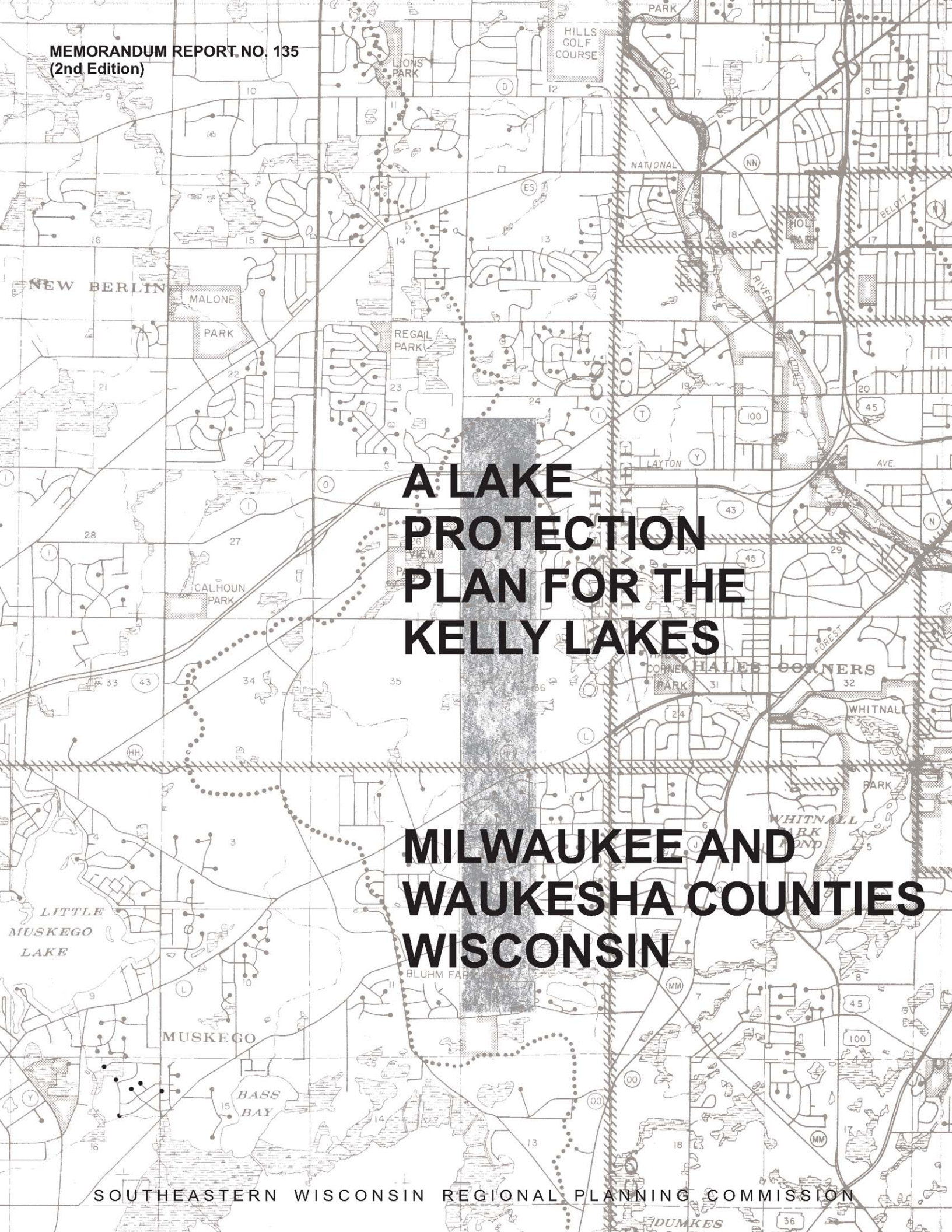
MEMORANDUM REPORT NO. 135
(2nd Edition)

A LAKE PROTECTION PLAN FOR THE KELLY LAKES

MILWAUKEE AND WAUKESHA COUNTIES WISCONSIN



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Special acknowledgement is due to Dr. Jeffrey A. Thornton, CLM, PH, and Dr. Thomas M. Slawski, SEWRPC Principal Planners; Mr. Edward J. Schmidt, SEWRPC GIS Planning Specialist; and, Mr. Michael A. Borst, SEWRPC Research Aide, for their contributions to the conduct of this study and the preparation of this report.

MEMORANDUM REPORT
NUMBER 135, 2nd Edition

A LAKE PROTECTION PLAN FOR THE KELLY LAKES MILWAUKEE AND WAUKESHA COUNTIES, WISCONSIN

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Chapter I

INTRODUCTION

Upper and Lower Kelly Lakes, located in the City of New Berlin, Waukesha County, Wisconsin, and the Village of Hales Corners, Milwaukee County, Wisconsin are a valuable resource offering a unique urban residential setting providing a variety of recreational and aesthetic opportunities to the resident community and its visitors. The Lakes are an integral part of the community. However, the recreational and visual value of the Lakes is perceived to be adversely affected by changing land use conditions in the drainage area tributary to the Upper and Lower Kelly Lakes. Seeking to improve the usability and to prevent deterioration of the natural assets and recreational potential of the Kelly Lakes, the riparian residents formed the Kelly Lakes Association, Inc., that has undertaken a lake-oriented program of community involvement, education, and management.

This program has included the participation of the Kelly Lakes Association in the Wisconsin Department of Natural Resources Self-Help Monitoring Program. In addition, the Association has undertaken an aggressive program of lake protection activities, including providing comment on proposed development and development-related issues, partnering with the municipal governments of the Village of Hales Corners and the City of New Berlin in stormwater management planning, cooperating with local schools and civic institutions utilizing the Lakes as an outdoor laboratory, and providing local residents and landowners with information on the lakes within their community. These activities have been undertaken by the Association and its partners pursuant to recommendations set forth in the current lake protection plan for the Upper and Lower Kelly Lakes.[1] In addition, the Kelly Lakes Association and the City of New Berlin have implemented stream and wetland restoration and stormwater management projects within the drainage area tributary to Upper Kelly Lake, as recommended in the current plan, during the planning period.

Specifically, this plan reviews the lake protection actions undertaken by the Kelly Lakes Association and its partners, and sets forth a refined and updated lake protection plan for the Kelly Lakes. This plan represents the ongoing commitment of the Kelly Lakes Association, the City of New Berlin, and the Village of Hales Corners to sound planning with respect to the Lakes. This plan was prepared over the period 2003-2005 by the Southeastern Wisconsin Regional Planning Commission (SEWRPC), in cooperation with the Kelly Lakes Association and includes the results of field surveys conducted by the Commission during 2005. The planning program was funded, in part, by Wisconsin Department of Natural Resources Chapter NR 190 Lake Management Planning Grants and Chapter NR 191 Lake Protection Grants awarded to the Kelly Lakes Association.

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[1]SEWRPC Memorandum Report No. 135, *A Lake Protection Plan for the Kelly Lakes, Milwaukee and Waukesha Counties, Wisconsin,* October 2000.

This plan, as was the current plan, is intended to form an integral part of any future comprehensive lake management plan for the Upper and Lower Kelly Lakes and Upper Root River watershed. The scope of this report is limited to a consideration of those further lake and watershed management measures that can be determined to contribute to the protection of lake water quality and lake use based upon the available data.

The lake protection and recreational use plan goals and objectives for the Kelly Lakes were developed in consultation with the City of New Berlin, the Village of Hales Corners, and the Kelly Lakes Association. The goals and objectives are:

1. To protect and maintain public health, and to promote public comfort, convenience, necessity, and welfare, through the environmentally sound management of the vegetation, fishery, and wildlife populations in and around the Kelly Lakes;

2. To provide for high-quality, water-oriented urban residential setting with recreational and aesthetic opportunities for residents and visitors to the Kelly Lakes, and to manage the Lakes in an environmentally sound manner; and,

3. To effectively maintain the water quality of the Kelly Lakes so as to better facilitate the conduct of water-related recreation, improve the aesthetic value of the resource to the community, and enhance the resource value of the waterbodies.

This refined plan, which conforms to the requirements and standards set forth in the relevant *Wisconsin Administrative Codes*,[2] should serve as a guide to the ongoing achievement of these objectives over time.

[2]This plan has been prepared pursuant to the standards and requirements set forth in Administrative Codes NR 1, *Public Access Policy for Waterways*; NR 103, *Water Quality Standards for Wetlands*; and, NR 107, *Aquatic Plant Management*.

Chapter II

INVENTORY FINDINGS

INTRODUCTION

The Kelly Lakes are located in the southeastern portion of the City of New Berlin, Waukesha County, and in the western portion of the Village of Hales Corners, Milwaukee County, as shown on Map 1. Lower Kelly Lake is a spring-fed lake, having an outlet to the north, into Upper Kelly Lake, through a wetland area and culvert. Upper Kelly Lake is a drainage lake, with a clearly defined, perennial inlet located on the southwestern shore and an intermittent inlet on the southern shore draining from Lower Kelly Lake. This hydrologic connection is clearly shown on the 1873 plat map, as shown on Map 2. Upper Kelly Lake has a well-defined outlet that flows to the east forming the headwaters of the Whitnall Park Creek, a tributary to the North Branch of the Root River.

The total drainage area tributary to the Kelly Lakes, located within the City of New Berlin in Waukesha County and the Village of Hales Corners in Milwaukee County, is approximately 983 acres in areal extent. More specifically, the drainage area tributary to Lower Kelly Lake is about 25 acres, while the remainder of the drainage area, approximately 958 acres in areal extent, drains to Upper Kelly Lake. The land uses in this area are primarily urban, with some open land including wetlands, woodlands, other natural areas, and some limited agricultural and other open lands. Urban-residential lands are the principal urban feature of the Kelly Lakes tributary drainage area.

WATERBODY CHARACTERISTICS

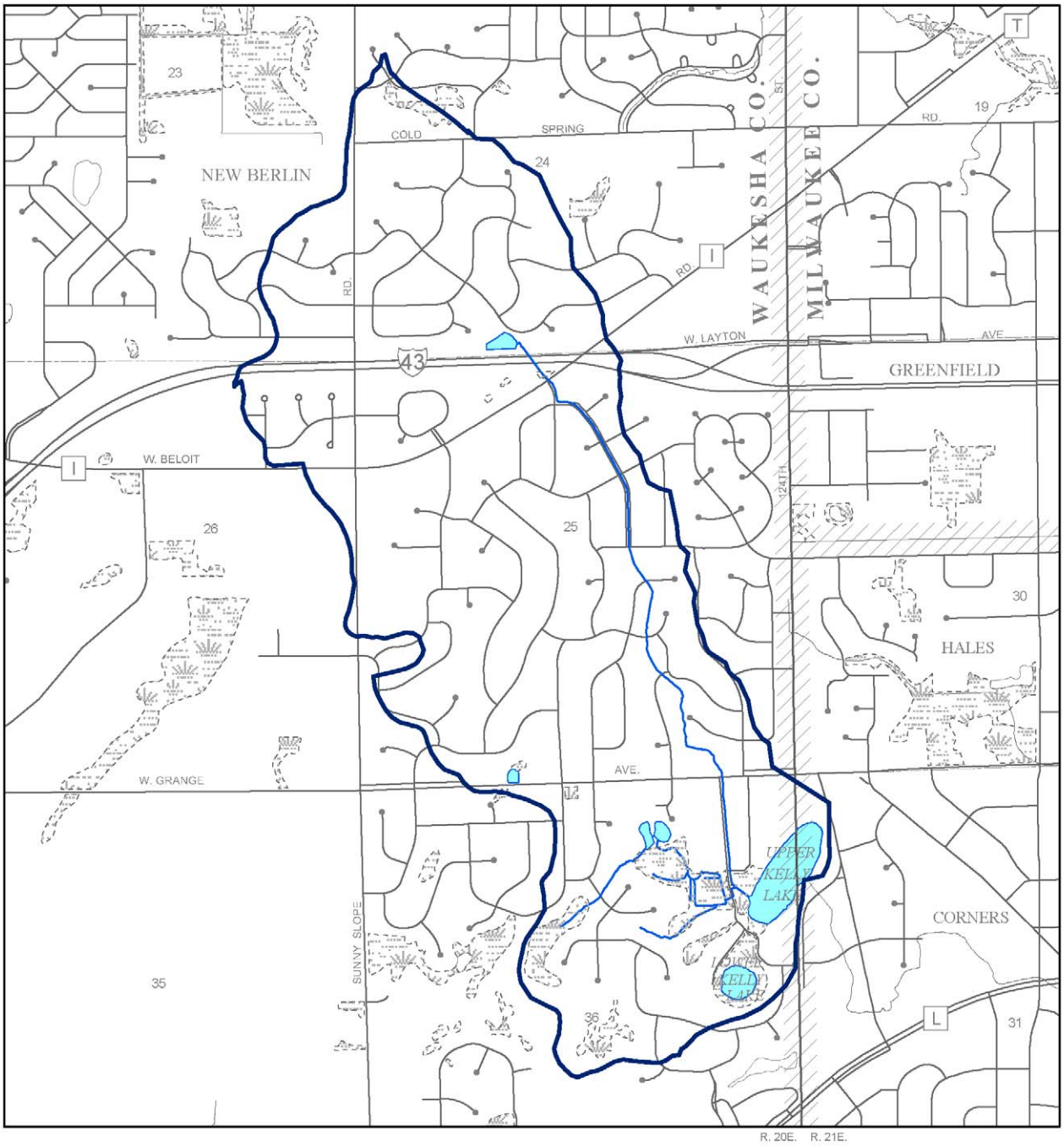
Lower Kelly Lake is a three-acre drained waterbody, which is primarily spring-fed with some contribution of water from localized surface runoff. It drains to the north to Upper Kelly Lake. Lower Kelly Lake is roughly circular in shape and has one large basin. The Lake has a maximum depth of 36 feet, a mean depth of 11.6 feet, and a volume of 35 acre-feet.

Upper Kelly Lake is a 12-acre drainage waterbody, which receives most of its water from surface runoff and some groundwater inflows. Upper Kelly Lake drains to the southeast to become the headwaters of the Whitnall Park Creek. The Lake is elongate in shape and has one large basin. Upper Kelly Lake has a maximum depth of 31 feet, a mean depth of 17 feet, and a volume of 211 acre-feet.

The hydrographical characteristics and the bathymetry of the two Lakes are shown in Table 1 and on Map 3, respectively.

Map 1

LOCATION OF UPPER AND LOWER KELLY LAKES



SURFACE WATER

STREAM

SUBWATERSHED BOUNDARY

Source: SEWRPC.

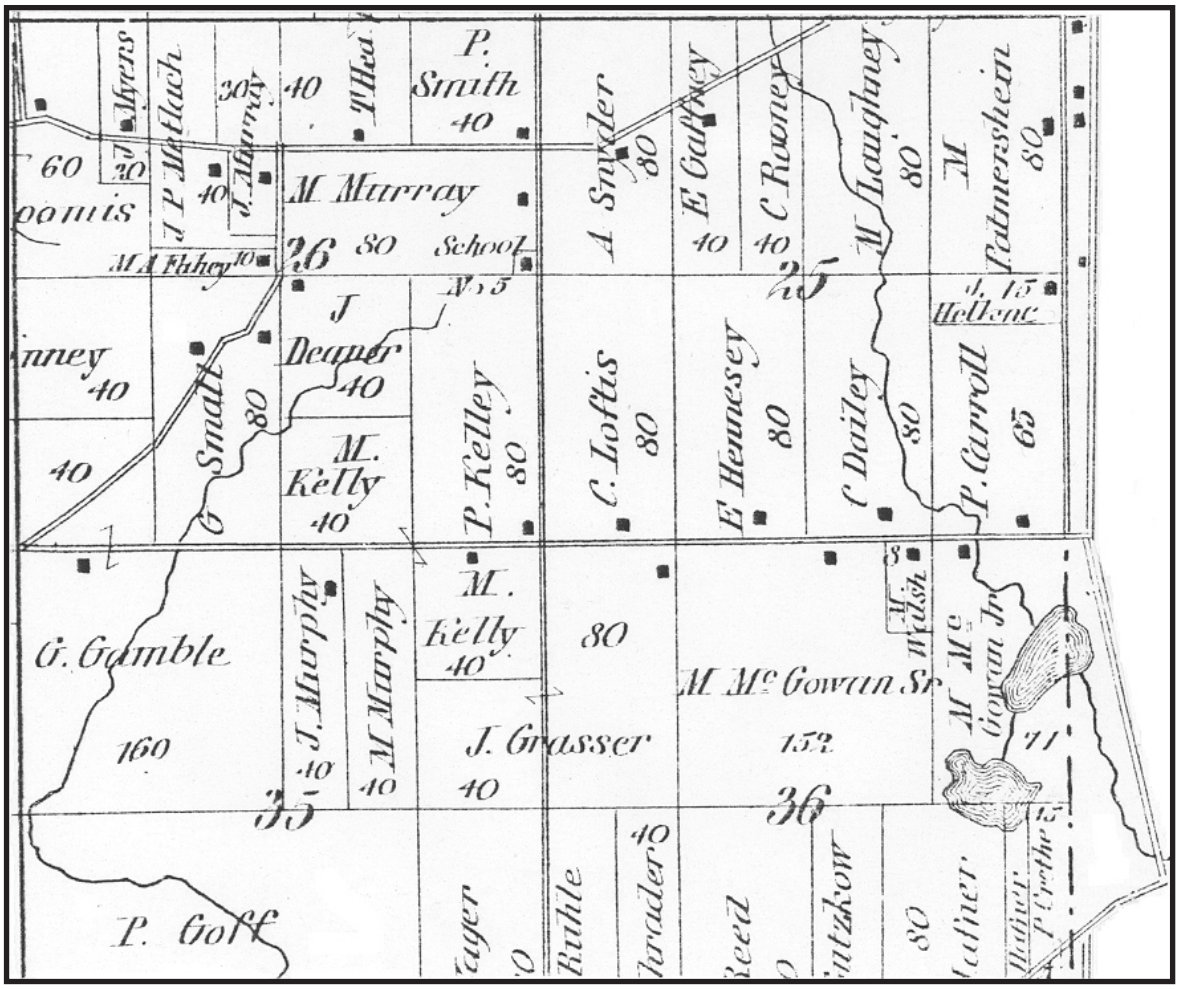
N

GRAPHIC SCALE

0 1,000 2,000 Feet

Map 2

HISTORIC PLAT MAP FOR THE KELLY LAKES AREA: 1873



Source: 1873 Atlas of Waukesha County, Wisconsin.

Table 1

HYDROGRAPHIC CHARACTERISTICS OF THE KELLY LAKES

Parameter	Upper Kelly Lake	Lower Kelly Lake
Surface Area	12 acres	3 acres
Volume	211 acre-feet	35 acre-feet
Maximum Depth	31 feet	36 feet
Mean Depth	17.0 feet	11.6 feet
Drainage Area	958 acres	25 acres

Source: SEWRPC.

LAND USE AND SHORELINE DEVELOPMENT

Population

As of 1990, there were approximately 2,500 persons residing within the drainage area tributary to the Kelly Lakes. There were approximately 850 housing units located within the drainage area tributary to the Kelly Lakes. By the year 2000, the population of the Kelly Lakes drainage area had increased to about 3,370 persons, residing in approximately 1,120 dwelling units. Urban development in the drainage area tributary to the Kelly Lakes consists primarily of residential development that has largely occurred prior to 1963, and since 1990, as shown on Map 4.

Land Use

Residential land uses occupy almost all of the upland portions of the shorelands of the Kelly Lakes, as shown on Map 5. With the exception of the wetland areas located on the southern and western shorelines of Upper Kelly Lake, residential land uses occupy the major portion of the shoreland of Upper Kelly Lake. Lower Kelly Lake is completely surrounded by wetland, with limited urban residential development located adjacent to the wetlands to the east and west of the Lake. The majority of the recent subdivision development has occurred in the northern portions of the drainage area tributary to Upper Kelly Lake and in the southwestern portions of the drainage area adjacent to Upper and Lower Kelly Lakes.

Public access to the Lakes is provided by a walk-in access at the City of New Berlin park site located at the southern end of Upper Kelly Lake, and a public recreational boating launch site located on the northeastern side of the Lake in the Village of Hales Corners. Parking facilities are not provided at this launch site.

The current lake protection plan indicated that, as of 1990, about 580 acres, or nearly 60 percent of the tributary drainage area, were devoted to urban uses, with residential lands forming the dominant urban land use, encompassing about 510 acres, or about 90 percent of the area in urban use. At that time, about 410 acres, or about 40 percent of the Kelly Lakes drainage area, were devoted to rural land uses. Approximately 270 acres, or about 65 percent of the rural area, were in agricultural and open land uses. Woodlands, wetlands, and surface waters, including the surface area of the Kelly Lakes accounted for approximately 140 acres, or about 35 percent of the rural land uses. Under buildout conditions, conversion of the majority of the remaining rural lands, excepting wetlands and woodlands—comprising the secondary environmental corridor lands and isolated natural resource features, and the portion of the Valley View Park—within the drainage area tributary to the Kelly Lakes to urban land uses was envisioned.

The existing year 2000 land use pattern in the drainage area tributary to the Kelly Lakes is shown on Map 5 and is quantified in Table 2. By the year 2000, urban land uses had increased to near buildout levels, with a concomitant reduction in the acreage of rural lands. Woodlands, wetlands, and environmental corridor lands within the

Map 3

BATHYMETRIC MAP OF UPPER AND LOWER KELLY LAKES

DATE OF PHOTOGRAPHY: APRIL 2005

— 20' — WATER DEPTH CONTOUR IN FEET

MONITORING SITE

PUBLIC ACCESS SITE

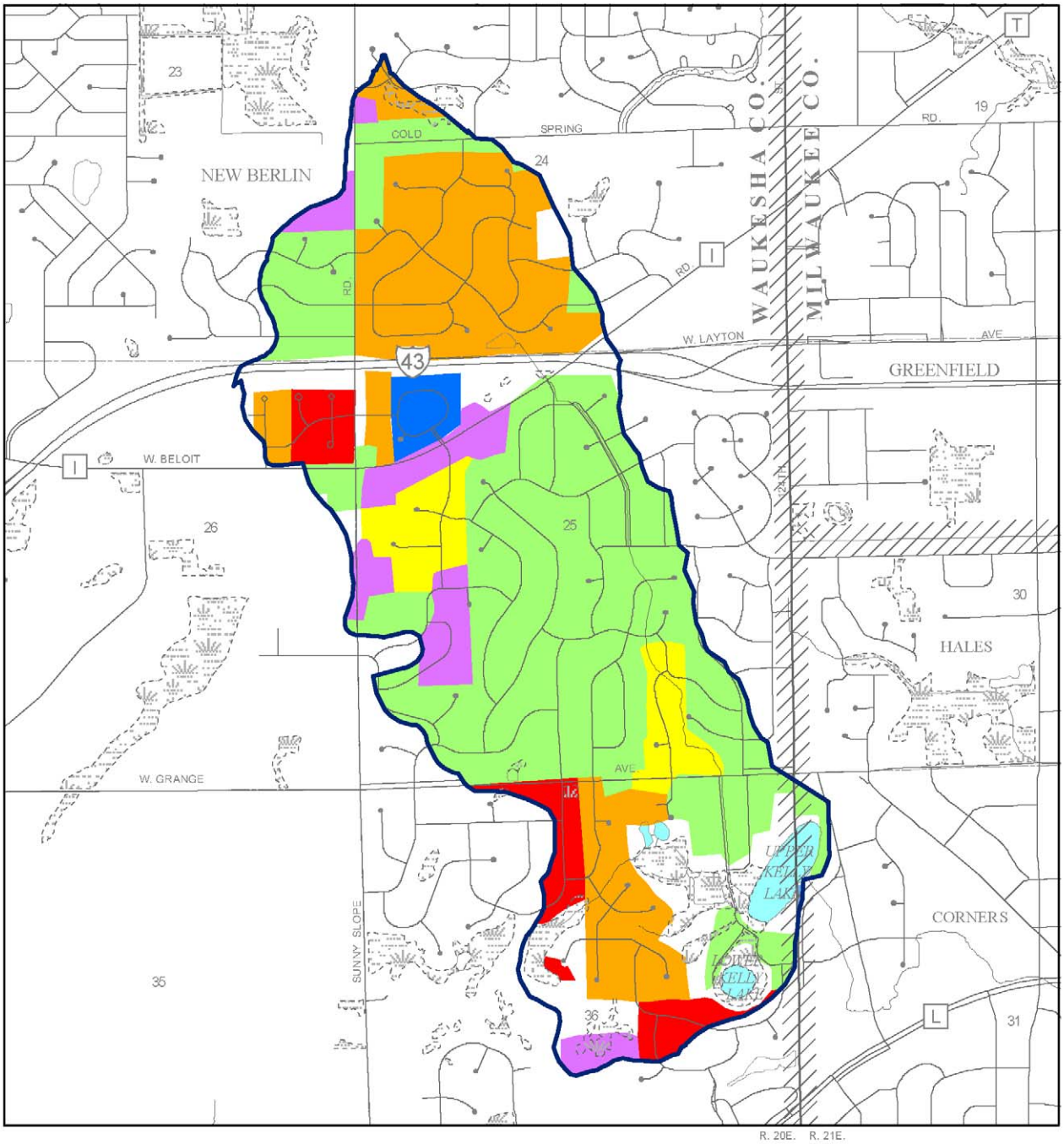
GRAPHIC SCALE

0 200 400 FEET

Source: U.S. Geological Survey and SEWRPC.

Map 4

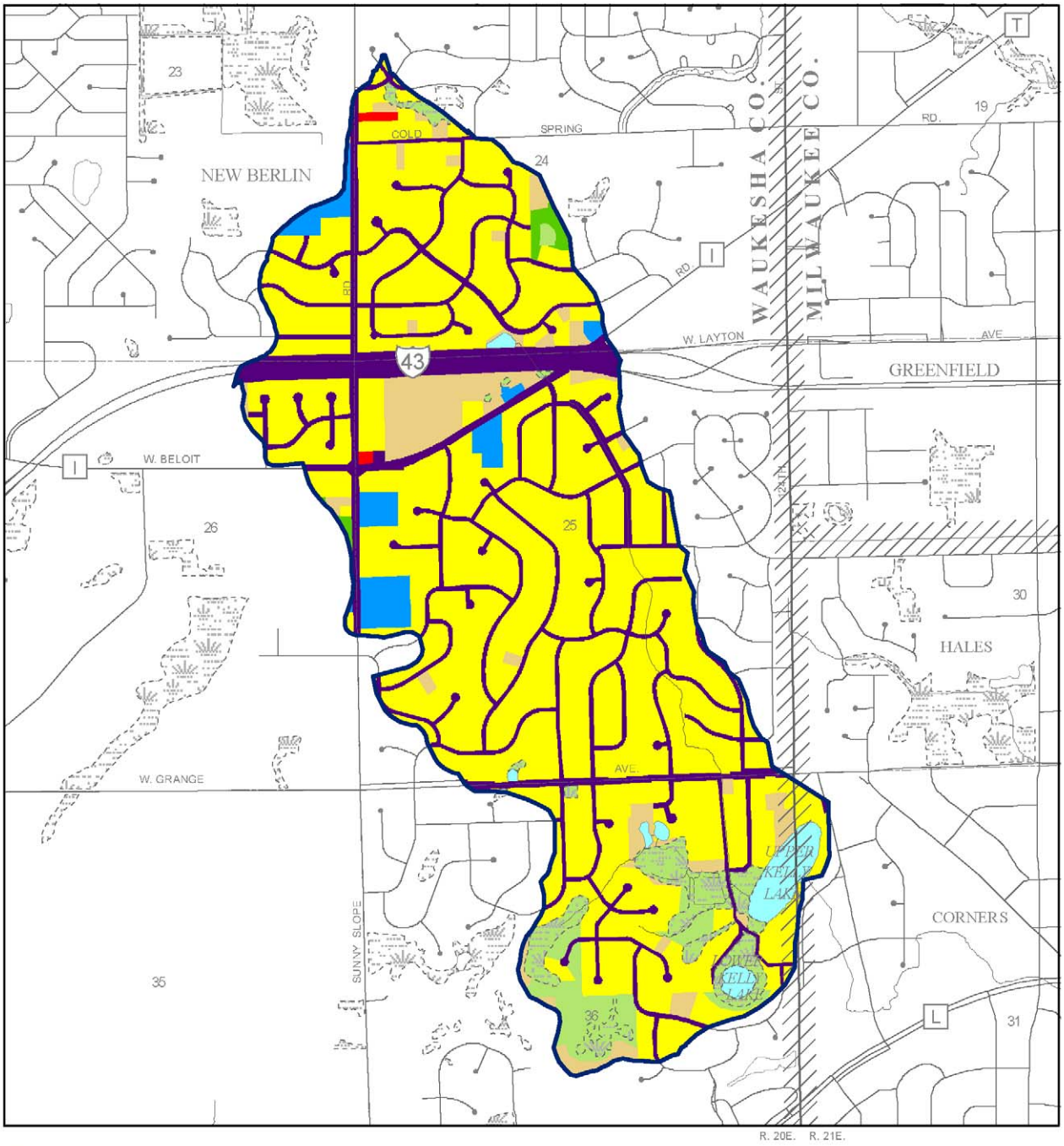
HISTORIC URBAN GROWTH WITHIN THE TOTAL AREA TRIBUTARY TO THE KELLY LAKES: 1963-2005



Source: SEWRPC.

Map 5

GENERALIZED LAND USE WITHIN THE TOTAL AREA TRIBUTARY TO THE KELLY LAKES: 2000



SINGLE-FAMILY RESIDENTIAL
COMMERCIAL
TRANSPORTATION, COMMUNICATIONS, AND UTILITIES
GOVERNMENT AND INSTITUTIONAL
RECREATION
WETLANDS AND WOODLANDS
SURFACE WATER
AGRICULTURAL, UNUSED, AND OTHER OPEN LANDS

Source: SEWRPC.

N

GRAPHIC SCALE
0 1,000 2,000 Feet

Table 2

EXISTING AND RECOMMENDED LAND USE WITHIN THE TOTAL TRIBUTARY DRAINAGE AREA TO THE KELLY LAKES

Land Use Categories	2000		Buildout	
	Acres	Percent of Drainage Area	Acres	Percent of Drainage Area
Urban				
Residential	625	63.5	782	79.6
Commercial	2	0.2	6	0.6
Industrial	- -	- -	- -	- -
Governmental and Institutional	26	2.6	24	2.4
Transportation and Utilities	185	18.8	35	3.6
Recreational	5	0.5	11	1.1
Subtotal	843	85.6	858	87.3
Rural				
Agricultural	56	5.9	- -	- -
Wetlands	40	4.1	58	5.9
Woodlands	25	2.5	38	3.9
Water	19	1.9	19	1.9
Other Open Land	- -	- -	10	1.0
Subtotal	140	14.4	125	12.7
Total	983	100.0	983	100.0

Source: SEWRPC.

drainage area tributary to the Kelly Lakes, as shown on Map 6, comprise the major rural land features within the watershed. Planned buildout land uses, per the adopted regional land use plan and Waukesha County development plan, are shown on Map 7.[1] In terms of these plans, limited infilling of existing platted lots with additional low-density, single-family residential development, and redevelopment of existing residential lots within the tributary drainage area of the Lakes also is expected to occur.

