Exhibit "C"

LOS OSOS WASTEWATER PROJECT TECHNICAL ADVISORY COMMITTEE

San Luis Obispo County Department of Public Works

TAC

PRO/CON ANALYSIS ON PROJECT COMPONENT ALTERNATIVES

Draft

August 6, 2007

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LOS OSOS WASTEWATER PROJECT TECHNICAL ADVISORY COMMITTEE

San Luis Obispo County Department of Public Works

Date: August 6, 2007

To: Jerry Lenthall, Chairperson, District 3
Harry Ovitt, Supervisor, District 1
Bruce Gibson, Supervisor, District 2
Katcho Achadjian, Supervisor, District 4
Jim Patterson, Supervisor, District 5

From: Los Osos Wastewater Project Technical Advisory Committee

CC: Noel King, Director of Public Works
Paavo Ogren, Deputy Director of Public Works

Subject: Pro/Con Analysis on Viable Components of the Los Osos Wastewater Project

Gentleman,

On March 20 your board appointed us to the newly formed Los Osos Wastewater Project Technical Advisory Committee with the direction to "As its "First Priority", (make) recommendations on the Pro's and Con's of the Project Alternatives developed by the Department of Public Works and consultants that comprise the "Project Team"."

The TAC was divided into three subcommittees in order to create a comprehensive and unbiased pro/con analysis on the major elements of a wastewater system. The Engineering and Water Resource committee focused mainly on the technical aspects of the sewer components as they related to the special circumstances in Los Osos. The Environmental committee concentrated on the affects each component would have on our community ecosystem, both during construction and on an ongoing basis. The Financial committee carefully researched the costs associated with building and operating each component and the associated financial risks.

Since our inception the thirteen members of this committee have met several times each week, both in public session and as individual committees, to analyze and critique both the Rough Screening Report and the Fine Screening Report submitted to us by the Project Team. Utilizing our own experience and the input that we have received from the community in public meetings, we have produced this report and respectfully submit it to your board.

We appreciate being given this opportunity to serve our community and support the Board of Supervisor's efforts and decision-making process. We will continue to serve as directed.

William Garfinkel, TAC Chair

Rob Miller, TAC Vice Chair

Engineering/Water Resources Committee
John Brady
Bob Semonsen
John Fouche
Russell Westman

Environmental Committee
Daniel Berman
Marshall Ochylski
Maria Kelly

Finance Committee
George Call
James Furman
Rob Shipe
Karen Venditti

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LOS OSOS WASTEWATER PROJECT – TECHNICAL ADVISORY COMMITTEE

EXECUTIVE SUMMARY OF PRO/CON ANAYLSIS

After being introduced to the project with presentations by the Project Team on the Potential Viable Project Alternatives Rough Screening Analysis, the TAC concentrated on how we would conduct our pro/con analysis. As a first step we adopted Core Values that we felt needed to be addressed in any project for Los Osos. Although each working committee would approach their analysis with a different emphasis, common core values would focus deliberations on what we believed were the basic issues.

Affordability of any project is one of the major concerns (and probably the most important) to the community. The Prohibition Zone residents who will be paying for the project are predominately middle to lower income people, and a sizable monthly payment could become a major burden for them. For some, any increase in their monthly cash outflow will be disastrous.

Los Osos with its location on sand dune ESHA and adjacent to the bay is rich in biodiversity and archeological sites therefore impacts on its environment must be carefully weighed.

With Los Osos currently in a Level III severity state for water and the tremendous impact a wastewater project will have on the basin, it became apparent that, although the wastewater issue and water issue were intended to be separate, there is no practical way of accomplishing that.

In addition to the financial impacts of the project there needs to be consideration given to other community issues, such as construction disturbances, site location, and individual property landscape destruction.

The TAC also felt that it was important for the community to have the ability to control its future destiny and minimize the affects of third party influences.

With these issues in mind, the TAC adopted the following listed of core values and the associated major criteria.

CORE VALUES	MAJOR CRITERIA
Affordability	• Capital costs, including: construction, road impacts on-lot costs • O&M costs, including: energy usage • Financing factors • Grant Eligibility
Environmental Stewardship	• Environmental impacts, including: biological and archeological considerations • Potential risks due to system failure • Carbon footprint, including energy, fuels, air pollution, chemicals
Flexibility	• Flexibility to meet future needs and opportunities, including: expansion, future higher regulations, regional opportunities • Potential alternative energy opportunities
Sustainability	• Restoring and protecting our groundwater resources, including: mitigating seawater intrusion and achieving groundwater balance in the basin
Community	• Impacts on individual homeowners, residents, and business, including: construction nuisance, odor, noise • Stakeholder support • Compatibility with Los Osos Vision Plan
Controllability	• Risks of third party decisions, policies • Financial risks associated with wastewater projects

Each of the working committees then identified their specific criteria, which they used to evaluate each of the component alternatives presented (see Appendix: A).

All TAC meetings were open to the public. The TAC carefully considered the many and varied public comments, and made every effort to take a comprehensive and unbiased approach in this analysis. We also recognize the concerns of many citizens regarding the assumptions and cost figures used in the draft Fine Screening; however, the purpose of this pro/con analysis was to make a broad comparison of the various components that make up a project. We trust that further investigation and value engineering will clarify assumptions that impact sizing and cost.

The following pages are a summary of the TAC pro/con analysis and a comparison of component costs for the components of the wastewater system. The complete pro/con analysis follows.

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LOS OSOS WASTEWATER PROJECT – TECHNICAL ADVISORY COMMITTEE

Summary of Collection Systems Pro/Con

The advantages of Gravity are that it has lower annual O&M costs and it has less impact on individual properties. The greatest concerns of Gravity are that it has higher capital costs; has greater impacts of construction, i.e. trenching up to 30 feet, dewatering, and longer street closures; and greater risks associated with I/I and system failure. Gravity collection will have long term street impacts due to lift stations and manhole maintenance. Also, Gravity collection results in significantly higher bio-solids handling.

The advantages of STEP/ STEG are that it has lower capital costs; it provides primary treatment in the septic tank, thereby reducing the costs associated with treatment and solids; has less road impacts due to smaller pipe and shallow trenching or directional drilling; and reduces the risk of archeological impacts and resultant delays. The greatest concerns are with higher annual O&M costs, and short term and permanent impacts on individual properties.

COLLECTION	PROS	CONS
Gravity	• Lower annual O&M costs for collection • Less on-lot disturbance to homeowner. • No easement or access required on private property	• Higher capital costs • Longer time to construct • Impact on treatment costs (higher capital costs, and annual O&M) • Increases cost of solids treatment and disposal • Higher risk of raw sewage spilling into Bay in event of system failure • Increased risk of I/I over time; may require additional cost of monitoring/ repair program • Requires deeper trenching and dewatering, resulting in need to protect water quality from disposal of collected water, significant soil erosion, traffic nuisance • Higher risk of impacts on archeological resources may result in delays, additional cost • Pump stations have permanent impact, requiring additional footprint and odor control • Potential odor issues at manholes, lift stations • Greater amount of road restoration resulting in longer closures and traffic
STEP/STEG	• Lower capital costs • Shorter time to construct street mains (9 months) • Provides primary treatment in septic tank, thereby reducing down-line costs for treatment system and solids treatment/ disposal • Effluent contains minimal solids, reducing risk and cost of clean-up in event of system failure • Shallow trenching and Horizontal Directional Drilling (HDD) where feasible, results in less road impacts and traffic nuisance, less risk to archeological resources and associated delays • Requires no lift stations, reducing footprint requirements • Minimal risk of I/I and resulting impact on Load	• Higher annual O&M costs for collection- • May require additional nitrification treatment for disposal options • If SRF loan is used, may require separate electrical connection premium • Permanent impact on individual property • Increased risk of impact on archeological resources due to new septic tanks • Nuisance and cost of regular pumping of septic tanks • Potential odor issues of (200-500 collection vents scattered around community) if not properly maintained • Higher total on-lot capital costs; unknown amount is homeowner responsibility; may be affected by funding • Individual properties have many active on-lot component systems including pumps, sensors, alarms that require periodic maintenance and have a greater risk of failure.

COMMENTS

- Note that 97% of trenching in town is less than 14 feet deep.
- Both systems result in abandonment of existing septic tanks.
- On-lot costs may not be covered if SRF funding is used for a STEP system
- (engineering) Considering life cycle costs for construction and O&M, the two systems appear comparable.

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LOS OSOS WASTEWATER PROJECT – TECHNICAL ADVISORY COMMITTEE

Summary of Treatment Technologies Pro/Con

Oxidation Ditch and BIOLAC are very similar in cost, footprint and results. BIOLAC has lower capital costs, but they both have similar annual O&M costs. With Gravity collection they require a larger footprint and may greater impact on biological and archeological resources.

The advantages of Facultative ponds are that they have the lowest capital cost and annual O&M. They also have the lowest energy usage, and they minimize the costs relating to solids treatment and handling. The disadvantage is that ponds require the largest footprint and produce methane in the process.

The advantage of MBR is that it produces the highest quality of effluent, allowing for greater flexibility in disposal options. It also requires the smallest footprint which makes it easier to control odors. The disadvantages of MBR are that it is the most expensive technology, both in capital costs and annual O&M, and requires the highest energy consumption and cost.

TREATMENT	PROS	CONS
Oxidation Ditch	• Small footprint (8 acres) • Lower annual O&M with STEP	• Higher capital costs than BIOLAC • Higher annual O&M with Gravity
BIOLAC	• Lower capital costs than Oxidation Ditch- • Small footprint (8-10 acres) • Lower annual O&M with STEP	• Higher annual O&M with Gravity • Higher energy usage with Gravity collection (1.1M kWh/yr)
Ponds	• Lowest capital costs • Lowest annual O&M • Lowest energy usage (600,000 kWh/yr) • Eliminates cost of solids treatment • Greatly reduces solids production and disposal (dredging required once every 20 years)	• Requires larger footprint (16-20 acres) • May require additional nitrification treatment with STEP • Releases methane gas (more powerful greenhouse gas than CO2) • Greater construction impacts
MBR	• Requires smallest footprint (4 acres) • Higher quality of effluent, suitable for discharge at Broderson leach field • Enclosed facility controls odors	• Extremely high capital cost • Highest energy usage (1.3M kWh/yr. EIR indicated 2.1M and expected to increase with time) • Higher annual O&M • High construction nuisance in center of town

COMMENTS

- All four treatment methods are proven reliable and will meet the requirements of secondary treatment.
- Tertiary treatment required for all treatment methods.
- If draft ground water recharge regulations are applied in the future then advanced treatment beyond tertiary may be required.
- All four treatment methods require higher frequency of sludge removal with gravity.
- (engineering) There is only a small difference in construction costs between Oxidation Ditches, Biolac and Facultative Ponds.

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Summary of Solids Treatment and Disposal Pro/Con

While Sub-Class B solids require the lowest capital costs, they have the highest risk for disposal costs and more stringent regulations in the future. Composted Class A bio-solids are the preferred solution and should be the ultimate goal of any sewage treatment system. All lower classes of solids should be viewed as short-term measures with the intent to be upgraded in the future.

Facultative ponds offer the least amount of solids generation and handling. It is recommended that, when ponds are dredged (every 15-20 years), further composting of solids be considered to produce Class A bio-solids.

Of note: Although solids treatment and disposal represent a very small portion of construction costs, they represent up to 42% of annual O&M costs. A STEP/STEG collection system significantly reduces the volume of bio-solids produced.

BIO-SOLIDS	PROS	CONS
Sub Class B	• Lowest capital cost for treatment • Low annual O&M • Flexibility to be upgraded • Low acreage requirements	• Produces greatest volume of sludge • Most restrictive disposal option and highly dependent on availability of receiver sites • Largest carbon footprint: Highest hauling costs and traffic nuisance in center of town • Produces lowest quality of sludge; may require additional treatment for disposal • Risk of substantial increase in hauling costs and more stringent regulations
Digested and/or Heat Dried Class B NOTE: Heat –dried process is typically used to produce Class A bio-solids. Since it has higher capital costs and O&M, it has been eliminated in this comparison.	Produces lower volume of sludge Lower hauling costs and traffic nuisance Flexibility for future upgrade Greater range of dispersal options Smaller footprint	Higher capital cost for treatment Higher annual O&M Limited disposal options Higher energy use for heat dried
Composted Class A	Produces lower volume of bio-solids minimal hauling costs Produces highest quality of bio-solids with greatest range of disposal options Potential regional solution; could generate revenue	Higher capital costs Higher annual O&M Requires supply of bulking agent and adequate user demand Regulations may limit direct land application
Facultative Ponds	Requires no ongoing sludge treatment or disposal. Ponds would be dredged approximately every 20 years, with amortized costs of $30k- $50k per year.	

