(DRAFT)

Wastewater Facilities Report
WASTEWATER TREATMENT PLANT EXPANSION

Quail Valley Lake Subdivision
Permit No. MO-0114081

Owner and Continuing Authority:
Aqua Missouri Incorporated
P.O. Box 7017
Jefferson City, Missouri 65102

DECEMBER 21, 2005

Report Prepared For:
Quail Valley Lake Homeowner's Association
c/o Ed Storey
2619 Foxdale Drive
Jefferson City, Missouri 65109

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EXECUTIVE SUMMARY

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SECTION 1: INTRODUCTION

The purpose of this report is to evaluate the existing Quail Valley Subdivision wastewater treatment facilities and provide a recommendation to upgrade the facilities to accommodate connection of new homes to the system. Subdivision development activities began in the 1970s with Phase I of the development providing for wastewater collection and treatment facilities for 80 homes surrounding the lake. Phase II will bring an additional 40 homes to the development. The existing collection system and treatment facility are owned and operated by Aqua Missouri, Inc. Each homeowner has a septic tank unit for pretreatment of domestic wastewater prior to the collection system.

SECTION 2: EXISTING CONDITIONS AND PROJECTIONS

A. Planning Period

The planning period for this report should be considered as a period of 10 years. This report will cover the second phase of the Quail Valley Lake Subdivision development. It is anticipated that future development will occur both to the west and south of the existing subdivision development. Cole County continues to grow and these areas are primed for additional residential development. These areas are owned by private entities other than the Quail Valley Homeowner's Association.

B. Land Use

The Quail Valley Subdivision is located adjacent to Route C in Cole County between the City of Jefferson City and Russellville. Previous land use for the area was agricultural and adjacent areas

still remain in agricultural use. However, significant residential development has occurred over the last 20 years throughout the area. The site for the additional 40 homes to be addressed in this report is currently within and adjacent to the Phase I area with most lots on the western side of the development. The western portion is currently undeveloped and prior to the subdivision development was considered agricultural land use.

The Phase II development area generally drains from north to south. The wastewater treatment facility is located at the south end of the development and at an elevation suitable to serve the Phase II area.

The Quail Valley Subdivision is a residential area; however, Cole County does not have zoning ordinances. The proposed Phase II development is suitable with the existing facilities and land use in the area.

C. Demographics and Economic Data

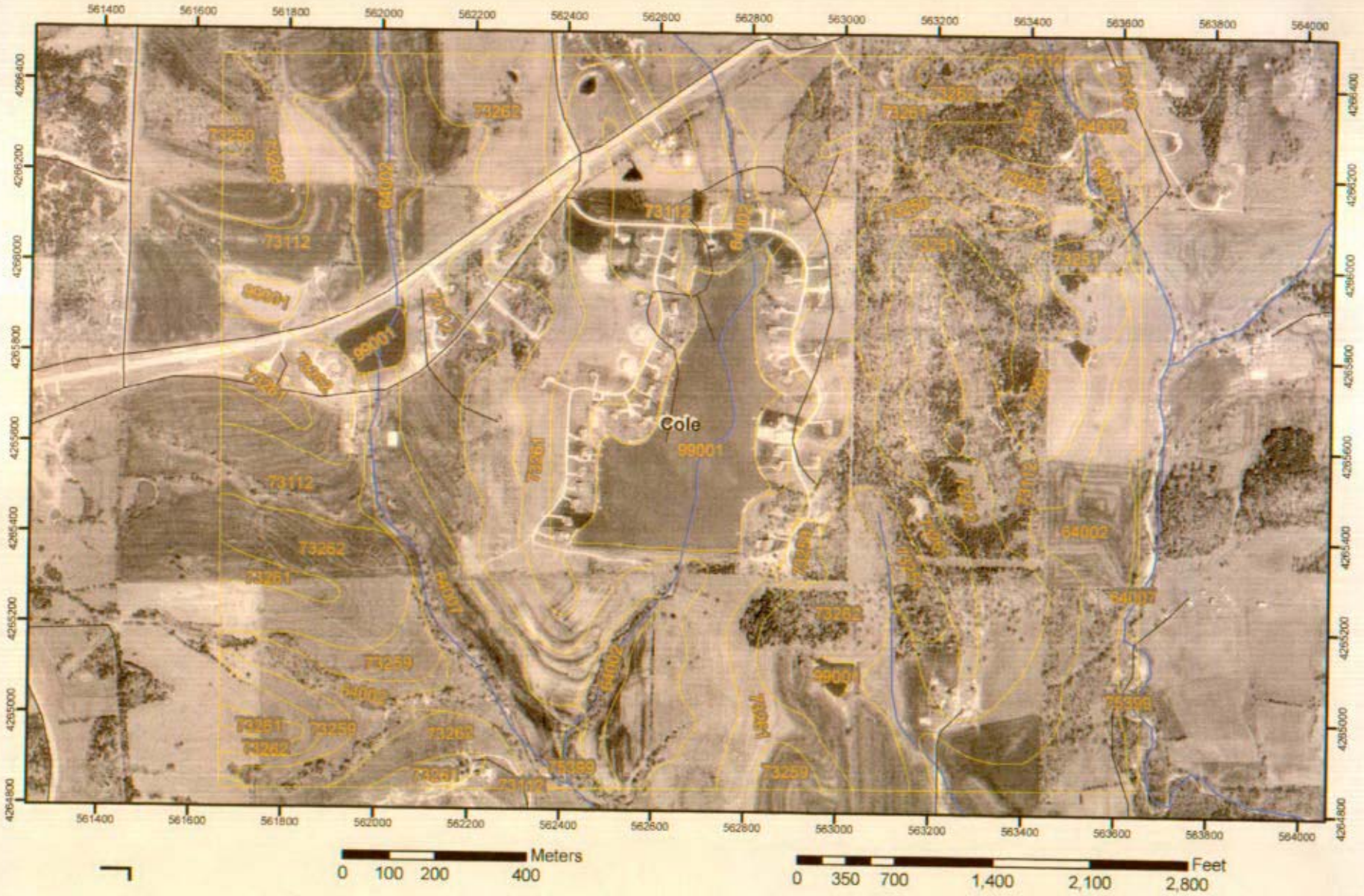
Over the past 14 years, the population in Cole County has grown from 63,579 people to 71,996 people. Growth of residential subdivisions has been relatively steady and projections are that it will continue in a similar pattern. The homes in the existing Quail Valley Subdivision are considered moderate to upper moderate scale homes. The Phase II development would be expected to be of a similar nature. No change is expected in either the economic or demographic status of the area as a result of development of the Phase II area within the Quail Valley Subdivision.

D. Topography and Geology

The Phase II area consists of rolling topography generally from the north to the south. The geology consists of a thin layer of silty loam overlaying clay and bedrock. More specifically, the geology as found in the "Soil Survey of Cole County" prepared by USDA can be described as follows:

Soil Survey of Cole County, Missouri: Map Unit Legend Summary

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
64002	Freeburg silt loam, 1 to 3 percent slopes	87.0	10.8
64007	Freeburg silt loam, 0 to 2 percent slopes, occasionally flooded	39.6	4.9
73112	Gunlock silt loam, 3 to 8 percent slopes	193.3	24.0
73250	Gatewood-Moko complex, 3 to 8 percent slopes, very stony	19.4	2.4
73251	Gatewood-Moko complex, 8 to 20 percent slopes, very stony	46.2	5.7
73259	Cotton silt loam, 3 to 8 percent slopes, eroded	16.0	2.0
73261	Wrengart silt loam, 5 to 9 percent slopes, bedrock substratum	75.9	9.4
73262	Wrengart silt loam, 9 to 14 percent slopes, bedrock substratum	278.1	34.5
75399	Jamesfin silt loam, 0 to 3 percent slopes, frequently flooded	5.4	0.7
99001	Water	46.0	5.7



USDA Natural Resources Conservation Service

MAP LEGEND

- Soil Map Units
- Cities
- Detailed Counties
- Interstate Highways
- Roads
- Rails
- Water
- Hydrography
- Oceans

MAP INFORMATION

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov

Coordinate System: UTM Zone 15

Soil Survey Area: Cole County, Missouri
Spatial Version of Data: 2
Soil Map Compilation Scale: 1:24000

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Temperature and precipitation are typical of central Missouri. The total precipitation for Cole County in 2004 was 49.34". The long-term rainfall average is approximately 41".

The existing wastewater treatment plant is not subject to flooding as it is located at the upper reaches of an unnamed tributary to the Moreau River. Likewise, any improvements to the facility are well above the 100-year flood level.

E. Forecasted Wastewater Flows

There are currently 78 homes connected to the existing wastewater collection and treatment facilities. Based upon standard design criteria of 3.7 persons per home, the population equivalent of the existing system is considered 289 people. The maximum number of homes in both the Phase I and Phase II developments combined would be 120 homes or a population equivalent of 444 people. The resulting wastewater flow based upon standard design criteria ranges as follows:

- Existing homes = 21,675 gallons/day to 28,900 gallons/day
- Phase I/Phase II flows = 33,300 gallons/day to 44,400 gallons/day

The operating permit for the facility was renewed on February 4, 2005. The facility description within the permit indicates that the design population equivalent for the existing facility is 296 people. The design flow is 22,000 gallons/day with the actual flow being 14,400 gallons/day. A review of monthly monitoring reports from 2005 shows that the reported actual flows range from a low of 1,440 gallons/day to a high of 30,436 gallons/day. The average for the period was 11,744 gallons/day. It should be noted that these monthly monitoring reports are an

instantaneous reading taken during daytime. Actual flows vary throughout the day and are low at night. The 2005 average flow was based upon 169 readings.

The impacts of infiltration inflow on the hydraulic loading were considered. Some volume of inflow is occurring after a rain; however, given the layout of the collection system, the volume of infiltration and inflow is not considered to be significant as only one (1) manhole structure exists. A portion of the system is under pressure as a series of pump stations are utilized. The Quail Valley Subdivision development is a septic tank effluent pumping system. Infiltration inflow is not considered a significant design concern.

F. Location Regulations

The proposed Phase II development will occur in Cole County. Regulations for subdivisions require that sanitary sewer facilities meet the requirements of the Missouri Department of Natural Resources Water Pollution Control regulations.

SECTION 3: EXISTING FACILITIES

A. Collection System

In the original development of the wastewater collection system for the Quail Valley Subdivision, a septic tank effluent pumping system was incorporated. Each home within the subdivision is equipped with an aerated septic tank. However, it should be noted that several years ago a decision was made to shut off all aerators and operate the system as a standard septic tank with the effluent, gravity-flowing to pumps stations. There are four (4) separate pump stations serving the development. These pump stations convey the wastewater to an interceptor

sewer that delivers the wastewater to the treatment plant. Plans were not available on the size or location of the wastewater collection system lines. The operators have reported that several lines are less than eight (8) inches in size and require periodic maintenance.

B. Treatment Plant

The existing wastewater treatment plant is a Model 220 extended aeration facility provided by the Murdon Corporation. The plant has an overall length of 47' 10", a plant width of 13' 10" and consists of the following:

- 6,450-gallon, aerated sludge holding tank
- A settling zone with a capacity of 3,958 gallons
- A settling zone area of 72 ft^2
- A Weir length of 11 ft
- An airlift pump capacity of 36,200 ft^3 per day
- A five (5) horsepower motor
- A 2,050 RPM blower
- A 134,000 ft^3 per day air availability with an operating pressure of five (5) psi

The plant is also equipped with a chlorinator and a chlorine contact chamber. The chlorinator is a tablet-type chlorinator. Following the contact chamber is an effluent box with a V-notch Weir measuring device.

Permit Number MO-0114081 indicates that the design sludge production is 5.3 dry tons/year. Actual sludge production is listed at 0.375 dry tons/year. The permit indicates that sludge is hauled to the municipal wastewater works of the City of Jefferson for disposal.

The permit renewal dated February 4, 2005, contains a schedule of compliance. The permit requires Aqua Missouri, Inc. to submit engineering plans, specifications and a construction permit application by July 1, 2006, for changes to the wastewater treatment facility so that the facility will meet final effluent limits for total residual chlorine. Aqua Missouri is required to meet final effluent limits by April 1, 2007. These final effluent limits include the following:

- Biochemical oxygen demand – 45 mg/L weekly average, 30 mg/L monthly average
- Total suspended solids – 45 mg/L weekly average, 30 mg/L monthly average
- pH – 6.0 to 9.0
- Fecal coliforms – 1,000 per 100 mL as a daily maximum and 400 per 100 mL as a monthly average
- Chlorination is required from April 1 through October 31
- Total residual chlorine – 0.019 mg/L daily maximum and 0.019 mg/L monthly average

C. Wastewater Characteristics

The wastewater characteristics are typical of a domestic sanitary sewer discharge. Only residential homes are connected to the wastewater system; therefore, commercial and industrial influences are not present. Based upon a review of data from 2005 monthly monitoring reports, the average effluent BOD is 7.4 mg/L. The average effluent suspended solids is 7.9 mg/L. See Table 3.1.

Table 3 - 1

Quail Valley Lake Subdivision WWTP
Quail Valley Lake, Route C
Jefferson City, MO 65109
Permit No. MO-0114081

Month		Influent	Effluent					
		Flow GPD Eff.	BOD mg/l	SUS SOLID mg/l	D.O. mg/L	TEMP °C	CL_2 mg/L	FECAL /100 ml
October, 2004	Monthly Avg.	7,603	6.0	17.0	4.2	16.2	0.3	50
	Daily Max	7,603	6.0	17.0		16.2	0.3	50
November, 2004	Monthly Avg.	2,851	8.0	9.0	6.5	17.4		
	Daily Max	2,851	8.0	9.0		17.4	0.0	0
February, 2005	Monthly Avg.	12,096	9.0	6.0	6.3	7.8		
	Daily Max	12,096	9.0	6.0		7.8	0.0	0
March, 2005	Monthly Avg.	15,218	10.0	6.0	5.7	9.9		
	Daily Max	15,218	10.0	6.0		9.9	0.0	0
April, 2005	Monthly Avg.	18,262	6.0	5.0	5.8	14.2	0.3	25
	Daily Max	18,262	6.0	5.0		14.2	0.3	25
May, 2005	Monthly Avg.	2,851	4.0	6.0	5.1	19.2	0.3	10
	Daily Max	2,851	4.0	6.0		19.2	0.3	10
June, 2005	Monthly Avg.	4,565	12.0	2.0	4.6	22.4	0.3	15
	Daily Max	4,565	12.0	2.0		22.4	0.3	15
July, 2005	Monthly Avg.	11,404	6.0	10.0	5.7	24.8	0.2	120
	Daily Max	11,404	6.0	10.0		24.8	0.2	120
September, 2005	Monthly Avg.	7,200	4.0	7.0	3.2	26.3	0.3	25
	Daily Max	7,200	4.0	7.0		26.3	0.3	25
October, 2005	Monthly Avg.	10,838	9.0	11.0	5.4	19.4	0.3	130
	Daily Max	22,827	9.0	11.0		23.1	0.7	130
	Monthly Average	9289	7.4	7.9	5.3	17.8		

The strength of influent wastewater may be influenced by the septic tanks located within the collection system. Septic tanks that are regularly pumped of solids provide a degree of removal for both solids and BOD. Septic tanks that are not maintained end up with minimal removal of solids and BOD. The Homeowner's Association does not have records on the frequency of septic

tank cleaning within the system. If properly operated, the septic tanks can be considered an untapped resource as an effective pretreatment device.

