SMALL COMMUNITY WASTEWATER FACILITY GRANT PROGRAM

Pescadero Community Sewer Project

FACILITIES PLANNING REPORT

OCTOBER 2008

Prepared for:
The County of San Mateo
Prepared by:
Hydroscience Engineers – Napa, Calif.

HydroScience Engineers, Inc.
STRATEGIC WATER SOLUTIONS

Pescadero Community Sewer Project

Small Community Wastewater Grant Facilities Plan

REGISTERED PROFESSIONAL ENGINEER
CURTIS M. LAM
No. C 59049
Exp. 06/30/09
CIVIL
STATE OF CALIFORNIA

October 2008

Prepared for

The County of San Mateo

Submitted by

HydroScience Engineers, Inc.
221 Gateway Road West
Suite 403
Napa, CA 94558

HydroScience Engineers

Table of Contents

List of Tables

List of Figures

following page

List of Appendices

This page intentionally left blank

SECTION 1 – INTRODUCTION

The town of Pescadero (Pescadero) is located in an unincorporated portion of San Mateo County (County), two miles east of State Highway 1 and Pescadero State Beach. A map showing the location of Pescadero is included as **Figure 1-1**. Currently, the area within the Rural-Urban Limit, which generally encompasses most of the urbanized area of Pescadero, has a population of approximately 755 according to the County's internal GIS database.

1.1 Purpose and Scope of Work

The County retained HydroScience Engineers (HSe) to develop a Facilities Plan for the installation of a new sewer collection and treatment system for Pescadero. Currently, each parcel within Pescadero has its' own individual septic system. The community does not have a centralized sewer collection system or wastewater treatment plant (WWTP). In 2004, The Regional Water Quality Control Board, San Francisco Bay Region (RWQCB), issued Resolution 04-R2-0088, supporting a 2004 Public Health Declaration by the County. The County declaration stated, "*inadequate soil structure and high groundwater in the area provides poor conditions for adequate treatment of septic wastes from the residences and businesses in the Community resulting in a threat to public health, and precludes the installation of effective new septic systems*". The RWQCB Resolution is attached as **Appendix A**.

The intent of this Plan is to evaluate the options available to the community for implementing a sewer collection and treatment system while optimizing the Project cost. The extent of the collection system is intended to mimic the existing potable water distribution system and greatly reduce the number of the septic tanks in service, thereby minimizing potential groundwater impacts and maximizing the public health benefit for Pescadero. A centralized WWTP would treat the wastewater collected from Pescadero to a level that would allow effluent from that facility to be reused or disposed of in accordance with Title 22 Water Recycling Criteria and the beneficial uses identified in the RWQCB Basin Plan. This Plan also recommends improvements to ensure adequate capacity for the next 20 years.

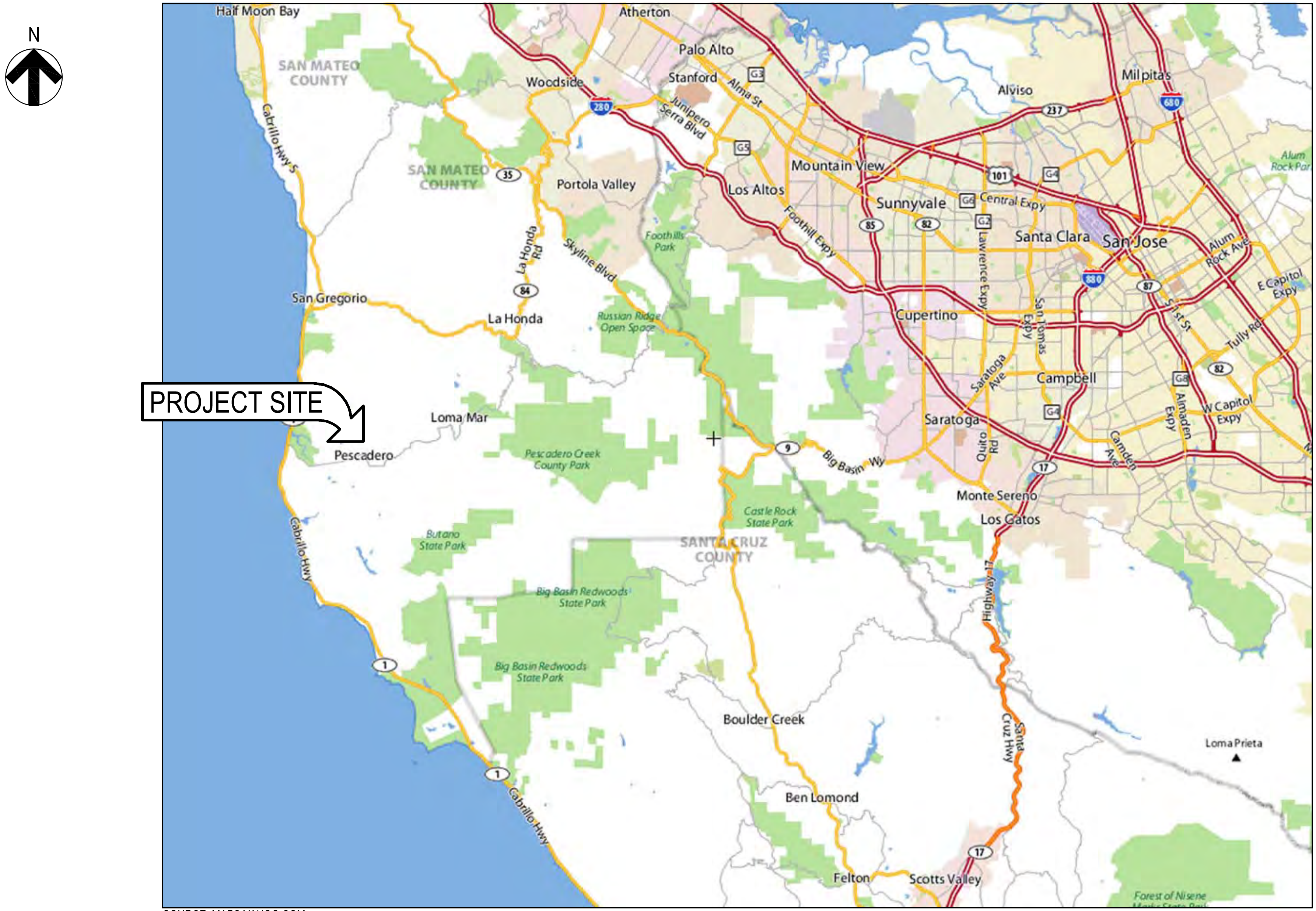
The purpose of this Plan is to:

- Develop projections for current and future wastewater flows for the proposed collection system;
- Determine cost-effective wastewater infrastructure requirements to accommodate projected wastewater flows;
- Provide an Operations Evaluation of existing and proposed wastewater infrastructure;
- Provide a Facility Plan that is consistent with the requirements of the Small Community Wastewater Grant (SCWG) Implementation Policy; and
- Obtain SCWG approval of this Plan and funding for the design and construction of these facilities.

1.2 Report Organization

This facility plan has been developed in accordance with the SCWG Implementation Policy, with the assistance of both County staff and the community. The following describes the chapter organization:

- Section 1 – Introduction
- Section 2 – General Conditions
- Section 3 – Wastewater Collection and Treatment Options
- Section 4 – Effluent Disposal
- Section 5 – Operations Evaluation
- Section 6 – Public Involvement
- Section 7 – Revenue Program
- Section 8 – Requirements and Recommendations
- Section 9 – References
- Appendices



SOURCE: MAPS.YAHOO.COM

FIGURE 1-1

PESCADERO COMMUNITY SEWER PROJECT

SMALL COMMUNITY WASTEWATER GRANT FACILITIES PLAN

REGIONAL LOCATION MAP

HydroScience Engineers

S:\Common\Projects\245_Pescadero\SCWG Facility Plan\Figures\FIG1-01.dwg DATE:10/14/08

SECTION 2 – GENERAL CONDITIONS

This section provides background on some of the general conditions for Pescadero, including topography, climatology, soil condition, seismic information, and flood protection.

2.1 Topography

Pescadero is located in a valley between hills to the north and south of town. Terrain in Pescadero is flat coastal settlement with a gentle slope from east to west, with elevations ranging from approximately 10 feet to 30 feet above mean sea level (MSL), according to parcel and topographic maps provided by the San Mateo County Department of Public Works.

Pescadero Creek winds through the town from the east, flowing under a creek crossing at Stage Road. South and west of Pescadero Creek is the slightly smaller Butano Creek, which winds from the south side of town until it crosses Pescadero Creek Road on the western edge of the town center. From there, Butano Creek flows roughly another two miles through the Pescadero Marsh before its confluence with Pescadero Creek to the northwest of town. From there, both creeks flow into the Pacific Ocean.

2.1.1 Flood Protection

Federal Emergency Management Agency (FEMA) flood insurance maps were consulted for information on the 100-year flood elevation. The most recent map for this area indicates that the majority of 100-year flood zone occurs to the east of Pescadero Creek Road with a typical base flood elevation of 15 feet. A small sliver of land to the south of the road is also in the flood plain and is about 1,000 feet long and 10 feet wide. This part of the map corresponds to a ditch that parallels the road from the Corporation Yard at 1000 Pescadero Creek Road as observed in HSe site visits. A copy of the Pescadero Floodway Map is attached at **Appendix B**.

WWTPs must be protected from the 100-year flood so they can continue to operate during a flood. Since FEMA maps indicate that the majority of 100-year flood zone occurs to the north and east of Pescadero Creek Road, the WWTP site options identified in this Plan are south of Pescadero Creek Road and outside of this floodplain.

2.2 Climatology

According to the National Weather Service, Pescadero has cool, wet winters and mild, mostly dry summers. Fog is common year-round, especially in summer, and strong winds can be encountered from the Pacific Ocean three miles west of town. The coolest month is January, with an average maximum and minimum of 60 and 40 degrees Fahrenheit, respectively. The warmest month is September, with an average maximum and minimum of 72 and 49 degrees Fahrenheit, respectively. Winter temperatures rarely fall below freezing, and summer temperatures rarely exceed 90 degrees Fahrenheit.

The average rainfall in the area, according to precipitation data from the Western Regional Climate Center (WRCC), San Gregorio station, is 29.45 inches per year and the peak 100-year, 24-hour storm event is approximately 10.3 inches. According to the California Irrigation Management Information System (CIMIS) Reference Evapotranspiration Map, Pescadero lies in the Coastal Plains Heavy Fog zone with evaporation rates of approximately 32 inches per year.

2.2.1 Water Balance

This Section describes the development of the Pescadero water balance, which incorporates methodology presented in the State Water Resources Control Board Training Handbook for Disposal of Non-Designated Waste to Land Systems: Design, Operation, and Monitoring, June 2004 (Handbook). The water balance is used to develop irrigation demands and seasonal storage requirements. The analysis is based on local climatological data including precipitation, evapotranspiration, and pan evaporation.

The water balance is for current and future anticipated flow conditions with an assumed 100-year annual precipitation return period (or event). All data used in this water balance are attached for reference in **Appendix C**. The duration of the water-year in this analysis begins in October and extends through September of the following year. The water balance provides the basis for the effluent disposal analysis discussed in **Section 4**.

To determine the total annual precipitation for the statistical 100-year annual return period, records for rainfall depth duration frequency were collected from the WRCC meteorological Station No. 047807, San Gregorio 2 SE. For a 100-year return period water year, the accumulative precipitation for Pescadero is statistically equal to 57.86 inches per water year and the average rainfall is approximately 29.45 inches per water year. Pan evaporation data was not available for Pescadero and was estimated based on evapotranspiration data. The recommended pan coefficient to account for larger bodies of water typically ranges between 0.7 and 0.8. Consistent with the Handbook, this water balance used a coefficient of 0.71. The factor was also based on an analysis conducted by Sentelhas & Folegatti, which related pan evaporation data to evapotranspiration data.

Monthly wastewater generation and irrigation demands were estimated to determine monthly storage inflows and outflows. A monthly effluent water balance to estimate seasonal storage requirements is discussed in **Section 4.1** and includes allowances for losses or gains due to evaporation, precipitation and inflow and infiltration during a 100-year return period precipitation event. Monthly evaporation from the ponds was estimated assuming that the ponds are at average yearly volumes. Evaporation was adjusted during winter months to account for a 100-year event. The disposal area was estimated to allow for disposal of all stored and produced effluent between the months of May and September based on a theoretical 100-year event irrigation demand as calculated above.

2.3 Soils

The USDA Natural Resource Conservation Service Soil Survey of San Mateo County describes the soil in Pescadero as primarily Coquille loam at the eastern portion of the town and Gazos loam at the western portion of the town. The saturated hydraulic conductivity is listed as ranging from 0.20 to 0.57 in/hr. The typical soil profile consists of: peaty loam from 0 to 10 inches below ground surface (bgs), clay loam from 10 to 18 inches bgs, and sandy loam 18 to 60 inches bgs on the eastern portion of town. On the western portion the soil profile consists of: loam from 0 to 11 inches bgs, silt loam from 12 inches to 25 inches bgs, and unweathered bedrock from 25 to 29 inches bgs.

Available geotechnical data for Pescadero was limited. In the 1980s, a new groundwater well was drilled approximately one mile to the south and west of town to serve the community (See **Section 2.5**). Currently, no additional soil boring logs for the well were available. Geotechnical studies, soil surveys, and percolation testing will be performed prior to detailed design of new wastewater infrastructure.

Likewise, groundwater elevation data for Pescadero was limited. Monthly groundwater well elevation readings were taken at the community water supply well from 2002 to 2006 and in January and October 2007. The data show that the average groundwater elevation is typically around 83 feet MSL in winter and 82 feet MSL in summer, dropping about one foot in elevation each year, apparently due to drawdown.

The RWQCB Resolution refers to “high groundwater” in general terms in Pescadero. No other data were available for other locations in Pescadero, but considering the typical elevation for the town is approximately 10 to 30 feet MSL, the water supply well groundwater elevations are of limited utility with regards to the town and the RWQCB Resolution.

2.4 Seismic Information

The town is not located on any known “active” fault trace, nor is it contained within an Alquist-Priolo Earthquake Fault Zone, i.e. in a zone that spans the "surface traces" of delineated active faults as defined by the California Alquist-Priolo Earthquake Fault Zoning Act regulations. The closest source of potential ground motion at the site is the San Gregorio Fault, located about one mile east of Pescadero. From review of Figure 1613.5(4) of the 2007 California Building Code, it appears that the maximum considered ground motion for 1.0-second spectral response (5% of critical damping) site class B would be equal to or greater than 0.75g. Thus, Pescadero is located within seismic design Category C.

This combination of factors places restrictions on reinforced concrete masonry construction. Thus, the recommended structure type is steel, with a moment resisting frame, for which a pre-engineered metal building would qualify. For the structure type and probable height in the 20 ft. range, fundamental period for the structure will likely be less than 0.5 seconds.

2.5 Water Supply

The County, through the development of a new water supply well, water storage tank, and potable water distribution system, provided potable water service to Pescadero in the 1980s. The service area was titled Community Service Area Number 11 (CSA-11).

One CSA-11 owned and operated drinking water well provides potable water to Pescadero residents and businesses. The CSA-11 service area, which encompasses most of Pescadero, has a total of 115 parcels, of which 94 are active accounts. It is expected that these same parcels would also receive sewage collection service. The 21 parcels that do not have active accounts are not currently connected to the CSA 11 distribution system, and are believed to be undeveloped. Combined, these parcels had an average metered water usage of approximately 26,000 gallons per day (gpd) in 2006 Stubs would be located at locations where there is the potential to extend the collection system, but these would be considered a future Project.

