Local Agency Management Program

for

Onsite Wastewater Treatment Systems

San Mateo County, California

San Mateo County
Environmental Health Services Division

May 11, 2016

Table of Contents

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 San Mateo, California. This LAMP has been prepared in accordance with the requirements of the State Water Resources Control Board's (SWRCB) *Water Quality Control Policy for Siting, Design, Operation, and Maintenance of Onsite Wastewater Treatment Systems*, dated June 19, 2012, also referred to as the "OWTS Policy".

The SWRCB OWTS Policy provides a multi-tiered strategy for management of OWTS in California. This LAMP has been prepared by San Mateo 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 San Mateo County; (b) meet or exceed the environmental protections of the "default" siting and design requirements for OWTS identified in Tier 1 of the SWRCB OWTS Policy; and (c) ensure the best opportunity for coordinated and comprehensive management of OWTS, public health and water quality in San Mateo County.

This LAMP is intended to apply to all OWTS within San Mateo County having wastewater design flows of up to 10,000 gpd. Any OWTS with a design flow exceeding 10,000 gpd would be regulated by the San Francisco Bay or Central Coast Regional Water Quality Control Board, as applicable.

In San Mateo County, the Health Officer has designated the Director of the Environmental Health Services Division (EHSD) as a County Health Officer for the purpose of enforcing State and local environmental health law. All cities within the County have designated the County's Health Officer as their jurisdictions' health officer.

Physical Setting

Located directly south of the City and County of San Francisco, San Mateo County completes the peninsula between the Pacific Ocean and the southern San Francisco Bay, and borders Santa Clara County to the southeast and Santa Cruz County to the south. The Santa Cruz Mountains run the entire north-south length of the county, as shown in **Figure 1-1**. Northern and northeastern parts of the county are densely populated with largely urban and suburban development, with many of its cities bordering San Francisco Bay. South and west central parts of the county are rural and coastal. There are broad swaths of flat land along the Bay, and to a lesser extent along the Pacific coastline, both of which transition sharply into the interior of the Santa Cruz Mountains of the Coastal Range.

San Mateo County Local Agency Management Program		**San Mateo County Geographical Features**	FIGURE **1-1**

Regulation of Onsite Wastewater Treatment Systems

The San Mateo County Environmental Health Services Division (EHSD) is responsible for regulating OWTS throughout the unincorporated areas of the County. The EHSD also administers OWTS regulations in the various cities and towns in the County. OWTS are used almost exclusively for properties located outside of municipal sewer service boundaries, which includes portions of the Towns of Portola Valley, Woodside and Half Moon Bay, and unincorporated areas of Los Trancos Woods, Redwood Terrace, La Honda, Kings Mountain, rural development in the Santa Cruz mountains, and coastal areas of Tunitas, San Gregorio, and Pescadero. Countywide there are currently estimated to be approximately 4,400 OWTS.

The County has historically operated its onsite wastewater management program under the authority granted to it by the San Francisco Bay and Central Coast Regional Water Quality Control Boards. **Figure 1-1** is a map of San Mateo County, showing the unincorporated areas, the heaviest concentration of OWTS, major watersheds, RWQCB jurisdiction boundaries, and other notable geographical features.

In response to the SWRCB OWTS Policy, beginning in 2013 the County started taking measures to modify and update the County's onsite wastewater system management program to meet provisions of the Policy. This effort has included enforcement of OWTS Policy Tier 3 requirements upon the effective date of the Policy, comprehensive review, update and revisions to the applicable sections of the County Code pertaining to OWTS and development of an "Onsite Systems Manual" containing various policies, procedures and technical information for implementation of the Ordinance.

San Mateo County OWTS Requirements

Requirements for the installation, use and maintenance of OWTS in San Mateo County are contained in two primary documents (summarized below), which accompany and form the basis for this LAMP.

Onsite Wastewater Ordinance

The County Onsite Wastewater Ordinance, as updated effective February 4, 2016, establishes standards for the approval, installation, and operation of OWTS within San Mateo 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 San Mateo County Board of Supervisors. **Table 1-1** presents a brief synopsis of various sections of the Ordinance.

Table 1-1. San Mateo County Onsite Wastewater Ordinance Summary

CHAPTER __. ONSITE WASTEWATER TREATMENT	
Section	**Synopsis**
4.84.010 Purpose and Authority	To establish stds for OWTS & protect health and water quality
4.84.015 Administration and Enforcement	Authorizes EHSD to administer and enforce Code
4.84.020 Onsite Systems Manual	Creates Onsite Systems Manual (OSM) for implementation
4.84.025 Definitions	Defines key terms used in the Code
4.84.030 Scope and Application	Applies to OWTS for domestic sewage up to 10,000 gpd
4.84.035 County Not Responsible for Damages	Releases County from liability re OWTS construction
4.84.040 Public Sanitary Sewer; Connection to	Requires connection to sanitary sewer if within 200 ft
4.84.045 Certification of Soil Percolation Testers	Details requirements for certification of percolation testers
4.84.050 Certification of OWTS Installers	Details requirements for certification of OWTS installers
4.84.055 Certification for Septage Pumping and Cleaning, OWTS, Holding Tanks and Portable Toilets	Details requirements for certification of septic tank pumpers
4.84.060 Suspension or Revocation of Soil Percolation Tester, OWTS Installer or Septage Pumper Certifications	Defines procedures for suspension or revocation of certifications, and provisions for appeal
4.84.065 OWTS; When Used	Buildings require flush toilet w/OWTS or sewer
4.84.070 Applications, Plot Plans, Inspections & Other Requirements	Requirements pertaining to permits for site evaluation, repairs, and destruction
4.84.075 Fees	Requires payment of permit fees
4.84.080 Expiration and transfer of permits	Permit valid for 1 yr, 1-yr extension; can't be transferred
4.84.085 Denial, Suspension or Revocation of OWTS Permit	EHSD may deny or suspend permit; appeal process
4.84.090 Issuance of Building Permit	Bldg permit requires EHSD clearance for OWTS/sewer
4.84.095 Issuance of Certificate of Occupancy	Bldg occupancy/cert. requires OWTS/sewer clearance
4.84.100 Violations; Public Nuisance	Defines OWTS failure and nuisance conditions
4.84.105 Prohibition of Installation of Cesspools & Seepage Pits	Cesspools and seepage pits not allowed
4.84.110 Prohibition of Holding Tanks; Portable Toilets; Exemptions	Holding tanks not allowed except in certain cases; limits usage of vault toilets
4.84.115 OWTS; Minimum Requirements	States general OWTS requirements, as well as rqts per OSM
4.84.120 OWTS; Minimum Siting Criteria	Details siting requirements, such as soils, slope, setbacks
4.84.125 OWTS Subject to CRWQCB Waste Discharge Requirements; County Permit Required	Defines cases requiring OWTS review/approval by RWQCB
4.84.130 OWTS; Repairs or Alterations	OWTS repairs must comply to max extent practicable
4.84.135 OWTS; Destruction	OWTS no longer in use must be destroyed under permit
4.84.140 OWTS; Subsurface Dispersal Systems Requirements	States general dispersal rqts, as well as rqts per OSM
4.84.145 Alternative OWTS; Use of	States terms under which alternative OWTS may be used
4.84.150 Alternative OWTS; Installation Permits and Review Requirements	Specifies site evaluation, design and permitting requirements for alternative OWTS
4.84.155 Alternative OWTS; Operating Permits	Describes operating permits and requirements
4.84.160 Alternative OWTS; Performance Monitoring and Reporting	Describes performance monitoring & reporting requirement
4.84.165 Alternative OWTS; Siting Criteria, Design and Construction Requirements	Details siting criteria, design and construction requirements for alternative OWTS; references OSM
4.84.170 Advanced Protection Management Program; Applicability	Describes applicability of additional protection measures for OWTS near impaired water bodies.
4.84.175 Advanced Protection Management Program; Requirements for	Details requirements applicable to OWTS located in Advanced Protection Management Areas
4.84.180 Cumulative Impacts and Areas of Environ Concern	Requires assessment of OWTS cumulative impacts, per OSM
4.84.185 Exemptions (Variance)	Provisions for granting OWTS exemptions by EHSD; not allowed for subdivisions
4.84.190 Abatement of Hazards	Procedures for abatement of OWTS hazards per EHSD findings
4.84.195 Enforcement and Penalties	Criminal penalties and admin fines for violations of Code

Onsite Systems Manual

The Onsite Systems Manual provides the policy, procedural and technical details for implementation of the Ordinance. It includes permitting forms and procedures, site evaluation requirements and methods, guidelines for cumulative impact studies and geotechnical reports, design details and guidelines related to both conventional and alternative systems, OWTS performance evaluation procedures, operation and monitoring requirements, and related technical and procedural information. The Onsite Systems Manual will be reviewed and updated from time-to-time, typically annually, to keep pace with new issues, policies, procedures, and technologies affecting the use and management of onsite systems in San Mateo County. The Onsite Manual will be maintained by Environmental Health. The initial document submitted with this LAMP, as well as any substantive changes in the future, will require approval by the director and the S.F. Bay Regional Water Quality Control Board.

The Onsite Systems Manual is divided into six main sections as follows:

1. **Section 1: Policies and Administrative Procedures.** This covers EHSD policies developed for explanation and/or clarification of various Ordinance provisions along with administrative procedures, such as general requirements for subdivisions, new construction, remodels, and system repairs.

2. **Section 2: Site Investigation Requirements and Procedures.** This presents the procedures and requirements covering such items as soil and site evaluations, percolation testing, groundwater determinations, geotechnical report requirements, and guidelines for cumulative impact assessments.

3. **Section 3: Design and Construction Requirements for Conventional OWTS.** This section presents general requirements and technical specifications applicable to all OWTS and specific design and construction requirements for conventional OWTS. This includes, for example: siting and design criteria; wastewater flows for OWTS design; and design and construction requirements for septic tanks, and conventional dispersal trenches.

4. **Section 4: Alternative OWTS Requirements.** This presents requirements and guidelines for design and construction of alternative treatment and dispersal systems permitted and/or required under the Ordinance, including: system description and applications, siting, design and construction requirements, typical details, and monitoring and maintenance requirements.

5. **Section 5: OWTS Performance, Monitoring and Evaluation.** This presents guidelines and criteria for operation, monitoring and maintenance of conventional and alternative OWTS, including: (a) performance requirements for different components and types of OWTS; (b) monitoring requirements; and (c) guidelines for evaluating the functioning status and performance of OWTS.

6. **Section 6**: **Advanced Protection Management Program.** This section describes advanced protection management requirements applicable to lands located adjacent to water bodies designated as "impaired" under Section 303(d) of the Clean Water Act, as well as other geographical areas the County (Board of Supervisors) may find to be impaired based on cumulative impact evaluations or other findings.

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 San Mateo County. It is also structured as much as possible to address the items listed in the SWRCB 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 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 San Mateo County.*** This section provides background information on environmental conditions pertinent to the use and suitability for OWTS, extent of OWTS usage in the County, and summary of OWTS management approaches and requirements adopted for protection of water quality in San Mateo County, addressing items in OWTS Policy Section 9.1.

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

- **Section 4 – Special Management Issues.** This section describes the provisions contained in the San Mateo 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 San Mateo County LAMP corresponding with the required prohibitions set forth in Section 9.4 of the SWRCB 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 RWQCB(s), as required under Sections 3.3 and 9.3, of the OWTS Policy.

- ***Appendix A – Supporting Rationale.*** This presents discussion of the supporting rationale (including literature sources) for the various San Mateo County siting and design requirements, focusing on vertical separation requirements for conventional and alternative OWTS, comparison with Tier 1 standards of the OWTS Policy, and highlighting the requirements and management practices that are more protective than the provisions of the OWTS Policy.

- ***Appendix B – OWTS Usage Estimates and Nitrate Loading.*** This presents the GIS-based methodology and resulting estimates of OWTS usage in San Mateo County and the distribution in different geographical and watershed area in the county. Also included are corresponding estimates of wastewater discharge volumes and nitrate loading contributions to watershed areas from the approximately 4,400 existing OWTS in the County, with emphasis on the areas of highest density of OWTS (Focus Areas). This will be part of the County's ongoing assessment of water quality impacts from OWTS.

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

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

Surface Water Hydrology

The surface hydrology of San Mateo County is influenced mainly by climate, topographical and land form conditions.

The climate of the region is generally temperate throughout the year with dry, mild summers and moist, cool winters. Temperatures are strongly influenced by large saltwater bodies on the east and the west, and the Santa Cruz Mountains running the north-south length of the county. Land form features combine to result in a variety of microclimates with hill and ridgetop areas, valley floors and coastal areas each experiencing different temperature and precipitation patterns.

Precipitation, mostly occurring as rainfall, is mainly concentrated in the winter months from December through March. Also, summer fog provides moisture and cool air for the coastal terraces. Mean annual precipitation generally increases with elevation, ranging from 15 inches at sea level to 50 inches in the mountains. Additionally, the Santa Cruz Mountains form a barrier to coastal fog and storm fronts approaching from the west, such that the majority of rainfall occurs on the Coastside of the watershed divide and in the mountains.

San Mateo County lies within two hydrological and Water Quality Control Board Regions: San Francisco Bay Region 2 (northern majority of the county) and Central Coast Region 3 (southern coastal tip of the county). Utilizing watershed boundaries established by the California Department of Water Resources (DWR), twenty-eight (28) hydrologic areas are delineated and labeled as shown in **Figure 2-1**. Twenty-four of the hydrologic areas are in the San Francisco Bay Region and four within the Central Coast Region. The boundaries match DWR delineations, except in some cases where smaller sub-regions are combined where they have a common outflow, e.g., to the Pacific Ocean or to the Crystal Springs Reservoir.

There are 10 major reservoirs and lakes, and many smaller man-made impoundments, which store water throughout the county. **Table 2-1** lists and summarizes the storage capacity of the major reservoirs and lakes which have more than 100 acre-feet of storage capacity. All of these reservoirs and lakes were originally natural lakes or depressions, and have been artificially expanded to increase their storage capacity.[1] There are also numerous springs found

[1] San Mateo County General Plan, 1986

San Mateo County Local Agency Management Program		**San Mateo County Watershed Areas Map**	FIGURE **2-1**

throughout the county that generally serve as small water sources. There are notable larger springs that occur at the headwaters of Purisima and Butano Creeks.

Table 2-1. Capacity of Major Reservoir and Lakes Unincorporated San Mateo County[1]

Lake/Reservoir	Storage Capacity (acre-feet)
Crystal Springs Reservoir	69,295
San Andreas Lake	18,996
Pilarcitos Lake	3,100
Bean Hollow Lakes	1,361
Searsville Lake	813
Lake Lucerne	455
Green Oaks	287
Pomponio	256
Lake Elizabeth	113
Coastways Ranch	112

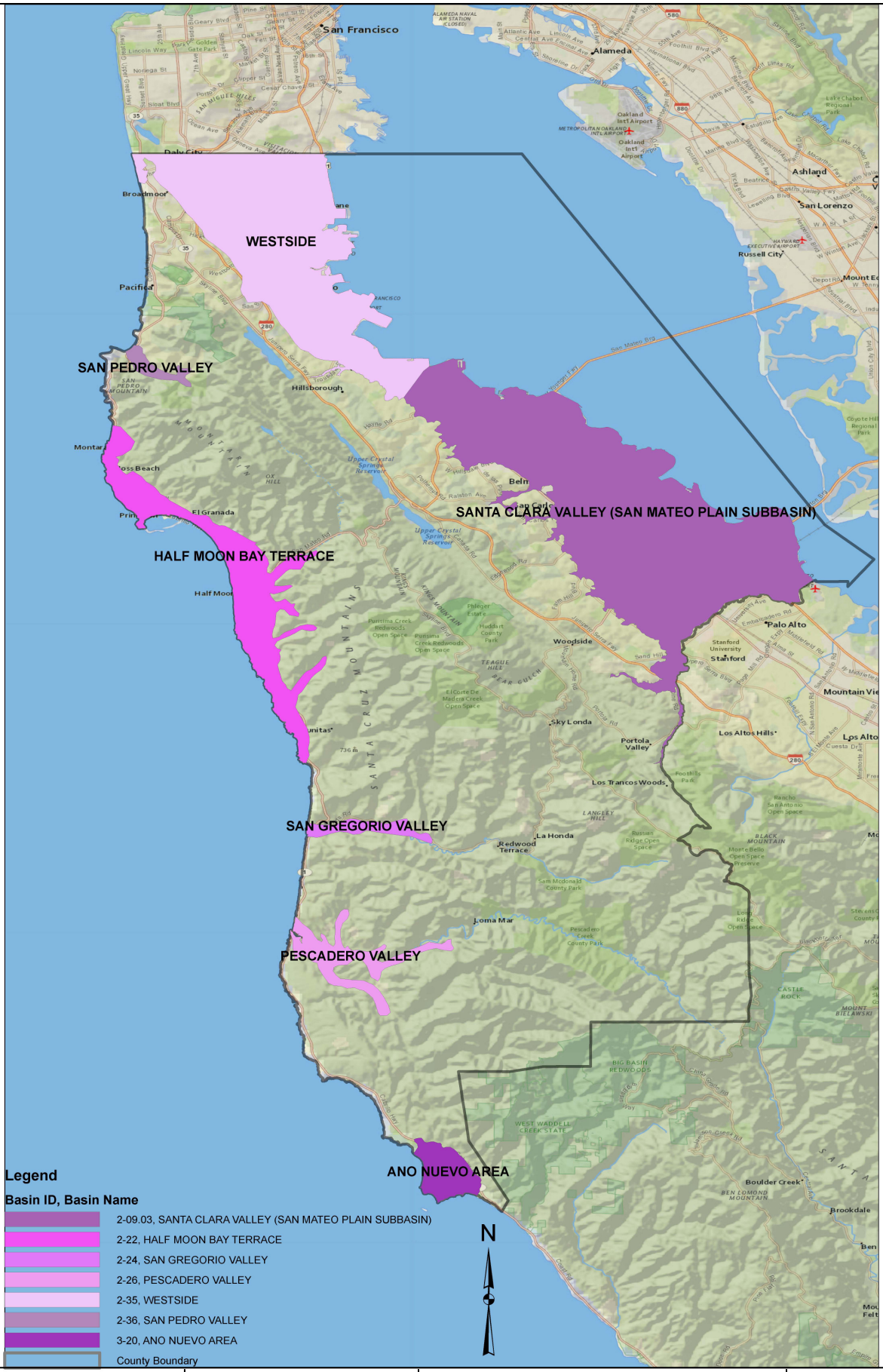
[1]San Mateo County General Plan, 1986.

Groundwater

Figure 2-2 identifies the boundaries of known groundwater basins in San Mateo County as identified by DWR[2], all composed of water-bearing younger alluvium deposits. The Westside Basin, spanning portions of San Francisco County and the northern end of San Mateo County, borders San Francisco Bay on the southeast side and opens to the Pacific Ocean on the northwest. To the south of the Westside Basin is the San Mateo Plain Subbasin, extending along the bay and forming the northern extent of the vast Santa Clara Valley Basin. These groundwater basins coincide with urban areas, having very little overlap or interaction with areas of OWTS usage. Only a very small part of the Santa Clara Valley Basin extends into the Woodside area (San Mateo Plain Sub-basin ID 2-09.03), where there are a small number of OWTS. The other groundwater basins in the county are all in the coastal region and include: (1) San Pedro Valley Basin, aligned with San Pedro Creek; (2) Half Moon Bay Terrace Basin, aligned with several coastal streams; (3) San Gregorio Valley Basin, aligned with San Gregorio Creek; (4) Pescadero Valley Basin, aligned with Pescadero Creek; and (5) Ano Nuevo Area Basin, the only basin in San Mateo County situated in RWQCB Central Coast Region 3, near Cascade Creek.

According to the DWR Bulletin 118, all basins except Half Moon Bay Terrace Basin are recharged by stream and tributary flow emanating higher up in the Santa Cruz Mountains. Half Moon Bay Terrace Basin is predominantly recharged by direct precipitation at its higher elevations. Limited data available for the coastal groundwater basins indicate wide variation, but relatively shallow depth to groundwater along the coast, as high as 2 to 6 feet below

[2] California Department of Water Resources (DWR). California's Groundwaters. Bulletin 118. 2004 Update.



San Mateo County Local Agency Management Program		**San Mateo County Groundwater Basin Map**	FIGURE **2-2**

ground surface (bgs); further inland groundwater depths up to 60 feet bgs are indicated. All wells reported by DWR for the six basins indicated groundwater levels at 30 feet or deeper.

The few studies conducted of the five Coastside groundwater basins in general indicate most wells to be adequate for domestic use, with mineral, chemical and physical constituents found generally in conformance with drinking water standards. DWR Bulletin 118, 2014 Update, cites information from the San Mateo County General Plan (1986), indicating a high percentage of wells around the community of Pescadero (Pescadero Valley Groundwater Basin), have been impacted by fecal coliform bacteria, and the groundwater also has high concentrations of nitrate. Historical data from four (4) wells in the basin indicate total dissolved solids values range from 403 to 1,790 milligrams per liter (mg/L), averaging about 900 mg/L.

Soils and OWTS Suitability Mapping

General Soils Map

Figure 2-3 presents a General Soils Map of San Mateo County compiled from information contained in two soil surveys and mapping published by the U.S. Department of Agriculture, which include: (1) Soil Survey of San Mateo Area, California, 1961; (2) Soil Survey San Mateo County, Eastern Part and San Francisco County, California, 1990; and (3) Online soils data base maintained by the Natural Resources Conservation Service (NRCS). The General Soils Map contained in the 1990 Soil Survey of San Mateo County, Eastern Part 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:

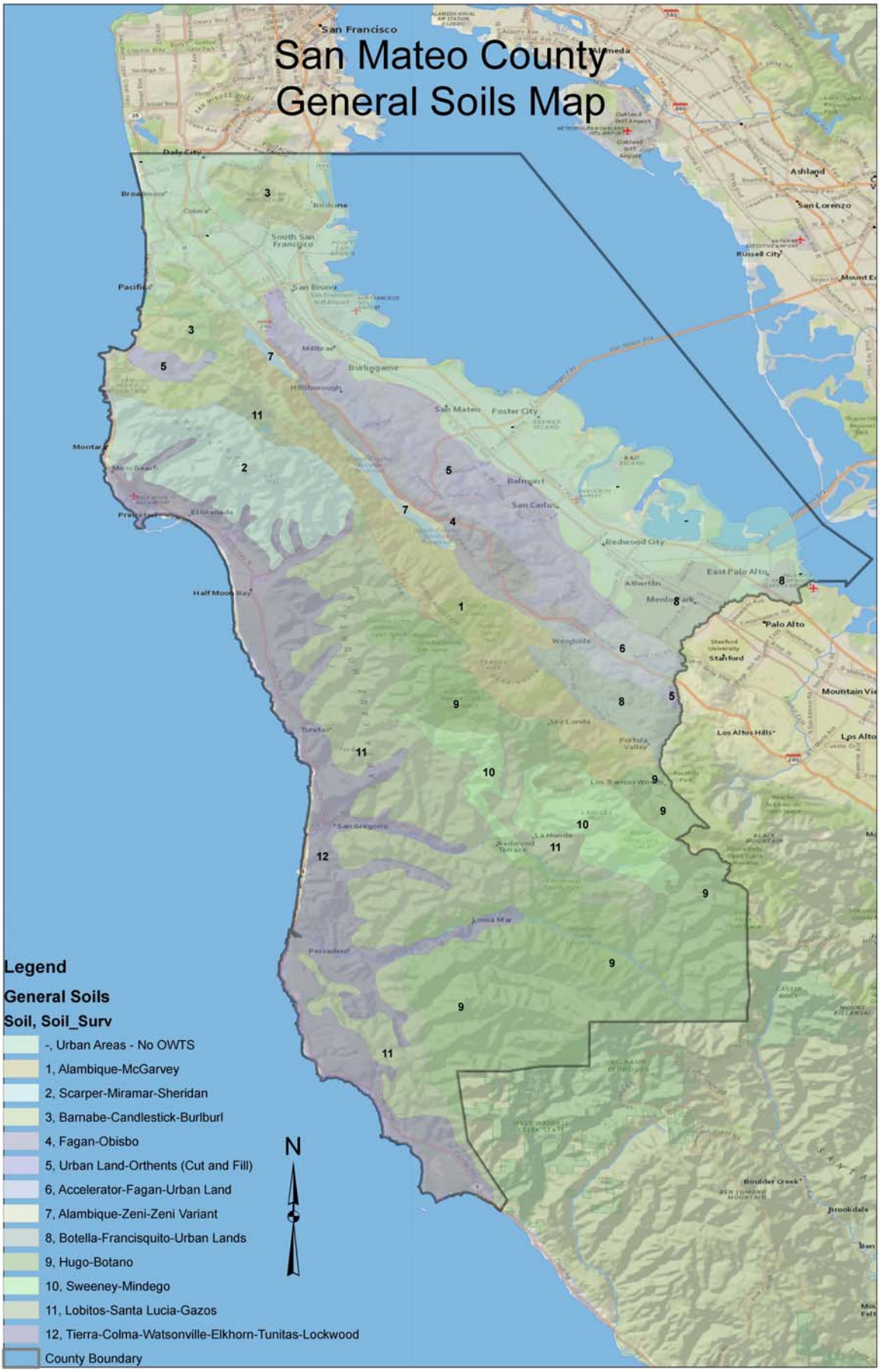
1990 Soil Survey of San Mateo County, Eastern Part

- **Uplands (1-7).** The soils of the Santa Cruz Mountains are generally moderately deep and well drained loams situated on gently rolling to steep slopes. Most OWTS development in the upland is located in 1, 4, 5 & 6 soil associations, in the vicinity of Woodside, and can have local constraints of steep slopes and/or shallow soils.