COMMENTS

- Solar drying is low in construction costs but requiresional acerage and may presents an odor issue

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LOS OSOS WASTEWATER PROJECT – TECHNICAL ADVISORY COMMITTEE

Summary of Sites Pro/Con

The advantages of the out-of-town sites (Cemetery, Giacomazzi, Branin, which are adjacent to each other as well as others) are that a larger site provides greater flexibility in treatment and biosolid technologies, and allows for alternative energy, regional solutions, future expansion and upgrades. They are in close proximity to agriculture for future water exchange and spray fields and/or wetlands that could be utilized as possible disposal options. They are also outside of a low density residential area, distant from community centers, and have a lower right of way acquisition cost. The disadvantage is in the additional costs for piping wastewater from the collection area and the return of effluent to the community ground water basin.

The advantages of the Tri-W site are that it is central to the collection system and close to the proposed Broderson leach field. However, its downtown location (near library, church, community center) and the high density residential area require that the most expensive treatment technology site improvements and odor controls be employed, Also, there are higher traffic impacts to the community with the hauling of bio-solids offsite and the importation of materials. It has high construction costs, annual O&M, and right of way acquisition costs, along with a large carbon footprint. Its small size lacks flexibility for future expansion or upgrade.

SITING	PROS	CONS
Cemetery	Adjacent to Giacomazzi: Potential of northern acreage for alternative energy, future expansion, upgrades Proximity to spray fields and ag reuse reduces cost of piping Low population density Sufficient acreage to build treatment facility	Inadequate footprint to accommodate entire treatment facility Questionable willingness of seller Proximity to funeral events, visitors Increased cost and impacts to pipe influent from collection area
Giacomazzi	Sufficient acreage to build treatment facility and adjacent to Branin and the Cemetery: Flexibility for alternative energy, future expansion, upgrades Screened from LOVR Low population density Willing seller Community acceptance of out-of-town site Proximity to spray fields and ag reuse	Increased cost and impacts to pipe influent from collection area Distance from potential Broderson leach field
Branin	Adjacent to Giacomazzi: Potential for wetland storage, alternative energy, future expansion, upgrades Proximity to spray fields and ag reuse	Inadequate footprint to accommodate some types of treatment facilities Proximity to Warden Lake
Tri-W	Already owned by CSD Site of project already mitigated and tribal agreements in place, which may shorten construction time Central location reduces cost of collection system Proximity to potential Broderson leach fields	Very high land value and mitigation requirements Small acreage in downtown locations requires most expensive treatment and higher costs overall Lacks flexibility for future expansion, upgrades, or alternative energy High risk associated with system failure due to proximity to Bay High population density, proximity to church, library, community center. Traffic impacts in center of town Greatest distance to spray fields and ag reuse ESHA – sensitive dune habitat Partial view obstruction of Morro Rock Inconsistent with LO vision statement; lacks community acceptance

<u>COMMENTS</u>

- All East of town sites have no traffic impacts and are close to LOVR. In addition minimal site improvements are required, they are level and suitable for construction Class III ag land.
- NOTE: It was the unanimous opinion of the NWRI that an out of town site is better due to problematic issues with the downtown site.

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LOS OSOS WASTEWATER PROJECT – TECHNICAL ADVISORY COMMITTEE

Summary of Effluent Reuse/ Disposal Pro/Con

Since the groundwater basin is the sole source of water supply, the way the wastewater treatment plant effluent is managed will have a major influence on the sustainable yield of the basin in terms of both volume and quality.

It appears that no one disposal option can provide benefits of seawater intrusion mitigation and accommodate the full requirements of the wastewater system - it will require an array of options to accomplish both. We believe that leach fields at Broderson should be part of any project in order to assure maximum recharge of the aquifer.

Due to the cost of land acquisition, as well as water lost to the groundwater basin, disposal at spray fields are considered a last resort, a back-up plan in the event that other disposal options are not available. We encourage the County to consider agricultural disposal at farms outside the basin before considering spray fields at Tonini.

DISPOSAL	PROS	CONS
Spray Fields* Capacity 1190 AFY Mitigation = -0-	• Greatest capacity (up to 1190 AFY); with start-up operations and emergency discharge. • Lower treatment requirements (tertiary and denitrification treatment probably not required) • Future flexibility • Purveyor and/or third party participation not required	• Zero Seawater Intrusion (SWI) Mitigation • Negative impact on groundwater balance; no agricultural reuse/ exchange. • Greatest footprint and highest land costs • Highest capital costs for pipe to fields and higher risks for trenching • Seasonal • Salt loading in soils
Cemetery Reuse Capacity 50 AFY Mitigation = 5 AFY	• Proximity to out-of-town site reduces pipe costs	• Limited capacity (50 AFY) • Minimal SWI Mitigation factor • Seasonal • Higher treatment required – tertiary and partial denitrification • Requires contract with end user
Agricultural In-lieu Capacity 460 AFY Mitigation = 46 AFY	• Potentially reduces pumping large volumes from aquifer • Proximity to Giacomazzi site reduces pipe costs • Flexibility to upgrade to Ag Exchange	• Low SWI Mitigation • Higher treatment required - tertiary and partial denitrification • Requires contract with end user, which may take time to obtain • Seasonal
Agricultural Exchange Capacity 460 AFY Mitigation = 250 AFY	• Highest SWI Mitigation • Proximity to out-of-town site reduces pipe costs	• Seasonal • Higher treatment required - tertiary and partial denitrification • Requires contract with end user, which may take time to obtain • Requires purveyor participation
Broderson Capacity 448 AFY Mitigation = 100 AFY	• Moderate capacity (448 AFY without Harvest Wells) • Moderate SWI Mitigation factor • Purveyor participation not required • Already owned by CSD • Only known method to directly recharge upper aquifer	• High capital costs • Distance from out-of-town site increases piping costs • Higher treatment required - full denitridication • Construction impacts and costs from monitoring wells • Large footprint and high land value ($4.7M) • High risk of more stringent DHS regulations in future (Total Organic Carbon concentration, and travel time/ distance to nearest production well) NWRI: If Broderson is used, it is important to evaluate compliance with new DHS Groundwater Recharge Reuse criteria. • EIR: Broderson is subject to land sliding once disturbed, due to sandy soils and 10% slope at southern portion of northern 40 acres • EIR: Leach field trenches pose significant risk of liquefaction • Higher capacity requires harvest wells, incurring additional capital costs, annual O&M, and purveyor participation • Grading impacts on habitat (initial construction and reconstruction every 10 years

COMMENTS

- The Finance Group recognizes the importance of mitigating Seawater Intrusion, but believes that associated costs should be paid for by the entire groundwater basin community.
- According to the most recent studies, it is possible to meet the demand for water using only the groundwater basin as the source of supply. However, this is highly dependent on the implementation of an agricultural exchange program of sufficient size and the use of the Broderson leach field.

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LOS OSOS WASTEWATER PROJECT – TECHNICAL ADVISORY COMMITTEE

COMPARISON OF COMPONENT COSTS FROM FINE SCREENING ANALYSIS

COLLECTION COST COMPARISON

	Gravity	STEP/ STEG
Total Construction and Homeowner Costs (1) (2)	**$80.3M - $89.7M**	**$64.8M - $81.2M** (3)
Annual Operations & Maintenance Costs	**$450,000** (4)	**$745,000** (4)

(1) Not including separate electrical premium.
(2) Homeowners' on-lot costs are not part of gravity collection project costs, but are included here for comparison purposes only.
(3) Additional research is required to determine if STEP costs for overhead, profit and taxes are already included. If so, the total construction costs would be lower by $10.6M to $13.2M.
(4) STEP's septic hauling costs ($150k) are included here. Gravity's hauling costs are included in Bio-solids, Sub Class B costs.

TREATMENT COST COMPARISON

Treatment Technology	**Total Capital Costs Level 2 Treatment**		**Annual O&M Level 2 Treatment**		**Energy Requirements (Kilowatt hours/ year)**		**Acerage Required**	
	Gravity	STEP	Gravity	STEP	Gravity	STEP	Gravity	STEP
Oxidation Ditches	$22.6M	$21.7M	$720,000-$790,000	$60,000-$760,000	900,000	800,000	8	8
BIOLAC	$19.9M	$19.4M	$730,000-$800,000	$670,000-$740,000	1,100,000	800,000	10	8
Facultative Ponds	$22.8M	$21.7M	$695,000-$765,000	$695,000-$765,000	600,000	600,000	20 (4)	20 (4)
MBR – Tri-W	$55.0M	NA	$700,000	NA	1,300,000	NA	4	NA

Assumptions:
(1) Denitrification needed for 0.8 MGD side stream at peak winter flow.
(2) Full 1.4M flow treated to tertiary level for agriculture, urban reuse, and future regulations.

NOTE: Report uses 1.4mgd in all final cost calculations. STEP costs should be recalculated based on 1.2mgd.

SOLIDS TREATMENT AND DISPOSAL COMPARISON

BIO-SOLIDS Alternatives	**Capital Costs**		**Annual O&M**		**Bio-solids Produced Tons/ year**		**Acres Required for Solar Drying**	
	Gravity	**STEP**	**Gravity**	**STEP**	**Gravity**	**STEP**	**Gravity**	**STEP**
Sub Class B	$1.9M - $2.4M	$1.1M - $1.7M	$430k - $470k	$190k - $270k	4,056	1,014	5.7	1.4
Digested Class B	$4.2M - $4.7M	$2.4M - $3.4M	$420k - $460k	$220k - $310k	3,103	776	4.4	1.1
Heat Dried B	$5.4M - $6.2M	$3.1M - $4.8M	$600k - $640k	$340k - $480k	1,043	261		
Composted Class A	$3.4M - $4.2M	$2.0M - $3.3M	$600k - $635k	$350k - $505k				
Facultative Ponds	-0-	-0-	$ 40k - $ 50k	$ 30k - $ 40k	(1)	(1)		

(1) Bio-solids will be dredged and hauled approximately every 20 years. STEP produces approximately 80% less solids than Gravity.

EFFLUENT REUSE/ DISPOSAL COMPARISON

Reuse/Disposal Level	**Capital Costs**	**Annual O&M Costs**	**Land (Spray field)**	**Storage**	**Seawater Intrusion Mitigation**
Level 1a: Full Ag Reuse	$12.7M - $14.3M	$100k - $190k	170 acres = $5.1M	290 AF	140 AFY
Level 1b: No Ag Reuse	$12.8M - $15.6M	$125k - $275k	280 acres = $8.4M	210 AF	90 AFY
Level 2a: Full Ag Reuse	$13.2M - $13.9M	$400k - $440k	70 acres = $2.1M	140 AF	240 AFY
Level 2b: No Ag Reuse	$14.9M - $16.7M	$440k - $530k	180 acres = $5.4M	30 AF	190 AFY
Level 3a: With Full Ag Use and Broderson	$25.6M - $27.3M	< $400k (1)	10 acres = $0.4M	115 AF	

(1) According to County staff, the O&M number in the Fine Screen needs to be revised downward.

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COMPLETE TAC PRO/CON ANALYSIS ON PROJECT COMPONENT ALTERNATIVES

TREATMENT PLANT SITES

CRITERIA	PROS	CONS

Cemetery

ENGINEERING & WATER RESOURCES

CRITERIA	PROS	CONS
Sufficient in size to meet environmental and potential future expansion needs	Site is large and preliminary review indicates all of the property is usable with the exception of the cemetery operation and its potential expansion area, as well as a known archaeological site.	The property is partially occupied by a business enterprise which may expand use on property.
	Adjacent to other candidate plant sites – potentially advantageous for future expansion options	A known archaeological site is located on the property
Minimize fluid transport costs	Located in close proximity to agricultural lands and the cemetery	Located away from collection system area
	Located mid-way between town and potential spray fields	Located distant from the potential Broderson leach field site
Minimize land costs, to include environmental mitigation costs	Due to non-urbanized land use, the land value is less.	A viable business enterprise currently occupies a portion of the property and may expand to include a larger portion of the property in the future
		Site located within 500 feet of a low density residential neighborhood
Site conditions with regards to constructability	Site is level and soils are suitable for construction	
	Water table is not an apparent construction issue at this site	

ENVIRONMENTAL

CRITERIA	PROS	CONS
Construction impact	Low population Density	Some Soil Erosion Potential
	Visual Screening	Proximity to Community Cemetery (Proximity greatest at Cemetery site)
	Construction Traffic out of town	Trenching to and from town
Community impact	Low population Density	Proximity to Community Cemetery
	Natural Screening	Future Cemetery expansion could increase proximity
Impact on biological resources	Minimal habitat value on site – some small areas of Sensitive Resources	Trenching to and from town, including crossing Los Osos Creek
		Proximity to Warden Lake (Branin> Giacomazzi> Cemetery)
System failure risk	Site area adequate for on-site containment (Branin may be small, depends on treatment technology footprint)	Proximity to Warden Lake (Branin> Giacomazzi> Cemetery)
Impact on archaeological resources		Limited information available: previously identified sites on portions of Cemetery and Branin
		Trenching to and from town
Energy Use	Site areas generally large enough to provide potential for alternative energy options	Energy requirements for pumping sewage out of town and effluent back in.
Land use plans and policies	Compatible	
Agriculture Land Use		Loss of Ag Land (Class III – not highly productive)