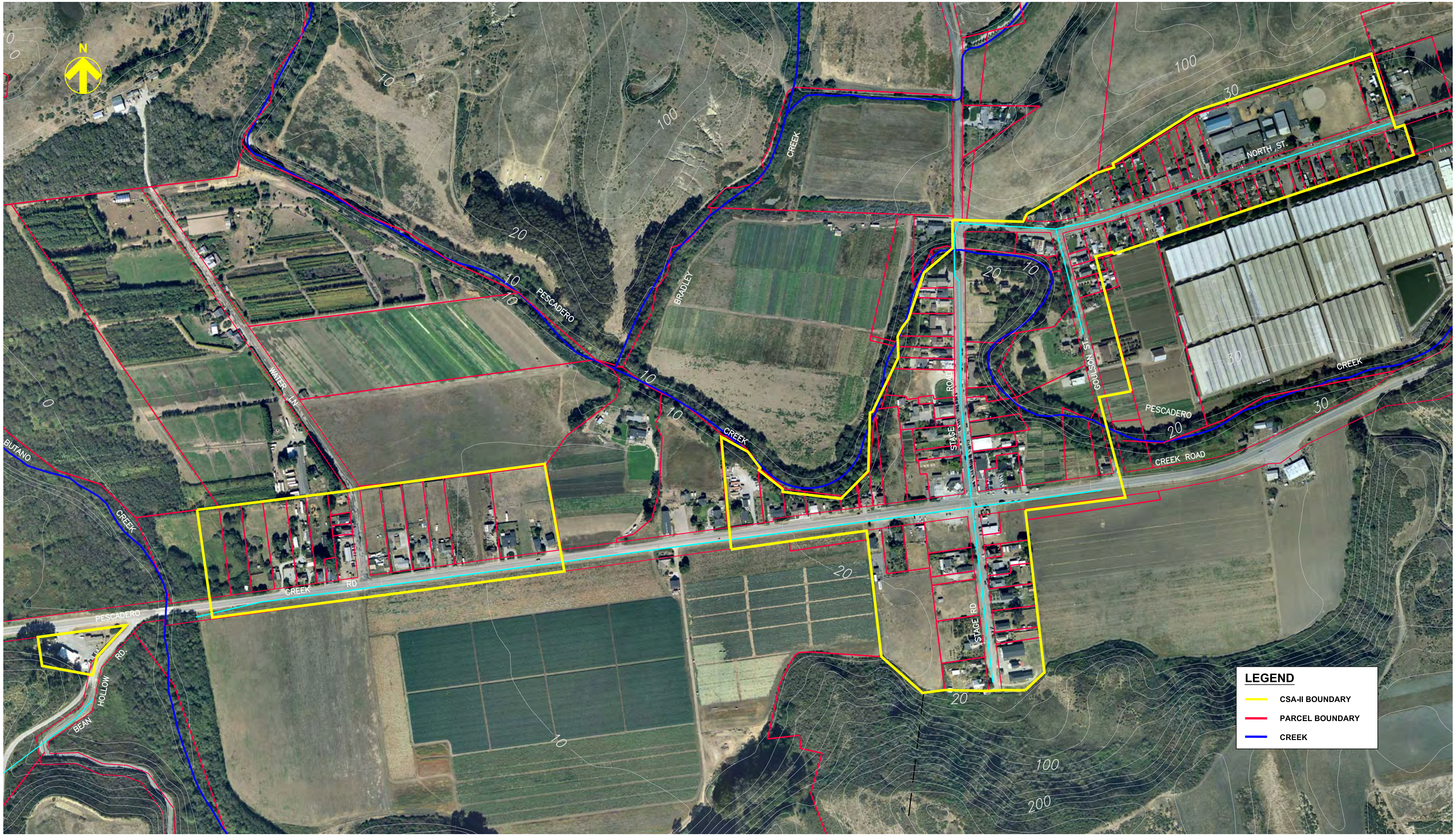
The Pescadero parcel map, including CSA-11 boundaries, and the potable water distribution system and connections is illustrated in **Figure 2-1**. The number of parcels served, and water demands, are expected to eventually double per the buildout plan identified in the County's Local Coastal Program (LCP). Relevant sections of the County's LCP are attached as **Appendix D**.

The drinking water well is situated on a vacant County parcel on a hill approximately 1.5 miles west of the community center. The well has a depth of 260 feet, and, although pump data is unavailable, it is assumed to produce a minimum of 20 gallons per minute (gpm) on average based on CSA-11 usage data. Adjacent to this well is a 140,000 gallon water storage tank that stores and distributes potable water via gravity throughout CSA-11, with the pipeline going downhill on Bean Hollow Road, and then along Pescadero Creek Road to the other roads in Pescadero including Stage Road, North Street, and Goulson Road. Current metered water use is presented in **Table 2-1.**

Table 2-1: Metered Potable Water Usage

Land Use Type	No. of Parcels	Metered Water Use[1] (100 cf/yr)[2]	Metered Water Use (gpd)[3]
Single Family Residential	71	9,513	19,496
Multi-family Residential	7	683	1,400
Commercial	11	1,342	2,750
Other	5	843	1,728
Total	**94**	**12,381**	**25,374**

Notes:
1. From San Mateo County Public Works 2006-07 Public Water System Statistics: CSA-11
2. cf/yr = cubic feet per year
3. gpd = gallons per day
4. There are currently no identified industrial or landscape irrigation users



HydroScience Engineers

FIGURE 2-1

PESCADERO COMMUNITY SEWER PROJECT

SMALL COMMUNITY WASTEWATER GRANT FACILITIES PLAN

PESCADERO/CSA-11 PARCEL MAP

S:\Common\Projects\245_Pescadero\SCWG Facility Plan\Figures\FIG2-01.dwg DATE: 10/14/08

Consumer Confidence Reports from 2003 through 2006, which contain laboratory analysis of Pescadero's water supply well, are included as **Appendix E**.

2.6 Population Projections

Approximately 755 people currently live in Pescadero according to the County's internal GIS database. It is unknown if those people all reside within the 115 separate parcels identified in the rural-urban boundary for the town as identified in the County parcel map represented in **Figure 2-1**. It is possible that some of those people live in an area outside of the rural-urban boundary.

At buildout, the existing LCP (2004) proposes that the number of parcels will double at buildout to total 291, as shown in **Table 2-3**. The future population is unknown, but if population expands at the same rate as the number of residential parcels, future population will significantly increase. It was noted that for this population projection to become reality, upgrades to the potable water supply and distribution system would be required (San Mateo County, May 2008). The location, type, and nature of these improvements are excluded from discussion within this document.

2.7 Wastewater

Currently, there is no available data representing the quantity or quality of wastewater generated by the town of Pescadero. This section identifies the estimated current and future quality and flows based on the types of users, current water demands, and future growth estimates.

2.7.1 Anticipated Wastewater Quality

It is expected that the quality of wastewater generated by these facilities will not differ significantly from the quality of typical domestic wastewater. Domestic wastewater is typically lower in strength than commercial or industrial wastewater. The anticipated influent concentrations are shown in **Table 2-2.**

Table 2-2: Anticipated WWTP Influent Water Quality

Parameter	Concentration (mg/L)
Biochemical Oxygen Demand (BOD)	200-300
Total Suspended Solids (TSS)	200-300

Domestic wastewater flows tend to peak in the mornings and evenings with little flow through the late evening and early morning hours.

2.7.2 Estimated Wastewater Flows

No known estimates of wastewater volumes were available for any of septic tanks in Pescadero. Based on County's limitations on providing public services beyond the rural-urban boundary (all of the areas within CSA-11 are zoned rural), only parcels currently within the boundaries of CSA-11, as shown in **Figure 2-1**, would be sewered.

Because not all of the 115 parcels in CSA-11 are connected to the water supply system and some of these parcels are vacant or undeveloped, the "existing" wastewater demand is calculated based on the metered data for the current parcels served and projected onto the remaining parcels to appropriately increase the flow estimates. This is done by estimating the flow per parcel type based on the metered water use and number of units shown in **Table 2-1**, and multiplying this use per parcel by the total number of parcels.

The results are shown in **Table 2-3** below and include estimates for existing metered users as well as for anticipated future buildout flows.

Table 2-3: Estimated Wastewater Flows

Land Use Type	Quantity	Flow per Unit[1] (gpd/unit)	Average Day Flows[2] (gpd)	Peak Day Flows[3] (gpd)
Existing Flows[4]				
Dwelling Units	78	255	19,900	49,700
Commercial	11	240	2,600	6,600
Other	5	325	1,600	4,100
Total			**24,100**	**60,400**
Buildout Flows[5]				
Dwelling Units	250	255	63,800	159,400
Commercial	40	240	9,600	24,000
Fire Station	1	325	300	800
Total			**73,700**	**184,200**

Notes:
1. Unit flows extracted from San Mateo County Public Works 2006-07 Public Water System Statistics for CSA-11 assuming that wastewater flows will be approximately 5% less than potable water flows due to consumptive losses.
2. All flows rounded to nearest 100 gpd.
3. A typical peaking factor of 2.5 was applied to average day flows to develop peak day flow estimates. Peak day flows represents peaking associated primarily with wet weather inflow and groundwater infiltration as well as peak usage.
4. Current flows are based on the number of meters provided in the San Mateo County Public Works 2006-07 Public Water System Statistics for CSA-11.
5. Buildout Flows are based on the same unit flows identified for current use as well as the projected buildout identified in the LCP, Table 2.16.

SECTION 3 – WASTEWATER COLLECTION AND TREATMENT OPTIONS

This section presents alternatives each for addressing how wastewater will be collected and treated. Multiple options are presented to provide flexibility for implementation and subsequent evaluation in the Environmental Impact Report (EIR).

One of the base assumptions of this document is that the County will not be the owner or operator of the WWTP or the collection system. The Owner/Operator of the WWTP and collection system is expected to be a non-County entity.

3.1 Wastewater Collection

Currently, Pescadero has no centralized wastewater collection system. The existing infrastructure consists of individual septic tanks located on each parcel. A new collection system will be required to connect to a centralized WWTP.

Two collection system options are considered for Pescadero. The collection system would follow the alignment of existing public right-of-ways and would be available to provide service to all parcels located within the existing boundary of the CSA-11.

The first option would be a gravity collection system. The second collection system option considered is a Septic Tank Effluent Pumping/Septic Tank Effluent Gravity (STEP/STEG) system. An example of each option is presented in **Figure 3-1** and is discussed below.

3.1.1 Option 1: Gravity Collection System

A gravity collection system would typically consist of a sewer main with laterals extending to each individual parcel. Each service lateral would include a cleanout to provide for maintenance and cleaning of the lateral. For any service laterals that serve fixtures that are at a lower elevation than the upstream manhole, an overflow prevention device is required to prevent back flow of sewage to the fixture. **Appendix F** contains applicable sections of Title 4 – Sanitation and Health, from the San Mateo County Code as well as an illustration of a standard service lateral connection and a typical sewer cleanout and box detail.

Each parcel would be served via a lateral connecting upstream of the existing septic tanks. Sewage would flow by gravity from each parcel through the lateral to the sewer main. The sewer main would flow roughly north to south and west to east along the existing public right-of-ways. A series of manholes along the sewer main will provide access for maintenance as well as locations for vertical transitions. Manholes will be located at the upstream end of a pipe run as well as at pipe intersections. The sewer main will be constructed with a minimum 2% slope. Typically, the service lateral at the edge of the right-of-way will be located at least three to four feet below existing ground surface to ensure adequate depth of sewer service to the intended parcel. Based on a preliminary sewer layout, the sewer depths may reach up to 10 feet in some locations.

Where sewer mains cannot continue to flow by gravity, such as at creek crossings, lift stations would be constructed. Based on the existing topography, it appears that lift stations will be required at three, or potentially four, locations: the crossing of Pescadero Creek at North Street and Stage Road, the crossing of Butano Creek at Pescadero Creek Road, and from the fire station on Pescadero Creek Road. These lift station locations and the proposed alignment of the collection system are identified in **Figure 3-2**. Each lift station would be equipped with two pumps, each capable of pumping the full design capacity. This would allow service to continue should one pump require maintenance for any reason. A backup generator may also be added to each lift station.

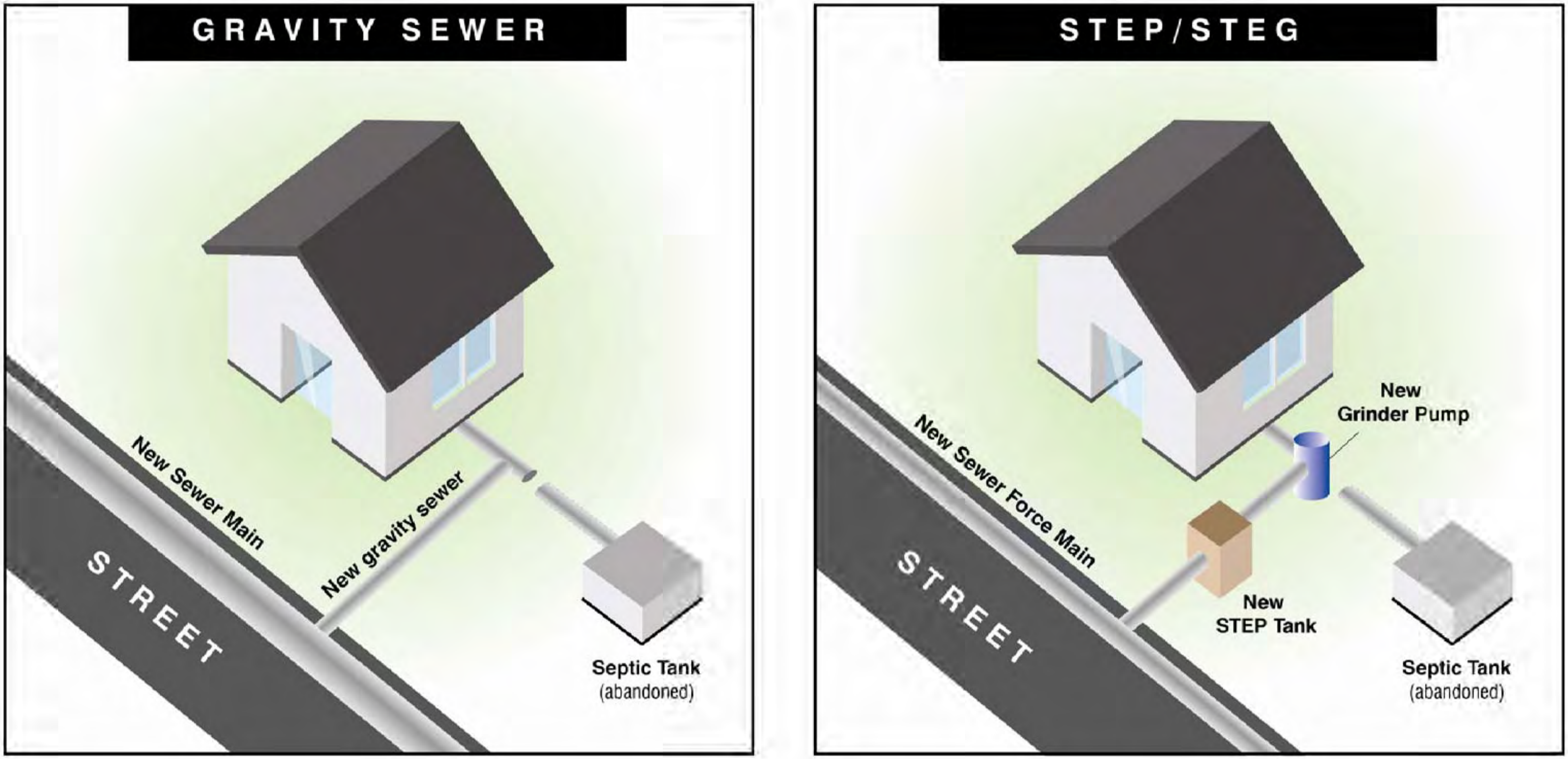
Based on the location of the parcels within CSA-11, and the intent to locate sewer mains within public rights-of-way, it is expected that approximately 9,000 linear feet (LF) of 8-inch gravity sewer collection pipelines would be required. Up to 6,600 LF of a pressurized 4-inch of sewer force main would also be required to cross creeks and convey sewage to the WWTP site.

