TASK BACKGROUND

Smith Engineering Company (SEC) has reviewed the City of Portales's Wastewater Treatment Plant *Draft* Preliminary Engineering Report (PER), dated December 2006, and makes the following comments and recommendations for improving the City' wastewater treatment plant while referencing the report.

This brief is formatted similarly to the draft PER for ease in referencing. It is an overview of points of interest. We have accepted as accurate the information in the draft PER and concurred with its statements or disagreed as noted. We have also, in proposing and evaluating additional alternatives, used the same goals and requirements set forth in the PER to allow a direct and accurate comparison.

1.0 GENERAL INTRODUCTION

1.1 Project Background

The City of Portales, the Roosevelt County seat, is located in eastern New Mexico approximately 19 miles southwest of the City of Clovis, New Mexico. The city's agricultural communities produce peanuts, wheat, corn, milo, potatoes, and alfalfa. Several dairies, a Glanbia Foods cheese plant, Southwest Canners and Abengoa Bioenergy Corporation (an ethanol plant) all contribute to Portales' industrial community. In addition, the city is home to the Eastern New Mexico University (ENMU) and 150 families who are associated with the Cannon Air Force Base.

In addition to a moderate population growth, the city is attracting several new dairy businesses to the area. However, except the Abengoa and Southwest Canners, new and existing industries provide in-house treatment of their wastewater.

The city's wastewater treatment and disposal is currently regulated by a New Mexico Environment Department (NMED) Groundwater Discharge Permit (DP-887). The city reuses the treated effluent for farm irrigation and is thus subject to the *NMED Policy for the Above Ground Use of Reclaimed Domestic Wastewater*. Because of the type of vegetation irrigated, a class 2 effluent is required.

SEC has reviewed this section and concurs with the Project Background.

1.2 Report Objectives

SEC has reviewed this section and concurs with the Report Objectives.

1.3 Report Organization

SEC has reviewed this section and concurs with the Report Organization.

2.0 PROJECT PLANNING AREA

2.1 Location and Service Area

Portales is located along US Highway 70, 90 miles from Roswell, New Mexico; 100 miles from Lubbock, Texas; and 240 miles from Albuquerque, New Mexico. The average elevation is 4,006

feet above mean sea level. The wastewater plant is located on South Roosevelt road approximately ¾ miles from the city limits.

The project planning area boundary is as shown in Figure 2-2 of the report and includes municipal (domestic, several retail business, restaurants, municipal schools, and city services) wastewater as well as the Abengoa and Southwest Canners' wastewater.

Temperature and precipitation is as shown in Tables 2-1 and 2-2. Temperatures range from a low of 23 degrees F in January to 91 degrees F in July. Precipitation ranges from a low of 0.5 inches for four months out of the year to a high of 3.2 inches in August.

SEC has reviewed this section and concurs with the Location and Service Area.

2.2 Environmental Resources Present

SEC has reviewed this section and concurs with this section, though a copy of the Environment Information Document was not available.

2.3 Population Trends and Growth Areas

The population is estimated to increase to 14,739 in 2030. An increase of 11 percent is estimated for ENMU. The total population increase for the 25 year planning period is estimated to be 18,739.

SEC has not researched the estimated population increase for ENMU. However, for this analysis, a population of 18,739 will be used.

3.0 EXISTING FACILITIES

SEC has reviewed this section and concurs with the Existing Facilities Section.

However, to elaborate, on Section 3.7.2, SEC would like to add that the existing pond system seems to be doing an exceptional job at reducing BOD when considering the high organic load from the industrial plants. This exceptional performance, however, likely contributes to the pond's poor nitrogen removal performance.

Nitrification is achieved by a biological group known as nitrifiers. This group is not as aggressive as the group of microbes who are responsible for reducing BOD. Because both groups require oxygen to sustain them, they have to compete for the available oxygen in the water. This becomes a problem when they are placed in the same environment. Nitrifies are slow to grow and thus, are slow to convert ammonia to nitrate. This phenomenon would explain the low nitrate concentrations and high TKN concentrations. The nitrifiers are not given a chance to proliferate. Typically, nitrification does not occur until after the BOD has been reduced to below 30 mg/L.

4.0 NEED FOR THE PROJECT

In order to comply with NMED's discharge permit and reuse policy, the City of Portales proposes to renovate (or replace) the existing wastewater treatment plant to:

- Accommodate current and future flows
- Provide total nitrogen reduction
- Handle sludge
- Provide disinfection and all necessary support facilities

Upgrades to the plant should also address several safety items such as the influent pump station, an emergency "off" cable for the barscreen and upgrading from chlorine gas to ultraviolet disinfection.

SEC does concur with Sections 4.1 to 4.2.2.

Section 4.2.3 Inefficient Designs – SEC does not concur with the report in regards to evaluating the existing lagoon system.

Wastewater lagoons are used widely throughout New Mexico. This state's climate and land availability make lagoons a very feasible option for many communities. In addition, using wastewater lagoons, when inflow has a large percentage of high strength industrial flow, is an excellent application. Wastewater lagoons provide for a high retention time, and when designed properly, have the ability to withstand a surge flow with high organic loads. An activated sludge plant cannot provide treatment to a volatile, high strength waste stream without some sort of industrial pre-treatment.

There are several lagoon systems that reliably treat to less than 15 mg/l of total nitrogen; two of which include the Capitan WWTP and the Deming WWTP. In light of this, SEC will evaluate the existing lagoon system.

SEC does concur with Sections 4.2.4 to 4.3.3.

