Phase 1 Report

Sunol Community Wastewater Feasibility Study

Prepared for:

Alameda County Department of Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502

Sunol Citizens' Advisory Council

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QUESTA ENGINEERING CORP.

April 2021

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April 2021

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EXECUTIVE SUMMARY:

This report presents the results of the first phase of a Feasibility Study regarding the needs and potential alternatives for improved sanitary wastewater management in the community of Sunol in East Alameda County.

The study originated out of discussions at community meetings of the Sunol Septic Work Group and in response to a variety of issues, including: (1) growing concerns about the condition and functioning of the many antiquated, non-conforming OWTS in Sunol; (2) physical constraints for modern OWTS posed by small lots sizes, steep slopes, and proximity to creeks; (3) regulatory challenges and costs encountered by homeowners in obtaining OWTS clearance for home additions and remodeling; and (4) designation of Kilkare Woods as an "Area of Concern" and Downtown Sunol as a "Potential Area of Concern" in the recently adopted Alameda County Local Agency Management Program (LAMP) for Onsite Wastewater Treatment Systems.

The overall aim of this Phase 1 Feasibility Study was to develop an improved understanding of the current conditions and challenges for onsite wastewater treatment systems (OWTS) in Sunol and to identify potentially feasible solutions or management practices. The specific objectives included:

- Compile and review information regarding existing onsite wastewater treatment system (OWTS) practices in the Sunol area;
- Collect and review environmental information, particularly related to soils, OWTS suitability and water quality;
- Formulate a range of potential alternative solutions to address long-term management of OWTS; and
- Provide conceptual plans and preliminary cost estimates for potentially viable community wastewater management alternatives.

In general, soils throughout most of Sunol are well drained and have suitable silt loam to gravelly loam textures, which are favorable conditions for onsite wastewater disposal. The main limitations are the steeply sloping terrain, shallow soil depths over bedrock, close proximity to streams, and small lot sizes, which was confirmed through voluntary field reviews of properties in different parts of the study area.

Questionnaire surveys, County records and field reviews show the vast majority of OWTS to be 40+ years old, indicating they were built under older code, likely not compliant with modern onsite wastewater standards. This is generally confirmed from ACDEH experience dealing with system repairs and replacement projects.

Watercourse setback limitations posed by Sinbad Creek and tributary streams are a significant code compliance issue for many properties in Sunol. Steep slopes and limited available land area on small lots also pose significant constraints.

Water quality sampling of Sinbad Creek in 2017 and 2018 showed exceedance of bacteriological standards, with an increasing trend downstream. Although not at levels that pose an imminent health hazard, the fecal indicator bacteria readings and the frequency of exceedance of water quality objectives, especially in the Downtown section of Sinbad Creek, support the LAMP designation of Sunol as an area of potential water quality concern. If the results from these two baseline studies were to be found through continuing monitoring to be a recurring or chronic condition, portions of Sinbad Creek could potentially be considered by the Regional Water Board to be "impaired" with respect to pathogens.

The study has identified and outlined the basic elements and estimated costs for several potentially viable community wastewater management alternatives for Sunol. Beyond the status quo (no project), the alternatives include the establishment of an OWTS management program, a standalone community system for Kilkare Woods, a community wastewater system located in Downtown Sunol on County-owned lands with potential service for: (a) Downtown; (b) Downtown plus Lower Kilkare Road; and (c) the entire Study Area extending from Downtown Sunol through all of Kilkare Woods. The alternative of sewer connection to City of Pleasanton is also described, although the viability is remote due to questionable financial feasibility and other uncertainties. A summary table provided at the end of this report outlines the alternatives identified and preliminary cost estimates.

It is intended that the results of this Phase 1 Feasibility Study will be distributed to members of the community for review, discussion and feedback. The response and feedback will provide the basis for judging the level of community interest in pursuing additional detailed analysis and comparative review of wastewater management alternatives, eventually leading to the selection of a preferred alternative(s) to address long-term OWTS management needs in Sunol.

SECTION 1: INTRODUCTION AND BACKGROUND

This report presents the results of the first phase of a Feasibility Study regarding the needs and potential alternatives for improved sanitary wastewater management in the community of Sunol located in Alameda County (**Figure 1**). The study, conducted by Questa Engineering Corporation, was authorized and funded jointly by Alameda County Department of Environmental Health (ACDEH) and the Sunol Citizens Advisory Council/Septic Work Group. The study was initiated in late 2016 and conducted over a 2½-year period, coordinated with periodic meetings, field trips and workshops held with members of the community and the Sunol Septic Work Group (see list of meeting dates at end of this section).

The study originated out of discussions at community meetings of the Septic Work Group and in response to a variety of issues, including: (1) growing concerns about the condition and functioning of the many antiquated, non-conforming OWTS or Onsite Wastewater Treatment Systems (OWTS) in Sunol; (2) physical constraints for modern OWTS posed by small lots sizes, steep slopes, and proximity to creeks; (3) regulatory challenges and costs encountered by homeowners in obtaining OWTS clearance for home additions and remodeling; and (4) designation of Kilkare Woods as an "Area of Concern" and Downtown Sunol as a "Potential Area of Concern" in the Alameda County Local Agency Management Program (LAMP) for Onsite Wastewater Treatment Systems adopted in June 2018.

The County Ordinance and Regulations provide a broad range of options for individual onsite wastewater solutions. However, in constrained areas approval of replacement or new OWTS requires the property owner to obtain a variance from the County Board of Supervisors, which is a lengthy process and costly to the property owner.

The overall aim of this Phase 1 Feasibility Study was to develop an improved understanding of the current conditions and challenges for OWTS in Sunol and to identify potentially feasible solutions or management practices. The specific objectives included:

- Compile and review information regarding existing onsite wastewater treatment system (OWTS) practices in the Sunol area;
- Collect and review environmental information, particularly related to soils, OWTS suitability and water quality;
- Formulate a range of potential alternative solutions to address long-term management of OWTS; and
- Provide conceptual plans and preliminary cost estimates for potentially viable community wastewater management alternatives.

It is intended that the results of this Phase 1 Feasibility Study will be distributed to members of the community for review, discussion and feedback. The response and feedback will provide the basis for judging the level of community interest in pursuing additional detailed analysis and comparative review of wastewater management alternatives (Phase 2), eventually leading to the selection of a preferred alternative(s) by the community to address long-term OWTS management needs in Sunol.

Sunol Septic Work Group meeting dates, 2015 through 2019:

2015
December 11th

2016
January 19th
February 9th
March 8th
April 12th
May 10th
June 14th
September 13th
October 11th
November 9th
December 9th - Lake Canyon field trip

2017
February 14th
April 11th
July 12th

2018
March 13th
April 10th
May 8th
June 12th
July 10th - Septic Systems 101 Workshop
September 11th - Planning Department Workshop
October 9th - Greywater Workshop
December 12th

2019
January 8th
March 12th
March 29th - Depot Gardens field meeting
April 10th
June 11th
July 9th
September 10th

PHASE 1 – SUNOL
WASTEWATER FEASIBILITY STUDY

SUNOL, CALIFORNIA
ALAMEDA COUNTY

QUESTA ENGINEERING CORP.

LOCATION MAP

FIGURE
1

SECTION 2: STUDY AREA CHARACTERISTICS

GEOGRAPHICAL SETTING

Sunol is an unincorporated rural community located in East Alameda County (**Figure 2**). With approximately 1,000 residents in an area of 86 square miles, the rural unincorporated community of Sunol is bordered by Fremont to the south and west, Pleasanton to the north, and Livermore to the east. Sunol's most eastern population is centered around Little Valley Road and Vallecitos. To the North, Sunol stretches along Foothill Road and Pleasanton Sunol Road, straddling Arroyo de La Laguna. To the Southwest, Sunol's homes and businesses climb the base of Mission Peak reaching toward the Calaveras Reservoir. The highest population density is in downtown Sunol and along Kilkare Road that follows Sinbad Creek north from town for more than 3.5 miles.

The small downtown area along Main Street includes of a small number of commercial businesses, a U.S. Post Office, and Sunol Glen School. In addition to their vast watershed land, the San Francisco Public Utilities Commission (SFPUC) has several large facilities in Sunol, including the historic Sunol Water Temple, the Watershed Interpretive Center, a maintenance yard, and a treatment plant. The Vallecitos Nuclear Facility, seven large sand and gravel quarries, farms, cattle grazing, three East Bay Regional Parks, a living railroad museum, and plant nurseries are located in Sunol.

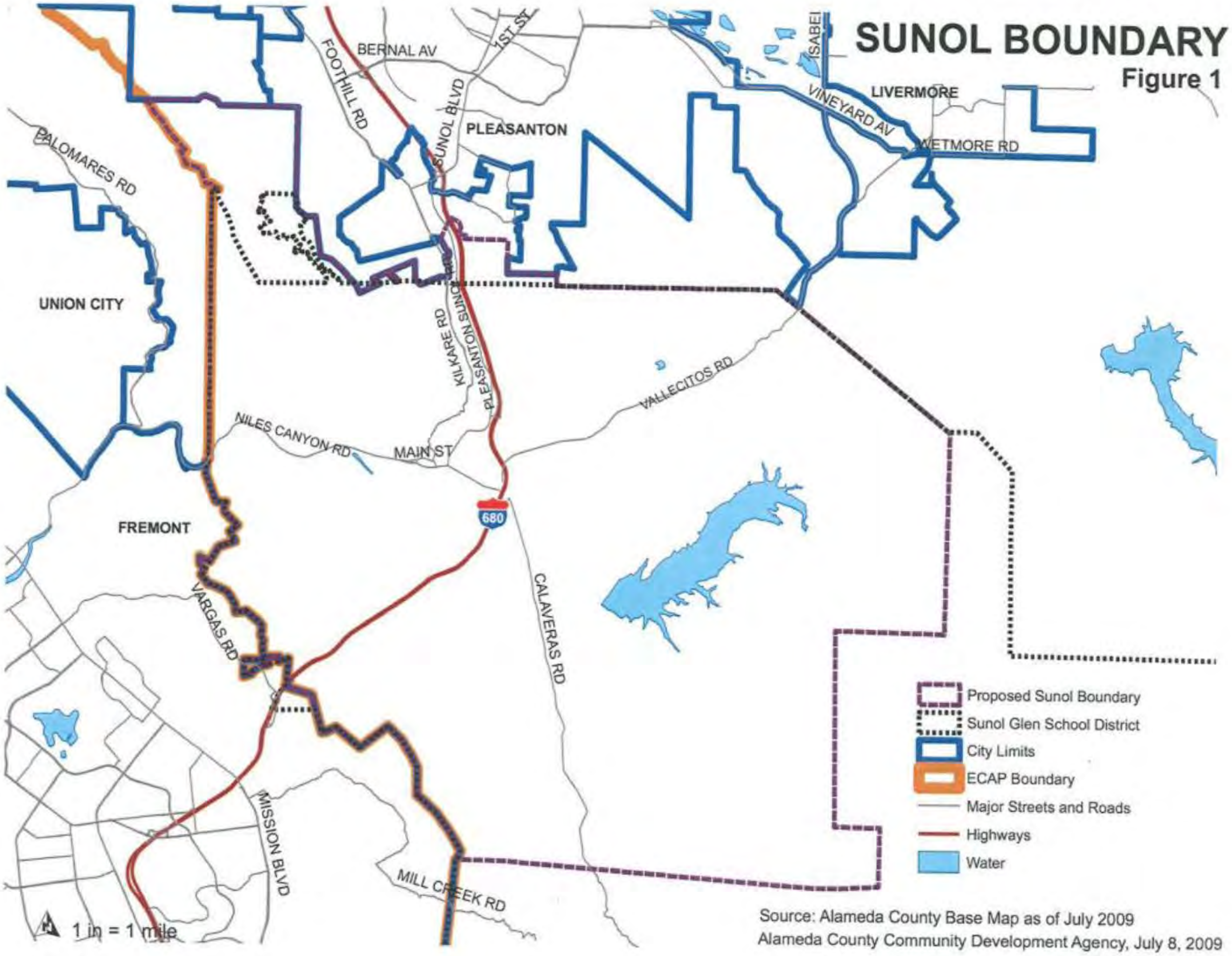
Two major roadways intersect Sunol: Freeway 680 travels North-South and Highway 84 runs East-West. There are two railroad lines that bisect downtown Sunol – (1) the Union Pacific (freight and ACE passenger trains), which operates on the former Western Pacific Railroad tracks, and (2) the Niles Canyon Railway, which operates on the former Southern Pacific Railroad tracks.

There are no sanitary sewer systems in Sunol; all developed properties are served either by individual OWTS or holding tanks ("haul-away"), which is the case for the SFPUC, East Bay Regional Parks, and Niles Canyon Railway facilities.

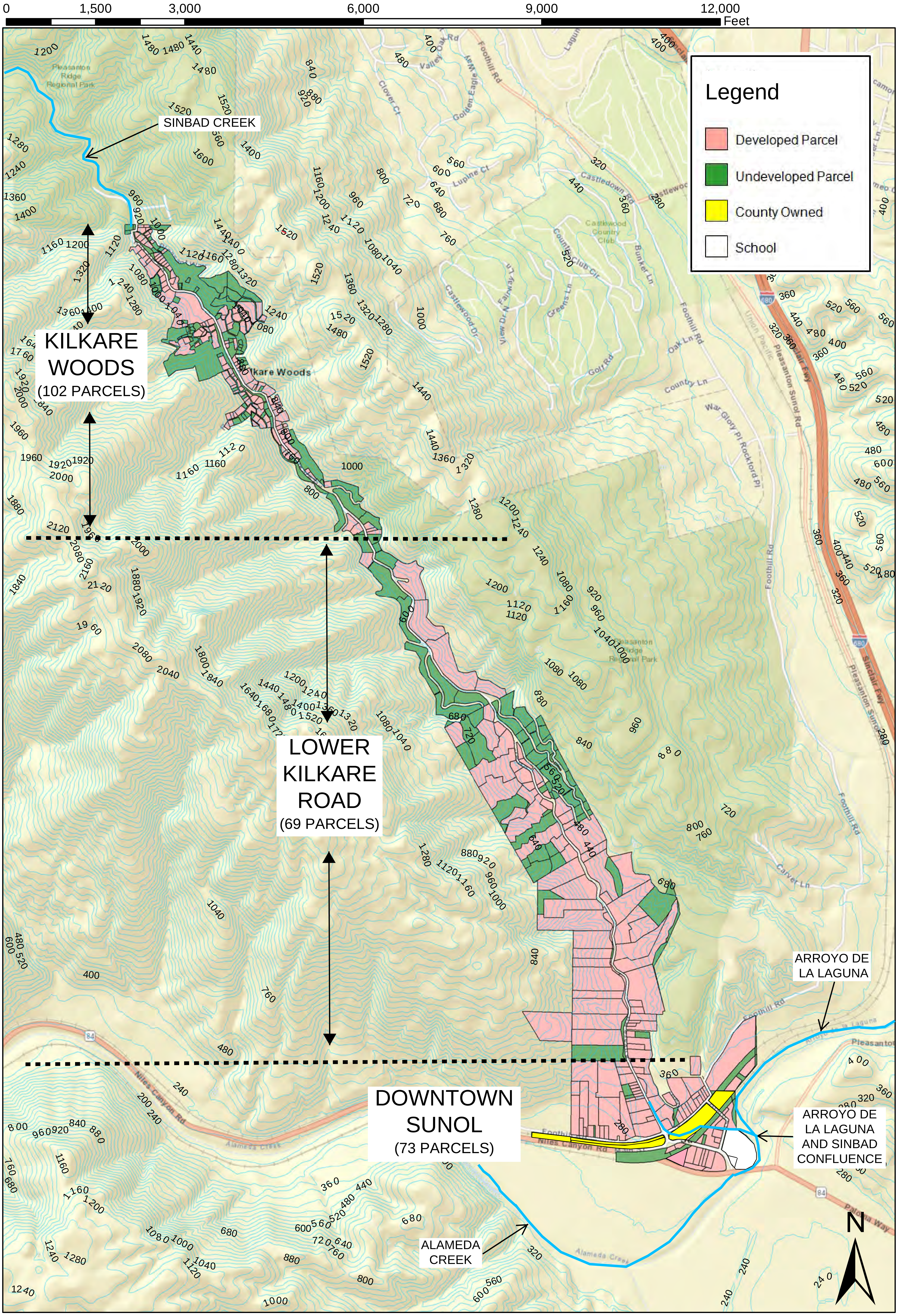
STUDY AREA BOUNDARIES

The Study Area for the Phase 1 Feasibility Study was chosen to focus on the largest number and highest concentration of OWTS in Sunol, including areas recognized in the Alameda County LAMP as potential or designated "Areas of Concern" for onsite wastewater systems. As shown in **Figure 3**, the Study Area encompasses all developed properties (and abutting undeveloped parcels) within the Sinbad Creek drainage basin. It extends from Downtown Sunol to the upper end of Kilkare Woods, including the intervening rural residential development area commonly referred to as Lower Kilkare Road.

Based on County Assessor records there are approximately 240 developed parcels in the Study Area, primarily single family residences with a small number of commercial occupancies mainly in the Downtown Sunol business district. There are an estimated 80 undeveloped properties in the Study Area.



PHASE 1 – SUNOL WASTEWATER FEASIBILITY STUDY SUNOL, CALIFORNIA ALAMEDA COUNTY	QUESTA ENGINEERING CORP.	**SUNOL BOUNDARY**	FIGURE 2



PROJECT NO. 1500042

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Study Area Map

Sunol Wastewater Feasibility Study - Phase I

SUNOL, CA

ALAMEDA COUNTY

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FIGURE 3

The LAMP provides for consideration of community management programs and solutions for areas within the County that are more constrained (small lots sizes, steep slopes, proximity to creeks) and in areas of higher development density. The Alameda County LAMP recognizes Downtown Sunol, including most of Lower Kilkare Road, as a "Potential Area of Concern" with respect to potential environmental constraints or impacts to the environment from OWTS. The LAMP classifies Kilkare Woods as a designated "Area of Concern". The study area chosen in Sunol meets these criteria. The study area did not include other areas of Sunol where larger lot sizes with fewer constraints are adequately addressed through adherence to the provisions and options in the County's OWTS Ordinance and Technical Manual.

Downtown Sunol

Downtown Sunol (73 developed parcels) consists of a large concentration of residences and small commercial district on an alluvial terrace at the confluence of Sinbad Creek and Arroyo de la Laguna, a short distance upstream from Alameda Creek. Soil conditions are generally very favorable for onsite wastewater systems, but parcels are limited by small lot sizes, many less than 10,000 square feet in size. Larger flows and high strength wastewater associated with certain businesses, e.g., restaurants, pose additional issues for onsite wastewater treatment. The overall cumulative wastewater loading impacts on groundwater from the high density of OWTS is also a potential concern.

Lower Kilkare Road

The area known as Lower Kilkare Road (69 developed parcels) has historically been rural residential in nature, and is made up of larger parcels than Downtown Sunol, ranging in size from 10,000 square feet to approximately 2.5 acres in size. These lots are located along both sides of Sinbad Creek with direct access off of Kilkare Road. The lots are generally developed with a single family residence built in the 1950s, and some have a private well in addition to an onsite OWTS. Soil conditions are generally favorable for OWTS in this area of Sunol, parcels are limited on a site specific basis by building and setback constraints, age of the existing OWTS, and close proximity to Sinbad Creek in some cases.

Kilkare Woods

Kilkare Woods (102 developed parcels) is an historical development dating to the 1920s. Original summer cabins and cottages have been converted over the years to full-time residences. The area is densely developed on steep wooded terrain and stream terraces. Development is characterized by very small lot sizes, minimal setbacks to drainages and steep embankments, and many antiquated and non-conforming OWTS. Repair, upgrade or replacement of existing OWTS is needed to accommodate building improvements and additions.

WATER RESOURCES

Alameda Creek Watershed

Sunol lies within the Alameda Creek watershed, the largest drainage in the southern San Francisco Bay, covering an area of approximately 700 square miles within Alameda, Contra Costa and Santa Clara Counties. Alameda Creek originates in the mountains of northeastern Santa Clara County and from there flows northwesterly through the hills of the Coast Range, merging with drainage from the Livermore-Amador Valley in the Sunol Valley, then flowing westerly through Niles Canyon and across the San Francisco Bay plain, ultimately discharging into San Francisco Bay near Coyote Hills Regional Park in Union City. Runoff from the Alameda Creek watershed is used to recharge the aquifers of the Niles Cone Groundwater Basin, and comprises about 40% of the total water supply for the Fremont, Newark and Union City areas, managed by the by the Alameda County Water District.

Sinbad Creek

The defining water feature in the Study Area is Sinbad Creek, which originates in the hills of Pleasanton Ridge and Upper Kilkare Canyon, north of Kilkare Woods. The creek flows north-to-south through Sunol, paralleling Kilkare Road, jogging through Depot Gardens in Downtown Sunol, and ultimately joining Arroyo de la Laguna on the north side of Sunol Glen School, at a point about a half mile upstream of the confluence with Alameda Creek. Arroyo de la Laguna is the principal stream that drains the Livermore-Amador Valley.

Sinbad Creek is about 7.5-miles long with a drainage area of 6.44 square miles. The creek is deeply incised through most of its length, with a gravel and boulder channel bottom and numerous natural pools and step sequences. The creek flows throughout the wet weather season, normally going “dry” early in early summer, when the water flow in the creek drops into the coarse gravel substrate.

Sinbad Creek is designated by the Regional Water Board as have the following Beneficial Uses:

- Cold Freshwater Habitat
- Warm Freshwater Habitat
- Fish Migration
- Fish Spawning
- Water Contact Recreation
- Noncontact Water Recreation
- Wildlife Habitat

The Regional Water Board is charged with protecting all these uses from pollution and nuisance that may occur as a result of waste discharges. Designated Beneficial Uses are used by the Regional Board in establishing water quality objectives and discharge prohibitions to attain these goals.

Sunol Valley Groundwater Basin

Although most all of the Sunol area is served by municipal water provided by the City of Pleasanton and City and County of San Francisco, there are a scattered number of individual wells in portions of the Study Area, particularly in the Lower Kilkare Road area and along Foothill Road. There is no inventory of existing wells, but it is believed that most are used for agricultural irrigation. Information on the location of wells occasionally shows up in connection with site evaluation studies for buildings and OWTS improvement projects.

Groundwater supplying local wells is from the Sunol Valley Groundwater Basin, which encompasses a surface area of approximately 41 square miles (26,240 acres). Streams contributing recharge to the groundwater basin include Upper Alameda, La Costa, Sinbad, Indian, Vallecitos and San Antonio Creeks, and Arroyo de la Laguna. The general direction of groundwater movement is from the upland areas toward Alameda Creek and then westward toward Niles Canyon, the outlet of the basin. Water bearing materials in the basin consist of unconsolidated to semi-consolidated continental deposits of gravels, sand, silts and clays laid down in alluvial fans, outwash plains and lakes. Well yields for domestic and municipal wells are reported to be in the range of 2 to 50 gpm, with well depths typically in the range of 200 to 350 feet[1]. Depth to groundwater on the order of 20 to 30 feet below ground surface is typical in the valley areas, which includes the Downtown Sunol area. Groundwater depth at the former Sunol Chevron Station (Main St. and Bond Street) was reported at 25 to 35 feet in 1993-1995.[2]

There is currently no significant groundwater management in the Sunol basin or identified areas of groundwater quality concern. However, Zone 7 Water Agency is designated the exclusive Groundwater Sustainability Agency for all groundwater basins within their jurisdiction. Alameda County LAMP includes limitations on nitrogen loading from onsite wastewater systems based on groundwater management criteria adopted by Zone 7. These requirements may trigger the need for advanced/supplemental treatment systems in connection with new development and building expansion projects in Sunol, depending on the type and size of the project.

SOIL CONDITIONS

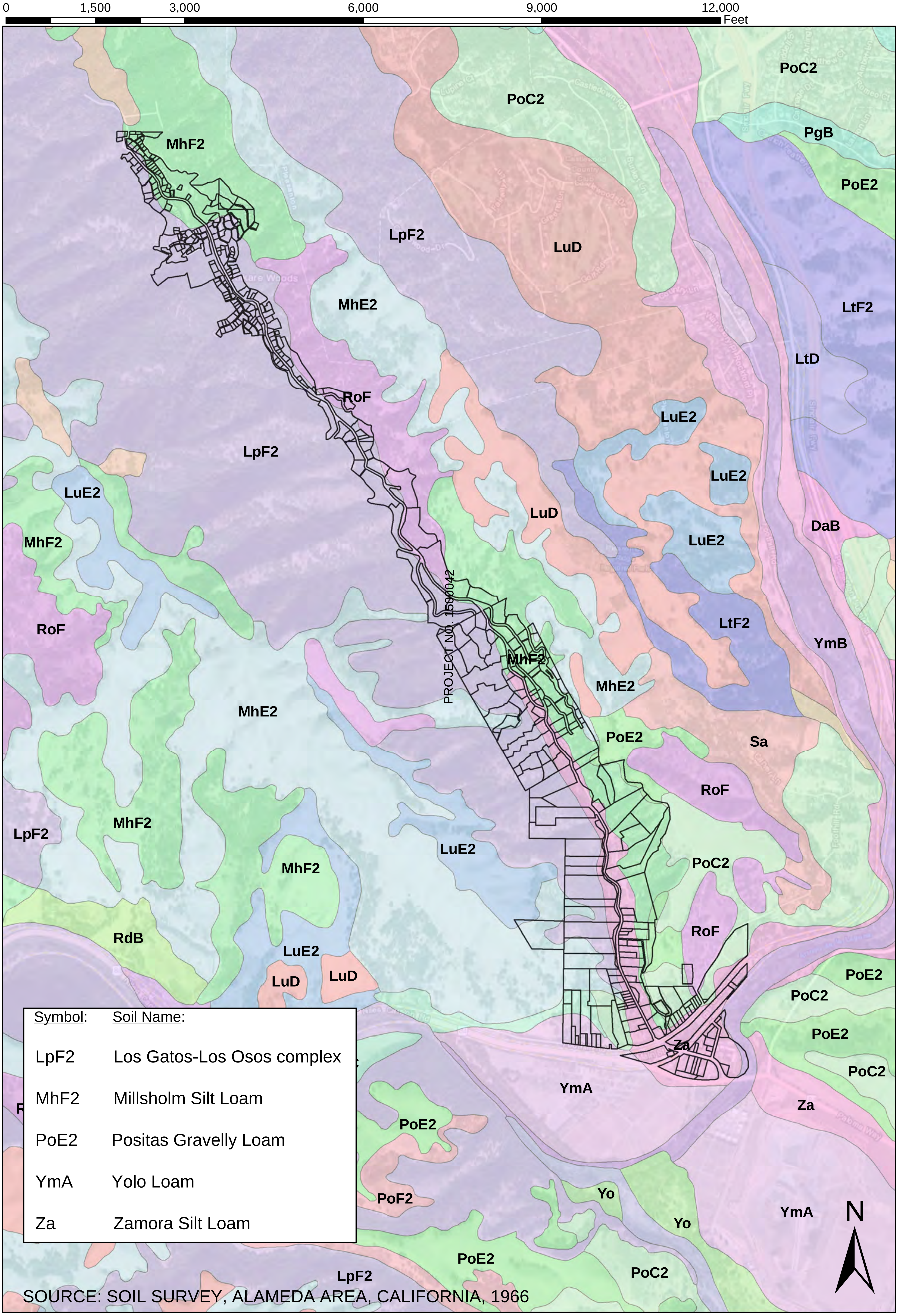
Soil Mapping

Soils in the Sunol area are derived from the accumulation of materials that have washed into the valley from the surrounding upland slopes and ridges and via stream transport. A detailed soil map for the area is provided in **Figure 4**, showing the following five major soil series in the developed portions of Sunol:

- **Los Gatos-Los Osos complex** – These soils consist of a complex of loam, silty clay loam and rocky sandy loam and occur on steep and very steep uplands in most of Kilkare Woods and on the hillsides west of Sinbad Creek in the Lower Kilkare Road area. The

[1] Evaluation of Ground Water Resources: Livermore and Sunol Valleys. Department of Water Resources. 1974

[2] "Report of Soil Remediation and Soil Sampling Activities, Niles Canyon Railway-Sunol Depot". Gribi Associates. July 20, 2016.



Soils Map

Sunol Wastewater Feasibility Study - Phase I

SUNOL, CA
ALAMEDA COUNTY

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FIGURE 4

soils are well drained and moderately deep, typically 2 to 4 feet to bedrock, and seasonal water table normally more than 6 feet below ground surface.

- **Millsholm Silt Loam –** These are well-drained silt loam soils weathered from sandstone and shale, typically on very steep slopes with shallow depth over bedrock. These soils occur on the slopes east of Sinbad Creek in portions of Kilkare Woods and Lower Kilkare Road.

- **Positas Gravelly Loam** – Positas soils consist of well-drained, shallow to moderately deep gravelly loam soils formed in alluvium derived from sandstone and shale. Some areas may exhibit a restrictive clay subsoil. These soils occur on hilly to steep terraces and are found in Downtown Sunol in the hillsides north of Foothill Road and east of Kilkare Road.

- **Yolo Loam –** Yolo soils are formed in alluvium weathered from shale and sandstone found on nearly level valley floors. They consist of well drained, moderately deep to very deep loamy soils, with the seasonal high water table normally more than 6 feet below ground surface. These soils are found on the west side of Sunol along Foothill Road.

- **Zamora Silt Loam** – Zamora soils are formed from parent material of alluvium derived from sandstone and shale. They are well drained, very deep, with the seasonal high water table normally more than 6 feet below ground surface. These soils occur throughout most of Downtown Sunol, extending northward along Sinbad Creek through a large portion of the Lower Kilkare Road area.

Table 1 provides further description of soil properties along with estimates of the number of developed parcels within each respective soil area in Sunol.

OWTS Suitability

Also included in **Table 1** for each soil type are general comments on the expected suitability and constraints for onsite wastewater disposal, based mainly on soil texture, depth and slope characteristics. The suitability comments to do not take into account site specific constraints such as proximity to wells, watercourses and other local landscape or development features that can further limit the placement or design of onsite wastewater systems.

In general, soils throughout most of Sunol are well drained and have suitable silt loam to gravelly loam textures, which are favorable conditions for onsite wastewater disposal. The main limitations are the steeply sloping terrain, shallow soil depths over bedrock, close proximity to streams, and small lot sizes. Conventional septic tank-gravity leachfields are suitable in some areas of Sunol where the parcel has sufficient land area and compatible slope, drainage and landscape conditions. However, the majority of the developed areas would typically require or be best served by some incorporation of advanced/supplemental treatment and/or alternative wastewater dispersal method such shallow pressure distribution, drip dispersal or raised sand filter beds.

Table 1: Summary of Major Soil Units in Sunol Area

Map Symbol	Soil Name	Description	Soil Depth	Slope	Drainage	Soil Texture	Suitability and Constraints for OWTS	Occurrence	Approximate # of Developed Parcels
LpF2	Los Gatos-Los Osos Complex	Loamy soils formed in material weathered from interpbedded sandstone and shale; found on steeply sloping uplands	moderately deep and deep	steep to very steep	well drained and somewhat excessively drained	complex of loam, silt loam and rocky sandy loam	May be suitable for conventional OWTS in some cases; advanced treatment and alternative dispersal designs commonly needed due to steep slopes,constrained land area and various setback contraints	Lower Kilkare Road west of Sinbad Creek, Kilkare Woods, about 80% of developed lots	120
MhF2	Milsohlm	Loamy soils formed in material weathered from interpbedded fine-grained sandstone and shale; found on steeply sloping uplands	very shallow to moderately deep	strongly sloping to very steep	well drained and somewhat excessively drained	silt loam to clay loam	Generally not suitable for conventional OWTS due to limited soil depth and steep slopes; advanced treatment and alternative dispersal methods needed due to shallow soils, steep slopes, land area and various setback contraints	Kilkare Woods northeast portion (20% of developed lots), small portion of Lower Kilkare Rd	25
PoE2	Positas	Gravelly loam soils formed in alluvium weathered from sedimentary rocks; found on slopes and high terraces	shallow to moderately deep	nearly level to strongly sloping	well drained to excessively well drained	gravelly loam, in some cases underlain by restrictive claypan	Generally not suitable for conventional OWTS due to steep slopes and in some cases limited soil depth over restricted clay subsoil; advanced treatment and alternative dispersal methods needed due to shallow depth to restrictive layer or site specific building constraints	Downtown Sunol, hillside areas north of Foothill Rd, east of Kilkare Road	20
YmA	Yolo	Loamy soils formed in alluvium weathered from sedimentary rocks; found on nearly level valley floors	moderately deep to very deep	nearly level to sloping	well drained	loam and very fine sandy loam	Generally suitable for conventional OWTS; advanced treatment systems may be needed for small lots or other site specific building contraints	Downtown Sunol, Foothill Rd, west side of town	10
Za	Zamora	Loamy soils formed in alluvium weathered from sedimentary rocks; found on nearly level flood plains and terraces	very deep	nearly level to gently sloping	well drained	silt loam underlain by heavier clay loam subsoil	Generally suitable for conventional OWTS; advanced treatment systems may be needed for small lots or other site specific building contraints	Most of Downtown Sunol and extending north along Lower Kilkare Road	70

SECTION 3: OWTS SURVEYS AND FIELD STUDIES

ONSITE WASTEWATER QUESTIONNAIRE SURVEY

Purpose and Scope

In summer of 2018 an Onsite Wastewater Questionnaire Survey was developed and mailed to approximately 350 property owners in the Sunol area. The mailing list for the survey was that used by Alameda County for the Sunol area. Purposes of the survey included:

a. To inform members of the community about the feasibility study being conducted;

b. To gather general information on the makeup and status of existing OWTS in different parts of Sunol; and

c. To obtain community input that might assist in the review and evaluation of future onsite wastewater treatment and disposal management options for Sunol.

The survey was voluntary and responses did not require identification of property owner name or address. The completed surveys were identified and grouped only in relation to general locations within Sunol; i.e., Downtown Sunol, Lower Kilkare Road, and Kilkare Woods (west and east sides of Sinbad Creek).

The scope of the survey and individual questions were developed jointly by ACDEH, members of the Sunol Septic Work Group, and Questa Engineering. The questionnaire was also presented and reviewed with attendees at monthly meetings of the Sunol Septic Work Group in June and July of 2018. Also included with the questionnaire were a reference map, glossary of onsite wastewater terminology, and graphic illustrations of common OWTS components.

The issues covered in the questionnaire survey related to:

- General location of the property in Sunol
- Amount of building/occupancy on the property
- Type of OWTS serving the property
- How greywater is handled
- Septic tank pump-out frequency
- Type of system problems, if any
- Record of prior system inspection(s)
- Repair history
- Other comments

A copy of the questionnaire and the accompanying transmittal letter sent to property owners is included in **Appendix A**.

Survey Results

A total of 34 completed questionnaires were returned to Questa Engineering in July and August 2018. **Table 2** summarizes the key information from the survey forms, organized by geographical sub-area.

Table 2. Onsite Wastewater Questionnaire Survey Results*

Survey Item	Sub-Area of Study Area				Total
	Downtown Sunol	Lower Kilkare Rd	Kilkare Woods West Side	Kilkare Woods East Side	
Total Responses	17	8	7	2	34
# of Buildings on property	2.1	2	1.4	2.5	2.0
# of Buildings with Plumbing Drains	1.75	1	1	1.5	1.4
Total # Bedrooms	4	3	2.3	3	3.4
# of Full-time Residents	2.25	2	2	2	2.1
Age of Septic Tank, years	44	44	18	44	39
Age of Leachfield, years	42	46	18	40	38
# of Separate Greywater Systems	2	0	4	0	6
Septic Tank Pump-out Frequency	2-5 yrs	Half 2-5 yrs Half >5 yrs	Half 2-5 yrs Half >5 yrs	> 5yrs	75% 2-5 yrs 25% >5 yrs
Formal OWTS Inspection	8	4	2	0	14
# with Reported Problem or Repairs	3	0	3	1	7

* Results shown area average values except as noted.

Key findings from the tabulation above and other comments contained in the completed questionnaire survey are summarized below.

- **Responses.** The 34 responses represent about 10% of the total surveys distributed and about 14% of the developed properties in the defined Study Area. This is a low response rate for these types of surveys; 30% to 50% response is common. Half of those responding to the survey were from Downtown Sunol, with the other half distributed about equally between Lower Kilkare Road and Kilkare Woods.

- **Property Features**. Most properties have two buildings, about half of which are accessory structures with plumbing drains; average house size is 3 to 4 bedrooms, with typically 2 occupants.

- **Age of Systems**. The vast majority indicated their OWTS to be 40+ years old, with the exception being the respondents from Kilkare Woods-West Side who indicated OWTS less than 20 years old; this may reflect recent building activity and associated OWTS upgrade and repair work in Kilkare Woods.

- **Greywater Systems.** Less than 20% of the properties have separate greywater systems, which is fairly typical for areas reliant on OWTS.

- **Pump-out Frequency.** Reported frequency of septic tank pump-out is normal, with about 75% indicating the common recommendation of every 2-5 years, and the remaining indicating more than 5 years between pump-outs.

- **System Inspections**. About half the respondents in Downtown Sunol and Lower Kilkare Road indicate having records of an inspection of their OWTS; only a few are reported for Kilkare Woods.

- **System Problems and Repair History.** The vast majority (80%) of respondents indicated no functional problems with their OWTS. For those reporting problems or repair activity, the types of issues noted were sluggish plumbing (1), tree roots (2), baffle failure and replacement (2), access riser (1), tank replacement (3), and leachfield replacement (2).

- **Comments.** Other comments added at the end of the questionnaire included more specific information the OWTS components (e.g., tank/leachfield size), emphasis on how well their system has operated for many years, caution against trying to fix what isn't broken, appreciation for the survey and overall effort to study OWTS issues, and one respondent urging a community wastewater system for Sunol.

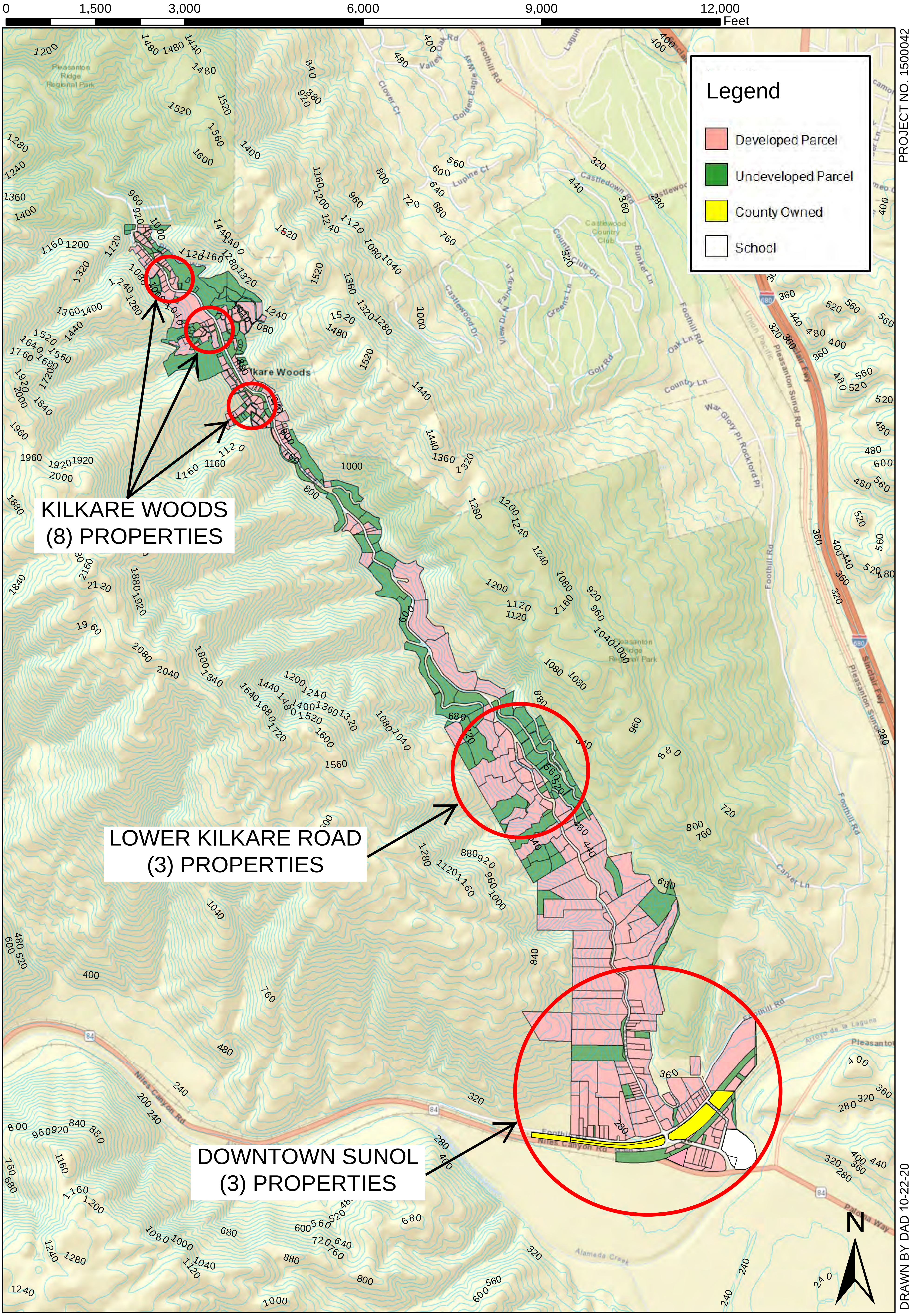
ONSITE FIELD REVIEWS

Overview

In August and September 2018 Questa Engineering conducted field reviews (at no cost to the property owner) of 14 residential properties in the Sunol study area to make site-specific assessment of constraints and available options for repair and/or upgrading existing on-lot OWTS. The field reviews were voluntary, arranged with willing property owners who requested to be included in this part of the study. **Figure 5** shows the general area where field reviews were conducted.

The field reviews involved collection and review of background information from County files, followed by site visits arranged with the property owners for mapping and measuring various property features along with hand-auger borings for soil/groundwater observations. From this an assessment was made of the apparent available area for onsite OWTS upgrade on each parcel, and to identify and evaluate some of the main construction issues and constraints that would be involved with the implementation of onsite system upgrades. Assessor Parcel Maps, County GIS data, and OWTS information on file with ACDEH were used in most cases to supplement field observations regarding property size, boundaries between parcels and setbacks to various landscape features. Field maps of each parcel were created, but are not published as a part of this report.

The information from these field reviews was intended to provide a representative cross-section of the different circumstances in the Sunol study area to assist in developing overall estimates of



Field Review of OWTS Constraints

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SUNOL, CA
ALAMEDA COUNTY

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FIGURE 5

the type of improvements, associated costs and other factors for continued use and maintenance of onsite wastewater systems as a long-term wastewater solution for the area.

Results and Evaluation

Observations. Results of the field reviews are summarized in **Table 3**, which includes field observations, recommendations and ratings as explained below. Field observations pertain to various site features relevant to the location and operation of onsite wastewater systems, including ground slope, soil depth, groundwater conditions, drainage and setback issues. A copy of the field evaluation form is included in **Appendix A,** showing the level of review conducted along with the types of observations and assessment made.

OWTS Recommendations. The recommendations for each site listed in **Table 3** represent Questa's best professional judgment regarding the type of onsite wastewater system (OWTS) upgrade to provide long-term reliability and best means of complying with regulations and standards of practice. The recommendations can be understood to be the type of improvements that would likely be required in connection with major building remodels/additions, property transfer, refinancing, or repair/replacement in the case of a system failure.

