Wastewater Facilities Plan

Elcho Sanitary District No. 1
MSA Project No. 259234FP.WPD

Prepared By:
MSA Professional Services, Inc.
Baraboo, Wisconsin 53913

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I. INTRODUCTION

A. Background

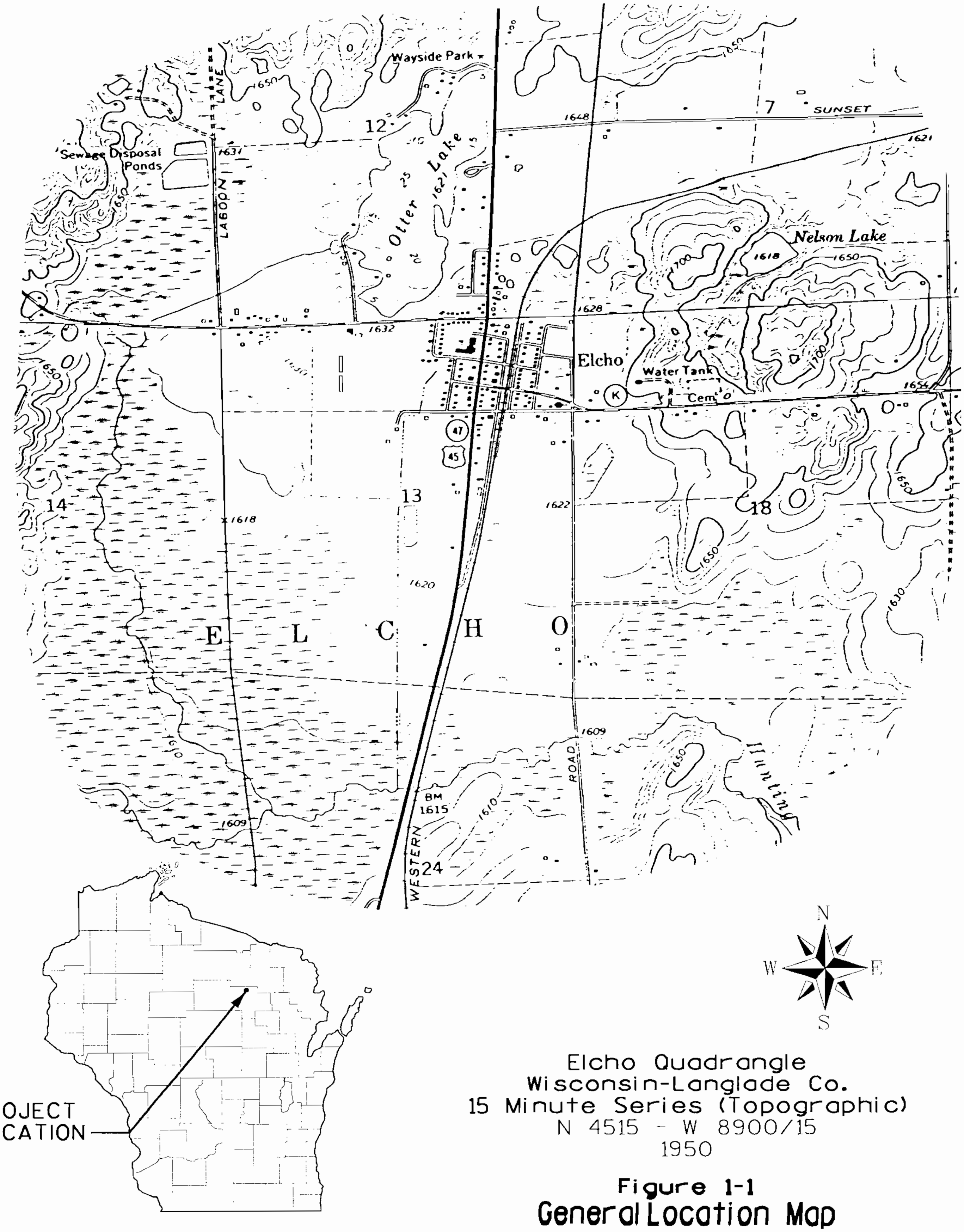
The unincorporated community of Elcho is located in the north-central portion of Langlade County in North-Central Wisconsin, approximately 190 miles north of Madison and 100 miles west of Green Bay. The general location of Elcho is shown in Figure 1-1. Elcho is located near the Hunting River at the intersection of County Trunk Highway K and U.S. Highway 45/State Trunk Highway 47.

Currently, the Elcho Sanitary District No. 1 (Sanitary District) operates a wastewater treatment facility to serve the Community of Elcho. The treatment plant consists of a conventional two cell facultative lagoon system. The existing wastewater treatment facility was constructed in 1970.

In 1992, the Sanitary District contracted MSA Professional Services, Inc. to prepare a facilities plan to review wastewater treatment alternatives. This plan is being prepared to recommend corrections for their current operational problems and address the new requirements of their most recent Wisconsin Pollution Discharge Elimination System (WPDES) permit. The plan will also address new requirements which are anticipated for the Sanitary District's future WPDES permits, including more stringent effluent limits.

Several neighboring Lake communities have expressed an interest in utilizing the Elcho treatment facility as a regional treatment facility. Recent regulations have limited the areas available for the disposal of wastes generated from private sewage systems, which consist primarily of holding tanks and conventional septic systems, and which are predominant in the lake communities surrounding the community of Elcho. As a result, the Town of Elcho and the Town of Upham have each completed a Notice of Intent to require the disposal of any wastewater and/or septage from private systems generated in each respective township to be disposed of at the Sanitary District's proposed treatment facility.

Included in this report, are the Wastewater Feasibility Studies for the Post Lake Protection and Rehabilitation District (Appendix E) and the Greater Bass Lake Protection and Rehabilitation District (Appendix F). These feasibility studies evaluate the alternatives for providing wastewater treatment to the Lake Districts and their impact on the Elcho Sanitary District No. 1.



Elcho Quadrangle
Wisconsin-Langlade Co.
15 Minute Series (Topographic)
N 4515 - W 8900/15
1950

Figure 1-1

General Location Map

ELCHO SANITARY DISTRICT, ELCHO, WISCONSIN

MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION DEVELOPMENT • ENVIRONMENTAL
1230 South Boulevard Baraboo, WI 53913
608-356-2771 1-800-362-4505 Fax: 608-356-2770

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B. Purpose and Scope

The purpose of the facilities plan is to determine the most cost effective and environmentally beneficial alternative in which the Elcho Sanitary District No. 1 can upgrade its treatment facilities to meet WPDES permit requirements under anticipated future loading conditions and to correct current operational and maintenance problems. An additional purpose of the facilities plan is to evaluate the feasibility of providing wastewater treatment facilities to outlying lake communities and the townships within the vicinity of the Sanitary District.

The scope of this facilities report is as follows:

1. To describe the Sanitary District and the surrounding Townships and Lake Districts, giving consideration to such factors as location, topography, geology, soils, water resources, climate, and ecology.

2. To characterize the existing wastewater flows in terms of both quantity and quality, and to estimate future wastewater flows over the next 20 years, giving consideration to the effects of increased service area, population, commercial, and industrial growth.

3. To develop various alternatives for wastewater treatment facilities to meet the future WPDES permit requirements for the anticipated wastewater flow.

4. To evaluate the various alternatives with respect to their environmental impact and cost effectiveness.

5. To present a recommendation of the most cost effective and environmentally sound plan for wastewater treatment for the Sanitary District and the surrounding Townships and Lake Districts.

6. To recommend a timetable for implementation of the recommended plan.

C. Planning Area

The planning area is shown in Figure 1-2, and includes all the lands which might be expected to be served by the District's wastewater treatment facility within the next 20 years. The planning area consists of the Community of Elcho, the Town of Elcho, which includes the majority of Post Lake Protection and Rehabilitation District, the Town of Upham, which includes the Greater Bass Lake Protection and Rehabilitation District, and the Rolling Stone Lake Protection and Rehabilitation District. A portion of the Post Lake Protection and Rehabilitation District is located in the Town of Schoepke in Oneida County. That portion of the Lake District is also included in the planning area. For simplicity the entire Post Lake Protection and Rehabilitation District will be referenced as an entity located within the Town of Elcho.

The Post Lake Protection and Rehabilitation District was created as two separate districts, but eventually combined into one district. In 1974 the Lower Post Lake Protection and Rehabilitation District was formed and then in 1975 the Upper Post Lake Protection and Rehabilitation District was formed. In 1982 the Upper and Lower Districts were merged into the current district. Currently there are approximately 618 homes, 5 resorts, 3 campsites, and a tavern located within the boundaries of the Post Lake Protection and Rehabilitation District. Lower Post Lake has a surface area of 375 acres and an average depth of 8 feet. Upper Post Lake has a surface area of 758 acres and an average depth of 14 feet. The present limits of the Lake District encompass an area of approximately 6,600 acres.

The Greater Bass Lake Protection and Rehabilitation District was created in 1981. The property owners formed an ad-hoc district in 1978 and obtained formal recognition in 1981. Currently there are 202 homes and the golf course located within the boundaries of the Greater Bass Lake Protection and Rehabilitation District. The Greater Bass Lake Protection and Rehabilitation District encompasses an area of approximately 900 acres. The watershed covers approximately 2,617 acres and includes nearby Summit Lake. The direct drainage basin of Greater Bass Lake covers approximately 760 acres.

The Rolling Stone Lake Protection and Rehabilitation District was created in 1975. Currently there are approximately 170 homes, 3 resorts, and 1 tavern located within the Rolling Stone Lake Protection and Rehabilitation District. Rolling Stone Lake has a surface area of approximately 672 acres. The Rolling Stone Lake Protection and Rehabilitation District encompasses an area of approximately 6,300 acres, and includes Lake Agnes and Berendsen Lake.

D. Definitions and Abbreviations

Definitions of some terms used in this facility plan are as follows:

Biochemical Oxygen Demand	The biochemical oxygen demand (BOD) of domestic and industrial wastewaters is the amount of molecular oxygen required to stabilize the decomposable matter present in a water by aerobic biochemical action.
Combined Sewer	A sewer intended to serve as a sanitary sewer and a storm sewer, or an industrial sewer and a storm sewer.
Infiltration	The water entering a sewer system (including service connections) from the ground, through such means as, but not limited to, defective pipes, pipe joints, connections, or manhole walls. Infiltration does not include, and is distinguished from, inflow.
Inflow	The water discharged into a sewer system (including service connections) from such sources as, but not limited to roof drains, cellar, yard and area drains, foundation drains, cooling water discharges, drains from springs and swampy areas, manhole covers, cross connections from storm sewers and combined sewers, catch basins, storm water, surface runoff, street wash waters, or drainage. It does not include, and is distinguished from, infiltration.
Infiltration/Inflow	The total quantity of water from both infiltration and inflow without distinguishing the source.
Weir	A device that has a crest and some side containment of known geometric shape, such as a vee, trapezoid, or rectangle, and is used to measure flow of liquid. The liquid surface is exposed to the atmosphere. Flow is related to upstream height of water above the crest, to position of the crest with respect to downstream water surface, and to geometry of the weir opening.

Invert	The floor, bottom, or lowest portion of the internal cross section of a closed conduit. Used particularly in reference to aqueducts, sewers, tunnels, and drains. Originally it referred to the inverted arch which was used to form the bottom of a masonry lined sewer.
Excessive Infiltration/Inflow	The quantity of infiltration/inflow which can be economically eliminated from a sewer system by rehabilitation, as determined by a cost-effective analysis that compares the costs for correcting the infiltration/inflow conditions with the total costs for transportation and treatment of the infiltration/inflow.
Present Worth	The total present worth method of evaluating sewage treatment systems involves bringing all costs of buildings, operating and maintaining the sewage treatment systems over a twenty year period to a total present worth in accordance with DNR guidelines.
Sanitary Sewer	A sewer intended to carry only sanitary or sanitary and industrial wastewaters, from residences, commercial buildings, industrial plants, and institutions.
Sewer Bypass	An arrangement of pipes, conduits, gates, and/or valves whereby the flow may be passed around a hydraulic structure or appurtenance.
Sewer System Evaluation	A systematic examination of the sewer system to determine the specific location, estimated flow rate, method of rehabilitation and cost of rehabilitation versus the cost of transportation and treatment for each defined source of infiltration/inflow.
Storm Sewer	A sewer intended to carry only storm waters, surface run-off, street wash waters, and drainage.
Suspended Solids	Those solids that either float to the surface of, or are suspended in water, sewage, or industrial waste which are removable by a laboratory filtration device.

Abbreviations of some terms used throughout the facilities plan evaluation are as follows:

BOD	Biochemical oxygen demand
cfs	cubic feet per second
CTH	County Trunk Highway
DNR	Department of Natural Resources (State of Wisconsin)
DILHR	Department of Industry, Labor and Human Relations (State of Wisconsin)
EPA	Environmental Protection Agency (Federal)
gpcd	gallons per capita per day
gpd	gallons per day
I/I	infiltration /inflow
mgd	million gallons per day
mg/l	milligrams per liter
MSA	MSA Professional Services, Inc.
STH	State Trunk Highway
TKN	Total Kjeldahl Nitrogen
TSS	Total Suspended Solids
USH	United States Highway
WPDES	Wisconsin Pollution Discharge Elimination System

II. ENVIRONMENTAL INVENTORY

A. Population Demographics

An analysis of population is an important aspect of any planning effort. The analysis is used to identify trends in the local population over time and also serves as the basis for projecting the need for facilities and services. Table 2-1 shows the historical population trends for the Town of Elcho, the Town of Upham, and Langlade County over the past 25 years.

Table 2-1
Historical Population Trends
Count and Percent Change
1970 - 1993

Location	1970	1980	%	1990	%	1995*	%
Town of Elcho	885	1,078	21.8	1,075	-0.3	1,102	2.5
Town of Upham	486	545	12.4	626	14.9	653	4.3
Langlade County	19,220	19,978	3.9	19,505	-2.4	20,300	4.1

*Estimated value

The data in Table 2-1 shows significant population increases in the Towns of Elcho and Upham during the 1970's. During the 1980's the Town of Upham experienced a considerable population increase. Generally, Langlade County has experienced only moderate growth, a trend which is expected to continue over the next 20 years, with peak populations occurring around 2005 for the Town of Elcho and 2015 for the Town of Upham. Table 2-2 below shows the population projections based on the Towns' past population performance and state and national trends. The future populations are based on the report titled "Official Municipal Population Projections 1990-2015" by the Demographic Services Center, Wisconsin Department of Administration. The population projections are located in Appendix A.

Table 2-2
Projected Populations
Count and Percent Change
1995 - 2015

Location	1995	2000	%	2005	%	2010	%	2015	%
Town of Elcho	1,102	1,113	1.0	1,115	--	1,113	--	1,104	-0.8
Town of Upham	653	669	2.4	679	1.5	684	0.7	687	0.4
Langlade County	20,300	20,272	1.3	20,650	0.4	20,658	--	20,548	-0.5

The Elcho Sanitary District No. 1 population, which consists of the Community of Elcho, was approximately 485 in 1993, which represents 44.8% of the total 1993 population estimate (1,082) for the Town of Elcho. For the 20-year design period, the maximum projected population for the Town of Elcho for the year 2005 (1,115) will be used. Using the percentage breakdown determined above, the 20 year design population for the Community of Elcho would be 0.448 x 1,115 = 500, which represents an increase of 15 people (3.1%) over the next 20 years. This design population has previously been approved by the WDNR as part of the "Elcho Sanitary District No. 1, Sanitary Sewer Evaluation Survey and Infiltration/Inflow Analysis", January 1995, by MSA Professional Services, Inc., which will be referenced as SSES throughout the remainder of this report.

Growth for the Post and Greater Bass Lake Districts was based on results of mail surveys conducted by the Lake Districts which are discussed in detail in the respective Wastewater Feasibility Study for each Lake District. Similarly, the growth estimates for the Rolling Stone Lake District was based on the results from a resident survey. From the mail surveys the estimated number of future full and part time residences was established. Growth of 10% was then assumed for the Lake Districts and the Towns of Elcho and Upham. The 10% growth factor was chosen arbitrarily, but was deemed necessary based on the high strength nature of the waste to accommodate unforseen growth and still provide adequate treatment plant capacity.

B. Employment and Land Use

Historically, Elcho's economy has been based on forest products, tourism, and to a lesser extent, small scale agriculture. The unincorporated Community of Elcho serves as the educational, retail, and light industrial center for the Sanitary District and the surrounding area. Tourism continues to be a growing business in the area as development continues near the lake areas within the Towns of Elcho and Upham.

Existing industries within the area include a machining company and a metal fabricator. It is anticipated that the existing industries will expand within the future creating up to 20 new jobs in the future. There are also approximately 30 commercial businesses within the sanitary district.

C. Natural Features

The Community of Elcho is located in the north-central portion of Langlade County on USH "45" and STH "47". It is also served by CTH "K" and one town road. Elcho is located 5 miles south of Pelican Lake and 20 miles north of the City of Antigo, the County Seat. Otter Lake, which is the beginning of the Hunting River, is located just north of Elcho. The Hunting River drains the Sanitary District and empties into the Wolf River. The present limits of the Elcho Sanitary District No.1 encompass an area of 226 acres. The community is surrounded by the Township of Elcho. Figure 1-1 includes a copy of the USGS map which shows the location of the Community and the surrounding areas.

The topography of the community is essentially flat. The elevation is approximately 1,635 feet above mean sea level. Groundwater is the primary source of potable water for the private wells within the Lake Districts as well as the Elcho public water supply system. The aquifer consists primarily of a high yielding glacial till. Crystalline rocks of pre-cambrian age underlie all of Langlade County, and consist chiefly of granites and gneiss. They were formed during the earliest geologic era. Shallow depth to groundwater is common in the area surrounding the Community of Elcho, particularly to the west where wetlands are common.

The general soil map on Figure 2-1 shows the soil associations in Langlade County. The soils in Elcho generally consist of Antigo-Pence soil. The soils are well drained and were generally formed in silty and loamy deposits and in the underlying sand and gravel. These soils are on outwash plains, kames, and eskers. The permeability is moderate in the upper part of the profile and rapid or very rapid in the lower part. Slope ranges from 0 to 15 percent.

The climate of the area is classified as continental which is characterized by marked weather changes common to northern latitudes and the interiors of large land masses. Possible sunshine averages between 65% in the summer and 45% in the winter. Mean temperatures range from 16 degrees Fahrenheit in January to 66 degrees Fahrenheit in the Summer. Average annual precipitation is 31.6 inches with snowfalls averaging 54 inches annually.

III. WASTEWATER FLOW AND ORGANIC LOADING DATA

A. Existing Wastewater Flows and Organic Loadings

The existing flow conditions for the treatment plant from January 1991 through July 1994 are summarized in the "Sanitary Sewer Evaluation Survey and Infiltration/Inflow Analysis for the Elcho Sanitary District No. 1," January 1995, by MSA Professional Services, Inc. The flow and organic loading data for the existing wastewater treatment plant was updated to include the data from August 1994 through December 1995 for this report.

