visibility and improving nighttime pedestrian security. They can also reduce nighttime pedestrian crashes by increasing the awareness of drivers relative to pedestrians.

VRPA Technologies surveyed existing street lights within each community. Many of the communities lack public street lights.

2.7 Fire Infrastructure and Response Times

The Tulare County Fire Department provides services within the County that includes responding to fires, medical emergencies, motor vehicle accidents, technical rescues, and other life threatening or dangerous conditions. There are 27 fire stations located throughout Tulare County which are made up of more than 400 personnel.

The Tulare County Fire Department is considered a career fire department because its staff is composed of paid personnel versus volunteers. The National Fire Protection Agency (NFPA) 1710 standard applies to career departments and states the following goals:

- 1 minute to turn-out
- 4 minutes for the first engine company to arrive
- 8 minutes for the first full-alarm assignment for at least 90% of all fire calls

Table 2-2 shows the nearest fire station, roadway distance between station and community, and calculated fire response times for each DUC. Insurance Services Office (ISO) recommends a first-due engine company be located within 1.5 miles of its district and a ladder-service company within 2.5 miles. As shown in Table 2-2, there are many communities located further than 2.5 miles from the nearest fire station which leads to much longer response times to these areas. Other factors that affect response times are road and traffic conditions, weather, and reaction times.

Most of the DUCs in Tulare County do not have a fire station or fire infrastructure (e.g. fire hydrants, fire control panels, Knox-boxes, gas shutoffs, and water meters) existing within their boundaries.

Methodology for Determining Fire Response Times

Fire response timing data for each DUC was unavailable from the Tulare County Fire Department. In order to determine the response times, the nearest fire station was first identified for each community. The shortest roadway path between the fire station and the community was then identified and the driving distance in miles was calculated. This distance was then input into a formula developed by the RAND Corporation.

The RAND Corporation has conducted extensive studies of fire response times, which have been validated several times by various agencies. The studies determined that the average speed is 35 miles per hour (mph) for a fire apparatus responding with emergency lights and siren. This average speed assumes average terrain, traffic, weather, and slowing for intersections. Based upon its studies, RAND developed a formula for calculating response times which was applied in this chapter to determine fire response times to each of the communities (Table 2-2 shows the results):

$T = 0.65+1.7D$
[T = time in minutes to the nearest 1/10 of a minute
0.65 = a vehicle-acceleration constant for the first 0.5 mile traveled
1.7 = a vehicle-speed constant validated for response distances ranging from 0.5 miles to 8.0 miles.
D = distance]

It should be noted that the NFPA uses this formula in its 1142 standard.

Table 2-2 Existing Fire Infrastructure in DUCs

Disadvantaged Unincorporated Community (DUC)	Nearest Fire Station	Distance	Fire Response Time (Rounded)	Existing Fire Hydrants
Valley				
Calgro	Cutler-Orosi Fire Station	3	6	No
Citro	Lemon Cove Fire Station	1.5	4	No
Deer Creek Colony	Terra Bella Fire Station	3.5	7	Yes
East Porterville	Doyle Colony Fire Station	1	3	Yes
El Monte Mobile Home	Dinuba Fire Station	3	6	No
Hawkins	Lindsay Fire Station	5	10	No
Higby	Visalia Fire Station	3.5	7	No
Hypericum	Visalia Fire Station	6.5	12	No
Jones Corner	West Olive Fire Station	2	5	Yes
Jovista	Richgrove Fire Station	5.5	10	No
Lort	Exeter Fire Station	3.5	7	No
Naranjo	Woodlake Fire Station	2.5	5	No
Paige	Tulare Fire Station	6	11	No
Peral	Ivanhoe Fire Station	6.5	12	No
Ponca	Doyle Colony Fire Station	3	6	Yes
Sandspur	Lemon Cove Fire Station	2	5	No
Taurusa	Ivanhoe Fire Station	5	10	No
Tooleville	Exeter Fire Station	2	5	No
Vance	Lindsay Fire Station	4	8	No
Venida	Exeter Fire Station	3	6	No
West Venida	Exeter Fire Station	3.5	7	No
Worth	Doyle Colony Fire Station	3.5	7	No
Yokohl	Exeter Fire Station	5.5	10	No
Zante	Strathmore Fire Station	2.5	5	No
Foothill				
Badger	Badger Fire Station	2.5	5	No
Elderwood	Woodlake Fire Station	5	10	No
Globe	Springville Fire Station	3	6	No
Mountain				
Balance Rock	Posey Fire Station	2	5	No
California Hot Springs	California Hot Springs Fire Station	3.5	7	No
Camp Nelson	Camp Nelson Fire Station	0.5	2	No
Cedar Slope	Camp Nelson Fire Station	4.5	9	No
Fairview	California Hot Springs Fire Station	29	50	No
Hartland	Badger Fire Station	8.5	16	No
Idlewild	Posey Fire Station	4.5	9	No
Johnsondale	California Hot Springs Fire Station	21	37	No
Kennedy Meadows	Kennedy Meadows Fire Station	2	5	No
Panorama Heights	Posey Fire Station	0.5	2	No
Pine Flat	California Hot Springs Fire Station	1	3	No
Ponderosa	Camp Nelson Fire Station	10	18	No
Posey	Posey Fire Station	4	8	No
Silver City	Three Rivers Fire Station	25	44 *	No
Sugarloaf Mountain Park	Posey Fire Station	5.5	10	No
Sugarloaf Park	Posey Fire Station	4	8	No
Sugarloaf Village	Posey Fire Station	3	6	No
Wilsonia	Badger Fire Station	16	28	No

* Fire response times may be even longer during certain seasons due to roadway conditions as well as weather.

The maps and tables on the following pages identify the presence and location of existing infrastructure in each DUC. The listing below separates the identified DUCs into the planning area region in which they are located.

Valley

1) Calgro
2) Citro
3) Deer Creek Colony
4) East Porterville
5) El Monte Mobile Home
6) Hawkins
7) Higby
8) Hypericum
9) Jones Corner
10) Jovista
11) Lort
12) Naranjo
13) Paige
14) Peral
15) Ponca
16) Sandspur
17) Taurusa
18) Tooleville
19) Vance
20) Venida
21) West Venida
22) Worth
23) Yokohl
24) Zante

Foothill

25) Badger
26) Elderwood
27) Globe

Mountain

28) Balance Rock
29) California Hot Springs
30) Camp Nelson
31) Cedar Slope
32) Fairview
33) Hartland
34) Idlewild
35) Johnsondale
36) Kennedy Meadows
37) Panorama Heights
38) Pine Flat
39) Ponderosa
40) Posey
41) Silver City
42) Sugarloaf Mountain Park
43) Sugarloaf Park/Guernsey Mill
44) Sugarloaf Village
45) Wilsonia

Figure 2-1 Inventory of Services in Calgro

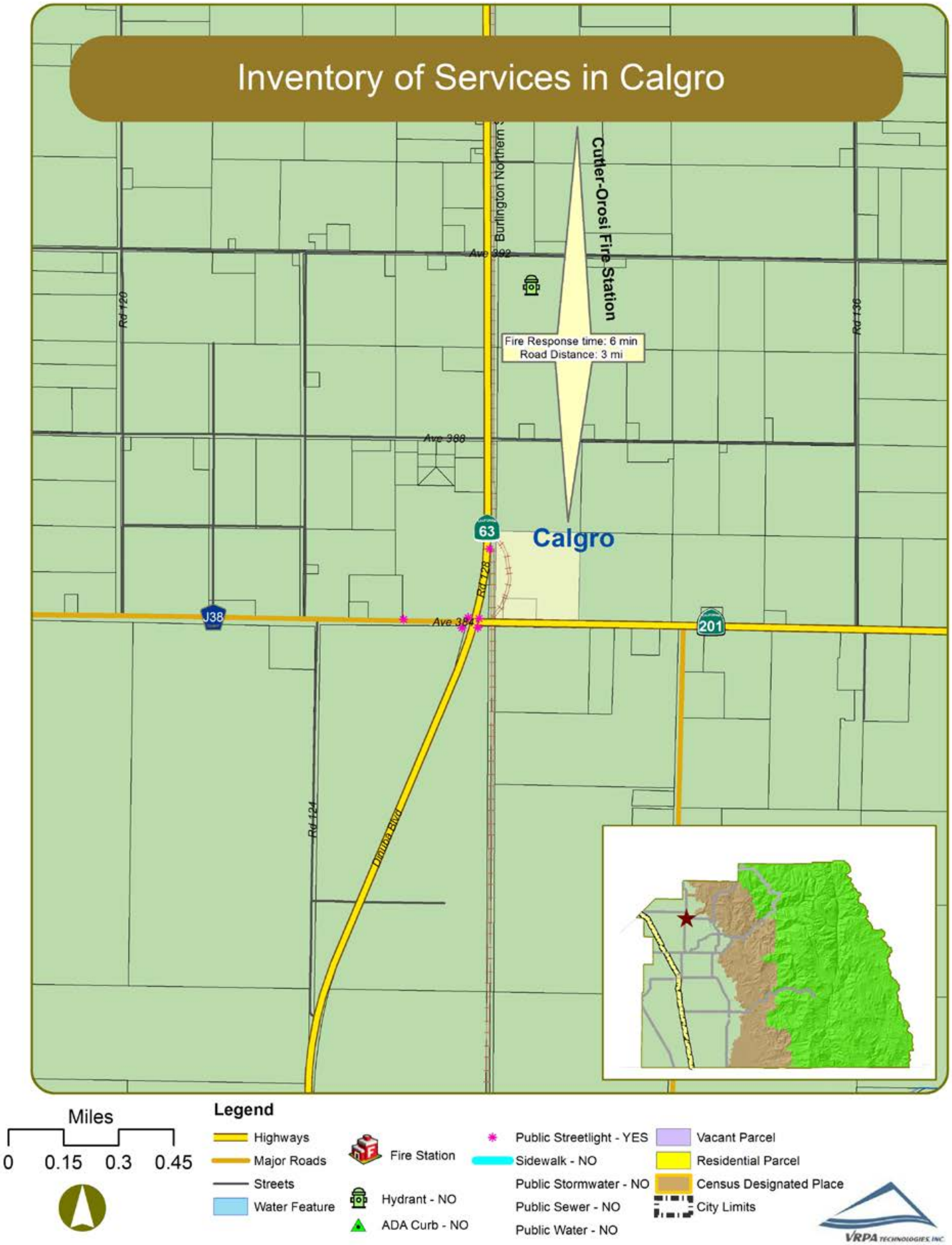


Table 2-3 Streetlight Site Inventory in Calgro

Streetlight Locations				
Community	**Main Road**	**Crossroad**	**Side**	**Corner**
Calgro	Ave 384	between Road 124 and Road 128	N	--
Calgro	SR 210 (Ave 384)	SR 210 (Rd 128)	--	S/W
Calgro	SR 210 (Ave 384)	SR 210 (Rd 128)	--	S/E
Calgro	SR 210 (Ave 384)	SR 210 (Rd 128)	--	N/E
Calgro	SR 210 (Ave 384)	SR 210 (Rd 128)	--	N/W
Calgro	SR 63 (Rd 128)	between Avenue 384 and Avenue 388	E	--

Figure 2-2 Inventory of Services in Citro

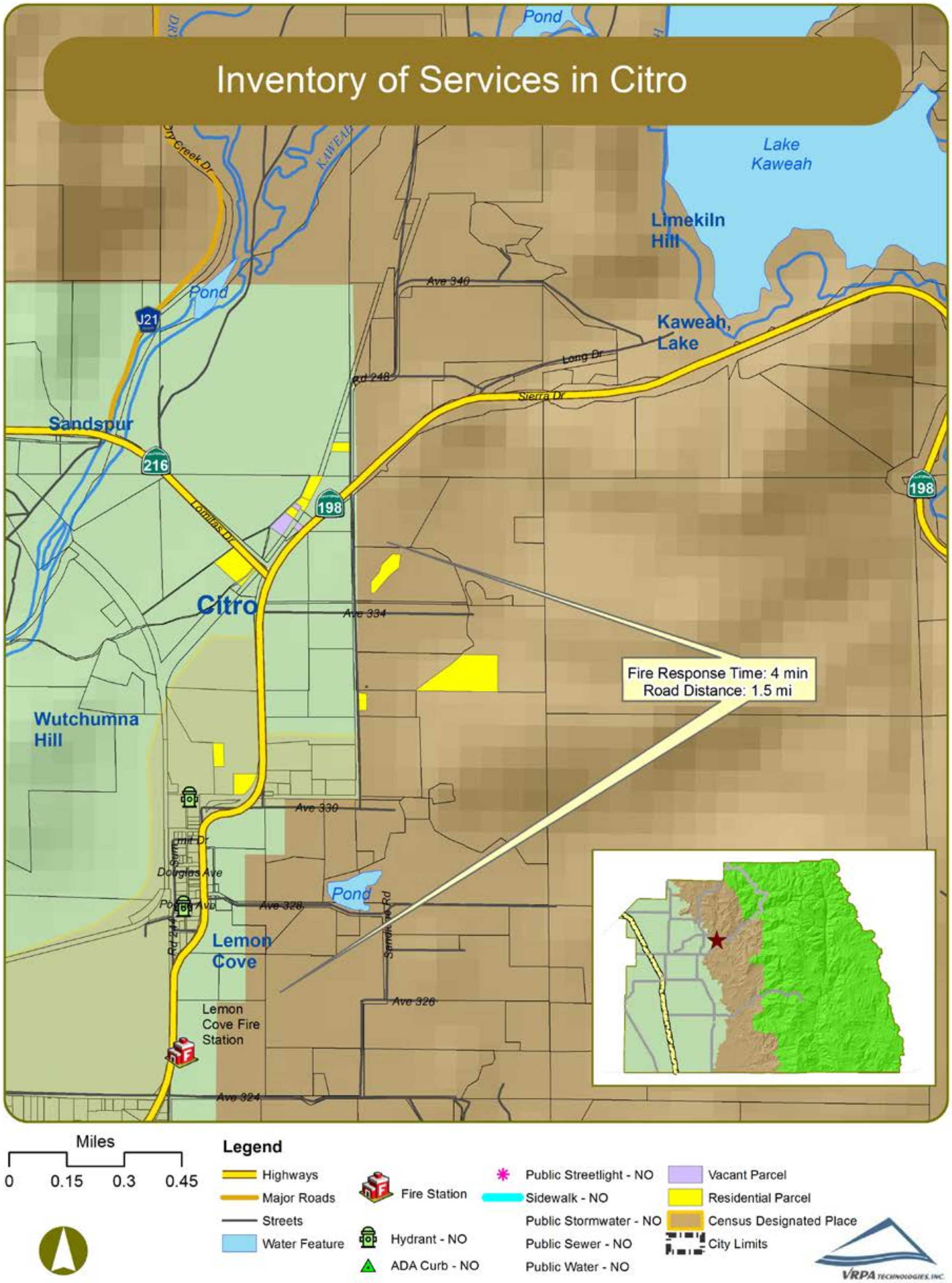


Figure 2-3 Inventory of Services in Deer Creek Colony

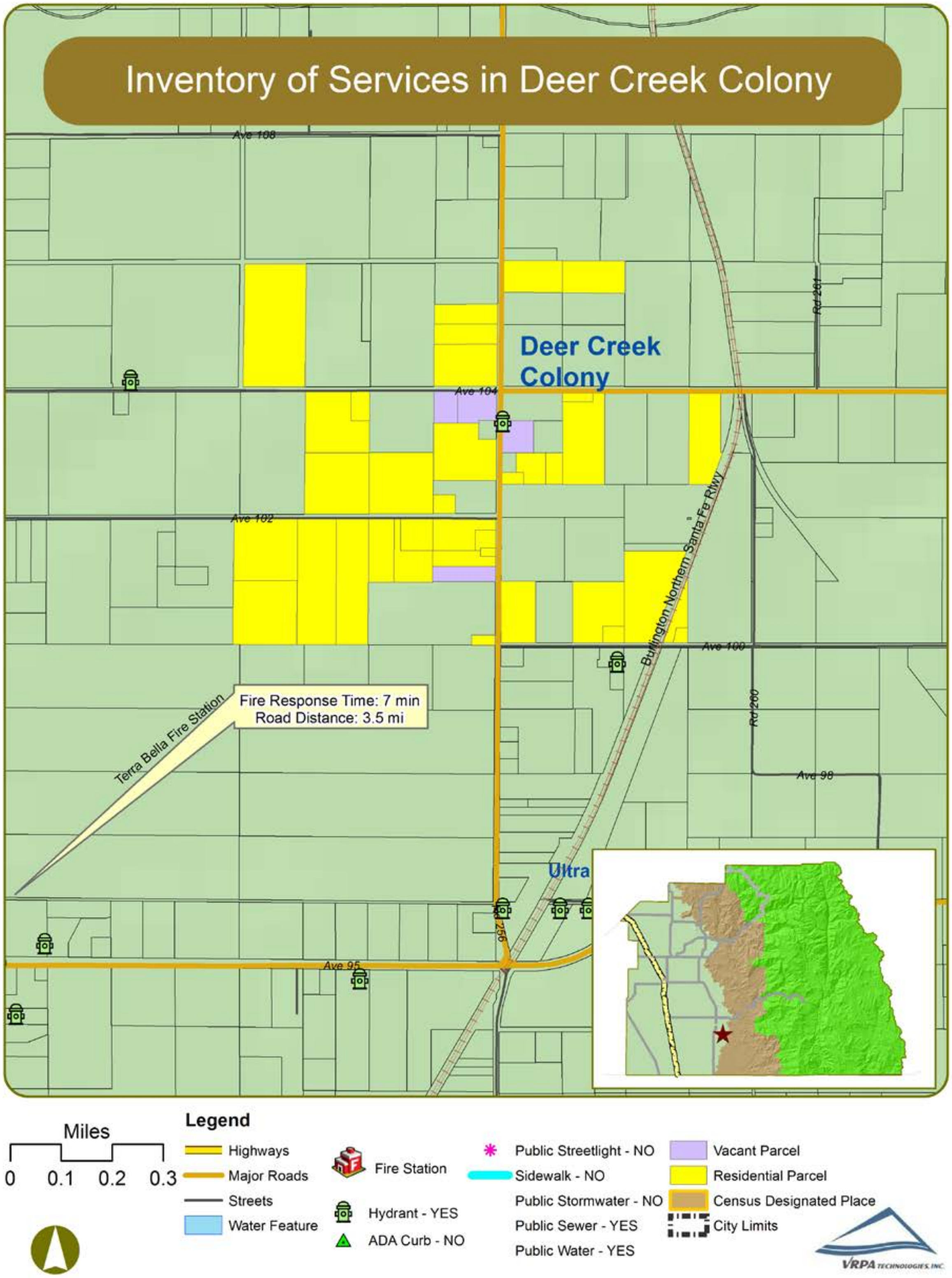


Table 2-4 Fire Hydrant Site Inventory in Deer Creek Colony

Fire Hydrant Locations					
Community	Main Road	Crossroad	Side	Corner	Location Detail
Deer Creek Colony	Road 256	between Avenue 102 and Avenue 104	E	--	--

Figure 2-4 Inventory of Services in East Porterville

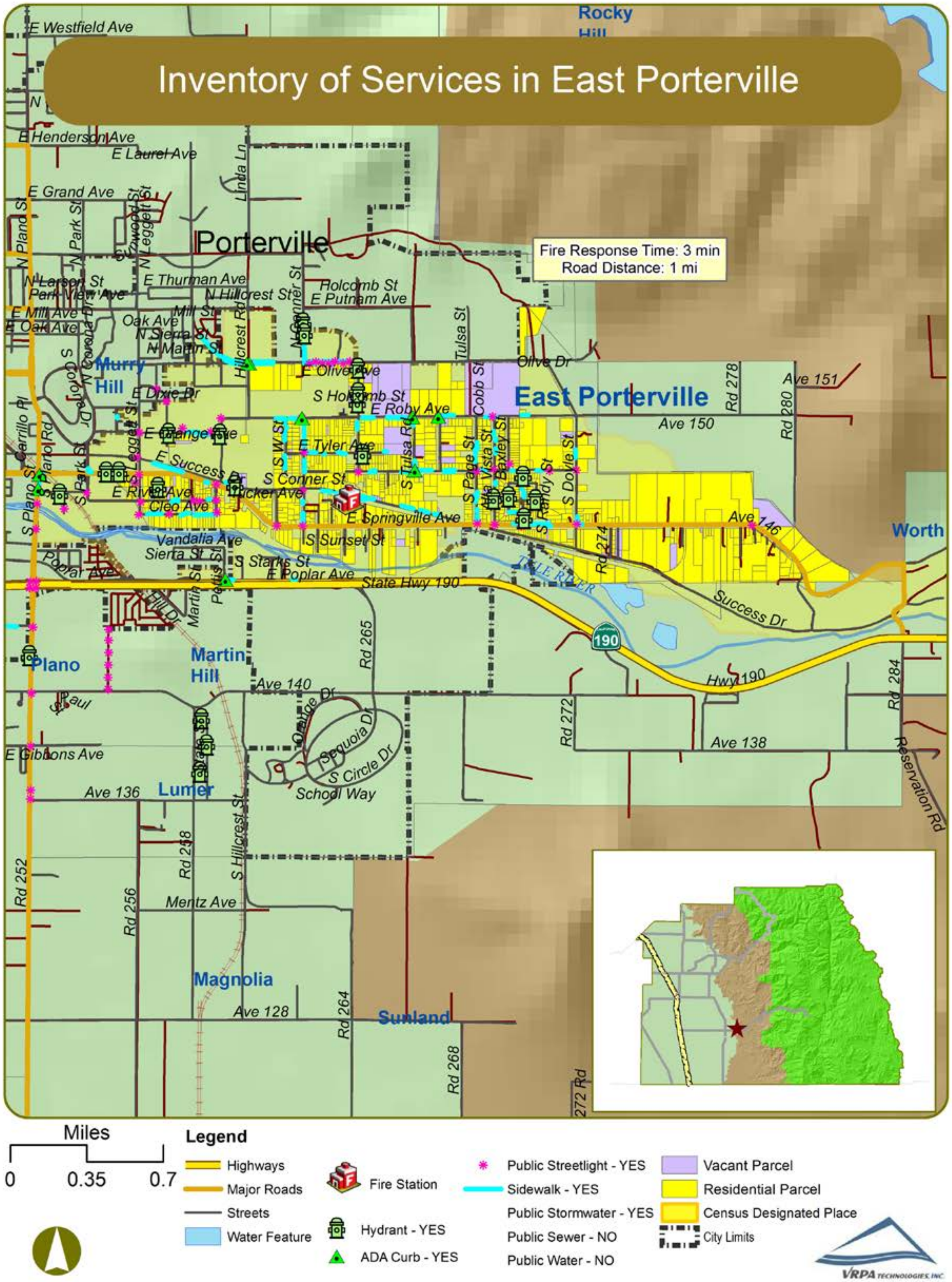


Table 2-5 Streetlight Site Inventory in East Porterville

Streetlight Locations				
Community	Main Road	Crossroad	Side	Corner
East Porterville	Ave 146	at curve	--	S/E
East Porterville	Cleo Ave	S Leggett St	--	S/W
East Porterville	Cleo Ave	between Leggett St and Ruth St	N	--
East Porterville	Cleo Ave	S Ruth St	--	S/W
East Porterville	E Crabtree Ave	between Bennett St and Doyle St	S	--
East Porterville	E Crabtree Ave	Bennett St	--	S/E
East Porterville	E Crabtree Ave	Alta Vista St	--	N/W
East Porterville	E Crabtree Ave	S Page St	--	S/E
East Porterville	E Crabtree Ave	S Holcomb St	--	S
East Porterville	E Date Ave	S Leggett St	--	S/W
East Porterville	E Date Ave	S Ruth St	--	N/E
East Porterville	E Olive Ave	S Hillcrest St	--	S/E
East Porterville	E Olive Ave	between Conner St and Holcomb St	N	--
East Porterville	E Olive Ave	between Conner St and Holcomb St	N	--
East Porterville	E Olive Ave	between Conner St and Holcomb St	N	--
East Porterville	E Olive Ave	between Conner St and Holcomb St	S	--
East Porterville	E Olive Ave	between Conner St and Holcomb St	S	--
East Porterville	E Olive Ave	between Conner St and Holcomb St	S	--
East Porterville	E Olive Ave	between Conner St and Holcomb St	S	--
East Porterville	E Olive Ave	S Holcomb St	--	S/E
East Porterville	E Orange Ave	Ruth St	--	S/W
East Porterville	E Orange Ave	S Maurer St	--	N/E
East Porterville	E Orange Ave	between Ruth St and Maurer St	N	--
East Porterville	E Poplar Ave	Pettis St	--	N/W
East Porterville	E River Ave	between Leggett St and Ruth St	S	--
East Porterville	E River Ave	between Leggett St and Ruth St	S	--
East Porterville	E Roby Ave	Alta Vista St	--	S/W
East Porterville	E Roby Ave	Ruth St	--	N/W
East Porterville	E Springville Ave	S Bennett St	--	S/W
East Porterville	E Springville Ave	S Conner St	--	N/W
East Porterville	E Springville Ave	S Page St	--	N/E
East Porterville	E Springville Ave	S 'W' St	--	N/W
East Porterville	E Success Dr	S Leggett St	--	N/W
East Porterville	E Success Dr	between Leggett St and Ruth St	--	S/E
East Porterville	E Tyler Ave	Holcomb St	--	N/E
East Porterville	S Larson St	between Leggett St and Ruth St	E	--
East Porterville	S Park St	E River Ave	--	S/W
East Porterville	S Plano St	E Date Ave	--	S/E
East Porterville	S Plano St	between Leggett St and Ruth St	E	--
East Porterville	S Plano St	between Leggett St and Ruth St	E	--
East Porterville	S Plano St	between Leggett St and Ruth St	E	--
East Porterville	S Ruth St	Cleo Ave	E	--
East Porterville	S Ruth St	E River Ave	E	S/E

Table 2-6 Sidewalk Site Inventory in East Porterville

Sidewalk Locations				
Community	Street	From *	To *	Side
East Porterville	Alta Vista St	E Crabtree Ave	E Roby Ave	E
East Porterville	Alta Vista St	E Crabtree Ave	E Roby Ave	E
East Porterville	Alta Vista St	E Crabtree Ave	E Roby Ave	W
East Porterville	Alta Vista St	E Crabtree Ave	E Springville Ave	E
East Porterville	Baxley St	E Richard Ave	E Cleo Ave	W
East Porterville	Baxley St	E Richard Ave	E Cleo Ave	E
East Porterville	Cleo Ave	S Leggett St	S Ruth St	S
East Porterville	Cleo Ave	S Leggett St	S Ruth St	S
East Porterville	Cleo Ave	S Leggett St	S Ruth St	N
East Porterville	Cleo Ave	S Leggett St	S Ruth St	S
East Porterville	Cleo Ave	S Leggett St	S Ruth St	N
East Porterville	Cleo Ave	S Leggett St	S Ruth St	N
East Porterville	E Bennett St	E Richard Ave	E Cleo Ave	E
East Porterville	E Bennett St	E Richard Ave	E Cleo Ave	W
East Porterville	E Bennett St	E Springville Ave	E Cleo Ave	W
East Porterville	E Bennett St	E Springville Ave	E Cleo Ave	E
East Porterville	E Cleo Ave	Baxley St	Bennett St	S
East Porterville	E Cleo Ave	Baxley St	Bennett St	S
East Porterville	E Crabtree Ave	Baxley St	Bennett St	S
East Porterville	E Crabtree Ave	Bennett St	S Doyle St	S
East Porterville	E Crabtree Ave	S Holcomb St	S McCoy Ln	N
East Porterville	E Crabtree Ave	S Holcomb St	S McCoy Ln	S
East Porterville	E Crabtree Ave	S Page St	Alta Vista St	N
East Porterville	E Crabtree Ave	S Rocky Hill St	S Pagel St	N
East Porterville	E Crabtree Ave	S Rocky Hill St	S Pagel St	S
East Porterville	E Crabtree Ave	S Rocky Hilll St	S Tulsa Rd	N
East Porterville	E Crabtree Ave	S Tulsa Rd	S McCoy Ln	S
East Porterville	E Dale Ave	S Park St	S Leggett St	N
East Porterville	E Dale Ave	S Plano St	S Park St	S
East Porterville	E Date Ave	S Leggett St	S Ruth St	S
East Porterville	E Date Ave	S Leggett St	S Ruth St	S
East Porterville	E Olive Ave	Hillcrest Rd	N Comet St	S
East Porterville	E Olive Ave	Hillcrest Rd	N Comet St	N
East Porterville	E Olive Ave	N Comet St	S Holcomb St	N
East Porterville	E Olive Ave	N Comet St	S Holcomb St	S
East Porterville	E Olive Ave	Oak Ave	Ruth St	S
East Porterville	E Olive Ave	Ruth St	Hillcrest Rd	S
East Porterville	E Olive Ave	Ruth St	Hillcrest Rd	N
East Porterville	E Orange Ave	Ruth St	S Maurer St	N
East Porterville	E Orange Ave	Ruth St	S Maurer St	S
East Porterville	E River Ave	S Ruth St	S Leggett St	N
East Porterville	E River Ave	S Ruth St	S Leggett St	S
East Porterville	E River Ave	S Ruth St	S Leggett St	N
East Porterville	E Roby Ave	Alta Vista St	Baxley St	S
East Porterville	E Roby Ave	BNaxley St	S Doyle St	N
East Porterville	E Roby Ave	S Hillcrest St	S 'W' St	S
East Porterville	E Roby Ave	S Holcomb St	S Tulsa Rd	S

Table 2-6 Sidewalk Site Inventory in East Porterville (continued)

Sidewalk Locations				
Community	**Street**	**From ***	**To ***	**Side**
East Porterville	E Roby Ave	S Holcomb St	S Tulsa Rd	S
East Porterville	E Roby Ave	S Holcomb St	S Tulsa Rd	S
East Porterville	E Roby Ave	S Page St	Alta Vista St	S
East Porterville	E Roby Ave	S Rocky Hill St	S Page St	N
East Porterville	E Roby Ave	S Tulsa Rd	S Holcomb St	S
East Porterville	E Roby Ave	S Tulsa Rd	S Rocky Hill St	S
East Porterville	E Roby Ave	S 'W' St	S Conner St	S
East Porterville	E Springville Ave	E Doyle St	Bennett St	N
East Porterville	E Springville Ave	E Doyle St	Bennett St	S
East Porterville	E Springville Ave	E Doyle St	Bennett St	N
East Porterville	E Springville Ave	S Doyle St	Bennett St	N
East Porterville	E Springville Ave	S Doyle St (Rd 272)	Rd 274	N
East Porterville	E Success Dr	Ruth St	E Success Dr	N
East Porterville	E Success Dr	S Comer St	E Springville Ave	S
East Porterville	E Success Dr	S Comer St	E Springville Ave	S
East Porterville	E Success Dr	S Comer St	E Springville Ave	S
East Porterville	E Success Dr	S Comer St	E Springville Ave	S
East Porterville	E Success Dr	S Comer St	E Springville Ave	N
East Porterville	E Success Dr	S Comer St	E Springville Ave	N
East Porterville	E Success Dr	S Comer St	E Springville Ave	N
East Porterville	E Success Dr	S Comer St	E Springville Ave	N
East Porterville	E Success Dr	S Comer St	E Springville Ave	N
East Porterville	E Tyler Ave	S Comer St	S Holcomb St	N
East Porterville	E Tyler Ave	S Comer St	S Holcomb St	S
East Porterville	E Tyler Ave	S Comer St	S Holcomb St	S
East Porterville	E Tyler Ave	S Comer St	S Holcomb St	N
East Porterville	E Tyler Ave	S Holcomb St	cul-de-sac	N
East Porterville	N Comer St	E Olive Ave	E Putnam Ave	E
East Porterville	N Tulsa Rd	E Crabtree Ave	E Roby Ave	E
East Porterville	S Comer St	E Roby Ave	100' south	W
East Porterville	S Comer St	E Roby Ave	E Tyler Ave	E
East Porterville	S Comer St	E Roby Ave	E Tyler Ave	E
East Porterville	S Comer St	E Springville Ave	E Success Dr	W
East Porterville	S Comer St	E Springville Ave	E Success Dr	W
East Porterville	S Comer St	E Springville Ave	E Success Dr	W
East Porterville	S Comer St	E Tyler Ave	E Crabtree Ln	E
East Porterville	S Comer St	E Tyler Ave	E Crabtree Ln	E
East Porterville	S Doyle St	E Crabtree Ave	E Roby Ave	W
East Porterville	S Doyle St	E Crabtree Ave	E Springville Ave	E
East Porterville	S Holcomb St	E Roby Ave	E Olive Ave	W
East Porterville	S Holcomb St	E Tyler Ave	E Roby Ave	W
East Porterville	S Page St	E Crabtree Ave	E Roby Ave	W
East Porterville	S Page St	E Crabtree Ave	E Roby Ave	E
East Porterville	S Page St	E Crabtree Ave	E Roby Ave	W
East Porterville	S Page St	E Springville Ave	E Crabtree Ave	E
East Porterville	S Page St	E Springville Ave	E Crabtree Ave	E
East Porterville	S Page St	E Springville Ave	E Crabtree Ave	E
East Porterville	S Page St	E Springville Ave	E Crabtree Ave	W
East Porterville	S Park St	E Dale Ave	E Success Dr	E

Table 2-6 Sidewalk Site Inventory in East Porterville (continued)

Sidewalk Locations				
Community	Street	From *	To *	Side
East Porterville	S Plano St	E River Ave	E Dale Ave	E
East Porterville	S Plano St	E River Ave	E Dale Ave	E
East Porterville	S Randy St	E Richard Ave	E Cleo Ave	W
East Porterville	S Sierra Vista St	Andres Ct	E Isham Ave	E
East Porterville	S Tulsa Rd	E Roby Ave	E Crabtree Ave	W
East Porterville	S 'W' St	E Roby Ave	E TylerAve	W
East Porterville	S 'W' St	E Roby Ave	E TylerAve	E
East Porterville	S 'W' St	E Roby Ave	E TylerAve	W
East Porterville	S 'W' St	E Tyler Ave	E Success Dr	W
East Porterville	St Hwy 190	Martin St	Rd 265	N
East Porterville	St Hwy 190	Martin St	Rd 265	N

* Sidewalk may be present for only a portion of the noted segment.

Table 2-7 ADA Curb Ramp Site Inventory in East Porterville

ADA Curb Ramp Locations				
Community	Main Road	Crossroad	Side	Corner
East Porterville	E Crabtree Ave	S Tulsa Rd	--	N/E
East Porterville	E Date Ave	S Leggett St	--	N/E
East Porterville	E Olive Ave	S Hillcrest St	--	S/E
East Porterville	E Olive Ave	S Hillcrest St	--	S/W
East Porterville	E Poplar Ave	Pettis St	--	N/W
East Porterville	E Roby Ave	Alta Vista St	--	S/E
East Porterville	E Roby Ave	S Conner St	--	S/W
East Porterville	E Roby Ave	S Rocky Hill St	--	S/W
East Porterville	E Roby Ave	S Tulsa Rd	--	S/W
East Porterville	E Springville Ave	S Bennett St	--	NW
East Porterville	E Springville Ave	S Bennett St	--	N/E
East Porterville	E Springville Ave	S Doyle St	--	N/E
East Porterville	E Tyler Ave	S Conner Ave	--	N/E
East Porterville	S Plano St	E Date Ave	--	S/E
East Porterville	S Plano St	E River Ave	E	N/E

Table 2-8 Fire Hydrant Site Inventory in East Porterville

Fire Hydrant Locations					
Community	Main Road	Crossroad	Side	Corner	Location Detail
East Porterville	Alta Vista St	between Springville Ave and Crabtree Ave	W	--	--
East Porterville	Baxley St	between Cleo Ave and Richard Ave	E	--	--
East Porterville	Bennett St	between Springville Ave and Cleo Ave	E	--	--
East Porterville	Bennett St	between Richard Ave and Crabtree Ave	E	--	--
East Porterville	between Date Ave and River Ave	east of Leggett St	--	--	centrally located within parcel
East Porterville	Conner St	between Olive Ave and Putnam Ave	E	--	--
East Porterville	Date Ave	between Park St and Leggett St	N	--	--
East Porterville	Date Ave	between Park St and Leggett St	N	--	--
East Porterville	Holcomb St	between Roby Ave and Olive Ave	W	--	--
East Porterville	Holcomb St	between Roby Ave and Olive Ave	E	--	--
East Porterville	Holcomb St	between Roby Ave and Olive Ave	E	--	--
East Porterville	Orange Ave	Maurer St	--	S/E	--
East Porterville	Orange Ave	at bend at Roby Ave	S	--	--
East Porterville	Randy St	between Cleo Ave and Richard Ave	W	--	--
East Porterville	River Ave	between Plano St and Larson St	S	--	--
East Porterville	Success Dr	Hillcrest Private Rd	N	--	--
East Porterville	Tyler Ave	east of Holcomb St	S	--	--

Figure 2-5 Inventory of Serviced in El Monte Mobile Village

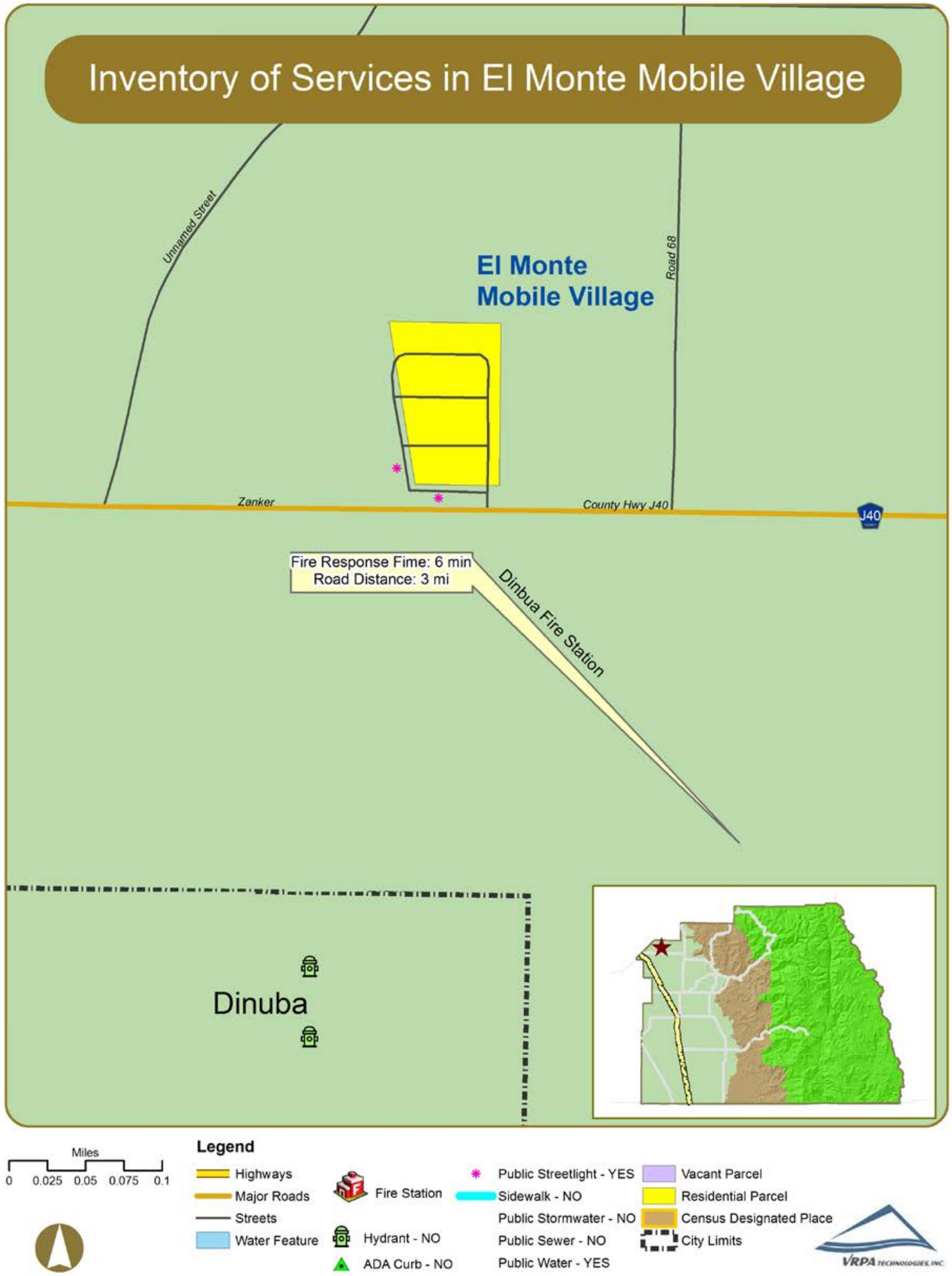


Table 2-9 Streetlight Site Inventory in El Monte Mobile Village

Streetlight Locations			
Community	**Main Road**	**Crossroad**	**Side**
El Monte Mobile Home	Ave 416	west of Mobile Home Park entrance	N
El Monte Mobile Home	Inside Park	--	W

Figure 2-6 Inventory of Services in Hawkins

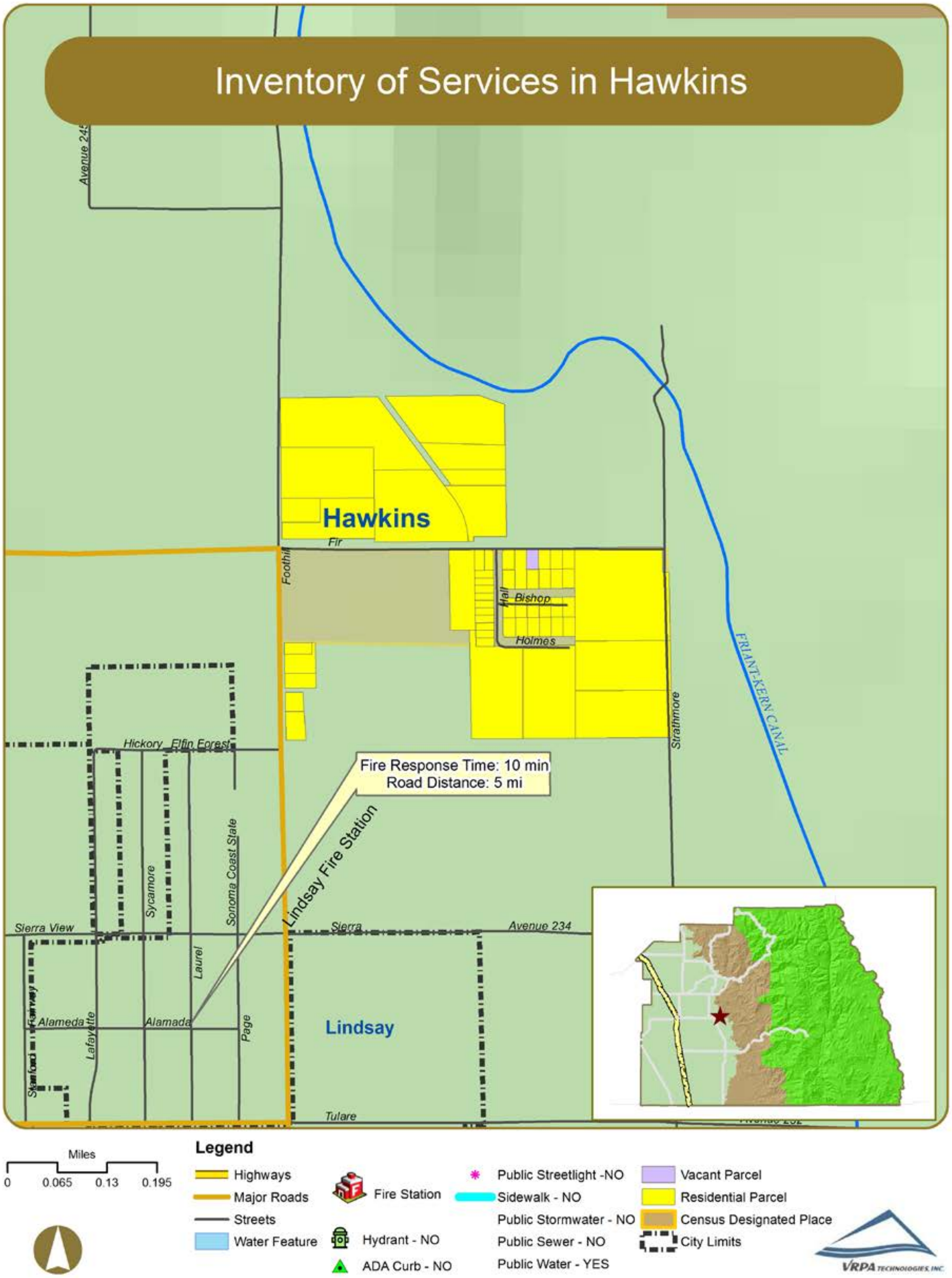


Figure 2-7 Inventory of Services in Higby

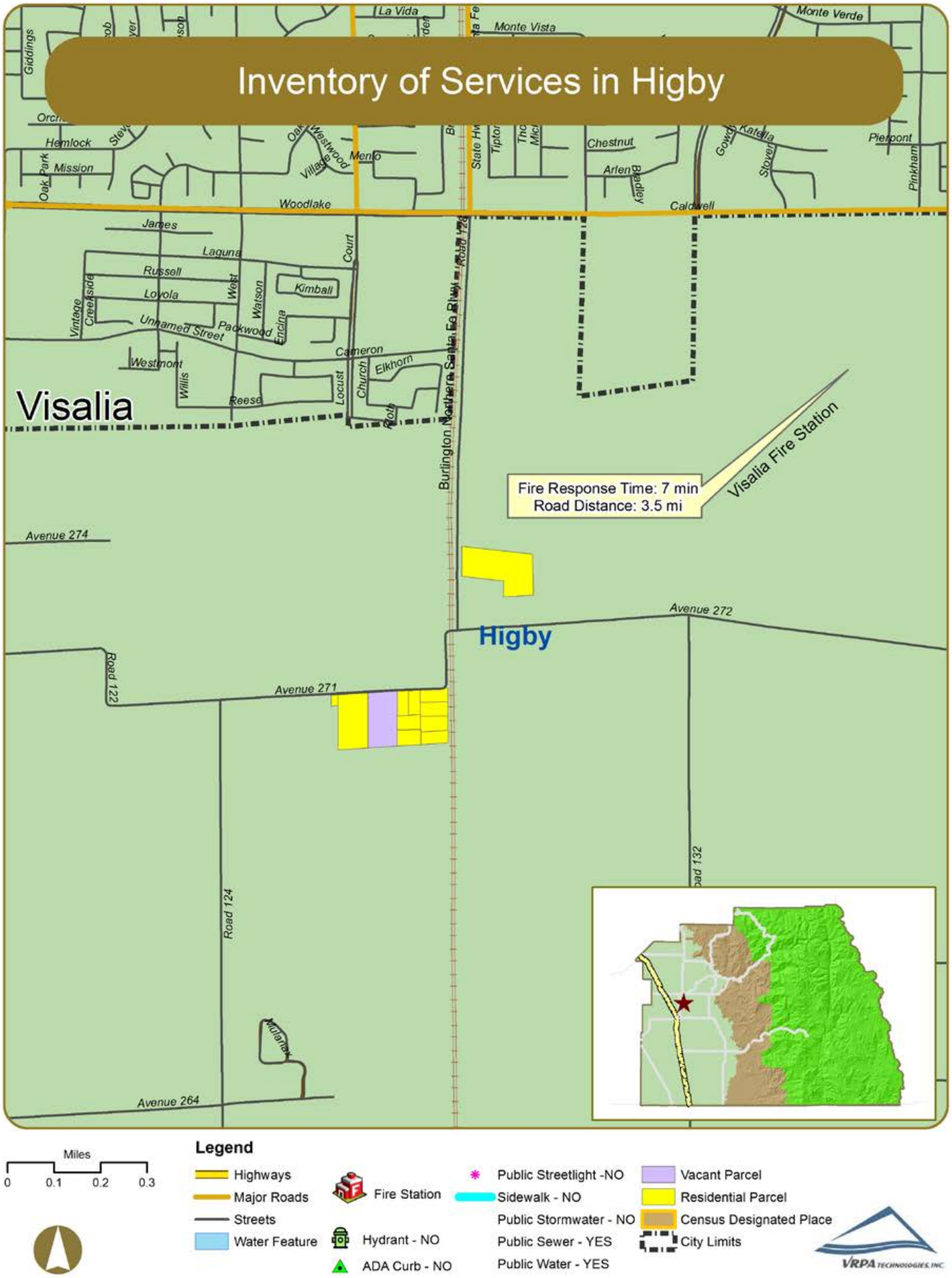


Figure 2-8 Inventory of Services in Hypericum

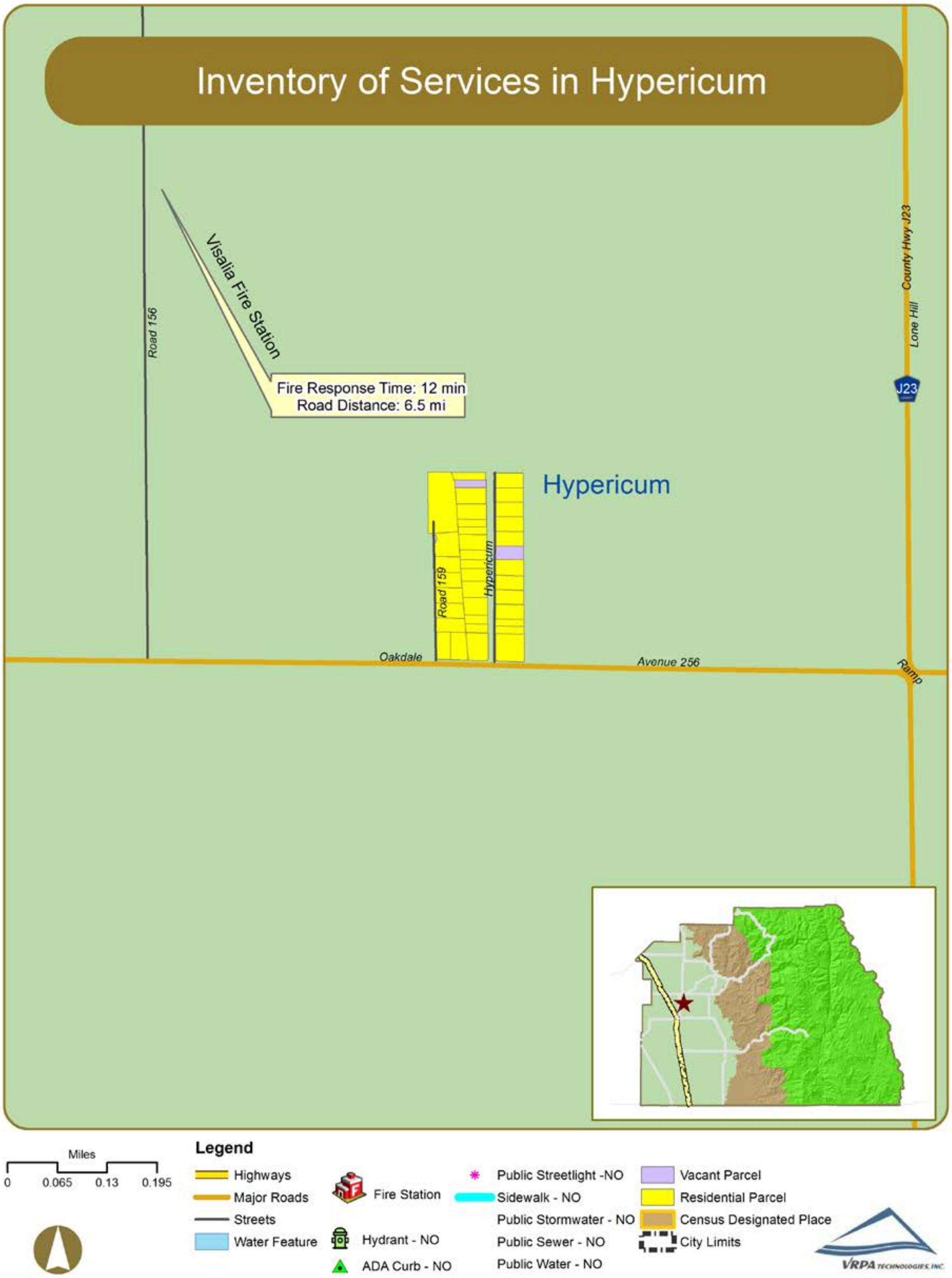


Figure 2-9 Inventory of Services in Jones Corner

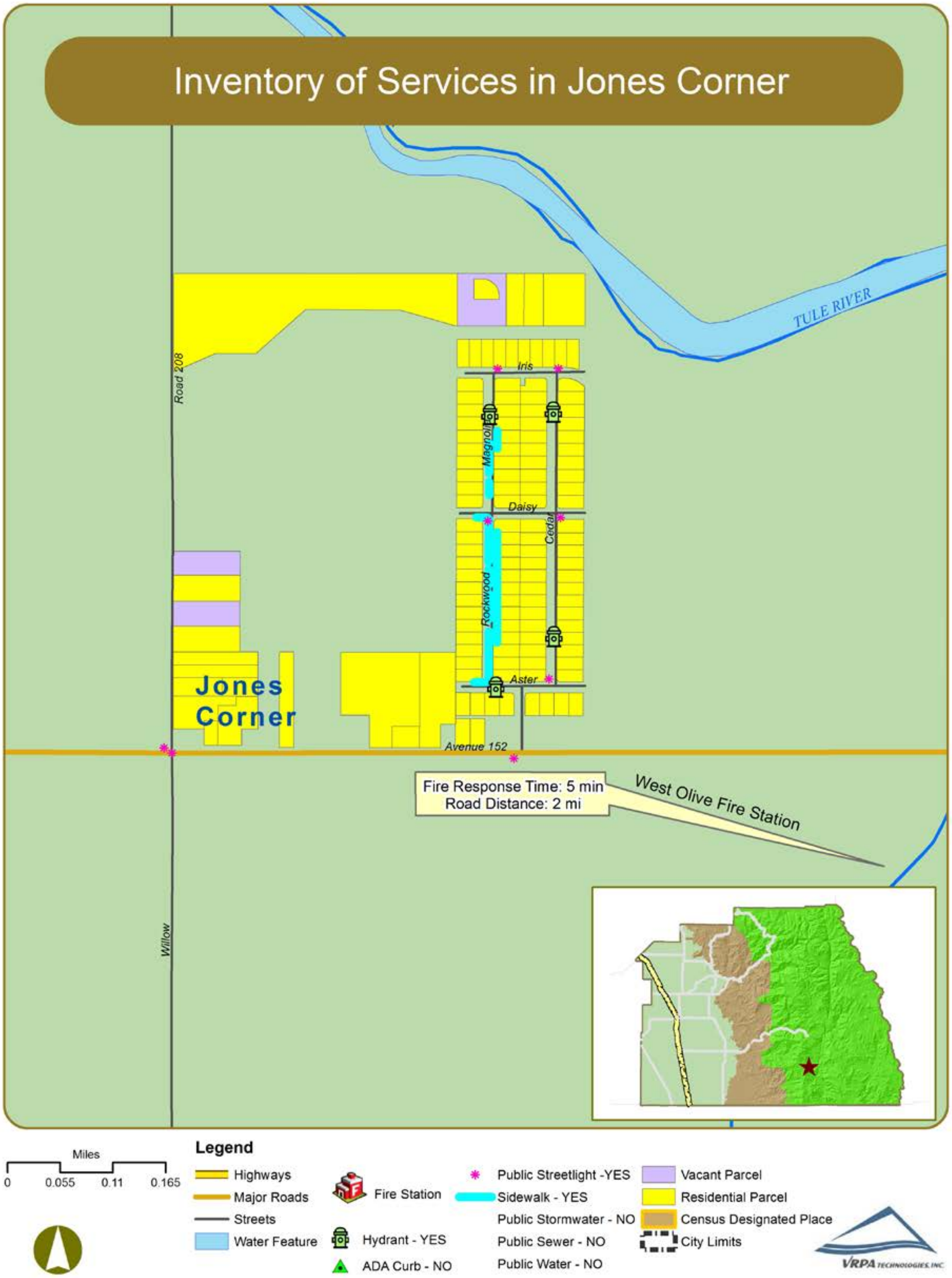


Table 2-10 Streetlight Site Inventory in Jones Corner

Streetlight Locations			
Community	Main Road	Crossroad	Corner
Jones Corner	Aster Ave	Cedar Rd	N/W
Jones Corner	Aster Ave	Magnolia Rd	N/E
Jones Corner	Ave 152	Cedar Rd	S/W
Jones Corner	Ave 152	Rd 208	N/W
Jones Corner	Cedar Rd	Daisy Ave	S/E
Jones Corner	Cedar Rd	Iris Ave	N/E
Jones Corner	Magnolia Rd	Daisy Ave	S/W
Jones Corner	Magnolia Rd	Iris Ave	N/E

Table 2-11 Sidewalk Site Inventory in Jones Corner

Sidewalk Locations				
Community	Street	From *	To *	Side
Jones Corner	Aster Ave	Magnolia Rd	75' west	N
Jones Corner	Daisy Ave	Magnolia Rd	75' west	S
Jones Corner	Magnolia Rd	Aster Ave	Daisy Ave	W
Jones Corner	Magnolia Rd	Aster Ave	Daisy Ave	W
Jones Corner	Magnolia Rd	Aster Ave	Daisy Ave	W
Jones Corner	Magnolia Rd	Aster Ave	Daisy Ave	W
Jones Corner	Magnolia Rd	Aster Ave	Daisy Ave	E
Jones Corner	Magnolia Rd	Daisy Ave	Iris Ave	W
Jones Corner	Magnolia Rd	Daisy Ave	Iris Ave	W
Jones Corner	Magnolia Rd	Daisy Ave	Iris Ave	E

* Sidewalk may be present for only a portion of the noted segment.