- **Bottom Lands (8).** Most soils associations found along the San Francisco Bay side of the county are all situated in urban, sewered areas, and hence are not part of this OWTS analysis. However, included in this landform classification is the Botella-Francisquito-Urban soil association located near Portola Valley where there is significant development utilizing OWTS.

1961 Soil Survey of San Mateo Area

- **Uplands (9-11).** Soils found in the rural mountainous portions of the county, west of the Santa Cruz Mountains divide, are well drained soils to excessively drained soils derived mostly from sedimentary parent material and formed in upland regions between the ridgetops and marine terraces near the coast. The loamy soils in these areas are well



San Mateo County Local Agency Management Program		**San Mateo County General Soils Map**	FIGURE **2-3**

suited for conventional OWTS, mostly found near Kings Mountain Road, Skylonda, Redwood Terrace and La Honda and scattered throughout mountainous rural areas to the central and southern parts of the county. Local constraints of shallow soils and/or steep slopes can potentially be overcome with shallow and/or pressure-dosed systems.

- **Marine Terraces, Alluvial Fans and Floodplains (12).** Soils found on the coastal terraces and coastal stream valleys are generally deep, well drained and suitable for conventional OWTS.

Soil-OWTS Suitability

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 2-2** 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 2-2** 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 residential OWTS within each general soil area, determined by merging the GIS parcel data with the soil mapping boundaries, as discussed further below.

OWTS Usage Estimates

Parcel Development Status

Since a comprehensive inventory of existing OWTS usage in San Mateo County does not exist, estimates were made by Questa Engineering in connection with studies supporting the development of this LAMP. This included 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, which was taken as the best estimate of the current number of OWTS in the county. Description of the methodology, assumptions and results is provided in **Appendix B**.

The geographic area covered in the analysis included the unincorporated area of San Mateo County, plus those portions of the Towns of Portola Valley and Woodside which do not have municipal sewer service and instead rely on the use of OWTS. All incorporated property within the remaining cities and sanitary districts was excluded, under the assumption that municipal sewer systems either serve or are available to all of these parcels. Some “islands” of unincorporated parcels were found to exist in the urban areas, and in most cases were

Table 2-2: San Mateo County General Soil Associations

General Soil Association Number	Soil Association Name	Description	Soil Depth	Slope	Drainage	Soil Texture	Suitability and Constraints for OWTS	Estimated Number of OWTS
1	**Alambique-McGarvey**	Soils formed in material weathered from sandstone found west of the San Andreas fault and south of California Highway 92	moderately deep	moderately steep to very steep (30-75%)	well drained	gravelley loam to clay loam underlain by sandstone	Generally suitable conditions for conventional OWTS; some inclusions of low permeability and perched groundwater favoring shallow dispersal designs	832
2	**Scarper-Miramar-Sheridan**	Soils formed in material weathered from quartz-diorite or acid igneous rock found on the coast from Devil's slide to Montara	moderately deep	steep and very steep	well drained	gravelley course sandy loam and clay loam underlain by quartz-diorite	Moderately constrained by steep slopes and shallow soils, potentially requiring alternative treatment and/or shallow dispersal designs	7
3	**Barnabe-Candlestick-Burlburl**	Soils formed in material weathered from sandstone found on San Bruno Mountain; Sweeny Ridge, west of Pacifica; and Skyline Boulevard, south of California Highway 92	very shallow to moderately deep	moderately steep to very steep (15-75%)	well drained	very gravelley sandy laom and sandy clay loam underlain by hard, fractured sandstone	Moderately constrained by steep slopes and shallow soils, potentially requiring alternative treatment and/or shallow dispersal designs	2
4	**Fagan-Obisbo**	Soils formed in material weathered from sandstone, shale and serpentine found along California Highway 92, on the eastern side of the San Andreas Fault	shallow and deep	gently sloping to steep (5-50%)	well drained	clay to sandy clay loam underlain by sandtone shale, or hard, sepentinitic rock	Moderately constrained by steep slopes and shallow soils, potentially requiring alternative treatment and/or shallow dispersal designs	180
5	**Urban Land-Orthents, Cut and Fill**	Soils formed in residuum derived from sandstone found east of California Highway 280 extending from San Bruno to Redwood City	very shallow to very deep	gently rolling to very steep	well drained	Urban Land, graded and mixed soils, or covered with fill material	Generally suitable conditions for conventional OWTS; some inclusions of low permeability and perched groundwater favoring shallow dispersal designs	297
6	**Accellerator-Fagan-Urban land**	Soils formed in residuum derived from sandstone, shale or siltstone found along California Highway 280, north of San Franciquito Creek	deep	gently rolling and rolling	well drained	loam to clay loam and clay	Suitable conditions for conventional OWTS	138
7	**Alambique-Zeni-Zeni Variant**	Soils formed in material weathered from sandstone and metasedimentary rock on Sawer Ridge and Cahill Ridge, in the San Francisco Water District	moderately deep	moderately steep to very steep (15-75%)	well drained	loam and sandy loam, and gravelley loam to gravelley clay loam	Moderately constrained by steep slopes and shallow soils, potentially requiring alternative treatment and/or shallow dispersal designs	0

General Soil Association Number	Soil Association Name	Description	Soil Depth	Slope	Drainage	Soil Texture	Suitability and Constraints for OWTS	Estimated Number of OWTS
8	**Botella-Francisquito-Urban Lands**	Soils formed on alluvial fans, flood plains and stream terraces along San Francisquito Creek, and in Menlo Park, Palo Alto, Woodside and Portola Valley	very deep	gently sloping to rolling	well drained, restricted permeability of the subsoils	clay loam to loam	Generally suitable conditions for conventional OWTS; some inclusions of low permeability and perched groundwater favoring shallow dispersal designs	1,112
9	**Hugo-Butano**	Soils formed in material weathered from sedimmentary rock found in the southern county, including nearly all of the Skyline crest	deep	steep and very steep	well drained to somewhat excessively drained	sandy loam to loam	Moderately to severely constrained by steep slopes and shallow soils, potentially requiring alternative treatment and/or shallow dispersal designs	1,022
10	**Sweeney-Mindego**	Soils developed from basic igneous rock on rounded, sloping and moderately steep ridgetops found mainly in the central eastern uplands Mindego and Langley Hills, and La Honda	moderately deep and shallow	steep and very steep	well drained to somewhat excessively drained	clay loam to sandy loam	Moderately to severely constrained by steep slopes and shallow soils, potentially requiring alternative treatment and/or shallow dispersal designs	158
11	**Lobitos-Santa Lucia-Gazos**	Soils formed in material weathered from sedimmentary rock and siliceous shale found in the western county between the ridgetops and the marine terraces near the coast	moderately deep and shallow	steep and very steep	well drained to excessively drained	loam and silt loam	Moderately to severely constrained by steep slopes and shallow coarse-textured soils, potentially suitable for supplemental treatment and/or shallow dispersal designs	323
12	**Tierra-Colma-Watsonville-Elkhorn-Tunitas-Lockwood**	Soils formed ins alluvium of mixed sources, some of which was reworked by the ocean and redeposited on marine terraces found along the majority of the county's coast	deep	nearly level with steep inclusions	well drained to imperfectly drained	sandy loam to clay loam	Moderately to severely constrained by steep slopes and shallow coarse-textured soils, potentially suitable for supplemental treatment and/or shallow dispersal designs	351

determined to be connected to a sewage treatment facility. There may be some additional isolated cases within sanitary district boundaries where individual lots or small pockets of development are not connected to the municipal sewer system; and these findings will be added to the inventory in the future as the information becomes available.

OWTS Distribution by Watershed Areas

To assist with present and future management of OWTS and water quality assessments, the GIS parcel status data were merged with watershed boundaries, providing useful information on the distribution of OWTS according to geographical and watershed areas in the county. The results are presented in **Tables 2-3** and **2-4** for the San Francisco Bay and Central Coast regions of the county, respectively. Shown in the tables for each watershed are the total land acreage comprising each basin, the lot area developed with OWTS, the estimated number of OWTS, and the average lot size for the developed parcels. As indicated, about 99% of the OWTS are located in the San Francisco Bay Region and 1% in the Central Coast Region.

Table 2-3. OWTS Usage and Distribution by Watershed, San Mateo County
San Francisco Bay Region 2

Watershed	Total Watershed Area (acres)	Developed Lot Area (acres)	Number of Developed Parcels	Average Developed Lot Size (acres)
Bear Gulch Reservoir	7,633	659	345	1.91
Butano Creek	13,836	327	113	2.89
Crystal Springs Reservoir	18,323	38	40	0.95
Denniston Creek	10,335	0	0	0
La Honda Creek	7,324	1,082	547	1.98
Lobitos Creek	3,942	325	9	36.13
Millbrae	2,996	2	4	0.62
Mills Creek	5,339	717	70	10.25
Oyster Point	11,843	0.25	1	0.25
Pescadero Creek	34,939	3494	347	10.07
Pilarcitos Creek	7,340	138	21	6.55
Pomponio Creek	5,648	83	4	20.66
Purisima Creek	9,597	1,640	251	6.54
San Francisquito Creek	13,440	5,896	1,578	3.74
San Gregorio Creek	25,951	1,371	193	7.10
San Pedro Creek	8,784	0.6	1	0.6
Tunitas Creek	7,871	928	36	25.79
West Union Creek	7,627	2,317	809	2.86
TOTAL	202,768	19,017	4,369	

Table 2-4. OWTS Usage & Distribution by Watershed, San Mateo County Central Coast Region 3

Watershed	Total Watershed Area (acres)	Developed Lot Area (acres)	Number of Developed Parcels	Average Developed Lot Size (acres)
Arroyo De los Frijoles	6,698	1,626	47	34.6
Gazos, Whitehouse, Cascade Creeks	10,501	304	3	101.23
Green Oaks Creek	2,102	98	2	48.94
Waddell Creek	815	1.96	1	1.96
TOTAL	20,116	2,030	53	

OWTS Focus Areas

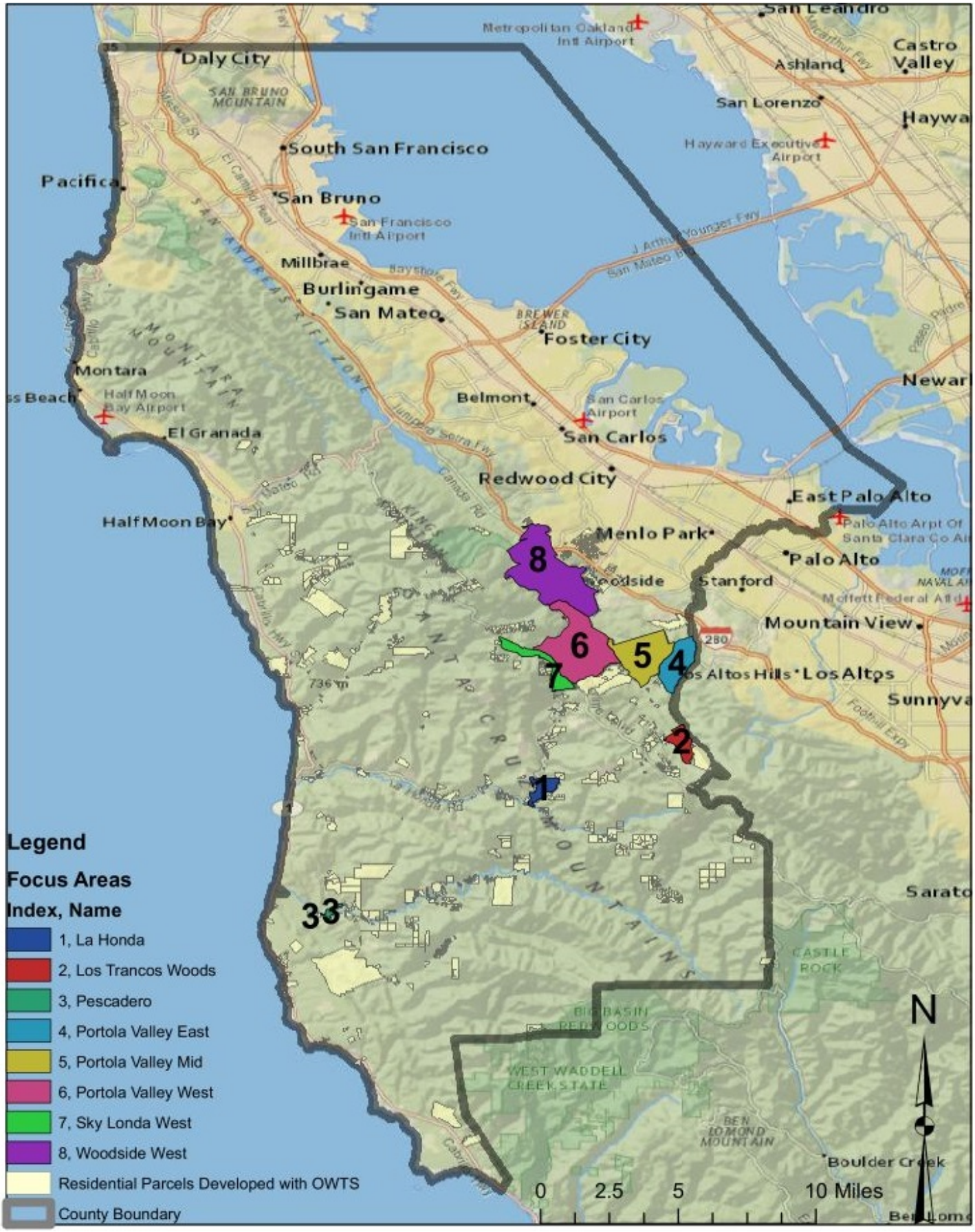
Table 2-5 summarizes OWTS development and wastewater loading information for eight (8) localized "OWTS Focus Areas", chosen for a more in-depth analysis based on the number and/or density of OWTS or other factors. These areas account for about 65% of the total number of OWTS in the county. All of the Focus Areas are within the S.F. Bay Region, including five (5) that drain to San Francisco Bay, and three that drain to the Pacific Ocean. The locations of these areas are shown in **Figure 2-4**. Detailed maps and wastewater loading information, including nitrate-nitrogen estimates developed for these Focus Areas is provided in **Appendix B**.

Table 2-5. Focus Areas – OWTS Usage and Wastewater Loading

Name	Primary Receiving Waters Surface & Groundwater	Overall Area (ac)	Number of Developed Parcels/OWTS	Median Parcel Size (ac)	Estimated OWTS Discharge (gpd)
1. La Honda	La Honda Creek	301	336	0.3	50,400
2. Los Trancos Woods	Los Trancos Creek	357	254	0.8	38,100
3. Pescadero	Pescadero Creek, Pescadero Valley GW Basin	73	73	0.3	10,950
4. Portola Valley East	Los Trancos Creek	791	235	1.2	35,250
5. Portola Valley Mid	Corte Madera Creek, Searsville Lake	1,341	464	2.2	69,600
6. Portola Valley West	Sausal Creek, Searsville Lake	2,256	560	1.6	84,000
7. Skylonda West	La Honda Creek	513	158	0.5	23,700
8. Woodside West	West Union Creek	2,763	787	1.7	118,050
Total		-	2,867	-	430,050

Water Quality Management Measures

The following summarizes how key site suitability, land use and development factors have been addressed in the OWTS requirements of San Mateo County's LAMP for protection of water



San Mateo County Local Agency Management Program		**San Mateo County Focus Areas Map**	FIGURE **2-4**

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. San Mateo County Onsite Wastewater Ordinance requires 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 San Mateo 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 percentage of OWTS usage in San Mateo County occurs in the 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 20% or near areas of unstable land masses, the completion of a geotechnical study, including assessment of hydrogeologic conditions, water movement and slope stability.

3. **Groundwater Conditions.** Groundwater conditions are of importance for OWTS usage in San Mateo County due to the generally high rainfall conditions, hilly terrain and interactions between groundwater and numerous coastal streams. Also, while most of the county is served by public water systems, certain parts of the coastal and mountainous areas of the county rely on local aquifers for both public and private water supplies in areas where OWTS discharges may be within the contributing watershed/recharge area. Site evaluation practices include requirements for documenting groundwater conditions, which include procedures for wet weather observations (see Onsite Systems Manual – Sections 2.1 and 2.3). Documentation of groundwater levels, in combination with soil permeability (percolation rate), provide the basis for selection of the appropriate OWTS design and maintenance of an appropriate 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 feet for conventional OWTS, increased from the prior historical 3-ft requirement;
- Reduced vertical separation distance of 3 feet, based on inclusion of supplemental treatment and/or alternative dispersal designs (e.g., pressure distribution, drip dispersal) found to provide more effective use of the shallow unsaturated soil zones for improved absorption and biodegradation of wastewater constituents, including pathogens.
- No provision for vertical separation distance of less than 3 feet.

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

4. **Areas with High Usage of Domestic Wells.** Most development in San Mateo County is served by public water systems. Domestic wells are used to a moderate extent in the more rural areas of the county. The higher concentrations of domestic wells and OWTS tend to be on larger parcels within the Santa Cruz Mountains in areas outside of housing concentrations. Measures to assure protection of existing and new domestic water supply wells from the effects of OWTS include the following:

    - Minimum horizontal setback distances between OWTS and water wells consistent with requirements of the SWRCB OWTS Policy;
    - Water well testing, review and approval by EHSD for any new development;
    - Provision in County Ordinance (Section 4.84.180) for EHSD to require completion of cumulative impact studies for new OWTS proposals in areas of water quality concern (see additional discussion below). This may include areas of high domestic well usage.
    - Availability of alternative treatment and dispersal technologies to mitigate documented or potential impacts to groundwater in areas of high domestic well usage.
    - The EHSD anticipates giving special attention to ongoing review of OWTS and water quality data in areas of high domestic well usage as part the Water Quality Assessment Program under this LAMP (see **Section 6**).

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 San Mateo County Onsite Wastewater Ordinance are consistent with current and historical policies and guidelines of the San Francisco Bay and Central Coast Regional Water Quality Control

Boards. They address setbacks to springs, drainage ditches/swales, watercourses, and reservoirs.

2. **Alternative treatment and dispersal technologies.** The County's updated Ordinance includes alternative treatment and dispersal technologies that provide greater flexibility and options for system repairs than have historically been available in San Mateo County. This will have two positive effects for surface water quality protection: (1) the use of alternative 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) alternative 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.

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. The County's new Onsite Systems Manual requires that erosion control measures be implemented in connection with the installation of OWTS.

4. **Flood protection measures.** Proximity to the floodplain is considered in the siting and design of OWTS. The County Ordinance requires that OWTS be located outside of low-lying areas that experience annual flooding. OWTS designers also routinely take into consideration and incorporate measures to ensure against flooding impacts from extreme events, including for example: (a) protection for OWTS supplemental treatment and mechanical/electrical 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 San Mateo County warranting special concern and enhanced water quality protection are the reservoirs and creeks that serve as a local source of supply for drinking water, along with the land uses and activities in the source watershed areas. These include portions of Tunitas Creek, San Gregorio (and Alpine) Creek, La Honda Creek, Pescadero Creek and Butano Creek watersheds. In accordance with the requirements of SWRCB OWTS Policy, San Mateo 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 (and State Small 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)

There are no water bodies in San Mateo County currently listed as impaired for nitrogen. However, the following are listed as impaired for pathogens and are located in areas where there may be contributions to the impairment from OWTS:

- Pacific Ocean at Fitzgerald Marine Reserve (proposed to be de-listed during 2016)
- San Vicente Creek
- Pacific Ocean at Pillar Point Beach (no known OWTS within setback)
- San Gregorio Creek
- Pomponio Creek

Figure 2-5 provides a map showing the location and extent of the above-listed impaired water bodies. Detailed maps including parcel boundaries and identification of 600-ft management boundaries are provided in Section 6 of the Onsite Systems Manual. The County's updated Ordinance and Onsite Systems Manual include provisions implementing Advanced Protection Management requirements consistent with Tier 3 of the SWRCB Policy, including the following:

(1) Compliance with OWTS requirements of any applicable Total Maximum Daily Load (TMDL) implementation plan, if and when adopted (Note: No relevant TMDLs issued to date);

(2) Operating permit for any new, replacement or expanded OWTS within 600 feet of an impaired water body;

(3) Supplemental treatment for pathogens or nitrogen, as applicable, for any new, replacement or expanded OWTS within 600 feet of an impaired water body.

Items (2) and (3) above will be implemented on an interim basis for the above-listed water bodies until such time as the requirements are replaced by those specified in an adopted TMDL or the water body is de-listed.

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) is addressed in San Mateo County primarily through Ordinance requirements under Section 4.84.180 that call for the completion of cumulative impact assessments for certain types of projects or locations, including consideration of such factors as the constituent levels (e.g., nitrogen content) in the wastewater, the volume of wastewater flow, the density of OWTS discharges in a given area, and/or the sensitivity and

San Mateo County Local Agency Management Program		**San Mateo County Impaired Water Bodies**	FIGURE **2-5**

beneficial uses of water resources in the discharge area. Guidelines for such studies are contained in the Onsite Systems Manual (Section 2.E and Attachment A). The guidelines 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 also allows for the County to designate areas of special environmental concern for OWTS that may be identified from the results of cumulative impact studies. Any new subdivision utilizing OWTS with lot sizes smaller than 2.5 acres requires cumulative impact assessment to evaluate nitrogen loading.

Additionally, the new Ordinance provisions allowing the use of alternative 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 throughout the mountain regions of the county. Some of the highest concentration of these OWTS is in areas such as La Honda and Loma Mar, where properties were originally developed for seasonal/recreational cabins and have converted over the years to year-round residences. Many of the properties are very small (e.g., less than one-third acre), with OWTS constructed prior to adoption of modern codes. Some systems may consist of cesspools, and repairs/replacement systems tend to be very challenging. Non-conformance with adopted setback requirements (e.g., from structures, water features, etc.) may also be encountered.

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

1. Availability of alternative treatment and dispersal system designs to provide more effective upgrades and repairs for lots having limited area, soil limitations or other constraints for conventional OWTS; and

2. The 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.

Section 3:
OWTS Siting, Design, and Construction Requirements

Site Evaluations for Onsite Wastewater Treatment Systems

(a) For all locations where an OWTS is proposed to be installed, a site evaluation shall be conducted prior to permit approval to verify conformance with applicable horizontal setbacks, ground slope, soils and groundwater requirements as prescribed in County Code, Section 4.84.120.

(b) Site evaluation methods shall include soil profiles, percolation tests and other exploratory tests, as necessary, to verify adequate depth and permeability of soil, and vertical separation between dispersal field and groundwater for both primary and reserve dispersal areas.

(c) Testing shall be conducted in accordance with standards and guidelines provided in the Onsite Systems Manual.