After successful connection of each individual parcel to the new collection system, the existing septic tanks will be properly abandoned. Typically, prior to abandonment, the remaining sewage from the tanks would be removed and then subsequently filled with an approved material such as sand, gravel, or concrete. The land where the septic tank is located could be used for other purposes at the discretion of the landowner.

3.1.2 Option 2: STEP/STEG System

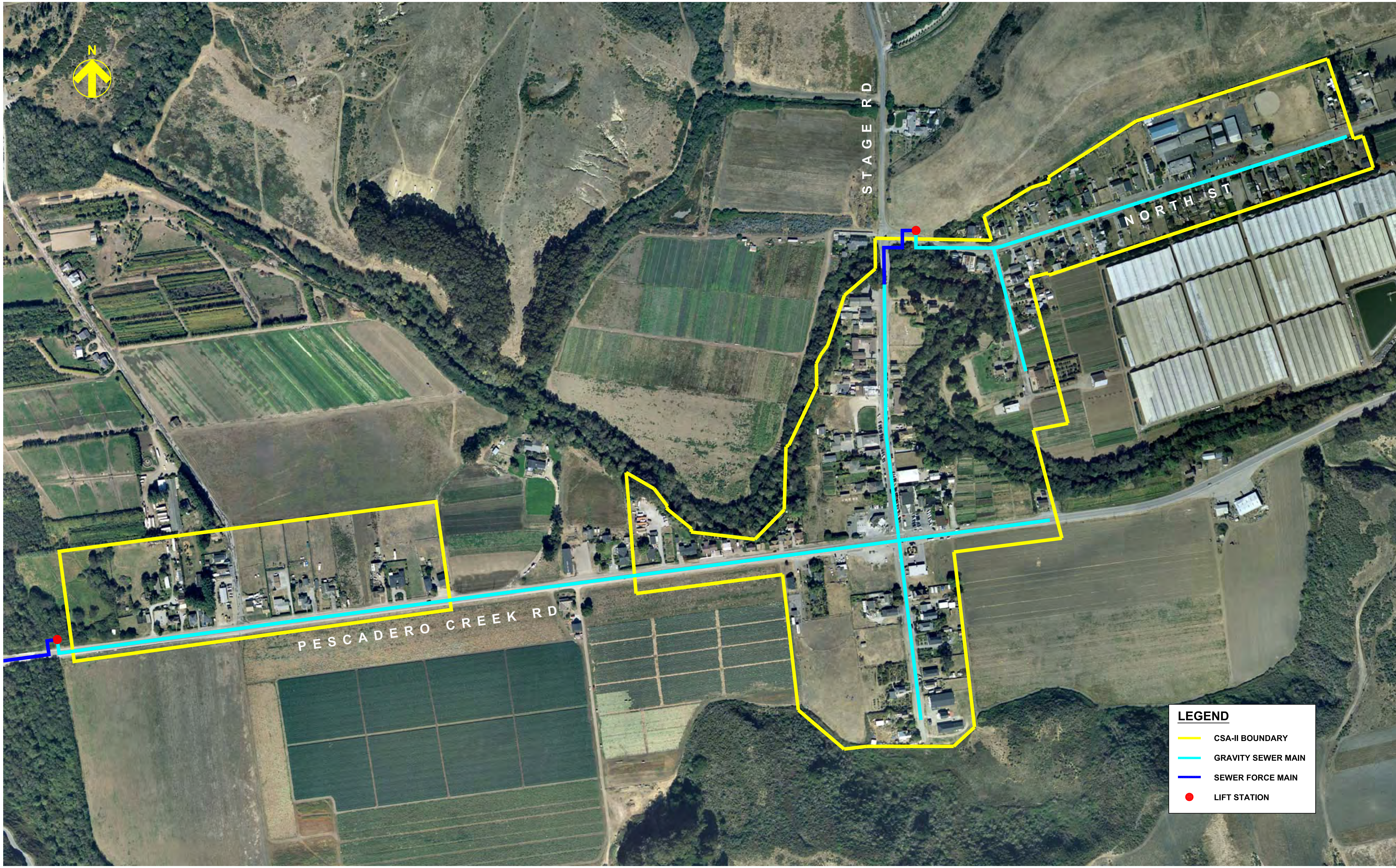
A system in which effluent from a septic tank flows into a collection system is referred to as a Septic Tank Effluent Pump (STEP) or Septic Tank Effluent Gravity (STEG) system. The difference in the two systems is whether the effluent is pumped to the collection system from the septic tank or flows by gravity to the collection system. The advantage to having a septic tank prior to the collection system is that the septic tank provides primary treatment of the wastewater. A STEG system would essentially be configured as a gravity system (Option 1) with the benefit of primary treatment prior to wastewater collection. The STEP system would have the same benefit as the STEG system with the added advantage of a shallower and smaller diameter collection system, fewer manholes, and less dependence on minimum slopes. For the purposes of this analysis, the STEP system will be discussed in detail, as it will contain all elements of the STEG system.

For this alternative, it would be expected that each parcel would install a new STEP tank and abandon the existing septic tank. As discussed above, prior to abandonment, the remaining sewage from the tanks would be removed and then subsequently filled will an approved material. The spoils from the excavation for the new STEP tank can potentially be used to fill the abandoned tanks. Typically, to retrofit an existing tank with the appurtenances to meet the requirements for the STEP tank system is impractical. A typical STEP tank will be sized between 1,000 and 1,500 gallons. The tank will consist of two chambers with the primary chamber between one-half and two-thirds the total capacity. All tanks in a collection system should be the same size to simplify record keeping and maintenance. Each tank would be equipped with an inlet and outlet access risers, a vent, an effluent screen, and a submersible turbine pump.



HydroScience Engineers

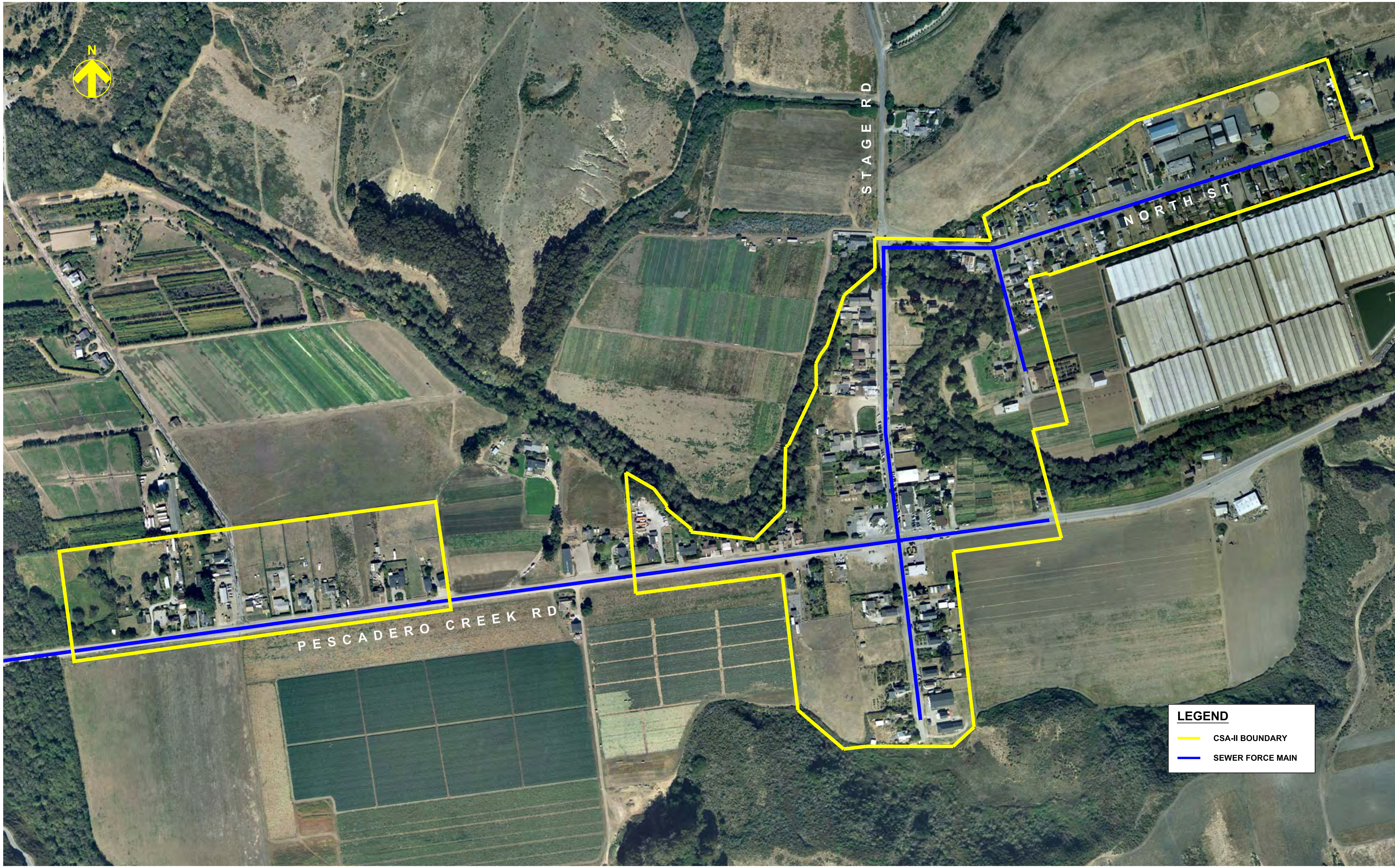
FIGURE 3-1
PESCADERO COMMUNITY SEWER PROJECT
SMALL COMMUNITY WASTEWATER GRANT FACILITIES PLAN
GRAVITY COLLECTION VS. STEP/STEG



HydroScience Engineers

FIGURE 3-2
PESCADERO COMMUNITY SEWER PROJECT
SMALL COMMUNITY WASTEWATER GRANT FACILITIES PLAN
OPTION 1: GRAVITY SEWER COLLECTION SYSTEM ALIGNMENT

S:\Common\Projects\245_Pescadero\SCWG Facility Plan\Figures\FIG3-02.dwg DATE:10/14/08



HydroScience Engineers

FIGURE 3-3

PESCADERO COMMUNITY SEWER PROJECT

SMALL COMMUNITY WASTEWATER GRANT FACILITIES PLAN

OPTION 2: STEP/STEG SEWER COLLECTION SYSTEM ALIGNMENT

S:\Common\Projects\245_Pescadero\SCWG Facility Plan\Figures\FIG3-03.dwg DATE:10/14/08

From the STEP tank, effluent would be pumped into a pressurized collection system that would be located along the same alignment identified for Option 1. Up to 15,600 LF of a pressurized 4-inch of sewer force main would be required to convey septic tank effluent to the WWTP site. The proposed alignment is shown in **Figure 3-3**. Collection system lift stations would not be required, but rather the pumps at each parcel would be sized to collectively pump sewage to the WWTP. The individual STEP ejector pumps would not operate during a power outage, since providing backup power to each individual pump would not be feasible.

The STEP tanks will require periodic maintenance and pumping; as solids accumulated in the tanks would need to be pumped out, though less frequently than standard septic systems; and the effluent screens will need to be cleaned. The pumps and pressurized lines on each parcel would also need to be maintained. There may also be additional maintenance on behalf of the owner, as well as increased record keeping by the Owner/Operator and the parcel owner.

3.1.3 Wastewater Collection System Comparison

Two collection system options were presented in the above sections, a conventional gravity collection system and a STEP collection system. Both options are feasible for Pescadero.

The gravity collection system is the more common option. The advantage of a conventional gravity collection system is that it does not require a substantial amount of maintenance except for regularly scheduled cleaning and inspection. The disadvantage of a gravity collection system is that, over time, the system can be susceptible to increased inflow and infiltration (I/I) and due to slope requirements, would be installed at a greater depth than a typical force main. However, I/I can be mitigated by careful construction of collection pipelines and joints, sealing manholes, prohibiting connection of downspouts and drains to the sewer system, and regular maintenance and inspection of the system. Because the majority of the town is located in a floodway, it will be especially important for the design of the collection system to include I/I prevention measures. Once constructed, the collection system will need to be maintained to minimize I/I.

STEP systems are typically constructed in small communities with a minimal number of connections. STEP systems are good for conventional treatment plants, since some of the solids settle out at the STEP tank. However, the STEP systems require increased maintenance and inspection simply because of the number of individual STEP tanks and pumps located on each parcel. In the interest of standardizing maintenance and compiling complete and updated maintenance records, the Owner/Operator should conduct all maintenance and inspections for the tanks and pumps.

Table 3-1 provides a summary of the cost comparison for the collection system options including the capital cost and estimated annual operation and maintenance (O&M) costs. **Appendix G** provides the detailed cost breakdown. Annual O&M costs were estimated to be approximately 2% of the capital cost for the gravity collection system and 2.5% for the STEP/STEG system, and escalate at a rate of 7% annually. It should be noted that the annualized cost is based on a 20-year time period with a 7% rate of return.

Table 3-1: Cost Comparison for Wastewater Collection System Options

Cost Item	**Gravity Collection**	**STEP/STEG**
Construction and Equipment	$1,807,000	$1,676,000
Construction Contingency (20%)	$361,000	$335,000
Engineering & Design (10%)	$181,000	$168,000
Permitting (3%)	$54,000	$50,000
Construction Management (10%)	$181,000	$168,000
Legal & Administrative (7%)	$126,000	$117,000
Total Capital Cost	**$2,710,000**	**$2,514,000**
Annualized Cost Over 20 Years	$256,000	$237,000
Annual O&M Cost	**$39,000**	**$54,000**

Notes:
1. All costs rounded to the nearest thousand.

The capital cost for the gravity system is more than for the STEP system; however, the O&M costs for the gravity collection system are lower than the costs for the STEP system. The STEP system requires a considerable amount more O&M than the gravity collection system would. In addition, the STEP system would also require more energy to run pumps on each of the parcels.

It is recommended that the community implement a new gravity collection system. The gravity collection system is a more conventional type of collection system and would require less maintenance than a STEP system would. There would be regular cleanings, but all work would be primarily in the rights-of-way, whereas STEP system maintenance would require access to individual parcels. Additionally, the STEP system would be more energy intensive than a gravity system.

3.2 WWTP Location

All sewage collected from Pescadero would be treated at a centralized WWTP. HSe analyzed several options for the new WWTP location as part of this Plan. The locations include:

- The Corporation Yard and adjacent landfill area;
- The base of the hill adjacent to the existing water storage tank; and
- The top of the hill southeast of the Corporation Yard.

Figure 3-4 identifies the location of each site. The intent was not to locate the WWTP in a location that would displace existing landowners. Therefore, only sites located on existing County owned parcels were considered as part of this evaluation. Though not specifically discussed in each option below, it was noted that an agreement between the County and the

LEGEND

WWTP SITE

FIGURE 3-4

PESCADERO COMMUNITY SEWER PROJECT
SMALL COMMUNITY WASTEWATER GRANT FACILITIES PLAN
PROPOSED WWTP SITE OPTIONS

HydroScience Engineers

S:\Common\Projects\245_Pescadero\SCWG Facility Plan\Figures\FIG3-04.dwg DATE:10/14/08

Owner/Operator of the WWTP would need to be reached regarding the use of County lands for this purpose, as well as the ability to access these lands on a perpetual basis. It is expected that this agreement would cover issues such as the cost for the land; security requirements; intended uses for the site; safety, liability, and indemnification. If there were to be a release of sewage from the WWTP or the collection system onto County lands, cleanup provisions may also need to be agreed upon. However, it is expected that this would be regulated by the Waste Discharge Requirements issued by the RWQCB. The terms of this agreement will be dependent on subsequent discussions, and are not further detailed in this Plan.