5.0 ALTERNATIVES CONSIDERED

The criteria used to evaluate alternatives for upgrades will be ranked in regards to:

- Regulatory Compliance (DP-88 and the *NMED Policy for the Above Ground Use of Reclaimed Domestic Wastewater – Class 2)*
- Expandability
- Site Efficiency and Constructability
- Operation and Maintenance
- Public Acceptance
- Cost

SEC does concur with section 5.1.

The following alternatives have been identified in section 5.2:

1. Conventional Biological Nutrient Removal (BNR)
2. Simultaneous Nitrification and Denitrification
3. Submerged Membrane Bioreactor
4. Existing Aerated Lagoons
5. No Action

SEC proposes to add the following alternative:

6. Extended Aeration

Treatment Alternative 4 – Existing Aerated Lagoons

The upgrades to the existing wastewater lagoon system will emphasize reusing the existing infrastructure with a simple operations and maintenance scheme. With this in mind, SEC proposes to upgrade to a High Performance Aerated Lagoon System.[1] Even with proper designing and long retention times, some pond systems do not provide consistent nitrification.[2] The proposed upgrades will solve this problem by providing systems that will target carbonaceous organic contaminants and nitrification separately. To do this, the upgrades will to consist of a (1) complete mix reactor pond followed by a (2) multi-cellular settling lagoon. After settling, the wastewater will proceed to (3) the heated nitrifying biotowers with forced ventilation then to (4) secondary settling. Afterwards, the wastewater will be further denitrified in a (5) constructed wetlands. In order to provide a completely consistence effluent quality with varying influent flow rates, a 100 percent recycle lift station will return 1.8 MGD back to the complete mix reactor basin. Industrial flow will be treated in a separate complete mix reactor pond to reduce the organic load before treatment. Plate 1 shows the proposed flow scheme. Table 1 below shows the estimated construction costs for this alternative.

The cost estimate assumes that there is natural gas available at the WWTP for heating the biotowers. In addition, the concrete side walls for each pond were noted to be in good condition in Table 3-1. Because of this, the estimate includes patching and repairing any minor cracks in the concrete sidewalls for each pond and relining the pond bottoms with 80 mil HDPE synthetic liner.

The aerators for the complete mix reactor pond and the industrial pre-treatment pond have new aerators sized for reducing carbonaceous BOD while maintaining a completely mixed water column. An aeration system using floating aspirating aerators sized to provide a total of 520 HP for the complete mix reactor pond and the industrial pre-treatment pond was included in the cost estimate. Because of the high turbulence in these ponds, a concrete anchor lining system was preliminarily designed and its cost estimated. The settling ponds (primary and secondary) will be sectioned off in cells to reduce the hydraulic retention time and thereby reducing algae growth. Each cell is sized to provide a retention time of 2 days and will use floating baffles. With the pond sizes, each settling pond will have three cells each. Junction boxes will be used to allow operators to control flow routes and sludge deposits at the pond bottoms. The biotowers will reuse the existing tower structures and center pivot system but will require a media specified for nitrification and a new recycling triplex pump station. Aerators sized at 2 HP were included for

[1] Linvil, Rich. High Performance Aerated Lagoon Systems. Clemson University; An American Academy of Environmental Engineers, 1999. and
[2] ibid

the storage ponds and settling ponds for odor control. Two aerators will be provided for each cell in the settling ponds. 24 aerators will be provided for the storage pond.

The constructed wetlands were preliminarily designed to provide 6 hours of detention time using a medium crushed gravel media.

Table 1: Alternative 4 - Modified Existing Lagoon System
Engineer's Estimate of Probable Cost (CIP. = Complete in Place)

#	Item	Cost/Unit	Unit	Quanity	Cost
	---------- COMPLETE MIX BASIN ---------				
1	Aspirating Aerators 500 HP, CIP	$ 225,000	LS	1	$ 225,000
2	Lagoon Liner, reline bottoms with 80 mil HDPE, Patch & Repair joints and crack existing concrete slope and 4" Concrete Slab 3000 psi with fiber reinforcement, CIP.	$ 60.00	SY	5263	$ 315,787
	---------- INDUSTRIAL PRETREATMENT LAGOON ----------				
3	Aspirating Aerators 500 HP, CIP	$ 225,000	LS	1	$ 225,000
4	Lagoon Liner, reline bottoms with 80 mil HDPE, Patch & Repair joints and crack existing concrete slope and 4" Concrete Slab 3000 psi with fiber reinforcement, CIP.	$ 60.00	SY	5263	$ 315,787
	---------- SETTLING LAGOON (Primary and Secondary with 3 cells each) ----------				
5	Aspirating Aerators, 12 at 2 HP each with a total of 24 HP, CIP	$ 7,000.00	EA	12	$ 84,000
6	Lagoon Liner, reline bottoms with 80 mil HDPE, Patch & Repair joints and crack existing concrete slope, CIP.	$ 28	SY	22849	$ 639,769
7	Lagoon Baffles, 3460 SF with 456 LF of floats, each baffles (4 total)	$ 20	SF	13840	$ 276,800
	---------- BIOTOWERS ----------				
8	Biotower Media for nitrification, 85 ft^2/ft^3 surface area, CIP.	$ 600	CY	1489	$ 893,600
9	Biotower Lift Station, triplex lift station pumps and controls, CIP.	$ 45,000	EA	1	$ 45,000
10	Heating and Ventilation System (assuming natural gas is available at the WWTP)	$ 60,000	LS	1	$ 60,000
	---------- CONSTRUCTED WETLANDS ----------				
11	Lagoon Liner, reline bottoms with 80 mil HDPE, Patch & Repair joints and crack existing concrete slope, CIP.	$ 28	SY	6658	$ 186,434
12	Media: Crushed medium gravel, 37500 CY, CIP.	$ 35	CY	65157	$ 2,280,507
13	Manifold Piping, 4 inch PVC, perforated, 460 ft long, each side, CIP	$ 22	LF	920	$ 20,240
	---------- STORAGE PONDS ----------				
15	Lagoon Liner, reline bottoms with 80 mil HDPE, Patch & Repair joints and crack existing concrete slope, CIP.	$ 28	SY	6658	$ 186,434
16	Storage Pond Aspirating Aerators, 12 - 2 HP each with a total of 24 HP	$ 7,000	EA	12	$ 84,000
	---------- MISC ----------				
17	42" Concrete Junction Boxes with sluice gates (2 each), CIP	$ 6,000	EA	27	$ 162,000
18	Piping, 12 inch Schedule PVC Sewer line with trenching, backfilling, and compaction, CIP.	$ 30	LF	4968	$ 149,040
19	Electrical Upgrades	$ 180,000	LS	1	$ 180,000
20	Remove and dispose of existing synthetic liner material, offsite	$ 52,631	LS	1	$ 52,631
	Subtotal				$ 6,382,029
	Contingency (25%)				$ 1,595,507
	Subtotal				$ 7,977,536
	NMGRT (7.625%)				$ 608,287
	Total Construction				**$ 8,585,823**

