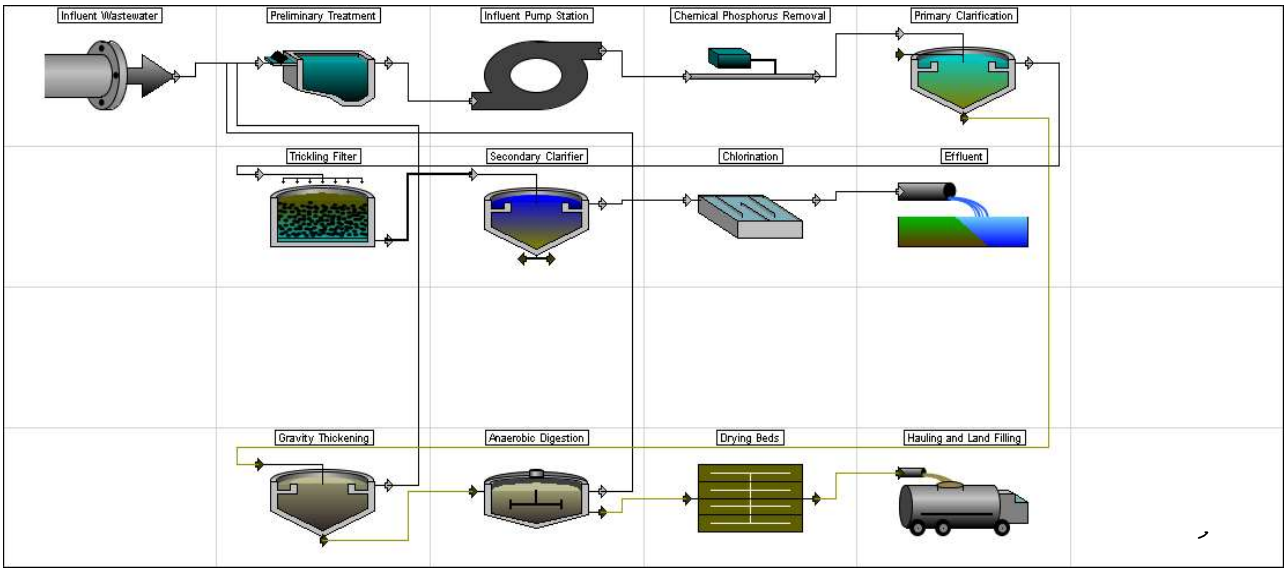
Layout South Davis North



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 battery	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