(d) For new divisions of land, soil profiles, percolation tests and groundwater determinations are required on every parcel

Siting Criteria for OWTS

Siting criteria for OWTS are specified in County Code, Section 4.84.120 and restated in the Onsite Systems Manual (Section 3). The siting criteria address the following:

(a) **Within property boundaries.** Placement of all OWTS components within the boundaries of the property served;

(b) **Soil depth.** Minimum soil depth below dispersal field;

(c) **Soil cover.** Minimum soil cover over dispersal field; no placement in fill soil;

(d) **Soil percolation rates**. Minimum and maximum soil percolation rates;

(e) **Underground utilities.** Avoidance of underground utility trenches;

(f) **Depth to groundwater**. Minimum required vertical separation to groundwater below dispersal field;

(g) **Areas of flooding.** Avoid locating OWTS in areas subject to flooding;

(h) **Accessible.** Accessibility for maintenance and repairs;

(i) **Traffic areas.** Avoid locating OWTS in areas subject to vehicular traffic or other compaction;

(j) Ground slope. Maximum ground slope in the dispersal field area and geotechnical report requirements;

(k) Horizontal setbacks. Minimum horizontal setback distances between OWTS components and wells, water bodies, and various other site features;

Wastewater Flows for OWTS Design

- **Single Family Residences and Second Units:** Based on a factor of 150 gal/day per bedroom. For a primary residence and secondary dwelling unit flows determined independently, regardless of whether the flows are treated separately or combined in a single OWTS.

- **Multiunit Residences and Non-residential Facilities:** Based on full consideration of projected activities, occupancy, and facilities. Primary references are guidelines provided in the 2002 US EPA Onsite Wastewater Treatment Systems Manual (Chapter 3). Where not covered in EPA, may be based on other appropriate literature references or (b) documented wastewater flow for a comparable facility. Minimum design flow for any OWTS shall not be less than 150 gpd.

- **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. Where used, OSM requires:

    - septic tank capacity be sized for peak daily flow;
    - design flow supplemental treatment unit(s) and/or the dispersal field may be based on the equalized (“average”) flow rate;
    - supporting engineering calculations and operational specifications must be provided; and
    - operating permit (per OWTS Ordinance section 4.84.170) will be required.

Conventional OWTS Requirements

Where an OWTS is required, it shall, at a minimum, consist of a septic tank and subsurface dispersal system for absorption and leaching of the effluent into the soil (Conventional 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 accompanying rules, regulations and guidelines prescribed by Environmental Health and contained in the Onsite Systems Manual.

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

Septic Tank Requirements

(1) Ma**terials for Construction –** concrete or alternative durable material.
(2) **Size of tank -** 1,500 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 –** accessible for pumping; in driveways/parking if traffic-rated; gravity flow from house plumbing; 8-inches minimum soil cover; water-tightness testing in place.

Dispersal System Requirements

(1) **Trench Specifications -** Width, spacing, diversion valve, on contour, piping, min/max length, materials.
(2) **Drain Field Sizing, Residential -** Based on number of bedrooms and percolation rate; standard up to 8-feet deep; 100% reserve area required.
(3) **Drain Field Sizing, Multifamily and Non-Residential –** Based on peak daily flow, effective trench sidewall area, and wastewater application rates related to percolation rate per **Table 3-1**; dual 200% dispersal system required.
(4) **Trench Construction -** level trenches, on contour, dry soil conditions, inspection standpipes.
(5) **Construction Inspection by EHSD -** Pre-construction staking; open trench dimensions; drain rock and pipe materials/placement; diversion valves(s); septic tank connections; final inspection and as-builts.

Table 3-1
Wastewater Application Rates for Drain Field Trench Sizing[1]
For Multifamily and Non-residential Installations

Percolation Rate		Wastewater Application Rate (gpd/ft^2)
Inches /Hr	Min per Inch	
> 12	< 5	Not Permitted
12.0	5	1.20
6.0	10	0.80
2.5	24	0.60
2.0	30	0.56
1.5	40	0.49
1	60	0.35
0.75	80	0.20
< 0.75	> 80	Not Permitted

[1] Interpolate between reference values for other percolation rates;

Alternative OWTS Requirements

San Mateo County Onsite Wastewater Ordinance defines "Alternative OWTS" as a type of OWTS that utilizes either: (a) a method of wastewater treatment other than a conventional septic tank for the purpose of producing a higher quality wastewater effluent; or (b) a method of wastewater dispersal other than a gravity fed drain field trench for effluent dispersal. "Supplemental treatment systems", as defined in the SWRCB OWTS Policy fall into the category of alternative OWTS. Additionally, by definition, any OWTS that includes the use of a pump system for effluent treatment and/or distribution is also considered to be an alternative OWTS in San Mateo County. The following summarize San Mateo County OWTS Ordinance requirements pertaining to the use of alternative OWTS.

Principles and General Requirements

The use of alternative systems in San Mateo County will be guided by the following principles and general requirements:

1. Supplemental treatment systems may be used to produce higher quality of wastewater effluent beyond that provided by a conventional septic tank and improve the performance of and siting options for the dispersal system.

2. Only those supplemental treatment systems (also termed “advanced” treatment) as listed in the Onsite Systems Manual shall be approved for use in San Mateo County.

3. All alternative dispersal systems installed in San Mateo County must be below-grade systems. Only those alternative dispersal systems as listed in the Onsite Systems Manual shall be approved for use in San Mateo County.

4. Alternative OWTS consisting of pressure-distribution dispersal methods shall be required on slopes exceeding thirty five percent (35%), and for areas with average soil percolation rate between 0.75 and 1.0 inches per hour.

5. Alternative OWTS may be permitted by Environmental Health for the repair or upgrading of any existing OWTS where it is determined that sewage cannot be disposed of in a sanitary manner by a conventional septic tank and gravity flow dispersal field system.

6. Alternative OWTS utilizing shallow subsurface drip dispersal may be permitted by Environmental Health for new construction on any legally-created parcel where Environmental Health determines such system would provide equal or greater protection to public health and the environment than a conventional or pressure-dosed trench dispersal field system. However, both a primary and reserve leaching system for a conventional or pressure-dosed trench dispersal system shall be designed, area reserved and such system could still be installed, if required. The area of the installed shallow subsurface drip dispersal system and the reserved conventional or pressure-dosed trench dispersal system can overlap as long as the operation of the shallow drip dispersal system will not affect the potential future function of trench dispersal system.

7. Alternative OWTS, including supplemental treatment of effluent, may be required by Environmental Health for any new construction or repair where three (3)-foot separation from base of distribution to groundwater was previously investigated and approved by Environmental Health prior to the effective date of the San Mateo County OWTS Ordinance.

8. Alternative OWTS, utilizing supplemental treatment of effluent, may be required by Environmental Health for any new construction or repair within designated impaired areas as described in the OWTS Ordinance Article 6.

9. All alternative systems must be installed by a contractor duly licensed by the Contractors State Licensing Board of the State of California to install OWTS. Where the installation includes a proprietary treatment system, the contractor shall also possess any required manufacturer certifications, as applicable.

10. Notwithstanding any other provisions of the OWTS Ordinance, Environmental Health shall have the authority to deny and/or require modifications to any alternative OWTS proposal where, in their opinion, such proposal poses an unacceptable threat to public health and/or water quality.

Permitting and Review Requirements

1. Engineering plans and site evaluation data for alternative OWTS shall be submitted in accordance with application procedures prescribed in the OSM.

2. Engineering plans for alternative OWTS shall be prepared and signed by a California Registered Civil Engineer, Professional Geologist, or Registered Environmental Health Specialist who is knowledgeable and experienced in the field of onsite wastewater treatment and dispersal. The designer shall also be responsible for inspection of system installation to assure conformance with approved plans, and shall provide an "As-Built" drawing of the installation to Environmental Health and the property owner.

3. Engineering plans will be reviewed by Environmental Health and, where warranted, Environmental Health may refer the plans to the applicable California Regional Water Quality Control Board staff and/or external third-party consultant(s) for additional review, the costs for which would be the responsibility of the applicant.

4. Upon completion of installation, a release letter shall be submitted by the system designer that the system has been installed and is functioning as designed.

Operating permits

A County-issued operating permit is required for all alternative systems. Operating permits are intended to serve as the basis for verifying the adequacy of alternative system performance and ensuring on-going maintenance, including requirements for system inspection, monitoring and reporting of results to Environmental Health, along with the requirement for permit renewal, typically on an annual basis. An OWTS operating permit gives Environmental Health right of inspection. In addition, failure to comply with requirements of an OWTS operating permit may subject the system owner or user to administrative enforcement and fines.

Alternative OWTS Performance Monitoring and Reporting

A monitoring program will be established for each alternative OWTS as a condition of the operating permit at the time of permit issuance, and may be amended at the time of permit renewal. Monitoring shall be performed to ensure that the alternative OWTS is functioning satisfactorily to protect water quality and public health and safety. The monitoring program will be in accordance with guidelines prescribed in the OSM.

Environmental Health will compile and review monitoring and inspection results for alternative OWTS and periodically provide a summary of results to the San Francisco Bay and Central Coast Regional Water Quality Control Boards. Based on this review, Environmental Health may require corrective action for specific properties or certain types of alternative OWTS, or general changes in monitoring and inspection requirements.

Alternative OWTS Siting Criteria, Design and Construction Requirements

All requirements specified in the OWTS Ordinance for conventional OWTS also apply to alternative OWTS with the following exceptions:

- **Reduced vertical separation distance to groundwater**. Vertical separation distance between trench bottom and groundwater may be reduced from five (5) feet to three (3) feet by utilizing supplemental treatment OWTS or pressure distribution dispersal system in compliance with criteria as prescribed in the Onsite Systems Manual.

- **Required use on slopes over 35% and percolation slower than 0.75 in/hr.** Alternative distribution systems shall be required on slopes exceeding thirty five percent (35%), and for areas with average soil percolation rate between 0.75- and one (1.0-) inches per hour.

Design and construction of alternative OWTS shall be in conformance with requirements as prescribed in the Onsite Systems Manual.

Section 4:
Special OWTS Management Issues

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

OWTS Inspection, Monitoring, Maintenance and Repair

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

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

Activity	Code or OSM* Section	Inspections	Monitoring	Maintenance & Repairs**
Building Additions & Remodels	OSM: Sec 1, 5	OWTS performance inspection required at time of application for building addition or remodel (OSM Section 1); procedures specified in OSM, Section 5.	May involve water sampling, dye testing or other monitoring	Maintenance and/or repair work may be required as a result of inspection findings.
Septic Tank Pumper Inspections	OSM: Sec 1	Basic walk-through inspection of OWTS conducted by septic tanks pumper in conjunction with pump-out of any septic tank.	N/A	Maintenance and/or repair work may be recommended or required as a result of inspection findings.
Operating Permits	Code: 4.84.155 OSM: Sec 1, 4, 5	Regular inspections of OWTS according to terms of operating permit for (a) alternative systems; (b) large flow OWTS, >2,500 gpd; (c) holding tanks; and (d) other OWTS at EH discretion.	Monitoring of OWTS under terms of operating permit, 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.
Property Transactions (Voluntary)	N/A	Basic walk-through inspection of OWTS conducted by independent maintenance provider or professional in conjunction with sale of a property or re-financing.	May involve water sampling, dye testing or other monitoring	Maintenance and/or repair work may be recommended or required as a result of inspection findings.
Complaint Investigations (Abatement)	Code: 4.84.190	Inspections of OWTS by EH staff in response to complaints or observed violation(s).	May involve water sampling, dye testing or other monitoring	Maintenance and/or repair work may be required as a result of inspection findings.

*OSM=Onsite Systems Manual **Repairs addressed in Code Section 4.84.130

OWTS Near Impaired Water Bodies

There are no water bodies in San Mateo County currently listed as impaired for nitrogen; however, the following are listed as impaired for pathogens:

- Pacific Ocean at Fitzgerald Marine Reserve (proposed to be de-listed during 2016)
- San Vicente Creek
- Pacific Ocean at Pillar Point Beach (no known OWTS within setback)
- San Gregorio Creek
- Pomponio Creek

The County's updated Ordinance and Onsite Systems Manual include provisions implementing Advanced Protection Management requirements consistent with Tier 3 of the SWRCB Policy, including the following:

(1) Compliance with OWTS requirements of any applicable TMDL implementation plan, if and when adopted (Note: No TMDLs issued to date);

(2) Supplemental treatment for pathogens or nitrogen, as applicable, for any new, replacement or expanded OWTS within 600 feet of an impaired water body.

(3) Operating permit for any new, replacement or expanded OWTS within 600 feet of an impaired water body;

Variances and Exceptions

Provisions for granting of exemptions to OWTS Ordinance requirements are summarized below:

A. Exemption Process. Code Section 4.84.185 addresses the process for EHSD to grant an exemption (variance) to any requirements of the Code or Onsite Systems Manual (OSM) and stipulates the following conditions must be met:

1. The exemption will not harm the public health, safety and welfare of the people or the environment of San Mateo County;
2. The basis for the exemption does not result from an intent to avoid the requirements of the Code or OSM.
3. The exemption will not have any adverse environmental effect on the use of the subject and adjoining properties.

The decision by EHSD may be appealed to the Board of Supervisors

B. Exemptions Prohibited.

1. No exemptions (variances) are permitted to prohibitions 1 through 9 listed in Section 5 of this LAMP.
2. No exemptions will be considered for the following:
   a. OWTS installation on slopes of 50% or greater, unless an OWTS Failure exists such that Environmental Health determines that the repair of the OWTS cannot be made in any other manner and the repair can be made in a way that still safeguards public health and the environment;
   b. OWTS installation for new development on property other than the property being served;
   c. In connection with land division application;
   d. Where there is a conflict with any other applicable State statute, regulation County ordinance, or local municipal code, ordinance or operating rules, without concurrence of the enforcing authority.

C. OWTS Repairs. Code Section 4.84.130 specifies repairs or alterations to OWTS must comply with applicable requirements of the County OWTS ordinance and Onsite Systems Manual "… to the maximum extent practicable." This may include the need for the processing of an exemption in accordance with Section 4.84.185, as outlined in (A) above. While all potential exemptions would be evaluated and documented by EHSD, in the case of repairs the formal exemption process may only be required where additional investigation is needed which would necessitate collection of additional fees to cover EHSD time, or where significant additional documentation or processing time is needed in review of the proposed repair or exemption.

D. Appeals. Code Section 4.84.085 allows for any applicant to appeal the decision of EHSD regarding action taken on a permit (e.g., denial, suspension or revocation) related to an element of the OWTS design, installation, repair or destruction. Such appeals are made to the Board of Supervisors, who may reject, affirm or modify the Environmental Health decision at issue.

Professional, Contractor and Maintenance Provider Qualifications

San Mateo County Ordinance requirements pertaining to qualifications for OWTS professionals, contractors and maintenance providers are summarized in **Table 4-2**.

The qualification notations and terminology in **Table 4-2** have the following meanings:

- RCE: Registered Civil Engineer
- REHS: Registered Environmental Health Specialist
- PG: Professional Geologist
- CEG: Certified Engineering Geologist

- Certified Septic Tank Pumper: Certified by San Mateo County EHSD in accordance with Ordinance Code Section 4.84.055 and Onsite Systems Manual Section 1.
- Wastewater Maintenance Provider: An individual registered having experience in the construction and/or operation of OWTS as evidenced by the either of the following:
  - Possession of a valid contractor's license (A, C-36 or C-42)
  - 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 Director.

Table 4-2. Qualifications for OWTS Practitioners

OWTS Activity	Required Work	Code or OSM* Section	Minimum Qualifications
Site Evaluation	Conduct field studies and evaluation of geology, soils, percolation, groundwater, slopes and other factors for design and use of OWTS	Code: 4.84.015 OSM: Sec 1, 2	EHSD staff RCE, REHS, PG EHSD-Certified Soil Percolation Tester
System Design	Prepare plans and supporting design analysis required for permitting and installation of OWTS	Code: 4.84.025, 4.84.165 OSM: Sec 1, 2	Qualified OWTS Design Professional (RCE, REHS, PG)
System Installation	Install OWTS in accordance with approved plans and permit conditions issued by EHSD	Code: 4.84.050 OSM: Sec 1	• General Engineering License, Class A • Class C-36 (Plumbing) • Class C-42 (Sanitation) Exception: Homeowner may install a conventional OWTS on their own property.
Cumulative Impact Assessment	Assess nitrate loading, groundwater mounding or other cumulative impacts of OWTS for flows >2,500 gpd or as otherwise required by EHSD	Code: 4.84.180 OSM: Sec 2	RCE, PG
Geotechnical Assessment	Assess slope stability, drainage and other geotechnical issues for OWTS located on slopes over 20%	Code: 4.84.120 OSM: Sec 2	RCE or PG (with CEG certificate or equivalent experience)
Performance Evaluation	Conduct performance evaluation of OWTS for building addition/remodel project, failure investigation or as otherwise required by EHSD	OSM: Sec 1, 5	RCE, REHS, PG Onsite Wastewater Provider, or EHSD-Certified Septic Tank Pumper
Septic Tank Pumping & Report	Pump and haul septage;	Code: 4.84.055 OSM: Sec 1	EHSD-Certified Septic Tank Pumper
Alternative System Inspection and Monitoring	Perform inspection, monitoring and reporting of alternative OWTS in accordance with conditions of operating permit issued by EHSD	Code: 4.84.160 OSM: Sec 1, 5	RCE, REHS, PG or Onsite Wastewater Provider

*OSM=Onsite Systems Manual

Education and Outreach

San Mateo County's LAMP includes the following provisions for education and outreach regarding OWTS:

A. **Website - Informational Material.** The EHSD 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.

B. **OWTS Operation and Maintenance Guidelines.** San Mateo County Onsite Systems Manual requires operation and maintenance guidelines to be provided to the OWTS owner (and EHSD) for each new or replacement OWTS by either the system designer or installer. This applies to both conventional and alternative OWTS. Final approval of system installation is contingent upon confirmation that the required operation and maintenance guidelines have been provided.

C. **Alternative Systems Operating Permits.** Owners of alternative OWTS will be issued an ongoing operating permit that specifies ongoing inspection, monitoring and reporting requirements for the system. Although the work will be conducted substantially by qualified maintenance providers, the system owner is ultimately responsible for compliance under the operating permit, which will indirectly promote an improved level of education and understanding of the OWTS operational requirements.

Septage Management

Based on an average pumping frequency of once every five (5) years and a pump-out volume of 1,500 gallons per tank, the estimated annual volume of septage generated by the approximately 4,400 OWTS in San Mateo County is on the order of 1.3 million gallons. This equates to an average of two to three pump-outs per day.

There are about a half-dozen septic tank pumping companies that service septic tanks in the county. Septage is hauled for disposal primarily at five municipal wastewater facilities: (1) Palo Alto Wastewater Treatment Plant; (2) Silicon Valley Clean Water facility in Redwood City; (3) East Bay Municipal Utility District (EBMUD) Wastewater Treatment Plant in Oakland; (4) Santa Cruz Wastewater Treatment Plant; and (5) San Jose/Santa Clara Regional Water Pollution Control Plant in San Jose.

Onsite Maintenance Districts

Presently there are no onsite wastewater maintenance districts in San Mateo County and none are currently under consideration. 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 newly adopted Onsite Wastewater Treatment Systems Ordinance and within the provisions of this LAMP, including: (a) operating permits for alternative OWTS and certain other OWTS based on system size or other factors; and (b) requirements for water quality assessment and reporting to the RWQCB. In the future, should a need arise for additional focused OWTS management activities or community-type wastewater solutions in given geographical areas of the County, 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.

Of note is a related type of onsite wastewater management program operated by West Bay Sanitary District, which provides sewer service to the Portola Valley, Woodside, Menlo Park, Atherton and East Palo Alto areas. The sanitary district has aided the extension of sewer connections for properties served by existing OWTS, especially in the hilly Portola Valley area, by allowing and facilitating the installation of STEP (septic tank effluent pump) sewers. The STEP sewers are less expensive and more suited to the hilly terrain than conventional gravity sewers, allowing properties distant from the sanitary sewer main to be connected when the onsite system is no longer functional and replacement or expansion is infeasible.

Regional Salt and Nutrient Management Plans

Groundwater resources of greatest significance in San Mateo County are the Westside Basin and the San Mateo Plain, which coincides almost entirely with the urban areas. The other groundwater basins are relatively small coastal basins. Regional salt and nutrient management is not a significant concern for the groundwater basins in the county, and there is no indication from the RWQCB of any planning effort underway or anticipated in the foreseeable future. Estimates have been made of wastewater discharge volumes, and nitrate loading contributions to groundwater from the approximately 4,400 existing OWTS in San Mateo County and are provided in **Appendix B**. Estimates have been developed for each of the watershed areas in the county where there are significant numbers of OWTS. This information will be made available for use in nutrient management studies in the future.

Watershed Management Coordination

The Environmental Health Services Division has been a key participant in the San Mateo County Stormwater Pollution Prevention Project (STOPP), as well as Beach Monitoring under a grant agreement with the SWRCB, primarily in the sampling and analysis of surface water samples at ocean, bay, and creek locations for assessment of bacteriological conditions and impacts to recreational uses. **Table 4-3** provides a list of creek mouth locations where EHSD conducts weekly sampling for total coliform and E. coli.

Additionally, with the development and implementation of this LAMP, the EHSD will be maintaining GIS-based information on OWTS densities, wastewater loading, functioning status

and water quality factors that will be a useful reference for watershed management activities in the future.

Table 4-3.
Creek Mouth Bacteriological Sampling Locations,
San Mateo County*

Calera Creek
San Pedro Creek, Linda Mar
Martini Creek (at Montara Beach)
San Vicente Creek (at Fitzgerald)
North Roosevelt Ditch (Naples Creek)
South Roosevelt Ditch
Frenchman's Creek (at Venice-North)
Pilarcitos Creek (at Venice-South)
San Gregorio Creek
Pomponio Creek
Pescadero Creek
Bean Hollow Creek
Gazos Creek

***sampled weekly by EHSD for total coliform and E. coli

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 (Section 4.84.040) for connection to public sanitary sewer where the property is within 200 feet of an available sewer.

(2) Permit application form to be completed and filed by the system designer and/or contractor includes an entry related to sewer line proximity.

(3) EHSD permit review includes sewer proximity as a checklist item for certain geographical areas of the County.

OWTS Notification to Public Water System Owner(s)

Under San Mateo County Onsite Wastewater Ordinance (Section 4.84.120) 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) EHSD 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 San Mateo County:

a. **State Small Drinking Water Systems.** San Mateo County Environmental Health regulates small systems under the State Small Water Systems Program. A State Small Water System is a system that serves water to 5 to 14 service connections and fewer than 25 people daily for at least 60 days out of a year. Information on the location of public water wells and public water system surface water intakes for State Small Drinking Water Systems are maintained by EHSD and will be routinely available for review in connection with applications for new and replacement OWTS.

b. **State Large Drinking Water Systems.** The SWRCB Drinking Water Division (DDW) regulates small and large public drinking water systems. This includes water systems that serve 15 or more service connections or 25 people daily for at least 60 days out of the year. EHSD 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.

(2) At the time of permit application for any new or replacement OWTS, EHSD staff will review the location of the proposed OWTS in relation to known public water wells and surface water intakes using information available per (1a) and (1b) above.

(3) Where EHSD 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, EHSD 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, EHSD 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 SWRCB OWTS Policy (May 13, 2013), and the dispersal field does not meet the specified OWTS horizontal setbacks (per Section 4.84.120) from public water wells or 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) Completion of a cumulative impact analysis regarding nitrate loading effects (per Ordinance Section 4.84.185) if the setback issue involves a public water well; and
(7) Other measures as specified by EHSD.

On a case by case basis, EHSD may establish alternative OWTS siting and operational requirements to those listed above where it is determined by EHSD 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 (per Section 4.84.120) from public water wells or 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 EHSD, unless EHSD 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 San Mateo County Onsite Wastewater Ordinance (Section 4.84.105). However, due to the age of many homes in the County (>75 years old), especially in mountain and coastal areas, it is assumed that some cesspools may still exist and will 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/remodeling projects. Newly adopted requirements related to septic tank servicing also provides an opportunity for septic pumping contractors to discover the existence of cesspools, report the findings to the County, and advise homeowners on abandonment requirements and options. Under the new ordinance, the expanded range of alternatives for system repairs/replacement is expected to provide some incentives and options to accelerate the gradual phase-out of the remaining cesspools in the County.

