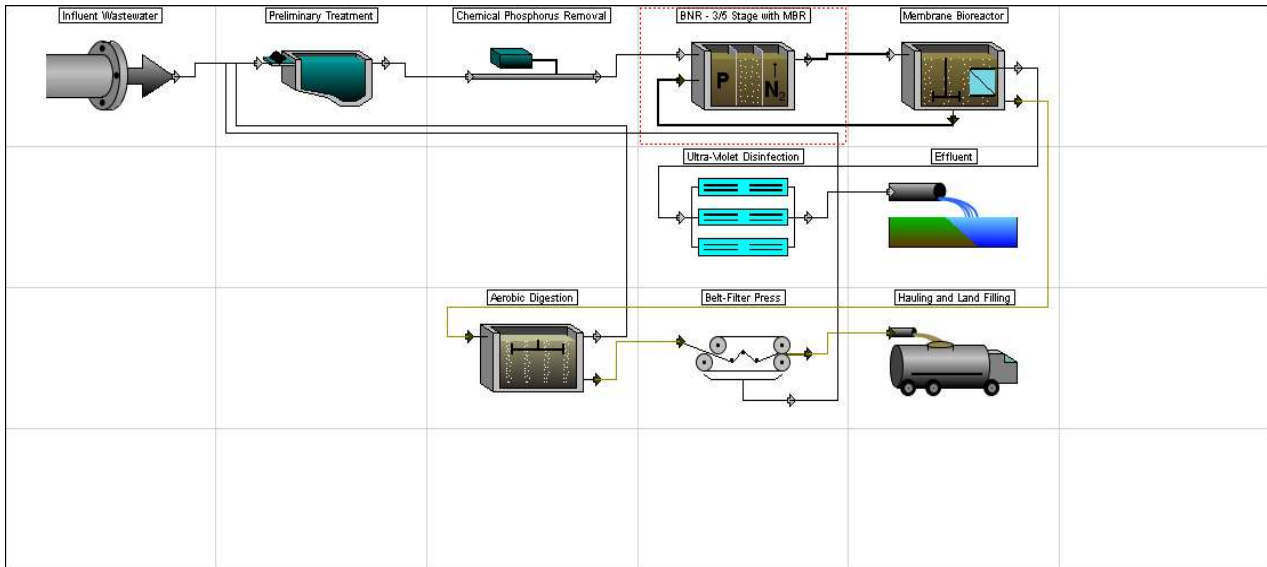


**Layout - Jordanelle SSD**



**Summary**

**Equipment Database**

Hydromantis 2014,(USA Avg)

**Layout Summary**

Description	Value	Units
<b>CONSTRUCTION COSTS</b>		
Unit process construction cost:	\$7,670,000	\$
Other direct construction costs	\$2,110,000	\$
Other indirect construction costs	\$7,420,000	\$
<b>Total construction costs</b>	<b>\$17,200,000</b>	<b>\$</b>

**ANNUAL COSTS**

**LABOR COSTS**

Administration labor cost	\$18,000	\$/yr
Laboratory labor cost	\$126,000	\$/yr
Unit process operation labor cost	\$502,000	\$/yr
Unit process maintenance labor cost	\$221,000	\$/yr
<b>Total labor costs</b>	<b>\$867,000</b>	<b>\$/yr</b>

**MATERIAL COSTS**

Total material cost	\$188,000	\$/yr
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**CHEMICAL COSTS**

Total chemical cost	\$145,000	\$/yr
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**ENERGY COSTS**

Total energy cost	\$191,000	\$/yr
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Total operation and maintenance	\$1,390,000	\$/yr
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**CONSTRUCTION COST AMC**

Amortization cost for total construction	\$1,630,000	\$/yr
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<b>Total annual project cost</b>	<b>\$3,020,000</b>	<b>\$/yr</b>
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**PROJECT SUMMARY**

Present worth	\$36,200,000	\$
Total project cost	\$17,200,000	\$
Total operation labor cost	\$646,000	\$/yr
Total maintenance labor cost	\$221,000	\$/yr
Total material cost	\$188,000	\$/yr
Total chemical cost	\$145,000	\$/yr
Total energy cost	\$191,000	\$/yr
Total amortization cost	\$1,630,000	\$/yr