Treatment Alternative 6 – Extended Aeration Plant

Extended Aeration process is another common form of wastewater treatment technology which also uses the same biological removal methods described in Alternative 1. There is no primary clarification and there are longer aeration times and less Wasted Activated Sludge (WAS). There are many extended aeration plant configurations but this report will look at the plants configured to a small footprint with common wall reinforced concrete basins as shown in Figure 1.

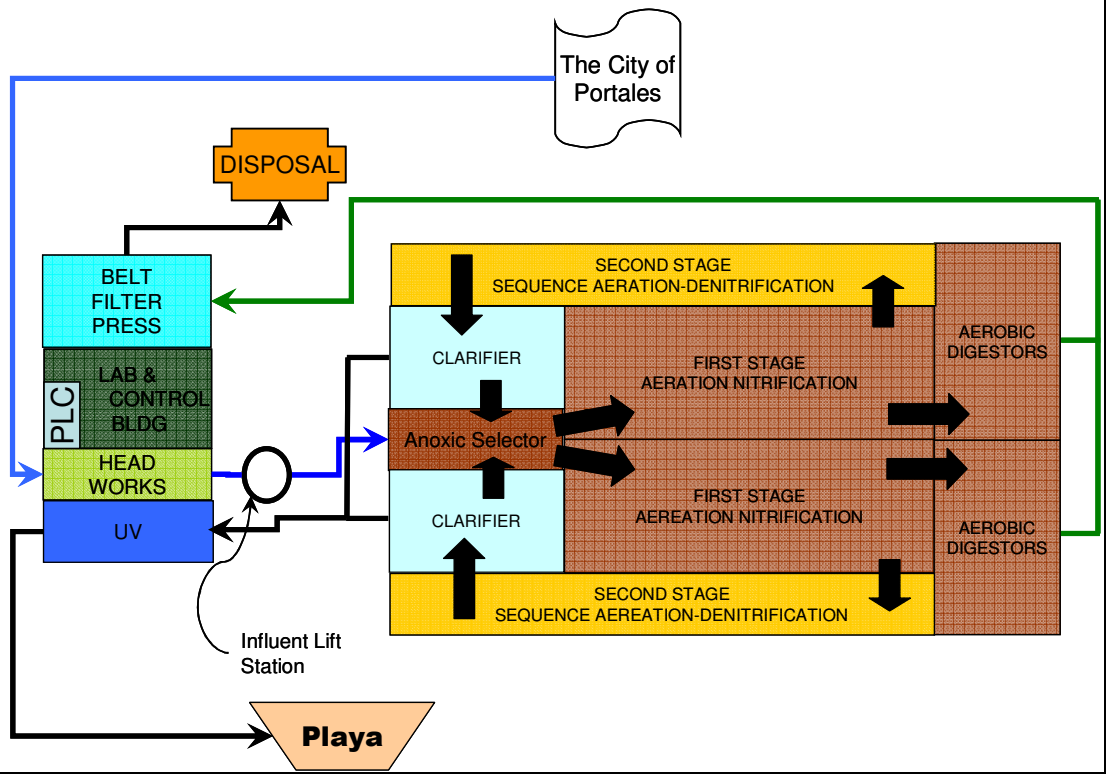
After primary treatment, the influent is then mixed with returned activated sludge, RAS, in the anoxic selector. Afterwards, the wastewater undergoes aeration in the First Stage Aeration Basin. Along with organic conversion, nitrification is also achieved within this basin. However, because nitrification is typically inhibited by a large organic carbon concentration, a second stage aeration is initiated in the Secondary Aeration Tank. Within this process, the diffusers are cycled on and off providing several periods of aerobic/anoxic/anaerobic environments for complete nitrification and de-nitrification. The wastewater is then directed to the clarifiers for solids settling. The clarified wastewater is decanted and sent to disinfection. Wasted sludge from the aeration basin is then processed in the aerobic digesters. After which the sludge is sent to the sludge handling facilities. See Table 2 for construction costs estimates.

Table 2: Alternative 6 - Extended Aeration Plant Project
Engineer's Estimate of Probable Cost

1	*Aeration Basin [1]*	$	5,172,000
2	*Aerobic Digesters*		
3	*Blowers Equipment*		
4	*Clarifiers*		
	Subtotal	$	5,172,000
	Contingency (25%)	$	1,293,000
	Subtotal	$	6,465,000
	NMGRT (7.625%)	$	492,956
	Total Construction	**$**	**6,957,956**

[1] Includes concrete basin, internal piping, equipment and equipment installation only.