Section 5: Prohibitions

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

1. ***Cesspools.*** The use of cesspools for sewage disposal is not authorized under San Mateo County Onsite Wastewater Ordinance (Section 4.84.105).

2. ***OWTS over 10,000 gpd capacity.*** San Mateo County Onsite Wastewater Ordinance applies to any OWTS where the maximum daily flow volume of waste produced is 10,000 gpd or less (Section 4.84.030). 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, the method of treatment and dispersal must be approved by either the San Francisco Bay RWQCB or Central Coast RWQCB, as applicable.

3. ***OWTS with surface discharge.*** Surface discharge of wastewater from an OWTS is not authorized under San Mateo County Onsite Wastewater Ordinance. Section 4.84.140 of the Ordinance defines dispersal systems as consisting only of "…an approved method for subsurface infiltration and absorption of wastewater effluent…" Additionally, Section 4.84.145 requires that "All alternative dispersal systems installed in San Mateo County must be below grade systems."

4. ***OWTS on steep slopes without slope stability report.*** San Mateo County Onsite Wastewater Ordinance Section 4.94.120(i) requires that any OWTS dispersal field located on slopes greater 20% shall require a geotechnical assessment and report addressing slope stability, drainage and other pertinent geotechnical factors affecting the operation and and/or impacts from the construction and use of the proposed OWTS.

5. ***Sizing reductions for IAPMO certified dispersal systems.*** San Mateo County Onsite Wastewater Ordinance Section 4.84.140(a) allows for the use of chambers or alternative filter material in place of standard drain rock in dispersal trenches. However, no reduction in drainfield sizing is permitted for such such methods/materials, regardless of whether or not they are certified by IAPMO.

6. ***Supplemental treatment systems without monitoring.*** Under the San Mateo County Onsite Wastewater Ordinance supplemental treatment is defined as an alternative system and, as such, is required to be inspected and monitored in accordance with an operating permit issued by the EHSD per Code Section 4.84.155(a).

7. ***OWTS for RV Dump Stations.*** San Mateo County Onsite Wastewater Ordinance pertains to the treatment and dispersal of domestic wastewater which, by definition in the SWRCB

OWTS Policy (included by reference in Ordinance Section 4.84.025) does not include wastewater from industrial processes or recreational vehicle (RV) dump stations. 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 RWQCB for permitting. 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.*** San Mateo County Onsite Wastewater Ordinance Section 4.84.120(b) sets forth minimum siting requirements for OWTS dispersal fields, which specifies a minimum vertical separation distance of three (3) feet to groundwater below the dispersal field, applicable to trenches or drip dispersal methods. Per Section 4.84.105 of the Ordinance, seepage pits are not allowed in San Mateo County.

9. ***Where public sewer connection is available.*** San Mateo County Onsite Wastewater Ordinance (Section 4.84.040) requires connection to an available public sewer, subject to approval by the sewer authority and the San Mateo County Local Agency Formation Commission, for: (a) newly proposed structures requiring sewage disposal that are within 200 feet of an available public sewer; and (b) developed property where structures served by an existing OWTS are within 200 feet of an available public sewer, at the time of OWTS failure or when replacement or addition to the OWTS is required.

10. ***Proximity to public water system wells and surface water intakes.*** San Mateo County Onsite Wastewater Ordinance Section 4.84.120(j) 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 10-feet deep
    - 200 feet for any dispersal system greater that 10-feet deep.
    - Completion of 2-yr microbial transport study for any OWTS >20-ft deep and within 600 feet.

    (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, EHSD will require the replacement OWTS to incorporate supplemental treatment and other measures, as appropriate, unless EHSD 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, EHSD will require the new OWTS to incorporate supplemental treatment, including pathogen removal, plus other requirements noted below. In accordance with SWRCB 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:

(1) providing a minimum vertical separation to groundwater of three (3) feet below the bottom of the dispersal field;
(2) providing a minimum dispersal field soil cover of 12 inches;
(3) completion of a cumulative impact analysis regarding nitrate loading effects (per Ordinance Section 4.84.180) if the setback issue involves a public water well; and
(4) other measures as specified by EHSD.

On a case-by-case basis, EHSD may establish alternative OWTS siting and operational requirements to those listed above where it is determined by EHSD 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 EHSD 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 Coast RWQCB. This includes:

- Installation permits issued for new, repair and replacement OWTS;
- OWTS variances and/or exemptions issued, including number, location and description;
- Operating permits issued for alternative systems, OWTS with flows >2,500 gpd, or other OWTS where EHSD has determined the need for an operating permit.

Water Quality Assessment Program

Objectives

The EHSD 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.

Watershed and Focus Area Approach

It is anticipated that the OWTS-water quality assessment will be organized according to the various watershed areas and special Focus Areas, including La Honda, Los Trancos Woods, Pescadero, Portola Valley, Skylonda, and Woodside, delineated and presented in **Section 2** and **Appendix B** of this LAMP, and utilized in supporting GIS studies. This will allow the existing GIS-based mapping, OWTS inventories, and nitrate loading analyses to be utilized, updated and tracked over time. Other localized Focus Areas may be delineated in the future if warranted.

Operational Status of OWTS

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

(1) Septic tank pumping/inspection reports;
(2) Complaints and abatement activities for failing OWTS;
(3) Exemptions issued for new and/or repair OWTS;
(4) Performance inspections of existing OWTS in connection with building additions/remodel projects, or property transactions;

(5) Monitoring reports for alternative systems or other OWTS with 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 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 discharges from OWTS will be updated based upon the running inventory of OWTS per above.

(3) **Nitrate Loading.** Nitrate loading estimates (by watershed or focus area) 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 alternative systems operating permits;
- Water quality data from cumulative impact studies;
- Groundwater reports from water districts and others;
- Domestic water wells sampling from new wells or other;
- Public water system raw water quality data monitoring reports;
- Reservoir, stream, bay and ocean water quality sampling data for surface waters in the County and other special studies, such as recreational water quality sampling, weekly bacteriological sampling at creek mouths; sampling by Public Works related to Areas of Special Biological Significance, etc.
- Receiving water sampling performed as part of any NPDES permits**;**
- Groundwater sampling performed as part of Waste Discharge Requirements;
- 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 review 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; and (d) identification of water quality data/areas indicating no apparent issues of concern related to OWTS.

Reporting to RWQCBs

Annual Report

An annual report pertaining to OWTS activities in San Mateo 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 Coast Regional Water Quality Control Board. 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 septic tank pumper inspection reports received per requirements of the County's Onsite Systems Manual; and

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

The report will include: (a) a summary of whether any further actions related to OWTS are warranted to protect water quality or public health; (b) status of water quality data collection and review; and (c) any other information deemed appropriate by Environmental Health.

5-Yr Water Quality Assessment Report to RWQCB

Every five (5) years the annual report to the RWQCB will be accompanied by a Water Quality Assessment Report that summarizes the information and findings from Environmental Health's Water Quality Assessment Program described above. The report will present an overall assessment regarding any evidence of water quality impact from OWTS along with any recommended changes in the LAMP to address the identified impacts. Additionally, any groundwater water quality data generated by the EH 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[3].

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

Appendix A

Supporting Rationale for
San Mateo County OWTS Siting and Design Criteria

Appendix A
Supporting Rationale
for
San Mateo 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 San Mateo 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 are the various requirements and management practices contained in San Mateo County's LAMP that constitute a higher level of water quality and environmental protection relative to OWTS than provided in the Tier 1 requirements.

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.[1] 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.

[1] "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.

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 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 San Mateo 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 alternative treatment and dispersal designs. Horizontal setbacks are the same for all OWTS (conventional and alternative) and are consistent with long-standing criteria contained in the guidelines of the SF Bay and Central Coast 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 dispersal trench to the seasonally high groundwater level (i.e., water table). **Table A-1** lists the depth to groundwater requirements for conventional OWTS in San Mateo County, along with the corresponding groundwater separation requirements contained in the historical guidelines of the San Francisco Bay and Central Coast RWQCB and the Tier 1 requirements in the SWRCB OWTS Policy.

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

Percolation Rate (min per inch)	San Mateo County	SF Bay RWQCB Guidelines (Historical)	Central Coast RWQCB Guidelines (Historical)	SWRCB OWTS Policy Tier 1 Requirements
1-<5	Not Permitted	20	20	20
5-30	5	3	8	8
31-80	5	3	5	5
81-120	Not Permitted	3	5	5

Under San Mateo County's updated OWTS Ordinance, the County will allow the groundwater separation distance to be reduced to 3 feet where either supplemental treatment and/or pressure distribution is provided. A minimum 3-ft separation to groundwater was the historical requirement in San Mateo County for many years until the recent Ordinance update was made to conform more closely to the SWRCB Policy, Tier 1 requirements. There is no evidence indicating any water quality or public health issue with the historical 3-ft groundwater separation requirement; the new requirement mandating either supplemental treatment or pressure distribution will be more conservative (safe). Note also that San Mateo County requirements are more restrictive than State Tier 1 requirements in regard to prohibition of OWTS for areas with percolation rates faster than 5 mpi, and slower than 80 mpi.

The supporting rationale for the allowing a 3-ft vertical separation requirement for alternative 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 alternative treatment and dispersal methods can improve the operation and treatment effectiveness of OWTS as compared with conventional 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 conventional 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 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 conventional septic tank is similar to that in raw sewage, and typically ranges from about 10,000 to 100,000 MPN/100 ml. (Crites and Tchobanoglous, 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 conventional 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 San Mateo County depth to groundwater criteria related to type of OWTS and percolation rates are similar to, and slightly more conservative (protective) than, 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). In several counties these criteria have been applied to new subdivisions as well as for existing lots of record. The San Mateo County LAMP only allows the use of alternative OWTS with 3-ft groundwater separation requirements for existing and future legal lots of record and for repair/replacement of existing OWTS; this option is not permitted to be used as the basis of new lot creation.

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 San Mateo 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 the establishment of an operating permit program for all alternative 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 alternative 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. San Mateo County requirements differ in some respects from the SWRCB Tier 1 criteria, but overall provide an equivalent design approach, as follows:

a. San Mateo 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 a significant safety factor in the San Mateo County design approach.

b. The standard allowance for infiltrative surface in San Mateo County requirements is 12 ft^2 per lineal foot of trench, which exceeds the Tier 1 requirement, but the total amount of effective trench infiltrative area in San Mateo County also exceeds the Tier 1 requirements.

c. **Table A-2** below shows a comparison of the wastewater application rate criteria based on percolation rate for a range of values, including San Mateo County requirements, Tier 1 criteria, US EPA and other SF Bay Area Counties, and the historical guidelines of the SF Bay and Central Coast RWQCB. As can be seen, there are similarities and differences among all of the criteria. San Mateo County requirements agree with Tier 1 in the lower (faster) percolation range, but differ for slower percolation rates. However, the difference in using peak flow rather than average flow (noted above) compensates for the difference in applications rate factor.

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

Percolation Rate (mpi)	San Mateo County LAMP	SWRCB OWTS Policy Tier 1	USEPA Design Manual & SF Bay Counties	SF Bay RWQCB Guidelines*	Central Coast RWQCB Guidelines*
1 - <5	Not Permitted	1.20	1.20 – 1.086	1.58 – 0.82	0.80
5	0.46	1.20	1.086	0.82	0.80
10	0.46	0.80	0.80	0.64	0.80
24	0.46	0.60	0.60	0.39	0.60
30	0.46	0.533	0.56	0.30	0.25
45	0.26	0.367	0.45	0.25	0.25
60	0.26	0.20	0.35	0.22	0.25
70	0.18**	0.10	0.20	0.22	0.10
80	0.18**	0.10	0.20	0.22	0.10
> 80	Not Permitted	0.10	0.20	0.22	0.10

*Former requirements contained in RWQCB Basin Plans, no longer in effect
**San Mateo County requires pressure distribution for soils with percolation rate >60 mpi

3. Horizontal Setbacks

San Mateo County's OWTS Ordinance includes horizontal setback distances that equal or exceed the SWRCB 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…". San Mateo County requirements treat these water bodies the same as

"watercourses", with a 100-ft horizontal setback requirement, which is consistent with historical RWQCB guidelines and requirements found in all other jurisdictions reviewed. The SWRCB'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 SWRCB OWTS Policy, San Mateo 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 7.5.5 appears to be without substantial merit and 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 the Pacific Ocean (tidal water), 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. With average rainfall amounts ranging from 15 to 50 inches/year in San Mateo County, Tier 1 would allow new lot sizes as low as 0.5 to 0.75 acres in large portions of the county. County Subdivision Regulations (Section 7027) do not specify a minimum lot size for parcels served by OWTS, but rather require project and site specific determinations as stated below:

> "Each parcel created by a subdivision must be served by a sanitary sewer or individual sewage disposal system, and no tentative map or tentative parcel map shall be approved unless the Advisory Agency is assured that safe and adequate sewage disposal will be provided. The subdivider will be responsible for the design and installation of a sewage disposal system in accordance with County standards. The type of sewage disposal system to be installed by the subdivider will be established by the Advisory Agency, upon the recommendation of the Planning Director. The Planning Director's recommendation shall be based on the recommendation of the Environmental Health Division..."

The Environmental Health Division recommendations are guided by the OWTS Ordinance (Section 4.84.180) and accompanying Onsite Systems Manual, which include requirements for the completion of cumulative impact studies, such as nitrate loading assessment, for proposed development that may have water quality effects related to the constituents, volume or density of wastewater discharges in a given area. The Onsite Systems Manual specifies that a cumulative impact assessment for nitrate loading is required for any subdivision with less than 2.5 acre lot size density, and provides evaluation criteria to assure adequate protection of

public health and water quality. This ensures that OWTS densities for new subdivisions will be addressed in a manner consistent with the Tier 1 requirements, with greater emphasis on site specific analysis of nitrate loading issues.

5. More Protective Aspects of San Mateo County LAMP

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

- **Alternative OWTS.** Establishes requirements for alternative OWTS, providing better options, design guidance and a managed system for dealing with repairs/replacement for the approximately 4,400+ existing OWTS in the county.

- **Operating Permits.** Establishes operating permit program for alternative OWTS and some other OWTS (e.g, over 2,500 gpd flow) 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 flows over 2,500 gpd. Tier 1 allows OWTS designs up to 3,500 gpd with no comparable requirements.

- **Septic Tank 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.

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

- **Pump Systems.** Onsite Systems Manual includes design guidance and requirements for pump systems.

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

- **Range of Acceptable Percolation Rates.** Limits OWTS to areas with percolation rates in the range of 5 to 80 mpi; Tier 1 percolation range is 1 to 120 mpi.

- **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 8 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 erosion control requirements for OWTS installations.

- **Floodplains.** Includes avoidance 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.

6. References

Anderson, D.L., A.L. Lewis, and K. M. Sherman. 1991. Human Enterovirus Monitoring at Onsite Sewage Disposal Systems in Florida. Pages 94-104 in *On-site Wastewater Treatment: Proceedings of the Sixth National Symposium on Individual and Small Community Sewage Systems,* December 16-17, 1991, Chicago, IL., American Society of Agricultural Engineers, ST. Joseph, MI.

Anderson, D. L., R. J. Otis, J. I. McNeillie, and R. A. Apfel . 1994. In-situ Lysimeter investigation of Pollutant Attenuation in the Vadose Sone of a Fine San. In *On-Site Wastewater Treatment: Proceedings of the Seventh International Symposium on Individual and Small Community Sewage Systems*. American Society of Agricultural Engineers, St. Joseph, MI.

Ayres Associates. 1993. Onsite Sewage Disposal Research in Florida: An Evaluation of Current OSDS Practices in Florida. Report to the Department of Health and Rehabilitative Services, Environmental Health Program, Tallahassee, FL. Ayres Associates, Madison, WI.

California Regional Water Quality Control Board, Central Coast Region. June 2011. *Water Quality Control Plan for the Central Coast Region.*

California Regional Water Quality Control Board, San Francisco Bay Region. December 2011. *Water Quality Control Plan for the San Francisco Bay Region* (Basin Plan).

California Regional Water Quality Control Board, San Francisco Bay Region. 1979. *Minimum Guidelines for the Control of Individual Wastewater Treatment and Disposal Systems.*

Converse, J.C., and E.J. Tyler. 1998. Soil Dispersal of Highly Pretreated Effluent – Considerations for Incorporation into Code. In Proceedings: Seventh Annual Conference and Exhibits. National Onsite Wastewater Association, Northbrook, IL.

Crites, R. W., and G. Tchobanoglous. 1998. *Small and Decentralized Wastewater Management Systems.* WCB/McGraw-Hill, New York, NY.

Duncan, C.S., R. B. Reneau, Jr., and C. Hagedorn. 1994. Impact of Effluent Quality and Soil Depth on Renovation of Domestic Wastewater. In Onsite Wastewater Treatment: Proceedings of the Seventh International Symposium on Individual and Small Community Sewage Systems, ed. E. Collins. American Society of Agricultural Engineers, St. Joseph, MI.

Leverenz, H., G. Tchobanoglous, and J.L. Darby. August 2002. *Review of Technologies for the On-site Treatment of Wastewater in California*. University of California, Davis. Report No. 02-2. Prepared for California State Water Resources Control Board.

Potts, David A., et al. 2003. Effects of Aeration on Water Quality from Septic Leachfields. Journal of Environmental Quality 33:1828-1838, 2004.

State Water Resources Control Board. June 2012. Final Draft Water Quality Control Policy for Siting, Design, Operation and Maintenance of On-site Wastewater Treatment Systems .

U.S. Environmental Protection Agency. February 2002. *Onsite Wastewater Treatment Systems Manual*. (EPA/625/R-00/008). Office of Water. Office of Research and Development. Washington, DC.

Washington State Department of Health. October 1990. Vertical Separation – A Review of Available Scientific Literature and Listing from Fifteen Other States. Olympia, Washington. http://www.doh.wa.gov/Portals/1/Documents/Pubs/337-094.pdf

Appendix B

OWTS Usage and Wastewater Loading Estimates for San Mateo County

Appendix B
OWTS Usage and Wastewater Loading Estimates for San Mateo County
May 2016
Prepared by Questa Engineering Corp

General Approach and Scope

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

There were four 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 residential parcels in non-sewered areas of the County. (Note: the analysis did not address OWTS serving commercial occupancies, or other non-residential uses, which may be significant locally, but overall represent a relatively small percentage of total OWTS discharges in the County. This should be addressed for selected areas as an addendum to this analysis).

2. **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.

3. **Hydrologic Areas.** Delineate general hydrologic areas of the County, consistent with State databases, in a GIS format compatible with parcel and soils information.

4. **Groundwater Basins.** Identify and compile information on recognized groundwater basins in San Mateo County, including GIS map files compatible with parcel, soils and hydrological data.

5. **OWTS Focus Areas.** Identify "OWTS Focus Areas" within the County on the basis of the overall number and/or density of OWTS, and conduct more in-depth analysis of wastewater-nitrate loading in these areas.

The geographic area covered in the analysis includes all of San Mateo County, with the parcel data analysis focused only on the unincorporated lands within the county. All incorporated property within the various cities was excluded, under the assumption that municipal sewer

systems either serve or are available to all of these parcels. Some "islands" of unincorporated parcels were found to exist in the urban areas; and in most cases found these areas to be connected to a sewage treatment facility. If additional information reveals any of these parcels to be connected to municipal sewers corrections will be made to remove these parcels from OWTS status. Additionally, any other unincorporated parcels determined to be connected to community sewer systems in other parts of the County will be have their OWTS status corrected.

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**

- City and sanitary district boundaries were applied to the County-wide data base to exclude parcels located within areas known to be served by public sewers. This included mainly incorporated lands, but it also included some unincorporated areas of (e.g. sanitary districts) which are served by their own community wastewater facilities. NOTE: "islands" of unincorporated lands falling within city boundaries were not excluded during this step, however, an additional review of these "islands" was made to assess and identify parcels that are connected to municipal sewers. In particular, the "island" communities of Broadmoor and Country Club Park were confirmed to be connected to sewer, while a small "island" in the northern county was found to be an unconnected mobile home park.

  For this analysis, the city boundaries of Woodside and Portola Valley were not used, and sewered areas were only determined by the sanitary districts within their city boundaries.

- From the above analysis, the total number of non-sewered parcels in the County was determined to be 9,811.

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.

- The GIS parcel database field, PUC_DESC, contained reasonable indicators of residential development. A developed residential parcel was identified by such keywords in this field as "Duplex", "SFR", "Five or More Units", etc. Other keywords such as "Office", "Grazing", "Community Center" etc. were eliminated from analysis to focus solely on residential development. It was further determined that about one percent of the developed residential parcels were indicated as multi-family units.

- The indicators as derived above were then assigned to the County-wide GIS inventory of unincorporated non-sewered parcels, with the following findings:

    - Developed Parcels: 4,422
    - Vacant Parcels: 5,389
      Total Parcels: 9,811

Soils/ OWTS Suitability Mapping

General Soils Map. Figure B-1 presents a General Soils Map of San Mateo County compiled from information contained in two soil surveys and mapping published by the U.S. Department of Agriculture, which include: (1) Soil Survey of San Mateo Area, California, 1961; (2) Soil Survey San Mateo County, Eastern Part and San Francisco County, California, 1990; and (3) Online soils data base maintained by the Natural Resources Conservation Service (NRCS). The General Soils Map contained in the 1990 Soil Survey of San Mateo County, Eastern Part provided the baseline groupings of general soil associations, which were extended to cover other portions of the County, as shown in **Figure B-1**.

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

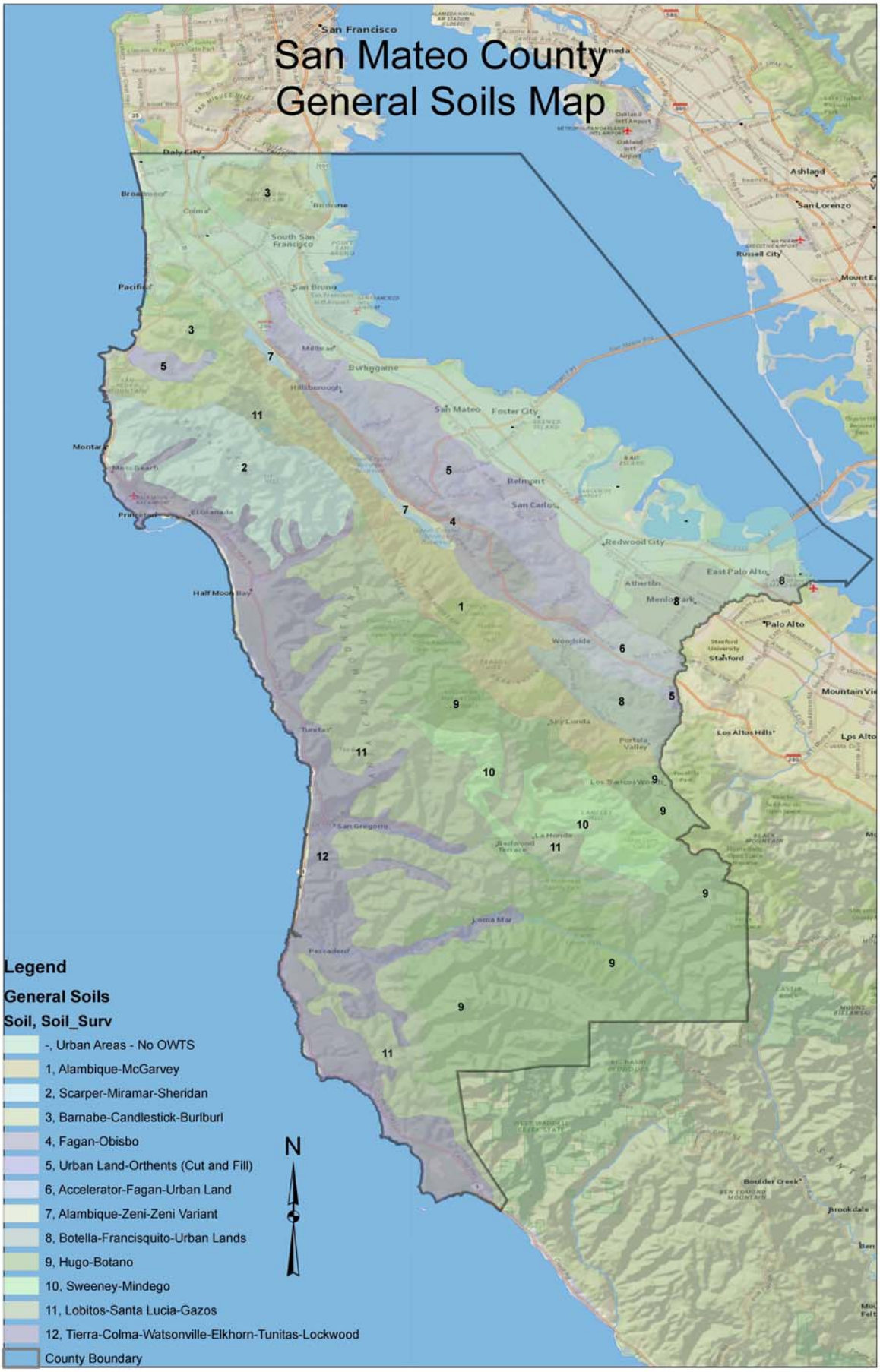
1990 Soil Survey of San Mateo County, Eastern Part

- **Uplands (1-7)** The soils of the Santa Cruz Mountains are generally moderately deep and well drained loams situated on gently rolling to steep slopes. Most OWTS development in the eastern uplands is located in 1, 4, 5 & 6 soil associations, in the vicinity of Woodside, and can have local constraints of steep slopes and/or shallow soils.