Table 3-1 shows the average, maximum, and minimum, flows received at the wastewater treatment facility from January 1993 through August 1997. This table shows that the wastewater flows to the treatment facility varied greatly over the period. The average daily flow during the period was 0.046 mgd. The peak month flow was 0.087 mgd which occurred in June 1993. The peak day flow for the period was 0.144 mgd in September 1994. The minimum day flow for the period was 0.012 mgd in August 1994.

Table 3-2 shows the average, maximum, and minimum wastewater organic concentration (5-day BOD) for each month from January 1993 through August 1997. Multiplying the average monthly flowrate by the average strength results in the approximate organic loading to the treatment plant in pounds (5-day BOD) per day, as included in Table 3-2. The average BOD over the period was 178 mg/l. The average 5-day BOD for a typical untreated domestic wastewater is 220 mg/l, therefore the values in Table 3-2 indicate a lower than normal organic strength wastewater.

Table 3-3 shows that average, maximum, and minimum wastewater suspended solids concentrations (TSS) for each month from January 1993 through August 1997. Multiplying the average monthly flowrate by the average solids loading results in the approximate solids loading to the treatment plant in pounds (TSS) per day, as included in Table 3-3. The average TSS over the period was 150 mg/l. The average TSS for a typical untreated domestic wastewater is 220 mg/l, therefore the values in Table 3-3 indicate a lower than normal suspended solids concentration in the wastewater.

TABLE 3-1
ELCHO SANITARY DISTRICT NO. 1
HISTORIC WASTEWATER FLOWS

MONTH			FLOW (mgd) Average	Maximum	Minimun
January	1993		0.043	0.047	0.037
February			0.041	0.045	0.038
March			0.040	0.055	0.032
April			0.060	0.077	0.039
May			0.075	0.084	0.069
June			0.087	0.067	0.067
July			0.064	0.092	0.033
August			0.048	0.064	0.033
September			0.055	0.090	0.026
October			0.048	0.059	0.040
November			0.040	0.072	0.024
December			0.040	0.060	0.024
		Average	0.053		
January	1994		0.035	0.048	0.024
February			0.035	0.048	0.024
March			0.034	0.048	0.024
April			0.036	0.048	0.024
May			0.043	0.060	0.024
June			0.036	0.048	0.024
July			0.035	0.048	0.024
August			0.030	0.036	0.012
September			0.056	0.144	0.024
October			0.053	0.072	0.036
November			0.040	0.084	0.036
December			0.037	0.042	0.014
		Average	0.039		
January	1995		0.037	0.042	0.028
February			0.038	0.056	0.028
March			0.043	0.070	0.028
April			0.060	0.126	0.028
May			0.072	0.126	0.042
June			0.042	0.056	0.028
July			0.043	0.056	0.028
August			0.050	0.056	0.042
September			0.047	0.056	0.028
October			0.052	0.056	0.028
November			0.052	0.070	0.042
December			0.045	0.056	0.028
		Average	0.048		
January	1996		0.048	0.056	0.042
February			0.046	0.056	0.028
March			0.049	0.056	0.042
April			0.116	0.336	0.042
May			0.132	0.168	0.084
June			0.091	0.126	0.070
July			0.069	0.084	0.042
August			0.056	0.060	0.056
September			0.059	0.084	0.042
October			0.048	0.070	0.042
November			0.045	0.056	0.042
December			0.046	0.056	0.042
		Average	0.067		
January	1997		0.047	0.056	0.042
February			0.045	0.056	0.042
March			0.055	0.070	0.042
April			0.150	0.294	0.126
May			0.101	0.126	0.070
June			0.064	0.084	0.056
July			0.060	0.070	0.056
August			0.049	0.056	0.042
		Average	0.071		
4-YEAR AVERAGE			0.055		

TABLE 3-2
ELCHO SANITARY DISTRICT NO. 1
HISTORIC WASTEWATER ORGANIC LOADING

MONTH			BOD (mg/l) Average	BOD (mg/l) Maximum	BOD (mg/l) Minimun		BOD (lbs/day) Average
January	1993		182	235	129		65
February			324	561	87		111
March			287	399	176		96
April			90	116	65		45
May			70	115	26		44
June			51	53	49		37
July			78	80	76		42
August			240	340	140		96
September			365	400	330		167
October			97	140	54		39
November			225	240	210		75
December			200	220	180		67
		Average	184			Average	74
January	1994		230	392	87		67
February			172	261	82		50
March			171	259	84		48
April			169	225	113		51
May			169	245	94		61
June			70	105	35		21
July			126	183	70		37
August			138	153	123		35
September			58	82	34		27
October			114	160	68		50
November			101	130	72		34
December			115	130	100		35
		Average	136			Average	43
January	1995		106	120	92		33
February			205	210	200		65
March			230	260	200		82
April			380	620	140		190
May			180	260	100		108
June			168	320	16		59
July			134	230	39		48
August			106	160	52		44
September			240	260	220		94
October			74	100	48		32
November			195	240	150		85
December			270	300	240		101
		Average	191			Average	78
January	1996		220	260	180		213
February			157	220	95		173
March			160	200	120		121
April			91	150	31		52
May			130	130	130		61
June			145	150	140		71
July			225	310	140		90
August			295	460	130		111
September			150	160	140		58
October			316	390	260		0
November			130	140	120		73
December			215	270	160		0
		Average	186			Average	85
January	1997		380	500	260		149
February			140	160	120		53
March			200	240	160		92
April			268	530	6		335
May			43	74	12		36
June			245	380	110		131
July			230	260	200		115
August			100	110	91		41
		Average	201			Average	119
4-YEAR AVERAGE			178		4-YEAR AVERAGE		77

TABLE 3-3
ELCHO SANITARY DISTRICT NO. 1
HISTORIC WASTEWATER SOLIDS LOADING

MONTH			TSS (mg/l) Average	Maximum	Minimun		TSS (lbs/day) Average
January	1993		403	595	212		145
February			471	850	92		161
March			424	800	48		141
April			118	126	110		59
May			132	136	128		83
June			44	48	41		32
July			24	24	24		13
August			117	190	43		47
September			910	1400	420		417
October			76	130	22		30
November			98	120	76		33
December			129	170	87		43
		Average	246			Average	100
January	1994		196	364	28		57
February			155	260	49		45
March			158	251	66		45
April			72	103	41		22
May			106	132	80		38
June			110	124	97		33
July			103	154	53		30
August			53	85	22		13
September			52	91	13		24
October			90	110	71		40
November			44	63	26		15
December			99	140	59		31
		Average	103			Average	35
January	1995		87.5	100	75		27
February			121	200	42		38
March			107	130	85		38
April			225	310	140		113
May			90.5	92	89		54
June			108	190	26		38
July			59	110	9		21
August			78	120	36		33
September			290	370	210		114
October			91	120	63		39
November			179	260	98		78
December			150	160	140		56
		Average	132			Average	54
January	1996		320	480	160		128
February			124	200	49		48
March			71	93	50		29
April			223	430	17		216
May			88	88	80		97
June			47	77	18		36
July			103	110	97		59
August			280	310	250		131
September			53.5	92	15		26
October			204	308	52		82
November			285	300	270		107
December			94	100	89		36
		Average	158			Average	83
January	1997		135	160	110		53
February			90	100	85		34
March			123	180	67		56
April			12	19	5		15
May			33.5	59	8		28
June			46	48	44		25
July			133	180	87		67
August			175	240	110		72
		Average	93			Average	44
4-YEAR AVERAGE			150			4-YEAR AVERAGE	64

The existing number of private systems for the Towns of Elcho and Upham and the Post, Greater Bass and Rolling Stone Protection and Rehabilitation Districts were estimated and are included in Table 3-4.

Table 3-4
Estimated Current Private Wastewater System Inventory

	Number of Homes Served by Respective System					
System Description	Town of Elcho*	Post Lake	Town of Upham*	Greater Bass Lake	Rolling Stone Lake	Totals
Holding Tanks						
Commercial	0	0	0	0	1	1
Full Time	0	4	0	3	15	22
Part Time	0	11	0	7	44	62
Septic Tanks						
Commercial	25	8	19	1	3	56
Full Time	338	157	518	50	53	1,116
Part Time	0	446	16	142	47	651
Totals	**363**	**626**	**553**	**203**	**163**	**1,908**

*Data for the Town of Elcho does not include Post Lake and the community of Elcho and data for the Town of Upham does not include Bass Lake.

The data in Table 3-4 was based on three sources which include community mail surveys performed by the respective Lake Districts, septic system surveys performed for the Post and Greater Bass Lake Districts by MSA Professional Services, Inc., and information from the Langlade County Land Records and Regulations Department. Data for the Towns of Elcho and Upham was based solely on information provided by the Langlade County Land Records and Regulations Department. It was assumed for the Towns of Elcho and Upham that all of the residences were full time homes (excluding Upper and Lower Post Lake). It was assumed that there were 65 homes on Summit Lake (included with the Town of Upham), and that those homes included 25% full time residences and 75% part time residences since actual data was not readily available. The assumption of the ratio of full time to part time residences is based on similar results for Post and Greater Bass Lakes as determined from the mail surveys. The rest of the homes in the Town of Upham were assumed to be full time residences.

B. Existing WPDES Requirements

The Elcho Sanitary District No. 1 is currently operating under Wisconsin Pollution Discharge Elimination System (WPDES) permit WI - 0029726 - 3. A copy of this permit is included in Appendix B. Effluent limits are listed in the WPDES permit for both a continuous discharge and a seasonal discharge (fill and draw). The effluent limits in the current WPDES permit are based on an average design flow of 60,000 gpd. Table 3-5 below shows the limits for operation of the treatment facility in continuous discharge mode.

Table 3-5
Existing WPDES Permit Limits - Continuous Discharge

	Effluent Limitations		
	Concentration		
Parameter	Minimum	Average	Maximum
BOD_5 (summer, weekly)	--	10 mg/l	--
BOD_5 (winter, weekly)	--	20 mg/l	--
TSS (summer, weekly)	--	10 mg/l	--
TSS (winter, weekly)	--	20 mg/l	--
Ammonia Nitrogen (summer, weekly)	--	2.5 mg/l	--
Ammonia Nitrogen (winter, weekly)	--	5.0 mg/l	--
pH (summer)*	6	--	7.2
pH (winter)*	6		7.4
Dissolved Oxygen	7.0 mg/l		

*pH is in "standard units" (s.u.) and fecal coliform is in number per 100 ml.

Table 3-6 below shows the existing limits for operation of the existing treatment facility under the current design conditions with a seasonal discharge.

Table 3-6
Existing WPDES Permit Limits - Seasonal Discharge

	Effluent Limitations		
		Concentration	
Parameter	Minimum	Average	Maximum
BOD_5 (monthly)	--	30 mg/l	--
BOD_5 (weekly)	--	45 mg/l	--
TSS (monthly)	--	60 mg/l	--
TSS (total annual)	--	--	10,960 lbs/yr
pH*	6	--	9

*pH is in "standard units" (s.u.) and fecal coliform is in number per 100 ml.

C. Future Wastewater Flows and Organic Loadings

The proposed wastewater facility for the Elcho Sanitary District No. 1 will serve all the communities within the planning area as shown in Figure 1-3 including the Town of Elcho, the Town of Upham, Post Lake Protection and Rehabilitation District, the Greater Bass Lake Protection and Rehabilitation District, and the Rolling Stone Lake Protection and Rehabilitation District.

The future wastewater flows for the Community of Elcho were developed in the SSES report by MSA Professional Services, Inc., and are summarized in Table 3-7.

Table 3-7
Future Flow Data for the Community of Elcho

Future Wet Weather Design Flows		
Residential		35,000 gpd
Commercial and Industrial		9,300 gpd
Public		6,400 gpd
Infiltration/Inflow		22,600 gpd
	TOTAL	73,300 gpd
Future Peak Day Flow		
Residential		35,000 gpd
Commercial and Industrial		9,300 gpd
Public		6,400 gpd
Infiltration/Inflow		173,900 gpd
	TOTAL	224,600 gpd

The future design organic loading data for the Community of Elcho includes a design BOD loading of 200 mg/l (122 lb/day at design flow), a TSS concentration of 200 mg/l (122 lb/day at design flow), a TKN concentration of 40 mg/l (24 lb/day at design flow), and a total phosphorous concentration of 4.0 mg/l (2.45 lb/day at design flow). The existing BOD concentrations are affected by relatively high infiltration/inflow to the sewer system as described in the SSES report. The organic loading concentrations to the plant are expected to increase in the future over current loadings discussed previously as improvements to the collection system progress to reduce infiltration/inflow. The SSES report also recommends that any future wastewater treatment facilities be designed to handle one day peak flows of 224,600 gpd during high I/I periods. It is anticipated that organic concentrations during these periods will be approximately one half of the normal concentrations.

The future numbers of private wastewater systems were calculated for all the other communities in the planning area, and were based on the assumptions discussed in Chapter 2. Table 3-8 includes a summary of the estimated private wastewater system inventory used in flow calculations. The flow data for the Lake Districts and the Towns of Elcho and Upham was calculated by estimating the future number of holding tanks and septic systems in each community. Where community mail survey or septic survey data was not available, the private system inventory was calculated assuming that reported land parcels with improvements contained on-site wastewater systems. It was assumed that all parcels not part of a lake district or lake community consisted of all full time residents or commercial properties. Summit Lake data, which is included with the values reported for the Town of Upham, was calculated assuming similar residency and on-site system failure rates as used for the Post and Greater Bass Lake Districts.

Table 3-8
Estimated Future Private Wastewater System Inventory

	Number of Homes Served by Respective Systems					
System Description	Town of Elcho	Post Lake	Town of Upham	Greater Bass Lake	Rolling Stone Lake	Totals
Holding Tanks						
Commercial	0	0	0	0	1	1
Full Time	37	59	121	28	17	262
Part Time	0	163	7	78	48	296
Septic Tanks						
Commercial	28	9	21	1	3	62
Full Time	334	136	448	36	70	1,024
Part Time	0	375	12	101	52	540
Totals	**399**	**742**	**609**	**244**	**191**	**2,185**

The future flow data for the Post, Greater Bass and Rollingstone Lake Districts was calculated based on community mail surveys, septic system surveys performed for the Post and Greater Bass Lake Districts by MSA Professional Services, Inc., and information from the Langlade County Land Records and Regulations Department. The assumptions used for Post and Greater Bass Lake Districts are discussed in detail in the respective Wastewater Feasibility Study for each Lake District.

The future flow data for the Rolling Stone Lake Protection and Rehabilitation District was estimated based on the results of a community mail survey and the septic system survey performed under the direction of the Lake District. The septic survey results were obtained from the Lake District and Langlade County Land Records and Regulations Department. The septic survey information indicated 50 percent failure of the septic systems within the Rolling Stone Lake Protection and Rehabilitation District. Of the systems to be replaced, approximately 57 percent will be replaced with holding tanks. The holding tank installations would be required where poor soil conditions and/or space limitations restrict the use of septic systems. The future estimated flows from the Rolling Stone Lake Protection and Rehabilitation District for summer and winter conditions are shown in Tables 3-9 and 3-10.

Table 3-9
Rolling Stone Lake Future Flow and Organic Loading Data - Summer

Component	# Homes Served	FLOW (gpd)	BOD5 (lbs/day)	TSS (lbs/day)	TKN (lbs/day)	PHOS. (lbs/day)
Holding Tanks						
Commercial	1	6,000	30	90	2.3	1.25
Full Time	17	1,030	5	16	0.4	0.22
Part Time	48	4,500	23	68	1.7	0.94
Septic Tanks						
Commercial	3	10	0	1	0.03	0.01
Full Time	70	130	6	16	0.6	0.16
Part Time	52	100	5	12	0.5	0.12
Totals	**191**	**11,770**	**69**	**202**	**5.5**	**2.70**

Table 3-10
Rolling Stone Lake Future Flow and Organic Loading Data - Winter

Component	FLOW (gpd)	BOD5 (lbs/day)	TSS (lbs/day)	TKN (lbs/day)	PHOS. (lbs/day)
Holding Tanks					
Commercial	1,710	9	26	0.6	0.36
Full Time	1,035	5	16	0.4	0.22
Part Time	535	3	8	0.2	0.11
Totals	**3,280**	**16**	**49**	**1.2**	**0.68**

The flow and organic loading data for the Rolling Stone Lake Protection and Rehabilitation District will consist of holding tank waste and septage. Based on the mail survey results, it was assumed that 40 percent of the existing homes were occupied full time and the remaining homes were seasonal residents with an average annual occupancy of 52 days. The surveys also showed the average number of residents per full time home to be approximately 2.0 people, while the average number of residents per part time residence was estimated to be 3.1 people when occupied. The holding tank flows were calculated assuming an average flow rate of 30 gpd per resident. This figure is based on conversations with local septic haulers which indicated holding tanks for full-time residences were typically pumped every 4 to 6 weeks. The septic system flows were calculated assuming an average tank size of 1,000 gallons and that each tank would be pumped every three years (one third of the tanks would be pumped each year).

The flow data for the Rolling Stone Lake Protection and Rehabilitation District was developed for summer and winter conditions to provide seasonal flow and organic loading data for use in sizing the proposed Elcho Wastewater Treatment Facility. In calculating the winter flow data it was assumed that commercial businesses would experience summer equivalent flow rates on two days of the week (weekends), that septage would only be discharged to the treatment plant only in the summer months, and that each part time residence holding tank would be pumped once during the winter.

The Wastewater Feasibility Studies for the Post and Greater Bass Lake Districts include flow scenarios for three different wastewater handling alternatives considered for each Lake District. The three alternatives include a low pressure sewer collection system alternative, a holding tank alternative, and a community septic system alternative. The holding tank option was identified as the most feasible wastewater handling and treatment option for each lake district, assuming that the waste would be disposed of at the proposed Elcho facility. The holding tank flow scenario was used in the development of treatment alternatives for the Elcho Sanitary District No. 1.

Tables 3-11 and 3-12 include summary of the summer and winter flows used in the preparation of the wastewater facility planning for the Elcho Sanitary District No. 1. The data in Table 3-11 assumes that all waste, including septage, would be treated at the proposed facility. Table 3-12 includes the summer and winter flow data assuming that septage would not be treated at the proposed Elcho facility, but rather land applied.

Data shown for the Town of Elcho in Tables 3-11 and 3-12 does not include the Community of Elcho or the Post Lake Protection and Rehabilitation District, which were calculated (and included) separately. Likewise, the Town of Upham data does not include the data for the Greater Bass Lake Protection and Rehabilitation District, which is included as a distinct entity as shown in Table 3-8. The Rolling Stone Lake District is also included separately.

