LONGVIEW VALUE ENGINEERING STUDY
WATER SUPPLY ALTERNATIVES

VE IDEA NUMBER: N1

DESCRIPTION: Use conventional filtration at Mint Farm

EVALUATED BY: Wesner, Hansen

ORIGINAL CONCEPT:
New 20 mgd microfiltration plant to treat groundwater produced from new wells at the Mint Farm. Chemicals for iron and manganese removal and membrane replacement were not included in the O&M cost.

PROPOSED ALTERNATIVE:
New 20 mgd mixed media gravity filtration plant to treat groundwater from new wells at the Mint Farm. Includes chemical conditioning for iron, manganese and arsenic removal.
See attached sketch of layout of plant and attached detailed cost estimate.

(Alternative Two – build first phase of 15 mgd and defer some portions of the plant needed to achieve the 5 mgd expansion)

ADVANTAGES:
Less complex system
Less electricity and chemical use
Uses the technology most widely used for iron and manganese removal

DISADVANTAGES:
None apparent

		20 mgd	15 mgd + 5 mgd phases
	ORIGINAL	ALTERNATIVE ONE	ALTERNATIVE TWO
INITIAL COST	$29,700,000[1]	$24,979,000	$23,379,000
INITIAL SAVINGS	XXXXXXXXXXXXXXXXX	$4,721,000	$6,321,000
ANNUAL COST	$2,644,760[2]	$1,180,000	$1,180,000
ANNUAL SAVINGS	XXXXXXXXXXXXXXXXX	$1,464,760	$1,464,760
PW SAVINGS	XXXXXXXXXXXXXXXXX	$21,126,000	$22,726,000

[1]VE team estimate of membrane filtration system cost
[2]PACE O&M costs adjusted include chemical costs for oxidizing iron and manganese, membrane replacement (10-year interval) and other maintenance materials

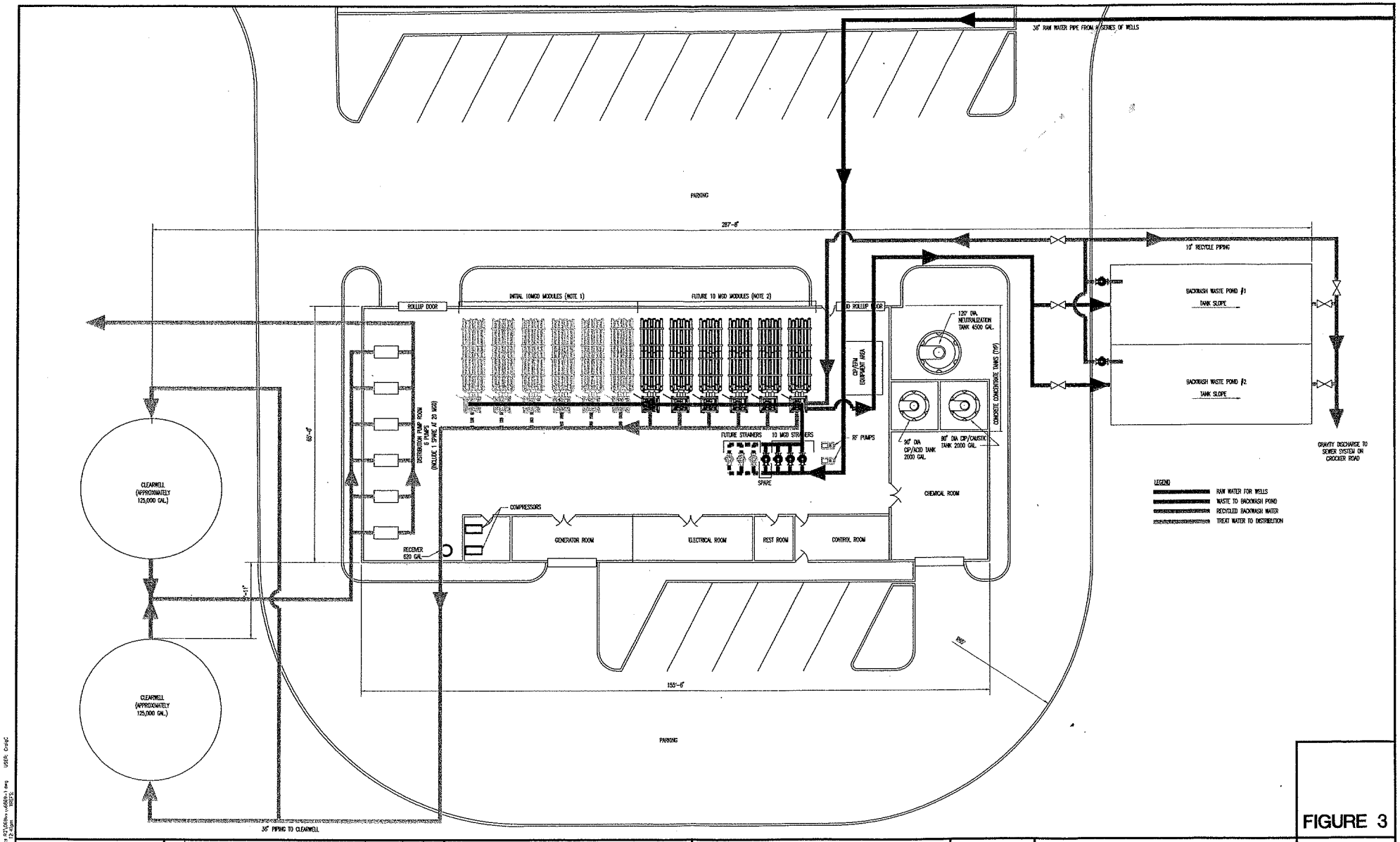


FIGURE 3

DESIGNED RPB
DRAWN CDC
CHECKED –
APPROVED BY

SYM	REVISION	DATE	BY	APP'D

PACE
An Engineering Services Company
1300 John Adams Street
Oregon City, OR 97045
p. 503.655.1342 | f. 503.655.1360
Civil | Structural | Planning | Survey
paceengrs.com

CITY OF LONGVIEW
SOURCE STUDY

DATE 06-05-06
SCALE 3/32"=1'-0"

SITE LAYOUT

JOB NUMBER 06869
SHEET NAME MODEL
SHEET 3 OF 3

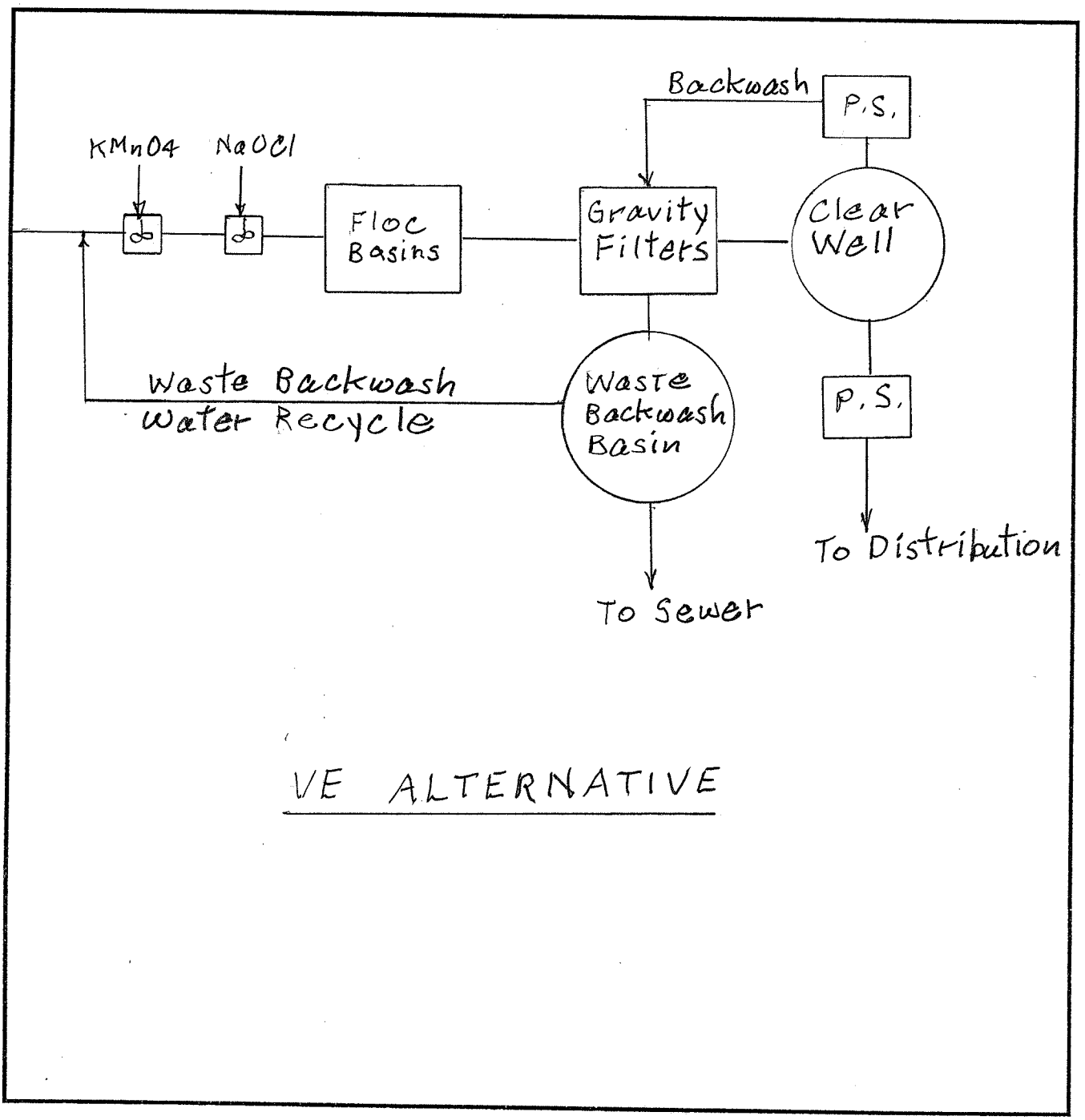
DWG L:\Land Projects\2\06869\civil\06869-1.dwg
DATE Sep 08, 2006 12:43pm
USER Craig

PACE ORIGINAL LAYOUT

WORKSHEET

No. - DESCRIPTION: N1- Use Conventional Filters

BY: Wesner



VE ALTERNATIVE

WORKSHEET

No. - DESCRIPTION: N1 - Use Conventional Filters

BY: Wesner

Original Design

20 mgd Microfiltration system - see Fig. 3, site Layout by PACE (attached)