Disposal Site Rating. For each property the area identified as the apparent best location for the wastewater disposal system was rated (A to E) in regard to the ability to comply with current Alameda County regulations, as follows:

A - <u>No variances required;</u> full compliance with current regulations regarding setbacks, ground slope, land area, and soil conditions;

B - <u>Non-watercourse setback variance(s) required</u>; compliance with watercourse and drainage setbacks, but variance required for other setback requirements, such as buildings, property lines, cut bank.

C - <u>Watercourse setback variance(s) required</u>; able to meet 50-ft setback, but not 100-ft watercourse setback.

D - <u>Major watercourse setback variance(s) required;</u> unable to meet 50-ft watercourse setback or combination of cut bank and watercourse setback variance issues.

E - Serious OWTS feasibility questions related to multiple factors such as watercourse setbacks, excessive slopes, inadequate soils, and cut banks. No reasonable opportunity for onsite wastewater disposal system; offsite easement or connection to community wastewater system needed.

Cost Rating for OWTS Upgrade. A general cost rating for implementing an OWTS upgrade was assigned for each property based on findings from the field review. Estimated construction costs matched with each rating category are addressed in the alternatives section of this report. Three rating categories were defined as follows:

Table 3. Sunol OWTS Field Reviews Summary

System ID	Subarea	Existing Development		Potential Leachfield Area			Setback Variances; Tank, Field					Recommended OWTS	Disposal Site Rating (A to E)	Upgrade Cost Rating (1 to 3)
		Bldg. Size (Bedrooms)	Lot Size (acres)	Ground Slope (%)	Soils[1]*	Distance to Stream	Property Lines	Building, driveway	Cut Banks	Drainage Ditches	Watercourse			
1	Downtown	3	5.08	40	18"+ Gr SCL	900' (Alameda Cr)						Treatment or PD trenches	A	2
2	Downtown	2	0.14	<3	30"+ Gr SCL	100' (Alameda Cr)						Pump-up to standard trenches	A	2
3	Downtown	4	5.2	<5	72"+ Gr SCL	85' (Sinbad Cr)	Tank, Field				Field	Treatment, w/subsurface drip	C	1
4	Lower Kilkare Rd	3	0.57	<3	72"+ Gr CL**	65' (Sinbad Cr)	Field				Field	Treatment	C	2
5	Lower Kilkare Rd	4	1.2	<5	72"+ Gr SCL	100' (Sinbad Cr)						Pump-up to standard trenches	A	2
6	Lower Kilkare Rd	3	0.44	<10	72"+, Gr SiCL**	65' (Sinbad Cr)			Tank, Field	Field	Field	Treatment, w/subsurface drip	D	3
7	Kilkare West	1	0.14	<10	72"+ SCL	45' (Sinbad Cr)***					Field***	Treatment, offsite adjacent PD trenches***	D	3
8	Kilkare West	1	0.12	45 - 75	30"+ SCL, bedrock at 30"	100' (Sinbad Cr)	Tank, Field	Field	Tank, Field			Off-site TBD	E	3
9	Kilkare West	3	0.72	<10	45"+ Gr SCL	50' (Sinbad Cr)	Tank	Tank	Tank, Field		Tank, Field	Treatment w/subsurface drip	D	3
10	Kilkare West	2	0.35	30	72"+ SCL	<50' (Tributary)		Tank	Tank		Tank, Field	Treatment w/PD trenches	D	3
11	Kilkare West	2	0.11	30-40	72"+ SCL	100' (Tributary)***	Field	Tank, Field			Tank	Treatment, offsite adjacent PD trenches***	C	3
12	Kilkare West	2	0.12	<25	72"+ SCL	200' (Sinbad Cr)	Field	Tank, Field	Tank, Field	Tank, Field		Treatment w/subsurface drip	B	1
13	Kilkare East	2	0.38	30-50	72"+ SCL**	50' (Sinbad Cr)	Field	Tank	Tank, Field		Tank, Field	Treatmen w/PD or subsurface drip	C	3
14	Kilkare East	3	0.3	40-60	96"+ Gr SiCL**	90' (Sinbad Cr)	Tank	Tank	Tank, Field		Field	Treatment w/subsurface drip	D	3

[1] All soils sampled using hand auger, except as noted. Auguring depth limited by gravels and cobbles in some cases.

* Soil types: Gr- Gravelly, SCL - Sandy Clay Loam, SiCL - Silty Clay Loam, CL - Clay Loam

** Denotes soil sampling performed by examination of nearby cut banks.

*** Off-site neighbor lot

Low This was assigned for recently permitted systems, where recommended upgrades are substantially in place, or where upgrade work would be limited to septic tank repair or replacement or addition of leaching trench.

Mid This was assigned where the recommended upgrade consists of either: (1) disposal field replacement; or (2) tank and leachfield upgrades.

High This was assigned where the recommended upgrade consists of: (1) new septic tank and disposal field changes, or addition of a supplemental treatment unit; or (2) an off-site easement for the OWTS.

Summary of Findings

The following summarize the key findings of the field reviews.

- **Representativeness**. The sample size (14 properties evaluated) was small, but included a fairly broad mix of conditions across the Sunol area, including (3) properties in the Downtown area, (3) in Lower Kilkare Road, and (8) in Kilkare Woods. Properties ranged in size from 0.11 acres to 5.2 acres in size, with the vast majority (70%) about ½-acre or smaller, which is a reasonable representation of Sunol.

- **Soil Conditions**. Soil conditions were generally found to be very favorable for onsite wastewater disposal. Soils were examined with hand-auger soil borings to a depth of about 6 feet in the most viable wastewater disposal areas on each property, and showed consistently well-drained gravelly loam and sandy clay loam soils, with no evidence of high groundwater conditions. A small number of sites (3) were found to have limited soil depths of 4 feet or less.

- **Ground Slope**. Ground slope was relatively mild (10% or less) for about half of properties, and 25% or more for the other half. About one-third of the sites (5) were found to have significant or extreme slope constraints, in the 40% to as high as 75%.

- **Watercourse Setbacks**. Watercourse setback limitations posed by Sinbad Creek and tributary streams were a significant compliance issue for a little over half of the sites (8 of 14). It was determined that 6 of these sites could maintain a setback between 50 and <100 feet, and 2 sites would have a watercourse setback of <50 feet.

- **Other Setback Issues.** Other common wastewater system setback-compliance issues found were:
  ✓ property line - 8 sites
  ✓ building/driveway - 7 sites
  ✓ cut banks - 7 sites
  ✓ drainage ditches - 2 sites

- **Site Suitability Ratings**. From our field reviews the onsite wastewater site suitability ratings and distribution were as shown in **Table 4**, indicating generally better conditions in Downtown and Lower Kilkare, and more difficult conditions in Kilkare Woods.

Table 4. Field Review Suitability Ratings by Subarea

Suitability Rating	# of Properties by Subarea		
	Downtown Sunol	Lower Kilkare Rd	Kilkare Woods
A	2	1	
B			1
C	1	1	2
D		1	4
E			1
Total	3	3	8

- **OWTS Upgrade Cost Ratings.** The cost ratings for OWTS upgrades are summarized in **Table 5** below, indicating lower expected costs for the Downtown and Lower Kilkare Road properties, and higher costs in Kilkare Woods.

Table 5. OWTS Upgrade Cost Ratings by Subarea

OWTS Upgrade Cost Rating	# of Properties by Subarea		
	Downtown Sunol	Lower Kilkare Rd	Kilkare Woods
Low	1		1
Mid	2	2	
High		1	7

- **Types of System Upgrades Identified.** The following types of system upgrades were identified in recommendations for individual sites:
  ✓ Pump-up to standard leaching trenches (2 sites)
  ✓ Add supplemental treatment unit (1 site)
  ✓ Supplemental treatment or pressure distribution leachfield (1 site)
  ✓ Supplemental treatment with drip dispersal (3 sites)
  ✓ Supplemental treatment with pressure distribution trenches (5 sites)
  ✓ Offsite easement for an OWTS component (3 sites)

Results from the field reviews along with other background information on existing conditions and practices provided input to the evaluation of feasibility and requirements for the onsite system upgrade Alternative 2 presented in **Section 5.**

SINBAD CREEK WATER QUALITY SAMPLING

Overview

Onsite wastewater systems have the potential to impact groundwater and surface water quality in a number of ways, with the primary health concerns being pathogens (bacteria and viruses) and nitrate additions. Due to the lack of historical water quality data for Sinbad Creek, a surface water bacteriological water quality sampling effort was included in the Feasibility Study to develop baseline information and to evaluate the data for evidence of possible water quality influences from onsite wastewater systems in Sunol. The scope of the sampling program included water quality measurements in late winter and spring of 2017 and 2018 at various locations along Sinbad Creek, from upstream of Kilkare Woods to the confluence with Arroyo de la Laguna.

In the course of planning the water quality sampling program, it was learned that EPA grant-funded monitoring of Sinbad Creek was also being undertaken by the Alameda Creek Alliance (ACA). The ACA study was a volunteer-staffed surface water bacteria monitoring program conducted according to protocols established by USEPA Region 9 Laboratory in Richmond, California. The ACA bacteria monitoring efforts complemented the work conducted by Questa and were determined to have relevance to the evaluation of potential effects of onsite wastewater systems. The results from both monitoring efforts are presented in this section.

Water Quality Criteria

California's regulatory framework uses water quality objectives to define appropriate levels of environmental quality and to control activities that can adversely affect aquatic systems. Bacteria levels in surface waters can impact uses of the water for recreation, drinking water, and shellfish harvesting. Sinbad Creek supports occasional water contact and non-contact recreation in certain parts of the creek at different times of the year. The creek drains into Alameda Creek which has similar water recreation uses and also serves as a principal source of aquifer recharge to Niles groundwater basin which is a major source of drinking water for Alameda County communities.

Table 6 provides a summary of the bacterial water quality objectives contained in the Water Quality Control Plan (Basin Plan) for the San Francisco Bay Region, established for protection of water contact recreation and drainage to municipal water supply. **Table 7** summarizes U.S. EPA's water quality criteria for water contact recreation based on the frequency of use a particular area receives. The water quality objectives are centered on the use of coliform bacteria as the indicator test organism. The following provides a brief summary of key terminology and their significance.

- **Coliform bacteria** are organisms that are present in the environment and in the feces of all warm-blooded animals and humans. Coliform bacteria will not likely cause illness. However, their presence in water indicates that disease-causing organisms (pathogens) could be in the water system.

- **Total coliform** group is a large collection of different kinds of bacteria commonly found in the environment, e.g., associated with soil, vegetation, animals, etc. They are generally harmless.

- **Fecal coliform bacteria** are a sub-group of total coliform bacteria. They appear in great quantities in the intestines and feces of people and animals. The presence of fecal coliform in a water sample often indicates recent fecal contamination, meaning that there is a greater risk that pathogens are present than if only total coliform bacteria is detected.

Table 6: Water Quality Objectives for Bacteria[a]

Beneficial Use	Fecal Coliform (MPN/100ml)	Total Coliform (MPN/100ml)	Enterococcus (MPN/100ml)[g]
Water Contact Recreation	geometric mean < 200 90th percentile < 400	median < 240 no sample > 10,000	geometric mean < 35 no sample > 104
Shellfish Harvesting[b]	median < 14 90th percentile < 43	median < 70 90th percentile < 230[c]	
Non-contact Water Recreation[d]	mean < 2000 90th percentile < 4000		
Municipal Supply: - Surface Water[e] - Groundwater	geometric mean < 20	geometric mean < 100 < 1.1[f]	

Notes:

a. Based on a minimum of five consecutive samples equally spaced over a 30-day period.
b. Source: National Shellfish Sanitation Program.
c. Based on a five-tube decimal dilution test or 300 MPN/100 ml when a three-tube decimal dilution test is used.
d. Source: Report of the Committee on Water Quality Criteria, National Technical Advisory Committee, 1968.
e. Source: California Department of Public Health recommendation.
f. Based on multiple tube fermentation technique; equivalent test results based on other analytical techniques, as specified in the National Primary Drinking Water Regulation, 40CFR, Part 141.21(f), revised June 10, 1992, are acceptable.
g. Applicable to marine and estuarine waters only. Numeric values are based on Section 7958of Title 17 of the California Code of Regulations, 69FR 67217 et seq., and 40 CFR Part 131.41 (effective date December 16, 2004).

Table 7: U.S. EPA Bacteriological Criteria for Water Contact Recreation[1] (in colonies per 100 ML)

	Fresh Water		Salt Water
	Enterococci	E. Coli	Enterococci
Steady State (all areas)	33	126	35
Maximum at:			
- designated beach	61	235	104
- moderately used area	89	298	124
- lightly used area	108	406	276
- infrequently used area	151	576	500

NOTES:

1. The U.S. EPA criteria apply to water contact recreation only. The criteria provide for a level of production based on the frequency of usage of a given water contact recreation area. The criteria may be employed in special studies within this region to differentiate between pollution sources or to supplement the current coliform objectives for water contact recreation.

Source: Water Quality Control Plan (Basin Plan) for the San Francisco Bay Basin

- ***E. coli*** is a sub-group of the fecal coliform group. Most *E. coli* bacteria are harmless and are found in great quantities in the intestines of people and warm-blooded animals. However, some strains can cause illness. When *E. coli* outbreaks are reported in media coverage, it is mostly caused by a specific strain of *E. coli* bacteria known as ***E. coli O157:H7***. When a water sample is reported as "*E. coli* present" it does not mean that this dangerous strain is present and, in general it is probably not present. However, it does indicate recent fecal contamination.

Monitoring Details

Questa Monitoring. The Questa bacteria monitoring program consisted of the following:

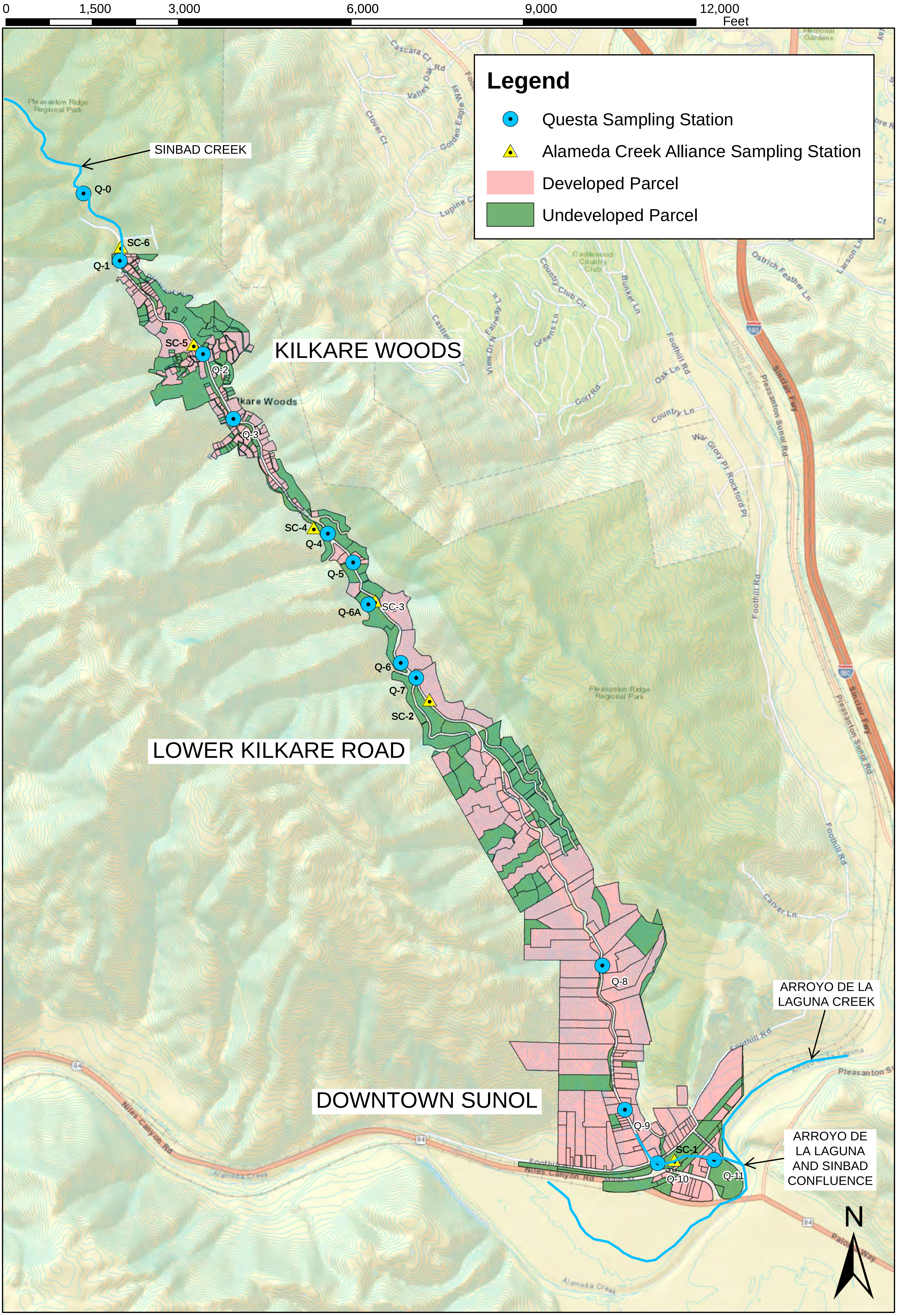
- Locations: 12 surface water sampling stations on Sinbad Creek, including one control station upstream of Kilkare Woods, plus one tributary drainage
- Sampling times: Spring 2017 (6/5/17); Spring 2018 (3/29/18; 4/23/18)
- Total samples: 36
- Bacteriological analyses: total coliform and fecal coliform
- Analytical laboratory: Alpha Analytical Laboratories, Inc., Dublin

Alameda Creek Alliance Monitoring Summary. The ACA bacteria monitoring program consisted of the following:

- Locations: 6 surface water sampling stations on Sinbad Creek, including one control station upstream of Kilkare Woods
- Sampling times: Feb 1, 8, 15 & 22, 2017; Mar 1, 2017; May 2, 9, 16, 23 & 30, 2017
- Total samples: 60
- Bacteriological analyses: total coliform and E. coli
- Analytical laboratory: USEPA Region 9 Laboratory, Richmond

Sampling Locations. **Figure 6** is a map showing the Sinbad Creek water sampling locations for both the Questa and ACA monitoring efforts. Both studies included a background "control" station upstream of Kilkare Woods, and the remaining sampling locations spaced along the creek within Kilkare Woods, Lower Kilkare Road, and Downtown Sunol. All Questa sampling stations were within public road rights-of-way, all but one at bridge/road crossings. Although planned separately, several of the Questa and ACA sampling locations turned out to be at roughly the same point along the creek. As indicated, Questa included a one-time sampling of a tributary stream (Station Q-6a), which was flowing during one of the sampling events. Questa station numbering is from upstream to downstream (Q-0 to Q11); ACA station numbering is from downstream to upstream (SC-1 to SC-6).

Sampling Procedures and Analyses. Water quality samples were collected following appropriate protocol, refrigerated in a portable ice chest, and delivered the same day for laboratory analysis. In the Questa sampling program, samples were analyzed for total coliform and fecal coliform, to provide data corresponding to the applicable water quality objectives for bacteria contained in the S.F. Bay Regional Water Board's Basin Plan for water contact



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Sinbad Creek Water Quality Sampling Locations Sunol Wastewater Feasibility Study - Phase I *SUNOL, CA* *ALAMEDA COUNTY*	QUESTA ENGINEERING CORP	**FIGURE 6**

recreation (**see above).** In the ACA sampling program, samples were analyzed for total coliform and E. coli, corresponding to U.S. EPA bacteriological criteria for water contact recreation (see above). Fecal coliform and E. coli are both considered to be Fecal Indicator Bacteria, for assessment of water quality for recreational uses and impacts to public health.

Sampling Times. Questa conducted three sampling "runs", one in the spring of 2017 (June 5th) and two in 2018 (March 29th, April 23rd). ACA conducted a winter and spring sampling in 2017, each consisting of five (5) weekly samples in a 30-day period as follows: winter: 2/1/17 - 3/1/17; spring: 5/2/17 - 5/30/17.

Results

Analytical results from the Questa sampling program are presented in **Table 8.** Results for total coliform, which encompasses a broad spectrum of naturally occurring bacteria in the environment, were all below the Regional Water Board's maximum objective of 10,000 MPN/100 ml. Results for fecal coliform, a component of total coliform, sometimes exceeded the 90th percentile limit of 400 MPN/100 ml established by the S.F. Bay Regional Water Board for water contact recreation, indicating a potential public health threat from contact with creek water. Those exceedances are highlighted in **Table 8**.

Table 8. Sinbad Creek Bacteriological Water Quality Sampling Results, Questa 2017-2018[1, 2]

Station #	Descriptor	June 5, 2017		March 29, 2018		April 23, 2018	
		Total Coliform	Fecal Coliform	Total Coliform	Fecal Coliform	Total Coliform	Fecal Coliform
Q-0	Upstream Control	350	46	26	7.8	240	49
Q-1	Kikare Woods	350	240	280	70	920	170
Q-2	Kikare Woods	540	2	540	170	920	79
Q-3	Kikare Woods	920	79	350	33	>1,600	**>1,600**
Q-4	Kikare Woods	>1,600	170	170	49	540	49
Q-5	Kikare Woods	920	79	540	33	1,600	130
Q-6	Lower Kilkare Rd	1,600	130	540	21	1,600	170
Q-6a	Tributary	540	130	NS	NS	NS	NS
Q-7	Lower Kilkare Rd	920	140	130	33	1,600	33
Q-8	Lower Kilkare Rd	>1,600	**540**	1,600	240	>1,600	350
Q-9	Downtown Sunol	350	130	1,600	**450**	>1,600	240
Q-10	Downtown Sunol	920	240	920	170	>1,600	**540**
Q-11	Downtown @ Alameda Crk	1,600	350	1,600	**540**	NS	NS

1 As reported by Alpha Analytical Laboratories, Inc., Dublin, California
2 MPN/100 ml: most probable number per 100 milliliters
NS: no sample taken due to lack of streamflow

Results from the ACA sampling program are presented in **Tables 9** and **10**, respectively, for 2017 winter and spring sampling events. Highlighted results indicate exceedance of the U.S. EPA E. coli criteria for water contact recreation applicable to "lightly used area"; these criteria are (a) 406 MPN/100 ml maximum and (b) 126 MPN/100 ml geometric mean. EPA does not include bacteriological criteria for total coliform; none of the results exceeded the Regional Water Board's total coliform objective of 10,000 MPN/100 ml for water contact recreation.

Table 9. Sinbad Creek Bacteriological Water Quality Sampling Results, Alameda Creek Alliance, Feb-Mar, 2017[1, 2]

Sampling Date	Sampling Station #					
	SCP1	SC2	SC3	SC4	SC5	SC6
	Downtown Sunol	Lower KIlkare Rd	Lower KIlkare Rd	Kilkare Woods	Kilkare Woods	Upstream Control
Total Coliform						
2/1/17	1,100	1,00	7,700	2,500	1,700	8,700
2/8/17	7,300	5,800	6,900	6,900	5,800	4,900
2/15/17	2,400	2,200	2,400	1,300	1,400	1,200
2/22/17	3,300	2,800	5,500	2,400	2,700	2,500
3/1/17	1,600	1,400	1,100	820	1,300	1,100
Geometric Mean	**2,500**	**2,187**	**3,800**	**2,100**	**2,200**	**2,700**
E. coli						
2/1/17	80	90	**6,100**	**1,500**	50	110
2/8/17	160	80	160	70	30	60
2/15/17	20	20	60	40	10	10
2/22/17	70	80	50	30	10	20
3/1/17	110	120	30	50	40	10
Geometric Mean	**72**	**67**	**150**	**91**	**23**	**27**

1 Reported by U.S. EPA Region 9 Laboratory, Richmond, California.
2 MPN/100 ml: colonies per 100 milliliters

Table 10. Sinbad Creek Bacteriological Water Quality Sampling Results, Alameda Creek Alliance, May, 2017[1, 2]

Sampling Date	Sampling Station #					
	SCP1	SC2	SC3	SC4	SC5	SC6
	Downtown Sunol	Lower KIlkare Rd	Lower KIlkare Rd	Kilkare Woods	Kilkare Woods	Upstream Control
Total Coliform						
5/2/17	3,900	4,600	1,800	1,500	3,400	2,100
5/9/17	5,500	6,500	2,600	5,200	2,200	4,200
5/16/17	4,600	2,500	2,500	1,900	2,500	3,300
5/23/17	8,700	4,600	2,500	1,800	2,200	3,900
5/30/17	4,400	2,600	2,000	1,400	2,400	2,100
Geometric Mean	**5,200**	**3,900**	**2,300**	**2,100**	**2,500**	**3,000**
E. coli						
5/2/17	**640**	**500**	50	40	120	80
5/9/17	**580**	**2,000**	130	60	90	110
5/16/17	**460**	230	170	30	260	30
5/23/17	280	250	400	30	**420**	100
5/30/17	**450**	200	300	40	10	30
Geometric Mean	**460**	**410**	**170**	**39**	**100**	**60**

`1 Reported by U.S. EPA Region 9 Laboratory, Richmond, California.
2 MPN/100 ml: most probable number per 100 milliliter

Discussion

The targeted 2017-2018 sampling of Sinbad Creek conducted independently by Questa and Alameda Creek Alliance provide a substantial amount of data (nearly 100 sample results) and good baseline coverage of the full length of the creek through the Sunol community. Review of the data also shows generally good consistency between the results from the two sampling programs, and form the basis for the preliminary findings discussed below.

- **Area of Potential Concern**. Although not at levels that pose an imminent health hazard, the Fecal Indicator Bacteria readings and the frequency of exceedance of water quality objectives, especially in the Downtown section of Sinbad Creek, support the LAMP designation of Sunol as an area of potential water quality concern and human health risk. If the results from these two baseline studies were to be found through continuing monitoring to be a recurring or chronic condition, portions of Sinbad Creek could potentially be considered by the Regional Water Board to be "impaired" with respect to pathogens. **Figure 7** is a graphical plot of the Fecal Indicator Bacteria results from Questa's 6/5/17 and 3/29/18 sampling and ACA's May 2017 sampling (geometric mean), also showing for comparison the applicable Regional Water Board and EPA bacteria objectives for recreational waters. **Table 11** summarizes the number of single sample Fecal Indicator Bacteria results exceeding the established bacteria criteria for water contact recreation, compiled according to the different areas of Sunol.

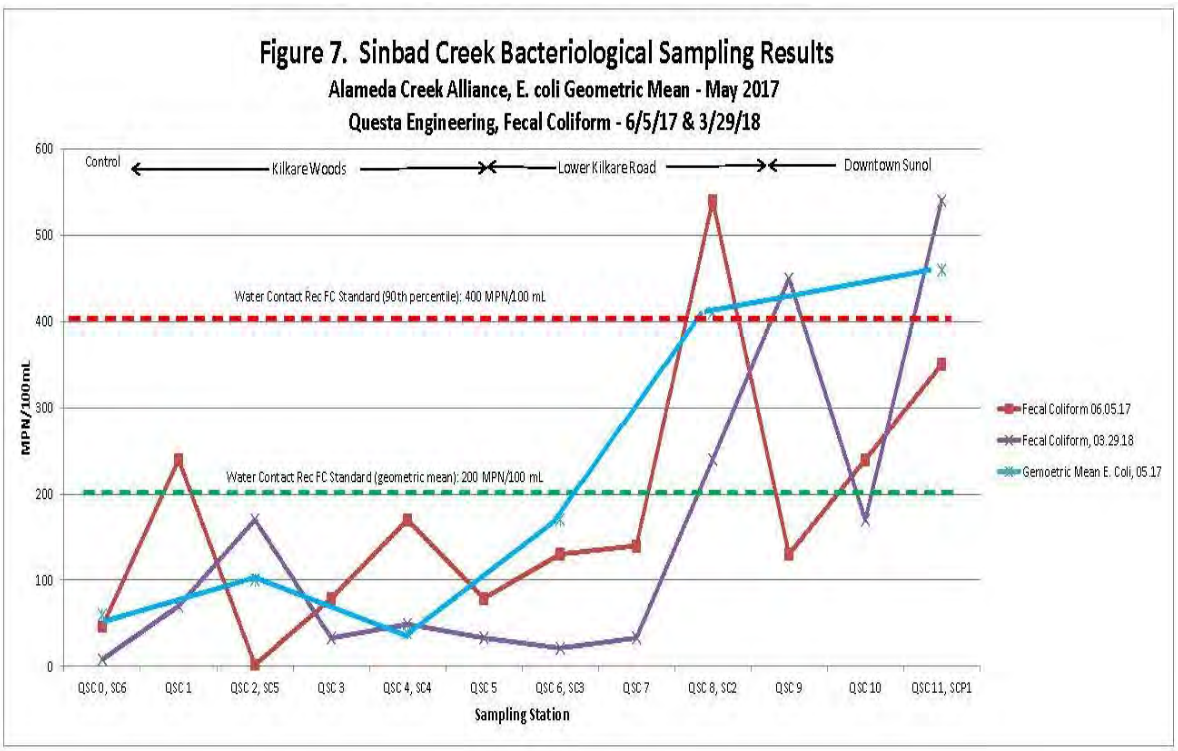
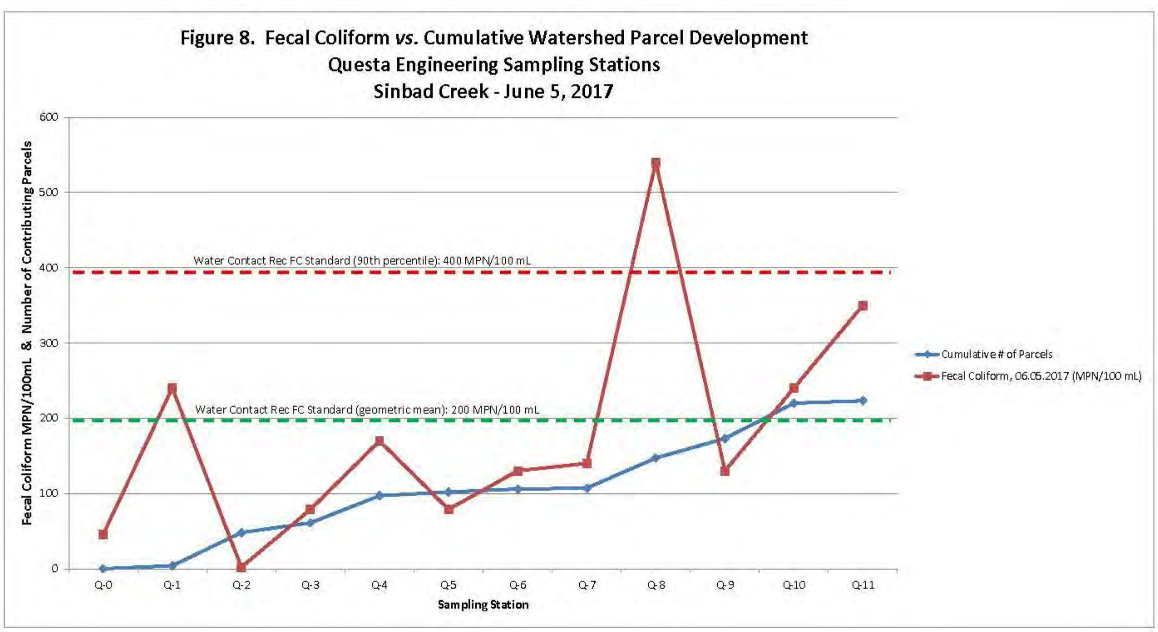


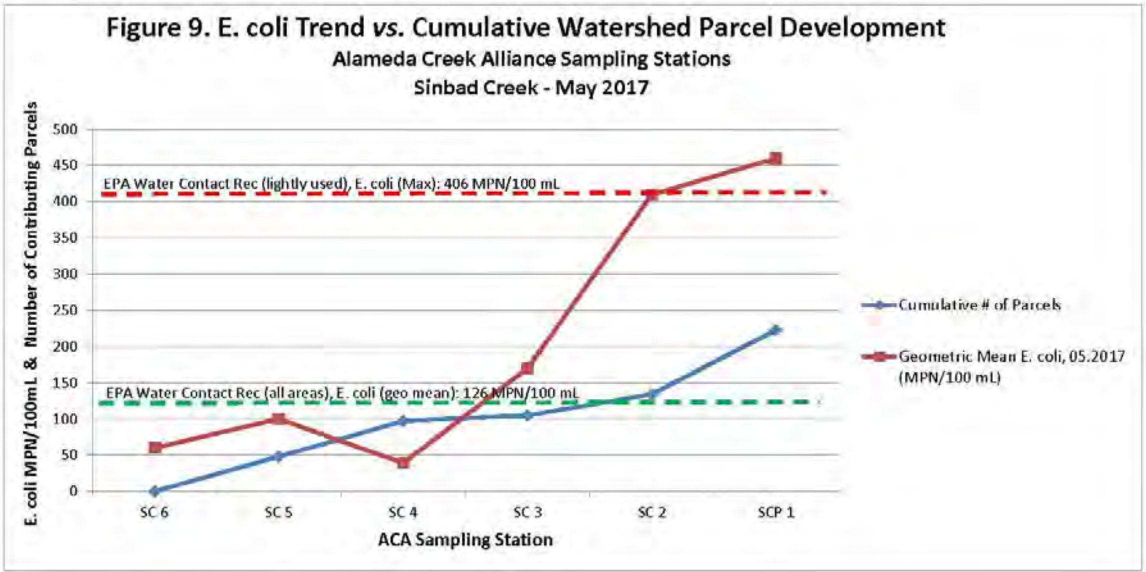
Figure 7. Sinbad Creek Bacteriological Sampling Results

Table 11. Fecal Bacteria Exceedances

Sampling Reach	Sampling Stations	Exceedances Questa Sampling	Exceedances ACA Sampling	Total Exceedances	Percent Exceedence
Upstream Control	Q-0 SC6	0 of 3 samples	0 of 10 samples	0 of 13 samples	0%
Kilkare Woods	Q-1, 2, 3, 4 & 5 SC4 & SC5	1 of 15 samples	2 of 20 samples	3 of 35 samples	9%
Lower Kilkare Rd	Q-6, 7 & 8; SC2 & SC3	1 of 9 samples	3 of 20 samples	4 of 29 samples	14%
Downtown Sunol	Q-9, 10 & 11 SCP1	3 of 9 samples	4 of 10 samples	7 of 19 samples	37%

- **Downstream Increasing Fecal Indicator Bacteria Levels**. As evident from the preceding summary table the water quality sampling results indicate a clear trend toward increasing bacteria levels in Sinbad Creek from upstream to downstream through Sunol. This is also illustrated graphically in **Figures 8** and **9**, respectively, for Questa sampling results of June 5, 2017 (discrete samples) and for ACA sampling results for May 2017 (geometric mean). Questa also determined the cumulative number of developed parcels and OWTS in the corresponding watershed area tributary to each sampling station. Cumulative development is also plotted in **Figures 8** and **9** and shows a direct relationship with the increasing downstream trends in Fecal Indicator Bacteria levels in the creek. Without follow-up sanitary surveys, (e.g., lot by lot inspections, targeted creek sampling, walking the creek to check for seepage areas, etc.) the increasing Fecal Indicator Bacteria levels cannot be pinpointed definitively as related to onsite wastewater systems. However, based on the age and prevalence of non-conforming OWTS and out-dated practices in the study area, OWTS must be considered as a likely contributor. The routes by which OWTS discharges may be impacting Sinbad Creek could include direct surface discharges, seepage along streambanks, or possibly via lateral groundwater inflow to the creek through highly permeable gravelly soils. It is also possible that human or animal interaction with the creek water could be a contributing factor.





- **Individual Fecal Indicator Bacteria Spikes**. Both Questa and ACA sampling encountered isolated spikes in Fecal Indicator Bacteria concentrations (e.g., >1,000 MPN/100 ml) suggestive of possible impact from an individual OWTS discharge or seepage near the sampling point at the time of sampling. This can be seen in the following results:

  - ✓ 2/1/17, SC3, Lower Kilkare Rd 6,100 MPN/100 ml
  - ✓ 2/1/17, SC4, Kilkare Woods 1,500 MPN/100 ml
  - ✓ 5/9/17, SC2, Lower Kilkare Rd 2,000 MPN/100 ml
  - ✓ 4/23/18, Q-3, Kilkare Rd >1,600 MPN/100 ml

- **Grazing Land Impacts.** Some community members raised the question of possible water quality impacts on Sinbad Creek from cattle grazing in the watershed lands above and around Kilkare Woods and Sunol. Questa conducted a preliminary inspection of maps and photos to determine the locations and approximate cumulative grazing land acreage tributary to each sampling station along the creek. This analysis found a total of about 1,800 acres of grazing lands in the Sinbad Creek watershed, of which about 1,300 acres (72%) are in the drainage area tributary to the upstream control sampling stations, Q-0 and SC6. Moving downstream each successive sampling location was determined to receive an incremental addition of runoff from grazing lands via side tributaries. Without conducting a targeted survey and sampling of tributary grazing land runoff, the best indicator of water quality impact from grazing would be the sampling results for the Questa and ACA upstream control stations. These stations exhibited the best water quality conditions of all sampling stations, with no Fecal Indicator Bacteria exceedances. Therefore, from the data collected thus far, cattle grazing does not appear to be the cause of or a significant contributor to the elevated bacteriological levels and trends in Sinbad Creek.

SECTION 4: FORMULATION OF ALTERNATIVES

WASTEWATER FLOWS

Estimates of daily wastewater flows are a necessary starting point for assessing the required capacity of collection, treatment, and dispersal facilities for community wastewater alternatives. The common approach takes into account the number of parcels to be served, the type of development on those parcels, and application of typical reference data or, where available, monitoring information from other comparable wastewater systems.

Unit Wastewater Flow Assumptions

The following discusses the unit wastewater flows assumptions, in gallons per day (gpd) per connection that were used to estimate wastewater flows for the various types of properties in the Study Area.

- **Single Family Residences**. This is the most significant category, as the vast majority of properties in the Study Area are single family residences. For feasibility analysis an average daily unit wastewater flow of 125 gpd/residence was assumed, which is equivalent to an average occupancy of 2.5 persons per residence and average wastewater generation of 50 gpd/person. This estimate was based on Questa's direct long-term monitoring experience with wastewater facilities for two small community wastewater systems in the San Francisco Bay Area: (1) Marshall Community Wastewater Facility in Marin County; and (2) Lake Canyon Community Services District in Los Gatos, Santa Clara County. **Table 12** summarizes actual wastewater flow monitoring data for these two facilities, and a graphical plot of monthly flow data for these two facilities is provided in **Figure 10**, showing flows consistently below 100 gpd per connections with rare exceptions. Both of these wastewater systems utilize STEP[3] collection systems, which greatly reduces the potential for extraneous inflow or infiltration (I/I) into the sewers. These actual operating data support the recommended unit flow of 125 gpd/residence as a reasonable design value for similar small community facilities as being considered for Sunol.

- **Multi-family Residences.** A unit flow of 500 gpd was assigned for multi-family residential parcels, based on the assumption of each property generating wastewater flows equivalent to four (4) single family residences.[4]

- **Commercial/Industrial Properties.** The types and scale of uses on commercial and industrial properties in Downtown Sunol are quite varied, with estimated wastewater flows ranging from less than 100 gpd for a store or shop to more than 1,000 gpd for the three food service establishments (Bosco's, Casa Bella, and the Railroad Cafe). For initial feasibility analysis, a total daily allowance of 4,500 gpd was estimated for the

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[3] STEP stands for "septic tank effluent pump", where individual septic tanks are maintained on each parcel for normal collection and digestion of sewage solids, with only the effluent portion collected for treatment and disposal.
[4] Alameda County Assessor's Office. http://gis.acgov.org/Html5Viewer/index.html?viewer=parcel_viewer

Downtown business district based on the size and type of businesses of (2) properties at 1,500 gpd and (6) properties at 300 gpd. These flow estimates should be refined with specific parcel-by-parcel inventory of businesses in subsequent phases. A unit flow estimate of 500 gpd was estimated for the one commercial property (Elliston Vineyards) in the Lower Kilkare Road area.

- **K-8 School.** Wastewater flows for the Sunol Glen School were estimated at 1,500 gpd, based on an average of 5 gpd per person for a total student enrollment and staffing of approximately 300. Questa relied upon direct long-term monitoring experience with the onsite wastewater system for the Lagunitas School in Marin County as the basis for this estimate, also having a total enrollment of about 300 students and staff.

- **Public Restroom.** A conservative (safe) wastewater flow allowance of up to 1,000 gpd was assumed for a potential new public restroom located at Depot Park. This estimate was based on Questa's direct long-term monitoring experience with wastewater facilities for a public restroom in Point Reyes Station in Marin County. Typical wastewater generated per person at public restrooms is on order of 2 to 2.5 gpd/user, per information compiled by Caltrans for highway rest stops in California.

- **Kilkare Woods Clubhouse.** The KWA Clubhouse is used occasionally for special events that should be accounted for in wastewater system planning. Assuming one event per month with up to 150 people and a unit wastewater flow of 10 gal per person gives a flow of 1,500 gallons. This would add approximately 50 gpd to the average monthly flow, which is the normal design basis for community wastewater systems.

Table 12: Unit Flow Reference Data for Community Wastewater Facilities[1]

Community System	Parcels	Years of Operation	Annual Ave. Daily Flow (gpd/parcel)	Winter Ave. Daily Flow (gpd/parcel)	Notes
Lake Canyon CSD (Santa Clara Co.)	51	20+	58	57	Older homes; STEP collection system to community leachfield
Marshall Phase 1 (Marin Co.)	32	12	79	80	Older homes w/some rentals, STEP collection to community treatment facility and leachfield

[1] *Source: Self-Monitoring Reports on file with RWQCB; average flows for 2009-2015*

Study Area Wastewater Flow Estimates

Incorporating the above unit flow assumptions, estimated wastewater flows for this study are presented in **Table 13**. As indicated, flows were developed for each of the three major subareas (Downtown Sunol, Lower Kilkare Road and Kilkare Woods), to facilitate the structuring and analysis of separate as well as combined facility alternatives for the three subareas.

