IPS ENVIRONMENTAL AND ANALYTICAL SERVICES
Appleton, Wisconsin

PHASE II
ENGLISH LAKE MANAGEMENT PLAN
MANITOWOC COUNTY, WISCONSIN

REPORT TO:
ENGLISH LAKE MANAGEMENT DISTRICT

January, 1995

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

Thanks is extended to the English Lake Management District for assistance with management plan development.

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LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDIXES

SUMMARY

An initial resource assessment of English Lake, Manitowoc County, Wisconsin was conducted in 1992 as Phase I of Lake Management Plan Development; this document presents the results of Phase II plan development activities. Phase II objectives were to supplement Phase I data specifically with respect to more intensive assessment of areas of concern in the watershed, continuation of water quality monitoring and public involvement, and evaluation of recreational use and sanitary systems.

English Lake is a small moderately deep seepage lake with a predominantly agricultural watershed. It receives runoff (surface and via drain tiles) from naturally fertile soils in the watershed, experiences periodic algae blooms, and is subject to considerable recreational use. Long-term trends of in-lake surface water quality reflected periods of stratification (lower nutrients) and mixing or increased inflow to the lake (higher nutrients). In-lake nutrient cycling also appeared to contribute to generally higher than typical nutrient levels for lakes in this geographic area.

Computer modeling (with soil texture, slope and land use inputs) and field measurements during rainfall events identified several areas of concern in the relatively small (195 acre) watershed. The most significant of these was an area associated with a drain tile inflow on the east shore of the lake. Considering volume of inflow and event measured nutrient levels, drain tile inflow on the south shore is also significant.

English Lake Management District (ELMD) members indicated moderate to high recreational use for the lake with most indicating preference for more passive recreational activities, e.g., swimming, viewing nature/wildlife and pontooning. Opinions relative to crowding or safety issues were mixed. Water quality was generally perceived to be poor to fair and deteriorating; the fishery was generally rated as fair to good and stable or deteriorating. Water quality and related issues (i.e., runoff and septic system maintenance), and weeds, were indicated to be the most important management concerns. Comments also indicated concern about pertinent regulations and lake size.

Eurasian Water Milfoil, Purple Loosestrife and Zebra Mussels (exotic species) were not observed in or around English Lake. Purple Loosestrife plants, once present, appear to have been effectively removed.

Most English Lake sanitary systems are septic tanks/fields; because of limited permeability, soils around English Lake are generally unsuitable for systems other than mound type systems or holding tanks.

Recommendations for the continued management of the English Lake resource include:

- Practical management options should be assessed and implemented for areas drained to the drain tile outfalls. Possible use of state/county/local funds toward the purchase of land draining to site 16E2 by the Department of Transportation should be assessed.

- Water quality monitoring should be continued on a similar schedule to track trends of the resource. Self-Help monitoring should be continued; rainfall monitoring should be initiated.

- An alum treatment for English Lake should be considered. In-lake cycling appears significant and cost-share funds may be available.

- The actual surface acreage of the lake should be determined. Pertinent boating ordinances should then be addressed to best suit the wants/needs of lake users.

- Lake users should be educated about exotic species and their effect on the resource. Signs should be posted at the public access and informational brochures circulated.

- Landowners should be educated about sanitary systems and encouraged to

maintain/replace systems as needed. The ELMD should consider the costs/benefits of sanitary sewer service.

INTRODUCTION

English Lake is located in the Town of Newton, Manitowoc County, Wisconsin. It is a small moderately deep seepage lake with a predominantly agricultural watershed. English Lake receives runoff (some via drain tiles) from naturally fertile soils and experiences seasonal algae blooms. It is also subject to significant recreational use.

The English Lake Management District (ELMD), which serves as the main steward for the resource, was formed in 1982 and currently has about 60 voting members. The ELMD was concerned with lake eutrophication and recreational use issues, and applied for and received its first Wisconsin Department of Natural Resources (WDNR) Lake Management Planning Grant in April, 1991. IPS Environmental & Analytical Services (IPS) of Appleton, Wisconsin was selected as their consultant to begin management planning efforts.

Phase I efforts included baseline assessment activities (for water quality and aquatic plants) and a public involvement program. Specific physical properties of the English Lake resource, preliminary methods, and other introductory and technical information were presented in the Phase I report (printed 1992).

A Phase II grant was received in September, 1992; Phase II efforts included more intensive assessment of areas of concern in the watershed, continuation of the water quality monitoring and public involvement programs, an assessment of recreational use and a review of sanitary systems for homes bordering the lake. This report presents the results of these Phase II lake management planning efforts for English Lake.

DESCRIPTION OF AREA

English Lake has a surface area of about 51 acres, a maximum depth of 85 feet, an average depth of 34 feet (1), and shoreline substrates comprised primarily of marl (90%) and sand/gravel (10%) (2). Major soil types near the lake are loams and silt loams with slow to moderately slow permeability; these soils often require artificial drainage for agricultural uses and are generally unsuitable for septic systems because of low permeability (3).

Algal blooms commonly occur on English Lake after ice out and before freeze up (4) when the lake volume is completely mixed. In the past, ELMD has targeted the shoreline perimeter of the lake with copper sulfate treatments (Table 1) to control these blooms. *Cladophora* sp. and *Spirogyra* sp. are the most common algae types in English Lake.

Public access to English Lake is available at a Manitowoc County park located on the southwest shore of the lake. The park provides a paved boat ramp with pier, and restroom and picnic facilities.

Table 1. Summary of Aquatic Herbicide Treatments, English Lake, 1969 - 1987 (5).

Year	Permit Issued	Chemical Used	Amount	Acreage Treated
1969	yes	Copper sulfate	200 lbs	18.0
1970	yes	Copper sulfate	100 lbs	20.0
1971	yes	Copper sulfate	100 lbs	18.5
1972	yes	Copper sulfate	100 lbs	18.0
1973	yes	no treatment		
1974	yes	Copper sulfate	100 lbs	13.3
1975	yes	no treatment		
1976	yes	Copper sulfate	100 lbs	16.6
1977	yes	no treatment		
1978	yes	no treatment		
1979	yes	Copper sulfate	90 lbs	13.0
1980	yes	no treatment		
1981	yes	Copper sulfate	85 lbs	13.3
1982	yes	Copper sulfate	100 lbs	13.0
1983	yes	Copper sulfate	100 lbs	9.5
1984	yes	Copper sulfate	100 lbs	13.5
1985	yes	no treatment		
1986	yes	no treatment		
1987	yes	no treatment[1]		
		TOTAL	1175 lbs copper sulfate	

[1] A permit was issued for the period 1988 - 1991, but it is unknown whether or not treatments occurred

METHODS

Watershed Characteristics

Watershed information was entered into the AGNPS (**AG**ricultural **N**on**P**oint **S**ource) computerized modeling program (6). The AGNPS program is a single storm event model for comparative evaluation of management practices within a watershed. Data collection and input was completed by the Manitowoc County Soil and Water Conservation Department (MCSWCD); analysis was completed by IPS.