Table 3-11
Combined Future Flows and Organic Loadings including Holding Tank Waste and Septage

Summer Flows Including Holding Tank Waste and Septage

Community	Flow (gpd)	BOD5 (lbs/day)	TSS (lbs/day)	TKN (lbs/day)	PHOS. (lbs/day)
Community of Elcho	73,300	122	122	24.5	2.45
Town of Elcho*	3,200	49	128	4.6	1.42
Post Lake	20,100	145	410	12.1	5.22
Town of Upham*	9,700	89	244	7.8	2.95
Greater Bass Lake	10,100	89	246	7.7	3.00
Rolling Stone Lake	11,800	69	202	5.5	2.70
Totals/Averages	128,200	563	1,352	62.1	17.73

Winter Flows Including Holding Tank Waste and Septage

Community	Flow (gpd)	BOD5 (lbs/day)	TSS (lbs/day)	TKN (lbs/day)	PHOS. (lbs/day)
Community of Elcho	73,300	122	122	24.5	2.45
Town of Elcho*	2,500	12	37	0.0	0.01
Post Lake	5,800	29	87	2.2	1.21
Town of Upham*	8,200	41	124	3.1	1.72
Greater Bass Lake	2,900	14	43	1.1	0.60
Rolling Stone Lake	3,300	16	49	1.2	0.68
Totals/Averages	96,000	236	463	32.0	6.66

*Data for the Town of Elcho does not include Post Lake and the community of Elcho and data for the Town of Upham does not include Bass Lake.

Table 3-12
Combined Future Flows and Organic Loadings Including Holding Tank Waste Only

Summer Flows Including Holding Tank Waste Only

Community	Flow (gpd)	BOD5 (lbs/day)	TSS (lbs/day)	TKN (lbs/day)	PHOS. (lbs/day)
Community of Elcho	73,300	122	122	24.5	2.45
Town of Elcho*	2,500	12	37	0.9	0.52
Post Lake	19,100	96	287	7.2	3.99
Town of Upham*	8,800	44	132	3.3	1.84
Greater Bass Lake	9,300	46	139	3.5	1.93
Rolling Stone Lake	11,500	52	157	3.9	2.18
Totals/Averages	124,500	373	875	43.3	12.90

Winter Flows Including Holding Tank Waste Only

Community	Flow (gpd)	BOD5 (lbs/day)	TSS (lbs/day)	TKN (lbs/day)	PHOS. (lbs/day)
Community of Elcho	73,300	122	122	24.5	2.45
Town of Elcho*	2,500	12	37	0.0	0.01
Post Lake	5,800	29	87	2.2	1.21
Town of Upham*	8,200	41	124	3.1	1.72
Greater Bass Lake	2,900	14	43	1.1	0.60
Rolling Stone Lake	3,300	16	49	1.2	0.68
Totals/Averages	96,000	236	463	32.0	6.66

*Data for the Town of Elcho does not include Post Lake and the community of Elcho and data for the Town of Upham does not include Bass Lake.

Table 3-13 shows the concentrations assumed in the calculation of organic, solids, and nutrient loadings. The holding tank loading concentrations were based on information presented in the Wisconsin Clean Water Fund Manual. The septic tank loading concentrations were based on information presented in the EPA Manual for Wastewater Treatment/Disposal for Small Communities (9/92).

Holding tank flows are based on 30 gpd per person as previously described and as described in the feasibility studies for Post and Greater Bass Lakes. As part of the flow calculation it was assumed that a holding tank for a full time residence would be pumped 12 times per year and a part time residence 3 times per the total future holding tank volume is estimated to be 8.4 million gallons per year.

Table 3-13
Holding Tank and Septage Waste Concentrations

Wastewater System	BOD (mg/L)	TSS (mg/L)	TKN (mg/L)	PHOS (mg/L)
Holding Tanks	600	1,800	45	25
Septic Tanks	6,000	15,000	600	150

D. Future WPDES Requirements

The future permit requirements for the Elcho Sanitary District No. 1 were developed by the Wisconsin Department of Natural Resources. The DNR correspondence discussing the proposed permit limits is included in Appendix C. Limits were provided for four discharge locations which include the following:

1. Hunting River, ½ mile downstream from Otter Lake (existing location)
2. Hunting River, near STH 45/47
3. Hunting River, at Fitzgerald Dam Road
4. Sucker Creek, just downstream of Sucker Lake

Location 4 was eliminated from consideration based on the distance from the existing or acceptable future wastewater treatment plant site locations, or because the limits did not offer any significant advantages with regards to future treatment requirements. In addition to the locations listed above, future effluent limits for a groundwater discharge (seepage cells) are listed in Table 3-17.

The future limit requirements for continuous discharge operation at the existing discharge location are listed below in Table 3-14.

Table 3-14
Proposed WPDES Permit Limits
For Continuous Discharge at Existing Location

Parameter	Effluent Limitations Concentration Flow = 0.073 MGD	Effluent Limitations Concentration Flow = 0.15 MGD
BOD_5 (summer, weekly)	8.6 mg/l	5.6 mg/l
BOD_5 (winter, weekly)	14 mg/l	10 mg/l
TSS (summer, weekly)	10 mg/l	10 mg/l
TSS (winter, weekly)	14 mg/l	10 mg/l
Ammonia Nitrogen (summer, weekly)	2.5 mg/l	1.6 mg/l
Ammonia Nitrogen (winter, weekly)	6.2 mg/l	4.1 mg/l
Total Phosphorous (if > 150 lb/month)	1.0 mg/l	1.0 mg/l
Dissolved Oxygen, for 10 <BOD< 45	6.0 mg/l	6.0 mg/l
Dissolved Oxygen, for BOD < 10 mg/l	7.0 mg/l	7.0 mg/l
pH* = 6.0 - 9.0		

*pH is in "standard units" (s.u.)

The proposed permit limits for continuous discharge to the Hunting River near the river crossing at STH 45/47 are listed below in Table 3-15.

Table 3-15
Proposed WPDES Permit Limits
For Continuous Discharge Near STH 45/47

Parameter	Effluent Limitations Concentration Flow = 0.073 MGD	Effluent Limitations Concentration Flow = 0.15 MGD
BOD_5 (summer, weekly)	28 mg/l	14 mg/l
BOD_5 (winter, weekly)	45 mg/l	23 mg/l
TSS (summer, weekly)	28 mg/l	14 mg/l
TSS (winter, weekly)	45 mg/l	23 mg/l
Ammonia Nitrogen (summer, weekly)	9.9 mg/l	5.0 mg/l
Ammonia Nitrogen (winter, weekly)	32 mg/l	16 mg/l
Total Phosphorous (if > 150 lb/month)	1.0 mg/l	1.0 mg/l
Dissolved Oxygen	6.0 mg/l	6.0 mg/l
pH* = 6.0 - 9.0		

*pH is in "standard units" (s.u.)

The proposed permit limits for continuous discharge to the Hunting River at the Fitzgerald Dam Road location are listed in Table 3-16. Utilization of the discharge location on Fitzgerald Dam Road was considered in the evaluation of alternatives for the Post and Greater Bass Lake Districts in their respective Wastewater Feasibility Studies. This alternative was ruled unfeasible as part of the Post Lake and Greater Bass Lake feasibility studies.

Table 3-16
Proposed WPDES Permit Limits
For Continuous Discharge at Fitzgerald Dam Road

	Effluent Limitations	
	Concentration	
Parameter	Flow = 0.1 MGD	Flow = 0.5 MGD
BOD_5 (summer, weekly)*	45 mg/l	27 mg/l
BOD_5 (winter, weekly)*	45 mg/l	45 mg/l
TSS (summer, weekly)*	45 mg/l	27 mg/l
TSS (winter, weekly)*	45 mg/l	45 mg/l
Ammonia Nitrogen (summer, weekly)	18 mg/l	3.7 mg/l
Ammonia Nitrogen (winter, weekly)	--	12 mg/l
Dissolved Oxygen, for 10 <BOD< 45	6.0 mg/l	6.0 mg/l
Dissolved Oxygen, for BOD < 10 mg/l	7.0 mg/l	7.0 mg/l
Total Phosphorous (if >150 lb/month)	1.0 mg/l	1.0 mg/l
pH** = 6.0 - 9.0		

*A monthly BOD and TSS of 30 mg/l is required for weekly limits of 45 mg/l
**pH is in "standard units" (s.u.)

The data in Table 3-14 and 3-15 was calculated after the Hunting River was sampled for pH and temperature during the months of July and August 1996. The average pH of the river was 7.6. This value was used in the effluent limit calculations. The data in Table 3-16 was calculated using the Wisconsin Department of Natural Resources default value 8.0. The default temperature of 20 degrees Celsius was used in the calculation of all the effluent limits.

Table 3-17
Proposed WPDES Permit Limits
For Continuous Groundwater Discharge

Parameter	Effluent Limitations Concentration
BOD_5	50 mg/l
Chlorides	250 mg/l

The values in Table 3-17 are considerably less stringent than the other discharge locations evaluated. It should be noted that a nitrogen limit was not included in Table 3-17. It is assumed that the groundwater discharge will be approved by the DNR as an indirect discharge to a surface water, thereby eliminating the nitrogen limit. In addition, groundwater discharges are not typically monitored for TSS, phosphorous and dissolved oxygen.

Review of the effluent limits shown in Tables 3-14 through 3-17 indicate that the most attracitve alternatives are discharge to groundwater or discharge to the Hunting River near STH 45/47.

IV. EXISTING WASTEWATER COLLECTION SYSTEM

A. Description

All of the developed areas in the Elcho Sanitary District No.1 are served by a municipal sewage collection system. A plan of the Elcho sanitary sewer system is included in Appendix D. The majority of the sanitary sewer was constructed in 1971, with a small extension being constructed in 1973 to serve the industrial park.

The Elcho sewage collection system is equipped with six lift stations. The locations of these lift stations are shown on the sanitary sewer system map, and the capacities of the stations are provided as follows:

Lift Station No. 1
Wetwell and Dry Pit Station
Number of Pumps = 2
Capacity per Pump = 150 gpm
TDH per Pump = 66 feet

Lift Station No. 2
Wetwell and Dry Pit Station
Number of Pumps = 2
Capacity per Pump = 100 gpm
TDH per Pump = 42 feet

Lift Station No. 3
Pneumatic Ejector Station
Number of Ejector Pots = 2
Capacity per Pot = 50 gpm
TDH per Pot = 20 feet

Lift Station No. 4
Pneumatic Ejector Station
Number of Ejector Pots = 2
Capacity per Pot = 30 gpm
TDH per Pot = 25 feet

Lift Station No. 5
Submersible Station
Number of Submersible Pumps = 1
Pump Capacity = 80 gpm
TDH for Pump = 10 feet

Lift Station No. 6
Submersible Station
Number of Submersible Pumps = 1
Pump Capacity = 80 gpm
TDH for Pump = 10 feet

Each of the pumps and ejector pots in the duplex lift stations operate alternately.

The sanitary sewer system was constructed of ABS truss pipe and PVC pipe. All of the sewer pipe is 8 inch, and the sizes of the forcemain pipes are 6 inch and 4 inch. The pipe sizes along with their respective lengths are shown in Table 4-1.

Table 4-1
Sanitary Sewer and Forcemain Inventory

Diameter	Length
8" Sewer	18,026 feet
6" Forcemain	2,400 feet
4" Forcemain	3,360 feet

The Sanitary District's 3.41 miles of sanitary sewer range from a depth of 3.7 feet to 15.5 feet with an average depth of 9.7 feet.

All collected wastewater is transported to the Lift Station No.1 wetwell. A communitor is located in this structure, however it is not currently operable. The wastewater is then pumped through approximately 2,400 feet of 6 inch diameter forcemain to the treatment facility.

V. EXISTING TREATMENT FACILITIES

A. Description of Existing Treatment Facilities

Currently, the Elcho Sanitary District No. 1 operates a wastewater treatment facility consisting of a conventional two-cell facultative lagoon system. The facility was originally constructed in 1970 for a design flow of 60,000 gpd and a design BOD of 102 lbs/day. The treatment facility is located in the northwest portion of the community. Figure 5-1 shows the layout of the existing facility.

The primary lagoon has a surface area of six acres with a five foot water depth and three feet of freeboard. The volume of the primary lagoon is approximately 10 million gallons. The secondary lagoon has a surface area of two acres with a five foot water depth and three feet of freeboard. The volume of the secondary lagoon is approximately 3.25 million gallons. Both lagoons were sealed with bentonite when constructed. The effluent is discharged from the secondary lagoon on a fill and draw basis. Discharge usually involves two to four cycles of filling and discharging the secondary pond and normally lasts about four weeks. Effluent is discharged during spring and autumn to the Hunting River.

B. Historic Treatment Plant Performance

The quality of the effluent from the Elcho wastewater treatment facility is shown in Table 5-1 for 1991 through spring 1997. Tables 3-1, 3-2, and 3-3 include the hydraulic, organic, and solids loadings to the treatment facility for this same period. Comparison of the values in Table 5-1 to the current permitted discharge limit of 30 mg/l on a monthly average and 45 mg/l on a weekly average for BOD and 60 mg/l for suspended solids concentrations, shows that the treatment facility is generally able to operate within its discharge limits.

The DNR has indicated that the future monthly discharge limits at the existing location may be significantly decreased. Additionally, ammonia limits and a phosphorus limit of 1 mg/l may also be added. Table 5-1 shows that the treatment facility will have difficulty meeting the proposed new BOD and TSS limits, and would not be able to meet the proposed ammonia or phosphorous limits without modification.

TABLE 5-1
ELCHO SANITARY DISTRICT NO. 1
HISTORIC WASTEWATER EFFLUENT QUALITY

DISCHARGE		FLOW (mgd)			BOD (mg/l)			TSS (mg/l)		
		Average	Maximum	Minimun	Average	Maximum	Minimun	Average	Maximum	Minimun
Spring	1991	0.435	0.598	0.288	21	24	19	38	48	22
Fall	1991	0.417	0.417	0.417	6	9	3	3	6	2
Spring	1992	0.393	0.417	0.288	19	22	15	30	76	4
Fall	1992	0.417	0.417	0.417	8	13	3	8	12	2
Spring	1993	0.479	0.598	0.288	18	34	7	47	104	20
Fall	1993	0.542	0.598	0.417	19	21	17	15	29	5
Spring	1994	0.242	0.342	0.051	33	80	8	28	45	5
Fall	1994	0.23	0.348	0.138	13	25	3	4	14	1
Spring	1995	0.24	0.514	0.189	18	21	15	45	68	24
Fall	1995	0.298	0.315	0.285	5	5	4	4	8	1
Spring	1996	0.193	0.234	0.104	20	31	10	19	39	2
Fall	1996	0.257	0.286	0.2	6	8	6	3	9	2
Spring	1997	0.28	0.286	0.194	16	96	1	12	60	1
Averages		0.340	0.413	0.252	15	30	8	20	40	7

C. Deficiencies of the Existing Treatment and Collection Facilities

The existing lift stations serving the Elcho Sanitary District No. 1 would be required to handle the 20 year flow conditions. Lift Station No. 1 would be replaced and larger pumps would be added to handle the peak day flow discussed in Chapter 3. Lift Stations No. 2, No. 3, and No. 4 would also require upgrading. Conversations with the Sanitary District indicate that No. 2 does not have the capacity to keep up with peak flows and that the ejector pumps in No. 3 and No. 4 are not performing adequately. It is proposed to replace the ejector pump stations with submersible pump stations. These lift station upgrades are included in each alternative evaluated in Chapter 6.

The existing treatment facility is capable of meeting the permit limits for the current average flow of 46,000 gpd and BOD loading of 66 lb/day. However, the existing lagoon system would not be able to meet the permit proposed limits for the future conditions developed in the Sanitary Sewer Evaluation Survey, which included a design flow of 73,300 gpd and a BOD loading of 122 lbs/day. Although the lagoons could meet the 150 day detention time and BOD loading requirements of 20 pounds per day per acre, the existing facility would likely exceed permit limits for BOD, TSS, and would be unable to meet the limits for ammonia nitrogen listed in Table 3-14 without an upgrade to the facility. Additionally, the existing facility would be unable to accept waste from the neighboring lake communities.

The existing lagoons do not have a synthetic liner system. A leakage study was performed by MSA Professional Services, Inc. for the Elcho Sanitary District No. 1 in the fall of 1994. The results of the study are included in the "Lagoon Leakage Study," December 1994, by MSA Professional Services, Inc. The results of the leakage study showed that the leakage from the lagoon was approximately 4,290 gallons per acre per day, exceeding the allowable limit of 1,000 gallons per day per acre specified in NR 110. The leakage from the lagoon could result in substantial groundwater degradation, and if the current facility is to remain in operation, it would be required to install a synthetic liner. The installation of a synthetic liner to the existing lagoon would be impractical do to the high groundwater levels at the site. It is estimated that the groundwater elevation at the site is approximately one foot above the elevation of the lagoon bottom. Additionally, it would not be possible to treat existing wastewater flows during the liner installation.

There is currently no system for disinfection at the existing facility, which is operated in the fill and draw mode. At increased flows, particularly considering the inclusion of the waste flows from the neighboring lake districts, the existing facility would have to operate in the continuous discharge mode. A disinfection system would be required for operation in this manner.

The existing facility is not capable of meeting the requirements for ammonia removal listed in Table 3-14 for continuous discharge at the existing location. The plant would need to be upgraded to achieve nitrogen removal.

Considering the deficiencies discussed above, it is recommended that the existing wastewater treatment facility be abandoned. Costs for the lagoon abandonment are included with each treatment alternative discussed in Chapter 6.

VI. WASTEWATER TREATMENT ALTERNATIVES

A. General

The following sections discuss various alternatives for wastewater treatment and their feasibility. Many of these alternatives can be quickly eliminated from consideration due to cost or improper site conditions. Included in this chapter is a comparison of the most feasible alternatives and a cost estimate for each different alternative.

1. No Action

An alternative to construction of new or upgraded wastewater treatment facilities is the "no action" concept. Federal requirements mandate that the "no action" option be considered. This concept has the advantage of requiring little or no effort or expenditure of funds by the Sanitary District. No disruption of the environment would result from construction activities.

No Action in the case of the Elcho Sanitary District No. 1 would mean continuing with current methods of wastewater treatment and limiting the use of the facility to the Sanitary District boundaries. As a minimum, a synthetic liner system would have to be installed in the existing lagoons based on the results of the leakage study, and monitoring wells would have to be installed to monitor groundwater impacts, resulting in significant costs. Given the future flows and organic loadings, the existing facultative lagoons could not meet required permit limits and would result in degradation of the water quality of the Hunting River. Based on the above discussion, the no action alternative was removed from further consideration.

2. Joint Treatment

Joint treatment for the Community of Elcho with a larger nearby community was considered. The closest candidate communities considered were Antigo and Rhinelander, however, the long distances between the Elcho and the other larger communities did not make joint treatment a feasible option.

The other joint treatment option would include joint treatment of the Lake Districts at a new Elcho facility as a regional treatment center. Joint treatment offers several advantages to all of the communities involved. The Lake District communities are in need of wastewater treatment facilities, but have limited resources available due to a small user base. Combining the users within the planning area will help to spread the costs of the treatment facility over a larger user base, thus lowering the overall costs for individual residents. This has added significance in lieu of the fact that the Lake Districts are recreational areas and as such, have substantial seasonal populations. The burden of separate waste treatment facilities would weigh heavily on the economic environment of the entire area.