WATER QUALITY

Based on Secchi-disk transparency measurements obtained by the IPS Environmental and Analytical Services, Inc., during 1995 and 1996,[2] and by Commission staff during 1997, the Upper and Lower Kelly Lakes have poor to good, and fair to very good water quality, respectively. Longer term Secchi-disk transparency values reported by the Upper Kelly Lake volunteer water quality monitor to the Wisconsin Department of Natural Resources Self-Help Monitoring Program, summarized in Figure 1 and Table 3, ranged from about 1.5 feet to 11 feet, or from very poor to very good based upon the typical data ranges for Wisconsin Lakes determined by the Wisconsin Department of Natural Resources.[3] These longer-term data suggest that, in the case of Upper Kelly Lake, the

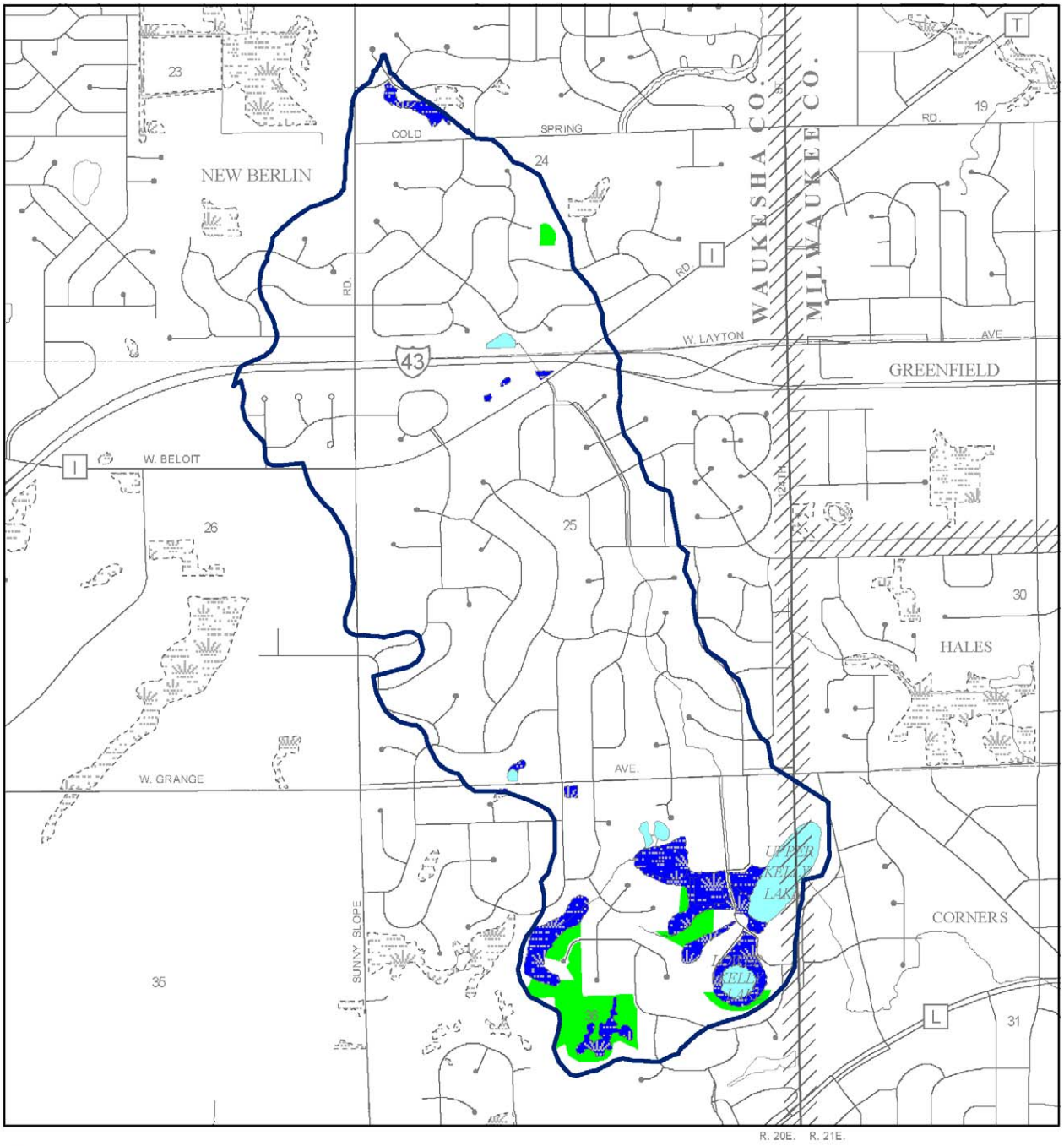
[1]*SEWRPC Planning Report No. 40,* A Regional Land Use Plan for Southeastern Wisconsin—2010, *January 1992; SEWRPC Community Assistance Planning Report No. 209,* A Development Plan for Waukesha County, Wisconsin, *August 1996.*

[2]*IPS Environmental and Analytical Services, Inc.*, Phase I Lake Management Plan, Upper and Lower Kelly Lakes, Waukesha and Milwaukee Counties, Wisconsin, *March 1997.*

[3]*R.A. Lillie and J.W. Mason, Wisconsin Department of Natural Resources Technical Bulletin No. 138,* Limnological Characteristics of Wisconsin Lakes, *1983.*

Map 6

WOODLANDS AND WETLANDS WITHIN THE TOTAL AREA TRIBUTARY TO THE KELLY LAKES: 2000



WETLANDS

WOODLANDS

SURFACE WATER

Source: SEWRPC.

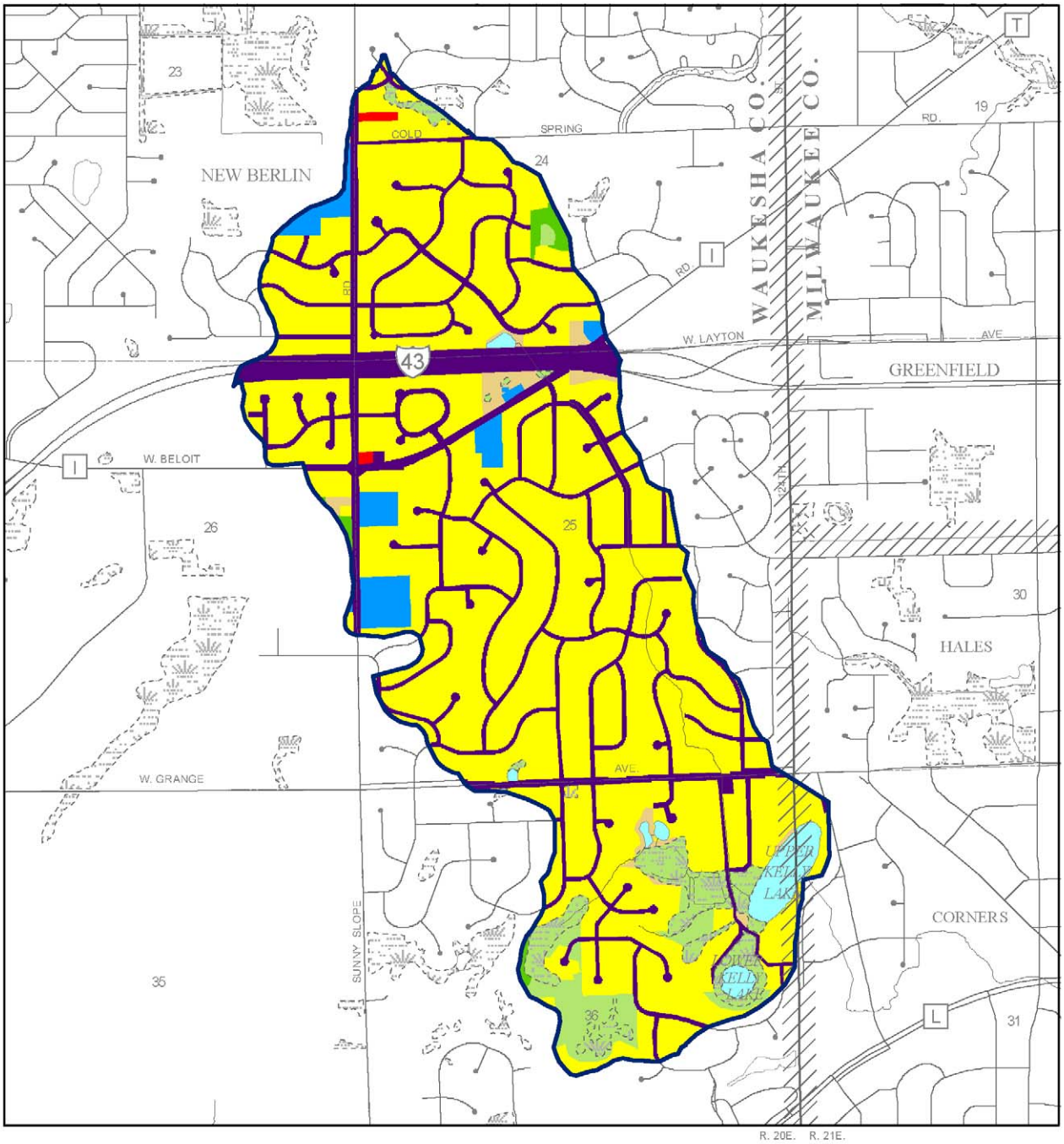
N

GRAPHIC SCALE

0 1,000 2,000 Feet

Map 7

PLANNED LAND USE WITHIN THE TOTAL AREA TRIBUTARY TO THE KELLY LAKES: 2020



- SINGLE-FAMILY RESIDENTIAL
- COMMERCIAL
- TRANSPORTATION, COMMUNICATIONS, AND UTILITIES
- GOVERNMENT AND INSTITUTIONAL
- RECREATION
- WETLANDS AND WOODLANDS
- SURFACE WATER
- AGRICULTURAL, UNUSED, AND OTHER OPEN LANDS

Source: SEWRPC.

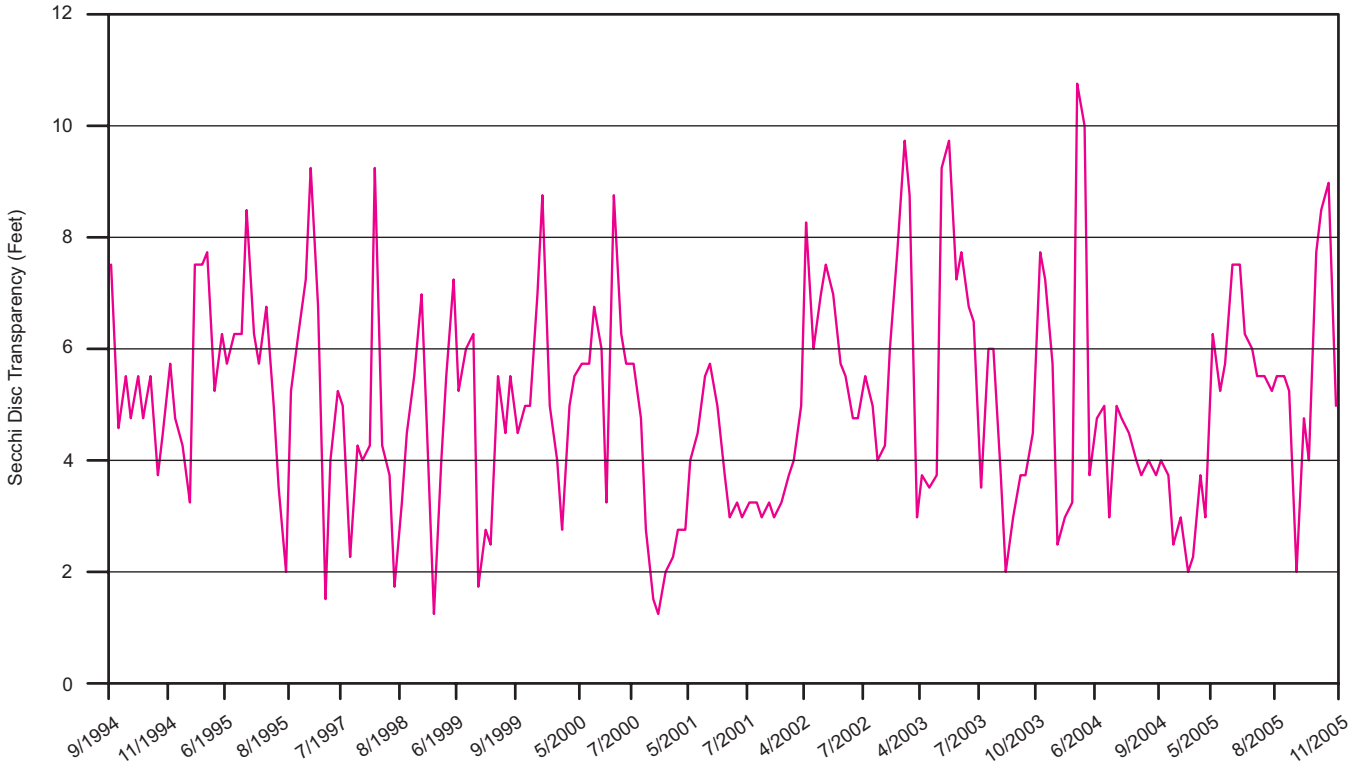
N

GRAPHIC SCALE

0 1,000 2,000 Feet

Figure 1

VARIATIONS IN SECCHI DISC TRANSPARENCY IN UPPER KELLY LAKE: 1994-2005



Source: Wisconsin Department of Natural Resources and SEWRPC.

values reported during the initial planning period were not dissimilar to those obtained more recently, and over the longer—decadal—period of record. During this approximately 11-year period of record, Secchi-disk transparencies averaged about five feet. These data suggest that water quality conditions in the Kelly Lakes have remained stable throughout a period of intensive urban density residential development within the tributary drainage area.[4]

The annual average surface water total phosphorus concentration of Upper Kelly Lake, reported by IPS Environmental and Analytical Services, Inc., for the period 1995-1996—summarized in Table 3, was approximately 58 micrograms per liter (µg/l), with an annual average chlorophyll-*a* concentration of 22 µg/l. In Lower Kelly Lake, the average surface water total phosphorus concentration was about 24 µg/l, and the average chlorophyll-*a* concentration was 6.5 µg/l. These data were similar to those obtained during 1996 by Wisconsin Department of Natural Resources staff and during 1997 by Commission staff. Surface water phosphorus concentrations measured during 1997 were 58 µg/l and 25 µg/l, in the Upper and Lower Kelly Lakes respectively, with corresponding chlorophyll-*a* concentrations of 18 µg/l and 9.0 µg/l. The surface water total phosphorus

[4]Ibid.*: Secchi-disk transparencies of between zero feet and three feet are reported to be indicative of very poor water quality; three feet and five feet, poor water quality; five feet and seven feet, fair water quality, seven feet and 10 feet, good water quality; 10 feet to 20 feet, very good water quality; and, greater than 20 feet, excellent water quality.*

Table 3

WATER QUALITY DATA FOR UPPER AND LOWER KELLY LAKES: 1995-1997[a]

Parameter	Upper Kelly Lake		Lower Kelly Lake	
	Winter	Summer	Winter	Summer
Water Temperature (^{o}F)	34 - 77	43-79	34-40	40-80
Secchi-Disc (feet)	2.5-9.75	1.3-10.8	4.3	8.5-14.7
Total Nitrogen (mg/l)	- -	1.058-1.078	0.9-2.8	- -
Total Phosphorus (mg/l)	0.035-1.095	0.031-1.130	0.035-0.435	0.016-0.686
Orthophosphorus (mg/l)	0.025-0.143	0.004-1.020	0.001-0.236	0.002-0.324
Chlorophyll-*a* (mg/l)	10.9-41.3	1.1-39.6	15.6-19.3	0.5-16.1

[a]*Secchi-disc data for Upper Kelly Lake are for the period 1994-2005.*

Source: IPS Environmental and Analytical Services, Inc.; Wisconsin Department of Natural Resources; and SEWRPC.

concentrations and chlorophyll-*a* concentrations are indicative of poor water quality in the case of Upper Kelly Lake, while these values are indicative of good water quality in Lower Kelly Lake.[5]

The observed water quality conditions are indicative of some potential problems, especially in Upper Kelly Lake where chlorophyll-*a* concentrations exceeded the 10 µg/l threshold generally considered as the lowest concentration at which lake water will appear greenish in color. The spring surface water total phosphorus concentrations in both lakes were in excess of the standard of 20 µg/l recommended by the Regional Planning Commission as the value below which few water quality problems are likely to occur. Based on the total phosphorus data, Upper Kelly Lake is a eutrophic waterbody, with a Wisconsin Trophic State Index (WTSI) value of about 60, while Lower Kelly Lake has a WTSI value of about 53 indicating that it is a meso-eutrophic waterbody, as shown in Figure 2.[6] Eutrophic lakes are fertile lakes that support abundant aquatic plant growths and may support productive fisheries. Nuisance growths of algae and plants are common in eutrophic lakes, and may occur in meso-eutrophic lakes. Many of the lakes in southeastern Wisconsin are classified as mesotrophic or meso-eutrophic.[7]

Data obtained by IPS Environmental and Analytical Services, Inc., and the Wisconsin Department of Natural Resources during 1995-1996 indicated that the Kelly Lakes stratify during the summer months, exhibiting both thermal and dissolved oxygen concentration stratification with depth for the months of June through September, and during the winter months. These data are typical of dimictic lakes in the temperate zone, with depletion of

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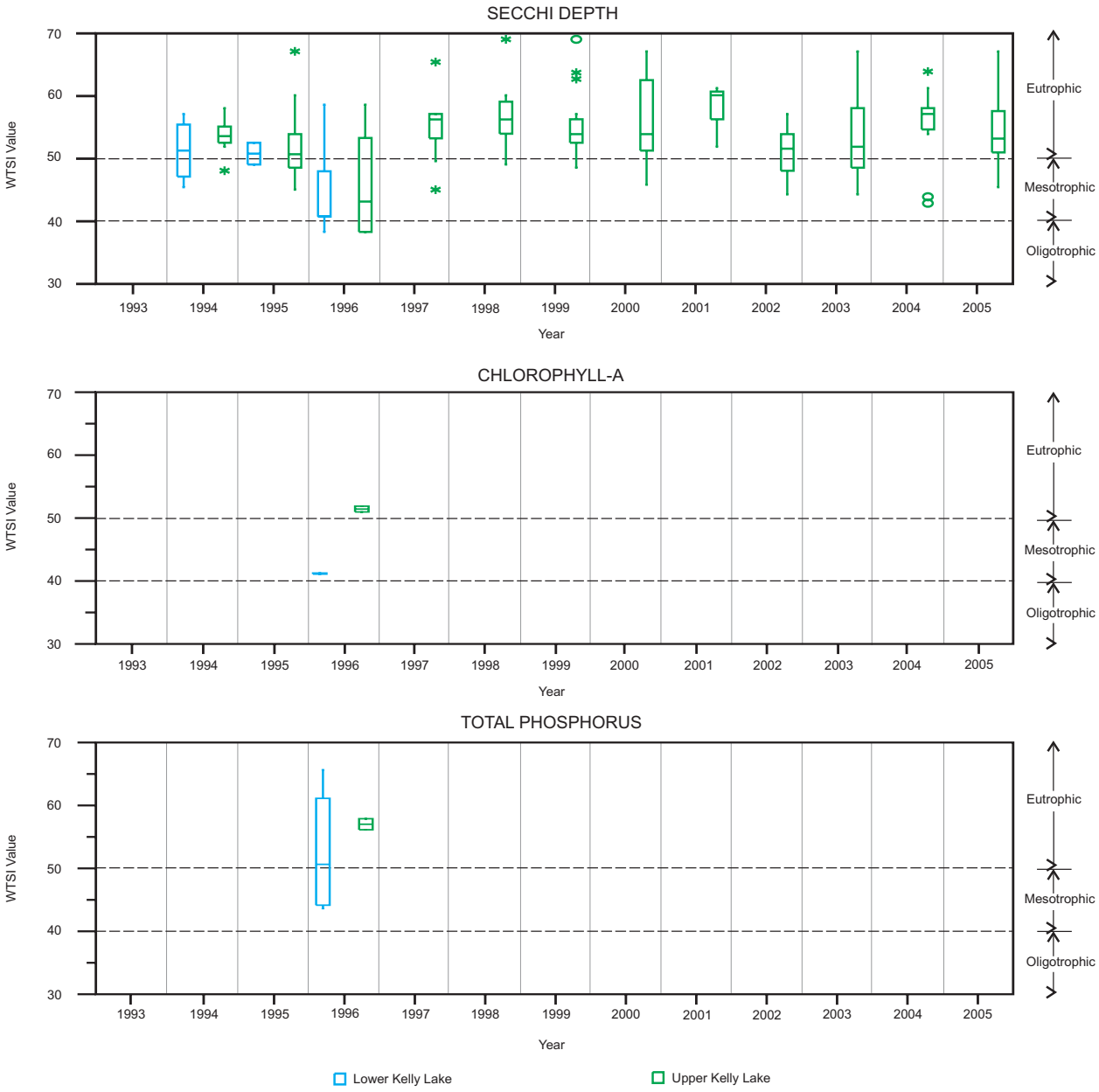
[5]Ibid.*: total phosphorus concentrations of less than 10 µg/l are indicative of very good to excellent water quality; 10 µg/l to 30 µg/l, good water quality; 30 µg/l to 50 µg/l, fair water quality; 50 µg/l to 150 µg/l, poor water quality; and, greater than 150 µg/l, very poor water quality . Chlorophyll* a *concentrations of less than 5 µg/l are indicative of very good to excellent water quality; 5 µg/l to 10 µg/l, good water quality; 10 µg/l to 15 µg/l, fair water quality; and 15 µg/l to 30 µg/l, poor water quality.*

[6]*R.A. Lillie, S. Graham, and P. Rasmussen, "Trophic State Index Equations and Regional Predictive Equations for Wisconsin Lakes,"* Research and Management Findings, *Wisconsin Department of Natural Resources Publication No. PUBL-RS-735 93, May 1993.*

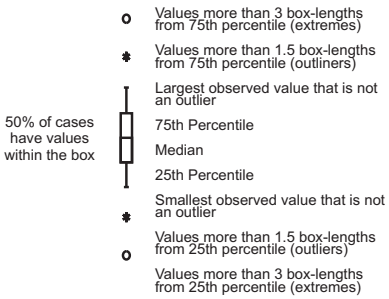
[7]*See R.A. Lillie, and J.W. Mason, Wisconsin Department of Natural Resources Technical Bulletin No. 138,op. cit.; also see SEWRPC Memorandum Report No. 93,* A Regional Water Quality Management Plan for Southeastern Wisconsin: An Update and Status Report, *March 1995.*

Figure 2

VARIATIONS IN WISCONSIN TROPHIC STATE INDEX VALUES IN THE UPPER AND LOWER KELLY LAKES, MILWAUKEE AND WAUKESHA COUNTIES: 1993-2005



Description of Symbols



Source: Wisconsin Department of Natural Resources and SEWRPC.

hypolimnetic or lake bottom water oxygen being common in mesotrophic and eutrophic waterbodies.[8] The increased conductivity in the hypolimnion, or bottom waters, of the Kelly Lakes, indicates a degree of internal loading occurring in the Lakes, the impact of which is related to the rate at which the Lakes mixes from top to bottom during the spring and fall overturn events. In spring and fall, differential warming and cooling of the lake surface waters, respectively, alters the density of lake waters in such a manner as to promote mixing of lake water. When the mixing process is relatively slow, on the order of days to weeks, minerals and nutrients released from the lake sediments into the hypolimnion of the lake tend to recombine with the multivalent cations, such as iron, calcium, and aluminum, present in the lake sediments and precipitate out of the water column. Conversely, if the mixing process is relatively rapid, on the order of hours or days as may occur due to the passage of an intense storm, the minerals and nutrients may be mixed upward into the epilimnion or surface waters where they are available for plant growth. Given the location of the Kelly Lakes within a wind-sheltered depression, it could be suggested that internal loading is likely to be minimal. This hypothesis is supported by the good agreement between predicted and observed total phosphorus concentrations in the Lakes.[9] However, observations by Commission staff during July 1998, revealed calcium carbonate, or marl, deposition on aquatic plants in Upper Kelly Lake, which would indicate some degree of groundwater inflow to this lake. Marl deposition occurs as a result of pH changes between the groundwater and lake water which results in the precipitation of dissolved calcium carbonate carried into Upper Kelly Lake by the groundwater inflows.[10]

POLLUTANT LOADINGS

Pollutant loads to a lake are generated by various natural processes and human activities that take place in the drainage area tributary to a lake. These loads are transported to the lake through the atmosphere, across the land surface, and by way of inflowing streams. Pollutants transported by the atmosphere are deposited onto the surface of the lake as dry fallout and direct precipitation. Pollutants transported across the land surface enter the lake as direct runoff and, indirectly, as groundwater inflows. Pollutants transported by streams enter a lake as surface water inflows. In drained lakes, like Lower Kelly Lake, pollutants are transported across the land surface directly tributary to the lake, and in the absence of point source discharges from industries or wastewater treatment facilities, comprise the principal route by which contaminants enter a waterbody.[11] Similarly, in drainage lakes, like Upper Kelly Lake, pollutants enter the waterbody in runoff from across the land surface directly tributary to the lake and from runoff collected by tributary streams from within a larger tributary watershed. There are no known point sources of water pollutants within the Kelly Lakes total tributary drainage area,[12] and all residential lands within the total tributary drainage area are served by public sanitary sewers. For this reason, the discussion that follows is based upon nonpoint source pollutant loadings to the Kelly Lakes.

The nonpoint source pollutant loads to the Kelly Lakes were estimated on the basis of 1990 land use inventory data and unit area load coefficients determined for southeastern Wisconsin. Annual contaminant loads entering the Kelly Lakes were calculated to be approximately 200 tons of sediment; 220 pounds of phosphorus; and 40

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[8]*R.G. Wetzel,* Limnology, *Saunders, Philadelphia, 1975.*

[9]*Estimates of the long-term annual average total phosphorus concentration in Kelly Lakes were derived from the WILMS model, described in Wisconsin Department of Natural Resources Publication No. PUBL-WR-363-96 REV,* Wisconsin Lake Model Spreadsheet, Version 2.00, User's Manual, *June 1994.*

[10]*W. Stumm, and J.J. Morgan,* Aquatic Chemistry: An Introduction Emphasizing Chemical Equilibria in Natural Waters, *Wiley-Interscience, New York, 1970.*

[11]*S.-O. Ryding and W. Rast,* The Control of Eutrophication of Lakes and Reservoirs, *Unesco Man and the Biosphere Series, Volume 1, Parthenon Press, Carnforth, 1989.*

[12]*SEWRPC Memorandum Report No. 93,* A Regional Water Quality Management Plan for Southeastern Wisconsin: An Update and Status Report, *March 1995.*

pounds and 195 pounds of copper and zinc, respectively, as shown in Table 4. Copper and zinc were used in this analysis as surrogates for metals and other pollutants that are contributed primarily from urban sources.

To validate the estimated contaminant loads to the Kelly Lakes, Commission staff applied the estimated phosphorus load of about 220 pounds in the Vollenweider-type OECD phosphorus budget model to estimate an in-lake total phosphorus concentration. This calculation resulted in an estimated annual average phosphorus concentration of about 53 μg/l, which value corresponds reasonably well to the observed in-lake phosphorus concentration of about 58 μg/l. This agreement would suggest that the estimated contaminant loads are a reasonable representation of the loads entering the Kelly Lakes, and that other pollutant sources, including internal loading, to the Kelly Lakes, are relatively small compared to the loading from external sources.

The relative percentage contributions of the various land uses to the pollutant loads to the Kelly Lakes suggest that, based on 1990 land use conditions in the drainage area tributary to the Kelly Lakes, about 40 percent of the phosphorus load to Upper Kelly Lake was contributed from open lands within the tributary drainage area; about 5 percent from wetlands, woodlands, and surface waters; and about 55 percent from residential areas, while, for Lower Kelly Lake, almost all of the phosphorus load was contributed from residential areas. About 70 percent of the sediment load to Upper Kelly Lake was generated from urban sources; about 30 percent from agricultural and open lands; and less than 1 percent from woodlands, wetlands, and surface water sources. For Lower Kelly Lake, virtually the entire sediment load was contributed from urban sources.

Of the controllable pollutant sources, the most significant sources under existing land use condition are urban lands, which generate the largest percentage of sediment, nutrient, and metals loadings. Control of contaminants from these various sources can be effected through a variety of measures, as set forth in Chapter IV.

GROUNDWATER RESOURCES

Groundwater resources constitute an extremely valuable element of the natural resource base related to the Kelly Lakes, both as a source of water, especially to Lower Kelly Lake, and as a component of the surface water system. Groundwater in the vicinity of the Kelly Lakes is available from three aquifers.[13] From the land surface downward, they are the sand and gravel aquifer, of approximately 100 feet in thickness in the vicinity of the Kelly Lakes; the dolomite aquifer, of approximately 300 feet in thickness; and, the sandstone aquifer, of approximately 1,600 feet in thickness, comprising the deep artesian system. The sand and gravel aquifer, consisting of water-bearing sand and gravel, and the dolomite aquifer, are underlain by the Maquoketa shale layer of approximately 200 feet in thickness and the deep sandstone aquifer. The shallow sand and gravel aquifer is the most significant in terms of its relationship with the Kelly Lakes and its tributary surface waters and adjacent wetlands. The groundwater in that aquifer flows from northwest to southeast across the Lakes, as shown on Map 8,[14] and has a direct affect on water quality and lake levels.

SOIL TYPES AND CONDITIONS

Soil type, land slope, and land use and management practices are among the more important factors determining lake water quality conditions. Soil type, land slope, and vegetative cover are also important factors affecting the rate, amount, and quality of stormwater runoff. The soil texture and soil particle structure influence the permeability, infiltration rate, and erodibility of soils. Land slopes are also important determinants of stormwater runoff rates and of susceptibility to erosion.

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[13] *An aquifer is a water-bearing stratum of rock, sand or gravel.*

[14] *J.B. Gonthier, U.S. Geological Survey Water-Resources Investigations Open-File Report No. 79-43,* Water-Table Map of Waukesha County, Wisconsin, *May 1979; M.G. Sherrill, J.J. Schiller, and J.R. Erickson, U.S. Geological Survey Water-Resources Investigations Open-File Report No. 79-40,* Water-Table Map of Milwaukee County, Wisconsin, *May 1979.*

Table 4

FORECAST ANNUAL POLLUTANT LOADINGS TO UPPER AND LOWER KELLY LAKES BY LAND USE CATEGORY: 1990

Land Use Category	Pollutant Loads			
	Sediment (tons)	Phosphorus (pounds)	Copper (pounds)	Zinc (pounds)
Urban				
Residential	54.9	113.5	10.2	71.3
Commercial	2.9	1.3	1.3	8.9
Transportation	17.1	7.3	26.2	95.2
Governmental and Institutional	5.4	4.9	1.7	19.2
Park and Open Space	0.4	6.9	- -	- -
Subtotal	80.7	133.9	39.4	194.6
Rural				
Agricultural	120.4	86.6	- -	- -
Atmosphere	- -	1.5	- -	- -
Total	201.1	222.0	39.4	194.6

Source: SEWRPC.