- **Bottom Lands (8).** Most soils associations found along the San Francisco Bay side of the county are all situated in urban sewered areas, and hence are not part of this OWTS analysis. However, included in this landform classification is the Botella-Francisquito-Urban soil association located near Portola Valley where there is significant development on OWTS.

1961 Soil Survey of San Mateo Area

- **Uplands (9-11).** Soils found in the rural mountainous portions of the county, west of the Santa Cruz Mountains divide, are well drained soils to excessively drained soils derived mostly from sedimentary parent material and formed in upland regions between the ridgetops and marine terraces near the coast. The loamy soils in these areas are well suited for conventional OWTS, mostly found near Kings Mountian Road, Sky Londa, Redwood Terrace and La Honda and scattered throughout mountainous rural areas to the



San Mateo County Local Agency Management Program		**San Mateo County General Soils Map**	FIGURE **B-1**

central and southern parts of the county. Local constraints of shallow soils and/or steep slopes can be potentially overcome with shallow drip/alternative systems.

- **Marine Terraces, Alluvial Fans and Floodplains (12).** Soils found on the coastal terraces and coastal stream valleys are generally deep, well drained and suitable for conventional OWTS.

Soil-OWTS Suitability. 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-1** was developed from the published soil survey information, summarizing the soil characteristics of the general soil associations mapped in **Figure B-1.**

The second to last right-hand column in **Table B-1** 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 Questa's best professional judgment (preliminary). 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. Included in **Table B-2** is the estimated number of residential OWTS within each general soil area, determined by merging the GIS parcel data with the soil mapping boundaries.

Table B-1: San Mateo County General Soil Associations

General Soil Association Number	Soil Association Name	Description	Soil Depth	Slope	Drainage	Soil Texture	Suitability and Constraints for OWTS	Estimated Number of OWTS
1	**Alambique-McGarvey**	Soils formed in material weathered from sandstone found west of the San Andreas fault and south of California Highway 92	moderately deep	moderately steep to very steep (30-75%)	well drained	gravelley loam to clay loam underlain by sandstone	Generally suitable conditions for conventional OWTS; some inclusions of low permeability and perched groundwater favoring shallow dispersal designs	832
2	**Scarper-Miramar-Sheridan**	Soils formed in material weathered from quartz-diorite or acid igneous rock found on the coast from Devil's slide to Montara	moderately deep	steep and very steep	well drained	gravelley course sandy loam and clay loam underlain by quartz-diorite	Moderately constrained by steep slopes and shallow soils, potentially requiring alternative treatment and/or shallow dispersal designs	7
3	**Barnabe-Candlestick-Burlburl**	Soils formed in material weathered from sandstone found on San Bruno Mountain; Sweeny Ridge, west of Pacifica; and Skyline Boulevard, south of California Highway 92	very shallow to moderately deep	moderately steep to very steep (15-75%)	well drained	very gravelley sandy laom and sandy clay loam underlain by hard, fractured sandstone	Moderately constrained by steep slopes and shallow soils, potentially requiring alternative treatment and/or shallow dispersal designs	2
4	**Fagan-Obisbo**	Soils formed in material weathered from sandstone, shale and serpentine found along California Highway 92, on the eastern side of the San Andreas Fault	shallow and deep	gently sloping to steep (5-50%)	well drained	clay to sandy clay loam underlain by sandtone shale, or hard, sepentinitic rock	Moderately constrained by steep slopes and shallow soils, potentially requiring alternative treatment and/or shallow dispersal designs	180
5	**Urban Land-Orthents, Cut and Fill**	Soils formed in residuum derived from sandstone found east of California Highway 280 extending from San Bruno to Redwood City	very shallow to very deep	gently rolling to very steep	well drained	Urban Land, graded and mixed soils, or covered with fill material	Generally suitable conditions for conventional OWTS; some inclusions of low permeability and perched groundwater favoring shallow dispersal designs	297
6	**Accellerator-Fagan-Urban land**	Soils formed in residuum derived from sandstone, shale or siltstone found along California Highway 280, north of San Franciquito Creek	deep	gently rolling and rolling	well drained	loam to clay loam and clay	Suitable conditions for conventional OWTS	138
7	**Alambique-Zeni-Zeni Variant**	Soils formed in material weathered from sandstone and metasedimentary rock on Sawer Ridge and Cahill Ridge, in the San Francisco Water District	moderately deep	moderately steep to very steep (15-75%)	well drained	loam and sandy loam, and gravelley loam to gravelley clay loam	Moderately constrained by steep slopes and shallow soils, potentially requiring alternative treatment and/or shallow dispersal designs	0

General Soil Association Number	Soil Association Name	Description	Soil Depth	Slope	Drainage	Soil Texture	Suitability and Constraints for OWTS	Estimated Number of OWTS
8	**Botella-Francisquito-Urban Lands**	Soils formed on alluvial fans, flood plains and stream terraces along San Francisquito Creek, and in Menlo Park, Palo Alto, Woodside and Portola Valley	very deep	gently sloping to rolling	well drained, restricted permeability of the subsoils	clay loam to loam	Generally suitable conditions for conventional OWTS; some inclusions of low permeability and perched groundwater favoring shallow dispersal designs	1,112
9	**Hugo-Butano**	Soils formed in material weathered from sedimmentary rock found in the southern county, including nearly all of the Skyline crest	deep	steep and very steep	well drained to somewhat excessively drained	sandy loam to loam	Moderately to severely constrained by steep slopes and shallow soils, potentially requiring alternative treatment and/or shallow dispersal designs	1,022
10	**Sweeney-Mindego**	Soils developed from basic igneous rock on rounded, sloping and moderately steep ridgetops found mainly in the central eastern uplands Mindego and Langley Hills, and La Honda	moderately deep and shallow	steep and very steep	well drained to somewhat excessively drained	clay loam to sandy loam	Moderately to severely constrained by steep slopes and shallow soils, potentially requiring alternative treatment and/or shallow dispersal designs	158
11	**Lobitos-Santa Lucia-Gazos**	Soils formed in material weathered from sedimmentary rock and siliceous shale found in the western county between the ridgetops and the marine terraces near the coast	moderately deep and shallow	steep and very steep	well drained to excessively drained	loam and silt loam	Moderately to severely constrained by steep slopes and shallow coarse-textured soils, potentially suitable for supplemental treatment and/or shallow dispersal designs	323
12	**Tierra-Colma-Watsonville-Elkhorn-Tunitas-Lockwood**	Soils formed ins alluvium of mixed sources, some of which was reworked by the ocean and redeposited on marine terraces found along the majority of the county's coast	deep	nearly level with steep inclusions	well drained to imperfectly drained	sandy loam to clay loam	Moderately to severely constrained by steep slopes and shallow coarse-textured soils, potentially suitable for supplemental treatment and/or shallow dispersal designs	351

Table B-2: San Mateo County OWTS Development by Soils

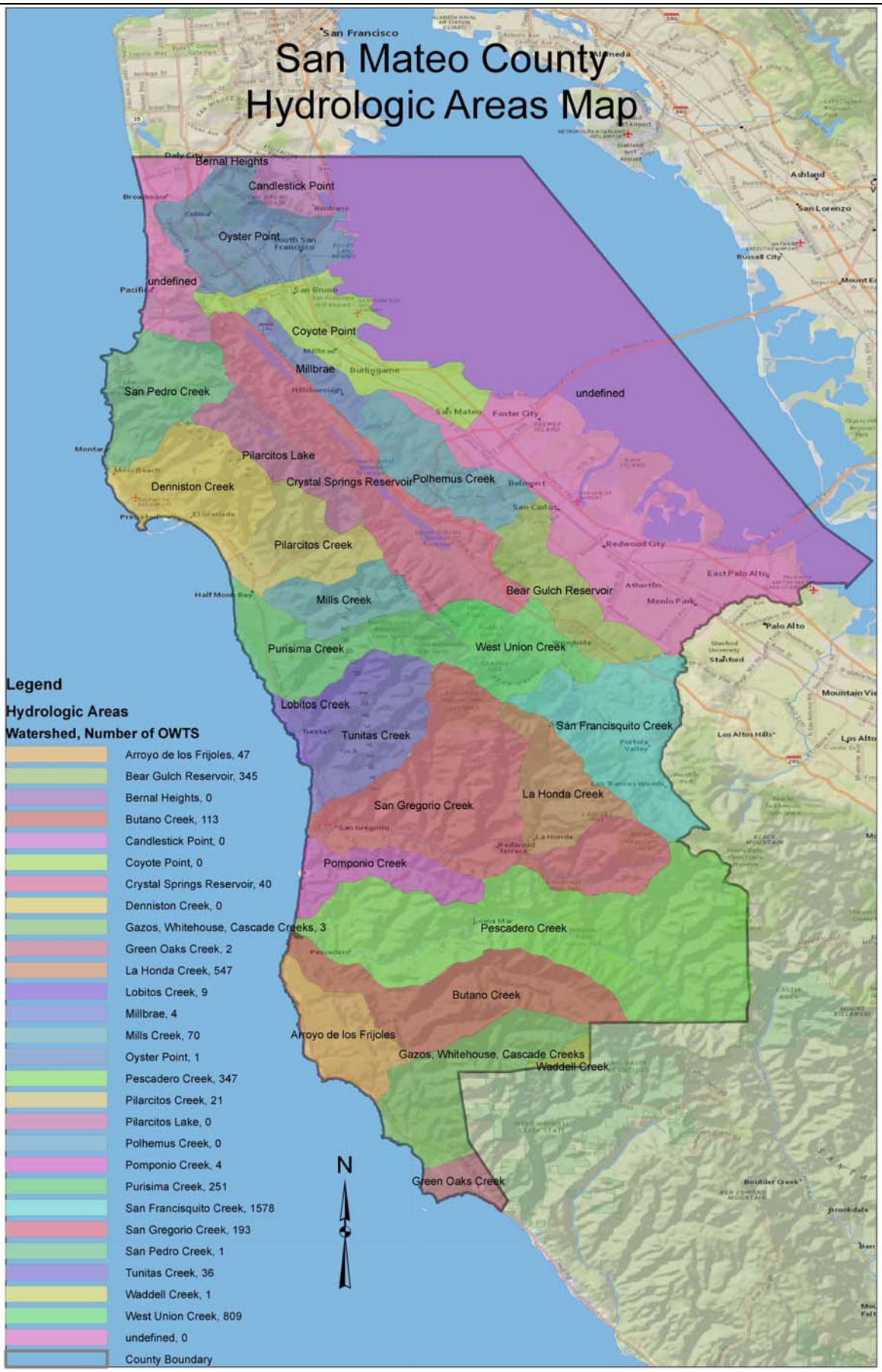
General Soil Association Map Index	Soil Association Name	Estimated Number of OWTS
1	Alambique-McGarvey	832
2	Scarper-Miramar-Sheridan	7
3	Barnabe-Candlestick-Burlburl	2
4	Fagan-Obisbo	180
5	Urban Land-Orthents, Cut and Fill	297
6	Accellerator-Fagan-Urban Land	138
7	Alambique-Zeni-Zeni Variant	0
8	Botella-Francisquito-Urban Lands	1,112
9	Hugo-Butano	1,022
10	Sweeney-Mindego	158
11	Lobitos-Santa Lucia-Gazos	323
12	Tierra-Colma-Watsonville-Elkhorn-Tunitas-Lockwood	351
	Total OWTS	**4,422**

Watershed Areas

Watershed Mapping. San Mateo County lies within two hydrological and Water Quality Control Board Regions: San Francisco Bay Region 2 (northern majority of the county) and Central Coast Region 3 (southern tip of the county). Utilizing watershed boundaries established by the California Department of Water Resources (DWR), twenty-eight (28) watershed areas were delineated and labeled as shown in **Figure B-2**. Twenty-four of the watersheds are in the San Francisco Bay Region and four within the Central Coast Region. The boundaries match DWR delineations, except in some cases smaller sub-regions were combined that either combined flow to the Pacific Ocean or to the Crystal Springs Reservoir. Some of the watersheds that drain to San Francisco Bay coincide with urban or otherwise sewered areas, and hence are not included in this OWTS analysis.

OWTS Distribution by Hydrologic Area. The hydrologic area information was merged with the GIS parcel status data to segregate the developed unincorporated parcels (i.e., OWTS) according to their location in different hydrologic areas in the county. The results are presented in **Tables B-3** and **B-4** for the San Francisco Bay and Central Coast regions of the county, respectively. Shown in the tables for each hydrologic area are the total land acreage comprising each hydrologic area, the lot area developed with OWTS, the number of OWTS, and the average lot size for the developed parcels. As indicated, about 99% of the OWTS are located in the San Francisco Bay Region and 1% in the Central Coast Region.

Cumulative Wastewater Loading by Hydrologic Area. Based on the estimated number and distribution of developed properties using OWTS determined above, estimates of the associated cumulative wastewater loading volumes were made for different geographical and hydrological regions of the County. This was done using an average daily wastewater flow of 150 per OWTS, which is typical for rural residences, equal to about one-third to one-half the peak daily design flow used for system sizing. **Tables B-5** and **B-6** present the estimated volume of wastewater generated for each of the 22 general hydrological areas in the County for existing development conditions. Estimated wastewater volumes are shown in gallons per day (gpd) and million gallons per year (Mgal/yr). Additionally, the average annual wastewater loadings, in gallons per acre, are calculated and presented based on the total acreage of non-sewered area within each hydrologic area. These estimates can be used subsequently to evaluate the nitrate and salt loading from OWTS for the different hydrologic areas of the county, and in the future provide a basis to track ongoing OWTS impacts from additional development.



San Mateo County Local Agency Management Program		**San Mateo County Watershed Areas Map**	FIGURE **B-2**

Table B-3. OWTS Distribution by Hydrologic Area, San Mateo County – San Francisco Bay Region 2

Hydrologic Area	Total Watershed Area (acres)	Developed Lot Area (acres)	Number of Developed Parcels	Average Developed Lot Size (acres)
Bear Gulch Reservoir	7,633	659	345	1.91
Butano Creek	13,836	327	113	2.89
Crystal Springs Reservoir	18,323	38	40	0.95
Denniston Creek	10,335	0	0	0
La Honda Creek	7,324	1,082	547	1.98
Lobitos Creek	3,942	325	9	36.13
Millbrae	2,996	2	4	0.62
Mills Creek	5,339	717	70	10.25
Oyster Point	11,843	0.25	1	0.25
Pescadero Creek	34,939	3494	347	10.07
Pilarcitos Creek	7,340	138	21	6.55
Pomponio Creek	5,648	83	4	20.66
Purisima Creek	9,597	1,640	251	6.54
San Francisquito Creek	13,440	5,896	1,578	3.74
San Gregorio Creek	25,951	1,371	193	7.10
San Pedro Creek	8,784	0.6	1	0.6
Tunitas Creek	7,871	928	36	25.79
West Union Creek	7,627	2,317	809	2.86
TOTAL	**202,768**	**19,017**	**4,369**	

Table B-4. OWTS Distribution by Hydrologic Area, San Mateo County – Central Coast Region 3

Hydrologic Area	Total Watershed Area (acres)	Developed Lot Area (acres)	Number of Developed Parcels	Average Developed Lot Size (acres)
Arroyo De los Frijoles	6,698	1,626	47	34.6
Gazos, Whitehouse, Cascade Creeks	10,501	304	3	101.23
Green Oaks Creek	2,102	98	2	48.94
Waddell Creek	815	1.96	1	1.96
TOTAL	**20,116**	**2,030**	**53**	

Table B-5. OWTS Wastewater Loading Volumes, San Mateo County – San Francisco Bay Region 2

Hydrologic Area	Developed Lot Area (acres)	Number of Developed Parcels	Discharge Volume (gpd)	Discharge Volume (Mgal/yr)	Average Wastewater Loading gal/ac-yr
Bear Gulch Reservoir	659	345	51,750	1.88	28,662
Butano Creek	327	113	16,950	6.19	18,919
Crystal Springs Reservoir	38	40	6,000	2.19	57,632
Denniston Creek	0	0	0	0	0
La Honda Creek	1,082	547	82,050	29.95	27,678
Lobitos Creek	325	9	1,350	0.49	1,516
Millbrae	2	4	600	0.22	109,500
Mills Creek	717	70	10,500	3.83	5,345
Oyster Point	0.25	1	150	0.05	219,000
Pescadero Creek	3494	347	52,050	19.00	5,437
Pilarcitos Creek	138	21	3,150	1.15	8,332
Pomponio Creek	83	4	600	0.22	2,639
Purisima Creek	1,640	251	37,650	13.74	8,379
San Francisquito Creek	5,896	1,578	236,700	86.40	14,653
San Gregorio Creek	1,371	193	28,950	10.57	7,707
San Pedro Creek	0.6	1	150	0.05	91,250
Tunitas Creek	928	36	5,400	1.97	2,124
West Union Creek	2,317	809	121,350	44.29	19,116
TOTAL	**19,017**	**4,369**	**655,350**	**239.20**	**12,578**

Table B-6. OWTS Wastewater Loading Volumes, San Mateo County – Central Coast Region 3

Hydrologic Area	Developed Lot Area (acres)	Number of Developed Parcels	Discharge Volume (gpd)	Discharge Volume (Mgal/yr)	Average Wastewater Loading gal/ac-yr
Arroyo De los Frijoles	1,626	47	7,050	2.57	1,583
Gazos, Whitehouse, Cascade Creeks	304	3	450	0.16	540
Green Oaks Creek	98	2	300	0.11	1,117
Waddell Creek	1.96	1	150	0.05	27,934
TOTAL	**2,030**	**53**	**7,950**	**2.89**	**1,429**

Groundwater Basins

Groundwater Basin Mapping. Utilizing boundaries established by the California Department of Water Resources (DWR), six (6) alluvial groundwater basins were delineated and labeled as shown in **Figure B-3**. The remaining basins are situated in urban areas, and thus not analyzed. There are also small portions of the vast Santa Clara Valley groundwater basin that lies predominantly in neighboring Santa Clara County, however, one of the Santa Clara Valley Basin sub-units was retained (2-09) for its location in Woodside, where there are known OWTS.

OWTS Distribution by Groundwater Basin. In an analysis similar to the one performed by hydrologic region, 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 the recognized alluvial groundwater basins in the county. The results are presented in **Table B-7**.

Table B-7. OWTS Development, San Mateo County Groundwater Basins

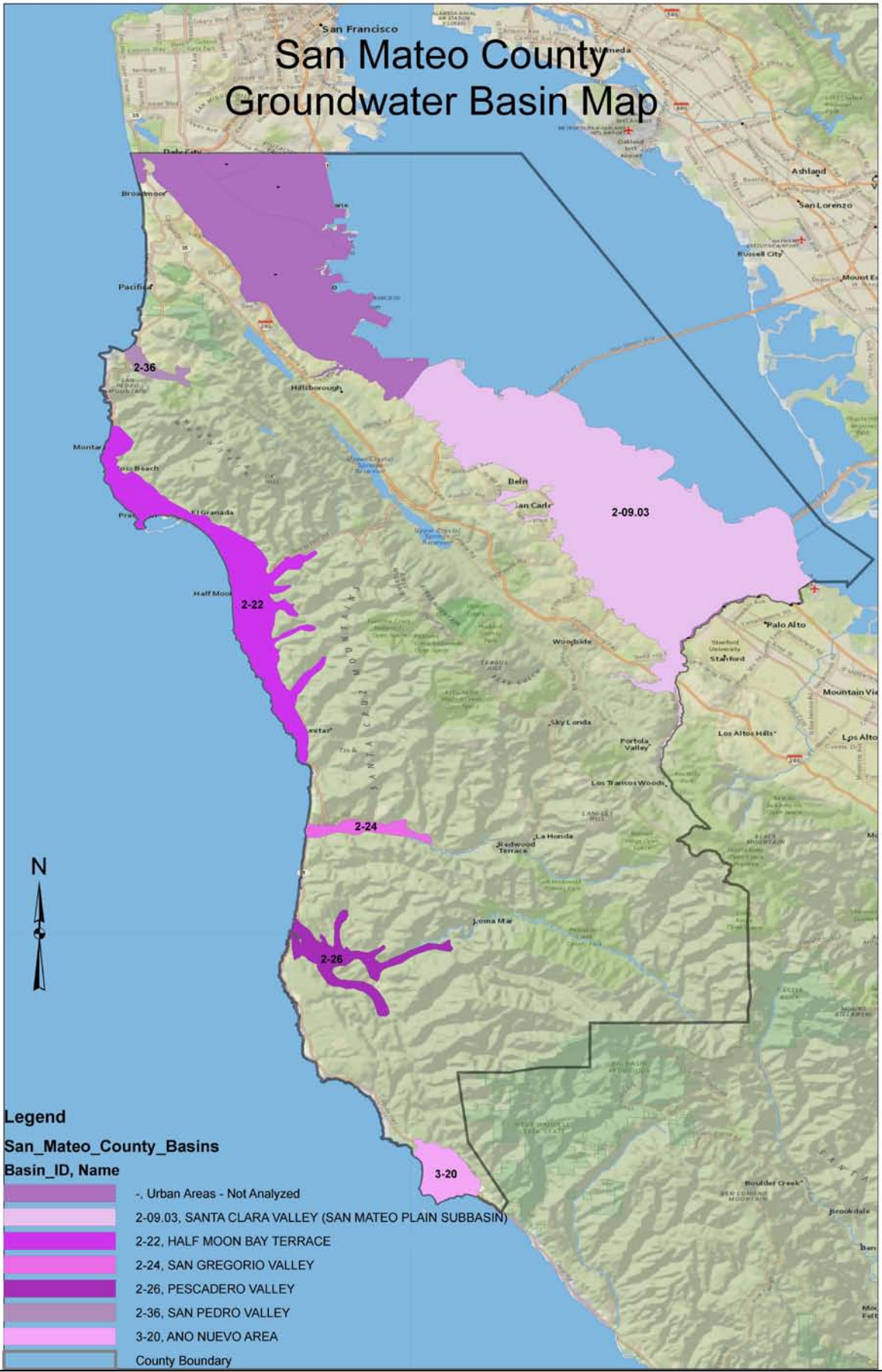
Groundwater Basin Name	Surface Area of Basin (ac)	Number of Developed Parcels with OWTS	Basin-wide OWTS Density (acres per OWTS)
Santa Clara Valley (San Mateo Plains Sub-basin)	48,100	12	4,008
Half Moon Bay Terrace	9,189	21	438
San Gregorio Valley	1,074	16	67
Pescadero Valley	2,904	106	27
San Pedro Valley	700	1	700
Ano Nuevo Area	2,032	0	n/a
Total		156	

As indicated, there is not a significant density of OWTS overlying any single basin, nor is there a significant total number of OWTS (156) overlying the groundwater basins in the county. Basins in San Mateo County coincide predominantly with sewered or sparsely populated areas.