Each of the potential sites are located outside of the 100-year floodplain. Below is a summary of each option, the required facilities, and the advantages and disadvantages of each.

WWTP Site 1: Corporation yard and adjacent landfill: This site is located along Pescadero Creek Road and includes the existing Corporation Yard as well as the landfill behind it. The Corporation Yard is currently owned and operated by the County for equipment storage, maintenance, and staging. A facilities building is also located on the Corporation Yard. Behind the Corporation Yard is a capped landfill owned and maintained by the County. The site is bordered by a hillside to the south and west, a stream to the southeast, and a ditch to the northeast.

The use of the landfill site for a WWTP requires coordination with the County's perpetual responsibility for that site. Since the landfill is capped, subsurface activities may be limited in order to maintain the cap.

The use or access through the Corporation yard would require County approval and coordination. Preliminary discussions with the County have indicated that all existing uses of the Corporation Yard are to be maintained.

Entry to the site would be from the north side from Pescadero Creek Road through the Corporation Yard entrance. There is also access to the site from the southeast side. An existing dirt road extends to the southeast from the site up the hillside. The dirt road crosses over the stream with a culvert. This road currently provides an alternate access to the water storage tank and well sites further to the southeast. Use of the access road to and from the Corporation Yard to the adjacent landfill would require County approval and possibly upgrades to the road. Access would also have to be maintained between the Corporation Yard and the quarry to the southeast.

The site has the lowest elevation of the sites considered, at approximately 30 feet, and is located adjacent to a potential surface water discharge location. The ditch located to the northeast of this site is hydraulically connected to Pescadero Marsh via a culvert under Pescadero Creek Road. The stream to the southeast of the site is also tributary to the Marsh and empties into the same ditch. The ditch would be the preferred surface water discharge location for this site. The backside of the site is partially hidden and would not be clearly visible to those traveling on Pescadero Creek Road. The hillside behind the site could be used for spray field irrigation and the agricultural parcels along Reservoir Road could be future recycled water users. The remaining area behind the Corporation Yard could also be utilized for leach field discharge.

The site is somewhat restricted to significant expansion due to the hillsides and the waterways. In the event that the future treatment requirements are significantly greater than anticipated in this Plan, the site may need to be reevaluated.

WWTP Site 2: Adjacent to Water Storage Tank: This site is also located along the service road to the water well and storage tank. The service road is gated and generally limited to County and CSA-11 staff access. The site under consideration is a generally flat gravelly area that is located downgradient from the well and storage tank. The site is located approximately 1,200 feet from the well and 400 feet from the storage tank. The site is currently vacant with some miscellaneous stored items.

The hillside adjacent to this site can potentially be used for spray field and leach field discharge.

Similar to WWTP Site 1, use of the access road to and from Pescadero Creek Road would require County approval and possibly upgrades to the road. Access would also have to be maintained to all existing uses of County lands.

The disadvantage of the site is that it is at a higher elevation, approximately 160 feet above the town, which would require increased pumping. The road is also narrow and winding and could pose some difficulty for equipment delivery and hauling. A surface water discharge from this location would be delivered to Butano Creek by gravity at or near the bridge. The discharge location is approximately 1,500 feet southeast of this site.

WWTP Site 3: Hillside east of the Corporation Yard: This site is located southeast of the Corporation Yard at the top of the hill northwest of the water storage tank. It is located at the highest elevation of the sites considered at approximately 210 feet. Typically, WWTPs are located at the lowest point of their drainage area to minimize the need for pumping. The site is located approximately 1,400 feet from the well and 600 feet from the storage tank. The site is currently vacant with some miscellaneous stored items.

The advantages and disadvantages for this site are the same as those discussed for the site adjacent to the water storage tank. The only variation is that this site is at a higher elevation.

Of note, this site is currently used as a stockpile area by the County. It is expected that the County would want to continue to have an area set aside for stockpiling materials. Thus, an alternate site for stockpiling materials on County lands would need to be identified and constructed if the site were to be used for a WWTP.

Similar to WWTP Site 1, use of the access road to and from Pescadero Creek Road would require County approval and possibly upgrades to the road. Access would also have to be maintained to all existing uses of County lands.

For this site option, the effluent storage could be located at the site adjacent to the water tank (discussed above) allowing treated effluent to flow by gravity from the WWTP to the tank and by gravity to the Butano Creek discharge, eliminating the need for a pump station. The discharge location is approximately 1,700 feet from the proposed WWTP site. Minimal pumping may be required for nearby spray fields and leach fields.

Summary: All of the identified sites are adequate locations for a WWTP. Each site is owned by the County, has existing or the potential for site access, is close to but not visible from the town, is nearby a potential surface water discharge location, and has the available footprint to treat the anticipated buildout wastewater flows. Geotechnical investigations will be required to confirm the structural integrity of the selected site. The site uses and access would also need to be coordinated with the County Road Department.

The presence of the closed landfill limits the feasibility of locating a WWTP at Site 1, since the landfill cap and long-term maintenance requirements must be preserved. Of the two higher elevation site options, Site 3 is preferred as it is furthest from the water storage tank, and does not require special construction to avoid the closed landfill.

3.3 Wastewater Treatment Process

Currently, Pescadero has no centralized wastewater treatment system. Each parcel has a septic system and disposal field to provide treatment of waste from households and businesses. The tanks are pumped periodically as part of the O&M of the systems. These septic systems are operating in less than ideal conditions and ultimately posing a threat to public health, as stated by the County in the 2004 Public Health Declaration.

As a result, the intent of this Plan is to evaluate options for wastewater treatment for the Community. Due to the relatively low anticipated wastewater flow rates for the community, both current and future, as well as the potential for reuse, only small packaged treatment processes certified by the state of California, Department of Public Health (CDPH), as meeting the Title 22 Water Recycling Criteria were considered.

For the range of proposed recycled water uses considered for this Project, the treated water must meet the definitions of “filtered wastewater” and “disinfected tertiary recycled water” as defined by the following Title 22 standards:

> *“Filtered wastewater” means an oxidized wastewater that meets the criteria in one of the two subsections below:*

- *Has been coagulated and passed through natural undisturbed soils or a bed of filter media pursuant to the following:*
  - *At a rate that does not exceed 5 gallons per minute per square foot of surface area in mono, dual or mixed media gravity, upflow or pressure filtration systems, or does not exceed 2 gallons per minute per square foot of surface area in traveling bridge automatic backwash filters; and*
  - *So that the turbidity of the filtered wastewater does not exceed any of the following:*

  - *An average of 2 NTU within a 24-hour period;*
  - *5 NTU more than 5 percent of the time within a 24-hour period; and*
  - *10 NTU at any time.*
- *Has been passed through a microfiltration, ultrafiltration, nanofiltration, or reverse osmosis membrane so that the turbidity of the filtered wastewater does not exceed any of the following:*
  - *0.2 NTU more than 5 percent of the time within a 24-hour period; and*
  - *0.5 NTU at any time.*

"Disinfected tertiary recycled water" means a filtered and subsequently disinfected wastewater that meets the following criteria:

- *The filtered wastewater has been disinfected by either:*
  - *A chlorine disinfection process following filtration that provides a Ct (the product of total chlorine residual and modal contact time measured at the same point) value of not less than 450 milligram-minutes per liter at all times with a modal contact time of at least 90 minutes, based on peak dry weather design flow; or*
  - *A disinfection process that, when combined with the filtration process, has been demonstrated to inactivate and/or remove 99.999% of the plaque forming units of F-specific bacteriophage MS2, or polio virus in the wastewater. A virus that is at least as resistant to disinfection as poliovirus may be used for purposes of the demonstration.*
- *The median concentration of total coliform bacteria measured in the disinfected effluent does not exceed an MPN of 2.2 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed and the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30-day period. No sample shall exceed an MPN of 240 total coliform bacteria per 100 milliliters.*

Any technology considered for use must be a CDPH approved technology listed in the Treatment Technology Report for Recycled Water, (January 2007).

Of note, using constructed wetlands to treat wastewater would not result in the production of effluent suitable for use as recycled water and may not reliably meet the anticipated effluent discharge requirements. It is expected that the use of constructed wetlands for treatment would not be feasible. However, the use of constructed wetlands for the purpose of effluent disposal is potentially feasible. This was not included in the Project at this time in order to minimize the overall capital cost. The three treatment options discussed are:

- Immersed Membrane Bioreactor (MBR);
- Integrated Membrane Activated Sludge (IMAS); and
- Integrated Surge Anoxic Mix (ISAM) sequencing batch reactor (SBR) with sand filter.

Each treatment option is discussed below. General information about each system is attached as **Appendix H**.

3.3.1 Immersed Membrane Bioreactor (MBR)

Immersed MBRs are state-of-the-art treatment plants designed to treat wastewater using the same biological principles as conventional activated sludge plants, but with a new concept in solids separation. The common driving principle is the conversion of soluble organic waste into biomass. The difference is the rate at which these conversions are occurring and the method by which the separation of solids occurs. Compared to conventional activated sludge, which relies on a clarifier for gravitational separation of solids, MBRs utilize membrane technology to physically separate the solids. Additionally, the mixed liquor suspended solids concentration in the aeration basin is approximately 8,000 mg/L in an MBR compared to 2,500 mg/L for a pure oxygen activated sludge plant. The high mixed liquor concentration results in a high level of BOD reduction, and partial sludge digestion. The result is a more uniform effluent quality and enhanced biological treatment performance because of the higher microorganism concentrations not previously possible with conventional activated sludge.

For a typical MBR system, the microfiltration membranes are immersed in the aeration basin, or in the aerated zone of an anoxic/aeration dual-zone basin. Dissolved BOD is converted into filterable solid material in the aeration basin by an aerobic suspended growth process. In this process, aerobic bacteria and other microorganisms use carbon in the wastewater for energy and cellular synthesis. Nitrification also occurs in the aeration basin, due to the high mean cell residence time.

The microfiltration membranes immersed in the aeration basin are generally housed in independent units called “cassettes.” Each cassette consists of several microfiltration “modules.” Membrane “modules” consist of a bundle of hollow microfiltration fibers with a nominal pore size of between 0.1 and 0.4 microns, depending on the membrane vendor. Packaged together, the MBR package plant is approximately 42 ft by 10 ft in size.

A typical MBR process utilizes permeate pumps to create suction from the hollow inner portion of the microfiltration fibers. The suction draws wastewater through the porous surface of the microfiltration fibers from the outside in. Scour air is applied underneath the membrane cassettes through the microfiltration modules to remove solids that would otherwise accumulate between and on the surface of the microfiltration fibers. In addition, process air is applied continuously via fine bubble diffusers in the aeration basin to support the microbiological activity.

The membranes are periodically backwashed with a brief backpulse cycle. During a backpulse cycle, the differential pressure across the membranes is reversed, and water is moved through the membrane tubes from the inside to the outside. The backpulse operation is fully automated by actuated control valves and a programmable logic controller (PLC). During a backpulse cycle, the direction of flow of water through the membranes is reversed for a short time to clean the membranes. Sodium hypochlorite is also injected into the backpulse flow to assist in the removal of solids from the membrane fibers.

MBRs consolidate many of the unit processes required in a conventional activated sludge design. The MBR process combines oxidation, clarification, and filtration into one step. A bioreactor with separate anoxic and aerobic cells provides the environment necessary for BOD removal, nitrification, and denitrification processes to occur. Because of the high concentrations of microorganism in the bioreactor that synthesize waste, uptake rates are significantly increased.

After filtration, the permeate is ready for disinfection and disposal. The water quality produced by a MBR is generally of very high quality. The effluent quality expected from a typical MBR WWTP is summarized in **Table 3-2**.

Table 3-2: Typical MBR WWTP Effluent Water Quality

Parameter	Units	WWTP Effluent
BOD_5	mg/L[1]	<1 - 3
TSS	mg/L	Non-detect
Ammonia	mg/L	0.2 - 0.8
Nitrate	mg/L	5.0
Turbidity	NTU[2]	< 0.1

Notes:
1. mg/L = milligrams per liter
2. NTU = nephelometric turbidity units

Sludge is generally wasted periodically from a MBR tank at reduced rates when compared to an SBR or activated sludge process. This is due to the endogenous respiration of solids within the aeration basin due to the high mixed liquor concentrations. Sludge generated in the microfiltration basin is pumped to a digester as required. Sludge would be hauled off-site for treatment and disposal to a third party treatment facility.

One nearby location where sludge is commonly hauled to is the East Bay Municipal Utility District Main WWTP in Oakland, CA. The cost for disposal is approximately $0.05/gallon for up to 3% total solids sludge, plus a $200 permit fee. Hauling costs by a private hauler would be an additional negotiated cost. At the existing projected flows and TSS concentrations, and assuming a 1% TS sludge that is hauled away, approximately 600 gallons of sludge would be hauled per day.

The total footprint of the MBR WWTP basin to serve the initial (current) flows, excluding screening, disinfection, etc. is approximately 12 ft in width, 42 ft in length, and 12 ft tall. Due to the relatively low flow rate expected in the influent, there are a number of pre-assembled "package" MBR WWTPs that could be purchased directly from a vendor that would provide this method of treatment at a reduced cost. These package MBRs are typically an approved Title 22 treatment technology that is suitable for producing recycled water. The package MBRs are all of slightly varying size and slightly varying methods of treatment, but all work on the fundamental premise of having membranes immersed in a mixed liquor that produce an effluent meeting the level of effluent water quality identified in **Table 3-2**.

3.3.2 Integrated Membrane Activated Sludge (IMAS)

The IMAS filtration treatment system differs from the conventional MBR process in that it utilizes separate biological and membrane filtration units in the process train. The system uses a spiral wound (Spirasep) polyethersulfone ultrafiltration membrane module with a nominal pore size of 0.05 micron. The membranes are operated under vacuum with a transmembrane pressure ranging from -1.0 to -10.0 psi (lower than a typical MBR) and a typical design flux of 20 to 45 gallons per square foot per day (higher than a typical MBR). The treatment system was approved by the State of California, Department of Public Health, as complying with the Title 22 Water Recycling Criteria.

The IMAS system is a prepackaged treatment system containing all of the aeration and membrane filtration process components. The system consists of

- A well-mixed anoxic zone for denitrification,
- An aerobic zone where BOD is converted into filterable solid material and nitrification occurs via nitrifying aerobic bacteria,
- A post-aeration anoxic zone performing the same functions as the first anoxic chamber, and
- A high rate clarifier chamber with two single hopper gravity clarifiers and airlift scum and sludge recycle pumps that direct scum and sludge to the sludge holding tank. Sludge would be hauled off-site for treatment and disposal to a third party treatment facility.

Solids are separated from the decant using high rate inclined plate settlers. The decant gravity flows over a weir and into the bottom of two parallel arrays of membrane elements, completely immersing the membranes. Suction created by a pump creates a low vacuum (<10 psi), drawing water into the membrane feed channel and through a proprietary Spirasep membrane with foul-resistant, spiral-wound hydrophilic elements, where it is directed by the permeate carrier to the central permeate tube. Upon exiting the membrane, permeate is conveyed to the permeate storage tank, which also serves as the backflush feed tank. The total footprint of the proposed IMAS WWTP basin, excluding screening, disinfection, etc. is approximately 10 ft X 42 ft X 11 ft (W:L:H).

Sludge hauling volumes, concentrations, and methods are expected to be similar to the MBR.

