Local Agency Management Program
for
Onsite Wastewater Treatment Systems

Alameda County, California

(Revised Draft)

County of Alameda
Department of Environmental Health

March 9, 2017

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Section 1:
Introduction and Background

Introduction

This document presents the proposed Local Agency Management Program (LAMP) pertaining to the oversight of onsite wastewater treatment systems (OWTS) within the County of Alameda, California. This document, along with its partner documents the Onsite Wastewater Treatment System Manual and the Onsite Wastewater Treatment System Ordinance (hereinafter referred to collectively as the LAMP) are the major components of Alameda County's LAMP, prepared in accordance with the requirements of the State Water Resources Control Board's (State Water Board) *Water Quality Control Policy for Siting, Design, Operation, and Maintenance of Onsite Wastewater Treatment Systems*, dated June 19, 2012, also referred to as the "State OWTS Policy".

The State OWTS Policy provides a multi-tiered strategy for management of OWTS in California. This LAMP has been prepared by Alameda County to obtain approval for OWTS management under Tier 2 of the OWTS Policy. As such, it is intended to allow the County to continue providing local oversight of OWTS by implementing practices that: (a) are suited to the conditions in Alameda County; (b) demonstrate standards that achieve the same purpose as the OWTS Policy, which is to protect water quality and public health; and (c) ensure the best opportunity for coordinated and comprehensive management of OWTS, public health and water quality in Alameda County.

This LAMP is intended to apply to all OWTS within Alameda County having wastewater design flows up to 10,000 gallons per day (gpd). Any OWTS with a design flow exceeding 10,000 gpd and/or where the wastewater includes industrial process wastewater, or a community system serving multiple discharges under separate ownership would be regulated jointly by Alameda County and the respective California Regional Water Quality Control Board (Regional Water Board), San Francisco Bay or Central Valley Region. All cities within the County, with the exception of the City of Berkeley, have designated the County's Health Officer as their jurisdictions' health officer. The Alameda County Health Officer has designated the Director of Environmental Health as a Deputy Health Officer for the purpose of enforcing State and local environmental health law.

Geographical Area

Alameda County is located in the San Francisco Bay Area and encompasses approximately 738 square miles. The county is bordered on the west by San Francisco Bay and on the north, east and south by Contra Costa, San Joaquin and Santa Clara Counties, respectively. The County seat and largest city is Oakland. The Berkeley hills form part of the northeastern boundary and reach into the center of the county roughly dividing the county into two halves – western and eastern.

A coastal plain several miles wide borders the bay in the western half. The Livermore Valley occupies a large portion of the eastern half of the county.

Regulation of Onsite Wastewater Treatment Systems

The Alameda County Department of Environmental Health (the Department) is responsible for regulating OWTS throughout the unincorporated areas of the county. The Department also administers OWTS regulations in the various cities in the county as discussed further below. OWTS are used largely for properties located outside of municipal sewer service boundaries, although there are still many isolated properties within the incorporated areas that have not been connected to sewers, and continue to use OWTS. More than half of the properties served by OWTS are in the eastern portions of the county within the Upper Alameda Creek Watershed. The largest concentrations are in the unincorporated community of Sunol and on the fringes of Pleasanton, Livermore and Castro Valley. Overall there are currently estimated to be approximately 2,500 OWTS in Alameda County.

The County has historically operated its onsite wastewater systems program under the authority granted by two Regional Water Boards: (1) the San Francisco Bay Region for those areas that drain to San Francisco Bay; and (2) the Central Valley Region for the small portion of the County that drains easterly to the Sacramento-San Joaquin Delta. **Figure 1-1** is a map of Alameda County showing the distribution of OWTS in the unincorporated areas of the county, Regional Water Board boundaries, cities/sewered area and the major roadway network.

OWTS located within the incorporated areas in the county have been regulated by the County by informal agreements with each city. Under this LAMP, the County of Alameda Department of Environmental Health is responsible for permitting the installation and regulation of OWTS within the County's jurisdictional boundaries.

Two of the largest landholders in Alameda County, especially in the unincorporated area, are the East Bay Regional Park District (EBRPD) and the San Francisco Public Utilities Commission (SFPUC). A map showing their landholdings is provided in **Figure 1-2**. Many of the EBRPD landholdings support recreational facilities that require OWTS or pump-and-haul vault systems that are under the regulatory authority of Alameda County Department. SFPUC properties include watershed lands around Calaveras Reservoir and other sites used mostly in connection with support facilities for water facilities or leased to private entities for a variety of uses including quarry operations. Historically, wastewater facilities on SFPUC properties have not been regulated by the Department, but will now need to be regulated under the County's LAMP, except where permitted separately under waste discharge requirements issued by the Regional Water Board.

Zone 7 of the Alameda Flood Control and Water Conservation District (Zone 7 Water Agency or Zone 7) was established in 1957 to manage water resources in the Upper Alameda Creek Watershed above Niles. Initially, Zone 7's focus was directed toward resolving groundwater overdraft, water supply imports and flood control and drainage issues within the watershed. This

Figure 1-1. Distribution of OWTS

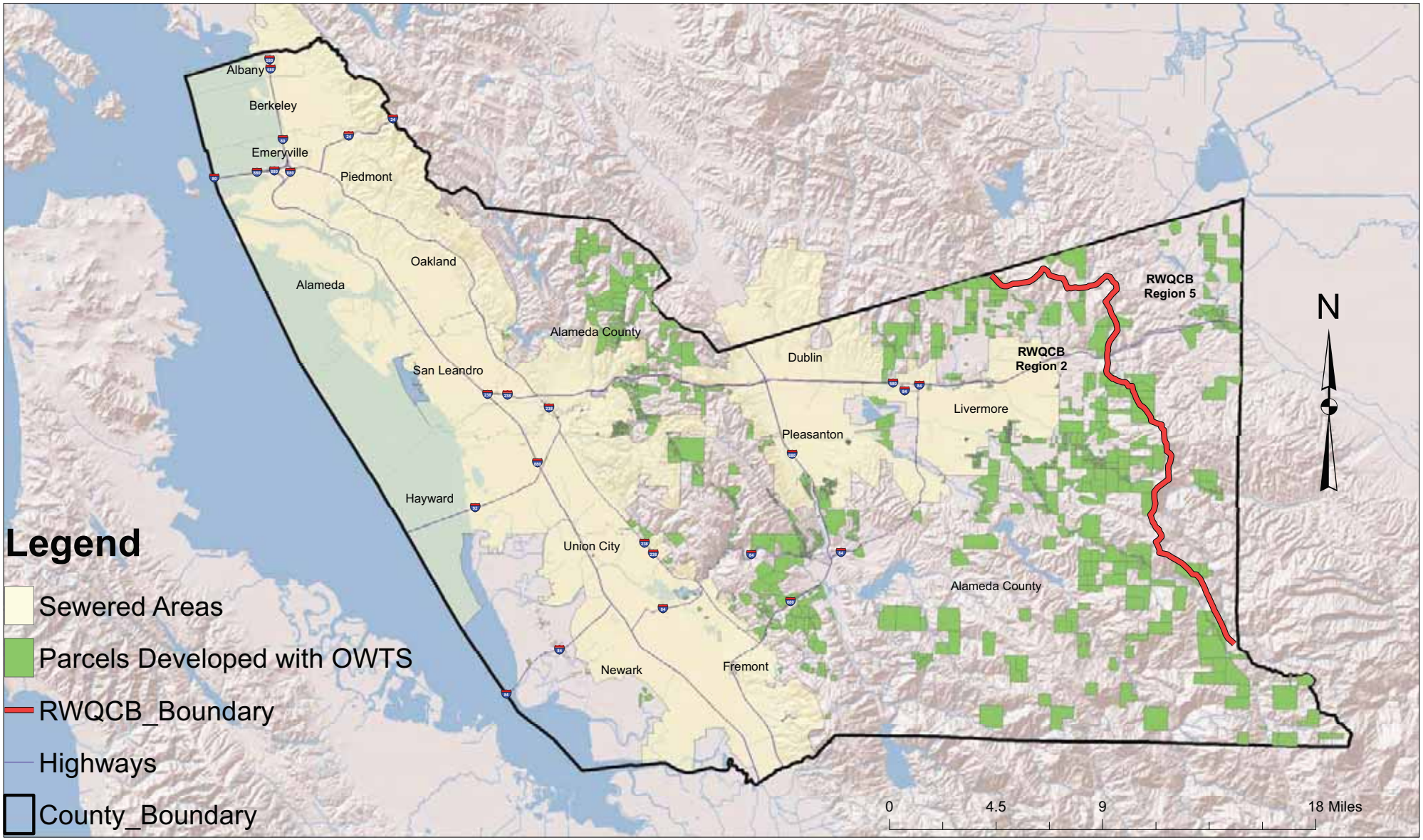
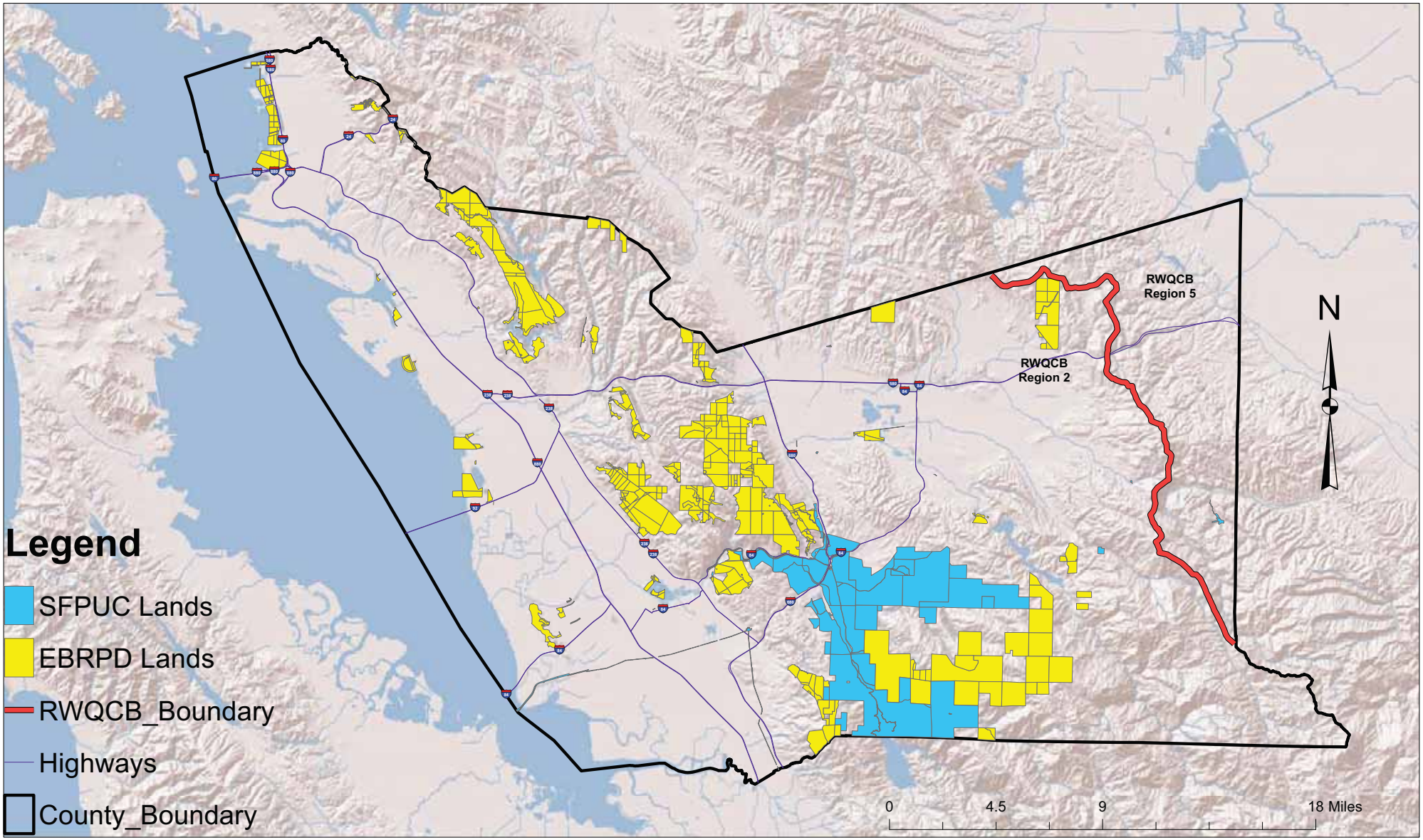


Figure 1-2. EBRPD and SFPUC Lands



led later to activities related to water quality and wastewater management. In 1982, Zone 7 completed the Wastewater Management Plan for the Unsewered, Unincorporated Area of Alameda Creek Watershed above Niles, and since that time has been active in supporting the County Department and helping to guide OWTS requirements and management activities as they relate to development and wastewater discharge impacts within their jurisdiction. Zone 7 does not have permitting authority for OWTS; however requires special approval for OWTS located within the watershed for: (1) new OWTS for a commercial or industrial use; (2) conversion of a residential OWTS to a commercial or industrial use; or (3) new residential OWTS that discharge greater than one rural residential equivalence of wastewater per 5 acres. Zone 7 and the County work cooperatively in the planning and implementation of OWTS requirements, ongoing water quality monitoring and assessment, with Zone 7 providing technical assistance and review of specific project proposals and issues of concern within the Upper Alameda Creek Watershed.

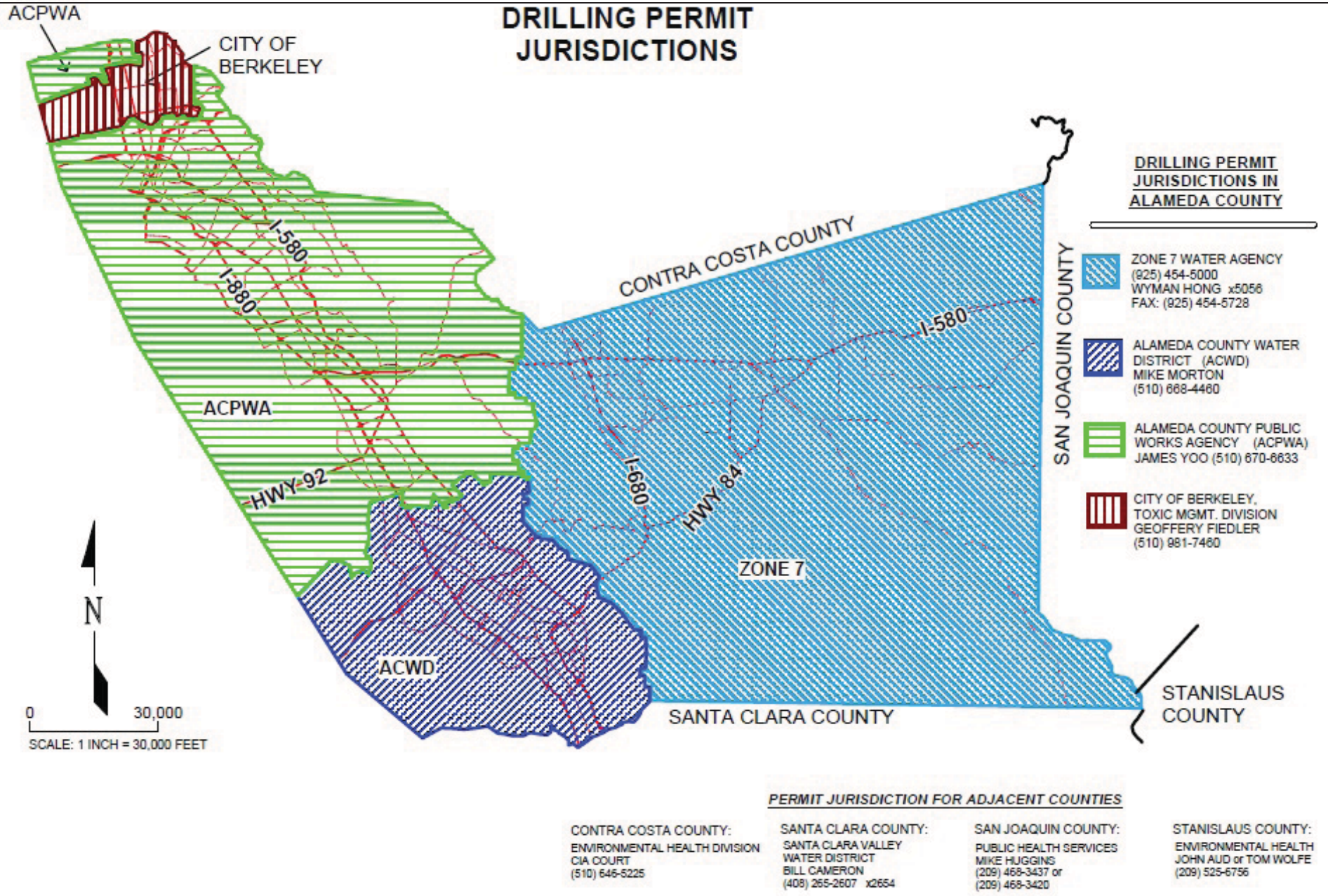
Zone 7 is the designated groundwater basin manager for the development and implementation of Salt and Nutrient Management Plans for the Livermore Valley Groundwater Basin, which includes recommendations relating to OWTS nitrogen loading, a key water quality issue in the basin. Alameda County Water District (ACWD) serves in a similar capacity as basin manager for the Niles Cone Groundwater Basin. Both of these agencies also are responsible for regulation of well drilling permits in their respective jurisdictions. **Figure 1-3** shows Zone 7 and ACWD jurisdictional boundaries, as well as the well drilling permit areas covered by Alameda County Public Works and City of Berkeley.

Alameda County OWTS Requirements

Requirements for the installation, use and maintenance of OWTS in Alameda County are contained in two primary documents, the Onsite Wastewater Treatment Systems Ordinance (Onsite Systems Ordinance or Ordinance) and the Onsite Wastewater Treatment Systems Manual (Onsite Wastewater Treatment Systems Manual or Manual), which accompany and form the basis for this LAMP. The OWTS Ordinance and OWTS Manual provide the policy, procedural and technical details for implementation of the LAMP.

Onsite Wastewater Treatment Systems Ordinance (Chapter 15.18)

The County Onsite Wastewater Treatment System Ordinance establishes standards for the approval, installation and operation of OWTS within Alameda County consistent with the County's overall responsibility to prevent the creation of health hazards and nuisance conditions and the protection of surface and groundwater quality. A copy of the Ordinance accompanies and is an integral part of this LAMP. Any change to the Ordinance requires approval by the Alameda County Board of Supervisors.



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PROJECT NO.:	1300096
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APPROVED:	NH

QUESTA ENGINEERING CORP.

Water Agency and Drilling Permit Jurisdictions

FIGURE 1-3

Onsite Wastewater Treatment Systems Manual

The Onsite Wastewater Treatment Systems Manual provides the procedural and technical details for implementation of the Ordinance. The Manual contains siting, evaluation, design, construction, and operating requirements for OWTS for residential and non-residential uses including Standard and Advanced Systems and Non-Discharging Wastewater Disposal Units. The Manual also contains procedural information on permitting of OWTS, the evaluation of OWTS proprietary treatment train components and qualifications and registration requirements of OWTS practitioners. The Onsite Wastewater Treatment Systems Manual will be reviewed and updated from time-to-time to keep pace with new issues, policies, procedures, and technologies affecting the use and management of onsite systems in Alameda County. The Onsite Wastewater Treatment Systems Manual will be maintained by the Department. Any substantive changes to the Manual will require review and approval by the San Francisco Bay Regional Water Board and adoption by Resolution of the Alameda County Board of Supervisors.

Organization of this LAMP

This LAMP is organized to present a comprehensive explanation of the various requirements, policies, procedures and measures used to regulate and oversee the use of OWTS in Alameda County. It is also structured as much as possible to address the items listed in the State OWTS Policy pertaining to Local Agency Requirements and Responsibilities (Section 3.0 of the OWTS Policy) and Local Agency Management Program for Minimum OWTS Standards (Section 9.0 of the OWTS Policy). Reference is made throughout this LAMP to the County's OWTS Ordinance and Onsite Wastewater Treatment Systems Manual, which are attached as part of this LAMP. The following briefly summarize the contents of this document.

- ***Section 1 - Introduction and Background.*** This introductory section describes the overall purpose, scope, geographical coverage and overview of the key elements of the LAMP.

- ***Section 2 - Environmental Conditions, OWTS Usage and Water Quality Management in Alameda County.*** This section provides background information on environmental conditions pertinent to the use and suitability of OWTS in the County, extent of OWTS usage in the County, and a summary of OWTS management approaches and requirements adopted for protection of water quality in Alameda County.

- ***Section 3 - OWTS Siting, Design, and Construction Requirements.*** This section summarizes key requirements of the County Ordinance and Onsite Wastewater Treatment Systems Manual pertaining to siting, design and construction of OWTS, per the requirements of section 9.2 and covering applicable items listed under Tier 1 (Sections 7.0 and 8.0) of the State OWTS Policy.

- **Section 4 – Special Management Issues.** This section describes the provisions contained in the Alameda County LAMP corresponding with special OWTS management issues listed in Sections 9.2.1 through 9.2.12 of the SWRCB OWTS Policy.

- ***Section 5 - Prohibitions*.** This section describes the provisions contained in the Alameda County LAMP corresponding with the required prohibitions set forth in Section 9.4 of the State OWTS Policy.

- ***Section 6 – Program Administration.*** This section presents the County's plan for addressing the administrative aspects of the LAMP, including record keeping, on-going assessment of water quality issues related to OWTS, and reporting to the Regional Water Board, as required under Section 9.3, of the OWTS Policy.

- ***Appendix A – Supporting Rationale.*** This appendix presents a discussion of the supporting rationale (including literature sources) for the various siting and design requirements, focusing on vertical separation requirements for Standard and Advanced OWTS and comparison with Tier 1 standards of the OWTS Policy.

- ***Appendix B – OWTS Usage and Wastewater Loading Estimates.*** This appendix describes the process followed to develop estimates of the number and distribution of OWTS in Alameda County, along with estimates made of wastewater discharge volumes and nitrate loading contributions to groundwater from OWTS in 12 localized areas of OWTS usage that have either been designated as Areas of Concern or are anticipated to be a primary focus for the long-term OWTS management program in Alameda County based on the number and/or density of OWTS or other factors (Focus Areas). Maps of these areas are provided. This information will provide the baseline for the County's ongoing assessment of water quality impacts from OWTS.

- ***Appendix C - Supplemental OWTS Data and Mapping for Oakland Hills, Department File Records.*** This appendix presents various maps and data summaries related to OWTS in Oakland Hills based on information contained in current records on file with the Alameda County Department.

- ***Appendix D - Section 6 of the Zone 7 Water Agency Nutrient Management Plan.*** This appendix reproduces Section 6 of the recently adopted Nutrient Management Plan for the Livermore Valley Groundwater Basin.

Section 2:
Environmental Conditions, OWTS Usage and Water Quality Management in Alameda County

This section provides background information on environmental conditions, OWTS usage and management approaches adopted for protection of water quality in Alameda County.

Geographical Setting

Alameda County can be viewed geographically as made up of two halves. The western half, consists of relatively flat urban frontage along the eastern shore of San Francisco Bay, transitioning up to the Berkeley Hills (part of the Pacific Coast range) trending northwest to southeast roughly parallel to the Bay shoreline. The urban shoreline plains, commonly referred to as the "East Bay", extend from the City of Berkeley in the north to the City of Fremont near the southern tip of the Bay. Then from Berkeley to Oakland, San Leandro to Fremont and also in Castro Valley, the urban areas extend eastward into the mountainous upland areas. Along the Berkeley Hills is the Hayward fault, Wildcat Fault and Calaveras Fault, where there are a great number of public lands, parks and trails making up the majority of the uplands. Since the majority of the western half of the county is urban or public, there is relatively minimal development using OWTS except in the remote canyon lands near Castro Valley, the ridge areas of Hayward, and scattered pockets on the fringes or within urban development, such as in the Oakland Hills.

To the east of the Berkeley Hills, roughly half of the County forms the Upper Alameda Creek Watershed and flat basin area of the Livermore Valley. The Livermore Valley extends north into Contra Costa County, and is bounded on the south and southeast by the northern tip of the Diablo Range. East of the Livermore Valley the elevation gently rises across grassy rangeland and wind farms through the Altamont Pass, located in the eastern portion of the County, before descending into the Central Valley and immediately into San Joaquin County.

Draining almost the entirety of the eastern half of the county, the streams forming the Upper Alameda Creek Watershed converge near the Town of Sunol, where Alameda Creek then drains to the important bayside freshwater Niles Cone Groundwater Basin in Fremont. South and southeast of Pleasanton and Livermore is where the majority of the incorporated areas of the eastern half of Alameda County are developed using OWTS. Also to the south of Livermore Valley in the Diablo Range are three major water supply reservoirs: Lake Del Valle, San Antonio Reservoir and Calaveras Reservoir (lying mostly in Santa Clara County). These surface water reservoirs are used to store runoff and imported water. The streams, Altamont Creek, Arroyo las Positas, Arroyo Mocho, Arroyo Del Valle, Arroyo de Laguna, Vallecitos Creek, and Alameda Creek, are used to transport runoff and stored and imported water to Zone 7, Alameda County Water District, and the City of San Francisco Public Utilities Commission Water Department facilities.

Surface Water Hydrology

There are two major watersheds that drain the unincorporated areas of Alameda County - Alameda Creek and San Lorenzo Creek. It is estimated that approximately 90% of the OWTS in the County are located in these two watersheds. **Figure 2-1** provides a map of the county showing the delineation of these two watersheds, along with major lakes and reservoirs, significant watercourses draining the Oakland hills, and the drainage divide in the Altamont Hills, which is the jurisdictional boundary between the San Francisco Bay and Central Valley Regional Water Boards.

Alameda Creek Watershed

The Alameda Creek Watershed is the largest drainage in the southern San Francisco Bay, covering an area of approximately 700 square miles within Alameda, Contra Costa and Santa Clara Counties. Alameda Creek originates in the mountains of northeastern Santa Clara County and from there flows northwesterly through the hills of the Coast Range, merging with drainage from the Livermore-Amador Valley in the Sunol Valley, then flowing westerly through Niles Canyon and across the San Francisco Bay plain, ultimately discharging into San Francisco Bay near Coyote Hills Regional Park in Union City. Major water bodies in the watershed include Del Valle, Calaveras and San Antonio Reservoirs. Major tributary streams include Arroyo Mocho, Arroyo las Positas, Arroyo del Valle, Arroyo de Laguna, San Antonio Creek, Sinbad Creek and Stonybrook Creek. Water from Alameda Creek is used for recharging the Niles Cone groundwater basin at Quarry Lakes Park, managed by the Alameda County Water District. Zone 7 Water Agency operates similar groundwater recharge facilities in the Livermore-Pleasanton area. There are an estimated 1,288 existing OWTS in the Alameda Creek Watershed (above Niles).

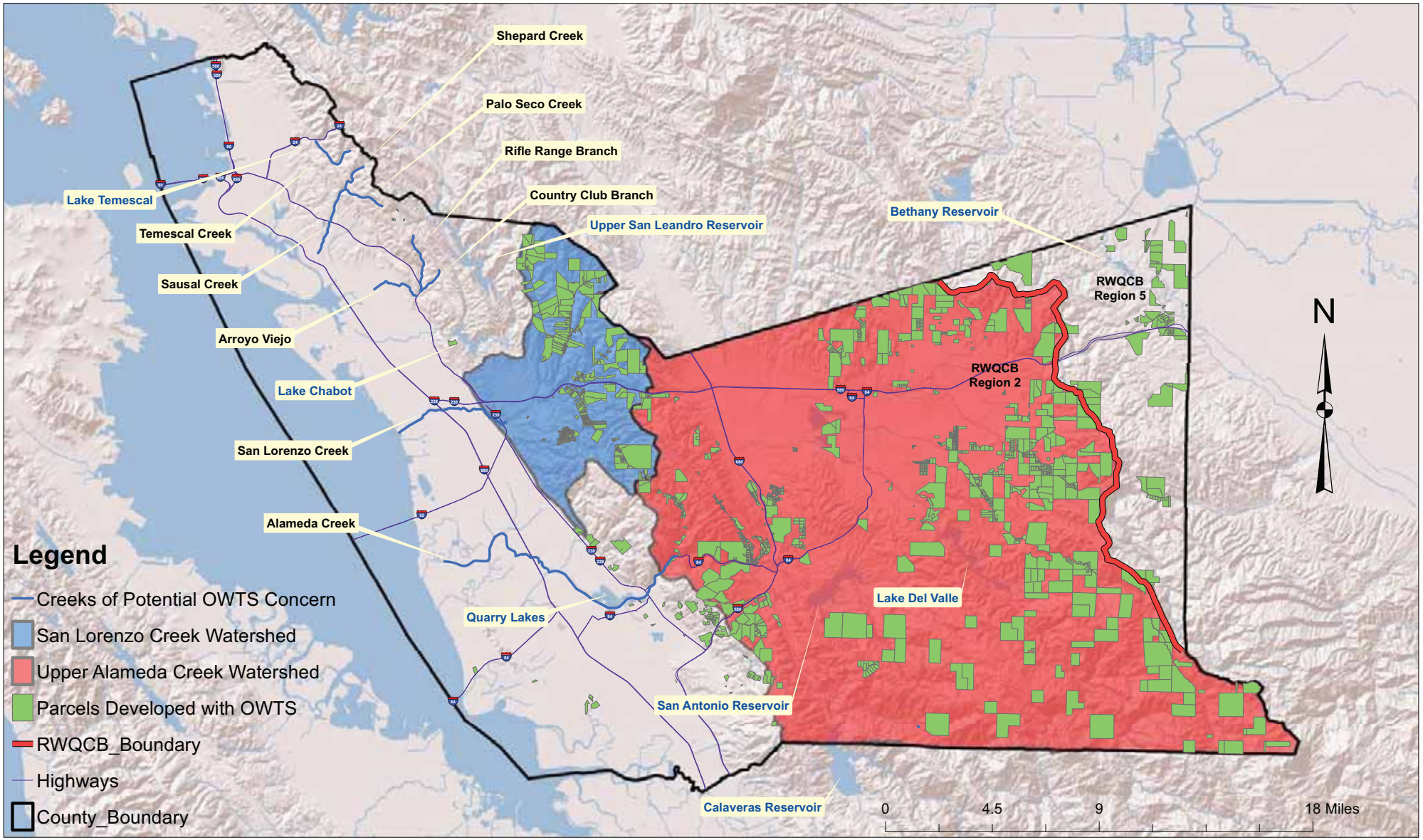
San Lorenzo Creek Watershed

San Lorenzo Creek drains an approximately 60-square mile fan-shaped watershed area originating in the hills to the north, south and east of Castro Valley. Major tributaries to San Lorenzo Creek include Cull Creek and Crow Creek to the northeast, and Palomares Creek to the southeast. These and other tributary drainages flow through steep, narrow canyons carved into the coastal hills, rising from elevations of about 200 feet above sea level at Castro Valley up to 1,850 feet above sea level at the ridgeline divides. From the confluence of streams at Castro Valley, the San Lorenzo Creek flows westerly across the San Francisco Bay plains, discharging to San Francisco Bay about three miles south of the Oakland Airport. There are an estimated 483 existing OWTS in the San Lorenzo Creek Watershed.

Oakland and Berkeley Hills

The Oakland and Berkeley Hills stretch northwest-southeast for a distance of about 15 miles along the border with Contra Costa County. The hills rise up from the East Bay plains to elevations of 1,000 to 1,400 feet above sea level and form the headwaters of numerous creeks and drainages that flow westerly through urban areas and eventually to Bay. The east side of the hills

Figure 2-1. Major Surface Water Features



consists primarily of open space park and watershed lands, most of which drain through Contra Costa County to San Leandro Creek, which in turn feeds Upper San Leandro Reservoir and Lake Chabot north of Castro Valley. Use of OWTS in the Oakland and Berkeley Hills (close to 100 systems) is primarily in various pockets of residential development within the City of Oakland along Skyline Boulevard and other areas where building took place before public sewers were extended into the hills. Streams draining the hills have steep gradients and many flow only intermittently, during the wet season or in response to rainfall events. Some of the notable streams draining areas of OWTS usage in the hills above Piedmont include Shepard and Palo Creeks, which are tributaries of Sausal Creek. The area south of Skyline High School drains to Rifle Range and Country Club Branches of Arroyo Viejo Creek, joining in the vicinity of Golf Links Road before flowing westerly past Castlemont High School and eventually to the Bay near the Oakland-Alameda County Coliseum. The hills near the junction of Highways 13 and 24 are drained by Temescal Creek, which feeds Lake Temescal, a popular recreational lake operated by the East Bay Regional Park District.

Lakes and Reservoirs

As indicated in **Figure 2-1** and summarized in **Table 2-1**, there are several important lakes and reservoirs in Alameda County. In addition, throughout the county there are a number of smaller lakes and water storage reservoirs (open and covered) used in connection with water distribution systems and agricultural operations. Also, Zone 7 and the ACWD operate large spreading basins for artificial recharge of the Livermore Valley and Niles Cone groundwater basins, some of which also provide recreational uses.

Table 2-1. Major Lakes and Reservoirs in Alameda County

Name	Watershed Area	Uses	Approximate Capacity (acre-feet)	Operated By
Calaveras Reservoir	Alameda Creek	Water Supply	100,000	SFPUC
San Antonio Reservoir	Alameda Creek	Water Supply	50,000	SFPUC
Lake Del Valle	Alameda Creek	Water Supply, Flood Control, Recreation	77,000	DWR
Upper San Leandro Reservoir	San Leandro Creek	Water Supply, Recreation	41,000	EBMUD
Lake Chabot	San Leandro Creek	Emergency Water Supply, Recreation	10,000	EBMUD
Bethany Reservoir	California Aqueduct	Water Supply, Recreation	5,000	DWR
Lake Temescal	Temescal Creek	Recreation	<100	EBRPD

Groundwater Basins

There are six distinct groundwater basins in Alameda County, as identified by the California Department of Water Resources (DWR, 2003). **Table 2-2** provides a list of the groundwater basins and **Figure 2-2** provides a map of the county showing the location and extent of these groundwater basins. The groundwater basins in the Livermore-Amador and Sunol Valleys, and in the Niles Cone, are invaluable, particularly during drought periods, as storage basins for domestic water. On average, groundwater provides about one third of the urban and agricultural demands of the Livermore valley.

Table 2-2. Groundwater Basins in Alameda County

Basin Number*	Groundwater Basin Name	Sub-basin Names
2-9.04	Santa Clara Valley	East Bay Plain
2-9.01	Santa Clara Valley	Niles Cone
2-10	Livermore Valley	Castle, Bernal, Amador, Mocho, Livermore Uplands, Spring, May, Cayetano, Cain, Dublin, Bishop, Livermore Uplands
2-08	Castro Valley	-
2-11	Sunol Valley	-
5-22.15	San Joaquin Valley	Tracy

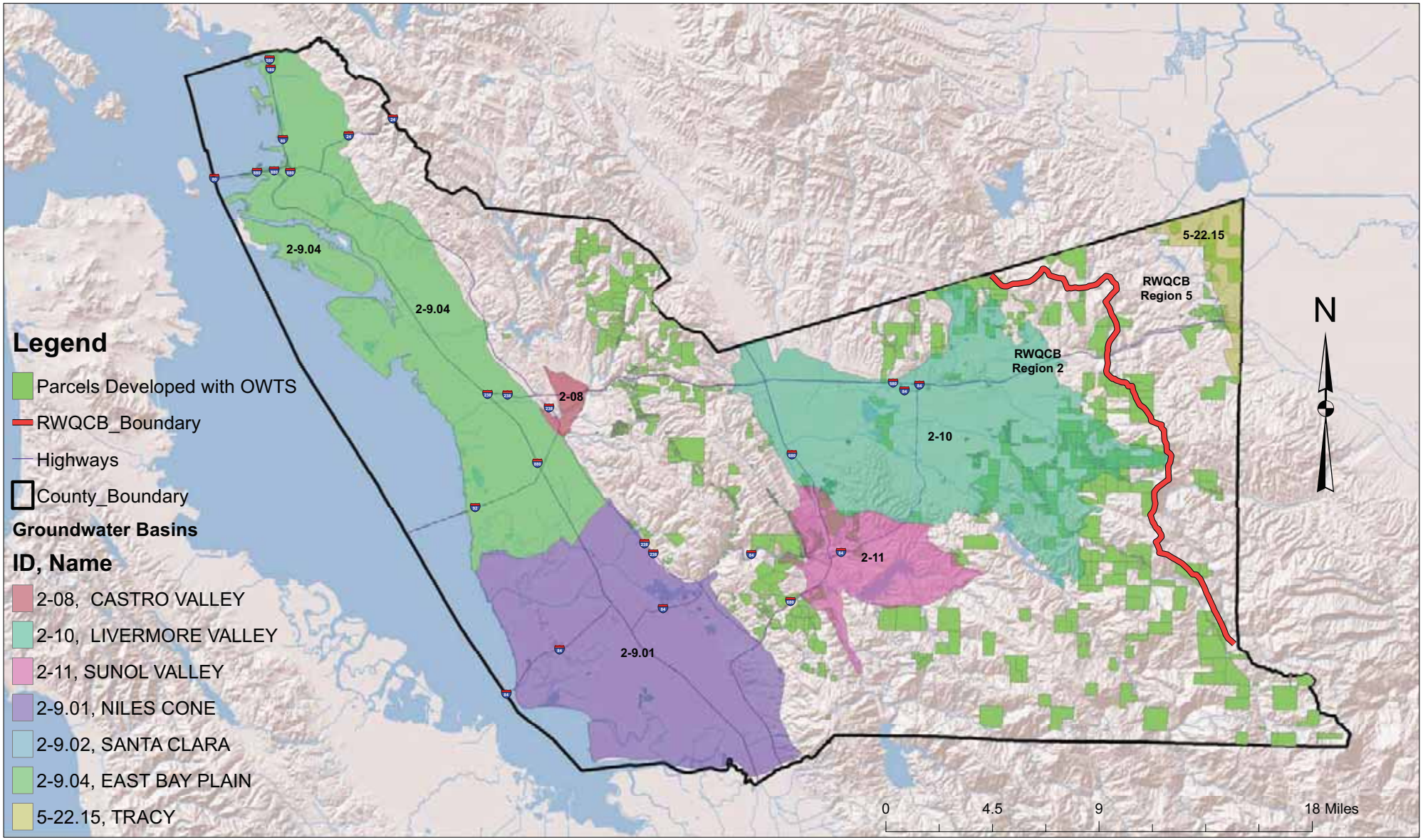
*Per DWR, Bulletin 118

Recent Groundwater Legislation Relevant to OWTS

In 2009, the State Water Board adopted the "Policy for Water Quality Control for Recycled Water" (Recycled Water Policy). The Recycled Water Policy requires among other things, that Salt and Nutrient Management Plans (SNMPs) be completed for all groundwater basins in California to manage salts and nutrients in a manner that ensures attainment of water quality objectives and protection of beneficial uses.

In 2014, the State Water Board adopted the Sustainable Groundwater Management Act (SGMA), effective January 1, 2015, which gives local agencies the authority to manage groundwater in a sustainable manner and allows for limited state intervention when necessary to protect groundwater resources. For SGMA DWR prioritizes groundwater basins with the greatest water supply importance (ranked as high- and medium-priority). Statewide 43 groundwater basins are ranked as high-priority and 84 are ranked as medium-priority basins. Alameda County has four distinct medium-priority groundwater basins: (1) Niles Cone Sub-basin; (3) East Bay Plain Sub-basin; and (3) Livermore Valley Basin and (4) a small portion of the Tracy Sub-basin. Sunol Valley and Castro Valley basins are ranked as very low-priority groundwater basins.

Figure 2-2. Major Groundwater Basins



The SGMA requires the creation of groundwater sustainability agencies (GSAs) to develop and implement local plans allowing 20 years to achieve sustainability. GSAs responsible for high- and medium priority basis must adopt Groundwater Sustainability Plans (GSPs) for the management and use of groundwater without causing undesirable results, including but not limited to degradation of water quality. The SGMA designates Alameda County Water District and Zone 7 as the GSAs for the Niles Cone Sub-basin and the Livermore Valley Basin, respectively. It is anticipated that one of the San Joaquin Valley Basin GSAs will manage the small portion of the Tracy Sub-basin that is within Alameda County.

The two major groundwater basins of significance in Alameda County with respect to OWTS are the Livermore Valley and the Niles Cone basins, and to lesser extent the Sunol Valley and Tracy Sub-basin.

Livermore Valley Groundwater Basin

The Livermore Valley Groundwater Basin lies within a structural trough of the Diablo Range, extending from east to west from the Pleasanton Ridge to the Altamont Hills, and south to north from the Livermore Upland to the Orinda Upland. The groundwater basin extends over a surface area of approximately 109 square miles (69,600 acres), including lands primarily in Alameda County and a small portion in Contra Costa County. Zone 7 Water Agency manages groundwater in the basin under authority from the California Water Code, and adopted a groundwater management plan in 2005. Zone 7 is also the designated GSA and is currently working on preparing a GSP for the Livermore Valley Basin.