English Lake watershed parameters were entered into the program for each of 78 2.5-acre cells. Information was obtained from the United States Geological Survey 7.5' quadrangle for the area (7), the Manitowoc County Soil Survey (3), MCSWCD file information and personal interviews with landowners. A weighted average was assigned for numeric cell data (i.e., slope, fertilization) while absolute information (i.e., soil type, use information) was recorded as the category with the greatest area for the cell.

Water Quality Monitoring

English Lake water samples were taken on September 14, 1992; February 1, May 17, August 12, and October 7, 1993 and January 25, May 12, July 24, and September 8, 1994. Samples were collected three feet below the surface and three feet above bottom for Station 1601 (deepest point) and at mid-depth for

Station 1602 (outlet) when flow was present (May 17 and August 12, 1993) (Table 2, Fig. 1). Parameters measured in the field were Secchi depth, water temperature, pH, dissolved oxygen (DO), and conductivity (see the Phase I document for specific equipment and methods information).

Water samples were also taken during surface runoff events at locations around the perimeter of the lake to evaluate nutrient inflows from the watershed. Eight event sample sites were located at drain tile outfalls and areas of significant runoff contribution to the lake (Fig. 1). Samples were collected by members of the ELMD and MCSWCD (with IPS instruction) on April 13, April 22, June 15, and August 13, 1993 and April 25 and August 2, 1994.

Recreational Use

A recreational use survey of the ELMD membership was conducted to obtain property and lake use, water use opinions and demographics information. About 50 questionnaires were distributed (one per household) by ELMD neighborhood volunteers to maximize the return rate. A sample survey questionnaire is included in Appendix I.

Exotic Species

Visual observations (including in-lake observations using raking and SCUBA) were made throughout the Phase I and II grant periods

Table 2. Sampling Station Locations, English Lake, 1992 - 1994.

REGULAR MONITORING

Site	Depth
1601	85.0 feet
1602	1.0 feet

EVENT MONITORING

Site	Description
16E1	Overland flow on property at 9304 S. Lake Drive
16E2	Drain tile outfall (multiple tiles) between 9112 and 9122 S. Lake Drive
16E3	Drain tile outfall between 4350 and 4402 S. Union Road
16E4	Overland flow between English Lake and parking lot at 4420 S. Union Road
16E5	Drain tile outfall between 9031 and 9109 N. Lake Drive
16E6	Overland flow between Westland and Rexrode residences
16E7	Overland runoff near 9221 North Lake Drive (on north side of road) - goes into tile and enters lake subsurface
16E8	Overland flow about 150 feet upstream from Site 16E3

to document the occurrence exotic species including Eurasian Water Milfoil (*Myriophyllum spicatum*), Purple Loosestrife (*Lythrum salicaria*) and Zebra Mussels (*Dreissena polymorpha*).

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Sanitary System Review

Sanitary system information was obtained by the ELMD from the lakeshore landowners. Available information included the presence of a structure (house or lot), sanitary system type (septic tank and field, holding tank, mound system or outhouse) and occupancy of the residence (permanent, seasonal or unoccupied). Sanitary system information is summarized in the Results and Discussion portion of this report.

Public Involvement Program

Public involvement activities were coordinated to inform and educate the ELMD about lake management in general and specifics regarding the English Lake resource. Activities included news releases, IPS newsletters, article preparation for ELMD newsletters, meeting attendance and presentations to the ELMD, the MCSWCD and other interested parties. Public involvement activities are summarized in Appendix II.

FIELD DATA DISCUSSION

Water quality in small seepage lakes, e.g., with long water residence times, can be strongly influenced by characteristics of and activities in the watershed. Watershed modeling and field measurements suggest that this is also the case for English Lake.

Watershed Characteristics

AGNPS program results for the English Lake watershed were:

- Soil textures - The watershed is comprised of silt [including loam (139 acres)], water (51 acres) and peat (6 acres) (Fig. 2). Excluding lake area, soil types were silt or loam (97%) and peat (3%).

- Land slopes - Slopes of 0 - 5% were most common (86 acres, 60%) followed by 5 - 10% (51 acres, 35%), 10 - 15% (5 acres, 3%) and 15 - 17% (3 acres, 2%) (Fig. 3).

- Surface runoff total nitrogen levels - Predicted total nitrogen output of 1 - 3 parts per million (ppm) was most common (136 acres, 96%); 4 acres (3%) had a predicted output of 3.1 - 7 ppm and 1 acre (less than 1%) had a predicted output between 7.1 and 10 ppm (Fig. 4). Predicted nitrogen output was highest for cells located near event Sites 16E3 and 16E8.

Figure 2. Watershed Soil Textures, English Lake, Manitowoc County, Wisconsin.

Figure 3. Watershed Land Slopes, English Lake, Manitowoc County,

Wisconsin.

Figure 4. Total Nitrogen Output by Cell, English Lake, Manitowoc County, Wisconsin.

- Surface runoff total phosphorus levels - Predicted phosphorus output of 0 - 1 ppm was most common (138 acres, 96%); 7 acres (5%) had a predicted output of 1.1 - 2 ppm (Fig. 5). Predicted phosphorus output was also highest near event Sites 16E3 and 16E8.

- Erosion - Eighty-one percent (116 acres) of the English Lake watershed was estimated to be below the tolerable soil erosion rate of 5 tons/acre. An erosion rate of 5.1 - 10 tons/acre was predicted for 21 acres (15%) and a rate of 10.1 - 15.1 tons/acre for about 8 acres (5%) (Fig. 6).

Figure 5. Total Phosphorus Output by Cell, English Lake, Manitowoc County, Wisconsin.

Figure 6. Soil Erosion by Cell, English Lake, Manitowoc County, Wisconsin.