D. Unsewered Areas

The Phase II area is currently unsewered. The area is located on the western edge of the development and will consist of homes located on either side of a proposed street that will serve the area. The street will be located from north to south at the west edge of the development with a sewer collection system paralleling the street. The currently unsewered area will be developed utilizing the same specifications as the existing Phase I development. Therefore, aerated septic tanks and pumping systems (if needed) will be provided to convey wastewater from the individual home to the collection system.

SECTION 4: PROJECTED DEVELOPMENT

A. Design Characteristics

The following design characteristics are based upon the combined Phase I/Phase II development area. The characteristics are as follows:

- Total population equivalent – 444
- Design flow – 33,300 gallons/day with a peak of 44,400 gallons/day
- BOD loading at 0.17 lbs/pe = 75.5 lbs/day
- Sludge production – 7.95 dry tons per year

B. Receiving Water Considerations

MDNR was contacted to determine if an analysis of the water quality impact had been studied for the unnamed tributary in which the wastewater plant discharges. MDNR indicated that the analysis had not been conducted and required the owner to conduct this study. Aqua Missouri, Inc. has a qualified scientist that will conduct the water quality impact study. A copy of the study will be submitted under separate cover letter from Aqua Missouri, Inc.

C. Effluent Limitations

Based upon the water quality impact study, the MDNR Northeast Regional Office in Macon, Missouri, will determine effluent limitations for the proposed facility upgrade. Based upon effluent limits from the permit for the existing facility, the average BOD in the effluent is 30 mg/L. The maximum daily value was 45 mg/L. The average effluent value for total suspended solids is 30 mg/L with a maximum daily value of 45 mg/L.

Given the location of the plant effluent from the Moreau River, chlorination and dechlorination will be required. Therefore, considering the current effluent data, the following alternatives in this report have been based upon meeting an average effluent BOD and suspended solids similar to existing concentrations being discharged. Chlorination and dechlorination as specified in the current permit will be provided. The results of the water quality impact study will dictate the final effluent limits.

D. Treatment Plant Site Requirements

The existing wastewater treatment plant is located on a plot of land just south of the dam for Quail Valley Lake. Only a portion of this area is fenced, that being directly around the extended aeration packaged plant. Additional fencing will be required to secure the chlorination and dechlorination facilities and any potential new wastewater treatment facilities that may result from this study. It appears that the existing treatment plant property is adequate for small additions to the wastewater structures. Final design of the facilities may require the purchase of some additional acreage; however, adequate land is available for this expansion.

E. Treatment Plant Alternatives

Four separate alternatives were reviewed to address the addition of wastewaters from the Phase II development of the Quail Valley Subdivision. The following is a discussion of each alternative.

Alternative 1: Connect to a larger regional wastewater operation

Cole County does not currently operate a regional wastewater treatment system. Furthermore, the Quail Valley Lake Subdivision is located at a considerable distance from any municipality that would have wastewater treatment capabilities. A review of other nearby private facilities find that none have the capabilities or are suitably located to be combined with the Quail Valley wastewater plant.

Therefore, based upon the lack of suitable facilities, the Quail Valley Lake Subdivision facility will be required to expand or modify the treatment system and treatment facility in order to accept wastewaters for the Phase II area.

Alternative 2: Plant expansion based on standard design criteria

It is possible to expand the plant to a hydraulic capacity of 33,000 gallons/day average with a peak of 44,400 gallons/day. The design criteria for this plant are shown in Table 4-2. Both the aeration capacity and settling, or clarification capacity, of the plant must be expanded. One method of incorporating this expansion would be to convert the existing settling chamber in the packaged extended aeration plant into additional aeration basin capacity. A new circular clarifier would then be added at the discharge from the aeration basin. Effluent from the clarifier could then be piped to the existing chlorination chamber. A dechlorination unit would be added at the exit of the chlorination chamber. Sizing calculations for these units are included in Table 4-2.

Table 4 - 2

Quail Valley Lake Subdivision WWTP
Quail Valley Lake, Route C
Jefferson City, MO 65109
Permit No. MO-0114081

Alternative #2: Plant expansion based on standard design parameters

Design Parameters:

Pop. Equiv. =	444	
Flow =	33300	GPD
BOD =	75	lbs/day
TSS =	89	lbs/day
sludge prod. =	7.95	dry tons/yr

Aeration Basin

basin size	37639	gallons @ 15 lbs/1000 CF
air required	196248	CFD @ 2600 CF/lb BOD

Convert current settling chamber and sludge holding tank to aeration

Current aeration volume =	22081	gallons
Added aeration volume =	11040	gallons
Total aeration volume =	33121	gallons

Air for lift pumps = 76,900 CFD
Motor = 7.5 HP
Blower speed = 2200 RPM
Air available = 233,300 CFD (162 CFM)
Operating psi = 5

Settling Basin

4 hours detention =	5550	gallons
Area @ 600 gpd/sf =	56	square feet **(allows for sludge return)
Weir length @ 2500 gpd/ft	13	feet

Install new circular clarifier

Diameter @ 10' =	78.5	square feet
Min. Depth = 12'	7046	volume in gallons
Detention time =	5.08	hours
Weir length =	22	linear feet

Alternative 3: Replacement Plant

Another option for consideration is replacement of the entire existing wastewater plant with a new packaged wastewater unit. The purpose of this replacement would be to provide additional capacity to allow for future growth of the facility. In effect, there are 17 acres located just west of the Quail Valley development that could be served by this larger wastewater treatment facility. This new wastewater treatment plant would then have the capacity to serve approximately 140 homes, or a population equivalent of 518. Table 4-3 provides the design parameters for this new, larger facility and includes calculations of the sizing of the aeration basin and final settling chamber.

Table 4 - 3

Quail Valley Lake Subdivision WWTP
Quail Valley Lake, Route C
Jefferson City, MO 65109
Permit No. MO-0114081

Alternative #3: New Plant

Design Parameters:

Pop. Equiv. =	518		
Flow =	40404	GPD	(based upon 78 GCPD)
BOD =	88	lbs/day	(based upon 0.17 lbs/PE)
TSS =	104	lbs/day	(based upon 0.20 lbs/PE)
sludge prod. =	9.2	dry tons/yr	

Aeration Basin		
equalization chamber	13,284	gallons
basin size	43913	gallons @ 15 lbs/1000 CF
air required	228956	CFD @ 2600 CF/lb BOD
40,000 GPD Extended Aeration Plant		
9,030 Gallon sludge holding tank		
Clarifier chamber volume =	6895	gallons
Settling time =	4	hours
Chlorine contact chamber =	1077	gallons
Two positive displacement blowers		

(See manufacturer's information - Appendix 4)

Alternative 4: Implementation of the septic tank pretreatment system

Given that each home within the Quail Valley Lake Subdivision has a septic tank pretreatment system, it is possible to utilize the potential treatment capacity within these units. Under this alternative each existing septic tank would be retrofitted with a new aeration unit. Likewise, all new homes within the Phase II area would be equipped with aerated septic tank units. Effluent from the septic tanks would then be conveyed through the collection system to the existing wastewater treatment facility. If maintained, aerated septic tanks provide an effective method of pretreating wastewater to reduce BOD and solids loading to a downstream treatment device. Table 4-4 provides calculations showing loadings based on both standard design criteria as well as actual plant data from the Quail Valley wastewater plant.

Based upon this data, both BOD and suspended solids loadings are far less than the treatment capacity of the existing facilities. A review of the hydraulic capacity of the plant would indicate that at actual flows the plant is capable of handling the entire flow from the Phase I and Phase II combined areas.

Probably more importantly, though, than the theoretical numbers on capacities and treatment efficiency is the actual operations of such a system. Well-maintained aerated septic tanks can produce an effluent that would require operational changes to the existing extended aeration plant. Only limited aeration would be required during the colder months while the summer months would operate more typical of a lightly-loaded wastewater plant. Long solids residence times would occur in the treatment

unit and sludge production would be reduced. Conversely, if the aerated septic tank systems are not maintained, then the potential exists for limited treatment from the septic units. With all homes hooked to the system, the potential to overload the treatment plant could occur. Therefore, provisions to ensure operation of the septic tanks systems must be included should this alternative be chosen. Aqua Missouri, Inc. does not have authority and is not compensated for operating the septic tanks. The Quail Valley Homeowner's Association would have to develop a mechanism such that maintenance of the aerated septic tanks is provided. The Homeowner's Association could contract with Aqua Missouri or it could hire a separate contractor, experienced with septic tank maintenance and solids removal, to perform scheduled and routine maintenance. The maintenance program suggested would be a monthly inspection of the aeration units and periodic pumpings of the septic tanks. Contract language could be provided between the Homeowner's Association and Aqua Missouri giving Aqua Missouri the right to shut off the connection from any home owner not meeting the requirements of the septic tank maintenance agreement.

Table 4 - 4

Quail Valley Lake Subdivision WWTP
Quail Valley Lake, Route C
Jefferson City, MO 65109
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Alternative 4: Plant expansion using septic tank effluent

Design Parameters:	Septic influent		Septic effluent		
Pop. Equiv. =	444				
Flow =	33300	GPD	33300	GPD	
BOD =	75	lbs/day	21	lbs/day	(based on 50 mg/l influent **)
TSS =	89	lbs/day	22	lbs/day	(based on 50 mg/l influent **)
sludge prod. =	7.95	dry tons/yr	4	dry tons/yr	

Aeration Basin

basin size	10248	gallons @ 15 lbs/1000 CF
air required	53434	CFD @ 2600 CF/lb BOD

Keep current plant the same

Current aeration volume =	22081	gallons
Added aeration volume =	0	gallons
Total aeration volume =	22081	gallons

Air for lift pumps =36,200 CFD
Motor = 5 HP
Blower speed = 2050 RPM
Air available = 134,000 CFD (93 CFM)
Operating psi = 3. 5

Settling Basin

Existing clarifier =	72	square feet
Min. Depth = 10.25'	5520	volume in gallons
Detention time =	3.98	hours
Total Weir length =	11	linear feet

** Based upon a study performed by the University of Wisconsin- Madison, the average effluent from an aerated septic tank unit is 37 mg/l BOD and 39 mg/l TSS. The values were doubled to provide a factor of safety.

F. Cost Estimates

The costs of the three (3) potential alternatives for treatment as discussed above are provided in Table 4-5. The cost estimate includes capital costs and added operational costs for each of the three (3) alternatives.

Table 4 - 5

Quail Valley Lake Subdivision WWTP
Quail Valley Lake, Route C
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Cost estimate of Alternatives

Item	Description	#2 Std. Design Alt.	#3 New Plant	#4 Septic Tank Effl.
1	Sitework	$1,500	$4,500	$0
2	Modify exist. Tankage	$2,000	$0	$0
3	Add aeration piping/diffusers	$2,500	$0	$0
4	Upgrade blower	$5,000	$0	$0
5	New clarifier unit	$80,000	$0	$0
6	New aeration unit	$0	$0	$0
7	Dechlorination unit	$750	$750	$750
8	New packaged plant	$0	$250,000	$0
9	Foundation/piping	$0	$24,000	$0
10	Fencing/signs	$2,000	$2,000	$2,000
11	miscellaneous	$1,000	$1,000	$1,000
	subtotal	$94,750	$282,250	$3,750
	contingency	$14,213	$42,338	$563
	design/legal	$6,633	$19,758	$263
	Project total	**$115,595**	**$344,345**	**$4,575**
	New O&M costs (added to existing costs)	**$12,000**	**$30,000**	**$72,000**

G. Selected Process

Protection of the environment is the main focus in the selection of the plant expansion system. A sustainability analysis to select a process includes not only the degree of treatment that can be obtained but impacts to neighbors, impacts to the Homeowner's Association, the operator of the facility and economics. This analysis recognizes competing interests, that being homeowners who wish to keep costs as low as possible, operators who wish to minimize the potential for operating problems and effluent violations, and the developer of the Phase II area looking for the most cost effective method to add new homes in a timely manner.

The simplest answer, but least cost effective, is to install a new, larger, packaged treatment plant with adequate capacity for future growth. The best utilization of resources and the highest potential treatment would occur from the more maintenance intensive alternative of utilizing aerated septic tanks throughout the system. While the most cost effective, this septic tank option also has the highest opportunity for maintenance-related issues. In any event, both the Homeowner's Association and the operator of the wastewater treatment facility must be in agreement on the chosen alternative.

Therefore, based upon meetings with the leadership of the Homeowner's Association and Aqua Missouri, Inc. the proposed alternative is _____.

H. Legal and Other Considerations

There are a number of legal issues that arise from expansion of the Quail Valley Lake Subdivision wastewater treatment plant. Aqua Missouri, Inc. is the owner and continuing

authority for the treatment plant. The Quail Valley Lake Homeowner's Association is the generator of the wastewater. A developer is involved in completing the Phase II portion of the subdivision development. Therefore, agreements between the three entities will be developed that incorporate all needed provisions to successfully implement the chosen alternative.