Table 2-12 Fire Hydrant Site Inventory in Jones Corner

Fire Hydrant Locations			
Community	Main Road	Crossroad	Side
Jones Corner	Aster Ave	Magnolia Rd	S
Jones Corner	Cedar Rd	Daisy Ave to Aster Ave	W
Jones Corner	Cedar Rd	Daisy Ave to Iris Ave	W
Jones Corner	Magnolia Rd	Daisy Ave to Iris Ave	W

Figure 2-10 Inventory of Services in Jovista

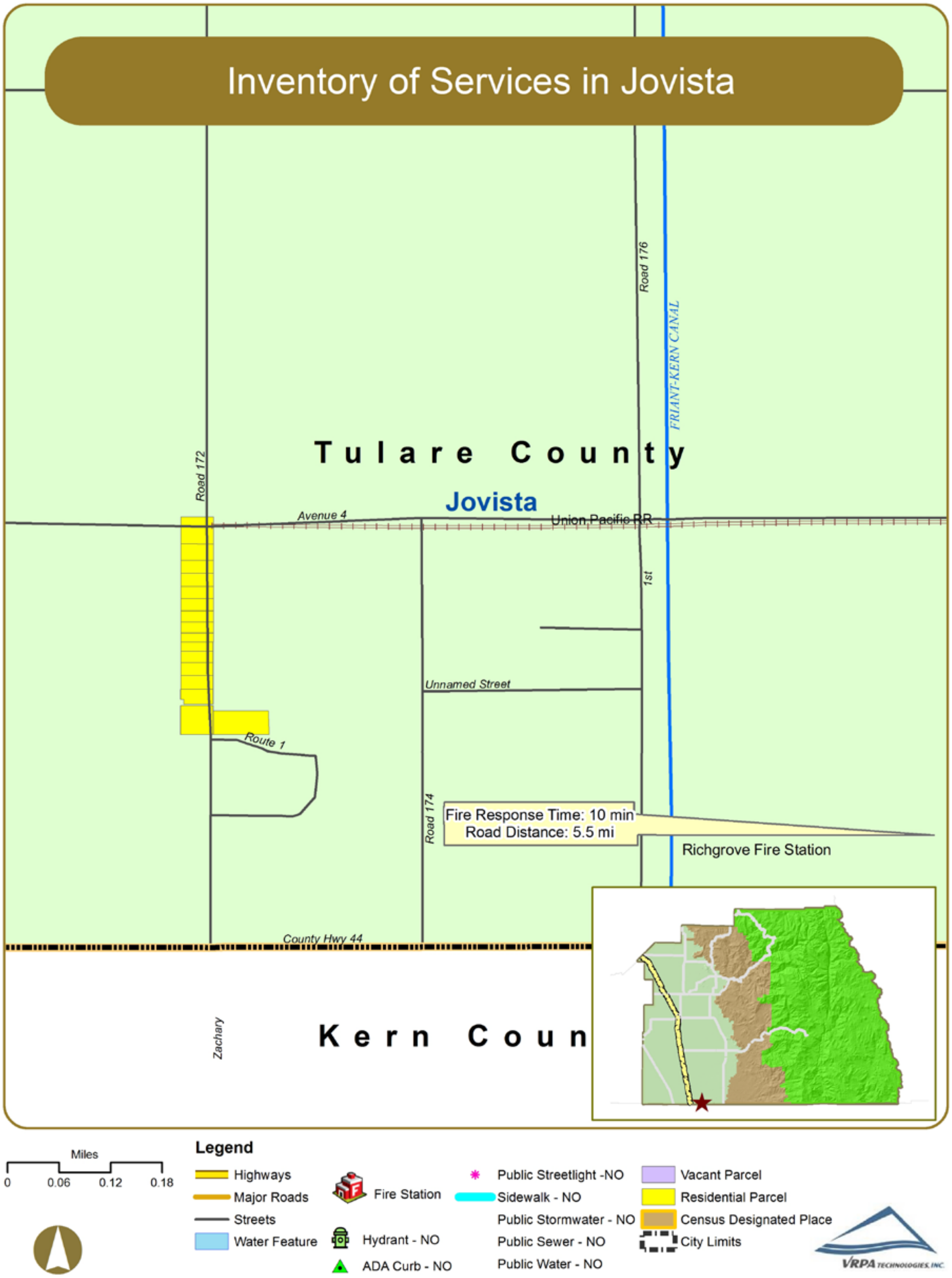


Figure 2-11 Inventory of Services in Lort

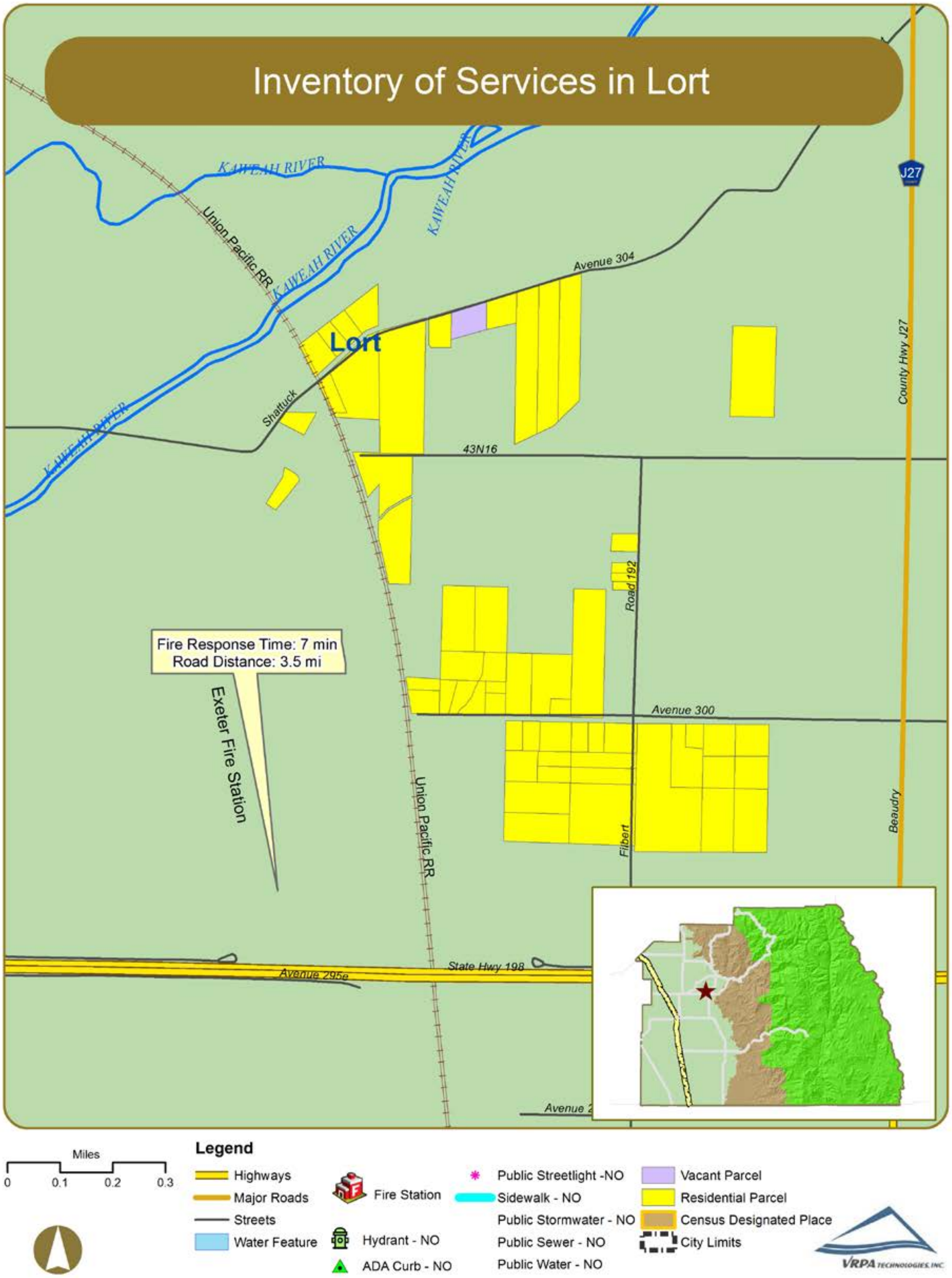


Figure 2-12 Inventory of Services in Naranjo

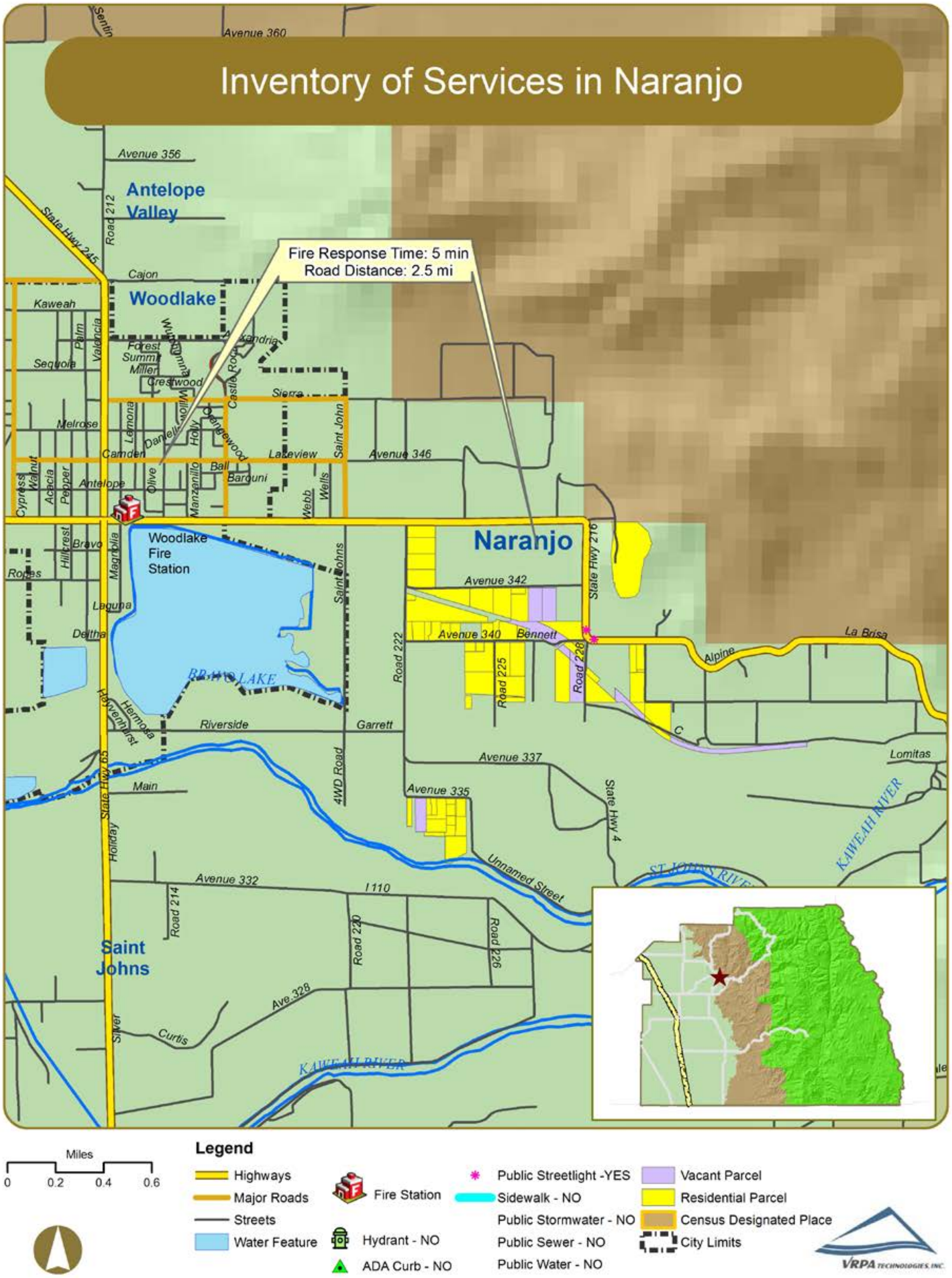


Table 2-13 Streetlight Site Inventory in Naranjo

Streetlight Locations			
Community	Main Road	Crossroad	Corner
Naranjo	Ave 340	Rd 228	N/E
Naranjo	Ave 340	Rd 228	N/E

Figure 2-13 Inventory of Services in Paige

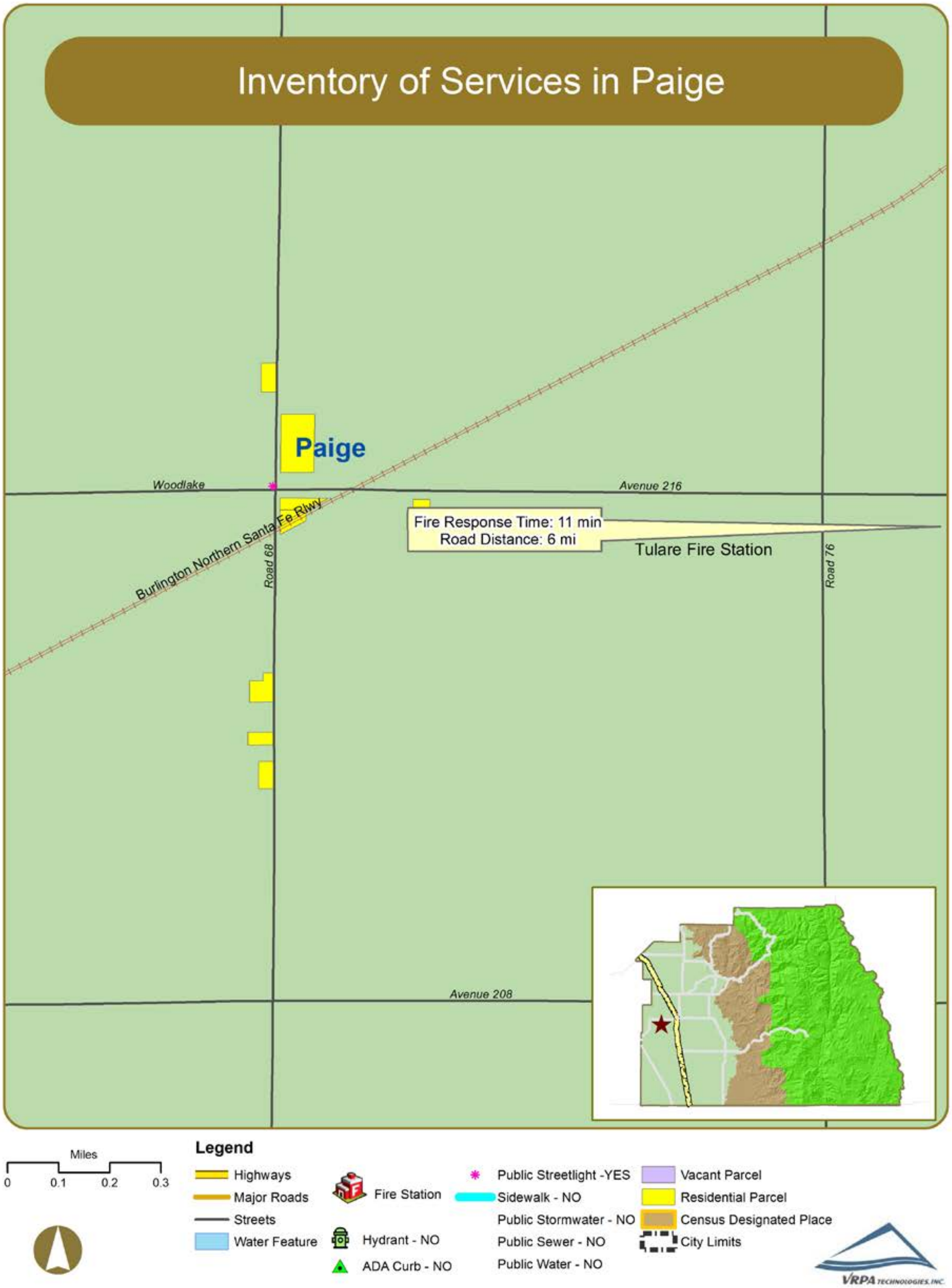


Table 2-14 Streetlight Site Inventory in Paige

Streetlight Locations			
Community	Main Road	Crossroad	Corner
Paige	Ave 216	Rd 68	N/W

Figure 2-14 Inventory of Services in Peral

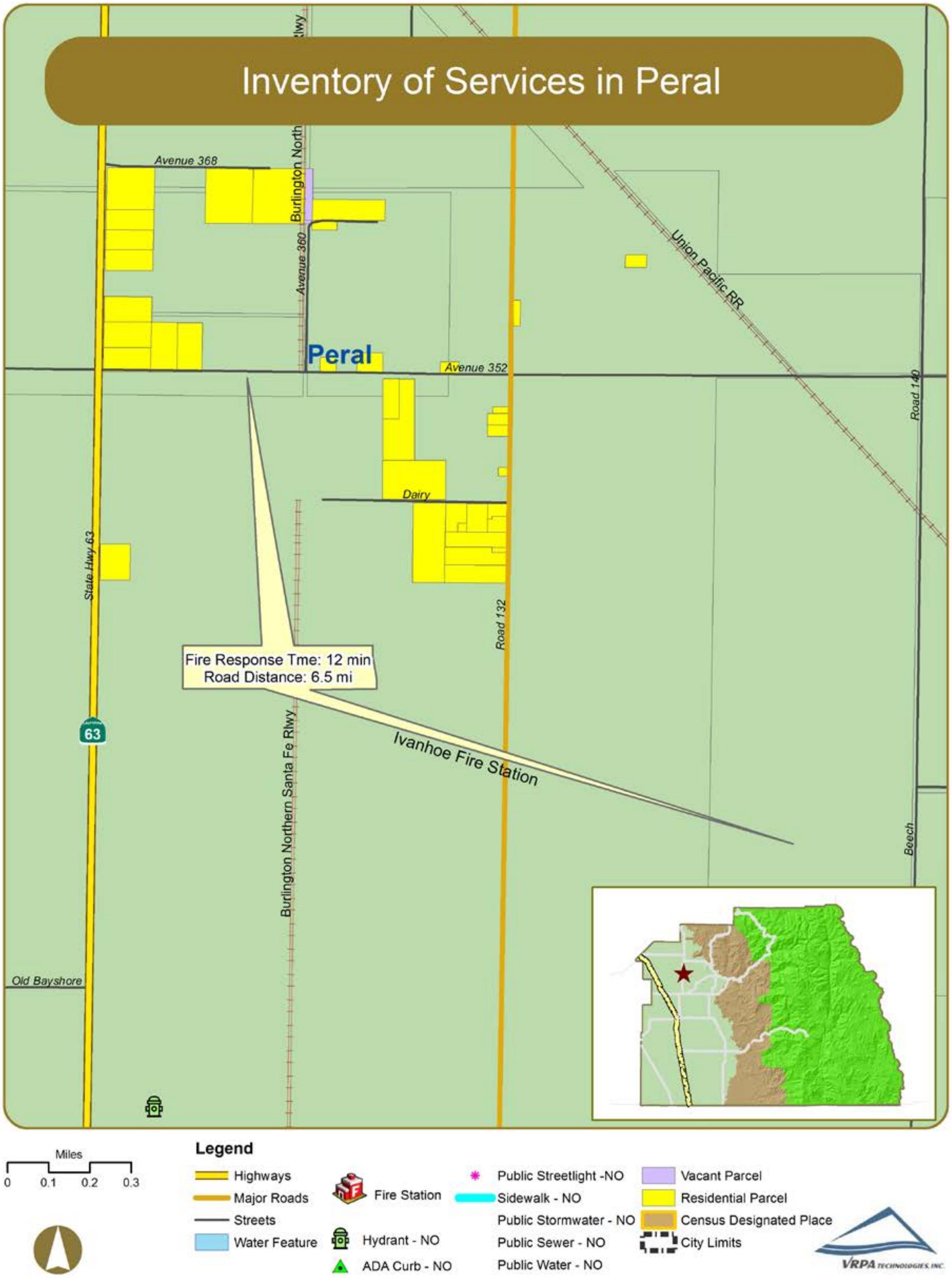


Figure 2-15 Inventory of Services in Ponca

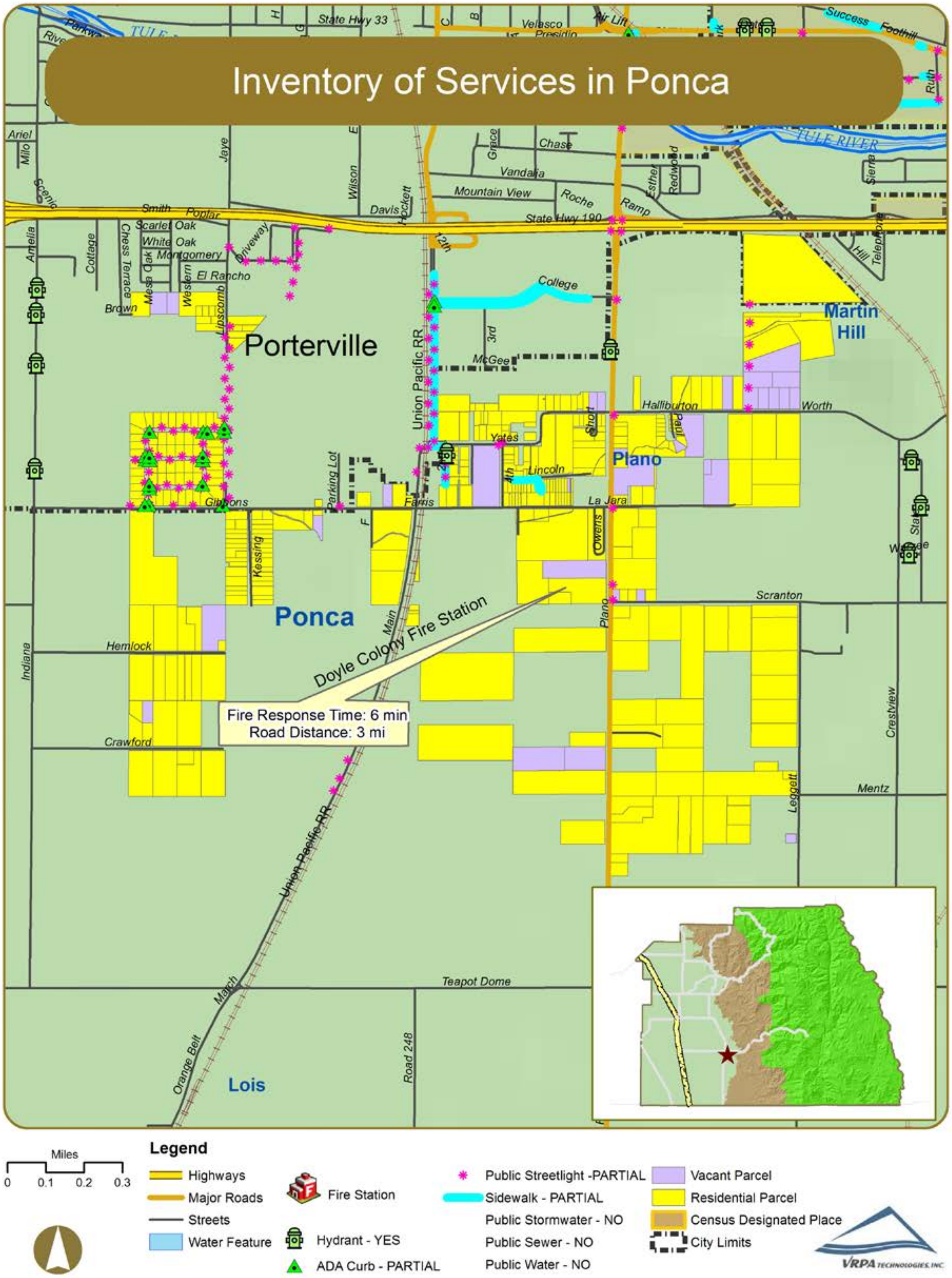


Table 2-15 Streetlight Site Inventory in Ponca

Streetlight Locations					
Community	**Main Road**	**Crossroad**	**Side**	**Corner**	**Location Detail**
Ponca	Poplar Ave	at north end	N	--	--
Ponca	Poplar Ave	north of Montgomery Ave	W	--	--
Ponca	Poplar Ave	north of Montgomery Ave	E	--	--
Ponca	Poplar Ave	north of Montgomery Ave	E	--	--
Ponca	Poplar Ave	south of Montgomery Ave	--	--	in center median
Ponca	Poplar Ave	south of Montgomery Ave	--	--	in center median
Ponca	Poplar Ave	south of Montgomery Ave	--	--	in center median
Ponca	Rd 252	Ave 136	--	N/E	--
Ponca	Rd 252	Ave 140	--	S/E	--
Ponca	Rd 252	Ave 252 (E College Ave)	E	--	--
Ponca	Rd 252	E Gibbons Ave	--	S/E	--
Ponca	S 2nd St	south of Yates Ave	W	--	--
Ponca	S 2nd St	south of Yates Ave	W	--	--
Ponca	S Jaye St	Gibbons Ave	--	N/W	--
Ponca	S Jaye St	between Gibbons Ave and Melinda Ave	E	--	--
Ponca	S Jaye St	between Gibbons Ave and Melinda Ave	W	--	--
Ponca	S Jaye St	between Gibbons Ave and Melinda Ave	E	--	--
Ponca	S Jaye St	between Gibbons Ave and Melinda Ave	W	--	--
Ponca	S Jaye St	between Gibbons Ave and Melinda Ave	E	--	--
Ponca	S Jaye St	between Gibbons Ave and Melinda Ave	W	--	--
Ponca	S Jaye St	W Melinda Ave	--	S/W	--
Ponca	S Jaye St	W Melinda Ave	E	--	--
Ponca	S Jaye St	between Melinda Ave and El Rancho Ave	W	--	--
Ponca	S Jaye St	between Melinda Ave and El Rancho Ave	E	--	--
Ponca	S Jaye St	between Melinda Ave and El Rancho Ave	W	--	--
Ponca	S Jaye St	between Melinda Ave and El Rancho Ave	E	--	--
Ponca	S Jaye St	between Melinda Ave and El Rancho Ave	W	--	--
Ponca	S Jaye St	between Melinda Ave and El Rancho Ave	E	--	--
Ponca	S Jaye St	between Melinda Ave and El Rancho Ave	W	--	--
Ponca	S Jaye St	between Melinda Ave and El Rancho Ave	E	--	--
Ponca	S Jaye St	between Melinda Ave and El Rancho Ave	W	--	--
Ponca	S Jaye St	between Melinda Ave and El Rancho Ave	E	--	--
Ponca	S Main St	E College Ave	--	S/E	--
Ponca	S Main St	E College Ave	--	S/E	--
Ponca	S Main St	north of College Ave	W	--	--
Ponca	S Main St	north of College Ave	E	--	--
Ponca	S Main St	between College Ave and Yates Ave	E	--	--
Ponca	S Main St	between College Ave and Yates Ave	W	--	--
Ponca	S Main St	between College Ave and Yates Ave	E	--	--
Ponca	S Main St	between College Ave and Yates Ave	W	--	--
Ponca	S Main St	between College Ave and Yates Ave	E	--	--
Ponca	S Main St	between College Ave and Yates Ave	W	--	--

Table 2-15 Streetlight Site Inventory in Ponca (continued)

Streetlight Locations					
Community	Main Road	Crossroad	Side	Corner	Location Detail
Ponca	S Main St	between College Ave and Yates Ave	E	--	--
Ponca	S Main St	between College Ave and Yates Ave	W	--	--
Ponca	S Main St	between College Ave and Yates Ave	E	--	--
Ponca	S Main St	between College Ave and Yates Ave	W	--	--
Ponca	S Main St	between College Ave and Yates Ave	W	--	--
Ponca	S Main St	Yates Ave	--	N/E	--
Ponca	S Main St	Yates Ave	--	S/E	--
Ponca	S Main St	between Yates Ave and Gibbons Ave	W	--	--
Ponca	S Main St	between Yates Ave and Gibbons Ave	W	--	--
Ponca	S Mesa Oak St	between Gibbons Ave and Stacie Ave	E	--	--
Ponca	S Mesa Oak St	between Stacie Ave and Yates Ave	E	--	--
Ponca	S Mesa Oak St	between Stacie Ave and Yates Ave	W	--	--
Ponca	S Mesa Oak St	between Yates Ave and Melinda Ave	W	--	--
Ponca	S Mesa Oak St	between Yates Ave and Melinda Ave	E	--	--
Ponca	S Mesa Oak St	Melinda Ave	--	S/E	--
Ponca	S Pearson St	between Stacie Ave and Yates Ave	E	--	--
Ponca	S Pearson St	between Stacie Ave and Yates Ave	W	--	--
Ponca	S Pearson St	between Yates Ave and Melinda Ave	W	--	--
Ponca	S Pearson St	between Yates Ave and Melinda Ave	E	--	--
Ponca	ɔ Golden Hills Mobile Estate	north of Worth Ave	E	--	--
Ponca	ɔ Golden Hills Mobile Estate	north of Worth Ave	E	--	--
Ponca	ɔ Golden Hills Mobile Estate	north of Worth Ave	E	--	--
Ponca	ɔ Golden Hills Mobile Estate	north of Worth Ave	E	--	--
Ponca	ɔ Golden Hills Mobile Estate	north of Worth Ave	E	--	--
Ponca	ɔ Golden Hills Mobile Estate	north of Worth Ave	E	--	--
Ponca	W Gibbons Ave	S 'F' St	--	N/E	--
Ponca	W Gibbons Ave	S Jaye St	--	N/W	--
Ponca	W Gibbons Ave	Mesa Oak St	--	N/E	--
Ponca	W Gibbons Ave	between Chess Terrace St and Mesa Oak St	N	--	--
Ponca	W Gibbons Ave	between Mesa Oak St and Jaye St	N	--	--
Ponca	W Gibbons Ave	between Mesa Oak St and Jaye St	N	--	--
Ponca	W Gibbons Ave	Plano St	--	S/E	--
Ponca	W Melinda Ave	between Mesa Oak St and Pearson St	N	--	--
Ponca	W Melinda Ave	between Mesa Oak St and Pearson St	S	--	--
Ponca	W Melinda Ave	between Mesa Oak St and Pearson St	N	--	--
Ponca	W Melinda Ave	between Mesa Oak St and Pearson St	S	--	--
Ponca	W Melinda Ave	S Pearson St	--	S/E	--
Ponca	W Melinda Ave	between Pearson St and Jaye St	N	--	--
Ponca	W Melinda Ave	S Jaye St	--	S/W	--
Ponca	W Montgomery Ave	Jaye St	--	S/W	--
Ponca	W Montgomery Ave	between Jaye St and Poplar Ave	--	--	in center median
Ponca	W Montgomery Ave	between Jaye St and Poplar Ave	--	--	in center median
Ponca	W Montgomery Ave	between Jaye St and Poplar Ave	--	--	in center median

Table 2-15 Streetlight Site Inventory in Ponca (continued)

Streetlight Locations					
Community	**Main Road**	**Crossroad**	**Side**	**Corner**	**Location Detail**
Ponca	W Montgomery Ave	between Jaye St and Poplar Ave	--	--	in center median
Ponca	W Stacie Ave	between Mesa Oak St and Pearson St	S	--	--
Ponca	W Stacie Ave	between Mesa Oak St and Pearson St	N	--	--
Ponca	W Stacie Ave	between Mesa Oak St and Pearson St	S	--	--
Ponca	W Stacie Ave	between Mesa Oak St and Pearson St	N	--	--
Ponca	W Stacie Ave	Pearson St	--	S/W	--
Ponca	Yates Ave	between Chess Terrace St and Mesa Oak St	S	--	--
Ponca	Yates Ave	Mesa Oak St	--	S/W	--
Ponca	Yates Ave	between Mesa Oak St and Pearson St	S	--	--
Ponca	Yates Ave	between Mesa Oak St and Pearson St	N	--	--
Ponca	Yates Ave	between Mesa Oak St and Pearson St	S	--	--
Ponca	Yates Ave	between Mesa Oak St and Pearson St	N	--	--
Ponca	Yates Ave	4th St	N	--	--

Table 2-16 Sidewalk Site Inventory in Ponca

Sidewalk Locations				
Community	**Street**	**From ***	**To ***	**Side**
Ponca	E College Ave	S Main St	Plano St	S
Ponca	E College Ave	S Main St	Plano St	N
Ponca	E Lincoln St	S 4th St	S Roche St	S
Ponca	E Yates	S Main St	S 2nd St	S
Ponca	S 2nd St	E Yates	deadend	E
Ponca	S Main St	E College Ave	350' north	E
Ponca	S Main St	E Yates	E College Ave	E
Ponca	S Roche St	E Lincoln St	deadend	E
Ponca	S Roche St	E Lincoln St	deadend	W

* Sidewalk may be present for only a portion of the noted segment.

Table 2-17 ADA Curb Ramp Site Inventory in Ponca

ADA Curb Ramp Locations			
Community	Main Road	Crossroad	Corner
Ponca	S Jaye St	S Jaye St	N/W
Ponca	S Jaye St	W Melinda Ave	S/W
Ponca	S Jaye St	W Melinda Ave	N/W
Ponca	S Main St	E College Ave	N/E
Ponca	S Main St	E College Ave	S/E
Ponca	W Melinda Ave	S Pearson St	N/E
Ponca	W Melinda Ave	S Pearson St	S/E
Ponca	S Mesa Oak St	W Gibbons Ave	S/E
Ponca	S Mesa Oak St	W Gibbons Ave	N/W
Ponca	S Mesa Oak St	W Melinda Ave	S/E
Ponca	S Mesa Oak St	W StacieAve	N/E
Ponca	S Mesa Oak St	W StacieAve	S/E
Ponca	S Mesa Oak St	W Yates Ave	N/E
Ponca	S Mesa Oak St	W Yates Ave	N/W
Ponca	S Mesa Oak St	W Yates Ave	N/E
Ponca	S Mesa Oak St	W Yates Ave	S/E
Ponca	S Pearson St	W State Ave	N/W
Ponca	S Pearson St	W Yates Ave	N/E
Ponca	S Pearson St	W Yates Ave	N/W
Ponca	E Yates	S 2nd St	S/W

Table 2-18 Fire Hydrant Site Inventory in Ponca

Fire Hydrant Locations			
Community	Main Road	Crossroad	Side
Ponca	2nd St	south of Yates Ave	W
Ponca	Plano St	between Worth Ave to College Ave	W

Figure 2-16 Inventory of Services in Sandspur

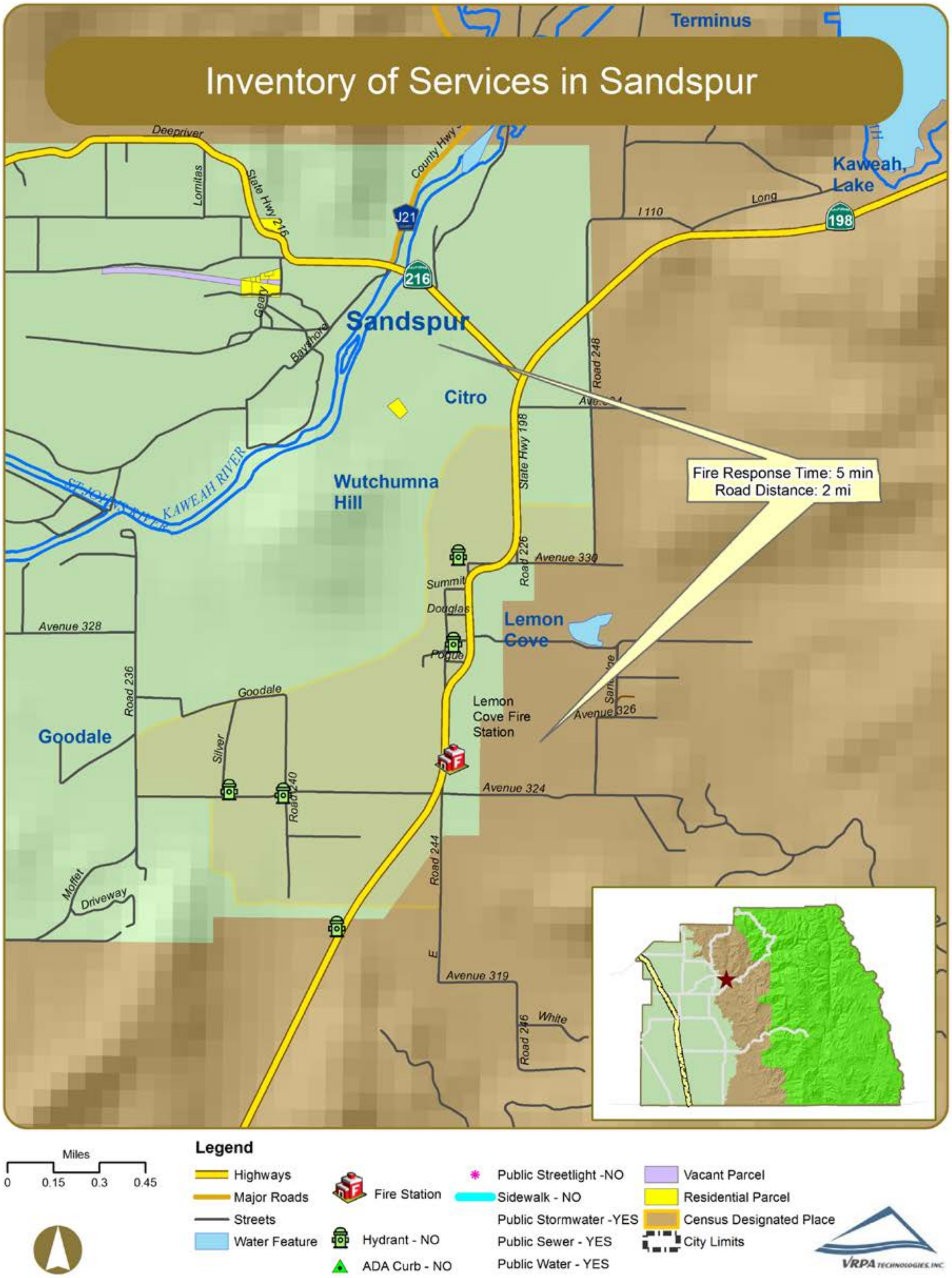


Figure 2-17 Inventory of Services in Taurusa

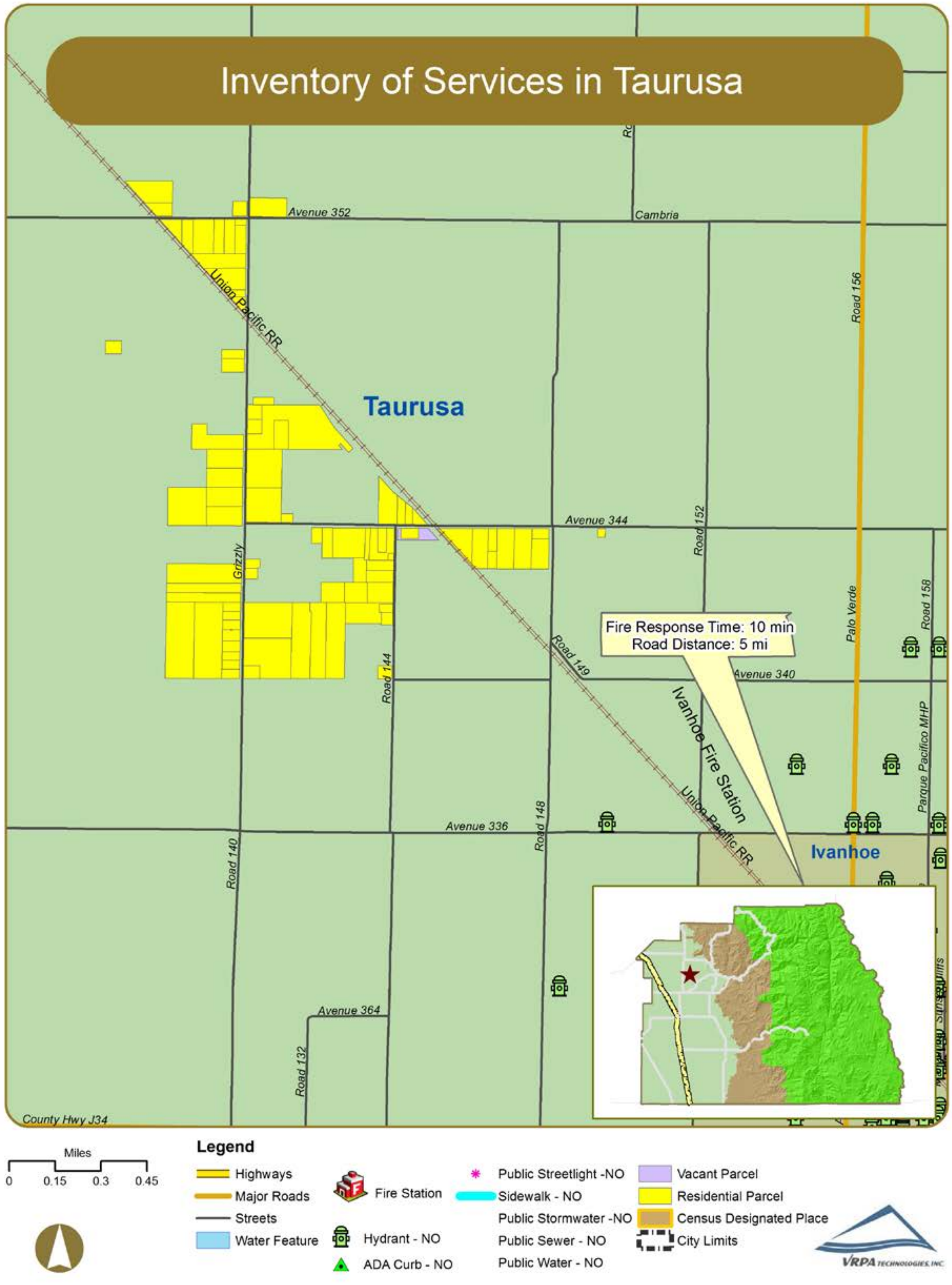


Figure 2-18 Inventory of Services in Tooleville

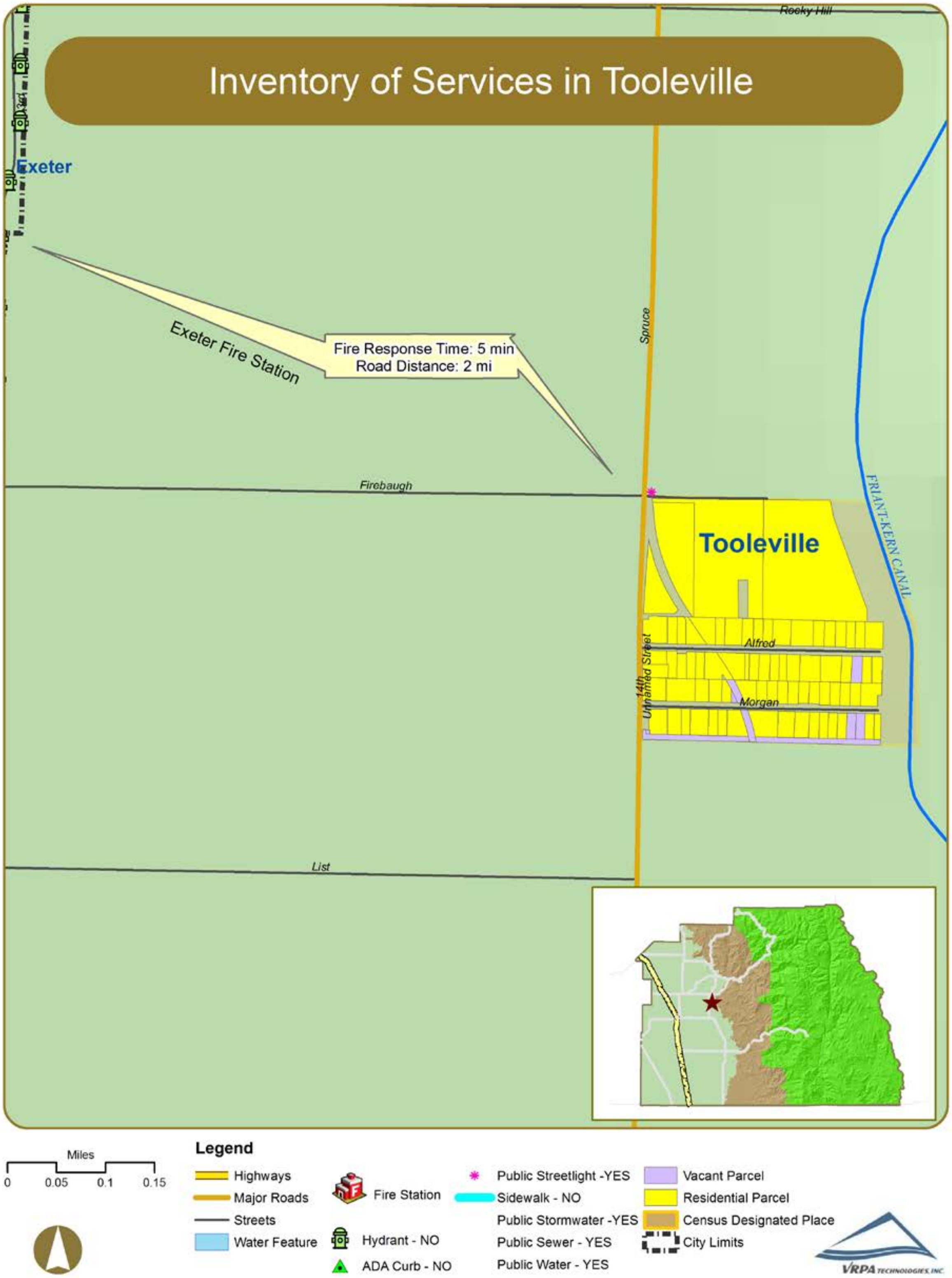


Table 2-19 Streetlight Site Inventory in Tooleville

Streetlight Locations			
Community	Main Road	Crossroad	Corner
Tooleville	E Firebaugh Ave (Ave 276)	Spruce Ave (14th Ave E)	N/E

Figure 2-19 Inventory of Services in Vance

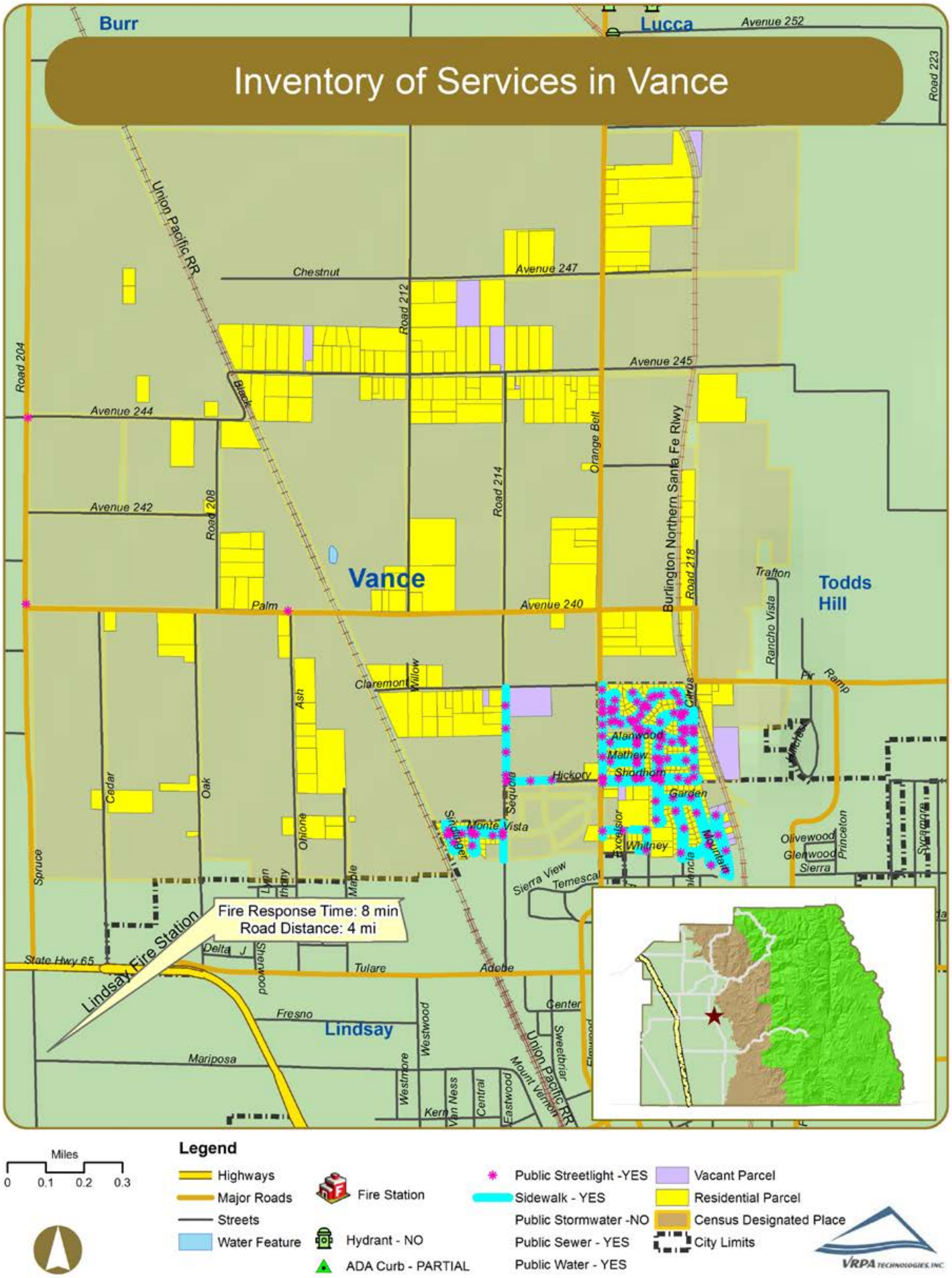


Table 2-20 Streetlight Site Inventory in Vance

Streetlight Locations					
Community	**Main Road**	**Crossroad**	**Side**	**Corner**	**Location Detail**
Vance	Alanwood Ct		W	--	cul-de-sac
Vance	Ave 240	Ash Ave	--	N/E	--
Vance	Bond Way	Rosewood St	E	--	--
Vance	Bond Way	north of Rosewood St	E	--	--
Vance	Cottonwood St	between Bond Way and Gale Hill Ave	S	--	--
Vance	Cottonwood St	Bond Way	W	--	--
Vance	Cottonwood St	Gale Hill Ave	N	--	--
Vance	Cottonwood St	between Gale Hill Ave and Homassel St	N	--	--
Vance	Cottonwood St	between Gale Hill Ave and Homassel St	S	--	--
Vance	Cottonwood St	between Gale Hill Ave and Homassel St	N	--	--
Vance	Cottonwood St	between Gale Hill Ave and Homassel St	S	--	--
Vance	Cottonwood St	between Gale Hill Ave and Homassel St	S	--	--
Vance	E Hickory St	Gale Hill Ave	--	N/W	--
Vance	E Hickory St	Hamlin Way	--	N/W	--
Vance	E Hickory St	Hamlin Way	--	S/E	--
Vance	E Hickory St	between Parkside Ave and Gale Hill Ave	N	--	--
Vance	E Hickory St	between Hamlin Way and Bellah Ave	N	--	--
Vance	E Hickory St	between Hamlin Way and Bellah Ave	S	--	--
Vance	E Hickory St	Parkside Ave	--	N/E	--
Vance	E Hickory St	between Road 214 and Parkside Ave	N	--	--
Vance	E Hickory St	between Road 214 and Parkside Ave	N	--	--
Vance	Gale Hill Ave	Alanwood Ct	--	S/W	--
Vance	Gale Hill Ave	Mandarin St	W	--	--
Vance	Gale Hill Ave	Matthew Ct	--	N/W	--
Vance	Gale Hill Ct	north of Cottonwood St	W	--	--
Vance	Gale Hill Ct	cul-de-sac	N	--	cul-de-sac
Vance	Garden Ave	Homassel Ave	N	--	--
Vance	Garden Ave	Mountain View Dr	N	N/W	--
Vance	Hamlin Way	cul-de-sac	W	--	--
Vance	Hamlin Way	Garden Ave	W	--	--
Vance	Hamlin Way	between Hickory St and Matthew Pl	E	--	--
Vance	Hamlin Way	Matthew Pl	W	--	--
Vance	Hamlin Way	between Matthew Pl and Mandarin St	E	--	--
Vance	Homassel Ave	Mountain View Dr	W	--	--
Vance	Homassel Ave	between Mountain View Dr and Garden Ave	W	--	--
Vance	Homassel Ave	between Mountain View Dr and Garden Ave	E	--	--
Vance	Homassel St	Plum St	W	--	--
Vance	Homassel St	Rosewood Ct	E	--	--
Vance	Homassel St	north of Rosewood Ct	W	--	--
Vance	Mandarin St	Hamlin Way	N	--	--
Vance	Mandarin St	between Gale Hill Ave and Hamlin Way	S	--	--
Vance	Mandarin St	between Hamlin Way and Homassel St	S	--	--
Vance	Mandarin St	Homassel Ave	S	--	--
Vance	Matthew Ct	cul-de-sac	W	--	cul-de-sac
Vance	Matthew Pl	cul-de-sac	E	--	cul-de-sac
Vance	Matthew Pl	east of Hamlin Way	N	--	--

Table 2-20 Streetlight Site Inventory in Vance (continued)

Streetlight Locations					
Community	**Main Road**	**Crossroad**	**Side**	**Corner**	**Location Detail**
Vance	Monte Vista St	between Sindlinger St and Sherman Ct	S	--	--
Vance	Monte Vista St	Sherman Ct	N	--	--
Vance	Monte Vista St	between Sherman Ct and Road 214	S	--	--
Vance	Mountain Cir	cul-de-sac	S	--	cul-de-sac
Vance	Mountain View Dr	Mountain Cir	E	S/E	--
Vance	Mountain View Dr	between Mountain Cir and Garden Ave	E	--	--
Vance	Mountain View Dr	between Mountain Cir and Garden Ave	W	--	--
Vance	Orange Ave	cul-de-sac	N	--	cul-de-sac
Vance	Orange Ave	north of Sierra View St	W	--	--
Vance	Orange Ave	north of Sierra View St	E	--	--
Vance	Orange Ave	north of Sierra View St	W	--	--
Vance	Parkside Ave	Rosewood St	E	S/E	--
Vance	Parkside Ave	north of Rosewood St	E	--	--
Vance	Parkside Ave	north of Rosewood St	E	--	--
Vance	Parkside Ave	between Hickory St and Rosewood St	E	--	--
Vance	Parkside Ave	between Hickory St and Rosewood St	E	--	--
Vance	Parkside Ave	between Hickory St and Rosewood St	E	--	--
Vance	Rd 204	Ave 240	--	N/E	--
Vance	Rd 204	Ave 244	--	S/W	--
Vance	Rd 214	E Hickory St	E	N/E	--
Vance	Rd 214	E Hickory St	E	--	--
Vance	Rd 214	north of Hickory St	E	--	--
Vance	Rd 214	north of Hickory St	E	--	--
Vance	Rd 214	north of Hickory St	E	--	--
Vance	Rd 218 (N Bellah Ave)	Plum St	W	S/W	--
Vance	Rd 218 (N Bellah Ave)	between Hickory St and Plum St	W	--	--
Vance	Rd 218 (N Bellah Ave)	between Hickory St and Plum St	W	--	--
Vance	Rosewood Ct	west of Homassel St	N	--	--
Vance	Rosewood Ct	west of Homassel St	W	--	--
Vance	Sheman Ct	south of Monte Vista St	W	--	--
Vance	Sindinger St	south of Monte Vista St	W	--	--
Vance	Sindinger St	south of Monte Vista St	E	--	--

Table 2-21 Sidewalk Site Inventory in Vance

Sidewalk Locations				
Community	**Street**	**From ***	**To ***	**Side**
Vance	AlanWood Ct	Gale Hill Ave	cul-de-sac	Both
Vance	Bond Way	Rosewood St	Cottonwood St	W
Vance	Bond Way	Rosewood St	Cottonwood St	E
Vance	Bond Way	Rosewood St	cul-de-sac	Both
Vance	Cottonwood St	Bond Way	Homassel St	Both
Vance	E Hickory St	Gale Hill Ave	Hamlin Way	N
Vance	E Hickory St	Hamlin Way	Rd 216	S
Vance	E Hickory St	Hamlin Way	Rd 218	N

Table 2-21 Sidewalk Inventory in Vance (continued)

Sidewalk Locations				
Community	Street	From *	To *	Side
Vance	E Hickory St	Parkside Ave	Gale Hill Ave	N
Vance	E Hickory St	Parkside Ave	Hamlin Way	S
Vance	E Hickory St	Rd 214	670' east	N
Vance	Gale Hill Ave	Alanwood Ct	Mandarin St	W
Vance	Gale Hill Ave	E Hickory St	Mandarin St	E
Vance	Gale Hill Ave	E Hickory St	Matthew Ct	W
Vance	Gale Hill Ave	Mandarin St	Cottonwood St	E
Vance	Gale Hill Ave	Matthew Ct	Alanwood Ct	W
Vance	Gale Hill Ct	Cottonwood St	cul-de-sac	Both
Vance	Garden Ave	Hamlin Ave	Homassel Ave	S
Vance	Garden Ave	Hamlin Ave	Mountain View Dr	S
Vance	Garden Ave	Homassel Ave	Mountain View Dr	N
Vance	Hamlin Ave	Garden Ave	cul-de-sac	Both
Vance	Hamlin Ave	Garden Ave	E Hickory St	W
Vance	Hamlin Ave	Garden Ave	E Hickory St	E
Vance	Hamlin Way	E Hickory St	Mandarin St	W
Vance	Hamlin Way	E Hickory St	Matthew Pl	E
Vance	Hamlin Way	Matthew Pl	Mandarin St	E
Vance	Hamlin Way	Whitney St	Monte Vista Dr	W
Vance	Homassel Ave	Garden Ave	Mountain View Dr	E
Vance	Homassel Ave	Garden Ave	Mountain View Dr	W
Vance	Homassel St	Manderin St	Plum St	E
Vance	Homassel St	Manderin St	Rosewood Ct	W
Vance	Homassel St	Plum St	Cottonwood St	E
Vance	Homassel St	Rosewood Ct	Cottonwood St	W
Vance	Mandarin St	Gale Hill Ave	Hamlin Way	S
Vance	Mandarin St	Gale Hill Ave	Hamlin Way	N
Vance	Mandarin St	Hamlin Way	Homassel St	S
Vance	Mandarin St	Hamlin Way	Homassel St	N
Vance	Matthew Ct	Gale Hill Ave	cul-de-sac	Both
Vance	Matthew Pl	Hamlin Way	cul-de-sac	Both
Vance	Monte Vista Dr	Bond Way	Hamlin Way	S
Vance	Monte Vista Dr	Parkside Ave	Bond Way	S
Vance	Monte Vista Dr	Shaman Ct	Rd 214	S
Vance	Monte Vista Dr	Sindinger St	Rd 214	N
Vance	Monte Vista Dr	Sindinger St	Shaman Ct	S
Vance	Mountain Cir	Mountain View Dr	cul-de-sac	Both
Vance	Mountain View Dr	Garden Ave	Homassel Ave	W
Vance	Mountain View Dr	Garden Ave	Mountain Cir	E
Vance	Mountain View Dri	Homassel Ave	Mountain Cir	S
Vance	Orange Ave	E Sierra View St	cul-de-sac	Both
Vance	Parkside Ave	E Hickory St	Rosewood St	E
Vance	Parkside Ave	Monte Vista Dr	100' south	E
Vance	Parkside Ave	Rosewood Ave	north of Rosewood Ave	E
Vance	Plum St	Rd 218 (N Bellah Ave)	Homassel St	N
Vance	Plum St	Rd 218 (N Bellah Ave)	Homassel St	S
Vance	Rd 214	E Hickory St	W Fir St	E
Vance	Rd 214	Monte Vista Dr	150' north	W
Vance	Rd 214	Monte Vista Dr	327' south	W

Table 2-21 Sidewalk Site Inventory in Vance (continued)

Sidewalk Locations				
Community	Street	From *	To *	Side
Vance	Rd 218	Plum St	Plum St	W
Vance	Rd 218 (Bellah)	E Hickory St	Plum St	W
Vance	Rosewood Ct	Homassel St	cul-de-sac	Both
Vance	Rosewood St	Parkside Ave	Bond Way	N
Vance	Rosewood St	Parkside Ave	Bond Way	S
Vance	Shaman Ct	Monte Vista Dr	cul-de-sac	Both
Vance	Sindinger St	Monte Vista Dr	cul-de-sac	W
Vance	Sindinger St	Monte Vista Dr	cul-de-sac	E
Vance	Sindinger St	Monte Vista Dr	deadend	E
Vance	Whitney St	Hamlin Way	Bond Way	N

* Sidewalk may be present for only a portion of the noted segment.