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TREATMENT PLANT SITES

CRITERIA	PROS	CONS

Cemetery

FINANCIAL

Capital Costs • Land Acquisition • Cost of road impacts, repairs • Cost implications to collection system, piping • Flexibility for future expansion		Cemetery occupies ~19A of 47.5; they require an additional 10A for expansion. Of the 17.5A remaining, ~8-9A are unusable (archeological area). This leaves ~8.5A (18%) usable land. Willingness of seller is highly questionable Higher cost for piping wastewater to treatment center Construction nuisance (air quality, noise, traffic, visual impacts) due to proximity to cemetery Cost to build intersection with LOVR
Operation & Maintenance • Energy requirements	Lower cost to pipe effluent to spray fields and/or to farms for ag in-lieu or ag exchange	Ongoing nuisance to cemetery (air quality, odors, noise, traffic, visual impacts, light pollution) Site allows little or no space for future expansion; upgrade in solids handling; wet winter or emergency storage; or cost-saving disposal or alternative energy options.
Financial Risks ▪ Potential costs relating to system failures		No space for storage to mitigate system failure risks Higher cost to pipe to Broderson leach field
Funding Factors ▪ Potential for revenue generation		Insufficient acreage for revenue-generating options

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LOS OSOS WASTEWATER PROJECT – TECHNICAL ADVISORY COMMITTEE

TREATMENT PLANT SITES

CRITERIA	PROS	CONS

Giacomazzi

ENGINEERING & WATER RESOURCES

Sufficient in size to meet environmental and potential future expansion needs	Site is large and preliminary review indicates all of the property is useable	
	No apparent environmental issues present that would constrain development and expansion options	
	Adjacent to other candidate plant sites, this may be advantageous for future expansion options.	
Minimize fluid transport costs	Located in close proximity to agricultural lands and the cemetery	Located away from collection system area
	Located mid-way between town and potential spray fields	Located distant from the potential Broderson leach field site
Minimize land costs, to include environmental mitigation costs	Due to non-urbanized land use, the land value is less	
	Reduced potential for odor control	
	Construction traffic out of town	
Site conditions with regards to constructability	Site is level and soils are suitable for construction	
	Water table is not an apparent construction issue at this site	

ENVIRONMENTAL

Construction impact	Low population Density	Some Soil Erosion Potential
	Visual Screening	Proximity to Community Cemetery (Proximity greatest at Cemetery site)
	Construction Traffic out of town	Trenching to and from town
Community impact	Low population Density	Proximity to Community Cemetery
	Natural Screening	Future Cemetery expansion could increase proximity
Impact on biological resources	Minimal habitat value on site – some small areas of Sensitive Resources	Trenching to and from town, including crossing Los Osos Creek
		Proximity to Warden Lake (Branin> Giacomazzi> Cemetery)
System failure risk	Site area adequate for on-site containment (Branin may be small, depends on treatment technology footprint)	Proximity to Warden Lake (Branin> Giacomazzi> Cemetery)
Impact on archaeological resources		Limited information available: previously identified sites on portions of Cemetery and Branin
		Trenching to and from town
Energy Use	Site areas generally large enough to provide potential for alternative energy options	Energy requirements for pumping sewage out of town and effluent back in.
Land use plans and policies	Compatible	
Agriculture Land Use		Loss of Ag Land (Class III – not highly productive)

FINANCIAL

Capital Costs • Land Acquisition • Cost of road impacts, repairs • Cost implications to collection system, piping • Flexibility for future expansion	Approximately 16-18 of 38 acres (45%) are usable	- Cost to build intersection with LOVR - Cost of piping wastewater to treatment plant
	Potentially willing seller	
	Allows for cost-reducing treatment and solids options (e.g. ponds, composting)	
	Moderate cost to improve road access	
	Lower cost to pipe effluent to spray fields and/or to farms for ag in-lieu or ag exchange	
	Allows for future expansion	
	Site allows for additional storage to mitigate system failure risks	
Operation & Maintenance • Energy requirements	Proximity to farms for ag in-lieu or ag exchange	
	- Site allows space for future expansion; upgrade in solids handling; wet winter or emergency storage; cost-saving disposal, and/ or alternative energy options.	
Financial Risks ▪ Potential costs relating to system failures	Allows for storage to mitigate system failures	Higher cost to pipe to Broderson leach field
Funding Factors ▪ Potential for revenue generation	Space for potential revenue- generating projects	
	- Site is suitable for alternative energy, which may attract grants	

LOS OSOS WASTEWATER PROJECT – TECHNICAL ADVISORY COMMITTEE

TREATMENT PLANT SITES

CRITERIA	PROS	CONS

Branin

ENGINEERING & WATER RESOURCES

Sufficient in size to meet environmental and potential future expansion needs	Adjacent to other candidate plant sites, this may be advantageous for future expansion options	Shape, slope and size of property limit development and expansion options
		Proximity to sensitive environmental areas may limit development and expansion options
Minimize fluid transport costs	Located in close proximity to agricultural lands and the cemetery	Located away from collection system area
	Located mid-way between town and potential spray fields	Located distant from the potential Broderson leach field site
Minimize land costs, to include environmental mitigation costs	Due to non-urbanized land use, the land value is less	
	Less potential for odor control	
Site conditions with regards to constructability	A portion of the site is level and has soils that are suitable for construction	
	Water table is not an apparent construction issue at this site	

ENVIRONMENTAL

Construction impact	Low population Density	Some Soil Erosion Potential
	Visual Screening	Proximity to Community Cemetery (Proximity greatest at Cemetery site)
	Construction Traffic out of town	Trenching to and from town
Community impact	Low population Density	Proximity to Community Cemetery
	Natural Screening	Future Cemetery expansion could increase proximity
Impact on biological resources	Minimal habitat value on site – some small areas of Sensitive Resources	Trenching to and from town, including crossing Los Osos Creek
		Proximity to Warden Lake (Branin> Giacomazzi> Cemetery)
System failure risk	Site area adequate for on-site containment (Branin may be small, depends on treatment technology footprint)	Proximity to Warden Lake (Branin> Giacomazzi> Cemetery)
Impact on archaeological resources		Limited information available: previously identified sites on portions of Cemetery and Branin
		Trenching to and from town
Energy Use	Site areas generally large enough to provide potential for alternative energy options	Energy requirements for pumping sewage out of town and effluent back in.
Land use plans and policies	Compatible	
Agriculture Land Use		Loss of Ag Land (Class III – not highly productive)

FINANCIAL

Capital Costs • Land Acquisition • Cost of road impacts, repairs • Cost implications to collection system, piping • Flexibility for future expansion	Cost/ acre should be low due to site constraints	- Cost to build intersection with LOVR - Approximately 8-10 of 43 acres (21%) are usable
		Insufficient space for future expansion, and/or disposal/ reuse options
		High risk of liquefaction and seismically-induced settlement – hydroconsolidation
		Higher cost for piping wastewater to treatment center
		Higher costs for road access and to build intersection with LOVR
Operation & Maintenance • Energy requirements	Lower cost to pipe effluent to spray fields and/or to farms for ag in-lieu or ag exchange	
Financial Risks ▪ Potential costs relating to system failures	* Higher cost to pipe to Broderson leach field	
Funding Factors ▪ Potential for revenue generation	Potential wetlands for storage, which may attract grants	F-1

LOS OSOS WASTEWATER PROJECT – TECHNICAL ADVISORY COMMITTEE

TREATMENT PLANT SITES

CRITERIA	PROS	CONS

Tri-W

ENGINEERING & WATER RESOURCES

CRITERIA	PROS	CONS
Sufficient in size to meet environmental and potential future expansion needs		Site is small and constrained in terms of future expansion options
		No room for expansion for ancillary operations, such as bio-solids treatment
Minimize fluid transport costs	Located within the collection system area	Located farthest away from the spray fields
	Located in close proximity to potential Broderson leach field	
Minimize land costs, to include environmental mitigation costs	LOCSD currently owns this property	Due to the proximity to near-by residence, engineered odor control features will be required
Site conditions with regards to constructability	Engineering work and preliminary site work already performed	Site requires higher construction costs

ENVIRONMENTAL

CRITERIA	PROS	CONS
Construction impact		High population density (Noise, dust…)
		Downtown traffic
Community impact	Resource park (if still included)	High population density (noise, odor)
		Partial visual obstruction of Morro Rock
Impact on biological resources	Site Graded & conditions mitigated	ESHA – Sensitive Dune Habitat
	No creek crossing for wastewater	
System failure risk		Proximity to Estuary
		Site size makes on-site containment more difficult
Impact on archaeological resources	Tribal agreements in place	
	Resources largely known (due to initial work on site)	
Energy Use	Less pumping of wastewater and effluent	Less potential for alternative energy (Site size limitation)
Land use plans and policies	Compatible	Inconsistent with LO vision statement
Agriculture Land Use	Non-Ag	

FINANCIAL

CRITERIA	PROS	CONS
Capital Costs ▪ Land Acquisition ▪ Cost of road impacts, repairs ▪ Cost implications to collection system, piping ▪ Flexibility for future expansion	Citizens currently own the property	Only 36% usable land
		Comparable land value estimated to be very high
		Property currently under litigation
	Lower cost for collection piping to treatment center	Possible need to expand LOVR
		Higher cost to pipe effluent to spray fields and/or to farms for ag in-lieu or ag exchange
		Limited space for future expansion, upgrade of solids treatment, or energy alternatives
		Proximity to church, library, community center, and residential areas
		Road impacts due to heavy vehicle traffic through main thoroughfare
Operation & Maintenance ▪ Energy requirements		Site necessitates treatment with high energy requirements
		Site does not allow for alternative energy options
Financial Risks ▪ Potential costs relating to system failures ▪ Site impacts on cost to mitigate seawater intrusion	Lower cost to pipe to Broderson leach field	Limited space for storage to mitigate system failure risks
		High financial risk in event of system failure due to proximity to Bay
Funding Factors ▪ Potential for revenue generation		Limited acreage for revenue-generating options

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LOS OSOS WASTEWATER PROJECT – TECHNICAL ADVISORY COMMITTEE

TREATMENT TECHNOLOGY

CRITERIA	PROS	CONS

Oxidation Ditch

ENGINEERING & WATER RESOURCES

Flexibility of treatment process to meet future needs and regulations	Proven to reduce BOD	With STEP - 39 mg/l nitrogen
	Relatively small footprint, at 8 acre	
	Can add tertiary treatment at end of treatment train. Also, advanced oxidation and membrane treatment can be added as well following	
	With gravity - proven to reduce nitrogen levels to less than 10 mg/l	
Demonstrated reliability of process	Proven history	With STEP - additional Nitrate treatment required
Effect of process on bio-solids production	With STEP - reduce volume of sludge	With gravity - frequency of sludge removal
	With STEP - 10 – 30 day SRT	
	With gravity - 15 – 30 day SRT	
Construction cost, replacement, operation and maintenance (1)	With Step - construction $23.1 mil, O&M $920,000	
	With gravity - construction $22.6 mil, O&M $790,000	
Energy	With Step - $100,000	
	With gravity - $110,000	

Note 1: used highest number from Table 4.19

ENVIRONMENTAL

Construction Impacts		
Community Impact		
Biological Impact (1)		
Archeological Resources(1)		
Energy Use kWh/yr (2)	800,000 Step Collection	900,000 Gravity Collection

(1)Table 4.18
(2) All impacts are high and PRO/CON is based on the comparison of higher vs. lower

FINANCIAL

Capital Costs ▪ **Construction costs** ▪ **Road impacts** ▪ **Cost implications with collection system** ▪ **Costs of future upgrades**	Requires 8 acre site	Tertiary treatment required for agriculture or urban reuse (+$1.6 – 3.5M)
	Moderate cost for plant construction ($16-19.1M)	STEP system requires denitrification for discharge at Broderson, adding from $2.2M to $3.6M to construction costs
Operation & Maintenance ▪ **Energy requirements** ▪ **Maintenance, repair, & replacement costs** ▪ **Impact on cost of solids handling/ disposal**	Lower O&M with a STEP collection system ($570,000/ year)	Higher O&M costs with Gravity collection system ($690,000/ year)
	Lower energy usage with a STEP collection system (800,000 kWh/yr)	Tertiary treatment required for agricultural or urban reuse (+$30,000 - $100,000/ year)