APPENDICES

Appendix 1

Site Map

Cole County, Missouri Property Map

FOXDALE DR, JEFFERSON CITY, MO 65109

OWNER INFORMATION	
Name:	QUAIL VALLEY LAKE ASSOCIATION % RITA STOREY
Owner Address:	2847 FOXDALE DR
City, State, ZIP:	JEFFERSON CITY, MO 65109
PROPERTY DETAILS	
Parcel ID:	1009290002000031
Address:	FOXDALE DR, JEFFERSON CITY, MO 65109
Deed Book/Page:	289/301 11-22-1985
Deed Book/Page:	
Deed Book/Page:	
Subdivision:	QUAIL VALLEY LAKE
Sec/Twn/Rng:	29/44/12
Property Desc:	ALL THAT PT OF QUAIL VALLEY LAKE KNOWN AS "RECREATIONAL AREA" LYING NORTH OF LAKE (**Property description is NOT a legal description**)
Year Built:	0
Living Units:	0
School District:	JEFFERSON CITY
Fire District:	COLE COUNTY
PROPERTY VALUES	
Exempt:	No
Total Appraised Value:	$34,700
Total Assessed Value:	$6,590
Tax, Year 2005: (Tax amounts do not include penalties and interest if applicable)	$321.88

Disclaimer:

This document was produced by the Cole County Geographic Information System. Cole County assumes no legal responsibility for the information contained on this document.

Cole County, Missouri
210 Adams Street
Jefferson City, MO 65101

Phone: 573.634.9132
Fax: 573.634.9139
Email: mjohnson@colecounty.org

Today's Date: 12/1/2005

Legend

MAIN ST Street Name

Property Boundary

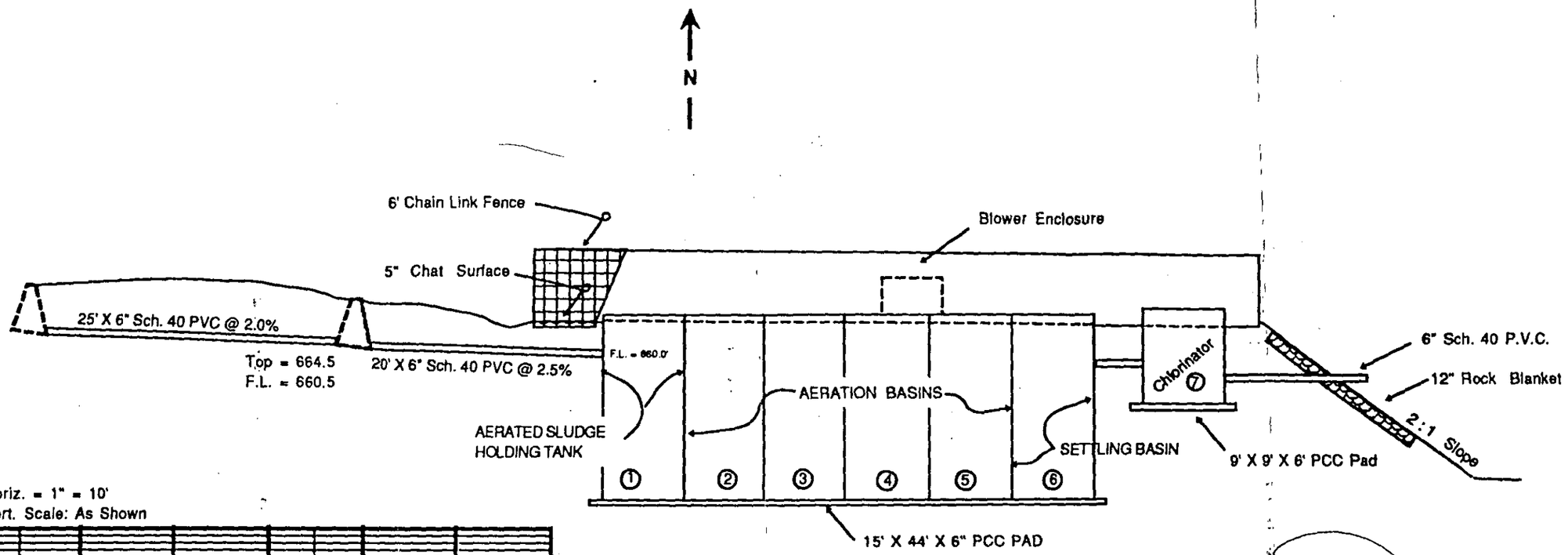
Property Selection

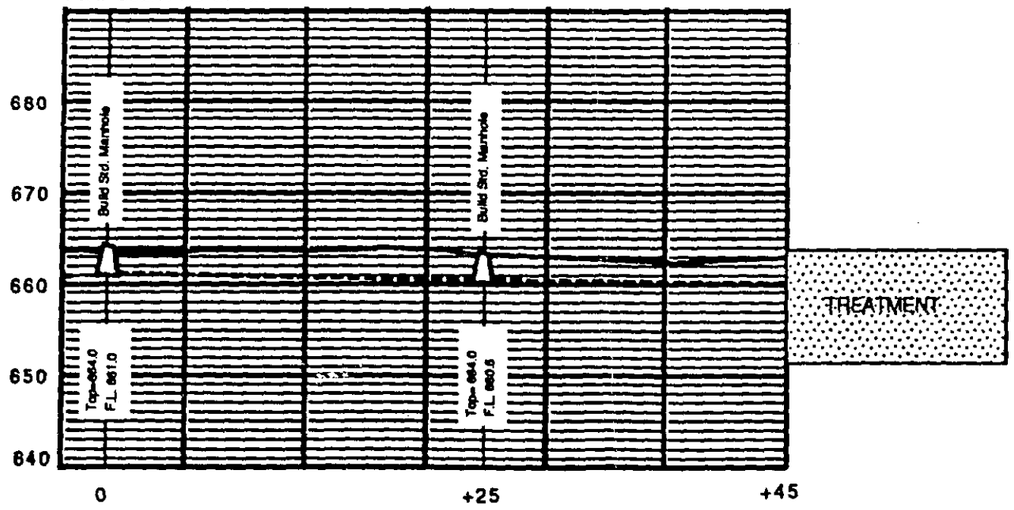
DATA INFORMATION:

Aerial Photography Date: 2002.
Assessment Map Last Updated: 9/15/2005.
City Limits boundaries are within Cole County only.

Appendix 2

Existing Plant Layout





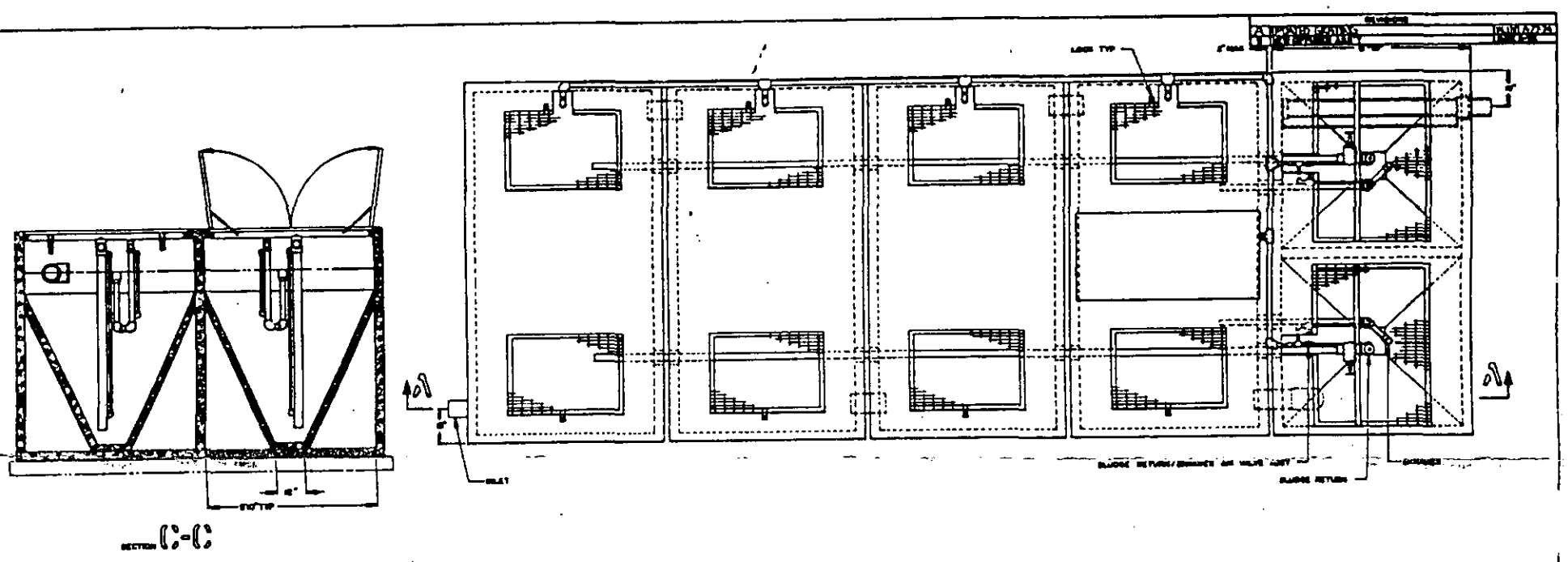
15X50

PCC PADS TO BE 5.5 BAG MIX
PADS TO BE REINFORCED WITH NO. 4 BARS @ 9" CENTERS EACH WAY.

ALL PLANT CASTINGS SHALL INCLUDE ONE ADDITIONAL 30" RISER.

FACILITY SHALL INCLUDE:
1) 6450 GAL. AERATED SLUDGE HOLDING TANK ①
2) 1-22,500 GPD EXTENDED AERATION PLANT ② ③ ④ ⑤ ⑥
3) 1-535 GAL. CHLORINATOR ⑦

PROFILE OF OUTFALL & TREATMENT PLANT
1" = 10'



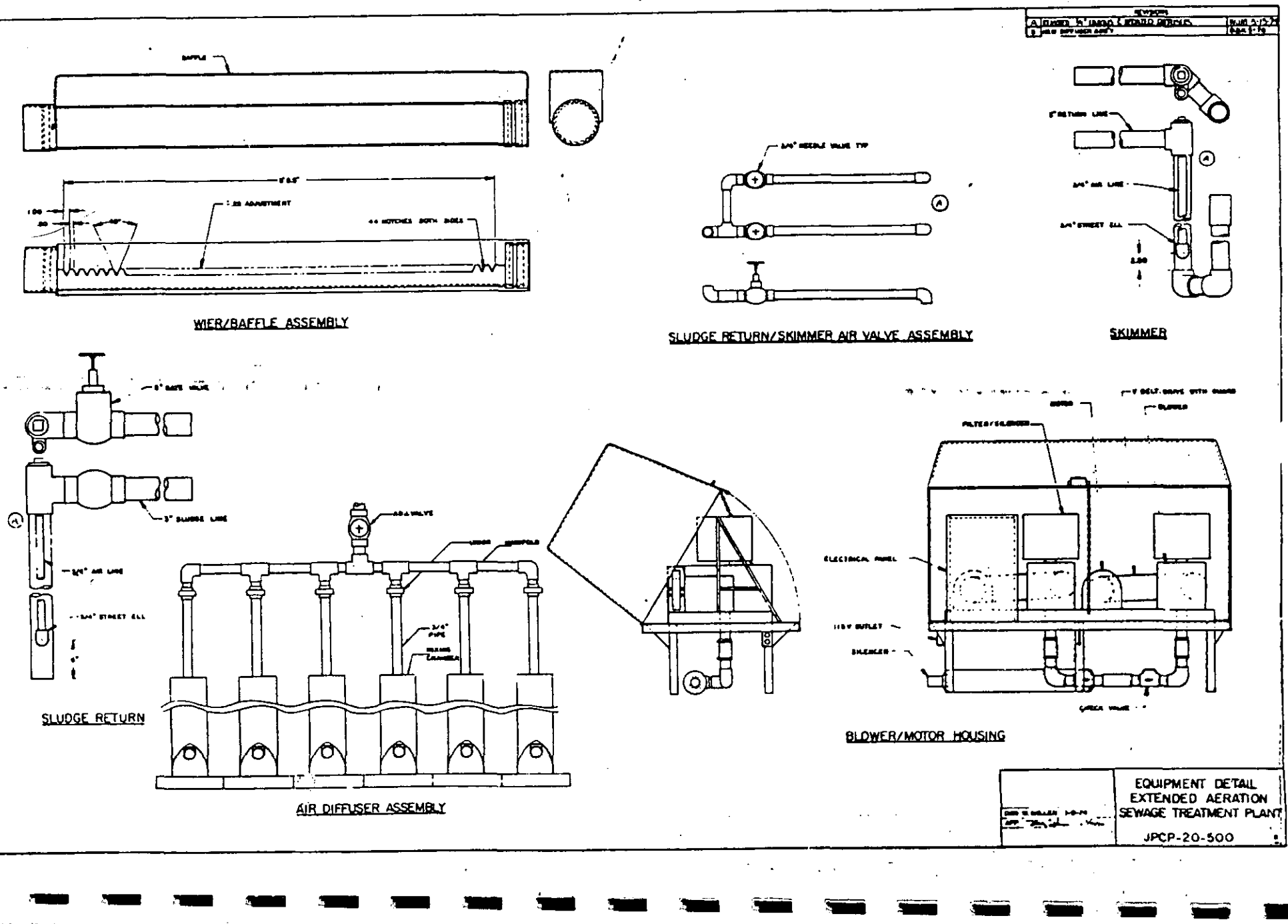
NOTES

240	24000 GAL	13'-3"	11'-6"	12'-6"	11'-6"
230	23000 GAL	13'-3"	10'-10"	12'-6"	10'-6"
220	22000 GAL	13'-3"	10'-4"	12'-6"	10'-0"
210	21000 GAL	13'-3"	9'-10"	12'-6"	9'-6"
200	20000 GAL	13'-3"	9'-4"	12'-6"	9'-0"
190	19000 GAL	13'-3"	8'-8"	12'-6"	8'-3"
MODEL	PLANT CAPACITY	A	B	C	D

TABULATED DIMENSIONS

EXTENDED AERATION
SEWAGE TREATMENT PLANT

JPCP-190-240



Appendix 3

Alternative 2 - Equipment

MODULAR CLARIFIER

Two 12' diameter modular clarifiers at a municipal WWTP

Davco Products manufactures small and intermediate size mechanical clarifiers that are efficient, compact, and designed to truly minimize installed cost. Whether the application calls for gravity settling for suspended solids, sludge thickening, flocculating types for chemical addition, or solids contact for sludge recirculation and softening; Davco Products can supply modular clarifiers for virtually any application with a variety of construction options to meet special code requirements.

DESIGN

Davco Products modular clarifiers are available in diameters from 8 ft. to 32 ft.. Clarifiers under 12 ft. in diameter are shipped to the jobsite as a single piece. Installation for these consists of running the electrical supply to the control panel, attaching the inlet, effluent, and sludge piping, and then filling. The system is complete and ready to run.