3.3.3 Integrated Surge Anoxic Mix (ISAM) Sequencing Batch Reactor (SBR) with Tertiary Filtration

The ISAM process is similar to a typical SBR in which stabilization and solids separation are sequentially accomplished with batch treatment in a single reactor. The surge tank is used for equalization and some treatment prior to entering the SBR. The SBR utilizes a five-step treatment process, in which the wastewater fills the tank, is aerated, the solids are allowed to settle, the effluent is decanted, and the tank is idle and ready for the next batch. The steps are described below:

Step 1. Fill: The SBR treatment process includes primary screening for inorganic solids. Screened influent fills the SBR tank until the basin is full. The influent mixes with biomass produced from previous operation of the SBR system.

Step 2. React: Inside the SBR basin, jet aerators supply both the oxygen and mixing power to stabilize the BOD and to keep the contents completely mixed. The air initiates an aerobic reaction where the nitrification process takes place. Mixers ensure distribution of the influent, the food source, to the biomass (organisms) for biological treatment. The biomass is selected to have an MCRT sufficient for partial nitrification and denitrification, though not necessarily at the peak daily capacity. Once mixing is complete, air is added for polishing as needed.

Step 3. Settle (sedimentation/clarification): After the tank fills and a specific aeration interval occurs, all physical activities (e.g. air and mixing) are stopped to allow for settling of the activated sludge.

Step 4. Draw/Decant: After the settling period, clear water, which is the secondary effluent, is decanted off the top of the second SBR basin and pumped to a flow equalization tank and sludge is drained from the bottom.

Step 5. Idle: Once the effluent from the SBR basin has been removed, the basin is once again ready for another cycle of treatment. After the tank empties (or achieves a minimum water level), the process repeats. A portion of the wastewater is recycled back to the surge tank to complete the nitrification and denitrification process.

This treatment plant can be designed to provide tertiary treatment of Project wastewater so effluent can be reused for Title 22 approved uses by adding a filter. A sand filter would be used to filter the treated wastewater that has been decanted from the reactor vessel. Sludge would be hauled off-site for treatment and disposal to a third party treatment facility.

Some of the advantages of SBR include: 1) greater economy due to a single reactor; 2) reliable under a range of changing influent conditions; 3) minimal footprint, and 4) easily expandable. Disadvantages include: 1) requires greater operator attention and maintenance than conventional activated sludge; 2) requires a more complex control system as well; 3) requires sand filtration step post-treatment that is not required by MBR; and 4) SBRs do not typically have quite as high quality effluent as MBRs.

The total footprint of the proposed SBR WWTP basin, excluding filtration, screening, disinfection, etc. is 12’ width, 32’ length, and 12’ height.

Sludge hauling volumes and concentrations are expected to be similar to the MBR.

3.3.4 Wastewater Treatment Comparison

All of the wastewater treatment options are potentially feasible for this Project. Due to the relatively low influent flows, there is a variety of reliable treatment options that could produce effluent suitable for disposal via multiple methods. Regardless of the treatment method selected, a Grade III wastewater operator must be hired to operate the WWTP.

Table 3-3 provides a summary of the cost comparison for the treatment options including the capital cost and estimated annual O&M costs. **Appendix G** provides the detailed cost breakdown. Annual O&M costs were estimated to be approximately 2 to 4% of the capital cost for the system (excluding labor), and escalate at a rate of approximately 7% annually. It should be noted that the annualized cost is based on a 20-year time period with a 7% rate of return.

Table 3-3: Cost Comparison of Various Tertiary Treatment Options

Cost Item	MBR	IMAS	SBR
Construction and Equipment Cost	$400,000	$266,000	$321,000
Construction Contingency (20%)	$80,000	$53,000	$64,000
Engineering & Design (10%)	$40,000	$27,000	$32,000
Permitting (3%)	$12,000	$8,000	$10,000
Construction Management (10%)	$40,000	$27,000	$32,000
Legal & Administrative (7%)	$28,000	$19,000	$22,000
Total Capital Cost	**$600,000**	**$400,000**	**$481,000**
Annualized Cost over 20 years	$57,000	$38,000	$45,000
Annual O&M Cost	**$12,000**	**$16,000**	**$19,000**

Notes:
1. All costs rounded to the nearest thousand.
2. Costs for all three systems include fine screening, but not disinfection
3. It was assumed that the processes upstream and downstream of these facilities are similar, which is why they were excluded from this comparison.
4. Cost for SBR includes redundant sand filtration facilities.

The SBR and tertiary filtration treatment process is not further considered, due to the need for a two-step treatment process with two unit processes. The quality of the effluent and required operator attention to this process would require more operator attention and potentially cost more to operate and maintain. It was assumed that the O&M cost would be approximately 4% of the capital cost.

The IMAS system is a relatively new product. Due to the few existing installations, a demonstrated long-term track record does not exist for this product. During the design phase, this product should be further considered in light of any new applications where it has been installed. Without adequate history of installations for this product, it was assumed that the O&M cost would be approximately 4% of the capital cost.

Due to the reliability and the demonstrated quality of the process throughout California, it is recommended that the Project utilize a package MBR plant for wastewater treatment. During the design phase, it is recommended that package MBRs from Zenon, Siemens, US Filter, Pall, and Enviroquip be considered for installation. This type of system has been successfully installed throughout California and it was assumed that the O&M cost would be lesser than the other two systems, approximately 2% of the capital cost.

3.3.5 Proposed Treatment Plant Process Train

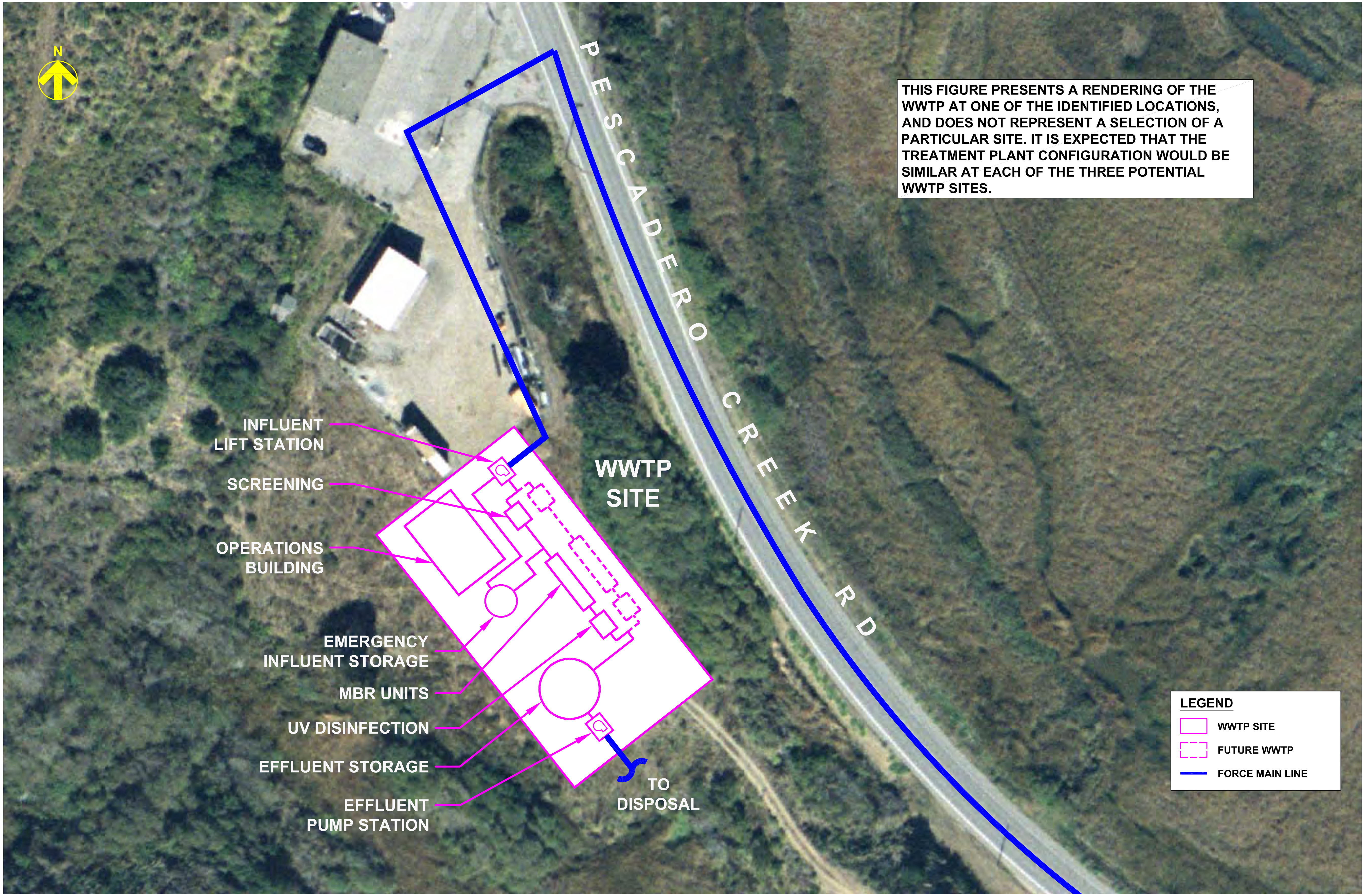
The major components of a treatment plant in addition to the type of treatment selected for the Project would include:

- Influent pump station;
- Screening;
- Immersed MBR (described in **Section 3.3.1**)
- Emergency storage;
- Disinfection system;
- Recycled water storage;
- Sludge dewatering; and
- Operations building.

Figure 3-5 contains the proposed layout of the treatment plant at one of the identified locations. The ultimate footprint for this WWTP is approximately 26,400 ft^2, or 0.6 acres. The size of the WWTP could be modified based on the WWTP site selected and components utilized. **Figure 3-6** shows a process flow diagram of the proposed treatment process. It is expected that each unit process will have sufficient redundancy or reliability components designed into it to allow the plant to comply with the expected Waste Discharge Requirements. The specific unit processes are further described below.

Influent Pumping: An influent sewage lift station will be required. This pump station is typically sited upstream of the treatment process. The lift station would be a wet well with submersible sewage pumps. All raw sewage would flow into the lift station prior to being pumped to the treatment process. The lift station located at the Butano Creek Crossing can serve the function of the influent lift station. The Butano Creek lift station would be sized to pump through the screenings to the MBR.

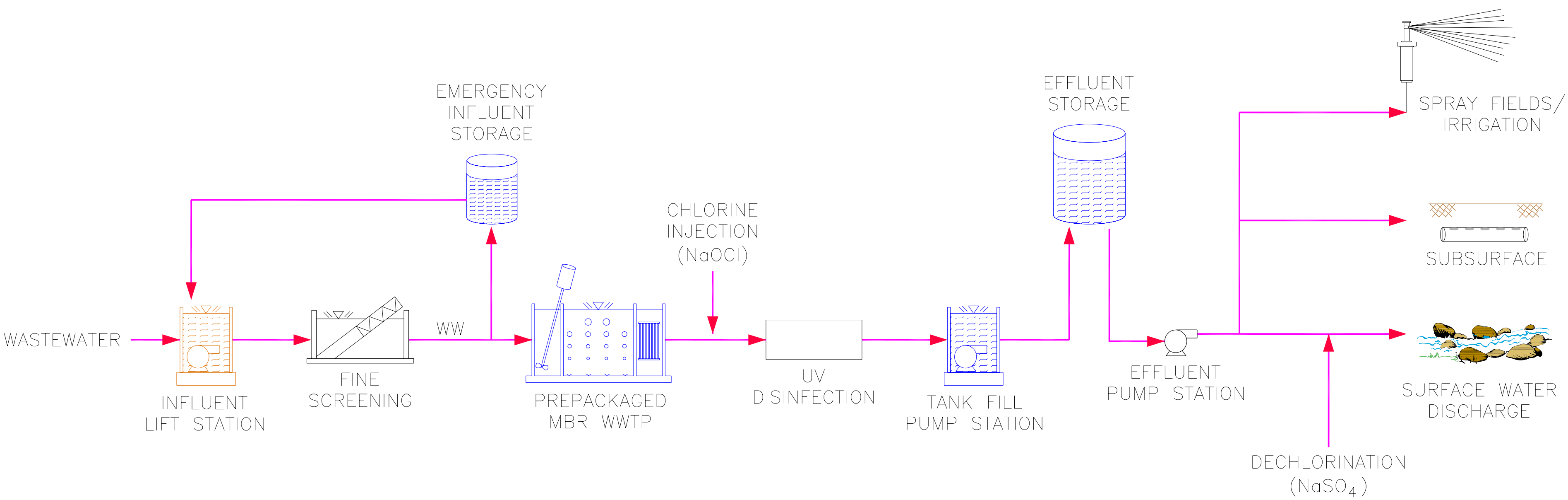
Screening: A headworks station including a self-cleaning cylindrical screen with an integral screenings scraper/conveyor and compactor will be required. The headworks will include a 1 to 3-mm perforated cylindrical basket type screen to protect the treatment system.



HydroScience Engineers

FIGURE 3-5
PESCADERO COMMUNITY SEWER PROJECT
SMALL COMMUNITY WASTEWATER GRANT FACILITIES PLAN
WWTP LOCATION AND LAYOUT

S:\Common\Projects\245_Pescadero\SCWG Facility Plan\Figures\FIG3-05.dwg DATE: 10/14/08



HydroScience Engineers

FIGURE 3-6

PESCADERO COMMUNITY SEWER PROJECT

SMALL COMMUNITY WASTEWATER GRANT FACILITIES PLAN

RECOMMENDED WASTEWATER TREATMENT PROCESS FLOW DIAGRAM

S:\Common\Projects\245_Pescadero\SCWG Facility Plan\Figures\FIG3-06.dwg DATE:10/14/08

Emergency Storage/Overflow Basin: Emergency storage helps attenuate peak influent flows, and reduces the capacity requirements for the treatment. The emergency storage typically would provide a minimum storage capacity equal to one day's average wastewater flow, which is anticipated to be approximately 25,000 gallons for existing customers and 75,000 gallons at buildout. The emergency storage will also serve to provide emergency storage of partially treated effluent, should the treatment process fail or overflow. It is recommended that a cylindrical storage tank constructed at-grade be used for emergency storage.

Disinfection System: WWTP effluent will be discharged to spray fields, to leach fields, to irrigated agricultural land, and to surface water. Disinfection requirements and preferred disinfection methods vary with the ultimate use or disposal method.

UV disinfection is the method of choice for treated effluent that will be directly discharged to surface water. For this type of discharge, it is required to have zero chlorine residual in the discharged effluent. Using UV disinfection instead of chlorination avoids the need to chlorinate and then de-chlorinate the effluent.

The UV disinfection process can either be an in-line process or a separate channel. The two options are implemented based on-site specific constraints such as footprint and hydraulics, but have been demonstrated to work similarly. It is expected that an in-line UV disinfection process is more suitable for this site, because the footprint is reduced. The UV disinfection system would be designed to provide a dose of 80 mJ/cm^2, which is the DHS design criteria for UV disinfection of membrane effluent or 100 mJ/cm^2, which is the design criteria for media filtration. A redundant UV unit in series would also be required. UV lamps typically need to be replaced after approximately 2000 hours of usage.

Chlorination is the preferred disinfection method for treated effluent that is to be recycled and/or stored in the recycled water storage tank. A UV system can be used for disinfection of recycled water, but cannot provide the residual to prevent the re-growth of bacteria or algae in the piping or storage tanks. A chlorination system can provide this residual.

Chlorination would occur either in a separate chlorine contact channel, or in the recycled water storage tank. The recycled water storage tank can be designed with baffles to provide the 90 minutes of contact time required to comply with Title 22 chlorination requirements. A 5 mg/L residual is also required for the effluent, resulting in compliance with the minimum dose requirements.

Vita-D-Chlor or another chemical similar to sodium bisulfite would be used as needed to dechlorinate effluent from the recycled water storage tank prior to discharge to surface water in accordance with the requirements of the discharge permit.