The basin has a total estimated storage capacity of about 500,000 acre-feet, with current groundwater in storage at roughly half the total capacity. Under average hydrologic conditions the basin is estimated to be in balance, with annual inflows and outflows totaling roughly 23,600 acre-feet (ac-ft). Primary inflows are from natural and artificial recharge operation (19,500 ac-ft/year); primary outflows are for urban water supply (12,700 ac-ft/yr) and evaporation from gravel mining operations (6,900 ac-ft/yr).

The water-bearing materials in the basin consist of continental deposits from alluvial fans, outwash plains and lakes. Depths of domestic wells range from about 100 to 350 feet; municipal and irrigation well depths range from about 300 to 800 feet. Well yields are generally moderate to high, on the order of 500 to 4,500 gallons per minute (gpm) in the Main Sub-basin, and 2 to 300 gpm in the Fringe Sub-basin.

Water quality in the groundwater basin is generally suitable for all uses; however, monitoring by Zone 7 has determined localized areas of high nitrate concentrations related to overlying land uses activities. Groundwater nitrate conditions and recommended management activities to correct impairments are addressed in the "*Nutrient Management Plan - Livermore Groundwater Basin"* (NMP), issued by Zone 7 in February 2015, and adopted by the San Francisco Bay Regional Water Board in March 2016. Specific recommendations for OWTS are covered in the NMP.

Niles Cone Groundwater Subbasin

Niles Cone is a structural subbasin of the larger Santa Clara Valley Groundwater Basin. The Niles Cone occupies about 103 square miles (65,800 acres) beneath the San Francisco Bay plains in the southern part of Alameda County. The basin is bounded to the east by the hills of the Diablo Range and on the west by San Francisco Bay. It extends north to south from about Hayward to the Alameda County-Santa Clara County border. The Alameda County Water District (ACWD) is responsible for management of the Niles Cone Groundwater Sub-basin under the authority from the Water Code and adopted the "Alameda County Water District Groundwater Management Policy" in 1989. ACWD is also the designated GSA and is currently working on preparing a SNMP and a GSP for the Niles Cone Sub-basin.

The Niles Cone is comprised mainly of the alluvial fan formed by Alameda Creek where it leaves the coastal hills (Niles Canyon) and spreads across the San Francisco Bay plains. Groundwater in storage above sea level is estimated to be about 38,000 acre feet. Annual inflows to the basin total approximately 45,000 ac-ft/yr, with 75% provided by artificial groundwater recharge operations conducted by ACWD principally supplied by runoff from Alameda Creek diverted to percolation ponds (Quarry Lakes Park). Outflows from the basin include approximately 23,000 ac-ft/yr for municipal supplies, 6,300 ac-ft/yr for saline water extraction (aquifer reclamation), and 6,000 -7,400 ac-ft/yr outflow to the Bay.

Average depth of water supply wells is about 200 feet. Well yields are typically moderate to high, ranging from 650 to about 3,000 gpm for municipal/irrigation wells. Management of salinity is the primary challenge for this groundwater basin. Water quality monitoring data indicate few incidences of elevated nitrate concentrations. There are very few OWTS located within the land area overlying the groundwater basin. However, since runoff from the Alameda Creek Watershed is an essential source of recharge to the groundwater basin, land use and wastewater management activities within the Alameda Creek Watershed can impact the Niles Cone groundwater.

Sunol Valley Groundwater Basin

The Sunol Valley Groundwater Basin occupies a structural trough in the hills of the Diablo Range with a surface area of approximately 41 square miles (26,240 acres). Streams in the contributing drainage area include Upper Alameda, La Costa, Sinbad, Indian, Vallecitos and San Antonio Creeks, and Arroyo de la Laguna. The principal source of recharge is infiltration of surface water along Arroyo de la Laguna and Alameda, San Antonio and Vallecitos Creeks. The general direction of groundwater movement is from the upland areas toward Alameda Creek and then westward toward Niles Canyon, the outlet of the basin.

Water bearing materials in the basin consist of unconsolidated to semi-consolidated continental deposits of gravels, sand, silts and clays laid down in alluvial fans, outwash plains and lakes. Well yields for domestic and municipal wells are reported to in the range of 2 to 50 gpm, with well depths typically in the range of 200 to 350 feet, based on approximately 70 well completion

reports on file with the DWR. Shallow depth to groundwater on the order of 20 to 30 feet below ground surface is typical in the valley areas. Water quality is generally good to excellent, limited in some areas high mineral content. High nitrate concentration in some shallow wells indicates degradation from surface sources (DWR, 1974). Mean annual precipitation in the basin ranges from 17 to 20 inches. There is currently no significant groundwater management in the Sunol basin, however Zone 7 is designated the exclusive GSA for all groundwater basins in its jurisdiction of which Sunol Valley Basin is, by SGMA, for when a groundwater sustainability plan becomes a requirement.

East Bay Plain Groundwater Subbasin

The East Bay Plain is a subbasin of the Santa Clara Valley Groundwater Basin. It underlies the urban western portions of Alameda and Contra Costa Counties, extending from San Pablo Bay in the north to Niles Cone Groundwater Subbasin in the south, with a surface area of about 77 square miles. The predominant water bearing materials are unconsolidated alluvial deposits, in places extending as deep as 1,000 feet. The basin is recharged largely from the numerous streams that originate in the East Bay hills and flow across the urban areas to the Bay. Some of the streams drain watersheds that support development using OWTS, e.g., Sausal Creek and Arroyo Viejo Creek. Although it is not a primary water resource for the area, there are several hundred wells that supply domestic, municipal and agricultural uses. Production amounts are indicated by the DWR (2004) to be on the order of about 2,500 ac-ft/yr for municipal supply and about 1,000 ac-ft/yr for agriculture. Typical well depths are in the range of 30 to 600 feet, with yields of 100 to 1,000 gal/min. Water quality is generally suitable for all uses; however, the Regional Water Board has identified more than a dozen areas of major groundwater pollution in shallow groundwater zones attributable to release of fuels and solvents in the heavily urbanized areas.

Castro Valley Groundwater Basin

Castro Valley Groundwater Basin is a small alluvial basin located north of Hayward and bisected by Interstate 580, with a surface area covering about 1,800 acres (three square miles). Natural recharge to the basin occurs principally as seepage from streams that drain the upland areas and by direct percolation of precipitation that fall on the basin floor. San Lorenzo Creek and its tributaries principally drain the basin and discharge to San Francisco Bay. The basin has been developed with only a small number of wells and, according to DWR (2004) there is no published information on aquifer conditions, water budget or water quality. Well yields are low, and considered suitable mainly for garden and lawn irrigation. The high permeability and near surface proximity of the thin alluvial deposits make them susceptible to contamination and should eliminate consideration as a source of drinking water. Mean annual precipitation in the basin ranges from 18 to 24 inches.

Tracy Sub-basin

A very small portion of the Tracy Sub-basin extends into the northeastern corner of Alameda County on the east side of the Altamont Hills. The Tracy Sub-basin covers 539 square miles (345,000 acres) mostly in San Joaquin County and is a part of the larger San Joaquin Valley Groundwater Basin. It is comprised of largely of alluvium and flood plain deposits, and is drained by the San Joaquin River. It represents a very small part of the groundwater resources in Alameda County in an area with sparse development and OWTS usage.

Upland and Highland Regions

In the upland and highland areas of the county groundwater conditions vary locally, depending on specific geologic conditions. The occurrence of groundwater is dependent on the presence of porous, permeable rock stratum capable of storing and transmitting water. In hard and fine-grained rock formations, as occur in the Diablo Range, water available to wells is commonly from the secondary permeability and porosity, which results from deep weathering, shearing and fracturing of the rock. Groundwater of sufficient quantity to supply individual domestic wells and springs can also occur locally in deep colluvial and landslide deposits in the upland and highland regions of the county.

Soils and OWTS Suitability Mapping

General Soils Map

Figure 2-3 presents a General Soils Map of Alameda County compiled from information contained in soil surveys and mapping published by the U.S. Department of Agriculture (USDA), which include: (1) Soil Survey of Alameda County, California, 1966; and (2) Online soils data base maintained by the Natural Resources Conservation Service (NRCS). The General Soils Map contained in the 1966 Soil Survey of Alameda County provided the baseline groupings of general soil associations, which were extended to cover other portions of the County, as shown in **Figure 2-3**.

Soils in the County can be grouped into general landform classifications as follows:

(1) **Urban Areas (0).** Soils found in the flat portions of the East Bay that occur in sewered areas were not analyzed.

(2) **Soils of the Uplands (1, 2, 3)**. Soils found in the uplands are shallow to moderately deep, well drained to excessively drained loams and gravelly loams. Constraints of steep slopes, shallow soils over rock, erosion and local landslides may be potentially overcome by alternative treatment and/or shallow dispersal designs in these areas.

(3) **Terraces, Alluvial Fans and Floodplains (4, 5, 6, 7).** Soils of the floodplains, alluvial fans and terraces are formed in alluvium weathered from sedimentary rocks. Many OWTS are

Figure 2-3. Alameda County General Soils Map

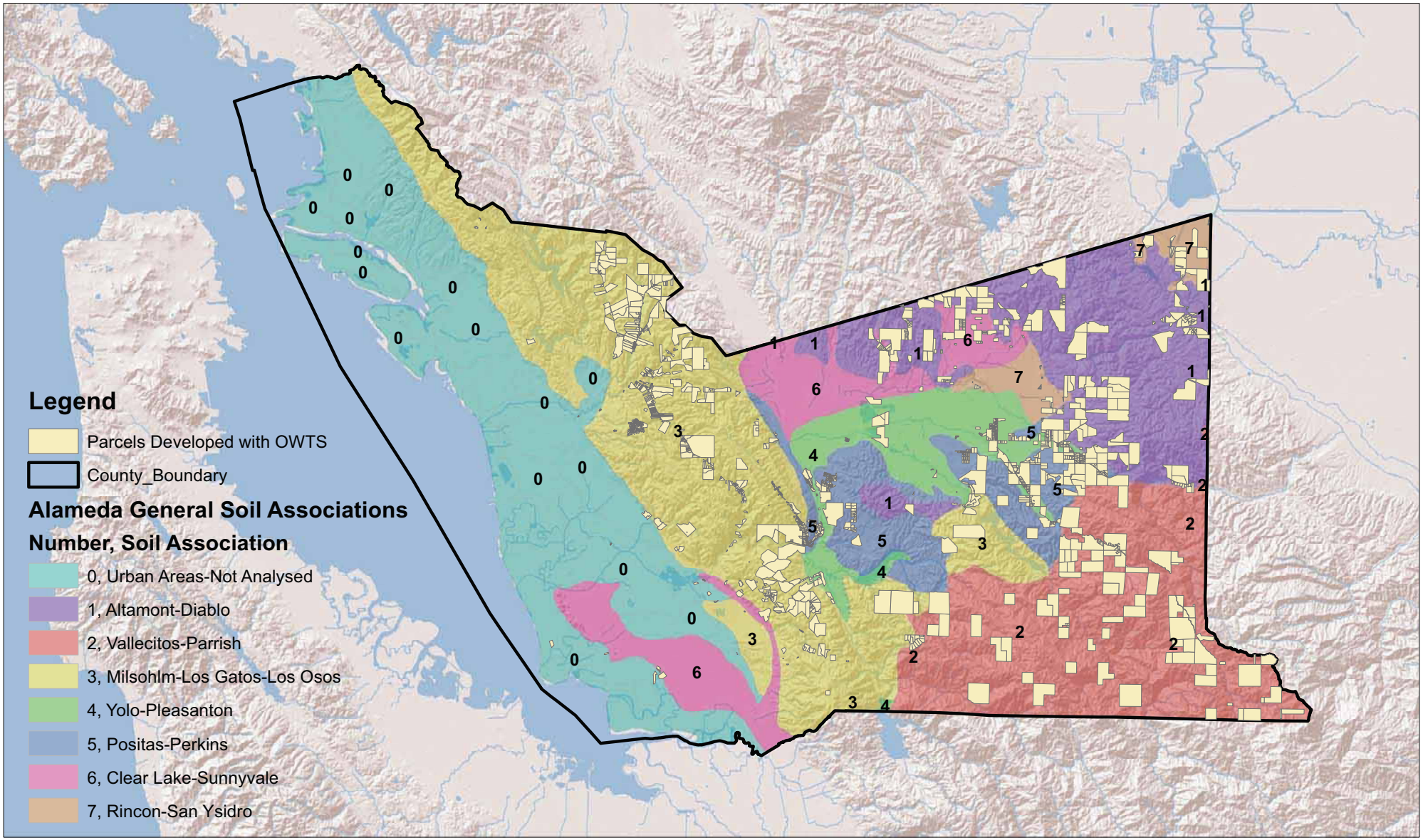


Table 2-3: Alameda County General Soil Associations

Legend No.	Soil Association Name	Description	Soil Depth	Slope	Drainage	Soil Texture	Suitability and Constraints for OWTS	Estimated Number of OWTS
1	Altamont-Diablo	Soils formed in material weathered from interbedded sedimentary rock found in the smooth, rounded uplands north and east of Livermore Valley	moderately deep	moderately sloping to very steep along streams	well drained to excessively drained	clay to gravelley loam and clay loam underlain by soft sandstone	Suitable conditions for conventional OWTS; some inclusions of low permeability and perched GW favoring shallow dispersal designs	202
2	Vallecitos-Parrish	Soils formed in material weathered from metasedimentary and basic igneous rocks found in the uplands of the southeast county	shallow to moderately deep	moderately steep and very steep	well drained to excessively drained	loam to gravelley loam	Moderately constrained by steep slopes and shallow soils, potentially requiring advanced treatment and/or shallow dispersal designs	105
3	Milsohlm-Los Gatos-Los Osos	Soils formed in material weathered from moderately hard sedimentary rocks found in the uplands from Calveras Reservoir to Upper San Leandro Reservoir	very shallow to moderately deep	strongly sloping to very steep	well drained to excessively drained	very gravelley sandy loam and sandy clay loam	Moderately constrained by steep slopes and shallow soils, potentially requiring advanced treatment and/or shallow dispersal designs. Erosion and landslide hazards locally.	820
4	Yolo-Pleasanton	Soils formed in alluvium weathered from sedimentary rocks found on flood plains and terraces	very deep	nearly level to sloping	well drained	clay to gravelley course sandy loam	Suitable conditions for conventional OWTS; some inclusions of low permeability and perched GW favoring shallow dispersal designs	356
5	Positas-Perkins	Soils formed in alluvium weathered from sedimentary rocks found on high terraces south of Livermore Valley	shallow to moderately deep	nearly level to strongly sloping	well drained	gravelly loam underlain by claypan soils	Suitable conditions for conventional OWTS; some inclusions of rapid percolation, potentially requiring advanced treatment and/or shallow dispersal designs.	362
6	Clear Lake-Sunnyvale	Soils formed in alluvium weathered from sedimentary rocks found in floodplains, basin areas and on low terraces east of Dublin, and also on low terraces in the southwest Urban area of the county	very deep	nearly level to gently sloping	well drained to imperfectly drained	clay to clay loam	Suitable conditions for conventional OWTS; some inclusions of low permeability and perched GW favoring shallow dispersal designs	64
7	Rincon-San Ysidro	Soils formed in alluvium weathered from sedimentary rocks found in the northeast corner of the county and in the Livermore Valley	shallow to very deep	nearly level	well drained	clay loam to loam	Suitable conditions for conventional OWTS; some inclusions of low permeability and perched GW favoring shallow dispersal designs	39

found in the Livermore Valley, where the floodplain soils may range from slowly permeable clays to rapidly permeable gravelly loams. Beneath the surface soils, it is not uncommon to find at shallow depth a restrictive layer, with low permeability and/or perched groundwater conditions, which favor shallow dispersal system designs. Some of the high terraces south of Livermore and west of Pleasanton (the Positas-Perkins Soil Association, 5) consist of gravelly loams underlain by claypan soils, which may be constrained locally by rapid percolation which can reduce the effectiveness of soil treatment.

Soil-OWTS Suitability

The general mapping of soil conditions takes into account location and landform conditions, soil depth above bedrock, slope, subsurface texture, and drainage conditions of the soils, which are all key factors that can affect the suitability of the soils for onsite wastewater treatment. **Table 2-3** was developed from the published soil survey information, summarizing the soil characteristics of the general soil associations mapped in **Figure 2-3**.

The second to last right-hand column in **Table 2-3** highlights the key constraints and overall suitability designation for OWTS for each general soil association. The designations were developed and assigned based on the USDA soils information and best professional judgment. This is provided as a general assessment tool and is not a substitute for site-specific investigation of and planning for onsite wastewater treatment systems. It provides a general indication of the management and design issues likely to be encountered in each area. It does not take into account local constraints such as steep slopes, setback or other anomalous conditions that may be found on particular sites. The last column in the table gives the estimated number of residential OWTS within each general soil area, determined by merging the parcel data reflecting OWTS usage estimates (see below) with the soil mapping boundaries.

OWTS Usage Estimates

Parcel Development Status

Since a comprehensive inventory of existing OWTS usage in Alameda County does not exist, estimates were made by Questa Engineering. The geographic area covered in the analysis includes all of Alameda County, with the parcel data analysis focused mainly on the unincorporated lands within the county. All incorporated property within the various cities (except for Oakland Hills, discussed below) was excluded, as was unincorporated property known to be within a sewer district. The analysis included a systematic geographic information system (GIS) based inventory to determine the development status (i.e., developed or vacant) of all parcels in non-sewered areas of the County; the evidence of a “building” (from assessor records) was used as the best indicator of the likely probability of an OWTS on the property. The step-by-step methodology followed to develop estimates of the number and distribution of OWTS in the county is provided in **Appendix B**. The analysis produced the totals below for the non-sewered

unincorporated areas of the County; the locations of parcel development with OWTS are shown in **Figure 2-4**.

- Developed Parcels (OWTS): 1,983
- Vacant Parcels: 3,156

  Total Parcels: 5,139

From County records there are known to be pockets and scattered individual OWTS in some urban areas, most notably in portions of the Oakland Hills. Utilizing records contained in Department files, the Department staff developed estimates and maps of OWTS usage in the Oakland Hills, which are provided in **Appendix C**. The Department inventory showed an estimated 85 existing developed properties using OWTS in the Oakland Hills; and this was added to the GIS-based inventory by Questa (above), bringing the total existing OWTS estimate to 2,068.

Based on County files, there are estimated to be more OWTS in other cities serving properties that, for one reason or another, never connected to available public sewers. However, these OWTS are assumed to be widely scattered and were not inventoried for the purposes of the County's LAMP. It is understood that municipal sewer systems either are currently or potentially available to all or most all of these parcels; and Ordinance requirements will generally lead to eventual sewer connection for these parcels in the future.

Areas of Concern and Focus Areas

In locations where there are special environmental or geographical concerns, additional evaluation, standards and requirements must be followed as set forth in the Ordinance and the Manual. Several Areas of Concern have been formally designated by Zone 7 and the San Francisco Bay Regional Water Board in the 2015 Nutrient Management Plan for the Livermore Valley Groundwater Basin due to nitrate impacted groundwater in these areas. Other Areas of Concern may be proposed for inclusion in the future as a result of information obtained during the development and/or implementation of this LAMP. **Table 2-4** presents a list and brief descriptions of 12 localized areas of OWTS usage that have either been designated as Areas of Concern or are anticipated to be a primary focus for the long-term OWTS management program in Alameda County based on the number and/or density of OWTS or other factors (Focus Areas). To assist with present and future management of OWTS and water quality assessments in these areas, GIS data, along with Department information for the Oakland Hills properties, have been compiled to give estimates of the number of OWTS in each area, along with median and average parcel size, which are presented in **Table 2-5**. From the OWTS/parcel data, estimates were then made of the approximate wastewater discharge volumes from OWTS as well as the associated loading of nitrogen to the soil and groundwater environment for each area, which are also given in **Table 2-5**. The locations of these areas are indicated in **Figure 2-4**; detailed GIS maps of each area are provided in **Appendix B** for further reference. Mapping of OWTS in the Oakland Hills is provided in **Appendix C**. As can be seen, these areas account for an estimated 1,241 OWTS, nearly 60% of the total OWTS in the unincorporated (plus Oakland Hills) areas of the county.

Figure 2-4. OWTS Areas of Concern & Focus Areas

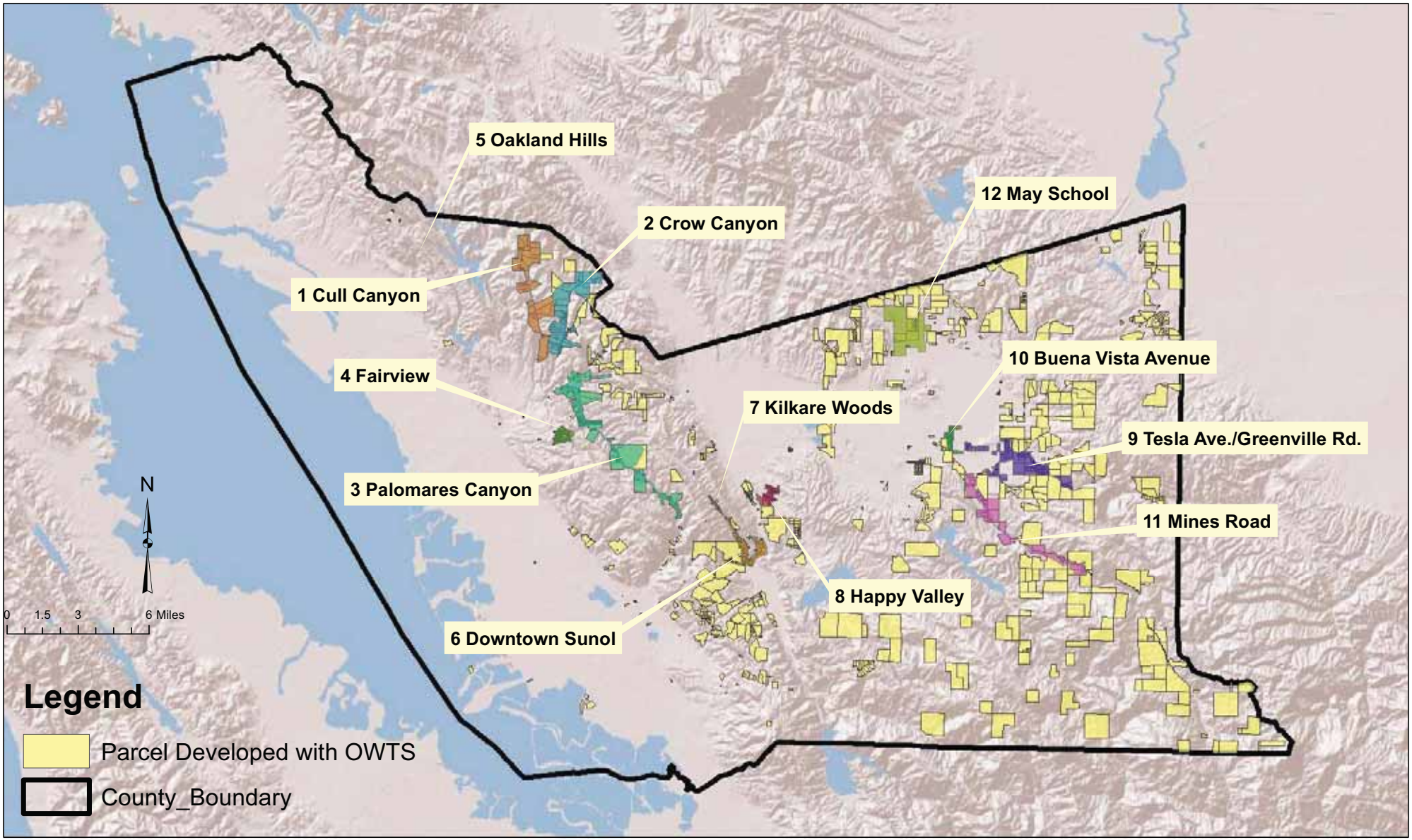


Table 2-4. Designated Areas of Concern & Focus Areas for OWTS in Alameda County

No.	Area of Concern Status	Area Name	Nearest City or Community	Affected Watercourses or Groundwater Basin	OWTS Issues
1		Cull Canyon	Castro Valley	Cull Creek, San Lorenzo Creek	Development in steep-sided canyon, rocky soils, steep terrain, encroachment within stream terraces, limited replacement area
2		Crow Canyon/Norris Canyon	Castro Valley	Crow Creek, San Lorenzo Creek	Development in steep-sided canyon, rocky soils, steep terrain, encroachment within stream terraces and stream-bank areas (Norris Canyon); limited replacement area;
3		Palomares Road	Castro Valley	Palomares Creek, San Lorenzo Creek	Dense development within steep-sided canyon, steep terrain, encroachment within stream terraces, limited replacement area
4		Fairview	Hayward	Ward Creek, Sulphur Creek, San Lorenzo Creek	100+ homes on ridge-top area; OWTS in some areas constrained by shallow soils over bedrock, limited replacement area, steep terrain
5		Oakland Hills	Oakland	East Bay Plain GW Basin, Sausal Creek	High number of failing systems, public sewer connection available using low pressure sewage systems (grinder pumps or STEP systems)
6		Downtown Sunol	Sunol	Sinbad Creek, Arroyo de la Laguna, Alameda Creek, Sunol GW Basin	Large concentration of residences (150+) and small commercial district at confluence of several drainages; generally suitable lot sizes and favorable soils for OWTS; cumulative wastewater loading impacts on groundwater a potential issue.
7		Kilkare Woods	Sunol	Sinbad Creek	Historical development dating to 1920s; summer cabins converted over the years to full-time residences; very small lot sizes, densely developed in steep, wooded terrain and stream terraces with minimal setbacks; many antiquated and non-conforming OWTS.
8	Designated	Happy Valley	Pleasanton	Livermore Valley GW Basin	Moratorium area established in 1973; high density of OWTS in area of localized nitrate-impacted groundwater.
9	Designated	Tesla Ave/Greenville Rd	Livermore	Livermore Valley GW Basin	Area with generally gravelly basin soils overlying localized nitrate-impacted groundwater
10	Designated	Buena Vista Ave	Livermore	Livermore Valley GW Basin	Area with generally gravelly basin soils overlying localized nitrate-impacted groundwater
11	Designated	Mines Rd	Livermore	Livermore Valley GW Basin	Area with generally gravelly basin soils overlying localized nitrate-impacted groundwater
12	Designated	May School	Livermore	Livermore Valley GW Basin	Area with generally gravelly basin soils overlying localized nitrate-impacted groundwater

Table 2-5. Alameda County Designated Areas of Concern & Focus Areas, OWTS Discharges and Loading Estimates

No.	Name	Area of Concern Status	Gross Acreage of Focus Area (ac)	Number of Developed Parcels with OWTS	Median Parcel Size (ac)	Area-wide OWTS Density (ac/OWTS)	Estimated Daily OWTS Discharge* (gpd)	Estimated OWTS Discharge		Estimated Annual Nitrogen Loading**	
								Daily Discharge per Acre (gpd/ac)	Annual Total (Mgal/yr)	Total Loading (lbs/yr)	Per Acre (lbs/ac-yr)
1	Cull Canyon		2,072	36	26.0	58	5,400	2.61	1.97	1,151	0.56
2	Crow/Norris Canyon		1,943	105	2.5	19	15,750	8.11	5.75	3,356	1.73
3	Palomares Canyon		2,818	196	4.4	14	29,400	10.43	10.73	6,265	2.22
4	Fairview		278	125	1.3	2	18,750	67.45	6.84	3,995	14.37
5	Oakland Hills		113	85	1.12	1.33	12,750	112.83	4.65	2,717	24.04
6	Downtown Sunol		556	162	1.2	3	24,300	43.71	8.87	5,178	9.31
7	Kilkare Woods		46	99	0.2	0.46	14,850	322.83	5.42	3,164	68.79
8	Happy Valley	Designated	293	92	1.3	3	13,800	47.10	5.04	2,941	10.04
9	Tesla Ave. Greenville Rd.	Designated	1,556	121	5.5	13	18,150	11.66	6.62	3,868	2.49
10	Buena Vista Avenue	Designated	224	98	1.4	2	14,700	65.63	5.37	3,132	13.98
11	Mines Road	Designated	1,589	72	5.1	22	10,800	6.80	3.94	2,301	1.45
12	May School	Designated	1,071	28	5.2	38	4,200	3.92	1.53	895	0.84
	Total			**1,219**			**182,850**	**703.06**	**66.74**	**38,963**	

** Based on 150 gpd/residence*

*** Based on 70 mg-N/L total nitrogen concentration*

Water Quality Management Measures

The following summarizes how key site suitability, land use and development factors have been addressed in the OWTS requirements of Alameda County's LAMP for protection of water quality. This summary is organized to correspond with the elements listed under Section 9.1 of the SWRCB OWTS Policy.

Groundwater Quality Protection

(1) **Soil Conditions.** Soil suitability is the single most critical aspect of onsite wastewater treatment and dispersal. The soil provides the medium for the absorption and treatment of wastewater discharged through sub-surface dispersal systems. This is accomplished mainly through a combination of physical filtering, biological and chemical processes, and dilution. Protection of underlying groundwater relies on provision of an adequate depth of permeable soil below the dispersal field (zone of aeration) for absorption and treatment to occur. The Alameda County OWTS Ordinance and Manual require detailed site evaluation to document suitable soil characteristics and depth for each OWTS installation consistent with industry practices and appropriate for the conditions and requirements in Alameda County (see **Section 3**). The observed depth and percolation characteristics of the soil are used to select the appropriate location, sizing and design of the OWTS to achieve proper effluent dispersal and groundwater protection.

(2) **Geologic Factors.** Geology is important to the suitability and performance of OWTS due to its influence on topography and landforms, the type and characteristics of soils that develop at the surface, the occurrence and movement of sub-surface water, and slope stability. A large number of OWTS in Alameda County are located in the valley-alluvial areas, where geology plays a relatively small role. Geologic conditions are of greater significance in the hills and mountainous regions, where the rock formations may influence the suitability for and effects of OWTS. Geologic factors are addressed for new OWTS based on: (a) information from basic site evaluations for all installations; and (b) for systems located on slopes over 30%, near areas of unstable land masses, or where otherwise required by the Department, the completion of a geotechnical study, including assessment of hydrogeologic conditions, water movement and slope stability.

(3) **Groundwater Conditions.** Groundwater conditions are of high importance for OWTS usage in Alameda County due to the extensive reliance on local aquifers for both public and private water supplies. This is especially true in the Upper Alameda Creek Watershed, where the great majority of OWTS are located. Site evaluation practices include requirements for documenting groundwater conditions, which include procedures for wet weather observations. Documentation of groundwater levels, in combination with observation of soil texture in soil profiles, hydrometer analysis test results, and soil permeability (percolation rate) test results, provide the basis for selection of the appropriate OWTS design required to maintain the requisite vertical separation distance between the point of effluent dispersal and the water table for protection against

pathogen impacts. Siting and design criteria addressing groundwater separation requirements have been developed to provide the following:

- Vertical separation distance of 5 to 20 feet for Standard OWTS;
- Reduced vertical separation distance of 3 feet for OWTS utilizing Advanced (supplemental) treatment or Advanced dispersal methods, such as pressure distribution;
- Reduced vertical separation distance of 2 feet for OWTS utilizing Advanced (supplemental) treatment and pressure distribution;
- No provision for vertical separation distance of less than 2 feet.

Appendix A provides further discussion of the supporting rationale, including literature sources, for the OWTS groundwater separation requirements adopted by Alameda County.

(4) **Areas with High Usage of Domestic Wells.** Water supply for incorporated areas in Alameda County is provided by public water systems. However, there are many rural regions of the county outside of municipal water service areas where water is supplied by individual domestic wells and sanitation is provided by OWTS. With the exception of Kilkare Woods, Downtown Sunol, Fairview Castle Homes, and Buena Vista Avenue, which are supplied by public water, the majority of areas with OWTS in Alameda County use private wells in large part for potable water supply. Also, groundwater flowing beneath areas with OWTS may reach municipal supply wells located downgradient of the OWTS areas. Measures to assure protection of existing, downgradient and new domestic water supply wells from the effects of OWTS include the following:

- Minimum horizontal setback distances between OWTS and private and public water supply wells;
- Water well testing, review and approval by the Department for new development; Zone 7 Water Agency, Alameda County Water District and Alameda County Public Works handle well drilling permits;
- Minimum 40,000 or 60,000 square foot lot size limitations for parcels using OWTS and public water supply or private water supply, respectively, in areas of the County outside of the Upper Alameda Creek Watershed;
- Minimum 5-acre lot size limitations for new single-family dwellings using OWTS in the Upper Alameda Creek Watershed;

- Maximum discharge limitations of 34 lbs total nitrogen per 5 acres for commercial OWTS in areas outside of Areas of Concern in the Upper Alameda Creek Watershed;

- Provisions for implementing standards for nitrogen removal in designated Areas of Concern (due to high nitrate concentrations) as outlined in Zone 7's 2015 Nutrient Management Plan for the Livermore Valley Groundwater Basin.

- Regulations requiring completion of cumulative impact analysis (nitrate loading, groundwater mounding) for certain types of projects posing additional concerns regarding groundwater or surface water impacts.

- Availability of Advanced treatment and dispersal technologies to mitigate documented or potential impacts to groundwater in areas of high domestic well usage and high nitrate concentrations, and for high flow OWTS.

Surface Water Quality Protection

(1) **Minimum watercourse/water body setback requirements.** The primary measure for protection of surface water quality is the establishment of safe horizontal setback buffers between OWTS components (treatment tanks and dispersal fields) and various water and landscape features. The requirements contained in the Alameda County OWTS Ordinance and Manual are consistent with current and historical policies of Alameda County and guidelines of the San Francisco Bay and Central Valley Regional Water Boards. They address setbacks to perennial and intermittent streams, springs, ponds, lakes (100 feet to dispersal fields, 50 feet to tanks), as well as ephemeral streams, swales, and drainage ways (25 to 50 feet, depending on the depth of the high water mark, from dispersal fields and tanks). A 200 to 400-foot setback to water supply reservoirs has been added to conform to the State OWTS Policy.

Additionally, Alameda County has enacted a water course protection ordinance (Code Chapter 13.012) to safeguard and preserve watercourses, including among other things, control of erosion and sedimentation, preservation of riparian habitat, and restricting the discharge of polluted materials to enhance recreational and beneficial uses of watercourses. A primary mechanism is the establishment of setback distances from the edge of the 100-year floodplain (or top of bank, if greater) for any new development, including OWTS.

(2) **Advanced treatment and dispersal technologies.** The County OWTS Ordinance and Manual include standards for Advanced treatment and dispersal technologies that provide greater flexibility and options for system repairs than can be achieved with Standard OWTS. This has two positive effects for surface water quality protection: (1) the use of Advanced treatment technologies, producing higher quality effluent, can compensate for reduced amount of soil absorption area where the repair system on an older non-conforming development site encroaches within the normal setback buffer;

and (2) Advanced dispersal methods and sizing criteria can reduce the amount of encroachment into the setback area by making more portions of the property (e.g., shallow soil areas) potentially feasible for wastewater dispersal, while also reducing the overall amount of land area needed for the dispersal system.

(3) **Erosion control measures.** Depending upon site conditions and system design, construction of an OWTS may pose a threat of soil erosion and impacts on downstream receiving waters from excavations for tanks, trenching for pipelines and dispersal trenches, and associated clearing and grading activities. Historically, erosion control measures for OWTS installations have not been mandated by Alameda County Regulations, nor are they addressed in the SWRCB OWTS Policy. The County's updated Ordinance and Manual require that erosion control measures be implemented in connection with the installation of OWTS under certain circumstances, based on the type and size of the system and the prevailing ground slope conditions. Final approval/certification of the OWTS installation is contingent upon confirmation that the specified erosion control measures have been implemented.

(4) **Flood protection measures.** The County's updated Ordinance and Manual include provisions for evaluation and incorporation of special design measures for systems located within areas subject to inundation by the 100-year flood. Specifically, the measures require: (a) protection for OWTS supplemental treatment, pressure distribution and/or drip dispersal components from flood damage, such as structural tie-downs and/or elevating critical components above the 100-year flood level; (b) prevention of discharge of wastewater into flooded dispersal areas from pump systems (e.g., using flood-activated float switches to override/disable pump operation during high water conditions); and (c) additional emergency storage capacity for flood periods.

(5) **Enhanced protection for Water Supply Watersheds.** Areas of Alameda County warranting special concern and enhanced water quality protection are the reservoirs that serve as a local source of supply for drinking water, along with the land uses and activities in the source watershed areas. The major reservoirs in Alameda County include Lake Temescal, Lake Chabot and Upper San Lorenzo Reservoir in the western side of the county, and Lake Del Valle, Bethany, San Andreas and Calaveras Reservoirs in the eastern side of the county. In accordance with the requirements of State OWTS Policy, Alameda County has adopted increased setback standards for any OWTS located in an area tributary to and within 1,200 feet and within 2,500 feet of a public water supply surface water intake. The provisions for identifying and notifying public water system owners of pending OWTS applications are discussed in **Sections 4** and **5** of this LAMP, along with the applicable requirements for OWTS design when the dispersal system must be located within the prescribed setback buffer, e.g., for a replacement system or pre-existing lot of record.

Impaired surface waters (nitrogen or pathogens)

Currently there are no surface water bodies in Alameda County listed as impaired for nitrogen or pathogens pursuant to Section 303(d) of the Clean Water Act. Therefore, at this time no special provisions related to impaired water bodies have been adopted for OWTS in Alameda County.

High Density of OWTS, parcel size and cumulative impacts

Consideration of OWTS density, parcel size and potential cumulative OWTS impact issues (e.g., groundwater mounding, nitrate loading, fecal coliform contamination) is addressed in Alameda County primarily through requirements for identified Areas of Concern under the Ordinance and the Manual as well as requirements that call for the completion of cumulative impact assessments for certain types of projects or locations. The requirements for the designated Areas of Concern are derived from Zone 7 Water Agency recommendations contained in the 2015 Nutrient Management Plan for the Livermore Valley Groundwater Basin. They impose additional OWTS requirements for nitrogen removal in certain groundwater-impacted areas of the county, with the overall goal of reducing the nitrate loading from OWTS that may have contributed to localized high groundwater-nitrate conditions.

There is also a lot size limitation of 5 acres (minimum) for new single family dwellings in the Upper Alameda Creek Watershed area, and a lot size limitation of 60,000 square feet for parcels being served by a private water supply and 40,000 square feet for parcels being served by a public water supply in other areas of the county, specifically aimed at controlling cumulative impacts of new OWTS discharges. The results of cumulative impact assessment (per above) may dictate larger lot sizes or other measures (e.g., supplemental treatment) to address potential water quality impacts associated with density of OWTS.

The existing requirements identify circumstances requiring cumulative impact studies, minimum qualifications of those conducting the work, typical data needs and assumptions, analytical methods, and evaluation criteria. The Ordinance authorizes Department to apply the requirements to any project of concern, and to amend or expand the guidelines as new information or issues/Areas of Concern arise.

Additionally, the Ordinance provisions allowing the use of Advanced treatment and dispersal technologies provide opportunities to mitigate nitrate loading (e.g., with supplemental treatment systems) and hydraulic mounding (e.g., with pressure distribution or drip dispersal designs).

Geographic areas with many older non-conforming OWTS installations and setbacks.

Older, non-conforming OWTS are common in throughout much of Alameda County. Some of the highest concentrations of non-conforming OWTS installations are in the development known as Kilkare Woods, located in the upper reaches of the Sinbad Creek watershed. Properties were originally developed for seasonal/recreational cabins nearly 100 years ago, and have converted

over the years to year-round residences. Many of the properties are very small (<1/4 to 1/2 acre in size), with OWTS constructed prior to the modern codes. Some systems consist of cesspools, and repairs and replacement systems tend to be very challenging. Non-conformance with adopted setback requirements (e.g., from structures, water features, etc.) are also common in some areas.

Measures contained in the County's Ordinance and Manual that will aid significantly in addressing problems of older, non-conforming OWTS are:

(1) Availability of Advanced treatment and dispersal system designs to provide more effective upgrades and repairs for lots having limited area, soil limitations or other constraints for Standard OWTS;

(2) Greater County focus on bringing about compliance with existing County requirements through submittal of Homeowner Questionnaires every five-year providing information on existing Standard OWTS in the County;

(3) New requirements for septic tank pumper inspections, which will aid in identifying and bringing about the correction of existing cesspools, system failures, and impending problems that might otherwise go unnoticed or unattended; and

(4) Continuation of the County's current outreach and support to OWTS communities and properties faced with aging OWTS, in the form of technical resources, funding and facilitation of efforts to explore community wastewater solutions, connection to public sewers and other approaches to improve OWTS management.