Estimates were developed based on the assumption of providing wastewater service to all existing developed properties, i.e., 100% participation. However, since there are no set service

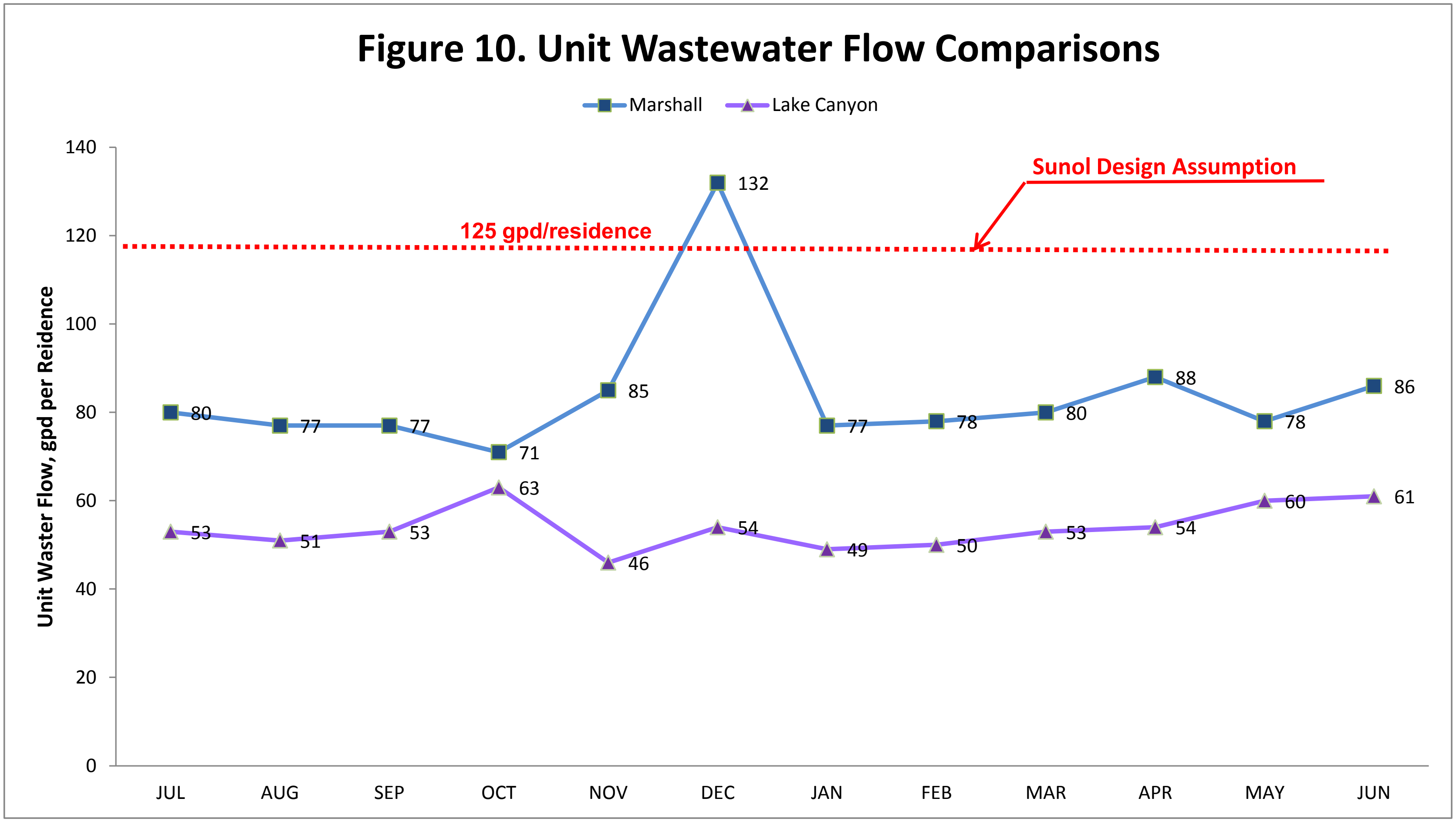


Figure 10. Unit Wastewater Flow Comparisons
Marshall
Lake Canyon
Sunol Design Assumption
125 gpd/residence
Unit Waster Flow, gpd per Reidence
0
20
40
60
80
100
120
140
JUL
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
80
77
77
71
85
132
77
78
80
88
78
86
53
51
53
63
46
54
49
50
53
54
60
61

area boundaries at this stage and connection to community facilities would not necessarily be a mandatory requirement, flow estimates are also presented for 75% and 50% levels of participation by adjusting the assumed number of residential property connections to the community facilities. The estimates assume service to all multi-family and non-residential properties; flows would be adjusted downward if some of these properties were to be excluded or chose not to connect.

It should be noted that these estimated wastewater flows would be appropriate for use in the preliminary design/sizing of community treatment facilities and dispersal fields (leachfields), under the assumption that the systems utilize STEP (effluent) sewers for the collection system. Additional allowance would need to be included for inflow/infiltration of extraneous water for project alternatives using conventional gravity sewers. Also, the unit wastewater flows for community facilities are less than those normally assumed for the design of individual onsite systems. This is because community systems receive and can be designed according to the combined average discharge from a large number of properties, rather than for the individual maximum flow that must be accommodated in the onsite system at any given property.

Table 13. Estimated Wastewater Flows for Study Area (gallons per day, gpd)

Land Use	# of Parcels	Unit Flow (gpd)	Level of Residential Participation		
			100%	75%	50%
Downtown Sunol					
Residential	60	125	7,500	5,625	3,750
Multi-Family	3	500	1,500	1,500	1,500
Commercial & Industrial	8	-	4,500	4,500	4,500
School	1	1,500	1,500	1,500	1,500
Railroad (Restroom)	1	1,000	1,000	1,000	1,000
Downtown Sunol Sub-total			**16,000**	**14,125**	**12,250**
Lower Kilkare Road					
Residential	68	125	8,500	6,375	4,250
Commercial	1	500	500	500	500
Lower Kilkare Road Sub-total			**9,000**	**6,875**	**4,750**
Kilkare Woods					
Residential	102	125	12,750	9,625	6,375
KWA Clubhouse	1	50	50	50	50
Kilkare Woods Sub-total			**12,800**	**9,675**	**6,425**
Study Area Total			**37,800**	**30,675**	**23,425**

POTENTIAL COMMUNITY WASTEWATER SITES

Reconnaissance field surveys along with review of air photos, soils and parcel maps were conducted by Questa to identify lands in and around the Study Area that could potentially serve as sites for community or cluster-type wastewater facilities. Priority was given to publicly and community-owned lands, proximity to the properties to be served, suitability of soils and other site conditions, and compatibility with current or planned land uses. Preliminary findings were reviewed at meetings of the Sunol Septic Work Group, and a field walk of one of the potential areas (Depot Gardens) was conducted with County staff and members of the community.

The following summarizes the areas identified and as the most viable potential locations for community wastewater facilities in the Study Area. **Table 14** provides a summary of the various sites along with preliminary estimates of wastewater dispersal capacity for each area. Included are several Alameda County-owned parcels in the Downtown area, and one community-owned site in Kilkare Woods. No potential sites were identified in the Lower Kilkare Road area.

Downtown Sunol

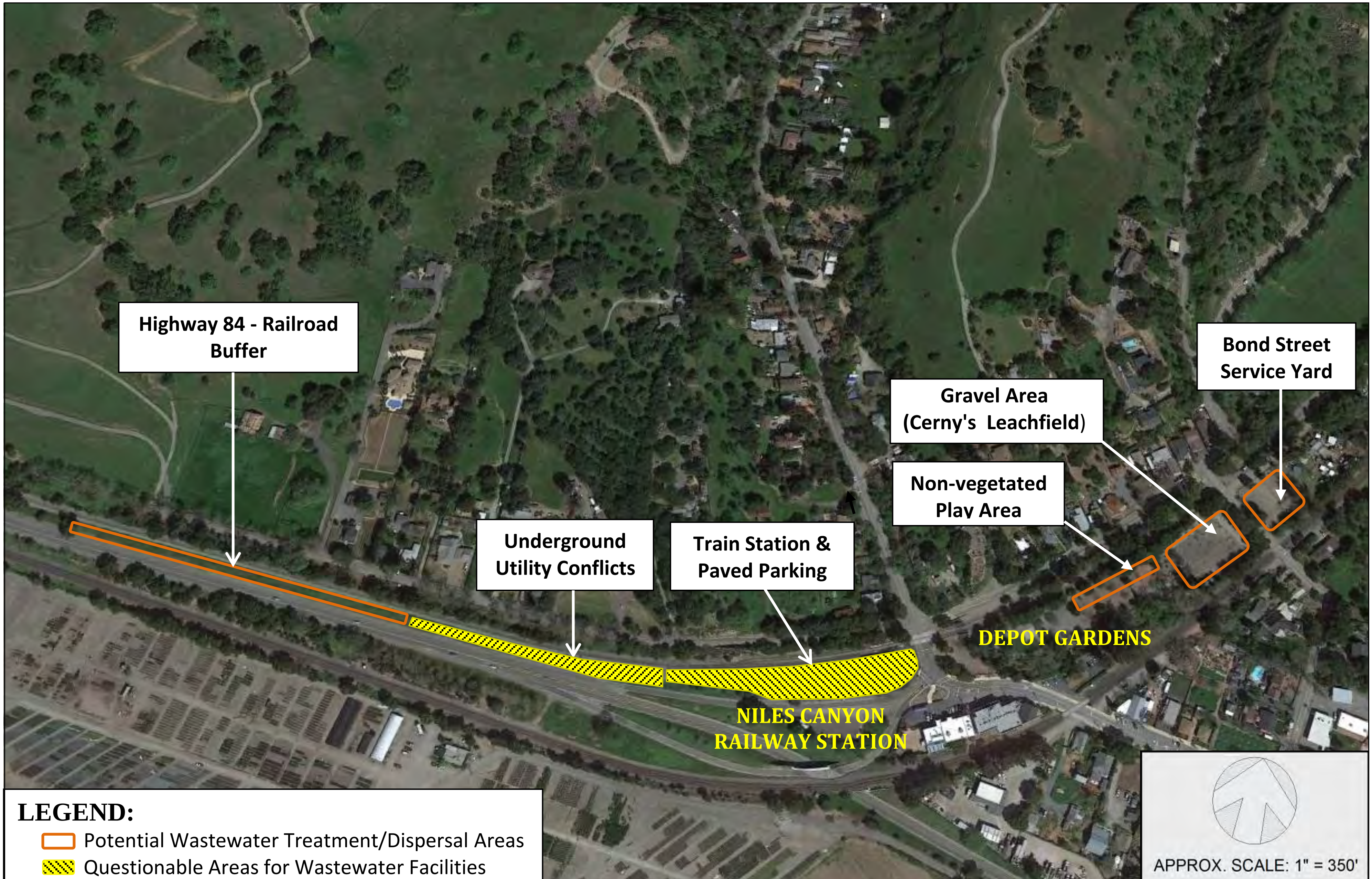
Alameda County owns a large amount of land in Downtown Sunol located along and between the two railroad lines. Some of the land is occupied by various existing facilities, including Depot Gardens, school bus service yard and fueling station, and Niles Canyon Railway line and train station. Most all of the County-owned lands in Sunol coincide with areas of deep, well-drained alluvial soils, including Yolo loam and Zamora silt loam. During the course of the study, the County indicated a willingness to make suitable portions of these parcels available for consideration as community wastewater sites. Under an agreement with the County, a portion of Depot Gardens area (east side) is currently used as a leachfield site for the Cerny building that includes the Bosco's restaurant and bar. **Figure 11** shows the location and preliminary assessment of the several different County-owned parcels in Downtown Sunol, briefly summarized below.

Depot Gardens (APN 96-140-18). The east side of Depot Gardens, near Bond Street, has an area of approximately 0.75 to 1.0 acres suitable for wastewater treatment and dispersal fields. The leachfield for Cerny Building/Bosco's currently occupies some of the area, which could potentially be incorporated into a community wastewater facility. Per State Water Board requirements for community wastewater facilities, areas more than 100 feet from Sinbad Creek would be suitable for leaching trenches and areas at least 50 feet from the creek could be used for wastewater treatment components and for sub-surface drip dispersal of disinfected secondary treated wastewater. Leachfields for dispersal of secondary treated water could be installed in traffic areas, allowing some portion of the area to be used jointly for a parking lot. The area near the center of Depot Gardens (approximately 10,000 ft^2) indicated in **Figure 11** as "Non-vegetated play area" could be sub-irrigated with treated water, integrated with existing and/or new landscaping. This could potentially provide a much needed source of irrigation water (recycled water) for trees and bushes during times of water rationing and drought.

- **Bond Street Service Yard** (APN 96-155-07). The County service yard at the corner of Bond Street and Railroad Road has an area of about 15,000 square feet, about one-third

Table 14. Estimated Wastewater Dispersal Capacities
County-Owned Parcels, Downtown Sunol

Parcel Location	Area Description	Estimated Dispersal Area, (ft^2)	Dispersal Method	Estimated Dispersal Capacity (gpd)	Notes
Depot Gardens	East Side Gravel Parking Area	15,000	Leachfield (Traffic Area)	15,360	Utilize, modify and/or replace existing Bosco leachfield; 1,600 lf of trench w/8 sf/lf effective infilt area; at 1.2 gpd/sf = 15,360 gpd; min secondary treatment for placement under traffic area.
		5,000	Subsurface Drip (New Landscaping)	6,000	Integrated with parking, wastewater treatment, and other landscaping; 1.2 gpd/sf; assumes disinfected secondary treatment
	Non-vegetated Play Area, (West of Garden)	10,000	Subsurface Drip Field	12,000	Approx. 40'x250' area, 50-ft setback from Sinbad Creek; new landscaping managed as part of wastewater operations; 1.2 gpd/sf; assumes disinfected secondary treatment
			Sub-total	**33,360 gpd**	Max available for primary + 100% reserve; Ok for 16,500 gpd design flow
Bond St.	County Equipment Service Yard	12,000	Option A Leachfield (Traffic Area)	Option A: 12,480	Leachfield designed for traffic area; 1,300 lf at 9.6 gpd/lf = 12,480 gpd
		10,000	Option B Subsurface Drip (No Traffic)	Option B: 12,000	Terminate current equipment and vehicle access; convert to drip irrigated landscaping; 10,000 sf at 1.2 gpd/sf = 12,000 gpd
			Depot Gardens & Bond St Sub-total	**45,840 gpd**	Max available for primary + 100% reserve; Ok for approx 23,000 gpd design flow.
Railroad Depot & West	Highway 84 - Railroad Utility Buffer Strip	18,000 (20' W x 900' L)	Leachfield	**17,280**	Long, narrow grass buffer between Hwy 84 and RR; restricted by underground utilities (TBD); 2 trenches at 900 lf = 1,800 lf at 9.6 gpd/lf = 17,280 gpd
			Estimated Total Potential Wastewater Dispersal Capacity	**63,000 gpd**	Max available for primary + 100% reserve; Ok for approx 31,000 gpd design flow



PHASE 1 – SUNOL WASTEWATER FEASIBILITY STUDY SUNOL, CALIFORNIA ALAMEDA COUNTY	QUESTA ENGINEERING CORP	POTENTIAL WASTEWATER SITES ON COUNTY-OWNED PARCELS IN DOWNTOWN SUNOL	FIGURE 11

of which is currently used for a fuel station, equipment servicing and storage. The remaining 10,000 square feet could potentially be used for dispersal of treated water (beneath traffic areas), or for treatment facilities. If the existing facilities were to be decommissioned, the entire area could be devoted to both wastewater treatment and dispersal (leachfields). The entire area is more than 100 feet from Arroyo de la Laguna, the nearest watercourse.

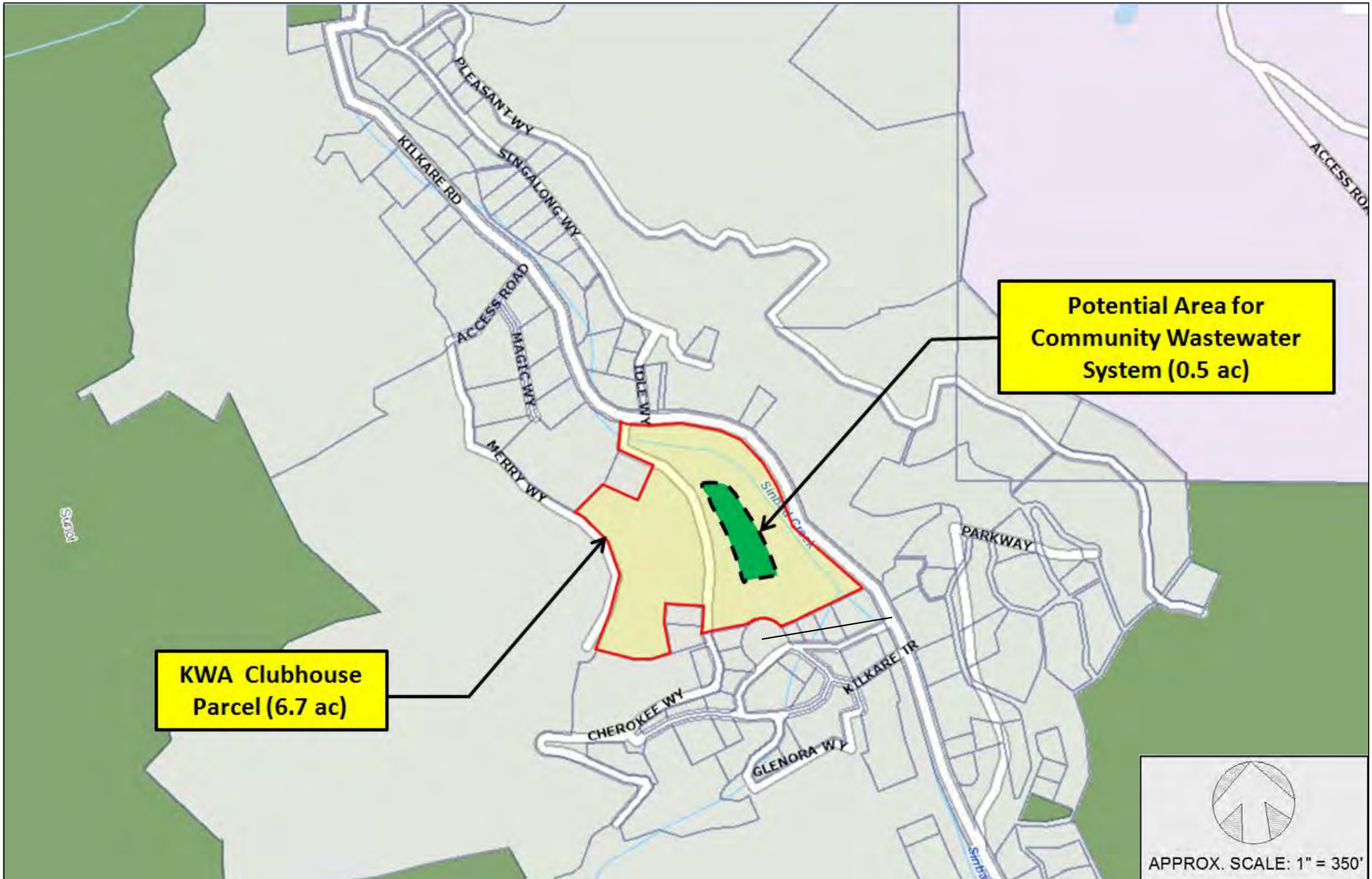
- **Niles Canyon Railway Station** (APN 96-175-09 & 96-180-13). The Niles Canyon Railway station and adjoining parking lot occupies an area of about 1.25 acres on the west side of Downtown Sunol. Potentially some of the parking area might be able to accommodate drip dispersal of treated water in landscape areas, or subsurface leachfields designed for traffic areas. However, due to the likely existence but unknown extent of underground utilities in this area, at this stage it is not considered a strong candidate for community wastewater dispersal.

- **Highway 84 –Railroad Buffer** (APN 96-125-08). West of the train station there is a long narrow strip of grassy buffer between Highway 84 and the Niles Canyon Railroad tracks. From field reconnaissance, a portion of this buffer strip (nearest the train station) has markings indicating underground utilities and would likely have to be excluded from consideration for wastewater facilities. However, the western portion, beginning about 1,000 feet west of the Railway buildinge, and extending to the west about 900 feet could potentially accommodate a long, narrow leachfield for wastewater disposal. The area identified is about 15 to 20 feet wide (see **Figure 11**). All of the area is several hundred feet from the nearest watercourse, Alameda Creek.

Alameda County also owns additional lands along the Niles Canyon Railway line extending westerly through Niles Canyon. There was interest expressed in community meetings about the possibility of exploring these additional lands as a potential alternate location for a community wastewater system for Sunol. A cursory review indicates sufficient land area may be available; however, further investigation would be needed to confirm potential suitability, since soil conditions, vegetation, slopes and close proximity to Alameda Creek pose greater constraints as compared with the identified sites in Downtown Sunol.

Kilkare Woods

Review of maps along with a reconnaissance field investigation of Kilkare Woods was conducted by Questa to identify possible sites for cluster leachfields (i.e., to serve a few to several houses) or a larger community leachfield area. The one viable site identified was the "Clubhouse" parcel owned by the Kilkare Woods Association (KWA), APN 96-542-09 (**Figure 12**). The overall parcel size is about 6.7 acres and includes a gently sloping ball field area near Sinbad Creek, plus a steeper wooded area farther from the creek. A portion of the ball field area, about ½ acre in size, was found to have suitable soils, slopes and setback from Sinbad Creek to potentially accommodate wastewater treatment and dispersal facilities. About one-third of the available area would be able to meet a 100-ft setback to the creek, allowing the use of conventional leachfields. The remaining area, with a minimum 50-ft creek setback, could accommodate sub-surface drip dispersal of disinfected secondary treated water as well as wastewater treatment facilities. Wastewater dispersal areas could continue to accommodate



PHASE 1 – SUNOL
WASTEWATER FEASIBILITY STUDY

SUNOL, CALIFORNIA
ALAMEDA COUNTY

QUESTA ENGINEERING CORP.

KILKARE WOODS POTENTIAL COMMUNITY WASTEWATER SITE

FIGURE

12

recreation uses. Authorization to locate any community wastewater facilities on this parcel rests with the KWA.

WASTEWATER COLLECTION AND TREATMENT

Wastewater Collection

The three main types of wastewater collection facilities to consider for a community wastewater system in Sunol are: (1) conventional gravity sewers; (2) grinder pump–pressure sewers; and (3) small diameter effluent sewers. Hybrid systems including combinations of two or all three methods are also possible. The basics of each option are described below; additional technical literature on grinder pump-pressure sewers and small diameter effluent sewers is provided in Environmental Protection Agency (EPA) Fact Sheets in **Appendix C**.

Conventional Gravity Sewers. In a conventional gravity sewer, raw wastewater travels through a system of sewer pipes installed at a minimum grade to maintain gravity flow. Sewer pipes are usually six or eight-inch minimum diameter, with four-inch diameter lateral connections from buildings, and typically require a minimum of four to five feet of backfill cover. Pipe and fitting material can be PVC, ABS, HDPE[5] or ductile iron. Conventional gravity sewers require manholes generally: (a) at all intersections of sewer lines other than side sewer connections less than six inches in diameter; (b) at all vertical or horizontal angle points; and (c) at intervals not greater than 400 feet. Manholes provide access for maintenance and cleaning. Since conventional gravity sewers require a constant downhill grade, gravity sewer mains may need to be installed at considerable depths where the terrain is flat or undulating. Where gravity flow cannot feasibly be continued, pump stations are commonly used to collect and "lift" the sewage to a higher point in the system where it can again flow by gravity, or to the treatment plant.

Grinder Pump - Pressure Sewers. A grinder-pump pressure sewer is an "alternative" sewer collection method developed in the early 1970s to provide a more affordable sewer option for areas of low-density development and undulating and hilly terrain. It utilizes a small diameter pressure pipeline, which is installed following the profile of the ground. Typical main diameters are 2 to 6 inches, and PVC and HDPE are the usual piping material. Burial depths usually maintain a 30-inch minimum cover.

In residential areas served by a pressure sewer, each home uses a small grinder pump and basin to discharge to the main line. The pump grinds the solids in the wastewater into slurry in the manner of a kitchen sink garbage grinder. Grinder pumps at individual homes and businesses are usually one to two-horsepower in size. Multifamily and commercial properties may make use of duplex grinder pump stations designed for larger flows and for failsafe redundancy.

The service line leading from the pumping unit to the main is usually 1.25-inch diameter PVC or HDPE pipe. A check valve on the service line prevents backflow, which is insured with a redundant check valve at the pumping unit. If a malfunction occurs, a high liquid level alarm is activated. This alarm may be a light mounted on the outside wall of the home, or an audible

[5] "PVC" stands for polyvinyl chloride; "ABS" stands for acrylonitrile butadiene styrene; "HDPE" stands for high density polyethylene.

alarm that can be silenced by the resident. To deal with power outages (a) the pump basin is normally sized with surplus storage capacity and (b) a transfer switch can be provided to allow temporary generator power operation.

Small Diameter Effluent Sewers. Unlike conventional and grinder pump-pressure sewers, in small diameter effluent sewers primary treatment is provided at each connection by a septic tank, and only the settled wastewater is collected. Where the terrain is appropriate, the septic tank effluent can be collected by gravity flow in a common small diameter collection main (4 to 6-inch diameter); this is termed a "STEG" system for "septic tank effluent gravity". Where the terrain requires pumping, individual "STEP" pumping units are provided at each connection; "STEP" is short for "septic tank effluent pump". In these cases, each connection includes an effluent pump located either in the second compartment of the septic tank or in a separate pump chamber. The septic tank effluent is then pumped into a small diameter force main (2 to 4-inch PVC or HDPE). Grit, grease, and other troublesome solids which might cause obstructions in the pumps or collector mains are separated from the waste flow and retained in septic tanks.

All properties connecting to a STEG/STEP community system would retain and/or upgrade their existing septic tanks so that they can continue to provide primary treatment of sewage. Property owners would have continuing responsibility to maintain and have their septic tank serviced (pumped) as needed. The piping connection to the existing leachfield would be capped off, and the effluent from the septic tank would be routed to the new community collection piping in the street using a gravity lateral (STEG) or pressure lateral (STEP), as applicable. An example of a STEG/STEP community wastewater collection system in the S.F. Bay Area is the Lake Canyon Community Wastewater System in Los Gatos, which was the site of a field trip by members of the Sunol community in December 2016.

Preliminary Recommendation for Sunol. Based on preliminary assessment of the terrain, housing/development density and ability to make use of existing/upgraded septic tanks, a small diameter effluent sewer would likely be the preferred wastewater collection method to be used in connection with development of community wastewater facilities in Sunol (see Alternatives 3, 4, 5 and 6 below). An exception to this would be for the project alternative (#7) proposing connection to the City of Pleasanton, where conventional gravity sewers with a main lift station is anticipated in order to be compatible with City of Pleasanton sewer system design. Additional detailed review and cost comparison of alternative sewer options should be included in the follow-up completion phase of this feasibility study.

Wastewater Treatment Facility

There are many wastewater treatment technologies that could be considered for a community system (or systems) in Sunol. ACDEH has standards for individual OWTS in the County OWTS Ordinance and OWTS Technical Manual adopted in June 2018. Community systems are allowed for in the County OWTS Ordinance and Manual; however, these documents do not contain requirements dictating the type of treatment system for community wastewater facilities. The Regional Water Board would be the governing agency for a community system and, although they have requirements pertaining to the siting of facilities, capacity, performance standards, failsafe/contingency features, monitoring and reporting, an engineering design firm would be required to submit a design for review and approval by the Regional Water Board.

It has been assumed in this Phase 1 Feasibility Study that a system providing secondary treatment followed by disinfection would be required and a practicable approach to: (a) make most efficient use of available land area for wastewater treatment and dispersal; (b) provide nitrogen removal consistent with Zone 7 requirements for groundwater management in the Upper Alameda Creek Watershed; and (c) meet overall objectives for public health and water quality protection.

The following reference provides a comprehensive review of onsite wastewater treatment for individual systems, but also applicable and small community systems: *"Review of Technologies for the Onsite Treatment of Wastewater in California", Prepared for California State Water Resources Control Board by U.C. Davis, August 2002*[6]. There are a number of proprietary (manufactured) treatment systems that could be used, including those utilizing aerobic treatment processes and various types of media filtration. There are also non-proprietary technologies that could be custom-designed, such as sand filters, trickling filters and submerged vegetated bed systems. Examples and photos of small community systems potentially well-suited for Sunol are provided in **Appendix D**, some of which were reviewed at meetings of the Sunol Septic Work Group.

Because of the wide range of possibilities no particular treatment system design is recommended at this stage of feasibility review. Comparative study of alternative wastewater treatment technologies as well the preferred location(s) would be taken up in subsequent phases of feasibility analysis and project planning.

COMMUNITY WASTEWATER ALTERNATIVES

Based on the Study Area conditions, wastewater requirements, and potential options, the following community wastewater alternatives were developed for feasibility analysis. **Section 5** provides further description and preliminary cost estimates for each alternative.

- **Alternative 1 - No Project**. This would involve maintaining the status quo, where individual property owners would be responsible for repair, upgrade and replacement of existing OWTS in accordance with County standards. This often includes the need to obtain case-by-case Alameda County Board of Supervisors approval for variances where County standards, such as stream setbacks, cannot be met.

- **Alternative 2 - Onsite Wastewater Management Program**. This alternative would provide for the upgrade of onsite systems to be done in conjunction with the formation of a OWTS maintenance district, with the Alameda County Board of Supervisors serving as governing board. This would allow more flexibility and options for OWTS improvements, especially through adoption of customized local standards and waivers for certain OWTS siting and design requirements.

[6] https://www.waterboards.ca.gov/sandiego/water_issues/programs/wine_country/docs/updates081910/owts_review.pdf

- **Alternative 3 - Kilkare Woods Community System.** This alternative covers the development of a community wastewater system to replace problematic OWTS in Kilkare Woods. It includes the establishment of community wastewater treatment and subsurface dispersal facilities at the KWA Clubhouse parcel, with capacity to serve a majority of the developed parcels in Kilkare Woods.

- **Alternative 4 – Downtown Sunol Community System.** This alternative consists of a community wastewater treatment system for the Downtown Sunol area. It would include a small diameter STEP effluent sewer system extending throughout the Downtown area, with effluent collected at the east side of Depot Gardens (at the site of the present Cerny Building leachfield) for secondary wastewater treatment and effluent dispersal using a combination of leachfields and sub-surface drip dispersal at Depot Gardens and potentially some use of the adjacent County service yard on Bond Street.

- **Alternative 5 – Downtown Sunol-Lower Kilkare Road Community System.** This alternative is an expanded version of Alternative 4, providing a community wastewater treatment system serving properties throughout both Downtown Sunol and Lower Kilkare Road area. It would include the same small diameter STEP effluent sewer system, extending further north along Kilkare Road. This alternative would include wastewater facilities on both the east end of Depot Gardens and the Bond Street service yard.

- **Alternative 6 – Sunol Community-wide System.** This alternative is an expanded version of Alternative 5, providing a community wastewater treatment system with sewer service extended to properties throughout the entire Study Area - Downtown Sunol, Lower Kilkare Road, and Kilkare Woods. It would include the same small diameter STEP effluent sewer system, extended to the end of Kilkare Woods. Secondary wastewater treatment facilities would be located at the County-owned Depot Gardens/Bond Street service yard properties. Treated effluent would be dispersed to a combination of leachfields and sub-surface drip dispersal at the east end of Depot Gardens, Bond Street service yard, and at additional areas on County-owned lands between Highway 84 and the railroad tracks, west of the Niles Canyon Railway station.

- **Alternative 7 – Sewer Connection to Pleasanton**. This alternative consists of a conventional gravity sewer system extending throughout the entire Sunol Study Area, with an intertie to the City of Pleasanton sewer system, which is the nearest municipal sewer system. Under this alternative all existing OWTS in Sunol would be formally abandoned and decommissioned. All raw sewage would be collected at a major sanitary lift station in Downtown Sunol, and from there pumped in a force main approximately 2.9 miles to the Pleasanton sewer system.

SECTION 5: DESCRIPTION OF WASTEWATER ALTERNATIVES

INTRODUCTION

This section provides additional description, graphics and preliminary cost estimates for each of the identified alternatives for the Sunol Study Area. The preliminary analysis included the completion of reconnaissance-level field investigations, which were used to determine the facility requirements, preliminary feasibility and capacity estimates, and estimated costs for the various alternatives. The alternatives have been developed to a "planning level" of detail rather than a "design level", which is an appropriate and sufficient basis for informing the community of the range of options available along with an understanding of the approximate costs. No attempt has been made to evaluate and compare the different alternatives; that would be the focus of a follow-on detailed feasibility analysis.

ALTERNATIVE 1 - NO PROJECT

Description

The No Project alternative, or status quo, is presented as a base case condition against which to judge other alternatives. Alternative 1 would provide for the continued use of onsite OWTS, with individual property owners responsible for the full cost of permitting, maintenance and repair of their own systems. Permitting and regulatory responsibility would remain with the ACDEH in accordance with the County OWTS Ordinance and Technical Manual adopted in 2018. This would continue to leave OWTS as an individual responsibility, with no community program.

In accordance with the current County Ordinance, individual property owners are required to perform OWTS upgrades, maintenance, and correction of failing OWTS under the following circumstances:

- As a direct result of abatement action taken by ACDEH for individual properties, in response to complaints or observed system failures;
- In connection with referrals from Alameda County Planning and Building Department regarding permits for site development conditional use permits and new construction or building modifications;
- At the time of property transfers; (Note: this is not a County requirement, but commonly arises as a condition of sale between buyer and seller); or
- By individual property owners on their own initiative as needed.

OWTS repair work expected under this alternative might include, for example, replacement of existing substandard or failing OWTS with a new septic tank and dispersal system.

In many cases, an advanced system, such as advanced ("supplemental") treatment unit with drip dispersal or pressure distribution leachfield, would likely be required because of stream setbacks, limited space, steep slopes, shallow soils or other site constraints for standard septic tank/leachfield systems.

Retrofitting houses with ultra-low flush toilets and other water conserving plumbing devices would also be a necessity for many houses to reduce the volume of wastewater to be treated and disposed. In some cased graywater reuse systems for laundry, shower/baths and hand sinks may be feasible and helpful to meet site specific requirements.

New residential construction, building additions and second units would not be permissible except where site conditions can support the installation of an OWTS that conforms to current code requirements, or where approval is granted by the Board of Supervisors and ACDEH. through a formal variance process. In many cases a repair system may also require variance approval, e.g., for reduction in standard setback distances for placement of treatment or dispersal facilities.

Estimated Costs

Costs for the No Project Alternative 1 are best estimated from the existing expenses incurred by individual property owners for upgrades or repair of their onsite wastewater systems in connection with building remodel project, property transfers or repairs. Most of the above scenarios under Alternative 1 would very likely require a formal variance to be granted by the Alameda County Board of Supervisors and ACDEH, and potentially recordation of legal easements. The costs associated with these items include preparation of a technical report prepared by an OWTS designer to support the variance, fees for ACDEH staff time, and legal costs and can range from $5,000 to $15,000.

Using the information and understanding of local OWTS challenges and options developed through the questionnaire survey, field reviews and other background information, general estimates for individual onsite system repair, upgrade, or upgrade were developed as follows:

1. Estimates were made of the percentage of properties falling in each of the upgrade and repair cost categories discussed in Section 4, under OWTS Field Reviews as follows:

    - Existing Code Compliant OWTS (no work required) 5%
    - Low level of upgrade required 20%
    - Mid level of upgrade required 25%
    - High level of upgrade required 50%

2. Cost estimates were developed for the different level of work required in each of the upgrade cost categories, using best professional judgment and experience with the range of OWTS repair and installation work for the given conditions in Sunol. Itemized cost estimates are included in **Appendix E**, including factors for inspection, repair, new facilities, engineering and permitting costs.

Using the information from **Appendix E** a summary of expected OWTS costs for individual properties falling within each cost upgrade category was developed as shown in **Table 15**. Additional cost allowance for contingencies and the variance process were also added to arrive at estimates of probable cost for OWTS upgrade under Alternative 1. As indicated, expected costs range from about $26,000 on the low end up to $90,000+ on the high end. Financing of costs would be left to the individual property owner.

Table 15. Estimated Costs for Individual System under Alternative 1

OWTS Upgrade Category	Estimated Percentage of Total OWTS	Number of OWTS	Estimated Average Cost ($)	Contingency 20%	Variance	Total Costs
Existing Code-Compliant OWTS	5%	12	0	0	0	0
Low Level of Upgrade	20%	49	$18,000	$3,600	$5,000	$26,600
Mid Level of Upgrade	25%	61	$37,000	$7,400	$10,000	$54,400
High Level of Upgrade	50%	121	$64,000	$12,800	$15,000	$91,800

Assuming most all systems require some advanced treatment components, the ongoing operation and maintenance requirements include service inspections, monitoring and reporting under the conditions of a OWTS Operating Permit issued by ACDEH to the property owner, plus electrical usage, routine septic tank pump-outs, and replacement of parts and system components over the life of the system. Average annual operating maintenance costs are typically in the range of $1,000 to $1,500 for advanced onsite wastewater treatment systems, including the above items and annual County permit fees.

ALTERNATIVE 2 - ONSITE WASTEWATER UPGRADE AND MANAGEMENT DISTRICT

Description

Alternative 2 would create an Onsite Wastewater Management District for the identified service area. Potential activities and benefits include the following:

1. Adoption of customized local standards, procedures and practices that vary from County-wide regulation for OWTS in the service area such as:

    - Local waiver and geographic variances to streamline approvals (e.g., setbacks, system sizing)
    - Alternative technologies and criteria, such as using greywater systems as a functional element of OWTS capacity, holding tanks, composting toilets
    - Credit for high efficiency water conservation fixtures
    - Streamlined investigative, design and submittal process
    - New site development, remodel and additions policies

2. Provisions for community oversight of OWTS and environmental conditions, such as
    - Stream and/or groundwater quality
    - Regular inspection, preventative maintenance/septic pump-out, and monitoring of OWTS under a community operating permit
    - Public education regarding OWTS related issues

3. Facilitation of the development of cluster and off-site easements, that my include:
    - Planning & design
    - Construction inspections
    - Ownership, operation and maintenance agreements system

4. Obtaining or facilitating public financing to support:
    - Ongoing OWTS management activities
    - Loans and grants to individual OWTS owners
    - Financing for construction of cluster systems

Alternative 2 would provide for inspection and as-needed upgrading of existing OWTS in the study area along with the formation of an OWTS management authority (district) to perform ongoing inspection, monitoring, and maintenance of these systems. It assumes that OWTS would need to be upgraded to a minimum set of requirements, or determined to be in compliance with a minimum performance standard that would assure proper functioning and elimination of public health and water quality problems. The current standards of the ACDEH and the Regional Water Board would apply, with the possibility of adopting certain local modifications with concurrence by both of these agencies; this would largely eliminate the requirement for individual property owners to obtain variances from the Alameda County Board of Supervisors as discussed in Alternative 1. In general, all applicable siting criteria (i.e., soil depth, percolation, groundwater, slope requirements, etc.) would be considered to the greatest extent possible in evaluating and designing OWTS upgrades.

On-lot OWTS improvements under Alternative 2 would be similar to those for the Alternative 1; i.e., replacement of substandard systems with new septic tanks, supplemental treatment units and new dispersal fields, most likely using pressure distribution or drip dispersal. Other advanced technologies might also be considered on a case-by-case basis. Retrofitting houses with ultra-low flush toilets and other water conserving plumbing devices would also be a necessity for many houses to reduce the volume of wastewater generated; and graywater systems may also be encouraged to a greater extent. The specific siting and design criteria for each alternative technology would have to be in accordance with currently adopted standards of the ACDEH and Regional Water Board, or based on criteria developed and agreed upon by both agencies specifically for the onsite wastewater management district. These criteria would be determined in consultation with these agencies in the follow-on feasibility stage .

Following OWTS upgrading, a continuing inspection and monitoring program would be carried out by a public management authority. This would entail regular inspection of each OWTS, water quality sampling of treatment systems as well as Sinbad Creek, possibly other local drainages, and groundwater monitoring wells, with periodic reporting to the ACDEH and

Regional Water Board on the inspection results and overall compliance with system performance, water quality and public health standards.

Appendix E provides background information on the history and formation process for an onsite wastewater management district program in California. Also included is an overview of different functions, activities and benefits that can be part of an onsite management program. Program activities can be customized to meet local needs.

Estimated Costs

Using the information and understanding of local OWTS challenges and options developed through the questionnaire survey, field reviews and other background information, a general estimates of cost for this onsite upgrade and management program were developed as follows:

1. Estimates were made of the percentage of properties falling in each of the upgrade and repair cost categories discussed in Section 4, under OWTS Field Reviews as follows:

    - Existing Code Compliant OWTS (no work required) 5%
    - Low level of upgrade required 20%
    - Mid level of upgrade required 25%
    - High level of upgrade required 50%

2. Cost estimates were developed for the different level of work required in each of the upgrade cost categories, using best professional judgment and experience with the range of OWTS repair and installation work for the given conditions in Sunol. Itemized cost estimates are included in **Appendix F**, including factors for inspection, repair, new facilities, engineering and permitting costs. The individual OWTS costs are similar to those presenting under Alternative 1, with the exception that the added contingency factor and costs associated with the variance process are not included in Alternative 2. This is attributable to the establishment of customized, agreed-upon local standards and design practices, streamlined design/permitting process, and elimination of the variance process except for rare cases.

3. Using the percentages in (1) above, the number of parcels in the overall Sunol Study Area within each cost category were estimated and then combined with the estimated average cost for each upgrade category to project a total estimated cost of OWTS upgrade for the Study Area. These calculations are summarized in **Table 16.**

In addition to the OWTS upgrade costs, there would be general program costs associated with the formal establishment of an onsite wastewater management district, the development of local design standards and practices, and organizational-administrative procedures. Such costs would be spread among all properties in the service area. Depending on the number of properties covered, the program-related costs would be expected to add in the range of $1,000 to $2,000 to the costs per parcel estimated in **Table 16**.

Table 16. Preliminary Cost Estimate, Alternative 2 Onsite Upgrades and Management District

OWTS Upgrade Category	Estimated Percentage of Total OWTS	Number of OWTS	Estimated Average Cost ($)	Estimated Total Cost ($)
Existing Code Compliant OWTS	5%	12	0	0
Low Level of Upgrade Required	20%	50	$18,000	$900,000
Mid Level of Upgrade Required	25%	61	$37,000	$2,257,000
High Level of Upgrade Required	50%	121	$64,000	$7,744,000
Total	**100%**	**244**		**$10,901,000**
Average Estimated Cost per Parcel (for 244 parcels)				**$44,676**

Once implemented there would be ongoing annual costs for the onsite wastewater management program to include administration costs, labor and expenses to perform the necessary system inspections and reporting, an allowance for equipment and material costs associated with system maintenance and replacement, laboratory costs for water quality sampling and analysis, plus other cost directly absorbed by individual property owners for electrical costs, treatment/disposal system equipment, and routine septic tank pump-outs. Estimates for annual operation and maintenance costs would be developed during follow-on detailed feasibility studies, and would depend on the scope of activities to be included and the number or properties sharing the costs. As a point of reference, the long-running onsite wastewater management program for the Stinson Beach community in Marin County, with about 600 properties, currently has a standard fee of $480 per year, plus special service charges. The onsite wastewater program for the Sea Ranch in Sonoma County (over 1,500 properties), currently has an annual fee of about $200 (see 2018 Annual Report for The Sea Ranch[7]).

It should be emphasized that the cost estimates provided here are very preliminary, and could be improved with access to and site specific assessment of a greater number of properties in the Study Area. However, they provide a reasonable starting point and a framework for further review and assessment of this alternative during follow-on feasibility studies.

ALTERNATIVE 3 – KILKARE WOODS COMMUNITY WASTEWATER SYSTEM

Description

This alternative deals specifically with the development of a community wastewater system to serve properties in Kilkare Woods. It includes the establishment of community wastewater treatment and subsurface dispersal facilities at the Kilkare Woods Association (KWA) Clubhouse parcel. It would have capacity to serve a majority of the developed parcels in Kilkare

[7] https://www.tsra.org/wp-content/uploads/2019/11/2017-ZONE-ANNUAL-RPT-wAttachments-ID_3278.pdf

Woods, with the primary intent of providing an option for replacement of failing OWTS and to support building improvements on marginal and problematic lots. A STEG-STEP effluent collection system, including a combination of gravity and pump systems, would be installed along Kilkare Road, extending uphill and downhill of the KWA Clubhouse site to allow connection of properties throughout the Kilkare Woods.