VE Alternative

20 mgd Gravity Mixed Media filter system

See attached Flow Diagram

- Two Rapid Mix Basins - 1.0 min. Dt ea
- Potassium permanganate storage and feed system
- Sodium hypochlorite storage and feed system
- Flocculation Basins - 10 min. Dt
- Gravity Filters - Mixed Media - Concrete 8 filters @ 18 ft × 20 ft ea
- Waste Backwash Water Receiving Basin and Return Pump Station - 130,000 gal
- Wells, Clear Well, Distribution from original design

WORKSHEET

No. - DESCRIPTION: N1 - Use Conventional Filters

BY: Wesner

- Filter loading = 4.8 gpm/sq ft with all filters in service
  5.5 gpm/sq ft with one filter out of service
- Backwash rate = 17.0 gpm/sq ft

O & M

- Labor: Design: 3 people (ref. Table 8)
  VE: 2512 + 3255 = 5,767 hr/year
  with wells, say 3 people
- Electricity: Design: #1,289,730 (Table 8)
  VE: 6,073,941 kwh/yr plant
  Wells ≅ 20 mgd @ 30 ft TDH
  ≅ 870,000 kwh/yr
  say 7×10^6 kwh/yr
- Chemicals: Design: #21,310 (Table 8)
  VE: $KMnO_4$ @ 2.5 mg/L & #3,000/ton
  NaOCl @ 4.0 mg/L & #1,400/ton

O & M COST ESTIMATE
($1,000/year)

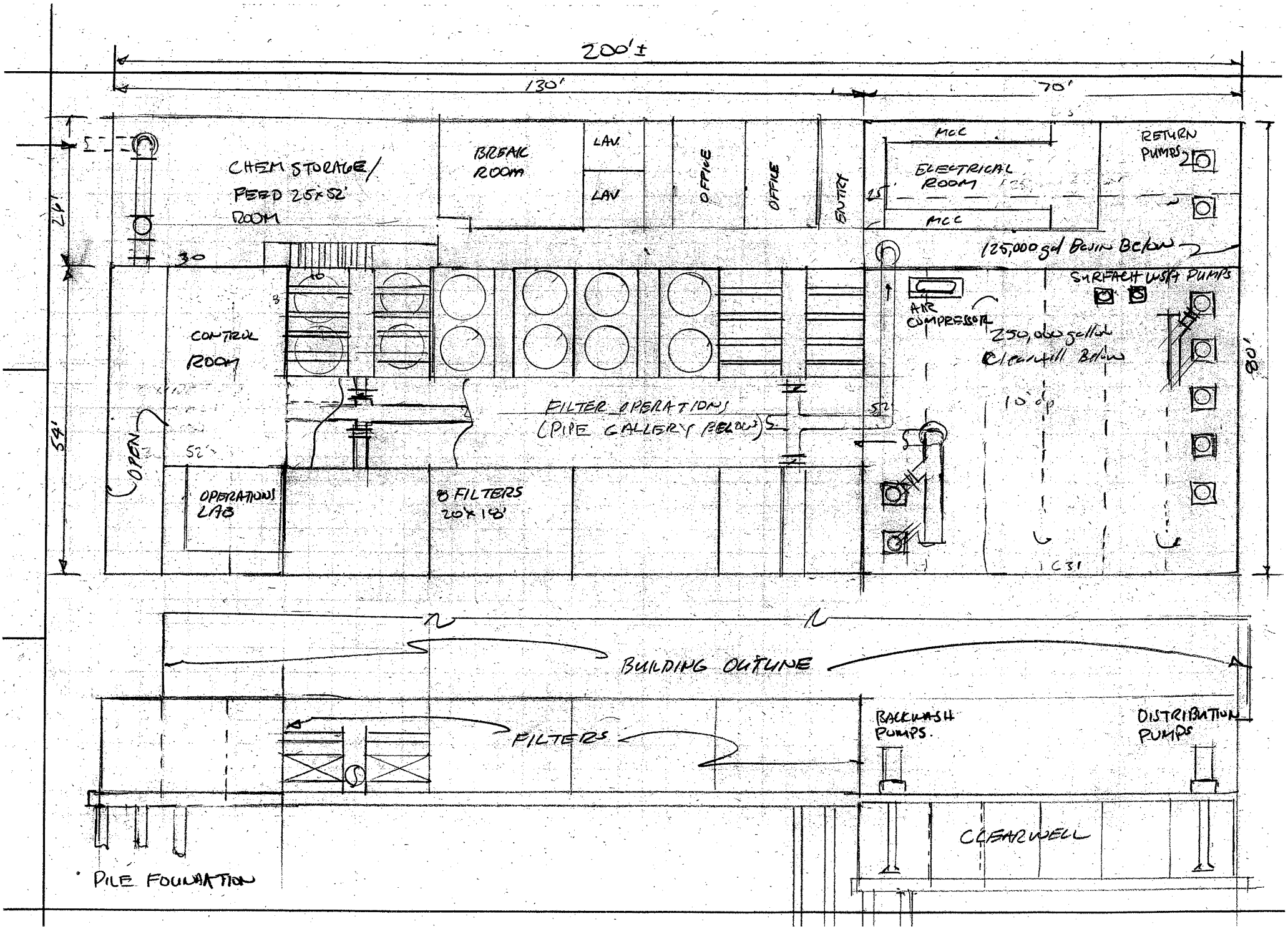
No. N 1

DESCRIPTION: Use Conventional Filters

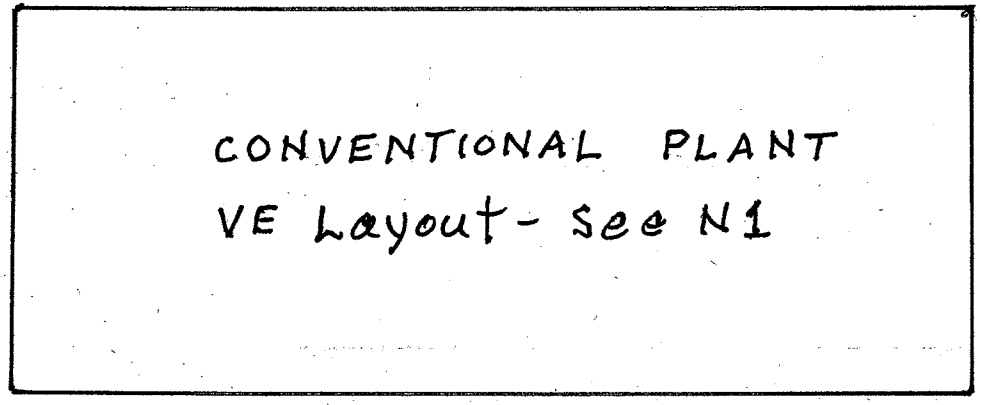
Item	Unit Cost	ORIGINAL DESIGN Quantity	ORIGINAL DESIGN Total	VE ALTERNATIVE Quantity	VE ALTERNATIVE Total
Labor 3 People	62/hr		386	6240	386
Electricity	0.05		Table 8	7×10^6	350
Fuel					
Material					44
Chemicals Permanganate			Table 8		400
& Hyochlorite in VE alt					
Other					

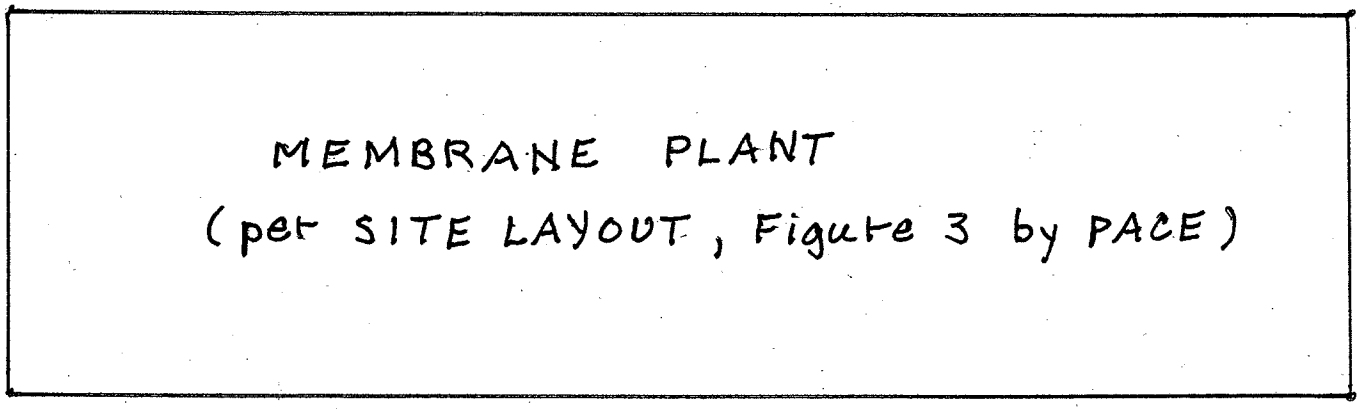
VE adjustment

	ORIGINAL DESIGN	VE ALTERNATIVE
TOTALS	1,801	1,180
+ chemicals	400	
+ membrane replacement	400	
+ other maint. materials	44	
	2,645	


200'±
130'
70'
CHEM STORAGE/
FEED 25x52'
ROOM
BREAK
ROOM
LAV.
LAV
OFFICE
OFFICE
ENTRY
MCC
ELECTRICAL
ROOM
MCC
RETURN
PUMPS
125,000 gal BELOW
SURFACE WASH PUMPS
AIR
COMPRESSOR
250,000 gallon
CLEARWELL BELOW
CONTROL
ROOM
FILTER OPERATIONS
(PIPE GALLERY BELOW)
OPEN
OPERATION/
LAB
8 FILTERS
20x18'
BUILDING OUTLINE
FILTERS
BACKWASH
PUMPS.
DISTRIBUTION
PUMPS
CLEARWELL
PILE FOUNDATION

RELATIVE PLANT FOOTPRINTS





VE TEAM ESTIMATE OF 20 MGD CONVENTIONAL FILTRATION TREATMENT PLANT FOR GROUNDWATER TREATMENT AT MINT FARM

	Unit Cost	Quantity	Est Cost
Site Work - Division 2			
Clear/Grub			$25,000
Excavation	$25/cy	3,200	$80,000
Structural fill for building pad	$30/cy	1200	$36,000
Gravel mat beneath basin	$30/cy	467	$1,401,000
Piling	$144/sf	16,000	$2,304,000
Grading/Paving	$250/sf	28,000	$70,000
Concrete			
Base slabs on grade	$600/cy	1232	$775,000
Basin walls/baffles	$1000/cy	1133	$1,133,000
Suspended slabs/walkway	$1200/cy	340	$408,000
Miscellaneous concrete	$600/cy	100	$60,000
CMU-8-inch interior walls	$25/sf	3699	$90,000
Preengineered steel building	$60/sf	14,920	$835,000
HVAC	$14/sf	14,920	$164,000
Painting of structure	$8/sf	14,920	$120,000
Interior partition walls, ceiling, gypsum over steel studs	$15/sf	2,000	$30,000
Laboratory cabinets, equipment			$25,000
Plumbing fixtures, trim			$5,000
Miscellaneous metals, walkways, grating, handrails			$200,000
Mechanical			
36" supply piping, FBWSP with side tees	$1000/ft	90	$90,000
36" inlet pipe fittings			$65,000
30" backwash waste, FBWSP with side tees	$850/ft	130	$111,000
20" filter to waste piping	$700/ft	250	$175,000
20" Filter effluent piping	$600/ft	250	$150,000
16" backwash supply with fittings	$500/ft	180	$90,000
16" valves	$4000 each	8	$32,000
20" valves - bachwash inlet	$4500 each	8	$36,000
20" valves - filter influent	$4500 each	8	$36,000
8" surface wash valves	$2000 each	8	$16,000