The Community of Elcho has an existing sewer system and has the largest full time population of any community in the planning area, and is therefore the most logical location for the wastewater facilities. The inclusion of the Lake District communities and the Towns of Elcho and Upham further justifies evaluation of new discharge locations. The proposed new discharge locations would result in permit limits that may be achieved by a more cost effective treatment alternative.

3. Land Disposal

The disposal of treated wastewater on land either via seepage cells or by irrigation was considered. Land disposal can be a viable alternative when the available receiving stream does not have adequate assimilative capacity to accept the effluent discharge. Where land is available with acceptable soils and percolation rates, and climate permits, land disposal is often a cost effective effluent disposal alternative. It may also be desirable from the standpoint of recharging the groundwater table.

Prior to discharge to seepage cells, effluent concentrations of 50 mg/l BOD, 250 mg/l chloride, and 10 mg/l total nitrogen are typically required. The 10 mg/l total nitrogen limit, and in some cases the 250 mg/l chloride limit, cannot be met reliably on a year-round basis without advanced treatment. Adequate land to construct a minimum of three seepage cells is required to allow a resting period for regeneration of the soil absorption properties. A depth of 10 feet from the bottom of the seepage pond to the bedrock is also required, and a 5 foot thick zone of unsaturated soil must separate the soil surface of the land disposal site and the highest anticipated groundwater elevation.

Groundwater monitoring would be required to verify that the land disposal system was not contaminating the groundwater. A system of monitoring wells would need to be installed and sampled regularly.

For the existing treatment facility site, this alternative will be pursued using the site directly north of the existing stabilization ponds. This site is in the unique situation where treated wastewater discharged to a seepage cell will ultimately flow to the adjacent wetland areas. This indirect surface water discharge allows the DNR to grant a variance removing the nitrogen limits typically required for a groundwater discharge. This variance makes the groundwater discharge a very attractive alternative.

Tentative approval of this site has already been granted by the DNR. This alternative will require more treatment than is currently available from the existing stabilization ponds, therefore some form of new treatment facility will be included in any alternatives utilizing a discharge to groundwater.

4. Treatment and Discharge to Surface Water

The concept of treatment and discharge to a surface water is generally the most widely used method of wastewater disposal. A combination of physical, chemical, and biological treatment processes are normally employed, as is the case at the existing Elcho wastewater treatment facility.

As previously mentioned, an aerated lagoon treatment system is typically the most practical solution for wastewater treatment for smaller communities. A lagoon system typically includes aerated lagoon cells for destruction of organics and a quiescent lagoon for solids settling prior to discharge. However, an aerated lagoon system by itself would not be able to meet the anticipated WPDES permit effluent limits for surface water discharge.

A mechanical treatment process, such as an oxidation ditch, could be used to achieve treatment objectives. If the entire Towns of Elcho and Upham, including the Post and Greater Bass Lake Districts and the Rolling Stone Lake District are included in the treatment scenario, evaluation of a mechanical treatment plant is appropriate given the relatively high flows.

Oxidation ditch treatment is a modification of the activated sludge process in which the facility is designed to operate as an extended aeration process, characterized by long hydraulic and solids detention times. The oxidation ditch process has been shown to be a cost-effective implementation of the activated sludge process for small communities where diurnal loadings vary considerably. Oxidation ditches are typically constructed in concentric circles or ovals with mechanical surface aeration devices used to provide both oxygen transfer and maintain circulation.

Another method capable of meeting the treatment objective is a recirculating sand filter (RSF). RSFs are open filters which utilize a coarse media and filtrate recirculation. Influent to the treatment system flows to a municipal septic tank where some solids settling and stabilization occurs, reducing the BOD and TSS load to the RSF. Wastewater is dosed to the RSF from a tank which receives both settled waste from the septic tank and the recirculated filtrate. Upon downward flow of wastewater through the sand filters, treatment occurs through a variety of physical, chemical and biological processes. The sand is primarily a growth surface for microorganisms. The organisms attach themselves to the sand, and use the wastewater as a food source. In the process, the organic pollutants in the wastewater are broken down into inert substances, such as carbon dioxide and water. A portion of the filtrate is diverted for disposal during each dose, while the remaining portion is recirculated. A recirculation rate of 3:1 to 5:1 is typical. RSFs have been applied to both individual homes and small communities with flow rates up to 0.2 MGD.

A RSF must be preceded by pretreatment to reduce BOD_5 and TSS loads. A municipal septic tank would be used for pretreatment. The experience of other communities with municipal septic tanks indicates that sludge removal every two years is sufficient to prevent sludge accumulation. Septage from a similar system in Ixonia met the WDNR's most recent criteria for landspreading. A contractor would be employed to pump the tank and dispose of it for the Sanitary District.

B. Treatment Unit Alternatives

Based on the future loading data, the future WPDES permitted effluent limits, and the discussion of treatment alternatives discussed in the previous section, five treatment unit alternatives were developed for further consideration for facility planning for the Elcho Sanitary District No. 1. The four alternatives are described as follows:

Alternative No. 1	RSF for the Community of Elcho only
Alternative No. 2	Aerated Lagoon and RSF for Combined Flow with Holding Tank Waste and Septage
Alternative No. 3	Oxidation Ditch for Combined Flow with Holding Tank Waste and Septage
Alternative No. 4	RSF for Combined Flow with Holding Tank Waste Only - No Septage
Alternative No. 5	Aerated Lagoon with Seepage Cell Discharge for Combined Flow with Holding Tank Waste Only - No Septage
Alternative No. 6	Aerated Lagoon with Seepage Cell Discharge for the Community of Elcho only

The alternatives evaluate the monetary significance of including septage in the waste stream with holding tank waste compared to including only holding tank waste. Previous studies have shown that RSFs and aerated lagoons are typically more economical than mechanical plants. Therefore, an RSF was chosen as the treatment method for the evaluation which excluded septage from the wastewater loading and the discharge was to surface water (Alternative 4). An aerated lagoon was chose as the treatment method for the evaluation when septage was excluded and the discharge was to groundwater (Alternative 5 and 6). For the inclusion of septage in the waste stream, both RSFs (Alternative 2) and an Oxidation Ditch (Alternative 3) were evaluated. An alternative including septage and a groundwater discharge was not evaluated.

These alternatives were evaluated based on an economic analysis and non-monetary differences to determine the most feasible solution to meet the wastewater treatment needs for the Community of Elcho and the neighboring communities. The economic analyses and non-monetary issues are discussed in the next two sections.

Based on the results of the Wastewater Feasibility Studies for the Post and Greater Bass Lake Districts, the combined flow alternatives (Alternatives 2 - 5) were evaluated assuming the flows from the neighboring communities would be generated from private systems and trucked to the new treatment facility. The private systems would include holding tanks and septic systems.

Other alternatives investigated for Post and Greater Bass Lakes in their respective wastewater feasibility studies include sewered systems for the Lake Districts consisting of low pressure sewers and private grinder pump stations and community septic systems where several homes in designated areas would be served by grinder pump stations and sewered to individual community septic systems located in areas with soils suitable for systems. Both alternatives were deemed unfeasible for both Post and Greater Bass Lakes and were not evaluated for incorporation into the Elcho facility planning effort.

Alternative No. 1 RSF for the Community of Elcho only

Alternative 1 would include construction of a new RSF for the treatment of wastewater from the community of Elcho alone. Raw wastewater would be pumped to a municipal septic tank from lift station No. 1, which would be equipped with new submersible pumps. From the septic tank, wastewater would flow by gravity to a dosing tank where it would be mixed with filtrate being recirculated from the filter effluent. The wastewater/filtrate mixture would then be pumped to the sand filter by the dosing pumps. Per NR 110.22(b)(c), the dosing/recirculation tank would provide at least 24 hours detention time. The wastewater/filtrate mixture would then be pumped to the sand filter by submersible pumps.

The recirculating sand filter would consist of a 36 inch deep bed of medium to coarse sand, underlain by gravel and perforated collection pipes. For flexibility and greater process control, the filter would be provided with four separate cells which could be loaded independently. The four cells would be sized so that typical flows could be treated with three cells on-line. The fourth cell would used during periods of extreme I/I. The configuration would also allow one cell to be taken out of service for maintenance. The wastewater would be applied to the filter through a network of perforated pipes designed to distribute the flow as evenly as possible over the filter surface.

A perforated underdrain system would collect the filtrate, which would then flow to a splitter box. The splitter box would contain five V-notch weirs to proportionally divide the flow, allowing recycle rates ranging between 1:1 and 4:1. One weir would discharge to ultraviolet disinfection facilities, while the others would direct flow back to the dosing tank.

The effluent from RSF plants is typically less than 10 mg/L BOD_5, TSS, and ammonia nitrogen. Nearly complete nitrification (conversion of ammonia nitrogen to nitrate nitrogen) has been observed during winter operation in areas of southern Wisconsin. However, considering the northern location of Elcho and the proposed ammonia nitrogen limits for the existing discharge location, the effluent from the facility proposed for Alternative 1 would be pumped for discharge to the Hunting River at the STH 45/47 location. A new lift station would be constructed for the discharge.

In addition to the treatment facilities described above, a control building, influent and effluent samplers, an ultraviolet disinfection system, an effluent flow meter, an emergency generator, and a cascade aerator would also be provided. Laboratory facilities are not included, assuming that analytical testing services will continue to be performed by an independent lab.

The facility described for Alternative No. 1 would be constructed on a 40 acre parcel of land located on Lagoon Lane, directly north of the existing facility. Lagoon Lane would be widened and paved up to the new facility to accommodate the truck traffic involved in the transportation of holding tank waste and septage.

The existing primary lagoon and holding pond would require abandonment in accordance with NR 110.09 which requires an abandonment plan. The proposed lagoon abandonment plan consists of the following steps:

1. Remove and dispose of accumulated solid matter and liquid waste.

   The volume of sludge in the lagoon system was estimated to be approximately 2,400,000 gallons. The sludge would be removed by a contracted hauler and disposed of as required by WDNR.

2. Penetrate berm to provide drainage.

3. Quarterly groundwater monitoring for at least one year.

   Quarterly groundwater monitoring will be done at four newly installed monitoring wells.

4. Petition WDNR for closure.

   When the chemical groundwater parameters return to background levels in the monitoring wells, a closure report will be prepared and submitted in the WDNR.

5. Abandon wells in accordance with NR 141.

Figure 6-1 shows a process schematic and Table 6-1 contains the design data for the RSF alternative. A cost estimate for this alternative is included in Appendix G as Table G-1.

Table 6-1
Alternative No. 1 - RSF Design Data for Elcho Alone

Design Flow	73,000 gpd
Septic Tank Detention Time Volume	 48 hours 146,000 gal
Recirculating Sand Filters Number of Cells Hydraulic Loading Rate Filter Dimensions Filter Media	 4 (3 operating, 1 stand-by) 3 gpd/ft^2 46' x 180' each 3 ft. coarse sand, 2 ft. washed stone
Recirculation Tank Volume Recirculation Pumps (3)	 73,000 gallons 550 gpm each
Disinfection	UV

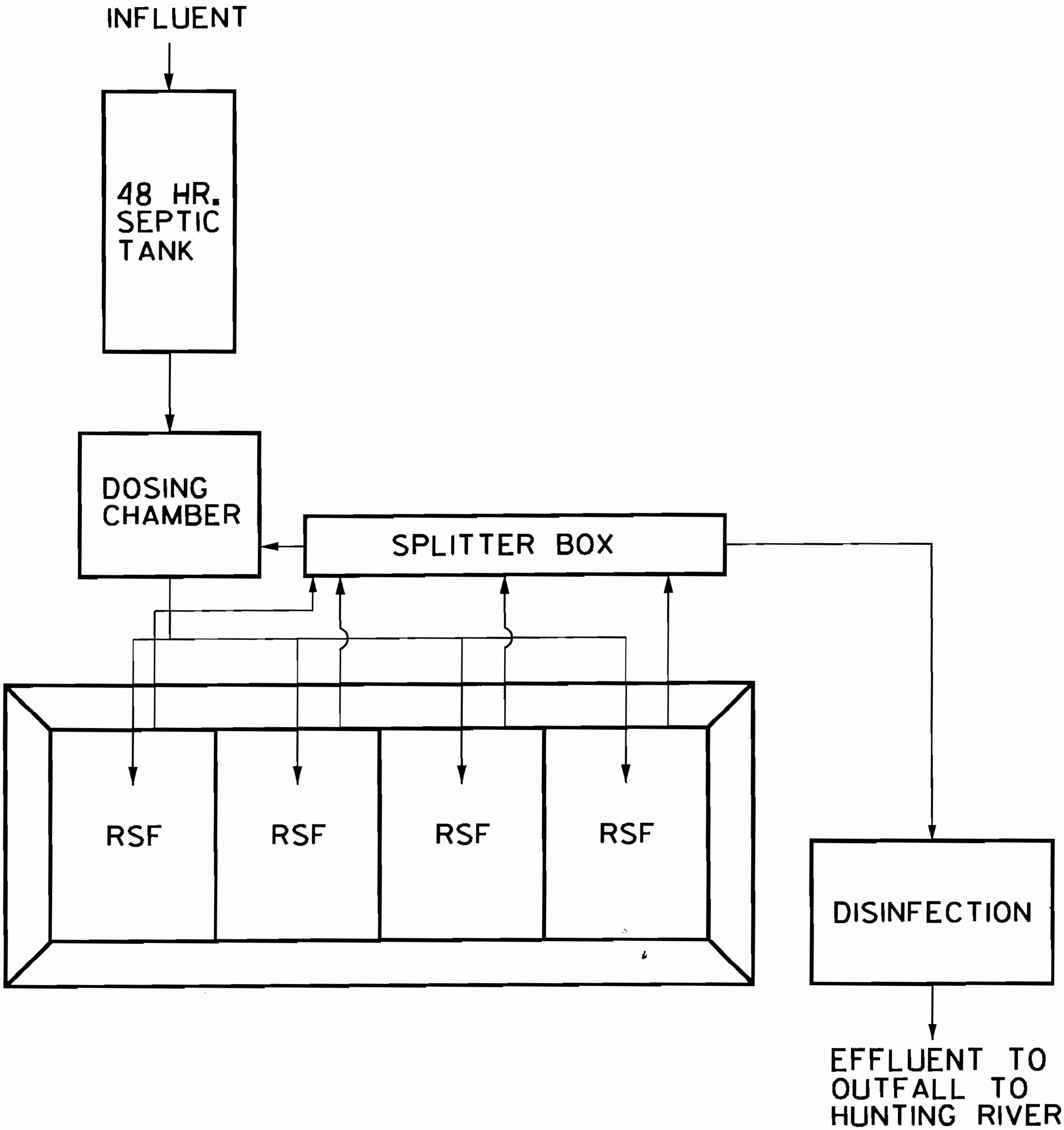

FIGURE 6-1

ALTERNATIVE 1
RECIRCULATING SAND FILTER SCHEMATIC

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Alternative No. 2 **Lagoon and RSF for Combined Flow with Holding Tank Waste and Septage**

Alternative No. 2 would include the construction of a lagoon system combined with a RSF to treat the combined flows from the neighboring communities in the planning area. The lagoon system would provide primary treatment of the high strength waste for the RSF which would provide final organics removal and nitrification to the meet the ammonia nitrogen limits. As previously discussed the flow from the neighboring communities would consist of holding tank waste and septage that would be trucked to the proposed facility.

Holding tank waste and septage would be introduced into the waste stream from the community of Elcho from a concrete receiving station. The wastewater would flow into a primary aerated lagoon with an 18 day detention time, where submerged, helixor aerators would be used to provide oxygen. Wastewater would flow by gravity from the aerated lagoon cell to a quiescent lagoon sized to provide 6 days of detention time.

Unlike Alternative 1, phosphorous removal would be required for the inclusion of high strength waste. Alum would be introduced to the wastewater flow stream between the aerated and quiescent lagoon cells. From the quiescent lagoon, wastewater would flow by gravity through a graded rock filter system. The rock filter would act as a straining mechanism for algae and duckweed to prevent clogging in the RSF.

The RSF would consist of components previously described for Alternative 1, including a septic tank with 48 hours detention time, a dosing/recirculation tank with 24 hours detention time, a four celled RSF, and submersible pumps. A perforated underdrain system would collect the filtrate, which would then flow to a splitter box. The splitter box would contain five V-notch weirs to proportionally divide the flow, allowing recycle rates ranging between 1:1 and 4:1. One weir would discharge to ultraviolet disinfection facilities, while the others would direct flow back to the dosing tank. The effluent from the facility proposed for Alternative 2 would be pumped for discharge to the Hunting River at the STH 45/47 location. A new lift station would be constructed for the discharge.

Due to the high strength of septage and treatment difficulties in cold weather, it was assumed that no septage would be accepted at the treatment facility during the winter season. A municipal septic tank would be installed for winter operation, while the lagoon system would be bypassed. Influent wastewater would flow directly into the septic tank after alum introduction and then to the dosing/recirculation tank by gravity.

In addition to the treatment facilities described above, a control building, influent and effluent samplers, an ultraviolet disinfection system, an effluent flow meter, an emergency generator, and a cascade aerator would also be provided. Laboratory facilities are not included, assuming that analytical testing services will continue to be performed by an independent lab.

The facility described for Alternative No. 2 would be constructed on a 40 acre parcel of land located on Lagoon Lane, directly north of the existing facility. Lagoon Lane would be widened and paved up to the new facility to accommodate the truck traffic involved in the transportation of holding tank waste and septage.

Alternative No. 2 would also require abandonment of the existing lagoons. The abandonment would be conducted as described for Alternative No. 1.

The design conditions for the proposed facility for Alternative No. 2 are included in Table 6-2. Figure 6-2 is a process schematic for Alternative No. 2. A cost estimate for Alternative 2 is included in Appendix G as Table G-2.