Figure 13 shows the general layout for this alternative, including the extent of sewer collection lines and location of the proposed community wastewater facilities. **Figure 14** shows the treatment and dispersal area in the playground area the KWA Clubhouse parcel and relationship to Sinbad Creek.

Service Area and Estimated Wastewater Flows

This alternative proposes a community system with service area limited to the existing 102 developed properties in Kilkare Woods. It is assumed that connection to the system would be optional, but would be available to any property.

Wastewater flows will depend on the number of properties opting to connect to the community system. Using wastewater flow information for Kilkare Woods detailed earlier in **Section 4**, the estimated wastewater flows for this alternative would be shown in **Table 17** below for different percentages of residential property connections, defined as Alternatives 3A, 3B and 3C:

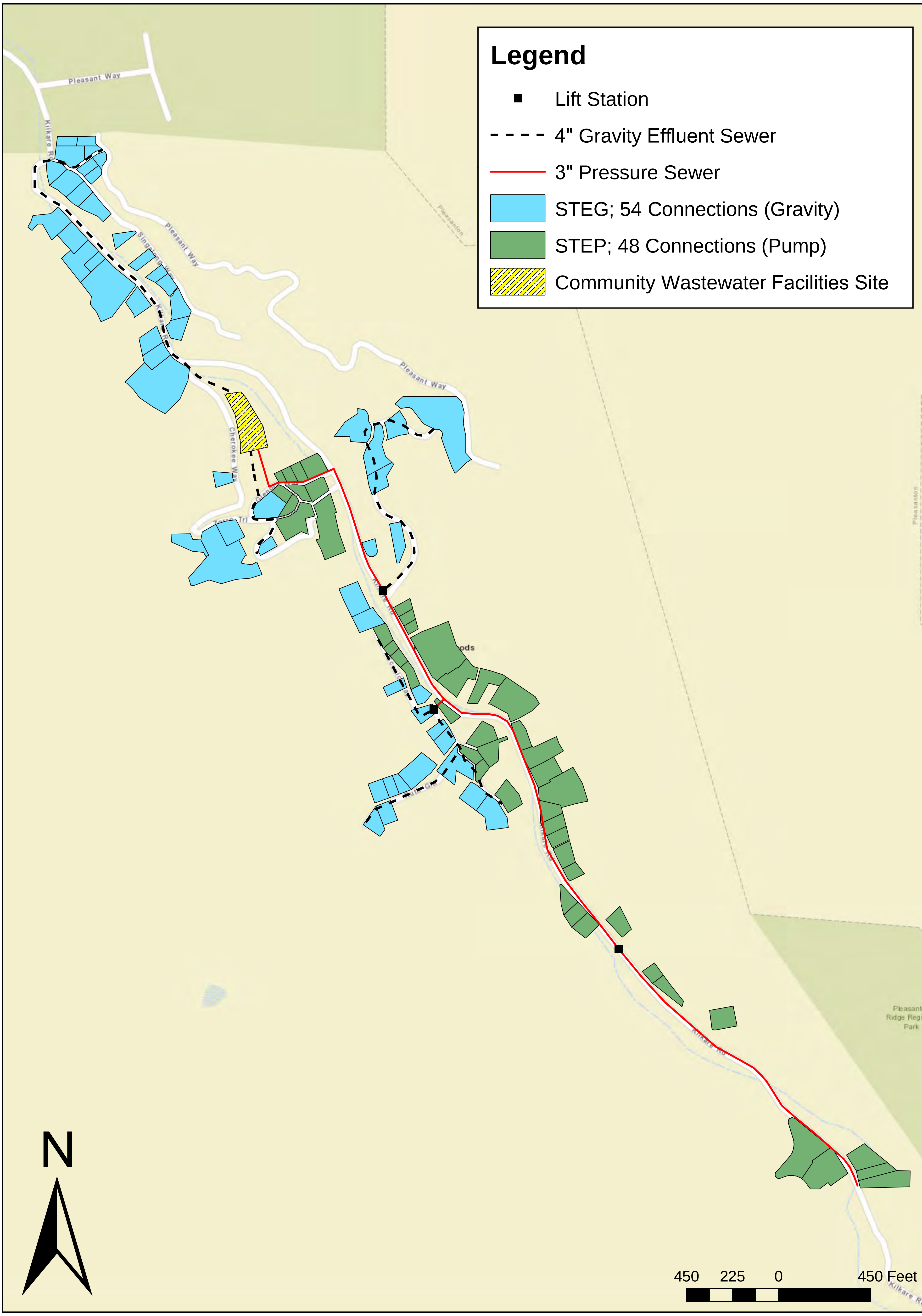
Table 17. Estimated Wastewater Flows for Kilkare Woods

Land Use	Unit Flow (gpd)	Level of Residential Participation					
		3A - 100%		3B - 75%		3C - 50%	
		Parcels	Flow (gpd)	Parcels	Flow (gpd)	Parcels	Flow (gpd)
Residential	125	102	12,750	77	9,625	51	6,375
KWA Clubhouse	50	1	50	1	50	1	50
	Total	**103**	**12,800**	**178**	**9,675**	**52**	**6,425**

Wastewater Facilities

The following summarizes the key wastewater facilities for this alternative.

Collection System. As shown in **Figure 12**, a STEG-STEP effluent collection system would be installed in Kilkare Road, extending uphill and downhill of the KWA Clubhouse site. Collection lines would also be installed in the side streets as necessary to reach all developed properties that might connect to the system (e.g., Glenora, Parkway, Ruth Glenn, Fern Trail). Preliminary layout of the collection system includes STEG gravity lines on Parkway and Fern Trail with "cluster" lift stations to pump the collected effluent to a leachfield located in the KWA Clubhouse ball field area. A third lift station would be needed as a booster pump for the small group of connections in the lower part of Kilkare Woods. The preliminary collection system layout is estimated to include the following pipeline lengths:



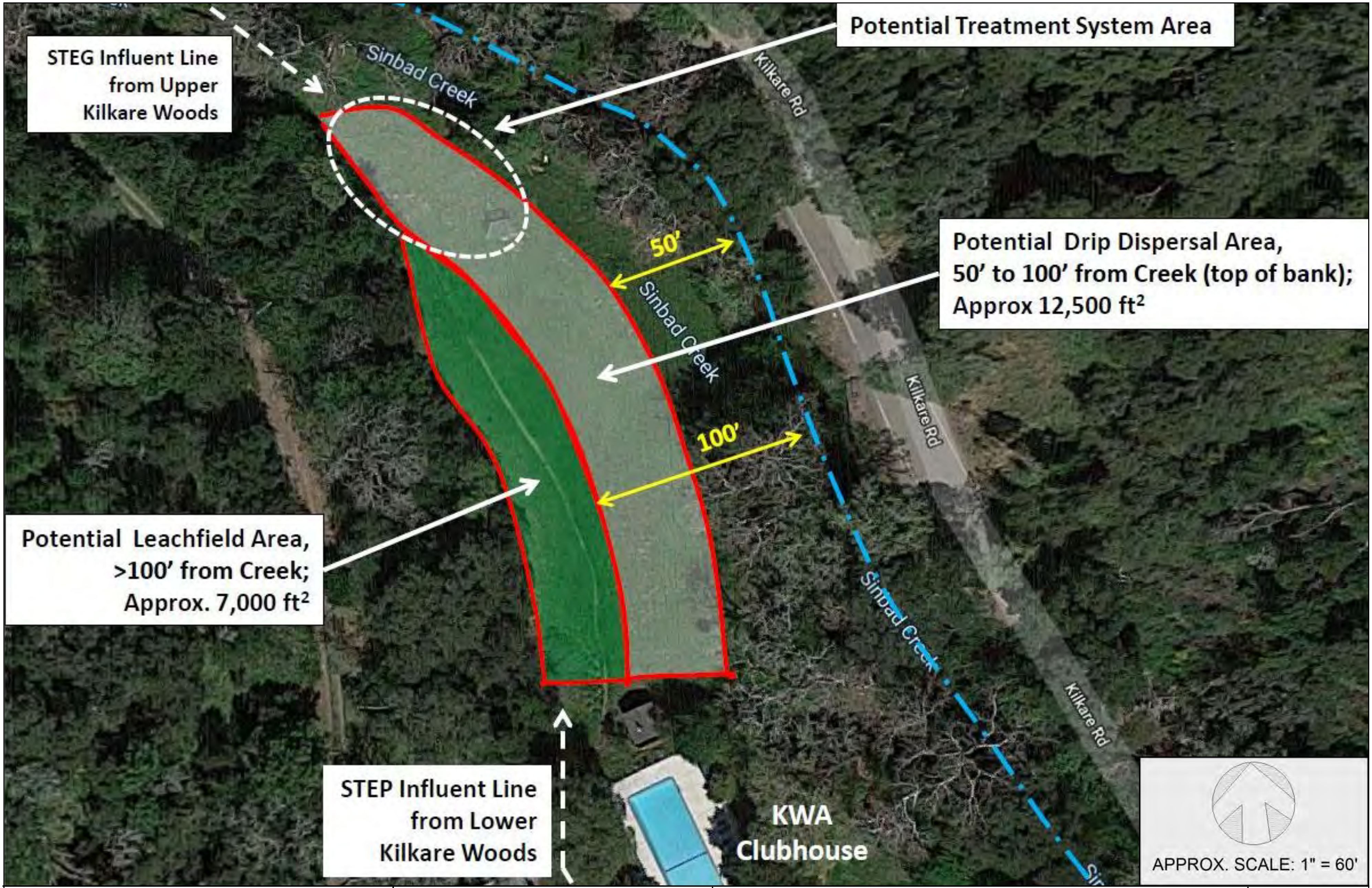
KILKARE WOODS COMMUNITY WASTEWATER ALTERNATIVE #3

ALAMEDA COUNTY
SUNOL, CA

QUESTA ENGINEERING CORP

FIGURE

13



PHASE 1 – SUNOL WASTEWATER FEASIBILITY STUDY SUNOL, CALIFORNIA ALAMEDA COUNTY	QUESTA ENGINEERING CORP	KWA WASTEWATER FACILITIES SITE ALTERNATIVE 3	FIGURE 14

- 4” dia. STEG sewers 5,570 feet
- 3” dia. STEP sewers 3,675 feet
- 2” dia. STEP sewers 1,475 feet

All properties connecting to the community system would retain and/or upgrade their existing septic tanks so that they can continue to provide primary treatment of sewage. The piping connection to the existing onsite leachfield on each property would be capped off, and the effluent from the septic tank would be routed to the new community collection piping in the street, either by gravity (STEG) or with a pump unit (STEP). Based on preliminary collection system layout, it is estimated for the 102 total properties in Kilkare Woods, 54 would have STEG connections, and 48 STEP connections.

Wastewater Treatment. A community wastewater treatment system would be located at the KWA Clubhouse parcel in the ball field area to treat all septic tank effluent to a secondary level or better, followed by disinfection such as UV light. The treatment system would need to be sited to meet a minimum 50-foot setback to Sinbad Creek, and would require an area of about 3,000 to 5,000 ft^2, depending on the number of connections. A broad range of treatment technologies are available and would be the subject of review and comparison during the final feasibility evaluation and recommended system for this alternative. For cost estimating purposes, a passive vegetative recirculating gravel filter was assumed for initial analysis.

Wastewater Dispersal. Treated effluent would be dispersed to leachfields and a subsurface drip dispersal field in a portion of the grass ball field at the KWA Clubhouse site as described in **Section 4** and illustrated in **Figure 14**. Leachfields would be used in an area of about 7,000 ft^2 where a greater than 100-ft setback can be maintained from Sinbad Creek. Drip dispersal would be used in areas that can maintain a 50 to 100 ft setback to the creek. **Table 18** summarizes how the ball field area would be utilized for treatment and dispersal, and the resulting capacity that could be provided for different levels of participation, i.e., 100, 75 and 50%, corresponding with options 3A, 3B and 3C. As indicated in the far right-hand column, capacity could be provided for a 100% dispersal system for all three scenarios, but only in scenario 3C (50%) would it be feasible to provide both a 100% field plus 100% reserve capacity. Assuming 100% system and 100% reserve field would be required, maximum use of the KWA Clubhouse ball field area would be for about 60 to 65 parcels.

Table 18. Estimated Wastewater Flows, Treatment and Dispersal, Kilkare Woods For Range of Connection Scenarios – 100, 75 and 50% of Service Area Parcels

Connection Scenario	# of Parcels	Estimated Design Flow, gpd	Treatment System Area, ft^2	Available Dispersal Area, ft^2		Potential Dispersal Capacity, gpd			
				50 - 100 ft Setback[1]	>100 ft Setback	50 - 100 ft Setback[2]	>100 ft Setback[3]	Total Capacity	% of Required
3A - 100%	103	**12,800**	5,000	7,500	7,000	9,000	6,000	**15,000**	116%
3B - 75%	78	**9,675**	4000	8,500	7,000	10,200	6,000	**16,200**	165%
3C - 50%	52	**6,425**	3,000	9,500	7,000	11,400	6,000	**17,400**	277%

Notes:
[1] 12,500 ft^2 total area minus space occupied by treatment system
[2] Capacity based on drip dispersal of treated, disinfected wastewater, at loading rate of 1.2 gpd per square foot of dispersal area
[3] Capacity based on 1,000 lineal feet of pressure distribution leachfield, at enhanced loading rate of 6 gpd/lf (5 ft^2 per lf)

Estimated Costs

Preliminary estimates of construction costs for Alternative 3 are summarized in **Table 19** below, with supporting details and cost assumptions provided in **Appendix F.** Estimates are provided for each of the three levels of residential parcel participation: 100%, 75% and 50%. The costs are itemized separately for the public sewer portion and the facilities on individual parcels (i.e., septic tank, STEP unit, septic tank abandonment, sewer lateral). Cost estimates for construction items are based on recent sewer projects in the S.F. Bay Area. Also included are estimates for engineering, environmental, permitting, and project administration, plus a 20% contingency.

Table 19. Preliminary Cost Estimate for Alternative 3 (A, B & C)

Item	Level of Residential Parcel Participation		
	3A - 100%	**3B - 75%**	**3C - 50%**
Total Parcels (ESDs)*	103	78	52
Public Facilities Cost	$2,476,000	$2,280,800	$2,070,400
On-lot Facilities Cost	$1,876,200	$1,421,400	$951,600
Total Estimated Cost	$4,352,200	$3,702,200	$3,022,000
Estimated Cost per Parcel (ESD)	$42,254	$47,464	$58,115
Approximate Homeowner Cost for On-lot Work**	$5,000	$5,000	$5,000
Net Cost to Assessment per Parcel (ESD)	$37,254	$42,464	$53,115
Annual Cost per Parcel (assume 20-years at 3%)	$2,504	$2,854	$3,570

* ESD stands for "equivalent single family dwelling"; costs for commercial and multifamily properties are assigned fees multiple ESDs according to their wastewater flow/strength as compared to a single family residence.

**Includes cost for septic tank abandonment, re-pluming, inspection, permitting. Assumes new tank, pump unit, & lateral can be covered under financing.

The above estimates do not reflect possible reduction in costs from grants that might be available for a community project, normally from State programs. Other recent wastewater-water quality improvement projects in the Bay Area have received grants in the range of 25% to 50% of construction costs. The balance of the project costs must come from the local community. The common method of funding the local share of community improvements such as wastewater facilities and other public works is through the formation of an assessment district. The assessments would be secured against the properties in the service area, which requires approval by more than 50% of the benefiting properties. The funds raised through this process would then be used to support low-interest loans and/or the sale of bonds to pay for the balance of the construction costs not covered by grants. Repayment of loans or bonds would be on the annual property tax bill, which is the bottom line estimate in the above table.

Once constructed, the project facilities would require ongoing operation and maintenance, the costs for which would be paid through the collection of fees or user charges from all properties served by the project. These fees are also normally collected as part of the annual property tax bill; it would be equivalent to the annual sewer service fees paid by anyone connected to a municipal sewer system. Annual sewer fees in the Bay Area range widely from $500 or less to more than $1,500. Estimates of operation and maintenance fees would be developed as part of the following detailed feasibility analysis (Phase 2).

In general, key benefits to the homeowner/business owner of connection to a community wastewater facility would be: (a) removes the obligation to maintain onsite wastewater disposal facilities; (b) frees up land area for other uses; (c) removes building restrictions related to limited wastewater disposal capacity of property; and (d) corrects unsafe or unhealthy conditions.

ALTERNATIVE 4 – DOWNTOWN SUNOL COMMUNITY WASTEWATER SYSTEM

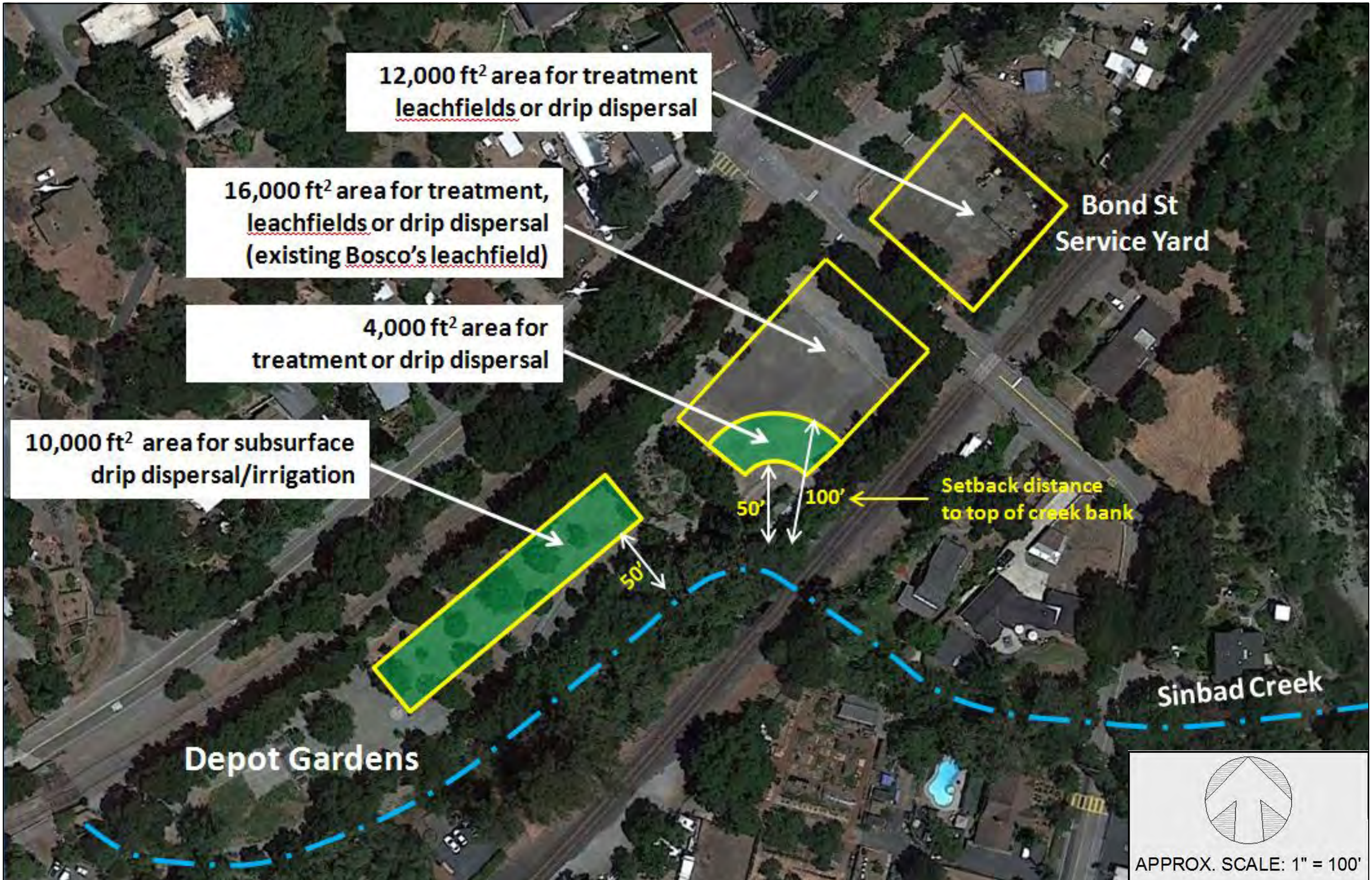
Description

This alternative would provide a community wastewater treatment system with capacity to serve the Downtown business district and higher density residential area of Sunol. It would include a small diameter STEP effluent sewer system extending throughout the Downtown area, portions of Foothill Road, and north on Kilkare Road a short distance beyond the Little Brown Church. The effluent would be conveyed to the east side of Depot Gardens for secondary wastewater treatment and effluent dispersal using a combination of leachfields and sub-surface drip dispersal. The treatment and dispersal fields would be located on County-owned lands either entirely in the eastern portion of Depot Gardens, or potentially in combination with some use of the County equipment-service yard on Bond Street. **Figure 15** shows the options for treatment and dispersal at these sites. **Figure 16** provides a general overview of Alternative 4. As previously noted, the areas indicated in **Figures 15** and **16** near the center of Depot Gardens could be sub-irrigated with treated water, integrated with existing and/or new landscaping. This could potentially provide a much needed source of irrigation water (recycled water) for trees and bushes during times of water rationing and drought.

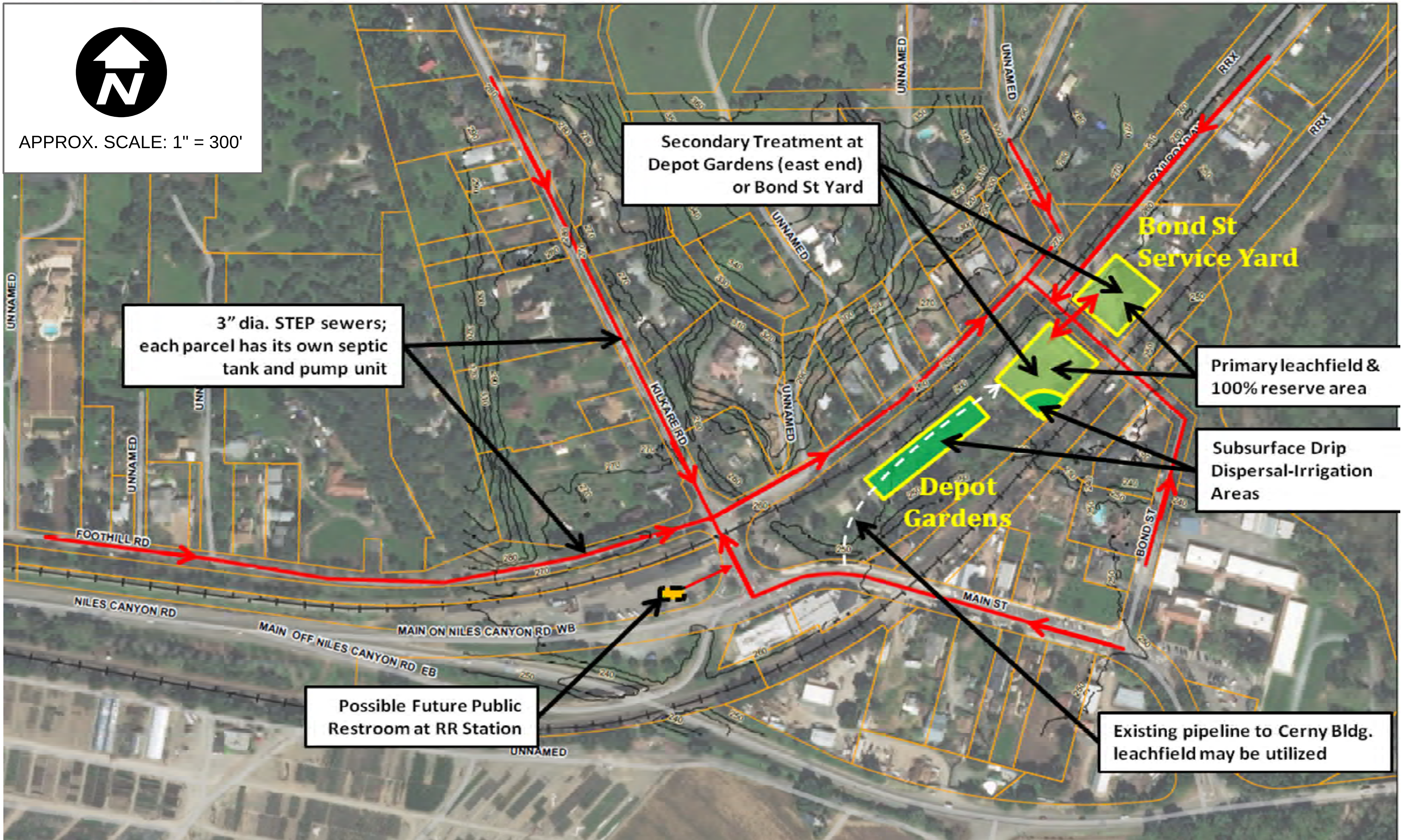
Service Area and Estimated Wastewater Flows

The proposed service area for this alternative would encompass the portion of the Study Area defined as the Downtown Sunol subarea. It would include service to the commercial district, up to about 60 residences, Sunol Glen School and a new public restroom at the train station (requested by lessee and the Sunol Citizens' Advisory Council). It is assumed that connection to the community wastewater system would be voluntary, but that the collection system would be extended throughout the entire Downtown area to allow any property within the service area to connect to the system. The Cerny Building would be required to connect to the community system as this building would no longer have access to the existing leach field at the east end of Depot Gardens.

Wastewater flows would depend on the number of properties opting to connect to the system. Using parcel and flow information for Downtown Sunol detailed earlier in **Section 4**, the estimated wastewater flows for this alternative are shown in **Table 20** for different percentages of residential property connections, defined as Alternatives 4A, 4B and 4C. For each scenario these preliminary estimates assume that all non-residential properties in the Downtown area would be connected to the community system; other scenarios could be developed and analyzed to different levels of participation for the non-residential parcels.



PHASE 1 – SUNOL WASTEWATER FEASIBILITY STUDY SUNOL, CALIFORNIA ALAMEDA COUNTY	QUESTA ENGINEERING CORP	DEPOT GARDENS - BOND STREET WASTEWATER FACILITIES SITE	FIGURE 15



PHASE 1 -- SUNOL WASTEWATER FEASIBILITY STUDY

SUNOL, CALIFORNIA
ALAMEDA COUNTY

QUESTA ENGINEERING CORP

ALTERNATIVE #4

DOWNTOWN SUNOL COMMUNITY WASTEWATER SYSTEM

FIGURE 16

Table 20. Estimated Wastewater Flows for Downtown Sunol (gpd)

Land Use	Unit Flow (gpd)	Level of Residential Participation					
		A - 100%		B - 75%		C - 50%	
		Parcels	Flow (gpd)	Parcels	Flow (gpd)	Parcels	Flow (gpd)
Residential	125	60	7,500	45	5,625	30	3,750
Multi-Family	500	3	1,500	3	1,500	3	1,500
Commercial & Industrial	-	8	4,500	8	4,500	8	4,500
School	1,500	1	1,500	1	1,500	1	1,500
Railroad (Restroom)	1,000	1	1,000	1	1,000	1	1,000
	Total	**73**	**16,000**	**58**	**14,125**	**43**	**12,250**

Wastewater Facilities

Collection System. As shown in **Figure 16**, a STEP effluent collection system would be installed throughout the Downtown area, east and west along Foothill Road, and extending short distance north on Kilkare Road. The preliminary collection system layout is estimated to include the approximately 6,300 lineal feet of 3” diameter STEP sewer.

All properties connecting to the community system would retain and/or upgrade their existing septic tanks so that they can continue to provide primary treatment of sewage. The septic tank would be converted to a STEP unit, with a pump installed in the second compartment or in a separate pump tank following the septic tank. The piping connection to the existing onsite leachfield would be capped off, and the effluent would be routed to the new community collection piping in the street in a small diameter (1.25-inch) pressure line. Larger flow commercial properties in the Downtown area (e.g., restaurants, apartments, school, public restroom) would be designed with a duplex pump system as a failsafe redundancy. The existing leach field on the east end of the Depot Gardens would be removed unless it is found to be functional and cost-effective to retain for the community system.

Wastewater Treatment. A community wastewater treatment system would be located at the eastern end of Depot Gardens or Bond St parcel to treat all septic tank effluent to a secondary level or better, followed by disinfection such as UV light. The eastern end of Depot Gardens is presently used as a leach field for the Cerny Building on Main Street, which includes a restaurant. The treatment system would need to be sited to meet a minimum 50-foot setback to Sinbad Creek, and would require an area of about 4,000 to 6,000 ft^2, depending on the number of connections. There are multiple options for wastewater treatment which could be located either at the east end of the Depot Gardens site or on the adjacent County-owned service yard on Bond St. One option presented and reviewed in the field and in community meetings is a vegetated recirculating gravel filter treatment system. There are other more compact package-type mechanical treatment systems that could also be considered to minimize land area requirements. Photos of different types of small community wastewater treatment systems are provided in

Appendix D for reference. Comparative study of alternative wastewater treatment technologies and preferred location would be taken up in subsequent phases of feasibility analysis.

Wastewater Dispersal. Treated effluent would be dispersed to a combination of leachfields and drip dispersal in the gravel area on the east end of Depot Park and potentially on the neighboring County-owned utility parcel on the east side of Bond St. Preliminary site information indicates very suitable soil conditions for leachfields, especially in combination with secondary treatment. The State requires that a 100% primary system would be installed, and additional area designated for a 100% reserve dispersal field. There are multiple ways of meeting this requirement. The following table shows possible arrangements of leachfield and drip dispersal used for developing preliminary cost estimates for Alternatives 4A, 4B and 4C. The designated 100% reserve area would be within the same general area of the primary field at Depot Gardens/Bond St service yard. The preliminary assumptions would be confirmed and dispersal system plans refined during the subsequent feasibility analysis and project planning.

Table 21. Preliminary Wastewater Dispersal Estimates for Alternative 4 (A, B & C)

Alternative	System Design Flow, gpd	Leachfield		Drip Dispersal Field		Total Dispersal Capacity (gpd)
		Trench Length (feet)	Capacity* (gpd)	Area (square feet)	Capacity** (gpd)	
4A – 100%	16,000	1,600	15,360	2,000	2,400	17,760
4B – 75%	14,125	1,400	13,440	2,000	2,400	15,880
4C - 50%	12,250	1,200	11,520	2,000	2,400	13,920

*Based on 8 ft^2 per lf @ 1.2 gpd/ft^2
** Based on 1.2 gpd per ft^2

Estimated Costs

Preliminary estimates of construction costs for Alternative 4 are summarized in **Table 22** below, with supporting details and cost assumptions provided in **Appendix F.** Estimates are provided for each of the three levels of residential parcel participation: 100%, 75% and 50%. The costs are itemized separately for the public sewer portion and the on-lot facilities (i.e., septic tank abandonment, new tank, STEP unit, sewer lateral). Cost estimates for construction items are based on recent sewer projects in the S.F. Bay Area. Also included are estimates for engineering, environmental, permitting, and project administration, plus a contingency factor of 20%.

These estimates do not reflect possible reduction in costs from grants that might be available for a community project, normally from State programs. Other recent wastewater-water quality improvement projects in the Bay Area have received grants in the range of 25% to 50% of construction costs. The balance of the project costs must come from the local community. The common method of funding the local share of community improvements such as wastewater facilities and other public works is through the formation of an assessment district. The assessments would be secured against the properties in the service area, which requires approval by more than 50% of the benefiting properties. The funds raised through this process would then be used to support low-interest loans and/or the sale of bonds to pay for the balance of the construction costs not covered by grants. Repayment of loans or bonds would be on the annual property tax bill, which is the bottom line estimate in the above table.

Table 22. Preliminary Cost Estimate for Alternative 4 (A, B & C)

Item	Level of Residential Parcel Participation		
	4A - 100%	4B - 75%	4C - 50%
Total Parcels	73	58	43
Residential Parcels	60	45	30
Multi-family and Non-residential Parcels	13	13	13
Multi-family and Non-residential ESDs*	39	39	39
Total Estimated ESDs	99	84	69
Public Facilities Cost	$2,133,600	$1,960,800	$1,768,000
On-lot Facilities Cost	$1,705,800	$1,372,800	$1,039,800
Total Estimated Cost	$3,839,400	$3,333,600	$2,807,800
Estimated Cost per Residence (ESD)	$38,782	$39,686	$40,693
Approximate Homeowner Cost for On-lot Work**	$5,000	$5,000	$5,000
Net Cost to Assessment per Parcel (ESD)	$33,782	$34,686	$35,693
Estimated Annual Cost per Parcel (ESD) (assume 20 years at 3% interest)	$2,270	2,331	$2,400

* ESD stands for "equivalent single family dwelling"; costs for commercial and multifamily properties are assigned fees multiple ESDs according to their wastewater flow/strength as compared to a single family residence.

**Includes cost for septic tank abandonment, re-pluming, inspection, permitting. Assumes new tank, pump unit, & lateral can be covered under financing.

Once constructed, the project facilities would require ongoing operation and maintenance, the costs for which would be paid through the collection of fees or user charges from all properties served by the project. These fees are also normally collected as part of the annual property tax bill; it would be equivalent to the annual sewer service fees paid by anyone connected to a municipal sewer system. Annual sewer fees in the Bay Area range widely from $500 or less to more than $1,500. Estimates of operation and maintenance fees would be developed as part of the following detailed feasibility analysis (Phase 2).

In general, key benefits to the homeowner/business owner of connection to a community wastewater facility would be: (a) removes the obligation to maintain onsite wastewater disposal facilities; (b) frees up land area for other uses; (c) removes building restrictions related to limited wastewater disposal capacity of property; and (d) corrects unsafe or unhealthy conditions.

ALTERNATIVE 5 – DOWNTOWN SUNOL & LOWER KILKARE ROAD COMMUNITY WASTEWATER SYSTEM

Description

This alternative is an expanded version of Alternative 4, providing a community wastewater treatment system serving properties throughout both Downtown Sunol and the Lower Kilkare Road area. It would include the same small diameter STEP effluent sewer system, which would be extended potentially as much as two miles further north along Kilkare Road to serve properties between Downtown and Kilkare Woods. Similar to Alternative 4, all effluent would be collected at the east side of Depot Gardens for secondary wastewater treatment and effluent dispersal using a combination of leachfields and sub-surface drip dispersal. This alternative would require use of a portion of both Depot Gardens (east side) and the County equipment-service yard on Bond Street to accommodate the expanded service area and higher expected wastewater flows. The Cerny Building would be required to connect to the community system as this building would no longer have access to the existing leach field at the east end of Depot Gardens.

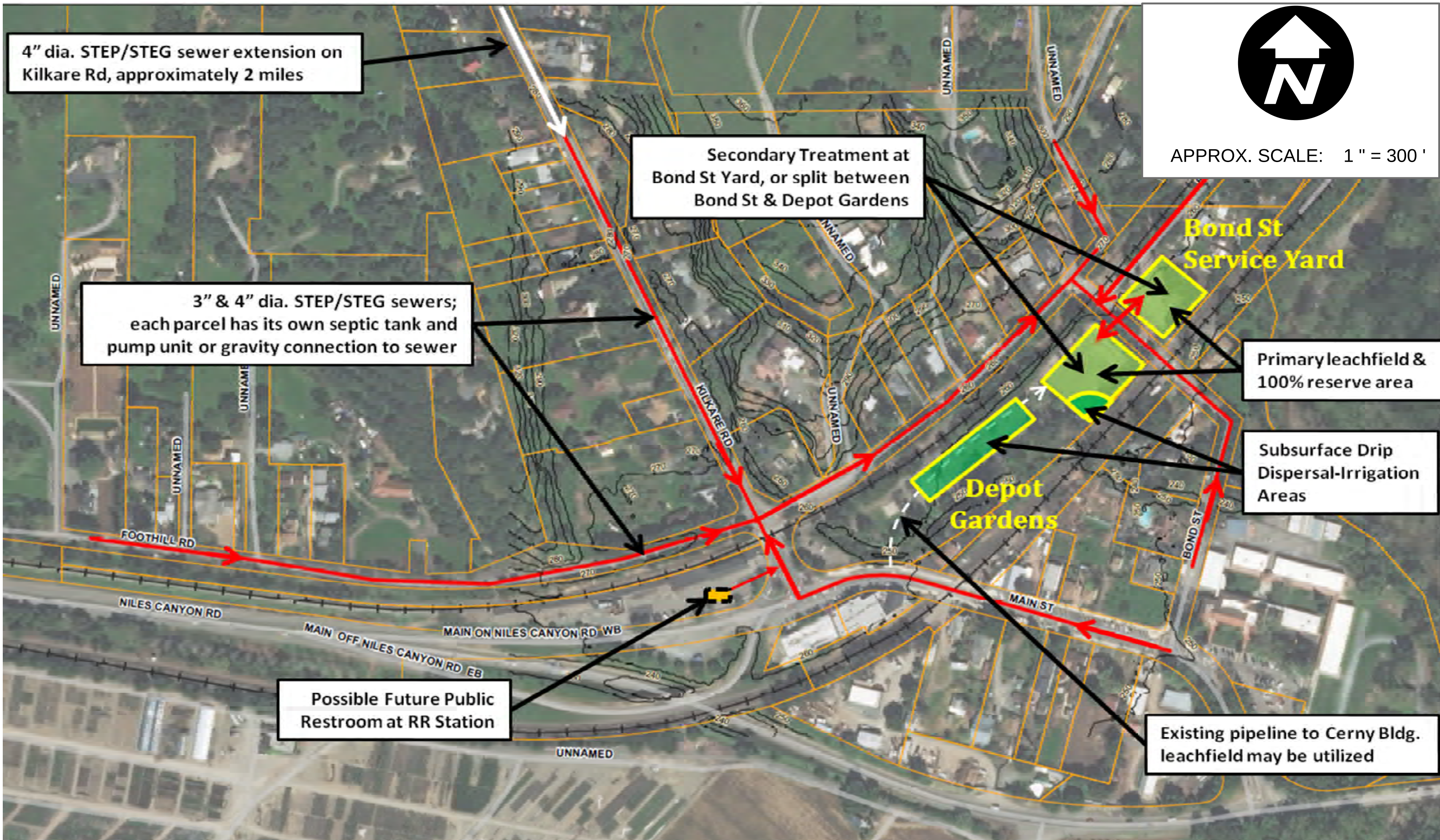
Service Area and Estimated Wastewater Flows

This proposed service area for this alternative would include a total of up to 142 parcels in the Downtown and Lower Kilkare Road subareas. It would include service to the commercial district, up to about 128 residences, Elliston Vineyards, the Little Brown Church, the school and a new public restroom at the train depot (requested by lessee and SCAC). It is assumed that connection to the community wastewater system would be voluntary, but that the collection system would be extended throughout the Downtown service area and as far north along Kilkare Road as needed to allow any interested property owner to connect to the system (See **Figure 17**).

Wastewater flows will depend on the number of properties opting to connect to the system. Using wastewater flow information for Downtown Sunol and Lower Kilkare Woods detailed earlier in **Section 4**, the estimated wastewater flows for this alternative would be as shown in **Table 23** for different percentages of residential property connections, defined as Alternatives 5A, 5B and 5C. For each scenario these preliminary estimates assume that all non-residential properties in the service area would be connected to the community system; other scenarios could be developed and analyzed to different levels of participation for the non-residential parcels.

Table 23. Estimated Wastewater Flows for Downtown Sunol & Lower Kilkare Road (gpd)

Land Use	Unit Flow (gpd)	Level of Residential Participation					
		5A - 100%		5B - 75%		5C - 50%	
		Parcels	Flow (gpd)	Parcels	Flow (gpd)	Parcels	Flow (gpd)
Downtown Sunol							
Residential	125	60	7,500	45	5,625	30	3,750
Multi-Family	500	3	1,500	3	1,500	3	1,500
Commercial & Industrial	-	8	4,500	8	4,500	8	4,500
School	1,500	1	1,500	1	1,500	1	1,500
Railroad (Restroom)	1,000	1	1,000	1	1,000	1	1,000
Downtown Sunol Sub-total		73	16,000	58	14,125	43	12,250
Lower Kilkare Road							
Residential	125	68	8,500	51	6,375	34	4,250
Commercial	500	1	500	1	500	1	500
Lower Kilkare Rd Sub-total		69	9,000	52	6,875	35	4,750
Combined Total		**142**	**25,000**	**110**	**21,000**	**78**	**17,000**



PHASE 1 -- SUNOL WASTEWATER FEASIBILITY STUDY

SUNOL, CALIFORNIA
ALAMEDA COUNTY

QUESTA ENGINEERING CORP

ALTERNATIVE #5

DOWNTOWN SUNOL & LOWER KILKARE RD COMMUNITY WASTEWATER SYSTEM

FIGURE 17

Wastewater Facilities

Collection System. A STEP effluent collection system would be installed throughout the Downtown area, east and west along Foothill Road, and extending north on Kilkare Road about 2 miles to potentially serve all parcels in the Lower Kilkare Road subarea. It is estimated that most of the STEP system extending up Kilkare Road would have sufficient grade and elevation to operate as a STEG (gravity) system. The preliminary collection system layout is estimated to include the approximately 12,600 feet of 4" diameter STEG sewer and 4,500 feet of 3" diameter STEP sewer.

As described for Alternative 4, all properties connecting to the community system would retain and/or upgrade their existing septic tanks so that they can continue to provide primary treatment of sewage. The septic tank would be converted either to a STEG or STEP unit, with gravity or pumped discharge of septic tank effluent to the collection piping in the street. Preliminary collection system layout indicates approximately 25% of properties would accommodate a STEG connection, and the other 75% would require STEP pumping units.

Wastewater Treatment. Similar to Alternative 4, a community wastewater treatment system would be located at the east end of Depot Gardens or Bond St parcel to treat all septic tank effluent to a secondary level or better, followed by disinfection such as UV light. Because of the larger number of connections and higher wastewater flows for this alternative, it is likely that a more compact manufactured treatment design option would be preferable to the gravel filter system considered for a Alternative 4. With this type of treatment design, is also probable that the Bond St service yard would be preferred over the Depot Gardens area for the treatment location. Comparative study of alternative wastewater treatment technologies and preferred location would be taken up in subsequent phases of feasibility analysis and project planning.

Wastewater Dispersal. Similar to Alternative 4, treated effluent would be dispersed to a combination of leachfields and drip dispersal in the gravel area on the east end of Depot Park and potentially on the County's neighboring Bond St. parcel. As previously noted, the area indicated in **Figure 17** near the center of Depot Gardens could be sub-irrigated with treated water, integrated with existing and/or new landscaping. This could potentially provide a much needed source of irrigation water (recycled water) for trees and bushes during times of water rationing and drought. **Table 24** shows possible arrangements of leachfield and drip dispersal used for developing preliminary cost estimates for Alternatives 5A, 5B and 5C. The designated 100% reserve area would be within the same general area of the primary field at Depot Gardens/Bond St service yard. The existing leach field would be abandoned unless it is found to be functional and cost-effective to retain for use as part of the community system. The preliminary assumptions would be confirmed and dispersal system plans refined during the subsequent feasibility analysis and project planning.