Water Quality

In-lake phosphorus levels (ave. = 0.085, σ = 0.068 mg/l) (Table 3) were well above levels for expected for seepage lakes (ave. = 0.021, σ = 0.028 mg/l), and slightly higher than for lakes in the southeast region of Wisconsin (ave. = 0.079, σ = 0.136) (8). Flow at the lake outlet (Site 1602) was sufficient for sampling on only two sample dates (Table 4). NOTE: Some data were indicated to have exceeded recommended holding time before analysis. A study has shown, however, that the data remain accurate for samples analyzed well after the 28-day holding time (9).

In-lake total nitrogen levels were somewhat higher (ave. = 1.41, σ = 0.32) (Table 3) than expected levels for seepage lakes (ave. = 0.76, σ = 0.57). Levels were near expected levels for lakes in the southeast region of Wisconsin (ave. = 1.43, σ = 1.10) (8).

In-lake surface monitoring data (1976 - 1994) indicated a trend of highest total phosphorus at times of unstratified conditions or runoff periods (Winter and Spring) (Figure 7). Phosphorus levels were generally low during thermal stratification (typically late May to October) when thermocline development inhibits mixing of nutrient rich deeper waters with surface water. The trend for total nitrogen was very similar to that of

total phosphorus (Fig. 7).

Table 3. Water Quality Parameters, Station 1601 (Deepest Point), English Lake, September, 1992 - September, 1994.

PARAMETER	SAMPLE[1]	DATE								
		09/14/92	02/01/93	05/17/93	08/12/93	10/07/93	01/25/94	05/12/94	07/24/94	09/08/94
Secchi (feet)		10.2	NR[2]	15.7	7.0	7.0	NR	10.7	7.3	5.2
Cloud Cover (percent)		100	0	90	100	10	100	70	30	0
Temperature (degrees Celsius)	S	18.34	1.91	15.04	24.44	13.69	0.14	13.41	24.83	19.74
	B	5.61	3.12	5.68	5.84	6.11	3.77	6.21	6.95	6.82
pH (surface units)	S	8.49	6.91	7.78	8.37	7.71	7.52	8.00	8.58	8.44
	B	NR	6.45	6.21	5.57	6.10	6.73	6.37	5.00	6.20
D.O. (mg/l)	S	9.05	9.57	10.90	9.04	9.55	11.72	12.10	8.74	8.49
	B	0.41	0.46	4.04	0.05	0.43	0.45	2.86	0.63	1.05
Conductivity (umhos/cm)	S	355	400	408	350	395	387	393	349	318
	B	420	411	411	416	446	434	406	412	419
Laboratory pH (surface units)	S	NR	NR	8.72	NR	NR	NR	8.83	NR	NR
	B	NR	NR	NR	NR	NR	NR	NR	NR	NR
Total Alkalinity (mg/l)	S	NR	NR	171	NR	NR	NR	173	NR	NR
	B	NR	NR	NR	NR	NR	NR	NR	NR	NR
Tot. Kjeld. Nitrogen (mg/l)	S	1.1	1.5	1.5	1.1	1.9	1.2	0.9	1.35[3]	1.26[3]
	B	3.6	1.9	1.8	3.8	3.4	2.2	1.5	1.47[3]	3.07[3]
Ammonia Nitrogen (mg/l)	S	0.027	0.556	0.097	0.098	0.833	0.234	0.068	0.050	0.007
	B	2.70	0.995	0.722	2.360	2.37	1.01	0.354	1.64	2.24
$NO_2 + NO_3$ Nit. (mg/l)	S	0.008	0.158	0.336	ND[3]	ND	0.332	0.053	ND	ND
	B	ND	0.080	0.364	ND	ND	0.018	0.424	ND	ND
Total Nitrogen (mg/l)	S	1.108	1.658	1.836	1.1	1.9	1.532	0.953	1.35	1.26
	B	3.6	1.980	2.164	3.8	3.4	2.218	1.924	1.47	3.07
Total Phosphorus (mg/l)	S	0.018	0.177	0.17	0.025	0.044	0.189	0.081	0.039	0.0240[3]
	B	0.70	0.26	0.27	0.76	0.68	0.35	0.254	0.410	0.656[3]
Dissolved Phos. (mg/l)	S	ND	0.150	0.101	ND	0.002	0.157	0.026	ND	ND
	B	0.69	0.23	0.23	0.67	0.61	0.292	0.190	0.450	0.640
Nit./Phos Ratio	S	60.0	9.4	10.8	--	43.2	8.1	11.8	34.6	52.5
	B	5.1	7.6	8.0	5.7	5.0	6.3	7.6	3.6	4.7
Chlorophyll a (ug/l)	S	6.40	NR	3.21	7.46	15.3	NR	11.7	15.2	13.7

[1] S = surface, B = bottom; [2] NR = no reading; [3] holding time exceeded by SLOH; [4] ND = not detectable;

Table 4. Water Quality Parameters, Station 1602 (Outlet), English Lake, September, 1992 - September, 1994.

PARAMETER	SAMPLE[1]	DATE								
		09/14/92[2]	02/01/93[2]	05/17/93	08/12/93	10/07/93[2]	01/25/94[2]	05/12/94[2]	07/24/94[2]	09/08/94[2]
Secchi (feet)		NR[3]	NR	>0.5	>0.3	NR	NR	NR	NR	NR
Cloud Cover (percent)		100	NR	90	10	NR	NR	NR	NR	NR
Temperature (degrees Celsius)	M	NR	NR	16.39	24.82	NR	NR	NR	NR	NR
pH (surface units)	M	NR	NR	8.00	7.49	NR	NR	NR	NR	NR
D.O. (mg/l)	M	NR	NR	7.74	7.33	NR	NR	NR	NR	NR
Conductivity (umhos/cm)	M	NR	NR	397	361	NR	NR	NR	NR	NR
Laboratory pH (surface units)	M	NR	NR	8.73	NR	NR	NR	NR	NR	NR
Total Alkalinity (mg/l)	M	NR	NR	171	NR	NR	NR	NR	NR	NR
Tot. Kjeld. Nitrogen (mg/l)	M	NR	NR	1.1	1.2	NR	NR	NR	NR	NR
Ammonia Nitrogen (mg/l)	M	NR	NR	0.068	0.038	NR	NR	NR	NR	NR
NO_2 + NO_3 Nit. (mg/l)	M	NR	NR	0.310	0.020	NR	NR	NR	NR	NR
Total Nitrogen (mg/l)	M	NR	NR	1.410	1.220	NR	NR	NR	NR	NR
Total Phosphorus (mg/l)	M	NR	NR	0.14	0.057	NR	NR	NR	NR	NR
Dissolved Phos. (mg/l)	M	NR	NR	0.109	ND[4]	NR	NR	NR	NR	NR
Nit./Phos Ratio	M	NR	NR	10.7	21.4	NR	NR	NR	NR	NR
Chlorophyll a (ug/l)	M	NR	NR	6.94	12.9	NR	NR	NR	NR	NR

[1] M = Mid-depth; [2] no flow at outlet; [3] NR = no reading; [4] ND = not detectable;

Figure 7. Surface Total Phosphorus and Total Nitrogen Trends for English Lake Station 1601, 1976 - 1994.

