Technical Memorandum

Date:	11/2/2015
To:	John Clemons South San Luis Obispo County Sanitation District 1600 Aloha Pl Oceano, CA 93475
Phone:	(805) 489-6666
Prepared by:	Kaylie Ashton, E.I.T, Jeanine Genchanok, E.I.T.
Reviewed by:	Dan Heimel, P.E., Jeffery Szytel, P.E.
Project:	Satellite Water Resource Recovery Facilities Planning Study
SUBJECT:	**INVESTMENT ANALYSIS**

The South San Luis Obispo County Sanitation District (District) is interested in evaluating the feasibility of constructing a satellite water resource recovery facility (SWRRF) to produce high quality recycled water by treating flows from a portion of their service area. The District contracted with Water Systems Consulting, Inc. (WSC) to prepare an application for a facilities planning grant under the state of California's Water Recycling Funding Program and to complete a Recycled Water Facilities Planning Study (RWFPS) for the project. Included as the first task of the RWFPS, is an Investment Analysis, intended to determine the economic feasibility of the proposed SWRRF.

This Investment Analysis Technical Memorandum (TM) identifies possible SWWRF treatment and beneficial reuse alternatives. Cost estimates for the SWWRF alternatives and potential costs savings for the District's Wastewater Treatment Plant (WWTP) Redundancy Project were developed and then compared against other potential supplemental water supply alternatives. The TM is organized into the following main sections:

1. Executive Summary
2. Background
3. Investment Analysis Assumptions
4. Potential Recycled Water Alternatives
5. Investment Analysis
6. Implementation Considerations
7. Conclusions and Recommendations

1 Executive Summary

To assist the District in evaluating the feasibility of constructing a SWRRF, WSC is preparing a RWFPS, which includes as the first task an Investment Analysis. The Investment Analysis is intended to be a higher level preliminary evaluation of the economic feasibility of the proposed SWRRF and includes the development of comparative cost estimates for five (5) potential Recycled Water (RW) conceptual alternatives. The conceptual alternatives include diverting flow at three different locations along the District's trunk lines and use of recycled water for agriculture (Ag) irrigation and groundwater recharge. The alternatives analyzed are outlined in Table ES 1. The Investment Analysis also included an evaluation of potential savings that could be achieved in the District's proposed Redundancy Project through the construction of a SWRRF.

Table ES 1. SWRRF Conceptual Alternatives Summary

	Approximate Plant Location	Average Annual Flow (MGD)	Treatment Level	RW Beneficial Use	Average Annual Supply Available for Beneficial Use(AFY)	Distribution System Requirements	
						Pipeline (Miles)	Pump Station (HP)
Alternative 1	Arroyo Grande Creek and Leanna Dr	0.63	Disinfected Tertiary	Agriculture Irrigation	704	1.9	40
Alternative 2	HWY 1 and 22nd ST	1.5	Disinfected Tertiary	Agriculture Irrigation	1,677	4.1	20
Alternative 3	Arroyo Grande High School	0.48	FAT	GWR through Percolation	322	0.2	2
Alternative 4	Arroyo Grande Creek and Leanna Dr	0.63	FAT	GWR through Injection Wells(1)	423	1.5	5
Alternative 5	HWY 1 and 22nd ST	1.5	FAT	GWR through Injection Wells(2)	1,006	3.4	12

Comparative Capital and Operations & Maintenance (O&M) cost estimates for each of the alternatives were developed to create estimates of Unit Cost (i.e. $/AF) for each of the alternatives. For the cost estimates, a 30-year life was assumed with an annual inflation rate of 3% and an interest rate on 100% debt of 5%. However, if the projects were to be funded through Clean Water State Revolving Fund (CWSRF) program the interest rate and associated unit costs could be much lower. The estimated costs for each of the alternatives are shown in Table ES 2.

Table ES 2. Unit Cost Estimates w/o Redundancy Project Cost Savings

Alternative	Capital Cost ($M)	Annual Debt Service Payment ($M)	Annual O&M Cost ($M)	Total Annualized Cost ($M)	Approximate Yield (AF)	Unit Cost ($/AF)
1 Ag Irrigation	$38.2	$1.7	$0.3	$2.0	704	$2,800
2 Ag Irrigation	$63.0	$2.8	$0.7	$3.4	1,677	$2,100
3 Percolation	$39.1	$1.7	$0.3	$2.0	322	$6,800
4 GW Injection	$55.8	$2.5	$0.7	$3.1	423	$7,400
5 GW Injection	$99.6	$4.4	$1.5	$5.9	1,006	$5,800

To estimate the potential savings that could be achieved in the Redundancy Project, it was assumed that a SWRRF could divert a portion of the collection system flow and proportionally reduce the total flow at the District's current WWTP and therefore the size of the Redundancy Project. These savings were then applied to the unit cost estimates for each of the RW alternatives and the results are shown in Table ES 3. The RW unit cost estimates were then compared to cost estimates for other potential supplemental supplies available in region, which ranged from $1,300 to $3,000/AF.

Table ES 3. Unit Cost Estimates w/ Redundancy Project Savings

Alternative	Capital Cost ($M)	Capital Cost w/ Redundancy Savings ($M)	Annual Capital Payment ($M)	Annual O&M Cost ($M)	Total Annual Cost ($M)	Yield (AF)	Unit Cost ($/AF)
1 Ag Irrigation	$38.2	$36.2	$1.6	$0.3	$1.9	704	$2,700
2 Ag Irrigation	$63.0	$58.0	$2.6	$0.7	$3.2	1,677	$1,900
3 Percolation	$39.1	$37.8	$1.7	$0.3	$2.0	322	$6,600
4 GW Injection	$55.8	$54.2	$2.4	$0.7	$3.1	423	$7,200
5 GW Injection	$99.6	$95.7	$4.2	$1.5	$5.7	1,006	$5,700

The Investment Analysis determined that the unit cost of the water from each SWRRF alternative could vary significantly depending upon the volume and type of beneficial reuse. Of the different SWRRF options, Alternative 2, which included 1,677 AFY of Ag Irrigation, appeared to have the lowest unit cost. The Investment Analysis additionally identified that a SWRRF could potentially reduce the capacity of the Redundancy Project by reducing the average annual flow to the WWTP. This reduction in capacity could result in a cost savings ranging from $1.2 to $5 M. When applying this potential cost savings to each of the SWRRF alternatives, it reduced the unit costs by approximately $100-200 per AF.

Based on the results of the Investment Analysis and the competiveness of the SWRRF alternatives with other potential supplemental supplies, it is recommended that the SWRRF concept be carried forward for further analysis and completion of the RWFPS. It is additionally recommended that the RWFPS include a supplementary alternative that evaluates the construction of an offsite tertiary or advanced water treatment facility that could treat effluent from the WWTP for use as agriculture irrigation or groundwater recharge. This facility could be located outside of the Coastal Zone, Tsunami Inundation Zone and the Arroyo Grande Creek 100-YR Flood Plain, but could take advantage of the existing primary and secondary treatment facilities at the WWTP. Additionally, this facility could be potentially expanded to receive effluent from the Pismo Beach WWTP and realize potential unit costs savings associated with larger capacity facilities.