Table 2-22 ADA Curb Ramp Site Inventory in Vance

ADA Curb Ramp Locations				
Community	Main Road	Crossroad	Side	Corner
Vance	Bond Way	Cottonwood St	E	N/E
Vance	Bond Way	Rosewood St	--	N/W
Vance	Bond Way	Rosewood St	--	S/W
Vance	Cottonwood St	Gale Hill Ct	--	N/E
Vance	Cottonwood St	Gale Hill Ct	--	S/W
Vance	Cottonwood St	Gale Hill Ave	--	S/E
Vance	Cottonwood St	Gale Hill Ave	--	S/W
Vance	Cottonwood St	Homassel St	--	S/W
Vance	Cottonwood St	at bend	S	--
Vance	E Hickory St	Gale Hill Ave	--	N/W
Vance	E Hickory St	Gale Hill Ave	--	N/E
Vance	E Hickory St	Hamlin Way	--	N/W
Vance	E Hickory St	Hamlin Way	--	N/E
Vance	E Hickory St	Parkside Ave	--	S/E
Vance	E Hickory St	Parkside Ave	--	N/E
Vance	E Hickory St	Bellah Ave	--	N/W
Vance	Gale Hill Ave	Alanwood Ct	--	S/W
Vance	Gale Hill Ave	Alanwood Ct	--	N/W
Vance	Gale Hill Ave	Mandarin St	--	S/E
Vance	Gale Hill Ave	Mandarin St	--	N/E

Table 2-22 ADA Curb Ramp Site Inventory in Vance (continued)

ADA Curb Ramp Locations				
Community	Main Road	Crossroad	Side	Corner
Vance	Gale Hill Ave	Matthew Ct	--	N/W
Vance	Gale Hill Ave	Matthew Ct	--	N/W
Vance	Hamlin Way	Matthew Pl	--	S/E
Vance	Hamlin Way	Matthew Pl	--	N/E
Vance	Homassel St	Plum St	--	S/E
Vance	Homassel St	Plum St	--	N/E
Vance	Homassel St	Rosewood Ct	--	N/W
Vance	Homassel St	Rosewood Ct	--	S/W
Vance	Mandarin St	Hamlin Way	--	S/E
Vance	Mandarin St	Hamlin Way	--	S/W
Vance	Mandarin St	Homassel St	--	N/W
Vance	Monte Vista Dr	Bond Way	--	S/W
Vance	Monte Vista Dr	Hamlin Way	--	S/W
Vance	Monte Vista Dr	Parkside Ave	--	S/E
Vance	Monte Viste Dr	Rd 214	S	S/W
Vance	Monte Viste Dr	Rd 214	N	N/W
Vance	Monte Viste Dr	Sheman Ct	S	S/E
Vance	Monte Viste Dr	Sheman Ct	S	S/W
Vance	Monte Viste Dr	Sindinger St	--	S/E
Vance	Monte Viste Dr	Sindinger St	--	N/E
Vance	Parkside Ave	Rosewood St	E	N/E
Vance	Parkside Ave	Rosewood St	E	S/E
Vance	Rd 214	E Hickory St	E	N/E
Vance	Rd 218 (N Bellah Ave)	Plum St	W	N/W
Vance	Rd 218 (N Bellah Ave)	Plum St	W	S/W
Vance	Whitney St	Hamlin Way	--	N/W

Figure 2-20 Inventory of Services in Venida

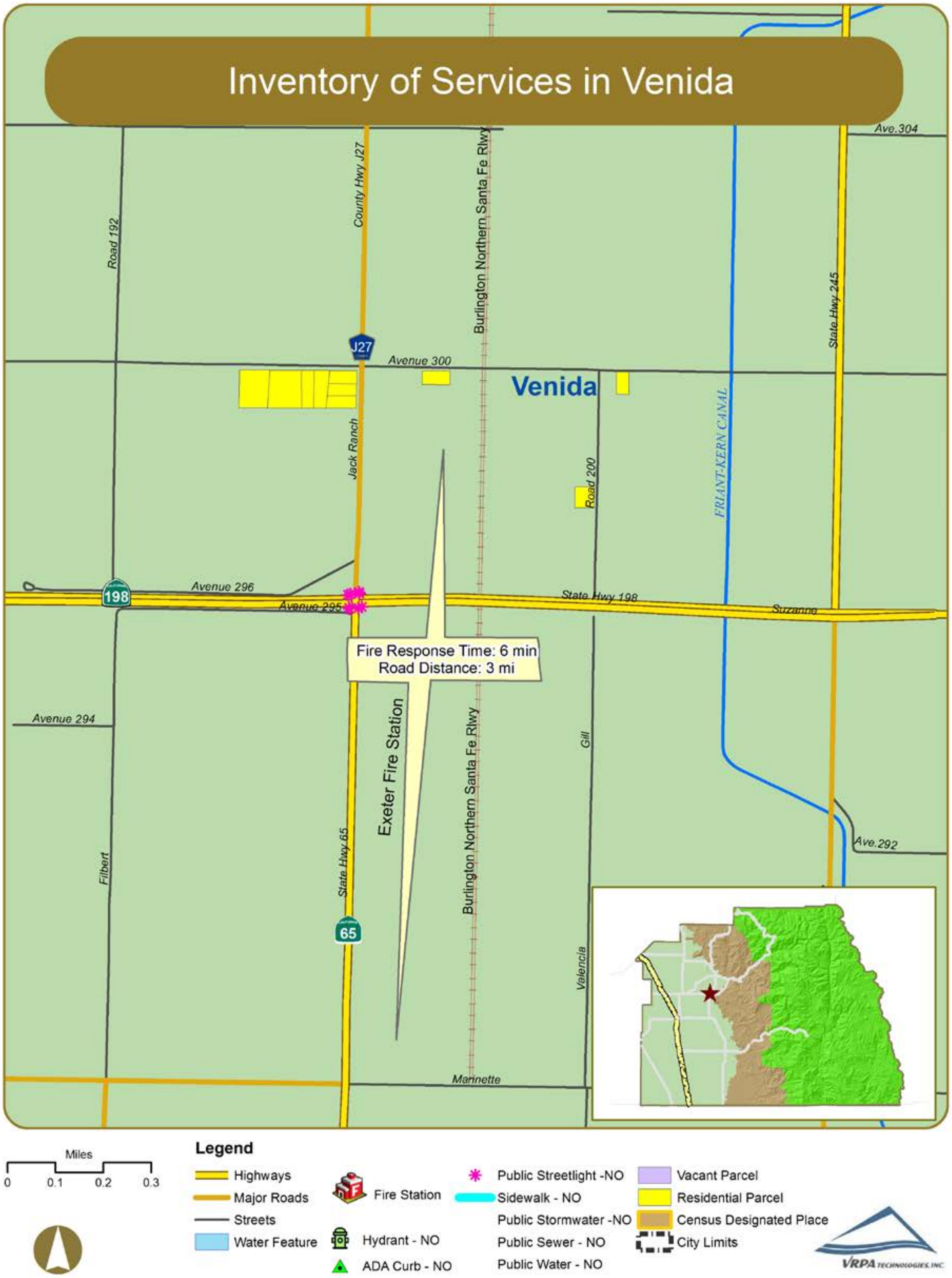


Figure 2-21 Inventory of Services in West Venida

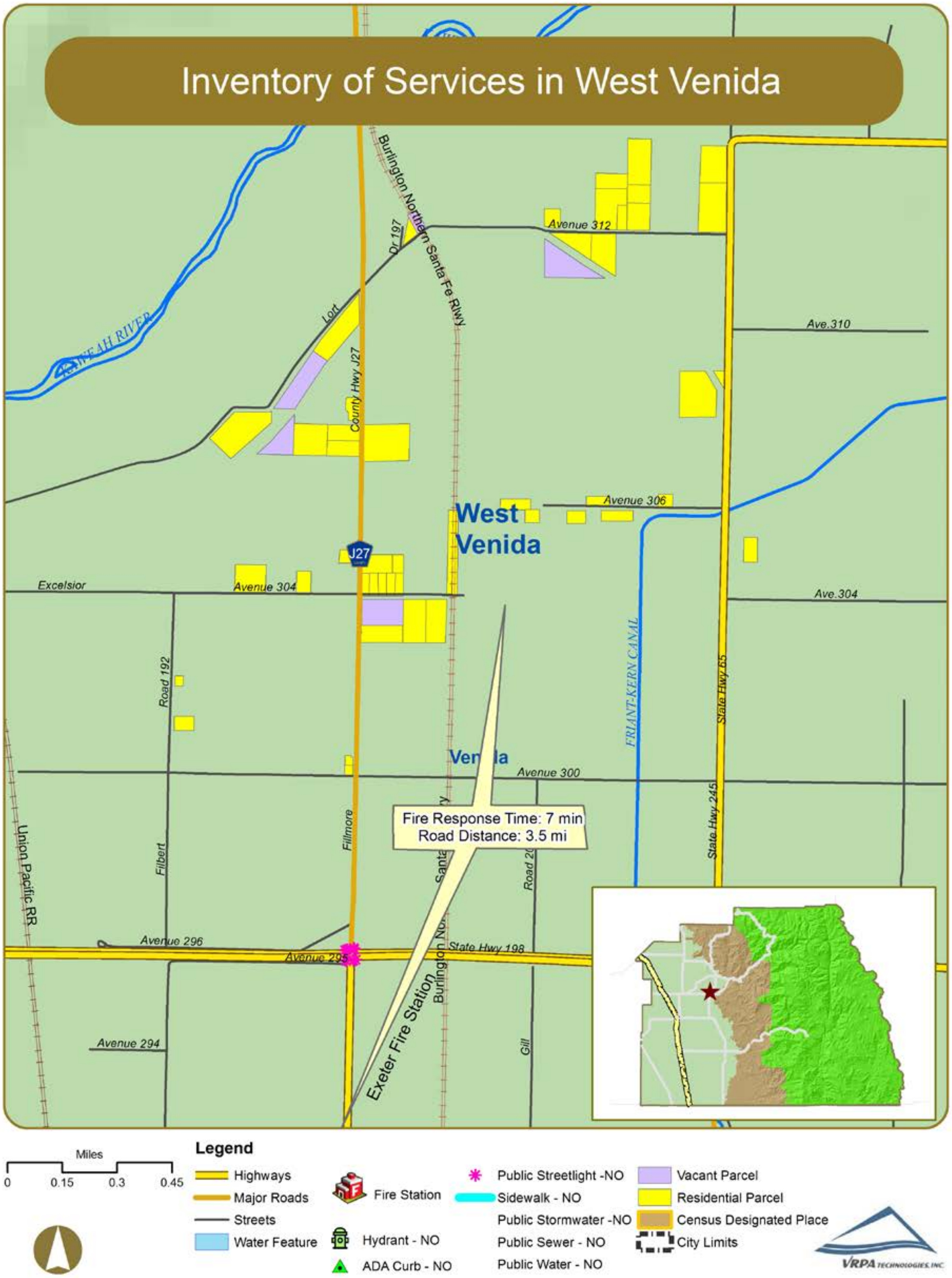


Figure 2-22 Inventory of Services in Worth

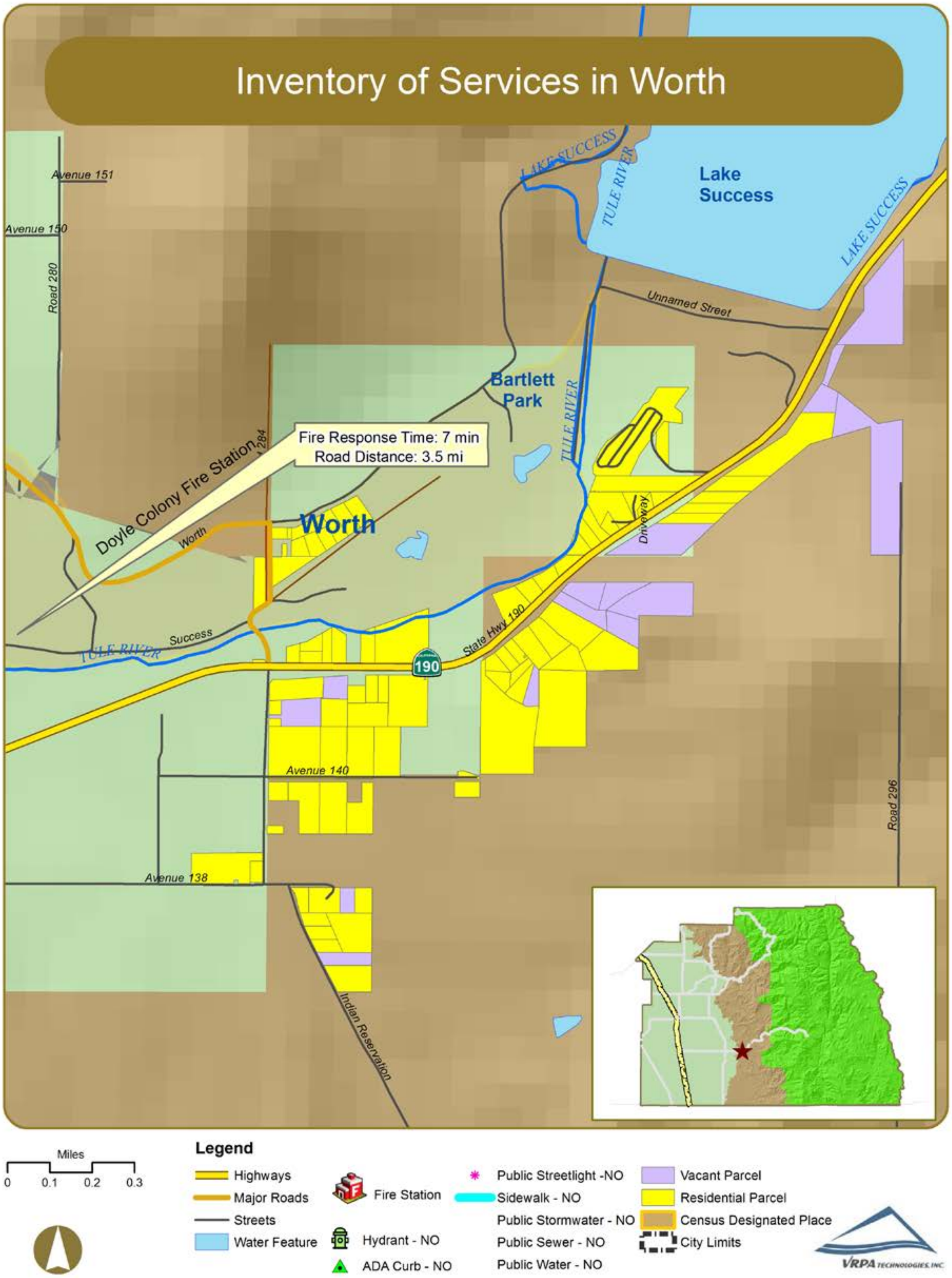


Figure 2-23 Inventory of Services in Yokohl

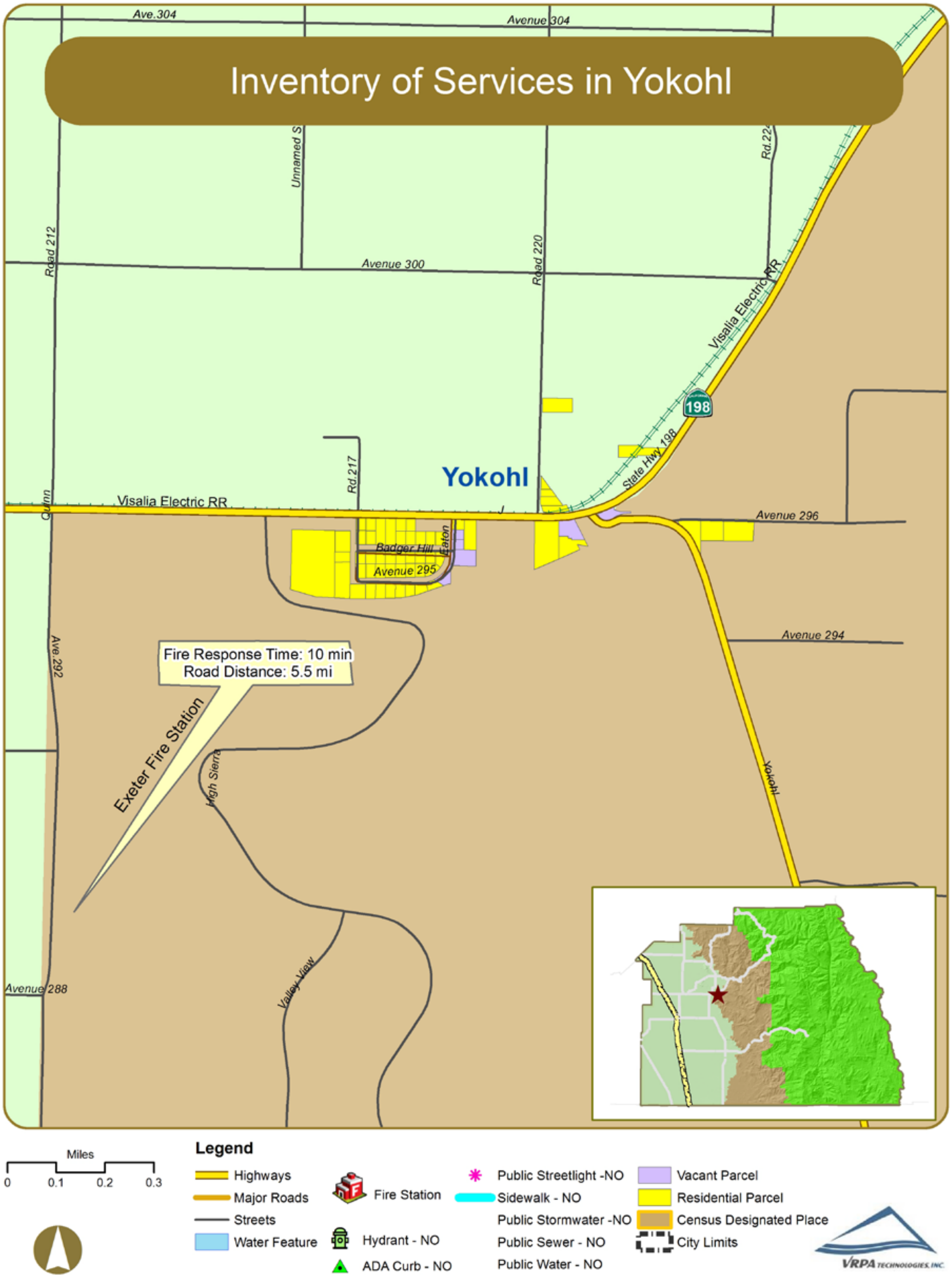


Figure 2-24 Inventory of Services in Zante

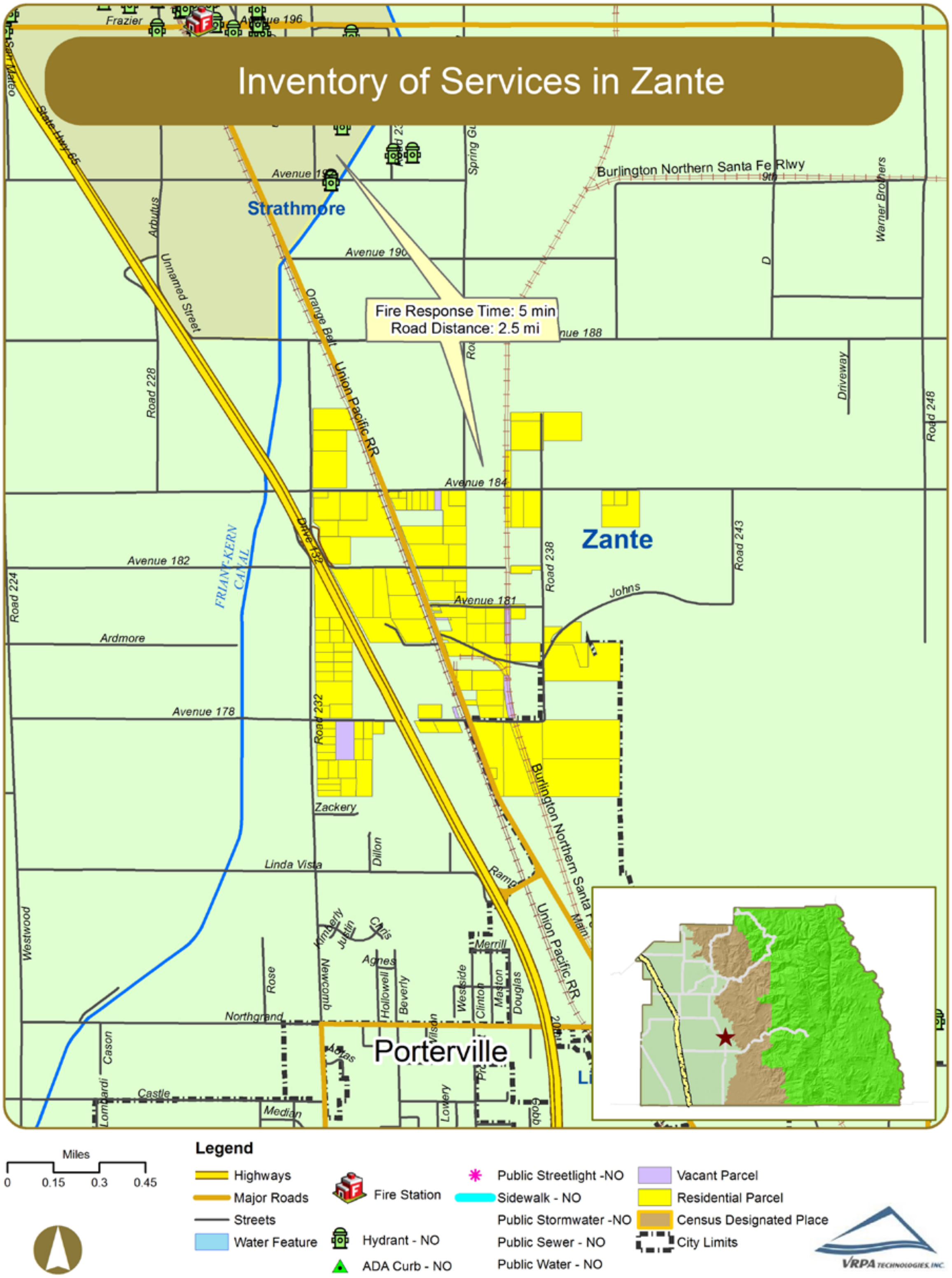


Figure 2-25 Inventory of Services in Badger

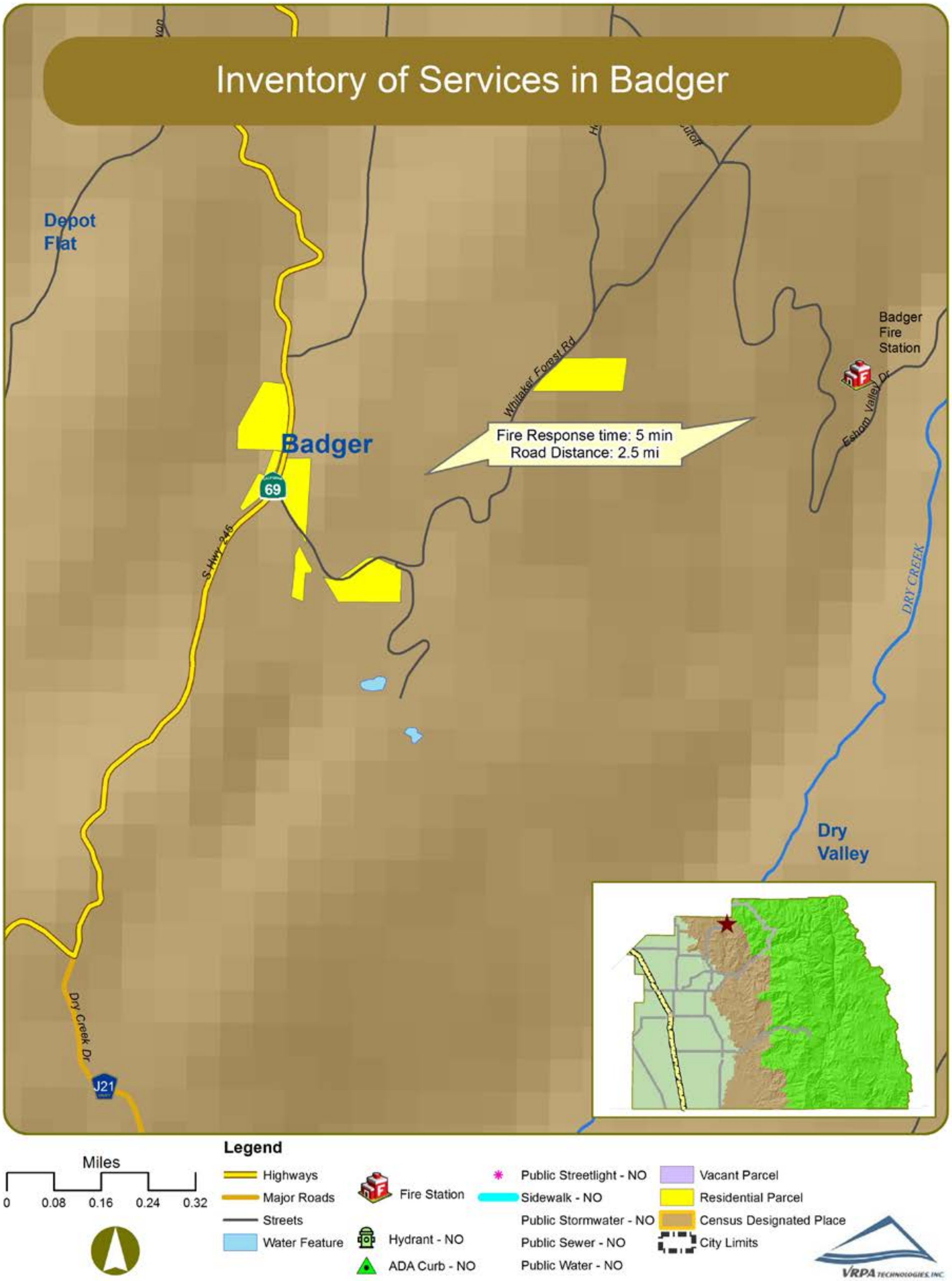


Figure 2-26 Inventory of Services in Elderwood

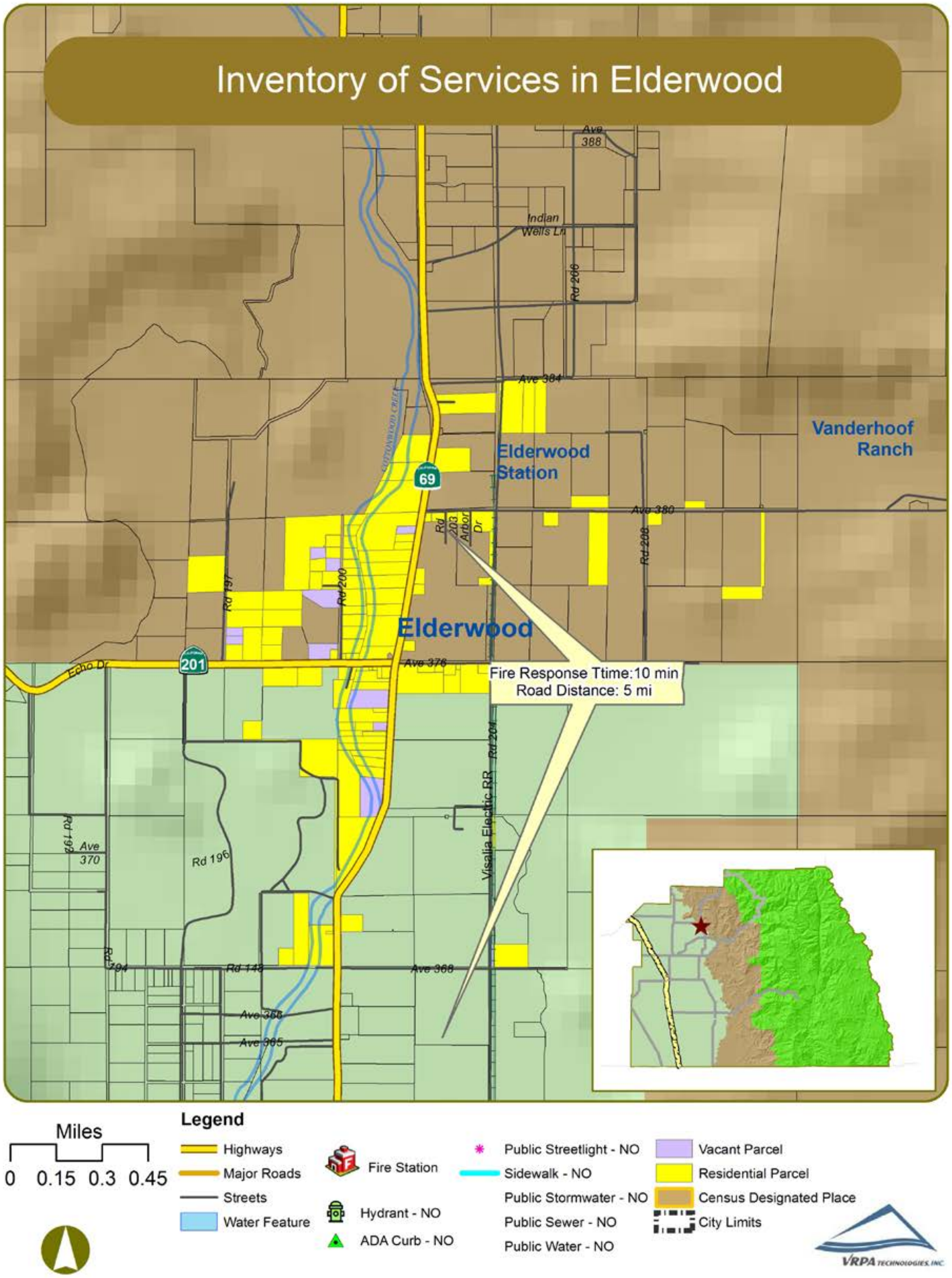


Figure 2-27 Inventory of Services in Globe

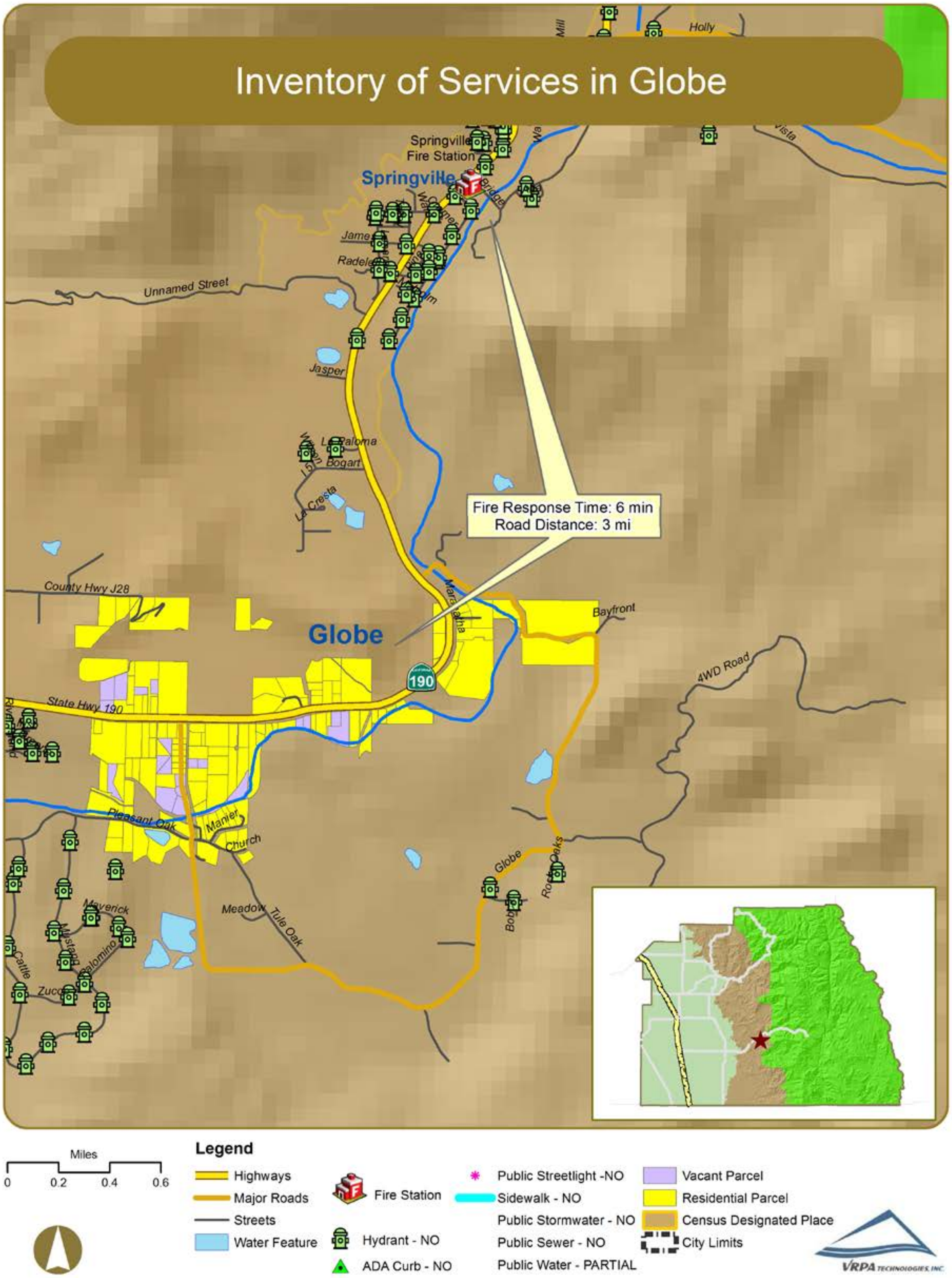


Figure 2-28 Inventory of Services in Balance Rock

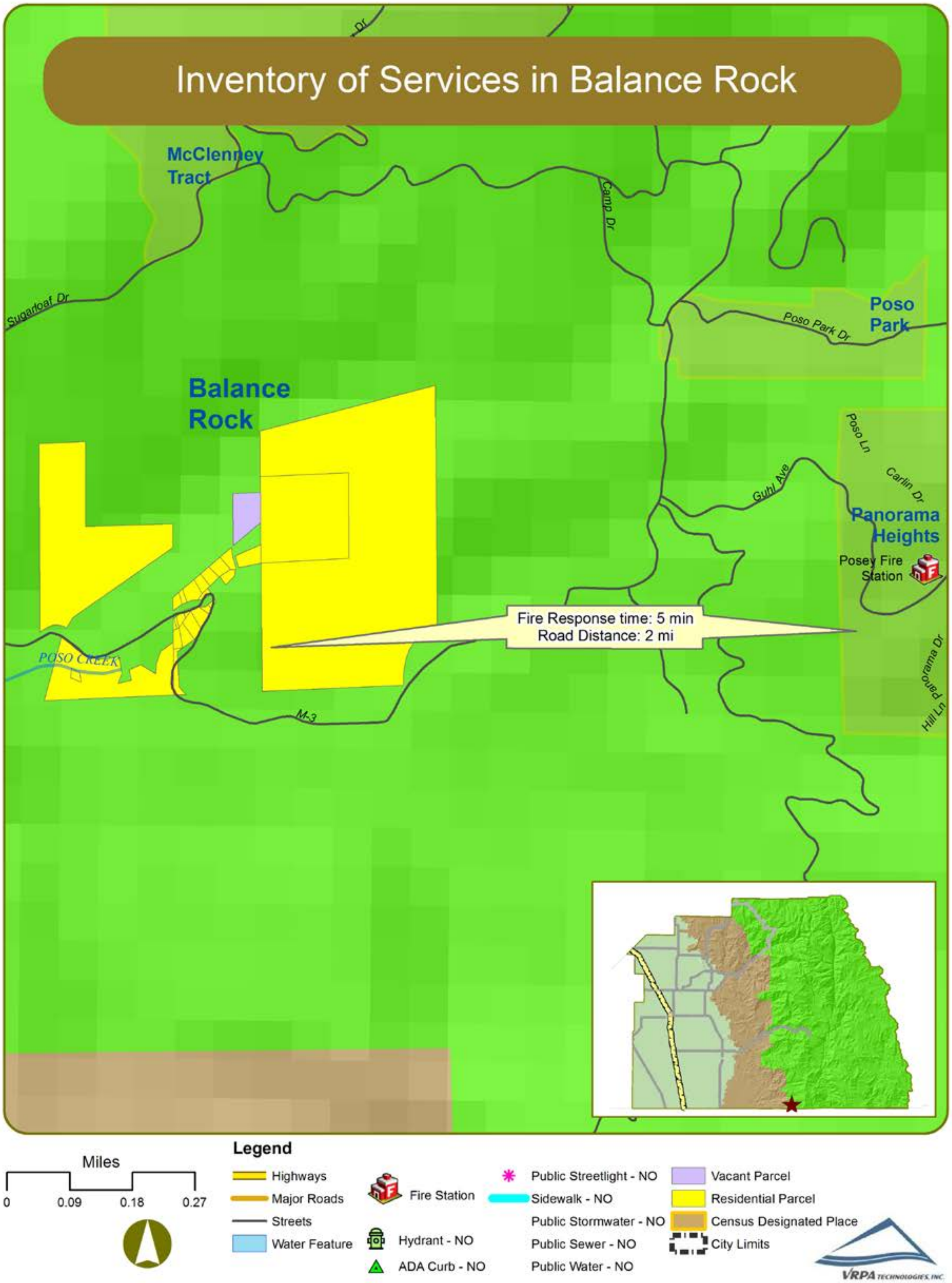


Figure 2-29 Inventory of Services in California Hot Springs

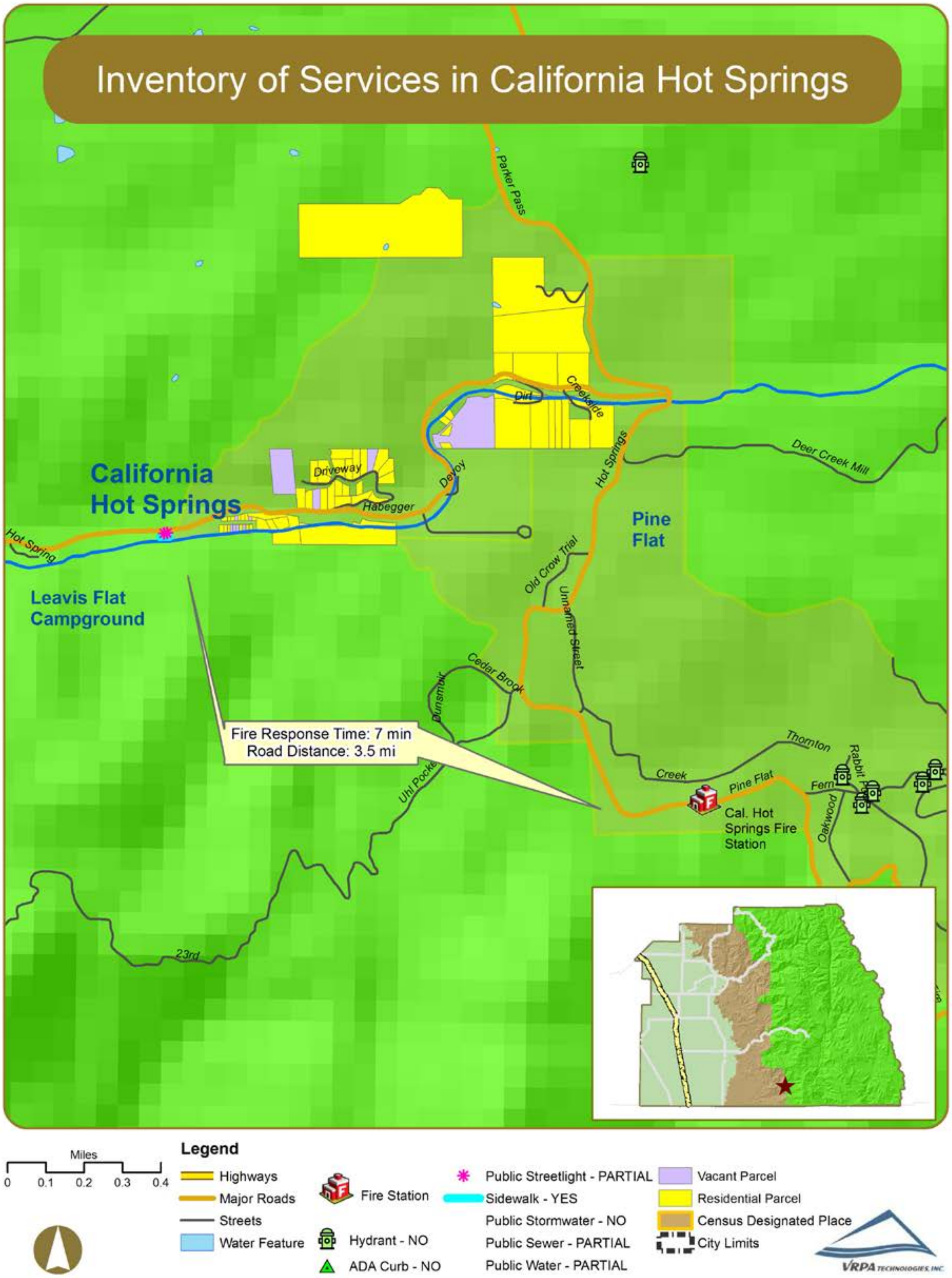


Table 2-23 Streetlight Site Inventory in California Hot Springs

Streetlight Locations					
Community	**Main Road**	**Crossroad**	**Side**	**Corner**	**Location Detail**
California Hot Springs	M-56	--	S		42177 Hot Spings Dr, CA Hot Spings Resort parking*
California Hot Springs	M-56	--	S		42177 Hot Spings Dr, CA Hot Spings Resort parking*

Table 2-24 Sidewalk Site Inventory in California Hot Springs

Sidewalk Locations				
Community	**Street**	**From**	**To**	**Side**
California Hot Springs	M 56	California Hot Springs Resort Parking Lot	--	S

