
APPENDIX D.1
IFAS PRELIMINARY COST ESTIMATE

Opinion of Probable Construction Costs

VTSV WWTF

IFAS Treatment Process

| Division | Description | Quantity | Units | Cost per Unit (\$) | Installation Multiplier | Cost (Nearest \$100) |
|-----------|--|----------|-------|--------------------|-------------------------|----------------------|
| 1 | GENERAL CONDITIONS | | | | | 0 |
| | | 1 | LS | | 1.0 | 0 |
| 2 | CIVIL / SITEWORK | | | | | 123,000 |
| | Excavation For New Basins And Clarifiers | 1200 | BCY | 2 | 1.3 | 3,000 |
| | Hauling Of Excavation | 1500 | CY | 9 | 1.3 | 16,000 |
| | Misc. Excavation For Yard Piping | 1 | LS | 35,000 | 1.3 | 45,500 |
| | New Concrete Pad For New Generator On West Side Of Existing Building | 1 | LS | 5,000 | 1.3 | 6,500 |
| | Grade Preperation For Extension Of Existing Building To West Side | 1 | LS | 40,000 | 1.3 | 52,000 |
| 3 | CONCRETE | | | | | 1,176,900 |
| | New Aeration Tanks | 150 | CY | 900.00 | 1.1 | 148,500 |
| | Clarifiers | 100 | CY | 900.00 | 1.1 | 99,000 |
| | Concrete Floor | 150 | CY | 900.00 | 1.1 | 148,500 |
| | Top Slab Of The Holding Tank | 110 | CY | 900.00 | 1.1 | 108,900 |
| | Misc. Concrete | 10 | CY | 900.00 | 1.1 | 9,900 |
| | Precast Insulated Walls | 12036 | SF | 34.00 | 1.1 | 450,200 |
| | Precast Double Tee Roof | 12036 | SF | 16.00 | 1.1 | 211,900 |
| 4 | MASONRY | | | | | 32,500 |
| | Misc. Masonary Wall Interior Of Building | 1 | LS | 25,000.00 | 1.3 | 32,500 |
| 5 | METALS | | | | | 17,500 |
| | Hand Rails, Misc Metal Grating | 1 | LS | 13,450.00 | 1.3 | 17,500 |
| 6 | WOOD AND PLASTIC | | | | | 0 |
| 7 | THERMAL & MOISTURE PROTECTION | | | | | 3,900 |
| | Misc. Sealants | 1 | LS | 3,000.00 | 1.3 | 3,900 |
| 8 | DOORS & WINDOWS | | | | | 32,500 |
| | 2- Garage Doors | 1 | LS | 10,000.00 | 1.3 | 13,000 |
| | 2- Double Doors | 1 | LS | 7,000.00 | 1.3 | 9,100 |
| | 4- Single Door | 1 | LS | 8,000.00 | 1.3 | 10,400 |
| 9 | FINISHES | | | | | 24,000 |
| | Paints On Door And Frames, Exposed Piping | 1 | LS | 20,000.00 | 1.2 | 24,000 |
| 10 | SPECIALITIES | | | | | 9,100 |
| | Fire Extinguishers | 1 | LS | 3,000.00 | 1.3 | 3,900 |
| | Bathroom Accessories | 1 | LS | 4,000.00 | 1.3 | 5,200 |
| 11 | EQUIPMENT | | | | | 1,828,600 |
| | IFAS Vendor quote | 1 | LS | 876,700 | 1.3 | 1,139,800 |
| | Teritary Filters For P-Removal And Denite | 1 | LS | 450,000 | 1.3 | 585,000 |
| | Chemical Skid For Carbon Addition | 1 | LS | 5,000 | 1.3 | 6,500 |
| | UV Disinfection | 3 | EA | 21,120 | 1.3 | 82,400 |
| | Chemical Storage Tank- PACI | 1 | EA | 5,940 | 1.3 | 7,800 |
| | Chemical Storage Tank- Micro-C | 1 | EA | 5,395 | 1.3 | 7,100 |

IFAS Treatment Process Alternative
Opinion of Probable Construction Cost

| | | | | | | |
|-------------------|---|-------|---------------|------------|-----|------------------|
| 12 | FURNISHINGS | | | | | 6,500 |
| | Lab, Operations Room | 1 | LS | 5,000.00 | 1.3 | 6,500 |
| 13 | SPECIAL CONSTRUCTION | | | | | 0 |
| 14 | HOISTS AND CRANES | | | | | 0 |
| 15 | MECHANICAL / HVAC | | | | | 178,100 |
| | Process Piping | 1 | LS | 50,000.00 | 1.3 | 65,000 |
| | HVAC | 1 | LS | 87,000.00 | 1.3 | 113,100 |
| 16 | ELECTRICAL and INSTRUMENTATION & CONTROLS | | | | | 682,500 |
| | New Scada System, Mcc, Misc.Electrical Connection, Controls | 1 | LS | 650,000.00 | 1.0 | 650,000 |
| | New Generator | 1 | LS | 25,000.00 | 1.3 | 32,500 |
| SUBTOTAL 1 | | | | | | 4,115,100 |
| | CONSTRUCTION PRORATES(See Note 1) | 18.0% | of Subtotal 1 | 740,718 | 1.0 | 740,800 |
| | CONTRACTOR'S OVERHEAD & PROFIT (See Note 2) | 15.0% | of Subtotal 1 | 617,265 | 1.0 | 617,300 |
| SUBTOTAL 2 | | | | | | 5,473,200 |
| | CONTINGENCY (See Note 4) | 25.0% | of Subtotal 2 | 1,368,300 | 1.0 | 1,368,300 |
| SUBTOTAL 3 | | | | | | 6,841,500 |
| | ENGINEERING COSTS | 15.0% | of Subtotal 3 | 1,026,225 | 1.0 | 1,026,300 |
| TOTAL | | | | | | 7,867,800 |

Notes

- 1 Construction Prorates ^{(a) (b)} 18%
(a) General conditions includes cost associated with permits, licenses, insurance, environmental safe guards, sediment and drainage control, and special construction practices to maintain continued plant operations. Also includes misc construction materials needed for project not included above.
- 2 Contractor's Overhead & Profit ^(a) 15.0%
(a) Contractor's overhead and profit include costs for mobilization/demobilization, administration, and contractor/subcontractor overhead costs and profits.
- 4 Design Contingency ^(a) 25.0%
(a) The design continency is added to the subtotal based on the conceptual nature of information developed for this evaluation.
- 5 Engineering Costs 15.0%
Costs incurred during Final Design and Construction.