Table 24. Preliminary Wastewater Dispersal Estimates for Alternative 5 (A, B & C)

Alternative	System Design Flow (gpd)	Leachfield		Drip Dispersal Field		Total Dispersal Capacity (gpd)
		Trench Length (feet)	Capacity* (gpd)	Area (square feet)	Capacity** (gpd)	
5A – 100%	25,000	1,600	15,360	8,500	10,200	25,200
5B – 75%	21,000	1,600	15,360	5,000	6,000	21,880
5C - 50%	17,000	1,600	15,360	2,000	2,400	17,760

*Based on 8 ft^2 per lf @ 1.2 gpd/ft^2
** Based on 1.2 gpd per ft^2

Estimated Costs

Preliminary estimates of construction costs for Alternative 5 are summarized in **Table 25** below, with supporting details and cost assumptions provided in **Appendix F.** Estimates are provided for 100% participation of commercial properties and each of the three levels of residential parcel participation: 100%, 75% and 50%. The costs are itemized separately for the public sewer portion and the on-lot facilities (i.e., septic tank upgrade and sewer lateral). Cost estimates for construction items are based on recent sewer projects in the S.F. Bay Area. Also included are estimates for engineering, environmental, permitting, and project administration, plus a contingency factor of 20%.

Table 25. Estimated Construction Costs for Alternative 5 (A, B & C)

Item	Level of Residential Parcel Participation		
	5A - 100%	**5B - 75%**	**5C - 50%**
Total Parcels	142	110	78
Residential Parcels	128	96	64
Multi-family and Non-residential Parcels	14	14	14
Multi-family and Non-residential ESDs*	42	42	42
Total Estimated ESDs	170	138	106
Public Facilities Cost	$4,378,400	$4,050,400	$3,660,800
On-lot Facilities Cost	$3,024,000	$2,379,000	$1,725,000
Total Estimated Cost	$7,402,400	$6,429,400	$5,385,800
Estimated Cost per Residence (ESD)	$43,544	$46,590	$50,809
Approximate Homeowner Cost for On-lot Work**	$5,000	$5,000	$5,000
Net Cost to Assessment per Parcel (ESD)	$38,544	$41,590	$45,809
Estimated Annual Cost per Parcel (assume 20 years at 3% interest)	$2,590	$2,796	$3,080

* ESD stands for "equivalent single family dwelling"; costs for commercial and multifamily properties are assigned fees multiple ESDs according to their wastewater flow/strength as compared to a single family residence.
**Includes cost for septic tank abandonment, re-pluming, inspection, permitting. Assumes new tank, pump unit, & lateral can be covered under financing.

The estimates above do not reflect possible reduction in costs from grants that might be available for a community project, normally from State programs. Other recent wastewater-water quality improvement projects in the Bay Area have received grants in the range of 25% to 50% of construction costs. The balance of the project costs must come from the local community. The common method of funding the local share of community improvements such as wastewater facilities and other public works is through the formation of an assessment district. The assessments would be secured against the properties in the service area, which requires approval by more than 50% of the benefiting properties. The funds raised through this process would then be used to support low-interest loans and/or the sale of bonds to pay for the balance of the construction costs not covered by grants. Repayment of loans or bonds would be on the annual property tax bill, which is the bottom line estimate in the table below.

Once constructed, the project facilities would require ongoing operation and maintenance, the costs for which would be paid through the collection of fees or user charges from all properties served by the project. These fees are also normally collected as part of the annual property tax bill; it would be equivalent to the annual sewer service fees paid by anyone connected to a municipal sewer system. Annual sewer fees in the Bay Area range widely from $500 or less to more than $1,500. Estimates of operation and maintenance fees would be developed as part of the following detailed feasibility analysis (Phase 2).

In general, key benefits to the homeowner/business owner of connection to a community wastewater facility would be: (a) removes the obligation to maintain onsite wastewater disposal facilities; (b) frees up land area for other uses; (c) removes building restrictions related to limited wastewater disposal capacity of property; and (d) corrects unsafe or unhealthy conditions.

ALTERNATIVE 6 – SUNOL COMMUNITY-WIDE WASTEWATER SYSTEM

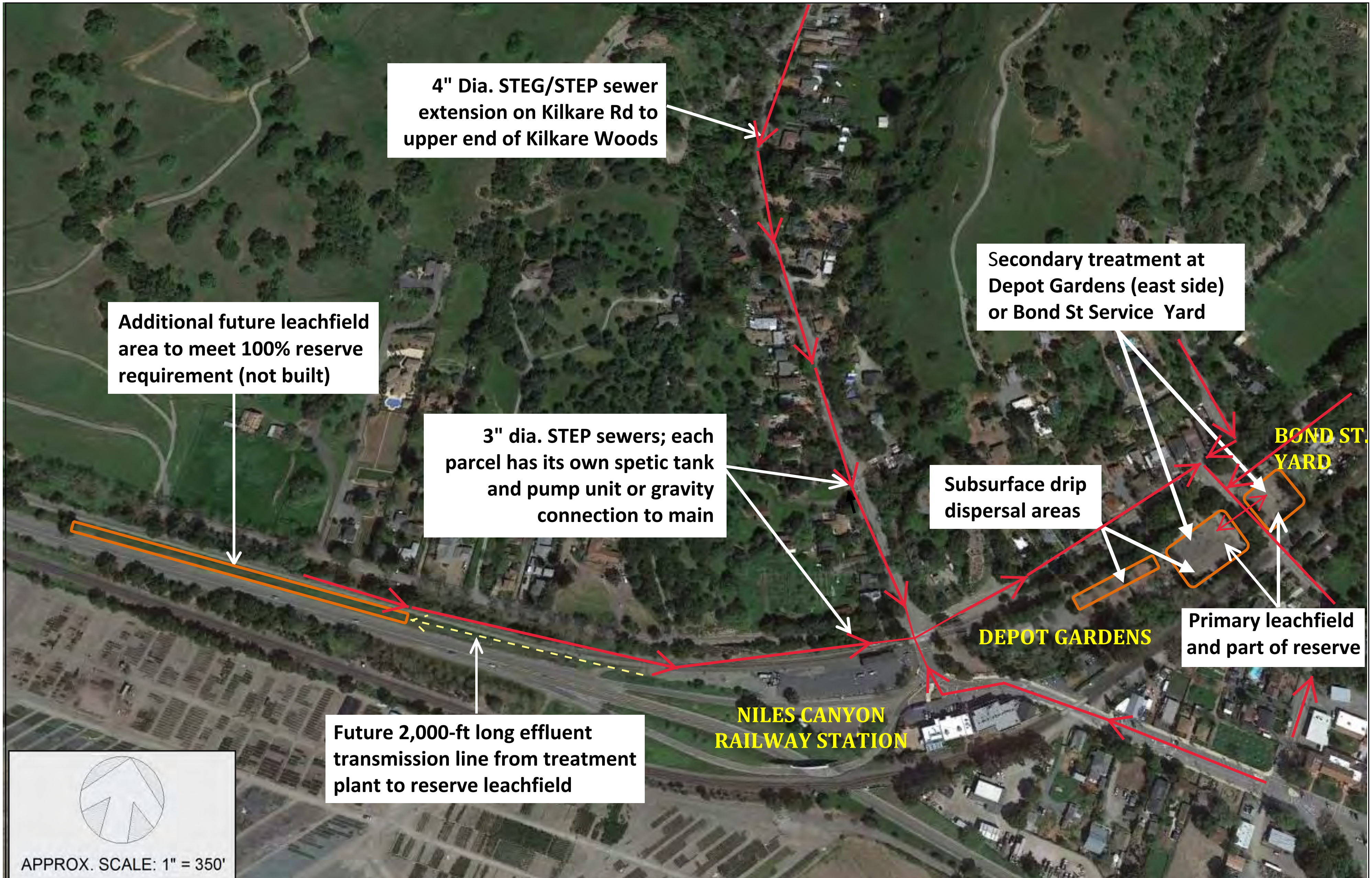
Description

This alternative is an expanded version of Alternative 5, providing a community wastewater treatment system with extended sewer service to properties throughout the entire Study Area - Downtown Sunol, Lower Kilkare Road, and Kilkare Woods. It would include the same small diameter STEP effluent sewer system, which would be extended up Kilkare Road to the end of Kilkare Woods. Similar to Alternatives 4 and 5, the effluent would be collected at the east side of Depot Gardens for secondary wastewater treatment and effluent dispersal using a combination of leachfields and sub-surface drip dispersal. This alternative would require use of both Depot Gardens (east side) and the County equipment-service yard on Bond Street, plus the designation of additional wastewater dispersal areas on County-owned lands on the west side of the railway station (**Figure 18**).

Service Area and Estimated Wastewater Flows

This alternative assumes sewer service would be extended to all properties in the Sunol Study Area, including Downtown, Lower Kilkare Road and Kilkare Woods. This includes an estimated 245 existing developed residences and businesses, including a new restroom at the railway station. It is assumed that connection to the community wastewater system would be voluntary, but that the collection system would be extended throughout the Downtown service area and along Kilkare Road to the north end of Kilkare Woods, as needed to allow any property owner to connect to the system.

Wastewater flows will depend on the number of properties opting to connect to the system. Using wastewater flow information for the entire Study Area detailed earlier in **Section 4**, the



PHASE 1 – SUNOL WASTEWATER FEASIBILITY STUDY SUNOL, CALIFORNIA ALAMEDA COUNTY	QUESTA ENGINEERING CORP	**ALTERNATIVE 6** **SUNOL COMMUNITY-WIDE WASTEWATER SYSTEM**	FIGURE 18

estimated wastewater flows for this alternative are shown in **Table 26** for different percentages of residential property connections, defined as Alternatives 6A, 6B and 6C. For each scenario these preliminary estimates assume that all non-residential properties in the service area would be connected to the community system.

Table 26. Estimated Wastewater Flows for Sunol Community-wide System (gallons per day, gpd)

Land Use	# of Parcels	Unit Flow (gpd)	Level of Residential Participation		
			100%	75%	50%
Downtown Sunol					
Residential	60	125	7,500	5,625	3,750
Multi-Family	3	500	1,500	1,500	1,500
Commercial & Industrial	8	-	4,500	4,500	4,500
School	1	1,500	1,500	1,500	1,500
Railroad (Restroom)	1	1,000	1,000	1,000	1,000
Downtown Sunol Sub-total			**16,000**	**14,125**	**12,250**
Lower Kilkare Road					
Residential	68	125	8,500	6,375	4,250
Commercial	1	500	500	500	500
Lower Kilkare Road Sub-total			**9,000**	**6,875**	**4,750**
Kilkare Woods					
Residential	102	125	12,750	9,625	6,375
KWA Clubhouse	1	50	50	50	50
Kilkare Woods Sub-total			**12,800**	**9,675**	**6,425**
Study Area Total			**37,800**	**30,675**	**23,425**

Wastewater Facilities

Collection System. A STEP effluent collection system would be installed throughout the Downtown area, east and west along Foothill Road, and extending north on Kilkare Road to the upper end of Kilkare Woods, a distance of approximately 3.5 miles. It is estimated that most of the STEP system extending up Kilkare Road would have sufficient grade and elevation to operate as a STEG (gravity) system. The preliminary collection system layout is estimated to include the approximately 24,000 feet of 4” diameter STEG sewer and 4,500 feet of 3” diameter STEP sewer.

As described for Alternatives 4 and 5, all properties connecting to the community system would retain and/or upgrade their existing septic tanks so that they can continue to provide primary treatment of sewage. The septic tank would be converted either to a STEG or STEP unit, with gravity or pumped discharge of septic tank effluent to the collection piping in the street. Preliminary collection system layout indicates approximately 60% of properties would accommodate a STEG connection, and the other 40% would require STEP pumping units.

Wastewater Treatment. Similar to Alternatives 4 and 5, a community wastewater treatment system would be located at the east end of Depot Gardens or Bond St parcel to treat all septic tank effluent to a secondary level or better, followed by disinfection such as UV light. Because of the larger number of connections and higher wastewater flows for this alternative, a compact manufactured treatment design option would be preferable to the gravel filter system considered for Alternative 4. With this type of treatment design, is also probable that the Bond St service yard would be preferred over the Depot Gardens area for the treatment location. Comparative study of alternative wastewater treatment technologies and preferred location would be taken up in subsequent phases of feasibility analysis and project planning.

Wastewater Dispersal. Similar to Alternatives 4 and 5, treated effluent would be dispersed to a combination of leachfields and drip dispersal in the gravel area on the east end of Depot Park and potentially on the neighboring on the County's Bond St. parcel. As previously noted, the area indicated in **Figure 18** near the center of Depot Gardens could be sub-irrigated with treated water, integrated with existing and/or new landscaping. This could potentially provide a much needed source of irrigation water (recycled water) for trees and bushes during times of water rationing and drought. However, there is insufficient area to also accommodate a designated 100% reserve in the Depot Gardens/Bond St area. Therefore, for this alternative to be feasible, additional area for wastewater dispersal would be designated (not built) on the County-owned lands on the west side of the railway station. A transmission line of approximately 2,000 feet would be required to pump treated water to the supplemental leachfield area in the event the reserve leachfield area needed to be installed in the future.

Table 27 shows possible arrangements of a primary (100%) leachfield and drip dispersal used for developing preliminary cost estimates for Alternatives 6A, 6B and 6C, using both the east end of Depot Gardens and portions of the Bond St parcel. The preliminary assumptions would be confirmed and dispersal system plans refined during the subsequent feasibility analysis and project planning.

Table 27. Preliminary Wastewater Dispersal Estimates for Alternative 6 (A, B & C)

Alternative	System Design Flow (gpd)	Leachfield		Drip Dispersal Field		Total Dispersal Capacity (gpd)
		Trench Length (feet)	Capacity* (gpd)	Area (square feet)	Capacity** (gpd)	
6A – 100%	37,800	2,100	20,160	15,000	18,000	38,160
6B – 75%	30,675	1,600	15,360	12,500	15,000	30,360
6C - 50%	23,425	1,600	15,360	7,000	8,400	23,760

*Based on 8 ft^2 per lf @ 1.2 gpd/ft^2
** Based on 1.2 gpd per ft^2

Estimated Costs

Preliminary estimates of construction costs for Alternative 6 are summarized in **Table 28** below, with supporting details and cost assumptions provided in **Appendix F.** Estimates are provided for each of the three levels of residential parcel participation: 100%, 75% and 50%. The costs are itemized separately for the public sewer portion and the on-lot facilities (i.e., septic tank abandonment and sewer lateral). Cost estimates for construction items are based on recent sewer projects in the S.F. Bay Area. Also included are estimates for engineering, environmental, permitting, and project administration, plus a contingency factor of 20%.

Table 28. Preliminary Cost Estimate for Alternative 6 (A, B & C)

Item	Level of Residential Parcel Participation		
	6A - 100%	6B - 75%	6C - 50%
Total Parcels	245	188	130
Residential Parcels + KWA Clubhouse	231	174	116
Multi-family and Non-residential Parcels	14	14	14
Multi-family and Non-residential ESDs*	42	42	42
Total Estimated ESDs	273	216	158
Public Facilities Cost	$7,188,000	$6,572,000	$5,837,600
On-lot Facilities Cost	$4,837,800	$3,732,900	$2,610,600
Total Estimated Cost	$12,025,800	$10,304,900	$8,448,200
Estimated Cost per Residence (ESD)	$44,051	$47,708	$53,470
Approximate Homeowner Cost for On-lot Work**	$5,000	$5,000	$5,000
Net Cost to Assessment per Parcel (ESD)	$39,051	$42,708	$48,470
Estimated Annual Cost per Parcel (assume 20 years at 3% interest)	$2,625	$2,870	$3,258

* ESD stands for "equivalent single family dwelling"; costs for commercial and multifamily properties are assigned fees multiple ESDs according to their wastewater flow/strength as compared to a single family residence.

**Includes cost for septic tank abandonment, re-pluming, inspection, permitting. Assumes new tank, pump unit, & lateral can be covered under financing.

The above estimates do not reflect possible reduction in costs from grants that might be available for a community project, normally from State programs. Other recent wastewater-water quality improvement projects in the Bay Area have received grants in the range of 25% to 50% of construction costs. The balance of the project costs must come from the local community. The common method of funding the local share of community improvements such as wastewater facilities and other public works is through the formation of an assessment district. The assessments would be secured against the properties in the service area, which requires approval by more than 50% of the benefiting properties. The funds raised through this process would then be used to support low-interest loans and/or the sale of bonds to pay for the balance of the construction costs not covered by grants. Repayment of loans or bonds would be on the annual property tax bill, which is the bottom line estimate in the above table.

Once constructed, the project facilities would require ongoing operation and maintenance, the costs for which would be paid through the collection of fees or user charges from all properties served by the project. These fees are also normally collected as part of the annual property tax bill; it would be equivalent to the annual sewer service fees paid by anyone connected to a municipal sewer system. Annual sewer fees in the Bay Area range widely from $500 or less to more than $1,500. Estimates of operation and maintenance fees would be developed as part of the following detailed feasibility analysis (Phase 2).

In general, key benefits to the homeowner/business owner of connection to a community wastewater facility would be: (a) removes the obligation to maintain onsite wastewater disposal facilities; (b) frees up land area for other uses; (c) removes building restrictions related to limited wastewater disposal capacity of property; and (d) corrects unsafe or unhealthy conditions.

ALTERNATIVE 7 – SEWER CONNECTION TO CITY OF PLEASANTON

Overview

This alternative would consist of a conventional gravity sewer system extending throughout the Sunol Study Area, with an intertie to the City of Pleasanton sewer system, which is the nearest municipal sewer system. It is assumed that all existing OWTS in the Study Area would be formally abandoned and decommissioned under this alternative (See **Figure 19**)

The City of Pleasanton operates a sanitary sewer system for a 24 square mile service area, which encompasses the entire City plus the neighboring Castlewood Area of Alameda County. The system consists of about 250 miles of gravity sewers, approximately 5 miles of force main, and ten pump stations. The nearest point of City sewer connection potentially available for Sunol would be the sanitary sewer manhole at the intersection of Foothill Road and Oak Tree Farm Drive. All sewage from Pleasanton is conveyed for treatment and disposal to the Dublin San Ramon Service District (DSRSD), which serves Dublin, Pleasanton and southern San Ramon.

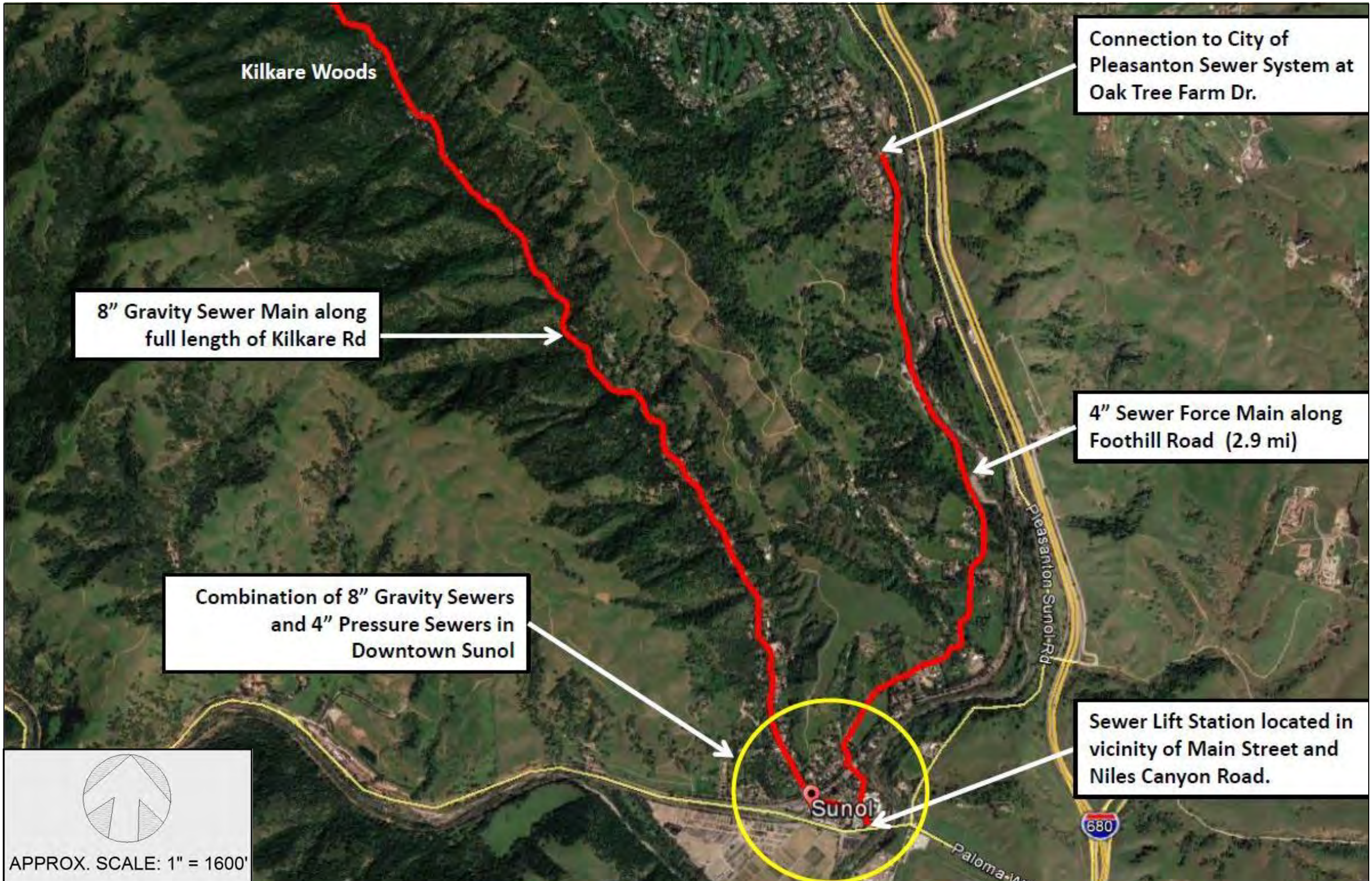
An essential implementation step for this alternative is to obtain an agreement with the City of Pleasanton for connection to their sewer system. Sunol is not in a position to connect directly to the DSRSD facilities. Options may include annexation to Pleasanton or possibly an arrangement similar to the sewer service agreement between the City and the Castlewood County Service Area, which is unincorporated. Either option would require approval by the City, Alameda County and LAFCO (Local Agency Formation Commission). The prospects for annexation seem slim since (a) Sunol does not lie within the sphere of influence of the Pleasanton; and (b) recent negative experience with other unincorporated areas adjacent to the City of Pleasanton seeking sewer service, e.g., Happy Valley area. The costs of this process will be significant (likely six figures); but there are too many unknowns at this initial stage of feasibility analysis to provide an estimate.

Service Area and Estimated Wastewater Flows

This alternative assumes sewer service would be extended to all properties in the Sunol Study Area, including Downtown, Lower Kilkare Road and Kilkare Woods. This includes an estimated 244 existing developed residences and businesses.

Sewer service could potentially also be made available to additional residents on Foothill Road and some number of currently vacant parcels in Sunol that would end up bordering the local sewer collection system. However, no attempt has been made in this initial feasibility phase to estimate the number or location of vacant parcels that might be included. That would be an issue to be evaluated and determined during subsequent feasibility analysis and project planning.

Based on providing service to all existing developed parcels, residential and non-residential occupancies, the estimated average dry weather wastewater flow for this alternative would be approximately 37,800 gpd, as follows:



PHASE 1 – SUNOL WASTEWATER FEASIBILITY STUDY SUNOL, CALIFORNIA ALAMEDA COUNTY	QUESTA ENGINEERING CORP.	**ALTERNATIVE #7 SEWER CONNECTION TO PLEASANTON**	FIGURE 19

- Downtown Sunol: 16,000 gpd
- Lower Kilkare Road: 9,000 gpd
- Kilkare Woods: 12,800 gpd

Total: 37,800 gpd

As a normal practice, the sewer system would have to be designed with surplus capacity to accommodate infiltration and inflow of extraneous water into the gravity sewers during the winter months, as well as reserve capacity for possible future building or land use changes in the service area.

Description of Wastewater Facilities

The following summarizes the key wastewater facilities for this alternative.

Decommission Existing Septic Tanks. All properties would abandon and decommission their existing septic tanks. This typically involves: (a) pumping out the tank; (b) removing and/or backfilling the tank in place; (c) capping the drain line to the leachfield; and (d) re-routing house plumbing to the new sanitary sewer system.

Sewer Laterals. Connection of individual properties to the new sewer system would require either (a) a 4-inch gravity line, where the sewer is at a lower elevation than the building plumbing; or (b) an ejector/grinder pump unit with a pressure line connection, where the sewer is at a higher elevation than the building plumbing. Preliminary estimates for the Study Area indicate approximately 200 properties would have a gravity connection and about 45 would require a pumped connection.

Collection Sewers. The collection system would include the following:

- **Gravity lines**. Approximately 25,000 lineal feet (4.8 miles) of conventional 8-inch diameter gravity sewers, with 50 to 60 manholes, installed in the roads and streets throughout the Downtown area and extending up Kilkare Road to the end of Kilkare Woods.

- **Pressure lines.** Approximately 2,800 lineal feet of small diameter (e.g., 3-inch) pressure sewers, serving about 45 properties needing to pump into the gravity lines; pressure sewers would mainly be along sections of Foothill Road.

Main Lift Station. The sewer collection system would drain to a Main Lift Station located in the vicinity of Main Street and Niles Canyon Road. It would consist of:

- Below-ground concrete vault (“wet well”)
- Two 30-horsepower submersible sewage pumps
- Above ground control equipment and building enclosure
- Standby emergency generator
- Security fencing and screening

Force Main Transmission Line. Approximately 15,400 lineal feet (2.9 miles) of 4-inch diameter sewer force main from the Sunol Main Lift Station to City of Pleasanton sewer system, via Main Street, Bond Street, and Foothill Road, terminating at the intersection of Foothill and Oak Tree Farm Drive.

Sewage Treatment and Disposal. Sewage from Pleasanton is conveyed to the Dublin San Ramon Service District for treatment and disposal. Treated wastewater from the DSRSD facility is recycled primarily for landscape irrigation at parks, roadway medians, golf courses and schoolyards. The rest is pumped through a 16-mile long pipeline to San Leandro for disposal through a deepwater outfall in San Francisco Bay, near the San Leandro Marina.

Estimated Costs

A preliminary estimate of construction costs for Alternative 7 are provided in **Appendix F** and summarized below. The costs are itemized separately for the public sewer portion and the on-lot facilities (i.e., septic tank abandonment and sewer lateral). Cost estimates for construction items are based on recent sewer projects in the S.F. Bay Area. Also included are estimates for engineering, environmental, permitting, and project administration, plus a contingency factor of 20%. A sewer connection fee (per residence) for tie-in to the Pleasanton/DSRSD system is included based on 2019 fees for City of Pleasanton. As noted earlier, there would be additional costs for annexation that have not been estimated for this initial feasibility phase.

The total estimated construction cost for this alternative is approximately $19.3 million, of which about $16.2 million is for the public sewer portion and about $3.1 million is for on-lot facility connections. Including the City's individual sewer connection fee of $14,885 per residence, the estimated cost per parcel for 245 connections in Sunol would be approximately $85,600.

- Public sewer facilities cost: $ 16,177,600
- On-lot facilities connection cost: $ 3,119,400
- Total estimated construction cost: $ 19,297,000
- Construction cost per residence (273 ESDs): $ 70,685
- City of Pleasanton connection fee per residence: $ 14,885
- Total estimated cost per connection: $ 85,570

Based on the projected high cost per parcel, public financing (loans or bonds) may be difficult to obtain for project construction. However, if financing was to be available, the costs to the homeowner would be estimated approximately as follows:

- Upfront cost: $27,000 for connection fee plus on-lot facility items (abandon and decommission septic tank, sewer lateral, permits)
- Annual payments: $3,937 per year, based on $58,570 amortized over 20 years at 3%.

SECTION 6: SUMMARY

This report presents the results of the first phase of a Feasibility Study regarding the needs and potential alternatives for improved sanitary wastewater management in the community of Sunol in East Alameda County.

The study originated out of discussions at community meetings of the Sunol Septic Work Group and in response to a variety of issues, including: (1) growing concerns about the condition and functioning of the many antiquated, non-conforming OWTS in Sunol; (2) physical constraints for modern OWTS posed by small lots sizes, steep slopes, and proximity to creeks; (3) regulatory challenges and costs encountered by homeowners in obtaining OWTS clearance for home additions and remodeling; and (4) designation of Kilkare Woods as an “Area of Concern” and Downtown Sunol as a “Potential Area of Concern” in the recently adopted Alameda County Local Agency Management Program (LAMP) for Onsite Wastewater Treatment Systems.

The overall aim of this Phase 1 Feasibility Study was to develop an improved understanding of the current conditions and challenges for onsite wastewater treatment systems (OWTS) in Sunol and to identify potentially feasible solutions or management practices. The specific objectives included:

- Compile and review information regarding existing onsite wastewater treatment system (OWTS) practices in the Sunol area;

- Collect and review environmental information, particularly related to soils, OWTS suitability and water quality;

- Formulate a range of potential alternative solutions to address long-term management of OWTS; and

- Provide conceptual plans and preliminary cost estimates for potentially viable community wastewater management alternatives.

In general, soils throughout most of Sunol are well drained and have suitable silt loam to gravelly loam textures, which are favorable conditions for onsite wastewater disposal. The main limitations are the steeply sloping terrain, shallow soil depths over bedrock, close proximity to streams, and small lot sizes, which was confirmed through voluntary field reviews of properties in different parts of the study area.

Questionnaire surveys, County records and field reviews show the vast majority of OWTS to be 40+ years old, indicating they were built under older code, likely not compliant with modern onsite wastewater standards. This is generally confirmed from ACDEH experience dealing with system repairs and replacement projects.

Watercourse setback limitations posed by Sinbad Creek and tributary streams are a significant code compliance issue for many properties in Sunol. Steep slopes and limited available land area on small lots also pose significant constraints.

Water quality sampling of Sinbad Creek in 2017 and 2018 showed exceedance of bacteriological standards, with an increasing trend downstream. Although not at levels that pose an imminent health hazard, the fecal indicator bacteria readings and the frequency of exceedance of water quality objectives, especially in the Downtown section of Sinbad Creek, support the LAMP designation of Sunol as an area of potential water quality concern. If the results from these two baseline studies were to be found through continuing monitoring to be a recurring or chronic condition, portions of Sinbad Creek could potentially be considered by the Regional Water Board to be "impaired" with respect to pathogens.

The study has identified and outlined the basic elements and estimated costs for several potentially viable community wastewater management alternatives for Sunol. Beyond the status quo (no project), the alternatives include the establishment of an OWTS management program, a standalone community system for Kilkare Woods, a community wastewater system located in Downtown Sunol on County-owned lands with potential service for: (a) Downtown; (b) Downtown plus Lower Kilkare Road; and (c) the entire Study Area extending from Downtown Sunol through all of Kilkare Woods. The alternative of sewer connection to City of Pleasanton is also described, although the viability is remote due to questionable financial feasibility and other uncertainties. **Table 29** summarizes the alternatives identified and preliminary cost estimates.

It is intended that the results of this Phase 1 Feasibility Study will be distributed to members of the community for review, discussion and feedback. The response and feedback will provide the basis for judging the level of community interest in pursuing additional detailed analysis and comparative review of wastewater management alternatives, eventually leading to the selection of a preferred alternative(s) to address long-term OWTS management needs in Sunol.

Table 29. Sunol Community Wastewater Feasibility Study - Phase 1
Project Alternatives Summary and Preliminary Cost Estimates

Alternatives		Description	Service Area		Estimated Wastewater Flow (gpd)	Estimated Total Project Cost	Estimated Cost per Residence		Notes
			Parcels	ESDs*			Total	Annual Amortized* (20 yrs at 3%)	
1	No Project	OWTS improvements and variances procesed individually between property owner & ACDEH	244	N/A	Per County Regulations for Individual OWTS	N/A	$27,000 to $92,000+	N/A	Status quo; individual property owners responsible for OWTS improvements and abatement of system failures & variance process, as needed; improvements likely to be implemented slowly over a period of many years.
2	OWTS Upgrades and Management District	Improvement of existing and upgraded OWTS under public management program, with locally-developed standards, streamlined variance process, monitoring and financing assistance	244	N/A	Per County Regulations for Individual OWTS w/ Local Variations	$10,883,000	$18,000 to $64,000+	Low interest loans may be availble to to spread costs over time	This alternative could be implemented along with Community System Alternatives 3, 4 or 5 for properties not connected to community facilities
3	Kilkare Woods Community System	STEP & STEG Collection System; Secondary Treatment and Community Leachfield/Drip Dispersal at KWA Clubhouse Site; Includes (1) connection for Clubhouse							
	3A	100% participation	103	103	12,800	$4,352,200	$42,254	$2,504	Assumes collection system throughout entire KW area; properties not connected would be addressed with OWTS per Alt 2, and/or Alts 4 or 5, as applicable
	3B	75% participation	78	78	9,675	$3,702,200	$47,464	$2,854	
	3C	50% participation	52	52	6,425	$3,022,000	$58,115	$3,570	
4	Downtown Sunol Community System	STEP Collection System throughout Downtown Sunol; Secondary Treatment, Community Leachfields & Drip Dispersal at east side of Depot Gardens							
	4A	100% participation	73	99	16,000	$3,839,400	$38,782	$2,270	Assumes collection system throughout entire Downtown area; properties not connected would be addressed with OWTS per Alt 2, and/or Kilkare Woods Alt 3, as applicable
	4B	75% participation	58	84	14,125	$3,333,600	$39,686	$2,331	
	4C	50% participation	38	69	12,250	$2,807,800	$40,693	$2,400	
5	Downtown Sunol Plus Lower Kilkare Road	STEP & STEG Collection System throughout Downtown Sunol,extending up through Lower Kilkare Rd area; Secondary Treatment, Community Leachfields & Drip Dispersal at east side Depot Gardens and/or Bond St yard							
	5A	100% participation	142	170	25,000	$7,402,400	$43,544	$2,590	Assumes service to 100% of Downtown and Lower Kilkare Rd properties; properties not connected would be addressed with OWTS per Alt 2, and/or Kilkare Woods Alt 3, as applicable
	5B	75% participation	110	138	21,000	$6,429,400	$46,590	$2,796	
	5C	50% participation	78	106	17,000	$5,385,800	$50,809	$3,080	
6	Community System for Entire Sunol Study Area	STEP & STEG Collection System throughout Downtown extending to top of Kilkare Rd; Secondary Treatment at Bond St yard; Community Leachfields & Drip Dispersal at Depot Gardens, Bond St; 100% reserve area west of Town							
	6A	100% participation	245	273	37,800	$12,025,800	$44,051	$2,625	Assumes service to entire Sunol study area; properties not participating would be addressed with OWTS per Alt 2, as applicable
	6B	75% participation	187	215	30,675	$10,304,900	$47,708	$2,870	
	6C	50% participation	129	157	23,425	$8,448,200	$53,470	$3,258	
7	Sewer to Pleasanton	Gravity sewers in Downtown extending to top of Kilkare Rd; Main Lift Station near School; 3-mile sewer force main on Foothill toPleasanton	245	273	37,800	$19,297,000	$85,570**	$3,937	Assumes service to entire Sunol study area; subject to approval by City of Pleasanton and Dublin San Ramon Services Distict for annexation or other sewer agreement.

*Estimated initial year cost of $5,000 for alternatives 3 through 6; $27,000 for Alternative 7; amortized cost figured on remaining balance.

**Per parcel/ESD cost includes $14,885 connection fee per residential parcel; multiple ESDs would be assigned for commercial properties; cost of annexation would be extra, not included here.

GLOSSARY OF TERMS
Onsite Wastewater Treatment Systems

Cesspool: An excavation in the ground that receives sewage from the house, retains the organic matter and solids in the excavation, and allows the liquids to seep into the soil through the sides and bottom of the excavation. The excavation may be lined with wood, stacked rock or brick, or concrete with perforations. A cesspool is an antiquated way of handling onsite sewage disposal and no longer permitted in California and most other states.

Graywater: Refers to wastewater from laundry machines, bathroom sinks, showers and bathtubs but not from kitchen sinks, dishwashers, toilets or waste from dirty diapers. Appropriate reuse of graywater can help in water conservation, relieve stress on OWTS and can be safe and effective if done following guidelines to prevent potential health threats and environmental contamination.

Holding Tank: A watertight receptacle designed to receive and store sewage from the house, which is then regularly pumped out and hauled for disposal at a municipal treatment facility or other approved disposal location.

Leachfield or Drainfield: A system of rock-filled trenches or beds with distribution piping, usually about 3 to 8 feet deep, that receives sewage effluent from the septic tank (or advanced treatment system) and disperses the effluent into the soil by percolation.

Onsite Wastewater Treatment System (OWTS): A system of pipes, tanks, trenches and other components used for the collection, treatment and subsurface dispersal of domestic wastewater at or near the building or buildings being served. It is commonly called an "OWTS".

Seepage Pit: A drilled or dug excavation, usually about 3 to 6 feet in diameter and 10 to 30+ feet deep, either lined or gravel-filled, that receives sewage effluent from the septic tank and disperses the effluent into the soil. Seepage pits have been used in the past but are no longer permitted under Alameda County regulations.

Septic Tank: A buried watertight tank that receives sewage from the house, that functions to separate solids from liquids, retains and digests organic matter and discharges the clarified effluent to a secondary treatment unit or directly to the disposal field (e.g., leachfield).

Septage and Septic Tank Pumping: Septage refers to the accumulated sewage solids and liquids in the septic tank that requires periodic removal (pumping), hauling and disposal at an approved septage receiving facility (e.g., municipal wastewater treatment plant). The frequency of required pumping depends on the number of occupants and amount of wastewater flow from the house. Typical pumping frequency is about every 2 to 5 years.

STEG: Stands for "septic tank effluent gravity", which is an alternative type of sewer collection system where septic tanks are used at individual properties for retention of sewage solids, and the effluent from the tank is collected by gravity for transmission to a community treatment and/or disposal facility.

STEP: Stands for "septic tank effluent pump", which is an alternative type of sewer collection system where septic tanks are used at individual properties for retention of sewage solids, and a pump is installed in the second chamber (or a separate pump tank) to pump the effluent to small diameter collection sewers for transmission to a community treatment and/or disposal facility. Depending on the terrain, an effluent sewer system can include both STEG and STEP units.

APPENDIX A

QUESTIONNAIRE SURVEYS & FIELD REVIEWS

QUESTA
ENGINEERING CORP.
Civil, Environmental & Water Resources

June 29, 2018

Subject: Sunol Wastewater Feasibility Study – Onsite Wastewater Questionnaire Survey

Dear Property Owner:

Questa Engineering Corporation has been retained by Alameda County Department of Environmental Health (ACDEH), with partial funding from the Sunol Citizen Advisory Committee, to conduct a preliminary feasibility study of existing conditions, wastewater treatment and disposal needs, and potential long-term wastewater management alternatives for the Sunol area. The study also includes sample collection and analysis of water quality in Sinbad Creek.

The area of study includes the developed properties mainly in the Sinbad Creek watershed, extending from downtown Sunol up through Kilkare Woods, as shown in **Figure 1**. The study includes review and evaluation of continued use, upgrades and management of existing onsite wastewater treatment systems (OWTS) as well as options for community wastewater treatment and disposal facilities.

Voluntary Questionnaire Survey. An important part of the study is to obtain as much information as possible about the type, age and condition of existing OWTS. This involves reviewing information in County files and also collecting information directly from property owners. To accomplish this we have prepared the attached voluntary questionnaire survey, which is being distributed to all property owners. The attachment also includes a glossary of OWTS terminology and graphics to help understand questions on the form. We would appreciate you completing the form to the best of your knowledge and bringing it to the July 10, 2018 meeting of the Sunol Septic Work Group, or returning it by mail to Questa Engineering Corporation, P.O. Box 70356, Richmond, CA 94807. Note: The survey is intended and designed for residential properties. If your property is developed with commercial uses there is no need to complete and return the form; commercial property owners will be contacted separately.

Please understand that the purpose of the survey is to gather general information on the makeup and status of existing OWTS in the different parts of Sunol. You will note that the survey does not ask for the owner's name or property address; instead we ask that you identify the general location of your property within the study area according to the four designated sub-areas shown in **Figure 1**:

1. Downtown Sunol;
2. Kilkare Road - Middle Reach;
3. Kilkare Woods-West Side;
4. Kilkare Woods – East Side.

Neither the completed survey forms nor specific information for individual properties will be provided to ACDEH or others for the purpose of enforcement or abatement action. The survey forms will be retained by Questa and reviewed solely for the purpose of developing general understanding, assessment and summary of OWTS in different parts of Sunol.

Box 70356, 1220 Brickyard Cove Rd. Suite 206 Pt. Richmond, CA 94807 T: 510/236.6114 F: 510/236.2423 E: Questa@QuestaEC.com

Voluntary Field Reviews. As mentioned above, the study of alternatives will include an evaluation of the feasibility of managing and upgrading (where needed) existing OWTS as a long-term solution. In order to make a fair assessment of this alternative, Questa plans to conduct a field review of a representative number of properties (aiming for about 20 to 30) to evaluate the available options and constraints for upgrading existing on-lot septic systems. The purpose of the field review is not to evaluate the functional condition of the existing septic systems, but rather to assess the conditions and constraints of typical properties (e.g., setbacks, slopes, area, soils, drainage) and how individual systems could be upgraded, if needed. The information from these field reviews is intended to provide a representative cross-section of the different circumstances in the Sunol study area, which can then be extrapolated to make an overall estimate of the type of improvements, associated costs and other factors for this alternative. The results will be provided to the property owner, but no lot-specific information from the field reviews will be reported to the County or shown on any maps.

If you are interested in participating in this part of the study, please contact the undersigned by email (nhantzsche@questaec.com), by phone at (510) 236-6114, ext. 214, or by including a note with your completed questionnaire. We will then get in touch with you to arrange the field visit. It will be on a first-come, first-serve basis. Questa plans to conduct the field reviews during the later part of July and August, so your timely attention and response would be greatly appreciated.

If you have any questions regarding this questionnaire or the study in general, please contact the undersigned. Your cooperation and assistance with these surveys will be greatly appreciated.

Sincerely,

Norman N. Hantzsche, PE
Principal/Managing Engineer

SUNOL WASTEWATER FEASIBILITY STUDY
SANITARY SURVEY QUESTIONNAIRE
(Residential)

Instructions: Please submit completed form to Questa Engineering at Box 70356, Richmond CA 94807. Separate forms should be used for each parcel you own.

Property Information

1. In what part of Sunol is your property located? (See Figure 1)

☐ 1. Downtown Sunol
☐ 2. Kilkare Road – Middle Reach
☐ 3. Kilkare Woods – West Side
☐ 4. Kilkare Woods – East Side

2. How many buildings on the property?

3. How many buildings have plumbing drains (sinks, toilets, floor drains)?

4. How many total bedrooms?

5. How many residents?

Full time:____________ Part time:______________

6. In the list below, check the type of onsite wastewater treatment system (OWTS) components on the property, along with your best estimate of how old each component is. See attachment for definition of terms and notes.