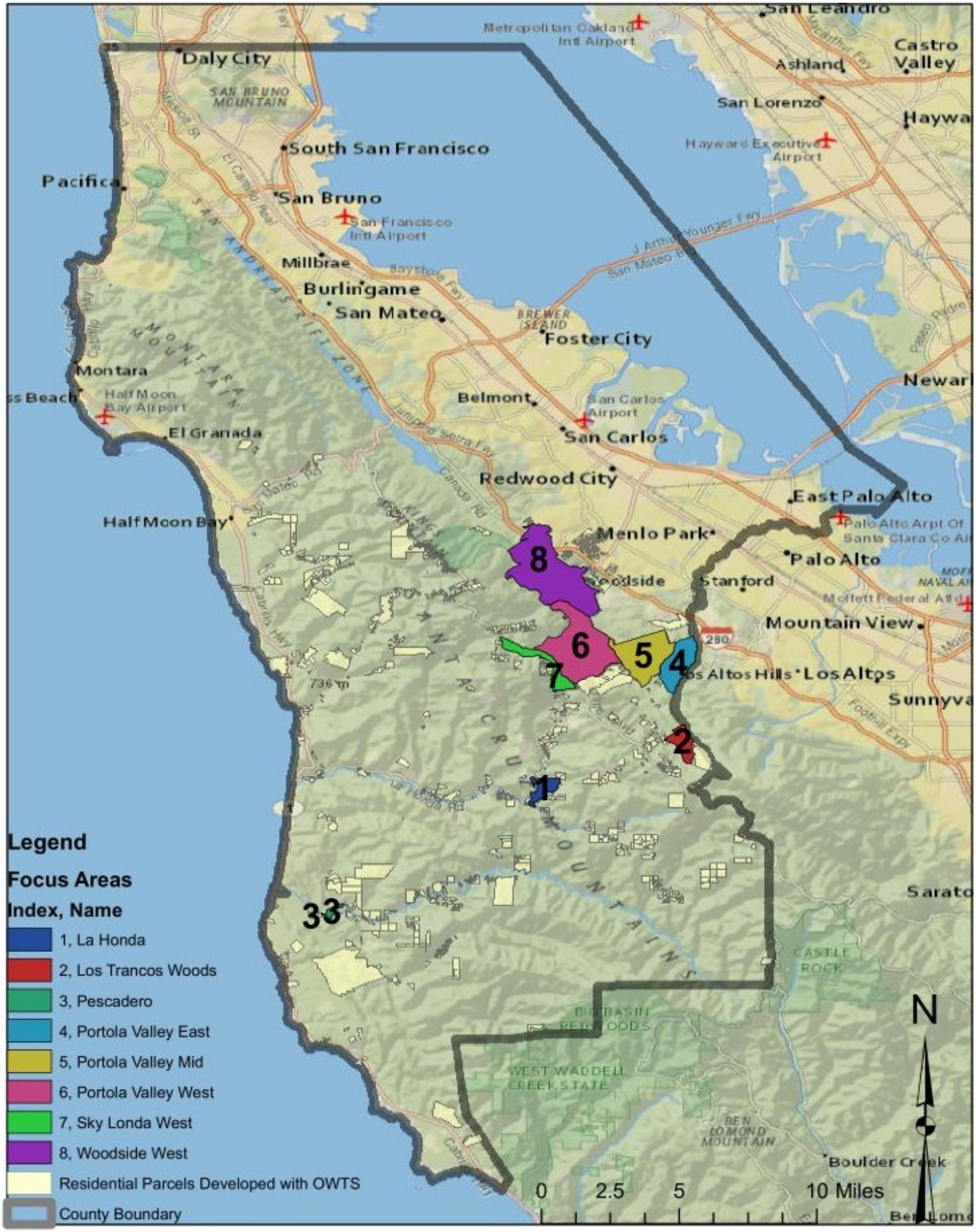
OWTS Focus Areas

Focus Areas. Table B-8 presents a list of eight (8) localized OWTS Focus Areas, chosen for a more in-depth analysis based on the number and/or density of OWTS or other factors. The table identifies the principal surface water and/or groundwater features in each area, and also a brief summary soils and OWTS suitability based on general soil mapping. The locations of the various OWTS Focus Areas are shown in **Figure B-4**; detailed GIS maps of each area are provided in **Attachment 1**. All of the Focus Areas are within the S.F. Bay Region, including five (5) that drain to San Francisco Bay, and three that drain to the Pacific Ocean.

San Mateo County Groundwater Basin Map



San Mateo County Local Agency Management Program		**San Mateo County Groundwater Basin Map**	FIGURE **B-3**



San Mateo County Local Agency Management Program		**San Mateo County Focus Areas Map**	FIGURE **B-4**

Table B-8. OWTS Focus Areas in San Mateo County

No.	Area Name	Drains To	Soils & OWTS Suitability
1	La Honda	La Honda Creek	**11** and some **10** - Moderately to severely constrained by steep slopes and shallow coarse-textured soils, potentially requiring supplemental treatment and/or shallow dispersal design
2	Los Trancos Woods	Los Trancos Creek	**9** - Moderately to severely constrained by steep slopes and shallow soils, potentially requiring alternative treatment and/or shallow dispersal designs
3	Pescadero	Pescadero Creek, Pescadero Valley GW Basin	**12** - Moderately to severely constrained by steep slopes and shallow coarse-textured soils, potentially requiring supplemental treatment and/or shallow dispersal designs
4	Portola Valley East	Los Trancos Creek	**8** and some **5** - Suitable conditions for conventional OWTS; some inclusions of low permeability and perched groundwater favoring shallow dispersal designs
5	Portola Valley Mid	Corte Madera Creek, Searsville Lake	**8** and some **9** – Mostly suitable conditions for conventional OWTS; some inclusions of low permeability and perched groundwater favoring shallow dispersal designs
6	Portola Valley West	Sausal, Alambique, Martin-Bull Run Creeks, Searsville Lake	**1** and some **8** - Suitable conditions for conventional OWTS; some inclusions of low permeability and perched groundwater favoring shallow dispersal designs
7	Sky Londa West	La Honda Creek	**1** and **9** - Suitable conditions for conventional OWTS; some inclusions of low permeability and perched groundwater favoring shallow dispersal designs; AND Moderately to severely constrained by steep slopes and shallow soils, potentially requiring alternative treatment and/or shallow dispersal designs
8	Woodside West	West Union Creek	Mostly **1 & 8,** some **4, 5 & 6** - Suitable conditions for conventional OWTS; some inclusions of low permeability and perched groundwater favoring shallow dispersal designs; inclusions of **4** -Moderately constrained by steep slopes and shallow soils, potentially requiring alternative treatment and/or shallow dispersal designs

OWTS Usage and Wastewater Loading Estimates. 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-9.** These potential areas of concern account for an estimated 2,867 OWTS, approximately 65% 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-9**.

Table B-9. OWTS Discharges and Loading Estimates, San Mateo County Focus Areas

Name	Gross Acreage of Focus Area (ac)	Number of Developed Parcels	Median Parcel Size (ac)	Area-wide OWTS Density (ac/OWTS)	Daily OWTS Discharge (gpd)	Annual OWTS Discharge (Mgal/yr)	Annual Nitrogen Loading	
							Total (lbs)	Per Acre (lbs/ac)
1. La Honda	301	336	0.3	0.90	50,400	18.40	9,205	30.58
2. Los Trancos Woods	357	254	0.8	1.41	38,100	13.91	6,959	19.49
3. Pescadero	73	73	0.3	1.00	10,950	4.00	2,000	27.40
4. Portola Valley East	791	235	1.2	3.37	35,250	12.87	6,438	8.14
5. Portola Valley Mid	1,341	464	2.2	2.89	69,600	25.40	12,712	9.48
6. Portola Valley West	2,256	560	1.6	4.03	84,000	30.66	15,342	6.80
7. Sky Londa West	513	158	0.5	3.25	23,700	8.65	4,329	8.44
8. Woodside West	2,763	787	1.7	3.51	118,050	43.09	21,561	7.80
Total	-	2,867	-	-	430,050	156.97	78,547	-

Nitrate-Nitrogen Water Quality Impacts. Wastewater loading from OWTS can potentially degrade groundwater quality and contribute to nutrient enrichment of surface waters. Nitrogen occurs in high concentrations in domestic sewage, typically in the range of 50 to 90 mg-N/L. It occurs mostly as ammonia and organic forms, and is removed only partially through conventional septic tank treatment. Upon entering the unsaturated soil environment, these forms of nitrogen undergo transformation to nitrate. Nitrate is highly soluble in water and moves readily through the soil and groundwater with limited removal by the soil under most circumstances. High levels of nitrate in water supplies can cause methemoglobinemia (blue baby syndrome) in infants and pregnant women. The drinking water standard (MCL) for nitrate-nitrogen is 10 mg/L (as nitrogen, N), which is equivalent to 45 mg/L as nitrate, NO_3.

Nitrate loading is normally not an issue for individual residential OWTS, but can become a "cumulative impact" concern for large concentrations of OWTS in a given area or for larger commercial or community-type OWTS. Elevated groundwater-nitrate concentrations have been

documented in a few areas of San Mateo County, but no assessment has been made to determine the primary source(s), including the possible contributions from OWTS.

Using the estimates of existing OWTS densities and wastewater loading volumes (per above), calculations have been made to estimate the existing contribution in groundwater-nitrate concentrations due to residential OWTS in the eight OWTS Focus Areas. The estimated nitrate concentration contributions per this analysis are in addition to other sources of nitrate-nitrogen that might occur in each sub-basin, such as leaching of agricultural fertilizers, confined animal wastes, municipal wastewater discharges, etc.

1. Methodology

The nitrate loading analysis was completed using an annual chemical-water balance analysis. The methodology followed is described in the publication "Predicting Groundwater Nitrate-Nitrogen Impacts" (Hantzsche and Finnemore, *Groundwater*, Vol. 30, No. 4, July-August 1992). According to this methodology, the long-term concentration of nitrate as nitrogen (NO_3-N or nitrate-nitrogen) in the upper saturated groundwater zone can be closely approximated by the quality of percolating recharge waters. Considering only the contributions from OWTS and natural sources picked up by rainfall leaching of soil and vegetation, the average concentration of nitrate-nitrogen in recharge water, n_r, is estimated using the following equation:

$$n_r = \frac{Wn_w(1-d) + Rn_b}{(W+R)}$$

where:
- n_r = resultant average concentration of NO_3-N in recharge water, mg-N/l
- W = average annual volume of wastewater entering the soil, acre-ft/yr (AFY)
- n_w = total nitrogen concentration of wastewater, mg-N/l
- d = fraction of NO_3-N loss due to denitrification in the soil
- R = average annual volume of rainfall recharge in sub-basin area, AFY
- n_b = background NO_3-N concentration of rainfall recharge at the water table, exclusive of wastewater, agriculture or other development influences, mg-N/l

2. Data and Assumptions

Per the equation presented above, resultant nitrate concentration in the groundwater is estimated to be the weighted average or combined concentration due to wastewater loading and recharge of rainfall ("deep percolation") contributed from the watershed sub-basin within

the area of concern. For this analysis, calculations were made for each of the eight Focus Areas. The analysis includes nitrate-nitrogen contributions from the existing OWTS plus a factor representing background nitrate concentrations associated with percolating rainfall in the open space areas. The following summarize the various assumptions.

- **Recharge Area.** The recharge area for each sub-basin includes the total estimated acreage encompassing the OWTS parcels in each Focus Area, as delineated and shown on the attached figures and listed in **Table B-8**. The acreage includes the parcels currently developed with OWTS, vacant lands, intervening public rights-of-way, and bordering areas judged to contribute recharge waters that mix with the discharges from OWTS.

- **Wastewater Flows.** The nitrate loading analysis was completed for the existing estimated annual wastewater volumes presented in **Table B-9**, which are based on an average wastewater flow assumption of 150 gpd per residential OWTS (3 persons per residence at approximately 50 gpd per person).

- **Wastewater Nitrogen Concentrations.** Total nitrogen concentration in wastewater effluent was assumed to be 70 mg/L, which is typical for domestic wastewater discharges from conventional septic tank – dispersal trench systems, as previously discussed.

- **Background Nitrogen Concentration.** Limited water quality sampling data are available for local wells. Therefore, a nominal value of 0.5 mg-N/L was assumed as the background concentration associated with percolating rainfall.

- **Soil Denitrification.** Total nitrogen removal in the upper soil zones (via denitrification) was estimated to be 20 percent of the total nitrogen in the percolating OWTS effluent, which is an upper mid-range value within the common range of values (10% to 25%) normally attributed to soil denitrification. This value was selected based on the relatively permeable, deep upland soil conditions in most parts of San Mateo County.

- **Rainfall Recharge (Deep Percolation).** Deep percolation was estimated through completion of a water balance analysis, which takes into account rainfall, runoff, and evapotranspiration losses. Water balance calculations were made for three different geographic and climatic regions of the County covering the eight Focus Areas: (1) Woodside-Portola Valley (inland); (2) La Honda (mountains); (3) Pescadero (coast-side). Key data sources used in the water balance and the resulting estimates of annual recharge (inches per year) are as shown in **Table B-10**; calculation sheets are attached at the end of this appendix.

Table B-10. Water Balance Data Source and Estimates

Geographic Area	Rainfall Station	Reference Evapotranspiration Zone (ETo)*	Estimated Annual Recharge	
			inches/yr	ac-ft/yr-ac
Woodside-Portola Valley (inland)	Searsville Lake	3 – Coastal Valleys/Mountains	12.31	1.03
La Honda (coastal mountains)	La Honda	3 – Coastal Valleys/Mountains	13.98	1.17
Pescadero (coast-side)	Pescadero	1 – Coastal Plains Heavy Fog Belt	16.54	1.38

*per California Irrigation Management Information System (CIMIS)

Results

The results of the nitrate loading calculations analysis are summarized in **Table B-11** for the various Focus Areas. The detailed calculation worksheet is included in **Attachment 2.**

Table B-11. Estimated Groundwater-Nitrate Contribution from OWTS

Focus Area	Contributing Recharge Area (acres)	Number of Developed Parcels with OWTS	Median Parcel Size (ac)	Estimated Groundwater-Nitrate Contribution from OWTS, mg-N/L
1. La Honda	301	336	0.3	8.20
2. Los Trancos Woods	357	254	0.8	6.29
3. Pescadero	73	73	0.3	6.53
4. Portola Valley East	791	235	1.2	3.08
5. Portola Valley Mid	1,341	464	2.2	3.48
6. Portola Valley West	2,256	560	1.6	2.67
7. Sky Londa West	513	158	0.5	2.86
8. Woodside West	2,763	787	1.7	2.97

As can be seen in the above results, none of the Focus Areas has an estimated nitrate loading contribution above the drinking water limit (10 mg-N/L). However, the more densely developed areas (La Honda, Pescadero and Los Trancos Woods) all indicate a potential impact on groundwater quality in the range of about 6 to 8.5 mg-N/L. The other Focus Areas (Woodside-Portola Valley areas) have an indicated nitrate concentration effect about half as much, in the range of about 2.5 to 3.5 mg-N/L. This can be attributed to the larger lot sizes in these areas, typically on the order of 1.0 to 2+ acres or more in these areas.

The following should be noted and considered in reviewing these results:

- The results are generalized over each Focus Area and represent the average, integrated effect of all OWTS and rainfall-recharge contributions;

- The analysis and results do not account for the nitrogen contributions from other possible sources, such as agricultural and landscape fertilizer use, and animal wastes.

- The analysis assumes one "average" residence per developed parcel and does not account for second dwelling units or larger wastewater flows that might be associated with especially large residences. Adjustments to account for these differences, where warranted, can be made to refine the analysis and would entail more detailed OWTS inventories.

- Localized results for a specific parcel or group of parcels (e.g., neighborhood) within each sub-basin would most probably differ from the generalize results presented due to site specific conditions such as:, parcel size(s) and configuration, local rainfall, site development and landscape features, runoff rates, and wastewater system flows and design.

Finally, it should be emphasized that the results of this analysis are estimates, and have not been field verified or compared against actual groundwater quality sample results for any of the areas. The analysis and results provide baseline information to help understand the conditions and potential water quality concerns in these areas of greatest OWTS usage in San Mateo County. They form a starting point for ongoing water quality assessments that will be required under the LAMP, and should be updated and refined as additional information and findings become available. The results, on their own, are not a basis for designating any particular areas for special OWTS management measures or finding of water quality impairment.

References

California Department of Water Resources. 2003. California's Groundwater, DWR Bulletin 118. Update 2003.

California Department of Water Resources, Basin Boundaries (GIS File, September 2006, I08_B118_CA_GroundwaterBasins)

California Department of Water Resources, Water Data Library, (Groundwater Levels), http://www.water.ca.gov/waterdatalibrary/index.cfm

California Interagency Watershed Map 1999 (Updated GIS file May, 2004 Calwater 2.2.1 or "calw221")

Crites, R. W., and G. Tchobanoglous. 1998. *Small and Decentralized Wastewater Management Systems*. WCB/McGraw-Hill, New York, NY.

San Mateo County General Plan, Department of Environmental Management Planning and Development Division, http://lafco.smcgov.org/documents/sewerwastewater-jurisdictions, GIS download data provided by SMC GIS Department (City Limits, Special Districts, Wastewater Service Areas)

San Mateo County Website, GIS Download Data (Parcels)

USDA, Natural Resources Conservation Service. 1961. Soil Survey of San Mateo Area, California.

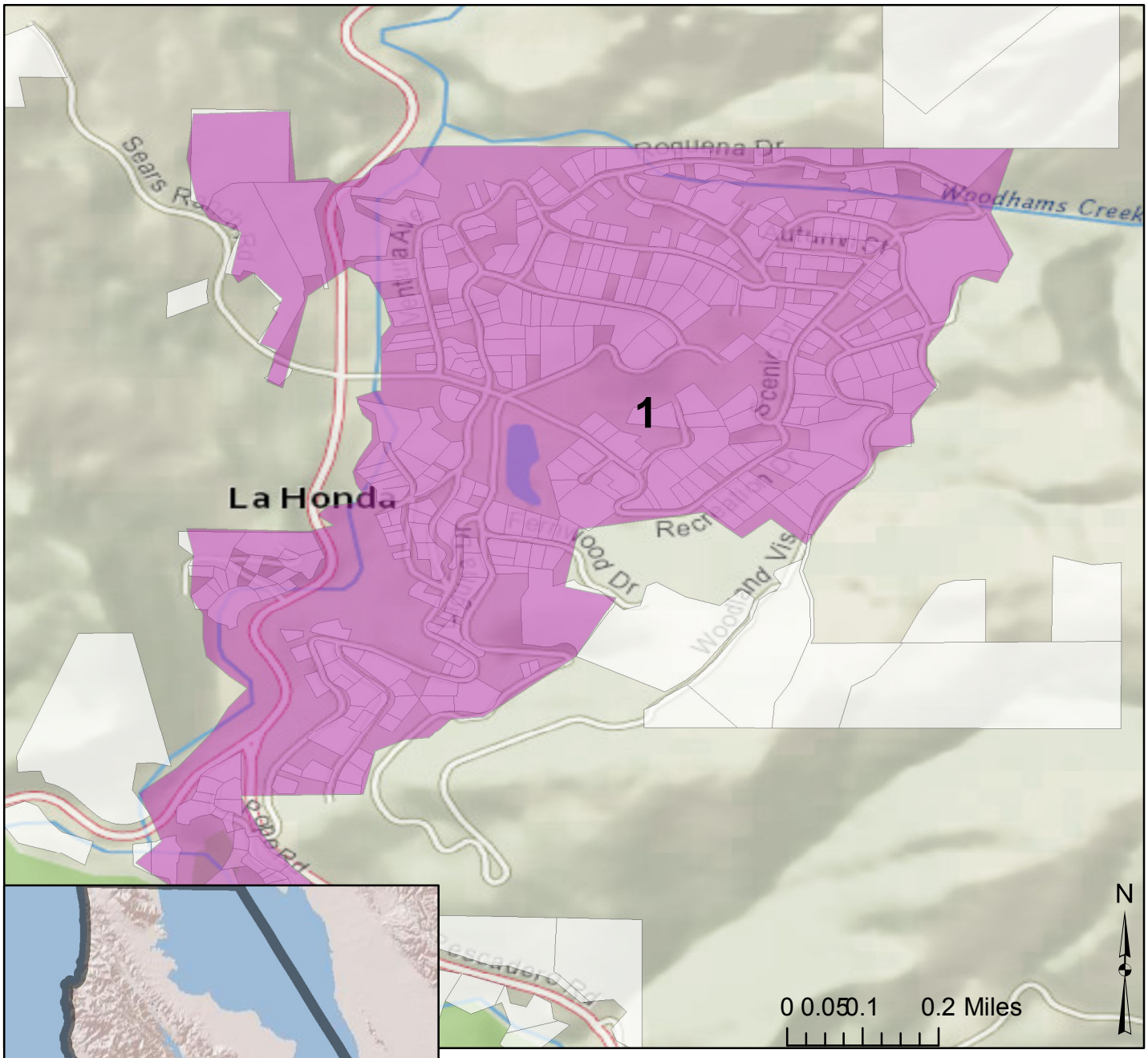
USDA, Natural Resources Conservation Service. 1990. Soil Survey of San Mateo County, Eastern Part, and San Francisco County, California.

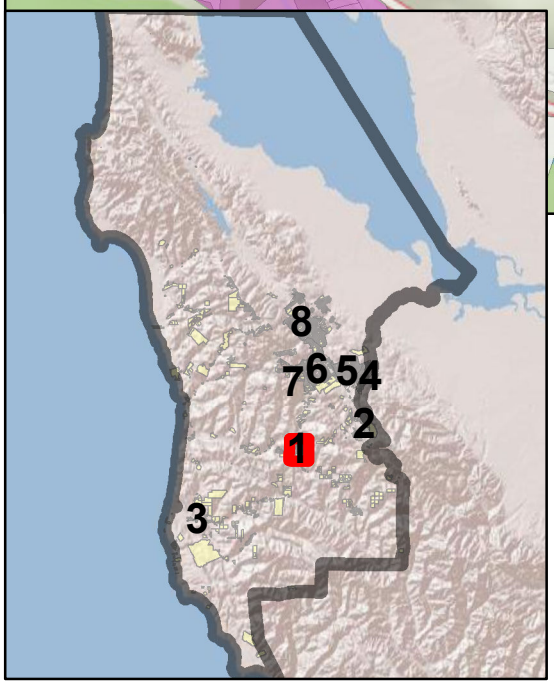
USDA, Natural Resources Conservation Service Online Soils Data Base.