The U.S. Natural Resources Conservation Service, under contract to the Southeastern Wisconsin Regional Planning Commission, completed a detailed soil survey of the Kelly Lakes area in 1966.[15] Using the regional soil survey, an assessment was made of the hydrologic characteristics of the soils in the drainage area tributary to the Kelly Lakes. Soils within the drainage area tributary to the Kelly Lakes were categorized into four main hydrologic soil groups, as well as an "other" category which included disturbed and filled lands, as shown on Map 9. Approximately 5 percent of the total tributary drainage area is covered by moderately drained soils, about 80 percent of the tributary drainage area by poorly drained soils, and about 10 percent is covered with very poorly drained soils, with the remaining areas of the watershed being surface water as shown on Map 9.

AQUATIC PLANTS, DISTRIBUTION, AND MANAGEMENT AREAS

Surveys of the aquatic plant flora of the Kelly Lakes were conducted by Commission staff during June 1997 and July 2005.[16] The results of the 2005 survey are tabulated in Tables 5 and 6, for Lower and Upper Kelly Lakes, respectively. The statistical evaluation of changes in the aquatic plant community within the Lake included: [17]

1. The frequency of occurrence (FREQ) is the number of occurrences of a species divided by the number of samples with vegetation, expressed as a percentage. It is the percentage of times a particular species occurred when there was aquatic vegetation present, and is analogous to the Jesson and Lound point system.

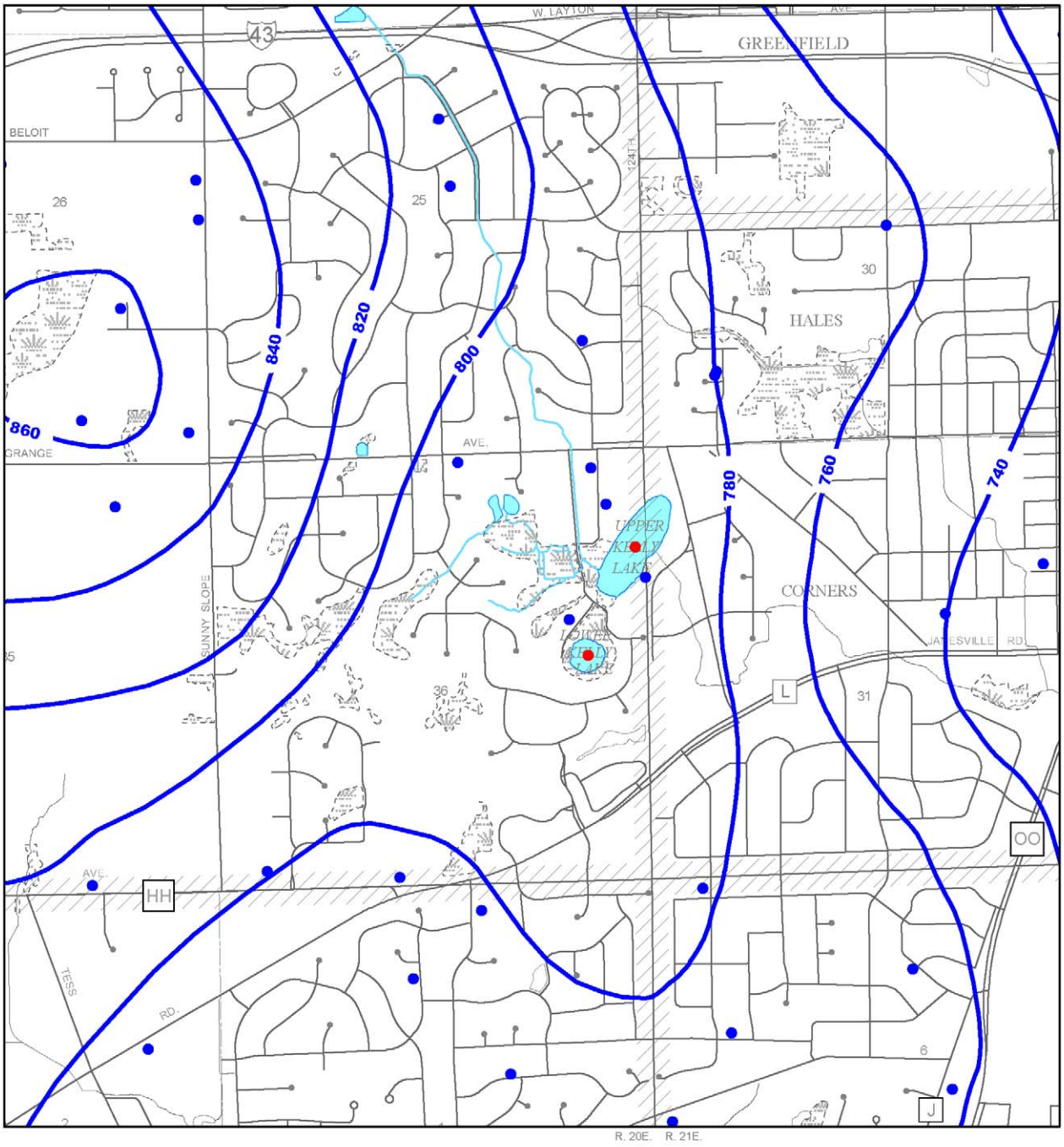
[15] *SEWRPC Planning Report No. 8,* The Soils of Southeastern Wisconsin, *June 1966.*

[16] *R. Jesson, and R. Lound, Minnesota Department of Conservation Game Investigational Report No. 6,* An Evaluation of a Survey Technique for Submerged Aquatic Plants, *1962.*

[17] *Memo from Stan Nichols, to J. Bode, J. Leverence, S. Borman, S. Engel, D., Helsel, entitled "Analysis of macrophtye data for ambient lakes-Dutch Hollow and Redstone Lakes example," Wisconsin Geological and Natural History Survey, University of Wisconsin-Extension, February 4, 1994.*

Map 8

WATER TABLE CONTOURS IN THE VICINITY OF THE KELLY LAKES



800 — AVERAGE WATER-TABLE ELEVATION (FEET ABOVE NATIONAL GEODETIC VERTICAL DATUM, 1929) AT A 20-FOOT CONTOUR INTERVAL

WELL DATA POINT

SURFACE WATER POINT

SURFACE WATER

N

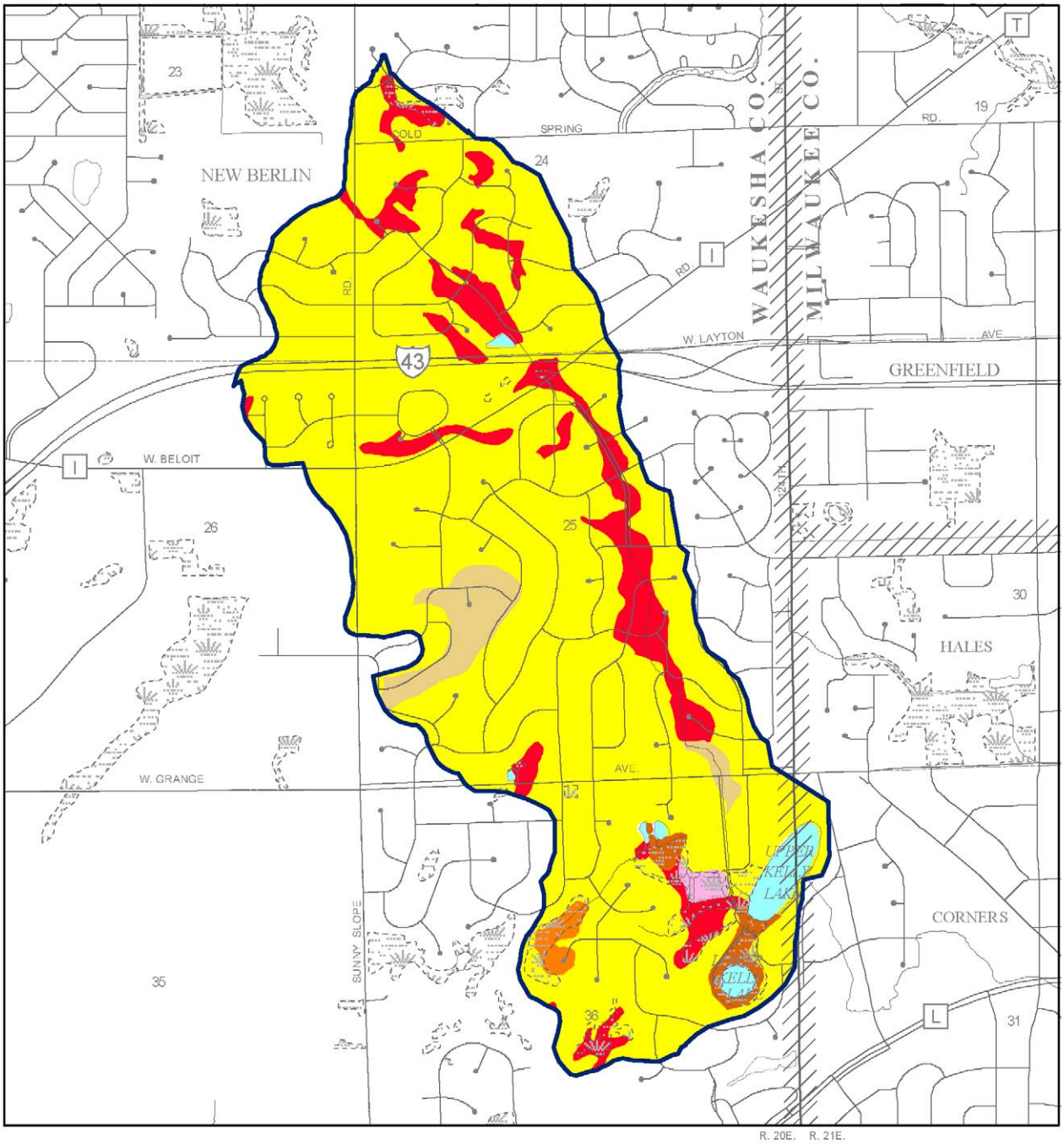
GRAPHIC SCALE

0 1,000 2,000 Feet

Source: SEWRPC.

Map 9

HYDROLOGIC SOIL GROUPS WITHIN THE TOTAL AREA TRIBUTARY TO THE KELLY LAKES



- GROUP A / D: WELL-DRAINED SOIL / VERY POORLY DRAINED SOIL (Well-drained soil if water table is lowered through provision of a drainage system. Very poorly drained soil if water table is not lowered.)
- GROUP B: MODERATELY DRAINED SOIL
- GROUP B / D: MODERATELY DRAINED SOIL / POORLY DRAINED SOIL (Moderately drained soil if water table is lowered through provision of a drainage system. Very poorly drained soil if water table is not lowered.)
- GROUP C: POORLY DRAINED SOIL
- GROUP C / D: POORLY DRAINED SOIL / VERY POORLY DRAINED SOIL (Poorly drained soil if water table is lowered through provision of a drainage system. Very poorly drained soil if water table is not lowered.)
- GROUP D: VERY POORLY DRAINED SOIL
- SURFACE WATER

N

GRAPHIC SCALE
0 1,000 2,000 Feet

Source: U.S. Department of Agriculture Natural Resource Conservation Service and SEWRPC.

Table 5

FREQUENCY OF OCCURRENCE AND DENSITY RATINGS OF SUBMERGENT PLANT SPECIES IN LOWER KELLY LAKE: JULY 2005

Plant Species	Sites Found	Frequency of Occurrence (percent)	Relative Frequency (percent)	Relative Density in Whole Lake	Importance Value
Ceratophyllum demersum (coontail)	24	100.0	37.5	3.80	142.5
Chara vulgaris (muskgrass)	3	12.5	4.7	0.20	0.9
Myriophyllum spp. (native milfoil)	1	4.2	1.6	0.04	0.1
Potamogeton amplifolius (large-leaf pondweed)	5	20.8	7.8	0.50	3.9
Potamogeton foliosus (leafy pondweed)	7	29.2	10.9	0.50	5.5
Potamogeton natans (floating-leaf pondweed)	3	12.5	4.7	0.20	0.9
Potamogeton pectinatus (Sago pondweed)	7	29.2	10.9	0.70	7.6
Potamogeton zosterformis (flat-stemmed pondweed)	10	41.6	15.6	1.20	18.7
Utricularia vulgaris (common bladderwort)	4	16.6	6.3	0.20	1.3

NOTE: There were 24 sampling points.

Source: SEWRPC.

Table 6

FREQUENCY OF OCCURRENCE AND DENSITY RATINGS OF SUBMERGENT PLANT SPECIES IN UPPER KELLY LAKE: JULY 2005

Plant Species	Sites Found	Frequency of Occurrence (percent)	Relative Frequency (percent)	Relative Density in Whole Lake	Importance Value
Ceratophyllum demersum (coontail)	43	97.7	38.8	3.30	128.0
Elodea canadensis (waterweed)	1	5.0	0.9	0.04	0.1
Myriophyllum spp. (native milfoil)	26	59.1	23.4	1.30	30.4
Myriophyllum spicatum (Eurasian water milfoil)	22	50.0	19.8	0.90	17.8
Potamogeton crispus (curly-leaf pondweed)	17	38.6	15.3	0.60	9.2
Potamogeton pectinatus (Sago pondweed)	2	4.5	1.8	0.04	0.1

NOTE: There were 44 sampling points.

Source: SEWRPC.

2. The relative frequency of occurrence (RFREQ) is the frequency of a species divided by the total frequency of all species. The sum of the relative frequencies should equal 100 percent. This statistic presents an indication of how the plants occur throughout a lake in relation to each other. It is used in the calculation of the Importance Value set forth below.

3. The average or relative density (ADEN) is the sum of the density ratings for a species divided by the number of sampling points with vegetation. The maximum density rating of 4.0 is assigned to plants that occur at all points sampled at a given depth, the modified Jesson and Lound protocol adopted by the WDNR uses four sampling points per depth sampled. The average density presents an indication of how abundant the growth of a particular plant is throughout the lake. This measure, along with the percent occurrence, gives a good indication of the distribution of aquatic plant communities in a lake.

4. The importance value (IV) is defined as the product of the relative frequency and the average density, expressed as a percentage:

   IV = (RFREQ) (ADEN) (100)

   where IV is the importance value, RFREQ is the relative frequency, and ADEN is the average density. This number provides an indication of the dominance of a species within a community based upon both frequency and density. It also somewhat addresses the problem of difference in stature between different plant species.

A tabulation of the ecological significance of the plants determined to be present in each of the Lakes is presented in Table 7. Table 8 presents a comparison of the data collected during the 1997 surveys with those collected during the 2005 surveys. The results of the 2005 surveys also are graphically depicted on Map 10. Illustrations of the common aquatic plants found in Upper and Lower Kelly Lakes are included in Appendix A.

The flora of the Lake basins was relatively impoverished compared with that of the wetlands adjacent to the southwest corner of Upper Kelly Lake, and the wetlands connecting Upper Kelly and Lower Kelly Lakes. During 1997, 10 submergent and two floating-leaved aquatic plant species were recorded within the Upper Kelly Lake basin. The Lake was dominated by coontail, *Ceratophyllum demersum*, which can pose recreational use problems when it is abundant, especially if it grows to the water surface. Several pondweeds, as well as white and yellow water lilies, were common to abundant throughout the Lake. Filamentous algae were present in the northeastern corner of the Lake. Eurasian water milfoil, *Myriophyllum spicatum*, also was present and widespread in Upper Kelly, and was especially dense in the shallower areas near the public-access site.

Eurasian water milfoil, one of the eight milfoil species found in Wisconsin, is an exotic, or nonnative species, known to exhibit "explosive" growth under suitable conditions, such as in the presence of organic-rich sediments or where the lake bottom has been disturbed, due to its ability to reproduce through the rooting of plant fragments. As a result of this ability to rapidly propagate, together with a lack of natural predators, this exotic species often outcompetes the native aquatic vegetation of lakes in southeastern Wisconsin, reducing the biodiversity of the lakes, and degrading the quality of fish and wildlife habitats.[18] It has also been known to cause severe recreational use problems in lakes in the Southeastern Wisconsin Region. All of these plants are indicative of a disturbed lake ecosystem. This is supported by the urbanized surroundings of the Kelly Lakes, and the results of wetland surveys conducted by Commission staff in the areas surrounding the Kelly Lakes. These terrestrial systems also showed significant levels of previous disturbance.

Lower Kelly Lake exhibited greater floral diversity during 1997, with 11 submergent, two floating-leaved, and one emergent aquatic plant species present. Coontail was the dominant species, along with water lilies, that surrounded the shoreline. Eurasian water milfoil was present throughout the Lake, but was not dense. Water buttercups, some pondweeds, and native milfoils were also common to abundant.

During 2005, some of the aquatic plant diversity in both Lakes was reduced. Lower Kelly Lake supported six submergent aquatic plant species during 2005, and three species of floating leaved aquatic plants. Water buttercup and eel grass, observed during the 1997 survey, were noted by their apparent absence. Curiously, Eurasian water milfoil, also observed during the 1997 survey, also appeared to be absent from Lower Kelly Lake. Similarly, in Upper Kelly Lake, six species of submergent aquatic plants, three floating leaves species, and one emergent species were recorded, as summarized in Table 6. Notably, chara, flat-stemmed pondweed, and eel grass, which were recorded during the 1997 survey, were not seen during the 2005 survey.

[18] *Wisconsin Department of Natural Resources,* Eurasian Water Milfoil in Wisconsin: A Report to the Legislature, *1993.*

Table 7

POSITIVE ECOLOGICAL SIGNIFICANCE OF AQUATIC PLANT SPECIES PRESENT IN UPPER AND LOWER KELLY LAKES

Aquatic Plant Species Present	Relative Abundance[a]	Ecological Significance[b]
Ceratophyllum demersum (coontail)	Abundant	Provides good shelter for young fish and supports insects valuable as food for fish and ducklings
Chara vulgaris (muskgrass)	Common	Excellent producer of fish food, especially for young trout, bluegill, and small and largemouth bass; stabilizes bottom sediments; and has softening effect on the water by removing lime and carbon dioxide
Elodea canadensis (waterweed)	Scarce	Provides shelter and support for insects valuable as fish food
Lemna minor (lesser duckweed)	Scarce	Provides important food for wildfowl and attracts small aquatic animals
Myriophyllum spp. (native milfoil)	Common	Provides valuable food and shelter for fish; fruits eaten by many wildfowl
Myriophyllum spicatum (Eurasian water milfoil)	Common	None known
Nuphar sp. (yellow water lily)	- -[c]	Leaves, stems, and flowers are eaten by deer; roots eaten by beaver and porcupine; seeds eaten by wildfowl; leaves provide harbor to insects, in addition to shade and shelter for fish
Nymphaea tuberosa (white water lily)	- -[c]	Provides shade and shelter for fish; seeds eaten by wildfowl; rootstocks and stalks eaten by muskrat; roots eaten by beaver, deer, moose, and porcupine
Potamogeton spp.(pondweeds)	Scarce	Provides food, shelter and shade for some fish and food for wildfowl
Potamogeton amplifolius (large-leaf pondweed)	Scarce	Provides cover for panfish, largemouth bass, muskellunge, and northern pike; nesting grounds for bluegill; supports insects valuable as food for fish and ducklings
Potamogeton crispus (curly-leaf pondweed)	Common	Provides food, shelter and shade for some fish and food for wildfowl
Potamogeton pectinatus (Sago pondweed)	Scarce	This plant is the most important pondweed for ducks, in addition to providing food and shelter for young fish
Potamogeton praelongus (white-stemmed pondweed)	Scarce	Provides feeding grounds for muskellunge; also good food producers for trout; good food producer for ducks
Potamogeton zosterformis (flat-stemmed pondweed)	Common	Provides some cover for bluegills, perch, northern pike, and muskellunge; food for waterfowl; supports insects valuable as food for fish and ducklings
Ranunculus sp. (white water crowfoot)	- -[c]	Provides food for trout, upland game birds and wildfowl
Typha augustafolia (cattail)	- -[c]	Supports insects; stalks and roots important food for muskrat and beaver; attracts marsh birds, wildfowl, and songbirds, in addition to being used as spawning grounds by sunfish and shelter for young fish
Vallisneria americana (water celery)	Scarce	Provides good shade and shelter, supports insects, and is valuable fish food

[a]*Species mean density for all sample points including sample points where a particular species did not occur in the Kelly Lakes: Abundant (density rating = 4 to 5). Common (density rating = 2 to 3), Scarce (density rating = 1), and - = Absent (density rating = 0).*

[b]*Information obtained from* A Manual of Aquatic Plants *by Norman C. Fassett and* Guide to Wisconsin Aquatic Plants*, Wisconsin Department of Natural Resources.*

[c]*Not measurable using the Jesson and Lound Survey Technique for Submerged Aquatic Plants.*

Source: SEWRPC.

Table 8

FREQUENCY OF OCCURRENCE OF SUBMERGENT PLANT SPECIES IN LOWER AND UPPER KELLY LAKES: 1997-2005

Plant Genus and Species	Plant Common Name	Lower Kelly Lake: Frequency of Occurrence (percent)[a]		Upper Kelly Lake: Frequency of Occurrence (percent)[a]	
		1997	2005	1997	2005
Ceratophyllum demersum	Coontail	100.0	100.0	97.5	97.7
Chara vulgaris	Muskgrass	20.8	12.5	12.5	- -
Elodea canadensis	Waterweed	- -	- -	2.3	5.0
Lemna minor	Lesser duckweed	- -[c]	- -[c]	- -[c]	- -[c]
Myriophyllum spicatum[d]	Eurasian water milfoil[d]	25.0	- -	50.0	50.0
Myriophyllum sp.	Native milfoil	54.2	4.2	2.5	59.1
Nuphar sp.	Yellow water lily	- -[c]	- -[c]	- -[c]	- -[c]
Nymphaea tuberosa	White water lily	- -[c]	- -[c]	- -[c]	- -[c]
Potamogeton amplifolius	Large-leaf pondweed	4.2	20.8	- -	- -
Potamogeton crispus	Curly-leaf pondweed	- -	- -	35.0	38.6
Potamogeton pectinatus	Sago pondweed	25.0	29.2	22.5	4.5
Potamogeton zosteriformis	Flat-stemmed pondweed	54.2	41.6	15.0	- -
Ranunculus sp.	Water buttercup	37.5	- -	- -	- -
Typha augustafolia	Cattail	- -[c]	- -[c]	- -[c]	- -[c]
Vallisneria americana	Eel grass	2.5	- -	10.0	- -

[a]*Maximum equals 100 percent.*

[b]*Information obtained from Norman C. Fassett,* A Manual of Aquatic Plants*, Wisconsin Department of Natural Resources,* Guide to Wisconsin Aquatic Plants*, and Wisconsin Lakes Partnership,* Through the Looking Glass…A Field Guide to Aquatic Plants, 1997.

[c]*Not measurable using the Jesson and Lound Survey Technique for Submersed Aquatic Plants.*

[d]Wisconsin Administrative Code *Section NR 109.07, "Designated Invasive and Nonnative Aquatic Plant."*

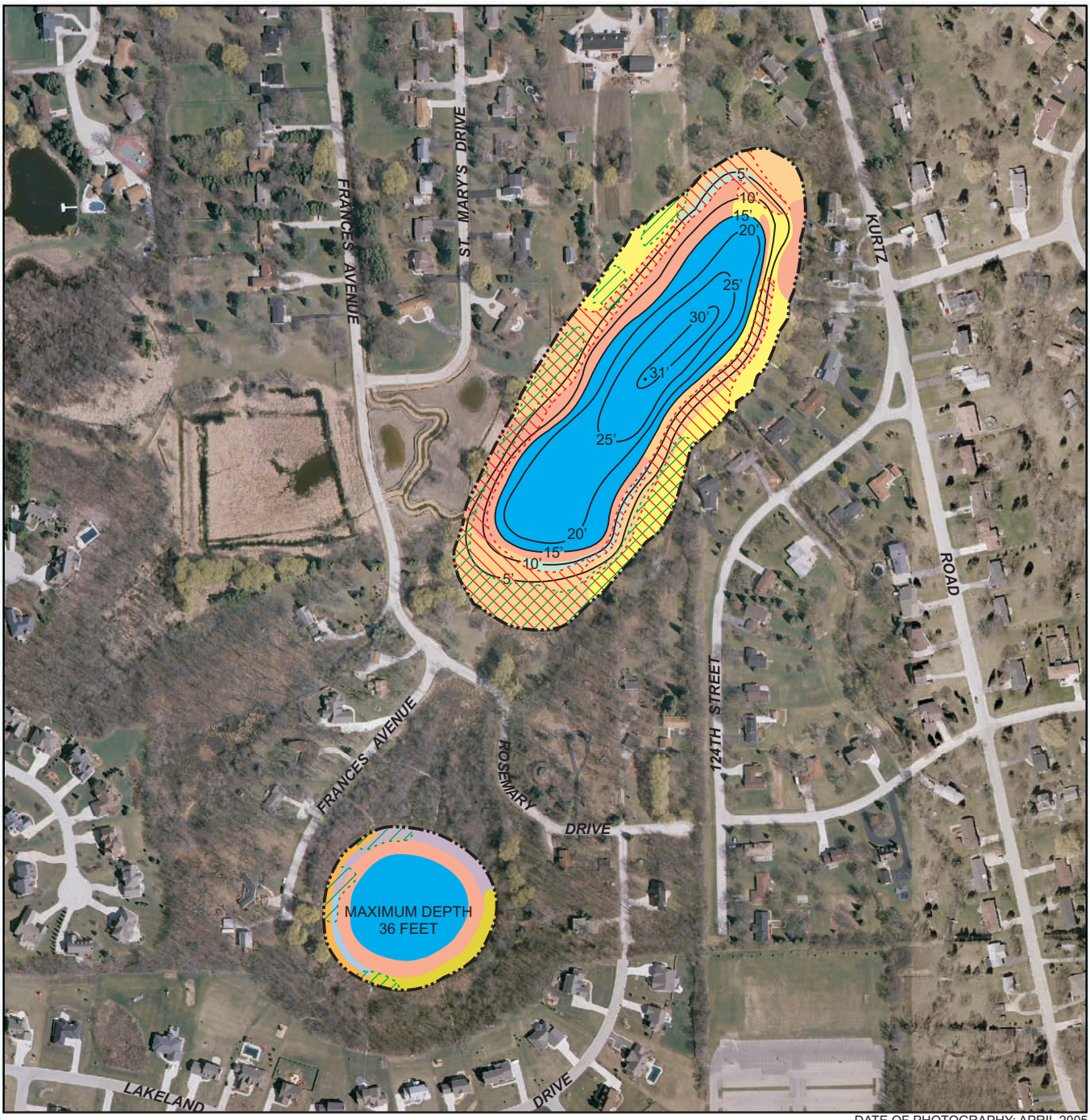
Source: SEWRPC.

While some of this difference may be ascribed to interannual variability amongst the aquatic plant communities in the Lakes, the observed aquatic flora of both Upper and Lower Kelly Lakes remain representative of eutrophic lakes. Eutrophic lakes exhibit abundant aquatic plant growths, usually dominated by a few, often nuisance, species. This condition in the Kelly Lakes may be maintained or accelerated due to the phosphorus loadings discussed above.

In addition to the aquatic plant surveys conducted in the Lakes and documented in the initial report, Commission staff conducted surveys during 1989 and 1990 of the wetlands located west of Upper Kelly Lake in the northeast one-quarter of U.S. Public Land Survey Section 36, Township 6 North, Range 20 East, City of New Berlin, Waukesha County, near and around the Woodfield Park Subdivision. The wetland plant species identified during these vegetation surveys are set forth in Appendix B**.** Commission staff concluded that all the areas surveyed had been subject to prior disturbances, including ditching, clear-cutting, filling, vegetation removal, agricultural activities, and dumping; the high number of exotic species present, 30 percent, indicated that the wetlands were

Map 10

AQUATIC PLANT COMMUNITY DISTRIBUTION IN UPPER AND LOWER KELLY LAKES: 2005



DATE OF PHOTOGRAPHY: APRIL 2005

— 20' — WATER DEPTH CONTOUR IN FEET

OPEN WATER

WATER LILIES

EURASIAN WATER MILFOIL

COONTAIL

COONTAIL, WATERWEED, NATIVE WATER MILFOIL, CURLY-LEAF PONDWEED, AND SAGO PONDWEED

COONTAIL, NATIVE WATER MILFOIL, AND SAGO PONDWEED

COONTAIL AND NATIVE WATER MILFOIL

COONTAIL, NATIVE WATER MILFOIL, AND FLAT-STEM PONDWEED

COONTAIL, MUSKGRASS, FLAT-STEM PONDWEED, LARGE-LEAF PONDWEED, LEAFY PONDWEED, FLOATING-LEAF PONDWEED, BLADDERWORT, AND SAGO PONDWEED

COONTAIL, MUSKGRASS, FLAT-STEM PONDWEED, SAGO PONDWEED, AND LEAFY PONDWEED

COONTAIL, FLAT-STEM PONDWEED, LARGE-LEAF PONDWEED, AND BLADDERWORT

GRAPHIC SCALE
0 200 400 FEET

Source: SEWRPC.

moderately to heavily disturbed in the past. The wetland area between Upper and Lower Kelly Lakes, though not surveyed, also appeared to have been heavily disturbed, not in the least by the construction of Frances Avenue and Rosemary Drive. This area is shown on Map 2 as the historic hydrologic connection between the two Lakes. Notwithstanding, all of the wetlands in the vicinity of the Kelly Lakes appear to have the potential to be restored to a higher level of ecosystem function through management interventions.

The invasive wetland plant, purple loosestrife, was not reported in the vicinity of Kelly Lakes during these surveys, nor was it observed in a subsequent reconnaissance surveys, although the plant is known to be present within Waukesha County and is rapidly spreading eastward.

FISHERIES

The most recent electrofishing survey was conducted by Wisconsin Department of Natural Resources staff on Upper Kelly Lake during 1993.[19] This survey supported the previous 1969 observations that panfish appeared to be relatively few in number and slow growing, and that carp were present in the Lake.[20] The 1993 survey results indicated that panfish remained small, but were more numerous than during the 1969 survey. Likewise, carp continued to be present and large, but did not appear to be over-abundant. Largemouth bass, the only gamefish species known to be present in Upper Kelly Lake, were small and scarce. Lake chubsuckers, an important forage fish and a Wisconsin threatened species, appeared in good numbers during both surveys. Other species present in order of dominance included: bluegill, pumpkinseed, black crappie, yellow perch, warmouth, green sunfish, golden shiner, yellow bullhead, grass pickerel, and white sucker.

As a result of these surveys, the Wisconsin Department of Natural Resources recommended promoting a voluntary program of catch and release bass fishing. It was further noted that the adoption of special regulations, including a total closure of the bass harvest to keep panfish growth rates up and carp numbers down, could be considered in the future.

No fish surveys have been conducted on Lower Kelly Lake.

WILDLIFE AND WATERFOWL

Given the single-family residential nature of the immediate shorelands of the Kelly Lakes and its highly urban location, it is likely that the wildlife community is comprised of small upland game animals, such as rabbit and squirrel; predators, such as fox and raccoon; marsh furbearers, such as muskrat; migratory and resident song birds; marsh birds, such as redwing blackbird and great blue heron; raptors, such as great horned owl and red-tailed hawk; and waterfowl. White-tailed deer have been reported in the area. The character of wildlife species, along with the nature of the habitat present in the planning area has undergone significant change since the time of European settlement and the subsequent clearing of forests, plowing of the prairie, and draining of wetlands for agricultural purposes. Modern practices that adversely affect wildlife and wildlife habitat include: the excessive use of fertilizers and pesticides, road salting, heavy traffic, the introduction of domestic animals, and the fragmentation and isolation of remaining habitat areas for human uses.