☐ Septic Tank age__________
☐ Leachfield age__________
☐ Seepage Pit age__________
☐ Pump System age__________
☐ Cesspool age__________
☐ Holding Tank age__________
☐ Unknown
☐ Other (describe): ____

7. How is greywater (laundry, showers, bathroom sinks) disposed of?

☐ Into septic tank
☐ Directly to leachfield
☐ Separate greywater system
☐ Onto ground surface.
☐ Unknown
☐ Other (describe): ____

8. How often is the septic tank pumped?

☐ More than once a year
☐ Once a year
☐ Every 2 to 5 years
☐ Less frequently
☐ Never

9. Approximately when was the septic tank last pumped (month & year):

10. Have any of the following problems been observed with the current OWTS (check as applicable)?

A: ☐ slow drainage of plumbing fixtures or backup into house:
- ☐ year-round
- ☐ seasonal
- ☐ after heavy rainfall
- ☐ occasional for unexplained reason

B: ☐ wet or noticeably damp soil in leachfield area and/or odors:
- ☐ year-round
- ☐ seasonal
- ☐ after heavy rainfall
- ☐ occasional for unexplained reason

C: ☐ visible liquid on ground surface within or near septic tank or leachfield area:
- ☐ year-round
- ☐ seasonal
- ☐ after heavy rainfall
- ☐ occasional for unexplained reason

11. Has OWTS ever been inspected formally, such as for property improvements, financing, etc?

___ Yes or ___No; when (date) ____________________

12. If the OWTS has been repaired provide the date of the repair, the nature of the problem, type of repair work performed, and whether or not the repair resolved the problem.

Year	Problem	Repair Work	Did Repair Fix Problem?
____	____________	____________	☐Yes ☐No
____	____________	____________	☐Yes ☐No
____	____________	____________	☐Yes ☐No

13. Other Comments

____
____
____
____
____
____
____
____
____
____

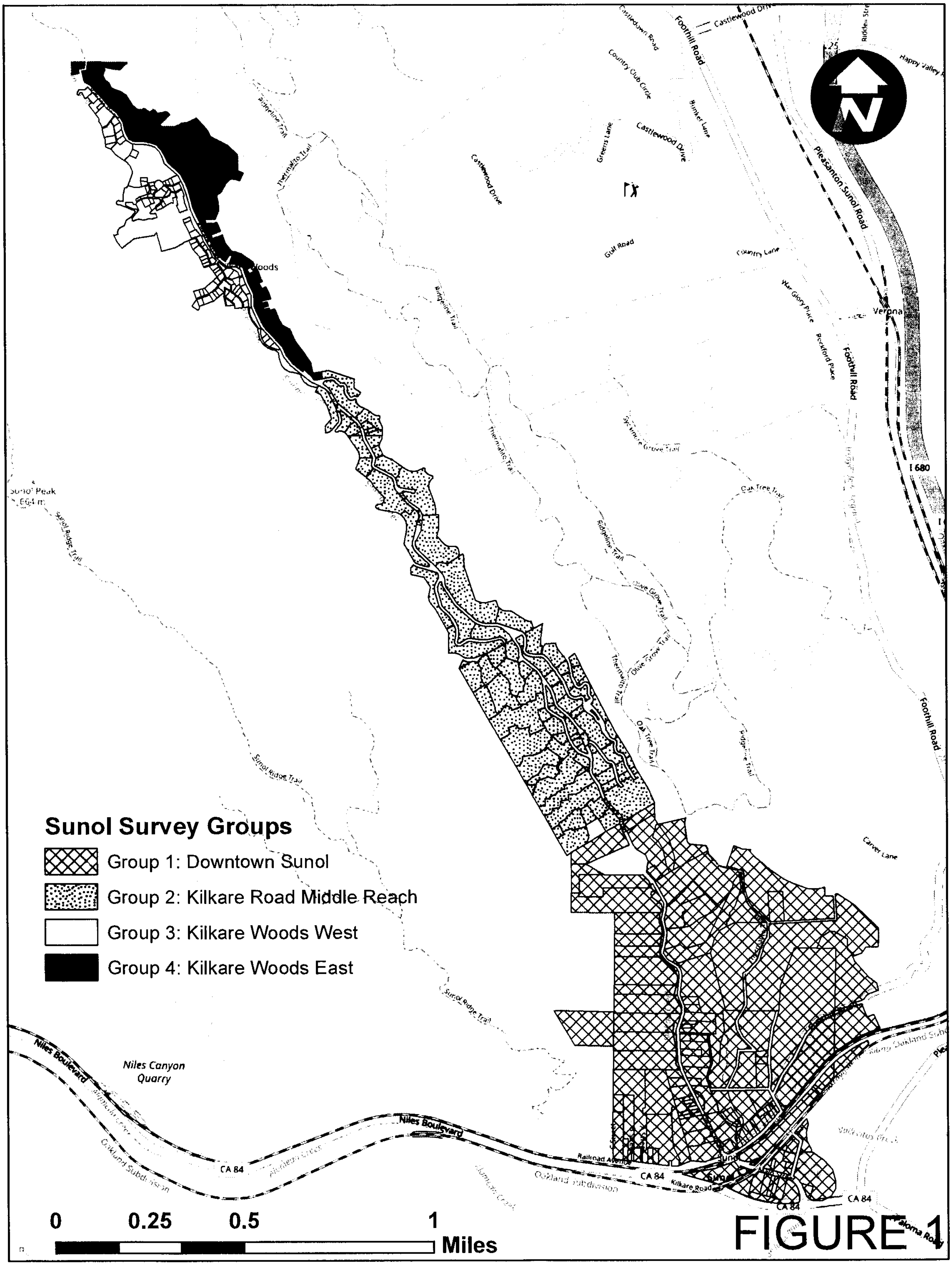

Sunol Survey Groups
Group 1: Downtown Sunol
Group 2: Kilkare Road Middle Reach
Group 3: Kilkare Woods West
Group 4: Kilkare Woods East
0
0.25
0.5
1
Miles
Foothill Road
Castlewood Drive
Country Club Circle
Pleasanton Sunol Road
Verona
I 680
Niles Boulevard
Niles Canyon Quarry
CA 84
Sunol Ridge Trail
Kilkare Road
Railroad Avenue
Paloma Road

FIGURE 1

Sunol Wastewater Feasibility Study – Questionnaire Survey

Onsite Wastewater Treatment Systems
Glossary of Terms

Cesspool: An excavation in the ground that receives sewage or other wastewater from the house, retains the organic matter and solids in the excavation, and allows the liquids to seep into the soil through the sides and bottom of the excavation. The excavation may be lined with wood, stacked rock or brick, or concrete with perforations. The term cesspool does not include pit-privies and out-houses. A cesspool is an antiquated way of handling onsite sewage disposal and no longer permitted in California and most other states.

Dispersal Field or System (Leachfield): The area where wastewater from the septic tank or other components such as a pump tank or treatment unit is dispersed into the soil for final treatment. The dispersal field can consist of a system of gravity fed trenches and piping or other types of systems for final wastewater treatment and subsurface discharge.

Graywater: Wastewater from laundry machines, bathroom sinks, showers and bathtubs but not from kitchen sinks, dishwashers, toilets or waste from dirty diapers. Graywater has not been affected by infectious, contaminated, or unhealthy bodily waste and does not present a threat of contamination by unhealthful processing, manufacturing or operating wastes. Appropriate reuse of graywater can help in water conservation, relieve stress on onsite wastewater treatment systems and can be safe and effective if done following guidelines to prevent potential health threats and environmental contamination.

Holding Tank: A self-contained watertight receptacle used to collect and store wastewater from buildings, and which is pumped out and disposed of at a municipal treatment facility or other approved disposal location. Holding tanks for wastewater are permitted in Alameda Count in limited circumstances.

Onsite Wastewater Treatment System (OWTS): A system of pipes, tanks, dispersal systems and other components used for the collection, treatment and subsurface dispersal of wastewater at or near the building or buildings being served. It is commonly called a "septic system".

Seepage Pit: A drilled or dug excavation, usually about 3 to 6 feet in diameter and 10 to 30+ feet deep, either lined or gravel-filled, that receives wastewater from the septic tank and disperses it into the soil. Seepage pits have been used in the past but are no longer permitted under Alameda County regulations.

Septage and Septic Tank Pumping: Septage refers to the accumulated wastewater solids and liquids in the septic tank that requires periodic removal (pumping), hauling and disposal at an approved septage receiving facility (e.g., municipal wastewater treatment plant). The frequency of required pumping depends on the number of occupants and amount of wastewater flow from the house. Typical pumping frequency is about every 2 to 5 years.

Septic Tank: A buried tank that receives wastewater from the buildings, that functions to separate solids from liquids, retain and digest organic matter and discharge the clarified wastewater to a secondary treatment unit or directly to the dispersal field (e.g., leachfield).

SUNOL WASTEWATER STUDY
ONSITE FIELD REVIEW

Date: ____________________

Property Address: ____

APN: ____________________ Owner(s) ____________________

FILE REVIEW

Permit data available? Y / N

Existing System Type: ____

Date of Installation: ____

House Size: ____________ Bedrooms ____________ ft^2

Other Notes: ____

____

____

SOILS/GROUNDWATER INFORMATION

SOILS: File Data: ____________________
Field Observed: ____________________

DEPTH TO GROUNDWATER: File Data: ____________________
Field Observed: ____________________

SETBACK CHECKS (Tank, Field)	NOTES
☐ Property Lines (10')	
☐ Buildings (5', 10')	
☐ Driveway/Pavement (5')	
☐ Cut Banks (4*h)	
☐ Streams (50',100')	
☐ Drainage Ditches/Subdrains (5'+d Up, 25' Lateral, 50' Downhill)	
☐ Slope %	
☐ Other Notes:	

TREATMENT SYSTEM UPGRADE	LOCATION	CONSTRUCTION ACCESS	SETBACK ISSUES
Septic Tank	ET / NT	Good Fair Poor	
Pump System	ET / NT	Good Fair Poor	
Treatment Unit	ET / NT	Good Fair Poor	
Notes:			

DISPERSAL SYSTEM UPGRADE – PRELIMINARY ASSESSMENT

- ☐ Standard Leachfield ______________________
- ☐ P.D. Trenches ______________________
- ☐ Coverfill ______________________
- ☐ Mound ______________________
- ☐ Drip Field ______________________
- ☐ Raised Drip Bed(s) ______________________
- ☐ Other/Notes: ______________________

____

____

FINAL DISPERSAL ASSESSMENT: ______________________

____

____

____

____

____

____

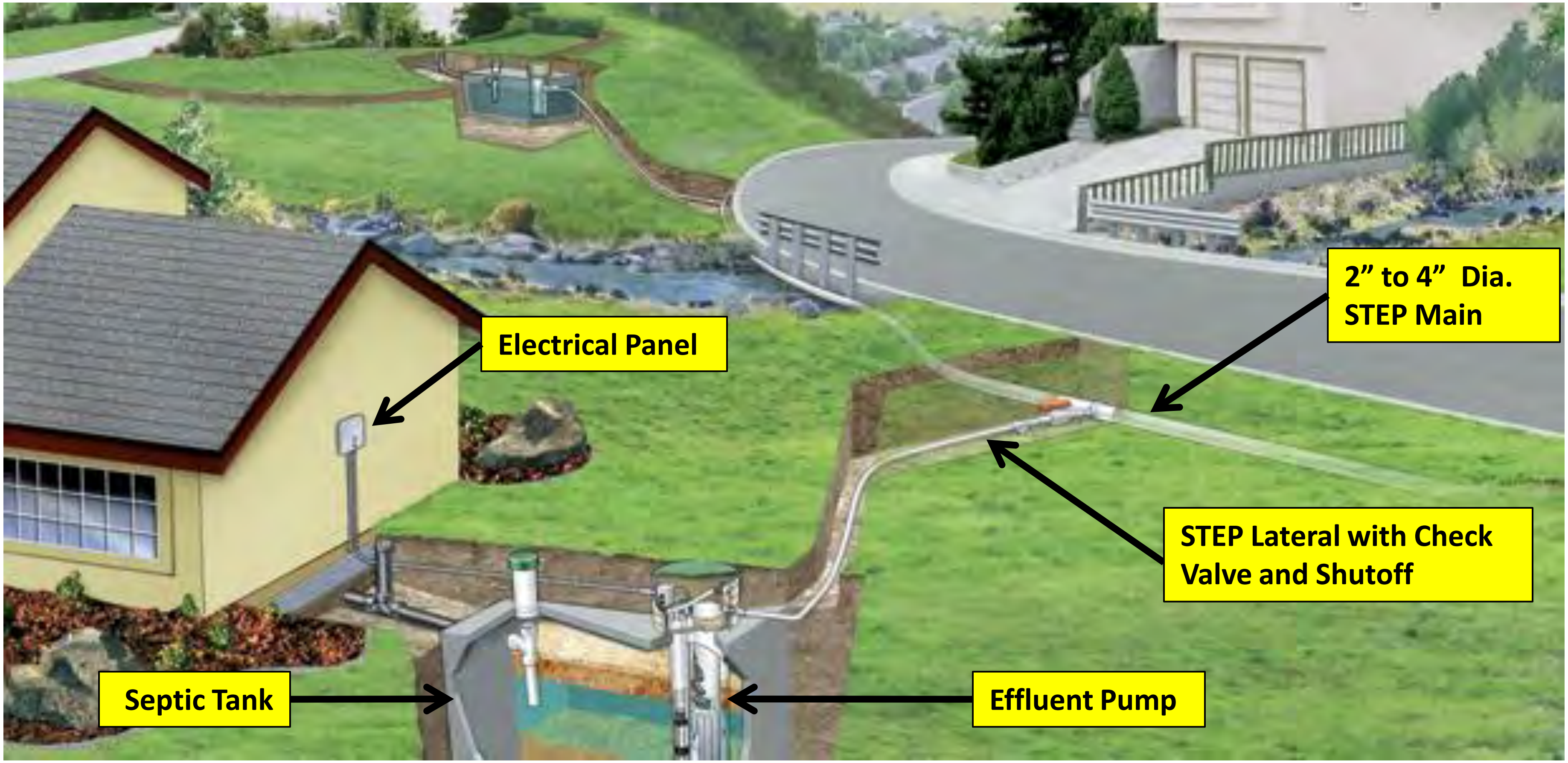
____

NOTES ON SEWER LATERAL CONNECTION:

- Route: ______________________
- Approx. Length: ______________________
- Pump: ______________ or Gravity: ______________

APPENDIX B

WASTEWATER COLLECTION ALTERNATIVES



Septic Tank Effluent Pump (STEP)
Wastewater Sewer Collection System

United States
Environmental Protection
Agency

Wastewater Technology Fact Sheet

Sewers, Pressure

DESCRIPTION

Conventional Wastewater Collection System

Conventional wastewater collection systems transport sewage from homes or other sources by gravity flow through buried piping systems to a central treatment facility. These systems are usually reliable and consume no power. However, the slope requirements to maintain adequate flow by gravity may require deep excavations in hilly or flat terrain, as well as the addition of sewage pump stations, which can significantly increase the cost of conventional collection systems. Manholes and other sewer appurtenances also add substantial costs to conventional collection systems.

Alternative

Alternative wastewater collection systems can be cost effective for homes in areas where traditional collection systems are too expensive to install and operate. Pressure sewers are used in sparsely populated or suburban areas in which conventional collection systems would be expensive. These systems generally use smaller diameter pipes with a slight slope or follow the surface contour of the land, reducing excavation and construction costs.

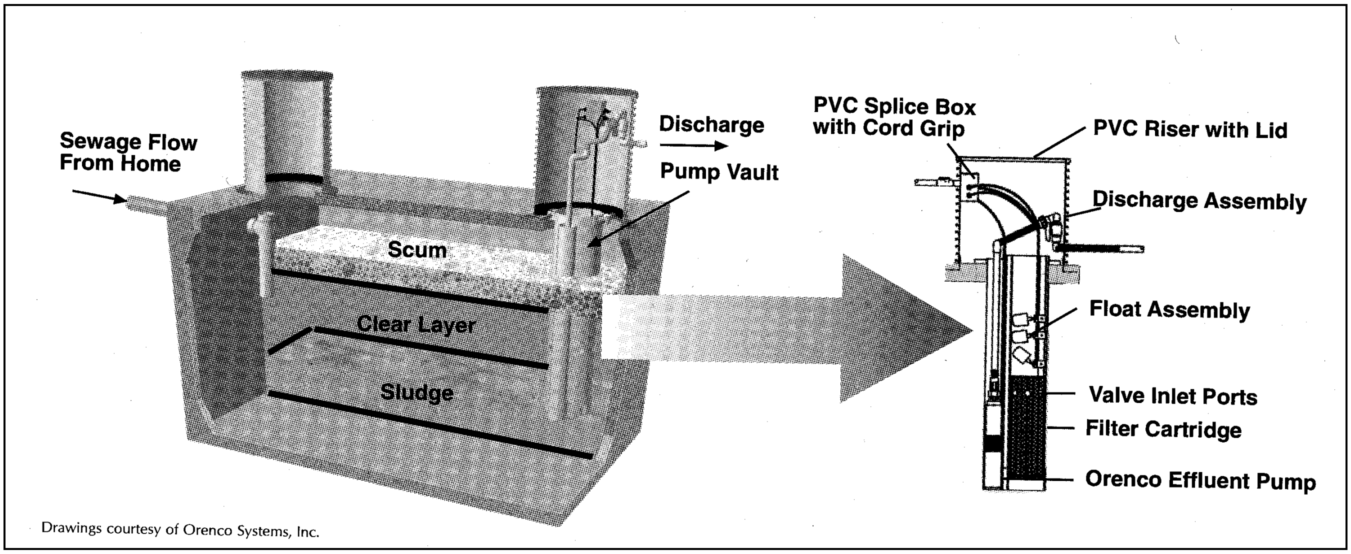
Pressure sewers differ from conventional gravity collection systems because they break down large solids in the pumping station before they are transported through the collection system. Their watertight design and the absence of manholes eliminates extraneous flows into the system. Thus, alternative sewer systems may be preferred in areas that have high groundwater that could seep into the sewer, increasing the amount of wastewater to be treated. They also protect groundwater sources by keeping wastewater in the sewer. The disadvantages of alternative sewage systems include increased energy demands, higher maintenance requirements, and greater on-lot costs. In areas with varying terrain and population density, it may prove beneficial to install a combination of sewer types.

This fact sheet discusses a sewer system that uses pressure to deliver sewage to a treatment system. Systems that use vacuum to deliver sewage to a treatment system are discussed in the *Vacuum Sewers* Fact Sheet, while gravity flow sewers are discussed in the *Small Diameter Sewers* Fact Sheet.

Pressure Sewers

Pressure sewers are particularly adaptable for rural or semi-rural communities where public contact with effluent from failing drain fields presents a substantial health concern. Since the mains for pressure sewers are, by design, watertight, the pipe connections ensure minimal leakage of sewage. This can be an important consideration in areas subject to groundwater contamination. Two major types of pressure sewer systems are the **septic tank effluent pump (STEP)** system and the **grinder pump (GP)**. Neither requires any modification to plumbing inside the house.

In STEP systems, wastewater flows into a conventional septic tank to capture solids. The liquid effluent flows to a holding tank containing a pump and control devices. The effluent is then pumped and transferred for treatment. Retrofitting existing septic tanks in areas served by septic tank/drain field systems would seem to present an opportunity for cost savings, but a large number (often a majority) must be replaced or expanded over the life of the system because of insufficient capacity, deterioration of concrete tanks, or leaks. In a GP system, sewage flows to a vault where a grinder pump grinds the solids and discharges the sewage into a pressurized pipe system. GP systems do not require a septic tank but may require more horsepower than STEP systems because of the grinding action. A GP system can result in significant capital cost



Source: C. Falvey, 2001.

FIGURE 1 TYPICAL SEPTIC TANK EFFLUENT PUMP

savings for new areas that have no septic tanks or in older areas where many tanks must be replaced or repaired. Figure 1 shows a typical septic tank effluent pump, while Figure 2 shows a typical grinder pump used in residential wastewater treatment.

The choice between GP and STEP systems depends on three main factors, as described below:

Cost: On-lot facilities, including pumps and tanks, will account for more than 75 percent of total costs, and may run as high as 90 percent. Thus, there is a strong motivation to use a system with the least expensive on-lot facilities. STEP systems may lower on-lot costs because they allow some gravity service connections due to the continued use of a septic tank. In addition, a grinder pump must be more rugged than a STEP pump to handle the added task of grinding, and, consequently, it is more expensive. If many septic tanks must be replaced, costs will be significantly higher for a STEP system than a GP system.

Downstream Treatment: GP systems produce a higher TSS that may not be acceptable at a downstream treatment facility.

Low Flow Conditions: STEP systems will better tolerate low flow conditions that occur in areas with highly fluctuating seasonal occupancy and those with slow build out from a small initial population to the ultimate design population. Thus, STEP systems may be better choices in these areas than GP systems.

APPLICABILITY

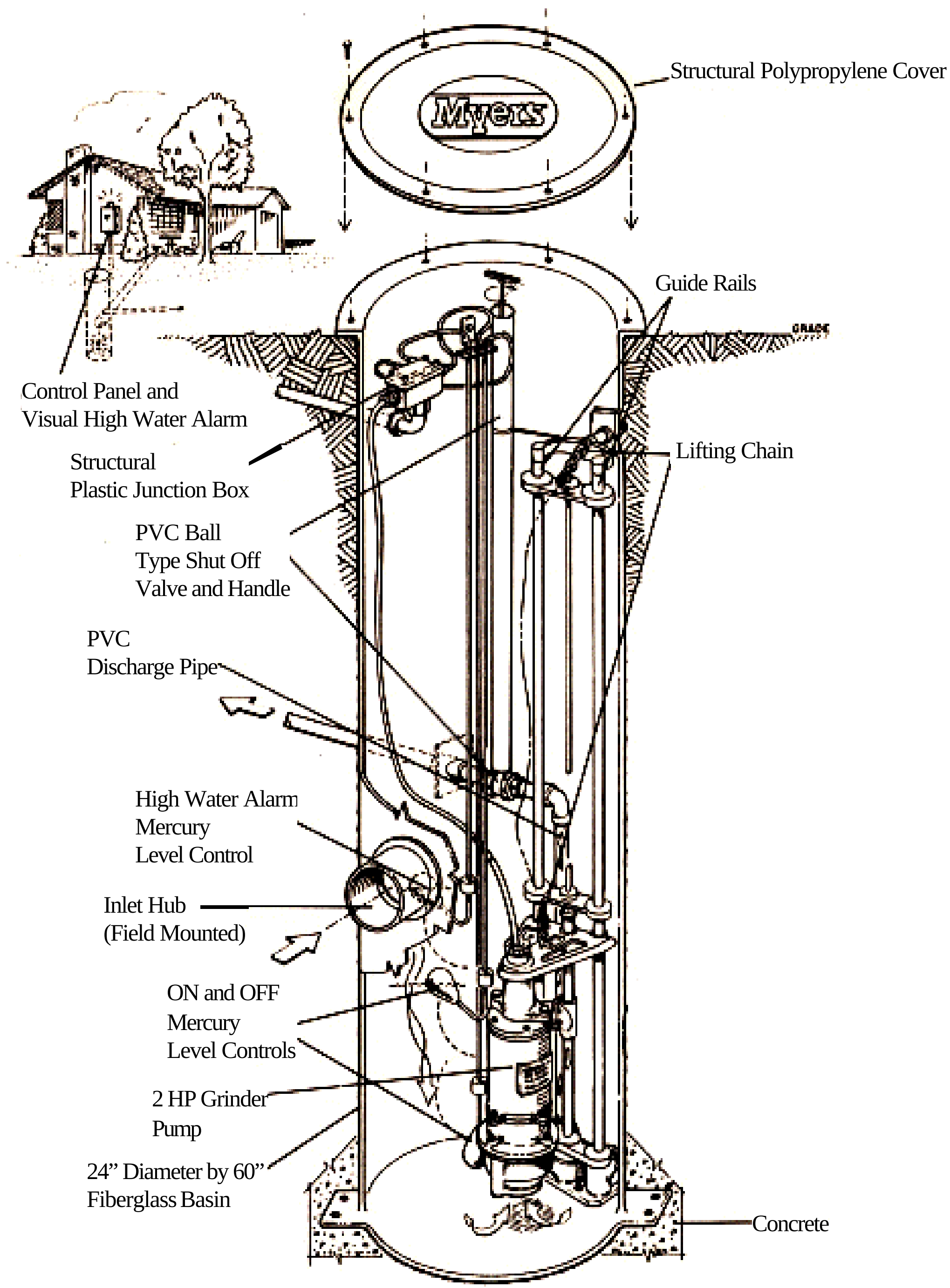
Pressure sewer systems are most cost effective where housing density is low, where the terrain has undulations with relatively high relief, and where the system outfall must be at the same or a higher elevation than most or all of the service area. They can also be effective where flat terrain is combined with high ground water or bedrock, making deep cuts and/or multiple lift stations excessively expensive. They can be cost effective even in densely populated areas where difficult construction or right of way conditions exist, or where the terrain will not accommodate gravity sewers.

Since pressure systems do not have the large excess capacity typical of conventional gravity sewers, they must be designed with a balanced approach, keeping future growth and internal hydraulic performance in mind.

ADVANTAGES AND DISADVANTAGES

Advantages

Pressure sewer systems that connect several residences to a "cluster" pump station can be less expensive than



Source: F.E. Meyers Company, 2000.

FIGURE 2 TYPICAL GRINDER PUMP

conventional gravity systems. On-property facilities represent a major portion of the capital cost of the entire system and are shared in a cluster arrangement. This can be an economic advantage since on-property components are not required until a house is constructed and are borne by the homeowner. Low front-end investment makes the present-value cost of the entire system lower than that of conventional gravity sewerage, especially in new development areas where homes are built over many years.

Because wastewater is pumped under pressure, gravity flow is not necessary and the strict alignment and slope restrictions for conventional gravity sewers can be relaxed. Network layout does not depend on ground contours: pipes can be laid in any location and extensions can be made in the street right-of-way at a relatively small cost without damage to existing structures.

Other advantages of pressure sewers include:

Material and trenching costs are significantly lower because pipe size and depth requirements are reduced.

Low-cost clean outs and valve assemblies are used rather than manholes and may be spaced further apart than manholes in a conventional system.

Infiltration is reduced, resulting in reductions in pipe size.

The user pays for the electricity to operate the pump unit. The resulting increase in electric bills is small and may replace municipality or community bills for central pumping eliminated by the pressure system.

Final treatment may be substantially reduced in hydraulic and organic loading in STEP systems. Hydraulic loadings are also reduced for GP systems.

Because sewage is transported under pressure, more flexibility is allowed in siting final treatment facilities and may help reduce the length of outfall lines or treatment plant construction costs.

Disadvantages

Requires much institutional involvement because the pressure system has many mechanical components throughout the service area.

The operation and maintenance (O&M) cost for a pressure system is often higher than a conventional gravity system due to the high number of pumps in use. However, lift stations in a conventional gravity sewer can reverse this situation.

Annual preventive maintenance calls are usually scheduled for GP components of pressure sewers. STEP systems also require pump-out of septic tanks at two to three year intervals.

Public education is necessary so the user knows how to deal with emergencies and how to avoid blockages or other maintenance problems.

The number of pumps that can share the same downstream force main is limited.

Power outages can result in overflows if standby generators are not available.

Life cycle replacement costs are expected to be higher because pressure sewers have a lower life expectancy than conventional systems.

Odors and corrosion are potential problems because the wastewater in the collection sewers is usually septic. Proper ventilation and odor control must be provided in the design and non-corrosive components should be used. Air release valves are often vented to soil beds to minimize odor problems and special discharge and treatment designs are required to avoid terminal discharge problems.

DESIGN CRITERIA

Many different design flows can be used in pressure systems. When positive displacement GP units are used, the design flow is obtained by multiplying the pump discharge by the maximum number of pumps expected to be operating simultaneously. When centrifugal pumps are used, the equation used is $Q= 20 + 0.5D$, where Q is the flow in gpm and D is the number of homes served. The operation of the system under various assumed conditions should be simulated by computer to check design adequacy. No allowances for infiltration and inflow are required. No minimum velocity is generally used in design, but GP systems must attain three to five feet per second at least once per day. A Hazen-Williams coefficient, (C) = 130 to 140, is suggested for hydraulic analysis. Pressure mains generally use 50 mm (2 inch) or larger PVC pipe (SDR 21) and rubber-ring joints or solvent welding to assemble the pipe joints. High-density polyethylene (HDPE) pipe with fused joints is widely used in Canada. Electrical requirements, especially for GP systems, may necessitate rewiring and electrical service upgrading in the service area. Pipes are generally buried to at least the winter frost penetration depth; in far northern sites insulated and heat-traced pipes are generally buried at a minimal depth. GP and STEP pumps are sized to accommodate the hydraulic grade requirements of the system. Discharge points must use drop inlets to minimize odors and corrosion. Air release valves are placed at high points in the sewer and often are vented to soil beds. Both STEP and GP systems can be assumed to be anaerobic and potentially odorous if subjected to turbulence (stripping of gases such as H_2S).

PERFORMANCE

STEP

When properly installed, septic tanks typically remove about 50 percent of BOD, 75 percent of suspended solids, virtually all grit, and about 90 percent of grease, reducing the likelihood of clogging. Also, wastewater reaching the treatment plant will be weaker than raw sewage. Typical average values of BOD and TSS are 110 mg/L and 50 mg/L, respectively. On the other hand, septic tank effluent has virtually zero dissolved oxygen.

Primary sedimentation is not required to treat septic tank effluent. The effluent responds well to aerobic treatment, but odor control at the headworks of the treatment plant should receive extra attention.

The small community of High Island, Texas, was concerned that septic tank failures were damaging a local area frequented by migratory birds. Funds and materials were secured from the EPA, several state agencies, and the Audubon Society to replace the undersized septic tanks with larger ones equipped with STEP units and low pressure sewerage ultimately discharging to a constructed wetland. This system is expected to achieve an effluent quality of less than 20 mg/L each of BOD and TSS, less than 8 mg/L ammonia, and greater than 4 mg/L dissolved oxygen (Jensen 1999).

In 1996, the village of Browns, Illinois, replaced a failing septic tank system with a STEP system discharging to low pressure sewers and ultimately to a recirculating gravel filter. Cost was a major concern to the residents of the village, who were used to average monthly sewer bills of $20. Conditions in the village were poor for conventional sewer systems, making them prohibitively expensive. An alternative low pressure-STEP system averaged only $19.38 per month per resident, and eliminated the public health hazard caused by the failed septic tanks (ICAA, 2000).

GP Treatment

The wastewater reaching the treatment plant will typically be stronger than that from conventional systems because infiltration is not possible. Typical design average concentrations of both BOD and TSS are 350 mg/L (WPCF, 1986).

GP/low pressure sewer systems have replaced failing septic tanks in Lake Worth, Texas (Head, et. al., 2000); Beach Drive in Kitsap County, Washington (Mayhew and Fitzwater, 1999); and Cuyler, New York (Earle, 1998). Each of these communities chose alternative systems over conventional systems based on lower costs and better suitability to local soil conditions.

OPERATION AND MAINTENANCE

Routine operation and maintenance requirements for both STEP and GP systems are minimal. Small systems that serve 300 or fewer homes do not usually require a full-time staff. Service can be performed by personnel from the municipal public works or highway department. Most system maintenance activities involve responding to homeowner service calls usually for electrical control problems or pump blockages. STEP systems also require pumping every two to three years.

TABLE 1 RELATIVE CHARACTERISTICS OF ALTERNATIVE SEWERS

Sewer Type	Slope Requirement	Construction Cost in Rocky, High Groundwater Sites	Operation and Maintenance Requirements	Ideal Power Requirements
Conventional	Downhill	High	Moderate	None*
Pressure				
STEP	None	Low	Moderate-high	Low
GP	None	Low	Moderate-high	Moderate

* Power may be required for lift stations
Source: Small Flows Clearinghouse, 1992.

The inherent septic nature of wastewater in pressure sewers requires that system personnel take appropriate safety precautions when performing maintenance to minimize exposure to toxic gases, such as hydrogen sulfide, which may be present in the sewer lines, pump vaults, or septic tanks. Odor problems may develop in pressure sewer systems because of improper house venting. The addition of strong oxidizing agents, such as chlorine or hydrogen peroxide, may be necessary to control odor where venting is not the cause of the problem.

Generally, it is in the best interest of the municipality and the homeowners to have the municipality or sewer utility be responsible for maintaining all system components. General easement agreements are needed to permit access to on-site components, such as septic tanks, STEP units, or GP units on private property.

COSTS

Pressure sewers are generally more cost-effective than conventional gravity sewers in rural areas because capital costs for pressure sewers are generally lower than for gravity sewers. While capital cost savings of 90 percent have been achieved, no universal statement of savings is possible because each site and system is unique. Table 1 presents a generic comparison of common characteristics of sanitary sewer systems that should be considered in the initial decision-making process on whether to use pressure sewer systems or conventional gravity sewer systems.

Table 2 presents data from recent evaluations of the costs of pressure sewer mains and appurtenances (essentially the same for GP and STEP), including items specific to each type of pressure sewer. Purchasing pumping stations in volume may reduce costs by up to 50 percent. The linear cost of mains can vary by a factor of two to three, depending on the type of trenching equipment and local costs of high-quality backfill and pipe. The local geology and utility systems will impact the installation cost of either system.

The homeowner is responsible for energy costs, which will vary from $1.00 to $2.50/month for GP systems, depending on the horsepower of the unit. STEP units generally cost less than $1.00/month.

Preventive maintenance should be performed annually for each unit, with monthly maintenance of other mechanical components. STEP systems require periodic pumping of septic tanks. Total O&M costs average $100-200 per year per unit, and include costs for troubleshooting, inspection of new installations, and responding to problems.

Mean time between service calls (MTBSC) data vary greatly, but values of 4 to 10 years for both GP and STEP units are reasonable estimates for quality installations.

TABLE 2 AVERAGE INSTALLED UNIT COSTS FOR PRESSURE SEWER MAINS & APPURTENANCES

Item	Unit Cost ($)
2 inch mains	9.40/LF
3 inch mains	10.00/LF
4 inch mains	11.30/LF
6 inch mains	15.80/LF
8 inch mains	17.60/LF
Extra for mains in asphalt concrete pavement	6.30/LF
2 inch isolation valves	315/each
3 inch isolation valves	345/each
4 inch isolation valves	440/each
6 inch isolation valves	500/each
8 inch isolation valves	720/each
Individual Grinder pump	1,505/each
Single (simplex) package pump system	5,140/each
package installation	625 - 1,880/each
Automatic air release stations	1,255/each

Source: U.S. EPA, 1991.

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Other Related Fact Sheets

Other EPA Fact Sheets can be found at the following web address:

http://www.epa.gov/owm/mtb/mtbfact.htm

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EPA 832-F-02-006
September 2002

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United States Environmental Protection Agency | Office of Water Washington, D.C. | EPA 832-F-00-038 September 2000

Decentralized Systems Technology Fact Sheet
Small Diameter Gravity Sewers

DESCRIPTION

Alternative wastewater collection systems are often implemented in situations where conventional wastewater collection systems are not feasible. Typically, it is desirable to use conventional wastewater collection systems based on a proven track record. However, in areas of hilly or flat terrain, the use of conventional wastewater collection systems may require deep excavation, significantly increasing the cost of conventional collection systems.

Conventional Wastewater Collection Systems

Conventional wastewater collection systems are the most popular method to collect and convey wastewater. Pipes are installed on a slope, allowing wastewater to flow by gravity from a house site to the treatment facility. Pipes are sized and designed with straight alignment and uniform gradients to maintain self-cleansing velocities. Manholes are installed between straight runs of pipe to ensure that stoppages can be readily accessed. Pipes are generally eight inches or larger and are typically installed at a minimum depth of three feet and a maximum depth of 25 feet. Manholes are located no more than 400 feet apart or at changes of direction or slope.

Alternative Wastewater Collection Systems

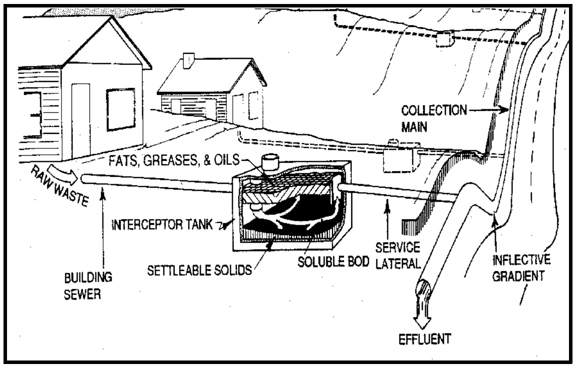
Where deep excavation is a concern, it may be beneficial to use an alternative wastewater collection system. These systems generally use smaller diameter pipes with a slight slope or follow the surface contour of the land, reducing the amount of excavation and construction costs. This is illustrated in Figure 1, which shows a pipe following an inflective gradient (the contours of the ground). As long as the head of the sewer is at a higher invert elevation than the tail of the sewer's invert elevation, flow will continue through the system in the intended direction. Alternative collection systems may be preferred in areas with high groundwater that may seep into the sewer, increasing the amount of wastewater to be treated. Areas where small lot sizes, poor soil conditions, or other site-related limitations make on-site wastewater treatment options inappropriate or expensive may benefit from alternative wastewater collection systems.

This Fact Sheet discusses small diameter gravity sewers.

Small Diameter Gravity Sewers

Small diameter gravity sewers (SDGS) convey effluent by gravity from an interceptor tank (or septic tank) to a centralized treatment location or pump station for transfer to another collection system or treatment facility. A typical SDGS system is depicted in Figure 1.

Most suspended solids are removed from the wastestream by septic tanks, reducing the potential for clogging to occur and allowing for smaller diameter piping both downstream of the septic tank in the lateral and in the sewer main. Cleanouts are used to provide access for flushing; manholes are rarely used. Air release risers are required at or slightly downstream of summits in the sewer profile. Odor control is important at all access points since the SDGS carries odorous septic tank effluent. Because of the small diameters and flexible slope and alignment of the SDGS, excavation depths and volumes are typically much smaller than with conventional sewers. Minimum pipe diameters can be three inches. Plastic pipe is typically used because it is economical in small sizes and resists corrosion.



Source: U.S. EPA, 1991.

FIGURE 1 SDGS SYSTEM

APPLICABILITY

- Approximately 250 SDGS systems have been financed in the United States by the EPA Construction Grants Program. Many more have been financed with private or local funding. These systems were introduced in the United States in the mid-1970s, but have been used in Australia since the 1960s.

- SDGS systems can be most cost-effective where housing density is low, the terrain has undulations of low relief, and the elevation of the system terminus is lower than all or nearly all of the service area. They can also be effective where the terrain is too flat for conventional gravity sewers without deep excavation, where the soil is rocky or unstable, or where the groundwater level is high.

- SDGS systems do not have the large excess capacity typical of conventional gravity sewers and should be designed with an adequate allowance for future growth.

ADVANTAGES AND DISADVANTAGES

Advantages

- Construction is fast, requiring less time to provide service.

- Unskilled personnel can operate and maintain the system.

- Elimination of manholes reduces a source of inflow, further reducing the size of pipes, lift/pumping stations, and final treatment, ultimately reducing cost.

- Reduced excavation costs: Trenches for SDGS pipelines are typically narrower and shallower than for conventional sewers.

- Reduced material costs: SDGS pipelines are smaller than conventional sewers, reducing pipe and trenching costs.

- Final treatment requirements are scaled down in terms of organic loading since partial removal is performed in the septic tank.

- Reduced depth of mains lessens construction costs due to high ground water or rocky conditions.

Disadvantages

Though not necessarily a disadvantage, limited experience with SDGS technology has yielded some situations where systems have performed inadequately. This is usually more a function of poor design and construction than the ability of a properly designed and constructed SDGS system to perform adequately.

While SDGS systems have no major disadvantages specific to temperate climates, some restrictions may limit their application:

- SDGS systems cannot handle commercial wastewater with high grit or settleable solids levels. Restaurants may be hooked up if they are equipped with effective grease traps. Laundromats may be a constraining factor for SDGS systems in small communities. No reports could be found on the use of SDGS systems as a commercial wastewater collection option.

- In addition to corrosion within the pipe from the wastewater, corrosion outside the pipe has been a problem in some SDGS systems in the United States where piping is installed in highly corrosive soil. If the piping will be exposed to a corrosive environment, non-corrosive materials must be incorporated in the design.

- Disposing of collected septage from septic tanks is probably the most complex aspect of the SDGS system and should be carried out by local authorities. However, many tanks are installed on private property requiring easement agreements for local authorities to gain access. Contracting to carry out these functions is an option, as long as the local authorities retain enforceable power for hygiene control.

- Odors are the most common problem. Many early systems used an on-lot balancing tank that promoted stripping of hydrogen sulfide from the interceptor (septic) tank effluent. Other odor problems are caused by inadequate house ventilation systems and mainline manholes or venting structures. Appropriate engineering can control odor problems.

- SDGS systems must be buried deep enough so that they will not freeze. Excavation may be substantial in areas where there is a deep frostline.

DESIGN CRITERIA

Peak flows are based on the formula Q=20 + 0.5D, where Q is flow (gallons per minute) and D is the number of dwelling units served by the system (EPA 1992). Whenever possible, it is desirable to use actual flow data for design purposes. However, if this is not available, peak flows are calculated. Each segment of the sewer is analyzed by the Hazen-Williams or Manning equations to determine if the pipe is of adequate size and slope to handle the peak design flow. No minimum velocity is required and PVC pipe (SDR 35) is commonly used for gravity segments. Stronger pipe (e.g., SDR 21) may be dictated where septic tank effluent pump (STEP) units feed the system. Check valves may also be used in flooded sections or where backup (surcharging) from the main may occur. These valves are installed downstream of mainline cleanouts.

Typical pipe diameters for SDGS are 80 millimeters (three inches) or more, but the minimum recommended pipe size is 101.6 mm (4 mm) because 80 mm (3 inch) pipes are not readily available and need to be special ordered. The slope of the pipe should be adequate to carry peak hourly flows. SDGS systems do not need to meet a minimum velocity because solids settling is not a design parameter in them. The depth of the piping should be the minimum necessary to prevent damage from anticipated earth and truck loadings and freezing. If no heavy earth or truck loadings are anticipated, a depth of 600 to 750 millimeters (24 to 30 inches) is typical.

All components must be corrosion-resistant and all discharges (e.g., to a conventional gravity interception or treatment facility) should be made through drop inlets below the liquid level to minimize odors. The system is ventilated through service-connection house vent stacks. Other atmospheric openings should be directed to soil beds for odor control, unless they are located away from the populace.

Septic tanks are generally sized based on local plumbing codes. STEP units used for below-grade services are covered in a Fact Sheet on pressure sewers. It is essential to ensure that on-lot infiltration and inflow (l/l) is eliminated through proper testing and repair, if required, of building sewers, as well as pre-installation testing of septic tanks.

Mainline cleanouts are generally spaced 120 to 300 meters (400 to 1,000 feet) apart. Treatment is normally by stabilization pond or subsurface infiltration. Effluent may also be directed to a pump station or treatment facility.

A well operated and maintained septic tank will typically remove up to 50 percent of BOD_5, 75 percent of SS, virtually all grit, and about 90 percent of grease. Clogging is not normally a problem. Also, wastewater reaching the treatment plant will typically be more dilute than raw sewage. Typical average values of BOD and TSS are 110 mg/l and 50 mg/l, respectively.

Primary sedimentation is not required to treat septic tank effluent. Sand filters are effective in treatment. Effluent responds well to aerobic treatment, but odor control at the headworks of the treatment plant should receive extra attention.

PERFORMANCE

Point Royal Estates, Texas

Point Royal Estates is an 80-home subdivision developed in the early 1970s near Lake Ray Hubbard in the northwest part of Rockwall County, Texas. For many years, septic tank and drainfield failures were a great inconvenience to the residents of Point Royal Estates, ultimately causing property values to decrease.

Originally, each home was served by two 250-gallon septic tanks, and gravity absorption field lines were placed in the back yards. The systems began to fail regularly, largely due to infiltration problems since soils in the area are mostly extremely tight clays. Many residents pumped their tanks twice a year but still reported system failures. Some residents resorted to renting "port-a-potties".