**Process Summary**

Process	Construction (\$)	Operation (\$/yr)	Maintenance (\$/yr)	Material (\$/yr)	Chemical (\$/yr)	Energy (\$/yr)	Amortization (\$/yr)
Preliminary Treatment	318000	31200	14200	7950	0	1620	26700
Chemical Phosphorus Removal	0	0	0	0	119000	0	0
Aerobic Digestion	538000	58300	23100	49200	0	38100	47600
BNR - 3/5 Stage with MBR	1620000	172000	87200	42100	0	82800	151000

Ultra-Violet Disinfection	358000	0	3730	3580	1250	8940	30300
Belt-Filter Press	812000	2850	573	0	9430	1850	74300
Membrane Bioreactor	2770000	194000	92500	26900	15600	57500	371000
Effluent	0	0	0	0	0	0	0
Hauling and Land Filling	303000	4160	0	53600	0	0	63000
Blower System	723000	0	0	0	0	0	60600
Alum Feed System	235000	39100	0	4710	0	0	19700
Other Costs	9530000	144000	0	0	0	0	781000

#### Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	11	acre
Administration labor hours	349	hr/yr
Laboratory labor hours	2450	hr/yr
Costs		
DIRECT COSTS		
Mobilization	184000	\$
Site preparation	322000	\$
Site electrical	484000	\$
Yard piping	333000	\$
Instrumentation and control	225000	\$
Lab and administration building	559000	\$
Total direct construction costs	2110000	\$
INDIRECT COSTS		
Cost of land	220000	\$
Miscellaneous cost	562000	\$
Legal cost	225000	\$
Engineering design fee	1690000	\$
Inspection cost	225000	\$
Contingency	1120000	\$
Technical	225000	\$
Interest during construction	1690000	\$
Profit	1470000	\$
Total indirect construction cost	7420000	\$
Total of other construction costs	9530000	\$
LABOR COSTS		
Administration labor cost	18000	\$/yr
Laboratory labor cost	126000	\$/yr

#### Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	7060	scfm
Safety factor	1.5	
Requested air flow capacity	10600	scfm
Total capacity of blowers	10600	scfm
Number of blowers in use	2	
Total number of blowers	3	
Capacity of individual blowers	5290	scfm
Estimated cost of an installed blower	167000	\$
Blower building area	1370	sqft
Costs		
Construction and equipment cost	723000	\$
Installed Blower Cost	500000	\$
Building Cost	151000	\$
Misc Costs	71600	\$
Operational labor cost	0	\$/yr
Maintenance labor cost	0	\$/yr
Material and supply cost	0	\$/yr
Chemical cost	0	\$/yr
Energy cost	0	\$/yr
Amortization cost	60600	\$/yr
Notes		

Energy costs are shown at the individual unit processes that require air

#### Summary of Chemical Feed System for Alum

Description	Value	Units
Alum Solution Feed System		
Design Information		
Alum dosage rate as Al <sub>2</sub> (SO <sub>4</sub> )	1210	lb/d
Alum dosage rate as equivalent	110	lb/d
Liquid chemical solution fed	225	gpd(US)
Operation labor required	759	pers-hrs/yr
Costs		
Construction and equipment cost	235000	\$
Operational labor cost	39100	\$/yr

Maintenance labor cost	0 \$/yr
Material and supply cost	4710 \$/yr
Chemical cost	0 \$/yr
Energy cost	0 \$/yr
Amortization cost	19700 \$/yr