Recycled Water Storage: Plant effluent will be pumped to a recycled water storage tank. Recycled water storage will provide flow equalization, storage for irrigation water, and hydraulic residence time adequate to meet regulatory disinfection requirements. A new storage tank will be sized to hold up to 225,000 gallons of effluent, which is equivalent to one peak day of storage for future flows, with a 20% factor of safety.

Sludge Dewatering: For a facility of this size, it is recommended that sludge be hauled off-site for treatment and disposal to a third party treatment facility. Sludge dewatering is typically implemented at larger facilities where the cost of dewatering sludge is more economical than the cost of hauling it for disposal.

Plant Drain Pumping: A plant drain pump station will be required. This pump would be sited downstream of the treatment process and emergency overflow basin. The pump station would be a wet well with submersible sewage pumps. All drains would flow by gravity into the plant drain. The plant drain would pump back to the headworks of the treatment system.

Operations Building: A new operations building will be constructed to provide an on-site laboratory and maintenance area as well as office space. The blowers and electrical gear associated with the MBR will be housed in a separate building near the MBR. For the Corporation Yard option, this building can be designed to include additional office and storage space to replace the existing Corporation Yard facilities building. Alternatively, the existing buildings within the Corporation Yard could serve a dual function. The size of the operations building shown in this document is approximately 40 ft by 60 ft. The footprint of this building can be reduced or increased based on the needs of the Project.

3.3.6 Treatment Plant Design Criteria

Table 3-4 below summarizes the specifications for a MBR treatment facility that would have the capacity to treat the current projected peak day wastewater flow of 61,400 gpd and will be expandable to treat future flows. The peak day flow is estimated to be 2.5 times the average day flow and represents peaking associated primarily with wet weather inflow and groundwater infiltration as well as peak usage. During the planning of the WWTP, influent water quality design criteria for BOD and TSS concentrations and loading will be determined to adequately size the biological portion of the aeration treatment process. The blowers and the aeration tank volume will be sized in a manner than ensures that enough oxygen can be delivered to the mixed liquor to promote biological activity in the aeration basin.

It is expected that the plant will be staffed by a Grade III operator, who will divided their time between operating and maintaining the treatment plant, effluent disposal, and collection system. At selected times, the operator may be supplemented by as-needed staff to perform selected activities or to provide relief during periods when the operator is otherwise unavailable. The Owner/Operator of the plant will determine plant staffing requirements, but the minimum staffing requirements are set by the RWQCB.

It is also expected that the plant will have backup power provided by a standby generator, and that there will be remote SCADA access for the plant operator to view plant conditions remotely.

Table 3-4: MBR Plant Design Summary for Existing Customers and Flows

Parameter	Value
Current Influent Water Quality	
BOD	200-300 mg/L
TSS	200-300 mg/L
Design Flows	
Average Daily Flow:	24,100 gpd
Peak Design Flow:	60,400 gpd
Influent Pump Station (Butano Creek Crossing Lift Station)	
Type:	Submersible non-clog centrifugal
Quantity:	1 duty, 1 standby (2 total)
Control:	Constant speed, level transmitter, back-up float switch start and shutoff
Headworks	
Screening Facilities:	Enclosed cylindrical screen with 1 to 3-mm circular perforations, integral shaftless helical scraper/conveyor and compactor, and mechanical washer
Metering Facilities:	Magnetic flow meter on influent pipe
Odor Control:	Corrosion resistant plate covered channels
Control:	Continuous operation
Emergency Storage	
Type:	Circular, at grade
Volume:	25,000 gallons
MBR Process Trains	
Number of Process Trains:	1
Total MBR Volume:	55,000 gal, typical (depending on manufacturer)
Process Train Basins:	Anoxic basin, aeration/microfiltration membrane basins
Plant Sludge Age:	14 days
Design Flux:	17.2 gal/(ft^2-day), typical (depending on manufacturer)
Anoxic Basin Volume:	30,000 gal, typical (depending on manufacturer)
Membranes	
Type:	Hollow fiber or flat plate, depending on manufacturer
Pore Size:	0.1 or 0.4 micron, depending on manufacturer
Dewatering	
Dewatering would be performed off-site. Mixed liquor would be hauled off to another location for treatment and disposal.	

Parameter	**Value**
Disinfection	
Type:	UV Disinfection (Surface Water Discharge) or Chlorination (All other disposal methods)
Dosing	80 mJ/cm^2 for UV, 2-5 mg/L for chlorine
Effluent Storage	
Volume:	225,000 gallons
Type:	Circular, at grade

SECTION 4 – EFFLUENT DISPOSAL

This section evaluates the effluent disposal options available to Pescadero for tertiary treated effluent. This discussion specifically describes the following options:

- Agricultural/spray field irrigation;
- Subsurface disposal; and
- Surface water discharge.

4.1 Agricultural/Spray Field Irrigation

It is expected that the available recycled water would be treated to tertiary standards that would make it suitable for unrestricted reuse, including irrigation of agricultural crops.

A cursory analysis of potential reuse sites in Pescadero indicates that there are opportunities to use recycled water for irrigation. Specifically, recycled water could be utilized by the local agricultural sites near the proposed WWTP site and around the town, including the Silver Terrace Nursery. Most, if not all, recycled water users would be located outside of the CSA-11 boundary.

Any excess water that could not be disposed of through irrigation of agricultural crops could be disposed of to spray fields. Spray fields are typically designed for the sole purpose of disposal and are usually seeded with a crop with high water demands, such as alfalfa.

Typically, spray fields are developed in conjunction with seasonal storage facilities. Seasonal storage is required during the periods when irrigation demands are low. Seasonal storage is determined by identifying the amount of spray fields required to dispose of all recycled water produced annually and determining, based on agronomic rates of disposal, how much storage is required to balance the disposal rates.

Table 4-1 below presents the preliminary spray field requirements for Pescadero.

Table 4-1: Spray Field and Seasonal Storage Requirements

Flow Scenario	Average Day Flow (gpd)	Spray Field Area[1] (acres)	Seasonal Storage Volume[2] (ac-ft)[3]
Existing Flows	24,100	20.0	22.8
Future Flows	73,700	58.3	62.3

Notes:
1. The spray field requirements are based on the assumption that there is no other method of disposal and that all recycled water would be disposed of to spray fields.
2. The storage volume for existing flows is based on a reservoir area of two acres. The storage volume for future flows is based on a reservoir area of four acres.
3. ac-ft = acre-feet
4. The spreadsheet analyses for both scenarios are attached as **Appendix C**.

Figure 4-1 identifies approximately 70.1 acres of County land potentially available for spray field irrigation. This figure does not identify any agricultural parcels for recycled water application. This available land includes a 200 ft buffer from any water tank or water well.

In order to alleviate the burden of seasonal storage, each individual user could provide storage onsite. This would reduce any storage that would need to be constructed. Currently, there is neither infrastructure available or planned for the purposes of recycled water distribution and storage nor is there funding available for this purpose.

This method of disposal will likely be supplemented with other methods of disposal to reduce or eliminate the seasonal storage requirements and to provide flexibility for disposal. Other methods of disposal are discussed further in the following sections.

Irrigation with recycled water would typically be limited to application at agronomic rates to prevent runoff of recycled water. Agronomic rates of disposal are specific to the local climate and crop used for disposal. To calculate the agronomic rates, the following methodology was utilized to determine the total application rate of water per unit acre. A summary of how these criteria are utilized is included below.

ET Rates: ET is a measure of water usage by a particular plant or crop, and is a function of the net solar radiation, air temperature, wind speed, and vapor pressure in a particular location. Evapotranspiration rates for a specific crop in a specific location are calculated on a monthly basis by the following equation:

$$ET = ET_o * k_c$$

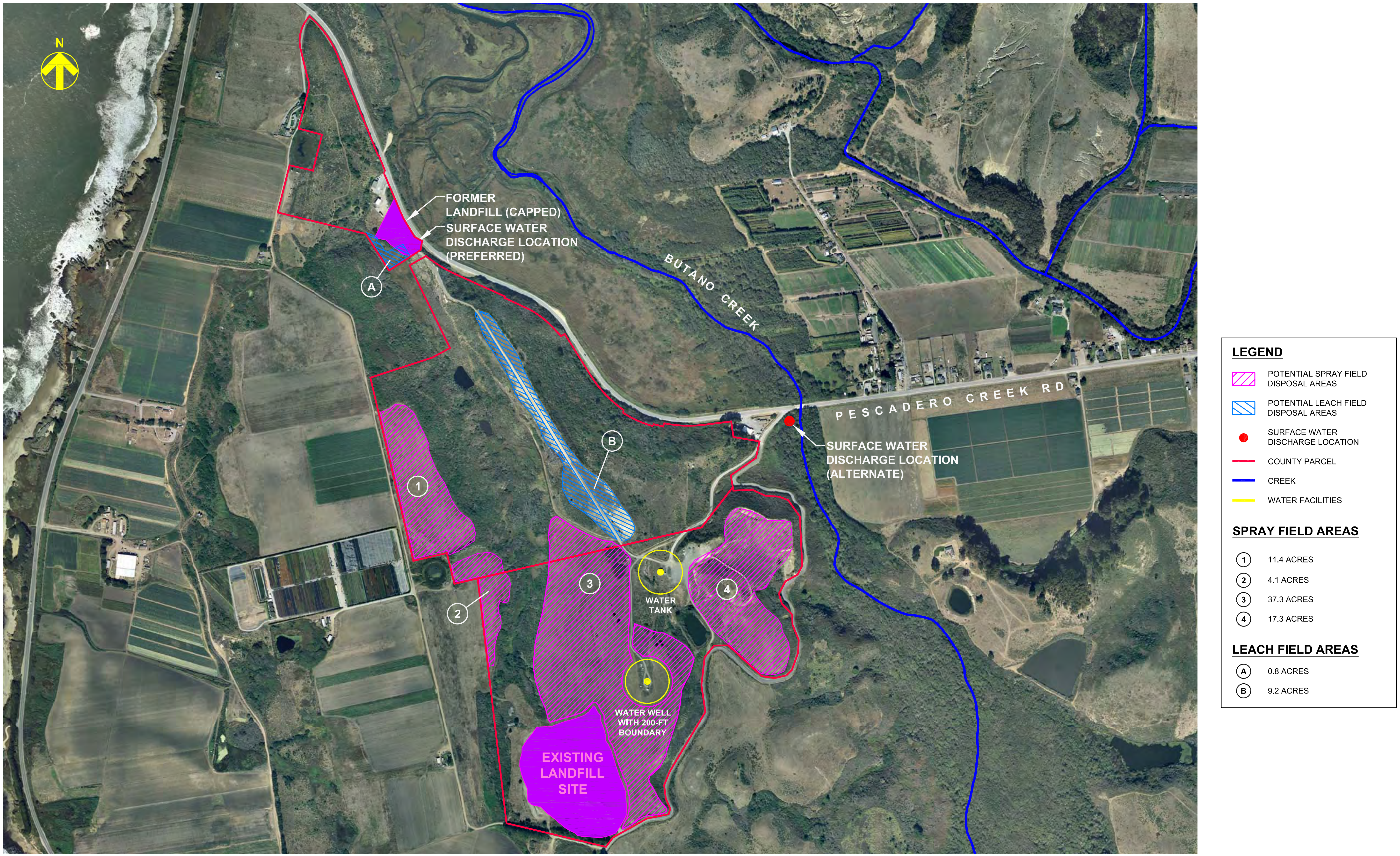
where:

ET_0 = *Normal year reference crop evapotranspiration rate for a given geographic location (California Department of Water Resources [DWR], California Irrigation Management Information System [CIMIS] database)*

k_c = *Crop coefficient for a given crop (University of California – Cooperative Extension, California Turfgrass Culture)*

For this study, reference crop normal year evapotranspiration rates (ET_0) for the region were obtained from the DWR CIMIS database. Crop coefficients for cool weather turf grasses were obtained from the University of California – Cooperative Extension leaflet. Calculated ET rates and irrigation demands are presented below in **Table 4-2**.

Precipitation: Monthly precipitation data for nearby San Gregorio was obtained from WRCC data. Monthly rainfall values from 1954 through 2007 were averaged to obtain typical annual rainfall data. During the months from November through March, an additional six inches for each month was added to account for rainfall from a 100-year storm.



HydroScience Engineers

FIGURE 4-1

PESCADERO COMMUNITY SEWER PROJECT
SMALL COMMUNITY WASTEWATER GRANT FACILITIES PLAN
PROPOSED EFFLUENT DISPOSAL OPTIONS

S:\Common\Projects\245_Pescadero\SCWG Facility Plan\Figures\FIG4-01.dwg DATE: 10/15/08

Estimated Unit Irrigation Demands: Typical monthly unit irrigation demands for turf grasses are summarized in **Table 4-2** and were calculated using the following formula:

$$ID = \frac{(ET - Pe_p)l_r}{e_i}$$

where:

ID = *Irrigation demand or allowable irrigation in inches.*

ET = *Evapotranspiration for turf grasses in the California coastal plains fog belt.*

P = *Average precipitation, DWR.*

e_p = *Precipitation irrigation efficiency, 0.75. Assumes 25% of rainfall during growing season is lost to evaporation, runoff, etc.*

l_r = *Loss Rate or Leachate Factor, equal to 1.1. This assumes that approximately 10% of the applied water passes through the grass root zone and is lost.*

e_i = *Irrigation efficiency, ranges from 0.6 to 0.95 (depending on season). This assumes that 5% to 40% of the applied irrigation water is lost to evaporation.*

Table 4-2 includes local pan evaporation data, evapotranspiration data, precipitation data and allowable spray field irrigation demands for Pescadero.

Table 4-2: Estimated Irrigation Demands for Pescadero

Month	**ET (Inches) [1]**	**P (Inches) [2]**	**ID (Inches)**
January	0.93	5.66	0.00
February	1.40	5.08	0.00
March	2.48	4.25	0.00
April	3.30	2.27	0.80
May	4.03	0.86	3.08
June	4.50	0.33	4.14
July	4.65	0.11	4.53
August	4.03	0.18	3.83
September	3.30	0.41	2.85
October	2.48	1.53	0.80
November	1.20	3.53	0.00
December	0.62	5.24	0.00
Total	**32.92**	**29.45**	**20.03**

Notes:
1. ET data source: CIMIS Reference Evapotranspiration Map, Coastal Plains Heavy Fog Belt zone.
2. Precipitation data from WRCC, San Gregorio 2 SE (047807) for 6/1954 - 6/2007.

As shown above, in **Table 4-2**, the peak monthly allowable irrigation of 4.53 inches is projected for July. The allowable irrigation for a winter month is assumed to never fall below zero. For months during which the allowable irrigation is positive, additional water from the recycled water system can be applied. The typical season for spray field irrigation demands stretches between April and October. No irrigation is projected between November and March.

4.2 Subsurface Discharge

Subsurface discharge for this Project would be expected to comprise of leach fields. Unlike spray fields, leach fields can be operated year round, making storage and weather conditions less of an integral part of the wastewater disposal system. Leach field capacities are based on local guidelines and site soil characteristics, which are discussed below.

Subsurface discharge typically consists of constructing an underground leach field for plant effluent to percolate into the subsurface. Soil characteristics play a dominant role in determining whether the site is suitable for subsurface disposal. Soils differ greatly in the amount of water that they can absorb. A description of the soil types are identified in **Section 2.3**. In the USEPA Onsite Wastewater Treatment Systems Manual, the recommended hydraulic loading rates for the soil types believed to be present in Pescadero range from 0.3 to 0.6 gpd/ft^2. Studies indicate that percolation rates significantly vary according to location and leach fields are sized based on individual percolation tests conducted on the site.

It is important to also consider site topography when locating the leach field and choosing between subsurface disposal options. For optimum subsurface system performance, leach fields are typically constructed on level, well-drained areas, crests of slopes, and convex slopes with natural ground sloping between 0% and 25%.