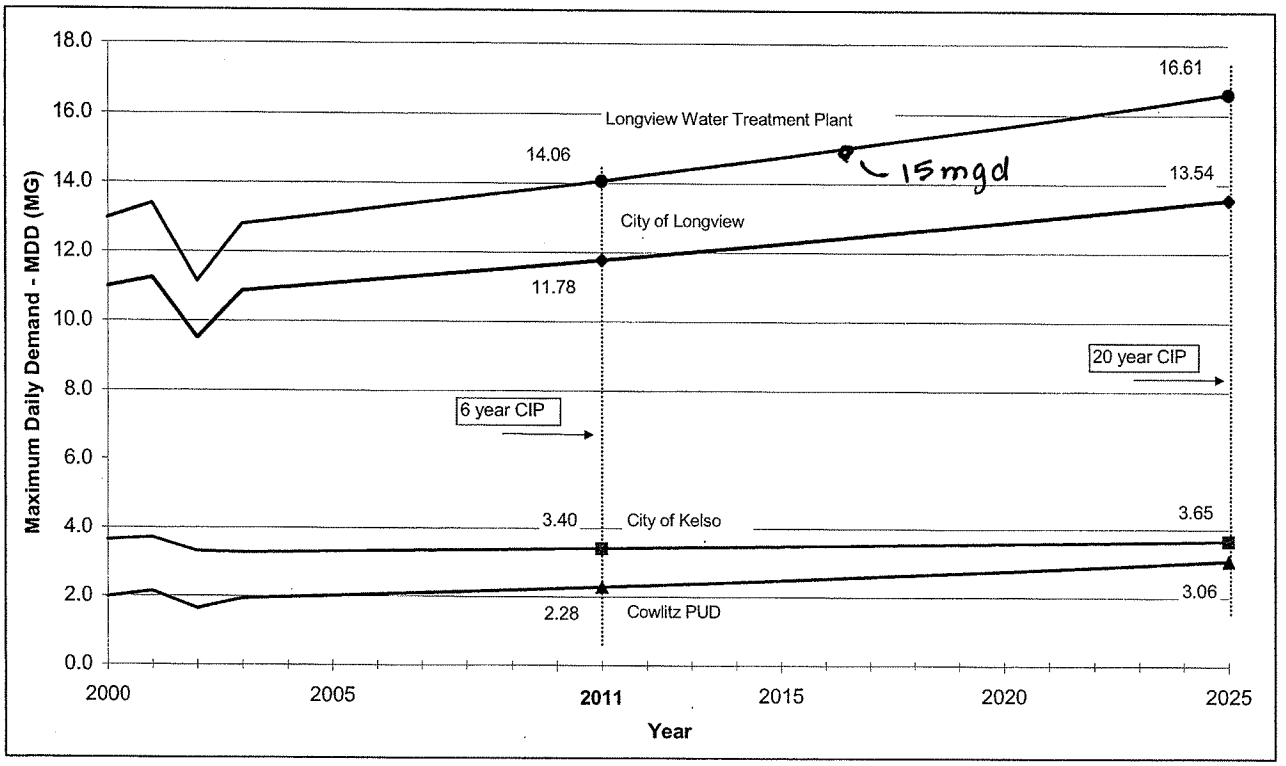
VE TEAM ESTIMATE OF 20 MGD CONVENTIONAL FILTRATION TREATMENT PLANT FOR GROUNDWATER TREATMENT AT MINT FARM

24" backwash waste valves	$3000 each	8	$24,000
Misc fittings, hangers, couplings, HVAC			$100,000
Backwash piping and valves			$80,000
High service pump piping and valves	$60000 each	5	$300,000
Air piping			$15,000
Equipment			
Inline mechanical mixer			$35,000
Potassium permanganate feed system			$240,000
Sodium hypochlorite feed system			$116,000
Filter underdrains, wash troughs	$275/sf	2880	$792,000
Filter media	$250/sf	2880	$720,000
Rotary surface wash	$800 each	32	$26,000
Backwash pumps (5400 gpm)			$104,000
Flow/level measuring devices	$30,000 each	8	$240,000
Surface wash pumps	$25,000 each	2	$50,000
Distribution pumps	$70,000 each	5	$350,000
Air compressor/supply			$35,000
Return/waste discharge pump	$18,000 each	2	$36,000
Submersible pumps, solids discharge	$25,000 each	2	$50,000
Electrical/Instrumentation			
Raw/final flow meters	$25,000 each	2	$50,000
Filter control panels	$50,000 each	4	$200,000
Programmable controller			$70,000
SCADA			$180,000
Filter instrumentation			$90,000
Electrical conduits			$260,000
Motor control centers			$740,000
Switchboard			$190,000
Duct banks			$280,000
Conduit encasement			$30,000
Wiring			$160,000
Transformers/panel boards			$45,000
Subtotal			$14,170,000
Wells, pumps, controls (PACE)			$2,022,000

VE TEAM ESTIMATE OF 20 MGD CONVENTIONAL FILTRATION TREATMENT PLANT FOR GROUNDWATER TREATMENT AT MINT FARM

Pipeline to sewer (PACE)			$110,000
Distribution piping improvcements (PACE)			$1,525,000
Subtotal			$17,827,000
Overhead, profit, contingency (38%)			$6,774,260
Land purchase (PACE)			$378,000
TOTAL			$24,979,260
Potential portion that could be deferred by building 15 mgd first phase			
and 5 mgd second phase - defer two filters and one well			$1,500,000

Figure 2-2: Longview-Kelso Urban Area Projected Future MDDs



Tables 2-21, 2-22, and 2-23 provide ERU projections by zone. The values shown in the tables are used to perform the source, treatment capacity, pump station capacity, and storage analyses discussed in Section 3. Calculations to obtain ERUs (in gpd) are explained in Section 2.2.1. The actual number of ERUs by zone was calculated by dividing the ERU basis (in gpd) into the demand by area. ERU by zone was forecast using the growth rates for Longview and Kelso shown in Table 2-15, because they are experiencing relatively uniform growth rates throughout their service areas. Because Cowlitz PUD is not growing uniformly, it was necessary to determine a growth rate based on individual service zones. This was estimated by averaging the historic demand data for each service zone, producing an overall projected growth rate of 2.1 percent for Cowlitz PUD (see Table 2-22). As discussed earlier in this section, the demands for Cowlitz PUD have been further refined by reservoir service area.

BASIS FOR PHASING

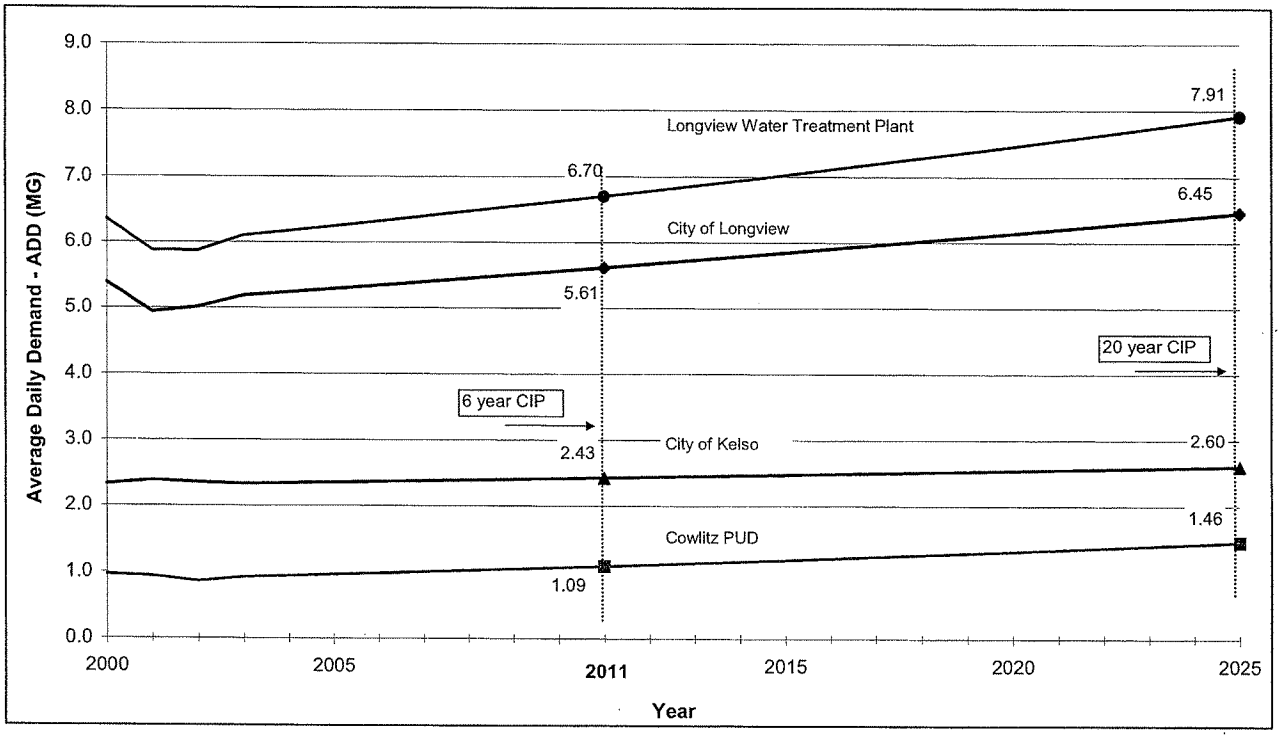
Table 2-20: Projected ERU Usage [a]

Purveyor	2011	2025
Longview	28,865	33,203
Cowlitz PUD	5,284	7,090
Longview RWTP	**34,150**	**40,293**
Kelso	12,804	13,732

Note:

(a) ERU includes losses and forecasting based on the population growth rates shown in Table 2-15.