For clarifiers greater than 12 ft. in diameter, components are shipped in 2 or 3 sections, dependent upon the flow rate. The minimum site work for these larger clarifiers requires only the on-site welding of 2 or 3 seams to seal the components, the installation of grout, a minimum of touch-up paint, and the electrical and piping hook-up. The simple, but efficient, design of the modular clarifier allows the buyer to get what is needed - when it is needed; saving both time and money.

Modular clarifiers manufactured by Davco Products are used in both municipal and industrial applications, and can be installed with new treatment systems or on existing projects where greater performance is required. They are constructed of A-36 steel, unless a stainless steel option is specified, and have a shop

MODULAR CLARIFIER

Above: Elevated modular sludge thickener for an industrial application.

Above: One section of a 20' dia. modular clarifier. Note- all internal components are factory installed.

applied epoxy finish coating. Process capacities range from 25,000 to 400,000 gpd. The major components featured with the modular clarifier are the drive mechanism, sludge collector mechanism, scum collection mechanism, and effluent launderer. These components are pre-assembled and factory installed.

CLARIFIER OPTIONS

Sludge Thickeners

Davco Products thickeners concentrate waste sludge solids to facilitate their handling and ultimate disposal. These units are specifically built to handle higher torque requirements and the viscosity levels of thickened solids.

Solids Contact

Solids Contact Clarifiers are recommended for applications where mixing of pre-treated influent with aged sludge is required to enhance settling. These units are provided with a separate internal mixing/flocculation zone that is appropriately isolated from an external clarification zone. These units can be used for lime softening, phosphorous removal, and other types of contact clarification.

Peripheral Feed

Peripheral feed clarifiers are normally used as secondary clarifiers in biological treatment systems. They employ a spiral feed system for enhanced solids separations.

Flocculating

Flocculating clarifiers provide a flocculation zone integrated with the clarifier thus eliminating the need for a separate flocculation tank and mixer. These clarifiers are engineered for specific applications and are equipped with specialized influent diffuser and mixing components.

Other Options

Davco Products modular clarifiers may be elevated on legs with sloped, steel bottoms for leakage inspection, and to meet pipe elevation requirements. Covers can be provided for controlling emissions, or construction may include secondary containment, dependent upon the industrial application. If additional pre-treatment is required, a rapid mix and/or flocculation basin can be included ahead of the clarifier.

USFilter

Taking care of the world's water.

Davco Products
1828 Metcalf Avenue
Thomasville, GA 31792
800.841.1550 *phone*
912.228.0312 *fax*
http://www.usfilter.com *website*

Appendix 4

Alternative 3 - Equipment

Ecologix Environmental Systems, LLC

120 Ansley Way
Roswell, GA 30075
Toll Free: 888-326-2020 Tel: 770.993.8292 Fax: 770.993.8824
Email: info@ecologixsystems.com Web Site: www.ecologixsystems.com

40,000/GPD Wastewater Treatment System
One (1) Model BC-40-ESC (Secondary Treatment)
One (1) Model TF-2-14-C (Tertiary Filter)
Proposal Package Plant

Date: December 15, 2005

Quote No: 8037-12155

To: Greg Haug, Director
Resource Institute
210 East High
Jefferson City, MO 65101
Email: greghaug@aol.com
Tel: (573) 634-5008 Fax: (573) 634-8730 Cell: (573) 680-0705

I. Ecologix Environmental Systems is pleased to provide the following equipment for your consideration.

One (1) Model BC-40-ESC prefabricated carbon steel packaged wastewater treatment plant. The package plant will use the extended aeration version of the activated sludge process and will be capable of treating 40,000 GPD of 240 mg/l -BOD5 wastewater down to 30 mg/l.

One (1) Model TF-2-14-C Tertiary Filter to treat 40,000 GPD 30 mg/l-BOD5 with an SS of 30 mg/l to less than 10 mg/l BOD5 & SS.

A. General Specifications

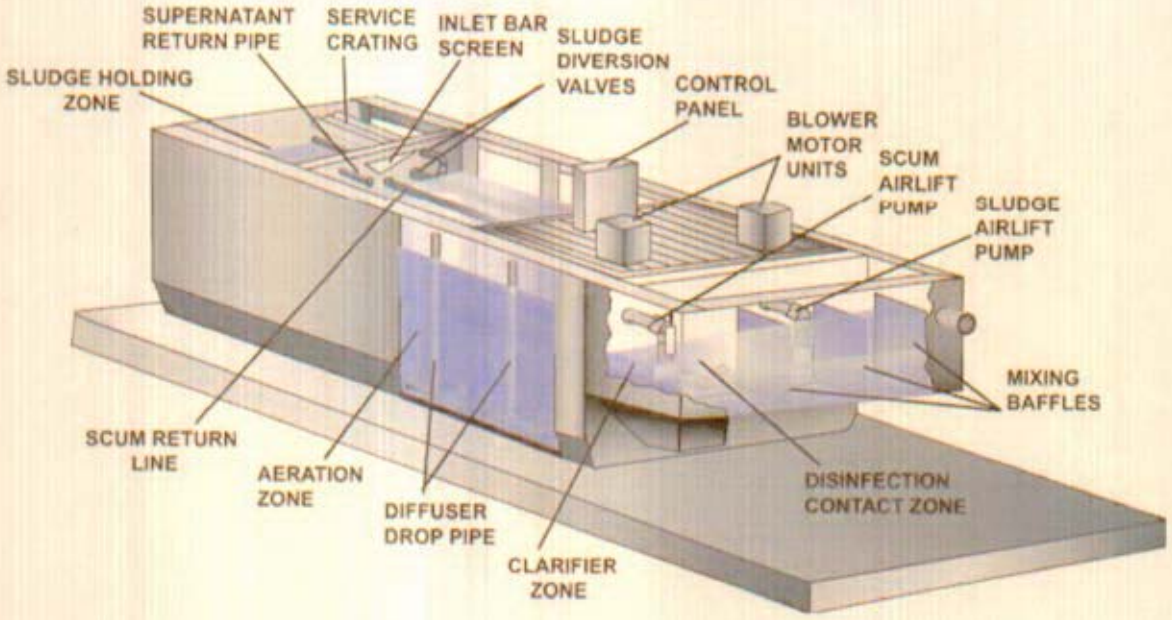
Equalization Chamber Volume: 13,284 gallons
Sludge Holding Chamber Volume: 9,030gallons
Aeration Chamber Volume: 40,110 gallons
Clarifier Chamber Volume: 6,895 gallons
Chlorine Contact Chamber Volume: 1077 gallons
Overall Site Requirement: Length/Width/Height: 99'-6" / 12'- 0" / 11'- 0"
Shipping Weight: 100,000 lbs. (approximate)

B. Materials of Construction

All tank vessels will be fabricated of 1/4" structural grade ASTM designation A-36 steel plates joined by arc welding with fillets of adequate section for the joint involved.
All walls will be continuous and watertight and will be supported by structural reinforcing members where required. Fabrication and erection would conform to the appropriate requirements of "AISC Specification for Buildings". Connections will

conform to the requirements of the American Welding Society's Code and will develop the full strength of the member.

All piping within the plant will be Schedule 40 steel pipe except as may be noted on other sections of the specifications. All vessel surfaces to be painted will be properly prepared in a workmanlike manner so as to obtain a smooth, clean and dry surface. All rust, dust and mill scale, as well as other extraneous matter, will be removed by means of cleaning by a SP-6 and SP-10 sandblast. All interior and exterior vessel surfaces will be painted with epoxy coal tar.



C. Equalization Chamber

A duplex set of equalization pumps will be furnished and installed within the chamber. The pumps will be rated 1/2 HP, 480 volt, 3 phase, and 60 cycle. An emergency overflow will be provided between the equalization and aeration chamber.

Flow control will be accomplished by pumping plant influent to a flow control box containing an adjustable overflow broad weir and two 45 degree V-notch discharge weir.
The overflow broad weir will be adjustable so that a measured amount of pumped influent will discharge through the V-notch weir to the dual aeration chambers, while overflowing the remaining pumped influent back into the equalization chamber.

A blower/motor unit in a fiberglass housing will be supplied for the equalization chamber air requirements. The blower will be capable of delivering 66 CFM when operating at 5 PSI. The motor will be 1 HP, ODP type for operating on 480 volts, 3 phase, 60 cycle service.

The pumps and blower/motor unit will be regulated by liquid level sensors. Controls will be provided in the plant control panel.

D. Sludge Holding Chamber

The chamber will be of the aerated type. Diffused air will be supplied by the plant blower system supplying 30 CFM of air per 1000 cubic feet of volume. The diffusers will be located parallel to and near the bottom of the tank. All piping and valves within the chamber will be factory installed.

E. Aeration Chamber

The aeration chamber will be of sufficient capacity to provide a minimum of 24 hours retention of the average daily flow, and/or maximum loading of 15 pounds of BOD5 per 1,000 cubic feet of aeration tank volume. The vessels will be shaped on each side to prevent scum and froth accumulation. To insure maximum retention and eliminate short circuiting of raw sewage, the aeration chamber will be constructed with air diffusers placed longitudinally along one side of the chamber so as to, in conjunction with the flow control baffles, enhance the spiral rotation of the chamber contents. To insure adequate circulation velocity, the proportion of chamber width to depth, in the direction of rotation, will not exceed 1.33 to 1. The velocity of rotation will be sufficient to scour the chamber bottom and prevent sludge filleting as well as to prevent the escape to the surface of minuscule air diffusion bubbles and by so causing their entrapment to provide maximum oxygenation efficiency.

F. Clarifier Chambers

The clarifier chambers will be of such size as to provide a minimum of 4 hours retention, based upon the same design flow rates governing the aeration chamber, but including adjustment of such rates to compensate for runoff periods, and will have proper baffling to prevent short circuiting and to provide maximum uniform retention.

The total settling volume will include the volume of the upper 1/3 of the sludge hopper or hoppers. Flat bottom area of hopper will in no case be greater than one square foot. The slope of the hopper walls will not be less than 1.7 vertical to 1.0 horizontal.

Settled sludge will be returned from the clarifier sludge hopper to the aeration chamber by the positive sludge return system, consisting of one or more airlift pumps. The clarifier effluent will pass over the edge of the baffled effluent weir into the effluent trough and then out of the chamber. The effluent weir trough will be equipped with adjustment to permit precise leveling of the serrated weir after plant installation.

G. Sludge Recirculation System

There will be installed within the clarifier chamber a positive sludge recirculation system consisting of one (1) 3 inch diameter airlift sludge return assembly per hopper meeting the following specifications: The airlift pump will have the recirculation capacity ranging from 0% to 150% of the design flow. The air line supplying air to the pump will be equipped with a cock valve to vary the amount of air supplied to each pump, thus varying the capacity of the pump. The airlift pump will be firmly supported and will be equipped with a clean-out plug to allow for easy cleaning and maintenance.

H. Scum Recirculation System

There will be installed within each clarifier chamber a positive scum and skimming recirculation system consisting of one (1) 2" diameter airlift skimming device meeting the following specifications: The skimming device will be of the positive airlift pump type, located in a position to skim and return floating material to the aeration chamber. The air line supplying air to the skimming device will be equipped with a valve to regulate the rate of return. The scum intake will be equipped with an adjustment assembly which will enable exact positioning of the skimmer at water level.

I. Chlorine Contact Chamber (on Tertiary)

J. Air Diffusion System

An air distribution manifold consisting of a rectangular hollow steel tube is installed along the entire length of the plant. The manifold feeds a series of assemblies.

Each diffuser drop assembly will be equipped with an air regulation and/or shut-off cock valve, union and an air diffuser header. The diffusers will be parallel to and near the base of the vessels side wall, at an elevation which will provide the optimum diffusion and mixing.

Each Hydro-Chek Model DP-75 air diffuser will be constructed of Celcon plastic with a removable and replaceable neoprene air check diaphragm. It will be designed to handle a wide range of air flow.
The oxygen transfer capacity of each diffuser will be such that an adequate supply of oxygen will be maintained in the aeration chamber to meet treatment requirements.

K. Blower/Motor Units

Two (2) positive displacement blower/motor units will be supplied. The blower/motors shall be mounted on the tank. The blower/motor unit (s) shall be capable of providing a minimum of 2100 cubic feet of air per pound of BOD5 plant loading.

The blowers will be capable of delivering 162 CFM when operating at 5 PSI. The motor will be 5 HP, ODP type, for operation on 480 volt, 3 phase, 60 cycle service.

The blower/motor will be mounted to a reinforced molded fiberglass base, with a molded fiberglass weatherproof hood.

The lockable fiberglass hood is designed for easy access to service the unit. It will be equipped with locking facilities.

The blower motor base and enclosures will be mounted on vibration dampeners. The motor will be mounted on an adjustable mounting base. The blower will be fitted with a dry type filter/silencer at the air intake. Each blower discharge will be fitted with a check valve, and a flexible rubber discharge coupling.

For purposes of determining the blower performance and/or diffuser condition, a pressure relief valve and pressure gauge will be mounted in the air manifold.

L. Central Control Panel

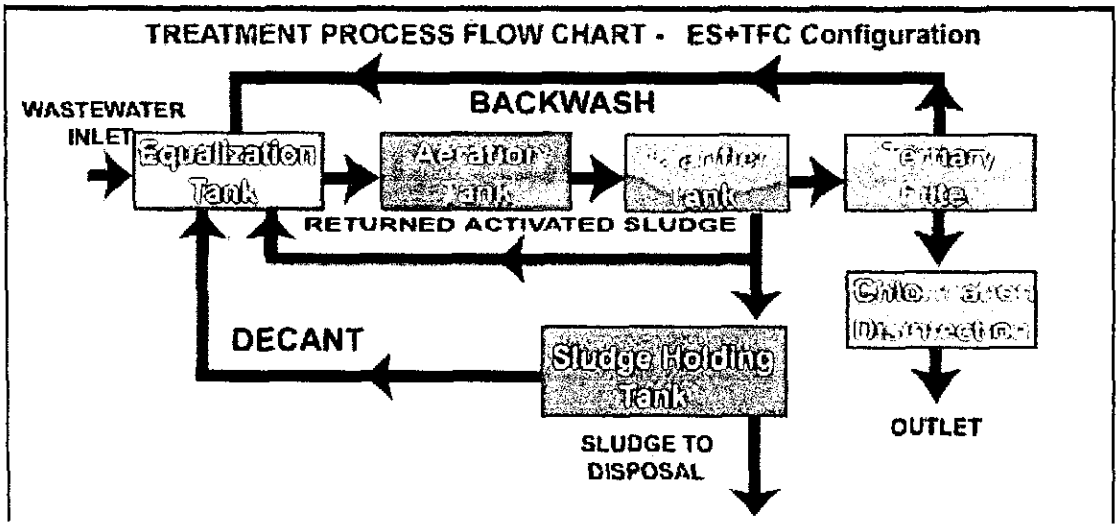
A central control system installed within a weatherproof enclosure will be provided.