Runoff event monitoring indicated that most of the higher [e.g., significant ($\propto$ = 0.1) vs the sample date mean] nutrient levels were observed at Site 16E3 or 16E8 (Tables 5 and 6). Both sites had significantly higher readings for at least one measured parameter on each sample date (six 16E3, two 16E8). While nutrient levels were lower, loading via Site 16E2 was considered significant in that inflow to the lake was almost continuous.

Recreational Use

The following summarizes pertinent information obtained from the completed and returned (30 of 49; 61%) questionnaires.

What year did you purchase your property on English Lake?

Thirty respondents indicated a range of 1941 to 1994 with a

Table 5. Event Nitrogen Parameters (in milligrams per liter), English Lake, 1993 - 1994.

DATE / PARAMETER	EVENT[1]	16E1	16E2	16E3	16E4	16E5	16E6	16E7	16E8
		SAMPLE SITE							
04-12-93									
TKN	0.45/0	0.5	1.3	2.3[2]	0.6	1.3	1.3	1.3	NS[3]
NH_4-N		NS	0.043	0.407	NS	NS	NS	0.204	NS
NO_2+NO_3-N		NS	2.97	3.38	NS	NS	NS	0.016	NS
Tot. N		--	4.27	5.68	--	--	--	1.316	--
04-21-93									
TKN	0.65/0	0.3	1.5	1.4	0.6	1.3	0.7	0.8	NS
NH_4-N		0.012	0.206	0.160	0.023	0.118	0.037	0.069	NS
NO_2+NO_3-N		0.081	1.06	0.889	0.494	2.70	2.17	0.303	NS
Tot. N		0.381	2.56	2.289	1.094	4.0	2.87	1.103	--
06-14-93									
TKN	0/0.40	0.4	1.6	4.5	0.8	2.1	1.3	1.1	NS
NH_4-N		0.028	0.068	0.458	0.024	0.250	0.079	0.059	NS
NO_2+NO_3-N		0.008	1.52	3.26	ND[4]	1.33	0.222	0.048	NS
Tot. N		0.408	3.12	7.76	0.8	3.43	1.522	1.148	--
08-12-93									
TKN	0/0	2.9	0.7	1.4	NS	NS	NS	NS	NS
NH_4-N		0.492	0.056	0.067	NS	NS	NS	NS	NS
NO_2+NO_3-N		7.24	3.19	9.31	NS	NS	NS	NS	NS
Tot. N		10.14	3.89	10.71	--	--	--	--	--
04-25-94									
TKN	0.25/1.80	1.0	1.8	4.0	1.1	2.4	1.0	0.6	2.0
NH_4-N		0.032	0.088	0.302	0.039	0.191	0.078	0.022	0.302
NO_2+NO_3-N		0.171	12.2	19.2	11.4	7.99	0.107	10.3	1.68
Tot. N		1.171	14.0	23.2	12.5	10.39	1.107	10.9	3.68
08-02-94									
TKN	1.15/0	NS	2.83[5]	3.25[5]	NS	2.24[5]	1.46[5]	NS	2.43[5]
NH_4-N		NS	0.066	0.111	0.033	0.020	0.140	NS	0.073
NO_2+NO_3-N		NS	4.06	4.47	2.24	5.53	0.385	NS	3.62
Tot. N		--	6.89	7.72	--	7.77	1.845	--	6.05

[1] rainfall (in.): day prior/day of (10); [2] bold values sig (α = 0.1) greater than event mean; [3] NS = no sample collected;

[4] ND = not detectable; [5] holding time exceeded by SLOH

median purchase date of 1972. Eleven respondents (37%) indicated their English Lake residence to be their primary residence.

Table 6. Event Phosphorus Parameters (in milligrams per liter), English Lake, 1993 - 1994.

DATE / PARAMETER	EVENT[1]	16E1	16E2	16E3	16E4	16E5	16E6	16E7	16E8
		SAMPLE SITE							
04-12-93									
Diss. P	0.45/0	0.004	0.155	**0.74**[2]	0.053	0.090	0.019	0.065	NS[3]
Tot. P		0.020	0.21	0.91	0.064	0.103	0.061	0.190	NS
04-21-93									
Diss. P	0.65/0	0.005	0.168	0.47	0.080	0.089	0.077	0.024	NS
Tot. P		0.026	0.29	0.66	0.136	0.153	0.121	0.086	NS
06-14-93									
Diss. P	0/0.40	0.010	0.032	1.21	0.064	0.050	0.048	0.48	NS
Tot. P		0.017	0.147	1.73	0.112	0.159	0.140	0.175	NS
08-12-93									
Diss. P	0/0	0.42	0.086	0.25	NS	NS	NS	NS	NS
Tot. P		1.04	0.119	0.30	NS	NS	NS	NS	NS
04-25-94									
Diss. P	0.25/1.80	0.017	0.101	1.19	0.095	0.055	0.076	0.024	0.81
Tot. P		0.57	0.28	1.59	0.19	0.14	0.172	0.051	0.87
08-02-94									
Diss. P	1.15/0	NS	0.288	1.22	0.152	0.003	0.178	NS	1.60
Tot. P		NS	0.571[4]	1.808[4]	NS	0.3020[4]	0.3740[4]	NS	1.38[4]

[1] rainfall (in.): day prior/day of (10); [2] bold values sig ($\alpha = 0.1$) greater than event mean;

[3] NS = no sample collected; [4] holding time exceeded by SLOH

How many weeks per season do you occupy your dwelling on English Lake?

Overall occupancy was greatest during Summer (Fig. 8). Excluding the 11 permanent residents, the average occupancy rate of the 19 remaining respondents was 14.7 weeks/year. The average seasonal occupancy rate for part-time residents was 3.3, 7.7, 3.2, and 0.5 weeks during Spring, Summer, Fall, and Winter, respectively .