Figure 2-1: Longview-Kelso Urban Area Projected Future ADDs



BASIS FOR PHASING

LONGVIEW VALUE ENGINEERING STUDY
WATER SUPPLY ALTERNATIVES

VE IDEA NUMBER: N14

DESCRIPTION: Relocate plant to avoid piling

EVALUATED BY: Sindt

ORIGINAL CONCEPT:

Construct plant on piling at Mint Farm site where foundation conditions are poor

PROPOSED ALTERNATIVE:

Relocate treatment plant to Mt. Solo reservoir site where piling would not be needed
36" raw water and 24" finished water lines on south side of Mt. Solo

(VE team suggests evaluation of relocating well field to area just south of Mt. Solo to avoid industrial park concern and to reduce piping costs. If feasible, the cost shown on this worksheet for relocating the plant to Mt. Solo would be reduced substantially)

ADVANTAGES:

Plant located remotely from industrial area which may alleviate public perception issues
Provides ready distribution service to developing area south of Mt. Solo

DISADVANTAGES:

Treatment plant located at far end of distribution system
Higher capital cost

	ORIGINAL	ALTERNATIVE ONE	ALTERNATIVE TWO
INITIAL COST	$5,318,000	$8,380,000	
INITIAL SAVINGS	XXXXXXXXXXXXXXXXX	($3,062,000)	
ANNUAL COST			
ANNUAL SAVINGS	XXXXXXXXXXXXXXXXX		
PW SAVINGS	XXXXXXXXXXXXXXXXX		

VALUE ENGINEERING

DEVELOPMENT
PHASE

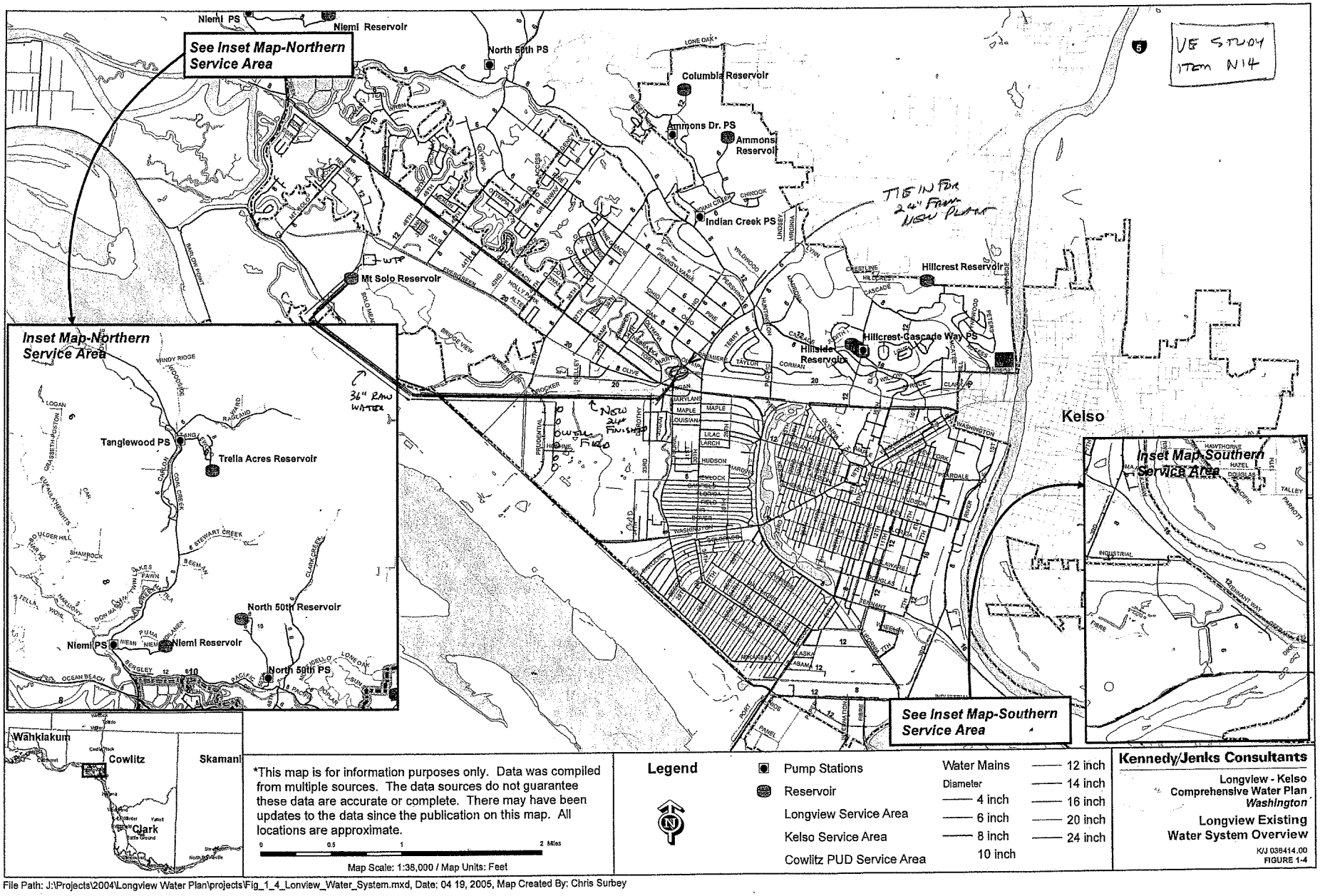
ESTIMATE WORKSHEET

PROJECT NAME: LONGVIEW, WA WTP

PROJECT NO.: _____ DATE: 8/28/07 WRITTEN BY: SINGH

ALT. NO.: N 14 - RELOCATE PLANT/AVOID PILING COSTS FOR: (check one) ☐ Original. ☒ Alternative.

ITEM	QUANTITY No. Units	QUANTITY Unit Meas.	LABOR Per Unit	LABOR Total	L+ MATERIAL Per Unit	L+ MATERIAL Total	TOTAL COST
1. BASIC PLANT & WELL COST							
LESS:							
PILING							
BUILDING (PACE DETAIL SHT)	(1,440,000)(1.20)(1.10) =					(1,900,000)	
CLEARWELLS (PACE DETAIL SHT)	(220,000)(1.20)(1.10)(x2) =					(500,000)	
TOTAL PILING							(2,400,000)
DIST SYSTEM PIPING (PACE OPINION, 4.13)							(2,460,000)
LAND PURCHASE (PACE OPINION, 4.15)							(378,000)
NET BASE PLANT & WELLS							$5,318,000
RAW WATER TRANSMISSION	PIPE						
36" DIP W/O RESTOR.	10,500	LF			$396		4,160,000
DIST SYSTEM PIPING (REF PAGES 39 - OCT. 06 PACE SOURCE ANALYSIS)							
24" FROM MT. SOLO RESERVOIR TO 32ND AVE. & N OF OCEAN BEACH HWY.							
COMMON TRENCH AT 36"	10,500	LF			$240		2,520,000
DEDICATED TRENCH	5,700	LF			$264		1,500,000
PLANT SITE WORK / ROCK EXCAV.							200,000
				Subtotal			$8,380,000
					TOTAL		3,062,000



*This map is for information purposes only. Data was compiled from multiple sources. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication on this map. All locations are approximate.

0 0.5 1 2 Miles

Map Scale: 1:36,000 / Map Units: Feet

Legend

- Pump Stations
- Reservoir
- Longview Service Area
- Kelso Service Area
- Cowlitz PUD Service Area

Water Mains Diameter

- 4 inch
- 6 inch
- 8 inch
- 10 inch
- 12 inch
- 14 inch
- 16 inch
- 20 inch
- 24 inch

Kennedy/Jenks Consultants

Longview - Kelso Comprehensive Water Plan
Washington

Longview Existing Water System Overview

K/J 036414.00
FIGURE 1-4

File Path: J:\Projects\2004\Longview Water Plan\projects\Fig_1_4_Lonview_Water_System.mxd, Date: 04 19, 2005, Map Created By: Chris Surbey

LONGVIEW VALUE ENGINEERING STUDY
WATER SUPPLY ALTERNATIVES

VE IDEA NUMBER: N24

DESCRIPTION: Install concrete clearwell at Mint Farm site

EVALUATED BY: Hansen

ORIGINAL CONCEPT:

Two 130,000 gallon bolted steel finished water storage tanks at Mint Farm plant

PROPOSED ALTERNATIVE:

Replace steel tanks with one 250,000 gallon buried concrete clearwell

ADVANTAGES:

More durable, longer lasting structure. No major maintenance cost. No concern for corrosion.

DISADVANTAGES:

Higher capital cost

	ORIGINAL	ALTERNATIVE ONE	ALTERNATIVE TWO
INITIAL COST	$996,860[1]	$1,514,600	
INITIAL SAVINGS	XXXXXXXXXXXXXXXXX	($517,740)	
ANNUAL COST			
ANNUAL SAVINGS	XXXXXXXXXXXXXXXXX		
PW SAVINGS	XXXXXXXXXXXXXXXXX	($517,740)	

[1]PACE estimate is $361,180 per tank, multiplied by two for two tanks and 38% factor for overhead, profit and contingency

VALUE ENGINEERING

DEVELOPMENT PHASE

ESTIMATE WORKSHEET

PROJECT NAME: Longview WA WTP

PROJECT NO.: _____ DATE: _____ WRITTEN BY: _____

ALT. NO.: Concrete clearwell – Membrane Alt COSTS FOR: (check one) ☐ Original. ☐ Alternative.

Compare 1–250,000 gal clearwell w/ 2–125,000 gallon tanks

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Site Preparation							
clear and grub site					L.S		15,000
Dewatering					L.S		50,000
Excavation							
60'×800'×13'=	2900 cyds				$20/cyd		58,000
Gravel base ~~50'×90'×1'-6"~~ =	250 cyds				$25/cyd		6300
Foundation piles – 44×75' = 3300 ft²	3300 ft²				$14/ft²		475,200
Concrete							
Base Slab	~~195~~ 192				$600/cyd		115,200
Walls	133				$1000/cyd		133,000
Baffle walls	93				$800/cyd		74,400
Floor Slab	92				$1200/cyd		110,400
Waterproofing					L.S.		60,000
				subtotal			1,097,500
			Total Cost w/ 38% OH, P, Cont.				1,514,600

TOTAL

APPENDIX C

VE TEAM MEMBERS

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APPENDIX D

EVALUATION OF PREVIOUS COST ESTIMATES

ESTIMATED COST OF MEMBRANE TREATMENT PLANT

A cost analysis was made by the VE team for a 20 mgd conceptual membrane microfiltration design to compare with the cost estimate previously prepared for the City for the Mint Farm treatment system (see Table D1). The design concept parallels that established by PACE with the exception that a pretreatment contact basin is included to permit satisfactory oxidation of manganese prior to filtration. The pre-contact tank was not included in the PACE design.