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LOS OSOS WASTEWATER PROJECT – TECHNICAL ADVISORY COMMITTEE

TREATMENT TECHNOLOGY

CRITERIA	PROS	CONS

Biolac

ENGINEERING & WATER RESOURCES

Flexibility of treatment process to meet future needs and regulations	Proven to reduce BOD	With STEP - 37 mg/l nitrogen
	Can add tertiary treatment at end of treatment train. Also, advanced oxidation and membrane treatment can be added as well following tertiary treatment.	
	With STEP - relatively small footprint, at 8 acres	
	With gravity - relatively small footprint, at 10 acres	
	With gravity - proven to reduce nitrogen levels to less than 10 mg/l	
Demonstrated reliability of process	Proven history	With STEP - additional Nitrate treatment required
	With gravity - maintenance is lower than STEP	
Effect of process on bio-solids production	With STEP - reduce volume of sludge	With gravity - frequency of sludge removal
	With gravity - 30 – 70 day SRT	
Construction cost, replacement, operation and maintenance (1)	With STEP - construction $20.8 mil, O&M $900,000	
	With gravity - construction $19.9 mil, O&M $800,000	
Energy	With STEP - $100,00	
	With gravity - $130,00	

Note 1: used highest number from Table 4.19

ENVIRONMENTAL

Construction Impacts		With gravity - largest footprint of systems other than ponds
Community Impact		With gravity - size prohibits odor control
Biological Impact (1)		With gravity - size required for treatment technology
Archeological Resources(1)		With gravity - size required for treatment technology
Energy Use kWh/yr (2)	With STEP/STEG - 800,000	With gravity - 1,100,000

(1)Table 4.18
(2) All impacts are high and PRO/CON is based on the comparison of higher vs. lower

FINANCIAL

Capital Costs ▪ **Construction costs** ▪ **Road impacts** ▪ **Cost implications with collection system** ▪ **Costs of future upgrades**	Requires 8-10 acre site	Tertiary treatment required for agricultural or urban re-use (+$1.6 – 3.5M)
	Low to moderate cost for plant construction ($13.7 – 16.4M. These costs represent the *upper* end of the baseline value, and still result in a 20% savings over the Oxidation Ditch facility	
	Denitrification of flows for Broderson discharge included in cost of construction	
	Lower cost to expand/ upgrade simply by adding basin	
Operation & Maintenance ▪ **Energy requirements** ▪ **Maintenance, repair, & replacement costs** ▪ **Impact on cost of solids handling/ disposal**	Low O&M with a STEP collection system ($550,000/ year)	High O&M costs with Gravity collection system ($700,000/ year)
	Denitrification of flows for Broderson discharge included in cost of construction	Higher energy usage with a Gravity collection system (1,100,000 kWh/yr)
	Moderate energy usage with a STEP collection system (800,000 kWh/yr)	Tertiary treatment required for agricultural or urban reuse (+$30,000 - $100,000/ year)

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TREATMENT TECHNOLOGY

CRITERIA	PROS	CONS

Partially Mixed Facultative Ponds

ENGINEERING & WATER RESOURCES

Flexibility of treatment process to meet future needs and regulations	Proven to reduce BOD	With STEP - 54 mg/l nitrogen
	Can add tertiary treatment at end of treatment train. Also, advanced oxidation and membrane treatment can be added as well following tertiary treatment	With gravity - 15 mg/l Nitrogen
		With gravity - large acreage requirement (20) may limit flexibility in terms of adding additional treatment unit due to space limitation of plant site
Demonstrated reliability of process	Proven history	Additional Nitrate treatment required
Effect of process on bio-solids production	Reduce volume of sludge	
	With gravity - less frequency of sludge handling	
	With gravity - Very long SRT, sludge production much less than suspended activated sludge systems	
Construction cost, replacement, operation and maintenance (1)	With STEP - construction $20.7 mil, O&M $890,000	
	With gravity - construction $25.6 mil, O&M $900,000	
Energy	$70,000	

Note 1: used highest number from Table 4.19

ENVIRONMENTAL

Construction Impacts		Earth moving
		Diesel
		Noise
		Dust
Community Impact		Primary treatment ponds are not a community amenity
Biological Impact (1)		Less energy but release methane gas which is a more powerful greenhouse gas than carbon dioxide
Archeological Resources(1)		Size required for treatment technology
Energy Use kWh/yr (2)	600,000 with both STEP or gravity	

(1)Table 4.18

FINANCIAL

Capital Costs ▪ **Construction costs** ▪ **Road impacts** ▪ **Cost implications with collection system** ▪ **Costs of future upgrades**	Low cost for plant construction ($13.1- 14.2M)	Requires 20 acre site
		May require Nitrification to convert ammonia into nitrate before denitrification (+$1.0- 3.8M in construction costs). See (1)
		Requires Denitrification of flows for Broderson discharge (+$2.2- 3.6M in construction costs).
		Tertiary treatment required for agricultural or urban reuse (+$2.1- 4.0M)
Operation & Maintenance ▪ **Energy requirements** ▪ **Maintenance, repair, & replacement costs** ▪ **Impact on cost of solids handling/ disposal**	Lower O&M with a Gravity or STEP collection system ($510,000/ year)	May require Nitrification to convert ammonia into nitrate before denitrification (+$30,000- 90,000/ year). See (1)
	Lower energy usage with a Gravity or STEP collection system (600,000 kWh/yr	Requires Denitrification of flows for Broderson discharge (+$90,000- 250,000/ year).
	Reduces cost of solids handling/ disposal	Tertiary treatment required for agricultural or urban reuse (+$60,000- 130,000/ year)
	Reduces traffic for sludge removal	Life cycle cost of dredging ponds

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LOS OSOS WASTEWATER PROJECT – TECHNICAL ADVISORY COMMITTEE

TREATMENT TECHNOLOGY

CRITERIA	PROS	CONS

MBR (Tri-W)

ENGINEERING & WATER RESOURCES

Flexibility of treatment process to meet future needs and regulations	High quality effluent	Small acreage available (11)
Demonstrated reliability of process	Proven history	
Effect of process on bio-solids production		Frequency of sludge removal
Construction cost, replacement, operation and maintenance (1)		
Energy		Highest

Note 1: used highest number from Table 4.19

ENVIRONMENTAL

Construction Impacts		High Construction activity concentrated in town
Community Impact	Enclosed facility odor control	
Biological Impact (1)	Highest quality effluent	
Archeological Resources(1)		
Energy Use kWh/yr (2)	Requested information	Requested information

(1)Table 4.18
(2) All impacts are high and PRO/CON is based on the comparison of higher vs. lower

FINANCIAL

Capital Costs ▪ **Construction costs** ▪ **Road impacts** ▪ **Cost implications with collection system** ▪ **Costs of future upgrades**	Requires 4 acre site Tertiary treatment included which meets Title 22 for agricultural and urban reuse Denitrification of flows for Broderson discharge included	High construction cost ($55M) Heavy vehicle traffic road impacts in center of town
Operation & Maintenance ▪ **Energy requirements** ▪ **Maintenance, repair, & replacement costs** ▪ **Impact on cost of solids handling/ disposal**	Tertiary treatment for agricultural and urban reuse included	Higher O&M with a Gravity collection system ($700,000/ year) Costs with a STEP collection system not available at Tri-W ***Need energy requirements for comparison**

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LOS OSOS WASTEWATER PROJECT – TECHNICAL ADVISORY COMMITTEE

TREATMENT TECHNOLOGY

CONSTRUCTION COSTS

Treatment Technology	Construction		Nitrification/ Denitrification (1)		Tertiary Treatment(3)		Total Cost Level 2 Treatment		Acreage Required	
	Gravity	STEP	Gravity	STEP	Gravity	STEP	Gravity	STEP	Gravity	STEP
Oxidation Ditches	$19.1M	$16.0M	Included	$2.2M	$3.5M	$3.5M	$22.6M	$21.7M	8	8
BIOLAC	$16.4M	$13.7M	Included	$2.2M	$3.5M	$3.5M	$19.9M	$19.4M	10	8
Facultative Ponds	$14.2M	$13.1M	$2.4M(2) +2.2M . $4.6M .	$2.4M(2) +2.2M . $4.6M .	$4.0M	$4.0M	$22.8M	$21.7M	20 (4)	20 (4)
MBR – Tri-W	$55.0M	NA	Included	NA	Included	NA	$55.0M	NA	4	NA

O&M COSTS

Treatment Technology	Annual Treatment O&M Cost		Nitrification/ Denitrification (5)		Tertiary Treatment(3)		Annual O & M Level 2 Treatment		Energy Requirements (Kilowatt hours/ year)	
	Gravity	STEP	Gravity	STEP	Gravity	STEP	Gravity	STEP	Gravity	STEP
Oxidation Ditches	$690,000	$570,000	Included	$90,000	$ 30,000- $100,000.	$ 30,000- $100,000.	$720,000- $790,000	$60,000- $760,000	900,000	800,000
BIOLAC	$700,000	$550,000	Included	$90,000	$ 30,000- $100,000.	$ 30,000- $100,000.	$730,000- $800,000	$670,000- $740,000	1,100,000	800,000
Facultative Ponds	$510,000	$510,000	$35,000(5) +90,000 . $125,000 .	$35,000(5) +90,000 . $125,000 .	$ 60,000- $130,000.	$ 60,000- $130,000.	$695,000- $765,000	$695,000- $765,000	600,000	600,000
MBR – Tri-W	$700,000	NA	Included	NA	Included	NA	$700,000	NA	***Numbers needed***	NA

(3) Assumes Denitrification only needed for Broderson Leachfield sized for 0.8 MGD side stream at peak winter flow.
(4) Requires Nitrification to convert Ammonia to Nitrate before Denitrification Process
(5) Assumes full 1.4M flow treated to tertiary level for agriculture, urban reuse, and future regulations.
(6) Ponds may only be possible on the Giacomazzi site.
(7) O&M costs assume 0.4MGD average Denitrification side stream flow.
NOTE: Report uses 1.4mgd in all final cost calculations. STEP costs should be based on 1.2mgd.

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LOS OSOS WASTEWATER PROJECT – TECHNICAL ADVISORY COMMITTEE

COLLECTION SYSTEM

CRITERIA	PROS	CONS

ENGINEERING & WATER RESOURCES

CRITERIA	PROS	CONS
STEP		
Life cycle costs Const. costs O & M costs	Lower construction costs	Higher operations and maintenance costs
Construction impacts	Smaller amounts of road restoration- 2ft wide vs several ft. Shorter periods of road disturbance/ traffic control- could be ½ the time as compared to a gravity system in some areas Shallower trenches-6' or less vs. a gravity system with an average trench depth of 8' and depths reaching 28' in some locations Possibility of limited directional boring being used	
Property impact for both private and public properties		Requires easements on private property Requires access on private property Higher on-site capital costs-approximately 3 times that of a gravity system Higher level of private property disturbance – new septic must be installed (digging area) Requires periodic (5 yr. max.) pumping of on-site septic tanks
Reliability of system	Very small chance for inflow and infiltration- mainly through septic tank risers and lids.	Many small pumps and support systems with possibility of failure
Environmental impact of system	Fewer impacts associated with small diameter pipe installation	Minor odor issues in conjunction with air release valves. However, this can be mitigated by installing carbon filtration treatment at the air release valves.
	Results in significant reduction of bio-solids volume Existing septic tanks will have to be abandoned or retrofitted for storm water disposal	Boring and trenching occurs in the cultural resource zone Higher level of private property disturbance (digging)
Infiltration and inflow potential	Very small chance for inflow and infiltration. When it does occur mainly at septic tank risers lids	
Energy		Many small sources (pumps and support electronics) of electrical use but comparable to gravity in total use
Gravity		
Life cycle costs Construction costs O&M costs	Lower O&M costs	Higher construction costs
Construction impacts		Greater amounts of road restoration Longer periods of road disturbance/ traffic control- twice the time as compared to a STEP/STEG system Deeper trenches, with an average trench depth of 8 feet and trench depths reaching up to 28 ft in some areas.
Property impact for both private and public properties	No easements on private property No access required on private property Lower on-site capital costs – approximately 1/3 that of step Lower level of private property disturbance (digging) No periodic pumping of septic tanks	
Reliability of system	Fewer pumps and support systems with possibility of failure	Greater chance for inflow and infiltration
Environmental impact of system	Lower level of private property disturbance (digging)	Greater impacts associated with large diameter pipe installation Significantly greater amount of bio-solids Minor odor issues in conjunction with manholes and pump stations but can be mitigated through installation of carbon filtration Trenching occurs in the cultural resources zone. Wider areas of disturbance. Wider and deeper trenches will require shoring and dewatering in some areas. Water will have to be treated and disposed of. Existing septic tanks will have to be abandoned or retrofitted for storm water disposal
Infiltration and inflow potential		Greater possibility for inflow and infiltration.- primarily through manhole installations.
Energy		Fewer, but larger sources (pumps and support electronics) of electrical use but comparable to step in total use

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LOS OSOS WASTEWATER PROJECT – TECHNICAL ADVISORY COMMITTEE

COLLECTION SYSTEM

CRITERIA	STEP/STEG	Gravity
ENVIRONMENTAL		
Construction disturbance	Excavation for new tank replacement est. @ 150 square feet	Excavation for installation
	Tank decommission est. @ 100 square feet	Tank decommission est. @ 100 square feet
	Higher on lot disturbances to residents	Street impact approximately 2 weeks for main installation
	Street impacts < significant; shallower & narrower trenches and increased potential for boring	Potential for 20+ feet excavation
Impact on biological resources	Dewatering less significant	Dewatering: the need to protect water quality with the disposal of collected water
Community impact	Permanent impacts Easements requires homeowner cooperation Manholes and controls in front yard of each home Ongoing pumping of tanks, approx. 5 per day; associated truck traffic and odor	Permanent impacts 20 Lift stations throughout the community Grinder pumps @ certain locations
	Pump on each tank	Truck traffic to plant
	Resident responsibility significant	Odor control @ lift stations
	Venting at high points of system< 200>500	
System failure risk	Homeowner responsibility significant	
	Effluent has less volume; with suspended solids in pressurized line	Effluent throughout system
Impact on archaeological resources	155 Square feet additional excavation	Increased volume of disturbance due to depth of pipe placement
	Assuming boring, less volume of disturbance	
Energy Kwh/year	500,000- energy required to convey 1.2 mgd to an out-of–town treatment facility	500,000- energy required to convey 1.4 mgd to an out-of– town treatment facility

The environmental committee felt that the PRO/CON format was inconclusive due to the lack of information. Since doing nothing is not an option, we have laid out a comparison table. We have submitted approximately 20 questions to the team for additional information.