2 Background

The District's WWTP currently lacks sufficient redundancy for its secondary treatment system to allow the existing trickling filter to be taken out of service for extended maintenance or in the event of a process upset. To provide the necessary redundancy, the District is currently planning the construction of a parallel secondary treatment train or Redundancy Project, which would include an activated sludge aeration tank, a secondary clarifier and sludge thickening/dewatering equipment. To help offset the costs of developing a recycled water system, it was envisioned that the construction of a SWRRF could provide increased upstream treatment capacity and reduce average flow rates at the existing WWTP. Consequently, the required capacity and cost of the Redundancy Project could be reduced. The recycled water from the SWRRF could provide the local water supply agencies and/or farms with access to a supplemental water supply that could be used to offset groundwater pumping or recharge the groundwater basin and improve water supply reliability for Southern San Luis Obispo County.

Figure 1 illustrates the proposed SWRRF trunk Line connection locations evaluated as part of the Investment Analysis. The potential locations are sited along the Arroyo Grande trunk line in the southern portion of the District's service area near the Cities of Arroyo Grande and Grover Beach. These sites were evaluated due to their proximity to the agriculture fields and the City of Arroyo Grande. WSC performed an Investment Analysis to develop the planning level cost estimates for a potential SWRRF. Several different site locations and beneficial use alternatives were evaluated to provide a range of potential costs. The cost analysis considered capital and O&M costs for each alternative and accounted for additional cost savings for reducing the current Redundancy Project at the WWTP.

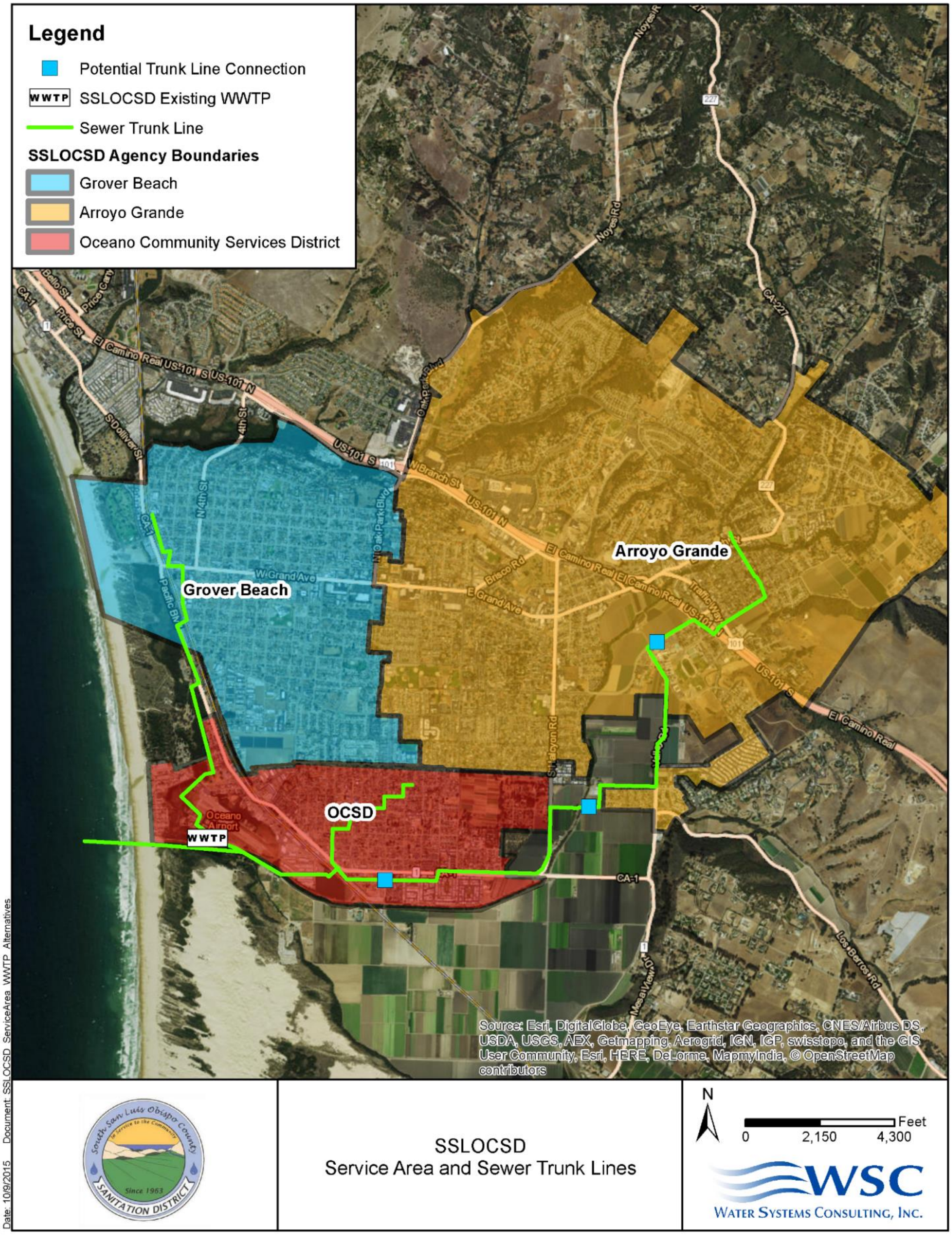


Figure 1. SSLOCSD Service Area and Proposed Trunk Line Connections

3 Investment Analysis Assumptions

The following section describes the sources of data and assumptions used in the Investment Analysis TM.

3.1 Wastewater Supply

WSC obtained estimates of the potential wastewater quantities that could be diverted at different locations along the Arroyo Grande trunk Line from the 2011 Arroyo Grande Collection System hydraulic model. It was determined from the City of Arroyo Grande Wastewater Master Plan (WSC 2012) that significant growth is not anticipated in the upstream portion of the collection system nor significant increase in future flow rates; therefore the current average annual demands were used for this analysis. It was assumed that the SWWRF would have capacity to treat current Average Annual Flow (AAF) at the Trunk Line connection point, which for the connection points evaluated in the Investment Analysis ranged from 0.48 Million Gallons/Day (MGD) to 1.5 MGD. The SWRRF was assumed to have sufficient redundancy capacity to allow for full time operations.

3.2 Redundancy Project

The Redundancy Project was assumed to have a capacity of 4.2 MGD (Kennedy/Jenks Consultants 2008) and a total project cost of $19 million (MKN & Associates 2015) For the Investment Analysis, it was assumed that a SWRRF would allow for a reduction in the sizing of the Redundancy Project.

3.3 Beneficial Use of Recycled Water

For this Investment Analysis, the types of reuse considered include:

- Agricultural Irrigation - Disinfected tertiary Recycled Water (RW).
- Indirect Potable Reuse (IPR) - Full Advanced Treatment (FAT) with groundwater recharge and extraction through surface spreading and/or direct injection.