Figure 1: Extended Aeration Layout and Process



SEC concurs with section 5.2.1 to 5.3.

Common Elements

Section 5.4 reviews the proposed designs for common elements to alternatives 1 through 3, which also includes proposed alternative 6. Sludge handling for alternative 5 is not required. Wastewater lagoons provide excellent digestion and storage and typically need to be desludged every 10 to 15 years.

SEC concurs with the proposed upgrades for the Influent Lift Station (Section 5.4.1).

SEC does not concur with the proposed upgrades for the Entrance Works but instead proposes an alternative treatment process for the entrance works.

Entrance Works Alternative

A new automatic mechanical bar screen system is proposed with a design flow of 3.6 MGD. This bar screen would be a screen in combination with an auger. The screen/auger combination would filter debris from the water, like the current bar screen, and systematically raise the debris and deposit them into a trashcan for easy disposal. The screen was specified to be a fine semi-cylindrical screen to be installed in the existing headworks box with ¼ inch openings.

The new headworks will be designed to provide two channels for flow filtration and two grit removal channels. The proposed automated bar screen was specified to be installed into one

filtration channel while the other would be used as a stand-by filtration system. A manual barscreen would remain to provide continuous filtration when the automatic screen required maintenance or in the event of a power failure. This alternative is estimated to cost approximately $750,000 (without NMGRT).

Disinfection Alternative

SEC does concur with the proposed disinfection upgrades. Chlorination systems for wastewater disinfection can be dangerous and require high dosing rates. Free chlorine will bind with available organics in the effluent increasing the chlorine demand of the wastewater. Instead ultraviolet disinfection is an excellent alternative. SEC, however, *does not concur* with the use of closed-vessel UV technology and recommend considering a channel UV system as a cost efficient alternative.

A new dual channel UV is proposed to be constructed near an exit Parshall flume (to provide effluent flow monitoring). The UV system will be designed to provide for a design flow of 3.6 MGD and is preliminarily estimated to cost approximately $200,000 (without NMGRT) to construct.

Daily Solids Handling

SEC concurs with the PER's proposed upgrades for sludge handling.

Building Alternative

SEC concurs with the recommendation to construct a separate sludge processing building and an administration/lab/ and operations building. However, combining the sludge processing building, the sludge pump building, the blower building, and the plant water pump building into one simple building will ease the cost of construction. Table 3 shows the estimate cost of construction for the common elements as described in this report.

Table 3: Common Elements to all Alternatives Engineer's Estimate of Probable Cost			
1	Mobilization/Demobilization	$	725,000
2	Demolition and site work (grading)	$	200,000
3	Buildings	$	2,000,000
4	Influent Lift Station & Screw Pump Replacement	$	200,000
5	Entrance Works	$	750,000
6	Sludge Processing Equipment	$	300,000
7	UV Disinfection Equipment	$	200,000
8	Plant Wash Water Lift Station	$	100,000
9	Yard Piping	$	50,000
10	Yard Lighting	$	30,000
11	Standby Power	$	50,000
	Allowance		
12	Inspection Testing	$	40,000
13	Electrical Service	$	5,000
14	Relocation of Underground Utilities	$	15,000
15	Laboratory Equipment	$	20,000
16	Plant Control System Spare Parts	$	5,000
	Subtotal	$	4,690,000
	Contingency (25%)	$	1,172,500
	Subtotal	$	5,862,500
	NMGRT (7.625%)	$	447,016
	Total Construction	**$**	**6,309,516**

For Alternative 4, sludge handling equipment and the facility is not required. The discounted common elements construction cost is estimated to be $4,560,700 (with NMGRT).

Alternative Comparison

See Table 4 for advantages, disadvantages, land requirements, and anticipated construction issues. Table 5 shows an estimated life-cycle analysis for the evaluated alternatives.

TABLE 4: Treatment Comparison

Description	Option 1 CONVENTIONAL BNR	Option 2 SIMULTANEOUS NITRIFICATION/DENITRIFICATION	Option 3 MEMBRANE BIOREACTR	Option 4 MODIFIED EXISTING LAGOON SYSTEM	Option 6 EXTENDED AERATION PLANT
Design Criteria	Average Design Flow: 1.8 MGD Peak Design Flow: 3.6 MGD 200 colonies/100 ml of Fecal Coliform (30 Day Average) 30 mg/L of BOD-5 (30 Day Average) 30 mg/L TSS (30 Day Average) TRC or UV Transmissivity (Monitor Only) 15 mg/L Total Nitrogen (Maximum Daily and Monthly Average) [1] Temperature: 10/23°C Influent Alkalinity: 350 mg/L pH: 7.0 - 9.0				
Environmental Impacts	-Increase in dust,noist and traffic due to construction. -Sludge will have to land applied or disposed of at a land fill daily.	-Sludge will have to land applied or disposed of at a land fill daily.	-Sludge will have to land applied or disposed of at a land fill daily.	-Sludge will have to be land applied or disposed of at a land fill every 5 to 10 years.	-Sludge will have to land applied or disposed of at a land fill daily.
Land Requirements	Proposed to be constructed in area currently used for Pond P-1.	Proposed to be constructed in area currently used for Pond P-1.	Proposed to be constructed in area currently used for Pond P-1.	None - upgrades to remain on site	Proposed to be constructed in area currently used for Pond P-1.
Construction Issues	-Unlikely interruption to WWTP operation	-Unlikely interruption to WWTP operation	-Unlikely interruption to WWTP operation	-Will interrupt WWTP operations. All upgrades constructions will have to be phased.	-Unlikely interruption to WWTP operation
Advantages	-Effective removal of BOD, TSS and Total Nitrogen -Relatively simple operation	-Effective removal of BOD, TSS and Total Nitrogen -Reduced Energy Costs through NADH based control -Reduced Basin size due to ability to run process at higher MLSS without affecting settleability. Reduced D.O. promotes better control of filamentous organisms.	-Effective removal of BOD, TSS and Total Nitrogen -Much higher removal rate of TSS -Membranes remove many pathogens, including viruses prior to disinfection. -Superior quality of effluent -Can be combined with SNdN processes for the pre-aeration basin for control of energy costs.	-Low O&M costs - Operators are already familiar with a lagoon system. - Handles surge flows with high organic loads fairly well as opposed to typical activated sludge plants. -Sludge handling will only be required every 5 to 10 years.	-Small plant footprint, allows for future expansion of plant. -Ease of equipment installation -Ease of maintenance -24 hr operator hotline by vender -Less prone to operational problems -Low long term O & M cost - Common wall design allows for lower construction costs.
Disadvantages	-High rate of internal recycle; added pumping costs -No advanced process controls for aeration for mitigation of energy costs -High construction costs	-Somewhat more complicated process controls -High construction costs	-More expensive equipment than other alternatives. -Maintanence costs can be higher than other alternatives -Process requires fine screening and thus more maintenance for this aspect of the operations -VERY high construction costs	- To achieve less than 10 mg/l not very likely. - Will require relining of every existing lagoon.	- Increase in O&M costs from existing plant - Will require daily sludge handling.