Following is a description of the system components:

- Iron and manganese oxidation with sodium hypochlorite and potassium permanganate
- Two 150,000 gallon contact basins (bolted steel tanks on piling) providing 10-minutes of detention time at 20 mgd
- Pall pressure membrane filtration equipment per updated proposal received by VE team during the workshop ($6,205,000)
- Added in-line mechanical mixer prior to contact tanks for chlorine/permanganate mixing
- Enlarged building compared to PACE design by increasing width from 65 feet to 75 feet to provide better access for O&M.
- Modified design to use below grade concrete clearwell of 250,000 gallon capacity. PACE design included two 125,000 gallon ground level steel tanks. Clearwell 75 ft by 44 ft by 12 ft deep with serpentine baffle walls.
- High service pumps assumes four 3500 gpm VFD vertical turbine pumps
- Two 125,000 gallon at grade backwash containment tanks, pile supported, 40 ft diameter by 16 ft high with 12 ft sidewater depth.
- Pre-engineered steel building used, pile foundation. 16 ft high, 12-inch slab floor over pile support matrix. Interior walls in chemical storage/feed area are 8-inch CMU with gypsum board ceilings. All other partitions are gypsum board over steel studs. Basic HVAC provided. Building includes overhead gantry crane over end of building housing high service pumps.
- Sodium hypochlorite system involves two 10,000 gallon storage tanks with feed pumps.
- Estimate for process piping and valves assumes use of above grade piping systems for interconnection of 7 membrane skids
- Costs include 1 megawatt standby generator to be located outside of building because of size and exhaust/ventilation/noise concerns. Unclear if PACE estimate includes generator.
- Electrical/instrumentation assumes basic facility interior power supply system. No costs are included for extending power to the treatment plant.
- Costs include allowance for basic SCADA to operate facilities and interface with distribution system monitoring points.
- Costs for well development, pumps, controls, supply piping were obtained from PACE documents and were not changed
- Costs for connecting the new facilities with the distribution system were obtained from the PACE report and were not changed.

VE TEAM ESTIMATE OF 20 MGD MEMBRANE TREATMENT PLANT

	Unit Cost	Quantity	Est Cost
Site Work - Division 2			
Clear and Grub site	$12500/acre	2 acres	$25,000
Construct buidling pad, driveway (assume fill 4 ft over 60,0000 sq ft)	$25/cu yd	8900	$223,000
Site paving	$1.50/ sq ft	9000	$135,000
Site dewatering			$150,000
Fencing	$20/ft	1000	$20,000
Piles, building	$144/sq ft	11,700	$1,684,800
Piles, 2 contact tanks, 666 sf each	$144/sq ft	1332 sf	$191,800
Piles, backwash water tank, 2 tanks, 1200 sf each	$144/sq ft	2400	$345,600
Site piping (PACE)			$970,000
Concrete - Division 3			
Clearwell			
slab	$600/cy	192	$115,200
end walls	$1000/cy	49	$49,000
baffle walls	$800/cy	93	$74,400
side walls	$1000/cy	84	$84,000
floor slab	$1200/cy	92	$110,400
Building floor slab	$600/cy	233	$140,000
Contact tank slab	$600/cy	44.6	$27,000
Foundations for 2-125,000 gallon backwash containment tanks	$600/cy	77	$46,200
Below slab encasement	$500/cy	50	$25,000
Masonry - Division 3			
8" CMC for interior walls isolating chemical feed rooms from remainder of building, also blower room	$25/sf	3600	$90,000
Miscellaneous Metals, Division 5			
Handrails, hatch covers, etc			$35,000
Wood and Plastics			
Rough carpentry, study walls, gypsum			$45,000
Finish carpentry, lab cabinets, trim			$40,000
Thermal/Moisture Protection - Division 7			
Included with pre-engineered building			

VE TEAM ESTIMATE OF 20 MGD MEMBRANE TREATMENT PLANT

Overhead doors	$6000 each	6	$36,000
Finishes, Division 9			
Building painting			$125,000
Equipment, Division 11			
30-inch in line rapid mixer			$35,000
Supply pressure membranes			$6,205,000
Install pressure membranes			$900,000
Membrane supply pumps - included in membrane equipment			
High service pumps (4@3500 gpm VFD)	$65,000 each	4	$260,000
Recycle pump station			$85,000
Special Construction, Division 13			
Bolted steel contact tanks, 75,000 gals each	$95,000 each	2	$190,000
Bolted steel backwash tanks, 125,000 gals each	$150,000 each	2	$300,000
Pre-engineered building	$60/sf	11,700 sf	$702,000
Potassium permanganate feed system			$240,000
Sodium hypochlorite storage and feed system			$116,000
Influent flow meter			$30,000
Effluent flow meter			$28,000
Instrumentation and controls			$250,000
Conveying systems, Division 14			
Overhead gravity crane over high service pumps and membrane skids			$135,000
Mechanical, Division 15			
30-inch, inlet piping	$250/ft	330	$82,500
18-inch, inlet piping	$198/ft	180	$35,600
10-inch, inlet piping	$110/ft	100	$11,000
Below slab piping			$55,000
Valves			
30-inch influent isolation	$6000 each	2	$12,000
12-inch influent isolation	$3000 each	2	$6,000
10-inch waste piping	$2400 each	4	$9,600

VE TEAM ESTIMATE OF 20 MGD MEMBRANE TREATMENT PLANT

Process piping membrane system face piping between units and			
below grade slab. Includes piping for reverse filtration and membrane			
cleaning for 7 skids	$35,000/skid	7	$245,000
Process valving, membrane system	$8,000/skid	7	$56,000
Chemical feed piping/fittings			$35,000
Building HVAC			$175,000
Electrical-Division 16			
Standby generator, 1 MW in self contained housing			$250,000
Switchgear, MCCs			$625,000
Electrical, instrumentation			$1,810,000
PACE Items			
Wells, pumps, controls			$2,022,000
Distribution system piping			$1,525,000
Subtotal			$21,218,100
Add-on for contractor overhead and profit, contingency (38% total)			$29,280,978
Land purchase			$378,000
TOTAL			**$29,658,978**

- The cost of land purchase is that used in the PACE report.
- The final estimated cost of $29.7 million includes a 38 percent allowance for contractor overhead and profit and estimating contingency. PACE used different allowances for different components of the plant but the 38 percent is representative of the allowances used by PACE for various components

ESTIMATED COST OF REHABILITATION OF EXISTING SURFACE WATER TREATMENT PLANT

The costs presented in Table One of the Master Plan Update prepared by PACE were evaluated. The item numbers shown below are the item numbers from Table One.

2.8 Solids handling equipment. The PACE estimate is $334,720. This cost was developed from a proposal from the vendor of hydrocyclone separators. No design criteria for the separators are offered in the report so it is assumed that they are properly selected for the hydraulic and solids loading conditions expected in the river. Our review of the costs suggests that they may not include the supply piping to and from the equipment. We estimated that the piping could add $110,000 to the cost. The cost estimate has been increased by $110,000.

3.1 Rebuild existing sludge collectors. The PACE estimate is $108,000. The cost covers replacing bearings, some shafts and a few flights. The costs were developed with assistance of the plant staff and appear to be reasonable. No change in the estimate was made.

3.2 Rebuild sludge collector drives. PACE estimate is $30,000. This covers motors and gear reducers for all three basins. Costs obtained by staff from vendors and appears reasonable. No change in the estimate was made.

3.3. Rebuild high head pumps. PACE estimate is $50,000. According to staff this budget amount would cover replacement of one pump or repair of motor, replacement of seals, etc. The amount may be light but without detailed examination of each pump, it is difficult to determine how much additional would be needed. No change in the estimate was made.

3.4 Replace sludge valves/3.5 Replace sludge valve actuators. PACE estimate is $60,000. The cost covers three new plug valves located in the sludge hopper in each cross collector of the three sedimentation basins. These valves are electrically operated, open and closed by the plant control system. The costs are documented with vendor quotes and appear to be realistic. No change in the estimate was made.

3.6 Replace basin influent gate. PACE estimate is $60,000. The cost covers three replacement, manually operated slide gates and appears to be adequate. No change in the estimate was made.

3.7 The work associated with this item has been completed and appropriately was not included in the PACE estimate.

3.8 Seal inside of flocculation/sedimentation basin. PACE estimate is $270,000. Staff advises that cost estimate is for a high build elastometric polyurethane liquid applied liner of 60-80 mil thickness. Our recent experience with use of this lining technique revealed somewhat lower costs, i.e. $15 per square foot versus $23 per square foot estimated by PACE. However, site conditions include factors that could lead to higher costs. No change in the estimate was made.

3.9 Stop leak in sludge sump well. PACE estimate is $22,500. We discussed proposed plans with staff and conclude that the estimate is reasonable. No change in the estimate was made.

3.10 Replace tube settlers. PACE estimate is $210,000. Cost estimate amounts to about $30.00 per square foot which is reasonable for the estimated 7700 square feet of tube settlers in the three basins. No change in the estimate was made.

3.11, 3.12, 3.13, 3.14 Incidental Facility Repairs. PACE estimate of $40,000 appears reasonable. No change in the estimate was made.

3.15 Replace filter underdrains and reinstall media. PACE estimate is $800,000. This estimate is based on historical costs from recent contract to rehabilitate two filter basins at cost of $120,000 each. Extrapolating these costs to remaining six filters equates to the $800,000 estimate. No change in the estimate was made.

3.16. Replace SCADA. PACE estimate is $597,600. The cost estimate is supported by vendor quotations and appears appropriate. The replacement is driven by the staff reported inability to secure replacement components and service. The age (more than10 years) justifies a phased or outright replacement of the existing SCADA with a modern, up-to-date system. No change in the estimate was made.

3.17, 3.18 Repair piping manifold and pipe gallery piping. PACE estimates $144,000 and $1,274,000. We understand that the replacement plan is driven by failing piping and undersized piping and valving. Improvements are not vitally necessary to continued operation but should be implemented to insure 20 mgd reliable capacity. Considerable research and analysis of various components involved in area of needed improvements beyond the scope of this effort would be required to develop an independent estimate. No change in the estimate was made.

3.19 Repair lime feed system. PACE estimate is $100,000. Staff reports this cost covers incidental items such as improvements to conveyance and application system and perhaps a "water champ" or similar mixing device at the point of application. It appears that a $100,000 budget should be adequate. No change in the estimate was made.

3.20 Improve backwash piping. PACE estimates $150,000. This item covers staff recommended changes to eliminate aging piping and valving to improve reliability at 20 mgd. Perhaps some work could be deferred to the future as plant demand increases. No change in the estimate was made.

3.21 Replace existing power supply. PACE estimate is $1,856,000. No change in the estimate was made.

3.22 Finished water pipeline. PACE estimate is $4,934,000. This cost covers a parallel pipeline to transmit the added capacity to the distribution system reservoir. The costs were reviewed and appear reasonable. No change in the estimate was made.