RW must meet the State Water Resource Control Board Division of Drinking Water's California Code of Regulations (CCR), Title 22. Title 22 defines four types of RW based on the treatment process used and water quality produced. The four types are disinfected secondary RW, disinfected secondary – 23 RW, disinfected secondary – 2.2 RW and disinfected tertiary RW. Groundwater Recharge Regulations were adopted into Title 22 on June 18th, 2014 due to the current drought conditions. These regulations discuss the following types of recharge:

- Surface spreading without FAT
- Subsurface application by direct injection (FAT required for the entire flow)
- Surface spreading with FAT

The types of beneficial use and wastewater treatment requirements for each type of reuse are described further in Sections 3.3.1 and 3.3.2.

3.3.1 Agriculture Irrigation

3.3.1.1 Potential RW Demand

To estimate potential RW demand for agriculture irrigation, WSC assumed that the crops being irrigated would be truck crops (vegetables and fruits) and used a demand factor of 1.4 AFY/acre, based on the Gross Irrigation Requirement Water Planning Area 5 (Fugro 2014). This demand factor was used to calculate the amount of acreage that could be irrigated depending on the range of RW supply available at the point of connection.

3.3.1.2 Wastewater Treatment Requirements

For unrestricted agricultural irrigation, RW must be treated to disinfected tertiary standards. Disinfected tertiary is defined by Title 22 as filtered and subsequently disinfected wastewater that meets the following criteria:

(a) The filtered wastewater has been disinfected by either:

(1) 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

(2) A disinfection process that, when combined with the filtration process, has been demonstrated to inactivate and/or remove 99.999 percent 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 polio virus may be used for purposes of the demonstration.

(b) 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.

For this study it was assumed that RW was treated to disinfected tertiary standards for the agriculture irrigation alternatives, and that reverse osmosis was not required for TDS reduction.

3.3.2 Groundwater Recharge

Two sub alternatives were considered for the case of indirect potable reuse through groundwater recharge: surface spreading basins and injection wells.

3.3.2.1 Surface Spreading Basin Locations

The San Luis Obispo County Regional Recycled Water Strategic Plan (RRWSP) has identified the agriculture fields to the north of Arroyo Grande High School as a site for potential surface spreading (Cannon 2014). A percolation rate of 1 foot per day was assumed for the Investment Analysis, consistent with the RRWSP.

3.3.2.2 Injection Well Locations

The City of Pismo Beach Recycled Water Facilities Planning Study (Pismo RWFPS) identified that inland injection wells required a 200-foot setback from any water supply wells to meet the minimum 8 month retention time within the groundwater basin before extraction per CCR Title 22 regulations (WSC 2015). For this alternative, consistent with the Pismo RWFPS, each well was assumed to be capable of injecting 200-300 AFY based on the transmissivity of the aquifers (WSC 2015).

3.3.2.3 Wastewater Treatment Requirements

Table 1 summarizes the required level of treatment for groundwater recharge through surface recharge and subsurface injection assumed for this analysis. According to CCR Title 22, FAT is required for groundwater augmentation using direct injection, unless an alternative treatment has been demonstrated to the Division of Drinking Water (DDW) as providing equal or better protection of public health and has received written approval from DDW. CCR Title 22, Section 60320.201 defines FAT as “the treatment of an oxidized wastewater . . . using a reverse osmosis (RO) and an oxidation treatment process (AOP)”. Groundwater augmentation using surface spreading requires disinfected tertiary as a minimum level of treatment. For this Investment Analysis, FAT was assumed for both surface spreading and subsurface injection.

Table 1. Summary of Assumptions for Surface and Subsurface Groundwater Recharge Alternatives

Element	Surface and Subsurface Recharge
Minimum Required Treatment Level	100% RO and AOP(3) treatment for the entire waste stream
Retention time(1)	Minimum 2 months
Total Nitrogen	Average <10 mg/L
Total Organic Carbon	< 0.5 mg/L
Dilution water compliance calculation	Based on 120-month running average
Pathogen Reduction2	12-log enteric virus reduction, 10-log Giardia cyst reduction, 10-log Cryptosporidium oocyst

Notes:
1. Must be verified by a tracer study. An 8 month minimum is required for planning level estimates based on numerical modeling.
2. Minimum of 3 barriers and each barrier must achieve a minimum of 1-log reduction. No barrier can achieve more than 6-log.
3. FAT requires Reverse Osmosis (RO) and advanced oxidation treatment (AOP).

3.3.3 Solids Conveyance

This analysis assumes that residuals from the SWRRF, including biosolids and RO concentrate, would be discharged to the existing trunk lines and conveyed by gravity to the existing WWTP for treatment.

3.4 Financing

For the planning level cost estimate, a 30-year life was assumed with an annual inflation rate of 3% and an interest rate on 100% debt of 5%. Should the project be funded through a State Revolving Fund (SRF) loan, the interest rate will be half of the General Obligation bond rate at the time of funding approval. Interest rates would therefore be substantially lower than 5% (most recently 1.6%). Grant funding was not considered for the purpose of this analysis. All costs were annualized and brought back to present value for relative comparison.

4 Potential RW Alternatives

4.1 Alternative Description

To obtain a range of costs for a potential SWRRF, WSC identified and evaluated five (5) conceptual alternatives. Each conceptual alternative was identified by a specific location of the SWRRF and type of beneficial use of the RW. Table 2 summarizes the conceptual alternatives. Figure 2 illustrates the locations for conceptual Alternatives 1 and 2 and the corresponding irrigation areas. Figure 3 illustrates the potential locations for conceptual Alternatives 3, 4, and 5, including potential groundwater injection points for Alternatives 4 and 5. The potential locations of the SWRRF were limited to outside of the Coastal Zone to limit permitting requirements. Appendix A provides additional information on design criteria for distribution and treatment.

Table 2. SWRRF Conceptual Alternatives Summary

	Approximate Plant Location	Average Annual Flow (MGD)	Treatment Level	RW Beneficial Use	Average Annual Supply Available for Beneficial Use(AFY)	Distribution System Requirements	
						Pipeline (Miles)	Pump Station (HP)
Alternative 1	Arroyo Grande Creek and Leanna Dr	0.63	Disinfected Tertiary	Agriculture Irrigation	704	1.9	40
Alternative 2	HWY 1 and 22nd ST	1.5	Disinfected Tertiary	Agriculture Irrigation	1,677	4.1	20
Alternative 3	Arroyo Grande High School	0.48	FAT	GWR through Percolation	322	0.2	2
Alternative 4	Arroyo Grande Creek and Leanna Dr	0.63	FAT	GWR through Injection Wells(1)	423	1.5	5
Alternative 5	HWY 1 and 22nd ST	1.5	FAT	GWR through Injection Wells(2)	1,006	3.4	12

Notes:
1. Alternative 4 used three injection wells, each with a capacity of approximately 190 AFY.
2. Alternative 5 used six injection wells, each with a capacity of approximately 230 AFY.