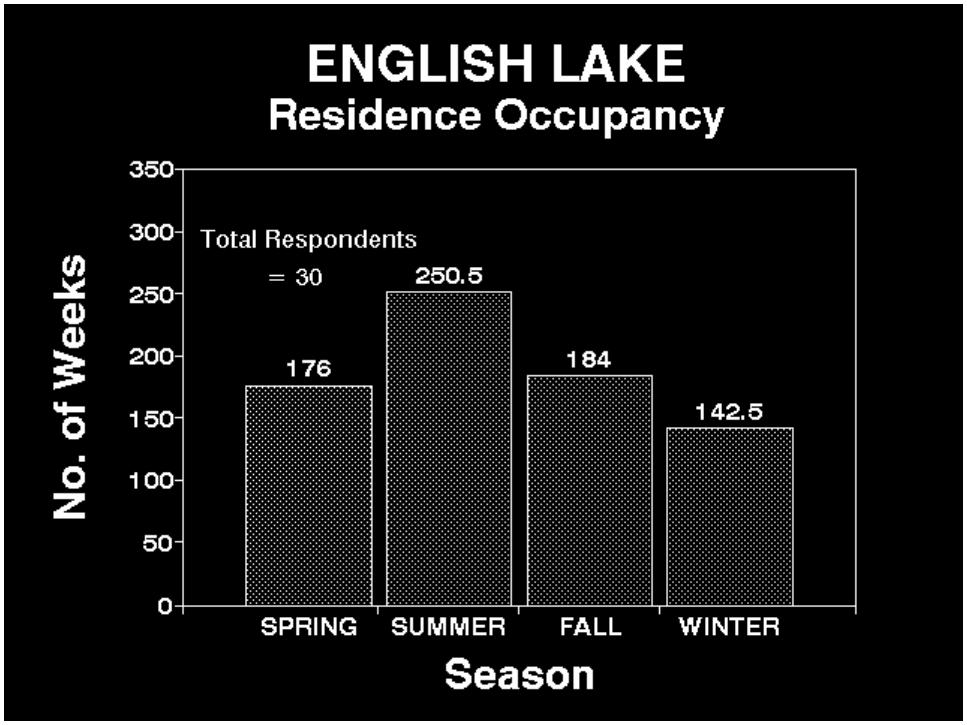

Figure 8. Residence Occupancy by Season, English Lake, Manitowoc County, Wisconsin.

Please identify the type and number of watercraft/ horsepower (HP) you own.

Respondents indicated a total of 94 watercraft on the approximately 50 surface acres of English Lake. Row/paddle boats were most numerous followed by canoes or kayaks, pontoons, motors < 25 horsepower and motors over 50 horsepower (Fig. 9). In addition, seven residents allowed a total of eight non-resident boats to be kept at their pier or on their frontage.

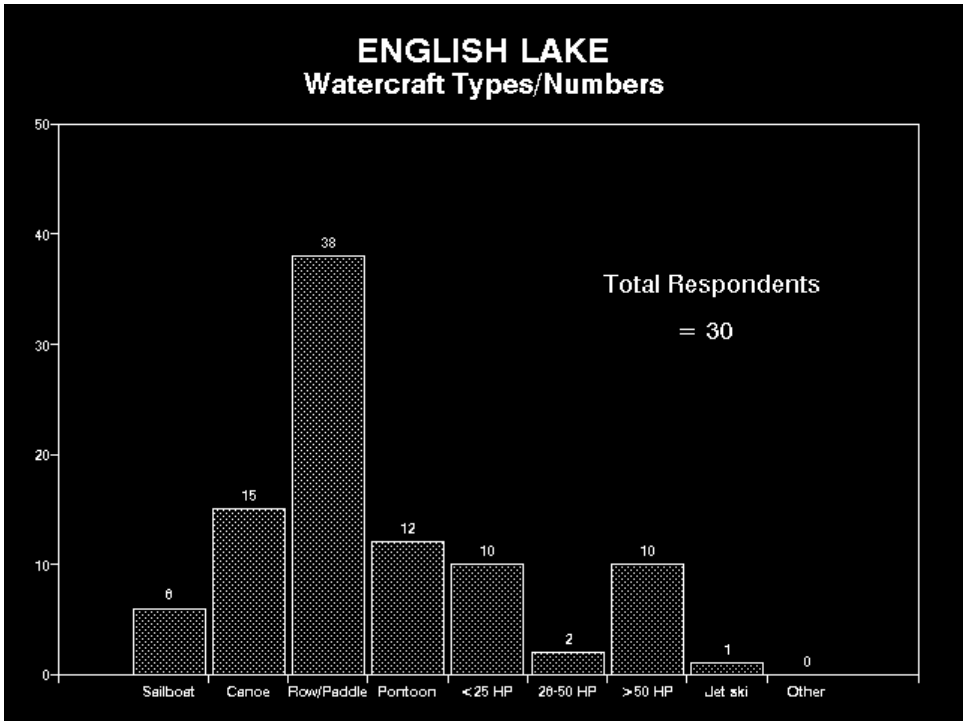

Figure 9. Watercraft Type and Numbers, English Lake, Manitowoc County, Wisconsin.

Please indicate how <u>you</u> spend <u>your</u> time on English Lake.

More "passive" activities were indicated as being most popular by respondents themselves. In order, those categories receiving most "frequent" responses were viewing nature, swimming/sunbathing and bird/wildlife watching (Table 7).

Table 7. Respondent Recreational Use by Category, English Lake, Manitowoc County, Wisconsin.

Surface Water Use	Amount of Time Spent				
	Frequently	Occasionally	Seldom	Never	TOTAL
Sailing	0	2	4	12	18
Canoeing	0	6	7	8	21
Pleasure Boating	9	7	5	4	25
Jet Skiing	0	0	3	14	17
Water Skiing	7	5	2	8	22
Fishing	10	6	5	4	25
Swim/Sunbathing	14	7	1	1	23
Pontooning	10	2	4	6	22
Bird/Wildlife Watching	13	4	3	2	22
Viewing Nature	15	4	2	2	23

Please indicate how other adults (18 and over) in your residence spend their time on English Lake.

Most "frequent" responses among other adults were given (in order) for swimming & sunbathing, viewing nature and pontooning (Table 8).

Table 8. Other Adult Recreational Use by Category, English Lake, Manitowoc County, Wisconsin.