As shown on Map 11, wildlife habitat areas in the Kelly Lakes tributary drainage area generally occur in association with existing surface water, wetland, and woodland resources located along the Kelly Lakes. Such areas covered about 210 acres, or 21 percent of the study area. Of this total habitat acreage, about 23 acres, or

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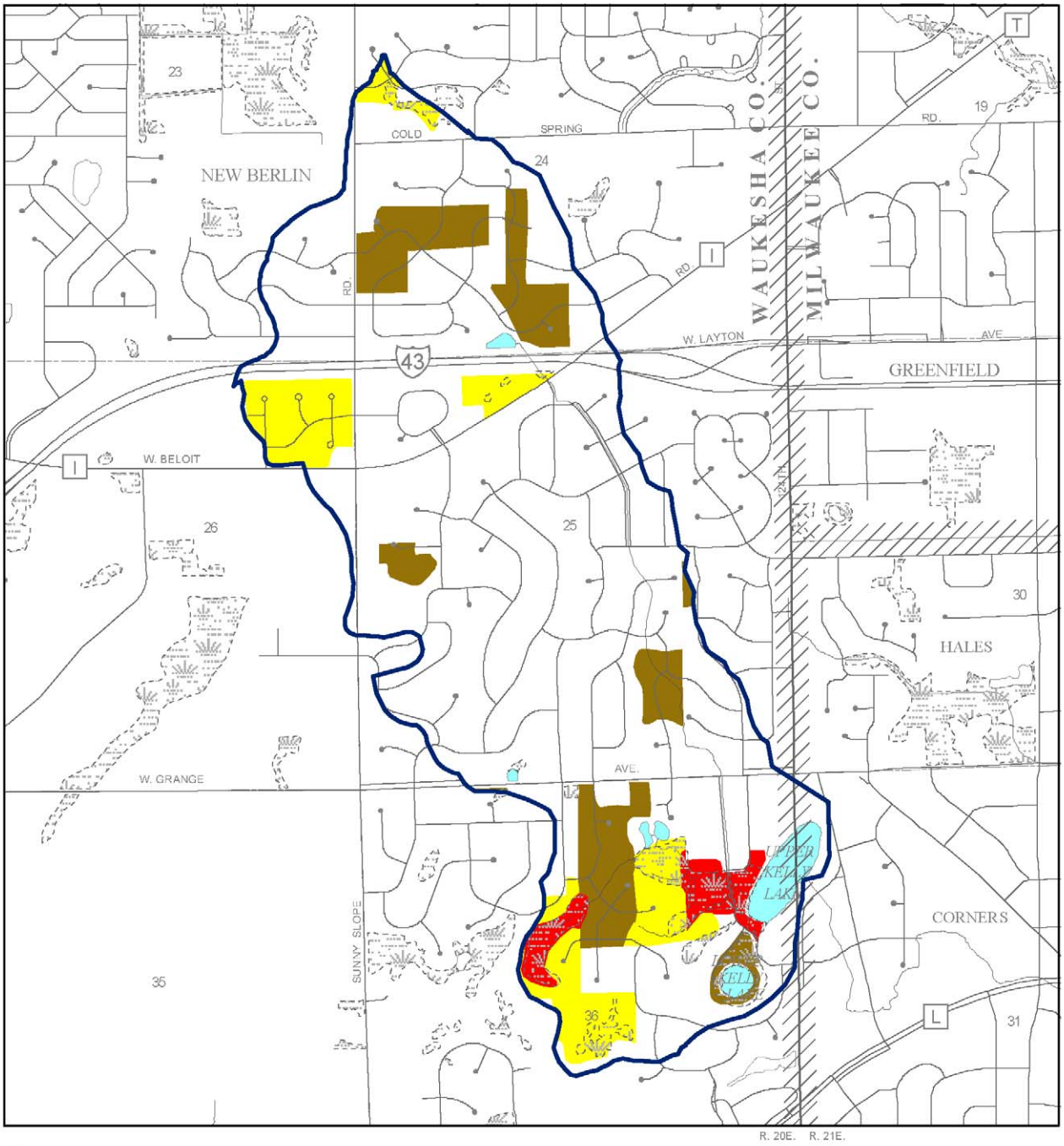
[19] *E.R. Schumacher and S. Beyler, DNR Memorandum No. 3600,* Single-run Electrofishing Survey on Upper Kelly Lake, *May 1993.*

[20] *D. Fago, Wisconsin Department of Natural Resources Report No. 148,* Retrieval and Analysis Used in Wisconsin's Statewide Fish Distribution Survey, *Second Edition, December 1988.*

Map 11

WILDLIFE HABITAT AREAS WITHIN THE TOTAL AREA TRIBUTARY TO THE KELLY LAKES: 1985



CLASS I, HIGH-VALUE HABITAT

CLASS II, MEDIUM-VALUE HABITAT

CLASS III, GOOD-VALUE HABITAT

SURFACE WATER

Source: SEWRPC.

N

GRAPHIC SCALE

0 1,000 2,000 Feet

2 percent, were rated as Class I habitat; about 89 acres, or 9 percent, were rated as Class II habitat; and about 98 acres, or 10 percent, were rated as Class III habitat. The habitat areas shown on Map 11 are largely coincident with Commission-delineated environmental corridors in this watershed, and are shown on Map 12.

ENVIRONMENTAL CORRIDORS

There is no primary environmental corridor in the watershed. Secondary environmental corridors covered about 136 acres, or 14 percent of the Kelly Lakes tributary drainage area. Isolated natural resource features covered about 33 acres, or about 3 percent of the tributary drainage area. The Commission recommends that to the extent practicable, remaining secondary corridor lands, shown on Map 12, be considered for preservation as the process of development proceeds within the Region, particularly where the opportunity is presented to incorporate such secondary corridors into urban stormwater retention basins, associated drainageways, and neighborhood parks.[21] Portions of these corridor lands have been incorporated into the shoreland wetland and stream recreation project completed during 2005 as a result of recommendations set forth in the adopted lake protection plan. This project is described in more detail in Chapter IV.

RECREATIONAL USES AND FACILITIES

The Kelly Lakes are multi-purpose recreational use waterbodies serving many forms of recreation, including boating, swimming, and fishing during the summer months, and cross-country skiing, snowmobiling, ice fishing, ice skating, and, occasionally, "polar bear" swimming during the winter months. The Lakes are used year round as visual amenities—walking, bird-watching, and picnicking being popular passive recreational uses of the waterbody. Recreational boating access to Upper Kelly Lake is limited at present to one boat launch site on the northeast corner of the Lake, off of Kurtz Road, as shown on Map 3. There is no public parking currently provided at this site. Walk-in access to Upper Kelly Lake is available at a City park in New Berlin, as shown on Map 3. Lower Kelly Lake has a walk-in public access on its northeast shore at Albert Avenue, as shown on Map 3. These latter sites provide adequate public recreational boating access to the Lakes, pursuant to the standards set forth in Chapter NR 1 of the *Wisconsin Administrative Code*. A boat survey conducted by Commission staff during June 1998 indicated that 16 boats were either moored in the water or stored on land adjacent to Upper and Lower Kelly Lakes. The types of boats included paddleboats, rowboats, canoes, and sailboats. A comparable survey conducted by Commission staff during 2005 indicated that the numbers of nonmotorized watercraft on Upper Kelly Lake had increased to about 40 vessels. There were about 10 watercraft moored in the water or stored in the vicinity of Lower Kelly Lake. These data are summarized in Table 9 for Upper Kelly Lake and Table 10 for Lower Kelly Lake.

Shoreline Protection Structures

Erosion of shorelines results in the loss of land, damage to shoreland infrastructure, and interference with lake access and use. Such erosion is usually caused by wind-wave erosion, ice movement, and motorized boat traffic. Motorized boat traffic is not an issue of concern on the Kelly Lakes due to their small size.[22] A survey of the Kelly Lakes shoreline, conducted by Commission staff during June 1997, indicated that a majority of the Upper Kelly Lake shoreline remains in a natural condition without shoreline protection structures. However, small sections of the shoreline of the Lake were protected with riprap, as shown on Map 13. The Lower Kelly Lake shoreline is completely natural, as the Lake is ringed by wetlands. Shoreline erosion is not considered a problem on the Kelly Lakes.

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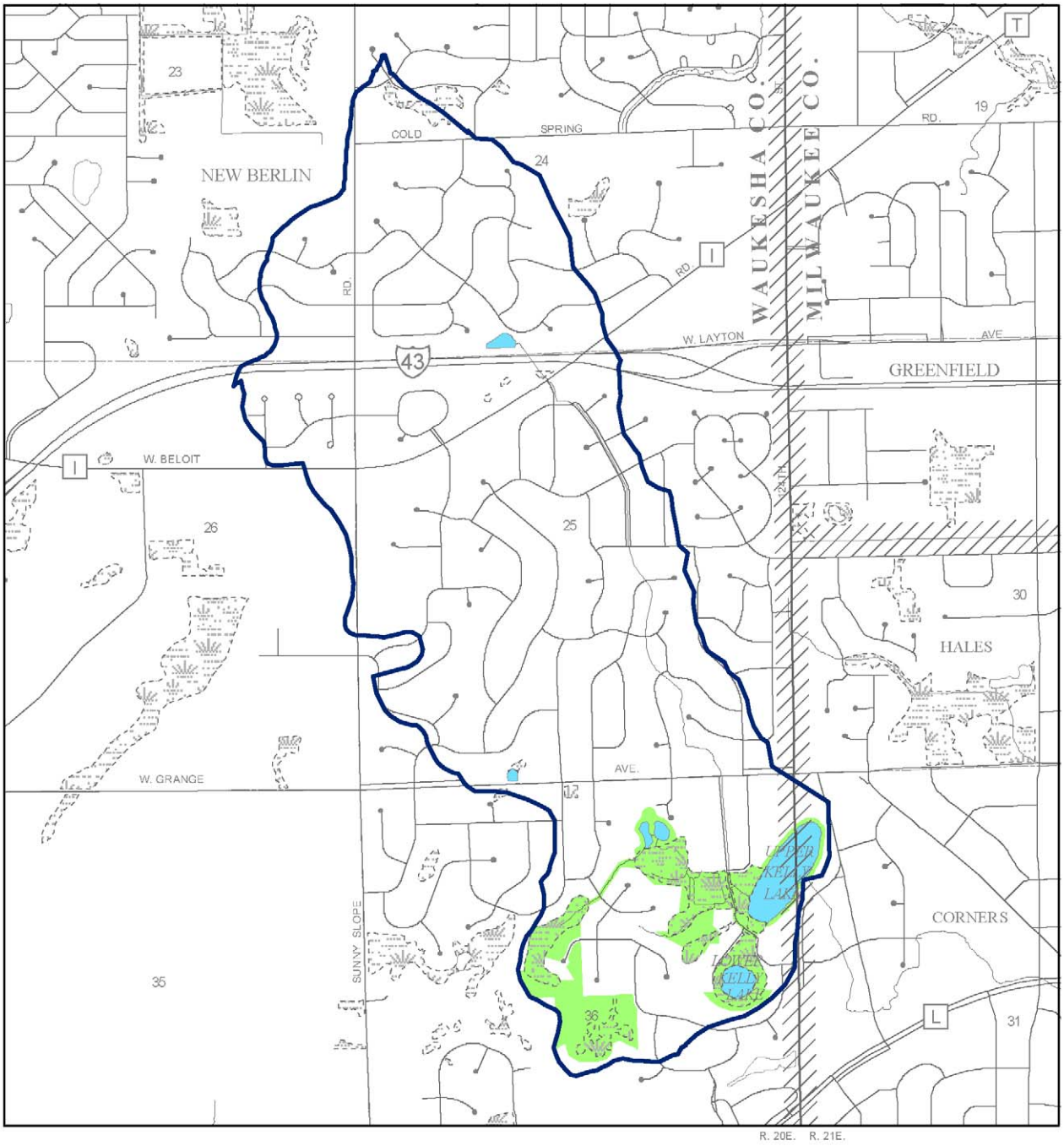
[21]*SEWRPC Planning Report No. 40,* A Regional Land Use Plan for Southeastern Wisconsin—2010, *January 1992.*

[22]*Section 30.635,* Wisconsin Statutes, *generally prohibits operation of motorboats in excess of slow-no-wake speed on lakes of 50 acres or less in areal extent having public access. The provisions of this Section are applicable on the Kelly Lakes.*

Map 12

ENVIRONMENTAL CORRIDORS WITHIN THE TOTAL AREA TRIBUTARY TO THE KELLY LAKES: 2000



SECONDARY ENVIRONMENTAL CORRIDOR

SURFACE WATER

Source: SEWRPC.

N

GRAPHIC SCALE

0 1,000 2,000 Feet

Table 9

WATERCRAFT ON UPPER KELLY LAKE: 2005

Type of Watercraft									
Power Boat	Fishing Boat	Pontoon Boat	Canoe	Paddleboat	Sailboat	Personal Watercraft	Kayak	Rowboat	Total
0	2	4	8	14	3	0	1	11	43

Source: SEWRPC.

Table 10

WATERCRAFT ON LOWER KELLY LAKE: 2005

Type of Watercraft									
Power Boat	Fishing Boat	Pontoon Boat	Canoe	Paddleboat	Sailboat	Personal Watercraft	Kayak	Rowboat	Total
0	1	1	2	3	1	0	0	2	10

Source: SEWRPC.

Local Ordinances

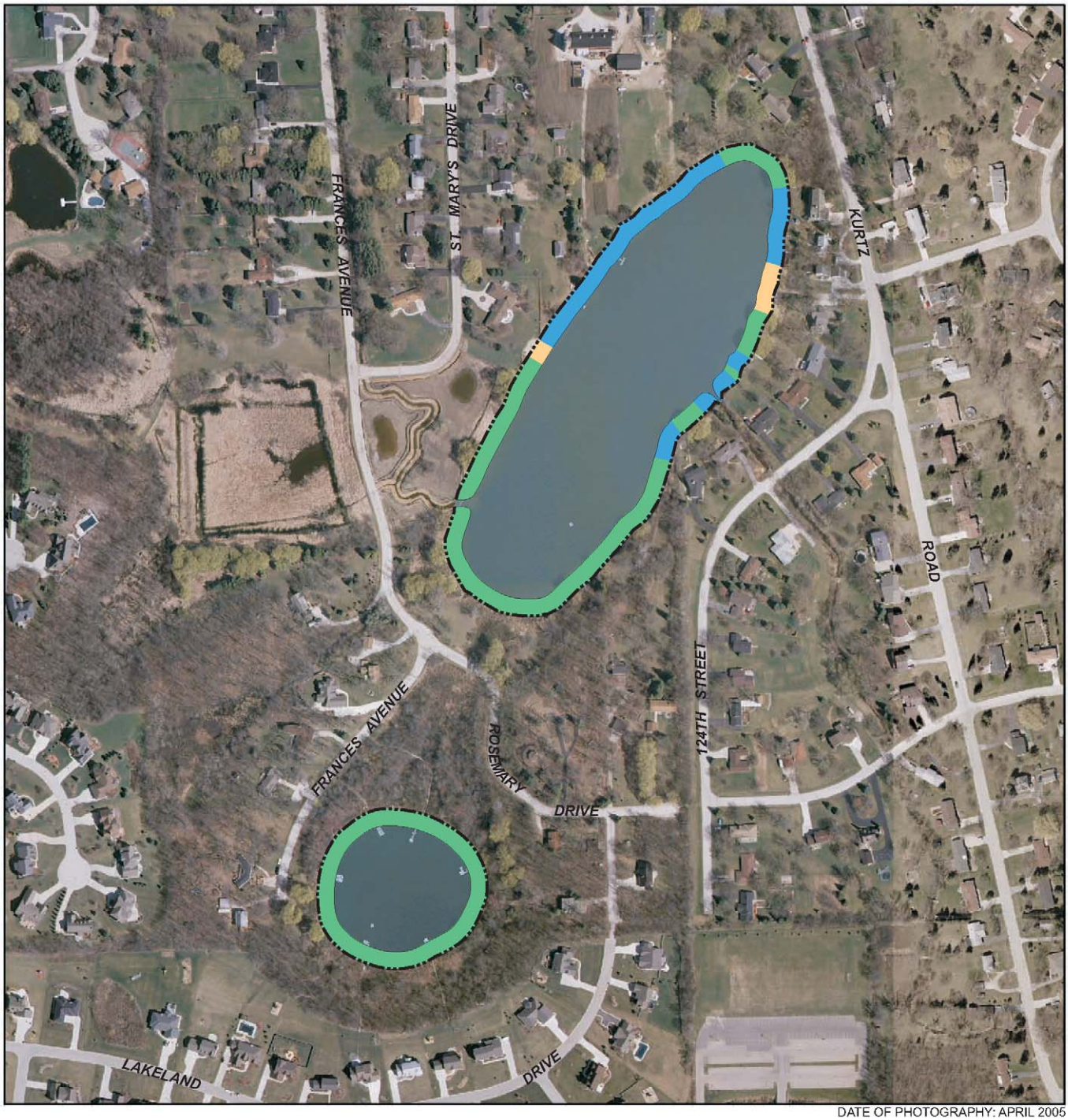
Based upon the constraints imposed by the limited open water acreage of Upper Kelly Lake, motorized vessels operated on that waterbody are not permitted to exceed no-wake speeds.[23] No motorized vessels are allowed to be operated on Lower Kelly Lake.[24] Neither the Village of Hales Corners nor the City of New Berlin have boating ordinances. Boating traffic on both Lakes is governed by state law as set forth in Chapter 30, *Wisconsin Statutes*.

[23]Ibid.

[24]Ibid.

Map 13

SHORELINE PROTECTION STRUCTURES ON UPPER AND LOWER KELLY LAKES: 2005



DATE OF PHOTOGRAPHY: APRIL 2005

RIPRAP

BEACH

NATURAL

GRAPHIC SCALE

0 200 400 FEET

Source: SEWRPC.

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Chapter III

LAKE USE PROBLEMS AND ISSUES

INTRODUCTION

Although the Kelly Lakes are in relatively good condition and are capable of supporting a variety of water uses, there are a number of existing and potential future problems and issues that should be addressed in this lake protection plan. These problems, or issues of concern, include: potential changes in ecologically valuable areas and in the aquatic plant and fisheries communities; construction site erosion; stormwater management, nonpoint source pollution and lake water quality; public recreational use and boating access to the Lakes; and, institutional development within the community to support lake management initiatives. Based upon recommendations set forth in the adopted lake protection plan, the Kelly Lakes Association, Inc., in partnership with the City of New Berlin and Wisconsin Department of Natural Resources, has implemented specific actions to: enhance ecologically valuable areas and habitat within the shoreland area of Kelly Lakes, and manage stormwater quality through a stream relocation and wetland restoration project completed during 2005 in the lower portions of the drainage area tributary to Upper Kelly Lake. While these actions have addressed a number of the concerns facing the Kelly Lakes community, further actions are required to address additional and ongoing issues.

ECOLOGICALLY VALUABLE AREAS AND AQUATIC PLANTS

The ecologically valuable areas within the tributary drainage area of the Kelly Lakes, as documented in Chapter II, include wetlands, woodlands, and wildlife habitat. Most of these areas are included in the lands designated as secondary environmental corridors. Critical sites within the Lakes include the fish spawning habitat, macrophyte beds—especially those containing a diverse flora—and the shoreline areas supporting productive aquatic habitat identified in the lake management planning studies.[1] Protection of these areas is an important issue that should be considered.

The presence of Eurasian water milfoil in Upper and Lower Kelly Lakes represents another important issue. Eurasian water milfoil often outcompetes native aquatic plants and dominates the plant communities in the lakes of southeastern Wisconsin, to the detriment of fish and wildlife populations, and native plant species. The dominance of Eurasian water milfoil in aquatic ecosystems in southeastern Wisconsin degrades the natural resource base and commonly interferes with human recreational and aesthetic use of the natural resources. As discussed in Chapter II, this aquatic plant is widespread in Upper Kelly Lake and, therefore, its monitoring and management is an issue that should be considered.

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[1]*IPS Environmental and Analytical Services, Inc.*, Phase I Lake Management Plan: Upper and Lower Kelly Lakes, Waukesha and Milwaukee Counties, Wisconsin, *March 1997; SEWRPC Memorandum Report No. 135,* A Lake Protection Plan for the Kelly Lakes, Milwaukee and Waukesha Counties, *Wisconsin, October 2000.*

Excessive plant growth in the Kelly Lakes can impede boating traffic and in-lake uses, such as swimming. At various sites around Upper Kelly Lake, growths of Eurasian water milfoil, and of coontail, curly-leaf pondweed, and native water milfoil equaled or exceeded a density rating of three, indicating moderate densities with quantities of plants ranging from common to abundant, as shown in Table 6 in Chapter II of this report. These plants can grow to the surface of the water, restricting boating, angling, and swimming. The abundance of plants can also adversely affect riparian property values[2] and the aesthetic enjoyment of the residents, and can have a significant impact on the aesthetic enjoyment of visitors to the Lakes.[3]

Currently, the Kelly Lakes Association has acquired and is operating an Aquamarine HS-5 aquatic plant harvester on Upper Kelly Lake. The management of this harvester and the aquatic plant harvesting program on Upper Kelly Lake should be carefully monitored in order to prevent the further spread of nuisance plants through drift and/or fragmentation. Periodic aquatic plant surveys should be considered as a means of monitoring the distribution of nuisance species. Hence, aquatic plant management on Upper Kelly Lake is an issue that should be considered.

As discussed in Chapter II, the wetland communities to the southwest of Upper Kelly Lake were surveyed by Commission staff during 1989 and 1990. These areas contained a moderately diverse plant community. There are substantial wetland areas surrounding the Kelly Lakes, particularly around Lower Kelly Lake. These areas provide important habitat for wildlife in addition to contributing to the scenic vistas that characterize the Kelly Lakes. Shoreland wetlands also help to absorb flood waters, and, by retaining sediments and nonpoint source pollutants, can help to protect the Lakes from degradation. Though the wetlands in the Kelly Lakes vicinity have historically been heavily disturbed, there are potentially some benefits that can be achieved by restoring them. These benefits include: providing a nutrient filter and a buffer that protects the Lakes from urban runoff; providing wildlife habitat; and maintaining the ecological structure and function of the wetland ecosystems which provides a broad range of benefits for the natural resources base and ambience of southeastern Wisconsin.[4]

The secondary environmental corridor in the Kelly Lakes tributary drainage area, together with the isolated natural resource features, contains almost all of the best remaining woodlands, wetlands, and wildlife habitat in the area. The protection of these resources from additional intrusion by incompatible land uses which degrade and destroy the environmental values of these sites, and the preservation of the corridor, is an important issue that should be considered.

FISHERIES

Based upon the fisheries surveys conducted by the Wisconsin Department of Natural Resources, and set forth in summary form in Chapter II, it would appear that the fishery in Upper Kelly Lake is limited by the small size of the panfish harvested. Further, as the most recent fish survey carried out on Upper Kelly Lake was conducted during 1993, and given that no surveys have been reported for Lower Kelly Lake, acquisition of recent data is indicated. Such data would also confirm that the carp population of Upper Kelly Lake remains within acceptable bounds. As angling is a popular recreational activity on both Lakes, identification of the current state of the fishery on the Lakes is an important issue that should be considered.

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[2]*H.J. Michael, K.J. Boyle, and R. Bouchard,* Water Quality Affects Property Prices: A Case Study of Selected Maine Lakes, *Maine Agricultural and Forest Experiment Station Miscellaneous Report 398, University of Maine, Orono, 1996.*

[3]*J.A. Thornton, "Perceptions of Public Waters: Water Quality and Water Usage in Wisconsin," In: T. van Valey, S.R. Krull and L. Walker,* The Small City and Regional Community: Volume 10, Proceedings of the 1992 Conference, Western Michigan University, *Foundation Press, Stevens Point, pp. 469-478, 1993.*

[4]*The range of benefits to be derived from a sound natural resources bases within Southeastern Wisconsin is summarized in SEWRPC Planning Report No. 42,* A Regional Natural Areas and Critical Species Habitat Protection and Management Plan for Southeastern Wisconsin, *September 1997.*

CONSTRUCTION SITE EROSION AND NONPOINT SOURCE POLLUTION

Erosion during construction and nonpoint source pollutants associated with new urban development in the drainage area tributary to the Kelly Lakes represents a potentially significant threat to both of the Lakes' water quality. Based upon recommendations set forth in the aforereferenced regional land use and Waukesha County development plans, future development of open lands within the drainage area tributary to the Kelly Lakes is expected to occur. Additionally, unplanned development could occur and impacts on lake water quality could potentially result. Hence, control of construction site erosion and stormwater nonpoint source pollution remains an important issue to be considered.

Recognition of this has resulted in the preparation of a stormwater management plan for the City of New Berlin,[5] the adoption of a stormwater ordinance,[6] and the implementation of a stormwater utility district to manage this concern.[7] Consequently, continued implementation of the recommended stormwater management measures set forth in the adopted stormwater management master plan also remains an issue to be considered.

SURFACE WATER QUALITY

Given the concerns expressed by some citizens within the Kelly Lakes community, the Kelly Lakes Association has undertaken a program of investigation and planning to identify and propose mitigation of the causes of degradation of water quality in the watershed of the Lakes. As of 1997, surface water quality within the Kelly Lakes was reported to range from very poor to fair, with Lower Kelly Lake being of somewhat better quality than Upper Kelly Lake. As of 2005, these conditions had not changed significantly. As both Lakes have been determined to be within the eutrophic range, indicating that some water quality problems are likely to exist, surface water quality is an issue to be considered.

Surface water quality of Upper Kelly Lake is determined by the transport of contaminants into the Lake from the tributary drainage area through the unnamed stream draining to the Lake. Pursuant to the adopted stormwater management master plan for the City of New Berlin, three areas of concern existed within this tributary drainage area. These were at the IH 43 culvert within the upper portions of the drainage area and at W. Grange Avenue and St. Mary's Drive in the lower portions of the drainage area. This latter area was included within the stream relocation and wetland restoration program carried out by the Kelly Lakes Association in partnership with the City of New Berlin during 2005. Notwithstanding, ongoing maintenance of this area will be required and is an issue of concern, as is the implementation of additional management measures necessary to address the W. Grange Avenue and IH 43 areas of concern.

PUBLIC RECREATIONAL USE AND BOATING ACCESS

Overcrowding and excessive recreational boating use create problems in many lakes in the Southeastern Wisconsin Region, especially those offering high-quality recreational opportunities within a one- to two-hour drive of the Chicago-Milwaukee metropolitan area. Given the small surface area of the Kelly Lakes and limited parking at, and nature of, the access sites, the potential for the occurrence of problems due to increased or inappropriate boating pressure is considered to be slight. Nevertheless, local use of the Lakes for water-based recreation could result in potentially significant boating pressure should the locations of these Lakes become better known.

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[5] *Camp, Dresser & McKee, Inc.,* Storm Water Master Plan for the City of New Berlin, *December 1998.*

[6] *City of New Berlin Code of Ordinances,* Chapter 226, Stormwater Runoff, *April 2003.*

[7] *City of New Berlin Code of Ordinances,* Chapter 65, Stormwater Utility, *March 2001.*

Notwithstanding, current public recreational boating standards as set forth in Sections NR 1.91(4) and NR 1.91(5) of the *Wisconsin Administrative Code*, establish minimum and maximum standards for public boating access development, respectively, to qualify waters for resource enhancement services provided by the Wisconsin Department of Natural Resources. Based upon these standards, both Lakes would be required to each have one carry-in access site with parking for five vehicles—for lakes of less than 50 open water acres, the minimum and maximum standards are the same—plus one handicapped accessible unit.

As noted in Chapter II, there is currently one public boating access site on the northeastern shore of Upper Kelly Lake, and one carry-in access site on the eastern shore of Lower Kelly Lake. In addition, the City of New Berlin maintains a park on the southern shore of Upper Kelly Lake, with roadside parking spaces for about five motor vehicles. Both Lakes meet the standards with regard to the numbers of access points; however, the Lakes have limited parking within the vicinities of the launch sites, and, hence, fail to conform to current State standards. Thus, provision of adequate public recreational boating access to the Kelly Lakes is an issue to be considered.

The City of New Berlin public park is located on a filled wetland at the southern end of Upper Kelly Lake within the City of New Berlin. The City has expressed an interest in enhancing this area for recreational lake activities in cooperation with the Kelly Lakes community and the Kelly Lakes Association. Consequently, the Association has proposed the creation of an ecological corridor along the southwestern shoreline of Upper Kelly Lake, combining recreational opportunities provided at the existing park site with wetland restoration and habitat creation within the secondary environmental corridor adjacent to the Lake and within the Woodfield Park Subdivision. This proposal is based, in part, upon recommendations set forth in the adopted lake protection plan. Therefore, wetland restoration and recreational usage are important issues to be considered.

INSTITUTIONAL DEVELOPMENT

As the Kelly Lakes community seeks a more active role in the management of the Kelly Lakes, it is essential that an adequate institutional base to support such activities be developed. Currently, the community-based lake management activities are being carried out by the Kelly Lakes Association, Inc., a Chapter 181, *Wisconsin Statutes*, nonstock corporation. The Association is a qualified lake association as defined in Chapter NR 190, *Wisconsin Administrative Code*. In addition to the provision of public information relating to lake use and management, the Association maintains an active aquatic plant management program as previously noted. Nevertheless, the Association's Board of Directors and members have expressed concern regarding the long-term viability of the lake management programs of the Association given its voluntary nature and reliance on informal financing measures. As a result, the development of an adequate institutional structure is an issue of concern.

Chapter IV

ALTERNATIVE AND RECOMMENDED LAKE PROTECTION MEASURES

INTRODUCTION

Chapter III described six issues of concern to be considered as part of this lake protection and recreational use plan. These issues are related to: 1) ecologically valuable areas and aquatic plants; 2) fisheries; 3) construction site erosion and nonpoint source pollution; 4) surface water quality; 5) public recreational use and boating access; and 6) institutional development for lake management. Following a brief summary of the ongoing lake management program activities, alternatives and recommended measures to address each of these issues and concerns are described in this chapter.

PAST AND PRESENT LAKE MANAGEMENT ACTIONS

The residents of the Kelly Lakes, in conjunction with the City of New Berlin and the Village of Hales Corners, have long recognized the importance of informed and timely action in the management of the Kelly Lakes. The initial action in this regard was the formation of the Kelly Lakes Association, Inc., a Chapter 181 nonstock, not-for-profit Wisconsin corporation which provides the forum for many of the lake management activities of the Lakes' residents. The Association is currently enrolled in the water quality monitoring program conducted under the auspices of the Wisconsin Department of Natural Resources Self-Help Monitoring Program. Data acquired under the auspices of this Program by the citizen volunteer are summarized in Chapter II.