The enclosures will be NEMA 4X. The electrical controls will consist of magnetic starters, program timers and switches necessary to automatically control all electro-mechanical components on the treatment system.

The blower motors will be controlled by M-O-A selector switches and magnetic starters in conjunction with the programmable timer. The programmable timers will have the capability to operate the aeration system as required by the variation in the daily flowrate. All electrical equipment and circuitry will be protected by properly sized circuit breakers and fuses. All duplex or standby equipment will be designed so that it may be operated by devices by the control system. The enclosure will be wired for 460 volt, 3 phase, 3 wire incoming power.

M. Service Walkways

A service walkway will be provided to service the plant equipment. Grating panels will each consist of one piece skid resistant steel plank. All grating panels will be constructed of 18 gauge, galvanized sheet steel. Each grating panel has a standard 9" surface width and a 2 ½ " rib depth. Each panel will be so supported as to have a safe uniform load carrying capacity of 80 pounds per square foot. The service walkways will also be provided with handrails where required.



II. **Tertiary Filter** - One (1) prefabricated carbon steel packaged tertiary treatment plant and related components. The tertiary treatment plant would be **Model TF-2-14-C**. The tertiary treatment plant would be a modified rapid sand filter designed specifically for filtering biological treatment plant effluent at a rate of 40,000 GPD of 30 mg/l BOD5 and 30 mg/l TSS.

A Process Description

The proposed packaged tertiary filter provides for flow division, filtration, backwashing, and surge control of the wastewater.

The influent wastewater would enter the filter through a flow division chamber where the flow would be divided equally to each of the two (2) filter cells. Each filter cell would provide for the filtration of biological treatment plant effluent by the use of a dual media. This media contains both sand and anthracite to accomplish the sequential filtration and removal of suspended solids.

The wastewater percolates through the filter cells and then into a false bottom. From here it flows through a riser pipe, backwash pumps and into the clearwell.

When surface of the filter cells become covered with solids, the wastewater level begins to rise. The rising wastewater level activates the air scouring and backwash cycles. As air and clean backwash water are pumped through the filter from the bottom up dislodging the retained solids. The media would then be automatically air scoured and backwashed. The air scouring cycle would provide for the agitation of the solids that have been collected in the upper portion of the media. The rising backwash water eventually overflows into the surge chamber. The surge chamber collects the backwash water and meters it back to the head of the biological treatment plant over several hours.

The backwash cycle would use wastewater from the clearwell to backwash and dislodge the solids entrapped in the lower portion of the media.

The treated wastewater would then flow via gravity to the discharge point.

B Scope of Supply

One (1) Model TF-2-14-C Packaged Tertiary Treatment Plant
General Specifications
Number of Filter Cells: 2
Square Feet of Filter Surface Area: 14 ft^2 each
Clearwell Chamber Volume: 2120 gal
Surge Chamber Volume: 2250 gal
Overall Length/Width/Height: 13'6" / 12' / 11'
Shipping Weight: 15,000 lbs. (approximate)

C. Flow Division Chamber

A flow division chamber would be provided at the inlet of the tertiary system. The chamber would be designed so as to divert the incoming flow equally to each of the two (2) filter cells.

D. Filter Media

Filter media would be furnished in sealed bags not to exceed 100 pounds each. The filter media would be installed in the field (by others). The filter media bed would consist of 8" of sand, .80 to 1.20 MM effective size with a uniform coefficient of 1.4 to 1.7 and 12" of anthracite, 1.08 MM effective size with a uniform coefficient of 1.42.

E. Clearwell

The clearwell would be located so that the filtrate from the filter cell would discharge into the clearwell from the false bottom below the media through a riser pipe and backwash pump.
An overflow weir trough would be provided for gravity discharge to the chlorine contact tank. The clearwell would be capable of storing at least two (2) backwash cycles.

F. Backwash Pumps

Two (2) backwash pumps would be furnished and installed in the clearwell so as to automatically backwash the filter cells at a backwash rate of 15 GPM per square foot of filter surface area.

G. Surge Chamber

The surge chamber of the tertiary system would be of such size as to handle the total volume of the clearwell and the average incoming flow during backwash cycle. A duplex set of pumps would be provided in the surge chamber for returning the backwash liquid to the secondary sewage treatment system. A throttling valve would be provided on the pump discharge piping to minimize hydraulic disturbance of the secondary treatment system.

H. Air Supply for Media Air Scouring

Facilities for air scouring the filter media prior to backwash would be provided. An air distribution system would be provided within the filter media. One (1) positive displacement blower/motor unit would be supplied, capable of providing a minimum of 1 CFM per square foot of filter bed. The blower would be capable of delivering 15 CFM when operating at 4 PSI. The motor would be 1 HP, ODP for operation on 460 volt, 3 phase and 60 cycle service.

The blower/motor would be mounted to a molded fiberglass base. The base structure would be adequately reinforced to support the blower/motor unit.

The blower/motor would be enclosed within a molded fiberglass weatherproof enclosure mounted to the base. The fiberglass hood would be designed for easy access to service the unit. It would be equipped with locking facilities.

To help reduce blower vibration and noise, the blower/motor base would be mounted on vibration dampeners.

For easy adjustment of the V-belt drive connection between the blower and motor, the motor would be mounted on an adjustable motor mounting base. The blower would be fitted with a dry type filter/silencer at the air intake. The blower discharge would be fitted with a check valve, and a flexible rubber discharge coupling.

For purposes of determining the blower performance and/or diffuser condition, a pressure relief valve and pressure gauge would be mounted in the air manifold.

I. Tertiary Control Panel

A tertiary control system would be provided. When resistance of the flow through the filter media causes the water level over the filter cells to rise to a predetermined level, a sensing device would initiate the automatic air scour/backwash cycle. The cycle would be set up for an air scour time of four minutes, a settling time of two minutes, backwash time of five minutes and a final settling time of 19 minutes.

The controls are housed in a NEMA 4X enclosure. All electrical equipment and circuitry would be protected by properly sized circuit breakers or fuses. The enclosure would be wired for 460 volt, 3 phase and 60 cycle service.

III. **Delivery Schedule:** Approximately 12 weeks.

IV. **Secondary Budget Price:** **$209,375.00** including epoxy paint

V. **Tertiary Filter Budget Price:** **$76,875.00** including epoxy paint

Additional Manufacturer's Technical Services (Add) $990.00 per day plus reasonable travel and living expenses.

- F.O.B. Factory
- Payment Terms: 50% down, net before shipping,
- All taxes are the responsibility of the purchaser.
- Installation of all tankage, field piping and wiring are the responsibility of the purchaser.
- A Purchase Order would be subject to the included Payment Terms and Conditions and the approval of an Officer of Ecologix.
- Cost increases, if any, will be based on cost increases incurred by Ecologix.
- Ecologix will take exception and exclude any equipment and services not stated on this document.
- This document is valid for 30 days.

PROPOSED BY:

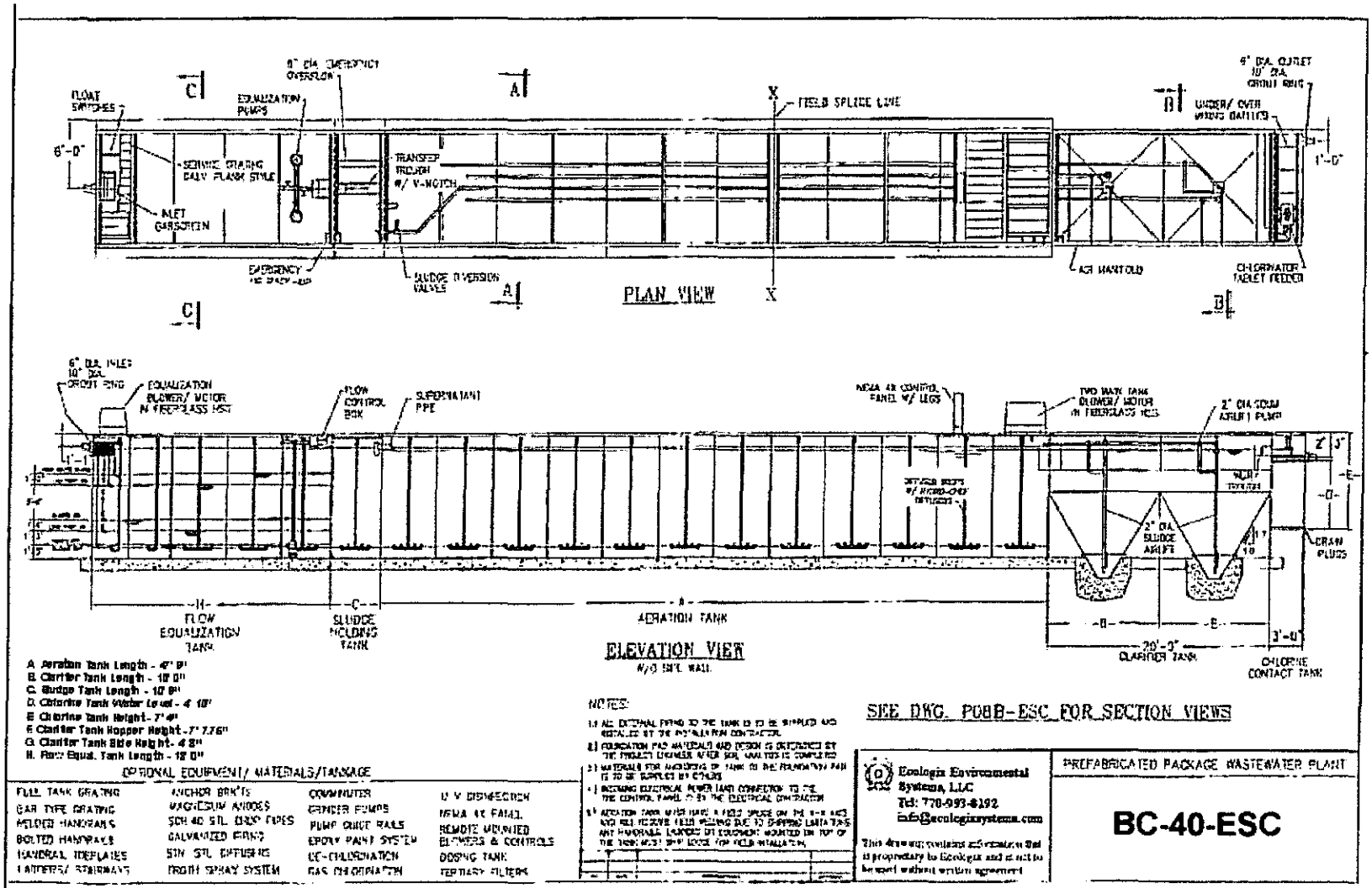
Eli Gruber
Ecologix Environmental Systems, LLC

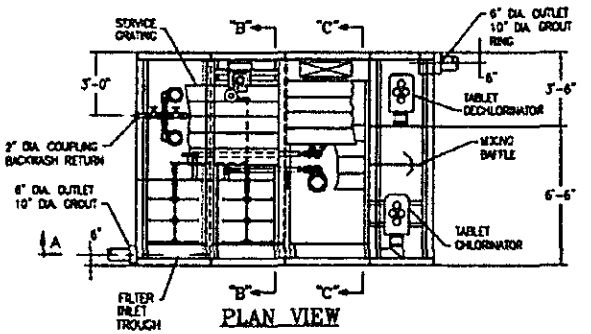
ACCEPTED BY:

Customer Representative
Company

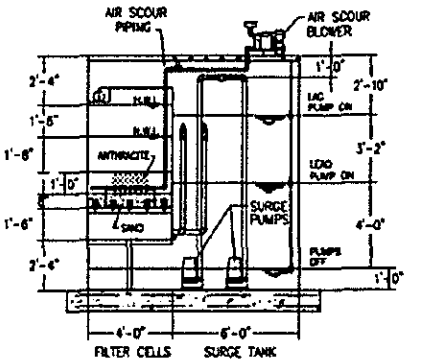
Example of
100K Packaged Wastewater Treatment Plant Estimated Annual Operational Cost

Estimated Electrical Cost							
Equipment	**HP**	**KW**	***FLA**	**Run Time**	**Rate/kw hr**	**Cost/day**	**Cost/year**
Lift Station Pumps-Inlet	7.50 HP	7.2 kW	10.3	18 hr/day	$ 0.10	$ 12.96	$ 4,730.40
Equalization Pumps	0.5 HP	1.00 kW	1.6	24 hr/day	$ 0.10	$ 2.40	$ 876.00
Equalization Blower	2.0 HP	2.33 kW	3.4	24 hr/day	$ 0.10	$ 5.59	$ 2,040.35
Process Blowers	15.0 HP	14.71 kW	21.0	18 hr/day	$ 0.10	$ 26.47	$ 9,664.47
Filter Blower	2.0 HP	2.33 kW	3.4	.4 hr/day	$ 0.10	$ 0.09	$34.01
Filter Backwash Pumps	7.5 HP	7.70 kW	11.3	.8 hr/day	$ 0.10	$ 0.62	$ 226.30
Filter Surge Pumps	0.5 HP	1.00 kW	1.6	10 hr/day	$ 0.10	$ 1.00	$ 365.00
Estimated Plant & Filter Daily & Annual Electrical Consumption Cost						$ 49.13	**$ 17,936.23**
* FLA indicates running amps not starting amps for generator sizing							