Surface Water Use	Amount of Time Spent				
	Frequently	Occasionally	Seldom	Never	TOTAL
Sailing	0	1	2	12	15
Canoeing	0	5	6	5	16
Pleasure Boating	4	11	3	3	21
Jet Skiing	0	1	2	12	15
Water Skiing	6	5	1	8	20
Fishing	7	10	6	1	24
Swim/Sunbathing	13	3	4	1	21
Pontooning	9	3	2	6	20
Bird/Wildlife Watching	7	5	4	3	19
Viewing Nature	11	4	3	3	21

Please indicate how youth (under age 18) in your residence spend their time on English Lake.

Most "frequent" responses were given for swimming & sunbathing and fishing for youth in the survey (Table 9).

How do you get your boat(s) in the water on English Lake?

Of the 26 responses, 11 used a private launch, 11 used a public launch and 4 used a combination of the two.

Table 9. Youth Recreational Use by Category, English Lake, Manitowoc County, Wisconsin.

Surface Water Use	Amount of Time Spent				
	Frequently	Occasionally	Seldom	Never	TOTAL
Sailing	0	2	2	7	11
Canoeing	0	5	4	5	14
Pleasure Boating	2	5	2	5	14
Jet Skiing	1	0	1	8	10
Water Skiing	4	6	0	6	16
Fishing	7	5	3	2	17
Swim/Sunbathing	11	5	0	2	18
Pontooning	5	3	1	5	14
Bird/Wildlife Watching	4	5	2	3	14
Viewing Nature	5	5	2	3	15

How often are members of your household likely to participate in the following winter sports activities?

Most "frequent" responses for winter sports activities (in order) were given for ice skating and ice fishing (Table 10).

Opinion: There are too many watercraft on English Lake.

Of 30 responses, 17 (57%) "strongly agreed" or "agreed" that there were too many watercraft on English Lake. In response to when there were too many watercraft, 16 "strongly agreed" or "agreed" there were too many watercraft on weekends and holidays.

Table 10. Winter Recreational Use by Category, English Lake, Manitowoc County, Wisconsin.

Surface Water Use	Amount of Time Spent				
	Frequently	Occasionally	Seldom	Never	TOTAL
Ice Fishing	2	7	8	12	29
Cross Country Skiing	1	5	3	14	23
Snowmobiling	1	3	3	17	24
Ice Skating	3	6	6	10	25
Ice Boating	0	0	1	21	22
Snow Shoeing	0	1	0	21	22

Opinion: The current number of watercraft causes safety problems.

Thirteen of 29 (43%) respondents "strongly agreed" or "agreed" that the number of watercraft posed a safety problem. Primary causes of safety problems were indicated to be non-residential watercraft (43%) followed by a combination of residential and non-residential watercraft (57%).

Opinion: There is adequate water safety enforcement during [weekdays, weekends and holidays].

Respondents generally agreed that water safety enforcement was adequate. Similar numbers "agreed" or "strongly agreed" that enforcement was adequate on weekdays (65%) and holidays (63%); somewhat fewer felt enforcement was adequate on weekends (55%).

Opinion: Surface water use conflicts on English Lake are extensive enough that additional surface water use regulations need to be enacted and enforced.

Only nine respondents (of 29, 31%) "strongly agreed" or "agreed" that additional regulations should be enacted.

Opinion: There should be limits set on the number of watercraft that can use the surface water at particular times.

Thirteen 13 of 29 (45%) 'strongly agreed" or 'agreed" numbers of watercraft should be limited on the lake at particular times.

Opinion: There is adequate public boater access to English Lake.

All respondents (100%) "strongly agreed" or "agreed" that the general public has adequate access to English Lake.

Opinion: There is need for a public swimming beach on English Lake.

Twenty-nine (97%) "disagree" or "strongly disagree" that there is a need for a public swimming beach on English Lake. Only one respondent (3%) "strongly agreed".

How would you rate existing water quality for English Lake?

Thirteen (of 30, 43%) respondents rated current water quality as "poor". Other responses included "fair", 8 (27%), "good", 8 (27%) and "excellent", 1 (3%) (Fig. 10).

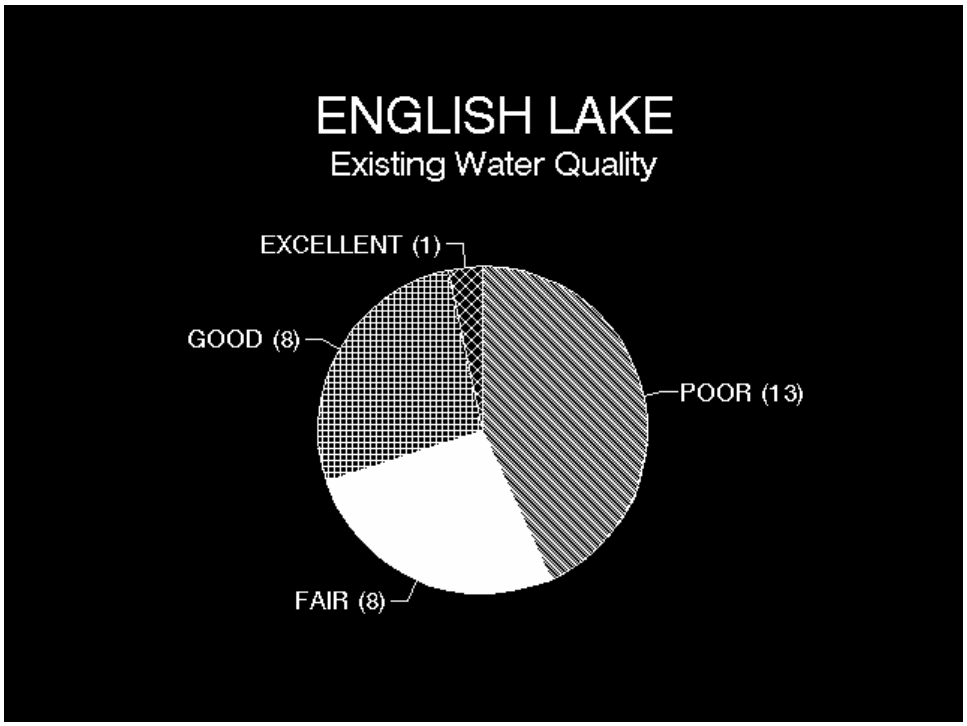

Figure 10. Perceived Existing Water Quality, English Lake, Manitowoc County, Wisconsin.