In 1990, the City of Rowlett formed a Public Improvement District to install a conventional sewer system in Point Royal Estates. The final cost estimate for this project was nearly $10,000 per residence. These high costs prompted the city to explore other alternatives.

In 1993, the Point Royal Water and Sewage Supply Corporation (PRWSSC) was formed to evaluate alternatives for sewage collection. After a series of public meetings, it became obvious that a small diameter sewer might be the best option for the subdivision. The final cost estimate for a SDGS system was about $3,500 per residence.

The system consisted of interceptor tanks ranging in size from 1,000-1,200 gallons installed at each residence. These tanks were installed with baffles and Clemson design tubes to prevent solids buildup and reduce the amount of sludge sent through the downstream sewer piping. Homes were connected to the interceptor tanks with four-inch PVC pipes installed at a 2 percent slope. Effluent was transported from the interceptor tanks to the SDGS collection line by a two-inch PVC gravity sewer. Valves and cleanout ports that could be easily accessed and serviced were installed at most homes. Existing septic tanks were abandoned and crushed, when practical.

Oxytec, Inc. was the general contractor for the installation, which began in April 1994. Final inspections were performed in July 1995 and no operational problems have yet been reported.

OPERATION AND MAINTENANCE

O&M requirements for SDGS systems are usually low, especially if there are no STEP units or lift stations. Periodic flushing of low-velocity segments of the collector mains may be required. The septic tanks must be pumped periodically to prevent solids from entering the collector mains. It is generally recommended that pumping be performed every three to five years. However, the actual operating experience of SDGS systems indicates that once every seven to ten years is adequate. Where lift stations are used, such as in low lying areas where waste is collected from multiple sources, they should be checked on a daily or weekly basis. A daily log should be kept on all operating checks, maintenance performed, and service calls. Regular flow monitoring is useful to evaluate whether inflow and infiltration problems are developing.

The municipality or sewer utility should be responsible for O&M of all of the SDGS system components to ensure a high degree of system reliability. General easement agreements are needed to permit access to components such as septic tanks or STEP units on private property.

COSTS

The installed costs of the collector mains and laterals and the interceptor tanks constitute more than 50 percent of total construction cost (see Table 1 for more detailed listing of component costs). Average unit costs for twelve projects (adjusted to January 1991) were: 10 cm (4 in.) mainline, $3.71/m ($12.19/ft); cleanouts, $290 each; and service connections, $2.76/m ($9.08/ft). A more detailed listing of this information may be found in Table 1. Average unit costs for 440 L (1,000 gal) septic tanks were $1,315, but are not included in Table 1. The average cost per connection was $5,353 (adjusted to January 1991) and the major O&M requirement for SDGS systems is the pumping of the tanks. Other O&M activities include gravity line repairs from excavation damage, supervision of new connections, and inspection and repair of mechanical components and lift stations. Most SDGS system users pay $10 to 20/month for management, including O&M and administrative costs.

TABLE 1 SMALL DIAMETER GRAVITY SEWER COMPONENT COSTS

Community (Cost Index)	In-Place Pipe	Man-holes	Clean outs	Lift Stations	Force Main	Bldg. Sewer	Service Conn.	Site Restoration	Total
Westboro, WI	5.27	0.60	-	1.65	0.55	0.76	a	0.75	13.03
Badger, SD	2.67	1.93	-	3.23	0.39	0.03	2.59	b	15.61
Avery, ID	8.57	0.60	0.25	5.11	1.64	-	0.69	b	43.39
Maplewood, WI	17.30	0.44	0.62	10.72	2.92	-	2.79	1.29	45.85
S. Corning, NY #1	13.36	0.44	0.48	-	-	1.62	7.72	3.08	43.63
S. Corning, NY #2	15.11	0.72	0.32	-	-	2.51	11.87	2.11	50.87
New Castle, VA	9.89	2.40	0.78	2.88	2.60	-	b	b	30.58
Miranda, CA	24.36	1.61	1.60	-	0.17	4.94	7.44	0.53	69.33
Gardiner, NY	15.07	1.47	0.37	0.78	0.50	0.72	2.50	0.77	30.84
Lafayette, TN	6.90	0.64	0.14	1.26	0.37	0.11	4.19	b	16.29
West Point, CA	7.26	-	0.35	2.22	1.56	-	6.00	-	38.64
Zanesville, OH	8.09	0.18	1.05	-	-	9.46	8.71	1.12	46.65
Adjusted Average	15.10	1.42	0.79	4.95	1.66	3.22	7.13	2.12	57.89

a Included in septic tank costs.
b Included in pipe costs. Costs are in $/ft pipe installed.

Source: U.S.EPA, 1991.

REFERENCES

Other Related Fact Sheets

Sewers, Pressure
EPA 832-F-00-070
September 2000

Sewers, Lift Stations
EPA 832-F-00-073
September 2000

Other EPA Fact Sheets can be found at the following web address:
http://www.epa.gov/owmitnet/mtbfact.htm

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APPENDIX C

WASTEWATER TREATMENT SYSTEM EXAMPLES

Fact Sheet
On-Site Sewage Denitrification Verification Project: Vegetated Recirculating Gravel Filter System

Background

Nitrogen removal from wastewater happens in a two step process.

1. Oxygen loving bacteria convert ammonia to nitrite. Other bacteria then convert nitrite to nitrate. This process is called “nitrification” and the effluent becomes “nitrified”.
2. Under oxygen-free conditions, another type of bacteria converts nitrate to nitrogen gas. This process is called denitrification. Denitrification can only occur in an oxygen-free environment. (Note: The bacteria in these conditions do not need oxygen to survive, but do require a carbon source as food to live.)

After denitrification occurs, nitrogen gas is released into the air. Nitrogen gas makes up most (78%) of the air we breathe, so its release does not cause an environmental concern.

VRGF System

The vegetated recirculating gravel filter (VRGF) system is designed for nitrification to take place in the oxygen rich top layer, and denitrification to take place in the oxygen-free bottom layer.

There are three distinct zones in the vegetated recirculating gravel filter system. Effluent is continually circulated through these zones. Denitrification occurs after a complete circuit is completed and the effluent flows a second time through the first zone of the system.

A diagram of the system and description of the process are on the back.

Photos of the VRGF

Sponsors

To learn more about the project go to
www.doh.wa.gov/CommunityandEnvironment/Shellfish/EPAGrants/Denitrification.aspx

Or contact:
Wastewater Management Section, Office of Shellfish and Water Protection
Phone: 360.236.3330 Email: wastewatermgmt@doh.wa.gov

Public Health – Always Working for a Safer and Healthier Washington

Zone 1 (beginning circuit): The septic tank effluent comes in through a gravelless chamber at the bottom of the filter system, and enters the gravel layer in this anoxic (oxygen-free) zone. Bacteria consume and oxidize organics in the effluent, which travels horizontally across the zone to an outlet pipe leading to the recirculating basin.

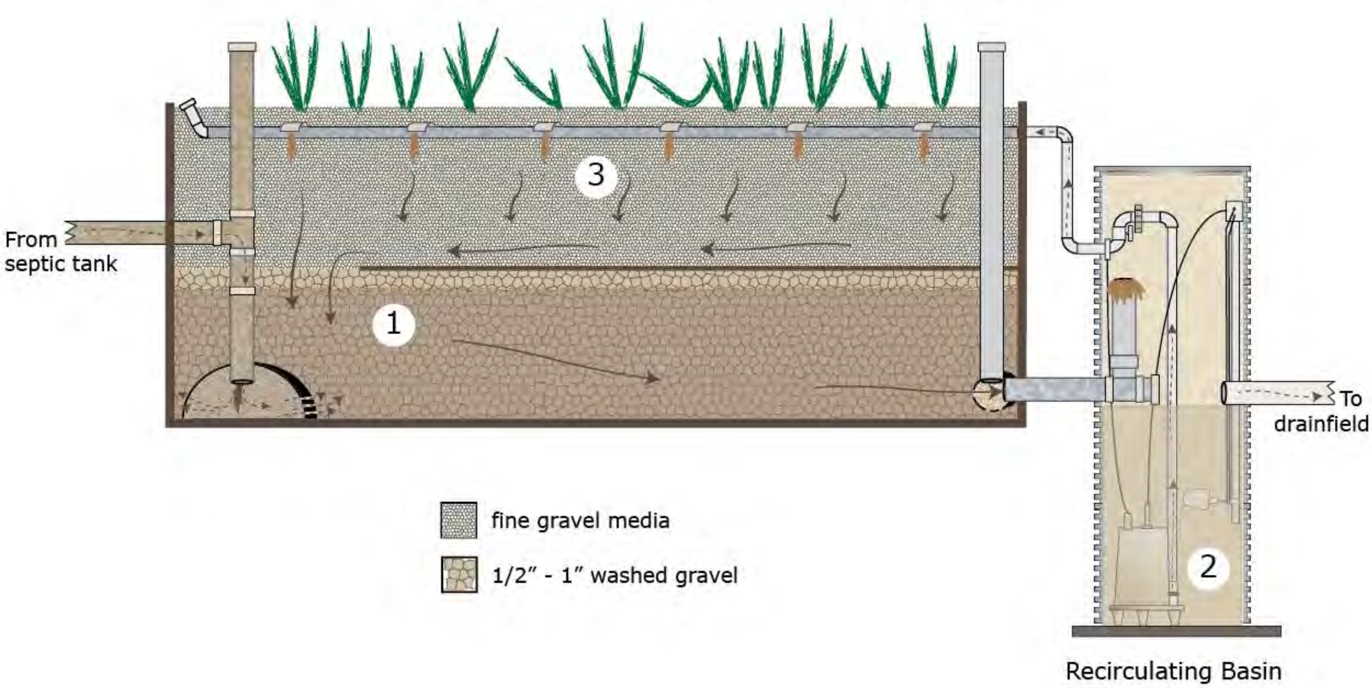
Zone 2: The treated effluent from Zone 1 enters the recirculating basin. As the effluent level rises, a float activates a timer to control the pump. The pump sends timed, multiple doses of effluent (60 doses/day) to the filter bed in Zone 3.

Zone 3: In this oxygen-rich zone, wastewater from the recirculating basin is distributed into the root zone of the vegetated bed. The effluent continues to trickle down through a fine gravel layer where oxygen loving bacteria convert ammonia to nitrate. The effluent then flows across a PVC liner and drops down into the uncovered portion of the bottom gravel layer at the inlet end of the filter in Zone 1.

Zone 1 (repeated circuits): The septic tank effluent, containing the carbon required for bacteria in this level to thrive, mixes with the nitrified effluent. The mixed effluent flows horizontally through the anoxic gravel layer, where bacteria convert nitrates to nitrogen gas.

Zone 2 (repeated circuits): The effluent flows back into the recirculating basin to repeat the process. When the recirculating tank fills to a certain level, the denitrified effluent is discharged to the drainfield.

Vegetated Recirculating Gravel Filter

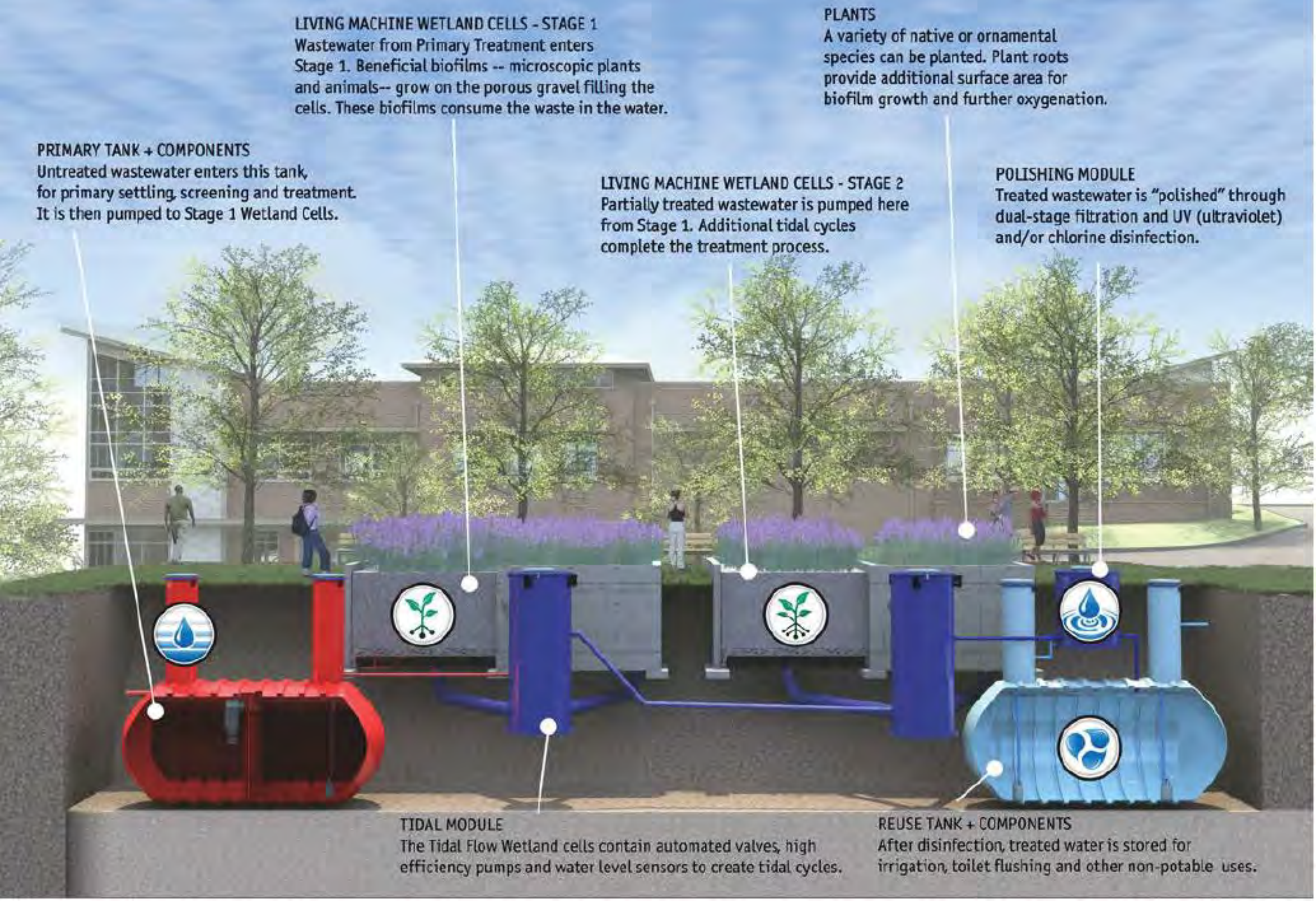


Project Facts

- Sidwell Friends is a K-12 private school located on a 15-acre site in historic Tenleytown, Washington, D.C.
- Completed in 2007, Sidwell Friends School renovated and expanded its fifty-year-old, 33,000 square-foot middle school building.
- The new facility includes an eco-friendly courtyard, a green roof, and an additional 39,000 square-feet of classroom space.
- A wastewater management system cleans 3,000 gallons of water per day. After circulating through the landscape for three to five days, the water is re-used in the building's toilets and cooling tower.
- On-site sewage treatment, water re-use, and water-efficient native plants reduce the school's water consumption by 93 percent.

Vegetative Treatment System - Esalen Institute, Big Sur

Living Machine



Living Machine, SFPUC

Reed bed Wastewater Wetland - UK

AdvanTex® AX-Max Treatment Systems

Applications

Orenco's AdvanTex® AX-Max is a complete, fully-plumbed, AdvanTex Wastewater Treatment Plant for residential, commercial, municipal, and mobile applications with medium-to-large-flows and permits requiring secondary treatment or better. It can be used as a stand-alone unit or in multi-unit arrays under adverse conditions in a wide range of environments. The AX-Max is ideal for:

- Small sites and poor soils
- At-grade or above-grade installations
- Mobile and temporary installations
- Disaster response sanitation
- Remote locations
- Extreme hot or cold climates

General

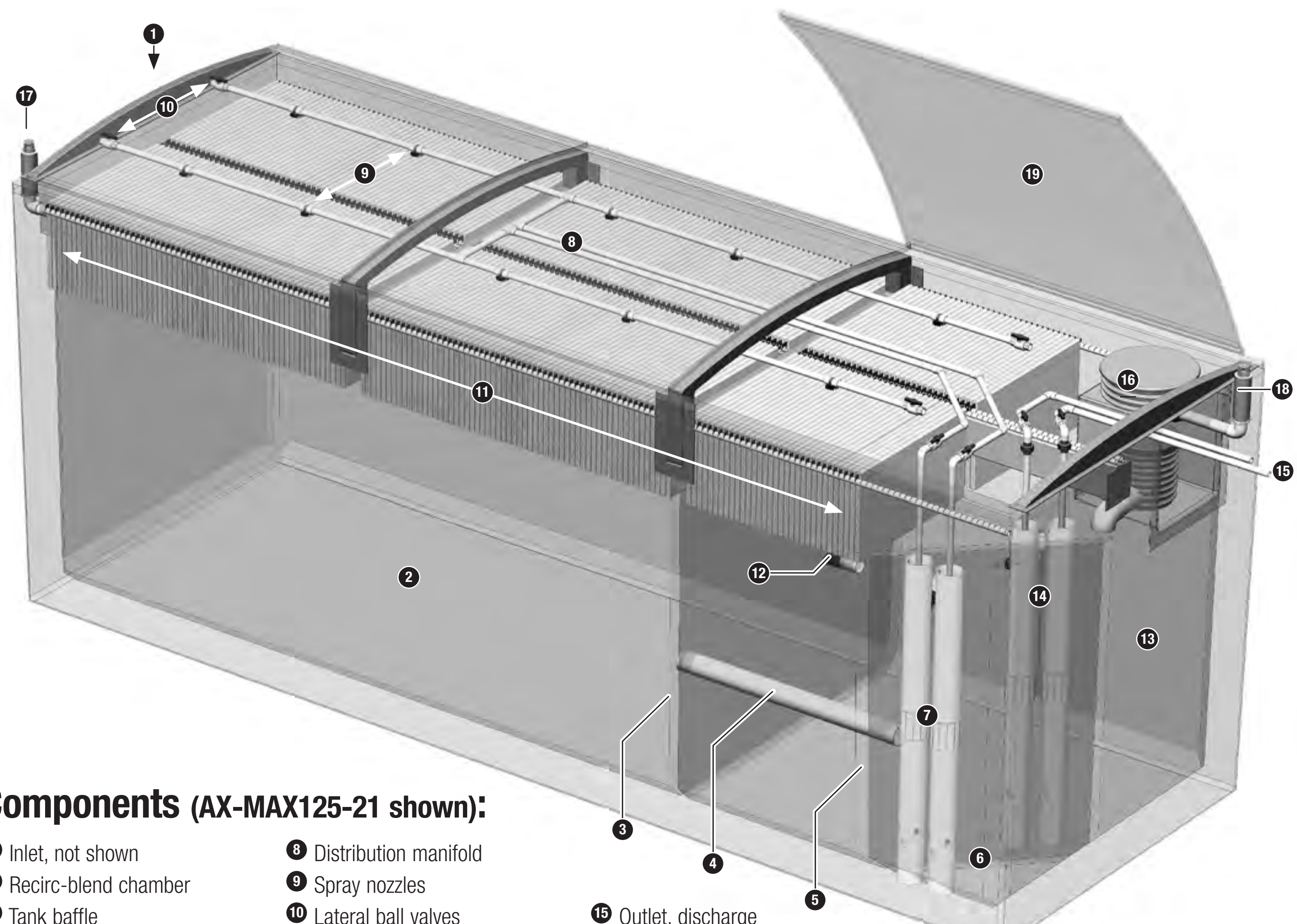
The AX-Max is a modular system that can be preceded by primary treatment or configured to incorporate primary, secondary, and tertiary wastewater treatment before reuse or dispersal.

The heart of the AX-Max system is the AdvanTex Recirculating Treatment Tank, a sturdy, watertight, corrosion-proof fiberglass tank that includes the same dependable, textile treatment media found in all AdvanTex products.

Standard Models

AX-MAX100-14, AX-MAX150-21, AX-MAX200-28, AX-MAX250-35, AX-MAX300-42 (Standard models without pump systems.)

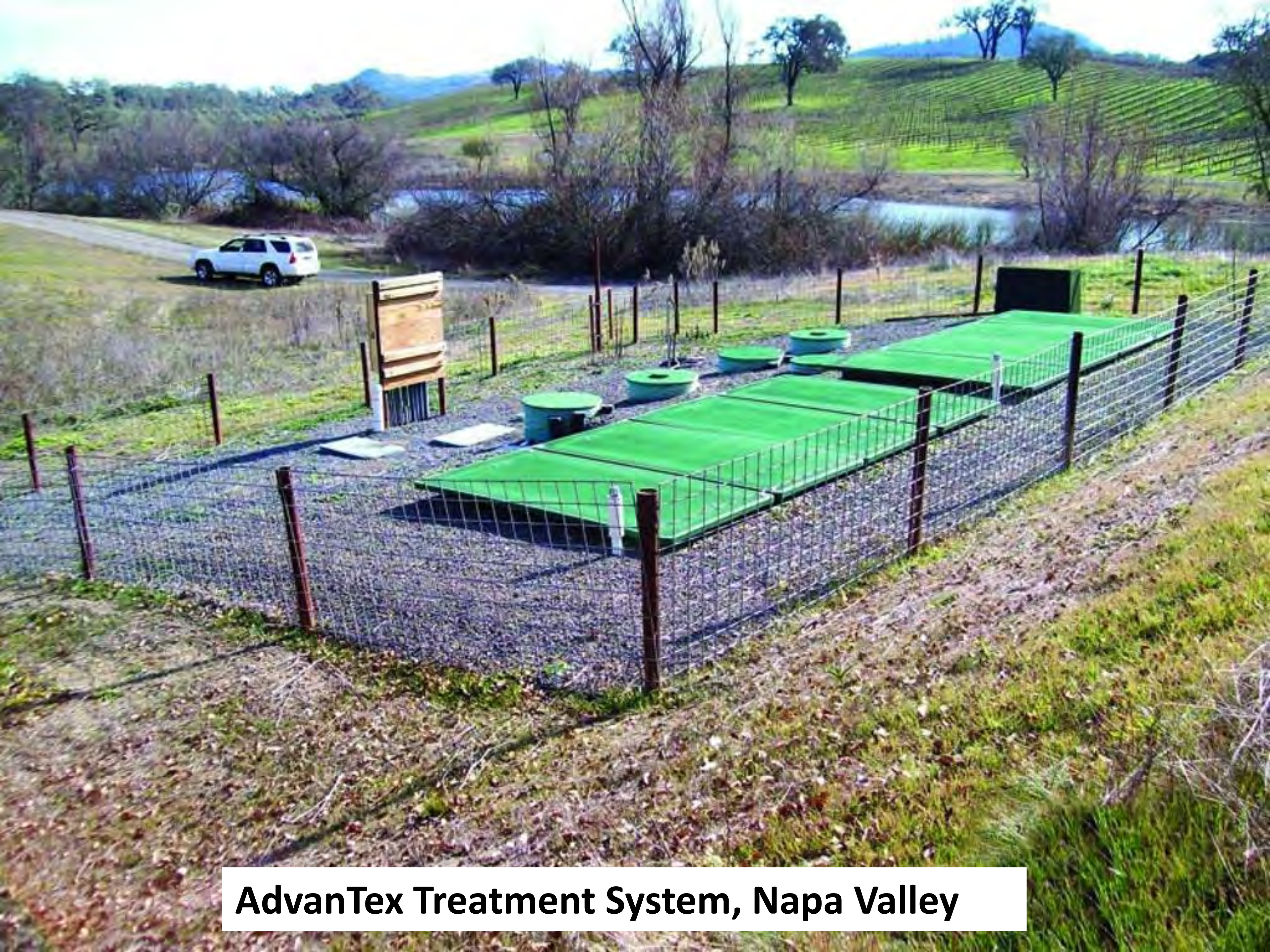
AX-MAX075-14, AX-MAX125-21, AX-MAX175-28, AX-MAX225-35, AX-MAX275-42 (Standard models with pump systems.)



Components (AX-MAX125-21 shown):

1. Inlet, not shown
2. Recirc-blend chamber
3. Tank baffle
4. Recirc-transfer line
5. Recirc-pump chamber baffle
6. Recirc-pump chamber
7. Recirc pumping assembly
8. Distribution manifold
9. Spray nozzles
10. Lateral ball valves
11. AdvanTex textile media
12. Recirc-return valve
13. Recirc-filtrate chamber
14. Discharge pumping assembly
15. Outlet, discharge
16. Air inlet
17. Vent fan assembly
18. Air outlet
19. Hinged lid, typical

AdvanTex Treatment System, Marshall, California



AdvanTex Treatment System, Napa Valley

AX-MAX Textile Filter Wastewater Treatment Plant

Package Wastewater Treatment Plant

APPENDIX D

ONSITE WASTEWATER MANAGEMENT PROGRAMS

ABC's of Onsite Wastewater Management Districts

aka Onsite Wastewater Disposal Zones – "OSWDZ" or "Zones"

Background

- Concept first developed in California in the mid-1970s (Stinson Beach), as an alternative to community sewerage project
- 1978 Authorized in Health and Safety Code, Section 6950
- Enables public agencies (Cities, Counties, Sanitary Districts, Water Districts, CSDs, CSAs) to form Onsite Wastewater Disposal Zones (Zones) to manage wastewater treatment and disposal with the need for area-wide sanitary sewers.
- Can include individual OWTS, Cluster Systems, Community Systems, and combinations
- Formed by local petition or resolution of County BOS
- Requires Public Hearing and possibly a vote - if >35% protests
- Requires County Health Officer and RWQCB approval of technical merits
- LAFCO approval of institutional structure

Examples in California

- Stinson Beach (County Water District)
- Auburn Lake Trails (Georgetown Divide PUD)
- Sea Ranch (Sonoma County Service Area)
- Marshall Community, Tomales Bay (Marin County BOS)
- Town of Paradise
- City of Malibu

General Purposes

1. **Small rural communities** with large numbers or concentrations of older non-conforming OWTS seeking more cost-effective alternative to public sewerage, or growth restrictions.

2. **Large rural subdivision**, including second home/recreational developments to assure proper and effective planning of septic systems, community leachfields, special designs for problem lots, and provide overall maintenance and monitoring functions to minimize long-term sewage disposal problems.

3. **Entire cities,** where onsite systems are the predominant method of wastewater treatment and disposal, such as Town of Paradise (Butte County, 11,000 OWTS) and City of Malibu (Los Angeles County, 6,000 OWTS).

Scope of Potential Activities and Benefits

- **<u>Adopt customized local standards, procedures and practices</u>** for OWTS that vary from County-wide regulations, such as:
  - ✓ Local waiver and variances to streamline approvals, e.g., setbacks, system sizing
  - ✓ Alternative technologies and criteria, such as using greywater systems as a functional element of OWTS capacity, holding tanks, composting toilets
  - ✓ Credit for high efficiency water conservation fixtures
  - ✓ Remodel and additions policies
  - ✓ Streamlined investigative, design and submittal process

- **<u>Provide higher level of community oversight</u>** of OWTS and environmental conditions, such as:
  - ✓ Stream and/or groundwater quality sampling
  - ✓ Regular OWTS inspection and monitoring of County operating permit requirements
  - ✓ Public education regarding OWTS-related issues
  - ✓ Facilitate septic tank pump-outs, as needed
  - ✓ General surveillance of OWTS conditions and preventative maintenance

- **<u>Facilitate the development of cluster systems</u>** and off-site easements, that may include:
  - ✓ Planning & design
  - ✓ Construction inspection
  - ✓ Ownership, operation and maintenance agreements

- **<u>Obtain or facilitate public financing</u>** to support:
  - ✓ Ongoing OWTS management activities
  - ✓ Loans and grants to individual OWTS owners
  - ✓ Financing for construction of cluster systems

Onsite Wastewater Management Zone/District
Alternative Approaches

Function/Activity	Base Program	Mid-Level Program	Comprehensive Program (District)
Summary	Creates a special management area to implement alternative OWTS design standards, along with provisions of additional monitoring and oversight, and a vehicle for cluster systems and public financing opportunities.	Similar to Base Program, but with added opportunities for local involvement in monitoring, inspections, corrective actions and oversight responsibilities; reduces ACDEH staff time with potential cost savings.	Public entity (such as Zone 7) assumes responsibility for all OWTS regulation in place of ACDEH; subject to RWQCB approval through WDRs; can cover all items in Base and Mid-level Programs, including cluster systems.
Structure	Zone of Benefit	Dependent District/Zone	Independent Special District
Examples	Marshall (Marin County)	Sea Ranch (Sonoma County)	Stinson Beach County Water District Town of Paradise City of Malibu
Board of Directors	BOS	BOS	Independent Board of Directors
Regulatory Coverage	ACDEH LAMP	ACDEH LAMP	RWQCB - WDRs
Staff	ACDEH	ACDEH, Zone & Outside Services	District Staff/Outside Services
OWTS Standards	ACDEH	ACDEH & Zone	District
Construction Permitting	New & Repairs – ACDEH	New – ACDEH; Repairs – Zone	District
Operating Permits – OWTS	ACDEH	Zone	District
Operating Permits - Cluster	ACDEH or RWQCB	ACDEH or RWQCB	RWQCB
Cluster System Ownership	County/Zone	County/Zone	District
Monitoring & Inspection	ACDEH & Outside Services	Zone & Outside Services	District
Record Keeping & Reporting	ACDEH/Zone	Zone	District
Public Education	ACDEH/Zone	Zone	District
Fees & Ordinances	Adopted by BOS	Adopted by BOS	Adopted by District
Grants & Loan Opportunities	Yes	Yes	Yes

Onsite Wastewater Disposal Zones

California Health and Safety Code (6950-6982)

Formation

Resolution of Intent to form the "Zone" must include:

(a) **Description.** A description of the boundaries of the territory proposed to be included within the zone. The description may be accompanied by a map showing such boundaries.

(b) **Public Benefit.** The public benefit to be derived from the establishment of such a zone.

(c) **Wastewater Plan**. A description of the proposed types of on-site wastewater disposal systems and a proposed plan for wastewater disposal.

(d) **Number of Users.** The number of residential units and commercial users in the proposed zone which the public agency proposes to serve.

(e) **Financing.** The proposed means of financing the operations of the zone.

(f) **Public Hearing Details.** The time and place for a hearing by the board on the question of the formation and extent of the proposed zone, and the question of the number and type of the residential units and commercial units that the public agency proposes to serve in the proposed zone and that at such time and place any interested persons will be heard.

Powers

An on-site waste water disposal zone shall have the following powers:

(a) To collect, treat, reclaim, or dispose of waste water without the use of communitywide sanitary sewers or sewage systems and without degrading water quality within or outside the zone.

(b) To acquire, design, own, construct, install, operate, monitor, inspect, and maintain on-site wastewater disposal systems, not to exceed the number of systems specified pursuant to either Section 6960 or Section 6960.1, within the zone in a manner which will promote water quality, prevent the pollution, waste, and contamination of water, and abate nuisances.

(c) To conduct investigations, make analyses, and monitor conditions with regard to water quality within the zone.

(d) To adopt and enforce reasonable rules and regulations necessary to implement the purposes of the zone. Such rules and regulations may be adopted only after the board conducts a public hearing after giving public notice pursuant to Section 6066 of the Government Code.

Health Officer and Regional Water Board Review and Report of Findings:

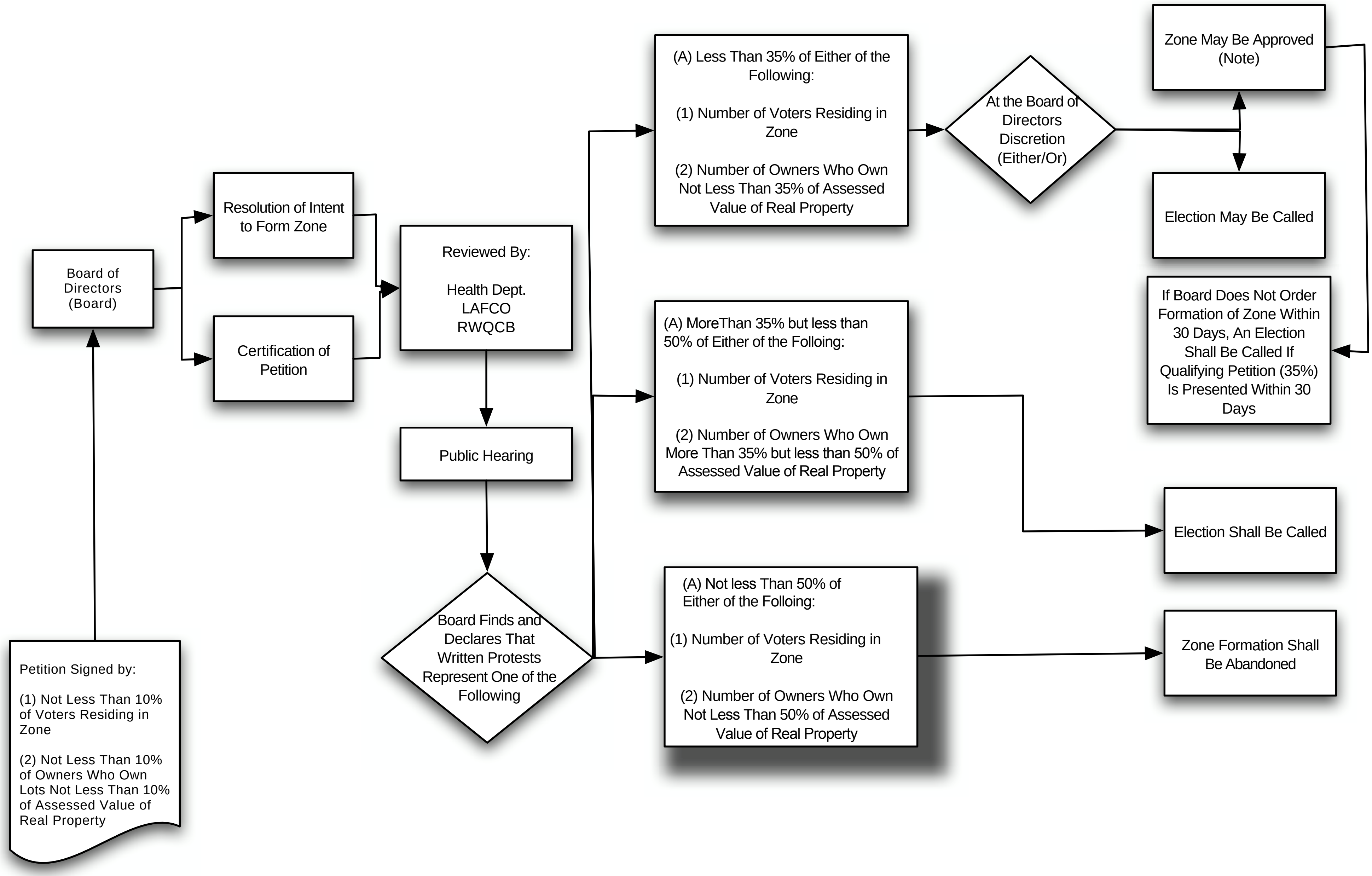
After receiving notice pursuant to subdivision (b) of Section 6958:

- The Health Officer and Regional Water Board shall each review the proposed formation and report their findings in writing to the board of directors of the public agency.

- The report(s) shall specify the maximum number, type, volume, and location of on-site wastewater disposal systems which could be operated within the proposed zone without individually or collectively, directly or indirectly, resulting in a nuisance or hazard to public health.

- The Health Officer and Regional Water Board may require from the public agency such information as may be reasonably necessary to make the findings required in this section.

Process for Formation of an On-Site Wastewater Disposal Zone
California Health and Safety Code, Article 2, Sections 6955 - 6973



APPENDIX E

COST ESTIMATION TABLES

Preliminary Composite Cost Estimate - Alternative 2
OWTS Upgrades and Management District

OWTS Upgrade Category	Estimated Percentage of Total OWTS	Number of OWTS	Estimated Average Cost ($)	Estimated Total Cost ($)
Existing Code Compliant OWTS	5%	12	0	0
Low Level of Upgrade Required	20%	50	$18,000	$900,000
Mid Level of Upgrade Required	25%	61	$37,000	$2,257,000
High Level of Upgrade Required	50%	121	$64,000	$7,744,000
Total	**100%**	**244**		**$10,901,000**
Estimated Average Cost Per Parcel (for 244 parcels)				**$44,676**

Preliminary Cost Estimate - Alternative 2

Onsite System Upgrade and Management Program

L1- Low-level Upgrade - Document, Inspect, Test and Add Risers				
Description	**Unit**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Document and Test Existing Field	LS	1	$2,500	$ 2,500
Pump-out, Clean and Inspect Exist Tank	LS	1	$1,500	$ 1,500
Upgrade Tank with Risers, Fittings, Grouting	LS	1	$2,500	$ 2,500
Engineering and Permitting	LS	1	$3,500	$ 3,500
			Sub-total	**$ 10,000**
			Contingency @ 20%	$ 2,000
			ON-LOT UPGRADE ESTIMATED COST	**$ 12,000**

L2 - Low-level - Inspect, Upgrade Tank, Add Leaching Trench				
Description	**Unit**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Pump-out, Clean and Inspect Exist Tank	LS	1	$1,500	$ 1,500
Upgrade Tank with Risers, Fittings, Grouting	LS	1	$2,500	$ 2,500
Pipe Replacement	LS	1	$1,500	$ 1,500
Leachfield Extension	LF	100	$50	$ 5,000
Engineering and Permitting	LS	1	$4,500	$ 4,500
			Sub-total	**$ 15,000**
			Contingency @ 20%	$ 3,000
			ON-LOT UPGRADE ESTIMATED COST	**$ 18,000**

L3 - Low-level - Replace Septic Tank				
Description	**Unit**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Document and Test Existing Field	LS	1	$2,500	$ 2,500
Inspect & Test Tank and Field	LS	1	$1,500	$ 1,500
Abandon Existing Septic Tank	LS	1	$2,500	$ 2,500
Install New Septic Tank	LS	1	$7,500	$ 7,500
Pipe Replacement	LS	1	$1,500	$ 1,500
Engineering and Permitting	LS	1	$4,500	$ 4,500
			Sub-total	**$ 20,000**
			Contingency @ 20%	$ 4,000
			ON-LOT UPGRADE ESTIMATED COST	**$ 24,000**

Preliminary Cost Estimate - Alternative 2

Onsite System Upgrade and Management Program

M1- Mid-level Repair - Upgrade Tank, Replace Leachfield				
Description	**Unit**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Pump-out, Clean and Inspect Exist Tank	LS	1	$1,500	$ 1,500
Upgrade Tank w/Risers, Fittings, Grout	LS	1	$2,500	$ 2,500
Pipe Replacement	LS	1	$1,500	$ 1,500
New Gravity Leachfield	LF	200	$60	$ 12,000
Engineering and Permitting	LS	1	$7,500	$ 7,500
			Sub-total	**$ 25,000**
			Contingency @ 20%	$ 5,000
			ON-LOT UPGRADE ESTIMATED COST	**$ 30,000**

M2- Mid-level Repair - Replace Tank, Expand Existing Leachfield				
Description	**Unit**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Inspect & Test Tank and Field	LS	1	$1,500	$ 1,500
Abandon Existing Septic Tank	LS	1	$2,500	$ 2,500
Install New Septic Tank	LS	1	$7,500	$ 7,500
Pipe Replacement	LS	1	$1,500	$ 1,500
Leachfield Extension	LF	100	$60	$ 6,000
Engineering and Permitting	LS	1	$9,000	$ 9,000
			Sub-total	**$ 28,000**
			Contingency @ 20%	$ 5,600
			ON-LOT UPGRADE ESTIMATED COST	**$ 33,600**

M3- Mid-level Repair - Upgrade Tank, Add Pressure Distribution Leachfield				
Description	**Unit**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Pump-out, Clean and Inspect Exist Tank	LS	1	$1,500	$ 1,500
Upgrade Tank w/Risers, Fittings, Grout	LS	1	$2,500	$ 2,500
Pipe Replacement	LS	1	$1,500	$ 1,500
Pump-Dosing System	LS	1	$12,000	$ 12,000
Pressure Distribution Leachfield	LF	200	$60	$ 12,000
Engineering and Permitting	LS	1	$10,000	$ 10,000
			Sub-total	**$ 39,500**
			Contingency @ 20%	$ 7,900
			ON-LOT UPGRADE ESTIMATED COST	**$ 47,400**

Preliminary Cost Estimate - Alternative 2
Onsite System Upgrade and Management Program

H1- High-level Replacement - New Tank, New Gravity Leachfield

Description	Unit	Est Qty	Unit Cost ($)	Total Cost ($)
Inspect & Test Tank and Field	LS	1	$1,500	$ 1,500
Abandon Existing Septic Tank	LS	1	$2,500	$ 2,500
Install New Septic Tank	LS	1	$7,500	$ 7,500
Pipe Replacement	LS	1	$1,500	$ 1,500
New Gravity Leachfield	LF	200	$60	$ 12,000
Engineering and Permitting	LS	1	$12,000	$ 12,000
			Sub-total	**$ 37,000**
			Contingency @ 20%	$ 7,400
			ON-LOT UPGRADE ESTIMATED COST	**$ 44,400**

H2-High-level Replacement - New Tank, Advanced Treatment, Expand Leachfield

Description	Unit	Est Qty	Unit Cost ($)	Total Cost ($)
Inspect & Test Tank and Field	LS	1	$1,500	$ 1,500
Abandon Existing Septic Tank	LS	1	$2,500	$ 2,500
Install New Septic Tank	LS	1	$7,500	$ 7,500
Supplemental Treatment System	LS	1	$18,000	$ 18,000
Pipe Replacement	LS	1	$1,500	$ 1,500
Leachfield Expansion (Gravity)	LF	100	$60	$ 6,000
Engineering and Permitting	LS	1	$15,000	$ 15,000
			Sub-total	**$ 52,000**
			Contingency @ 20%	$ 10,400
			ON-LOT UPGRADE ESTIMATED COST	**$ 62,400**

H3- High-level Replacement - New Tank, Supplemental Treatment & Drip or PD Leachfield

Description	Unit	Est Qty	Unit Cost ($)	Total Cost ($)
Inspect & Test Tank and Field	LS	1	$1,500	$ 1,500
Abandon Existing Septic Tank	LS	1	$2,500	$ 2,500
Install New Septic Tank	LS	1	$7,500	$ 7,500
Supplemental Treatment System	LS	1	$18,000	$ 18,000
Pipe Replacement	LS	1	$1,500	$ 1,500
Pump-Dosing System	LS	1	$10,000	$ 10,000
Drip or Pressure Distribution Leachfield	LF	200	$60	$ 12,000
Engineering and Permitting	LS	1	$18,000	$ 18,000
			Sub-total	**$ 71,000**
			Contingency @ 20%	$ 14,200
			ON-LOT UPGRADE ESTIMATED COST	**$ 85,200**

Preliminary Cost Estimate - Alternative 3A
Kilkare Woods Community Wastewater System
100% Participation (103 parcels) Design Flow: 12,800 gpd