Conventional leach fields consist of a series of looped or lateral trenches 1.5 to 2 feet wide and 2 to 5 feet in depth. Perforated pipes run along the trenches to disperse the effluent into the soil. The trenches are filled with stone or gravel and covered to reduce surface water inflow. The wastewater is directed into the pipe by gravity and into the soil, where microorganisms treat the organic matter, solids, and nutrients through an aerobic process. The air enters the gravel, usually through the backfill.

Percolation testing at the leach field sites would be required to adequately size the leach fields. However, for the purposes of making preliminary estimates, based on the site soil type and the recommended hydraulic loading for leach fields, the Project site leach field capacity rate is estimated to be about 6,500 gpd/acre, assuming the following:

- Soil texture described as sandy clay loam, clay loam, silty clay loam;
- Hydraulic loading rate of 0.3 gpd/ft^2 recommended in the USEPA Onsite Wastewater Treatment Systems Manual; and
- 100% redundancy.

Table 4-3 presents the total leach field areas required to dispose of anticipated wastewater flows. The leach fields are designed for average day flows and can accommodate peak flows associated with I/I with the redundant facilities. This table presents the leach field area required assuming that all recycled water would be disposed of to leach fields.

Table 4-3: Leach Field Area Requirements

Flow Scenario	Average Day Flow (gpd)	Total Leach Field Area Required (acres)
Existing Flows	24,100	3.7
Buildout Flows	73,700	11.3

Approximately 9 acres of County land may be suitable for leach field disposal and are identified in **Figure 4-1**. Prior to final design, it would need to be verified that these locations are at least 100 feet from any flowing stream and 200 feet from any groundwater well or tank. It is also intended to not locate leach fields underneath existing roads. It is noted that not all available areas identified may be required.

It is expected that the cost for leach field construction would be approximately $200,000 per acre. Those costs are based on construction cost estimates elsewhere in California. For four acres of leach fields, it is expected that the total cost for this option would be approximately $800,000. For nine acres, the total cost would be approximately $1,800,000.

4.3 Surface Water Discharge

In order to discharge wastewater produced on-site to local surface waters, a National Pollutant Discharge Elimination System (NPDES) permit is required. As a basis for a NPDES permit application, the following assumptions were incorporated into the wastewater handling strategy.

- The wastewater will be treated to tertiary standards, maximizing available disposal options, and protecting the beneficial uses of the waters of the State; and
- The community will comply with all applicable regulatory requirements.

Two discharge locations were evaluated for this Plan. The first point of discharge considered is at Butano Creek and Pescadero Creek Road. This location would be a direct discharge to Butano Creek, which is tributary to Pescadero Creek. The second point of discharge considered is to a ditch that is hydraulically connected to Pescadero Marsh via a culvert under Pescadero Creek Road. Pescadero Marsh is located at the confluence of Pescadero and Butano Creeks. No direct discharge to Pescadero Creek was considered. **Figure 4-1** identifies the potential discharge locations.

Butano Creek and Pescadero Creek are both considered impaired waterways and are identified on the 2006 CWA Section 303(d) List of Water Quality Limited Segments. The list identifies the two creeks as impaired due to sedimentation/siltation, which in turn is impairment to steelhead habitat.

For either potential discharge location, it is expected that the NPDES Permit will define, at a minimum, the following:

- **Discharge prohibitions:** Explicitly states that the discharge of wastewater that is not treated to the standard that is identified in the permit is prohibited. This may include sanitary sewer overflows. Also states the allowable discharge rates;
- **Effluent limitations and discharge specifications:** Identifies the constituents and level of treatment required to be in compliance with the permit;
- **Receiving water limitations:** Ensures protection of the waterway or water body and is based on the beneficial uses identified in the Water Quality Control Plan (Basin Plan); and
- **Monitoring and reporting requirements:** Identifies the ongoing monitoring and reporting requirements that will become the burden of the discharger to maintain compliance with the permit.

The intent of a NPDES permit is to protect the beneficial uses of the waters of the State. Beneficial uses of waters of the State are uses that require protection against water quality degradation by any proposed discharge, and reflect the demands on those water resources.

The RWQCB does not identify specific beneficial uses for Butano Creek in the Basin Plan. However, several beneficial uses are identified for Pescadero Creek and Marsh. Tributaries are typically assigned the same beneficial uses as the streams they discharge into. Water quality objectives for Pescadero Creek and Marsh and their tributaries are based on the identified beneficial uses. The beneficial uses are listed in **Table 4-4**, below.

Table 4-4: Beneficial Uses for Pescadero Creek and Marsh

Pescadero Creek[1]	Pescadero Marsh[2]	Beneficial Uses	Description
x		AGR	Agricultural Supply
x		MUN	Municipal and Domestic Supply
x		COLD	Cold Freshwater Habitat
	x	MAR	Marine Habitat
x	x	MIGR	Fish Migration
x	x	RARE	Preservation of Rare and Endangered Species
x	x	SPWN	Fish Spawning
x		WARM	Warm Freshwater Habitat
x	x	WILD	Wildlife Habitat
x	x	REC1	Water Contact Recreation
x	x	REC2	Non-Contact Water Recreation
	x	SALT	Brackish Water Marsh

Notes:
1. The beneficial uses for Butano Creek are the same as the beneficial uses of Pescadero Creek, as Butano Creek is tributary to Pescadero Creek.
2. Pescadero Marsh is listed in the Basin Plan as a fresh water wetland.

The benefit of a discharge to Butano Creek and Pescadero Marsh is that the discharger will provide a consistent and drought resistant supply of water to maintain the Marsh habitat throughout the year. It is believed that this portion of the Marsh is water short during many periods of the year, and may potentially benefit from a year-round supply of water.

The City of Pacifica is an example of a discharger that is currently permitted to discharge to a restored wetland where the discharge itself contributes to the beneficial maintenance of the wetland. The Calera Creek Water Recycling Plant provides tertiary treatment of domestic wastewater from the City of Pacifica. The plant discharges treated water to Calera Creek. Calera Creek, in turn flows through a restored wetland, which drains to the Pacific Ocean. The NPDES permit for the Calera Creek Water Recycling Plant is attached as **Appendix I**.

The additional cost for a surface water discharge is expected to be nominal. This would require the construction of a pipeline to the proposed discharge location, an outfall to the ditch, and appropriate monitoring equipment to comply with a NPDES permit. The total estimated cost to construct this discharge would be approximately $50,000. The cost to permit this discharge is expected to be approximately $150,000 to $200,000.

4.4 Effluent Disposal Strategy

The recommended effluent disposal strategy is as follows:

- Design an effluent disposal system that will allow for 100% land disposal of all effluent;
- Apply for a NPDES permit to discharge effluent to the Pescadero Marsh tributary;
- If a NPDES permit is issued or expected to be issued, reevaluate needs to construct the land disposal system; and
- Allow for future recycled water usage.

The advantage of leach fields is that they provide a method for year-round disposal. Septic tanks already drain to leach fields on each parcel within Pescadero, so it is expected that the capacity for subsurface disposal exists. For current flows, it is estimated that approximately four acres of leach fields will be required and an additional seven acres for buildout flows. This estimate is based on the assumptions stated in **Section 4.2**. Percolation testing will determine the actual capacity of leach fields.

It is also recommended that a NPDES discharge permit be pursued as an approved discharge will provide additional flexibility in disposal methods. The discharge can provide a consistent and high quality source of water to improve and maintain the marsh habitat, particularly during typically low flow conditions in the summer as well as drought years.

In the event that a NPDES permit is granted for surface water discharge to Pescadero Marsh, the extent of effluent disposal facilities could be reduced based on the discharge limitations. This could include eliminating the redundancy of the leach field disposal method for discharge, which would still allow for the occasional disposal of effluent to the leach field when the effluent may not meet the water quality standards, or if the Marsh is flooded. Eliminating the redundancy would reduce the leach field size by half, reducing the cost to an estimated $400,000.

It is recommended that the potential for recycled water use for agricultural parcels be further investigated. The first priority should be to provide recycled water to those parcels as long as infrastructure can be made available to distribute recycled water to those users. Any remaining recycled water should be disposed of to leach fields. It is recommended that a hydrogeological investigation and percolation testing be conducted to provide more accurate information about the hydraulic loading rates for each leach field site under consideration so that they can be sized appropriately. The area of leach fields developed should be sized to provide disposal of all effluent produced. This will ensure adequate capacity during the periods when there is no irrigation demand.

4.4.1 Budgetary Capital Cost Summary

A summary of the budgetary costs for the recommended effluent disposal strategy is presented in **Table 4-5** below. The detailed cost analysis is attached as **Appendix G**.

Table 4-5: Effluent Disposal Cost Summary

Cost Item	**Total Cost[1]**
Leach Fields[2]	$400,000
NPDES Permit Application	$175,000
Effluent Pump Station	$40,000
Effluent Distribution	$180,000
Creek Outfall	$10,000
Subtotal	**$805,000**
Construction Contingency (20%)	$161,000
Engineering & Design (10%)	$81,000
Permitting (3%)[3]	$24,000
Construction Management (10%)	$81,000
Legal & Administrative (7%)	$56,000
Total Capital Cost	**$1,208,000**

Notes:
1. All costs rounded to the nearest thousand.
2. It is assumed that half of the leach field area required would be developed for current flows (two acres). This assumption is based on acquisition of a NPDES permit for surface water discharge to Butano Creek.
3. Permitting charges for these facilities include other permits besides the NPDES permit from the RWQCB. These permits and approvals are listed in **Section 8**.

This page intentionally left blank

SECTION 5 – OPERATIONS EVALUATION

This section is prefaced to state that there are currently no treatment facilities within the town of Pescadero. Thus, this section focuses on the degree to which the groundwater basin can be improved by the construction of this Project.

Pescadero is currently an unsewered community that relies on septic systems for the capture of domestic wastewater. These septic tanks were cited by the RWQCB as "*providing inadequate treatment and safe dispersion of waste, posing a serious water quality threat to the local aquifer*" in a resolution (attached as **Appendix A**) supporting Pescadero's SCWG application.

The construction of a new collection system and WWTP will provide increased treatment of waste and increased protection of local groundwater supplies. Pescadero relies solely on groundwater for its water supply, and during the 1980s, it was discovered that groundwater wells contained high concentrations of nitrates. In response to this issue, the County located a remote water source, drilled a new well, and constructed the local potable water distribution system.

One of the keys for determining the water quality benefits of establishing a community sewer collection system will be to determine the extents of that system. The sewer collection service area is expected to overlap the existing CSA-11, which generally encompasses all of the non-agricultural parcels within Pescadero that are located along Pescadero Creek Road, Stage Road, and North Street. Constructing a collection system in this area will have the beneficial effect of reducing the water quality impacts from all of the septic tanks that are closest to the existing water supply facilities, both private and public. This should result in significant long-term groundwater quality improvements.

To quantify the expected benefits, it was assumed that the 94 existing CSA-11 accounts (out of 115 total parcels) contributed sewage at the loading and flow specified in this report (**Section 2.7**). It was also assumed that 95% of the BOD and TSS loadings made it into the drain fields, and did not remain in the septic tanks.

Table 5-1: Estimate of Current and Future Sewer Loadings to Groundwater

Scenario[1]	Without Project[2,3] (lb/year)	With Project[2,4] (lbs/year)	Net Difference (lbs/year)
Current	17,400	700	16,700
Buildout	53,200	2,200	51,000

Notes:
1. Based on the projected flows identified in **Section 2.7**.
2. Assumes that the BOD and TSS are both 250 mg/L in the influent, and 10 mg/L in the effluent.
3. Assumes 95% of the current influent BOD/TSS loadings make it to the subsurface.
4. Assumes that 100% of the effluent loadings from the Project would make it into the groundwater basin.

Construction of the collection system will require the County to adopt a resolution requiring connection of existing CSA-11 customers to the community wastewater system when it is available. This resolution would be similar to those in effect in other cities that prevent the use of leach fields when a sewer collection system is available. The County will also prohibit the construction and use of new septic tanks within the collection system service area. The Owner/Operator of the collection system would then be responsible for constructing the Project.

SECTION 6 – PUBLIC INVOLVEMENT

The Pescadero Municipal Advisory Council (PMAC) has been actively involved in the procurement of the SCWG grant, and is generally familiar with the Project goals. HSe is using the PMAC as the public stakeholder to help develop Project alternatives and disposal methods, identify pros and cons for proposed WWTP sites, and to provide overall Project input.

HSe prepared and delivered a presentation of the Project concept recommended in this report at the December 11, 2007 PMAC public meeting. Approximately 25 people attended the meeting. A copy of the presentation is attached as **Appendix J**.

Overall, the general consensus was that the PMAC and community supported the Project concept and proposed location for the WWTP. The PMAC voiced some concern about the Project costs, which were not yet available prior to the presentation. Following issuance of this report, it is expected that a follow-up presentation and discussion with the PMAC will occur. The PMAC will also have the opportunity to review and comment on the contents of this Plan.

Additionally, preparation of the environmental documentation will be coordinated with the community, as required by CEQA. This public involvement will be scheduled as that process continues forward.

This page intentionally left blank

SECTION 7 – REVENUE PROGRAM

The intent for this Revenue Program is to develop annual sewer rates and connection fees for the first full year of operation of the Project recommended in the Facilities Plan. The content of this section is based on the SCWG Revenue Program Guidelines.

Since Pescadero does not have any centralized wastewater collection, treatment, or disposal facilities, this revenue program covers the design and construction of those facilities for the Project, as defined in the Facilities Plan. It was also noted that the actual current wastewater flow is unknown. Influent flow estimates were developed as part of **Section 2.7**.

Additionally, since there is no centralized wastewater treatment or disposal, there is currently no budgeting, capital reserve, funds, expenses, staff, or other resources currently allocated for this Project. Pescadero also does not currently have any customers, user accounts, or other methods to bill wastewater customers.

7.1 Population Projections

The proposed Project will only serve the area bounded by the rural-urban limit, which is equivalent to the service area receiving potable water, CSA-11. The LCP (June 1998) envisages the Town of Pescadero having 146 current parcels that would receive sewage treatment, and an additional 145 parcels that would receive sewage treatment at buildout. This would result in a total of 291 parcels connected at buildout. These additional parcels will be located as infill within the current extents of Pescadero.

It was noted that **Section 2.6** shows that there are currently 115 parcels within the rural-urban boundary that can receive potable water. Not all parcels are receiving potable water during 2008, since not all of those parcels are developed. To maintain consistency with the LCP, it was assumed that the building permits allowed within the Pescadero and Butano Creek watersheds would be ten per year over the 40-year buildout time period. According to the LCP, this would result in 291 parcels connected to the collection system at buildout.

The current population for Pescadero is highly dependent on the area assumed included in the census. **Section 2.6** assumed that the total population of Pescadero was 755. However, it is expected that this population includes areas that would not be served by the collection system. The LCP assumes that 3.5 people would occupy every residence, and that approximately 85% of the parcels are residential. Based on the actual active residential accounts for 78 parcels, it is estimated that the current population that would be served by the WWTP would be 273. At the buildout number of parcels, and assuming the same number of people per dwelling unit, the connected population would increase to approximately 875.

Table 7-1: Pescadero Population Projection

Residential Parcels	Number	Population Estimate
Current	78	273
Buildout	250	875

7.2 Construction Cost Estimate

Project costs, including construction, design, construction management, inspection, administration are shown in **Table 7-2**. These costs are for the collection and disposal facilities recommended in **Sections 3 and 4**. The treatment plant costs are currently estimated to be similar for any of the selected alternatives. Costs for services not completely defined, such as easements, land, relocation of existing uses, and the like, are excluded from the WWTP cost estimate.