3.23 Raw water pipeline. PACE estimated $1,480,190. This item is for the expected costs to replace and parallel existing piping from the intake structure to the treatment plant. These costs cover boring under the roadway between the plant and the intake. The costs appear to be reasonable. No change in the estimate was made.

3.24 Air scour. The PACE estimate is $1,231,000. The VE team position is that the existing surface wash system is adequate which was confirmed by operating staff. The cost estimate is reduced by $1,231,000.

The adjustments to the estimated cost to rehabilitate the plant were a deduction of $1,231,000 for deleting the air scour and an addition of $110,000 for piping associated with the solids handling equipment for a net reduction of $1,121,000.

APPENDIX E

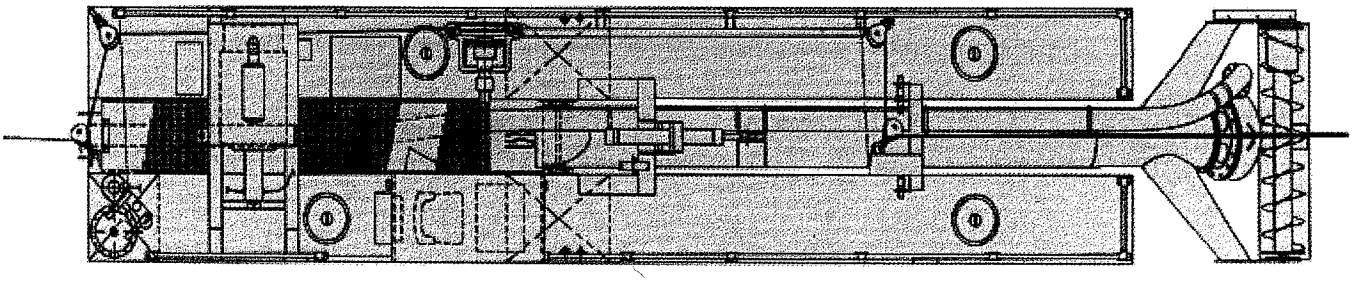
NOTES TO DESIGNER

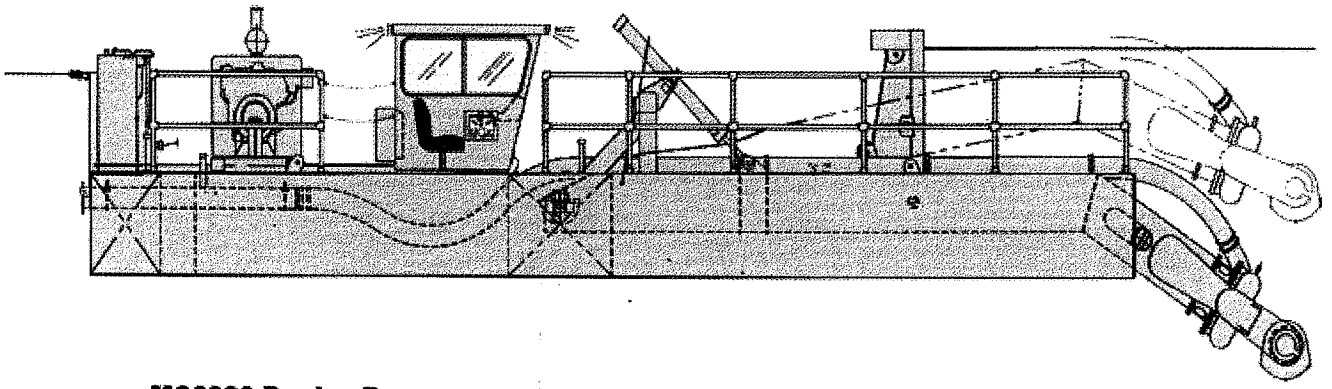
1. Check adequacy of filter rate of flow controllers in existing plant at flow of 20 mgd.
2. Check loading rates on clarifiers in existing plant at flow of 20 mgd.
3. New plant – add mixing and flocculation, need to add contact time ahead of membranes to oxidize manganese.
4. New plant – provide disinfection to meet requirements for ground water under the influence of surface water.
5. New plant – conduct pilot test on-site, check membrane fouling/cleaning, flux rates, water quality produced.
6. Test water from pilot plant for tastes and odor, use odor panel.
7. New plant – check cost to see if cost for waste line to sewer is included.
8. New plant – check size of building to be sure room adequate for maintenance.
9. Assess results of THM tests in deciding on disinfection approach.
10. Consider use of Weyerhauser intake to obtain Columbia River Water and treat at Mint Farm site.
11. Consider alternate route for new pipeline from Mint Farm site to distribution system to create loop.
12. Consider use of multiple lines from Mint Farm site to distribution system rather than one pipeline to distribution system.
13. New plant – consider aeration and detention as alternate to chemical oxidation.
14. Use backwash water treatment system such as small DensaDeg unit instead of dedicating a membrane module to backwash water treatment.
15. Labor cost used in October 2006 Source Analysis Report, Table 8, Annual Operating Costs, used labor rates not including benefits and, as a result, total labor costs are understated by a factor of about two.
16. Membrane replacement costs are not included in the Mint Farm costs (page 46 October 2006 Source Analysis Report) in the O&M costs for the Mint Farm membrane treatment plant. Membrane replacement costs based on 7-10 year replacement cycle should be included.
17. Current design shows wells pumping directly into membrane system strainers. Per manufacturer recommendations, well pumps should discharge to a feed tank.
18. Reactive silica concentrations in Mirant well are high. Analyze for reactive silica in pilot tests. Reactive silica could cause treatment issues which need to be addressed in pilot study.

APPENDIX F

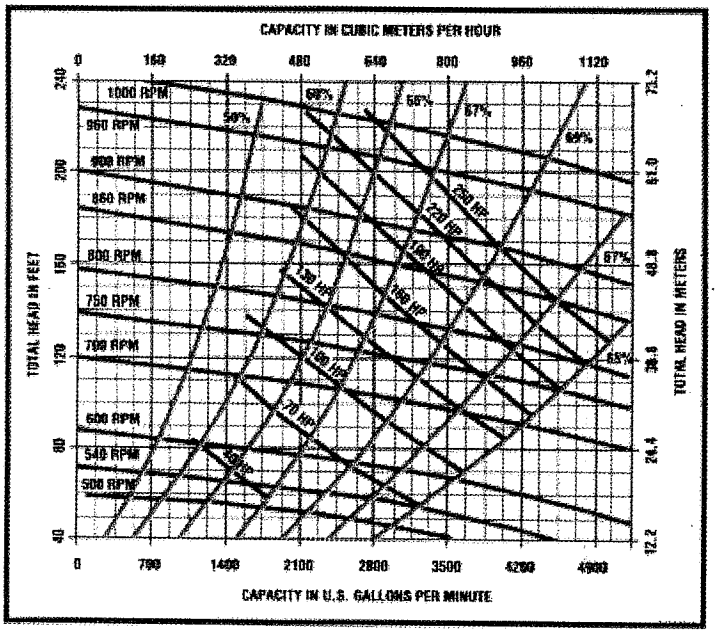
MUD CAT DREDGE INFORMATION

MODEL MC-2000



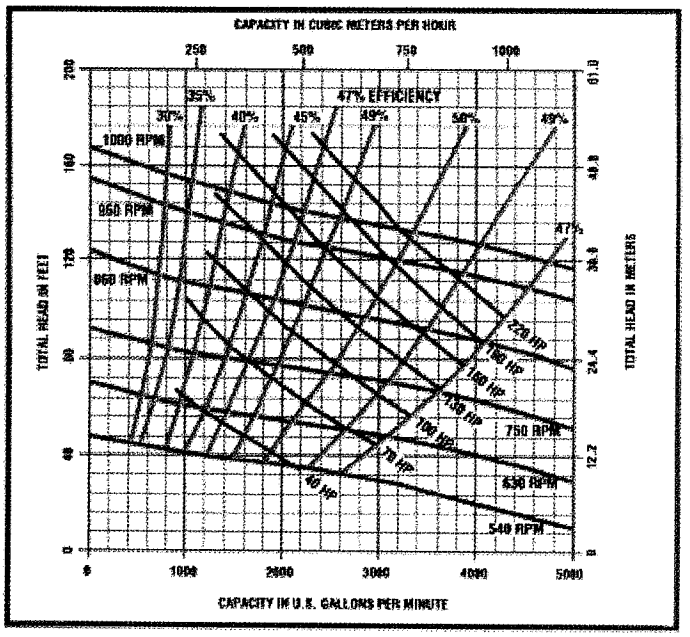


MC2000 Dredge Pump



Impeller Diameter 24" • Eye Diameter 10" • Blade Width 5.86"
Number of Blades 3 • Blade Type Warped • Specific Gravity 1.0

MC2000 Sludge Pump



Impeller Diameter 25" • Number of Blades 8 • Blade Type Recessed
Specific Gravity 1.0

1611 Bush St., Baltimore, Maryland 21230, U.S.A.
Telephone (410) 545-0232 • FAX (410) 752-3294 • Website www.dredge.com

MODEL MC-2000

MUD CAT DIV

ELLICOTT INTERNATIONAL

1611 Bush Street
Baltimore, MD
21230 U.S.A.

MACHINE SPECIFICATIONS

General	Length (O.A.)	47.58 ft	(14.5 m)
	Width (O.A.)	8.5 ft	(2.6 m)
	Height (O.A.)	8.5 ft	(2.6 m)
	Weight (dry)	28,300 lbs	(12,860 kg)
	Draft (fully loaded)	2.5 ft	(0.76 m)
	Maximum Dredging Depth	20 ft	(6.1 m)
	Fuel Capacity	500 gal	(1,890 l)
Auger Assembly	Type	Single-Pitch-Counter Flight	
	Pitch	11 in	(280 mm)
	Diameter Over Flights	19.625 in	(498 mm)
	Diameter Over Knives	24 in	(610 mm)
	Overall Width	8.5 ft	(2.6 m)
	RPM-Max	83.5	
	Torque-Max	22,000 in. lbs	(3,937 kg cm)
	Power	30 HP	(22,4 kw)
	Features: shroud for low turbidity (forward and reverse dredging)		
Engine	Caterpillar 3208	272 HP (203 kw) (Continuous) @ 2400 RPM	
Main Pump	The MC-2000 submerged pump can be supplied with two different types of impellers:		
		Dredge Pump	**Sludge Pump**
	Make	Ellicott	Ellicott
	Impeller Type	Closed	Recessed
	Impeller Dia.	24 in (610 mm)	25 in (635 mm)
	Suction Size	10 in (254 mm)	10 in (254 mm)
	Discharge Size	8 in (203 mm)	8 in (203 mm)
	Particle Clearance	6 in (152 mm)	8 in (203 mm)
	Capacity-Water		
	(GPM@Feet TDH)	2500@143	2000 @ 105
	(liters/min @m/TDH)	660@44	528 @ 32
	Speed-RPM	859	859
	Drive	Hydraulic Vane Motor	Hydraulic Vane Motor
	HP	155 (116 kw)	155 (116 kw)
Hydraulic System	Pump	3 Section Tandem Gear Type	
	RPM	2400	
	Reservoir Capacity	245 gal	(927 L)
	Working Pressure-Max	2500 PSI	(17.24 M Pa)
	Features: 12 VDC Electrical - Hydraulic Controls Suitable for Dredge Automation		
Propulsion	Type	Triple Wrap Friction Drive Winch	
	Make	Ellicott	
	Line Pull-Max	2300 lbs	(1,045 kg)
	Line Speed-Max	50 fpm	(15.24 mp/min)
	Rope Diameter & Type	3/8 in 6x37 IWRC	
	Drum Diameter	22.5 in	(572 mm)