Attachment 1

OWTS Focus Area Maps

La Honda 1





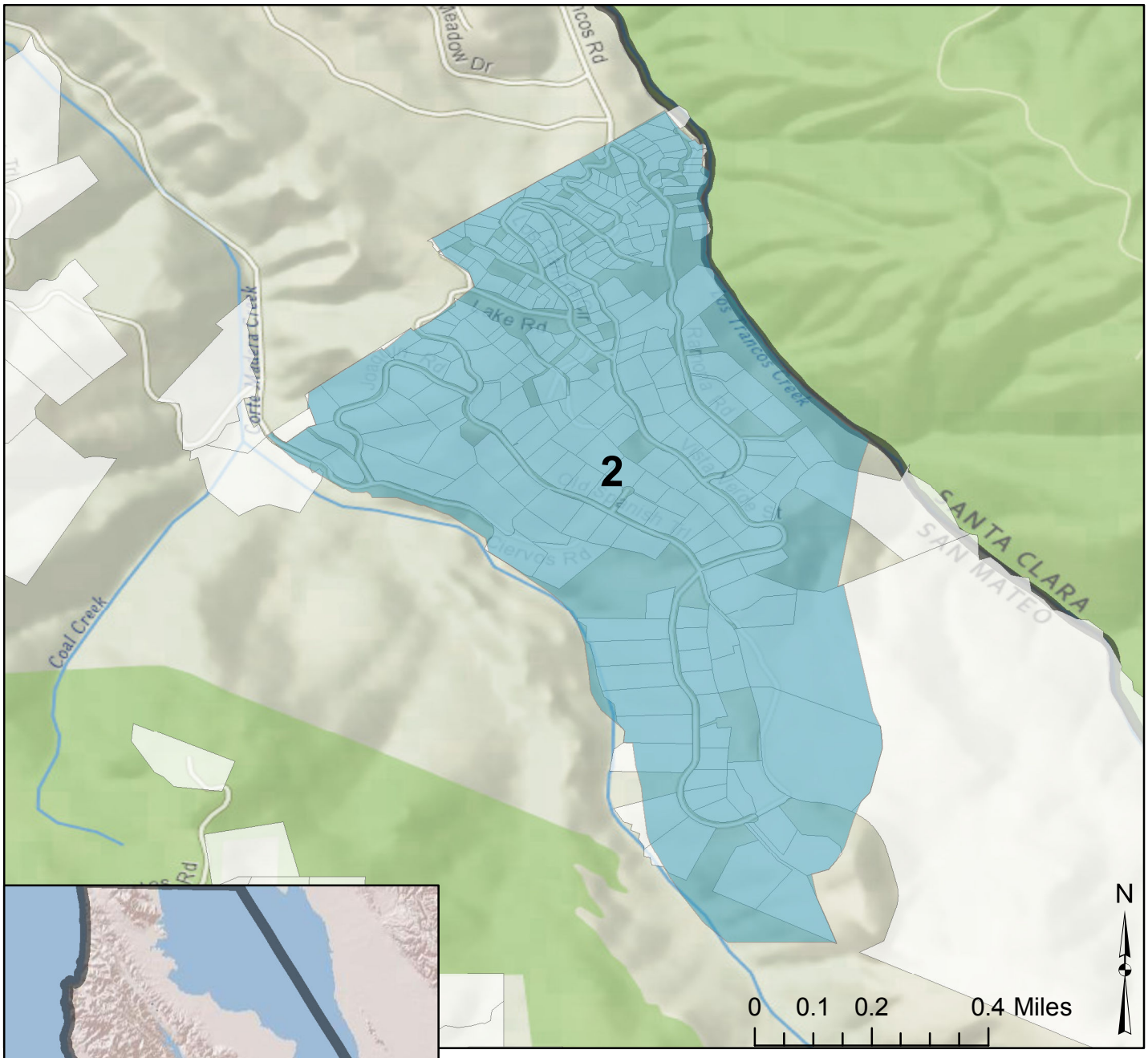
Legend

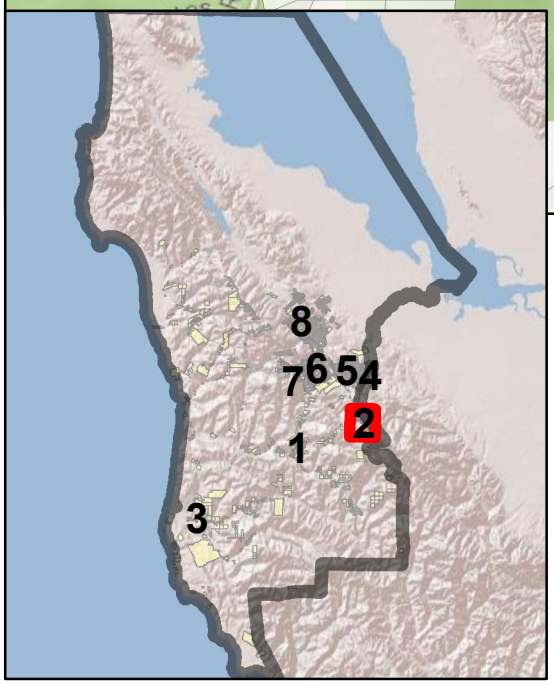
County Boundary

Residential Parcels Developed with OWTS

OWTS Focus Areas

Los Trancos Woods 2



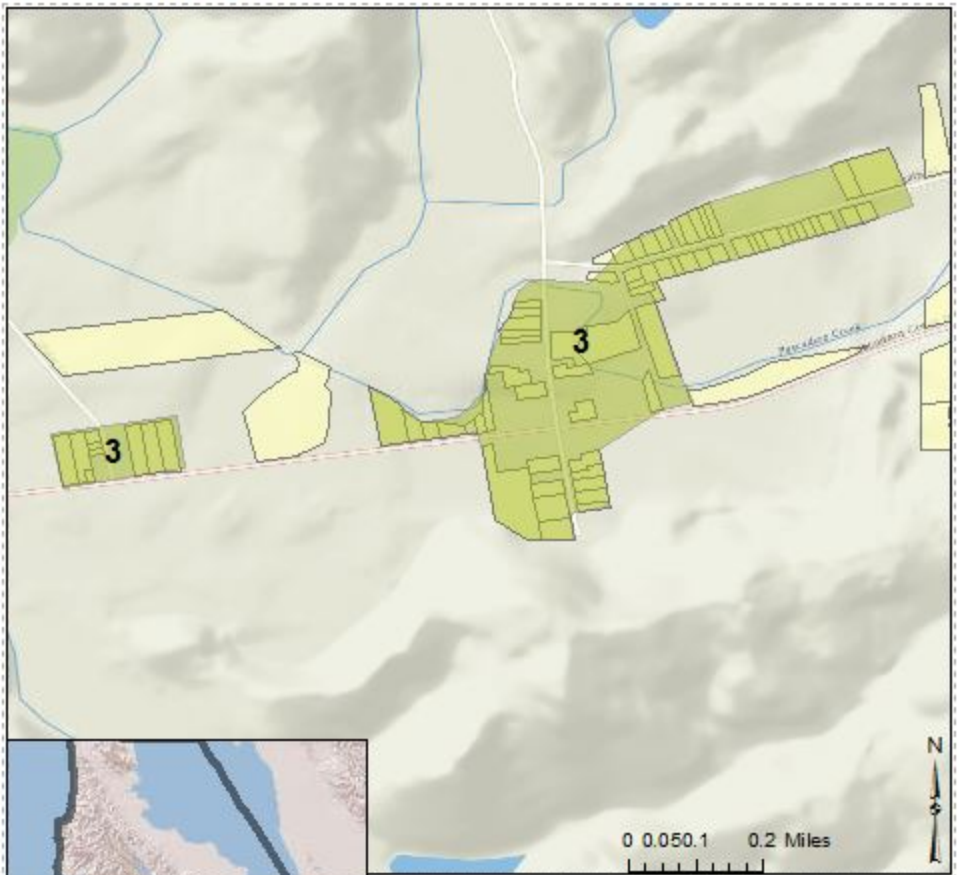


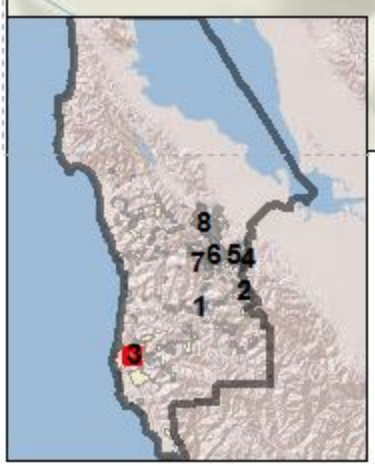
Legend

- County Boundary
- Residential Parcels Developed with OWTS

OWTS Focus Areas

Pescadero 3





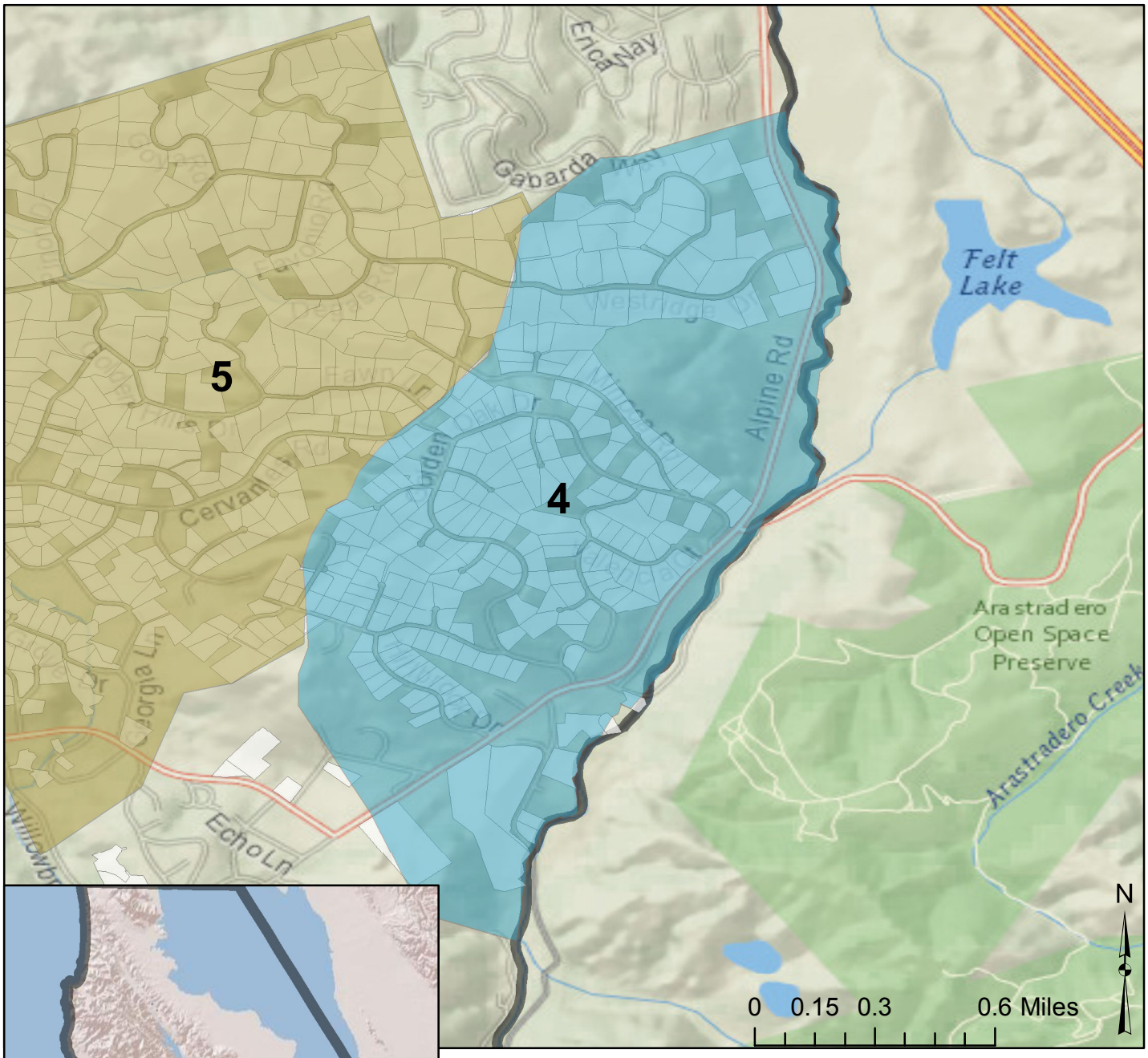
Legend

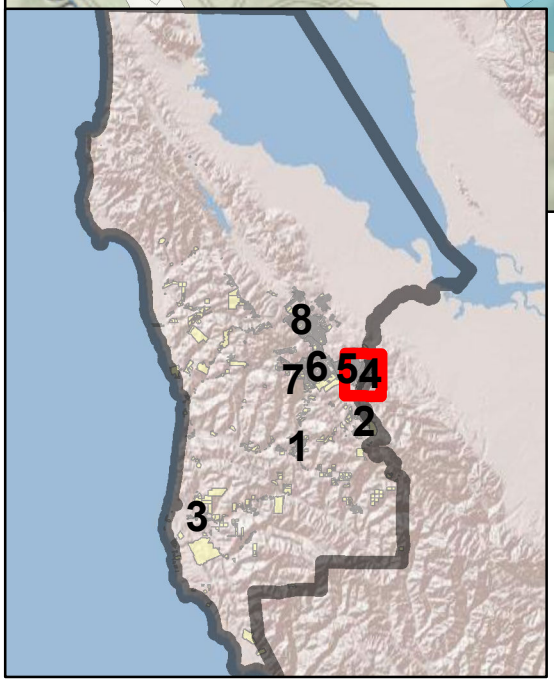
County Boundary

Residential Parcels Developed with OWTS

OWTS Focus Areas

Portola Valley East 4



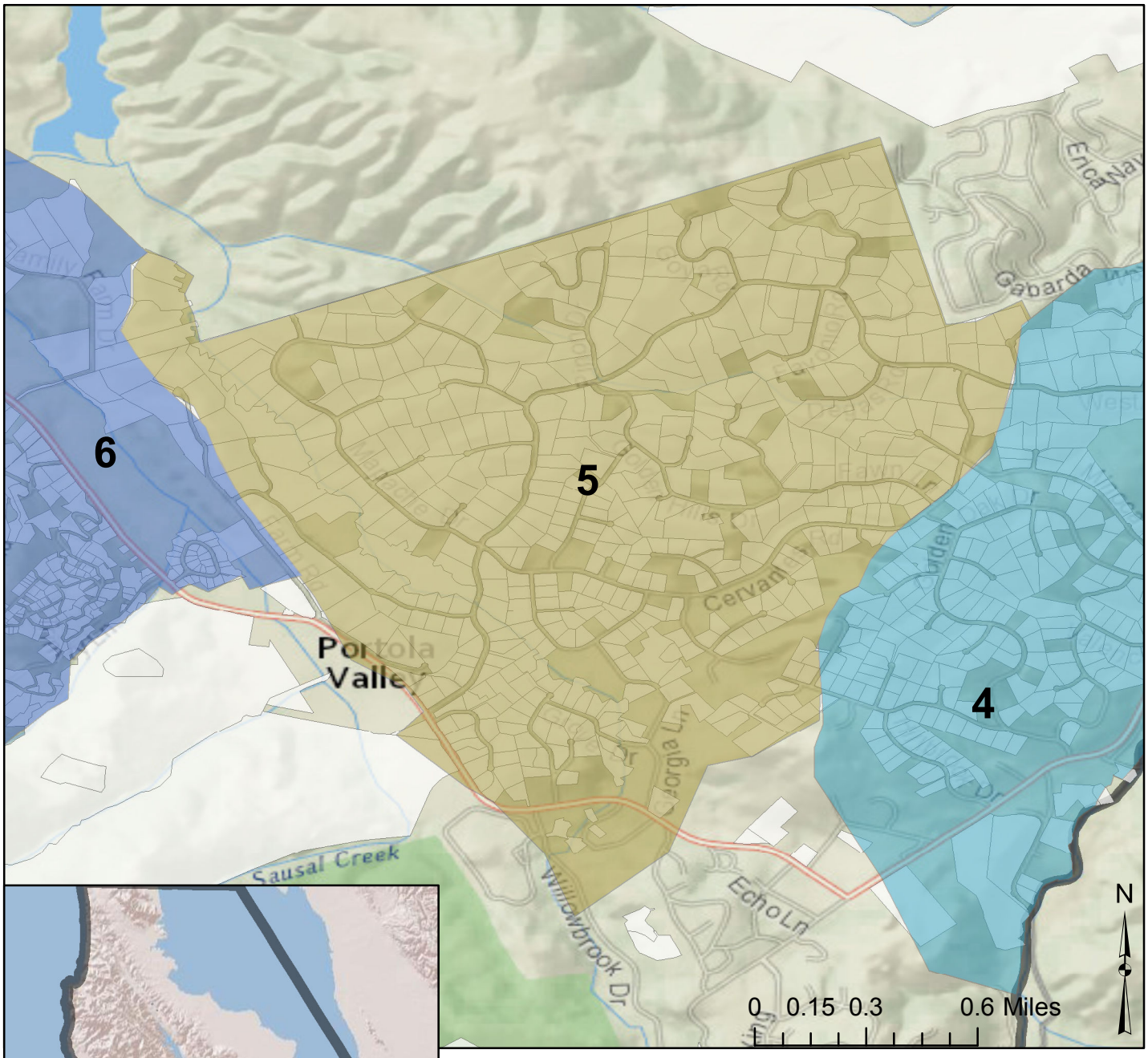


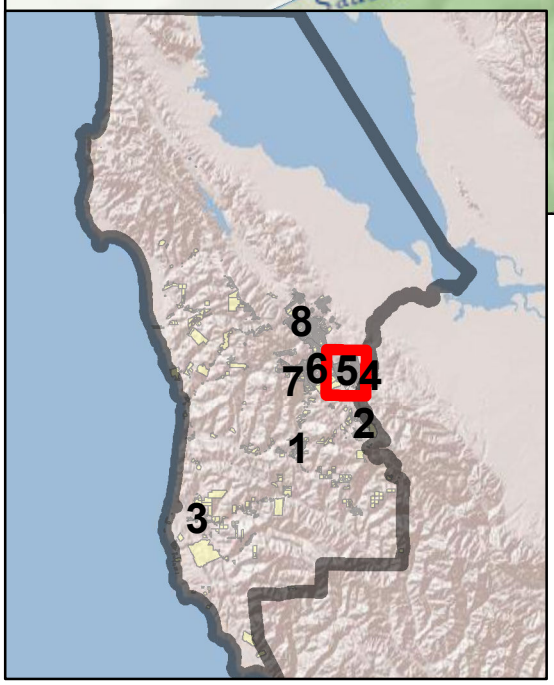
Legend

- County Boundary
- Residential Parcels Developed with OWTS

OWTS Focus Areas

Portola Valley Mid 5





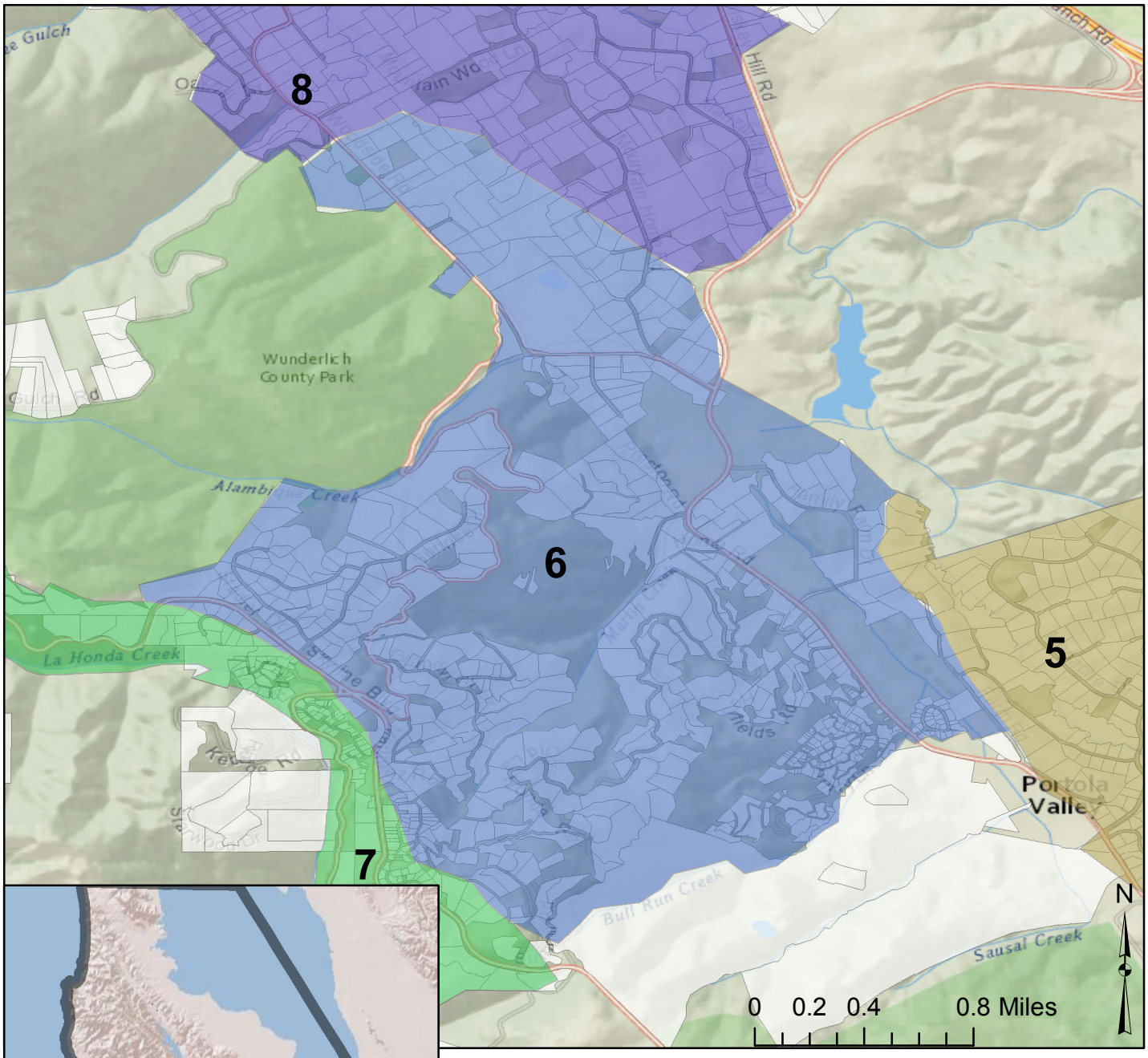
Legend

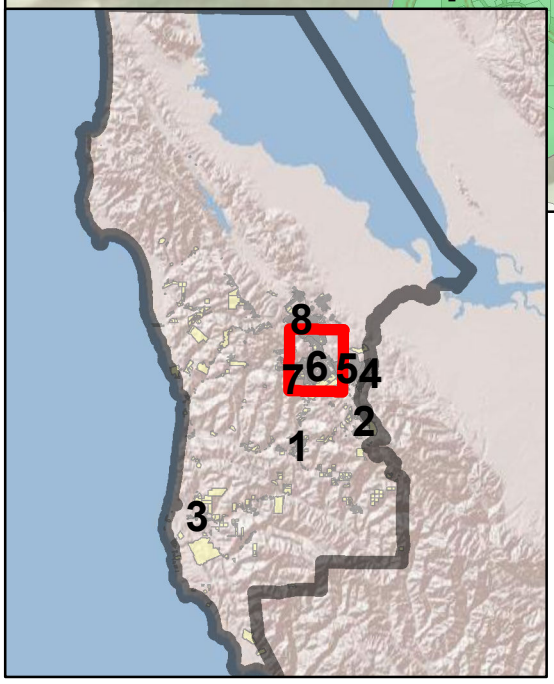
County Boundary

Residential Parcels Developed with OWTS

OWTS Focus Areas

Portola Valley West 6





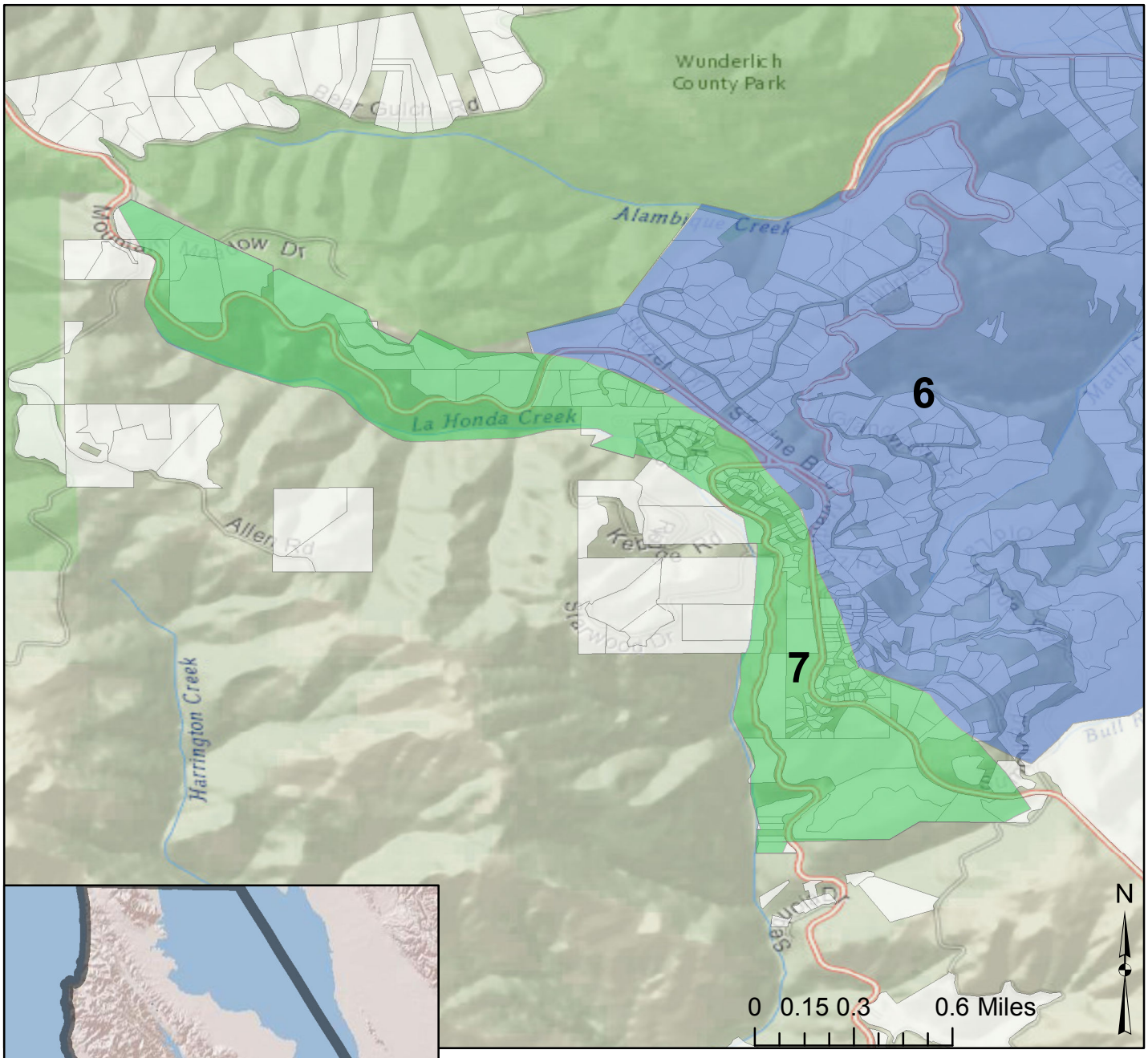
Legend

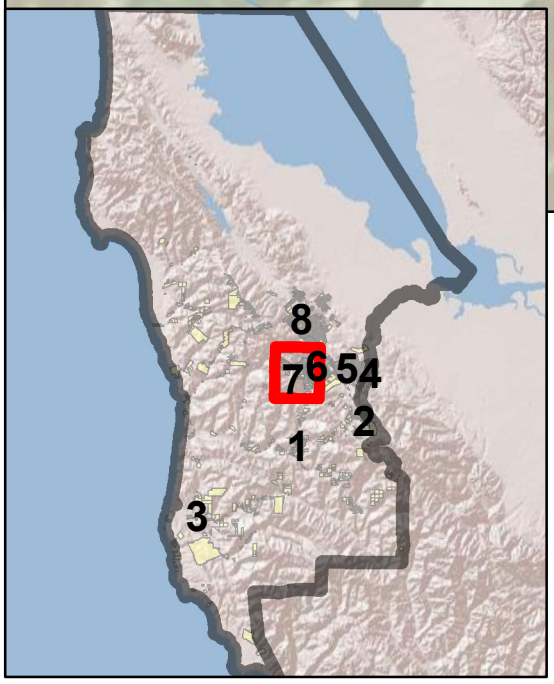
County Boundary

Residential Parcels Developed with OWTS

OWTS Focus Areas

Sky Londa West 7



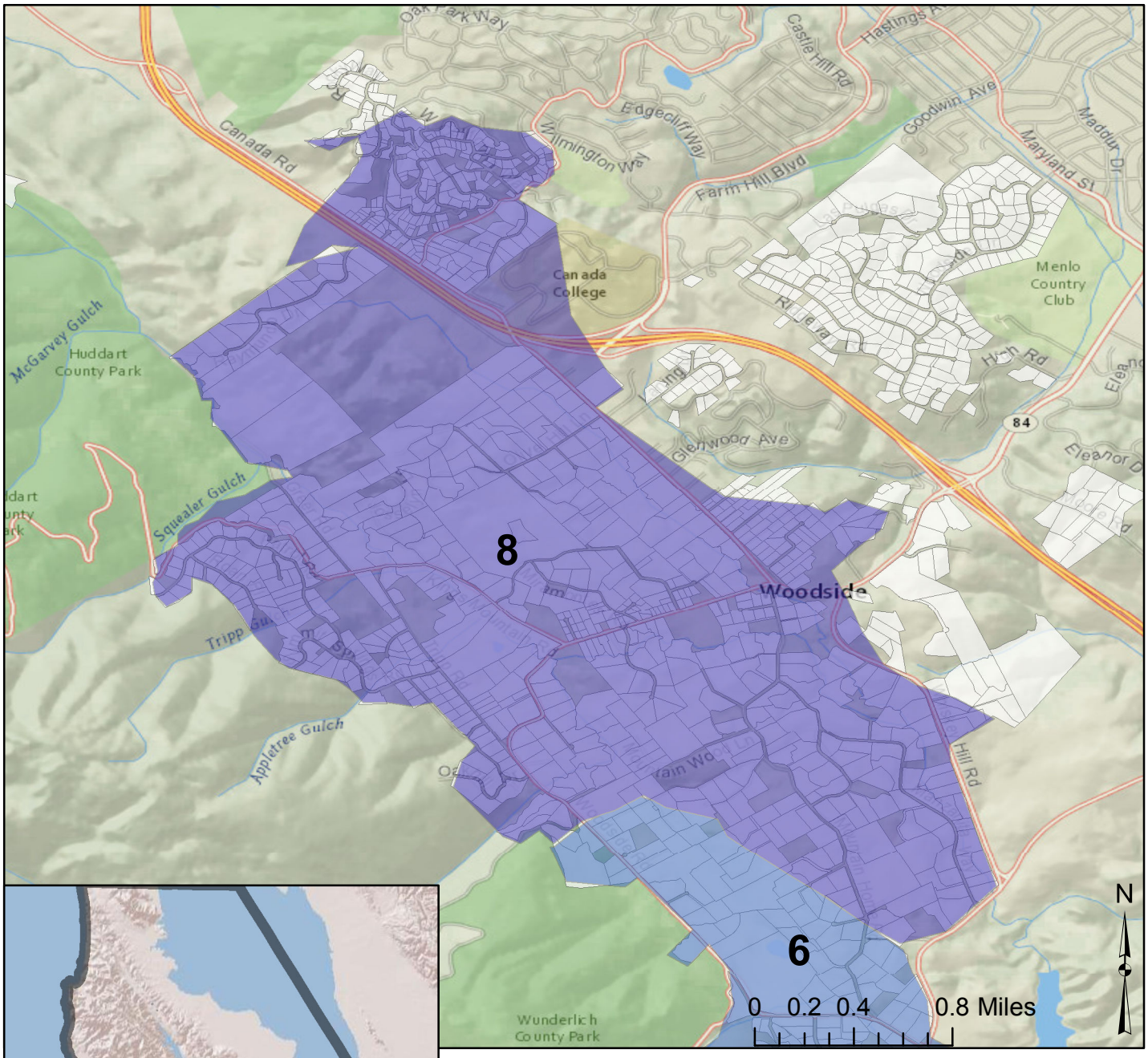


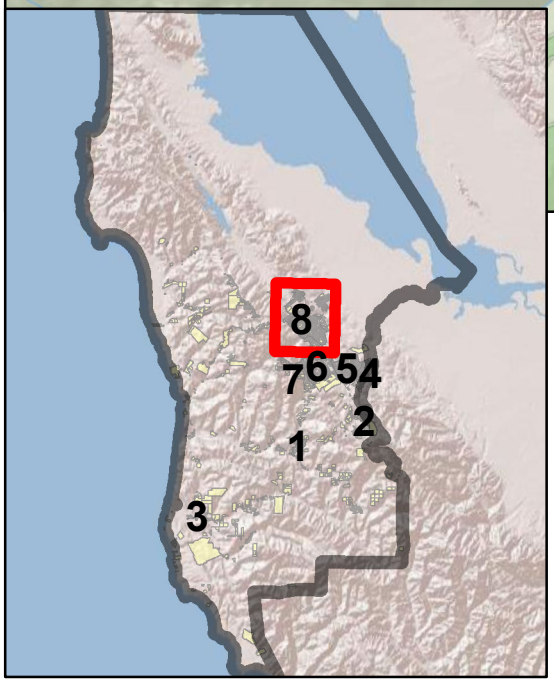
Legend

- County Boundary
- Residential Parcels Developed with OWTS

OWTS Focus Areas

Woodside West 8





Legend

County Boundary

Residential Parcels Developed with OWTS

OWTS Focus Areas

Attachment 2

Rainfall Recharge and Nitrate Loading Calculations

Table B2-1. Water Balance Recharge Analysis -Woodside/Portola Valley (ETo Climate Zone 3)

Month	Ave Precip. (in/month)	Average Runoff Rate (%)	Available Precip. (in/month)	Reference ETo (in/month)	Adjusted ET (in/month)	Net Rainfall Recharge (in/month)
Jan	5.68	0.20	4.54	1.86	0.93	3.61
Feb	4.04	0.15	3.43	2.24	1.12	2.31
Mar	3.43	0.10	3.09	3.72	1.86	1.23
Apr	2.05	0.05	1.95	4.80	2.40	0.00
May	0.59	0.00	0.59	5.27	2.64	0.00
Jun	0.12	0.00	0.12	5.70	2.85	0.00
Jul	0.01	0.00	0.01	5.58	2.79	0.00
Aug	0.04	0.00	0.04	5.27	2.64	0.00
Sep	0.23	0.00	0.23	4.20	2.10	0.00
Oct	1.33	0.05	1.26	3.41	1.71	0.00
Nov	3.15	0.10	2.84	2.40	1.20	1.64
Dec	5.56	0.20	4.45	1.86	0.93	3.52
Total	**26.23**		**22.55**	**46.31**	**23.16**	**12.31**

Notes:

1. Ave monthly precip for, determined from NOAA, Western Regional Climate Cntr for Searsville Lake
2. "Available Precip" equal to ave monthly precip minus estimated runoff volume;
3. Reference ETo obtained from CIMIS for Zone 3, Coastal Valleys/North Coastal Mtns
4. Potential ET adjusted with 0.6 Landscape Coefficient multiplier

Table B2-2. Water Balance Recharge Analysis -La Honda
(ETo Climate Zone 3)

Month	Ave Precip. (in/month)	Average Runoff Rate (%)	Available Precip. (in/month)	Potential ET (in/month)	Adjusted ET (in/month)	Net Rainfall Recharge (in/month)
Jan	6.21	0.20	4.97	1.86	0.93	4.04
Feb	4.19	0.15	3.56	2.24	1.12	2.44
Mar	4.04	0.15	3.43	3.72	1.86	1.57
Apr	2.36	0.10	2.12	4.80	2.40	0.00
May	0.79	0.00	0.79	5.27	2.64	0.00
Jun	0.35	0.00	0.35	5.70	2.85	0.00
Jul	0.09	0.00	0.09	5.58	2.79	0.00
Aug	0.18	0.00	0.18	5.27	2.64	0.00
Sep	0.44	0.00	0.44	4.20	2.10	0.00
Oct	1.87	0.10	1.68	3.41	1.71	0.00
Nov	4.17	0.15	3.54	2.40	1.20	2.34
Dec	5.64	0.20	4.51	1.86	0.93	3.58
Total	**30.33**		**25.68**	**46.31**	**23.16**	**13.98**

Notes:

1. Ave monthly precip for, determined fromNOAA, Western Regional Climate Cntr for La Honda
2. "Available Precip" equal to ave monthly precip minus estimated runoff volume;
3. Reference ETo obtained from CIMIS for Zone 3, Coastal Valleys/North Coastal Mtns
4. Potential ET adjusted with 0.5 Landscape Coefficient multiplier

Table B2-3. Water Balance Recharge Analysis - Pescadero
ETo Climate Zone 1

Month	Ave Precip. (in/month)	Average Runoff Rate (%)	Available Precip. (in/month)	Reference ETo (in/month)	Adjusted ET (in/month)	Net Rainfall Recharge (in/month)
Jan	5.66	0.15	4.81	0.93	0.56	4.25
Feb	5.08	0.15	4.32	1.40	0.84	3.48
Mar	4.25	0.15	3.61	2.48	1.49	2.12
Apr	2.27	0.05	2.16	3.30	1.98	0.18
May	0.86	0.00	0.86	4.03	2.42	0.00
Jun	0.33	0.00	0.33	4.50	2.70	0.00
Jul	0.11	0.00	0.11	4.65	2.79	0.00
Aug	0.18	0.00	0.18	4.03	2.42	0.00
Sep	0.41	0.00	0.41	3.30	1.98	0.00
Oct	1.55	0.05	1.47	2.48	1.49	0.00
Nov	3.49	0.10	3.14	1.20	0.72	2.42
Dec	5.24	0.15	4.45	0.62	0.37	4.08
Total	**29.43**		**25.86**	**32.92**	**19.75**	**16.54**

Notes:

1. Ave monthly precip for, determined from NOAA, Western Regional Climate Cntr for Pescadero
2. "Available Precip" equal to ave monthly precip minus estimated runoff volume;
3. Reference ETo obtained from DWR/CIMIS for Zone 1, Coastal Plains Heavy Fog Belt
4. Potential ET adjusted with 0.6 Landscape Coefficient multiplier

Figure B2-4 Estimated Groundwater-Nitrate Concentration Effects in OWTS Focus Areas

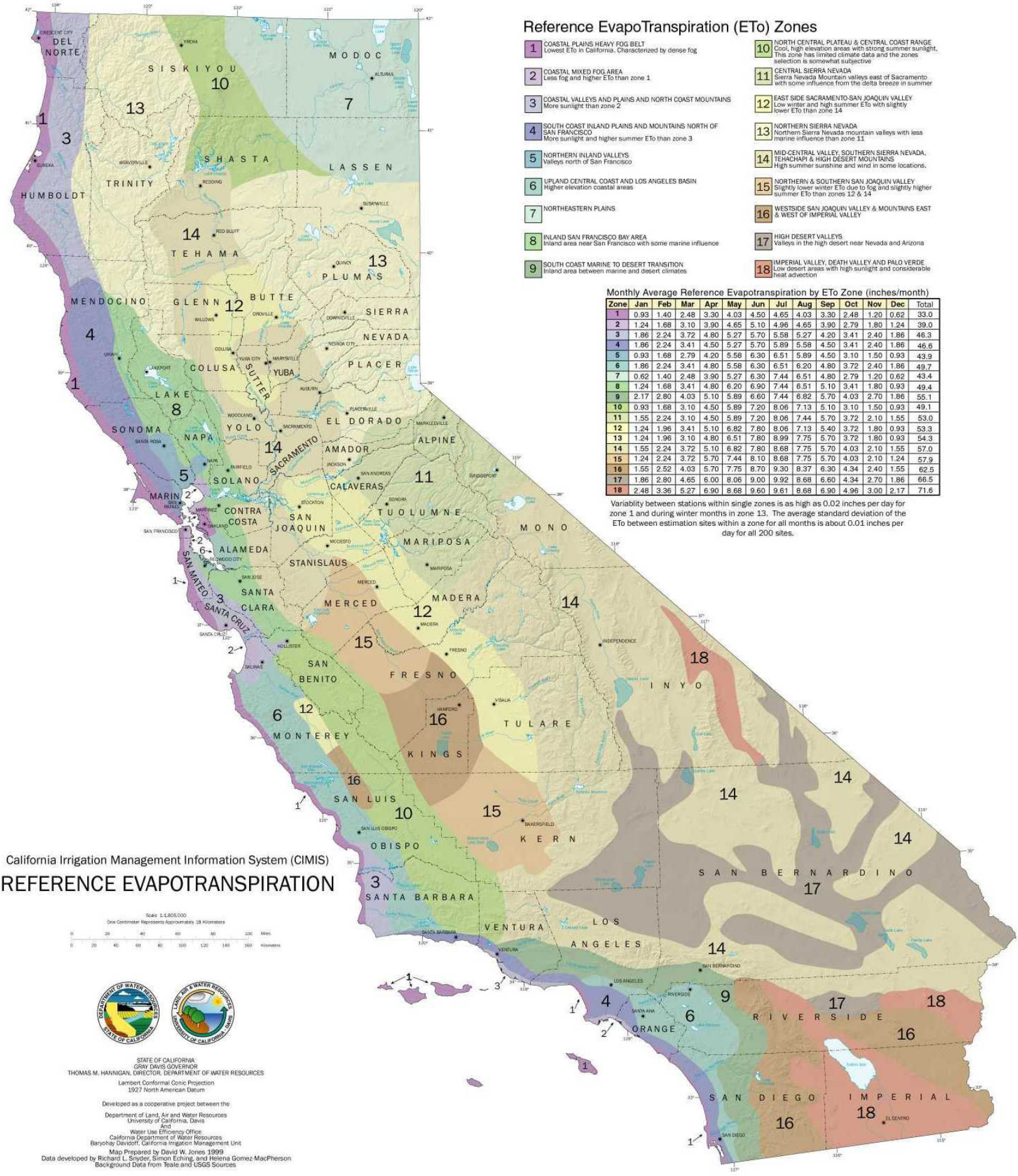
Focus Area	Recharge (acres)	Estimated OWTS	Wastewater Discharge Volumes (W)			Rainfall Recharge (R)		Total Recharge	Mass Nitrogen Loading To GW			Resultant
			Discharge Volume (gpd)	Discharge Volume (Mgal/yr)	Discharge Volume (ac-ft/yr)	Rainfall Recharge (inches/yr)	Rainfall Recharge (ac-ft/yr)	Total Recharge (ac-ft/yr)	Wastewater Mass N Loading	Background Mass N Loading	Total Mass N Loading	Resultant GW Nitrate-N Concentration (mg-N/L)