IFAS Treatment Process Alternative
Net Present Value Summary

| |
|---------------------------------------|
| 20-Year Present Value Analysis |
|---------------------------------------|

| IFAS treatment Process | |
|---|--------------------|
| IFAS | |
| Capital Costs | \$7,867,800 |
| | |
| Annual Operating and Maintenance Costs | |
| Chemicals & Reagents Delivered | \$58,500 |
| Energy Cost | \$55,300 |
| Labor | \$1,700 |
| <i>Subtotal</i> | \$115,500 |
| <i>NPV of Annual O&M Costs</i> | \$2,043,000 |
| Total Net Present Cost | \$9,361,800 |

Assumptions:

- | | |
|----------------------------|------|
| 1. Life cycle, n (years): | 20 |
| 2. Annual inflation rate | 2.0% |
| 3. Discount Rate | 3.2% |
| 3. Labor cost of \$25/hour | |

$$NPV = Annual_Cost \times \left[\frac{(1+i)^n - 1}{i \times (1+i)^n} \right]$$

IFAS Treatment Process Alternative
Operation and Maintenance Cost Estimate

| Description | Quantity Installed | Operating | Motor Size | Total operating | Operating Load ⁽¹⁾ | Run Time, hrs | | | Annual Energy Use | Unit Cost | Annual Electricity Cost |
|---|--------------------|---------------------------|------------|-----------------|-------------------------------|---------------|----------|---------|--------------------------------------|-----------|-------------------------|
| | | | | | | (kW) | (hr/day) | (hr/yr) | | | |
| Anoxic Mixers | 6 | 6 | 1.3 | 7.80 | 6.24 | 4.7 | 24 | 8760 | 40,887 | \$0.090 | \$3,680 |
| IMLR Pumps | 2 | 2 | 1.5 | 3.00 | 2.40 | 1.8 | 24 | 8760 | 15,726 | \$0.090 | \$1,415 |
| Aeration Blowers | 2 | 2 | 50 | 100.00 | 1,200.00 | 897.6 | 24 | 8760 | 327,624 | \$0.090 | \$29,486 |
| Clarifier Mechanism | 2 | 2 | 2 | 4.00 | 3.20 | 2.4 | 24 | 8760 | 20,968 | \$0.090 | \$1,887 |
| Tertiary Filters | --- | | | | | 3.7 | 24 | 8760 | 32,412 | \$0.090 | \$2,917 |
| Tertiary Filter Feed Pump or UV Feed Pump | 2 | 2 | 2 | 4.00 | 3.20 | 2.4 | 24 | 8760 | 20,968 | \$0.090 | \$1,887 |
| RAS Pump | 2 | 2 | 14.8 | 29.60 | 23.68 | 17.7 | 24 | 8760 | 155,163 | \$0.090 | \$13,965 |
| | | Total operating HP | | 148 | | | | | Total Annual Electricity Cost | | \$55,300 |

(1) Operating load based on 80% of total operating HP to account for motor inefficiencies and correction for elevation.

| Chemical Cost/ year | | |
|------------------------|-------------------|-----------|
| Ferric cost | From Vendor calcs | \$ 13,500 |
| Mico-C | | \$ 45,000 |
| Chemical Cost per year | | \$ 58,500 |

IFAS Treatment Process Alternative
Net Present Value Calculations

| End of Year | O&M Costs | Present Value of O&M Costs | Short Lived Assets | Present Value of Short Lived Assets |
|--------------------------|-----------|----------------------------|--|-------------------------------------|
| 1 | \$115,500 | \$114,130 | | \$0 |
| 2 | \$115,500 | \$112,777 | | \$0 |
| 3 | \$115,500 | \$111,440 | | \$0 |
| 4 | \$115,500 | \$110,118 | | \$0 |
| 5 | \$115,500 | \$108,813 | | \$0 |
| 6 | \$115,500 | \$107,522 | | \$0 |
| 7 | \$115,500 | \$106,247 | | \$0 |
| 8 | \$115,500 | \$104,988 | | \$0 |
| 9 | \$115,500 | \$103,743 | | \$0 |
| 10 | \$115,500 | \$102,513 | \$5,000 | \$4,438 |
| 11 | \$115,500 | \$101,297 | | \$0 |
| 12 | \$115,500 | \$100,096 | | \$0 |
| 13 | \$115,500 | \$98,909 | | \$0 |
| 14 | \$115,500 | \$97,736 | | \$0 |
| 15 | \$115,500 | \$96,577 | \$144,700 | \$120,993 |
| 16 | \$115,500 | \$95,432 | | \$0 |
| 17 | \$115,500 | \$94,300 | | \$0 |
| 18 | \$115,500 | \$93,182 | | \$0 |
| 19 | \$115,500 | \$92,077 | | \$0 |
| 20 | \$115,500 | \$90,985 | | \$0 |
| Capital Costs | | \$7,867,800 | Discount Rate = 1.2% (Takes into account inflation) | |
| O&M Costs | | \$2,043,000 | | |
| Short Lived Asset | | \$126,000 | | |
| Salvage Value | | \$675,000 | | |
| NPV | | \$9,361,800 | | |

IFAS Treatment Process Alternative
Net Present Value Calculations

| IFAS Alternative | Life Expectancy | Replacement Cost | Salvage Value at 20 yrs |
|--------------------------------|-----------------|------------------|-------------------------|
| Short Lived Assets | | | |
| Existing Bar Screen | 15 | \$ 86,000 | \$ 21,500 |
| Exisitng Grit Pump | 15 | \$ 15,000 | \$ 3,750 |
| Exisitng Grit Classifier | 15 | \$ 35,000 | \$ 8,750 |
| Influent EQ tank Mixer 1 | 15 | \$ 13,800 | \$ 3,450 |
| Influent EQ tank Mixer 2 | 15 | \$ 13,800 | \$ 3,450 |
| Submersible Mixers | 15 | \$ 55,200 | \$ 13,800 |
| Aerobic Diffusers | 10 | \$ 10,000 | \$ 5,000 |
| Blowers (3 duty) | 15 | \$ 240,000 | \$ 60,000 |
| IMLR Pump (2 Duty) | 15 | \$ 30,000 | \$ 7,500 |
| Clarifier Mechanism (2 Duty) | 15 | \$ 25,000 | \$ 6,250 |
| RAS/WAS Pumps (2 Duty) | 15 | \$ 30,000 | \$ 7,500 |
| Tertiary Filter Feed Pump | 15 | \$ 15,000 | \$ 3,750 |
| Tertiary Filter- Polymer Pump | 15 | \$ 5,000 | \$ 1,250 |
| Tertiary Filter- Ferric Pump | 15 | \$ 5,000 | \$ 1,250 |
| Chemical Skid- Alum | 15 | \$ 5,000 | \$ 1,250 |
| Chemical Skid- Carbon | 15 | \$ 5,000 | \$ 1,250 |
| Long Life Assets | | | |
| New Concrete Structures | 50 | \$ 1,176,900 | \$ 706,140 |
| Total Salvage Value | | | \$ 855,840 |
| Present Value of Salvage Costs | | | \$675,000 |

Depreciation Calcs

Depreciation Value = (Cost - Salvage Value)/Life

SL = (C-SV)/L

Then adjust to present day

APPENDIX D.2
MBR PRELIMINARY COST ESTIMATE

Opinion of Probable Construction Costs

VTSV WWTF

MBR Treatment Process

| Division | Description | Quantity | Units | Cost per Unit (\$) | Installation Multiplier | Cost (nearest \$100) |
|----------|--|----------|-------|--------------------|-------------------------|----------------------|
| 1 | GENERAL CONDITIONS | | | | | 0 |
| | | 1 | LS | | 1.0 | 0 |
| 2 | CIVIL / SITEWORK | | | | | 154,300 |
| | Grade Preperation For Headworks Expansion And Flume Relocation | 1 | LS | 20,000 | 1.3 | 25,000 |
| | Excavation Within The Existing Headworks For New Channel | 3 | CY | 10 | 1.3 | 100 |
| | Excavation For Concrete Tanks (An, Ax, Ox) | 850 | CY | 11 | 1.3 | 12,200 |
| | Yard Piping Excavation, Installation. Material, Bedding, Compacting | 1 | LS | 35,000 | 1.3 | 45,500 |
| | Grade Preperation For New Carport On South Side Of Existing Building | 1 | LS | 20,000 | 1.3 | 26,000 |
| | New Retaining Wall Next To The Car Port | 1 | LS | 20,000 | 1.3 | 26,000 |
| | New Concrete Pad For New Generator On West Side Of Existing Building | 1 | LS | 5,000 | 1.3 | 6,500 |
| | Grade Preperation For Extension Of Existing Building To West Side | 1 | LS | 10,000 | 1.3 | 13,000 |
| 3 | CONCRETE | | | | | 674,800 |
| | New Tanks | 200 | CY | 900.00 | 1.1 | 198,000 |
| | Existing Aeration Tank Retrofit With Walls | 9 | CY | 800.00 | 1.1 | 7,500 |
| | Misc. Concrete For Headworks Retrofit | 10 | CY | 800.00 | 1.1 | 8,800 |
| | Misc. Concrete For Clarifier Base Slab Levelling | 5 | CY | 800.00 | 1.1 | 4,400 |
| | Concrete For Basins Top Slab | 78 | CY | 900.00 | 1.1 | 77,300 |
| | New Slab On West Side For Building Expansion | 21 | CY | 800.00 | 1.1 | 18,500 |
| | Pad For Generator | 13 | CY | 800.00 | 1.1 | 11,500 |
| | Misc. Concrete | 15 | CY | 800.00 | 1.1 | 13,200 |
| | Precast Insulated Wall | 6100 | SF | 34.00 | 1.1 | 228,200 |
| | Precast Double Tee Roof | 6100 | SF | 16.00 | 1.1 | 107,400 |
| 4 | MASONRY | | | | | 25,800 |
| | Misc. Masonary Wall Interior Of Building | 1 | LS | 19,800.00 | 1.3 | 25,800 |
| 5 | METALS | | | | | 14,100 |
| | Hand Rails, Misc Metal Grating | 1 | LS | 10,800.00 | 1.3 | 14,100 |
| 6 | WOOD AND PLASTIC | | | | | 0 |
| 7 | THERMAL & MOISTURE PROTECTION | | | | | 0 |
| 8 | DOORS & WINDOWS | | | | | 27,500 |
| | 2- Garage Doors | 1 | LS | 10,000.00 | 1.1 | 11,000 |
| | 2- Double Doors | 1 | LS | 7,000.00 | 1.1 | 7,700 |
| | 4- Single Door | 1 | LS | 8,000.00 | 1.1 | 8,800 |
| 9 | FINISHES | | | | | 20,000 |
| | Paints On Door And Frames, Exposed Piping, Bollards | 1 | LS | 20,000.00 | 1.0 | 20,000 |
| 10 | SPECIALITIES | | | | | 6,900 |
| | Fire Extinguishers | 1 | LS | 2,350.00 | 1.1 | 2,600 |
| | Bathroom Accessories | 1 | LS | 3,850.00 | 1.1 | 4,300 |
| 11 | EQUIPMENT | | | | | 1,598,100 |
| | MBR Vendor Quote | 1 | LS | 1,097,000 | 1.3 | 1,426,100 |
| | Headworks New Fine Screen | 1 | EA | 86,900 | 1.3 | 108,700 |
| | UV Disinfection | 2 | EA | 21,120 | 1.2 | 50,700 |
| | Chemical Storage Tank- Pacl | 1 | EA | 5,940 | 1.1 | 6,600 |
| | Chemical Storage Tank- Micro-C | 1 | EA | 5,395 | 1.1 | 6,000 |

MBR Treatment Process Alternative
Opinion Of Probable Construction Cost

| | | | | | | |
|-------------------|---|-------|---------------|------------|-----|------------------|
| 12 | FURNISHINGS | | | | | 6,500 |
| | Lab, Operations Room | 1 | LS | 5,000.00 | 1.3 | 6,500 |
| 13 | SPECIAL CONSTRUCTION | | | | | 0 |
| 14 | HOISTS AND CRANES | | | | | 19,500 |
| | Mono Rail And Hoist For Moving Of Membrane Cassettes | 1 | LS | 15,000.00 | 1.3 | 19,500 |
| 15 | MECHANICAL / HVAC | | | | | 174,800 |
| | Process Piping | 1 | LS | 47,400.00 | 1.3 | 61,700 |
| | HVAC | 1 | LS | 87,000.00 | 1.3 | 113,100 |
| 16 | ELECTRICAL and INSTRUMENTATION & CONTROLS | | | | | 682,500 |
| | New Scada System, Mcc, Misc.Electrical Connection, Controls | 1 | LS | 650,000.00 | 1.0 | 650,000 |
| | New Generator | 1 | LS | 25,000.00 | 1.3 | 32,500 |
| SUBTOTAL 1 | | | | | | 3,404,800 |
| | CONSTRUCTION PRORATES(See Note 1) | 18.0% | of Subtotal 1 | 612,864 | 1.0 | 612,900 |
| | CONTRACTOR'S OVERHEAD & PROFIT (See Note 2) | 15.0% | of Subtotal 1 | 510,720 | 1.0 | 510,800 |
| SUBTOTAL 2 | | | | | | 4,528,500 |
| | CONTINGENCY (See Note 4) | 25.0% | of Subtotal 2 | 1,132,125 | 1.0 | 1,132,200 |
| SUBTOTAL 3 | | | | | | 5,660,700 |
| | ENGINEERING COSTS | 15.0% | of Subtotal 3 | 849,105 | 1.0 | 849,200 |
| TOTAL | | | | | | 6,509,900 |

Notes

- 1

Construction Prorates^{(a) (b)}

18%
- (a)

General conditions includes cost associated with permits, licenses, insurance, environmental safe guards, sediment and drainage control, and special construction practices to maintain continued plant operations. Also includes misc construction materials needed for project not included above.
- 2

Contractor's Overhead & Profit^(a)

15.0%
- (a)

Contractor's overhead and profit include costs for mobilization/demobilization, administration, and contractor/subcontractor overhead costs and profits.
- 4

Design Contingency^(a)

25.0%
- (a)

The design continency is added to the subtotal based on the conceptual nature of information developed for this evaluation.
- 5

Engineering Costs

15.0%
- Costs incurred during Final Design and Construction.

MBR Treatment Process Alternative
Net Present Value Summary

| |
|--------------------------------|
| 20-Year Present Value Analysis |
|--------------------------------|

| Capital Costs | |
|--|--------------------|
| MBR Process | |
| <i>Capital Cost</i> | \$6,509,900 |
| Annual Operating and Maintenance Costs | |
| Chemicals & Reagents Delivered | \$50,600 |
| Energy Cost | \$45,000 |
| Labor Cost | \$2,000 |
| <i>Subtotal</i> | \$97,600 |
| <i>NPV of Annual O&M Costs</i> | \$1,727,000 |
| Total Net Present Cost | \$7,928,900 |

Assumptions:

- | | |
|----------------------------|------|
| 1. Life cycle, n (years): | 20 |
| 2. Annual inflation rate | 2.0% |
| 3. Discount Rate | 3.2% |
| 3. Labor cost of \$25/hour | |

$$NPV = Annual_Cost \times \left[\frac{(1+i)^n - 1}{i \times (1+i)^n} \right]$$

MBR Treatment Process Alternative
Operations and Maintenance Cost Estimate

| Description | Quantity Installed | Operating | Motor Size | Total operating | KWhrs/day (from Vendor) | Annual Energy Use | Unit Cost | Annual Electricity Cost |
|-------------------------------|--------------------|-----------|------------|-----------------|----------------------------|-------------------|-----------|-------------------------|
| | | | (HP) | (HP) | | (kWh/yr) | (\$/kWh) | (\$/yr) |
| New Mechanical Screen | 1 | 1 | 2.0 | 2.00 | 29 | 10,456 | \$0.090 | \$941 |
| Pre- Anoxic Mixing | 1 | 1 | 4.2 | 4.21 | 75 | 27,503 | \$0.090 | \$2,475 |
| Recycle Pump | 1 | 1 | 15 | 14.80 | 120 | 43,705 | \$0.090 | \$3,933 |
| Post Anoxic Mixer | 1 | 1 | 4 | 4.21 | 75 | 27,503 | \$0.090 | \$2,475 |
| Permeate Pump | 2 | 2 | 2 | 4.00 | 98 | 35,814 | \$0.090 | \$3,223 |
| MBR Blowers | 2 | 2 | 25 | 50.00 | 478 | 174,532 | \$0.090 | \$15,708 |
| Aeration Blowers | 1 | 1 | 40.0 | 40.00 | 493 | 179,941 | \$0.090 | \$16,195 |
| Total Annual Electricity Cost | | | | | | | | \$45,000 |

| Chemical Cost/ year | | |
|--|-------------------|------------------|
| Sodium Hypochlorite For 12 Cleaning Events | From Vendor calcs | \$ 146 |
| Oxalic Acid- Membrane CIP- 1/Year | | \$ 149 |
| Alum | | \$ 5,260 |
| Mico-C | | \$ 45,000 |
| Chemical Cost per year | | \$ 50,600 |

MBR Treatment Process Alternative
Net Present Value Calculations

| End of Year | O&M Costs | Present Value of O&M Costs | Short Lived Assets | Present Value of Short Lived Assets |
|--------------------------|-----------|----------------------------|--|-------------------------------------|
| 1 | \$97,600 | \$96,443 | | \$0 |
| 2 | \$97,600 | \$95,299 | | \$0 |
| 3 | \$97,600 | \$94,169 | | \$0 |
| 4 | \$97,600 | \$93,052 | | \$0 |
| 5 | \$97,600 | \$91,949 | | \$0 |
| 6 | \$97,600 | \$90,859 | | \$0 |
| 7 | \$97,600 | \$89,781 | | \$0 |
| 8 | \$97,600 | \$88,717 | | \$0 |
| 9 | \$97,600 | \$87,665 | | \$0 |
| 10 | \$97,600 | \$86,625 | \$5,000 | \$4,438 |
| 11 | \$97,600 | \$85,598 | \$13,019 | \$11,418 |
| 12 | \$97,600 | \$84,583 | \$11,572 | \$10,029 |
| 13 | \$97,600 | \$83,580 | \$10,126 | \$8,671 |
| 14 | \$97,600 | \$82,589 | \$8,679 | \$7,344 |
| 15 | \$97,600 | \$81,610 | \$153,733 | \$128,546 |
| 16 | \$97,600 | \$80,642 | | \$0 |
| 17 | \$97,600 | \$79,686 | | \$0 |
| 18 | \$97,600 | \$78,741 | | \$0 |
| 19 | \$97,600 | \$77,807 | | \$0 |
| 20 | \$97,600 | \$76,885 | | \$0 |
| Capital Costs | | \$6,509,900 | Discount Rate = 1.2% (Takes into account inflation) | |
| O&M Costs | | \$1,727,000 | | |
| Short Lived Asset | | \$171,000 | | |
| Salvage Value | | \$479,000 | | |
| NPV | | \$7,928,900 | | |

MBR Treatment Process Alternative
Net Present Value Calculations

| MBR Alternative | Life Expectancy | Replacement Cost | Salvage Value at 20 yrs |
|--------------------------------|-----------------|------------------|-------------------------|
| Short Lived Assets | | | |
| Existing Bar Screen | 15 | \$ 86,000 | \$ 21,500 |
| Exisitng Grit Pump | 15 | \$ 15,000 | \$ 3,750 |
| Exisitng Grit Classifier | 15 | \$ 35,000 | \$ 8,750 |
| New Bar Screen | 15 | \$ 86,000 | \$ 21,500 |
| EQ Tank Mixer 1 | 15 | \$ 13,800 | \$ 3,450 |
| EQ Tank Mixer 2 | 15 | \$ 13,800 | \$ 3,450 |
| Anaerobic Mixer | 15 | \$ 13,800 | \$ 3,450 |
| Anoxic Mixer (2 Duty) | 15 | \$ 27,600 | \$ 6,900 |
| Aerobic Diffusers | 10 | \$ 10,000 | \$ 5,000 |
| MBR Membrane Year 11 | 11 | \$ 28,930 | \$ 13,019 |
| MBR Membrane Year 12 | 12 | \$ 28,930 | \$ 11,572 |
| MBR Membrane Year 13 | 13 | \$ 28,930 | \$ 10,126 |
| MBR Membrane Year 14 | 14 | \$ 28,930 | \$ 8,679 |
| MBR Membrane Year 15 | 15 | \$ 28,930 | \$ 7,233 |
| Blowers (3 Duty) | 15 | \$ 240,000 | \$ 60,000 |
| IMLR/WAS Pump | 15 | \$ 15,000 | \$ 3,750 |
| Permeate Pump (2 Duty) | 15 | \$ 30,000 | \$ 7,500 |
| Chemical Skid- Alum | 15 | \$ 5,000 | \$ 1,250 |
| Chemical Skid- Carbon | 15 | \$ 5,000 | \$ 1,250 |
| Long Life Assets | | | |
| New concrete structures | 50 | \$ 674,800 | \$ 404,880 |
| Total Salvage Value | | | \$ 607,008 |
| Present Value of Salvage Costs | | | \$479,000 |

Depreciation Calcs

Depreciation Value = (Cost - Salvage Value)/Life

SL = (C-SV)/L

Then adjust to present day

APPENDIX D.2A

MBR PRELIMINARY COST ESTIMATE WITH GRT

Opinion of Probable Construction Costs

VTSV WWTF
MBR Treatment Process

| Division | Description | Quantity | Units | Cost per Unit (\$) | Installation Multiplier | Installation/Labor Cost | Cost (nearest \$100) |
|----------|--|----------|-------|--------------------|-------------------------|-------------------------|----------------------|
| 1 | GENERAL CONDITIONS | | | | | | 0 |
| | | 1 | LS | | 1.0 | | 0 |
| 2 | CIVIL / SITEWORK | | | | | | 154,300 |
| | Grade Preperation For Headworks Expansion And Flume Relocation | 1 | LS | 20,000 | 1.3 | 5000 | 25,000 |
| | Excavation Within The Existing Headworks For New Channel | 3 | CY | 10 | 1.3 | 9 | 100 |
| | Excavation For Concrete Tanks (An, Ax, Ox) | 850 | CY | 11 | 1.3 | 2805 | 12,200 |
| | Yard Piping Excavation, Installation. Material, Bedding, Compacting | 1 | LS | 35,000 | 1.3 | 10500 | 45,500 |
| | Grade Preperation For New Carport On South Side Of Existing Building | 1 | LS | 20,000 | 1.3 | 6000 | 26,000 |
| | New Retaining Wall Next To The Car Port | 1 | LS | 20,000 | 1.3 | 6000 | 26,000 |
| | New Concrete Pad For New Generator On West Side Of Existing Building | 1 | LS | 5,000 | 1.3 | 1500 | 6,500 |
| | Grade Preperation For Extension Of Existing Building To West Side | 1 | LS | 10,000 | 1.3 | 3000 | 13,000 |
| 3 | CONCRETE | | | | | | 674,800 |
| | New Tanks | 200 | CY | 900.00 | 1.1 | 39600 | 198,000 |
| | Existing Aeration Tank Retrofit With Walls | 9 | CY | 800.00 | 1.1 | 1500 | 7,500 |
| | Misc. Concrete For Headworks Retrofit | 10 | CY | 800.00 | 1.1 | 1760 | 8,800 |
| | Misc. Concrete For Clarifier Base Slab Levelling | 5 | CY | 800.00 | 1.1 | 880 | 4,400 |
| | Concrete For Basins Top Slab | 78 | CY | 900.00 | 1.1 | 15460 | 77,300 |
| | New Slab On West Side For Building Expansion | 21 | CY | 800.00 | 1.1 | 3700 | 18,500 |
| | Pad For Generator | 13 | CY | 800.00 | 1.1 | 2300 | 11,500 |
| | Misc. Concrete | 15 | CY | 800.00 | 1.1 | 2640 | 13,200 |
| | Precast Insulated Wall | 6100 | SF | 34.00 | 1.1 | 45640 | 228,200 |
| | Precast Double Tee Roof | 6100 | SF | 16.00 | 1.1 | 21480 | 107,400 |
| 4 | MASONRY | | | | | | 25,800 |
| | Misc. Masonary Wall Interior Of Building | 1 | LS | 19,800.00 | 1.3 | 5940 | 25,800 |
| 5 | METALS | | | | | | 14,100 |
| | Hand Rails, Misc Metal Grating | 1 | LS | 10,800.00 | 1.3 | 3240 | 14,100 |
| 6 | WOOD AND PLASTIC | | | | | | 0 |
| 7 | THERMAL & MOISTURE PROTECTION | | | | | | 0 |
| 8 | DOORS & WINDOWS | | | | | | 27,500 |
| | 2- Garage Doors | 1 | LS | 10,000.00 | 1.1 | 1000 | 11,000 |
| | 2- Double Doors | 1 | LS | 7,000.00 | 1.1 | 700 | 7,700 |
| | 4- Single Door | 1 | LS | 8,000.00 | 1.1 | 800 | 8,800 |
| 9 | FINISHES | | | | | | 20,000 |
| | Paints On Door And Frames, Exposed Piping, Bollards | 1 | LS | 20,000.00 | 1.0 | 4000 | 20,000 |
| 10 | SPECIALITIES | | | | | | 6,900 |
| | Fire Extinguishers | 1 | LS | 2,350.00 | 1.1 | 235 | 2,600 |
| | Bathroom Accessories | 1 | LS | 3,850.00 | 1.1 | 385 | 4,300 |
| 11 | EQUIPMENT | | | | | | 1,598,100 |
| | MBR Vendor Quote | 1 | LS | 1,097,000 | 1.3 | 329100 | 1,426,100 |
| | Headworks New Fine Screen | 1 | EA | 86,900 | 1.3 | 21725 | 108,700 |
| | UV Disinfection | 2 | EA | 21,120 | 1.2 | 8448 | 50,700 |
| | Chemical Storage Tank- Pacl | 1 | EA | 5,940 | 1.1 | 594 | 6,600 |
| | Chemical Storage Tank- Micro-C | 1 | EA | 5,395 | 1.1 | 540 | 6,000 |

MBR Treatment Process Alternative Opinion Of Probable Construction Cost

| | | | | | | | |
|-----------|---|-------|---------------------|------------|-------------------|--------|------------------|
| 12 | FURNISHINGS | | | | | | 6,500 |
| | Lab, Operations Room | 1 | LS | 5,000.00 | 1.3 | 1500 | 6,500 |
| 13 | SPECIAL CONSTRUCTION | | | | | | 0 |
| 14 | HOISTS AND CRANES | | | | | | 19,500 |
| | Mono Rail And Hoist For Moving Of Membrane Cassettes | 1 | LS | 15,000.00 | 1.3 | 4500 | 19,500 |
| 15 | MECHANICAL / HVAC | | | | | | 174,800 |
| | Process Piping | 1 | LS | 47,400.00 | 1.3 | 14220 | 61,700 |
| | HVAC | 1 | LS | 87,000.00 | 1.3 | 26100 | 113,100 |
| 16 | ELECTRICAL and INSTRUMENTATION & CONTROLS | | | | | | 682,500 |
| | New Scada System, Mcc, Misc.Electrical Connection, Controls | 1 | LS | 500,000.00 | 1.3 | 150000 | 650,000 |
| | New Generator | 1 | LS | 25,000.00 | 1.3 | 7500 | 32,500 |
| | LABOR COST (Division 2- Division16) | | | | | 750301 | |
| | | | | | SUBTOTAL 1 | | 3,404,800 |
| | CONSTRUCTION PRORATES(See Note 1) | 18.0% | of Subtotal 1 | 612,864 | | | 612,900 |
| | CONTRACTOR'S OVERHEAD & PROFIT (See Note 2) | 15.0% | of Subtotal 1 | 510,720 | | | 510,800 |
| | | | | | SUBTOTAL 2 | | 4,528,500 |
| | CONTINGENCY (See Note 4) | 25.0% | of Subtotal 2 | 1,132,125 | | | 1,132,200 |
| | | | | | SUBTOTAL 3 | | 5,660,700 |
| | ENGINEERING COSTS | 15.0% | of Subtotal 3 | 849,105 | | | 849,200 |
| | | | | | | | |
| | | | Of Engineering Cost | 73,800 | | | 73,800 |
| | GROSS RECEIPTS TAX | 8.69% | Of labor cost | 65,200 | | | 65,200 |
| | | | | | TOTAL | | 6,648,900 |

Notes

- | | | |
|-----|---|--------------|
| 1 | <u>Construction Prorates</u> ^(a) ^(b) | <u>18%</u> |
| (a) | General conditions includes cost associated with permits, licenses, insurance, environmental safe guards, sediment and drainage control, and special construction practices to maintain continued plant operations. Also includes misc construction materials needed for project not included above | |
| 2 | <u>Contractor's Overhead & Profit</u> ^(a) | <u>15.0%</u> |
| (a) | Contractor's overhead and profit include costs for mobilization/demobilization, administration, and contractor/subcontractor overhead costs and profits. | |
| 4 | <u>Design Contingency</u> ^(a) | <u>25.0%</u> |
| (a) | The design contingency is added to the subtotal based on the conceptual nature of information developed for this evaluation. | |
| 5 | <u>Engineering Costs</u> | <u>15.0%</u> |
| | Costs incurred during Final Design and Construction | |

MBR Treatment Process Alternative
Net Present Value Summary

| |
|--------------------------------|
| 20-Year Present Value Analysis |
|--------------------------------|

| Capital Costs | |
|--|--------------------|
| MBR Process | |
| <i>Capital Cost</i> | \$6,648,900 |
| Annual Operating and Maintenance Costs | |
| Chemicals & Reagents Delivered | \$50,600 |
| Energy Cost | \$45,000 |
| Labor Cost | \$2,000 |
| <i>Subtotal</i> | \$97,600 |
| <i>NPV of Annual O&M Costs</i> | \$1,727,000 |
| Total Net Present Cost | \$8,067,900 |

Assumptions:

- | | |
|----------------------------|------|
| 1. Life cycle, n (years): | 20 |
| 2. Annual inflation rate | 2.0% |
| 3. Discount Rate | 3.2% |
| 3. Labor cost of \$25/hour | |

$$NPV = Annual_Cost \times \left[\frac{(1+i)^n - 1}{i \times (1+i)^n} \right]$$

MBR Treatment Process Alternative
Operations and Maintenance Cost Estimate

| Description | Quantity Installed | Operating | Motor Size (HP) | Total operating (HP) | KWhrs/day (from Vendor) | Annual Energy Use (kWh/yr) | Unit Cost (\$/kWh) | Annual Electricity Cost (\$/yr) |
|-------------------------------|--------------------|-----------|--------------------|-------------------------|-------------------------|-------------------------------|-----------------------|------------------------------------|
| | | | | | | | | |
| New Mechanical Screen | 1 | 1 | 2.0 | 2.00 | 29 | 10,456 | \$0.090 | \$941 |
| Pre- Anoxic Mixing | 1 | 1 | 4.2 | 4.21 | 75 | 27,503 | \$0.090 | \$2,475 |
| Recycle Pump | 1 | 1 | 15 | 14.80 | 120 | 43,705 | \$0.090 | \$3,933 |
| Post Anoxic Mixer | 1 | 1 | 4 | 4.21 | 75 | 27,503 | \$0.090 | \$2,475 |
| Permeate Pump | 2 | 2 | 2 | 4.00 | 98 | 35,814 | \$0.090 | \$3,223 |
| MBR Blowers | 2 | 2 | 25 | 50.00 | 478 | 174,532 | \$0.090 | \$15,708 |
| Aeration Blowers | 1 | 1 | 40.0 | 40.00 | 493 | 179,941 | \$0.090 | \$16,195 |
| Total Annual Electricity Cost | | | | | | | \$45,000 | |

| Chemical Cost/ year | | | |
|--|-------------------|----|--------|
| Sodium Hypochlorite For 12 Cleaning Events | From Vendor calcs | \$ | 146 |
| | | \$ | 149 |
| Oxalic Acid- Membrane CIP- 1/Year | | \$ | 5,260 |
| Alum | | \$ | 45,000 |
| Mico-C | | \$ | |
| Chemical Cost per year | | \$ | 50,600 |

MBR Treatment Process Alternative
Net Present Value Calculations

| End of Year | O&M Costs | Present Value of O&M Costs | Short Lived Assets | Present Value of Short Lived Assets |
|--------------------------|-----------|----------------------------|--|-------------------------------------|
| 1 | \$97,600 | \$96,443 | | \$0 |
| 2 | \$97,600 | \$95,299 | | \$0 |
| 3 | \$97,600 | \$94,169 | | \$0 |
| 4 | \$97,600 | \$93,052 | | \$0 |
| 5 | \$97,600 | \$91,949 | | \$0 |
| 6 | \$97,600 | \$90,859 | | \$0 |
| 7 | \$97,600 | \$89,781 | | \$0 |
| 8 | \$97,600 | \$88,717 | | \$0 |
| 9 | \$97,600 | \$87,665 | | \$0 |
| 10 | \$97,600 | \$86,625 | \$5,000 | \$4,438 |
| 11 | \$97,600 | \$85,598 | \$13,019 | \$11,418 |
| 12 | \$97,600 | \$84,583 | \$11,572 | \$10,029 |
| 13 | \$97,600 | \$83,580 | \$10,126 | \$8,671 |
| 14 | \$97,600 | \$82,589 | \$8,679 | \$7,344 |
| 15 | \$97,600 | \$81,610 | \$153,733 | \$128,546 |
| 16 | \$97,600 | \$80,642 | | \$0 |
| 17 | \$97,600 | \$79,686 | | \$0 |
| 18 | \$97,600 | \$78,741 | | \$0 |
| 19 | \$97,600 | \$77,807 | | \$0 |
| 20 | \$97,600 | \$76,885 | | \$0 |
| Capital Costs | | \$6,648,900 | Discount Rate = 1.2% (Takes into account inflation) | |
| O&M Costs | | \$1,727,000 | | |
| Short Lived Asset | | \$171,000 | | |
| Salvage Value | | \$479,000 | | |
| NPV | | \$8,067,900 | | |

MBR Treatment Process Alternative
Net Present Value Calculations

| MBR Alternative | Life Expectancy | Replacement Cost | Salvage Value at 20 yrs |
|--------------------------------|-----------------|------------------|-------------------------|
| Short Lived Assets | | | |
| Existing Bar Screen | 15 | \$ 86,000 | \$ 21,500 |
| Exisitng Grit Pump | 15 | \$ 15,000 | \$ 3,750 |
| Exisitng Grit Classifier | 15 | \$ 35,000 | \$ 8,750 |
| New Bar Screen | 15 | \$ 86,000 | \$ 21,500 |
| EQ Tank Mixer 1 | 15 | \$ 13,800 | \$ 3,450 |
| EQ Tank Mixer 2 | 15 | \$ 13,800 | \$ 3,450 |
| Anaerobic Mixer | 15 | \$ 13,800 | \$ 3,450 |
| Anoxic Mixer (2 Duty) | 15 | \$ 27,600 | \$ 6,900 |
| Aerobic Diffusers | 10 | \$ 10,000 | \$ 5,000 |
| MBR Membrane Year 11 | 11 | \$ 28,930 | \$ 13,019 |
| MBR Membrane Year 12 | 12 | \$ 28,930 | \$ 11,572 |
| MBR Membrane Year 13 | 13 | \$ 28,930 | \$ 10,126 |
| MBR Membrane Year 14 | 14 | \$ 28,930 | \$ 8,679 |
| MBR Membrane Year 15 | 15 | \$ 28,930 | \$ 7,233 |
| Blowers (3 Duty) | 15 | \$ 240,000 | \$ 60,000 |
| IMLR/WAS Pump | 15 | \$ 15,000 | \$ 3,750 |
| Permeate Pump (2 Duty) | 15 | \$ 30,000 | \$ 7,500 |
| Chemical Skid- Alum | 15 | \$ 5,000 | \$ 1,250 |
| Chemical Skid- Carbon | 15 | \$ 5,000 | \$ 1,250 |
| Long Life Assets | | | |
| New concrete structures | 50 | \$ 674,800 | \$ 404,880 |
| Total Salvage Value | | | \$ 607,008 |
| Present Value of Salvage Costs | | | \$479,000 |

Depreciation Calcs

Depreciation Value = (Cost - Salvage Value)/Life

SL = (C-SV)/L

Then adjust to present day

APPENDIX D.3
SBR PRELIMINARY COST ESTIMATE

Opinion of Probable Construction Costs

VTSV WWTF
SBR Treatment Process

| Division | Description | Quantity | Units | Cost per Unit (\$) | Installation Multiplier | Cost (Nearest \$100) |
|-----------|--|----------|-------|--------------------|-------------------------|----------------------|
| 1 | GENERAL CONDITIONS | | | | | 0 |
| | | 1 | LS | | 1.0 | 0 |
| 2 | CIVIL / SITEWORK | | | | | 172,300 |
| | Excavation For New Basins | 3240 | BCY | 3 | 1.3 | 12,200 |
| | Hauling Of Excavation | 4050 | CY | 9 | 1.3 | 43,100 |
| | Cost For Misc Yard Piping | 1 | LS | 30,000 | 1.3 | 39,000 |
| | Removing Of Existing Steel Eq | 1 | LS | 15,000 | 1.3 | 19,500 |
| | Grade Preperation For New Carport On South Side Of Existing Building | 1 | LS | 20,000 | 1.3 | 26,000 |
| | New Retaining Wall Next To The Car Port | 1 | LS | 20,000 | 1.3 | 26,000 |
| | New Concrete Pad For New Generator On West Side Of Existing Building | 1 | LS | 5,000 | 1.3 | 6,500 |
| 3 | CONCRETE | | | | | 1,177,800 |
| | Total Cost For Sbr Tank | 800 | CY | 900.00 | 1.1 | 792,000 |
| | Misc. Concrete | 10 | CY | 800.00 | 1.1 | 8,800 |
| | Retrofit To Existing Aeration Tank | 9 | CY | 800.00 | 1.1 | 8,000 |
| | Pad For Generator | 13 | CY | 800.00 | 1.1 | 11,500 |
| | Precast Insulated Wall | 6500 | SF | 34.00 | 1.1 | 243,100 |
| | Precast Double Tee Roof | 6500 | SF | 16.00 | 1.1 | 114,400 |
| 4 | MASONRY | | | | | 25,800 |
| | Misc. Masonary Wall Interior Of Building | 1 | LS | 19,800.00 | 1.3 | 25,800 |
| 5 | METALS | | | | | 14,100 |
| | Hand Rails, Misc Metal Grating | 1 | LS | 10,800.00 | 1.3 | 14,100 |
| 6 | WOOD AND PLASTIC | | | | | 0 |
| 7 | THERMAL & MOISTURE PROTECTION | | | | | 3,200 |
| | Misc. Sealants | 1 | LS | 2,400.00 | 1.3 | 3,200 |
| 8 | DOORS & WINDOWS | | | | | 32,500 |
| | 2- Garage Doors | 1 | LS | 10,000.00 | 1.3 | 13,000 |
| | 2- Double Doors | 1 | LS | 7,000.00 | 1.3 | 9,100 |
| | 4- Single Door | 1 | LS | 8,000.00 | 1.3 | 10,400 |
| 9 | FINISHES | | | | | 26,000 |
| | Paints On Door And Frames, Exposed Piping | 1 | LS | 20,000.00 | 1.3 | 26,000 |
| 10 | SPECIALITIES | | | | | 8,200 |
| | Fire Extinguishers | 1 | LS | 2,350.00 | 1.3 | 3,100 |
| | Bathroom Accessories | 1 | LS | 3,850.00 | 1.3 | 5,100 |
| 11 | EQUIPMENT | | | | | 1,365,500 |
| | SBR Vendor Quote | 1 | LS | 490,500 | 1.3 | 637,700 |
| | Effluent Equilization Tank | 2 | EA | 15,000 | 1.3 | 39,000 |
| | Teritary Filters For P-Removal And Denite | 1 | LS | 450,000 | 1.3 | 585,000 |
| | Cost For Carbon Chemical Skid | 1 | LS | 5,000 | 1.3 | 6,500 |
| | UV Disinfection | 3 | EA | 21,120 | 1.3 | 82,400 |
| | Chemical Storage Tank- PACI | 1 | EA | 5,940 | 1.3 | 7,800 |
| | Chemical Storage Tank- Micro-C | 1 | EA | 5,395 | 1.3 | 7,100 |

SBR Treatment Process Alternative
Opinion Of Provavle Construction Cost

| | | | | | | |
|-------------------|---|-------|---------------|------------|-----|------------------|
| 12 | FURNISHINGS | | | | | 6,500 |
| | Lab, Operations Room | 1 | LS | 5,000.00 | 1.3 | 6,500 |
| 13 | SPECIAL CONSTRUCTION | | | | | 0 |
| 14 | HOISTS AND CRANES | | | | | 0 |
| 15 | MECHANICAL / HVAC | | | | | 174,800 |
| | Process Piping | 1 | LS | 47,400.00 | 1.3 | 61,700 |
| | HVAC | 1 | LS | 87,000.00 | 1.3 | 113,100 |
| 16 | ELECTRICAL and INSTRUMENTATION & CONTROLS | | | | | 682,500 |
| | New Scada System, Mcc, Misc.Electrical Connection, Controls | 1 | LS | 650,000.00 | 1.0 | 650,000 |
| | New Generator | 1 | LS | 25,000.00 | 1.3 | 32,500 |
| SUBTOTAL 1 | | | | | | 3,689,200 |
| | CONSTRUCTION PRORATES(See Note 1) | 18.0% | of Subtotal 1 | 664,056 | 1.0 | 664,100 |
| | CONTRACTOR'S OVERHEAD & PROFIT (See Note 2) | 15.0% | of Subtotal 1 | 553,380 | 1.0 | 553,400 |
| SUBTOTAL 2 | | | | | | 4,906,700 |
| | CONTINGENCY (See Note 4) | 25.0% | of Subtotal 2 | 1,226,675 | 1.0 | 1,226,700 |
| SUBTOTAL 3 | | | | | | 6,133,400 |
| | ENGINEERING COSTS | 15.0% | of Subtotal 3 | 920,010 | 1.0 | 920,100 |
| TOTAL | | | | | | 7,053,500 |

Notes

- 1

Construction Prorates^{(a) (b)}

18%
- (a)

General conditions includes cost associated with permits, licenses, insurance, environmental safe guards, sediment and drainage control, and special construction practices to maintain continued plant operations. Also includes misc construction materials needed for proiect not included above.
- 2

Contractor's Overhead & Profit^(a)

15.0%
- (a)

Contractor's overhead and profit include costs for mobilization/demobilization, administration, and contractor/subcontractor overhead costs and profits.
- 4

Design Contingency^(a)

25.0%
- (a)

The design continency is added to the subtotal based on the conceptual nature of information developed for this evaluation.
- 5

Engineering Costs

15.0%
- Costs incurred during Final Design and Construction.

