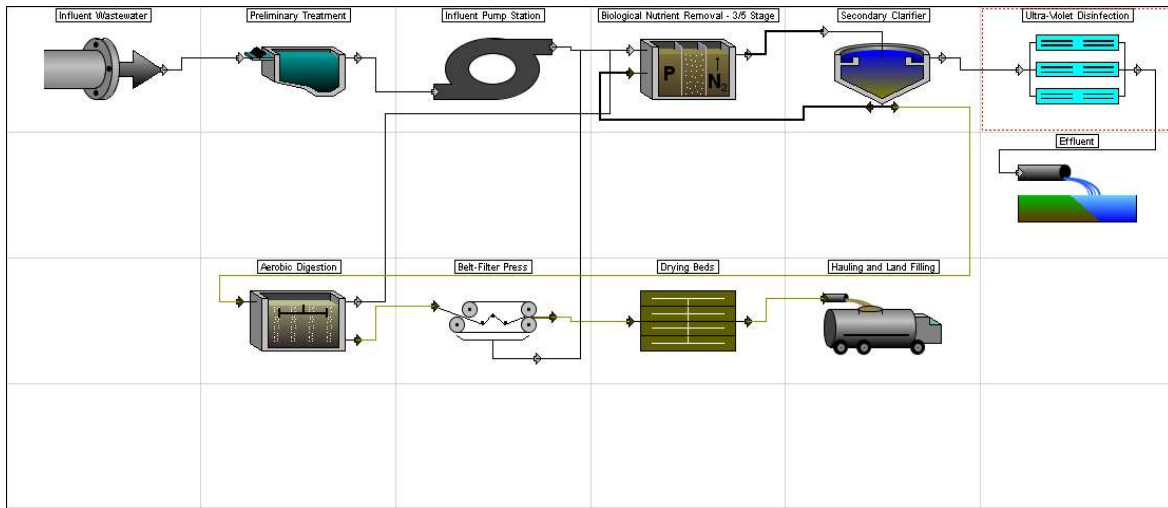


**Layout 1 Timpanogos**



**Summary**

**Equipment Database**

Hydromantis 2014,(USA Avg)

**Layout Summary**

Description	Value	Units
<b>CONSTRUCTION COSTS</b>		
Unit process construction cost	\$89,300,000	\$
Other direct construction costs	\$23,200,000	\$
Other indirect construction costs	\$83,800,000	\$
<b>Total construction costs</b>	<b>\$196,000,000</b>	<b>\$</b>

**ANNUAL COSTS**

**LABOR COSTS**

Administration labor cost	\$290,000	\$/yr
Laboratory labor cost	\$264,000	\$/yr
Unit process operation labor cost	\$3,030,000	\$/yr
Unit process maintenance labor cost	\$1,690,000	\$/yr
<b>Total labor costs</b>	<b>\$5,280,000</b>	<b>\$/yr</b>

**MATERIAL COSTS**

Total material cost	\$1,270,000	\$/yr
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**CHEMICAL COSTS**

Total chemical cost	\$285,000	\$/yr
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**ENERGY COSTS**

Total energy cost	\$5,800,000	\$/yr
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<b>Total operation and maintenance</b>	<b>\$12,600,000</b>	<b>\$/yr</b>
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**CONSTRUCTION COST AMC**

Amortization cost for total construction	\$16,900,000	\$/yr
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<b>Total annual project cost</b>	<b>\$29,600,000</b>	<b>\$/yr</b>
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**PROJECT SUMMARY**

Present worth	\$354,000,000	\$
Total project cost	\$196,000,000	\$
Total operation labor cost	\$3,580,000	\$/yr
Total maintenance labor cost	\$1,690,000	\$/yr
Total material cost	\$1,270,000	\$/yr
Total chemical cost	\$285,000	\$/yr
Total energy cost	\$5,800,000	\$/yr
Total amortization cost	\$16,900,000	\$/yr

**Process Summary**

Process	Construction (\$)	Operation (\$/yr)	Maintenance (\$/yr)	Material (\$/yr)	Chemical (\$/yr)	Energy (\$/yr)	Amortization (\$/yr)
Preliminary Treatment	2350000	295000	119000	58800	0	8300	197000
Aerobic Digestion	19400000	360000	234000	711000	0	1640000	1730000
Influent Pump Station	3230000	113000	84000	22600	0	265000	294000
Belt-Filter Press	9130000	70300	16600	0	233000	35900	860000
Biological Nutrient Removal - 3	29000000	564000	377000	59800	0	3470000	2550000
Drying Beds	1380000	1120000	528000	12500	0	0	118000
Secondary Clarifier	10600000	391000	214000	105000	0	8390	937000
Hauling and Land Filling	519000	117000	0	200000	0	0	89300
Ultra-Violet Disinfection	10500000	0	123000	105000	52300	375000	1030000
Effluent	0	0	0	0	0	0	0
Blower System	3190000	0	0	0	0	0	268000
Other Costs	107000000	554000	0	0	0	0	8880000

**Summary of Other Costs for Layout**

Description	Value	Units
Other Costs		
Quantities		
Required land	54.9	acre
Administration labor hours	5640	hr/yr
Laboratory labor hours	5120	hr/yr
Costs		
DIRECT COSTS		
Mobilization	2140000	\$
Site preparation	2440000	\$
Site electrical	6480000	\$
Yard piping	4160000	\$
Instrumentation and control	3610000	\$
Lab and administration building	4400000	\$
Total direct construction costs	23200000	\$
INDIRECT COSTS		
Cost of land	1100000	\$
Miscellaneous cost	6470000	\$
Legal cost	2590000	\$
Engineering design fee	19400000	\$
Inspection cost	2590000	\$
Contingency	12900000	\$
Technical	2590000	\$
Interest during construction	19200000	\$
Profit	16900000	\$
Total indirect construction cost	83800000	\$
Total of other construction costs	107000000	\$
LABOR COSTS		
Administration labor cost	290000	\$/yr
Laboratory labor cost	264000	\$/yr

#### Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	63600	scfm
Safety factor	1.5	
Requested air flow capacity	95500	scfm
Total capacity of blowers	95500	scfm
Number of blowers in use	1	
Total number of blowers	2	
Capacity of individual blowers	95500	scfm
Estimated cost of an installed blower	1310000	\$
Blower building area	2410	sqft
Costs		
Construction and equipment cost	3190000	\$
Installed Blower Cost	2610000	\$
Building Cost	265000	\$
Misc Costs	316000	\$
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	268000	\$/yr

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

#### Influent Wastewater

##### Preliminary Treatment

##### Design Output Data

Description	Value	Units
Preliminary Treatment		
Design Information		
Mechanically Cleaned Bar Screen		
Bar size	0.25	in
Bar spacing	0.375	in
Slope of bars from horizontal	30	degrees
Head loss through screen	0.444	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	7.19	ft
Average channel depth	3	ft
Aerated Grit Chamber		
Maximum flow	116	cuft/s
Average flow	53.9	cuft/s
Minimum flow	15.4	cuft/s
Temperature	10	deg C
Maximum flow through velocity	0.127	ft/s
Average flow through velocity	0.0591	ft/s
Size of smallest particle 100%	0.2	mm
Specific gravity of particle	1.75	
Number of units	3	
Maximum flow/unit	38.5	cuft/s
Width of channel	76	ft
Depth of channel	4	ft
Length of channel	76	ft
Settling velocity of particle	0.0346	ft/s

Hydraulic retention time	10 min
Volume of grit	140 cuft/d
Air supply	3 cfm
Costs	
Construction and equipment cost	2350000 \$
Operational labor cost	295000 \$/yr
Maintenance labor cost	119000 \$/yr
Material and supply cost	58800 \$/yr
Chemical cost	0 \$/yr
Energy cost	8300 \$/yr
Amortization cost	197000 \$/yr