MUD CAT machines are operating in a growing list of countries throughout the world. To obtain complete information, call the MUD CAT DIVISION of ELLICOTT MACHINE CORPORATION
Phone: 410-837-7900
Fax: 410-752-3294
www.dredge.com

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APPENDIX G

CRISAFULLI SD-110 DREDGE INFORMATION

Crisafulli *Dredges*

Crisafulli *Rotomites*™ - self-propelled diesel dredges
Can dredge about anywhere without cumbersome cabling

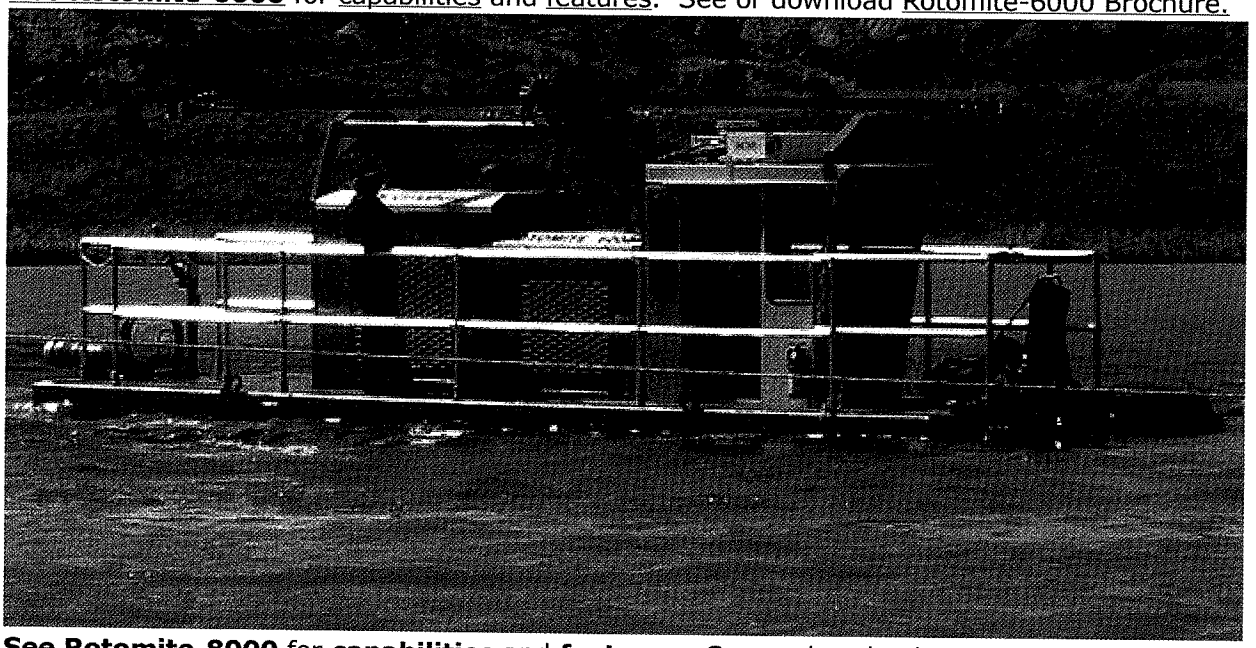
Home Page|Rotomites|Rentals|Customers|Components
Applications - Municipal|Applications - Industrial|Questionnaire|Search Site

Crisafulli Rotomite™ Dredges

Crisafulli builds diesel powered, self-propelled, maneuverable, manned Rotomite dredges to provide customers with maximum versatility, ease of use, economy, and productivity for applications in five market sectors – industry (including utilities), municipalities, dredging contractors, state and federal government agencies, and agriculture. Crisafulli customers have purchased more than 89 Rotomites in the last few years. See Rotomite Customers. See **Key Benefits from ownership of a Rotomite.**

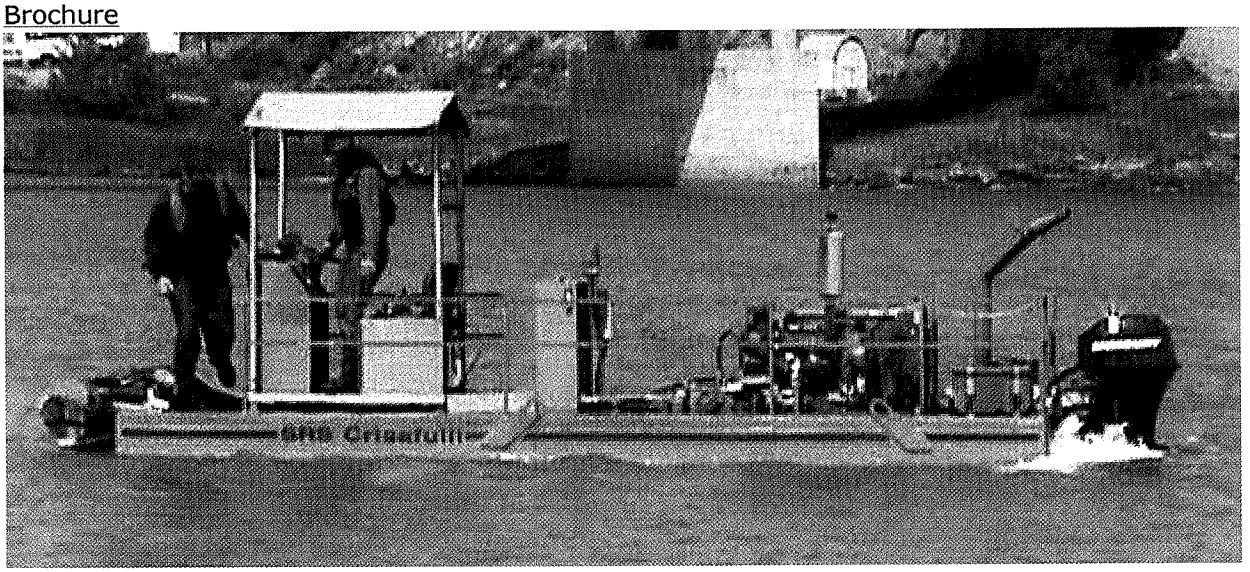
Standard Models. Crisafulli has built Rotomites for more than twenty-five years and presently offers three standard models shown below –

See Rotomite-6000 for capabilities and features. See or download Rotomite-6000 Brochure.



See Rotomite-8000 for **capabilities** and **features.** See or download Rotomite-8000 Brochure

See Rotomite-SD-110 for **capabilities** and **features.** See or download Rotomite-SD-110 Brochure



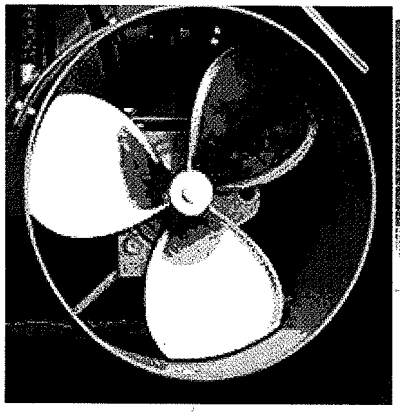
Key Benefits from ownership of a Rotomite

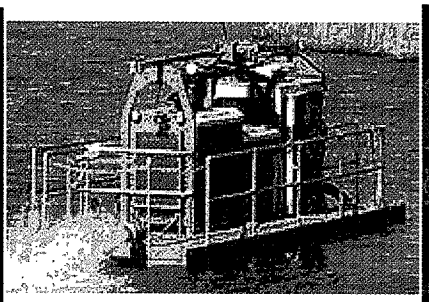
• Crisafulli's Rotomites enable you to dramatically cut your sludge management costs.	• Owning a Rotomite puts you in control of your dredging schedule.
• Self-propelled and steerable the Rotomite can dredge about anywhere without the cost and delays of a cabled traverse system.	• When used with a cabled traverse system Crisafulli's exclusive Pivoting Traverse System increases productivity 48-95% - i.e., with only a minute to reposition, you get 100% efficient reverse dredging.
• Alternatively, can be used effectively with a cabled traverse system	• Easily transported to multiple sites
• Sophisticated instrumentation options to measure dredging performance	• We'll custom design your Rotomite to your specifications.
• The most productive cutterheads available from any source	• Simple to maintain

• **Engineered for performance**	• **Reliable and Manufactured to last**
• **High solids dredging performance with minimum turbidity**	• **Superior after-sale support from Crisafulli worldwide**

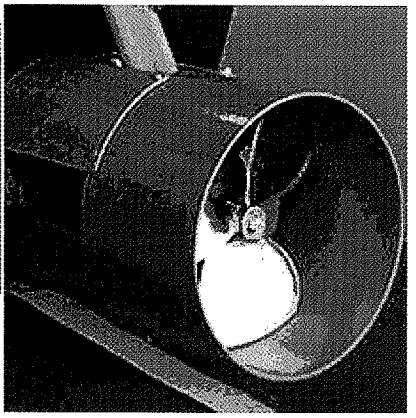
Crisafulli's Rotomites are all self-propelled and steerable.

The propulsion and steering system of the Rotomite-6000 and Rotomite-8000 are shown below. The small, shallow draft, lightweight Rotomite-SD-110 is propelled with a 40 HP outboard engine coupled with a turnable transom that results in 120 degrees of engine angle on each side (240 degrees of total engine angle).





Stern view of Rotomite-6000 with Pivoting Traverse System mounted on top



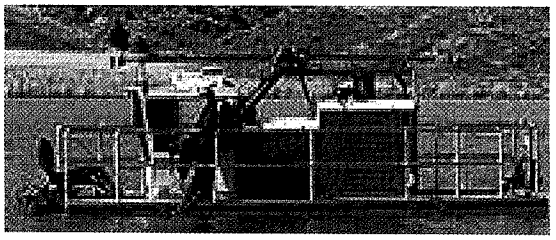
Portable. Each Rotomite can be moved at high speed on US highways and meet all DOT regulations regarding vehicle weight, width and height without wide-load compliance.