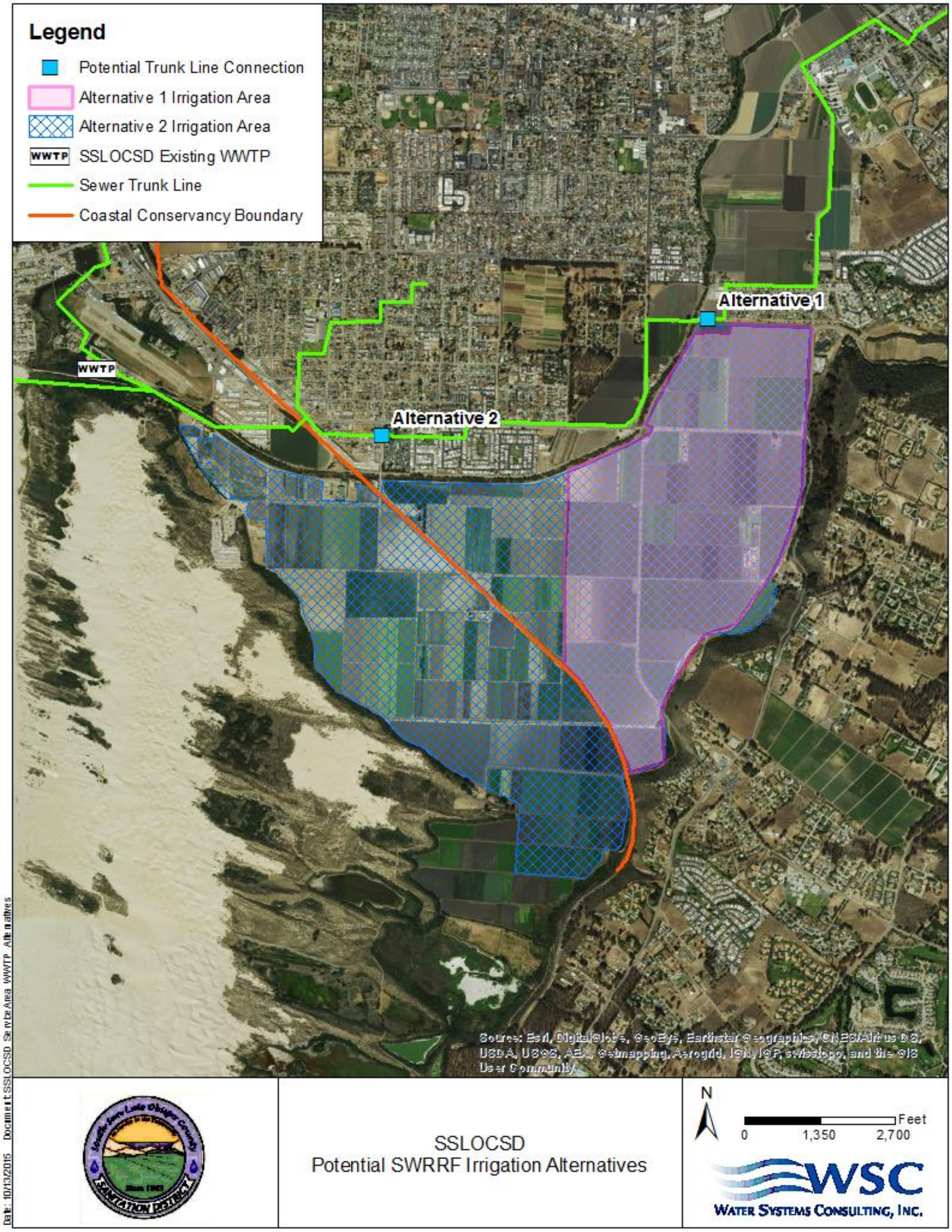


Figure 2. Potential SWRRF Irrigation Alternatives

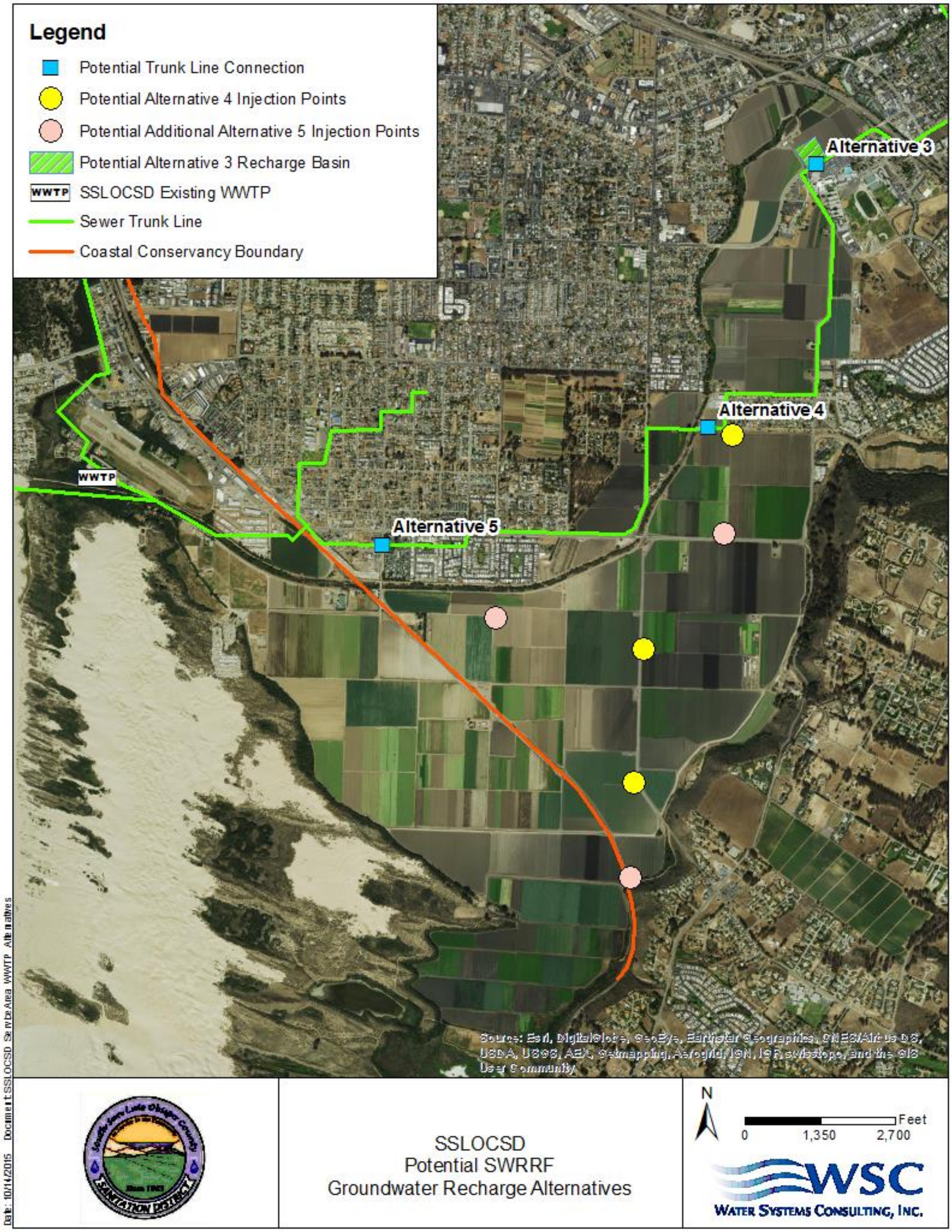


Figure 3. Potential SWRRF Groundwater Recharge Locations

5 Investment Analysis

For the Investment Analysis, estimates of the unit cost (i.e. $/AF) for each of the SWRRF alternatives were developed. These estimates are shown Table 3. The cost estimates include cost for the treatment facility, pipelines, pump stations, customer conversions and annual O&M costs. These planning level costs were based on cost estimate assumptions from the RRWSP (Cannon 2014) and other sources. Additional details on each of the cost estimates for each alternative are provided in Appendix C. The cost estimates are for comparison purpose and should be considered order of magnitude or planning level costs only.