### Influent Wastewater

#### Preliminary Treatment

##### Design Output Data

Description	Value	Units
Preliminary Treatment		
Design Information		
Mechanically Cleaned Bar Screen		
Bar size	0.2	in
Bar spacing	0.25	in
Slope of bars from horizontal	30	degrees
Head loss through screen	1.12	ft
Approach velocity	2.5	ft/s
Average flow through velocity (	2.5	ft/s
Maximum flow through velocity	3	ft/s
Screen channel width	0.632	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	4.66	cuft/s
Average flow	1.58	cuft/s
Minimum flow	0.502	cuft/s
Temperature	10.3	deg C
Maximum flow through velocity	1.5	ft/s
Average flow through velocity (	1	ft/s
Size of smallest particle 100%	0.2	mm
Specific gravity of particle	2.65	
Number of units	2	
Maximum flow/unit	2.33	cuft/s
Width of channel	0.388	ft
Depth of channel	4	ft
Length of channel	143	ft
Settling velocity of particle	0.0712	ft/s
Slope of channel bottom	0.00555	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.59	min
Volume of grit	4.1	cuft/d
Costs		
Construction and equipment cost	318000	\$
Operational labor cost	31200	\$/yr
Maintenance labor cost	14200	\$/yr
Material and supply cost	7950	\$/yr
Chemical cost	0	\$/yr
Energy cost	1620	\$/yr
Amortization cost	26700	\$/yr

### Chemical Phosphorus Removal

#### Design Output Data

Description	Value	Units
Chemical Phosphorus Removal		
Design Information		
Chemical used	Equivalent Aluminum	
Chemical dosage	12.8	g/m3
Mass of chemical per year	18200	kg/yr
Chemical sludge production	69.9	g/m3
Organic sludge production	7.06	g/m3
Costs		
Construction and equipment cost	0	\$
Operational labor cost	0	\$/yr
Maintenance labor cost	0	\$/yr
Material and supply cost	0	\$/yr
Chemical cost	119000	\$/yr
Energy cost	0	\$/yr
Amortization cost	0	\$/yr

### Aerobic Digestion

#### Design Output Data

Description	Value	Units
Aerobic Digestion		
Design Information		
Solids retention time	27.8	d
Design SS	12000	mg/L
Calculated VSS	3930	mg/L
Calculated VSS:TSS ratio	0.327	mg VSS/mg SS
Total volume of reactors	1830	m3
Length of parallel train	19	m
Width of parallel train	10	m

Sidewater depth	5 m
Number of batteries	1
Number of parallel trains per b	2
Oxygen requirement to meet a	438 kg/d
Air flow required to meet avera	2420 N m3/hr
Design air flow	22 N m3/min/1000 m3
Volatile solids loading	0.0195 lb/(cuft-d)
Solids accumulated	1740 lb/d
Digester capacity	48500 lb
Volume of wasted sludge	221000 gal(US)
Quantities	
Operation labor required	1130 pers-hrs/yr
Maintenance labor required	558 pers-hrs/yr
Electrical energy required	381000 kWh/yr
Volume of earthwork required	46100 cuft
Volume of slab concrete requir	10000 cuft
Volume of wall concrete requir	7500 cuft
Handrail length	205 ft
Number of diffusers per train	62
Number of swing arm headers	3
Costs	
Construction and equipment co	538000 \$
Earthwork Cost	13700 \$
Wall Concrete Cost	180000 \$
Slab Concrete Cost	130000 \$
Handrail Cost	15400 \$
Installed Aerator Equipment	124000 \$
Air Piping Cost	21000 \$
Misc Costs	53300 \$
Operational labor cost	58300 \$/yr
Maintenance labor cost	23100 \$/yr
Material and supply cost	49200 \$/yr
Chemical cost	0 \$/yr
Energy cost	38100 \$/yr
Amortization cost	47600 \$/yr