Section 3:
OWTS Siting, Design, and Construction Requirements

Siting Criteria

Siting criteria for OWTS are specified in in the Alameda County OWTS Ordinance and Manual.

General. Siting criteria applicable to all OWTS address the following:

(1) **Slope, stability and cut and fill.** Maximum ground slope in the dispersal field area, placement in native soils, and geotechnical evaluation requirements for grading or other stability issues;

(2) **Soil and depth to ground water.** Minimum depth of effective soil and vertical separation to high seasonal groundwater below the dispersal field for Standard and Advanced OWTS;

(3) **Soil percolation rates**. Minimum and maximum soil percolation rates for Standard and Advanced OWTS;

(4) **Horizontal setbacks.** Minimum horizontal setback distances between OWTS components and wells, watercourses, and various other site features.

Additional Geographical Area Requirements. Additional siting requirements apply to new, upgraded, or replacement OWTS located in the Upper Alameda Creek Watershed above Niles, in areas both inside and outside the designated Areas of Concern contained in the 2015 Nutrient Management Plan for the Livermore Valley Groundwater Basin to minimize nutrient loading from current and future development in unsewered areas of the basin. The additional requirements do not apply to existing, properly-working and properly-sized OWTS; however, they are designed to reduce existing loading in the Areas of Concern over time by replacing Standard OWTS with new treatment systems when the opportunities arise. A summary of the additional requirements for new or replacement OWTS in the Upper Alameda Creek Watershed above Niles is provided below. Details of the requirements are included in Figure 6-6 of Appendix D.

(1) **Outside Areas of Concern**. Minimize nitrogen loading from new OWTS by applying one rural residential equivalence of wastewater (RRE) per 5-acre maximum limitation.

(2) **Inside Areas of Concern**. Minimize or when practical, reduce the overall nitrogen loading to the property by installing only new, advanced OWTS with nitrogen-reducing treatment. Encourage or require hydrogeological studies as part of new commercial developments. Cap nitrogen loading at one RRE per 10-acres when no study is provided.

(3) **High-strength and High Flow Systems**. Install groundwater monitoring wells to monitor nutrient loading from onsite operations.

Site Evaluation Requirements for OWTS

Site evaluation requirements for OWTS are specified in Alameda County Ordinance and Manual addressing the following:

(1) **Site evaluation and map.** For all locations where an OWTS is proposed to be installed, a site evaluation shall be conducted and a topographic site map prepared prior to permit approval to verify conformance with applicable horizontal setbacks, ground slope, soils, percolation and groundwater requirements.

(2) **Soil profiles.** Soil profiles, performed by a Qualified Professional, are required in the primary and secondary/replacement dispersal field areas to verify adequate soil characteristics, depth and other limiting factors for sewage disposal. More in-depth soils investigation may be required on a case-by-case basis as determined by the Department.

(3) **Percolation testing.** Percolation tests, performed under the supervision of a Qualified Professional, are required in the primary and secondary/replacement dispersal field areas. Wet weather testing is required in areas of expansive (shrink/swell) soils.

(4) **Groundwater determinations.** Determination of the anticipated highest level of groundwater is required based on either estimation from soil profile inspection (evidence of mottling) or direct observation during the wet weather season.

(5) **Geotechnical slope stability analysis.** Geotechnical slope stability analysis is required on a case-by-case basis for any OWTS proposed (as a variance) on slopes exceeding 30% or within an area identified on a seismic hazard zone map, for site grading work involving significant cuts in or near the dispersal field, or other conditions where slope stability is deemed a potentially significant concern.

(6) **Cumulative impact analysis**. For certain projects, typically non-residential and large flow OWTS, the completion of additional technical studies, termed "cumulative impact assessment", may be required. This is to address the cumulative impact issues (mainly groundwater mounding and nitrogen loading) from OWTS that can result from such factors as the constituent levels in the wastewater (e.g., nitrogen content), the volume of wastewater flow, the density of OWTS discharges in a given area, and/or the sensitivity and beneficial uses of water resources in a particular location. The Manual provides guidelines and criteria for cumulative impact and analysis and identifies the following situations where the requirement will apply:

   a. OWTS with flows of greater than 1,500 gpd;
   b. OWTS deemed "high strength";
   c. High concentration of flow in a limited area;

d. New development in Upper Alameda Creek Watershed not in conformance with lot size limitations per Section 3;

e. OWTS in areas of known groundwater degradation;

f. Other situations where OWTS judged by Department to have a potential significant cumulative impact on groundwater or surface water, e.g., clustering of OWTS near parcel boundaries.

(7) **Subdivisions**. For new divisions of land proposing the use of OWTS, soil profiles and percolation tests are required to demonstrate conformance with applicable siting criteria for all proposed OWTS locations. For any subdivision creating five (5) or more parcels, the proposal must be provided to the respective Regional Water Board for review.

Wastewater Flows for OWTS Design

Wastewater flow requirements for OWTS design are covered in the Ordinance and Manual and include the following provisions:

(1) **Peak daily flow.** All OWTS sized for peak daily flow;

(2) **Residential OWTS.** Based on a minimum factor of 150 gpd per bedroom, with provision for 20% reduction (to 120 gpd per bedroom) where approved water conserving plumbing installed.

(3) **Non-Residential and Multi-Unit Residential OWTS.** Based on consideration of projected activities, occupancy, and facilities and estimating factors (unit flows). Alternative flows may be based on other appropriate literature references (e.g., EPA Manuals) or documented wastewater flow for a comparable facility, as deemed acceptable by Department.

(4) **Flow Equalization.** Flow equalization may be used for non-residential and mixed use facilities that experience significant, regular and predictable fluctuations in wastewater flows, such as churches, schools, and special event venues. Flow equalization is the process of controlling the rate of wastewater flow through an OWTS by providing surge capacity storage and timed-dosing of the incoming flow. It allows peak surges (e.g., weekend usage) to be spread out over several subsequent days to aid in overall OWTS performance.

Design and Construction Requirements

Onsite Wastewater Containment Units (OWCU)

Onsite Wastewater Containment Units (holding tanks, vault toilets, portable toilets and waterless toilets) requirements, where such waste handling methods are allowed, are provided in the Ordinance and the Manual and summarized below.

(1) Holding Tanks may only be permitted under the following conditions:

a. On a temporary measure for existing residential dwellings while corrective action on a failed OWTS is being completed;

b. On a non-temporary basis as a last resort when an OWTS has failed and the Site cannot be approved for the installation of a replacement OWTS due to severe site constraints such as lack of effective soil, high ground water, etc., and no public sewer system is legally and physically available;

c. The tank is intended to serve only non-residential or small occasional use industrial, commercial, or recreational facility where installation of an OWTS for sanitary or process wastewater is not feasible or allowed.

(2) Vault toilets will only be allowed for non-residential and non-commercial, limited use applications, such as primitive type picnic grounds, campsites, camps and recreation areas where OWTS are not practicable due to factors such as remote location, limited water supply, and site constraints for an OWTS as determined by a site evaluation.

(3) Portable Toilets may be allowed for temporary or limited use areas, such as construction sites (for use by onsite employees), mobile or temporary agricultural uses, temporary campsites, and special events.

(4) Non-discharging wastewater disposal units shall meet the same horizontal setback requirements as for tanks specified in the Manual and will require operating permits.

Standard OWTS

Where an OWTS is required, it shall, at a minimum, consist of a septic tank and subsurface gravity fed trench dispersal system for absorption and leaching of the effluent into the soil (Standard OWTS). The septic tank and effluent dispersal system must be designed, permitted, and so constructed as to meet the requirements prescribed by the County OWTS Ordinance and Manual.

All Standard OWTS require submittal of a Homeowner Questionnaire to the Department by the property owner every five years reporting on the condition of the system. The five year reporting requirement is intended to assist the County in complying with State reporting requirements.

Key design and construction requirements detailed in the Manual include the following.

Septic Tank Requirements.

(1) **Materials for Construction –** concrete or alternative durable material.

(2) **Size of tank -** 1,000 gal minimum; increased capacity per bedroom count or daily design flow.

(3) **Design –** 2-compartment; IAPMO or equal; traffic-rated as needed; access risers; effluent filter.

(4) **Location and Installation –** minimum 10 feet from building; accessible for maintenance and repair; level, solid bedding; no more than 24 inches cover; and water-tightness testing in place.

Standard Leachfield Requirements.

(1) **Trench Specifications -** Width, spacing, diversion valve, piping, distribution box, max length, materials.

(2) **Leachfield Sizing -** Based on design wastewater flow, percolation rate and table of wastewater application rates; effective infiltrative area limited to four (4) square feet per lineal foot utilizing bottom and sidewall area; dual, 200% capacity required (primary and secondary fields, with diversion valve).

(3) **Trench Construction -** level trenches, on contour, drainage and grading to promote runoff away from field, no paving or soil compaction that may impair functioning.

Advanced OWTS

General. Alameda County Ordinance and Manual allow for, and in some cases require, the use of an "Advanced OWTS" which is defined as a OWTS that: "…utilizes either a method of wastewater treatment or supplemental treatment other than a septic tank and/or a method of wastewater dispersal other than a gravity trench dispersal system. Advanced OWTS are designed to allow siting of an OWTS where a Standard OWTS is not suitable due to site constraints or wastewater strength."

General requirements guiding the use of Advanced OWTS include the following:

(1) Types of Advanced OWTS permitted are limited to those identified in the Manual for which siting and design standards have been adopted and approved by the Board of Supervisors and the Regional Water Board as part of the County's LAMP.

(2) All Advanced OWTS must be designed by a Qualified Professional (RCE, PG or REHS) as allowed by their registration and installed by a contractor duly licensed by the Contractors State License Board of the State of California to install OWTS (A, B, C-42 or C-36).

(3) All Advanced OWTS require the issuance of a renewable annual operating permit which is in addition to the construction permit issued for system installation. Operating permits are intended to serve as the basis for ensuring on-going maintenance, and require that such work be performed by a Qualified Professional or qualified Service Provider registered with the County.

(4) Monitoring and reporting requirements to verify adequate performance of Advanced OWTS are implemented as conditions of the operating permit and vary according to the type of system and site condition/location.

Types of Advanced OWTS. The types of Advanced OWTS approved for use in Alameda County include the following:

(1) **Supplemental Treatment:**

a. Intermittent and recirculating sand filters;

b. Proprietary Systems

(2) **Advanced Subsurface Dispersal Systems**

a. Trench dispersal systems with pressure distribution

b. At-grade dispersal systems

c. Mound dispersal systems

d. Subsurface drip dispersal systems

e. Raised sand filter bed systems

Siting, Design and Construction Requirements. Siting, design, and construction requirements are provided in the Manual for each respective type of Advanced OWTS.

Performance monitoring requirements. Performance monitoring requirements and frequencies for Advanced OWTS are provided in the Manual and are dependent on the type and complexity of the system, treatment train components, and dispersal system. Performance monitoring may include but not be limited to the following:

(1) Installation and regular inspection of water levels in OWTS inspection wells and performance monitoring wells;

(2) Water/wastewater flow readings;

(3) Operational inspection of the OWTS;

(4) Annual inspections of pump systems;

(5) Inspections of sludge and scum and/or pumping of tanks

(6) Sampling and analysis of water from OWTS inspection wells and performance monitoring wells;

(7) Sampling and analysis of influent and effluent

(8) Submission of annual monitoring report to Department.

Commercial, High Strength and High Flow OWTS

All requirements for Advanced OWTS also apply to OWTS classified as Non-Residential or Multi-unit Residential, High Strength or High Flow systems, which are defined briefly as follows:

(1) Non-Residential or Multi-unit Residential OWTS – serving a business or other non-residential occupancy;

(2) High Strength – having wastewater characteristics of higher strength than domestic wastewater, such as BOD >300 mg/L and/or TSS >330 mg/L and/or fats, oils and grease >100 mg/L.

(3) High Flow – having peak wastewater flow >1,500 gpd.

Additional requirements for High Strength and High Flow OWTS include installation of groundwater monitoring wells and analysis of water samples from those wells to monitor effects on groundwater quality in the area of the discharge.

Section 4:
Special OWTS Management Issues

The following describe the provisions contained in the Alameda County LAMP corresponding with special OWTS management issues listed in sections 9.2.1 through 9.2.12 of the State OWTS Policy.

OWTS Inspection, Monitoring, Maintenance and Repair

Alameda County Ordinance and Manual requirements pertaining to operational inspections, monitoring, maintenance and repair of OWTS are summarized in **Table 4-1** below.

Table 4-1. Summary of Alameda County Provisions for OWTS Inspection, Monitoring, Maintenance and Repairs

Activity	Inspections	Monitoring	Maintenance & Repairs*
Building Permits	Performance evaluation for existing systems required at time of application for site development or building permit; verify that proposed work will not impact the integrity of the system; verify safe & effective operation (i.e., prevent environmental degradation including pollution of surface water and groundwater and protect public health, safety and welfare), no surfacing effluent, & positive flow to septic tank and to dispersal system).	May involve water-tightness tests, documentation of system components, water sampling, dye testing, other monitoring, or preparation of as-built conditions.	Maintenance, and/or corrective action may be required as a result of performance evaluation findings.
Five Year Reporting	Basic inspection of OWTS and submittal of Homeowner Questionnaire by property owner, septic system contractor or Qualified Professional.	N/A	Maintenance and/or repair work may be recommended or required as a result of inspection findings.
Operating Permit	Performance monitoring requirements and frequencies for Advanced OWTS and OWCU are dependent on the type and complexity of the system, treatment train components, and dispersal system.	Monitoring of OWTS or OWCU, including flows, water levels, pump-out volumes, and water quality sampling, as applicable.	Maintenance and/or repair work may be required from time-to-time based on observations during routine inspections or as part of normal system servicing.
Complaint Investigations (Abatement)	Inspections of OWTS or OWCU by Qualified Professional in response to complaints or observed violation(s).	May involve water-tightness tests, water sampling, dye testing or other monitoring.	Maintenance, repair, and/or corrective action work may be required as a result of inspection findings.

OWTS Near Impaired Surface Water Bodies

Currently there are no surface water bodies in Alameda County listed as impaired pursuant to Section 303(d) of the Clean Water Act; therefore, no special provisions for advanced protection management requirements related to impaired surface water bodies have been adopted for OWTS in Alameda County.

Variances and Exceptions

Ordinance Code

Provisions for variances to OWTS and OWCU requirements are specified in the Ordinance, which reads as follows:

A. A variance to any requirement may only be granted if the applicant demonstrates all of the following criteria:

   1. Special circumstances and conditions exist on the property which deprive the property owner of privileges enjoyed by other property subject to the Ordinance;

   2. The granting of the variance will not constitute a grant of special privileges inconsistent with any limitation on other property subject to the Ordinance;

   3. The granting of the variance will not be detrimental to other persons or property (including but not limited to watercourses or wetlands or the water quality of subsurface water) or to the public health, safety or welfare.

B. The Department will review any request for variance and may deny it. If the Department does not deny a variance request, a recommendation to grant the variance will be sent to the Board of Supervisors for final review and approval.

OWTS Repairs and Corrective Actions

OWTS that require corrective action to address a current or threatened failure condition shall be repaired in a manner, approved by the Department that brings the OWTS into substantial conformance with County Ordinance and Manual to the greatest extent practicable. For systems that can be repaired, the work shall be implemented as soon as is reasonably possible and in accordance with any time limits issued by the Department.

The overall goal with all OWTS repairs is to obtain a practical, timely and effective long-term correction to the failure condition. In determining the level of corrective work required, the Department will take into consideration a variety of factors, generally according to the following priorities:

(1) public health and safety

(2) soil characteristics and groundwater separation

(3) setbacks from wells and streams

(4) ground slope and setback from unstable landforms

(5) OWTS sizing standards

(6) other setback criteria, e.g., foundations, pipelines, trees

Interim measures such as installation of a non-discharging holding tank and pumping of septage may be required for failed systems that require replacement and submittal of a new system design plans. Submittal requirements for OWTS repairs may vary case-by-case, and will depend on the nature of the failure condition, the property location and type of occupancy, and the type of corrective work needed.

A phased corrective action plan may be submitted to the Department for consideration to allow property owners time to plan for the costs of implementing corrective action measures. Phased corrective action plans shall be prepared by a Qualified Professional and shall include immediate, intermediate and long-term recommendations, as applicable, based on the results of system inspections, performance evaluations and site evaluations. Phased corrective action plan approvals will be conditioned upon issuance of an Operating Permit with monitoring and reporting requirements during the period of corrective action implementation.

- Immediate measures shall be implemented within 1 to 3 months and shall include measures to eliminate surface discharge and safety issues and may include but not be limited to source control measures, plumbing and tank repairs, and pump and haul by a septage pumper registered with the County.

- Intermediate measures shall be implemented within 1 year and may include but are not limited to additional source control measures, site modifications, septic tank replacement, dispersal system renovations/expansion, monitoring well installation and continued pump and haul as needed.

- Long-term measures shall be implemented within 1 to 3 years and may include but are not limited to additional source control measures such as installation of graywater systems, treatment train modifications including addition of flow equalization tanks, dosing tanks, supplemental treatment, and/or dispersal system redesign or replacement. Longer time frames (up to nine years) may be approved for communities with plans for a public sewer or community wastewater system.

Potential corrective action remedies may include:

- **Source Control Measure and Maintenance:** Modification of water use habits, installation of low, ultra-low flow plumbing fixtures, flow equalization, timed-dosing, installation of graywater systems, installation of waterless toilets, and/or maintenance pumping of tanks.

- **Site Modifications:** Removal of trees, conflicting landscaping, irrigation, or structures; diversion of surface water drainage; and/or interception/diversion of groundwater.

- **Plumbing and Tank Repairs/Modifications/Replacement.** Repair or replacement of plumbing lines, fittings, vents, equipment, etc.; installation of effluent filters; and/or repair or replacement of tanks with watertight tanks.

- **Treatment Improvements:** Installation of supplemental treatment.

- **Dispersal System Improvements:** Increase capacity of existing dispersal system by utilizing "reserve area" or other suitable area (e.g., installation of additional dispersal trenches, etc.); reconstruct or modify existing trench systems (e.g., convert gravity systems to pressure distribution systems, replace rock with new rock or install chambers to allow dispersal area sizing reductions, use of cover fill with shallow in-ground trenches to increase vertical separation distance to groundwater, etc.); or replace existing dispersal system with new system.

Prohibitions

No variances or exceptions are permitted to prohibitions 1 through 9 listed in **Section 5** of this LAMP.

Prohibition 10 in **Section 5,** relating to OWTS in proximity to public water wells and/or water supply intakes, contains specific exception clauses applicable to OWTS repairs and new or replacement OWTS on existing legal lots of record.

Appeals

The Ordinance sets forth a tiered process for appeals of an OWTS decision; this may include issues related to variances or exceptions to Ordinance requirements. The first level of appeal is to the Director and the last level of appeal is to the Board of Supervisors.

Professional, Contractor and Maintenance Provider Qualifications

Alameda County OWTS Ordinance requirements and Regulations pertaining to qualifications for OWTS professionals, contractors and service providers are summarized in **Table 4-2**.
The qualification notations and terminology in **Table 4-2** have the following meanings:

- CEG: Certified Engineering Geologist
- CHG: Certified Hydrogeologist
- CPSS Soil Scientist: Certified Professional Soil Scientist, Soil Science Society of America
- GE: Professional Geotechnical Engineer
- LLS: Licensed Land Surveyor
- Licensed Contractor: Possessing valid California Contractor's license A, B, C-36, C-42 or C-57
- PE: Professional Civil Engineer
- PG: Professional Geologist
- REHS: Registered Environmental Health Specialist
- Registered Septage Tank Pumper: Registered with Alameda County in accordance with California Health and Safety Code 117400 et seq
- Service Provider: An individual registered with Department and having experience in the design, construction and/or operation of OWTS as evidenced by the either of the following:
    - Qualified Professional
    - Completion of an onsite wastewater certification training course by a third-party entity, such as the California Onsite Wastewater Association (COWA), National Association of Waste Transporters (NAWT), National Sanitation Foundation (NSF), or other acceptable training program as determined by the Department.

Table 4-2. Qualifications for OWTS Practitioners

OWTS Activity	Required Work	Minimum Qualifications
Site Evaluation	Conduct field studies and evaluation of geology, soils, percolation, groundwater, slopes and other factors for design and use of OWTS	PE, REHS, PG, NRCS Soil Scientist, or Licensed Contractor (percolation testing) under the oversight of a PE, REHS, PG or CPSS as allowed by their registration, certification, license and provisions in the Manual
Topographic Surveying	Perform site surveys, property line determinations, and generate topographic maps for system siting and design	PE or LLS as allowed by their license

Cumulative Impact Assessment	Assess nitrate loading, groundwater mounding or other cumulative impacts of OWTS for flows as required by the Manual	PE, PG or CHG as allowed by their registration, certification, license and provisions in the Manual
Geotechnical Assessment	Assess slope stability, drainage and other geotechnical issues for OWTS located on slopes over 30 percent and in areas of geologic instability	PE, GE, CEG
Performance Evaluation	Conduct performance evaluation of OWTS in connection with building permits, land use project, annual operating permit, failure investigation or as otherwise required by Department	PE, REHS, PG or Contractor depending on the scope of work and provisions in the Manual
System Design	Prepare plans and supporting design analysis required for permitting and installation of OWTS and OWCU	PE, REHS or PG as allowed by their registration
Drainage Structures	Prepare plans and supporting design analysis required for permitting and installation of groundwater or surface water drainage structures	PE
System Installation, Repair, Modification or Abandonment	Install, repair, modify or abandon OWTS or OWCU in accordance with approved plans and permit conditions issued by Department	General Engineering Contractor License (Class A, Class B, Class C-42 or Class -36)
Inspection and Monitoring of Systems with an Operating Permit	Perform inspection, monitoring and annual reporting of OWTS and OWCU in accordance with conditions of operating permit issued by Department	PE, REHS, PG or Service Provider registered with the Department
Inspection and Monitoring of Standard OWTS	Perform inspection, monitoring, or functionality testing and five year reporting to Department confirming proper functioning	Property owner, PE, REHS, PG or Licensed Contractor, depending on the system type and as allowed by their registration or license
Septage Pumping	Pumping or cleaning of vault/portable toilets, holding tanks, tanks in an OWTS treatment train, cesspools, seepage pits, or other wastewater source or containment unit	Registered Septage Pumper
Groundwater Monitoring Well Installation or Abandonment	Install or abandon a well under permit by the well permitting agency	Licensed Contractor (C-57)

Education and Outreach

Alameda County's LAMP includes the following provisions for education and outreach regarding OWTS.

(1) **Website - Informational Material.** The Department maintains a website including up-to-date information on various OWTS matters, such as: (a) regulatory issues; (b) permitting requirements, procedures, fees, forms, etc; (c) meetings and other announcements; and (d) OWTS user information, guidelines and references.

(2) **Onsite Wastewater Treatment System Commission.** The Alameda County Board of Supervisors has established an "Onsite Wastewater System Commission", which meets several times a year to provide a public forum to hear, discuss and review various matters related to the regulation, planning and status of OWTS in the county. This Commission played an important role during the development of the LAMP by providing a forum for community input to the Department.

(3) **Outreach with Local Community Working Groups.** The Department makes routine outreach efforts to keep local citizen groups and committees in the county informed about policies and other matters related to OWTS. During LAMP preparation, numerous meetings were held with groups such as those listed below, forming the foundation for continued OWTS outreach and education in the future.

- Alameda County Agricultural Advisory Committee
- Castro Valley Municipal Advisory Council
- Agriculture Advisory Committee
- District 4 Agriculture Committee
- Cattleman's Association
- Fairview Community Stakeholders
- Sunol Citizens Advisory Council
- Sunol Septic Working Group
- Livermore Valley Winegrowers Association
- Local Agency Formation Commission
- Unincorporated Services Committee
- East County Community

Septage Management

Septic tank pumping in Alameda County is currently provided by approximately a half-dozen registered septic tank pumper contractors. Based on a phone survey (February 2016), the number of septic tank pump-outs conducted in the County is estimated to be in the range of about 600 to 900 per year. This equates to an average pumping frequency of roughly once every 3 to 4 years for the estimated 2,700 existing OWTS in Alameda County, which is consistent with

normally recommended septic tank serving frequency for residential OWTS. These estimates do not include pumping of vault toilets, such as those at park facilities in the County.

The primary receiving location for hauled septage in Alameda County is the East Bay Municipal Utility District (EBMUD) Wastewater Treatment Plant in Oakland. The EBMUD plant processes a wide range and large volume of trucked wastes from many different sources, and receives wastes 24 hours a day, 365 days a year. The EBMUD facility, with overall treatment capacity of more than 300 million gallons per day (MGD), has more than ample capacity to handle current and projected septage volumes of a few thousand gallons per day generated from pump-outs of Alameda County OWTS.

Onsite Maintenance Districts

Presently, there are no onsite wastewater maintenance districts in Alameda County. Some of the key functions of an onsite wastewater management district are already covered on a county-wide basis by requirements and activities under the County's OWTS Ordinance, Manual and the provisions of this LAMP, including: (a) five year reporting for Standard Systems without operating permits, (b) operating permits for Advanced, Multi-unit Residential and Non-Residential, High Strength and High Flow OWTS and Non-discharging wastewater units; and (c) requirements for water quality assessment and reporting to the Regional Water Board.

However, the Ordinance and Manual provide for the identification of Areas of Concern, in consultation with the Regional Water Board, Zone 7 Water Agency and other agencies, as applicable. Areas so identified may then be subject to additional standards and OWTS oversight to address special environmental concerns, which could include increased requirements for OWTS maintenance. As described in Section 2 of this LAMP, several Areas of Concern have been formally identified. Other Areas of Concern may arise in the future out of the background studies conducted for the development of this LAMP and through the implementation of on-going monitoring and reporting activities required under the State OWTS Policy.

The County recognizes that some designated Areas of Concern or focus areas, especially those with a large number and high density of OWTS, may be candidates for considering a community wastewater management solution. Examples are the Kilkare Woods and Downtown Sunol areas, where a local working group has been formed to begin discussions of a community approach to long-term wastewater management. For these and other cases that may follow, it is anticipated that feasibility studies would include (as a project alternative) consideration of the formation of an onsite wastewater maintenance district ("zone"), in accordance with the provisions of Health and Safety Code (Sections 6950-6982).

Regional Salt and Nutrient Management Plans

Salt Management Plan

The Salt Management Plan (SMP) for the Livermore Valley Groundwater Basin was developed and issued by Zone 7 Water Agency in 2004, and incorporated into Zone 7's Groundwater Management Plan (GWMP) for the Basin in 2005. The SMP reported a gradual increase in salt (total dissolved solids, TDS) concentrations on the order of 10 mg/L per year. The primary sources of salt loading to the main groundwater basin are estimated to be natural and artificial recharge operations (48%), percolation of urban irrigation water (35%), and subsurface inflow from fringe groundwater areas (13%). Percolating water from OWTS contributes a small amount to the overall salt additions to the groundwater basin, but it was not identified as a significant source in the SMP. Therefore, no specific limitations or control measures were recommended for management of salt additions from OWTS.

Nutrient Management Plan

The Nutrient Management Plan (NMP) for the Livermore Valley Groundwater Basin was developed and issued by Zone 7 Water Agency in February 2015, and incorporated in Zone 7's GWMP for the Basin, along with the SMP. The NMP provides an assessment of the existing and future groundwater nutrient concentrations related to recycled water projects, and also specifically addresses nitrogen loading from OWTS in high groundwater nitrate Areas of Special Concern.

Sections 6.1.5.2 and 6.1.5.3 of the NMP outline recommended implementation measures related to control of nitrate loading from OWTS. The key points are summarized below. Additional details are contained in Section 6 of the NMP, which is copied and provided for reference in **Appendix D**.

(1) **Section 6.1.5.2. General Septic Tank Program.** The NMP recommends continued application of existing OWTS regulations that limit: (a) new parcel creation for single family residential dwellings to 5-acre minimum lot size; and (b) commercial OWTS discharges to maximum of one (1) RRE per 5 acres. Additionally, the NMP recommends:

- Continued cooperation between the Department and Zone 7 regarding groundwater issues and OWTS approvals consistent with NMP goals and objectives;
- Continued collaboration on review and approval of commercial OWTS on a case-by-case basis;
- Continued collaboration on review of any OWTS variances.

(2) **Section 6.1.5.3. Septic Tank Management in Areas of Concern.** The NMP identifies five Areas of Concern, where OWTS discharges are believed to be or potentially be a significant contributor of nitrogen to the existing high groundwater-nitrate levels. The NMP recommends adoption of planning, design and management practices aimed at reducing the level of nitrogen discharge from current conditions. General recommendations are:

- Zone 7 to coordinate further characterization of groundwater information and monitoring well installations;
- Zone 7 to continue efforts to inform and participate in review of projects proposing OWTS in Areas of Concern;
- County and City planning entities and others to continue to pursue opportunities to convert areas from OWTS to municipal sewers in Areas of Concern, when feasible;
- Department, Zone 7 and Regional Water Board work together on development, approval and implementation of LAMP, including measures aimed at reducing nitrogen loading and ongoing regional groundwater monitoring.

The NMP identified five Areas of Concern where connection to municipal sewers appears unlikely, and recommended specific requirements for OWTS to be implemented to achieve long-term reductions in nitrate loading. The five Areas of Concern are listed below; the recommended management requirements are summarized in **Table 4.3**, as presented in the NMP.

- Happy Valley
- Buena Vista
- Mines Road
- May School
- Greenville

Briefly, the recommendations include requirements for incorporating additional supplemental treatment providing nitrogen removal for new and expanded residential and non-residential development, with limited exemptions granted for:

- Existing residences, as is, with no building or OWTS permitting activity;
- Existing residences with OWTS repair involving no building additions or increase in OWTS capacity;

Table 4-3. Excerpt from Nutrient Management Plan for Livermore Valley Groundwater Basin

FIGURE 6-6
PROPOSED OWTS PERMIT REQUIREMENTS
FOR SPECIAL OWTS REQUIREMENT AREAS
NUTRIENT MANAGEMENT PLAN

OWTS Scenario	Parcel Size	New Requirement	Max Nitrogen Loading Rate[2]
New, upgraded, or replacement OWTS required by County OWTS Ordinance[1]	*≤ 7 acres*	*Must install/upgrade/replace with code-compliant nitrogen-reducing system(s).*	*23.8 lbs/year Per Parcel*
	> 7 acres	*Total nitrogen loading on the parcel must not exceed the Maximum Nitrogen Loading Rate. Commercial uses must also install/upgrade/replace with code-compliant nitrogen-reducing system(s).*	*3.4 lbs/year Per Parcel Acre*
		OR	
		Prepare hydrogeologic study that assesses current groundwater nitrate conditions beneath the site and demonstrates that nitrate concentration of total onsite recharge[3] *does not exceed 36 mg/L (80% of MCL) or the maximum concentration at the site, whichever is lower.*	*6.8 lbs/year Per Parcel Acre*

[1] Does not apply to existing, properly-working and properly-sized OWTS.

[2] Loading rates calculated based on 1 RRE = 34 lbs/yr.

[3] Assume that 18% of rainfall naturally recharges to groundwater unless study demonstrates otherwise.

ACEH = Alameda County of Environmental Health
OWTS = Onsite Wastewater Treatment System
RRE = Rural Residential Equivalence
MCL = Maximum Conaminant Level (NO_3 = 45 mg/L)

- Existing residences with proposed building additions/remodeling, but triggering no expansion or replacement of OWTS.

Watershed Management Coordination

(1) **Zone 7 Water Agency.** Alameda County Department works closely with Zone 7 Water Agency in regard to both groundwater and watershed management issues related to OWTS discharges in the Upper Alameda Creek Watershed, where more than half the OWTS in the county are located. Over the past 30+ years, Zone 7 has been a key partner with the County in evaluating and developing OWTS management requirements for OWTS relative to issues affecting groundwater quality. For example, Zone 7 has been instrumental in identifying "Areas of Special Concern", recommending specific OWTS development standards and practices, and monitoring and evaluating water quality impacts within their jurisdiction. Zone 7 will continue to be important partner in the County's ongoing and future responsibilities to track, assess and report on the status and water quality impacts of OWTS in the county.

(2) **Alameda County Resource Conservation District and NRCS.** The Alameda County Resource Conservation District (ACRCD) and the USDA Natural Resources Conservation Service (NRCS) collaborate to provide technical and educational services for natural resource conservation and agriculture enhancement strategies. They have been a key player in stream restoration projects in Alameda County, including some in urban settings, but also in rural watershed areas where OWTS are used. Historically, the Department has not had occasion to interact and coordinate OWTS activities with the ACRCD. However, future coordination with the ACRDD and partner groups, such as the Alameda Creek Watershed Forum, may be useful in connection with surface water quality monitoring, assessment, and community wastewater management planning efforts in areas like Sunol and other Areas of Special Concern.

Evaluating Proximity to Public Sewers

Evaluating the proximity to public sewers for new and replacement OWTS is accomplished by the following:

(1) OWTS permit instructions advise applicants of the code requirement for connection to public sanitary sewer where the property is within 200 feet of an available sewer.

(2) Department permit review includes sewer proximity as a checklist item.

(3) Department maintains GIS-based information on the location of public sanitary sewers in the County, which facilitates the review of permit applications for new and replacement OWTS, as well as may be needed from time-to-time in handling repairs of existing OWTS.

Additionally, the Department is actively involved and in communication with cities, sanitary districts, community groups and individuals in certain key areas of the county to advance the opportunities for conversion from OWTS to sanitary sewers where it is either a necessary or favored long-term wastewater solution.

OWTS Notification to Public Water System Owner(s)

The Ordinance and Manual provides special horizontal setback requirements apply to OWTS located in the proximity of public water supply wells and public water system surface water intakes. Providing adequate notification to the owner(s) of public water systems about OWTS installations near their facilities will be accomplished by the following procedures:

(1) Department will rely upon the following information to determine the locations and respective owner(s) of water wells and public water system surface water intake locations in Alameda County:

a. **Local Small Drinking Water Systems.** Alameda County Department regulates local small systems under the State Small Water Systems Program. A local small water system is a water system that serves more than one but less than five service connections, fewer than 25 year-long residents, any number of non-residents less than 60 days per year, and less than 25 non-resident users greater than 60 day per year. Information on the location of public water wells and public water system surface water intakes for local small water systems will be maintained by Department and will be routinely available for review in connection with applications for new and replacement OWTS.

b. **Other Public Water Systems.** The State Water Board Drinking Water Division (DDW) regulates all other public water systems in Alameda County. This includes water systems that serve 5 or more service connections or 25 people daily for at least 60 days out of the year. Department will rely on information provided by the DDW regarding the location of and respective owner(s) of public water wells and surface water intakes associated with large drinking water systems in the County. Department will also rely on information from Alameda County Water District and Zone 7 Water Agency for information regarding the location of public water wells and surface water supply intakes.

(2) At the time of permit application for any new or replacement OWTS, Department staff will review the location of the proposed OWTS in relation to known public water wells and surface water intakes.

(3) Where Department staff determines the proposed OWTS dispersal system is closer than 150 feet to a public water well, or closer than 1,200 feet to a public water system surface water intake in a location tributary to the intake, notification of the proposed OWTS application will be sent to the water system owner(s). The notification will be

accompanied by a copy of the permit application and supporting OWTS design information, including documented soils, topography, groundwater and percolation data.

(4) The owner(s) receiving notification of proposed OWTS installations per (3) above will be afforded a 15-day period in which to submit comments on the proposed OWTS application.

(5) Prior to issuing an OWTS installation permit for any system per (3) above, the Department will review and consider any comments and recommendations submitted by affected water system owner(s) per (4) above.

(6) Upon issuance and/or denial of an OWTS installation permit per (3) above, the Department will provide notification to the affected water system owner(s) of the action taken.

Procedures for Dispersal Field Located Within Public Well/Intake Setback

New OWTS

In cases where a new OWTS is proposed on a lot created prior to the effective date of the State OWTS Policy (May 13, 2013), and the dispersal field does not meet the specified OWTS horizontal setbacks (per Regulations, Section 12, Table 1) from public water wells and public water supply intakes, the OWTS may be permitted subject to complying with the following requirements to address possible water source impacts:

(1) The dispersal field shall be sited to comply with the setback requirements to the maximum extent practicable;

(2) The OWTS shall incorporate supplemental treatment, including pathogen removal;

(3) Pathogen removal is defined as achieving an effluent fecal coliform bacteria concentration less than or equal to 200 Most Probable Number (MPN) per 100 milliliters;

(4) Minimum vertical separation to groundwater shall be three (3) feet below the bottom of the dispersal field;

(5) The minimum dispersal field soil cover shall be 12 inches;

(6) Other measures as specified by the Department.

On a case by case basis, the Department may establish alternative OWTS siting and operational requirements to those listed above where it is determined by the Department that the alternate requirements will provide a similar level of protection against adverse impact to the public water source.

Repair/Replacement OWTS

For repair or replacement of an existing OWTS where the dispersal field does not meet the specified OWTS horizontal setbacks from public water wells and public water supply intakes, the OWTS may be permitted subject to complying with the following requirements to address possible water source impacts:

(1) The dispersal field shall be sited to comply with the setback requirements to the maximum extent practicable;

(2) The OWTS shall incorporate supplemental treatment or other mitigation measures specified by the Department, unless he/she finds no evidence of an existing or potential threat of impact to the public water source by the OWTS based on topography, soil depth and groundwater conditions.

Phase-Out of Cesspool Usage

The use of cesspools for sewage disposal is not authorized under Alameda County Ordinance. Cesspools are deemed failing systems and must be immediately corrected. Due to the age of many homes in the County (>50 years old) a number of cesspools still exist and continue to be discovered from time-to-time. Historically, discovery and abandonment of existing cesspools has come about: (a) voluntarily by the property owner; (b) in response to complaints; or (c) through OWTS inspections associated with property transfers or building addition or remodeling projects. In Alameda County the Septage Pumper reporting requirements is expected to accelerate the identification and gradual phase-out of the remaining cesspools in the county.

Section 5: Prohibitions

The following describe the provisions contained in the Alameda County LAMP corresponding with the required prohibitions set forth in section 9.4 of the SWRCB OWTS Policy.

(1) **Cesspools, Seepage Pits, and Dry Wells.** The use of cesspools, seepage pits and dry wells for sewage disposal is not authorized in Alameda County per requirements adopted in the Ordinance. Cesspools are deemed failing systems and must be immediately corrected.

(2) **OWTS over 10,000 gpd capacity.** The Alameda County Ordinance applies to any OWTS where the maximum daily flow volume of waste produced is 10,000 gpd or less. If the amount of waste produced is more than 10,000 gpd or where a community system serving multiple discharges under separate ownership is proposed, joint oversight by the Department and the San Francisco Bay Regional Water Board or the Central Valley Regional Water Board, as applicable, is required for design, installation and operation approvals.

(3) **OWTS with surface discharge.** Subsurface discharge of wastewater is authorized by the County Ordinance in accordance with State OWTS Policy. If surface discharge of wastewater is proposed, joint oversight by the Department and the San Francisco Bay Regional Water Board or the Central Valley Regional Water Board, as applicable, is required for design, installation and operation approvals.

(4) **OWTS on slopes greater than 30% without slope stability report**. The Alameda County Onsite Wastewater Ordinance and Manual require that OWTS dispersal fields located on slopes greater than 30% include an assessment and technical report addressing slope stability.

(5) **Sizing reductions for IAPMO certified dispersal systems.** The Alameda County OWTS Manual allows the use of IAPMO-approved gravelless chamber dispersal systems with no more than a 20-percent reduction in dispersal system sizing requirements.

(6) **Supplemental treatment systems without monitoring.** Alameda County Manual defines "supplemental treatment" as an advanced system and, as such, is required to be inspected and monitored under an annual operating permit issued by the Department per the requirements of the Ordinance and Manual.

(7) **OWTS for RV Dump Stations.** Treatment and dispersal of domestic wastewater is authorized by the Manual in accordance with State OWTS Policy. Domestic wastewater may include incidental RV holding tank discharges, e.g., at the owner's residence/storage location. Any proposals for RV Dump Stations will be referred to the appropriate Regional Water Board for joint permitting by Department and the San Francisco Bay or Central

Valley Regional Water Board, as applicable. This limitation does not apply to full hook-up sewer connections similar to those used at a recreational vehicle park.

(8) **Groundwater separation less than two (2) feet, or less than 10 feet for seepage pits.** The Alameda County OWTS Manual sets forth minimum siting requirements for OWTS dispersal fields and requires a minimum vertical separation distance from the bottom of the dispersal system to the seasonal high water table of 24 inches or greater below the bottom of the dispersal trench or bed. The Alameda County OWTS Ordinance does not authorize the use of seepage pits for the dispersal of wastewater effluent.