Table 3. Unit Cost Estimates w/o Redundancy Project Cost Savings

Alternative	Capital Cost ($M)	Annual Debt Service Payment ($M)	Annual O&M Cost ($M)	Total Annualized Cost ($M)	Approximate Yield (AF)	Unit Cost ($/AF)
1 Ag Irrigation	$38.2	$1.7	$0.3	$2.0	704	$2,800
2 Ag Irrigation	$63.0	$2.8	$0.7	$3.4	1,677	$2,100
3 Percolation	$39.1	$1.7	$0.3	$2.0	322	$6,800
4 GW Injection	$55.8	$2.5	$0.7	$3.1	423	$7,400
5 GW Injection	$99.6	$4.4	$1.5	$5.9	1,006	$5,800

To account for potential Redundancy Project cost savings, which may be achieved through construction of a SWRRF, additional unit cost estimates were developed for each of the SWRRF alternatives. It was assumed that a SWRRF could divert a portion of the collection system flow and proportionally reduce the total flow at the District's current WWTP and therefore the size and cost of the Redundancy Project. This is a simplification assumed for the purposes of the Investment Analysis, however, additional evaluation of the possible reductions in the sizing of the Redundancy Project will need to be performed in latter phases of the study. It was assumed that the reduced capital costs for the Redundancy Project could then be applied to the unit costs (i.e. $/AF) for the recycled water produced at the SWRRF. Estimates of the potential reduction in Redundancy Project capital costs were calculated using the activated sludge with complex solids handling cost curve from the Construction Costs for Municipal Wastewater Treatment Plants: 1973-1982 (EPA 1983). The cost curve data were adjusted to 2015 dollars and to match the latest capital cost estimates for the Redundancy Project and used to establish a relationship between the capacity of the Redundancy Project and total project cost. For this level of analysis, it was assumed that O&M cost estimates for the Redundancy Project would not change. Estimates of the potential reductions in capital costs for the Redundancy Project are shown Table 4.

Table 4. Potential Redundancy Project Cost Savings[1]

Alternative	SWRRF Capacity (MGD)	Diverted Flow (MGD)	Required Redundancy Project Capacity (MGD)	Estimated Redundancy Cost Estimated ($M)	Estimated Redundancy Cost Savings ($M)[1]
1 Ag Irrigation	0.63	0.63	3.57	$16.9	$2.0
2 Ag Irrigation	1.50	1.50	2.70	$13.9	$5.0
3 Percolation	0.48	0.38	3.82	$17.7	$1.2
4 GW Injection	0.63	0.50	3.70	$17.3	$1.6
5 GW Injection	1.50	1.20	3.00	$15.0	$4.0

Accounting for the potential cost savings that could be achieved in the Redundancy Project through development of a SWRRF, updated unit cost estimates for the each of the SWRRF alternatives were developed and shown in Table 5.

Table 5. Unit Cost Estimates w/ Redundancy Project Savings[1]

Alternative	Capital Cost ($M)	Capital Cost w/ Redundancy Savings ($M)	Annual Capital Payment ($M)	Annual O&M Cost ($M)	Total Annual Cost ($M)	Yield (AF)	Unit Cost ($/AF)
1 Ag Irrigation	$38.2	$36.2	$1.6	$0.3	$1.9	704	$2,700
2 Ag Irrigation	$63.0	$58.0	$2.6	$0.7	$3.2	1,677	$1,900
3 Percolation	$39.1	$37.8	$1.7	$0.3	$2.0	322	$6,400
4 GW Injection	$55.8	$54.2	$2.4	$0.7	$3.1	423	$7,200
5 GW Injection	$99.6	$95.7	$4.2	$1.5	$5.7	1,006	$5,700

5.1 Supplemental Supply Alternatives

To provide a comparison of the estimated unit costs for recycled water produced by the SWRRF, cost estimates for several other potential supplemental supply sources were compiled and shown in Table 6. All unit costs were escalated to July 2015 dollars using the ENR Construction Cost Index.

[1] These estimated cost savings are planning level only, and represent order of magnitude estimates. Additional evaluation to further refine the estimated cost savings will be completed in the RWFPS.

Table 6. Supplemental Water Supply Costs

Supply	Supplemental Source	Unit Cost ($/AF)	Reference
Recycled Water - Ag Irrigation	Upgrade to existing SSLOCSD WWTP	$1,003 to $1,986	Cannon 2014
Recycled Water - GW Recharge	Upgrade to existing SSLOCSD WWTP	$1,361 to $ 2,098	Cannon 2014
Surface Water	Lopez Lake Spillway Raise Project (Stetson 2012)	$1,300	WSC 2015
Ocean Water	South San Luis Obispo County Desalination Funding Study (Wallace 2008)	$3,000	WSC 2015
State Water	Nipomo Community Services District SWP Supply Analysis (Boyle 2007)	$2,000 to $2,600	WSC 2015

Note: Unit cost from each reference are escalated to July 2015 based on ENR Construction Cost Index. Financing assumptions applied by each study are not reconciled.

6 Conclusions and Recommendations

The Investment Analysis determined that the unit cost of the water from each SWRRF alternative could vary significantly depending upon the volume and type of beneficial reuse. The agriculture irrigation alternatives showed a significantly lower unit cost than the groundwater recharge alternatives, primarily related to the increased treatment costs and reduced efficiencies associated with FAT. Of the different SWRRF options, Alternative 2, which included 1,677 AFY of agricultural irrigation, appeared to have the lowest unit cost.

The Investment Analysis additionally identified that a SWRRF could potentially reduce the capacity of the Redundancy Project by reducing the average annual flow to the WWTP. This reduction in capacity could result in a cost savings ranging from $1.2 to $5 M. When applying this potential cost savings to each of the SWRRF alternatives, it reduced the unit costs by approximately $100-200 per AF.

Based on the results of the Investment Analysis, it is recommended that the SWRRF concept be carried forward for further analysis. The estimated unit costs for the agriculture irrigation SWRRF alternatives appear to be cost competitive with the other identified supplemental supply alternatives. Additional analysis through development of the RWFPS will help further refine these cost estimates.

One conceptual alternative that was not considered in this Investment Analysis is the construction of an offsite tertiary or advanced water treatment facility that could treat effluent from the WWTP for use as agriculture irrigation or groundwater recharge. This facility could be located outside of the Coastal Zone, Tsunami Inundation Zone and the Arroyo Grande Creek 100-YR Flood Plain, but could take advantage of the existing primary and secondary treatment facilities at the WWTP. Additionally, this facility could be potentially expanded to receive effluent from the Pismo Beach WWTP and realize potential unit costs savings associated with larger capacity facilities. Considering the potential benefits and cost efficiencies of this conceptual alternative, it is recommended that it be carried forward in the RWFPS as well.