[1] Total Nitrogen => From PER, <2 mg/l NH_3-N; ≤5 mg/l TKN; ≤5 mg/l NO_2/NO_3-N

[2] No Action Alternative is not evaluated

TABLE 5: Alternative Rating Matrix

	Regulatory Compliance	Expandability	Site Efficiency and Constructability	Operation and Maintenance	Public Acceptance	Cost Consideration	Total Score	Notes
Alternative 5 - No Action	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
Evaulated Alternatives								
Alternative 1 - BNR	3	2	2	3	2	3	**15**	
Alternative 2 - SDdN	3	2	2	3	2	3	**15**	
Alterantive 3 - SMBR	3	3	3	1	2	1	13	
Alternative 4 - Modified Existing Lagoon System	1	1	1	3	1	3	10	
Alternative 6 - Extended Aeration Plant	3	3	3	3	2	3	**17**	***Recommended***

Note: Ranked according to scale: (1) Least favorable score, (2) Neutral Score, (3) More favorable score

Regulatory Compliance

Alternative 4, in regards to regulatory compliance, has shown to provide the necessary BOD, TSS and TN reduction needed for discharge. Wastewater lagoon performance, however, are dependent on the climate and typically drop in performance during colder weather. The existing lagoons in Portales are even more susceptible to cold climates because of the large surface area of the ponds. Even with upgrades to the lagoon system, Portales may not be able to get as a consistent effluent quality in the colder months. Because of this, Alternative 4 was given a least favorable score for regulatory compliance.

Alternative 6 includes an anoxic selector which will provide for di-nitrification and organic reduction. Two aeration tanks will reduce the organic load to far below 30 mg/l and provide the aerobic environment necessary for ammonification and nitrification. The secondary aeration tank will cycle aeration on and off to provide some additional dinitrification further reducing total nitrogen. Plants of similar design have achieved a TN concentration of 3 mg/l in their effluent. Because of this, Alternative 6 was given a more favorable score.

Expandability, Site Efficiency, and Constructability

The lagoon system maximizes the area available for treatment at the existing site. To expand the plant, additional area would be needed. This alternative was given a least favorable score in regards to expandability. Alternative 6 has a common wall, small foot print design. Upgrading to a higher treatment capacity is easily done by attaching more treatment trains. The tank configuration also minimizes piping costs and reduces the size of sludge pumps. Expandability for Alternative 6 was given a more favorable score.

Operation and Maintenance

Upgrading the lagoon system will maintain the same general treatment scheme as is currently used in Portales. The proposed upgrades to the lagoons will consist of lagoon baffles, junction boxes to control flow paths, additional aerators, and heaters for the nitrifying biotowers. Operation and maintenance of these proposed equipment items will not dramatically change from the existing equipment. In this aspect, this alternative was given a neutral score for operation and maintenance.

Alternative 6, like Alternative 1, 2, and 3, are activated sludge plants. Sludge will be handled daily increasing overall plant operation and maintenance requirements. Proposed equipment items for Alternative 6 include blowers, sludge pumps, RAS pumps, WAS pumps, and diffusers. Maintenance will be required more frequently for these items when compared to Alternative 4 or the existing plant. However, just as with Alternative 1, 2 and 3, the plant will be controlled with a programmable logic control (PLC) system reducing some daily operational requirements. Differences between Alternative 6 and Alternatives 1 and 2 include:

- The plant is designed to have no moving parts below water.
- The clarifiers don't require motors, gears or electrical components, and have a stainless steel fabrication.
- The plant is capable of treating a wide range of flows. The plant design allows for a 4:1 peak flow to be sustained.

Because of this, Alternative 6 was given a more favorable score in regards to operations and maintenance.

Public Acceptance

Wastewater lagoons have been known to create odors during seasonal overturns. However, if the ponds are aerated, as in the case with Alternative 4, there should be no sludge turn-overs experienced, and thus, reduced odors. As with all the alternatives, with a sludge handling facility in place, odors should be reduced to where they are minimally detectable at the WWTP site boundary. Alternative 4 and 6 are given a neutral score for public acceptance.