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LOS OSOS WASTEWATER PROJECT – TECHNICAL ADVISORY COMMITTEE

COLLECTION SYSTEM

FINANCIAL

CRITERIA	Collection System	PROS	CONS
Capital Costs ▪ **Land acquisition** ▪ **Construction costs** ▪ **Road impacts** ▪ **Cost for individual hook-up** ▪ **Cost of future expansion, upgrades**	GRAVITY	- Potential modest savings with combined gravity/ vacuum/ low pressure system.	- Higher construction cost range $69.4M to $77.7M. - Construction costs do not include additional road restoration for out-of-town treatment sites - Higher homeowner costs (approx. $6M higher than STEP) - Unknown additional costs for land and easement to convey pipe to out-of-town site
	STEP/STEG	- Lower STEP construction cost range of $59.4M to $75.3M (vs. Gravity $69.4M to $77.7M) due primarily to open trenching; elimination of manholes pump stations, standby power; and minimal shallow access points. (Assumes that separate electrical connections are not required.) - On-lot costs include new septic tanks and all work on private property up to house inlet. (Additional homeowner costs are detailed in following table.)	- Costs for new electrical connection for pump, etc. range from $1,900 to $3,000 per connection; could be much high for separate electrical connection.
Operations, Maintenance & Repair ▪ **Maintenance, repair, & replacement costs**	GRAVITY	- Lower annual O&M at $450,000/ year	
	STEP/STEG		- Higher O&M at $750,000/ year
Financial Risk Factors ▪ **Financial risk relating to system failures and natural disasters**	GRAVITY		- Additional cost of bell & spigot maintenance program to address risk of future leakage
	STEP/STEG		
Funding Factors ▪ **Eligibility for best financing** ▪ **Grant attractiveness** ▪ **Potential for revenue generation**	GRAVITY		
	STEP/STEG		- SRF loan may require separate electrical connection, adding significant cost to system ($13.4M to $25.3M) STEP/STEG

Construction Costs	**Gravity**		**STEP/ STEG**	
	Low	**High**	**Low**	**High**
Mobilization	$3.7M	$4.2M	$2.4M	$3.1M
Common facilities	$57.6M	$64.2M	$11.8M	$15.5M
On-lot facilities	-0-	-0-	$33.3M	$40.9M
Road restoration (1)	$5.2M	$5.2M	$1.3M	$2.6M
Conveyance to out-of-town site	$2.9M	$4.1M	Included	Included
Overhead, profit & taxes	Included	Included	$10.6M	$13.2M
Total Construction Costs	**$69.4M**	**$77.7M**	**$59.4M**	**$75.3M**
Premium electrical costs (2)	-0-	-0-	$13.4M	$25.3M
Total Costs with electrical premium (not incl. homeowner costs	**$69.4M**	**$77.7M**	**$72.8M**	**$100.6M**
Homeowner on-lot costs (3)	$10.9M	$12.0M	$5.4M	$5.9M
Total Construction and Homeowner Costs (not including electrical premium) (3)	**$80.3M**	**$89.7M**	**$64.8M**	**$81.2M**
Operations & Maintenance Costs	**Gravity**		**STEP/ STEG**	
Labor	$140,000		$175,000	
Energy requirements	$ 60,000		$ 60,000	
Maintenance, Replacement	$250,000		$360,000	
Septic hauling	$ -0-		$150,000	
Total O&M Costs	$450,000		$745,000	

(5) Road restoration for additional conveyance of gravity pipeline out of town not included.
(6) Separate electrical required if project is financed with SRF loan
(7) Homeowners' on-lot costs are not part of gravity collection project costs, but presented for comparison purposes only.

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SOLID DISPOSAL SYSTEMS

ENGINEERING & WATER RESOURCES

Criteria	Method	Pro	Con
Maintain control and flexibility of disposal process.	Sub-Class B Disposal	Only thickening and dewatering treatment is required. Since thickening and dewatering are required for all of the other bio-solids management alternatives, this option can be developed into a Class A or B operation in the future without decommissioning any of the initial project improvements.	Sub-Class B Bio-solids must receive further treatment for land application or must be disposed of at a landfill. Fine Screen report assumes disposal at composting facility.
			The acceptance criteria of disposal facilities may become more stringent with time, which may require additional future treatment of bio-solids.
			The percent solids achieved in this alternative is estimated to be less than 20%. Therefore, the local landfill could not accept this waste stream.
			This option produces the greatest mass of bio-solids at 4,056 tons/year for a gravity system or 1,014 tons/year for STEP/STEG system.
			All bio-solids would be shipped offsite for disposal.
	Digested Class B	Due to achieving Class B quality, the range of disposal options is much greater than for Sub-Class B bio-solids.	This option produces a large mass of bio-solids at 3,103 tons/year for a gravity system or 776 tons/year for STEP/STEG system (23.5% less than the Sub-Class B option).
		Produces bio-solids with a 20% solids content and therefore meets the percent solids acceptance criteria at the local landfill.	All bio-solids would be shipped offsite for disposal.
	Heat Dried Class B	Due to achieving Class B quality, the range of disposal options is much greater than for Sub-Class B Bio-solids.	Operation of the system is relatively complex and would require a higher level of training for staff.
		This option produces the least amount of bio-solids at 1,043 tons/year for gravity or 261 tons/year for STEP/STEG system.	
		Produces bio-solids with a 90% solids content and therefore meets the percent solids acceptance criteria at the local landfill.	Heat Drying is typically utilized for producing Class A Bio-solids.
		This process can potentially produce Class A Bio-solids	
	Composted Class B	Due to achieving Class B quality, the range of disposal options is much greater than for Sub-Class B Bio-solids.	Composting bio-solids will require the addition of a bulking agent for a carbon source and to increase porosity. Therefore, the process will require a reliable source of bulking agent to be brought to the plant.
		This option produces a low mass of bio-solids, very similar to the Heat Dried Class B option, at 1,460 tons/year for gravity or 365 tons/year for STEP/STEG system.	
		Produces bio-solids with a 50% solids content and therefore meets the percent solids acceptance criteria at the local landfill.	All bio-solids would be shipped offsite for disposal.
		This process can potentially produce Class A Bio-solids, but would require increased process time and footprint at plant site.	
	Composted Class A	Due to achieving Class A quality, the range of disposal options is much greater than for Sub-Class B and Class B Bio-solids.	Although there is the potential for local use of Class A Bio-solids, the County currently has an Ordinance in place that limits bio-solids application to land to no greater than 1500 cubic yards per year. In addition, the Ordinance allows only Class A – Exceptional Quality to be applied to land in the County.
		This option produces a low mass of bio-solids, very similar to the Heat Dried Class B option, at 1,327 tons/year for gravity or 332 tons/year for STEP/STEG system.	Composting bio-solids will require the addition of a bulking agent for a carbon source and to increase porosity. Therefore, the process will require a reliable source of bulking agent to be brought to the plant.
		Produces bio-solids with a 55% solids content and therefore meets the percent solids acceptance criteria at the local landfill.	
	Digested/Composted Class A	Due to achieving Class A quality, the range of disposal options is much greater than for Sub-Class B and Class B Bio-solids.	Although there is the potential for local use of Class A Bio-solids, the County currently has an Ordinance in place that limits bio-solids application to land to no greater than 1500 cubic yards per year. In addition, the Ordinance allows only Class A – Exceptional Quality to be applied to land in the County.

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SOLID DISPOSAL SYSTEMS

ENGINEERING & WATER RESOURCES

Criteria	Method	Pro	Con
Maintain control and flexibility of disposal process. (continued)		This option produces a low mass of bio-solids, very similar to the Heat Dried Class B option, at 1,128 tons/year for gravity or 282 tons/year for STEP/STEG system.	Composting bio-solids will require the addition of a bulking agent for a carbon source and to increase porosity. Therefore, the process will require a reliable source of bulking agent to be brought to the plant.
		Produces bio-solids with a 55% solids content and therefore meets the percent solids acceptance criteria at the local landfill.	The long term use of compost materials at one location has the potential to accumulate
Nuisance assessment of bio-solids process and disposal	Sub-Class B Disposal	If thickening is achieved by a Belt Filter Press, there will be a minimal footprint requirement, estimated at 0.1 acre.	If solar drying is used, the operation will require 5.7 acres of land for bio-solids produced from a gravity systems and 1.4 acres of land for bio-solids produced from a STEP/STEG system.
			Solar drying has a high potential to be odiferous and also has the potential to attract vectors.
			This option is not designed to reduce the potential pathogen content in the produced bio-solids.
			This alternative would require 4 to 5 truck trips per week leaving the plant.
	Digested Class B	This method is designed to reduce the potential pathogen content to very low levels so that any remaining pathogens in the bio-solids will die-off in soil within short timeframe.	If solar drying is used, the operation will require 4.4 acres of land for bio-solids produced from a gravity systems and 1.1 acres of land for bio-solids produced from a STEP/STEG system.
		If thickening is achieved by a Belt Filter Press, there will be a minimal footprint requirement, estimated at 0.1 acre	Solar drying has a high potential to be odiferous and also has the potential to attract vectors.
			This alternative would require 3 to 4 truck trips per week leaving the plant.
	Heat Dried Class B	This method is designed to reduce the potential pathogen content to very low levels so that any remaining pathogens in the bio-solids will die-off in soil within short timeframe.	This alternative would require 1 to 2 truck trips per week leaving the plant.
			Process may generate dust, which may potentially be explosive or present exposure/health concern.
		There will be a minimal footprint requirement for this alternative, estimated at 0.1 acre.	Exhaust gas may be odiferous, but can likely be mitigated through controls.
			Process is typically used to produce Class A Bio-solids.
	Composted Class B	This method is designed to reduce the potential pathogen content to very low levels so that any remaining pathogens in the bio-solids will die-off in soil within short timeframe.	Composting will require approximately 2.1 acre footprint for bio-solids produced from a gravity system and 0.7 acres for bio-solids produced from a STEP/STEG system.
			Storage of compost presents a potential fire hazard due to large volumes of carbonaceous materials. Sufficient moisture content, aeration and limited storage time reduces fire hazard.
			If not properly aerated, the compost operation can generate odors.
			Storm water infiltration into the compost windrows has the potential to produce compost leachate, which may require control.
			This alternative would require 1 to 2 truck trips per week leaving the plant.
	Composted Class A	This option is designed to produce bio-solids that are essentially pathogen free.	If not properly aerated, the compost operation can generate odors.
			Storm water infiltration into the compost windrows has the potential to produce compost leachate, which may require control.
			Storage of compost presents a potential fire hazard due to large volumes of carbonaceous materials. Sufficient moisture content, aeration and limited storage time reduces fire hazard.
			If Class A Bio-solids are locally used, additional provisions may be needed for winter storage in order to prevent odor production and to mitigate fire hazard.