Table 6-2
Alternative No. 2 - Lagoon System and RSF Design Data

Design Flow	128,200 gpd
Lagoon Volume	
18 Day Aerated	2.3 million gallons
6 Day Quiescent	0.76 million gallons
Septic Tank	
Detention Time	48 hours
Volume	256,400 gal
Recirculating Sand Filters	
Number of Cells	4 (3 operating, 1 stand-by)
Hydraulic Loading Rate	3 gpd/ft^2
Filter Dimensions	57' x 250' each
Filter Media	3 ft. coarse sand, 2 ft. washed stone
Recirculation Tank	
Volume	128,200 gallons
Recirculation Pumps (4)	570 gpm each
Disinfection	UV

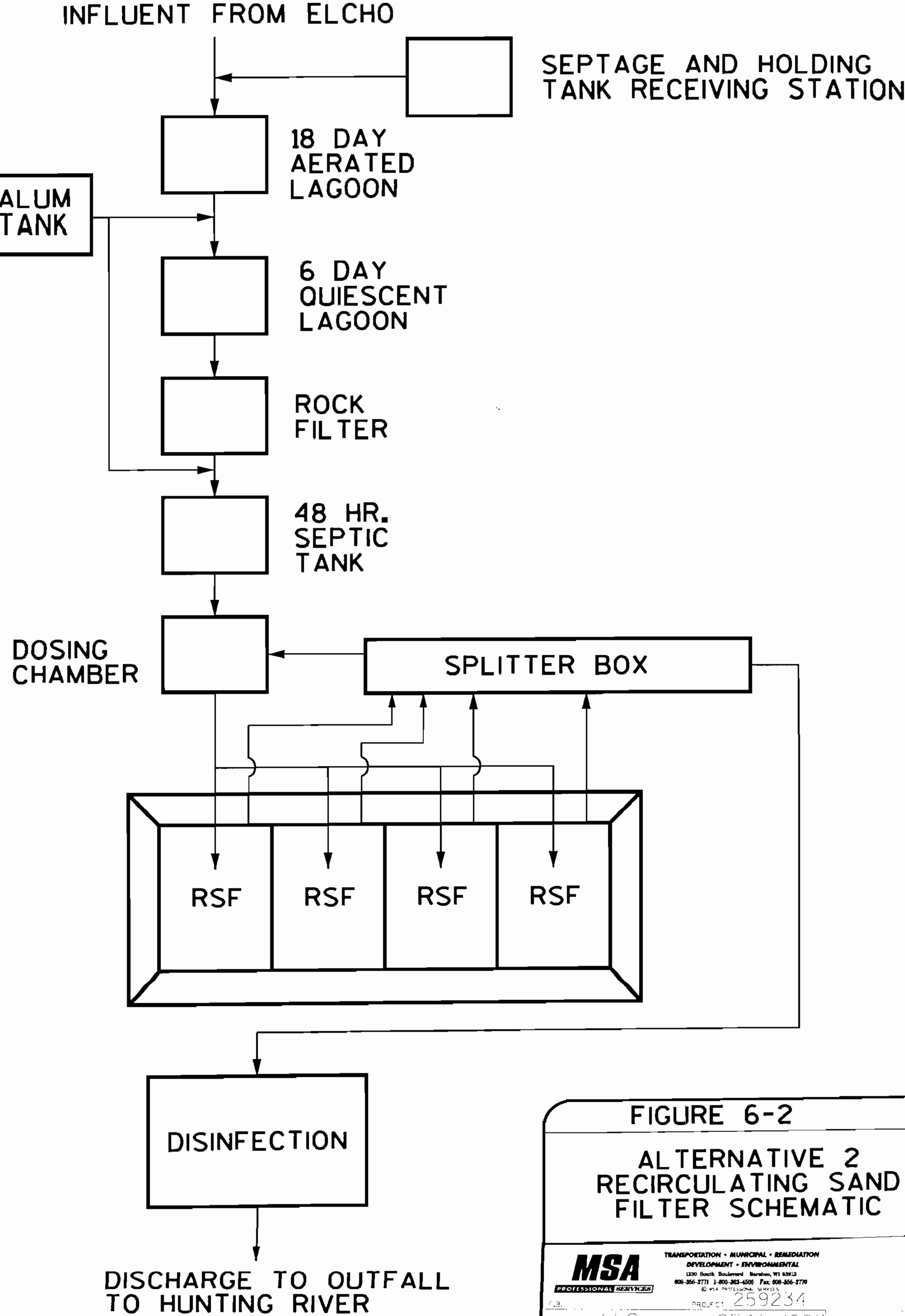

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FIGURE 6-2

ALTERNATIVE 2
RECIRCULATING SAND FILTER SCHEMATIC

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Alternative No. 3 Oxidation Ditch for Combined Flow with Holding Tank Waste and Septage

Alternative No. 3 would include the use of an oxidation ditch to treat the combined flows, including septagc, from the communities in the planning area. Raw wastewater from the Community of Elcho would be pumped from the modified lift station No. 1. A holding tank waste and septage receiving station would be constructed to accept the waste from the other communities. The two waste flows would be combined for screening and grit removal. Wastewater would flow by gravity to the oxidation ditch for ammonia nitrogen and BOD_5 removal. Following biological treatment, alum would be added to the waste stream for phosphorous removal. The wastewater would then flow to the secondary clarifier for solids separation and a portion of the settled sludge would be returned to the oxidation ditch to maintain the desired biomass concentration. Effluent from the secondary clarifier would flow by gravity to the UV disinfection system prior to being discharged.

Treated wastewater would be discharged to the Hunting River at the STH 45/47 location. A new lift station would be constructed to pump the effluent to the discharge outfall. Excess solids generated in the activated sludge process would be wasted to an aerobic holding tank for digestion then pumped to a storage tank.

The proposed facility would be constructed near the industrial park on the west side of the Community of Elcho. In addition to the treatment facilities described above, a new lift station, control building, headworks building, influent and effluent samplers, an emergency generator, and influent and effluent flow meters would be provided. The new control building would house the new pumps and controls for the oxidation ditch. Laboratory facilities are not included assuming that analytical testing services will continue to be performed by an independent lab.

The existing primary lagoon and holding pond would require abandonment in accordance with NR 110.09. The abandonment plan would be the same as that described previously for Alternative 1.

Figure 6-3 shows a process schematic and Table 6-3 contains the design data for the oxidation ditch alternative. Table G-3 in Appendix G includes a cost estimate for this alternative.

Table 6-3
Alternative No. 3 - Oxidation Ditch Design Data

Design Flow	128,200 gpd
Oxidation Ditch	
Number of Channels	2
Basin Volume	288,000 gallons
Detention Time	54.4 hours
RAS/WAS Pumps	175 gpm
Final Clarifier	
Number of Units	1
Diameter	20 feet
Sidewater Depth	12 feet
Surface Overflow Rate @ Avg. Flow	404 gpd/ft^2
Surface Overflow Rate @ Peak Flow	870 gpd/ft^2
Disinfection	Ultraviolet
Aerobic Sludge Holding Tank	
Basin Volume	97,000 gallons
Detention Time	30 days
Aeration	Diffused Air
Sludge Holding Tank	
Tank Volume	580,000 gallons
Detention Time	180 days

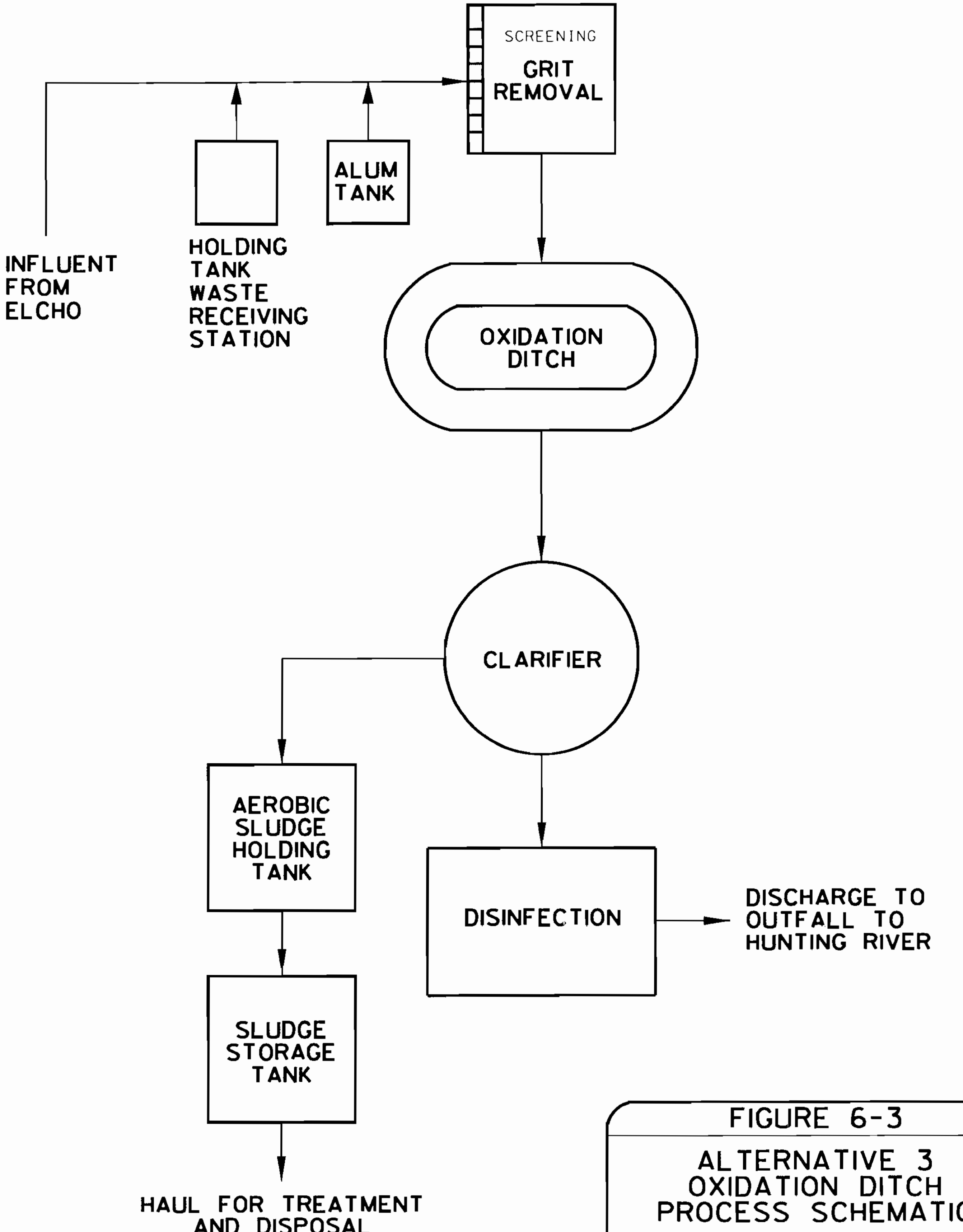

FIGURE 6-3

ALTERNATIVE 3
OXIDATION DITCH
PROCESS SCHEMATIC

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Alternative No. 4 RSF for Combined Flow with Holding Tank Waste Only - No Septage

Alternative No. 4 would include a RSF treatment system to accept the wastes from the Community of Elcho and the flow from holding tank waste from the neighboring communities in the Towns of Elcho and Upham, including the Post, Greater Bass, and Rolling Stone Lake Districts. The septage generated in the planning area would not be accepted at the treatment facility, but would instead be land applied by the local septage hauler on land purchased by the Sanitary District. The land available in the area is adequate to handle the loading from the septage generated in the planning area, however, there is not enough land in the immediate area to handle the anticipated holding tank waste loading. Removing the septage from the waste stream to the treatment plant would substantially decrease the capital and treatment costs for the facility, while treatment of holding tank waste at the proposed regional facility would insure that sufficient land remains available for disposal of the septage.

The elimination of septage will eliminate the need for a lagoon system as described under Alternative 2. Instead, a municipal septic tank would be installed as described for Alternative 1. Holding tank waste would be combined with the waste stream from the Community of Elcho in the municipal septic tank. A concrete receiving station would be constructed for introduction of holding tank waste to the facility.

The RSF system would consist of components previously described for Alternative 1, including a dosing/recirculation tank with 24 hours detention time, a four celled RSF, and submersible pumps. A perforated underdrain system would collect the filtrate, which would then flow to a splitter box. The splitter box would contain five V-notch weirs to proportionally divide the flow, allowing recycle rates ranging between 1:1 and 4:1. One weir would discharge to ultraviolet disinfection facilities, while the others would direct flow back to the dosing tank. The effluent from the facility proposed for Alternative 4 would be pumped for discharge to the Hunting River at the STH 45/47 location as described for Alternatives 1 and 3. A new lift station would be constructed for the discharge.

Unlike Alternative 1, phosphorous removal would be required for the inclusion of high strength waste as described for Alternatives 2 and 3. Alum would be introduced to the wastewater flow stream prior to the 48 hour septic tank.

The facility described for Alternative No. 2 would be constructed on a 40 acre parcel of land located on Lagoon Lane, directly north of the existing facility. Lagoon Lane would be widened and paved up to the new facility to accommodate the truck traffic involved in the transportation of holding tank waste. In addition to the treatment facilities described above, a new lift station, control building, influent and effluent samplers, an emergency generator, and influent and effluent flow meters would be provided. Laboratory facilities are not included assuming that analytical testing services will continue to be performed by an independent lab.

The existing primary lagoon and holding pond would require abandonment in accordance with NR 110.09. The abandonment plan would be the same as that described previously for Alternatives 1 - 3.

Figure 6-4 shows a process schematic and Table 6-4 contains the design data for the Alternative No. 4. Table G-4 in Appendix G includes a cost estimate for this alternative.

Table 6-4
Alternative No. 4 - RSF Design Data for Combined Flow with No Septage

Design Flow	124,500 gpd
Septic Tank Detention Time Volume	 48 hours 249,000 gal
Recirculating Sand Filters Number of Cells Hydraulic Loading Rate Filter Dimensions Filter Media	 4 (3 operating, 1 stand-by) 3 gpd/ft^2 55' x 250' each 3 ft. coarse sand, 2 ft. washed stone
Recirculation Tank Volume Recirculation Pumps (4)	 124,500 gallons 570 gpm each
Disinfection	UV

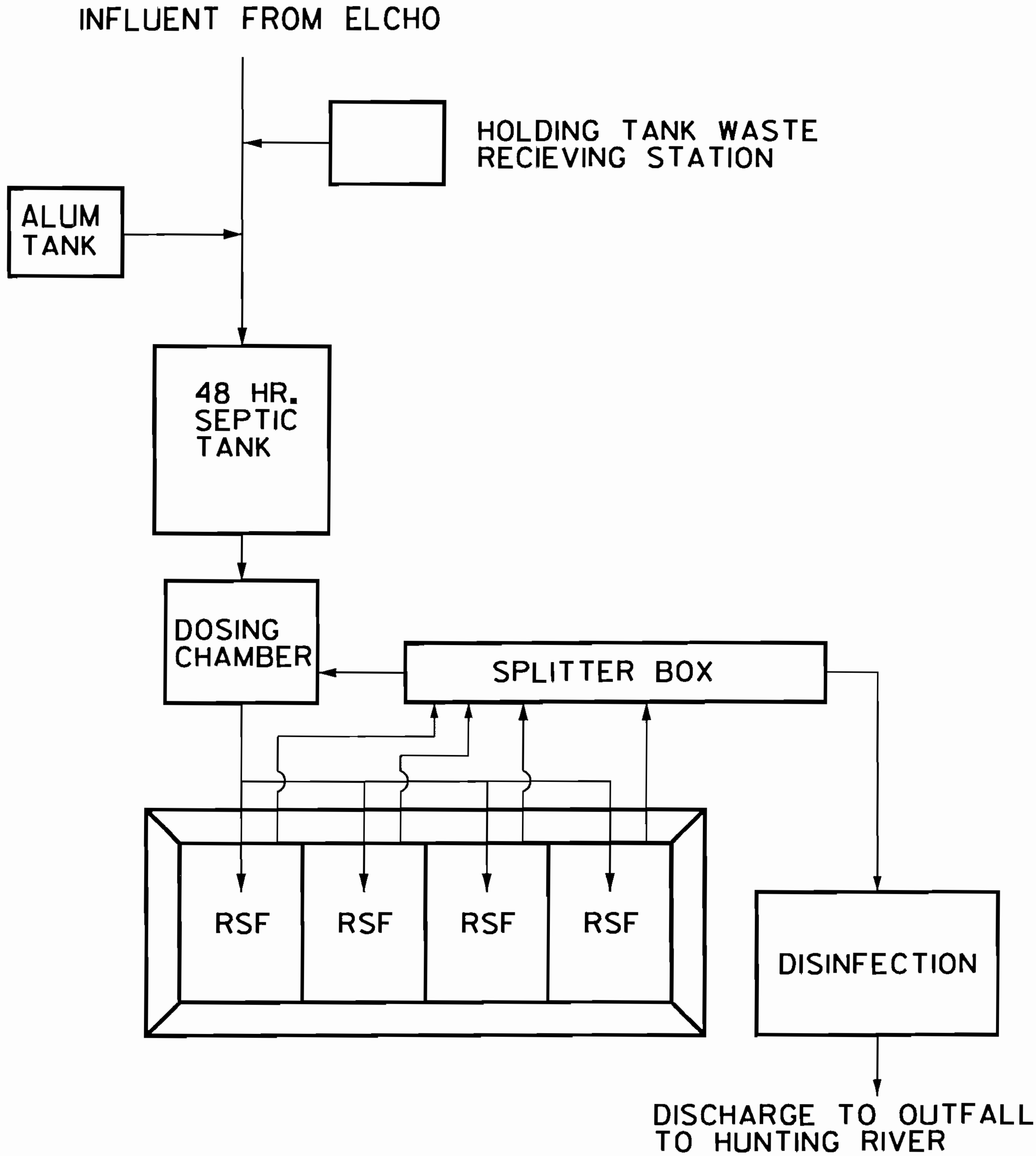

FIGURE 6-4

ALTERNATIVE 4
RECIRCULATING SAND
FILTER SCHEMATIC

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Alternative No. 5 **Aerated Lagoon with Seepage Cell Discharge for Combined Flow with Holding Tank Waste Only - No Septage**

Alternative No. 5 would include an aerated lagoon treatment system with a groundwater discharge to accept the wastes from the Community of Elcho and the flow from holding tank waste from the neighboring communities in the Towns of Elcho and Upham, including the Post, Greater Bass, and Rolling Stone Lake Districts. The septage generated in the planning area would not be accepted at the treatment facility, but would instead be land applied by the local septage hauler. The land available in the area is adequate to handle the loading from the septage generated in the planning area, however, there is not enough land in the immediate area to handle the anticipated holding tank waste loading. Removing the septage from the waste stream to the treatment plant would substantially decrease the capital and treatment costs for the facility, while treatment of holding tank waste at the proposed regional facility would insure that sufficient land remains available for disposal of the septage.

The aerated lagoon system would consist of three lagoons, two aerated and one quiescent. The lagoon system would be sized to provide enough detention time to adequately treat the wastewater. The first and second lagoons would be divided into two cells with a baffle separating them into two equal halves. A synthetic liner would be installed and a minimum separation from the groundwater of 2 feet would be maintained. The third lagoon would be quiescent for settling and provide approximately 3 days of detention time as required in NR 110.

Holding tank waste would be introduced into the waste stream from the community of Elcho from a concrete receiving station at the beginning of the first lagoon.

Following the lagoons, wastewater would flow to a pump station for distribution to the seepage cells. A minimum of three seepage cells would be provided sized based upon the soil characteristics and the DNR criteria of 90,000 gpd.

