

Sacramento Regional County Sanitation District

Interceptor Sequencing Study

**Technical Memorandum 9
Unit Costs for Centralized, Scalping, and Satellite
Wastewater Treatment Plants**

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NO. 9**

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TABLE OF CONTENTS

	<u>Page No.</u>
1.0 INTRODUCTION.....	9-2
2.0 BACKGROUND.....	9-2
3.0 CENTRALIZED TREATMENT FACILITY.....	9-3
4.0 SCALPING TREATMENT FACILITY.....	9-3
5.0 SATELLITE TREATMENT FACILITY.....	9-4
6.0 MAJOR ASSUMPTIONS MADE	9-4
7.0 UNIT COST ANALYSIS	9-5
7.1 Cost for Liquid Treatment Facilities	9-5
7.2 Cost for Solid Handling Facilities	9-5
7.3 Cost Parameters and Assumptions	9-5
7.4 Advanced Treatment	9-6
7.5 Piping.....	9-6
8.0 UNIT COST SUMMARY	9-6

LIST OF TABLES

Table 9.1	Estimated SRCSD Wastewater Treatment Plant Costs.....	9-7
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UNIT COSTS FOR CENTRALIZED, SCALPING, AND SATELLITE WASTEWATER TREATMENT PLANTS

1.0 INTRODUCTION

The Sacramento Regional County Sanitation District (SRCSD) is carrying out a high-level Interceptor Sequencing Study (ISS) to determine alternatives that would provide build-out regional sewer service for future developments. This technical memorandum (TM) addresses the wastewater treatment costs of centralized, satellite, and scalping treatment facilities for this planning effort. Traditional water recycling alternatives are not being evaluated through this process. This TM will recommend unit costs for satellite or scalping treatment plants to be used for rough estimates of capital costs. The Operations and Maintenance (O&M) will be derived as percentages of the construction costs. Due to the high level nature of the ISS, allowances for details are very limited and this analysis excludes the following:

- Value for remaining life of the assets including the conveyance system and decentralized treatment facilities.
- Cost saving for the potential delay and/or elimination of capital improvement projects at the SRWTP.
- Potential revenue from the distribution of recycled water.

2.0 BACKGROUND

SRCSD has experience constructing and operating major wastewater treatment processes at the Sacramento Regional Wastewater Treatment Plant (SRWTP). The SRWTP is a secondary treatment facility with a permitted capacity of 181 million gallons per day (mgd) seasonal dry weather flow and includes on-site solids disposal facilities. SRCSD also operates a Water Reclamation Facility (WRF) within the SRWTP property. A small amount of the secondary effluent is diverted to the WRF for tertiary treatment and the remaining flow is discharged to the Sacramento River.

The cost estimating methodology used to evaluate the decentralized treatment plant alternatives come from several different sources:

- The Water Recycling Opportunities Study (WROS) was completed in 2007 to evaluate the feasibility of implementing a large scale water Recycling Program. Project alternatives were evaluated for potential costs, which were used to determine the potential costs of the liquid treatment processes of satellite and scalping treatment facilities. The WROS uses Membrane BioReactor (MBR)

technology, which this TM assumes for decentralized facilities. The use of any other technology would require re-evaluation of the projected costs.

- The Update of Estimated Project Costs for the SRCSD 2020 Master Plan Advanced Treatment Alternatives Technical Memorandum, completed by Corollo Engineers in 2007, provided the costs for advanced tertiary treatment.
- The Walnut Grove Wastewater Treatment Plant Reconnaissance-Level MBR, RO, and Chemical Precipitation Cost Estimate Technical Memorandum was completed in 2006 by SRCSD. This study provided the specific process costs for solids treatment at the satellite plants.
- The Legal and Permitting Issues Associated with Future South Sacramento County Satellite Facility Discharging to the Cosumnes River Memorandum was completed in 2010 by Somach Simmons & Dunn (SSD). This memo provided the high level potential treatment requirements for satellite plants.