The Kelly Lakes Association has also undertaken planning studies to identify issues of concern relating to the Kelly Lakes. The initial study, prepared for Kelly Lakes Association by IPS Environmental and Analytical Services, Inc., identified six issues of concern to be addressed by the Kelly Lakes community, including: public information and education, water quality assessment, watershed boundary delineation, aquatic plant management, phosphorus load estimation, and subdivision design and impact minimization.[1] This study was followed by a more detailed investigation of aquatic plant, stormwater, and lake water quality management issues of concern that were addressed within the adopted lake protection plan for the Kelly Lakes.[2] With respect to stormwater

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[1] *IPS Environmental and Analytical Services, Inc.*, Phase I Lake Management Plan: Upper and Lower Kelly Lakes, Waukesha and Milwaukee Counties, Wisconsin, *March 1997.*

[2] *SEWRPC Memorandum Report No. 135,* A Lake Protection Plan for the Kelly Lakes, Milwaukee and Waukesha Counties, Wisconsin, *October 2000.*

management, the lake protection plan was fully integrated with the City of New Berlin stormwater management plan.

Pursuant to these plans, the Kelly Lakes Association is actively pursuing public participation opportunities relating to land use and stormwater management in the vicinity of the Kelly Lakes. Members of the Kelly Lakes Association Board of Directors regularly attend City of New Berlin Plan Commission and Public Works Committee meetings regarding land development plans within the drainage area tributary to the Kelly Lakes, and have provided testimony to the City relative to a number of subdivision developments, including Kelly Pointe. In like manner, the Association was an active participant in the public process relating to the preparation of the stormwater management plan and adoption of a stormwater management ordinance by the City of New Berlin.

The Kelly Lakes Association maintains an active in-lake aquatic plant management program. The Association initiated aquatic plant harvesting operations on Upper Kelly Lake during the summer of 1997. These operations are ongoing, within the limitations of the current machinery, an Aquamarine H-5 aquatic plant harvester. In addition, the Association is a participant in the Wisconsin Department of Natural Resources Self-Help Monitoring Program. Reports of water clarity trends within the Lakes are a regular feature of the annual membership meeting, which is open to all Kelly Lakes community residents and interested parties. An occasional newsletter is also published and distributed by the Association.

ECOLOGICALLY VALUABLE AREAS AND AQUATIC PLANTS

The Kelly Lakes and their tributary drainage area contain ecologically valuable areas, including diverse aquatic and wetland vegetation and substrates suitable for fish spawning, located within and immediately adjacent to the Lakes. As described in Chapter III, the potential problems associated with ecologically valuable areas in and near the Kelly Lakes include the potential loss of wetlands and other important ecologically valuable areas due to urbanization or other encroachments; and the degradation of wetlands and aquatic habitat due to the presence of invasive species, including Eurasian water milfoil and purple loosestrife.

Array of Protection Measures

Three measures to protect and maintain the biodiversity of the Kelly Lakes and their direct tributary drainage area have been identified as potentially viable: 1) land management measures, 2) in-lake management measures, and 3) citizen informational and educational measures.

Land Management Measures

The recommended future land use plan for the drainage area tributary to the Kelly Lakes is set forth in the adopted regional land use plan and, for those portions of the drainage area located within Waukesha County, in the county development plan.[3] Those plans recommend the preservation of environmental corridor lands in essentially natural, open uses. Within the drainage area tributary to the Kelly Lakes, these lands consist of secondary environmental corridors that were delineated by the Regional Planning Commission in 1997, in response to submissions made by the citizens of the Kelly Lakes community in cooperation with the City of New Berlin, and isolated natural resource features.

In addition to the recommendations set forth in the adopted regional land use plan, the Waukesha County development plan specifically recommends that, with respect to secondary environmental corridor lands and isolated natural resource features such as those that occur within the drainage area tributary to the Kelly Lakes, protections be afforded through placement of these lands in appropriate zoning districts, depending on the type and character of the natural resource to be preserved and protected. The County development plan further recommends incorporation of secondary environmental corridor lands into the urban stormwater management

[3]*SEWRPC Planning Report No. 40,* A Regional Land Use Plan for Southeastern Wisconsin—2010, *January 1992; and SEWRPC Community Assistance Planning Report No. 209,* A Development Plan for Waukesha County, Wisconsin, *August 1996.*

systems, including associated detention basins and drainageways, and neighborhood parks where possible and feasible.

Currently, most of the wetlands and other ecologically valuable lands adjacent to the Kelly Lakes and within the tributary drainage area are included in secondary environmental corridors and isolated natural resource features. Many of the wetlands, however, have a history of prior or current disturbance that, to varying extents, could affect the structure and functioning of these valuable areas.

The existing zoning of the lands within the total tributary drainage area to the Kelly Lakes is generally consistent with the recommended future land use plan set forth in the regional land use and county development plans. However, two upland areas within the middle to upper portions of the drainage area north of IH 43, recommended for preservation as recreational land and as an isolated natural resource feature under the County development plan, have not been zoned in a manner consistent with such preservation, being included within a residentially zoned area. Rezoning, and possible purchase or preservation by site development planning for these areas, are two potential means that could be considered in this regard.

In-Lake Management Measures

The presence of nonnative and nuisance aquatic plant species within the Lake basins and along their shorelines is indicative of a further loss of ecosystem integrity and function, affecting submergent and emergent lacustrine vegetation. Various in-lake management actions may be considered to mitigate and manage the consequences of aquatic habitat degradation in the Kelly Lakes. Generally, aquatic plant management measures, designed to minimize the environmental and recreational impacts of degraded habitat, are classed into four groups: chemical measures which include the use of aquatic herbicides; mechanical measures which include harvesting and manual removal; biological control measures which include the use of various organisms, including insects; and physical measures which include lake bottom coverings and water level management, all of which are regulated and require a State permit. Costs range from minimal for manual removal of plants using rakes and hand-pulling to upwards of $50,000 for the purchase of a mechanical plant harvester, the operational costs for which can approach $2,500 to $5,000 per year depending on staffing and operating policies. Harvesting is probably the measure best suited to large areas of open water, while chemical controls may be best suited for use in confined areas and for the initial control of invasive plants. Controlling Eurasian water milfoil by planting native plant species or by introducing the milfoil weevil, *Eurhychiopsis lecontei*, is largely experimental and currently subject to State permitting, while the use of other biological controls, such as grass carp, is prohibited in Wisconsin.

Aquatic Herbicides

Chemical treatment with aquatic herbicides is a short-term method of controlling heavy growths of aquatic macrophytes and algae. Chemicals are applied to the growing plants in either liquid or granular form. The advantages of using chemical herbicides to control aquatic macrophyte growth are the relatively low cost and the ease, speed, and convenience of application. However, the disadvantages associated with chemical control include unknown long-term effects on fish, fish food sources, and humans; a risk of increased algal blooms due to the eradication of macrophyte competitors; an increase in organic matter in the sediments, possibly leading to increased plant growth as well as anoxic conditions which can cause fish kills; adverse effects on desirable aquatic organisms; loss of desirable fish habitat and food sources; and, finally, a need to repeat the treatment the following summer due to existing seed banks and/or plant fragments. To minimize the collateral impacts of deoxygenation, loss of desirable plant species, and contribution of organic matter to the sediments, early spring or late fall applications should be considered. Such applications also minimize the concentration and amount of chemicals used due to the colder water temperatures that enhance the herbicidal effects. Use of chemical herbicides in aquatic environments is subject to State permitting requirements pursuant to Chapter NR 107 of the *Wisconsin Administrative Code*. Because the Kelly Lakes do not have significant growths of nuisance plant species, chemical treatment is not recommended as a means of controlling aquatic plant growth.

Mechanical Harvesting

Aquatic macrophytes may be mechanically harvested with specialized equipment consisting of a cutting apparatus, which cuts up to five feet below the water surface, and a conveyor system that picks up the cut plants

and hauls them to shore. Mechanical harvesting appears to be a practical and efficient means of controlling plant growth as it removes the plant biomass and nutrients from a lake. Limited aquatic plant harvesting is currently carried out on Upper Kelly Lake. Because some plant fragments are lost during the harvesting process due to the hydrodynamic design of the harvester, the addition of a shoreline cleanup program to remove the plant fragments from the Lake should be considered.

The advantages of aquatic plant harvesting are that the harvester typically leaves enough plant material in the lake to provide shelter for fish and other aquatic organisms, and to stabilize the lake bottom sediments. The disadvantages of mechanical harvesting are that the harvesting operation may cause fragmentation and facilitate the spread of some plants, including Eurasian water milfoil, and may disturb loosely consolidated bottom sediments increasing turbidity and smothering fish breeding habitat and nesting sites. Disrupting the bottom sediments by plant removal also could increase the risk that an exotic species, such as Eurasian water milfoil, may colonize the disturbed area. Nevertheless, if done correctly and carefully, harvesting has been shown to be of benefit in ultimately reducing the regrowth of nuisance plants. Use of aquatic plant harvesters is subject to State permitting requirements pursuant to Chapter NR 109 of the *Wisconsin Administrative Code*.

Operation of a harvester requires managerial oversight and a secure financial basis.[4] The formation of a public inland lake protection and rehabilitation district around the Kelly Lakes could be considered as one means of providing such an organizational basis.

Mechanical harvesting is considered a viable management option to continue as a control of aquatic plants in Upper Kelly Lake. An aquatic plant management plan is set forth in Appendix C.

Manual Harvesting

Mechanical harvesting requires a minimum depth of water in which to operate the harvesting equipment. When the water depth is inadequate depth, as in shoreline areas, manual harvesting provides a reasonable alternative technique. Manual harvesting involves the use of specially designed rakes to remove aquatic plants. The advantage of the rakes is that they are relatively inexpensive, easy and quick to use, and immediately remove the plant material from the lake, without a waiting period. Removal of the plants from the lake avoids the accumulation of organic matter on the lake bottom, which adds to the nutrient pool that favors further plant growth. Use of manual harvesting devices is subject to State permitting requirements pursuant to Chapter NR 109 of the *Wisconsin Administrative Code*, with the exception that a corridor of up to 30 feet in width along the shoreline can be harvested without a permit provided the harvested material is removed from the Lake—there are no lakeward limits set under the provisions of the *Code*.

Manual harvesting is recommended for use in small areas of Upper Kelly Lake, but is not recommended for use on Lower Kelly Lake unless nearshore aquatic plants around piers are perceived as a severe nuisance.

Biological Controls

An alternative approach to controlling nuisance plants, particularly Eurasian water milfoil, is biological control. Classical biological control techniques have been successfully used to control both nuisance plants and herbivorous insects.[5] Recent studies have shown that *Eurhychiopsis lecontei*, an aquatic weevil, has potential as a biological control agent for Eurasian water milfoil.[6] Based upon a reconnaissance conducted by the Wisconsin

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[4]*Wisconsin Lakes Partnership Publication No. FH-205-97,* Your Aquatic Plant Harvesting Program: A How-to Field Manual*, 1997.*

[5]*C.B. Huffacker, D.L. Dahlsen, D.H. Janzen, and G.G. Kennedy,* Insect Influences in the Regulation of Plant Population and Communities*, 1984, pp. 659-696; and C.B. Huffacker and R.L. Rabb, editors,* Ecological Entomology*, John Wiley, New York, New York, USA.*

[6]*Sally P. Sheldon, "The Potential for Biological Control of Eurasian Water Milfoil (*Myriophyllum spicatum*) 1990-1995 Final Report," Department of Biology Middlebury College, February 1995.*

Department of Natural Resources during June 1997, this weevil appears to be naturally occurring in the Kelly Lakes. However, as very few studies have been completed using *Eurhychiopsis lecontei* as a means of aquatic plant management control, it is not recommended that it be added to the Lakes at this time. Use of biological control agents, with the exception of grass carp, is subject to State permitting requirements pursuant to Chapter NR 109 of the *Wisconsin Administrative Code*. Grass carp, *Ctenopharyngodon idella*, are not permitted for use in Wisconsin.

Physical Controls

Lake bottom covers and screens provide limited control of rooted plants by creating a physical barrier which reduces or eliminates the amount of sunlight available to the plants. Placement of bottom covers on the beds of inland lakes is subject to State permitting requirements pursuant to Chapter NR 109 of the *Wisconsin Administrative Code*. Due to the steeply sloping bathymetry of the Kelly Lakes, lake bottom coverings are not considered a viable plant management option.

Citizen Information and Education

In addition to these in-lake management measures, an ongoing campaign of community information will support the aquatic plant management program by encouraging the use of shoreland buffer strips, responsible use of household and garden chemicals, and adoption of environmentally friendly household and garden practices to minimize the input of nutrients from these riparian areas. Aquatic plant management usually centers on the eradication of nuisance aquatic plants for the improvement of recreational lake use. The majority of the public views all aquatic plants as "weeds" and residents often spend considerable time and money removing desirable plant species from a lake without considering the environmental impacts. Thus, public information is an important component of an aquatic plant management program. Posters and pamphlets are available from the University of Wisconsin-Extension and Wisconsin Department of Natural Resources that provide information about and illustrations of aquatic plants, detailing their importance in providing habitat and food resources in aquatic environments, and explaining the need to control the spread of undesirable and nuisance plant species.

Recommended Protection Measures

The following actions are recommended for the management of ecologically valuable areas and aquatic plants:

1. The Kelly Lakes Association should continue to support the preservation and rehabilitation of the secondary environmental corridor lands and isolated natural resource features in the Kelly Lakes tributary drainage area. These lands, and especially their associated wetland areas, are recommended to be protected and preserved to the extent practicable through their incorporation into the stormwater management system and related drainageways, or inclusion in site plans as local parks, recreational trails, or open spaces; and restoration to reestablish their natural structure and function within the landscape.[7] Such preservation and rehabilitation should be promoted through the existing regulations and programs intended to protect such natural resources.

2. The Kelly Lakes Association, in cooperation with the City of New Berlin and the Wisconsin Department of Natural Resources, should maintain the restored wetlands adjacent to the southwestern portion of Upper Kelly Lake. Such an action enhances the ecological value of the Commission-delineated secondary environmental corridor within which the wetland system is located.

3. Monitoring of the Lakes and surrounding wetlands for the presence or spread of nuisance plant species such as Eurasian water milfoil and purple loosestrife should continue, with careful attention being paid to the presence of the *Eurhychiopsis lecontei*, an aquatic weevil species believed to control Eurasian water milfoil and naturally occurring in the Kelly Lakes.

[7] *SEWRPC Community Assistance Planning Report No. 209,* op. cit.

4. The Kelly Lakes Association should continue its limited harvesting operations, in accordance with the aquatic plant management plan set forth in Appendix C. Use of contract harvesting, rather than operation of a wholly-owned machine, may be a viable alternative for the Kelly Lakes Association.

5. In areas that are inaccessible to the harvester in Upper Kelly Lake, manual harvesting of plants around piers and docks is the recommended means of controlling milfoil and other nuisance species of plants in those areas given the small size of the Lake. In this regard, the Association could consider purchasing several specialty rakes designed for the removal of vegetation from shoreline property and make these available to riparian owners. This would allow the riparian owners to use the rakes on a trial basis before purchasing their own. The rakes cost approximately $90 each. Provided their use is restricted to an approximately 30-foot-wide corridor along the shoreline, extending lakewards for an unlimited distance, use of manual control agents does not require a permit.

6. Should Eurasian water milfoil be determined to reach nuisance proportions, the use of chemical herbicides should be considered. Early spring or late fall treatments to control the growth of Eurasian water milfoil have proven effective in other lakes in southeastern Wisconsin and are recommended. Early spring herbicide treatments reduce the biomass subject to decomposition and limit the accumulation of organic materials on the Lake bottom.

7. It is recommended that aquatic plant surveys continue to be conducted every three to five years in order to track the success of the aquatic plant management program, as well as any other changes in the tributary drainage area that may affect the Kelly Lakes, and make adjustments as necessary and appropriate.

8. The Kelly Lakes Association, through an educational and informational program, should promote awareness of Lake residents, visitors, and watershed residents of good urban housekeeping practices, and the invasive nature of such exotic, nonnative species as Eurasian water milfoil and purple loosestrife. Participation in citizen-based control programs coordinated by the Wisconsin Department of Natural Resources and University of Wisconsin-Extension should be encouraged.

FISHERIES

Few data on the fisheries of the Upper Kelly Lake are available. Notwithstanding, as has been noted in Chapter III, fishing is a popular pastime on the Kelly Lakes. Because those data that are available suggest that the fishery in the Lakes may be unbalanced, the conduct of a fisheries inventory is considered to be an issue of concern. Given the conclusion set forth by the Wisconsin Department of Natural Resources as a consequence of their 1993 fisheries survey on Upper Kelly Lake, additional measures for managing the fishery of the Kelly Lakes may be required to maintain the bass fishery.

Recommended Management Measures

It is recommended that the Wisconsin Department of Natural Resources conduct a follow-up fisheries survey to determine if more restrictive regulatory measures are required. It is further recommended that a fisheries survey be conducted in Lower Kelly Lake to establish a fisheries baseline for that waterbody. Implementation of regulatory or remedial measures, such as modified size limits for catches and stocking, in both Lakes should be based upon the findings set forth in the recommended surveys.

NONPOINT SOURCE POLLUTION CONTROLS AND SURFACE WATER QUALITY

The Kelly Lakes are eutrophic waterbodies. As such, they may be considered, by definition, to be in need of protection and rehabilitation if they are to maintain and enhance their current aesthetic and recreational uses. The anticipated urbanization of the watershed under buildout conditions, as set forth in the aforenoted regional land

use and County development plans and when viewed in light of the recent U.S. Geological Survey findings regarding the potential impacts of suburban lawn care practices on stormwater runoff in urbanized watersheds in Wisconsin,[8] has heightened concern among lakeshore residents that the water quality of the Lakes may deteriorate further. Thus, consideration is given in this section to those actions that will protect lake water quality and reduce contaminant loads to the Lakes.

As described in Chapter II, the primary sources of pollutant loadings to the Kelly Lakes are nonpoint sourced contaminants generated in the drainage area tributary to the Lakes. The regional land use plan and Waukesha County development plan envisions a significant increase in the area of urban residential lands in the drainage area tributary to the Kelly Lakes. Such development has the potential to result in increased loadings of some pollutants associated with urban development and construction sites. For this reason, the adopted regional water quality management plan nonpoint source pollution abatement plan element for the Root River watershed generally recommends urban nonpoint source pollution control practices designed to reduce the pollutant loadings from nonpoint sources by about 50 percent, plus additional controls in the downstream portions of the drainage basin.[9] The initial regional plan also recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans. The preparation of a stormwater management plan by the City of New Berlin during 1998 is consistent with this recommendation.[10]

Watershed management measures may be used to reduce nonpoint source pollutant loadings from such rural sources as runoff from cropland and pastureland; from such urban sources as runoff from residential, commercial, transportation, and recreational land uses; and from construction activities. The alternative, nonpoint source pollution control measures considered in this report are based upon the recommendations set forth in the regional water quality management plan,[11] the Waukesha County soil erosion control plan,[12] and information presented by the U.S. Environmental Protection Agency.[13]

Array of Control Measures

To control nonpoint source pollution to the Kelly Lakes and its tributary drainage area, both urban nonpoint source controls, and rural nonpoint source controls, are considered viable options. In addition, specific wetland restoration and storage options are discussed.

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[8]*U.S. Geological Survey Water-Resources Investigations Report,* Sources of Phosphorus in Stormwater from Two Residential Urban Basins in Madison, Wisconsin: 1994-95, *in press.*

[9]*SEWRPC Planning Report No. 30,* A Regional Water Quality Management Plan for Southeastern Wisconsin: 2000, *Volume One,* Inventory Findings, *September 1978; Volume Two,* Alternative Plans, *February 1979; and Volume Three,* Recommended Plan, *June 1979.*

[10]*Camp Dresser & McKee, Inc.,* Storm Water Master Plan for the City of New Berlin, *December 1998.*

[11]*SEWRPC Planning Report No. 30,* op. cit.*; and SEWRPC Memorandum Report No. 93,* A Regional Water Quality Management Plan for Southeastern Wisconsin: An Update and Status Report, *March 1995.*

[12]*SEWRPC Community Assistance Planning Report No. 159,* Waukesha County Agricultural Soil Erosion Control Plan, *June 1988.*

[13]*U.S. Environmental Protection Agency, Report No. EPA-440/4-90-006,* The Lake and Reservoir Restoration Guidance Manual, *2nd Edition, August 1990; and its technical supplement, U.S. Environmental Protection Agency, Report No. EPA-841/ R-93-002,* Fish and Fisheries Management in Lakes and Reservoirs: Technical Supplement to the Lake and Reservoirs Restoration Guidance Manual, *May 1993.*

Urban Nonpoint Source Controls

Potentially applicable urban nonpoint source control measures include wet detention basins, grassed swales, and good urban housekeeping practices. Generally, the application of low-cost urban housekeeping practices may be expected to reduce nonpoint source loadings from urban lands by about 25 percent. Public informational programs can be developed to encourage such good urban housekeeping practices, to promote the selection of building and construction materials which reduce the runoff contribution of metals and other toxic pollutants, and to promote the acceptance and understanding of the proposed pollution abatement measures and the importance of lake water quality protection. Urban housekeeping practices and source controls include restricted use of fertilizers and pesticides; improved pet waste and litter control; the substitution of plastic for galvanized steel and copper roofing materials and gutters; proper disposal of motor vehicle fluids; increased leaf collection; and reduced use of street deicing salt.

Proper design and application of urban nonpoint source control measures such as grassed swales and detention basins requires the preparation of a detailed stormwater management system plan that addresses stormwater drainage problems and controls nonpoint sources of pollution. Such a detailed plan has been prepared for the City of New Berlin,[14] and has been implemented pursuant to the stormwater management ordinance adopted in April 2003 as Chapter 226, "Stormwater Runoff," of the Municipal Code of the City of New Berlin. This ordinance establishes standards and permitting requirements for the control of post-construction stormwater runoff. The ordinance provisions affect residential land development activities of five acres or greater in areal extent as well as nonresidential land development activities of five acres or greater in areal extent or that create impervious surfaces of one-half acre or greater in areal extent. In addition, all land development activities, regardless of area, considered by the City Engineer to be likely to result in runoff that exceeds the safe capacity of existing drainage facilities, causes undue channel erosion, increases water pollution by scouring or transportation of particulates, or endangers property or public safety, are subject to the provisions of the ordinance.

Notwithstanding, practices considered to be effective within the existing urban areas and recommended in the lake protection plan for the Kelly Lakes revolved around the implementation of adequate urban housekeeping practices, maintenance of grassed swales, and provision for stormwater detention. Implementation of the latter practice was proposed to be accomplished through, and would be compatible with, the restoration of the structure and function of the wetland ecosystems immediately upstream of Kelly Lakes pursuant to recommendations set forth above for the protection of ecologically valuable areas. To this end, the Kelly Lakes Association, in partnership with the City of New Berlin and Wisconsin Department of Natural Resources, implemented a stream recreation and wetland restoration project at the debouchment of the unnamed stream drain into Upper Kelly Lake during 2005. The installation of an approximately three-acre wetland basin within a restored shallow-water marsh ecosystem at the headwaters of Upper Kelly Lake was recommended as a means of potentially further reducing phosphorus levels entering Upper Kelly Lake to meet the balance of the approximately 50 percent reduction goal established in the adopted nonpoint source pollution control plan for the Root River basin.[15] This project is described in detail in Appendix D.

Developing areas can generate significantly higher pollutant loadings than established areas of similar size. These areas include a wide array of activities, including individual site development within the existing urban area, and new land subdivision development. As previously noted, additional residential development is presently occurring and/or planned within the drainage area tributary to the Kelly Lakes. These construction sites may be expected to produce suspended solids and phosphorus loadings at rates several times higher than established urban lands, and control of sediment loss from construction sites is recommended. In the City of New Berlin, construction site erosion controls are currently provided for by measures set forth in Chapter 110, "Erosion Control," City of New Berlin Code of Ordinances. This Code is administered and enforced by the City in both the shoreland and nonshoreland areas of the drainage area within the City of New Berlin tributary to the Kelly Lakes. The

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[14]*Camp Dresser & McKee, Inc.,* op. cit.

[15]*SEWRPC Planning Report No. 9,* A Comprehensive Plan for the Root River Watershed, *July 1966.*

provisions of this ordinance apply to all land disturbing activities in the City that occur on platted lots within a subdivision plat, lots developed under a certified survey map, areas of 4,000 square feet or greater, works where fill and/or excavation volumes exceed 400 cubic yards, public streets, roads, or highways, watercourses, and utilities.

In the Village of Hales Corners, such controls are currently provided by measures set forth in Section Comm 21.125, Erosion Control Procedures of Uniform Dwellings, Chapters 20-25 of the *Wisconsin Administrative Code*. These controls include temporary measures taken to reduce pollutant loadings from construction sites during stormwater runoff events, in a manner consistent with the provisions set forth in the construction site management handbook developed by the Wisconsin Department of Natural Resources in cooperation with the Wisconsin League of Municipalities.[16]

Construction erosion controls may be expected to reduce pollutant loadings from construction sites by about 75 percent. However, such practices are expected to have only a minimal impact on the total pollutant loading to the Kelly Lakes due to the relatively small amount of land being developed at any given time. Nevertheless, such controls are important pollution control measures that can abate localized short-term loadings of phosphorus and sediment from the drainage area and the upstream tributary area, and minimize the cumulative impacts of such loadings. The control measures include such revegetation practices as temporary seeding, mulching, and sodding; such runoff control measures as placement of filter fabric fences, straw bale barriers, storm sewer inlet protection devices, diversion swales, sediment traps, and sedimentation basins; and such site management practices as placement of tracking pads to limit the movement of soils from work sites.

Rural Nonpoint Source Controls

Upland erosion from agricultural and other rural lands is a minor contributor of sediment within the tributary drainage area to the Kelly Lakes, and is expected to diminish substantially under buildout conditions. Estimated phosphorus and sediment loadings from croplands, woodlots, pastures, and grasslands in the drainage area tributary to the Kelly Lakes were presented in Chapter II. These loadings are recommended to be reduced to the target level of agricultural erosion control of three tons per acre per year identified in the Waukesha County agricultural soil erosion control plan as the tolerable levels that can be sustained without impairing productivity. Since agriculture is a minor and diminishing land use within the drainage area, implementation of these recommendations is considered to be a secondary water quality management measure for the Kelly Lakes. However, until such time as they are converted from agricultural usage, existing farming operations should continue to implement and maintain nonpoint source pollution control measures to reduce current sediment, nutrient, and agri-chemical loading rates to the extent practicable.

Wetland Restoration for Water Quality Protection

As noted above, significant areas of wetland exist within the drainage area tributary to the Kelly Lakes. Many of these systems have been subjected to prior disturbances that may have reduced their effectiveness as areas providing natural stormwater storage and water quality improvement. These wetlands have now been largely protected through local zoning. However, additional actions were recommended to restore the natural functioning of prior-disturbed shoreland wetland systems. In this regard, specific actions have been implemented to mitigate flooding created by the construction of Frances Avenue, St. Mary's Drive, and Rosemary Drive in the City of New Berlin, and to enhance the water quality protection that such wetland flooding regimes provide along the unnamed tributary discharging to Upper Kelly Lake, as described in Appendix D. Diversion of the inflow to Upper Kelly Lake through a recreated stream and restored wetland system located in the southeastern quadrant of the intersection of Frances Avenue and St. Mary's Drive to increase the degree of water quality protection for Upper Kelly Lake.[17] The wetland would be similar in size to the prior-disturbed wetland at that location, as shown

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[16]*Wisconsin League of Municipalities and Wisconsin Department of Natural Resources,* Wisconsin Construction Site Best Management Practices Handbook, *November 1993.*

[17]*Camp Dresser & McKee, Inc.,* op. cit.

on Map 14, and potentially increase opportunities for passive recreational use of Upper Kelly Lake, maintain existing levels of public access to the Lake, and enhance the aesthetic and habitat value of the existing secondary environmental corridor delineated in this area. As of late 2005, the grading and planting activities associated with this restoration project had been completed, funded in part by Chapter NR 191 Lake Protection Grant funds provided through the Wisconsin Department of Natural Resources with additional funds provided by the City of New Berlin and Kelly Lakes Association.

Public Informational Programming

In addition to actions designed to restore the natural structure and function of wetland systems upstream of Upper Kelly Lakes as a means of protecting water quality within the Kelly Lakes system—and the downstream Root River—additional actions can be undertaken to minimize nutrient loadings from source areas within the drainage area tributary to the Kelly Lakes. Based upon the aforereferenced findings of the U.S. Geological Survey, residential lawns form a major source of phosphorus to watercourses in urban areas. In some cases, this phosphorus source is enhanced as a consequence of the lawn care practices employed by householders within the drainage area. For this reason, informational programming directed at alternative and appropriate lawn care practices should be provided within this rapidly urbanizing drainage area. Such programming should be predicated upon the soil chemistry and soil nutrient requirements for urban residential lawns and gardens that can be determined through relatively simple soil testing conducted by the University of Wisconsin-Extension. Soil test results allow householders to apply appropriate levels of fertilization to their gardens, generally saving the householder some level of expense and effort, while providing additional protections to the Lakes.[18] In addition, distribution of lawn care pamphlets within the drainage area, providing information on composting, yard care, and maintenance of the grassed swale stormwater system, would apprise householders of alternative means of maintaining their properties.[19]

Additional programming should be continued to keep the householders in the Kelly Lakes community informed of the current state of their Lakes' water quality. To this end, ongoing participation in the Wisconsin Department of Natural Resources Self-Help Monitoring Program is recommended as a means of assessing the health of the Kelly Lakes on a regular basis. Reports on the results of these studies should continue to be featured at the annual meetings of the Kelly Lakes Association.

Recommended Control Measures

The following management actions are recommended for the management of nonpoint source pollution sources and surface water quality:

1. The Kelly Lakes Association, in conjunction with the City of New Berlin, should assume the lead in the development of a public educational and informational program for the residents around the Kelly Lakes and within the drainage area tributary to the Kelly Lakes, which encourages the institution of good urban housekeeping practices including, pesticide and fertilizer use management, improved pet waste and litter control, and yard waste management, as well as other lake management-related topics. The Kelly Lakes Association, in cooperation with service clubs and other nongovernmental organizations within the drainage area tributary to the Kelly Lakes, should acquire and distribute relevant publications in the University of Wisconsin-Extension "Yard Care and the Environment" series to encourage sound yard care practices within the watershed, and encourage their memberships to participate in the soil testing program offered by the University of Wisconsin-Extension. It is recommended that informational programming related to nonpoint source pollution abatement and other lake management topics be included at the annual meetings of the Kelly Lakes Association.