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SOLID DISPOSAL SYSTEMS

ENGINEERING & WATER RESOURCES

Criteria	Method	Pro	Con
Nuisance assessment of bio-solids process and disposal	Digested/Composted Class A	This option is designed to produce bio-solids that are essentially pathogen free.	If not properly aerated, the compost operation can generate odors.
			Storm water infiltration into the compost windrows has the potential to produce compost leachate, which may require control.
			Storage of compost presents a potential fire hazard due to large volumes of carbonaceous materials. Sufficient moisture content, aeration and limited storage time reduces fire hazard.
Nuisance assessment of bio-solids process and disposal (continued)			If Class A Bio-solids are locally used, additional provisions may be needed for winter storage in order to prevent odor production and to mitigate fire hazard.
Cost of process facilities, operations and maintenance, and ultimate disposal	Sub-Class B Disposal	Construction constitutes between **0.9** and 1.0% of total project construction costs for STEP/STEG	O&M costs constitutes between 10.0 and 12.18% of total project O&M costs for STEP/STEG
		Construction constitutes between 1.32 and 1.48% of total project construction costs for Gravity	O&M costs constitutes between 16.03 and 28.86% of total project O&M costs for Gravity
	Digested Class B	Construction constitutes between 1.44 and 1.49% of total project construction costs for STEP/STEG	O&M costs constitutes between 10.45 and 12.74% of total project O&M costs for STEP/STEG
		Construction constitutes between 2.17 and 2.43% of total project construction costs for Gravity	
		Potential for revenue.	O&M costs constitutes between 15.82 and 28.38% of total project O&M costs for Gravity
	Heat Dried Class B	Construction constitutes between 1.74 and 1.94% of total project construction costs for STEP/STEG	O&M costs constitutes between 11.55 and 17.96% of total project O&M costs for STEP/STEG
		Construction constitutes between 2.81 and 3.03% of total project construction costs for Gravity	O&M costs constitutes between 15.82 and 33.33% of total project O&M costs for Gravity
		Potential for revenue.	Requires 1,400 to 1,700 BTU/ pound of water evaporated.
	Composted Class B	Construction constitutes between 1.24 and 1.64% of total project construction costs for STEP/STEG	O&M costs constitutes between **9.77** and 19.88% of total project O&M costs for STEP/STEG
		Construction constitutes between 2.0 and 2.37% of total project construction costs for Gravity	O&M costs constitutes between 16.24 and 34.57% of total project O&M costs for Gravity
		Potential for revenue	
	Composted Class A	Construction constitutes between 1.24 and 1.64% of total project construction costs for STEP/STEG	O&M costs constitutes between 10.22 and 20.81% of total project O&M costs for STEP/STEG
		Construction constitutes between 2.0 and 2.37% of total project construction costs for Gravity	29 and 36.14% of total project O&M costs for Gravity O&M costs constitutes between 17.
		Potential for revenue.	
	Digested/Composted Class A	Construction constitutes between 1.79 and 2.24% of total project construction costs for STEP/STEG	O&M costs constitutes between 15.29 and 25.54% of total project O&M costs for STEP/STEG
		Construction constitutes between 3.14 and **3.29%** of total project construction costs for Gravity	O&M costs constitutes between 25.00 and **41.76%** of total project O&M costs for Gravity
		Potential for revenue.	

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LOS OSOS WASTEWATER PROJECT – TECHNICAL ADVISORY COMMITTEE

SOLID DISPOSAL SYSTEMS

ENVIRONMENTAL

CRITERIA		PROS	CONS
Volume	Sub-Class B		- Largest volume
			- Most expensive hauling costs
	Class B		- Largest volume
			- High hauling costs
	Composted Class A (all treatment alternatives)	+ Minimal volume	
		+ Minimal hauling cost	
	Faculatative Ponds	+ Reduced volume	
		+ Low hauling cost	
Class	Sub-Class B		- Worst quality
			- Most restrictive disposal options (Dependant on outside parties for disposal*)
			- Odor problems (Especially if solar drying is used)
	Class B		- Poor quality
			- Restrictive disposal options (Dependant on outside parties for disposal)
			- Odor problems
	Composted Class A (all treatment alternatives)	+ Best quality	- Least restrictive disposal options (Not dependent on outside parties for disposal)
		+ Least restrictive disposal options (Not dependant on outside parties for disposal)	
	Faculatative Ponds		- Unknown future disposal options (Dependant on outside parties for disposal)
Community impact	Sub-Class B	+ Least expensive construction cost	- Largest carbon footprint (High diesel consumption)
		+ Future flexibility	
		+ Relatively low annual O&M	
		+ Low acreage requirements	
	Class B	+ Moderate construction cost	- High carbon footprint (High diesel consumption)
		+ Future flexibility[1]	- Availability of adequate green waste for use as a compost bulking agent
		+ Moderate annual O&M	
		+ Low acreage requirements	
	Composted Class A (all treatment alternatives)	+ Least expensive construction cost	- Highest annual O&M
		+ Sustainability	- High acreage requirements
		+ Best regional solution	- Availability of adequate green waste for use as a compost bulking agent
	Faculatative Ponds	+ Least expensive construction costs	- High acreage requirements
		+ Lowest annual O&M	
		+ Moderate sustainability	
		+ Reduced carbon footprint (Low diesel consumption)	
		+ Minimal odor	
Traffic	Sub-Class B		- High wear and tear on road infrastructure from truck traffic
	Class B		

[1] Flexibility for off-site recycling and disposal increases from Digested through Heat Dried to Composted Class B Bio-solids.

SOLID DISPOSAL SYSTEMS

FINANCIAL

SOLIDS CLASS	PROS	CONS
Sub-Class B ▪ **Capital Costs** ▪ **O&M** ▪ **Financial Risks**	- Lowest construction costs: $1.9M - $2.4M for Gravity, $1.1M-$1.7M for STEP - O&M costs: $430,000-$470,000 for Gravity; $190,000-$270,000 for STEP - Flexibility to be upgraded	- Higher hauling costs - Most restrictive disposal option - Risk of third party cost escalations and future disposal restrictions
Composted A: **Assumes Gravity Belt Thickening, BFP, Windrow composting** ▪ **Capital Costs** ▪ **O&M** ▪ **Financial Risks**	- Construction costs: from $900,000 to $1,800,000 higher than Sub Class B - O&M costs: from $160,000 to $235,000 higher than Sub Class B - Greatest range of options for recycling/ disposal	- Requires willing compost users; risk of hauling - Composting requires larger amount of land
Ponds ▪ **Capital Costs** ▪ **O&M** ▪ **Financial Risks**	- Lowest O&M costs - Least amount of sludge handling, hauling, and least associated risks	- Land requirements are included in Treatment

* A complete table with all classes of solids is available. However, due to the relatively small cost differential between various levels of solids treatments, the Finance Working Group has chosen to compare Sub Class B and Composted A, thereby eliminating Digested Class B, Heat Dried Class B, and Composted B in the comparison above.

TAC Financial Working Group- Working Cost Table

SOLIDS TREATMENT COMPONENTS	CAPITAL COSTS (1) (2)		O & M COSTS (1) (3)	
	Gravity	**STEP**	**Gravity 3,900 lbs/day** (1)	**STEP 1,000 lbs/day** (5)
Thickening • Assumes Gravity Belt	$900,000- $1,100,000	$520,000- $830,000	$170,000- $180,000	$100,000- $140,000
Dewatering • Assumes Belt Filter Press	$1,600,000- $2,200,000	$900,000- $1,700,000	$270,000- $300,000	$160,000- $240,000
• Option: Solar Bed	$1,000,000- $1,300,000	$650,000- $900,000	$70,000- $100,000	$40,000- $80,000
Digestion • Assumes Aerobic	$2,300,000	$1,200,000- $1,600,000	$50,000	$30,000- $35,000
Heat Dried • Assumes Indirect	$2,900,000	$1,700,000- $2,200,000	$100,000	$60,000- $80,000
Composting • Assumes Windrows	$1,000,000	$600,000- $800,000	$155,000	$90,000- $120,000
Hauling (4) • Sub-Class B	$190,000	$ 47,000	$190,000	$ 47,000
• Digested Class B	$130,000	$ 33,000	$130,000	$ 33,000
• Heat Dried Class B	$ 44,000	$ 11,000	$ 44,000	$ 11,000
• Composted Class B	$ 61,000	$ 15,000	$ 61,000	$ 15,000
• Composted Class A	$ -0-	$ -0-	$ -0-	$ -0-
Ponds (6)			$40,000- $50,000	$30,000- $40,000

(1) Based on Tables 5.3; 5.5; 5.7; 5.9; 5.11; and 5.15
(2) Includes 30% contingency
(3) Based on a 20 to 40 percent reduction in costs for reduced solids loading with a STEP/ STEG collection system.
(4) Based on Table 5.12 and 5.13. **(Check numbers!)**
(5) Average solids production of Extended Aeration MLE, BIOLAC, and Oxidation Ditch
(6) Includes dredging and hauling every 20 years, in 20 equal annual installments, escalated at 5% per year until 2027.

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SOLID DISPOSAL SYSTEMS

FINANCIAL

SOLIDS TREATMENT COMBINATIONS	CAPITAL COSTS		O & M COSTS (3)	
	Gravity	STEP	Gravity	STEP
Sub Class B • Assumes Gravity Belt Thickening, Solar Drying	$1.9M - $2.4M	$1.1M - $1.7M	$430,000- $470,000	$190,000- $270,000
Digested Class B • Assumes Gravity Belt, Aerobic Digestion, Solar Drying	$4.2M - $4.7M	$2.4M - $3.4M	$420,000- $460,000	$220,000- $310,000
Heat Dried Class B • Assumes Gravity Belt, BFP, Indirect Heat Drying	$5.4M - $6.2M	$3.1M - $4.8M	$600,000- $640,000	$340,000- $480,000
Composted Class B • Assumes Gravity Belt, BFP, Windrows	$3.5M - $4.3M	$2.0M - $3.3M	$660,000- $700,000	$370,000- $520,000
Composting • Assumes Gravity Belt, BFP, Windrows	$3.4M - $4.2M	$2.0M - $3.3M	$600,000- $635,000	$350,000- $505,000
Ponds (1)	- -	- -	$ 40,000- $ 50,000	$ 30,000- $ 40,000

(1) Includes dredging and hauling. Based on $600,000 (escalated at 5% per year until 2027) in equal annual installments over 20 years.

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EFFLUENT REUSE/DISPOSAL SYSTEMS

ENGINEERING & WATER RESOURCES

Criteria	Option	Pro	Con
Level of control over disposal options, multi-faceted approach that does not depend on 3rd parties	Level 1A Spray Fields (680 AFY) Agricultural Reuse (460 AFY) Conservation (160 AFY) Cemetery Reuse (50 AFY) Storage (290 AF)	The spray field, conservation program and storage features are under the direct control of the wastewater purveyor.	The cemetery and agricultural reuse programs will require contracts with the end users.
	Level 1B Spray Fields (1190 AFY) Conservation (160 AFY) Storage (210 AF)	The spray field, conservation program and storage features are under the direct control of the wastewater purveyor.	The cemetery and agricultural reuse programs will require contracts with the end users.
	Level 2A Spray Fields (232 AFY) Broderson, ½ (448 AFY) Agricultural Reuse (460 AFY) Conservation (160 AFY) Cemetery Reuse (50 AFY) Storage (140 AF)	The spray field, Broderson Leach Field, conservation program and storage features are under the direct control of the wastewater purveyor. The Broderson Leach Field property is already owned by the wastewater purveyor.	The cemetery and agricultural reuse programs will require contracts with the end users.
	Level 2B Spray Fields (742 AFY) Broderson, ½ (448 AFY) Conservation (160 AFY) Storage (30 AF)	All elements are under the direct control of the wastewater purveyor. The Broderson Leach Field property is already owned by the wastewater purveyor.	
	Level 3A Spray Fields (Minimal AFY) Broderson, 3/4 (680 AFY) Harvest Wells (232 AFY offset) Agricultural Reuse (460 AFY) Conservation (160 AFY) Cemetery Reuse (50 AFY) Storage (115 AF)	The spray field, Broderson Leach Field, conservation program and storage features are under the direct control of the wastewater purveyor. The Broderson Leach Field property is already owned by the wastewater purveyor.	The cemetery and agricultural reuse programs will require contracts with the end users. The use of harvest wells will require the participation of the water purveyors. There is uncertainty associated with operating the Broderson Leach Field at ¾ capacity.
	Level 3B Spray Fields (680 AFY) Agricultural Reuse (460 AFY) Conservation (160 AFY) Cemetery Reuse (50 AFY) Storage (290 AF) Water Purveyor Shift (400 AF)	The spray field, conservation program and storage features are under the direct control of the wastewater purveyor.	The cemetery and agricultural reuse programs will require contracts with the end users. Requires water purveyor participation.
Retain water in the basin for sustainability and increased yield/seawater intrusion mitigation	Level 1A Spray Fields (680 AFY) Agricultural Reuse (460 AFY) Conservation (160 AFY) Cemetery Reuse (50 AFY) Storage (290 AF)	Conservation, when coupled with reduced pumping from western lower zone wells, provides a seawater intrusion mitigation factor of 0.55. Export of effluent out of the basin to spray fields is a favorable option as a short term situation associated with start-up operations and emergency discharge. Agricultural reuse and cemetery reuse of recycled water translates to decreased pumping from the eastern lower zone wells, which provides a seawater intrusion mitigation factor of 0.10. This option reduces the seawater intrusion rate by 140 AFY.	In the long term, export of effluent outside of the groundwater basin will have a detrimental effect on the sustainable yield of the groundwater basin. This option exports 686 AFY out of the groundwater basin. Without the Broderson Leach Field, the project has no means for directly recharging the upper zone of the groundwater basin.
	Level 1B Spray Fields (1190 AFY) Conservation (160 AFY) Storage (210 AF)	Conservation, when coupled with reduced pumping from western lower zone wells, provides a seawater intrusion mitigation factor of 0.55. . Export of effluent out of the basin to spray fields is a favorable option as a short term situation associated with start-up operations and emergency discharge. This option reduces the seawater intrusion rate by 90 AFY.	In the long term, export of effluent outside of the groundwater basin will have a detrimental effect on the sustainable yield of the groundwater basin. This option exports 1190 AFY out of the groundwater basin. Without the Broderson Leach Field, the project has no means for directly recharging the upper zone of the groundwater basin.