Standard Options – Custom Models. Crisafulli offers standard options for each of the three Rotomite dredge series, and, in addition, builds custom versions of each. Earlier versions of the Rotomite include the Rotomite-180P, and the Rotomite-140P.

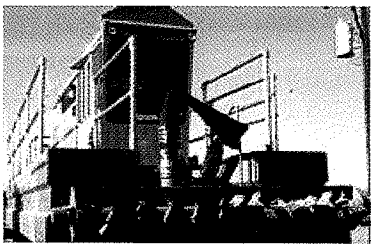
See Rotomite-6000 product video in Quick Time Player format. Due to large file size recommend downloading file to your computer and then play; or contact us to have DVD mailed to you.

History. Crisafulli introduced the Rotomite-6000 in 2002, then the most recent of several models of self-propelled Rotomites engineered and manufactured by Crisafulli over more than twenty-five years. In December 2003, Crisafulli introduced the Rotomite-8000, an 8- inch dredge with approximately 50% more capability than the Rotomite-6000. In August 2005, Crisafulli introduced the new shallow draft (17"), lightweight, 4-inch Rotomite-SD-110.

To the left, Rotomite-6000 with Crisafulli's patented Pivoting Traverse System mounted on top. To the right, frontal view of



Rotomite cab, mounted forward with great view for operator, and Cobra Cutterhead.



Pumps - Dredges - Power Units - Custom or Standard

Manufacturers of reliable Crisafulli products supported by superior service worldwide

SRS Crisafulli, Inc. - 1610 Crisafulli Drive - P.O. Box 1051 - Glendive, MT 59330 - USA
Phone: 406-365-3393 - Toll free: 800-442-7867 - Fax: 406-365-8088 - E-mail: srsc@crisafulli.com - www.crisafulli.com

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APPENDIX H

DREDGING COST ESTIMATES

Vendor: MudCat
Contact: Paul Quin (410)545-0240
Date Contacted: 27-Aug-07

Capitol Cost		
Dredge	$	250,000
Piping, misc for on-shore disposal	$	50,000
O&M Costs		
Operating cost ($/hr)	$	10
Maintenance ($/hr)	$	10
Total O&M	$	20

Dredge Capacity (yd^3/hr)	100
Cutter head width (ft)	8.5
Max. dredge depth (ft)	20

Volumes and cost per event'		
Channel width (ft)		16
Depth (ft)		5
Cross sectional area (ft^2)		80
Unit Volume (yd^3/ft)		3.0
Length (ft)		300
Total volume (yd^3)		889
Operating time (hours)		8.9
O&M cost	$	178
Labor cost	$	1,378
Total	$	1,556
# event per year		12
Annual O&M and Labor Cost	$	18,667
Present Value of O&M and Labor	$	214,107
Subtotal present value	$	464,107
Contingency (25%)		116,027
Total estimated present value	**$**	**580,133**
Annualized cost	**$**	**50,579**

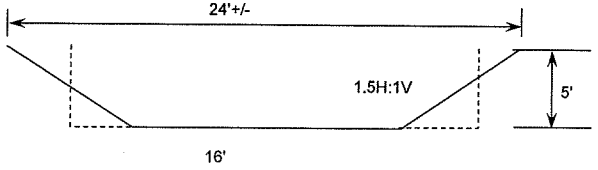
Assume 2 people for operation plus 0.5 people for O&M at $62/hr

Assume 2 per month for 6 month of low flows

Assume 20 years @ 6%

Assume 20 years @ 6%

Approximate dredge channel dimensions. Dashed line at time of dredging; solid line after dredge channel sides slump to near angle of repose.



Note: This estimate assumes dredge material can be discharge back into river downstream from the intake (i.e., no disposal costs included).

	Present Worth	Dredge Channel Length (ft)			
		200	300	400	500
# events per year	1	$ 327,369	$ 334,803	$ 342,237	$ 349,671
	2	$ 342,237	$ 357,106	$ 371,974	$ 386,843
	3	$ 357,106	$ 379,408	$ 401,711	$ 424,014
	4	$ 371,974	$ 401,711	$ 431,448	$ 461,185
	5	$ 386,843	$ 424,014	$ 461,185	$ 498,356
	6	$ 401,711	$ 446,317	$ 490,922	$ 535,528
	7	$ 416,580	$ 468,619	$ 520,659	$ 572,699
	8	$ 431,448	$ 490,922	$ 550,396	$ 609,870
	9	$ 446,317	$ 513,225	$ 580,133	$ 647,042
	10	$ 461,185	$ 535,528	$ 609,870	$ 684,213
	11	$ 476,054	$ 557,831	$ 639,607	$ 721,384
	12	$ 490,922	$ 580,133	$ 669,344	$ 758,556
	13	$ 505,791	$ 602,436	$ 699,081	$ 795,727
	14	$ 520,659	$ 624,739	$ 728,819	$ 832,898
	15	$ 535,528	$ 647,042	$ 758,556	$ 870,069

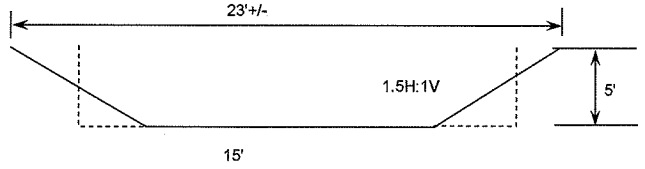
Annualized Cost	Dredge Channel Length (ft)			
	200	300	400	500
1	$ 28,541	$ 29,190	$ 29,838	$ 30,486
2	$ 29,838	$ 31,134	$ 32,430	$ 33,727
3	$ 31,134	$ 33,079	$ 35,023	$ 36,967
4	$ 32,430	$ 35,023	$ 37,616	$ 40,208
5	$ 33,727	$ 36,967	$ 40,208	$ 43,449
6	$ 35,023	$ 38,912	$ 42,801	$ 46,690
7	$ 36,319	$ 40,856	$ 45,393	$ 49,931
8	$ 37,616	$ 42,801	$ 47,986	$ 53,171
9	$ 38,912	$ 44,745	$ 50,579	$ 56,412
10	$ 40,208	$ 46,690	$ 53,171	$ 59,653
11	$ 41,505	$ 48,634	$ 55,764	$ 62,894
12	$ 42,801	$ 50,579	$ 58,356	$ 66,134
13	$ 44,097	$ 52,523	$ 60,949	$ 69,375
14	$ 45,393	$ 54,468	$ 63,542	$ 72,616
15	$ 46,690	$ 56,412	$ 66,134	$ 75,857

Vendor: Crisafulli SD-110
Contact: Russell (800) 442-7867
Date Contacted: 27-Aug-07

Capitol Cost			
Dredge	$	180,000	
Piping, misc for on-shore disposal	$	50,000	Assumed to be the same as Mud Cat
O&M Costs			
Operating cost ($/hr)	$	10	Assumed to be the same as Mud Cat
Maintenance ($/hr)	$	10	Assumed to be the same as Mud Cat
Total O&M	$	20	

Dredge Capacity (yd^3/hr)	85
Cutter head width (ft)	8
Max. dredge depth (ft)	10

Approximate dredge channel dimensions. Dashed line at time of dredging; solid line after dredge channel sides slump to near angle of repose.



Volumes and cost per event'		
Channel width (ft)		15
Depth (ft)		5
Cross sectional area (ft^2)		75
Unit Volume (yd^3/ft)		2.8
Length (ft)		300
Total volume (yd^3)		833

Operating time (hours)		9.8	
O&M cost	$	196	
Labor cost	$	1,520	Assume 2 people for operation plus 0.5 people for O&M at $62/hr
Total	$	1,716	

# event per year		12	Assume 2 per month for 6 month of low flows
Annual O&M and Labor Cost	$	20,588	

Present Value of O&M and Labor	$	236,147	Assume 20 years @ 6%

Subtotal present value	$	416,147	
Contingency (25%)		104,037	
Total estimated present value	**$**	**520,184**	
Annualized cost	**$**	**45,352**	Assume 20 years @ 6%

Note: This estimate assumes dredge material can be discharge back into river downstream from the intake (i.e., no disposal costs included).

	Present Worth	Dredge Channel Length (ft)			
		200	300	400	500
# events per year	1	$ 241,399	$ 249,599	$ 257,798	$ 265,998
	2	$ 257,798	$ 274,197	$ 290,596	$ 306,996
	3	$ 274,197	$ 298,796	$ 323,395	$ 347,993
	4	$ 290,596	$ 323,395	$ 356,193	$ 388,991
	5	$ 306,996	$ 347,993	$ 388,991	$ 429,989
	6	$ 323,395	$ 372,592	$ 421,789	$ 470,987
	7	$ 339,794	$ 397,191	$ 454,587	$ 511,984
	8	$ 356,193	$ 421,789	$ 487,386	$ 552,982
	9	$ 372,592	$ 446,388	$ 520,184	$ 593,980
	10	$ 388,991	$ 470,987	$ 552,982	$ 634,978
	11	$ 405,390	$ 495,585	$ 585,780	$ 675,975
	12	$ 421,789	$ 520,184	$ 618,578	$ 716,973
	13	$ 438,188	$ 544,782	$ 651,377	$ 757,971
	14	$ 454,587	$ 569,381	$ 684,175	$ 798,969
	15	$ 470,987	$ 593,980	$ 716,973	$ 839,966

Annualized Cost	Dredge Channel Length (ft)			
	200	300	400	500
1	$ 21,046	$ 21,761	$ 22,476	$ 23,191
2	$ 22,476	$ 23,906	$ 25,336	$ 26,765
3	$ 23,906	$ 26,050	$ 28,195	$ 30,340
4	$ 25,336	$ 28,195	$ 31,055	$ 33,914
5	$ 26,765	$ 30,340	$ 33,914	$ 37,488
6	$ 28,195	$ 32,484	$ 36,774	$ 41,063
7	$ 29,625	$ 34,629	$ 39,633	$ 44,637
8	$ 31,055	$ 36,774	$ 42,492	$ 48,211
9	$ 32,484	$ 38,918	$ 45,352	$ 51,786
10	$ 33,914	$ 41,063	$ 48,211	$ 55,360
11	$ 35,344	$ 43,207	$ 51,071	$ 58,935
12	$ 36,774	$ 45,352	$ 53,930	$ 62,509
13	$ 38,203	$ 47,497	$ 56,790	$ 66,083
14	$ 39,633	$ 49,641	$ 59,649	$ 69,658
15	$ 41,063	$ 51,786	$ 62,509	$ 73,232