Figure 2-30 Inventory of Services in Camp Nelson

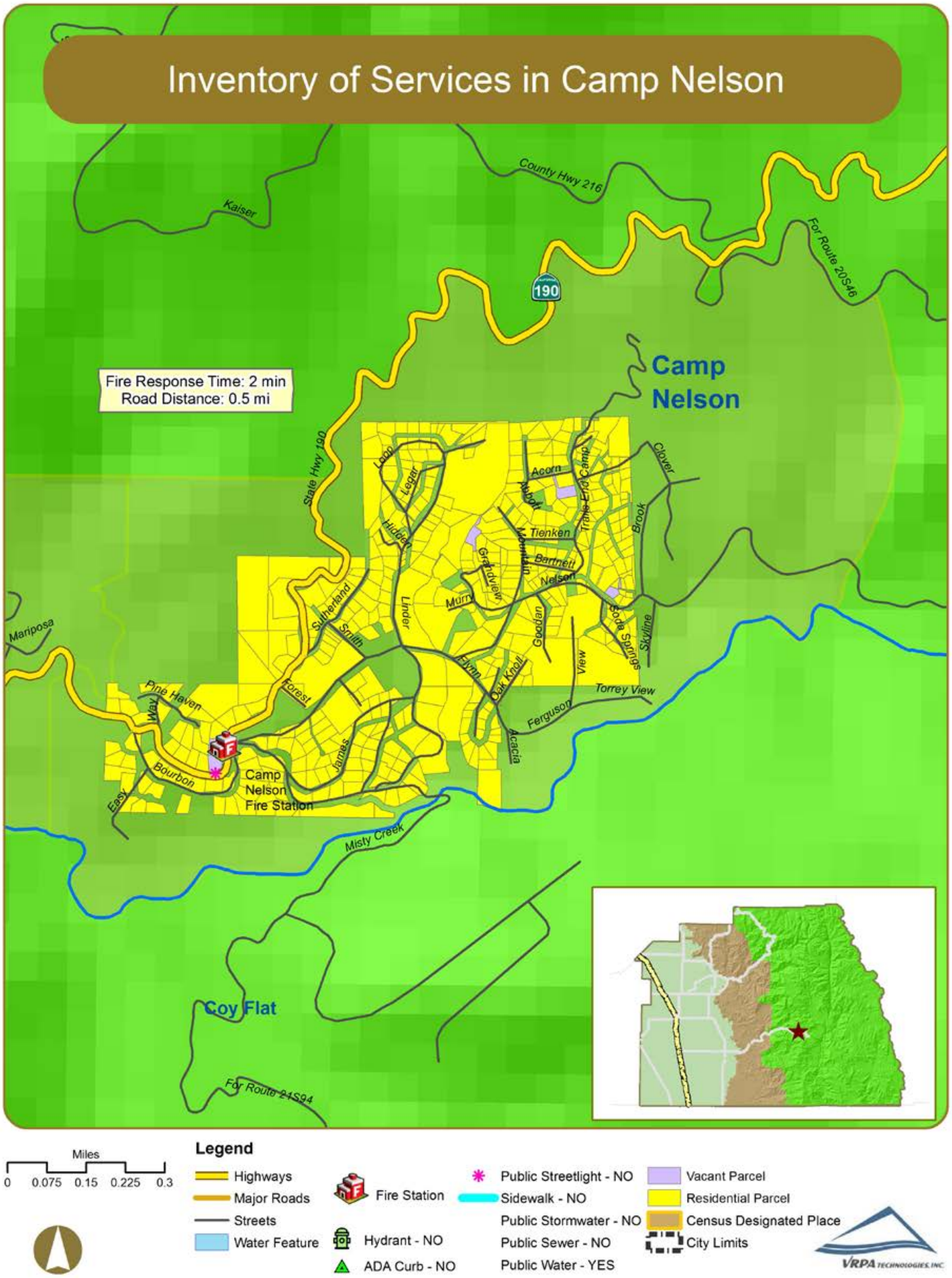


Figure 2-31 Inventory of Services in Cedar Slope

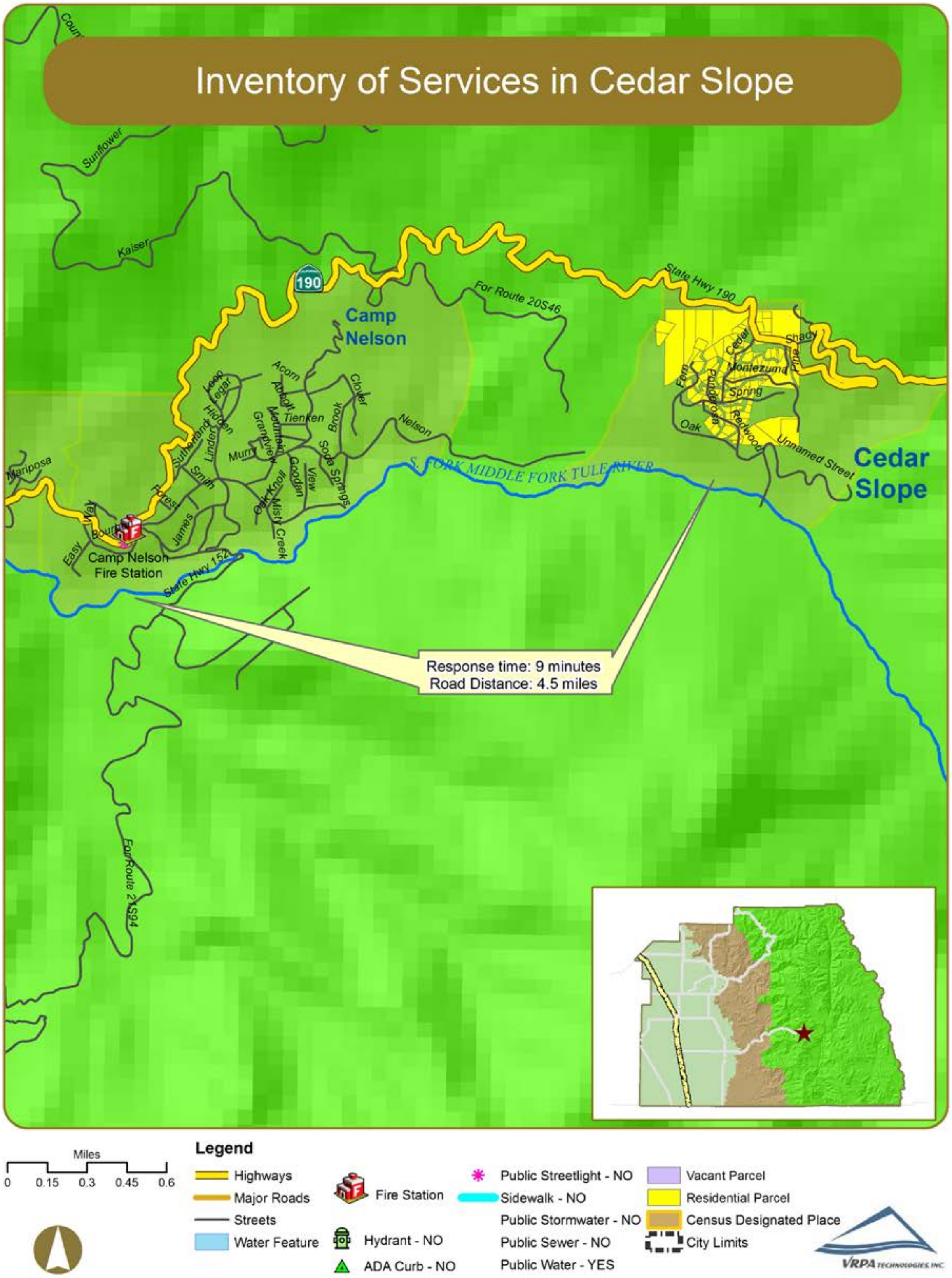


Figure 2-32 Inventory of Services in Fairview

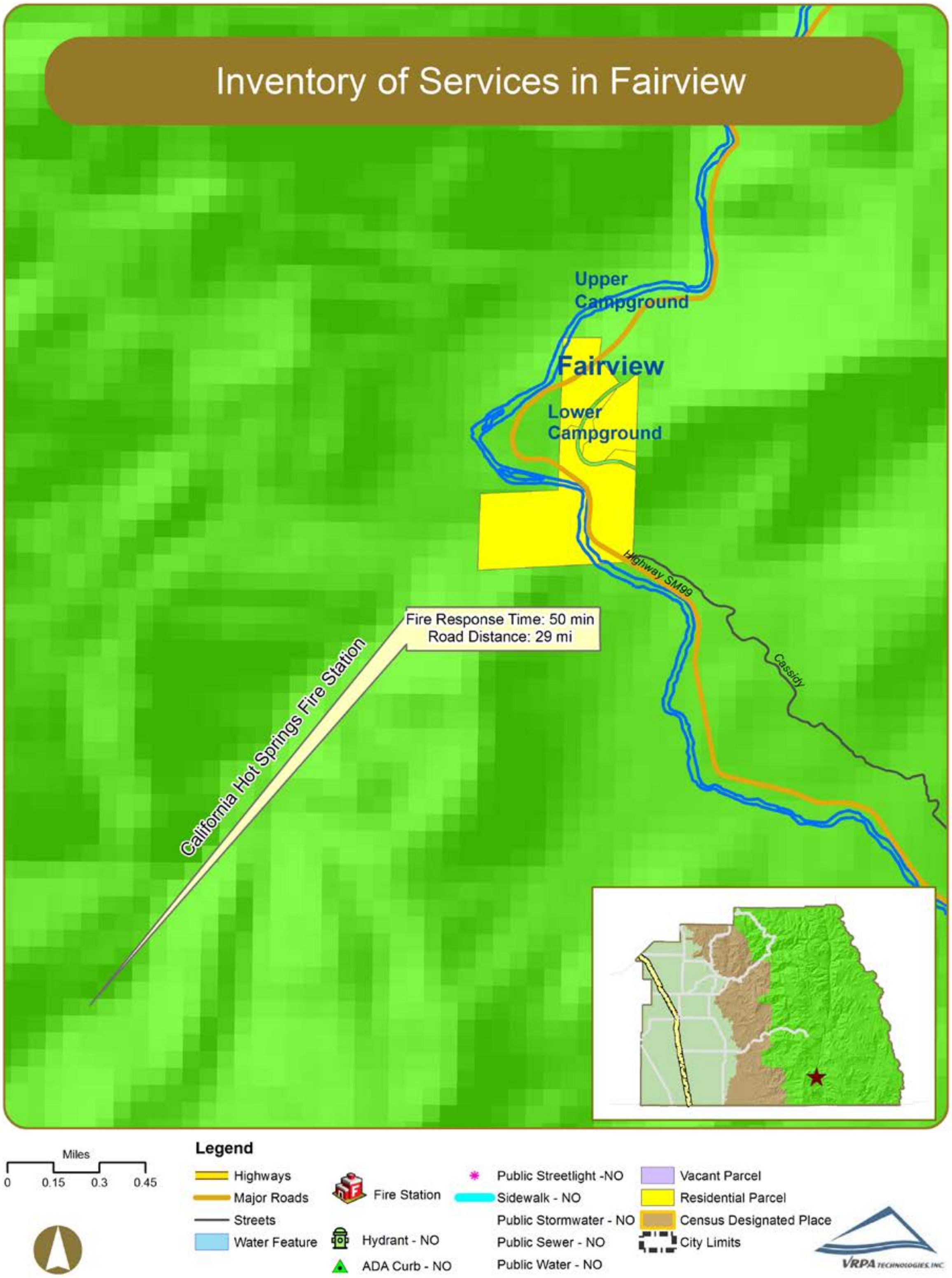


Figure 2-33 Inventory of Services in Hartland

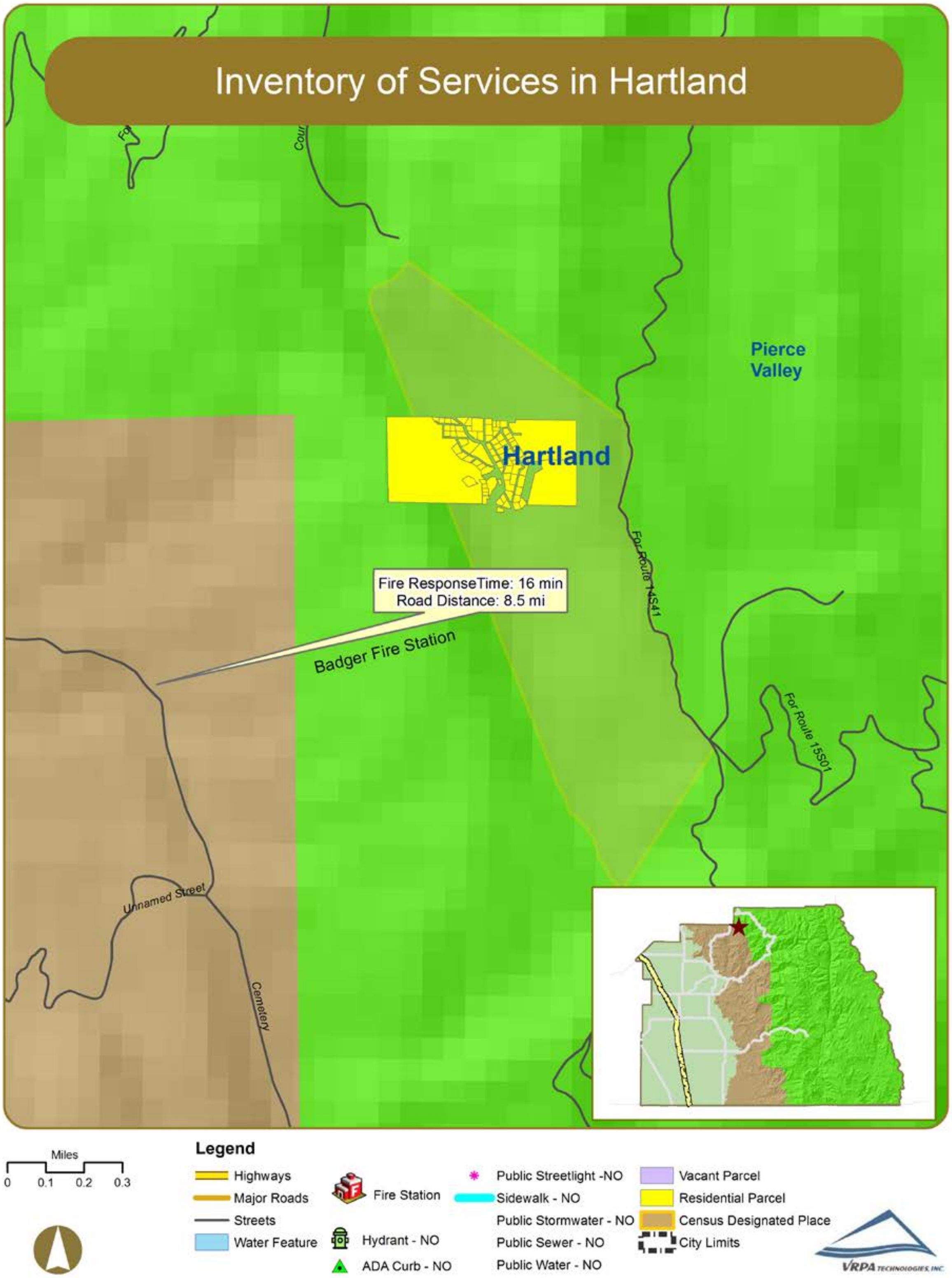


Figure 2-34 Inventory of Services in Idlewild

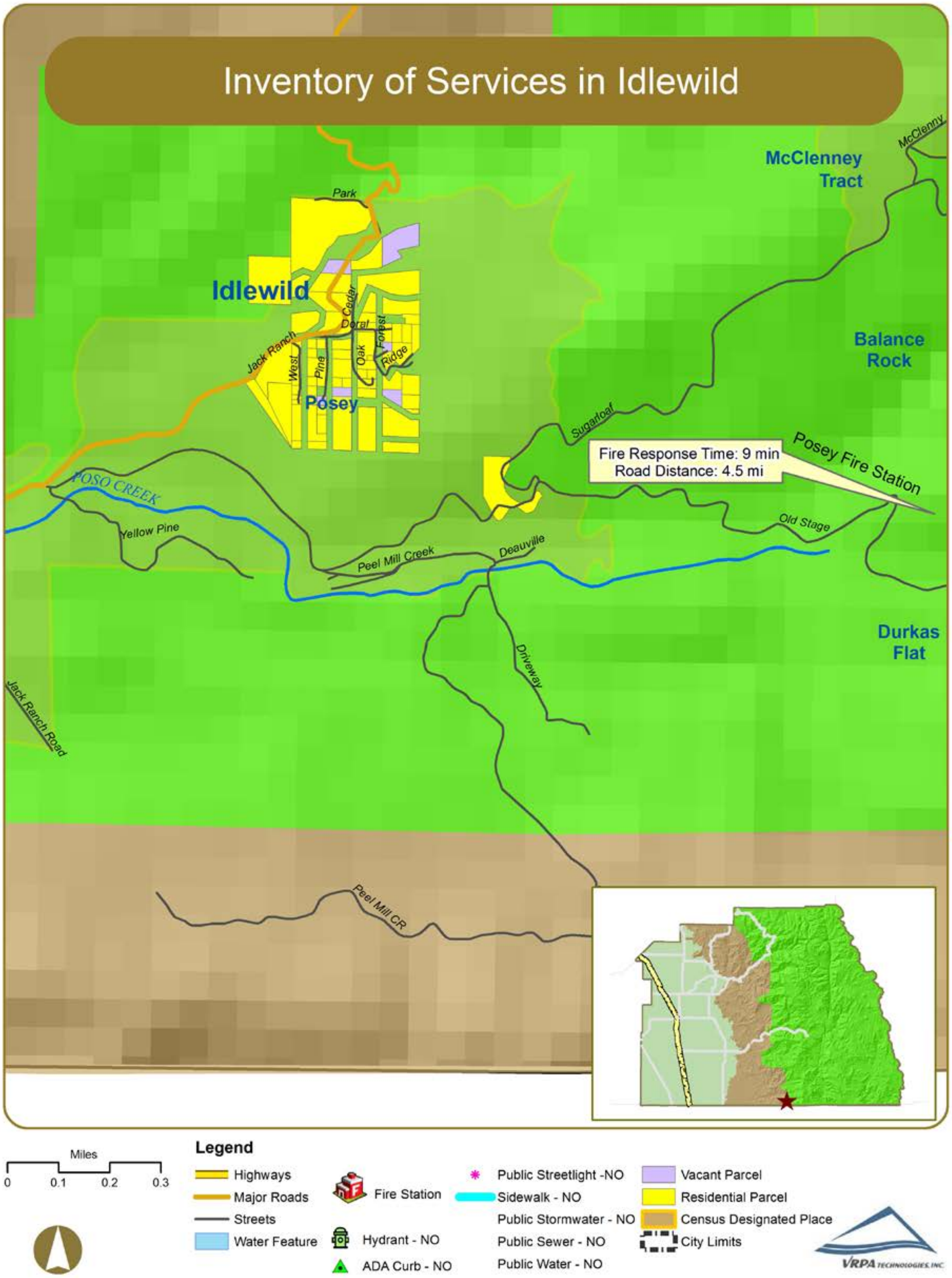


Figure 2-35 Inventory of Services in Johnsondale

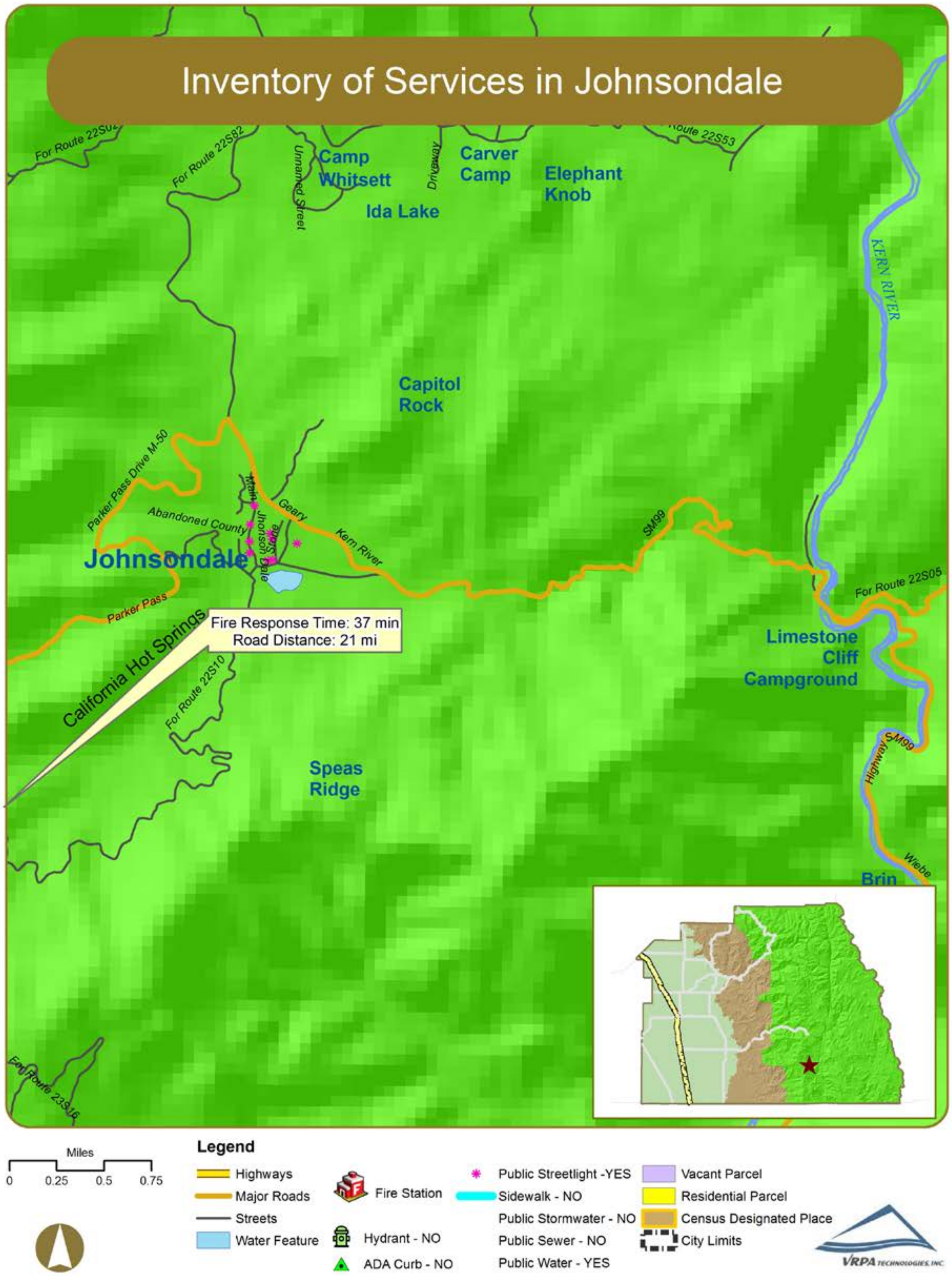


Table 2-25 Streetlight Site Inventory in Johnsondale

Streetlight Locations			
Community	**Main Road**	**Crossroad**	**Side**
Johnsondale	Main St	between County Rd and north end	E
Johnsondale	Main St	between County Rd and north end	E
Johnsondale	Main St	between County Rd and north end	W
Johnsondale	Main St	between County Rd and north end	W
Johnsondale	Ranch Entrance	west of Johnsondale Blvd	N
Johnsondale	Ranch Entrance	west of Johnsondale Blvd	S
Johnsondale	School St	north of Skunk Hollow	W
Johnsondale	School St	north of Skunk Hollow	E

Figure 2-36 Inventory of Services in Kennedy Meadows

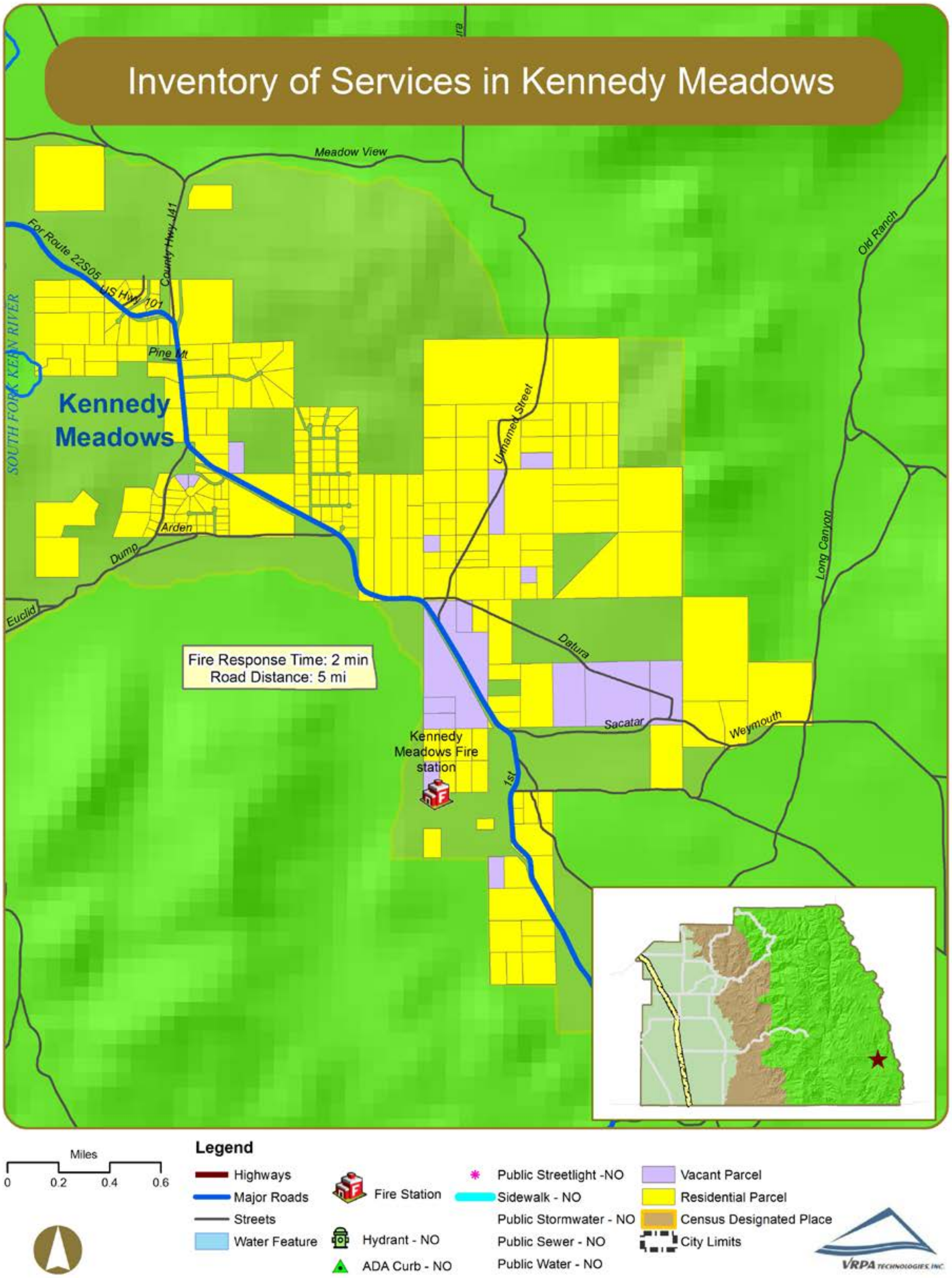


Figure 2-37 Inventory of Services in Panorama Heights

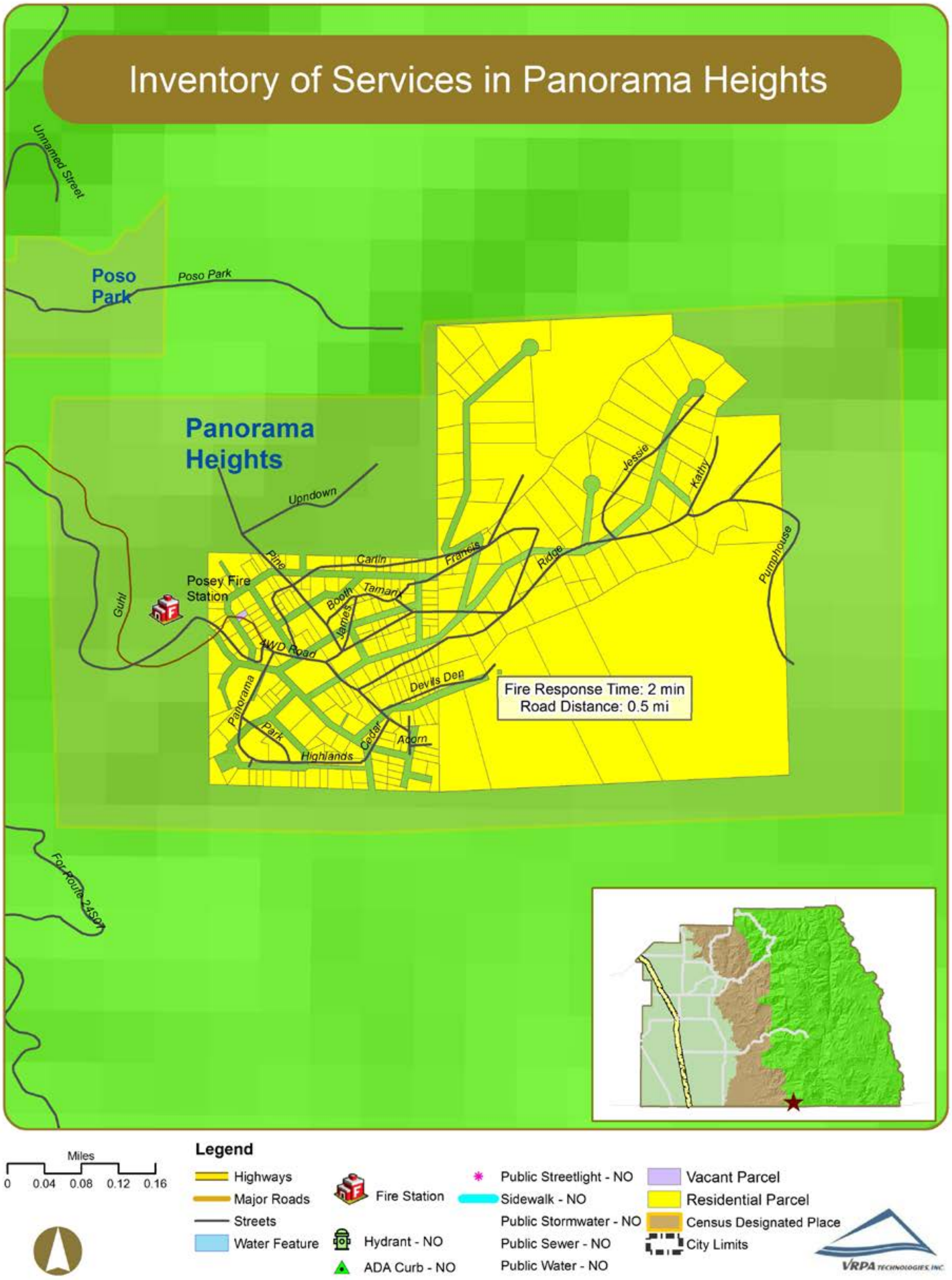


Figure 2-38 Inventory of Services in Pine Flat

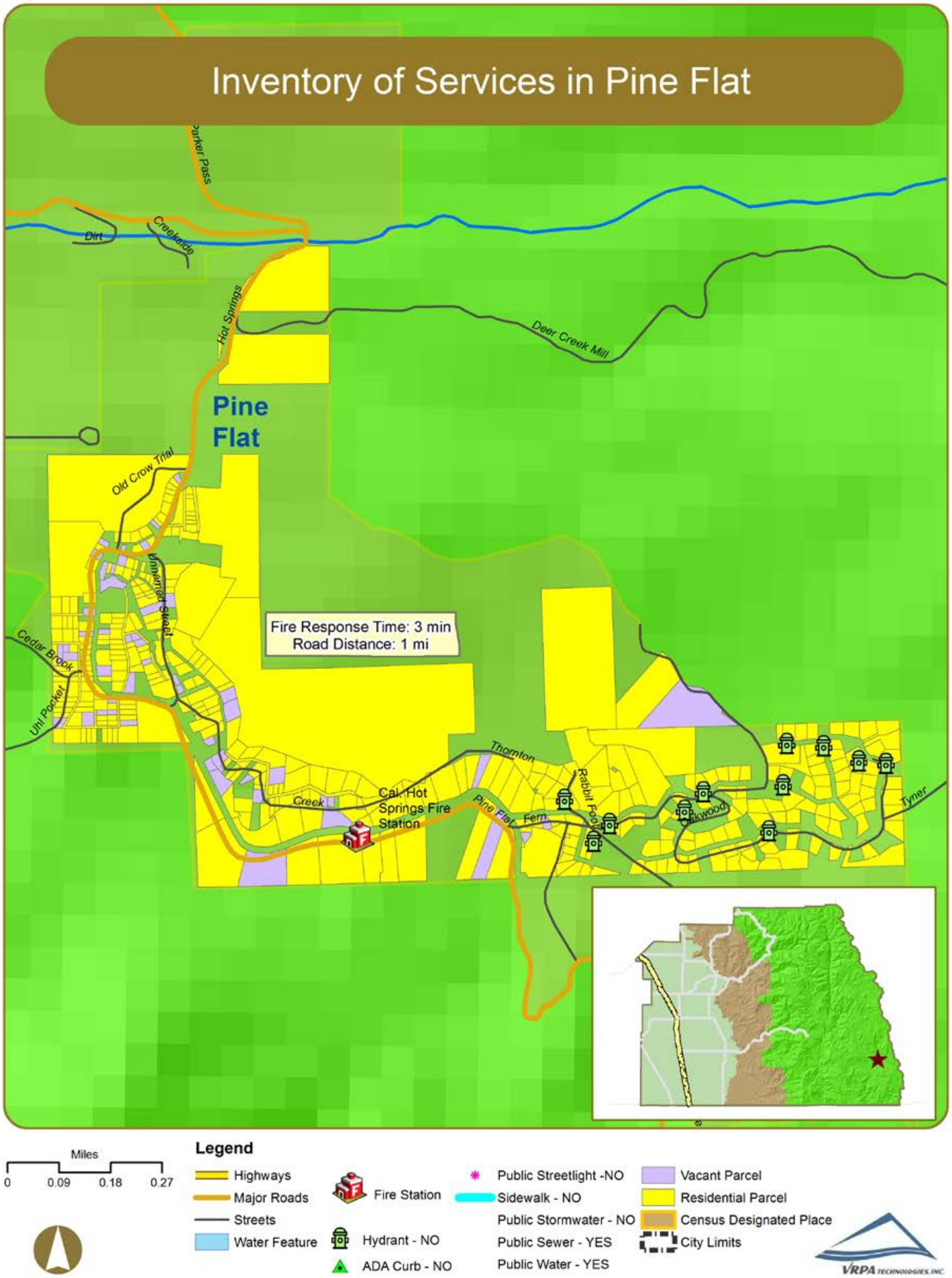


Figure 2-39 Inventory of Services in Ponderosa

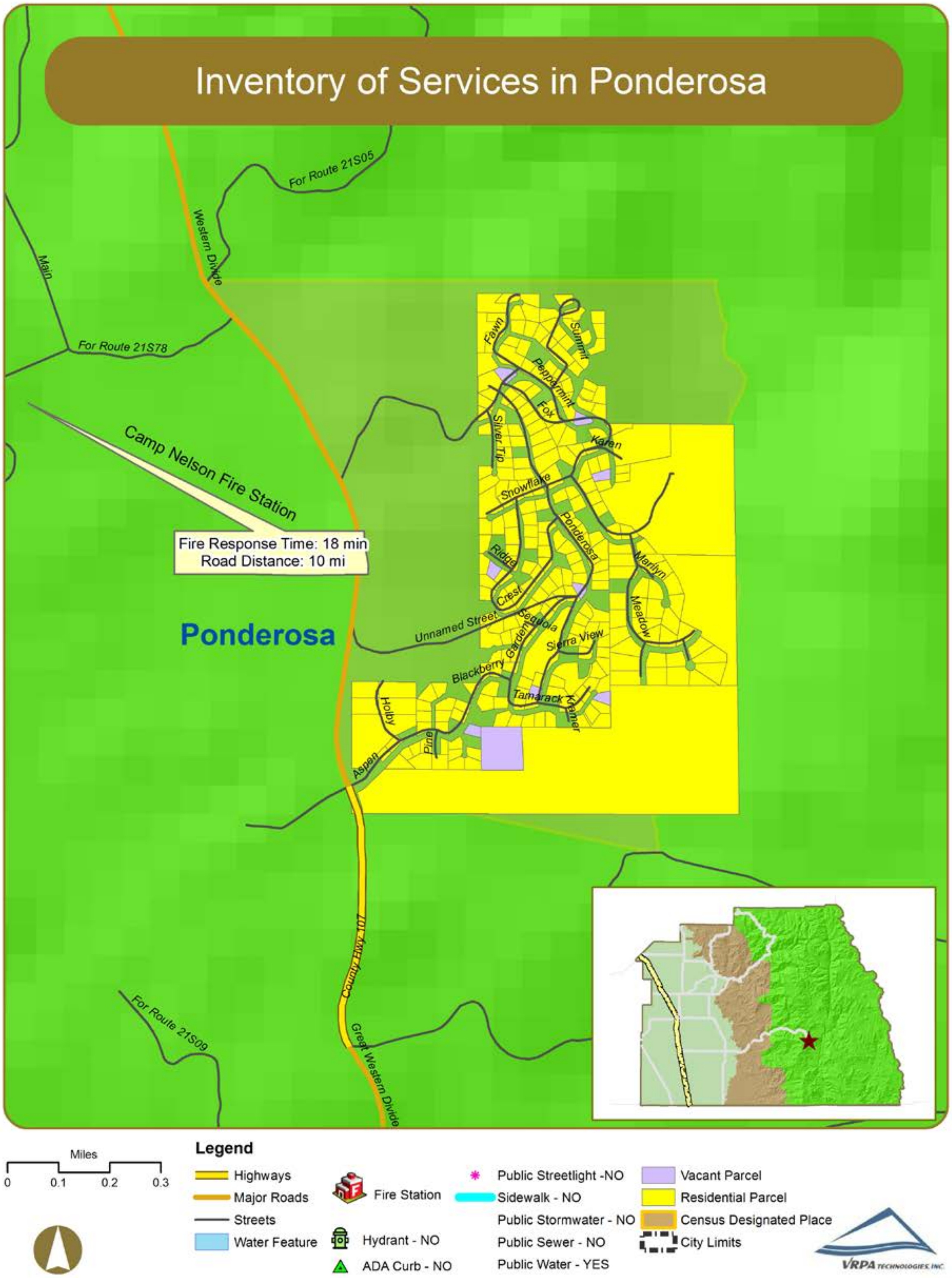


Figure 2-40 Inventory of Services in Posey

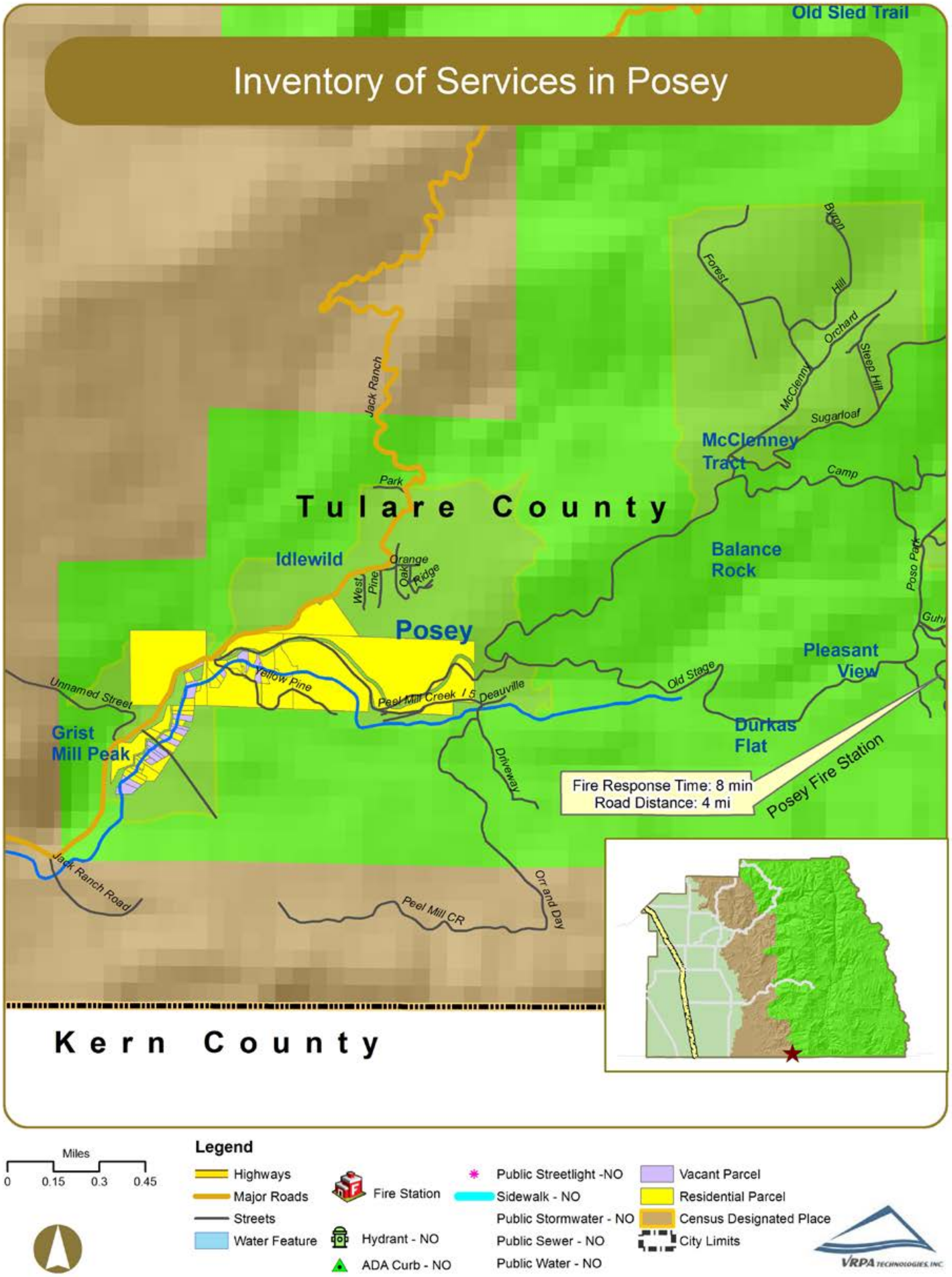


Figure 2-41 Inventory of Services in Silver City

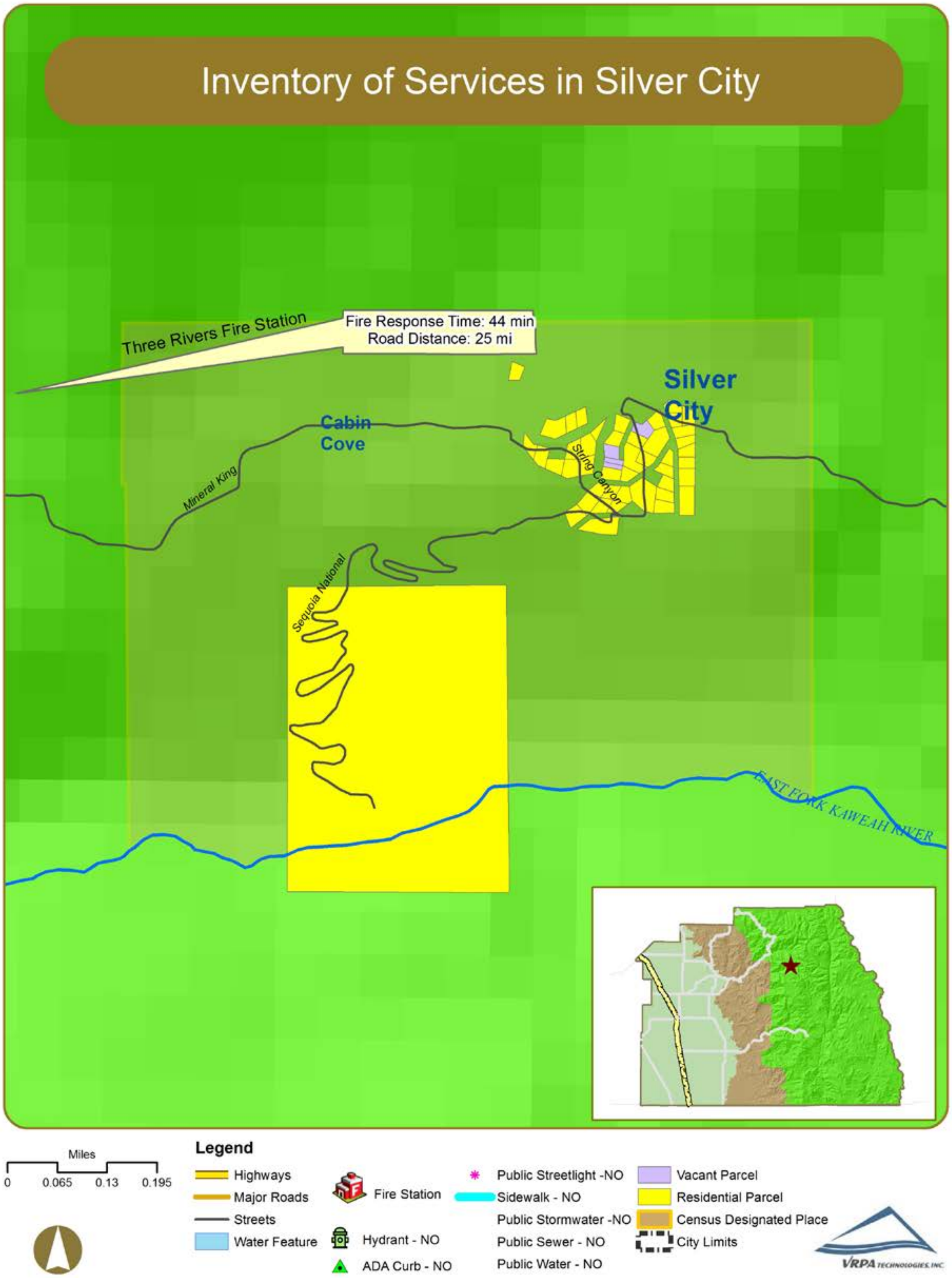


Figure 2-42 Inventory of Services in Sugarloaf Mountain Park

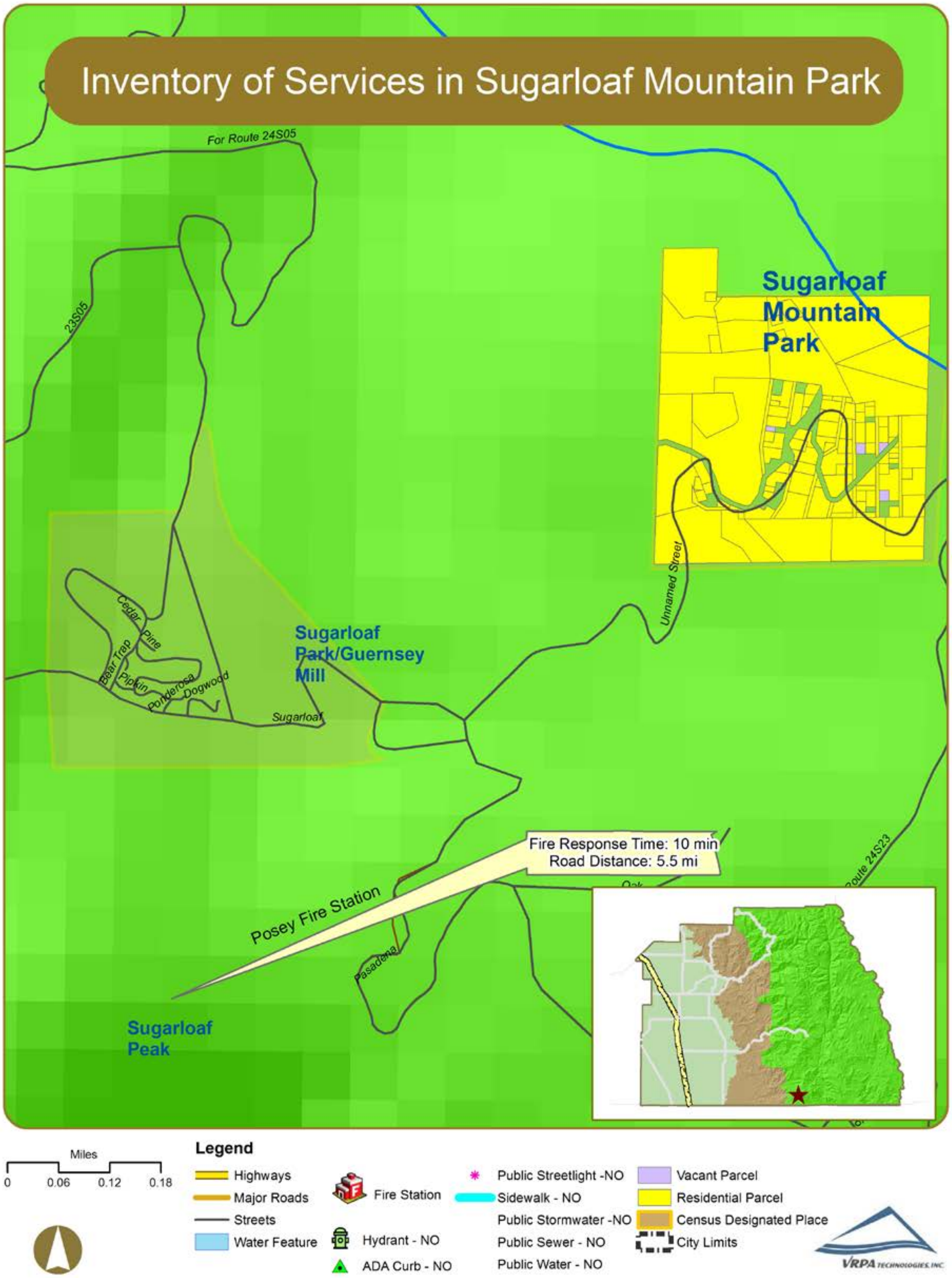


Figure 2-43 Inventory of Services in Sugarloaf Park/Guernsey Mill

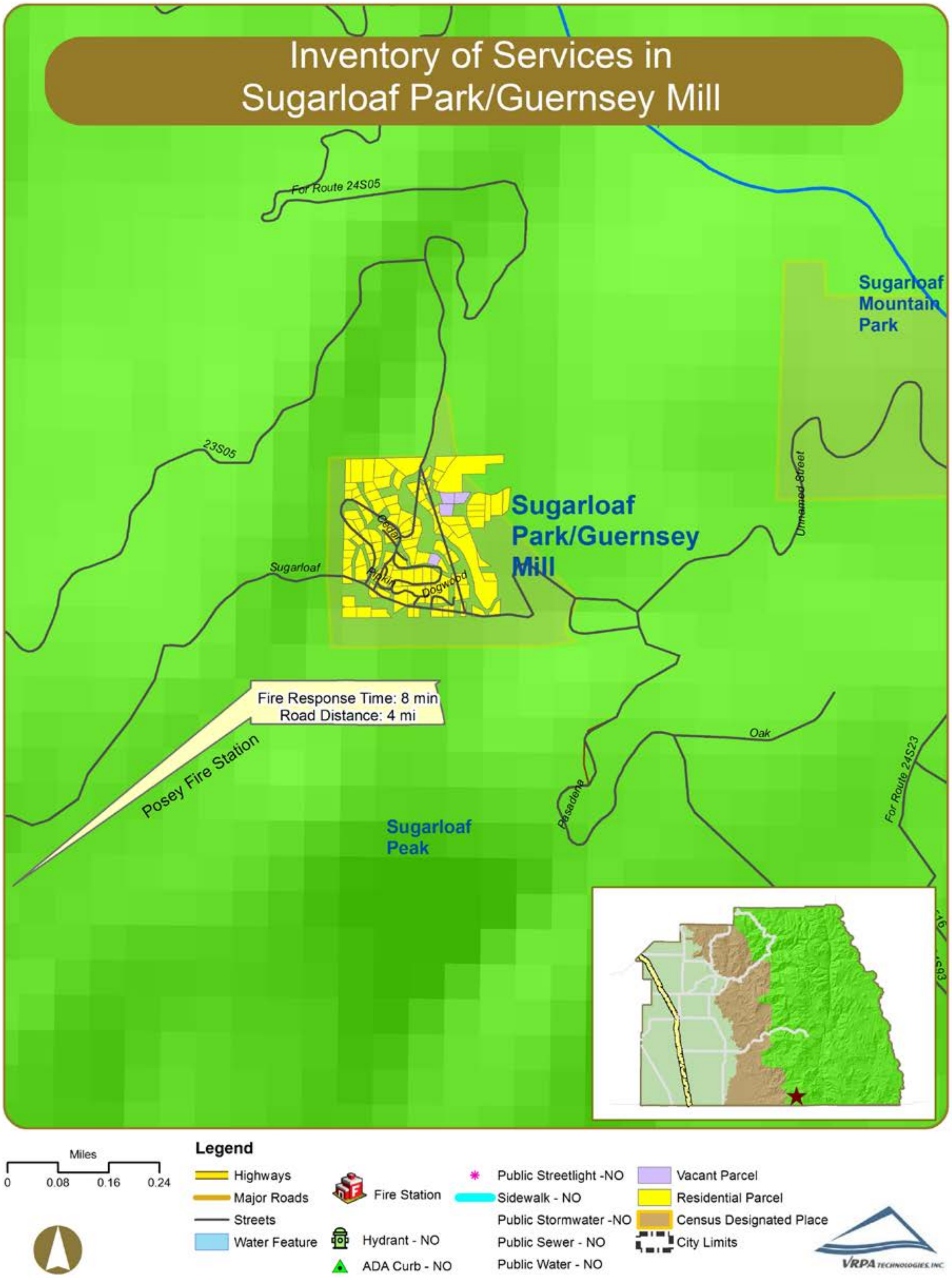


Figure 2-44 Inventory of Services in Sugarloaf Village

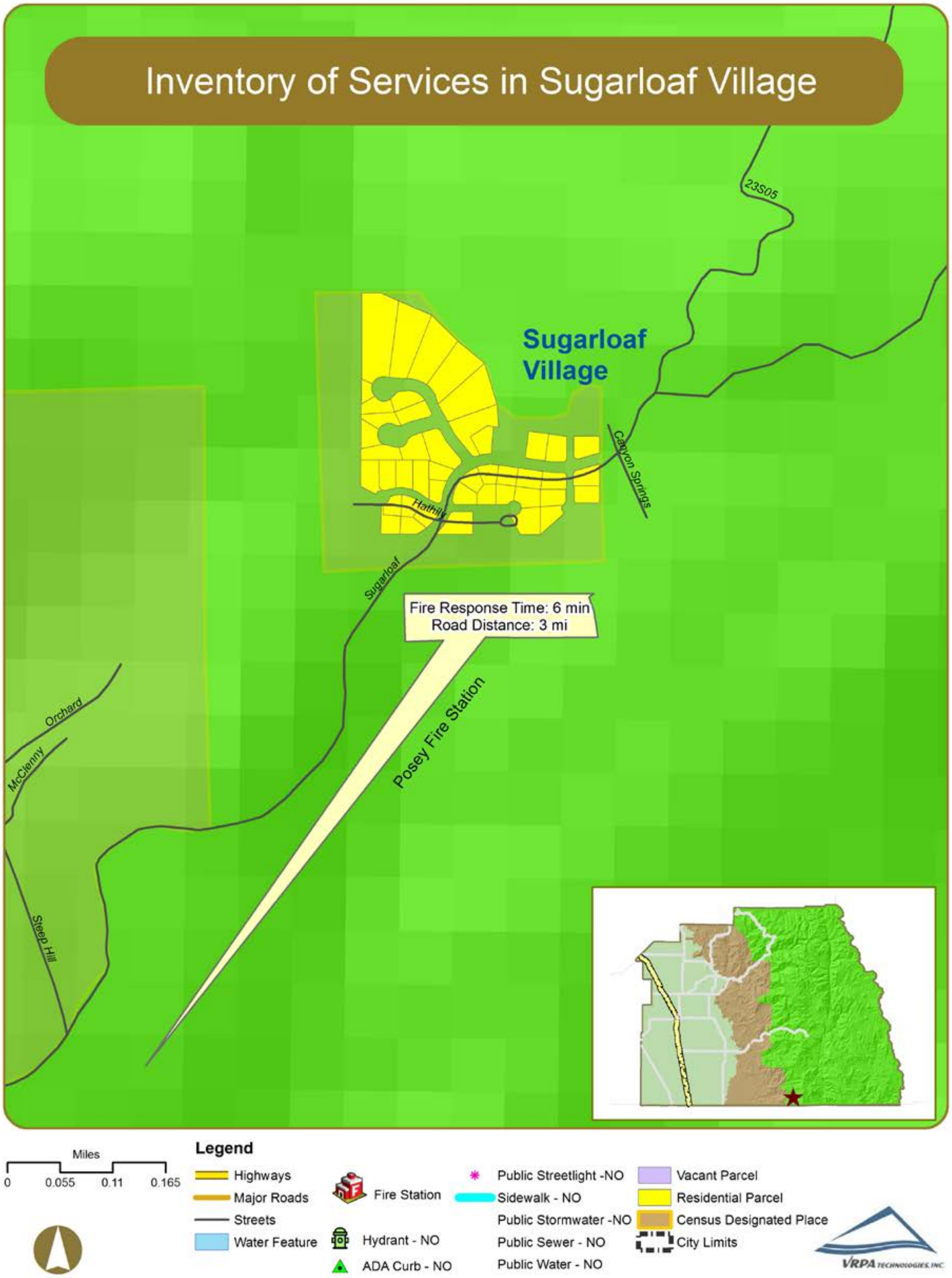
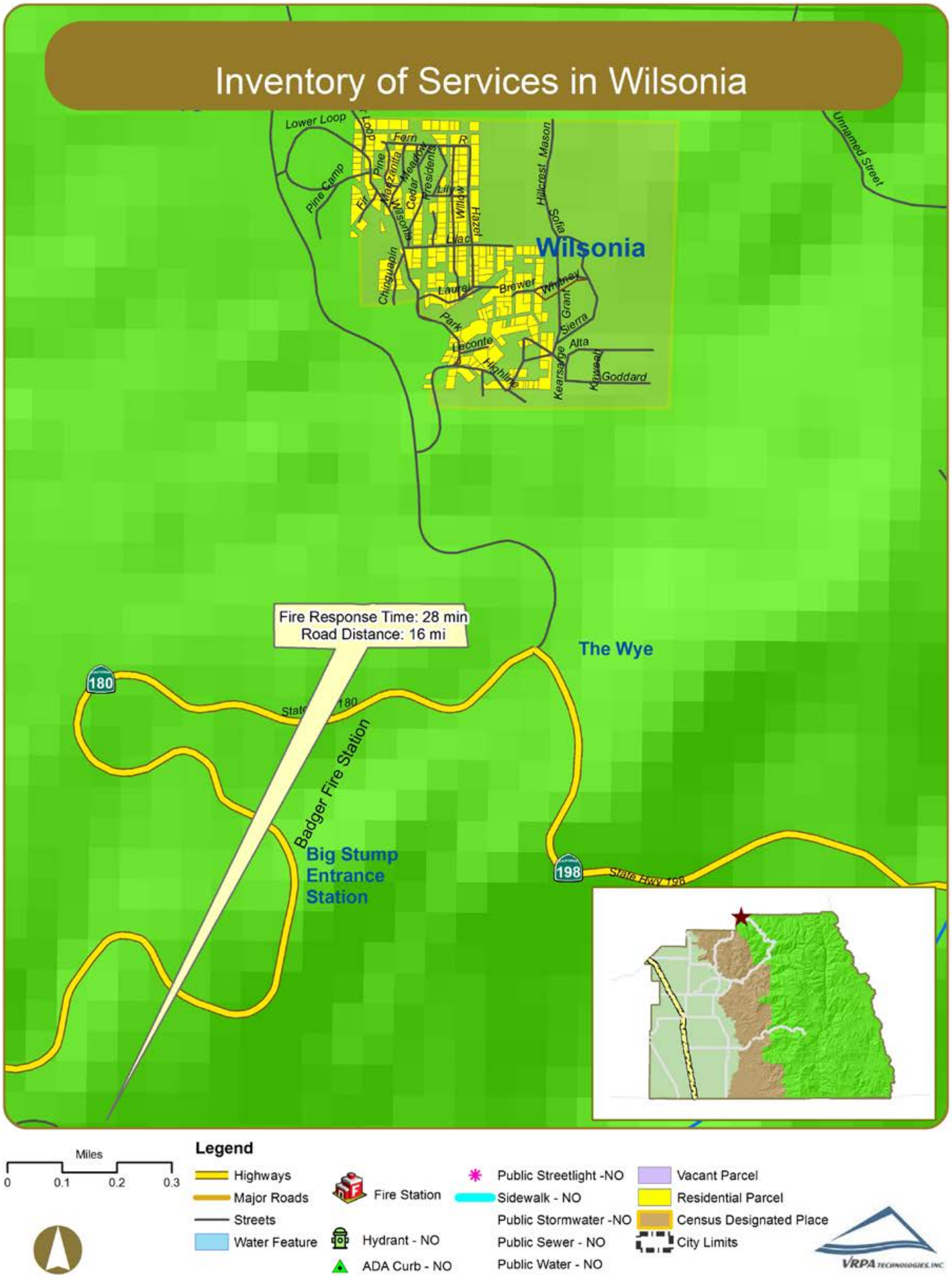


Figure 2-45 Inventory of Services in Wilsonia



3. INFRASTRUCTURE NEEDS

3.1 General

Chapter 2 of this report showing the existing infrastructure of each disadvantaged unincorporated community (DUC) indicates that most communities are lacking various types of infrastructure. The purpose of this chapter is to identify the infrastructure needs of each community as well as any planned and programmed projects that would provide this infrastructure.