(9) **Where public sewer connection is available.** For any property where the installation of a new, expanded or replacement OWTS is proposed, the Alameda County OWTS Ordinance requires connection to an available public sewer when it is within 200 feet of a building being served.

(10) **Proximity to public water system wells and surface water intakes.** The Alameda County Onsite Wastewater Manual sets forth minimum horizontal setback requirements for OWTS that include the following restrictions for OWTS dispersal systems located in the proximity of public water supply wells and public water system surface water intakes.

a. **Public water well:**

- 150 feet setback for any dispersal system (no greater than 8-feet deep)
- Dry wells, seepage pits, cesspools, and dispersal systems deeper than 8 feet are not authorized

b. **Public water system surface water intake:**

- 400 feet setback from edge of watercourse/water body where OWTS dispersal field is <1,200 feet to water supply intake
- 200 feet setback from edge of watercourse/water body where OWTS dispersal field is >1,200 feet to water supply intake

c. **Exceptions for replacement OWTS.** For replacement OWTS unable to meet the horizontal setback requirements of (A) or (B) above, the replacement dispersal field shall meet the setback requirements to the greatest extent practicable. Additionally, the Department will require the replacement OWTS to incorporate supplemental treatment and other measures, as appropriate, unless he/she finds no evidence of an existing or potential threat of impact to the public water source by the OWTS based on topography, soil depth and groundwater conditions.

d. **Exceptions for new OWTS.** For new OWTS on parcels created prior to May 13, 2013, that are unable to meet the horizontal setback requirements of (A) or (B) above, the new dispersal field shall meet the setback requirements to the greatest extent practicable. Additionally, the Department will require the new OWTS to incorporate Advanced ("supplemental") treatment, including pathogen removal, plus other requirements noted below. In accordance with State OWTS Policy, pathogen removal in this case is defined as achieving an effluent fecal coliform bacteria concentration less than or equal to 200 Most Probable Number (MPN) per 100 milliliters. Other requirements include:

- providing a minimum vertical separation to groundwater of three (3) feet below the bottom of the dispersal field;
- providing a minimum dispersal field soil cover of 12 inches;
- completion of a cumulative impact analysis regarding nitrate loading effects if the setback issue involves a public water well; and
- other measures as specified by the Department.

On a case-by-case basis, the Department may establish alternative OWTS siting and operational requirements to those listed above where it is determined by the Department that the alternate requirements will provide a similar level of protection against adverse impact to the public water source.

Section 6:
Program Administration

OWTS Permitting Records

The Department will retain permanent records of OWTS permitting actions and will make those records available within 10 working days upon written request for review by either the San Francisco Bay or Central Valley Regional Water Board. This includes:

(1) Design approvals for new, repair and replacement OWTS;

(2) Installation permits issued for new, repair and replacement OWTS;

(3) OWTS variances and/or exemptions issued, including number, location and description;

(4) Annual operating permits issued for Advanced OWTS, Multi-unit Residential and Non-Residential, High Strength or High Flow OWTS, or other OWTS where the Department has determined the need for an operating permit;

(5) Five year reporting for Standard OWTS without operating permits.

Water Quality Assessment Program

Objectives

The Department will maintain an OWTS water quality assessment program having three primary objectives: (1) to determine the general operational status of OWTS in the county; (2) assess possible impacts of OWTS on groundwater and surface water quality, and their associated beneficial uses; and (3) identify areas for changes to existing OWTS management practices.

Areas of Special Concern

It is anticipated that the OWTS-water quality assessment will be organized generally according to the various Areas of Special Concern delineated and described in this LAMP. This will allow the existing GIS-based mapping, OWTS inventories, and nitrate loading analyses to be utilized and built-upon. Other localized Areas of Special Concern within Alameda County may be delineated in the future if warranted. Also, some Areas of Special Concern may be dropped in the future if alternative wastewater management solutions (e.g., connection to public sewers, community system) are implemented.

Operational Status of OWTS

The general operational status of OWTS will be assessed through compilation and review of the following types of information:

(1) Septage pumper reports;

(2) Complaints and abatement activities for failing OWTS;

(3) Variances issued for new and/or repaired OWTS;

(4) Performance evaluations of existing OWTS in connection with building permits, land use projects, or property transactions;

(5) inspection of existing Standard OWTS without operating permits as reported under five year reporting requirements;

(6) Monitoring reports for Advanced OWTS and other OWTS under an operating permit.

The data review and assessment will focus on both positive and negative findings, apparent trends, and areas for changes in practices. The assessment will maintain and update the existing inventory records of OWTS in the county.

Water Quality Assessment

The water quality assessment will include the following:

(1) **Water Quality Parameters of Concern.** The initial focus of the water quality assessment program will be on two key water quality parameters – pathogens and nitrate-nitrogen. Other parameters of concern may be added if warranted.

(2) **Wastewater Discharge Volumes.** Estimates of annual wastewater discharge estimates from OWTS will be updated based upon the running inventory of OWTS per above.

(3) **Nitrate Loading.** Nitrate loading estimates (for Areas of Special Concern) will be maintained and updated based on the running inventory of OWTS in the county.

(4) **Water Quality Data Sources**. Relevant water quality monitoring data for (pathogens and nitrate-nitrogen will be compiled from available sources, anticipated to include:

- Receiving water quality monitoring data reported under operating permits for High Strength and High Flow OWTS and others;
- Water quality data from cumulative impact studies;
- Zone 7 Water Agency monitoring data and reports;
- Domestic water well potability testing or other;
- Public water system raw water quality data from monitoring reports;
- Reservoir or stream water quality sampling data from Zone 7, Alameda County Water District and other watershed special studies;

- Receiving water sampling performed as part of a of a National Pollutant Discharge Elimination system (NPDES) permit or waste discharge requirements (WDR);
- Groundwater sampling performed as part of WDR;
- Data from the California Water Quality Assessment Database; and
- Groundwater data collected as part of the Groundwater Ambient Monitoring and Assessment Program available in the Geotracker Database.

(5) **Assessment.** In addition to periodically updating the OWTS nitrate loading estimates for the county, it is anticipated that assessment of the data will include a collaborative review with Zone 7 Water Agency to: (a) determine relevance of the various data to OWTS; (b) identification of any obvious water quality degradation attributable to OWTS warranting follow-up investigation or action; (c) identification of any water quality degradation where OWTS may be implicated as a possible source; (d) identification of water quality data/areas where no apparent issues of concern related to OWTS; and (e) assessment of the assimilative capacity for nitrate in certain OWTS areas.

Reporting to Regional Water Board

Annual Report

An annual report pertaining to OWTS activities in Alameda County for submission to the San Francisco Bay Regional Water Quality Control Board by February 1st of each year, with a copy also sent to the Central Valley Regional Water Quality Control Board and Zone 7. The annual report will, at a minimum, include the following information, organized in a tabular spreadsheet format:

(1) Number and location of complaints pertaining to OWTS operation and maintenance, and identification of those which were investigated and how they were resolved;

(2) Number, location and description of permits issued for new and replacement OWTS, including any variances and/or exemptions issued;

(3) Number, location and results of septage pumper reports;

(4) List of applications and registrations issued as part of the local septage pumper registration program pursuant to Section 117400 et seq. of the California Health and Safety Code;

(5) Number and location of advanced systems and summary of their performance (I.e., effluent concentrations).

The report will include: (a) a summary of whether any further actions related to OWTS are warranted to protect water quality or public health; and (b) any other information deemed appropriate by the Department.

5-Year Water Quality Assessment Report to Regional Water Board

Every five (5) years the annual report to the Regional Water Board will be accompanied by a Water Quality Assessment Report that summarizes the information and findings from the Department Water Quality Assessment Program described above. The report will present an overall assessment regarding any evidence of water quality impacts from OWTS along with any recommended changes in the LAMP to address the identified impacts. Additionally, any groundwater water quality data generated by the Department from monitoring activities will be submitted in electronic data format (EDF) for inclusion in Geotracker, and any surface water quality data will be submitted to CEDEN in a SWAMP comparable format.[1]

[1] CEDN stands for California Electronic Data Exchange Network; SWAMP stands for Surface Water Ambient Monitoring Program

Appendix A

Supporting Rationale for Alameda County OWTS Siting and Design Criteria

Appendix A

Supporting Rationale
for
Alameda County OWTS Siting and Design Criteria

Following is a discussion of the supporting rationale (including literature references) for the various siting and design requirements for OWTS contained in Alameda County's LAMP for those items that differ from the Tier 1 requirements of the SWRCB OWTS Policy. The topic areas addressed include: (1) groundwater separation requirements beneath dispersal systems; (2) dispersal trench sizing; (3) horizontal setbacks; and (4) allowable OWTS densities (lot size) for new subdivisions. Additionally, highlighted at the end of the discussion are the various requirements and management practices contained in Alameda County's LAMP that constitute a higher level of water quality and environmental protection by advanced OWTS relative to the Tier 1 requirements for standard OWTS.

1. Pathogen Removal and Groundwater Separation Requirements

Bacteria, viruses, and other pathogens are present in great numbers in sewage and represent an ongoing threat to public health. Preventing the transmission of disease is the foremost concern associated with the treatment and dispersal of sewage and is the basis for many of the established standards that dictate how, where and when wastewater treatment and dispersal can occur. Ground waters and surface waters are afforded protection from OWTS contamination through the establishment of specific criteria pertaining to the soil properties, vertical separation (i.e., the distance from the bottom of the dispersal trench to the seasonal high groundwater below), and horizontal (surface water) setback requirements. The level of wastewater treatment (prior to dispersal) and the design of the dispersal system can also play a role in pathogen removal. The soil is critical, but the factors are complex, and there is no simple rule for proper design and operation. Attenuation and removal of pathogens in the soil is accomplished through such mechanisms as microbial predation, filtration, adsorption, and die-off.[2] Related factors include the depth, texture, and structure of the soil, hydraulic loading rate, and other physicochemical properties such as moisture, temperature, oxygen and pH.

It is well known that soils have a tremendous capacity to remove bacteria from percolating wastewater. The retention and die-off of most, if not all, pathogenic bacteria occur within 2 to 3

[2] "microbial predation" refers to consumption by other soil microbes; "filtration" refers to physical trapping between soil particles; "adsorption" refers to attachment to the surfaces of soil particles; "die-off" refers to degradation or inactivation due to the inability of the pathogen to sustain itself in the soil environment.

feet of the soil infiltrative surface in a properly functioning OWTS (Anderson et al, 1994; Washington Dept. of Health, 1990). Viruses can also be retained and eliminated within a few feet, depending on the soil conditions; but it is generally accepted that they can persist longer and travel farther in the soil than bacteria (Anderson, et al, 1991; Ayres and Associates, 1993). Unlike bacteria, viruses are not always present in individual residential OWTS discharges, since it depends on the health status of the residents. Viruses are more likely to be consistently present at some level in commercial and community wastewater systems, which accept wastes from a broader segment of the population. Once reaching the water table, bacteria and viruses have been found to survive and travel significant distances with the groundwater (potentially hundreds of feet), depending on the rate of groundwater movement. Survival time in soil and groundwater is typically on the order of days to weeks for bacteria, and weeks to months for viruses.

Consistent with current knowledge and practices for preventing pathogen impacts from OWTS, the Alameda County LAMP includes a combination of siting and design requirements including: soil depth and percolation characteristics, minimum vertical separation to groundwater, minimum horizontal setbacks to various water/landscape features, dispersal field design/sizing criteria based on percolation rates, and, for some situations, options for use of Advanced treatment and dispersal designs. Horizontal setbacks are the same for all OWTS (Standard and Advanced) and are consistent with long-standing criteria contained in the guidelines of the San Francisco Bay and Central Valley Regional Water Quality Control Boards. The setback requirements also include more restrictive requirements for public water wells and public water system surface water intakes per the 2012 SWRCB OWTS Policy.

The key issue related to potential pathogen impacts from OWTS is the vertical separation below the bottom of the dispersal system to the seasonally high groundwater level (i.e., water table). **Table A-1** lists the depth to groundwater requirements for Standard OWTS in Alameda County, along with the corresponding groundwater separation requirements contained in the historical guidelines of the San Francisco Bay Regional Water Board and the Tier 1 requirements in the SWRCB OWTS Policy. As indicated, the adopted approach utilizes a standard depth to groundwater distance of 20 feet for 1 to 5 mpi, 5 feet for 6 to 60 mpi, and does not permit Standard OWTS in areas of percolation rates slower than 60 mpi. The County requirements for Standard OWTS are more restrictive than the historical guidelines of the SF Bay Regional Water Board, and similar but not exactly equivalent to Tier 1 criteria.

Table A-1
Comparison of Depth to Groundwater Requirements for Standard OWTS
(feet, below trench bottom)

Percolation Rate (min per inch)	Alameda County	SF Bay Regional Water Board Guidelines	SWRCB OWTS Policy Tier 1 Requirements
1-5	20	20	20
6-30	5	3	8
31-60	5	3	5
61-120	Not permitted	3	5

Under the historical practices and this LAMP, the County allows reduced groundwater separation distances for different types of Advanced treatment and dispersal systems as shown in **Table A-2**, also including the requirements for Standard OWTS for comparison.

Table A-2
Depth to Groundwater Requirements, Alameda County

Type of OWTS	Percolation Rate (MPI)	Min. Depth to Groundwater (feet)[1]			
		2	3	5	20
• Primary Treatment & Gravity Dispersal Trench	1-5 6-60			 X	X
• Primary Treatment & Pressure Dosed Trench (Conventional Trench)	1-5 6-120		 X	X	
• Primary Treatment & Pressure Dosed Sand Trench	1-5 6-120	 X	X		
• Primary Treatment & At-Grade Dispersal System	1-5 6-60	 X	X		
• Supplemental Treatment & Pressure Distribution Trenches • Supplemental Treatment & At-Grade Dispersal System • Primary Treatment & Mound Dispersal System • Supplemental Treatment & Drip Dispersal System	1-5 6-120	X	X		
• Supplemental Treatment & Mound Dispersal System	1-120	X			

[1] Measured from the bottom of the dispersal system

The supporting rationale for the reduced vertical separation requirement for the various Advanced OWTS designs is derived from research studies done over the past 30 to 40 years, largely funded by the USEPA and referenced in the *On-site Wastewater Treatment Systems Manual* (US EPA, 2002). These studies have documented how various advanced treatment and dispersal methods can improve the operation and treatment effectiveness of OWTS as compared with Standard septic tank-gravity dispersal trench designs. A major focus of the research efforts has been on finding methods to augment or improve the natural pollutant removal processes in the soil (especially related to pathogens) to help overcome limited soil depth and high groundwater conditions, which are a common constraint virtually everywhere OWTS are used. The following is a review of some of the key findings and principles that have emerged from the research and have supported changes in OWTS siting and design criteria.

a. **Pressure Distribution.** There is strong evidence and agreement in the professional literature that pressure distribution improves the performance of any soil absorption system as compared with Standard gravity distribution, and should be the distribution method of choice (US EPA, 2002). This is due to two main factors: (1) pressure distribution disperses the wastewater flow uniformly over the entire available soil infiltrative surface, which allows the maximum absorption potential to be realized for any given soil condition; and (2) creation of wetting and draining cycles (via effluent dosing) promotes the maintenance of aerobic soil conditions at the infiltrative surface, which improves biodegradation and reduces the potential for soil clogging caused by the buildup of organic matter. The professional literature also notes that uniform spreading of the effluent discharge to the soil with the use of pressure distribution (or drip dispersal), ideally with timed-dosing, is critical to assure effective pathogen reduction in situations where the vertical separation is reduced.

b. **Supplemental (Advanced) Treatment.** Pathogen removal efficiencies can vary greatly amongst the different types of supplemental treatment systems that would be permitted and used under the County Ordinance. The greatest removal efficiencies are generally attributed to intermittent sand filters. Crites and Tchobanoglous (1998) present data showing fecal coliform removal efficiencies of 97.9 percent to 99.9 percent for intermittent sand filters. Leverenz, et al (2002) estimate intermittent sand filters as having the ability to produce effluent with fecal coliform concentrations <800 MPN/100 ml. For comparison, the fecal coliform concentration in effluent from a Standard septic tank is similar to that in raw sewage, and typically ranges from about 10,000 to 100,000 MPN/100 ml. (Crites and Tchbanoglous, 1998). Additionally, however, an important purpose of the supplemental treatment unit in combination with the dispersal system design is to establish and maintain aerobic/unsaturated conditions in the soil absorption field. Maintenance of aerobic soil conditions is conducive to pathogen removal and an improvement over the operational conditions of Standard gravity dispersal fields, which are designed to allow a saturated (anaerobic) soil-infiltrative surface. Research has

demonstrated that aerobic effluent: (a) promotes the growth of aerobic soil microflora that can have antagonistic effects on viruses; and (b) reduces the amount of organic compounds that compete for adsorption sites with viruses and bacteria (Potts, 2003).

c. **Pathogen Removal in Soils.** The retention and die-off of most, if not all, pathogenic bacteria occur within 2 to 3 feet of the soil infiltrative surface in a properly functioning OWTS (Anderson et al, 1994; Washington State DOH, 1990). Viruses can also be retained and eliminated within a few feet, depending on the soil conditions; but it is generally accepted that they can persist longer and travel farther in the soil than bacteria (Anderson et al, 1991; Ayres Associates, 1993). Studies have shown that vertical separation distances to groundwater of 12 to 18 inches are sufficient to achieve good fecal coliform removal where the wastewater receives supplemental treatment prior to soil application along with pressure distribution or drip dispersal methods (Converse and Tyler, 1998; Duncan et al, 1994). Additionally, most of the research studies of OWTS pathogen removal have focused on sandy soil types; and the results of these studies have formed the basis for the soil depth criteria, such as those contained in the EPA Design Manual (2 to 4 feet unsaturated soil depth). Consequently, the soil depth criteria are already oriented toward the "worst case" conditions (sandy, permeable soils), and there is a built-in safety factor, with respect to pathogen removal, for finer textured soils with higher silt and clay fractions.

As previously noted, while there is no simple rule or absolute formula for OWTS-groundwater separation, the Alameda County depth to groundwater criteria related to type of OWTS and percolation rates are similar to standards adopted and followed in many other counties in Northern California over the past 10 to 20+ years (for example, Marin, Sonoma, Napa, Contra Costa, Mendocino, Placer, Nevada, among others).

Additionally, an important aspect of siting and design of OWTS under these criteria is the process for determining seasonally high groundwater levels in the dispersal field area. The requirements in Alameda County specify field observation methods for groundwater determination consistent with best industry practices. These requirements have been in effect for a number of years and will continue under the County LAMP.

Finally, the LAMP includes an operating permit program for all Advanced OWTS that will ensure ongoing inspection and monitoring of OWTS for verification of proper performance.

Based on the above considerations, the criteria relative to the depth to groundwater requirements and use of Advanced treatment and dispersal methods are consistent with the current state of knowledge and best management practices and would provide suitable protection against pathogen impacts from onsite wastewater treatment systems.

2. Dispersal Trench Sizing

Dispersal trench sizing (i.e., length) is commonly based on three factors: (a) design wastewater flow; (b) trench infiltrative surface dimensions (width and depth); and (c) wastewater application rates (gpd/ft^2) related to percolation rate or soil type. Alameda County requirements differ in some respects from the State OWTS Policy Tier 1 criteria, but overall provide a more conservative (safe) design approach, as follows:

a. Alameda County specifies the use of peak daily wastewater flow for dispersal system sizing; Tier 1 specifies the use of average daily wastewater flow (8.1.3). As a rule of thumb, average daily flow is typically about 50% of peak wastewater flow, resulting in 100% greater sizing/safety factor in the Alameda County design approach.

b. The standard allowance for infiltrative surface in Alameda County requirements is trench bottom areas, up to 4 ft^2 per lineal foot of trench, which conforms with the 4 ft^2 per lineal foot specified in the Tier 1 requirements (8.1.6). Alameda County also includes limits on the use of Standard trenches to sites having percolation rates up to 60 mpi, compared with allowance for percolation rates up to 120 mpi in Tier 1.

c. **Table A-3** below shows a comparison of the wastewater application rate criteria based on percolation rate for a range of values, including Alameda County requirements, Tier 1 criteria, US EPA and other SF Bay Area Counties, and the historical guidelines of the SF Bay Regional Water Board. As can be seen, there are similarities and differences among all of the criteria. Alameda County requirements are patterned after US EPA guidelines, which have been followed in several other SF Bay Area counties for the past 20+ years. Alameda County requirements agree with Tier 1 in the lower (faster) percolation range, but differ for slower percolation rates. However, Alameda County does not permit Standard trench design beyond 60 mpi percolation rates, making the requirements more restrictive compared to Tier 1.

Table A-3
Wastewater Application Rates for OWTS Dispersal Field Sizing (gpd/ft^2)

Percolation Rate (mpi)	Alameda County LAMP	SWRCB OWTS Policy Tier 1	USEPA Design Manual & SF Bay Counties	SF Bay Regional Water Board Guidelines
1-5	1.20 – 1.086	1.20	1.20 – 1.086	1.58 – 0.82
10	0.80	0.80	0.80	0.64
24	0.60	0.60	0.60	0.39
30	0.56	0.533	0.56	0.30
45	0.45	0.367	0.45	0.25
60	0.35	0.2	0.35	0.22
90	Not permitted	0.1	0.20	0.22
91-120	Not permitted	0.1	0.20	0.22

Additionally, it should be noted that Alameda County requires the installation of dual (200%) dispersal fields, whereas Tier 1 requires 100% installation plus a set-a-side 100% reserve area for future replacement. A dual system installation gives a significant built-in safety factor for public health and water quality protection not provided by the Tier 1 approach.

3. Horizontal Setbacks

Alameda County's OWTS Ordinance includes horizontal setback distances that equal or exceed the State OWTS Policy Tier 1 requirements in all respects except for Tier 1 item 7.5.5 which specifies a 200-ft setback from "… vernal pools, wetlands, lakes, ponds, or other surface waters…". Alameda County requirements treat these water bodies the same as "watercourses", with a 100-ft horizontal setback requirement, which is consistent with Regional Water Board guidelines and requirements found in all other jurisdictions reviewed. The State Water Board's rationale for the 200-ft setback distance is not known.

The County's 100-ft setback distance is meant to protect beneficial uses of both watercourses and water bodies, which primarily include contact and non-contact recreation and aquatic resources. Consistent with the State OWTS Policy, Alameda County includes a 200-ft to 400-ft setback for surface waters in proximity to public water supply intakes – a beneficial use of water warranting a higher level of protection from waste sources.

The Tier 1 200-ft setback in Item 7.5.5 appears to be without substantial merit and is at odds with other setback requirements – e.g., 100-ft setback from a domestic water supply well. The possible justification for a 200-ft setback from stock watering ponds, golf course lakes, and wetlands (that may or may not have any surface water features) is not known.

4. Allowable Densities for New Subdivisions

Tier 1 (section 7.8) specifies that average development density (i.e., acres per dwelling unit/OWTS) be based on a sliding scale (0.5 to 2.5 acres) related to average rainfall. Alameda County requirements are more conservative (safe) in that they specify a minimum lot size of 5 acres in the Upper Alameda Creek Watershed Area, based on groundwater-nitrate and OWTS loading studies conducted by Zone 7 Water Agency. For all other areas of the county, minimum lot size for new lot creation is 40,000 square feet where public water is provided and 60,000 square feet for areas reliant on private water supply. However, cumulative impact assessment (e.g., nitrate loading) is also required, the results of which would be the basis for increasing minimum lot size or imposing other mitigation measures (e.g., supplemental treatment providing nitrogen removal), where warranted on a case-by-case basis. This would meet the same objective of Section 7.8, but would be done on the basis of site specific conditions and analysis.

5. More Protective Aspects of Alameda County LAMP

The following highlight the more protective aspects of the Alameda County LAMP as compared with the Tier 1 requirements of the SWRCB OWTS Policy.

- **Advanced OWTS.** Establishes requirements for Advanced OWTS, providing better options, design guidance and a managed system for dealing with repairs/replacement for the approximately 2,500 – 2,700 existing OWTS in the county.

- **Operating Permits.** Establishes operating permit program for Advanced, Multi-Unit Residential and Non-Residential, High Strength and High Flow OWTS to ensure a higher level of performance monitoring and regular reporting to the County.

- **Cumulative Impact Assessments.** Includes requirements and guidelines for conducting cumulative impact assessments related to nitrate loading, groundwater mounding or other issues or locations of concern; mandatory for High Strength and High Flow OWTS (over 1,500 gpd). Tier 1 allows OWTS designs up to 3,500 gpd with no comparable requirements.

- **Minimum Lot Size Requirements.** Includes a 5-acre minimum lot size requirement for new lot creation in the area of the county (Upper Alameda Creek Watershed) most reliant on OWTS; this compares with a 2.5 acre minimum lot size under Tier 1. For all other areas of the county, minimum lot size for new lot creation is 40,000 square feet where public water is provided and 60,000 square feet for areas reliant on private water supply. Additionally, however, cumulative impact assessment (e.g., nitrate loading) is also required, the results of which would be the basis for increasing minimum lot size, where warranted.

- **Areas of Special Concern.** Includes identification of Areas of Special Concern within the county based on groundwater-nitrate impacts, along with imposition of Advanced treatment requirements for nitrogen removal; Tier 1 criteria would allow Standard OWTS in many of the identified areas.

- **Septage Pumper Inspection & Reporting Requirements.** Institutes a program for basic inspection of OWTS at the time of septic tank servicing, and reporting of results to the County.

- **Dual (200%) Dispersal System.** Requires installation of dual (200%) dispersal fields for Standard OWTS rather than 100% installed, 100% reserve.

- **Seepage Pits.** Prohibits the use of seepage pits; Tier 1 identifies seepage pits as an alternative for OWTS repairs (8.1.6).

- **Pump Systems.** Includes design guidance and requirements for pump systems.

- **Pressure Distribution Systems.** Treats pressure distribution systems as an "Advanced" OWTS, including requirements for operating permit and performance monitoring/reporting. Tier 1 (8.1.4) implies that pressure distribution is a Standard trench design option.

- **Cut Banks and Steep Slopes.** Includes horizontal setback requirement for cut banks and steep slopes, which represent potential avenues for effluent seepage.

- **Maximum Trench Depth.** Specifies maximum depth of 5 feet for dispersal trench, compared with 10 feet allowed by Tier 1.

- **Peak vs Average Flow.** Dispersal system design based on peak, rather than average wastewater flow as provided in Tier 1.

- **Erosion Control.** Includes requirements for OWTS installations for certain slopes, type and size of project.

- **Floodplains.** Includes setback and design requirements related to floodplains.

- **Performance Evaluation Guidelines.** Provides procedures and criteria to guide performance evaluations of OWTS in connection with building remodel projects, property transfers, abatement investigations, etc.

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Appendix B
OWTS Usage and Loading Estimates for Alameda County
Prepared by Questa Engineering Corporation – March 2016

General Approach and Scope

The following describes the process used to develop an inventory of the total number and distribution of residential OWTS in Alameda County, organized and integrated with hydrologic and soils mapping information. The analysis was completed by Questa Engineering using GIS parcel data supplied by County of Alameda, along with soils and hydrological data primarily from the USDA National Resource Conservation Service (NRCS) and California Department of Water Resources (DWR).

There were five basic elements of this analysis as follows:

1. **Parcel Development Status.** Conduct a systematic GIS-based inventory to determine the development status (i.e., developed or vacant) of all parcels in non-sewered areas of the County. Note: the analysis did not attempt to distinguish between OWTS serving single family residences and those serving commercial occupancies or other non-residential uses. The vast majority of OWTS in the county are for residential use. Non-residential OWTS may be significant locally in some cases, and may warrant separate analysis in the County's future OWTS management program.

2. **Watershed Areas.** Delineate the two major watershed areas of OWTS significance in the County – Upper Alameda Creek and San Lorenzo Creek - consistent with State databases, in a GIS format compatible with parcel data.

3. **Groundwater Basins.** Delineate the three major groundwater basins of significance for OWTS in Alameda County – Livermore Valley, Sunol Valley and Niles Cone, including GIS map files compatible with parcel data.

4. **General Soil/OWTS Suitability Mapping.** Define and construct GIS map of general soil associations for the County, focused on factors pertinent to the use of OWTS.

5. **Potential Areas of Concern.** Identify potential geographical areas of concern related to the high numbers and/or concentration of OWTS in certain areas, and develop for each area estimates of the total OWTS, lot size/density factors, wastewater volumes and nitrogen loading to the soil/groundwater environment.

The geographical area covered in the analysis included the southern and eastern portions of Alameda County, the primary areas where OWTS are in use; parcel data analysis focused only

on the unincorporated lands. All incorporated property within the various cities was excluded, as well as all unincorporated property within a sewer district, under the assumption that municipal sewer systems either currently serve or are potentially available to all parcels in these areas.

Parcel Development Status

The first step in the analysis was to identify and create an inventory of the non-sewered parcels in the County along with their development status (i.e., developed or vacant). It was found that this information is not readily available from any County department. Therefore, this was done according to the following process using the County GIS database.

1. **Identify Non-sewered Parcels**

- First, we obtained and applied city and sanitary district boundaries to the County-wide GIS data base to create a composite map of parcels located within areas known to be served by public sewers. This included mainly incorporated lands, but it also included some unincorporated areas of Hayward and Castro Valley (e.g. Oro Loma and CVSAN sanitary districts) which are served by municipal wastewater facilities.

- We excluded parcels within the GIS map of sewered areas determined above, leaving an inventory of parcels that may currently or potentially be developed with OWTS.

- From the above analysis, the total number of non-sewered parcels in the County was determined to be 5,139.

2. **Determine Development Status.**

- County Assessor's information and other GIS parcel data were reviewed and found not to have any designation indicating whether or not a particular property is developed or vacant.

- Per discussions with knowledgeable County staff, the Tax Roll data fields for the following were judged to be the most reasonable indicators of developed vs vacant status: (1) number of bedrooms, (2) number of buildings, (3) improvement value, and (4) parcels with an assigned street address (and street number).

- A separate analysis was made for each Tax Roll data field above, with the following results:

    1) 1,404 parcels having >0 bedrooms
    2) 1,983 parcels having >0 buildings
    3) 2,134 parcels having >0 improvement value
    4) 2,733 parcels with a street listing (of which 2,345) parcels also included an actual street number)

- The County DEH provided GIS-based data indicating 2,459 parcels which have some type of record on file at DEH. However, DEH cautioned that the records are not necessarily related to the permitting or existence of an OWTS on the property; they could pertain to OWTS abandonments at time of sewer connection; or they may be related to other environmental health matters and property may be connected to sewer. We sorted the County file data according to sewered vs non-sewered delineations from step 1 above, and found 718 pertained to sewered areas, and 1,741 pertained to non-sewered areas.

- We then spot-checked satellite imagery against the findings from each of the above "developed status" indicators, and against the County DEH records data based; we found the best apparent match to be the Assessor's entry for "buildings", i.e., >0 buildings;

- The indicators as derived above were then assigned to the County-wide GIS inventory of unincorporated non-sewered parcels giving the best estimate of developed parcels/OWTS vs undeveloped as follows:

    1) Developed/OWTS Parcels: 1,983
    2) Vacant Parcels: 3,156
    Total Parcels: 5,139

- From County records there are known to be pockets and scattered individual OWTS in some urban areas, most notably in portions of the Oakland hills. Utilizing records contained in DEH files, the DEH staff developed estimates and maps of OWTS usage in the Oakland hills, which are provided in **Appendix C**. The DEH inventory showed an estimated 85 existing developed properties using OWTS in the Oakland hills; and this was added to the GIS-based inventory by Questa (above), bringing the total existing OWTS estimate to 2,068.

Watershed Areas

Watershed Mapping. Alameda County lies almost entirely within the jurisdiction of the San Francisco Bay Regional Water Quality Control Board (Region 2). A small portion of the county, east of the Altamont Hills, lies in the Central Valley Region 5. The two main watersheds of significance for OWTS are the Upper Alameda Creek and San Lorenzo Creek (Castro Valley Area). **Figure B-1** provides a map of the county showing the location and extent of these watersheds, based on boundaries established by the California Department of Water Resources (DWR); also shown is the drainage divide between the S.F. Bay and Central Valley Regions.

OWTS Distribution by Watershed. The watershed mapping information was merged with the GIS parcel status data to determine the distribution of developed unincorporated parcels (i.e., OWTS) according to their location in different watershed areas in the county. The results are summarized in **Table B-1** below. The OWTS parcels lying in the Central Valley Region were tallied and listed under the heading "Eastside Altamont Hills". The OWTS parcels in the remainder of the county are listed under "Other".

Major Surface Water Features

Alameda County LAMP Fig. B-1

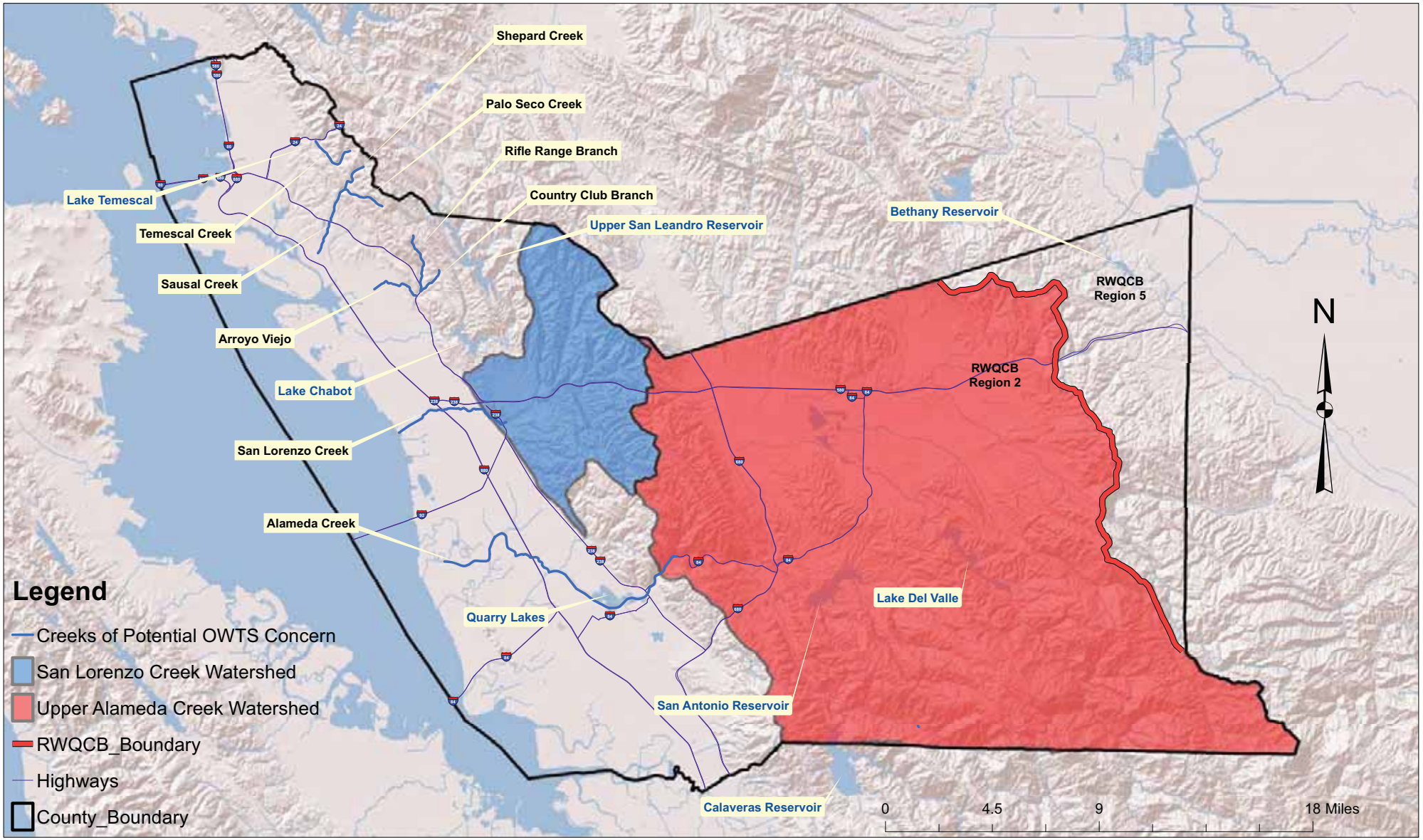


Table B-1. Estimated OWTS by Watershed Area

Watershed	Watershed Area (sq miles)	Estimated Number of OWTS Within Watershed
Upper Alameda Creek	351	1,288
San Lorenzo Creek	53	483
Oakland Hills	-	85
Eastside Altamont Hills	69	85
Other	N/A	127
Total		**2,068**

Groundwater Basins

Groundwater Basin Mapping. The three major groundwater basins in Alameda County of significance for OWTS management are the Livermore Valley Groundwater Basin, Sunol Valley Groundwater Basin and the Niles Cone Sub-basin. **Figure B-2** provides a map of the county showing the location and delineation of these three groundwater basins according to boundaries established by the California Department of Water Resources (DWR).

OWTS Distribution by Groundwater Basin. In an analysis similar to conducted by watershed area, the groundwater basin boundaries were merged with the GIS parcel status data to obtain estimates of the number of developed unincorporated parcels/ OWTS overlying each of these three major groundwater basins of interest. The results are summarized in **Table B-2** below.

Table B-2. Estimated OWTS Distribution by Groundwater Basin

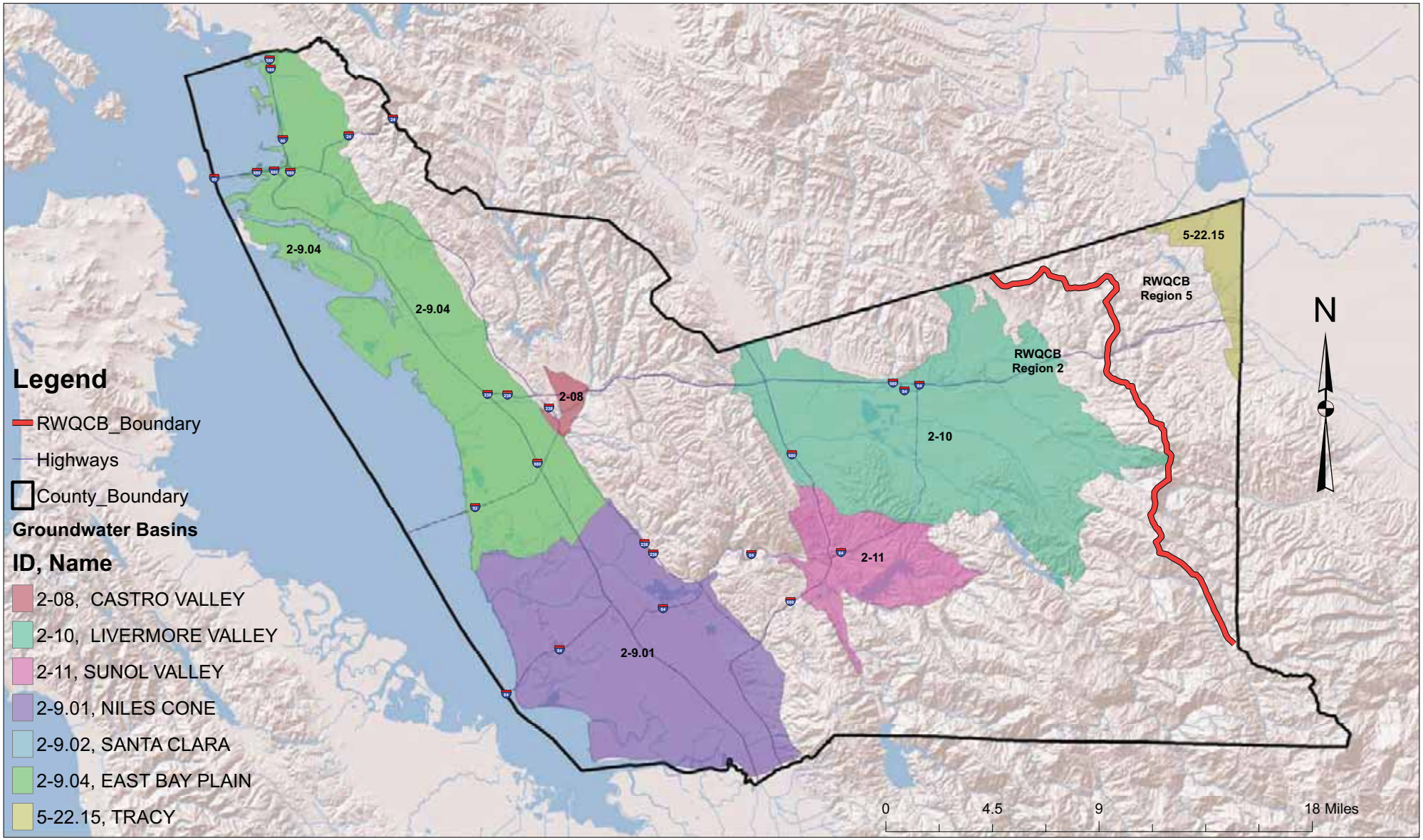
Groundwater Basin	Basin Area (sq miles)	Estimated Number of OWTS Within Basin
Livermore Valley	167	612
Sunol Valley	41	189
Niles Cone	144	41
Oakland Hills	-	85
Eastside Altamont Hills	69	85
Other	N/A	1,056
Total		**2,068**

Soils/ OWTS Suitability Mapping

General Soils Map. Figure B-3 presents a General Soils Map of Alameda County compiled from information contained in several soil surveys and mapping published by the U.S. Department of Agriculture, which include: (1) Soil Survey of Alameda County, California, 1966;

Major Groundwater Basins

Alameda County LAMP Fig. B-2



and (2) Online soils data base maintained by the Natural Resources Conservation Service (NRCS). The General Soils Map contained in the 1966 Soil Survey of Alameda County provided the baseline groupings of general soil associations, which were extended to cover other portions of the County, as shown in **Figure B-3**.