EFFLUENT REUSE/DISPOSAL SYSTEMS

ENGINEERING & WATER RESOURCES

Criteria	Option	Pro	Con
Retain water in the basin for sustainability and increased yield/seawater intrusion mitigation (continued)	Level 2A Spray Fields (232 AFY) Broderson, ½ (448 AFY) Agricultural Reuse (460 AFY) Conservation (160 AFY) Cemetery Reuse (50 AFY) Storage (140 AF)	Conservation, when coupled with reduced pumping from western lower zone wells, provides a seawater intrusion mitigation factor of 0.55.	A limited volume of effluent is exported out of the basin to spray fields. This option exports 232 AFY.
		Export of effluent out of the basin to spray fields is a favorable option as a short term situation associated with start-up operations and emergency discharge.	
		Agricultural reuse and cemetery reuse of recycled water translates to decreased pumping from the eastern lower zone wells, which provides a seawater intrusion mitigation factor of 0.10	
		The Broderson Leach Field will recharge the upper zone of the groundwater basin and will provide a seawater intrusion mitigation factor of 0.22	
		This option reduces the seawater intrusion rate by 240 AFY.	
	Level 2B Spray Fields (742 AFY) Broderson, ½ (448 AFY) Conservation (160 AFY) Storage (30 AF)	Conservation, when coupled with reduced pumping from western lower zone wells, provides a seawater intrusion mitigation factor of 0.55.	In the long term, export of effluent outside of the groundwater basin will have a detrimental effect on the sustainable yield of the groundwater basin. This option exports 742 AFY out of the groundwater basin.
		Export of effluent out of the basin to spray fields is a favorable option as a short term situation associated with start-up operations and emergency discharge.	
		The Broderson Leach Field will recharge the upper zone of the groundwater basin and will provide a seawater intrusion mitigation factor of 0.22	
		This option reduces the seawater intrusion rate by 190 AFY.	
	Level 3A Spray Fields (Minimal AFY) Broderson, 3/4 (680 AFY) Harvest Wells (232 AFY offset) Agricultural Exchange (460 AFY) Conservation (160 AFY) Cemetery Reuse (50 AFY) Storage (115 AF)	Conservation, when coupled with reduced pumping from western lower zone wells, provides a seawater intrusion mitigation factor of 0.55.	
		Cemetery reuse of recycled water translates to decreased pumping from the eastern lower zone wells, which provides a seawater intrusion mitigation factor of 0.10.	
		Agricultural Exchange, when coupled with decreased pumping from the western lower zone wells, provides a seawater intrusion mitigation factor of 0.55.	
		The Broderson Leach Field will recharge the upper zone of the groundwater basin and will provide a seawater intrusion mitigation factor of 0.22	
		The export of effluent out of the groundwater basin is minimized.	
		This option reduces the seawater intrusion rate by 600 AFY.	

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EFFLUENT REUSE/DISPOSAL SYSTEMS

ENGINEERING & WATER RESOURCES

Criteria	Option	Pro	Con
Retain water in the basin for sustainability and increased yield/seawater intrusion mitigation (continued)	Level 3B Spray Fields (680 AFY) Agricultural Exchange (460 AFY) Conservation (160 AFY) Cemetery Reuse (50 AFY) Storage (290 AF) Water Purveyor Shift (400 AF)	Conservation, when coupled with reduced pumping from western lower zone wells, provides a seawater intrusion mitigation factor of 0.55.	In the long term, export of effluent outside of the groundwater basin will have a detrimental effect on the sustainable yield of the groundwater basin. This option exports 680 AFY out of the groundwater basin.
		Cemetery reuse of recycled water translates to decreased pumping from the eastern lower zone wells, which provides a seawater intrusion mitigation factor of 0.10.	Without the Broderson Leach Field, the project has no means for directly recharging the upper zone of the groundwater basin
		Agricultural Exchange, when coupled with decreased pumping from the western lower zone wells, provides a seawater intrusion mitigation factor of 0.55.	
		Export of effluent out of the basin to spray fields is a favorable option as a short term situation associated with start-up operations and emergency discharge.	
		With a water purveyor shift in pumping to the upper zone, coupled with all of the other measures of this option, the seawater intrusion rate is reduced by 550 AFY.	
Cost of various disposal options and energy consumption.	Level 1A Spray Fields (680 AFY) Agricultural Reuse (460 AFY) Conservation (160 AFY) Cemetery Reuse (50 AFY) Storage (290 AF)	Construction Cost: $12,700,000 to $14,300,000	This option will lead to the need to import water from outside the basin. Importation of water will have a construction cost of $3,900,000 and an operations and maintenance cost of $1200 per AF.
		Operations and Maintenance Cost: $100,000 to $190,000 per year	This option will require a higher level of treatment.
	Level 1B Spray Fields (1190 AFY) Conservation (160 AFY) Storage (210 AF)	Construction Cost: $12,800,000 to $15,600,000	This option will lead to the need to import water from outside the basin. Importation of water will have a construction cost of $3,900,000 and an operations and maintenance cost of $1200 per AF.
		Operations and Maintenance Cost: $125,000 to $275,000 per year	
	Level 2A Spray Fields (232 AFY) Broderson, ½ (448 AFY) Agricultural Reuse (460 AFY) Conservation (160 AFY) Cemetery Reuse (50 AFY) Storage (140 AF)	Construction Cost: $13,200,000 to $13,900,000	This option will lead to the need to import water from outside the basin. Importation of water will have a construction cost of $3,900,000 and an operations and maintenance cost of $1200 per AF.
		Operations and Maintenance Cost: $400,000 to $444,000 per year	This option will require a higher level of treatment.
	Level 2B Spray Fields (742 AFY) Broderson, ½ (448 AFY) Conservation (160 AFY) Storage (30 AF)	Construction Cost: $14,900,000 to $16,700,000	This option will lead to the need to import water from outside the basin. Importation of water will have a construction cost of $3,900,000 and an operations and maintenance cost of $1200 per AF.
		Operations and Maintenance Cost: $440,000 to $530,000 per year	This option will require a higher level of treatment.
	Level 3A Spray Fields (Minimal AFY) Broderson, 3/4 (680 AFY) Harvest Wells (232 AFY offset) Agricultural Reuse (460 AFY) Conservation (160 AFY) Cemetery Reuse (50 AFY) Storage (115 AF)	Construction Cost: $25,600,000 to $27,300,000	This option will lead to the need to import water from outside the basin. Importation of water will have a construction cost of $3,900,000 and an operations and maintenance cost of $1200 per AF.
		Operations and Maintenance Cost: Approximately $410,000 per year	This option will require a higher level of treatment.
	Level 3B Spray Fields (680 AFY) Agricultural Reuse (460 AFY) Conservation (160 AFY) Cemetery Reuse (50 AFY) Storage (290 AF) Water Purveyor Shift (400 AF)	Construction Cost: $26,000,000 to $29,800,000	This option will lead to the need to import water from outside the basin. Importation of water will have a construction cost of $3,900,000 and an operations and maintenance cost of $1200 per AF.
		Operations and Maintenance Cost: $130,000 and up per year	This option will require a higher level of treatment.

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LOS OSOS WASTEWATER PROJECT – TECHNICAL ADVISORY COMMITTEE

EFFLUENT REUSE/DISPOSAL SYSTEMS

ENVIRONMENTAL

METHODS		PROS	CONS
Spray Fields [1]	Disposal Capacity (1,190 AFY)	Community owned asset	Cost to purchase land
	Saltwater Mitigation (0 AFY)	Tertiary treatment not required	Loss of water (no exchange/reuse)
		Denitrification not required	Seasonal
		Purveyor's cooperation not required	Salt loading in soils
		Future flexibility	Chlorination preferred
			Trenching for pipeline to spray fields (degree of impact dependent on treatment plant location)
			Unknown future regulatory requirements
Cemetery In Lieu	Disposal Capacity (50 AFY)	Minimal saltwater intrusion mitigation	Seasonal
	Saltwater Mitigation (5 AFY)	Purveyors' cooperation not required	Partial denitrification required
		If located adjacent to treatment plant minimal trenching impacts	Tertiary treatment required
			Unknown future regulatory requirements
Urban Reuse (Shallow Wells) [2]	Disposal Capacity (63 AFY)	Minimal saltwater intrusion mitigation	Seasonal
	Saltwater Mitigation (35 AFY)	No off-site trenching impacts	
		Purveyors' cooperation not required	
AG Reuse	Disposal Capacity (460 AFY)	Minimal saltwater intrusion mitigation	Seasonal
	Saltwater Mitigation (46 AFY)	Purveyors' cooperation not required	Partial denitrification required
			Tertiary treatment required
			Farmers' cooperation required
			Trenching for pipeline (degree of impact dependent on treatment plant location)
			Unknown future regulatory requirements
AG Exchange	Disposal Capacity (460 AFY)	Highest saltwater intrusion mitigation	Seasonal
	Saltwater Mitigation (250 AFY)		Partial denitrification required
			Tertiary treatment required
			Purveyors' cooperation required
			Farmers' cooperation required
			Trenching for pipeline (degree of impact dependent on treatment plant location)
			Unknown future regulatory requirements
Leachfields/Percolation Ponds (Broderson)	Disposal Capacity (448 AFY)	Significant saltwater intrusion mitigation	Full denitrification required
	Saltwater Mitigation (100 AFY)	Tertiary treatment not required	Construction impacts and costs from monitoring wells
		Purveyor participation not required[3]	Grading impacts on habitat (Initial construction and rehabilitation every 10 to 15 years)
			Negative community perception
			Unknown future regulatory requirements

1 - Undetermined natural habitats impacts and visual impacts.
2 - A purple pipe system was deemed to be infeasible because of significantly higher construction costs and environmental impacts and required cooperation by the purveyors without significant additional benefits.
3 - Without harvest wells.
4 – Energy Consumption of various alternatives will be added at a later date.

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LOS OSOS WASTEWATER PROJECT – TECHNICAL ADVISORY COMMITTEE

EFFLUENT REUSE/DISPOSAL SYSTEMS

FINANCIAL

Seawater Intrusion Mitigation Level	Configuration/ Capacity	PROS	CONS
Level 1a: **Full Ag Reuse**	Spray Fields (170 acres) 680 AF Ag Reuse 460 AF Conservation 160 AF Cemetery 50 AF Total capacity 1,350 AF Storage (290 AF)	Total Mitigation = 140 AFY (1) Total Capital Cost = $12.7M - $14.3M Total O&M Cost = $100k- $190k / yr Potential for additional Mitigation of 207 AF with Ag Exchange	680 AF water is permanently lost to ground water basin. Slow ramp-up period to develop agreements with farmers Cost to transport effluent 10,500 ft =$1.4M Land acquisition costs (6) = $5.1M Requires more storage
Level 1b: **No Ag Reuse**	Spray Fields (280 acres) 1190 AF Conservation 160 AF Storage (210 AF)	Total Mitigation = 90 AFY Total Capital Cost: $12.8M- $15.6M	1190 AF water is permanently lost to groundwater basin. Land acquisition costs = $8.4M Higher O&M Costs = $125k - $275k/ yr Fails to utilize opportunity for agricultural in-lieu or exchange Cost to transport effluent 10,500 ft= $1.4M Requires more storage
Level 2a: **Full Ag Reuse**	Spray Fields (70 acres) 232 AF Broderson 448 AF Ag Reuse 460 AF Cemetery 50 AF Conservation 160 AF 1,300 AF Storage (140 AF)	Total Mitigation = 240 AFY Potential for additional Mitigation of 207 AF with Ag Exchange Total capital cost = $13.2M - $13.9M (comparable to Level 1a) Land acquisition costs = $2.1M Less acres required for spray fields than Level 1a, 1b, or 2b Requires less storage than Level 1a or b projects	232 AF water is permanently lost to groundwater basin Higher O&M = $400k - $440k/ yr Cost to transport effluent 10,500 ft = $1.4M
Level 2b: **No Ag Reuse**	Spray Fields (180 acres) 742 AF Broderson 448 AF Conservation 160 AF Total capacity 1,350 AF Storage (30 AF)	Total Mitigation = 190 AFY Requires less storage than any other project No ramp-up time required as for ag exchange	742 AF water is permanently lost to groundwater basin Higher capital cost = $14.9M-$16.7M Land acquisition costs = $5.4M Higher O&M cost = $440k- $530k/ yr Cost to transport effluent 10,500 ft = $1.4M Lower mitigation than less expensive projects Fails to utilize opportunity for mitigation through agricultural in-lieu or exchange
Level 3a: **With Broderson**	Spray Fields (10 acres) -0- (2) Broderson 680 AF Harvest as offset (3) Ag Exchange 460 AF Conservation 160 AF Cemetery 50 AF Total capacity 1,350 AF Storage (115 AF)	Total Mitigation = 600 AFY Maximizes potential for mitigation with ag exchange O&M costs <$400k/ yr, comparable to Level 2a	Higher capital costs = $25.6M-$27.3M Land acquisition costs = $0.4M Slow ramp-up period to develop agreements with farmers Requires purveyor participation in shift in 400 AF of water production Cost to transport effluent 10,500 ft = $1.4M Requires more storage
Level 3b: **Without Broderson**	Spray Fields 680 AF Ag Exchange 460 AF Cemetery 50 AF Conservation 160 AF Shift in water production (4) Total capacity 1,350 AF Storage (290 AF)	Total Mitigation = 550 AF Maximizes potential for mitigation with ag exchange	Higher Capital Costs = $26.0M - $29.8M (5) Land acquisition costs = $20.4M High O&M costs= $130k -$1,100,000/ yr (5) Cost to transport effluent (10,500 ft)=$1.4M Slow ramp-up period to develop agreements with farmers Requires purveyor participation in shift or water importation Requires greatest storage, as much as Level 1a project Fails to utilize opportunity for mitigation through use of Broderson

(1) Mitigation: Ag in-lieu = 46; Conservation = 90; Cemetery = 5
(2) None during normal precipitation years
(3) Offsets pumping 232 AF/ year
(4) Shift in water production of 400 AF could involve upper aquifer pumping, water importation, or other strategies.
(5) Upper range of costs are for water importation.
(6) Land acquisition costs based on $30,000 per acre due to large size of parcel to be purchased.