3.2 Applicable Projects

The Tulare County Resource Management Agency (RMA) Five Year Capital Improvement Plan (CIP), the 2013-2018 Tulare County Comprehensive Economic Development (CED) project list, and the Tulare County Association of Governments (TCAG) 2014 Regional Transportation Plan & Sustainable Communities Strategy (RTP & SCS) identify infrastructure projects planned for some of the DUCs. Table 3-1 lists each of these applicable projects.

3.3 Remaining Infrastructure Needs

The planned and programmed projects identified in Table 3-1 fall short of meeting all of the infrastructure needs for the DUCs. Table 3-2 provides definitions for each type of infrastructure while Table 3-3 provides an explanation of what is considered a deficiency for each type. Table 3-4 identifies the unmet needs for each DUC by identifying whether there are deficiencies in each system. More detailed information for each community is provided on the following pages. The detailed information separates the identified DUCs into the planning area region in which they are located.

Valley
1) Calgro
2) Citro
3) Deer Creek Colony
4) East Porterville
5) El Monte Mobile Home
6) Hawkins
7) Higby
8) Hypericum
9) Jones Corner
10) Jovista
11) Lort
12) Naranjo
13) Paige
14) Peral
15) Ponca
16) Sandspur
17) Taurusa
18) Tooleville
19) Vance
20) Venida
21) West Venida
22) Worth
23) Yokohl
24) Zante

Foothill
25) Badger
26) Elderwood
27) Globe

Mountain
28) Balance Rock
29) California Hot Springs
30) Camp Nelson
31) Cedar Slope
32) Fairview
33) Hartland
34) Idlewild
35) Johnsondale
36) Kennedy Meadows
37) Panorama Heights
38) Pine Flat
39) Ponderosa
40) Posey
41) Silver City
42) Sugarloaf Mountain Park
43) Sugarloaf Park/Guernsey Mill
44) Sugarloaf Village
45) Wilsonia

Table 3-1 Planned Infrastructure Projects

Community	Project	Fiscal Year	Funding Sources [1]	Reference [2]
East Porterville	1400-35 John Doyle SR2S State - Pedestrian improvements on Orange Avenue from Crestview Street to Maurer Street and pedestrian improvements from Date Avenue to Success Drive and ultimately to the school grounds at Ruth Street. The project consists of construction of sidewalks, curb ramps, and additional pedestrian safety improvements.	2014/2015		CIP
Yokohl	No. 8 Yokohl Creek (Meyer Drive to Hwy 198) - Construct a 800 foot berm with flow control weir. Will reduce flooding on north side of Hwy 198 - farmland protection measure.	Under Consideration [3]	EDA, FEMA sources	CED
Various	No. 5 Community flood control pump replacement program - Purchase 25 new pumps in order to provide critical protection to small communities and rural areas during flood events. Some of the existing pumps distributed countywide are near or have exceeded their service life. The purchase will employ green technology standards, reduce air pollution and develop reliable flood water pumping capability in emergency conditions.	Planned, Estimated Start Date Unavailable [3]	County funding, FEMA, EDA, state sources, Local Air District	CED
Various	No. 6 Flood Control Master Plan Update - Update the Tulare County Flood Control Master Plan which has not been updated since 1971. The Master Plan will study the overall hydrology of the County and identify flood control needs that have changed due to growth and business development during the past half century. Updating this Master Plan will allow the County to plan strategically for flood mitigation projects proactively instead of reactively; apply modern sustainability and groundwater recharge principles; and provide upstream/downstream collaboration with local cities.	Under Consideration [3]	County funding, FEMA, EDA, state sources	CED
Various	No. 12 Dry Creek-North of Lake Kaweah - Construct a series of weirs in Dry Creek upstream of Lake Kaweah. Project to control periodic flooding of farmland that historically has caused $1.5-$3 million in flood damages to area communities and farmland. Project will also help sustain farmland by preventing widespread systemic erosion.	Under Consideration [3]	EDA, FEMA	CED
All	No. 14 Unincorporated Areas of Tulare County - Implementation of SB 244 regarding the investigation, analysis, and development of implementation plans for infrastructure for the disadvantaged communities within Tulare County.	Under Consideration [3]	EDA, Caltrans	CED

1) EDA = Economic Development Agency, FEMA = Federal Emergency Management Agency,
2) CIP = Capital Improvement Plan, CED = Comprehensive Economic Development
3) Tulare County Project List for the 2013-2018 Tulare County Comprehensive Economic Development Strategy

Table 3-2 Infrastructure Definitions

Infrastructure	Definition
Wastewater	Wastewater is any water that has been adversely affected in quality by human activity. Wastewater can originate from a combination of domestic, industrial, commercial, or agricultural activities, surface runoff or stormwater. Watewater can also be generated from stormwater that has been misdirected into a sanitary sewer system instead of into stormwater systems. Groundwater that seeps into the sanitary sewer system through cracks or leaks is also considered wastewater. Types • Municipal wastewater is typically treated at a wastewater treatment plant with treated wastewater discharged into receiving water • Rural wastewater or those with no access to a centralized wastewater treatment plant rely on on-site wastewater systems such as a septic tank, drain field, or on-site treatment unit.
Water	• Public Water Systems, a system for the provision of water to public for human consumptions through pipes or other constructed conveyances. A public system has at least 15 service connections or regularly services at least 25 individuals daily for at least 60 days out of the year. • Community water systems is a public water system that services 15 service connections used by yearlong residents or regularly services at least 25 yearlong residents. Additional information concerning California's water can be found at the California Environmental Protection Agency State Water Resources Control Board website, http://www.waterboards.ca.gov. Specific information concerning water system classifications can be found in Appendix X. http://www.waterboards.ca.gov/drinking _water/certlic/drinkingwater/documents/publicwatersystems/class_dec_tree.pdf "
Stormwater	Stormwater drainage systems are a tool for managing the runoff of weather events such as rain, sleet, snow, and ice melt. In nature, stormwater drainage systems are present in the form of soils and plants, excess precipitation (runoff) flows to nearby streams, rivers, or other bodies of water. In developed areas, stormwater drainage systems are manmade and are designed to control the quantity, quality, timing, and distribution of precipitation and runoff. Runoff can carry harmful materials to streams, ponds, and rivers making them unsafe. Preventing contaminated runoff is a growing concern. Other system objectives include erosion control and groundwater recharge. Types • Stormwater Retention Basin • Stormwater Swale • Dry Detention • Wet Detention • Inlets, discharged directly to a receiving body of water • Inlets, routed to a treatment unit
Streetlights	A raised source of light on the edge of a road or walkway, which prevent accidents and increase safety.
Sidewalks	Sidewalks provide a safe path for people to walk along that is separated from motorized traffic. Sidewalks aid in road safety by minimizing interaction between pedestrians and motorized traffic.
ADA Curb Ramps	Curb ramps are a small but important part of making sidewalks, street crossings, and other pedestrian routes accessible to people with disabilities. Curb ramps and pedestrian crossings are covered under Title II of the Americans with Disabilities Act (ADA) which requires an accessible route that people with disabilities can use to safely transition from a roadway to a curbed sidewalk and vice versa.

Infrastructure	Definition
Fire Infrastructure	Fire infrastructure includes fire protection and emergency services infrastructure to make sure that wildland, rural, and suburban areas have the resources and strategies in place to protect people and property from fire dangers and to allow fire fighters to do their jobs safely and effectively. Provisions cover means of access including roadways; fire lanes and parking lots; building access and separation; fire protection and fire warning systems; water supply, fire protection during construction; capacity of fire protection services; and community safety and emergency preparedness.

Table 3-3 Explanation of Infrastructure Deficiencies

Infrastructure	No Deficiencies	Potential Deficiencies	Deficiencies
Wastewater	Testing data is current and falls within legal limits.	Wastewater systems testing data exceeds legal limits.	Wastewater systems testing data exceeds legal limits.
Water	Testing data is current and falls within legal limits.	• Data related to private or community water wells testing is not available and deficiencies may exist. • Recent testing data is not available and deficiencies may exist. • Data related to capacity and demand is not available and deficiencies may exist.	Private or community water wells tested above the Maximum Contaminant Level or Notification Level.
Stormwater	• Community is prone to flooding and has sufficient public stormwater infrastructure to address storm runoff. • Community is not prone to flooding, public stormwater infrastructure is not needed.	Community is prone to flooding and has some public stormwater infrastructure. Data is not available to determine if current infrastructure is adequate.	Community is prone to flooding and has no public stormwater infrastructure.
Streetlights	Community has a sufficient number of streetlights.	Community has some streetlights, but not a sufficient number.	Community has no streetlights.
Sidewalks	Community has sidewalks throughout.	Community has sidewalks in some areas, but are lacking in others.	Community has no sidewalks.
ADA Curb Ramps	Community has ADA curb ramps throughout.	Community has some ADA curb ramps, but not all areas have ADA curb ramps.	Community has no ADA curb ramps.
Fire Infrastructure	• Community has a fire station or has fire response services from a nearby community fire station located within 5 miles. • Community has a sufficient number of fire hydrants.	• Community has no fire station and may have fire response services from a nearby community fire station. • Community has fire hydrants in some areas, but are lacking in other areas.	• Community has no fire station and fire response services from a nearby community fire station are over 5 miles away. • Community has no fire hydrants.

Table 3-4 Infrastructure Deficiencies by DUC

Disadvantaged Unincorporated Community (DUC)	Wastewater	Water	Stormwater	Streetlights	Sidewalks	ADA Curb Ramps	Fire Infrastructure
Valley							
Calgro	Potential deficiencies	Deficiencies	Deficiencies	No deficiencies	Deficiencies	Deficiencies	Deficiencies
Citro	Deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Deer Creek Colony	Deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
East Porterville, CDP	Potential deficiencies	Deficiencies	Potential deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
El Monte Mobile Home	Potential deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Hawkins	Potential deficiencies	Potential deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Higby	Potential deficiencies	Potential deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Hypericum	Potential deficiencies	Potential deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Jones Corner	Potential deficiencies	Potential deficiencies	Deficiencies	No deficiencies	Deficiencies	Deficiencies	No deficiencies
Jovista	Potential deficiencies	Potential deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Lort	Potential deficiencies	Potential deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Naranjo	Potential deficiencies	Potential deficiencies	Potential deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Paige	Potential deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Peral	Potential deficiencies	Potential deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Ponca	Potential deficiencies	Potential deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Sandspur	Deficiencies	Deficiencies	Potential deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Taurusa	Potential deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Tooleville, CDP	Deficiencies	Deficiencies	Potential deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Vance	Potential deficiencies	Potential deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Venida	Potential deficiencies	Potential deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
West Venida	Potential deficiencies	Potential deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Worth	Potential deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Yokohl	Potential deficiencies	Potential deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Zante	Potential deficiencies	Potential deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies

Table 3-4 Infrastructure Deficiencies by DUC (continued)

Disadvantaged Unincorporated Community (DUC)	Wastewater	Water	Stormwater	Streetlights	Sidewalks	ADA Curb Ramps	Fire Infrastructure
Foothill							
Elderwood	Potential deficiencies	Potential deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Badger	Potential deficiencies	Deficiencies	No deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Globe	Potential deficiencies	Deficiencies	No deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Mountain							
Balance Rock	Potential deficiencies	Potential deficiencies	No deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
California Hot Springs, CDP	Potential deficiencies	Potential deficiencies	No deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Camp Nelson, CDP	Potential deficiencies	Potential deficiencies	No deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Cedar Slope, CDP	Potential deficiencies	Potential deficiencies	No deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Fairview	Potential deficiencies	Potential deficiencies	No deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Hartland, CDP	Potential deficiencies	Potential deficiencies	No deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Idlewild, CDP	Potential deficiencies	Potential deficiencies	No deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Johnsondale	Potential deficiencies	Deficiencies	No deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Kennedy Meadows, CDP	Potential deficiencies	Potential deficiencies	No deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Panorama Heights, CDP	Potential deficiencies	Potential deficiencies	No deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Pine Flat, CDP	Potential deficiencies	Potential deficiencies	No deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Ponderosa, CDP	Potential deficiencies	Deficiencies	No deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Posey, CDP	Potential deficiencies	Potential deficiencies	No deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Silver City	Potential deficiencies	Potential deficiencies	No deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Sugarloaf Mountain Park, CDP	Potential deficiencies	Potential deficiencies	No deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Sugarloaf Park/Guernsey Mill, CDP	Potential deficiencies	Potential deficiencies	No deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Sugarloaf Village, CDP	Potential deficiencies	Potential deficiencies	No deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies
Wilsonia	Potential deficiencies	Potential deficiencies	No deficiencies	Deficiencies	Deficiencies	Deficiencies	Deficiencies

Valley

1) Calgro - The drinking water is provided by private and/or small community wells. Water quality of private wells is not regulated by the State of California, however, the Groundwater Ambient Monitoring & Assessment (GAMA) Domestic Well Project sampled well water from 181 domestic wells in Tulare County in 2006. Three wells were noted within a half-mile of Calgro on the GeoTracker GAMA website with no wells having results above comparison concentrations. While these testing results note no deficiencies for water quality, it is still difficult to determine the availability for groundwater in the area and deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. The area is prone to flooding, does not have any public stormwater infrastructure and a deficiency is identified. There are streetlights located in the area which appear to be sufficient. There are no sidewalks and ADA curb ramps, therefore the community is deficient in these areas. Calgro does not include its own fire station, however, the nearby community of Cutler-Orosi has a fire station. No fire hydrants exist in the area which is considered a deficiency.

2) Citro – The source for the community's water and wastewater systems are not known. GeoTracker GAMA noted 14 wells within a half-mile of Citro with four wells testing 75% above comparison concentration. Water quality for this community is considered a deficiency. The area is prone to flooding, does not have any public stormwater infrastructure and a deficiency is identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Citro does not include its own fire station, however, the nearby community of Lemon Cove has a fire station. No fire hydrants exist in the area which is considered a deficiency.

3) Deer Creek Colony – The source for the community's water and wastewater systems are not known. Per the Geo Tracker GAMA mapping tool, there is one well located within a half-mile of Deer Creek Colony with no above comparison concentration percentages noted. While these testing results note no deficiencies for water quality, it is still difficult to determine the availability for groundwater in the area and deficiencies may exist. The area is prone to flooding, does not have any public stormwater infrastructure and a deficiency is identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Deer Creek Colony does not include its own fire station, however, the nearby community of Terra Bella has a fire station. One (1) fire hydrant exists in the area. Lack of sufficient fire hydrants is considered a deficiency.

4) East Porterville - The drinking water is provided by private and/or small community wells. Water quality of private wells is not regulated by the State of California, however the Groundwater Ambient Monitoring & Assessment (GAMA) Domestic Well Project sampled well water from 181 domestic wells in Tulare County in 2006 with three wells tested within a half-mile of the community. Wells tested near East Porterville were above Maximum Contaminant Levels (MCLs) or Notification Levels and tested greater than 10 mg/L of nitrate. This is considered a deficiency. In addition, nearly 1,000 residents in East Porterville are without water since summer and fall of 2014. Private wells have gone dry due to the severe drought conditions and residents are relying on bottled water for consumption and bathing. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. Some wastewater treatment may be provided for the community by the City of Porterville. The area is prone to flooding and does have some public stormwater infrastructure. Data is not available to determine whether

the stormwater infrastructure is sufficient and a potential deficiency is identified. There are streetlights, sidewalks, and ADA curb ramps provided in some areas of the community but are lacking in other areas, therefore the community is deficient in these areas. East Porterville does include its own fire station and fire hydrants do exist in some areas of the community but are lacking in other areas, therefore the community is deficient in these areas.

5) El Monte Mobile Home Park – The drinking water services are provided by the El Monte Village Mobile Home Park (MHP) according to the Environmental Working Group National Drinking Water Database with services for 100 people. Testing conducted between 2004 and 2009 and provided to the EWG by the California Department of Public Health did indicate nitrite and nitrate levels over the legal and health limits, as well as alpha particle activity, lead, 1,2-dibromo-3-chloropropane, and arsenic over the health limit. Environmental Protection Agency (EPA) violations were noted for nitrate levels over the MCL (2007-2008), failure to report information to the public or state agency in the Consumer Confidence Report (2004), and failure to regularly monitor nitrate (2007). Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. The area is prone to flooding, does not have any public stormwater infrastructure and a deficiency is identified. Streetlights are provided in some areas of the community but are lacking in others, therefore the community is deficient in these areas. There are no sidewalks and ADA curb ramps, therefore the community is deficient in all these areas. El Monte Mobile Home Park does not include its own fire station, however, the nearby community of Dinuba has a fire station. No fire hydrants exist in the area which is considered a deficiency.

6) Hawkins – The source of the community's water system is unknown. With no available data, potential deficiencies may exist for the community's water quality and available groundwater. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. The area is prone to flooding, does not have any public stormwater infrastructure and a deficiency is identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Hawkins does not include its own fire station, however, the nearby community of Lindsay has a fire station. No fire hydrants exist in the area which is considered a deficiency.

7) Higby – The source of the community's water and wastewater systems are unknown. With no available data, it is difficult to determine the availability of groundwater in the area, as well as the water quality and deficiencies may exist. The area is prone to flooding, does not have any public stormwater infrastructure and a deficiency is identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Higby does not include its own fire station, however, the nearby city of Visalia has a fire station. No fire hydrants exist in the area which is considered a deficiency.

8) Hypericum – The drinking water is provided by private and/or small community wells. Data related to any well monitoring in this area is unavailable. Therefore it is difficult to determine the availability of groundwater in the area as well as the water quality and potential deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. The area is prone to flooding, does not have any public stormwater infrastructure and a deficiency is identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Hypericum

does not include its own fire station and the nearest fire station is in Visalia, approximately 6.5 miles away which is considered a deficiency. In addition, no fire hydrants exist in the area which is also considered a deficiency.

9) Jones Corner – The drinking water is provided by private and/or small community wells. Data related to any well monitoring in this area is unavailable. Therefore it is difficult to determine the availability of groundwater in the area as well as the water quality and potential deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. The area is prone to flooding, does not have any public stormwater infrastructure and a deficiency is identified. There are streetlights located throughout the community that appear to be sufficient. There are also sidewalks in portions of the west side of the community that appear sufficient, however the east side is deficient. There are no ADA curb ramps, therefore the community is deficient. Jones Corner does not include its own fire station, however, the nearby city of Porterville has a fire station. Fire hydrants are located throughout the community that appear sufficient.

10) Jovista – The drinking water is provided by private and/or small community wells. Data related to any well monitoring in this area is unavailable. Therefore it is difficult to determine the availability of groundwater in the area as well as the water quality and potential deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. The area is prone to flooding, does not have any public stormwater infrastructure and a deficiency is identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Jovista does not include its own fire station, however, the nearby community of Richgrove has a fire station. No fire hydrants exist in the area which is considered a deficiency.

11) Lort – The drinking water is provided by private and/or small community wells. Water quality of private wells is not regulated by the State of California, however the Groundwater Ambient Monitoring & Assessment (GAMA) Domestic Well Project sampled well water from 181 domestic wells in Tulare County in 2006 with 2 wells test within a half-mile of Lort. Wells tested near Lort were below Maximum Contaminant Levels (MCLs) or Notification Levels and tested between 2 and 10 mg/L of nitrate. However, more recent data is not available, therefore potential deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. The area is prone to flooding, does not have any public stormwater infrastructure and a deficiency is identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Lort does not include its own fire station, however, the nearby city of Exeter has a fire station. No fire hydrants exist in the area which is considered a deficiency.

12) Naranjo – The source of the community's water system is unknown. With no available data, it is difficult to determine the availability of groundwater in the area, as well as the water quality and deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. The area is prone to flooding but does have ponding basins located nearby. It is not clear whether the public stormwater infrastructure is sufficient and a potential deficiency is identified. There are two (2) streetlights located in the community which are not sufficient. In addition, there are no sidewalks

and ADA curb ramps, therefore the community is deficient in all these areas. Naranjo does not include its own fire station, however, the nearby city of Woodlake has a fire station. No fire hydrants exist in the area which is considered a deficiency.

13) Paige – The drinking water is provided by private and/or small community wells. Water quality of private wells is not regulated by the State of California, however, the Groundwater Ambient Monitoring & Assessment (GAMA) Domestic Well Project sampled well water from 181 domestic wells in Tulare County in 2006 with 4 wells tested within a half-mile of Paige. Wells tested near Paige were above Maximum Contaminant Levels (MCLs) or Notification Levels, tested greater than 10 mg/L of nitrate, and coliform was detected. This is considered a deficiency. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. The area is prone to flooding, does not have any public stormwater infrastructure and a deficiency is identified. There is one (1) streetlight located in the community which is not sufficient. In addition, there are no sidewalks and ADA curb ramps, therefore the community is deficient in all these areas. Paige does not include its own fire station and the nearest fire station is in the city of Tulare, approximately 6 miles away which is considered a deficiency. In addition, no fire hydrants exist in the area which is also considered a deficiency.

14) Peral – The drinking water is provided by private and/or small community wells. Data related to any well monitoring in this area is unavailable. Therefore it is difficult to determine the availability of groundwater in the area as well as the water quality and potential deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. The area is prone to flooding, does not have any public stormwater infrastructure and a deficiency is identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Peral does not include its own fire station and the nearest fire station is in the city of Ivanhoe, approximately 6.5 miles away which is considered a deficiency. In addition, no fire hydrants exist in the area which is also considered a deficiency.

15) Ponca – The drinking water is provided by private and/or community wells. Data related to any well monitoring in this area is unavailable. Therefore it is difficult to determine the availability of groundwater in the area as well as the water quality and potential deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. The area is prone to flooding, does not have any public stormwater infrastructure and a deficiency is identified. There are streetlights, sidewalks, and ADA curb ramps in Ponca and coverage is sufficient in the northwest area of the community, however the remaining parts of the community are deficient. Ponca does not include its own fire station, however, the nearby community of East Porterville has a fire station. Several fire hydrants exist in the area, however coverage is not sufficient and it is considered a deficiency.

16) Sandspur – The source of the community's water and wastewater systems are unknown. With no available data, it is difficult to determine the availability of groundwater in the area, as well as the water quality and deficiencies may exist. The area is prone to flooding but does have ponding basins located nearby. It is not clear whether the public stormwater infrastructure is sufficient and a potential deficiency is identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Sandspur does not include its own fire station, however,

the nearby community of Lemon Cove has a fire station. No fire hydrants exist in the area which is considered a deficiency.

17) Taurusa – The drinking water is provided by private and/or small community wells. Water quality of private wells is not regulated by the State of California, however, the Groundwater Ambient Monitoring & Assessment (GAMA) Domestic Well Project sampled well water from 181 domestic wells in Tulare County in 2006 with two wells tested in the community. Wells tested near Taurusa were above Maximum Contaminant Levels (MCLs) or Notification Levels and tested greater than 10 mg/L of nitrate. This is considered a deficiency. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. The area is prone to flooding, does not have any public stormwater infrastructure and a deficiency is identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Taurusa does not include its own fire station, however, the nearby city of Ivanhoe has a fire station. No fire hydrants exist in the area which is considered a deficiency.

18) Tooleville – The community is connected to water and wastewater systems that are provided by Tooleville Water Company according to the Environmental Working Group National Drinking Water Database with services for 300 people. Testing conducted between 2005 and 2008 and provided to the Environmental Working Group (EWG) by the California Department of Public Health did indicate nitrate and nitrite levels over the legal and health limits, as well as radium-228, alpha particle activity, and lead over the health limit. Environmental Protection Agency (EPA) violations were noted for coliform bacteria levels over the MCL (2004, 2007, and 2008), nitrate levels over the MCL (2005-2007), failure to report information to the public or state agency in the Consumer Confidence Report (2004-2005), and failure to monitor coliform bacteria (2004-2006). The area is prone to flooding but does have ponding basins located nearby. It is not clear whether the public stormwater infrastructure is sufficient and a potential deficiency is identified. There is one (1) streetlight which is insufficient for the area. There are no sidewalks and ADA curb ramps, therefore the community is deficient in all these areas. Tooleville does not include its own fire station, however, the nearby city of Exeter has a fire station. No fire hydrants exist in the area which is considered a deficiency.

19) Vance – The source of the community's water and wastewater systems are unknown. With no available data, potential deficiencies may exist for the community's water quality and available groundwater. The area is prone to flooding, does not have any public stormwater infrastructure and a deficiency is identified. There are streetlights, sidewalks, and ADA curb ramps in Vance and coverage is sufficient in the southeast area of the community, however the remaining parts of the community are deficient. Vance does not include its own fire station, however, the nearby city of Lindsay has a fire station. No fire hydrants exist in the area which is considered a deficiency.

20) Venida – The drinking water is provided by private and/or small community wells. Water quality of private wells is not regulated by the State of California, however the Groundwater Ambient Monitoring & Assessment (GAMA) Domestic Well Project sampled well water from 181 domestic wells in Tulare County in 2006. Wells tested near Venida were below Maximum Contaminant Levels (MCLs) or Notification Levels and tested between 2 and 10 mg/L of nitrate. However, more recent data is not available, therefore potential deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. The area is prone to flooding, does not have any public stormwater infrastructure and a

deficiency is identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Venida does not include its own fire station, however, the nearby city of Exeter has a fire station. No fire hydrants exist in the area which is considered a deficiency.

21) West Venida – The drinking water is provided by private and/or small community wells. Water quality of private wells is not regulated by the State of California, however the Groundwater Ambient Monitoring & Assessment (GAMA) Domestic Well Project sampled well water from 181 domestic wells in Tulare County in 2006. Wells tested near West Venida were below Maximum Contaminant Levels (MCLs) or Notification Levels and tested between 2 and 10 mg/L of nitrate. However, more recent data is not available, therefore potential deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. The area is prone to flooding, does not have any public stormwater infrastructure and a deficiency is identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. West Venida does not include its own fire station, however, the nearby city of Exeter has a fire station. No fire hydrants exist in the area which is considered a deficiency.

22) Worth – The drinking water is provided by private and/or small community wells. Water quality of private wells is not regulated by the State of California, however the Groundwater Ambient Monitoring & Assessment (GAMA) Domestic Well Project sampled well water from 181 domestic wells in Tulare County in 2006. Wells tested near Worth were above Maximum Contaminant Levels (MCLs) or Notification Levels, tested between 2 and 10 mg/L of nitrate, and total coliform was detected. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. The area is prone to flooding, does not have any public stormwater infrastructure and a deficiency is identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Worth does not include its own fire station, however, the nearby community of East Porterville has a fire station. No fire hydrants exist in the area which is considered a deficiency.

23) Yokohl – The drinking water is provided by private and/or small community wells connected to the Yokohl Mutual Water Company according to the Environmental Working Group National Drinking Water Database with services for 75 people. Testing conducted between 2004 and 2008 and provided to the Environmental Working Group (EWG) by the California Department of Public Health did not indicate any levels over the legal limits, however radium-228, alpha particle activity, bromoform, dibromochloromethane, and arsenic were shown over the health limits. No Environmental Protection Agency (EPA) violations were noted since 2004. However, more recent data is not available, therefore potential deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. The area is prone to flooding, does not have any public stormwater infrastructure and a deficiency is identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Yokohl does not include its own fire station, however, the nearby city of Exeter has a fire station. No fire hydrants exist in the area which is considered a deficiency.

24) Zante – The drinking water is provided by private and/or community wells. Data related to any well monitoring in this area is unavailable. Therefore it is difficult to determine the availability of groundwater in the area as well as the water quality and potential deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. The area is prone to flooding, does not have any public stormwater infrastructure and a deficiency is identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Zante does not include its own fire station, however, the nearby community of Strathmore has a fire station. No fire hydrants exist in the area which is considered a deficiency.

Foothill

25) Badger – The drinking water is provided by private and/or small community wells. Water quality of private wells is not regulated by the State of California, however, the Groundwater Ambient Monitoring & Assessment (GAMA) Domestic Well Project sampled well water from 181 domestic wells in Tulare County in 2006. A total of 7 wells were tested within one mile of Badger. Wells tested near Badger were above Maximum Contaminant Levels (MCLs) or Notification Levels, tested greater than 10 mg/L of nitrate, and coliform was detected. This is considered a deficiency in the quality of water. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. While Badger does not have any public stormwater infrastructure, the area is not prone to flooding and a deficiency is not identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Badger does include its own fire station, however, no fire hydrants exist in the area which is considered a deficiency.

26) Elderwood – The drinking water is provided by private and/or small community wells. Water quality of private wells is not regulated by the State of California, however the Groundwater Ambient Monitoring & Assessment (GAMA) Domestic Well Project sampled well water from 181 domestic wells in Tulare County in 2006 with seven wells located within a half-mile of Elderwood. Wells tested near Elderwood were below Maximum Contaminant Levels (MCLs) or Notification Levels and tested between 2 and 10 mg/L of nitrate. However, more recent data is not available, therefore potential deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. The area is prone to flooding, does not have any public stormwater infrastructure and a deficiency is identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Elderwood does not include its own fire station, however, the nearby community of Woodlake has a fire station. No fire hydrants exist in the area which is considered a deficiency.

27) Globe – The source of the community's water system is unknown. With no available data, it is difficult to determine the availability of groundwater in the area, as well as the water quality and deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. While Globe does not have any public stormwater infrastructure, the area is not prone to flooding and a deficiency is not identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Globe does not include its own fire station, however, the nearby

community of Springville has a fire station. No fire hydrants exist in the area which is considered a deficiency.

Mountain

28) Balance Rock – The drinking water is provided by private and/or small community wells. Data related to any well monitoring in this area is unavailable. Therefore it is difficult to determine the availability of groundwater in the area as well as the water quality and potential deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. While Balance Rock does not have any public stormwater infrastructure, the area is not prone to flooding and a deficiency is not identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Balance Rock does not include its own fire station, however, the nearby community of Posey has a fire station. No fire hydrants exist in the area which is considered a deficiency.

29) California Hot Springs – The drinking water and wastewater services are provided by the California Hot Springs Resort. Data related to water quality, capacity, and demand is unavailable. Therefore it is difficult to determine the availability of groundwater in the area as well as the water quality and potential deficiencies may exist. While California Hot Springs does not have any public stormwater infrastructure, the area is not prone to flooding and a deficiency is not identified. There are several streetlights and a sidewalk present near the resort, but this infrastructure is lacking in the remaining community areas which are considered deficient. There are no ADA curb ramps which is also considered a deficiency. California Hot Springs does include its own fire station, however, no fire hydrants exist in the area which is considered a deficiency.

30) Camp Nelson – According to the Environmental Working Group National Drinking Water Database, the drinking water is provided by the Camp Nelson Water Company and serves 900 people. Testing conducted between 2004 and 2007 and provided to the Environmental Working Group (EWG) by the California Department of Public Health did not indicate any water quality violations. However, more recent data is not available, therefore potential deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. While Camp Nelson does not have any public stormwater infrastructure, the area is not prone to flooding and a deficiency is not identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Camp Nelson does include its own fire station, however, no fire hydrants exist in the area which is considered a deficiency.

31) Cedar Slope – The source of the community's water system is unknown. With no available data, it is difficult to determine the availability of groundwater in the area, as well as the water quality and deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. While Cedar Slope does not have any public stormwater infrastructure, the area is not prone to flooding and a deficiency is not identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Cedar Slope does not include its own fire station, however, the nearby community of Camp Nelson has a fire station. No fire hydrants exist in the area which is considered a deficiency.

32) Fairview – The drinking water is provided by private and/or small community wells. Data related to any well monitoring in this area is unavailable. Therefore it is difficult to determine the availability of groundwater in the area, as well as the water quality and potential deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. While Fairview does not have any public stormwater infrastructure, the area is not prone to flooding and a deficiency is not identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Fairview does not include its own fire station and the nearest fire station is in California Hot Springs, approximately 29 miles away which is considered a deficiency. In addition, no fire hydrants exist in the area which is also considered a deficiency.

33) Hartland – The drinking water is provided by private and/or small community wells. Data related to any well monitoring in this area is unavailable. Therefore it is difficult to determine the availability of groundwater in the area as well as the water quality and potential deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. While Hartland does not have any public stormwater infrastructure, the area is not prone to flooding and a deficiency is not identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Hartland does not include its own fire station and the nearest fire station is in Badger, approximately 8.5 miles away which is considered a deficiency. In addition, no fire hydrants exist in the area which is also considered a deficiency.

34) Idlewild – The drinking water is provided by private and/or small community wells. Data related to any well monitoring in this area is unavailable. Therefore it is difficult to determine the availability of groundwater in the area as well as the water quality and potential deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. While Idlewild does not have any public stormwater infrastructure, the area is not prone to flooding and a deficiency is not identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Idlewild does not include its own fire station, however, the nearby community of Posey has a fire station. No fire hydrants exist in the area which is considered a deficiency.

35) Johnsondale – The source of the community's water system is unknown. With no available data, it is difficult to determine the availability of groundwater in the area, as well as the water quality and deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. While Johnsondale does not have any public stormwater infrastructure, the area is not prone to flooding and a deficiency is not identified. The community has streetlights, but they don't appear to be sufficient for the western side of the community and a deficiency is identified. There are no sidewalks and ADA curb ramps, therefore the community is deficient in all these areas. Johnsondale does not include its own fire station and the nearest fire station is in California Hot Springs, approximately 21 miles away which is considered a deficiency. In addition, no fire hydrants exist in the area which is also considered a deficiency.

36) Kennedy Meadows – The drinking water is provided by private and/or small community wells. Data related to any well monitoring in this area is unavailable. Therefore it is difficult to determine the availability of groundwater in the area as well as the water quality and potential deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. While Kennedy Meadows does not have any public stormwater infrastructure, the area is not prone to flooding and a deficiency is not identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Kennedy Meadows does include its own fire station, however, no fire hydrants exist in the area which is considered a deficiency.

37) Panorama Heights – The drinking water is provided by private and/or small community wells. Data related to any well monitoring in this area is unavailable. Therefore it is difficult to determine the availability of groundwater in the area as well as the water quality and potential deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. While Panorama Heights does not have any public stormwater infrastructure, the area is not prone to flooding and a deficiency is not identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Panorama Heights does not include its own fire station, however, the nearby community of Posey has a fire station. No fire hydrants exist in the area which is considered a deficiency.

38) Pine Flat – The community is connected to water and wastewater systems that are provided by the Pine Flat Water Company according to the Environmental Working Group National Drinking Water Database. The company provides services for 110 people. Recent data is not available for the Pine Flat Water Company, therefore potential deficiencies may exist. While Pine Flat does not have any public stormwater infrastructure, the area is not prone to flooding and a deficiency is not identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Pine Flat does not include its own fire station, however, the nearby community of California Hot Springs has a fire station. No fire hydrants exist in the area which is considered a deficiency.

39) Ponderosa – The community is connected to a water system that is provided by the Ponderosa Community Services District (CSD) according to the Environmental Working Group National Drinking Water Database with services for 232 people. Testing conducted between 2004 and 2008 and provided to the Environmental Working Group (EWG) by the California Department of Public Health did not indicate any levels over the legal limits, however alpha particle activity and lead were over the health limits. Environmental Protection Agency (EPA) violations were noted for failure to report information to the public or state agency in the Consumer Confidence Report (2004) and failure to regularly monitor nitrate (2006) and coliform bacteria (2005, 2006, and 2008). Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. While Ponderosa does not have any public stormwater infrastructure, the area is not prone to flooding and a deficiency is not identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Ponderosa does not include its own fire station and the nearest fire station is in Camp Nelson, approximately 10 miles away which is considered a deficiency. In addition, no fire hydrants exist in the area which is also considered a deficiency.

40) Posey – The drinking water is provided by private and/or small community wells. Data related to any well monitoring in this area is unavailable. Therefore it is difficult to determine the availability of groundwater in the area as well as the water quality and potential deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. While Posey does not have any public stormwater infrastructure, the area is not prone to flooding and a deficiency is not identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Posey does include its own fire station, however, no fire hydrants exist in the area which is considered a deficiency.

41) Silver City – The drinking water is provided by private and/or small community wells. Data related to any well monitoring in this area is unavailable. Therefore it is difficult to determine the availability of groundwater in the area as well as the water quality and potential deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. While Silver City does not have any public stormwater infrastructure, the area is not prone to flooding and a deficiency is not identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Silver City does not include its own fire station and the nearest fire station is in Three Rivers, approximately 25 miles away which is considered a deficiency. In addition, no fire hydrants exist in the area which is also considered a deficiency.

42) Sugarloaf Mountain Park – The drinking water is provided by private and/or small community wells. Data related to any well monitoring in this area is unavailable. Therefore it is difficult to determine the availability of groundwater in the area as well as the water quality and potential deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. While Sugarloaf Mountain Park does not have any public stormwater infrastructure, the area is not prone to flooding and a deficiency is not identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Sugarloaf Mountain Park does not include its own fire station, however, the nearby community of Posey has a fire station. No fire hydrants exist in the area which is considered a deficiency.

43) Sugarloaf Park/Guernsey Mill – The drinking water is provided by private and/or small community wells. Data related to any well monitoring in this area is unavailable. Therefore it is difficult to determine the availability of groundwater in the area as well as the water quality and potential deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. While Sugarloaf Park/Guernsey Mill does not have any public stormwater infrastructure, the area is not prone to flooding and a deficiency is not identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Sugarloaf Park/Guernsey Mill does not include its own fire station, however, the nearby community of Posey has a fire station. No fire hydrants exist in the area which is considered a deficiency.

44) Sugarloaf Village – The drinking water is provided by private and/or small community wells. Data related to any well monitoring in this area is unavailable. Therefore it is difficult to determine the

availability of groundwater in the area as well as the water quality and potential deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. While Sugarloaf Village does not have any public stormwater infrastructure, the area is not prone to flooding and a deficiency is not identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Sugarloaf Village does not include its own fire station, however, the nearby community of Posey has a fire station. No fire hydrants exist in the area which is considered a deficiency.

45) Wilsonia – The drinking water is provided by private and/or small community wells. Data related to any well monitoring in this area is unavailable. Therefore it is difficult to determine the availability of groundwater in the area as well as the water quality and potential deficiencies may exist. Wastewater treatment is provided by septic systems and information is unavailable regarding any potential leaching and potential deficiencies may exist. While Wilsonia does not have any public stormwater infrastructure, the area is not prone to flooding and a deficiency is not identified. There are no streetlights, sidewalks, and ADA curb ramps, therefore the community is deficient in all these areas. Wilsonia does not include its own fire station and the nearest fire station is in Badger, approximately 16 miles away which is considered a deficiency. In addition, no fire hydrants exist in the area, which is also considered a deficiency.

4. Potential Funding Sources

4.1 General

Chapter 3 of this report identifies the infrastructure needs of each community as well as any planned and programmed projects that would provide this infrastructure. The purpose of this chapter is to describe potential funding sources that may make extension of services and infrastructure to these communities financially feasible.

4.2 Potential Funding Sources

Principal funding sources to provide infrastructure include taxes, benefit assessments, bonds, and exactions (including impact fees). The following is a list of funding options to address existing deficiencies and/or expansion of infrastructure for new development:

- User rate increases
- Revenue bonds
- Tax allocation bonds
- Certificates of Participation (COP)
- General obligation bonds
- Infrastructure financing district (IFD)
- Mello-Roos Community Facilities District (CFD)
- Assessment district (AD)

There are other funding opportunities as listed in Table 4-1. Most of the available funding sources relate to clean drinking water, community water systems, and water treatment and quality. Several of them pertain specifically to disadvantaged communities.

Table 4-1 Potential Funding Sources

Agency	Program (year passed or created)	Funding Provided (in million $)	Funding Remaining/Available (in million $)	Limitations/Barriers on Use of Funds for Drinking Water Treatment (capital or O&M)
Water				
California Department of Public Health (CDPH)	Safe Drinking Water State Revolving Fun (SDWSRF) (1996) (grants and loans)	Generally $100-$150: Low-interest loans and some grants to support water systems with technical, managerial, and financial development and infrastructure improvements.	$130-$150 (revolving funds) (annually)	* 20% to 30% of annual federal contribution can be used for grants. The remainder must be committed to loans. * Funds can be used only for capital costs. Cannot be used for O&M. * Only loans (not grants) for privately owned water systems. * Some funds available for feasibility and planning studies for eligible projects/systems. * Can only be used for Public Water Systems (not domestic wells or State Small Systems).
	Proposition 84 (2006) (grants)	$180: Small community improvements.	$0 (Over subscribed)	* Funds can be used only for capital costs. Cannot be used for O&M. * Some funding available for feasibility and planning studies for eligible projects/systems. * Can only be used for Public Water Systems not domestic wells or State Small Systems.
		$60: Protection and reduction of contamination of groundwater sources. $50: Matching funds for federal DWSRF.	$0 (Fully allocated) Will be fully committed with the current year grant but not yet liquidated	
		$10: Emergency and urgent projects.	$7	* Used to address sudden unanticipated emergency situations such as fires, earthquakes, and mud slides that damage critical water infrastructure. May fund short-term mitigations such as hauled water.
	Proposition 50 (2002) (grants) (fully allocated)	$50: Water security for drinking water systems.	$0 (Fully allocated)	* Can only be used for capital costs. Cannot be used for O&M. * Can only be used for Public Water Systems, not domestic wells or State Small Systems.
		$69: Community treatment facilities and monitoring programs.	$0 (Fully allocated)	
		$105: Matching funds for federal grants for public water system infrastructure improvements.	$0 (Fully allocated, mostly liquidated)	
State Water Resources Control Board (State Water Board)	Clean Water State Revolving Fund (Expanded Use Program) (CWSRF) (1987) (loans)	$200-$300 per year: Water quality protection projects, wastewater treatment, nonpoint source contamination control, and watershed management.	$50 per agency per year; can be waived	Eligible Uses: Stormwater treatment and diversion, sediment and erosion control, streatm restoration, land acquisition. Drinking water treatment generally not eligible except under certain Expanded Use scenarios. Capital cost only. O&M not eligible.
	Small Community Groundwater Grants (Prop 40) (2004, amended 2007) (grants)	$9.5: Assist small disadvantaged communities (<20,000pp) with projects where the existing groundwater supply exceeds maximum contaminant levels, particularly for arsenic or nitrate.	$1.4 remaining $0.3 available to encumber; $1.1 available to appropriate	$ can go to local government or NGO. Must demonstrate financial hardship. Can only provide alternate water supply. No O&M costs. Program not currently active due to staff resource limitations.
	State Water Quality Control Fund: Cleanup and Abatement Account (2009)	$10 in 2012 (varies annually): Projects to a) clean up waste or abate its effects on waters of the state, when there is no viable responsible party, or b) address a significant unforeseen water pollution problem (regional water boards only). Funds can be allocated to: Public Agencies, specified tribal governments, and not-for-profit organizations that serve disadvantaged communities.	$10, but varies	Eligible Uses: Emergency cleanup projects; projects to clean up waste or abate its effects on waters of the state; regional water board projects to address a significant unforeseen water pollution problem. Recipient must have authority to clean up waste. Under certain circumstances this fund has been used to provide drinking water O&M for limited durations.
	Integrated Regional Water Management (IRWM) (2002)	$380 (Prop 50): Planning ($15) and implementation ($365) projects related to protecting and improving water quality.	$0 (Fully committed)	
	Small Community Wastewater Grant Program	$380 (Prop 50): Planning ($15) and implementation ($365) projects related to protecting and improving water quality.	$0 (Fully committed)	

Table 4-1 Potential Funding Sources (continued)

Agency	Program (year passed or created)	Funding Provided (in million $)	Funding Remaining/Available (in million $)	Limitations/Barriers on Use of Funds for Drinking Water Treatment (capital or O&M)
Water				
State Water Resources Control Board (State Water Board)	Water Recycling Funding Program (2008) (grants)	$5 for construction.	$0 (Fully committed)	* Provide for treatment and delivery of municipal wastewater to users that replace the use of local water supply with recycled water. * Provide treatment and reuse of groundwater contaminated due to human activity; and provide local water supply benefits. * Provide for the treatment and disposal of municipal wastewater to meet waste discharge requirements imposed for water pollution control. * Projects that do not have identifiable benefits to the state or local water supply.
California Department of Water Resources (DWR)	Integrated Regional Water Management	$600 remaining (Prop 84): Regional water planning and implementation.	$28 (Central Coast projects)	Must be consistent with an adopted IRWM Plan and other program requirements. For capital investment only.
	Contaminant treatment or removal technology pilot	Up to $5 per grant	$15 available	Eligible applicants are public water systems under the regulatory jurisdiction of CDPH and other public entities. For capital investment only.
	Safe Drinking Water Bond Law (Prop 81) (1988)	Up to $74 to be awarded to current priority list. $0.025 max per project.	Remaining balance to be determined	Provides funding for projects that investigate and identify alternatives for drinking water system improvements.
	Drinking water disinfecting projects using UV technology and ozone treatment	$0.05 minimum, up to $5 per grant.	$19 remaining	Eligible applicants are public water systems under the regulatory jurisdiction of CDPH. For capital investment only.
iBank (CA Infrastructure and Development Bank)	Infrastructure State Revolving Fund (ISRF) Program (2000) (loans)	$0.25 to $10 per project to finance water infrastructure that promotes job opportunities. Eligible projects include construction or repair of publicly owned water supply, treatment, and distribution systems.	$52.6 million approved to date for Water Supply, Water Treatment and Distribution. Applications continually accepted.	Finances system capital improvements only. Must show job creation. Special loan tier for DACs was discontinued.
United States Housing and Urban Development Department (HUD)	Community Development Block Grants (CDBG) (1974) (grants)	Grants of various sizes, generally $0.25 to $100, for the construction or reconstruction of streets, water and sewer facilities, neighborhood centers, recreation facilities, and other public works.	Annually	Not less than 70% of CDBG funds must be used for activities that benefit low- and moderate-income persons. In addition, each activity must meet one of the following national objectives for the program: benefit low- and moderate-income persons, prevention or elimination of slums or blight, or address community development needs having a particular urgency because existing conditions pose a serious and immediate threat to the health or welfare of the community for which other funding is not available.

Table 4-1 Potential Funding Sources (continued)

Agency	Program	Funding Provided (in million $)	Funding Remaining/Available (in million $)	Description
Other Infrastructure				
Department of Conservation's Division of Land Resource Protection and Strategic Growth Council	Sustainable Communities Planning Grants and Incentives Program	$66.945: Dispersed to agencies in three funding cycles.	$0 (Fully allocated) Tulare County was awarded over $1.3 in Round 2 for Sustainable Highway Corridor Plan ($0.384) and AAA Water and MT Sewer Project ($0.94)	Competitive grants to cities, counties, and designated regional agencies to promote sustainable community planning and natural resource conservation. The grant program supports development, adoption, and implementation of various planning elements. It offers a unique opportunity to improve and sustain the wise use of infrastructure and natural resources through a coordinated and collaborative approach.
United State Department of Agriculture Rural Development	Community Facilities Direct Loan and Grant Program	Agencies can apply for the following types of funding: low interest direct loans, grants, or a combination of the two	N/A	Funds can be used to purchase, construct, and/or improve essential community facilities, purchase equipment and pay related project expenses. Examples of essential community facilities include: * Health care facilities such as hospitals, medical clinics, dental clinics, nursing homes or assisted living facilities * Public facilities such as town halls, courthouses, airport hangars or street improvements * Community support services such as child care centers, community centers, fairgrounds or transitional housing * Public safety services such as fire departments, police stations, prisons, police vehicles, fire trucks, public works vehicles or equipment * Educational services such as museums, libraries or private schools * Utility services such as telemedicine or distance learning equipment * Local food systems such as community gardens, food pantries, community kitchens, food banks, food hubs or greenhouses
	Emergency Community Water Assistance Grants	Water transmission line grants up to $150,000 are for construction of waterline extensions, repairs to breaks or leaks in existing water distribution lines, and related maintenance necessary to replenish water supply. Water Source grants up to $500,000 are for construction of a new water source, intake and/or treatment facility.	N/A	This program helps eligible communities prepare for, or recover from, an emergency that threatens the availability of safe, reliable drinking water for households and businesses. The following events qualify: *Drought or flood *Earthquake *Tornado or hurricane *Disease outbreak *Chemical spill, leak or seepage *Other disasters

Table 4-1 Potential Funding Sources (continued)

Agency	Program	Funding Provided (in million $)	Funding Remaining/Available (in million $)	Description
Other Infrastructure				
United State Department of Agriculture Rural Development	Water and Waste Disposal Loan and Grant Program	Agencies can apply for long-term, low-interest loans. If funds are available, grants may be combined with a loan if necessary to keep user costs reasonable.	N/A	Funds may be used to finance the acquisition, construction or improvement of: *Drinking water sourcing, treatment, storage and distribution *Sewer collection, transmission, treatment and disposal *Solid waste collection, disposal and closure *Storm water collection, transmission and disposal In some cases, funding may also be available for related activities such as: *Legal and engineering fees *Land acquisition, water and land rights, permits and equipment *Start-up operations and maintenance *Interest incurred during construction *Purchase of existing facilities to improve service or prevent loss of service *Other costs determined to be necessary for completion of the project *For a complete list, see 7 CFR Part 1780.7 and 1780.9
	Water and Waste Disposal Predevelopment Planning Grants	Maximum of $30,000 or 75% of the predevelopment planning costs. At least 25% of the project cost must come from the applicant or third party sources. In-kind contributions do not count toward this minimum.	N/A	Grants may be used to pay part of the costs of developing a complete application for USDA Rural Development Water & Waste Disposal direct loan/grant and loan guarantee programs.

5. REFERENCES

5.1 Documents and Websites

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Tulare County Local Agency Formation Commission. *Cities and Special Districts Inventory, Updated as of April 2013.*

Tulare County Association of Governments. 2014. *TCAG Regional Transportation Plan, Action Element.*

State of California, Office of Planning and Research. *Senate Bill 244: Land Use, General Plans and Disadvantaged Communities.*

California Environmental Protection Agency, State Water Resources Control Board. *Groundwater Ambient Monitoring and Assessment (GAMA), Domestic Well Project Groundwater Quality Data Report Tulare County Focus Report. Revised August 2013. http://www.swrcb.ca.gov/gama/docs/tularesummaryreport.pdf*

California Environmental Protection Agency, State Water Resources Control Board. *Geo Tracker GAMA.* http://geotracker.waterboards.ca.gov/gama/gamamap/public.

Environmental Working Group. *National Drinking Water Database. http://www.ewg.org/tap-water/whatsinyourwater/CA.*

Google Earth.

5.2 Persons and Agencies Consulted

El Monte Village Mobile Home Village. Sanitary Survey

Lemon Cove Water Company, Sanitary Survey

APPENDIX A

GROUNDWATER AMBIENT MONITORING AND ASSESSMENT (GAMA)

DOMESTIC WELL PROJECT
GROUNDWATER QUALITY DATA REPORT
TULARE COUNTY FOCUS AREA

CALIFORNIA
Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

California State Water Resources Control Board
Groundwater Protection Section
Revised August 2013

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ACKNOWLEDGEMENTS

The GAMA Program staff and management thank all of the volunteer well owners and cooperating county and state agencies that participated in the Tulare County Domestic Well Project.

ABBREVIATIONS AND ACRONYMS

CDPH	California Department of Public Health
DWR	California Department of Water Resources
EC	Electrical Conductivity
GAMA	Groundwater Ambient Monitoring and Assessment
LLNL	Lawrence Livermore National Laboratory
MCL	Maximum Contaminant Level
NL	Notification Level
SMCL	Secondary Maximum Contaminant Level
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
VOCs	Volatile Organic Compounds
µg/L	Micrograms per Liter
mg/L	Milligrams per Liter

ABSTRACT

The State Water Resources Control Board (State Water Board) established the Groundwater Ambient Monitoring and Assessment (GAMA) Program in 2000. Private domestic wells in Tulare County were sampled in 2006 as part of the GAMA Domestic Well Project. Tulare County was selected for sampling due to the large number of domestic wells located within the county and the availability of well-owner data. A total of 181 wells were sampled by Water Board staff, primarily in the valley and foothill areas of the county.

Groundwater samples were analyzed by an accredited environmental laboratory for commonly observed chemical constituents such as bacteria (total and fecal coliform), inorganic parameters (metals, major anions and general minerals), and volatile organic compounds (VOCs). Test results were compared against three public drinking water standards established by the California Department of Public Health (CDPH): primary maximum contaminant levels (MCLs), secondary maximum contaminant levels (SMCLs), and notification levels (NLs). These water quality standards are used for comparison purposes only, since private domestic well water quality is not regulated by the State of California. A total of twenty-two constituents were detected at concentrations above public drinking water standards. Fourteen constituents were detected above a primary MCL, five constituents were above an SMCL, and three were above NLs.

The fourteen constituents were detected above MCLs included total and fecal coliform bacteria, arsenic, beryllium, chromium, nickel, nitrate, nitrite, perchlorate, thallium, 1,2-dibromo-3-chloropropane (DBCP), gross alpha activity, combined radium activity, and uranium activity. Nitrate was the most frequently detected chemical above an MCL, and was detected in 75 wells at concentrations greater than or equal to the MCL of 10 mg/L (nitrate as N). Total coliform bacteria were present in 60 wells, and fecal coliform bacteria were present in 13 wells. DBCP and thallium were detected at concentrations above the MCL in eight and six wells, respectively. All other constituents detected above an MCL were observed in three or fewer wells.

The five chemicals were detected at concentrations above SMCLs, including aluminum, iron, manganese, total dissolved solids (TDS), and zinc. The chemicals detected above an SMCL were all observed in four or fewer wells. Three chemicals were detected above NLs: boron, vanadium, and 1,2,3-trichloropropane. Vanadium was detected in 14 wells at concentrations greater than the NL of 50 µg/L. 1,2,3-trichloroproane and boron were detected above the NL in a single well each.

INTRODUCTION

More than 95 percent of Californians get their drinking water from a public or municipal source - these supplies are typically treated to ensure that the water is safe to drink. However, private domestic wells supply drinking water to approximately 1.6 million Californians. Those served by public or municipal supplies should be concerned about groundwater quality too, as groundwater supplies part or all of the water delivered to approximately 15 million municipal public water supply users. Contaminated groundwater results in treatment costs, well closures, and new well construction which increases costs for consumers.

Groundwater is also an important source of irrigation and industrial supply water. Reliance upon this resource is expected to increase in the future, in part due to increased agricultural and industrial demand, drought, climate change, and population/land-use changes. Consequently, there are growing concerns regarding groundwater quality in California, and whether decreases in quality will affect the availability of this resource. Since the 1980s, over 8,000 public groundwater drinking water sources have been shut down – some due to the detection of chemicals such as nitrate, arsenic, or methyl tert-butyl ether (MTBE).

The State Water Board created the Groundwater Ambient Monitoring and Assessment (GAMA) Program to address public concerns over groundwater quality. The primary objectives of the GAMA Program are to improve comprehensive statewide groundwater monitoring and to increase the public availability of groundwater quality information. The data gathered by GAMA highlight regional and local groundwater quality concerns, and may be used to evaluate whether there are specific chemicals of concern in specific areas throughout the state. The GAMA Program consists of four current projects:

- **Domestic Well Project**: A voluntary groundwater monitoring project that provides water quality information to private (domestic) well owners. To date, the Domestic Well Project has sampled over 1,000 private domestic wells in five county focus areas: Yuba (2002), El Dorado (2003-2004), Tehama (2005), Tulare (2006), and San Diego (2008-2009). State Water Board staff sample the participants' well at no cost to the well owner.