Appendix A. DESIGN CRITERIA FOR DISTRIBUTION AND TREATMENT

The RW systems consist of three primary sets of facilities:

- SWRRF plant facilities (treatment, storage / equalization and product water pump station)
- Distribution system facilities (pipelines, storage and booster pump station)
- Customer facilities or recharge facilities (pipeline, recharge basins, and injection wells)

Facilities	Design Criteria
SWRRF Plant Facilities	
Tertiary Satellite Plant	Plant will include headworks, Membrane Bioreactor and disinfection to Title 22 Standards
Full Advance Treatment Satellite Plant	Plant will include headworks, Membrane Bioreactor, UV disinfection and disinfection to Title 22 Standards
Distribution System Facilities	
Pipelines	Sized to maintain a headloss gradient of less than 10 ft of headloss per 1000 ft of pipeline during peak hour
Booster Pump Stations	Capacity based on peak hour demand (assumes no gravity system storage) Station efficiency is assumed to be 75% All pumps will have Variable Frequency Drives (VFDs) Irrigation system booster stations will be equipped with a hydropneumatic tank to control pressure variations
System Storage	Capacity based on average daily flow
Injection Well Site Size	50' x 50' permanent site; additional construction easements based on site specific requirements
Customer or Recharge Facilities	
Main Irrigation Customer Services	Sized to maintain a headloss gradient of less than 10 ft of headloss per 1000 ft of pipeline during peak hour
Recharge Basin	Recharge rate 1ft/day[1]

1. Recharge rate was identified from the RRWSP.

Customer Conversion Cost

For this investment Analysis, the cost to convert existing agriculture irrigation to include RW services was estimated based on either 1) storage tank and pump or 2) flow control valve with backflow prevention depending on existing customer irrigation system.

1) RW would be pumped to the agriculture customer where it would be stored in an onsite storage tank along with potable or non-potable water necessary to mean either peak demands or water quality specific to the crop. From there a pump would be required to irrigation the crops.
2) RW would be pumped to the agriculture customer where it go through a flow control valve and be combined with potable or non-potable water necessary to mean either peak demands or water quality specific to the crop. The potable or non-potable line would be fitted with backflow prevention to assure no cross contamination. It is assumed that both options will cost approximately $50,000 for the conversion and testing to assure no cross contamination.

Appendix B. IMPLEMENTATION CONSIDERATIONS

There are many factors that will go into implementing a RW System. The first step will be to prepare and complete a RWFPS. On behalf of the District, WSC has prepared and submitted the grant application for the RWFPS which has been accepted. In preparing the RWFPS, variety of SWRRF locations, sizes and treatment will be analyzed along with reuse alternatives. Through this process, a recommended alternative will be identified and refined. Implementing the preferred RW alternative will consist of the following components:

- Preliminary and Final Design
- Permitting
- Environmental Documents
- Coordination and Public Outreach
- Implementation Schedule

Preliminary and Final Design

Depending on the preferred RW alternative, Preliminary and Final Design can include groundwater modeling, test injection well, water quality sampling and design of the SWRRF.

Permitting

The permitting process can include obtaining the Water Recycling Requirement and updating the District's Water Discharge Requirement permit through Central Coast Regional Water Quality Control Board; infrastructure permits; and obtain approval from the State Water Resource Control Board in accordance with California Water Code sections 1210-1212 addressing water rights before changing the purpose of use of treated water. A Salt and Management Plan will need to be developed by the Northern Cities Management Area agencies, which would identify the groundwater quality, implementation plan and monitoring program. If groundwater recharge is the preferred alternative, the implementation plan and monitoring program will need to be updated to the preferred alternative.

Environmental Documents

In accordance with the California Environmental Quality Act, it is anticipated the District will need to prepare an Initial Study followed by an Environmental Impact Report for the recommended project. To apply for federal funding sources, the District may also need to prepare an Environmental Assessment and an Environmental Impact Statement to comply with the National Environmental Policy Act.

Coordination and Public Outreach

The development of SWRRF would benefit the water purveyors/users in and around the District's service area by providing a supplemental drought resilient water supply. Since the District does not currently supply potable water, the District would need to developed partnerships with interested water agencies and/or agricultural farmers. The District may also need to focus on public outreach to obtain public acceptance. The public outreach program can vary depending on the preferred alternative.

Implementation Schedule

An implementation schedule will need to be develop to identify and schedule funding opportunities, permitting requirements, design and construction.

Appendix C. DETAILS OF RW COST ESTIMATE

Planning level cost estimates for each potential alternative were developed. Assumptions used as the basis of these cost estimates are discussed in this section.

Scope and Accuracy

The cost estimates included in this Investment Analysis are based upon the Class 4 Conceptual Report Classification of Opinion of Probable Construction Cost as developed by the Association for the Advancement of Cost Engineering Cost Estimate Classification System. The purpose of a Class 4 Estimate is to provide a conceptual level effort that has an expected accuracy range from -30% to +50% and the inclusion of an appropriate contingency for planning and feasibility studies. The conceptual nature of the design concepts and associated costs presented in this Investment Analysis are based upon limited design information available at this stage of the projects.

These cost estimates have been developed using a combination of data from RS Means CostWorks®, recent bids, experience with similar projects, current and foreseeable regulatory requirements and an understanding of the necessary project components. As the projects progress, the design and associated costs could vary significantly from the project components identified in this Investment Analysis.

For projects where applicable cost data is available in RS Means CostWorks® (e.g. pipeline installation), cost data released in Quarter 2 of 2015, adjusted for San Luis Obispo, California, is used. Material prices were adjusted in some cases to provide estimates that align closer with actual local bid results.

For projects where RS Means CostWorks® data is not available, cost opinions are generally derived from bid prices from similar projects, vendor quotes, material prices, and labor estimates, with adjustments for inflation, size, complexity and location.

Cost opinions are in 2015 dollars (ENR 20 City Average Construction Cost Index of: 10,037 for July 2015). When budgeting for future years, appropriate escalation factors should be applied.

Cost opinions are “planning-level” and may not fully account for site-specific conditions that will affect the actual costs, such as soils conditions and utility conflicts.

Markups and Contingencies

For the development of the planning level cost estimates, several markups and contingencies are applied to the estimated construction costs to obtain the total estimated project costs. The markups are intended to account for costs of engineering, design, administration, and legal efforts associated with implementing the project (collectively, Implementation Markup). For the Investment Analysis, two different Implementation Markups are used depending on the type of project. Irrigation projects have a 30% markup, while groundwater recharge projects have a 40% markup. This difference is to account for the greater number of studies required and the extended implementation schedule of a groundwater recharge project.

Unaccounted-for Items and Contingency account for additional construction costs that could not be anticipated at the time of this analysis. A summary of the markups and contingencies applied in this Investment Analysis are presented in the table below.

