



Filtro percolador.

Computer Assisted Procedure for the Design and Evaluation of
Wastewater Treatment Systems

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Version 2.06

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* Gerencia de Tratamiento de Agua*
* Cda. de J. Sanchez Azcona #1723*
* Mexico, D.F. 03100 *
* 524-3795 *

Input data file: UTLA2.TXT

SMALL FACILITIES

IS NOT A VALID PROCESS CARD
LIQUID LINE
BLOCK PRELIM
BLOCK PRIMAR
BLOCK TRICKL
BLOCK FILTRA
BLOCK CHLORI
HLOR NOT A VALID PROCESS - ON BLOCK CARD
SECONDARY SLUDGE LINE
BLOCK BMIX
IX NOT A VALID PROCESS - ON BLOCK CARD
PRIMARY SLUDGE LINE
BLOCK AEROBI
BI NOT A VALID PROCESS - ON BLOCK CARD
BLOCK DRYING
NG NOT A VALID PROCESS - ON BLOCK CARD
WASTEWATER CHARACTERISTICS
AVERAGE FLOW 0.1386 MGD INITIAL 0.1386 MGD (GASTO = 6 L/SEG
TEMPERATURE SUMMER 17 WINTER 14 C
SUSPENDED SOLIDS 460 MG/L
VOLATILE SOLIDS 60 %
BOD5 581 MG/L



SBOD 250 MG/L
COD 1100 MG/L
SCOD 500 MG/L
PH 8.0
PO4 20 MG/L
TKN 51 MG/L
NH3 35 MG/L
OIL AND GREASE 94 MG/L
DESIRED EFFLUENT CHARACTERISTICS
UNIT COSTS (COSTOS COMUNES DE PLANTAS, ESTIMADOS)
EIGHT INCH PIPE 4.4 DLL/PIE CODO 44 D/U TEE 70.4 DLL/U VALV 770 DLL/UNID
BUILDING COST 22 DLL/PIE2 = 236.5 DLL/M2
WALL CONCRETE 22 DLL/YARDA3 = 286 DLL/M3
SLAB CONCRETE 99 DLL/YARDA3 = 129.8 DLL/M3
EXCAVATION COST 4.4 DLL/YARDA3 = 5.874 DLL/M3
ELECTRICITY .0495 DLL/KWHR
CRANE RENTAL 74 DLL/HR
LABOR RATE 7.2 DLL/HR
OPERATOR 5.5 DLL/HR
INSTALLATION LABOR RATE 7.7 DLL/HR
LAND COST 4057.5 DLL/ACRE (APROX. 10000 DIIs/HA)
MARSHALL AND SWIFT INDEX 1200 ESTIMADOS A SEPT. 1998
LARGE CITY EPA INDEX 320
ENGINEERING NEWS RECORD INDEX 6580.7
PIPE COST INDEX 595
END
CONTROL CARDS
ANALYSE
OUTPUT QUANTITIES
LIST TOTAL OF 10 TRAINS
GO I=10.00 NYD=20.00 NYC=1.5
1 COST ANALYSIS INPUT PARAMETERS
Interest rate 10.000 %
Planning period 20 years

0 UNIT PRICES AND COSTS INDICES
I Building 22.00 \$/sq ft
I Excavation 4.40 \$/cu yd
I Wall concrete 22.00 \$/cu yd
I Slab concrete 99.00 \$/cu yd
I Marshall and Swift index 1200.00
I Crane rental 74.00 \$/hr
I EPA construction cost index 320.00
D Canopy roof 15.75 \$/sq ft
I Labor rate 7.20 \$/hr
I Operator class II 5.50 \$/hr
I Electricity 0.05 \$/kWhr
D Chemical costs
Lime 0.03 \$/lb
Alum 0.04 \$/lb
Iron salts 0.06 \$/lb
Polymer 1.62 \$/lb
I Engineering News Record cost index 6580.70
D Handrail 25.20 \$/ft
I Pipe cost index 595.00
I Pipe installation labor rate 0.00 \$/hr
I Eight inch pipe 4.40 \$/ft



I Eight inch pipe bend 44.00 \$/unit
 I Eight inch pipe tee 70.40 \$/unit
 I Eight inch pipe valve 770.00 \$/unit
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0 ANALYZE 1 TRAIN No 1