Cost Consideration

A review of the construction costs and the estimated annual costs is presented in Table 6, below. Alternative 6 has the lowest annual and construction costs and is thus given a more favorable score for cost considerations. Alternative 4 has a high construction cost but low annual O&M cost. When the present worth is calculated for each alternative, Table 6 shows that Alternative 4 is very similar to Alternatives 1 and 2 and is thus rated similarly in cost considerations.

TABLE 6: Annual Operation and Maintenance Cost Analysis

Item	Alternative 1 CONVENTIONAL BNR [c]	Alternative 2 SIMULTANEOUS NITRIFICATION /DENITRIFICATION [c]	Alternative 3 MEMBRANE BIOREACTOR [c]	Alternative 4 MODIFIED EXISTING LAGOON SYSTEM [a], [b]	Alternative 6 EXTENDED AERATION PLANT [a], [b]
Electricity	$ 251,697	$ 233,660	$ 300,644	$ 210,000	$ 280,000
Labor	$ 349,440	$ 349,440	$ 349,440	$ 349,440	$ 349,440
Vehicle Expense	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
Equipment Replacement	$ 6,500	$ 6,500	$ 6,500	$ 6,500	$ 4,500
Annual Reserve Deposits; Short Lived Assets	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000
TOTAL ANNUAL COST	**$ 622,637**	**$ 604,600**	**$ 671,584**	**$ 580,940**	**$ 648,940**
Common Elements Construction Cost	$ 21,158,799	$ 19,131,635	$ 21,017,747	$ 4,560,700	$ 6,309,516
Plant Construction Cost [d]				$ 8,585,823	$ 6,957,959
TOTAL CONSTRUCTION COST	**$ 21,158,799**	**$ 19,131,635**	**$ 21,017,747**	**$ 13,146,523**	**$ 13,267,475**
PRESENT WORTH [e]	**$ 28,724,593**	**$ 26,478,264**	**$ 29,178,304**	**$ 20,205,649**	**$ 21,152,883**

[a] Using $0.03/kW-hr to calculate power costs.
[b] With alternatives to common elements as discussed in text.
[c] Includes draft PER's common elements as they were sized and priced.
[d] Construction costs do not include Engineering, Construction Observation, or NMGRT on engineering
[e Using 5.3% Nominal Interest Rate for 20 years based on Discount Rates for Cost-Effectiveness, Lease Purchase, and Related Analysis, OMB Circular No. A-94 (2006).

Based on the evaluation presented, Alternative 6 is the most favorable option.

6.0 PROPOSED PROJECT

SEC does not concur with the proposed project as described in the PER. A BNR or SNdN is not as cost efficient as an Extended Aeration Plant. In addition, several elements that were common to each alternative are presented differently in this report and is proposed. The following is a description of the alternative proposed project.

The new or renovated facilities to be included in the project are the following:

1. New General Building to include:
    a. Administration and PLC Control Room
    b. Laboratory
2. Sludge Dewatering Facility to include
    a. Belt Filter Press
    b. Wash water pump system
    c. Blowers and Equipment
    d. WAS pumping station (RAS pumping handled within plant)
    e. UV disinfection
3. Renovation of existing screw pump influent lift station
4. New entrance works
5. New Extended Aeration Treatment Plant to include:
    a. Anoxic Selector tank and appurtenances
    b. First Stage Aeration and appurtenances
    c. Second Stage Aeration and appurtenances
    d. Aerobic Sludge Digesters (3 day Hydraulic Retention Time)

6. Facility lighting, piping, etc.

Table 8 shows the estimated construction costs for the proposed project, including engineering fees and New Mexico Gross Receipt Taxes.

Table 8: Proposed Extended Aeration Plant Project
Engineer's Estimate of Probable Cost

1	Mobilization/Demobilization	$	772,160
2	Demolition and site work (grading)	$	200,000
3	General Building and Dewatering Facility	$	2,000,000
4	Influent Lift Station & Screw Pump Replacement	$	200,000
5	Entrance Works	$	750,000
6	*Aeration Basin*	$	5,772,000
7	*Aerobic Digesters*		
8	*Blowers Equipment*		
9	*Clarifiers*		
10	Sludge Processing Equipment	$	300,000
11	UV Disinfection Equipment	$	200,000
12	Plant Wash Water Lift Station	$	100,000
13	Yard Piping	$	50,000
14	Yard Lighting	$	30,000
15	Standby Power	$	50,000
	Allowance		
16	Inspection Testing	$	40,000
17	Electrical Service	$	5,000
18	Relocation of Underground Utilities	$	15,000
19	Laboratory Equipment	$	20,000
20	Plant Control System Spare Parts	$	5,000
	Subtotal	$	10,509,160
	Contingency (25%)	$	2,627,290
	Subtotal	$	13,136,450
	NMGRT (7.625%)	$	1,001,654
	Total Construction	**$**	**14,138,104**
	Civil Engineering	$	1,413,810
	Surveying	$	4,500
	Construction Observation	$	270,000
	Geotechnical Engineering	$	5,000
	Electrical Engineering	$	5,000
	NPDES Permitting (Stormwater)	$	7,000
	Structural Engineering	$	5,000
	Subtotal	$	1,710,310
	NMGRT (7.625%)		130,411.17
	Total Engineering	**$**	**1,840,722**
	Total Project Costs	**$**	**15,978,826**

Description of Proposed Project

Influent Lift Station – The existing screw pumps in the lift station will be removed and replaced with variable frequency drive submersible pumps. Screening of the incoming flow will be provided to remove large rags, plastics, etc. which could damage pumps.