### BNR - 3/5 Stage with MBR

#### Design Output Data

Description	Value	Units
BNR System for BIO-P and N Removal		
Design Information		
3-Stage Biological Phosphorus		
Design aerobic SRT for nitrifica	12.5 d	
Total reactor SRT	25 d	
Design SS	9000 mg/L	
Calculated VSS	4030 mg/L	
Calculated VSS:TSS ratio	0.448 mg VSS/mg SS	
Total volume of anaerobic reac	-64.7 m3	
Total volume of anoxic reactor	1810 m3	
Total volume of aerobic reacto	1750 m3	
Total volume of all reactors	3490 m3	
Width of parallel train	10 m	
Sidewater depth	5 m	
Number of batteries	1	
Number of parallel trains per b	2	
Number of anoxic cells within c	2	
Number of aerobic cells within	1	
Anaerobic hydraulic retention ti	-0.4 hr	
Anoxic hydraulic retention time	11.2 hr	
Aerobic hydraulic retention tim	10.8 hr	
Amount of sludge generated	1260 kg/d	
Sludge recycle ratio	300 %	
Sludge recycle rate	11600 m3/d	
Nitrogen required for biomass	22.6 mg/L	
Phosphorus required for biome	4.51 mg/L	
Oxygen required to meet avera	1360 kg/d	
Air flow required to meet avera	2250 N m3/hr	
Design air flow	21.5 N m3/min/1000 m3	
Quantities		
Operation labor required	1960 pers-hrs/yr	
Maintenance labor required	957 pers-hrs/yr	
Electrical energy required	553000 kWh/yr	
Volume of earthwork required	78700 cuft	
Volume of slab concrete requir	17500 cuft	
Volume of wall concrete requir	11900 cuft	
Handrail length	323 ft	
Number of diffusers per train	342	
Fine bubble diffuser floor cover	7.8 %	
Number of swing arm headers	5	
Required mixing power	24.7 kW	
Total number of mixers	6	
Required mixing power per mi	4.12 kW	

Design mixing power per mixer 3.73 kW  
 Mixing power for each unaerated tank 4.12 kW

Costs  
 Construction and equipment cost 1110000 \$  
 Earthwork Cost 23300 \$  
 Wall Concrete Cost 287000 \$  
 Slab Concrete Cost 226000 \$  
 Handrail Cost 24200 \$  
 Installed Aerator Equipment 244000 \$  
 Air Piping Cost 90200 \$  
 Installed Mixer Equipment Cost 103000 \$  
 Misc Costs 110000 \$  
 Operational labor cost 101000 \$/yr  
 Maintenance labor cost 39700 \$/yr  
 Material and supply cost 38500 \$/yr  
 Chemical cost 0 \$/yr  
 Energy cost 55300 \$/yr  
 Amortization cost 102000 \$/yr

Internal Recycle Pumping  
 Design Information  
 Average daily pumping rate 1.54 MGD(US)  
 Total pumping capacity 1.54 MGD(US)  
 Design capacity per pump 534 gpm(US)  
 Number of pumps 6  
 Number of batteries 1  
 Firm pumping capacity 1.54 MGD(US)  
 Quantities  
 Operation labor required 465 pers-hrs/yr  
 Maintenance labor required 384 pers-hrs/yr  
 Electrical energy required 103000 kWh/yr  
 Volume of earthwork required 1840 cuft  
 Area of pump building 230 sqft

Costs  
 Construction and equipment cost 201000 \$  
 Earthwork Cost 1090 \$  
 Pump Building Cost 50700 \$  
 Installed Pump Cost 118000 \$  
 Misc Costs 30600 \$  
 Operational labor cost 24000 \$/yr  
 Maintenance labor cost 15900 \$/yr  
 Material and supply cost 1410 \$/yr  
 Chemical cost 0 \$/yr  
 Energy cost 10300 \$/yr  
 Amortization cost 19000 \$/yr

Internal Recycle Pumping  
 Design Information  
 Average daily pumping rate 2.05 MGD(US)  
 Total pumping capacity 2.05 MGD(US)  
 Design capacity per pump 712 gpm(US)  
 Number of pumps 6  
 Number of batteries 1  
 Firm pumping capacity 2.05 MGD(US)  
 Quantities  
 Operation labor required 483 pers-hrs/yr  
 Maintenance labor required 400 pers-hrs/yr  
 Electrical energy required 137000 kWh/yr  
 Volume of earthwork required 1920 cuft  
 Area of pump building 240 sqft

Costs  
 Construction and equipment cost 222000 \$  
 Earthwork Cost 1140 \$  
 Pump Building Cost 52900 \$  
 Installed Pump Cost 135000 \$  
 Misc Costs 33900 \$  
 Operational labor cost 24900 \$/yr  
 Maintenance labor cost 16600 \$/yr  
 Material and supply cost 1560 \$/yr  
 Chemical cost 0 \$/yr  
 Energy cost 13700 \$/yr  
 Amortization cost 21000 \$/yr