- **Priority Basin Project**: A comprehensive, statewide groundwater monitoring program that primarily uses public groundwater supply wells in high-use, or "priority," groundwater basins. These high-use basins contain more than 95% of all public groundwater supply wells. As of April 2009, the Priority Basin Project has sampled over 1,700 wells in over 90 different groundwater basins. The United States Geological Survey (USGS) is the project technical lead, with support from Lawrence Livermore National Laboratory (LLNL).

- **Special Studies Project**: Focuses on identification of contaminant sources and assessing the effects of remediation in private domestic and public supply wells. The Special Studies Project also studies aquifer storage and recovery projects. LLNL is the project technical lead.

- **GeoTracker GAMA**: A publicly-accessible, map-based on-line query tool that helps users find useful groundwater quality data and information.

This Data Summary Report summarizes Domestic Well Project results from 181 domestic wells sampled in the Tulare County Focus Area collected during 2006. Sampled well locations are shown in Figure 1.

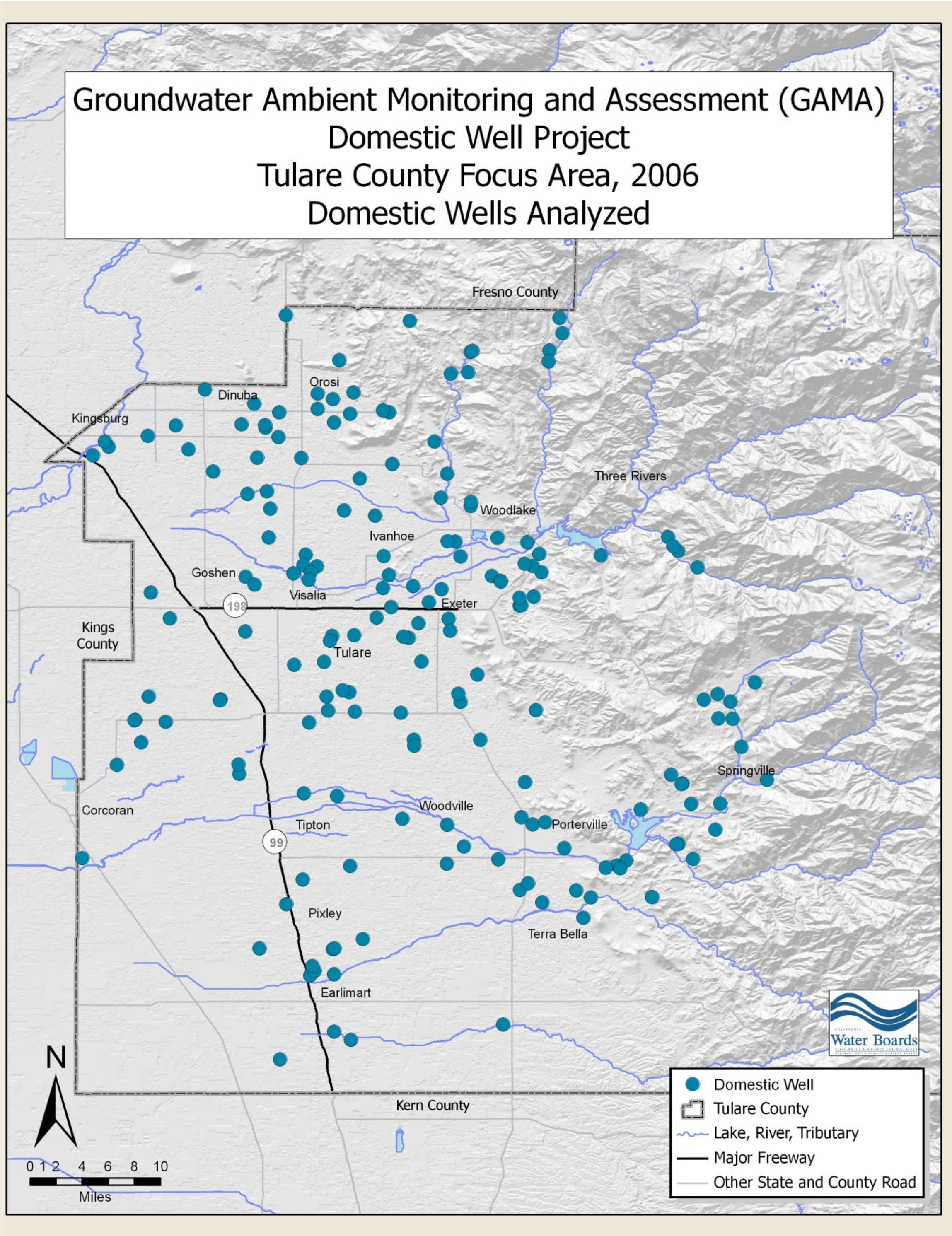
Domestic Well Project Overview

Domestic wells differ from public drinking water supply wells in several respects; domestic wells are generally shallower, are privately owned, supply a single household, and tend to be located in more rural settings where public water supply systems are not available. Census data indicate that there are over 600,000 private domestic wells in California, supplying water to approximately 1.6 million Californians. Tulare County has more than 20,000 domestic wells alone. Due to low pumping rates, the volume of groundwater use by domestic well owners is estimated at 2 percent of the total groundwater volume used in California. The State of California does not regulate water quality in private domestic wells. As a result, many well owners do not have an accurate assessment of their own well water quality.

Domestic well owners are responsible for testing the water quality of their well to know if it is safe for consumption. Domestic wells typically produce very high quality drinking water. However, poor well construction or placement close to a potential source of contamination can result in poor water quality. Chemicals from surface-related activities such as industrial spills, leaking underground fuel tanks, and agricultural applications can impact groundwater. Biological pathogens from sewers, septic systems, and animal facilities can infiltrate into groundwater. Naturally-occurring chemicals can also contaminate groundwater supplies.

Water quality testing results from the Domestic Well Project are compared to existing groundwater information and public supply well data to help assess California groundwater quality and to better identify issues that may impact private domestic well water.

Figure 1: Location of Sampled Domestic Wells



TULARE COUNTY BACKGROUND

Tulare County is part of one of the nation's most productive agricultural regions. The major economic activity in the county is agriculture, and agricultural output from Tulare County alone accounts for approximately 35% of the state's total agricultural economy. With over $3.5 billion in annual agricultural revenues, Tulare County is the most productive county in the United States in terms of revenue. Tulare has been the number one milk-producing county in the United States since 2003.

HYDROGEOLOGIC SETTING

The western half of Tulare County is comprised of flat valley lands of the southern San Joaquin Valley, while rolling foothills associated with the Sierra Nevada Mountains characterize its eastern half. Topography consists of flat valley land, gently rolling foothills, and canyons of the Sierra Nevada Mountains. Water bearing units within Tulare County include younger and older alluvium, flood-basin deposits, lacustrine, marsh and continental deposits. The older alluvium is moderately to highly permeable and is the major aquifer for Tulare County. Regional groundwater flow is generally southwestward; however, pumping can affect local groundwater flow direction.

Tulare County is located within the San Joaquin Valley Groundwater Basin. The California Department of Water Resources (DWR) Bulletin 118 identifies several groundwater subbasins in Tulare County, including the following:

- **Kings Subbasin**: The Kings Subbasin underlies northern Tulare County west of the Sierra foothills. The groundwater system consists of unconsolidated deposits of alluvium, lacustrine sediments, and flood plain deposits. Approximately 17% of the sampled wells were located in the Kings Subbasin.

- **Kaweah Subbasin**: The Kaweah Subbasin underlies central Tulare County west of the Sierra foothills. The major water-bearing units are made up of unconsolidated Pliocene, Pleistocene, and Holocene-age sediments. Continental lacustrine and marsh deposits are found in the western portion of the subbasin, closer to the Tulare Lake bed. Clay beds associated with lacustrine deposits form aquitards that influence the vertical and possibly horizontal movement of local groundwater. The most well-known clay bed is the Corcoran clay, which underlies the western half of the Kaweah Subbasin from 200 to 500 feet below ground surface (bgs). Paleosols or similar oxidized deposits outcrop in the eastern parts of the subbasin closer to the Sierra foothills. The county's population centers of Visalia and Tulare are located within the Kaweah Subbasin. Approximately 44% of the sampled wells were located in the Kaweah Subbasin.

- **<u>Tule Subbasin</u>**: The Tule Subbasin underlies southern Tulare County west of the Sierra foothills. Water bearing deposits in the Tulare Subbasin are comprised of flood-basin deposits, alluvium, the Tulare Formation, and undifferentiated continental sediments deposited during the Pliocene to Holocene. The Tulare Formation contains the Corcoran Clay, which is the major confining unit in the subbasin. Approximately 20% of the sampled wells were located in the Tule Subbasin.

- **<u>Foothills</u>**: The Foothills area is not a DWR-defined basin. It is comprised of wells located east of the valley portion of Tulare County in the higher-elevation. The water bearing unit is generally fractured crystalline rock associated with uplift and emplacement of the Sierra Nevada Mountains. Approximately 19% of the sampled wells were located in the foothills.

In Tulare County, municipal and irrigation wells are typically completed to a total depth of 100 to 500 feet bgs, except for within the Tule Subbasin where well depths range between 200 to 1,400 feet bgs (DWR, 2004). Groundwater recharge in the county occurs through river and stream seepage, percolation of irrigation water, canal seepage, and intentional recharge. Land subsidence of up to 16 feet occurred due to deep compaction of fine-grained units. This subsidence is thought to be due to groundwater withdrawal.

Well Construction Data

The completed depths of wells sampled in Tulare County as part of the Domestic Well Project are shown in Table 1 (well construction data was available for 141 of the 181 sampled wells). The data suggest that the shallow aquifer system provides adequate water supply for domestic use. Over 50% of the wells sampled as part of the Domestic Well Project were completed at a depth less than 200 feet.

Table 1: Domestic Well Depths

GAMA Domestic Well Project, Tulare County Focus Area

Total Well Depth (feet bgs)	**Number of Wells**
0-24	1
25-49	1
50-74	8
75-99	19
100-124	9
125-149	18
150-174	14
175-199	13
200-224	5
225-249	8
250-274	7
275-299	9
300-324	11
325-349	0
350-374	1
375-400	4
400-900	12

Note: Well depth data not available for all wells

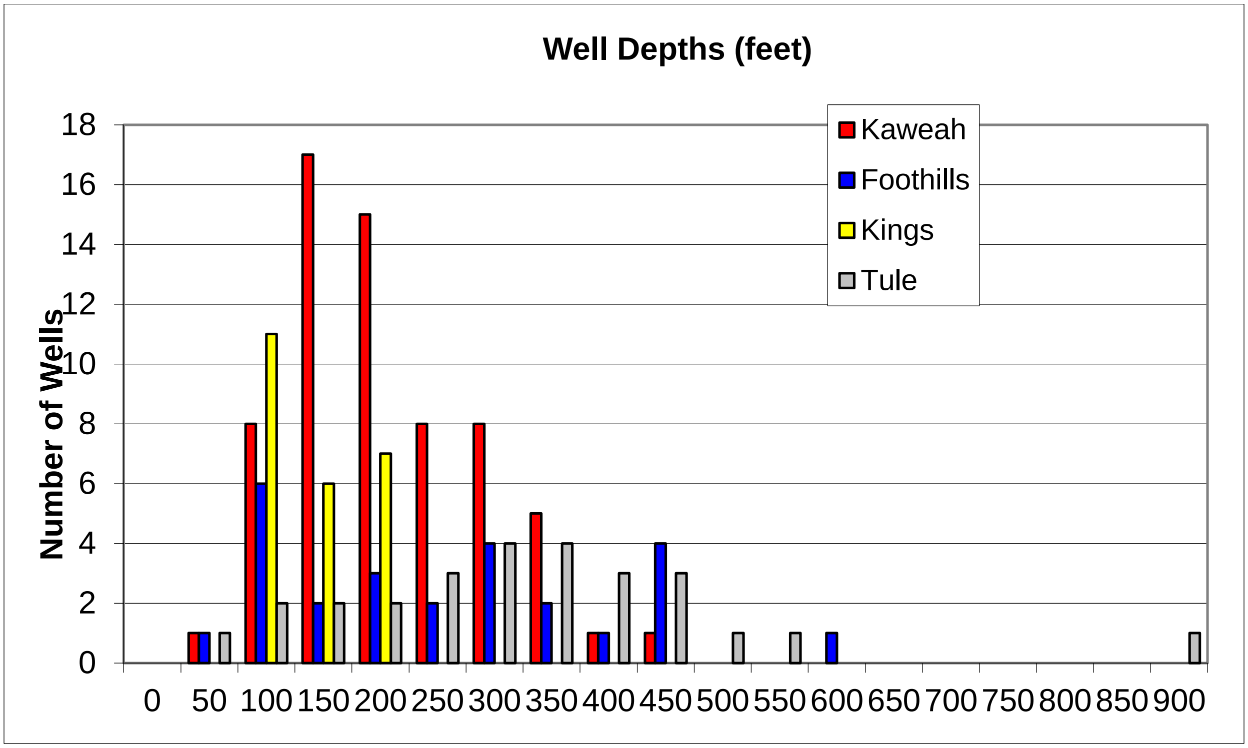


Figure 2: Well Depth Histogram by Subbasin

The depths of wells sampled as part of the Domestic Well Project were grouped by subbasin.

- Wells sampled in the Kaweah Subbasin are generally completed to depths between 100 and 250 feet bgs. However, a significant number of wells in the Kaweah Subbasin are completed at depths greater than 250 feet bgs.

- Wells sampled in the Kings Subbasin are generally completed at shallower depths – all sampled wells are less than 200 feet bgs.

- Wells sampled in the Tule Subbasin are in general deeper than wells drilled in other parts of the county. Approximately 68% of wells sampled in the Tule Subbasin are completed to depths greater than 250 feet bgs, suggesting that either depth to groundwater is greater or that domestic well owners are avoiding shallower groundwater in this subbasin.

- There is no discernable pattern observed in wells sampled in the Foothills area, where both very shallow and very deep wells are observed.

METHODS

Well Selection

Tulare County was selected by GAMA due to the large number of domestic wells within the county and the availability of electronic well owner data. Based on a 1999 survey by the State of California, Department of Finance census, over 20,000 private domestic wells are located in Tulare County. Tulare County is the eighth largest user of domestic well water in California, based upon volume of withdrawals (Figure 3).

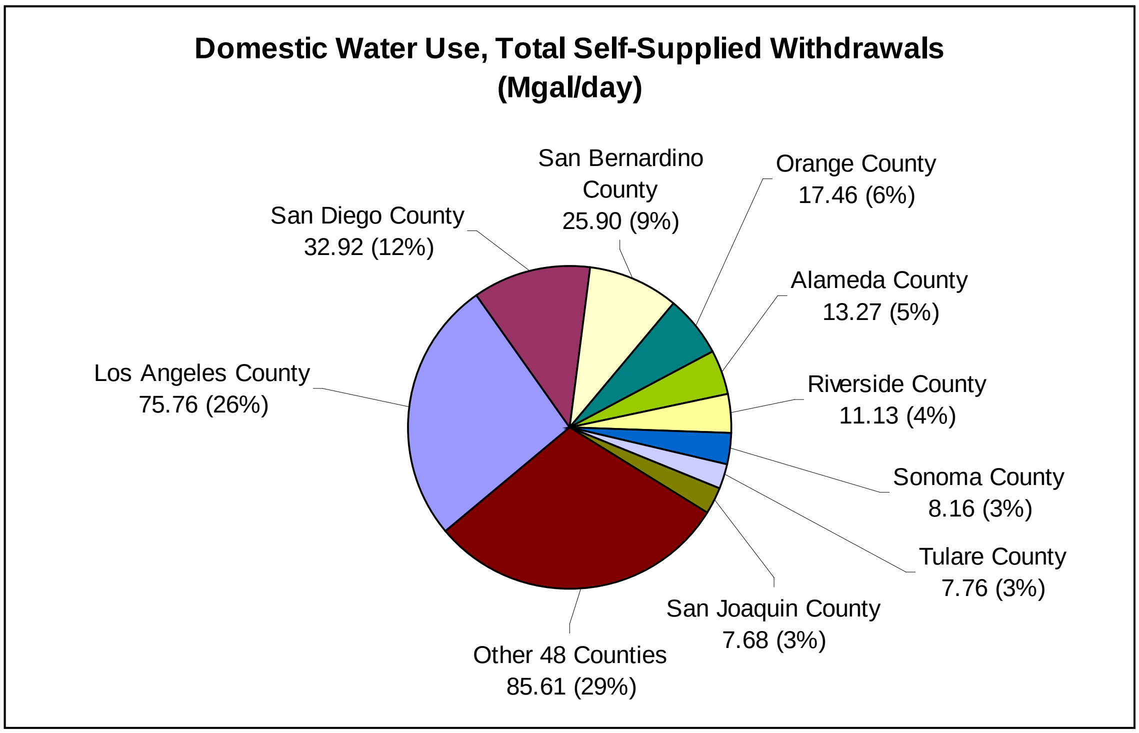


Figure 3: Top 10 California Counties, Volume of Domestic Water Use (USGS, 2000)

The Tulare County Department of Health and Human Services provided GAMA staff with an electronic database containing the names, mailing addresses, and parcel map book numbers of domestic well owners. Approximately 1,500 of these domestic well owners were mailed a brochure in Spanish and English containing information about the GAMA well testing program and inviting them to participate. A total of 181 domestic well owners volunteered to have their well tested.

Sample and Data Collection

Well construction information was obtained from either well owners or well completion reports (well logs). Observations at each well noted the location of nearby septic systems, large-scale agriculture, or livestock enclosures that could result in contamination of the well. Well locations were recorded using a Geographic Positioning Satellite (GPS) unit. Water temperature, pH, and specific electrical conductance were measured and documented in the field.

Groundwater samples were collected as close to the well head as possible. Most often the sample was collected from a faucet or spigot just before or after the pressure tank. New nitrile gloves were worn by field staff during sample collection to minimize contamination during sampling. Samples were collected in laboratory supplied pre-cleaned bottles, and were stored in an iced cooler until delivery to the lab within 24 hours.

Trip blank and duplicate samples were collected at approximately 10 percent of the well locations. These samples are collected and analyzed to help determine if cross contamination was introduced during sample collection, processing, storage, and/or transportation. All trip blank and duplicate data results were within acceptable range criteria.

Sample Analysis

Groundwater samples were analyzed by Delta Environmental Laboratories in Benicia, California for the following:

- Bacteria (total and fecal coliform)
- Inorganic parameters (metals, major anions and general minerals)
- Volatile organic compounds (VOCs)
- Non-routine analytes: radionuclides, pesticides, perchlorate

Selected groundwater samples were also analyzed by LLNL for the following:

- Stable isotopes of oxygen and hydrogen in water
- Stable isotopes of nitrogen and oxygen in nitrate

Stable isotope results are summarized in the report by LLNL, Appendix B.

RESULTS

Detections Above a Drinking Water Standard

There are no Federal or State water quality standards that regulate private domestic well water quality. The Domestic Well Project has compared the test results to the following public drinking water standards: CDPH primary maximum contaminant levels (MCLs), secondary MCLs (SMCLs), and notification levels (NLs). The MCL is the highest concentration of a contaminant allowed in public drinking water. Primary MCLs address health concerns, while secondary MCLs (SMCLs) address aesthetics, such as taste and odor. NLs are health-based advisory levels for chemicals in public drinking water that have no formal regulatory standards.

Analytes that were detected in one or more wells above a drinking water standard:

- Total and Fecal Coliform Bacteria
- Nitrate (NO_3^-)
- Nitrite
- 1,2-Dibromo-3-Chloropropane (DBCP)
- 1,2,3-Trichloropropane
- Gross alpha activity
- Radium 226+228
- Uranium
- Perchlorate
- Arsenic
- Beryllium
- Boron
- Chromium
- Thallium
- Nickel
- Iron
- Aluminum
- Manganese
- Vanadium
- Zinc
- Total Dissolved Solids (TDS)

A summary of all analytes detected above a drinking water standard is outlined in Table 2. Detailed results of the domestic well sampling are summarized below.

Table 2: Summary of Detections Above a Drinking Water Standard

GAMA Domestic Well Project, Tulare County Focus Area, Concentrations Above Public Drinking Water Standards

Total Number of Wells Sampled: 181

Compound	Wells Above a Public Drinking Water Standard		Range of Detected Values Above Public Drinking Water Standards	Public Drinking Water Standards[3]		
	Number	Percentage		MCL	SMCL	NL
Major Ions & General Chemistry						
Nitrate (as N)	72	40%	10.1 - 54 mg/L	10 mg/L		
Perchlorate	2 (of 30 sampled)	6%	7.9 - 13 µg/L	6 µg/L		
Nitrite (as N)	4	2%	1.52 - 4.08 mg/L	1 mg/L		
Total Diss. Solids (TDS)	4	2%	1,002 - 1,052 mg/L		1,000 mg/L	
Metals						
Vanadium	14	8%	50.1 - 42.9 µg/L			50 µg/L
Aluminum	2	1%	275 - 450 µg/L		200 µg/L	
Arsenic	2	2%	10.4 - 14 µg/L	10 µg/L		
Beryllium	1	<1%	113 µg/L	4 µg/L		
Boron	1	<1%	48.4 mg/L			1 mg/L
Chromium	2	1%	76.7 - 91.9 µg/L	50 µg/L		
Iron	2	1%	608 - 650 µg/L		300 µg/L	
Manganese	2	1%	93.5 - 172 µg/L		50 µg/L	
Nickel	3	2%	121 - 213 µg/L	100 µg/L		
Thallium	6	3%	2.11 - 7.32 µg/L	2 µgL		
Zinc	1	<1%	17.3 mg/L		5 mg/L	
Radionuclides						
Gross Alpha	3 (of 13 sampled)	23%	15.1 - 602 pCi/L	15 pCi/L[1]		
Radium 226+228	1 (of 13 sampled)	8%	5.1 pCi/L	5 pCI/L[1]		
Uranium	1 (of 13 sampled)	8%	228 pCi/L	20 pCi/L[1]		
Bacteria Indicators						
Total Coliform	60	33%	NA[2]	Present		
Fecal Coliform	13	7%	NA[2]	Present		
Organic Compounds (Pesticides and VOCs)						
1,2-dibromo 3-chloropropane (DBCP)	8	4%	0.221 - 2.83 µg/L	0.2 µg/L		
1,2,3-trichloropropane	1	<1%	0.8			0.005 µg/L

Notes:

1. pCi/L = picocuries per liter; mg/L = milligrams per liter, or parts per million (ppm); µg/L = micrograms per liter or parts per billion (ppb)
2. Coliform are evaluated on a presence/absence criteria. No range can be determined
3. MCL = California Department of Public Health (CDPH) Primary Maximum Contaminant Level; SMCL = CDPH Secondary Maximum Contaminant Level; NL = CDPH Notification Level

Coliform Bacteria

Total coliform bacteria were detected in 60 wells (33% of total samples). Thirteen of the wells with positive total coliform detections also tested positive for fecal coliform (7% of sampled wells). Figure 4 shows the distribution of total and fecal coliform bacteria detected in sampled domestic wells.

General Minerals

General minerals detected in domestic well samples are summarized in Table 3. General minerals include measures of alkalinity, hardness, and total dissolved solids (TDS). All of the general minerals listed in Table 3, with the exception of foaming agents (MBAS), naturally occur in groundwater. However, human activities can sometimes change the concentrations of these minerals in groundwater.

There are no established regulatory levels for many general mineral analytes; only foaming agents (MBAS), EC, and TDS have SMCLs. MBAS, which are typically associated with the presence of detergents, were not detected at a concentration above the MCL. TDS, which is an estimate of the total concentration of all non-settleable (dissolved) components in water, was detected at concentrations above the SMCL (1,000 mg/L) in four wells.

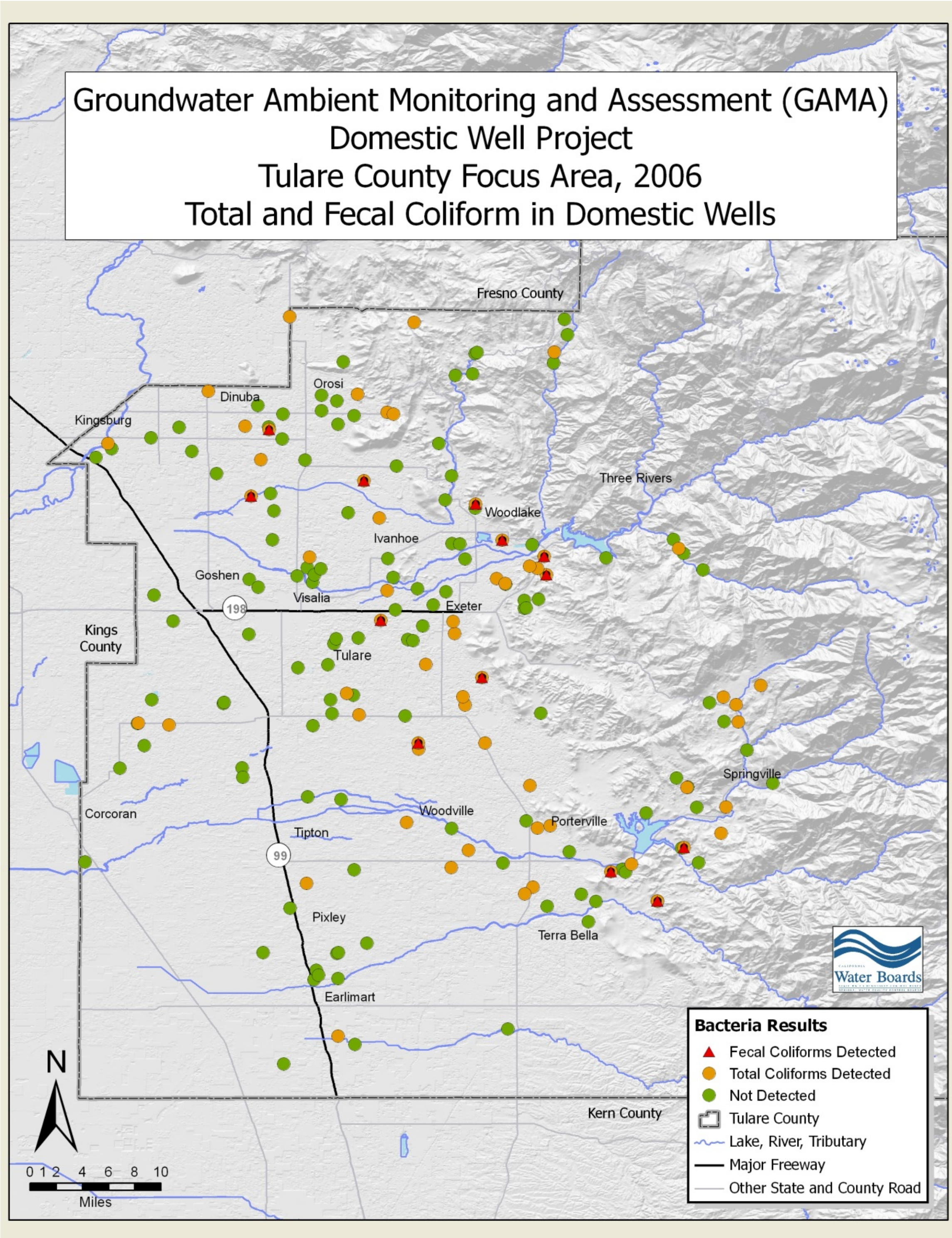
Table 3: General Minerals

GAMA Domestic Well Project, Tulare County Focus Area

Analyte	Range of Detected Values (mg/L)	Public Drinking Water Standard (mg/L)	Number of Wells Above Standard
Total Alkalinity (as $CaCO_3$)	34 - 660	NA	0
Bicarbonate	41 - 805	NA	0
Carbonate	122	NA	0
Calcium	7.92 - 169	NA	0
Magnesium	0.42 - 93.3	NA	0
Potassium	0.35 - 14.1	NA	0
Sodium	230 - 296	NA	0
Foaming Agents (MBAS)	0.06 - 0.07	0.5 (SMCL)	0
Hardness (Total) as $CaCO_3$	19.8 - 608	NA	0
pH, Laboratory	5.48 - 8.39	NA	0
Total Dissolved Solids (TDS)	5.52 – 1,052	1,000 (SMCL)	4

Notes:
1. SMCL = Secondary Maximum Contaminant Level
2. mg/L = milligrams per liter
3. NA = Health or aesthetic standards are not available for this constituent

Figure 4: Total and Fecal Coliform Results



Major Anions

Major anions detected in domestic well samples are summarized in Table 4. Nitrate (NO_3^-), nitrite (NO_2), and perchlorate were detected at concentrations above a drinking water standard. Nitrate was measured as mg/L as N. Nitrate was detected in 173 wells at concentrations ranging from 0.11 to 54 mg/L (as N). Nitrate was detected above the MCL (10 mg/L as N) in 72 wells. The distribution of nitrate in domestic wells is shown on Figure 5. Nitrite was detected in 68 wells, and was detected at concentrations above the MCL (1.0 mg/L) in four wells. Perchlorate was sampled in a smaller subset of wells (30 wells), and was detected above the MCL (0.006 mg/L) in two wells.

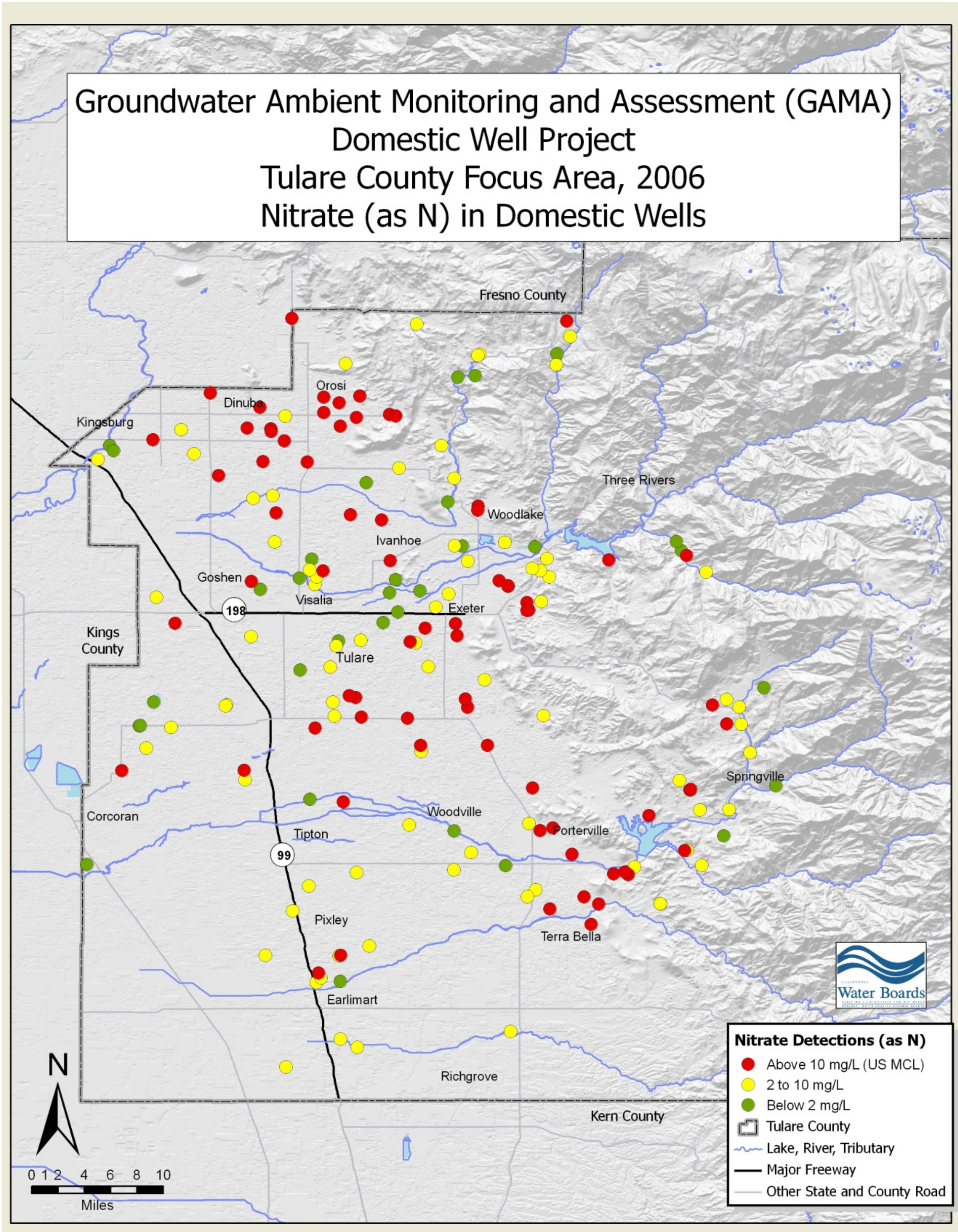
Table 4: Major Anions

GAMA Domestic Well Project, Tulare County Focus Area

Analyte	Range of Detected Values (mg/L)	Public Drinking Water Standard (mg/L)	Number of Wells Above Standard
Chloride	1.1 - 341	500 SMCL	0
Fluoride	0.1- 0.7	2 MCL	0
Nitrate (as N)	0.11 - 54	10 MCL	72
Nitrite (as N)	0.1 - 4.1	1 MCL	4
Perchlorate	0.6 - 13	0.006 MCL	2
Sulfate	2.4 - 220	500 SMCL	0

Notes: MCL = Maximum Contaminant Level, SMCL = Secondary Maximum Contaminant Level. mg/L = milligrams per liter

Figure 5: Nitrate (as N) Results



Metals

Metals detected in domestic well samples are shown in Table 5. Eleven metals (aluminum, arsenic, beryllium, boron, chromium, iron, manganese, nickel, thallium, vanadium, and zinc) were detected at concentrations above a public drinking water standard. A summary of metals detected above a drinking water standard is provided below. The locations of wells with detections of vanadium are shown in Figure 6. The locations of thallium and nickel above a drinking water standard are shown in Figure 7.

- Aluminum was detected in 120 wells at concentrations ranging from 5.85 to 450 µg/L. Aluminum was detected above the SMCL (200 µg/L) in two wells.

- Arsenic was detected in 126 wells at concentrations ranging from 0.1 to 14 µg/L. Arsenic was detected above the MCL (10 µg/L) in two wells.

- Beryllium was detected in one sample at 113 µg/L. This concentration is above the MCL of 4 µg/L.

- Boron was detected in 161 wells at concentrations ranging from 7.8 to 48,400 µg/L. Boron was detected above the NL (1,000 µg/L) in one well.

- Total chromium was detected in 42 wells at concentrations ranging from 2.36 to 91.9 µg/L. Chromium was detected above the MCL (50 µg/L) in two wells.

- Manganese was detected in 149 wells at concentrations ranging from 0.11 to 172 µg/L. Manganese was detected above the SMCL (50 µg/L) in two wells.

- Iron was detected in 44 wells at concentrations ranging from 20.1 to 650 µg/L. Iron was detected above the SMCL (300 µg/L) in two wells.

- Nickel was detected in 55 wells at concentrations ranging from 2.16 to 213 µg/L. Nickel was detected above the MCL (100 µg/L) in three wells.

- Thallium was detected in 25 wells at concentrations ranging from 0.2 to 7.32 µg/L. Thallium was detected above the MCL (2 µg/L) in six wells.

- Vanadium was detected in 165 wells at concentrations ranging from 3.77 to 92.9 µg/L. Vanadium was detected above the NL (50 µg/L) in 14 wells.

- Zinc was detected in 171 wells at concentrations ranging from 1.37 to 17,300 µg/L. Zinc was detected above the SMCL (5 mg/L) in one sample.

Table 5: Metals

GAMA Domestic Well Project, Tulare County Focus Area

Analyte	Range of Detected Values (µg/L)	Public Drinking Water Standard (µg/L)	Number of Wells Above Standard
Aluminum	5.85 - 450	200 SMCL	2
Arsenic	0.1 - 14	10 MCL	2
Barium	1.54 - 495	1,000 MCL	0
Beryllium	113	4 MCL	1
Boron	7.8 – 48,400	1,000 NL	1
Cadmium	1.16	5 MCL	0
Chromium (Total)	0 - 91.9	50 MCL	2
Copper	1.1 - 60.6	1,000 SMCL	0
Iron	20.1 - 650	300 SMCL	2
Lead	0.11 - 6.48	15 NL	0
Manganese	0.11 - 172	50 SMCL	2
Nickel	3.16 - 213	100 MCL	3
Selenium	0.11 - 1.55	50 MCL	0
Silver	33.6	100 SMCL	0
Thallium	0.2 - 7.32	2 MCL	6
Vanadium	0.2 92.9	50 NL	14
Zinc	1.37 - 17,300	5,000 SMCL	1

Notes:

1. MCL = Maximum Contaminant Level, SMCL = Secondary Maximum Contaminant Level, NL = Notification level
2. µg/L = micrograms per liter

Figure 6: Vanadium Results

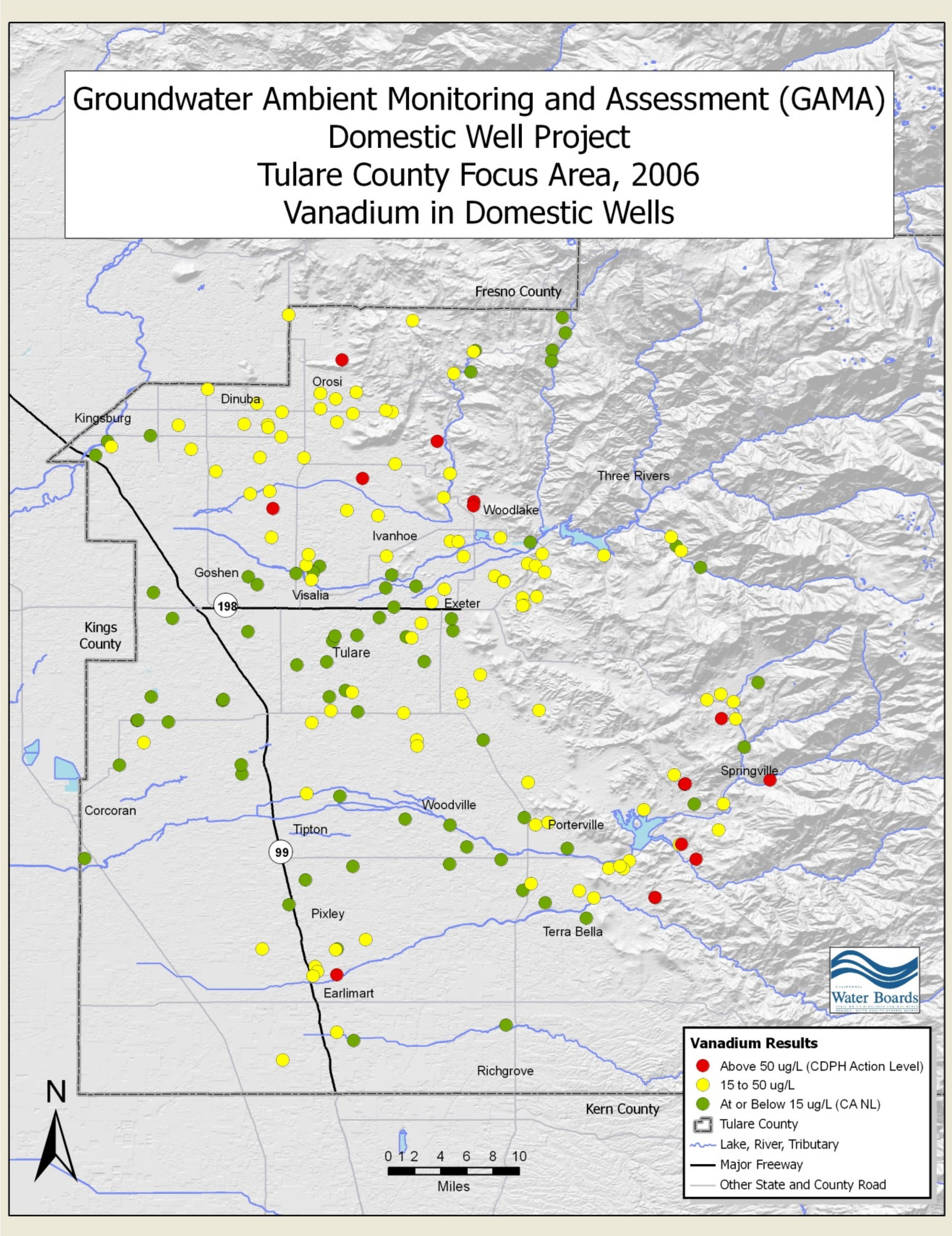
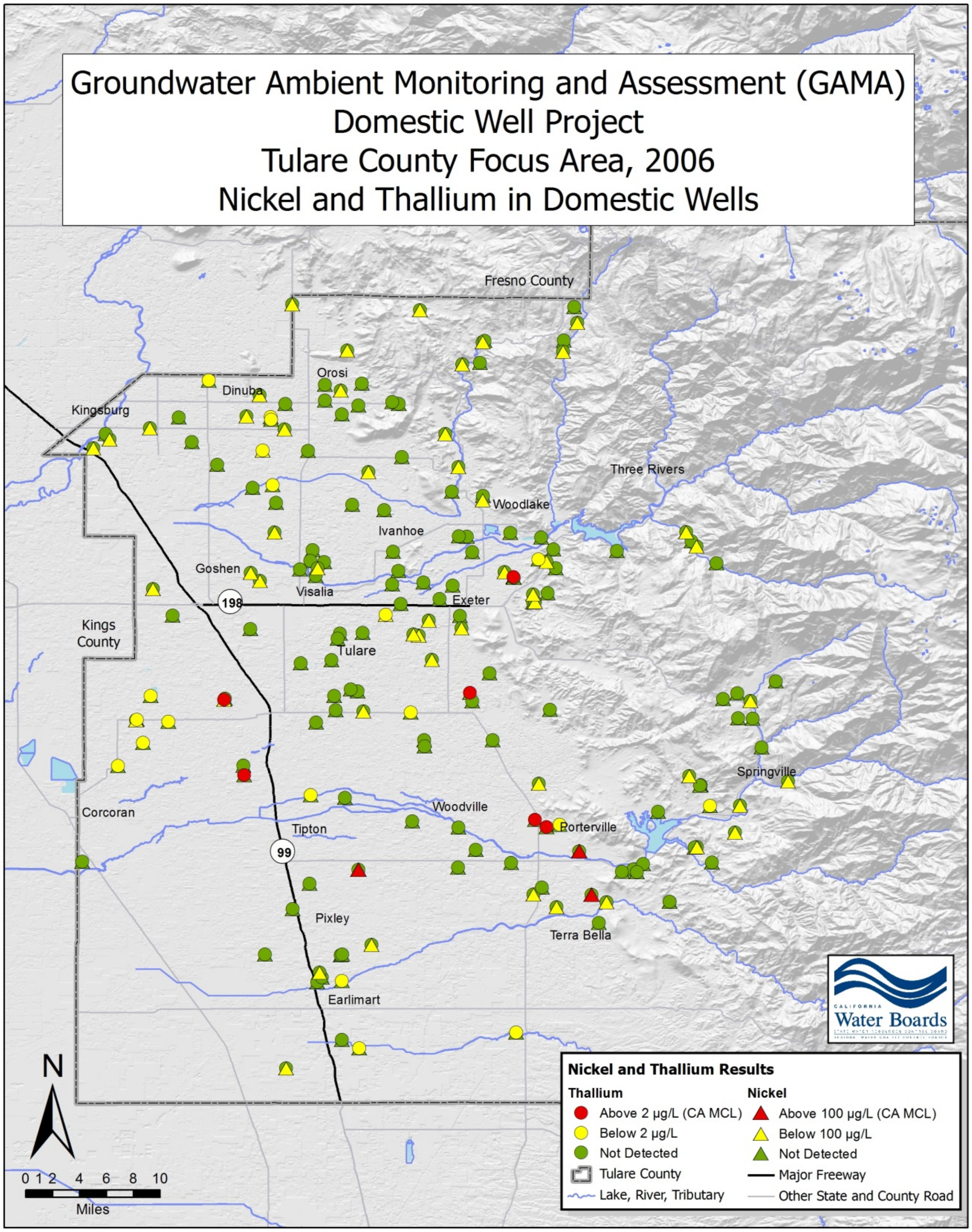


Figure 7: Thallium and Nickel Results



Radionuclides

Thirteen domestic wells were selected for radionuclide analyses. Test results are shown in Table 6. Radionuclide analyses included gross alpha particle activity, gross beta particle activity, combined radium (the activity of radium-226 and radium-228), tritium, and uranium. Drinking water standards for radionuclides are in picocuries per liter (pCi/L) or millirems per year (millirem/yr). A curie is the radioactivity associated with one gram of radium – a picocurie is one trillionth of a curie. The gross beta activity drinking water standard is in terms of millirems per year. A 'rem' is a unit of measure describing how a specific type of radiation damages biologic tissue. A millirem is one thousandth of a rem. There is no simple conversion between a curie and a rem. Gross beta activity previously had an MCL of 50 pCi/L, which was replaced by the 4 millirem/yr standard. Gross beta activity of 50 pCi/L is still used as a trigger for additional testing by CDPH. A summary of radionuclide test results is included below. The locations of wells sampled for uranium, gross alpha activity, and radium (226+228) is shown in Figure 8.

- Gross alpha activity was detected in all thirteen sampled wells at activities ranging from 2.8 to 602 pCi/L. Gross alpha activity was above the MCL (15 pCi/L) in three wells.

- Gross beta activity was detected in twelve of the thirteen sampled wells, with activities ranging from 2.8 to 7.15 pCi/L. None of the gross beta activities were above the NL of 50 pCi/L.

- Combined radium (radium 226+228) activity was detected in nine of thirteen wells at activities ranging from 0.71 to 5.2 pCi/L. Radium activity was above the MCL (5 pCi/L) in one well.

- Tritium activity was detected in ten of thirteen sampled wells at activities ranging from 181 to 1,264 pCi/L. None of the wells were above the MCL (20,000 pCi/L).

- Uranium activity was detected in all thirteen sampled wells at activities ranging from 2.15 to 228 pCi/L. Uranium activity was above the MCL (20 pCi/L) in one well.

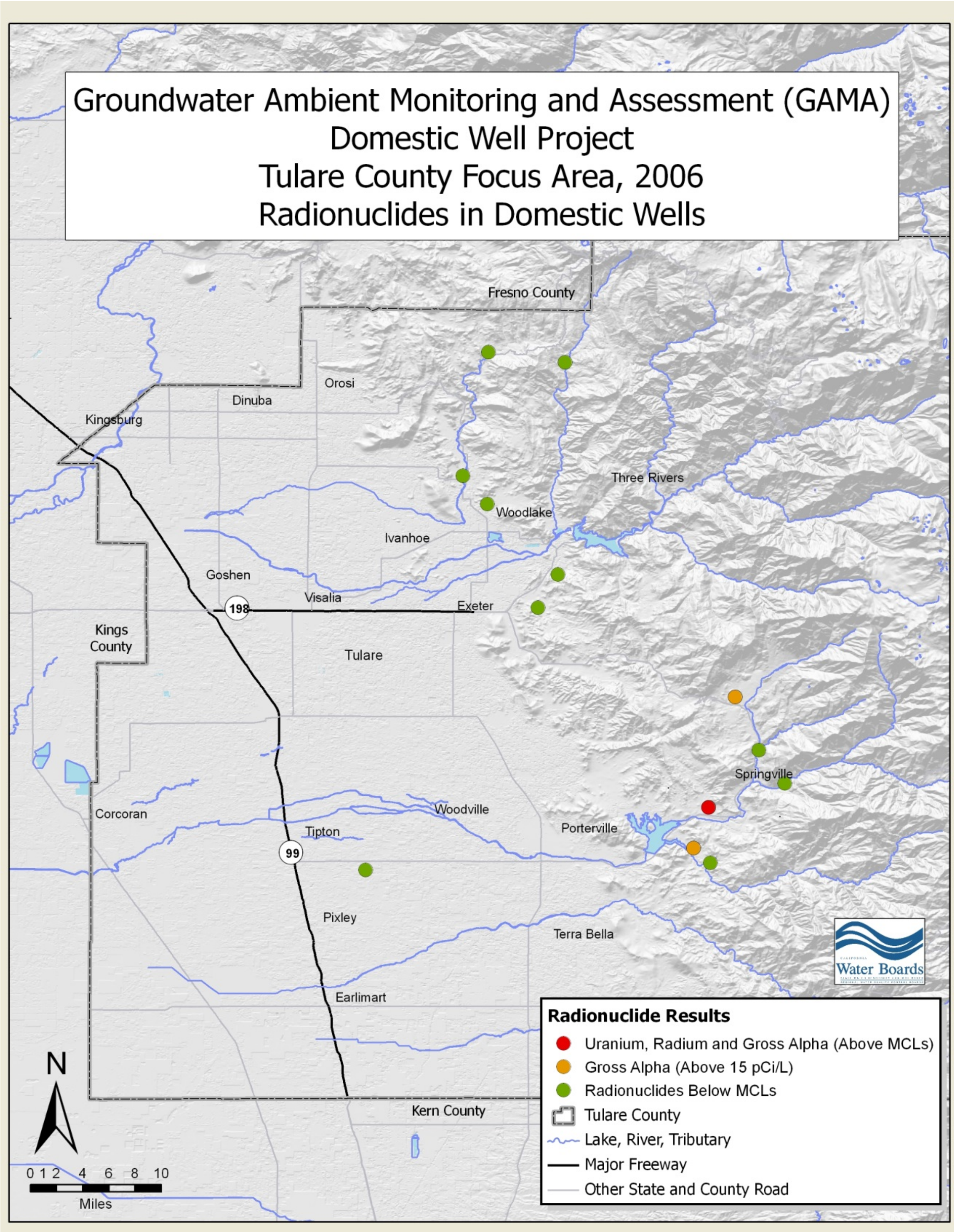
Table 6: Radionuclides

GAMA Domestic Well Project, Tulare County Focus Area

Analyte	Range of Detected Values (pCi/L)	Public Drinking Water Standard (pCi/L)	Number of Wells Above Standard
Gross alpha	2.8 - 602	15 MCL	3
Gross beta	2.8 - 7.15	50 NL 4 milirem/yr MCL	0
Radium 226+228	0.71 - 5.2	5 MCL	1
Tritium	181 – 1,264	20,000 MCL	0
Uranium	2.15 - 228	20 MCL	1

Notes: MCL = Maximum Contaminant Level. pCi/L = picocurie per liter. milirem/yr = milirems per year

Figure 8: Radionuclides (Gross Alpha, Radium 226+228, and Uranium)



Pesticides

Pesticides have been used on crops for decades to maintain high production and prevent loss.

Historically, 1,2-dibromo-3-chloropropane (DBCP) has been detected in groundwater in the San Joaquin Valley at concentrations greater than the MCL. All 181 samples were analyzed for DBCP, EDB and 1,2,3-TCP using EPA method E504.1. Only DBCP was detected using this method; the locations of wells with detections of DBCP are shown in Figure 9.

Eighteen selected domestic well samples were also tested by LLNL for additional pesticides and pesticide degradates using California Department of Food and Agriculture (CDFA) method EMON-SM-62.9. Results are displayed on Figure 10 and detailed in the table shown in Appendix A. Prometon, metribuzin, and prometryn were not detected in any of the wells selected for pesticide testing. All pesticides, with the exception of DBCP, were detected at concentrations less than established drinking water standards. Pesticide compounds were detected as follows:

Analyzed in all 181 wells:

- DBCP was detected in 27 wells at concentrations ranging from 0.01 to 1.63 µg/L. Concentrations of DBCP were above the MCL of 0.2 µg/L in eight wells.

Analyzed in 18 selected wells by LLNL (CDFA Method):

- Hexazinone was detected in one sample at a concentration of 0.027 µg/L.
- Metolachlor was detected in one sample at a concentration of 0.077 µg/L.
- Cyanazine was detected in two samples, both at concentrations of 0.012 µg/L.
- Atrazine was detected in three wells at concentrations ranging from 0.012 to 0.037 µg/L.
- Deisopropyl-atrazine (DIA was detected in eleven wells at concentrations ranging from 0.016 to 0.732 µg/L.
- Diaminochlorotriazine (DACT) was detected in five wells at concentrations ranging from 0.031 to 0.099 µg/L.
- Deethyl-atrazine (DEA) was detected in six wells at concentrations ranging from 0.012 to 0.050 µg/L.

- Diuron was detected in nine wells at concentrations ranging from 0.011 to 0.750 µg/L.

- Simazine was detected in ten wells with concentrations ranging from 0.011 to 0.158 µg/L.

- Bromacil was detected in eight wells at concentrations ranging from 0.016 to 1.021 µg/L.

- Norflurazon was detected in five wells at concentrations ranging from 0.022 to 1.390 µg/L.

- Desmethyl Norflurazon (a degradate of norflurazon) was detected in four wells at concentrations ranging from 0.093 to 0.323 µg/L

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In addition to pesticides, LLNL detected primidone at concentration of 0.067µg/L. This was confirmed in a duplicate sample at 0.070µg/L. Primodone is a pharmaceutical (anticonvulsant), and may indicate a connection between septic leachate and groundwater.

