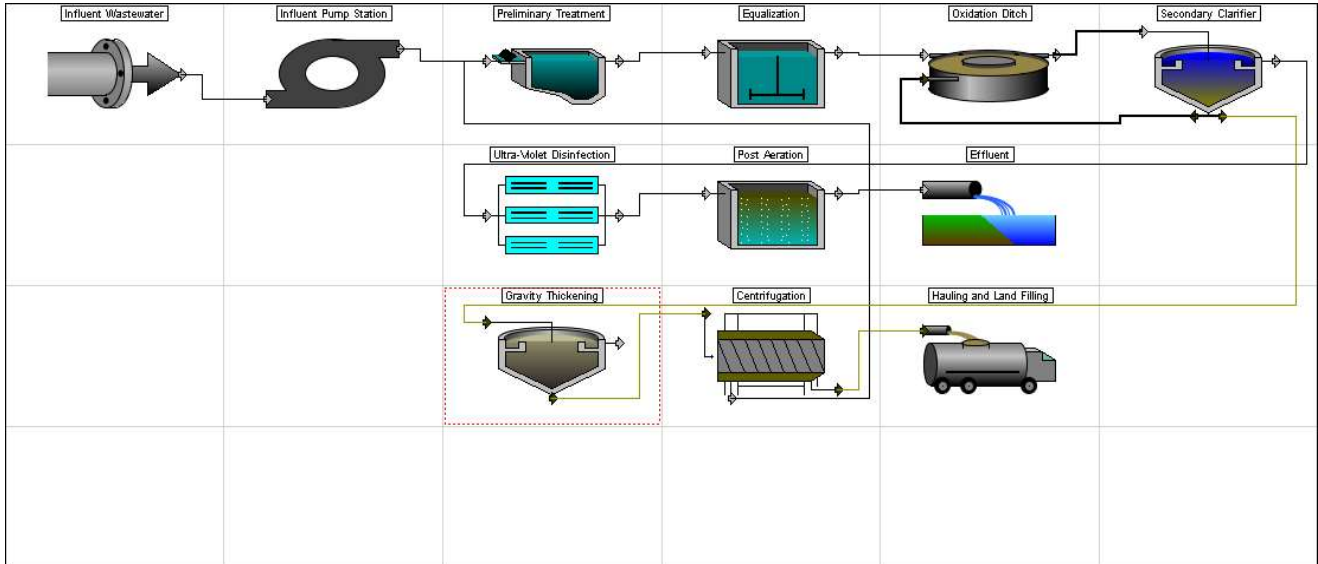


**Layout - St George City**



**Summary**

**Equipment Database**

Hydromantis 2014,(USA Avg)

**Layout Summary**

Description	Value	Units
<b>CONSTRUCTION COSTS</b>		
Unit process construction cost:	\$49,600,000	\$
Other direct construction costs	\$14,200,000	\$
Other indirect construction costs	\$47,800,000	\$
<b>Total construction costs</b>	<b>\$112,000,000</b>	<b>\$</b>

**ANNUAL COSTS**

**LABOR COSTS**

Administration labor cost	\$165,000	\$/yr
Laboratory labor cost	\$194,000	\$/yr
Unit process operation labor cost	\$1,830,000	\$/yr
Unit process maintenance labor cost	\$466,000	\$/yr
<b>Total labor costs</b>	<b>\$2,650,000</b>	<b>\$/yr</b>

**MATERIAL COSTS**

Total material cost	\$634,000	\$/yr
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**CHEMICAL COSTS**

Total chemical cost	\$161,000	\$/yr
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**ENERGY COSTS**

Total energy cost	\$2,560,000	\$/yr
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Total operation and maintenance	\$6,000,000	\$/yr
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**CONSTRUCTION COST AMC**

Amortization cost for total construction	\$9,750,000	\$/yr
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<b>Total annual project cost</b>	<b>\$15,800,000</b>	<b>\$/yr</b>
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**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 costs	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 required	357000	cuft
Volume of wall concrete required	93200	cuft
Capacity per pump	35100	gpm(US)
Number of constant speed pumps	2	
Number of variable speed pumps	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 cost	11000000 \$
Earthwork Cost	1080000 \$
Wall Concrete Cost	2240000 \$
Slab Concrete Cost	4630000 \$
Building Cost	144000 \$
Installed Pump Equipment Cost	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 cost	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 calculation	0.294	gal(US)/(min·W)
System is not headloss constr		
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 cost	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	lbO <sub>2</sub> /(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
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Post Aeration by Diffused Aeration

Design Information

Dissolved oxygen in influent	2 mg/L
Desired dissolved oxygen in effluent	5 mg/L
Correction factor for pressure	1
Minimum dissolved oxygen in tank	2 mg/L
Oxygen saturation at summer temperature	8.5 mg/L
Oxygen required	418 lb/d
Operating transfer efficiency	2.95 lbO <sub>2</sub> /(HP·h)
Total volume of aerobic reactor	232000 gal(US)
Air flow rate required to meet oxygen demand	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 lines	3
Volume of wall concrete required	2220 cuft
Volume of slab concrete required	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 cost	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
<b>Centrifugation</b>		
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 cost	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 mixing	1450	pers-hrs/yr
Total operation labor required	8100	pers-hrs/yr
Costs		
Construction and equipment cost	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 winter	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	m <sup>3</sup>
Ditch length	168	m
Ditch width	27.8	m
Sidewater depth	3.66	m
Number of batteries	4	
Number of parallel ditches per battery	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 battery	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/m <sup>3</sup> /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	gCaCO <sub>3</sub> /m <sup>3</sup>
Amount of sludge generated	13100	kg/d
Sludge recycle rate	21500	m <sup>3</sup> /d
Nitrogen requirement for biomass	14.3	mg/L
Phosphorus requirement for biomass	2.86	mg/L
Oxygen requirement to meet aeration	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 battery	12100	cuft
Volume of wall concrete required per battery	41100	cuft
Volume of slab concrete required per battery	67100	cuft
Length of adjustable weir	67.1	ft
Volume of concrete required per battery	288	cuft
Total handrail length	0	ft
Operation labor required	8800	pers-hrs/yr
Electrical energy required	14100000	kWh/yr
Costs		
Construction and equipment cost	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 cost	0	\$
Operational labor cost	0	\$/yr
Maintenance labor cost	0	\$/yr
Material and supply cost	0	\$/yr
Chemical cost	0	\$/yr
Energy cost	0	\$/yr
Amortization cost	0	\$/yr

### Hauling and Land Filling

#### Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	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 cc	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 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	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 cc	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 c	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