Over the past 10 - 15 years, English Lake water quality has:

Twenty-one of 27 (78%) respondents perceived water quality to have deteriorated; two (7%) thought it had "improved" and four (15%) thought it had "stayed the same".

Over the past 5 years, English Lake water quality has:

Fourteen of 28 (50%) respondents perceived water quality to have deteriorated; seven (25%) thought it had "improved" and seven (25%) thought it had "stayed the same".

How would you rate the English Lake fishery?

Seven of 29 respondents (24%) rated the fishery as "poor". Other responses included "fair" (12; 41%) and "good" (10; 34%); none rated the fishing as excellent (Fig. 11).

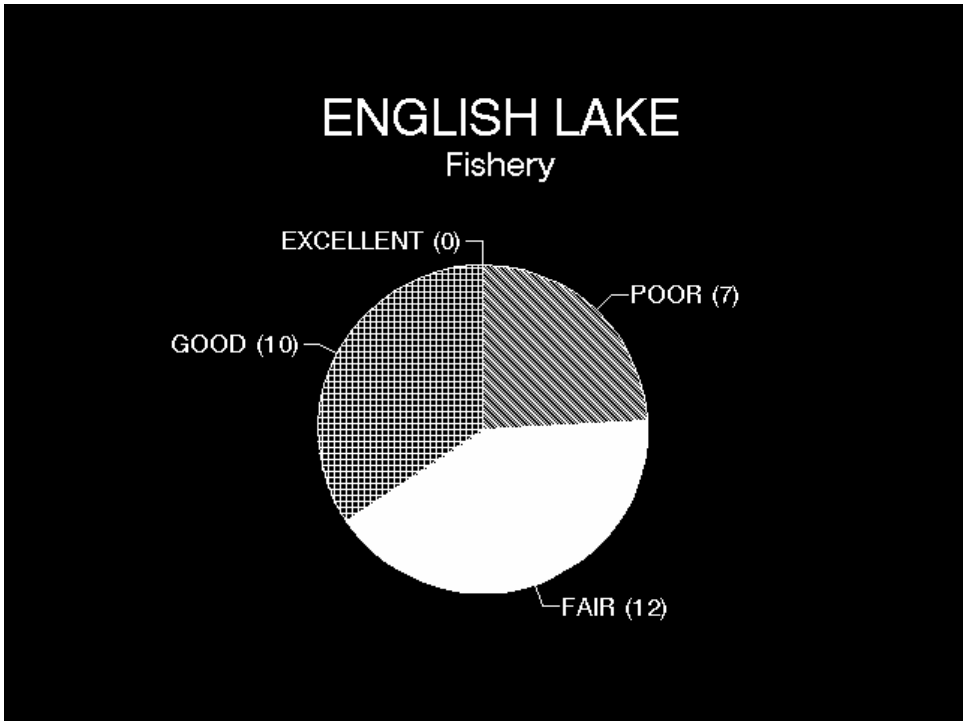

Figure 11. Perceived Fishery Status, English Lake, Manitowoc County, Wisconsin.

Over the past 10 - 15 years, the English Lake fishery has:

Thirteen of 24 (54%) respondents perceived the fishery to have deteriorated; three (13%) thought it had "improved" and eight (33%) thought it has "stayed the same".

Over the past 5 years, the English Lake fishery has:

Twelve of 27 (44%) respondents perceived the fishery to have deteriorated; four (15%) thought it had "improved" and eleven (41%) thought it has "stayed the same".

What three aspects of the English Lake resource do you feel currently require the most management attention?

Respondents generally gave highest rank for the categories of lake water quality (average rank = 2.50), watershed runoff (ave. rank = 2.87) and weed populations (ave. rank = 2.93) (Fig. 12). Watershed runoff rank probably reflects additional concern for lake water quality and water quality issues as a whole. While weed populations received more ranked responses than watershed runoff, responses were secondary in nature. Next ranked was septic system maintenance (ave. rank = 3.27) and adjacent runoff (ave. rank = 3.30) and further reflect water quality concerns. Regulations/enforcement issues (ave. rank = 3.53) received no primary ranks.

Demographics

Thirty respondents indicated a total of 69 adults (range: 1 - 7/dwelling), five children 12 - 18 (range: 0 - 2) and eight children 12 and under (range: 0 - 3) for a total of 82 residents. There was a total of 18 adults age 61 or older (range: 0 - 2).

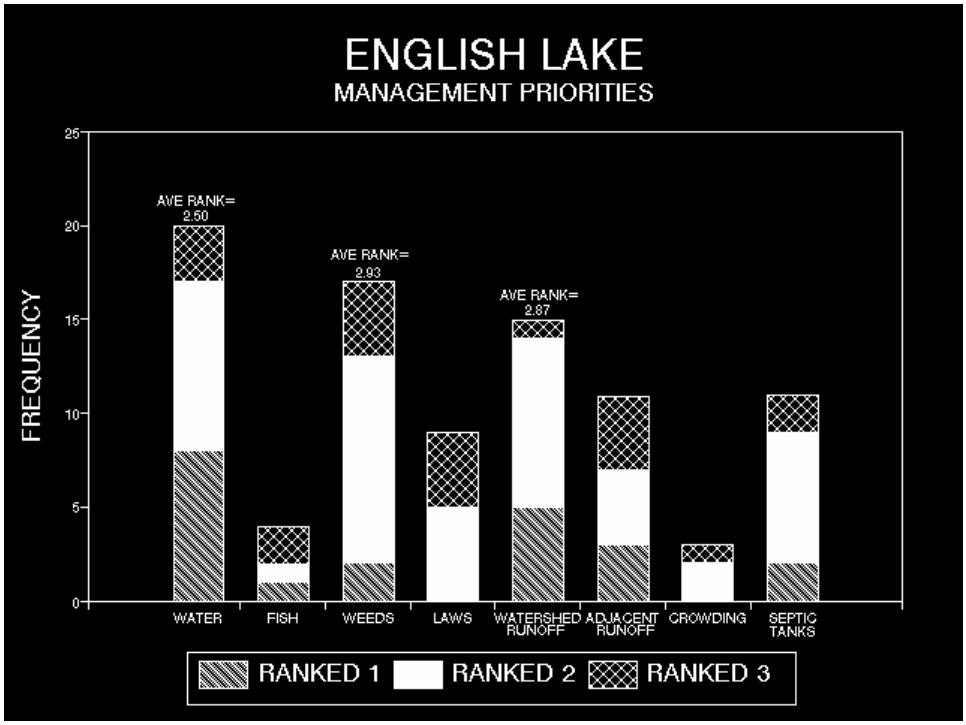

Figure 12. Management Priorities, English Lake, Manitowoc County, Wisconsin.

Seventeen of thirty respondents (57%) offered comments at the end of the survey. Comments were mainly directed at issues of boat speed, boat regulations, watershed runoff and water quality concerns. Comment information will be furnished to ELMD for further consideration.

Exotic Species

Eurasian Water Milfoil has not been observed in English Lake; aquatic plant surveys (1991) and observations (1991 - 1994) indicated no water milfoil (*Myriophyllum sp.*), native or exotic. There were also no observations of Zebra Mussels or Purple

Loosestrife plants. A few stems of Purple Loosestrife were present near the county park in 1990, but efforts to eliminate the plants appear to have been effective.

Sanitary System Review

Currently, there are 49 land parcels on English Lake; 45 with dwellings and 4 without. Occupancy categories for the parcels are 23 seasonal, 18 permanent, five no occupancy and three unknown.

Sanitary systems for the 49 parcels include 25 septic tanks and fields, 12 holding tanks, five outhouses, two mound systems, four none (lots) and one unknown. Of the 18 permanent residents there are nine septic tanks and fields, seven holding tanks and two mound systems. For the 23 seasonal dwellings, there are 14 septic tanks and fields, four holding tanks, four outhouses and one unknown.

For English Lake watershed soil types, holding tanks and mound treatment systems are most suitable. Outhouses provide no treatment of sanitary waste and can allow nutrients and bacteria to enter surface and ground water. Because of soil permeability limitations, standard septic tank/field systems may also be inadequate.

BASELINE CONCLUSIONS

- Areas of concern for the English Lake watershed, as indicated by the AGNPS model and supported by field measurements, include the drain tile inflows. The model also estimated over 28 acres with predicted soil losses in excess of the recommended five tons per acre.

- In-lake surface water quality for English Lake was highly variable and dependent upon mixed or stratified conditions. Nutrient release from anoxic sediments probably accounts for a large portion of the nutrient cycle in English Lake. Runoff event monitoring indicated highest nutrient levels at Site 16E3 and 16E8 (for English Lake event data), but overall loading was probably most significant from Site 16E2. Many event sites had high nutrient readings compared to other in-lake nutrient data.

- A survey of district members estimated English Lake recreational use to be moderate to high. Landowners are very concerned about the size of the lake and regulations relative to lake size. Respondents' opinions relative to lake crowding or water safety

problems for English Lake are mixed. Perceived water quality is poor to fair; perceived fishery status is fair to good. Both are perceived to be deteriorating. Water quality issues were ranked highest in need of management attention.

- No Zebra Mussels, Eurasian Milfoil or Purple Loosestrife were observed for the period 1991 - 1994. Purple Loosestrife present in previous years appears to have been effectively removed.

- There were four outhouses being used at least seasonally on English Lake. Also, septic tanks/fields were the most common sanitary system type even though soils are ,at best, marginal for those systems.

MANAGEMENT RECOMMENDATIONS

- Areas draining to Sites 16E2, 16E3, 16E8 and other drain tiles should be further investigated for soil and nutrient management practices. A potential land purchase and wetland restoration south of English Lake by the Department of Transportation should be encouraged. Possible use of ELMD, MCSWCD and/or Lake Protection Grant moneys should be assessed.

- Water quality monitoring should be continued to track trends of the resource through management. Monitoring should include regular (quarterly) sampling of the deepest point only and event sampling of similar sites. Self-help secchi monitoring should be continued; rainfall monitoring should be initiated.

- Ideally, an alum treatment for English Lake would take place after nutrient inflows are reduced. Because of the limited time frame for cost-share funding, a treatment could be undertaken to reduce the effects of in-lake nutrient cycling. Water quality monitoring should accompany an alum treatment program.

- The actual surface acreage of English Lake should be determined to help resolve boat regulation issues. Boat regulations should amended (if necessary) to best suit the needs/wants of the public.

- Landowners and lake users should be informed and educated about problems associated with exotic species. Signs should be posted at public access points and brochures circulated. Monitoring for exotics should be continued and control or removal methods initiated promptly as occurrences are documented.

- Landowners should be educated on the detrimental effects of outhouses and failing/ineffective septic systems. Installation of holding tank systems should be encouraged. ELMD may consider the costs/benefits of sanitary sewer service around the lake.

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APPENDIX I
SAMPLE RECREATIONAL USE SURVEY
English Lake Management Plan

APPENDIX I
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APPENDIX I
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APPENDIX II
SUMMARY OF PUBLIC INVOLVEMENT ACTIVITIES
English Lake Management Plan

The English Lake Management District (ELMD) initiated steps to develop a comprehensive lake management plan under the Wisconsin Department of Natural Resources (WDNR) Lake Management Planning Grant Program in the Fall of 1990. A public involvement program was immediately initiated as part of the planning process. The following is a summary of Phase I and Phase II major public involvement efforts.

Planning Advisory Committee

A working group comprised of the ELMD president, WDNR, MCSWCD and IPS representatives was established at the start of the program. The group provided planning direction and served as main reviewer of the draft plan document.

Brochures

A informational brochure titled "English Lake Management Planning Program" was developed and distributed which outlined objectives, elements and ways for ELMD members to get involved in the planning process.

A Phase I plan summary brochure was also produced. It was made available for ELMD use and distribution when the plan document was approved by WDNR. The brochure described the main features of plan development, plan recommendations and other pertinent information. Another plan brochure will be produced upon conclusion of Phase II.

Meetings

IPS presented progress reports, provided information about the resource and interpretations of these results periodically at ELMD member meetings.

Print Media

After receipt of the grant award, a news release was issued to The Valders Journal. The release highlighted information about the length and scope of the project and persons to contact for additional information.

A quarterly IPS newsletter entitled "Lake Management News" was developed and distributed to the ELMD for the Board's use and distribution among the membership. A special "English Lake Edition" was also developed to notify the ELMD of any late developments in the planning program. Information was also prepared for inclusion into the ELMD newsletter.

PHASE II
LAKE MANAGEMENT PLAN
ENGLISH LAKE
MANITOWOC COUNTY, WISCONSIN

Prepared for

English Lake Management District District

by

February, 1995