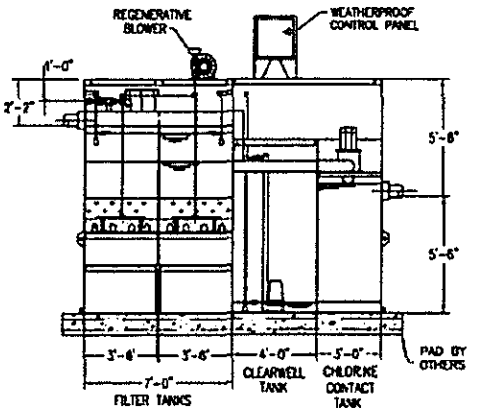

PLAN VIEW
ELEVATION VIEW
w/o SIDE WALL
FLOAT SWITCHES
EQUALIZATION PUMPS
FIELD SPLICE LINE
TRANSFER TROUGH w/ V-NOTCH
INLET GARGOYLES
SLUDGE DIVERSION VALVES
AIR MANIFOLD
CHLORINATOR TABLET FEEDER
EQUALIZATION BLOWER/ MOTOR IN FIBERGLASS HUT
FLOW CONTROL BOX
SUPERNATANT PIPE
TWO MAIN TANK BLOWER/ MOTOR IN FIBERGLASS HUTS
2" DIA SCUM AIRLIFT PUMP
2" DIA SLUDGE AIRLIFT
DRAIN PLUGS
FLOW EQUALIZATION TANK
SLUDGE HOLDING TANK
AERATION TANK
CLARIFIER TANK
CHLORINE CONTACT TANK
A Aeration Tank Length - 47' 9"
B Clarifier Tank Length - 12' 0"
C Sludge Tank Length - 12' 6"
D Chlorine Tank Water Level - 4' 10"
E Chlorine Tank Height - 7' 4"
F Clarifier Tank Hopper Height - 3' 7.75"
G Clarifier Tank Side Height - 4' 8"
H Flow Equal. Tank Length - 12' 0"
OPTIONAL EQUIPMENT/ MATERIALS/TANKAGE
FULL TANK GRATING
BAR TYPE GRATING
WELDED HANDRAILS
BOLTED HANDRAILS
HANDRAIL TOEPLATES
LADDERS/ STAIRWAYS
ANCHOR BRKTS
MAGNESIUM ANODES
SCH 40 STL DISCH PIPES
GALVANIZED PIPING
STN STL DIFFUSERS
FROTH SPRAY SYSTEM
COMMINUTER
GRINDER PUMPS
PUMP GUIDE RAILS
EPOXY PAINT SYSTEM
DE-CHLORINATION
GAS CHLORINATION
U V DISINFECTION
NEMA 4X PANEL
REMOTE MOUNTED BLOWERS & CONTROLS
DOSING TANK
TERTIARY FILTERS
NOTES:
SEE DWG. P08B-ESC FOR SECTION VIEWS
Ecologix Environmental Systems, LLC
Tel: 770-993-8192
info@ecologixsystems.com
PREFABRICATED PACKAGE WASTEWATER PLANT
BC-40-ESC



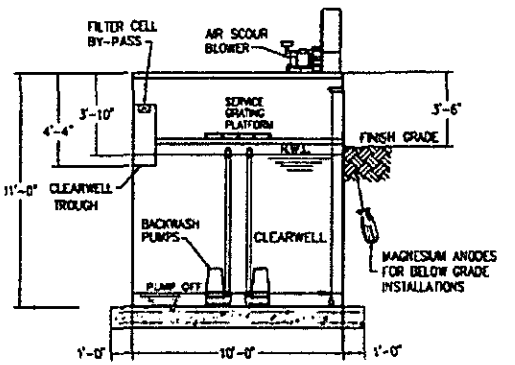
PLAN VIEW



VIEW B-B



ELEVATION VIEW w/o WALL



SECTION C-C

NOTES:

1.) ALL EXTERNAL TANK PIPING IS NOT SUPPLIED BY PCS

2.) INCOMING ELECTRICAL POWER SUPPLY AND THE CONNECTION TO THE CONTROL PANEL IS BY OTHERS.

3.) FOUNDATION PAD DESIGN IS DETERMINED BY THE PROJECT ENGINEER AFTER PROJECT SITE SOIL ANALYSIS IS COMPLETED

DESIGN FLOW: MAXIMUM 40,000 GPD

TERTIARY FILTER MODEL NO.	AREA IN SQ. FT.		CHAMBER VOLUME IN GAL.		
	FILTER CELL NO. 1	FILTER CELL NO. 2	CLEARWELL	SURGE	CHLORINE CONTACT
TF-2-14-C	14	14	2120	2250	875

REV.	DATE	DESCRIPTION	APPROV.

Ecologic Environmental Systems, LLC
Tel: 770-993-8292
info@ecologicsystems.com

40,000 GPD STEEL PACKAGE TERTIARY FILTER

SCALE	PLOT: 3/16"=1'	SHEET NO.	PROJECT NO.
DRAWN BY: JJM	DATE: 10-12-05	SHEET	DRAWING NO.
DESIGNED BY: JJM	DATE: 10-12-05	1 OF 1	15362-02

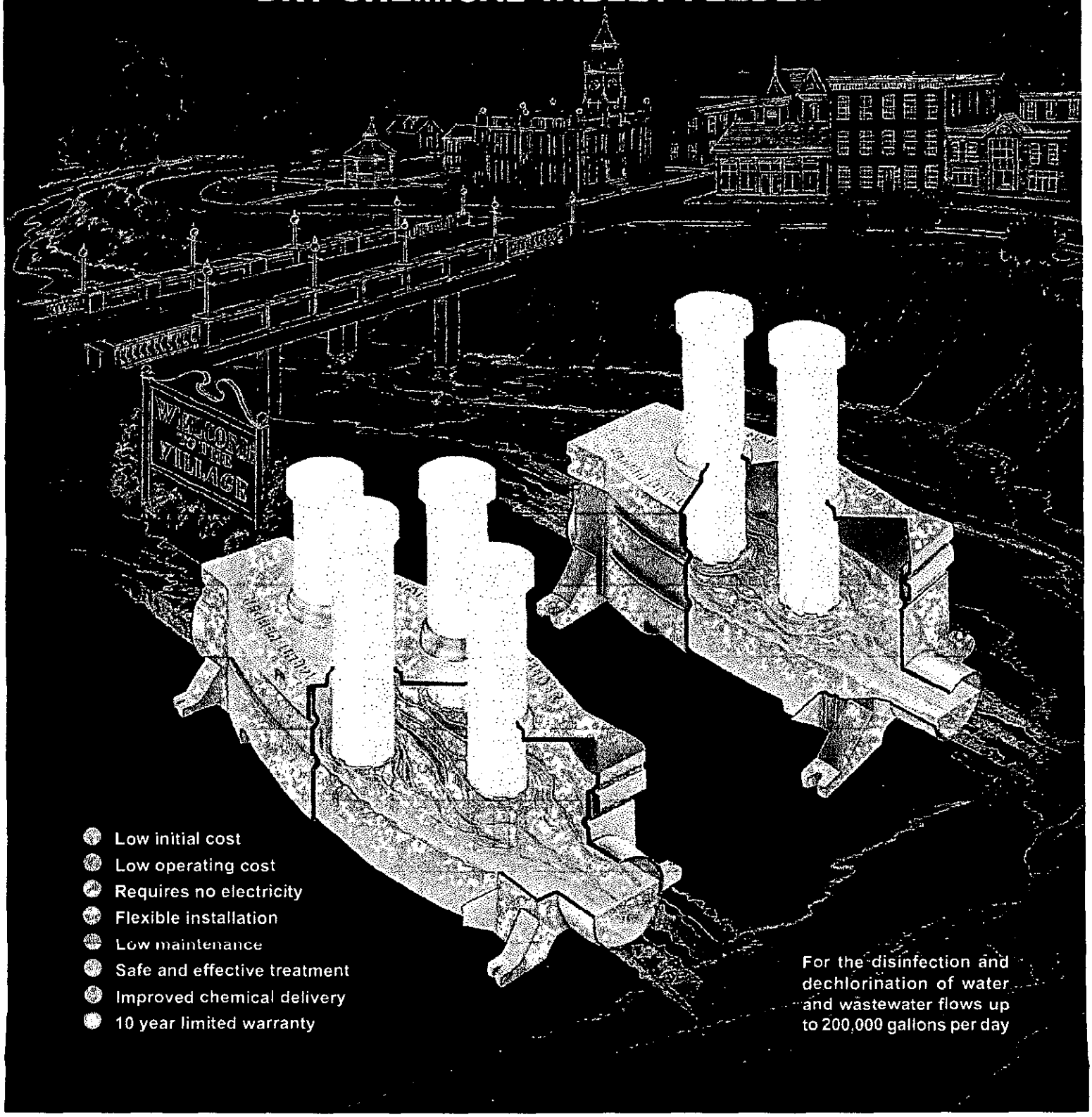
Appendix 5

Dechlorination Equipment

NORWECO.
NORWALK WASTEWATER EQUIPMENT COMPANY

BIO-DYNAMIC®

DRY CHEMICAL TABLET FEEDER



- Low initial cost
- Low operating cost
- Requires no electricity
- Flexible installation
- Low maintenance
- Safe and effective treatment
- Improved chemical delivery
- 10 year limited warranty

For the disinfection and dechlorination of water and wastewater flows up to 200,000 gallons per day

NORWECO BIO-DYNAMIC®

NORWALK WASTEWATER EQUIPMENT COMPANY

THE SAFE AND EFFECTIVE ALTERNATIVE TO GAS AND LIQUID SYSTEMS...

Bio-Dynamic tablet feeders are a technological advancement in self-contained dry chemical dosing systems for the treatment of water or wastewater. Providing a low cost, low maintenance and extremely effective method of chemical treatment, Bio-Dynamic tablet feeders have no mechanical components and require no electricity. The safety, accuracy and reliability provided by Bio-Dynamic tablet feeders, utilizing Bio-Sanitizer disinfecting tablets or Bio-Neutralizer dechlorination tablets, obsoletes dangerous and expensive gas and liquid chemical feed technology.

PRECISE CHEMICAL DOSAGE BY INTERCHANGEABLE WEIR OR ADJUSTABLE SLUICE...

Chemical dosage applied by the Bio-Dynamic feeder is regulated by interchangeable weir plates or an optional adjustable sluice. Weir plates are easily installed and replaced during tablet feeder operation. The sluice can be completely adjusted during operation using only a standard socket wrench. The adjustable outlet sluice of the Bio-Dynamic tablet feeder allows safe, convenient and precise control of chemical dosage to meet even the most stringent treatment requirements.

EFFECTIVELY TREATS LOW, INTERMITTENT AND SURGE FLOWS AUTOMATICALLY...

The entire treatment process of the Bio-Dynamic tablet feeder is gravity fed. Flow enters the feeder and is channeled under an adjustable inlet baffle to protect the system from hydraulic surges. Liquid proceeds through the tiered flow deck and contacts the chemical tablets, which dissolve in response to the flow rate. As flow into the feeder increases, the dosage increases and results in a consistent chemical level. When incoming flow decreases, the chemical dose is proportionally reduced. The tiered flow deck directs liquid to the tablets during low flows and disperses hydraulic velocity during peak flows to control chemical dosage. The weir or optional sluice regulates the liquid level within the feeder to further control chemical application. All outflow passes through the hydrodynamic mixing chamber to insure complete chemical contact. Each step in the treatment process insures superior performance for any loading pattern or treatment requirement.

DIRECT BURIAL OR CONTACT CHAMBER INSTALLATION...

The Bio-Dynamic tablet feeder has multiple installation options that provide maximum flexibility, including direct burial, in-line and contact chamber mounting. All models include integrally molded mounting feet and molded inlet and outlet hubs that allow connection to standard Schedule 40 PVC piping. Fall through the body of the feeder and the molded outlet hub insure proper drainage of the feeder and eliminate the need for a separate drop box. Bio-Dynamic feeders are designed for direct burial, which allows in-line installation prior to, or following, a chemical contact tank or subsurface filter. Safety/reinforcing struts are included with each direct burial model and riser for additional safety and strength. For installation within a chemical contact chamber, optional non-corrosive mounting brackets are available to mount the feeder directly to the chamber wall. Once properly installed and adjusted, the automatic operation of the Bio-Dynamic feeder requires no further calibration and will function automatically with minimal maintenance.

EXTENSION RISERS ELIMINATE THE NEED FOR A MANHOLE...

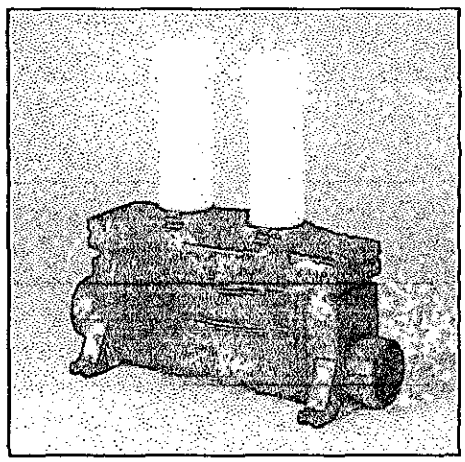
Riser assemblies in standard 24" heights are available for all Bio-Dynamic feeders. Eliminating the need for a manhole or separate enclosure during direct burial installations, access risers significantly reduce installation costs. Fully accessible from finished grade, risers alleviate maintenance difficulties and remove the need for expensive confined space entry equipment required by OSHA regulations. Access risers connect directly to the feeder body and utilize the standard lid. Only a few minutes are required to install and seal risers to produce a watertight connection. Multiple risers may be used on deeper installations. Trim lines are located at 6" vertical increments on each riser to allow a customized fit to the desired excavation depth.

BACKED BY A TEN YEAR LIMITED WARRANTY...

Bio-Dynamic tablet feeders are backed by a comprehensive ten-year limited warranty. The limited warranty protects system owners from defects in material and workmanship under normal use and service for a period of ten years. A warranty registration card and a detailed Installation and Operation manual are included with each new tablet feeder. The Installation and Operation manual provides a description of the components and detailed instructions regarding the use, configuration, adjustment and routine maintenance of the tablet feeder. Comprehensive instructional material accompanied by a ten-year limited warranty insure that each Bio-Dynamic tablet feeder will provide years of trouble-free service.

SERIES 2000 TABLET FEEDER

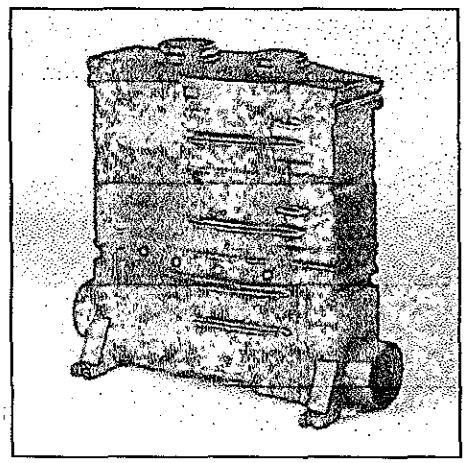
XT 2000 FOR INSTALLATION AT GRADE



A complete dry chemical dosing system for liquid flows from 200 GPD to 20,000 GPD. The XT 2000 has a maximum flow rate of 70 GPM which allows use in flow equalized applications up to 100,000 GPD. Pre-engineered bypass arrangements are available to increase capacity to 500,000 GPD. Molded mounting feet permit direct connection to the deck of a contact tank, concrete pad or mounting brackets using 3/8" corrosion resistant bolts.