Table 7: Pesticides

GAMA Domestic Well Project, Tulare County Focus Area

Analyte	Range of Detected Values (µg/L)	Public Drinking Water Standard (µg/L)	Number of Wells Above Standard	Wells Sampled/Detection
DBCP	0.01 - 1.63	0.2 MCL	8	181/28
Diuron	0.011 - 0.750	NA	0	18/9
DACT	0.031 - 0.099	NA	0	18/5
DIA	0.016 - 0.732	NA	0	1812
DEA	0.012 - 0.050	NA	0	18/7
Prometon	Not Detected	NA	0	18/0
Simazine	0.011 - 0.158	4 MCL	0	18/11
Atrazine	0.012 - 0.037	1 MCL	0	18/4
Metribuzin	Not Detected	NA	0	18/0
Prometryn	Not Detected	NA	0	18/0
Bromacil	0.016 - 1.021	NA	0	18/8
Cyanazine	0.012	NA	0	18/2
Hexazinone	0.027	NA	0	18/1
Primidone*	0.070	NA	0	18/1
Metolachlor	0.077	NA	0	18/1
Norflurazon	0.022 - 1.390	NA	0	18/5
Desmethyl Norflurazon	0.093 - 0.323	NA	0	18/4

Notes: NA = Not Available
Public Drinking Water Standards are not available for all chemicals
MCL = Maximum Contaminant Level
µg/L = micrograms per liter
*= Primidone is a pharmaceutical

Figure 9: DBCP Results

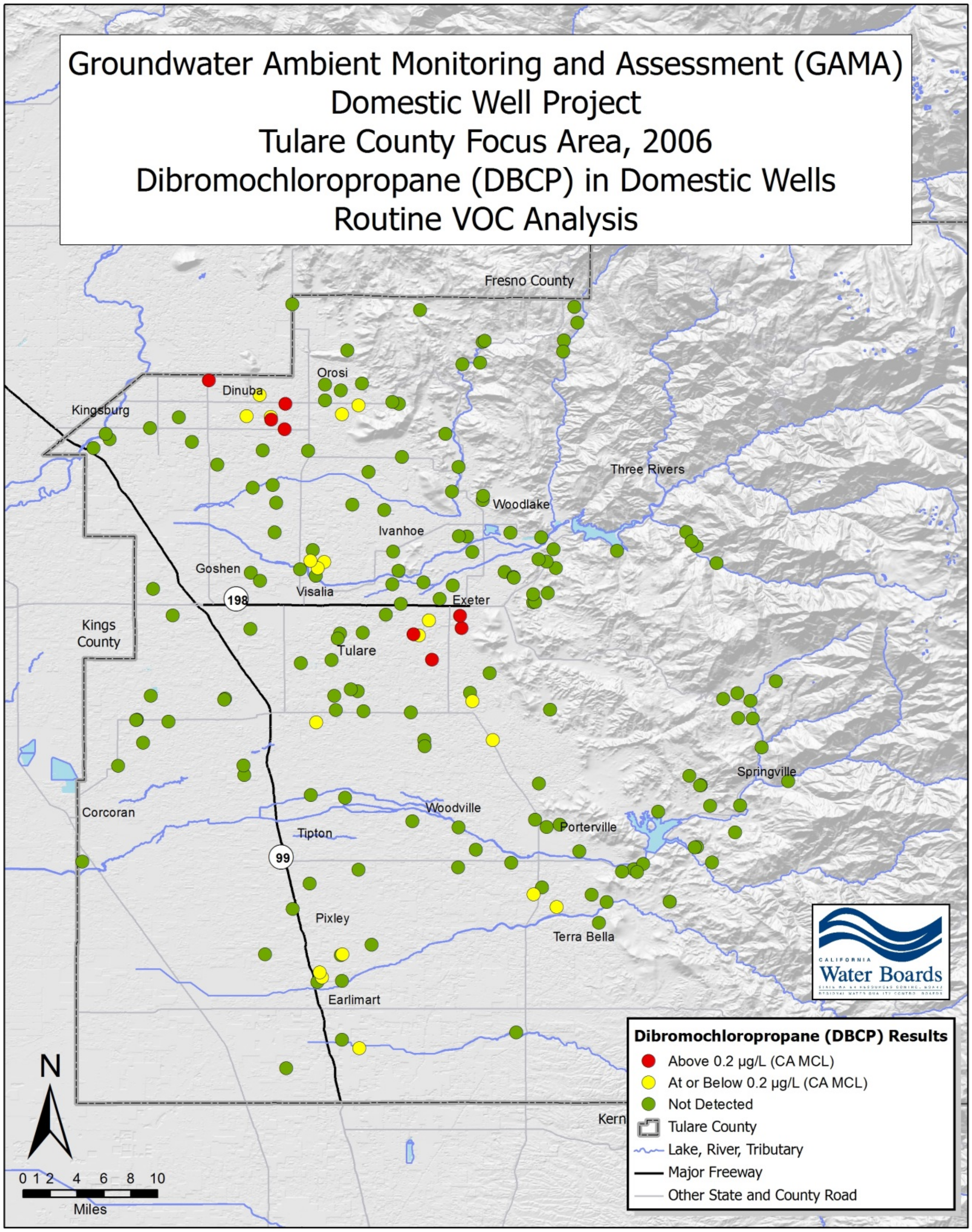
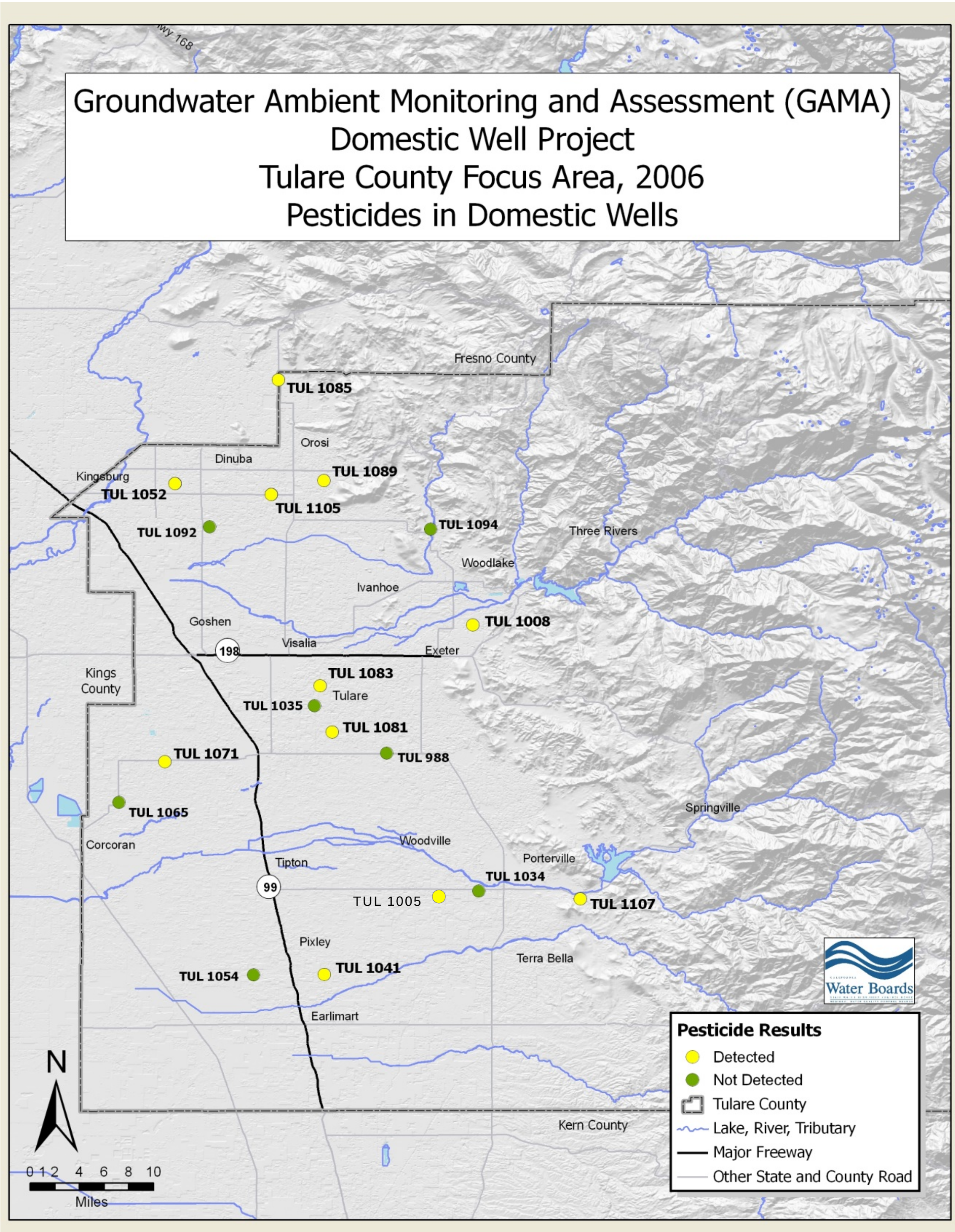


Figure 10: Pesticide Results (LLNL Analysis)



Volatile Organic Compounds

Volatile Organic Compounds (VOCs) detected in domestic wells are summarized in Table 8. Dozens of VOCs were tested including benzene, toluene, ethylbenzene and xylenes. For a full list of analytes see table 8. A single VOC, 1,2,3-Trichloropropane was detected above a public drinking water standard (NL) in wells sampled as part of the Domestic Well Project. Low-level concentrations, below public drinking water standards, of six additional VOCs were detected.

- 1,1-Dichloroethane at a concentration of 0.6 µg/L in one well
- 1,2,3-Trichloropropane at a concentration of 0.8 µg/L in one well. This concentration is above the NL (0.005 µg/L).
- Chloroform at concentrations ranging from 0.7 to 15.8 µg/L in five wells
- Chloromethane at a concentration of 1 µg/L in one well
- N-butylbenzene at a concentration of 0.2 µg/L in one well
- Tetrachloroethene (PCE) at a concentration of 2.33 µg/L in one well
- Toluene at a concentration of 22 µg/L in one well

Table 8: VOCs

GAMA Domestic Well Project, Tulare County Focus Area

Analyte	Range of Detected Values (µg/L)	Public Drinking Water Standard (µg/L)	Number of Wells Above Standard
1,1-Dichloroethane	0.6	5 MCL	0
1,2,3-Trichloropropane	0.8	0.005 NL	1
Chloroform	0.7 - 15.8	80 MCL	0
Chloromethane	1.0	NA	0
n-butylbenzene	0.2	260 NL	0
Tetrachloroethene (PCE)	2.33	5 MCL	0
Toluene	22	150 MCL	0

Notes:
1. MCL = Maximum Contaminant Level , NL = Notification Level
2. µg/L = micrograms per liter
3. NA = Public drinking water standards are not available for this constituent

Isotopic Data Results

LLNL's data of stable isotope compositions of oxygen (O) and hydrogen in water show that private domestic wells in the Sierra foothills above an elevation of 400 feet mean sea level receive groundwater recharge derived from local precipitation that has experienced some evaporation. In contrast, Central Valley private domestic wells below an elevation of 400 feet mean sea level draw on groundwater heavily affected by irrigation from Kings and Kaweah River source water, as indicated by water isotopic composition.

Measured nitrate isotopic composition in the wells sampled varies with land use (dairies, agricultural/residential, and natural settings). Dairy nitrate-N (nitrogen) isotopic compositions are consistent with a manure source. Nitrate-O isotopic compositions are consistent with local nitrification of ammonium from manure, septic effluent, and/or synthetic ammonium fertilizer. In similar hydrogeologic settings, private domestic wells located close to dairies frequently have a different nitrate isotopic composition than wells distant from dairies. The isotopic compositions measured in wells distant from dairies are consistent with suspected sources of nitrate such as soil, fertilizer, manure, septic and/or community wastewater. Regardless of land-use, high concentrations of nitrate were detected in wells located in every land use category that has been developed.

Detailed description of data and methodology are described in the LLNL report, Appendix B.

POSSIBLE SOURCES OF CHEMICALS IN GROUNDWATER

Twenty one constituents were detected above water quality standards in the Tulare County Focus Area. Five of these constituents were observed in more than five percent of the sampled wells. Potential sources for these constituents, summarized from groundwater collected across the country, are discussed below. The focus of this sampling was not to pinpoint a source of chemicals found in groundwater, and the source descriptions do not imply that a chemical observed in a domestic well comes from any single, specific source. The summaries are provided as information for well owners. Additional information for domestic well owners is available on the GAMA website at: http://www.waterboards.ca.gov/gama/wq_privatewells.shtml

Nitrate

Nitrate is commonly found in groundwater. Low levels of nitrate may be natural in origin; however, high concentrations of nitrate are generally related to fertilizer production and application, septic systems, agricultural and animal waste ponds, leaking sewer lines, sludge or manure application, and the production of explosives. The most significant health threat associated with nitrate is associated with methemoglobinaemia (“blue baby” syndrome). Toxic effects occur when bacteria in an infant’s stomach convert nitrate to more toxic nitrite, interfering with the body’s ability to carry oxygen. High nitrate levels are also a health risk for pregnant women. Some studies suggest an association between high nitrate in drinking water and certain types of cancers (Weyer et al., 2001).

Coliform Bacteria

Total coliform bacteria are naturally present in the environment, and in general are harmless to people. However, some coliforms may cause illness in humans, and the presence of coliforms is an indication that other micro-organisms may be present. Fecal coliforms are found in human and animal wastes and, when present, indicate contamination. Drinking water that contains coliform bacteria increases the risk of becoming ill. Well owners should not drink water with fecal coliform in it.

Vanadium

Vanadium enters the environment from natural sources and from the burning of fossil fuels. It is generally considered a naturally-occurring element in groundwater although some industrial activities, such as mining, may result in increased groundwater concentrations. The health effects of ingesting high doses of vanadium are relatively unknown. Some animals that have ingested vanadium over a long time have developed minor kidney and liver damage, while ingestion of high levels of vanadium by pregnant animals has resulted in minor birth defects.

Radionuclides

Radionuclides are a natural component of groundwater, and are naturally present, typically at very low levels. Most radiation detected in groundwater is the result of interactions with natural geologic materials that contain trace levels of radioactive elements. Different radionuclides will interact and damage biologic activity differently – as a result, some constituents have greater or lower MCLs than others. Drinking water with concentrations of radionuclides above a public drinking water standard increases the risk of certain types of cancers.

DBCP

DBCP was used as a soil fumigant to control nematodes. Prior to 1979, DBCP was widely applied to over 40 types of crops. In California, DBCP was primarily used on grapes and tomatoes. DBCP was banned in the continental United States in 1979. However, DBCP travels easily in groundwater and may persist in groundwater for long periods of time. In sunlight, DBCP is rapidly degraded. Data collected on workers involved in manufacturing DBCP has shown that

DBCP can cause sterility or other reproductive effects at very low levels of exposure. There is some evidence that DBCP may have the potential to cause cancer with lifetime exposure at levels above the MCL.
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Appendix A: LLNL Pesticide and Pharmaceutical Results (Part 1 of 2)

Well ID	Diuron	DACT	DIA	DEA	Prometon	Simazine	Atrazine	Metribuzin	Prometryn	Bromacil	Cyanazine	Norflourazon	Hexazinone
MDL(µg/L)	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
TUL1005	0.045	ND	0.016	ND	ND	0.011	ND	ND	ND	ND	ND	1.390	ND
TUL1008	0,750	0.099	0.732	0.022	ND	0.065	ND	ND	ND	1.021	ND	0.053	ND
TUL1034	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TUL1035	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TUL1041	0.226	0.031	0.400	0.014	ND	0.100	ND	ND	ND	0.590	ND	ND	ND
TUL1043	ND	ND	0.025	0.031	ND	0.011	0.022	ND	ND	ND	ND	ND	ND
TUL1052*	ND	ND	0.055	0.050	ND	0.023	0.037	ND	ND	0.016	0.012	ND	ND
TUL1054	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TUL1065	0.498	ND	0.174	0.020	ND	0.062	0.017	ND	ND	0.060	ND	ND	0.027
TUL1071	0.011	0.049	0.620	ND	ND	ND	ND	ND	ND	0.053	ND	ND	ND
TUL1081	ND	ND	0.113	ND	ND	0.054	ND	ND	ND	ND	ND	0.019	ND
TUL1083	0.548	ND	0.130	ND	ND	0.155	ND	ND	ND	ND	ND	ND	ND
TUL1085	0.041	0.054	0.499	ND	ND	0.094	ND	ND	ND	0.054	ND	ND	ND
TUL1089	0.464	0.065	0.650	0.012	ND	0.048	ND	ND	ND	0.757	ND	0.155	ND
TUL1092	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TUL1094	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TUL1105	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TUL1107	0.050	ND	0.419	0.027	ND	0.158	0.012	ND	ND	0.772	0.012	0.022	ND
TUL988	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:
All results reported in micrograms per liter (µg/L, parts per billion)
MDL = Method Detection Limit
ND = Non-Detect, reported as below MDL
*Duplicate of TUL1043

Appendix A: LLNL Pesticide Results (Part 2 of 2)

Well ID	Desmethyl Norflurazone	DBCP	Metolachlor	Primidone**
MDL (µg/L)	0.010	0.010	0.010	0.040
TUL1005	ND	ND	ND	ND
TUL1008	0.202	ND	0.077	ND
TUL1034	0.093	ND	ND	ND
TUL1035	ND	ND	ND	ND
TUL1041	ND	ND	ND	ND
TUL1043	ND	ND	ND	0.067
TUL1052*	ND	ND	ND	0.070
TUL1054	ND	ND	ND	ND
TUL1065	ND	ND	ND	ND
TUL1071	ND	ND	ND	ND
TUL1081	0.210	ND	ND	ND
TUL1083	ND	ND	ND	ND
TUL1085	ND	ND	ND	ND
TUL1089	0.323	ND	ND	ND
TUL1092	ND	ND	ND	ND
TUL1094	ND	ND	ND	ND
TUL1105	ND	0.221	ND	ND
TUL1107	ND	ND	ND	ND
TUL988	ND	ND	ND	ND

Notes:
All results reported in micrograms per liter(µg/L, parts per billion)
MDL = Method Detection Limit
ND = Non-Detect, reported as below MDL
*Duplicate of TUL1043
**Primidone is a pharmaceutical (anticonvulsant), indicating a possible septic system impact

Appendix B: Nitrate and Water Isotopic Data for Tulare County (LLNL report, January 2011)

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LLNL-TR-450497

California GAMA Domestic Wells: Nitrate and Water Isotopic Data for Tulare County

Michael J. Singleton, Sarah K. Roberts, Jean E. Moran and Bradley K. Esser

Lawrence Livermore National Laboratory

January 2011
August 2013 revised

Final Report for the California State Water Resources Control Board

GAMA Special Studies Task 7.2:
Specialized Analyses for GAMA Domestic Wells

Auspices Statement

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GAMA: AMBIENT GROUNDWATER MONITORING & ASSESSMENT PROGRAM SPECIAL STUDY

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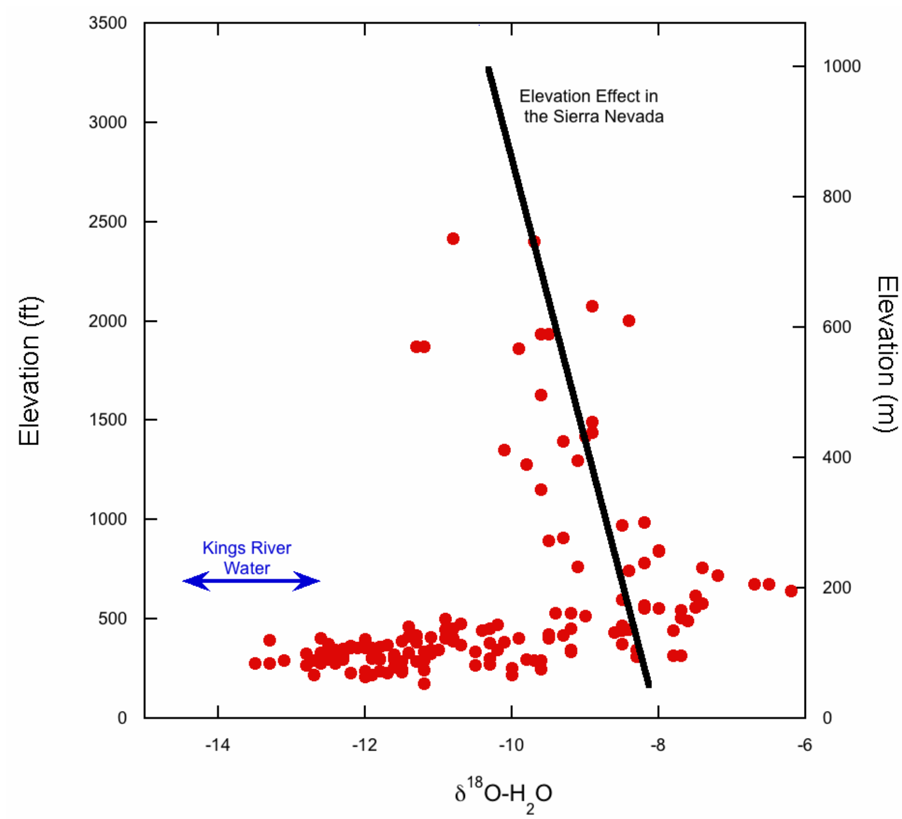

Final Report for GAMA Special Studies Task 7.2
Specialized Analyses for GAMA Domestic Wells
LLNL-TR-450497

Prepared in cooperation with the California
State Water Resource Control Board
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California GAMA Domestic Wells: Nitrate and Water Isotopic Data for Tulare County

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Prepared in cooperation with the California State Water Resource Control Board

Introduction and Executive Summary

The Groundwater Ambient Monitoring and Assessment (GAMA) Program is a comprehensive groundwater quality monitoring program managed by the California State Water Resources Control Board (SWRCB). The goals of the GAMA Domestic Well Project are to provide specific information on water quality to domestic well owners, to provide a public outreach component to aid the public in understanding water quality issues affecting domestic water wells, and to help assess California groundwater quality and identify issues that may impact private domestic well water. The State Water Board works with local county agencies and Regional Water Boards to arrange sampling, which is voluntary and at no cost to the well owner. Results are shared with the well owners and used by GAMA to evaluate the quality of groundwater used by private well owners, which is largely unknown in the State of California. Lawrence Livermore National Laboratory performs specialized analyses of domestic well groundwater for the SWRCB.

In 2006, the Domestic Well Project sampled wells in Tulare County. LLNL analyzed 151 of the 181 domestic well water samples collected by the SWRCB for stable isotopes of oxygen and hydrogen in water; and analyzed 29 samples for stable isotopes of nitrogen and oxygen in dissolved nitrate. These isotopic data constrain the source of water recharging the groundwater produced by the domestic wells in this survey, and help to constrain the source of nitrate in these groundwaters.

For the purpose of discussion, wells with ground surface elevations below 400 feet are referred to as “valley” wells, and wells with ground surface elevations above 400 feet are referred to as “foothill” wells. The water isotopic evidence shows that domestic wells in the foothills (with elevations above 400 feet) receive recharge derived from local precipitation that has experienced some evaporation. In contrast, valley domestic wells below 400 feet surface elevation draw on groundwater heavily impacted by irrigation with Kings and Kaweah River water, as indicated by water isotopic composition. This finding is consistent with both the long and heavy usage of Kings River water for irrigation in this area, and with the assumed shallow depth of these domestic wells. Nitrate associated with these waters is presumably associated with the same source (chemical or organic fertilizer in irrigation water) or is mobilized by irrigation (septic effluent or soil nitrogen compounds).

Foothill and valley domestic wells in Tulare County differ in dissolved nitrate concentration (SWRCB, 2010). In general, foothill wells have low nitrate concentrations, while valley wells have moderate to high nitrate concentrations. Nitrate concentrations in the most polluted wells are sufficiently high to preclude a significant contribution from soil or atmospheric sources. Such sources cannot be precluded in wells with nitrate concentrations below the regulatory drinking water limit, however the data set does not include enough samples near typical background concentration levels to assess the isotopic characteristics of natural nitrate sources in this area.

Nitrate isotopic compositions indicate a dairy manure or septic effluent source for the majority of the most heavily impacted wells, with the exception of one well with high nitrate concentration and an isotopic composition indicative of a synthetic fertilizer source. For less heavily impacted wells, the sparse nitrate isotopic data alone does not definitively constrain the nitrate source. The observed pattern could be produced by a single source (natural soil N) or by mixing between multiple sources (fertilizer, manure, septic). An analysis of land use and the distribution of potential nitrate sources would be extremely useful.

A preliminary investigation of the correlation between land use and nitrate isotopic composition was conducted (see Appendix "GAMA Domestic Well Project - Tulare County. Nitrate Source Attribution: The Isotopic Evidence"). The sparse nitrate isotopic data set, and the cursory approach to assigning land use limit conclusions, but patterns observed are suggestive of multiple anthropogenic sources, including dairy wastewater, septic effluent and synthetic fertilizer.

Significant findings of the study are listed below:

- Nitrate isotopic composition appears to vary with land use
  - Dairy, agricultural/residential, and wild-land sites are isotopically distinct
  - Dairy site nitrate-N isotopic data are isotopically consistent with a manure source
  - Nitrate-O isotopic data are isotopically consistent with local nitrification of ammonium (from manure, septic effluent, or synthetic ammonium fertilizer)
- The isotopic evidence is consistent with more than one nitrate source
  - Domestic wells located close to dairies frequently have a different nitrate isotopic composition than wells not close to dairies in similar hydrogeologic settings.
  - The isotopic compositions measured are consistent with the suspected sources of nitrate to these wells (soil, fertilizer, manure, septic or community wastewater).
  - High concentrations of nitrate occur in all developed land use categories.

Suggested citation:
Singleton, M.J., Roberts, S.R., Moran, J.E.and Esser, B.K. 2011. California GAMA Domestic Wells: Nitrate and Water Isotopic Data for Tulare County, LLNL-TR-450497, 34 pages

Sampling Protocols and Analytical Methods

SAMPLE HANDLING

Sampling and handling requirements, including hold times, are listed in Table 1. Groundwater samples for the project were collected by State Water Resources Control Board. Samples for specialized analyses were collected following guidance provided by LLNL. When possible, wells were purged by pumping at least three (3) well casing volumes were pumped prior to collecting the water sample. Samples collected for determination of nitrate and water stable isotope composition do not require filtering.

Stable isotopes of water: A 30-mL glass bottle (clear, French-square type) with Qorpak™ polyseal-lined cap is triple rinsed with water directly from the sampling port, then filled just below the threads on the bottle. Filtering, preservatives and/or refrigeration are not required, but the cap should be tightly closed. Samples may be shipped at room temperature or in a cooler with ice, and are stored at room temperature.

Stable isotopes of nitrate: Either a 50-mL polyethylene centrifuge tube or a small (60-mL or 125-mL) HDPE bottle is triple rinsed with water directly from the sampling port, then filled with approximately 40-mL of sample water leaving sufficient head space to accommodate freezing.

Shipping and preservation: During field sampling, samples were shipped to LLNL by next-day service within three days of collection. Upon arrival at LLNL, samples were logged with both the supplied GAMA Domestic Wells Project ID and with a unique LLNL ID and preserved appropriately. Water Board staff also supplied LLNL with nitrate concentration data for collected samples to allow appropriate aliquoting for nitrate isotopic composition analysis. For samples collected for nitrate isotopic composition determination, a small aliquot was taken for confirmation of nitrate concentration by ion chromatography as necessary and the remainder of the sample was frozen. Samples collected for determination of water isotopic composition were stored at room temperature with a tightly sealed cap.

Table 1: Sampling and Handling Requirements for Stable Isotope Analysis

Determination	Container	Min. sample size (mL)	Preservation	Recommended Hold	Regulatory hold
Nitrate $\delta^{18}O$ and $\delta^{15}N$	Plastic	30 mL	Refrigerate at 6°C or freeze	6 months after thawing	Not applicable
Water $\delta^{18}O$ and $\delta^{2}H$	Glass	30 mL	None	1 year	Not applicable

STABLE ISOTOPE TERMINOLOGY AND REPORTING

Isotopic composition is determined by measuring the atom ratio of a minor abundance isotope to a major abundance isotope. For oxygen, the ratio measured is $^{18}O/^{16}O$, i.e. the atom ratio of Oxygen-18 to Oxygen-16. Oxygen-18 is a minor isotope of oxygen (approximately 0.2% of oxygen isotopes are ^{18}O), while Oxygen-16 is the major isotope of oxygen (approximately 99.76% of oxygen isotopes are ^{16}O).

For hydrogen, the ratio measured is $^2H/^1H$, i.e. the atom ratio of hydrogen-2 (~0.015%, abundant) to hydrogen-1 (~99.985% abundant). Hydrogen-2 is also referred to as deuterium (D). For nitrogen, the ratio measured is $^{15}N/^{14}N$, i.e. the atom ratio of nitrogen-15 (~0.37% abundant) to nitrogen-14 (~99.63% abundant).

Isotope ratios are reported in the standard delta (δ) notation as parts per thousand (per mil or ‰) variations relative to a reference material of known composition and defined by the following equation:

$$\delta_x = 1000\frac{R_x - R_{ref}}{R_{ref}}$$

where R_x is the ratio of the sample and R_{ref} is the ratio of the reference material. For oxygen and for hydrogen in water, we use Vienna Standard Mean Ocean Water (VSMOW; Craig, 1961). We also use VSMOW for oxygen in nitrate. For nitrogen in nitrate, we use air as a reference material.

ANALYTICAL METHODS—STABLE ISOTOPES OF WATER

Water $\delta^{18}O$ and δ^2H values are determined on unfiltered samples. Water δ^2H is also referred to as δD. Water δ^2H is determined on unfiltered samples, usually the same bottle collected for water-$\delta^{18}O$. Oxygen isotope analyses are conducted using the carbon dioxide equilibration method for $^{18}O/^{16}O$ and analyzed with an automated water equilibration unit. Hydrogen isotope compositions of water were analyzed using the Pt-H_2 equilibration method. Isotope ratio measurements are performed on a VG PRISM III isotope ratio mass spectrometer housed in the Chemical Sciences Division at Lawrence Livermore National Laboratory. The LLNL standard operating procedure for determination of the stable isotopic composition of water in groundwater samples is SOP-UGTA-128, and is available upon request.

Analyses in the Stable Isotope Laboratory are calibrated to internal standards referenced against National Institute of Standards and Technology (NIST) standard reference materials. The waters chosen as in-house standards consist of three isotopically distinct water samples ($\delta^{18}O$ = -3.1, -9.9 and -15.5‰). The composition and isotopic values of these internal standards span the range of natural waters typically observed in potable groundwater of California. For each set of $\delta^{18}O$ analyses, 2 each of 3 internal standards are also analyzed and used for calibration. The internal standards are periodically compared to the three NIST reference standards (NIST RM 8535; NIST RM 8536; NIST RM 8537): SMOW, Standard Light Antarctic Precipitation (SLAP), and Greenland Ice Sheet Precipitation (GISP). The analytical precision for these $\delta^{18}O$

measurements, from one run to the next, is ± 0.10‰, and the analytical precision for δ^2H values is ± 2‰.

Craig, H. 1961. Standard for reporting concentrations of deuterium and oxygen-18 in natural waters. *Science*, **133**, 1833-1834.

Epstein, S., and Mayeda, T.K. 1953. Variation of O-18 content of waters from natural sources. *Geochimica Cosmochimica Acta*, **4**, 213-224.

Coplen, T.B., Wildman, J.D., and Chen, J. 1991. Improvements in the gaseous hydrogen-water equilibration technique for hydrogen isotope-ratio analysis. *Analytical Chemistry*, **63**, p. 910-912.

ANALYTICAL METHOD—STABLE ISOTOPES OF NITRATE

The isotopic composition of dissolved nitrate ($\delta^{15}N$ and $\delta^{18}O$) is determined on water samples filtered through 0.2 μm syringe filters (0.45 μm filters may be used for pre-filtering sediment-laden water). The samples are stored frozen in pre-cleaned, HDPE bottles. Samples are analyzed using an automated version of a new microbial denitrifier method (Casciotti et al., 2002; Sigman et al., 2001). In this method, a strain of denitrifying bacteria is used to reduce dissolved nitrate in water samples to N_2O gas that can be analyzed for N and O isotopic composition on the MicroMass IsoPrime IRMS. Dr. Mike Singleton, the Stable Isotope Mass Spectrometry Laboratory Manager, has implemented this method at the Center for Isotope Geochemistry at Lawrence Berkeley National Laboratory (LBNL) and in the Chemical Sciences Division at LLNL. He has safely carried out hundreds of successful analyses over a period of four years. The original method has been adapted to decrease the time required for culture preparation and sample processing.

Casciotti, K.L., Sigman, D.M., Hastings, M.G., Bohlke, J.K., Hilkert, A. 2002. Measurement of the oxygen isotopic composition of nitrate in seawater and freshwater using the denitrifier method. *Analytical Chemistry,* **74**, p. 4905-4912.

Sigman, D. M., Casciotti, K. L., Andreani, M., Barford, C., Galanter, M., Bohlke, J. K. 2001. A bacterial method for the nitrogen isotopic analysis of nitrate in seawater and freshwater. *Analytical Chemistry,* **73**, p. 4145-4153.

Singleton, M.J., Woods, K.N., Conrad, M.E., DePaolo, D.J., and Dresel, P.E. 2005. Tracking sources of unsaturated zone and groundwater nitrate contamination using nitrogen and oxygen stable isotopes at the Hanford Site, Washington. *Environmental Science & Technology*, **39(10)**, p. 3563-3570.

DATA QUALITY OBJECTIVES AND QUALITY CONTROL

Data Objectives: Minimum acceptable measurement quality objectives (MQOs) for analytical techniques used in this project are summarized in Table 2. The MQOs for isotopic analyses reflect “accepted methods” for publication in high-quality scientific journals. Whenever possible, the methods with greater sensitivity and lowest detection limit will be employed as the primary method. Methods with lesser sensitivity and higher detection limits will be used for samples known to contain high concentrations of analytes, field confirmations, or as back-up methods in the case that the primary methods are not available or functioning properly for a particular sampling event. Analyses that do not meet minimum acceptable data quality objectives will be re-run when sample is available. When sample is not available, such data will not be reported or will be reported and flagged.

Precision and Accuracy: Precision (e.g., the reproducibility among replicate samples) will be determined by analysis of duplicate samples, laboratory control standards and matrix spikes as appropriate for each method. Precision is determined as the standard deviation of measurements divided by the mean and multiplied by 100. Precision measurements will be determined on both field and laboratory replicates).

Accuracy (e.g., how close the measurement is to the true value) will be measured on one or more quality control check standards (QCCS) prepared exactly as the calibration standards. The QCCS is analyzed after the calibration standards. The QCCS should be within 10% of the actual concentration or problems will be resolved and samples re-analyzed. For some methods, accuracy cannot be rigorously determined because there are no absolute external standards available.

Quality Control: Quality control samples will be analyzed to ensure valid data are collected. Field duplicates are collected and analyzed for at least every 20th sample. The precision of duplicates and splits are used to help identify sampling handling and preparation problems. All samples that fall outside the expected range for the sample type, location, and collection time are assessed for proper size and instrument function. The expected ranges are dependent on many factors and cannot easily be defined. Expected ranges are therefore determined on a case by case basis, initially by the analyst and finally by the PI in charge of data interpretation. Samples are re-analyzed as necessary to achieve the desired precision.

Instrument behavior is assessed by analysis of working standards as described in the individual SOPs for the various analysis types. Instruments are regularly tested for stability and linearity as described in Section 15 below. LLNL laboratories routinely participate in international calibration exercises to ensure the precision and accuracy of data reported. All instruments are regularly calibrated using NIST or IAEA standard reference materials with internationally-agreed-upon values. When in-run reference standards do not meet precision or accuracy criteria, samples from the same run will be re-analyzed. Records of instrument performance will be maintained indefinitely. All laboratories use Good Laboratory Practices (GLP), and routine analyses follow SOPs.

Table 2: Data Quality Objectives and Reporting for Stable Isotope Analysis.

Parameter	Method/ Range	Units	Reference	External Precision[1]	Instrumental precision[2]
Nitrate $\delta^{18}O$ **Nitrate $\delta^{15}N$**	Continuous Flow Mass Spectrometry	Per mil (‰)	$\delta^{15}N$: Air $\delta^{18}O$: VSMOW	$\delta^{15}N$ ± 0.3 ‰ $\delta^{18}O$ ± 0.8 ‰	$\delta^{15}N$ ± 0.2 ‰ $\delta^{18}O$ ± 0.5 ‰
Water $\delta^{18}O$ **Water $\delta^{2}H$**	Dual Inlet and/or Continuous Flow Mass Spectrometry	Per mil (‰)	$\delta^{18}O$: VSMOW $\delta^{2}H$: VSMOW	$\delta^{18}O$ ± 0.3 ‰ $\delta^{2}H$ ± 2 ‰	± 0.15 ‰ ± 1 ‰

1. External (1 sigma) precision objectives apply to replicate analyses of a single sample.
2. Instrumental precision (1 sigma) applies to calibration check samples, laboratory control samples and other measurements of samples of known concentration and isotopic composition where the known value is compared to the measured value.
3. VSMOW = Vienna Standard Mean Ocean Water.

Data: Tulare County Domestic Wells

SAMPLE ISOTOPIC DATA

This data report represents specialized analyses performed by LLNL on domestic well groundwater samples collected in Tulare County by State Water Resources Control Board staff for the GAMA Domestic Wells Project. Samples were collected between April, May and June of 2006. In total, LLNL analyzed 151 samples for water isotopic composition of both oxygen and hydrogen, and 29 samples for nitrate isotopic composition of both nitrogen and oxygen. Analyzed samples included 15 field duplicates for water isotopic composition; and two field duplicates for nitrate isotopic composition. Data are tabulated in Table 3. Sample name are of the form “TUL nnnn”. Samples with nnnn less than 1000 are labeled to as either “TUL nnn” or “TUL 0nnn” or “TULnnnn”. These three forms are equivalent, e.g. TUL 979, TUL 0979, and TUL0979 all refer to the same sample.

Table 3: Water and Nitrate Isotopic Composition in Tulare County Domestic Well Water Samples

SWRCB ID	LLNL ID	Collection Date	Water-δ^{18}O (‰, VSMOW)	Water-δ^{2}H (‰, VSMOW)	Nitrate-δ^{15}N (‰, Air)	Nitrate-δ^{18}O (‰, VSMOW)
TUL 901	103893	04/18/2006	-12.4	-89		
TUL 902	103894	04/18/2006	-12.8	-93		
TUL 903	103895	04/18/2006	-12.5	-89		
TUL 904	103896	04/18/2006	-10.2	-74		
TUL 905	103897	04/18/2006	-12.2	-87		
TUL 906	103898	04/18/2006	-12.2	-87		
TUL 907	103899	04/18/2006	-10.8	-81		
TUL 908	103900	04/18/2006	-12.5	-89		
TUL 909	103904	04/19/2006	-12.0	-84		
TUL 910	103905	04/19/2006	-10.8	-79		
TUL 911	103906	04/19/2006	-11.3	-81		
TUL 912	103907	04/19/2006	-10.9	-82		
TUL 913	103908	04/19/2006	-11.4	-81	0.0	3.7
TUL 914	103909	04/19/2006	-10.9	-80		
TUL 915	103910	04/19/2006	-8.0	-59		
TUL 916	103911	04/19/2006	-7.7	-58		
TUL 917	103912	04/19/2006	-10.8	-80	7.7	-1.7
TUL 918	103915	04/20/2006	-9.6	-67		
TUL 919	103913	04/19/2006	-7.5	-58		
TUL 920	103916	04/20/2006	-8.9	-65	1.5	2.8
TUL 921	103917	04/20/2006	-8.2	-58		
TUL 922	103918	04/20/2006	-9.9	-74		
TUL 923	103919	04/20/2006	-9.2	-63		
TUL 924	103920	04/20/2006	-9.4	-71	5.6	1.8
TUL 925	103921	04/20/2006	-11.3	-83		
TUL 926	103922	04/20/2006	-12.4	-87		
TUL 927	103923	04/20/2006	-11.2	-79		
TUL 928	103924	04/20/2006	-8.3	-64	6.2	11.0
TUL 929	103901	04/18/2006	-11.9	-86		
TUL 930	103954	04/25/2006	-11.3	-82		
TUL 932	103956	04/25/2006	-10.1	-76	3.5	-4.3
TUL 933	103957	04/25/2006	-10.7	-80		
TUL 934	103958	04/25/2006	-7.7	-64		
TUL 935	103976	04/27/2006	-9.2	-71	6.6	3.8
TUL 936	103966	04/26/2006	-11.8	-86		
TUL 937	103967	04/26/2006	-12.7	-91		
TUL 938	103968	04/26/2006			4.8	-3.2
TUL 939	103969	04/26/2006	-12.8	-92		
TUL 941	103960	04/25/2006	-12.4	-86	8.2	-0.3
TUL 943	103962	04/25/2006	-11.2	-79		
TUL 944	103980	04/27/2006	-10.4	-74	8.6	1.3
TUL 945	103977	04/27/2006	-7.8	-63		
TUL 946	103978	04/27/2006	-11.1	-77		
TUL 947	103963	04/25/2006	-12.0	-84		
TUL 948	103970	04/27/2006				

SWRCB ID	LLNL ID	Collection Date	Water-δ18O (‰, VSMOW)	Water-δ2H (‰, VSMOW)	Nitrate-δ15N (‰, Air)	Nitrate-δ18O (‰, VSMOW)
TUL 949	103971	04/26/2006				
TUL 950	103972	04/26/2006			8.0	1.8
TUL 951	103973	04/26/2006				
TUL 952	103974	04/26/2006				
TUL 954	103964	04/26/2006	-12.4	-88	8.1	-0.8
TUL 955	103965	04/26/2006	-7.8	-63		
TUL 956	103975	04/25/2006				
TUL 957	103979	05/09/2006	-7.8	-63		
TUL 978	104106	06/06/2006	-8.5	-62	6.4	3.1
TUL 979	104107	06/06/2006	-7.8	-60	6.1	8.2
TUL 980	104108	06/06/2006	-9.1	-63	3.3	3.8
TUL 981	104025	05/16/2006	-6.5	-55		
TUL 981-1	104027	05/16/2006	-6.7	-55		
TUL 982	104026	05/16/2006	-8.5	-62		
TUL 983	104028	05/17/2006	-11.5	-85	7.2	3.8
TUL 984	104029	05/17/2006	-9.3	-66		
TUL 985	104030	05/16/2006	-9.6	-66		
TUL 986	104031	05/18/2006	-10.3	-72		
TUL 987	104032	05/18/2006	-9.6	-66		
TUL 988	104109	06/06/2006	-8.3	-62	7.2	1.8
TUL 989	104116	06/07/2006	-10.1	-74		
TUL 990	104033	05/16/2006	-7.4	-59		
TUL 991	104034	05/16/2006	-9.2	-71		
TUL 992	104035	05/18/2006	-11.5	-81		
TUL 993	104036	05/17/2006	-13.3	-98		
TUL 994	104037	05/17/2006	-9.5	-70		
TUL 995	104038	05/17/2006	-7.4	-54		
TUL 996	104039	05/16/2006	-11.8	-83		
TUL 997	104040	05/17/2006	-9.3	-71	7.0	3.3
TUL 998	104041	05/17/2006	-7.2	-60		
TUL 999	104042	05/18/2006	-11.2	-79		
TUL 1000	104043	05/18/2006	-12.0	-87		
TUL 1001	104044	05/16/2006	-10.8	-74		
TUL 1002	104045	05/16/2006	-8.9	-65		
TUL 1003	104046	05/18/2006	-12.3	-88		
TUL 1004	104047	05/18/2006	-11.5	-82		
TUL 1005	104110	06/06/2006	-10.7	-76	2.9	-0.3
TUL 1006	104117	06/08/2006	-10.3	-74	5.1	0.3
TUL 1007	104118	06/07/2006	-12.7	-94	5.3	-0.2
TUL 1008	104119	06/08/2006	-9.5	-73		
TUL 1009	104120	06/07/2006	-8.0	-59		
TUL 1010	104066	05/24/2006	-13.3	-97		
TUL 1011	104067	05/24/2006	-10.0	-70		
TUL 1012	104068	05/24/2006	-10.3	-72		
TUL 1013	104069	05/24/2006	-11.6	-84	8.6	-2.6
TUL 1014	104070	05/25/2006	-13.1	-96		
TUL 1015	104071	05/23/2006	-10.2	-75		

SWRCB ID	LLNL ID	Collection Date	Water-$\delta^{18}O$ (‰, VSMOW)	Water-$\delta^{2}H$ (‰, VSMOW)	Nitrate-$\delta^{15}N$ (‰, Air)	Nitrate-$\delta^{18}O$ (‰, VSMOW)
TUL 1016	104072	05/23/2006	-8.5	-66		
TUL 1017	104073	05/24/2006	-11.5	-84		
TUL 1019	104074	05/23/2006	-9.3	-66		
TUL 1020	104075	05/25/2006	-11.6	-84		
TUL 1021	104076	05/23/2006	-9.2	-68		
TUL 1022	104077	05/24/2006	-11.2	-83		
TUL 1024	104078	05/25/2006	-8.2	-61		
TUL 1025	104079	05/23/2006	-11.9	-88		
TUL 1026	104080	05/23/2006	-8.5	-63		
TUL 1027	104081	05/23/2006	-12.4	-86		
TUL 1028	104082	05/23/2006	-12.3	-89		
TUL 1029	104083	05/25/2006	-11.9	-83		
TUL 1031	104084	05/24/2006	-13.5	-98		
TUL 1032	104085	05/25/2006	-10.5	-77		
TUL 1033	104086	05/25/2006	-11.5	-85		
TUL 1034	104121	06/08/2006	-11.3	-76		
TUL 1035	104111	06/06/2006	-12.5	-89	4.1	-1.0
TUL 1036	104112	06/06/2006	-12.5	-89	4.6	-2.4
TUL 1038	104087	05/23/2006	-12.0	-90		
TUL 1039	104088	05/24/2006	-11.2	-83		
TUL 1040	104089	05/25/2006	-11.5	-81		
TUL 1041	104122	05/24/2006	-10.5	-75		
TUL 1042	104123	06/07/2006	-11.8	-80		
TUL 1043	104124	06/08/2006	-8.5	-67		
TUL 1044	104125	06/08/2006	-12.6	-89		
TUL 1050	104113	06/06/2006	-12.4	-89	4.3	-3.2
TUL 1051	104126	06/07/2006	-11.8	-80		
TUL 1052	104127	06/08/2006	-8.5	-67		
TUL 1053	104128	06/07/2006	-8.0	-58		
TUL 1054	104134	06/13/2006	-10.0	-67		
TUL 1055	104135	06/13/2006	-11.9	-87		
TUL 1056	104136	06/13/2006	-12.5	-88		
TUL 1057	104149	06/14/2006	-11.4	-84		
TUL 1058	104150	06/14/2006	-8.5	-64	6.3	4.9
TUL 1059	104151	06/14/2006	-8.4	-65		
TUL 1060	104152	06/15/2006	-11.0	-81		
TUL 1061	104153	06/14/2006	-8.5	-65		
TUL 1062	104154	06/15/2006	-8.6	-65		
TUL 1063	104155	06/14/2006	-9.1	-67		
TUL 1064	104137	06/13/2006	-12.8	-93		
TUL 1065	104138	06/13/2006	-12.0	-87		
TUL 1066	104139	06/13/2006	-12.2	-86		
TUL 1070	104156	06/14/2006	-11.6	-85		
TUL 1071	104140	06/13/2006	-11.7	-85		
TUL 1072	104157	06/14/2006	-9.6	-69		
TUL 1073	104158	06/14/2006	-11.9	-88		
TUL 1074	104159	06/14/2006	-11.2	-80		

SWRCB ID	LLNL ID	Collection Date	Water-$\delta^{18}O$ (‰, VSMOW)	Water-$\delta^{2}H$ (‰, VSMOW)	Nitrate-$\delta^{15}N$ (‰, Air)	Nitrate-$\delta^{18}O$ (‰, VSMOW)
TUL 1075	104160	06/15/2006	-11.7	-84		
TUL 1076	104161	06/15/2006	-11.1	-81		
TUL 1077	104141	06/13/2006	-12.5	-87	5.4	-0.2
TUL 1078	104162	06/14/2006	-9.7	-69		
TUL 1079	104163	06/15/2006	-12.5	-91		
TUL 1080	104164	06/15/2006	-12.3	-84		
TUL 1081	104165	06/15/2006	-11.9	-84	11.2	-1.9
TUL 1082	104166	06/15/2006	-12.6	-89		
TUL 1083	104167	06/15/2006	-12.6	-89		
TUL 1084	104169	06/20/2006	-12.6	-93		
TUL 1085	104170	06/20/2006	-10.9	-79		
TUL 1086	104171	06/20/2006	-9.7	-67		
TUL 1087	104172	06/20/2006	-8.9	-65		
TUL 1088	104173	06/20/2006	-8.2	-61		
TUL 1089	104174	06/20/2006	-10.3	-77		
TUL 1090	104180	06/21/2006	-7.5	-59		
TUL 1091	104181	06/21/2006	-7.6	-60		
TUL 1092	104182	06/21/2006	-11.2	-84		
TUL 1093	104183	06/21/2006	-9.8	-72		
TUL 1094	104184	06/21/2006	-9.0	-62		
TUL 1095	104185	06/21/2006	-9.8	-70		
TUL 1096	104190	06/22/2006	-8.4	-61		
TUL 1097	104191	06/22/2006	-9.9	-71		
TUL 1098	104186	06/21/2006	-11.8	-85		
TUL 1099	104192	06/22/2006	-8.4	-63		
TUL 1100	104175	06/20/2006	-9.0	-62		
TUL 1101	104193	06/22/2006	-6.2	-52		
TUL 1103	104176	06/20/2006	-12.5	-89		
TUL 1104	104194	06/22/2006	-9.5	-67		
TUL 1105	104177	06/20/2006	-11.1	-81	8.2	1.4
TUL 1106	104195	06/22/2006	-12.3	-87		
TUL 1107	104196	06/22/2006	-8.2			
TUL 1108	104178	06/20/2006	-10.9	-80		
TUL 1109	104187	06/21/2006	-9.0	-62		
TUL 1110	104197	06/22/2006	-9.5	-66		
TUL 1111	104198	06/22/2006	-9.5	-72	7.2	3.1
TUL 1201	103902	04/18/2006	-12.1	-87		
TUL 1202	103925	04/20/2006	-11.3	-79		
TUL 1205	103914	04/19/2006	-11.4	-82		
TUL 1505	104090	06/08/2006	-10.0	-70	3.7	4.2

SAMPLE QA/QC DATA

Field duplicate data are tabulated in Table 4. For the two nitrate field duplicates, nitrate-$\delta^{15}N$ analyses agreed to better than 0.3‰, and nitrate-$\delta^{18}O$ analyses agreed to better than 0.8‰. For the 15 water field duplicates, water-$\delta^{18}O$ analyses agreed to within 0.1‰. Water-$\delta^{2}H$ analyses agreed to 2‰ or better with the exception of three samples which agreed to within 4‰. The agreement between the original and duplicate water isotopic composition determinations is shown in Figure 1.

Table 4: Isotopic Composition Analyses of Field Duplicates

SWRCB ID	LLNL ID	Collection Date	Water-$\delta^{18}O$ (‰, SMOW)	Water-$\delta^{2}H$ (‰, SMOW)	Nitrate-$\delta^{15}N$ (‰, Air)	Nitrate-$\delta^{18}O$ (‰, SMOW)
TUL0945	103977	4/27/06	-7.8	-63		
TUL0957	103979	4/27/06	-7.8	-63		
TUL0992	104035	5/18/06	-11.5	-81		
TUL1004	104047	5/18/06	-11.5	-82		
TUL0941	103960	4/25/06	-12.4	-86	8.2	-0.3
TUL0954	103964	4/25/06	-12.4	-88	8.1	-0.8
TUL1104	104194	6/22/06	-9.5	-67		
TUL1110	104197	6/22/06	-9.5	-66		
TUL1036	104112	6/6/06	-12.5	-89	4.6	-2.4
TUL1050	104113	6/6/06	-12.4	-89	4.3	-3.2
TUL1079	104163	6/15/06	-12.5	-91		
TUL1083	104167	6/15/06	-12.6	-89		
TUL0906	103898	4/18/06	-12.2	-87		
TUL1201	103902	4/18/06	-12.1	-87		
TUL1056	104136	6/13/06	-12.5	-88		
TUL1077	104141	6/13/06	-12.5	-88		
TUL1033	104086	5/25/06	-11.5	-85		
TUL1040	104089	5/25/06	-11.5	-81		
TUL1042	104123	6/7/06	-11.8	-80		
TUL1051	104126	6/7/06	-11.8	-80		
TUL0927	103923	4/20/06	-11.3	-79		

SWRCB ID	LLNL ID	Collection Date	Water-δ^{18}O (‰, SMOW)	Water-δ^{2}H (‰, SMOW)	Nitrate-δ^{15}N (‰, Air)	Nitrate-δ^{18}O (‰, SMOW)
TUL1202	103925	4/20/06	-11.3	-79		
TUL0911	103906	4/19/06	-11.4	-81		
TUL1205	103914	4/19/06	-11.4	-82		
TUL1094	104184	6/21/06	-9.0	-62		
TUL1109	104187	6/21/06	-9.0	-62		
TUL1025	104079	5/23/06	-11.9	-88		
TUL1038	104087	5/23/06	-12.0	-91		
TUL1085	104170	6/20/06	-10.9	-79		
TUL1108	104178	6/20/06	-10.9	-80		

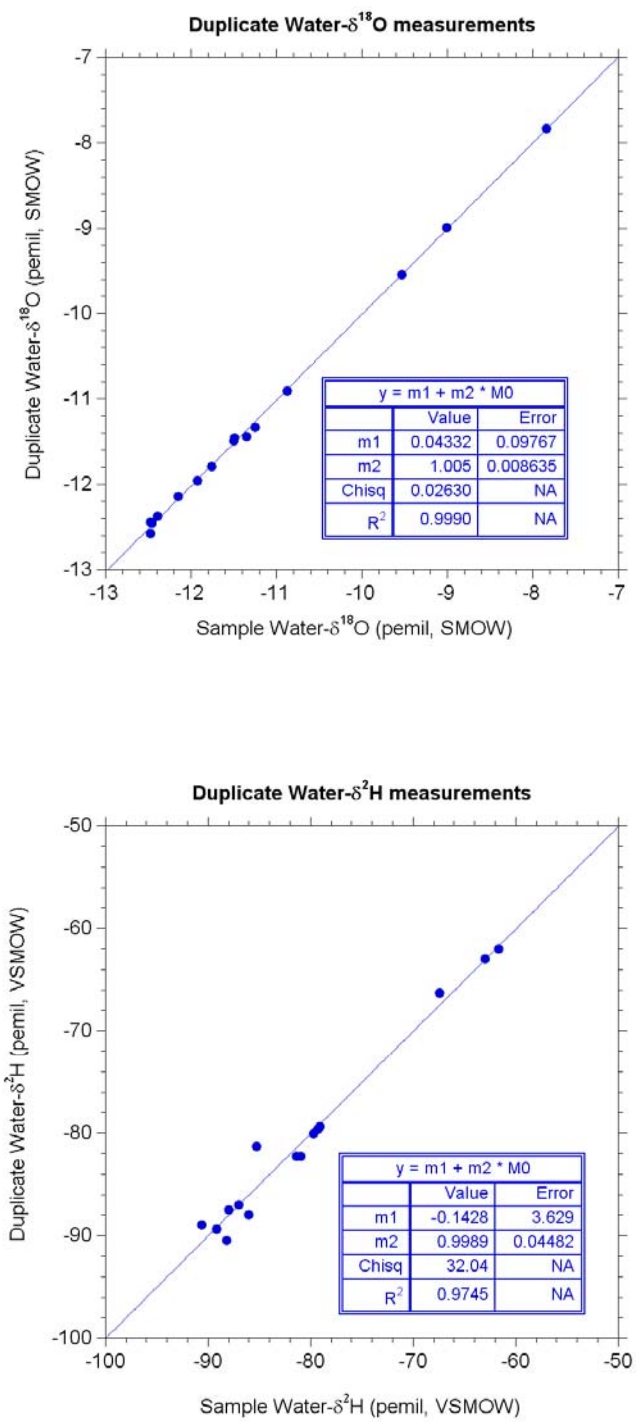


Figure 1. Plot of field duplicate water isotopic composition measurement against sample water isotopic composition measurements.

Discussion and Interpretation

Analyses

The spatial distribution of sampling for nitrate concentration, isotopic composition of water and isotopic composition of nitrate is shown in Figure 2.

Approximately 204 samples (including duplicates) were collected from domestic wells in Tulare County for the State Water Board GAMA Domestic Wells Project. These wells had NO_3 concentrations ranging from 0.8 to 240 mg/L as NO_3. The highest nitrate concentrations were observed from wells located in the valley and along the margin of the foothills. Above 1000 ft elevation, only two samples had nitrate concentrations above the MCL.

A majority (151) of the samples from the Tulare County Private Domestic Well study area were analyzed for O and H isotope compositions of water. A small number (29) of samples were analyzed for the isotopic composition of N and O isotopic compositions of nitrate. The small number of nitrate isotopic samples analyzed were biased toward waters containing high concentrations of nitrate (median and mean of 23 and 49 mg/L as nitrate versus 12 and 26 mg/L for the entire sample set). The isotopic composition of water for samples analyzed for nitrate isotopic composition was not significantly different than for the entire data set (mean $\delta^{18}O\text{-}H_2O$ of -10.8‰ versus -10.4‰ for the entire data set).

Isotopic composition of water

A total of 151 samples were analyzed for O and H isotope compositions of water from the Tulare County Private Domestic Well study area. A large range in both $\delta^{18}O$ and $\delta^{2}H$ is observed, from a very light $\delta^{18}O$ value of -13.5‰ to a rather heavy $\delta^{18}O$ of -6.2‰ (Figure 3).