Table 7-2: Overall Construction Cost Estimate

Item	Qty.	Unit	Unit Cost	Total[1,2]		
Collection System				**Site 1**	**Site 2**	**Site 3**
8-inch gravity sewer	9,000	LF	$100	$900,000	$900,000	$900,000
Creek crossing (bore and jack)	150	LF	$200	$30,000	$30,000	$30,000
Manholes	20	LS	$3,500	$70,000	$70,000	$70,000
Lift Stations	2	LS	$85,000	$170,000	$250,000	$250,000
Sewer laterals/connection	94	EA	$2,000	$188,000	$188,000	$188,000
Disconnect and decommission septic tanks	94	EA	$1,000	$94,000	$94,000	$94,000
Miscellaneous	1	LS	$25,000	$25,000	$25,000	$25,000
4-inch force main	Varies	LF	$60	$360,000	$150,000	$210,000
Fire station pump station	1	LS	$40,000	$40,000	$40,000	$40,000
Collection System Subtotal				**$1,877,000**	**$1,747,000**	**$1,807,000**
Treatment Plant						
Package MBR with Fine Screening	1	LS	$400,000	$400,000	$400,000	$400,000
Emergency Storage	1	LS	$25,000	$25,000	$25,000	$25,000
Chlorination	1	LS	$25,000	$25,000	$25,000	$25,000
Effluent Storage	1	LS	$115,000	$115,000	$115,000	$115,000
Operations Building	1	LS	$30,000	$30,000	$30,000	$30,000
Site Work	1	LS	$50,000	$50,000	$50,000	$50,000

Item	**Qty.**	**Unit**	**Unit Cost**	**Total[1,2]**		
Electrical and Instrumentation	1	LS	$100,000	$100,000	$100,000	$100,000
Miscellaneous	1	LS	$10,000	$10,000	$10,000	$10,000
Treatment Plant Subtotal				**$755,000**	**$755,000**	**$755,000**
Effluent Disposal						
Leach Fields	2	AC	$200,000	$400,000	$400,000	$400,000
NPDES Permit Application	1	LS	$175,000	$175,000	$175,000	$175,000
Effluent Pump Station	1	LS	$40,000	$40,000	$40,000	$40,000
Effluent Distribution (4-inch FM)	3,000	LF	$60	$180,000	$180,000	$180,000
Creek outfall	1	LS	$10,000	$10,000	$10,000	$10,000
Effluent Disposal Subtotal				**$805,000**	**$805,000**	**$805,000**
Construction Subtotal				**$3,437,000**	**$3,307,000**	**$3,367,000**
Construction Contingency (20%)				$651,000	$625,000	$631,000
Design (10%)				$326,000	$313,000	$316,000
Permitting (3%)				$98,000	$94,000	$95,000
Construction Management (10%)				$326,000	$313,000	$316,000
Legal and Administrative (7%)				$228,000	$219,000	$221,000
Overall Capital Cost Estimate				**$5,156,000**	**$4,960,000**	**$5,051,000**

Notes:
1. All costs rounded to the nearest thousand.
2. All costs based on March 2008 construction costs at ENR 20-city construction cost index of 8109.00.

Additionally, there are annual costs associated with the O&M of the Project facilities. These costs are estimated in **Table 7-3**. These costs were developed assuming that the equivalent of one full-time employee would be responsible for the O&M of the Pescadero wastewater collection system, WWTP, and effluent disposal system. This FTE would be a non-County employee from a company with staff who are accredited in the operation of WWTPs in California in accordance with RWQCB requirements.

The O&M costs assume that a Grade III operator would be responsible for the operation of the WWTP, while a technician or operator with a grade license less than Grade III would perform collection system maintenance activities. These costs also assume that a contract Owner/Operator would perform and be responsible for all O&M activities.

Table 7-3: Annual Operations and Maintenance Costs

Item	Qty.	Unit	Unit Cost	Total
Jet-clean Gravity Mains (8 Hrs/Mo)	96	MH	$50	$5,000
Cleaning & Inspection of Manholes (2x20/yr)	40	MH	$50	$2,000
Lift Station Inspection (4 Hrs/Mo)	48	MH	$50	$2,000
Lift Station Maintenance (3 Hrs/Pump/yr)	18	MH	$50	$1,000
Sewer Lateral Service (6 Hrs/Mo)	72	MH	$50	$4,000
Labor (Other)	100	MH	$50	$5,000
Materials (other)	1	LS	$20,000	$20,000
Collection System O&M Subtotal				**$39,000**
Annual Treatment and Effluent Disposal Cost Estimate				
Labor	1666	MH	$60	$99,960
Power	1	LS	$20,000	$20,000
Materials	1	LS	$25,000	$25,000
Treatment and Distribution Subtotal				**$144,960**

Notes:
1. The amount of labor is equivalent to one FTE employee performing all of the O&M for the wastewater collection system, WWTP, effluent disposal, as well as the CSA-11 water system.

7.3 Funding Sources

Based upon the estimated Project costs, it is expected that capital will have to be obtained from both the community and external sources to fund construction activities. The total amount of funding required would need to equal the capital cost estimate.

The County has previously been qualified to receive up to $2,000,000 from the SCWG to fund this Project, pending various approvals by the SCWG. Of this amount, the County has received $137,355, which is funding this Plan and the environmental documentation. That leaves $1,862,645 from the SCWG that the County could receive to fund construction activities. Should the County receive this funding, they would be responsible for identifying a way to procure the remaining capital cost of $3,029,159.

Currently, it is expected that another entity may both own and operate the WWTP and collection system. This would essentially result in the County passing through the available grant funding to that entity to help fund Project construction, and result in the Owner/Operator funding the remainder of the Project through the assessment and sewer rates.

7.4 Calculating Costs per EDU

If the users of the CSA-11 distribution system are to equitably fund the Project, various existing land uses (e.g. commercial, institutional) have to be converted into equivalent dwelling units (EDUs). This contribution required from each parcel would be equitably distributed amongst the identified parcels. It is a relatively common to apply an assessment as a cost per residential customer or an EDU. The single-family residential dwelling unit has been selected as the basic unit for calculation of assessments and is defined as one EDU. Every other land use is converted to EDUs based on a formula that considers lot size and level of development.

To calculate EDUs in Pescadero, the following assumptions were utilized for every active account in the CSA 11 distribution system:

- Residential accounts were assumed to have an EDU of 1.
- Commercial or institutional accounts with a historic water usage less than the historical average residential account were assumed to have an EDU of 1.
- Commercial or institutional accounts with a historic water usage greater than the historical average residential account had their EDU calculated by the following formula:

EDUs = (Historic Water Usage) / (Average Residential Water Usage)

Of the active CSA-11 accounts, the following calculations were made for the period for which water meter data was available, which is between November 2005 and May 2008. This period was selected because it comprised the most recent 2+ year period for which water meter data was available. Complete calculations for individual parcel used to calculate this data were not included in this report due to the desire not to publicize individual water usage, but are available upon request.

Table 7-4: Calculation of Equivalent Dwelling Units

Land Use[1]	Number of Accounts	Total Water Usage[2] (100 cf/yr)	Actual Active EDUs
Residential	77	20,888	77
Commercial	10	6,646	27.0
Institutional	7	2,847	13.6
Total	**94**	**30,381**	**117.6**

Notes:
1. Note that the classification of the accounts by CSA-11 is not necessarily equivalent to land use (as shown in **Table 2-1**, but rather how the account was classified by CSA-11 in their account database.
2. Total water usage based on CSA-11 records between November 2005 and May 2008.

Thus, the actual number of EDUs for which O&M costs will be applied is 117.6. Not included in this calculation are the vacant parcels, of which there are 21. These vacant parcels will have the ability to connect to the system at any time, but will not have the benefit of actually using the wastewater collection and treatment system until they are occupied. Thus, vacant parcels are assumed to have to pay for their fair share of the capital costs of the Project as one EDU, but not have to pay anything for O&M costs. Thus, for calculation purposes, the following data was used:

- EDUs for Capital: 117.6 + 21 = **138.6 EDUs**
- EDUs for O&M: **117.6**

The County has previously been qualified to receive up to $2,000,000 from the SCWG to fund this Project, pending various approvals by the SCWG. Of this amount, the County has received $137,355, which is funding this Plan and the environmental documentation. That leaves $1,862,645 from the SCWG that the County could receive to fund construction activities. Should the County receive this funding, they would be responsible for identifying a way to procure the remaining capital cost for whichever WWTP site is recommended. For the purposes of calculation and demonstrating sample costs, WWTP Site 3 was used as an example of what the capital and O&M costs per EDU would be.

For WWTP Site 3, if the remaining SCWG amount were received and 100% applied to the capital cost of that Project, the remaining capital cost burden would be $3,188,355. Currently, it is expected that another entity may both own and operate the WWTP and collection system. This would essentially result in the County passing through the available grant funding to that entity to help fund Project construction, and result in the Owner/Operator funding the remainder of the Project through the assessment and sewer rates based on the number of identified EDUs.

Based on the estimated capital cost for WWTP Site 3 shown in **Table 7-2**, the total capital and O&M costs per EDU are as follows:

- **Estimated Capital Cost:** $3,188,355 / 138.6 EDU = **$23,004 per EDU**
- **Estimated O&M cost:** $183,960/ 117.6 EDU = **$1,565 per EDU**

Capital costs would be applied on a per EDU basis to all parcels within CSA-11, whether they are active accounts or vacant parcels. O&M costs would only apply to active accounts. Inactive accounts, or more accurately, parcels without existing development within the collection service area that would not receive a sewer lateral at this time, would still have the ability to connect to the collection system in the future due to their contribution to the capital cost and participation in that assessment.

O&M rates in subsequent years may need to be adjusted based on actual O&M budgets or the Owner/Operator's agreement with the County. **Section 3.1.3** estimated that annual sewer rates were estimated to increase by approximately 7% annually. This increase is expected to account for inflation and the increasing cost of compliance with regulations, materials, power, and labor.

It is noted that the amount of the assessment and the annual sewer rate is borne by a relatively small parcel base. It is also noted that there are currently no existing funding sources, capital budget, or other local resources available to fund the Project other than the SCWG grant funding.

As additional parcels are constructed through buildout, it is possible that annual O&M charges will be allocated to more parcels. Having more parcels contribute to the O&M of the sewer Project would potentially reduce annual sewer rates. Additional development within the collection area would be responsible for paying into the system through a connection fee and payment of the annual sewer rates.

This page intentionally left blank

SECTION 8 – REQUIREMENTS AND RECOMMENDATIONS

The section provides a summary of the requirements and recommendations for developing a community sewer system for Pescadero.

- **Wastewater Collection:** Construct a gravity collection system consisting of approximately 9,000 LF of 8-inch gravity sewer within CSA-11 and between 4,000-6,000 LF of 4-inch force main from the collection system to the WWTP location. Two collection system lift stations would be located to pump sewage across Butano and Pescadero Creeks, respectively. The Butano Creek lift station may also be sized to pump through the screening facility at the WWTP.

- **Wastewater Treatment:** The WWTP will be located at Site 3. The treatment process will include a screen, prepackaged MBR treatment system, UV disinfection and/or chlorination, effluent storage, dechlorination (for surface water discharge) and an effluent pump station.

- **Effluent Disposal:** It is expected that a surface water discharge to a tributary of Butano Creek will be the primary means for wastewater disposal. During periods when discharge to Butano Creek is not feasible, leach fields would be used for disposal of effluent. These leach fields would be located on County land. If the opportunities exist for recycled water use by local farmers, those opportunities would be utilized on a case-by-case basis.

- **NPDES Permit:** The Owner/Operator should pursue a NPDES permit to discharge effluent to the Butano Creek tributary. It is expected that this discharge would also provide ancillary benefits of providing a consistent water source to areas of the Pescadero Marsh that may be water short at times.

- **Other permits and approvals:** Permits and approvals that would be required prior to construction of the Project include: approval of the EIR, Coastal Commission, parcel assessment, receipt of funds from the SCWG, various County approvals, selection of an Owner/Operator of the WWTP, and the designer and contractor for the Project. Subsequent external grant or loan funding may also be pursued to reduce the overall Project cost to the community.

A complete summary of the estimated Project construction costs are included in **Table 7-2**. A summary of the annual O&M Costs is included in **Table 7-3**.

This page intentionally left blank

SECTION 9 – REFERENCES

1. California Building Standards Commission, *2007 California Building Code*, 2007.

2. California Irrigation Management Information System (CIMIS), *Reference Evapotranspiration Map, Coastal Plains Heavy Fog Belt zone,* http://www.cimis.water.ca.gov

3. California Regional Water Quality Control Board – San Francisco Bay Region, *Resolution 04-R2-0088: Support for the San Mateo County Declaration of Public Health Threat Related to Sewage Disposal for the Community of Pescadero,* October 20, 2004.

4. California Regional Water Quality Control Board – San Francisco Bay Region, *San Francisco Bay Basin (Region 2), Water Quality Control Plan (Basin Plan),* January 18, 2007.

5. Federal Emergency Management Agency (FEMA), *Flood Insurance Rate Map – San Mateo County, California and Incorporated Area Map Number 0603110400 B,* Effective date July 5, 1984.

6. Metcalf & Eddy, Inc, *Wastewater Engineering: Treatment and Reuse (4th edition)*, 2002.

7. Oregon Climate Service, *Burlingame station,* http://www.ocs.orst.edu/page_links/comparative_climate/california/california.html

8. San Mateo County, personal communication with Ann Stillman, May 2008.

9. San Mateo County Planning Department, *Local Coastal Program,* June 1998.

10. San Mateo County Environmental Health Services, *Consumer Confidence Report: County Service Area No. 11,* 2003-2006.

11. San Mateo County Department of Public Works, *COUNTY SERVICE AREA NO. 11 – AutoCAD drawing,* September 20, 2004.

12. San Mateo County Department of Water Resources, *Public Water System Statistics 2006-2007: Community Service Area 11*, 2006-2007.

13. Sentelhas & Folegatti, *Class A pan coefficients (K_p) to estimate daily reference evapotranspiration (ET_o)*, February 14, 2003.

14. State of California Division of Drinking Water and Environmental Management, *Treatment Technology Report for Recycled Water,* January 2007.

15. State Water Resources Control Board, *Clean Water Act Section 303(d) List of Water Quality Limited Segments,* 2006.

16. State Water Resources Control Board, *Training Handbook for Disposal of Non-Designated Waste to Land Systems,* July 2004.

17. U.S. Department of Agriculture: Natural Resource Conservation Service, *Soil Survey of San Mateo County,* http://www.ca.nrcs.usda.gov/

18. United States Environmental Protection Agency, *Onsite Wastewater Treatment Systems Manual,* February 2002.

19. University of California – Cooperative Extension, *California Turfgrass Culture: Using ET_0 (Reference Evapotranspiration) for Turfgrass Irrigation Efficiency,* 1997.

20. Western Regional Climate Center, *San Gregorio 2 SE (047807), Period of Record Monthly Climate Summary,* 06/1954 to 06/2007. http://www.wrcc.dri.edu/

www.hydroscience.com

HYDROSCIENCE ENGINEERS, INC. (HSe) is a civil and environmental engineering firm that plans, designs, and manages the construction of water, wastewater, and recycled water projects. With offices in Sacramento, Napa, Stockton, and San Jose, we understand and address the complex water needs of California.

NAPA
221 Gateway Road West Ste 403, Napa, CA 94558
Tel: (707) 254-1900 Fax: (707) 254-1901

SACRAMENTO
10569 Old Placerville Road, Sacramento, CA 95827
Tel: (916) 364-1490 Fax: (916) 364-1491

STOCKTON
2111 West March Lane Ste 200, Stockton, CA 95207
Tel: (209) 473-9100 Fax: (209) 473-9101

SAN JOSE
6090 Hellyer Avenue Ste 150, San Jose, CA 95138
Tel: (408) 363-3884 Fax: (408) 363-3886

HydroScience Engineers, Inc.
STRATEGIC WATER SOLUTIONS