Public Sewer Facilities				
Description	**Units**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Wastewater Collection System				
4-inch Gravity Effluent Sewer	LF	5,570	$75	$ 417,750
3-inch Dia STEP Sewer	LF	3,675	$60	$ 220,500
2-inch Dia STEP Sewer	LF	1,475	$50	$ 73,750
Cluster Lift Station	LS	3	$25,000	$ 75,000
Terminal Flush Ports	EA	3	$7,500	$ 22,500
Cleanouts	EA	28	$1,500	$ 42,000
Utility Locating (est. 6 per 1,000 ft)	EA	60	$1,000	$ 60,000
Traffic Control	Days	40	$2,000	$ 80,000
			Collection Subtotal	**$ 991,500**
Wastewater Treatment				
Influent EQ Tank, Pumps & Controls	GAL	6,000	$5	$ 30,000
Recirculating Gravel Filter Beds	SF	3,200	$75	$ 240,000
Recirculation Tank, Pumps and Controls	GAL	3,000	$6	$ 18,000
Disinfection System	LS	1	$15,000	$ 15,000
Electrical, Control Bldg, Site Work & Fencing	LS	1	$50,000	$ 50,000
Emergency Generator	LS	1	$40,000	$ 40,000
			Treatment Subtotal	**$ 393,000**
Wastewater Dispersal				
Leachfield Dosing Tank, Pumps, & Controls	GAL	6,000	$5	$ 30,000
PD Chamber Leachfield	LF	1,000	$50	$ 50,000
Drip Dispersal Field	SF	6,000	$5	$ 30,000
Piping, Valves & Appurtenances	LF	2,000	$15	$ 30,000
Erosion Control and Site Restoration	LS	1	$15,000	$ 15,000
Monitoring Wells	EA	4	$2,000	$ 8,000
			Dispersal Sub-total	**$ 163,000**
			Public Facilities Subtotal	**$ 1,547,500**
			Miscellaneous & Contingency @ 20%	**$ 309,500**
			Planning, Engineering, Permitting & Administration @ 40%	**$ 619,000**
			PUBLIC FACILITIES - TOTAL ESTIMATED COST	**$ 2,476,000**

Individual On-lot Facilites				
Description	**Unit**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Septic Tank Abandonments*	EA	77	$2,500	$ 192,500
STEG Unit - Upgrade Existing Septic Tank	EA	14	$2,500	$ 35,000
STEG Unit - New Septic Tank	EA	41	$7,500	$ 307,500
Gravity Lateral Connections (50 ft ea)	LF	2,700	$50	$ 135,000
STEP Unit - Existing tank, new pump	EA	12	$7,500	$ 90,000
STEP Unit - New tank and pump	EA	36	$12,500	$ 450,000
Pressure Lateral Connections (50 ft ea)	LF	2,400	$40	$ 96,000
Engineering and Permitting	EA	103	$2,500	$ 257,500
			Sub-total	**$ 1,563,500**
			Contingency @ 20%	$ 312,700
			ON-LOT FACILIITES - TOTAL ESTIMATED COST	**$ 1,876,200**

TOTAL ESTIMATED CONSTRUCTION COST	**$ 4,352,200**
ESTIMATED COST PER RESIDENTIAL CONNECTION	**$ 42,254**

* Assume 25% of septic tanks can be salvaged, 75% replaced

Preliminary Cost Estimate - Alternative 3B
Kilkare Woods Community Wastewater System
75% Participation (78 parcels) Design Flow: 9,675 gpd

Public Sewer Facilities				
Description	**Units**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Wastewater Collection System				
4-inch Gravity Effluent Sewer	LF	5,570	$75	$ 417,750
3-inch Dia STEP Sewer	LF	3,675	$60	$ 220,500
2-inch STEP Sewer	LF	1,475	$50	$ 73,750
Cluster Lift Station	LS	3	$25,000	$ 75,000
Terminal Flush Ports	EA	3	$7,500	$ 22,500
Cleanouts	EA	28	$1,500	$ 42,000
Utility Locating (est. 5 per 1,000 ft)	EA	50	$1,000	$ 50,000
Traffic Control	Days	35	$2,000	$ 70,000
			Collection Subtotal	**$ 971,500**
Wastewater Treatment				
Influent EQ Tank, Pumps & Controls	GAL	5,000	$5	$ 25,000
Recirculating Gravel Filter Beds	SF	2,400	$75	$ 180,000
Recirculation Tank, Pumps and Controls	GAL	2,500	$6	$ 15,000
Disinfection System	LS	1	$12,000	$ 12,000
Electrical, Control Bldg, Site Work & Fencing	LS	1	$45,000	$ 45,000
Emergency Generator	LS	1	$40,000	$ 40,000
			Treatment Subtotal	**$ 317,000**
Wastewater Dispersal				
Leachfield Dosing Tank, Pumps, Controls	GAL	5,000	$5	$ 25,000
PD Chamber Leachfield	LF	1,000	$50	$ 50,000
Drip Dispersal Field	SF	3,000	$5	$ 15,000
Piping, Valves & Appurtenances	LF	1,800	$15	$ 27,000
Erosion Control and Site Restoration	LS	1	$12,000	$ 12,000
Monitoring Wells	EA	4	$2,000	$ 8,000
			Dispersal Sub-total	**$ 137,000**
			Public Facilities Subtotal	**$ 1,425,500**
			Miscellaneous & Contingency @ 20%	**$ 285,100**
			Planning, Engineering, Permitting & Administration @ 40%	**$ 570,200**
			PUBLIC FACILITIES - TOTAL ESTIMATED COST	**$ 2,280,800**

Individual On-lot Facilites				
Description	**Unit**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Septic Tank Abandonments*	EA	59	$2,500	$ 147,500
STEG Unit - Upgrade Existing Septic Tank	EA	10	$2,500	$ 25,000
STEG Unit - New Septic Tank	EA	32	$7,500	$ 240,000
Gravity Lateral Connections (50 ft ea)	LF	2,000	$50	$ 100,000
STEP Unit - Existing tank, new pump	EA	9	$7,500	$ 67,500
STEP Unit - New tank and pump	EA	27	$12,500	$ 337,500
Pressure Lateral Connections (50 ft ea)	LF	1800	$40	$ 72,000
Engineering and Permitting	EA	78	$2,500	$ 195,000
			Sub-total	**$ 1,184,500**
			Contingency @ 20%	$ 236,900
			ON-LOT FACILIITES - TOTAL ESTIMATED COST	**$ 1,421,400**

TOTAL ESTIMATED CONSTRUCTION COST	**$ 3,702,200**
ESTIMATED COST PER RESIDENTIAL CONNECTION	**$ 47,464**

* Assume 25% of septic tanks can be salvaged, 75% replaced

Preliminary Cost Estimate - Alternative 3C
Kilkare Woods Community Wastewater System
50% Participation (52 parcels) Design Flow: 6,425 gpd

Public Sewer Facilities				
Description	**Units**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Wastewater Collection System				
4-inch Gravity Effluent Sewer	LF	5,570	$75	$ 417,750
3-inch Dia STEP Sewer	LF	3,675	$60	$ 220,500
2-inch STEP Sewer	LF	1,475	$50	$ 73,750
Cluster Lift Station	LS	3	$25,000	$ 75,000
Terminal Flush Ports	EA	3	$7,500	$ 22,500
Cleanouts	EA	28	$1,500	$ 42,000
Utility Locating (est. 4 per 1,000 ft)	EA	40	$1,000	$ 40,000
Traffic Control	Days	30	$2,000	$ 60,000
			Collection Subtotal	**$ 951,500**
Wastewater Treatment				
Influent EQ Tank, Pumps & Controls	GAL	4,000	$5	$ 20,000
Recirculating Gravel Filter Beds	SF	1,600	$75	$ 120,000
Recirculation Tank, Pumps and Controls	GAL	2,000	$6	$ 12,000
Disinfection System	LS	-	$10,000	$ -
Electrical, Control Bldg, Site Work & Fencing	LS	1	$40,000	$ 40,000
Emergency Generator	LS	1	$40,000	$ 40,000
			Treatment Subtotal	**$ 232,000**
Wastewater Dispersal				
Leachfield Dosing Tank (5,000 gal)	GAL	4,000	$5	$ 20,000
PD Chamber Leachfield	LF	1,000	$50	$ 50,000
Drip Dispersal Field	SF	-	$5	$ -
Piping, Valves & Appurtenances	LF	1,500	$15	$ 22,500
Erosion Control and Site Restoration	LS	1	$10,000	$ 10,000
Monitoring Wells	EA	4	$2,000	$ 8,000
			Dispersal Sub-total	**$ 110,500**
			Public Facilities Subtotal	**$ 1,294,000**
			Miscellaneous & Contingency @20%	**$ 258,800**
			Planning, Engineering, Permitting & Administration @ 40%	**$ 517,600**
			PUBLIC FACILITIES - TOTAL ESTIMATED COST	**$ 2,070,400**

Individual On-lot Facilites				
Description	**Unit**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Septic Tank Abandonments*	EA	40	$2,500	$ 100,000
STEG Unit - Upgrade Existing Septic Tank	EA	6	$2,500	$ 15,000
STEG Unit - New Septic Tank	EA	22	$7,500	$ 165,000
Gravity Lateral Connections (50 ft ea)	LF	1,300	$50	$ 65,000
STEP Unit - Existing tank, new pump	EA	6	$7,500	$ 45,000
STEP Unit - New tank and pump	EA	18	$12,500	$ 225,000
Pressure Lateral Connections (50 ft ea)	LF	1,200	$40	$ 48,000
Engineering and Permitting	EA	52	$2,500	$ 130,000
			Sub-total	**$ 793,000**
			Contingency @ 20%	$ 158,600
			ON-LOT FACILIITES - TOTAL ESTIMATED COST	**$ 951,600**

TOTAL ESTIMATED CONSTRUCTION COST	**$ 3,022,000**
ESTIMATED COST PER RESIDENTIAL CONNECTION	**$ 58,115**

* Assume 25% of septic tanks can be salvaged, 75% replaced

Preliminary Cost Estimate - Alternative 4A
Downtown Sunol Community Wastewater System

100% Residential Participation (73 total parcels)[1] **Design Flow: 16,000 gpd**

Public Sewer Facilities				
Description	**Units**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Wastewater Collection System				
3-inch Dia STEP Sewer	LF	6,300	$60	$ 378,000
Terminal Flush Ports	EA	7	$7,500	$ 52,500
Cleanouts	EA	0	$1,500	$ -
Utility Locating (est. 10 per 1,000 ft)	EA	60	$1,000	$ 60,000
Traffic Control	Days	35	$2,000	$ 70,000
			Collection Subtotal	**$ 560,500**
Wastewater Treatment				
Influent EQ Tank & Pumps	GAL	10,000	$5	$ 50,000
Recirculating Gravel Filter Beds	SF	4,000	$75	$ 300,000
Recirculation Tank, Pumps and Controls	GAL	5,000	$6	$ 30,000
Disinfection System	LS	1	$20,000	$ 20,000
Electrical, Control Building, Fencing, Site Work	LS	1	$60,000	$ 60,000
Emergency Generator	LS	1	$40,000	$ 40,000
			Treatment Subtotal	**$ 500,000**
Wastewater Dispersal				
Leachfield Dosing Tank, Pumps, Controls	GAL	5,000	$5	$ 25,000
PD Traffic Rated Chamber Leachfield	LF	1,600	$100	$ 160,000
Drip Dispersal Field	SF	2,000	$5	$ 10,000
Piping, Valves & Appurtenances	LF	3,000	$15	$ 45,000
Erosion Control and Site Restoration	LS	1	$25,000	$ 25,000
Monitoring Wells	EA	4	$2,000	$ 8,000
			Dispersal Sub-total	**$ 273,000**
			Public Facilities Subtotal	**$ 1,333,500**
			Miscellaneous & Contingency @ 20%	**$ 266,700**
			Planning, Engineering, Permitting & Administration @ 40%	**$ 533,400**
			PUBLIC FACILITIES - TOTAL ESTIMATED COST	**$ 2,133,600**

Individual On-lot Facilites				
Description	**Unit**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Septic Tank Abandonments*	EA	54	$2,500	$ 135,000
STEG Unit - Upgrade Existing Septic Tank	EA	0	$2,500	$ -
STEG Unit - New Septic Tank	EA	0	$7,500	$ -
Gravity Lateral Connections (75 ft ea)	LF	0	$50	$ -
STEP Unit - Existing tank, new pump	EA	18	$7,500	$ 135,000
STEP Unit - New tank and pump	EA	54	$12,500	$ 675,000
Pressure Lateral Connections (75 ft ea)	LF	5,475	$40	$ 219,000
Additional costs for Large Non-Residential	EA	5	$10,000	$ 50,000
New Public Restroom STEP Unit	LS	1	$25,000	$ 25,000
Engineering and Permitting	EA	73	$2,500	$ 182,500
			Sub-total	**$ 1,421,500**
			Contingency @ 20%	$ 284,300
			ON-LOT FACILIITES - TOTAL ESTIMATED COST	**$ 1,705,800**

TOTAL ESTIMATED CONSTRUCTION COST	**$ 3,839,400**
ESTIMATED COST PER RESIDENTIAL CONNECTION	**$ 38,782**

[1]Service Area: 60 residences, 13 non-residential, School, Public Restroomat 3 each (99 ESDs)

* Assume 25% of septic tanks can be salvaged, 75% replaced

Preliminary Cost Estimate - Alternative 4B
Downtown Sunol Community Wastewater System

75% Residential Participation (58 total parcels)[1] **Design Flow: 14,125 gpd**

Public Sewer Facilities				
Description	**Units**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Wastewater Collection System				
3-inch Dia STEP Sewer	LF	6,300	$60	$ 378,000
Terminal Flush Ports	EA	7	$7,500	$ 52,500
Cleanouts	EA	0	$1,500	$ -
Utility Locating (est. 8 per 1,000 ft)	EA	48	$1,000	$ 48,000
Traffic Control	Days	30	$2,000	$ 60,000
			Collection Subtotal	**$ 538,500**
Wastewater Treatment				
Influent EQ Tank & Pumps	GAL	9,000	$5	$ 45,000
Recirculating Gravel Filter Beds	SF	3,600	$75	$ 270,000
Recirculation Tank, Pumps and Controls	GAL	4,000	$6	$ 24,000
Disinfection System	LS	1	$15,000	$ 15,000
Electrical, Control Building, Fencing, Site Work	LS	1	$50,000	$ 50,000
Emergency Generator	LS	1	$40,000	$ 40,000
			Treatment Subtotal	**$ 444,000**
Wastewater Dispersal				
Leachfield Dosing Tank, Pumps, Controls	GAL	4,500	$5	$ 22,500
PD Traffic Rated Chamber Leachfield	LF	1,400	$100	$ 140,000
Drip Dispersal Field	SF	2,000	$5	$ 10,000
Piping, Valves & Appurtenances	LF	2,500	$15	$ 37,500
Erosion Control and Site Restoration	LS	1	$25,000	$ 25,000
Monitoring Wells	EA	4	$2,000	$ 8,000
			Dispersal Sub-total	**$ 243,000**
			Public Facilities Subtotal	**$ 1,225,500**
			Miscellaneous & Contingency @ 20%	**$ 245,100**
			Planning, Engineering, Permitting & Administration @ 40%	**$ 490,200**
			PUBLIC FACILITIES - TOTAL ESTIMATED COST	**$ 1,960,800**

Individual On-lot Facilites				
Description	**Unit**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Septic Tank Abandonments*	EA	43	$2,500	$ 107,500
STEG Unit - Upgrade Existing Septic Tank	EA	0	$2,500	$ -
STEG Unit - New Septic Tank	EA	0	$7,500	$ -
Gravity Lateral Connections (75 ft ea)	LF	0	$50	$ -
STEP Unit - Existing tank, new pump	EA	14	$7,500	$ 105,000
STEP Unit - New tank and pump	EA	43	$12,500	$ 537,500
Pressure Lateral Connections (75 ft ea)	LF	4,350	$40	$ 174,000
Additional costs for Large Non-Residential	EA	5	$10,000	$ 50,000
New Public Restroom STEP Unit	LS	1	$25,000	$ 25,000
Engineering and Permitting	EA	58	$2,500	$ 145,000
			Sub-total	**$ 1,144,000**
			Contingency @ 20%	$ 228,800
			ON-LOT FACILIITES - TOTAL ESTIMATED COST	**$ 1,372,800**

TOTAL ESTIMATED CONSTRUCTION COST	**$ 3,333,600**
ESTIMATED COST PER RESIDENTIAL CONNECTION	**$ 39,686**

[1]Service Area: 45 residences, 13 non-residential, School, Public Restroom at 3 each (84 ESDs)

* Assume 25% of septic tanks can be salvaged, 75% replaced

Preliminary Cost Estimate - Alternative 4C
Downtown Sunol Community Wastewater System
50% Residential Participation (43 total parcels) Design Flow: 12,250 gpd

Public Sewer Facilities				
Description	**Units**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Wastewater Collection System				
3-inch Dia STEP Sewer	LF	6,300	$60	$ 378,000
Terminal Flush Ports	EA	7	$7,500	$ 52,500
Cleanouts	EA	0	$1,500	$ -
Utility Locating (est. 6 per 1,000 ft)	EA	36	$1,000	$ 36,000
Traffic Control	Days	25	$2,000	$ 50,000
			Collection Subtotal	**$ 516,500**
Wastewater Treatment				
Influent EQ Tank & Pumps	GAL	7,500	$5	$ 37,500
Recirculating Gravel Filter Beds	SF	3,000	$75	$ 225,000
Recirculation Tank, Pumps and Controls	GAL	3,500	$6	$ 21,000
Disinfection System	LS	1	$12,000	$ 12,000
Electrical, Control Building, Fencing, Site Work	LS	1	$45,000	$ 45,000
Emergency Generator	LS	1	$40,000	$ 40,000
			Treatment Subtotal	**$ 380,500**
Wastewater Dispersal				
Leachfield Dosing Tank, Pumps, Controls	GAL	4,000	$5	$ 20,000
PD Traffic Rated Chamber Leachfield	LF	1,200	$100	$ 120,000
Drip Dispersal Field	SF	2,000	$5	$ 10,000
Piping, Valves & Appurtenances	LF	2,000	$15	$ 30,000
Erosion Control and Site Restoration	LS	1	$20,000	$ 20,000
Monitoring Wells	EA	4	$2,000	$ 8,000
			Dispersal Sub-total	**$ 208,000**
			Public Facilities Subtotal	**$ 1,105,000**
			Miscellaneous & Contingency @ 20%	**$ 221,000**
			Planning, Engineering, Permitting & Administration @ 40%	**$ 442,000**
			PUBLIC FACILITIES - TOTAL ESTIMATED COST	**$ 1,768,000**

Individual On-lot Facilites				
Description	**Unit**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Septic Tank Abandonments*	EA	32	$2,500	$ 80,000
STEG Unit - Upgrade Existing Septic Tank	EA	0	$2,500	$ -
STEG Unit - New Septic Tank	EA	0	$7,500	$ -
Gravity Lateral Connections (75 ft ea)	LF	0	$50	$ -
STEP Unit - Existing tank, new pump	EA	10	$7,500	$ 75,000
STEP Unit - New tank and pump	EA	32	$12,500	$ 400,000
Pressure Lateral Connections (75 ft ea)	LF	3,225	$40	$ 129,000
Additional costs for Large Non-Residential	EA	5	$10,000	$ 50,000
New Public Restroom STEP Unit	LS	1	$25,000	$ 25,000
Engineering and Permitting	EA	43	$2,500	$ 107,500
			Sub-total	**$ 866,500**
			Contingency @ 20%	$ 173,300
			ON-LOT FACILIITES - TOTAL ESTIMATED COST	**$ 1,039,800**

TOTAL ESTIMATED CONSTRUCTION COST	**$ 2,807,800**
ESTIMATED COST PER ESD/CONNECTION	**$ 40,693**

[1] Service Area: 30 residences,13 non-residential, School, Public Restroom at 3 each (69 ESDs)

* Assume 25% of septic tanks can be salvaged, 75% replaced

Preliminary Cost Estimate - Alternative 5A
Downtown - Lower Kilkare Road Community Wastewater System
100% Participation (142 parcels) Design Flow: 25,000 gpd

Public Sewer Facilities				
Description	**Units**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Wastewater Collection System				
4-inch Gravity Effluent Sewer	LF	12,600	$75	$ 945,000
3-inch Dia STEP Sewer	LF	4,500	$60	$ 270,000
Terminal Flush Ports	EA	8	$7,500	$ 60,000
Cleanouts	EA	60	$1,500	$ 90,000
Utility Locating (est. 6 per 1,000 ft)	EA	100	$1,000	$ 100,000
Traffic Control	Days	50	$2,000	$ 100,000
			Collection Subtotal	**$ 1,565,000**
Wastewater Treatment				
Influent EQ Tank & Pumps	GAL	18,000	$5	$ 90,000
Recirculating Gravel Filter Beds	SF	6,400	$75	$ 480,000
Recirculation Tank, Pumps and Controls	GAL	8,000	$6	$ 48,000
Disinfection System	LS	1	$30,000	$ 30,000
Site Improvements, Control Building and Fencing	LS	1	$80,000	$ 80,000
Emergency Generator	LS	1	$50,000	$ 50,000
			Treatment Subtotal	**$ 778,000**
Wastewater Dispersal				
Leachfield Dosing Tank, Pumps, Controls	GAL	10,000	$5	$ 50,000
PD Traffic-rated Chamber Leachfield - Depot Park	LF	1,600	$100	$ 160,000
Drip Dispersal Field - Depot Park	SF	8,500	$5	$ 42,500
Piping, Valves & Appurtenances	LF	5,000	$15	$ 75,000
Erosion Control and Site Restoration	LS	1	$50,000	$ 50,000
Monitoring Wells	EA	8	$2,000	$ 16,000
			Dispersal Sub-total	**$ 393,500**
			Public Facilities Subtotal	**$ 2,736,500**
			Miscellaneous & Contingency @ 20%	**$ 547,300**
			Planning, Engineering, Permitting & Administration @ 40%	**$ 1,094,600**
			PUBLIC FACILITIES - TOTAL ESTIMATED COST	**$ 4,378,400**

Individual On-lot Facilites				
Description	**Unit**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Septic Tank Abandonment*	EA	107	$2,500	$ 267,500
STEG Unit - Upgrade Existing Septic Tank	EA	12	$2,500	$ 30,000
STEG Unit - New Septic Tank	EA	39	$7,500	$ 292,500
Gravity Lateral Connections (75 ft ea)	LF	3,830	$50	$ 191,500
STEP Unit - Existing tank, new pump	EA	23	$7,500	$ 172,500
STEP Unit - New tank and pump	EA	68	$12,500	$ 850,000
Pressure Lateral Connections (75 ft ea)	LF	6,900	$40	$ 276,000
Additional costs for Large Non-Residential STEPs	EA	6	$10,000	$ 60,000
New Public Restroom STEP Unit	LS	1	$25,000	$ 25,000
Engineering and Permitting	EA	142	$2,500	$ 355,000
			Sub-total	**$ 2,520,000**
			Contingency @ 20%	$ 504,000
			ON-LOT FACILIITES - TOTAL ESTIMATED COST	**$ 3,024,000**

TOTAL ESTIMATED CONSTRUCTION COST	**$ 7,402,400**
ESTIMATED COST PER RESIDENTIAL CONNECTION	**$ 43,544**

[1]Service Area: 128 residences, 14 non-residential, School, Public Restroom at 3 each (170 ESDs)

* Assume 25% of septic tanks can be salvaged, 75% replaced

Preliminary Cost Estimate - Alternative 5B
Downtown - Lower Kilkare Rd Community Wastewater System
75% Participation (110 parcels) Design Flow: 21,000 gpd

Public Sewer Facilities				
Description	**Units**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Wastewater Collection System				
4-inch Gravity Effluent Sewer	LF	12,600	$75	$ 945,000
3-inch Dia STEP Sewer	LF	4,500	$60	$ 270,000
Terminal Flush Ports	EA	8	$7,500	$ 60,000
Cleanouts	EA	60	$1,500	$ 90,000
Utility Locating (est. 5 per 1,000 ft)	EA	85	$1,000	$ 85,000
Traffic Control	Days	45	$2,000	$ 90,000
			Collection Subtotal	**$ 1,540,000**
Wastewater Treatment				
Influent EQ Tank & Pumps	GAL	15,000	$5	$ 75,000
Recirculating Gravel Filter Beds	SF	5,400	$75	$ 405,000
Recirculation Tank, Pumps and Controls	GAL	7,000	$6	$ 42,000
Disinfection System	LS	1	$25,000	$ 25,000
Site Improvements, Control Building and Fencing	LS	1	$70,000	$ 70,000
Emergency Generator	LS	1	$45,000	$ 45,000
			Treatment Subtotal	**$ 662,000**
Wastewater Dispersal				
Leachfield Dosing Tank, Pumps, Controls	GAL	7,500	$5	$ 37,500
PD Traffic-rated Chamber Leachfield - Depot Par	LF	1,600	$100	$ 160,000
Drip Dispersal Field - Depot Park	SF	5,000	$5	$ 25,000
Piping, Valves & Appurtenances	LF	4,000	$15	$ 60,000
Erosion Control and Site Restoration	LS	1	$35,000	$ 35,000
Monitoring Wells	EA	6	$2,000	$ 12,000
			Dispersal Sub-total	**$ 329,500**
			Public Facilities Subtotal	**$ 2,531,500**
			Miscellaneous & Contingency @ 20%	**$ 506,300**
			Planning, Engineering, Permitting & Administration @ 40%	**$ 1,012,600**
			PUBLIC FACILITIES - TOTAL ESTIMATED COST	**$ 4,050,400**

Individual On-lot Facilites				
Description	**Unit**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Septic Tank Abandonments*	EA	84	$2,500	$ 210,000
STEG Unit - Upgrade Existing Septic Tank	EA	10	$2,500	$ 25,000
STEG Unit - New Septic Tank	EA	30	$7,500	$ 225,000
Gravity Lateral Connections (75 ft ea)	LF	3,000	$50	$ 150,000
STEP Unit - Existing tank, new pump	EA	17	$7,500	$ 127,500
STEP Unit - New tank and pump	EA	54	$12,500	$ 675,000
Pressure Lateral Connections (75 ft ea)	LF	5,250	$40	$ 210,000
Additional costs for Large Non-Residential	EA	6	$10,000	$ 60,000
New Public Restroom STEP Unit	LS	1	$25,000	$ 25,000
Engineering and Permitting	EA	110	$2,500	$ 275,000
			Sub-total	**$ 1,982,500**
			Contingency @ 20%	$ 396,500
			ON-LOT FACILIITES - TOTAL ESTIMATED COST	**$ 2,379,000**

TOTAL ESTIMATED CONSTRUCTION COST	**$ 6,429,400**
ESTIMATED COST PER RESIDENTIAL CONNECTION	**$ 46,590**

[1]Service Area: 96 residences, 14 non-residential, School, Public Restroom at 3 each (138 ESDs)

* Assume 25% of septic tanks can be salvaged, 75% replaced

Preliminary Cost Estimate - Alternative 5C
Downtown - Lower Kilkare Rd Community Wastewater System
50% Participation (78 parcels) **Design Flow: 17,000 gpd**

Public Sewer Facilities				
Description	**Units**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Wastewater Collection System				
4-inch Gravity Effluent Sewer	LF	12,600	$75	$ 945,000
3-inch Dia STEP Sewer	LF	4,500	$60	$ 270,000
Terminal Flush Ports	EA	8	$7,500	$ 60,000
Cleanouts	EA	60	$1,500	$ 90,000
Utility Locating (est. 4 per 1,000 ft)	EA	70	$1,000	$ 70,000
Traffic Control	Days	40	$2,000	$ 80,000
			Collection Subtotal	**$ 1,515,000**
Wastewater Treatment				
Influent EQ Tank & Pumps	GAL	10,000	$5	$ 50,000
Recirculating Gravel Filter Beds	SF	4,000	$75	$ 300,000
Recirculation Tank, Pumps and Controls	GAL	5,000	$6	$ 30,000
Disinfection System	LS	1	$20,000	$ 20,000
Site Improvements, Control Building and Fencing	LS	1	$60,000	$ 60,000
Emergency Generator	LS	1	$40,000	$ 40,000
			Treatment Subtotal	**$ 500,000**
Wastewater Dispersal				
Leachfield Dosing Tank, Pumps, Controls	GAL	5,000	$5	$ 25,000
PD Traffic-rated Chamber Leachfield - Depot Park	LF	1,600	$100	$ 160,000
Drip Dispersal Field - Depot Park	SF	2,000	$5	$ 10,000
Piping, Valves & Appurtenances	LF	3,000	$15	$ 45,000
Erosion Control and Site Restoration	LS	1	$25,000	$ 25,000
Monitoring Wells	EA	4	$2,000	$ 8,000
			Dispersal Sub-total	**$ 273,000**
			Public Facilities Subtotal	**$ 2,288,000**
			Miscellaneous & Contingency @ 20%	**$ 457,600**
			Planning, Engineering, Permitting & Administration @ 40%	**$ 915,200**
			PUBLIC FACILITIES - TOTAL ESTIMATED COST	**$ 3,660,800**

Individual On-lot Facilites				
Description	**Unit**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Septic Tank Abandonments*	EA	60	$2,500	$ 150,000
STEG Unit - Upgrade Existing Septic Tank	EA	7	$2,500	$ 17,500
STEG Unit - New Septic Tank	EA	21	$7,500	$ 157,500
Gravity Lateral Connections (75 ft ea)	LF	2,100	$50	$ 105,000
STEP Unit - Existing tank, new pump	EA	12	$7,500	$ 90,000
STEP Unit - New tank and pump	EA	39	$12,500	$ 487,500
Pressure Lateral Connections (75 ft ea)	LF	3,750	$40	$ 150,000
Additional costs for Large Non-Residential STEPs	EA	6	$10,000	$ 60,000
New Public Restroom STEP Unit	LS	1	$25,000	$ 25,000
Engineering and Permitting	EA	78	$2,500	$ 195,000
			Sub-total	**$ 1,437,500**
			Contingency @ 20%	$ 287,500
			ON-LOT FACILIITES - TOTAL ESTIMATED COST	**$ 1,725,000**

TOTAL ESTIMATED CONSTRUCTION COST	**$ 5,385,800**
ESTIMATED COST PER RESIDENTIAL CONNECTION	**$ 50,809**

[1]Service Area: 64 residences, 14 non-residential, School, Public Restroom at 3 each (106 ESDs)

* Assume 25% of septic tanks can be salvaged, 75% replaced

Preliminary Cost Estimate - Alternative 6A
Sunol Community Wastewater System
100% Participation (245 parcels) Design Flow: 37,800 gpd

Public Sewer Facilities				
Description	**Units**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Wastewater Collection System				
4-inch Gravity Effluent Sewer	LF	24,000	$75	$ 1,800,000
3-inch Dia STEP Sewer	LF	4,500	$60	$ 270,000
Terminal Flush Ports	EA	10	$7,500	$ 75,000
Cleanouts	EA	120	$1,500	$ 180,000
Utility Locating (est. 5 per 1,000 ft)	EA	120	$1,000	$ 120,000
Traffic Control	Days	80	$2,000	$ 160,000
			Collection Subtotal	**$ 2,605,000**
Wastewater Treatment				
Influent EQ-Pre-anoxic Tanks & Pumps	GAL	40,000	$5	$ 200,000
Package Treatment System (AdvanTex or Equal)	LS	1	$900,000	$ 900,000
Disinfection System	LS	1	$50,000	$ 50,000
Site Work, Control Building, Electrical, Fencing	LS	1	$120,000	$ 120,000
Emergency Generator	LS	1	$50,000	$ 50,000
			Treatment Subtotal	**$ 1,320,000**
Wastewater Dispersal				
Leachfield Dosing Tank, Pumps, Controls	GAL	15,000	$5	$ 75,000
PD Traffic-rated Chamber Leachfield,Depot Garde	LF	1,600	$100	$ 160,000
PD Traffic-rated Chamber Leachfield, Bond St	LF	500	$100	$ 50,000
Drip dispersal Depot Gardens	SF	15,000	$5	$ 75,000
Piping, Valves & Appurtenances	LF	7,500	$15	$ 112,500
Erosion Control, Site Restoration, Landscaping	LS	1	$75,000	$ 75,000
Monitoring Wells	EA	10	$2,000	$ 20,000
			Dispersal Sub-total	**$ 567,500**
			Public Facilities Subtotal	**$ 4,492,500**
			Miscellaneous & Contingency @ 20%	**$ 898,500**
			Planning, Engineering, Permitting & Administration @ 40%	**$ 1,797,000**
			PUBLIC FACILITIES - TOTAL ESTIMATED COST	**$ 7,188,000**

Individual On-lot Facilites				
Description	**Unit**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Septic Tank Abandonments*	EA	184	$2,500	$ 460,000
STEG Unit - Upgrade Existing Septic Tank	EA	36	$2,500	$ 90,000
STEG Unit - New Septic Tank	EA	110	$7,500	$ 825,000
Gravity Lateral Connections (75 ft ea)	LF	10,950	$50	$ 547,500
STEP Unit - Existing tank, new pump	EA	24	$7,500	$ 180,000
STEP Unit - New tank and pump	EA	75	$12,500	$ 937,500
Pressure Lateral Connections (75 ft ea)	LF	7,350	$40	$ 294,000
Additional costs for Large Non-Residential STEPs	EA	6	$10,000	$ 60,000
New Public Restroom STEP Unit	LS	1	$25,000	$ 25,000
Engineering and Permitting	EA	245	$2,500	$ 612,500
			Sub-total	**$ 4,031,500**
			Contingency @ 20%	$ 806,300
			ON-LOT FACILIITES - TOTAL ESTIMATED COST	**$ 4,837,800**

TOTAL ESTIMATED CONSTRUCTION COST	**$ 12,025,800**
ESTIMATED COST PER RESIDENTIAL CONNECTION	**$ 44,051**

[1]Service Area: 231 residences, 14 non-residential, School, Public Restroom at 3 each (273 ESDs)

* Assume 25% of septic tanks can be salvaged, 75% replaced

Preliminary Cost Estimate - Alternative 6B

Sunol Community Wastewater System

75% Participation (188 parcels) Design Flow: 30,675 gpd

Public Sewer Facilities				
Description	**Units**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Wastewater Collection System				
4-inch Gravity Effluent Sewer	LF	24,000	$75	$ 1,800,000
3-inch Dia STEP Sewer	LF	4,500	$60	$ 270,000
Terminal Flush Ports	EA	10	$7,500	$ 75,000
Cleanouts	EA	120	$1,500	$ 180,000
Utility Locating (est. 4 per 1,000 ft)	EA	100	$1,000	$ 100,000
Traffic Control	Days	70	$2,000	$ 140,000
			Collection Subtotal	**$ 2,565,000**
Wastewater Treatment				
Influent EQ Tank & Pumps	GAL	30,000	$5	$ 150,000
Package Treatment System (AdvanTex or Equal	LS	1	$750,000	$ 750,000
Disinfection System	LS	1	$40,000	$ 40,000
Site Work, Control Building, Electrical, Fencing	LS	1	$100,000	$ 100,000
Emergency Generator	LS	1	$50,000	$ 50,000
			Treatment Subtotal	**$ 1,090,000**
Wastewater Dispersal				
Leachfield Dosing Tank, Pumps, Controls	GAL	12,000	$5	$ 60,000
PD Traffic-rated Chamber Leachfield,Depot Gard	LF	1,600	$100	$ 160,000
PD Traffic-rated Chamber Leachfield, Bond St	LF	-	$100	$ -
Drip dispersal Depot Gardens	SF	12,500	$5	$ 62,500
Piping, Valves & Appurtenances	LF	6,000	$15	$ 90,000
Erosion Control, Site Restoration, Landscaping	LS	1	$60,000	$ 60,000
Monitoring Wells	EA	10	$2,000	$ 20,000
			Dispersal Sub-total	**$ 452,500**
			Public Facilities Subtotal	**$ 4,107,500**
			Miscellaneous & Contingency @ 20%	**$ 821,500**
			Planning, Engineering, Permitting & Administration @ 40%	**$ 1,643,000**
			PUBLIC FACILITIES - TOTAL ESTIMATED COST	**$ 6,572,000**

Individual On-lot Facilites				
Description	**Unit**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Septic Tank Abandonments*	EA	142	$2,500	$ 355,000
STEG Unit - Upgrade Existing Septic Tank	EA	28	$2,500	$ 70,000
STEG Unit - New Septic Tank	EA	85	$7,500	$ 637,500
Gravity Lateral Connections (75 ft ea)	LF	8,475	$50	$ 423,750
STEP Unit - Existing tank, new pump	EA	18	$7,500	$ 135,000
STEP Unit - New tank and pump	EA	57	$12,500	$ 712,500
Pressure Lateral Connections (75 ft ea)	LF	5,550	$40	$ 222,000
Additional costs for Large Non-Residential	EA	6	$10,000	$ 60,000
New Public Restroom STEP Unit	LS	1	$25,000	$ 25,000
Engineering and Permitting	EA	188	$2,500	$ 470,000
			Sub-total	**$ 3,110,750**
			Contingency @ 20%	$ 622,150
			ON-LOT FACILIITES - TOTAL ESTIMATED COST	**$ 3,732,900**

TOTAL ESTIMATED CONSTRUCTION COST	**$ 10,304,900**
ESTIMATED COST PER RESIDENTIAL CONNECTION	**$ 47,708**

[1]Service Area: 173 SFRs, 14 non-residential, School, Public Restroom at 3 each = 215 ESDs

* Assume 25% of septic tanks can be salvaged, 75% replaced

Preliminary Cost Estimate - Alternative 6C
Sunol Community Wastewater System
50% Participation (130 parcels) Design Flow: 23,425 gpd

Public Sewer Facilities				
Description	**Units**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Wastewater Collection System				
4-inch Gravity Effluent Sewer	LF	24,000	$75	$ 1,800,000
3-inch Dia STEP Sewer	LF	4,500	$60	$ 270,000
Terminal Flush Ports	EA	10	$7,500	$ 75,000
Cleanouts	EA	120	$1,500	$ 180,000
Utility Locating (est. 3.5 per 1,000 ft)	EA	85	$1,000	$ 85,000
Traffic Control	Days	65	$2,000	$ 130,000
			Collection Subtotal	**$ 2,540,000**
Wastewater Treatment				
Influent EQ Tank & Pumps	GAL	16,000	$5	$ 80,000
Recirculating Gravel Filter Beds	SF	6,000	$75	$ 450,000
Recirculation Tank, Pumps and Controls	GAL	7,500	$6	$ 45,000
Disinfection System	LS	1	$30,000	$ 30,000
Site Improvements, Control Building and Fencing	LS	1	$80,000	$ 80,000
Emergency Generator	LS	1	$50,000	$ 50,000
			Treatment Subtotal	**$ 735,000**
Wastewater Dispersal				
Leachfield Dosing Tank, Pumps, Controls	GAL	10,000	$5	$ 50,000
PD Traffic-rated Chamber Leachfield - Depot Park	LF	1,600	$100	$ 160,000
Drip Dispersal Field - Depot Park	SF	7,000	$5	$ 35,000
Piping, Valves & Appurtenances	LF	4,500	$15	$ 67,500
Erosion Control, Site Restoration & Landscaping	LS	1	$45,000	$ 45,000
Monitoring Wells	EA	8	$2,000	$ 16,000
			Dispersal Sub-total	**$ 373,500**
			Public Facilities Subtotal	**$ 3,648,500**
			Miscellaneous & Contingency @ 20%	**$ 729,700**
			Planning, Engineering, Permitting & Administration @ 40%	**$ 1,459,400**
			PUBLIC FACILITIES - TOTAL ESTIMATED COST	**$ 5,837,600**

Individual On-lot Facilites				
Description	**Unit**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Septic Tank Abandonments*	EA	98	$2,500	$ 245,000
STEG Unit - Upgrade Existing Septic Tank	EA	19	$2,500	$ 47,500
STEG Unit - New Septic Tank	EA	59	$7,500	$ 442,500
Gravity Lateral Connections (75 ft ea)	LF	5,850	$50	$ 292,500
STEP Unit - Existing tank, new pump	EA	13	$7,500	$ 97,500
STEP Unit - New tank and pump	EA	39	$12,500	$ 487,500
Pressure Lateral Connections (75 ft ea)	LF	3,825	$40	$ 153,000
Additional costs for Large Non-Residential STEPs	EA	6	$10,000	$ 60,000
New Public Restroom STEP Unit	LS	1	$25,000	$ 25,000
Engineering and Permitting	EA	130	$2,500	$ 325,000
			Sub-total	**$ 2,175,500**
			Contingency @ 20%	$ 435,100
			ON-LOT FACILIITES - TOTAL ESTIMATED COST	**$ 2,610,600**

TOTAL ESTIMATED CONSTRUCTION COST	**$ 8,448,200**
ESTIMATED COST PER RESIDENTIAL CONNECTION	**$ 53,470**

[1]Service Area: 116 residences/KWA, 14 non-residential, School, Public Restroom at 3 ESD each = 158 ESDs

* Assume 25% of septic tanks can be salvaged, 75% replaced

Preliminary Cost Estimate - Alternative 7*

Sunol Gravity Sewers & Intertie to Pleasanton/Dublin San Ramon Services District

100% Participation (245 parcels) **Design Flow: 37,800 gpd**

Public Sewer Facilities				
Description	**Est Qty**	**Unit**	**Unit Cost ($)**	**Total Cost ($)**
8-inch Gravity Sewers, Kilkare Rd	25,040	LF	$275	$ 6,886,000
4-inch Pressure Sewer, Downtown	2,820	LF	$75	$ 211,500
4-inch Dia Force Main to Pleasanton	15,400	LF	$100	$ 1,540,000
48" Dia Manholes (avg. 5' deep)	56	EA	$12,500	$ 701,000
Main Lift Station	1	LS	$250,000	$ 250,000
Terminal Flush Ports, Lamp holes	10	EA	$2,500	$ 25,000
Air Release Valve (w/ Manhole)	5	EA	$8,500	$ 42,500
Utility Locating (est. 5 per 1,000 ft)	215	EA	$1,000	$ 215,000
Traffic Control	120	Days	$2,000	$ 240,000
Pubic Facilities Subtotal				**$ 10,111,000**
Miscellaneous & Contingency @ 20%				$ 2,022,200
Planning, Engineering, Permitting & Administration @ 40%				$ 4,044,400
PUBLIC FACILITIES - TOTAL ESTIMATED COST				**$ 16,177,600**

Individual On-lot Facilites				
Description	**Unit**	**Est Qty**	**Unit Cost ($)**	**Total Cost ($)**
Septic Tank Abandonments	EA	244	$2,500	$ 610,000
Gravity Lateral Connections (200 at 75 ft ea)	LF	15,000	$50	$ 750,000
Grinder/Ejector Pump Units	EA	45	$10,000	$ 450,000
Pressure Lateral Connections (45 @ 75 ft ea)	LF	3,375	$40	$ 135,000
Additional Costs for Large Non-Residential	EA	5	$7,000	$ 35,000
New Public Restroom Connection	LS	1	$7,000	$ 7,000
Engineering and Permitting	EA	245	$2,500	$ 612,500
Sub-total				**$ 2,599,500**
Contingency @ 20%				$ 519,900
ON-LOT FACILIITES - TOTAL ESTIMATED COST				**$ 3,119,400**

TOTAL ESTIMATED CONSTRUCTION COST	**$ 19,297,000**
COST PER ESD	**$ 70,685**
SEWER CONNECTION FEE PER CONNECTION**	**$ 14,885**
TOTAL ESTIMATED COST PER RESIDENTIAL CONNECTION	**$ 85,570**

* Does not include costs of annexation for sewer service

** 2019 Fees (per residence), City of Pleasanton and Dublin San Ramon Services District

ESDs = 231 SFR + 14 non-SFR at ave 3 each = 273