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LOS OSOS WASTEWATER PROJECT – TECHNICAL ADVISORY COMMITTEE

EFFLUENT REUSE/DISPOSAL SYSTEMS

FINANCIAL

COST/ BENEFIT ANALYSIS OF EFFLUENT REUSE/ DISPOSAL ALTERNATIVES

Reuse/Disposal Level	Capital Costs	Annual O&M Costs	Land (Spray field)	Storage	Seawater Intrusion Mitigation
Level 1a: Full Ag Reuse	$12.7M - $14.3M	$100k - $190k	170 acres = $5.1M	290 AF	140 AFY
Level 1b: No Ag Reuse	$12.8M - $15.6M	$125k - $275k	280 acres = $8.4M	210 AF	90 AFY
Level 2a: Full Ag Reuse	$13.2M - $13.9M	$400k - $440k	70 acres = $2.1M	140 AF	240 AFY
Level 2b: No Ag Reuse	$14.9M - $16.7M	$440k - $530k	180 acres = $5.4M	30 AF	190 AFY
Level 3a: With Full Ag Use and Broderson	$25.6M - $27.3M	< $400k (1)	10 acres = $0.4M	115 AF	

(1) According to County staff, the O&M number in the Fine Screen needs to be revised downward.

ALTERNATIVE	Mitigation Factor	PROS	CONS
Spray fields (Tonini)	**-0-**	Capacity up to 1190 AFY	-0- Seawater Intrusion Mitigation. Water is lost to groundwater basin. - $
		Unlikely that tertiary treatment is required – save $3.5M in construction and $30,000- $100,000/ year in O&M costs	Need up to 270 acres to dispose of 1190 AFY: land acquisition cost - $5.1M
		Unlikely that denitrification treatment is required – save $4.6M from ponds construction	Construction Costs, incl. 10,500 feet pipe - $5.2M
			$O&M Costs
			Possible loss of agricultural viability
			Requires winter storage - $2.8M
Urban Reuse: - Cemetery - Middle School, Other	.55 = 5 AFY .55 = 35 AFY 40 AFY	Capacity 50 AFY	Cost to transport effluent to town
		Capacity 63 AFY	Requires Tertiary treatment – add $3.5M to construction costs, and $30,000- $100,000/ year in O&M costs
			Requires some nitrification/ denitrification
			Urban in-lieu requires purveyor participation
Agricultural Reuse (In-Lieu using treated wastewater instead of pumping from lower aquifer)	.1 = 46 AFY	Capacity 460 AFY	Cost to transport effluent to farms $900k
		Reduces pumping from lower aquifer	Requires storage + $16k
			Requires tertiary treatment – add $3.5M to construction costs, and $30,000- $100,000/ yr in O&M costs
			Requires some nitrification/ denitricication
			Slow ramp-up period to develop agreements with farmers
Agricultural Exchange (using treated wastewater on fields; sending water pumped from wells to town for potable use)	**.55 = 253 AFY**	Capacity 460 AFY	Cost to transport well water back to town
		Replaces pumping from lower aquifer at west end: highest mitigation factor	Requires tertiary treatment
			Requires some nitrification/ denitricication
			Slow ramp-up period to develop agreements with farmers
			Requires purveyor participation
Broderson - Leachfield - Percolation Pond	.22 = 100AFY at 448 AFY Less at 896 AFY	Capacity: 448 AFY without harvest wells	NWRI: If Broderson is used, it is important evaluate compliance with new DHS Groundwater Recharge Reuse criteria..
		Capacity 896 AFY with harvest wells	Cost for environmental mitigation of percolation ponds could be substantial
		Best location to recharge lower aquifer	Cost to develop leachfield = $2.4M
		Tertiary treatment not required - saves $3.5M in construction costs, and $30,000- $100,000 per year in O&M costs	Cost to transport effluent to town (piping & pump) $4.4M
			Value of Broderson land $4.7M
			Harvest wells, treatment & water main $3.1M
			Requires full nitrification/ denitricication – add $2.2M to construction costs and $90k - $250k per year for O&M costs for STEP
			Requires purveyor participation
			Percolation ponds problems include potential flow releases of effluent, permanent loss of sensitive habitat, odor issues, vector propagation

EFFLUENT REUSE/DISPOSAL SYSTEMS

FINANCIAL

Storage: Need up to 30 acres - Wells - Constructed Wetlands	- 0 -	/NWRI: winter storage will be required for land application (incl. spray fields) and for -0- discharge. Constructed wetlands could enhance community	Construction wetlands on Broderson will add to construction costs

* Cost figures found in Table A1

Other Strategies to Achieve Balance of Water Resources in the Groundwater Basin

Conservation	**.55 = 90 AFY**	Equivalent to disposal capacity of 160 AFY	Cost to retrofit 5,000 toilets ($200 ea) $1.3M
Storm water Runoff Detention (1)	**.55 = xx AFY**	Low construction costs Maximum mitigation factor	Requires CSD, water purveyors support.

(1) Requires purveyor support and cooperation

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LOS OSOS WASTEWATER PROJECT – TECHNICAL ADVISORY COMMITTEE

APPENDIX A: CRITERIA FOR PRO/CON ANALYSIS

EFFULENT DISPOSAL/WATER RESOURCES

Engineering & Water Resources

- Level of control over disposal options, multi-faceted approach that does not depend on 3rd parties.
- Cost of various disposal options.
- Retain water in the basin for sustainability and increased yield.
- Seawater intrusion mitigated.
- Water Purveyors input and acceptance.
- Stakeholders input and acceptance.
- Energy

Environment

- Construction disturbance
- Impact on biological resources
- Community impact
- System failure
- Land use compatibility
- Surface water quality
- Effluent quality
- Aquifer recharge
- Saltwater intrusion

Financial

- Capital Costs:
  - Land acquisition
  - Construction costs
  - Road impacts
  - Cost for individual hook-up
  - Cost of future upgrades
  - Potential environmental mitigation costs
- Operations & Maintenance Costs
  - Energy requirements
  - Labor, materials, overhead
  - Cost of solids handling/ disposal
  - Projected schedule for repairs, replacements, and maintenance
- Financial Risk Factors
  - Construction risks associated with archeological and biological impacts
  - Costs relating to system failure risks
  - Cost of achieving groundwater balance
  - Cost of potential repairs resulting from natural disasters (earthquake, flood)
  - Risk of inflated costs and uncertainty of 3rd party handling and/or participation
- Funding Factors
  - Eligibility for best financing (rate, terms, engineering constraints, flexibility, timing)
  - Grant eligibility, attractiveness
  - Conducive to 3rd party financial participation
  - Potential for revenue generation

TREATMENT TECHNOLOGY

Engineering & Water Resources

- Flexibility of treatment process to meet future needs and regulations.
- Demonstrated reliability of process.
- Effect of process on bio-solids production.
- Cost consideration, replacement, operation and maintenance.
- Energy.

Environment

- Construction disturbance
- Impact on biological resources
- Community impact
- System failure
- Impact on archaeological resources
- Energy use

Financial

- Capital Costs:
  - Land acquisition
  - Construction costs
  - Road impacts
  - Cost for individual hook-up
  - Cost of future upgrades
  - Potential environmental mitigation costs
- Operations & Maintenance Costs
  - Energy requirements
  - Labor, materials, overhead

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Cost of solids handling/ disposal

Projected schedule for repairs, replacements, and maintenance

Financial Risk Factors

Construction risks associated with archeological and biological impacts
Costs relating to system failure risks
Cost of achieving groundwater balance
Cost of potential repairs resulting from natural disasters (earthquake, flood)
Risk of inflated costs and uncertainty of 3rd party handling and/or participation

Funding Factors

Eligibility for best financing (rate, terms, engineering constraints, flexibility, timing)
Grant eligibility, attractiveness
Conducive to 3rd party financial participation
Potential for revenue generation

BIO-SOLIDS TREATMENT & DISPOSAL

Engineering & Water Resources

Maintain control of disposal process.
Flexibility of bio-solid process and disposal.
Nuisance assessment of bio-solids process and disposal.
Cost of process facilities, operations and maintenance, and ultimate disposal.
Energy

Environment

Volume
Class
Community impact
Traffic

Financial

Capital Costs:

Land acquisition
Construction costs
Road impacts
Cost for individual hook-up
Cost of future upgrades
Potential environmental mitigation costs

Operations & Maintenance Costs

Energy requirements
Labor, materials, overhead
Cost of solids handling/ disposal
Projected schedule for repairs, replacements, and maintenance

Financial Risk Factors

Construction risks associated with archeological and biological impacts
Costs relating to system failure risks
Cost of achieving groundwater balance
Cost of potential repairs resulting from natural disasters (earthquake, flood)
Risk of inflated costs and uncertainty of 3rd party handling and/or participation

Funding Factors

Eligibility for best financing (rate, terms, engineering constraints, flexibility, timing)
Grant eligibility, attractiveness
Conducive to 3rd party financial participation
Potential for revenue generation

TREATMENT PLANT SITE

Engineering & Water Resources

Sufficient in size to meet environmental and potential future expansion needs.
Minimize fluid transport costs.
Minimize land costs, to include environmental mitigation costs.
Site conditions with regards to constructability.

Environment

Construction disturbance
Community impact
Impact on biological resources
System failure risk
Impact on archaeological resources
Land use compatibility
Growth Inducement

Financial

Capital Costs:

Land acquisition
Construction costs
Road impacts
Cost for individual hook-up
Cost of future upgrades
Potential environmental mitigation costs

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Operations & Maintenance Costs
- Energy requirements
- Labor, materials, overhead
- Cost of solids handling/ disposal
- Projected schedule for repairs, replacements, and maintenance

Financial Risk Factors
- Construction risks associated with archeological and biological impacts
- Costs relating to system failure risks
- Cost of achieving groundwater balance
- Cost of potential repairs resulting from natural disasters (earthquake, flood)
- Risk of inflated costs and uncertainty of 3rd party handling and/or participation

Funding Factors
- Eligibility for best financing (rate, terms, engineering constraints, flexibility, timing)
- Grant eligibility, attractiveness
- Conducive to 3rd party financial participation
- Potential for revenue generation

COLLECTION SYSTEM

Engineering & Water Resources

Life cycle costs.
Design life.
Property impact for both private and public properties.
Reliability of System.
Environmental impact of system.
Infiltration and inflow potential.
Energy.

Environment

Construction disturbance
Impact on biological resources
Community impact
System failure risk
Impact on archaeological resources

Financial

Capital Costs:
- Land acquisition
- Construction costs
- Road impacts
- Cost for individual hook-up
- Cost of future upgrades
- Potential environmental mitigation costs

Operations & Maintenance Costs
- Energy requirements
- Labor, materials, overhead
- Cost of solids handling/ disposal
- Projected schedule for repairs, replacements, and maintenance

Financial Risk Factors
- Construction risks associated with archeological and biological impacts
- Costs relating to system failure risks
- Cost of achieving groundwater balance
- Cost of potential repairs resulting from natural disasters (earthquake, flood)
- Risk of inflated costs and uncertainty of 3rd party handling and/or participation

Funding Factors
- Eligibility for best financing (rate, terms, engineering constraints, flexibility, timing)
- Grant eligibility, attractiveness
- Conducive to 3rd party financial participation
- Potential for revenue generation

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