Soils in the County can be grouped into general landform classifications as follows:

- **Urban Areas (0).** Soils found in the flat portions of the East Bay that occur in sewered areas were not analyzed.

- **Soils of the Uplands (1, 2, 3)**. Soils found in the uplands are shallow to moderately deep, well drained to excessively drained loams and gravelly loams. Constraints of steep slopes, shallow soils over rock, erosion and local landslides may be potentially overcome by alternative treatment and/or shallow dispersal designs.

- **Terraces, Alluvial Fans and Floodplains (4, 5, 6, 7).** Soils of the floodplains, alluvial fans and terraces are formed in alluvium weathered from sedimentary rocks. Many OWTS are found in the Livermore Valley, where the floodplain soils are clays to gravelly loams that are generally shallow above a limiting layer, with inclusions of low permeability and/or perched groundwater favoring shallow dispersal designs.

Soil-OWTS Suitability and OWTS Distribution. The general mapping of soil conditions takes into account location and landform conditions, depth to bedrock, slope, subsurface texture, and drainage conditions of the soils, which are all key factors that can affect the suitability of the soils for onsite wastewater treatment. **Table B-3** was developed from the published soil survey information, summarizing the soil characteristics of the general soil associations mapped in **Figure B-3.**

The second to last right-hand column in **Table B-3** highlights the key constraints and overall suitability designation for OWTS for each general soil association. The designations were developed and assigned based on the USDA soils information and best professional judgment. This is provided as a general assessment tool and is not a substitute for site-specific investigation of and planning for onsite wastewater treatment systems. It provides a general indication of the management and design issues likely to be encountered in each area. It does not take into account local constraints such as steep slopes, setback or other anomalous conditions that may be found on particular sites.

The last column gives the estimated number of developed OWTS parcels within each general soil area, determined by merging the GIS parcel data with the soil mapping boundaries, as similarly done and presented above for watershed areas and groundwater basins.

Potential Areas of Concern

In locations where there are special environmental or geographical concerns, additional evaluation, standards and requirements must be followed as set forth in the Ordianace and the Manual.

General Soils Map

Alameda County LAMP Fig. B-3

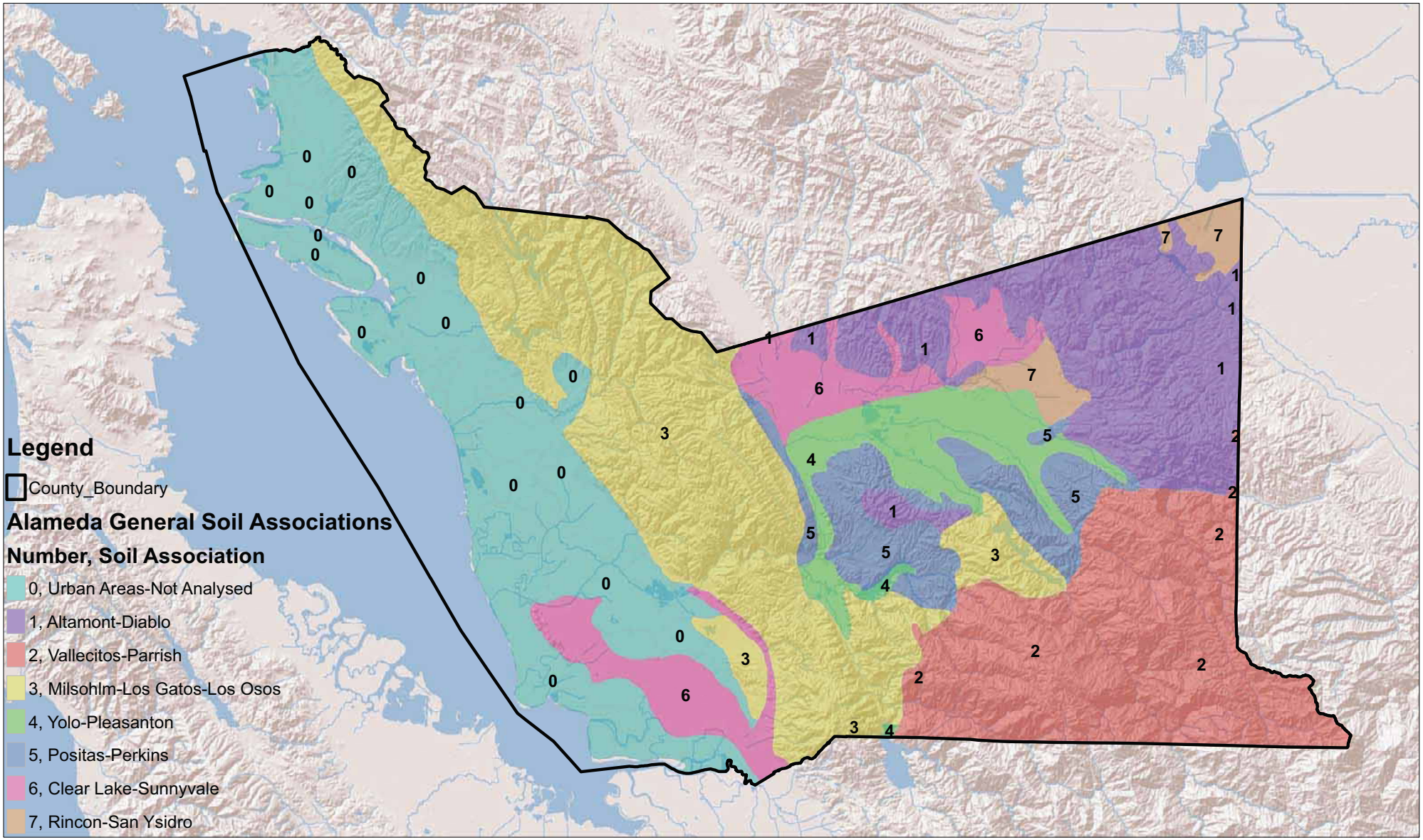


Table B-3: Alameda County General Soil Associations

Legend No.	Soil Association Name	Description	Soil Depth	Slope	Drainage	Soil Texture	Suitability and Constraints for OWTS	Estimated Number of OWTS
1	**Altamont-Diablo**	**Soils formed in material weathered from interbedded sedimentary rock found in the smooth, rounded uplands north and east of Livermore Valley**	moderately deep	moderately sloping to very steep along streams	well drained to excessively drained	clay to gravelley loam and clay loam underlain by soft sandstone	Suitable conditions for conventional OWTS; some inclusions of low permeability and perched GW favoring shallow dispersal designs	202
2	**Vallecitos-Parrish**	**Soils formed in material weathered from metasedimentary and basic igneous rocks found in the uplands of the southeast county**	shallow to moderately deep	moderately steep and very steep	well drained to excessively drained	loam to gravelley loam	Moderately constrained by steep slopes and shallow soils, potentially requiring advanced treatment and/or shallow dispersal designs	105
3	**Milsohlm-Los Gatos-Los Osos**	**Soils formed in material weathered from moderately hard sedimentary rocks found in the uplands from Calveras Reservoir to Upper San Leandro Reservoir**	very shallow to moderately deep	strongly sloping to very steep	well drained to excessively drained	very gravelley sandy loam and sandy clay loam	Moderately constrained by steep slopes and shallow soils, potentially requiring advanced treatment and/or shallow dispersal designs. Erosion and landslide hazards locally.	820
4	**Yolo-Pleasanton**	**Soils formed in alluvium weathered from sedimentary rocks found on flood plains and terraces**	very deep	nearly level to sloping	well drained	clay to gravelley course sandy loam	Suitable conditions for conventional OWTS; some inclusions of low permeability and perched GW favoring shallow dispersal designs	356
5	**Positas-Perkins**	**Soils formed in alluvium weathered from sedimentary rocks found on high terraces south of Livermore Valley**	shallow to moderately deep	nearly level to strongly sloping	well drained	gravelly loam underlain by claypan soils	Suitable conditions for conventional OWTS; some inclusions of rapid percolation, potentially requiring advanced treatment and/or shallow dispersal designs.	362
6	**Clear Lake-Sunnyvale**	**Soils formed in alluvium weathered from sedimentary rocks found in floodplains, basin areas and on low terraces east of Dublin, and also on low terraces in the southwest Urban area of the county**	very deep	nearly level to gently sloping	well drained to imperfectly drained	clay to clay loam	Suitable conditions for conventional OWTS; some inclusions of low permeability and perched GW favoring shallow dispersal designs	64
7	**Rincon-San Ysidro**	**Soils formed in alluvium weathered from sedimentary rocks found in the northeast corner of the county and in the Livermore Valley**	shallow to very deep	nearly level	well drained	clay loam to loam	Suitable conditions for conventional OWTS; some inclusions of low permeability and perched GW favoring shallow dispersal designs	39

Several Areas of Concern have been formally designated by Zone 7 and the San Francisco Bay Regional Water Board in the 2015 Nutrient Managment Plan for the Livermore Valley Groundwater Basin due to nitrate impacted groundwater in these areas; others areas may be proposed for inclusion in the future as a result of information from the development and/or implementation of the County's LAMP. **Table B-4** presents a list and brief descriptions of 12 localized areas of OWTS usage that have either been designated as Areas of Concern or are anticipated to be a primary focus for the long-term OWTS managmeent program in Alameda County, based on the number and/or density of OWTS or other factors. The locations of these areas are indicated in **Figure B- 4**; detailed GIS maps of each area are attached for reference. Additional details and mapping of the OWTS areas in the Oakland Hills developed by Department staff are included in Appendix C.

To assist with present and future management of OWTS and water quality assessments in these areas, GIS data were compiled to give estimates of the number of OWTS in each area, along with median and average parcel size, which are presented in **Table B-5.** These areas of concern account for an estimated 1,241 OWTS, about 60% of the total OWTS in the unincorporated areas of the county.

From the OWTS/parcel data, estimates were then made of the approximate wastewater discharge volumes from OWTS, based on the assumption of an average daily discharge of 150 gpd per OWTS (3 persons per dwelling @ 50 gpd/person). Using an assumed total nitrogen concentration of 70 mg-N/L appropriate for 50 gpd/person wastewater generation (Crites and Tchobanoglous, 1998), estimates of total loading of nitrogen to the soil and groundwater environment were developed for each area and also listed in **Table B-5**.

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USDA, Natural Resources Conservation Service. March 1966. Soil Survey Alameda Area, California.

USDA, Natural Resources Conservation Service. March 1981. Soil Survey of Alameda County, California, Western Part.

Zone 7 Water Agency. February 2015. Nutrient Management Plan, Livermore Valley Groundwater Basin.

Designated OWTS Areas of Concern & Focus Areas

Fig B-4

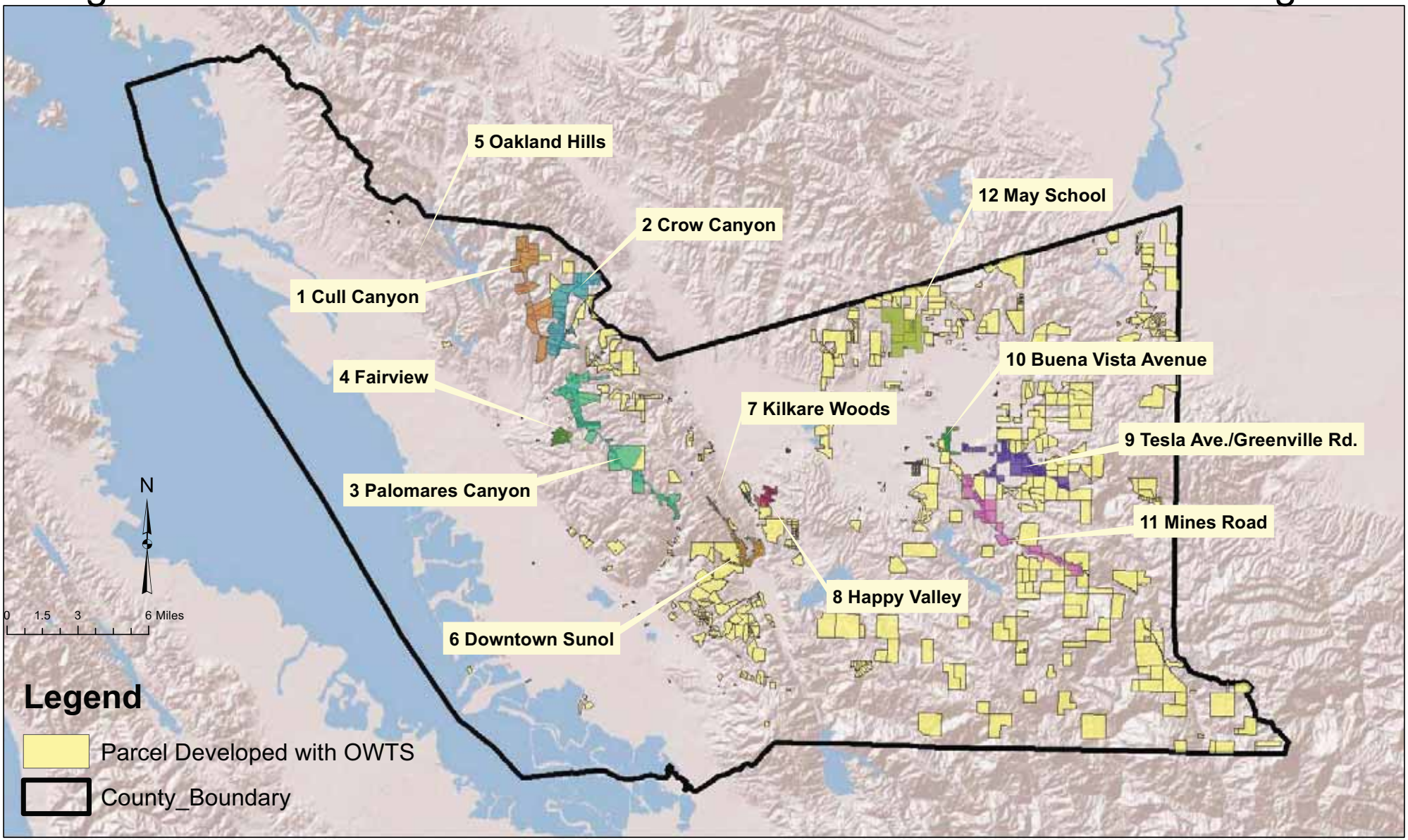


Table B-4. Designated Areas of Concern & Focus Areas for OWTS in Alameda County

No.	Area of Concern Status	Area Name	Nearest City or Community	Affected Watercourses or Groundwater Basin	OWTS Issues
1		Cull Canyon	Castro Valley	Cull Creek, San Lorenzo Creek	Development in steep-sided canyon, rocky soils, steep terrain, encroachment within stream terraces, limited replacement area
2		Crow Canyon/Norris Canyon	Castro Valley	Crow Creek, San Lorenzo Creek	Development in steep-sided canyon, rocky soils, steep terrain, encroachment within stream terraces and stream-bank areas (Norris Canyon); limited replacement area;
3		Palomares Road	Castro Valley	Palomares Creek, San Lorenzo Creek	Dense development within steep-sided canyon, steep terrain, encroachment within stream terraces, limited replacement area
4		Fairview	Hayward	Ward Creek, Sulphur Creek, San Lorenzo Creek	100+ homes on ridge-top area; OWTS in some areas constrained by shallow soils over bedrock, limited replacement area, steep terrrain
5		Oakland Hills	Oakland	East Bay Plain GW Basin, Sausal Creek	High number of failing systems, public sewer connection available using low pressure sewage systems (grinder pumps or STEP systems)
6		Downtown Sunol	Sunol	Sinbad Creek, Arroyo de la Laguna, Alameda Creek, Sunol GW Basin	Large concentration of residences (150+) and small commercial district at confluence of several drainages; generally suitable lot sizes and favorable soils for OWTS; cumulative wastewater loading impacts on groundwater a potential issue.
7		Kilkare Woods	Sunol	Sinbad Creek	Historical development dating to 1920s; summer cabins converted over the years to full-time residences; very small lot sizes, densely developed in steep, wooded terrain and stream terraces with minimal setbacks; many antiquated and non-conforming OWTS.
8	Designated	Happy Valley	Pleasanton	Livermore Valley GW Basin	Moratorium area established in 1973; high density of OWTS in area of localized nitrate-impacted groundwater.
9	Designated	Tesla Ave/Greenville Rd	Livermore	Livermore Valley GW Basin	Area with generally gravelly basin soils overlying localized nitrate-impacted groundwater
10	Designated	Buena Vista Ave	Livermore	Livermore Valley GW Basin	Area with generally gravelly basin soils overlying localized nitrate-impacted groundwater
11	Designated	Mines Rd	Livermore	Livermore Valley GW Basin	Area with generally gravelly basin soils overlying localized nitrate-impacted groundwater
12	Designated	May School	Livermore	Livermore Valley GW Basin	Area with generally gravelly basin soils overlying localized nitrate-impacted groundwater

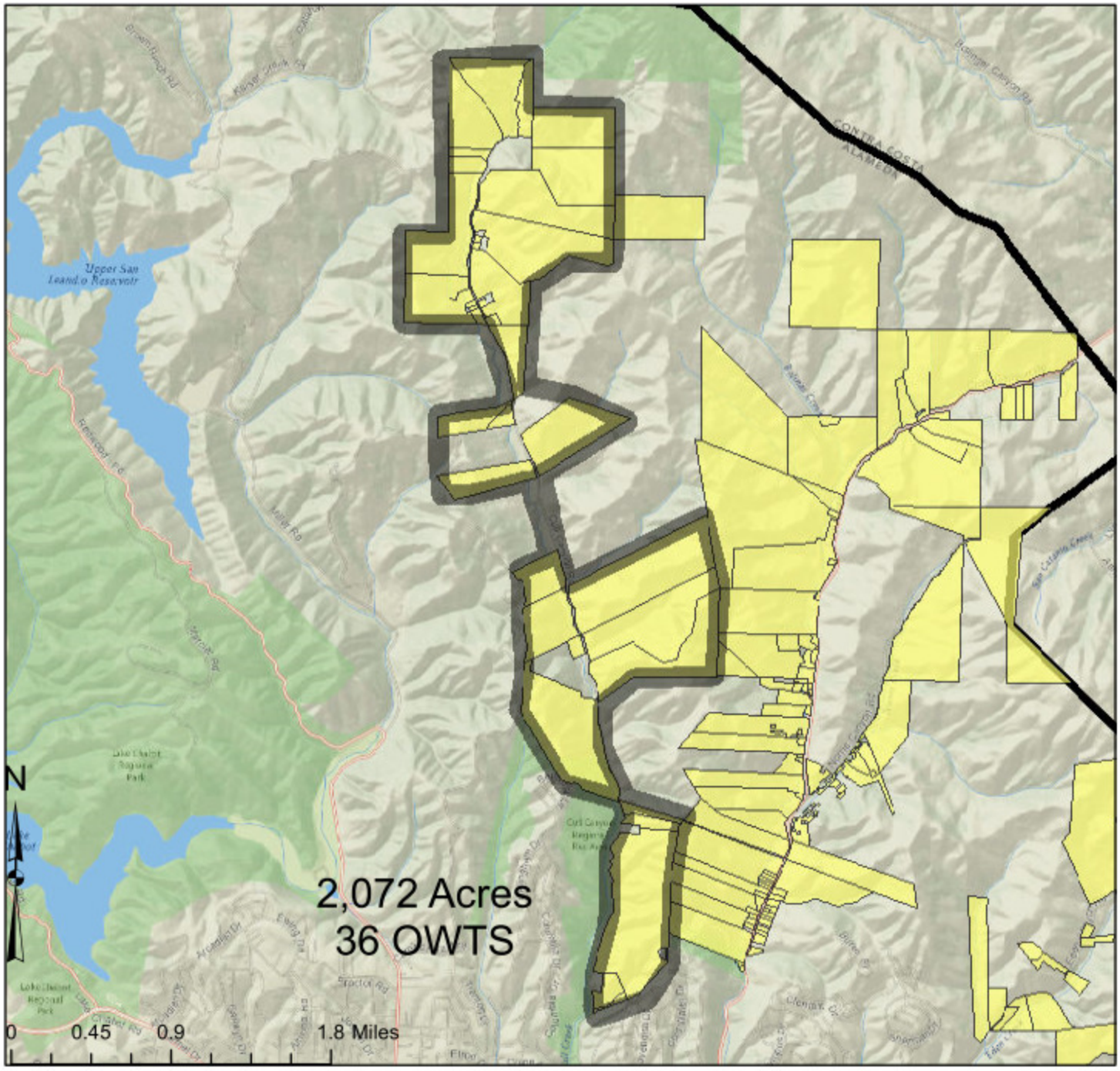
Table B-5. Alameda County Designated Areas of Concern and Focus Areas, OWTS Discharges and Loading Estimates

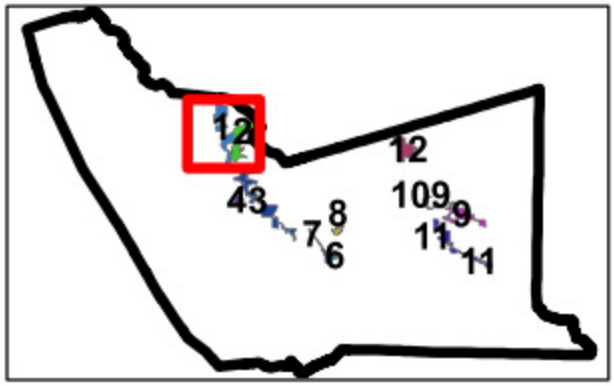
No.	Name	Area of Concern Status	Gross Acresage of Focus Area (ac)	Number of Developed Parcels with OWTS	Median Parcel Size (ac)	Area-wide OWTS Density (ac/OWTS)	Estimated Daily OWTS Discharge* (gpd)	Estimated OWTS Discharge		Estimated Annual Nitrogen Loading**	
								Daily Discharge per Acre (gpd/ac)	Annual Total (Mgal/yr)	Total Loading (lbs/yr)	Per Acre (lbs/ac-yr)
1	Cull Canyon		2,072	36	26.0	58	5,400	2.61	1.97	1,151	0.56
2	Crow/Norris Canyon		1,943	105	2.5	19	15,750	8.11	5.75	3,356	1.73
3	Palomares Canyon		2,818	196	4.4	14	29,400	10.43	10.73	6,265	2.22
4	Fairview		278	125	1.3	2	18,750	67.45	6.84	3,995	14.37
5	Oakland Hills		113	85	1.12	1.33	12,750	112.83	4.65	2,717	24.04
6	Downtown Sunol		556	162	1.2	3	24,300	43.71	8.87	5,178	9.31
7	Kilkare Woods		46	99	0.2	0.46	14,850	322.83	5.42	3,164	68.79
8	Happy Valley	Designated	293	92	1.3	3	13,800	47.10	5.04	2,941	10.04
9	Tesla Ave. Greenville Rd.	Designated	1,556	121	5.5	13	18,150	11.66	6.62	3,868	2.49
10	Buena Vista Avenue	Designated	224	98	1.4	2	14,700	65.63	5.37	3,132	13.98
11	Mines Road	Designated	1,589	72	5.1	22	10,800	6.80	3.94	2,301	1.45
12	May School	Designated	1,071	28	5.2	38	4,200	3.92	1.53	895	0.84
	Total			**1,219**			**182,850**	**703.06**	**66.74**	**38,963**	