Entrance Works – A new headworks will be designed to include a grit channel, a mechanical screen/auger system, ultrasonic flow metering, sampling equipment and a by-pass manual barscreen.

Extended Aeration System – A new extended aeration system will be designed to include:

- An anoxic selector
- First Stage Aeration
- Second Stage Aeration
- Clarification
- Aerobic Sludge Digestion (3 day Hydraulic Retention Time)

The plant will employ a common wall design which will reduce the amount of concrete and internal piping needed but still allow for easy expansion when flows increase.

Disinfection – A new channel UV system will be designed to provide for the peak flow before discharge.

Sludge Dewatering Facility – A new belt filter press will be designed to provide for the design flow and sludge produced from the extended aeration plant. The building will also house the blowers, the wash water pump system, the WAS pumping station (RAS pumping handled within plant), and the UV disinfection system.

General Building – A new building will provide areas for general administration, a control room, and the laboratory.

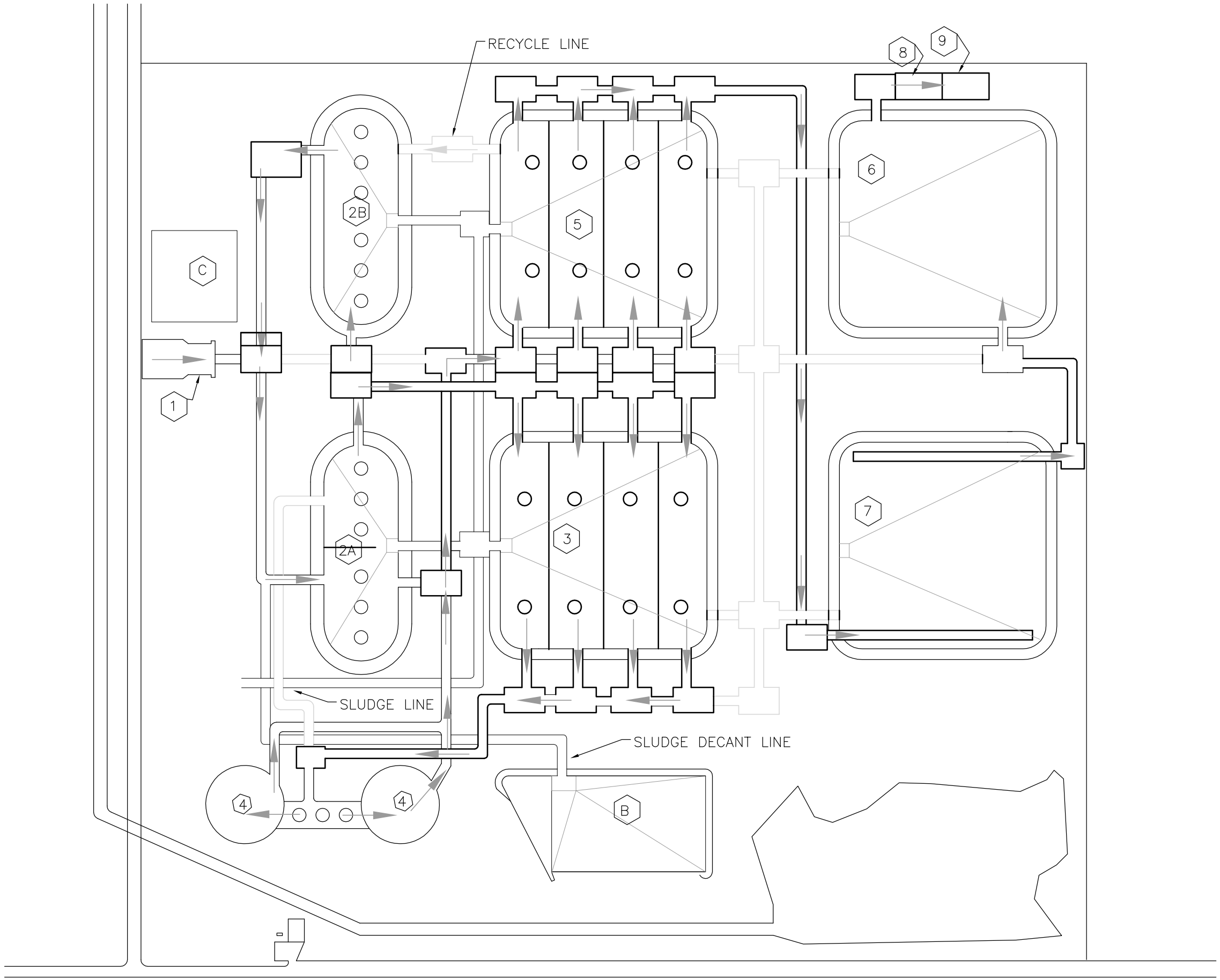
Standby Power – *SEC concurs with the recommendations for the standby power system.*

SEC concurs with Section 6.5 concerning Site Considerations and Section 6.3.9 concerning Aerobic Digestion.

7.0 CONCLUSION AND RECOMMENDATIONS

SEC concurs with Section 7 concerning report conclusions and recommendations.

However, in light of the difference in construction costs, SEC recommends that the City of Portales consider upgrading their wastewater treatment plant to an Extended Aeration Plant described in Section 6 of this brief. The plant's design provides a robust and dependable treatment scheme that will provide an effluent with far less than 10 mg/l total nitrogen, 30 mg/l BOD and TSS concentrations. In addition, the tank layout and configuration reduce the amount of concrete and piping needed while still allowing for future expansion when flows increase. A total project savings of around $4 to $5 Million and simpler operation will be realized with no loss in performance.