	Estimated Construction Cost
+	20% of Construction Subtotal for Contingency
+	20% of Construction Cost for Unaccounted-for items
=	**Subtotal 1**
+	30% of Subtotal 1 for Irrigation (or 40% of Subtotal 1 for GRRP) for Implementation Cost
=	**Total Capital Cost**

Excluded Costs

- Overall Program Management. If the magnitude of the capital program exceeds the capacity of City staff to manage all of the work, then the services of a program management team may be required.
- Public Information Program. Depending on the relative public acceptability of a major RW facility or a group of facilities, there may be a need for a public information program, which could take many different forms. It is recommended that the City engage in a proactive public outreach program in coordination with other existing or planned outreach programs.

Unit Cost for Potential Alternatives

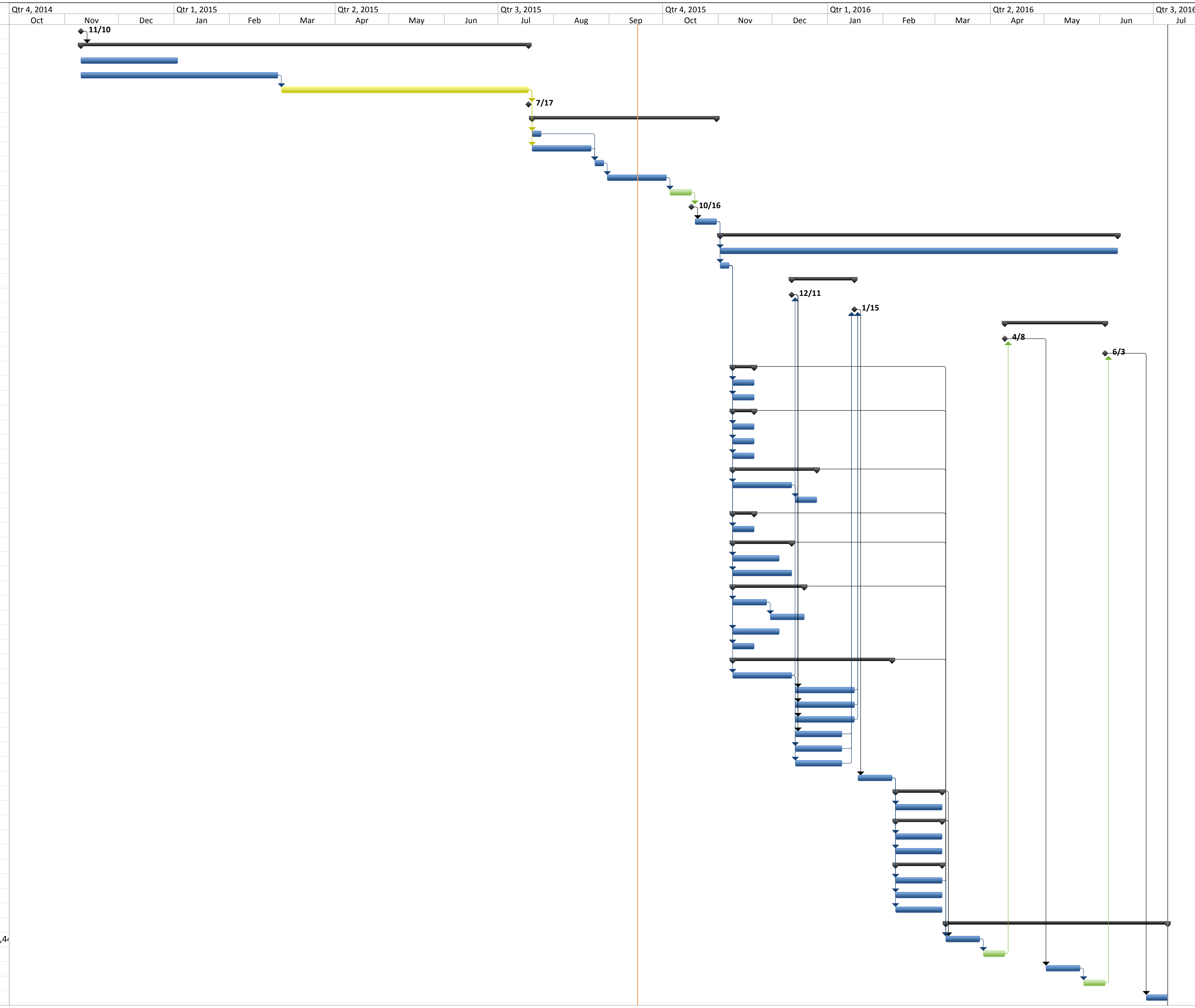
Unit costs of the various alternatives are compared using the annual payment method. The unit cost is calculated with this method by adding the annual payment for borrowed capital costs to the annual O&M cost and dividing by the annual project yield. This method provides a simple comparison between potential alternatives in this Investment Analysis. The factors described below are used to calculate the unit cost with the annual payment method.

The economic factors used to analyze the estimated costs for each of the project concepts are:

- Inflation: Escalation of capital and O&M costs is assumed to be 3.0% based on a combination of California CCI and Western Region Consumer Price Index (CPI) for the past 10 years (June 2004 to June 2014). The average annual escalation rate for California CCI is 3.6%, while the average annual inflation rate for CPI is 2.3%.
- Project Financing: Interest Rate & Payback Period: 5% over 30 years. Note that State Revolving Fund (SRF) loans are at a lower rate and potentially shorter payback period.
- Useful Life of Facilities: The useful life of facilities will vary based on several factors, including type of facility, operating conditions, design life, and maintenance upkeep. Structural components of most facilities are typically designed to last 50 years or longer. However, mechanical and electrical components tend to have a much shorter lifespan and typically require replacement or rehabilitation at regular intervals. To simplify the lifecycle evaluation, this Investment Analysis assumes that all facilities have a useful life matching the financing payback period of 30 years.

Recycled Water Facilities Planning Study

ID	Task Name	Duration	Start	Finish	Predecessors
1	Notice to proceed	0 days	Mon 11/10/14	Mon 11/10/14	
2	**1.0 FPGP Application Assistance**	**180 days**	**Mon 11/10/14**	**Fri 7/17/15**	**1**
3	1.1 FPGP Application Management and Support	40 days	Mon 11/10/14	Fri 1/2/15	
4	1.2 FPGP Application Preparation	16 wks	Mon 11/10/14	Fri 2/27/15	
5	SWRCB Review of FPGP Application	20 wks	Mon 3/2/15	Fri 7/17/15	4
6	Notification of FPGP Application Approval	0 days	Fri 7/17/15	Fri 7/17/15	5
7	**2.0.1 Investment Analysis**	**75 days**	**Mon 7/20/15**	**Fri 10/30/15**	
8	2.0.1 Conceptual Design Criteria	1 wk	Mon 7/20/15	Fri 7/24/15	5
9	2.0.2 Cost Estimates	5 wks	Mon 7/20/15	Fri 8/21/15	5
10	2.0.3 Investment Analysis	1 wk	Mon 8/24/15	Fri 8/28/15	8,9
11	2.0.4 Draft Investment Analysis TM	5 wks	Mon 8/31/15	Fri 10/2/15	10
12	SSLOCSD Review of Draft Investment Analysis TM	2 wks	Mon 10/5/15	Fri 10/16/15	11
13	2.0.5 Investment Analysis Review Meeting	0 days	Fri 10/16/15	Fri 10/16/15	12
14	2.0.6 Final Investment Analysis TM	2 wks	Mon 10/19/15	Fri 10/30/15	13
15	**Task 2.1 Project Management**	**160 days**	**Mon 11/2/15**	**Fri 6/10/16**	
16	2.1.1 Project Administration	160 days	Mon 11/2/15	Fri 6/10/16	14
17	2.1.2 Kickoff Meeting	5 days	Mon 11/2/15	Fri 11/6/15	14
18	**2.1.3 Workshops**	**25 days**	**Fri 12/11/15**	**Fri 1/15/16**	
19	Workshop #1 - Conceptual Alternatives Development	0 days	Fri 12/11/15	Fri 12/11/15	45
20	Workshop #2 - Alternatives Screening	0 days	Fri 1/15/16	Fri 1/15/16	46,47,48,49,50,51
21	**2.1.4 Deliverable Review Meetings**	**40 days**	**Fri 4/8/16**	**Fri 6/3/16**	
22	Deliverable Review Meeting #1 - Draft RWFPS	0 days	Fri 4/8/16	Fri 4/8/16	64
23	Deliverable Review Meeting #2 - Final Draft RWFPS	0 days	Fri 6/3/16	Fri 6/3/16	66
24	**Task 2.2 Background**	**10 days**	**Mon 11/9/15**	**Fri 11/20/15**	
25	2.2.1 Study Area	10 days	Mon 11/9/15	Fri 11/20/15	17
26	2.2.2 Goals and Objectives	10 days	Mon 11/9/15	Fri 11/20/15	17
27	**Task 2.3 Water Supplies and Characteristics**	**10 days**	**Mon 11/9/15**	**Fri 11/20/15**	
28	2.3.1 Water Supply Characteristics	10 days	Mon 11/9/15	Fri 11/20/15	17
29	2.3.2 Water Demand Characteristics	10 days	Mon 11/9/15	Fri 11/20/15	17
30	2.3.3 Water Pricing	10 days	Mon 11/9/15	Fri 11/20/15	17
31	**Task 2.4 Wastewater Characteristics and Facilities**	**35 days**	**Mon 11/9/15**	**Fri 12/25/15**	
32	2.4.1 Existing Facilities	25 days	Mon 11/9/15	Fri 12/11/15	17
33	2.4.2 Future Facilities	10 days	Mon 12/14/15	Fri 12/25/15	32
34	**Task 2.5 Treatment Requirements**	**10 days**	**Mon 11/9/15**	**Fri 11/20/15**	
35	2.5.1 Recycled Water Quality Requirements	10 days	Mon 11/9/15	Fri 11/20/15	17
36	**Task 2.6 Recycled Water Market/Opportunities**	**25 days**	**Mon 11/9/15**	**Fri 12/11/15**	
37	2.6.1 Update Market Analysis	20 days	Mon 11/9/15	Fri 12/4/15	17
38	2.6.2 Preliminary Market Assurances	25 days	Mon 11/9/15	Fri 12/11/15	17
39	**Task 2.7 Legal, Permitting and Environmental Criteria**	**30 days**	**Mon 11/9/15**	**Fri 12/18/15**	
40	2.7.1 Preliminary Recycled Water System Requirements	15 days	Mon 11/9/15	Fri 11/27/15	17
41	2.7.2 Permitting Requirements	15 days	Mon 11/30/15	Fri 12/18/15	40
42	2.7.3 Water Rights Considerations	20 days	Mon 11/9/15	Fri 12/4/15	17
43	2.7.4 Environmental Documentation Requirements (CEQA)	10 days	Mon 11/9/15	Fri 11/20/15	17
44	**2.8 Project Alternatives Analysis**	**65 days**	**Mon 11/9/15**	**Fri 2/5/16**	
45	2.8.1 Planning and Design Assumptions	25 days	Mon 11/9/15	Fri 12/11/15	17
46	2.8.2 Alternatives Development - Treatment	25 days	Mon 12/14/15	Fri 1/15/16	19
47	2.8.3 Alternatives Development - Distribution	25 days	Mon 12/14/15	Fri 1/15/16	19
48	2.8.4 Alternatives Development - Recycled Water Storage	25 days	Mon 12/14/15	Fri 1/15/16	19
49	2.8.5 Non-Recycled Water Alternative	20 days	Mon 12/14/15	Fri 1/8/16	19
50	2.8.6 Water Conservation/Reduction Analysis	20 days	Mon 12/14/15	Fri 1/8/16	45
51	2.8.7 No Project Alternative	20 days	Mon 12/14/15	Fri 1/8/16	45
52	2.8.8 Conceptual Alternatives Analysis	15 days	Mon 1/18/16	Fri 2/5/16	20
53	**Tank 2.9 Recommended Facilities Project Plan**	**20 days**	**Mon 2/8/16**	**Fri 3/4/16**	
54	2.9.1 Preferred Alternative	20 days	Mon 2/8/16	Fri 3/4/16	52
55	**Task 2.10 Stakeholder Involvement**	**20 days**	**Mon 2/8/16**	**Fri 3/4/16**	
56	2.10.1 Stakeholder Outreach	20 days	Mon 2/8/16	Fri 3/4/16	52
57	2.10.2 Public Outreach	20 days	Mon 2/8/16	Fri 3/4/16	52
58	**Task 2.11 Implementation Plan**	**20 days**	**Mon 2/8/16**	**Fri 3/4/16**	
59	2.11.1 Coordination and Governance	20 days	Mon 2/8/16	Fri 3/4/16	52
60	2.11.2 Construction Financing Plan and Revenue Program	20 days	Mon 2/8/16	Fri 3/4/16	52
61	2.11.3 Detailed Schedule	20 days	Mon 2/8/16	Fri 3/4/16	52
62	**Task 2.12 Prepare RWFPS**	**90 days**	**Mon 3/7/16**	**Fri 7/8/16**	
63	2.12.1 Draft RWFPS	3 wks	Mon 3/7/16	Fri 3/25/16	24,27,31,34,36,39,4
64	SSLOCSD Review of Draft RWFPS	2 wks	Mon 3/28/16	Fri 4/8/16	63
65	2.12.2 Final Draft RWFPS	3 wks	Mon 5/2/16	Fri 5/20/16	22FS+15 days
66	SSLOCSD Review of Draft RWFPS	2 wks	Mon 5/23/16	Fri 6/3/16	65
67	2.12.3 Final RWFPS	2 wks	Mon 6/27/16	Fri 7/8/16	23FS+15 days



Project: Schedule_SWRRF RWFPS
Date: Thu 9/17/15

Task	Milestone	Project Summary	External Milestone	Inactive Milestone	Manual Task	Manual Summary Rollup	Start-only	Deadline	
Split	Summary	External Tasks	Inactive Task	Inactive Summary	Duration-only	Manual Summary	Finish-only	Progress	