** Based on 150 gpd/residence*

*** Based on 70 mg-N/L total nitrogen concentration*

Alameda County OWTS Focus Areas 1



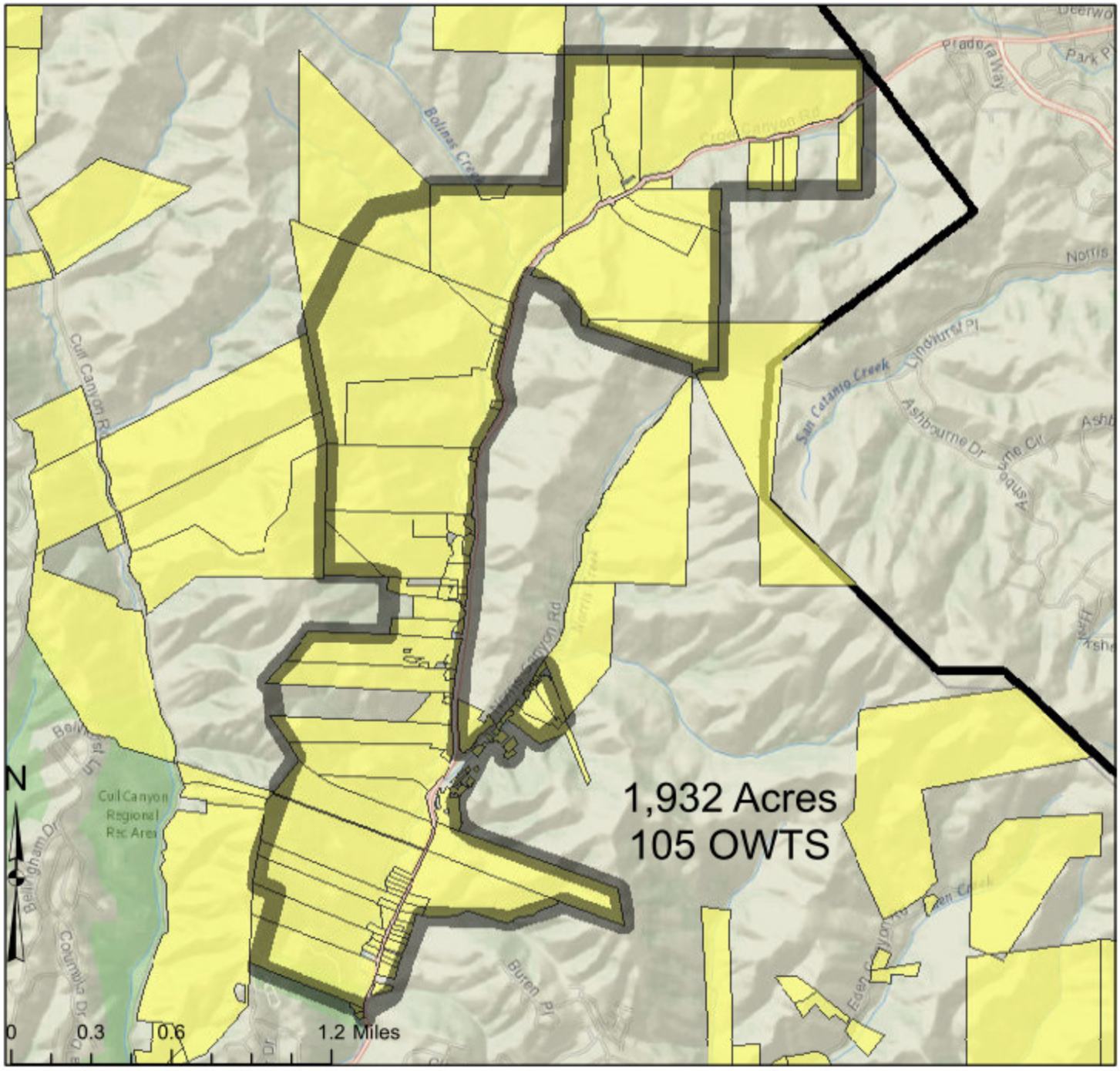


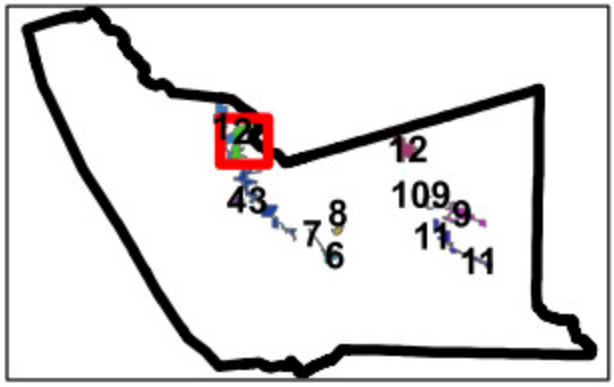
Legend

- Cull Canyon
- Parcel Developed with OWTS
- County_Boundary

Cull Canyon

Alameda County OWTS Focus Areas 2



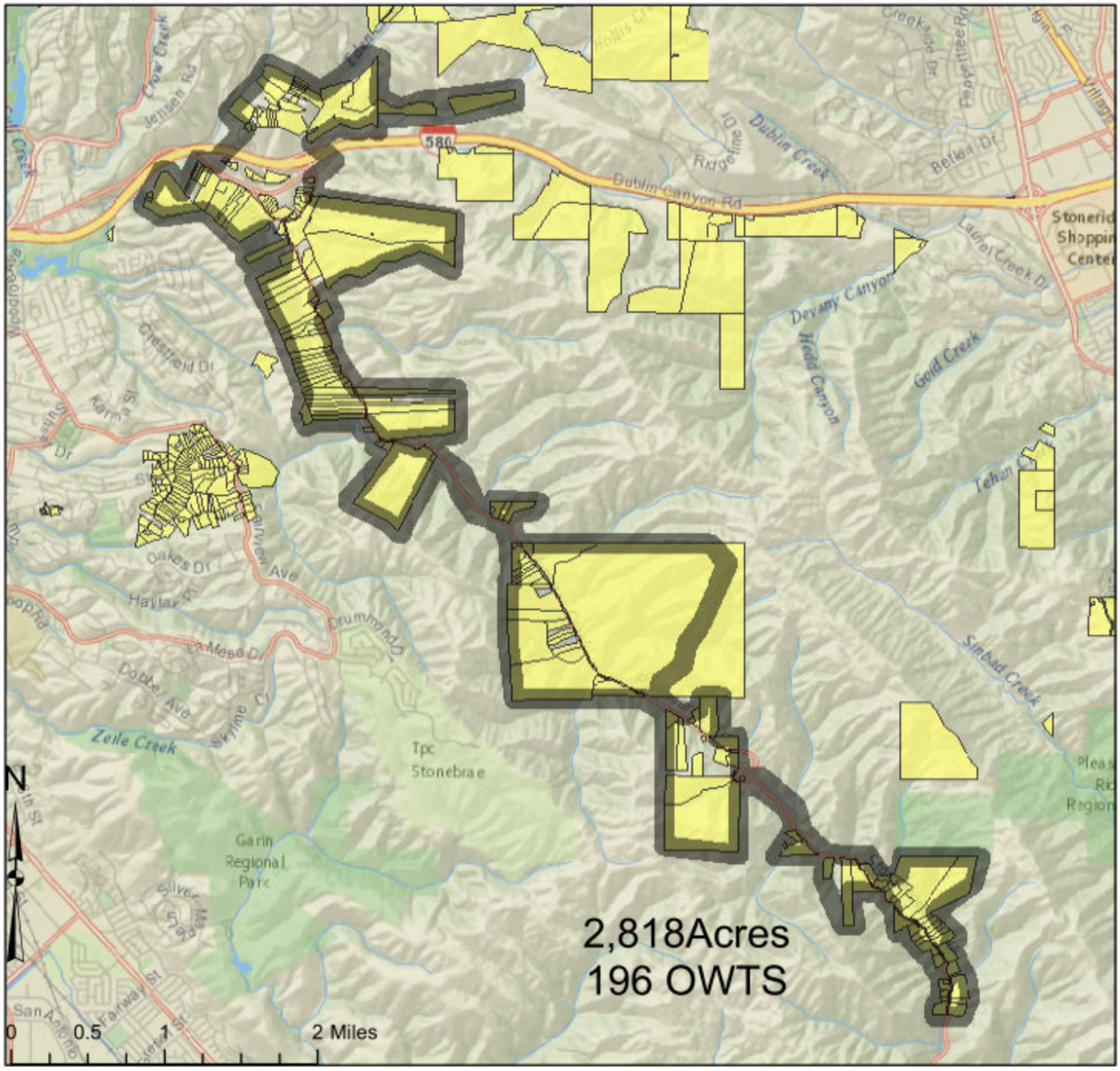


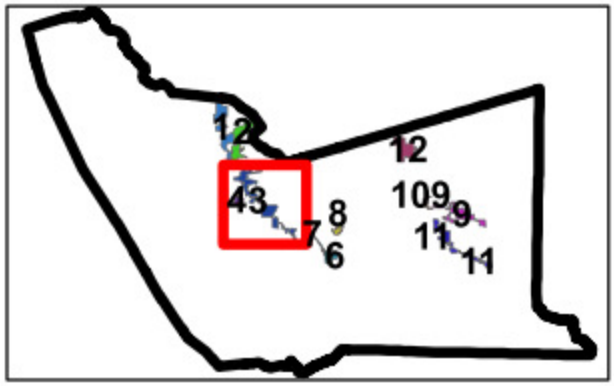
Legend

- Crow Canyon
- Parcel Developed with OWTS
- County_Boundary

Crow Canyon

Alameda County OWTS Focus Areas 3



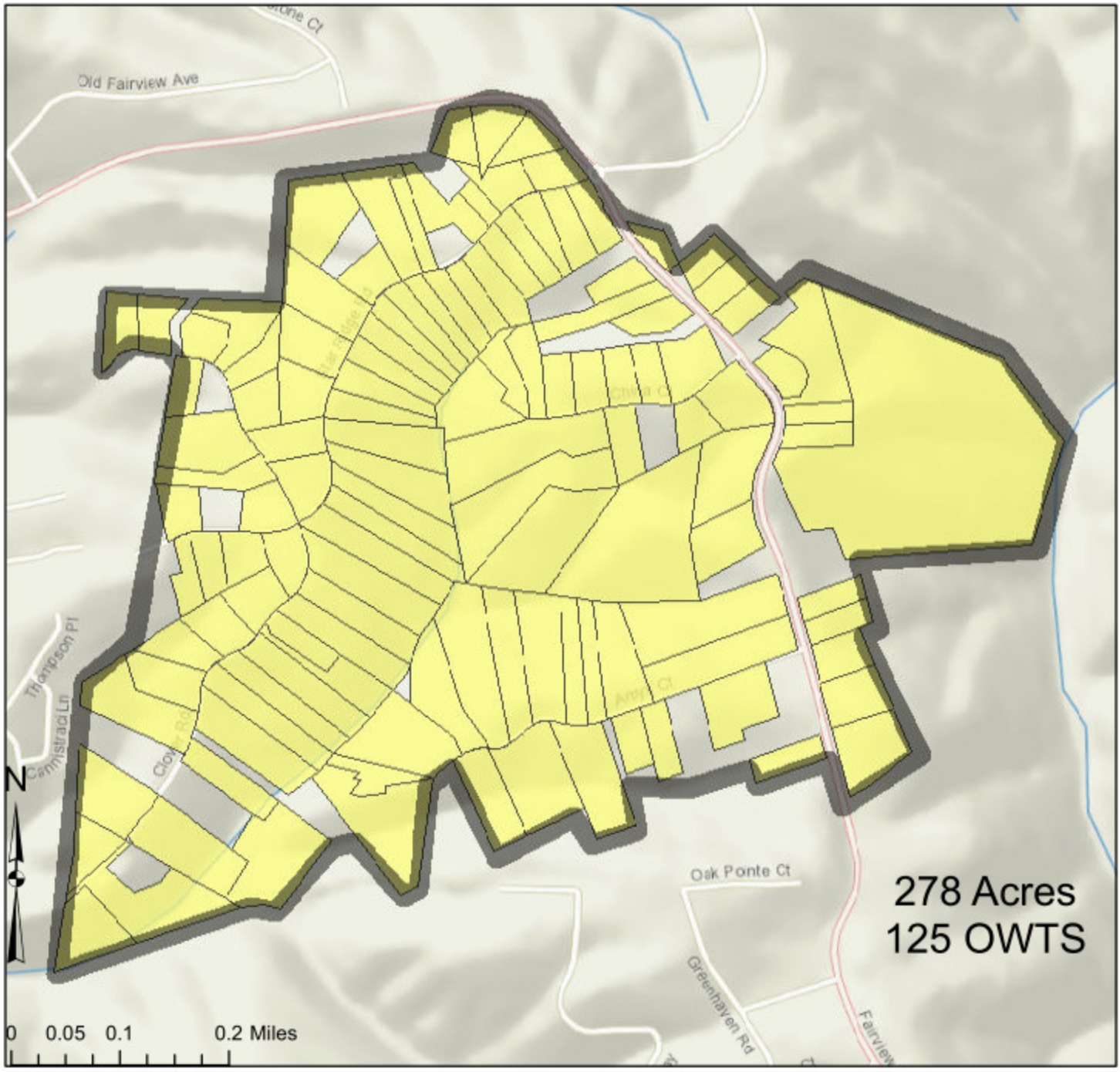


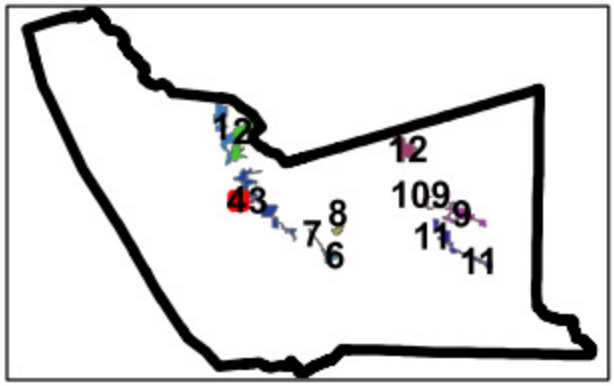
Legend

- Palomares Canyon
- Parcel Developed with OWTS
- County_Boundary

Palomares Canyon

Alameda County OWTS Focus Areas 4



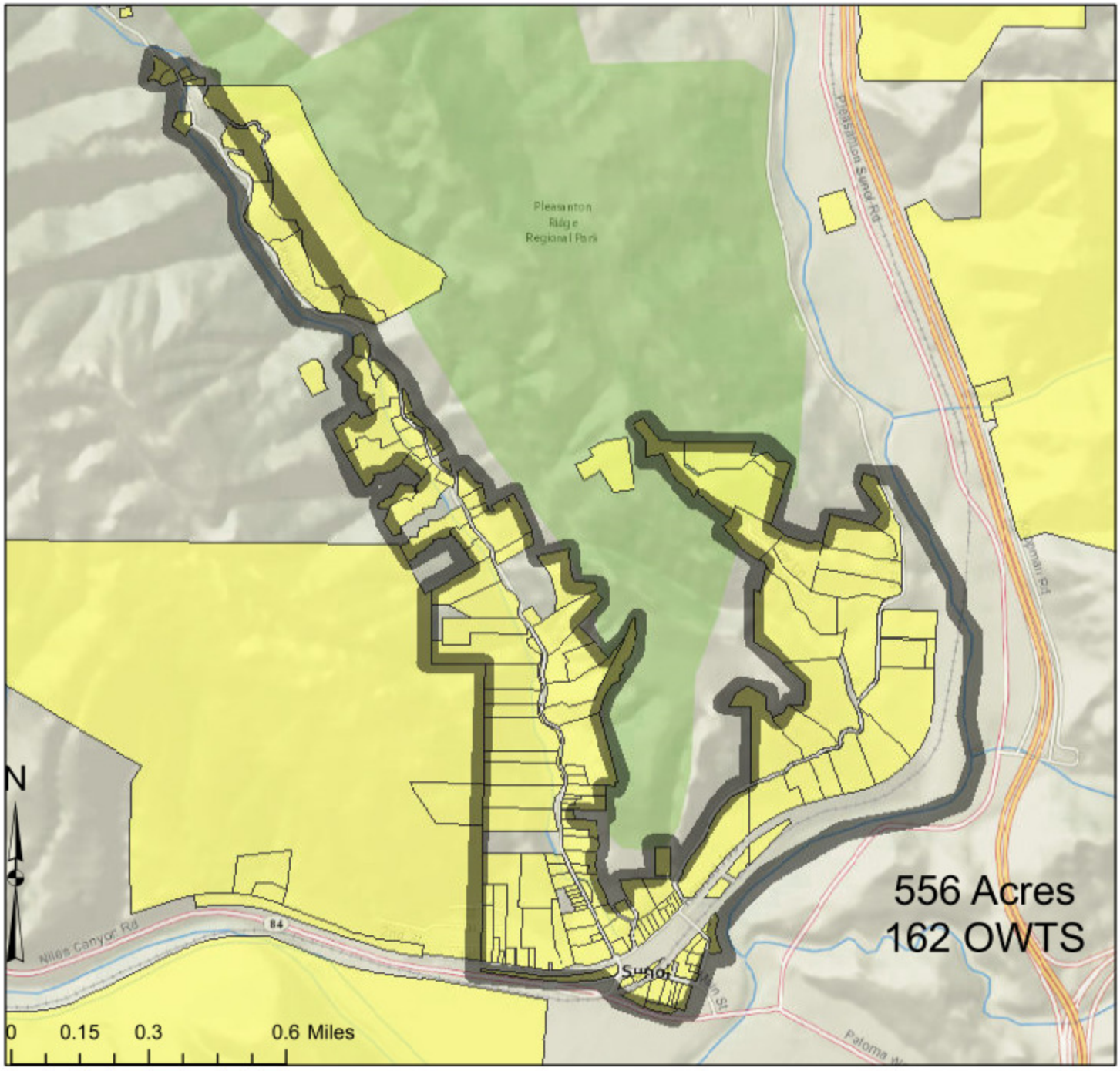


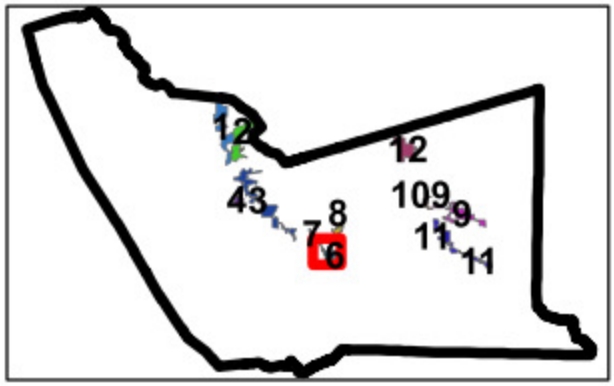
Legend

- Fairview
- Parcel Developed with OWTS
- County_Boundary

Fairview

Alameda County OWTS Focus Areas 6





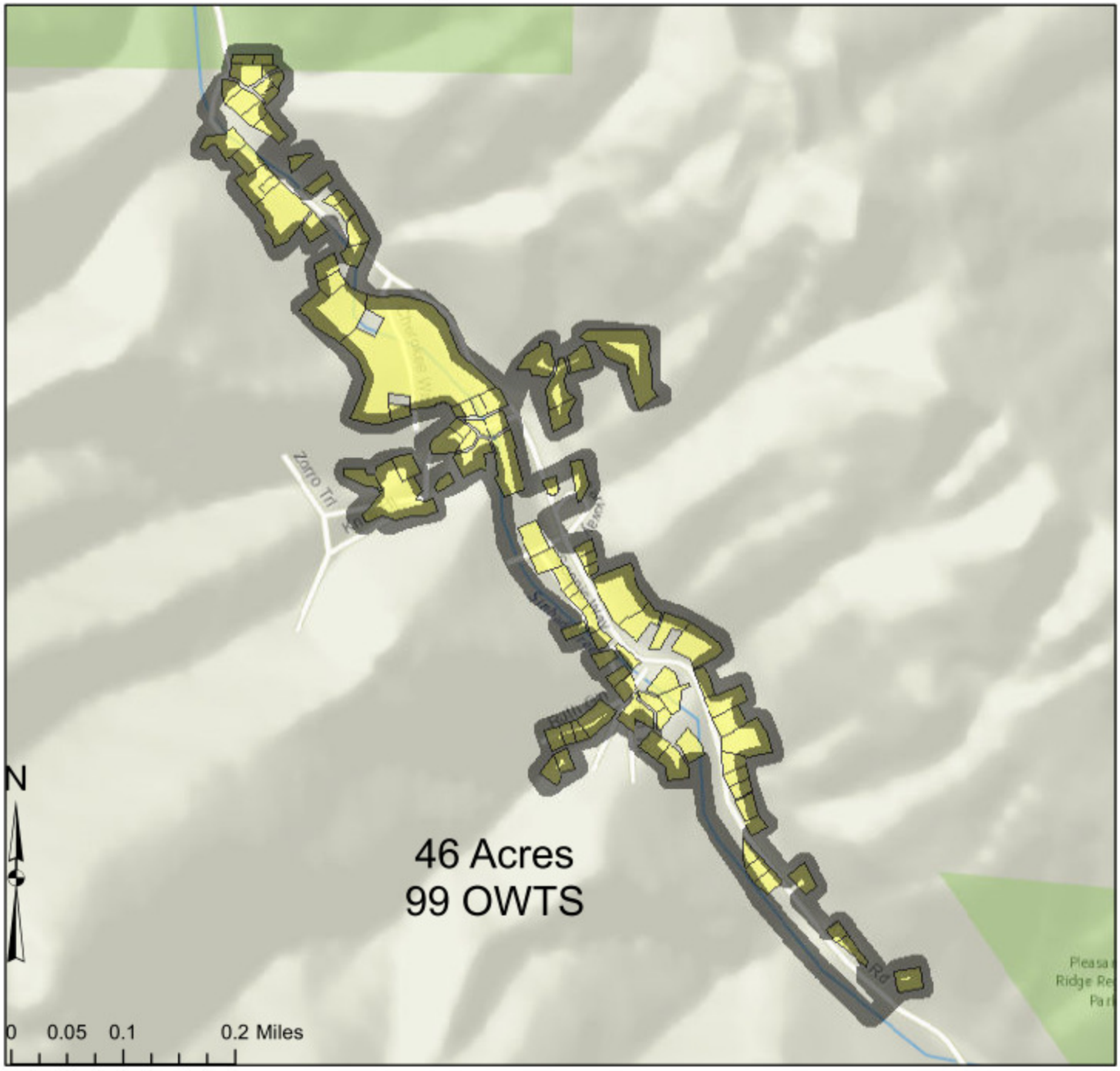
Legend

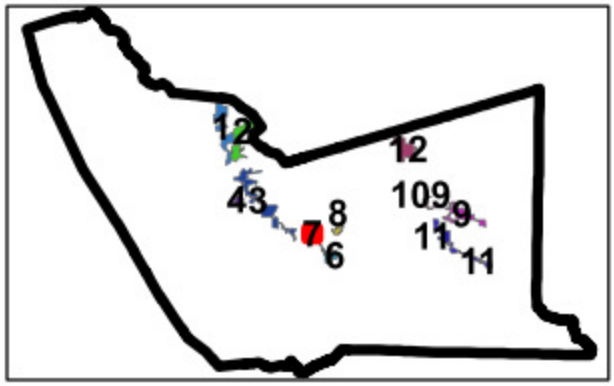
- Downtown Sunol
- Parcel Developed with OWTS
- County_Boundary

Downtown Sunol

and Lower Kilkare Canyon

Alameda County OWTS Focus Areas 7



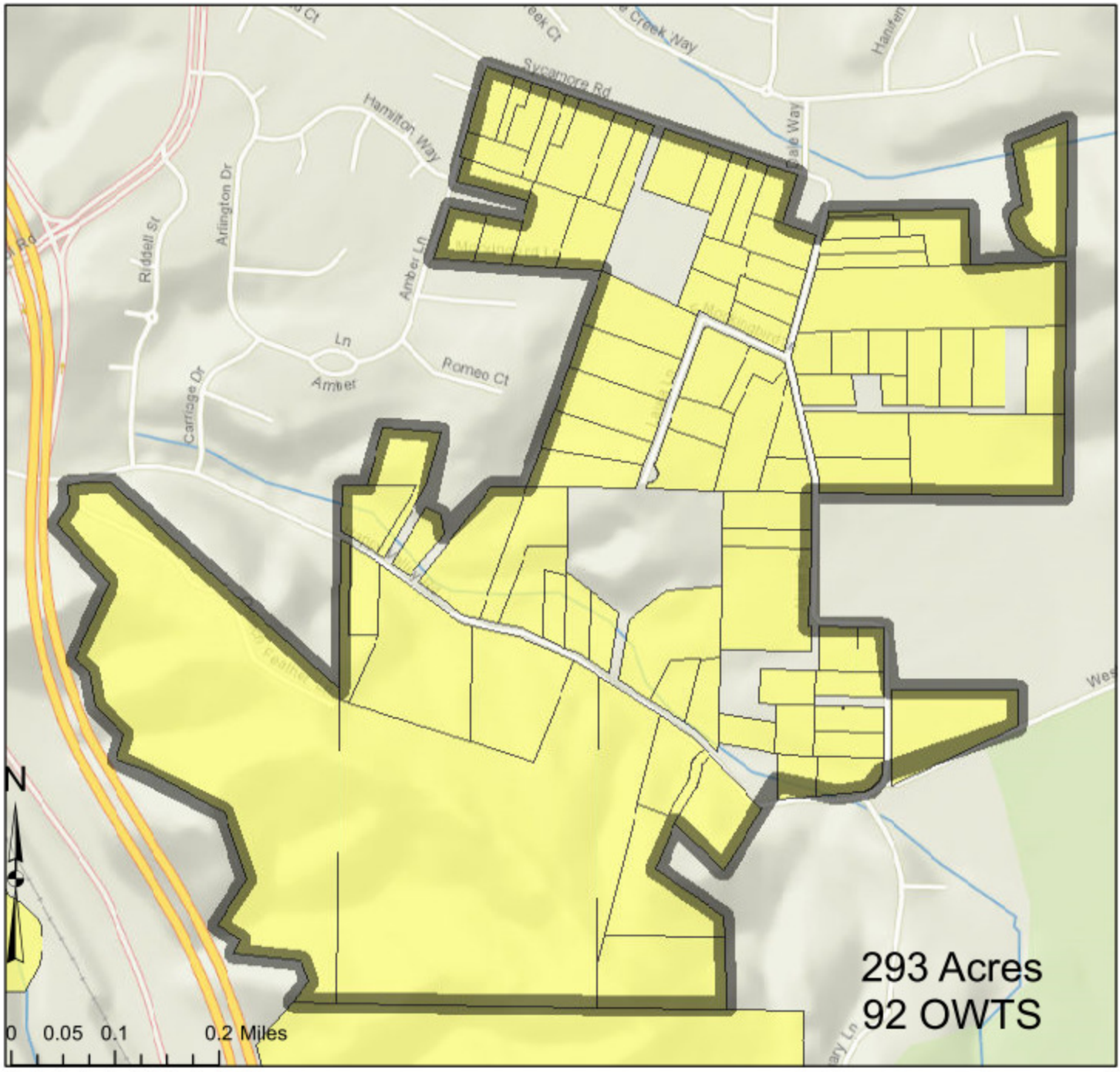


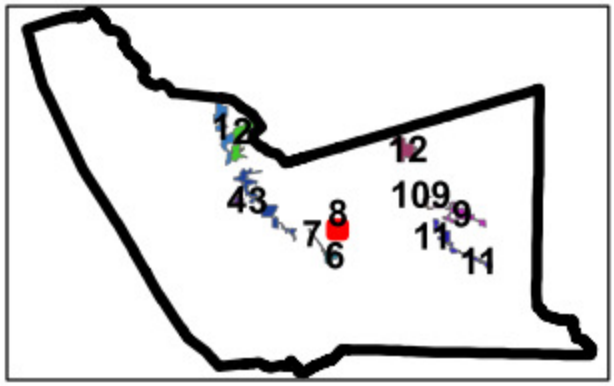
Legend

- Kilkare Woods
- Parcel Developed with OWTS
- County_Boundary

Kilkare Woods

Alameda County OWTS Focus Areas 8



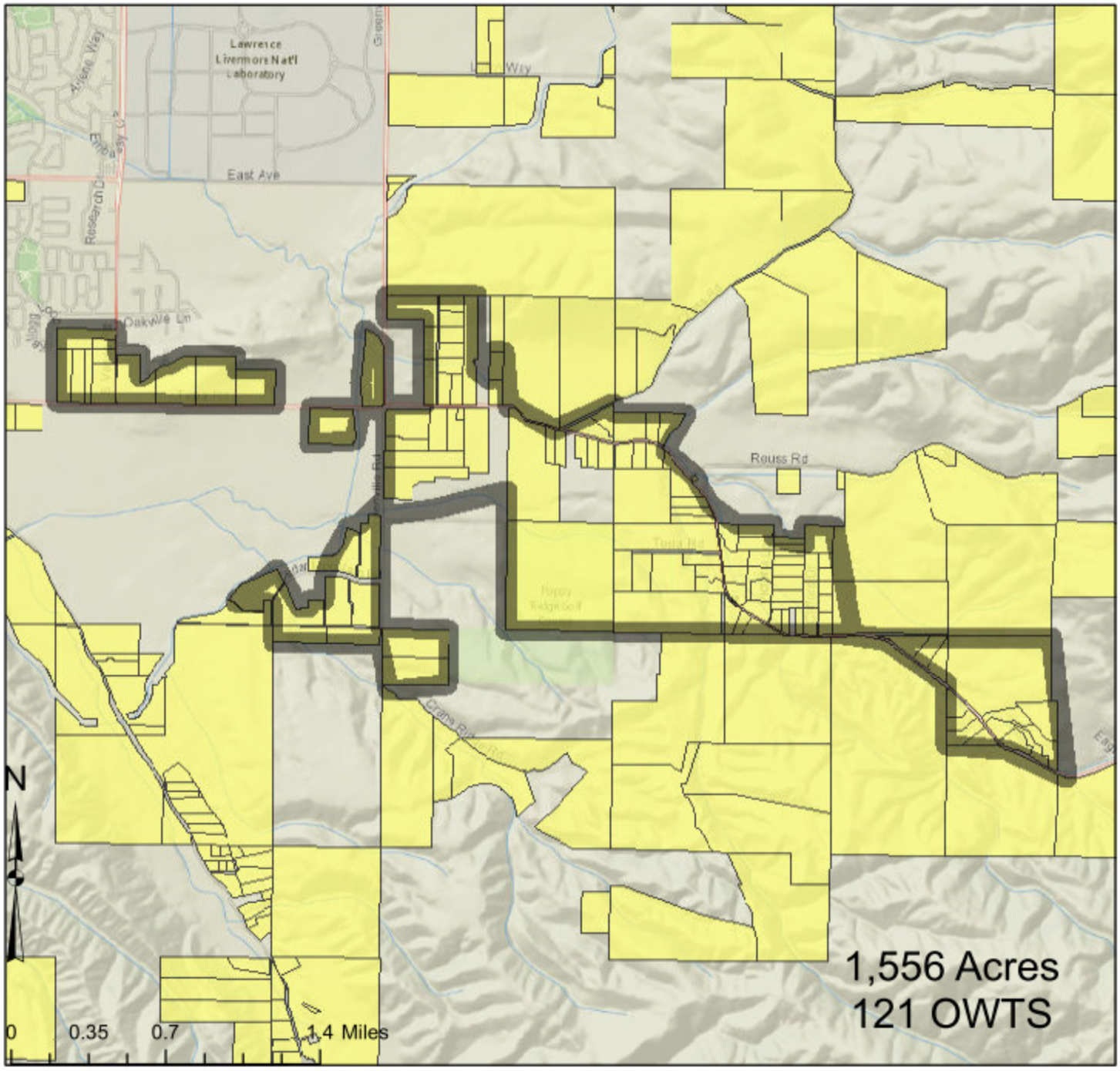


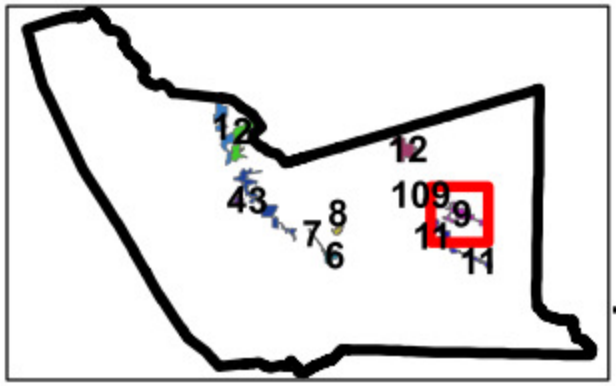
Legend

- Happy Valley
- Parcel Developed with OWTS
- County_Boundary

Happy Valley

Alameda County OWTS Focus Areas 9



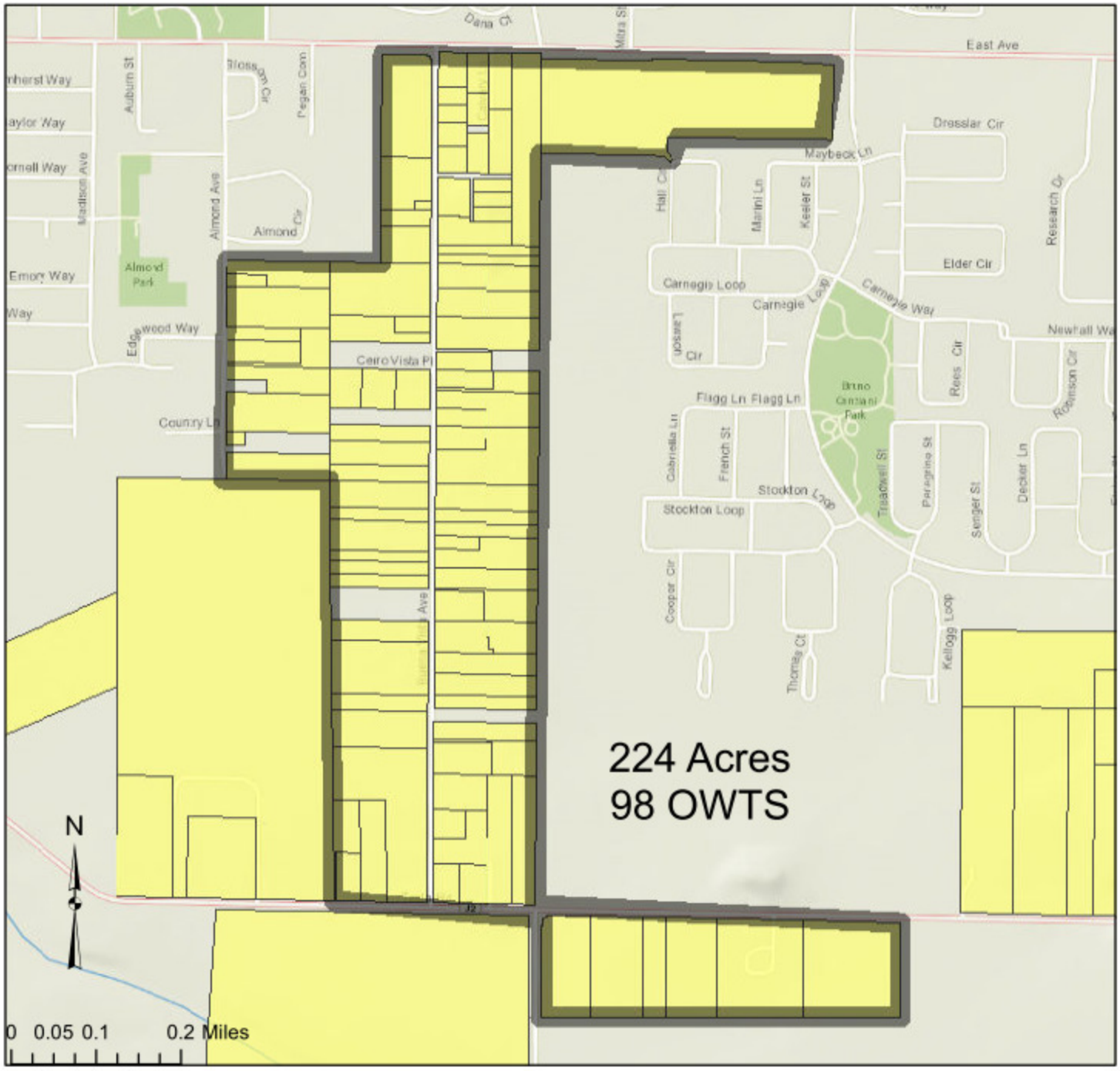


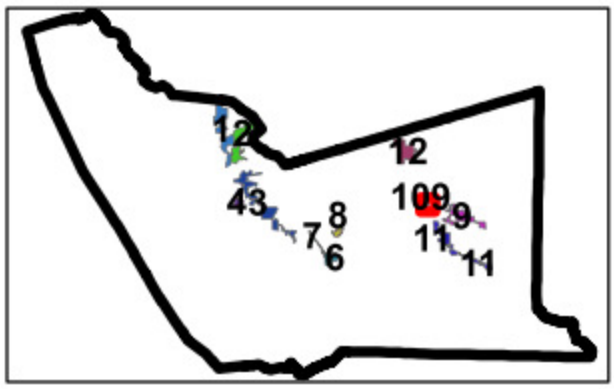
Legend

- Tesla Ave. Greenville Rd.
- Parcel Developed with OWTS
- County_Boundary

Tesla Ave. Greenville Rd.

Alameda County OWTS Focus Areas 10



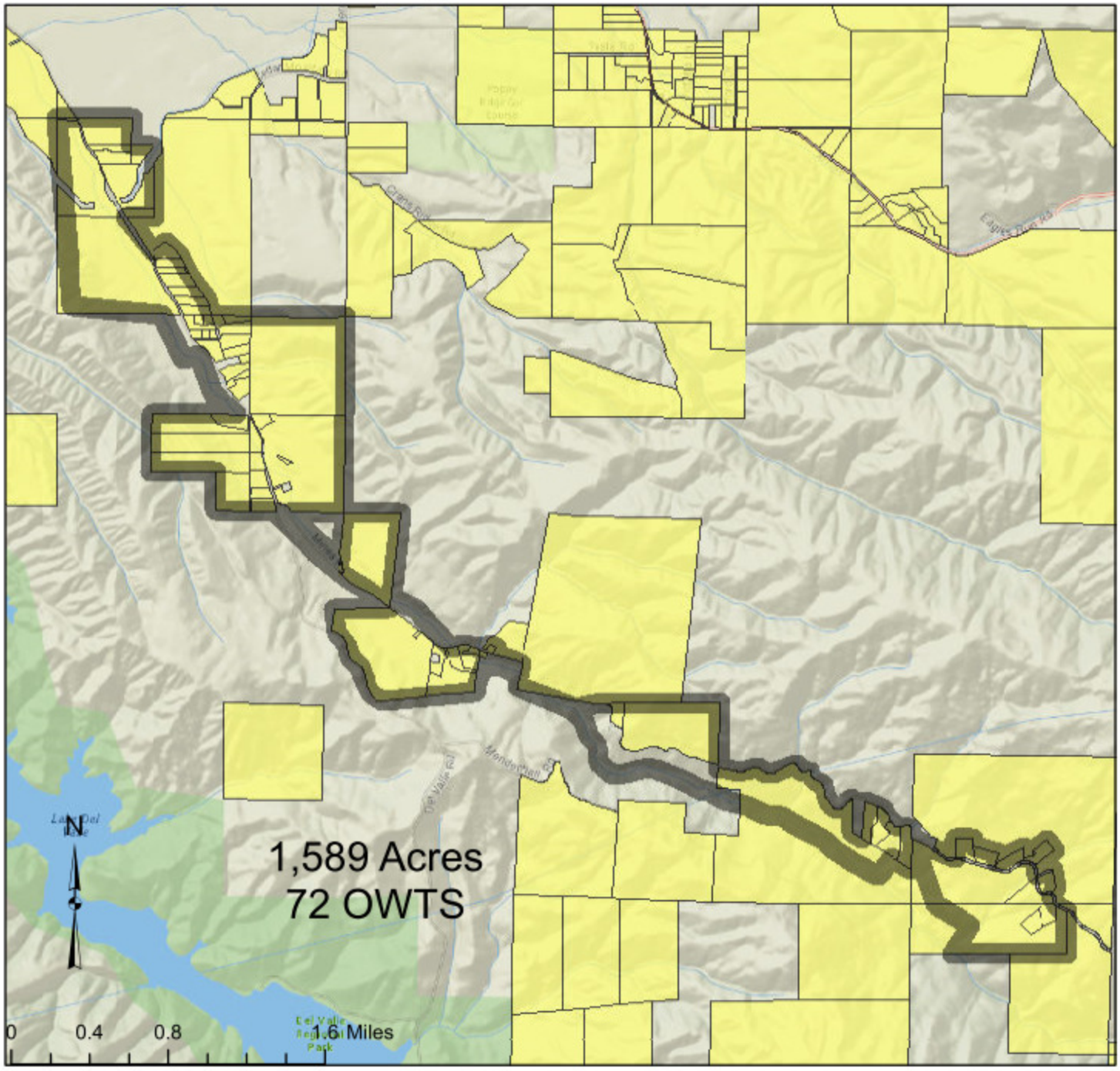


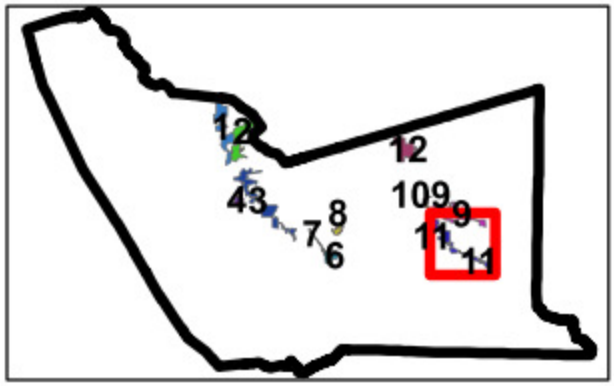
Legend

- Buena Vista Avenue
- Parcel Developed with OWTS
- County_Boundary

Buena Vista Avenue

Alameda County OWTS Focus Areas 11



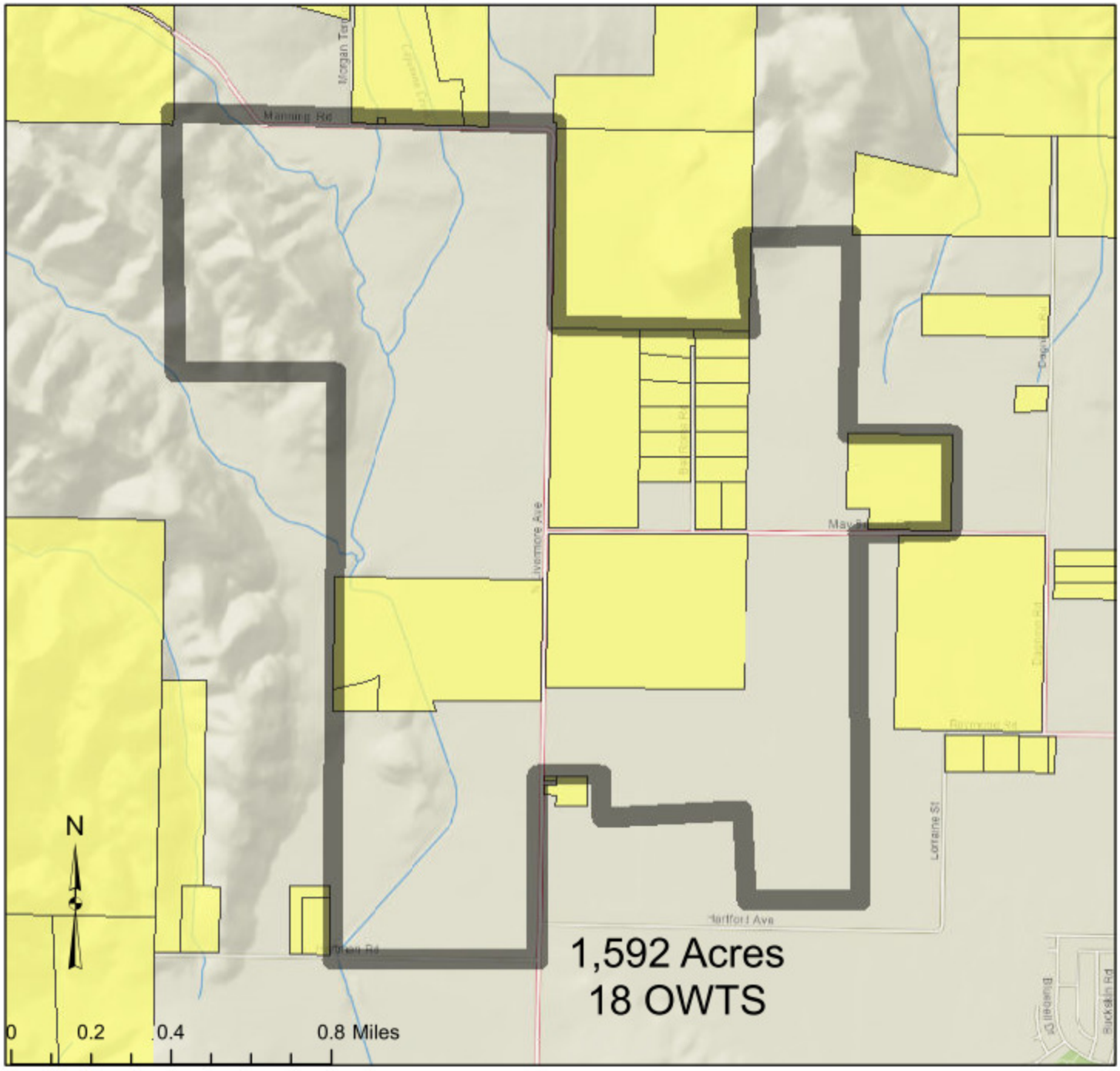


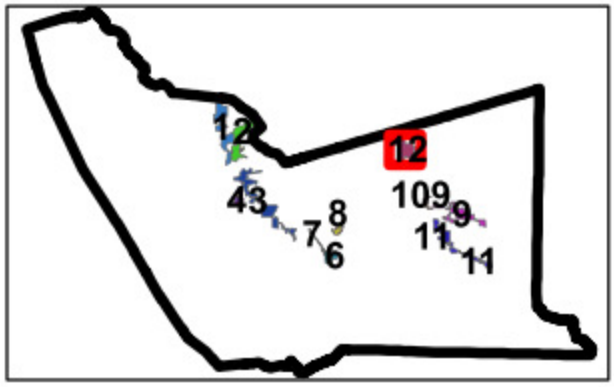
Legend

- Mines Road
- Parcel Developed with OWTS
- County_Boundary

Mines Road

Alameda County OWTS Focus Areas 12





Legend

- May School
- Parcel Developed with OWTS
- County_Boundary

May School

Appendix C

Supplemental OWTS Data and Mapping
DEH File Records for Oakland Hills

Table C-2. OWTS Discharges and Loading Estimates, City of Oakland/Oakland Hills Focus Area

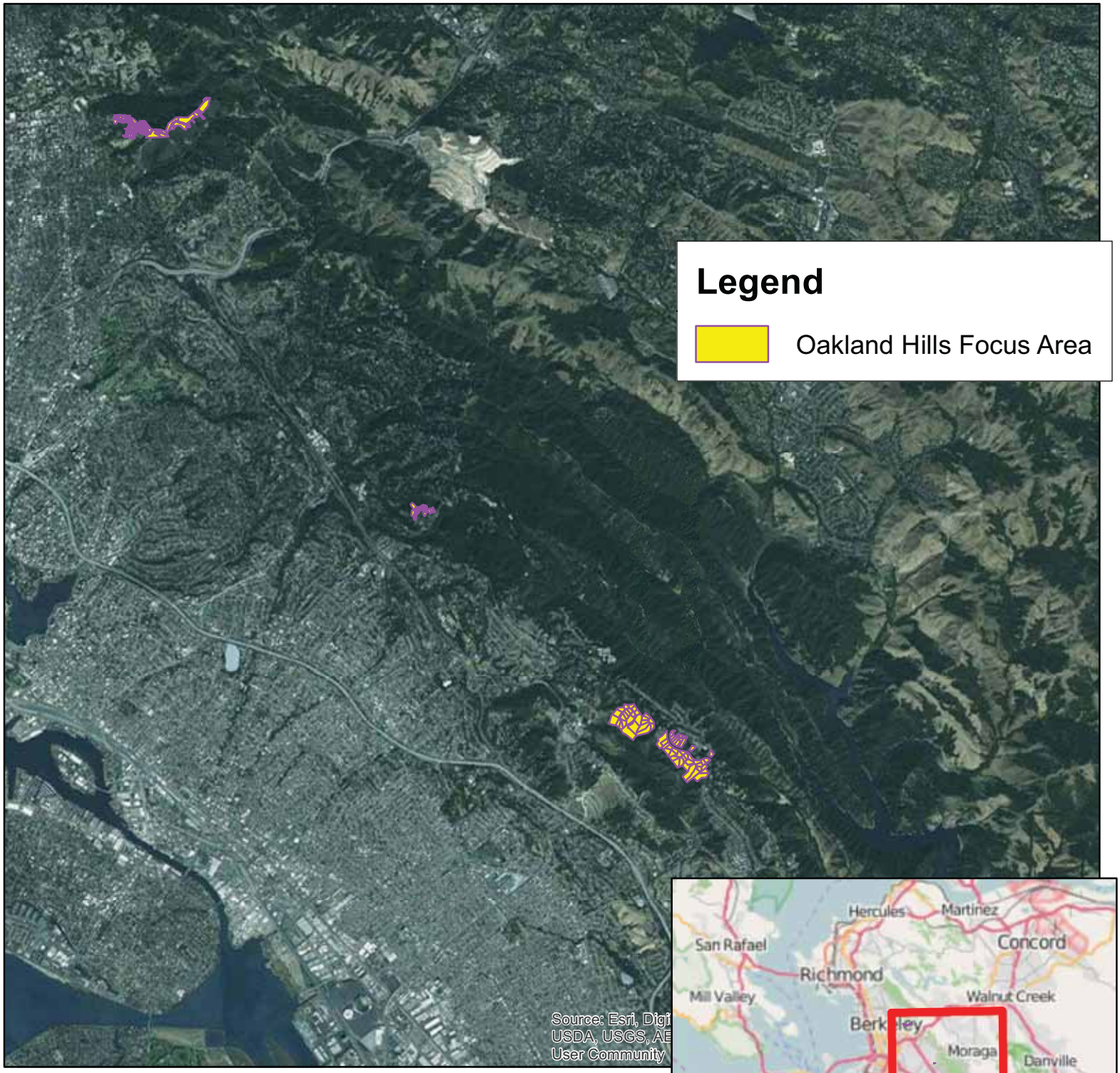
Street Name	Gross Acreage of Focus Area (ac)	Number of Known Parcels with OWTS	Median Parcel Size (ac)	Area-wide OWTS Density (ac/OWTS)	Estimated Daily OWTS Discharge* (gpd)	Estimated OWTS Discharge		Estimated Annual Nitrogen Loading**	
						Daily Discharge per Acre (gpd/ac)	Annual Total (Mgal/yr)	Total Loading (lbs/yr)	Per Acre (lbs/ac-yr)
1. Barmied Pl	0.12	2	2.53	0.06	300	2,531	0.11	64	539
2. Castle Dr / Castle Ln[1]	6	15	0.40	0.43	2,250	351	0.82	479	75
3. Cathy Ln	16	7	1.66	2.25	1,050	67	0.38	224	14
4. Colbourn Pl	13	7	1.14	1.80	1,050	83	0.38	224	18
5. Cornwall Ct	2	6	0.25	0.27	900	555	0.33	192	118
6. Denton Pl	16	9	1.38	1.74	1,350	86	0.49	288	18
7. Graham Pl	4	3	1.63	1.41	450	106	0.16	96	23
8. Lexford Pl	8	6	1.41	1.37	900	109	0.33	192	23
9. Skyline Blvd[1]	25	20	1.12	1.27	3,000	118	1.10	639	25
10. Weaver Pl	23	10	1.10	2.31	1,500	65	0.55	320	14
Total		**85**			**12,750**	**4,072**	**4.65**	**2,717**	

[1] *Represents a subset of parcels on these streets known to be on OWTS. All other streets listed in table are assumed to be 100% on OWTS.*

[2] *Based on 150 gpd/OWTS*

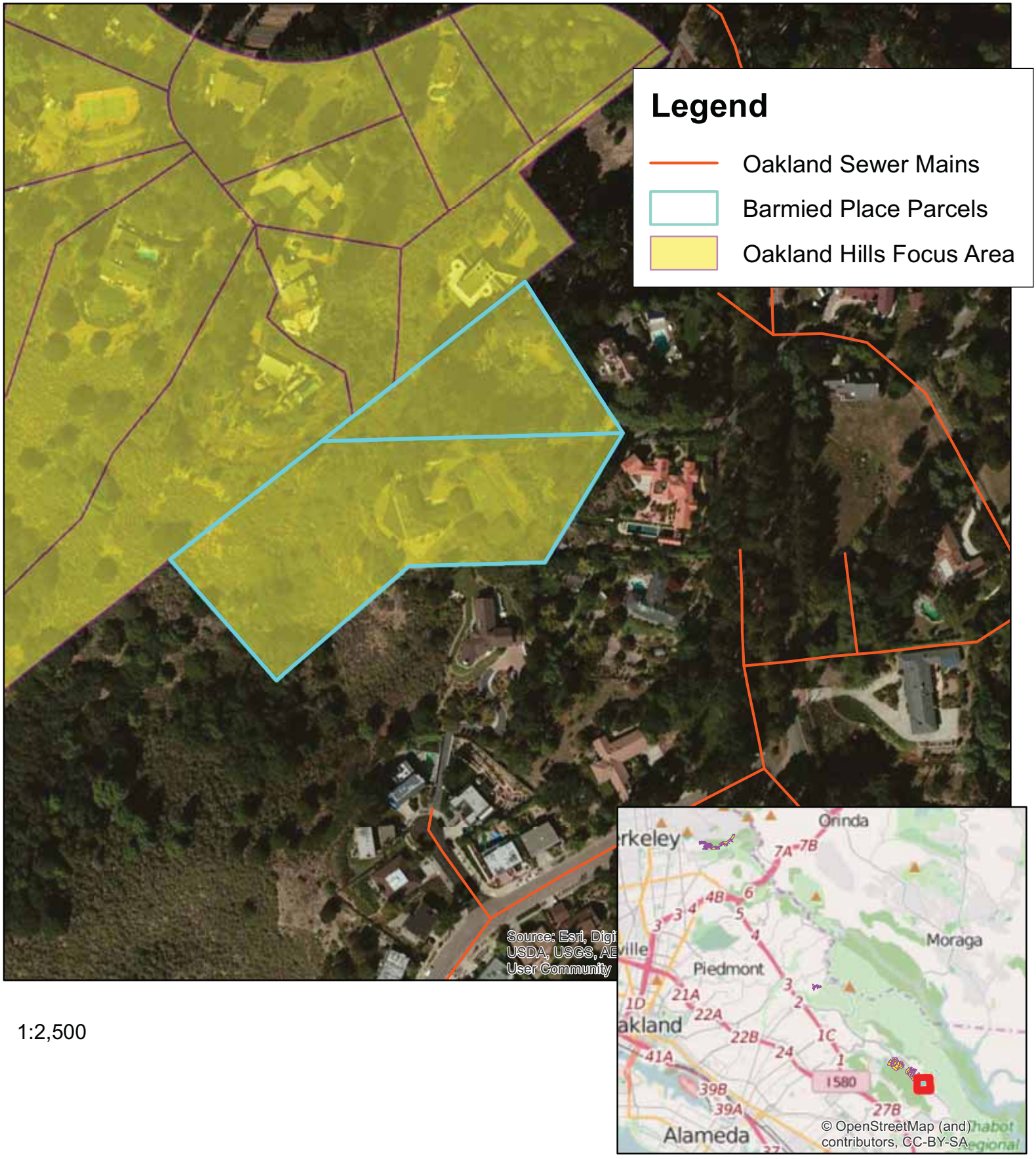
[3] *Based on 70 mg-N/L total nitrogen concentration*

Fig. C-2. Focus Area: Oakland Hills
Pockets of Known OWTS



1:80,000

Fig. C-2.1. Focus Area: Oakland - Barmied Place Pockets of Known OWTS



1:2,500

Fig. C-2.2. Focus Area: Oakland - Castle Lane / Castle Drive Pockets of Known OWTS