1. PROPOSED HEADWORKS

2A. PROPOSED COMPLETE MIXED AERATION POND #1

2B. PROPOSED COMPLETE MIXED AERATION POND #2

3. PROPOSED PRIMARY SETTLING POND

4. PROPOSED NITRIFYING BIOTOWERS (HEATED)

5. PROPOSED SECONDARY SETTLING POND

6. PROPOSED STORAGE POND

7. PROPOSED WETLANDS

8. PROPOSED EFFLUENT FLOW MEASUREMENT

9. PROPOSED EFFLUENT CHLORINATION SYSTEM

A. NOT USED

B. PROPOSED SLUDGE STORAGE BEDS

C. PROPOSED LAB/ADMIN. BUILDING

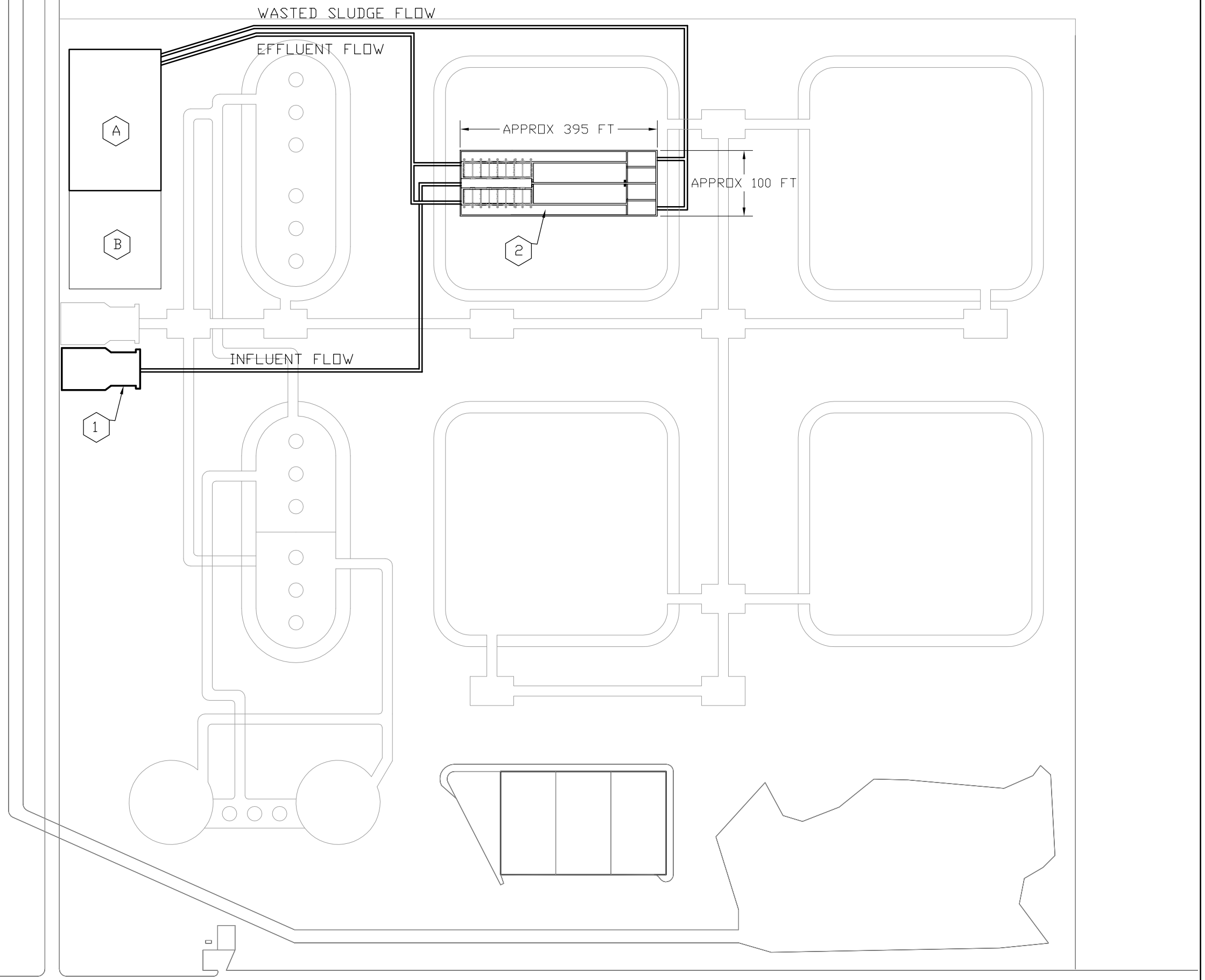
NO.	REVISION DESCRIPTION	DATE	BY
3			
2			
1			

THE CITY OF PORTALES
WASTEWATER TREATMENT SYSTEM UPGRADE ALTERNATIVES

PLATE 1 – MODIFY EXISTING PLANT

Smith Engineering Company
A Full Service Engineering Company
Albuquerque, NM
Roswell, NM

JOB NO: 106114B
DATE: MARCH 2007
SHEET NO:



1. PROPOSED HEADWORKS

2. PROPOSED EXTENDED AERATION PLANT

A. PROPOSED SLUDGE HANDLING FACILITY

B. PROPOSED LAB/ADMIN. BUILDING

NO.	REVISION DESCRIPTION	DATE	BY
3			
2			
1			

THE CITY OF PORTALES
WASTEWATER TREATMENT SYSTEM UPGRADE ALTERNATIVES

PLATE 2 - EXTENDED AERATION PLANT

Smith Engineering Company
A Full Service Engineering Company
Albuquerque, NM
Roswell, NM

JOB NO: 106114B
DATE: MARCH 2007
SHEET NO: