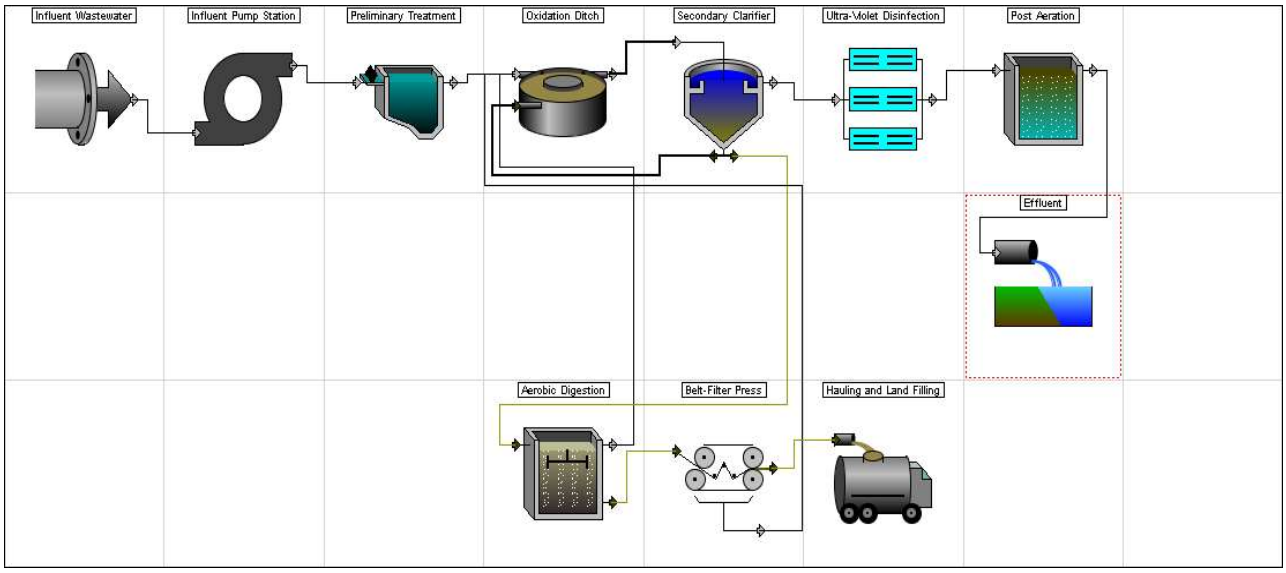
Ashley Valley Water and Sewer Improvement District

Layout 1 Ashley Valley



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$14,900,000	$
Other direct construction costs	$5,930,000	$
Other indirect construction cos	$15,700,000	$
Total construction costs	$36,600,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$60,300	$/yr
Laboratory labor cost	$160,000	$/yr
Unit process operation labor c	$454,000	$/yr
Unit process maintenance labc	$199,000	$/yr
Total labor costs	$873,000	$/yr
MATERIAL COSTS		
Total material cost	$283,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$55,900	$/yr
ENERGY COSTS		
Total energy cost	$616,000	$/yr
Total operation and maintanen	$1,830,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$3,150,000	$/yr
Total annual project cost	$4,980,000	$/yr
PROJECT SUMMARY		
Present worth	$59,600,000	$
Total project cost	$36,600,000	$
Total operation labor cost	$674,000	$/yr
Total maintenance labor cost	$199,000	$/yr
Total material cost	$283,000	$/yr
Total chemical cost	$55,900	$/yr
Total energy cost	$616,000	$/yr
Total amortization cost	$3,150,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Influent Pump Station	1110000	38100	25600	7790	0	31600	100000
Preliminary Treatment	670000	57700	24400	16800	0	3280	56200
Oxidation Ditch	3110000	121000	0	24600	0	305000	302000
Aerobic Digestion	1520000	96000	40500	95000	0	119000	135000

Secondary Clarifier	736000	73500	35500	7210	0	1420	67800
Belt-Filter Press	918000	10700	2140	0	35600	6310	83700
Ultra-Violet Disinfection	5850000	0	60400	58500	20300	146000	495000
Hauling and Land Filling	387000	22900	0	72000	0	0	70000
Post Aeration	59400	33800	10500	1420	0	3900	5390
Effluent	0	0	0	0	0	0	0
Blower System	587000	0	0	0	0	0	49200
Other Costs	21600000	220000	0	0	0	0	1790000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	16	acre
Administration labor hours	1170	hr/yr
Laboratory labor hours	3100	hr/yr
Costs		
DIRECT COSTS		
Mobilization	534000	$
Site preparation	777000	$
Site electrical	1500000	$
Yard piping	1000000	$
Instrumentation and control	754000	$
Lab and administration building	1370000	$
Total direct construction costs	5930000	$
INDIRECT COSTS		
Cost of land	320000	$
Miscellaneous cost	1200000	$
Legal cost	480000	$
Engineering design fee	3600000	$
Inspection cost	480000	$
Contingency	2400000	$
Technical	480000	$
Interest during construction	3580000	$
Profit	3130000	$
Total indirect construction cost	15700000	$
Total of other construction cos	21600000	$
LABOR COSTS		
Administration labor cost	60300	$/yr
Laboratory labor cost	160000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	4620	scfm
Safety factor	1.5	
Requested air flow capacity	6920	scfm
Total capacity of blowers	6920	scfm
Number of blowers in use	1	
Total number of blowers	2	
Capacity of individual blowers	6920	scfm
Estimated cost of an installed l	197000	$
Blower building area	1230	sqft
Costs		
Construction and equipment co	587000	$
Installed Blower Cost	394000	$
Building Cost	135000	$
Misc Costs	58200	$
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	49200	$/yr
Notes		
Energy costs are shown at the individual unit processes that require air		

Influent Wastewater

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	1720	cuft
Width of wet well	12.6	ft
Depth of the pumping station	28.7	ft
Length of the pumping station	22.8	ft
Width of the pumping station	45.1	ft

Minimum depth of water in wet	7.71	ft
Area of pump building	777	sqft
Peak capacity of pumps	15.7	MGD(US)
Firm pumping capacity	15.7	MGD(US)
Total dynamic head - average	44.4	ft
Quantities		
Operation labor required	741	pers-hrs/yr
Maintenance labor required	624	pers-hrs/yr
Electrical energy required	316000	kWh/yr
Volume of earthwork required	184000	cuft
Volume of slab concrete requir	8350	cuft
Volume of wall concrete requir	6110	cuft
Capacity per pump	10900	gpm(US)
Number of constant speed pur	0	
Number of variable speed pur	2	
Diameter of discharge header	23.6	in
Total dynamic head	58.8	ft
Size of selected pump	24	in
Specific speed of pump	4420	
Pump rotating speed	814	rpm
Motor size required	181	HP
Size of selected motor	200	HP
Width of pump system	5.4	ft
Length of pump system	23.5	ft
Length of the dry well	22.8	ft
Width of the dry well	32.5	ft
Costs		
Construction and equipment cc	1110000	$
Earthwork Cost	54400	$
Wall Concrete Cost	147000	$
Slab Concrete Cost	108000	$
Building Cost	85500	$
Installed Pump Equipment C	512000	$
Installed Control Module Cos	35600	$
Misc Costs	170000	$
Operational labor cost	38100	$/yr
Maintenance labor cost	25600	$/yr
Material and supply cost	7790	$/yr
Chemical cost	0	$/yr
Energy cost	31600	$/yr
Amortization cost	100000	$/yr

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	0.965	ft
Average channel depth	3	ft
Horizontal Flow Grit Chamber		
Maximum flow	15.4	cuft/s
Average flow	7.24	cuft/s
Minimum flow	4.16	cuft/s
Temperature	10	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	7.7	cuft/s
Width of channel	1.28	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.00131	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	18.8	cuft/d
Costs		
Construction and equipment cc	670000	$
Operational labor cost	57700	$/yr
Maintenance labor cost	24400	$/yr
Material and supply cost	16800	$/yr

Chemical cost	0	$/yr
Energy cost	3280	$/yr
Amortization cost	56200	$/yr

Oxidation Ditch

Design Output Data

Description	Value	Units
Oxidation Ditch		
Design Information		
Carbon & Nitrification Design		
Design SRT for design at winte	25	d
Design SS	4000	mg/L
Calculated VSS	2790	mg/L
Calculated VSS:TSS ratio	0.697	mg VSS/mg SS
Total volume of reactors	28300	m3
Ditch length	137	m
Ditch width	29.9	m
Sidewater depth	3.66	m
Number of batteries	1	
Number of parallel ditches per	2	
Number of rotors per ditch	4	
Rotor length for aeration	60.3	m
Rotor length for mixing	108	m
Installed rotor length per rotor	13.6	m
Rotor horsepower	20	HP
Total installed horsepower per	160	HP
Assumed surface velocity	0.46	m/s
Hydraulic retention time	37.3	hr
F/M ratio	0.0518	lb BOD/lb MLSS/d
Volumetric BOD loading	0.144	kg BOD/m3/d
Observed yield (VSS basis)	0.591	g VSS/g BOD
Observed yield (TSS basis)	0.848	g TSS/g BOD
Amount of alkalinity required	140	gCaCO3/m3
Amount of sludge generated	4530	kg/d
Sludge recycle rate	12100	m3/d
Nitrogen requirement for biom	17.3	mg/L
Phosphorus requirement for bi	3.46	mg/L
Oxygen requirement to meet a	8060	kg/d
Quantities		
Ditch bottom width	48.5	ft
Length of straight section	352	ft
Volume of excavation required	495000	cuft
Volume of backfill required per	10600	cuft
Volume of wall concrete requir	34900	cuft
Volume of slab concrete requir	59500	cuft
Length of adjustable weir	75.8	ft
Volume of concrete required p	323	cuft
Total handrail length	0	ft
Operation labor required	2350	pers-hrs/yr
Electrical energy required	3050000	kWh/yr
Costs		
Construction and equipment co	3110000	$
Earthwork Cost	147000	$
Wall Concrete Cost	855000	$
Slab Concrete Cost	772000	$
Handrail Cost	0	$
Installed Equipment Cost	1180000	$
Misc Costs	154000	$
Operational labor cost	121000	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	24600	$/yr
Chemical cost	0	$/yr
Energy cost	305000	$/yr
Amortization cost	302000	$/yr

Aerobic Digestion

Design Output Data

Description	Value	Units
Aerobic Digestion		
Design Information		
Solids retention time	26.6	d
Design SS	12000	mg/L
Calculated VSS	7770	mg/L
Calculated VSS:TSS ratio	0.648	mg VSS/mg SS
Total volume of reactors	6600	m3
Length of parallel train	66	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	1230	kg/d
Air flow required to meet avera	7840	N m3/hr

Design air flow	19.8	N m3/min/1000 m3
Volatile solids loading	0.0304	lb/(cuft·d)
Solids accumulated	6570	lb/d
Digester capacity	174000	lb
Volume of wasted sludge	796000	gal(US)
Quantities		
Operation labor required	1860	pers-hrs/yr
Maintenance labor required	986	pers-hrs/yr
Electrical energy required	1190000	kWh/yr
Volume of earthwork required	131000	cuft
Volume of slab concrete requir	29500	cuft
Volume of wall concrete requir	19100	cuft
Handrail length	513	ft
Number of diffusers per train	193	
Number of swing arm headers	9	
Costs		
Construction and equipment cc	1520000	$
Earthwork Cost	38900	$
Wall Concrete Cost	460000	$
Slab Concrete Cost	382000	$
Handrail Cost	38500	$
Installed Aerator Equipment	373000	$
Air Piping Cost	76300	$
Misc Costs	151000	$
Operational labor cost	96000	$/yr
Maintenance labor cost	40500	$/yr
Material and supply cost	95000	$/yr
Chemical cost	0	$/yr
Energy cost	119000	$/yr
Amortization cost	135000	$/yr

Secondary Clarifier

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	11200	sqft
Surface area per circular clarifi	5580	sqft
Diameter of each circular clarif	85	ft
Number of clarifiers per battery	2	
Number of batteries	1	
Solids loading rate	24	lb/(sqft·d)
Hydraulic retention time	3.75	hr
Designed surface overflow rate	431	gal(US)/(sqft·d)
Weir length	674	ft
Volume of wasted sludge	116000	gpd(US)
Quantities		
Operation labor required	1090	pers-hrs/yr
Maintenance labor required	602	pers-hrs/yr
Electrical energy required	10300	kWh/yr
Volume of earthwork required	146000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	11100	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	5590	cuft
Costs		
Construction and equipment cc	686000	$
Earthwork Cost	43400	$
Wall Concrete Cost	135000	$
Slab Concrete Cost	143000	$
Installed Equipment Cost	261000	$
Misc Costs	105000	$
Operational labor cost	56300	$/yr
Maintenance labor cost	24800	$/yr
Material and supply cost	6860	$/yr
Chemical cost	0	$/yr
Energy cost	1030	$/yr
Amortization cost	63100	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.116	MGD(US)
Total pumping capacity	0.116	MGD(US)
Design capacity per pump	40.3	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.116	MGD(US)
Quantities		
Operation labor required	334	pers-hrs/yr
Maintenance labor required	262	pers-hrs/yr
Electrical energy required	3910	kWh/yr
Volume of earthwork required	1620	cuft
Area of pump building	202	sqft

Costs		
Construction and equipment cc	49200	$
Earthwork Cost	480	$
Pump Building Cost	22300	$
Installed Pump Cost	19000	$
Misc Costs	7510	$
Operational labor cost	17200	$/yr
Maintenance labor cost	10800	$/yr
Material and supply cost	345	$/yr
Chemical cost	0	$/yr
Energy cost	391	$/yr
Amortization cost	4660	$/yr

Belt-Filter Press

Design Output Data

Description	Value	Units
Belt-Filter Press		
Design Information		
Belt filter width	2	m
Number of units	1	
Hydraulic loading per unit per r	70	gpm(US)
Hydraulic loading required per	87.5	gpm(US)
Final solids content	13	%
Solids capture fraction	0.996	
Quantities		
Operation labor required	208	pers-hrs/yr
Maintenance labor required	52.1	pers-hrs/yr
Power	63100	kWh/yr
Polymer required	27300	lb/yr
Dry solids produced	7490	lb/d
Belt filter(s)	301000	$
Building	322000	$
Installation	75300	$
Polymer system	111000	$
Feed pumps	33100	$
Conveyor system	75300	$
Costs		
Construction and equipment cc	918000	$
Building Cost	322000	$
Polymer System Cost	111000	$
Feed Pumps Cost	33100	$
Conveyor System Cost	75300	$
Installed Belt Filter	376000	$
Operational labor cost	10700	$/yr
Maintenance labor cost	2140	$/yr
Material and supply cost	0	$/yr
Chemical cost	35600	$/yr
Energy cost	6310	$/yr
Amortization cost	83700	$/yr

Ultra-Violet Disinfection

Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calc	0.294	gal(US)/(min·W)
Total number of lamps needed	1810	
Number of spare channels	1	
Total number of lamps used in	1960	
Number of excess lamps	155	
Number of lamps/modules	4	
Number of modules/bank	5	
Number of banks/channel	7	
Number of channels	14	
Calculated headloss	3.02	in
Costs		
Construction and equipment cc	5850000	$
Cost of installation	3510000	$
Total cost of UV lamps	2340000	$
Operational labor cost	0	$/yr
Maintenance labor cost	60400	$/yr
Material and supply cost	58500	$/yr
Chemical cost	20300	$/yr
Energy cost	146000	$/yr
Amortization cost	495000	$/yr

Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	28.5	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	28.5	cuyd/d
Maximum anticipated landfill d	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	2880	sqft
Width of sludge storage shed s	38	ft
Length of sludge storage shed	75.9	ft
Volume of earthwork required	7940	cuft
Volume of slab concrete requir	3400	cuft
Surface area of canopy roof	2880	sqft
Round trip haul distance	20	miles
Round trips per day per truck	2	
Distance traveled per year per	10000	miles
Sludge hauled	25.2	ton(short)/d
Operation labor required	445	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment co	387000	$
Earthwork Cost	2350	$
Slab Concrete Cost	44100	$
Canopy Roof Cost	57600	$
Vehicle Cost	283000	$
Operational labor cost	22900	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	72000	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	70000	$/yr

Post Aeration

Design Output Data

Description	Value	Units
Post Aeration by Diffused Aeration		
Design Information		
Dissolved oxygen in influent	2	mg/L
Desired dissolved oxygen in ef	5	mg/L
Correction factor for pressure	1	
Minimum dissolved oxygen in t	2	mg/L
Oxygen saturation at summer t	8.55	mg/L
Oxygen required	117	lb/d
Operating transfer efficiency	2.96	lbO2/(HP·h)
Total volume of aerobic reacto	32600	gal(US)
Air flow rate required to meet a	157	scfm
Quantities		
Basin depth	15	ft
Length of basin	9.68	ft
Width of basin	30	ft
Number of diffusers	14	
Number of swing arm diffuser l	1	
Volume of wall concrete requir	893	cuft
Volume of slab concrete requir	218	cuft
Electrical energy required	39000	kWh/yr
Operation labor required	657	pers-hrs/yr
Maintenance labor required	255	pers-hrs/yr
Costs		
Construction and equipment co	59400	$
Wall Concrete Cost	21500	$
Slab Concrete Cost	11600	$
Installed Equipment Cost	20400	$
Misc Costs	5890	$
Operational labor cost	33800	$/yr
Maintenance labor cost	10500	$/yr
Material and supply cost	1420	$/yr
Chemical cost	0	$/yr
Energy cost	3900	$/yr
Amortization cost	5390	$/yr

Effluent

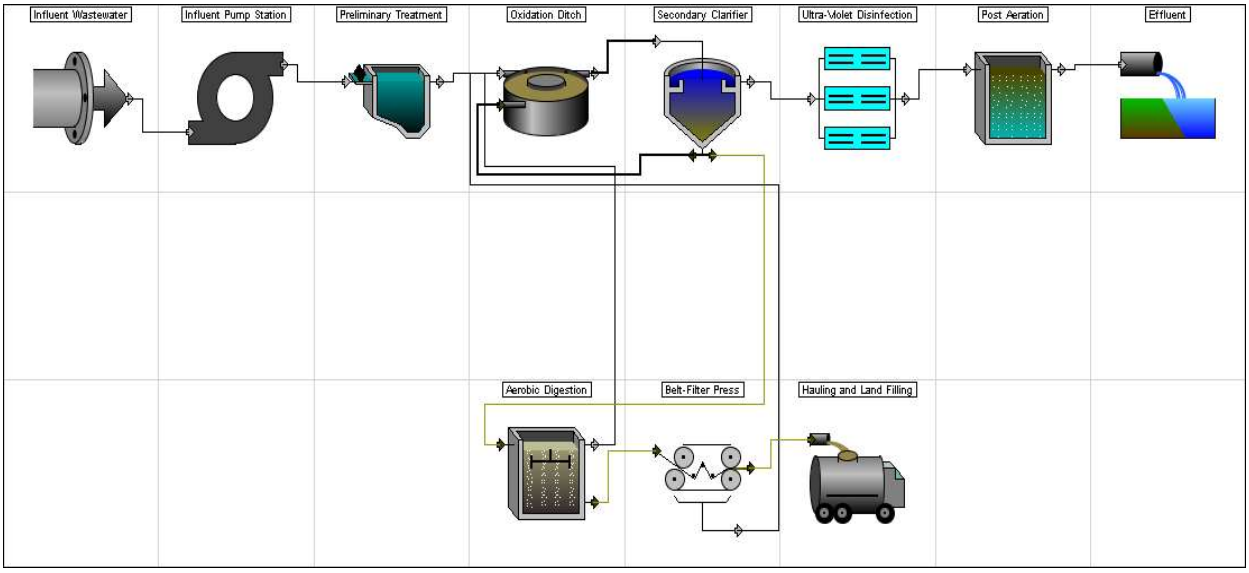
Design Output Data

Description	Value	Units
Costs		
Construction and equipment co	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

Brigham City

Layout - Brigham City



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$20,000,000	$
Other direct construction costs	$7,000,000	$
Other indirect construction cos	$20,200,000	$
Total construction costs	$47,100,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$73,000	$/yr
Laboratory labor cost	$166,000	$/yr
Unit process operation labor c	$566,000	$/yr
Unit process maintenance labc	$284,000	$/yr
Total labor costs	$1,090,000	$/yr
MATERIAL COSTS		
Total material cost	$339,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$85,200	$/yr
ENERGY COSTS		
Total energy cost	$884,000	$/yr
Total operation and maintanen	$2,400,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$4,090,000	$/yr
Total annual project cost	$6,490,000	$/yr
PROJECT SUMMARY		
Present worth	$77,700,000	$
Total project cost	$47,100,000	$
Total operation labor cost	$805,000	$/yr
Total maintenance labor cost	$284,000	$/yr
Total material cost	$339,000	$/yr
Total chemical cost	$85,200	$/yr
Total energy cost	$884,000	$/yr
Total amortization cost	$4,090,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Influent Pump Station	1230000	41100	28300	8600	0	37400	111000
Preliminary Treatment	751000	66100	28500	18800	0	3670	63000
Oxidation Ditch	3640000	190000	0	20400	0	389000	338000
Aerobic Digestion	1950000	109000	48500	114000	0	153000	173000

Secondary Clarifier	885000	86000	42400	8700	0	1580	81100
Belt-Filter Press	918000	13700	2810	0	45400	7910	83700
Ultra-Violet Disinfection	9460000	0	122000	94600	39800	286000	863000
Hauling and Land Filling	398000	25400	0	72000	0	0	70900
Post Aeration	62000	35200	11600	1390	0	4980	5610
Effluent	0	0	0	0	0	0	0
Blower System	660000	0	0	0	0	0	55300
Other Costs	27100000	239000	0	0	0	0	2250000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	17	acre
Administration labor hours	1420	hr/yr
Laboratory labor hours	3210	hr/yr
Costs		
DIRECT COSTS		
Mobilization	632000	$
Site preparation	893000	$
Site electrical	1790000	$
Yard piping	1190000	$
Instrumentation and control	912000	$
Lab and administration building	1580000	$
Total direct construction costs	7000000	$
INDIRECT COSTS		
Cost of land	340000	$
Miscellaneous cost	1550000	$
Legal cost	620000	$
Engineering design fee	4650000	$
Inspection cost	620000	$
Contingency	3100000	$
Technical	620000	$
Interest during construction	4610000	$
Profit	4040000	$
Total indirect construction cost	20200000	$
Total of other construction cos	27100000	$
LABOR COSTS		
Administration labor cost	73000	$/yr
Laboratory labor cost	166000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	5940	scfm
Safety factor	1.5	
Requested air flow capacity	8920	scfm
Total capacity of blowers	8920	scfm
Number of blowers in use	2	
Total number of blowers	3	
Capacity of individual blowers	4460	scfm
Estimated cost of an installed l	150000	$
Blower building area	1310	sqft
Costs		
Construction and equipment co	660000	$
Installed Blower Cost	450000	$
Building Cost	144000	$
Misc Costs	65400	$
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	55300	$/yr
Notes		
Energy costs are shown at the individual unit processes that require air		

Influent Wastewater
Influent Pump Station
Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	1810	cuft
Width of wet well	13.2	ft
Depth of the pumping station	29.4	ft
Length of the pumping station	22.8	ft
Width of the pumping station	45.7	ft

Minimum depth of water in wet	8.38	ft
Area of pump building	777	sqft
Peak capacity of pumps	19.6	MGD(US)
Firm pumping capacity	19.6	MGD(US)
Total dynamic head - average	44.3	ft
Quantities		
Operation labor required	798	pers-hrs/yr
Maintenance labor required	671	pers-hrs/yr
Electrical energy required	374000	kWh/yr
Volume of earthwork required	193000	cuft
Volume of slab concrete requir	8680	cuft
Volume of wall concrete requir	6330	cuft
Capacity per pump	13600	gpm(US)
Number of constant speed pur	0	
Number of variable speed pur	2	
Diameter of discharge header	26.4	in
Total dynamic head	57.3	ft
Size of selected pump	24	in
Specific speed of pump	3360	
Pump rotating speed	714	rpm
Motor size required	205	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	22.8	ft
Width of the dry well	32.5	ft
Costs		
Construction and equipment co	1230000	$
Earthwork Cost	57100	$
Wall Concrete Cost	152000	$
Slab Concrete Cost	112000	$
Building Cost	85500	$
Installed Pump Equipment C	590000	$
Installed Control Module Cos	44200	$
Misc Costs	187000	$
Operational labor cost	41100	$/yr
Maintenance labor cost	28300	$/yr
Material and supply cost	8600	$/yr
Chemical cost	0	$/yr
Energy cost	37400	$/yr
Amortization cost	111000	$/yr

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	1.23	ft
Average channel depth	3	ft
Horizontal Flow Grit Chamber		
Maximum flow	18.5	cuft/s
Average flow	9.24	cuft/s
Minimum flow	3.85	cuft/s
Temperature	10	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	9.24	cuft/s
Width of channel	1.54	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.00106	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	24	cuft/d
Costs		
Construction and equipment co	751000	$
Operational labor cost	66100	$/yr
Maintenance labor cost	28500	$/yr
Material and supply cost	18800	$/yr

Chemical cost	0	$/yr
Energy cost	3670	$/yr
Amortization cost	63000	$/yr

Oxidation Ditch

Design Output Data

Description	Value	Units
Oxidation Ditch		
Design Information		
Carbon & Nitrification Design		
Design SRT for design at winte	25	d
Design SS	4000	mg/L
Calculated VSS	2790	mg/L
Calculated VSS:TSS ratio	0.697	mg VSS/mg SS
Total volume of reactors	36100	m3
Ditch length	102	m
Ditch width	25.8	m
Sidewater depth	3.66	m
Number of batteries	2	
Number of parallel ditches per	2	
Number of rotors per ditch	3	
Rotor length for aeration	77	m
Rotor length for mixing	138	m
Installed rotor length per rotor	11.5	m
Rotor horsepower	20	HP
Total installed horsepower per	120	HP
Assumed surface velocity	0.46	m/s
Hydraulic retention time	37.3	hr
F/M ratio	0.0518	lb BOD/lb MLSS/d
Volumetric BOD loading	0.144	kg BOD/m3/d
Observed yield (VSS basis)	0.591	g VSS/g BOD
Observed yield (TSS basis)	0.848	g TSS/g BOD
Amount of alkalinity required	140	gCaCO3/m3
Amount of sludge generated	5780	kg/d
Sludge recycle rate	15500	m3/d
Nitrogen requirement for biom	17.3	mg/L
Phosphorus requirement for bi	3.46	mg/L
Oxygen requirement to meet a	10300	kg/d
Quantities		
Ditch bottom width	41.9	ft
Length of straight section	251	ft
Volume of excavation required	653000	cuft
Volume of backfill required per	8380	cuft
Volume of wall concrete requir	26600	cuft
Volume of slab concrete requir	40000	cuft
Length of adjustable weir	48.4	ft
Volume of concrete required p	214	cuft
Total handrail length	0	ft
Operation labor required	3680	pers-hrs/yr
Electrical energy required	3890000	kWh/yr
Costs		
Construction and equipment co	3640000	$
Earthwork Cost	194000	$
Wall Concrete Cost	1300000	$
Slab Concrete Cost	1040000	$
Handrail Cost	0	$
Installed Equipment Cost	928000	$
Misc Costs	180000	$
Operational labor cost	190000	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	20400	$/yr
Chemical cost	0	$/yr
Energy cost	389000	$/yr
Amortization cost	338000	$/yr
Notes		
Minimum winter SRT not calculated, design SRT specified by user		

Aerobic Digestion

Design Output Data

Description	Value	Units
Aerobic Digestion		
Design Information		
Solids retention time	26.6	d
Design SS	12000	mg/L
Calculated VSS	7770	mg/L
Calculated VSS:TSS ratio	0.648	mg VSS/mg SS
Total volume of reactors	8420	m3
Length of parallel train	85	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	1560	kg/d
Air flow required to meet avera	10000	N m3/hr
Design air flow	19.8	N m3/min/1000 m3
Volatile solids loading	0.0304	lb/(cuft·d)
Solids accumulated	8380	lb/d
Digester capacity	223000	lb
Volume of wasted sludge	1020000	gal(US)
Quantities		
Operation labor required	2120	pers-hrs/yr
Maintenance labor required	1150	pers-hrs/yr
Electrical energy required	1530000	kWh/yr
Volume of earthwork required	166000	cuft
Volume of slab concrete requir	37300	cuft
Volume of wall concrete requir	23800	cuft
Handrail length	638	ft
Number of diffusers per train	248	
Number of swing arm headers	12	
Costs		
Construction and equipment cc	1950000	$
Earthwork Cost	49100	$
Wall Concrete Cost	573000	$
Slab Concrete Cost	484000	$
Handrail Cost	47800	$
Installed Aerator Equipment	497000	$
Air Piping Cost	102000	$
Misc Costs	193000	$
Operational labor cost	109000	$/yr
Maintenance labor cost	48500	$/yr
Material and supply cost	114000	$/yr
Chemical cost	0	$/yr
Energy cost	153000	$/yr
Amortization cost	173000	$/yr
Notes		

Calculated effluent particulate COD is greater than user-specified effluent COD, consider changing user input.

Secondary Clarifier

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	15400	sqft
Surface area per circular clarifi	7680	sqft
Diameter of each circular clarif	99	ft
Number of clarifiers per battery	2	
Number of batteries	1	
Solids loading rate	22.2	lb/(sqft·d)
Hydraulic retention time	4.04	hr
Designed surface overflow rate	400	gal(US)/(sqft·d)
Weir length	1520	ft
Volume of wasted sludge	148000	gpd(US)
Quantities		
Operation labor required	1320	pers-hrs/yr
Maintenance labor required	732	pers-hrs/yr
Electrical energy required	10800	kWh/yr
Volume of earthwork required	206000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	14800	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	6470	cuft
Costs		
Construction and equipment cc	833000	$
Earthwork Cost	61200	$
Wall Concrete Cost	156000	$
Slab Concrete Cost	192000	$
Installed Equipment Cost	297000	$
Misc Costs	127000	$
Operational labor cost	68200	$/yr
Maintenance labor cost	30900	$/yr
Material and supply cost	8330	$/yr
Chemical cost	0	$/yr
Energy cost	1080	$/yr
Amortization cost	76200	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.148	MGD(US)
Total pumping capacity	0.148	MGD(US)
Design capacity per pump	51.5	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.148	MGD(US)
Quantities		
Operation labor required	344	pers-hrs/yr

Maintenance labor required	272	pers-hrs/yr
Electrical energy required	4990	kWh/yr
Volume of earthwork required	1620	cuft
Area of pump building	203	sqft
Costs		
Construction and equipment cc	51900	$
Earthwork Cost	481	$
Pump Building Cost	22300	$
Installed Pump Cost	21100	$
Misc Costs	7910	$
Operational labor cost	17700	$/yr
Maintenance labor cost	11500	$/yr
Material and supply cost	363	$/yr
Chemical cost	0	$/yr
Energy cost	499	$/yr
Amortization cost	4900	$/yr

Belt-Filter Press

Design Output Data

Description	Value	Units
Belt-Filter Press		
Design Information		
Belt filter width	2	m
Number of units	1	
Hydraulic loading per unit per r	70	gpm(US)
Hydraulic loading required per	112	gpm(US)
Final solids content	15	%
Solids capture fraction	0.996	
Quantities		
Operation labor required	266	pers-hrs/yr
Maintenance labor required	66.5	pers-hrs/yr
Power	79100	kWh/yr
Polymer required	34900	lb/yr
Dry solids produced	9560	lb/d
Belt filter(s)	301000	$
Building	322000	$
Installation	75300	$
Polymer system	111000	$
Feed pumps	33100	$
Conveyor system	75300	$
Costs		
Construction and equipment cc	918000	$
Building Cost	322000	$
Polymer System Cost	111000	$
Feed Pumps Cost	33100	$
Conveyor System Cost	75300	$
Installed Belt Filter	376000	$
Operational labor cost	13700	$/yr
Maintenance labor cost	2810	$/yr
Material and supply cost	0	$/yr
Chemical cost	45400	$/yr
Energy cost	7910	$/yr
Amortization cost	83700	$/yr

Ultra-Violet Disinfection

Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calc	0.226	gal(US)/(min·W)
System is not headloss constra		
Total number of lamps needed	2820	
Number of spare channels	1	
Total number of lamps used in	3840	
Number of excess lamps	1020	
Number of lamps/modules	16	
Number of modules/bank	20	
Number of banks/channel	3	
Number of channels	4	
Calculated headloss	0.137	in
Costs		
Construction and equipment cc	9460000	$
Cost of installation	5680000	$
Total cost of UV lamps	3790000	$
Operational labor cost	0	$/yr
Maintenance labor cost	122000	$/yr
Material and supply cost	94600	$/yr
Chemical cost	39800	$/yr
Energy cost	286000	$/yr
Amortization cost	863000	$/yr

Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	31.5	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	31.5	cuyd/d
Maximum anticipated landfill d	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	3190	sqft
Width of sludge storage shed s	39.9	ft
Length of sludge storage shed	79.9	ft
Volume of earthwork required	8740	cuft
Volume of slab concrete requir	3740	cuft
Surface area of canopy roof	3190	sqft
Round trip haul distance	20	miles
Round trips per day per truck	2	
Distance traveled per year per	10000	miles
Sludge hauled	27.9	ton(short)/d
Operation labor required	492	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment co	398000	$
Earthwork Cost	2590	$
Slab Concrete Cost	48400	$
Canopy Roof Cost	63800	$
Vehicle Cost	283000	$
Operational labor cost	25400	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	72000	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	70900	$/yr

Post Aeration

Design Output Data

Description	Value	Units
Post Aeration by Diffused Aeration		
Design Information		
Dissolved oxygen in influent	2	mg/L
Desired dissolved oxygen in ef	5	mg/L
Correction factor for pressure	1	
Minimum dissolved oxygen in t	2	mg/L
Oxygen saturation at summer t	8.55	mg/L
Oxygen required	150	lb/d
Operating transfer efficiency	2.96	lbO2/(HP·h)
Total volume of aerobic reacto	41600	gal(US)
Air flow rate required to meet a	200	scfm
Quantities		
Basin depth	15	ft
Length of basin	12.4	ft
Width of basin	30	ft
Number of diffusers	17	
Number of swing arm diffuser l	1	
Volume of wall concrete requir	953	cuft
Volume of slab concrete requir	278	cuft
Electrical energy required	49800	kWh/yr
Operation labor required	684	pers-hrs/yr
Maintenance labor required	274	pers-hrs/yr
Costs		
Construction and equipment co	62000	$
Wall Concrete Cost	22900	$
Slab Concrete Cost	12400	$
Installed Equipment Cost	20600	$
Misc Costs	6150	$
Operational labor cost	35200	$/yr
Maintenance labor cost	11600	$/yr
Material and supply cost	1390	$/yr
Chemical cost	0	$/yr
Energy cost	4980	$/yr
Amortization cost	5610	$/yr

Effluent

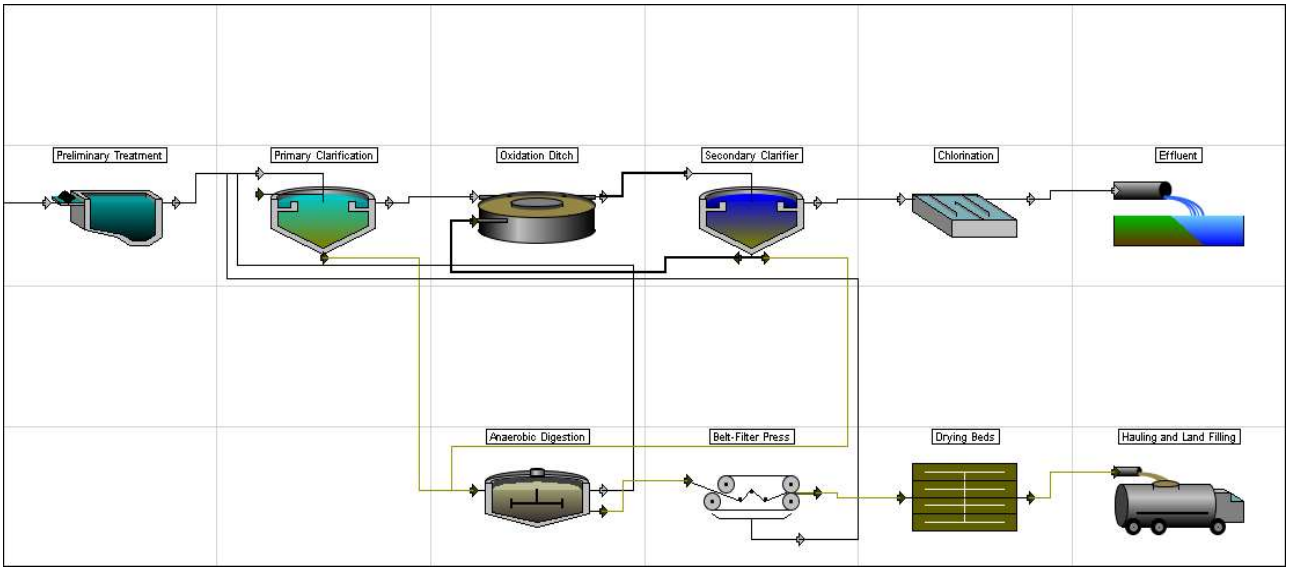
Design Output Data

Description	Value	Units
Costs		

Construction and equipment cc	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

Cedar City

Layout - Cedar City



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$18,200,000	$
Other direct construction costs	$6,020,000	$
Other indirect construction cos	$18,100,000	$
Total construction costs	$42,300,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$61,300	$/yr
Laboratory labor cost	$160,000	$/yr
Unit process operation labor c	$695,000	$/yr
Unit process maintenance labc	$247,000	$/yr
Total labor costs	$1,160,000	$/yr
MATERIAL COSTS		
Total material cost	$242,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$136,000	$/yr
ENERGY COSTS		
Total energy cost	$316,000	$/yr
Total operation and maintanen	$1,860,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$3,720,000	$/yr
Total annual project cost	$5,580,000	$/yr
PROJECT SUMMARY		
Present worth	$66,800,000	$
Total project cost	$42,300,000	$
Total operation labor cost	$916,000	$/yr
Total maintenance labor cost	$247,000	$/yr
Total material cost	$242,000	$/yr
Total chemical cost	$136,000	$/yr
Total energy cost	$316,000	$/yr
Total amortization cost	$3,720,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Influent Pump Station	2430000	38400	26200	17000	0	32000	210000
Preliminary Treatment	670000	58300	25100	16800	0	3310	56200
Primary Clarification	516000	52900	25900	5050	0	1000	48000
Oxidation Ditch	2420000	122000	0	19500	0	229000	234000

Anaerobic Digestion	8580000	82100	43500	87400	0	30500	812000
Secondary Clarifier	845000	74800	36300	8320	0	1230	77000
Belt-Filter Press	812000	12300	2500	0	41000	7180	74300
Chlorination	716000	50400	7450	26600	94900	11800	70700
Drying Beds	877000	197000	79900	7890	0	0	76300
Effluent	0	0	0	0	0	0	0
Hauling and Land Filling	316000	6870	0	53600	0	0	64000
Other Costs	24100000	221000	0	0	0	0	2000000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	16	acre
Administration labor hours	1190	hr/yr
Laboratory labor hours	3110	hr/yr
Costs		
DIRECT COSTS		
Mobilization	542000	$
Site preparation	786000	$
Site electrical	1520000	$
Yard piping	1010000	$
Instrumentation and control	766000	$
Lab and administration building	1390000	$
Total direct construction costs	6020000	$
INDIRECT COSTS		
Cost of land	320000	$
Miscellaneous cost	1390000	$
Legal cost	557000	$
Engineering design fee	4170000	$
Inspection cost	557000	$
Contingency	2780000	$
Technical	557000	$
Interest during construction	4140000	$
Profit	3630000	$
Total indirect construction cost	18100000	$
Total of other construction cos	24100000	$
LABOR COSTS		
Administration labor cost	61300	$/yr
Laboratory labor cost	160000	$/yr

Influent Wastewater

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	31200	cuft
Width of wet well	221	ft
Depth of the pumping station	28.8	ft
Length of the pumping station	22.8	ft
Width of the pumping station	254	ft
Minimum depth of water in wet	7.77	ft
Area of pump building	777	sqft
Peak capacity of pumps	16	MGD(US)
Firm pumping capacity	16	MGD(US)
Total dynamic head - average	44.4	ft
Quantities		
Operation labor required	745	pers-hrs/yr
Maintenance labor required	628	pers-hrs/yr
Electrical energy required	320000	kWh/yr
Volume of earthwork required	710000	cuft
Volume of slab concrete requir	56200	cuft
Volume of wall concrete requir	21700	cuft
Capacity per pump	11100	gpm(US)
Number of constant speed pur	2	
Number of variable speed pur	0	
Diameter of discharge header	23.8	in
Total dynamic head	58.7	ft
Size of selected pump	24	in
Specific speed of pump	4470	
Pump rotating speed	805	rpm
Motor size required	183	HP
Size of selected motor	200	HP
Width of pump system	5.4	ft
Length of pump system	23.5	ft
Length of the dry well	22.8	ft
Width of the dry well	32.5	ft
Costs		

Construction and equipment cc	2430000	$
Earthwork Cost	210000	$
Wall Concrete Cost	523000	$
Slab Concrete Cost	729000	$
Building Cost	85500	$
Installed Pump Equipment C	512000	$
Misc Costs	371000	$
Operational labor cost	38400	$/yr
Maintenance labor cost	26200	$/yr
Material and supply cost	17000	$/yr
Chemical cost	0	$/yr
Energy cost	32000	$/yr
Amortization cost	210000	$/yr

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	2.96	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	15.4	cuft/s
Average flow	7.39	cuft/s
Minimum flow	2.31	cuft/s
Temperature	10	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	7.7	cuft/s
Width of channel	1.28	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.0013	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	19.2	cuft/d
Costs		
Construction and equipment cc	670000	$
Operational labor cost	58300	$/yr
Maintenance labor cost	25100	$/yr
Material and supply cost	16800	$/yr
Chemical cost	0	$/yr
Energy cost	3310	$/yr
Amortization cost	56200	$/yr

Primary Clarification

Design Output Data

Description	Value	Units
Primary Clarification		
Design Information		
Surface area	6090	sqft
Surface area per circular clarifi	3040	sqft
Diameter of each circular clarif	63	ft
Number of clarifiers per battery	2	
Number of batteries	1	
Solids loading rate	1.94	lb/(sqft·d)
Hydraulic retention time	2.02	hr
Weir length	1010	ft
Volume of sludge generated	20600	gpd(US)
Quantities		
Operation labor required	759	pers-hrs/yr
Maintenance labor required	416	pers-hrs/yr
Electrical energy required	9300	kWh/yr
Volume of earthwork required	76600	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	6260	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	4200	cuft
Costs		

Construction and equipment cc	479000	$
Earthwork Cost	22700	$
Wall Concrete Cost	101000	$
Slab Concrete Cost	81200	$
Installed Equipment Cost	201000	$
Misc Costs	73100	$
Operational labor cost	39100	$/yr
Maintenance labor cost	17400	$/yr
Material and supply cost	4790	$/yr
Chemical cost	0	$/yr
Energy cost	930	$/yr
Amortization cost	44500	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0206	MGD(US)
Total pumping capacity	0.0206	MGD(US)
Design capacity per pump	7.17	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.0206	MGD(US)
Quantities		
Operation labor required	267	pers-hrs/yr
Maintenance labor required	203	pers-hrs/yr
Electrical energy required	698	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment cc	37000	$
Earthwork Cost	475	$
Pump Building Cost	22000	$
Installed Pump Cost	8870	$
Misc Costs	5650	$
Operational labor cost	13800	$/yr
Maintenance labor cost	8480	$/yr
Material and supply cost	259	$/yr
Chemical cost	0	$/yr
Energy cost	70	$/yr
Amortization cost	3500	$/yr

Oxidation Ditch

Design Output Data

Description	Value	Units
Oxidation Ditch		
Design Information		
Carbon & Nitrification Design		
Design SRT for design at winte	25	d
Design SS	2500	mg/L
Calculated VSS	1830	mg/L
Calculated VSS:TSS ratio	0.733	mg VSS/mg SS
Total volume of reactors	21200	m3
Ditch length	104	m
Ditch width	29.9	m
Sidewater depth	3.66	m
Number of batteries	1	
Number of parallel ditches per	2	
Number of rotors per ditch	3	
Rotor length for aeration	51.8	m
Rotor length for mixing	81.4	m
Installed rotor length per rotor	13.6	m
Rotor horsepower	20	HP
Total installed horsepower per	120	HP
Assumed surface velocity	0.46	m/s
Hydraulic retention time	27.8	hr
F/M ratio	0.0735	lb BOD/lb MLSS/d
Volumetric BOD loading	0.135	kg BOD/m3/d
Observed yield (VSS basis)	0.509	g VSS/g BOD
Observed yield (TSS basis)	0.694	g TSS/g BOD
Amount of alkalinity required	253	gCaCO3/m3
Amount of sludge generated	2120	kg/d
Sludge recycle rate	6120	m3/d
Nitrogen requirement for biom	8.48	mg/L
Phosphorus requirement for bi	1.7	mg/L
Oxygen requirement to meet a	6920	kg/d
Quantities		
Ditch bottom width	48.5	ft
Length of straight section	245	ft
Volume of excavation required	381000	cuft
Volume of backfill required per	8930	cuft
Volume of wall concrete requir	27900	cuft
Volume of slab concrete requir	46900	cuft
Length of adjustable weir	76.4	ft
Volume of concrete required p	326	cuft

Total handrail length	0	ft
Operation labor required	2360	pers-hrs/yr
Electrical energy required	2290000	kWh/yr
Costs		
Construction and equipment cc	2420000	$
Earthwork Cost	113000	$
Wall Concrete Cost	687000	$
Slab Concrete Cost	608000	$
Handrail Cost	0	$
Installed Equipment Cost	888000	$
Misc Costs	119000	$
Operational labor cost	122000	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	19500	$/yr
Chemical cost	0	$/yr
Energy cost	229000	$/yr
Amortization cost	234000	$/yr

Anaerobic Digestion

Design Output Data

Description	Value	Units
Anaerobic Digestion		
Design Information		
Percent VSS destroyed	50	%
Solids concentration in digeste	5	%
Detention time	30	d
Digester depth	35	ft
Digester diameter	110	ft
Effective digester volume	753000	cuft
Number of digesters per batter	2	
Number of primary digesters p	1	
Number of secondary digester	1	
Number of batteries	1	
Gas produced	46.4	cuft/min
Heat required	2200000	BTU/hr
Digester gas required	84.8	cuft/min
Total natural gas required	995000	cuft/yr
Quantities		
Operation labor required	1590	pers-hrs/yr
Maintenance labor required	1040	pers-hrs/yr
Electrical energy required	136000	kWh/yr
Volume of earthwork required	751000	cuft
Slab thickness	12.7	in
Volume of slab concrete requir	21400	cuft
Wall thickness	25	in
Volume of wall concrete requir	59800	cuft
Sidewater depth	35	ft
Surface area/floor of 2-story cc	3560	sqft
Piping size	12	in
Length of total piping system	937	ft
Number of 90 degree elbows	26	
Number of tees	51	
Number of plug valves	37	
Total dry solids treated	6	ton(short)/d
Costs		
Construction and equipment cc	8580000	$
Earthwork Cost	222000	$
Wall Concrete Cost	1440000	$
Slab Concrete Cost	278000	$
Building Cost	391000	$
Piping System Cost	704000	$
Floating Cover Cost	3590000	$
Gas Recirculation Units Cost	387000	$
Heating Units Cost	425000	$
Gas Safety Equipment Cost	150000	$
Installed Pumps Cost	150000	$
Operational labor cost	82100	$/yr
Maintenance labor cost	43500	$/yr
Material and supply cost	87400	$/yr
Chemical cost	0	$/yr
Energy cost	30500	$/yr
Amortization cost	812000	$/yr

Secondary Clarifier

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	12100	sqft
Surface area per circular clarifi	6060	sqft
Diameter of each circular clarif	88	ft
Number of clarifiers per battery	2	

Number of batteries	1	
Solids loading rate	11.1	lb/(sqft·d)
Hydraulic retention time	5.39	hr
Designed surface overflow rate	400	gal(US)/(sqft·d)
Weir length	1260	ft
Volume of wasted sludge	54500	gpd(US)
Quantities		
Operation labor required	1150	pers-hrs/yr
Maintenance labor required	634	pers-hrs/yr
Electrical energy required	10400	kWh/yr
Volume of earthwork required	158000	cuft
Slab thickness	10.9	in
Volume of slab concrete requir	12700	cuft
Wall thickness	13	in
Volume of wall concrete requir	8300	cuft
Costs		
Construction and equipment co	802000	$
Earthwork Cost	46900	$
Wall Concrete Cost	200000	$
Slab Concrete Cost	164000	$
Installed Equipment Cost	268000	$
Misc Costs	122000	$
Operational labor cost	59200	$/yr
Maintenance labor cost	26500	$/yr
Material and supply cost	8020	$/yr
Chemical cost	0	$/yr
Energy cost	1040	$/yr
Amortization cost	72900	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0545	MGD(US)
Total pumping capacity	0.0545	MGD(US)
Design capacity per pump	18.9	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.0545	MGD(US)
Quantities		
Operation labor required	303	pers-hrs/yr
Maintenance labor required	234	pers-hrs/yr
Electrical energy required	1840	kWh/yr
Volume of earthwork required	1610	cuft
Area of pump building	201	sqft
Costs		
Construction and equipment co	42700	$
Earthwork Cost	477	$
Pump Building Cost	22100	$
Installed Pump Cost	13600	$
Misc Costs	6520	$
Operational labor cost	15600	$/yr
Maintenance labor cost	9790	$/yr
Material and supply cost	299	$/yr
Chemical cost	0	$/yr
Energy cost	184	$/yr
Amortization cost	4040	$/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	50.3	gpm(US)
Final solids content	15	%
Solids capture fraction	0.998	
Quantities		
Operation labor required	240	pers-hrs/yr
Maintenance labor required	59.9	pers-hrs/yr
Power	71800	kWh/yr
Polymer required	31500	lb/yr
Dry solids produced	8630	lb/d
Belt filter(s)	275000	$
Building	279000	$
Installation	68800	$
Polymer system	82500	$
Feed pumps	30300	$
Conveyor system	77000	$
Costs		
Construction and equipment co	812000	$
Building Cost	279000	$
Polymer System Cost	82500	$

Feed Pumps Cost	30300	$
Conveyor System Cost	77000	$
Installed Belt Filter	344000	$
Operational labor cost	12300	$/yr
Maintenance labor cost	2500	$/yr
Material and supply cost	0	$/yr
Chemical cost	41000	$/yr
Energy cost	7180	$/yr
Amortization cost	74300	$/yr

Chlorination

Design Output Data

Description	Value	Units
Chlorination		
Design Information		
Volume of tank	416000	gal(US)
Average chlorine required	400	lb/d
Peak chlorine required	834	lb/d
Influent coliform count	10000000	/100ml
Effluent coliform count	3.72	/100ml
Quantities		
Operational labor required	978	pers-hrs/yr
Maintenance labor required	178	pers-hrs/yr
Electrical energy required	118000	kWh/yr
Volume of earthwork required	23700	cuft
Volume of slab concrete requir	5580	cuft
Volume of wall concrete requir	8150	cuft
Number of chlorinators and ev	1	
Chlorination building area	220	sqft
Number of chlorine cylinders	6	
Area of chlorine storage buildir	840	sqft
Costs		
Construction and equipment cc	716000	$
Earthwork Cost	7030	$
Wall Concrete Cost	196000	$
Slab Concrete Cost	72300	$
Installed Equipment Cost	320000	$
Building Cost	24200	$
Storage Building Cost	46200	$
Misc Costs	49600	$
Operational labor cost	50400	$/yr
Maintenance labor cost	7450	$/yr
Material and supply cost	26600	$/yr
Chemical cost	94900	$/yr
Energy cost	11800	$/yr
Amortization cost	70700	$/yr

Drying Beds

Design Output Data

Description	Value	Units
Sludge Drying Beds		
Design Information		
Total surface area required	62500	sqft
Initial depth of sludge	12	in
Final solids	50	%
Bed holding time	81.4	d
Quantities		
Total drying bed surface area	62500	sqft
Number beds	21	
Surface area of each individua	2970	sqft
Length of each bed	149	ft
Volume of earthwork required	307000	cuft
Volume concrete for dividing w	20800	cuft
Volume of R.C. in-place for tru	4680	cuft
Volume of sand	46800	cuft
Volume of gravel	62500	cuft
Clay pipe diameter	6	in
Total length clay pipe	6250	in
Sludge solids produced	3.59	ton(short)/d
Operational labor required	3830	pers-hrs/yr
Maintenance labor required	1910	pers-hrs/yr
Costs		
Construction and equipment cc	877000	$
Earthwork Cost	91000	$
Wall Concrete Cost	351000	$
Slab Concrete Cost	36400	$
Drying Bed Media Cost	174000	$
Drain Pipe System Cost	137000	$
Misc Costs	86900	$
Operational labor cost	197000	$/yr
Maintenance labor cost	79900	$/yr
Material and supply cost	7890	$/yr

Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	76300	$/yr

Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	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

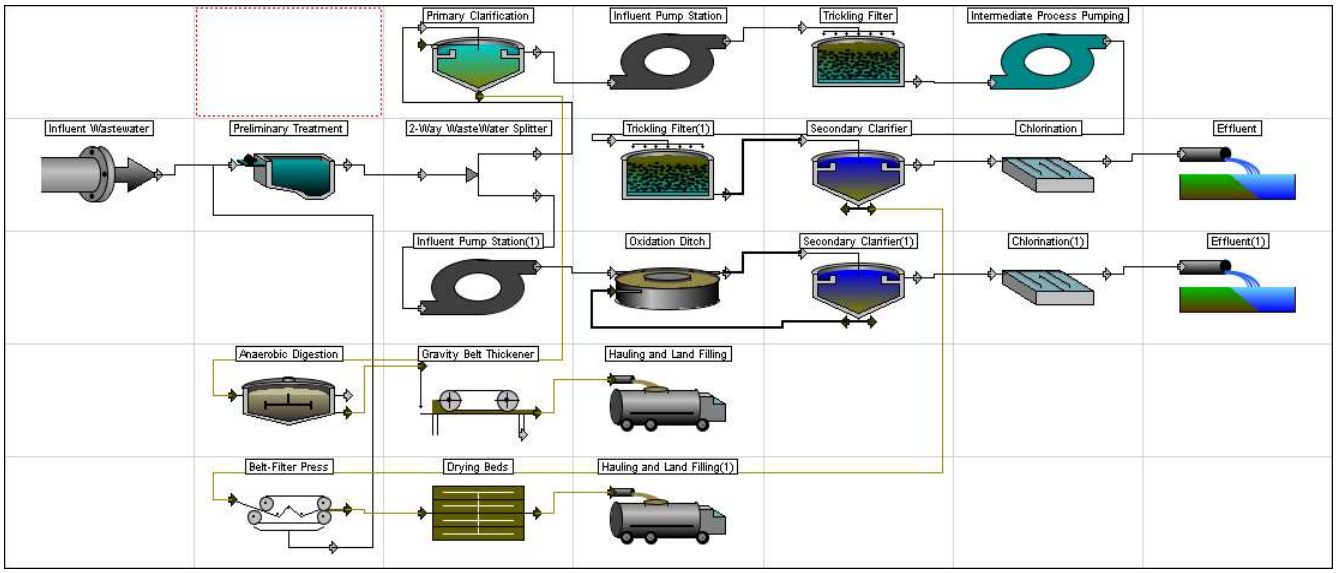
Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	8.52	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	8.52	cuyd/d
Maximum anticipated landfill dc	30	d
Anticipated sludge storage heig	8	ft
Sludge storage shed area	863	sqft
Width of sludge storage shed s	20.8	ft
Length of sludge storage shed	41.5	ft
Volume of earthwork required	2570	cuft
Volume of slab concrete requir	1150	cuft
Surface area of canopy roof	863	sqft
Round trip haul distance	20	miles
Round trips per day per truck	1	
Distance traveled per year per	5000	miles
Sludge hauled	7.54	ton(short)/d
Operation labor required	133	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment cc	316000	$
Earthwork Cost	761	$
Slab Concrete Cost	14900	$
Canopy Roof Cost	17300	$
Vehicle Cost	283000	$
Operational labor cost	6870	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	53600	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	64000	$/yr

Central Davis Sewer District

Layout 1 - Central Davis Sewer District



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$23,600,000	$
Other direct construction costs	$10,200,000	$
Other indirect construction cos	$25,300,000	$
Total construction costs	$59,000,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$126,000	$/yr
Laboratory labor cost	$184,000	$/yr
Unit process operation labor c	$981,000	$/yr
Unit process maintenance labc	$370,000	$/yr
Total labor costs	$1,660,000	$/yr
MATERIAL COSTS		
Total material cost	$380,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$243,000	$/yr
ENERGY COSTS		
Total energy cost	$675,000	$/yr
Total operation and maintanen	$2,960,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$5,170,000	$/yr
Total annual project cost	$8,130,000	$/yr
PROJECT SUMMARY		
Present worth	$97,300,000	$
Total project cost	$59,000,000	$
Total operation labor cost	$1,290,000	$/yr
Total maintenance labor cost	$370,000	$/yr
Total material cost	$380,000	$/yr
Total chemical cost	$243,000	$/yr
Total energy cost	$675,000	$/yr
Total amortization cost	$5,170,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Preliminary Treatment	1240000	116000	47300	31100	0	5060	104000
Anaerobic Digestion	3110000	55100	29400	41600	0	24300	294000
Belt-Filter Press	812000	864	181	0	2850	614	74300
Primary Clarification	456000	47500	24200	4450	0	957	42400

2-Way WasteWater Splitter	0	0	0	0	0	0	0
Influent Pump Station(1)	1110000	43400	30500	7800	0	40400	99900
Gravity Belt Thickener	812000	4600	963	0	5290	2160	74300
Drying Beds	1520000	28100	10600	13600	0	0	133000
Influent Pump Station	985000	38300	27100	6900	0	39900	87900
Trickling Filter(1)	986000	50700	36200	5030	0	36800	88400
Oxidation Ditch	4710000	207000	0	37800	0	445000	456000
Hauling and Land Filling	367000	18300	0	72000	0	0	68300
Hauling and Land Filling(1)	286000	477	0	53600	0	0	61500
Trickling Filter	2790000	50700	36200	16200	0	36900	241000
Secondary Clarifier	637000	63100	31000	6270	0	1020	59000
Secondary Clarifier(1)	1690000	117000	57900	16800	0	1960	151000
Intermediate Process Pumping	220000	27700	19600	1540	0	15900	20800
Chlorination	884000	50300	7670	32800	94500	11800	84800
Chlorination(1)	970000	61900	11200	32900	140000	12300	94200
Effluent	0	0	0	0	0	0	0
Effluent(1)	0	0	0	0	0	0	0
Other Costs	35400000	309000	0	0	0	0	2930000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	22	acre
Administration labor hours	2440	hr/yr
Laboratory labor hours	3570	hr/yr
Costs		
DIRECT COSTS		
Site preparation	1330000	$
Site electrical	2970000	$
Yard piping	1940000	$
Instrumentation and control	1570000	$
Lab and administration building	2360000	$
Total direct construction costs	10200000	$
INDIRECT COSTS		
Cost of land	440000	$
Miscellaneous cost	1940000	$
Legal cost	777000	$
Engineering design fee	5820000	$
Inspection cost	777000	$
Contingency	3880000	$
Technical	777000	$
Interest during construction	5780000	$
Profit	5060000	$
Total indirect construction cost	25300000	$
Total of other construction cos	35400000	$
LABOR COSTS		
Administration labor cost	126000	$/yr
Laboratory labor cost	184000	$/yr

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	2.47	ft
Average channel depth	3	ft
Aerated Grit Chamber		
Maximum flow	41.6	cuft/s
Average flow	18.5	cuft/s
Minimum flow	15.4	cuft/s
Temperature	10	deg C
Maximum flow through velocity	0.152	ft/s
Average flow through velocity (	0.0676	ft/s
Size of smallest particle 100%	0.2	mm
Specific gravity of particle	2.65	
Number of units	2	
Maximum flow/unit	20.8	cuft/s
Width of channel	22.8	ft
Depth of channel	6	ft

Length of channel	22.8	ft
Settling velocity of particle	0.0707	ft/s
Hydraulic retention time	2.5	min
Volume of grit	48	cuft/d
Air supply	3	cfm
Costs		
Construction and equipment cc	1240000	$
Operational labor cost	116000	$/yr
Maintenance labor cost	47300	$/yr
Material and supply cost	31100	$/yr
Chemical cost	0	$/yr
Energy cost	5060	$/yr
Amortization cost	104000	$/yr

Anaerobic Digestion

Design Output Data

Description	Value	Units
Anaerobic Digestion		
Design Information		
Percent VSS destroyed	50	%
Solids concentration in digeste	5	%
Detention time	30	d
Digester depth	26.2	ft
Digester diameter	60	ft
Effective digester volume	162000	cuft
Number of digesters per batter	2	
Number of primary digesters p	1	
Number of secondary digester	1	
Number of batteries	1	
Gas produced	21.7	cuft/min
Heat required	801000	BTU/hr
Digester gas required	30.9	cuft/min
Total natural gas required	960000	cuft/yr
Quantities		
Operation labor required	1070	pers-hrs/yr
Maintenance labor required	682	pers-hrs/yr
Electrical energy required	79600	kWh/yr
Volume of earthwork required	162000	cuft
Slab thickness	10.6	in
Volume of slab concrete requir	5510	cuft
Wall thickness	20.6	in
Volume of wall concrete requir	20900	cuft
Sidewater depth	26.2	ft
Surface area/floor of 2-story cc	1060	sqft
Piping size	8	in
Length of total piping system	590	ft
Number of 90 degree elbows	26	
Number of tees	51	
Number of plug valves	37	
Total dry solids treated	2.45	ton(short)/d
Costs		
Construction and equipment cc	3110000	$
Earthwork Cost	47900	$
Wall Concrete Cost	502000	$
Slab Concrete Cost	71500	$
Building Cost	116000	$
Piping System Cost	377000	$
Floating Cover Cost	1060000	$
Gas Recirculation Units Cost	254000	$
Heating Units Cost	182000	$
Gas Safety Equipment Cost	120000	$
Installed Pumps Cost	74800	$
Operational labor cost	55100	$/yr
Maintenance labor cost	29400	$/yr
Material and supply cost	41600	$/yr
Chemical cost	0	$/yr
Energy cost	24300	$/yr
Amortization cost	294000	$/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	17.6	gpm(US)
Final solids content	19	%
Solids capture fraction	0.99	
Quantities		
Operation labor required	16.8	pers-hrs/yr

Maintenance labor required	4.2	pers-hrs/yr
Power	6140	kWh/yr
Polymer required	2190	lb/yr
Dry solids produced	600	lb/d
Belt filter(s)	275000	$
Building	279000	$
Installation	68800	$
Polymer system	82500	$
Feed pumps	30300	$
Conveyor system	77000	$
Costs		
Construction and equipment cc	812000	$
Building Cost	279000	$
Polymer System Cost	82500	$
Feed Pumps Cost	30300	$
Conveyor System Cost	77000	$
Installed Belt Filter	344000	$
Operational labor cost	864	$/yr
Maintenance labor cost	181	$/yr
Material and supply cost	0	$/yr
Chemical cost	2850	$/yr
Energy cost	614	$/yr
Amortization cost	74300	$/yr

Primary Clarification

Design Output Data

Description	Value	Units
Primary Clarification		
Design Information		
Surface area	4800	sqft
Surface area per circular clarifi	2400	sqft
Diameter of each circular clarif	56	ft
Number of clarifiers per batter	2	
Number of batteries	1	
Solids loading rate	1.67	lb/(sqft·d)
Hydraulic retention time	1.62	hr
Weir length	720	ft
Volume of sludge generated	18600	gpd(US)
Quantities		
Operation labor required	658	pers-hrs/yr
Maintenance labor required	360	pers-hrs/yr
Electrical energy required	8940	kWh/yr
Volume of earthwork required	60100	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	5020	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	3760	cuft
Costs		
Construction and equipment cc	419000	$
Earthwork Cost	17800	$
Wall Concrete Cost	90500	$
Slab Concrete Cost	65100	$
Installed Equipment Cost	182000	$
Misc Costs	63900	$
Operational labor cost	33900	$/yr
Maintenance labor cost	15500	$/yr
Material and supply cost	4190	$/yr
Chemical cost	0	$/yr
Energy cost	894	$/yr
Amortization cost	39000	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0186	MGD(US)
Total pumping capacity	0.0186	MGD(US)
Design capacity per pump	6.46	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.0186	MGD(US)
Quantities		
Operation labor required	264	pers-hrs/yr
Maintenance labor required	200	pers-hrs/yr
Electrical energy required	630	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment cc	36600	$
Earthwork Cost	475	$
Pump Building Cost	22000	$
Installed Pump Cost	8480	$
Misc Costs	5580	$
Operational labor cost	13600	$/yr
Maintenance labor cost	8620	$/yr

Material and supply cost	256	$/yr
Chemical cost	0	$/yr
Energy cost	63	$/yr
Amortization cost	3460	$/yr

2-Way WasteWater Splitter

Design Output Data

Description	Value	Units
2-Way Wastewater Flow Splitter		
Design Information		
Flow to first split (average)	4.8	MGD(US)
Flow to first split (peak)	10.8	MGD(US)
Flow to first split (minimum)	4	MGD(US)
Flow to second split (average)	7.2	MGD(US)
Flow to second split (peak)	16.2	MGD(US)
Flow to second split (minimum	6	MGD(US)
Costs		
Construction and equipment cc	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

Influent Pump Station(1)

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	2040	cuft
Width of wet well	11.9	ft
Depth of the pumping station	27.9	ft
Length of the pumping station	28.6	ft
Width of the pumping station	41.7	ft
Minimum depth of water in wet	6.91	ft
Area of pump building	893	sqft
Peak capacity of pumps	23.1	MGD(US)
Firm pumping capacity	23.1	MGD(US)
Total dynamic head - average	34.2	ft
Quantities		
Operation labor required	843	pers-hrs/yr
Maintenance labor required	708	pers-hrs/yr
Electrical energy required	404000	kWh/yr
Volume of earthwork required	186000	cuft
Volume of slab concrete requir	9740	cuft
Volume of wall concrete requir	6280	cuft
Capacity per pump	8040	gpm(US)
Number of constant speed pur	1	
Number of variable speed pur	2	
Diameter of discharge header	28.7	in
Total dynamic head	46.2	ft
Size of selected pump	18	in
Specific speed of pump	4550	
Pump rotating speed	791	rpm
Motor size required	114	HP
Size of selected motor	125	HP
Width of pump system	4.2	ft
Length of pump system	20.7	ft
Length of the dry well	28.6	ft
Width of the dry well	29.7	ft
Costs		
Construction and equipment cc	1110000	$
Earthwork Cost	55200	$
Wall Concrete Cost	151000	$
Slab Concrete Cost	126000	$
Building Cost	98200	$
Installed Pump Equipment C	487000	$
Installed Control Module Cos	25800	$
Misc Costs	170000	$
Operational labor cost	43400	$/yr
Maintenance labor cost	30500	$/yr
Material and supply cost	7800	$/yr
Chemical cost	0	$/yr
Energy cost	40400	$/yr
Amortization cost	99900	$/yr

Gravity Belt Thickener

Design Output Data

Description	Value	Units
Gravity Belt Thickener		
Design Information		

Belt filter width	1	m
Number of units	1	
Hydraulic loading per unit per r	125	gpm(US)
Hydraulic loading required per	18.7	gpm(US)
Final solids content	7	%
Solids capture fraction	0.998	
Quantities		
Operation labor required	89.3	pers-hrs/yr
Maintenance labor required	22.3	pers-hrs/yr
Power	21600	kWh/yr
Polymer required	4070	lb/yr
Dry solids produced	2790	lb/d
Costs		
Construction and equipment cc	812000	$
Building Cost	279000	$
Polymer System Cost	82500	$
Feed Pump Cost	30300	$
Conveyor System Cost	77000	$
Installed Belt Filter System C	344000	$
Operational labor cost	4600	$/yr
Maintenance labor cost	963	$/yr
Material and supply cost	0	$/yr
Chemical cost	5290	$/yr
Energy cost	2160	$/yr
Amortization cost	74300	$/yr

Drying Beds

Design Output Data

Description	Value	Units
Sludge Drying Beds		
Design Information		
Total surface area required	100000	sqft
Initial depth of sludge	12	in
Final solids	50	%
Bed holding time	103	d
Quantities		
Total drying bed surface area	100000	sqft
Number beds	3	
Surface area of each individua	33300	sqft
Length of each bed	1670	ft
Volume of earthwork required	479000	cuft
Volume concrete for dividing w	34300	cuft
Volume of R.C. in-place for tru	7500	cuft
Volume of sand	75000	cuft
Volume of gravel	100000	cuft
Clay pipe diameter	8	in
Total length clay pipe	10000	in
Sludge solids produced	0.249	ton(short)/d
Operational labor required	546	pers-hrs/yr
Maintenance labor required	245	pers-hrs/yr
Costs		
Construction and equipment cc	1520000	$
Earthwork Cost	142000	$
Wall Concrete Cost	579000	$
Slab Concrete Cost	58300	$
Drying Bed Media Cost	279000	$
Drain Pipe System Cost	308000	$
Misc Costs	150000	$
Operational labor cost	28100	$/yr
Maintenance labor cost	10600	$/yr
Material and supply cost	13600	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	133000	$/yr

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	2090	cuft
Width of wet well	10.9	ft
Depth of the pumping station	26.3	ft
Length of the pumping station	32	ft
Width of the pumping station	38.1	ft
Minimum depth of water in wet	5.34	ft
Area of pump building	913	sqft
Peak capacity of pumps	16	MGD(US)
Firm pumping capacity	16	MGD(US)
Total dynamic head - average	44.4	ft
Quantities		
Operation labor required	745	pers-hrs/yr

Maintenance labor required	627	pers-hrs/yr
Electrical energy required	399000	kWh/yr
Volume of earthwork required	170000	cuft
Volume of slab concrete requir	9420	cuft
Volume of wall concrete requir	5950	cuft
Capacity per pump	3690	gpm(US)
Number of constant speed pur	2	
Number of variable speed pur	2	
Diameter of discharge header	23.8	in
Total dynamic head	58.7	ft
Size of selected pump	12	in
Specific speed of pump	3440	
Pump rotating speed	1400	rpm
Motor size required	76.1	HP
Size of selected motor	100	HP
Width of pump system	3	ft
Length of pump system	18.2	ft
Length of the dry well	32	ft
Width of the dry well	27.2	ft
Costs		
Construction and equipment co	985000	$
Earthwork Cost	50500	$
Wall Concrete Cost	143000	$
Slab Concrete Cost	122000	$
Building Cost	100000	$
Installed Pump Equipment C	395000	$
Installed Control Module Cos	23100	$
Misc Costs	150000	$
Operational labor cost	38300	$/yr
Maintenance labor cost	27100	$/yr
Material and supply cost	6900	$/yr
Chemical cost	0	$/yr
Energy cost	39900	$/yr
Amortization cost	87900	$/yr

Trickling Filter(1)

Design Output Data

Description	Value	Units
Trickling Filtration		
Design Information		
Reaction rate constant	0.00156	
Hydraulic loading rate	0.75	gal(US)/(sqft·min)
Total hydraulic loading rate	0.75	gal(US)/(sqft·min)
Recirculation ratio	0	
Number of towers per stage	2	
Number of stages	1	
Depth of filter tower	8	ft
Diameter of filter tower	53.1	ft
Surface area per filter tower	2210	sqft
Total surface area	4430	sqft
Volume per filter tower	17700	cuft
Total volume	35400	cuft
Quantities		
Operation labor required	332	pers-hr/yr
Maintenance labor required	287	pers-hr/yr
Volume of earthwork required	53900	cuft
Volume of slab concrete requir	2950	cuft
Volume of wall concrete requir	4770	cuft
Number of posts per tower	161	
Total length of precast beams	2360	ft
Costs		
Construction and equipment co	767000	$
Earthwork Cost	16000	$
Wall Concrete Cost	115000	$
Slab Concrete Cost	38300	$
Concrete Beam Cost	94700	$
Media Cost	202000	$
Installed Distributor Arm Cos	148000	$
Misc Costs	153000	$
Operational labor cost	17100	$/yr
Maintenance labor cost	12400	$/yr
Material and supply cost	3500	$/yr
Chemical cost	0	$/yr
Energy cost	882	$/yr
Amortization cost	67600	$/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	3	
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	359000	kWh/yr
Volume of earthwork required	3300	cuft
Area of pump building	413	sqft
Costs		
Construction and equipment cc	220000	$
Earthwork Cost	978	$
Pump Building Cost	45400	$
Installed Pump Cost	140000	$
Misc Costs	33500	$
Operational labor cost	33600	$/yr
Maintenance labor cost	23800	$/yr
Material and supply cost	1540	$/yr
Chemical cost	0	$/yr
Energy cost	35900	$/yr
Amortization cost	20800	$/yr

Oxidation Ditch

Design Output Data

Description	Value	Units
Oxidation Ditch		
Design Information		
Carbon & Nitrification Design		
Design SRT for design at winte	25	d
Design SS	2500	mg/L
Calculated VSS	2000	mg/L
Calculated VSS:TSS ratio	0.802	mg VSS/mg SS
Total volume of reactors	41300	m3
Ditch length	104	m
Ditch width	29.1	m
Sidewater depth	3.66	m
Number of batteries	2	
Number of parallel ditches per	2	
Number of rotors per ditch	3	
Rotor length for aeration	67	m
Rotor length for mixing	158	m
Installed rotor length per rotor	13.2	m
Rotor horsepower	20	HP
Total installed horsepower per	120	HP
Assumed surface velocity	0.46	m/s
Hydraulic retention time	36.3	hr
F/M ratio	0.0658	lb BOD/lb MLSS/d
Volumetric BOD loading	0.132	kg BOD/m3/d
Observed yield (VSS basis)	0.61	g VSS/g BOD
Observed yield (TSS basis)	0.761	g TSS/g BOD
Amount of alkalinity required	113	gCaCO3/m3
Amount of sludge generated	4130	kg/d
Sludge recycle rate	12400	m3/d
Nitrogen requirement for biom	12.1	mg/L
Phosphorus requirement for bi	2.43	mg/L
Oxygen requirement to meet a	8960	kg/d
Quantities		
Ditch bottom width	47.3	ft
Length of straight section	246	ft
Volume of excavation required	743000	cuft
Volume of backfill required per	8830	cuft
Volume of wall concrete requir	27700	cuft
Volume of slab concrete requir	45600	cuft
Length of adjustable weir	56.8	ft
Volume of concrete required p	247	cuft
Total handrail length	0	ft
Operation labor required	4020	pers-hrs/yr
Electrical energy required	4450000	kWh/yr
Costs		
Construction and equipment cc	4710000	$
Earthwork Cost	220000	$
Wall Concrete Cost	1360000	$
Slab Concrete Cost	1180000	$
Handrail Cost	0	$
Installed Equipment Cost	1720000	$
Misc Costs	233000	$
Operational labor cost	207000	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	37800	$/yr
Chemical cost	0	$/yr
Energy cost	445000	$/yr
Amortization cost	456000	$/yr

Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	22.7	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	22.7	cuyd/d
Maximum anticipated landfill dc	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	2300	sqft
Width of sludge storage shed s	33.9	ft
Length of sludge storage shed	67.8	ft
Volume of earthwork required	6400	cuft
Volume of slab concrete requir	2760	cuft
Surface area of canopy roof	2300	sqft
Round trip haul distance	20	miles
Round trips per day per truck	2	
Distance traveled per year per	10000	miles
Sludge hauled	20.1	ton(short)/d
Operation labor required	355	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment cc	367000	$
Earthwork Cost	1900	$
Slab Concrete Cost	35800	$
Canopy Roof Cost	46000	$
Vehicle Cost	283000	$
Operational labor cost	18300	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	72000	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	68300	$/yr

Hauling and Land Filling(1)

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	0.592	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	0.592	cuyd/d
Maximum anticipated landfill dc	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	60	sqft
Width of sludge storage shed s	5.48	ft
Length of sludge storage shed	11	ft
Volume of earthwork required	273	cuft
Volume of slab concrete requir	135	cuft
Surface area of canopy roof	60	sqft
Round trip haul distance	20	miles
Round trips per day per truck	1	
Distance traveled per year per	5000	miles
Sludge hauled	0.524	ton(short)/d
Operation labor required	9.26	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment cc	286000	$
Earthwork Cost	81	$
Slab Concrete Cost	1750	$
Canopy Roof Cost	1200	$
Vehicle Cost	283000	$
Operational labor cost	477	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	53600	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	61500	$/yr

Trickling Filter

Design Output Data

Description	Value	Units
Trickling Filtration		
Design Information		
Reaction rate constant	0.00156	
Hydraulic loading rate	0.75	gal(US)/(sqft·min)
Adjusted hydraulic loading rate	0.399	gal(US)/(sqft·min)
Total hydraulic loading rate	0.5	gal(US)/(sqft·min)
Recirculation ratio	0.254	
Number of towers per stage	2	
Number of stages	1	
Depth of filter tower	26.9	ft
Diameter of filter tower	72.8	ft
Surface area per filter tower	4170	sqft
Total surface area	8330	sqft
Volume per filter tower	112000	cuft
Total volume	224000	cuft
Quantities		
Operation labor required	332	pers-hr/yr
Maintenance labor required	287	pers-hr/yr
Volume of earthwork required	104000	cuft
Volume of slab concrete requir	5560	cuft
Volume of wall concrete requir	13000	cuft
Number of posts per tower	297	
Total length of precast beams	4490	ft
Costs		
Construction and equipment co	2570000	$
Earthwork Cost	30900	$
Wall Concrete Cost	312000	$
Slab Concrete Cost	72000	$
Concrete Beam Cost	180000	$
Media Cost	1280000	$
Installed Distributor Arm Cos	183000	$
Misc Costs	514000	$
Operational labor cost	17100	$/yr
Maintenance labor cost	12400	$/yr
Material and supply cost	14600	$/yr
Chemical cost	0	$/yr
Energy cost	980	$/yr
Amortization cost	220000	$/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	3	
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	359000	kWh/yr
Volume of earthwork required	3300	cuft
Area of pump building	413	sqft
Costs		
Construction and equipment co	220000	$
Earthwork Cost	978	$
Pump Building Cost	45400	$
Installed Pump Cost	140000	$
Misc Costs	33500	$
Operational labor cost	33600	$/yr
Maintenance labor cost	23800	$/yr
Material and supply cost	1540	$/yr
Chemical cost	0	$/yr
Energy cost	35900	$/yr
Amortization cost	20800	$/yr

Secondary Clarifier

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	9570	sqft
Surface area per circular clarifi	4780	sqft
Diameter of each circular clarif	79	ft
Number of clarifiers per batter	2	
Number of batteries	1	
Solids loading rate	0.0542	lb/(sqft·d)
Hydraulic retention time	2.87	hr
Designed surface overflow rate	500	gal(US)/(sqft·d)
Weir length	719	ft
Volume of wasted sludge	6040	gpd(US)

Quantities		
Operation labor required	997	pers-hrs/yr
Maintenance labor required	549	pers-hrs/yr
Electrical energy required	10000	kWh/yr
Volume of earthwork required	125000	cuft
Slab thickness	9.9	in
Volume of slab concrete requir	9380	cuft
Wall thickness	11	in
Volume of wall concrete requir	4540	cuft
Costs		
Construction and equipment cc	604000	$
Earthwork Cost	36900	$
Wall Concrete Cost	109000	$
Slab Concrete Cost	122000	$
Installed Equipment Cost	245000	$
Misc Costs	92200	$
Operational labor cost	51300	$/yr
Maintenance labor cost	23700	$/yr
Material and supply cost	6040	$/yr
Chemical cost	0	$/yr
Energy cost	1000	$/yr
Amortization cost	55900	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.00604	MGD(US)
Total pumping capacity	0.00604	MGD(US)
Design capacity per pump	2.1	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.00604	MGD(US)
Quantities		
Operation labor required	228	pers-hrs/yr
Maintenance labor required	169	pers-hrs/yr
Electrical energy required	205	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment cc	32600	$
Earthwork Cost	474	$
Pump Building Cost	22000	$
Installed Pump Cost	5160	$
Misc Costs	4980	$
Operational labor cost	11800	$/yr
Maintenance labor cost	7300	$/yr
Material and supply cost	228	$/yr
Chemical cost	0	$/yr
Energy cost	20	$/yr
Amortization cost	3090	$/yr

Secondary Clarifier(1)

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	28800	sqft
Surface area per circular clarifi	14400	sqft
Diameter of each circular clarif	136	ft
Number of clarifiers per batter	2	
Number of batteries	1	
Solids loading rate	7.58	lb/(sqft·d)
Hydraulic retention time	11.5	hr
Designed surface overflow rate	250	gal(US)/(sqft·d)
Weir length	2030	ft
Volume of wasted sludge	132000	gpd(US)
Quantities		
Operation labor required	1940	pers-hrs/yr
Maintenance labor required	1070	pers-hrs/yr
Electrical energy required	15100	kWh/yr
Volume of earthwork required	435000	cuft
Slab thickness	11.9	in
Volume of slab concrete requir	32100	cuft
Wall thickness	15	in
Volume of wall concrete requir	18900	cuft
Costs		
Construction and equipment cc	1640000	$
Earthwork Cost	129000	$
Wall Concrete Cost	455000	$
Slab Concrete Cost	416000	$
Installed Equipment Cost	391000	$
Misc Costs	250000	$
Operational labor cost	99700	$/yr
Maintenance labor cost	46400	$/yr

Material and supply cost	16400	$/yr
Chemical cost	0	$/yr
Energy cost	1510	$/yr
Amortization cost	146000	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.132	MGD(US)
Total pumping capacity	0.132	MGD(US)
Design capacity per pump	46	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.132	MGD(US)
Quantities		
Operation labor required	339	pers-hrs/yr
Maintenance labor required	267	pers-hrs/yr
Electrical energy required	4460	kWh/yr
Volume of earthwork required	1620	cuft
Area of pump building	203	sqft
Costs		
Construction and equipment cc	50600	$
Earthwork Cost	480	$
Pump Building Cost	22300	$
Installed Pump Cost	20100	$
Misc Costs	7720	$
Operational labor cost	17500	$/yr
Maintenance labor cost	11500	$/yr
Material and supply cost	354	$/yr
Chemical cost	0	$/yr
Energy cost	446	$/yr
Amortization cost	4790	$/yr

Intermediate Process Pumping

Design Output Data

Description	Value	Units
Intermediate Pumping		
Design Information		
Average daily pumping rate	4.78	MGD(US)
Total pumping capacity	10.8	MGD(US)
Design capacity per pump	3740	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	4.78	MGD(US)
Quantities		
Operation labor required	538	pers-hrs/yr
Maintenance labor required	454	pers-hrs/yr
Electrical energy required	159000	kWh/yr
Volume of earthwork required	3300	cuft
Area of pump building	413	sqft
Costs		
Construction and equipment cc	220000	$
Earthwork Cost	978	$
Pump Building Cost	45400	$
Installed Pump Cost	140000	$
Misc Costs	33500	$
Operational labor cost	27700	$/yr
Maintenance labor cost	19600	$/yr
Material and supply cost	1540	$/yr
Chemical cost	0	$/yr
Energy cost	15900	$/yr
Amortization cost	20800	$/yr

Chlorination

Design Output Data

Description	Value	Units
Chlorination		
Design Information		
Volume of tank	674000	gal(US)
Average chlorine required	398	lb/d
Peak chlorine required	899	lb/d
Influent coliform count	10000000	/100ml
Effluent coliform count	1.11	/100ml
Quantities		
Operational labor required	976	pers-hrs/yr
Maintenance labor required	178	pers-hrs/yr
Electrical energy required	118000	kWh/yr
Volume of earthwork required	38300	cuft
Volume of slab concrete requir	9030	cuft
Volume of wall concrete requir	12000	cuft
Number of chlorinators and ev	1	
Chlorination building area	220	sqft
Number of chlorine cylinders	6	
Area of chlorine storage buildir	840	sqft

Costs		
Construction and equipment cc	884000	$
Earthwork Cost	11300	$
Wall Concrete Cost	290000	$
Slab Concrete Cost	117000	$
Installed Equipment Cost	320000	$
Building Cost	24200	$
Storage Building Cost	46200	$
Misc Costs	75200	$
Operational labor cost	50300	$/yr
Maintenance labor cost	7670	$/yr
Material and supply cost	32800	$/yr
Chemical cost	94500	$/yr
Energy cost	11800	$/yr
Amortization cost	84800	$/yr

Chlorination(1)

Design Output Data

Description	Value	Units
Chlorination		
Design Information		
Volume of tank	670000	gal(US)
Average chlorine required	590	lb/d
Peak chlorine required	1340	lb/d
Influent coliform count	10000000	/100ml
Effluent coliform count	3.72	/100ml
Quantities		
Operational labor required	1200	pers-hrs/yr
Maintenance labor required	260	pers-hrs/yr
Electrical energy required	123000	kWh/yr
Volume of earthwork required	38000	cuft
Volume of slab concrete requir	8970	cuft
Volume of wall concrete requir	12000	cuft
Number of chlorinators and ev	1	
Chlorination building area	220	sqft
Number of chlorine cylinders	9	
Area of chlorine storage buildir	1260	sqft
Costs		
Construction and equipment cc	970000	$
Earthwork Cost	11300	$
Wall Concrete Cost	288000	$
Slab Concrete Cost	116000	$
Installed Equipment Cost	386000	$
Building Cost	24200	$
Storage Building Cost	69300	$
Misc Costs	74800	$
Operational labor cost	61900	$/yr
Maintenance labor cost	11200	$/yr
Material and supply cost	32900	$/yr
Chemical cost	140000	$/yr
Energy cost	12300	$/yr
Amortization cost	94200	$/yr

Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	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

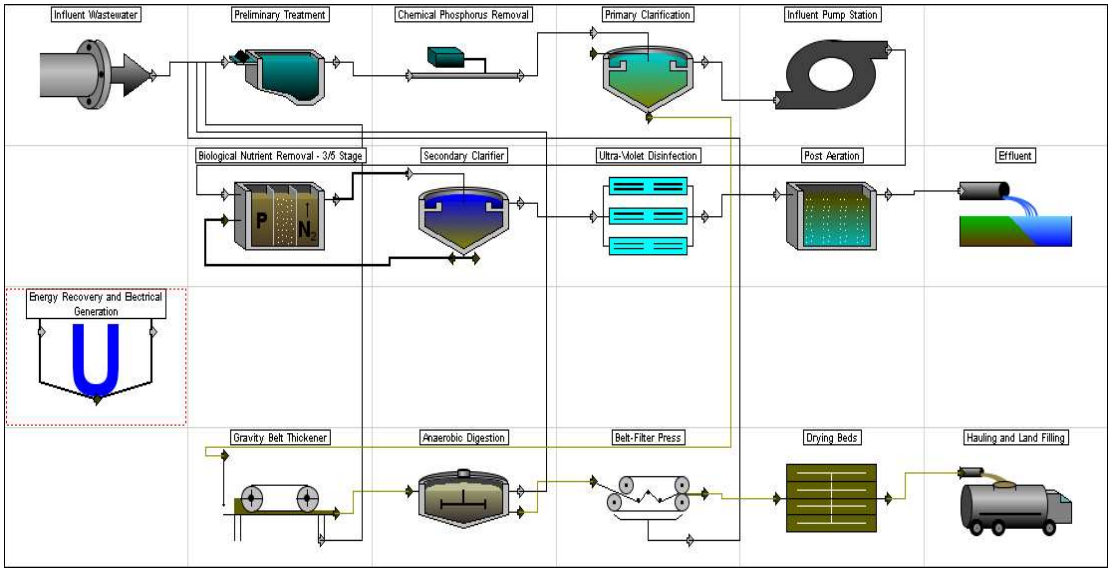
Effluent(1)

Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	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

Central Valley Water Reclamation Facility

Layout - Central Valley



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$313,000,000	$
Other direct construction costs	$39,200,000	$
Other indirect construction cos	$260,000,000	$
Total construction costs	$612,000,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$528,000	$/yr
Laboratory labor cost	$370,000	$/yr
Unit process operation labor c	$5,340,000	$/yr
Unit process maintenance labc	$3,580,000	$/yr
Total labor costs	$9,810,000	$/yr
MATERIAL COSTS		
Total material cost	$2,560,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$7,600,000	$/yr
ENERGY COSTS		
Total energy cost	$7,900,000	$/yr
Total operation and maintanen	$27,900,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$48,800,000	$/yr
Total annual project cost	$76,700,000	$/yr
PROJECT SUMMARY		
Present worth	$916,000,000	$
Total project cost	$612,000,000	$
Total operation labor cost	$6,240,000	$/yr
Total maintenance labor cost	$3,580,000	$/yr
Total material cost	$2,560,000	$/yr
Total chemical cost	$7,600,000	$/yr
Total energy cost	$7,900,000	$/yr
Total amortization cost	$48,800,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Energy Recovery and Electrica	55000000	0	0	0	0	0	0
Preliminary Treatment	3780000	576000	225000	94400	0	11800	317000
Biological Nutrient Removal - 3	82700000	788000	549000	901000	0	4880000	7660000
Gravity Belt Thickener	2810000	174000	43600	0	200000	62300	263000

Chemical Phosphorus Remova	0	0	0	0	6640000	0	0
Secondary Clarifier	10900000	388000	225000	109000	0	8470	984000
Anaerobic Digestion	18900000	407000	252000	156000	0	73700	1790000
Primary Clarification	8990000	328000	189000	89700	0	5520	815000
Ultra-Violet Disinfection	73100000	0	907000	731000	365000	2620000	7180000
Belt-Filter Press	2810000	121000	30200	0	400000	59100	263000
Influent Pump Station	39600000	228000	164000	277000	0	113000	3350000
Post Aeration	421000	53400	30100	4900	0	61600	39800
Drying Beds	8390000	1930000	963000	75600	0	0	731000
Effluent	0	0	0	0	0	0	0
Hauling and Land Filling	655000	67100	0	90100	0	0	103000
Blower System	3220000	0	0	0	0	0	270000
Alum Feed System	1420000	282000	0	28500	0	0	119000
Other Costs	299000000	897000	0	0	0	0	25000000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	81.6	acre
Administration labor hours	10200	hr/yr
Laboratory labor hours	7180	hr/yr
Costs		
DIRECT COSTS		
Mobilization	3610000	$
Site preparation	3770000	$
Site electrical	11300000	$
Yard piping	7140000	$
Instrumentation and control	6540000	$
Lab and administration building	6840000	$
Total direct construction costs	39200000	$
INDIRECT COSTS		
Cost of land	1630000	$
Miscellaneous cost	20200000	$
Legal cost	8090000	$
Engineering design fee	60700000	$
Inspection cost	8090000	$
Contingency	40500000	$
Technical	8090000	$
Interest during construction	59900000	$
Profit	52800000	$
Total indirect construction cost	260000000	$
Total of other construction cos	299000000	$
LABOR COSTS		
Administration labor cost	528000	$/yr
Laboratory labor cost	370000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	64900	scfm
Safety factor	1.5	
Requested air flow capacity	97400	scfm
Total capacity of blowers	97400	scfm
Number of blowers in use	1	
Total number of blowers	2	
Capacity of individual blowers	97400	scfm
Estimated cost of an installed l	1320000	$
Blower building area	2420	sqft
Costs		
Construction and equipment cc	3220000	$
Installed Blower Cost	2630000	$
Building Cost	266000	$
Misc Costs	319000	$
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	270000	$/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 Al2(SO4)	67400	lb/d

Alum dosage rate as equivaler	6120	lb/d
Liquid chemical solution fed	12600	gpd(US)
Operation labor required	5470	pers-hrs/yr
Costs		
Construction and equipment cc	1420000	$
Operational labor cost	282000	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	28500	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	119000	$/yr

Influent Wastewater

Energy Recovery and Electrical Generation

Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	Overridden	
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

Preliminary Treatment

Design Output Data

Description	Value	Units
Preliminary Treatment		
Design Information		
Mechanically Cleaned Bar Screen		
Bar size	0.25	in
Bar spacing	0.5	in
Slope of bars from horizontal	30	degrees
Head loss through screen	0.176	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	46.4	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	247	cuft/s
Average flow	116	cuft/s
Minimum flow	100	cuft/s
Temperature	10	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	123	cuft/s
Width of channel	20.6	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.000191	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	301	cuft/d
Costs		
Construction and equipment cc	3780000	$
Operational labor cost	576000	$/yr
Maintenance labor cost	225000	$/yr
Material and supply cost	94400	$/yr
Chemical cost	0	$/yr
Energy cost	11800	$/yr
Amortization cost	317000	$/yr

Biological Nutrient Removal - 3/5 Stage

Design Output Data

Description	Value	Units
BNR System for BIO-P and N Removal		
Design Information		
5-Stage Biological Phosphorus		
Design aerobic SRT for nitrifica	12.5	d
Total reactor SRT	25	d
Design SS	3000	mg/L
Calculated VSS	1790	mg/L
Calculated VSS:TSS ratio	0.596	mg VSS/mg SS
Total volume of anaerobic reac	-4790	m3
Total volume of anoxic reactor	158000	m3

Total volume of aerobic reacto	154000	m3
Total volume of all reactors	307000	m3
Width of parallel train	10	m
Sidewater depth	5	m
Number of batteries	1	
Number of parallel trains per b	24	
Number of anoxic cells within c	3	
Number of aerobic cells within	3	
Anaerobic hydraulic retention ti	-0.405	hr
Anoxic hydraulic retention time	13.4	hr
Aerobic hydraulic retention time	13	hr
Amount of sludge generated	36800	kg/d
Sludge recycle ratio	42.9	%
Sludge recycle rate	122000	m3/d
Nitrogen required for biomass	12.7	mg/L
Phosphorus required for bioma	2.55	mg/L
Oxygen required to meet avera	66400	kg/d
Air flow required to meet avera	110000	N m3/hr
Design air flow	12	N m3/min/1000 m3
Quantities		
Operation labor required	12200	pers-hrs/yr
Maintenance labor required	8100	pers-hrs/yr
Electrical energy required	26400000	kWh/yr
Volume of earthwork required	4640000	cuft
Volume of slab concrete requir	1240000	cuft
Volume of wall concrete requir	745000	cuft
Handrail length	24600	ft
Number of diffusers per train	1350	
Fine bubble diffuser floor cover	4.34	%
Number of swing arm headers	34	
Required mixing power	2010	kW
Total number of mixers	288	
Required mixing power per mix	6.99	kW
Design mixing power per mixer	3.73	kW
Mixing power for each unaerate	21	kW
Costs		
Construction and equipment co	70100000	$
Earthwork Cost	1370000	$
Wall Concrete Cost	17900000	$
Slab Concrete Cost	16100000	$
Handrail Cost	1840000	$
Installed Aerator Equipment	18400000	$
Air Piping Cost	2640000	$
Installed Mixer Equipment Co	4940000	$
Misc Costs	6950000	$
Operational labor cost	630000	$/yr
Maintenance labor cost	418000	$/yr
Material and supply cost	814000	$/yr
Chemical cost	0	$/yr
Energy cost	2640000	$/yr
Amortization cost	6470000	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	12.5	MGD(US)
Total pumping capacity	12.5	MGD(US)
Design capacity per pump	4340	gpm(US)
Number of pumps	72	
Number of batteries	1	
Firm pumping capacity	12.5	MGD(US)
Quantities		
Operation labor required	686	pers-hrs/yr
Maintenance labor required	579	pers-hrs/yr
Electrical energy required	9980000	kWh/yr
Volume of earthwork required	3570	cuft
Area of pump building	446	sqft
Costs		
Construction and equipment co	5640000	$
Earthwork Cost	25400	$
Pump Building Cost	1180000	$
Installed Pump Cost	3580000	$
Misc Costs	860000	$
Operational labor cost	35300	$/yr
Maintenance labor cost	29900	$/yr
Material and supply cost	39500	$/yr
Chemical cost	0	$/yr
Energy cost	998000	$/yr
Amortization cost	533000	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	12.5	MGD(US)
Total pumping capacity	12.5	MGD(US)
Design capacity per pump	4340	gpm(US)

Number of pumps	72	
Number of batteries	1	
Firm pumping capacity	12.5	MGD(US)
Quantities		
Operation labor required	686	pers-hrs/yr
Maintenance labor required	579	pers-hrs/yr
Electrical energy required	9980000	kWh/yr
Volume of earthwork required	3570	cuft
Area of pump building	446	sqft
Costs		
Construction and equipment cc	5640000	$
Earthwork Cost	25400	$
Pump Building Cost	1180000	$
Installed Pump Cost	3580000	$
Misc Costs	860000	$
Operational labor cost	35300	$/yr
Maintenance labor cost	29900	$/yr
Material and supply cost	39500	$/yr
Chemical cost	0	$/yr
Energy cost	998000	$/yr
Amortization cost	533000	$/yr
Sludge Recycle Pumping		
Design Information		
Average daily pumping rate	75	MGD(US)
Total pumping capacity	75	MGD(US)
Design capacity per pump	17400	gpm(US)
Number of pumps	4	
Number of batteries	1	
Firm pumping capacity	75	MGD(US)
Quantities		
Operation labor required	1700	pers-hrs/yr
Maintenance labor required	1390	pers-hrs/yr
Electrical energy required	2490000	kWh/yr
Volume of earthwork required	13400	cuft
Area of pump building	1680	sqft
Costs		
Construction and equipment cc	1280000	$
Earthwork Cost	3980	$
Pump Building Cost	185000	$
Installed Pump Cost	898000	$
Misc Costs	196000	$
Operational labor cost	87700	$/yr
Maintenance labor cost	71700	$/yr
Material and supply cost	8970	$/yr
Chemical cost	0	$/yr
Energy cost	249000	$/yr
Amortization cost	121000	$/yr

Gravity Belt Thickener

Design Output Data

Description	Value	Units
Gravity Belt Thickener		
Design Information		
Belt filter width	2	m
Number of units	4	
Hydraulic loading per unit per r	125	gpm(US)
Hydraulic loading required per	887	gpm(US)
Final solids content	7	%
Solids capture fraction	0.998	
Quantities		
Operation labor required	3380	pers-hrs/yr
Maintenance labor required	845	pers-hrs/yr
Power	623000	kWh/yr
Polymer required	154000	lb/yr
Dry solids produced	106000	lb/d
Costs		
Construction and equipment cc	2810000	$
Building Cost	429000	$
Polymer System Cost	445000	$
Feed Pump Cost	132000	$
Conveyor System Cost	301000	$
Installed Belt Filter System C	1510000	$
Operational labor cost	174000	$/yr
Maintenance labor cost	43600	$/yr
Material and supply cost	0	$/yr
Chemical cost	200000	$/yr
Energy cost	62300	$/yr
Amortization cost	263000	$/yr

Chemical Phosphorus Removal

Design Output Data

Description	Value	Units

Chemical Phosphorus Removal			
Design Information			
Chemical used	Equivalent Aluminum		
Chemical dosage		9.75	g/m3
Mass of chemical per year		1010000	kg/yr
Chemical sludge production		52.4	g/m3
Organic sludge production		5.34	g/m3
Costs			
Construction and equipment cc		0	$
Operational labor cost		0	$/yr
Maintenance labor cost		0	$/yr
Material and supply cost		0	$/yr
Chemical cost		6640000	$/yr
Energy cost		0	$/yr
Amortization cost		0	$/yr

Secondary Clarifier

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	250000	sqft
Surface area per circular clarifi	15600	sqft
Diameter of each circular clarif	141	ft
Number of clarifiers per batter	16	
Number of batteries	1	
Solids loading rate	10.7	lb/(sqft·d)
Hydraulic retention time	5.39	hr
Designed surface overflow rate	300	gal(US)/(sqft·d)
Weir length	20000	ft
Volume of wasted sludge	945000	gpd(US)
Quantities		
Operation labor required	7100	pers-hrs/yr
Maintenance labor required	4010	pers-hrs/yr
Electrical energy required	53100	kWh/yr
Volume of earthwork required	3800000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	235000	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	73600	cuft
Costs		
Construction and equipment cc	10800000	$
Earthwork Cost	1120000	$
Wall Concrete Cost	1770000	$
Slab Concrete Cost	3040000	$
Installed Equipment Cost	3230000	$
Misc Costs	1650000	$
Operational labor cost	366000	$/yr
Maintenance labor cost	207000	$/yr
Material and supply cost	108000	$/yr
Chemical cost	0	$/yr
Energy cost	5310	$/yr
Amortization cost	976000	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.945	MGD(US)
Total pumping capacity	0.945	MGD(US)
Design capacity per pump	328	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.945	MGD(US)
Quantities		
Operation labor required	437	pers-hrs/yr
Maintenance labor required	357	pers-hrs/yr
Electrical energy required	31700	kWh/yr
Volume of earthwork required	1750	cuft
Area of pump building	219	sqft
Costs		
Construction and equipment cc	85400	$
Earthwork Cost	518	$
Pump Building Cost	24100	$
Installed Pump Cost	47800	$
Misc Costs	13000	$
Operational labor cost	22500	$/yr
Maintenance labor cost	18400	$/yr
Material and supply cost	598	$/yr
Chemical cost	0	$/yr
Energy cost	3170	$/yr
Amortization cost	8080	$/yr

Anaerobic Digestion

Design Output Data

Description	Value	Units
Anaerobic Digestion		
Design Information		
Percent VSS destroyed	50	%
Solids concentration in digeste	5	%
Detention time	25	d
Digester depth	26.2	ft
Digester diameter	60	ft
Effective digester volume	973000	cuft
Number of digesters per batter	12	
Number of primary digesters p	8	
Number of secondary digester	4	
Number of batteries	1	
Gas produced	339	cuft/min
Heat required	4770000	BTU/hr
Digester gas required	184	cuft/min
Total natural gas required	0	cuft/yr
Quantities		
Operation labor required	7900	pers-hrs/yr
Maintenance labor required	4880	pers-hrs/yr
Electrical energy required	737000	kWh/yr
Volume of earthwork required	970000	cuft
Slab thickness	10.6	in
Volume of slab concrete requir	33100	cuft
Wall thickness	20.6	in
Volume of wall concrete requir	125000	cuft
Sidewater depth	26.2	ft
Surface area/floor of 2-story cc	5330	sqft
Piping size	8	in
Length of total piping system	3540	ft
Number of 90 degree elbows	156	
Number of tees	306	
Number of plug valves	222	
Total dry solids treated	53.2	ton(short)/d
Costs		
Construction and equipment cc	18900000	$
Earthwork Cost	287000	$
Wall Concrete Cost	3010000	$
Slab Concrete Cost	429000	$
Building Cost	586000	$
Piping System Cost	2260000	$
Floating Cover Cost	6340000	$
Gas Recirculation Units Cost	2030000	$
Heating Units Cost	872000	$
Gas Safety Equipment Cost	721000	$
Installed Pumps Cost	449000	$
Operational labor cost	407000	$/yr
Maintenance labor cost	252000	$/yr
Material and supply cost	156000	$/yr
Chemical cost	0	$/yr
Energy cost	73700	$/yr
Amortization cost	1790000	$/yr

Primary Clarification

Design Output Data

Description	Value	Units
Primary Clarification		
Design Information		
Surface area	188000	sqft
Surface area per circular clarifi	11800	sqft
Diameter of each circular clarif	123	ft
Number of clarifiers per battery	16	
Number of batteries	1	
Solids loading rate	0.926	lb/(sqft·d)
Hydraulic retention time	4.04	hr
Weir length	20000	ft
Volume of sludge generated	304000	gpd(US)
Quantities		
Operation labor required	5990	pers-hrs/yr
Maintenance labor required	3370	pers-hrs/yr
Electrical energy required	45000	kWh/yr
Volume of earthwork required	2740000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	180000	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	64500	cuft
Costs		
Construction and equipment cc	8930000	$
Earthwork Cost	811000	$
Wall Concrete Cost	1550000	$
Slab Concrete Cost	2330000	$
Installed Equipment Cost	2870000	$

Misc Costs	1360000	$
Operational labor cost	308000	$/yr
Maintenance labor cost	174000	$/yr
Material and supply cost	89300	$/yr
Chemical cost	0	$/yr
Energy cost	4500	$/yr
Amortization cost	810000	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.304	MGD(US)
Total pumping capacity	0.304	MGD(US)
Design capacity per pump	106	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.304	MGD(US)
Quantities		
Operation labor required	378	pers-hrs/yr
Maintenance labor required	302	pers-hrs/yr
Electrical energy required	10200	kWh/yr
Volume of earthwork required	1650	cuft
Area of pump building	206	sqft
Costs		
Construction and equipment cc	61500	$
Earthwork Cost	488	$
Pump Building Cost	22700	$
Installed Pump Cost	29000	$
Misc Costs	9390	$
Operational labor cost	19400	$/yr
Maintenance labor cost	15600	$/yr
Material and supply cost	431	$/yr
Chemical cost	0	$/yr
Energy cost	1020	$/yr
Amortization cost	5820	$/yr

Ultra-Violet Disinfection

Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calc	0.294	gal(US)/(min·W)
Total number of lamps needed	28700	
Number of spare channels	2	
Total number of lamps used in	35200	
Number of excess lamps	6470	
Number of lamps/modules	16	
Number of modules/bank	25	
Number of banks/channel	8	
Number of channels	11	
Calculated headloss	4.56	in
Costs		
Construction and equipment cc	73100000	$
Cost of installation	43800000	$
Total cost of UV lamps	29200000	$
Operational labor cost	0	$/yr
Maintenance labor cost	907000	$/yr
Material and supply cost	731000	$/yr
Chemical cost	365000	$/yr
Energy cost	2620000	$/yr
Amortization cost	7180000	$/yr

Belt-Filter Press

Design Output Data

Description	Value	Units
Belt-Filter Press		
Design Information		
Belt filter width	2	m
Number of units	4	
Hydraulic loading per unit per r	70	gpm(US)
Hydraulic loading required per	491	gpm(US)
Final solids content	19	%
Solids capture fraction	0.998	
Quantities		
Operation labor required	2340	pers-hrs/yr
Maintenance labor required	585	pers-hrs/yr
Power	591000	kWh/yr
Polymer required	308000	lb/yr
Dry solids produced	84300	lb/d
Belt filter(s)	1200000	$
Building	429000	$
Installation	301000	$
Polymer system	445000	$
Feed pumps	132000	$

Conveyor system	301000	$
Costs		
Construction and equipment cc	2810000	$
Building Cost	429000	$
Polymer System Cost	445000	$
Feed Pumps Cost	132000	$
Conveyor System Cost	301000	$
Installed Belt Filter	1510000	$
Operational labor cost	121000	$/yr
Maintenance labor cost	30200	$/yr
Material and supply cost	0	$/yr
Chemical cost	400000	$/yr
Energy cost	59100	$/yr
Amortization cost	263000	$/yr

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	669000	cuft
Width of wet well	2170	ft
Depth of the pumping station	43.1	ft
Length of the pumping station	42	ft
Width of the pumping station	2230	ft
Minimum depth of water in wet	22.1	ft
Area of pump building	2670	sqft
Peak capacity of pumps	195	MGD(US)
Firm pumping capacity	195	MGD(US)
Total dynamic head - average	43.5	ft
Quantities		
Operation labor required	4420	pers-hrs/yr
Maintenance labor required	3180	pers-hrs/yr
Electrical energy required	1130000	kWh/yr
Volume of earthwork required	13700000	cuft
Volume of slab concrete requir	1510000	cuft
Volume of wall concrete requir	286000	cuft
Capacity per pump	135000	gpm(US)
Number of constant speed pur	2	
Number of variable speed pur	0	
Diameter of discharge header	83.2	in
Total dynamic head	49	ft
Size of selected pump	72	in
Specific speed of pump	11900	
Pump rotating speed	201	rpm
Motor size required	429	HP
Size of selected motor	450	HP
Width of pump system	15	ft
Length of pump system	51.4	ft
Length of the dry well	42	ft
Width of the dry well	60.4	ft
Costs		
Construction and equipment cc	39600000	$
Earthwork Cost	4070000	$
Wall Concrete Cost	6880000	$
Slab Concrete Cost	19500000	$
Building Cost	293000	$
Installed Pump Equipment C	2750000	$
Misc Costs	6040000	$
Operational labor cost	228000	$/yr
Maintenance labor cost	164000	$/yr
Material and supply cost	277000	$/yr
Chemical cost	0	$/yr
Energy cost	113000	$/yr
Amortization cost	3350000	$/yr

Post Aeration

Design Output Data

Description	Value	Units
Post Aeration by Diffused Aeration		
Design Information		
Dissolved oxygen in influent	2	mg/L
Desired dissolved oxygen in ef	5	mg/L
Correction factor for pressure	1	
Minimum dissolved oxygen in t	2	mg/L
Oxygen saturation at summer t	8.5	mg/L
Oxygen required	1850	lb/d
Operating transfer efficiency	2.95	lbO2/(HP·h)
Total volume of aerobic reacto	514000	gal(US)
Air flow rate required to meet a	2480	scfm
Quantities		
Basin depth	15	ft

Length of basin	153	ft
Width of basin	30	ft
Number of diffusers	207	
Number of swing arm diffuser l	11	
Volume of wall concrete requir	4110	cuft
Volume of slab concrete requir	3440	cuft
Electrical energy required	616000	kWh/yr
Operation labor required	1040	pers-hrs/yr
Maintenance labor required	584	pers-hrs/yr
Costs		
Construction and equipment cc	421000	$
Wall Concrete Cost	99000	$
Slab Concrete Cost	53300	$
Installed Equipment Cost	227000	$
Misc Costs	41700	$
Operational labor cost	53400	$/yr
Maintenance labor cost	30100	$/yr
Material and supply cost	4900	$/yr
Chemical cost	0	$/yr
Energy cost	61600	$/yr
Amortization cost	39800	$/yr

Drying Beds

Design Output Data

Description	Value	Units
Sludge Drying Beds		
Design Information		
Total surface area required	607000	sqft
Initial depth of sludge	12	in
Final solids	50	%
Bed holding time	103	d
Quantities		
Total drying bed surface area	607000	sqft
Number beds	203	
Surface area of each individua	2990	sqft
Length of each bed	150	ft
Volume of earthwork required	2990000	cuft
Volume concrete for dividing w	195000	cuft
Volume of R.C. in-place for tru	45500	cuft
Volume of sand	455000	cuft
Volume of gravel	607000	cuft
Clay pipe diameter	6	in
Total length clay pipe	60700	in
Sludge solids produced	35.1	ton(short)/d
Operational labor required	37400	pers-hrs/yr
Maintenance labor required	18700	pers-hrs/yr
Costs		
Construction and equipment cc	8390000	$
Earthwork Cost	885000	$
Wall Concrete Cost	3290000	$
Slab Concrete Cost	354000	$
Drying Bed Media Cost	1690000	$
Drain Pipe System Cost	1340000	$
Misc Costs	832000	$
Operational labor cost	1930000	$/yr
Maintenance labor cost	963000	$/yr
Material and supply cost	75600	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	731000	$/yr

Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	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

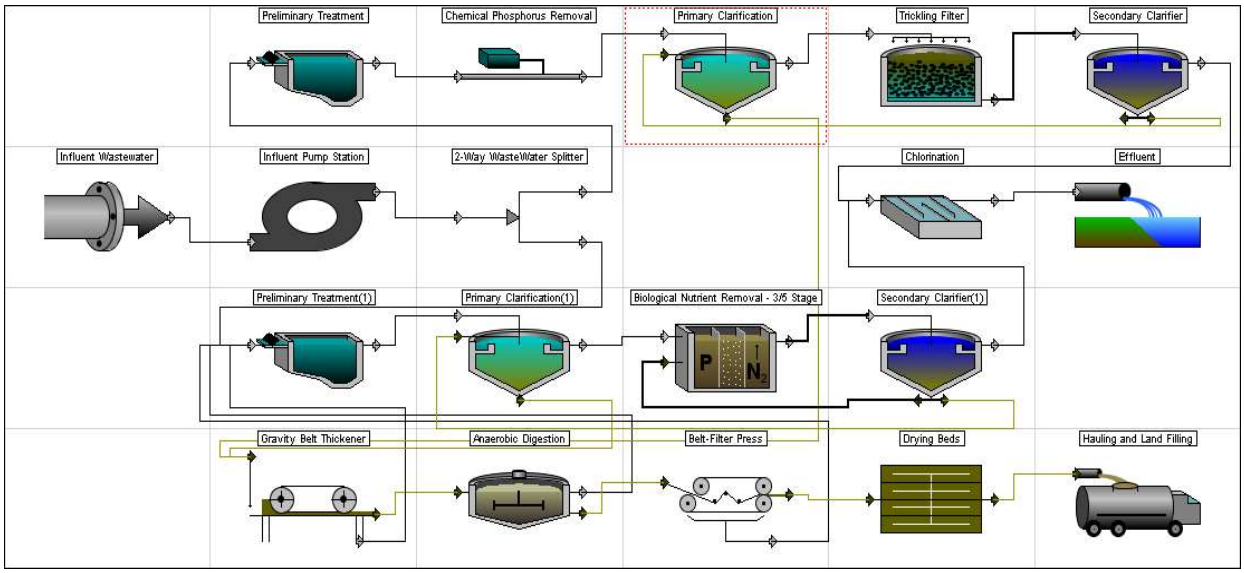
Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	83.3	cuyd/d
Truck capacity	30	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	83.3	cuyd/d
Maximum anticipated landfill d	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	8430	sqft
Width of sludge storage shed s	64.9	ft
Length of sludge storage shed	130	ft
Volume of earthwork required	22300	cuft
Volume of slab concrete requir	9330	cuft
Surface area of canopy roof	8430	sqft
Round trip haul distance	20	miles
Round trips per day per truck	3	
Distance traveled per year per	15000	miles
Sludge hauled	73.7	ton(short)/d
Operation labor required	1300	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment co	655000	$
Earthwork Cost	6610	$
Slab Concrete Cost	121000	$
Canopy Roof Cost	169000	$
Vehicle Cost	359000	$
Operational labor cost	67100	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	90100	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	103000	$/yr

Central Weber Sewer District

Layout - Central Weber SID



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$121,000,000	$
Other direct construction costs	$30,900,000	$
Other indirect construction cos	$113,000,000	$
Total construction costs	$265,000,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$402,000	$/yr
Laboratory labor cost	$317,000	$/yr
Unit process operation labor c	$4,700,000	$/yr
Unit process maintenance labc	$2,330,000	$/yr
Total labor costs	$7,750,000	$/yr
MATERIAL COSTS		
Total material cost	$1,260,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$3,370,000	$/yr
ENERGY COSTS		
Total energy cost	$2,150,000	$/yr
Total operation and maintanen	$14,500,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$22,900,000	$/yr
Total annual project cost	$37,400,000	$/yr
PROJECT SUMMARY		
Present worth	$447,000,000	$
Total project cost	$265,000,000	$
Total operation labor cost	$5,420,000	$/yr
Total maintenance labor cost	$2,330,000	$/yr
Total material cost	$1,260,000	$/yr
Total chemical cost	$3,370,000	$/yr
Total energy cost	$2,150,000	$/yr
Total amortization cost	$22,900,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Preliminary Treatment	2050000	231000	99200	51200	0	7300	172000
Influent Pump Station	28700000	166000	120000	201000	0	103000	2440000
Preliminary Treatment(1)	2050000	233000	99900	51300	0	7330	172000
Gravity Belt Thickener	2810000	172000	41600	0	198000	61500	263000

Chemical Phosphorus Remova	0	0	0	0	1750000	0	0
2-Way WasteWater Splitter	0	0	0	0	0	0	0
Primary Clarification(1)	2380000	128000	73000	23600	0	2200	219000
Anaerobic Digestion	16000000	402000	241000	135000	0	73000	1520000
Primary Clarification	2340000	127000	72100	23200	0	2120	216000
Biological Nutrient Removal - 3	28100000	462000	299000	395000	0	1610000	2600000
Belt-Filter Press	2810000	111000	26900	0	368000	54800	263000
Trickling Filter	12600000	137000	101000	72800	0	202000	1080000
Chlorination	3300000	181000	90900	70000	1050000	18300	313000
Secondary Clarifier(1)	3630000	187000	106000	36100	0	4160	332000
Drying Beds	7730000	1770000	857000	69500	0	0	673000
Secondary Clarifier	3570000	184000	104000	35600	0	3360	327000
Effluent	0	0	0	0	0	0	0
Hauling and Land Filling	632000	61700	0	90100	0	0	101000
Blower System	2310000	0	0	0	0	0	194000
Alum Feed System	429000	141000	0	8580	0	0	36000
Other Costs	144000000	719000	0	0	0	0	12000000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	48.2	acre
Administration labor hours	7810	hr/yr
Laboratory labor hours	6160	hr/yr
Costs		
DIRECT COSTS		
Mobilization	2840000	$
Site preparation	3090000	$
Site electrical	8780000	$
Yard piping	5580000	$
Instrumentation and control	4990000	$
Lab and administration building	5590000	$
Total direct construction costs	30900000	$
INDIRECT COSTS		
Cost of land	965000	$
Miscellaneous cost	8760000	$
Legal cost	3500000	$
Engineering design fee	26300000	$
Inspection cost	3500000	$
Contingency	17500000	$
Technical	3500000	$
Interest during construction	26000000	$
Profit	22800000	$
Total indirect construction cost	113000000	$
Total of other construction cos	144000000	$
LABOR COSTS		
Administration labor cost	402000	$/yr
Laboratory labor cost	317000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	26100	scfm
Safety factor	1.5	
Requested air flow capacity	39100	scfm
Total capacity of blowers	39100	scfm
Number of blowers in use	3	
Total number of blowers	4	
Capacity of individual blowers	13000	scfm
Estimated cost of an installed I	469000	$
Blower building area	1920	sqft
Costs		
Construction and equipment cc	2310000	$
Installed Blower Cost	1870000	$
Building Cost	211000	$
Misc Costs	229000	$
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	194000	$/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 Al2(SO4)	17800	lb/d
Alum dosage rate as equivaler	1620	lb/d
Liquid chemical solution fed	3320	gpd(US)
Operation labor required	2740	pers-hrs/yr
Costs		
Construction and equipment cc	429000	$
Operational labor cost	141000	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	8580	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	36000	$/yr

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	0.5	in
Slope of bars from horizontal	30	degrees
Head loss through screen	0.176	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	16.3	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	92.4	cuft/s
Average flow	40.8	cuft/s
Minimum flow	24.6	cuft/s
Temperature	10	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	46.2	cuft/s
Width of channel	7.7	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.000302	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	106	cuft/d
Costs		
Construction and equipment cc	2050000	$
Operational labor cost	231000	$/yr
Maintenance labor cost	99200	$/yr
Material and supply cost	51200	$/yr
Chemical cost	0	$/yr
Energy cost	7300	$/yr
Amortization cost	172000	$/yr

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	497000	cuft
Width of wet well	1610	ft
Depth of the pumping station	40.1	ft
Length of the pumping station	42	ft
Width of the pumping station	1670	ft
Minimum depth of water in wet	19.1	ft
Area of pump building	2670	sqft
Peak capacity of pumps	142	MGD(US)
Firm pumping capacity	142	MGD(US)
Total dynamic head - average	43.6	ft
Quantities		
Operation labor required	3220	pers-hrs/yr
Maintenance labor required	2410	pers-hrs/yr
Electrical energy required	1030000	kWh/yr
Volume of earthwork required	9430000	cuft
Volume of slab concrete requir	1060000	cuft
Volume of wall concrete requir	198000	cuft

Capacity per pump	98800	gpm(US)
Number of constant speed pur	2	
Number of variable speed pur	0	
Diameter of discharge header	71	in
Total dynamic head	49.6	ft
Size of selected pump	72	in
Specific speed of pump	10100	
Pump rotating speed	238	rpm
Motor size required	409	HP
Size of selected motor	450	HP
Width of pump system	15	ft
Length of pump system	51.4	ft
Length of the dry well	42	ft
Width of the dry well	60.4	ft
Costs		
Construction and equipment cc	28700000	$
Earthwork Cost	2790000	$
Wall Concrete Cost	4760000	$
Slab Concrete Cost	13700000	$
Building Cost	293000	$
Installed Pump Equipment C	2750000	$
Misc Costs	4370000	$
Operational labor cost	166000	$/yr
Maintenance labor cost	120000	$/yr
Material and supply cost	201000	$/yr
Chemical cost	0	$/yr
Energy cost	103000	$/yr
Amortization cost	2440000	$/yr

Preliminary Treatment(1)

Design Output Data

Description	Value	Units
Preliminary Treatment		
Design Information		
Mechanically Cleaned Bar Screen		
Bar size	0.25	in
Bar spacing	0.5	in
Slope of bars from horizontal	30	degrees
Head loss through screen	0.176	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	16.5	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	92.8	cuft/s
Average flow	41.2	cuft/s
Minimum flow	25	cuft/s
Temperature	10	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	46.4	cuft/s
Width of channel	7.73	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.0003	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	107	cuft/d
Costs		
Construction and equipment cc	2050000	$
Operational labor cost	233000	$/yr
Maintenance labor cost	99900	$/yr
Material and supply cost	51300	$/yr
Chemical cost	0	$/yr
Energy cost	7330	$/yr
Amortization cost	172000	$/yr

Gravity Belt Thickener

Design Output Data

Description	Value	Units
Gravity Belt Thickener		
Design Information		
Belt filter width	2	m
Number of units	4	
Hydraulic loading per unit per r	125	gpm(US)
Hydraulic loading required per	875	gpm(US)

Final solids content	7	%
Solids capture fraction	0.998	
Quantities		
Operation labor required	3340	pers-hrs/yr
Maintenance labor required	834	pers-hrs/yr
Power	615000	kWh/yr
Polymer required	152000	lb/yr
Dry solids produced	104000	lb/d
Costs		
Construction and equipment cc	2810000	$
Building Cost	429000	$
Polymer System Cost	445000	$
Feed Pump Cost	132000	$
Conveyor System Cost	301000	$
Installed Belt Filter System C	1510000	$
Operational labor cost	172000	$/yr
Maintenance labor cost	41600	$/yr
Material and supply cost	0	$/yr
Chemical cost	198000	$/yr
Energy cost	61500	$/yr
Amortization cost	263000	$/yr

Chemical Phosphorus Removal

Design Output Data

Description	Value	Units
Chemical Phosphorus Removal		
Design Information		
Chemical used	Equivalent Aluminum	
Chemical dosage	7.32	g/m3
Mass of chemical per year	268000	kg/yr
Chemical sludge production	38.1	g/m3
Organic sludge production	4.02	g/m3
Costs		
Construction and equipment cc	0	$
Operational labor cost	0	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	0	$/yr
Chemical cost	1750000	$/yr
Energy cost	0	$/yr
Amortization cost	0	$/yr

2-Way WasteWater Splitter

Design Output Data

Description	Value	Units
2-Way Wastewater Flow Splitter		
Design Information		
Flow to first split (average)	26.5	MGD(US)
Flow to first split (peak)	60	MGD(US)
Flow to first split (minimum)	16	MGD(US)
Flow to second split (average)	26.5	MGD(US)
Flow to second split (peak)	60	MGD(US)
Flow to second split (minimum	16	MGD(US)
Costs		
Construction and equipment cc	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

Primary Clarification(1)

Design Output Data

Description	Value	Units
Primary Clarification		
Design Information		
Surface area	34100	sqft
Surface area per circular clarifi	4260	sqft
Diameter of each circular clarif	74	ft
Number of clarifiers per batter	8	
Number of batteries	1	
Solids loading rate	2.68	lb/(sqft·d)
Hydraulic retention time	2.02	hr
Weir length	6080	ft
Volume of sludge generated	160000	gpd(US)
Quantities		
Operation labor required	2140	pers-hrs/yr
Maintenance labor required	1190	pers-hrs/yr
Electrical energy required	16600	kWh/yr
Volume of earthwork required	432000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	34000	cuft

Wall thickness	11.5	in
Volume of wall concrete requir	19800	cuft
Costs		
Construction and equipment cc	2320000	$
Earthwork Cost	128000	$
Wall Concrete Cost	476000	$
Slab Concrete Cost	440000	$
Installed Equipment Cost	924000	$
Misc Costs	354000	$
Operational labor cost	110000	$/yr
Maintenance labor cost	59300	$/yr
Material and supply cost	23200	$/yr
Chemical cost	0	$/yr
Energy cost	1660	$/yr
Amortization cost	214000	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.16	MGD(US)
Total pumping capacity	0.16	MGD(US)
Design capacity per pump	55.4	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.16	MGD(US)
Quantities		
Operation labor required	348	pers-hrs/yr
Maintenance labor required	274	pers-hrs/yr
Electrical energy required	5370	kWh/yr
Volume of earthwork required	1630	cuft
Area of pump building	203	sqft
Costs		
Construction and equipment cc	52700	$
Earthwork Cost	482	$
Pump Building Cost	22300	$
Installed Pump Cost	21800	$
Misc Costs	8040	$
Operational labor cost	17900	$/yr
Maintenance labor cost	13700	$/yr
Material and supply cost	369	$/yr
Chemical cost	0	$/yr
Energy cost	537	$/yr
Amortization cost	4980	$/yr

Anaerobic Digestion

Design Output Data

Description	Value	Units
Anaerobic Digestion		
Design Information		
Percent VSS destroyed	50	%
Solids concentration in digeste	5	%
Detention time	25	d
Digester depth	27.1	ft
Digester diameter	65	ft
Effective digester volume	889000	cuft
Number of digesters per batter	9	
Number of primary digesters p	6	
Number of secondary digester	3	
Number of batteries	1	
Gas produced	386	cuft/min
Heat required	4480000	BTU/hr
Digester gas required	173	cuft/min
Total natural gas required	0	cuft/yr
Quantities		
Operation labor required	7810	pers-hrs/yr
Maintenance labor required	4830	pers-hrs/yr
Electrical energy required	730000	kWh/yr
Volume of earthwork required	886000	cuft
Slab thickness	10.8	in
Volume of slab concrete requir	29500	cuft
Wall thickness	21	in
Volume of wall concrete requir	107000	cuft
Sidewater depth	27.1	ft
Surface area/floor of 2-story cc	4610	sqft
Piping size	8	in
Length of total piping system	2810	ft
Number of 90 degree elbows	117	
Number of tees	230	
Number of plug valves	167	
Total dry solids treated	52.5	ton(short)/d
Costs		
Construction and equipment cc	16000000	$
Earthwork Cost	263000	$
Wall Concrete Cost	2570000	$

Slab Concrete Cost	382000	$
Building Cost	507000	$
Piping System Cost	1720000	$
Floating Cover Cost	5480000	$
Gas Recirculation Units Cost	1600000	$
Heating Units Cost	950000	$
Gas Safety Equipment Cost	600000	$
Installed Pumps Cost	349000	$
Operational labor cost	402000	$/yr
Maintenance labor cost	241000	$/yr
Material and supply cost	135000	$/yr
Chemical cost	0	$/yr
Energy cost	73000	$/yr
Amortization cost	1520000	$/yr

Primary Clarification

Design Output Data

Description	Value	Units
Primary Clarification		
Design Information		
Surface area	33500	sqft
Surface area per circular clarifi	4180	sqft
Diameter of each circular clarif	73	ft
Number of clarifiers per battery	8	
Number of batteries	1	
Solids loading rate	2.4	lb/(sqft·d)
Hydraulic retention time	2.02	hr
Weir length	60300	ft
Volume of sludge generated	140000	gpd(US)
Quantities		
Operation labor required	2120	pers-hrs/yr
Maintenance labor required	1180	pers-hrs/yr
Electrical energy required	16500	kWh/yr
Volume of earthwork required	419000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	33100	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	19500	cuft
Costs		
Construction and equipment co	2280000	$
Earthwork Cost	124000	$
Wall Concrete Cost	469000	$
Slab Concrete Cost	429000	$
Installed Equipment Cost	914000	$
Misc Costs	349000	$
Operational labor cost	109000	$/yr
Maintenance labor cost	58700	$/yr
Material and supply cost	22800	$/yr
Chemical cost	0	$/yr
Energy cost	1650	$/yr
Amortization cost	211000	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.14	MGD(US)
Total pumping capacity	0.14	MGD(US)
Design capacity per pump	48.7	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.14	MGD(US)
Quantities		
Operation labor required	342	pers-hrs/yr
Maintenance labor required	269	pers-hrs/yr
Electrical energy required	4720	kWh/yr
Volume of earthwork required	1620	cuft
Area of pump building	203	sqft
Costs		
Construction and equipment co	51200	$
Earthwork Cost	481	$
Pump Building Cost	22300	$
Installed Pump Cost	20600	$
Misc Costs	7820	$
Operational labor cost	17600	$/yr
Maintenance labor cost	13400	$/yr
Material and supply cost	359	$/yr
Chemical cost	0	$/yr
Energy cost	472	$/yr
Amortization cost	4850	$/yr

Biological Nutrient Removal - 3/5 Stage

Design Output Data

Description	Value	Units
BNR System for BIO-P and N Removal		

Design Information		
Influent BOD/TP ratio too smal		
3-Stage Biological Phosphorus		
Design aerobic SRT for nitrifica	7.62	d
Total reactor SRT	15	d
Design SS	3000	mg/L
Calculated VSS	2080	mg/L
Calculated VSS:TSS ratio	0.693	mg VSS/mg SS
Total volume of anaerobic reac	0	m3
Total volume of anoxic reactor	48000	m3
Total volume of aerobic reacto	49600	m3
Total volume of all reactors	97600	m3
Width of parallel train	10	m
Sidewater depth	5	m
Number of batteries	1	
Number of parallel trains per b	8	
Number of anoxic cells within c	3	
Number of aerobic cells within	3	
Anaerobic hydraulic retention ti	0	hr
Anoxic hydraulic retention time	11.2	hr
Aerobic hydraulic retention time	11.6	hr
Amount of sludge generated	19500	kg/d
Sludge recycle ratio	42.9	%
Sludge recycle rate	44000	m3/d
Nitrogen required for biomass	15.8	mg/L
Phosphorus required for bioma	3.15	mg/L
Oxygen required to meet avera	26600	kg/d
Air flow required to meet avera	44300	N m3/hr
Design air flow	14.9	N m3/min/1000 m3
Quantities		
Operation labor required	6740	pers-hrs/yr
Maintenance labor required	4130	pers-hrs/yr
Electrical energy required	8860000	kWh/yr
Volume of earthwork required	1520000	cuft
Volume of slab concrete requir	420000	cuft
Volume of wall concrete requir	270000	cuft
Handrail length	9970	ft
Number of diffusers per train	1630	
Fine bubble diffuser floor cover	5.39	%
Number of swing arm headers	33	
Required mixing power	624	kW
Total number of mixers	64	
Required mixing power per mi	9.76	kW
Design mixing power per mixe	3.73	kW
Mixing power for each unaerat	19.5	kW
Costs		
Construction and equipment co	24000000	$
Earthwork Cost	449000	$
Wall Concrete Cost	6510000	$
Slab Concrete Cost	5440000	$
Handrail Cost	747000	$
Installed Aerator Equipment	6110000	$
Air Piping Cost	1260000	$
Installed Mixer Equipment Co	1100000	$
Misc Costs	2380000	$
Operational labor cost	347000	$/yr
Maintenance labor cost	206000	$/yr
Material and supply cost	366000	$/yr
Chemical cost	0	$/yr
Energy cost	886000	$/yr
Amortization cost	2200000	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	10.2	MGD(US)
Total pumping capacity	10.2	MGD(US)
Design capacity per pump	3530	gpm(US)
Number of pumps	24	
Number of batteries	1	
Firm pumping capacity	10.2	MGD(US)
Quantities		
Operation labor required	640	pers-hrs/yr
Maintenance labor required	542	pers-hrs/yr
Electrical energy required	2710000	kWh/yr
Volume of earthwork required	3200	cuft
Area of pump building	400	sqft
Costs		
Construction and equipment co	1710000	$
Earthwork Cost	7590	$
Pump Building Cost	352000	$
Installed Pump Cost	1090000	$
Misc Costs	261000	$
Operational labor cost	33000	$/yr

Maintenance labor cost	27000	$/yr
Material and supply cost	12000	$/yr
Chemical cost	0	$/yr
Energy cost	271000	$/yr
Amortization cost	162000	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	13.6	MGD(US)
Total pumping capacity	13.6	MGD(US)
Design capacity per pump	4700	gpm(US)
Number of pumps	24	
Number of batteries	1	
Firm pumping capacity	13.6	MGD(US)
Quantities		
Operation labor required	705	pers-hrs/yr
Maintenance labor required	595	pers-hrs/yr
Electrical energy required	3610000	kWh/yr
Volume of earthwork required	3740	cuft
Area of pump building	467	sqft
Costs		
Construction and equipment cc	1950000	$
Earthwork Cost	8860	$
Pump Building Cost	411000	$
Installed Pump Cost	1240000	$
Misc Costs	298000	$
Operational labor cost	36300	$/yr
Maintenance labor cost	29600	$/yr
Material and supply cost	13700	$/yr
Chemical cost	0	$/yr
Energy cost	361000	$/yr
Amortization cost	185000	$/yr
Sludge Recycle Pumping		
Design Information		
Average daily pumping rate	27.1	MGD(US)
Total pumping capacity	27.1	MGD(US)
Design capacity per pump	9410	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	27.1	MGD(US)
Quantities		
Operation labor required	889	pers-hrs/yr
Maintenance labor required	745	pers-hrs/yr
Electrical energy required	901000	kWh/yr
Volume of earthwork required	5880	cuft
Area of pump building	734	sqft
Costs		
Construction and equipment cc	488000	$
Earthwork Cost	1740	$
Pump Building Cost	80800	$
Installed Pump Cost	331000	$
Misc Costs	74500	$
Operational labor cost	45800	$/yr
Maintenance labor cost	37100	$/yr
Material and supply cost	3420	$/yr
Chemical cost	0	$/yr
Energy cost	90100	$/yr
Amortization cost	46200	$/yr

Belt-Filter Press

Design Output Data

Description	Value	Units
Belt-Filter Press		
Design Information		
Belt filter width	2	m
Number of units	4	
Hydraulic loading per unit per r	70	gpm(US)
Hydraulic loading required per	452	gpm(US)
Final solids content	19	%
Solids capture fraction	0.998	
Quantities		
Operation labor required	2150	pers-hrs/yr
Maintenance labor required	539	pers-hrs/yr
Power	548000	kWh/yr
Polymer required	283000	lb/yr
Dry solids produced	77600	lb/d
Belt filter(s)	1200000	$
Building	429000	$
Installation	301000	$
Polymer system	445000	$
Feed pumps	132000	$
Conveyor system	301000	$
Costs		

Construction and equipment cc	2810000	$
Building Cost	429000	$
Polymer System Cost	445000	$
Feed Pumps Cost	132000	$
Conveyor System Cost	301000	$
Installed Belt Filter	1510000	$
Operational labor cost	111000	$/yr
Maintenance labor cost	26900	$/yr
Material and supply cost	0	$/yr
Chemical cost	368000	$/yr
Energy cost	54800	$/yr
Amortization cost	263000	$/yr

Trickling Filter

Design Output Data

Description	Value	Units
Trickling Filtration		
Design Information		
Reaction rate constant	0.00156	
Hydraulic loading rate	0.75	gal(US)/(sqft·min)
Total hydraulic loading rate	0.781	gal(US)/(sqft·min)
Recirculation ratio	0.0419	
Number of towers per stage	2	
Number of stages	2	
Depth of filter tower	21.4	ft
Diameter of filter tower	125	ft
Surface area per filter tower	6160	sqft
Total surface area	24700	sqft
Volume per filter tower	264000	cuft
Total volume	1060000	cuft
Quantities		
Operation labor required	1250	pers-hr/yr
Maintenance labor required	813	pers-hr/yr
Volume of earthwork required	715000	cuft
Volume of slab concrete requir	32900	cuft
Volume of wall concrete requir	40300	cuft
Number of posts per tower	848	
Total length of precast beams	27100	ft
Costs		
Construction and equipment cc	11600000	$
Earthwork Cost	212000	$
Wall Concrete Cost	969000	$
Slab Concrete Cost	426000	$
Concrete Beam Cost	1090000	$
Media Cost	6030000	$
Installed Distributor Arm Cos	555000	$
Misc Costs	2320000	$
Operational labor cost	64200	$/yr
Maintenance labor cost	40500	$/yr
Material and supply cost	65800	$/yr
Chemical cost	0	$/yr
Energy cost	2060	$/yr
Amortization cost	985000	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	60.1	MGD(US)
Total pumping capacity	60.1	MGD(US)
Design capacity per pump	13900	gpm(US)
Number of pumps	4	
Number of batteries	1	
Firm pumping capacity	60.1	MGD(US)
Quantities		
Operation labor required	1410	pers-hrs/yr
Maintenance labor required	1210	pers-hrs/yr
Electrical energy required	1990000	kWh/yr
Volume of earthwork required	11100	cuft
Area of pump building	1390	sqft
Costs		
Construction and equipment cc	1000000	$
Earthwork Cost	3290	$
Pump Building Cost	152000	$
Installed Pump Cost	695000	$
Misc Costs	153000	$
Operational labor cost	72500	$/yr
Maintenance labor cost	60100	$/yr
Material and supply cost	7030	$/yr
Chemical cost	0	$/yr
Energy cost	199000	$/yr
Amortization cost	95000	$/yr

Chlorination

Design Output Data

Description	Value	Units
Chlorination		
Design Information		
Volume of tank	2500000	gal(US)
Average chlorine required	4420	lb/d
Peak chlorine required	10000	lb/d
Influent coliform count	10000000	/100ml
Effluent coliform count	29.2	/100ml
Quantities		
Operational labor required	3510	pers-hrs/yr
Maintenance labor required	1820	pers-hrs/yr
Electrical energy required	183000	kWh/yr
Volume of earthwork required	139000	cuft
Volume of slab concrete requir	33500	cuft
Volume of wall concrete requir	38400	cuft
Number of chlorinators and ev	1	
Chlorination building area	360	sqft
Number of chlorine cylinders	67	
Area of chlorine storage buildir	9380	sqft
Costs		
Construction and equipment cc	3300000	$
Earthwork Cost	41200	$
Wall Concrete Cost	925000	$
Slab Concrete Cost	434000	$
Installed Equipment Cost	1090000	$
Building Cost	39600	$
Storage Building Cost	516000	$
Misc Costs	252000	$
Operational labor cost	181000	$/yr
Maintenance labor cost	90900	$/yr
Material and supply cost	70000	$/yr
Chemical cost	1050000	$/yr
Energy cost	18300	$/yr
Amortization cost	313000	$/yr

Secondary Clarifier(1)

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	67800	sqft
Surface area per circular clarifi	8470	sqft
Diameter of each circular clarif	104	ft
Number of clarifiers per battery	8	
Number of batteries	1	
Solids loading rate	14.3	lb/(sqft·d)
Hydraulic retention time	4.04	hr
Designed surface overflow rate	400	gal(US)/(sqft·d)
Weir length	6060	ft
Volume of wasted sludge	501000	gpd(US)
Quantities		
Operation labor required	3240	pers-hrs/yr
Maintenance labor required	1810	pers-hrs/yr
Electrical energy required	24800	kWh/yr
Volume of earthwork required	925000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	65100	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	27300	cuft
Costs		
Construction and equipment cc	3560000	$
Earthwork Cost	274000	$
Wall Concrete Cost	658000	$
Slab Concrete Cost	844000	$
Installed Equipment Cost	1240000	$
Misc Costs	543000	$
Operational labor cost	167000	$/yr
Maintenance labor cost	90200	$/yr
Material and supply cost	35600	$/yr
Chemical cost	0	$/yr
Energy cost	2480	$/yr
Amortization cost	325000	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.501	MGD(US)
Total pumping capacity	0.501	MGD(US)
Design capacity per pump	174	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.501	MGD(US)
Quantities		
Operation labor required	403	pers-hrs/yr

Maintenance labor required	325	pers-hrs/yr
Electrical energy required	16800	kWh/yr
Volume of earthwork required	1680	cuft
Area of pump building	210	sqft
Costs		
Construction and equipment cc	70500	$
Earthwork Cost	497	$
Pump Building Cost	23100	$
Installed Pump Cost	36100	$
Misc Costs	10800	$
Operational labor cost	20700	$/yr
Maintenance labor cost	16200	$/yr
Material and supply cost	493	$/yr
Chemical cost	0	$/yr
Energy cost	1680	$/yr
Amortization cost	6660	$/yr

Drying Beds

Design Output Data

Description	Value	Units
Sludge Drying Beds		
Design Information		
Total surface area required	559000	sqft
Initial depth of sludge	12	in
Final solids	50	%
Bed holding time	103	d
Quantities		
Total drying bed surface area	559000	sqft
Number beds	187	
Surface area of each individua	2990	sqft
Length of each bed	149	ft
Volume of earthwork required	2750000	cuft
Volume concrete for dividing w	180000	cuft
Volume of R.C. in-place for tru	41900	cuft
Volume of sand	419000	cuft
Volume of gravel	559000	cuft
Clay pipe diameter	6	in
Total length clay pipe	55900	in
Sludge solids produced	32.3	ton(short)/d
Operational labor required	34400	pers-hrs/yr
Maintenance labor required	17200	pers-hrs/yr
Costs		
Construction and equipment cc	7730000	$
Earthwork Cost	814000	$
Wall Concrete Cost	3030000	$
Slab Concrete Cost	326000	$
Drying Bed Media Cost	1560000	$
Drain Pipe System Cost	1230000	$
Misc Costs	766000	$
Operational labor cost	1770000	$/yr
Maintenance labor cost	857000	$/yr
Material and supply cost	69500	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	673000	$/yr

Secondary Clarifier

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	66600	sqft
Surface area per circular clarifi	8320	sqft
Diameter of each circular clarif	103	ft
Number of clarifiers per battery	8	
Number of batteries	1	
Solids loading rate	0.348	lb/(sqft·d)
Hydraulic retention time	4.04	hr
Designed surface overflow rate	400	gal(US)/(sqft·d)
Weir length	6010	ft
Volume of wasted sludge	270000	gpd(US)
Quantities		
Operation labor required	3200	pers-hrs/yr
Maintenance labor required	1790	pers-hrs/yr
Electrical energy required	24600	kWh/yr
Volume of earthwork required	904000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	63900	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	27100	cuft
Costs		
Construction and equipment cc	3510000	$

Earthwork Cost	268000	$
Wall Concrete Cost	652000	$
Slab Concrete Cost	829000	$
Installed Equipment Cost	1230000	$
Misc Costs	536000	$
Operational labor cost	165000	$/yr
Maintenance labor cost	89200	$/yr
Material and supply cost	35100	$/yr
Chemical cost	0	$/yr
Energy cost	2460	$/yr
Amortization cost	321000	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.27	MGD(US)
Total pumping capacity	0.27	MGD(US)
Design capacity per pump	93.6	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.27	MGD(US)
Quantities		
Operation labor required	372	pers-hrs/yr
Maintenance labor required	297	pers-hrs/yr
Electrical energy required	9060	kWh/yr
Volume of earthwork required	1640	cuft
Area of pump building	205	sqft
Costs		
Construction and equipment co	59700	$
Earthwork Cost	487	$
Pump Building Cost	22600	$
Installed Pump Cost	27500	$
Misc Costs	9110	$
Operational labor cost	19100	$/yr
Maintenance labor cost	14800	$/yr
Material and supply cost	418	$/yr
Chemical cost	0	$/yr
Energy cost	906	$/yr
Amortization cost	5640	$/yr

Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment co	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

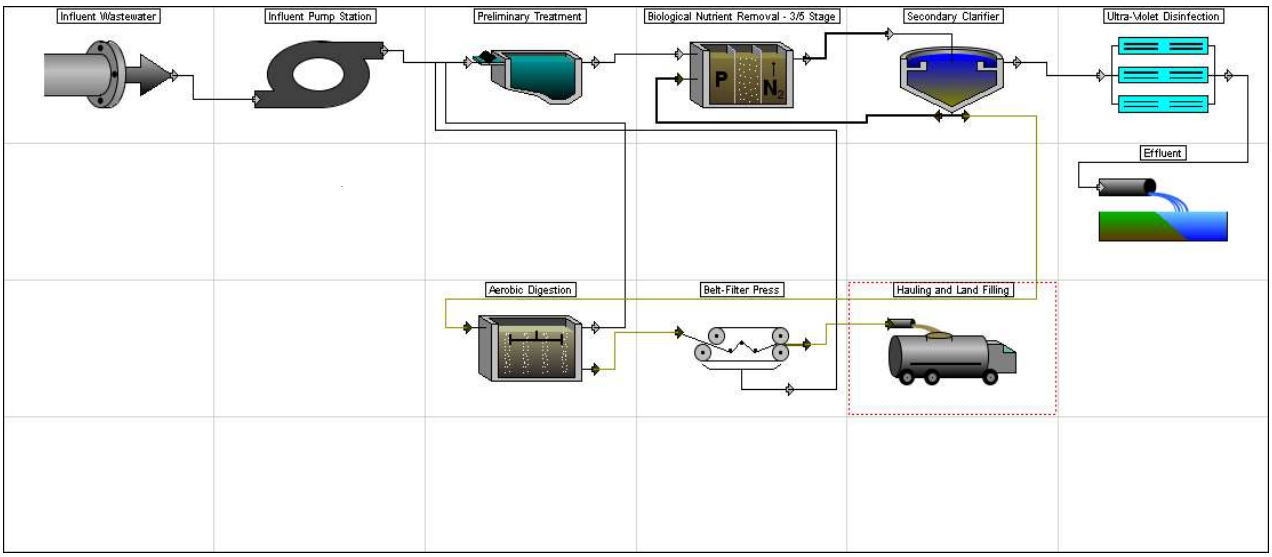
Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	76.6	cuyd/d
Truck capacity	30	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	76.6	cuyd/d
Maximum anticipated landfill d	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	7760	sqft
Width of sludge storage shed s	62.3	ft
Length of sludge storage shed	125	ft
Volume of earthwork required	20600	cuft
Volume of slab concrete requir	8620	cuft
Surface area of canopy roof	7760	sqft
Round trip haul distance	20	miles
Round trips per day per truck	3	
Distance traveled per year per	15000	miles
Sludge hauled	67.8	ton(short)/d
Operation labor required	1200	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment co	632000	$
Earthwork Cost	6100	$
Slab Concrete Cost	112000	$

Canopy Roof Cost	155000	$
Vehicle Cost	359000	$
Operational labor cost	61700	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	90100	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	101000	$/yr

Coalville City

Layout - Coalville City



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$5,180,000	$
Other direct construction costs	$1,500,000	$
Other indirect construction cos	$5,130,000	$
Total construction costs	$11,800,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$12,000	$/yr
Laboratory labor cost	$117,000	$/yr
Unit process operation labor c	$289,000	$/yr
Unit process maintenance labc	$142,000	$/yr
Total labor costs	$560,000	$/yr
MATERIAL COSTS		
Total material cost	$149,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$5,590	$/yr
ENERGY COSTS		
Total energy cost	$92,100	$/yr
Total operation and maintanen	$808,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$1,040,000	$/yr
Total annual project cost	$1,840,000	$/yr
PROJECT SUMMARY		
Present worth	$22,200,000	$
Total project cost	$11,800,000	$
Total operation labor cost	$418,000	$/yr
Total maintenance labor cost	$142,000	$/yr
Total material cost	$149,000	$/yr
Total chemical cost	$5,590	$/yr
Total energy cost	$92,100	$/yr
Total amortization cost	$1,040,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Influent Pump Station	886000	27100	17700	6200	0	5100	76500
Preliminary Treatment	379000	26200	11800	9480	0	1280	31800
Aerobic Digestion	261000	48500	18200	27700	0	24000	22700
Biological Nutrient Removal - 3	1500000	150000	73400	45600	0	49400	138000

Belt-Filter Press	812000	1240	240	0	4100	856	74300
Secondary Clarifier	266000	33900	16800	2560	0	801	25100
Hauling and Land Filling	295000	2290	0	53600	0	0	62300
Ultra-Violet Disinfection	430000	0	4320	4300	1490	10700	36400
Effluent	0	0	0	0	0	0	0
Blower System	351000	0	0	0	0	0	29400
Other Costs	6630000	129000	0	0	0	0	539000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	10	acre
Administration labor hours	234	hr/yr
Laboratory labor hours	2270	hr/yr
Costs		
DIRECT COSTS		
Mobilization	129000	$
Site preparation	240000	$
Site electrical	333000	$
Yard piping	232000	$
Instrumentation and control	151000	$
Lab and administration building	416000	$
Total direct construction costs	1500000	$
INDIRECT COSTS		
Cost of land	200000	$
Miscellaneous cost	384000	$
Legal cost	154000	$
Engineering design fee	1150000	$
Inspection cost	154000	$
Contingency	768000	$
Technical	154000	$
Interest during construction	1160000	$
Profit	1000000	$
Total indirect construction cost	5130000	$
Total of other construction cos	6630000	$
LABOR COSTS		
Administration labor cost	12000	$/yr
Laboratory labor cost	117000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	1690	scfm
Safety factor	1.5	
Requested air flow capacity	2530	scfm
Total capacity of blowers	2530	scfm
Number of blowers in use	1	
Total number of blowers	2	
Capacity of individual blowers	2530	scfm
Estimated cost of an installed l	106000	$
Blower building area	952	sqft
Costs		
Construction and equipment cc	351000	$
Installed Blower Cost	212000	$
Building Cost	105000	$
Misc Costs	34800	$
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	29400	$/yr
Notes		
Energy costs are shown at the individual unit processes that require air		

Influent Wastewater

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	9470	cuft
Width of wet well	86.8	ft
Depth of the pumping station	25.9	ft
Length of the pumping station	18	ft
Width of the pumping station	114	ft
Minimum depth of water in wet	4.9	ft

Area of pump building	514	sqft
Peak capacity of pumps	4	MGD(US)
Firm pumping capacity	4	MGD(US)
Total dynamic head - average	43.9	ft
Quantities		
Operation labor required	526	pers-hrs/yr
Maintenance labor required	442	pers-hrs/yr
Electrical energy required	51000	kWh/yr
Volume of earthwork required	273000	cuft
Volume of slab concrete requir	16400	cuft
Volume of wall concrete requir	9440	cuft
Capacity per pump	2780	gpm(US)
Number of constant speed pur	2	
Number of variable speed pur	0	
Diameter of discharge header	11.9	in
Total dynamic head	74.5	ft
Size of selected pump	12	in
Specific speed of pump	3740	
Pump rotating speed	1920	rpm
Motor size required	74.9	HP
Size of selected motor	75	HP
Width of pump system	3	ft
Length of pump system	18.2	ft
Length of the dry well	18	ft
Width of the dry well	27.2	ft
Costs		
Construction and equipment co	886000	$
Earthwork Cost	80900	$
Wall Concrete Cost	227000	$
Slab Concrete Cost	212000	$
Building Cost	56500	$
Installed Pump Equipment C	174000	$
Misc Costs	135000	$
Operational labor cost	27100	$/yr
Maintenance labor cost	17700	$/yr
Material and supply cost	6200	$/yr
Chemical cost	0	$/yr
Energy cost	5100	$/yr
Amortization cost	76500	$/yr

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	0.379	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	6.18	cuft/s
Average flow	0.946	cuft/s
Minimum flow	0.484	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	3.09	cuft/s
Width of channel	0.515	ft
Depth of channel	4	ft
Length of channel	143	ft
Settling velocity of particle	0.0711	ft/s
Slope of channel bottom	0.00469	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.59	min
Volume of grit	2.46	cuft/d
Costs		
Construction and equipment co	379000	$
Operational labor cost	26200	$/yr
Maintenance labor cost	11800	$/yr
Material and supply cost	9480	$/yr
Chemical cost	0	$/yr
Energy cost	1280	$/yr

Amortization cost	31800	$/yr

Aerobic Digestion

Design Output Data

Description	Value	Units
Aerobic Digestion		
Design Information		
Solids retention time	20	d
Design SS	12000	mg/L
Calculated VSS	5620	mg/L
Calculated VSS:TSS ratio	0.469	mg VSS/mg SS
Total volume of reactors	572	m3
Length of parallel train	6	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	272	kg/d
Air flow required to meet avera	1510	N m3/hr
Design air flow	43.9	N m3/min/1000 m3
Volatile solids loading	0.039	lb/(cuft·d)
Solids accumulated	757	lb/d
Digester capacity	15100	lb
Volume of wasted sludge	69100	gal(US)
Quantities		
Operation labor required	942	pers-hrs/yr
Maintenance labor required	455	pers-hrs/yr
Electrical energy required	240000	kWh/yr
Volume of earthwork required	22600	cuft
Volume of slab concrete requir	4630	cuft
Volume of wall concrete requir	4280	cuft
Handrail length	119	ft
Number of diffusers per train	39	
Number of swing arm headers	1	
Costs		
Construction and equipment cc	261000	$
Earthwork Cost	6680	$
Wall Concrete Cost	103000	$
Slab Concrete Cost	60000	$
Handrail Cost	8960	$
Installed Aerator Equipment	42900	$
Air Piping Cost	13200	$
Misc Costs	25800	$
Operational labor cost	48500	$/yr
Maintenance labor cost	18200	$/yr
Material and supply cost	27700	$/yr
Chemical cost	0	$/yr
Energy cost	24000	$/yr
Amortization cost	22700	$/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 nitrifica	10	d
Total reactor SRT	20	d
Design SS	3000	mg/L
Calculated VSS	1790	mg/L
Calculated VSS:TSS ratio	0.595	mg VSS/mg SS
Total volume of anaerobic reac	412	m3
Total volume of anoxic reactor	1550	m3
Total volume of aerobic reacto	1960	m3
Total volume of all reactors	3930	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	1	
Number of aerobic cells within	1	
Anaerobic hydraulic retention ti	4.25	hr
Anoxic hydraulic retention time	16	hr
Aerobic hydraulic retention tim	20.3	hr
Amount of sludge generated	589	kg/d
Sludge recycle ratio	42.9	%
Sludge recycle rate	997	m3/d
Nitrogen required for biomass	22.4	mg/L
Phosphorus required for bioma	4.48	mg/L
Oxygen required to meet avera	760	kg/d
Air flow required to meet avera	1260	N m3/hr
Design air flow	10.7	N m3/min/1000 m3

Quantities		
Operation labor required	1610	pers-hrs/yr
Maintenance labor required	772	pers-hrs/yr
Electrical energy required	329000	kWh/yr
Volume of earthwork required	86000	cuft
Volume of slab concrete requir	19100	cuft
Volume of wall concrete requir	12900	cuft
Handrail length	349	ft
Number of diffusers per train	190	
Fine bubble diffuser floor cover	3.9	%
Number of swing arm headers	6	
Required mixing power	27.3	kW
Total number of mixers	4	
Required mixing power per mi	6.83	kW
Design mixing power per mixe	3.73	kW
Mixing power for each unaerat	6.82	kW
Costs		
Construction and equipment co	1070000	$
Earthwork Cost	25500	$
Wall Concrete Cost	311000	$
Slab Concrete Cost	248000	$
Handrail Cost	26200	$
Installed Aerator Equipment	264000	$
Air Piping Cost	20500	$
Installed Mixer Equipment Co	68600	$
Misc Costs	106000	$
Operational labor cost	82900	$/yr
Maintenance labor cost	30900	$/yr
Material and supply cost	42600	$/yr
Chemical cost	0	$/yr
Energy cost	32900	$/yr
Amortization cost	97800	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	0.922	MGD(US)
Total pumping capacity	0.922	MGD(US)
Design capacity per pump	320	gpm(US)
Number of pumps	6	
Number of batteries	1	
Firm pumping capacity	0.922	MGD(US)
Quantities		
Operation labor required	435	pers-hrs/yr
Maintenance labor required	356	pers-hrs/yr
Electrical energy required	61800	kWh/yr
Volume of earthwork required	1750	cuft
Area of pump building	218	sqft
Costs		
Construction and equipment co	169000	$
Earthwork Cost	1030	$
Pump Building Cost	48000	$
Installed Pump Cost	94600	$
Misc Costs	25800	$
Operational labor cost	22400	$/yr
Maintenance labor cost	14200	$/yr
Material and supply cost	1190	$/yr
Chemical cost	0	$/yr
Energy cost	6180	$/yr
Amortization cost	16000	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	1.23	MGD(US)
Total pumping capacity	1.23	MGD(US)
Design capacity per pump	427	gpm(US)
Number of pumps	6	
Number of batteries	1	
Firm pumping capacity	1.23	MGD(US)
Quantities		
Operation labor required	452	pers-hrs/yr
Maintenance labor required	371	pers-hrs/yr
Electrical energy required	82300	kWh/yr
Volume of earthwork required	1790	cuft
Area of pump building	224	sqft
Costs		
Construction and equipment co	186000	$
Earthwork Cost	1060	$
Pump Building Cost	49300	$
Installed Pump Cost	107000	$
Misc Costs	28400	$
Operational labor cost	23300	$/yr
Maintenance labor cost	14900	$/yr
Material and supply cost	1300	$/yr
Chemical cost	0	$/yr

Energy cost	8230	$/yr
Amortization cost	17600	$/yr
Sludge Recycle Pumping		
Design Information		
Average daily pumping rate	0.615	MGD(US)
Total pumping capacity	0.615	MGD(US)
Design capacity per pump	213	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.615	MGD(US)
Quantities		
Operation labor required	413	pers-hrs/yr
Maintenance labor required	335	pers-hrs/yr
Electrical energy required	20600	kWh/yr
Volume of earthwork required	1700	cuft
Area of pump building	212	sqft
Costs		
Construction and equipment cc	74800	$
Earthwork Cost	503	$
Pump Building Cost	23300	$
Installed Pump Cost	39500	$
Misc Costs	11400	$
Operational labor cost	21300	$/yr
Maintenance labor cost	13400	$/yr
Material and supply cost	524	$/yr
Chemical cost	0	$/yr
Energy cost	2060	$/yr
Amortization cost	7070	$/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	10.1	gpm(US)
Final solids content	15	%
Solids capture fraction	0.996	
Quantities		
Operation labor required	24	pers-hrs/yr
Maintenance labor required	6.01	pers-hrs/yr
Power	8560	kWh/yr
Polymer required	3150	lb/yr
Dry solids produced	864	lb/d
Belt filter(s)	275000	$
Building	279000	$
Installation	68800	$
Polymer system	82500	$
Feed pumps	30300	$
Conveyor system	77000	$
Costs		
Construction and equipment cc	812000	$
Building Cost	279000	$
Polymer System Cost	82500	$
Feed Pumps Cost	30300	$
Conveyor System Cost	77000	$
Installed Belt Filter	344000	$
Operational labor cost	1240	$/yr
Maintenance labor cost	240	$/yr
Material and supply cost	0	$/yr
Chemical cost	4100	$/yr
Energy cost	856	$/yr
Amortization cost	74300	$/yr

Secondary Clarifier

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	1540	sqft
Surface area per circular clarifi	768	sqft
Diameter of each circular clarif	32	ft
Number of clarifiers per battery	2	
Number of batteries	1	
Solids loading rate	14.3	lb/(sqft·d)
Hydraulic retention time	4.04	hr
Designed surface overflow rate	400	gal(US)/(sqft·d)
Weir length	502	ft
Volume of wasted sludge	15100	gpd(US)
Quantities		

Operation labor required	402	pers-hrs/yr
Maintenance labor required	225	pers-hrs/yr
Electrical energy required	7500	kWh/yr
Volume of earthwork required	20600	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	1810	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	2240	cuft
Costs		
Construction and equipment cc	231000	$
Earthwork Cost	6100	$
Wall Concrete Cost	54000	$
Slab Concrete Cost	23400	$
Installed Equipment Cost	112000	$
Misc Costs	35200	$
Operational labor cost	20700	$/yr
Maintenance labor cost	9010	$/yr
Material and supply cost	2310	$/yr
Chemical cost	0	$/yr
Energy cost	750	$/yr
Amortization cost	21700	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0151	MGD(US)
Total pumping capacity	0.0151	MGD(US)
Design capacity per pump	5.25	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.0151	MGD(US)
Quantities		
Operation labor required	257	pers-hrs/yr
Maintenance labor required	194	pers-hrs/yr
Electrical energy required	512	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment cc	35700	$
Earthwork Cost	475	$
Pump Building Cost	22000	$
Installed Pump Cost	7740	$
Misc Costs	5440	$
Operational labor cost	13200	$/yr
Maintenance labor cost	7760	$/yr
Material and supply cost	250	$/yr
Chemical cost	0	$/yr
Energy cost	51	$/yr
Amortization cost	3370	$/yr

Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	2.84	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	2.84	cuyd/d
Maximum anticipated landfill dc	30	d
Anticipated sludge storage heig	8	ft
Sludge storage shed area	288	sqft
Width of sludge storage shed s	12	ft
Length of sludge storage shed	24	ft
Volume of earthwork required	964	cuft
Volume of slab concrete requir	453	cuft
Surface area of canopy roof	288	sqft
Round trip haul distance	20	miles
Round trips per day per truck	1	
Distance traveled per year per	5000	miles
Sludge hauled	2.51	ton(short)/d
Operation labor required	44.5	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment cc	295000	$
Earthwork Cost	286	$
Slab Concrete Cost	5870	$
Canopy Roof Cost	5760	$
Vehicle Cost	283000	$

Operational labor cost	2290	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	53600	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	62300	$/yr

Ultra-Violet Disinfection

Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calc	1.63	gal(US)/(min·W)
Total number of lamps needed	130	
Number of spare channels	1	
Total number of lamps used in	144	
Number of excess lamps	14	
Number of lamps/modules	2	
Number of modules/bank	3	
Number of banks/channel	2	
Number of channels	12	
Calculated headloss	2.14	in
Costs		
Construction and equipment cc	430000	$
Cost of installation	258000	$
Total cost of UV lamps	172000	$
Operational labor cost	0	$/yr
Maintenance labor cost	4320	$/yr
Material and supply cost	4300	$/yr
Chemical cost	1490	$/yr
Energy cost	10700	$/yr
Amortization cost	36400	$/yr

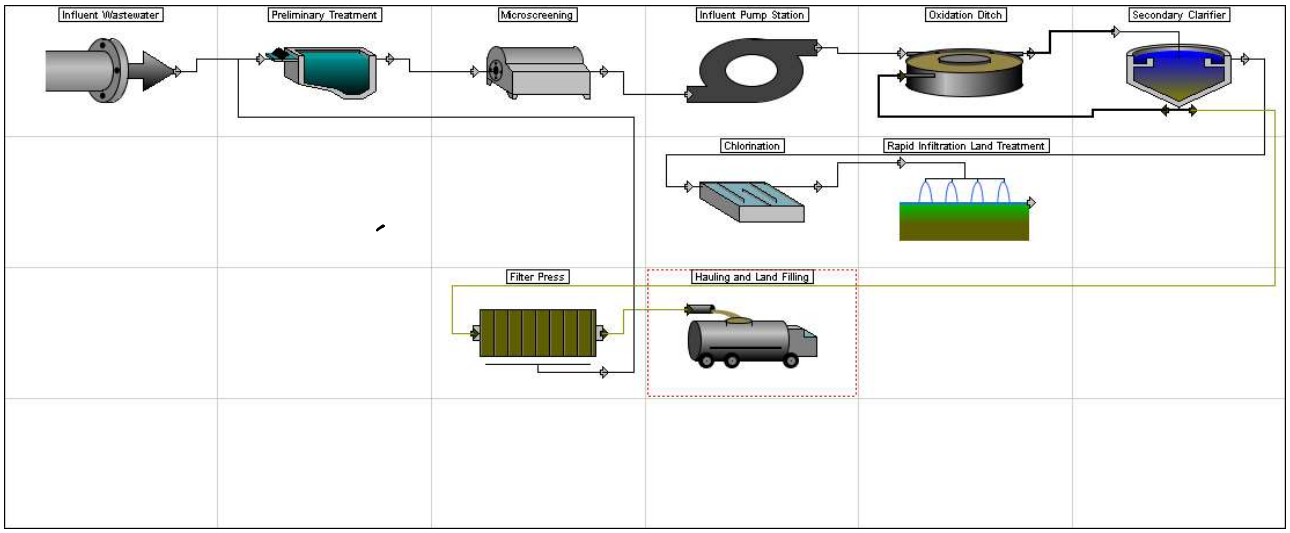
Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	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

Eagle Mountain City

Layout - Eagle Mountain



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$6,850,000	$
Other direct construction costs	$1,500,000	$
Other indirect construction cos	$6,350,000	$
Total construction costs	$14,700,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$12,000	$/yr
Laboratory labor cost	$117,000	$/yr
Unit process operation labor c	$288,000	$/yr
Unit process maintenance labc	$58,200	$/yr
Total labor costs	$475,000	$/yr
MATERIAL COSTS		
Total material cost	$216,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$11,900	$/yr
ENERGY COSTS		
Total energy cost	$57,600	$/yr
Total operation and maintanen	$761,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$1,350,000	$/yr
Total annual project cost	$2,110,000	$/yr
PROJECT SUMMARY		
Present worth	$25,400,000	$
Total project cost	$14,700,000	$
Total operation labor cost	$417,000	$/yr
Total maintenance labor cost	$58,200	$/yr
Total material cost	$216,000	$/yr
Total chemical cost	$11,900	$/yr
Total energy cost	$57,600	$/yr
Total amortization cost	$1,350,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Preliminary Treatment	317000	26100	10900	7920	0	1270	26600
Microscreening	619000	4990	2330	64300	0	13900	68500
Filter Press	3250000	103000	0	0	0	0	331000
Influent Pump Station	711000	26100	15800	4980	0	5380	61500

Chlorination	452000	16700	2020	20700	11900	11800	48600
Hauling and Land Filling	286000	1960	0	109000	0	0	61500
Oxidation Ditch	561000	39200	0	2390	0	22500	50200
Rapid Infiltration Land Treatme	394000	38100	12500	4900	0	2040	38100
Secondary Clarifier	263000	32200	14600	2530	0	769	24800
Other Costs	7860000	129000	0	0	0	0	642000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	10	acre
Administration labor hours	234	hr/yr
Laboratory labor hours	2270	hr/yr
Costs		
DIRECT COSTS		
Mobilization	129000	$
Site preparation	240000	$
Site electrical	333000	$
Yard piping	232000	$
Instrumentation and control	151000	$
Lab and administration building	416000	$
Total direct construction costs	1500000	$
INDIRECT COSTS		
Cost of land	200000	$
Miscellaneous cost	480000	$
Legal cost	192000	$
Engineering design fee	1440000	$
Inspection cost	192000	$
Contingency	961000	$
Technical	192000	$
Interest during construction	1440000	$
Profit	1250000	$
Total indirect construction cost	6350000	$
Total of other construction cos	7860000	$
LABOR COSTS		
Administration labor cost	12000	$/yr
Laboratory labor cost	117000	$/yr

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	1.5	in
Slope of bars from horizontal	30	degrees
Head loss through screen	0.0206	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	0.373	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	4.63	cuft/s
Average flow	0.932	cuft/s
Minimum flow	0.624	cuft/s
Temperature	10	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	2.31	cuft/s
Width of channel	0.386	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.00604	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	2.42	cuft/d
Costs		
Construction and equipment cc	317000	$
Operational labor cost	26100	$/yr
Maintenance labor cost	10900	$/yr

Material and supply cost	7920	$/yr
Chemical cost	0	$/yr
Energy cost	1270	$/yr
Amortization cost	26600	$/yr

Microscreening

Design Output Data

Description	Value	Units
Microscreening		
Design Information		
Microscreen loading rate	7	gal(US)/(sqft·min)
Quantity of wash water require	4	%
Area of microscreens required	298	sqft
Quantities		
Number of batteries	1	
Number of units/battery	2	
Drum diameter	10	ft
Drum width	10	ft
Area of selected unit	315	sqft
Area of building	223	sqft
Operation labor required	96.9	pers-hrs/yr
Maintenance labor required	62.4	pers-hrs/yr
Electrical energy required	139000	kWh/yr
Volume of wall concrete requir	3440	cuft
Volume of earthwork required	8540	cuft
Costs		
Construction and equipment co	619000	$
Earthwork Cost	2530	$
Slab Concrete Cost	82800	$
Building Cost	24500	$
Installed Equipment Cost	429000	$
Misc Costs	80800	$
Operational labor cost	4990	$/yr
Maintenance labor cost	2330	$/yr
Material and supply cost	64300	$/yr
Chemical cost	0	$/yr
Energy cost	13900	$/yr
Amortization cost	68500	$/yr

Filter Press

Design Output Data

Description	Value	Units
Filter Press		
Design Information		
Total dry solids produced	465	lb/d
Weight of filter cake produced	1030	lb/d
Cake volume	15.9	cuft/d
Number of chambers per day	7.95	
Number of cycles per day	4	
Number of chambers required	1.99	
Costs		
Construction and equipment co	3250000	$
Operational labor cost	103000	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	0	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	331000	$/yr

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	6680	cuft
Width of wet well	64.2	ft
Depth of the pumping station	25.5	ft
Length of the pumping station	17.2	ft
Width of the pumping station	90.5	ft
Minimum depth of water in wet	4.52	ft
Area of pump building	476	sqft
Peak capacity of pumps	3.01	MGD(US)
Firm pumping capacity	3.01	MGD(US)
Total dynamic head - average	44.7	ft
Quantities		
Operation labor required	507	pers-hrs/yr
Maintenance labor required	424	pers-hrs/yr
Electrical energy required	53800	kWh/yr
Volume of earthwork required	218000	cuft
Volume of slab concrete requir	11800	cuft
Volume of wall concrete requir	7680	cuft
Capacity per pump	2090	gpm(US)

Number of constant speed pur	2	
Number of variable speed pur	0	
Diameter of discharge header	10.3	in
Total dynamic head	79.7	ft
Size of selected pump	10	in
Specific speed of pump	3080	
Pump rotating speed	2330	rpm
Motor size required	61.7	HP
Size of selected motor	75	HP
Width of pump system	2.6	ft
Length of pump system	17.4	ft
Length of the dry well	17.2	ft
Width of the dry well	26.4	ft
Costs		
Construction and equipment co	711000	$
Earthwork Cost	64600	$
Wall Concrete Cost	185000	$
Slab Concrete Cost	153000	$
Building Cost	52400	$
Installed Pump Equipment C	148000	$
Misc Costs	108000	$
Operational labor cost	26100	$/yr
Maintenance labor cost	15800	$/yr
Material and supply cost	4980	$/yr
Chemical cost	0	$/yr
Energy cost	5380	$/yr
Amortization cost	61500	$/yr

Chlorination

Design Output Data

Description	Value	Units
Chlorination		
Design Information		
Volume of tank	62500	gal(US)
Average chlorine required	50	lb/d
Peak chlorine required	250	lb/d
Influent coliform count	10000000	/100ml
Effluent coliform count	29.2	/100ml
Quantities		
Operational labor required	324	pers-hrs/yr
Maintenance labor required	54.1	pers-hrs/yr
Electrical energy required	118000	kWh/yr
Volume of earthwork required	3570	cuft
Volume of slab concrete requir	837	cuft
Volume of wall concrete requir	2750	cuft
Number of chlorinators and ev	1	
Chlorination building area	220	sqft
Number of chlorine cylinders	2	
Area of chlorine storage buildir	280	sqft
Costs		
Construction and equipment co	452000	$
Earthwork Cost	1060	$
Wall Concrete Cost	66300	$
Slab Concrete Cost	10900	$
Installed Equipment Cost	320000	$
Building Cost	24200	$
Storage Building Cost	15400	$
Misc Costs	14100	$
Operational labor cost	16700	$/yr
Maintenance labor cost	2020	$/yr
Material and supply cost	20700	$/yr
Chemical cost	11900	$/yr
Energy cost	11800	$/yr
Amortization cost	48600	$/yr

Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	0.608	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	40	miles
Quantities		
Total sludge volume hauled	0.608	cuyd/d
Maximum anticipated landfill d	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	61.5	sqft

Width of sludge storage shed s	5.55	ft
Length of sludge storage shed	11.1	ft
Volume of earthwork required	278	cuft
Volume of slab concrete requir	138	cuft
Surface area of canopy roof	61.5	sqft
Round trip haul distance	80	miles
Round trips per day per truck	1	
Distance traveled per year per	20000	miles
Sludge hauled	0.538	ton(short)/d
Operation labor required	38	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment co	286000	$
Earthwork Cost	82	$
Slab Concrete Cost	1790	$
Canopy Roof Cost	1230	$
Vehicle Cost	283000	$
Operational labor cost	1960	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	109000	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	61500	$/yr

Oxidation Ditch

Design Output Data

Description	Value	Units
Oxidation Ditch		
Design Information		
Carbon & Nitrification Design		
Design SRT for design at winte	24	d
Design SS	2500	mg/L
Calculated VSS	1920	mg/L
Calculated VSS:TSS ratio	0.769	mg VSS/mg SS
Total volume of reactors	2090	m3
Ditch length	113	m
Ditch width	13.2	m
Sidewater depth	1.83	m
Number of batteries	1	
Number of parallel ditches per	1	
Number of rotors per ditch	2	
Rotor length for aeration	5.13	m
Rotor length for mixing	8	m
Installed rotor length per rotor	4	m
Rotor horsepower	20	HP
Total installed horsepower per	40	HP
Assumed surface velocity	0.46	m/s
Hydraulic retention time	21.8	hr
F/M ratio	0.0623	lb BOD/lb MLSS/d
Volumetric BOD loading	0.12	kg BOD/m3/d
Observed yield (VSS basis)	0.427	g VSS/g BOD
Observed yield (TSS basis)	0.555	g TSS/g BOD
Amount of alkalinity required	125	gCaCO3/m3
Amount of sludge generated	217	kg/d
Sludge recycle rate	764	m3/d
Nitrogen requirement for biom	7.29	mg/L
Phosphorus requirement for bi	1.46	mg/L
Oxygen requirement to meet a	686	kg/d
Quantities		
Ditch bottom width	14.1	ft
Length of straight section	329	ft
Volume of excavation required	109000	cuft
Volume of backfill required per	0	cuft
Volume of wall concrete requir	8460	cuft
Volume of slab concrete requir	11200	cuft
Length of adjustable weir	19.1	ft
Volume of concrete required p	96.3	cuft
Total handrail length	793	ft
Operation labor required	761	pers-hrs/yr
Electrical energy required	225000	kWh/yr
Costs		
Construction and equipment co	561000	$
Earthwork Cost	32300	$
Wall Concrete Cost	206000	$
Slab Concrete Cost	145000	$
Handrail Cost	59500	$
Installed Equipment Cost	89600	$
Misc Costs	27700	$
Operational labor cost	39200	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	2390	$/yr
Chemical cost	0	$/yr

Energy cost	22500	$/yr
Amortization cost	50200	$/yr

Rapid Infiltration Land Treatment

Design Output Data

Description	Value	Units
Rapid Infiltration Land Treatment		
Design Information		
Soil uptake of phosphorus	83.7	lb/(acre·yr)
Volume of percolate	0.609	MGD(US)
Quality of percolate		
Percolate suspended solids	0.2	mg/L
Percolate % volatile solids	76.9	%
Percolate BOD	0.0353	mg/L
Percolate soluble BOD	0.0146	mg/L
Percolate COD	10.9	mg/L
Percolate soluble COD	0.38	mg/L
Percolate TKN	7.24	mg/L
Percolate total phosphorus	0.103	mg/L
Percolate ammonia	4.22	mg/L
Percolate nitrite	0	mg/L
Percolate nitrate	4.83	mg/L
Percolate oil and grease	0	mg/L
Fencing required	1960	ft
Treatment area required	4.43	acre
Land area for buffer zones	0	acre
Total land area	6.53	acre
Quantities		
Generated flow	0.609	MGD(US)
Number of infiltration basins	4	
Area of individual infiltration ba	1.11	acre
Length of individual infiltration b	220	ft
Volume of earthwork required	357000	cuft
Header pipe diameter	8	in
Length of header pipe required	879	ft
Lateral pipe diameter	6	in
Number of valves required	4	
Length of lateral pipe required	400	ft
Operational labor for monitorin	109	pers-hrs/yr
Operational labor for distributio	328	pers-hrs/yr
Costs		
Construction and equipment co	319000	$
Earthwork Cost	106000	$
Distribution System Cost	116000	$
Monitoring Wells Cost	3270	$
Installed Fence Cost	44800	$
Misc Costs	48700	$
Operational labor cost	16900	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	4370	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	31100	$/yr
Intermediate Pumping		
Design Information		
Average daily pumping rate	0.609	MGD(US)
Total pumping capacity	0.609	MGD(US)
Design capacity per pump	211	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.609	MGD(US)
Quantities		
Operation labor required	413	pers-hrs/yr
Maintenance labor required	335	pers-hrs/yr
Electrical energy required	20400	kWh/yr
Volume of earthwork required	1700	cuft
Area of pump building	212	sqft
Costs		
Construction and equipment co	74600	$
Earthwork Cost	503	$
Pump Building Cost	23300	$
Installed Pump Cost	39400	$
Misc Costs	11400	$
Operational labor cost	21300	$/yr
Maintenance labor cost	12500	$/yr
Material and supply cost	522	$/yr
Chemical cost	0	$/yr
Energy cost	2040	$/yr
Amortization cost	7050	$/yr

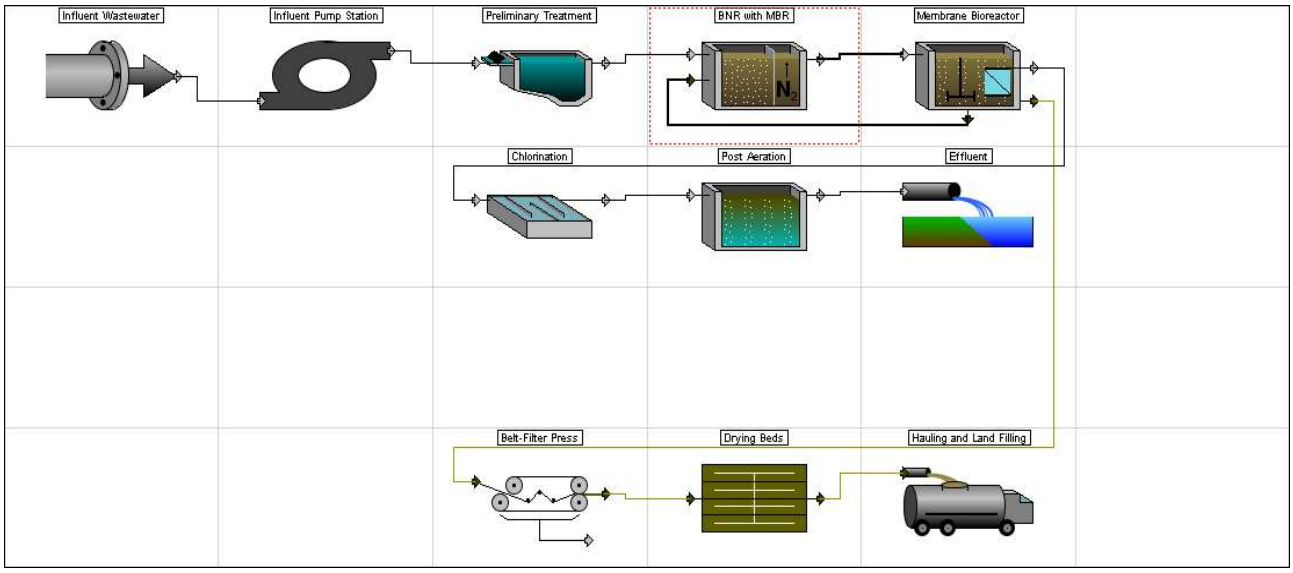
Secondary Clarifier

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	1510	sqft
Surface area per circular clarifi	757	sqft
Diameter of each circular clarif	32	ft
Number of clarifiers per battery	2	
Number of batteries	1	
Solids loading rate	11.1	lb/(sqft·d)
Hydraulic retention time	4.04	hr
Designed surface overflow rate	400	gal(US)/(sqft·d)
Weir length	301	ft
Volume of wasted sludge	5580	gpd(US)
Quantities		
Operation labor required	400	pers-hrs/yr
Maintenance labor required	224	pers-hrs/yr
Electrical energy required	7500	kWh/yr
Volume of earthwork required	20600	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	1810	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	2240	cuft
Costs		
Construction and equipment co	231000	$
Earthwork Cost	6100	$
Wall Concrete Cost	54000	$
Slab Concrete Cost	23400	$
Installed Equipment Cost	112000	$
Misc Costs	35200	$
Operational labor cost	20600	$/yr
Maintenance labor cost	8370	$/yr
Material and supply cost	2310	$/yr
Chemical cost	0	$/yr
Energy cost	750	$/yr
Amortization cost	21700	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.00558	MGD(US)
Total pumping capacity	0.00558	MGD(US)
Design capacity per pump	1.94	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.00558	MGD(US)
Quantities		
Operation labor required	226	pers-hrs/yr
Maintenance labor required	167	pers-hrs/yr
Electrical energy required	189	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment co	32400	$
Earthwork Cost	474	$
Pump Building Cost	22000	$
Installed Pump Cost	4990	$
Misc Costs	4950	$
Operational labor cost	11600	$/yr
Maintenance labor cost	6240	$/yr
Material and supply cost	227	$/yr
Chemical cost	0	$/yr
Energy cost	19	$/yr
Amortization cost	3070	$/yr

Fairview City

Layout - Fairview



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$4,080,000	$
Other direct construction costs	$1,100,000	$
Other indirect construction cos	$4,000,000	$
Total construction costs	$9,190,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$8,330	$/yr
Laboratory labor cost	$109,000	$/yr
Unit process operation labor c	$329,000	$/yr
Unit process maintenance labc	$140,000	$/yr
Total labor costs	$586,000	$/yr
MATERIAL COSTS		
Total material cost	$105,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$16,300	$/yr
ENERGY COSTS		
Total energy cost	$64,800	$/yr
Total operation and maintanen	$772,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$861,000	$/yr
Total annual project cost	$1,630,000	$/yr
PROJECT SUMMARY		
Present worth	$19,600,000	$
Total project cost	$9,190,000	$
Total operation labor cost	$446,000	$/yr
Total maintenance labor cost	$140,000	$/yr
Total material cost	$105,000	$/yr
Total chemical cost	$16,300	$/yr
Total energy cost	$64,800	$/yr
Total amortization cost	$861,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Influent Pump Station	419000	24000	15400	2930	0	3590	36500
Preliminary Treatment	160000	22200	10200	3990	0	1020	13400
Chlorination	329000	12900	1850	15600	7280	11800	35400
Belt-Filter Press	812000	1180	229	0	3900	820	74300

BNR with MBR	444000	90600	39500	15700	0	28200	42000
Post Aeration	50600	22200	4730	2340	0	306	4640
Drying Beds	90200	32000	11100	812	0	0	7740
Membrane Bioreactor	1090000	123000	56600	10300	5140	19100	139000
Effluent	0	0	0	0	0	0	0
Hauling and Land Filling	287000	653	0	53600	0	0	61600
Blower System	404000	0	0	0	0	0	33900
Other Costs	5100000	117000	0	0	0	0	413000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	9	acre
Administration labor hours	162	hr/yr
Laboratory labor hours	2110	hr/yr
Costs		
DIRECT COSTS		
Mobilization	93400	$
Site preparation	184000	$
Site electrical	236000	$
Yard piping	166000	$
Instrumentation and control	105000	$
Lab and administration building	317000	$
Total direct construction costs	1100000	$
INDIRECT COSTS		
Cost of land	180000	$
Miscellaneous cost	298000	$
Legal cost	119000	$
Engineering design fee	894000	$
Inspection cost	119000	$
Contingency	596000	$
Technical	119000	$
Interest during construction	901000	$
Profit	777000	$
Total indirect construction cost	4000000	$
Total of other construction cos	5100000	$
LABOR COSTS		
Administration labor cost	8330	$/yr
Laboratory labor cost	109000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	2240	scfm
Safety factor	1.5	
Requested air flow capacity	3360	scfm
Total capacity of blowers	3360	scfm
Number of blowers in use	1	
Total number of blowers	2	
Capacity of individual blowers	3360	scfm
Estimated cost of an installed l	126000	$
Blower building area	1020	sqft
Costs		
Construction and equipment co	404000	$
Installed Blower Cost	252000	$
Building Cost	113000	$
Misc Costs	40100	$
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	33900	$/yr
Notes		
Energy costs are shown at the individual unit processes that require air		

Influent Wastewater

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	1670	cuft
Width of wet well	16.8	ft
Depth of the pumping station	24.8	ft
Length of the pumping station	16.4	ft
Width of the pumping station	42.4	ft

Minimum depth of water in wet	3.83	ft
Area of pump building	440	sqft
Peak capacity of pumps	1.57	MGD(US)
Firm pumping capacity	1.57	MGD(US)
Total dynamic head - average	46.5	ft
Quantities		
Operation labor required	466	pers-hrs/yr
Maintenance labor required	385	pers-hrs/yr
Electrical energy required	35900	kWh/yr
Volume of earthwork required	120000	cuft
Volume of slab concrete requir	4430	cuft
Volume of wall concrete requir	4340	cuft
Capacity per pump	1090	gpm(US)
Number of constant speed pur	2	
Number of variable speed pur	0	
Diameter of discharge header	7.47	in
Total dynamic head	95.1	ft
Size of selected pump	8	in
Specific speed of pump	1950	
Pump rotating speed	3680	rpm
Motor size required	40	HP
Size of selected motor	40	HP
Width of pump system	2.2	ft
Length of pump system	16.6	ft
Length of the dry well	16.4	ft
Width of the dry well	25.6	ft
Costs		
Construction and equipment co	419000	$
Earthwork Cost	35500	$
Wall Concrete Cost	105000	$
Slab Concrete Cost	57400	$
Building Cost	48400	$
Installed Pump Equipment C	109000	$
Misc Costs	63900	$
Operational labor cost	24000	$/yr
Maintenance labor cost	15400	$/yr
Material and supply cost	2930	$/yr
Chemical cost	0	$/yr
Energy cost	3590	$/yr
Amortization cost	36500	$/yr

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	0.231	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	1.54	cuft/s
Average flow	0.578	cuft/s
Minimum flow	0.154	cuft/s
Temperature	10	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	0.77	cuft/s
Width of channel	0.128	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.0223	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	1.5	cuft/d
Costs		
Construction and equipment co	160000	$
Operational labor cost	22200	$/yr
Maintenance labor cost	10200	$/yr
Material and supply cost	3990	$/yr
Chemical cost	0	$/yr

Energy cost	1020	$/yr
Amortization cost	13400	$/yr

Chlorination

Design Output Data

Description	Value	Units
Chlorination		
Design Information		
Volume of tank	20700	gal(US)
Average chlorine required	30.7	lb/d
Peak chlorine required	82.8	lb/d
Influent coliform count	10000000	/100ml
Effluent coliform count	29.2	/100ml
Quantities		
Operational labor required	250	pers-hrs/yr
Maintenance labor required	46.4	pers-hrs/yr
Electrical energy required	118000	kWh/yr
Volume of earthwork required	1180	cuft
Volume of slab concrete requir	277	cuft
Volume of wall concrete requir	2110	cuft
Number of chlorinators and ev	1	
Chlorination building area	220	sqft
Number of chlorine cylinders	7	
Area of chlorine storage buildir	112	sqft
Costs		
Construction and equipment cc	329000	$
Earthwork Cost	351	$
Wall Concrete Cost	50800	$
Slab Concrete Cost	3590	$
Installed Equipment Cost	234000	$
Building Cost	24200	$
Storage Building Cost	6160	$
Misc Costs	9860	$
Operational labor cost	12900	$/yr
Maintenance labor cost	1850	$/yr
Material and supply cost	15600	$/yr
Chemical cost	7280	$/yr
Energy cost	11800	$/yr
Amortization cost	35400	$/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	20.1	gpm(US)
Final solids content	19	%
Solids capture fraction	0.992	
Quantities		
Operation labor required	22.9	pers-hrs/yr
Maintenance labor required	5.74	pers-hrs/yr
Power	8200	kWh/yr
Polymer required	3000	lb/yr
Dry solids produced	821	lb/d
Belt filter(s)	275000	$
Building	279000	$
Installation	68800	$
Polymer system	82500	$
Feed pumps	30300	$
Conveyor system	77000	$
Costs		
Construction and equipment cc	812000	$
Building Cost	279000	$
Polymer System Cost	82500	$
Feed Pumps Cost	30300	$
Conveyor System Cost	77000	$
Installed Belt Filter	344000	$
Operational labor cost	1180	$/yr
Maintenance labor cost	229	$/yr
Material and supply cost	0	$/yr
Chemical cost	3900	$/yr
Energy cost	820	$/yr
Amortization cost	74300	$/yr

BNR with MBR

Design Output Data

Description	Value	Units
Biological Nitrogen Removal		
Design Information		

Biological Nitrogen Removal D		
Max. specific growth of nitrifier	0.2	1/d
Death rate of nitrifiers at winter	0.0301	1/d
Minimum aerobic SRT for nitrif	5.89	d
Design aerobic SRT for nitrifica	8.83	d
Total reactor SRT	12.6	d
Design SS	9000	mg/L
Calculated VSS	6810	mg/L
Calculated VSS:TSS ratio	0.757	mg VSS/mg SS
Total volume of anoxic reactor	135	m3
Total volume of aerobic reacto	315	m3
Total volume of all reactors	451	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	1	
Number of aerobic cells within	1	
Aerobic hydraulic retention time	5.33	hr
Anoxic hydraulic retention time	2.29	hr
Amount of sludge generated	322	kg/d
Sludge recycle ratio	300	%
Sludge recycle rate	4260	m3/d
Nitrogen required for biomass	19.9	mg/L
Phosphorus required for bioma	3.99	mg/L
Oxygen required to meet avera	487	kg/d
Air flow required to meet avera	1130	N m3/hr
Design air flow	59.8	N m3/min/1000 m3
Quantities		
Operation labor required	1310	pers-hrs/yr
Maintenance labor required	622	pers-hrs/yr
Electrical energy required	244000	kWh/yr
Volume of earthwork required	22600	cuft
Volume of slab concrete requir	4630	cuft
Volume of wall concrete requir	4280	cuft
Handrail length	119	ft
Number of diffusers per train	212	
Fine bubble diffuser floor cover	21.8	%
Number of swing arm headers	1	
Required mixing power	2.6	kW
Total number of mixers	2	
Design mixing power per mixer	1.49	kW
Mixing power for each unaerate	1.3	kW
Costs		
Construction and equipment co	329000	$
Earthwork Cost	6680	$
Wall Concrete Cost	103000	$
Slab Concrete Cost	60000	$
Handrail Cost	8960	$
Installed Aerator Equipment	67800	$
Air Piping Cost	21100	$
Installed Mixer Equipment Co	29000	$
Misc Costs	32600	$
Operational labor cost	67600	$/yr
Maintenance labor cost	24900	$/yr
Material and supply cost	14900	$/yr
Chemical cost	0	$/yr
Energy cost	24400	$/yr
Amortization cost	31100	$/yr
Sludge Recycle Pumping		
Design Information		
Average daily pumping rate	1.13	MGD(US)
Total pumping capacity	2.25	MGD(US)
Design capacity per pump	781	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	1.13	MGD(US)
Quantities		
Operation labor required	447	pers-hrs/yr
Maintenance labor required	366	pers-hrs/yr
Electrical energy required	37700	kWh/yr
Volume of earthwork required	1960	cuft
Area of pump building	244	sqft
Costs		
Construction and equipment co	115000	$
Earthwork Cost	579	$
Pump Building Cost	26900	$
Installed Pump Cost	70000	$
Misc Costs	17500	$
Operational labor cost	23000	$/yr
Maintenance labor cost	14600	$/yr
Material and supply cost	805	$/yr

Chemical cost	0	$/yr
Energy cost	3770	$/yr
Amortization cost	10900	$/yr
Costs		
Construction and equipment cc	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

Post Aeration

Design Output Data

Description	Value	Units
Post Aeration by Diffused Aeration		
Design Information		
Dissolved oxygen in influent	2	mg/L
Desired dissolved oxygen in ef	5	mg/L
Correction factor for pressure	1	
Minimum dissolved oxygen in t	2	mg/L
Oxygen saturation at summer t	8.5	mg/L
Oxygen required	9.21	lb/d
Operating transfer efficiency	2.95	lbO2/(HP·h)
Total volume of aerobic reacto	2560	gal(US)
Air flow rate required to meet a	12.3	scfm
Quantities		
Basin depth	15	ft
Length of basin	0.759	ft
Width of basin	30	ft
Number of diffusers	1	
Number of swing arm diffuser l	1	
Volume of wall concrete requir	692	cuft
Volume of slab concrete requir	17.1	cuft
Electrical energy required	3060	kWh/yr
Operation labor required	432	pers-hrs/yr
Maintenance labor required	118	pers-hrs/yr
Costs		
Construction and equipment cc	50600	$
Wall Concrete Cost	16700	$
Slab Concrete Cost	8970	$
Installed Equipment Cost	19900	$
Misc Costs	5010	$
Operational labor cost	22200	$/yr
Maintenance labor cost	4730	$/yr
Material and supply cost	2340	$/yr
Chemical cost	0	$/yr
Energy cost	306	$/yr
Amortization cost	4640	$/yr

Drying Beds

Design Output Data

Description	Value	Units
Sludge Drying Beds		
Design Information		
Total surface area required	5910	sqft
Initial depth of sludge	12	in
Final solids	50	%
Bed holding time	103	d
Quantities		
Total drying bed surface area	5910	sqft
Number beds	3	
Surface area of each individua	1970	sqft
Length of each bed	98.5	ft
Volume of earthwork required	29500	cuft
Volume concrete for dividing w	2600	cuft
Volume of R.C. in-place for tru	443	cuft
Volume of sand	4430	cuft
Volume of gravel	5910	cuft
Clay pipe diameter	4	in
Total length clay pipe	591	in
Sludge solids produced	0.341	ton(short)/d
Operational labor required	621	pers-hrs/yr
Maintenance labor required	279	pers-hrs/yr
Costs		
Construction and equipment cc	90200	$
Earthwork Cost	8740	$
Wall Concrete Cost	43800	$
Slab Concrete Cost	3450	$
Drying Bed Media Cost	16500	$
Drain Pipe System Cost	8750	$
Misc Costs	8940	$

Operational labor cost	32000	$/yr
Maintenance labor cost	11100	$/yr
Material and supply cost	812	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	7740	$/yr

Membrane Bioreactor

Design Output Data

Description	Value	Units
Membrane Bioreactor		
Design Information		
Total volume of reactors	6190	cuft
Length of parallel train	15.9	ft
Width of parallel train	7.93	ft
Sidewater depth	16.4	ft
Number of batteries	1	
Number of parallel trains per b	3	
Total Membrane Area	7890	m2
Total Scour Air Requirement	1580	N m3/hr
Quantities		
Operation labor required	1720	pers-hrs/yr
Maintenance labor required	877	pers-hrs/yr
Electrical energy required	179000	kWh/yr
Volume of earthwork required	11100	cuft
Volume of slab concrete requir	2160	cuft
Volume of wall concrete requir	3120	cuft
Handrail length	180	ft
Number of diffusers per train	39	
Number of swing arm headers	1	
Costs		
Construction and equipment co	907000	$
Earthwork Cost	3300	$
Wall Concrete Cost	75000	$
Slab Concrete Cost	28000	$
Handrail Cost	13500	$
Membrane Cost	681000	$
Installed Aerator Equipment	64300	$
Air Piping Cost	19600	$
Misc Cost	29500	$
Operational labor cost	88400	$/yr
Maintenance labor cost	35100	$/yr
Material and supply cost	9070	$/yr
Chemical cost	5140	$/yr
Energy cost	17900	$/yr
Amortization cost	122000	$/yr
Permeate Pumping		
Design Information		
Average daily pumping rate	0.188	MGD(US)
Total pumping capacity	0.5	MGD(US)
Design capacity per pump	193	gpm(US)
Number of pumps	6	
Number of batteries	1	
Firm pumping capacity	1.11	MGD(US)
Quantities		
Operation labor required	446	pers-hrs/yr
Maintenance labor required	366	pers-hrs/yr
Electrical energy required	11400	kWh/yr
Volume of earthwork required	1690	cuft
Area of pump building	211	sqft
Costs		
Construction and equipment co	145000	$
Earthwork Cost	1000	$
Pump Building Cost	46400	$
Installed Pump Cost	75700	$
Misc Costs	22200	$
Operational labor cost	23000	$/yr
Maintenance labor cost	14600	$/yr
Material and supply cost	1020	$/yr
Chemical cost	0	$/yr
Energy cost	1140	$/yr
Amortization cost	13700	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.00688	MGD(US)
Total pumping capacity	0.00688	MGD(US)
Design capacity per pump	2.39	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.00688	MGD(US)
Quantities		
Operation labor required	232	pers-hrs/yr

Maintenance labor required	172	pers-hrs/yr
Electrical energy required	233	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment cc	33000	$
Earthwork Cost	474	$
Pump Building Cost	22000	$
Installed Pump Cost	5470	$
Misc Costs	5030	$
Operational labor cost	11900	$/yr
Maintenance labor cost	6890	$/yr
Material and supply cost	231	$/yr
Chemical cost	0	$/yr
Energy cost	23	$/yr
Amortization cost	3120	$/yr

Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	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

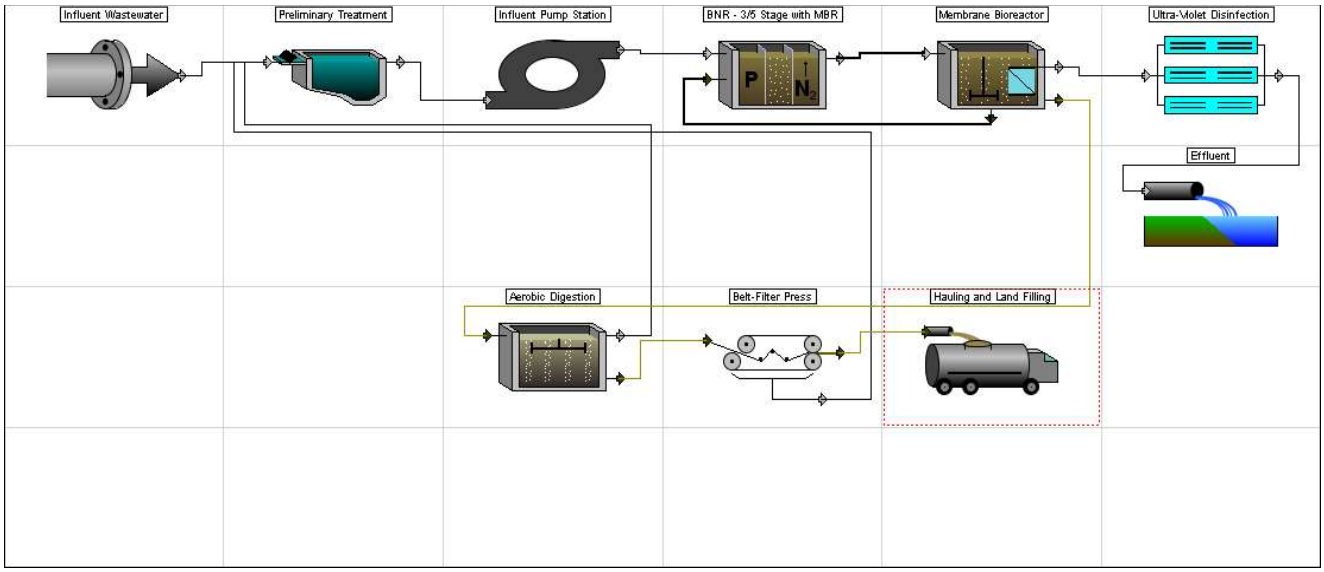
Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	0.811	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	0.811	cuyd/d
Maximum anticipated landfill dc	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	82.1	sqft
Width of sludge storage shed s	6.41	ft
Length of sludge storage shed	12.8	ft
Volume of earthwork required	345	cuft
Volume of slab concrete requir	170	cuft
Surface area of canopy roof	82.1	sqft
Round trip haul distance	20	miles
Round trips per day per truck	1	
Distance traveled per year per	5000	miles
Sludge hauled	0.717	ton(short)/d
Operation labor required	12.7	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment cc	287000	$
Earthwork Cost	102	$
Slab Concrete Cost	2210	$
Canopy Roof Cost	1640	$
Vehicle Cost	283000	$
Operational labor cost	653	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	53600	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	61600	$/yr

Hyrum City

Layout 1 - Hyrum City



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$11,200,000	$
Other direct construction costs	$3,340,000	$
Other indirect construction cos	$10,900,000	$
Total construction costs	$25,500,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$30,900	$/yr
Laboratory labor cost	$140,000	$/yr
Unit process operation labor c	$617,000	$/yr
Unit process maintenance labc	$301,000	$/yr
Total labor costs	$1,090,000	$/yr
MATERIAL COSTS		
Total material cost	$242,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$42,000	$/yr
ENERGY COSTS		
Total energy cost	$359,000	$/yr
Total operation and maintanen	$1,730,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$2,410,000	$/yr
Total annual project cost	$4,150,000	$/yr
PROJECT SUMMARY		
Present worth	$49,600,000	$
Total project cost	$25,500,000	$
Total operation labor cost	$788,000	$/yr
Total maintenance labor cost	$301,000	$/yr
Total material cost	$242,000	$/yr
Total chemical cost	$42,000	$/yr
Total energy cost	$359,000	$/yr
Total amortization cost	$2,410,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Preliminary Treatment	437000	39300	17800	10900	0	2230	36700
Influent Pump Station	1240000	29600	20700	8700	0	16500	107000
Aerobic Digestion	571000	84100	35700	45700	0	91500	50500
BNR - 3/5 Stage with MBR	1930000	191000	98800	38600	0	137000	182000

Belt-Filter Press	812000	4330	892	0	14300	2730	74300
Membrane Bioreactor	4330000	245000	121000	42400	25900	96800	593000
Hauling and Land Filling	321000	24000	0	90400	0	0	64400
Ultra-Violet Disinfection	501000	0	5350	5010	1740	12500	42500
Effluent	0	0	0	0	0	0	0
Blower System	1040000	0	0	0	0	0	86900
Other Costs	14300000	171000	0	0	0	0	1180000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	12	acre
Administration labor hours	600	hr/yr
Laboratory labor hours	2720	hr/yr
Costs		
DIRECT COSTS		
Mobilization	296000	$
Site preparation	477000	$
Site electrical	802000	$
Yard piping	545000	$
Instrumentation and control	387000	$
Lab and administration building	836000	$
Total direct construction costs	3340000	$
INDIRECT COSTS		
Cost of land	240000	$
Miscellaneous cost	835000	$
Legal cost	334000	$
Engineering design fee	2510000	$
Inspection cost	334000	$
Contingency	1670000	$
Technical	334000	$
Interest during construction	2490000	$
Profit	2180000	$
Total indirect construction cost	10900000	$
Total of other construction cos	14300000	$
LABOR COSTS		
Administration labor cost	30900	$/yr
Laboratory labor cost	140000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	13000	scfm
Safety factor	1.5	
Requested air flow capacity	19500	scfm
Total capacity of blowers	19500	scfm
Number of blowers in use	3	
Total number of blowers	4	
Capacity of individual blowers	6490	scfm
Estimated cost of an installed l	189000	$
Blower building area	1600	sqft
Costs		
Construction and equipment cc	1040000	$
Installed Blower Cost	757000	$
Building Cost	176000	$
Misc Costs	103000	$
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	86900	$/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	1.26	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	7.77	cuft/s
Average flow	3.15	cuft/s
Minimum flow	1.3	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	3.88	cuft/s
Width of channel	0.647	ft
Depth of channel	4	ft
Length of channel	143	ft
Settling velocity of particle	0.0711	ft/s
Slope of channel bottom	0.00294	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.59	min
Volume of grit	8.17	cuft/d
Costs		
Construction and equipment cc	437000	$
Operational labor cost	39300	$/yr
Maintenance labor cost	17800	$/yr
Material and supply cost	10900	$/yr
Chemical cost	0	$/yr
Energy cost	2230	$/yr
Amortization cost	36700	$/yr

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	14800	cuft
Width of wet well	130	ft
Depth of the pumping station	26.9	ft
Length of the pumping station	18.8	ft
Width of the pumping station	158	ft
Minimum depth of water in wet	5.92	ft
Area of pump building	553	sqft
Peak capacity of pumps	7.36	MGD(US)
Firm pumping capacity	7.36	MGD(US)
Total dynamic head - average	44.9	ft
Quantities		
Operation labor required	574	pers-hrs/yr
Maintenance labor required	488	pers-hrs/yr
Electrical energy required	165000	kWh/yr
Volume of earthwork required	387000	cuft
Volume of slab concrete requir	25300	cuft
Volume of wall concrete requir	13000	cuft
Capacity per pump	5110	gpm(US)
Number of constant speed pur	2	
Number of variable speed purr	0	
Diameter of discharge header	16.2	in
Total dynamic head	66	ft
Size of selected pump	14	in
Specific speed of pump	3700	
Pump rotating speed	1300	rpm
Motor size required	113	HP
Size of selected motor	125	HP
Width of pump system	3.4	ft
Length of pump system	19	ft
Length of the dry well	18.8	ft
Width of the dry well	28	ft
Costs		
Construction and equipment cc	1240000	$
Earthwork Cost	115000	$
Wall Concrete Cost	313000	$
Slab Concrete Cost	329000	$
Building Cost	60800	$
Installed Pump Equipment C	236000	$
Misc Costs	190000	$
Operational labor cost	29600	$/yr
Maintenance labor cost	20700	$/yr
Material and supply cost	8700	$/yr
Chemical cost	0	$/yr
Energy cost	16500	$/yr

Amortization cost	107000	$/yr

Aerobic Digestion

Design Output Data

Description	Value	Units
Aerobic Digestion		
Design Information		
Solids retention time	17	d
Design SS	12000	mg/L
Calculated VSS	6080	mg/L
Calculated VSS:TSS ratio	0.507	mg VSS/mg SS
Total volume of reactors	1700	m3
Length of parallel train	18	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	1030	kg/d
Air flow required to meet avera	5710	N m3/hr
Design air flow	55.9	N m3/min/1000 m3
Volatile solids loading	0.0496	lb/(cuft·d)
Solids accumulated	2650	lb/d
Digester capacity	45000	lb
Volume of wasted sludge	205000	gal(US)
Quantities		
Operation labor required	1630	pers-hrs/yr
Maintenance labor required	842	pers-hrs/yr
Electrical energy required	915000	kWh/yr
Volume of earthwork required	44300	cuft
Volume of slab concrete requir	9600	cuft
Volume of wall concrete requir	7250	cuft
Handrail length	198	ft
Number of diffusers per train	149	
Number of swing arm headers	3	
Costs		
Construction and equipment cc	571000	$
Earthwork Cost	13100	$
Wall Concrete Cost	174000	$
Slab Concrete Cost	124000	$
Handrail Cost	14900	$
Installed Aerator Equipment	131000	$
Air Piping Cost	56800	$
Misc Costs	56600	$
Operational labor cost	84100	$/yr
Maintenance labor cost	35700	$/yr
Material and supply cost	45700	$/yr
Chemical cost	0	$/yr
Energy cost	91500	$/yr
Amortization cost	50500	$/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		
Max. specific growth of nitrifier	0.381	1/d
Death rate of nitrifiers at winter	0.0606	1/d
Minimum aerobic SRT for nitrif	4.67	d
Design aerobic SRT for nitrifica	6.43	d
Total reactor SRT	10.5	d
Design SS	9000	mg/L
Calculated VSS	5680	mg/L
Calculated VSS:TSS ratio	0.631	mg VSS/mg SS
Total volume of anaerobic reac	368	m3
Total volume of anoxic reactor	581	m3
Total volume of aerobic reacto	1500	m3
Total volume of all reactors	2450	m3
Width of parallel train	10	m
Sidewater depth	5	m
Number of batteries	1	
Number of parallel trains per b	3	
Number of anoxic cells within c	1	
Number of aerobic cells within	1	
Anaerobic hydraulic retention ti	1.14	hr
Anoxic hydraulic retention time	1.8	hr
Aerobic hydraulic retention time	4.66	hr
Amount of sludge generated	2100	kg/d
Sludge recycle ratio	300	%
Sludge recycle rate	23200	m3/d
Nitrogen required for biomass	21.9	mg/L
Phosphorus required for bioma	4.38	mg/L

Oxygen required to meet avera	2240	kg/d
Air flow required to meet avera	3720	N m3/hr
Design air flow	41.3	N m3/min/1000 m3
Quantities		
Operation labor required	2240	pers-hrs/yr
Maintenance labor required	1110	pers-hrs/yr
Electrical energy required	820000	kWh/yr
Volume of earthwork required	61500	cuft
Volume of slab concrete requir	13500	cuft
Volume of wall concrete requir	10500	cuft
Handrail length	361	ft
Number of diffusers per train	401	
Fine bubble diffuser floor cove	15	%
Number of swing arm headers	3	
Required mixing power	13.7	kW
Total number of mixers	6	
Design mixing power per mixe	3.73	kW
Mixing power for each unaerat	2.28	kW
Costs		
Construction and equipment co	1120000	$
Earthwork Cost	18200	$
Wall Concrete Cost	254000	$
Slab Concrete Cost	175000	$
Handrail Cost	27000	$
Installed Aerator Equipment	258000	$
Air Piping Cost	171000	$
Installed Mixer Equipment Co	103000	$
Misc Costs	111000	$
Operational labor cost	115000	$/yr
Maintenance labor cost	47100	$/yr
Material and supply cost	32900	$/yr
Chemical cost	0	$/yr
Energy cost	82000	$/yr
Amortization cost	105000	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	2.04	MGD(US)
Total pumping capacity	2.04	MGD(US)
Design capacity per pump	709	gpm(US)
Number of pumps	9	
Number of batteries	1	
Firm pumping capacity	2.04	MGD(US)
Quantities		
Operation labor required	482	pers-hrs/yr
Maintenance labor required	400	pers-hrs/yr
Electrical energy required	205000	kWh/yr
Volume of earthwork required	1920	cuft
Area of pump building	240	sqft
Costs		
Construction and equipment co	333000	$
Earthwork Cost	1710	$
Pump Building Cost	79300	$
Installed Pump Cost	201000	$
Misc Costs	50800	$
Operational labor cost	24800	$/yr
Maintenance labor cost	17000	$/yr
Material and supply cost	2330	$/yr
Chemical cost	0	$/yr
Energy cost	20500	$/yr
Amortization cost	31500	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	2.72	MGD(US)
Total pumping capacity	2.72	MGD(US)
Design capacity per pump	946	gpm(US)
Number of pumps	9	
Number of batteries	1	
Firm pumping capacity	2.72	MGD(US)
Quantities		
Operation labor required	500	pers-hrs/yr
Maintenance labor required	417	pers-hrs/yr
Electrical energy required	273000	kWh/yr
Volume of earthwork required	2030	cuft
Area of pump building	254	sqft
Costs		
Construction and equipment co	371000	$
Earthwork Cost	1800	$
Pump Building Cost	83700	$
Installed Pump Cost	229000	$
Misc Costs	56500	$
Operational labor cost	25800	$/yr
Maintenance labor cost	17700	$/yr

Material and supply cost	2590	$/yr
Chemical cost	0	$/yr
Energy cost	27300	$/yr
Amortization cost	35000	$/yr
Sludge Recycle Pumping		
Design Information		
Average daily pumping rate	2.04	MGD(US)
Total pumping capacity	2.04	MGD(US)
Design capacity per pump	709	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	2.04	MGD(US)
Quantities		
Operation labor required	482	pers-hrs/yr
Maintenance labor required	400	pers-hrs/yr
Electrical energy required	68300	kWh/yr
Volume of earthwork required	1920	cuft
Area of pump building	240	sqft
Costs		
Construction and equipment cc	111000	$
Earthwork Cost	570	$
Pump Building Cost	26400	$
Installed Pump Cost	67100	$
Misc Costs	16900	$
Operational labor cost	24800	$/yr
Maintenance labor cost	17000	$/yr
Material and supply cost	777	$/yr
Chemical cost	0	$/yr
Energy cost	6830	$/yr
Amortization cost	10500	$/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	35.3	gpm(US)
Final solids content	15	%
Solids capture fraction	0.996	
Quantities		
Operation labor required	84	pers-hrs/yr
Maintenance labor required	21	pers-hrs/yr
Power	27300	kWh/yr
Polymer required	11000	lb/yr
Dry solids produced	3020	lb/d
Belt filter(s)	275000	$
Building	279000	$
Installation	68800	$
Polymer system	82500	$
Feed pumps	30300	$
Conveyor system	77000	$
Costs		
Construction and equipment cc	812000	$
Building Cost	279000	$
Polymer System Cost	82500	$
Feed Pumps Cost	30300	$
Conveyor System Cost	77000	$
Installed Belt Filter	344000	$
Operational labor cost	4330	$/yr
Maintenance labor cost	892	$/yr
Material and supply cost	0	$/yr
Chemical cost	14300	$/yr
Energy cost	2730	$/yr
Amortization cost	74300	$/yr

Membrane Bioreactor

Design Output Data

Description	Value	Units
Membrane Bioreactor		
Design Information		
Total volume of reactors	31200	cuft
Length of parallel train	35.6	ft
Width of parallel train	17.8	ft
Sidewater depth	16.4	ft
Number of batteries	1	
Number of parallel trains per b	3	
Total Membrane Area	39800	m2
Total Scour Air Requirement	7950	N m3/hr
Quantities		

Operation labor required	3920	pers-hrs/yr
Maintenance labor required	2170	pers-hrs/yr
Electrical energy required	904000	kWh/yr
Volume of earthwork required	27600	cuft
Volume of slab concrete requir	5790	cuft
Volume of wall concrete requir	6970	cuft
Handrail length	398	ft
Number of diffusers per train	196	
Number of swing arm headers	2	
Costs		
Construction and equipment cc	4040000	$
Earthwork Cost	8170	$
Wall Concrete Cost	168000	$
Slab Concrete Cost	75100	$
Handrail Cost	29800	$
Membrane Cost	3430000	$
Installed Aerator Equipment	143000	$
Air Piping Cost	123000	$
Misc Cost	75800	$
Operational labor cost	202000	$/yr
Maintenance labor cost	92000	$/yr
Material and supply cost	40400	$/yr
Chemical cost	25900	$/yr
Energy cost	90400	$/yr
Amortization cost	565000	$/yr
Permeate Pumping		
Design Information		
Average daily pumping rate	1.02	MGD(US)
Total pumping capacity	2.52	MGD(US)
Design capacity per pump	973	gpm(US)
Number of pumps	6	
Number of batteries	1	
Firm pumping capacity	5.6	MGD(US)
Quantities		
Operation labor required	549	pers-hrs/yr
Maintenance labor required	464	pers-hrs/yr
Electrical energy required	61600	kWh/yr
Volume of earthwork required	2040	cuft
Area of pump building	255	sqft
Costs		
Construction and equipment cc	250000	$
Earthwork Cost	1210	$
Pump Building Cost	56200	$
Installed Pump Cost	154000	$
Misc Costs	38100	$
Operational labor cost	28300	$/yr
Maintenance labor cost	19700	$/yr
Material and supply cost	1750	$/yr
Chemical cost	0	$/yr
Energy cost	6160	$/yr
Amortization cost	23600	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0449	MGD(US)
Total pumping capacity	0.0449	MGD(US)
Design capacity per pump	15.6	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.0449	MGD(US)
Quantities		
Operation labor required	295	pers-hrs/yr
Maintenance labor required	228	pers-hrs/yr
Electrical energy required	1520	kWh/yr
Volume of earthwork required	1610	cuft
Area of pump building	201	sqft
Costs		
Construction and equipment cc	41400	$
Earthwork Cost	476	$
Pump Building Cost	22100	$
Installed Pump Cost	12500	$
Misc Costs	6310	$
Operational labor cost	15200	$/yr
Maintenance labor cost	9660	$/yr
Material and supply cost	290	$/yr
Chemical cost	0	$/yr
Energy cost	152	$/yr
Amortization cost	3910	$/yr

Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		

Design Information		
Volume of sludge hauled	9.95	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	30	miles
Quantities		
Total sludge volume hauled	9.95	cuyd/d
Maximum anticipated landfill d	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	1010	sqft
Width of sludge storage shed s	22.4	ft
Length of sludge storage shed	44.9	ft
Volume of earthwork required	2960	cuft
Volume of slab concrete requir	1320	cuft
Surface area of canopy roof	1010	sqft
Round trip haul distance	60	miles
Round trips per day per truck	1	
Distance traveled per year per	15000	miles
Sludge hauled	8.8	ton(short)/d
Operation labor required	467	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment co	321000	$
Earthwork Cost	876	$
Slab Concrete Cost	17100	$
Canopy Roof Cost	20100	$
Vehicle Cost	283000	$
Operational labor cost	24000	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	90400	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	64400	$/yr

Ultra-Violet Disinfection

Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calc	2.12	gal(US)/(min·W)
Total number of lamps needed	124	
Number of spare channels	1	
Total number of lamps used in	168	
Number of excess lamps	44	
Number of lamps/modules	2	
Number of modules/bank	3	
Number of banks/channel	7	
Number of channels	4	
Calculated headloss	158	in
Costs		
Construction and equipment co	501000	$
Cost of installation	301000	$
Total cost of UV lamps	200000	$
Operational labor cost	0	$/yr
Maintenance labor cost	5350	$/yr
Material and supply cost	5010	$/yr
Chemical cost	1740	$/yr
Energy cost	12500	$/yr
Amortization cost	42500	$/yr

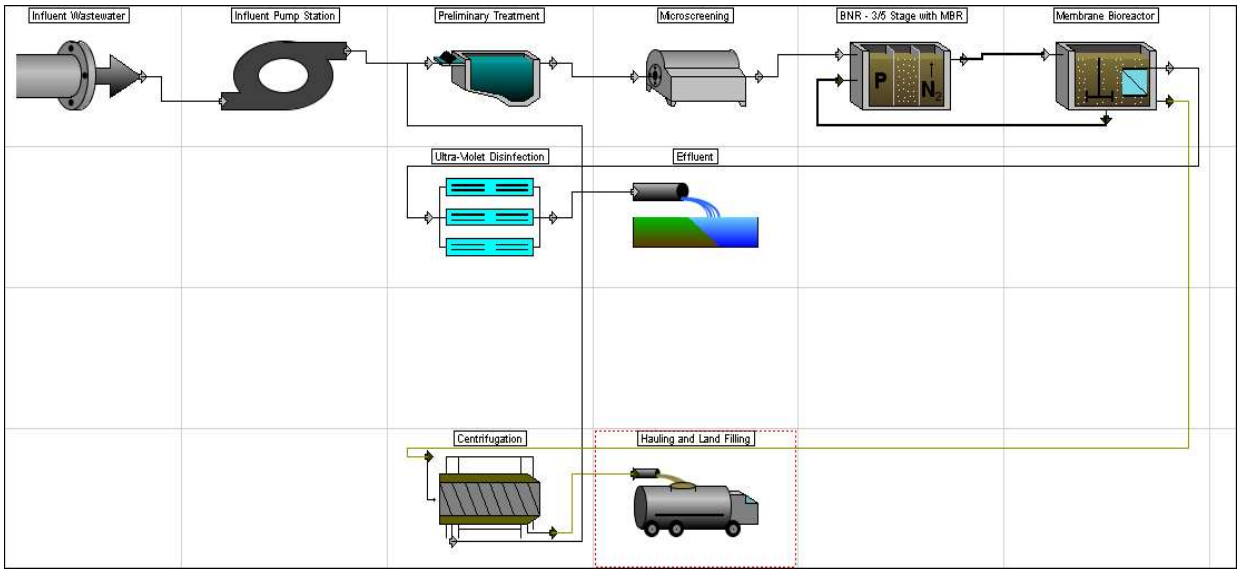
Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment co	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

Jordan Basin Water
Water Reclamation Facility

Layout - Jordan Basin WRF



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$53,000,000	$
Other direct construction costs	$13,000,000	$
Other indirect construction cos	$49,000,000	$
Total construction costs	$115,000,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$150,000	$/yr
Laboratory labor cost	$190,000	$/yr
Unit process operation labor c	$1,750,000	$/yr
Unit process maintenance labc	$684,000	$/yr
Total labor costs	$2,770,000	$/yr
MATERIAL COSTS		
Total material cost	$1,240,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$226,000	$/yr
ENERGY COSTS		
Total energy cost	$1,390,000	$/yr
Total operation and maintanen	$5,630,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$11,000,000	$/yr
Total annual project cost	$16,600,000	$/yr
PROJECT SUMMARY		
Present worth	$198,000,000	$
Total project cost	$115,000,000	$
Total operation labor cost	$2,090,000	$/yr
Total maintenance labor cost	$684,000	$/yr
Total material cost	$1,240,000	$/yr
Total chemical cost	$226,000	$/yr
Total energy cost	$1,390,000	$/yr
Total amortization cost	$11,000,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Influent Pump Station	9960000	56500	45400	69700	0	64200	848000
Preliminary Treatment	1250000	142000	59100	31200	0	5630	105000
Ultra-Violet Disinfection	1740000	0	19000	17400	8720	62500	171000
Centrifugation	6740000	542000	32100	219000	77200	22000	634000

Microscreening	4360000	125000	70600	482000	0	93400	489000
Effluent	0	0	0	0	0	0	0
Hauling and Land Filling	893000	74300	0	146000	0	0	150000
BNR - 3/5 Stage with MBR	6870000	304000	173000	95100	0	711000	647000
Membrane Bioreactor	18100000	506000	285000	178000	140000	435000	2500000
Blower System	3100000	0	0	0	0	0	260000
Other Costs	62000000	340000	0	0	0	0	5160000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	24	acre
Administration labor hours	2910	hr/yr
Laboratory labor hours	3690	hr/yr
Costs		
DIRECT COSTS		
Mobilization	1190000	$
Site preparation	1510000	$
Site electrical	3490000	$
Yard piping	2280000	$
Instrumentation and control	1860000	$
Lab and administration building	2690000	$
Total direct construction costs	13000000	$
INDIRECT COSTS		
Cost of land	480000	$
Miscellaneous cost	3800000	$
Legal cost	1520000	$
Engineering design fee	11400000	$
Inspection cost	1520000	$
Contingency	7600000	$
Technical	1520000	$
Interest during construction	11300000	$
Profit	9910000	$
Total indirect construction cost	49000000	$
Total of other construction cos	62000000	$
LABOR COSTS		
Administration labor cost	150000	$/yr
Laboratory labor cost	190000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	40300	scfm
Safety factor	1.5	
Requested air flow capacity	60500	scfm
Total capacity of blowers	60500	scfm
Number of blowers in use	4	
Total number of blowers	5	
Capacity of individual blowers	15100	scfm
Estimated cost of an installed l	512000	$
Blower building area	2140	sqft
Costs		
Construction and equipment cc	3100000	$
Installed Blower Cost	2560000	$
Building Cost	236000	$
Misc Costs	307000	$
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	260000	$/yr
Notes		
Energy costs are shown at the individual unit processes that require air		

Influent Wastewater

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	168000	cuft
Width of wet well	949	ft
Depth of the pumping station	32.7	ft
Length of the pumping station	27.6	ft
Width of the pumping station	988	ft
Minimum depth of water in wet	11.7	ft

Area of pump building	1110	sqft
Peak capacity of pumps	45.1	MGD(US)
Firm pumping capacity	45.1	MGD(US)
Total dynamic head - average	43.9	ft
Quantities		
Operation labor required	1100	pers-hrs/yr
Maintenance labor required	1000	pers-hrs/yr
Electrical energy required	642000	kWh/yr
Volume of earthwork required	3370000	cuft
Volume of slab concrete requir	317000	cuft
Volume of wall concrete requir	90400	cuft
Capacity per pump	31300	gpm(US)
Number of constant speed pur	2	
Number of variable speed pur	0	
Diameter of discharge header	40	in
Total dynamic head	52.9	ft
Size of selected pump	36	in
Specific speed of pump	5410	
Pump rotating speed	444	rpm
Motor size required	302	HP
Size of selected motor	350	HP
Width of pump system	7.8	ft
Length of pump system	29.4	ft
Length of the dry well	27.6	ft
Width of the dry well	38.4	ft
Costs		
Construction and equipment cc	9960000	$
Earthwork Cost	998000	$
Wall Concrete Cost	2180000	$
Slab Concrete Cost	4110000	$
Building Cost	123000	$
Installed Pump Equipment C	1030000	$
Misc Costs	1520000	$
Operational labor cost	56500	$/yr
Maintenance labor cost	45400	$/yr
Material and supply cost	69700	$/yr
Chemical cost	0	$/yr
Energy cost	64200	$/yr
Amortization cost	848000	$/yr

Preliminary Treatment

Design Output Data

Description	Value	Units
Preliminary Treatment		
Design Information		
Mechanically Cleaned Bar Screen		
Bar size	0.25	in
Bar spacing	1.5	in
Slope of bars from horizontal	30	degrees
Head loss through screen	0.0206	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	9.32	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	41.8	cuft/s
Average flow	23.3	cuft/s
Minimum flow	14.1	cuft/s
Temperature	10	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	20.9	cuft/s
Width of channel	3.48	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.00046	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	60.5	cuft/d
Costs		
Construction and equipment cc	1250000	$
Operational labor cost	142000	$/yr
Maintenance labor cost	59100	$/yr
Material and supply cost	31200	$/yr
Chemical cost	0	$/yr
Energy cost	5630	$/yr

Amortization cost	105000	$/yr

Ultra-Violet Disinfection

Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calc	2.12	gal(US)/(min·W)
Total number of lamps needed	674	
Number of spare channels	1	
Total number of lamps used in	840	
Number of excess lamps	166	
Number of lamps/modules	4	
Number of modules/bank	5	
Number of banks/channel	7	
Number of channels	6	
Calculated headloss	149	in
Costs		
Construction and equipment cc	1740000	$
Cost of installation	1050000	$
Total cost of UV lamps	697000	$
Operational labor cost	0	$/yr
Maintenance labor cost	19000	$/yr
Material and supply cost	17400	$/yr
Chemical cost	8720	$/yr
Energy cost	62500	$/yr
Amortization cost	171000	$/yr

Centrifugation

Design Output Data

Description	Value	Units
Centrifugation		
Design Information		
Total power required	566	HP
Power required per unit	189	HP
Excess capacity factor	1.25	
Number of units	3	
Chemical dose	1	% dry wt
Chemicals required	28.6	lb/hr
Sludge flow	453	gpm(US)
Initial solid conc	1.2	%
Operational hours per day	8	hr
Operational days per week	5	d
Quantities		
Number of centrifuges	3	
Power required per unit	189	HP
Area of building	960	sqft
Dry solids produced	7.77	ton(short)/d
Operation labor required	4230	pers-hrs/yr
Maintenance labor required	708	pers-hrs/yr
Electrical energy required	220000	kWh/yr
Costs		
Construction and equipment cc	6320000	$
Operational labor cost	218000	$/yr
Maintenance labor cost	32100	$/yr
Material and supply cost	210000	$/yr
Chemical cost	0	$/yr
Energy cost	22000	$/yr
Amortization cost	634000	$/yr
Polymer Feed System		
Quantities		
Polymer dosage	228	lb/d
Liquid chemical solution fed	11000	gpd(US)
O&M labor required	5010	pers-hrs/yr
Dry material handling and mixi	1280	pers-hrs/yr
Total operation labor required	6300	pers-hrs/yr
Costs		
Construction and equipment cc	425000	$
Operational labor cost	324000	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	8490	$/yr
Chemical cost	77200	$/yr
Energy cost	0	$/yr
Amortization cost	0	$/yr

Microscreening

Design Output Data

Description	Value	Units
Microscreening		
Design Information		
Microscreen loading rate	7	gal(US)/(sqft·min)
Quantity of wash water require	4	%

Area of microscreens required	2690	sqft
Quantities		
Number of batteries	1	
Number of units/battery	15	
Drum diameter	10	ft
Drum width	10	ft
Area of selected unit	315	sqft
Area of building	1620	sqft
Operation labor required	2420	pers-hrs/yr
Maintenance labor required	1560	pers-hrs/yr
Electrical energy required	934000	kWh/yr
Volume of wall concrete requir	15700	cuft
Volume of earthwork required	65900	cuft
Costs		
Construction and equipment cc	4360000	$
Earthwork Cost	19500	$
Slab Concrete Cost	378000	$
Building Cost	178000	$
Installed Equipment Cost	3220000	$
Misc Costs	569000	$
Operational labor cost	125000	$/yr
Maintenance labor cost	70600	$/yr
Material and supply cost	482000	$/yr
Chemical cost	0	$/yr
Energy cost	93400	$/yr
Amortization cost	489000	$/yr

Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	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	92.3	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	2	
Distance to disposal site	10	miles
Quantities		
Total sludge volume hauled	92.3	cuyd/d
Maximum anticipated landfill dc	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	9340	sqft
Width of sludge storage shed s	68.3	ft
Length of sludge storage shed	137	ft
Volume of earthwork required	24700	cuft
Volume of slab concrete requir	10300	cuft
Surface area of canopy roof	9340	sqft
Round trip haul distance	20	miles
Round trips per day per truck	3	
Distance traveled per year per	15000	miles
Sludge hauled	81.6	ton(short)/d
Operation labor required	1440	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment cc	893000	$
Earthwork Cost	7300	$
Slab Concrete Cost	133000	$
Canopy Roof Cost	187000	$
Vehicle Cost	566000	$
Operational labor cost	74300	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	146000	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	150000	$/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		
Max. specific growth of nitrifier	0.374	1/d
Death rate of nitrifiers at winter	0.0601	1/d
Minimum aerobic SRT for nitrif	4.67	d
Design aerobic SRT for nitrifica	6.54	d
Total reactor SRT	10.5	d
Design SS	9000	mg/L
Calculated VSS	6560	mg/L
Calculated VSS:TSS ratio	0.729	mg VSS/mg SS
Total volume of anaerobic reac	1270	m3
Total volume of anoxic reactor	1930	m3
Total volume of aerobic reacto	5270	m3
Total volume of all reactors	8470	m3
Width of parallel train	10	m
Sidewater depth	5	m
Number of batteries	1	
Number of parallel trains per b	6	
Number of anoxic cells within c	1	
Number of aerobic cells within	1	
Anaerobic hydraulic retention ti	0.532	hr
Anoxic hydraulic retention time	0.806	hr
Aerobic hydraulic retention time	2.21	hr
Amount of sludge generated	7260	kg/d
Sludge recycle ratio	300	%
Sludge recycle rate	172000	m3/d
Nitrogen required for biomass	12.7	mg/L
Phosphorus required for bioma	2.53	mg/L
Oxygen required to meet avera	10100	kg/d
Air flow required to meet avera	16700	N m3/hr
Design air flow	52.8	N m3/min/1000 m3
Quantities		
Operation labor required	3960	pers-hrs/yr
Maintenance labor required	2180	pers-hrs/yr
Electrical energy required	3080000	kWh/yr
Volume of earthwork required	173000	cuft
Volume of slab concrete requir	75100	cuft
Volume of wall concrete requir	37600	cuft
Handrail length	1260	ft
Number of diffusers per train	840	
Fine bubble diffuser floor cover	19.2	%
Number of swing arm headers	4	
Required mixing power	46.8	kW
Total number of mixers	24	
Design mixing power per mixer	2.24	kW
Mixing power for each unaerat	3.9	kW
Costs		
Construction and equipment co	4210000	$
Earthwork Cost	51300	$
Wall Concrete Cost	904000	$
Slab Concrete Cost	974000	$
Handrail Cost	94500	$
Installed Aerator Equipment	810000	$
Air Piping Cost	586000	$
Installed Mixer Equipment Co	369000	$
Misc Costs	417000	$
Operational labor cost	204000	$/yr
Maintenance labor cost	98500	$/yr
Material and supply cost	76500	$/yr
Chemical cost	0	$/yr
Energy cost	308000	$/yr
Amortization cost	395000	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	7.57	MGD(US)
Total pumping capacity	7.57	MGD(US)
Design capacity per pump	2630	gpm(US)
Number of pumps	18	
Number of batteries	1	
Firm pumping capacity	7.57	MGD(US)
Quantities		
Operation labor required	580	pers-hrs/yr
Maintenance labor required	492	pers-hrs/yr
Electrical energy required	1510000	kWh/yr
Volume of earthwork required	2790	cuft
Area of pump building	349	sqft
Costs		
Construction and equipment co	1120000	$
Earthwork Cost	4970	$
Pump Building Cost	231000	$

Installed Pump Cost	717000	$
Misc Costs	171000	$
Operational labor cost	29900	$/yr
Maintenance labor cost	22300	$/yr
Material and supply cost	7870	$/yr
Chemical cost	0	$/yr
Energy cost	151000	$/yr
Amortization cost	106000	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	10.1	MGD(US)
Total pumping capacity	10.1	MGD(US)
Design capacity per pump	3500	gpm(US)
Number of pumps	18	
Number of batteries	1	
Firm pumping capacity	10.1	MGD(US)
Quantities		
Operation labor required	639	pers-hrs/yr
Maintenance labor required	541	pers-hrs/yr
Electrical energy required	2020000	kWh/yr
Volume of earthwork required	3190	cuft
Area of pump building	399	sqft
Costs		
Construction and equipment co	1280000	$
Earthwork Cost	5670	$
Pump Building Cost	263000	$
Installed Pump Cost	814000	$
Misc Costs	195000	$
Operational labor cost	32900	$/yr
Maintenance labor cost	24500	$/yr
Material and supply cost	8940	$/yr
Chemical cost	0	$/yr
Energy cost	202000	$/yr
Amortization cost	121000	$/yr
Sludge Recycle Pumping		
Design Information		
Average daily pumping rate	15.1	MGD(US)
Total pumping capacity	15.1	MGD(US)
Design capacity per pump	5260	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	15.1	MGD(US)
Quantities		
Operation labor required	732	pers-hrs/yr
Maintenance labor required	617	pers-hrs/yr
Electrical energy required	504000	kWh/yr
Volume of earthwork required	3990	cuft
Area of pump building	499	sqft
Costs		
Construction and equipment co	265000	$
Earthwork Cost	1180	$
Pump Building Cost	54800	$
Installed Pump Cost	169000	$
Misc Costs	40400	$
Operational labor cost	37700	$/yr
Maintenance labor cost	27900	$/yr
Material and supply cost	1850	$/yr
Chemical cost	0	$/yr
Energy cost	50400	$/yr
Amortization cost	25100	$/yr

Membrane Bioreactor

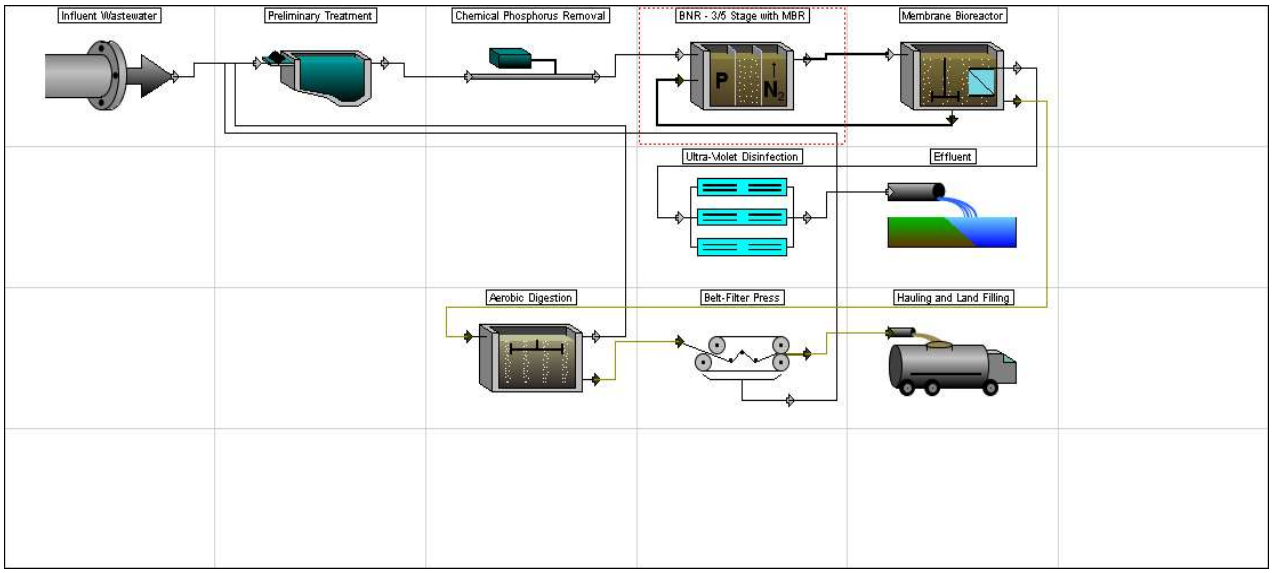
Design Output Data

Description	**Value**	**Units**
Membrane Bioreactor		
Design Information		
Total volume of reactors	134000	cuft
Length of parallel train	52.3	ft
Width of parallel train	26.1	ft
Sidewater depth	16.4	ft
Number of batteries	1	
Number of parallel trains per b	6	
Total Membrane Area	171000	m2
Total Scour Air Requirement	42800	N m3/hr
Quantities		
Operation labor required	8700	pers-hrs/yr
Maintenance labor required	5250	pers-hrs/yr
Electrical energy required	3890000	kWh/yr
Volume of earthwork required	87900	cuft
Volume of slab concrete requir	48600	cuft
Volume of wall concrete requir	22400	cuft
Handrail length	1250	ft

Number of diffusers per train	420	
Number of swing arm headers	3	
Costs		
Construction and equipment cc	17200000	$
Earthwork Cost	26100	$
Wall Concrete Cost	539000	$
Slab Concrete Cost	629000	$
Handrail Cost	93800	$
Membrane Cost	14800000	$
Installed Aerator Equipment	459000	$
Air Piping Cost	449000	$
Misc Cost	292000	$
Operational labor cost	448000	$/yr
Maintenance labor cost	238000	$/yr
Material and supply cost	172000	$/yr
Chemical cost	140000	$/yr
Energy cost	389000	$/yr
Amortization cost	2420000	$/yr
Permeate Pumping		
Design Information		
Average daily pumping rate	3.03	MGD(US)
Total pumping capacity	5.43	MGD(US)
Design capacity per pump	2090	gpm(US)
Number of pumps	15	
Number of batteries	1	
Firm pumping capacity	30.2	MGD(US)
Quantities		
Operation labor required	774	pers-hrs/yr
Maintenance labor required	773	pers-hrs/yr
Electrical energy required	455000	kWh/yr
Volume of earthwork required	2550	cuft
Area of pump building	319	sqft
Costs		
Construction and equipment cc	849000	$
Earthwork Cost	3780	$
Pump Building Cost	175000	$
Installed Pump Cost	541000	$
Misc Costs	130000	$
Operational labor cost	39900	$/yr
Maintenance labor cost	35000	$/yr
Material and supply cost	5950	$/yr
Chemical cost	0	$/yr
Energy cost	45500	$/yr
Amortization cost	80300	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.155	MGD(US)
Total pumping capacity	0.155	MGD(US)
Design capacity per pump	53.9	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.155	MGD(US)
Quantities		
Operation labor required	346	pers-hrs/yr
Maintenance labor required	273	pers-hrs/yr
Electrical energy required	5220	kWh/yr
Volume of earthwork required	1620	cuft
Area of pump building	203	sqft
Costs		
Construction and equipment cc	52400	$
Earthwork Cost	481	$
Pump Building Cost	22300	$
Installed Pump Cost	21600	$
Misc Costs	7990	$
Operational labor cost	17800	$/yr
Maintenance labor cost	12400	$/yr
Material and supply cost	367	$/yr
Chemical cost	0	$/yr
Energy cost	522	$/yr
Amortization cost	4950	$/yr

Jordanelle Special Service District

Layout - Jordanelle SSD



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$7,670,000	$
Other direct construction costs	$2,110,000	$
Other indirect construction cos	$7,420,000	$
Total construction costs	$17,200,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$18,000	$/yr
Laboratory labor cost	$126,000	$/yr
Unit process operation labor c	$502,000	$/yr
Unit process maintenance labc	$221,000	$/yr
Total labor costs	$867,000	$/yr
MATERIAL COSTS		
Total material cost	$188,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$145,000	$/yr
ENERGY COSTS		
Total energy cost	$191,000	$/yr
Total operation and maintanen	$1,390,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$1,630,000	$/yr
Total annual project cost	$3,020,000	$/yr
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 Remova	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 cos	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 l	167000	$
Blower building area	1370	sqft
Costs		
Construction and equipment co	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 Al2(SO4)	1210	lb/d
Alum dosage rate as equivaler	110	lb/d
Liquid chemical solution fed	225	gpd(US)
Operation labor required	759	pers-hrs/yr
Costs		
Construction and equipment co	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 cc	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 cc	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 cc	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 reactors	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 time	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 bioma	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 mixe	3.73	kW
Mixing power for each unaerat	4.12	kW
Costs		
Construction and equipment cc	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 C	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 cc	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 cc	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 cc	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 calc	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 cc	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 cc	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 co	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 co	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 co	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 cc	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

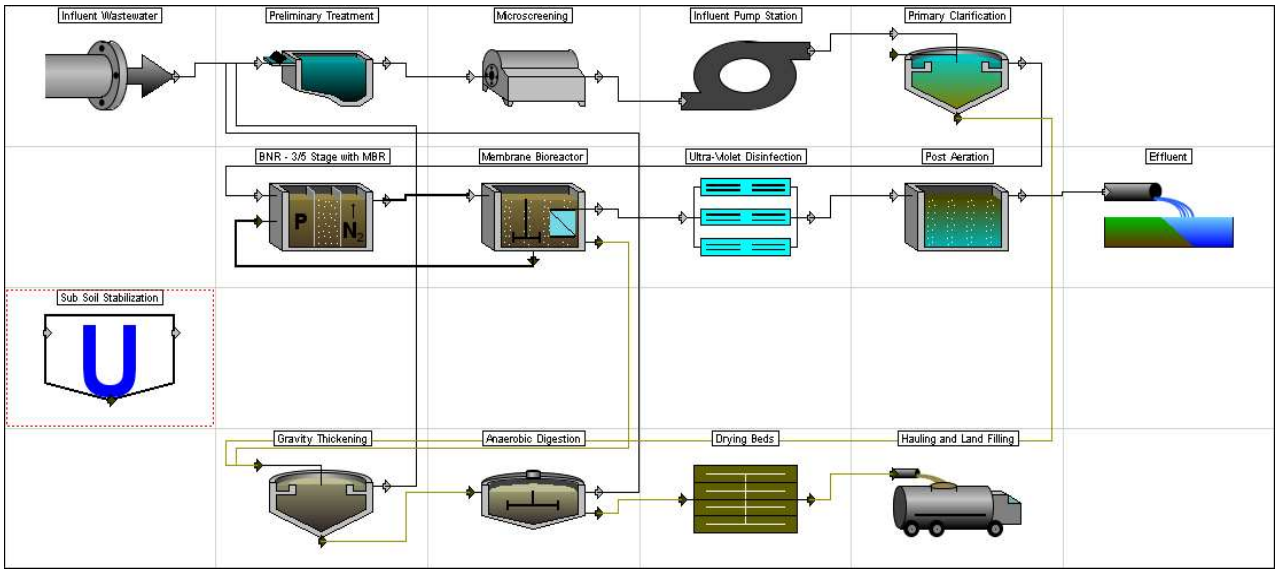
Hauling and Land Filling

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 dc	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	523	sqft
Width of sludge storage shed s	16.2	ft
Length of sludge storage shed	32.3	ft
Volume of earthwork required	1630	cuft
Volume of slab concrete requir	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	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 cc	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

Logan City

Layout - Logan City



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$71,100,000	$
Other direct construction costs	$14,700,000	$
Other indirect construction cos	$63,600,000	$
Total construction costs	$150,000,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$173,000	$/yr
Laboratory labor cost	$196,000	$/yr
Unit process operation labor c	$1,870,000	$/yr
Unit process maintenance labc	$1,060,000	$/yr
Total labor costs	$3,300,000	$/yr
MATERIAL COSTS		
Total material cost	$1,100,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$218,000	$/yr
ENERGY COSTS		
Total energy cost	$1,790,000	$/yr
Total operation and maintanen	$6,410,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$13,700,000	$/yr
Total annual project cost	$20,100,000	$/yr
PROJECT SUMMARY		
Present worth	$240,000,000	$
Total project cost	$150,000,000	$
Total operation labor cost	$2,240,000	$/yr
Total maintenance labor cost	$1,060,000	$/yr
Total material cost	$1,100,000	$/yr
Total chemical cost	$218,000	$/yr
Total energy cost	$1,790,000	$/yr
Total amortization cost	$13,700,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Sub Soil Stabilization	7000000	0	0	0	0	0	0
Preliminary Treatment	1590000	165000	69900	39800	0	6120	134000
BNR - 3/5 Stage with MBR	7710000	327000	193000	103000	0	835000	724000
Gravity Thickening	297000	27800	18500	2970	0	854	28400

Microscreening	4650000	149000	87300	482000	0	131000	514000
Membrane Bioreactor	25900000	627000	370000	256000	206000	629000	3610000
Anaerobic Digestion	3810000	91000	54300	31200	0	15600	361000
Influent Pump Station	11600000	65500	52400	81300	0	70200	990000
Ultra-Violet Disinfection	2280000	0	25800	22800	11400	81900	224000
Drying Beds	1150000	248000	113000	10400	0	0	100000
Primary Clarification	1680000	117000	61600	16700	0	1630	154000
Post Aeration	131000	42200	17900	2200	0	15000	12200
Hauling and Land Filling	324000	8620	0	53600	0	0	64700
Effluent	0	0	0	0	0	0	0
Blower System	3010000	0	0	0	0	0	253000
Other Costs	78400000	368000	0	0	0	0	6530000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	27	acre
Administration labor hours	3350	hr/yr
Laboratory labor hours	3800	hr/yr
Costs		
DIRECT COSTS		
Mobilization	1350000	$
Site preparation	1670000	$
Site electrical	3990000	$
Yard piping	2590000	$
Instrumentation and control	2150000	$
Lab and administration building	2990000	$
Total direct construction costs	14700000	$
INDIRECT COSTS		
Cost of land	540000	$
Miscellaneous cost	4940000	$
Legal cost	1980000	$
Engineering design fee	14800000	$
Inspection cost	1980000	$
Contingency	9880000	$
Technical	1980000	$
Interest during construction	14600000	$
Profit	12900000	$
Total indirect construction cost	63600000	$
Total of other construction cos	78400000	$
LABOR COSTS		
Administration labor cost	173000	$/yr
Laboratory labor cost	196000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	55300	scfm
Safety factor	1.5	
Requested air flow capacity	82900	scfm
Total capacity of blowers	82900	scfm
Number of blowers in use	1	
Total number of blowers	2	
Capacity of individual blowers	82900	scfm
Estimated cost of an installed I	1230000	$
Blower building area	2320	sqft
Costs		
Construction and equipment cc	3010000	$
Installed Blower Cost	2460000	$
Building Cost	256000	$
Misc Costs	298000	$
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	253000	$/yr
Notes		
Energy costs are shown at the individual unit processes that require air		

Influent Wastewater
Sub Soil Stabilization
Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	Overridden	
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

Preliminary Treatment

Design Output Data

Description	Value	Units
Preliminary Treatment		
Design Information		
Mechanically Cleaned Bar Screen		
Bar size	0.25	in
Bar spacing	0.5	in
Slope of bars from horizontal	30	degrees
Head loss through screen	0.176	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	11.1	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	61.7	cuft/s
Average flow	27.9	cuft/s
Minimum flow	18.6	cuft/s
Temperature	10	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	30.9	cuft/s
Width of channel	5.14	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.000381	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	72.4	cuft/d
Costs		
Construction and equipment cc	1590000	$
Operational labor cost	165000	$/yr
Maintenance labor cost	69900	$/yr
Material and supply cost	39800	$/yr
Chemical cost	0	$/yr
Energy cost	6120	$/yr
Amortization cost	134000	$/yr

BNR - 3/5 Stage with MBR

Design Output Data

Description	Value	Units
BNR System for BIO-P and N Removal		
Design Information		
Influent BOD/TP ratio too smal		
3-Stage Biological Phosphorus		
Design aerobic SRT for nitrifica	12.5	d
Total reactor SRT	25	d
Design SS	9000	mg/L
Calculated VSS	6710	mg/L
Calculated VSS:TSS ratio	0.746	mg VSS/mg SS
Total volume of anaerobic reac	0	m3
Total volume of anoxic reactor	5470	m3
Total volume of aerobic reacto	5470	m3
Total volume of all reactors	10900	m3
Width of parallel train	10	m
Sidewater depth	5	m
Number of batteries	1	
Number of parallel trains per b	6	
Number of anoxic cells within c	1	
Number of aerobic cells within	1	
Anaerobic hydraulic retention ti	0	hr
Anoxic hydraulic retention time	1.92	hr
Aerobic hydraulic retention tim	1.92	hr
Amount of sludge generated	3930	kg/d
Sludge recycle ratio	300	%
Sludge recycle rate	205000	m3/d
Nitrogen required for biomass	7.95	mg/L
Phosphorus required for bioma	1.59	mg/L
Oxygen required to meet avera	10400	kg/d
Air flow required to meet avera	17300	N m3/hr

Design air flow	52.8	N m3/min/1000 m3
Quantities		
Operation labor required	4280	pers-hrs/yr
Maintenance labor required	2370	pers-hrs/yr
Electrical energy required	3540000	kWh/yr
Volume of earthwork required	211000	cuft
Volume of slab concrete requir	84700	cuft
Volume of wall concrete requir	44400	cuft
Handrail length	1530	ft
Number of diffusers per train	886	
Fine bubble diffuser floor cove	19.1	%
Number of swing arm headers	5	
Required mixing power	74.1	kW
Total number of mixers	24	
Design mixing power per mixe	3.73	kW
Mixing power for each unaerat	6.18	kW
Costs		
Construction and equipment co	4790000	$
Earthwork Cost	62400	$
Wall Concrete Cost	1070000	$
Slab Concrete Cost	1100000	$
Handrail Cost	114000	$
Installed Aerator Equipment	948000	$
Air Piping Cost	612000	$
Installed Mixer Equipment C	412000	$
Misc Costs	475000	$
Operational labor cost	221000	$/yr
Maintenance labor cost	111000	$/yr
Material and supply cost	82600	$/yr
Chemical cost	0	$/yr
Energy cost	354000	$/yr
Amortization cost	448000	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	9.03	MGD(US)
Total pumping capacity	9.03	MGD(US)
Design capacity per pump	3140	gpm(US)
Number of pumps	18	
Number of batteries	1	
Firm pumping capacity	9.03	MGD(US)
Quantities		
Operation labor required	615	pers-hrs/yr
Maintenance labor required	521	pers-hrs/yr
Electrical energy required	1810000	kWh/yr
Volume of earthwork required	3020	cuft
Area of pump building	378	sqft
Costs		
Construction and equipment co	1220000	$
Earthwork Cost	5380	$
Pump Building Cost	250000	$
Installed Pump Cost	775000	$
Misc Costs	185000	$
Operational labor cost	31700	$/yr
Maintenance labor cost	24400	$/yr
Material and supply cost	8510	$/yr
Chemical cost	0	$/yr
Energy cost	181000	$/yr
Amortization cost	115000	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	12	MGD(US)
Total pumping capacity	12	MGD(US)
Design capacity per pump	4180	gpm(US)
Number of pumps	18	
Number of batteries	1	
Firm pumping capacity	12	MGD(US)
Quantities		
Operation labor required	678	pers-hrs/yr
Maintenance labor required	573	pers-hrs/yr
Electrical energy required	2410000	kWh/yr
Volume of earthwork required	3500	cuft
Area of pump building	437	sqft
Costs		
Construction and equipment co	1390000	$
Earthwork Cost	6220	$
Pump Building Cost	289000	$
Installed Pump Cost	880000	$
Misc Costs	211000	$
Operational labor cost	34900	$/yr
Maintenance labor cost	26800	$/yr
Material and supply cost	9700	$/yr
Chemical cost	0	$/yr

Energy cost	241000	$/yr
Amortization cost	131000	$/yr
Sludge Recycle Pumping		
Design Information		
Average daily pumping rate	18.1	MGD(US)
Total pumping capacity	18.1	MGD(US)
Design capacity per pump	6270	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	18.1	MGD(US)
Quantities		
Operation labor required	776	pers-hrs/yr
Maintenance labor required	653	pers-hrs/yr
Electrical energy required	601000	kWh/yr
Volume of earthwork required	4450	cuft
Area of pump building	556	sqft
Costs		
Construction and equipment cc	318000	$
Earthwork Cost	1320	$
Pump Building Cost	61200	$
Installed Pump Cost	207000	$
Misc Costs	48500	$
Operational labor cost	40000	$/yr
Maintenance labor cost	30600	$/yr
Material and supply cost	2220	$/yr
Chemical cost	0	$/yr
Energy cost	60100	$/yr
Amortization cost	30100	$/yr

Gravity Thickening

Design Output Data

Description	Value	Units
Gravity Thickening		
Design Information		
Initial concentration	1.84	%
Thickened concentration	5	%
Mass loading	10	lb/(sqft·d)
Hydraulic loading	65	gal(US)/(sqft·d)
Hydraulic retention time	24.8	hr
Number of tanks	2	
Tank volume	15100	cuft
Depth	9	ft
Surface area per tank	840	sqft
Tank diameter	33	ft
Quantities		
Amount of sludge generated	8.4	ton(short)/d
Volume of thickened sludge	34500	gpd(US)
Operation labor required	539	pers-hrs/yr
Maintenance labor required	394	pers-hrs/yr
Electrical energy required	8540	kWh/yr
Volume of earthwork required	21800	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	1910	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	2300	cuft
Costs		
Construction and equipment cc	297000	$
Earthwork Cost	6450	$
Wall Concrete Cost	55500	$
Slab Concrete Cost	24800	$
Installed Equipment Cost	165000	$
Misc Costs	45300	$
Operational labor cost	27800	$/yr
Maintenance labor cost	18500	$/yr
Material and supply cost	2970	$/yr
Chemical cost	0	$/yr
Energy cost	854	$/yr
Amortization cost	28400	$/yr

Microscreening

Design Output Data

Description	Value	Units
Microscreening		
Design Information		
Microscreen loading rate	7	gal(US)/(sqft·min)
Quantity of wash water require	4	%
Area of microscreens required	3980	sqft
Quantities		
Number of batteries	1	
Number of units/battery	15	
Drum diameter	10	ft
Drum width	10	ft

Area of selected unit	315	sqft
Area of building	2300	sqft
Operation labor required	2890	pers-hrs/yr
Maintenance labor required	1860	pers-hrs/yr
Electrical energy required	1310000	kWh/yr
Volume of wall concrete requir	22900	cuft
Volume of earthwork required	94700	cuft
Costs		
Construction and equipment co	4650000	$
Earthwork Cost	28100	$
Slab Concrete Cost	551000	$
Building Cost	252000	$
Installed Equipment Cost	3220000	$
Misc Costs	607000	$
Operational labor cost	149000	$/yr
Maintenance labor cost	87300	$/yr
Material and supply cost	482000	$/yr
Chemical cost	0	$/yr
Energy cost	131000	$/yr
Amortization cost	514000	$/yr

Membrane Bioreactor

Design Output Data

Description	Value	Units
Membrane Bioreactor		
Design Information		
Total volume of reactors	198000	cuft
Length of parallel train	63.5	ft
Width of parallel train	31.7	ft
Sidewater depth	16.4	ft
Number of batteries	1	
Number of parallel trains per b	6	
Total Membrane Area	253000	m2
Total Scour Air Requirement	63200	N m3/hr
Quantities		
Operation labor required	10800	pers-hrs/yr
Maintenance labor required	6650	pers-hrs/yr
Electrical energy required	5750000	kWh/yr
Volume of earthwork required	120000	cuft
Volume of slab concrete requir	60900	cuft
Volume of wall concrete requir	27000	cuft
Handrail length	1500	ft
Number of diffusers per train	620	
Number of swing arm headers	3	
Costs		
Construction and equipment co	24800000	$
Earthwork Cost	35600	$
Wall Concrete Cost	651000	$
Slab Concrete Cost	790000	$
Handrail Cost	112000	$
Membrane Cost	21800000	$
Installed Aerator Equipment	506000	$
Air Piping Cost	615000	$
Misc Cost	354000	$
Operational labor cost	555000	$/yr
Maintenance labor cost	312000	$/yr
Material and supply cost	248000	$/yr
Chemical cost	206000	$/yr
Energy cost	575000	$/yr
Amortization cost	3510000	$/yr
Permeate Pumping		
Design Information		
Average daily pumping rate	3.61	MGD(US)
Total pumping capacity	8.01	MGD(US)
Design capacity per pump	3090	gpm(US)
Number of pumps	15	
Number of batteries	1	
Firm pumping capacity	44.5	MGD(US)
Quantities		
Operation labor required	1080	pers-hrs/yr
Maintenance labor required	994	pers-hrs/yr
Electrical energy required	543000	kWh/yr
Volume of earthwork required	3000	cuft
Area of pump building	376	sqft
Costs		
Construction and equipment co	1010000	$
Earthwork Cost	4450	$
Pump Building Cost	207000	$
Installed Pump Cost	642000	$
Misc Costs	154000	$
Operational labor cost	55900	$/yr
Maintenance labor cost	46600	$/yr

Material and supply cost	7040	$/yr
Chemical cost	0	$/yr
Energy cost	54300	$/yr
Amortization cost	95200	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0842	MGD(US)
Total pumping capacity	0.0842	MGD(US)
Design capacity per pump	29.2	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.0842	MGD(US)
Quantities		
Operation labor required	320	pers-hrs/yr
Maintenance labor required	250	pers-hrs/yr
Electrical energy required	2840	kWh/yr
Volume of earthwork required	1610	cuft
Area of pump building	202	sqft
Costs		
Construction and equipment cc	46200	$
Earthwork Cost	478	$
Pump Building Cost	22200	$
Installed Pump Cost	16500	$
Misc Costs	7040	$
Operational labor cost	16500	$/yr
Maintenance labor cost	11700	$/yr
Material and supply cost	323	$/yr
Chemical cost	0	$/yr
Energy cost	284	$/yr
Amortization cost	4370	$/yr

Anaerobic Digestion

Design Output Data

Description	Value	Units
Anaerobic Digestion		
Design Information		
Percent VSS destroyed	50	%
Solids concentration in digeste	5	%
Detention time	25	d
Digester depth	28	ft
Digester diameter	70	ft
Effective digester volume	238000	cuft
Number of digesters per batter	2	
Number of primary digesters p	1	
Number of secondary digester	1	
Number of batteries	1	
Gas produced	58.9	cuft/min
Heat required	894000	BTU/hr
Digester gas required	34.5	cuft/min
Total natural gas required	0	cuft/yr
Quantities		
Operation labor required	1770	pers-hrs/yr
Maintenance labor required	1160	pers-hrs/yr
Electrical energy required	156000	kWh/yr
Volume of earthwork required	237000	cuft
Slab thickness	11	in
Volume of slab concrete requir	7710	cuft
Wall thickness	21.5	in
Volume of wall concrete requir	26800	cuft
Sidewater depth	28	ft
Surface area/floor of 2-story cc	1440	sqft
Piping size	8	in
Length of total piping system	659	ft
Number of 90 degree elbows	26	
Number of tees	51	
Number of plug valves	37	
Total dry solids treated	7.56	ton(short)/d
Costs		
Construction and equipment cc	3810000	$
Earthwork Cost	70200	$
Wall Concrete Cost	646000	$
Slab Concrete Cost	99900	$
Building Cost	158000	$
Piping System Cost	384000	$
Floating Cover Cost	1400000	$
Gas Recirculation Units Cost	280000	$
Heating Units Cost	198000	$
Gas Safety Equipment Cost	120000	$
Installed Pumps Cost	74800	$
Operational labor cost	91000	$/yr
Maintenance labor cost	54300	$/yr
Material and supply cost	31200	$/yr

Chemical cost	0	$/yr
Energy cost	15600	$/yr
Amortization cost	361000	$/yr

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	197000	cuft
Width of wet well	1010	ft
Depth of the pumping station	33.5	ft
Length of the pumping station	30	ft
Width of the pumping station	1050	ft
Minimum depth of water in wet	12.5	ft
Area of pump building	1310	sqft
Peak capacity of pumps	53.5	MGD(US)
Firm pumping capacity	53.5	MGD(US)
Total dynamic head - average	43.8	ft
Quantities		
Operation labor required	1270	pers-hrs/yr
Maintenance labor required	1120	pers-hrs/yr
Electrical energy required	702000	kWh/yr
Volume of earthwork required	3860000	cuft
Volume of slab concrete requir	380000	cuft
Volume of wall concrete requir	99000	cuft
Capacity per pump	37100	gpm(US)
Number of constant speed pur	2	
Number of variable speed purr	0	
Diameter of discharge header	43.6	in
Total dynamic head	52.3	ft
Size of selected pump	42	in
Specific speed of pump	5950	
Pump rotating speed	404	rpm
Motor size required	321	HP
Size of selected motor	350	HP
Width of pump system	9	ft
Length of pump system	32.7	ft
Length of the dry well	30	ft
Width of the dry well	41.7	ft
Costs		
Construction and equipment cc	11600000	$
Earthwork Cost	1140000	$
Wall Concrete Cost	2380000	$
Slab Concrete Cost	4920000	$
Building Cost	144000	$
Installed Pump Equipment C	1250000	$
Misc Costs	1770000	$
Operational labor cost	65500	$/yr
Maintenance labor cost	52400	$/yr
Material and supply cost	81300	$/yr
Chemical cost	0	$/yr
Energy cost	70200	$/yr
Amortization cost	990000	$/yr

Ultra-Violet Disinfection

Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calc	2.12	gal(US)/(min·W)
Total number of lamps needed	999	
Number of spare channels	1	
Total number of lamps used in	1100	
Number of excess lamps	101	
Number of lamps/modules	4	
Number of modules/bank	5	
Number of banks/channel	5	
Number of channels	11	
Calculated headloss	58.3	in
Costs		
Construction and equipment cc	2280000	$
Cost of installation	1370000	$
Total cost of UV lamps	913000	$
Operational labor cost	0	$/yr
Maintenance labor cost	25800	$/yr
Material and supply cost	22800	$/yr
Chemical cost	11400	$/yr
Energy cost	81900	$/yr
Amortization cost	224000	$/yr

Drying Beds

Design Output Data

Description	Value	Units
Sludge Drying Beds		
Design Information		
Total surface area required	82300	sqft
Initial depth of sludge	12	in
Final solids	50	%
Bed holding time	28.5	d
Quantities		
Total drying bed surface area	82300	sqft
Number beds	28	
Surface area of each individua	2940	sqft
Length of each bed	147	ft
Volume of earthwork required	405000	cuft
Volume concrete for dividing w	27200	cuft
Volume of R.C. in-place for tru	6170	cuft
Volume of sand	61700	cuft
Volume of gravel	82300	cuft
Clay pipe diameter	6	in
Total length clay pipe	8230	in
Sludge solids produced	4.51	ton(short)/d
Operational labor required	4810	pers-hrs/yr
Maintenance labor required	2400	pers-hrs/yr
Costs		
Construction and equipment cc	1150000	$
Earthwork Cost	120000	$
Wall Concrete Cost	459000	$
Slab Concrete Cost	48000	$
Drying Bed Media Cost	230000	$
Drain Pipe System Cost	181000	$
Misc Costs	114000	$
Operational labor cost	248000	$/yr
Maintenance labor cost	113000	$/yr
Material and supply cost	10400	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	100000	$/yr

Primary Clarification

Design Output Data

Description	Value	Units
Primary Clarification		
Design Information		
Surface area	30100	sqft
Surface area per circular clarifi	7540	sqft
Diameter of each circular clarif	98	ft
Number of clarifiers per battery	4	
Number of batteries	1	
Solids loading rate	0.479	lb/(sqft·d)
Hydraulic retention time	2.69	hr
Weir length	4010	ft
Volume of sludge generated	25100	gpd(US)
Quantities		
Operation labor required	1990	pers-hrs/yr
Maintenance labor required	1100	pers-hrs/yr
Electrical energy required	15500	kWh/yr
Volume of earthwork required	403000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	29000	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	12900	cuft
Costs		
Construction and equipment cc	1650000	$
Earthwork Cost	120000	$
Wall Concrete Cost	310000	$
Slab Concrete Cost	376000	$
Installed Equipment Cost	589000	$
Misc Costs	251000	$
Operational labor cost	102000	$/yr
Maintenance labor cost	51800	$/yr
Material and supply cost	16500	$/yr
Chemical cost	0	$/yr
Energy cost	1550	$/yr
Amortization cost	151000	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0251	MGD(US)
Total pumping capacity	0.0251	MGD(US)
Design capacity per pump	8.73	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.0251	MGD(US)

Quantities		
Operation labor required	274	pers-hrs/yr
Maintenance labor required	209	pers-hrs/yr
Electrical energy required	849	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment cc	38000	$
Earthwork Cost	475	$
Pump Building Cost	22100	$
Installed Pump Cost	9680	$
Misc Costs	5800	$
Operational labor cost	14100	$/yr
Maintenance labor cost	9790	$/yr
Material and supply cost	266	$/yr
Chemical cost	0	$/yr
Energy cost	85	$/yr
Amortization cost	3590	$/yr

Post Aeration

Design Output Data

Description	Value	Units
Post Aeration by Diffused Aeration		
Design Information		
Dissolved oxygen in influent	2	mg/L
Desired dissolved oxygen in ef	5	mg/L
Correction factor for pressure	1	
Minimum dissolved oxygen in t	2	mg/L
Oxygen saturation at summer t	8.5	mg/L
Oxygen required	450	lb/d
Operating transfer efficiency	2.95	lbO2/(HP·h)
Total volume of aerobic reacto	125000	gal(US)
Air flow rate required to meet a	601	scfm
Quantities		
Basin depth	15	ft
Length of basin	37.1	ft
Width of basin	30	ft
Number of diffusers	51	
Number of swing arm diffuser l	3	
Volume of wall concrete requir	1510	cuft
Volume of slab concrete requir	835	cuft
Electrical energy required	150000	kWh/yr
Operation labor required	820	pers-hrs/yr
Maintenance labor required	382	pers-hrs/yr
Costs		
Construction and equipment cc	131000	$
Wall Concrete Cost	36300	$
Slab Concrete Cost	19600	$
Installed Equipment Cost	61700	$
Misc Costs	12900	$
Operational labor cost	42200	$/yr
Maintenance labor cost	17900	$/yr
Material and supply cost	2200	$/yr
Chemical cost	0	$/yr
Energy cost	15000	$/yr
Amortization cost	12200	$/yr

Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	10.7	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	10.7	cuyd/d
Maximum anticipated landfill dc	30	d
Anticipated sludge storage heig	8	ft
Sludge storage shed area	1080	sqft
Width of sludge storage shed s	23.3	ft
Length of sludge storage shed	46.6	ft
Volume of earthwork required	3170	cuft
Volume of slab concrete requir	1400	cuft
Surface area of canopy roof	1080	sqft
Round trip haul distance	20	miles
Round trips per day per truck	1	
Distance traveled per year per	5000	miles

Sludge hauled	9.47	ton(short)/d
Operation labor required	167	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment cc	324000	$
Earthwork Cost	938	$
Slab Concrete Cost	18200	$
Canopy Roof Cost	21700	$
Vehicle Cost	283000	$
Operational labor cost	8620	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	53600	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	64700	$/yr

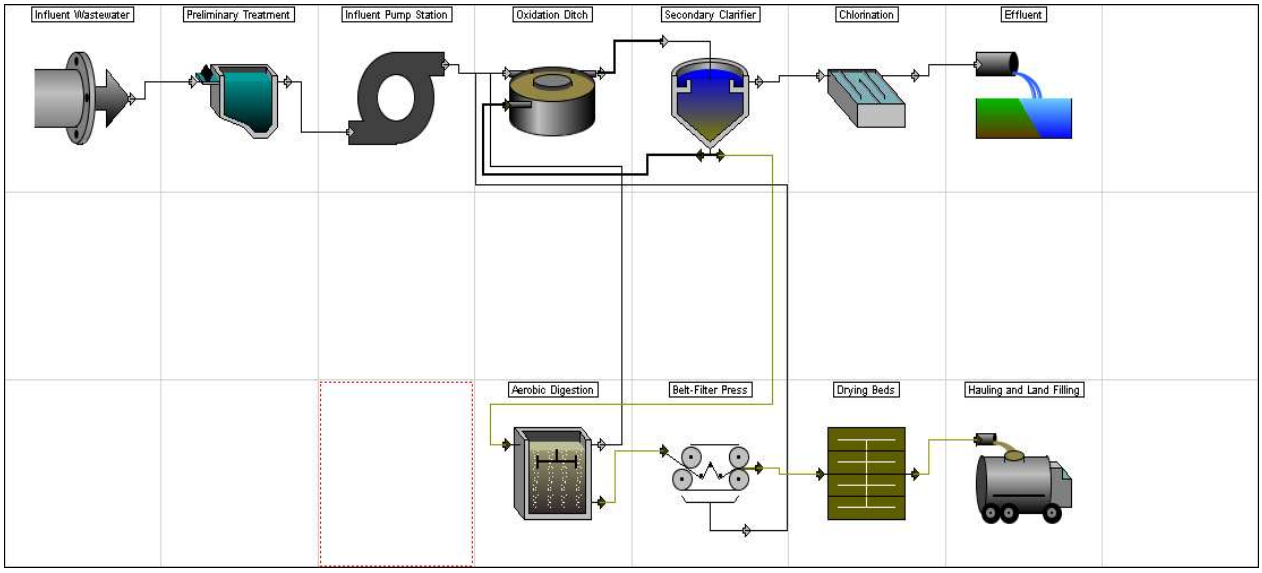
Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	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

Magna Water and Sewer District

Layout 1 - Magna



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$19,100,000	$
Other direct construction costs	$8,500,000	$
Other indirect construction cos	$20,700,000	$
Total construction costs	$48,300,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$91,500	$/yr
Laboratory labor cost	$173,000	$/yr
Unit process operation labor c	$967,000	$/yr
Unit process maintenance labc	$302,000	$/yr
Total labor costs	$1,530,000	$/yr
MATERIAL COSTS		
Total material cost	$329,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$219,000	$/yr
ENERGY COSTS		
Total energy cost	$759,000	$/yr
Total operation and maintanen	$2,840,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$4,160,000	$/yr
Total annual project cost	$7,000,000	$/yr
PROJECT SUMMARY		
Present worth	$83,800,000	$
Total project cost	$48,300,000	$
Total operation labor cost	$1,230,000	$/yr
Total maintenance labor cost	$302,000	$/yr
Total material cost	$329,000	$/yr
Total chemical cost	$219,000	$/yr
Total energy cost	$759,000	$/yr
Total amortization cost	$4,160,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Preliminary Treatment	898000	81000	34300	22500	0	4190	75300
Influent Pump Station	5920000	44800	31000	41400	0	45100	506000
Oxidation Ditch	4680000	222000	0	25700	0	519000	436000
Aerobic Digestion	1730000	114000	51300	94300	0	167000	154000

Secondary Clarifier	1070000	99500	49100	10600	0	1900	97600
Belt-Filter Press	1550000	18300	3770	0	60500	10300	143000
Chlorination	975000	66100	12400	32100	158000	12600	94700
Drying Beds	1290000	291000	120000	11600	0	0	112000
Effluent	0	0	0	0	0	0	0
Hauling and Land Filling	331000	30400	0	90400	0	0	65200
Blower System	690000	0	0	0	0	0	57900
Other Costs	29200000	264000	0	0	0	0	2420000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	19	acre
Administration labor hours	1780	hr/yr
Laboratory labor hours	3360	hr/yr
Costs		
DIRECT COSTS		
Mobilization	771000	$
Site preparation	1050000	$
Site electrical	2210000	$
Yard piping	1460000	$
Instrumentation and control	1140000	$
Lab and administration building	1870000	$
Total direct construction costs	8500000	$
INDIRECT COSTS		
Cost of land	380000	$
Miscellaneous cost	1590000	$
Legal cost	636000	$
Engineering design fee	4770000	$
Inspection cost	636000	$
Contingency	3180000	$
Technical	636000	$
Interest during construction	4740000	$
Profit	4150000	$
Total indirect construction cost	20700000	$
Total of other construction cos	29200000	$
LABOR COSTS		
Administration labor cost	91500	$/yr
Laboratory labor cost	173000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	6470	scfm
Safety factor	1.5	
Requested air flow capacity	9700	scfm
Total capacity of blowers	9700	scfm
Number of blowers in use	2	
Total number of blowers	3	
Capacity of individual blowers	4850	scfm
Estimated cost of an installed l	158000	$
Blower building area	1340	sqft
Costs		
Construction and equipment co	690000	$
Installed Blower Cost	474000	$
Building Cost	148000	$
Misc Costs	68400	$
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	57900	$/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	1.64	ft
Average channel depth	3	ft
Horizontal Flow Grit Chamber		
Maximum flow	24.6	cuft/s
Average flow	12.3	cuft/s
Minimum flow	5.39	cuft/s
Temperature	10	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	12.3	cuft/s
Width of channel	2.05	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.000789	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	32	cuft/d
Costs		
Construction and equipment cc	898000	$
Operational labor cost	81000	$/yr
Maintenance labor cost	34300	$/yr
Material and supply cost	22500	$/yr
Chemical cost	0	$/yr
Energy cost	4190	$/yr
Amortization cost	75300	$/yr

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	97300	cuft
Width of wet well	615	ft
Depth of the pumping station	30.3	ft
Length of the pumping station	25.2	ft
Width of the pumping station	650	ft
Minimum depth of water in wet	9.27	ft
Area of pump building	936	sqft
Peak capacity of pumps	25.5	MGD(US)
Firm pumping capacity	25.5	MGD(US)
Total dynamic head - average	44.1	ft
Quantities		
Operation labor required	871	pers-hrs/yr
Maintenance labor required	730	pers-hrs/yr
Electrical energy required	451000	kWh/yr
Volume of earthwork required	1930000	cuft
Volume of slab concrete requir	174000	cuft
Volume of wall concrete requir	55000	cuft
Capacity per pump	17700	gpm(US)
Number of constant speed pur	2	
Number of variable speed pur	0	
Diameter of discharge header	30.1	in
Total dynamic head	55.7	ft
Size of selected pump	30	in
Specific speed of pump	3910	
Pump rotating speed	613	rpm
Motor size required	235	HP
Size of selected motor	250	HP
Width of pump system	6.6	ft
Length of pump system	26.4	ft
Length of the dry well	25.2	ft
Width of the dry well	35.4	ft
Costs		
Construction and equipment cc	5920000	$
Earthwork Cost	572000	$
Wall Concrete Cost	1320000	$
Slab Concrete Cost	2250000	$
Building Cost	103000	$
Installed Pump Equipment C	765000	$
Misc Costs	903000	$
Operational labor cost	44800	$/yr
Maintenance labor cost	31000	$/yr
Material and supply cost	41400	$/yr
Chemical cost	0	$/yr

Energy cost	45100	$/yr
Amortization cost	506000	$/yr

Oxidation Ditch

Design Output Data

Description	Value	Units
Oxidation Ditch		
Design Information		
Carbon & Nitrification Design		
Design SRT for design at winte	25	d
Design SS	4000	mg/L
Calculated VSS	2790	mg/L
Calculated VSS:TSS ratio	0.697	mg VSS/mg SS
Total volume of reactors	48100	m3
Ditch length	134	m
Ditch width	25.8	m
Sidewater depth	3.66	m
Number of batteries	2	
Number of parallel ditches per	2	
Number of rotors per ditch	4	
Rotor length for aeration	103	m
Rotor length for mixing	185	m
Installed rotor length per rotor	11.5	m
Rotor horsepower	20	HP
Total installed horsepower per	160	HP
Assumed surface velocity	0.46	m/s
Hydraulic retention time	37.3	hr
F/M ratio	0.0518	lb BOD/lb MLSS/d
Volumetric BOD loading	0.144	kg BOD/m3/d
Observed yield (VSS basis)	0.591	g VSS/g BOD
Observed yield (TSS basis)	0.848	g TSS/g BOD
Amount of alkalinity required	140	gCaCO3/m3
Amount of sludge generated	7700	kg/d
Sludge recycle rate	20700	m3/d
Nitrogen requirement for biom	17.3	mg/L
Phosphorus requirement for bi	3.46	mg/L
Oxygen requirement to meet a	13700	kg/d
Quantities		
Ditch bottom width	41.9	ft
Length of straight section	357	ft
Volume of excavation required	850000	cuft
Volume of backfill required per	10100	cuft
Volume of wall concrete requir	33500	cuft
Volume of slab concrete requir	51000	cuft
Length of adjustable weir	64.5	ft
Volume of concrete required p	278	cuft
Total handrail length	0	ft
Operation labor required	4310	pers-hrs/yr
Electrical energy required	5190000	kWh/yr
Costs		
Construction and equipment co	4680000	$
Earthwork Cost	252000	$
Wall Concrete Cost	1640000	$
Slab Concrete Cost	1320000	$
Handrail Cost	0	$
Installed Equipment Cost	1240000	$
Misc Costs	232000	$
Operational labor cost	222000	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	25700	$/yr
Chemical cost	0	$/yr
Energy cost	519000	$/yr
Amortization cost	436000	$/yr

Aerobic Digestion

Design Output Data

Description	Value	Units
Aerobic Digestion		
Design Information		
Solids retention time	17.7	d
Design SS	12000	mg/L
Calculated VSS	7770	mg/L
Calculated VSS:TSS ratio	0.648	mg VSS/mg SS
Total volume of reactors	7480	m3
Length of parallel train	75	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	2090	kg/d
Air flow required to meet avera	11000	N m3/hr
Design air flow	24.4	N m3/min/1000 m3

Volatile solids loading	0.0456	lb/(cuft·d)
Solids accumulated	11200	lb/d
Digester capacity	198000	lb
Volume of wasted sludge	904000	gal(US)
Quantities		
Operation labor required	2210	pers-hrs/yr
Maintenance labor required	1210	pers-hrs/yr
Electrical energy required	1670000	kWh/yr
Volume of earthwork required	148000	cuft
Volume of slab concrete requir	33200	cuft
Volume of wall concrete requir	21300	cuft
Handrail length	572	ft
Number of diffusers per train	270	
Number of swing arm headers	10	
Costs		
Construction and equipment cc	1730000	$
Earthwork Cost	43700	$
Wall Concrete Cost	513000	$
Slab Concrete Cost	430000	$
Handrail Cost	42900	$
Installed Aerator Equipment	419000	$
Air Piping Cost	112000	$
Misc Costs	172000	$
Operational labor cost	114000	$/yr
Maintenance labor cost	51300	$/yr
Material and supply cost	94300	$/yr
Chemical cost	0	$/yr
Energy cost	167000	$/yr
Amortization cost	154000	$/yr

Secondary Clarifier

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	20500	sqft
Surface area per circular clarifi	10200	sqft
Diameter of each circular clarif	115	ft
Number of clarifiers per battery	2	
Number of batteries	1	
Solids loading rate	22.2	lb/(sqft·d)
Hydraulic retention time	4.04	hr
Designed surface overflow rate	400	gal(US)/(sqft·d)
Weir length	2020	ft
Volume of wasted sludge	198000	gpd(US)
Quantities		
Operation labor required	1580	pers-hrs/yr
Maintenance labor required	872	pers-hrs/yr
Electrical energy required	12400	kWh/yr
Volume of earthwork required	292000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	19800	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	7490	cuft
Costs		
Construction and equipment cc	1020000	$
Earthwork Cost	86500	$
Wall Concrete Cost	180000	$
Slab Concrete Cost	256000	$
Installed Equipment Cost	338000	$
Misc Costs	155000	$
Operational labor cost	81100	$/yr
Maintenance labor cost	37000	$/yr
Material and supply cost	10200	$/yr
Chemical cost	0	$/yr
Energy cost	1240	$/yr
Amortization cost	92400	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.198	MGD(US)
Total pumping capacity	0.198	MGD(US)
Design capacity per pump	68.6	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.198	MGD(US)
Quantities		
Operation labor required	357	pers-hrs/yr
Maintenance labor required	283	pers-hrs/yr
Electrical energy required	6650	kWh/yr
Volume of earthwork required	1630	cuft
Area of pump building	204	sqft
Costs		

Construction and equipment cc	55400	$
Earthwork Cost	483	$
Pump Building Cost	22400	$
Installed Pump Cost	24000	$
Misc Costs	8440	$
Operational labor cost	18400	$/yr
Maintenance labor cost	12000	$/yr
Material and supply cost	387	$/yr
Chemical cost	0	$/yr
Energy cost	665	$/yr
Amortization cost	5230	$/yr

Belt-Filter Press

Design Output Data

Description	Value	Units
Belt-Filter Press		
Design Information		
Belt filter width	2	m
Number of units	2	
Hydraulic loading per unit per r	70	gpm(US)
Hydraulic loading required per	149	gpm(US)
Final solids content	15	%
Solids capture fraction	0.996	
Quantities		
Operation labor required	355	pers-hrs/yr
Maintenance labor required	88.7	pers-hrs/yr
Power	103000	kWh/yr
Polymer required	46500	lb/yr
Dry solids produced	12800	lb/d
Belt filter(s)	602000	$
Building	358000	$
Installation	151000	$
Polymer system	223000	$
Feed pumps	66200	$
Conveyor system	151000	$
Costs		
Construction and equipment cc	1550000	$
Building Cost	358000	$
Polymer System Cost	223000	$
Feed Pumps Cost	66200	$
Conveyor System Cost	151000	$
Installed Belt Filter	753000	$
Operational labor cost	18300	$/yr
Maintenance labor cost	3770	$/yr
Material and supply cost	0	$/yr
Chemical cost	60500	$/yr
Energy cost	10300	$/yr
Amortization cost	143000	$/yr

Chlorination

Design Output Data

Description	Value	Units
Chlorination		
Design Information		
Volume of tank	666000	gal(US)
Average chlorine required	666	lb/d
Peak chlorine required	1330	lb/d
Influent coliform count	10000000	/100ml
Effluent coliform count	3.72	/100ml
Quantities		
Operational labor required	1280	pers-hrs/yr
Maintenance labor required	292	pers-hrs/yr
Electrical energy required	126000	kWh/yr
Volume of earthwork required	37800	cuft
Volume of slab concrete requir	8930	cuft
Volume of wall concrete requir	11900	cuft
Number of chlorinators and ev	1	
Chlorination building area	220	sqft
Number of chlorine cylinders	10	
Area of chlorine storage buildir	1400	sqft
Costs		
Construction and equipment cc	975000	$
Earthwork Cost	11200	$
Wall Concrete Cost	287000	$
Slab Concrete Cost	116000	$
Installed Equipment Cost	386000	$
Building Cost	24200	$
Storage Building Cost	77000	$
Misc Costs	74500	$
Operational labor cost	66100	$/yr
Maintenance labor cost	12400	$/yr
Material and supply cost	32100	$/yr

Chemical cost	158000	$/yr
Energy cost	12600	$/yr
Amortization cost	94700	$/yr

Drying Beds

Design Output Data

Description	Value	Units
Sludge Drying Beds		
Design Information		
Total surface area required	92300	sqft
Initial depth of sludge	12	in
Final solids	50	%
Bed holding time	81.4	d
Quantities		
Total drying bed surface area	92300	sqft
Number beds	31	
Surface area of each individua	2980	sqft
Length of each bed	149	ft
Volume of earthwork required	454000	cuft
Volume concrete for dividing w	30400	cuft
Volume of R.C. in-place for tru	6920	cuft
Volume of sand	69200	cuft
Volume of gravel	92300	cuft
Clay pipe diameter	6	in
Total length clay pipe	9230	in
Sludge solids produced	5.3	ton(short)/d
Operational labor required	5660	pers-hrs/yr
Maintenance labor required	2830	pers-hrs/yr
Costs		
Construction and equipment cc	1290000	$
Earthwork Cost	135000	$
Wall Concrete Cost	512000	$
Slab Concrete Cost	53800	$
Drying Bed Media Cost	258000	$
Drain Pipe System Cost	203000	$
Misc Costs	128000	$
Operational labor cost	291000	$/yr
Maintenance labor cost	120000	$/yr
Material and supply cost	11600	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	112000	$/yr

Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	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

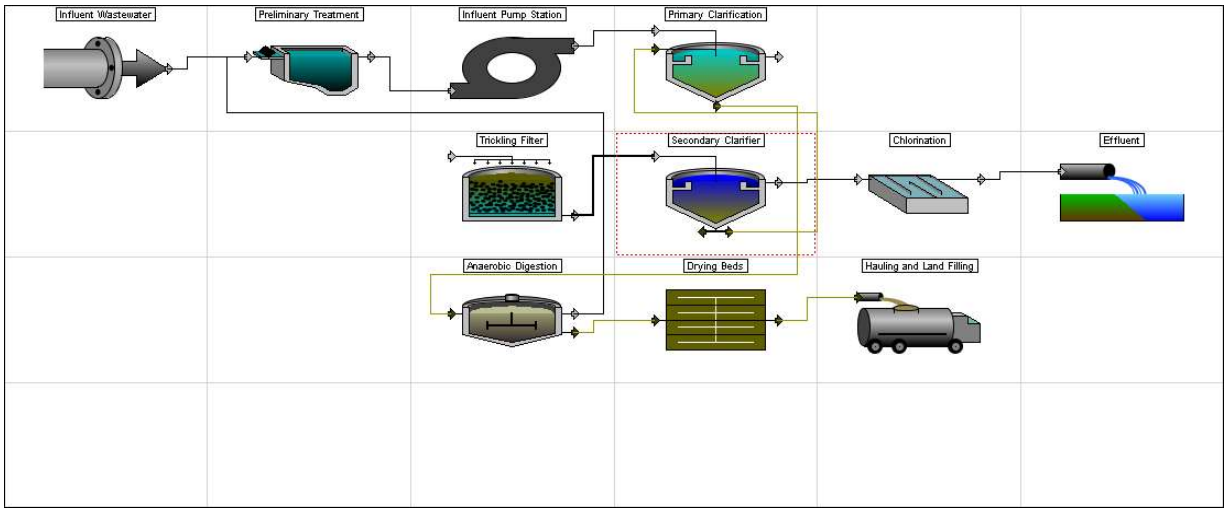
Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	12.6	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	30	miles
Quantities		
Total sludge volume hauled	12.6	cuyd/d
Maximum anticipated landfill dc	30	d
Anticipated sludge storage heig	8	ft
Sludge storage shed area	1280	sqft
Width of sludge storage shed s	25.3	ft
Length of sludge storage shed	50.5	ft
Volume of earthwork required	3680	cuft
Volume of slab concrete requir	1620	cuft
Surface area of canopy roof	1280	sqft
Round trip haul distance	60	miles
Round trips per day per truck	1	
Distance traveled per year per	15000	miles
Sludge hauled	11.1	ton(short)/d
Operation labor required	591	pers-hrs/yr

LandFilling cost	35200	$/yr
Costs		
Construction and equipment cc	331000	$
Earthwork Cost	1090	$
Slab Concrete Cost	21000	$
Canopy Roof Cost	25500	$
Vehicle Cost	283000	$
Operational labor cost	30400	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	90400	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	65200	$/yr

Moab City

Layout 1 Moab City



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$3,750,000	$
Other direct construction costs	$3,880,000	$
Other indirect construction cos	$5,890,000	$
Total construction costs	$13,500,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$36,800	$/yr
Laboratory labor cost	$145,000	$/yr
Unit process operation labor c	$206,000	$/yr
Unit process maintenance labc	$93,800	$/yr
Total labor costs	$481,000	$/yr
MATERIAL COSTS		
Total material cost	$89,300	$/yr
CHEMICAL COSTS		
Total chemical cost	$0	$/yr
ENERGY COSTS		
Total energy cost	$28,600	$/yr
Total operation and maintanen	$599,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$1,170,000	$/yr
Total annual project cost	$1,770,000	$/yr
PROJECT SUMMARY		
Present worth	$21,300,000	$
Total project cost	$13,500,000	$
Total operation labor cost	$387,000	$/yr
Total maintenance labor cost	$93,800	$/yr
Total material cost	$89,300	$/yr
Total chemical cost	$0	$/yr
Total energy cost	$28,600	$/yr
Total amortization cost	$1,170,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Preliminary Treatment	488000	42100	17300	12200	0	2450	40900
Influent Pump Station	1440000	31500	20100	10100	0	19500	124000
Trickling Filter	0	0	0	0	0	0	0
Anaerobic Digestion	929000	43900	20800	7800	0	5870	87900
Primary Clarification	363000	38500	17600	3530	0	861	34000
Secondary Clarifier	0	0	0	0	0	0	0
Drying Beds	235000	47900	18000	2120	0	0	20400
Chlorination	0	0	0	0	0	0	0
Hauling and Land Filling	292000	1670	0	53600	0	0	62000
Effluent	0	0	0	0	0	0	0
Other Costs	9770000	182000	0	0	0	0	798000

Summary of Other Costs for Layout

Description	Value	Units

Other Costs		
Quantities		
Required land	13	acre
Administration labor hours	714	hr/yr
Laboratory labor hours	2810	hr/yr
Costs		
DIRECT COSTS		
Mobilization	346000	$
Site preparation	542000	$
Site electrical	944000	$
Yard piping	639000	$
Instrumentation and control	461000	$
Lab and administration building	951000	$
Total direct construction costs	3880000	$
INDIRECT COSTS		
Cost of land	260000	$
Miscellaneous cost	439000	$
Legal cost	176000	$
Engineering design fee	1320000	$
Inspection cost	176000	$
Contingency	878000	$
Technical	176000	$
Interest during construction	1330000	$
Profit	1140000	$
Total indirect construction cost	5890000	$
Total of other construction cos	9770000	$
LABOR COSTS		
Administration labor cost	36800	$/yr
Laboratory labor cost	145000	$/yr

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	1.5	in
Slope of bars from horizontal	30	degrees
Head loss through screen	0.0206	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	1.54	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	9.25	cuft/s
Average flow	3.86	cuft/s
Minimum flow	1.39	cuft/s
Temperature	10	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	4.62	cuft/s
Width of channel	0.771	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.00238	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	10	cuft/d
Costs		
Construction and equipment c	488000	$
Operational labor cost	42100	$/yr
Maintenance labor cost	17300	$/yr
Material and supply cost	12200	$/yr
Chemical cost	0	$/yr
Energy cost	2450	$/yr
Amortization cost	40900	$/yr

Influent Pump Station

Design Output Data

Description	**Value**	**Units**
Pump Station		
Design Information		
Volume of wet well	17700	cuft
Width of wet well	148	ft
Depth of the pumping station	27.3	ft
Length of the pumping station	19.6	ft
Width of the pumping station	177	ft
Minimum depth of water in wet	6.3	ft
Area of pump building	594	sqft
Peak capacity of pumps	8.85	MGD(US)
Firm pumping capacity	8.85	MGD(US)

Total dynamic head - average	44.7	ft
Quantities		
Operation labor required	611	pers-hrs/yr
Maintenance labor required	518	pers-hrs/yr
Electrical energy required	195000	kWh/yr
Volume of earthwork required	445000	cuft
Volume of slab concrete requir	30600	cuft
Volume of wall concrete requir	14700	cuft
Capacity per pump	6150	gpm(US)
Number of constant speed pur	2	
Number of variable speed pur	0	
Diameter of discharge header	17.7	in
Total dynamic head	63.9	ft
Size of selected pump	16	in
Specific speed of pump	4160	
Pump rotating speed	1150	rpm
Motor size required	127	HP
Size of selected motor	150	HP
Width of pump system	3.8	ft
Length of pump system	19.9	ft
Length of the dry well	19.6	ft
Width of the dry well	28.9	ft
Costs		
Construction and equipment c	1440000	$
Earthwork Cost	132000	$
Wall Concrete Cost	353000	$
Slab Concrete Cost	396000	$
Building Cost	65300	$
Installed Pump Equipment C	275000	$
Misc Costs	220000	$
Operational labor cost	31500	$/yr
Maintenance labor cost	20100	$/yr
Material and supply cost	10100	$/yr
Chemical cost	0	$/yr
Energy cost	19500	$/yr
Amortization cost	124000	$/yr

Trickling Filter

Design Output Data

Description	Value	Units
Costs		
Construction and equipment c	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

Anaerobic Digestion

Design Output Data

Description	Value	Units
Anaerobic Digestion		
Design Information		
Percent VSS destroyed	50	%
Solids concentration in digeste	5	%
Detention time	40	d
Digester depth	22.7	ft
Digester diameter	40	ft
Effective digester volume	30600	cuft
Number of digesters per batter	1	
Number of primary digesters p	0	
Number of secondary digester	0	
Number of batteries	1	
Gas produced	11.5	cuft/min
Heat required	236000	BTU/hr
Digester gas required	9.09	cuft/min
Total natural gas required	0	cuft/yr
Quantities		
Operation labor required	853	pers-hrs/yr
Maintenance labor required	536	pers-hrs/yr
Electrical energy required	58700	kWh/yr
Volume of earthwork required	30400	cuft
Slab thickness	9.72	in
Volume of slab concrete requir	1180	cuft
Wall thickness	18.8	in
Volume of wall concrete requir	5630	cuft
Sidewater depth	22.7	ft
Surface area/floor of 2-story c	315	sqft
Piping size	6	in
Length of total piping system	225	ft
Number of 90 degree elbows	13	
Number of tees	26	
Number of plug valves	19	
Total dry solids treated	1.47	ton(short)/d
Costs		
Construction and equipment c	929000	$
Earthwork Cost	9020	$
Wall Concrete Cost	135000	$
Slab Concrete Cost	15200	$
Building Cost	34700	$
Piping System Cost	123000	$

Floating Cover Cost	292000	$
Gas Recirculation Units Cost	0	$
Heating Units Cost	72500	$
Gas Safety Equipment Cost	105000	$
Installed Pumps Cost	49900	$
Operational labor cost	43900	$/yr
Maintenance labor cost	20800	$/yr
Material and supply cost	7800	$/yr
Chemical cost	0	$/yr
Energy cost	5870	$/yr
Amortization cost	87900	$/yr

Primary Clarification

Design Output Data

Description	Value	Units
Primary Clarification		
Design Information		
Surface area	3130	sqft
Surface area per circular clarifi	1570	sqft
Diameter of each circular clarif	45	ft
Number of clarifiers per battery	2	
Number of batteries	1	
Solids loading rate	1.54	lb/(sqft·d)
Hydraulic retention time	2.02	hr
Weir length	400	ft
Volume of sludge generated	8370	gpd(US)
Quantities		
Operation labor required	509	pers-hrs/yr
Maintenance labor required	278	pers-hrs/yr
Electrical energy required	8330	kWh/yr
Volume of earthwork required	38800	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	3350	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	3060	cuft
Costs		
Construction and equipment co	329000	$
Earthwork Cost	11500	$
Wall Concrete Cost	73700	$
Slab Concrete Cost	43400	$
Installed Equipment Cost	150000	$
Misc Costs	50200	$
Operational labor cost	26200	$/yr
Maintenance labor cost	10800	$/yr
Material and supply cost	3290	$/yr
Chemical cost	0	$/yr
Energy cost	833	$/yr
Amortization cost	30800	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.00837	MGD(US)
Total pumping capacity	0.00837	MGD(US)
Design capacity per pump	2.91	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.00837	MGD(US)
Quantities		
Operation labor required	238	pers-hrs/yr
Maintenance labor required	178	pers-hrs/yr
Electrical energy required	284	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment co	33600	$
Earthwork Cost	474	$
Pump Building Cost	22000	$
Installed Pump Cost	5960	$
Misc Costs	5120	$
Operational labor cost	12300	$/yr
Maintenance labor cost	6880	$/yr
Material and supply cost	235	$/yr
Chemical cost	0	$/yr
Energy cost	28	$/yr
Amortization cost	3180	$/yr

Secondary Clarifier

Design Output Data

Description	Value	Units
Costs		
Construction and equipment co	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

Drying Beds

Design Output Data

Description	Value	Units
Sludge Drying Beds		
Design Information		

Total surface area required	15900	sqft
Initial depth of sludge	12	in
Final solids	50	%
Bed holding time	28.5	d
Quantities		
Total drying bed surface area	15900	sqft
Number beds	6	
Surface area of each individua	2660	sqft
Length of each bed	133	ft
Volume of earthwork required	78700	cuft
Volume concrete for dividing w	5920	cuft
Volume of R.C. in-place for tru	1200	cuft
Volume of sand	12000	cuft
Volume of gravel	15900	cuft
Clay pipe diameter	6	in
Total length clay pipe	1590	in
Sludge solids produced	0.873	ton(short)/d
Operational labor required	931	pers-hrs/yr
Maintenance labor required	465	pers-hrs/yr
Costs		
Construction and equipment c	235000	$
Earthwork Cost	23300	$
Wall Concrete Cost	99700	$
Slab Concrete Cost	9300	$
Drying Bed Media Cost	44500	$
Drain Pipe System Cost	35100	$
Misc Costs	23300	$
Operational labor cost	47900	$/yr
Maintenance labor cost	18000	$/yr
Material and supply cost	2120	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	20400	$/yr

Chlorination

Design Output Data

Description	Value	Units
Costs		
Construction and equipment c	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	2.07	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	2.07	cuyd/d
Maximum anticipated landfill d	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	210	sqft
Width of sludge storage shed s	10.2	ft
Length of sludge storage shed	20.5	ft
Volume of earthwork required	737	cuft
Volume of slab concrete requir	351	cuft
Surface area of canopy roof	210	sqft
Round trip haul distance	20	miles
Round trips per day per truck	1	
Distance traveled per year per	5000	miles
Sludge hauled	1.83	ton(short)/d
Operation labor required	32.4	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment c	292000	$
Earthwork Cost	218	$
Slab Concrete Cost	4550	$
Canopy Roof Cost	4200	$
Vehicle Cost	283000	$
Operational labor cost	1670	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	53600	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	62000	$/yr

Effluent

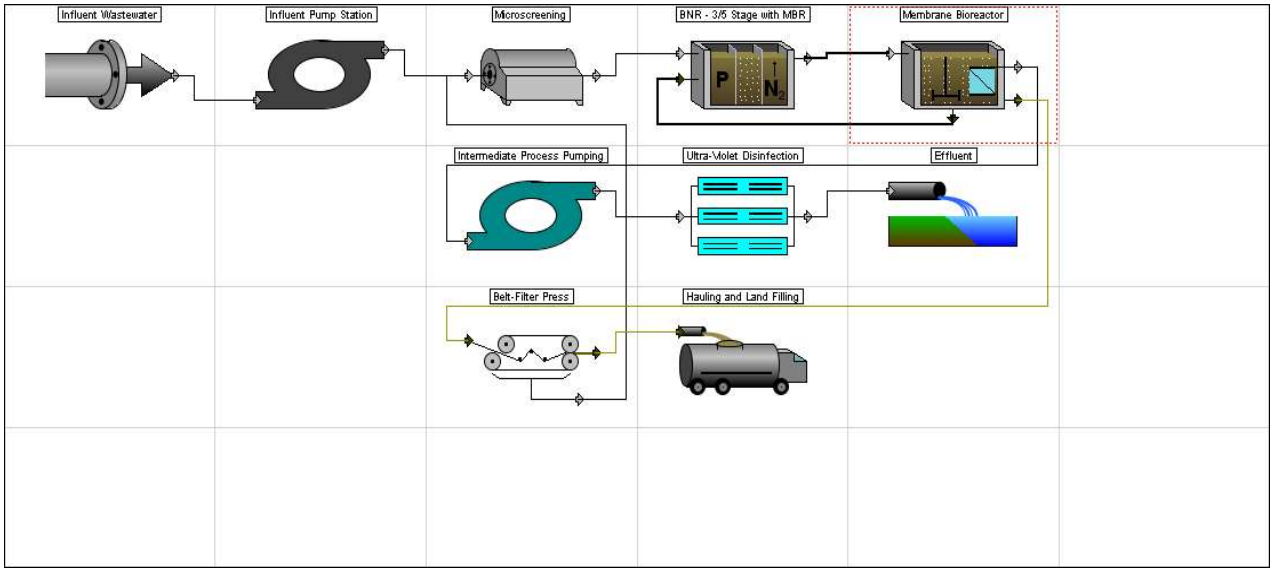
Design Output Data

Description	Value	Units
Costs		
Construction and equipment c	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

Mona City

Layout - Mona City



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$5,300,000	$
Other direct construction costs	$1,330,000	$
Other indirect construction cos	$5,090,000	$
Total construction costs	$11,700,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$10,400	$/yr
Laboratory labor cost	$114,000	$/yr
Unit process operation labor c	$336,000	$/yr
Unit process maintenance labc	$171,000	$/yr
Total labor costs	$631,000	$/yr
MATERIAL COSTS		
Total material cost	$123,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$13,500	$/yr
ENERGY COSTS		
Total energy cost	$87,900	$/yr
Total operation and maintanen	$855,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$1,120,000	$/yr
Total annual project cost	$1,970,000	$/yr
PROJECT SUMMARY		
Present worth	$23,700,000	$
Total project cost	$11,700,000	$
Total operation labor cost	$460,000	$/yr
Total maintenance labor cost	$171,000	$/yr
Total material cost	$123,000	$/yr
Total chemical cost	$13,500	$/yr
Total energy cost	$87,900	$/yr
Total amortization cost	$1,120,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Influent Pump Station	448000	24800	16300	3130	0	4690	39000
Microscreening	307000	4150	2110	27800	0	9780	32900
Intermediate Process Pumping	110000	20700	13200	771	0	1670	10400
Belt-Filter Press	812000	733	145	0	2420	528	74300

BNR - 3/5 Stage with MBR	744000	125000	63800	16900	0	28300	69700
Ultra-Violet Disinfection	215000	0	2190	2150	747	5360	18200
Hauling and Land Filling	289000	1070	0	53600	0	0	61800
Membrane Bioreactor	1890000	159000	73700	18300	10300	37500	251000
Effluent	0	0	0	0	0	0	0
Blower System	486000	0	0	0	0	0	40800
Other Costs	6420000	124000	0	0	0	0	522000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	10	acre
Administration labor hours	203	hr/yr
Laboratory labor hours	2210	hr/yr
Costs		
DIRECT COSTS		
Mobilization	114000	$
Site preparation	217000	$
Site electrical	292000	$
Yard piping	204000	$
Instrumentation and control	131000	$
Lab and administration building	374000	$
Total direct construction costs	1330000	$
INDIRECT COSTS		
Cost of land	200000	$
Miscellaneous cost	381000	$
Legal cost	153000	$
Engineering design fee	1140000	$
Inspection cost	153000	$
Contingency	763000	$
Technical	153000	$
Interest during construction	1150000	$
Profit	995000	$
Total indirect construction cost	5090000	$
Total of other construction cos	6420000	$
LABOR COSTS		
Administration labor cost	10400	$/yr
Laboratory labor cost	114000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	3210	scfm
Safety factor	1.5	
Requested air flow capacity	4820	scfm
Total capacity of blowers	4820	scfm
Number of blowers in use	1	
Total number of blowers	2	
Capacity of individual blowers	4820	scfm
Estimated cost of an installed l	157000	$
Blower building area	1120	sqft
Costs		
Construction and equipment cc	486000	$
Installed Blower Cost	315000	$
Building Cost	123000	$
Misc Costs	48200	$
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	40800	$/yr
Notes		
Energy costs are shown at the individual unit processes that require air		

Influent Wastewater

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	2150	cuft
Width of wet well	21.6	ft
Depth of the pumping station	25.1	ft
Length of the pumping station	16.4	ft
Width of the pumping station	47.2	ft
Minimum depth of water in wet	4.08	ft

Area of pump building	440	sqft
Peak capacity of pumps	2.04	MGD(US)
Firm pumping capacity	2.04	MGD(US)
Total dynamic head - average	46.1	ft
Quantities		
Operation labor required	482	pers-hrs/yr
Maintenance labor required	400	pers-hrs/yr
Electrical energy required	46900	kWh/yr
Volume of earthwork required	131000	cuft
Volume of slab concrete requir	5110	cuft
Volume of wall concrete requir	4700	cuft
Capacity per pump	1420	gpm(US)
Number of constant speed pur	2	
Number of variable speed pur	0	
Diameter of discharge header	8.51	in
Total dynamic head	88.1	ft
Size of selected pump	8	in
Specific speed of pump	2360	
Pump rotating speed	3050	rpm
Motor size required	47.6	HP
Size of selected motor	50	HP
Width of pump system	2.2	ft
Length of pump system	16.6	ft
Length of the dry well	16.4	ft
Width of the dry well	25.6	ft
Costs		
Construction and equipment co	448000	$
Earthwork Cost	38700	$
Wall Concrete Cost	113000	$
Slab Concrete Cost	66300	$
Building Cost	48400	$
Installed Pump Equipment C	113000	$
Misc Costs	68300	$
Operational labor cost	24800	$/yr
Maintenance labor cost	16300	$/yr
Material and supply cost	3130	$/yr
Chemical cost	0	$/yr
Energy cost	4690	$/yr
Amortization cost	39000	$/yr

Microscreening

Design Output Data

Description	Value	Units
Microscreening		
Design Information		
Microscreen loading rate	7	gal(US)/(sqft·min)
Quantity of wash water require	4	%
Area of microscreens required	199	sqft
Quantities		
Number of batteries	1	
Number of units/battery	2	
Drum diameter	6	ft
Drum width	6	ft
Area of selected unit	108	sqft
Area of building	155	sqft
Operation labor required	80.6	pers-hrs/yr
Maintenance labor required	51.9	pers-hrs/yr
Electrical energy required	97800	kWh/yr
Volume of wall concrete requir	2600	cuft
Volume of earthwork required	5860	cuft
Costs		
Construction and equipment co	307000	$
Earthwork Cost	1740	$
Slab Concrete Cost	62600	$
Building Cost	17000	$
Installed Equipment Cost	186000	$
Misc Costs	40000	$
Operational labor cost	4150	$/yr
Maintenance labor cost	2110	$/yr
Material and supply cost	27800	$/yr
Chemical cost	0	$/yr
Energy cost	9780	$/yr
Amortization cost	32900	$/yr

Intermediate Process Pumping

Design Output Data

Description	Value	Units
Intermediate Pumping		
Design Information		
Average daily pumping rate	0.5	MGD(US)
Total pumping capacity	2	MGD(US)
Design capacity per pump	694	gpm(US)

Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.5	MGD(US)
Quantities		
Operation labor required	402	pers-hrs/yr
Maintenance labor required	325	pers-hrs/yr
Electrical energy required	16700	kWh/yr
Volume of earthwork required	1920	cuft
Area of pump building	239	sqft
Costs		
Construction and equipment cc	110000	$
Earthwork Cost	568	$
Pump Building Cost	26300	$
Installed Pump Cost	66500	$
Misc Costs	16800	$
Operational labor cost	20700	$/yr
Maintenance labor cost	13200	$/yr
Material and supply cost	771	$/yr
Chemical cost	0	$/yr
Energy cost	1670	$/yr
Amortization cost	10400	$/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	12.5	gpm(US)
Final solids content	19	%
Solids capture fraction	0.992	
Quantities		
Operation labor required	14.2	pers-hrs/yr
Maintenance labor required	3.56	pers-hrs/yr
Power	5280	kWh/yr
Polymer required	1860	lb/yr
Dry solids produced	510	lb/d
Belt filter(s)	275000	$
Building	279000	$
Installation	68800	$
Polymer system	82500	$
Feed pumps	30300	$
Conveyor system	77000	$
Costs		
Construction and equipment cc	812000	$
Building Cost	279000	$
Polymer System Cost	82500	$
Feed Pumps Cost	30300	$
Conveyor System Cost	77000	$
Installed Belt Filter	344000	$
Operational labor cost	733	$/yr
Maintenance labor cost	145	$/yr
Material and supply cost	0	$/yr
Chemical cost	2420	$/yr
Energy cost	528	$/yr
Amortization cost	74300	$/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	6490	mg/L
Calculated VSS:TSS ratio	0.721	mg VSS/mg SS
Total volume of anaerobic reac	83.2	m3
Total volume of anoxic reactors	194	m3
Total volume of aerobic reacto	277	m3
Total volume of all reactors	554	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	1	
Number of aerobic cells within	1	
Anaerobic hydraulic retention ti	1.05	hr
Anoxic hydraulic retention time	2.44	hr

Aerobic hydraulic retention time	3.49	hr
Amount of sludge generated	200	kg/d
Sludge recycle ratio	300	%
Sludge recycle rate	5720	m3/d
Nitrogen required for biomass	12.8	mg/L
Phosphorus required for biomass	2.56	mg/L
Oxygen required to meet avera	397	kg/d
Air flow required to meet avera	659	N m3/hr
Design air flow	39.6	N m3/min/1000 m3
Quantities		
Operation labor required	1160	pers-hrs/yr
Maintenance labor required	540	pers-hrs/yr
Electrical energy required	148000	kWh/yr
Volume of earthwork required	22600	cuft
Volume of slab concrete requir	4630	cuft
Volume of wall concrete requir	4280	cuft
Handrail length	119	ft
Number of diffusers per train	105	
Fine bubble diffuser floor cover	14.4	%
Number of swing arm headers	1	
Required mixing power	3.9	kW
Total number of mixers	4	
Design mixing power per mixer	1.12	kW
Mixing power for each unaerate	0.975	kW
Costs		
Construction and equipment co	340000	$
Earthwork Cost	6680	$
Wall Concrete Cost	103000	$
Slab Concrete Cost	60000	$
Handrail Cost	8960	$
Installed Aerator Equipment	53700	$
Air Piping Cost	17600	$
Installed Mixer Equipment Co	56200	$
Misc Costs	33700	$
Operational labor cost	59700	$/yr
Maintenance labor cost	21900	$/yr
Material and supply cost	14100	$/yr
Chemical cost	0	$/yr
Energy cost	14800	$/yr
Amortization cost	31500	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	0.756	MGD(US)
Total pumping capacity	0.756	MGD(US)
Design capacity per pump	263	gpm(US)
Number of pumps	6	
Number of batteries	1	
Firm pumping capacity	0.756	MGD(US)
Quantities		
Operation labor required	424	pers-hrs/yr
Maintenance labor required	345	pers-hrs/yr
Electrical energy required	50700	kWh/yr
Volume of earthwork required	1720	cuft
Area of pump building	215	sqft
Costs		
Construction and equipment co	159000	$
Earthwork Cost	1020	$
Pump Building Cost	47300	$
Installed Pump Cost	86700	$
Misc Costs	24300	$
Operational labor cost	21900	$/yr
Maintenance labor cost	14000	$/yr
Material and supply cost	1110	$/yr
Chemical cost	0	$/yr
Energy cost	5070	$/yr
Amortization cost	15100	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	1.01	MGD(US)
Total pumping capacity	1.01	MGD(US)
Design capacity per pump	350	gpm(US)
Number of pumps	6	
Number of batteries	1	
Firm pumping capacity	1.01	MGD(US)
Quantities		
Operation labor required	440	pers-hrs/yr
Maintenance labor required	360	pers-hrs/yr
Electrical energy required	67500	kWh/yr
Volume of earthwork required	1760	cuft
Area of pump building	220	sqft
Costs		
Construction and equipment co	174000	$

Earthwork Cost	1040	$
Pump Building Cost	48400	$
Installed Pump Cost	98400	$
Misc Costs	26600	$
Operational labor cost	22700	$/yr
Maintenance labor cost	14600	$/yr
Material and supply cost	1220	$/yr
Chemical cost	0	$/yr
Energy cost	6750	$/yr
Amortization cost	16500	$/yr
Sludge Recycle Pumping		
Design Information		
Average daily pumping rate	0.504	MGD(US)
Total pumping capacity	0.504	MGD(US)
Design capacity per pump	175	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.504	MGD(US)
Quantities		
Operation labor required	403	pers-hrs/yr
Maintenance labor required	325	pers-hrs/yr
Electrical energy required	16900	kWh/yr
Volume of earthwork required	1680	cuft
Area of pump building	210	sqft
Costs		
Construction and equipment cc	70600	$
Earthwork Cost	498	$
Pump Building Cost	23100	$
Installed Pump Cost	36200	$
Misc Costs	10800	$
Operational labor cost	20800	$/yr
Maintenance labor cost	13200	$/yr
Material and supply cost	494	$/yr
Chemical cost	0	$/yr
Energy cost	1690	$/yr
Amortization cost	6680	$/yr

Ultra-Violet Disinfection

Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calc	2.12	gal(US)/(min·W)
Total number of lamps needed	50	
Number of spare channels	1	
Total number of lamps used in	72	
Number of excess lamps	22	
Number of lamps/modules	2	
Number of modules/bank	3	
Number of banks/channel	3	
Number of channels	4	
Calculated headloss	10.8	in
Costs		
Construction and equipment cc	215000	$
Cost of installation	129000	$
Total cost of UV lamps	85900	$
Operational labor cost	0	$/yr
Maintenance labor cost	2190	$/yr
Material and supply cost	2150	$/yr
Chemical cost	747	$/yr
Energy cost	5360	$/yr
Amortization cost	18200	$/yr

Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	1.32	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	1.32	cuyd/d
Maximum anticipated landfill dc	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	134	sqft
Width of sludge storage shed s	8.19	ft
Length of sludge storage shed	16.4	ft

Volume of earthwork required	509	cuft
Volume of slab concrete requir	247	cuft
Surface area of canopy roof	134	sqft
Round trip haul distance	20	miles
Round trips per day per truck	1	
Distance traveled per year per	5000	miles
Sludge hauled	1.17	ton(short)/d
Operation labor required	20.7	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment cc	289000	$
Earthwork Cost	151	$
Slab Concrete Cost	3200	$
Canopy Roof Cost	2680	$
Vehicle Cost	283000	$
Operational labor cost	1070	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	53600	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	61800	$/yr

Membrane Bioreactor

Design Output Data

Description	Value	Units
Membrane Bioreactor		
Design Information		
Total volume of reactors	12400	cuft
Length of parallel train	22.5	ft
Width of parallel train	11.2	ft
Sidewater depth	16.4	ft
Number of batteries	1	
Number of parallel trains per b	3	
Total Membrane Area	15800	m2
Total Scour Air Requirement	3160	N m3/hr
Quantities		
Operation labor required	2390	pers-hrs/yr
Maintenance labor required	1250	pers-hrs/yr
Electrical energy required	359000	kWh/yr
Volume of earthwork required	15800	cuft
Volume of slab concrete requir	3180	cuft
Volume of wall concrete requir	4400	cuft
Handrail length	253	ft
Number of diffusers per train	78	
Number of swing arm headers	1	
Costs		
Construction and equipment cc	1680000	$
Earthwork Cost	4680	$
Wall Concrete Cost	106000	$
Slab Concrete Cost	41200	$
Handrail Cost	19000	$
Membrane Cost	1360000	$
Installed Aerator Equipment	69000	$
Air Piping Cost	43100	$
Misc Cost	38700	$
Operational labor cost	123000	$/yr
Maintenance labor cost	50700	$/yr
Material and supply cost	16800	$/yr
Chemical cost	10300	$/yr
Energy cost	35900	$/yr
Amortization cost	231000	$/yr
Permeate Pumping		
Design Information		
Average daily pumping rate	0.252	MGD(US)
Total pumping capacity	1	MGD(US)
Design capacity per pump	387	gpm(US)
Number of pumps	6	
Number of batteries	1	
Firm pumping capacity	2.23	MGD(US)
Quantities		
Operation labor required	488	pers-hrs/yr
Maintenance labor required	405	pers-hrs/yr
Electrical energy required	15200	kWh/yr
Volume of earthwork required	1780	cuft
Area of pump building	222	sqft
Costs		
Construction and equipment cc	180000	$
Earthwork Cost	1050	$
Pump Building Cost	48800	$
Installed Pump Cost	103000	$
Misc Costs	27500	$
Operational labor cost	25100	$/yr

Maintenance labor cost	16500	$/yr
Material and supply cost	1260	$/yr
Chemical cost	0	$/yr
Energy cost	1520	$/yr
Amortization cost	17000	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.00427	MGD(US)
Total pumping capacity	0.00427	MGD(US)
Design capacity per pump	1.48	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.00427	MGD(US)
Quantities		
Operation labor required	218	pers-hrs/yr
Maintenance labor required	161	pers-hrs/yr
Electrical energy required	145	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment cc	31800	$
Earthwork Cost	474	$
Pump Building Cost	22000	$
Installed Pump Cost	4430	$
Misc Costs	4840	$
Operational labor cost	11200	$/yr
Maintenance labor cost	6530	$/yr
Material and supply cost	222	$/yr
Chemical cost	0	$/yr
Energy cost	14	$/yr
Amortization cost	3000	$/yr

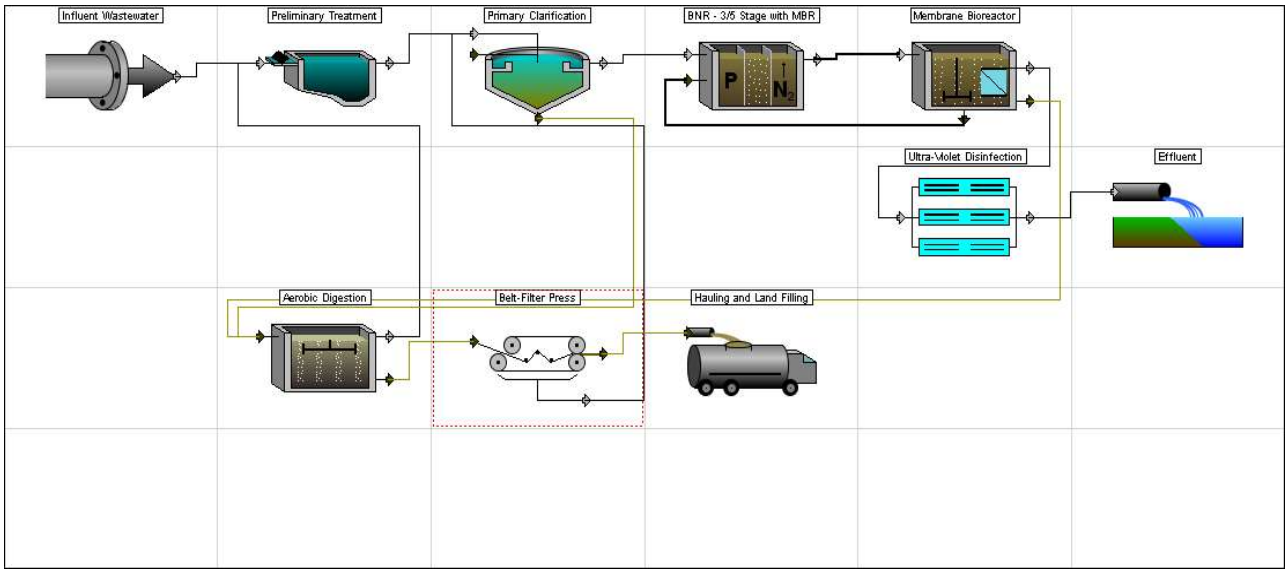
Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	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

Moroni City

Layout 1 Moroni City



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$6,760,000	$
Other direct construction costs	$1,960,000	$
Other indirect construction cos	$6,620,000	$
Total construction costs	$15,300,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$16,500	$/yr
Laboratory labor cost	$124,000	$/yr
Unit process operation labor c	$462,000	$/yr
Unit process maintenance labc	$223,000	$/yr
Total labor costs	$826,000	$/yr
MATERIAL COSTS		
Total material cost	$157,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$23,000	$/yr
ENERGY COSTS		
Total energy cost	$167,000	$/yr
Total operation and maintanen	$1,170,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$1,470,000	$/yr
Total annual project cost	$2,640,000	$/yr
PROJECT SUMMARY		
Present worth	$31,700,000	$
Total project cost	$15,300,000	$
Total operation labor cost	$603,000	$/yr
Total maintenance labor cost	$223,000	$/yr
Total material cost	$157,000	$/yr
Total chemical cost	$23,000	$/yr
Total energy cost	$167,000	$/yr
Total amortization cost	$1,470,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Preliminary Treatment	317000	29900	13700	7920	0	1530	26600
Aerobic Digestion	420000	63800	25500	46200	0	47700	36900
Primary Clarification	226000	29600	15000	2170	0	761	21300
Belt-Filter Press	812000	1910	384	0	6320	1280	74300

BNR - 3/5 Stage with MBR	864000	142000	73900	17000	0	50300	81700
Hauling and Land Filling	301000	3530	0	53600	0	0	62700
Membrane Bioreactor	2750000	191000	91100	26800	15500	56700	369000
Ultra-Violet Disinfection	358000	0	3730	3580	1250	8940	30300
Effluent	0	0	0	0	0	0	0
Blower System	714000	0	0	0	0	0	59900
Other Costs	8590000	141000	0	0	0	0	704000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	10	acre
Administration labor hours	321	hr/yr
Laboratory labor hours	2410	hr/yr
Costs		
DIRECT COSTS		
Mobilization	171000	$
Site preparation	303000	$
Site electrical	448000	$
Yard piping	309000	$
Instrumentation and control	208000	$
Lab and administration building	526000	$
Total direct construction costs	1960000	$
INDIRECT COSTS		
Cost of land	200000	$
Miscellaneous cost	502000	$
Legal cost	201000	$
Engineering design fee	1500000	$
Inspection cost	201000	$
Contingency	1000000	$
Technical	201000	$
Interest during construction	1500000	$
Profit	1310000	$
Total indirect construction cost	6620000	$
Total of other construction cos	8590000	$
LABOR COSTS		
Administration labor cost	16500	$/yr
Laboratory labor cost	124000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	6890	scfm
Safety factor	1.5	
Requested air flow capacity	10300	scfm
Total capacity of blowers	10300	scfm
Number of blowers in use	2	
Total number of blowers	3	
Capacity of individual blowers	5170	scfm
Estimated cost of an installed l	164000	$
Blower building area	1360	sqft
Costs		
Construction and equipment cc	714000	$
Installed Blower Cost	493000	$
Building Cost	150000	$
Misc Costs	70800	$
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	59900	$/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	0.559	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	4.63	cuft/s
Average flow	1.4	cuft/s
Minimum flow	0.936	cuft/s
Temperature	10.1	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	2.32	cuft/s
Width of channel	0.386	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0708	ft/s
Slope of channel bottom	0.00567	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	3.63	cuft/d
Costs		
Construction and equipment cc	317000	$
Operational labor cost	29900	$/yr
Maintenance labor cost	13700	$/yr
Material and supply cost	7920	$/yr
Chemical cost	0	$/yr
Energy cost	1530	$/yr
Amortization cost	26600	$/yr

Aerobic Digestion

Design Output Data

Description	Value	Units
Aerobic Digestion		
Design Information		
Solids retention time	28.2	d
Design SS	12000	mg/L
Calculated VSS	7280	mg/L
Calculated VSS:TSS ratio	0.607	mg VSS/mg SS
Total volume of reactors	1240	m3
Length of parallel train	13	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	544	kg/d
Air flow required to meet avera	3010	N m3/hr
Design air flow	40.3	N m3/min/1000 m3
Volatile solids loading	0.0358	lb/(cuft·d)
Solids accumulated	1170	lb/d
Digester capacity	32900	lb
Volume of wasted sludge	150000	gal(US)
Quantities		
Operation labor required	1240	pers-hrs/yr
Maintenance labor required	615	pers-hrs/yr
Electrical energy required	477000	kWh/yr
Volume of earthwork required	35200	cuft
Volume of slab concrete requir	7530	cuft
Volume of wall concrete requir	6010	cuft
Handrail length	165	ft
Number of diffusers per train	78	
Number of swing arm headers	2	
Costs		
Construction and equipment cc	420000	$
Earthwork Cost	10400	$
Wall Concrete Cost	145000	$
Slab Concrete Cost	97600	$
Handrail Cost	12400	$
Installed Aerator Equipment	85800	$
Air Piping Cost	27100	$
Misc Costs	41600	$
Operational labor cost	63800	$/yr
Maintenance labor cost	25500	$/yr
Material and supply cost	46200	$/yr
Chemical cost	0	$/yr
Energy cost	47700	$/yr
Amortization cost	36900	$/yr

Primary Clarification

Design Output Data

Description	Value	Units
Primary Clarification		
Design Information		
Surface area	1140	sqft
Surface area per circular clarifi	570	sqft
Diameter of each circular clarif	27	ft
Number of clarifiers per battery	2	
Number of batteries	1	
Solids loading rate	1.65	lb/(sqft·d)
Hydraulic retention time	2.02	hr
Weir length	301	ft
Volume of sludge generated	3270	gpd(US)
Quantities		
Operation labor required	365	pers-hrs/yr
Maintenance labor required	207	pers-hrs/yr
Electrical energy required	7500	kWh/yr
Volume of earthwork required	15400	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	1340	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	1930	cuft
Costs		
Construction and equipment cc	195000	$
Earthwork Cost	4550	$
Wall Concrete Cost	46300	$
Slab Concrete Cost	17400	$
Installed Equipment Cost	96800	$
Misc Costs	29700	$
Operational labor cost	18800	$/yr
Maintenance labor cost	8600	$/yr
Material and supply cost	1950	$/yr
Chemical cost	0	$/yr
Energy cost	750	$/yr
Amortization cost	18400	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.00327	MGD(US)
Total pumping capacity	0.00327	MGD(US)
Design capacity per pump	1.14	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.00327	MGD(US)
Quantities		
Operation labor required	211	pers-hrs/yr
Maintenance labor required	155	pers-hrs/yr
Electrical energy required	111	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment cc	31200	$
Earthwork Cost	474	$
Pump Building Cost	22000	$
Installed Pump Cost	3940	$
Misc Costs	4760	$
Operational labor cost	10900	$/yr
Maintenance labor cost	6410	$/yr
Material and supply cost	218	$/yr
Chemical cost	0	$/yr
Energy cost	11	$/yr
Amortization cost	2950	$/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	15.5	gpm(US)
Final solids content	15	%
Solids capture fraction	0.996	
Quantities		
Operation labor required	37	pers-hrs/yr
Maintenance labor required	9.26	pers-hrs/yr
Power	12800	kWh/yr
Polymer required	4860	lb/yr
Dry solids produced	1330	lb/d
Belt filter(s)	275000	$
Building	279000	$
Installation	68800	$

Polymer system	82500	$
Feed pumps	30300	$
Conveyor system	77000	$
Costs		
Construction and equipment cc	812000	$
Building Cost	279000	$
Polymer System Cost	82500	$
Feed Pumps Cost	30300	$
Conveyor System Cost	77000	$
Installed Belt Filter	344000	$
Operational labor cost	1910	$/yr
Maintenance labor cost	384	$/yr
Material and supply cost	0	$/yr
Chemical cost	6320	$/yr
Energy cost	1280	$/yr
Amortization cost	74300	$/yr

BNR - 3/5 Stage with MBR

Design Output Data

Description	Value	Units
BNR System for BIO-P and N Removal		
Design Information		
Influent BOD/TP ratio too smal		
3-Stage Biological Phosphorus		
Max. specific growth of nitrifier	0.379	1/d
Death rate of nitrifiers at winter	0.0604	1/d
Minimum aerobic SRT for nitrif	4.67	d
Design aerobic SRT for nitrifica	6.47	d
Total reactor SRT	10.5	d
Design SS	9000	mg/L
Calculated VSS	6360	mg/L
Calculated VSS:TSS ratio	0.706	mg VSS/mg SS
Total volume of anaerobic reac	0	m3
Total volume of anoxic reactors	207	m3
Total volume of aerobic reacto	332	m3
Total volume of all reactors	539	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	1	
Number of aerobic cells within	1	
Anaerobic hydraulic retention ti	0	hr
Anoxic hydraulic retention time	1.44	hr
Aerobic hydraulic retention time	2.32	hr
Amount of sludge generated	462	kg/d
Sludge recycle ratio	300	%
Sludge recycle rate	10300	m3/d
Nitrogen required for biomass	13.3	mg/L
Phosphorus required for bioma	2.67	mg/L
Oxygen required to meet avera	725	kg/d
Air flow required to meet avera	1200	N m3/hr
Design air flow	60.4	N m3/min/1000 m3
Quantities		
Operation labor required	1380	pers-hrs/yr
Maintenance labor required	657	pers-hrs/yr
Electrical energy required	260000	kWh/yr
Volume of earthwork required	24400	cuft
Volume of slab concrete requir	5040	cuft
Volume of wall concrete requir	4530	cuft
Handrail length	126	ft
Number of diffusers per train	214	
Fine bubble diffuser floor cover	22	%
Number of swing arm headers	1	
Required mixing power	3.9	kW
Total number of mixers	4	
Design mixing power per mixer	1.12	kW
Mixing power for each unaerate	0.975	kW
Costs		
Construction and equipment cc	374000	$
Earthwork Cost	7220	$
Wall Concrete Cost	109000	$
Slab Concrete Cost	65400	$
Handrail Cost	9450	$
Installed Aerator Equipment	68100	$
Air Piping Cost	21100	$
Installed Mixer Equipment Cc	56200	$
Misc Costs	37000	$
Operational labor cost	71200	$/yr
Maintenance labor cost	27300	$/yr
Material and supply cost	13600	$/yr
Chemical cost	0	$/yr

Energy cost	26000	$/yr
Amortization cost	35400	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	1.36	MGD(US)
Total pumping capacity	1.36	MGD(US)
Design capacity per pump	473	gpm(US)
Number of pumps	6	
Number of batteries	1	
Firm pumping capacity	1.36	MGD(US)
Quantities		
Operation labor required	458	pers-hrs/yr
Maintenance labor required	377	pers-hrs/yr
Electrical energy required	91300	kWh/yr
Volume of earthwork required	1820	cuft
Area of pump building	227	sqft
Costs		
Construction and equipment cc	193000	$
Earthwork Cost	1080	$
Pump Building Cost	49900	$
Installed Pump Cost	112000	$
Misc Costs	29400	$
Operational labor cost	23600	$/yr
Maintenance labor cost	15600	$/yr
Material and supply cost	1350	$/yr
Chemical cost	0	$/yr
Energy cost	9130	$/yr
Amortization cost	18200	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	1.82	MGD(US)
Total pumping capacity	1.82	MGD(US)
Design capacity per pump	631	gpm(US)
Number of pumps	6	
Number of batteries	1	
Firm pumping capacity	1.82	MGD(US)
Quantities		
Operation labor required	475	pers-hrs/yr
Maintenance labor required	393	pers-hrs/yr
Electrical energy required	122000	kWh/yr
Volume of earthwork required	1890	cuft
Area of pump building	236	sqft
Costs		
Construction and equipment cc	213000	$
Earthwork Cost	1120	$
Pump Building Cost	51900	$
Installed Pump Cost	128000	$
Misc Costs	32500	$
Operational labor cost	24500	$/yr
Maintenance labor cost	16300	$/yr
Material and supply cost	1490	$/yr
Chemical cost	0	$/yr
Energy cost	12200	$/yr
Amortization cost	20100	$/yr
Sludge Recycle Pumping		
Design Information		
Average daily pumping rate	0.909	MGD(US)
Total pumping capacity	0.909	MGD(US)
Design capacity per pump	316	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.909	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 cc	84300	$
Earthwork Cost	517	$
Pump Building Cost	24000	$
Installed Pump Cost	47000	$
Misc Costs	12900	$
Operational labor cost	22400	$/yr
Maintenance labor cost	14700	$/yr
Material and supply cost	590	$/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	4.38	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	4.38	cuyd/d
Maximum anticipated landfill dc	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	444	sqft
Width of sludge storage shed s	14.9	ft
Length of sludge storage shed	29.8	ft
Volume of earthwork required	1410	cuft
Volume of slab concrete requir	648	cuft
Surface area of canopy roof	444	sqft
Round trip haul distance	20	miles
Round trips per day per truck	1	
Distance traveled per year per	5000	miles
Sludge hauled	3.88	ton(short)/d
Operation labor required	68.5	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment cc	301000	$
Earthwork Cost	417	$
Slab Concrete Cost	8400	$
Canopy Roof Cost	8870	$
Vehicle Cost	283000	$
Operational labor cost	3530	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	53600	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	62700	$/yr

Membrane Bioreactor

Design Output Data

Description	Value	Units
Membrane Bioreactor		
Design Information		
Total volume of reactors	18600	cuft
Length of parallel train	27.5	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	23700	m2
Total Scour Air Requirement	4750	N m3/hr
Quantities		
Operation labor required	2960	pers-hrs/yr
Maintenance labor required	1580	pers-hrs/yr
Electrical energy required	540000	kWh/yr
Volume of earthwork required	19900	cuft
Volume of slab concrete requir	4090	cuft
Volume of wall concrete requir	5390	cuft
Handrail length	309	ft
Number of diffusers per train	117	
Number of swing arm headers	2	
Costs		
Construction and equipment cc	2510000	$
Earthwork Cost	5910	$
Wall Concrete Cost	130000	$
Slab Concrete Cost	53000	$
Handrail Cost	23100	$
Membrane Cost	2050000	$
Installed Aerator Equipment	133000	$
Air Piping Cost	68400	$
Misc Cost	60200	$
Operational labor cost	152000	$/yr
Maintenance labor cost	65700	$/yr
Material and supply cost	25100	$/yr
Chemical cost	15500	$/yr
Energy cost	54000	$/yr
Amortization cost	346000	$/yr
Permeate Pumping		
Design Information		
Average daily pumping rate	0.454	MGD(US)

Total pumping capacity	1.5	MGD(US)
Design capacity per pump	580	gpm(US)
Number of pumps	6	
Number of batteries	1	
Firm pumping capacity	3.34	MGD(US)
Quantities		
Operation labor required	514	pers-hrs/yr
Maintenance labor required	430	pers-hrs/yr
Electrical energy required	27500	kWh/yr
Volume of earthwork required	1860	cuft
Area of pump building	233	sqft
Costs		
Construction and equipment cc	207000	$
Earthwork Cost	1100	$
Pump Building Cost	51300	$
Installed Pump Cost	123000	$
Misc Costs	31500	$
Operational labor cost	26500	$/yr
Maintenance labor cost	17800	$/yr
Material and supply cost	1450	$/yr
Chemical cost	0	$/yr
Energy cost	2750	$/yr
Amortization cost	19600	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.00988	MGD(US)
Total pumping capacity	0.00988	MGD(US)
Design capacity per pump	3.43	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.00988	MGD(US)
Quantities		
Operation labor required	243	pers-hrs/yr
Maintenance labor required	182	pers-hrs/yr
Electrical energy required	335	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment cc	34100	$
Earthwork Cost	475	$
Pump Building Cost	22000	$
Installed Pump Cost	6410	$
Misc Costs	5200	$
Operational labor cost	12500	$/yr
Maintenance labor cost	7550	$/yr
Material and supply cost	239	$/yr
Chemical cost	0	$/yr
Energy cost	34	$/yr
Amortization cost	3230	$/yr

Ultra-Violet Disinfection

Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calc	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 cc	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

Effluent

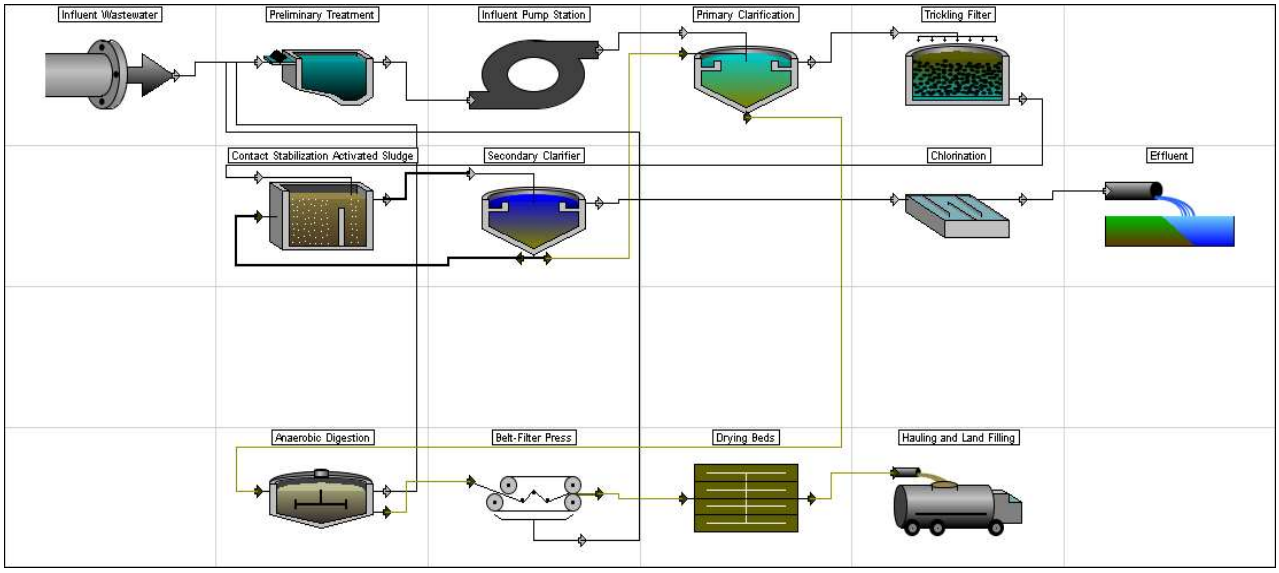
Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	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

North Davis Sewer District

Layout - North Davis SD



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$90,100,000	$
Other direct construction costs	$23,200,000	$
Other indirect construction cos	$84,000,000	$
Total construction costs	$197,000,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$290,000	$/yr
Laboratory labor cost	$264,000	$/yr
Unit process operation labor c	$2,930,000	$/yr
Unit process maintenance labc	$1,460,000	$/yr
Total labor costs	$4,950,000	$/yr
MATERIAL COSTS		
Total material cost	$934,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$946,000	$/yr
ENERGY COSTS		
Total energy cost	$911,000	$/yr
Total operation and maintanen	$7,740,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$17,000,000	$/yr
Total annual project cost	$24,700,000	$/yr
PROJECT SUMMARY		
Present worth	$296,000,000	$
Total project cost	$197,000,000	$
Total operation labor cost	$3,490,000	$/yr
Total maintenance labor cost	$1,460,000	$/yr
Total material cost	$934,000	$/yr
Total chemical cost	$946,000	$/yr
Total energy cost	$911,000	$/yr
Total amortization cost	$17,000,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Preliminary Treatment	2450000	296000	118000	61300	0	8320	206000
Contact Stabilization Activated	10900000	190000	118000	149000	0	383000	990000
Anaerobic Digestion	20300000	302000	177000	211000	0	95500	1930000
Influent Pump Station	20500000	114000	83300	143000	0	91300	1740000

Secondary Clarifier	4390000	218000	119000	43700	0	5010	399000
Belt-Filter Press	2180000	76600	17900	0	254000	38900	203000
Primary Clarification	2810000	149000	81300	27900	0	2670	258000
Drying Beds	5340000	1220000	570000	48000	0	0	465000
Trickling Filter	16200000	176000	118000	93400	0	270000	1380000
Chlorination	3630000	145000	58700	84800	692000	16800	341000
Hauling and Land Filling	549000	42600	0	71800	0	0	93600
Effluent	0	0	0	0	0	0	0
Blower System	911000	0	0	0	0	0	76400
Other Costs	107000000	554000	0	0	0	0	8930000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	38	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	760000	$
Miscellaneous cost	6520000	$
Legal cost	2610000	$
Engineering design fee	19600000	$
Inspection cost	2610000	$
Contingency	13000000	$
Technical	2610000	$
Interest during construction	19300000	$
Profit	17000000	$
Total indirect construction cost	84000000	$
Total of other construction cos	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	10300	scfm
Safety factor	1.5	
Requested air flow capacity	15400	scfm
Total capacity of blowers	15400	scfm
Number of blowers in use	3	
Total number of blowers	4	
Capacity of individual blowers	5130	scfm
Estimated cost of an installed l	164000	$
Blower building area	1510	sqft
Costs		
Construction and equipment co	911000	$
Installed Blower Cost	654000	$
Building Cost	166000	$
Misc Costs	90300	$
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	76400	$/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	0.5	in

Slope of bars from horizontal	30	degrees
Head loss through screen	0.176	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	21.7	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	123	cuft/s
Average flow	54.2	cuft/s
Minimum flow	35.7	cuft/s
Temperature	10	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	61.7	cuft/s
Width of channel	10.3	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.000263	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	141	cuft/d
Costs		
Construction and equipment cc	2450000	$
Operational labor cost	296000	$/yr
Maintenance labor cost	118000	$/yr
Material and supply cost	61300	$/yr
Chemical cost	0	$/yr
Energy cost	8320	$/yr
Amortization cost	206000	$/yr

Contact Stabilization Activated Sludge

Design Output Data

Description	Value	Units
Contact Stabilization Activated Sludge		
Design Information		
Calculated SRT for design	15	d
Average SS	3880	mg/L
Average VSS	2870	mg/L
Calculated VSS:TSS ratio	0.74	mg VSS/mg SS
Total volume of reactors	39300	m3
Volume of contact tank	11200	m3
Volume of stabilization tank	28100	m3
Length of parallel train	79	m
Width of parallel train	10	m
Sidewater depth	5	m
Number of batteries	1	
Number of parallel trains per b	10	
F/M ratio	0.0239	lb BOD/lb MLSS/d
Volumetric BOD loading	0.0686	kg BOD/m3/d
Observed yield (VSS basis)	4.18	g VSS/g BOD
Observed yield (TSS basis)	5.65	g TSS/g BOD
Amount of sludge generated	11200	kg/d
Sludge recycle rate	85300	m3/d
Nitrogen requirement for biom	5.58	mg/L
Phosphorus requirement for bi	1.12	mg/L
Oxygen requirement to meet a	3370	kg/d
Air flow required to meet avera	17300	N m3/hr
Design air flow	7.36	N m3/min/1000 m3
Quantities		
Operation labor required	2790	pers-hrs/yr
Maintenance labor required	1600	pers-hrs/yr
Electrical energy required	2640000	kWh/yr
Volume of earthwork required	652000	cuft
Volume of slab concrete requir	211000	cuft
Volume of wall concrete requir	119000	cuft
Handrail length	4070	ft
Number of diffusers per train	514	
Fine bubble diffuser floor cover	2.67	%
Number of swing arm headers	11	
Costs		
Construction and equipment cc	10200000	$
Earthwork Cost	193000	$
Wall Concrete Cost	2870000	$
Slab Concrete Cost	2740000	$
Handrail Cost	305000	$
Installed Aerator Equipment	2530000	$

Air Piping Cost	595000	$
Misc Costs	1010000	$
Operational labor cost	144000	$/yr
Maintenance labor cost	76700	$/yr
Material and supply cost	144000	$/yr
Chemical cost	0	$/yr
Energy cost	264000	$/yr
Amortization cost	928000	$/yr
Sludge Recycle Pumping		
Design Information		
Average daily pumping rate	35.6	MGD(US)
Total pumping capacity	35.6	MGD(US)
Design capacity per pump	12400	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	35.6	MGD(US)
Quantities		
Operation labor required	894	pers-hrs/yr
Maintenance labor required	860	pers-hrs/yr
Electrical energy required	1180000	kWh/yr
Volume of earthwork required	7220	cuft
Area of pump building	902	sqft
Costs		
Construction and equipment cc	656000	$
Earthwork Cost	2140	$
Pump Building Cost	99200	$
Installed Pump Cost	454000	$
Misc Costs	100000	$
Operational labor cost	46000	$/yr
Maintenance labor cost	41300	$/yr
Material and supply cost	4590	$/yr
Chemical cost	0	$/yr
Energy cost	118000	$/yr
Amortization cost	62000	$/yr

Anaerobic Digestion

Design Output Data

Description	Value	Units
Anaerobic Digestion		
Design Information		
Percent VSS destroyed	50	%
Solids concentration in digeste	5	%
Detention time	25	d
Digester depth	29.7	ft
Digester diameter	80	ft
Effective digester volume	1330000	cuft
Number of digesters per batter	8	
Number of primary digesters p	5	
Number of secondary digester	3	
Number of batteries	1	
Gas produced	290	cuft/min
Heat required	8100000	BTU/hr
Digester gas required	313	cuft/min
Total natural gas required	2350000	cuft/yr
Quantities		
Operation labor required	5870	pers-hrs/yr
Maintenance labor required	3670	pers-hrs/yr
Electrical energy required	556000	kWh/yr
Volume of earthwork required	1320000	cuft
Slab thickness	11.4	in
Volume of slab concrete requir	41500	cuft
Wall thickness	22.4	in
Volume of wall concrete requir	135000	cuft
Sidewater depth	29.7	ft
Surface area/floor of 2-story cc	6140	sqft
Piping size	10	in
Length of total piping system	2910	ft
Number of 90 degree elbows	104	
Number of tees	204	
Number of plug valves	148	
Total dry solids treated	37.3	ton(short)/d
Costs		
Construction and equipment cc	20300000	$
Earthwork Cost	393000	$
Wall Concrete Cost	3240000	$
Slab Concrete Cost	537000	$
Building Cost	676000	$
Piping System Cost	2100000	$
Floating Cover Cost	7370000	$
Gas Recirculation Units Cost	1540000	$
Heating Units Cost	1270000	$
Gas Safety Equipment Cost	598000	$

Installed Pumps Cost	599000	$
Operational labor cost	302000	$/yr
Maintenance labor cost	177000	$/yr
Material and supply cost	211000	$/yr
Chemical cost	0	$/yr
Energy cost	95500	$/yr
Amortization cost	1930000	$/yr

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	350000	cuft
Width of wet well	1470	ft
Depth of the pumping station	37.2	ft
Length of the pumping station	34.8	ft
Width of the pumping station	1520	ft
Minimum depth of water in wet	16.2	ft
Area of pump building	1780	sqft
Peak capacity of pumps	98	MGD(US)
Firm pumping capacity	98	MGD(US)
Total dynamic head - average	43.7	ft
Quantities		
Operation labor required	2210	pers-hrs/yr
Maintenance labor required	1730	pers-hrs/yr
Electrical energy required	913000	kWh/yr
Volume of earthwork required	6950000	cuft
Volume of slab concrete requir	723000	cuft
Volume of wall concrete requir	163000	cuft
Capacity per pump	68100	gpm(US)
Number of constant speed pur	2	
Number of variable speed pur	0	
Diameter of discharge header	59	in
Total dynamic head	50.4	ft
Size of selected pump	54	in
Specific speed of pump	8270	
Pump rotating speed	290	rpm
Motor size required	381	HP
Size of selected motor	400	HP
Width of pump system	11.4	ft
Length of pump system	39.7	ft
Length of the dry well	34.8	ft
Width of the dry well	48.7	ft
Costs		
Construction and equipment co	20500000	$
Earthwork Cost	2060000	$
Wall Concrete Cost	3910000	$
Slab Concrete Cost	9370000	$
Building Cost	196000	$
Installed Pump Equipment C	1800000	$
Misc Costs	3120000	$
Operational labor cost	114000	$/yr
Maintenance labor cost	83300	$/yr
Material and supply cost	143000	$/yr
Chemical cost	0	$/yr
Energy cost	91300	$/yr
Amortization cost	1740000	$/yr

Secondary Clarifier

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	89000	sqft
Surface area per circular clarifi	11100	sqft
Diameter of each circular clarif	120	ft
Number of clarifiers per batter	8	
Number of batteries	1	
Solids loading rate	21.1	lb/(sqft·d)
Hydraulic retention time	4.04	hr
Designed surface overflow rate	400	gal(US)/(sqft·d)
Weir length	5370	ft
Volume of wasted sludge	627000	gpd(US)
Quantities		
Operation labor required	3820	pers-hrs/yr
Maintenance labor required	2140	pers-hrs/yr
Electrical energy required	29100	kWh/yr
Volume of earthwork required	1290000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	85800	cuft
Wall thickness	11.5	in

Volume of wall concrete requir	31400	cuft
Costs		
Construction and equipment cc	4310000	$
Earthwork Cost	383000	$
Wall Concrete Cost	755000	$
Slab Concrete Cost	1110000	$
Installed Equipment Cost	1400000	$
Misc Costs	658000	$
Operational labor cost	197000	$/yr
Maintenance labor cost	103000	$/yr
Material and supply cost	43100	$/yr
Chemical cost	0	$/yr
Energy cost	2910	$/yr
Amortization cost	391000	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.627	MGD(US)
Total pumping capacity	0.627	MGD(US)
Design capacity per pump	218	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.627	MGD(US)
Quantities		
Operation labor required	414	pers-hrs/yr
Maintenance labor required	336	pers-hrs/yr
Electrical energy required	21000	kWh/yr
Volume of earthwork required	1700	cuft
Area of pump building	212	sqft
Costs		
Construction and equipment cc	75200	$
Earthwork Cost	503	$
Pump Building Cost	23400	$
Installed Pump Cost	39900	$
Misc Costs	11500	$
Operational labor cost	21300	$/yr
Maintenance labor cost	16100	$/yr
Material and supply cost	527	$/yr
Chemical cost	0	$/yr
Energy cost	2100	$/yr
Amortization cost	7110	$/yr

Belt-Filter Press

Design Output Data

Description	Value	Units
Belt-Filter Press		
Design Information		
Belt filter width	2	m
Number of units	3	
Hydraulic loading per unit per r	70	gpm(US)
Hydraulic loading required per	312	gpm(US)
Final solids content	19	%
Solids capture fraction	0.998	
Quantities		
Operation labor required	1490	pers-hrs/yr
Maintenance labor required	372	pers-hrs/yr
Power	389000	kWh/yr
Polymer required	196000	lb/yr
Dry solids produced	53600	lb/d
Belt filter(s)	903000	$
Building	393000	$
Installation	226000	$
Polymer system	334000	$
Feed pumps	99300	$
Conveyor system	226000	$
Costs		
Construction and equipment cc	2180000	$
Building Cost	393000	$
Polymer System Cost	334000	$
Feed Pumps Cost	99300	$
Conveyor System Cost	226000	$
Installed Belt Filter	1130000	$
Operational labor cost	76600	$/yr
Maintenance labor cost	17900	$/yr
Material and supply cost	0	$/yr
Chemical cost	254000	$/yr
Energy cost	38900	$/yr
Amortization cost	203000	$/yr

Primary Clarification

Design Output Data

Description	Value	Units
Primary Clarification		

Design Information		
Surface area	44800	sqft
Surface area per circular clarifi	5600	sqft
Diameter of each circular clarif	85	ft
Number of clarifiers per batter	8	
Number of batteries	1	
Solids loading rate	2.73	lb/(sqft·d)
Hydraulic retention time	2.02	hr
Weir length	8080	ft
Volume of sludge generated	213000	gpd(US)
Quantities		
Operation labor required	2520	pers-hrs/yr
Maintenance labor required	1410	pers-hrs/yr
Electrical energy required	19500	kWh/yr
Volume of earthwork required	586000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	44200	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	22500	cuft
Costs		
Construction and equipment co	2750000	$
Earthwork Cost	173000	$
Wall Concrete Cost	542000	$
Slab Concrete Cost	573000	$
Installed Equipment Cost	1040000	$
Misc Costs	420000	$
Operational labor cost	130000	$/yr
Maintenance labor cost	67500	$/yr
Material and supply cost	27500	$/yr
Chemical cost	0	$/yr
Energy cost	1950	$/yr
Amortization cost	253000	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.213	MGD(US)
Total pumping capacity	0.213	MGD(US)
Design capacity per pump	74	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.213	MGD(US)
Quantities		
Operation labor required	361	pers-hrs/yr
Maintenance labor required	286	pers-hrs/yr
Electrical energy required	7170	kWh/yr
Volume of earthwork required	1630	cuft
Area of pump building	204	sqft
Costs		
Construction and equipment co	56400	$
Earthwork Cost	484	$
Pump Building Cost	22500	$
Installed Pump Cost	24800	$
Misc Costs	8600	$
Operational labor cost	18600	$/yr
Maintenance labor cost	13800	$/yr
Material and supply cost	394	$/yr
Chemical cost	0	$/yr
Energy cost	717	$/yr
Amortization cost	5330	$/yr

Drying Beds

Design Output Data

Description	Value	Units
Sludge Drying Beds		
Design Information		
Total surface area required	386000	sqft
Initial depth of sludge	12	in
Final solids	50	%
Bed holding time	103	d
Quantities		
Total drying bed surface area	386000	sqft
Number beds	129	
Surface area of each individua	2990	sqft
Length of each bed	149	ft
Volume of earthwork required	1900000	cuft
Volume concrete for dividing w	124000	cuft
Volume of R.C. in-place for tru	28900	cuft
Volume of sand	289000	cuft
Volume of gravel	386000	cuft
Clay pipe diameter	6	in
Total length clay pipe	38600	in
Sludge solids produced	22.3	ton(short)/d
Operational labor required	23800	pers-hrs/yr

Maintenance labor required	11900	pers-hrs/yr
Costs		
Construction and equipment cc	5340000	$
Earthwork Cost	562000	$
Wall Concrete Cost	2100000	$
Slab Concrete Cost	225000	$
Drying Bed Media Cost	1080000	$
Drain Pipe System Cost	848000	$
Misc Costs	529000	$
Operational labor cost	1220000	$/yr
Maintenance labor cost	570000	$/yr
Material and supply cost	48000	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	465000	$/yr

Trickling Filter

Design Output Data

Description	Value	Units
Trickling Filtration		
Design Information		
Reaction rate constant	0.00156	
Hydraulic loading rate	0.75	gal(US)/(sqft·min)
Total hydraulic loading rate	0.752	gal(US)/(sqft·min)
Recirculation ratio	0.00313	
Number of towers per stage	2	
Number of stages	2	
Depth of filter tower	20.6	ft
Diameter of filter tower	145	ft
Surface area per filter tower	8240	sqft
Total surface area	33000	sqft
Volume per filter tower	340000	cuft
Total volume	1360000	cuft
Quantities		
Operation labor required	1610	pers-hr/yr
Maintenance labor required	998	pers-hr/yr
Volume of earthwork required	1010000	cuft
Volume of slab concrete requir	43900	cuft
Volume of wall concrete requir	46200	cuft
Number of posts per tower	1120	
Total length of precast beams	36400	ft
Costs		
Construction and equipment cc	14800000	$
Earthwork Cost	300000	$
Wall Concrete Cost	1110000	$
Slab Concrete Cost	570000	$
Concrete Beam Cost	1460000	$
Media Cost	7740000	$
Installed Distributor Arm Cos	626000	$
Misc Costs	2950000	$
Operational labor cost	83000	$/yr
Maintenance labor cost	48000	$/yr
Material and supply cost	83700	$/yr
Chemical cost	0	$/yr
Energy cost	2440	$/yr
Amortization cost	1250000	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	80.6	MGD(US)
Total pumping capacity	80.6	MGD(US)
Design capacity per pump	18700	gpm(US)
Number of pumps	4	
Number of batteries	1	
Firm pumping capacity	80.6	MGD(US)
Quantities		
Operation labor required	1810	pers-hrs/yr
Maintenance labor required	1460	pers-hrs/yr
Electrical energy required	2670000	kWh/yr
Volume of earthwork required	14300	cuft
Area of pump building	1790	sqft
Costs		
Construction and equipment cc	1390000	$
Earthwork Cost	4240	$
Pump Building Cost	197000	$
Installed Pump Cost	977000	$
Misc Costs	212000	$
Operational labor cost	93200	$/yr
Maintenance labor cost	70200	$/yr
Material and supply cost	9730	$/yr
Chemical cost	0	$/yr
Energy cost	267000	$/yr
Amortization cost	131000	$/yr

Chlorination

Design Output Data

Description	Value	Units
Chlorination		
Design Information		
Volume of tank	3330000	gal(US)
Average chlorine required	2920	lb/d
Peak chlorine required	6670	lb/d
Influent coliform count	10000000	/100ml
Effluent coliform count	3.72	/100ml
Quantities		
Operational labor required	2810	pers-hrs/yr
Maintenance labor required	1220	pers-hrs/yr
Electrical energy required	168000	kWh/yr
Volume of earthwork required	184000	cuft
Volume of slab concrete requir	44700	cuft
Volume of wall concrete requir	49800	cuft
Number of chlorinators and ev	1	
Chlorination building area	360	sqft
Number of chlorine cylinders	44	
Area of chlorine storage buildir	6160	sqft
Costs		
Construction and equipment cc	3630000	$
Earthwork Cost	54500	$
Wall Concrete Cost	1200000	$
Slab Concrete Cost	579000	$
Installed Equipment Cost	1090000	$
Building Cost	39600	$
Storage Building Cost	339000	$
Misc Costs	330000	$
Operational labor cost	145000	$/yr
Maintenance labor cost	58700	$/yr
Material and supply cost	84800	$/yr
Chemical cost	692000	$/yr
Energy cost	16800	$/yr
Amortization cost	341000	$/yr

Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	52.9	cuyd/d
Truck capacity	30	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	52.9	cuyd/d
Maximum anticipated landfill dc	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	5360	sqft
Width of sludge storage shed s	51.8	ft
Length of sludge storage shed	104	ft
Volume of earthwork required	14400	cuft
Volume of slab concrete requir	6070	cuft
Surface area of canopy roof	5360	sqft
Round trip haul distance	20	miles
Round trips per day per truck	2	
Distance traveled per year per	10000	miles
Sludge hauled	46.8	ton(short)/d
Operation labor required	827	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment cc	549000	$
Earthwork Cost	4260	$
Slab Concrete Cost	78700	$
Canopy Roof Cost	107000	$
Vehicle Cost	359000	$
Operational labor cost	42600	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	71800	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	93600	$/yr

Effluent

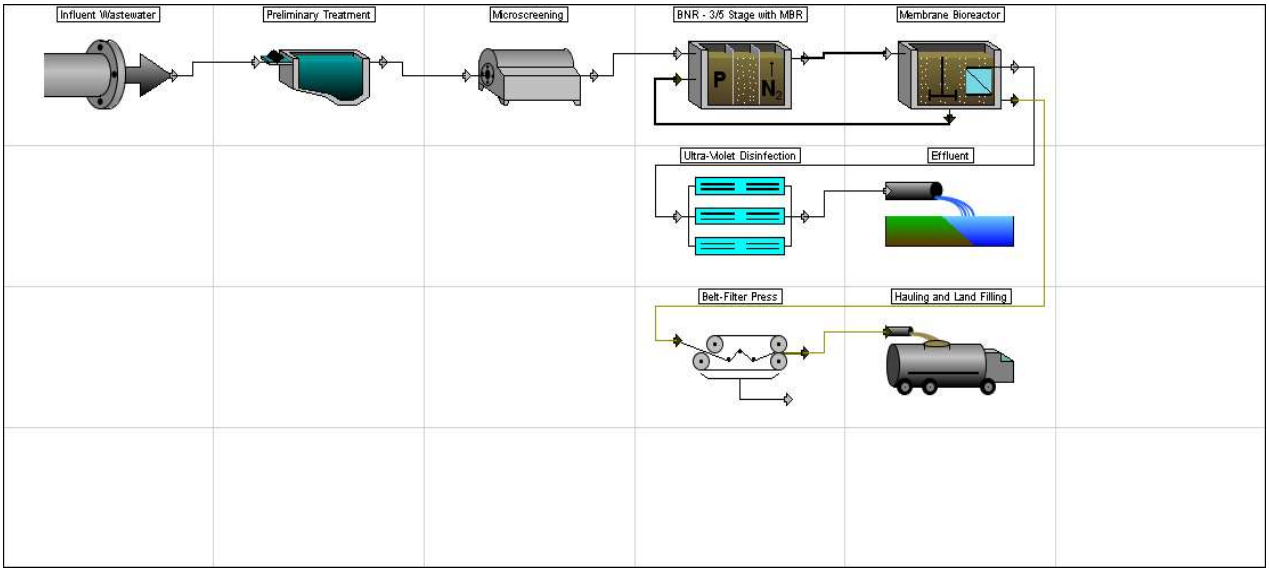
Design Output Data

Description	Value	Units

Costs		
Construction and equipment cc	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

North Fork Special Service District

Layout - North Fork



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$4,860,000	$
Other direct construction costs	$729,000	$
Other indirect construction cos	$4,300,000	$
Total construction costs	$9,880,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$5,090	$/yr
Laboratory labor cost	$98,900	$/yr
Unit process operation labor c	$291,000	$/yr
Unit process maintenance labc	$138,000	$/yr
Total labor costs	$534,000	$/yr
MATERIAL COSTS		
Total material cost	$163,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$12,000	$/yr
ENERGY COSTS		
Total energy cost	$69,200	$/yr
Total operation and maintanen	$778,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$963,000	$/yr
Total annual project cost	$1,740,000	$/yr
PROJECT SUMMARY		
Present worth	$20,900,000	$
Total project cost	$9,880,000	$
Total operation labor cost	$395,000	$/yr
Total maintenance labor cost	$138,000	$/yr
Total material cost	$163,000	$/yr
Total chemical cost	$12,000	$/yr
Total energy cost	$69,200	$/yr
Total amortization cost	$963,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Preliminary Treatment	246000	17900	8450	6140	0	759	20600
Microscreening	307000	1650	823	27800	0	9770	32900
BNR - 3/5 Stage with MBR	630000	112000	55400	18400	0	16600	58800
Ultra-Violet Disinfection	215000	0	2160	2150	747	5360	18200

Belt-Filter Press	812000	293	57	0	966	226	74300
Membrane Bioreactor	1890000	158000	71600	18200	10300	36500	250000
Effluent	0	0	0	0	0	0	0
Hauling and Land Filling	286000	1280	0	90400	0	0	61500
Blower System	475000	0	0	0	0	0	39800
Other Costs	5030000	104000	0	0	0	0	407000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	9	acre
Administration labor hours	98.9	hr/yr
Laboratory labor hours	1920	hr/yr
Costs		
DIRECT COSTS		
Mobilization	60500	$
Site preparation	128000	$
Site electrical	149000	$
Yard piping	106000	$
Instrumentation and control	64200	$
Lab and administration building	220000	$
Total direct construction costs	729000	$
INDIRECT COSTS		
Cost of land	180000	$
Miscellaneous cost	321000	$
Legal cost	128000	$
Engineering design fee	963000	$
Inspection cost	128000	$
Contingency	642000	$
Technical	128000	$
Interest during construction	969000	$
Profit	838000	$
Total indirect construction cost	4300000	$
Total of other construction cos	5030000	$
LABOR COSTS		
Administration labor cost	5090	$/yr
Laboratory labor cost	98900	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	3070	scfm
Safety factor	1.5	
Requested air flow capacity	4600	scfm
Total capacity of blowers	4600	scfm
Number of blowers in use	1	
Total number of blowers	2	
Capacity of individual blowers	4600	scfm
Estimated cost of an installed l	153000	$
Blower building area	1110	sqft
Costs		
Construction and equipment co	475000	$
Installed Blower Cost	306000	$
Building Cost	122000	$
Misc Costs	47100	$
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	39800	$/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	1.5	in
Slope of bars from horizontal	30	degrees
Head loss through screen	0.0206	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	0.123	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	3.08	cuft/s
Average flow	0.308	cuft/s
Minimum flow	0.154	cuft/s
Temperature	10	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	1.54	cuft/s
Width of channel	0.257	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.0111	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	0.8	cuft/d
Costs		
Construction and equipment cc	246000	$
Operational labor cost	17900	$/yr
Maintenance labor cost	8450	$/yr
Material and supply cost	6140	$/yr
Chemical cost	0	$/yr
Energy cost	759	$/yr
Amortization cost	20600	$/yr

Microscreening

Design Output Data

Description	Value	Units
Microscreening		
Design Information		
Microscreen loading rate	7	gal(US)/(sqft·min)
Quantity of wash water require	4	%
Area of microscreens required	198	sqft
Quantities		
Number of batteries	1	
Number of units/battery	2	
Drum diameter	6	ft
Drum width	6	ft
Area of selected unit	108	sqft
Area of building	155	sqft
Operation labor required	32	pers-hrs/yr
Maintenance labor required	20.6	pers-hrs/yr
Electrical energy required	97700	kWh/yr
Volume of wall concrete requir	2600	cuft
Volume of earthwork required	5850	cuft
Costs		
Construction and equipment cc	307000	$
Earthwork Cost	1730	$
Slab Concrete Cost	62500	$
Building Cost	17000	$
Installed Equipment Cost	186000	$
Misc Costs	40000	$
Operational labor cost	1650	$/yr
Maintenance labor cost	823	$/yr
Material and supply cost	27800	$/yr
Chemical cost	0	$/yr
Energy cost	9770	$/yr
Amortization cost	32900	$/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	6490	mg/L
Calculated VSS:TSS ratio	0.721	mg VSS/mg SS
Total volume of anaerobic reac	4.42	m3
Total volume of anoxic reactor	106	m3
Total volume of aerobic reacto	111	m3
Total volume of all reactors	221	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	1	
Number of aerobic cells within	1	
Anaerobic hydraulic retention ti	0.14	hr
Anoxic hydraulic retention time	3.37	hr
Aerobic hydraulic retention tim	3.51	hr
Amount of sludge generated	79.7	kg/d
Sludge recycle ratio	300	%
Sludge recycle rate	2270	m3/d
Nitrogen required for biomass	12.9	mg/L
Phosphorus required for bioma	2.58	mg/L
Oxygen required to meet avera	159	kg/d
Air flow required to meet avera	264	N m3/hr
Design air flow	39.7	N m3/min/1000 m3
Quantities		
Operation labor required	1060	pers-hrs/yr
Maintenance labor required	488	pers-hrs/yr
Electrical energy required	112000	kWh/yr
Volume of earthwork required	20700	cuft
Volume of slab concrete requir	4210	cuft
Volume of wall concrete requir	4040	cuft
Handrail length	113	ft
Number of diffusers per train	71	
Fine bubble diffuser floor cove	14.6	%
Number of swing arm headers	1	
Required mixing power	3.9	kW
Total number of mixers	4	
Design mixing power per mixe	1.12	kW
Mixing power for each unaerat	0.975	kW
Costs		
Construction and equipment co	319000	$
Earthwork Cost	6150	$
Wall Concrete Cost	97200	$
Slab Concrete Cost	54600	$
Handrail Cost	8470	$
Installed Aerator Equipment	49200	$
Air Piping Cost	15900	$
Installed Mixer Equipment C	56200	$
Misc Costs	31600	$
Operational labor cost	54500	$/yr
Maintenance labor cost	19500	$/yr
Material and supply cost	16200	$/yr
Chemical cost	0	$/yr
Energy cost	11200	$/yr
Amortization cost	29400	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	0.3	MGD(US)
Total pumping capacity	0.3	MGD(US)
Design capacity per pump	104	gpm(US)
Number of pumps	6	
Number of batteries	1	
Firm pumping capacity	0.3	MGD(US)
Quantities		
Operation labor required	377	pers-hrs/yr
Maintenance labor required	301	pers-hrs/yr
Electrical energy required	20200	kWh/yr
Volume of earthwork required	1650	cuft
Area of pump building	206	sqft
Costs		
Construction and equipment co	123000	$
Earthwork Cost	976	$
Pump Building Cost	45300	$
Installed Pump Cost	57700	$
Misc Costs	18700	$
Operational labor cost	19400	$/yr
Maintenance labor cost	12000	$/yr
Material and supply cost	859	$/yr
Chemical cost	0	$/yr
Energy cost	2020	$/yr
Amortization cost	11600	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	0.4	MGD(US)
Total pumping capacity	0.4	MGD(US)
Design capacity per pump	139	gpm(US)
Number of pumps	6	
Number of batteries	1	
Firm pumping capacity	0.4	MGD(US)
Quantities		

Operation labor required	391	pers-hrs/yr
Maintenance labor required	314	pers-hrs/yr
Electrical energy required	26900	kWh/yr
Volume of earthwork required	1660	cuft
Area of pump building	208	sqft
Costs		
Construction and equipment cc	132000	$
Earthwork Cost	986	$
Pump Building Cost	45700	$
Installed Pump Cost	65500	$
Misc Costs	20200	$
Operational labor cost	20100	$/yr
Maintenance labor cost	12600	$/yr
Material and supply cost	927	$/yr
Chemical cost	0	$/yr
Energy cost	2690	$/yr
Amortization cost	12500	$/yr
Sludge Recycle Pumping		
Design Information		
Average daily pumping rate	0.2	MGD(US)
Total pumping capacity	0.2	MGD(US)
Design capacity per pump	69.4	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.2	MGD(US)
Quantities		
Operation labor required	358	pers-hrs/yr
Maintenance labor required	284	pers-hrs/yr
Electrical energy required	6730	kWh/yr
Volume of earthwork required	1630	cuft
Area of pump building	204	sqft
Costs		
Construction and equipment cc	55500	$
Earthwork Cost	483	$
Pump Building Cost	22400	$
Installed Pump Cost	24100	$
Misc Costs	8470	$
Operational labor cost	18400	$/yr
Maintenance labor cost	11300	$/yr
Material and supply cost	389	$/yr
Chemical cost	0	$/yr
Energy cost	673	$/yr
Amortization cost	5250	$/yr

Ultra-Violet Disinfection

Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calc	2.12	gal(US)/(min·W)
Total number of lamps needed	49	
Number of spare channels	1	
Total number of lamps used in	72	
Number of excess lamps	23	
Number of lamps/modules	2	
Number of modules/bank	3	
Number of banks/channel	3	
Number of channels	4	
Calculated headloss	10.8	in
Costs		
Construction and equipment cc	215000	$
Cost of installation	129000	$
Total cost of UV lamps	85900	$
Operational labor cost	0	$/yr
Maintenance labor cost	2160	$/yr
Material and supply cost	2150	$/yr
Chemical cost	747	$/yr
Energy cost	5360	$/yr
Amortization cost	18200	$/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	4.97	gpm(US)
Final solids content	19	%
Solids capture fraction	0.992	
Quantities		

Operation labor required	5.69	pers-hrs/yr
Maintenance labor required	1.42	pers-hrs/yr
Power	2260	kWh/yr
Polymer required	743	lb/yr
Dry solids produced	204	lb/d
Belt filter(s)	275000	$
Building	279000	$
Installation	68800	$
Polymer system	82500	$
Feed pumps	30300	$
Conveyor system	77000	$
Costs		
Construction and equipment cc	812000	$
Building Cost	279000	$
Polymer System Cost	82500	$
Feed Pumps Cost	30300	$
Conveyor System Cost	77000	$
Installed Belt Filter	344000	$
Operational labor cost	293	$/yr
Maintenance labor cost	57	$/yr
Material and supply cost	0	$/yr
Chemical cost	966	$/yr
Energy cost	226	$/yr
Amortization cost	74300	$/yr

Membrane Bioreactor

Design Output Data

Description	Value	Units
Membrane Bioreactor		
Design Information		
Total volume of reactors	12400	cuft
Length of parallel train	22.4	ft
Width of parallel train	11.2	ft
Sidewater depth	16.4	ft
Number of batteries	1	
Number of parallel trains per b	3	
Total Membrane Area	15800	m2
Total Scour Air Requirement	3150	N m3/hr
Quantities		
Operation labor required	2380	pers-hrs/yr
Maintenance labor required	1250	pers-hrs/yr
Electrical energy required	359000	kWh/yr
Volume of earthwork required	15800	cuft
Volume of slab concrete requir	3170	cuft
Volume of wall concrete requir	4400	cuft
Handrail length	253	ft
Number of diffusers per train	78	
Number of swing arm headers	1	
Costs		
Construction and equipment cc	1680000	$
Earthwork Cost	4680	$
Wall Concrete Cost	106000	$
Slab Concrete Cost	41100	$
Handrail Cost	19000	$
Membrane Cost	1360000	$
Installed Aerator Equipment	69000	$
Air Piping Cost	43000	$
Misc Cost	38700	$
Operational labor cost	123000	$/yr
Maintenance labor cost	49800	$/yr
Material and supply cost	16800	$/yr
Chemical cost	10300	$/yr
Energy cost	35900	$/yr
Amortization cost	231000	$/yr
Permeate Pumping		
Design Information		
Average daily pumping rate	0.1	MGD(US)
Total pumping capacity	1	MGD(US)
Design capacity per pump	386	gpm(US)
Number of pumps	6	
Number of batteries	1	
Firm pumping capacity	2.22	MGD(US)
Quantities		
Operation labor required	488	pers-hrs/yr
Maintenance labor required	405	pers-hrs/yr
Electrical energy required	6060	kWh/yr
Volume of earthwork required	1780	cuft
Area of pump building	222	sqft
Costs		
Construction and equipment cc	180000	$
Earthwork Cost	1050	$
Pump Building Cost	48800	$

Installed Pump Cost	103000	$
Misc Costs	27500	$
Operational labor cost	25100	$/yr
Maintenance labor cost	16200	$/yr
Material and supply cost	1260	$/yr
Chemical cost	0	$/yr
Energy cost	606	$/yr
Amortization cost	17000	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0017	MGD(US)
Total pumping capacity	0.0017	MGD(US)
Design capacity per pump	0.592	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.0017	MGD(US)
Quantities		
Operation labor required	194	pers-hrs/yr
Maintenance labor required	140	pers-hrs/yr
Electrical energy required	58	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment cc	30000	$
Earthwork Cost	474	$
Pump Building Cost	22000	$
Installed Pump Cost	2960	$
Misc Costs	4580	$
Operational labor cost	9990	$/yr
Maintenance labor cost	5610	$/yr
Material and supply cost	210	$/yr
Chemical cost	0	$/yr
Energy cost	6	$/yr
Amortization cost	2840	$/yr

Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	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

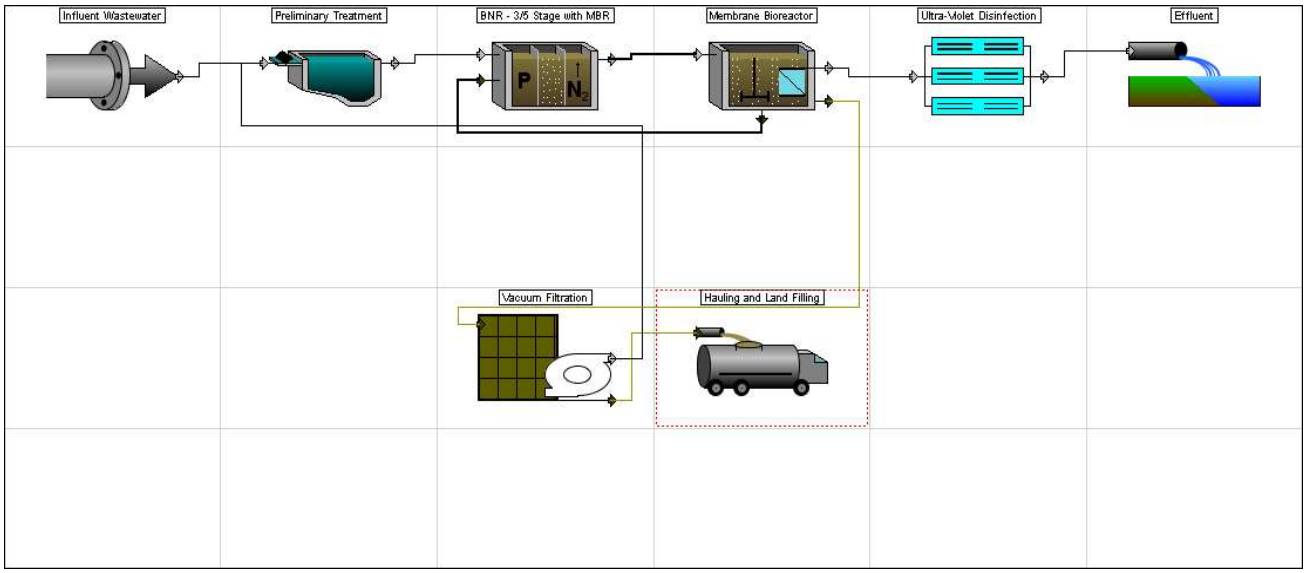
Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	0.529	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	30	miles
Quantities		
Total sludge volume hauled	0.529	cuyd/d
Maximum anticipated landfill dc	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	53.6	sqft
Width of sludge storage shed s	5.17	ft
Length of sludge storage shed	10.3	ft
Volume of earthwork required	251	cuft
Volume of slab concrete requir	125	cuft
Surface area of canopy roof	53.6	sqft
Round trip haul distance	60	miles
Round trips per day per truck	1	
Distance traveled per year per	15000	miles
Sludge hauled	0.468	ton(short)/d
Operation labor required	24.8	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment cc	286000	$
Earthwork Cost	74	$
Slab Concrete Cost	1620	$
Canopy Roof Cost	1070	$
Vehicle Cost	283000	$
Operational labor cost	1280	$/yr

Maintenance labor cost	0	$/yr
Material and supply cost	90400	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	61500	$/yr

Oakley City

Layout 1 Oakley City



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$3,340,000	$
Other direct construction costs	$844,000	$
Other indirect construction cos	$3,270,000	$
Total construction costs	$7,450,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$6,070	$/yr
Laboratory labor cost	$102,000	$/yr
Unit process operation labor c	$358,000	$/yr
Unit process maintenance labc	$126,000	$/yr
Total labor costs	$593,000	$/yr
MATERIAL COSTS		
Total material cost	$161,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$9,360	$/yr
ENERGY COSTS		
Total energy cost	$41,500	$/yr
Total operation and maintanen	$804,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$706,000	$/yr
Total annual project cost	$1,510,000	$/yr
PROJECT SUMMARY		
Present worth	$18,200,000	$
Total project cost	$7,450,000	$
Total operation labor cost	$466,000	$/yr
Total maintenance labor cost	$126,000	$/yr
Total material cost	$161,000	$/yr
Total chemical cost	$9,360	$/yr
Total energy cost	$41,500	$/yr
Total amortization cost	$706,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Preliminary Treatment	160000	19500	9020	4000	0	850	13400
BNR - 3/5 Stage with MBR	635000	111000	55200	17000	0	17000	59400
Vacuum Filtration	547000	46000	4560	25900	3630	799	51400
Membrane Bioreactor	1090000	123000	56000	10400	5170	18800	139000

Hauling and Land Filling	288000	2820	0	99600	0	0	61600
Ultra-Violet Disinfection	161000	0	1610	1610	560	4020	13600
Effluent	0	0	0	0	0	0	0
Lime Feed System	104000	55300	0	2080	0	0	8730
Blower System	351000	0	0	0	0	0	29400
Other Costs	4110000	108000	0	0	0	0	330000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	9	acre
Administration labor hours	118	hr/yr
Laboratory labor hours	1990	hr/yr
Costs		
DIRECT COSTS		
Mobilization	70600	$
Site preparation	146000	$
Site electrical	176000	$
Yard piping	125000	$
Instrumentation and control	76400	$
Lab and administration building	250000	$
Total direct construction costs	844000	$
INDIRECT COSTS		
Cost of land	180000	$
Miscellaneous cost	240000	$
Legal cost	96100	$
Engineering design fee	721000	$
Inspection cost	96100	$
Contingency	481000	$
Technical	96100	$
Interest during construction	731000	$
Profit	627000	$
Total indirect construction cost	3270000	$
Total of other construction cos	4110000	$
LABOR COSTS		
Administration labor cost	6070	$/yr
Laboratory labor cost	102000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	1690	scfm
Safety factor	1.5	
Requested air flow capacity	2530	scfm
Total capacity of blowers	2530	scfm
Number of blowers in use	1	
Total number of blowers	2	
Capacity of individual blowers	2530	scfm
Estimated cost of an installed l	106000	$
Blower building area	952	sqft
Costs		
Construction and equipment co	351000	$
Installed Blower Cost	212000	$
Building Cost	105000	$
Misc Costs	34800	$
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	29400	$/yr
Notes		
Energy costs are shown at the individual unit processes that require air		

Summary of Chemical Feed System for Lime

Description	Value	Units
Lime Solution Feed System		
Quantities		
Lime feed rate of Ca(OH)2	77.5	lb/d
Liquid chemical solution fed	155	gpd(US)
O&M labor required	690	pers-hrs/yr
Dry material handling and mixi	385	pers-hrs/yr
Total operation labor required	1070	pers-hrs/yr
Costs		
Construction and equipment co	104000	$
Operational labor cost	55300	$/yr
Maintenance labor cost	0	$/yr

Material and supply cost	2080	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	8730	$/yr

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	0.157	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	1.55	cuft/s
Average flow	0.393	cuft/s
Minimum flow	0.162	cuft/s
Temperature	10	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	0.774	cuft/s
Width of channel	0.129	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.0226	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	1.02	cuft/d
Costs		
Construction and equipment cc	160000	$
Operational labor cost	19500	$/yr
Maintenance labor cost	9020	$/yr
Material and supply cost	4000	$/yr
Chemical cost	0	$/yr
Energy cost	850	$/yr
Amortization cost	13400	$/yr

BNR - 3/5 Stage with MBR
Design Output Data

Description	Value	Units
BNR System for BIO-P and N Removal		
Design Information		
Influent BOD/TP ratio too smal		
3-Stage Biological Phosphorus		
Max. specific growth of nitrifier	0.374	1/d
Death rate of nitrifiers at winter	0.0601	1/d
Minimum aerobic SRT for nitrif	4.67	d
Design aerobic SRT for nitrifica	6.54	d
Total reactor SRT	10.5	d
Design SS	9000	mg/L
Calculated VSS	6210	mg/L
Calculated VSS:TSS ratio	0.69	mg VSS/mg SS
Total volume of anaerobic reac	0	m3
Total volume of anoxic reactor	108	m3
Total volume of aerobic reacto	179	m3
Total volume of all reactors	287	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	1	
Number of aerobic cells within	1	
Anaerobic hydraulic retention ti	0	hr
Anoxic hydraulic retention time	2.69	hr
Aerobic hydraulic retention time	4.45	hr
Amount of sludge generated	246	kg/d
Sludge recycle ratio	300	%
Sludge recycle rate	2900	m3/d
Nitrogen required for biomass	20.1	mg/L

Phosphorus required for bioma	4.02	mg/L
Oxygen required to meet avera	264	kg/d
Air flow required to meet avera	439	N m3/hr
Design air flow	40.9	N m3/min/1000 m3
Quantities		
Operation labor required	998	pers-hrs/yr
Maintenance labor required	459	pers-hrs/yr
Electrical energy required	101000	kWh/yr
Volume of earthwork required	18900	cuft
Volume of slab concrete requir	3800	cuft
Volume of wall concrete requir	3790	cuft
Handrail length	106	ft
Number of diffusers per train	73	
Fine bubble diffuser floor cover	15	%
Number of swing arm headers	1	
Required mixing power	2.6	kW
Total number of mixers	4	
Design mixing power per mixer	0.745	kW
Mixing power for each unaerat	0.65	kW
Costs		
Construction and equipment co	304000	$
Earthwork Cost	5610	$
Wall Concrete Cost	91200	$
Slab Concrete Cost	49300	$
Handrail Cost	7980	$
Installed Aerator Equipment	49400	$
Air Piping Cost	16000	$
Installed Mixer Equipment Co	54400	$
Misc Costs	30100	$
Operational labor cost	51400	$/yr
Maintenance labor cost	18200	$/yr
Material and supply cost	14700	$/yr
Chemical cost	0	$/yr
Energy cost	10100	$/yr
Amortization cost	28100	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	0.383	MGD(US)
Total pumping capacity	0.383	MGD(US)
Design capacity per pump	133	gpm(US)
Number of pumps	6	
Number of batteries	1	
Firm pumping capacity	0.383	MGD(US)
Quantities		
Operation labor required	389	pers-hrs/yr
Maintenance labor required	312	pers-hrs/yr
Electrical energy required	25700	kWh/yr
Volume of earthwork required	1660	cuft
Area of pump building	208	sqft
Costs		
Construction and equipment co	131000	$
Earthwork Cost	984	$
Pump Building Cost	45700	$
Installed Pump Cost	64200	$
Misc Costs	20000	$
Operational labor cost	20000	$/yr
Maintenance labor cost	12400	$/yr
Material and supply cost	916	$/yr
Chemical cost	0	$/yr
Energy cost	2570	$/yr
Amortization cost	12400	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	0.51	MGD(US)
Total pumping capacity	0.51	MGD(US)
Design capacity per pump	177	gpm(US)
Number of pumps	6	
Number of batteries	1	
Firm pumping capacity	0.51	MGD(US)
Quantities		
Operation labor required	404	pers-hrs/yr
Maintenance labor required	326	pers-hrs/yr
Electrical energy required	34200	kWh/yr
Volume of earthwork required	1680	cuft
Area of pump building	210	sqft
Costs		
Construction and equipment co	142000	$
Earthwork Cost	996	$
Pump Building Cost	46200	$
Installed Pump Cost	72900	$
Misc Costs	21600	$
Operational labor cost	20800	$/yr

Maintenance labor cost	12900	$/yr
Material and supply cost	992	$/yr
Chemical cost	0	$/yr
Energy cost	3420	$/yr
Amortization cost	13400	$/yr
Sludge Recycle Pumping		
Design Information		
Average daily pumping rate	0.255	MGD(US)
Total pumping capacity	0.255	MGD(US)
Design capacity per pump	88.6	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.255	MGD(US)
Quantities		
Operation labor required	369	pers-hrs/yr
Maintenance labor required	294	pers-hrs/yr
Electrical energy required	8570	kWh/yr
Volume of earthwork required	1640	cuft
Area of pump building	205	sqft
Costs		
Construction and equipment cc	58900	$
Earthwork Cost	486	$
Pump Building Cost	22600	$
Installed Pump Cost	26800	$
Misc Costs	8980	$
Operational labor cost	19000	$/yr
Maintenance labor cost	11700	$/yr
Material and supply cost	412	$/yr
Chemical cost	0	$/yr
Energy cost	857	$/yr
Amortization cost	5570	$/yr

Vacuum Filtration

Design Output Data

Description	Value	Units
Vacuum Filtration		
Design Information		
Total filter area required	29	sqft
Number of filters	1	
Area of single filter unit	60	sqft
Area of building	262	sqft
Hydrated lime [Ca(OH)2] requi	9.68	lb/hr
Quantities		
Volume of sludge	5270	gpd(US)
Initial moisture content of sludg	98.8	%
Dry solids produced	0.261	ton(short)/d
Operation labor required	894	pers-hrs/yr
Maintenance labor required	115	pers-hrs/yr
Electrical energy required	7990	kWh/yr
Costs		
Construction and equipment cc	547000	$
Installed Equipment Cost	518000	$
Building Cost	28800	$
Operational labor cost	46000	$/yr
Maintenance labor cost	4560	$/yr
Material and supply cost	25900	$/yr
Chemical cost	3630	$/yr
Energy cost	799	$/yr
Amortization cost	51400	$/yr

Membrane Bioreactor

Design Output Data

Description	Value	Units
Membrane Bioreactor		
Design Information		
Total volume of reactors	6220	cuft
Length of parallel train	15.9	ft
Width of parallel train	7.95	ft
Sidewater depth	16.4	ft
Number of batteries	1	
Number of parallel trains per b	3	
Total Membrane Area	7930	m2
Total Scour Air Requirement	1590	N m3/hr
Quantities		
Operation labor required	1720	pers-hrs/yr
Maintenance labor required	880	pers-hrs/yr
Electrical energy required	180000	kWh/yr
Volume of earthwork required	11200	cuft
Volume of slab concrete requir	2160	cuft
Volume of wall concrete requir	3120	cuft
Handrail length	181	ft
Number of diffusers per train	39	

Number of swing arm headers	1	
Costs		
Construction and equipment cc	911000	$
Earthwork Cost	3310	$
Wall Concrete Cost	75200	$
Slab Concrete Cost	28100	$
Handrail Cost	13600	$
Membrane Cost	684000	$
Installed Aerator Equipment	64300	$
Air Piping Cost	19700	$
Misc Cost	29500	$
Operational labor cost	88600	$/yr
Maintenance labor cost	34900	$/yr
Material and supply cost	9110	$/yr
Chemical cost	5170	$/yr
Energy cost	18000	$/yr
Amortization cost	122000	$/yr
Permeate Pumping		
Design Information		
Average daily pumping rate	0.128	MGD(US)
Total pumping capacity	0.503	MGD(US)
Design capacity per pump	194	gpm(US)
Number of pumps	6	
Number of batteries	1	
Firm pumping capacity	1.12	MGD(US)
Quantities		
Operation labor required	446	pers-hrs/yr
Maintenance labor required	366	pers-hrs/yr
Electrical energy required	7730	kWh/yr
Volume of earthwork required	1690	cuft
Area of pump building	211	sqft
Costs		
Construction and equipment cc	145000	$
Earthwork Cost	1000	$
Pump Building Cost	46400	$
Installed Pump Cost	75800	$
Misc Costs	22200	$
Operational labor cost	23000	$/yr
Maintenance labor cost	14500	$/yr
Material and supply cost	1020	$/yr
Chemical cost	0	$/yr
Energy cost	773	$/yr
Amortization cost	13800	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.00527	MGD(US)
Total pumping capacity	0.00527	MGD(US)
Design capacity per pump	1.83	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.00527	MGD(US)
Quantities		
Operation labor required	224	pers-hrs/yr
Maintenance labor required	166	pers-hrs/yr
Electrical energy required	179	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment cc	32300	$
Earthwork Cost	474	$
Pump Building Cost	22000	$
Installed Pump Cost	4860	$
Misc Costs	4920	$
Operational labor cost	11500	$/yr
Maintenance labor cost	6580	$/yr
Material and supply cost	226	$/yr
Chemical cost	0	$/yr
Energy cost	18	$/yr
Amortization cost	3050	$/yr

Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	0.999	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	35	miles

Quantities		
Total sludge volume hauled	0.999	cuyd/d
Maximum anticipated landfill d	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	101	sqft
Width of sludge storage shed s	7.11	ft
Length of sludge storage shed	14.2	ft
Volume of earthwork required	406	cuft
Volume of slab concrete requir	199	cuft
Surface area of canopy roof	101	sqft
Round trip haul distance	70	miles
Round trips per day per truck	1	
Distance traveled per year per	17500	miles
Sludge hauled	0.884	ton(short)/d
Operation labor required	54.7	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment cc	288000	$
Earthwork Cost	120	$
Slab Concrete Cost	2580	$
Canopy Roof Cost	2020	$
Vehicle Cost	283000	$
Operational labor cost	2820	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	99600	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	61600	$/yr

Ultra-Violet Disinfection

Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calc	2.12	gal(US)/(min·W)
Total number of lamps needed	25	
Number of spare channels	1	
Total number of lamps used in	54	
Number of excess lamps	29	
Number of lamps/modules	2	
Number of modules/bank	3	
Number of banks/channel	3	
Number of channels	3	
Calculated headloss	6.08	in
Costs		
Construction and equipment cc	161000	$
Cost of installation	96700	$
Total cost of UV lamps	64400	$
Operational labor cost	0	$/yr
Maintenance labor cost	1610	$/yr
Material and supply cost	1610	$/yr
Chemical cost	560	$/yr
Energy cost	4020	$/yr
Amortization cost	13600	$/yr

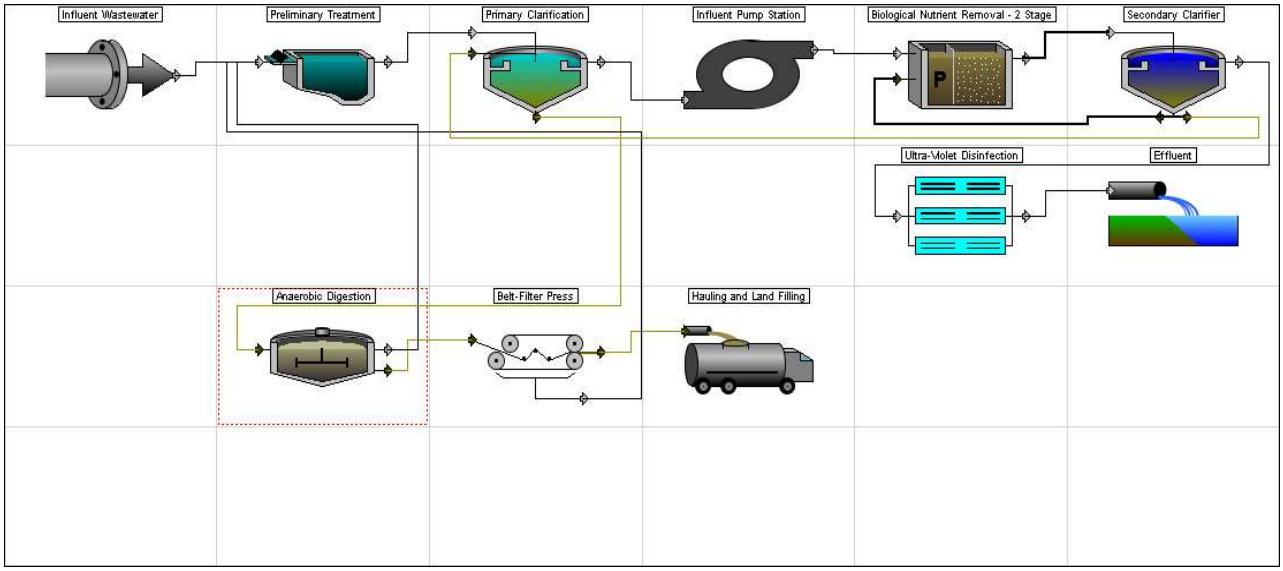
Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	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

Orem City

Layout Orem City



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$62,900,000	$
Other direct construction costs	$12,100,000	$
Other indirect construction cos	$55,600,000	$
Total construction costs	$131,000,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$138,000	$/yr
Laboratory labor cost	$187,000	$/yr
Unit process operation labor c	$922,000	$/yr
Unit process maintenance labc	$617,000	$/yr
Total labor costs	$1,860,000	$/yr
MATERIAL COSTS		
Total material cost	$868,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$163,000	$/yr
ENERGY COSTS		
Total energy cost	$1,370,000	$/yr
Total operation and maintanen	$4,260,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$11,500,000	$/yr
Total annual project cost	$15,700,000	$/yr
PROJECT SUMMARY		
Present worth	$188,000,000	$
Total project cost	$131,000,000	$
Total operation labor cost	$1,250,000	$/yr
Total maintenance labor cost	$617,000	$/yr
Total material cost	$868,000	$/yr
Total chemical cost	$163,000	$/yr
Total energy cost	$1,370,000	$/yr
Total amortization cost	$11,500,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Preliminary Treatment	1330000	129000	54000	33300	0	5350	112000
Anaerobic Digestion	7190000	129000	73300	68800	0	32600	682000
Primary Clarification	1220000	89400	46300	12100	0	1380	113000
Belt-Filter Press	918000	27900	6080	0	92500	15300	83700

Influent Pump Station	9200000	52600	42700	64400	0	61300	784000
Hauling and Land Filling	465000	40800	0	90400	0	0	76500
Biological Nutrient Removal - 2	24300000	324000	175000	440000	0	741000	2220000
Ultra-Violet Disinfection	14100000	0	153000	141000	70600	506000	1390000
Secondary Clarifier	1860000	129000	66500	18400	0	2380	170000
Effluent	0	0	0	0	0	0	0
Blower System	2300000	0	0	0	0	0	192000
Other Costs	67700000	325000	0	0	0	0	5640000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	23	acre
Administration labor hours	2680	hr/yr
Laboratory labor hours	3630	hr/yr
Costs		
DIRECT COSTS		
Mobilization	1110000	$
Site preparation	1420000	$
Site electrical	3230000	$
Yard piping	2110000	$
Instrumentation and control	1720000	$
Lab and administration building	2530000	$
Total direct construction costs	12100000	$
INDIRECT COSTS		
Cost of land	460000	$
Miscellaneous cost	4310000	$
Legal cost	1730000	$
Engineering design fee	12900000	$
Inspection cost	1730000	$
Contingency	8630000	$
Technical	1730000	$
Interest during construction	12800000	$
Profit	11300000	$
Total indirect construction cost	55600000	$
Total of other construction cos	67700000	$
LABOR COSTS		
Administration labor cost	138000	$/yr
Laboratory labor cost	187000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	25700	scfm
Safety factor	1.5	
Requested air flow capacity	38500	scfm
Total capacity of blowers	38500	scfm
Number of blowers in use	3	
Total number of blowers	4	
Capacity of individual blowers	12800	scfm
Estimated cost of an installed l	464000	$
Blower building area	1910	sqft
Costs		
Construction and equipment co	2300000	$
Installed Blower Cost	1860000	$
Building Cost	210000	$
Misc Costs	227000	$
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	192000	$/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	0.2	in
Bar spacing	0.375	in
Slope of bars from horizontal	30	degrees
Head loss through screen	0.21	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	8.36	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	46.3	cuft/s
Average flow	20.9	cuft/s
Minimum flow	14	cuft/s
Temperature	10	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	23.2	cuft/s
Width of channel	3.86	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.000471	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	54.3	cuft/d
Costs		
Construction and equipment cc	1330000	$
Operational labor cost	129000	$/yr
Maintenance labor cost	54000	$/yr
Material and supply cost	33300	$/yr
Chemical cost	0	$/yr
Energy cost	5350	$/yr
Amortization cost	112000	$/yr

Anaerobic Digestion

Design Output Data

Description	Value	Units
Anaerobic Digestion		
Design Information		
Percent VSS destroyed	50	%
Solids concentration in digeste	5	%
Detention time	25	d
Digester depth	28.8	ft
Digester diameter	75	ft
Effective digester volume	424000	cuft
Number of digesters per batte	3	
Number of primary digesters p	2	
Number of secondary digester	1	
Number of batteries	1	
Gas produced	106	cuft/min
Heat required	2860000	BTU/hr
Digester gas required	110	cuft/min
Total natural gas required	461000	cuft/yr
Quantities		
Operation labor required	2510	pers-hrs/yr
Maintenance labor required	1630	pers-hrs/yr
Electrical energy required	248000	kWh/yr
Volume of earthwork required	422000	cuft
Slab thickness	11.2	in
Volume of slab concrete requir	13500	cuft
Wall thickness	21.9	in
Volume of wall concrete requir	45200	cuft
Sidewater depth	28.8	ft
Surface area/floor of 2-story cc	2200	sqft
Piping size	10	in
Length of total piping system	1040	ft
Number of 90 degree elbows	39	
Number of tees	77	
Number of plug valves	56	
Total dry solids treated	13.6	ton(short)/d
Costs		
Construction and equipment cc	7190000	$
Earthwork Cost	125000	$
Wall Concrete Cost	1090000	$
Slab Concrete Cost	175000	$
Building Cost	242000	$
Piping System Cost	787000	$
Floating Cover Cost	2470000	$
Gas Recirculation Units Cost	587000	$
Heating Units Cost	519000	$
Gas Safety Equipment Cost	240000	$
Installed Pumps Cost	250000	$

Operational labor cost	129000	$/yr
Maintenance labor cost	73300	$/yr
Material and supply cost	68800	$/yr
Chemical cost	0	$/yr
Energy cost	32600	$/yr
Amortization cost	682000	$/yr

Primary Clarification

Design Output Data

Description	Value	Units
Primary Clarification		
Design Information		
Surface area	17200	sqft
Surface area per circular clarifi	4310	sqft
Diameter of each circular clarif	75	ft
Number of clarifiers per battery	4	
Number of batteries	1	
Solids loading rate	2.58	lb/(sqft·d)
Hydraulic retention time	2.02	hr
Weir length	3030	ft
Volume of sludge generated	77700	gpd(US)
Quantities		
Operation labor required	1420	pers-hrs/yr
Maintenance labor required	785	pers-hrs/yr
Electrical energy required	11200	kWh/yr
Volume of earthwork required	222000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	17400	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	9960	cuft
Costs		
Construction and equipment co	1180000	$
Earthwork Cost	65900	$
Wall Concrete Cost	240000	$
Slab Concrete Cost	226000	$
Installed Equipment Cost	468000	$
Misc Costs	180000	$
Operational labor cost	73100	$/yr
Maintenance labor cost	35300	$/yr
Material and supply cost	11800	$/yr
Chemical cost	0	$/yr
Energy cost	1120	$/yr
Amortization cost	109000	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0777	MGD(US)
Total pumping capacity	0.0777	MGD(US)
Design capacity per pump	27	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.0777	MGD(US)
Quantities		
Operation labor required	317	pers-hrs/yr
Maintenance labor required	247	pers-hrs/yr
Electrical energy required	2620	kWh/yr
Volume of earthwork required	1610	cuft
Area of pump building	202	sqft
Costs		
Construction and equipment co	45500	$
Earthwork Cost	478	$
Pump Building Cost	22200	$
Installed Pump Cost	15900	$
Misc Costs	6940	$
Operational labor cost	16300	$/yr
Maintenance labor cost	11100	$/yr
Material and supply cost	318	$/yr
Chemical cost	0	$/yr
Energy cost	262	$/yr
Amortization cost	4300	$/yr

Belt-Filter Press

Design Output Data

Description	Value	Units
Belt-Filter Press		
Design Information		
Belt filter width	2	m
Number of units	1	
Hydraulic loading per unit per r	70	gpm(US)
Hydraulic loading required per	114	gpm(US)
Final solids content	19	%
Solids capture fraction	0.998	
Quantities		

Operation labor required	542	pers-hrs/yr
Maintenance labor required	135	pers-hrs/yr
Power	153000	kWh/yr
Polymer required	71200	lb/yr
Dry solids produced	19500	lb/d
Belt filter(s)	301000	$
Building	322000	$
Installation	75300	$
Polymer system	111000	$
Feed pumps	33100	$
Conveyor system	75300	$
Costs		
Construction and equipment cc	918000	$
Building Cost	322000	$
Polymer System Cost	111000	$
Feed Pumps Cost	33100	$
Conveyor System Cost	75300	$
Installed Belt Filter	376000	$
Operational labor cost	27900	$/yr
Maintenance labor cost	6080	$/yr
Material and supply cost	0	$/yr
Chemical cost	92500	$/yr
Energy cost	15300	$/yr
Amortization cost	83700	$/yr

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	155000	cuft
Width of wet well	878	ft
Depth of the pumping station	32.3	ft
Length of the pumping station	27.6	ft
Width of the pumping station	916	ft
Minimum depth of water in wet	11.3	ft
Area of pump building	1110	sqft
Peak capacity of pumps	41.5	MGD(US)
Firm pumping capacity	41.5	MGD(US)
Total dynamic head - average	43.9	ft
Quantities		
Operation labor required	1020	pers-hrs/yr
Maintenance labor required	950	pers-hrs/yr
Electrical energy required	613000	kWh/yr
Volume of earthwork required	3080000	cuft
Volume of slab concrete requir	291000	cuft
Volume of wall concrete requir	82800	cuft
Capacity per pump	28900	gpm(US)
Number of constant speed pur	2	
Number of variable speed pur	0	
Diameter of discharge header	38.4	in
Total dynamic head	53.3	ft
Size of selected pump	36	in
Specific speed of pump	5170	
Pump rotating speed	464	rpm
Motor size required	292	HP
Size of selected motor	300	HP
Width of pump system	7.8	ft
Length of pump system	29.4	ft
Length of the dry well	27.6	ft
Width of the dry well	38.4	ft
Costs		
Construction and equipment cc	9200000	$
Earthwork Cost	912000	$
Wall Concrete Cost	1990000	$
Slab Concrete Cost	3770000	$
Building Cost	123000	$
Installed Pump Equipment C	998000	$
Misc Costs	1400000	$
Operational labor cost	52600	$/yr
Maintenance labor cost	42700	$/yr
Material and supply cost	64400	$/yr
Chemical cost	0	$/yr
Energy cost	61300	$/yr
Amortization cost	784000	$/yr

Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	50.7	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	50.7	cuyd/d
Maximum anticipated landfill d	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	5130	sqft
Width of sludge storage shed s	50.7	ft
Length of sludge storage shed	101	ft
Volume of earthwork required	13800	cuft
Volume of slab concrete requir	5830	cuft
Surface area of canopy roof	5130	sqft
Round trip haul distance	20	miles
Round trips per day per truck	3	
Distance traveled per year per	15000	miles
Sludge hauled	44.8	ton(short)/d
Operation labor required	793	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment co	465000	$
Earthwork Cost	4090	$
Slab Concrete Cost	75600	$
Canopy Roof Cost	103000	$
Vehicle Cost	283000	$
Operational labor cost	40800	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	90400	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	76500	$/yr

Biological Nutrient Removal - 2 Stage

Design Output Data

Description	Value	Units
2-Stage Biological Nitrogen Removal		
Design Information		
Aerobic SRT is greater than 7		
2-Stage Biological Nutrient Re		
Design aerobic SRT for nitrifica	30	d
Total reactor SRT	31	d
Design SS	2500	mg/L
Calculated VSS	1850	mg/L
Calculated VSS:TSS ratio	0.741	mg VSS/mg SS
Total volume of anaerobic reac	3240	m3
Total volume of aerobic reacto	99100	m3
Total volume of all reactors	102000	m3
Width of parallel train	10	m
Sidewater depth	5	m
Number of batteries	1	
Number of parallel trains per b	16	
Number of anaerobic cells with	1	
Number of aerobic cells within	3	
Anaerobic hydraulic retention ti	1.5	hr
Aerobic hydraulic retention tim	45.9	hr
Design F/M ratio	0.0438	1/d
Aerobic F:M is less than user-s		
Amount of sludge generated	8260	kg/d
Sludge recycle ratio	33.3	%
Sludge recycle rate	17300	m3/d
Nitrogen required for biomass	14.9	mg/L
Phosphorus required for bioma	2.97	mg/L
Oxygen required to meet avera	18000	kg/d
Air flow required to meet avera	43600	N m3/hr
Design air flow	7.33	N m3/min/1000 m3
Quantities		
Operation labor required	5750	pers-hrs/yr
Maintenance labor required	3450	pers-hrs/yr
Electrical energy required	7250000	kWh/yr
Volume of earthwork required	1590000	cuft
Volume of slab concrete requir	466000	cuft
Volume of wall concrete requir	271000	cuft
Handrail length	9110	ft
Number of diffusers per train	802	
Fine bubble diffuser floor cover	2.65	%
Number of swing arm headers	17	
Required mixing power	52	kW
Total number of mixers	32	
Design mixing power per mixer	2.24	kW

Mixing power for each unaerat	3.25	kW
Costs		
Construction and equipment cc	24100000	$
Earthwork Cost	471000	$
Wall Concrete Cost	6530000	$
Slab Concrete Cost	6040000	$
Handrail Cost	683000	$
Installed Aerator Equipment	6260000	$
Air Piping Cost	1250000	$
Installed Mixer Equipment C	492000	$
Misc Costs	2390000	$
Operational labor cost	296000	$/yr
Maintenance labor cost	155000	$/yr
Material and supply cost	438000	$/yr
Chemical cost	0	$/yr
Energy cost	725000	$/yr
Amortization cost	2210000	$/yr
Sludge Recycle Pumping		
Design Information		
Average daily pumping rate	4.57	MGD(US)
Total pumping capacity	9.13	MGD(US)
Design capacity per pump	3170	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	4.57	MGD(US)
Quantities		
Operation labor required	535	pers-hrs/yr
Maintenance labor required	451	pers-hrs/yr
Electrical energy required	152000	kWh/yr
Volume of earthwork required	3040	cuft
Area of pump building	380	sqft
Costs		
Construction and equipment cc	204000	$
Earthwork Cost	901	$
Pump Building Cost	41800	$
Installed Pump Cost	130000	$
Misc Costs	31100	$
Operational labor cost	27500	$/yr
Maintenance labor cost	20200	$/yr
Material and supply cost	1430	$/yr
Chemical cost	0	$/yr
Energy cost	15200	$/yr
Amortization cost	19300	$/yr

Ultra-Violet Disinfection

Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calc	0.294	gal(US)/(min·W)
System is not headloss constra		
Total number of lamps needed	5420	
Number of spare channels	1	
Total number of lamps used in	6800	
Number of excess lamps	1380	
Number of lamps/modules	16	
Number of modules/bank	17	
Number of banks/channel	5	
Number of channels	5	
Calculated headloss	1.11	in
Costs		
Construction and equipment cc	14100000	$
Cost of installation	8470000	$
Total cost of UV lamps	5650000	$
Operational labor cost	0	$/yr
Maintenance labor cost	153000	$/yr
Material and supply cost	141000	$/yr
Chemical cost	70600	$/yr
Energy cost	506000	$/yr
Amortization cost	1390000	$/yr

Secondary Clarifier

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	34300	sqft
Surface area per circular clarifi	8560	sqft
Diameter of each circular clarif	105	ft
Number of clarifiers per batter	4	
Number of batteries	1	
Solids loading rate	11.1	lb/(sqft·d)

Hydraulic retention time	4.04	hr
Designed surface overflow rate	400	gal(US)/(sqft·d)
Weir length	3020	ft
Volume of wasted sludge	212000	gpd(US)
Quantities		
Operation labor required	2150	pers-hrs/yr
Maintenance labor required	1190	pers-hrs/yr
Electrical energy required	16700	kWh/yr
Volume of earthwork required	473000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	33200	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	13700	cuft
Costs		
Construction and equipment co	1800000	$
Earthwork Cost	140000	$
Wall Concrete Cost	331000	$
Slab Concrete Cost	430000	$
Installed Equipment Cost	625000	$
Misc Costs	275000	$
Operational labor cost	111000	$/yr
Maintenance labor cost	53600	$/yr
Material and supply cost	18000	$/yr
Chemical cost	0	$/yr
Energy cost	1670	$/yr
Amortization cost	164000	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.212	MGD(US)
Total pumping capacity	0.212	MGD(US)
Design capacity per pump	73.6	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.212	MGD(US)
Quantities		
Operation labor required	360	pers-hrs/yr
Maintenance labor required	286	pers-hrs/yr
Electrical energy required	7130	kWh/yr
Volume of earthwork required	1630	cuft
Area of pump building	204	sqft
Costs		
Construction and equipment co	56300	$
Earthwork Cost	484	$
Pump Building Cost	22500	$
Installed Pump Cost	24700	$
Misc Costs	8580	$
Operational labor cost	18600	$/yr
Maintenance labor cost	12900	$/yr
Material and supply cost	394	$/yr
Chemical cost	0	$/yr
Energy cost	713	$/yr
Amortization cost	5320	$/yr

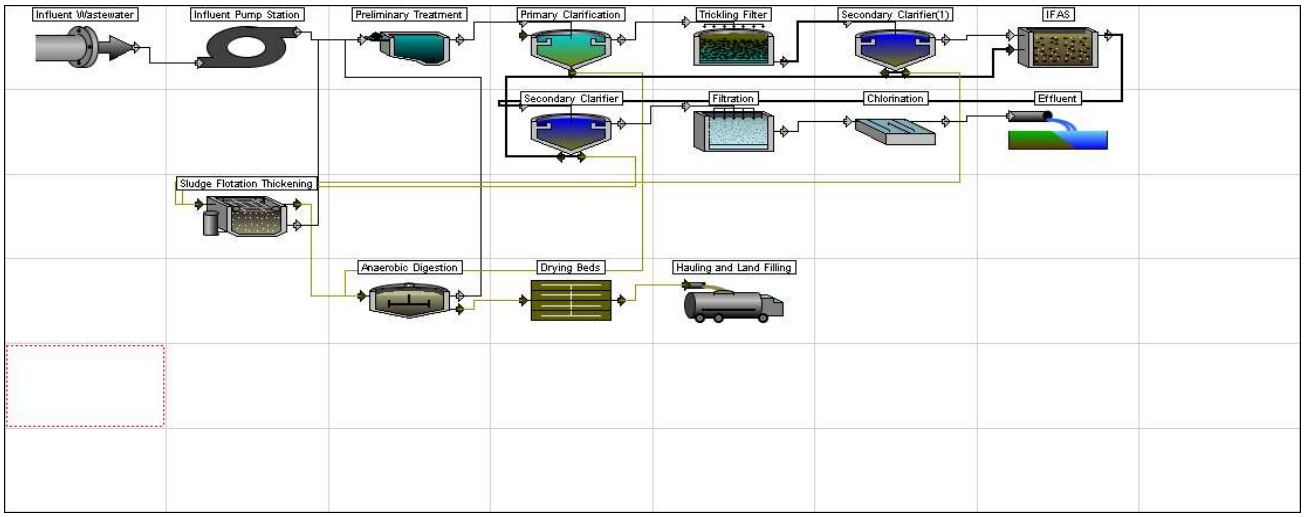
Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment co	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

Payson City

Layout 1 Payson City



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$16,500,000	$
Other direct construction costs	$5,760,000	$
Other indirect construction cos	$16,700,000	$
Total construction costs	$38,900,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$58,300	$/yr
Laboratory labor cost	$158,000	$/yr
Unit process operation labor c	$838,000	$/yr
Unit process maintenance labc	$370,000	$/yr
Total labor costs	$1,420,000	$/yr
MATERIAL COSTS		
Total material cost	$282,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$89,900	$/yr
ENERGY COSTS		
Total energy cost	$263,000	$/yr
Total operation and maintanen	$2,060,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$3,430,000	$/yr
Total annual project cost	$5,490,000	$/yr
PROJECT SUMMARY		
Present worth	$65,700,000	$
Total project cost	$38,900,000	$
Total operation labor cost	$1,050,000	$/yr
Total maintenance labor cost	$370,000	$/yr
Total material cost	$282,000	$/yr
Total chemical cost	$89,900	$/yr
Total energy cost	$263,000	$/yr
Total amortization cost	$3,430,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Influent Pump Station	2230000	37600	26600	15600	0	30600	192000
Sludge Flotation Thickening	504000	90600	9650	5300	1120	14200	46500
Preliminary Treatment	753000	56700	25200	18800	0	3230	63200
Anaerobic Digestion	2820000	75700	41100	23100	0	12200	267000

Primary Clarification	439000	46300	23600	4280	0	946	40900
Secondary Clarifier	633000	62400	31000	6230	0	1040	58500
Drying Beds	751000	161000	67200	6760	0	0	65300
Trickling Filter	1360000	51500	36700	7660	0	41000	120000
Filtration	2210000	9770	5610	62300	0	3530	213000
Hauling and Land Filling	310000	5590	0	53600	0	0	63500
Secondary Clarifier(1)	649000	64900	32700	6370	0	1140	60000
Chlorination	606000	48600	7210	22900	88800	11800	61500
IFAS	2600000	128000	63200	49400	0	144000	271000
Effluent	0	0	0	0	0	0	0
Blower System	627000	0	0	0	0	0	52500
Other Costs	22400000	217000	0	0	0	0	1860000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	15	acre
Administration labor hours	1130	hr/yr
Laboratory labor hours	3080	hr/yr
Costs		
DIRECT COSTS		
Mobilization	519000	$
Site preparation	758000	$
Site electrical	1450000	$
Yard piping	969000	$
Instrumentation and control	729000	$
Lab and administration building	1340000	$
Total direct construction costs	5760000	$
INDIRECT COSTS		
Cost of land	300000	$
Miscellaneous cost	1280000	$
Legal cost	512000	$
Engineering design fee	3840000	$
Inspection cost	512000	$
Contingency	2560000	$
Technical	512000	$
Interest during construction	3810000	$
Profit	3340000	$
Total indirect construction cost	16700000	$
Total of other construction cos	22400000	$
LABOR COSTS		
Administration labor cost	58300	$/yr
Laboratory labor cost	158000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	5390	scfm
Safety factor	1.5	
Requested air flow capacity	8080	scfm
Total capacity of blowers	8080	scfm
Number of blowers in use	2	
Total number of blowers	3	
Capacity of individual blowers	4040	scfm
Estimated cost of an installed l	141000	$
Blower building area	1280	sqft
Costs		
Construction and equipment cc	627000	$
Installed Blower Cost	424000	$
Building Cost	141000	$
Misc Costs	62100	$
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	52500	$/yr
Notes		
Energy costs are shown at the individual unit processes that require air		

Influent Wastewater
Influent Pump Station
Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	29500	cuft

Width of wet well	227	ft
Depth of the pumping station	28.6	ft
Length of the pumping station	21.2	ft
Width of the pumping station	258	ft
Minimum depth of water in wet	7.6	ft
Area of pump building	682	sqft
Peak capacity of pumps	15.1	MGD(US)
Firm pumping capacity	15.1	MGD(US)
Total dynamic head - average	44.4	ft
Quantities		
Operation labor required	731	pers-hrs/yr
Maintenance labor required	616	pers-hrs/yr
Electrical energy required	306000	kWh/yr
Volume of earthwork required	689000	cuft
Volume of slab concrete requir	52000	cuft
Volume of wall concrete requir	21700	cuft
Capacity per pump	10500	gpm(US)
Number of constant speed pur	2	
Number of variable speed pur	0	
Diameter of discharge header	23.1	in
Total dynamic head	59.1	ft
Size of selected pump	20	in
Specific speed of pump	4320	
Pump rotating speed	833	rpm
Motor size required	177	HP
Size of selected motor	200	HP
Width of pump system	4.6	ft
Length of pump system	21.6	ft
Length of the dry well	21.2	ft
Width of the dry well	30.6	ft
Costs		
Construction and equipment co	2230000	$
Earthwork Cost	204000	$
Wall Concrete Cost	522000	$
Slab Concrete Cost	675000	$
Building Cost	75000	$
Installed Pump Equipment C	410000	$
Misc Costs	340000	$
Operational labor cost	37600	$/yr
Maintenance labor cost	26600	$/yr
Material and supply cost	15600	$/yr
Chemical cost	0	$/yr
Energy cost	30600	$/yr
Amortization cost	192000	$/yr

Sludge Flotation Thickening

Design Output Data

Description	Value	Units
Sludge Flotation Thickening		
Design Information		
Air to solids ratio	0.02	
Air pressure	60	psig
Solids loading rate	10	lb/(sqft·d)
Recycle flow	0.249	MGD(US)
Surface area required	473	sqft
Volume of pressure tank	46.2	cuft
Volume of flotation tank	5100	cuft
Pressure tank detention time	2	min
Flotation tank detention time	3	hr
Polymer required	2.37	lb/d
Quantities		
Number units	1	
Surface area per flotation unit	570	sqft
Diameter per flotation unit	26.9	ft
Amount of sludge generated	2.37	ton(long)/d
Area of flotation building	924	sqft
Volume of earthwork required	7650	cuft
Slab thickness	9.9	in
Volume of slab concrete requir	652	cuft
Wall thickness	11	in
Volume of wall concrete requir	798	cuft
Sidewater depth	8	ft
Operation labor required	769	pers-hrs/yr
Maintenance labor required	224	pers-hrs/yr
Electrical energy required	142000	kWhr/yr
Costs		
Construction and equipment co	479000	$
Earthwork Cost	2270	$
Wall Concrete Cost	19200	$
Slab Concrete Cost	8450	$
Building Cost	76300	$
Installed Equipment Cost	300000	$

Misc Costs	73000	$
Operational labor cost	39600	$/yr
Maintenance labor cost	9650	$/yr
Material and supply cost	4790	$/yr
Chemical cost	0	$/yr
Energy cost	14200	$/yr
Amortization cost	46500	$/yr
Polymer Feed System		
Quantities		
Polymer dosage	2.37	lb/d
Liquid chemical solution fed	114	gpd(US)
O&M labor required	637	pers-hrs/yr
Dry material handling and mixi	353	pers-hrs/yr
Total operation labor required	990	pers-hrs/yr
Costs		
Construction and equipment c	25600	$
Operational labor cost	51000	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	513	$/yr
Chemical cost	1120	$/yr
Energy cost	0	$/yr
Amortization cost	0	$/yr

Preliminary Treatment

Design Output Data

Description	Value	Units
Preliminary Treatment		
Design Information		
Mechanically Cleaned Bar Screen		
Bar size	0.25	in
Bar spacing	0.5	in
Slope of bars from horizontal	30	degrees
Head loss through screen	0.176	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	2.81	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	18.6	cuft/s
Average flow	7.02	cuft/s
Minimum flow	4.71	cuft/s
Temperature	10	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	9.29	cuft/s
Width of channel	1.55	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.00115	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	18.2	cuft/d
Costs		
Construction and equipment c	753000	$
Operational labor cost	56700	$/yr
Maintenance labor cost	25200	$/yr
Material and supply cost	18800	$/yr
Chemical cost	0	$/yr
Energy cost	3230	$/yr
Amortization cost	63200	$/yr

Anaerobic Digestion

Design Output Data

Description	Value	Units
Anaerobic Digestion		
Design Information		
Percent VSS destroyed	50	%
Solids concentration in digeste	5	%
Detention time	15	d
Digester depth	25.3	ft
Digester diameter	55	ft
Effective digester volume	131000	cuft
Number of digesters per batte	2	
Number of primary digesters p	1	
Number of secondary digester	1	
Number of batteries	1	

Gas produced	40	cuft/min
Heat required	630000	BTU/hr
Digester gas required	24.3	cuft/min
Total natural gas required	0	cuft/yr
Quantities		
Operation labor required	1470	pers-hrs/yr
Maintenance labor required	954	pers-hrs/yr
Electrical energy required	122000	kWh/yr
Volume of earthwork required	131000	cuft
Slab thickness	10.4	in
Volume of slab concrete requir	4570	cuft
Wall thickness	20.2	in
Volume of wall concrete requir	18200	cuft
Sidewater depth	25.3	ft
Surface area/floor of 2-story cc	889	sqft
Piping size	8	in
Length of total piping system	555	ft
Number of 90 degree elbows	26	
Number of tees	51	
Number of plug valves	37	
Total dry solids treated	4.99	ton(short)/d
Costs		
Construction and equipment cc	2820000	$
Earthwork Cost	38700	$
Wall Concrete Cost	437000	$
Slab Concrete Cost	59300	$
Building Cost	97800	$
Piping System Cost	373000	$
Floating Cover Cost	914000	$
Gas Recirculation Units Cost	247000	$
Heating Units Cost	182000	$
Gas Safety Equipment Cost	120000	$
Installed Pumps Cost	74800	$
Operational labor cost	75700	$/yr
Maintenance labor cost	41100	$/yr
Material and supply cost	23100	$/yr
Chemical cost	0	$/yr
Energy cost	12200	$/yr
Amortization cost	267000	$/yr

Primary Clarification

Design Output Data

Description	Value	Units
Primary Clarification		
Design Information		
Surface area	4560	sqft
Surface area per circular clarifi	2280	sqft
Diameter of each circular clarif	54	ft
Number of clarifiers per battery	2	
Number of batteries	1	
Solids loading rate	2.22	lb/(sqft·d)
Hydraulic retention time	1.62	hr
Weir length	804	ft
Volume of sludge generated	17700	gpd(US)
Quantities		
Operation labor required	638	pers-hrs/yr
Maintenance labor required	349	pers-hrs/yr
Electrical energy required	8860	kWh/yr
Volume of earthwork required	55800	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	4690	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	3630	cuft
Costs		
Construction and equipment cc	402000	$
Earthwork Cost	16500	$
Wall Concrete Cost	87400	$
Slab Concrete Cost	60900	$
Installed Equipment Cost	176000	$
Misc Costs	61400	$
Operational labor cost	32900	$/yr
Maintenance labor cost	15100	$/yr
Material and supply cost	4020	$/yr
Chemical cost	0	$/yr
Energy cost	886	$/yr
Amortization cost	37500	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0177	MGD(US)
Total pumping capacity	0.0177	MGD(US)
Design capacity per pump	6.14	gpm(US)
Number of pumps	3	

Number of batteries	1	
Firm pumping capacity	0.0177	MGD(US)
Quantities		
Operation labor required	262	pers-hrs/yr
Maintenance labor required	198	pers-hrs/yr
Electrical energy required	598	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment co	36300	$
Earthwork Cost	475	$
Pump Building Cost	22000	$
Installed Pump Cost	8290	$
Misc Costs	5540	$
Operational labor cost	13500	$/yr
Maintenance labor cost	8550	$/yr
Material and supply cost	254	$/yr
Chemical cost	0	$/yr
Energy cost	60	$/yr
Amortization cost	3440	$/yr

Secondary Clarifier

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	9000	sqft
Surface area per circular clarifi	4500	sqft
Diameter of each circular clarif	76	ft
Number of clarifiers per battery	2	
Number of batteries	1	
Solids loading rate	13.9	lb/(sqft·d)
Hydraulic retention time	3.23	hr
Designed surface overflow rate	500	gal(US)/(sqft·d)
Weir length	800	ft
Volume of wasted sludge	12800	gpd(US)
Quantities		
Operation labor required	960	pers-hrs/yr
Maintenance labor required	528	pers-hrs/yr
Electrical energy required	9920	kWh/yr
Volume of earthwork required	114000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	8930	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	5020	cuft
Costs		
Construction and equipment co	598000	$
Earthwork Cost	33900	$
Wall Concrete Cost	121000	$
Slab Concrete Cost	116000	$
Installed Equipment Cost	236000	$
Misc Costs	91300	$
Operational labor cost	49500	$/yr
Maintenance labor cost	22800	$/yr
Material and supply cost	5980	$/yr
Chemical cost	0	$/yr
Energy cost	992	$/yr
Amortization cost	55200	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0128	MGD(US)
Total pumping capacity	0.0128	MGD(US)
Design capacity per pump	4.43	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.0128	MGD(US)
Quantities		
Operation labor required	251	pers-hrs/yr
Maintenance labor required	189	pers-hrs/yr
Electrical energy required	432	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment co	35000	$
Earthwork Cost	475	$
Pump Building Cost	22000	$
Installed Pump Cost	7180	$
Misc Costs	5340	$
Operational labor cost	12900	$/yr
Maintenance labor cost	8150	$/yr
Material and supply cost	245	$/yr
Chemical cost	0	$/yr

Energy cost	43	$/yr
Amortization cost	3310	$/yr

Drying Beds

Design Output Data

Description	Value	Units
Sludge Drying Beds		
Design Information		
Total surface area required	53400	sqft
Initial depth of sludge	12	in
Final solids	50	%
Bed holding time	28.5	d
Quantities		
Total drying bed surface area	53400	sqft
Number beds	18	
Surface area of each individua	2960	sqft
Length of each bed	148	ft
Volume of earthwork required	263000	cuft
Volume concrete for dividing w	17900	cuft
Volume of R.C. in-place for tru	4000	cuft
Volume of sand	40000	cuft
Volume of gravel	53400	cuft
Clay pipe diameter	6	in
Total length clay pipe	5340	in
Sludge solids produced	2.92	ton(short)/d
Operational labor required	3120	pers-hrs/yr
Maintenance labor required	1560	pers-hrs/yr
Costs		
Construction and equipment cc	751000	$
Earthwork Cost	77800	$
Wall Concrete Cost	301000	$
Slab Concrete Cost	31100	$
Drying Bed Media Cost	149000	$
Drain Pipe System Cost	117000	$
Misc Costs	74400	$
Operational labor cost	161000	$/yr
Maintenance labor cost	67200	$/yr
Material and supply cost	6760	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	65300	$/yr

Trickling Filter

Design Output Data

Description	Value	Units
Trickling Filtration		
Design Information		
Reaction rate constant	0.00156	
Hydraulic loading rate	0.75	gal(US)/(sqft·min)
Total hydraulic loading rate	0.761	gal(US)/(sqft·min)
Recirculation ratio	0.0141	
Number of towers per stage	2	
Number of stages	1	
Depth of filter tower	19.2	ft
Diameter of filter tower	51.7	ft
Surface area per filter tower	2100	sqft
Total surface area	4210	sqft
Volume per filter tower	40300	cuft
Total volume	80600	cuft
Quantities		
Operation labor required	322	pers-hr/yr
Maintenance labor required	279	pers-hr/yr
Volume of earthwork required	51200	cuft
Volume of slab concrete requir	2800	cuft
Volume of wall concrete requir	6540	cuft
Number of posts per tower	154	
Total length of precast beams	2240	ft
Costs		
Construction and equipment cc	1130000	$
Earthwork Cost	15200	$
Wall Concrete Cost	157000	$
Slab Concrete Cost	36400	$
Concrete Beam Cost	89800	$
Media Cost	459000	$
Installed Distributor Arm Cos	145000	$
Misc Costs	226000	$
Operational labor cost	16600	$/yr
Maintenance labor cost	12000	$/yr
Material and supply cost	6050	$/yr
Chemical cost	0	$/yr
Energy cost	874	$/yr
Amortization cost	98000	$/yr

Internal Recycle Pumping		
Design Information		
Average daily pumping rate	12	MGD(US)
Total pumping capacity	12	MGD(US)
Design capacity per pump	4180	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	12	MGD(US)
Quantities		
Operation labor required	678	pers-hrs/yr
Maintenance labor required	573	pers-hrs/yr
Electrical energy required	401000	kWh/yr
Volume of earthwork required	3500	cuft
Area of pump building	438	sqft
Costs		
Construction and equipment cc	231000	$
Earthwork Cost	1040	$
Pump Building Cost	48100	$
Installed Pump Cost	147000	$
Misc Costs	35200	$
Operational labor cost	34900	$/yr
Maintenance labor cost	24700	$/yr
Material and supply cost	1620	$/yr
Chemical cost	0	$/yr
Energy cost	40100	$/yr
Amortization cost	21800	$/yr

Filtration

Design Output Data

Description	Value	Units
Filtration		
Design Information		
Surface area	2220	sqft
Depth	9	ft
Terminal headloss through bec	192000	ft
Maximum head for backwashir	19.6	ft
Backwash rate	20	gal(US)/(sqft·min)
Washwater gutter depth	0.798	ft
Washwater needed	222000	gal(US)
Quantities		
Operation labor required	190	pers-hrs/yr
Maintenance labor required	130	pers-hrs/yr
Electrical energy required	35300	kWh
Surface area per filter unit	2220	sqft
Number of cells per filter unit	4	
Number of filter units per batte	1	
Number of batteries	1	
Volume of earthwork for filter	25000	cuft
Volume of concrete for filter	12600	cuft
Volume of surge tank	29700	cuft
Width of surge tank	46	ft
Length of surge tank	92.1	ft
Volume of earthwork for surge	60000	cuft
Volume of concrete for surge t	7870	cuft
Costs		
Construction and equipment cc	2210000	$
Earthwork Cost for Filter	7410	$
Earthwork Cost for Surge Ta	17800	$
Concrete Cost for Filter	304000	$
Concrete Cost for Surge Tar	189000	$
Installed Equipment Cost	1250000	$
Misc Costs	441000	$
Operational labor cost	9770	$/yr
Maintenance labor cost	5610	$/yr
Material and supply cost	62300	$/yr
Chemical cost	0	$/yr
Energy cost	3530	$/yr
Amortization cost	213000	$/yr

Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	6.94	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	6.94	cuyd/d
Maximum anticipated landfill dc	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	703	sqft
Width of sludge storage shed s	18.7	ft
Length of sludge storage shed	37.5	ft
Volume of earthwork required	2130	cuft
Volume of slab concrete requir	960	cuft
Surface area of canopy roof	703	sqft
Round trip haul distance	20	miles
Round trips per day per truck	1	
Distance traveled per year per	5000	miles
Sludge hauled	6.14	ton(short)/d
Operation labor required	109	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment cc	310000	$
Earthwork Cost	631	$
Slab Concrete Cost	12400	$
Canopy Roof Cost	14100	$
Vehicle Cost	283000	$
Operational labor cost	5590	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	53600	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	63500	$/yr

Secondary Clarifier(1)

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	9090	sqft
Surface area per circular clarifi	4540	sqft
Diameter of each circular clarif	77	ft
Number of clarifiers per battery	2	
Number of batteries	1	
Solids loading rate	0.416	lb/(sqft·d)
Hydraulic retention time	3.23	hr
Designed surface overflow rate	500	gal(US)/(sqft·d)
Weir length	803	ft
Volume of wasted sludge	44000	gpd(US)
Quantities		
Operation labor required	966	pers-hrs/yr
Maintenance labor required	532	pers-hrs/yr
Electrical energy required	9940	kWh/yr
Volume of earthwork required	118000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	9160	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	5080	cuft
Costs		
Construction and equipment cc	608000	$
Earthwork Cost	34900	$
Wall Concrete Cost	122000	$
Slab Concrete Cost	119000	$
Installed Equipment Cost	239000	$
Misc Costs	92700	$
Operational labor cost	49800	$/yr
Maintenance labor cost	22900	$/yr
Material and supply cost	6080	$/yr
Chemical cost	0	$/yr
Energy cost	994	$/yr
Amortization cost	56100	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.044	MGD(US)
Total pumping capacity	0.044	MGD(US)
Design capacity per pump	15.3	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.044	MGD(US)
Quantities		
Operation labor required	295	pers-hrs/yr
Maintenance labor required	227	pers-hrs/yr
Electrical energy required	1490	kWh/yr
Volume of earthwork required	1610	cuft
Area of pump building	201	sqft
Costs		
Construction and equipment cc	41200	$
Earthwork Cost	476	$

Pump Building Cost	22100	$
Installed Pump Cost	12400	$
Misc Costs	6290	$
Operational labor cost	15200	$/yr
Maintenance labor cost	9790	$/yr
Material and supply cost	289	$/yr
Chemical cost	0	$/yr
Energy cost	149	$/yr
Amortization cost	3900	$/yr

Chlorination

Design Output Data

Description	Value	Units
Chlorination		
Design Information		
Volume of tank	250000	gal(US)
Average chlorine required	374	lb/d
Peak chlorine required	1000	lb/d
Influent coliform count	10000000	/100ml
Effluent coliform count	29.2	/100ml
Quantities		
Operational labor required	944	pers-hrs/yr
Maintenance labor required	167	pers-hrs/yr
Electrical energy required	118000	kWh/yr
Volume of earthwork required	14200	cuft
Volume of slab concrete requir	3350	cuft
Volume of wall concrete requir	5620	cuft
Number of chlorinators and ev	1	
Chlorination building area	220	sqft
Number of chlorine cylinders	6	
Area of chlorine storage buildir	840	sqft
Costs		
Construction and equipment cc	606000	$
Earthwork Cost	4220	$
Wall Concrete Cost	135000	$
Slab Concrete Cost	43400	$
Installed Equipment Cost	320000	$
Building Cost	24200	$
Storage Building Cost	46200	$
Misc Costs	32900	$
Operational labor cost	48600	$/yr
Maintenance labor cost	7210	$/yr
Material and supply cost	22900	$/yr
Chemical cost	88800	$/yr
Energy cost	11800	$/yr
Amortization cost	61500	$/yr

IFAS

Design Output Data

Description	Value	Units
IFAS		
Design Information		
Carbon & Nitrification Design		
Max. specific growth of nitrifier	0.2	1/d
Death rate of nitrifiers at winter	0.0301	1/d
Minimum SRT for design at wi	5.89	d
Design SRT for design at winte	8.83	d
Design SS	2500	mg/L
Calculated VSS	1920	mg/L
Calculated VSS:TSS ratio	0.766	mg VSS/mg SS
Total volume of reactors	4270	m3
Length of parallel train	22	m
Width of parallel train	10	m
Sidewater depth	5	m
Number of batteries	1	
Number of parallel trains per b	4	
Number of cells within one trai	2	
Total number of dividing walls	4	
Hydraulic retention time	6.02	hr
F/M ratio	0.17	kg BOD/kg MLSS/d
Volumetric BOD loading	0.134	kg BOD/m3/d
Observed yield (VSS basis)	0.876	g VSS/g BOD
Observed yield (TSS basis)	0.762	g TSS/g BOD
Amount of alkalinity required	128	gCaCO3/m3
Amount of sludge generated	497	kg/d
Sludge recycle rate	5680	m3/d
Nitrogen requirement for biom	1.6	mg/L
Phosphorus requirement for bi	0.319	mg/L
Oxygen requirement to meet a	1910	kg/d
Air flow required to meet avera	8890	N m3/hr
Design air flow	34.7	N m3/min/1000 m3
Quantities		

Operation labor required	2010	pers-hrs/yr
Maintenance labor required	1080	pers-hrs/yr
Electrical energy required	1390000	kWh/yr
Volume of earthwork required	92300	cuft
Volume of slab concrete requir	46200	cuft
Volume of wall concrete requir	21400	cuft
Handrail length	771	ft
Number of diffusers per train	113	
Number of swing arm headers	3	
Volume of Media required	2140	m3
Sieve Area required	45.4	m2
Costs		
Construction and equipment co	2470000	$
Earthwork Cost	27300	$
Wall Concrete Cost	516000	$
Slab Concrete Cost	599000	$
Handrail Cost	57800	$
Installed Aerator Equipment	257000	$
Air Piping Cost	90900	$
Misc Costs	170000	$
Media Cost	705000	$
Screen Cost	50000	$
Operational labor cost	104000	$/yr
Maintenance labor cost	46700	$/yr
Material and supply cost	48500	$/yr
Chemical cost	0	$/yr
Energy cost	139000	$/yr
Amortization cost	259000	$/yr
Sludge Recycle Pumping		
Design Information		
Average daily pumping rate	1.5	MGD(US)
Total pumping capacity	3	MGD(US)
Design capacity per pump	1040	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	1.5	MGD(US)
Quantities		
Operation labor required	464	pers-hrs/yr
Maintenance labor required	382	pers-hrs/yr
Electrical energy required	50200	kWh/yr
Volume of earthwork required	2070	cuft
Area of pump building	259	sqft
Costs		
Construction and equipment co	128000	$
Earthwork Cost	614	$
Pump Building Cost	28500	$
Installed Pump Cost	79500	$
Misc Costs	19500	$
Operational labor cost	23900	$/yr
Maintenance labor cost	16500	$/yr
Material and supply cost	897	$/yr
Chemical cost	0	$/yr
Energy cost	5020	$/yr
Amortization cost	12100	$/yr

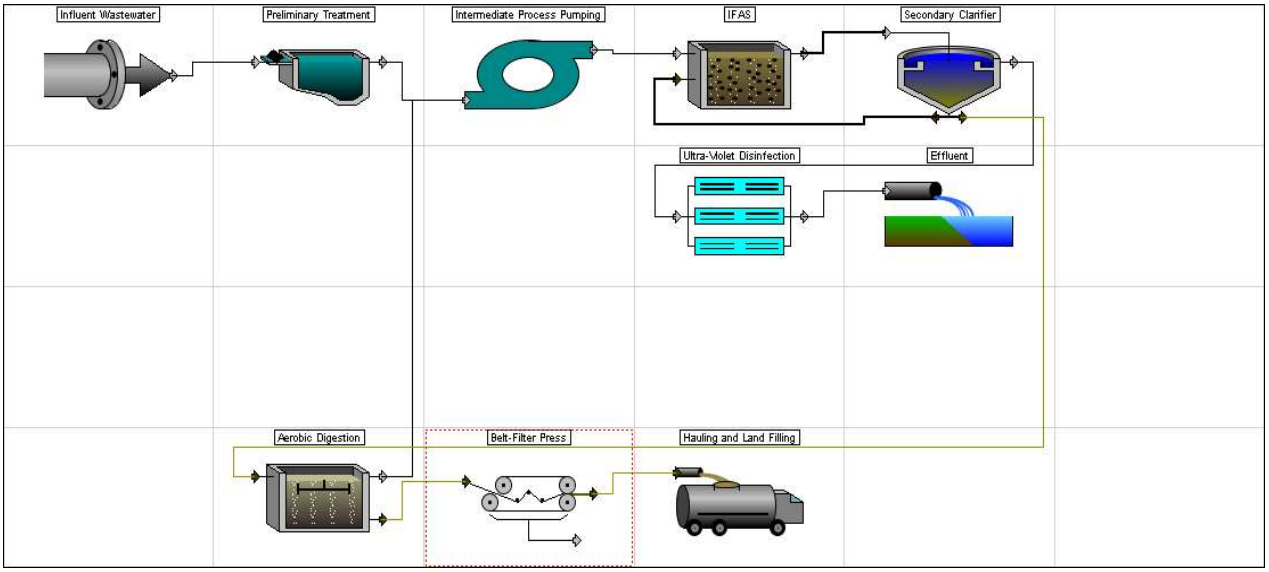
Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment co	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

Perry Willard Regional

Layout - Perry Willard



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$5,920,000	$
Other direct construction costs	$3,340,000	$
Other indirect construction cos	$7,060,000	$
Total construction costs	$16,300,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$30,900	$/yr
Laboratory labor cost	$140,000	$/yr
Unit process operation labor c	$372,000	$/yr
Unit process maintenance labc	$171,000	$/yr
Total labor costs	$713,000	$/yr
MATERIAL COSTS		
Total material cost	$180,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$15,800	$/yr
ENERGY COSTS		
Total energy cost	$333,000	$/yr
Total operation and maintanen	$1,240,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$1,450,000	$/yr
Total annual project cost	$2,690,000	$/yr
PROJECT SUMMARY		
Present worth	$32,300,000	$
Total project cost	$16,300,000	$
Total operation labor cost	$543,000	$/yr
Total maintenance labor cost	$171,000	$/yr
Total material cost	$180,000	$/yr
Total chemical cost	$15,800	$/yr
Total energy cost	$333,000	$/yr
Total amortization cost	$1,450,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Preliminary Treatment	128000	39100	16900	3190	0	2210	10700
Aerobic Digestion	1000000	83900	34100	75400	0	91200	89300
Intermediate Process Pumping	79200	24800	16200	555	0	6820	7490
Belt-Filter Press	812000	4670	920	0	15500	2920	74300

IFAS	1810000	155000	73500	39600	0	226000	196000
Ultra-Violet Disinfection	107000	0	1100	1070	374	2680	9100
Hauling and Land Filling	316000	6820	0	53600	0	0	64000
Secondary Clarifier	656000	57500	27700	6430	0	1140	59900
Effluent	0	0	0	0	0	0	0
Blower System	998000	0	0	0	0	0	83700
Other Costs	10400000	171000	0	0	0	0	853000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	12	acre
Administration labor hours	600	hr/yr
Laboratory labor hours	2720	hr/yr
Costs		
DIRECT COSTS		
Mobilization	296000	$
Site preparation	477000	$
Site electrical	802000	$
Yard piping	545000	$
Instrumentation and control	387000	$
Lab and administration building	836000	$
Total direct construction costs	3340000	$
INDIRECT COSTS		
Cost of land	240000	$
Miscellaneous cost	532000	$
Legal cost	213000	$
Engineering design fee	1600000	$
Inspection cost	213000	$
Contingency	1060000	$
Technical	213000	$
Interest during construction	1600000	$
Profit	1390000	$
Total indirect construction cost	7060000	$
Total of other construction cos	10400000	$
LABOR COSTS		
Administration labor cost	30900	$/yr
Laboratory labor cost	140000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	12100	scfm
Safety factor	1.5	
Requested air flow capacity	18200	scfm
Total capacity of blowers	18200	scfm
Number of blowers in use	3	
Total number of blowers	4	
Capacity of individual blowers	6060	scfm
Estimated cost of an installed l	181000	$
Blower building area	1580	sqft
Costs		
Construction and equipment cc	998000	$
Installed Blower Cost	725000	$
Building Cost	173000	$
Misc Costs	98900	$
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	83700	$/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	1.23	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	1.08	cuft/s
Average flow	3.08	cuft/s
Minimum flow	7.7	cuft/s
Temperature	10	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	0.539	cuft/s
Width of channel	0.0898	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.0348	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	8	cuft/d
Costs		
Construction and equipment cc	128000	$
Operational labor cost	39100	$/yr
Maintenance labor cost	16900	$/yr
Material and supply cost	3190	$/yr
Chemical cost	0	$/yr
Energy cost	2210	$/yr
Amortization cost	10700	$/yr

Aerobic Digestion

Design Output Data

Description	Value	Units
Aerobic Digestion		
Design Information		
Solids retention time	36.3	d
Design SS	12000	mg/L
Calculated VSS	5820	mg/L
Calculated VSS:TSS ratio	0.485	mg VSS/mg SS
Total volume of reactors	3920	m3
Length of parallel train	40	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	1060	kg/d
Air flow required to meet avera	5890	N m3/hr
Design air flow	25.1	N m3/min/1000 m3
Volatile solids loading	0.0222	lb/(cuft·d)
Solids accumulated	2850	lb/d
Digester capacity	104000	lb
Volume of wasted sludge	473000	gal(US)
Quantities		
Operation labor required	1630	pers-hrs/yr
Maintenance labor required	840	pers-hrs/yr
Electrical energy required	912000	kWh/yr
Volume of earthwork required	84100	cuft
Volume of slab concrete requir	18700	cuft
Volume of wall concrete requir	12700	cuft
Handrail length	343	ft
Number of diffusers per train	148	
Number of swing arm headers	6	
Costs		
Construction and equipment cc	1000000	$
Earthwork Cost	24900	$
Wall Concrete Cost	305000	$
Slab Concrete Cost	242000	$
Handrail Cost	25700	$
Installed Aerator Equipment	250000	$
Air Piping Cost	56500	$
Misc Costs	99600	$
Operational labor cost	83900	$/yr
Maintenance labor cost	34100	$/yr
Material and supply cost	75400	$/yr
Chemical cost	0	$/yr
Energy cost	91200	$/yr
Amortization cost	89300	$/yr

Intermediate Process Pumping

Design Output Data

Description	Value	Units
Intermediate Pumping		
Design Information		
Average daily pumping rate	2.04	MGD(US)
Total pumping capacity	0.744	MGD(US)
Design capacity per pump	258	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	2.04	MGD(US)
Quantities		
Operation labor required	482	pers-hrs/yr
Maintenance labor required	400	pers-hrs/yr
Electrical energy required	68200	kWh/yr
Volume of earthwork required	1720	cuft
Area of pump building	215	sqft
Costs		
Construction and equipment cc	79200	$
Earthwork Cost	509	$
Pump Building Cost	23600	$
Installed Pump Cost	43000	$
Misc Costs	12100	$
Operational labor cost	24800	$/yr
Maintenance labor cost	16200	$/yr
Material and supply cost	555	$/yr
Chemical cost	0	$/yr
Energy cost	6820	$/yr
Amortization cost	7490	$/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	50.7	gpm(US)
Final solids content	19	%
Solids capture fraction	0.996	
Quantities		
Operation labor required	90.6	pers-hrs/yr
Maintenance labor required	22.7	pers-hrs/yr
Power	29200	kWh/yr
Polymer required	11900	lb/yr
Dry solids produced	3260	lb/d
Belt filter(s)	275000	$
Building	279000	$
Installation	68800	$
Polymer system	82500	$
Feed pumps	30300	$
Conveyor system	77000	$
Costs		
Construction and equipment cc	812000	$
Building Cost	279000	$
Polymer System Cost	82500	$
Feed Pumps Cost	30300	$
Conveyor System Cost	77000	$
Installed Belt Filter	344000	$
Operational labor cost	4670	$/yr
Maintenance labor cost	920	$/yr
Material and supply cost	0	$/yr
Chemical cost	15500	$/yr
Energy cost	2920	$/yr
Amortization cost	74300	$/yr

IFAS

Design Output Data

Description	Value	Units
IFAS		
Design Information		
Carbon & Nitrification Design		
Max. specific growth of nitrifier	0.205	1/d
Death rate of nitrifiers at winter	0.0303	1/d
Minimum SRT for design at wi	5.72	d
Design SRT for design at winte	8.58	d
Design SS	4000	mg/L
Calculated VSS	2440	mg/L
Calculated VSS:TSS ratio	0.611	mg VSS/mg SS
Total volume of reactors	3490	m3
Length of parallel train	24	m
Width of parallel train	10	m

Sidewater depth	5	m
Number of batteries	1	
Number of parallel trains per b	3	
Number of cells within one trai	2	
Total number of dividing walls	3	
Hydraulic retention time	10.8	hr
F/M ratio	0.149	kg BOD/kg MLSS/d
Volumetric BOD loading	0.502	kg BOD/m3/d
Observed yield (VSS basis)	0.875	g VSS/g BOD
Observed yield (TSS basis)	0.954	g TSS/g BOD
Amount of alkalinity required	172	gCaCO3/m3
Amount of sludge generated	2240	kg/d
Sludge recycle rate	5160	m3/d
Nitrogen requirement for biom	11.8	mg/L
Phosphorus requirement for bi	2.36	mg/L
Oxygen requirement to meet a	3040	kg/d
Air flow required to meet avera	14100	N m3/hr
Design air flow	67.5	N m3/min/1000 m3
Quantities		
Operation labor required	2550	pers-hrs/yr
Maintenance labor required	1430	pers-hrs/yr
Electrical energy required	2210000	kWh/yr
Volume of earthwork required	76600	cuft
Volume of slab concrete requir	17000	cuft
Volume of wall concrete requir	12700	cuft
Handrail length	439	ft
Number of diffusers per train	239	
Number of swing arm headers	4	
Volume of Media required	1740	m3
Sieve Area required	2.82	m2
Costs		
Construction and equipment co	1690000	$
Earthwork Cost	22700	$
Wall Concrete Cost	305000	$
Slab Concrete Cost	220000	$
Handrail Cost	33000	$
Installed Aerator Equipment	267000	$
Air Piping Cost	154000	$
Misc Costs	110000	$
Media Cost	575000	$
Screen Cost	3100	$
Operational labor cost	131000	$/yr
Maintenance labor cost	58200	$/yr
Material and supply cost	38700	$/yr
Chemical cost	0	$/yr
Energy cost	221000	$/yr
Amortization cost	185000	$/yr
Sludge Recycle Pumping		
Design Information		
Average daily pumping rate	1.36	MGD(US)
Total pumping capacity	2.73	MGD(US)
Design capacity per pump	947	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	1.36	MGD(US)
Quantities		
Operation labor required	458	pers-hrs/yr
Maintenance labor required	377	pers-hrs/yr
Electrical energy required	45600	kWh/yr
Volume of earthwork required	2030	cuft
Area of pump building	254	sqft
Costs		
Construction and equipment co	124000	$
Earthwork Cost	602	$
Pump Building Cost	27900	$
Installed Pump Cost	76200	$
Misc Costs	18900	$
Operational labor cost	23600	$/yr
Maintenance labor cost	15300	$/yr
Material and supply cost	865	$/yr
Chemical cost	0	$/yr
Energy cost	4560	$/yr
Amortization cost	11700	$/yr

Ultra-Violet Disinfection

Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calc	1.63	gal(US)/(min·W)
System is not headloss constra		
Total number of lamps needed	22	

Number of spare channels	1	
Total number of lamps used in	36	
Number of excess lamps	14	
Number of lamps/modules	2	
Number of modules/bank	3	
Number of banks/channel	2	
Number of channels	3	
Calculated headloss	1.91	in
Costs		
Construction and equipment co	107000	$
Cost of installation	64400	$
Total cost of UV lamps	43000	$
Operational labor cost	0	$/yr
Maintenance labor cost	1100	$/yr
Material and supply cost	1070	$/yr
Chemical cost	374	$/yr
Energy cost	2680	$/yr
Amortization cost	9100	$/yr

Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	8.46	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	8.46	cuyd/d
Maximum anticipated landfill d	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	857	sqft
Width of sludge storage shed s	20.7	ft
Length of sludge storage shed	41.4	ft
Volume of earthwork required	2550	cuft
Volume of slab concrete requir	1140	cuft
Surface area of canopy roof	857	sqft
Round trip haul distance	20	miles
Round trips per day per truck	1	
Distance traveled per year per	5000	miles
Sludge hauled	7.49	ton(short)/d
Operation labor required	132	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment co	316000	$
Earthwork Cost	756	$
Slab Concrete Cost	14800	$
Canopy Roof Cost	17100	$
Vehicle Cost	283000	$
Operational labor cost	6820	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	53600	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	64000	$/yr

Secondary Clarifier

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	6810	sqft
Surface area per circular clarifi	3410	sqft
Diameter of each circular clarif	66	ft
Number of clarifiers per battery	2	
Number of batteries	1	
Solids loading rate	16.7	lb/(sqft·d)
Hydraulic retention time	8.38	hr
Designed surface overflow rate	300	gal(US)/(sqft·d)
Weir length	74.4	ft
Volume of wasted sludge	57500	gpd(US)
Quantities		
Operation labor required	812	pers-hrs/yr
Maintenance labor required	446	pers-hrs/yr
Electrical energy required	9480	kWh/yr
Volume of earthwork required	84500	cuft
Slab thickness	11.4	in
Volume of slab concrete requir	7680	cuft

Wall thickness	14	in
Volume of wall concrete requir	7710	cuft
Costs		
Construction and equipment co	613000	$
Earthwork Cost	25000	$
Wall Concrete Cost	186000	$
Slab Concrete Cost	99600	$
Installed Equipment Cost	209000	$
Misc Costs	93500	$
Operational labor cost	41800	$/yr
Maintenance labor cost	18100	$/yr
Material and supply cost	6130	$/yr
Chemical cost	0	$/yr
Energy cost	948	$/yr
Amortization cost	55900	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0575	MGD(US)
Total pumping capacity	0.0575	MGD(US)
Design capacity per pump	20	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.0575	MGD(US)
Quantities		
Operation labor required	305	pers-hrs/yr
Maintenance labor required	236	pers-hrs/yr
Electrical energy required	1940	kWh/yr
Volume of earthwork required	1610	cuft
Area of pump building	201	sqft
Costs		
Construction and equipment co	43100	$
Earthwork Cost	477	$
Pump Building Cost	22100	$
Installed Pump Cost	13900	$
Misc Costs	6580	$
Operational labor cost	15700	$/yr
Maintenance labor cost	9590	$/yr
Material and supply cost	302	$/yr
Chemical cost	0	$/yr
Energy cost	194	$/yr
Amortization cost	4080	$/yr

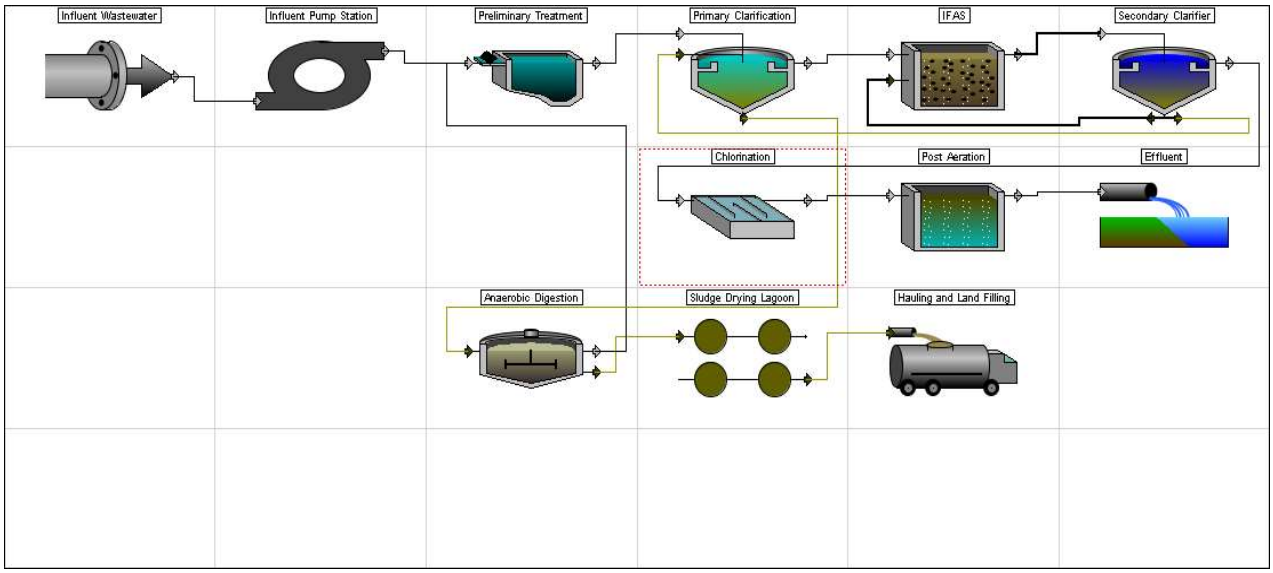
Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment co	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

Price River Water Improvement District

Layout - Price River



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$13,500,000	$
Other direct construction costs	$5,320,000	$
Other indirect construction cos	$14,800,000	$
Total construction costs	$33,600,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$53,200	$/yr
Laboratory labor cost	$156,000	$/yr
Unit process operation labor c	$576,000	$/yr
Unit process maintenance labc	$268,000	$/yr
Total labor costs	$1,050,000	$/yr
MATERIAL COSTS		
Total material cost	$224,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$78,900	$/yr
ENERGY COSTS		
Total energy cost	$476,000	$/yr
Total operation and maintanen	$1,830,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$2,930,000	$/yr
Total annual project cost	$4,770,000	$/yr
PROJECT SUMMARY		
Present worth	$57,600,000	$
Total project cost	$33,600,000	$
Total operation labor cost	$785,000	$/yr
Total maintenance labor cost	$268,000	$/yr
Total material cost	$224,000	$/yr
Total chemical cost	$78,900	$/yr
Total energy cost	$476,000	$/yr
Total amortization cost	$2,930,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Influent Pump Station	2070000	36300	25000	14500	0	28000	179000
Preliminary Treatment	671000	52800	23000	16800	0	3040	56200
Anaerobic Digestion	3440000	73100	38700	27900	0	11600	325000
Primary Clarification	474000	49400	24600	4630	0	993	44100

Chlorination	571000	45700	6270	22100	78900	11800	58600
Sludge Drying Lagoon	98000	4390	2310	0	0	0	8210
IFAS	3910000	203000	104000	76300	0	416000	415000
Post Aeration	58000	32900	10200	1440	0	3320	5270
Hauling and Land Filling	325000	8990	0	53600	0	0	64800
Secondary Clarifier	693000	69800	34500	6790	0	1300	63900
Effluent	0	0	0	0	0	0	0
Blower System	1210000	0	0	0	0	0	101000
Other Costs	20100000	209000	0	0	0	0	1610000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	43	acre
Administration labor hours	1030	hr/yr
Laboratory labor hours	3020	hr/yr
Costs		
DIRECT COSTS		
Mobilization	478000	$
Site preparation	709000	$
Site electrical	1330000	$
Yard piping	892000	$
Instrumentation and control	665000	$
Lab and administration building	1250000	$
Total direct construction costs	5320000	$
INDIRECT COSTS		
Cost of land	860000	$
Miscellaneous cost	1080000	$
Legal cost	433000	$
Engineering design fee	3250000	$
Inspection cost	433000	$
Contingency	2170000	$
Technical	433000	$
Interest during construction	3300000	$
Profit	2820000	$
Total indirect construction cost	14800000	$
Total of other construction cos	20100000	$
LABOR COSTS		
Administration labor cost	53200	$/yr
Laboratory labor cost	156000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	16000	scfm
Safety factor	1.5	
Requested air flow capacity	23900	scfm
Total capacity of blowers	23900	scfm
Number of blowers in use	4	
Total number of blowers	5	
Capacity of individual blowers	5990	scfm
Estimated cost of an installed I	180000	$
Blower building area	1690	sqft
Costs		
Construction and equipment co	1210000	$
Installed Blower Cost	900000	$
Building Cost	186000	$
Misc Costs	119000	$
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	101000	$/yr
Notes		
Energy costs are shown at the individual unit processes that require air		

Influent Wastewater

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	26600	cuft
Width of wet well	205	ft
Depth of the pumping station	28.3	ft
Length of the pumping station	21.2	ft

Width of the pumping station	236	ft
Minimum depth of water in wet	7.31	ft
Area of pump building	682	sqft
Peak capacity of pumps	13.6	MGD(US)
Firm pumping capacity	13.6	MGD(US)
Total dynamic head - average	44.5	ft
Quantities		
Operation labor required	705	pers-hrs/yr
Maintenance labor required	595	pers-hrs/yr
Electrical energy required	280000	kWh/yr
Volume of earthwork required	626000	cuft
Volume of slab concrete requir	47000	cuft
Volume of wall concrete requir	19800	cuft
Capacity per pump	9410	gpm(US)
Number of constant speed pur	2	
Number of variable speed pur	0	
Diameter of discharge header	21.9	in
Total dynamic head	60	ft
Size of selected pump	20	in
Specific speed of pump	4050	
Pump rotating speed	889	rpm
Motor size required	166	HP
Size of selected motor	200	HP
Width of pump system	4.6	ft
Length of pump system	21.6	ft
Length of the dry well	21.2	ft
Width of the dry well	30.6	ft
Costs		
Construction and equipment co	2070000	$
Earthwork Cost	186000	$
Wall Concrete Cost	477000	$
Slab Concrete Cost	609000	$
Building Cost	75000	$
Installed Pump Equipment C	410000	$
Misc Costs	316000	$
Operational labor cost	36300	$/yr
Maintenance labor cost	25000	$/yr
Material and supply cost	14500	$/yr
Chemical cost	0	$/yr
Energy cost	28000	$/yr
Amortization cost	179000	$/yr

Preliminary Treatment

Design Output Data

Description	Value	Units
Preliminary Treatment		
Design Information		
Mechanically Cleaned Bar Screen		
Bar size	0.25	in
Bar spacing	0.5	in
Slope of bars from horizontal	30	degrees
Head loss through screen	0.176	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	2.47	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	15.4	cuft/s
Average flow	6.18	cuft/s
Minimum flow	2.79	cuft/s
Temperature	10	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	7.71	cuft/s
Width of channel	1.28	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.00137	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	16.1	cuft/d
Costs		
Construction and equipment co	671000	$
Operational labor cost	52800	$/yr
Maintenance labor cost	23000	$/yr
Material and supply cost	16800	$/yr

Chemical cost	0	$/yr
Energy cost	3040	$/yr
Amortization cost	56200	$/yr

Anaerobic Digestion

Design Output Data

Description	Value	Units
Anaerobic Digestion		
Design Information		
Percent VSS destroyed	50	%
Solids concentration in digeste	5	%
Detention time	25	d
Digester depth	27.1	ft
Digester diameter	65	ft
Effective digester volume	198000	cuft
Number of digesters per batter	2	
Number of primary digesters p	1	
Number of secondary digester	1	
Number of batteries	1	
Gas produced	34.6	cuft/min
Heat required	719000	BTU/hr
Digester gas required	27.7	cuft/min
Total natural gas required	0	cuft/yr
Quantities		
Operation labor required	1420	pers-hrs/yr
Maintenance labor required	920	pers-hrs/yr
Electrical energy required	116000	kWh/yr
Volume of earthwork required	197000	cuft
Slab thickness	10.8	in
Volume of slab concrete requir	6560	cuft
Wall thickness	21	in
Volume of wall concrete requir	23700	cuft
Sidewater depth	27.1	ft
Surface area/floor of 2-story cc	1240	sqft
Piping size	8	in
Length of total piping system	624	ft
Number of 90 degree elbows	26	
Number of tees	51	
Number of plug valves	37	
Total dry solids treated	4.62	ton(short)/d
Costs		
Construction and equipment cc	3440000	$
Earthwork Cost	58400	$
Wall Concrete Cost	572000	$
Slab Concrete Cost	85000	$
Building Cost	137000	$
Piping System Cost	381000	$
Floating Cover Cost	1220000	$
Gas Recirculation Units Cost	267000	$
Heating Units Cost	182000	$
Gas Safety Equipment Cost	120000	$
Installed Pumps Cost	74800	$
Operational labor cost	73100	$/yr
Maintenance labor cost	38700	$/yr
Material and supply cost	27900	$/yr
Chemical cost	0	$/yr
Energy cost	11600	$/yr
Amortization cost	325000	$/yr

Primary Clarification

Design Output Data

Description	Value	Units
Primary Clarification		
Design Information		
Surface area	5120	sqft
Surface area per circular clarifi	2560	sqft
Diameter of each circular clarif	58	ft
Number of clarifiers per batter	2	
Number of batteries	1	
Solids loading rate	2.95	lb/(sqft·d)
Hydraulic retention time	2.02	hr
Weir length	673	ft
Volume of sludge generated	26400	gpd(US)
Quantities		
Operation labor required	684	pers-hrs/yr
Maintenance labor required	375	pers-hrs/yr
Electrical energy required	9040	kWh/yr
Volume of earthwork required	64500	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	5360	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	3880	cuft

Costs		
Construction and equipment cc	436000	$
Earthwork Cost	19100	$
Wall Concrete Cost	93500	$
Slab Concrete Cost	69500	$
Installed Equipment Cost	187000	$
Misc Costs	66500	$
Operational labor cost	35200	$/yr
Maintenance labor cost	15800	$/yr
Material and supply cost	4360	$/yr
Chemical cost	0	$/yr
Energy cost	904	$/yr
Amortization cost	40500	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0264	MGD(US)
Total pumping capacity	0.0264	MGD(US)
Design capacity per pump	9.17	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.0264	MGD(US)
Quantities		
Operation labor required	276	pers-hrs/yr
Maintenance labor required	210	pers-hrs/yr
Electrical energy required	892	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	201	sqft
Costs		
Construction and equipment cc	38300	$
Earthwork Cost	475	$
Pump Building Cost	22100	$
Installed Pump Cost	9890	$
Misc Costs	5840	$
Operational labor cost	14200	$/yr
Maintenance labor cost	8850	$/yr
Material and supply cost	268	$/yr
Chemical cost	0	$/yr
Energy cost	89	$/yr
Amortization cost	3620	$/yr

Chlorination

Design Output Data

Description	Value	Units
Chlorination		
Design Information		
Volume of tank	208000	gal(US)
Average chlorine required	332	lb/d
Peak chlorine required	833	lb/d
Influent coliform count	10000000	/100ml
Effluent coliform count	29.2	/100ml
Quantities		
Operational labor required	887	pers-hrs/yr
Maintenance labor required	149	pers-hrs/yr
Electrical energy required	118000	kWh/yr
Volume of earthwork required	11900	cuft
Volume of slab concrete requir	2790	cuft
Volume of wall concrete requir	4980	cuft
Number of chlorinators and ev	1	
Chlorination building area	220	sqft
Number of chlorine cylinders	5	
Area of chlorine storage buildir	700	sqft
Costs		
Construction and equipment cc	571000	$
Earthwork Cost	3520	$
Wall Concrete Cost	120000	$
Slab Concrete Cost	36100	$
Installed Equipment Cost	320000	$
Building Cost	24200	$
Storage Building Cost	38500	$
Misc Costs	28700	$
Operational labor cost	45700	$/yr
Maintenance labor cost	6270	$/yr
Material and supply cost	22100	$/yr
Chemical cost	78900	$/yr
Energy cost	11800	$/yr
Amortization cost	58600	$/yr

Sludge Drying Lagoon

Design Output Data

Description	Value	Units
Sludge Drying Lagoon		
Design Information		

Sludge flow	13500	gpd(US)
Initial solids content in sludge	5	%
Sludge depth in lagoon	1	ft
Dry solids produced	2060000	lb/yr
Lagoon volume	896000	cuft
Total lagoon surface area	896000	sqft
Number of lagoons required	2	
Quantities		
Operation labor required	85.2	pers-hrs/yr
Maintenance labor required	55	pers-hrs/yr
Volume of earthwork required	258000	cuft
Volume of wall concrete requir	80	cuft
Surface area per lagoon	448000	sqft
Length of lagoon at top of leve	681	ft
Depth of cut	0.24	ft
Depth of fill	2.76	ft
Costs		
Construction and equipment cc	98000	$
Earthwork Cost	76400	$
Wall Concrete Cost	1930	$
Misc Costs	19600	$
Operational labor cost	4390	$/yr
Maintenance labor cost	2310	$/yr
Material and supply cost	0	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	8210	$/yr

IFAS

Design Output Data

Description	Value	Units
IFAS		
Design Information		
Carbon & Nitrification Design		
Max. specific growth of nitrifier	0.2	1/d
Death rate of nitrifiers at winter	0.0301	1/d
Minimum SRT for design at wi	5.89	d
Design SRT for design at winte	8.83	d
Design SS	2500	mg/L
Calculated VSS	1710	mg/L
Calculated VSS:TSS ratio	0.686	mg VSS/mg SS
Total volume of reactors	7060	m3
Length of parallel train	36	m
Width of parallel train	10	m
Sidewater depth	5	m
Number of batteries	1	
Number of parallel trains per b	4	
Number of cells within one trai	2	
Total number of dividing walls	4	
Hydraulic retention time	11	hr
F/M ratio	0.127	kg BOD/kg MLSS/d
Volumetric BOD loading	0.362	kg BOD/m3/d
Observed yield (VSS basis)	0.999	g VSS/g BOD
Observed yield (TSS basis)	0.972	g TSS/g BOD
Amount of alkalinity required	268	gCaCO3/m3
Amount of sludge generated	3320	kg/d
Sludge recycle rate	5140	m3/d
Nitrogen requirement for biom	8.71	mg/L
Phosphorus requirement for bi	1.74	mg/L
Oxygen requirement to meet a	5720	kg/d
Air flow required to meet avera	26600	N m3/hr
Design air flow	62.8	N m3/min/1000 m3
Quantities		
Operation labor required	3480	pers-hrs/yr
Maintenance labor required	2090	pers-hrs/yr
Electrical energy required	4110000	kWh/yr
Volume of earthwork required	137000	cuft
Volume of slab concrete requir	57800	cuft
Volume of wall concrete requir	30200	cuft
Handrail length	1140	ft
Number of diffusers per train	333	
Number of swing arm headers	5	
Volume of Media required	3530	m3
Sieve Area required	38.1	m2
Costs		
Construction and equipment cc	3780000	$
Earthwork Cost	40600	$
Wall Concrete Cost	727000	$
Slab Concrete Cost	749000	$
Handrail Cost	85400	$
Installed Aerator Equipment	451000	$
Air Piping Cost	268000	$

Misc Costs	255000	$
Media Cost	1160000	$
Screen Cost	41900	$
Operational labor cost	179000	$/yr
Maintenance labor cost	87700	$/yr
Material and supply cost	75500	$/yr
Chemical cost	0	$/yr
Energy cost	411000	$/yr
Amortization cost	403000	$/yr
Sludge Recycle Pumping		
Design Information		
Average daily pumping rate	1.36	MGD(US)
Total pumping capacity	2.71	MGD(US)
Design capacity per pump	943	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	1.36	MGD(US)
Quantities		
Operation labor required	458	pers-hrs/yr
Maintenance labor required	377	pers-hrs/yr
Electrical energy required	45400	kWh/yr
Volume of earthwork required	2030	cuft
Area of pump building	254	sqft
Costs		
Construction and equipment co	123000	$
Earthwork Cost	601	$
Pump Building Cost	27900	$
Installed Pump Cost	76100	$
Misc Costs	18800	$
Operational labor cost	23600	$/yr
Maintenance labor cost	15800	$/yr
Material and supply cost	864	$/yr
Chemical cost	0	$/yr
Energy cost	4540	$/yr
Amortization cost	11700	$/yr

Post Aeration

Design Output Data

Description	Value	Units
Post Aeration by Diffused Aeration		
Design Information		
Dissolved oxygen in influent	2	mg/L
Desired dissolved oxygen in ef	5	mg/L
Correction factor for pressure	1	
Minimum dissolved oxygen in t	2	mg/L
Oxygen saturation at summer t	8.5	mg/L
Oxygen required	99.7	lb/d
Operating transfer efficiency	2.95	lbO2/(HP·h)
Total volume of aerobic reacto	27700	gal(US)
Air flow rate required to meet a	133	scfm
Quantities		
Basin depth	15	ft
Length of basin	8.22	ft
Width of basin	30	ft
Number of diffusers	12	
Number of swing arm diffuser l	1	
Volume of wall concrete requir	860	cuft
Volume of slab concrete requir	185	cuft
Electrical energy required	33200	kWh/yr
Operation labor required	640	pers-hrs/yr
Maintenance labor required	243	pers-hrs/yr
Costs		
Construction and equipment co	58000	$
Wall Concrete Cost	20700	$
Slab Concrete Cost	11100	$
Installed Equipment Cost	20400	$
Misc Costs	5740	$
Operational labor cost	32900	$/yr
Maintenance labor cost	10200	$/yr
Material and supply cost	1440	$/yr
Chemical cost	0	$/yr
Energy cost	3320	$/yr
Amortization cost	5270	$/yr

Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	11.2	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	11.2	cuyd/d
Maximum anticipated landfill d	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	1130	sqft
Width of sludge storage shed s	23.8	ft
Length of sludge storage shed	47.6	ft
Volume of earthwork required	3290	cuft
Volume of slab concrete requir	1460	cuft
Surface area of canopy roof	1130	sqft
Round trip haul distance	20	miles
Round trips per day per truck	1	
Distance traveled per year per	5000	miles
Sludge hauled	9.88	ton(short)/d
Operation labor required	175	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment co	325000	$
Earthwork Cost	975	$
Slab Concrete Cost	18900	$
Canopy Roof Cost	22600	$
Vehicle Cost	283000	$
Operational labor cost	8990	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	53600	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	64800	$/yr

Secondary Clarifier

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	10200	sqft
Surface area per circular clarifi	5090	sqft
Diameter of each circular clarif	81	ft
Number of clarifiers per battery	2	
Number of batteries	1	
Solids loading rate	11.1	lb/(sqft·d)
Hydraulic retention time	4.04	hr
Designed surface overflow rate	400	gal(US)/(sqft·d)
Weir length	671	ft
Volume of wasted sludge	85200	gpd(US)
Quantities		
Operation labor required	1030	pers-hrs/yr
Maintenance labor required	570	pers-hrs/yr
Electrical energy required	10100	kWh/yr
Volume of earthwork required	132000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	10100	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	5340	cuft
Costs		
Construction and equipment co	647000	$
Earthwork Cost	39000	$
Wall Concrete Cost	128000	$
Slab Concrete Cost	131000	$
Installed Equipment Cost	250000	$
Misc Costs	98700	$
Operational labor cost	53300	$/yr
Maintenance labor cost	24000	$/yr
Material and supply cost	6470	$/yr
Chemical cost	0	$/yr
Energy cost	1010	$/yr
Amortization cost	59500	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0852	MGD(US)
Total pumping capacity	0.0852	MGD(US)
Design capacity per pump	29.6	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.0852	MGD(US)
Quantities		
Operation labor required	321	pers-hrs/yr
Maintenance labor required	250	pers-hrs/yr
Electrical energy required	2870	kWh/yr

Volume of earthwork required	1610	cuft
Area of pump building	202	sqft
Costs		
Construction and equipment cc	46300	$
Earthwork Cost	478	$
Pump Building Cost	22200	$
Installed Pump Cost	16600	$
Misc Costs	7060	$
Operational labor cost	16500	$/yr
Maintenance labor cost	10500	$/yr
Material and supply cost	324	$/yr
Chemical cost	0	$/yr
Energy cost	287	$/yr
Amortization cost	4380	$/yr

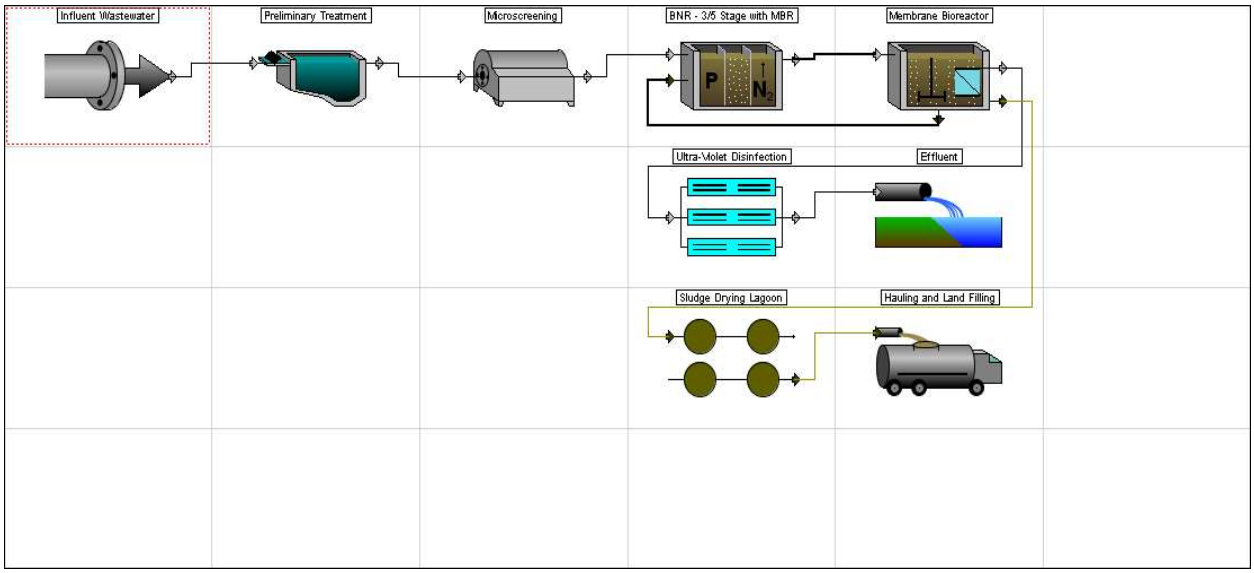
Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	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

Richmond City

Layout - Richmond City



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$4,210,000	$
Other direct construction costs	$1,330,000	$
Other indirect construction cos	$4,290,000	$
Total construction costs	$9,830,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$10,400	$/yr
Laboratory labor cost	$114,000	$/yr
Unit process operation labor c	$320,000	$/yr
Unit process maintenance labc	$154,000	$/yr
Total labor costs	$598,000	$/yr
MATERIAL COSTS		
Total material cost	$162,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$11,000	$/yr
ENERGY COSTS		
Total energy cost	$83,300	$/yr
Total operation and maintanen	$855,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$952,000	$/yr
Total annual project cost	$1,810,000	$/yr
PROJECT SUMMARY		
Present worth	$21,700,000	$
Total project cost	$9,830,000	$
Total operation labor cost	$444,000	$/yr
Total maintenance labor cost	$154,000	$/yr
Total material cost	$162,000	$/yr
Total chemical cost	$11,000	$/yr
Total energy cost	$83,300	$/yr
Total amortization cost	$952,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Preliminary Treatment	246000	24400	11200	6140	0	1160	20600
Microscreening	307000	4120	2070	27800	0	9770	32900
BNR - 3/5 Stage with MBR	759000	128000	64300	17500	0	29600	71000
Ultra-Violet Disinfection	215000	0	2180	2150	747	5360	18200

Sludge Drying Lagoon	22600	2720	1160	0	0	0	1900
Membrane Bioreactor	1890000	159000	73000	18200	10300	37400	251000
Effluent	0	0	0	0	0	0	0
Hauling and Land Filling	287000	2040	0	90400	0	0	61600
Blower System	486000	0	0	0	0	0	40700
Other Costs	5620000	124000	0	0	0	0	455000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	10	acre
Administration labor hours	203	hr/yr
Laboratory labor hours	2210	hr/yr
Costs		
DIRECT COSTS		
Mobilization	114000	$
Site preparation	217000	$
Site electrical	292000	$
Yard piping	204000	$
Instrumentation and control	131000	$
Lab and administration building	374000	$
Total direct construction costs	1330000	$
INDIRECT COSTS		
Cost of land	200000	$
Miscellaneous cost	319000	$
Legal cost	127000	$
Engineering design fee	956000	$
Inspection cost	127000	$
Contingency	637000	$
Technical	127000	$
Interest during construction	964000	$
Profit	831000	$
Total indirect construction cost	4290000	$
Total of other construction cos	5620000	$
LABOR COSTS		
Administration labor cost	10400	$/yr
Laboratory labor cost	114000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	3210	scfm
Safety factor	1.5	
Requested air flow capacity	4810	scfm
Total capacity of blowers	4810	scfm
Number of blowers in use	1	
Total number of blowers	2	
Capacity of individual blowers	4810	scfm
Estimated cost of an installed l	157000	$
Blower building area	1120	sqft
Costs		
Construction and equipment cc	486000	$
Installed Blower Cost	314000	$
Building Cost	123000	$
Misc Costs	48200	$
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	40700	$/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	1.5	in
Slope of bars from horizontal	30	degrees
Head loss through screen	0.0206	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	0.308	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	3.08	cuft/s
Average flow	0.77	cuft/s
Minimum flow	0.385	cuft/s
Temperature	10	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	1.54	cuft/s
Width of channel	0.257	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.00952	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	2	cuft/d
Costs		
Construction and equipment cc	246000	$
Operational labor cost	24400	$/yr
Maintenance labor cost	11200	$/yr
Material and supply cost	6140	$/yr
Chemical cost	0	$/yr
Energy cost	1160	$/yr
Amortization cost	20600	$/yr

Microscreening

Design Output Data

Description	Value	Units
Microscreening		
Design Information		
Microscreen loading rate	7	gal(US)/(sqft·min)
Quantity of wash water require	4	%
Area of microscreens required	198	sqft
Quantities		
Number of batteries	1	
Number of units/battery	2	
Drum diameter	6	ft
Drum width	6	ft
Area of selected unit	108	sqft
Area of building	155	sqft
Operation labor required	80	pers-hrs/yr
Maintenance labor required	51.5	pers-hrs/yr
Electrical energy required	97700	kWh/yr
Volume of wall concrete requir	2600	cuft
Volume of earthwork required	5850	cuft
Costs		
Construction and equipment cc	307000	$
Earthwork Cost	1730	$
Slab Concrete Cost	62500	$
Building Cost	17000	$
Installed Equipment Cost	186000	$
Misc Costs	40000	$
Operational labor cost	4120	$/yr
Maintenance labor cost	2070	$/yr
Material and supply cost	27800	$/yr
Chemical cost	0	$/yr
Energy cost	9770	$/yr
Amortization cost	32900	$/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	6490	mg/L
Calculated VSS:TSS ratio	0.721	mg VSS/mg SS
Total volume of anaerobic reac	11	m3
Total volume of anoxic reactor	266	m3
Total volume of aerobic reacto	277	m3
Total volume of all reactors	554	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	1	
Number of aerobic cells within	1	
Anaerobic hydraulic retention ti	0.14	hr
Anoxic hydraulic retention time	3.37	hr
Aerobic hydraulic retention tim	3.51	hr
Amount of sludge generated	199	kg/d
Sludge recycle ratio	300	%
Sludge recycle rate	5680	m3/d
Nitrogen required for biomass	12.9	mg/L
Phosphorus required for bioma	2.58	mg/L
Oxygen required to meet avera	397	kg/d
Air flow required to meet avera	659	N m3/hr
Design air flow	39.7	N m3/min/1000 m3
Quantities		
Operation labor required	1210	pers-hrs/yr
Maintenance labor required	567	pers-hrs/yr
Electrical energy required	162000	kWh/yr
Volume of earthwork required	24400	cuft
Volume of slab concrete requir	5040	cuft
Volume of wall concrete requir	4530	cuft
Handrail length	126	ft
Number of diffusers per train	106	
Fine bubble diffuser floor cover	14.5	%
Number of swing arm headers	1	
Required mixing power	5.2	kW
Total number of mixers	4	
Design mixing power per mixer	1.49	kW
Mixing power for each unaerat	1.3	kW
Costs		
Construction and equipment co	356000	$
Earthwork Cost	7220	$
Wall Concrete Cost	109000	$
Slab Concrete Cost	65400	$
Handrail Cost	9450	$
Installed Aerator Equipment	53800	$
Air Piping Cost	17600	$
Installed Mixer Equipment Co	58000	$
Misc Costs	35300	$
Operational labor cost	62500	$/yr
Maintenance labor cost	22900	$/yr
Material and supply cost	14700	$/yr
Chemical cost	0	$/yr
Energy cost	16200	$/yr
Amortization cost	32800	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	0.75	MGD(US)
Total pumping capacity	0.75	MGD(US)
Design capacity per pump	260	gpm(US)
Number of pumps	6	
Number of batteries	1	
Firm pumping capacity	0.75	MGD(US)
Quantities		
Operation labor required	424	pers-hrs/yr
Maintenance labor required	345	pers-hrs/yr
Electrical energy required	50300	kWh/yr
Volume of earthwork required	1720	cuft
Area of pump building	215	sqft
Costs		
Construction and equipment co	159000	$
Earthwork Cost	1020	$
Pump Building Cost	47300	$
Installed Pump Cost	86300	$
Misc Costs	24200	$
Operational labor cost	21800	$/yr
Maintenance labor cost	13900	$/yr
Material and supply cost	1110	$/yr
Chemical cost	0	$/yr
Energy cost	5030	$/yr
Amortization cost	15000	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	1	MGD(US)
Total pumping capacity	1	MGD(US)
Design capacity per pump	347	gpm(US)
Number of pumps	6	
Number of batteries	1	
Firm pumping capacity	1	MGD(US)
Quantities		

Operation labor required	440	pers-hrs/yr
Maintenance labor required	360	pers-hrs/yr
Electrical energy required	67000	kWh/yr
Volume of earthwork required	1760	cuft
Area of pump building	220	sqft
Costs		
Construction and equipment cc	174000	$
Earthwork Cost	1040	$
Pump Building Cost	48300	$
Installed Pump Cost	98000	$
Misc Costs	26500	$
Operational labor cost	22700	$/yr
Maintenance labor cost	14500	$/yr
Material and supply cost	1220	$/yr
Chemical cost	0	$/yr
Energy cost	6700	$/yr
Amortization cost	16400	$/yr
Sludge Recycle Pumping		
Design Information		
Average daily pumping rate	0.5	MGD(US)
Total pumping capacity	0.5	MGD(US)
Design capacity per pump	174	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.5	MGD(US)
Quantities		
Operation labor required	403	pers-hrs/yr
Maintenance labor required	325	pers-hrs/yr
Electrical energy required	16800	kWh/yr
Volume of earthwork required	1680	cuft
Area of pump building	210	sqft
Costs		
Construction and equipment cc	70400	$
Earthwork Cost	497	$
Pump Building Cost	23100	$
Installed Pump Cost	36100	$
Misc Costs	10700	$
Operational labor cost	20700	$/yr
Maintenance labor cost	13100	$/yr
Material and supply cost	493	$/yr
Chemical cost	0	$/yr
Energy cost	1680	$/yr
Amortization cost	6660	$/yr

Ultra-Violet Disinfection

Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calc	2.12	gal(US)/(min·W)
Total number of lamps needed	49	
Number of spare channels	1	
Total number of lamps used in	72	
Number of excess lamps	23	
Number of lamps/modules	2	
Number of modules/bank	3	
Number of banks/channel	3	
Number of channels	4	
Calculated headloss	10.8	in
Costs		
Construction and equipment cc	215000	$
Cost of installation	129000	$
Total cost of UV lamps	85900	$
Operational labor cost	0	$/yr
Maintenance labor cost	2180	$/yr
Material and supply cost	2150	$/yr
Chemical cost	747	$/yr
Energy cost	5360	$/yr
Amortization cost	18200	$/yr

Sludge Drying Lagoon

Design Output Data

Description	Value	Units
Sludge Drying Lagoon		
Design Information		
Sludge flow	4260	gpd(US)
Initial solids content in sludge	1.2	%
Sludge depth in lagoon	1	ft
Dry solids produced	156000	lb/yr
Lagoon volume	67700	cuft
Total lagoon surface area	67700	sqft
Number of lagoons required	2	

Quantities		
Operation labor required	52.9	pers-hrs/yr
Maintenance labor required	28.9	pers-hrs/yr
Volume of earthwork required	54600	cuft
Volume of wall concrete requir	80	cuft
Surface area per lagoon	33800	sqft
Length of lagoon at top of leve	196	ft
Depth of cut	0.82	ft
Depth of fill	2.18	ft
Costs		
Construction and equipment cc	22600	$
Earthwork Cost	16200	$
Wall Concrete Cost	1930	$
Misc Costs	4520	$
Operational labor cost	2720	$/yr
Maintenance labor cost	1160	$/yr
Material and supply cost	0	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	1900	$/yr

Membrane Bioreactor

Design Output Data

Description	Value	Units
Membrane Bioreactor		
Design Information		
Total volume of reactors	12400	cuft
Length of parallel train	22.4	ft
Width of parallel train	11.2	ft
Sidewater depth	16.4	ft
Number of batteries	1	
Number of parallel trains per b	3	
Total Membrane Area	15800	m2
Total Scour Air Requirement	3150	N m3/hr
Quantities		
Operation labor required	2380	pers-hrs/yr
Maintenance labor required	1250	pers-hrs/yr
Electrical energy required	359000	kWh/yr
Volume of earthwork required	15800	cuft
Volume of slab concrete requir	3170	cuft
Volume of wall concrete requir	4400	cuft
Handrail length	253	ft
Number of diffusers per train	78	
Number of swing arm headers	1	
Costs		
Construction and equipment cc	1680000	$
Earthwork Cost	4680	$
Wall Concrete Cost	106000	$
Slab Concrete Cost	41100	$
Handrail Cost	19000	$
Membrane Cost	1360000	$
Installed Aerator Equipment	69000	$
Air Piping Cost	43000	$
Misc Cost	38700	$
Operational labor cost	123000	$/yr
Maintenance labor cost	50200	$/yr
Material and supply cost	16800	$/yr
Chemical cost	10300	$/yr
Energy cost	35900	$/yr
Amortization cost	231000	$/yr
Permeate Pumping		
Design Information		
Average daily pumping rate	0.25	MGD(US)
Total pumping capacity	1	MGD(US)
Design capacity per pump	386	gpm(US)
Number of pumps	6	
Number of batteries	1	
Firm pumping capacity	2.22	MGD(US)
Quantities		
Operation labor required	488	pers-hrs/yr
Maintenance labor required	405	pers-hrs/yr
Electrical energy required	15100	kWh/yr
Volume of earthwork required	1780	cuft
Area of pump building	222	sqft
Costs		
Construction and equipment cc	180000	$
Earthwork Cost	1050	$
Pump Building Cost	48800	$
Installed Pump Cost	103000	$
Misc Costs	27500	$
Operational labor cost	25100	$/yr
Maintenance labor cost	16300	$/yr

Material and supply cost	1260	$/yr
Chemical cost	0	$/yr
Energy cost	1510	$/yr
Amortization cost	17000	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.00426	MGD(US)
Total pumping capacity	0.00426	MGD(US)
Design capacity per pump	1.48	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.00426	MGD(US)
Quantities		
Operation labor required	218	pers-hrs/yr
Maintenance labor required	161	pers-hrs/yr
Electrical energy required	145	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment cc	31800	$
Earthwork Cost	474	$
Pump Building Cost	22000	$
Installed Pump Cost	4430	$
Misc Costs	4840	$
Operational labor cost	11200	$/yr
Maintenance labor cost	6470	$/yr
Material and supply cost	222	$/yr
Chemical cost	0	$/yr
Energy cost	14	$/yr
Amortization cost	3000	$/yr

Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	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

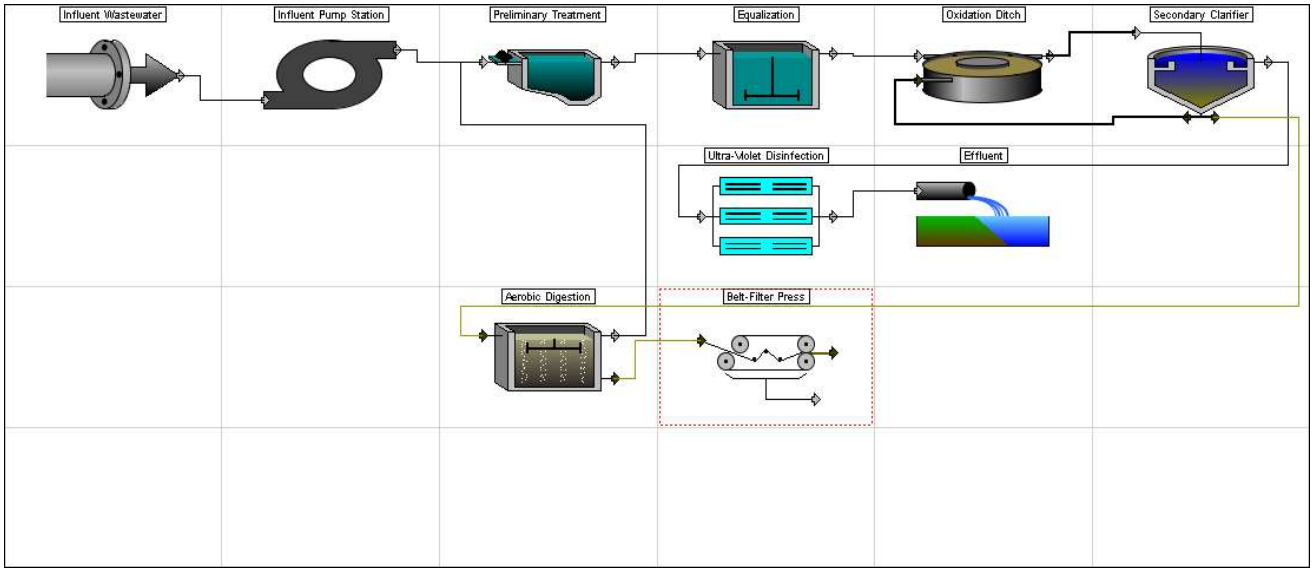
Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	0.844	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	30	miles
Quantities		
Total sludge volume hauled	0.844	cuyd/d
Maximum anticipated landfill dc	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	85.5	sqft
Width of sludge storage shed s	6.54	ft
Length of sludge storage shed	13.1	ft
Volume of earthwork required	356	cuft
Volume of slab concrete requir	175	cuft
Surface area of canopy roof	85.5	sqft
Round trip haul distance	60	miles
Round trips per day per truck	1	
Distance traveled per year per	15000	miles
Sludge hauled	0.747	ton(short)/d
Operation labor required	39.6	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment cc	287000	$
Earthwork Cost	106	$
Slab Concrete Cost	2270	$
Canopy Roof Cost	1710	$
Vehicle Cost	283000	$
Operational labor cost	2040	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	90400	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr

Amortization cost	61600	$/yr

Salem City

Layout 1 Salem City



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$7,940,000	$
Other direct construction costs	$2,760,000	$
Other indirect construction cos	$8,090,000	$
Total construction costs	$18,800,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$24,700	$/yr
Laboratory labor cost	$134,000	$/yr
Unit process operation labor c	$277,000	$/yr
Unit process maintenance labc	$139,000	$/yr
Total labor costs	$574,000	$/yr
MATERIAL COSTS		
Total material cost	$89,400	$/yr
CHEMICAL COSTS		
Total chemical cost	$21,100	$/yr
ENERGY COSTS		
Total energy cost	$297,000	$/yr
Total operation and maintanen	$981,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$1,590,000	$/yr
Total annual project cost	$2,570,000	$/yr
PROJECT SUMMARY		
Present worth	$30,800,000	$
Total project cost	$18,800,000	$
Total operation labor cost	$435,000	$/yr
Total maintenance labor cost	$139,000	$/yr
Total material cost	$89,400	$/yr
Total chemical cost	$21,100	$/yr
Total energy cost	$297,000	$/yr
Total amortization cost	$1,590,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Influent Pump Station	555000	28200	18500	3890	0	12600	49200
Preliminary Treatment	409000	35600	15400	10200	0	1950	34300
Aerobic Digestion	303000	69200	26900	26400	0	58600	26300
Equalization	248000	32000	20200	1840	0	18500	23400

Ultra-Violet Disinfection	3580000	0	36000	35800	12500	89400	303000
Belt-Filter Press	812000	2600	504	0	8610	1700	74300
Oxidation Ditch	1210000	64800	0	7270	0	113000	112000
Effluent	0	0	0	0	0	0	0
Secondary Clarifier	409000	44100	21200	3970	0	969	38200
Blower System	408000	0	0	0	0	0	34200
Other Costs	10900000	159000	0	0	0	0	892000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	11	acre
Administration labor hours	479	hr/yr
Laboratory labor hours	2610	hr/yr
Costs		
DIRECT COSTS		
Mobilization	243000	$
Site preparation	405000	$
Site electrical	650000	$
Yard piping	444000	$
Instrumentation and control	309000	$
Lab and administration building	707000	$
Total direct construction costs	2760000	$
INDIRECT COSTS		
Cost of land	220000	$
Miscellaneous cost	615000	$
Legal cost	246000	$
Engineering design fee	1840000	$
Inspection cost	246000	$
Contingency	1230000	$
Technical	246000	$
Interest during construction	1840000	$
Profit	1600000	$
Total indirect construction cost	8090000	$
Total of other construction cos	10900000	$
LABOR COSTS		
Administration labor cost	24700	$/yr
Laboratory labor cost	134000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	2270	scfm
Safety factor	1.5	
Requested air flow capacity	3410	scfm
Total capacity of blowers	3410	scfm
Number of blowers in use	1	
Total number of blowers	2	
Capacity of individual blowers	3410	scfm
Estimated cost of an installed l	127000	$
Blower building area	1030	sqft
Costs		
Construction and equipment cc	408000	$
Installed Blower Cost	254000	$
Building Cost	113000	$
Misc Costs	40400	$
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	34200	$/yr
Notes		
Energy costs are shown at the individual unit processes that require air		

Influent Wastewater

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	1180	cuft
Width of wet well	10.9	ft
Depth of the pumping station	26.4	ft
Length of the pumping station	18	ft
Width of the pumping station	38.1	ft
Minimum depth of water in wet	5.41	ft

Area of pump building	514	sqft
Peak capacity of pumps	5.55	MGD(US)
Firm pumping capacity	5.55	MGD(US)
Total dynamic head - average	45.1	ft
Quantities		
Operation labor required	548	pers-hrs/yr
Maintenance labor required	464	pers-hrs/yr
Electrical energy required	126000	kWh/yr
Volume of earthwork required	130000	cuft
Volume of slab concrete requir	4620	cuft
Volume of wall concrete requir	4560	cuft
Capacity per pump	3860	gpm(US)
Number of constant speed pur	0	
Number of variable speed pur	2	
Diameter of discharge header	14	in
Total dynamic head	69.5	ft
Size of selected pump	12	in
Specific speed of pump	4640	
Pump rotating speed	1550	rpm
Motor size required	93.6	HP
Size of selected motor	100	HP
Width of pump system	3	ft
Length of pump system	18.2	ft
Length of the dry well	18	ft
Width of the dry well	27.2	ft
Costs		
Construction and equipment co	555000	$
Earthwork Cost	38500	$
Wall Concrete Cost	110000	$
Slab Concrete Cost	59900	$
Building Cost	56500	$
Installed Pump Equipment C	183000	$
Installed Control Module Cos	23100	$
Misc Costs	84700	$
Operational labor cost	28200	$/yr
Maintenance labor cost	18500	$/yr
Material and supply cost	3890	$/yr
Chemical cost	0	$/yr
Energy cost	12600	$/yr
Amortization cost	49200	$/yr

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	0.939	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	6.97	cuft/s
Average flow	2.35	cuft/s
Minimum flow	0.808	cuft/s
Temperature	10.2	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	3.48	cuft/s
Width of channel	0.581	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.071	ft/s
Slope of channel bottom	0.00344	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	6.1	cuft/d
Costs		
Construction and equipment co	409000	$
Operational labor cost	35600	$/yr
Maintenance labor cost	15400	$/yr
Material and supply cost	10200	$/yr
Chemical cost	0	$/yr

Energy cost	1950	$/yr
Amortization cost	34300	$/yr

Aerobic Digestion

Design Output Data

Description	Value	Units
Aerobic Digestion		
Design Information		
Solids retention time	10.1	d
Design SS	12000	mg/L
Calculated VSS	5970	mg/L
Calculated VSS:TSS ratio	0.498	mg VSS/mg SS
Total volume of reactors	611	m3
Length of parallel train	7	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	609	kg/d
Air flow required to meet avera	3370	N m3/hr
Design air flow	92	N m3/min/1000 m3
Volatile solids loading	0.0816	lb/(cuft·d)
Solids accumulated	1590	lb/d
Digester capacity	16100	lb
Volume of wasted sludge	73700	gal(US)
Quantities		
Operation labor required	1340	pers-hrs/yr
Maintenance labor required	673	pers-hrs/yr
Electrical energy required	586000	kWh/yr
Volume of earthwork required	24400	cuft
Volume of slab concrete requir	5040	cuft
Volume of wall concrete requir	4530	cuft
Handrail length	126	ft
Number of diffusers per train	95	
Number of swing arm headers	1	
Costs		
Construction and equipment co	303000	$
Earthwork Cost	7220	$
Wall Concrete Cost	109000	$
Slab Concrete Cost	65400	$
Handrail Cost	9450	$
Installed Aerator Equipment	47400	$
Air Piping Cost	34200	$
Misc Costs	30000	$
Operational labor cost	69200	$/yr
Maintenance labor cost	26900	$/yr
Material and supply cost	26400	$/yr
Chemical cost	0	$/yr
Energy cost	58600	$/yr
Amortization cost	26300	$/yr

Equalization

Design Output Data

Description	Value	Units
Equalization		
Design Information		
Effective storage volume	305000	gal(US)
Average hourly flow	63500	gph(US)
Length of basin	76.5	ft
Width of basin	76.5	ft
Tank volume	525000	gal(US)
Operating transfer efficiency	4.2	lbO2/(HP·h)
Power required	31.5	HP
Quantities		
Volume of earthwork required	99100	cuft
Volume of slab concrete requir	4380	cuft
Volume of wall concrete requir	3210	cuft
Number of aerators per basin	4	
Power of selected aerator	10	HP
Total installed power	40	HP
Operational labor required	621	pers-hrs/yr
Maintenance labor required	506	pers-hrs/yr
Electrical energy required	185000	kWh/yr
Costs		
Construction and equipment co	248000	$
Earthwork Cost	29400	$
Wall Concrete Cost	77300	$
Slab Concrete Cost	56800	$
Installed Aerator Equipment	73100	$
Misc Costs	11800	$
Operational labor cost	32000	$/yr
Maintenance labor cost	20200	$/yr

Material and supply cost	1840	$/yr
Chemical cost	0	$/yr
Energy cost	18500	$/yr
Amortization cost	23400	$/yr

Ultra-Violet Disinfection

Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calc	0.1	gal(US)/(min·W)
System is not headloss constra		
Total number of lamps needed	792	
Number of spare channels	1	
Total number of lamps used in	1200	
Number of excess lamps	408	
Number of lamps/modules	8	
Number of modules/bank	10	
Number of banks/channel	5	
Number of channels	3	
Calculated headloss	0.127	in
Costs		
Construction and equipment cc	3580000	$
Cost of installation	2150000	$
Total cost of UV lamps	1430000	$
Operational labor cost	0	$/yr
Maintenance labor cost	36000	$/yr
Material and supply cost	35800	$/yr
Chemical cost	12500	$/yr
Energy cost	89400	$/yr
Amortization cost	303000	$/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	21.2	gpm(US)
Final solids content	16	%
Solids capture fraction	0.996	
Quantities		
Operation labor required	50.5	pers-hrs/yr
Maintenance labor required	12.6	pers-hrs/yr
Power	17000	kWh/yr
Polymer required	6620	lb/yr
Dry solids produced	1820	lb/d
Belt filter(s)	275000	$
Building	279000	$
Installation	68800	$
Polymer system	82500	$
Feed pumps	30300	$
Conveyor system	77000	$
Costs		
Construction and equipment cc	812000	$
Building Cost	279000	$
Polymer System Cost	82500	$
Feed Pumps Cost	30300	$
Conveyor System Cost	77000	$
Installed Belt Filter	344000	$
Operational labor cost	2600	$/yr
Maintenance labor cost	504	$/yr
Material and supply cost	0	$/yr
Chemical cost	8610	$/yr
Energy cost	1700	$/yr
Amortization cost	74300	$/yr

Oxidation Ditch

Design Output Data

Description	Value	Units
Oxidation Ditch		
Design Information		
Carbon & Nitrification Design		
Design SRT for design at winte	25	d
Design SS	3000	mg/L
Calculated VSS	1870	mg/L
Calculated VSS:TSS ratio	0.623	mg VSS/mg SS
Total volume of reactors	10500	m3
Ditch length	68.2	m
Ditch width	22.8	m

Sidewater depth	3.66	m
Number of batteries	1	
Number of parallel ditches per	2	
Number of rotors per ditch	2	
Rotor length for aeration	20	m
Rotor length for mixing	40.2	m
Installed rotor length per rotor	10	m
Rotor horsepower	20	HP
Total installed horsepower per	80	HP
Assumed surface velocity	0.46	m/s
Hydraulic retention time	43.5	hr
F/M ratio	0.0596	lb BOD/lb MLSS/d
Volumetric BOD loading	0.111	kg BOD/m3/d
Observed yield (VSS basis)	0.485	g VSS/g BOD
Observed yield (TSS basis)	0.779	g TSS/g BOD
Amount of alkalinity required	161	gCaCO3/m3
Amount of sludge generated	1260	kg/d
Sludge recycle rate	2470	m3/d
Nitrogen requirement for biom	13.6	mg/L
Phosphorus requirement for bi	2.71	mg/L
Oxygen requirement to meet a	2680	kg/d
Quantities		
Ditch bottom width	36.9	ft
Length of straight section	150	ft
Volume of excavation required	200000	cuft
Volume of backfill required per	6290	cuft
Volume of wall concrete requir	18900	cuft
Volume of slab concrete requir	25100	cuft
Length of adjustable weir	24	ft
Volume of concrete required p	116	cuft
Total handrail length	0	ft
Operation labor required	1260	pers-hrs/yr
Electrical energy required	1130000	kWh/yr
Costs		
Construction and equipment co	1210000	$
Earthwork Cost	59200	$
Wall Concrete Cost	460000	$
Slab Concrete Cost	326000	$
Handrail Cost	0	$
Installed Equipment Cost	307000	$
Misc Costs	59900	$
Operational labor cost	64800	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	7270	$/yr
Chemical cost	0	$/yr
Energy cost	113000	$/yr
Amortization cost	112000	$/yr

Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment co	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

Secondary Clarifier

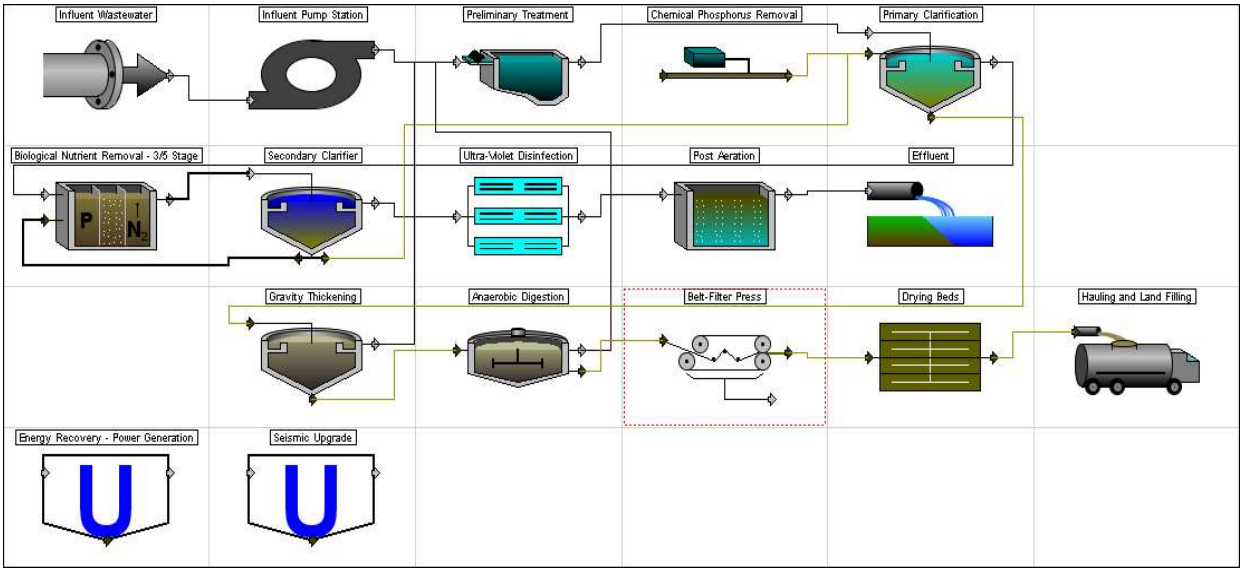
Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	3810	sqft
Surface area per circular clarifi	1910	sqft
Diameter of each circular clarif	50	ft
Number of clarifiers per battery	2	
Number of batteries	1	
Solids loading rate	14.3	lb/(sqft·d)
Hydraulic retention time	4.04	hr
Designed surface overflow rate	400	gal(US)/(sqft·d)
Weir length	191	ft
Volume of wasted sludge	32300	gpd(US)
Quantities		
Operation labor required	573	pers-hrs/yr
Maintenance labor required	313	pers-hrs/yr
Electrical energy required	8600	kWh/yr
Volume of earthwork required	47800	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	4070	cuft

Wall thickness	11.5	in
Volume of wall concrete requir	3380	cuft
Costs		
Construction and equipment cc	369000	$
Earthwork Cost	14200	$
Wall Concrete Cost	81300	$
Slab Concrete Cost	52800	$
Installed Equipment Cost	165000	$
Misc Costs	56300	$
Operational labor cost	29500	$/yr
Maintenance labor cost	12500	$/yr
Material and supply cost	3690	$/yr
Chemical cost	0	$/yr
Energy cost	860	$/yr
Amortization cost	34500	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0323	MGD(US)
Total pumping capacity	0.0323	MGD(US)
Design capacity per pump	11.2	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.0323	MGD(US)
Quantities		
Operation labor required	283	pers-hrs/yr
Maintenance labor required	217	pers-hrs/yr
Electrical energy required	1090	kWh/yr
Volume of earthwork required	1610	cuft
Area of pump building	201	sqft
Costs		
Construction and equipment cc	39300	$
Earthwork Cost	476	$
Pump Building Cost	22100	$
Installed Pump Cost	10800	$
Misc Costs	6000	$
Operational labor cost	14600	$/yr
Maintenance labor cost	8660	$/yr
Material and supply cost	275	$/yr
Chemical cost	0	$/yr
Energy cost	109	$/yr
Amortization cost	3720	$/yr

Salt Lake City

Layout - Salt Lake City



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$354,000,000	$
Other direct construction costs	$32,100,000	$
Other indirect construction cos	$286,000,000	$
Total construction costs	$672,000,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$420,000	$/yr
Laboratory labor cost	$325,000	$/yr
Unit process operation labor c	$4,570,000	$/yr
Unit process maintenance labc	$3,130,000	$/yr
Total labor costs	$8,450,000	$/yr
MATERIAL COSTS		
Total material cost	$2,610,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$669,000	$/yr
ENERGY COSTS		
Total energy cost	$6,590,000	$/yr
Total operation and maintanen	$18,300,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$49,400,000	$/yr
Total annual project cost	$67,800,000	$/yr
PROJECT SUMMARY		
Present worth	$810,000,000	$
Total project cost	$672,000,000	$
Total operation labor cost	$5,320,000	$/yr
Total maintenance labor cost	$3,130,000	$/yr
Total material cost	$2,610,000	$/yr
Total chemical cost	$669,000	$/yr
Total energy cost	$6,590,000	$/yr
Total amortization cost	$49,400,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Biological Nutrient Removal - 3	103000000	747000	516000	1220000	0	4290000	9510000
Energy Recovery - Power Gen	50000000	0	0	0	0	0	0
Influent Pump Station	30100000	174000	128000	211000	0	105000	2560000
Secondary Clarifier	8280000	333000	192000	82600	0	8140	747000

Gravity Thickening	875000	116000	66100	8750	0	1670	81700
Seismic Upgrade	50000000	0	0	0	0	0	0
Preliminary Treatment	3430000	446000	179000	85700	0	10300	287000
Ultra-Violet Disinfection	55300000	0	680000	553000	277000	1980000	5430000
Anaerobic Digestion	17400000	428000	262000	146000	0	77400	1650000
Chemical Phosphorus Remova	5000000	0	0	0	0	0	0
Post Aeration	318000	50900	27400	3980	0	46500	30000
Belt-Filter Press	2810000	118000	29300	0	392000	58100	263000
Primary Clarification	4750000	207000	119000	47300	0	4040	435000
Effluent	0	0	0	0	0	0	0
Drying Beds	18100000	1890000	934000	163000	0	0	1570000
Hauling and Land Filling	649000	65800	0	90100	0	0	102000
Blower System	3600000	0	0	0	0	0	302000
Other Costs	318000000	745000	0	0	0	0	26500000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	117	acre
Administration labor hours	8150	hr/yr
Laboratory labor hours	6310	hr/yr
Costs		
DIRECT COSTS		
Mobilization	2950000	$
Site preparation	3190000	$
Site electrical	9140000	$
Yard piping	5810000	$
Instrumentation and control	5210000	$
Lab and administration building	5770000	$
Total direct construction costs	32100000	$
INDIRECT COSTS		
Cost of land	2350000	$
Miscellaneous cost	22200000	$
Legal cost	8880000	$
Engineering design fee	66600000	$
Inspection cost	8880000	$
Contingency	44400000	$
Technical	8880000	$
Interest during construction	65800000	$
Profit	57900000	$
Total indirect construction cost	286000000	$
Total of other construction cos	318000000	$
LABOR COSTS		
Administration labor cost	420000	$/yr
Laboratory labor cost	325000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	67000	scfm
Safety factor	1.5	
Requested air flow capacity	101000	scfm
Total capacity of blowers	101000	scfm
Number of blowers in use	2	
Total number of blowers	3	
Capacity of individual blowers	50300	scfm
Estimated cost of an installed I	992000	$
Blower building area	2440	sqft
Costs		
Construction and equipment cc	3600000	$
Installed Blower Cost	2980000	$
Building Cost	269000	$
Misc Costs	357000	$
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	302000	$/yr
Notes		
Energy costs are shown at the individual unit processes that require air		

Influent Wastewater

Biological Nutrient Removal - 3/5 Stage

Design Output Data

Description	Value	Units
BNR System for BIO-P and N Removal		

Design Information		
Influent BOD/TP ratio too smal		
5-Stage Biological Phosphorus		
Design aerobic SRT for nitrifica	15	d
Total reactor SRT	30	d
Design SS	3000	mg/L
Calculated VSS	2060	mg/L
Calculated VSS:TSS ratio	0.688	mg VSS/mg SS
Total volume of anaerobic reac	0	m3
Total volume of anoxic reactor	210000	m3
Total volume of aerobic reacto	210000	m3
Total volume of all reactors	421000	m3
Width of parallel train	10	m
Sidewater depth	5	m
Number of batteries	1	
Number of parallel trains per b	32	
Number of anoxic cells within c	3	
Number of aerobic cells within	3	
Anaerobic hydraulic retention ti	0	hr
Anoxic hydraulic retention time	23.4	hr
Aerobic hydraulic retention tim	23.4	hr
Amount of sludge generated	42100	kg/d
Sludge recycle ratio	42.9	%
Sludge recycle rate	92300	m3/d
Nitrogen required for biomass	16	mg/L
Phosphorus required for bioma	3.2	mg/L
Oxygen required to meet avera	68300	kg/d
Air flow required to meet avera	113000	N m3/hr
Design air flow	8.98	N m3/min/1000 m3
Quantities		
Operation labor required	12000	pers-hrs/yr
Maintenance labor required	7980	pers-hrs/yr
Electrical energy required	25800000	kWh/yr
Volume of earthwork required	6290000	cuft
Volume of slab concrete requir	1670000	cuft
Volume of wall concrete requir	999000	cuft
Handrail length	32400	ft
Number of diffusers per train	1050	
Fine bubble diffuser floor cover	3.26	%
Number of swing arm headers	35	
Required mixing power	2750	kW
Total number of mixers	256	
Required mixing power per mi	10.7	kW
Design mixing power per mixe	3.73	kW
Mixing power for each unaerat	21.5	kW
Costs		
Construction and equipment co	90600000	$
Earthwork Cost	1860000	$
Wall Concrete Cost	24100000	$
Slab Concrete Cost	21700000	$
Handrail Cost	2430000	$
Installed Aerator Equipment	24500000	$
Air Piping Cost	2710000	$
Installed Mixer Equipment C	4390000	$
Misc Costs	8980000	$
Operational labor cost	619000	$/yr
Maintenance labor cost	407000	$/yr
Material and supply cost	1130000	$/yr
Chemical cost	0	$/yr
Energy cost	2580000	$/yr
Amortization cost	8300000	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	7.11	MGD(US)
Total pumping capacity	7.11	MGD(US)
Design capacity per pump	2470	gpm(US)
Number of pumps	96	
Number of batteries	1	
Firm pumping capacity	7.11	MGD(US)
Quantities		
Operation labor required	568	pers-hrs/yr
Maintenance labor required	483	pers-hrs/yr
Electrical energy required	7590000	kWh/yr
Volume of earthwork required	2720	cuft
Area of pump building	340	sqft
Costs		
Construction and equipment co	5830000	$
Earthwork Cost	25800	$
Pump Building Cost	1200000	$
Installed Pump Cost	3720000	$
Misc Costs	890000	$
Operational labor cost	29300	$/yr

Maintenance labor cost	24600	$/yr
Material and supply cost	40800	$/yr
Chemical cost	0	$/yr
Energy cost	759000	$/yr
Amortization cost	552000	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	7.11	MGD(US)
Total pumping capacity	7.11	MGD(US)
Design capacity per pump	2470	gpm(US)
Number of pumps	96	
Number of batteries	1	
Firm pumping capacity	7.11	MGD(US)
Quantities		
Operation labor required	568	pers-hrs/yr
Maintenance labor required	483	pers-hrs/yr
Electrical energy required	7590000	kWh/yr
Volume of earthwork required	2720	cuft
Area of pump building	340	sqft
Costs		
Construction and equipment cc	5830000	$
Earthwork Cost	25800	$
Pump Building Cost	1200000	$
Installed Pump Cost	3720000	$
Misc Costs	890000	$
Operational labor cost	29300	$/yr
Maintenance labor cost	24600	$/yr
Material and supply cost	40800	$/yr
Chemical cost	0	$/yr
Energy cost	759000	$/yr
Amortization cost	552000	$/yr
Sludge Recycle Pumping		
Design Information		
Average daily pumping rate	56.9	MGD(US)
Total pumping capacity	56.9	MGD(US)
Design capacity per pump	19800	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	56.9	MGD(US)
Quantities		
Operation labor required	1340	pers-hrs/yr
Maintenance labor required	1160	pers-hrs/yr
Electrical energy required	1890000	kWh/yr
Volume of earthwork required	10600	cuft
Area of pump building	1320	sqft
Costs		
Construction and equipment cc	1100000	$
Earthwork Cost	3130	$
Pump Building Cost	145000	$
Installed Pump Cost	783000	$
Misc Costs	168000	$
Operational labor cost	69100	$/yr
Maintenance labor cost	59400	$/yr
Material and supply cost	7700	$/yr
Chemical cost	0	$/yr
Energy cost	189000	$/yr
Amortization cost	104000	$/yr

Energy Recovery - Power Generation

Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	Overridden	
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

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	521000	cuft
Width of wet well	1690	ft
Depth of the pumping station	40.6	ft
Length of the pumping station	42	ft
Width of the pumping station	1750	ft
Minimum depth of water in wet	19.6	ft
Area of pump building	2670	sqft

Peak capacity of pumps	150	MGD(US)
Firm pumping capacity	150	MGD(US)
Total dynamic head - average	43.6	ft
Quantities		
Operation labor required	3380	pers-hrs/yr
Maintenance labor required	2520	pers-hrs/yr
Electrical energy required	1050000	kWh/yr
Volume of earthwork required	10000000	cuft
Volume of slab concrete requir	1120000	cuft
Volume of wall concrete requir	209000	cuft
Capacity per pump	104000	gpm(US)
Number of constant speed pur	2	
Number of variable speed purr	0	
Diameter of discharge header	72.8	in
Total dynamic head	49.5	ft
Size of selected pump	72	in
Specific speed of pump	10400	
Pump rotating speed	231	rpm
Motor size required	413	HP
Size of selected motor	450	HP
Width of pump system	15	ft
Length of pump system	51.4	ft
Length of the dry well	42	ft
Width of the dry well	60.4	ft
Costs		
Construction and equipment cc	30100000	$
Earthwork Cost	2960000	$
Wall Concrete Cost	5040000	$
Slab Concrete Cost	14500000	$
Building Cost	293000	$
Installed Pump Equipment C	2750000	$
Misc Costs	4590000	$
Operational labor cost	174000	$/yr
Maintenance labor cost	128000	$/yr
Material and supply cost	211000	$/yr
Chemical cost	0	$/yr
Energy cost	105000	$/yr
Amortization cost	2560000	$/yr

Secondary Clarifier

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	190000	sqft
Surface area per circular clarifi	15800	sqft
Diameter of each circular clarif	142	ft
Number of clarifiers per battery	12	
Number of batteries	1	
Solids loading rate	10.7	lb/(sqft·d)
Hydraulic retention time	5.39	hr
Designed surface overflow rate	300	gal(US)/(sqft·d)
Weir length	17200	ft
Volume of wasted sludge	1080000	gpd(US)
Quantities		
Operation labor required	6020	pers-hrs/yr
Maintenance labor required	3390	pers-hrs/yr
Electrical energy required	45200	kWh/yr
Volume of earthwork required	2900000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	178000	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	55500	cuft
Costs		
Construction and equipment cc	8190000	$
Earthwork Cost	858000	$
Wall Concrete Cost	1340000	$
Slab Concrete Cost	2310000	$
Installed Equipment Cost	2440000	$
Misc Costs	1250000	$
Operational labor cost	310000	$/yr
Maintenance labor cost	173000	$/yr
Material and supply cost	81900	$/yr
Chemical cost	0	$/yr
Energy cost	4520	$/yr
Amortization cost	739000	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	1.08	MGD(US)
Total pumping capacity	1.08	MGD(US)
Design capacity per pump	375	gpm(US)
Number of pumps	3	

Number of batteries	1	
Firm pumping capacity	1.08	MGD(US)
Quantities		
Operation labor required	444	pers-hrs/yr
Maintenance labor required	364	pers-hrs/yr
Electrical energy required	36200	kWh/yr
Volume of earthwork required	1770	cuft
Area of pump building	221	sqft
Costs		
Construction and equipment cc	89100	$
Earthwork Cost	525	$
Pump Building Cost	24300	$
Installed Pump Cost	50700	$
Misc Costs	13600	$
Operational labor cost	22900	$/yr
Maintenance labor cost	18600	$/yr
Material and supply cost	624	$/yr
Chemical cost	0	$/yr
Energy cost	3620	$/yr
Amortization cost	8430	$/yr

Gravity Thickening

Design Output Data

Description	Value	Units
Gravity Thickening		
Design Information		
Initial concentration	4	%
Thickened concentration	5	%
Mass loading	10	lb/(sqft·d)
Hydraulic loading	30	gal(US)/(sqft·d)
Hydraulic retention time	53.9	hr
Number of tanks	2	
Tank volume	113000	cuft
Depth	9	ft
Surface area per tank	6280	sqft
Tank diameter	90	ft
Quantities		
Amount of sludge generated	62.8	ton(short)/d
Volume of thickened sludge	258000	gpd(US)
Operation labor required	2260	pers-hrs/yr
Maintenance labor required	1300	pers-hrs/yr
Electrical energy required	16700	kWh/yr
Volume of earthwork required	166000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	12300	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	5910	cuft
Costs		
Construction and equipment cc	875000	$
Earthwork Cost	49300	$
Wall Concrete Cost	142000	$
Slab Concrete Cost	160000	$
Installed Equipment Cost	391000	$
Misc Costs	134000	$
Operational labor cost	116000	$/yr
Maintenance labor cost	66100	$/yr
Material and supply cost	8750	$/yr
Chemical cost	0	$/yr
Energy cost	1670	$/yr
Amortization cost	81700	$/yr

Seismic Upgrade

Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	Overridden	
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

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	34.6	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	211	cuft/s
Average flow	86.6	cuft/s
Minimum flow	61.9	cuft/s
Temperature	10	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	106	cuft/s
Width of channel	17.6	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.000231	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	225	cuft/d
Costs		
Construction and equipment cc	3430000	$
Operational labor cost	446000	$/yr
Maintenance labor cost	179000	$/yr
Material and supply cost	85700	$/yr
Chemical cost	0	$/yr
Energy cost	10300	$/yr
Amortization cost	287000	$/yr

Ultra-Violet Disinfection

Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calc	0.294	gal(US)/(min·W)
Total number of lamps needed	24700	
Number of spare channels	1	
Total number of lamps used in	26700	
Number of excess lamps	1940	
Number of lamps/modules	16	
Number of modules/bank	17	
Number of banks/channel	7	
Number of channels	14	
Calculated headloss	3.06	in
Costs		
Construction and equipment cc	55300000	$
Cost of installation	33200000	$
Total cost of UV lamps	22100000	$
Operational labor cost	0	$/yr
Maintenance labor cost	680000	$/yr
Material and supply cost	553000	$/yr
Chemical cost	277000	$/yr
Energy cost	1980000	$/yr
Amortization cost	5430000	$/yr

Anaerobic Digestion

Design Output Data

Description	Value	Units
Anaerobic Digestion		
Design Information		
Percent VSS destroyed	50	%
Solids concentration in digeste	5	%
Detention time	15	d
Digester depth	25.3	ft
Digester diameter	55	ft
Effective digester volume	787000	cuft
Number of digesters per batter	12	
Number of primary digesters p	8	
Number of secondary digester	4	
Number of batteries	1	
Gas produced	425	cuft/min
Heat required	5440000	BTU/hr
Digester gas required	210	cuft/min
Total natural gas required	0	cuft/yr
Quantities		
Operation labor required	8320	pers-hrs/yr

Maintenance labor required	5130	pers-hrs/yr
Electrical energy required	774000	kWh/yr
Volume of earthwork required	784000	cuft
Slab thickness	10.4	in
Volume of slab concrete requir	27400	cuft
Wall thickness	20.2	in
Volume of wall concrete requir	109000	cuft
Sidewater depth	25.3	ft
Surface area/floor of 2-story cc	4480	sqft
Piping size	8	in
Length of total piping system	3330	ft
Number of 90 degree elbows	156	
Number of tees	306	
Number of plug valves	222	
Total dry solids treated	56.5	ton(short)/d
Costs		
Construction and equipment cc	17400000	$
Earthwork Cost	232000	$
Wall Concrete Cost	2620000	$
Slab Concrete Cost	356000	$
Building Cost	492000	$
Piping System Cost	2240000	$
Floating Cover Cost	5480000	$
Gas Recirculation Units Cost	1980000	$
Heating Units Cost	1110000	$
Gas Safety Equipment Cost	721000	$
Installed Pumps Cost	449000	$
Operational labor cost	428000	$/yr
Maintenance labor cost	262000	$/yr
Material and supply cost	146000	$/yr
Chemical cost	0	$/yr
Energy cost	77400	$/yr
Amortization cost	1650000	$/yr

Chemical Phosphorus Removal

Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	Overridden	
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

Post Aeration

Design Output Data

Description	Value	Units
Post Aeration by Diffused Aeration		
Design Information		
Dissolved oxygen in influent	2	mg/L
Desired dissolved oxygen in ef	5	mg/L
Correction factor for pressure	1	
Minimum dissolved oxygen in t	2	mg/L
Oxygen saturation at summer t	8.5	mg/L
Oxygen required	1400	lb/d
Operating transfer efficiency	2.95	lbO2/(HP·h)
Total volume of aerobic reacto	388000	gal(US)
Air flow rate required to meet a	1870	scfm
Quantities		
Basin depth	15	ft
Length of basin	115	ft
Width of basin	30	ft
Number of diffusers	156	
Number of swing arm diffuser l	8	
Volume of wall concrete requir	3270	cuft
Volume of slab concrete requir	2590	cuft
Electrical energy required	465000	kWh/yr
Operation labor required	989	pers-hrs/yr
Maintenance labor required	537	pers-hrs/yr
Costs		
Construction and equipment cc	318000	$
Wall Concrete Cost	78600	$
Slab Concrete Cost	42300	$
Installed Equipment Cost	165000	$
Misc Costs	31500	$
Operational labor cost	50900	$/yr
Maintenance labor cost	27400	$/yr
Material and supply cost	3980	$/yr
Chemical cost	0	$/yr
Energy cost	46500	$/yr

Amortization cost	30000	$/yr

Belt-Filter Press

Design Output Data

Description	Value	Units
Belt-Filter Press		
Design Information		
Belt filter width	2	m
Number of units	4	
Hydraulic loading per unit per r	70	gpm(US)
Hydraulic loading required per	482	gpm(US)
Final solids content	25	%
Solids capture fraction	0.998	
Quantities		
Operation labor required	2300	pers-hrs/yr
Maintenance labor required	574	pers-hrs/yr
Power	581000	kWh/yr
Polymer required	302000	lb/yr
Dry solids produced	82700	lb/d
Belt filter(s)	1200000	$
Building	429000	$
Installation	301000	$
Polymer system	445000	$
Feed pumps	132000	$
Conveyor system	301000	$
Costs		
Construction and equipment cc	2810000	$
Building Cost	429000	$
Polymer System Cost	445000	$
Feed Pumps Cost	132000	$
Conveyor System Cost	301000	$
Installed Belt Filter	1510000	$
Operational labor cost	118000	$/yr
Maintenance labor cost	29300	$/yr
Material and supply cost	0	$/yr
Chemical cost	392000	$/yr
Energy cost	58100	$/yr
Amortization cost	263000	$/yr

Primary Clarification

Design Output Data

Description	Value	Units
Primary Clarification		
Design Information		
Surface area	81800	sqft
Surface area per circular clarifi	6820	sqft
Diameter of each circular clarif	94	ft
Number of clarifiers per battery	12	
Number of batteries	1	
Solids loading rate	2.63	lb/(sqft·d)
Hydraulic retention time	2.31	hr
Weir length	13800	ft
Volume of sludge generated	377000	gpd(US)
Quantities		
Operation labor required	3630	pers-hrs/yr
Maintenance labor required	2030	pers-hrs/yr
Electrical energy required	27700	kWh/yr
Volume of earthwork required	1100000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	80400	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	37300	cuft
Costs		
Construction and equipment cc	4690000	$
Earthwork Cost	326000	$
Wall Concrete Cost	898000	$
Slab Concrete Cost	1040000	$
Installed Equipment Cost	1710000	$
Misc Costs	715000	$
Operational labor cost	187000	$/yr
Maintenance labor cost	104000	$/yr
Material and supply cost	46900	$/yr
Chemical cost	0	$/yr
Energy cost	2770	$/yr
Amortization cost	429000	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.377	MGD(US)
Total pumping capacity	0.377	MGD(US)
Design capacity per pump	131	gpm(US)
Number of pumps	3	
Number of batteries	1	

Firm pumping capacity	0.377	MGD(US)
Quantities		
Operation labor required	388	pers-hrs/yr
Maintenance labor required	312	pers-hrs/yr
Electrical energy required	12600	kWh/yr
Volume of earthwork required	1660	cuft
Area of pump building	207	sqft
Costs		
Construction and equipment cc	65100	$
Earthwork Cost	492	$
Pump Building Cost	22800	$
Installed Pump Cost	31900	$
Misc Costs	9930	$
Operational labor cost	20000	$/yr
Maintenance labor cost	15900	$/yr
Material and supply cost	456	$/yr
Chemical cost	0	$/yr
Energy cost	1260	$/yr
Amortization cost	6160	$/yr

Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	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

Drying Beds

Design Output Data

Description	Value	Units
Sludge Drying Beds		
Design Information		
Total surface area required	1310000	sqft
Initial depth of sludge	12	in
Final solids	50	%
Bed holding time	297	d
Quantities		
Total drying bed surface area	1310000	sqft
Number beds	437	
Surface area of each individua	3000	sqft
Length of each bed	150	ft
Volume of earthwork required	6440000	cuft
Volume concrete for dividing w	421000	cuft
Volume of R.C. in-place for tru	98200	cuft
Volume of sand	982000	cuft
Volume of gravel	1310000	cuft
Clay pipe diameter	6	in
Total length clay pipe	131000	in
Sludge solids produced	34.4	ton(short)/d
Operational labor required	36700	pers-hrs/yr
Maintenance labor required	18300	pers-hrs/yr
Costs		
Construction and equipment cc	18100000	$
Earthwork Cost	1910000	$
Wall Concrete Cost	7090000	$
Slab Concrete Cost	764000	$
Drying Bed Media Cost	3660000	$
Drain Pipe System Cost	2880000	$
Misc Costs	1790000	$
Operational labor cost	1890000	$/yr
Maintenance labor cost	934000	$/yr
Material and supply cost	163000	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	1570000	$/yr

Hauling and Land Filling

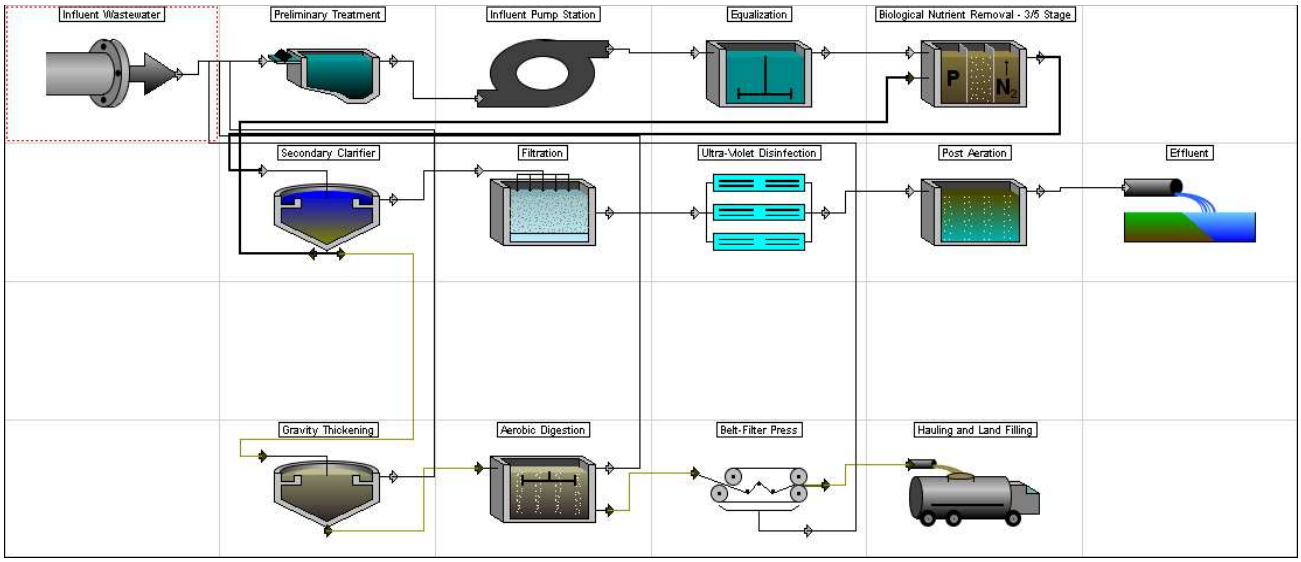
Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	81.6	cuyd/d
Truck capacity	30	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	81.6	cuyd/d
Maximum anticipated landfill d	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	8270	sqft
Width of sludge storage shed s	64.3	ft
Length of sludge storage shed	129	ft
Volume of earthwork required	21900	cuft
Volume of slab concrete requir	9150	cuft
Surface area of canopy roof	8270	sqft
Round trip haul distance	20	miles
Round trips per day per truck	3	
Distance traveled per year per	15000	miles
Sludge hauled	72.2	ton(short)/d
Operation labor required	1280	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment co	649000	$
Earthwork Cost	6490	$
Slab Concrete Cost	119000	$
Canopy Roof Cost	165000	$
Vehicle Cost	359000	$
Operational labor cost	65800	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	90100	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	102000	$/yr

Snyderville Basin
East Canyon

Layout - Snyderville Basin East Canyon



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$20,000,000	$
Other direct construction costs	$5,320,000	$
Other indirect construction cos	$18,900,000	$
Total construction costs	$44,200,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$53,200	$/yr
Laboratory labor cost	$156,000	$/yr
Unit process operation labor c	$652,000	$/yr
Unit process maintenance labc	$344,000	$/yr
Total labor costs	$1,200,000	$/yr
MATERIAL COSTS		
Total material cost	$405,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$21,000	$/yr
ENERGY COSTS		
Total energy cost	$706,000	$/yr
Total operation and maintanen	$2,340,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$3,840,000	$/yr
Total annual project cost	$6,170,000	$/yr
PROJECT SUMMARY		
Present worth	$73,900,000	$
Total project cost	$44,200,000	$
Total operation labor cost	$861,000	$/yr
Total maintenance labor cost	$344,000	$/yr
Total material cost	$405,000	$/yr
Total chemical cost	$21,000	$/yr
Total energy cost	$706,000	$/yr
Total amortization cost	$3,840,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Preliminary Treatment	674000	53300	23700	16800	0	3070	56500
Secondary Clarifier	693000	70000	35300	6790	0	1310	63900
Gravity Thickening	201000	18200	12000	2010	0	665	19300
Influent Pump Station	2100000	36500	25700	14700	0	28500	181000

Filtration	1050000	9150	5210	29800	0	3160	101000
Aerobic Digestion	318000	102000	45600	33900	0	135000	27800
Equalization	1830000	53000	42300	3380	0	174000	161000
Ultra-Violet Disinfection	430000	0	4630	4300	1490	10700	36400
Belt-Filter Press	812000	5900	1230	0	19600	3630	74300
Biological Nutrient Removal - 3	10600000	262000	138000	238000	0	343000	962000
Post Aeration	58000	33000	10400	1440	0	3330	5270
Hauling and Land Filling	324000	8620	0	53600	0	0	64700
Effluent	0	0	0	0	0	0	0
Blower System	905000	0	0	0	0	0	75900
Other Costs	24200000	209000	0	0	0	0	2010000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	15	acre
Administration labor hours	1030	hr/yr
Laboratory labor hours	3020	hr/yr
Costs		
DIRECT COSTS		
Mobilization	478000	$
Site preparation	709000	$
Site electrical	1330000	$
Yard piping	892000	$
Instrumentation and control	665000	$
Lab and administration building	1250000	$
Total direct construction costs	5320000	$
INDIRECT COSTS		
Cost of land	300000	$
Miscellaneous cost	1460000	$
Legal cost	582000	$
Engineering design fee	4370000	$
Inspection cost	582000	$
Contingency	2910000	$
Technical	582000	$
Interest during construction	4330000	$
Profit	3800000	$
Total indirect construction cost	18900000	$
Total of other construction cos	24200000	$
LABOR COSTS		
Administration labor cost	53200	$/yr
Laboratory labor cost	156000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	10100	scfm
Safety factor	1.5	
Requested air flow capacity	15200	scfm
Total capacity of blowers	15200	scfm
Number of blowers in use	3	
Total number of blowers	4	
Capacity of individual blowers	5070	scfm
Estimated cost of an installed l	162000	$
Blower building area	1510	sqft
Costs		
Construction and equipment cc	905000	$
Installed Blower Cost	650000	$
Building Cost	166000	$
Misc Costs	89700	$
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	75900	$/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	0.25	in
Slope of bars from horizontal	30	degrees
Head loss through screen	1.7977E+308	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	2.52	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	15.5	cuft/s
Average flow	6.29	cuft/s
Minimum flow	3.98	cuft/s
Temperature	10	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	7.77	cuft/s
Width of channel	1.29	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.00135	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	16.3	cuft/d
Costs		
Construction and equipment cc	674000	$
Operational labor cost	53300	$/yr
Maintenance labor cost	23700	$/yr
Material and supply cost	16800	$/yr
Chemical cost	0	$/yr
Energy cost	3070	$/yr
Amortization cost	56500	$/yr

Secondary Clarifier

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	10200	sqft
Surface area per circular clarifi	5110	sqft
Diameter of each circular clarif	81	ft
Number of clarifiers per battery	2	
Number of batteries	1	
Solids loading rate	14.3	lb/(sqft·d)
Hydraulic retention time	4.04	hr
Designed surface overflow rate	400	gal(US)/(sqft·d)
Weir length	272	ft
Volume of wasted sludge	87600	gpd(US)
Quantities		
Operation labor required	1040	pers-hrs/yr
Maintenance labor required	571	pers-hrs/yr
Electrical energy required	10100	kWh/yr
Volume of earthwork required	132000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	10100	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	5340	cuft
Costs		
Construction and equipment cc	647000	$
Earthwork Cost	39000	$
Wall Concrete Cost	128000	$
Slab Concrete Cost	131000	$
Installed Equipment Cost	250000	$
Misc Costs	98700	$
Operational labor cost	53400	$/yr
Maintenance labor cost	24500	$/yr
Material and supply cost	6470	$/yr
Chemical cost	0	$/yr
Energy cost	1010	$/yr
Amortization cost	59500	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0876	MGD(US)
Total pumping capacity	0.0876	MGD(US)
Design capacity per pump	30.4	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.0876	MGD(US)

Quantities		
Operation labor required	322	pers-hrs/yr
Maintenance labor required	251	pers-hrs/yr
Electrical energy required	2950	kWh/yr
Volume of earthwork required	1610	cuft
Area of pump building	202	sqft
Costs		
Construction and equipment cc	46500	$
Earthwork Cost	478	$
Pump Building Cost	22200	$
Installed Pump Cost	16800	$
Misc Costs	7100	$
Operational labor cost	16600	$/yr
Maintenance labor cost	10800	$/yr
Material and supply cost	326	$/yr
Chemical cost	0	$/yr
Energy cost	295	$/yr
Amortization cost	4400	$/yr

Gravity Thickening

Design Output Data

Description	Value	Units
Gravity Thickening		
Design Information		
Initial concentration	1	%
Thickened concentration	5	%
Mass loading	10	lb/(sqft·d)
Hydraulic loading	120	gal(US)/(sqft·d)
Hydraulic retention time	13.5	hr
Number of tanks	2	
Tank volume	6570	cuft
Depth	9	ft
Surface area per tank	365	sqft
Tank diameter	22	ft
Quantities		
Amount of sludge generated	3.65	ton(short)/d
Volume of thickened sludge	15000	gpd(US)
Operation labor required	354	pers-hrs/yr
Maintenance labor required	280	pers-hrs/yr
Electrical energy required	6650	kWh/yr
Volume of earthwork required	11000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	943	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	1610	cuft
Costs		
Construction and equipment cc	201000	$
Earthwork Cost	3260	$
Wall Concrete Cost	38700	$
Slab Concrete Cost	12200	$
Installed Equipment Cost	116000	$
Misc Costs	30700	$
Operational labor cost	18200	$/yr
Maintenance labor cost	12000	$/yr
Material and supply cost	2010	$/yr
Chemical cost	0	$/yr
Energy cost	665	$/yr
Amortization cost	19300	$/yr

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	27100	cuft
Width of wet well	209	ft
Depth of the pumping station	28.4	ft
Length of the pumping station	21.2	ft
Width of the pumping station	239	ft
Minimum depth of water in wet	7.36	ft
Area of pump building	682	sqft
Peak capacity of pumps	13.8	MGD(US)
Firm pumping capacity	13.8	MGD(US)
Total dynamic head - average	44.5	ft
Quantities		
Operation labor required	710	pers-hrs/yr
Maintenance labor required	599	pers-hrs/yr
Electrical energy required	285000	kWh/yr
Volume of earthwork required	637000	cuft
Volume of slab concrete requir	47800	cuft
Volume of wall concrete requir	20100	cuft
Capacity per pump	9600	gpm(US)

Number of constant speed pur	2	
Number of variable speed pur	0	
Diameter of discharge header	22.1	in
Total dynamic head	59.8	ft
Size of selected pump	20	in
Specific speed of pump	4100	
Pump rotating speed	878	rpm
Motor size required	168	HP
Size of selected motor	200	HP
Width of pump system	4.6	ft
Length of pump system	21.6	ft
Length of the dry well	21.2	ft
Width of the dry well	30.6	ft
Costs		
Construction and equipment co	2100000	$
Earthwork Cost	189000	$
Wall Concrete Cost	484000	$
Slab Concrete Cost	620000	$
Building Cost	75000	$
Installed Pump Equipment C	410000	$
Misc Costs	320000	$
Operational labor cost	36500	$/yr
Maintenance labor cost	25700	$/yr
Material and supply cost	14700	$/yr
Chemical cost	0	$/yr
Energy cost	28500	$/yr
Amortization cost	181000	$/yr

Filtration

Design Output Data

Description	Value	Units
Filtration		
Design Information		
Surface area	740	sqft
Depth	9	ft
Terminal headloss through bec	192000	ft
Maximum head for backwashir	19.6	ft
Backwash rate	20	gal(US)/(sqft·min)
Washwater gutter depth	0.384	ft
Washwater needed	74000	gal(US)
Quantities		
Operation labor required	178	pers-hrs/yr
Maintenance labor required	121	pers-hrs/yr
Electrical energy required	31600	kWh
Surface area per filter unit	740	sqft
Number of cells per filter unit	4	
Number of filter units per batte	1	
Number of batteries	1	
Volume of earthwork for filter	11900	cuft
Volume of concrete for filter	6110	cuft
Volume of surge tank	9900	cuft
Width of surge tank	26.6	ft
Length of surge tank	53.2	ft
Volume of earthwork for surge	24900	cuft
Volume of concrete for surge t	3520	cuft
Costs		
Construction and equipment co	1050000	$
Earthwork Cost for Filter	3520	$
Earthwork Cost for Surge Ta	7380	$
Concrete Cost for Filter	147000	$
Concrete Cost for Surge Tar	84800	$
Installed Equipment Cost	595000	$
Misc Costs	209000	$
Operational labor cost	9150	$/yr
Maintenance labor cost	5210	$/yr
Material and supply cost	29800	$/yr
Chemical cost	0	$/yr
Energy cost	3160	$/yr
Amortization cost	101000	$/yr

Aerobic Digestion

Design Output Data

Description	Value	Units
Aerobic Digestion		
Design Information		
Solids retention time	2.08	d
Design SS	12000	mg/L
Calculated VSS	6570	mg/L
Calculated VSS:TSS ratio	0.548	mg VSS/mg SS
Total volume of reactors	284	m3
Length of parallel train	3	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	1520	kg/d
Air flow required to meet avera	8420	N m3/hr
Design air flow	494	N m3/min/1000 m3
Volatile solids loading	0.438	lb/(cuft·d)
Solids accumulated	3610	lb/d
Digester capacity	7510	lb
Volume of wasted sludge	34300	gal(US)
Quantities		
Operation labor required	1980	pers-hrs/yr
Maintenance labor required	1060	pers-hrs/yr
Electrical energy required	1350000	kWh/yr
Volume of earthwork required	17100	cuft
Volume of slab concrete requir	3390	cuft
Volume of wall concrete requir	3540	cuft
Handrail length	99.8	ft
Number of diffusers per train	218	
Number of swing arm headers	1	
Costs		
Construction and equipment co	318000	$
Earthwork Cost	5070	$
Wall Concrete Cost	85300	$
Slab Concrete Cost	43900	$
Handrail Cost	7490	$
Installed Aerator Equipment	57200	$
Air Piping Cost	87900	$
Misc Costs	31600	$
Operational labor cost	102000	$/yr
Maintenance labor cost	45600	$/yr
Material and supply cost	33900	$/yr
Chemical cost	0	$/yr
Energy cost	135000	$/yr
Amortization cost	27800	$/yr

Equalization

Design Output Data

Description	Value	Units
Equalization		
Design Information		
Effective storage volume	817000	gal(US)
Average hourly flow	170000	gph(US)
Length of basin	331	ft
Width of basin	331	ft
Tank volume	4920000	gal(US)
Operating transfer efficiency	3.16	lbO2/(HP·h)
Power required	295	HP
Quantities		
Volume of earthwork required	991000	cuft
Volume of slab concrete requir	82200	cuft
Volume of wall concrete requir	7950	cuft
Number of aerators per basin	3	
Power of selected aerator	100	HP
Total installed power	300	HP
Operational labor required	1030	pers-hrs/yr
Maintenance labor required	987	pers-hrs/yr
Electrical energy required	1740000	kWh/yr
Costs		
Construction and equipment co	1830000	$
Earthwork Cost	294000	$
Wall Concrete Cost	191000	$
Slab Concrete Cost	1070000	$
Installed Aerator Equipment	194000	$
Misc Costs	87300	$
Operational labor cost	53000	$/yr
Maintenance labor cost	42300	$/yr
Material and supply cost	3380	$/yr
Chemical cost	0	$/yr
Energy cost	174000	$/yr
Amortization cost	161000	$/yr

Ultra-Violet Disinfection

Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calc	1.98	gal(US)/(min·W)
Total number of lamps needed	107	
Number of spare channels	1	
Total number of lamps used in	144	
Number of excess lamps	37	

Number of lamps/modules	2	
Number of modules/bank	3	
Number of banks/channel	6	
Number of channels	4	
Calculated headloss	86.4	in
Costs		
Construction and equipment cc	430000	$
Cost of installation	258000	$
Total cost of UV lamps	172000	$
Operational labor cost	0	$/yr
Maintenance labor cost	4630	$/yr
Material and supply cost	4300	$/yr
Chemical cost	1490	$/yr
Energy cost	10700	$/yr
Amortization cost	36400	$/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	48.1	gpm(US)
Final solids content	19	%
Solids capture fraction	0.996	
Quantities		
Operation labor required	115	pers-hrs/yr
Maintenance labor required	28.7	pers-hrs/yr
Power	36300	kWh/yr
Polymer required	15000	lb/yr
Dry solids produced	4120	lb/d
Belt filter(s)	275000	$
Building	279000	$
Installation	68800	$
Polymer system	82500	$
Feed pumps	30300	$
Conveyor system	77000	$
Costs		
Construction and equipment cc	812000	$
Building Cost	279000	$
Polymer System Cost	82500	$
Feed Pumps Cost	30300	$
Conveyor System Cost	77000	$
Installed Belt Filter	344000	$
Operational labor cost	5900	$/yr
Maintenance labor cost	1230	$/yr
Material and supply cost	0	$/yr
Chemical cost	19600	$/yr
Energy cost	3630	$/yr
Amortization cost	74300	$/yr

Biological Nutrient Removal - 3/5 Stage

Design Output Data

Description	Value	Units
BNR System for BIO-P and N Removal		
Design Information		
Influent BOD/TP ratio too smal		
3-Stage Biological Phosphorus		
Design aerobic SRT for nitrifica	15	d
Total reactor SRT	30	d
Design SS	3000	mg/L
Calculated VSS	2010	mg/L
Calculated VSS:TSS ratio	0.669	mg VSS/mg SS
Total volume of anaerobic reac	0	m3
Total volume of anoxic reactor	17100	m3
Total volume of aerobic reacto	17100	m3
Total volume of all reactors	34100	m3
Width of parallel train	10	m
Sidewater depth	5	m
Number of batteries	1	
Number of parallel trains per b	4	
Number of anoxic cells within c	3	
Number of aerobic cells within	3	
Anaerobic hydraulic retention ti	0	hr
Anoxic hydraulic retention time	26.5	hr
Aerobic hydraulic retention tim	26.5	hr
Amount of sludge generated	3410	kg/d
Sludge recycle ratio	42.9	%
Sludge recycle rate	6630	m3/d
Nitrogen required for biomass	18.8	mg/L

Phosphorus required for bioma	3.75	mg/L
Oxygen required to meet avera	4990	kg/d
Air flow required to meet avera	8280	N m3/hr
Design air flow	8.09	N m3/min/1000 m3
Quantities		
Operation labor required	3530	pers-hrs/yr
Maintenance labor required	1900	pers-hrs/yr
Electrical energy required	2340000	kWh/yr
Volume of earthwork required	571000	cuft
Volume of slab concrete requir	170000	cuft
Volume of wall concrete requir	115000	cuft
Handrail length	4710	ft
Number of diffusers per train	615	
Fine bubble diffuser floor cover	2.94	%
Number of swing arm headers	23	
Required mixing power	224	kW
Total number of mixers	32	
Required mixing power per mi	6.99	kW
Design mixing power per mixe	3.73	kW
Mixing power for each unaerat	14	kW
Costs		
Construction and equipment co	9360000	$
Earthwork Cost	169000	$
Wall Concrete Cost	2780000	$
Slab Concrete Cost	2210000	$
Handrail Cost	353000	$
Installed Aerator Equipment	1990000	$
Air Piping Cost	385000	$
Installed Mixer Equipment Co	549000	$
Misc Costs	928000	$
Operational labor cost	182000	$/yr
Maintenance labor cost	81500	$/yr
Material and supply cost	230000	$/yr
Chemical cost	0	$/yr
Energy cost	234000	$/yr
Amortization cost	845000	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	3.06	MGD(US)
Total pumping capacity	3.06	MGD(US)
Design capacity per pump	1060	gpm(US)
Number of pumps	12	
Number of batteries	1	
Firm pumping capacity	3.06	MGD(US)
Quantities		
Operation labor required	508	pers-hrs/yr
Maintenance labor required	425	pers-hrs/yr
Electrical energy required	409000	kWh/yr
Volume of earthwork required	2080	cuft
Area of pump building	260	sqft
Costs		
Construction and equipment co	517000	$
Earthwork Cost	2470	$
Pump Building Cost	115000	$
Installed Pump Cost	321000	$
Misc Costs	78800	$
Operational labor cost	26200	$/yr
Maintenance labor cost	18200	$/yr
Material and supply cost	3620	$/yr
Chemical cost	0	$/yr
Energy cost	40900	$/yr
Amortization cost	48900	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	4.09	MGD(US)
Total pumping capacity	4.09	MGD(US)
Design capacity per pump	1420	gpm(US)
Number of pumps	12	
Number of batteries	1	
Firm pumping capacity	4.09	MGD(US)
Quantities		
Operation labor required	527	pers-hrs/yr
Maintenance labor required	443	pers-hrs/yr
Electrical energy required	546000	kWh/yr
Volume of earthwork required	2240	cuft
Area of pump building	281	sqft
Costs		
Construction and equipment co	579000	$
Earthwork Cost	2660	$
Pump Building Cost	123000	$
Installed Pump Cost	364000	$
Misc Costs	88300	$

Operational labor cost	27200	$/yr
Maintenance labor cost	19000	$/yr
Material and supply cost	4050	$/yr
Chemical cost	0	$/yr
Energy cost	54600	$/yr
Amortization cost	54700	$/yr
Sludge Recycle Pumping		
Design Information		
Average daily pumping rate	4.09	MGD(US)
Total pumping capacity	4.09	MGD(US)
Design capacity per pump	1420	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	4.09	MGD(US)
Quantities		
Operation labor required	527	pers-hrs/yr
Maintenance labor required	443	pers-hrs/yr
Electrical energy required	136000	kWh/yr
Volume of earthwork required	2240	cuft
Area of pump building	281	sqft
Costs		
Construction and equipment cc	145000	$
Earthwork Cost	665	$
Pump Building Cost	30900	$
Installed Pump Cost	91100	$
Misc Costs	22100	$
Operational labor cost	27200	$/yr
Maintenance labor cost	19000	$/yr
Material and supply cost	1010	$/yr
Chemical cost	0	$/yr
Energy cost	13600	$/yr
Amortization cost	13700	$/yr

Post Aeration

Design Output Data

Description	Value	Units
Post Aeration by Diffused Aeration		
Design Information		
Dissolved oxygen in influent	2	mg/L
Desired dissolved oxygen in ef	5	mg/L
Correction factor for pressure	1	
Minimum dissolved oxygen in t	2	mg/L
Oxygen saturation at summer t	8.5	mg/L
Oxygen required	100	lb/d
Operating transfer efficiency	2.95	lbO2/(HP·h)
Total volume of aerobic reacto	27800	gal(US)
Air flow rate required to meet a	134	scfm
Quantities		
Basin depth	15	ft
Length of basin	8.25	ft
Width of basin	30	ft
Number of diffusers	12	
Number of swing arm diffuser l	1	
Volume of wall concrete requir	861	cuft
Volume of slab concrete requir	186	cuft
Electrical energy required	33300	kWh/yr
Operation labor required	640	pers-hrs/yr
Maintenance labor required	243	pers-hrs/yr
Costs		
Construction and equipment cc	58000	$
Wall Concrete Cost	20700	$
Slab Concrete Cost	11200	$
Installed Equipment Cost	20400	$
Misc Costs	5750	$
Operational labor cost	33000	$/yr
Maintenance labor cost	10400	$/yr
Material and supply cost	1440	$/yr
Chemical cost	0	$/yr
Energy cost	3330	$/yr
Amortization cost	5270	$/yr

Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	10.7	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	10.7	cuyd/d
Maximum anticipated landfill d	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	1080	sqft
Width of sludge storage shed	23.3	ft
Length of sludge storage shed	46.6	ft
Volume of earthwork required	3170	cuft
Volume of slab concrete requir	1400	cuft
Surface area of canopy roof	1080	sqft
Round trip haul distance	20	miles
Round trips per day per truck	1	
Distance traveled per year per	5000	miles
Sludge hauled	9.47	ton(short)/d
Operation labor required	167	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment c	324000	$
Earthwork Cost	938	$
Slab Concrete Cost	18200	$
Canopy Roof Cost	21700	$
Vehicle Cost	283000	$
Operational labor cost	8620	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	53600	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	64700	$/yr

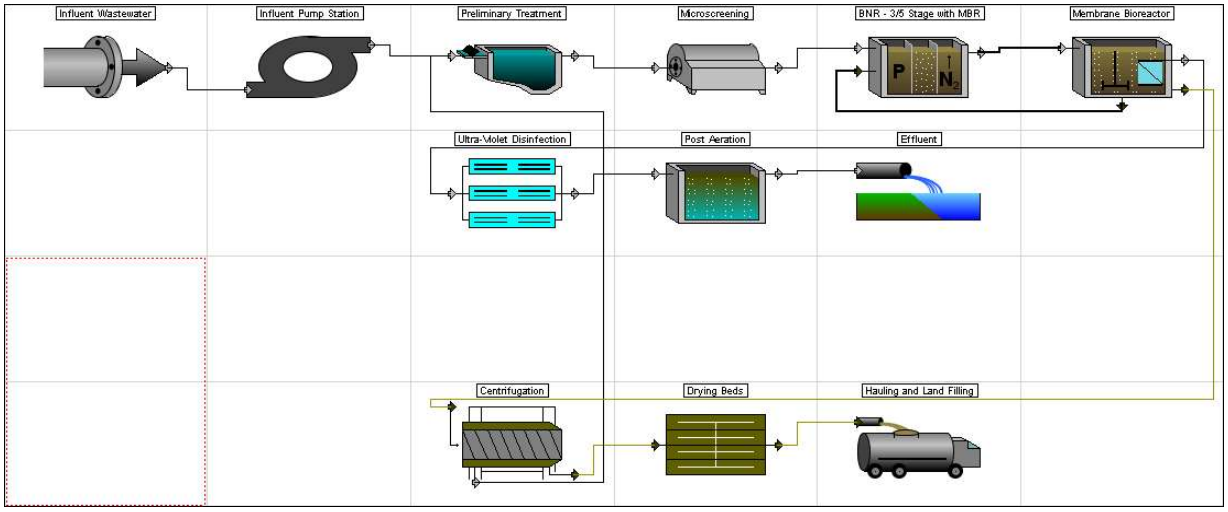
Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment c	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

Snyderville Basin
Silver Creek

Layout - Snyderville Basin Silver Creek



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$24,300,000	$
Other direct construction costs	$5,320,000	$
Other indirect construction cos	$22,000,000	$
Total construction costs	$51,600,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$53,200	$/yr
Laboratory labor cost	$156,000	$/yr
Unit process operation labor c	$1,060,000	$/yr
Unit process maintenance labc	$426,000	$/yr
Total labor costs	$1,690,000	$/yr
MATERIAL COSTS		
Total material cost	$497,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$71,400	$/yr
ENERGY COSTS		
Total energy cost	$550,000	$/yr
Total operation and maintanen	$2,810,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$4,880,000	$/yr
Total annual project cost	$7,690,000	$/yr
PROJECT SUMMARY		
Present worth	$92,000,000	$
Total project cost	$51,600,000	$
Total operation labor cost	$1,260,000	$/yr
Total maintenance labor cost	$426,000	$/yr
Total material cost	$497,000	$/yr
Total chemical cost	$71,400	$/yr
Total energy cost	$550,000	$/yr
Total amortization cost	$4,880,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Influent Pump Station	3310000	36300	26000	23200	0	47000	283000
Preliminary Treatment	671000	52900	23900	16800	0	3050	56300
Ultra-Violet Disinfection	877000	0	9620	8770	3050	21900	74300
Centrifugation	4360000	264000	14800	109000	16800	5360	426000
Microscreening	1300000	33200	18100	129000	0	39500	142000
Post Aeration	58000	32900	10600	1440	0	3330	5270
Drying Beds	385000	83400	35300	3470	0	0	33500
BNR - 3/5 Stage with MBR	3990000	226000	120000	75800	0	258000	371000
Effluent	0	0	0	0	0	0	0
Hauling and Land Filling	298000	2910	0	53600	0	0	62500
Membrane Bioreactor	7800000	324000	167000	76700	51600	172000	1060000
Blower System	1200000	0	0	0	0	0	101000
Other Costs	27400000	209000	0	0	0	0	2270000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	15	acre
Administration labor hours	1030	hr/yr
Laboratory labor hours	3020	hr/yr
Costs		
DIRECT COSTS		
Mobilization	478000	$
Site preparation	709000	$
Site electrical	1330000	$
Yard piping	892000	$
Instrumentation and control	665000	$
Lab and administration building	1250000	$
Total direct construction costs	5320000	$
INDIRECT COSTS		
Cost of land	300000	$
Miscellaneous cost	1700000	$
Legal cost	680000	$
Engineering design fee	5100000	$
Inspection cost	680000	$
Contingency	3400000	$
Technical	680000	$
Interest during construction	5060000	$
Profit	4440000	$
Total indirect construction cost	22000000	$
Total of other construction cos	27400000	$
LABOR COSTS		
Administration labor cost	53200	$/yr
Laboratory labor cost	156000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	15900	scfm
Safety factor	1.5	
Requested air flow capacity	23800	scfm
Total capacity of blowers	23800	scfm
Number of blowers in use	4	
Total number of blowers	5	
Capacity of individual blowers	5950	scfm
Estimated cost of an installed b	179000	$
Blower building area	1690	sqft
Costs		
Construction and equipment co	1200000	$
Installed Blower Cost	896000	$
Building Cost	186000	$
Misc Costs	119000	$
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	101000	$/yr
Notes		
Energy costs are shown at the individual unit processes that require air		

Influent Wastewater

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	53200	cuft
Width of wet well	410	ft
Depth of the pumping station	28.3	ft
Length of the pumping station	21.2	ft
Width of the pumping station	441	ft
Minimum depth of water in wet	7.31	ft
Area of pump building	682	sqft
Peak capacity of pumps	13.6	MGD(US)
Firm pumping capacity	13.6	MGD(US)
Total dynamic head - average	74.5	ft
Quantities		
Operation labor required	705	pers-hrs/yr
Maintenance labor required	595	pers-hrs/yr
Electrical energy required	470000	kWh/yr
Volume of earthwork required	1110000	cuft
Volume of slab concrete requir	89400	cuft
Volume of wall concrete requir	34800	cuft
Capacity per pump	9410	gpm(US)
Number of constant speed pur	2	
Number of variable speed pur	0	
Diameter of discharge header	21.9	in
Total dynamic head	90	ft
Size of selected pump	20	in
Specific speed of pump	3980	

Pump rotating speed	1200	rpm
Motor size required	249	HP
Size of selected motor	250	HP
Width of pump system	4.6	ft
Length of pump system	21.6	ft
Length of the dry well	21.2	ft
Width of the dry well	30.6	ft
Costs		
Construction and equipment c	3310000	$
Earthwork Cost	330000	$
Wall Concrete Cost	839000	$
Slab Concrete Cost	1160000	$
Building Cost	75000	$
Installed Pump Equipment C	407000	$
Misc Costs	506000	$
Operational labor cost	36300	$/yr
Maintenance labor cost	26000	$/yr
Material and supply cost	23200	$/yr
Chemical cost	0	$/yr
Energy cost	47000	$/yr
Amortization cost	283000	$/yr

Preliminary Treatment

Design Output Data

Description	Value	Units
Preliminary Treatment		
Design Information		
Mechanically Cleaned Bar Screen		
Bar size	0.25	in
Bar spacing	1.5	in
Slope of bars from horizontal	30	degrees
Head loss through screen	0.0206	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	2.48	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	15.4	cuft/s
Average flow	6.21	cuft/s
Minimum flow	3.13	cuft/s
Temperature	10	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	7.72	cuft/s
Width of channel	1.29	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.00136	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	16.1	cuft/d
Costs		
Construction and equipment c	671000	$
Operational labor cost	52900	$/yr
Maintenance labor cost	23900	$/yr
Material and supply cost	16800	$/yr
Chemical cost	0	$/yr
Energy cost	3050	$/yr
Amortization cost	56300	$/yr

Ultra-Violet Disinfection

Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calc	2.12	gal(US)/(min·W)
Total number of lamps needed	249	
Number of spare channels	1	
Total number of lamps used in	294	
Number of excess lamps	45	
Number of lamps/modules	2	
Number of modules/bank	3	
Number of banks/channel	7	
Number of channels	7	
Calculated headloss	158	in
Costs		
Construction and equipment c	877000	$
Cost of installation	526000	$
Total cost of UV lamps	351000	$
Operational labor cost	0	$/yr
Maintenance labor cost	9620	$/yr
Material and supply cost	8770	$/yr
Chemical cost	3050	$/yr
Energy cost	21900	$/yr
Amortization cost	74300	$/yr

Centrifugation

Design Output Data

Description	Value	Units
Centrifugation		
Design Information		
Total power required	123	HP
Power required per unit	61.5	HP
Excess capacity factor	1.25	
Number of units	2	
Chemical dose	1	% dry wt
Chemicals required	6.2	lb/hr
Sludge flow	98.4	gpm(US)
Initial solid conc	1.2	%
Operational hours per day	8	hr
Operational days per week	5	d
Quantities		
Number of centrifuges	2	
Power required per unit	61.5	HP
Area of building	422	sqft
Dry solids produced	1.69	ton(short)/d
Operation labor required	1970	pers-hrs/yr
Maintenance labor required	340	pers-hrs/yr
Electrical energy required	53600	kWh/yr
Costs		
Construction and equipment cc	4250000	$
Operational labor cost	102000	$/yr
Maintenance labor cost	14800	$/yr
Material and supply cost	106000	$/yr
Chemical cost	0	$/yr
Energy cost	5360	$/yr
Amortization cost	426000	$/yr
Polymer Feed System		
Quantities		
Polymer dosage	49.6	lb/d
Liquid chemical solution fed	2380	gpd(US)
O&M labor required	2330	pers-hrs/yr
Dry material handling and mixi	833	pers-hrs/yr
Total operation labor required	3160	pers-hrs/yr
Costs		
Construction and equipment cc	115000	$
Operational labor cost	163000	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	2300	$/yr
Chemical cost	16800	$/yr
Energy cost	0	$/yr
Amortization cost	0	$/yr

Microscreening

Design Output Data

Description	Value	Units
Microscreening		
Design Information		
Microscreen loading rate	7	gal(US)/(sqft·min)
Quantity of wash water require	4	%
Area of microscreens required	995	sqft
Quantities		
Number of batteries	1	
Number of units/battery	4	
Drum diameter	10	ft
Drum width	10	ft
Area of selected unit	315	sqft
Area of building	660	sqft
Operation labor required	645	pers-hrs/yr
Maintenance labor required	415	pers-hrs/yr
Electrical energy required	395000	kWh/yr
Volume of wall concrete requir	7900	cuft
Volume of earthwork required	26100	cuft
Costs		
Construction and equipment cc	1300000	$
Earthwork Cost	7750	$
Slab Concrete Cost	190000	$
Building Cost	72600	$
Installed Equipment Cost	857000	$
Misc Costs	169000	$
Operational labor cost	33200	$/yr
Maintenance labor cost	18100	$/yr
Material and supply cost	129000	$/yr
Chemical cost	0	$/yr
Energy cost	39500	$/yr
Amortization cost	142000	$/yr

Post Aeration

Design Output Data

Description	Value	Units
Post Aeration by Diffused Aeration		
Design Information		
Dissolved oxygen in influent	2	mg/L
Desired dissolved oxygen in ef	5	mg/L
Correction factor for pressure	1	
Minimum dissolved oxygen in E	2	mg/L
Oxygen saturation at summer t	8.5	mg/L
Oxygen required	100	lb/d

Operating transfer efficiency	2.95	lbO2/(HP·h)
Total volume of aerobic reacto	27700	gal(US)
Air flow rate required to meet a	134	scfm
Quantities		
Basin depth	15	ft
Length of basin	8.24	ft
Width of basin	30	ft
Number of diffusers	12	
Number of swing arm diffuser l	1	
Volume of wall concrete requir	860	cuft
Volume of slab concrete requir	185	cuft
Electrical energy required	33300	kWh/yr
Operation labor required	640	pers-hrs/yr
Maintenance labor required	243	pers-hrs/yr
Costs		
Construction and equipment cc	58000	$
Wall Concrete Cost	20700	$
Slab Concrete Cost	11200	$
Installed Equipment Cost	20400	$
Misc Costs	5750	$
Operational labor cost	32900	$/yr
Maintenance labor cost	10600	$/yr
Material and supply cost	1440	$/yr
Chemical cost	0	$/yr
Energy cost	3330	$/yr
Amortization cost	5270	$/yr

Drying Beds

Design Output Data

Description	Value	Units
Sludge Drying Beds		
Design Information		
Total surface area required	26900	sqft
Initial depth of sludge	12	in
Final solids	50	%
Bed holding time	49.6	d
Quantities		
Total drying bed surface area	26900	sqft
Number beds	9	
Surface area of each individua	2990	sqft
Length of each bed	149	ft
Volume of earthwork required	132000	cuft
Volume concrete for dividing w	9370	cuft
Volume of R.C. in-place for tru	2010	cuft
Volume of sand	20100	cuft
Volume of gravel	26900	cuft
Clay pipe diameter	6	in
Total length clay pipe	2690	in
Sludge solids produced	1.52	ton(short)/d
Operational labor required	1620	pers-hrs/yr
Maintenance labor required	809	pers-hrs/yr
Costs		
Construction and equipment cc	385000	$
Earthwork Cost	39200	$
Wall Concrete Cost	158000	$
Slab Concrete Cost	15700	$
Drying Bed Media Cost	75000	$
Drain Pipe System Cost	59100	$
Misc Costs	38200	$
Operational labor cost	83400	$/yr
Maintenance labor cost	35300	$/yr
Material and supply cost	3470	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	33500	$/yr

BNR - 3/5 Stage with MBR

Design Output Data

Description	Value	Units
BNR System for BIO-P and N Removal		
Design Information		
5-Stage Biological Phosphorus		
Design aerobic SRT for nitrifica	15	d
Total reactor SRT	30	d
Design SS	9000	mg/L
Calculated VSS	6430	mg/L
Calculated VSS:TSS ratio	0.715	mg VSS/mg SS
Total volume of anaerobic reac	789	m3
Total volume of anoxic reactors	1840	m3
Total volume of aerobic reacto	2630	m3
Total volume of all reactors	5260	m3
Width of parallel train	10	m
Sidewater depth	5	m
Number of batteries	1	
Number of parallel trains per b	4	
Number of anoxic cells within c	2	
Number of aerobic cells within	2	
Anaerobic hydraulic retention t	1.24	hr
Anoxic hydraulic retention time	2.9	hr
Aerobic hydraulic retention tim	4.14	hr
Amount of sludge generated	1580	kg/d
Sludge recycle ratio	300	%

Sludge recycle rate	45800	m3/d
Nitrogen required for biomass	12.7	mg/L
Phosphorus required for bioma	2.54	mg/L
Oxygen required to meet avera	3310	kg/d
Air flow required to meet avera	5490	N m3/hr
Design air flow	34.8	N m3/min/1000 m3
Quantities		
Operation labor required	2800	pers-hrs/yr
Maintenance labor required	1420	pers-hrs/yr
Electrical energy required	1370000	kWh/yr
Volume of earthwork required	111000	cuft
Volume of slab concrete requir	51100	cuft
Volume of wall concrete requir	25200	cuft
Handrail length	928	ft
Number of diffusers per train	431	
Fine bubble diffuser floor cove	12.6	%
Number of swing arm headers	4	
Required mixing power	36.4	kW
Total number of mixers	24	
Design mixing power per mixe	2.24	kW
Mixing power for each unaerat	3.03	kW
Costs		
Construction and equipment c	2700000	$
Earthwork Cost	33000	$
Wall Concrete Cost	606000	$
Slab Concrete Cost	663000	$
Handrail Cost	69600	$
Installed Aerator Equipment	432000	$
Air Piping Cost	257000	$
Installed Mixer Equipment C	369000	$
Misc Costs	267000	$
Operational labor cost	144000	$/yr
Maintenance labor cost	62000	$/yr
Material and supply cost	66700	$/yr
Chemical cost	0	$/yr
Energy cost	137000	$/yr
Amortization cost	249000	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	4.03	MGD(US)
Total pumping capacity	4.03	MGD(US)
Design capacity per pump	1400	gpm(US)
Number of pumps	12	
Number of batteries	1	
Firm pumping capacity	4.03	MGD(US)
Quantities		
Operation labor required	526	pers-hrs/yr
Maintenance labor required	442	pers-hrs/yr
Electrical energy required	538000	kWh/yr
Volume of earthwork required	2240	cuft
Area of pump building	279	sqft
Costs		
Construction and equipment c	576000	$
Earthwork Cost	2650	$
Pump Building Cost	123000	$
Installed Pump Cost	362000	$
Misc Costs	87800	$
Operational labor cost	27100	$/yr
Maintenance labor cost	19300	$/yr
Material and supply cost	4030	$/yr
Chemical cost	0	$/yr
Energy cost	53800	$/yr
Amortization cost	54400	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	4.03	MGD(US)
Total pumping capacity	4.03	MGD(US)
Design capacity per pump	1400	gpm(US)
Number of pumps	12	
Number of batteries	1	
Firm pumping capacity	4.03	MGD(US)
Quantities		
Operation labor required	526	pers-hrs/yr
Maintenance labor required	442	pers-hrs/yr
Electrical energy required	538000	kWh/yr
Volume of earthwork required	2240	cuft
Area of pump building	279	sqft
Costs		
Construction and equipment c	576000	$
Earthwork Cost	2650	$
Pump Building Cost	123000	$
Installed Pump Cost	362000	$
Misc Costs	87800	$
Operational labor cost	27100	$/yr
Maintenance labor cost	19300	$/yr
Material and supply cost	4030	$/yr
Chemical cost	0	$/yr
Energy cost	53800	$/yr
Amortization cost	54400	$/yr
Sludge Recycle Pumping		
Design Information		
Average daily pumping rate	4.03	MGD(US)

Total pumping capacity	4.03	MGD(US)
Design capacity per pump	1400	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	4.03	MGD(US)
Quantities		
Operation labor required	526	pers-hrs/yr
Maintenance labor required	442	pers-hrs/yr
Electrical energy required	135000	kWh/yr
Volume of earthwork required	2240	cuft
Area of pump building	279	sqft
Costs		
Construction and equipment c	144000	$
Earthwork Cost	662	$
Pump Building Cost	30700	$
Installed Pump Cost	90500	$
Misc Costs	21900	$
Operational labor cost	27100	$/yr
Maintenance labor cost	19300	$/yr
Material and supply cost	1010	$/yr
Chemical cost	0	$/yr
Energy cost	13500	$/yr
Amortization cost	13600	$/yr

Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment c	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	3.61	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	3.61	cuyd/d
Maximum anticipated landfill d	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	365	sqft
Width of sludge storage shed s	13.5	ft
Length of sludge storage shed	27	ft
Volume of earthwork required	1190	cuft
Volume of slab concrete requir	551	cuft
Surface area of canopy roof	365	sqft
Round trip haul distance	20	miles
Round trips per day per truck	1	
Distance traveled per year per	5000	miles
Sludge hauled	3.19	ton(short)/d
Operation labor required	56.4	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment c	298000	$
Earthwork Cost	352	$
Slab Concrete Cost	7140	$
Canopy Roof Cost	7310	$
Vehicle Cost	283000	$
Operational labor cost	2910	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	53600	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	62500	$/yr

Membrane Bioreactor

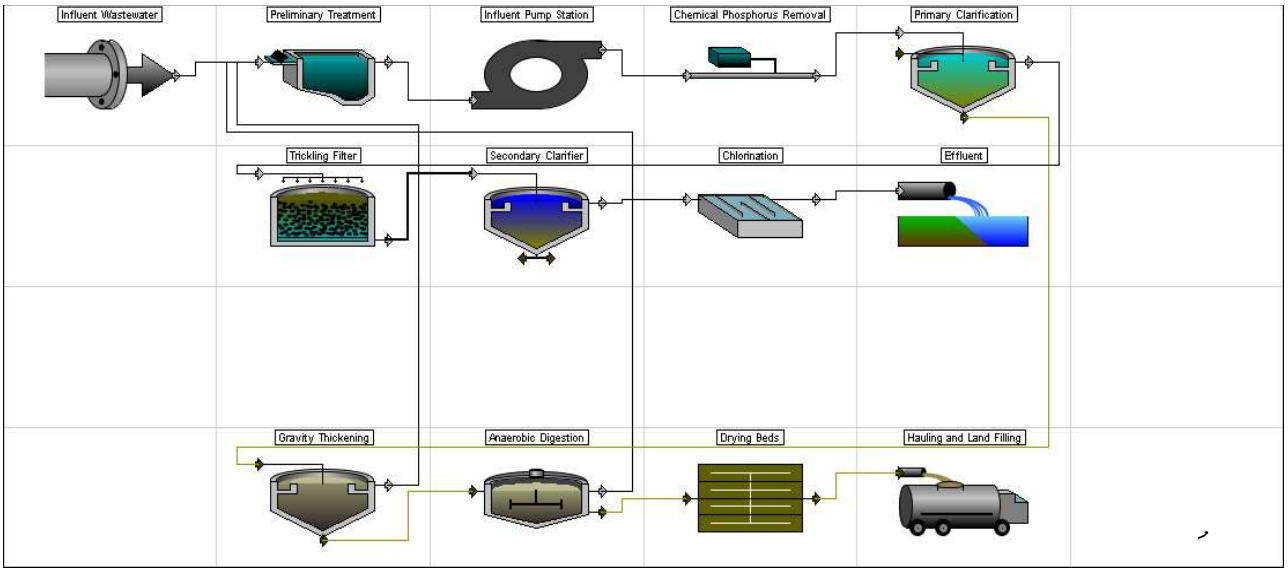
Design Output Data

Description	Value	Units
Membrane Bioreactor		
Design Information		
Total volume of reactors	55200	cuft
Length of parallel train	41	ft
Width of parallel train	20.5	ft
Sidewater depth	16.4	ft
Number of batteries	1	
Number of parallel trains per b	4	
Total Membrane Area	70300	m2
Total Scour Air Requirement	15800	N m3/hr
Quantities		
Operation labor required	5350	pers-hrs/yr

Maintenance labor required	3060	pers-hrs/yr
Electrical energy required	1600000	kWh/yr
Volume of earthwork required	42100	cuft
Volume of slab concrete requir	27100	cuft
Volume of wall concrete requir	13000	cuft
Handrail length	738	ft
Number of diffusers per train	259	
Number of swing arm headers	2	
Costs		
Construction and equipment co	7350000	$
Earthwork Cost	12500	$
Wall Concrete Cost	313000	$
Slab Concrete Cost	351000	$
Handrail Cost	55300	$
Membrane Cost	6070000	$
Installed Aerator Equipment C	200000	$
Air Piping Cost	218000	$
Misc Cost	149000	$
Operational labor cost	275000	$/yr
Maintenance labor cost	134000	$/yr
Material and supply cost	73500	$/yr
Chemical cost	51600	$/yr
Energy cost	160000	$/yr
Amortization cost	1020000	$/yr
Permeate Pumping		
Design Information		
Average daily pumping rate	1.34	MGD(US)
Total pumping capacity	3.34	MGD(US)
Design capacity per pump	1290	gpm(US)
Number of pumps	9	
Number of batteries	1	
Firm pumping capacity	11.1	MGD(US)
Quantities		
Operation labor required	660	pers-hrs/yr
Maintenance labor required	558	pers-hrs/yr
Electrical energy required	121000	kWh/yr
Volume of earthwork required	2190	cuft
Area of pump building	273	sqft
Costs		
Construction and equipment co	418000	$
Earthwork Cost	1940	$
Pump Building Cost	90200	$
Installed Pump Cost	262000	$
Misc Costs	63700	$
Operational labor cost	34000	$/yr
Maintenance labor cost	24400	$/yr
Material and supply cost	2930	$/yr
Chemical cost	0	$/yr
Energy cost	12100	$/yr
Amortization cost	39500	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0337	MGD(US)
Total pumping capacity	0.0337	MGD(US)
Design capacity per pump	11.7	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.0337	MGD(US)
Quantities		
Operation labor required	285	pers-hrs/yr
Maintenance labor required	218	pers-hrs/yr
Electrical energy required	1140	kWh/yr
Volume of earthwork required	1610	cuft
Area of pump building	201	sqft
Costs		
Construction and equipment co	39600	$
Earthwork Cost	476	$
Pump Building Cost	22100	$
Installed Pump Cost	11000	$
Misc Costs	6040	$
Operational labor cost	14700	$/yr
Maintenance labor cost	9520	$/yr
Material and supply cost	277	$/yr
Chemical cost	0	$/yr
Energy cost	114	$/yr
Amortization cost	3750	$/yr

South Davis Sewer District
North Plant

Layout South Davis North



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$26,600,000	$
Other direct construction costs	$11,200,000	$
Other indirect construction cos	$28,200,000	$
Total construction costs	$66,000,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$126,000	$/yr
Laboratory labor cost	$184,000	$/yr
Unit process operation labor c	$1,080,000	$/yr
Unit process maintenance labc	$455,000	$/yr
Total labor costs	$1,850,000	$/yr
MATERIAL COSTS		
Total material cost	$340,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$1,300,000	$/yr
ENERGY COSTS		
Total energy cost	$190,000	$/yr
Total operation and maintanen	$3,670,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$5,650,000	$/yr
Total annual project cost	$9,330,000	$/yr
PROJECT SUMMARY		
Present worth	$112,000,000	$
Total project cost	$66,000,000	$
Total operation labor cost	$1,390,000	$/yr
Total maintenance labor cost	$455,000	$/yr
Total material cost	$340,000	$/yr
Total chemical cost	$1,300,000	$/yr
Total energy cost	$190,000	$/yr
Total amortization cost	$5,650,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Preliminary Treatment	1270000	116000	48100	31800	0	5060	107000
Trickling Filter	6100000	77900	53300	34300	0	94300	526000
Gravity Thickening	306000	28700	17800	3060	0	871	29200
Influent Pump Station	8280000	47500	38600	57900	0	57200	707000

Secondary Clarifier	1700000	119000	59800	16800	0	1940	155000
Anaerobic Digestion	4500000	93700	52500	36400	0	16200	424000
Chemical Phosphorus Remova	0	0	0	0	1060000	0	0
Chlorination	1330000	81500	18800	40100	235000	13600	125000
Drying Beds	1360000	293000	125000	12200	0	0	118000
Primary Clarification	1130000	82900	41900	11200	0	1260	104000
Effluent	0	0	0	0	0	0	0
Hauling and Land Filling	331000	30600	0	90400	0	0	65300
Alum Feed System	300000	110000	0	5990	0	0	25100
Other Costs	39400000	309000	0	0	0	0	3270000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	22	acre
Administration labor hours	2440	hr/yr
Laboratory labor hours	3570	hr/yr
Costs		
DIRECT COSTS		
Mobilization	1020000	$
Site preparation	1330000	$
Site electrical	2970000	$
Yard piping	1940000	$
Instrumentation and control	1570000	$
Lab and administration building	2360000	$
Total direct construction costs	11200000	$
INDIRECT COSTS		
Cost of land	440000	$
Miscellaneous cost	2170000	$
Legal cost	869000	$
Engineering design fee	6520000	$
Inspection cost	869000	$
Contingency	4350000	$
Technical	869000	$
Interest during construction	6460000	$
Profit	5670000	$
Total indirect construction cost	28200000	$
Total of other construction cos	39400000	$
LABOR COSTS		
Administration labor cost	126000	$/yr
Laboratory labor cost	184000	$/yr

Summary of Chemical Feed System for Alum

Description	Value	Units
Alum Solution Feed System		
Design Information		
Alum dosage rate as Al2(SO4)	10800	lb/d
Alum dosage rate as equivaler	980	lb/d
Liquid chemical solution fed	2010	gpd(US)
Operation labor required	2140	pers-hrs/yr
Costs		
Construction and equipment cc	300000	$
Operational labor cost	110000	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	5990	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	25100	$/yr

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	0.5	in
Slope of bars from horizontal	30	degrees
Head loss through screen	0.176	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	7.41	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	43.2	cuft/s
Average flow	18.5	cuft/s

Minimum flow	13.1	cuft/s
Temperature	10	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	21.6	cuft/s
Width of channel	3.6	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.000511	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	48.1	cuft/d
Costs		
Construction and equipment cc	1270000	$
Operational labor cost	116000	$/yr
Maintenance labor cost	48100	$/yr
Material and supply cost	31800	$/yr
Chemical cost	0	$/yr
Energy cost	5060	$/yr
Amortization cost	107000	$/yr

Trickling Filter

Design Output Data

Description	Value	Units
Trickling Filtration		
Design Information		
Reaction rate constant	0.00156	
Hydraulic loading rate	0.75	gal(US)/(sqft·min)
Total hydraulic loading rate	0.772	gal(US)/(sqft·min)
Recirculation ratio	0.0287	
Number of towers per stage	2	
Number of stages	2	
Depth of filter tower	21.2	ft
Diameter of filter tower	84	ft
Surface area per filter tower	2770	sqft
Total surface area	11100	sqft
Volume per filter tower	117000	cuft
Total volume	469000	cuft
Quantities		
Operation labor required	614	pers-hr/yr
Maintenance labor required	462	pers-hr/yr
Volume of earthwork required	285000	cuft
Volume of slab concrete requir	14800	cuft
Volume of wall concrete requir	26500	cuft
Number of posts per tower	392	
Total length of precast beams	12000	ft
Costs		
Construction and equipment cc	5590000	$
Earthwork Cost	84500	$
Wall Concrete Cost	637000	$
Slab Concrete Cost	192000	$
Concrete Beam Cost	482000	$
Media Cost	2670000	$
Installed Distributor Arm Cos	407000	$
Misc Costs	1120000	$
Operational labor cost	31600	$/yr
Maintenance labor cost	20300	$/yr
Material and supply cost	30800	$/yr
Chemical cost	0	$/yr
Energy cost	1300	$/yr
Amortization cost	478000	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	28	MGD(US)
Total pumping capacity	28	MGD(US)
Design capacity per pump	9710	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	28	MGD(US)
Quantities		
Operation labor required	899	pers-hrs/yr
Maintenance labor required	753	pers-hrs/yr
Electrical energy required	930000	kWh/yr
Volume of earthwork required	6010	cuft
Area of pump building	752	sqft
Costs		
Construction and equipment cc	505000	$

Earthwork Cost	1780	$
Pump Building Cost	82700	$
Installed Pump Cost	344000	$
Misc Costs	77000	$
Operational labor cost	46300	$/yr
Maintenance labor cost	33000	$/yr
Material and supply cost	3540	$/yr
Chemical cost	0	$/yr
Energy cost	93000	$/yr
Amortization cost	47800	$/yr

Gravity Thickening

Design Output Data

Description	Value	Units
Gravity Thickening		
Design Information		
Initial concentration	4	%
Thickened concentration	5	%
Mass loading	10	lb/(sqft·d)
Hydraulic loading	30	gal(US)/(sqft·d)
Hydraulic retention time	53.9	hr
Number of tanks	2	
Tank volume	16200	cuft
Depth	9	ft
Surface area per tank	898	sqft
Tank diameter	34	ft
Quantities		
Amount of sludge generated	8.98	ton(short)/d
Volume of thickened sludge	36900	gpd(US)
Operation labor required	558	pers-hrs/yr
Maintenance labor required	405	pers-hrs/yr
Electrical energy required	8710	kWh/yr
Volume of earthwork required	23000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	2020	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	2370	cuft
Costs		
Construction and equipment cc	306000	$
Earthwork Cost	6800	$
Wall Concrete Cost	57000	$
Slab Concrete Cost	26100	$
Installed Equipment Cost	169000	$
Misc Costs	46600	$
Operational labor cost	28700	$/yr
Maintenance labor cost	17800	$/yr
Material and supply cost	3060	$/yr
Chemical cost	0	$/yr
Energy cost	871	$/yr
Amortization cost	29200	$/yr

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	139000	cuft
Width of wet well	784	ft
Depth of the pumping station	31.7	ft
Length of the pumping station	27.6	ft
Width of the pumping station	823	ft
Minimum depth of water in wet	10.7	ft
Area of pump building	1110	sqft
Peak capacity of pumps	36.9	MGD(US)
Firm pumping capacity	36.9	MGD(US)
Total dynamic head - average	44	ft
Quantities		
Operation labor required	922	pers-hrs/yr
Maintenance labor required	880	pers-hrs/yr
Electrical energy required	572000	kWh/yr
Volume of earthwork required	2710000	cuft
Volume of slab concrete requir	257000	cuft
Volume of wall concrete requir	73200	cuft
Capacity per pump	25600	gpm(US)
Number of constant speed pur	2	
Number of variable speed pur	0	
Diameter of discharge header	36.2	in
Total dynamic head	53.8	ft
Size of selected pump	36	in
Specific speed of pump	4840	
Pump rotating speed	496	rpm
Motor size required	279	HP

Size of selected motor	300	HP
Width of pump system	7.8	ft
Length of pump system	29.4	ft
Length of the dry well	27.6	ft
Width of the dry well	38.4	ft
Costs		
Construction and equipment cc	8280000	$
Earthwork Cost	803000	$
Wall Concrete Cost	1760000	$
Slab Concrete Cost	3330000	$
Building Cost	123000	$
Installed Pump Equipment C	998000	$
Misc Costs	1260000	$
Operational labor cost	47500	$/yr
Maintenance labor cost	38600	$/yr
Material and supply cost	57900	$/yr
Chemical cost	0	$/yr
Energy cost	57200	$/yr
Amortization cost	707000	$/yr

Secondary Clarifier

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	29900	sqft
Surface area per circular clarifi	7480	sqft
Diameter of each circular clarif	98	ft
Number of clarifiers per batter	4	
Number of batteries	1	
Solids loading rate	0.341	lb/(sqft·d)
Hydraulic retention time	4.04	hr
Designed surface overflow rate	400	gal(US)/(sqft·d)
Weir length	2800	ft
Volume of wasted sludge	119000	gpd(US)
Quantities		
Operation labor required	1980	pers-hrs/yr
Maintenance labor required	1100	pers-hrs/yr
Electrical energy required	15400	kWh/yr
Volume of earthwork required	403000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	29000	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	12900	cuft
Costs		
Construction and equipment cc	1650000	$
Earthwork Cost	120000	$
Wall Concrete Cost	310000	$
Slab Concrete Cost	376000	$
Installed Equipment Cost	589000	$
Misc Costs	251000	$
Operational labor cost	102000	$/yr
Maintenance labor cost	48200	$/yr
Material and supply cost	16500	$/yr
Chemical cost	0	$/yr
Energy cost	1540	$/yr
Amortization cost	151000	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.119	MGD(US)
Total pumping capacity	0.119	MGD(US)
Design capacity per pump	41.2	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.119	MGD(US)
Quantities		
Operation labor required	335	pers-hrs/yr
Maintenance labor required	263	pers-hrs/yr
Electrical energy required	4000	kWh/yr
Volume of earthwork required	1620	cuft
Area of pump building	202	sqft
Costs		
Construction and equipment cc	49500	$
Earthwork Cost	480	$
Pump Building Cost	22300	$
Installed Pump Cost	19200	$
Misc Costs	7540	$
Operational labor cost	17200	$/yr
Maintenance labor cost	11500	$/yr
Material and supply cost	346	$/yr
Chemical cost	0	$/yr
Energy cost	400	$/yr

Amortization cost	4680	$/yr

Anaerobic Digestion

Design Output Data

Description	Value	Units
Anaerobic Digestion		
Design Information		
Percent VSS destroyed	50	%
Solids concentration in digeste	5	%
Detention time	25	d
Digester depth	28.8	ft
Digester diameter	75	ft
Effective digester volume	282000	cuft
Number of digesters per batter	2	
Number of primary digesters p	1	
Number of secondary digester	1	
Number of batteries	1	
Gas produced	51.8	cuft/min
Heat required	998000	BTU/hr
Digester gas required	38.5	cuft/min
Total natural gas required	0	cuft/yr
Quantities		
Operation labor required	1820	pers-hrs/yr
Maintenance labor required	1200	pers-hrs/yr
Electrical energy required	162000	kWh/yr
Volume of earthwork required	281000	cuft
Slab thickness	11.2	in
Volume of slab concrete requir	8980	cuft
Wall thickness	21.9	in
Volume of wall concrete requir	30100	cuft
Sidewater depth	28.8	ft
Surface area/floor of 2-story cc	1650	sqft
Piping size	10	in
Length of total piping system	694	ft
Number of 90 degree elbows	26	
Number of tees	51	
Number of plug valves	37	
Total dry solids treated	8.09	ton(short)/d
Costs		
Construction and equipment cc	4500000	$
Earthwork Cost	83400	$
Wall Concrete Cost	726000	$
Slab Concrete Cost	116000	$
Building Cost	182000	$
Piping System Cost	521000	$
Floating Cover Cost	1640000	$
Gas Recirculation Units Cost	294000	$
Heating Units Cost	215000	$
Gas Safety Equipment Cost	120000	$
Installed Pumps Cost	150000	$
Operational labor cost	93700	$/yr
Maintenance labor cost	52500	$/yr
Material and supply cost	36400	$/yr
Chemical cost	0	$/yr
Energy cost	16200	$/yr
Amortization cost	424000	$/yr

Chemical Phosphorus Removal

Design Output Data

Description	Value	Units
Chemical Phosphorus Removal		
Design Information		
Chemical used	Equivalent Aluminum	
Chemical dosage	9.77	g/m3
Mass of chemical per year	162000	kg/yr
Chemical sludge production	51.5	g/m3
Organic sludge production	5.35	g/m3
Costs		
Construction and equipment cc	0	$
Operational labor cost	0	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	0	$/yr
Chemical cost	1060000	$/yr
Energy cost	0	$/yr
Amortization cost	0	$/yr

Chlorination

Design Output Data

Description	Value	Units
Chlorination		
Design Information		
Volume of tank	1160000	gal(US)

Average chlorine required	989	lb/d
Peak chlorine required	2320	lb/d
Influent coliform count	10000000	/100ml
Effluent coliform count	3.72	/100ml
Quantities		
Operational labor required	1580	pers-hrs/yr
Maintenance labor required	428	pers-hrs/yr
Electrical energy required	136000	kWh/yr
Volume of earthwork required	65600	cuft
Volume of slab concrete requir	15600	cuft
Volume of wall concrete requir	19300	cuft
Number of chlorinators and ev	1	
Chlorination building area	220	sqft
Number of chlorine cylinders	15	
Area of chlorine storage buildir	2100	sqft
Costs		
Construction and equipment cc	1330000	$
Earthwork Cost	19400	$
Wall Concrete Cost	464000	$
Slab Concrete Cost	202000	$
Installed Equipment Cost	386000	$
Building Cost	24200	$
Storage Building Cost	116000	$
Misc Costs	123000	$
Operational labor cost	81500	$/yr
Maintenance labor cost	18800	$/yr
Material and supply cost	40100	$/yr
Chemical cost	235000	$/yr
Energy cost	13600	$/yr
Amortization cost	125000	$/yr

Drying Beds

Design Output Data

Description	Value	Units
Sludge Drying Beds		
Design Information		
Total surface area required	97400	sqft
Initial depth of sludge	12	in
Final solids	50	%
Bed holding time	28.5	d
Quantities		
Total drying bed surface area	97400	sqft
Number beds	33	
Surface area of each individua	2950	sqft
Length of each bed	148	ft
Volume of earthwork required	479000	cuft
Volume concrete for dividing w	32100	cuft
Volume of R.C. in-place for tru	7300	cuft
Volume of sand	73000	cuft
Volume of gravel	97400	cuft
Clay pipe diameter	6	in
Total length clay pipe	9740	in
Sludge solids produced	5.33	ton(short)/d
Operational labor required	5690	pers-hrs/yr
Maintenance labor required	2840	pers-hrs/yr
Costs		
Construction and equipment cc	1360000	$
Earthwork Cost	142000	$
Wall Concrete Cost	540000	$
Slab Concrete Cost	56800	$
Drying Bed Media Cost	272000	$
Drain Pipe System Cost	214000	$
Misc Costs	135000	$
Operational labor cost	293000	$/yr
Maintenance labor cost	125000	$/yr
Material and supply cost	12200	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	118000	$/yr

Primary Clarification

Design Output Data

Description	Value	Units
Primary Clarification		
Design Information		
Surface area	15000	sqft
Surface area per circular clarifi	3760	sqft
Diameter of each circular clarif	70	ft
Number of clarifiers per batter	4	
Number of batteries	1	
Solids loading rate	2.05	lb/(sqft·d)
Hydraulic retention time	2.02	hr

Weir length	2800	ft
Volume of sludge generated	53900	gpd(US)
Quantities		
Operation labor required	1310	pers-hrs/yr
Maintenance labor required	723	pers-hrs/yr
Electrical energy required	10800	kWh/yr
Volume of earthwork required	192000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	15300	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	9330	cuft
Costs		
Construction and equipment co	1090000	$
Earthwork Cost	56800	$
Wall Concrete Cost	225000	$
Slab Concrete Cost	198000	$
Installed Equipment Cost	441000	$
Misc Costs	166000	$
Operational labor cost	67400	$/yr
Maintenance labor cost	31700	$/yr
Material and supply cost	10900	$/yr
Chemical cost	0	$/yr
Energy cost	1080	$/yr
Amortization cost	100000	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0539	MGD(US)
Total pumping capacity	0.0539	MGD(US)
Design capacity per pump	18.7	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.0539	MGD(US)
Quantities		
Operation labor required	302	pers-hrs/yr
Maintenance labor required	234	pers-hrs/yr
Electrical energy required	1820	kWh/yr
Volume of earthwork required	1610	cuft
Area of pump building	201	sqft
Costs		
Construction and equipment co	42600	$
Earthwork Cost	477	$
Pump Building Cost	22100	$
Installed Pump Cost	13500	$
Misc Costs	6500	$
Operational labor cost	15600	$/yr
Maintenance labor cost	10300	$/yr
Material and supply cost	298	$/yr
Chemical cost	0	$/yr
Energy cost	182	$/yr
Amortization cost	4030	$/yr

Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment co	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

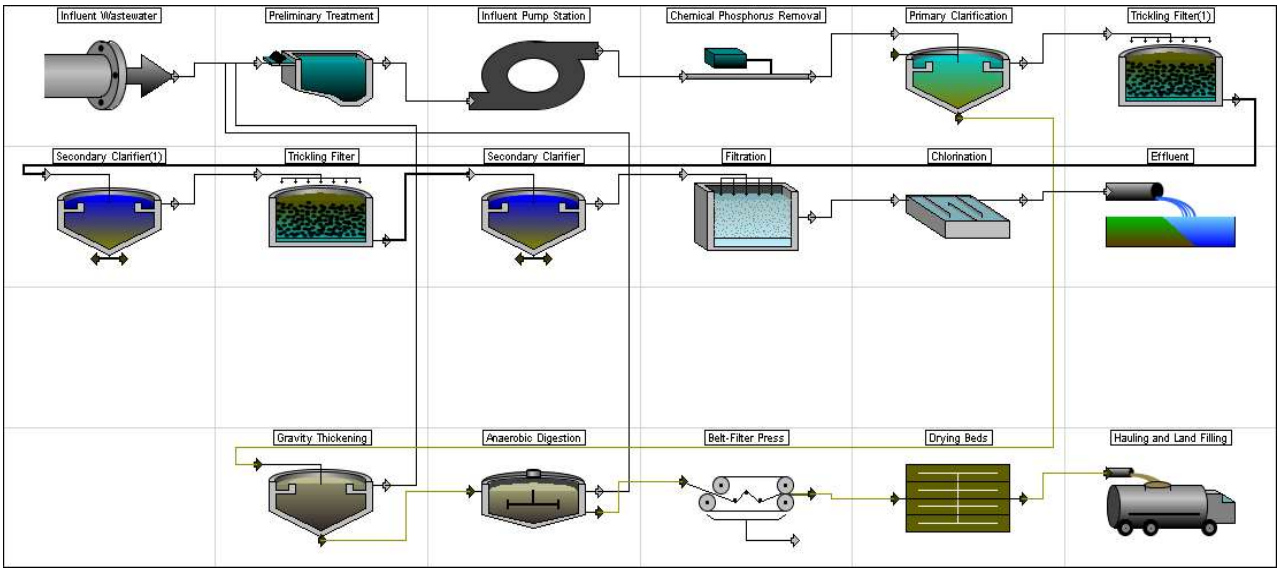
Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	12.7	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	30	miles
Quantities		
Total sludge volume hauled	12.7	cuyd/d
Maximum anticipated landfill de	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	1280	sqft
Width of sludge storage shed s	25.3	ft
Length of sludge storage shed	50.6	ft

Volume of earthwork required	3700	cuft
Volume of slab concrete requir	1630	cuft
Surface area of canopy roof	1280	sqft
Round trip haul distance	60	miles
Round trips per day per truck	1	
Distance traveled per year per	15000	miles
Sludge hauled	11.2	ton(short)/d
Operation labor required	594	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment cc	331000	$
Earthwork Cost	1100	$
Slab Concrete Cost	21100	$
Canopy Roof Cost	25600	$
Vehicle Cost	283000	$
Operational labor cost	30600	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	90400	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	65300	$/yr

South Davis Sewer District
South Plant

Layout - SDSD South Plant



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$14,500,000	$
Other direct construction costs	$5,320,000	$
Other indirect construction cos	$14,900,000	$
Total construction costs	$34,700,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$53,200	$/yr
Laboratory labor cost	$156,000	$/yr
Unit process operation labor c	$669,000	$/yr
Unit process maintenance labc	$298,000	$/yr
Total labor costs	$1,180,000	$/yr
MATERIAL COSTS		
Total material cost	$269,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$453,000	$/yr
ENERGY COSTS		
Total energy cost	$130,000	$/yr
Total operation and maintanen	$2,030,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$3,030,000	$/yr
Total annual project cost	$5,050,000	$/yr
PROJECT SUMMARY		
Present worth	$60,500,000	$
Total project cost	$34,700,000	$
Total operation labor cost	$878,000	$/yr
Total maintenance labor cost	$298,000	$/yr
Total material cost	$269,000	$/yr
Total chemical cost	$453,000	$/yr
Total energy cost	$130,000	$/yr
Total amortization cost	$3,030,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Secondary Clarifier(1)	677000	67600	33400	6650	0	1140	62500
Preliminary Treatment	670000	52700	23200	16800	0	3040	56200
Trickling Filter	877000	48000	33700	4540	0	34000	79000
Gravity Thickening	126000	16500	11000	1260	0	626	12100

Influent Pump Station	2080000	36300	25300	14500	0	28100	179000
Secondary Clarifier	668000	63200	30300	6590	0	1020	61600
Anaerobic Digestion	2380000	57600	30300	20400	0	8440	226000
Chemical Phosphorus Remova	0	0	0	0	354000	0	0
Filtration	1930000	9080	5120	54700	0	3120	186000
Belt-Filter Press	812000	6100	1260	0	20300	3750	74300
Primary Clarification	464000	48300	24100	4530	0	961	43200
Chlorination	707000	45400	6270	27400	78100	11800	70000
Drying Beds	440000	97500	40100	3960	0	0	38300
Trickling Filter(1)	2140000	48100	33800	12200	0	34200	185000
Effluent	0	0	0	0	0	0	0
Hauling and Land Filling	300000	10200	0	90400	0	0	62700
Alum Feed System	235000	62700	0	4710	0	0	19700
Other Costs	20200000	209000	0	0	0	0	1670000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	15	acre
Administration labor hours	1030	hr/yr
Laboratory labor hours	3020	hr/yr
Costs		
DIRECT COSTS		
Mobilization	478000	$
Site preparation	709000	$
Site electrical	1330000	$
Yard piping	892000	$
Instrumentation and control	665000	$
Lab and administration building	1250000	$
Total direct construction costs	5320000	$
INDIRECT COSTS		
Cost of land	300000	$
Miscellaneous cost	1140000	$
Legal cost	456000	$
Engineering design fee	3420000	$
Inspection cost	456000	$
Contingency	2280000	$
Technical	456000	$
Interest during construction	3400000	$
Profit	2970000	$
Total indirect construction cost	14900000	$
Total of other construction cos	20200000	$
LABOR COSTS		
Administration labor cost	53200	$/yr
Laboratory labor cost	156000	$/yr

Summary of Chemical Feed System for Alum

Description	Value	Units
Alum Solution Feed System		
Design Information		
Alum dosage rate as Al2(SO4)	3590	lb/d
Alum dosage rate as equivaler	327	lb/d
Liquid chemical solution fed	670	gpd(US)
Operation labor required	1220	pers-hrs/yr
Costs		
Construction and equipment cc	235000	$
Operational labor cost	62700	$/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
Secondary Clarifier(1)
Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	9980	sqft
Surface area per circular clarifi	4990	sqft
Diameter of each circular clarif	80	ft
Number of clarifiers per batter	2	
Number of batteries	1	
Solids loading rate	0.341	lb/(sqft·d)
Hydraulic retention time	4.04	hr
Designed surface overflow rate	400	gal(US)/(sqft·d)
Weir length	999	ft

Volume of wasted sludge	39600	gpd(US)
Quantities		
Operation labor required	1020	pers-hrs/yr
Maintenance labor required	563	pers-hrs/yr
Electrical energy required	10100	kWh/yr
Volume of earthwork required	128000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	9850	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	5270	cuft
Costs		
Construction and equipment cc	637000	$
Earthwork Cost	37900	$
Wall Concrete Cost	127000	$
Slab Concrete Cost	128000	$
Installed Equipment Cost	247000	$
Misc Costs	97200	$
Operational labor cost	52600	$/yr
Maintenance labor cost	23900	$/yr
Material and supply cost	6370	$/yr
Chemical cost	0	$/yr
Energy cost	1010	$/yr
Amortization cost	58700	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0396	MGD(US)
Total pumping capacity	0.0396	MGD(US)
Design capacity per pump	13.7	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.0396	MGD(US)
Quantities		
Operation labor required	291	pers-hrs/yr
Maintenance labor required	223	pers-hrs/yr
Electrical energy required	1340	kWh/yr
Volume of earthwork required	1610	cuft
Area of pump building	201	sqft
Costs		
Construction and equipment cc	40600	$
Earthwork Cost	476	$
Pump Building Cost	22100	$
Installed Pump Cost	11800	$
Misc Costs	6190	$
Operational labor cost	15000	$/yr
Maintenance labor cost	9480	$/yr
Material and supply cost	284	$/yr
Chemical cost	0	$/yr
Energy cost	134	$/yr
Amortization cost	3840	$/yr

Preliminary Treatment

Design Output Data

Description	Value	Units
Preliminary Treatment		
Design Information		
Mechanically Cleaned Bar Screen		
Bar size	0.25	in
Bar spacing	0.5	in
Slope of bars from horizontal	30	degrees
Head loss through screen	0.176	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	2.47	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	15.4	cuft/s
Average flow	6.17	cuft/s
Minimum flow	5.87	cuft/s
Temperature	10	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	7.71	cuft/s
Width of channel	1.28	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.00137	
Allowance for currents	1.7	

Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	16	cuft/d
Costs		
Construction and equipment cc	670000	$
Operational labor cost	52700	$/yr
Maintenance labor cost	23200	$/yr
Material and supply cost	16800	$/yr
Chemical cost	0	$/yr
Energy cost	3040	$/yr
Amortization cost	56200	$/yr

Trickling Filter

Design Output Data

Description	Value	Units
Trickling Filtration		
Design Information		
Reaction rate constant	0.00156	
Hydraulic loading rate	0.75	gal(US)/(sqft·min)
Total hydraulic loading rate	0.75	gal(US)/(sqft·min)
Recirculation ratio	0	
Number of towers per stage	2	
Number of stages	1	
Depth of filter tower	8	ft
Diameter of filter tower	48.3	ft
Surface area per filter tower	1830	sqft
Total surface area	3660	sqft
Volume per filter tower	14600	cuft
Total volume	29300	cuft
Quantities		
Operation labor required	295	pers-hr/yr
Maintenance labor required	256	pers-hr/yr
Volume of earthwork required	44500	cuft
Volume of slab concrete requir	2440	cuft
Volume of wall concrete requir	4310	cuft
Number of posts per tower	134	
Total length of precast beams	1940	ft
Costs		
Construction and equipment cc	666000	$
Earthwork Cost	13200	$
Wall Concrete Cost	104000	$
Slab Concrete Cost	31600	$
Concrete Beam Cost	78000	$
Media Cost	167000	$
Installed Distributor Arm Cos	139000	$
Misc Costs	133000	$
Operational labor cost	15200	$/yr
Maintenance labor cost	10900	$/yr
Material and supply cost	3060	$/yr
Chemical cost	0	$/yr
Energy cost	854	$/yr
Amortization cost	58900	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	9.95	MGD(US)
Total pumping capacity	9.95	MGD(US)
Design capacity per pump	3460	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	9.95	MGD(US)
Quantities		
Operation labor required	636	pers-hrs/yr
Maintenance labor required	538	pers-hrs/yr
Electrical energy required	332000	kWh/yr
Volume of earthwork required	3170	cuft
Area of pump building	396	sqft
Costs		
Construction and equipment cc	212000	$
Earthwork Cost	939	$
Pump Building Cost	43600	$
Installed Pump Cost	135000	$
Misc Costs	32300	$
Operational labor cost	32700	$/yr
Maintenance labor cost	22800	$/yr
Material and supply cost	1480	$/yr
Chemical cost	0	$/yr
Energy cost	33200	$/yr
Amortization cost	20000	$/yr

Gravity Thickening

Design Output Data

Description	Value	Units

Gravity Thickening		
Design Information		
Initial concentration	4	%
Thickened concentration	5	%
Mass loading	10	lb/(sqft·d)
Hydraulic loading	30	gal(US)/(sqft·d)
Hydraulic retention time	53.9	hr
Number of tanks	1	
Tank volume	5390	cuft
Depth	9	ft
Surface area per tank	599	sqft
Tank diameter	28	ft
Quantities		
Amount of sludge generated	2.99	ton(short)/d
Volume of thickened sludge	12300	gpd(US)
Operation labor required	320	pers-hrs/yr
Maintenance labor required	258	pers-hrs/yr
Electrical energy required	6260	kWh/yr
Volume of earthwork required	8170	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	715	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	985	cuft
Costs		
Construction and equipment cc	126000	$
Earthwork Cost	2420	$
Wall Concrete Cost	23700	$
Slab Concrete Cost	9260	$
Installed Equipment Cost	71600	$
Misc Costs	19300	$
Operational labor cost	16500	$/yr
Maintenance labor cost	11000	$/yr
Material and supply cost	1260	$/yr
Chemical cost	0	$/yr
Energy cost	626	$/yr
Amortization cost	12100	$/yr

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	26700	cuft
Width of wet well	205	ft
Depth of the pumping station	28.3	ft
Length of the pumping station	21.2	ft
Width of the pumping station	236	ft
Minimum depth of water in wet	7.32	ft
Area of pump building	682	sqft
Peak capacity of pumps	13.6	MGD(US)
Firm pumping capacity	13.6	MGD(US)
Total dynamic head - average	44.5	ft
Quantities		
Operation labor required	706	pers-hrs/yr
Maintenance labor required	595	pers-hrs/yr
Electrical energy required	281000	kWh/yr
Volume of earthwork required	627000	cuft
Volume of slab concrete requir	47000	cuft
Volume of wall concrete requir	19800	cuft
Capacity per pump	9430	gpm(US)
Number of constant speed pur	2	
Number of variable speed pur	0	
Diameter of discharge header	21.9	in
Total dynamic head	60	ft
Size of selected pump	20	in
Specific speed of pump	4060	
Pump rotating speed	888	rpm
Motor size required	166	HP
Size of selected motor	200	HP
Width of pump system	4.6	ft
Length of pump system	21.6	ft
Length of the dry well	21.2	ft
Width of the dry well	30.6	ft
Costs		
Construction and equipment cc	2080000	$
Earthwork Cost	186000	$
Wall Concrete Cost	478000	$
Slab Concrete Cost	610000	$
Building Cost	75000	$
Installed Pump Equipment C	410000	$
Misc Costs	317000	$
Operational labor cost	36300	$/yr

Maintenance labor cost	25300	$/yr
Material and supply cost	14500	$/yr
Chemical cost	0	$/yr
Energy cost	28100	$/yr
Amortization cost	179000	$/yr

Secondary Clarifier

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	9880	sqft
Surface area per circular clarifi	4940	sqft
Diameter of each circular clarif	80	ft
Number of clarifiers per batter	2	
Number of batteries	1	
Solids loading rate	0.0295	lb/(sqft·d)
Hydraulic retention time	4.04	hr
Designed surface overflow rate	400	gal(US)/(sqft·d)
Weir length	995	ft
Volume of wasted sludge	3390	gpd(US)
Quantities		
Operation labor required	1020	pers-hrs/yr
Maintenance labor required	559	pers-hrs/yr
Electrical energy required	10100	kWh/yr
Volume of earthwork required	128000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	9850	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	5270	cuft
Costs		
Construction and equipment co	637000	$
Earthwork Cost	37900	$
Wall Concrete Cost	127000	$
Slab Concrete Cost	128000	$
Installed Equipment Cost	247000	$
Misc Costs	97200	$
Operational labor cost	52300	$/yr
Maintenance labor cost	23700	$/yr
Material and supply cost	6370	$/yr
Chemical cost	0	$/yr
Energy cost	1010	$/yr
Amortization cost	58700	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.00339	MGD(US)
Total pumping capacity	0.00339	MGD(US)
Design capacity per pump	1.18	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.00339	MGD(US)
Quantities		
Operation labor required	212	pers-hrs/yr
Maintenance labor required	155	pers-hrs/yr
Electrical energy required	115	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment co	31300	$
Earthwork Cost	474	$
Pump Building Cost	22000	$
Installed Pump Cost	4000	$
Misc Costs	4770	$
Operational labor cost	10900	$/yr
Maintenance labor cost	6590	$/yr
Material and supply cost	219	$/yr
Chemical cost	0	$/yr
Energy cost	12	$/yr
Amortization cost	2960	$/yr

Anaerobic Digestion

Design Output Data

Description	Value	Units
Anaerobic Digestion		
Design Information		
Percent VSS destroyed	50	%
Solids concentration in digeste	5	%
Detention time	25	d
Digester depth	24.4	ft
Digester diameter	50	ft
Effective digester volume	104000	cuft
Number of digesters per batter	2	

Number of primary digesters p	1	
Number of secondary digester	1	
Number of batteries	1	
Gas produced	17.3	cuft/min
Heat required	369000	BTU/hr
Digester gas required	14.2	cuft/min
Total natural gas required	0	cuft/yr
Quantities		
Operation labor required	1120	pers-hrs/yr
Maintenance labor required	714	pers-hrs/yr
Electrical energy required	84400	kWh/yr
Volume of earthwork required	104000	cuft
Slab thickness	10.1	in
Volume of slab concrete requir	3740	cuft
Wall thickness	19.7	in
Volume of wall concrete requir	15700	cuft
Sidewater depth	24.4	ft
Surface area/floor of 2-story cc	735	sqft
Piping size	6	in
Length of total piping system	520	ft
Number of 90 degree elbows	26	
Number of tees	51	
Number of plug valves	37	
Total dry solids treated	2.7	ton(short)/d
Costs		
Construction and equipment cc	2380000	$
Earthwork Cost	30700	$
Wall Concrete Cost	377000	$
Slab Concrete Cost	48400	$
Building Cost	80900	$
Piping System Cost	247000	$
Floating Cover Cost	789000	$
Gas Recirculation Units Cost	240000	$
Heating Units Cost	152000	$
Gas Safety Equipment Cost	105000	$
Installed Pumps Cost	74800	$
Operational labor cost	57600	$/yr
Maintenance labor cost	30300	$/yr
Material and supply cost	20400	$/yr
Chemical cost	0	$/yr
Energy cost	8440	$/yr
Amortization cost	226000	$/yr

Chemical Phosphorus Removal

Design Output Data

Description	Value	Units
Chemical Phosphorus Removal		
Design Information		
Chemical used	Equivalent Aluminum	
Chemical dosage	9.77	g/m3
Mass of chemical per year	54100	kg/yr
Chemical sludge production	51.5	g/m3
Organic sludge production	5.35	g/m3
Costs		
Construction and equipment cc	0	$
Operational labor cost	0	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	0	$/yr
Chemical cost	354000	$/yr
Energy cost	0	$/yr
Amortization cost	0	$/yr

Filtration

Design Output Data

Description	Value	Units
Filtration		
Design Information		
Surface area	1840	sqft
Depth	9	ft
Terminal headloss through bec	192000	ft
Maximum head for backwashir	19.6	ft
Backwash rate	20	gal(US)/(sqft·min)
Washwater gutter depth	0.704	ft
Washwater needed	184000	gal(US)
Quantities		
Operation labor required	176	pers-hrs/yr
Maintenance labor required	121	pers-hrs/yr
Electrical energy required	31200	kWh
Surface area per filter unit	1840	sqft
Number of cells per filter unit	4	
Number of filter units per batte	1	
Number of batteries	1	

Volume of earthwork for filter	21700	cuft
Volume of concrete for filter	11000	cuft
Volume of surge tank	24600	cuft
Width of surge tank	41.9	ft
Length of surge tank	83.9	ft
Volume of earthwork for surge	51300	cuft
Volume of concrete for surge t	6830	cuft
Costs		
Construction and equipment cc	1930000	$
Earthwork Cost for Filter	6410	$
Earthwork Cost for Surge Ta	15200	$
Concrete Cost for Filter	264000	$
Concrete Cost for Surge Tar	164000	$
Installed Equipment Cost	1090000	$
Misc Costs	386000	$
Operational labor cost	9080	$/yr
Maintenance labor cost	5120	$/yr
Material and supply cost	54700	$/yr
Chemical cost	0	$/yr
Energy cost	3120	$/yr
Amortization cost	186000	$/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	24.9	gpm(US)
Final solids content	19	%
Solids capture fraction	0.998	
Quantities		
Operation labor required	119	pers-hrs/yr
Maintenance labor required	29.6	pers-hrs/yr
Power	37500	kWh/yr
Polymer required	15600	lb/yr
Dry solids produced	4270	lb/d
Belt filter(s)	275000	$
Building	279000	$
Installation	68800	$
Polymer system	82500	$
Feed pumps	30300	$
Conveyor system	77000	$
Costs		
Construction and equipment cc	812000	$
Building Cost	279000	$
Polymer System Cost	82500	$
Feed Pumps Cost	30300	$
Conveyor System Cost	77000	$
Installed Belt Filter	344000	$
Operational labor cost	6100	$/yr
Maintenance labor cost	1260	$/yr
Material and supply cost	0	$/yr
Chemical cost	20300	$/yr
Energy cost	3750	$/yr
Amortization cost	74300	$/yr

Primary Clarification

Design Output Data

Description	Value	Units
Primary Clarification		
Design Information		
Surface area	5010	sqft
Surface area per circular clarifi	2510	sqft
Diameter of each circular clarif	57	ft
Number of clarifiers per batter	2	
Number of batteries	1	
Solids loading rate	2.05	lb/(sqft·d)
Hydraulic retention time	2.02	hr
Weir length	1000	ft
Volume of sludge generated	18000	gpd(US)
Quantities		
Operation labor required	675	pers-hrs/yr
Maintenance labor required	370	pers-hrs/yr
Electrical energy required	9000	kWh/yr
Volume of earthwork required	62300	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	5190	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	3820	cuft

Costs		
Construction and equipment cc	427000	$
Earthwork Cost	18500	$
Wall Concrete Cost	92000	$
Slab Concrete Cost	67300	$
Installed Equipment Cost	184000	$
Misc Costs	65200	$
Operational labor cost	34800	$/yr
Maintenance labor cost	15700	$/yr
Material and supply cost	4270	$/yr
Chemical cost	0	$/yr
Energy cost	900	$/yr
Amortization cost	39800	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.018	MGD(US)
Total pumping capacity	0.018	MGD(US)
Design capacity per pump	6.23	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.018	MGD(US)
Quantities		
Operation labor required	262	pers-hrs/yr
Maintenance labor required	199	pers-hrs/yr
Electrical energy required	607	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment cc	36400	$
Earthwork Cost	475	$
Pump Building Cost	22000	$
Installed Pump Cost	8340	$
Misc Costs	5550	$
Operational labor cost	13500	$/yr
Maintenance labor cost	8430	$/yr
Material and supply cost	255	$/yr
Chemical cost	0	$/yr
Energy cost	61	$/yr
Amortization cost	3440	$/yr

Chlorination

Design Output Data

Description	Value	Units
Chlorination		
Design Information		
Volume of tank	415000	gal(US)
Average chlorine required	329	lb/d
Peak chlorine required	830	lb/d
Influent coliform count	10000000	/100ml
Effluent coliform count	3.72	/100ml
Quantities		
Operational labor required	882	pers-hrs/yr
Maintenance labor required	148	pers-hrs/yr
Electrical energy required	118000	kWh/yr
Volume of earthwork required	23600	cuft
Volume of slab concrete requir	5550	cuft
Volume of wall concrete requir	8130	cuft
Number of chlorinators and ev	1	
Chlorination building area	220	sqft
Number of chlorine cylinders	5	
Area of chlorine storage buildir	700	sqft
Costs		
Construction and equipment cc	707000	$
Earthwork Cost	6990	$
Wall Concrete Cost	196000	$
Slab Concrete Cost	72000	$
Installed Equipment Cost	320000	$
Building Cost	24200	$
Storage Building Cost	38500	$
Misc Costs	49400	$
Operational labor cost	45400	$/yr
Maintenance labor cost	6270	$/yr
Material and supply cost	27400	$/yr
Chemical cost	78100	$/yr
Energy cost	11800	$/yr
Amortization cost	70000	$/yr

Drying Beds

Design Output Data

Description	Value	Units
Sludge Drying Beds		
Design Information		

Total surface area required	30700	sqft
Initial depth of sludge	12	in
Final solids	50	%
Bed holding time	103	d
Quantities		
Total drying bed surface area	30700	sqft
Number beds	11	
Surface area of each individua	2790	sqft
Length of each bed	140	ft
Volume of earthwork required	151000	cuft
Volume concrete for dividing w	10700	cuft
Volume of R.C. in-place for tru	2300	cuft
Volume of sand	23000	cuft
Volume of gravel	30700	cuft
Clay pipe diameter	6	in
Total length clay pipe	3070	in
Sludge solids produced	1.78	ton(short)/d
Operational labor required	1890	pers-hrs/yr
Maintenance labor required	946	pers-hrs/yr
Costs		
Construction and equipment cc	440000	$
Earthwork Cost	44900	$
Wall Concrete Cost	180000	$
Slab Concrete Cost	17900	$
Drying Bed Media Cost	85800	$
Drain Pipe System Cost	67600	$
Misc Costs	43600	$
Operational labor cost	97500	$/yr
Maintenance labor cost	40100	$/yr
Material and supply cost	3960	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	38300	$/yr

Trickling Filter(1)

Design Output Data

Description	Value	Units
Trickling Filtration		
Design Information		
Reaction rate constant	0.00156	
Hydraulic loading rate	0.75	gal(US)/(sqft·min)
Total hydraulic loading rate	0.772	gal(US)/(sqft·min)
Recirculation ratio	0.0287	
Number of towers per stage	1	
Number of stages	2	
Depth of filter tower	21.2	ft
Diameter of filter tower	68.6	ft
Surface area per filter tower	1850	sqft
Total surface area	3700	sqft
Volume per filter tower	78200	cuft
Total volume	156000	cuft
Quantities		
Operation labor required	297	pers-hr/yr
Maintenance labor required	258	pers-hr/yr
Volume of earthwork required	91800	cuft
Volume of slab concrete requir	4930	cuft
Volume of wall concrete requir	9220	cuft
Number of posts per tower	265	
Total length of precast beams	3970	ft
Costs		
Construction and equipment cc	1920000	$
Earthwork Cost	27200	$
Wall Concrete Cost	222000	$
Slab Concrete Cost	63900	$
Concrete Beam Cost	159000	$
Media Cost	891000	$
Installed Distributor Arm Cos	176000	$
Misc Costs	385000	$
Operational labor cost	15300	$/yr
Maintenance labor cost	10900	$/yr
Material and supply cost	10700	$/yr
Chemical cost	0	$/yr
Energy cost	960	$/yr
Amortization cost	165000	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	9.99	MGD(US)
Total pumping capacity	9.99	MGD(US)
Design capacity per pump	3470	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	9.99	MGD(US)

Quantities		
Operation labor required	637	pers-hrs/yr
Maintenance labor required	539	pers-hrs/yr
Electrical energy required	333000	kWh/yr
Volume of earthwork required	3180	cuft
Area of pump building	397	sqft
Costs		
Construction and equipment cc	212000	$
Earthwork Cost	941	$
Pump Building Cost	43700	$
Installed Pump Cost	135000	$
Misc Costs	32300	$
Operational labor cost	32800	$/yr
Maintenance labor cost	22900	$/yr
Material and supply cost	1480	$/yr
Chemical cost	0	$/yr
Energy cost	33300	$/yr
Amortization cost	20000	$/yr

Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	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

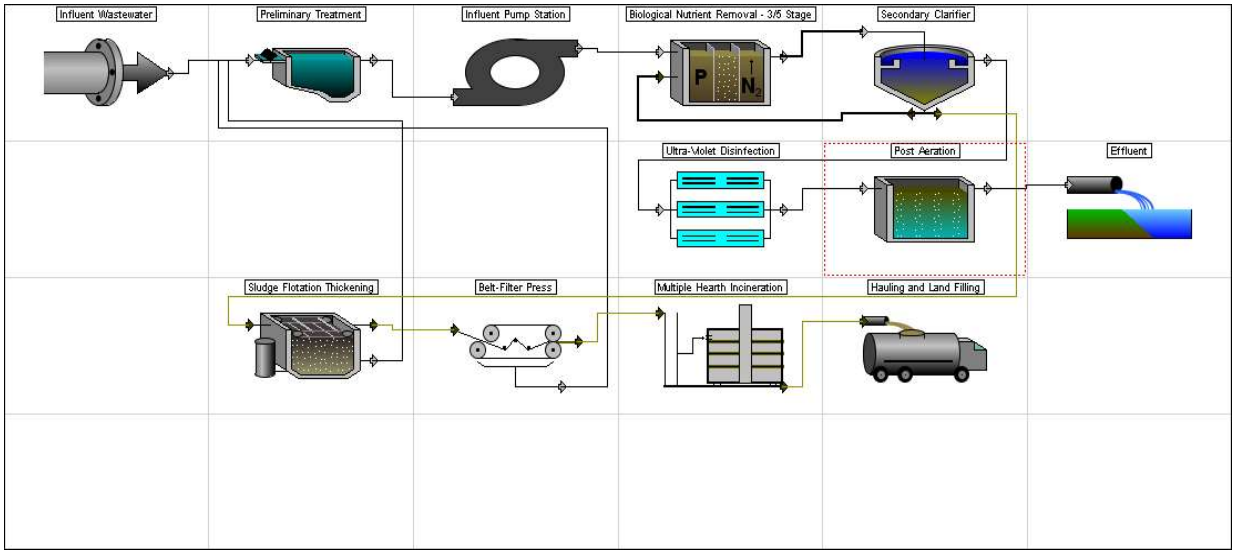
Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	4.22	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	30	miles
Quantities		
Total sludge volume hauled	4.22	cuyd/d
Maximum anticipated landfill dc	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	427	sqft
Width of sludge storage shed s	14.6	ft
Length of sludge storage shed	29.2	ft
Volume of earthwork required	1360	cuft
Volume of slab concrete requir	628	cuft
Surface area of canopy roof	427	sqft
Round trip haul distance	60	miles
Round trips per day per truck	1	
Distance traveled per year per	15000	miles
Sludge hauled	3.73	ton(short)/d
Operation labor required	198	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment cc	300000	$
Earthwork Cost	403	$
Slab Concrete Cost	8130	$
Canopy Roof Cost	8540	$
Vehicle Cost	283000	$
Operational labor cost	10200	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	90400	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	62700	$/yr

South Valley Water
Reclamation Facility

Layout - South Valley WRF



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$223,000,000	$
Other direct construction costs	$32,500,000	$
Other indirect construction cos	$189,000,000	$
Total construction costs	$444,000,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$426,000	$/yr
Laboratory labor cost	$327,000	$/yr
Unit process operation labor c	$3,140,000	$/yr
Unit process maintenance labc	$2,050,000	$/yr
Total labor costs	$5,940,000	$/yr
MATERIAL COSTS		
Total material cost	$2,610,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$773,000	$/yr
ENERGY COSTS		
Total energy cost	$10,900,000	$/yr
Total operation and maintanen	$20,200,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$39,100,000	$/yr
Total annual project cost	$59,400,000	$/yr
PROJECT SUMMARY		
Present worth	$709,000,000	$
Total project cost	$444,000,000	$
Total operation labor cost	$3,890,000	$/yr
Total maintenance labor cost	$2,050,000	$/yr
Total material cost	$2,610,000	$/yr
Total chemical cost	$773,000	$/yr
Total energy cost	$10,900,000	$/yr
Total amortization cost	$39,100,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Preliminary Treatment	2840000	461000	178000	71000	0	10500	238000
Sludge Flotation Thickening	8990000	384000	85500	91300	28700	301000	858000
Influent Pump Station	31300000	181000	128000	219000	0	106000	2660000
Belt-Filter Press	4080000	158000	37900	0	525000	76000	382000

Biological Nutrient Removal - 3	114000000	774000	517000	1340000	0	4350000	10500000
Ultra-Violet Disinfection	43900000	0	522000	439000	220000	1580000	4320000
Multiple Hearth Incineration	6510000	837000	390000	325000	0	4350000	658000
Secondary Clarifier	6940000	288000	161000	69100	0	8730	630000
Post Aeration	687000	51100	26600	8560	0	139000	67500
Hauling and Land Filling	295000	2310	0	53600	0	0	62300
Effluent	0	0	0	0	0	0	0
Blower System	3690000	0	0	0	0	0	309000
Other Costs	221000000	753000	0	0	0	0	18500000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	55.2	acre
Administration labor hours	8260	hr/yr
Laboratory labor hours	6360	hr/yr
Costs		
DIRECT COSTS		
Mobilization	2990000	$
Site preparation	3220000	$
Site electrical	9260000	$
Yard piping	5880000	$
Instrumentation and control	5280000	$
Lab and administration building	5830000	$
Total direct construction costs	32500000	$
INDIRECT COSTS		
Cost of land	1100000	$
Miscellaneous cost	14700000	$
Legal cost	5880000	$
Engineering design fee	44100000	$
Inspection cost	5880000	$
Contingency	29400000	$
Technical	5880000	$
Interest during construction	43500000	$
Profit	38300000	$
Total indirect construction cost	189000000	$
Total of other construction cos	221000000	$
LABOR COSTS		
Administration labor cost	426000	$/yr
Laboratory labor cost	327000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	71000	scfm
Safety factor	1.5	
Requested air flow capacity	107000	scfm
Total capacity of blowers	107000	scfm
Number of blowers in use	2	
Total number of blowers	3	
Capacity of individual blowers	53300	scfm
Estimated cost of an installed I	1020000	$
Blower building area	2480	sqft
Costs		
Construction and equipment co	3690000	$
Installed Blower Cost	3050000	$
Building Cost	273000	$
Misc Costs	366000	$
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	309000	$/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	0.5	in
Slope of bars from horizontal	30	degrees

Head loss through screen	0.176	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	36	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	156	cuft/s
Average flow	89.9	cuft/s
Minimum flow	32.9	cuft/s
Temperature	10	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	78.1	cuft/s
Width of channel	13	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.000186	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	234	cuft/d
Costs		
Construction and equipment cc	2840000	$
Operational labor cost	461000	$/yr
Maintenance labor cost	178000	$/yr
Material and supply cost	71000	$/yr
Chemical cost	0	$/yr
Energy cost	10500	$/yr
Amortization cost	238000	$/yr

Sludge Flotation Thickening

Design Output Data

Description	Value	Units
Sludge Flotation Thickening		
Design Information		
Air to solids ratio	0.02	
Air pressure	60	psig
Solids loading rate	10	lb/(sqft·d)
Recycle flow	6.35	MGD(US)
Surface area required	12100	sqft
Volume of pressure tank	1180	cuft
Volume of flotation tank	130000	cuft
Pressure tank detention time	2	min
Flotation tank detention time	3	hr
Polymer required	60.5	lb/d
Quantities		
Number units	10	
Surface area per flotation unit	1250	sqft
Diameter per flotation unit	39.9	ft
Amount of sludge generated	60.5	ton(long)/d
Area of flotation building	18800	sqft
Volume of earthwork required	154000	cuft
Slab thickness	10.1	in
Volume of slab concrete requir	13300	cuft
Wall thickness	11.3	in
Volume of wall concrete requir	12700	cuft
Sidewater depth	8.62	ft
Operation labor required	4010	pers-hrs/yr
Maintenance labor required	1730	pers-hrs/yr
Electrical energy required	3010000	kWhr/yr
Costs		
Construction and equipment cc	8860000	$
Earthwork Cost	45700	$
Wall Concrete Cost	306000	$
Slab Concrete Cost	173000	$
Building Cost	1550000	$
Installed Equipment Cost	5430000	$
Misc Costs	1350000	$
Operational labor cost	206000	$/yr
Maintenance labor cost	85500	$/yr
Material and supply cost	88600	$/yr
Chemical cost	0	$/yr
Energy cost	301000	$/yr
Amortization cost	858000	$/yr
Polymer Feed System		
Quantities		
Polymer dosage	60.5	lb/d

Liquid chemical solution fed	2900	gpd(US)
O&M labor required	2560	pers-hrs/yr
Dry material handling and mixi	881	pers-hrs/yr
Total operation labor required	3450	pers-hrs/yr
Costs		
Construction and equipment cc	136000	$
Operational labor cost	177000	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	2720	$/yr
Chemical cost	28700	$/yr
Energy cost	0	$/yr
Amortization cost	0	$/yr

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	540000	cuft
Width of wet well	1750	ft
Depth of the pumping station	40.9	ft
Length of the pumping station	42	ft
Width of the pumping station	1810	ft
Minimum depth of water in wet	19.9	ft
Area of pump building	2670	sqft
Peak capacity of pumps	155	MGD(US)
Firm pumping capacity	155	MGD(US)
Total dynamic head - average	43.6	ft
Quantities		
Operation labor required	3520	pers-hrs/yr
Maintenance labor required	2600	pers-hrs/yr
Electrical energy required	1060000	kWh/yr
Volume of earthwork required	10500000	cuft
Volume of slab concrete requir	1170000	cuft
Volume of wall concrete requir	219000	cuft
Capacity per pump	108000	gpm(US)
Number of constant speed pur	2	
Number of variable speed pur	0	
Diameter of discharge header	74.2	in
Total dynamic head	49.4	ft
Size of selected pump	72	in
Specific speed of pump	10600	
Pump rotating speed	227	rpm
Motor size required	415	HP
Size of selected motor	450	HP
Width of pump system	15	ft
Length of pump system	51.4	ft
Length of the dry well	42	ft
Width of the dry well	60.4	ft
Costs		
Construction and equipment cc	31300000	$
Earthwork Cost	3100000	$
Wall Concrete Cost	5270000	$
Slab Concrete Cost	15100000	$
Building Cost	293000	$
Installed Pump Equipment C	2750000	$
Misc Costs	4770000	$
Operational labor cost	181000	$/yr
Maintenance labor cost	128000	$/yr
Material and supply cost	219000	$/yr
Chemical cost	0	$/yr
Energy cost	106000	$/yr
Amortization cost	2660000	$/yr

Belt-Filter Press

Design Output Data

Description	Value	Units
Belt-Filter Press		
Design Information		
Belt filter width	2	m
Number of units	6	
Hydraulic loading per unit per r	70	gpm(US)
Hydraulic loading required per	806	gpm(US)
Final solids content	19	%
Solids capture fraction	0.998	
Quantities		
Operation labor required	3070	pers-hrs/yr
Maintenance labor required	768	pers-hrs/yr
Power	760000	kWh/yr
Polymer required	404000	lb/yr
Dry solids produced	111000	lb/d
Belt filter(s)	1810000	$

Building	501000	$
Installation	452000	$
Polymer system	668000	$
Feed pumps	199000	$
Conveyor system	452000	$
Costs		
Construction and equipment cc	4080000	$
Building Cost	501000	$
Polymer System Cost	668000	$
Feed Pumps Cost	199000	$
Conveyor System Cost	452000	$
Installed Belt Filter	2260000	$
Operational labor cost	158000	$/yr
Maintenance labor cost	37900	$/yr
Material and supply cost	0	$/yr
Chemical cost	525000	$/yr
Energy cost	76000	$/yr
Amortization cost	382000	$/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 nitrifica	12.5	d
Total reactor SRT	25	d
Design SS	3000	mg/L
Calculated VSS	2000	mg/L
Calculated VSS:TSS ratio	0.668	mg VSS/mg SS
Total volume of anaerobic reac	42200	m3
Total volume of anoxic reactor	193000	m3
Total volume of aerobic reacto	235000	m3
Total volume of all reactors	471000	m3
Width of parallel train	10	m
Sidewater depth	5	m
Number of batteries	1	
Number of parallel trains per b	36	
Number of anoxic cells within c	3	
Number of aerobic cells within	3	
Anaerobic hydraulic retention ti	4.58	hr
Anoxic hydraulic retention time	21	hr
Aerobic hydraulic retention time	25.6	hr
Amount of sludge generated	56500	kg/d
Sludge recycle ratio	42.9	%
Sludge recycle rate	94700	m3/d
Nitrogen required for biomass	20.2	mg/L
Phosphorus required for bioma	4.04	mg/L
Oxygen required to meet avera	72600	kg/d
Air flow required to meet avera	121000	N m3/hr
Design air flow	8.53	N m3/min/1000 m3
Quantities		
Operation labor required	12600	pers-hrs/yr
Maintenance labor required	8380	pers-hrs/yr
Electrical energy required	27900000	kWh/yr
Volume of earthwork required	7040000	cuft
Volume of slab concrete requir	1870000	cuft
Volume of wall concrete requir	1110000	cuft
Handrail length	35900	ft
Number of diffusers per train	987	
Fine bubble diffuser floor cover	3.09	%
Number of swing arm headers	35	
Required mixing power	3090	kW
Total number of mixers	288	
Required mixing power per mi	10.7	kW
Design mixing power per mixe	3.73	kW
Mixing power for each unaerat	21.5	kW
Costs		
Construction and equipment cc	101000000	$
Earthwork Cost	2090000	$
Wall Concrete Cost	26800000	$
Slab Concrete Cost	24200000	$
Handrail Cost	2690000	$
Installed Aerator Equipment	27400000	$
Air Piping Cost	2840000	$
Installed Mixer Equipment Cc	4940000	$
Misc Costs	10000000	$
Operational labor cost	647000	$/yr
Maintenance labor cost	413000	$/yr
Material and supply cost	1250000	$/yr
Chemical cost	0	$/yr
Energy cost	2790000	$/yr

Amortization cost	9250000	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	4.87	MGD(US)
Total pumping capacity	4.87	MGD(US)
Design capacity per pump	1690	gpm(US)
Number of pumps	108	
Number of batteries	1	
Firm pumping capacity	4.87	MGD(US)
Quantities		
Operation labor required	539	pers-hrs/yr
Maintenance labor required	455	pers-hrs/yr
Electrical energy required	5850000	kWh/yr
Volume of earthwork required	2370	cuft
Area of pump building	296	sqft
Costs		
Construction and equipment cc	5590000	$
Earthwork Cost	25300	$
Pump Building Cost	1170000	$
Installed Pump Cost	3540000	$
Misc Costs	853000	$
Operational labor cost	27800	$/yr
Maintenance labor cost	22400	$/yr
Material and supply cost	39100	$/yr
Chemical cost	0	$/yr
Energy cost	585000	$/yr
Amortization cost	529000	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	6.49	MGD(US)
Total pumping capacity	6.49	MGD(US)
Design capacity per pump	2250	gpm(US)
Number of pumps	108	
Number of batteries	1	
Firm pumping capacity	6.49	MGD(US)
Quantities		
Operation labor required	560	pers-hrs/yr
Maintenance labor required	475	pers-hrs/yr
Electrical energy required	7790000	kWh/yr
Volume of earthwork required	2620	cuft
Area of pump building	328	sqft
Costs		
Construction and equipment cc	6310000	$
Earthwork Cost	28000	$
Pump Building Cost	1300000	$
Installed Pump Cost	4020000	$
Misc Costs	962000	$
Operational labor cost	28800	$/yr
Maintenance labor cost	23400	$/yr
Material and supply cost	44200	$/yr
Chemical cost	0	$/yr
Energy cost	779000	$/yr
Amortization cost	597000	$/yr
Sludge Recycle Pumping		
Design Information		
Average daily pumping rate	58.4	MGD(US)
Total pumping capacity	58.4	MGD(US)
Design capacity per pump	13500	gpm(US)
Number of pumps	4	
Number of batteries	1	
Firm pumping capacity	58.4	MGD(US)
Quantities		
Operation labor required	1370	pers-hrs/yr
Maintenance labor required	1180	pers-hrs/yr
Electrical energy required	1940000	kWh/yr
Volume of earthwork required	10800	cuft
Area of pump building	1350	sqft
Costs		
Construction and equipment cc	972000	$
Earthwork Cost	3200	$
Pump Building Cost	149000	$
Installed Pump Cost	672000	$
Misc Costs	148000	$
Operational labor cost	70600	$/yr
Maintenance labor cost	58400	$/yr
Material and supply cost	6810	$/yr
Chemical cost	0	$/yr
Energy cost	194000	$/yr
Amortization cost	91900	$/yr

Ultra-Violet Disinfection

Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calc	0.294	gal(US)/(min·W)
Total number of lamps needed	18100	
Number of spare channels	1	
Total number of lamps used in	21200	
Number of excess lamps	3110	
Number of lamps/modules	16	
Number of modules/bank	27	
Number of banks/channel	7	
Number of channels	7	
Calculated headloss	3.04	in
Costs		
Construction and equipment cc	43900000	$
Cost of installation	26400000	$
Total cost of UV lamps	17600000	$
Operational labor cost	0	$/yr
Maintenance labor cost	522000	$/yr
Material and supply cost	439000	$/yr
Chemical cost	220000	$/yr
Energy cost	1580000	$/yr
Amortization cost	4320000	$/yr

Multiple Hearth Incineration

Design Output Data

Description	Value	Units
Multiple Hearth Incineration		
Design Information		
Dry solids loading rate	45.6	lb/(sqft·hr)
Wet sludge loading rate	10	lb/(sqft·hr)
Hearth area required per furna	2830	sqft
Hearth area furnished per furn	2860	sqft
Outside diameter of hearth	22.3	ft
Number of hearths	11	
Combustion air blower power r	2.15	HP
Combustion air flow required	322	scfm
Cooling air blower power requi	1.14	HP
Cooling air flow required	515	scfm
Quantities		
Number of furnaces	1	
Incinerator building area	1980	sqft
Volume of slab concrete	4330	cuft
Total dry solids produced	64.6	ton(short)/d
Operation labor required	16200	pers-hrs/yr
Maintenance labor required	7900	pers-hrs/yr
Electrical energy required	908000	kWh/yr
Auxiliary fuel required	1.98E+11	BTU/yr
Costs		
Construction and equipment cc	6510000	$
Slab Concrete Cost	56100	$
Building Cost	218000	$
Incinerator Cost	6240000	$
Operational labor cost	837000	$/yr
Maintenance labor cost	390000	$/yr
Material and supply cost	325000	$/yr
Chemical cost	0	$/yr
Energy cost	4350000	$/yr
Amortization cost	658000	$/yr

Secondary Clarifier

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	146000	sqft
Surface area per circular clarifi	12200	sqft
Diameter of each circular clarif	125	ft
Number of clarifiers per battery	12	
Number of batteries	1	
Solids loading rate	14.3	lb/(sqft·d)
Hydraulic retention time	4.04	hr
Designed surface overflow rate	400	gal(US)/(sqft·d)
Weir length	10100	ft
Volume of wasted sludge	1450000	gpd(US)
Quantities		
Operation labor required	5140	pers-hrs/yr
Maintenance labor required	2890	pers-hrs/yr
Electrical energy required	38800	kWh/yr
Volume of earthwork required	2130000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	139000	cuft

Wall thickness	11.5	in
Volume of wall concrete requir	49100	cuft
Costs		
Construction and equipment cc	6850000	$
Earthwork Cost	632000	$
Wall Concrete Cost	1180000	$
Slab Concrete Cost	1810000	$
Installed Equipment Cost	2180000	$
Misc Costs	1040000	$
Operational labor cost	265000	$/yr
Maintenance labor cost	143000	$/yr
Material and supply cost	68500	$/yr
Chemical cost	0	$/yr
Energy cost	3880	$/yr
Amortization cost	620000	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	1.45	MGD(US)
Total pumping capacity	1.45	MGD(US)
Design capacity per pump	504	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	1.45	MGD(US)
Quantities		
Operation labor required	462	pers-hrs/yr
Maintenance labor required	380	pers-hrs/yr
Electrical energy required	48500	kWh/yr
Volume of earthwork required	1830	cuft
Area of pump building	229	sqft
Costs		
Construction and equipment cc	98400	$
Earthwork Cost	542	$
Pump Building Cost	25100	$
Installed Pump Cost	57700	$
Misc Costs	15000	$
Operational labor cost	23800	$/yr
Maintenance labor cost	18800	$/yr
Material and supply cost	689	$/yr
Chemical cost	0	$/yr
Energy cost	4850	$/yr
Amortization cost	9310	$/yr

Post Aeration

Design Output Data

Description	Value	Units
Post Aeration by Diffused Aeration		
Design Information		
Dissolved oxygen in influent	2	mg/L
Desired dissolved oxygen in ef	5	mg/L
Correction factor for pressure	1	
Minimum dissolved oxygen in t	6	mg/L
Oxygen saturation at summer t	8.5	mg/L
Oxygen required	1420	lb/d
Operating transfer efficiency	1.01	lbO2/(HP·h)
Total volume of aerobic reacto	395000	gal(US)
Air flow rate required to meet a	5580	scfm
Quantities		
Basin depth	15	ft
Length of basin	117	ft
Width of basin	30	ft
Number of diffusers	465	
Number of swing arm diffuser l	24	
Volume of wall concrete requir	3320	cuft
Volume of slab concrete requir	2640	cuft
Electrical energy required	1390000	kWh/yr
Operation labor required	992	pers-hrs/yr
Maintenance labor required	540	pers-hrs/yr
Costs		
Construction and equipment cc	687000	$
Wall Concrete Cost	79900	$
Slab Concrete Cost	43000	$
Installed Equipment Cost	496000	$
Misc Costs	68100	$
Operational labor cost	51100	$/yr
Maintenance labor cost	26600	$/yr
Material and supply cost	8560	$/yr
Chemical cost	0	$/yr
Energy cost	139000	$/yr
Amortization cost	67500	$/yr

Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	2.87	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	2.87	cuyd/d
Maximum anticipated landfill d	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	291	sqft
Width of sludge storage shed s	12.1	ft
Length of sludge storage shed	24.1	ft
Volume of earthwork required	973	cuft
Volume of slab concrete requir	457	cuft
Surface area of canopy roof	291	sqft
Round trip haul distance	20	miles
Round trips per day per truck	1	
Distance traveled per year per	5000	miles
Sludge hauled	2.54	ton(short)/d
Operation labor required	44.9	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment co	295000	$
Earthwork Cost	288	$
Slab Concrete Cost	5920	$
Canopy Roof Cost	5820	$
Vehicle Cost	283000	$
Operational labor cost	2310	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	53600	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	62300	$/yr

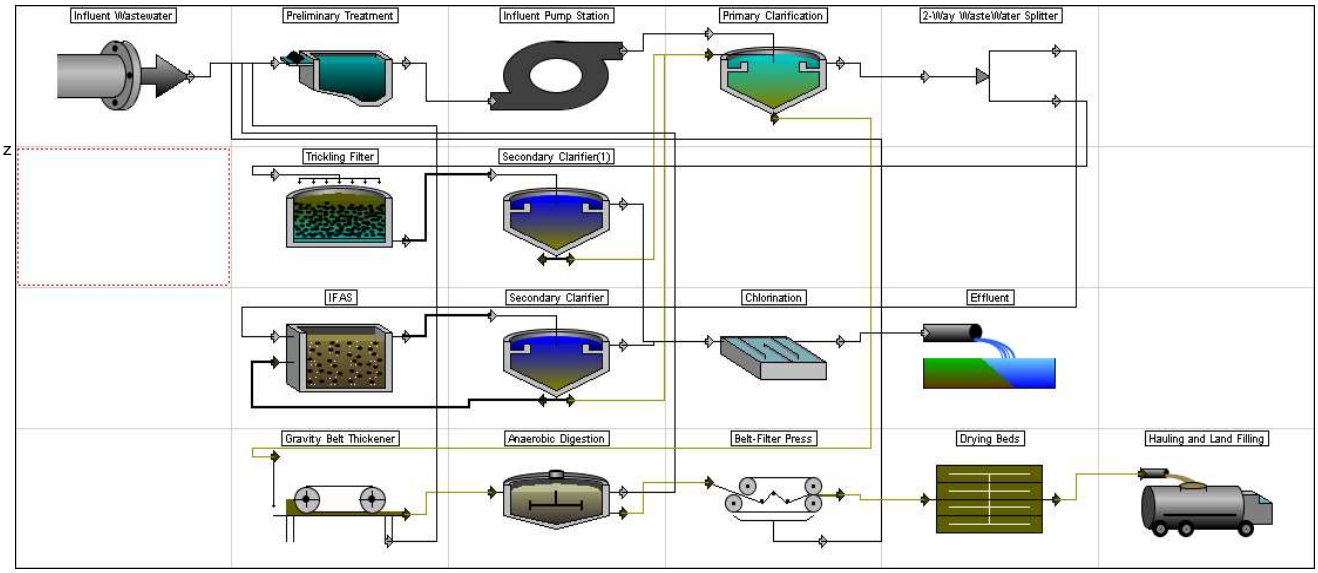
Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment co	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

Spanish Fork City

Layout - Spanish Fork City



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$17,400,000	$
Other direct construction costs	$7,000,000	$
Other indirect construction cos	$18,300,000	$
Total construction costs	$42,700,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$73,000	$/yr
Laboratory labor cost	$166,000	$/yr
Unit process operation labor c	$878,000	$/yr
Unit process maintenance labc	$420,000	$/yr
Total labor costs	$1,540,000	$/yr
MATERIAL COSTS		
Total material cost	$264,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$177,000	$/yr
ENERGY COSTS		
Total energy cost	$519,000	$/yr
Total operation and maintanen	$2,500,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$3,810,000	$/yr
Total annual project cost	$6,300,000	$/yr
PROJECT SUMMARY		
Present worth	$75,500,000	$
Total project cost	$42,700,000	$
Total operation labor cost	$1,120,000	$/yr
Total maintenance labor cost	$420,000	$/yr
Total material cost	$264,000	$/yr
Total chemical cost	$177,000	$/yr
Total energy cost	$519,000	$/yr
Total amortization cost	$3,810,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Preliminary Treatment	752000	66300	29400	18800	0	3680	63000
Trickling Filter	1230000	37100	26700	6880	0	14200	108000
IFAS	5660000	204000	108000	109000	0	421000	615000
Gravity Belt Thickener	812000	18000	3800	0	20700	7620	74300

Influent Pump Station	1230000	41100	29300	8610	0	37600	111000
Secondary Clarifier(1)	464000	48500	24900	4530	0	968	43200
Secondary Clarifier	690000	69100	35200	6770	0	1220	63700
Anaerobic Digestion	2150000	78900	43500	18700	0	12900	205000
Primary Clarification	581000	59300	30200	5700	0	1070	53900
Chlorination	687000	56700	9650	24200	119000	11900	70600
Belt-Filter Press	812000	11300	2400	0	37600	6640	74300
2-Way WasteWater Splitter	0	0	0	0	0	0	0
Effluent	0	0	0	0	0	0	0
Drying Beds	805000	181000	76500	7240	0	0	70000
Hauling and Land Filling	313000	6300	0	53600	0	0	63800
Blower System	1210000	0	0	0	0	0	102000
Other Costs	25300000	239000	0	0	0	0	2090000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	17	acre
Administration labor hours	1420	hr/yr
Laboratory labor hours	3210	hr/yr
Costs		
DIRECT COSTS		
Mobilization	632000	$
Site preparation	893000	$
Site electrical	1790000	$
Yard piping	1190000	$
Instrumentation and control	912000	$
Lab and administration building	1580000	$
Total direct construction costs	7000000	$
INDIRECT COSTS		
Cost of land	340000	$
Miscellaneous cost	1400000	$
Legal cost	561000	$
Engineering design fee	4210000	$
Inspection cost	561000	$
Contingency	2810000	$
Technical	561000	$
Interest during construction	4180000	$
Profit	3660000	$
Total indirect construction cost	18300000	$
Total of other construction cos	25300000	$
LABOR COSTS		
Administration labor cost	73000	$/yr
Laboratory labor cost	166000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	16200	scfm
Safety factor	1.5	
Requested air flow capacity	24300	scfm
Total capacity of blowers	24300	scfm
Number of blowers in use	4	
Total number of blowers	5	
Capacity of individual blowers	6060	scfm
Estimated cost of an installed I	181000	$
Blower building area	1700	sqft
Costs		
Construction and equipment cc	1210000	$
Installed Blower Cost	907000	$
Building Cost	187000	$
Misc Costs	120000	$
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	102000	$/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	1	in
Slope of bars from horizontal	30	degrees
Head loss through screen	0.0407	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	3.71	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	18.5	cuft/s
Average flow	9.28	cuft/s
Minimum flow	6.2	cuft/s
Temperature	10	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	9.26	cuft/s
Width of channel	1.54	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.00106	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	24.1	cuft/d
Costs		
Construction and equipment cc	752000	$
Operational labor cost	66300	$/yr
Maintenance labor cost	29400	$/yr
Material and supply cost	18800	$/yr
Chemical cost	0	$/yr
Energy cost	3680	$/yr
Amortization cost	63000	$/yr

Trickling Filter

Design Output Data

Description	Value	Units
Trickling Filtration		
Design Information		
Reaction rate constant	0.00156	
Hydraulic loading rate	0.75	gal(US)/(sqft·min)
Total hydraulic loading rate	0.772	gal(US)/(sqft·min)
Recirculation ratio	0.0293	
Number of towers per stage	1	
Number of stages	2	
Depth of filter tower	21.2	ft
Diameter of filter tower	48.6	ft
Surface area per filter tower	929	sqft
Total surface area	1860	sqft
Volume per filter tower	39300	cuft
Total volume	78600	cuft
Quantities		
Operation labor required	196	pers-hr/yr
Maintenance labor required	170	pers-hr/yr
Volume of earthwork required	45200	cuft
Volume of slab concrete requir	2480	cuft
Volume of wall concrete requir	6460	cuft
Number of posts per tower	136	
Total length of precast beams	1970	ft
Costs		
Construction and equipment cc	1090000	$
Earthwork Cost	13400	$
Wall Concrete Cost	155000	$
Slab Concrete Cost	32100	$
Concrete Beam Cost	79200	$
Media Cost	448000	$
Installed Distributor Arm Cos	140000	$
Misc Costs	217000	$
Operational labor cost	10100	$/yr
Maintenance labor cost	7420	$/yr
Material and supply cost	5880	$/yr
Chemical cost	0	$/yr
Energy cost	857	$/yr
Amortization cost	94100	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	3.99	MGD(US)

Total pumping capacity	3.99	MGD(US)
Design capacity per pump	1380	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	3.99	MGD(US)
Quantities		
Operation labor required	526	pers-hrs/yr
Maintenance labor required	442	pers-hrs/yr
Electrical energy required	133000	kWh/yr
Volume of earthwork required	2230	cuft
Area of pump building	279	sqft
Costs		
Construction and equipment cc	143000	$
Earthwork Cost	660	$
Pump Building Cost	30600	$
Installed Pump Cost	90100	$
Misc Costs	21900	$
Operational labor cost	27100	$/yr
Maintenance labor cost	19200	$/yr
Material and supply cost	1000	$/yr
Chemical cost	0	$/yr
Energy cost	13300	$/yr
Amortization cost	13500	$/yr

IFAS

Design Output Data

Description	Value	Units
IFAS		
Design Information		
Carbon & Nitrification Design		
Design SRT for design at winte	20	d
Design SS	2500	mg/L
Calculated VSS	1720	mg/L
Calculated VSS:TSS ratio	0.689	mg VSS/mg SS
Total volume of reactors	11700	m3
Length of parallel train	59	m
Width of parallel train	10	m
Sidewater depth	5	m
Number of batteries	1	
Number of parallel trains per b	4	
Number of cells within one trai	3	
Total number of dividing walls	8	
Hydraulic retention time	18.1	hr
F/M ratio	0.0728	kg BOD/kg MLSS/d
Volumetric BOD loading	0.208	kg BOD/m3/d
Observed yield (VSS basis)	0.803	g VSS/g BOD
Observed yield (TSS basis)	0.777	g TSS/g BOD
Amount of alkalinity required	256	gCaCO3/m3
Amount of sludge generated	2420	kg/d
Sludge recycle rate	5140	m3/d
Nitrogen requirement for biom	5.58	mg/L
Phosphorus requirement for bi	1.12	mg/L
Oxygen requirement to meet a	5830	kg/d
Air flow required to meet avera	27100	N m3/hr
Design air flow	38.8	N m3/min/1000 m3
Quantities		
Operation labor required	3500	pers-hrs/yr
Maintenance labor required	2100	pers-hrs/yr
Electrical energy required	4170000	kWh/yr
Volume of earthwork required	210000	cuft
Volume of slab concrete requir	76800	cuft
Volume of wall concrete requir	44600	cuft
Handrail length	1740	ft
Number of diffusers per train	337	
Number of swing arm headers	8	
Volume of Media required	5830	m3
Sieve Area required	30.6	m2
Costs		
Construction and equipment cc	5530000	$
Earthwork Cost	62300	$
Wall Concrete Cost	1070000	$
Slab Concrete Cost	996000	$
Handrail Cost	131000	$
Installed Aerator Equipment	690000	$
Air Piping Cost	271000	$
Misc Costs	355000	$
Media Cost	1920000	$
Screen Cost	33700	$
Operational labor cost	180000	$/yr
Maintenance labor cost	91600	$/yr
Material and supply cost	108000	$/yr
Chemical cost	0	$/yr

Energy cost	417000	$/yr
Amortization cost	604000	$/yr
Sludge Recycle Pumping		
Design Information		
Average daily pumping rate	1.36	MGD(US)
Total pumping capacity	2.71	MGD(US)
Design capacity per pump	943	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	1.36	MGD(US)
Quantities		
Operation labor required	458	pers-hrs/yr
Maintenance labor required	377	pers-hrs/yr
Electrical energy required	45400	kWh/yr
Volume of earthwork required	2030	cuft
Area of pump building	254	sqft
Costs		
Construction and equipment cc	123000	$
Earthwork Cost	601	$
Pump Building Cost	27900	$
Installed Pump Cost	76100	$
Misc Costs	18800	$
Operational labor cost	23600	$/yr
Maintenance labor cost	16400	$/yr
Material and supply cost	864	$/yr
Chemical cost	0	$/yr
Energy cost	4540	$/yr
Amortization cost	11700	$/yr

Gravity Belt Thickener

Design Output Data

Description	Value	Units
Gravity Belt Thickener		
Design Information		
Belt filter width	1	m
Number of units	1	
Hydraulic loading per unit per r	125	gpm(US)
Hydraulic loading required per	91.5	gpm(US)
Final solids content	7	%
Solids capture fraction	0.998	
Quantities		
Operation labor required	349	pers-hrs/yr
Maintenance labor required	87.2	pers-hrs/yr
Power	76200	kWh/yr
Polymer required	15900	lb/yr
Dry solids produced	10900	lb/d
Costs		
Construction and equipment cc	812000	$
Building Cost	279000	$
Polymer System Cost	82500	$
Feed Pump Cost	30300	$
Conveyor System Cost	77000	$
Installed Belt Filter System C	344000	$
Operational labor cost	18000	$/yr
Maintenance labor cost	3800	$/yr
Material and supply cost	0	$/yr
Chemical cost	20700	$/yr
Energy cost	7620	$/yr
Amortization cost	74300	$/yr

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	1810	cuft
Width of wet well	13.3	ft
Depth of the pumping station	29.4	ft
Length of the pumping station	22.8	ft
Width of the pumping station	45.7	ft
Minimum depth of water in wet	8.39	ft
Area of pump building	777	sqft
Peak capacity of pumps	19.7	MGD(US)
Firm pumping capacity	19.7	MGD(US)
Total dynamic head - average	44.3	ft
Quantities		
Operation labor required	799	pers-hrs/yr
Maintenance labor required	672	pers-hrs/yr
Electrical energy required	376000	kWh/yr
Volume of earthwork required	193000	cuft
Volume of slab concrete requir	8680	cuft
Volume of wall concrete requir	6340	cuft

Capacity per pump	13700	gpm(US)
Number of constant speed pur	0	
Number of variable speed pur	2	
Diameter of discharge header	26.4	in
Total dynamic head	57.3	ft
Size of selected pump	24	in
Specific speed of pump	3370	
Pump rotating speed	712	rpm
Motor size required	206	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	22.8	ft
Width of the dry well	32.5	ft
Costs		
Construction and equipment co	1230000	$
Earthwork Cost	57100	$
Wall Concrete Cost	153000	$
Slab Concrete Cost	113000	$
Building Cost	85500	$
Installed Pump Equipment C	590000	$
Installed Control Module Cos	44200	$
Misc Costs	188000	$
Operational labor cost	41100	$/yr
Maintenance labor cost	29300	$/yr
Material and supply cost	8610	$/yr
Chemical cost	0	$/yr
Energy cost	37600	$/yr
Amortization cost	111000	$/yr

Secondary Clarifier(1)

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	5010	sqft
Surface area per circular clarifi	2510	sqft
Diameter of each circular clarif	57	ft
Number of clarifiers per battery	2	
Number of batteries	1	
Solids loading rate	0.341	lb/(sqft·d)
Hydraulic retention time	4.04	hr
Designed surface overflow rate	400	gal(US)/(sqft·d)
Weir length	266	ft
Volume of wasted sludge	19900	gpd(US)
Quantities		
Operation labor required	675	pers-hrs/yr
Maintenance labor required	370	pers-hrs/yr
Electrical energy required	9000	kWh/yr
Volume of earthwork required	62300	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	5190	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	3820	cuft
Costs		
Construction and equipment co	427000	$
Earthwork Cost	18500	$
Wall Concrete Cost	92000	$
Slab Concrete Cost	67300	$
Installed Equipment Cost	184000	$
Misc Costs	65200	$
Operational labor cost	34800	$/yr
Maintenance labor cost	16100	$/yr
Material and supply cost	4270	$/yr
Chemical cost	0	$/yr
Energy cost	900	$/yr
Amortization cost	39800	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0199	MGD(US)
Total pumping capacity	0.0199	MGD(US)
Design capacity per pump	6.91	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.0199	MGD(US)
Quantities		
Operation labor required	266	pers-hrs/yr
Maintenance labor required	202	pers-hrs/yr
Electrical energy required	673	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		

Construction and equipment cc	36900	$
Earthwork Cost	475	$
Pump Building Cost	22000	$
Installed Pump Cost	8730	$
Misc Costs	5630	$
Operational labor cost	13700	$/yr
Maintenance labor cost	8790	$/yr
Material and supply cost	258	$/yr
Chemical cost	0	$/yr
Energy cost	67	$/yr
Amortization cost	3490	$/yr

Secondary Clarifier

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	10200	sqft
Surface area per circular clarifi	5090	sqft
Diameter of each circular clarif	81	ft
Number of clarifiers per batter	2	
Number of batteries	1	
Solids loading rate	11.1	lb/(sqft·d)
Hydraulic retention time	4.04	hr
Designed surface overflow rate	400	gal(US)/(sqft·d)
Weir length	1010	ft
Volume of wasted sludge	62100	gpd(US)
Quantities		
Operation labor required	1030	pers-hrs/yr
Maintenance labor required	570	pers-hrs/yr
Electrical energy required	10100	kWh/yr
Volume of earthwork required	132000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	10100	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	5340	cuft
Costs		
Construction and equipment cc	647000	$
Earthwork Cost	39000	$
Wall Concrete Cost	128000	$
Slab Concrete Cost	131000	$
Installed Equipment Cost	250000	$
Misc Costs	98700	$
Operational labor cost	53300	$/yr
Maintenance labor cost	24800	$/yr
Material and supply cost	6470	$/yr
Chemical cost	0	$/yr
Energy cost	1010	$/yr
Amortization cost	59500	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0621	MGD(US)
Total pumping capacity	0.0621	MGD(US)
Design capacity per pump	21.5	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.0621	MGD(US)
Quantities		
Operation labor required	308	pers-hrs/yr
Maintenance labor required	239	pers-hrs/yr
Electrical energy required	2090	kWh/yr
Volume of earthwork required	1610	cuft
Area of pump building	201	sqft
Costs		
Construction and equipment cc	43700	$
Earthwork Cost	477	$
Pump Building Cost	22100	$
Installed Pump Cost	14400	$
Misc Costs	6660	$
Operational labor cost	15900	$/yr
Maintenance labor cost	10400	$/yr
Material and supply cost	306	$/yr
Chemical cost	0	$/yr
Energy cost	209	$/yr
Amortization cost	4130	$/yr

Anaerobic Digestion

Design Output Data

Description	Value	Units
Anaerobic Digestion		
Design Information		
Percent VSS destroyed	50	%

Solids concentration in digeste	5	%
Detention time	15	d
Digester depth	23.5	ft
Digester diameter	45	ft
Effective digester volume	80800	cuft
Number of digesters per batter	2	
Number of primary digesters p	1	
Number of secondary digester	1	
Number of batteries	1	
Gas produced	42.1	cuft/min
Heat required	399000	BTU/hr
Digester gas required	15.4	cuft/min
Total natural gas required	0	cuft/yr
Quantities		
Operation labor required	1530	pers-hrs/yr
Maintenance labor required	997	pers-hrs/yr
Electrical energy required	129000	kWh/yr
Volume of earthwork required	80500	cuft
Slab thickness	9.93	in
Volume of slab concrete requir	3000	cuft
Wall thickness	19.3	in
Volume of wall concrete requir	13400	cuft
Sidewater depth	23.5	ft
Surface area/floor of 2-story cc	595	sqft
Piping size	6	in
Length of total piping system	486	ft
Number of 90 degree elbows	26	
Number of tees	51	
Number of plug valves	37	
Total dry solids treated	5.49	ton(short)/d
Costs		
Construction and equipment cc	2150000	$
Earthwork Cost	23900	$
Wall Concrete Cost	322000	$
Slab Concrete Cost	38900	$
Building Cost	65500	$
Piping System Cost	244000	$
Floating Cover Cost	680000	$
Gas Recirculation Units Cost	233000	$
Heating Units Cost	152000	$
Gas Safety Equipment Cost	105000	$
Installed Pumps Cost	74800	$
Operational labor cost	78900	$/yr
Maintenance labor cost	43500	$/yr
Material and supply cost	18700	$/yr
Chemical cost	0	$/yr
Energy cost	12900	$/yr
Amortization cost	205000	$/yr

Primary Clarification

Design Output Data

Description	Value	Units
Primary Clarification		
Design Information		
Surface area	7640	sqft
Surface area per circular clarifi	3820	sqft
Diameter of each circular clarif	70	ft
Number of clarifiers per battery	2	
Number of batteries	1	
Solids loading rate	2.35	lb/(sqft·d)
Hydraulic retention time	2.02	hr
Weir length	1210	ft
Volume of sludge generated	31400	gpd(US)
Quantities		
Operation labor required	870	pers-hrs/yr
Maintenance labor required	478	pers-hrs/yr
Electrical energy required	9660	kWh/yr
Volume of earthwork required	95800	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	7640	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	4640	cuft
Costs		
Construction and equipment cc	542000	$
Earthwork Cost	28400	$
Wall Concrete Cost	112000	$
Slab Concrete Cost	99100	$
Installed Equipment Cost	220000	$
Misc Costs	82700	$
Operational labor cost	44800	$/yr
Maintenance labor cost	20800	$/yr
Material and supply cost	5420	$/yr

Chemical cost	0	$/yr
Energy cost	966	$/yr
Amortization cost	50100	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0314	MGD(US)
Total pumping capacity	0.0314	MGD(US)
Design capacity per pump	10.9	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.0314	MGD(US)
Quantities		
Operation labor required	282	pers-hrs/yr
Maintenance labor required	216	pers-hrs/yr
Electrical energy required	1060	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	201	sqft
Costs		
Construction and equipment cc	39200	$
Earthwork Cost	476	$
Pump Building Cost	22100	$
Installed Pump Cost	10700	$
Misc Costs	5980	$
Operational labor cost	14500	$/yr
Maintenance labor cost	9400	$/yr
Material and supply cost	274	$/yr
Chemical cost	0	$/yr
Energy cost	106	$/yr
Amortization cost	3710	$/yr

Chlorination

Design Output Data

Description	Value	Units
Chlorination		
Design Information		
Volume of tank	250000	gal(US)
Average chlorine required	500	lb/d
Peak chlorine required	1000	lb/d
Influent coliform count	10000000	/100ml
Effluent coliform count	29.2	/100ml
Quantities		
Operational labor required	1100	pers-hrs/yr
Maintenance labor required	221	pers-hrs/yr
Electrical energy required	119000	kWh/yr
Volume of earthwork required	14300	cuft
Volume of slab concrete requir	3350	cuft
Volume of wall concrete requir	5620	cuft
Number of chlorinators and ev	1	
Chlorination building area	220	sqft
Number of chlorine cylinders	8	
Area of chlorine storage buildir	1120	sqft
Costs		
Construction and equipment cc	687000	$
Earthwork Cost	4220	$
Wall Concrete Cost	135000	$
Slab Concrete Cost	43400	$
Installed Equipment Cost	386000	$
Building Cost	24200	$
Storage Building Cost	61600	$
Misc Costs	32900	$
Operational labor cost	56700	$/yr
Maintenance labor cost	9650	$/yr
Material and supply cost	24200	$/yr
Chemical cost	119000	$/yr
Energy cost	11900	$/yr
Amortization cost	70600	$/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	46.2	gpm(US)
Final solids content	19	%
Solids capture fraction	0.998	
Quantities		
Operation labor required	220	pers-hrs/yr
Maintenance labor required	55	pers-hrs/yr
Power	66400	kWh/yr

Polymer required	28900	lb/yr
Dry solids produced	7930	lb/d
Belt filter(s)	275000	$
Building	279000	$
Installation	68800	$
Polymer system	82500	$
Feed pumps	30300	$
Conveyor system	77000	$
Costs		
Construction and equipment cc	812000	$
Building Cost	279000	$
Polymer System Cost	82500	$
Feed Pumps Cost	30300	$
Conveyor System Cost	77000	$
Installed Belt Filter	344000	$
Operational labor cost	11300	$/yr
Maintenance labor cost	2400	$/yr
Material and supply cost	0	$/yr
Chemical cost	37600	$/yr
Energy cost	6640	$/yr
Amortization cost	74300	$/yr

2-Way WasteWater Splitter

Design Output Data

Description	Value	Units
2-Way Wastewater Flow Splitter		
Design Information		
Flow to first split (average)	4.07	MGD(US)
Flow to first split (peak)	8.09	MGD(US)
Flow to first split (minimum)	2.73	MGD(US)
Flow to second split (average)	2.01	MGD(US)
Flow to second split (peak)	3.99	MGD(US)
Flow to second split (minimum	1.35	MGD(US)
Costs		
Construction and equipment cc	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

Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	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

Drying Beds

Design Output Data

Description	Value	Units
Sludge Drying Beds		
Design Information		
Total surface area required	57100	sqft
Initial depth of sludge	12	in
Final solids	50	%
Bed holding time	103	d
Quantities		
Total drying bed surface area	57100	sqft
Number beds	20	
Surface area of each individua	2850	sqft
Length of each bed	143	ft
Volume of earthwork required	281000	cuft
Volume concrete for dividing w	19200	cuft
Volume of R.C. in-place for tru	4280	cuft
Volume of sand	42800	cuft
Volume of gravel	57100	cuft
Clay pipe diameter	6	in
Total length clay pipe	5710	in
Sludge solids produced	3.3	ton(short)/d
Operational labor required	3520	pers-hrs/yr
Maintenance labor required	1760	pers-hrs/yr
Costs		
Construction and equipment cc	805000	$
Earthwork Cost	83300	$
Wall Concrete Cost	324000	$

Slab Concrete Cost	33300	$
Drying Bed Media Cost	159000	$
Drain Pipe System Cost	126000	$
Misc Costs	79700	$
Operational labor cost	181000	$/yr
Maintenance labor cost	76500	$/yr
Material and supply cost	7240	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	70000	$/yr

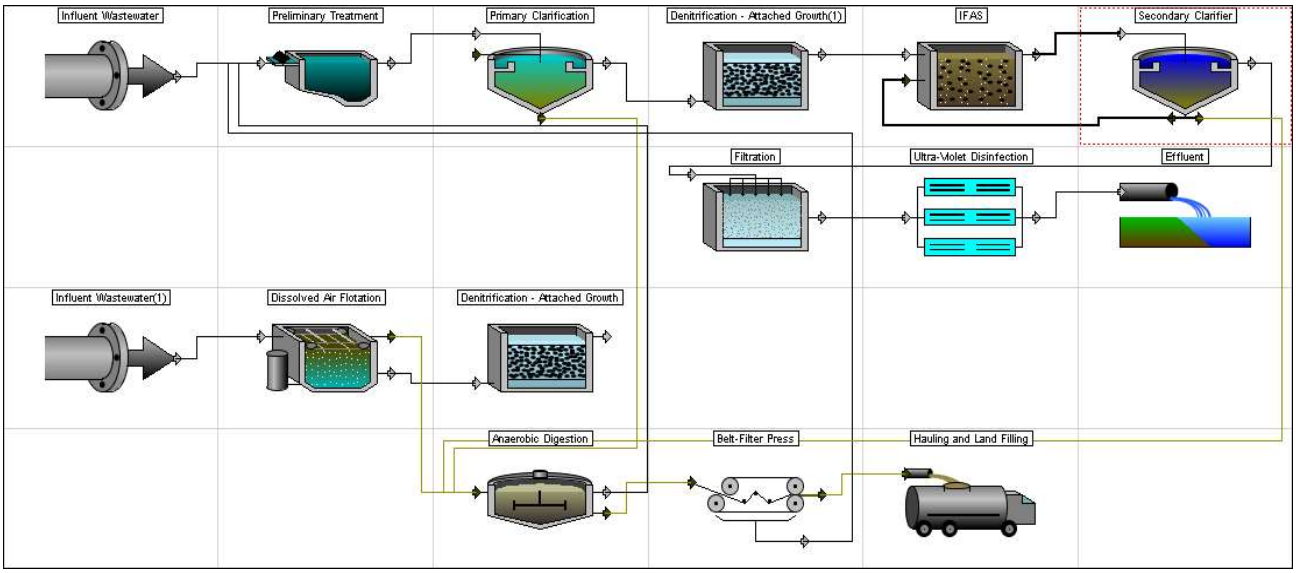
Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	7.83	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	7.83	cuyd/d
Maximum anticipated landfill d	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	793	sqft
Width of sludge storage shed s	19.9	ft
Length of sludge storage shed	39.8	ft
Volume of earthwork required	2370	cuft
Volume of slab concrete requir	1070	cuft
Surface area of canopy roof	793	sqft
Round trip haul distance	20	miles
Round trips per day per truck	1	
Distance traveled per year per	5000	miles
Sludge hauled	6.92	ton(short)/d
Operation labor required	122	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment co	313000	$
Earthwork Cost	704	$
Slab Concrete Cost	13800	$
Canopy Roof Cost	15900	$
Vehicle Cost	283000	$
Operational labor cost	6300	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	53600	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	63800	$/yr

Springville City

Layout - Springville City



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$23,200,000	$
Other direct construction costs	$8,710,000	$
Other indirect construction cos	$23,800,000	$
Total construction costs	$55,700,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$94,100	$/yr
Laboratory labor cost	$174,000	$/yr
Unit process operation labor c	$1,350,000	$/yr
Unit process maintenance labc	$651,000	$/yr
Total labor costs	$2,270,000	$/yr
MATERIAL COSTS		
Total material cost	$352,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$65,900	$/yr
ENERGY COSTS		
Total energy cost	$608,000	$/yr
Total operation and maintanen	$3,300,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$4,950,000	$/yr
Total annual project cost	$8,250,000	$/yr
PROJECT SUMMARY		
Present worth	$98,700,000	$
Total project cost	$55,700,000	$
Total operation labor cost	$1,620,000	$/yr
Total maintenance labor cost	$651,000	$/yr
Total material cost	$352,000	$/yr
Total chemical cost	$65,900	$/yr
Total energy cost	$608,000	$/yr
Total amortization cost	$4,950,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Preliminary Treatment	865000	71300	32600	21600	0	3900	72500
Dissolved Air Flotation	587000	54200	14500	5870	0	25300	56900
Primary Clarification	617000	62200	32600	6060	0	1070	57100
Denitrification - Attached Grow	867000	262000	137000	5010	0	29300	78600

Anaerobic Digestion	4610000	95800	55200	37900	0	16700	436000
Denitrification - Attached Grow	2800000	479000	199000	15300	489	122000	253000
Filtration	2600000	12400	7490	73100	0	5310	251000
Belt-Filter Press	918000	17400	3820	0	57900	9890	83700
IFAS	5180000	186000	101000	88400	0	339000	561000
Ultra-Violet Disinfection	1770000	0	24400	17700	7470	53600	162000
Hauling and Land Filling	398000	25500	0	72000	0	0	70900
Secondary Clarifier	935000	85600	43700	9240	0	1160	85400
Effluent	0	0	0	0	0	0	0
Blower System	1030000	0	0	0	0	0	86500
Other Costs	32500000	268000	0	0	0	0	2700000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	19	acre
Administration labor hours	1830	hr/yr
Laboratory labor hours	3380	hr/yr
Costs		
DIRECT COSTS		
Mobilization	791000	$
Site preparation	1070000	$
Site electrical	2270000	$
Yard piping	1500000	$
Instrumentation and control	1170000	$
Lab and administration building	1910000	$
Total direct construction costs	8710000	$
INDIRECT COSTS		
Cost of land	380000	$
Miscellaneous cost	1830000	$
Legal cost	734000	$
Engineering design fee	5500000	$
Inspection cost	734000	$
Contingency	3670000	$
Technical	734000	$
Interest during construction	5460000	$
Profit	4780000	$
Total indirect construction cost	23800000	$
Total of other construction cos	32500000	$
LABOR COSTS		
Administration labor cost	94100	$/yr
Laboratory labor cost	174000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	12900	scfm
Safety factor	1.5	
Requested air flow capacity	19300	scfm
Total capacity of blowers	19300	scfm
Number of blowers in use	3	
Total number of blowers	4	
Capacity of individual blowers	6440	scfm
Estimated cost of an installed l	188000	$
Blower building area	1600	sqft
Costs		
Construction and equipment cc	1030000	$
Installed Blower Cost	753000	$
Building Cost	176000	$
Misc Costs	102000	$
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	86500	$/yr
Notes		
Energy costs are shown at the individual unit processes that require air		

Influent Wastewater
Influent Wastewater(1)
Preliminary Treatment
Design Output Data

Description	Value	Units
Preliminary Treatment		
Design Information		
Mechanically Cleaned Bar Screen		

Bar size	0.25	in
Bar spacing	0.5	in
Slope of bars from horizontal	30	degrees
Head loss through screen	0.176	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	4.22	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	23.2	cuft/s
Average flow	10.6	cuft/s
Minimum flow	6.25	cuft/s
Temperature	10	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	11.6	cuft/s
Width of channel	1.93	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.000865	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	27.4	cuft/d
Costs		
Construction and equipment cc	865000	$
Operational labor cost	71300	$/yr
Maintenance labor cost	32600	$/yr
Material and supply cost	21600	$/yr
Chemical cost	0	$/yr
Energy cost	3900	$/yr
Amortization cost	72500	$/yr

Dissolved Air Flotation

Design Output Data

Description	Value	Units
Dissolved Air Flotation		
Design Information		
Recycle flow	0.823	MGD(US)
Surface area	584	sqft
Volume of pressure tank	229	cuft
Volume of flotation tank	6470	cuft
Quantities		
Amount of sludge generated	4.38	ton(short)/d
Operation labor required	1050	pers-hour/yr
Maintenance labor required	320	pers-hour/yr
Electrical energy required	253000	kWh/yr
Slab thickness	9.95	in
Volume of slab concrete requir	833	cuft
Wall thickness	11.1	in
Volume of wall concrete requir	925	cuft
Sidewater depth	8.19	ft
Surface area per flotation unit	750	sqft
Diameter per flotation unit	30.9	ft
Number of units	1	
Area of flotation building	1180	sqft
Volume of earthwork required	9690	cuft
Costs		
Construction and equipment cc	587000	$
Earthwork Cost	2870	$
Wall Concrete Cost	22300	$
Slab Concrete Cost	10800	$
Building Cost	97500	$
Installed Equipment Cost	364000	$
Misc Costs	89500	$
Operational labor cost	54200	$/yr
Maintenance labor cost	14500	$/yr
Material and supply cost	5870	$/yr
Chemical cost	0	$/yr
Energy cost	25300	$/yr
Amortization cost	56900	$/yr

Primary Clarification

Design Output Data

Description	Value	Units
Primary Clarification		
Design Information		

Surface area	8570	sqft
Surface area per circular clarifi	4290	sqft
Diameter of each circular clarif	74	ft
Number of clarifiers per battery	2	
Number of batteries	1	
Solids loading rate	1.7	lb/(sqft·d)
Hydraulic retention time	2.02	hr
Weir length	1510	ft
Volume of sludge generated	25400	gpd(US)
Quantities		
Operation labor required	933	pers-hrs/yr
Maintenance labor required	513	pers-hrs/yr
Electrical energy required	9840	kWh/yr
Volume of earthwork required	108000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	8490	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	4900	cuft
Costs		
Construction and equipment co	579000	$
Earthwork Cost	32000	$
Wall Concrete Cost	118000	$
Slab Concrete Cost	110000	$
Installed Equipment Cost	231000	$
Misc Costs	88400	$
Operational labor cost	48000	$/yr
Maintenance labor cost	23100	$/yr
Material and supply cost	5790	$/yr
Chemical cost	0	$/yr
Energy cost	984	$/yr
Amortization cost	53500	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0254	MGD(US)
Total pumping capacity	0.0254	MGD(US)
Design capacity per pump	8.83	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.0254	MGD(US)
Quantities		
Operation labor required	274	pers-hrs/yr
Maintenance labor required	209	pers-hrs/yr
Electrical energy required	859	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	201	sqft
Costs		
Construction and equipment co	38100	$
Earthwork Cost	475	$
Pump Building Cost	22100	$
Installed Pump Cost	9730	$
Misc Costs	5810	$
Operational labor cost	14100	$/yr
Maintenance labor cost	9440	$/yr
Material and supply cost	266	$/yr
Chemical cost	0	$/yr
Energy cost	86	$/yr
Amortization cost	3600	$/yr

Denitrification - Attached Growth

Design Output Data

Description	Value	Units
Attached Growth Denitrification		
Design Information		
Surface removal rate	3.28	lb/(1000 sqft·d)
Total media surface area	-22700	sqft
Total volume of media needed	-554	cuft
Total column area	1360	sqft
Actual media volume	16400	cuft
Hydraulic retention time	120	min
Daily methanol required	0	lb/d
Total backwash required	13600	gpm(US)
Costs		
Construction and equipment co	529000	$
Earthwork Cost	6290	$
Wall Concrete Cost	101000	$
Slab Concrete Cost	67700	$
Installed Media Cost	91500	$
Methanol Feed System Cost	0	$
Distribution System Cost	181000	$
Operational labor cost	205000	$/yr
Maintenance labor cost	95200	$/yr
Material and supply cost	2640	$/yr

Chemical cost	0	$/yr
Energy cost	24300	$/yr
Amortization cost	46600	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	1.47	MGD(US)
Total pumping capacity	2.97	MGD(US)
Design capacity per pump	1030	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	1.47	MGD(US)
Quantities		
Operation labor required	462	pers-hrs/yr
Maintenance labor required	381	pers-hrs/yr
Electrical energy required	49300	kWh/yr
Volume of earthwork required	2070	cuft
Area of pump building	259	sqft
Costs		
Construction and equipment cc	128000	$
Earthwork Cost	613	$
Pump Building Cost	28500	$
Installed Pump Cost	79200	$
Misc Costs	19500	$
Operational labor cost	23800	$/yr
Maintenance labor cost	17200	$/yr
Material and supply cost	894	$/yr
Chemical cost	0	$/yr
Energy cost	4930	$/yr
Amortization cost	12100	$/yr
Wash Water Pumping		
Design Information		
Average daily pumping rate	9.82	MGD(US)
Total pumping capacity	9.82	MGD(US)
Design capacity per pump	3410	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	9.82	MGD(US)
Quantities		
Operation labor required	633	pers-hrs/yr
Maintenance labor required	536	pers-hrs/yr
Electrical energy required	448	kWh/yr
Volume of earthwork required	3150	cuft
Area of pump building	394	sqft
Costs		
Construction and equipment cc	210000	$
Earthwork Cost	933	$
Pump Building Cost	43300	$
Installed Pump Cost	134000	$
Misc Costs	32100	$
Operational labor cost	32600	$/yr
Maintenance labor cost	24200	$/yr
Material and supply cost	1470	$/yr
Chemical cost	0	$/yr
Energy cost	45	$/yr
Amortization cost	19900	$/yr

Anaerobic Digestion

Design Output Data

Description	Value	Units
Anaerobic Digestion		
Design Information		
Percent VSS destroyed	50	%
Solids concentration in digeste	5	%
Detention time	15	d
Digester depth	28.8	ft
Digester diameter	75	ft
Effective digester volume	282000	cuft
Number of digesters per batter	2	
Number of primary digesters p	1	
Number of secondary digester	1	
Number of batteries	1	
Gas produced	65.9	cuft/min
Heat required	1360000	BTU/hr
Digester gas required	52.5	cuft/min
Total natural gas required	0	cuft/yr
Quantities		
Operation labor required	1860	pers-hrs/yr
Maintenance labor required	1220	pers-hrs/yr
Electrical energy required	167000	kWh/yr
Volume of earthwork required	281000	cuft
Slab thickness	11.2	in
Volume of slab concrete requir	8980	cuft

Wall thickness	21.9	in
Volume of wall concrete requir	30100	cuft
Sidewater depth	28.8	ft
Surface area/floor of 2-story cc	1650	sqft
Piping size	10	in
Length of total piping system	694	ft
Number of 90 degree elbows	26	
Number of tees	51	
Number of plug valves	37	
Total dry solids treated	8.5	ton(short)/d
Costs		
Construction and equipment cc	4610000	$
Earthwork Cost	83400	$
Wall Concrete Cost	726000	$
Slab Concrete Cost	116000	$
Building Cost	182000	$
Piping System Cost	521000	$
Floating Cover Cost	1640000	$
Gas Recirculation Units Cost	294000	$
Heating Units Cost	317000	$
Gas Safety Equipment Cost	120000	$
Installed Pumps Cost	150000	$
Operational labor cost	95800	$/yr
Maintenance labor cost	55200	$/yr
Material and supply cost	37900	$/yr
Chemical cost	0	$/yr
Energy cost	16700	$/yr
Amortization cost	436000	$/yr

Denitrification - Attached Growth(1)

Design Output Data

Description	Value	Units
Attached Growth Denitrification		
Design Information		
Surface removal rate	3.28	lb/(1000 sqft·d)
Total media surface area	-112000	sqft
Total volume of media needed	-2730	cuft
Total column area	6330	sqft
Actual media volume	75900	cuft
Hydraulic retention time	120	min
Daily methanol required	12.2	lb/d
Total backwash required	63300	gpm(US)
Costs		
Construction and equipment cc	2130000	$
Earthwork Cost	23100	$
Wall Concrete Cost	375000	$
Slab Concrete Cost	129000	$
Installed Media Cost	424000	$
Methanol Feed System Cost	14600	$
Distribution System Cost	841000	$
Operational labor cost	407000	$/yr
Maintenance labor cost	146000	$/yr
Material and supply cost	10700	$/yr
Chemical cost	489	$/yr
Energy cost	99600	$/yr
Amortization cost	190000	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	6.83	MGD(US)
Total pumping capacity	15	MGD(US)
Design capacity per pump	5220	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	6.83	MGD(US)
Quantities		
Operation labor required	563	pers-hrs/yr
Maintenance labor required	478	pers-hrs/yr
Electrical energy required	228000	kWh/yr
Volume of earthwork required	3970	cuft
Area of pump building	496	sqft
Costs		
Construction and equipment cc	263000	$
Earthwork Cost	1180	$
Pump Building Cost	54600	$
Installed Pump Cost	167000	$
Misc Costs	40100	$
Operational labor cost	29000	$/yr
Maintenance labor cost	21600	$/yr
Material and supply cost	1840	$/yr
Chemical cost	0	$/yr
Energy cost	22800	$/yr
Amortization cost	24900	$/yr

Wash Water Pumping		
Design Information		
Average daily pumping rate	22.8	MGD(US)
Total pumping capacity	22.8	MGD(US)
Design capacity per pump	7910	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	22.8	MGD(US)
Quantities		
Operation labor required	839	pers-hrs/yr
Maintenance labor required	704	pers-hrs/yr
Electrical energy required	1040	kWh/yr
Volume of earthwork required	5190	cuft
Area of pump building	649	sqft
Costs		
Construction and equipment cc	405000	$
Earthwork Cost	1540	$
Pump Building Cost	71400	$
Installed Pump Cost	271000	$
Misc Costs	61900	$
Operational labor cost	43200	$/yr
Maintenance labor cost	31800	$/yr
Material and supply cost	2840	$/yr
Chemical cost	0	$/yr
Energy cost	104	$/yr
Amortization cost	38300	$/yr

Filtration

Design Output Data

Description	Value	Units
Filtration		
Design Information		
Surface area	2780	sqft
Depth	9	ft
Terminal headloss through bec	192000	ft
Maximum head for backwashir	19.6	ft
Backwash rate	20	gal(US)/(sqft·min)
Washwater gutter depth	0.927	ft
Washwater needed	278000	gal(US)
Quantities		
Operation labor required	241	pers-hrs/yr
Maintenance labor required	166	pers-hrs/yr
Electrical energy required	53100	kWh
Surface area per filter unit	2780	sqft
Number of cells per filter unit	4	
Number of filter units per batte	1	
Number of batteries	1	
Volume of earthwork for filter	30000	cuft
Volume of concrete for filter	15100	cuft
Volume of surge tank	37200	cuft
Width of surge tank	51.5	ft
Length of surge tank	103	ft
Volume of earthwork for surge	72600	cuft
Volume of concrete for surge t	9370	cuft
Costs		
Construction and equipment cc	2600000	$
Earthwork Cost for Filter	8880	$
Earthwork Cost for Surge Ta	21500	$
Concrete Cost for Filter	363000	$
Concrete Cost for Surge Tar	226000	$
Installed Equipment Cost	1460000	$
Misc Costs	520000	$
Operational labor cost	12400	$/yr
Maintenance labor cost	7490	$/yr
Material and supply cost	73100	$/yr
Chemical cost	0	$/yr
Energy cost	5310	$/yr
Amortization cost	251000	$/yr

Belt-Filter Press

Design Output Data

Description	Value	Units
Belt-Filter Press		
Design Information		
Belt filter width	2	m
Number of units	1	
Hydraulic loading per unit per r	70	gpm(US)
Hydraulic loading required per	71.1	gpm(US)
Final solids content	19	%
Solids capture fraction	0.998	
Quantities		
Operation labor required	339	pers-hrs/yr

Maintenance labor required	84.7	pers-hrs/yr
Power	98900	kWh/yr
Polymer required	44500	lb/yr
Dry solids produced	12200	lb/d
Belt filter(s)	301000	$
Building	322000	$
Installation	75300	$
Polymer system	111000	$
Feed pumps	33100	$
Conveyor system	75300	$
Costs		
Construction and equipment cc	918000	$
Building Cost	322000	$
Polymer System Cost	111000	$
Feed Pumps Cost	33100	$
Conveyor System Cost	75300	$
Installed Belt Filter	376000	$
Operational labor cost	17400	$/yr
Maintenance labor cost	3820	$/yr
Material and supply cost	0	$/yr
Chemical cost	57900	$/yr
Energy cost	9890	$/yr
Amortization cost	83700	$/yr

IFAS

Design Output Data

Description	Value	Units
IFAS		
Design Information		
Carbon & Nitrification Design		
Max. specific growth of nitrifier	0.2	1/d
Death rate of nitrifiers at winter	0.0301	1/d
Minimum SRT for design at wi	5.89	d
Design SRT for design at winte	8.83	d
Design SS	2500	mg/L
Calculated VSS	1680	mg/L
Calculated VSS:TSS ratio	0.67	mg VSS/mg SS
Total volume of reactors	10400	m3
Length of parallel train	53	m
Width of parallel train	10	m
Sidewater depth	5	m
Number of batteries	1	
Number of parallel trains per b	4	
Number of cells within one trai	3	
Total number of dividing walls	8	
Hydraulic retention time	9.69	hr
F/M ratio	0.0904	kg BOD/kg MLSS/d
Volumetric BOD loading	0.0248	kg BOD/m3/d
Observed yield (VSS basis)	2.17	g VSS/g BOD
Observed yield (TSS basis)	2.15	g TSS/g BOD
Amount of alkalinity required	289	gCaCO3/m3
Amount of sludge generated	484	kg/d
Sludge recycle rate	8620	m3/d
Nitrogen requirement for biom	0.652	mg/L
Phosphorus requirement for bi	0.13	mg/L
Oxygen requirement to meet a	4640	kg/d
Air flow required to meet avera	21600	N m3/hr
Design air flow	34.4	N m3/min/1000 m3
Quantities		
Operation labor required	3120	pers-hrs/yr
Maintenance labor required	1830	pers-hrs/yr
Electrical energy required	3320000	kWh/yr
Volume of earthwork required	192000	cuft
Volume of slab concrete requir	72000	cuft
Volume of wall concrete requir	40900	cuft
Handrail length	1590	ft
Number of diffusers per train	269	
Number of swing arm headers	7	
Volume of Media required	5220	m3
Sieve Area required	56.9	m2
Costs		
Construction and equipment cc	5030000	$
Earthwork Cost	56800	$
Wall Concrete Cost	984000	$
Slab Concrete Cost	933000	$
Handrail Cost	119000	$
Installed Aerator Equipment	600000	$
Air Piping Cost	225000	$
Misc Costs	321000	$
Media Cost	1720000	$
Screen Cost	62600	$
Operational labor cost	161000	$/yr

Maintenance labor cost	82600	$/yr
Material and supply cost	87400	$/yr
Chemical cost	0	$/yr
Energy cost	332000	$/yr
Amortization cost	547000	$/yr
Sludge Recycle Pumping		
Design Information		
Average daily pumping rate	2.28	MGD(US)
Total pumping capacity	4.56	MGD(US)
Design capacity per pump	1580	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	2.28	MGD(US)
Quantities		
Operation labor required	489	pers-hrs/yr
Maintenance labor required	407	pers-hrs/yr
Electrical energy required	76100	kWh/yr
Volume of earthwork required	2320	cuft
Area of pump building	290	sqft
Costs		
Construction and equipment cc	151000	$
Earthwork Cost	687	$
Pump Building Cost	31900	$
Installed Pump Cost	95600	$
Misc Costs	23100	$
Operational labor cost	25200	$/yr
Maintenance labor cost	18300	$/yr
Material and supply cost	1060	$/yr
Chemical cost	0	$/yr
Energy cost	7610	$/yr
Amortization cost	14300	$/yr

Ultra-Violet Disinfection

Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calc	1.34	gal(US)/(min·W)
Total number of lamps needed	595	
Number of spare channels	1	
Total number of lamps used in	720	
Number of excess lamps	125	
Number of lamps/modules	4	
Number of modules/bank	6	
Number of banks/channel	5	
Number of channels	6	
Calculated headloss	22.9	in
Costs		
Construction and equipment cc	1770000	$
Cost of installation	1060000	$
Total cost of UV lamps	710000	$
Operational labor cost	0	$/yr
Maintenance labor cost	24400	$/yr
Material and supply cost	17700	$/yr
Chemical cost	7470	$/yr
Energy cost	53600	$/yr
Amortization cost	162000	$/yr

Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	31.7	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	31.7	cuyd/d
Maximum anticipated landfill dc	30	d
Anticipated sludge storage heig	8	ft
Sludge storage shed area	3210	sqft
Width of sludge storage shed s	40.1	ft
Length of sludge storage shed	80.1	ft
Volume of earthwork required	8800	cuft
Volume of slab concrete requir	3760	cuft
Surface area of canopy roof	3210	sqft
Round trip haul distance	20	miles
Round trips per day per truck	2	

Distance traveled per year per	10000	miles
Sludge hauled	28	ton(short)/d
Operation labor required	496	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment cc	398000	$
Earthwork Cost	2610	$
Slab Concrete Cost	48800	$
Canopy Roof Cost	64200	$
Vehicle Cost	283000	$
Operational labor cost	25500	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	72000	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	70900	$/yr

Secondary Clarifier

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	17100	sqft
Surface area per circular clarifi	8540	sqft
Diameter of each circular clarif	105	ft
Number of clarifiers per battery	2	
Number of batteries	1	
Solids loading rate	11.1	lb/(sqft·d)
Hydraulic retention time	4.04	hr
Designed surface overflow rate	400	gal(US)/(sqft·d)
Weir length	1500	ft
Volume of wasted sludge	12400	gpd(US)
Quantities		
Operation labor required	1410	pers-hrs/yr
Maintenance labor required	781	pers-hrs/yr
Electrical energy required	11100	kWh/yr
Volume of earthwork required	236000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	16600	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	6850	cuft
Costs		
Construction and equipment cc	900000	$
Earthwork Cost	70000	$
Wall Concrete Cost	165000	$
Slab Concrete Cost	215000	$
Installed Equipment Cost	313000	$
Misc Costs	137000	$
Operational labor cost	72800	$/yr
Maintenance labor cost	35200	$/yr
Material and supply cost	9000	$/yr
Chemical cost	0	$/yr
Energy cost	1110	$/yr
Amortization cost	82100	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0124	MGD(US)
Total pumping capacity	0.0124	MGD(US)
Design capacity per pump	4.31	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.0124	MGD(US)
Quantities		
Operation labor required	250	pers-hrs/yr
Maintenance labor required	188	pers-hrs/yr
Electrical energy required	420	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment cc	34900	$
Earthwork Cost	475	$
Pump Building Cost	22000	$
Installed Pump Cost	7090	$
Misc Costs	5330	$
Operational labor cost	12900	$/yr
Maintenance labor cost	8490	$/yr
Material and supply cost	244	$/yr
Chemical cost	0	$/yr
Energy cost	42	$/yr
Amortization cost	3300	$/yr

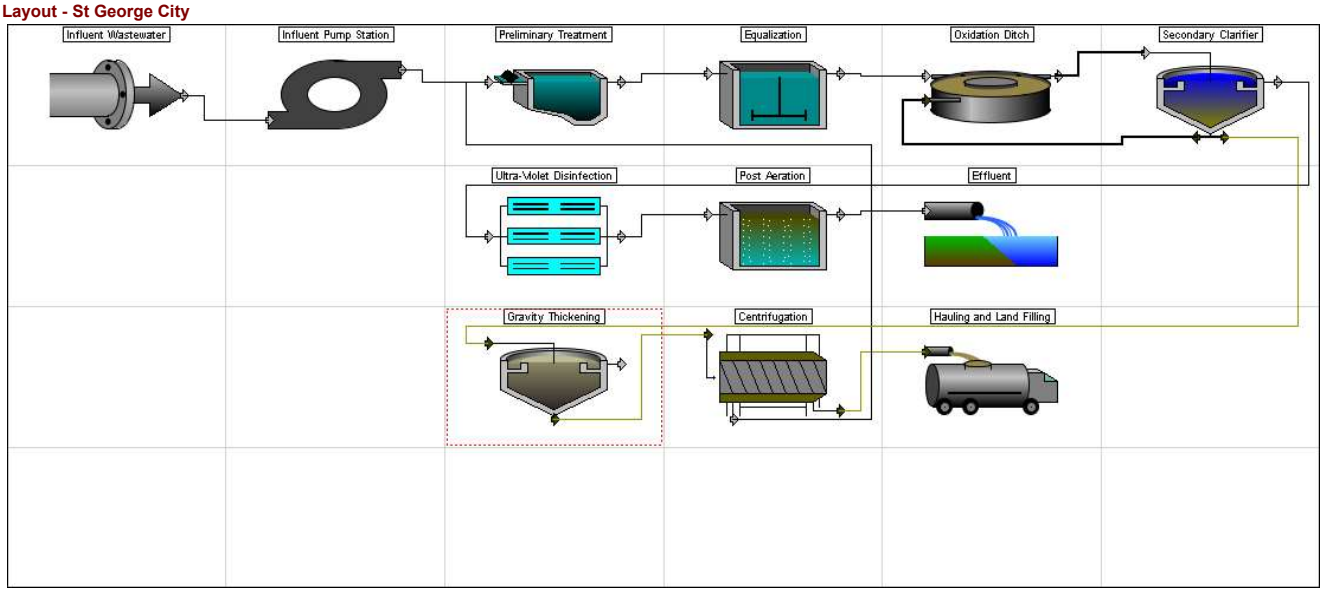
Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	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

St. George City

Layout - St George City



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$49,600,000	$
Other direct construction costs	$14,200,000	$
Other indirect construction cos	$47,800,000	$
Total construction costs	$112,000,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$165,000	$/yr
Laboratory labor cost	$194,000	$/yr
Unit process operation labor c	$1,830,000	$/yr
Unit process maintenance labc	$466,000	$/yr
Total labor costs	$2,650,000	$/yr
MATERIAL COSTS		
Total material cost	$634,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$161,000	$/yr
ENERGY COSTS		
Total energy cost	$2,560,000	$/yr
Total operation and maintanen	$6,000,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$9,750,000	$/yr
Total annual project cost	$15,800,000	$/yr
PROJECT SUMMARY		
Present worth	$189,000,000	$
Total project cost	$112,000,000	$
Total operation labor cost	$2,180,000	$/yr
Total maintenance labor cost	$466,000	$/yr
Total material cost	$634,000	$/yr
Total chemical cost	$161,000	$/yr
Total energy cost	$2,560,000	$/yr
Total amortization cost	$9,750,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Influent Pump Station	11000000	62400	47400	77200	0	68200	941000
Preliminary Treatment	1460000	157000	62700	36600	0	5950	123000
Ultra-Violet Disinfection	8370000	0	88600	83700	41800	300000	822000
Gravity Thickening	387000	36700	21800	3870	0	996	36900

Equalization	7330000	110000	114000	12400	0	723000	648000
Post Aeration	160000	41700	16400	2740	0	13900	14600
Centrifugation	3240000	704000	41400	107000	119000	32900	263000
Oxidation Ditch	14300000	453000	0	108000	0	1410000	1390000
Effluent	0	0	0	0	0	0	0
Hauling and Land Filling	1190000	115000	0	181000	0	0	192000
Secondary Clarifier	2150000	146000	73400	21300	0	3020	195000
Other Costs	61900000	359000	0	0	0	0	5120000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	41.8	acre
Administration labor hours	3200	hr/yr
Laboratory labor hours	3760	hr/yr
Costs		
DIRECT COSTS		
Mobilization	1300000	$
Site preparation	1620000	$
Site electrical	3830000	$
Yard piping	2490000	$
Instrumentation and control	2050000	$
Lab and administration building	2890000	$
Total direct construction costs	14200000	$
INDIRECT COSTS		
Cost of land	836000	$
Miscellaneous cost	3670000	$
Legal cost	1470000	$
Engineering design fee	11000000	$
Inspection cost	1470000	$
Contingency	7340000	$
Technical	1470000	$
Interest during construction	10900000	$
Profit	9570000	$
Total indirect construction cost	47800000	$
Total of other construction cos	61900000	$
LABOR COSTS		
Administration labor cost	165000	$/yr
Laboratory labor cost	194000	$/yr

Influent Wastewater

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	187000	cuft
Width of wet well	953	ft
Depth of the pumping station	33.2	ft
Length of the pumping station	30	ft
Width of the pumping station	995	ft
Minimum depth of water in wet	12.2	ft
Area of pump building	1310	sqft
Peak capacity of pumps	50.6	MGD(US)
Firm pumping capacity	50.6	MGD(US)
Total dynamic head - average	43.9	ft
Quantities		
Operation labor required	1210	pers-hrs/yr
Maintenance labor required	1080	pers-hrs/yr
Electrical energy required	682000	kWh/yr
Volume of earthwork required	3630000	cuft
Volume of slab concrete requir	357000	cuft
Volume of wall concrete requir	93200	cuft
Capacity per pump	35100	gpm(US)
Number of constant speed pur	2	
Number of variable speed pur	0	
Diameter of discharge header	42.3	in
Total dynamic head	52.5	ft
Size of selected pump	42	in
Specific speed of pump	5760	
Pump rotating speed	416	rpm
Motor size required	315	HP
Size of selected motor	350	HP
Width of pump system	9	ft
Length of pump system	32.7	ft
Length of the dry well	30	ft
Width of the dry well	41.7	ft
Costs		

Construction and equipment cc	11000000	$
Earthwork Cost	1080000	$
Wall Concrete Cost	2240000	$
Slab Concrete Cost	4630000	$
Building Cost	144000	$
Installed Pump Equipment C	1250000	$
Misc Costs	1680000	$
Operational labor cost	62400	$/yr
Maintenance labor cost	47400	$/yr
Material and supply cost	77200	$/yr
Chemical cost	0	$/yr
Energy cost	68200	$/yr
Amortization cost	941000	$/yr

Preliminary Treatment

Design Output Data

Description	Value	Units
Preliminary Treatment		
Design Information		
Mechanically Cleaned Bar Screen		
Bar size	0.25	in
Bar spacing	1.5	in
Slope of bars from horizontal	30	degrees
Head loss through screen	0.0206	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	10.5	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	53.9	cuft/s
Average flow	26.2	cuft/s
Minimum flow	15.4	cuft/s
Temperature	10	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	27	cuft/s
Width of channel	4.5	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.000401	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	68.1	cuft/d
Costs		
Construction and equipment cc	1460000	$
Operational labor cost	157000	$/yr
Maintenance labor cost	62700	$/yr
Material and supply cost	36600	$/yr
Chemical cost	0	$/yr
Energy cost	5950	$/yr
Amortization cost	123000	$/yr

Ultra-Violet Disinfection

Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calc	0.294	gal(US)/(min·W)
System is not headloss constra		
Total number of lamps needed	3020	
Number of spare channels	1	
Total number of lamps used in	4030	
Number of excess lamps	1020	
Number of lamps/modules	16	
Number of modules/bank	21	
Number of banks/channel	3	
Number of channels	4	
Calculated headloss	0.24	in
Costs		
Construction and equipment cc	8370000	$
Cost of installation	5020000	$
Total cost of UV lamps	3350000	$
Operational labor cost	0	$/yr
Maintenance labor cost	88600	$/yr
Material and supply cost	83700	$/yr
Chemical cost	41800	$/yr

Energy cost	300000	$/yr
Amortization cost	822000	$/yr

Gravity Thickening

Design Output Data

Description	Value	Units
Gravity Thickening		
Design Information		
Initial concentration	1	%
Thickened concentration	5	%
Mass loading	10	lb/(sqft·d)
Hydraulic loading	120	gal(US)/(sqft·d)
Hydraulic retention time	13.5	hr
Number of tanks	2	
Tank volume	25200	cuft
Depth	9	ft
Surface area per tank	1400	sqft
Tank diameter	43	ft
Quantities		
Amount of sludge generated	14	ton(short)/d
Volume of thickened sludge	57600	gpd(US)
Operation labor required	712	pers-hrs/yr
Maintenance labor required	495	pers-hrs/yr
Electrical energy required	9960	kWh/yr
Volume of earthwork required	35600	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	3080	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	2940	cuft
Costs		
Construction and equipment cc	387000	$
Earthwork Cost	10500	$
Wall Concrete Cost	70700	$
Slab Concrete Cost	40000	$
Installed Equipment Cost	207000	$
Misc Costs	59100	$
Operational labor cost	36700	$/yr
Maintenance labor cost	21800	$/yr
Material and supply cost	3870	$/yr
Chemical cost	0	$/yr
Energy cost	996	$/yr
Amortization cost	36900	$/yr

Equalization

Design Output Data

Description	Value	Units
Equalization		
Design Information		
Effective storage volume	3410000	gal(US)
Average hourly flow	710000	gph(US)
Length of basin	676	ft
Width of basin	676	ft
Tank volume	20500000	gal(US)
Operating transfer efficiency	4.2	lbO2/(HP·h)
Power required	1230	HP
Quantities		
Volume of earthwork required	4060000	cuft
Volume of slab concrete requir	343000	cuft
Volume of wall concrete requir	16200	cuft
Number of aerators per basin	18	
Power of selected aerator	75	HP
Total installed power	1350	HP
Operational labor required	2140	pers-hrs/yr
Maintenance labor required	2600	pers-hrs/yr
Electrical energy required	7230000	kWh/yr
Costs		
Construction and equipment cc	7330000	$
Earthwork Cost	1200000	$
Wall Concrete Cost	391000	$
Slab Concrete Cost	4440000	$
Installed Aerator Equipment	942000	$
Misc Costs	349000	$
Operational labor cost	110000	$/yr
Maintenance labor cost	114000	$/yr
Material and supply cost	12400	$/yr
Chemical cost	0	$/yr
Energy cost	723000	$/yr
Amortization cost	648000	$/yr

Post Aeration

Design Output Data

Description	Value	Units

Post Aeration by Diffused Aeration		
Design Information		
Dissolved oxygen in influent	2	mg/L
Desired dissolved oxygen in ef	5	mg/L
Correction factor for pressure	1	
Minimum dissolved oxygen in t	2	mg/L
Oxygen saturation at summer t	8.5	mg/L
Oxygen required	418	lb/d
Operating transfer efficiency	2.95	lbO2/(HP·h)
Total volume of aerobic reacto	232000	gal(US)
Air flow rate required to meet a	558	scfm
Quantities		
Basin depth	15	ft
Length of basin	68.9	ft
Width of basin	30	ft
Number of diffusers	47	
Number of swing arm diffuser l	3	
Volume of wall concrete requir	2220	cuft
Volume of slab concrete requir	1550	cuft
Electrical energy required	139000	kWh/yr
Operation labor required	810	pers-hrs/yr
Maintenance labor required	373	pers-hrs/yr
Costs		
Construction and equipment co	160000	$
Wall Concrete Cost	53600	$
Slab Concrete Cost	28800	$
Installed Equipment Cost	61500	$
Misc Costs	15800	$
Operational labor cost	41700	$/yr
Maintenance labor cost	16400	$/yr
Material and supply cost	2740	$/yr
Chemical cost	0	$/yr
Energy cost	13900	$/yr
Amortization cost	14600	$/yr

Centrifugation

Design Output Data

Description	Value	Units
Centrifugation		
Design Information		
Total power required	210	HP
Power required per unit	105	HP
Excess capacity factor	1.25	
Number of units	2	
Chemical dose	1	% dry wt
Chemicals required	44.1	lb/hr
Sludge flow	168	gpm(US)
Initial solid conc	5	%
Operational hours per day	8	hr
Operational days per week	5	d
Quantities		
Number of centrifuges	2	
Power required per unit	105	HP
Area of building	529	sqft
Dry solids produced	12	ton(short)/d
Operation labor required	5560	pers-hrs/yr
Maintenance labor required	943	pers-hrs/yr
Electrical energy required	329000	kWh/yr
Costs		
Construction and equipment co	2620000	$
Operational labor cost	287000	$/yr
Maintenance labor cost	41400	$/yr
Material and supply cost	94800	$/yr
Chemical cost	0	$/yr
Energy cost	32900	$/yr
Amortization cost	263000	$/yr
Polymer Feed System		
Quantities		
Polymer dosage	353	lb/d
Liquid chemical solution fed	16900	gpd(US)
O&M labor required	6650	pers-hrs/yr
Dry material handling and mixi	1450	pers-hrs/yr
Total operation labor required	8100	pers-hrs/yr
Costs		
Construction and equipment co	617000	$
Operational labor cost	417000	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	12300	$/yr
Chemical cost	119000	$/yr
Energy cost	0	$/yr
Amortization cost	0	$/yr

Oxidation Ditch

Design Output Data

Description	Value	Units
Oxidation Ditch		
Design Information		
Carbon & Nitrification Design		
Design SRT for design at winte	25	d
Design SS	2500	mg/L
Calculated VSS	1760	mg/L
Calculated VSS:TSS ratio	0.705	mg VSS/mg SS
Total volume of reactors	131000	m3
Ditch length	168	m
Ditch width	27.8	m
Sidewater depth	3.66	m
Number of batteries	4	
Number of parallel ditches per	2	
Number of rotors per ditch	5	
Rotor length for aeration	200	m
Rotor length for mixing	502	m
Installed rotor length per rotor	12.5	m
Rotor horsepower	20	HP
Total installed horsepower per	200	HP
Assumed surface velocity	0.46	m/s
Hydraulic retention time	48.7	hr
F/M ratio	0.0555	lb BOD/lb MLSS/d
Volumetric BOD loading	0.0979	kg BOD/m3/d
Observed yield (VSS basis)	0.564	g VSS/g BOD
Observed yield (TSS basis)	0.799	g TSS/g BOD
Amount of alkalinity required	136	gCaCO3/m3
Amount of sludge generated	13100	kg/d
Sludge recycle rate	21500	m3/d
Nitrogen requirement for biom	14.3	mg/L
Phosphorus requirement for bi	2.86	mg/L
Oxygen requirement to meet a	26700	kg/d
Quantities		
Ditch bottom width	45.2	ft
Length of straight section	461	ft
Volume of excavation required	2270000	cuft
Volume of backfill required per	12100	cuft
Volume of wall concrete requir	41100	cuft
Volume of slab concrete requir	67100	cuft
Length of adjustable weir	67.1	ft
Volume of concrete required p	288	cuft
Total handrail length	0	ft
Operation labor required	8800	pers-hrs/yr
Electrical energy required	14100000	kWh/yr
Costs		
Construction and equipment co	14300000	$
Earthwork Cost	671000	$
Wall Concrete Cost	4020000	$
Slab Concrete Cost	3480000	$
Handrail Cost	0	$
Installed Equipment Cost	5440000	$
Misc Costs	707000	$
Operational labor cost	453000	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	108000	$/yr
Chemical cost	0	$/yr
Energy cost	1410000	$/yr
Amortization cost	1390000	$/yr

Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment co	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	143	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	2	
Distance to disposal site	10	miles
Quantities		
Total sludge volume hauled	143	cuyd/d
Maximum anticipated landfill d	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	14400	sqft
Width of sludge storage shed	85	ft
Length of sludge storage shed	170	ft
Volume of earthwork required	37700	cuft
Volume of slab concrete requir	15600	cuft
Surface area of canopy roof	14400	sqft
Round trip haul distance	20	miles
Round trips per day per truck	4	
Distance traveled per year per	20000	miles
Sludge hauled	126	ton(short)/d
Operation labor required	2230	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment c	1190000	$
Earthwork Cost	11200	$
Slab Concrete Cost	202000	$
Canopy Roof Cost	289000	$
Vehicle Cost	690000	$
Operational labor cost	115000	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	181000	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	192000	$/yr

Secondary Clarifier

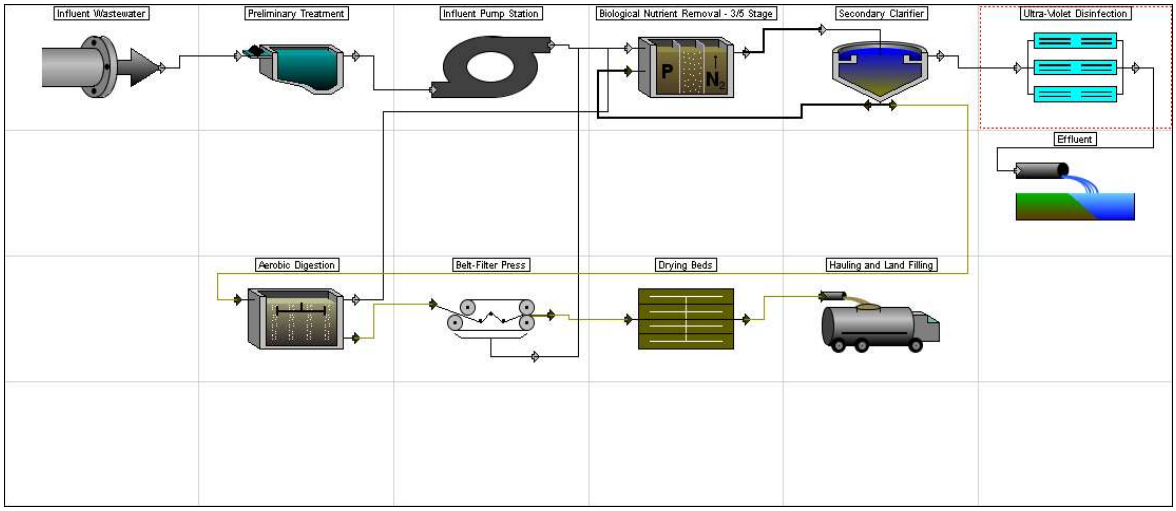
Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	42600	sqft
Surface area per circular clarifi	10600	sqft
Diameter of each circular clarif	117	ft
Number of clarifiers per battery	4	
Number of batteries	1	
Solids loading rate	11.1	lb/(sqft·d)
Hydraulic retention time	4.04	hr
Designed surface overflow rate	400	gal(US)/(sqft·d)
Weir length	1140	ft
Volume of wasted sludge	336000	gpd(US)
Quantities		
Operation labor required	2450	pers-hrs/yr
Maintenance labor required	1360	pers-hrs/yr
Electrical energy required	18900	kWh/yr
Volume of earthwork required	608000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	40900	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	15300	cuft
Costs		
Construction and equipment c	2080000	$
Earthwork Cost	180000	$
Wall Concrete Cost	368000	$
Slab Concrete Cost	530000	$
Installed Equipment Cost	687000	$
Misc Costs	318000	$
Operational labor cost	126000	$/yr
Maintenance labor cost	59900	$/yr
Material and supply cost	20800	$/yr
Chemical cost	0	$/yr
Energy cost	1890	$/yr
Amortization cost	189000	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.336	MGD(US)
Total pumping capacity	0.336	MGD(US)
Design capacity per pump	117	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.336	MGD(US)
Quantities		
Operation labor required	382	pers-hrs/yr
Maintenance labor required	306	pers-hrs/yr
Electrical energy required	11300	kWh/yr
Volume of earthwork required	1650	cuft

Area of pump building	207	sqft
Costs		
Construction and equipment cc	63200	$
Earthwork Cost	490	$
Pump Building Cost	22700	$
Installed Pump Cost	30300	$
Misc Costs	9640	$
Operational labor cost	19700	$/yr
Maintenance labor cost	13500	$/yr
Material and supply cost	442	$/yr
Chemical cost	0	$/yr
Energy cost	1130	$/yr
Amortization cost	5970	$/yr

Timpanogos Special Service District

Layout 1 Timpanogos



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$89,300,000	$
Other direct construction costs	$23,200,000	$
Other indirect construction cos	$83,800,000	$
Total construction costs	$196,000,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$290,000	$/yr
Laboratory labor cost	$264,000	$/yr
Unit process operation labor c	$3,030,000	$/yr
Unit process maintenance labc	$1,690,000	$/yr
Total labor costs	$5,280,000	$/yr
MATERIAL COSTS		
Total material cost	$1,270,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$285,000	$/yr
ENERGY COSTS		
Total energy cost	$5,800,000	$/yr
Total operation and maintanen	$12,600,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$16,900,000	$/yr
Total annual project cost	$29,600,000	$/yr
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 cos	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 b	1310000	$
Blower building area	2410	sqft
Costs		
Construction and equipment co	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 c	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	m3
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 b	14	
Oxygen requirement to meet a	19400	kg/d
Air flow required to meet avera	107000	N m3/hr
Design air flow	20.8	N m3/min/1000 m3
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 requir	397000	cuft
Volume of wall concrete requir	233000	cuft
Handrail length	7880	ft
Number of diffusers per train	379	
Number of swing arm headers	17	
Costs		
Construction and equipment c	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	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	2650000	kWh/yr
Volume of earthwork required	336000	cuft
Volume of slab concrete requir	26500	cuft
Volume of wall concrete requir	10700	cuft
Capacity per pump	13500	gpm(US)
Number of constant speed pur	4	
Number of variable speed pur	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 c	3230000	$
Earthwork Cost	99500	$
Wall Concrete Cost	256000	$
Slab Concrete Cost	344000	$
Building Cost	227000	$
Installed Pump Equipment C	1770000	$
Installed Control Module Cos	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 c	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 nitrifica	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 reac	27200	m3
Total volume of anoxic reactors	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 avera	42600	kg/d
Total aerator power required to	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	257000	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 co	23600000	$
Earthwork Cost	1040000	$
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 co	2190000	$
Earthwork Cost	9770	$
Pump Building Cost	454000	$
Installed Pump Cost	1400000	$
Misc Costs	335000	$
Operational labor cost	33600	$/yr
Maintenance labor cost	26800	$/yr
Material and supply cost	15400	$/yr
Chemical cost	0	$/yr
Energy cost	359000	$/yr
Amortization cost	207000	$/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 co	2510000	$
Earthwork Cost	11500	$
Pump Building Cost	531000	$
Installed Pump Cost	1580000	$
Misc Costs	383000	$
Operational labor cost	37000	$/yr
Maintenance labor cost	29500	$/yr
Material and supply cost	17600	$/yr
Chemical cost	0	$/yr
Energy cost	478000	$/yr
Amortization cost	237000	$/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	1190000	kWh/yr
Volume of earthwork required	7260	cuft
Area of pump building	908	sqft
Costs		
Construction and equipment co	661000	$

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 c	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 battery	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 requir	79700	cuft
Costs		
Construction and equipment c	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 c	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 d	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	4900	sqft
Width of sludge storage shed s	49.5	ft
Length of sludge storage shed	99	ft
Volume of earthwork required	13200	cuft
Volume of slab concrete requir	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	45000	miles
Sludge hauled	42.8	ton(short)/d
Operation labor required	2270	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment c	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 calc	1.19	gal(US)/(min·W)
Total number of lamps needed	3350	
Number of spare channels	1	
Total number of lamps used in	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 c	10500000	$
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

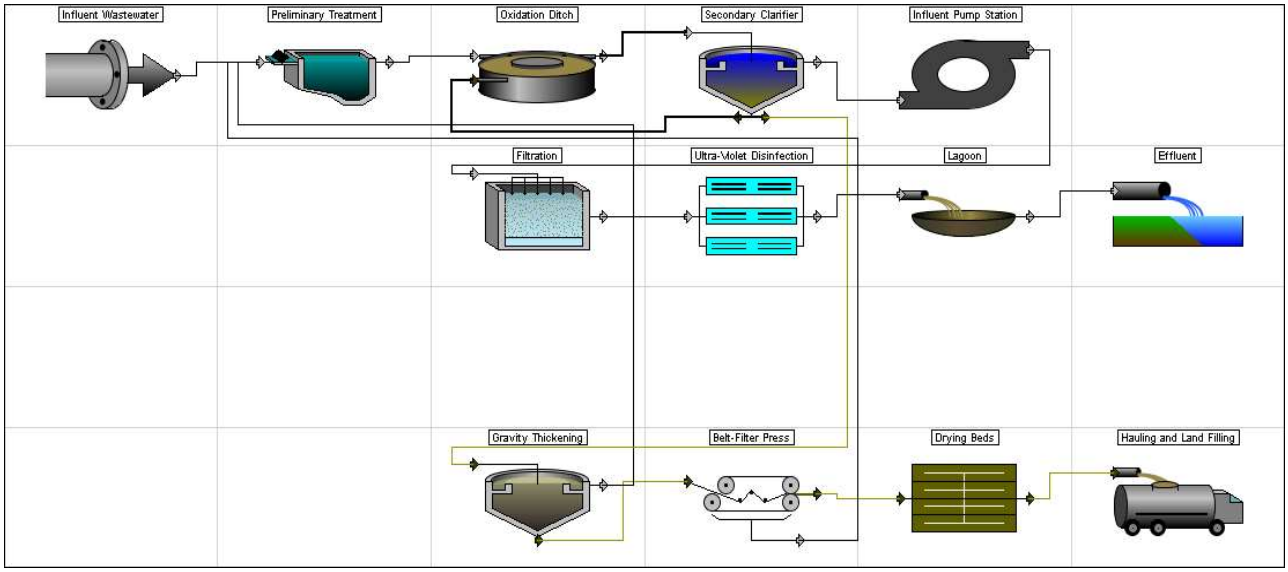
Design Output Data

Description	Value	Units

Costs		
Construction and equipment c	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

Tooele City

Layout - Tooele City.



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$11,300,000	$
Other direct construction costs	$4,770,000	$
Other indirect construction cos	$12,100,000	$
Total construction costs	$28,100,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$46,800	$/yr
Laboratory labor cost	$152,000	$/yr
Unit process operation labor c	$453,000	$/yr
Unit process maintenance labc	$161,000	$/yr
Total labor costs	$813,000	$/yr
MATERIAL COSTS		
Total material cost	$180,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$34,500	$/yr
ENERGY COSTS		
Total energy cost	$377,000	$/yr
Total operation and maintanen	$1,400,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$2,460,000	$/yr
Total annual project cost	$3,860,000	$/yr
PROJECT SUMMARY		
Present worth	$46,300,000	$
Total project cost	$28,100,000	$
Total operation labor cost	$652,000	$/yr
Total maintenance labor cost	$161,000	$/yr
Total material cost	$180,000	$/yr
Total chemical cost	$34,500	$/yr
Total energy cost	$377,000	$/yr
Total amortization cost	$2,460,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Preliminary Treatment	586000	48600	20500	14700	0	2850	49200
Oxidation Ditch	3100000	101000	0	24500	0	304000	302000
Filtration	1650000	8330	4460	47000	0	2700	160000
Gravity Thickening	126000	16600	10500	1260	0	628	12100

Secondary Clarifier	634000	64600	30800	6200	0	1230	58600
Ultra-Violet Disinfection	1430000	0	14600	14300	4980	35700	121000
Belt-Filter Press	812000	8900	1750	0	29500	5310	74300
Influent Pump Station	1830000	34500	22900	12800	0	24800	158000
Lagoon	140000	23100	0	0	0	0	14900
Drying Beds	632000	142000	55700	5690	0	0	55000
Effluent	0	0	0	0	0	0	0
Hauling and Land Filling	307000	4950	0	53600	0	0	63300
Other Costs	16800000	199000	0	0	0	0	1390000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	14	acre
Administration labor hours	909	hr/yr
Laboratory labor hours	2950	hr/yr
Costs		
DIRECT COSTS		
Mobilization	427000	$
Site preparation	646000	$
Site electrical	1180000	$
Yard piping	794000	$
Instrumentation and control	585000	$
Lab and administration building	1140000	$
Total direct construction costs	4770000	$
INDIRECT COSTS		
Cost of land	280000	$
Miscellaneous cost	922000	$
Legal cost	369000	$
Engineering design fee	2770000	$
Inspection cost	369000	$
Contingency	1840000	$
Technical	369000	$
Interest during construction	2750000	$
Profit	2400000	$
Total indirect construction cost	12100000	$
Total of other construction cos	16800000	$
LABOR COSTS		
Administration labor cost	46800	$/yr
Laboratory labor cost	152000	$/yr

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	2.14	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	12.4	cuft/s
Average flow	5.34	cuft/s
Minimum flow	3.49	cuft/s
Temperature	10	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	6.21	cuft/s
Width of channel	1.04	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.00169	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	13.9	cuft/d
Costs		

Construction and equipment cc	586000	$
Operational labor cost	48600	$/yr
Maintenance labor cost	20500	$/yr
Material and supply cost	14700	$/yr
Chemical cost	0	$/yr
Energy cost	2850	$/yr
Amortization cost	49200	$/yr

Oxidation Ditch

Design Output Data

Description	Value	Units
Oxidation Ditch		
Design Information		
Carbon & Nitrification Design		
Design SRT for design at winte	25	d
Design SS	2500	mg/L
Calculated VSS	1770	mg/L
Calculated VSS:TSS ratio	0.709	mg VSS/mg SS
Total volume of reactors	28200	m3
Ditch length	137	m
Ditch width	29.8	m
Sidewater depth	3.66	m
Number of batteries	1	
Number of parallel ditches per	2	
Number of rotors per ditch	4	
Rotor length for aeration	41.8	m
Rotor length for mixing	108	m
Installed rotor length per rotor	13.5	m
Rotor horsepower	20	HP
Total installed horsepower per	160	HP
Assumed surface velocity	0.46	m/s
Hydraulic retention time	51.6	hr
F/M ratio	0.0571	lb BOD/lb MLSS/d
Volumetric BOD loading	0.101	kg BOD/m3/d
Observed yield (VSS basis)	0.572	g VSS/g BOD
Observed yield (TSS basis)	0.808	g TSS/g BOD
Amount of alkalinity required	128	gCaCO3/m3
Amount of sludge generated	2820	kg/d
Sludge recycle rate	4380	m3/d
Nitrogen requirement for biom	15.2	mg/L
Phosphorus requirement for bi	3.05	mg/L
Oxygen requirement to meet a	5580	kg/d
Quantities		
Ditch bottom width	48.4	ft
Length of straight section	352	ft
Volume of excavation required	495000	cuft
Volume of backfill required per	10600	cuft
Volume of wall concrete requir	34800	cuft
Volume of slab concrete requir	59400	cuft
Length of adjustable weir	54.7	ft
Volume of concrete required p	239	cuft
Total handrail length	0	ft
Operation labor required	1970	pers-hrs/yr
Electrical energy required	3040000	kWh/yr
Costs		
Construction and equipment cc	3100000	$
Earthwork Cost	147000	$
Wall Concrete Cost	850000	$
Slab Concrete Cost	771000	$
Handrail Cost	0	$
Installed Equipment Cost	1180000	$
Misc Costs	153000	$
Operational labor cost	101000	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	24500	$/yr
Chemical cost	0	$/yr
Energy cost	304000	$/yr
Amortization cost	302000	$/yr

Filtration

Design Output Data

Description	Value	Units
Filtration		
Design Information		
Surface area	1480	sqft
Depth	9	ft
Terminal headloss through bec	192000	ft
Maximum head for backwashir	19.6	ft
Backwash rate	20	gal(US)/(sqft·min)
Washwater gutter depth	0.609	ft
Washwater needed	148000	gal(US)
Quantities		

Operation labor required	162	pers-hrs/yr
Maintenance labor required	110	pers-hrs/yr
Electrical energy required	27000	kWh
Surface area per filter unit	1480	sqft
Number of cells per filter unit	4	
Number of filter units per batte	1	
Number of batteries	1	
Volume of earthwork for filter	18400	cuft
Volume of concrete for filter	9370	cuft
Volume of surge tank	19800	cuft
Width of surge tank	37.6	ft
Length of surge tank	75.2	ft
Volume of earthwork for surge	42900	cuft
Volume of concrete for surge t	5800	cuft
Costs		
Construction and equipment cc	1650000	$
Earthwork Cost for Filter	5460	$
Earthwork Cost for Surge Ta	12700	$
Concrete Cost for Filter	225000	$
Concrete Cost for Surge Tar	140000	$
Installed Equipment Cost	940000	$
Misc Costs	331000	$
Operational labor cost	8330	$/yr
Maintenance labor cost	4460	$/yr
Material and supply cost	47000	$/yr
Chemical cost	0	$/yr
Energy cost	2700	$/yr
Amortization cost	160000	$/yr

Gravity Thickening

Design Output Data

Description	Value	Units
Gravity Thickening		
Design Information		
Initial concentration	1	%
Thickened concentration	5	%
Mass loading	10	lb/(sqft·d)
Hydraulic loading	120	gal(US)/(sqft·d)
Hydraulic retention time	13.5	hr
Number of tanks	1	
Tank volume	5440	cuft
Depth	9	ft
Surface area per tank	605	sqft
Tank diameter	28	ft
Quantities		
Amount of sludge generated	3.02	ton(short)/d
Volume of thickened sludge	12400	gpd(US)
Operation labor required	322	pers-hrs/yr
Maintenance labor required	259	pers-hrs/yr
Electrical energy required	6280	kWh/yr
Volume of earthwork required	8170	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	715	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	985	cuft
Costs		
Construction and equipment cc	126000	$
Earthwork Cost	2420	$
Wall Concrete Cost	23700	$
Slab Concrete Cost	9260	$
Installed Equipment Cost	71600	$
Misc Costs	19300	$
Operational labor cost	16600	$/yr
Maintenance labor cost	10500	$/yr
Material and supply cost	1260	$/yr
Chemical cost	0	$/yr
Energy cost	628	$/yr
Amortization cost	12100	$/yr

Secondary Clarifier

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	8670	sqft
Surface area per circular clarifi	4340	sqft
Diameter of each circular clarif	75	ft
Number of clarifiers per battery	2	
Number of batteries	1	
Solids loading rate	11.1	lb/(sqft·d)
Hydraulic retention time	4.04	hr
Designed surface overflow rate	400	gal(US)/(sqft·d)

Weir length	807	ft
Volume of wasted sludge	72500	gpd(US)
Quantities		
Operation labor required	939	pers-hrs/yr
Maintenance labor required	517	pers-hrs/yr
Electrical energy required	9860	kWh/yr
Volume of earthwork required	111000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	8710	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	4960	cuft
Costs		
Construction and equipment cc	589000	$
Earthwork Cost	32900	$
Wall Concrete Cost	119000	$
Slab Concrete Cost	113000	$
Installed Equipment Cost	234000	$
Misc Costs	89800	$
Operational labor cost	48400	$/yr
Maintenance labor cost	20900	$/yr
Material and supply cost	5890	$/yr
Chemical cost	0	$/yr
Energy cost	986	$/yr
Amortization cost	54300	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0725	MGD(US)
Total pumping capacity	0.0725	MGD(US)
Design capacity per pump	25.2	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.0725	MGD(US)
Quantities		
Operation labor required	314	pers-hrs/yr
Maintenance labor required	244	pers-hrs/yr
Electrical energy required	2440	kWh/yr
Volume of earthwork required	1610	cuft
Area of pump building	201	sqft
Costs		
Construction and equipment cc	44900	$
Earthwork Cost	477	$
Pump Building Cost	22200	$
Installed Pump Cost	15400	$
Misc Costs	6850	$
Operational labor cost	16200	$/yr
Maintenance labor cost	9870	$/yr
Material and supply cost	314	$/yr
Chemical cost	0	$/yr
Energy cost	244	$/yr
Amortization cost	4250	$/yr

Ultra-Violet Disinfection

Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calc	1.34	gal(US)/(min·W)
System is not headloss constra		
Total number of lamps needed	316	
Number of spare channels	1	
Total number of lamps used in	480	
Number of excess lamps	164	
Number of lamps/modules	8	
Number of modules/bank	10	
Number of banks/channel	2	
Number of channels	3	
Calculated headloss	1.46	in
Costs		
Construction and equipment cc	1430000	$
Cost of installation	859000	$
Total cost of UV lamps	573000	$
Operational labor cost	0	$/yr
Maintenance labor cost	14600	$/yr
Material and supply cost	14300	$/yr
Chemical cost	4980	$/yr
Energy cost	35700	$/yr
Amortization cost	121000	$/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	36.2	gpm(US)
Final solids content	19	%
Solids capture fraction	0.998	
Quantities		
Operation labor required	173	pers-hrs/yr
Maintenance labor required	43.2	pers-hrs/yr
Power	53100	kWh/yr
Polymer required	22700	lb/yr
Dry solids produced	6220	lb/d
Belt filter(s)	275000	$
Building	279000	$
Installation	68800	$
Polymer system	82500	$
Feed pumps	30300	$
Conveyor system	77000	$
Costs		
Construction and equipment cc	812000	$
Building Cost	279000	$
Polymer System Cost	82500	$
Feed Pumps Cost	30300	$
Conveyor System Cost	77000	$
Installed Belt Filter	344000	$
Operational labor cost	8900	$/yr
Maintenance labor cost	1750	$/yr
Material and supply cost	0	$/yr
Chemical cost	29500	$/yr
Energy cost	5310	$/yr
Amortization cost	74300	$/yr

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	23100	cuft
Width of wet well	185	ft
Depth of the pumping station	27.9	ft
Length of the pumping station	20.4	ft
Width of the pumping station	215	ft
Minimum depth of water in wet	6.93	ft
Area of pump building	637	sqft
Peak capacity of pumps	11.7	MGD(US)
Firm pumping capacity	11.7	MGD(US)
Total dynamic head - average	44.6	ft
Quantities		
Operation labor required	671	pers-hrs/yr
Maintenance labor required	567	pers-hrs/yr
Electrical energy required	248000	kWh/yr
Volume of earthwork required	556000	cuft
Volume of slab concrete requir	40200	cuft
Volume of wall concrete requir	17900	cuft
Capacity per pump	8110	gpm(US)
Number of constant speed pur	2	
Number of variable speed purr	0	
Diameter of discharge header	20.4	in
Total dynamic head	61.3	ft
Size of selected pump	18	in
Specific speed of pump	3700	
Pump rotating speed	972	rpm
Motor size required	152	HP
Size of selected motor	200	HP
Width of pump system	4.2	ft
Length of pump system	20.7	ft
Length of the dry well	20.4	ft
Width of the dry well	29.7	ft
Costs		
Construction and equipment cc	1830000	$
Earthwork Cost	165000	$
Wall Concrete Cost	431000	$
Slab Concrete Cost	522000	$
Building Cost	70100	$
Installed Pump Equipment C	364000	$
Misc Costs	279000	$
Operational labor cost	34500	$/yr
Maintenance labor cost	22900	$/yr
Material and supply cost	12800	$/yr
Chemical cost	0	$/yr
Energy cost	24800	$/yr

Amortization cost	158000	$/yr

Lagoon

Design Output Data

Description	Value	Units
Aerobic Lagoon		
Design Information		
Hydraulic retention time	0.131	d
BOD loading rate	90	lb/(acre·d)
Number of units	2	
Sidewater depth	3	ft
Depth of cut	2.4	ft
Length of unit at water level	112	ft
Surface area per unit	0.228	acre
Total surface area	0.456	acre
Volume of one unit	0.223	Mgal(US)
Total volume	0.446	Mgal(US)
Freeboard	2	ft
Quantities		
Area of lagoon liner	20300	sqft
Operation and maintenance lal	449	pers-hrs/yr
Pipe diameter	28	in
Length of pipe	56	ft
Number of butterfly valves	3	
Diameter of butterfly valves	28	in
Volume of earthwork required	35000	cuft
Volume of slab concrete requir	8	cuft
Volume of wall concrete requir	40	cuft
Costs		
Construction and equipment cc	140000	$
Earthwork Cost	10400	$
Wall Concrete Cost	963	$
Slab Concrete Cost	104	$
Installed Valves Cost	29700	$
Installed Pipe Cost	32500	$
Liner Cost	52500	$
Misc Costs	13900	$
Operational labor cost	23100	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	0	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	14900	$/yr

Drying Beds

Design Output Data

Description	Value	Units
Sludge Drying Beds		
Design Information		
Total surface area required	44800	sqft
Initial depth of sludge	12	in
Final solids	50	%
Bed holding time	103	d
Quantities		
Total drying bed surface area	44800	sqft
Number beds	15	
Surface area of each individua	2990	sqft
Length of each bed	149	ft
Volume of earthwork required	220000	cuft
Volume concrete for dividing w	15100	cuft
Volume of R.C. in-place for tru	3360	cuft
Volume of sand	33600	cuft
Volume of gravel	44800	cuft
Clay pipe diameter	6	in
Total length clay pipe	4480	in
Sludge solids produced	2.59	ton(short)/d
Operational labor required	2760	pers-hrs/yr
Maintenance labor required	1380	pers-hrs/yr
Costs		
Construction and equipment cc	632000	$
Earthwork Cost	65300	$
Wall Concrete Cost	255000	$
Slab Concrete Cost	26100	$
Drying Bed Media Cost	125000	$
Drain Pipe System Cost	98500	$
Misc Costs	62700	$
Operational labor cost	142000	$/yr
Maintenance labor cost	55700	$/yr
Material and supply cost	5690	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	55000	$/yr

Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	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

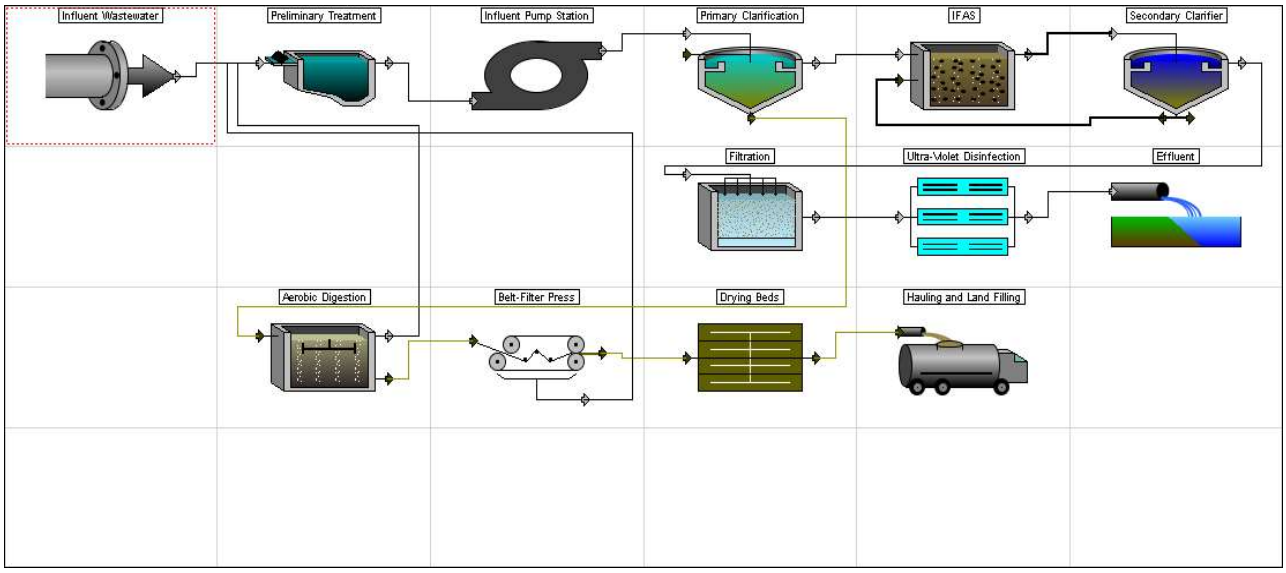
Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	6.14	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	6.14	cuyd/d
Maximum anticipated landfill dc	30	d
Anticipated sludge storage heig	8	ft
Sludge storage shed area	622	sqft
Width of sludge storage shed s	17.6	ft
Length of sludge storage shed	35.3	ft
Volume of earthwork required	1910	cuft
Volume of slab concrete requir	864	cuft
Surface area of canopy roof	622	sqft
Round trip haul distance	20	miles
Round trips per day per truck	1	
Distance traveled per year per	5000	miles
Sludge hauled	5.43	ton(short)/d
Operation labor required	96.1	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment cc	307000	$
Earthwork Cost	565	$
Slab Concrete Cost	11200	$
Canopy Roof Cost	12400	$
Vehicle Cost	283000	$
Operational labor cost	4950	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	53600	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	63300	$/yr

Tremonton City

Layout - Tremonton City



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$8,570,000	$
Other direct construction costs	$3,340,000	$
Other indirect construction cos	$9,010,000	$
Total construction costs	$20,900,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$30,900	$/yr
Laboratory labor cost	$140,000	$/yr
Unit process operation labor c	$409,000	$/yr
Unit process maintenance labc	$195,000	$/yr
Total labor costs	$775,000	$/yr
MATERIAL COSTS		
Total material cost	$200,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$8,670	$/yr
ENERGY COSTS		
Total energy cost	$275,000	$/yr
Total operation and maintanen	$1,260,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$1,860,000	$/yr
Total annual project cost	$3,120,000	$/yr
PROJECT SUMMARY		
Present worth	$37,400,000	$
Total project cost	$20,900,000	$
Total operation labor cost	$580,000	$/yr
Total maintenance labor cost	$195,000	$/yr
Total material cost	$200,000	$/yr
Total chemical cost	$8,670	$/yr
Total energy cost	$275,000	$/yr
Total amortization cost	$1,860,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Preliminary Treatment	435000	39100	17100	10900	0	2210	36500
Aerobic Digestion	273000	67900	27100	36200	0	55900	23800
Influent Pump Station	1230000	29400	19900	8610	0	16200	106000
Belt-Filter Press	812000	1940	387	0	6430	1300	74300

Primary Clarification	323000	36100	17600	3130	0	824	30300
Filtration	1200000	6120	3300	34000	0	1600	116000
Drying Beds	149000	39300	14000	1340	0	0	12900
IFAS	1930000	139000	65900	40800	0	180000	213000
Ultra-Violet Disinfection	644000	0	6650	6440	2240	16100	54600
Hauling and Land Filling	289000	1080	0	53600	0	0	61800
Secondary Clarifier	464000	48400	23400	4530	0	967	43200
Effluent	0	0	0	0	0	0	0
Blower System	826000	0	0	0	0	0	69200
Other Costs	12400000	171000	0	0	0	0	1020000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	12	acre
Administration labor hours	600	hr/yr
Laboratory labor hours	2720	hr/yr
Costs		
DIRECT COSTS		
Mobilization	296000	$
Site preparation	477000	$
Site electrical	802000	$
Yard piping	545000	$
Instrumentation and control	387000	$
Lab and administration building	836000	$
Total direct construction costs	3340000	$
INDIRECT COSTS		
Cost of land	240000	$
Miscellaneous cost	685000	$
Legal cost	274000	$
Engineering design fee	2060000	$
Inspection cost	274000	$
Contingency	1370000	$
Technical	274000	$
Interest during construction	2050000	$
Profit	1790000	$
Total indirect construction cost	9010000	$
Total of other construction cos	12400000	$
LABOR COSTS		
Administration labor cost	30900	$/yr
Laboratory labor cost	140000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	9040	scfm
Safety factor	1.5	
Requested air flow capacity	13600	scfm
Total capacity of blowers	13600	scfm
Number of blowers in use	2	
Total number of blowers	3	
Capacity of individual blowers	6780	scfm
Estimated cost of an installed l	194000	$
Blower building area	1460	sqft
Costs		
Construction and equipment cc	826000	$
Installed Blower Cost	583000	$
Building Cost	161000	$
Misc Costs	81800	$
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	69200	$/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	0.1	in
Bar spacing	0.25	in

Slope of bars from horizontal	30	degrees
Head loss through screen	0.103	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	1.24	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	7.71	cuft/s
Average flow	3.09	cuft/s
Minimum flow	2.32	cuft/s
Temperature	10	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	3.85	cuft/s
Width of channel	0.642	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.00297	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	8.02	cuft/d
Costs		
Construction and equipment cc	435000	$
Operational labor cost	39100	$/yr
Maintenance labor cost	17100	$/yr
Material and supply cost	10900	$/yr
Chemical cost	0	$/yr
Energy cost	2210	$/yr
Amortization cost	36500	$/yr

Aerobic Digestion

Design Output Data

Description	Value	Units
Aerobic Digestion		
Design Information		
Solids retention time	9.79	d
Design SS	12000	mg/L
Calculated VSS	7700	mg/L
Calculated VSS:TSS ratio	0.642	mg VSS/mg SS
Total volume of reactors	440	m3
Length of parallel train	5	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	585	kg/d
Air flow required to meet avera	3240	N m3/hr
Design air flow	123	N m3/min/1000 m3
Volatile solids loading	0.109	lb/(cuft·d)
Solids accumulated	1190	lb/d
Digester capacity	11600	lb
Volume of wasted sludge	53100	gal(US)
Quantities		
Operation labor required	1320	pers-hrs/yr
Maintenance labor required	660	pers-hrs/yr
Electrical energy required	559000	kWh/yr
Volume of earthwork required	20700	cuft
Volume of slab concrete requir	4210	cuft
Volume of wall concrete requir	4040	cuft
Handrail length	113	ft
Number of diffusers per train	91	
Number of swing arm headers	1	
Costs		
Construction and equipment cc	273000	$
Earthwork Cost	6150	$
Wall Concrete Cost	97200	$
Slab Concrete Cost	54600	$
Handrail Cost	8470	$
Installed Aerator Equipment	47000	$
Air Piping Cost	32400	$
Misc Costs	27000	$
Operational labor cost	67900	$/yr
Maintenance labor cost	27100	$/yr
Material and supply cost	36200	$/yr
Chemical cost	0	$/yr
Energy cost	55900	$/yr

Amortization cost	23800	$/yr

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	14600	cuft
Width of wet well	128	ft
Depth of the pumping station	26.9	ft
Length of the pumping station	18.8	ft
Width of the pumping station	156	ft
Minimum depth of water in wet	5.89	ft
Area of pump building	553	sqft
Peak capacity of pumps	7.23	MGD(US)
Firm pumping capacity	7.23	MGD(US)
Total dynamic head - average	44.9	ft
Quantities		
Operation labor required	571	pers-hrs/yr
Maintenance labor required	485	pers-hrs/yr
Electrical energy required	162000	kWh/yr
Volume of earthwork required	382000	cuft
Volume of slab concrete requir	25000	cuft
Volume of wall concrete requir	12800	cuft
Capacity per pump	5020	gpm(US)
Number of constant speed pur	2	
Number of variable speed pur	0	
Diameter of discharge header	16	in
Total dynamic head	66.2	ft
Size of selected pump	14	in
Specific speed of pump	3670	
Pump rotating speed	1310	rpm
Motor size required	112	HP
Size of selected motor	125	HP
Width of pump system	3.4	ft
Length of pump system	19	ft
Length of the dry well	18.8	ft
Width of the dry well	28	ft
Costs		
Construction and equipment co	1230000	$
Earthwork Cost	113000	$
Wall Concrete Cost	309000	$
Slab Concrete Cost	324000	$
Building Cost	60800	$
Installed Pump Equipment C	236000	$
Misc Costs	188000	$
Operational labor cost	29400	$/yr
Maintenance labor cost	19900	$/yr
Material and supply cost	8610	$/yr
Chemical cost	0	$/yr
Energy cost	16200	$/yr
Amortization cost	106000	$/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	15.8	gpm(US)
Final solids content	19	%
Solids capture fraction	0.996	
Quantities		
Operation labor required	37.7	pers-hrs/yr
Maintenance labor required	9.42	pers-hrs/yr
Power	13000	kWh/yr
Polymer required	4940	lb/yr
Dry solids produced	1350	lb/d
Belt filter(s)	275000	$
Building	279000	$
Installation	68800	$
Polymer system	82500	$
Feed pumps	30300	$
Conveyor system	77000	$
Costs		
Construction and equipment co	812000	$
Building Cost	279000	$
Polymer System Cost	82500	$
Feed Pumps Cost	30300	$
Conveyor System Cost	77000	$

Installed Belt Filter	344000	$
Operational labor cost	1940	$/yr
Maintenance labor cost	387	$/yr
Material and supply cost	0	$/yr
Chemical cost	6430	$/yr
Energy cost	1300	$/yr
Amortization cost	74300	$/yr

Primary Clarification

Design Output Data

Description	Value	Units
Primary Clarification		
Design Information		
Surface area	2510	sqft
Surface area per circular clarifi	1250	sqft
Diameter of each circular clarif	40	ft
Number of clarifiers per batter	2	
Number of batteries	1	
Solids loading rate	1.48	lb/(sqft·d)
Hydraulic retention time	2.02	hr
Weir length	501	ft
Volume of sludge generated	6450	gpd(US)
Quantities		
Operation labor required	471	pers-hrs/yr
Maintenance labor required	257	pers-hrs/yr
Electrical energy required	8020	kWh/yr
Volume of earthwork required	31000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	2700	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	2750	cuft
Costs		
Construction and equipment co	290000	$
Earthwork Cost	9190	$
Wall Concrete Cost	66100	$
Slab Concrete Cost	35000	$
Installed Equipment Cost	136000	$
Misc Costs	44300	$
Operational labor cost	24300	$/yr
Maintenance labor cost	10600	$/yr
Material and supply cost	2900	$/yr
Chemical cost	0	$/yr
Energy cost	802	$/yr
Amortization cost	27200	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.00645	MGD(US)
Total pumping capacity	0.00645	MGD(US)
Design capacity per pump	2.24	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.00645	MGD(US)
Quantities		
Operation labor required	230	pers-hrs/yr
Maintenance labor required	171	pers-hrs/yr
Electrical energy required	219	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment co	32800	$
Earthwork Cost	474	$
Pump Building Cost	22000	$
Installed Pump Cost	5320	$
Misc Costs	5000	$
Operational labor cost	11900	$/yr
Maintenance labor cost	7010	$/yr
Material and supply cost	230	$/yr
Chemical cost	0	$/yr
Energy cost	22	$/yr
Amortization cost	3100	$/yr

Filtration

Design Output Data

Description	Value	Units
Filtration		
Design Information		
Surface area	922	sqft
Depth	9	ft
Terminal headloss through bec	192000	ft
Maximum head for backwashir	19.6	ft
Backwash rate	20	gal(US)/(sqft·min)
Washwater gutter depth	0.444	ft

Washwater needed	92200	gal(US)
Quantities		
Operation labor required	119	pers-hrs/yr
Maintenance labor required	80.5	pers-hrs/yr
Electrical energy required	16000	kWh
Surface area per filter unit	922	sqft
Number of cells per filter unit	4	
Number of filter units per batte	1	
Number of batteries	1	
Volume of earthwork for filter	13500	cuft
Volume of concrete for filter	6910	cuft
Volume of surge tank	12300	cuft
Width of surge tank	29.7	ft
Length of surge tank	59.3	ft
Volume of earthwork for surge	29500	cuft
Volume of concrete for surge t	4110	cuft
Costs		
Construction and equipment cc	1200000	$
Earthwork Cost for Filter	4000	$
Earthwork Cost for Surge Ta	8730	$
Concrete Cost for Filter	166000	$
Concrete Cost for Surge Tar	99000	$
Installed Equipment Cost	680000	$
Misc Costs	239000	$
Operational labor cost	6120	$/yr
Maintenance labor cost	3300	$/yr
Material and supply cost	34000	$/yr
Chemical cost	0	$/yr
Energy cost	1600	$/yr
Amortization cost	116000	$/yr

Drying Beds

Design Output Data

Description	Value	Units
Sludge Drying Beds		
Design Information		
Total surface area required	9750	sqft
Initial depth of sludge	12	in
Final solids	50	%
Bed holding time	103	d
Quantities		
Total drying bed surface area	9750	sqft
Number beds	4	
Surface area of each individua	2440	sqft
Length of each bed	122	ft
Volume of earthwork required	48300	cuft
Volume concrete for dividing w	3890	cuft
Volume of R.C. in-place for tru	731	cuft
Volume of sand	7310	cuft
Volume of gravel	9750	cuft
Clay pipe diameter	6	in
Total length clay pipe	975	in
Sludge solids produced	0.563	ton(short)/d
Operational labor required	762	pers-hrs/yr
Maintenance labor required	342	pers-hrs/yr
Costs		
Construction and equipment cc	149000	$
Earthwork Cost	14300	$
Wall Concrete Cost	65600	$
Slab Concrete Cost	5690	$
Drying Bed Media Cost	27200	$
Drain Pipe System Cost	21500	$
Misc Costs	14800	$
Operational labor cost	39300	$/yr
Maintenance labor cost	14000	$/yr
Material and supply cost	1340	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	12900	$/yr

IFAS

Design Output Data

Description	Value	Units
IFAS		
Design Information		
Carbon & Nitrification Design		
Design SRT for design at winte	25	d
Design SS	3000	mg/L
Calculated VSS	2090	mg/L
Calculated VSS:TSS ratio	0.695	mg VSS/mg SS
Total volume of reactors	4170	m3
Length of parallel train	42	m

Width of parallel train	10	m
Sidewater depth	5	m
Number of batteries	1	
Number of parallel trains per b	2	
Number of cells within one trai	3	
Total number of dividing walls	4	
Hydraulic retention time	13.2	hr
F/M ratio	0.0846	kg BOD/kg MLSS/d
Volumetric BOD loading	0.271	kg BOD/m3/d
Observed yield (VSS basis)	0.617	g VSS/g BOD
Observed yield (TSS basis)	0.592	g TSS/g BOD
Amount of alkalinity required	219	gCaCO3/m3
Amount of sludge generated	768	kg/d
Sludge recycle rate	3240	m3/d
Nitrogen requirement for biom	4.3	mg/L
Phosphorus requirement for bi	0.86	mg/L
Oxygen requirement to meet a	2490	kg/d
Air flow required to meet avera	11600	N m3/hr
Design air flow	46.3	N m3/min/1000 m3
Quantities		
Operation labor required	2280	pers-hrs/yr
Maintenance labor required	1250	pers-hrs/yr
Electrical energy required	1770000	kWh/yr
Volume of earthwork required	87800	cuft
Volume of slab concrete requir	19500	cuft
Volume of wall concrete requir	13200	cuft
Handrail length	356	ft
Number of diffusers per train	287	
Number of swing arm headers	6	
Volume of Media required	2090	m3
Sieve Area required	18.9	m2
Costs		
Construction and equipment co	1820000	$
Earthwork Cost	26000	$
Wall Concrete Cost	317000	$
Slab Concrete Cost	253000	$
Handrail Cost	26700	$
Installed Aerator Equipment	262000	$
Air Piping Cost	120000	$
Misc Costs	110000	$
Media Cost	688000	$
Screen Cost	20800	$
Operational labor cost	117000	$/yr
Maintenance labor cost	51400	$/yr
Material and supply cost	40100	$/yr
Chemical cost	0	$/yr
Energy cost	177000	$/yr
Amortization cost	203000	$/yr
Sludge Recycle Pumping		
Design Information		
Average daily pumping rate	0.857	MGD(US)
Total pumping capacity	1.71	MGD(US)
Design capacity per pump	595	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.857	MGD(US)
Quantities		
Operation labor required	431	pers-hrs/yr
Maintenance labor required	352	pers-hrs/yr
Electrical energy required	28700	kWh/yr
Volume of earthwork required	1870	cuft
Area of pump building	234	sqft
Costs		
Construction and equipment co	104000	$
Earthwork Cost	554	$
Pump Building Cost	25700	$
Installed Pump Cost	62100	$
Misc Costs	15900	$
Operational labor cost	22200	$/yr
Maintenance labor cost	14400	$/yr
Material and supply cost	730	$/yr
Chemical cost	0	$/yr
Energy cost	2870	$/yr
Amortization cost	9860	$/yr

Ultra-Violet Disinfection

Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calc	1.34	gal(US)/(min·W)
Total number of lamps needed	197	

Number of spare channels	1	
Total number of lamps used in	216	
Number of excess lamps	19	
Number of lamps/modules	2	
Number of modules/bank	3	
Number of banks/channel	3	
Number of channels	12	
Calculated headloss	4.99	in
Costs		
Construction and equipment cc	644000	$
Cost of installation	387000	$
Total cost of UV lamps	258000	$
Operational labor cost	0	$/yr
Maintenance labor cost	6650	$/yr
Material and supply cost	6440	$/yr
Chemical cost	2240	$/yr
Energy cost	16100	$/yr
Amortization cost	54600	$/yr

Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	1.34	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	1.34	cuyd/d
Maximum anticipated landfill dc	30	d
Anticipated sludge storage heig	8	ft
Sludge storage shed area	135	sqft
Width of sludge storage shed s	8.23	ft
Length of sludge storage shed	16.5	ft
Volume of earthwork required	513	cuft
Volume of slab concrete requir	249	cuft
Surface area of canopy roof	135	sqft
Round trip haul distance	20	miles
Round trips per day per truck	1	
Distance traveled per year per	5000	miles
Sludge hauled	1.18	ton(short)/d
Operation labor required	20.9	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment cc	289000	$
Earthwork Cost	152	$
Slab Concrete Cost	3220	$
Canopy Roof Cost	2710	$
Vehicle Cost	283000	$
Operational labor cost	1080	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	53600	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	61800	$/yr

Secondary Clarifier

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	5000	sqft
Surface area per circular clarifi	2500	sqft
Diameter of each circular clarif	57	ft
Number of clarifiers per battery	2	
Number of batteries	1	
Solids loading rate	14.3	lb/(sqft·d)
Hydraulic retention time	4.04	hr
Designed surface overflow rate	400	gal(US)/(sqft·d)
Weir length	500	ft
Volume of wasted sludge	19700	gpd(US)
Quantities		
Operation labor required	674	pers-hrs/yr
Maintenance labor required	369	pers-hrs/yr
Electrical energy required	9000	kWh/yr
Volume of earthwork required	62300	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	5190	cuft

Wall thickness	11.5	in
Volume of wall concrete requir	3820	cuft
Costs		
Construction and equipment cc	427000	$
Earthwork Cost	18500	$
Wall Concrete Cost	92000	$
Slab Concrete Cost	67300	$
Installed Equipment Cost	184000	$
Misc Costs	65200	$
Operational labor cost	34700	$/yr
Maintenance labor cost	15200	$/yr
Material and supply cost	4270	$/yr
Chemical cost	0	$/yr
Energy cost	900	$/yr
Amortization cost	39800	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0197	MGD(US)
Total pumping capacity	0.0197	MGD(US)
Design capacity per pump	6.85	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.0197	MGD(US)
Quantities		
Operation labor required	266	pers-hrs/yr
Maintenance labor required	202	pers-hrs/yr
Electrical energy required	667	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment cc	36800	$
Earthwork Cost	475	$
Pump Building Cost	22000	$
Installed Pump Cost	8700	$
Misc Costs	5620	$
Operational labor cost	13700	$/yr
Maintenance labor cost	8270	$/yr
Material and supply cost	258	$/yr
Chemical cost	0	$/yr
Energy cost	67	$/yr
Amortization cost	3480	$/yr

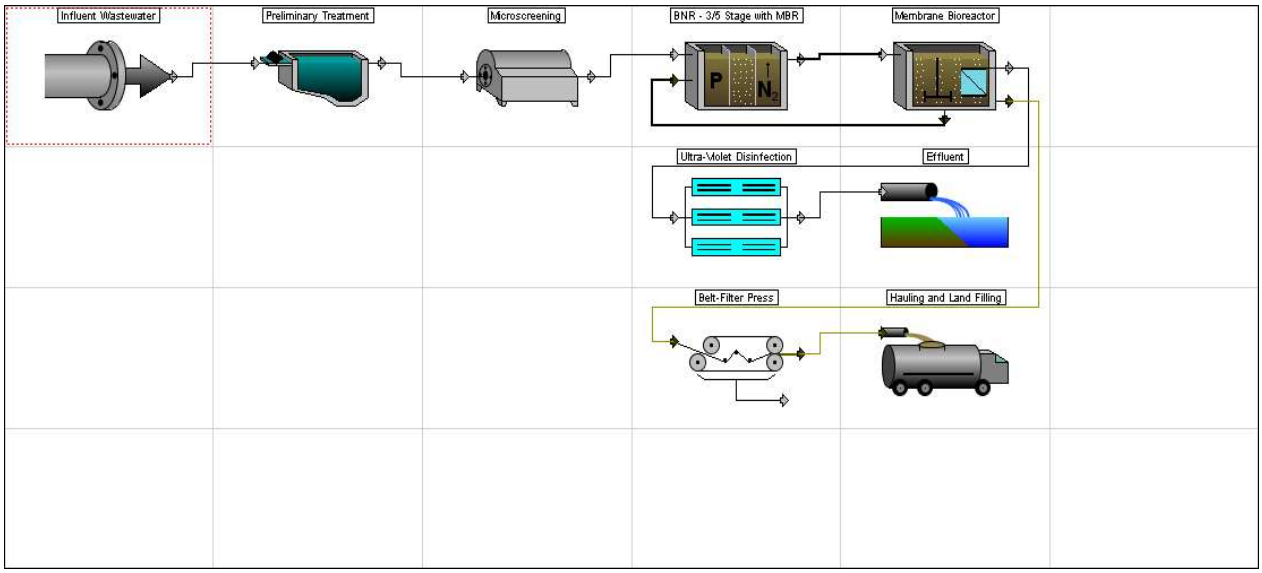
Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	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

Wolf Creek Water Reclamation Facility

Layout - Wolf Creek



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$5,000,000	$
Other direct construction costs	$1,330,000	$
Other indirect construction cos	$4,870,000	$
Total construction costs	$11,200,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$10,400	$/yr
Laboratory labor cost	$114,000	$/yr
Unit process operation labor c	$319,000	$/yr
Unit process maintenance labc	$153,000	$/yr
Total labor costs	$596,000	$/yr
MATERIAL COSTS		
Total material cost	$162,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$13,400	$/yr
ENERGY COSTS		
Total energy cost	$83,800	$/yr
Total operation and maintanen	$856,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$1,070,000	$/yr
Total annual project cost	$1,930,000	$/yr
PROJECT SUMMARY		
Present worth	$23,200,000	$
Total project cost	$11,200,000	$
Total operation labor cost	$443,000	$/yr
Total maintenance labor cost	$153,000	$/yr
Total material cost	$162,000	$/yr
Total chemical cost	$13,400	$/yr
Total energy cost	$83,800	$/yr
Total amortization cost	$1,070,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Preliminary Treatment	246000	24400	11200	6140	0	1160	20600
Microscreening	307000	4120	2070	27800	0	9770	32900
BNR - 3/5 Stage with MBR	759000	128000	64300	17500	0	29600	71000
Ultra-Violet Disinfection	215000	0	2170	2150	747	5360	18200

Belt-Filter Press	812000	732	143	0	2410	527	74300
Membrane Bioreactor	1890000	159000	72900	18200	10300	37400	251000
Effluent	0	0	0	0	0	0	0
Hauling and Land Filling	289000	3190	0	90400	0	0	61800
Blower System	486000	0	0	0	0	0	40700
Other Costs	6200000	124000	0	0	0	0	503000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	10	acre
Administration labor hours	203	hr/yr
Laboratory labor hours	2210	hr/yr
Costs		
DIRECT COSTS		
Mobilization	114000	$
Site preparation	217000	$
Site electrical	292000	$
Yard piping	204000	$
Instrumentation and control	131000	$
Lab and administration building	374000	$
Total direct construction costs	1330000	$
INDIRECT COSTS		
Cost of land	200000	$
Miscellaneous cost	364000	$
Legal cost	146000	$
Engineering design fee	1090000	$
Inspection cost	146000	$
Contingency	728000	$
Technical	146000	$
Interest during construction	1100000	$
Profit	950000	$
Total indirect construction cost	4870000	$
Total of other construction cos	6200000	$
LABOR COSTS		
Administration labor cost	10400	$/yr
Laboratory labor cost	114000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	3210	scfm
Safety factor	1.5	
Requested air flow capacity	4810	scfm
Total capacity of blowers	4810	scfm
Number of blowers in use	1	
Total number of blowers	2	
Capacity of individual blowers	4810	scfm
Estimated cost of an installed l	157000	$
Blower building area	1120	sqft
Costs		
Construction and equipment co	486000	$
Installed Blower Cost	314000	$
Building Cost	123000	$
Misc Costs	48200	$
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	40700	$/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	1.5	in
Slope of bars from horizontal	30	degrees
Head loss through screen	0.0206	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	0.308	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	3.08	cuft/s
Average flow	0.77	cuft/s
Minimum flow	0.462	cuft/s
Temperature	10	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	1.54	cuft/s
Width of channel	0.257	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.00952	
Allowance for currents	1.7	
Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	2	cuft/d
Costs		
Construction and equipment cc	246000	$
Operational labor cost	24400	$/yr
Maintenance labor cost	11200	$/yr
Material and supply cost	6140	$/yr
Chemical cost	0	$/yr
Energy cost	1160	$/yr
Amortization cost	20600	$/yr

Microscreening

Design Output Data

Description	Value	Units
Microscreening		
Design Information		
Microscreen loading rate	7	gal(US)/(sqft·min)
Quantity of wash water require	4	%
Area of microscreens required	198	sqft
Quantities		
Number of batteries	1	
Number of units/battery	2	
Drum diameter	6	ft
Drum width	6	ft
Area of selected unit	108	sqft
Area of building	155	sqft
Operation labor required	80	pers-hrs/yr
Maintenance labor required	51.5	pers-hrs/yr
Electrical energy required	97700	kWh/yr
Volume of wall concrete requir	2600	cuft
Volume of earthwork required	5850	cuft
Costs		
Construction and equipment cc	307000	$
Earthwork Cost	1730	$
Slab Concrete Cost	62500	$
Building Cost	17000	$
Installed Equipment Cost	186000	$
Misc Costs	40000	$
Operational labor cost	4120	$/yr
Maintenance labor cost	2070	$/yr
Material and supply cost	27800	$/yr
Chemical cost	0	$/yr
Energy cost	9770	$/yr
Amortization cost	32900	$/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	6490	mg/L
Calculated VSS:TSS ratio	0.721	mg VSS/mg SS
Total volume of anaerobic reac	11	m3
Total volume of anoxic reactor	266	m3
Total volume of aerobic reacto	277	m3
Total volume of all reactors	554	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	1	
Number of aerobic cells within	1	
Anaerobic hydraulic retention ti	0.14	hr
Anoxic hydraulic retention time	3.37	hr
Aerobic hydraulic retention tim	3.51	hr
Amount of sludge generated	199	kg/d
Sludge recycle ratio	300	%
Sludge recycle rate	5680	m3/d
Nitrogen required for biomass	12.9	mg/L
Phosphorus required for bioma	2.58	mg/L
Oxygen required to meet avera	397	kg/d
Air flow required to meet avera	659	N m3/hr
Design air flow	39.7	N m3/min/1000 m3
Quantities		
Operation labor required	1210	pers-hrs/yr
Maintenance labor required	567	pers-hrs/yr
Electrical energy required	162000	kWh/yr
Volume of earthwork required	24400	cuft
Volume of slab concrete requir	5040	cuft
Volume of wall concrete requir	4530	cuft
Handrail length	126	ft
Number of diffusers per train	106	
Fine bubble diffuser floor cove	14.5	%
Number of swing arm headers	1	
Required mixing power	5.2	kW
Total number of mixers	4	
Design mixing power per mixe	1.49	kW
Mixing power for each unaerat	1.3	kW
Costs		
Construction and equipment co	356000	$
Earthwork Cost	7220	$
Wall Concrete Cost	109000	$
Slab Concrete Cost	65400	$
Handrail Cost	9450	$
Installed Aerator Equipment	53800	$
Air Piping Cost	17600	$
Installed Mixer Equipment C	58000	$
Misc Costs	35300	$
Operational labor cost	62500	$/yr
Maintenance labor cost	22800	$/yr
Material and supply cost	14700	$/yr
Chemical cost	0	$/yr
Energy cost	16200	$/yr
Amortization cost	32800	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	0.75	MGD(US)
Total pumping capacity	0.75	MGD(US)
Design capacity per pump	260	gpm(US)
Number of pumps	6	
Number of batteries	1	
Firm pumping capacity	0.75	MGD(US)
Quantities		
Operation labor required	424	pers-hrs/yr
Maintenance labor required	345	pers-hrs/yr
Electrical energy required	50300	kWh/yr
Volume of earthwork required	1720	cuft
Area of pump building	215	sqft
Costs		
Construction and equipment co	159000	$
Earthwork Cost	1020	$
Pump Building Cost	47300	$
Installed Pump Cost	86300	$
Misc Costs	24200	$
Operational labor cost	21800	$/yr
Maintenance labor cost	13900	$/yr
Material and supply cost	1110	$/yr
Chemical cost	0	$/yr
Energy cost	5030	$/yr
Amortization cost	15000	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	1	MGD(US)
Total pumping capacity	1	MGD(US)
Design capacity per pump	347	gpm(US)
Number of pumps	6	
Number of batteries	1	
Firm pumping capacity	1	MGD(US)
Quantities		

Operation labor required	440	pers-hrs/yr
Maintenance labor required	360	pers-hrs/yr
Electrical energy required	67000	kWh/yr
Volume of earthwork required	1760	cuft
Area of pump building	220	sqft
Costs		
Construction and equipment cc	174000	$
Earthwork Cost	1040	$
Pump Building Cost	48300	$
Installed Pump Cost	98000	$
Misc Costs	26500	$
Operational labor cost	22700	$/yr
Maintenance labor cost	14500	$/yr
Material and supply cost	1220	$/yr
Chemical cost	0	$/yr
Energy cost	6700	$/yr
Amortization cost	16400	$/yr
Sludge Recycle Pumping		
Design Information		
Average daily pumping rate	0.5	MGD(US)
Total pumping capacity	0.5	MGD(US)
Design capacity per pump	174	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.5	MGD(US)
Quantities		
Operation labor required	403	pers-hrs/yr
Maintenance labor required	325	pers-hrs/yr
Electrical energy required	16800	kWh/yr
Volume of earthwork required	1680	cuft
Area of pump building	210	sqft
Costs		
Construction and equipment cc	70400	$
Earthwork Cost	497	$
Pump Building Cost	23100	$
Installed Pump Cost	36100	$
Misc Costs	10700	$
Operational labor cost	20700	$/yr
Maintenance labor cost	13100	$/yr
Material and supply cost	493	$/yr
Chemical cost	0	$/yr
Energy cost	1680	$/yr
Amortization cost	6660	$/yr

Ultra-Violet Disinfection

Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calc	2.12	gal(US)/(min·W)
Total number of lamps needed	49	
Number of spare channels	1	
Total number of lamps used in	72	
Number of excess lamps	23	
Number of lamps/modules	2	
Number of modules/bank	3	
Number of banks/channel	3	
Number of channels	4	
Calculated headloss	10.8	in
Costs		
Construction and equipment cc	215000	$
Cost of installation	129000	$
Total cost of UV lamps	85900	$
Operational labor cost	0	$/yr
Maintenance labor cost	2170	$/yr
Material and supply cost	2150	$/yr
Chemical cost	747	$/yr
Energy cost	5360	$/yr
Amortization cost	18200	$/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	12.4	gpm(US)
Final solids content	19	%
Solids capture fraction	0.992	
Quantities		

Operation labor required	14.2	pers-hrs/yr
Maintenance labor required	3.55	pers-hrs/yr
Power	5270	kWh/yr
Polymer required	1860	lb/yr
Dry solids produced	509	lb/d
Belt filter(s)	275000	$
Building	279000	$
Installation	68800	$
Polymer system	82500	$
Feed pumps	30300	$
Conveyor system	77000	$
Costs		
Construction and equipment cc	812000	$
Building Cost	279000	$
Polymer System Cost	82500	$
Feed Pumps Cost	30300	$
Conveyor System Cost	77000	$
Installed Belt Filter	344000	$
Operational labor cost	732	$/yr
Maintenance labor cost	143	$/yr
Material and supply cost	0	$/yr
Chemical cost	2410	$/yr
Energy cost	527	$/yr
Amortization cost	74300	$/yr

Membrane Bioreactor

Design Output Data

Description	Value	Units
Membrane Bioreactor		
Design Information		
Total volume of reactors	12400	cuft
Length of parallel train	22.4	ft
Width of parallel train	11.2	ft
Sidewater depth	16.4	ft
Number of batteries	1	
Number of parallel trains per b	3	
Total Membrane Area	15800	m2
Total Scour Air Requirement	3150	N m3/hr
Quantities		
Operation labor required	2380	pers-hrs/yr
Maintenance labor required	1250	pers-hrs/yr
Electrical energy required	359000	kWh/yr
Volume of earthwork required	15800	cuft
Volume of slab concrete requir	3170	cuft
Volume of wall concrete requir	4400	cuft
Handrail length	253	ft
Number of diffusers per train	78	
Number of swing arm headers	1	
Costs		
Construction and equipment cc	1680000	$
Earthwork Cost	4680	$
Wall Concrete Cost	106000	$
Slab Concrete Cost	41100	$
Handrail Cost	19000	$
Membrane Cost	1360000	$
Installed Aerator Equipment	69000	$
Air Piping Cost	43000	$
Misc Cost	38700	$
Operational labor cost	123000	$/yr
Maintenance labor cost	50200	$/yr
Material and supply cost	16800	$/yr
Chemical cost	10300	$/yr
Energy cost	35900	$/yr
Amortization cost	231000	$/yr
Permeate Pumping		
Design Information		
Average daily pumping rate	0.25	MGD(US)
Total pumping capacity	1	MGD(US)
Design capacity per pump	386	gpm(US)
Number of pumps	6	
Number of batteries	1	
Firm pumping capacity	2.22	MGD(US)
Quantities		
Operation labor required	488	pers-hrs/yr
Maintenance labor required	405	pers-hrs/yr
Electrical energy required	15100	kWh/yr
Volume of earthwork required	1780	cuft
Area of pump building	222	sqft
Costs		
Construction and equipment cc	180000	$
Earthwork Cost	1050	$
Pump Building Cost	48800	$

Installed Pump Cost	103000	$
Misc Costs	27500	$
Operational labor cost	25100	$/yr
Maintenance labor cost	16300	$/yr
Material and supply cost	1260	$/yr
Chemical cost	0	$/yr
Energy cost	1510	$/yr
Amortization cost	17000	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.00426	MGD(US)
Total pumping capacity	0.00426	MGD(US)
Design capacity per pump	1.48	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.00426	MGD(US)
Quantities		
Operation labor required	218	pers-hrs/yr
Maintenance labor required	161	pers-hrs/yr
Electrical energy required	145	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment cc	31800	$
Earthwork Cost	474	$
Pump Building Cost	22000	$
Installed Pump Cost	4430	$
Misc Costs	4840	$
Operational labor cost	11200	$/yr
Maintenance labor cost	6470	$/yr
Material and supply cost	222	$/yr
Chemical cost	0	$/yr
Energy cost	14	$/yr
Amortization cost	3000	$/yr

Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	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	1.32	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	30	miles
Quantities		
Total sludge volume hauled	1.32	cuyd/d
Maximum anticipated landfill dc	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	134	sqft
Width of sludge storage shed s	8.18	ft
Length of sludge storage shed	16.4	ft
Volume of earthwork required	508	cuft
Volume of slab concrete requir	246	cuft
Surface area of canopy roof	134	sqft
Round trip haul distance	60	miles
Round trips per day per truck	1	
Distance traveled per year per	15000	miles
Sludge hauled	1.17	ton(short)/d
Operation labor required	62	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment cc	289000	$
Earthwork Cost	151	$
Slab Concrete Cost	3190	$
Canopy Roof Cost	2680	$
Vehicle Cost	283000	$
Operational labor cost	3190	$/yr

Maintenance labor cost	0	$/yr
Material and supply cost	90400	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	61800	$/yr