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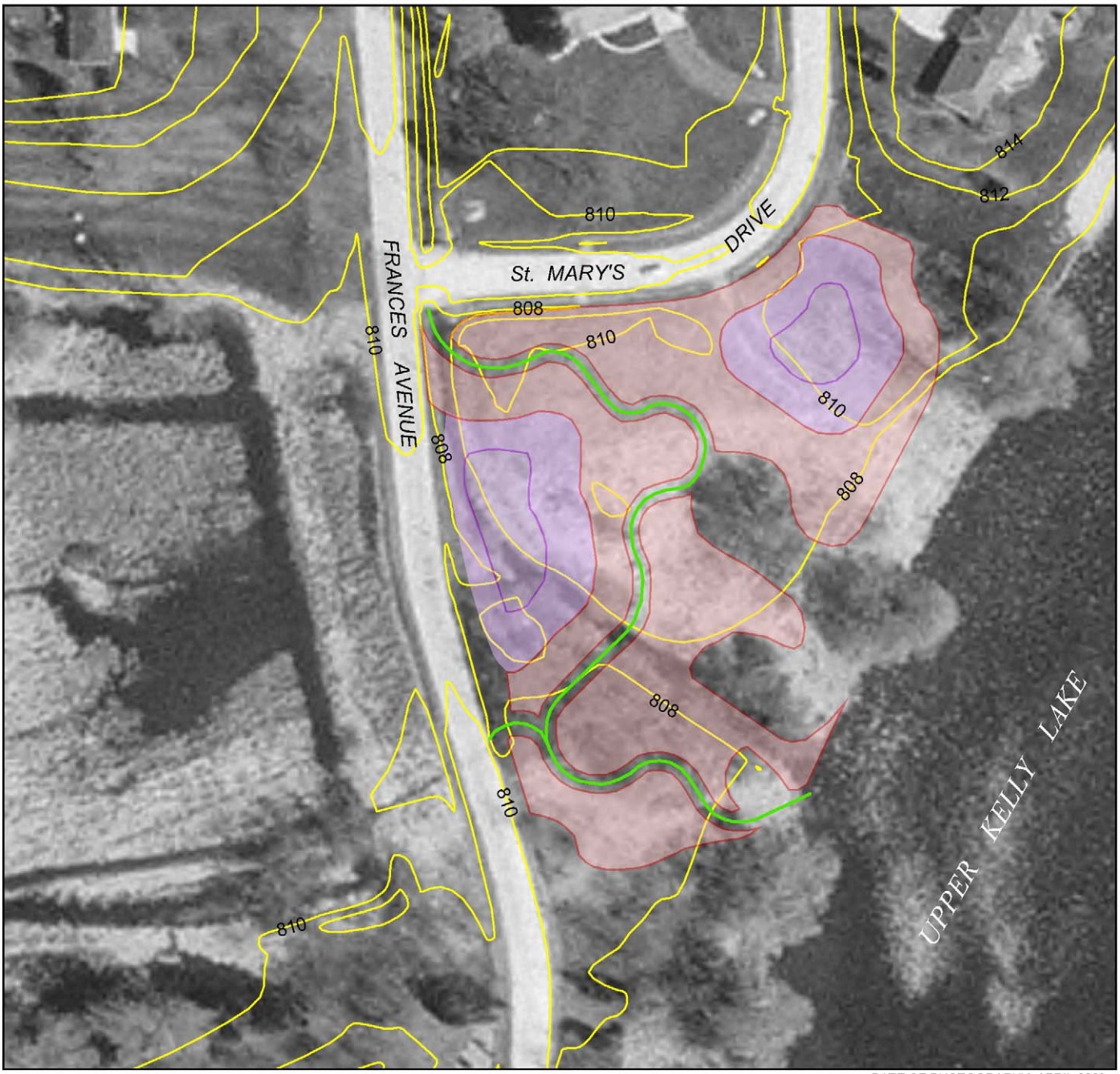
[18]*See Wisconsin Department of Natural Resources Technical Standard No. 1100, "Turf Nutrient Management," the latest edition of which is currently under revision by the Department, as of December 2005.*

[19]*For example, see University of Wisconsin-Extension Publication No. GWQ007,* Practical Tips for Home and Yard*, 1993, and related publications in the "Yard Care and the Environment" series.*

Map 14

PROPOSED LOCATIONS OF THE UPPER KELLY LAKE TRIBUTARY AND EXTENT OF WETLAND RESTORATION AREAS FOR UPPER KELLY LAKE RESTORATION PROJECT



DATE OF PHOTOGRAPHY: APRIL 2003

PROPOSED CHANNEL
WET MEADOW
SHALLOW MARSH
PROPOSED CONTOUR AT 807.5 FEET
PROPOSED CONTOUR AT 806.5 FEET
TOPOGRAPHIC LINES AT TWO FOOT CONTOURS

N

GRAPHIC SCALE
0 25 50 100 Feet

Source: SEWRPC.

2. The construction site erosion control, stormwater and water quality protection ordinances adopted by the City of New Berlin and Waukesha County, and the Village of Hales Corners and Milwaukee County should be strictly enforced to reduce sediment and contaminant loadings from the urbanizing areas in the tributary drainage area to the Kelly Lakes, especially in those areas nearest to the Lakes.

3. The existing grassed swale drainage system within the Kelly Lakes drainage area should be maintained to minimize the nutrient and sediment loads delivered to the Kelly Lakes, especially Upper Kelly Lake, which is directly affected by the quality of water entering the lake through the tributary stream.

4. The Kelly Lakes Association should continue to participate in the Wisconsin Department of Natural Resources Self-Help Monitoring Program as a means of regularly assessing the health of the Lakes and in order to provide an early warning of undesirable changes in lake water quality and aquatic species composition so as to allow the Association, in cooperation with relevant governmental agencies, to initiate appropriate responses in a timely manner. Participation in the Expanded Self-Help Monitoring Program is recommended. The report of the citizen monitor should continue to be featured at the annual meeting of the Association.

PUBLIC RECREATION AND BOATING ACCESS

The Kelly Lakes provide opportunities for water-based recreation to the residents of the City of New Berlin and the Village of Hales Corners and within the Southeastern Wisconsin Region. As described in Chapter III, potential recreational use problems are related to the current public recreational boating access to Upper Kelly Lake which may not meet the minimum standards set forth in Chapter NR 1 of the *Wisconsin Administrative Code*. Associated with this is the fact that the existing public park on Upper Kelly Lake is situated on filled wetland, a site that has potential for restoration of wetland structure and function.

Access Standards

Determination of the amount of access that should be accommodated at Upper Kelly Lake is dependent on the areal extent of the open water lake surface. Upper Kelly Lake, with a surface area of 12 acres, falls in the one- to 50-acre category for recreational use lakes established in Section NR 1.91 of the *Wisconsin Administrative Code*. Within this category, the minimum and maximum standards are the same; namely, one carry-in access site for five vehicles plus a handicapped accessible unit, for a total of six units.

Pursuant to state boating laws as set forth in Chapter 30, *Wisconsin Statutes*, and based upon their small open water area, the Kelly Lakes are slow-no-wake Lakes. As reported in Chapter II, the numbers of watercraft moored or stored around the Kelly Lakes had increased from the approximately 20 watercraft observed by Commission staff during July 1998 to approximately 40 watercraft observed on the Lakes during 2005. At the time of the 1998 survey, one watercraft was in operation on Upper Kelly Lake during a typical weekday. Observations, conducted during 2005, suggest little change in the intensity of use of recreational watercraft on the Kelly Lakes.

Array of Options

Two options to provide public recreational boating access and other recreational activities to Upper Kelly Lake have been identified; namely, 1) to provide a level of access fully consistent with the standards set forth in Chapter NR 1 of the *Wisconsin Administrative Code*, and 2) to provide enhanced lakeside educational and recreational opportunities through creation of a lakeside ecological corridor, wetland restoration in the vicinity of the existing park and along the unnamed influent tributary to Upper Kelly Lake, and provision of appropriate signage.

Recommended Boating Access

1. It is recommended that provision of adequate public parking be considered for the existing public recreational boating access site at the S. Kurtz Avenue right-of-way. It is recommended that parking be provided for six vehicles, including one handicapped accessible unit. No parking is currently provided at or near the access site; onstreet parking is currently very limited. The proposed parking

facilities should conform to the guidance on accessibility contained in Wisconsin Department of Natural Resources Publication No. CA-003-88, *Handbook for Accessibility...A Reference to Help Develop Outdoor Recreation Areas to Include People with Disabilities*. Such access facilities would provide for greater convenience of the residents of Upper Kelly Lake as well as for the convenience and safety of the public at large by providing an improved public launch site with adequate parking facilities.

2. It is further recommended that consideration be given to integrating existing public recreational opportunities into an enhanced ecological corridor located along the southwestern shoreline of Upper Kelly Lake. This corridor, situated adjacent to and south of the intersection of Frances Avenue and St. Mary's Drive, is proposed to include lands proposed for acquisition to support the restoration of wetland structure and function in the vicinity of the unnamed tributary draining to Upper Kelly Lake, as well as existing park and open space lands previously acquired by the City of New Berlin and outlots of the Woodfield Park Subdivision currently in open space use. Such action would allow the existing City park and adjacent properties, in part, to be restored to their original wetland condition for enhanced wildlife, aesthetic, educational, and hydrologic purposes.

INSTITUTIONAL DEVELOPMENT

Both public and private organizational options for the management of lakes in the State of Wisconsin exist.[20] Private lake organizations also have the option to be incorporated, generally as nonstock, not-for-profit corporations under Chapter 181, *Wisconsin Statutes*. Public lake organizations are special purpose units of government that are created generally as public inland lake protection and rehabilitation districts under Chapter 33, *Wisconsin Statutes*, although some sanitary districts and utility districts created pursuant to the municipal statutes also engage in lake management activities. The specific type of organizations created is based upon the decision of the community.

Types of Lake Organizations

Private lake organizations are voluntary. Such organizations have the advantage that there are few restrictions imposed upon the types of activities in which they engage, subject to relevant permits and laws. Incorporated associations generally have a somewhat greater number of restrictions imposed upon them, but may be considered qualified associations for purposes of obtained state cost-share grants. Because of their voluntary nature, membership levels, and, therefore, income levels, of associations often fluctuate from year-to-year. Thus, when associations take on specific tasks such as aquatic plant management, for example, the community often elects to create a public inland lake protection and rehabilitation, or lake management, district.

Lake districts are public governmental units formed for the specific purpose of managing and protecting lake water quality. Inclusion in the district, once the district is created, is mandatory; registered voters and persons owning property within the district become the electors of the district for purposes of governance. Lake management districts have the capability of raising public funds subject to majority approval of the district budget at the annual meeting of the district. For this reason, lake management districts can provide a more stable financial base from which to undertake lake management activities. Often, lake associations and lake districts operate in harmony around lakes throughout Wisconsin.

The decision by the Kelly Lakes Association membership in 1995 to acquire and operate an aquatic plant harvester on Upper Kelly Lake has prompted community consideration of alternative means of lake management organization. Currently, while the majority of lakeshore householders express concern about the state of the Kelly Lakes, relatively few comprise the dues paying membership of the Kelly Lakes Association. In contrast, the benefits of the aquatic plant harvesting operation accrue to the entire Kelly Lakes community. Further, the operation and maintenance costs of the harvesting program, while relatively modest at approximately $2,400 per

[20]*See University of Wisconsin-Extension Publication No. G3216,* The Lake in Your Community, *1986.*

year, are unlikely to fluctuate markedly and may even escalate as operating costs increase and the need for maintenance recurs. Thus, there is some concern that the voluntary association may not be able to reliably fund this operation and attendant insurance costs on an ongoing basis. For this reason, formation of a public inland lake protection and rehabilitation district, pursuant to Chapter 33, *Wisconsin Statutes*, is recommended.

Section 33.25, *Wisconsin Statutes*, provides for the formation of public inland lake protection and rehabilitation districts by petition. In the case of the Kelly Lakes community, such a petition would be most likely to be directed to Waukesha County as the county likely to have the largest portion of the equalized value of the proposed district within its jurisdiction. This petition would have to identify a name for the proposed district, define the boundaries of the district, and contain the signatures 51 percent of the landowners or those of the owners of 51 percent of the land within the proposed district. In addition, the petition should set forth the necessity for the district—the basis upon which a district is being formed and the reason why a district is necessary, and the purpose that the district will serve—that the district will promote the public health, convenience, necessity, or public welfare and benefit the lands being included within the district.[21]

In the case of the Kelly Lakes, an additional requirement applicable to the formation of a district, set forth in Section 33.24, *Wisconsin Statutes*, would be that approvals have to be obtained from the City of New Berlin and Village of Hales Corners for inclusion of their territory within the proposed district prior to the petition to form a lake management district being submitted to Waukesha County for consideration.

Other considerations relating to the definition of a lake management district boundary are the extent to which the drainage area tributary to a lake is included in a district, and, in the case of a chain of lakes, the numbers of lakes to be included. It is rarely practical to include a lake's total tributary drainage area within a lake management district. Based upon guidance provided by the University of Wisconsin-Extension, it is recommended that the entire lakeshore, all riparian property, areas directly affecting the lake and/or which are included in planned service areas, and entire parcels be included.[22]

Array of Institutional Measures

Given the small sizes of the Kelly Lakes, and the limited numbers of riparian residents, it would be appropriate to include both Lakes within a single district. Pursuant to the guidance provided by the University of Wisconsin-Extension, riparian properties surrounding the lakes should be included within the proposed district; to wit, properties within a boundary demarcated by W. Grange Avenue between St. Mary's Drive and Kurtz Road, by Kurtz Road between W. Grange Avenue and 124th Street, by 124th Street extended to about Rosemary Drive at Albert Avenue, by Albert Avenue, by Rosemary Drive between Albert Avenue and Frances Avenue, by Frances Avenue and by Frances Avenue between Rosemary Drive and St. Mary's Drive, and by St. Mary's Drive to W. Grange Avenue. This area, shown on Map 15 as Alternative 1, encompasses small tracts and portions of the Kelly Subdivision within the City of New Berlin and Village of Hales Corners.

An alternative district boundary could be defined as encompassing lands in the northeast one-quarter and southeast one-quarter of the northeast one-quarter of U.S. Public Land Survey Section 36, Town 6 North, Range 20 East, and the northwest one-quarter and southwest one-quarter of the northwest one-quarter of U.S. Public Land Survey Section 31, Town 6 North, Range 21 East, or an area approximately bounded by W. Grange Avenue on the north, Kurtz Road on the east, Glengary Road extended on the south, and Greentree Drive extended on the west. This alternative, shown on Map 16 as Alternative 2, encompasses small tracts and portions of the Kelly and Wood Field Park Subdivisions within the City of New Berlin and Village of Hales Corners.

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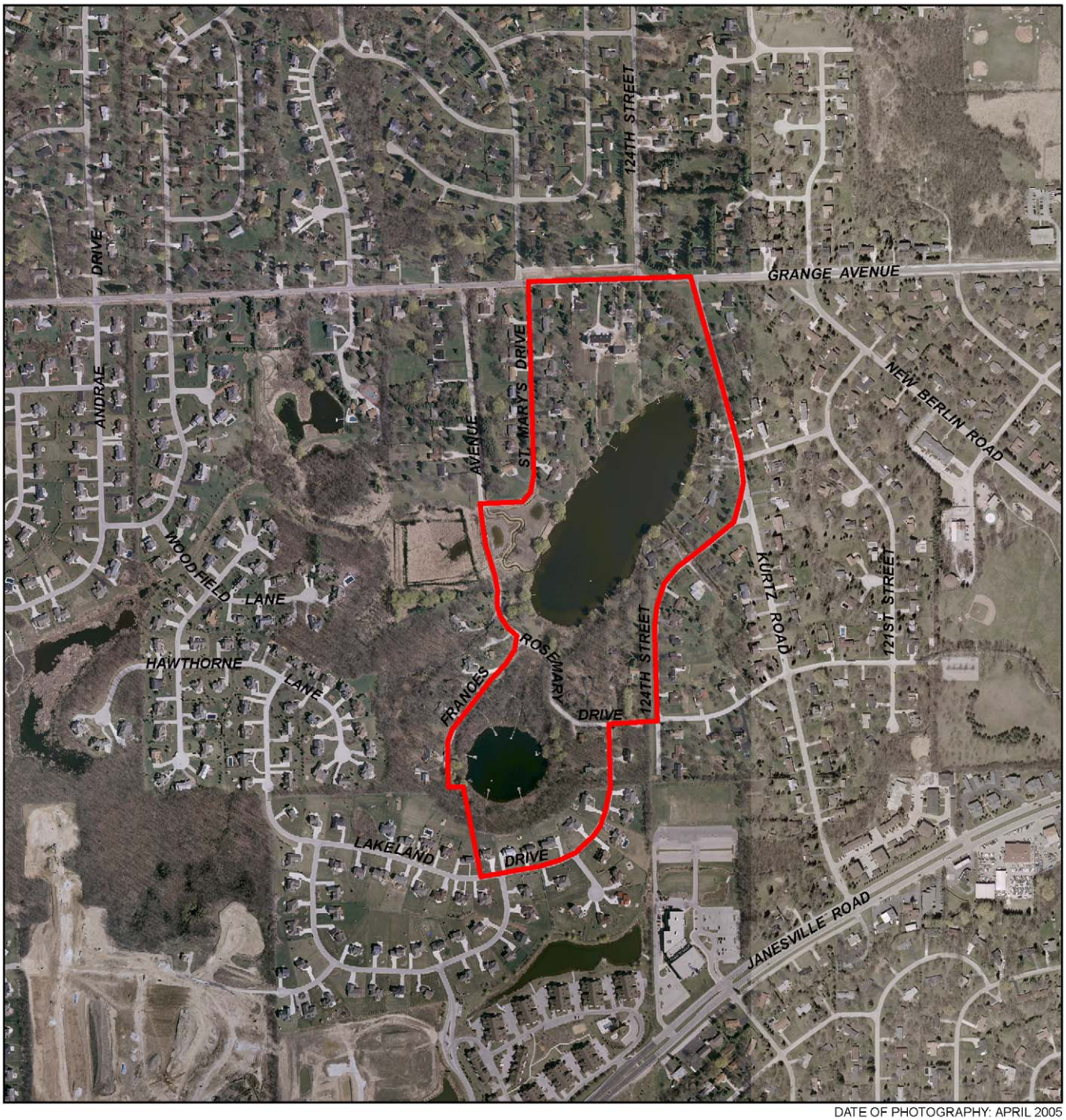
[21]*Benefit has been defined in terms of the benefit to the district of having particular lands included within the district boundaries, rather than the benefit to the individual landowner. See University of Wisconsin-Extension,* Guide to Wisconsin's Lake Management Law, Tenth Edition, *1996.*

[22]*University of Wisconsin-Extension,* Guide to Wisconsin's Lake Management Law, Tenth Edition, *1996.*

Map 15

ALTERNATIVE 1: DISTRICT BOUNDARY FOR UPPER AND LOWER KELLY LAKES MANAGEMENT DISTRICT INCORPORATING RIPARIAN LANDS



DATE OF PHOTOGRAPHY: APRIL 2005

POTENTIAL DISTRICT BOUNDARY

Source: SEWRPC.

N

GRAPHIC SCALE

0 400 800 Feet

Map 16

ALTERNATIVE 2: DISTRICT BOUNDARY LINES FOR UPPER AND LOWER KELLY LAKES MANAGEMENT DISTRICT

DATE OF PHOTOGRAPHY: APRIL 2005

POTENTIAL DISTRICT BOUNDARY

Source: SEWRPC.

N

GRAPHIC SCALE

0 400 800 Feet

A drainage basin-based alternative, Alternative 3, would encompass additional lands to the north and west of the area described above, including small tracts and portions of the Kelly, Wood Field Park, High Grove, Hales Heights, Kelly Brook, Hale Crest, Sunny Slope Heights, Orchard Valley, Sommerset Gardens, Timber Edge, and Rolling Hills Subdivisions within the City of New Berlin and Village of Hales Corners. However, such an alternative is not considered to be feasible as electors within the lands more than three tiers of development removed from the Lakes rarely recognize any substantial connection to the Lakes. Inclusion of potentially large numbers of electors from outside of the first and second tier developments surrounding the Lakes could reduce the ability of the proposed district to conduct lake management activities.

The establishment of the boundaries of a lake protection and rehabilitation district should be undertaken with care. As noted, guidance provided by the University of Wisconsin-Extension suggests inclusion within a district of the entire lakeshore, of all riparian properties, of lake-related properties, of as much of the lake's watershed as is logistically and politically feasible, of all lands to be included in proposed service areas, of entire parcels, and of all parcels necessary to avoid holes within the district. While there are sound technical and economic reasons for including the Lakes' watershed or direct tributary drainage area in the district, as provided for under Alternative 3, significant political and social difficulties may arise that limit the ability of the district encompassing the entire drainage area to carry out a program of lake protection and rehabilitation activities. Similarly, the inclusion of only riparian owners under Alternative 1 fails to provide adequate geographic scope for the proposed district to exercise management control over the recommended wetland restoration project. While it is not impossible for a district to operate outside of its immediate boundaries, exclusion of the project area from within the district limits access and "community-ownership" of the project. Therefore, should a public inland lake protection and rehabilitation district be formed around the Kelly Lakes, it is recommended that the district boundaries be similar to those set forth under Alternative 2, wherein not only the two Lakes are included within the district but also the proposed wetland restoration project area.

Recommended Institutional Structure

It is recommended that the Kelly Lakes Association consider forming a public inland lake protection and rehabilitation district around the Kelly Lakes, the approximate boundaries of which should be W. Grange Avenue on the north, Kurtz Road on the east, Glengary Road extended on the south, and Greentree Drive extended on the west. This area would encompass the two Lakes and the proposed wetland area to be restored as set forth herein. Creation of a lake management district for the Kelly Lakes would enhance the ability of the Kelly Lakes community to manage the Kelly Lakes on a sustainable basis, and provide a sound fiscal base from which to conduct lake management activities.

SUMMARY

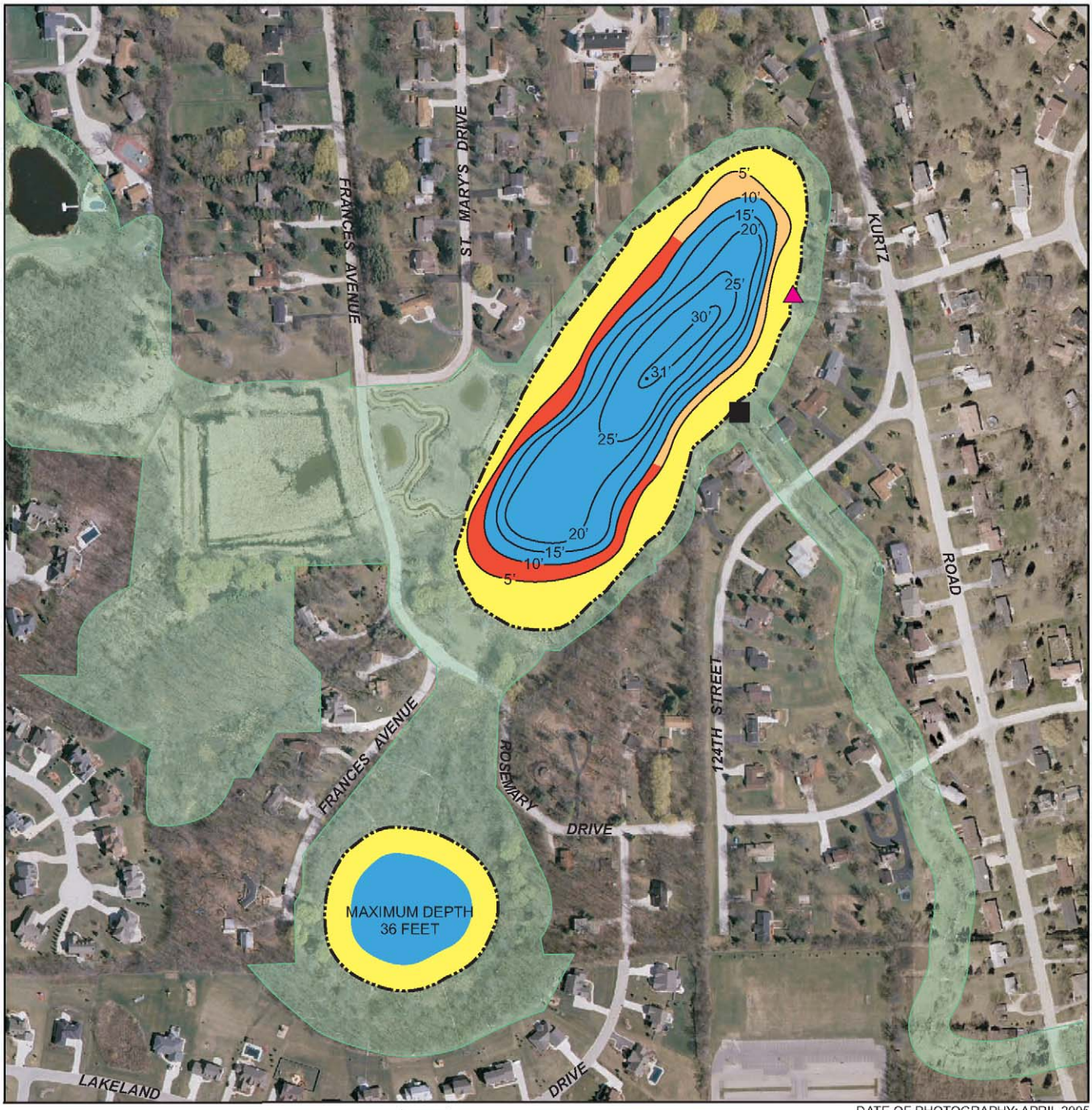
This plan, which documents the findings and recommendations of a study requested by the Kelly Lakes Association, Inc., examines existing and anticipated conditions and potential management problems of the Kelly Lakes and presents a recommended plan for the resolution of these problems.

The Kelly Lakes were found to be eutrophic, moderately deep water lakes of average quality located in close proximity to the Milwaukee metropolitan area and adjacent to an increasingly urban part of Waukesha County in which its tributary drainage area is almost entirely located. Surveys indicated that the Lakes and their tributary drainage area contain significant areas of ecological value, including numerous wetlands and high-quality wildlife habitat surrounding the Lakes.

The Kelly Lakes protection and recreational use plan, summarized on Map 17 and in Table 11, recommends ongoing action be taken to limit human impacts on the Lake and in its watershed. Ongoing maintenance of the recreated stream and restored wetland system at the inflow to Upper Kelly Lake is recommended, as are additional actions proposed within the adopted City of New Berlin stormwater management plan at IH 43 and W. Grange Avenue. To this end, consideration of additional public acquisition of lands or acquisition of conservation easements over lands within the environmental corridors to ensure the protection and preservation of these ecologically valuable areas is also recommended. The development of adequate public parking to serve the

Map 17

RECOMMENDED LAKE MANAGEMENT PLAN FOR THE KELLY LAKES



DATE OF PHOTOGRAPHY: APRIL 2005

— 20' — WATER DEPTH CONTOUR IN FEET

PUBLIC ACCESS SITE

WATER LEVEL CONTROL STRUCTURE

AQUATIC PLANT MANAGEMENT

EURASIAN WATER MILFOIL CONTROL AREA
HARVESTING: HIGH PRIORITY
CHEMICALS: LIMITED

HARVEST ACCESS LANES
HARVESTING: MODERATE PRIORITY
CHEMICALS: NONE

SHALLOW WATER HABITAT AREA
HARVESTING: NONE
CHEMICALS: NONE

DEEP WATER AREA: NO CONTROL

LAND USE MANAGEMENT

PROTECT ENVIRONMENTALLY VALUABLE AREAS

- PROVIDE PUBLIC FISHING PIER
- RESTORE WETLAND FOR LAKE QUALITY PROTECTION

SHORELINE PROTECTION

- MAINTAIN EXISTING STRUCTURES
- PROTECT UNSTABLE AREAS AND RESTORE SHORELAND WETLANDS

LAKE MANAGEMENT

- ESTABLISH PUBLIC INLAND LAKE PROTECTION AND REHABILITATION DISTRICT

GRAPHIC SCALE
0 200 400 FEET

Source: SEWRPC.

Table 11

RECOMMENDED PROTECTION PLAN ELEMENTS FOR THE KELLY LAKES

Issue	Plan Element	Subelement	Location	Management Measures	Management Responsibility
Ecologically Valuable Areas and Aquatic Plants	Land management measures	Land use plan implementation	Entire watershed	Support implementation set forth in the regional land use plan for Milwaukee County and in the development plan for Waukesha County	City of New Berlin and Village of Hales Corners
		Environmentally sensitive lands protection	Entire watershed	Support preservation and rehabilitation of secondary environmental corridors and isolated natural resource features	Kelly Lakes Association and City of New Berlin
	Watershed land management	Construction site erosion control	Entire watershed	Continue to enforce existing erosion control and water quality protection ordinances; refine ordinances where necessary	City of New Berlin and Village of Hales Corners
		Urban nonpoint source controls	Entire watershed	Implement and maintain recommended good urban housekeeping practices, maintenance of grassed swales, and provision for stormwater detention	City of New Berlin and Village of Hales Corners
			Drainage area directly tributary to the Kelly Lakes	Continue informational programming to encourage good housekeeping measures and sound shoreland management practices	Kelly Lakes Association
		Rural nonpoint source controls	Entire watershed	Implement and maintain rural land best management practices	City of New Berlin
	Aquatic plant management	Mechanical harvesting	Areas of nuisance growth in Upper Kelly Lake	Harvest nuisance aquatic plants	Kelly Lakes Association
		Manual harvesting	Areas of nuisance growth	Harvest nuisance plants, including Eurasian water milfoil, as required around docks and piers	Kelly Lakes Association and individual property owners
		Chemical control	Areas of nuisance growths of nonnative species	Consider chemical control of designated nonnative aquatic plant species such as Eurasian water milfoil and purple loosestrife, as required	Kelly Lakes Association and individual property owners
		Nuisance species monitoring program	Entire watershed	Monitor lakes and surrounding wetlands for the presence or spread of nuisance species, including Eurasian water milfoil, purple loosestrife, and zebra mussel	Kelly Lakes Association
Fisheries	Fisheries management	Fisheries survey	Upper and Lower Kelly Lakes	Conduct fisheries survey of both lakes to determine the current status of the fishery; implement recommendations as necessary	Wisconsin Department of Natural Resources, and Kelly Lakes Association
		Develop a fishery enhancement program based upon survey	Upper and Lower Kelly Lakes	Review survey data and develop fishing regulations and habitat protection measures for improved fisheries as needed	Wisconsin Department of Natural Resources, and Kelly Lakes Association
Nonpoint Source Pollution Controls and Surface Water Quality	Water quality management	Water quality control	Entire lake	Continue to implement specific actions recommended in the adopted stormwater management plan for the protection of the surface water quality of the Kelly Lakes	City of New Berlin
		Water quality monitoring	Entire lake	Continue to participate in the WDNR Self-Help Monitoring Program	Kelly Lakes Association
		Water quality protection	Entire watershed	Purchase of conservation easements and implementation of management practices as appropriate	Kelly Lakes Association, City of New Berlin, and Village of Hales Corners

Table 11 (continued)

Issue	Plan Element	Subelement	Location	Management Measures	Management Responsibility
Public Recreation and Boating Access	Recreational use management	Public access	Upper Kelly Lake	Provide adequate public access Provide enhanced lakeside recreational activities through the establishment of additional open space lands, wetland restoration in the area of the existing park, and enhanced public recreational boating access	City of New Berlin, Village of Hales Corners, Kelly Lakes Association, and WDNR
Institutional Development	Institutional development for lake management	Kelly Lakes Association	W. Grange Avenue on the north, Kurtz Road on the east, Glengary Road extended on the south, and Greentree Drive extended on the West	Consider forming a public inland lake protection and rehabilitation district around the Kelly Lakes	City of New Berlin, Village of Hales Corners, Kelly Lakes Association, and Waukesha County
	Informational program	Public informational programming	Entire watershed	Continue public awareness and information programming Encourage householders to adopt environmentally sustainable land management practices Participate in soil testing program offered by UW-Extension	City of New Berlin, Village of Hales Corners, and Kelly Lakes Association

[a]*Costs to be determined.*

Source: SEWRPC.

recreational boating and public access sites serving the Kelly Lakes is also recommended. Posting of appropriate signage at these sites should be undertaken to support the application of applicable recreational use ordinances and enhance awareness of the lake and watershed management practices being undertaken at the Kelly Lakes.