Typically for stable isotopes of water, there is a correlated decrease in the isotopic composition of precipitation with increasing elevation. In the Sierra, this correlation has been observed to be approximately -2.3‰ in $\delta^{18}O\text{-}H_2O$ per kilometer of elevation (Figure 4; Rose et al., 1996). This general pattern is observed in GAMA Private Domestic Well study results from El Dorado County, where lighter signatures (more negative $\delta^{18}O$ values) were observed with increasing elevation and heavier signatures (less negative $\delta^{18}O$ values) were observed in the valley floor, indicating the predominance of locally-derived water in the domestic wells sampled. The Tulare County pattern is distinctly different (Figure 5a). Many of the samples collected from lower elevations have *lower* $\delta^{18}O\text{-}H_2O$ and $\delta D\text{-}H_2O$ values than would be predicted for precipitation at those elevations (Figure 4).

This apparent discrepancy is caused by extensive use of imported water from the Kings and Kaweah Rivers, which are fed from the upper Sierra. This water is used for irrigation, and recharges the shallow aquifer. Coplen and Kendall (2000) report $\delta^{18}O$-H_2O values in the Kings River at Trimmer (elev. 942 ft RMSL) that range from -14.6 to -12.5 ‰, with an average value of -13.3 ‰. The low $\delta^{18}O$-H_2O and δD-H_2O values in samples collected from domestic wells on the valley floor (Figures 4 and 5) indicate that these wells tap groundwater that is a mix of irrigation return water and locally derived precipitation. The extent of King's river water present in parts of the Tulare County valley groundwater system may be up to 100 percent.

The excess irrigation water has not experienced significant evaporation, despite the fact that it is applied mainly during summer months. Infiltration must take place relatively quickly after application. Evidence for lack of evaporative effects on these isotopically light samples comes from a plot of $\delta^{18}O$ vs. $\delta^{2}H$ (Figure 3). Samples with isotope pairs that fall below the global meteoric water line (GMWL) have experienced significant evaporation, but for Tulare samples, only samples with $\delta^{18}O$ values greater than -9‰ show an evaporation effect. Samples with water $\delta^{18}O$ values greater than -9‰ are found on the eastern side of the study area, primarily in the foothills (Figures 4 and 5). These areas are not surrounded by irrigated agricultural fields, and irrigation return flow is not a likely source of significant recharge. Rather, $\delta^{18}O$ results from wells in the eastern portion of the study area suggest that local precipitation is the main source of recharge and that evaporation prior to recharge affects some wells. The $\delta^{18}O$ value for precipitation in the Tulare County valley area is predicted to be approximately -7.5‰ to -8‰. A pattern of decreasing $\delta^{18}O$ with increasing elevation within the foothill samples is evident in Figure 3. This is further evidence that recharge to wells in the foothill area is mainly from locally derived precipitation.

ISOTOPIC COMPOSITION OF NITRATE

The nitrate N and O isotope data set consists of 29 distinct samples (plus two duplicates), and is small relative to the total set of samples collected (n=203 including 22 duplicates). Of the samples analyzed for N and O isotope compositions, only two samples are from wells above 800 ft elevation (Figure 6). Most samples are collected from the valley and the margins of the foothills (Figures 7 and 8). We have delineated the sample set into two groups based on elevation (Figures 6): the valley wells (<400 ft. MSL) and the foothills and margins of the foothills (>400 ft. MSL). In general, these two areas are distinct in both hydrogeology and land use. The valley wells are located in the thick alluvial fan deposits, while the margin/foothills wells are more likely to overly a thinner sequence of alluvium and bedrock. Dairy operations, orchards and row crops are densely distributed at the valley elevations, while the margins and upper foothills are commonly planted with orchards. Most of Tulare County's population (which can be used as a proxy for septic effluent sources of nitrate) is located below 400 feet.

Seven samples that were analyzed for nitrate N and O isotopic composition had nitrate concentrations over the MCL. These seven samples with high NO_3 concentration have $\delta^{15}N$-NO_3 values that range from 3.7 to 11.2 ‰, with an average of 6.9 ‰. Nitrate $\delta^{15}N$-NO_3 values in this range are typically consistent with nitrification of ammonium from human waste or animal waste, i.e. septic effluent or dairy manure (see Figure 9).

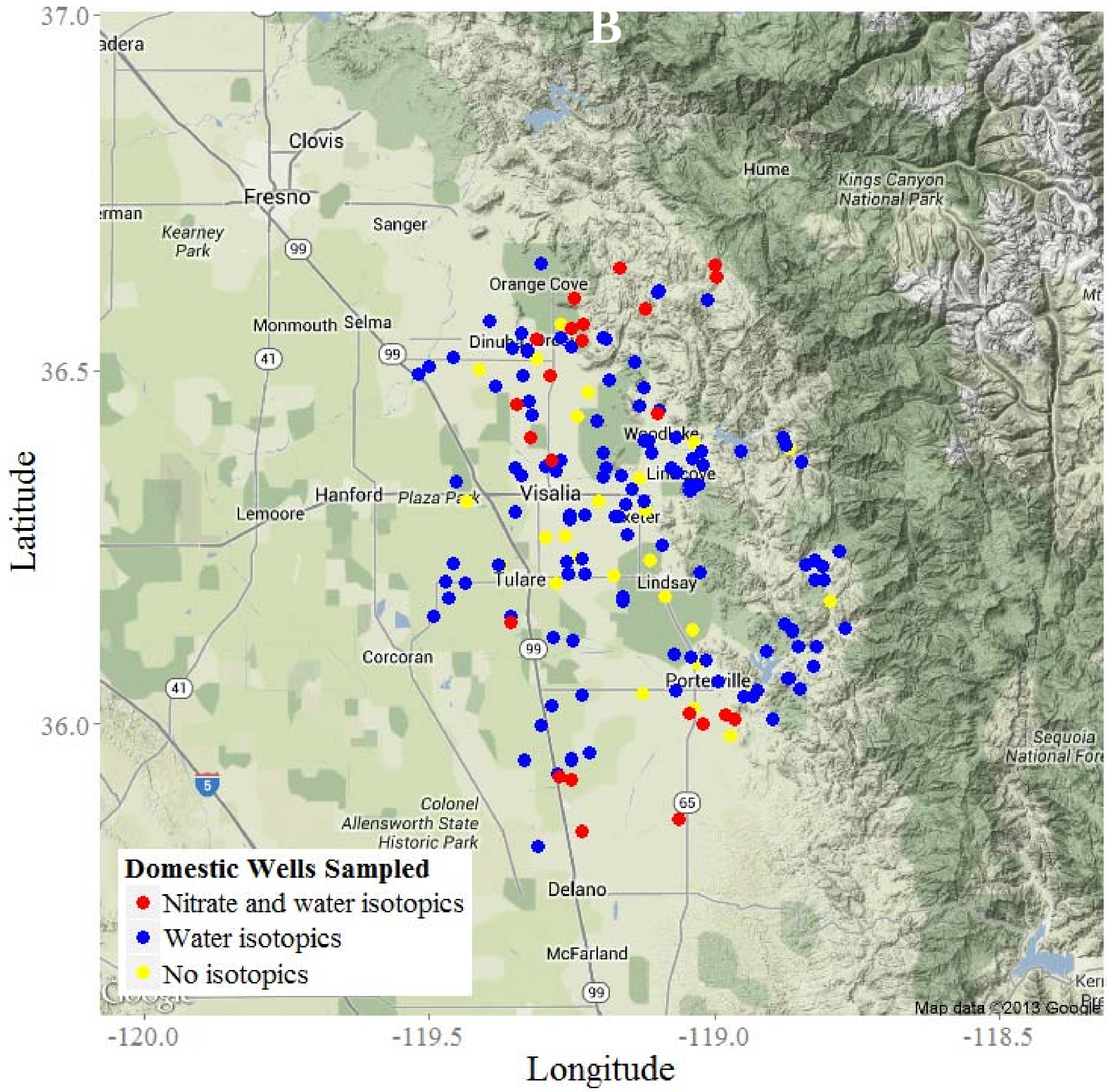


Figure 2. Tulare County domestic wells sampled for analysis of water and/or nitrate isotopic composition for the State Water Board GAMA Domestic Well Project.

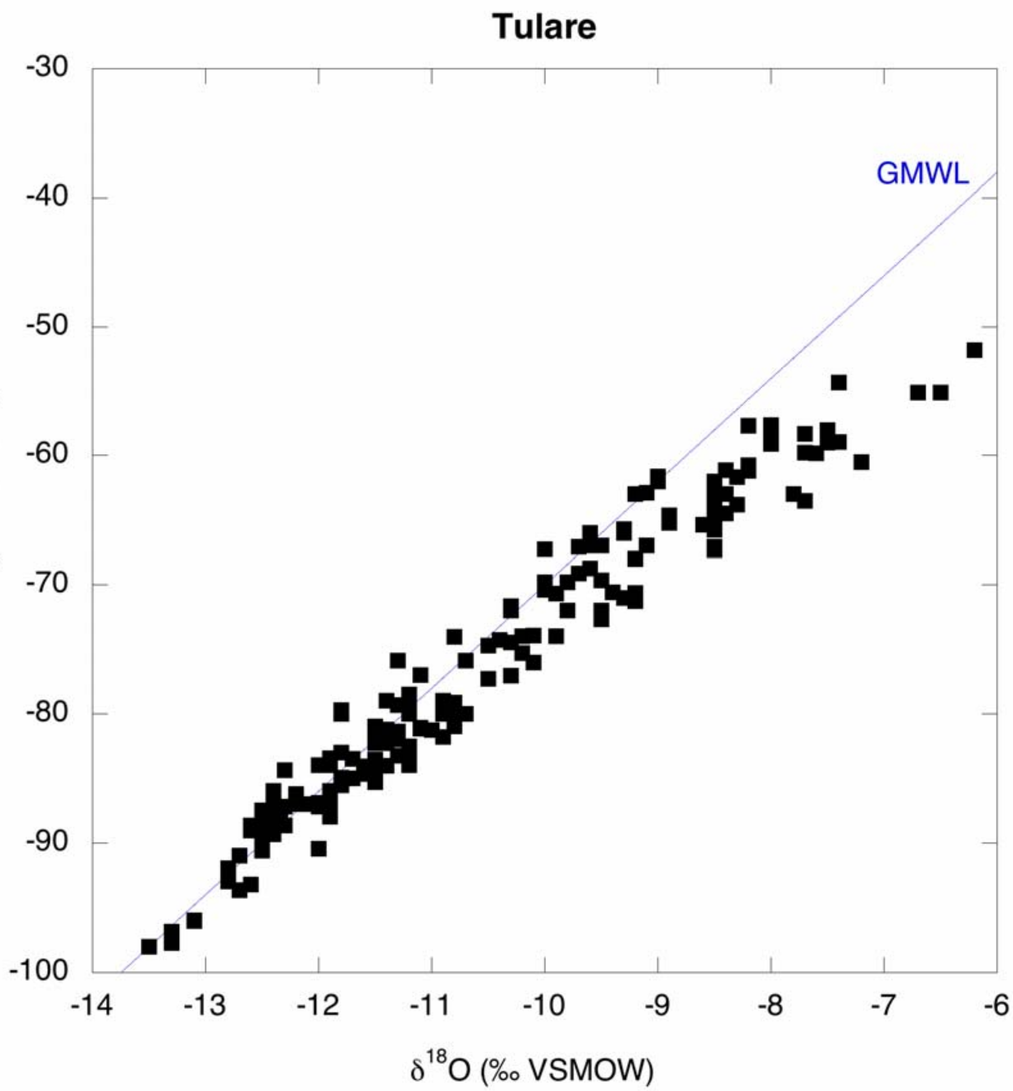


Figure 3. Stable isotope plot for samples from Tulare County Private Domestic wells. The most depleted (most negative) ratios observed are typical for Sierran River runoff sourced at high elevation. Enriched ratios (less negative) show evidence for evaporation, plotting below the meteoric water line.

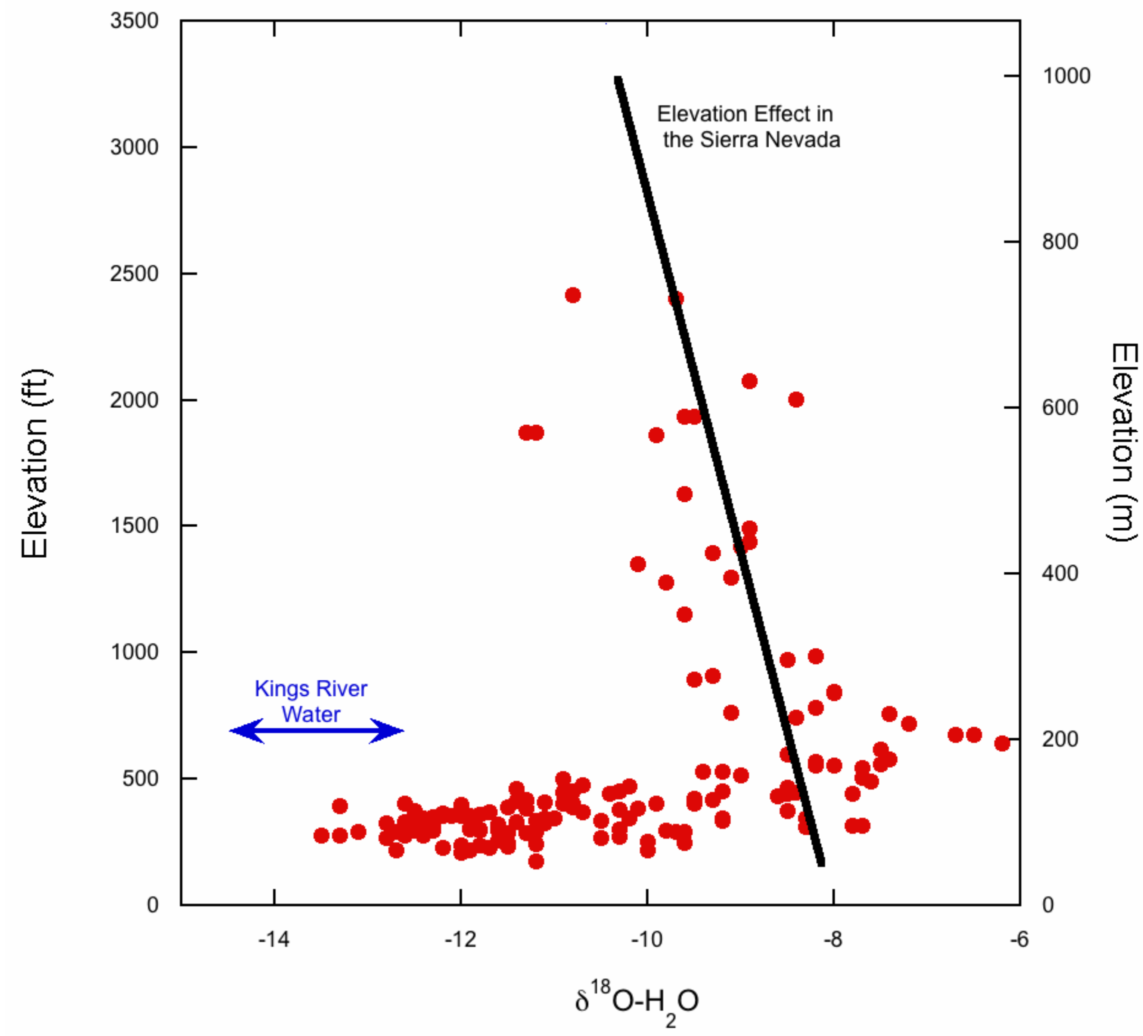


Figure 4. The elevation and oxygen isotope composition of waters collected from Tulare County domestic wells. The solid line shows the observed relation between elevation and δ^{18}O-H_2O in the Sierra (Rose et al., 1996). The observed range of Kings River water is shown based on data from Coplen and Kendall (2000).

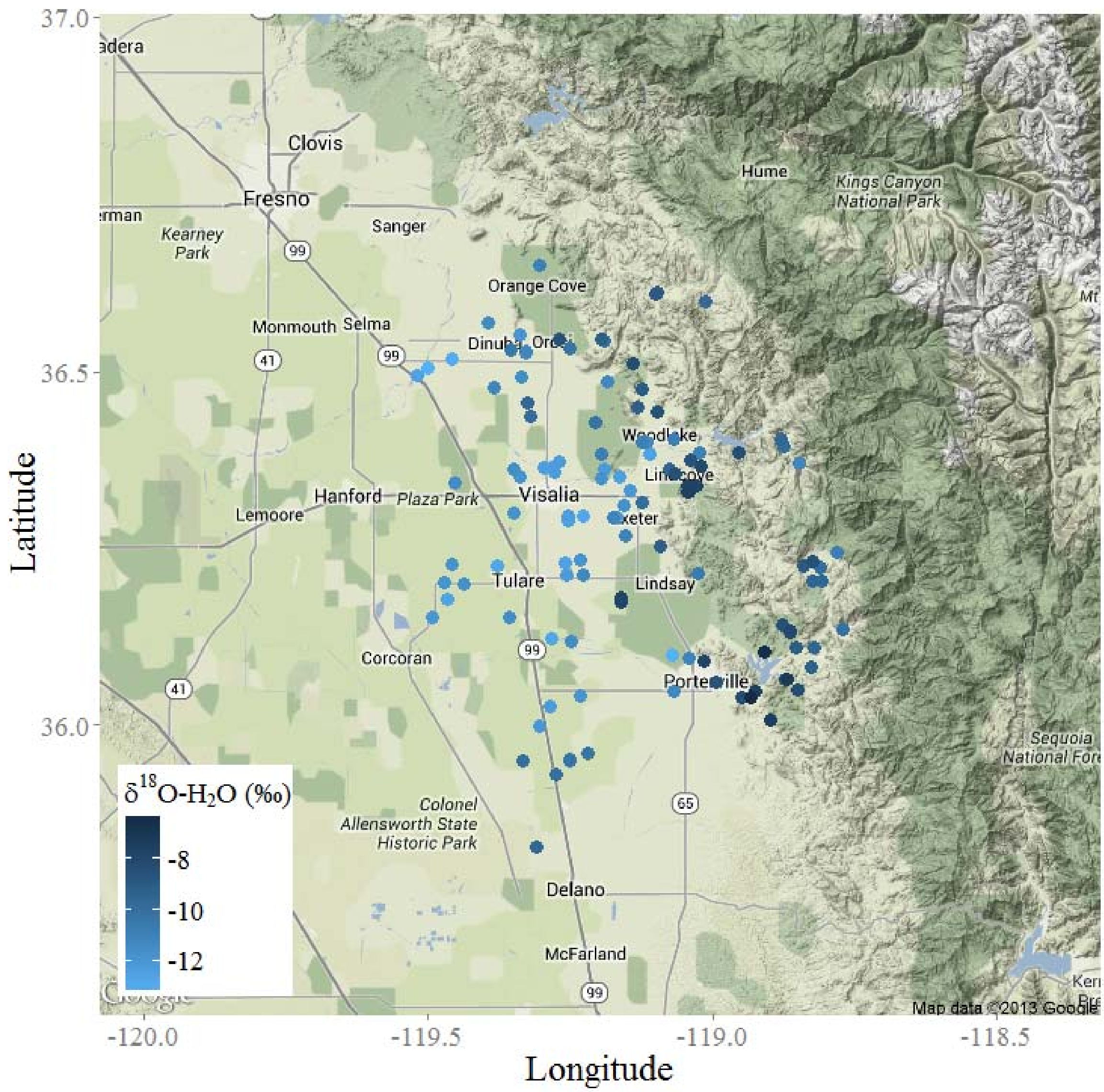


Figure 5a. Spatial distribution of water isotopic composition in Tulare County domestic wells.

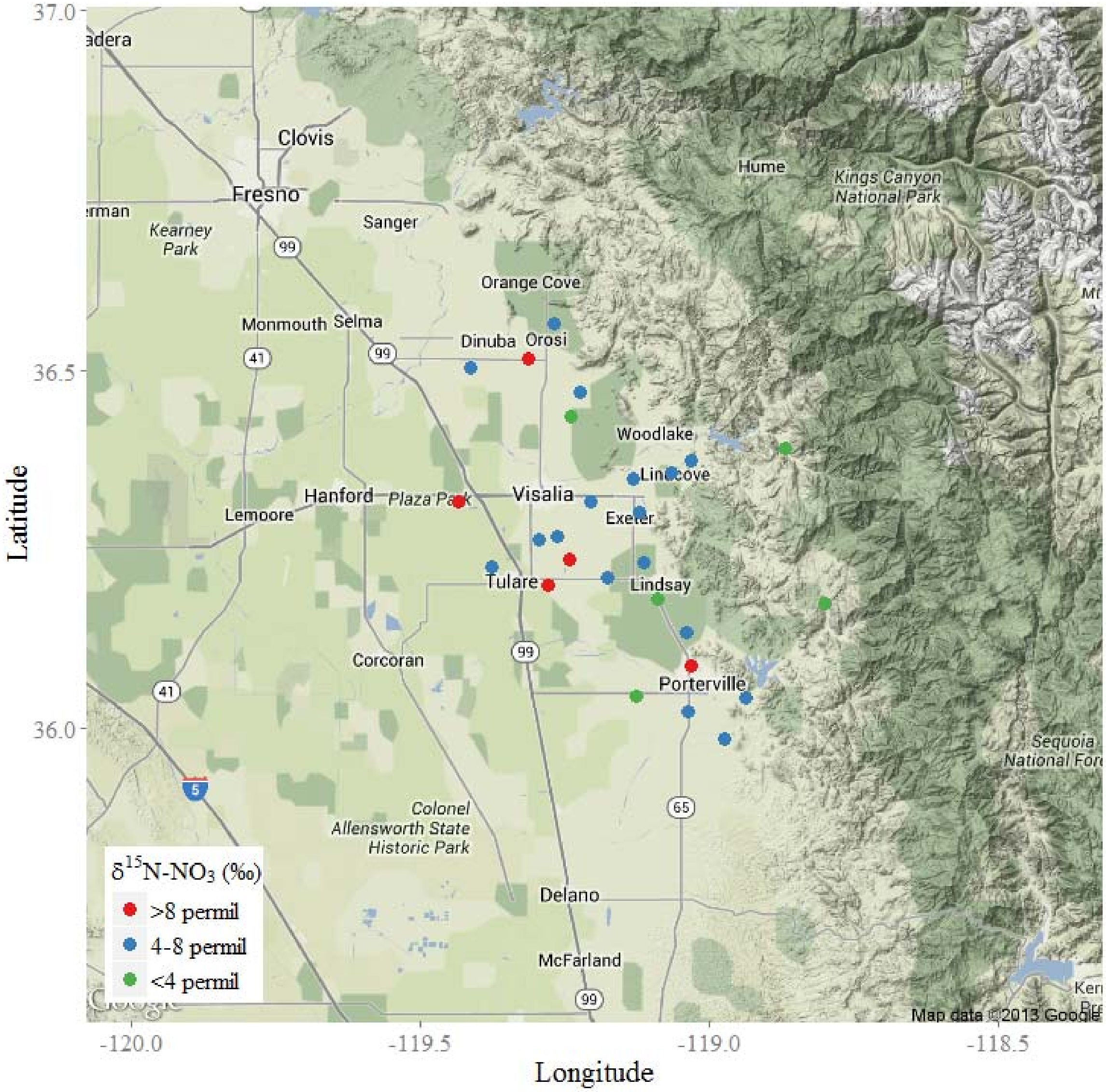


Figure 5b. Spatial distribution of nitrate isotopic composition in Tulare County domestic wells

The highest concentration sample, TUL 0979, was 240 mg/L-NO_3 and had a $\delta^{15}N$-NO_3 value of 6.1‰ and a $\delta^{18}O$-NO_3 value of 8.2‰ (Figure 6 and 7). The isotopic composition of nitrate in TUL 0979 is generally consistent with containing a component of nitrate or mixed nitrate/ammonium synthetic fertilizer (Figure 9). Nitrate in TUL 0928 also has an isotopic composition consistent with synthetic nitrate, but its nitrate concentration is low (1.6 mg/L-NO_3).

In general, the oxygen isotope composition of nitrate ($\delta^{18}O$-NO_3) produced by nitrification of ammonium is correlated with the oxygen isotope composition of local water ($\delta^{18}O$-H_2O). This correlation is due to incorporation of local water and atmospheric oxygen, typically in a 2:1 ratio, during production of nitrate from ammonium from either synthetic ammonium fertilizer or animal/human waste. The relation of oxygen isotope compositions in nitrate and water for Tulare County domestic wells is shown in Figure 10. Lines showing the predicted nitrate and water $\delta^{18}O$ values produced from nitrification of ammonium are also plotted, with a range reflecting uncertainty in the local pore water $\delta^{18}O$ values in the unsaturated zone where nitrification is most likely to occur. Most samples have nitrate and water $\delta^{18}O$ values that are consistent with nitrification of ammonium in the presence of local water. Samples from the valley fall lower on the plot and reflect nitrification of ammonium in the presence of the irrigation return water with low $\delta^{18}O$-H_2O. Mixing with synthetic NO_3 fertilizer would cause samples to fall above the predicted lines.

Coplen, T.B., and Kendall, C. 2000. Stable Hydrogen and Oxygen Isotope Ratios for Selected Sites of the U.S. Geological Survey's NASQAN and Benchmark Surface-water Networks. USGS Open-File Report 00-160.

Kendall, C. 1998. Tracing nitrogen sources and cycling in catchments. In: Kendall, C. and McDonnell, J. J. Eds.), *Isotope Tracers in Catchment Hydrology*. Elsevier, New York.

SWRCB. 2010. GAMA Domestic Well Project Groundwater Quality Data Report: Tulare County Focus Area (Draft). California State Water Resources Control Board Groundwater Protection Section (Groundwater Ambient Monitoring & Assessment Program). http://www.swrcb.ca.gov/gama/domestic_well.shtml.

Rose, T.P., Davisson, M.L., and Criss, R.E. 1996. Isotope hydrology of voluminous cold springs in fractured rock from an active volcanic region, northeastern California. *Journal of Hydrology* **179**, 207-236.

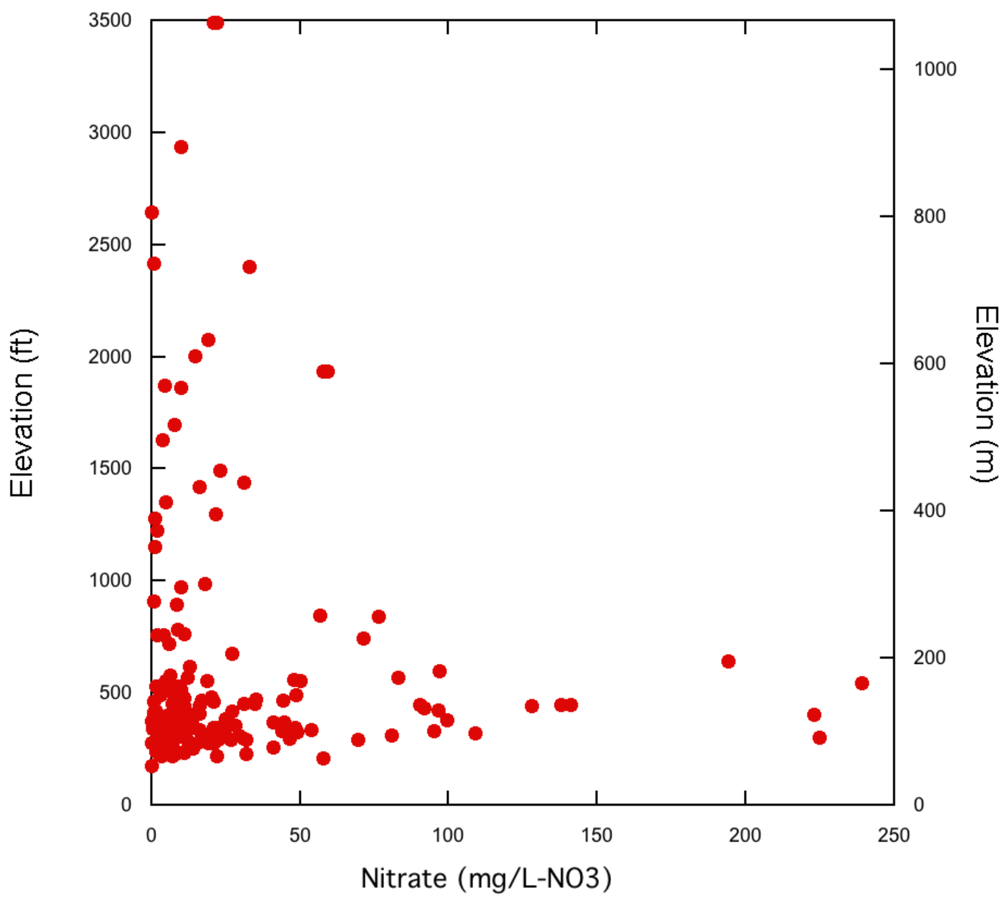


Figure 6. Well elevation versus dissolved nitrate concentrations in Tulare County domestic well samples.

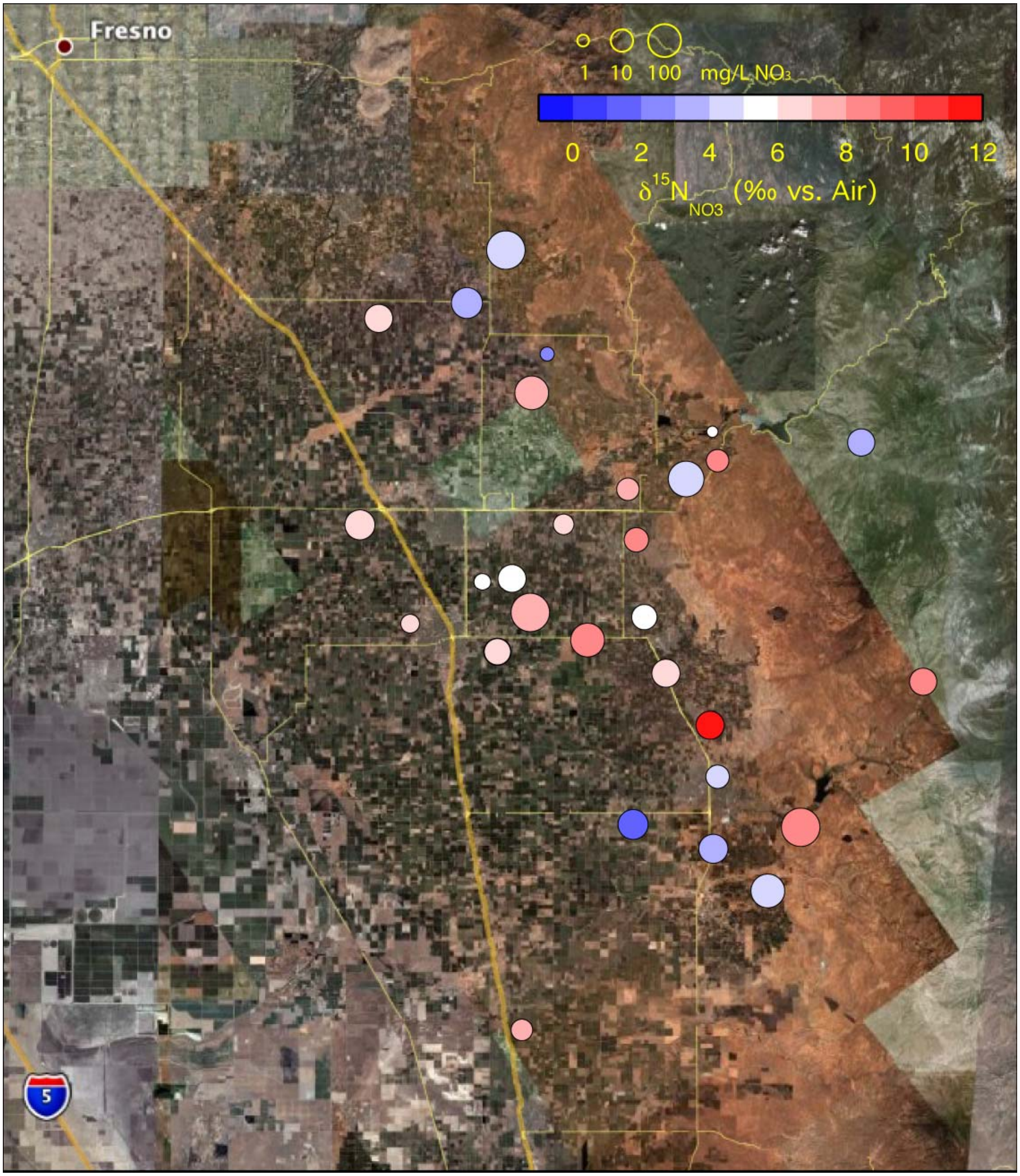


Figure 7. Wells analyzed for N isotope compositions in nitrate are shown on a Google Earth satellite image. The isotopic composition of nitrate-N ($\delta^{15}N$-NO_3) is represented by the color of the dot. The nitrate concentration of each well is represented by the size of the dot.

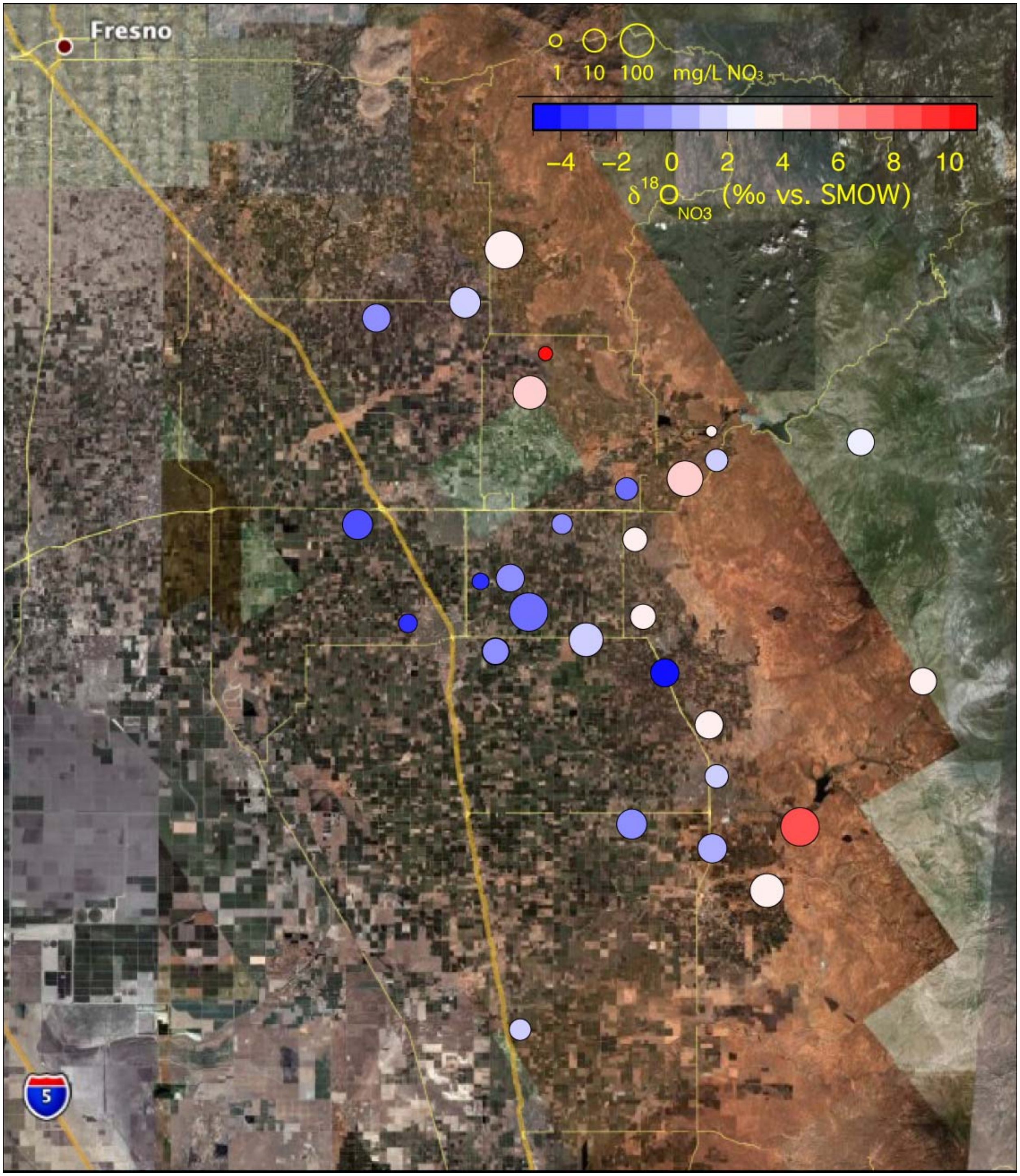


Figure 8. Wells analyzed for O isotope compositions in nitrate are shown on a Google Earth satellite image. The isotopic composition of nitrate-O ($\delta^{18}O\text{-}NO_3$) is represented by the color of the dot. The nitrate concentration of each well is represented by the size of the dot.

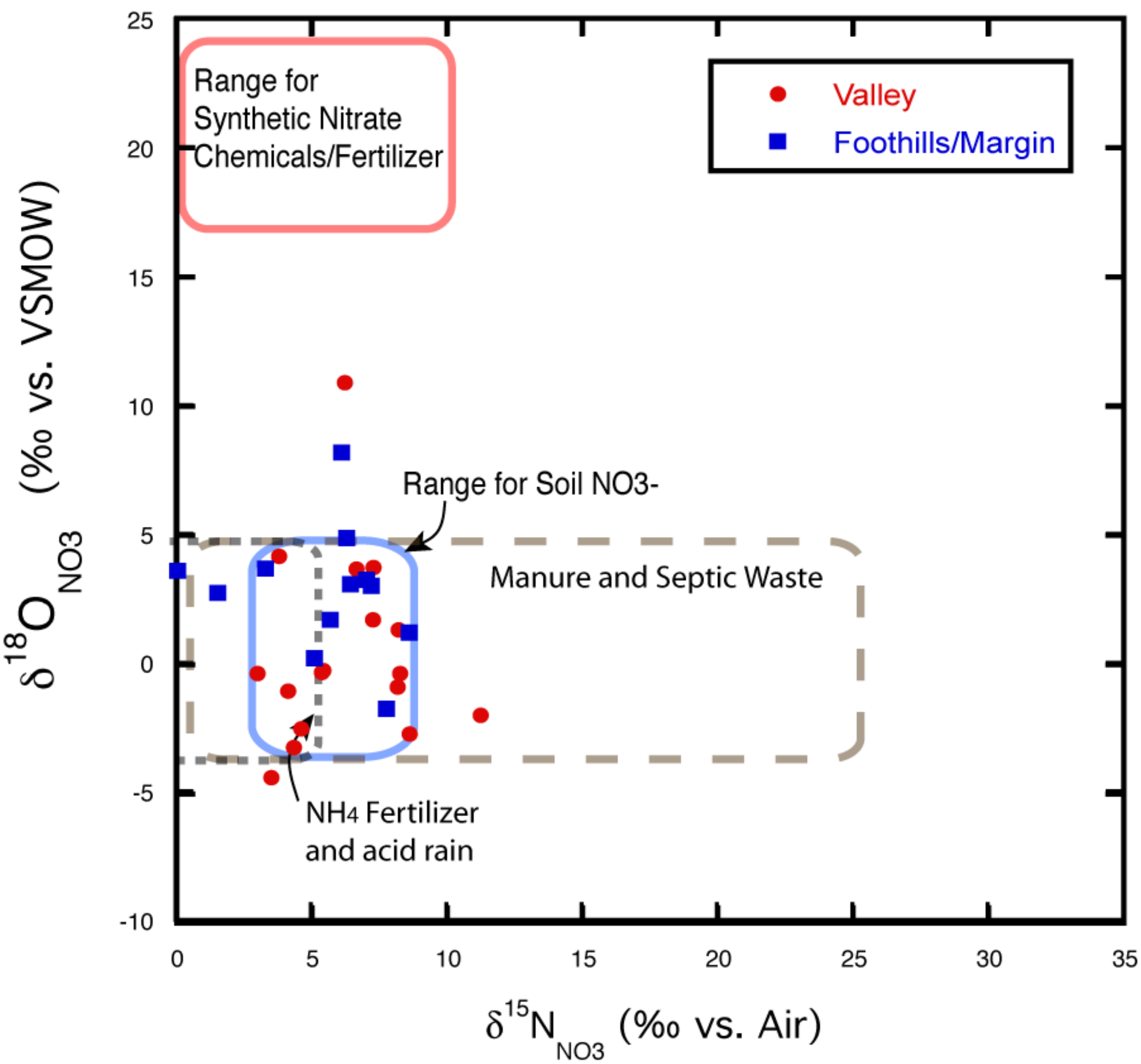


Figure 9. Nitrogen and oxygen isotope compositions of dissolved nitrate in Tulare County wells. Observed ranges from nitrate sources are modified from Kendall (1998) based on the observed oxygen isotope composition of water from this study.

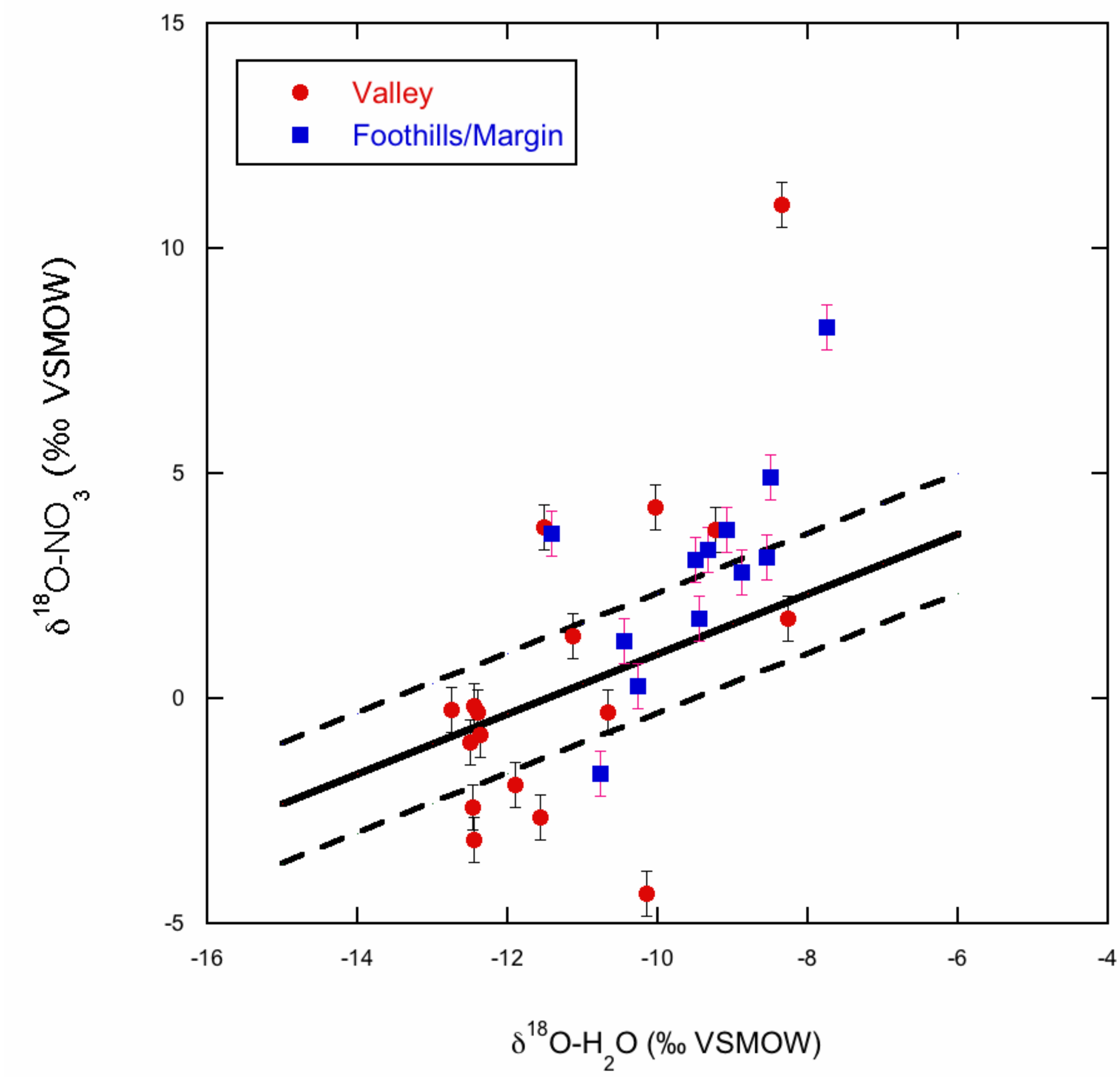


Figure 10. Oxygen isotope compositions in water and nitrate from Tulare County domestic wells. The predicted relation between oxygen isotope compositions in water and nitrate produced by nitrification of ammonium are shown (solid line) with additional lines to account for a range of $\delta^{18}O$-H_2O values that may occur in unsaturated zone pore waters where nitrification is likely to occur (dashed lines).

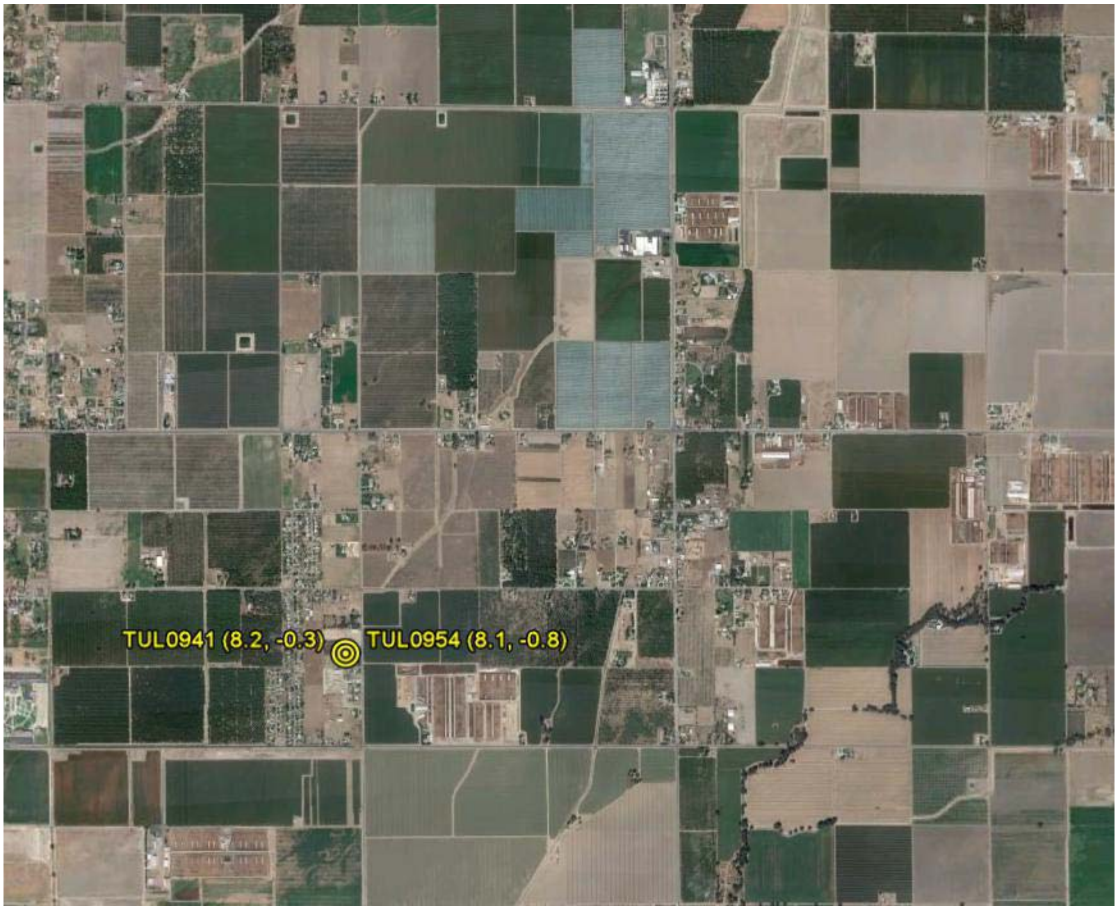


Figure 11. Location of duplicate samples TUL 0941 and TUL 0954 on a Google Earth 2010 satellite image. Both isotopic composition and concentration for these samples reproduced well: 19 vs. 21 mg/L nitrate; 8.2 vs. 8.1 ‰ $\delta^{15}N\text{-}NO_3$,, -0.3 vs. -0.8 ‰ $\delta^{18}O\text{-}NO_3$ (TUL 0941 vs TUL 0954). This valley well (elevation 279 feet) is close to two dairy operations, and the groundwaters have nitrate isotopic compositions within the range of nitrate associated with a dairy manure source.

Figure 12. Location of well TUL979 on a Google Earth 2010 satellite image. This foothill well (elevation 546 feet) is in a sparsely populated area surrounded by orchards and has high nitrate concentration (240 mg/L nitrate). The nitrate isotopic composition (δ^{15}N-NO_3= 6.1, δ^{18}O-NO_3 = 8.2), in particular the high δ^{18}O-NO_3, is indicative of a synthetic fertilizer source.

SIGNIFICANT FINDINGS

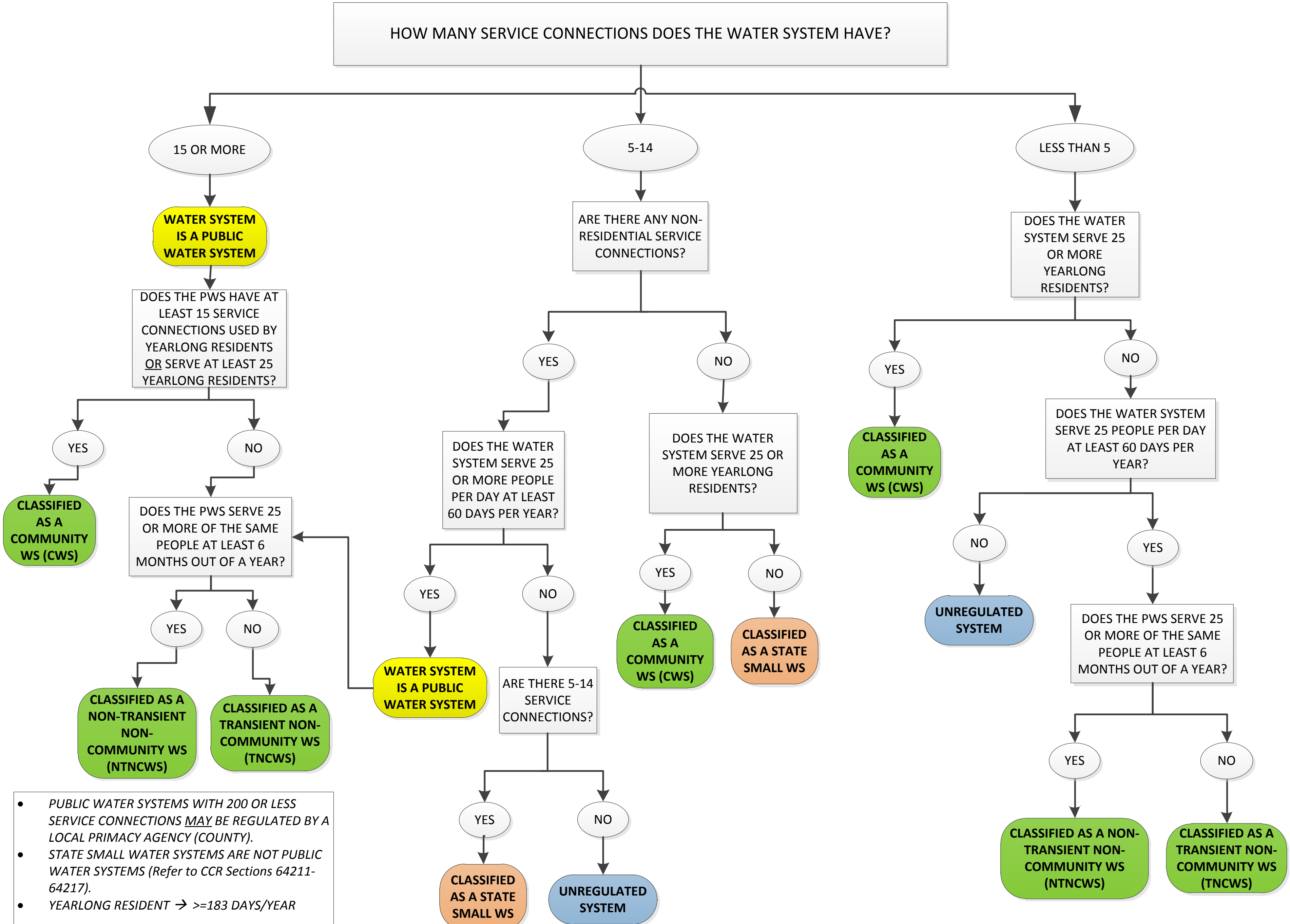
- In general, higher domestic well water nitrate concentrations are found in valley wells below 400 feet surface elevation.
- Domestic wells below 400 feet surface elevation draw on groundwater heavily impacted by irrigation with Kings and Kaweah River water, as indicated by water isotopic composition. This finding is consistent with both the long and heavy usage of Kings River water for irrigation in this area, and with the assumed shallow depth of these domestic wells. Nitrate associated with these waters is presumably associated with the same source (chemical or organic fertilizer in irrigation water) or is mobilized by irrigation (septic effluent or soil nitrogen).
- Domestic wells in the foothills (with elevations above 400 feet) receive recharge derived from local precipitation that has experienced some evaporation.
- Nitrate concentrations in the most polluted wells are sufficiently high to preclude a significant contribution from soil or atmospheric sources. Such sources cannot be precluded in wells with nitrate concentrations below the regulatory drinking water limit, however the data set does not include enough samples near typical background concentration levels to assess the isotopic characteristics of natural nitrate sources in this area.
- Nitrate isotopic compositions indicate a dairy manure or septic effluent source for the majority of the most heavily impacted wells, with the exception of one well with high nitrate concentration and an isotopic composition indicative of a synthetic fertilizer source. An analysis of land use and the distribution of potential nitrate sources would be extremely useful.

A preliminary investigation of the correlation between land use and nitrate isotopic composition was conducted (see Appendix “GAMA Domestic Well Project - Tulare County. Nitrate Source Attribution: The Isotopic Evidence”). The sparse nitrate isotopic data set is under-represented by domestic wells with no potential anthropogenic sources within 500 m of the well, and the method used to assign land use is cursory. Patterns observed, however, are consistent with multiple anthropogenic sources, including dairy wastewater, septic effluent and synthetic fertilizer.

- Nitrate isotopic composition does appear to vary with land use
  - Dairy, agricultural/residential, and wild-land sites are isotopically distinct
  - Dairy site nitrate-N isotopic data are isotopically consistent with a manure source
  - Nitrate-O isotopic data are isotopically consistent with local nitrification of ammonium (from manure, septic effluent, or synthetic ammonium fertilizer)
- The isotopic evidence is consistent with more than one nitrate source
  - Domestic wells located close to dairies do have a different nitrate isotopic composition than wells not close to dairies in similar hydrogeologic settings.
  - The isotopic compositions measured are consistent with the suspected sources of nitrate to these wells (soil, fertilizer, manure, septic or community wastewater).
  - High concentrations of nitrate occur in all developed land use categories.

APPENDIX B

DECISION TREE FOR CLASSIFICATION OF WATER SYSTEMS



Primacy Liaison Unit-WKK 7/22/2015