In addition to the treatment facilities described above, a control building, influent and effluent samplers, and an effluent flow meter would also be provided. Laboratory facilities are not included, assuming that analytical testing services will continue to be performed by an independent lab. It should be noted that disinfection and phosphorous removal are not required with this alternative. An emergency generator is also not required with this alternative. In the event of an electrical power outage the lagoons would provide many days of storage volume until power was restored. A portable gas driven pump will also be supplied in case power is off for an extended number of days.

The facility described for Alternative No. 5 would be constructed on a 40 acre parcel of land located on Lagoon Lane, directly north of the existing facility. Lagoon Lane would be widened and paved up to the new facility to accommodate the truck traffic involved in the transportation of holding tank waste.

Alternative No. 5 would also require abandonment of the existing lagoons. The abandonment would be conducted as described for Alternative No. 1.

The design conditions for the proposed facility for Alternative No. 5 are included in Table 6-5. The lagoons were sized based upon the two seasonal conditions described in Table 3-12 and the lagoon design equations given in NR 110.24. These equations are as follows:

$T = E \div (K \times (100\text{-}E))$, where

- T = detention time in days
- E = BOD_5 removal efficiency in percent, calculated using an effluent BOD_5 concentration of 30 mg/l
- K = reaction coefficient in 1/days = 0.5 at 20 degrees C.

$K_T = K_{20}\theta^{T-20}$ where

- K_T = temperature corrected reaction coefficient
- K_{20} = 0.50 per NR 110
- θ = 1.07 per NR 110
- T = temperature

In addition, the required volume was checked using the I/I flow recommended in the SSES report of 224,600 gpd for the community of Elcho and the summer flow and BOD_5 loadings for holding tank waste (total flow = 275,800 gpd, total BOD_5 = 438 lbs/day). The BOD_5 concentration for the Elcho waste during periods of high I/I was assumed to be 100 mg/l.

Table 6-5
Alternative No. 5 - Aerated Lagoon System with Seepage Cell Discharge

Design Flow (summer condition)	124,500 gpd
BOD_5 Loading	373 lbs/day
Wastewater Temperature	15° C
Lagoon Volume	
Aerated Cells (2)	1.92 million gallons each
3 Day Quiescent Cell	0.37 million gallons
Design Flow (winter condition)	96,000 gpd
BOD_5 Loading	236 lbs/day
Wastewater Temperature	2° C
Lagoon Volume	
Aerated Cells (2)	**2.86 million gallons each**
3 Day Quiescent Cell	0.29 million gallons
Design Flow (I/I condition, spring)	274,700 gpd
BOD_5 Loading	438 lbs/day
Wastewater Temperature	10° C
Lagoon Volume	
Aerated Cells (2)	2.39 million gallons each
3 Day Quiescent Cell	**0.82 million gallons**
Seepage Cell Area	77,500 square feet

Table 6-5 shows that the aerated lagoons shall be sized based upon the winter conditions and that the 3-day quiescent cell shall be sized based upon spring I/I conditions.

Figure 6-5 is a process schematic for Alternative No. 5. A cost estimate for Alternative 5 is included in Appendix G as Table G-5.

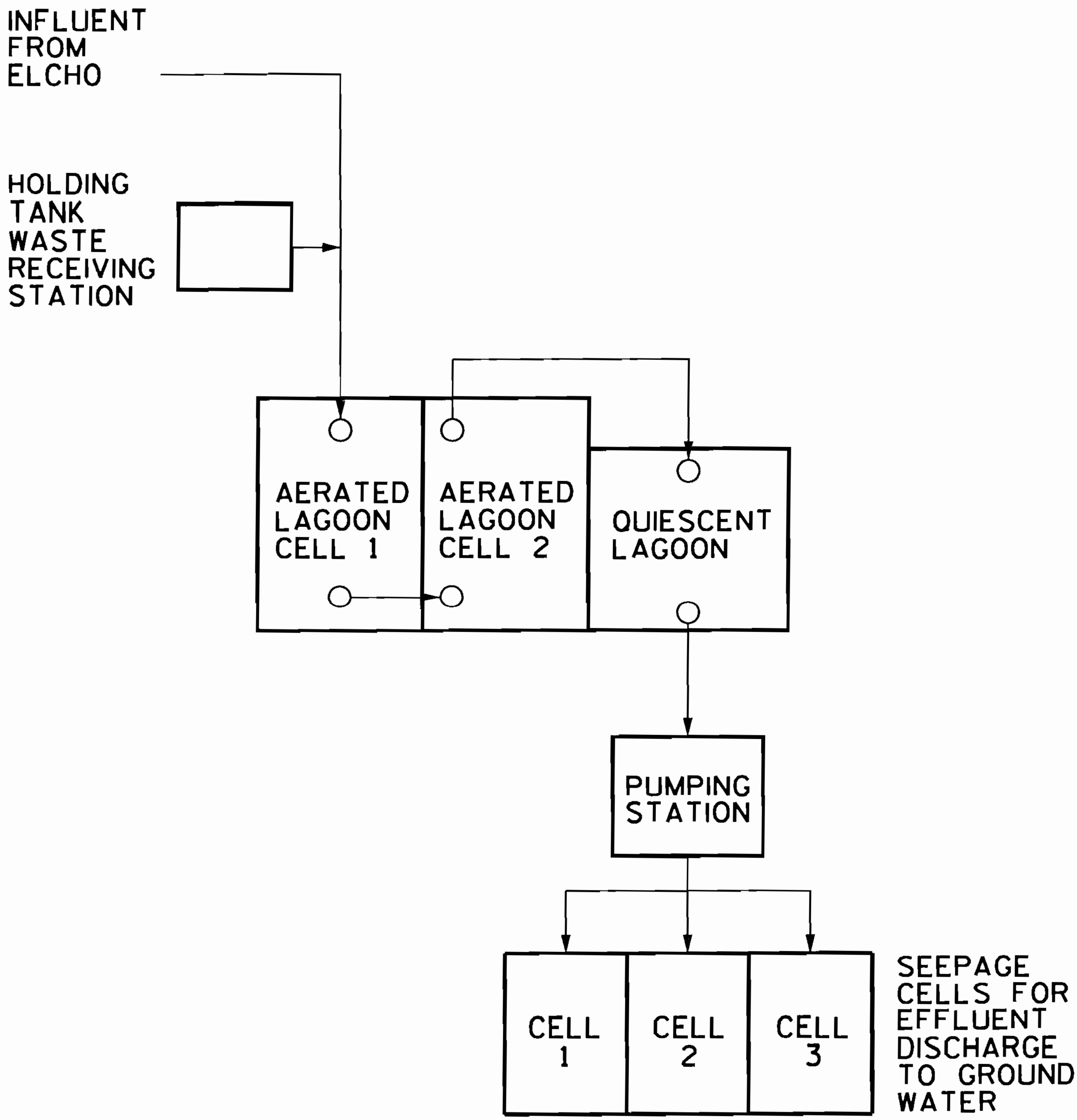

FIGURE 6-5

ALTERNATIVE 5
AERATED LAGOON
SCHEMATIC

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Alternative No. 6 Aerated Lagoon with Seepage Cell Discharge for Community of Elcho only

Alternative No. 6 is similar to Alternative No. 5, however in this alternative the facility would treat wastewater from the community of Elcho only. The treatment facility would include an aerated lagoon treatment system with a groundwater discharge.

The aerated lagoon system would consist of three lagoons, two aerated and one quiescent. The lagoon system would be sized to provide enough detention time to adequately treat the wastewater. The first and second lagoons would be divided into two cells with a baffle separating them into two equal halves. A synthetic liner would be installed and a minimum separation from the groundwater of 2 feet would be maintained. The third lagoon would be quiescent for settling and provide approximately 3 days of detention time as required in NR 110.

Following the lagoons, wastewater would flow to a pump station for distribution to the seepage cells. A minimum of three seepage cells would be provided sized based upon the soil characteristics and the DNR criteria of 90,000 gpd.

In addition to the treatment facilities described above, a control building, influent and effluent samplers, and an effluent flow meter would also be provided. Laboratory facilities are not included, assuming that analytical testing services will continue to be performed by an independent lab. It should be noted that disinfection and phosphorous removal are not required with this alternative. An emergency generator is also not required with this alternative. In the event of an electrical power outage the lagoons would provide many days of storage volume until power was restored. A portable gas driven pump will also be supplied in case power is off for an extended number of days.

The facility described for Alternative No. 6 would be constructed on a 40 acre parcel of land located on Lagoon Lane, directly north of the existing facility.

Alternative No. 6 would also require abandonment of the existing lagoons. The abandonment would be conducted as described for Alternative No. 1.

The design conditions for the proposed facility for Alternative No. 6 are included in Table 6-6. The facilities were sized as previously described under Alternative No. 5. Figure 6-6 is a process schematic for Alternative No. 6. A cost estimate for Alternative 6 is included in Appendix G as Table G-6.

Table 6-6
Alternative No. 6 - Aerated Lagoon System with Seepage Cell Discharge

Design Flow (winter condition) BOD$_5$ Loading Wastewater Temperature Lagoon Volume Aerated Cells (2) 3 Day Quiescent Cell	73,300 gpd 122 lbs/day 2 degree C 1.4 million gallons each 0.22 million gallons
Design Flow (I/I condition, spring) BOD$_5$ Loading Wastewater Temperature Lagoon Volume **Aerated Cells (2)** **3 Day Quiescent Cell**	224,600 gpd 187 lbs/day 10 degree C **1.89 million gallons each** **0.67 million gallons**
Seepage Cell Area	35,000 square feet

Table 6-6 shows that the design of the lagoons shall be based upon the spring I/I conditions.

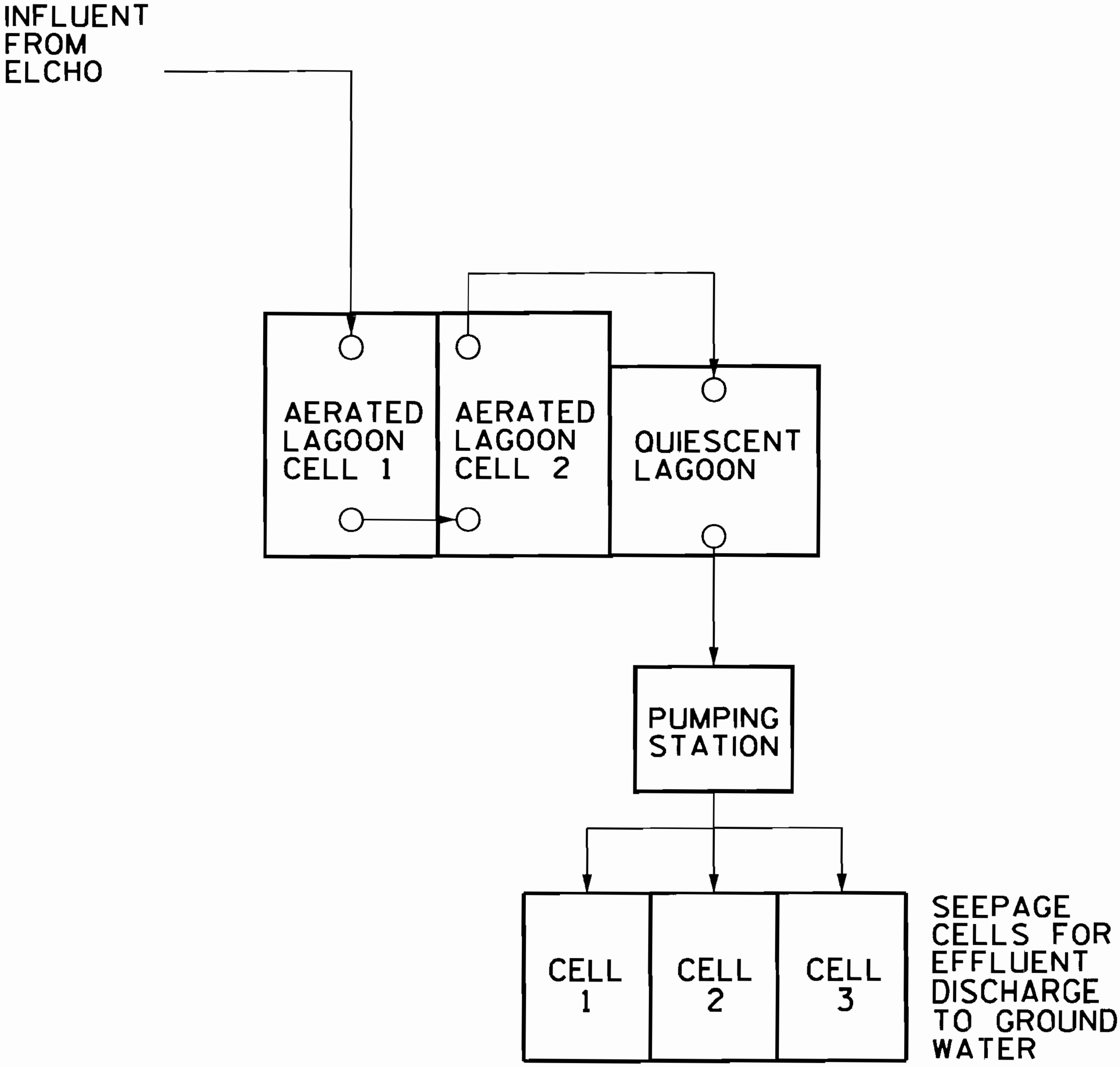

FIGURE 6-6

ALTERNATIVE 6
AERATED LAGOON
SCHEMATIC

MSA PROFESSIONAL SERVICES
TRANSPORTATION • MUNICIPAL • REMEDIATION
DEVELOPMENT • ENVIRONMENTAL
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F.B. PROJECT 259234
DRAWN BY LFC DATE SEPT. 1997 SHEET of
CHECKED BY SCALE FILE NO.

V:/25/259234/CADD/25923410.DGN

VII. EVALUATION OF ALTERNATIVES

A. General

The previous chapter identified six alternatives for wastewater treatment facilities to meet the needs of Elcho and the neighboring communities over the next 20 years. This chapter provides a comparison of the six alternatives from both a monetary and non-monetary standpoint. From a monetary stand point, the alternatives can be compared by conducting a cost-effective analysis to determine their relative present worth costs. Non-monetary differences are more difficult to evaluate, since they cannot be as easily quantified. The more significant non-monetary differences are identified in this chapter, with some discussion regarding their relative impacts. Based on the cost-effective analysis and the discussion of non-monetary differences, a recommended plan for providing wastewater treatment facilities is presented.

B. Cost-effective Analysis

The basic guidelines from which cost-effective analyses must be developed are given in Wisconsin Administrative Code NR 110.09. The method of cost-effective analysis to be used is the total present worth method. The total present worth of a wastewater treatment facility is the amount of money needed now in order to build, operate, and maintain the system over a specified planning period. For the purposes of the DNR Clean Water Fund program, the planning period has been specified as 20 years. A discount rate of 7-5/8% was used to convert future (replacement) costs and annual (operation and maintenance) costs to present worth costs.

Tables G-1 through G-6, included in Appendix G show detailed estimates of the present worth and initial capital costs for each of the alternatives. Prices given are the best estimates of current prices, and must be updated after final design. The equipment cost estimates are based on prices obtained from suppliers. Because of the preliminary nature of these costs estimates, differences of less than 10% in total estimated cost are not considered significant. The total estimated capital costs for the four alternatives are summarized in Table 7-1.

Table 7-1
Elcho Facility Planning - Capital Cost Estimates

Alternative	Capital Cost	Difference	%
1	$2,847,100	+477,500	20.2%
2	$3,709,200	+1,339,600	56.5%
3	$3,647,000	+1,277,400	53.9%
4	$3,094,100	+724,500	30.6%
5	$2,599,800	+230,200	9.7%
6	$2,369,600	---	0%

Tables G-1 through G-6 also include estimated annual O&M costs for the six alternatives. These estimates include all costs to fully operate and maintain the treatment plant based on Elcho's current O&M costs and the alternative specific costs previously described. Sludge hauling was assumed to cost $0.06 per gallon. This included hauling, spreading, and permitting agricultural sites. Electricity costs were assumed to be $0.07 per kilowatt-hour. Chemical costs are based on the use of alum for phosphorus removal. The dosage was assumed to be 40 mg/l. The estimated O&M costs are shown in Table 7-2.

Table 7-2
Elcho Facility Planning - Estimated Operation and Maintenance Costs

Alternative	Estimated Annual O&M Cost
1	$57,000
2	$96,200
3	$147,600
4	$92,100
5	$63,800
6	$50,000

Tables G-1 through G-6 also include the estimated present worth cost estimates for the six alternatives. The total present worth cost is based on the capital costs, operation and maintenance costs, replacement costs, and salvage values. In determining replacement costs and salvage values, an estimated service life is assigned to each component of the cost estimate. New structures, piping, and valves are typically assumed to have a service life of 40 years. The various equipment is estimated to have a service life of 10, 15, or 20 years, depending on the nature of the equipment and the severity of service. The present worth analysis assumed a discount rate of 7-5/8%. The estimated total present worth costs for the six alternatives are summarized in Table 7-3.

Table 7-3
Elcho Facility Planning - Estimated Present Worth Costs

Alternative	Estimated Total Present Worth Cost	Difference
1	$3,317,800	+542,900
2	$4,520,800	+1,745,900
3	$5,065,300	+2,290,400
4	$3,907,800	+1,132,900
5	$3,131,900	+357,000
6	$2,774,900	---

C. Non-monetary Differences

Several non-monetary differences were considered in the evaluation of the various alternatives. Those differences are identified below.

Alternative No. 1 - RSF for Elcho Alone

Advantages:
- Smaller facility required
- Minimal sludge produced
- Simpler operation is more stable
- Requires minimum operator time
- Ease of expansion of RSF

Disadvantages:
- Does not address regional needs

Alternative No. 2 - Lagoon and RSF for Combined Flow with Holding Tank and Septage

Advantages:
- Addresses regional needs
- Minimal sludge produced
- Simpler operation is more stable
- Requires minimum operator time
- Ease of Expansion of RSF

Disadvantages:
- More potential for odor problem
- Requires more space
- Requires a site with high depth to groundwater

Alternative No. 3 - Oxidation Ditch for Combined Flow with Septage

Advantages:
- Addresses regional needs

Disadvantages:
- Requires higher operator training and higher certification
- Requires more operator time
- Sludge disposal implies potential liability
- Sophisticated controls offer greater opportunity for malfunction
- Difficult to expand

Alternative No. 4. RSF for Combined Flow with Holding Tank Waste- No Septage

Advantages:
- Addresses regional needs
- Minimal sludge produced
- Simpler operation is more stable
- Requires minimum operator time
- Ease of Expansion of RSF

Disadvantages:
- Septage would require land disposal

Alternative No. 5. - Aerated Lagoon with Seepage Cell Discharge for Combined Flow with Holding Tank Waste Only - No Septage

Advantages
- Addresses regional needs
- Minimal sludge produced
- Simpler operation is more stable
- Requires minimum operator time
- Less restrictive permit will be easier to meet
- Better treatment during periods of high I/I

Disadvantages:
- Septage would require land disposal
- Requires more space
- Requires a site with high depth to groundwater

Alternative No. 6. - Aerated Lagoon with Seepage Cell Discharge - Community of Elcho only

Advantages
- Minimal sludge produced
- Simpler operation is more stable
- Requires minimum operator time
- Less restrictive permit will be easier to meet
- Better treatment during periods of high I/I

Disadvantages:
- Does not address regional needs
- Requires more space
- Requires a site with high depth to groundwater

The most significant non-monetary difference evaluated is the ability of an alternative to meet the needs the of the Towns of Elcho and Upham. The poor soil conditions and large number of failing septic systems in the area will result in the generation of a high volume of high strength holding tank waste . There is not enough suitable land available in the immediate area to handle the waste loading by landspreading alone. Residents with private systems would be required to have wastes hauled to other treatment facilities, such as Antigo or Rhinelander. Based on this, Alternative No. 1 and No. 6 should be excluded from further consideration. In addition, the extra income generated from accepting holding tank waste from these areas should offset the additional cost required to build the treatment facility with additional capacity and may actually lower the user fees for an Elcho resident.