The plan recommends only limited aquatic plant management action. These actions include limited aquatic plant harvesting in Upper Kelly Lake, as well as selected manual removal and surveillance activities in both Lakes at this time. In cases where purple loosestrife and Eurasian water milfoil are present, limited use of chemical treatments could be considered to control these designated nonnative invasive species, as necessary and subject to the necessary Wisconsin Department of Natural Resources permitting.

The recommended plan includes continuation of the ongoing program of public information and education providing riparian residents and lake users. For example, additional options regarding household chemical usage, lawn and garden care, shoreland protection and maintenance, and recreational usage of the Lakes should be made available to riparian householders, thereby providing riparian residents with alternatives to traditional alternatives and activities.

The plan recommends ongoing activities to maintain the natural structure and function of the wetland system immediately upstream of Upper Kelly Lake to more effectively control nutrient and sediment loading rates into the Lake from the tributary drainage area. Restoration of the prior converted wetlands adjacent to IH 43 within the drainage area tributary to the Kelly Lakes, recommended in the City of New Berlin stormwater management plan, is endorsed.

The recommended plan seeks to balance the demand for high-quality residential and recreational opportunities at the Kelly Lakes with the requirements for environmental protection and preservation of the ambience provided by the wetland and water resources extant within the Kelly Lakes community.

APPENDICES

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Appendix A

REPRESENTATIVE ILLUSTRATIONS OF AQUATIC PLANTS FOUND IN THE KELLY LAKES

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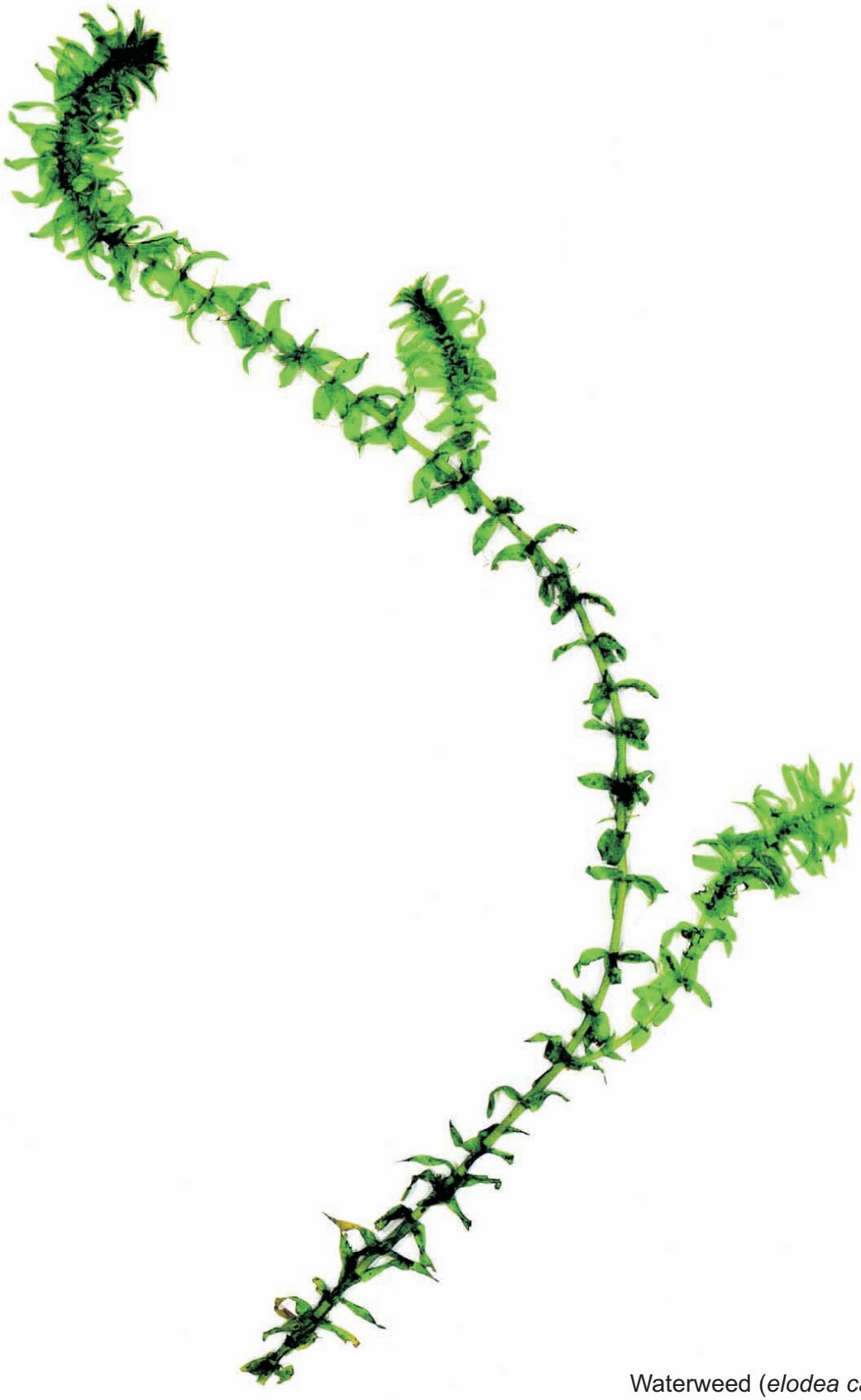
Coontail (*ceratophyllum demersum*)

Muskgrass (*chara vulgaris*)

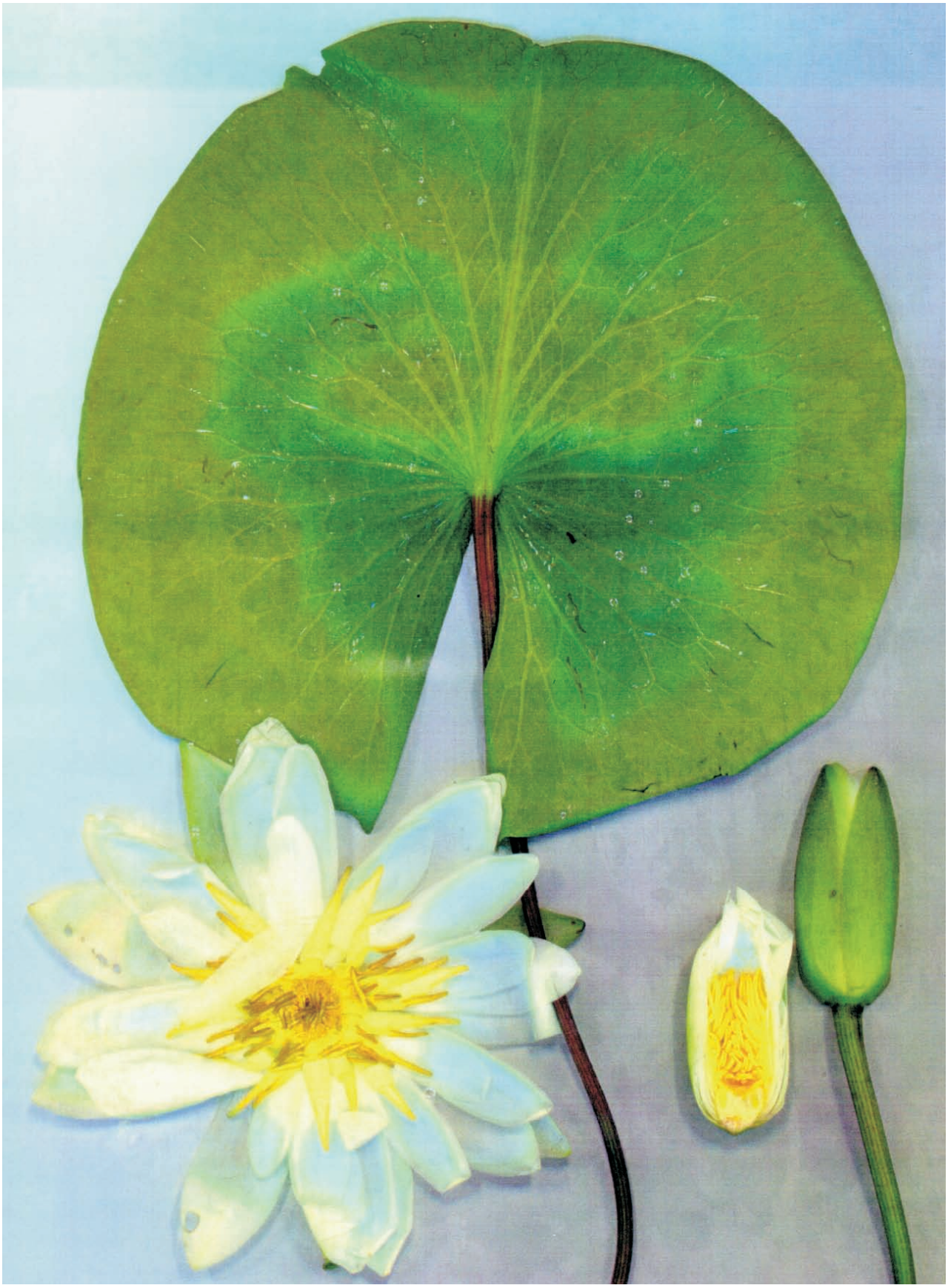


Waterweed (*elodea canadensis*)

Sago Pondweed (*potamogeton pectinatus*)

Curly-Leaf Pondweed (*potamogeton crispus*)

Large-Leaf Pondweed (*potamogeton amplifolius*)

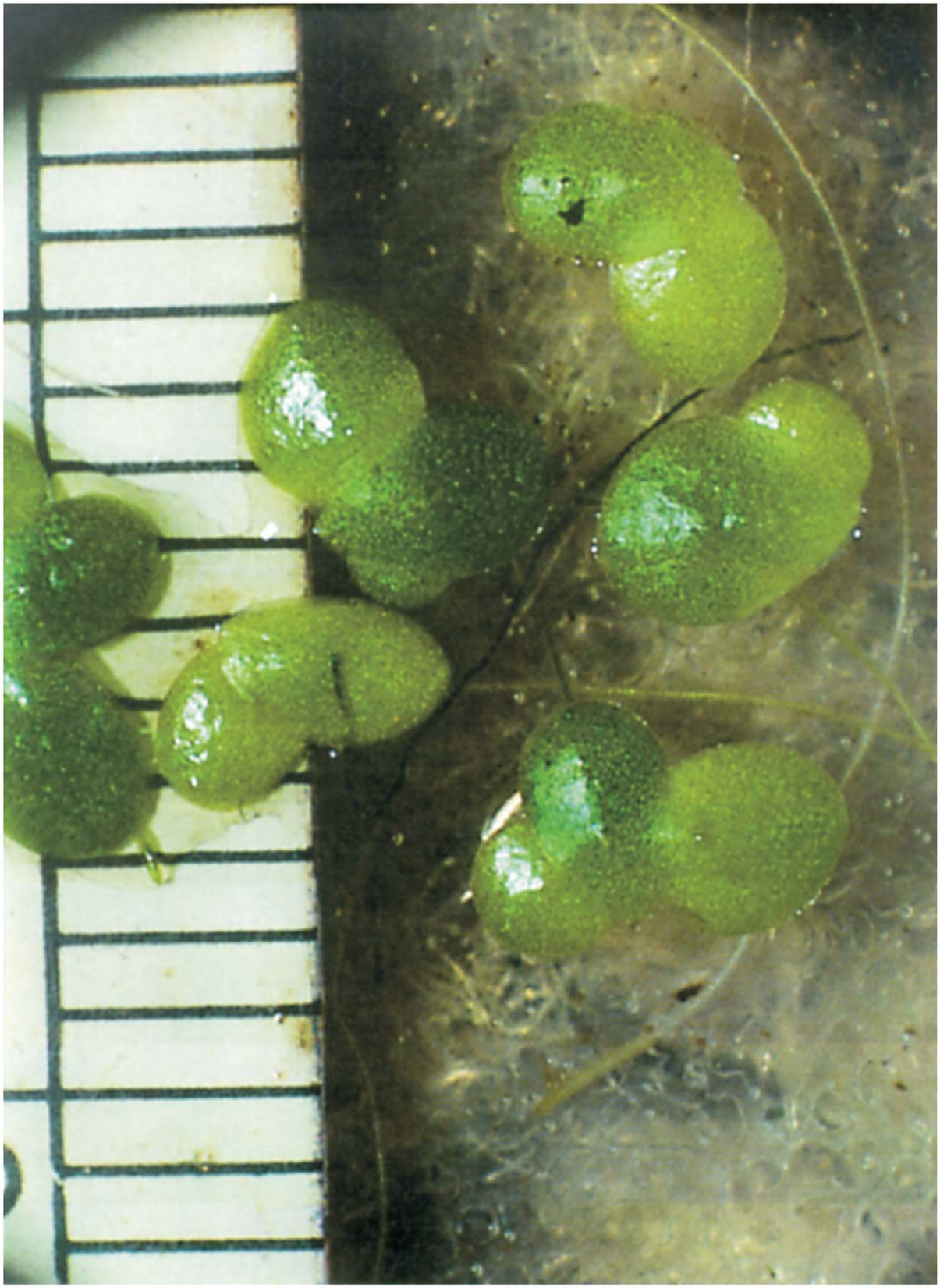


White Water Lily (*nymphaea odorata*)

Yellow Water Lily (*nuphar variegatum*)

Eurasian Water Milfoil (*myriophyllum spicatum*)

Native Water Milfoil (*myriophyllum* sp.)



Lesser Duckweed (*lemna minor*)

NOTE: Plant species in photograph are not shown proportionate to actual size

Source: Steve D. Eggers and Donald M. Reed, Wetland Plants and Plant Communities of Minnesota & Wisconsin, *2nd Edition, 1997*

White-Stem Pondweed (*potamogeton praelongus*)

Flat-Stem Pondweed (*potamogeton zosteriformis*)

Eel Grass / Wild Celery (*valisneria americana*)

White Water Crowfoot (*ranunculus longirostris*)

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Appendix B

SEWRPC LETTER REPORTS
PRELIMINARY VEGETATION SURVEYS
THE KELLY LAKES

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PREMLIMINARY VEGETATION SURVEY
J. GORSEGNER PROPERTY-UPPER KELLY LAKE WETLAND

Date: April 3, 1990

Observers: Donald M. Reed, Principal Biologist
Rachel E. Lang, Assistant Biologist
Southeastern Wisconsin Regional Planning Commission

Location: City of New Berlin in the Northeast one-quarter of U.S. Public Land Survey Section 36, Township 6 North, Range 20 East, Town of New Berlin, Waukesha County, Wisconsin.

Species List:

TYPHACEAE
Typha latifolia[1]--Broad-leaved cat-tail

GRAMINEAE
Bromus inermis[2,3]--Smooth brome grass
Poa pratensis--Kentucky bluegrass
Phalaris arundinacea[2]--Reed canary grass

CYPERACEAE
Carex blanda--Wood sedge
Carex sp. --Sedge

IRIDACEAE
Iris versicolor--Blue flag iris

SALICACEAE
Salix nigra--Black willow
Salix interior--Sand-bar willow
Salix discolor--Pussy willow
Salix sp. --Willow

JUGLANDACEAE
Juglans nigra[3]--Black walnut

ULMACEAE
Ulmus americana--American elm

URTICACEAE
Urtica dioica--Stinging nettle

CRUCIFERAE
Alliaria officinalis[2]--Garlic-mustard

SAXIFRAGACEAE
Ribes americanum--Wild black currant

ROSACEAE
- *Fragaria virginiana*--Wild strawberry
- *Geum canadense*--White avens
- *Rosa palustris*--Swamp rose
- *Crataegus* sp.[3]--Hawthorn

ANACARDIACEAE
- *Rhus glabra*[3]--Smooth sumac

ACERACEAE
- *Acer saccharinum*--Silver maple

VITACEAE
- *Vitis riparia*--River-bank grape

UMBELLIFERAE
- *Daucus carota*[2,3]--Queen Anne's lace

CORNACEAE
- *Cornus stolonifera*--Red osier dogwood

OLEACEAE
- *Fraxinus pennsylvanica*--Green ash

LABIATAE
- *Monarda fistulosa*[3]--Wild bergamont

CAPRIFOLIACEAE
- *Sambucus canadensis*--Elderberry
- *Lonicera* X *bella*[2]--Hybrid honeysuckle

COMPOSITAE
- *Rudbeckia laciniata*--Green-headed coneflower
- *Ambrosia trifida*--Giant ragweed
- *Solidago gigantea*--Giant goldenrod
- *Solidago altissima* x *gigantea*[3]--Hybrid goldenrod

Total number of plant species: 33
Number of alien, or non-native, plant species: 5 (15 percent)

This approximately 0.25-acre wetland plant community area is part of the Upper Kelly Lake wetland complex and consists of shallow marsh, fresh (wet) meadow, shrub-carr, willow thicket, and scattered southern wet- to wet-mesic lowland hardwoods. Disturbances to this plant community include vegetation removal, side casting of dredge spoil, past wetland filling, and water level changes due to ditching. No federal- or state-designated rare, threatened, or endangered species were observed during the field inspection.

---

[1] Growing along the shoreland edge.

[2] Alien, or non-native, plant species.

[3] Growing along the wetland edge.

COPY

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION
W239 N1812 ROCKWOOD DRIVE • PO BOX 1607 • WAUKESHA, WI 53187-1607• TELEPHONE (262) 547-6721
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Serving the Counties of: KENOSHA
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March 20, 1989

Mr. James B. Carpentier
Assistant Director of Planning
City of New Berlin
3805 S. Casper Drive
New Berlin, Wisconsin 53151-5510

Re: SEWRPC No. CA 724-93

Dear Mr. Carpentier:

This is to acknowledge receipt of your letter of February 1, 1989, requesting the Commission staff to conduct an environmental evaluation of the proposed Woodfield Park Subdivision located in the Northeast one-quarter of U.S. Public Land Survey Section 36, Township 6 North, Range 20 East, City of New Berlin, Waukesha County, Wisconsin. Pursuant to your request, Mr. Donald M. Reed, Principal Biologist of the Commission staff, met with you on February 10, 1989, to conduct a field inspection of the subject development site. The results of the field inspection are attached hereto as Exhibit A and may be summarized as follows:

1. Seven plant community areas were identified on the subject development site. The areal extent of the plant community areas are shown on the 1" = 400' scale 1985 aerial photograph attached hereto as Exhibit B.

2. Plant community area No. 1 is an approximately 6.0-acre wetland complex consisting of shallow marsh, shrub-carr, and southern wet to wet-mesic lowland hardwoods. Disturbances to this wetland plant community include past agricultural activities and past filling due to pond construction.

3. Plant community area No. 2 is an approximately 11.8-acre woodland consisting of second growth southern wet-mesic to mesic hardwoods. Disturbances include past timber cutting and clear cutting for proposed roads.

4. Plant community area No. 3 is an approximately 7.8-acre wetland consisting of shallow marsh and fresh (wet) meadow. Disturbances to this wetland plant community include past agricultural activities, ditching, and past dumping.

5. Plant community area No. 4 is an approximately 1.0-acre wetland consisting of fresh (wet) meadow with shrub-carr along the wetland edge. Disturbances to this wetland plant plant community include past agricultural activities.

6. Plant community area No. 5 is an approximately 14.0-acre plowed corn field. Disturbances to this area include plowing for row crop uses.

7. Plant community area No. 6 is an approximately 25.0-acre old field. Disturbances to this area include past agricultural uses.

8. Plant community area No. 7 is an approximately 1.0-acre wetland complex consisting of shallow marsh, fresh (wet) meadow, and southern wet to wet-mesic lowland hardwoods. Disturbances to this wetland complex includes past agricultural activities.

9. The entire plant community area Nos. 3 and 7 contain Class I wildlife habitat, plant community area No. 2 is a Class II wildlife habitat, and plant community area No. 1 contains both Class II and III wildlife habitat. The areal extent of the wildlife habitat is shown on the 1" = 400' scale 1985 aerial photograph attached hereto as Exhibit C.

10. No federal- or state-designated rare, threatened, or endangered species were observed during the field inspection.

11. The entire area of plant community area Nos. 1, 2, 3, 4, and 7 are located within a Commission-delineated secondary environmental corridor. The areal extent of the secondary environmental corridor is shown on Exhibit B.

In your letter you ask if, based upon the field inspection, any portions of the delineated secondary environmental corridor are particularly valuable and should, therefore, be considered for preservation as the platting of the lands proceeds. In this respect, the Commission staff would suggest that the wetlands identified as plant community area Nos. 1, 3, and 7 not be filled and developed and, that, to the greatest extent practicable given platting considerations, the woodland identified as plant community area No. 2 be preserved and protected. These objectives can be accomplished by requiring the developer to design the plat to place the environmentally sensitive lands either in common open space areas or in the rear yards of lots that are deed restricted against future division, filling, and development.

With respect to your specific question concerning the provision of public sanitary sewer service to the development site, please be advised that this matter was specifically addressed in our letter to you of February 28, 1989.

Finally, with respect to the wetlands identified in plant community area Nos. 1 and 3, because of their association with Upper Kelly Lake, it is likely that the U.S. Army Corps of Engineers will require a federal Section 404 individual permit for any filling activities in these wetlands. Further, that portion of the wetlands lying within the 1,000 foot shoreland zone attendant to Upper Kelly Lake should be maintained within an appropriate shoreland-wetland conservancy district zone as required under Chapter NR 117 of the Wisconsin Administrative Code. Should the landowners propose to drain or fill all or a portion of these wetlands, we suggest they contact:

Mr. Gary L. Nelson
Water Management Coordinator
Wisconsin Department of
Natural Resources
P.O. Box 12436
Milwaukee, WI 53212

District Engineer
Regulatory Functions Branch
St. Paul District
Corps of Engineers
U.S. Dept. of the Army
1421 U.S. Post Office & Customs House
St. Paul, MN 55101-1479

We trust that the foregoing information is responsive to your request. Should you have any questions concerning this matter, please do not hesitate to contact Mr. Reed directly.

Sincerely,

Kurt W. Bauer
Executive Director

KWB/ib
Enclosures

cc: Mr. Gary L. Nelson, DNR
Mr. Ben Wopat, COE

EXHIBIT A

Preliminary Vegetation Survey

PROPOSED WOODFIELD PARK SUBDIVISION SITE

DATE: February 10, 1989

OBSERVER: Donald M. Reed, Principal Biologist
Rachel E. Lang, Assistant Biologist
Southeastern Wisconsin Regional Planning Commission

LOCATION: City of New Berlin in the Northeast one-quarter of U.S. Public Land Survey Section 36, Township 6 North, Range 20 East, Town of New Berlin, Waukesha County, Wisconsin.

SPECIES LIST: Plant Community Area No. 1

Typhaceae

Typha latifolia--Broad-leaved cat-tail

Gramineae

Elymus virginicus--Virginia wild rye

Phalaris arundinacea[1]--Reed canary grass

Cyperaceae

Carex stricta--Tussock sedge

Salicaceae

Salix nigra--Black willow

Salix interior--Sand-bar willow

Ulmaceae

Ulmus americana--American elm

Rosaceae

Rubus occidentalis--Black raspberry

Aceraceae

Acer saccharinum[2]--Silver maple

Onagraceae

Epilobium coloratum--Willow herb

Umbelliferae

Daucus carota[1,2]--Queen Anne's lace

Cornaceae

Cornus stolonifera--Red-osier dogwood

Oleaceae

Fraxinus pennsylvanica--Green ash

Solanaceae

Solanum dulcamara[1]--Deadly nighshade

Caprifoliaceae

Sambucus canadensis--Elderberry

Compositae

Ambrosia trifida--Giant ragweed

Solidago gigantea--Giant goldenrod

Aster simplex--Marsh aster

Arctium minus[1,3]--Common burdock

Total number of plant species: 19
Number of alien, or non-native, plant species: 4 (21%)

This approximately 6.0-acre wetland plant community area consists of shallow marsh, fresh (wet) meadow, shrub-carr, and southern wet to wet-mesic lowland hardwoods. Disturbances to this plant community include past agricultural activities and past filling due to pond construction. No federal- or state-designated rare, threatened, or endangered species were observed during the field inspection.

---

[1]Alien, or non-native, plant species.

[2]Growing along wetland edge.

[3]Growing on fill material.

Plant Community Area No. 2

Pinaceae

Pinus strobus[1]--White pine

Gramineae

Setaria sp.[2]--Foxtail grass

Salicaceae

Populus tremuloides--Quaking aspen

Betulaceae

Ostrya virginiana--Ironwood

Fagaceae

Quercus alba--White oak

Quercus macrocarpa--Bur oak

Quercus borealis[3]--Northern red oak

Ulmaceae

Ulmus americana--American elm

Rosaceae

Geum canadense--White avens

Rosa multiflora[2]--Multiflora rose

Crataegus sp.--Hawthorn

Rhamnaceae

Rhamnus catharticus[2]--Common buckthorn

Rutaceae

Zanthoxylum americanum--Prickly ash

Vitaceae

Vitis sp.--Grape

Tiliaceae

Tilia americana[4]--Basswood

Malvaceae

Abutilon theophrasti[2]--Velvet leaf

Umbelliferae

Daucus carota[2]--Queen Anne's lace

Cornaceae

Cornus rugosa--Round-leaf dogwood

Caprifoliaceae

Viburnum opulus[2]--High-bush cramberry

Viburnum sp.--Viburnum

Lonicera X *bella*[2]--Hybrid honeysuckle

Compositae

Solidago ulmifolia--Elmleaf goldenrod

Aster lateriflorus--Calico aster

Total number of plant species: 23
Number of alien, or non-native, plant species: 7 (30%)

This approximately 11.8-acre plant community area consists of second growth southern wet-mesic to mesic hardwoods. Disturbances to this area include past timber cutting and clear cutting for proposed roads. No federal- or state-designated rare, threatened, or endangered species were observed during the field inspection.

---

[1]Planted tree species.

[2]Alien, or non-native, plant species.

[3]Dominant tree species.

[4]Pole-size trees.

Plant Community Area No. 3

Typhaceae

Typha latifolia[1]--Broad-leaved cat-tail

Typha angustifolia[1]--Narrow-leaved cat-tail

Gramineae

Phalaris arundinacea[1,2]--Reed canary grass

Salicaceae

Populus tremuloides[3]--Quaking aspen

Populus deltoides[3]--Cottonwood

Salix babylonica[2,3]--Weeping willow

Salix nigra--Black willow

Salix interior--Sand-bar willow

Ulmaceae

Ulmus americana[3]--American elm

Urticaceae

Urtica dioica--Stinging nettle

Polygonaceae

Polygonum pensylvanicum--Pinkweed

Aceraceae

Acer saccharinum[3]--Silver maple

Acer negundo[3]--Boxelder

Cornaceae

Cornus amomum--Silky dogwood

Compositae

Solidago gigantea--Giant goldenrod

Aster simplex--Marsh aster

Total number of plant species: 16
Number of alien, or non-native, plant species: 2 (13%)

This approximately 7.8-acre wetland plant community area consists of shallow marsh and fresh (wet) meadow. Disturbances to this plant community include past agricultural activities, ditching, and past dumping. No federal- or state-designated rare, threatened, or endangered species were observed during the field inspection.

---

[1]Co-dominant plant species.

[2]Alien, or non-native, plant species.

[3]Growing along the wetland edge.

Plant Community Area No. 4

Gramineae

Phalaris arundinacea[1,2]--Reed canary grass

Cyperaceae

Scirpus cyperinus--Wool sedge

Salicaceae

Salix interior[3]--Sand-bar willow

Ulmaceae

Ulmus americana--American elm

Polygonaceae

Polygonum pensylvanicum--Pinkweed

Amaranthaceae

Amaranthus retroflexus[2]--Redroot pigweed

Rosaceae

Rosa multiflora[2]--Multiflora rose

Cornaceae

Cornus stolonifera[1,3]--Red-osier dogwood

Oleaceae

Fraxinus pennsylvanica--Green ash

Asclepiadaceae

Asclepias incarnata--Marsh milkweed

Caprifoliaceae

Lonicera X bella[2,3]--Hybrid honeysuckle

Compositae

Solidago gigantea--Giant goldenrod

Aster simplex--Marsh aster

Total number of plant species: 13
Number of alien, or non-native, plant species: 4 (31%)

This approximately 1.0-acre wetland plant community area consists of fresh (wet) meadow with shrub-carr along the wetland edge. Disturbances to this wetland plant community area include past agricultural activities. No federal- or state-designated rare, threatened, or endangered species were observed during the field inspection.

---

[1]Co-dominant plant species.

[2]Alien, or non-native, plant species.

[3]Growing along the wetland edge.

Plant Community Area No. 5

Gramineae

Setaria sp.[1]--Foxtail grass

Zea mays[1,2]--Domestic corn

Amaranthaceae

Amaranthus retroflexus[1]--Redroot pigweed

Malvaceae

Abutilon theophrasti[1]--Velvet-leaf

Total number of plant species: 4
Number of alien, or non-native, plant species: 4(100%)

This approximately 14.0-acre plant community area consists of plowed corn field. Disturbance to this area includes plowing for row crop uses. No federal- or state-designated rare, threatened, or endangered species were observed during the field inspection.

---

[1]Alien, or non-native, plant species.

[2]Planted.

Plant Community Area No. 6

Gramineae

Bromus intermis[1]--Smooth brome grass

Poa pratensis--Kentucky blue grass

Rosaceae

Potentilla simplex--Old field cinquefoil

Rubus occidentalis--Black raspberry

Crataegus sp.--Hawthorn

Aceraceae

Acer negundo--Boxelder

Umbelliferae

Daucus carota[1]--Queen Anne's lace

Oleaceae

Fraxinus pennsylvanica[2]--Green ash

Scrophulariaceae

Linaria vulgaris[1]--Butter-and-Eggs

Caprifoliaceae

Lonicera sp.[1]--Honeysuckle

Compositae

Aster pilosus--Frost aster

Total number of plant species: 11
Number of alien, or non-native, plant species: 4 (36%)

This approximately 25.0-acre plant community area consists of old field. Disturbances to this area include past agricultural uses. No federal- or state-designated rare, threatened, or endangered species were observed during the field inspection.

---

[1]Alien, or non-native, plant species.

[2]Sapling tree.