Sludge Recycle Pumping  
 Design Information  
 Average daily pumping rate 1.03 MGD(US)  
 Total pumping capacity 1.03 MGD(US)  
 Design capacity per pump 356 gpm(US)  
 Number of pumps 3  
 Number of batteries 1  
 Firm pumping capacity 1.03 MGD(US)  
 Quantities  
 Operation labor required 441 pers-hrs/yr  
 Maintenance labor required 361 pers-hrs/yr  
 Electrical energy required 34400 kWh/yr

Volume of earthwork required	1760 cuft
Area of pump building	220 sqft
Costs	
Construction and equipment cost	87700 \$
Earthwork Cost	522 \$
Pump Building Cost	24200 \$
Installed Pump Cost	49600 \$
Misc Costs	13400 \$
Operational labor cost	22700 \$/yr
Maintenance labor cost	15000 \$/yr
Material and supply cost	614 \$/yr
Chemical cost	0 \$/yr
Energy cost	3440 \$/yr
Amortization cost	8290 \$/yr

### Ultra-Violet Disinfection

#### Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calculation	2.12	gal(US)/(min·W)
Total number of lamps needed	74	
Number of spare channels	1	
Total number of lamps used in	120	
Number of excess lamps	46	
Number of lamps/modules	4	
Number of modules/bank	5	
Number of banks/channel	2	
Number of channels	3	
Calculated headloss	3.28	in
Costs		
Construction and equipment cost	358000 \$	
Cost of installation	215000 \$	
Total cost of UV lamps	143000 \$	
Operational labor cost	0 \$/yr	
Maintenance labor cost	3730 \$/yr	
Material and supply cost	3580 \$/yr	
Chemical cost	1250 \$/yr	
Energy cost	8940 \$/yr	
Amortization cost	30300 \$/yr	

### Belt-Filter Press

#### Design Output Data

Description	Value	Units
Belt-Filter Press		
Design Information		
Belt filter width	1	m
Number of units	1	
Hydraulic loading per unit per r	70	gpm(US)
Hydraulic loading required per	23.2	gpm(US)
Final solids content	19	%
Solids capture fraction	0.996	
Quantities		
Operation labor required	55.3	pers-hrs/yr
Maintenance labor required	13.8	pers-hrs/yr
Power	18500	kWh/yr
Polymer required	7250	lb/yr
Dry solids produced	1990	lb/d
Belt filter(s)	275000	\$
Building	279000	\$
Installation	68800	\$
Polymer system	82500	\$
Feed pumps	30300	\$
Conveyor system	77000	\$
Costs		
Construction and equipment cost	812000 \$	
Building Cost	279000 \$	
Polymer System Cost	82500 \$	
Feed Pumps Cost	30300 \$	
Conveyor System Cost	77000 \$	
Installed Belt Filter	344000 \$	
Operational labor cost	2850 \$/yr	
Maintenance labor cost	573 \$/yr	
Material and supply cost	0 \$/yr	
Chemical cost	9430 \$/yr	
Energy cost	1850 \$/yr	
Amortization cost	74300 \$/yr	

### Membrane Bioreactor

#### Design Output Data

Description	Value	Units
Membrane Bioreactor		

Design Information	
Total volume of reactors	18700 cuft
Length of parallel train	27.6 ft
Width of parallel train	13.8 ft
Sidewater depth	16.4 ft
Number of batteries	1
Number of parallel trains per b	3
Total Membrane Area	23900 m2
Total Scour Air Requirement	4770 N m3/hr
Quantities	
Operation labor required	2970 pers-hrs/yr
Maintenance labor required	1590 pers-hrs/yr
Electrical energy required	543000 kWh/yr
Volume of earthwork required	20000 cuft
Volume of slab concrete requir	4110 cuft
Volume of wall concrete requir	5410 cuft
Handrail length	309 ft
Number of diffusers per train	118
Number of swing arm headers	2

Costs	
Construction and equipment cc	2520000 \$
Earthwork Cost	5930 \$
Wall Concrete Cost	130000 \$
Slab Concrete Cost	53200 \$
Handrail Cost	23200 \$
Membrane Cost	2060000 \$
Installed Aerator Equipment	133000 \$
Air Piping Cost	68800 \$
Misc Cost	60300 \$
Operational labor cost	153000 \$/yr
Maintenance labor cost	65900 \$/yr
Material and supply cost	25200 \$/yr
Chemical cost	15600 \$/yr
Energy cost	54300 \$/yr
Amortization cost	348000 \$/yr

Permeate Pumping	
Design Information	
Average daily pumping rate	0.513 MGD(US)
Total pumping capacity	1.51 MGD(US)
Design capacity per pump	584 gpm(US)
Number of pumps	6
Number of batteries	1
Firm pumping capacity	3.36 MGD(US)
Quantities	
Operation labor required	514 pers-hrs/yr
Maintenance labor required	431 pers-hrs/yr
Electrical energy required	31000 kWh/yr
Volume of earthwork required	1870 cuft
Area of pump building	233 sqft

Costs	
Construction and equipment cc	207000 \$
Earthwork Cost	1110 \$
Pump Building Cost	51300 \$
Installed Pump Cost	123000 \$
Misc Costs	31600 \$
Operational labor cost	26500 \$/yr
Maintenance labor cost	17800 \$/yr
Material and supply cost	1450 \$/yr
Chemical cost	0 \$/yr
Energy cost	3100 \$/yr
Amortization cost	19600 \$/yr

Waste Sludge Pumping	
Design Information	
Average daily pumping rate	0.0269 MGD(US)
Total pumping capacity	0.0269 MGD(US)
Design capacity per pump	9.34 gpm(US)
Number of pumps	3
Number of batteries	1
Firm pumping capacity	0.0269 MGD(US)
Quantities	
Operation labor required	276 pers-hrs/yr
Maintenance labor required	211 pers-hrs/yr
Electrical energy required	909 kWh/yr
Volume of earthwork required	1600 cuft
Area of pump building	201 sqft

Costs	
Construction and equipment cc	38400 \$
Earthwork Cost	475 \$
Pump Building Cost	22100 \$
Installed Pump Cost	9970 \$
Misc Costs	5850 \$
Operational labor cost	14200 \$/yr

Maintenance labor cost	8740 \$/yr
Material and supply cost	268 \$/yr
Chemical cost	0 \$/yr
Energy cost	91 \$/yr
Amortization cost	3630 \$/yr

### Effluent

#### Design Output Data

Description	Value	Units
Costs		
Construction and equipment cost	0	\$
Operational labor cost	0	\$/yr
Maintenance labor cost	0	\$/yr
Material and supply cost	0	\$/yr
Chemical cost	0	\$/yr
Energy cost	0	\$/yr
Amortization cost	0	\$/yr

### Hauling and Land Filling

#### Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling Design Information		
Volume of sludge hauled	5.16	cuyd/d
Truck capacity	19	cuyd
Round trip time to disposal site	1	hr
Truck loading time	0.75	hr
Operational hours per day	8	hr
Number of trucks required	1	
Distance to disposal site	10	miles
Quantities		
Total sludge volume hauled	5.16	cuyd/d
Maximum anticipated landfill depth	30	d
Anticipated sludge storage height	8	ft
Sludge storage shed area	523	sqft
Width of sludge storage shed	16.2	ft
Length of sludge storage shed	32.3	ft
Volume of earthwork required	1630	cuft
Volume of slab concrete required	745	cuft
Surface area of canopy roof	523	sqft
Round trip haul distance	20	miles
Round trips per day per truck	1	
Distance traveled per year per truck	5000	miles
Sludge hauled	4.57	ton(short)/d
Operation labor required	80.7	pers-hrs/yr
LandFilling cost	35200	\$/yr
Costs		
Construction and equipment cost	303000	\$
Earthwork Cost	483	\$
Slab Concrete Cost	9660	\$
Canopy Roof Cost	10500	\$
Vehicle Cost	283000	\$
Operational labor cost	4160	\$/yr
Maintenance labor cost	0	\$/yr
Material and supply cost	53600	\$/yr
Chemical cost	0	\$/yr
Energy cost	0	\$/yr
Amortization cost	63000	\$/yr