Alternative No. 3 is a much more complex system than any of the other alternatives. The need for a highly trained operator, and possibly two full-time operators in the future make this alternative very unattractive.

Alternative No. 2 requires a large land area to build the aerated lagoon. This area would require a high depth to groundwater to meet the requirements of NR 110. Considering the high groundwater conditions within the Elcho area, there are very few acceptable locations for this facility. The site chosen for this alternative would require the existing road, Lagoon Lane, to be reconstructed at a high cost. Other concerns with this treatment system are odor and the potential for algae to plug the RSF causing additional maintenance and poor treatment efficiency.

Alternative No. 4 addresses the needs of the region while also lowering the overall project cost by not treating septage waste at the facility. However, this alternative must still meet the stringent effluent criteria established for the Hunting River. Another concern with Alternative No. 4 is the potential for solids washout from the septic system during periods of high infiltration and inflow experienced within the Elcho collection system possibly causing the facility to exceed discharge limits.

Alternatives No. 5 and No. 6 require a large land area as described for Alternative No. 2. addresses the needs of the region while also lowering the overall project cost by not treating septage waste at the facility. Alternative No. 5 is also a very attractive option with regard to effluent permit limits. The relaxed limits granted to a groundwater discharge which flows indirectly to a surface water will be much easier for the facility to meet while still protecting the Hunting River. Another benefit of a lagoon system is the ability of the long detention times to buffer the effects of high I/I flows received at the Elcho facility.

D. Recommended Plan

Monetary evaluation of the four treatment alternatives which provide for regional treatment show that Alternative No. 5 is the most cost effective. Non-monetary differences also show this to be the most attractive alternative.

Therefore, based on both monetary and non-monetary considerations, the recommended alternative to meet the future wastewater treatment needs for the Elcho Sanitary District No. 1 is Alternative 5 - Aerated Lagoon with Seepage Cell Discharge for combined flow with Holding Tank Waste only - No Septage.

VIII. RECOMMENDED ALTERNATIVE

A. Summary Description of Recommended Plan

Based on the monetary and non-monetary differences, the recommended alternative is Alternative 5 - Aerated Lagoon with Seepage Cells with Holding Tank Waste- No Septage. Alternative 5 would include the construction of an aerated lagoon and seepage cells for the treatment of the combined wastes from the Community of Elcho, the Town of Elcho, including the Post Lake Protection and Rehabilitation District, the Town of Upham, including the Greater Bass Lake Protection and Rehabilitation District, and the Rolling Stone Protection and Rehabilitation District.

The proposed facility would be constructed as described in Chapter 6 north of the existing treatment facility. Discharge of effluent would be to three newly constructed seepage cells.

B. Summary of Probable Environmental Impacts

The positive aspects of the proposed project include the improved effluent quality and greater reliability of treatment. Most importantly, the proposed regional facility will provide a disposal site for the waste generated at the private systems throughout the Towns of Elcho and Upham. There is currently not sufficient suitable land available for landspreading the waste that will be generated in the area. The proposed facility will provide a guaranteed, local, and environmentally sound location for disposal for the communities in the planning area.

Potential adverse impacts of the project include the effects due to construction which are discussed further below.

C. Minimization of Adverse Impacts

The recommended plan includes construction of major structures including a blower building, lagoons and the seepage cells. The construction documents for the proposed project will contain several "special conditions" to minimize or prevent potential adverse effects due to construction, including:

Dust - Requirements for the application of water to minimize dust in the project area.

Cleaning - Requirements to keep the project area free of accumulations of surplus materials or rubbish.

Safety - Requirements for proper traffic control, barricade, fences, signal lights or watchmen to prevent injury.

Air Quality - Prohibition against burning.

Erosion and Siltation - An entire specification section related to erosion control.

Noise - Limitations on allowable work hours.

D. Required Permits

Construction of the treatment facility will require a minimum of permits from regulatory authorities. Approval of the plans and specifications for the proposed project must be obtained from the Department of Natural Resources (DNR) Municipal Wastewater Section. Approval for the new outfall will be required from the DNR and the Army Corps of Engineers. Approval is also required from the Department of Labor, Industry, and Human Relations (DILHR) for the proposed new buildings and for any plumbing improvements.

E. Future Operator Requirements

The implementation of the recommended alternative will require one full time operator. The District currently employs one individual on a part time basis. Although additional hours will be required with the installation of mechanical equipment, the current operator is qualified to provide services for the new facility. Routine tasks performed at the treatment plant include sampling, inspections and operating adjustments, equipment maintenance, janitorial and mowing tasks, reports, and calculations. A minimal amount of operator time will be required on weekends for inspections and operating adjustments. In addition to typical plant operation and maintenance, the operator will be responsible for coordination and acceptance of holding tank waste disposed of at the facility.

F. Public Participation

A public hearing will be held to discuss the content of this facility plan and the anticipated effect on sewer user charges. The minutes of this meeting will be forwarded to the DNR. The problems with the existing treatment facilities, and the alternative solutions have been discussed at various meetings of the Elcho Sanitary District No. 1 and meetings of the Post and Greater Bass Lake Protection and Rehabilitation Districts.

IX. ENVIRONMENTAL ASSESSMENT OF THE RECOMMENDED ALTERNATIVE

A. Description of the Existing Environment

Currently, treated effluent from the Elcho wastewater treatment facility is discharged to the Hunting River in Langlade County. Since certain discharge limitations have been occasionally exceeded it can be expected that the water quality of the Hunting River has been adversely affected. In addition, leakage from the existing lagoons was determined to be excessive, therefore groundwater in the area may have been adversely affected also.

B. Description of the Future Environment Without the Project

Future environmental conditions in the categories of air quality, noise levels, wetlands, flood plain, and historic and archaeological sites will be unaffected if the proposed project is not implemented. However, due to the slow but steady growth of Elcho, the quality of the treated wastewater will deteriorate and water quality in the Hunting River could degrade significantly as the result of increasingly frequent violations of discharge limitations in the WPDES permit. This could affect the aquatic plant and animal life in the Hunting River and also terrestrial animals dependent on the aquatic life for food. Also this would have the effect of limiting residential and commercial/industrial growth, which, in turn would reduce the potential tax revenue and jobs for the citizens of Elcho. Groundwater in the area of the treatment facility will also continue to be affected if the lagoon is allowed to continue to leak in the future. At the very minimum, the existing lagoons would require lining if they are to continue to be used.

C. Environmental Assessment of the Proposed Alternative

The new facility will be constructed on vacant property near the industrial park in the Community of Elcho which will be purchased by the Elcho Sanitary District No. 1. A summary of the anticipated impacts on different aspects of the surrounding environment follows.

1. Land Use

The proposed treatment plant site is located to the west of the community of Elcho, directly north of the existing lagoons. No existing residences are located within 500 feet of the proposed location.

The new site is currently idle land. There will be clearing done in the areas sited for construction and an access road will be constructed on the site. Total land area required for the new treatment facility will be similar to the amount used for the existing lagoon facility.

The old facility will be abandoned and the area regraded and seeded. The berms of the existing lagoon will be breached to allow water to drain from the existing ponds.

2. Water Quality

Construction of a new treatment facility will have a positive impact on the water quality of the Hunting River due to the higher level of treatment achieved before discharge to groundwater and the added treatment received while flowing through the ground. Additionally, with the inclusion of holding tank waste disposal at the new facility, there is less potential for illegal dumping of waste.

3. Air Quality

No long-term adverse effect in air quality would result from the construction of a new aerated lagoon. During the construction period, the immediate area will be disrupted and windblown dust and some exhaust fumes from construction equipment may be evident. These effects will be temporary and are judged insignificant.

The new facility will result in a general decrease in odor compared to the old facility.

4. Noise

There will be new blowers included in the proposed treatment system and an additional lift station for the discharge, but all will be enclosed. It is not expected that nuisance levels of noise will be created by the new facility. Some additional noise will be created by heavy equipment during the construction phase, but will not have any lasting effect.

5. Appearance

The actual area taken up by treatment facilities will be reduced over the present system. There will be one building at the new site to house the blowers, equipment, controls and sampling equipment. The facility will not be in view from any of the major highways serving the community of Elcho.

6. Traffic

There will be an increase in traffic required for construction of the facility for the short term. The traffic in the community of Elcho will increase due to the transport of wastewater from private wastewater systems in the planning area to the new facility. This increase is expected to be 10 trucks or less per day.

7. Wildlife and Vegetation

Approximately 10 acres of the site will be used for construction purposes. Wildlife and vegetation will be disturbed on the 10 acres, however this will have no overall effect on vegetation and wildlife in the Elcho area. A summary of the recommended plan will be submitted to the DNR Endangered Species Bureau and the U.S. Fish and Wildlife Service for their concurrence.

8. Social and Economic Impacts

Continued modernization of the Elcho wastewater treatment facilities would assure a facility that is capable of meeting the long term needs of Elcho and the neighboring lake communities is available. Pro-active management of the waste treatment facilities will also help ensure that Clean Water Fund loans are available to the community at below market interest rates. Communities which are in continued violation of their permit do not get the lowest available interest rates.

9. Historical

The proposed treatment plant site has previously been disturbed by logging activities. It is unlikely that the construction of the new treatment facility would create any additional impacts on historical or archaeological resources in the area. A summary of the recommended plan will be submitted to the State Historical Society for their concurrence.

10. Energy Consumption

The recommended alternative will result in increased energy consumption compared to the existing stabilization ponds. New power service will be extended to the new site to provide power for the blowers, pumps, samplers, and disinfection system. This cost is taken into account in the 20-year present worth as an annual operating cost. The increased energy consumption is required to attain higher water quality.

X. PROJECT IMPLEMENTATION

A. Implementation Responsibilities

The entity primarily responsible for implementation of this facility plan is the Elcho Sanitary District No. 1. The facility will be owned and operated by the Elcho Sanitary District No. 1. Additional responsibility of the recommendations within the report belong to the Town of Elcho and the Town of Upham. The Post Lake, Greater Bass Lake, and Rolling Stone Lake Districts will likely maintain their present status as municipal entities, but will have no jurisdiction over the proposed new facility.

B. Implementation Steps

The following sequence of important steps are expected to be followed in the implementation of this Facilities Plan, assuming an environmental impact statement is not needed.

1. Submittal of this plan for review by the Wisconsin Department of Natural Resources.
2. Holding a Public Hearing.
3. Incorporation of comments from the public into the Facilities Plan.
4. Approval of the Facility Plan
5. Complete design, construction plans and specifications.
6. Submit plans and specifications for review by the Wisconsin Department of Natural Resources.
7. Submit applications for financial assistance.
8. Incorporate comments from reviewing agencies into plans and specifications.
9. Obtain approval of funding agency to bid the project.
10. Advertisement for bids.
11. Receive bids.
12. Update sewer use/user charge ordinance.
13. Award bids.
14. Start construction.
15. Complete construction.
16. Develop operation and maintenance manual.

The estimated timing of the most important of these steps can be summarized as follows:

Step	Time
Approval of Facilities Plan	October, 1997
Submit CWF financial assistance application	October, 1997
Submit plans and specifications	October, 1997
Approval of plans and specifications	January, 1998
Advertise for bids	February, 1998
Open bids	March, 1998
Award bids	March, 1998
Start construction	April, 1998
Complete construction	November, 1998

C. Project Financing

Project financing requires that a method be devised for allocating the project costs among the users of the facilities in an equitable manner. The most typical method, in the case of major facilities such as a wastewater treatment plant, is to assume that the benefit obtained by each user from the facilities is proportional to the amount of wastewater generated by the particular user. The project costs are therefore allocated according to the concept of "residential equivalent units" (REU's). A residential unit equivalent is defined as the amount of wastewater contributed by a typical residential dwelling. In the case of the Elcho Sanitary District No. 1, many of the potential users will not be connected directly to the sanitary sewer collection system, therefore the concept of the residential unit equivalent does not apply. It is anticipated that these users will be charged either partially or totally based upon the number of times the users holding tank or septic is pumped. A preliminary user charge system is included in Appendix H which determines the cost for each type of user.

1. Revenue Sources

Wisconsin State Statutes empowers a Sanitary District to construct, maintain, and expand a wastewater system, and to supply the revenues to support such a system. There are five potential sources of revenue available to the Sanitary District for support of the wastewater treatment facilities. They are as follows:

- special assessments
- general fund revenues
- service charges
- taxes
- grants-in-aid

The levy of special assessments is provided for by Section 66.60 of the Wisconsin State Statutes. Generally, the special assessment principal is used primarily to recover the costs of services and facilities provided immediately adjacent to the property assessed. One additional use of the special assessment provision employed elsewhere from time to time is that of directly assessing the cost of major capital improvements. This is generally utilized in cases where no service charges are made, but the governing body wishes to recover the cost of the improvements. It is more applicable to the financing of a collection system than to the treatment plant itself. If the Sanitary District were to provide the proposed wastewater treatment facilities as a general service, it would be possible to assess the costs of the improvements to the benefitted parties. However, the Sanitary District would not be able to do so unless the proper legal procedures were followed, and the assessments did not exceed the benefit received by the property assessed.

General Fund revenues obtained from general taxation sources and other routine sources of Sanitary District income can be used to pay for the proposed project. It is assumed that the Sanitary District General Fund does not have a surplus of sufficient size for an expenditure of this amount. Therefore, direct General Fund expenditures is not a feasible financing method. The use of General Fund monies on a debt service basis is a potential method of financing. This would be accomplished through issuance of general obligation bonds (see below).

Wisconsin State Statutes 66.076(1) empowers the Sanitary District to establish service charges in such amount as to meet all the financial requirements for the construction, reconstruction, improvement, extension, operation, maintenance, and repair of the wastewater system. Service charges may be adjusted to cover the payment of all principal and interest of any indebtedness incurred thereof, including the replacement of funds advanced by or paid from the general fund of the municipality. These charges may include a reasonable excess. To date the Sanitary

District has produced revenue to operate its wastewater treatment facilities chiefly by the service charge method. The actual basis of the charges is at the discretion of the Sanitary District Board, subject to the approval of the Wisconsin Department of Natural Resources where the use of DNR Clean Water Fund program money is involved.

A direct tax levy to recover the costs of the proposed project is possible. It is all possible to apply an annual tax to each user to pay for debt service on any loan obtain by the Sanitary.

The institution of grants-in-aid has resulted from past demand for wastewater treatment improvements nationwide, including both state and federal programs for financial assistance to communities undertaking construction of wastewater treatment facility improvements. In the past years many of these programs included outright grants. At the present time, however, there is very little grant funding available. The following paragraphs will summarize the grants-in-aid which may be available.

The Environmental Protection Agency (EPA) is the federal pollution control agency which has in years past been authorized to make grants up to 85% of the project costs to municipalities for the construction of wastewater treatment facilities. Funding for direct grants to municipalities was dropped from the Federal budget in favor of grants to states for the establishment of revolving loan programs administered by the individual states (see below).

Rural Development (RD, formerly FmHA) of the U.S. Department of Agriculture provides financial assistance to small rural communities (those under 10,000 population). RD has a program in which it provides financial assistance for construction of wastewater collection and treatment systems. Part of this assistance program is for grants of up to 75% of the cost of construction for those communities which have a median household income of less than $24,000 (1990 census), and up to 55% for those communities in which median household income is between $24,000 and $30,000. Although the grants are made to the Sanitary District, the grant is intended to benefit only residential and small commercial users. The portion of the project which might benefit larger commercial users would be deducted from the eligible project costs. In 1990, the Community of Elcho had a median household income of $17,358 and therefore would qualify for a 75% grant. Also, other RD criteria require that no commercial credit be available for the project. According to RD, in nearly all cases commercial lenders will make a loan if the resulting debt per RUE is less than $1,500. The anticipated debt will be well in excess of the $1,500 criteria so that it is unlikely that the Sanitary District could obtain commercial credit for the project. Also, the RD has developed a policy of denying grants for projects that will result in total wastewater charges (including debt service and operation/maintenance costs) of less than $20.00 per month. This policy was developed due to the high demand for RD grant money and the desire on the part of RD to only provide grant money to communities with the highest wastewater service charges. As shown below, financing under the DNR Clean Water Fund would result in estimated typical residential wastewater charges greater than $20.00 per month. Based on the above, it appears that the Sanitary District is qualified to receive a RD grant and loan, however the amount of funds available from RD is very limited and it could be a few years until money is available to fund the project.

The Wisconsin Development Fund (WDF) is a program offered by the Wisconsin Department of Development, which provides grants of up to $750,000 to help fund public facilities in communities with a high percentage of low and moderate income households. The Sanitary District may wish to apply for WDF funding for a portion of the wastewater treatment facilities. WDF grants are typically awarded in the spring of each year.

2. Financing Methods

There are six possible methods of financing the portion of the proposed improvements not funded by grants. These are as follows:

- General Obligation Bonds
- Revenue Bonds
- Special Assessment Bonds
- Direct Loans
- Tax Incremental Financing (TIF) Districts
- Immediate Payment

Of these six types of financing, several can be immediately eliminated. Immediate payment is assumed to be unfeasible due to the lack of available Sanitary District general funds. Assessment bonds are eliminated for the reasons discussed above in the special assessment revenue section. Tax incremental financing (TIF) may be feasible, however, the Sanitary District currently has no plans to create a TIF District.

General Obligation Bonds are readily saleable and the interest rate is currently very favorable. The bonds are not dependent on service charges, although service charges can be used to provide the needed revenue. The total amount of general obligation bonds which can be issued by the Sanitary District is limited by Wisconsin State Statutes to 5% of the equalized valuation of the Sanitary District.

There are several disadvantages to this method of financing which should be mentioned. First, it is possible that not all users of the new facilities would contribute to the support of the facilities depending upon the method used to recover the payment for these bonds. Secondly, the use made of the wastewater facilities will not necessarily be directly related to the value of a property utilizing the facilities. Third, the sale of general obligation bonds for a utility purpose can affect the credit rating issued to the Sanitary District at the time of the sale of future bonds issues covering other general expenditures.