1:2,500

Fig. C-2.3. Focus Area: Oakland - Cathy Lane
Pockets of Known OWTS

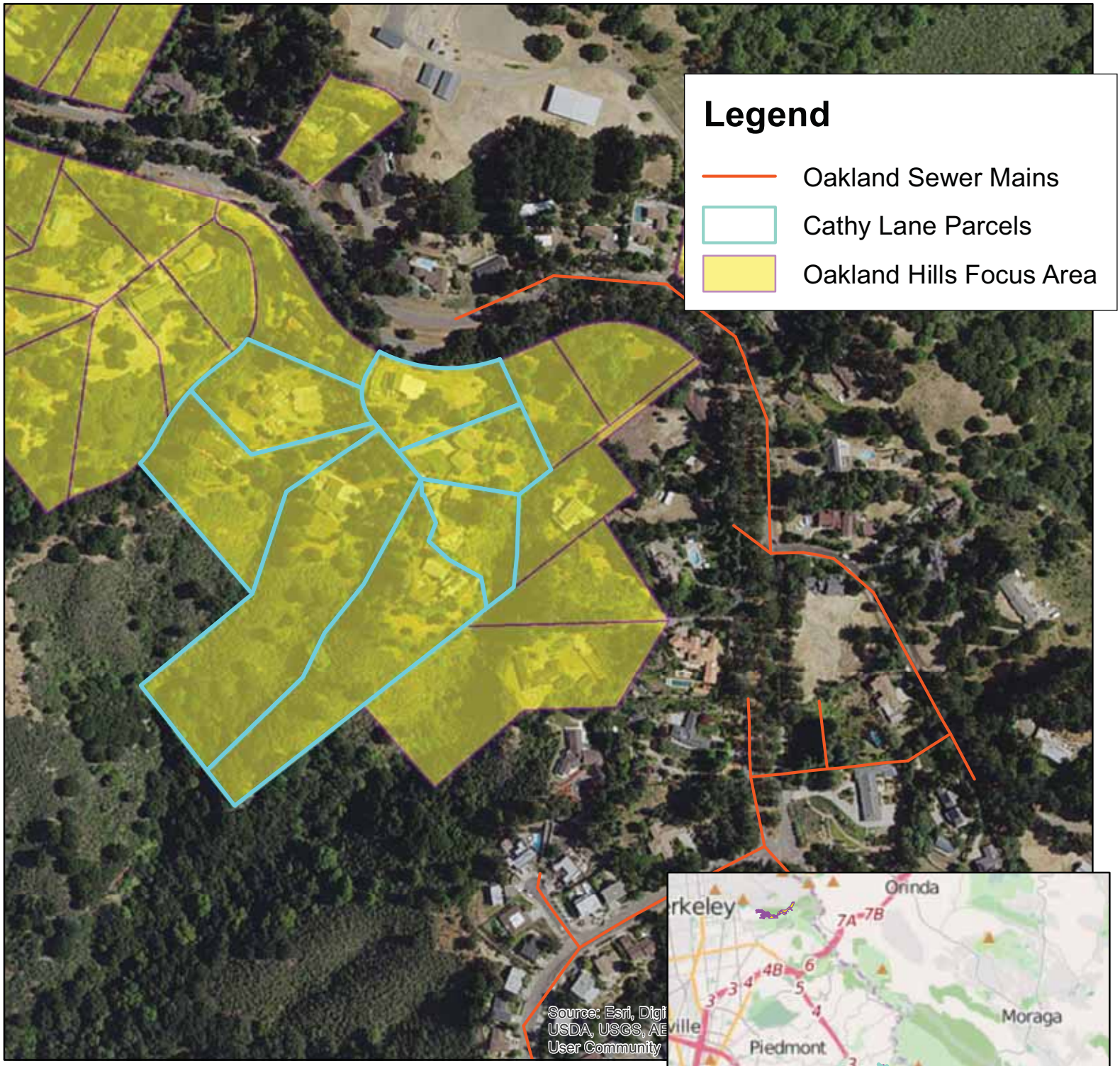


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Fig. C-2.4. Focus Area: Oakland - Colbourn Place Pockets of Known OWTS

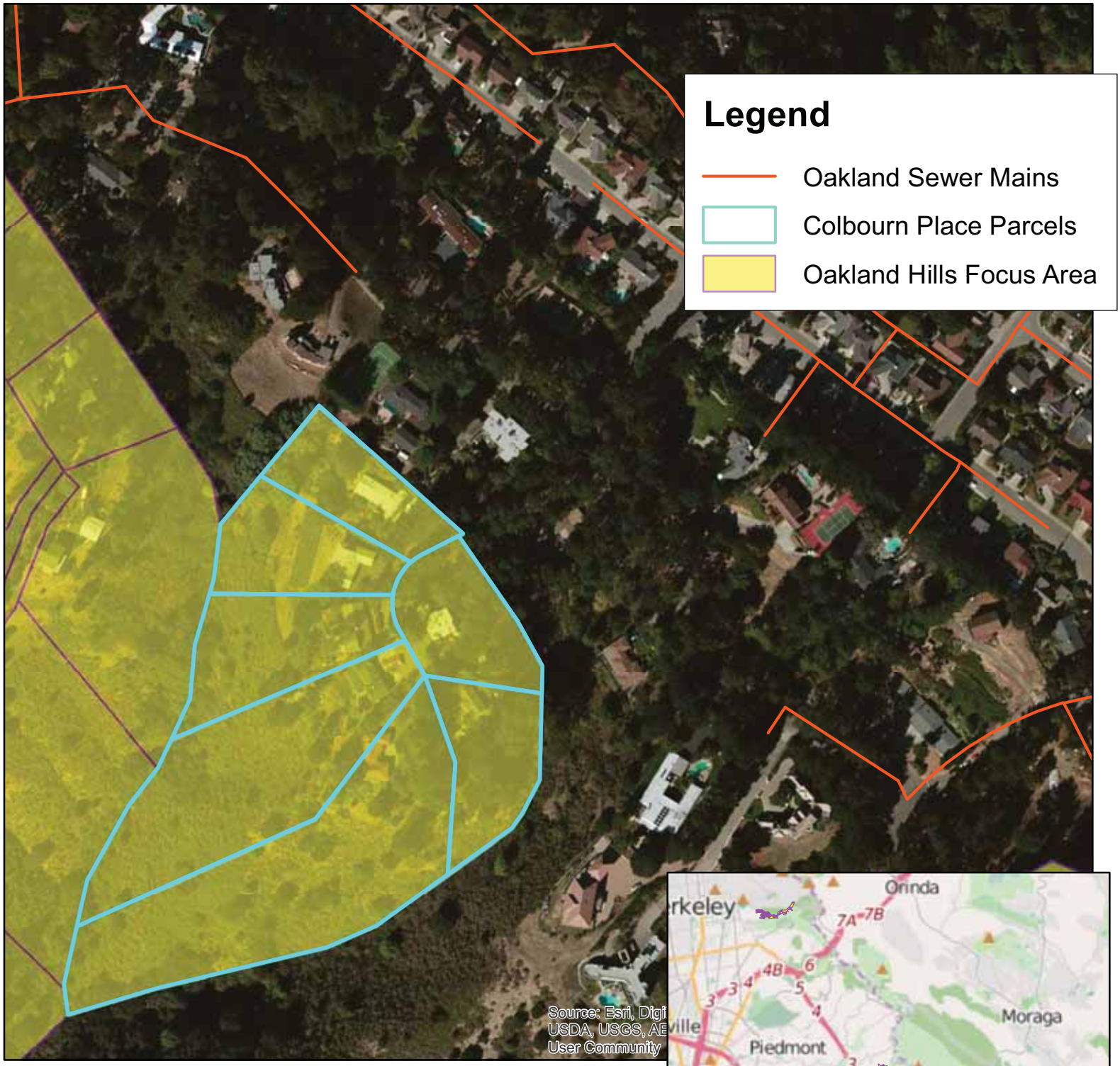

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Fig. C-2.5. Focus Area: Oakland - Cornwall Court Pockets of Known OWTS

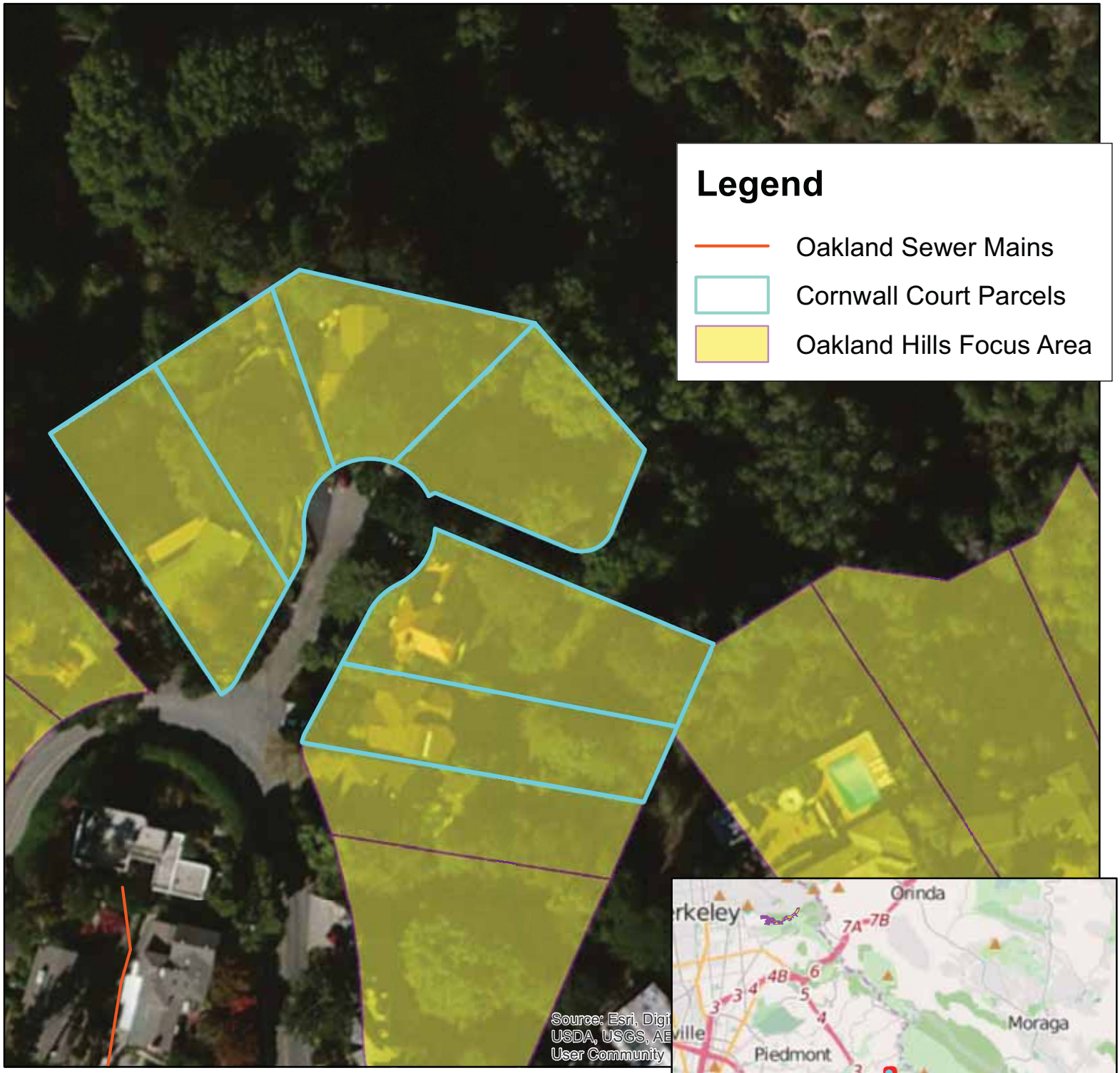

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Fig. C-2.6. Focus Area: Oakland - Denton Place Pockets of Known OWTS

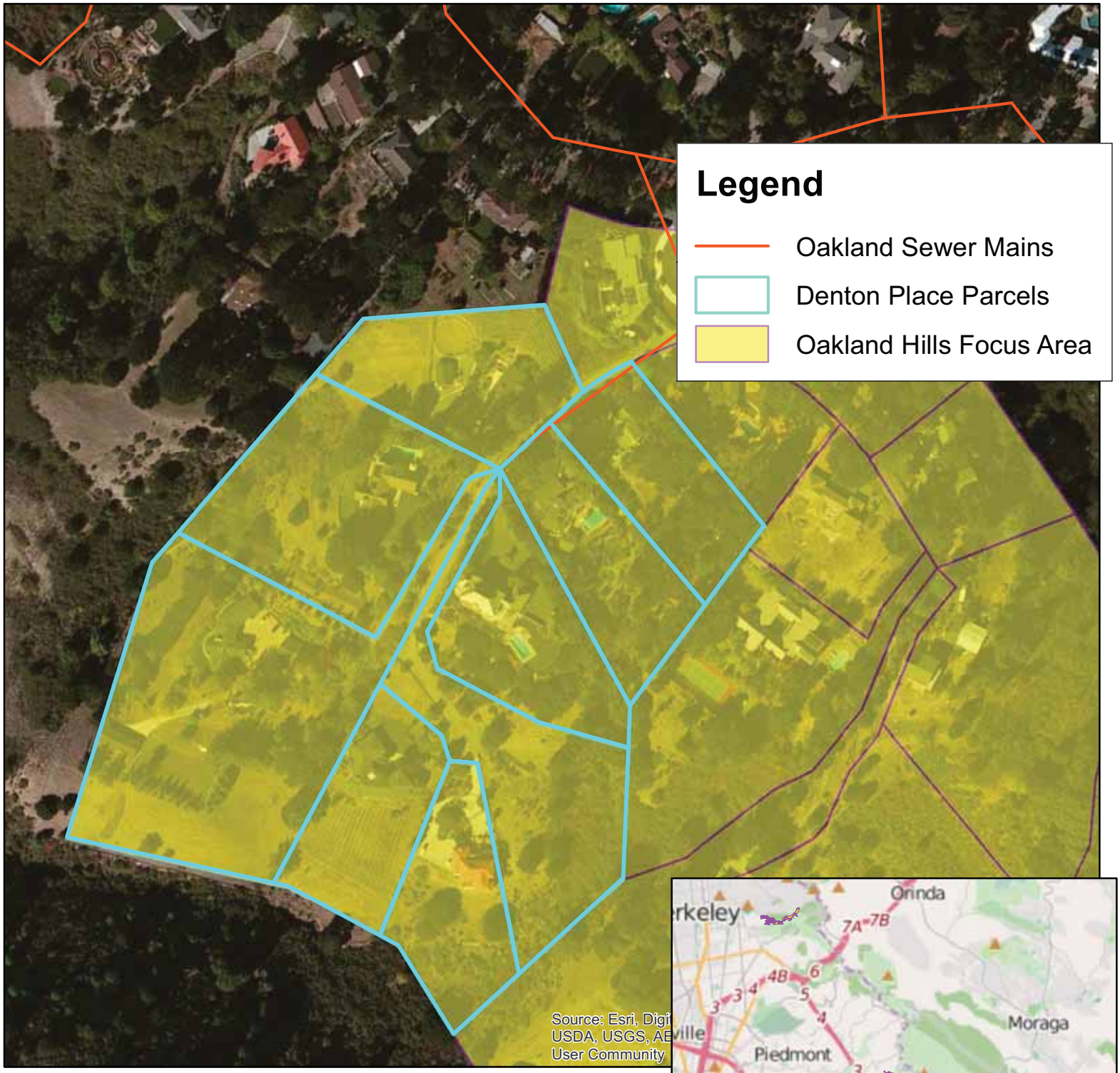

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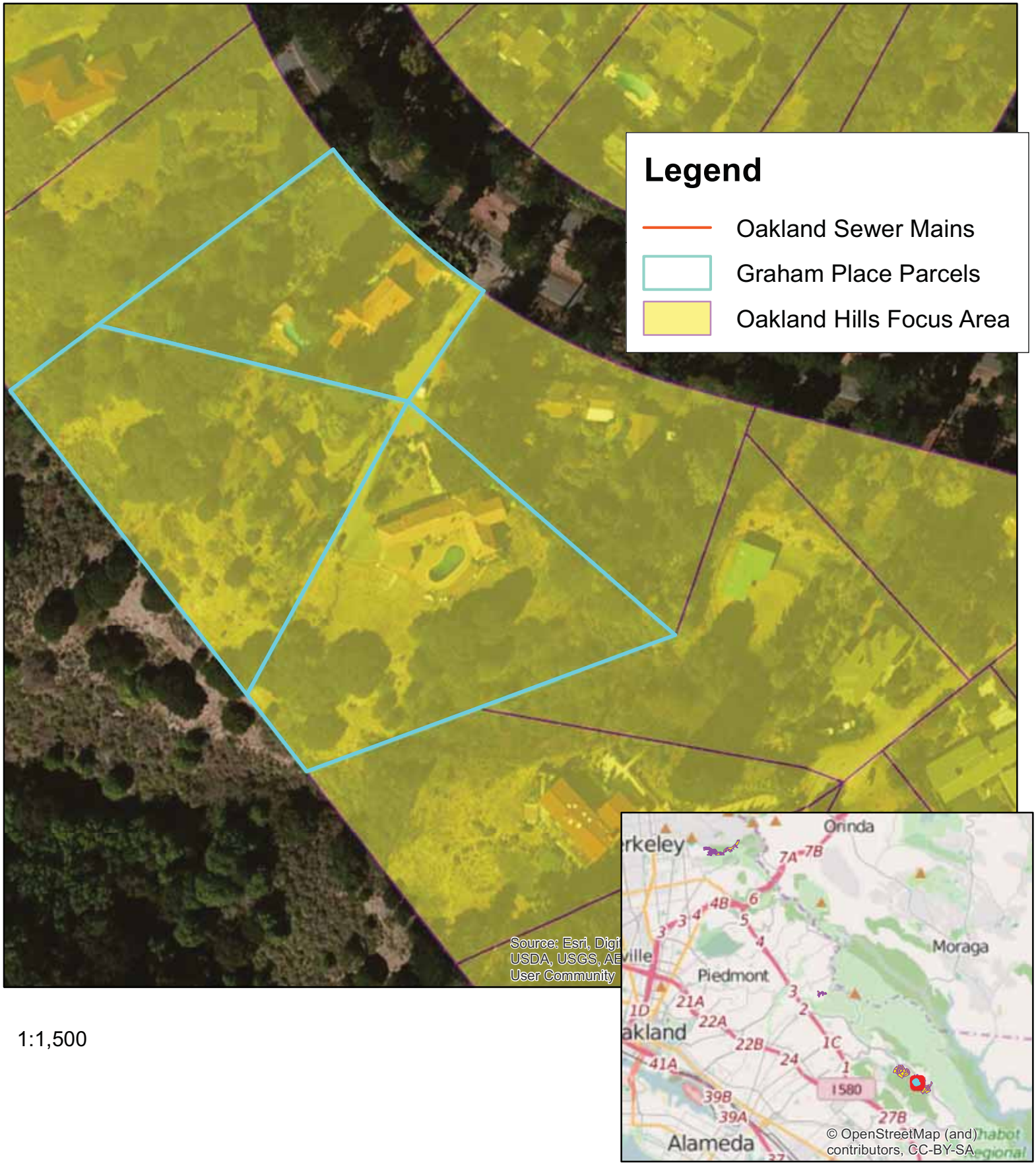
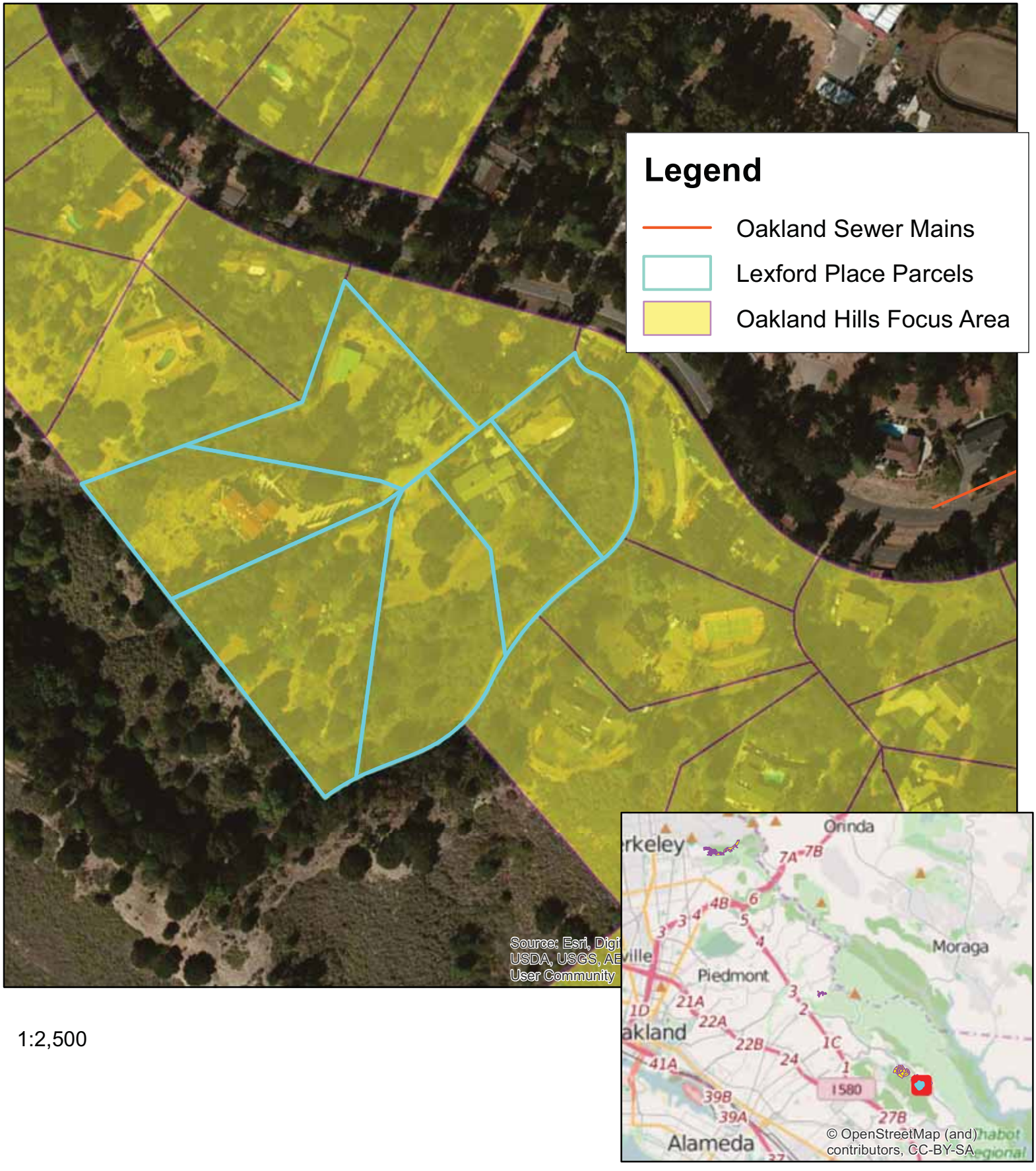
Fig. C-2.7. Focus Area: Oakland - Graham Place Pockets of Known OWTS



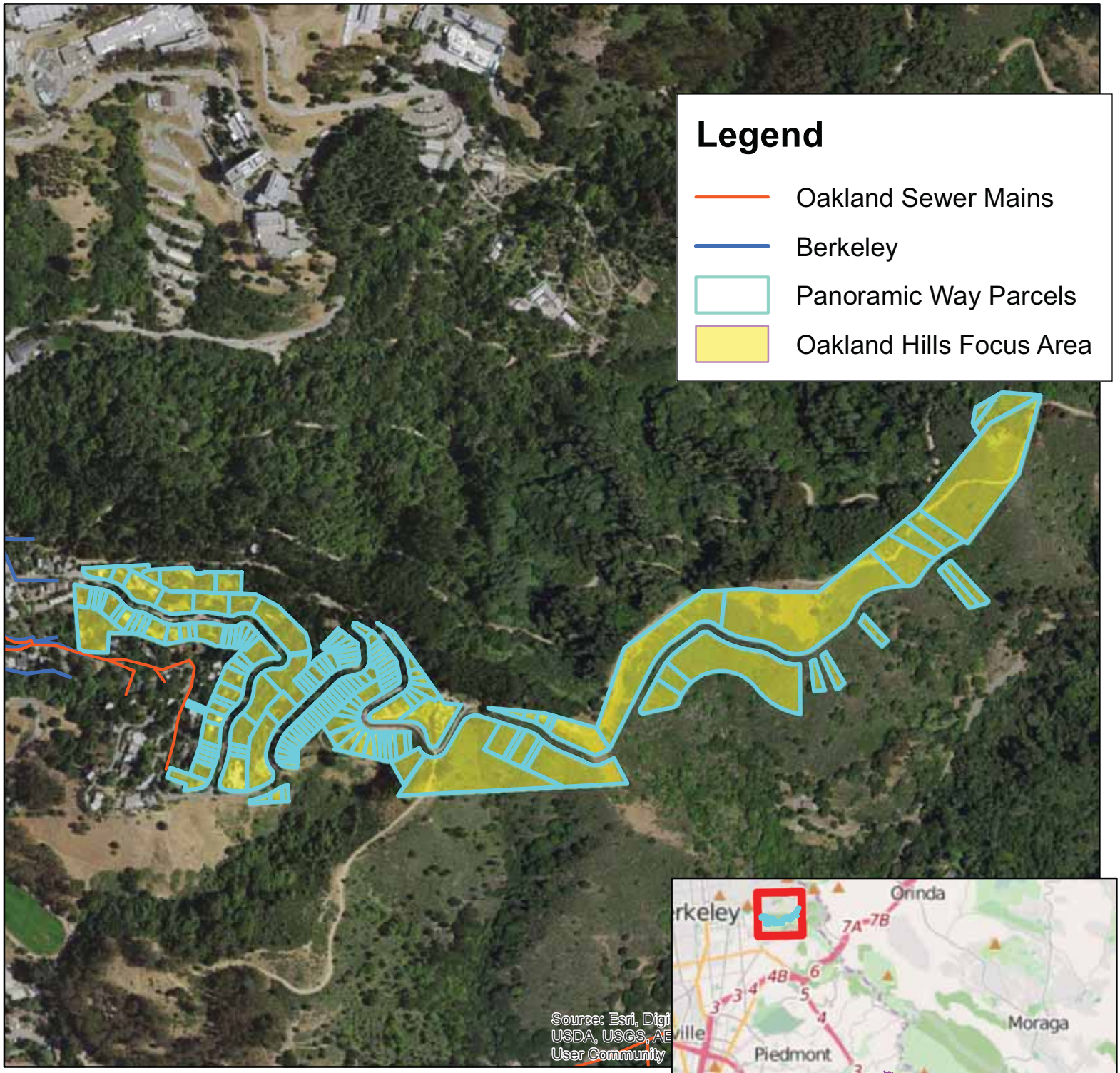
1:1,500

Fig. C-2.8. Focus Area: Oakland - Lexford Place Pockets of Known OWTS



1:2,500

Fig. C-2.9. Focus Area: Oakland - Panoramic Way Pockets of Known OWTS



1:8,000

Fig. C-2.10. Focus Area: Oakland - Skyline Boulevard Pockets of Known OWTS

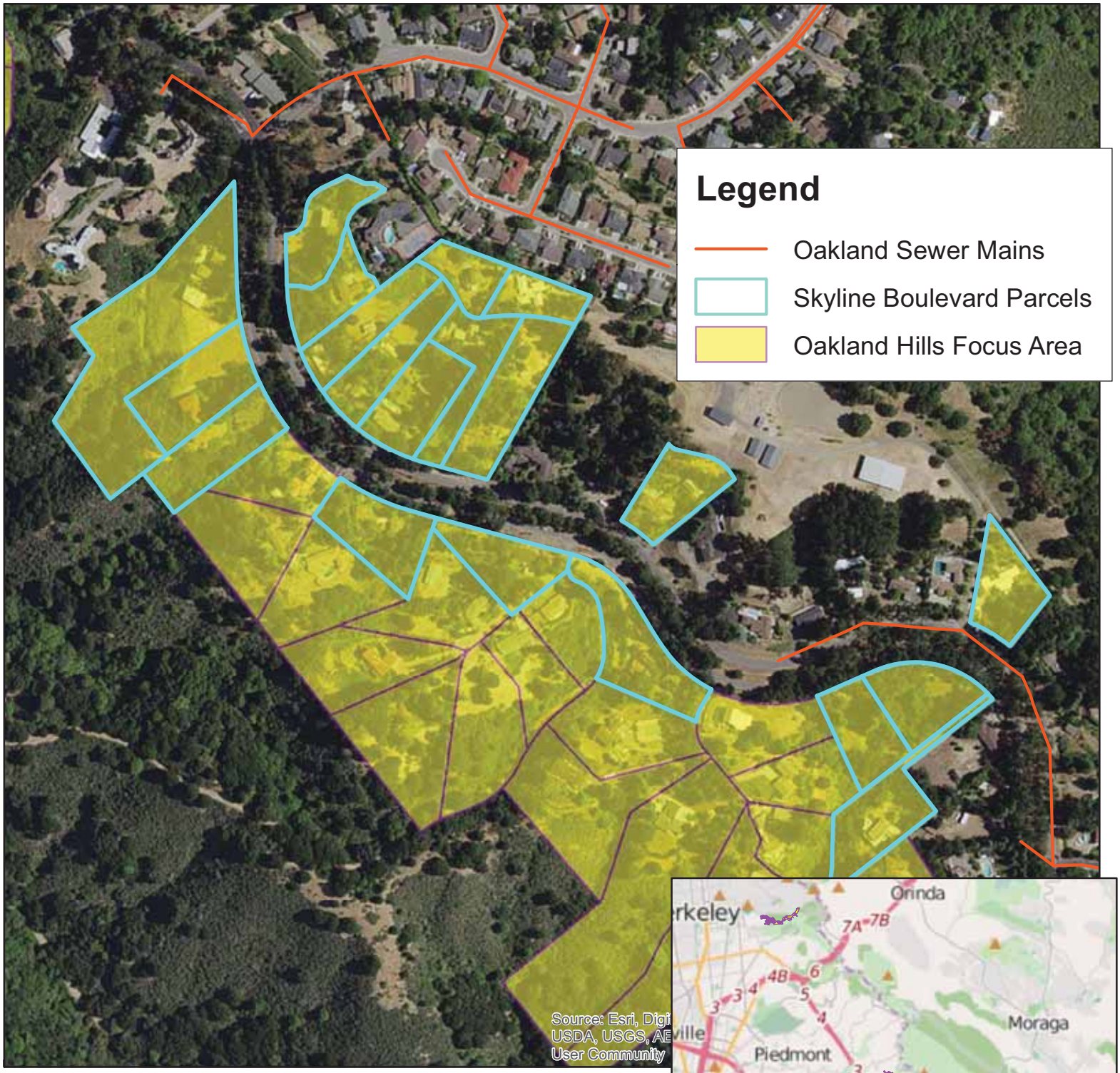


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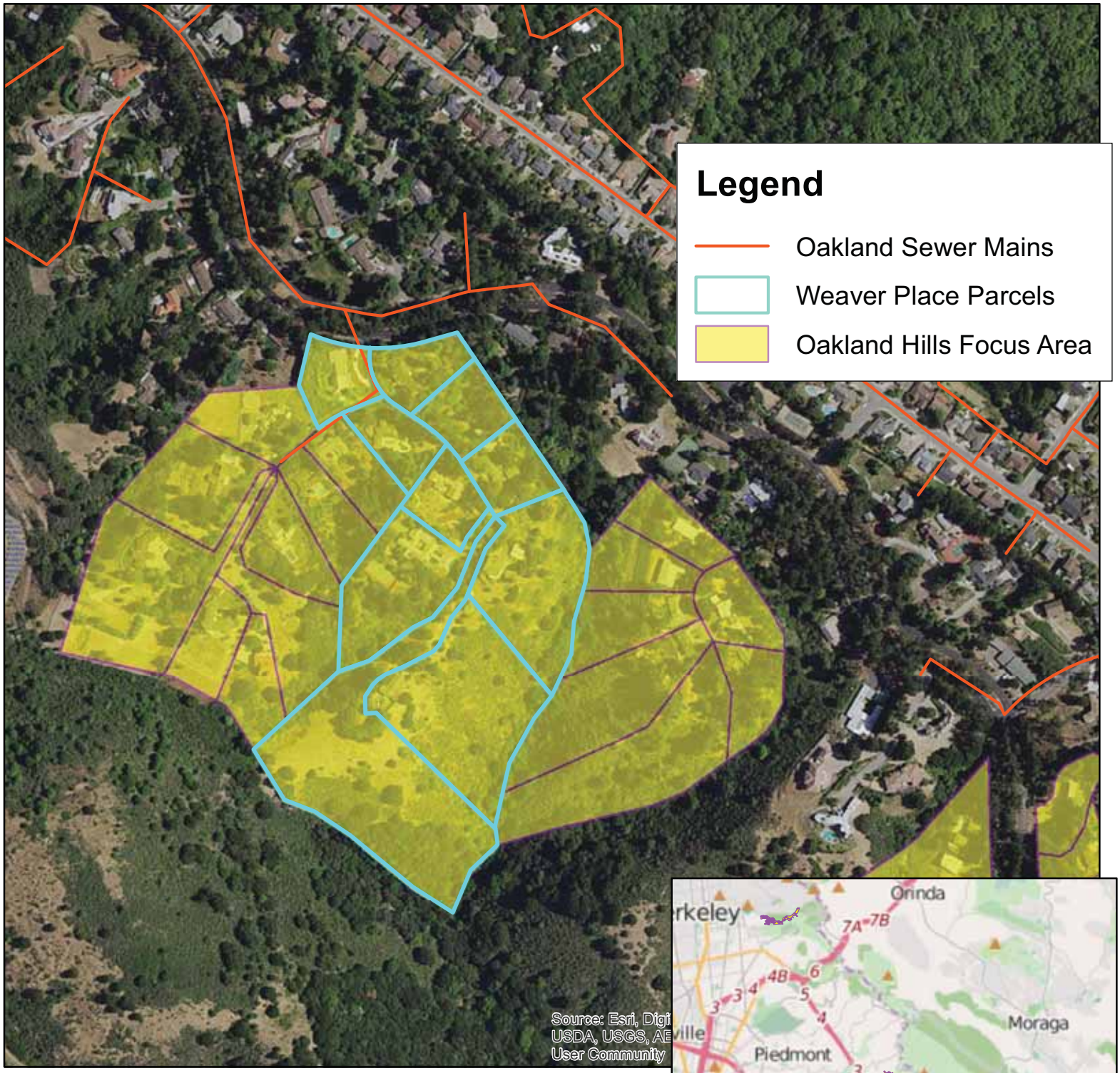
Fig. C-2.11. Focus Area: Oakland - Weaver Place Pockets of Known OWTS



1:5,000

Appendix D

Section 6 of the Zone 7 Water Agency Nutrient Management Plan For Livermore Valley Groundwater Basin July 2015

6 Plan Implementation

6.1 Investigate Boundaries of Areas of Concern

Zone 7 intends to obtain additional information regarding the extent of high nitrate concentrations near Areas of Concern that have significant data gaps, proposed development with OWTS, and/or increasing nitrate concentrations. To this end, Zone 7 plans on pursuing the following options to further investigate the extent of nitrate concentrations:

- Zone 7 will work with well owners to sample existing shallow wells for nitrate. This process could include public outreach to homeowners to identify domestic wells with ideal characteristics (e.g., location, screened intervals, well depth) for further delineating the extent of nitrate concentrations in Areas of Concern. These wells could then be sampled and analyzed by Zone 7 at no cost to the well owner.

- Zone 7 will assess the data available, identify data gaps, and prepare maps showing preferred locations for future monitoring wells potentially to be installed by developers for each Area of Concern. It is anticipated that the studies will be conducted in the following priority: Greenville, Buena Vista, Mines Road, May School, Happy Valley, Staples Ranch, Jack London, Constitution, Charlotte Way, and Bernal.

- Zone 7 will work with Alameda County planning and health agencies to encourage or require hydrogeologic studies as part of new commercial developments. These studies could include installing new monitoring wells in locations identified on the preferred well location maps, sampling of existing wells, or drilling direct-push type borings.

- Zone 7 may require that new wells and borings near Areas of Concern include the running of electronic logs (elogs) and/or collecting and analyzing groundwater samples. The results of these elogs and groundwater samples can be used to better understand the geology and assess the extent of contamination in the Areas of Concern.

- The data results and work products generated from the tasks above (e.g., preferred well location maps, well sampling results) will be presented in the GWMP Annual Reports or as a separate report, as appropriate, based on the size and extent of the study and/or timing of its completion.

6.2 Implementation Measures to Minimize Nitrogen Loading

6.2.1 Introduction

Nitrate concentrations are expected to remain well below 20% of the assimilative capacity limit for all four groundwater areas in the Livermore Valley Groundwater Basin; however there are local Areas of

Concern where nitrate concentrations are above the Basin Objective (BO, 45 mg/L as NO_3). The main sources of nitrogen loading throughout the groundwater basin include fertilizer application, recycled water irrigation, livestock facilities, and onsite wastewater treatment systems. The implementation measures presented below are designed to minimize loading from these main sources, particularly in the Areas of Concern shown on *Figure 2-15* and described in *Section 2.4*. Many of these implementation measures include continuing with existing Best Management Practices (BMPs) that are monitored and administered by other agencies.

6.2.2 Fertilizer BMPs

Fertilizer application should be adjusted to the needs of the plants/crops to which it is being applied and take into account the nutrients already present in soil and irrigation water to avoid over-fertilization. The implementation plan promotes the continued use of the following fertilizer BMPs by agriculturists, park districts, school districts and other landscape and turf managers and practitioners.

- Targeted application of fertilizer and soil amendments – limit the application of salts and nutrients to the area at the point of the irrigation drip emitter, rather than broadcast across a large area.

- Adjust fertilizer amounts to account for nutrients already present in irrigation water and soil. Nutrient levels can be assessed by testing soil and water.

- Apply irrigation at agronomic rates to prevent nutrients in fertilizer from leaching into the groundwater.

- Effective vineyard management includes regular soil and petiole testing to help understand what, and volume of, nutrients that need to be added to the soil to produce the desired grape production and flavor. When the soil and petiole testing includes nitrogen as a test parameter, the results can be used to ensure that the amount of additional nitrogen applied is limited to that amount needed by the vines.

6.2.3 Recycled Water Irrigation BMPs

The use of recycled water for irrigation is controlled by water recycling criteria in Title 22 of the California Code of Regulations, and by discharge requirements established by the Regional Water Board. In addition to adhering to these regulations related to recycled water, the implementation plan recommends the continued use of the following BMPs by those who irrigate with recycled water:

- Reduce application of fertilizer to account for nitrogen in the recycled water.

- Irrigate during evening and early morning hours to reduce evaporation and human exposure.

- An effective irrigation system should be used that applies recycled water at agronomic rates. Infiltration of recycled water past the active root zone should be limited to only what is needed to remove salts from the root zone.

6.2.4 Livestock Manure Management

Livestock and Equestrian Facilities are another source of nitrates due to concentrated amounts of manure where animals are kept. Equestrian Facilities include horse boarding, training, and breeding facilities. The NMP endorses the County's requirement for concentrated and confined livestock facilities to implement design measures and BMPs for livestock manure management, such as:

- Manure management – remove manure regularly. If manure can't be removed daily then it should be covered and stockpiled on an impervious surface. Surface water should be prevented from reaching the storage area.

- Building and site design – should keep animal areas, such as paddocks and corrals, as dry as possible during the rainy season.

- Wash rack design – should not allow water to flow into storm drains, creeks, or recharge areas. Wash racks should be connected to the sanitary sewer or lined evaporation ponds, if possible.

- Facility and BMP inspections are performed by Alameda County Public Works as part of their Clean Water Program.

Additional guidance for manure management can be found in existing documents such as *Horse Manure Management – A Guide for Bay Area Horse Keepers (Buchanan et al., 2003)*. The existing City and County proposed development review and referral process is another opportunity to educate facility managers and architects on the design and operation considerations for limiting nutrient impacts to surface waters and groundwater.

6.2.5 Onsite Wastewater Treatment and Disposal

Limitations for the expansion of municipal sewer coverage in the Livermore-Amador Valley associated with the establishment of urban growth boundaries have resulted in the continued reliance of OWTS for development in the unincorporated areas. In particular, the continued growth of winery-related commercial development in or near the south Livermore high nitrate areas is a concern for maintaining or improving groundwater quality. OWTS that may have been allowed in the past may not be appropriate in the future as conditions and circumstances surrounding particular locations change or become known.

As provided for in the Water Board Basin Plan, ACEH has committed to developing a Local Agency Management Program (LAMP) for Water Board approval that will address their management of OWTS in unincorporated Alameda County. A LAMP is a management program that allows local agencies to establish minimum standards that are different from those specified in the State OWTS Policy, but are

necessary to protect water quality and public health. Requirements for different minimum lot size for new development using OWTS and the addition of nitrogen-removing treatment equipment on OWTS for certain conditions are examples of special provisions that ACEH will likely include in its LAMP.

6.2.5.1 Winery Process Wastewater

There are currently over 50 wineries located over the Livermore Valley Groundwater Basin, however, many of them do not produce or bottle wine onsite. The ones that do produce or bottle wine, also produce a wastewater stream during the wine production and bottling operations. This winery process water, which contains nutrients, is often disposed of in evaporation ponds, on the surface as irrigation or dust control water, or in the subsurface using OWTS and leachfields. Regardless of which of these disposal methods is used, the Water Board has authority to regulate the discharge; thus a Report of Waste Discharge is required to be submitted to the Water Board for the discharge of wastewater to the surface or subsurface. The Water Board will then approve the discharge by issuing Waste Discharge Requirements, waive the need of a WDR, or deny approval of the discharge.