3.0 CENTRALIZED TREATMENT FACILITY

The SRWTP is a secondary treatment facility with a permitted capacity of 181 mgd seasonal dry weather flow and includes on-site solids disposal facilities. The treatment train includes: aerated grit chambers followed by primary sedimentation, secondary treatment with high-purity oxygen activated sludge process and secondary clarifiers, and a disinfecting process that includes chlorination/dechlorination basins. SRCSD also operates a Water Reclamation Facility (WRF) for tertiary treatment and the remaining flow is discharged to the Sacramento River.

Centralized treatment will be provided by a new or expanded Water Reclamation Facility at the SRWTP, which will provide Title 22 tertiary treatment of the secondary effluent produced by the SRWTP. The tertiary effluent (i.e. Recycled Water) is then transported from the SRWTP via distribution pipes to the point of discharge for the local system. Solid waste is treated on-site at the SRWTP.

The advantage of centralized treatment is that it eliminates the need for an off-site facility, and that the WRF can be operated seasonally, producing recycled water for irrigation only during summer or dry months. The plant would not operate during wet months when the demand is low or non-existent, when the minimal requirements could more cost-effectively be met by other sources.

4.0 SCALPING TREATMENT FACILITY

A scalping plant is an MBR treatment facility located along a major interceptor sewer to treat wastewater generated from certain areas. These plants are typically placed in close proximity to water recycling opportunities, which significantly reduces the transmission costs of pumping treated wastewater from the SRWTP to the recycled water place of use.

As would be expected, the transmission savings associated with building a satellite facility increase with the distance from the SRWTP.

Depending on the interceptor flow rate, the scalping facility can be designed to provide recycled water based on the demand pattern or based on a steady flow making the design flexible with minimal need of redundant units. This facility treats the “scalped” sewer flows, discharges the tertiary treated effluent to a local distribution system, and returns the solid waste back into the sewer collections system for standard treatment at the SRWTP.

A scalping plant can be operated seasonally, producing recycled water for irrigation during summer or dry months. The plant would not operate during wet months when the demand is low or non-existent, when the minimal requirements could more cost-effectively be met by other sources.

The advantage of discharging the residuals back to the sewer interceptor to be treated downstream at the SRWTP facility is that it eliminates the need for on-site solid handling processes, which in turn reduces the footprint, costs, and odor emissions of the scalping facility.

5.0 SATELLITE TREATMENT FACILITY

A satellite plant is a MBR treatment facility that treats all influent flows and consistently produces acceptable water quality. As a result, sufficient reliability must be installed to allow for one or more membrane basins to be out of service and still maintain sufficient capacity to treat the influent flow under all conditions. This “end of pipe” treatment facility must accommodate the flow fluctuation from both diurnal flow and peak flows by either installing larger treatment units or by adding equalization tanks. Solid waste is treated on-site at the satellite facility or trucked back to the SRWTP for treatment. It also requires a discharge permit for excess flows and solid handling processes, which makes them less desirable in neighborhood locations due to its footprint.

The advantage of treating solids on-site is that it eliminates the need for an extensive network of interceptor pipes connecting to the SRWTP.

6.0 MAJOR ASSUMPTIONS MADE

Due to the lack of information available for this level of analysis, the following major assumptions were made:

- The effluent from the decentralized satellite plants are discharged into the nearby Cosumnes River.
- MBR Technology is used to treat the wastewater.
- The NPDES permitting requirements are for Title 22 tertiary effluent.

- No major land requirement issues are encountered.

7.0 UNIT COST ANALYSIS

7.1 Cost for Liquid Treatment Facilities

This unit cost analysis is based on using MBRs as the technology for liquid treatment. Capital costs developed under the WROS with appropriate inflation escalation were used.

7.2 Cost for Solid Handling Facilities

Solids removed from the decentralized MBR facilities will be transported to the SRWTP, handled through a separate treatment process on-site at the satellite treatment facility, or piped back to the sanitary sewer system for handling and disposal at the SRWTP.