SBR Treatment Process Alternative
Net Present Value Summary

| |
|--------------------------------|
| 20-Year Present Value Analysis |
|--------------------------------|

| Capital Costs | |
|--|--------------------|
| SBR | |
| <i>Capital Cost</i> | \$7,053,500 |
| | |
| Annual Operating and Maintenance Costs | |
| Chemicals & Reagents Delivered | \$58,500 |
| Energy Cost | \$46,900 |
| Labor | \$1,700 |
| <i>Subtotal</i> | <i>\$107,100</i> |
| <i>NPV of Annual O&M Costs</i> | <i>\$1,895,000</i> |
| Total Net Present Cost | \$8,387,500 |

Assumptions:

- | | |
|----------------------------|------|
| 1. Life cycle, n (years): | 20 |
| 2. Annual inflation rate | 2.0% |
| 3. Discount Rate | 3.2% |
| 3. Labor cost of \$25/hour | |

$$NPV = Annual_Cost \times \left[\frac{(1+i)^n - 1}{i \times (1+i)^n} \right]$$

SBR Treatment Process Alternative
Operations and Maintenance Cost Estimate

| Description | Quantity Installed | Operating | Motor Size (HP) | Total operating (HP) | Operating Load ⁽¹⁾ | kW | KWhrs/day | Annual Energy Use | | Unit Cost (\$/kWh) | Annual Electricity Cost (\$/yr) |
|---------------------|-----------------------|-----------|--------------------|----------------------------|----------------------------------|------|-----------|-------------------------------|--|-----------------------|---------------------------------------|
| | | | | | | | | (kWh/yr) | | | |
| Decanter Drive Unit | 2 | 2 | 0.25 | 0.50 | 0.40 | 0.1 | 2 | 548 | | \$0.090 | \$49 |
| Anoxic Mixers | 2 | 2 | 11 | 22.00 | 17.60 | 3.3 | 79 | 28,762 | | \$0.090 | \$2,589 |
| Waste Sludge Pump | 2 | 2 | 2.4 | 4.80 | 3.84 | 0.1 | 3 | 1,168 | | \$0.090 | \$105 |
| Effluent EQ Pump | 2 | 2 | 2 | 4.00 | 3.20 | 2.4 | 7 | 2,614 | | \$0.090 | \$235 |
| Tertiary Filters | | | --- | | | 3.7 | 89 | 32,412 | | \$0.090 | \$2,917 |
| IMLR Wall Pump | 2 | 2 | 1.5 | 3.00 | 2.40 | 1.8 | 43 | 15,684 | | \$0.090 | \$1,412 |
| Aeration Blowers | 2 | 2 | 75.0 | 150.00 | 120.00 | 50.2 | 1204.3 | 439,570 | | \$0.090 | \$39,561 |
| | | | | | | | | Total Annual Electricity Cost | | | \$46,900 |

(1) Operating load based on 80% of total operating HP to account for motor inefficiencies and correction for elevation.

| Chemical Cost/ year | | | |
|------------------------|--|-------------------|-----------|
| Ferric cost | | From Vendor calcs | \$ 13,500 |
| | | | |
| Mico-C | | | \$ 45,000 |
| Chemical Cost per year | | | \$ 58,500 |

SBR Treatment Process Alternative
Net Present Value Calculations

| End of Year | O&M Costs | Present Value of O&M Costs | Short Lived Assets | Present Value of Short Lived Assets |
|--------------------------|-----------|----------------------------|--|-------------------------------------|
| 1 | \$107,100 | \$105,830 | | \$0 |
| 2 | \$107,100 | \$104,575 | | \$0 |
| 3 | \$107,100 | \$103,335 | | \$0 |
| 4 | \$107,100 | \$102,110 | | \$0 |
| 5 | \$107,100 | \$100,899 | | \$0 |
| 6 | \$107,100 | \$99,703 | | \$0 |
| 7 | \$107,100 | \$98,520 | | \$0 |
| 8 | \$107,100 | \$97,352 | | \$0 |
| 9 | \$107,100 | \$96,198 | | \$0 |
| 10 | \$107,100 | \$95,057 | \$5,000 | \$4,102 |
| 11 | \$107,100 | \$93,930 | | \$0 |
| 12 | \$107,100 | \$92,816 | | \$0 |
| 13 | \$107,100 | \$91,716 | | \$0 |
| 14 | \$107,100 | \$90,628 | | \$0 |
| 15 | \$107,100 | \$89,553 | \$107,800 | \$80,097 |
| 16 | \$107,100 | \$88,491 | | \$0 |
| 17 | \$107,100 | \$87,442 | | \$0 |
| 18 | \$107,100 | \$86,405 | | \$0 |
| 19 | \$107,100 | \$85,381 | | \$0 |
| 20 | \$107,100 | \$84,368 | | \$0 |
| Capital Costs | | \$7,053,500 | Discount Rate = 1.2% (Takes into account inflation) | |
| O&M Costs | | \$1,895,000 | | |
| Short Lived Asset | | \$85,000 | | |
| Salvage Value | | \$646,000 | | |
| NPV | | \$8,387,500 | | |

SBR Treatment Process Alternative
Net Present Value Calculations

| SBR Alternative | Life Expectancy | Replacement Cost | Salvage Value at 20 yrs |
|-------------------------------------|-----------------|------------------|-------------------------|
| Short Lived Assets | | | |
| Existing Bar Screen | 15 | \$ 86,000 | \$ 21,500 |
| Existing Grit Pump | 15 | \$ 15,000 | \$ 3,750 |
| Existing Grit Classifier | 15 | \$ 35,000 | \$ 8,750 |
| EQ tank Mixer 1 | 15 | \$ 13,800 | \$ 3,450 |
| EQ tank Mixer 2 | 15 | \$ 13,800 | \$ 3,450 |
| Submersible Mixer (2 duty) | 15 | \$ 27,600 | \$ 6,900 |
| Aerobic Diffusers | 10 | \$ 10,000 | \$ 5,000 |
| Blowers (2 duty) | 15 | \$ 160,000 | \$ 40,000 |
| IMLR/WAS Pump (2 duty) | 15 | \$ 30,000 | \$ 7,500 |
| Effluent Equalization Pump (2 duty) | 15 | \$ 30,000 | \$ 7,500 |
| Tertiary Filter- Polymer Pump | 15 | \$ 5,000 | \$ 1,250 |
| Tertiary Filter- Ferric Pump | 15 | \$ 5,000 | \$ 1,250 |
| Chemical Skid- Alum | 15 | \$ 5,000 | \$ 1,250 |
| Chemical Skid- Carbon | 15 | \$ 5,000 | \$ 1,250 |
| Long Life Assets | | | |
| New Concrete structures | 50 | \$ 1,177,800 | \$ 706,680 |
| Total Salvage Value | | | \$ 819,480 |
| Present Value of Salvage Costs | | | \$ 646,000 |

Depreciation Calcs

Depreciation Value = (Cost - Salvage Value)/Life

SL = (C-SV)/L

Then adjust to present day