- To assist applicants with their ROWD preparation and the Water Board with their evaluation of ROWDs and WDR decisions, Zone 7 and ACEH will continue to provide relevant information on groundwater occurrence, use, quality and vulnerability to the Water Board and applicants.

- The preparation of a guidance document on the proper treatment and disposal of wastewater and organic wastes generated from the wine making and wine bottling processes would be beneficial for the development of plans that are effective at minimizing nutrient loading to the groundwater basin.

6.2.5.2 General OWTS Program

One of the purposes of the Alameda County Onsite Wastewater and Individual/Small Water Systems Ordinance and Regulations is to prevent environmental degradation of surface water and groundwater from onsite disposal of private sewage to the greatest extent possible. Included in the regulations are special provisions for the Upper Alameda Creek Watershed, above Niles; namely:

a. a minimum parcel size requirement of 5 acres for new single-family OWTS; and
b. a maximum discharge of 320 gallons per day per 5 acres for commercial OWTS.

Continued application of the general provisions of the County OWTS Ordinance and Regulation and these special provisions are expected to minimize the groundwater nitrate impact from OWTS use in the majority of the unincorporated areas of the Livermore Valley Groundwater Basin except in the Areas of Concern. Additionally, the following measures are planned:

- Zone 7 and ACEH will continue working together to ensure that both agencies are aware of groundwater issues in the Livermore Valley Groundwater Basin and that any OWTS approvals are consistent with the adopted NMP goals and objectives.

- Zone 7 and ACEH will continue to collaborate on the decisions surrounding approval of new OWTS for commercial facilities' domestic wastewater disposal on a case-by-case basis and to evaluate the potential risks and make proper decisions as additional information becomes available.

- Zone 7 and ACEH will continue to collaborate on assessing the potential risks and impact(s) associated with granting OWTS regulation variances and on developing any special requirements necessary to ensure groundwater quality protection.

- Zone 7 and ACEH will collaborate to determine the applicable time periods of any new OWTS permits, and continued compliance monitoring and renewal requirements to ensure long-term successful performance.

6.2.5.3 OWTS Management in Areas of Concern

Zone 7 has identified ten Areas of Concern with elevated nitrate concentrations in groundwater. Current and past onsite wastewater disposal practices are thought to be an important contributor to the high nitrate concentrations found in these areas. As such, ongoing and future wastewater disposal projects in the Areas of Concern should be managed with a bias towards reduction of the current loading. It is also important to increase the understanding of the extent of the nitrate impacts in many of these areas and to monitor the concentration trends as projects add and subtract wastewater loading in these areas. Towards these goals the following measures are expected to be performed:

- Zone 7 will coordinate further characterization and monitoring of the local nitrate plumes by working with ACEH, the Water Board and various property owners and consultants on the development of plans for the construction and operation of additional monitoring wells.

- Zone 7 will continue its effort to inform ACEH and Alameda CDA of the nitrate issues in the Livermore Valley Groundwater Basin and to collaborate on development plans, permit reviews, and CEQA analyses for projects involving onsite wastewater disposal in Areas of Concern to assure approvals are consistent with adopted NMP goals and objectives.

- Local Agency Formation Commission (LAFCO), developers and County and City planning agencies are expected to continue to work together to create opportunities for discontinuing onsite disposal of nutrient-rich wastewater within the Areas of Concern, such as connecting dwellings and businesses to municipal or community sewage treatment works when feasible.

- ACEH, Zone 7, and the Water Board will work together on the development, approval, and implementation of the LAMP to identify the special need areas, contributing local groundwater and geologic expertise, and providing ongoing regional groundwater monitoring.

In five of the ten Areas of Concern, OWTS are the predominant method of wastewater disposal, but unlike the other Areas of Concern, there are no current plans for extending the municipal sewer service to these five areas. The five areas are:

- Happy Valley (*Figure 6-2*)
- Buena Vista (*Figure 6-4*)
- Mines Road (*Figure 6-5*)
- May School (*Figure 6-3*)
- Greenville (*Figure 6-4*)

Accordingly, special OWTS permit requirements have been developed for new OWTS applications received for these five Areas of Concern. These five special OWTS permit requirement areas are shown in *Figure 6-1* to *Figure 6-5*, and the recommended permit requirements are summarized below and presented in a table in *Figure 6-6*. These requirements are intended to minimize the impact to existing homeowners and future development while still being protective of the environment and groundwater quality.

These special permit provisions are designed to limit or reduce the amount of nitrogen loading from OWTS in the five Areas of Concern over time by requiring parcels planned for new or replacement OWTS to meet a lower nitrogen loading standard than what exists for parcels located outside of the Special OWTS Permit Areas. These proposed requirements do not apply to existing, properly-working and properly-sized OWTS.

As is the case for properties outside Special OWTS Permit Areas, the requirements are based on the total size of the property parcel (see graph on *Figure 6-7*), and assume that the nitrogen loading from one Rural Residential Equivalent (RRE), i.e., a typical, single-family home served by a conventional OWTS is 34 lbs N/year. For new or remodel development on parcels of less than seven acres in the special OWTS permit requirement areas, the project must achieve a total nitrogen loading from all OWTS on the property of less than 0.7 RRE (23.8 lbs N/year) per parcel. This is the equivalent to the loading from two advanced single-family OWTS, each capable of 65% nitrogen reduction. For example, in order to add an additional single-family dwelling with a new OWTS to a parcel that already has an existing single-family dwelling with a conventional OWTS, the project must include installation of pre-treatment equipment, capable of removing 65% of the nitrogen content from the wastewater stream, on both OWTS (new and existing systems). As a consequence, the net result would be an onsite loading reduction from a pre-project total of one RRE to a post- project total of 0.7 RRE. (0.35 + 0.35 RRE).

For parcels equal to or greater than 7 acres, the total nitrogen loading from all OWTS must not exceed 0.5 RRE per 5 acres (3.4 lbs N/parcel acre/year). For example, the total nitrogen loading limit for a ten acre parcel is calculated as follows:

$$10\ acres \times \frac{0.5\ RRE}{5\ acres} = 1\ RRE = 34\ lbsN/yr$$

Alternatively, if the property owner performs a hydrogeologic study demonstrating that the proposed project will not cause nitrate concentrations to rise, then the total nitrogen loading limit is 1 RRE/5 acres (6.8 lbs N/parcel acre). The study must show that total on-site recharge does not exceed 36 mg/L (80% of

the MCL) or the maximum concentration at the site, whichever is lower. The 80% MCL limit is based on Zone 7 Water Quality Policy and provides a standard buffer for not exceeding the MCL. This alternative is intended to encourage additional hydrogeologic studies that can further define the boundaries and nitrate concentrations of Areas of Concern.

Because wastewater generated by commercial operations can result in higher loading rates than residential flows, the permitting of OWTS for new commercial projects within the special permit requirement areas require a higher level of scrutiny. At a minimum, projects must include a nitrogen-removing system, but also must demonstrate by analysis that the project will result in an improved nitrate condition beneath the site and not cause the offsite condition to worsen. Many of the commercial use OWTS will fall under the Water Board's jurisdiction and thus be subject to their Report of Waste Discharge (ROWD) requirements.

These same permit criteria are anticipated to be incorporated into the County's LAMP and used by the Water Board while developing Waste Discharge Requirements (WDR) for commercial projects within their purview if they prove to be effective at improving or halting groundwater quality degradation in these Areas of Concern. The following are measures specific to the special permit requirement areas:

- Until ACEH's LAMP has been finalized and approved by the Water Board, ACEH should incorporate and implement an interim permit approval policy such as the one recommended in *Figure 6-6*.

- Zone 7 will continue to refine the special permit area boundaries as more groundwater quality data becomes available in the future.

- Zone 7 and ACEH will continue to support the Water Board in its WDR decisions and specific requirements.

- Zone 7 will work with ACEH to assess the effectiveness of the County's OWTS moratorium in Happy Valley and whether this regulation should be continued in the County's LAMP.

Figure 6-1: Special OWTS Permit Areas

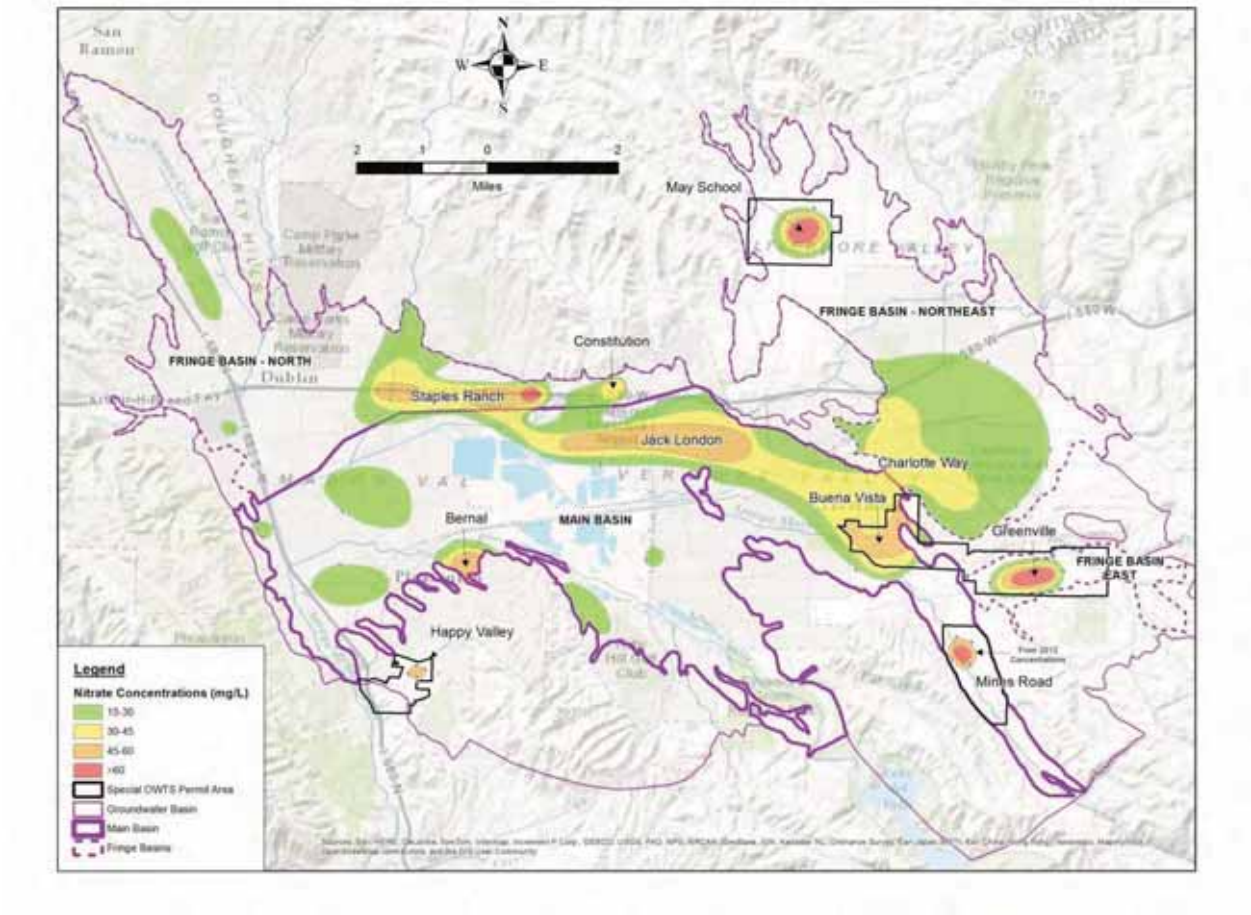


Figure 6-2: Happy Valley Area of Concern

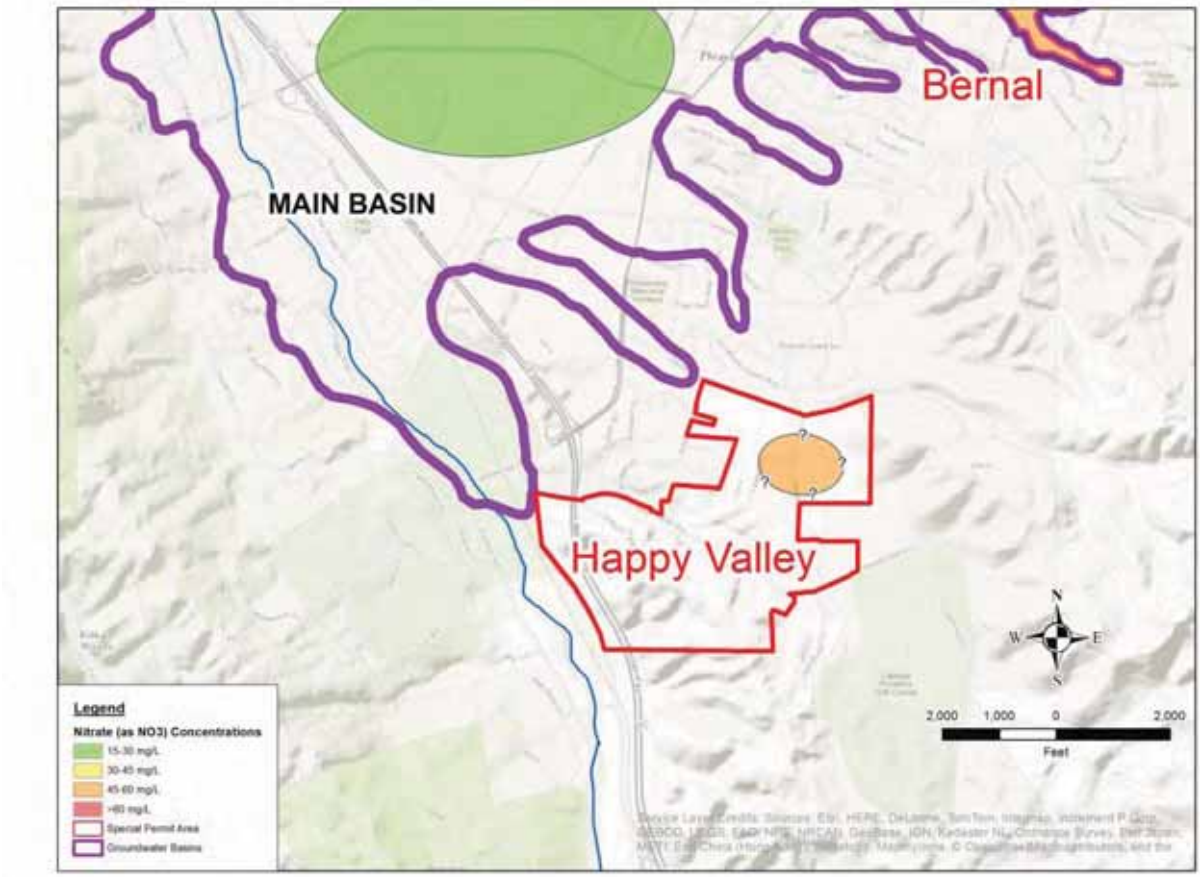


Figure 6-3: May School Area of Concern

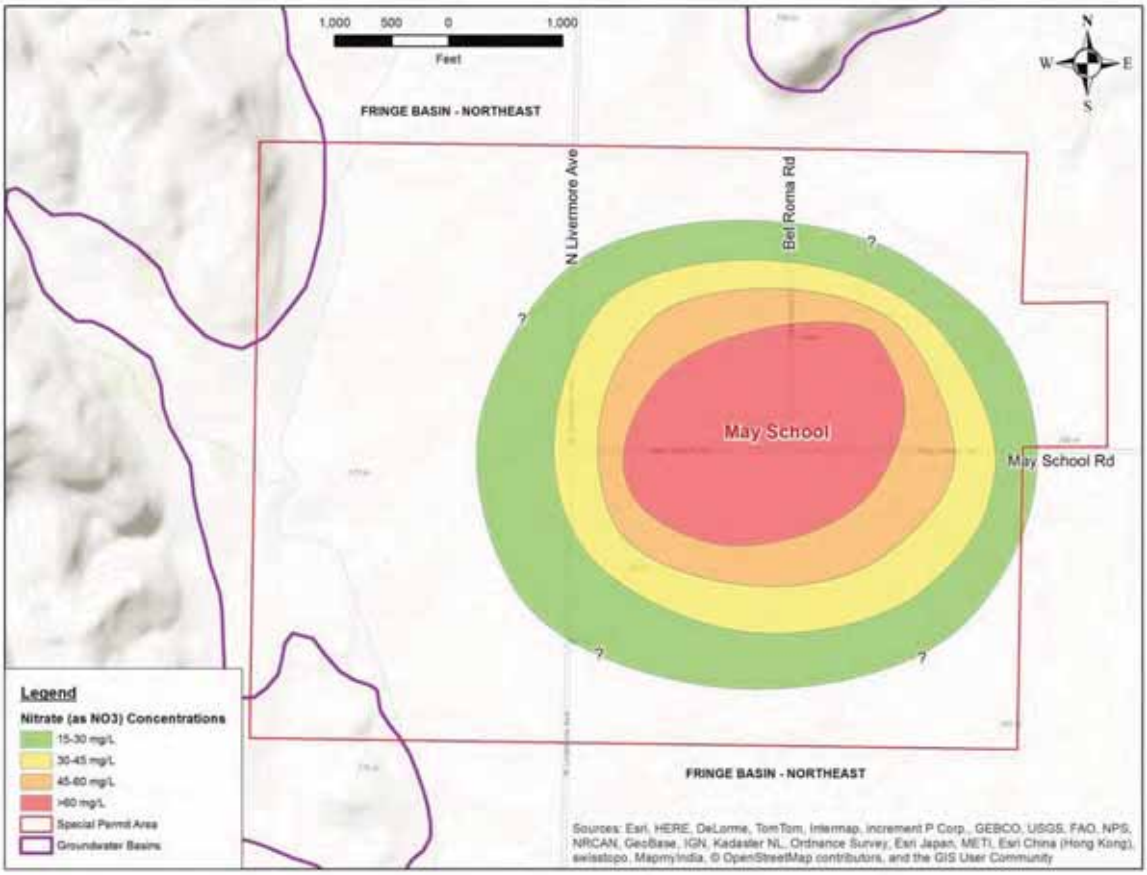


Figure 6-4: Buena Vista/Greenville Areas of Concern

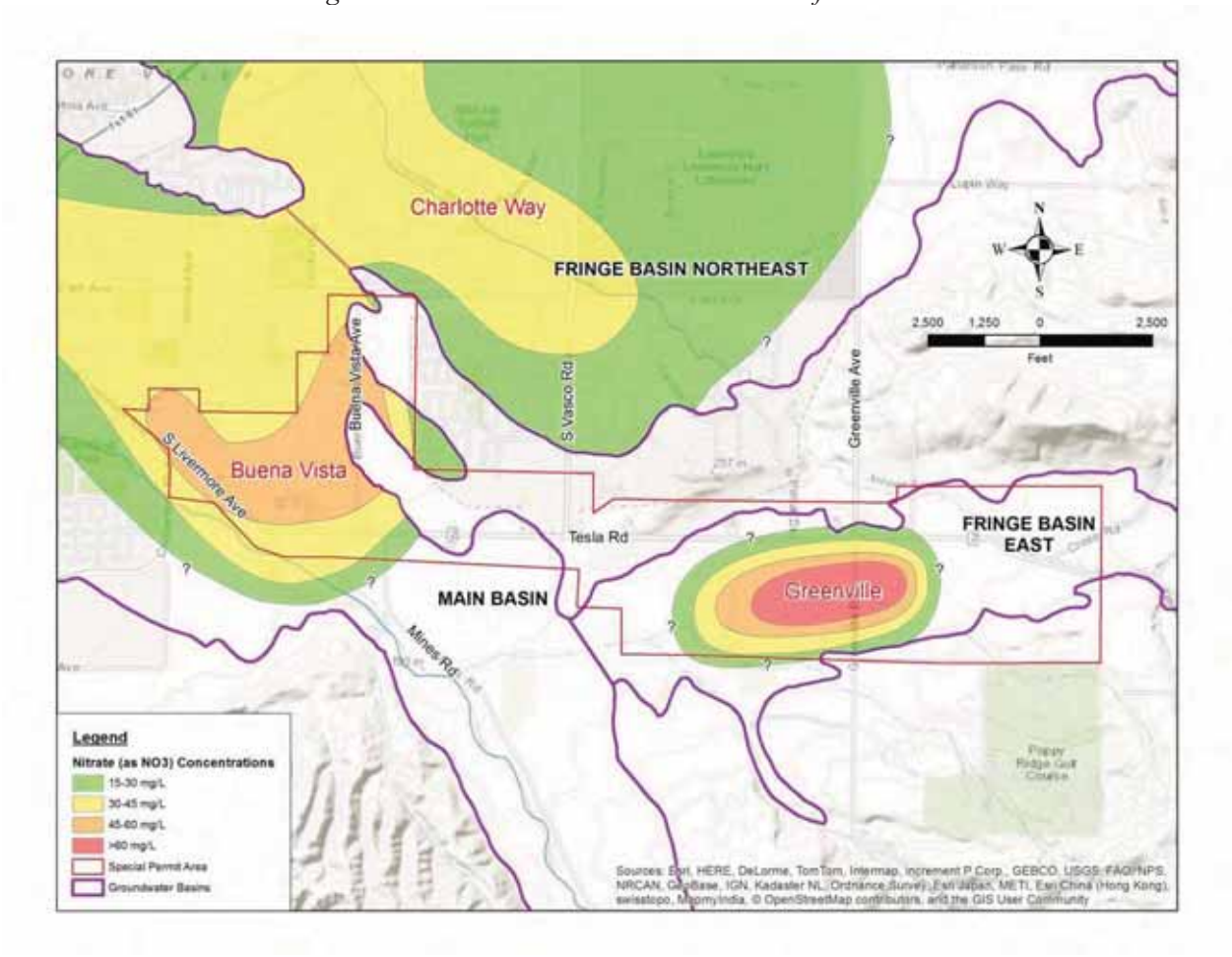


Figure 6-5: Mines Road Area of Concern

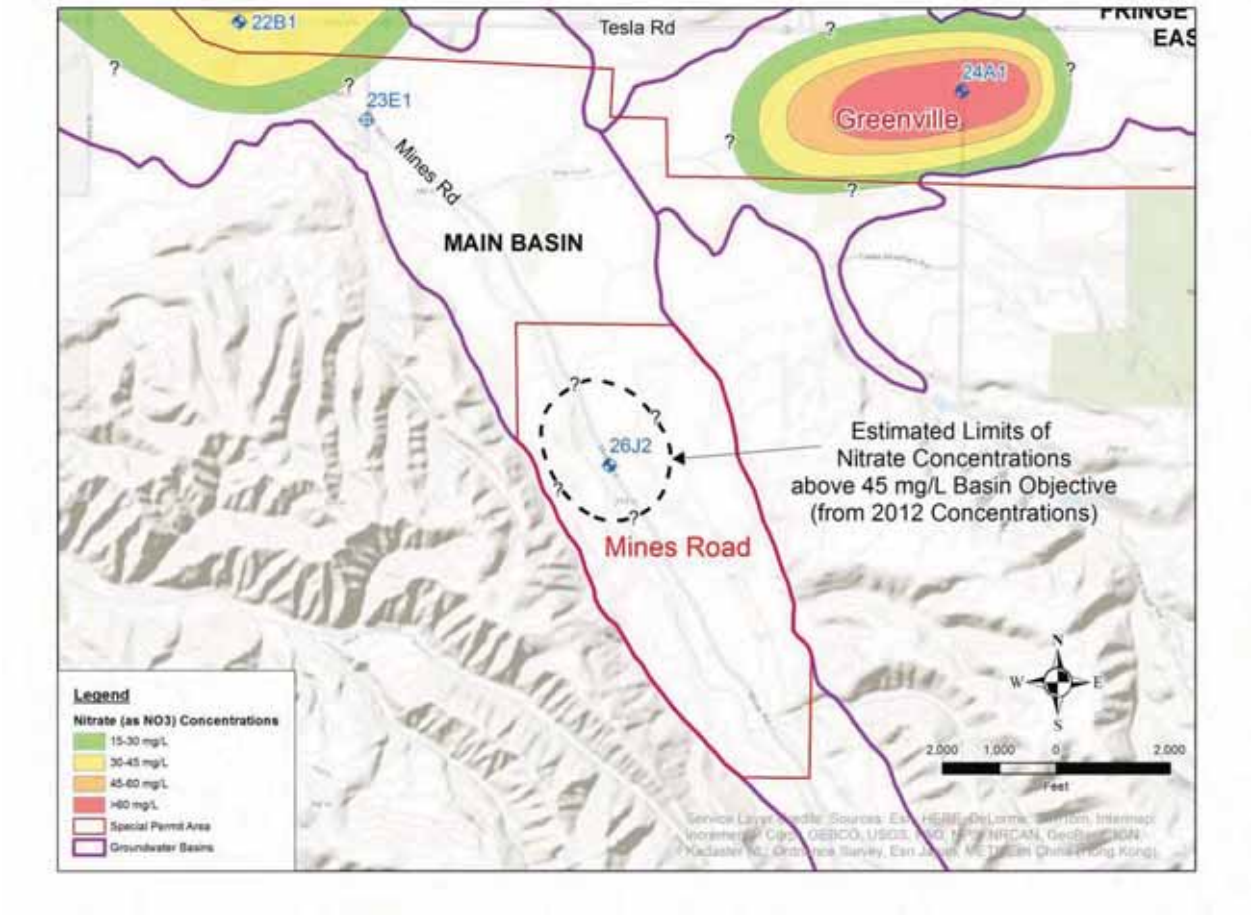


FIGURE 6-6
PROPOSED OWTS PERMIT REQUIREMENTS
FOR SPECIAL OWTS REQUIREMENT AREAS
NUTRIENT MANAGEMENT PLAN

OWTS Scenario	Parcel Size	New Requirement	Max Nitrogen Loading Rate[2]
New, upgraded, or replacement OWTS required by County OWTS Ordinance[1]	*≤ 7 acres*	*Must install/upgrade/replace with code-compliant nitrogen-reducing system(s).*	*23.8 lbs/year Per Parcel*
	> 7 acres	*Total nitrogen loading on the parcel must not exceed the Maximum Nitrogen Loading Rate. Commercial uses must also install/upgrade/replace with code-compliant nitrogen-reducing system(s).* *OR* *Prepare hydrogeologic study that assesses current groundwater nitrate conditions beneath the site and demonstrates that nitrate concentration of total onsite recharge*[3] *does not exceed 36 mg/L (80% of MCL) or the maximum concentration at the site, whichever is lower.*	*3.4 lbs/year Per Parcel Acre* *6.8 lbs/year Per Parcel Acre*

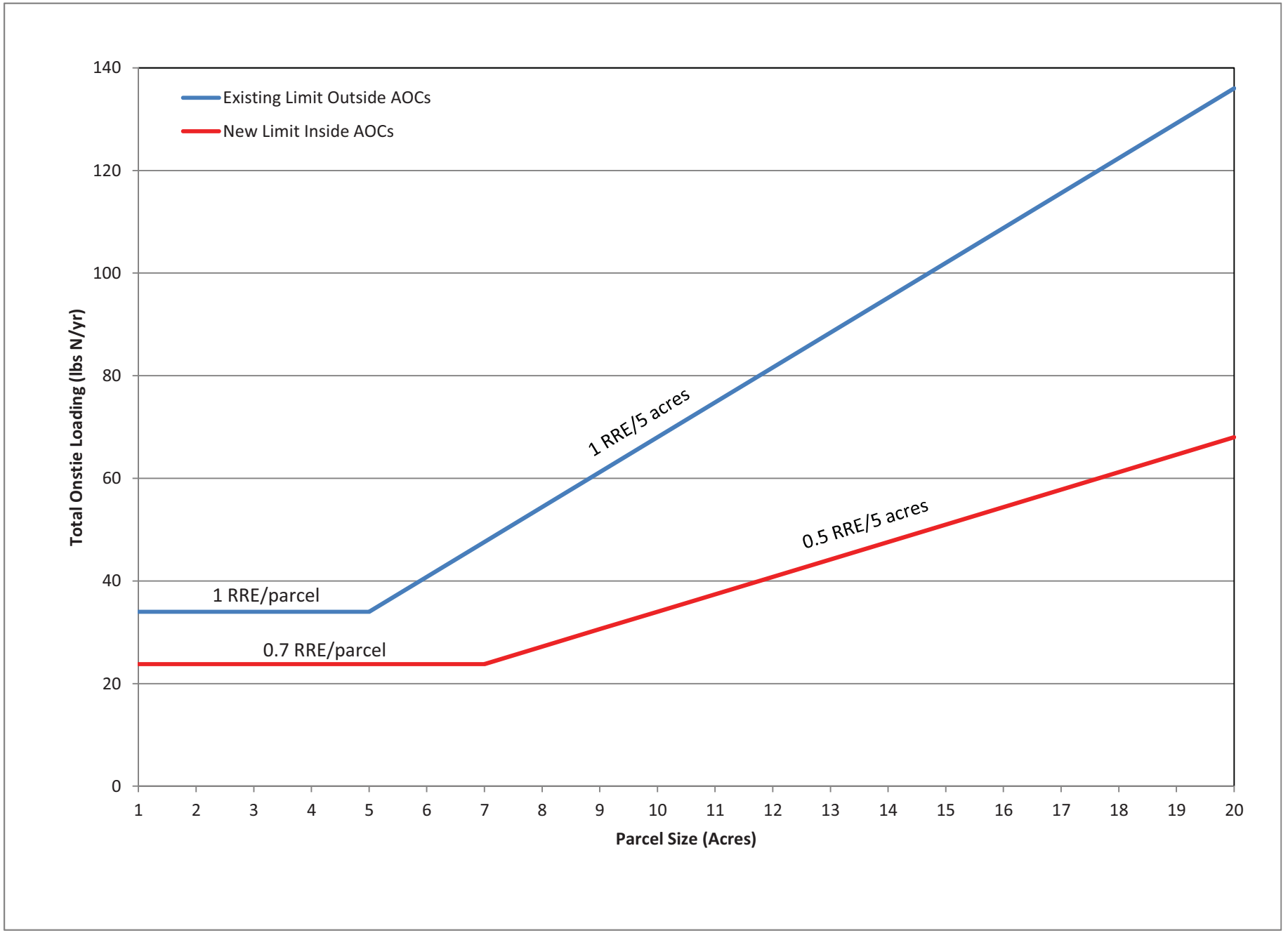
[1] Does not apply to existing, properly-working and properly-sized OWTS.

[2] Loading rates calculated based on 1 RRE = 34 lbs/yr.

[3] Assume that 18% of rainfall naturally recharges to groundwater unless study demonstrates otherwise.

ACEH = Alameda County of Environmental Health
OWTS = Onsite Wastewater Treatment System
RRE = Rural Residential Equivalence
MCL = Maximum Conaminant Level (NO_3 = 45 mg/L)

FIGURE 6-7
Graphs of OWTS Limits



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6/8/2015

6.3 Implementation Measures to Enhance Nitrate Attenuation

6.3.1 Low Impact Development BMPs

Low Impact Development (LID) BMPs promote the use of small-scale, natural drainage features to slow, clean, capture, and infiltrate rainfall in an effort to replenish local aquifers, reduce pollution, and increase the reuse of water. This NMP encourages development approval agencies to require LID BMPs such as those listed below to help dilute and attenuate nitrate concentrations in groundwater:

- Bioretention cells and swales,
- Permeable pavement blocks, and
- Soil amendments to improve soil permeability

6.4 Basin Monitoring Programs

6.4.1 Introduction

Zone 7 currently monitors the following as part of its GWMP:

- groundwater (levels and quality),
- climatological (precipitation and evaporation),
- surface water (streamflow and quality),
- mining area (mining activities and water export volumes),
- land use (area),
- groundwater production (volume and quality),
- land surface subsidence (inelastic and elastic), and
- wastewater/recycled water (use and quality).

The monitoring programs focus on the Main Basin where groundwater is pumped for municipal uses, but monitoring stations are located throughout the groundwater basin to assess conditions in the fringe and upland basins. The programs are designed to assess the sustainability and quality of the groundwater basin, and the results are used in water resources management planning and decision making. Complete descriptions of the monitoring programs are provided in Zone 7's GWMP and SMP. The components of the programs that address nutrient monitoring are outlined below. These programs are evaluated annually and revised as necessary as part of Zone 7's Annual Reports for the GWMP.

Zone 7's existing monitoring programs already address nutrient monitoring, and no changes are proposed at this time. Zone 7 will identify data gaps and suggested locations and depths for new monitoring wells

and/or soil borings for expedited groundwater sampling in the Areas of Concern. Zone 7 will provide this information to property owners, developers, and regulatory agencies to assist in developing efficient strategies for fully characterizing nitrate concentrations and nitrogen loading for projects inside Areas of Concern. Zone 7 will also work with ACEH to develop OWTS monitoring plans that may require the installation and monitoring of additional regional monitoring wells, up-gradient and down-gradient of high nitrate concentration areas, by the owners and developers.

State policy does not require monitoring for Constituents of Emerging Concern (CECs) for basins where recycled water use is limited to irrigation projects. Since the recycled water use in the Valley is currently limited to irrigation projects, Zone 7 does not monitor for CECs at this time; however, Zone 7 will continue to review the regulations and Valley conditions to assess whether future CEC monitoring is appropriate.

6.4.2 Nutrient Specific Monitoring Programs

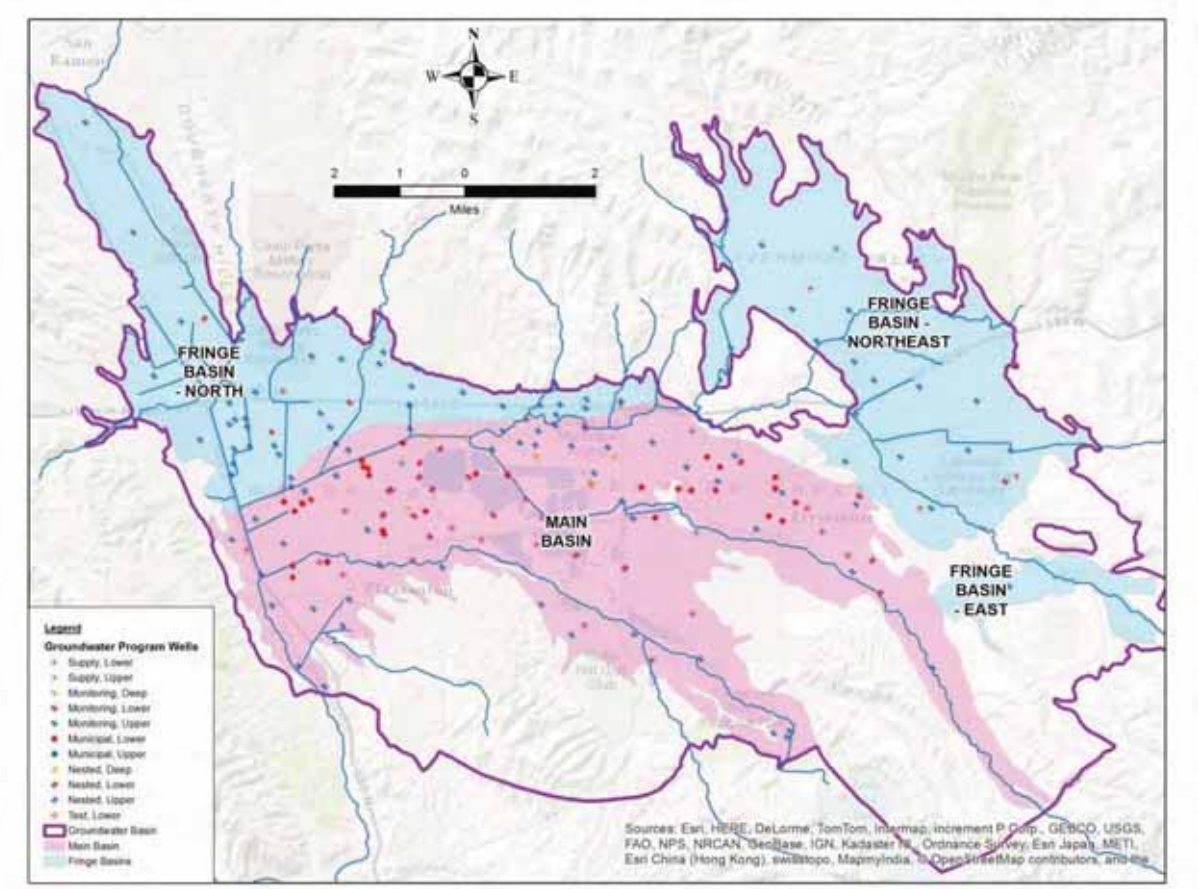
Climatological Monitoring – Zone 7's network of seven rainfall stations, two pan evaporation stations, and one California Irrigation Management Information System (CIMIS) station provide daily rainfall and evaporation data for basin recharge calculations. This information is used to calculate the volume of recharge, evaporation, and nitrogen loading from rainfall.

Surface Water Monitoring – This program focuses on the four main gaining and losing streams that impact the groundwater basin (i.e., Arroyo Valle, Arroyo Mocho, Arroyo Las Positas, and Arroyo De La Laguna), and the diversions and accretions that affect the flows into or from each of them. Zone 7 measures the inflow and outflow from the streams to quantify the volume of water recharging or discharging from the groundwater basin's aquifers. Zone 7 also samples and analyzes water from the streams to provide a record of water quality for the basin's recharge and discharge waters from which the groundwater basin's annual nitrate loading is calculated.

Zone 7's Water Level Monitoring – Zone 7 measures groundwater levels in over 230 monitoring and production wells (see *Figure 6-8* below and *Figure A-7*) twice per year during seasonal extremes (i.e., spring highs and fall lows) for storage tracking. Water level measurements are also measured monthly in some wells to monitor subsidence, adjust recharge operations, and identify when semi-annual water level measurements should be scheduled.

Zone 7's Water Quality Sampling –Zone 7 samples groundwater at least annually from all accessible groundwater wells in the program. Samples are analyzed by Zone 7's laboratory for metals and general minerals (including Nitrate as NO_3 and Phosphate as PO_4).

Figure 6-8: Map of Program Wells



Land Use Monitoring – Zone 7 maps and quantifies Valley land use (see *Figure 3-7* for the 2013 land use map) for areal recharge calculations (e.g., rainfall recharge, applied water recharge, and unmetered groundwater pumping for agriculture) and salt/nutrient loading (e.g., from irrigation, horse boarding facilities, and properties with OWTS). The program identifies changes in land use with an emphasis on changes in impervious areas and the volume and quality of irrigation water that could impact the volume or quality of water recharging the Main Basin. Land use data are derived from aerial photography, permit applications, field observations, and City and County planning documents.

Wastewater and Recycled Water Monitoring - Zone 7 compiles and reviews data on the volume and quality of wastewater collected and recycled water used within the watershed from the Livermore Water Reclamation Plant (LWRP), DSRSD Water Reclamation plant, and the Veterans Hospital sewage treatment plant. Zone 7 also reviews new OWTS applications located within the Valley for compliance with Zone 7's Wastewater Management Plan. Zone 7 must approve all onsite disposal systems for new commercial developments or any residential OWTS that will potentially exceed the loading allowed for the site.

6.5 Implementation Schedule

- The investigation of the Areas of Concern is ongoing. Zone 7 is currently soliciting permission to sample existing wells from homeowners near the Areas of Concern. Zone 7 is also currently working with several commercial developers to perform hydrogeologic studies in the Greenville special permit area.

- The Implementation Measure BMPs for Fertilizers, Irrigation, Livestock Manure Management, and Low Impact Development are already in place throughout the Valley.

- Zone 7 will assess the available data, identify data gaps, and prepare preferred well location maps for each of the Areas of Concern as identified in *Section 6.1*. These monitoring wells will potentially be installed by the developers. These will be prepared with the following schedule:

Figure 6-9: Proposed Schedule for Areas of Concern

Area of Concern	Calendar Year of Completion
Greenville	2016
Buena Vista	2016
Mines Road	2016
May School	2017
Happy Valley	2017
Staples Ranch	2018
Jack London	2018
Constitution	2018
Charlotte Way	2018
Bernal	2018

The results of the data and work products generated from the tasks above (e.g., preferred well location maps, well sampling results) will be presented in the GWMP Annual Reports or as a separate report, as appropriate, based on the size and extent of the study and/or timing of its completion.

- Zone 7's groundwater monitoring programs are also already in place, the results of which are presented in Zone 7's Annual Reports for the GWMP. New monitoring wells constructed as part of new developments (*Section 6.1.5.3*) will be added to the existing programs.

- The NMP recommends that the special OWTS permit requirements discussed in *Section 6.2.5.3* and described in *Figure 6.6* be incorporated into the LAMP, which ACEH anticipates completing a draft in 2016, and finalizing it by 2018.