0 INFLUENT

LIQUID CHARACTERISTICS

FLOW (MGD)	SOLIDS (mg/l)	(mg/l)	(mg/l)
Maximum 0.1386	Suspended 460.00	BOD5 581.00	TKN 51.00
Average 0.1386	Volatile 60.00 %	BOD5S 250.00	NH3 35.00
Minimum 0.1386	Settleable 15.00	COD 1100.00	NO2 0.00
		CODS 500.00	NO3 0.00
Temp (W) 14.0 C	Oil & grease 94.00	PO4 20.00	
Temp (S) 17.0 C	Cations 160.00		
pH 8.0	Anions 160.00		

0 SLUDGE CHARACTERISTICS

	Primary	Secondary	Chemical
Volume (gal/d)	0.00	0.00	0.00
% Solids	0.00	0.00	0.00
% Volatile	0.00	0.00	0.00

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0 ANALYZE 1 TRAIN No 1

0BAR SCREENS

0D Wet weather flow factor	0.350E+01
Wet weather flow	0.485E+00 MGD
D Maximum head loss through screens	0.500E+00 feet
D Bar spacing	0.100E+01 inches
D Width of bars	0.313E+00 inches
D Bar shape factor	0.167E+01
D Slope of bars	0.100E+02 degrees
Width of channel	0.200E+01 feet
Depth of channel	0.216E+01 feet

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0 ANALYZE 1 TRAIN No 1

0QUANTITIES FOR BAR SCREENS

0 Length of channel	0.140E+02 feet
Volume of earthwork	0.342E+03 cu ft
Volume of wall concrete	0.658E+02 cu ft
Volume of slab concrete	0.543E+02 cu ft
Operation manpower	0.317E+01 pers-hrs/yr
Maintenance manpower	0.801E+01 pers-hrs/yr
Energy requirement	0.727E+03 kWhr/yr
O & M material and supply cost	0.200E+01 %

LIQUID CHARACTERISTICS

FLOW (MGD)	SOLIDS (mg/l)	(mg/l)	(mg/l)
Maximum 0.1386	Suspended 460.00	BOD5 581.00	TKN 51.00



LIQUID CHARACTERISTICS

FLOW (MGD) SOLIDS (mg/l) (mg/l) (mg/l)
Maximum 0.1386 Suspended 193.20 BOD5 395.08 TKN 48.45
Average 0.1386 Volatile 60.00 % BOD5S 250.00 NH3 35.00
Minimum 0.1386 Settleable 0.00 COD 660.00 NO2 0.00
CODS 500.00 NO3 0.00
Temp (W) 14.0 C Oil & grease 94.00 PO4 19.00
Temp (S) 17.0 C Cations 160.00
pH 8.0 Anions 160.00

0 SLUDGE CHARACTERISTICS

Primary Secondary Chemical
Volume (gal/d) 880.44 0.00 0.00
% Solids 4.00 0.00 0.00
% Volatile 60.00 0.00 0.00

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0 ANALYZE 1 TRAIN No 1

0TRICKLING FILTRATION

0D Solid production rate 0.650E+00 lb/lb BOD
D Hydraulic loading rate 0.750E+00
D Surfpac media
D Specific surface area 0.260E+02 sq ft/cu ft
Reaction rate constant 0.179E-02
Recirculation ratio 0.980E+00
Total hydraulic loading rate 0.149E+01 gal/min-sq ft
Depth of filter tower 0.275E+02 feet
Number of stages 2
Surface area of filter 0.128E+03 sq ft
Media volume 0.705E+04 cu ft

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0QUANTITIES FOR TRICKLING FILTER

0 Number of towers 2
Volume per filter tower 0.352E+04 cu ft
Diameter of filter tower 0.128E+02 feet
Total number of posts 3
Total length of precast beams 0.452E+02 feet
Total reinforced wall concrete 0.339E+04 cu ft
Total reinforced slab concrete 0.171E+03 cu ft
Total earthwork required 0.507E+04 cu ft
Operational manpower 0.706E+02 pers-hr/year
Maintenance manpower 0.693E+02 pers-hr/year

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0 ANALYZE 1 TRAIN No 1

0QUANTITIES FOR RECYCLE PUMPING

0Average daily pumping rate 0.924E-01 MGD
Total pumping capacity 0.274E+00 MGD
Design capacity per pump 0.953E+02 gpm
Number of pumps 3
Number of batteries 1
Area of pump building 0.205E+03 sq ft
Volume of earthwork required 0.164E+04 cu ft