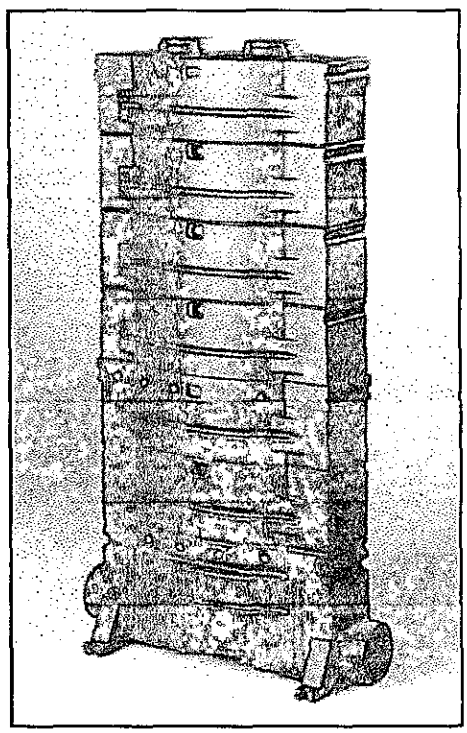
DIMENSIONS, STANDARD FEATURES, EQUIPMENT, COMPONENTS AND OPTIONS	● 25½" Length, 10½" Width, 12" Body Height ● Two Chemical Feed Tubes, 22½" Height ○ Interchangeable 1", 2" and 3" Outlet Weir Plates ● Molded 4" Inlet and Outlet Hubs ○ Adjustable Inlet Baffle ○ Optional Adjustable Sluice ○ Optional Mounting Brackets

IT 2000 FOR AT GRADE OR SHALLOW BURIAL INSTALLATION



DIMENSIONS, STANDARD FEATURES, EQUIPMENT, COMPONENTS AND OPTIONS	○ 25½" Length, 10½" Width, 24" Body Height ○ Two Chemical Feed Tubes, 22½" Height ○ Interchangeable 1", 2" and 3" Outlet Weir Plates ○ Molded 4" Inlet and Outlet Hubs ○ Adjustable Inlet Baffle ○ One Safety/Reinforcing Strut ○ Optional Adjustable Sluice ○ Optional Mounting Brackets

Treatment capacity from 200 GPD to 20,000 GPD. The maximum flow rate of 70 GPM permits use in flow equalized applications up to 100,000 GPD. Designed for mounting at grade or direct burial with in-line connection to piping up to 18" below grade. A molded trim line allows field adjustment for shallow burial installation up to 12" below grade.



ITR 2000-S FOR DEEP DIRECT BURIAL

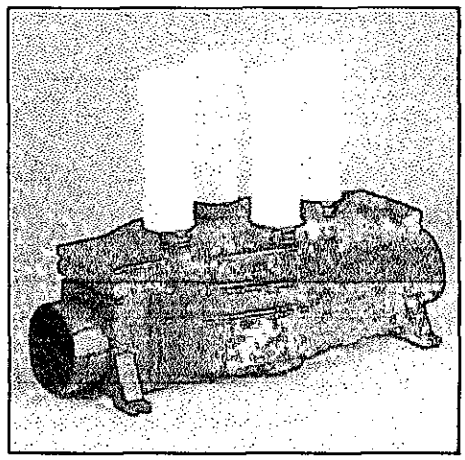
For liquid flows from 200 GPD to 20,000 GPD. The ITR 2000-S has a maximum flow rate of 70 GPM which allows use in flow equalized applications up to 100,000 GPD. Suitable for direct burial installation up to 42" below grade without additional risers, the ITR 2000-S has trim lines at 6" vertical increments to customize each installation. This model includes an outlet sluice adjustable from grade using a standard 5/8" socket with extension. Additional risers may be added, as required, for deeper installations.

DIMENSIONS, STANDARD FEATURES, EQUIPMENT, COMPONENTS AND OPTIONS	● 25½" Length, 10½" Width, 24" Body Height ● Includes 24" Riser for Overall Height of 48" ● Two Chemical Feed Tubes, 22½" Height ○ Adjustable Outlet Sluice ○ Molded 4" Inlet and Outlet Hubs ● Adjustable Inlet Baffle ○ Three Safety/Reinforcing Struts ○ Remote Feed Tube Removal System ● Bio-Dynamic Sealant and Drive Rivets ○ Molded Trim Lines at 6" Vertical Increments ○ Optional Baffle Adjustment Tool ● Optional Cable Locking Device ● Optional Cleaning Brush

SERIES 4000 TABLET FEEDER

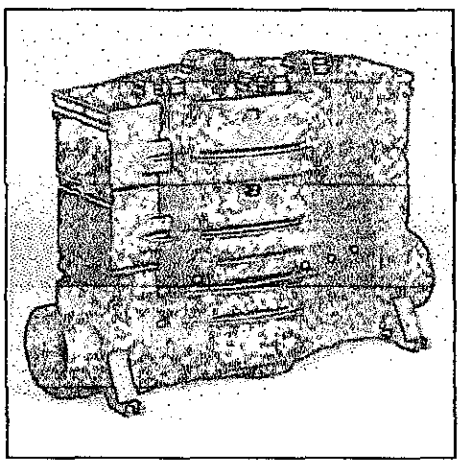
XT 4000 FOR INSTALLATION AT GRADE

A complete dry chemical dosing system for liquid flows from 20,000 GPD to 200,000 GPD. The XT 4000 has a maximum flow rate of 150 GPM which allows use in non-flow equalized wastewater applications up to 50,000 GPD. Pre-engineered bypass arrangements are available to increase capacity to 5,000,000 GPD. Molded mounting feet permit direct connection to the deck of a contact tank, concrete pad or mounting brackets using 3/8" corrosion resistant bolts.



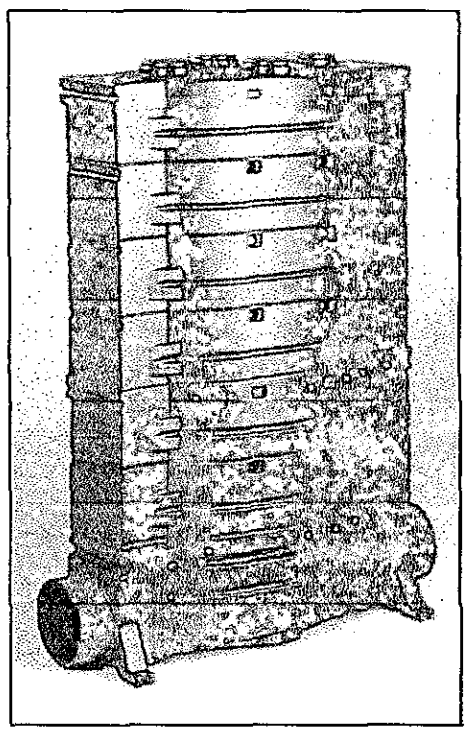
DIMENSIONS, STANDARD FEATURES, EQUIPMENT, COMPONENTS AND OPTIONS	● 35 3/4" Length, 14 1/2" Width, 12" Body Height ● Four Chemical Feed Tubes, 22 1/2" Height ● Interchangeable 1", 2" and 3" Outlet Weir Plates ● Molded 6" Inlet and Outlet Hubs ● Adjustable Inlet Baffle ○ Optional Adjustable Sluice ○ Optional Mounting Brackets

IT 4000 FOR AT GRADE OR SHALLOW BURIAL INSTALLATION



DIMENSIONS, STANDARD FEATURES, EQUIPMENT, COMPONENTS AND OPTIONS	● 35 3/4" Length, 14 1/2" Width, 24" Body Height ● Four Chemical Feed Tubes, 22 1/2" Height ● Interchangeable 1", 2" and 3" Outlet Weir Plates ● Molded 6" Inlet and Outlet Hubs ● Adjustable Inlet Baffle ● Two Safety/Reinforcing Struts ○ Optional Adjustable Sluice ○ Optional Mounting Brackets

Treatment capacity from 20,000 GPD to 200,000 GPD. The maximum flow rate of 150 GPM permits non-flow equalized wastewater applications up to 50,000 GPD. Designed for mounting at grade or direct burial with in-line connection to piping up to 18" below grade. A trim line allows field adjustment for shallow burial installation up to 12" below grade.



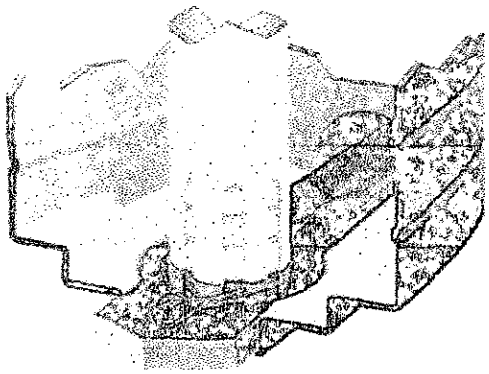
ITR 4000-S FOR DEEP DIRECT BURIAL

For liquid flows from 20,000 GPD to 200,000 GPD. The ITR 4000-S has a maximum flow rate of 150 GPM which allows use in non-flow equalized wastewater applications up to 50,000 GPD. Suitable for direct burial installation up to 42" below grade without additional risers, the ITR 4000-S has trim lines at 6" vertical increments to customize each installation. This model includes an outlet sluice adjustable from grade using a standard 1" socket with extension. Additional risers may be added, as required, for deeper installations.

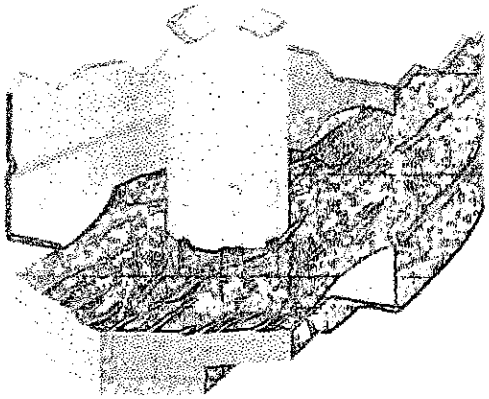
DIMENSIONS, STANDARD FEATURES, EQUIPMENT, COMPONENTS AND OPTIONS	● 35 3/4" Length, 14 1/2" Width, 24" Body Height ● Includes 24" Riser for Overall Height of 48" ○ Four Chemical Feed Tubes, 22 1/2" Height ○ Adjustable Outlet Sluice ● Molded 6" Inlet and Outlet Hubs ○ Adjustable Inlet Baffle ● Six Safety/Reinforcing Struts ● Remote Feed Tube Removal System ● Bio-Dynamic Sealant and Drive Rivets ○ Molded Trim Lines at 6" Vertical Increments ● Optional Baffle Adjustment Tool ○ Optional Cable Locking Device ● Optional Cleaning Brush

CHEMICAL TABLET FEEDERS

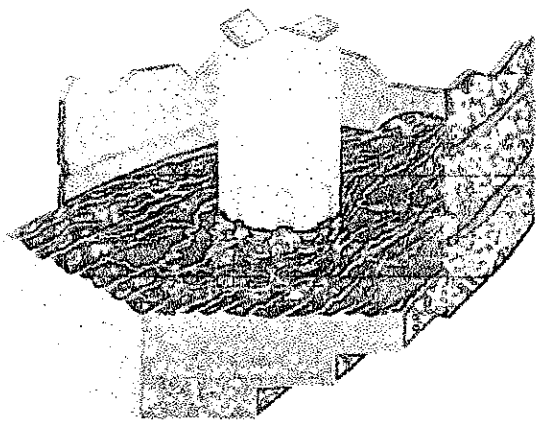
A PRECISION ENGINEERED CHEMICAL TREATMENT SYSTEM THAT DELIVERS SAFE, RELIABLE AND COST EFFECTIVE PERFORMANCE TO MEET A WIDE RANGE OF TREATMENT REQUIREMENTS...



INERT DRAINAGE TIER



INTERMEDIATE FLOW TIER



UPPER FLOW TIER

- Fully serviceable from grade — risers eliminate the need for confined space entry equipment as required by OSHA regulations.
- Customized installation — integrally molded trim lines and riser sections allow height adjustment on site for each installation.
- Inlet and outlet hubs — internal fall through the system and integrally molded hubs allow direct connection to treatment system piping.
- Adjustable inlet baffle — protects chemical tablets and the treatment process during intermittent hydraulic surges and peak loading.
- One-piece feed tubes with twist-lock caps — allows safe handling of chemical tablets, insures dependable performance and long life.
- Accommodates variable flow rates — tiered flow deck automatically treats low, intermittent and surge flows without adjustment.
- Safe and reliable — Bio-Sanitizer disinfecting tablets and Bio-Neutralizer dechlorination tablets outperform gas, liquid and ultraviolet systems.
- Low installation and operating cost — no electrical or mechanical equipment, no manholes or drop boxes. Flow deck, interchangeable weir plates and adjustable sluice minimize chemical consumption.
- Easily adjustable chemical dosage — interchangeable weir plates or adjustable outlet sluice allow precise chemical application.

TIERED FLOW DECK INSURES CONSISTENT CHEMICAL APPLICATION EVEN AT SUSTAINED, VARIABLE AND INTERMITTENT FLOW RATES...

Treatment systems seldom discharge at a consistent rate. Surges many times the average daily flow rate may occur during the morning while no flow conditions may last throughout the night. This variation in flow rate frequently causes problems for conventional tablet feeders and manually adjusted gas or liquid chemical feed systems. The tiered flow deck of the Bio-Dynamic tablet feeder is designed to insure that all incoming liquid is properly treated regardless of the flow pattern. Engineered to enhance the fluid dynamics of the liquid passing through the system, the tiered flow deck strategically directs and controls the velocity of incoming flow. During low flow conditions, all liquid is directed through the lowest tier of the feeder, the inert drainage tier. This tier forms a narrow hydraulic channel that increases the velocity of the liquid, uniformly eroding the tablets and assuring accurate chemical delivery. As flow into the feeder increases, the liquid level rises to the intermediate flow tier. The intermediate flow tier creates a flume to accelerate the liquid as it passes the chemical tablets. Flow greater than the capacity of the intermediate tier rises to the upper flow tier. The larger upper flow tier causes the liquid to lose velocity and prevents excessive chemical consumption. Using this precisely controlled flow pattern to promote uniform tablet erosion, the Bio-Dynamic tablet feeder insures that chemical application remains consistent throughout the design flow range of the water or wastewater treatment system.