### Aerobic Digestion

#### Design Output Data

Description	Value	Units
Aerobic Digestion		
Design Information		
Solids retention time	53	d
Design SS	12000	mg/L
Calculated VSS	7040	mg/L
Calculated VSS:TSS ratio	0.587	mg VSS/mg SS
Total volume of reactors	86200	m <sup>3</sup>
Length of parallel train	124	m
Width of parallel train	10	m
Sidewater depth	5	m
Number of batteries	1	
Number of parallel trains per battery	14	
Oxygen requirement to meet average	19400	kg/d
Air flow required to meet average	107000	N m <sup>3</sup> /hr
Design air flow	20.8	N m <sup>3</sup> /min/1000 m <sup>3</sup>
Volatile solids loading	0.0184	lb/(cuft-d)
Solids accumulated	43000	lb/d
Digester capacity	2280000	lb
Volume of wasted sludge	10400000	gal(US)
Quantities		
Operation labor required	6990	pers-hrs/yr
Maintenance labor required	4810	pers-hrs/yr
Electrical energy required	16400000	kWh/yr
Volume of earthwork required	1340000	cuft
Volume of slab concrete required	397000	cuft
Volume of wall concrete required	233000	cuft
Handrail length	7880	ft
Number of diffusers per train	379	
Number of swing arm headers	17	
Costs		
Construction and equipment cost	19400000	\$
Earthwork Cost	397000	\$
Wall Concrete Cost	5620000	\$
Slab Concrete Cost	5140000	\$
Handrail Cost	591000	\$
Installed Aerator Equipment	4940000	\$
Air Piping Cost	819000	\$
Misc Costs	1930000	\$
Operational labor cost	360000	\$/yr
Maintenance labor cost	234000	\$/yr
Material and supply cost	711000	\$/yr
Chemical cost	0	\$/yr
Energy cost	1640000	\$/yr
Amortization cost	1730000	\$/yr

### Influent Pump Station

#### Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	4790	cuft
Width of wet well	13.2	ft
Depth of the pumping station	29.4	ft
Length of the pumping station	60.4	ft
Width of the pumping station	45.7	ft
Minimum depth of water in wet well	8.36	ft
Area of pump building	2060	sqft
Peak capacity of pumps	97.5	MGD(US)
Firm pumping capacity	97.5	MGD(US)
Total dynamic head - average	53.7	ft
Quantities		
Operation labor required	2190	pers-hrs/yr
Maintenance labor required	1730	pers-hrs/yr
Electrical energy required	26500000	kWh/yr
Volume of earthwork required	336000	cuft
Volume of slab concrete required	26500	cuft
Volume of wall concrete required	10700	cuft
Capacity per pump	13500	gpm(US)
Number of constant speed pumps	4	
Number of variable speed pumps	2	
Diameter of discharge header	58.8	in
Total dynamic head	60.4	ft
Size of selected pump	24	in
Specific speed of pump	3220	
Pump rotating speed	745	rpm
Motor size required	216	HP
Size of selected motor	250	HP

Width of pump system	5.4 ft
Length of pump system	23.5 ft
Length of the dry well	60.4 ft
Width of the dry well	32.5 ft
Costs	
Construction and equipment cost	3230000 \$
Earthwork Cost	99500 \$
Wall Concrete Cost	256000 \$
Slab Concrete Cost	344000 \$
Building Cost	227000 \$
Installed Pump Equipment Cost	1770000 \$
Installed Control Module Cost	44200 \$
Misc Costs	493000 \$
Operational labor cost	113000 \$/yr
Maintenance labor cost	84000 \$/yr
Material and supply cost	22600 \$/yr
Chemical cost	0 \$/yr
Energy cost	265000 \$/yr
Amortization cost	294000 \$/yr

**Belt-Filter Press**

**Design Output Data**

Description	Value	Units
Belt-Filter Press		
Design Information		
Belt filter width	2	m
Number of units	14	
Hydraulic loading per unit per r	35	gpm(US)
Hydraulic loading required per	954	gpm(US)
Final solids content	16	%
Solids capture fraction	0.996	
Quantities		
Operation labor required	1360	pers-hrs/yr
Maintenance labor required	341	pers-hrs/yr
Power	359000	kWh/yr
Polymer required	179000	lb/yr
Dry solids produced	49000	lb/d
Belt filter(s)	4210000	\$
Building	787000	\$
Installation	1050000	\$
Polymer system	1560000	\$
Feed pumps	464000	\$
Conveyor system	1050000	\$
Costs		
Construction and equipment cost	9130000	\$
Building Cost	787000	\$
Polymer System Cost	1560000	\$
Feed Pumps Cost	464000	\$
Conveyor System Cost	1050000	\$
Installed Belt Filter	5270000	\$
Operational labor cost	70300	\$/yr
Maintenance labor cost	16600	\$/yr
Material and supply cost	0	\$/yr
Chemical cost	233000	\$/yr
Energy cost	35900	\$/yr
Amortization cost	860000	\$/yr

**Biological Nutrient Removal - 3/5 Stage**

**Design Output Data**

Description	Value	Units
BNR System for BIO-P and N Removal		
Design Information		
3-Stage Biological Phosphorus		
Design aerobic SRT for nitrific	12.5	d
Total reactor SRT	25	d
Design SS	4000	mg/L
Calculated VSS	2810	mg/L
Calculated VSS:TSS ratio	0.703	mg VSS/mg SS
Total volume of anaerobic react	27200	m3
Total volume of anoxic reactor	83700	m3
Total volume of aerobic reacto	111000	m3
Total volume of all reactors	222000	m3
Width of parallel train	28	m
Sidewater depth	5	m
Number of batteries	1	
Number of parallel trains per b	10	
Number of anoxic cells within c	3	
Number of aerobic cells within	3	
Anaerobic hydraulic retention t	4.81	hr
Anoxic hydraulic retention time	14.8	hr
Aerobic hydraulic retention tim	19.6	hr
Amount of sludge generated	35500	kg/d
Sludge recycle ratio	66.7	%
Sludge recycle rate	90500	m3/d
Nitrogen required for biomass	21.8	mg/L
Phosphorus required for bioma	4.36	mg/L
Oxygen required to meet aver	42600	kg/d
Total aerator power required tc	3750	HP
Number of mechanical aerator	3	-
Total number of mechanical ae	30	
Horsepower of each mechanic	125	HP
Quantities		

Operation labor required	8690 pers-hrs/yr
Maintenance labor required	5730 pers-hrs/yr
Electrical energy required	25100000 kWh/yr
Volume of earthwork required	3520000 cuft
Volume of slab concrete requir	789000 cuft
Volume of wall concrete requir	2570000 cuft
Length of the basin slab	1110 ft
Width of the basin slab	474 ft
Width of the platform	14.8 ft
Handrail length	11200 ft
Costs	
Construction and equipment c	23600000 \$
Earthwork Cost	10400000 \$
Wall Concrete Cost	6180000 \$
Slab Concrete Cost	10200000 \$
Handrail Cost	839000 \$
Installed Aerator Equipment	3000000 \$
Misc Costs	2340000 \$
Operational labor cost	447000 \$/yr
Maintenance labor cost	279000 \$/yr
Material and supply cost	22200 \$/yr
Chemical cost	0 \$/yr
Energy cost	2510000 \$/yr
Amortization cost	2040000 \$/yr
Internal Recycle Pumping	
Design Information	
Average daily pumping rate	10.8 MGD(US)
Total pumping capacity	10.8 MGD(US)
Design capacity per pump	3740 gpm(US)
Number of pumps	30
Number of batteries	1
Firm pumping capacity	10.8 MGD(US)
Quantities	
Operation labor required	653 pers-hrs/yr
Maintenance labor required	552 pers-hrs/yr
Electrical energy required	3590000 kWh/yr
Volume of earthwork required	3300 cuft
Area of pump building	412 sqft
Costs	
Construction and equipment c	21900000 \$
Earthwork Cost	9770 \$
Pump Building Cost	4540000 \$
Installed Pump Cost	14000000 \$
Misc Costs	3350000 \$
Operational labor cost	336000 \$/yr
Maintenance labor cost	268000 \$/yr
Material and supply cost	15400 \$/yr
Chemical cost	0 \$/yr
Energy cost	3590000 \$/yr
Amortization cost	2070000 \$/yr
Internal Recycle Pumping	
Design Information	
Average daily pumping rate	14.4 MGD(US)
Total pumping capacity	14.4 MGD(US)
Design capacity per pump	4980 gpm(US)
Number of pumps	30
Number of batteries	1
Firm pumping capacity	14.4 MGD(US)
Quantities	
Operation labor required	719 pers-hrs/yr
Maintenance labor required	606 pers-hrs/yr
Electrical energy required	4780000 kWh/yr
Volume of earthwork required	3860 cuft
Area of pump building	483 sqft
Costs	
Construction and equipment c	25100000 \$
Earthwork Cost	11500 \$
Pump Building Cost	5310000 \$
Installed Pump Cost	15800000 \$
Misc Costs	3830000 \$
Operational labor cost	370000 \$/yr
Maintenance labor cost	295000 \$/yr
Material and supply cost	17600 \$/yr
Chemical cost	0 \$/yr
Energy cost	4780000 \$/yr
Amortization cost	2370000 \$/yr
Sludge Recycle Pumping	
Design Information	
Average daily pumping rate	35.9 MGD(US)
Total pumping capacity	35.9 MGD(US)
Design capacity per pump	12500 gpm(US)
Number of pumps	3
Number of batteries	1
Firm pumping capacity	35.9 MGD(US)
Quantities	
Operation labor required	900 pers-hrs/yr
Maintenance labor required	865 pers-hrs/yr
Electrical energy required	11900000 kWh/yr
Volume of earthwork required	7260 cuft
Area of pump building	908 sqft
Costs	
Construction and equipment c	6610000 \$

Earthwork Cost	2150 \$
Pump Building Cost	99800 \$
Installed Pump Cost	459000 \$
Misc Costs	101000 \$
Operational labor cost	46300 \$/yr
Maintenance labor cost	42000 \$/yr
Material and supply cost	4630 \$/yr
Chemical cost	0 \$/yr
Energy cost	119000 \$/yr
Amortization cost	62500 \$/yr

### Drying Beds

#### Design Output Data

Description	Value	Units
Sludge Drying Beds		
Design Information		
Total surface area required	250000	sqft
Initial depth of sludge	12	in
Final solids	50	%
Bed holding time	86.7	d
Quantities		
Total drying bed surface area	250000	sqft
Number beds	3	
Surface area of each individua	83300	sqft
Length of each bed	417	ft
Volume of earthwork required	721000	cuft
Volume concrete for dividing w	14500	cuft
Volume of R.C. in-place for tru	1870	cuft
Volume of sand	187000	cuft
Volume of gravel	250000	cuft
Clay pipe diameter	8	in
Total length clay pipe	2500	in
Sludge solids produced	20.4	ton(short)/d
Operational labor required	21700	pers-hrs/yr
Maintenance labor required	10900	pers-hrs/yr
Costs		
Construction and equipment cc	1380000	\$
Earthwork Cost	214000	\$
Wall Concrete Cost	244000	\$
Slab Concrete Cost	14600	\$
Drying Bed Media Cost	698000	\$
Drain Pipe System Cost	77000	\$
Misc Costs	137000	\$
Operational labor cost	1120000	\$/yr
Maintenance labor cost	528000	\$/yr
Material and supply cost	12500	\$/yr
Chemical cost	0	\$/yr
Energy cost	0	\$/yr
Amortization cost	118000	\$/yr

### Secondary Clarifier

#### Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	253000	sqft
Surface area per circular clarifi	28100	sqft
Diameter of each circular clarif	190	ft
Number of clarifiers per batter	9	
Number of batteries	1	
Solids loading rate	7.89	lb/(sqft-d)
Hydraulic retention time	15.2	hr
Designed surface overflow rate	300	gal(US)/(sqft-d)
Weir length	9480	ft
Volume of wasted sludge	910000	gpd(US)
Quantities		
Operation labor required	7160	pers-hrs/yr
Maintenance labor required	4040	pers-hrs/yr
Electrical energy required	53400	kWh/yr
Volume of earthwork required	4460000	cuft
Slab thickness	10.9	in
Volume of slab concrete requir	254000	cuft
Wall thickness	13	in
Volume of wall concrete requin	79700	cuft
Costs		
Construction and equipment cc	10500000	\$
Earthwork Cost	1320000	\$
Wall Concrete Cost	1920000	\$
Slab Concrete Cost	3290000	\$
Installed Equipment Cost	2350000	\$
Misc Costs	1600000	\$
Operational labor cost	369000	\$/yr
Maintenance labor cost	196000	\$/yr
Material and supply cost	105000	\$/yr
Chemical cost	0	\$/yr
Energy cost	5340	\$/yr
Amortization cost	929000	\$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.91	MGD(US)
Total pumping capacity	0.91	MGD(US)
Design capacity per pump	316	gpm(US)

Number of pumps	3
Number of batteries	1
Firm pumping capacity	0.91 MGD(US)
Quantities	
Operation labor required	435 pers-hrs/yr
Maintenance labor required	355 pers-hrs/yr
Electrical energy required	30500 kWh/yr
Volume of earthwork required	1740 cuft
Area of pump building	218 sqft
Costs	
Construction and equipment cost	84400 \$
Earthwork Cost	517 \$
Pump Building Cost	24000 \$
Installed Pump Cost	47000 \$
Misc Costs	12900 \$
Operational labor cost	22400 \$/yr
Maintenance labor cost	17300 \$/yr
Material and supply cost	591 \$/yr
Chemical cost	0 \$/yr
Energy cost	3050 \$/yr
Amortization cost	7980 \$/yr

### Hauling and Land Filling

#### Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	48.4	cuyd/d
Truck capacity	22	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	30	miles
Quantities		
Total sludge volume hauled	48.4	cuyd/d
Maximum anticipated landfill depth	30	d
Anticipated sludge storage height	8	ft
Sludge storage shed area	4900	sqft
Width of sludge storage shed	49.5	ft
Length of sludge storage shed	99	ft
Volume of earthwork required	13200	cuft
Volume of slab concrete required	5580	cuft
Surface area of canopy roof	4900	sqft
Round trip haul distance	60	miles
Round trips per day per truck	3	
Distance traveled per year per truck	45000	miles
Sludge hauled	42.8	ton(short)/d
Operation labor required	2270	pers-hrs/yr
LandFilling cost	35200	\$/yr
Costs		
Construction and equipment cost	519000	\$
Earthwork Cost	3910	\$
Slab Concrete Cost	72400	\$
Canopy Roof Cost	98100	\$
Vehicle Cost	345000	\$
Operational labor cost	117000	\$/yr
Maintenance labor cost	0	\$/yr
Material and supply cost	200000	\$/yr
Chemical cost	0	\$/yr
Energy cost	0	\$/yr
Amortization cost	89300	\$/yr

### Ultra-Violet Disinfection

#### Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calculation	1.19	gal(US)/(min-W)
Total number of lamps needed	3350	
Number of spare channels	1	
Total number of lamps used in channels	5040	
Number of excess lamps	1690	
Number of lamps/modules	16	
Number of modules/bank	21	
Number of banks/channel	5	
Number of channels	3	
Calculated headloss	18.2	in
Costs		
Construction and equipment cost	1050000	\$
Cost of installation	6280000	\$
Total cost of UV lamps	4180000	\$
Operational labor cost	0	\$/yr
Maintenance labor cost	123000	\$/yr
Material and supply cost	105000	\$/yr
Chemical cost	52300	\$/yr
Energy cost	375000	\$/yr
Amortization cost	1030000	\$/yr

### Effluent

#### Design Output Data

Description	Value	Units
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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