Firm pumping capacity 0.924E-01 MGD
 Operating manpower required 0.324E+03 pers-hours/yr
 Maintenance manpower required 0.253E+03 pers-hours/yr
 Electrical energy required 0.623E+04 kWhr/yr
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0 ANALYZE 1 TRAIN No 1

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0SECONDARY CLARIFIER FOR TRICKLING FILTRATION

0 Circular Clarifier
 0 Solids loading rate 0.107E+02 lb/sq ft-day
 D Surface overflow rate 0.800E+03 gal/sq ft-day
 Detention time 0.202E+01 hours
 D Weir overflow rate 0.150E+05 gal/ft-day
 D Tank sidewater depth 0.900E+01 feet
 Weir length 0.183E+02 feet
 Volume of wasted sludge 0.222E+03 gal/day
 D Underflow concentration 0.300E+01 %
 Total surface area 0.173E+03 sq ft

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0 ANALYZE 1 TRAIN No 1

0QUANTITIES FOR SEDIMENTATION

0CIRCULAR CLARIFIER

0SECONDARY CLARIFIER

Excess capacity factor 0.100E+01
 Calculated surface area 0.173E+03 sq ft
 Adjusted surface area 0.173E+03 sq ft
 Average daily wastewater flow 0.139E+00 MGD
 Number of circular clarifiers 2
 Number of batteries 1
 Surface area per unit 0.866E+02 sq ft
 Diameter of unit 0.110E+02 feet
 Earthwork required 0.422E+04 cu ft
 Sidewater depth 0.900E+01 feet
 Thickness of the slab 0.101E+02 inches
 Wall thickness 0.115E+02 inches
 Total wall concrete required 0.914E+03 cu ft
 Total slab concrete required 0.314E+03 cu ft
 Maintenance manpower required 0.200E+03 pers-hours/yr
 Operation manpower required 0.350E+03 pers-hours/yr
 Electrical energy required 0.750E+04 kWhr/yr

LIQUID CHARACTERISTICS

FLOW (MGD)	SOLIDS (mg/l)	(mg/l)	(mg/l)	(mg/l)
Maximum 0.1386	Suspended 20.00	BOD5 30.00	TKN 33.92	
Average 0.1386	Volatile 80.00 %	BOD5S 15.00	NH3 33.92	
Minimum 0.1386	Settleable 0.00	COD 45.00	NO2 0.00	
		CODS 22.50	NO3 14.54	
Temp (W) 14.0 C	Oil & grease 0.00	PO4 13.30		
Temp (S) 17.0 C	Cations 160.00			
pH 8.0	Anions 160.00			

0 SLUDGE CHARACTERISTICS



	Primary	Secondary	Chemical
Volume (gal/d)	880.44	221.76	0.00
% Solids	4.00	3.00	0.00
% Volatile	60.00	80.00	0.00

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0 ANALYZE 1 TRAIN No 1

0PACKAGE PLANT GRAVITY FILTRATION

0I Hydraulic loading rate	0.500E+01 gpm/sq ft
I Number of filter cells	4
D Minimum backwash rate	0.200E+02 gpm/sq ft
D Minimum backwash period	0.100E+02 min
I Number of backwash volumes	2
Filter area required (hydraulic loading)	0.192E+02 sq ft
Filter area required (peak flow)	0.257E+02 sq ft
Design filter surface area	0.257E+02 sq ft
Volume of backwash surge tank	0.343E+03 cu ft

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0 ANALYZE 1 TRAIN No 1

0QUANTITIES FOR GRAVITY FILTRATION

0 Volume of reinforced slab concrete	0.696E+02 cu ft
Volume of reinforced wall concrete	0.445E+03 cu ft
Width of backwash surge tank	0.495E+01 feet
Length of backwash surge tank	0.990E+01 feet
Volume of earthwork required	0.529E+04 cu ft
Electrical energy required	0.120E+04 kWhr/year
Maintenance manpower required	0.136E+03 pers-hours/year
Operation manpower required	0.208E+03 pers-hours/year
O & M material and supply costs	0.500E+01 %

LIQUID CHARACTERISTICS

FLOW (MGD)	SOLIDS (mg/l)	(mg/l)	(mg/l)
Maximum 0.1386	Suspended 8.00	BOD5 15.00	TKN 33.92
Average 0.1386	Volatile 80.00 %	BOD5S 15.00	NH3 33.92
Minimum 0.1386	Settleable 0.00	COD 22.50	NO2 0.00
		CODS 22.50	NO3 14.54
Temp (W) 14.0 C	Oil & grease 0.00	PO4 13.30	
Temp (S) 17.0 C	Cations 160.00		
pH 8.0	Anions 160.00		

0 SLUDGE CHARACTERISTICS

	Primary	Secondary	Chemical
Volume (gal/d)	880.44	221.76	0.00
% Solids	4.00	3.00	0.00
% Volatile	60.00	80.00	0.00

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0 ANALYZE 1 TRAIN No 1

0LIQUID PREL 0 PRIM 0 TRIC 0 FILT 0

0 ==> COST SUMMARY <==



0	OPER	MAINT	TOTAL						
UNIT	CAPITAL COST	AMMORT COST	LABOR COST	LABOR COST	POWER COST	MATERIAL COST	CHEMICAL COST	O & M	
	\$	\$/yr	\$/yr	\$/yr	\$/yr	\$/yr	\$/yr		
SCREENS	33994	3989	16	30	35	679	0	760	
PRIM CLA	79673	8662	1867	758	371	796	0	3792	
TRIC FIL	225176	24483	376	262	0	1758	0	2396	
T SEC CL	86509	9406	1867	758	371	865	0	3861	
RCY PUMP	70640	8021	1728	960	308	494	0	3490	
FILTRATI	295524	34696	1108	515	59	11746	0	13428	
0SUB TOTAL	791518	89259	6964	3285	1146	16341	0	27727	

0DIRECT COSTS

Control and instrument 7 \$
 Profit/overhead 174135 \$

0 SUB TOTAL (OTHER DIRECT) 174142 \$ TOTAL CONSTRUCTION COST 965660 \$

0INDIRECT COSTS

Misc non const costs 48283 \$
 Admin/legal 19313 \$
 201 planning 33798 \$
 A/E design fee 73050 \$
 Inspection 19313 \$
 Contingencies 77252 \$
 Technical costs 19313 \$

0 SUB TOTAL (INDIRECT) 290322 \$

0LAND COSTS 36517 \$ 9. acres

INTEREST DURING CONSTRUCTION 96937 \$

0ADMINISTRATIVE COST 2142 \$/yr

LABORATORY COST 10987 \$/yr

0TOTAL PROJECT COST 1389436 \$ TOTAL CONSTRUCTION COST 965660 \$

FINAL YEAR O & M 40869 \$/yr TOTAL STEP III COST 1282588 \$

INITIAL YEAR O & M 40869 \$/yr PRESENT WORTH (APP. A) 1704069 \$

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0 ANALYZE 1 TRAIN No 1

0USER CHARGE SUMMARY

D EPA grant 0.750E+02 %
 D State grant 0.000E+00 %
 D Allowance for financing 0.300E+01 %
 Bonds Percent Rate Life
 D Revenue 100.00 10.00 30
 D General obligation 0.00 0.00 30
 D Other 0.00 0.00 30
 D Number of billing units 0.506E+05 \$/T gal
 D Existing sewer rate 0.000E+00
 D Persons per household 0.350E+01
 D Gallons/capita/day (water use) 0.100E+03 gal/cap-day
 D Current annual O & M cost 0.000E+00 \$/year
 Total project cost 0.139E+07 \$
 EPA Eligible cost 0.135E+07 \$
 Local share 0.385E+06 \$
 Annual debt service 0.408E+05 \$/year
 Principal and interest reserve 0.583E+04 \$/year
 Contingency reserve 0.583E+04 \$/year
 Total annual operating cost 0.934E+05 \$/year
 Treatment cost



Cost per 1000 gallons treated (new system) 0.185E+01 \$/T gal
Cost per 1000 gallons treated (total system) 0.185E+01 \$/T gal
Cost per billing unit (new system) 0.185E+01 \$/T gal
Cost per billing unit (total system) 0.185E+01 \$/T gal
Cost per household (new system) 0.194E+02 \$/month
Cost per household (total system) 0.194E+02 \$/month

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1

0	Present TRN	Project TRN	Construct TRN	O&M TRN	Energy TRN				
Worth #	Cost #	Cost #	Cost #	Cost #					
1704069	1	1389436	1	965660	1	40869	1	1146	1

0TRAIN N 1

LIQUID PREL 0 PRIM 0 TRIC 0 FILT 0