U.S. and Foreign Patents Pending

ENVIRONMENTAL LABORATORY AND TESTING FACILITIES

Norweco operates a complete, full-service environmental laboratory to serve licensed distributors and to enhance research and development. Laboratory services are available through distributors to determine the exact performance characteristics and treatment requirements for any water or wastewater treatment system. Samples can be sent to Norweco for complete analysis with regard to a wide range of treatment requirements, including physical, chemical and biological parameters. Test results can be returned directly to the distributor or submitted to a regulatory agency for their records. Our scientists and laboratory staff are always available to assist distributors and answer questions regarding water, wastewater or chemical treatment systems. Laboratory services and technical support are available to our Singulair, Modulair, Travalair and Chemical distributors for analysis, testing and regulatory reporting.

BIO-SANITIZER® DISINFECTING TABLETS

Bio-Sanitizer disinfecting tablets are uniquely formulated to provide efficient and reliable disinfection of water or wastewater. Recommended for use in Bio-Dynamic tablet feeders, Bio-Sanitizer tablets provide treatment plant operators a means to consistently meet disinfection standards without exceeding new and stringent limits for total residual chlorine. Produced from a proprietary grade of calcium hypochlorite and containing a minimum of 70% available chlorine, Bio-Sanitizer tablets are registered by the U.S. Environmental Protection Agency and the Ministry of the Environment. With a proprietary beveled edge to minimize wicking, Bio-Sanitizer tablets dissolve slowly and evenly, providing effective, economical bacteria killing power. Bio-Sanitizer disinfecting tablets are packaged in easy to open, resealable 10 lb., 25 lb., 45 lb. and 100 lb. Department of Transportation approved containers.

CAUTION: The improper handling of Bio-Sanitizer tablets may cause injury or property damage. Keep out of the reach of children. Do not handle without first carefully reading the product container label and/or the handling and storage instructions. Do not use swimming pool chemicals in Bio-Dynamic feeders. For additional information, contact your local distributor.

BIO-NEUTRALIZER® DECHLORINATION TABLETS

Bio-Neutralizer dechlorination tablets are formulated to effectively remove both free and combined chlorine from water or wastewater. Containing 35% active sodium sulfite, Bio-Neutralizer tablets will remove chlorine without degrading the quality of the environment. Bio-Neutralizer dechlorination tablets contain a unique chemical blend that protects water quality while reducing or removing chlorine. Research shows that higher concentrations of sodium sulfite will degrade beneficial dissolved oxygen in receiving environments, producing harmful effects on the ecosystem. The superior formulation of Bio-Neutralizer tablets provides consistent reduction or elimination of residual chlorine without affecting water quality, dissolved oxygen, or other discharge parameters. Bio-Neutralizer tablets are packaged in easy to open, resealable 25 lb. and 45 lb. Department of Transportation approved containers.

CAUTION: Bio-Neutralizer dechlorination tablets should not be mixed with Bio-Sanitizer tablets or the remnants of any other product. Do not handle without first carefully reading the product container label and/or the handling and storage instructions. For additional information regarding Bio-Neutralizer dechlorination tablets, contact your local distributor.

NORWECO®
NORWALK WASTEWATER EQUIPMENT COMPANY

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PROGRESS THROUGH SERVICE SINCE 1906

Appendix 6

Aerated Septic Tank Report

Aerated Tanks (Aerobic Units)

Austin WATER
Austin Water Utility

I. Description

Aerobic units, or small extended aeration package plants, utilize a suspended growth wastewater treatment process, and may be used to remove substantial amounts of BOD and suspended solids which are not removed by simple sedimentation (as occurs in septic tanks) . Under appropriate conditions, aerobic units may also provide for nitrification of ammonia, as well as significant pathogen reduction.

Some type of primary treatment usually precedes the aerated tank. The aerated tanks contain an aeration chamber, with either mechanical aerators or blowers, or air diffusers, and an area for final clarification (settling) . Aerobic units may be designed as either continuous flow or batch flow systems, with most commercially available units being the continuous flow type. Effluent from the aerated tank is conveyed either by gravity flow or pumping to either further treatment/pretreatment processes, or final treatment and disposal in a subsurface soil disposal system.

II. Common Modifications

Various types of pretreatment may be employed ahead of the aerobic units, including septic tanks, trash traps, and comminutors. Septic tanks or trash traps are most commonly used for pretreatment for smaller onsite systems.

Aerobic units may be of either the continuous flow, or batch type. The batch (fill and draw) flow system collects and treats wastewater over a period of time (usually one day) , then discharges the settled effluent at the end of the cycle.

Some proprietary package treatment units are equipped with filters for providing further treatment following the extended aeration activated sludge process. This system modification may provide for additional TSS and BOD.

A modified type of proprietary aerobic treatment unit has been undergoing research and demonstration during the past few years. The "biofilter" unit consists of a covered tank (usually concrete) containing foamed plastic media packing. The foamed plastic is very porous, so flow paths through and around the

media is possible. Septic tank, or "trash trap", effluent uniformly distributed over the surface of the media. A fan (or blower) is used to simultaneously circulate air through the media via vent pipes in the tank. The system appears to provide very effective removal of BOD, TSS, as well as nitrification.

III. Technology Status

Aerobic units have been commercially available for approximately 25 years.

IV. Applications

Aerobic units may be used by individual or clustered residences and establishments for treating wastewater prior to (1) further treatment/pretreatment, or (2) final onsite subsurface treatment and disposal. They are particularly applicable where enhanced pretreatment is important, and where there is limited availability of land which is suitable for final onsite disposal of wastewater effluent.

Due to the need for routine maintenance of these systems in order to ensure proper operation and performance, aerobic units may be well-suited for multiple-home or commercial applications, where economies of scale tend to reduce maintenance and/or repair costs per user. The lower organic and suspended solids content of the effluent may allow a reduction of land area requirements for subsurface disposal systems.

V. Limitations

The rate of sludge production for aerobic units is much greater than for septic tanks, necessitating more frequent sludge removal by a licensed transporter. To ensure proper performance of the units, it may be necessary in at least some cases to require a maintenance contract. Electrical power is required for aerobic units. Current Austin-Travis County Health and Human Services rules require that this type of system be designed by a licensed professional engineer.

VI. Typical Equipment/Number of Manufacturers

Aerated tank units are commercially available from several suppliers in Texas. The TNRCC provides a list of State-approved units.

VII. Performance

Numerous studies have been conducted during the past 20 to 25 years to evaluate the performance of aerobic treatment units. The results of a 4-year study conducted in Wisconsin appear to be representative of, and consistent with other studies conducted during that same general time period (late 1970's and early 1980's). Mean effluent values for various wastewater parameters measured

during that study are presented in a table included as the last page of this fact sheet. Although the nitrification (ammonia removal) reported in the table is very high, levels of nitrification in aerobic units will be very dependent on a variety of factors including loading rates for key wastewater constituents, detention times, oxygen transfer, and temperature. More recent testing of certain aerobic unit models has been performed by NSF International. Those results indicate that there may have been some design and performance improvements for those models as compared with the systems tested in the earlier studies. Operation and maintenance practices could however be responsible for the different performance reported from those studies. NSF studies on several units showed the following effluent quality for TSS and BOD:

Parameter	Average Concentration (mg/L)
BOD_5	5-20
TSS	7-22

VIII. Residuals Generation

U.S. EPA literature generally recommends that aerobic units are pumped out at least about once every year.

IX. Overall Reliability

Several studies conducted to evaluate the performance of aerobic units have shown that, if properly designed, installed, and maintained for a particular site's application, these units can perform reliably. Those same studies have also found that home owner neglect, or in general, failures to maintain or replace system components as needed can result in the failure of systems using these units. The acceptable operation of aerobic units has been found to be a function of (1) home owners' understanding of the limitations of the unit, (2) a dependable power supply, and (3) sufficient maintenance.

X. Operation and Maintenance Requirements

Pretreatment Units: If septic tanks or "trash traps" are used as a pretreatment unit prior to an aerobic unit, as discussed under "Residuals Generation" in the Septic Tanks fact sheet, septic tanks should be pumped at an average frequency of 2 to 5 years, depending on their size relative to the system's capacity and use. Communitors or other pretreatment units with mechanical or electrical components must occasionally be serviced or replaced.

Aerobic Units: Sludge must be removed from these units, on the average, about once every eight to

twelve months, based upon studies conducted to evaluate their performance. EPA recommendations include performing certain maintenance activities on a monthly basis. These include: (1) Checking for foaming and uneven air distribution in the aeration tank; (2) Checking the air distribution system components, including filters, seals, oil level, pressure (for diffused air systems) , vibration or overheating (for mechanical air systems), and any other manufacturer's required or recommended maintenance procedures; (3) Check the clarifier for floating scum, appearance of effluent, location of sludge blanket, and any mechanical equipment in accordance with manufacturer's recommendations; and (4) Check controls, alarms, and controls box.

Results of several studies on aerobic units have consistently indicated that home owners usually have neither the expertise nor the incentive to properly maintain their own treatment units. In order to provide assurance to regulatory authorities that these systems will be properly maintained and operated, and ensure adequate environmental and public health protection, it may be essential to require that home owners enter into maintenance agreements with either a local utility district or private service provider.

XI. Potential Environmental Impacts

Properly designed, installed, and maintained aerobic units can, on the average, produce effluent of the quality indicated on the attached table. In addition, the effluent from aerobic treatment processes tends to have much less odor than does effluent from septic tanks. If environmental conditions for a given site for onsite disposal are such that enhanced total nitrogen and pathogen reduction are needed prior to final land disposal, then adverse environmental impacts might result from the use of these units alone, without an additional pretreatment process(es)

XII. Energy Consumption

Studies show that the energy consumption for aerobic units averages between 2.5 to 10 KWH/day, depending upon the motor design and time of operation.

XIII. Costs

Estimated initial aerobic unit costs, installed, and including septic tank pretreatment unit,	$6,000
Equipment repair/replacement costs, estimated at $50/year	$4.17/month
O&M, with a maintenance contract of $360/year (est. 12 hrs. @ $15/hour * 2.0, including taxes, overhead, and profit),	$30/month
Septage and sludge pumping once annually (it is assumed that the septic tank is pumped simultaneously, as needed, so as to	$14.58/month

eliminate separate costs for that),	
Energy costs (using 6 KWH/day energy use),	$14.60/month
20-year NPW (not incl. design & permitting costs),	**$13,573.76**

XIV. Aesthetic Considerations

Both septic tanks and aerobic units are typically buried below grade, and usually do not have significant visual impacts on the site. Some minor background sound may be associated with the operation of the aerobic unit. A properly functioning aerobic unit should produce an effluent with far less odor than would be characteristic of septic tank effluent, should that be of concern for the particular site.

XV. State and Local Acceptance

Aerobic units have been used extensively in the State of Texas and elsewhere in the U.S. A list of state-approved aerobic units is attached.

XVI. References

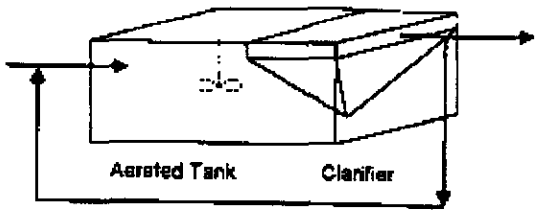
1. U.S. EPA, "Onsite Wastewater Treatment and Disposal Systems Design Manual", EPA/625/I-80-0I2, October 1980.

2. "Performance of Aerobic Treatment Units", N.J. Hutzler, L.E. Waldorf, and J. Fancy. Distributed by the University of Wisconsin, Madison, SSWMP.

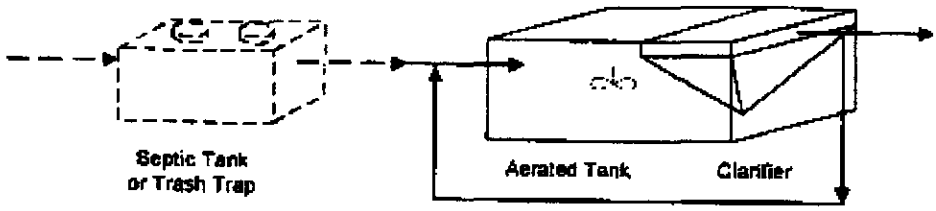
3. Manufacturers' information.

Conceptual Drawing

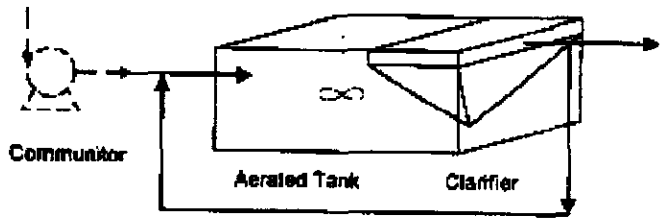
Aerated Tanks (Aerobic Units)



Aerated Unit



Aerated Unit with Septic Tank or Trash Trap Pretreatment



Aerated Unit with Comminutor

Effluent Quality of University of Wisconsin Aerobic Units (SSWMP, 1978)

Effluent Quality Parameter	Mean	No. of Samples	95% Confidence Interval	Range of Data
BOD_5, (mg/L)	37	112	32-42	0-208

Soluble BOD_5, (mg/L)	15	94	12-18	0-120
COD, (mg/L)	108	116	100-116	20-349
TSS, (mg/L)	39	117	33-46	3-252
VSS, (mg/L)	27	118	23-32	1-144
Total N, (mg/L)	36	87	34-38	15-78
NH_3 - N, (mg/L)	0.9	92	0.1-1.7	0-60
$NO_2 + NO_3$, (mg/L)	30	95	27-33	0.3-72
Total P, (mg/L)	26	80	22-30	6-140
PO_4 - P, (mg/L)	21	78	18-24	6-51
Fecal Coliform, (Log no./L)	5	115	4.7-5.3	2.8-7.3
Fecal Streptococci, (Log no./L)	4.3	113	3.9-4.7	2.0-6.3

From: "Performance of Aerobic Treatment Units", N.J. Hutzler, L.E. Waldorf and J. Fancy. Distributed by the University of Wisconsin - Madison, College of Agricultural and Life Sciences and College of Engineering, Small Scale Waste Management

Information provided by

Community Environmental Services Inc.

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