1. La Honda	301	336	50,400	18.40	56.46	13.98	351	407.12	3,162	175	3,337	8.20
2. Los Trancos Woods	357	254	38,100	13.91	42.68	12.31	366	408.90	2,390	183	2,573	6.29
3. Pescadero	73	73	10,950	4.00	12.27	16.54	101	112.88	687	50	737	6.53
4. Portola Valley East	791	235	35,250	12.87	39.49	12.31	811	850.92	2,211	406	2,617	3.08
5. Portola Valley Mid	1,341	464	69,600	25.40	77.96	12.31	1,376	1,453.61	4,366	688	5,054	3.48
6. Portola Valley West	2,256	560	84,000	30.66	94.10	12.31	2,314	2,408.38	5,269	1,157	6,426	2.67
7. Sky Londa West	513	158	23,700	8.65	26.55	13.98	598	624.19	1,487	299	1,786	2.86
8. Woodside West	2,763	787	118,050	43.09	132.24	12.31	2,834	2,966.62	7,405	1,417	8,823	2.97
TOTAL	**8,395**	**2,867**	**430,050**	**157**	**482**		**8,751**	**9,233**	**26,977**	**4,375**	**31,353**	

Calculation Notes:

Wastewater Mass N = W*70 mg/L*(1-0.20)

Background Mass N = R*0.5 mg/L

Resultant N, mg/L = Total Mass N/Total Rechage Vol



Reference EvapoTranspiration (ETo) Zones

1. COASTAL PLAINS HEAVY FOG BELT — Lowest ETo in California. Characterized by dense fog
2. COASTAL MIXED FOG AREA — Less fog and higher ETo than zone 1
3. COASTAL VALLEYS AND PLAINS AND NORTH COAST MOUNTAINS — More sunlight than zone 2
4. SOUTH COAST INLAND PLAINS AND MOUNTAINS NORTH OF SAN FRANCISCO — More sunlight and higher summer ETo than zone 3
5. NORTHERN INLAND VALLEYS — Valleys north of San Francisco
6. UPLAND CENTRAL COAST AND LOS ANGELES BASIN — Higher elevation coastal areas
7. NORTHEASTERN PLAINS
8. INLAND SAN FRANCISCO BAY AREA — Inland area near San Francisco with some marine influence
9. SOUTH COAST MARINE TO DESERT TRANSITION — Inland area between marine and desert climates
10. NORTH CENTRAL PLATEAU & CENTRAL COAST RANGE — Cool, high elevation areas with strong summer sunlight. This zone has limited climate data and the zones selection is somewhat subjective
11. CENTRAL SIERRA NEVADA — Sierra Nevada Mountain valleys east of Sacramento with some influence from the delta breeze in summer
12. EAST SIDE SACRAMENTO-SAN JOAQUIN VALLEY — Low winter and high summer ETo with slightly lower ETo than zone 14
13. NORTHERN SIERRA NEVADA — Northern Sierra Nevada mountain valleys with less marine influence than zone 11
14. MID-CENTRAL VALLEY, SOUTHERN SIERRA NEVADA, TEHACHAPI & HIGH DESERT MOUNTAINS — High summer sunshine and wind in some locations.
15. NORTHERN & SOUTHERN SAN JOAQUIN VALLEY — Slightly lower winter ETo due to fog and slightly higher summer ETo than zones 12 & 14
16. WESTSIDE SAN JOAQUIN VALLEY & MOUNTAINS EAST & WEST OF IMPERIAL VALLEY
17. HIGH DESERT VALLEYS — Valleys in the high desert near Nevada and Arizona
18. IMPERIAL VALLEY, DEATH VALLEY AND PALO VERDE — Low desert areas with high sunlight and considerable heat advection

Monthly Average Reference Evapotranspiration by ETo Zone (inches/month)

Zone	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1	0.93	1.40	2.48	3.30	4.03	4.50	4.65	4.03	3.30	2.48	1.20	0.62	33.0
2	1.24	1.68	3.10	3.90	4.65	5.10	4.96	4.65	3.90	2.79	1.80	1.24	39.0
3	1.86	2.24	3.72	4.80	5.27	5.70	5.58	5.27	4.20	3.41	2.40	1.86	46.3
4	1.86	2.24	3.41	4.50	5.27	5.70	5.89	5.58	4.50	3.41	2.40	1.86	46.6
5	0.93	1.68	2.79	4.20	5.58	6.30	6.51	5.89	4.50	3.10	1.50	0.93	43.9
6	1.86	2.24	3.41	4.80	5.58	6.30	6.51	6.20	4.80	3.72	2.40	1.86	49.7
7	0.62	1.40	2.48	3.90	5.27	6.30	7.44	6.51	4.80	2.79	1.20	0.62	43.4
8	1.24	1.68	3.41	4.80	6.20	6.90	7.44	6.51	5.10	3.41	1.80	0.93	49.4
9	2.17	2.80	4.03	5.10	5.89	6.60	7.44	6.82	5.70	4.03	2.70	1.86	55.1
10	0.93	1.68	3.10	4.50	5.89	7.20	8.06	7.13	5.10	3.10	1.50	0.93	49.1
11	1.55	2.24	3.10	4.50	5.89	7.20	8.06	7.44	5.70	3.72	2.10	1.55	53.0
12	1.24	1.96	3.41	5.10	6.82	7.80	8.06	7.13	5.40	3.72	1.80	0.93	53.3
13	1.24	1.96	3.10	4.80	6.51	7.80	8.99	7.75	5.70	3.72	1.80	0.93	54.3
14	1.55	2.24	3.72	5.10	6.82	7.80	8.68	7.75	5.70	4.03	2.10	1.55	57.0
15	1.24	2.24	3.72	5.70	7.44	8.10	8.68	7.75	5.70	4.03	2.10	1.24	57.9
16	1.55	2.52	4.03	5.70	7.75	8.70	9.30	8.37	6.30	4.34	2.40	1.55	62.5
17	1.86	2.80	4.65	6.00	8.06	9.00	9.92	8.68	6.60	4.34	2.70	1.86	66.5
18	2.48	3.36	5.27	6.90	8.68	9.60	9.61	8.68	6.90	4.96	3.00	2.17	71.6

Variablity between stations within single zones is as high as 0.02 inches per day for zone 1 and during winter months in zone 13. The average standard deviation of the ETo between estimation sites within a zone for all months is about 0.01 inches per day for all 200 sites.

California Irrigation Management Information System (CIMIS)

REFERENCE EVAPOTRANSPIRATION

Scale 1:1,805,000
One Centimeter Represents Approximately 18 Kilometers

0 20 40 60 80 100 Miles
0 20 40 60 80 100 120 140 160 Kilometers

STATE OF CALIFORNIA
GRAY DAVIS GOVERNOR
THOMAS M. HANNIGAN, DIRECTOR, DEPARTMENT OF WATER RESOURCES

Lambert Conformal Conic Projection
1927 North American Datum

Developed as a cooperative project between the

Department of Land, Air and Water Resources
University of California, Davis
And
Water Use Efficiency Office
California Department of Water Resources
Baryohay Davidoff, California Irrigation Management Unit

Map Prepared by David W. Jones 1999
Data developed by Richard L. Snyder, Simon Eching, and Helena Gomez-MacPherson
Background Data from Teale and USGS Sources