- Solids transportation will be a permanent O&M cost, consisting of a significant number of truckloads going from the satellite facility to the SRWTP daily. There will be additional administrative costs involved by monitoring staff at the SRWTP, as well as the standard construction and O&M liquid treatment costs at the SRWTP.
- A separate treatment process conducted at the satellite location would involve construction and O&M of the treatment facilities, as well as the additional land (which is a minimal investment financially, but would increase the complexity of finding an appropriate site for the facility). The final disposal product would still have to be processed on-site, and then trucked to another facility; trucking costs would be significantly less than trucking the solids to the SRWTP for treatment.
- A scalping plant would place the solids waste back into the sewer conveyance system for treatment at the SRWTP. There will be the standard construction and O&M liquid treatment costs for the scalping plants, but the solids treatment costs will all be at the SRWTP. This option requires the use of sewer conveyance pipes to the SRCSD; minimal expense if the facility is located adjacent to a sewer interceptor, but very expensive if new pipe must be constructed to serve the facility.

For these reasons, a satellite plant is financially viable only if it avoids the construction of a new interceptor. If an interceptor system is already in place, then a scalping plant makes much more sense financially.

7.3 Cost Parameters and Assumptions

The final cost of any satellite or scalping wastewater treatment plant was determined by a number of cost parameters. By analyzing these cost parameters, we are able to determine the unit costs for any final project. These cost parameters are shown in Table 9.3.

7.4 Advanced Treatment

Satellite plants may require additional advanced treatment, based upon the final permitting required for any specific site. The Memo by Somach Simmons & Dunn outlined multiple possible requirements, and the more likely possibilities are included in satellite treatment costs. These possible requirements include Nitrifying Trickling Filter, Ultra Violet radiation, Reverse Osmosis, Ozone Oxidation, and Cooling of the final effluent.

7.5 Piping

Three types of piping may be required, depending on the alternative selected. Transmission piping is used for distributing Recycled Water from the facility that created it to the local network of users. Discharge piping is used to take treated effluent from the satellite facility to a discharge point (in this study, to the Cosumnes River). Conveyance piping is used to transport sewer flows to the point of treatment.

All piping is constructed at essentially the same cost: the miles of pipe required multiplied by the pipe size in inches (known as “inch diameter miles” or IDM) multiplied by \$66,787.

8.0 UNIT COST SUMMARY

The summary of expected costs for the treatment plants are shown below in Table 1. The size of the facility is unknown, so the costs are shown for different treatment capacities.

Table 9.1 Estimated SRCSD Wastewater Treatment Plant Costs			
Treatment/Unit Process	Centralized Costs	Scalping Plant Costs	Satellite Plant Costs
Probable Capital Cost			
Facilities (per mgd)	\$2,226,712	\$4,211,058	\$4,211,058
Transmission Piping (per IDM)	\$66,787	\$66,787	\$66,787
Discharge Piping (per IDM)	\$66,787	-	\$66,787
Pumps at SRWTP (per hp)	\$2,000	\$2,000	\$2,000
Storage (per mg)	\$1,000,000	-	\$1,000,000
Solids Handling	\$1,300,000	-	\$1,300,000
Adv Treatment: NTF (per mgd)	-	-	\$2,130,000
ADV Treatment: UV (per mgd)	-	-	\$450,000
Adv Treatment: RO (per mgd)	-	-	\$5,110,000
Adv Treatment: Ozone (per mgd)	-	-	\$190,000
Base Construction Costs			
Contingency	30%	30%	30%
Engineering, CM, and Administrative	30%	30%	30%
Environmental Documentation, Permitting, and Mitigation	5%	5%	5%
Legal	2%	2%	2%
Net Present Value Analysis			
O&M of WRF	9.00%	9.00%	9.00%
O&M of SRWTP	\$436	\$436	-
O&M of Transmission Piping	0.50%	0.50%	0.50%
O&M of Pump Station	5.00%	5.00%	5.00%
Power Cost	\$0.10	\$0.10	\$0.10
O&M of Solids Handling (per AF)	\$82	\$82	-
O&M of Solids Handling (per mgd)	-	-	\$69,129
O&M Adv Treatment: NTF	-	-	\$200
O&M ADV Treatment: UV	-	-	\$31
O&M Adv Treatment: RO	-	-	\$1,400
O&M Adv Treatment: Ozone	-	-	\$11