Revenue Bonds could be issued to finance the project, and have the advantage of not affecting the credit rating or bonding power of the Sanitary District. Revenue bonds are also equitable in that the users of the system pay the capital cost of the facilities in close proportion to the amount of use. Mortgage revenue bonds are very saleable in Wisconsin if the service charge is such that the net revenues of the utility, after expenses and depreciation, are approximately 1.25 times the debt retirement and operation and maintenance costs. The interest rate for these bonds is generally 1/2 to 1-1/2 percent greater than for general obligation bonds.

Direct loans are available from either governmental agencies or from commercial lenders. The interest rate on direct loans may be less than for either general obligation or mortgage revenue bonds. There are fewer restrictions on the method of revenue generation, and there is less effect on the bonding powers and credit rating of the community than with general obligation bonds. Direct loans may be available from these sources:

The DNR Clean Water Fund program is available to finance wastewater treatment plant improvements. The interest rate depends on the nature of the project. The improvements proposed at Elcho fall under the definition of "compliance maintenance" and "new or changed limits", therefore the interest rate offered will be 55% of the market rate. The interest rate is subject to adjustment for the portion of the project intended for industrial flows or capacity beyond 10 years, resulting in a composite interest rate. The term of a loan under the Clean Water Fund program is generally 20 years. Interest rates can be reduced even further, or grants may be available, for projects in communities which qualify for "Hardship Assistance" under the Clean Water Fund program. However, the portion of the project required for commercial flows would not be eligible for hardship assistance.

The Rural Development Administration also offers loans to fund wastewater facilities in small communities. The loans are typically classified as revenue bond type loans, and are secured by the sewer user charges. The term of this loan is usually set at 20 years for wastewater treatment plants. The current RDA interest rate is 6.0%, which is higher than that offered by the DNR Clean Water Fund, therefore there is no apparent advantage to a RDA loan unless coupled with a RDA grant.

Other loans may be available from financial institutions, but the amount of money involved is quite high, making direct loans doubtful. The State Employees Trust Fund may also have funds available. However, the interest rate on these types of loans will generally be higher that for a DNR Clean Water Fund loan. Also, these types of loans are considered as general obligation debts, and thus would count against the Sanitary District's statutory debt limit.

3. Summary of Probable Financing

It is obviously an advantage to obtain any grant money that might be available, since these funds do not need to be repaid. Unfortunately, there are very few sources of grant money. Based on the project costs anticipated, it does appear that the Sanitary District would qualify for a RDA grant or a DNR Hardship grant. Grants are no longer available from the EPA. The other apparent source of potential grant funds is from the Wisconsin Department of Development's Wisconsin Development Fund. This grant would be limited to a maximum of $750,000. With the current rating system and the Sanitary District’s estimated distress score of 33.7, it is doubtful the Sanitary District can obtain a WDF grant.

There are several options available for financing the project cost: DNR Cleanwater Fund Loan, DNR Hardship Grant and Loan, and a RD Grant and Loan. An annual debt service and a user charge is calculated for each of the methods below.

Clean Water Fund Financing Scenario

It is assumed that the Clean Water Fund loan would be secured through revenue bond financing (through the DNR Bureau of Environmental Loans). The DNR requires total net revenues equal the operation and maintenance costs plus 1.1 times the debt cost.

To assure availability of funds when they are required, a Wastewater Facility Plan and Notice of Intent to Apply for financial assistance must be submitted to DNR by December 31 of the year before which payments are to be made. New IRS rules also require that a municipality enact a "Comfort Resolution" stating their intent to be reimbursed through the Clean Water Fund. It is anticipated that all of these requirements would be met.

Upon receiving the Notice of Intent to Apply and Wastewater Facility Plan, the DNR will prioritize the proposed project in accordance with the project ranking system described by NR 161. Plans and biddable specifications will be prepared and submitted to the DNR along with a financial assistance application, a sewer use ordinance and user charge system having contingent approval, and a statement assuring that the proposed site will be available for project use. The DNR will issue a notice of financial assistance commitment to the Sanitary District within 90 days for all proper submissions.

A parallel cost estimate is required to accompany all Wastewater Facility Plans for which Clean Water Funds are sought under NR 162.05. A parallel cost estimate is used to determine the added cost of treating industrial waste and for providing reserve capacity for future growth, and comparing it to the total cost to treat the design flow of 124,500 gpd. Only capital required to provide treatment to non-industrial flows for the next 10 years is eligible for financial assistance at below market interest rates. Loans for providing any additional capacity are available at market interest rates from the Clean Water Fund.

The majority of the 20 year design flow for Elcho alone is eligible for funding at reduced market rates. Therefore, the parallel cost ratio was calculated based upon the cost of providing additional capacity for the Lake Districts and the Towns of Elcho and Upham.

The calculation of the parallel design flow for use in the parallel cost estimate is shown in Table 10-1. All values are in gpd.

Table 10-1
Parallel Design Flow Calculation - gpd

Flow Component	Daily Ave
Design Flow	124,500
Reserve for Unsewered Areas	-51,200
Parallel Design Flow (Elcho Alone)	= 73,300

The size of the lagoon and seepage cells would be reduced in direct proportion to the reduction in flow. The parallel cost estimate presented below reflects the reduced size of these components. Other costs such as the construction of lift stations and sewer system rehabilitation would be unaffected by the reduction in flow. The parallel cost estimate is summarized below:

Alternative	Cost
Alternative No. 5	$2,599,800
Alternative No. 6	$2,369,000

The parallel cost ratio for Alternative No. 5 is estimated as follows:

$$\frac{\$2,369,600}{\$2,599,800} = 0.9115$$

The estimated debt service for a Clean Water Fund loan is calculated below.

Estimated Total Capital Cost:	$2,599,800
Parallel Cost Ratio	0.9115
Tier 1 Costs	$2,369,600
Tier 3 Costs	$230,200
Tier 1 Interest Rate	3.00%
Tier 3 Interest Rate	5.45%
Composite Interest Rate (NR 162.07 (6))	3.21%

Annual Debt Service Increase
Assume: 2 Payments per year
20 Year Term
40 Total Payments

Total Annual Debt Service Increase	**$178,420**

Estimated user charges for a Clean Water Fund loan is calculated below.

New Debt Service at 3.21%	\$178,420x 1.1 = \$196,262
Existing Debt Service	\$11,250
Subtotal	\$207,512
O,M&R Cost	+\$63,800
Future Required Income	\$271,312
Estimated Future Household User Charge Based on the existing connections	\$1,350/yr

DNR Hardship Grant and Loan Financing Scenario

The DNR requirements for hardship funding are similar to those outlined under the Clean Water Funding Scenario except that financial assistance applications must be submitted prior to June 30th of each year.

For a community to be eligible for hardship assistance, the following criteria must be met:

a. The median household income in the municipality is 80% or less of the median household income in this state.

b. The estimated total annual charges per residential user in the municipality that relate to wastewater treatment would exceed 2% of the 1993 median household income in the municipality without assistance.

Actual eligibility will be determined based on the following method.

$$S = (AT + M + O + W)R/(MHI)(N)$$

where:

S = the estimated total annual charges per residential user as a percentage of the median household income in the municipality

AT = the annual debt service for a tier rate loan for below market eligible project costs

M = the annual principal and interest costs based upon a 20 year repayment schedule at the market rate for that portion of the project that is eligible for the market interest rate.

O = the annual operation, maintenance and replacement costs of the treatment works to be paid by the recipient of the financial hardship assistance

W = the total remaining prior wastewater debt service of the municipality divided by 20 years, and the estimated annual debt service amortized over 20 years for project costs ineligible for clean water fund funding, such as hook-up fees owed another municipality and debt for lateral sewers
R = the residential percentage
MHI = the median household income
N = the number of residential users

If S is greater than 2% and the municipality meets the criteria listed above, then the municipality is eligible for hardship subsidy. For the Town of Elcho Sanitary District No. 1, S is calculated as follows:

AT = $159,238, based on $2,369,600 at 3.00% (55% of market rate) for 20 years
M = $19,183, based on $230,200 at 5.45% (current market rate) for 20 years
O = $25,809 This represent the maximum operation, maintenance and replacement cost that the DNR Hardship Program will fund for a community of Elcho's size. Actual O,M&R costs will be $63,800 per year.
W = $11,250
R = 69.0%, (based upon 1996 flows)
MHI = $20,830 (estimated 1993)
N = 161

S = 4.43%

Based on the above calculation, the Sanitary District is eligible for hardship funding.

A community is eligible for grant funding if their calculated user charge is greater than 2% of the median household income. To determine if a community is eligible for grant funds, the following method is used:

A = (MHI)(N)(.02)
B = A÷R
C = B - O - W - M
D = P ÷ 20
H = D - C

where:

MHI = the median household income
N = the number of residential users in the municipality
A = the estimated amount the residential users can afford annually for wastewater treatment
R = the residential percentage
B = the estimated amount the residential and nonresidential users can afford for all wastewater treatment costs annually
O = the annual operation, maintenance and replacement costs of the treatment works to be paid by the recipient of the financial hardship assistance
W = the total remaining prior wastewater debt service of the municipality divided by 20 years, and the estimated annual debt service amortized over 20 years for project costs ineligible for clean water fund funding, such as hook-up fees owed another municipality and debt for lateral sewers
M= the annual principal and interest costs based upon a 20 year repayment schedule at the market rate for that portion of the project that is eligible for the market interest rate.
C = the estimated amount the residential and nonresidential users can afford annually to pay for debt service on the clean water fund project loan.
P = the project costs eligible for below market interest rate
D = the annual debt service for a zero percent interest rate loan for below market eligible project costs

If H is positive, it equals the annual grant amount a municipality needs to keep total annual charges per household at 2% of the communities median household income. If H is negative, the community is not eligible for a grant.

MHI = $20,830(estimated 1993)
N = 161
A = $67,073
R = 69.0%
B = A/R = $97,212
O = $25,809 This represent the maximum operation, maintenance and replacement cost that the DNR Hardship Program will fund for a community of Elcho's size. Actual O,M&R costs will be $63,800 per year.
W = $11,250
M = $19,183, based on $230,200 at 5.45% (current market rate) for 20 years

C = B - O - W - M = $40,984
P = $2,599,800 x 0.9115 = $
D = P/20 = $118,480
H = D - C = $118,480 - $40,984 = $77,496 - The annual grant amount the community is eligible to receive.

The above calculations show that the Sanitary District is eligible to receive an annual grant of $77,496 over the 20 year life of the loan or a total grant of $1,549,921. In addition, $819,679 would be financed at 0% interest. The remaining $230,200 would be financed at the current market rate of 5.45%.

This financing scenario would provide an estimated annual user charge of $417 per household connection. Commercial user fees may vary from this based on the user's estimated number of REU's. Actual required revenues and rates depend on actual project costs, funding availability, number of users and the actual O&M costs. It should be noted that the maximum operation, maintenance and replacement cost that the DNR Hardship Program will fund for a community of Elcho's size is $25,809 per year. Actual O,M&R costs will be $63,800 per year.

The preliminary user charge system included in Appendix H shows the total annual revenue required to operate and maintain the new facility to be $135,000. Based upon this required revenue, the anticipated user charges are shown below in Table 10-2.

Table 10-2
Anticipated User Charges

Fixed Monthly Fee	$17.03
Volume Charge	$5.98 per 1000 gallons
Typical Annual Bill based upon 5,158 gallons per month	$574 per year
Holding Tank Waste	$10.57 per 1000 gallons

The user charges shown in Table 10-2 do not include any revenues from other sources such as holding tank waste dumped at the facility. It is anticipated that approximately 238 holding tanks will be installed by completion of the project. Adding this revenue into the rate calculation will allow the typical user charges to be reduced. Table 10-3 shows the revised rates including income from holding tank waste.

Table 10-3
Anticipated User Charges including Holding Tank Waste

Fixed Monthly Fee	$14.73
Volume Charge	$4.50 per 1000 gallons
Typical Annual Bill based upon 5,158 gallons per month	$455 per year
Holding Tank Waste	$10.57 per 1000 gallons

It should be noted that as more holding tanks are installed within the area, sewer rates within the community of Elcho will continue to decrease. In addition, it is assumed that holding tank waste from other communities will be accepted at the facility while capacity is available. This additional revenue should also help decrease rates within the community.

It is recommended that the Sanitary District pursue DNR Hardship Funding.

XI. PRELIMINARY DESIGN SUMMARY

A. Wastewater Flows and Loadings

Combined future flows and organic loadings including holding tank waste are summarized below in 11-1.

Table 11-1
Combined Future Flows and Organic Loadings including Holding Tank Waste Only

Summer Flows Including Holding Tank Waste Only

Community	Flow (gpd)	BOD5 (lbs/day)	TSS (lbs/day)	TKN (lbs/day)	PHOS. (lbs/day)
Community of Elcho	73,300	122	122	24.5	2.45
Town of Elcho*	2,500	12	37	0.9	0.52
Post Lake	19,100	96	287	7.2	3.99
Town of Upham*	8,800	44	132	3.3	1.84
Greater Bass Lake	9,300	46	139	3.5	1.93
Rolling Stone Lake	11,500	52	157	3.9	2.18
Totals/Averages	124,500	373	875	43.3	12.90

Winter Flows Including Holding Tank Waste Only

Community	Flow (gpd)	BOD5 (lbs/day)	TSS (lbs/day)	TKN (lbs/day)	PHOS. (lbs/day)
Community of Elcho	73,300	122	122	24.5	2.45
Town of Elcho*	2,500	12	37	0.0	0.01
Post Lake	5,800	29	87	2.2	1.21
Town of Upham*	8,200	41	124	3.1	1.72
Greater Bass Lake	2,900	14	43	1.1	0.60
Rolling Stone Lake	3,300	16	49	1.2	0.68
Totals/Averages	96,000	236	463	32.0	6.66

Spring Flows Including Holding Tank Waste Only

Community	Flow (gpd)	BOD5 (lbs/day)	TSS (lbs/day)	TKN (lbs/day)	PHOS. (lbs/day)
Community of Elcho**	224,600	187	187	37.5	3.7
Town of Elcho*	2,500	12	37	0.9	0.52
Post Lake	19,100	96	287	7.2	3.99
Town of Upham*	8,800	44	132	3.3	1.84
Greater Bass Lake	9,300	46	139	3.5	1.93
Rolling Stone Lake	11,500	52	157	3.9	2.18
Totals/Averages	275,800	437	939	56.3	14.16

*Data for the Town of Elcho does not include Post Lake and the community of Elcho and data for the Town of Upham does not include Bass Lake.

** Organic concentrations for the Elcho Sanitary District during periods of high I/I are assumed to be one half of the normal design concentration.

B. Lagoon Sizing

The lagoons were sized based upon the three seasonal conditions described above and the lagoon design equations given in NR 110.24. These equations are as follows:

$T = E \div (K \times (100-E))$, where

- T = detention time in days
- E = BOD_5 removal efficiency in percent, calculated using an effluent BOD_5 concentration of 30 mg/l
- K = reaction coefficient in 1/days = 0.5 at 20 degrees C.

$K_T = K_{20}\theta^{T-20}$ where

- K_T = temperature corrected reaction coefficient
- K_{20} = 0.50 per NR 110
- θ = 1.07 per NR 110
- T = temperature

The temperatures assumed for the design calculations are as follows:

Summer	15° C
Winter	2° C
Spring	10° C

The design conditions for the proposed facility are shown in the Table 11-2 below.

Table 11-2
Aerated Lagoon System with Seepage Cell Discharge

Design Flow (summer condition)	123,400 gpd
BOD_5 Loading	373 lbs/day
Wastewater Temperature	15° C
Lagoon Volume	
Aerated Cells (2)	1.92 million gallons each
3 Day Quiescent Cell	0.37 million gallons
Design Flow (winter condition)	96,000 gpd
BOD_5 Loading	236 lbs/day
Wastewater Temperature	2° C
Lagoon Volume	
Aerated Cells (2)	**2.86 million gallons each**
3 Day Quiescent Cell	0.29 million gallons
Design Flow (I/I condition, spring)	274,700 gpd
BOD_5 Loading	438 lbs/day
Wastewater Temperature	10° C
Lagoon Volume	
Aerated Cells (2)	2.39 million gallons each
3 Day Quiescent Cell	**0.82 million gallons**

Table 11-2 above shows that the aerated lagoons shall be sized based upon the winter conditions and that the 3-day quiescent cell shall be sized based upon spring I/I conditions.

C. Lagoon Placement

It is proposed to construct the new aerated lagoons in the area currently used for stabilization pond #2 and the area directly north of this pond. Figure 11-1 shows the preliminary location and dimensions for the proposed lagoons. It is recommended that the bottom elevation of the proposed lagoons be set at elevation 99.50. This elevation is two feet (as required by NR 110) above the level of water in the monitoring wells installed in June of this year. The location of the monitoring wells are also shown in Figure 11-1. The elevation of groundwater within the wells is summarized below in Table 11-3.

Table 11-3
Monitoring Well Elevations

Monitoring Well Number	Elevation
MW-1	96.41
MW-2	97.56
MW-3	97.15
MW-4	98.38
SB1	99.31
SB2	99.16

In addition to the monitoring wells installed at the site, there were also numerous backhoe test pits dug in the area. Some of the test pits in the area of the new aerated lagoons indicated soil mottling at elevations higher than the 99.50 elevation recommended above. It is felt that this mottling was cause by perched levels of groundwater as a result of thin clay layers within the soil profile. These layers will be removed as a result of construction therefore the true groundwater elevation will be used as a basis for the lagoon bottom elevation.

Boring logs for the monitoring wells are included in Appendix J and soil description reports for the test pits are included in Appendix K. In addition, Appendix L contains a water analysis for the four monitoring wells.

D. Seepage Cell Sizing

Evaluation of the area directly north of the existing treatment ponds indicates that there are acceptable locations for construction of the seepage cells where the soils are suitable and the point of groundwater discharge is less than 375 feet from the surface water. Figure 11-1 shows the proposed seepage cells. The wetlands boundary as shown in the figure was delineated by William Jaeger of the DNR.

The seepage cells, as shown on the attached plan, provide a total surface area of 77,500 square feet. Based on the DNR criteria of 90,000 gpd/acre, the minimum area required is 1.4 acres (60,000 square feet). Included as Appendix I are infiltration test results from four infiltration tests performed at the site. These tests show the minimum infiltration rate to be 3.10 inches per hour. Using 4% of this value as recommended by the EPA Process Design Manual "Land Treatment of Municipal Wastewater", the required area of the seepage cells is 66,500 square feet. The total surface of the seepage cells as shown on the attached map satisfies both of these criteria.

The elevation of each seepage cell is also shown on Figure 11-1. These elevations are based on the results of the soil test pit results which are included in Appendix K.

E. Additional Design Parameters

Additional required design information including aeration and hydraulic calculations will be submitted within the Design Report as part of the plan and specification submittal.