Plant Community Area No. 7

Typhaceae

Typha latifolia--Broad-leaved cat-tail

Typha angustifolia--Narrow-leave cat-tail

Gramineae

Phalaris arundinacea[1]--Reed canary grass

Salicaceae

Salix interior--Sand-bar willow

Ulmaceae

Ulmus americana--American elm

Cornaceae

Cornus stolonifera--Red-osier dogwood

Oleaceae

Fraxinus pennsylvanica--Green ash

Compositae

Solidago gigantea--Giant goldenrod

Aster simplex--Marsh aster

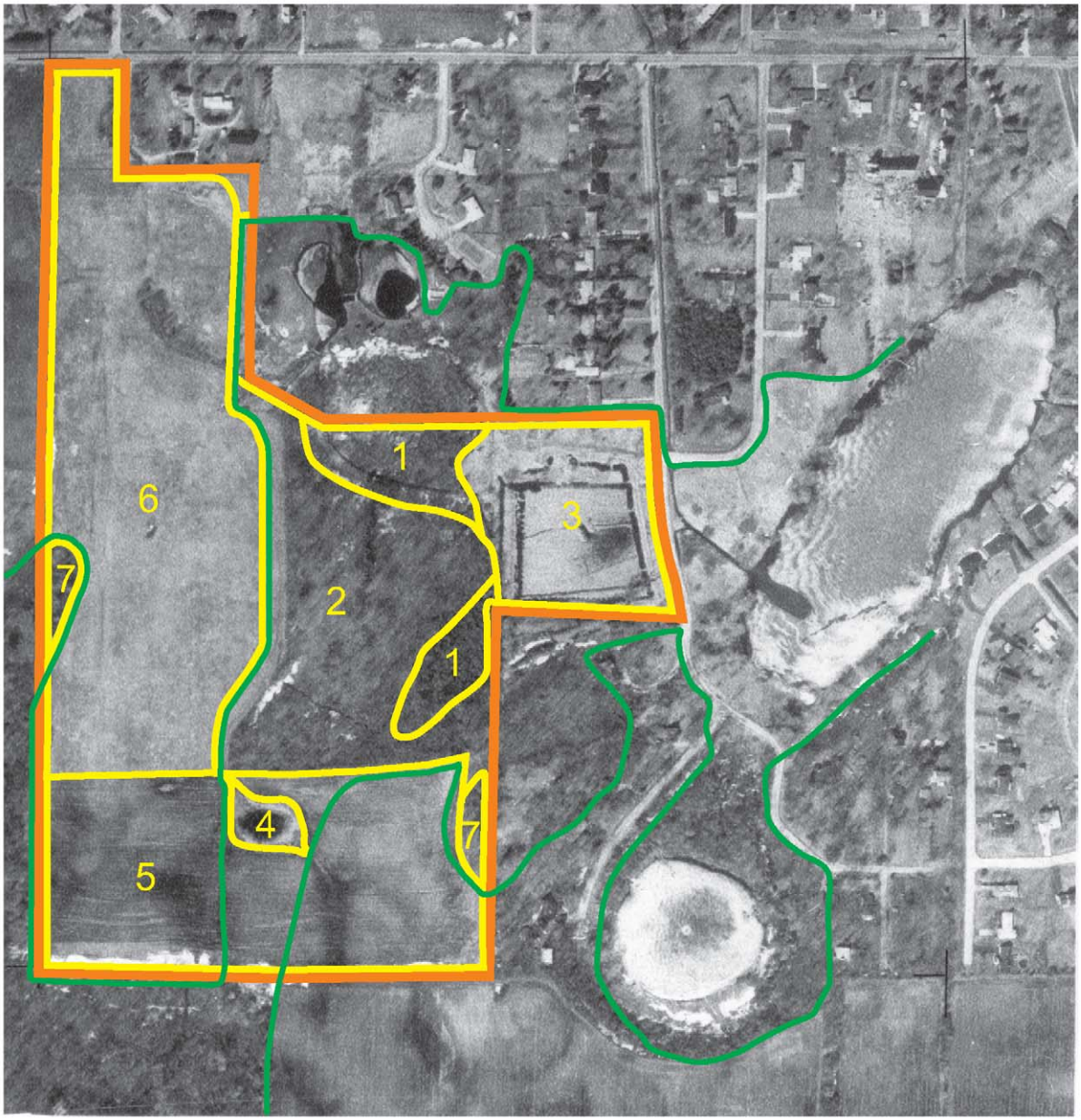
Total number of plant species: 9
Number of alien, or non-native, plant species: 1 (11%)

This approximately 1.0-acre wetland plant community area consists of shallow marsh, fresh (wet) meadow, and southern wet to wet-mesic hardwoods. Disturbance to this wetland plant community area includes past agricultural activities. No federal- or state-designated rare, threatened, or endangered species were observed during the field inspection.

---

[1]Alien, or non-native, plant species.

Exhibit B



LEGEND

PARCEL BOUNDARY

6 PLANT COMMUNITY AREA AND NUMBER

SECONDARY ENVIRONMENTAL CORRIDOR

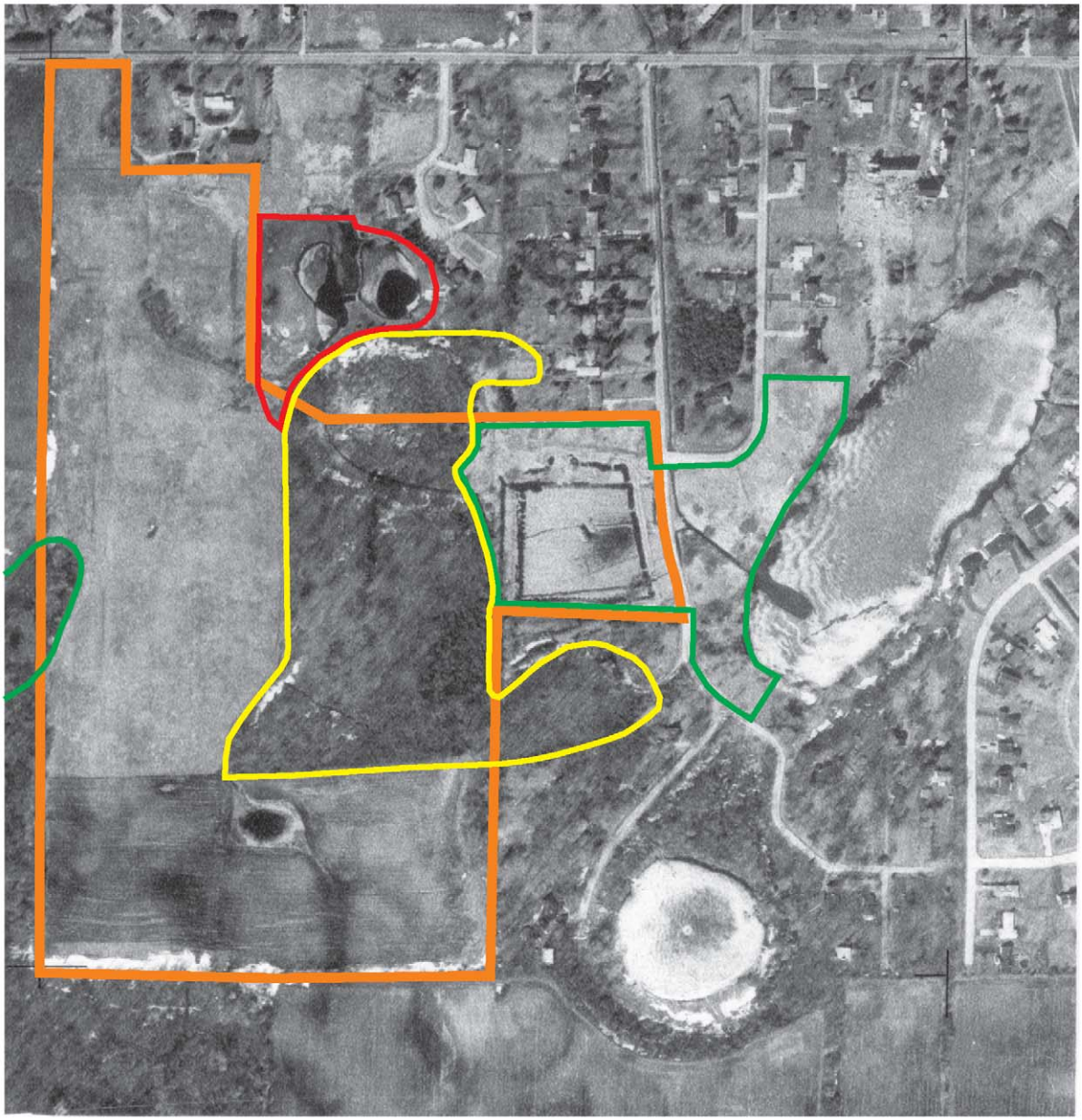
N

GRAPHIC SCALE

0 150 300 FEET

Source: SEWRPC.

Exhibit C



LEGEND

- PARCEL BOUNDARY
- CLASS I WILDLIFE HABITAT
- CLASS II WILDLIFE HABITAT
- CLASS III WILDLIFE HABITAT

N

GRAPHIC SCALE

0 150 300 FEET

Source: SEWRPC.

Appendix C

AN AQUATIC PLANT MANAGEMENT PLAN FOR THE KELLY LAKES, MILWAUKEE AND WAUKESHA COUNTIES, WISCONSIN

INTRODUCTION

This aquatic plant management plan is an integral part of the Kelly Lakes Protection Plan, and represents an important element of the ongoing commitment of the Kelly Lakes Association, City of New Berlin, and Village of Hales Corners to sound environmental management with respect to the Lakes. The initial aquatic plant management portion of the lake management plan was prepared between 1997 and 1999 by the Regional Planning Commission, and was based on field surveys conducted by Commission staff during 1997 and 1998. This plan refines the initial plan, based upon surveys also conducted by Commission staff during 2005.

The plan follows the format adopted by the Wisconsin Department of Natural Resources for aquatic plant management plans pursuant to Chapters NR 103, NR 107 and NR 109 of the *Wisconsin Administrative Code*. Its scope is limited to those management measures which can be effective in the control of aquatic plant growth; those measures which can be readily undertaken by the Association in concert with the riparian residents; and those measures which will directly affect the use of Upper Kelly Lake.

This report is comprised of seven main sections:

1. A set of aquatic plant management objectives;
2. A brief description of the Lake and its watershed;
3. A statement of the current use restrictions and the need for aquatic plant management in Upper Kelly Lake;
4. An evaluation of alternative means of aquatic plant management;
5. A description of the recommended plan;
6. A description of the equipment needs for the recommended plan; and
7. A recommended means of monitoring and evaluating the efficacy of the plan and equipment.

STATEMENT OF AQUATIC PLANT MANAGEMENT GOALS AND OBJECTIVES

The goals and objectives of the Kelly Lakes Association, developed in consultation with the City of New Berlin and Village of Hales Corners, are to:

1. Effectively control the quantity and density of aquatic plant growths in portions of the Upper Kelly Lake basin to enhance water-related recreational activities; to improve the aesthetic character of the resource; and to preserve and enhance the overall value of the waterbody;

2. Contribute to overall conservation and wise use of Upper Kelly Lake through the environmentally sound management of vegetation, fish and wildlife populations in and around the Lakes; and,

3. Promote a high-quality, water-oriented urban residential setting with recreational and aesthetic opportunities for residents and visitors of Upper Kelly Lake.

UPPER KELLY LAKE AND ITS WATERSHED CHARACTERISTICS

Upper Kelly Lake is a 12-acre drainage lake located in the southeastern portion of the City of New Berlin in Waukesha County and western portion of the Village of Hales Corners in Milwaukee County as shown on Map C-1. An unnamed stream tributary to the Root River system forms the principle inflow to Upper Kelly Lake, while the Whitnall Park Creek forms the principle outflow from the Lake. Upper Kelly Lake has a single basin with a total tributary drainage area of about 980 acres.

Land Use and Shoreline Development

Residential land uses occupy almost all of the upland portions of the shorelands of the Kelly Lakes, as shown on Map C-2. With the exception of the wetland areas located on the southern and western shorelines of Upper Kelly Lake, residential land uses occupy the major portion of the shoreland of Upper Kelly Lake. Public access to the Lakes is provided through a walk-in access at the City of New Berlin park site located at the southern end of Upper Kelly Lake, and a public recreational boating launch site located on the northeastern side of the Lake in the Village of Hales Corners. Parking facilities are not provided at this launch site. At the time of the initial plan, a majority of the Upper Kelly Lake shoreline remained in a natural condition without shoreline protection structures. However, small sections of the shoreline of the Lake were protected with riprap, as shown on Map C-3. Under buildout conditions, conversion of the majority of the remaining rural lands, excepting wetlands and woodlands comprising the secondary environmental corridor lands and isolated natural resource areas, and the portion of the Valley View Park, within the drainage area tributary to the Kelly Lakes, to urban land uses is envisioned in the adopted regional land use plan and Waukesha County development plan.[1] Infilling of existing platted lots and additional low-density, single-family residential development within the tributary drainage area of the Lakes is expected to occur.

Aquatic Plants, Distribution and Management Areas

A survey of aquatic plants within the Kelly Lakes was conducted by Commission staff during July 2005. The results of this survey are tabulated in Tables C-1 and C-2, and a tabulation of the ecological significance of the plants determined to be present in each of the Lakes is presented in Table C-3. The results of the surveys also are graphically depicted on Map C-4. Illustrations of the common aquatic plants found in Upper and Lower Kelly Lakes are included in Appendix A.

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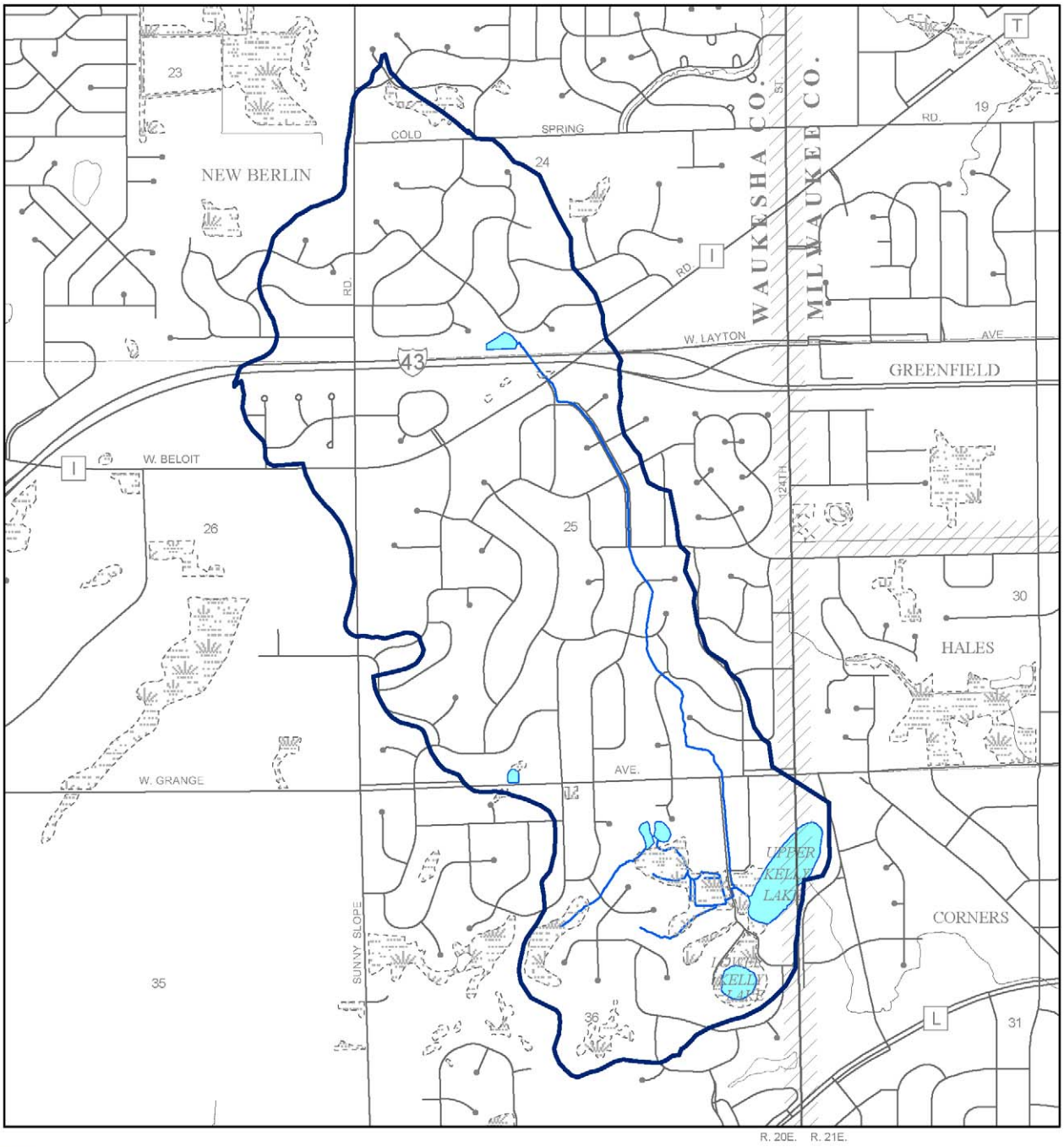
[1]*SEWRPC Planning Report No. 40,* A Regional Land Use Plan for Southeastern Wisconsin—2010*, January 1992; and SEWRPC Community Assistance Planning Report No. 209,* A Development Plan for Waukesha County, Wisconsin, *August 1996.*

Map C-1

LOCATION OF UPPER AND LOWER KELLY LAKES



SURFACE WATER

STREAM

SUBWATERSHED BOUNDARY

Source: SEWRPC.

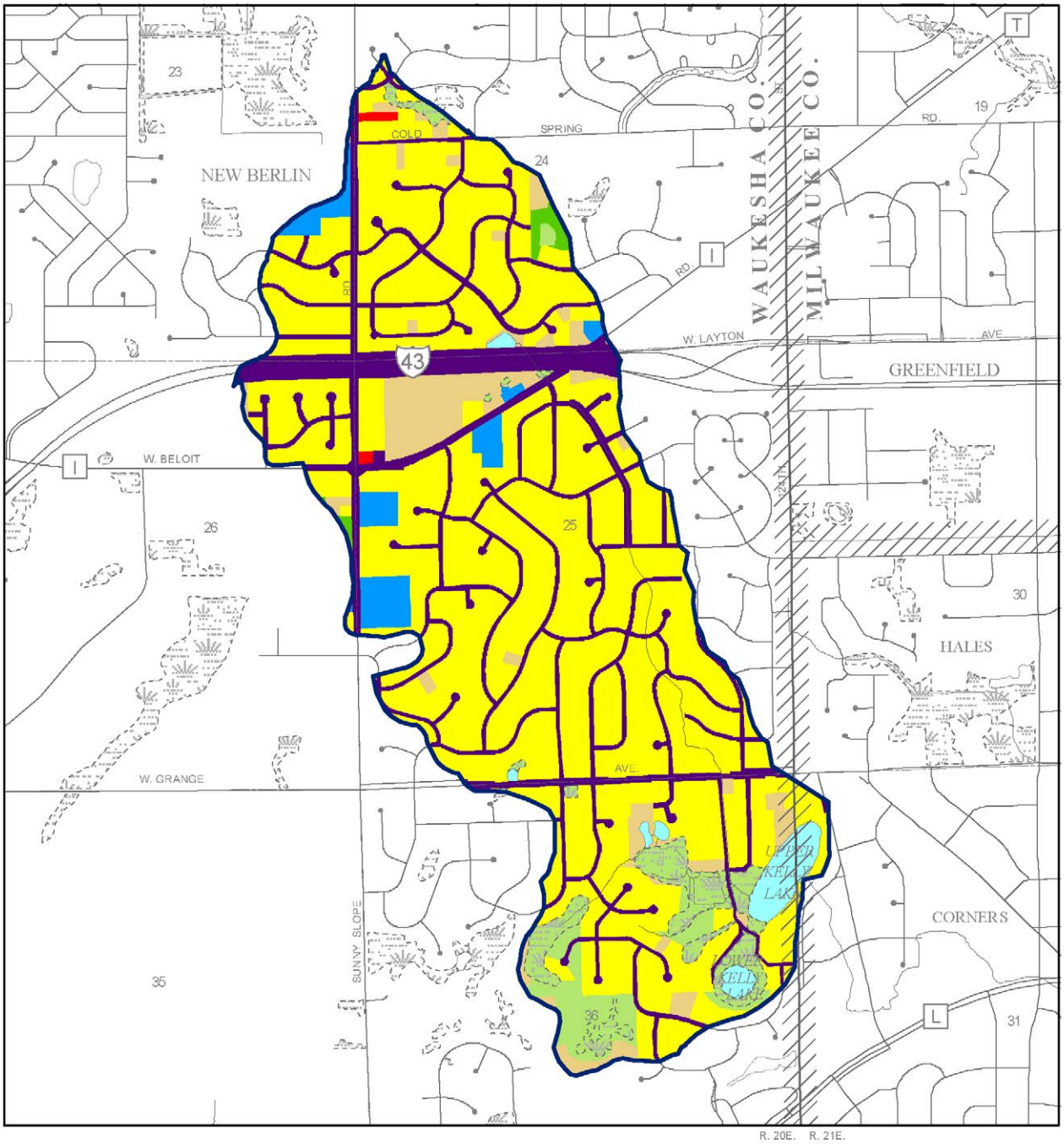
N

GRAPHIC SCALE

0 1,000 2,000 Feet

Map C-2

GENERALIZED LAND USE WITHIN THE TOTAL AREA TRIBUTARY TO THE KELLY LAKES: 2000



SINGLE-FAMILY RESIDENTIAL
COMMERCIAL
TRANSPORTATION, COMMUNICATIONS, AND UTILITIES
GOVERNMENT AND INSTITUTIONAL
RECREATION
WETLANDS AND WOODLANDS
SURFACE WATER
AGRICULTURAL, UNUSED, AND OTHER OPEN LANDS

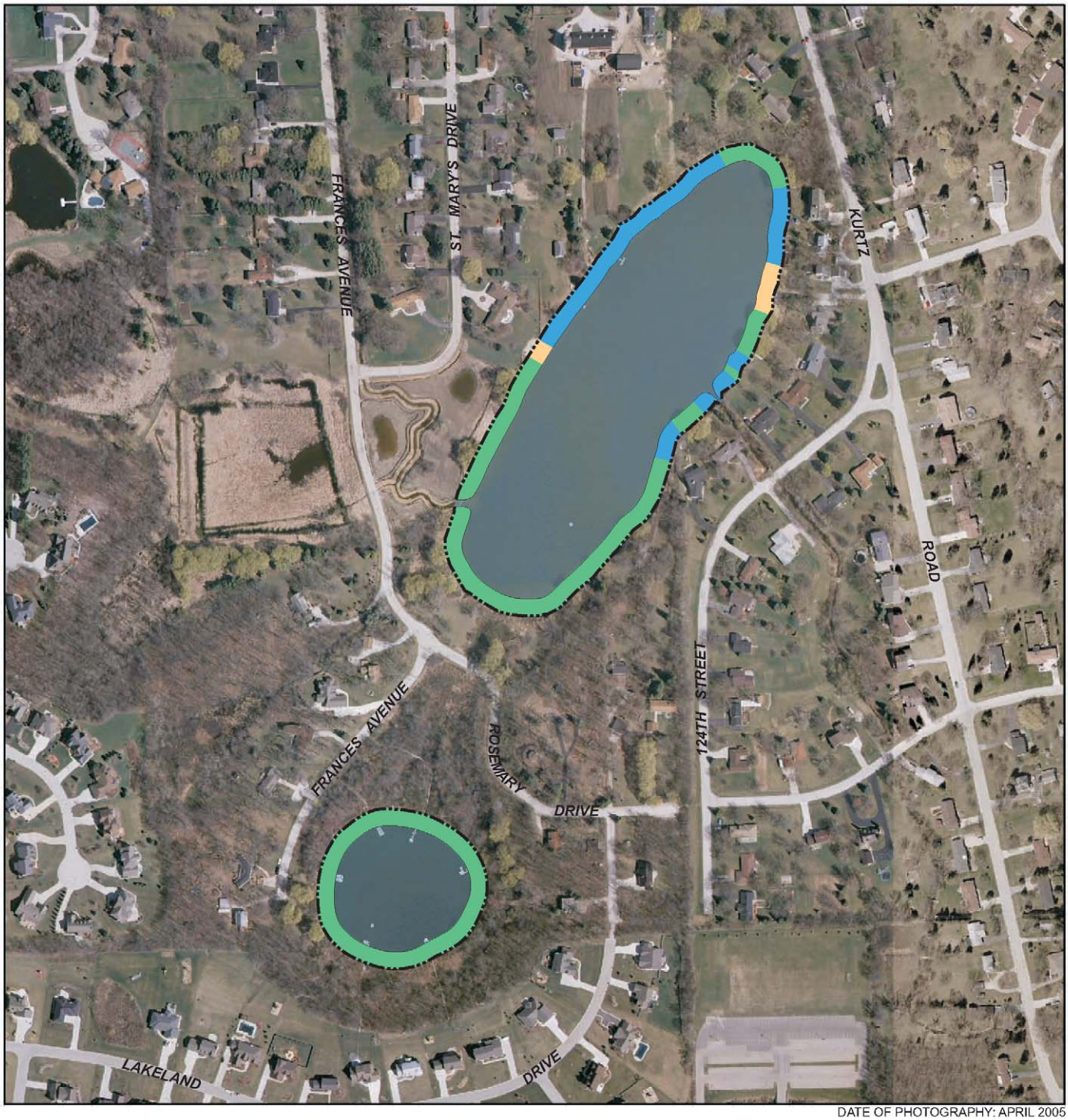
Source: SEWRPC.

N

GRAPHIC SCALE
0 1,000 2,000 Feet

Map C-3

SHORELINE PROTECTION STRUCTURES ON UPPER AND LOWER KELLY LAKES: 2005



DATE OF PHOTOGRAPHY: APRIL 2005

RIPRAP

BEACH

NATURAL

GRAPHIC SCALE

0 200 400 FEET

Source: SEWRPC.

Table C-1

FREQUENCY OF OCCURRENCE AND DENSITY RATINGS OF SUBMERGENT PLANT SPECIES IN UPPER KELLY LAKE: JULY 2005

Plant Species	Sites Found	Frequency of Occurrence (percent)	Relative Frequency (percent)	Relative Density in Whole Lake	Importance Value
Ceratophyllum demersum (coontail)	43	97.7	38.8	3.30	128.0
Elodea canadensis (waterweed)	1	5.0	0.9	0.04	0.1
Myriophyllum spp. (native milfoil)	26	59.1	23.4	1.30	30.4
Myriophyllum spicatum (Eurasian water milfoil)	22	50.0	19.8	0.90	17.8
Potamogeton crispus (curly-leaf pondweed)	17	38.6	15.3	0.60	9.2
Potamogeton pectinatus (Sago pondweed)	2	4.5	1.8	0.04	0.1

NOTE: There were 44 sampling points.

Source: SEWRPC.

Table C-2

FREQUENCY OF OCCURRENCE AND DENSITY RATINGS OF SUBMERGENT PLANT SPECIES IN LOWER KELLY LAKE: JULY 2005

Plant Species	Sites Found	Frequency of Occurrence (percent)	Relative Frequency (percent)	Relative Density in Whole Lake	Importance Value
Ceratophyllum demersum (coontail)	24	100.0	37.5	3.80	142.5
Chara vulgaris (muskgrass)	3	12.5	4.7	0.20	0.9
Myriophyllum spp. (native milfoil)	1	4.2	1.6	0.04	0.1
Potamogeton amplifolius (large-leaf pondweed)	5	20.8	7.8	0.50	3.9
Potamogeton foliosus (leafy pondweed)	7	29.2	10.9	0.50	5.5
Potamogeton natans (floating-leaf pondweed)	3	12.5	4.7	0.20	0.9
Potamogeton pectinatus (Sago pondweed)	7	29.2	10.9	0.70	7.6
Potamogeton zosterformis (flat-stemmed pondweed)	10	41.6	15.6	1.20	18.7
Utricularia vulgaris (common bladderwort)	4	16.6	6.3	0.20	1.3

NOTE: There were 24 sampling points.

Source: SEWRPC.

The flora of the Upper Kelly Lake basin was relatively impoverished compared with that of the wetlands adjacent to the southwest corner of the Upper Kelly, and the wetlands connecting Upper Kelly and Lower Kelly Lakes. Six species of submergent aquatic plants, three floating leaves species, and one emergent species were recorded, as summarized in Table C-1. The Lake was dominated by coontail, *Ceratophyllum demersum*, which can pose recreational use problems when it is abundant, especially if it grows to the water surface. Several of the pondweeds, which are a pollution tolerant species normally dominant or subdominant in disturbed ecosystems,[2] including *Potamogeton crispus*, *P. pectinatus*, and *P. zosterformis*, as well as white and yellow water lilies, were common to abundant throughout the Lake. Filamentous algae were present in the northeastern corner of the Lake.

[2]*G.J. Davis and M.M. Brinson,* Responses of Submersed Vascular Plant Communities to Environmental Change, *Fish and Wildlife Service Publication No. OBS-80/42, August 1980.*

Table C-3

POSITIVE ECOLOGICAL SIGNIFICANCE OF AQUATIC PLANT SPECIES PRESENT IN UPPER AND LOWER KELLY LAKES

Aquatic Plant Species Present	Relative Abundance[a]	Ecological Significance[b]
Ceratophyllum demersum (coontail)	Abundant	Provides good shelter for young fish and supports insects valuable as food for fish and ducklings
Chara vulgaris (muskgrass)	Common	Excellent producer of fish food, especially for young trout, bluegill, and small and largemouth bass; stabilizes bottom sediments; and has softening effect on the water by removing lime and carbon dioxide
Elodea canadensis (waterweed)	Scarce	Provides shelter and support for insects valuable as fish food
Lemna minor (lesser duckweed)	Scarce	Provides important food for wildfowl and attracts small aquatic animals
Myriophyllum spp. (native milfoil)	Common	Provides valuable food and shelter for fish; fruits eaten by many wildfowl
Myriophyllum spicatum (Eurasian water milfoil)	Common	None known
Nuphar sp. (yellow water lily)	- -[c]	Leaves, stems, and flowers are eaten by deer; roots eaten by beaver and porcupine; seeds eaten by wildfowl; leaves provide harbor to insects, in addition to shade and shelter for fish
Nymphaea tuberosa (white water lily)	- -[c]	Provides shade and shelter for fish; seeds eaten by wildfowl; rootstocks and stalks eaten by muskrat; roots eaten by beaver, deer, moose, and porcupine
Potamogeton spp.(pondweeds)	Scarce	Provides food, shelter and shade for some fish and food for wildfowl
Potamogeton amplifolius (large-leaf pondweed)	Scarce	Provides cover for panfish, largemouth bass, muskellunge, and northern pike; nesting grounds for bluegill; supports insects valuable as food for fish and ducklings
Potamogeton crispus (curly-leaf pondweed)	Common	Provides food, shelter and shade for some fish and food for wildfowl
Potamogeton pectinatus (sago pondweed)	Scarce	This plant is the most important pondweed for ducks, in addition to providing food and shelter for young fish
Potamogeton praelongus (white-stemmed pondweed)	Scarce	Provides feeding grounds for muskellunge; also good food producers for trout; good food producer for ducks
Potamogeton zosterformis (flat-stemmed pondweed)	Common	Provides some cover for bluegills, perch, northern pike, and muskellunge; food for waterfowl; supports insects valuable as food for fish and ducklings
Ranunculus sp. (water buttercup)	- -[c]	Provides food for trout, upland game birds and wildfowl
Typha augustafolia (cattail)	- -[c]	Supports insects; stalks and roots important food for muskrat and beaver; attracts marsh birds, wildfowl, and songbirds, in addition to being used as spawning grounds by sunfish and shelter for young fish
Vallisneria sp. (water celery)	Scarce	Provides good shade and shelter, supports insects, and is valuable fish food
Vallisneria americana (water celery)	Scarce	Provides good shade and shelter, supports insects, and is valuable fish food

[a]*Species mean density for all sample points including sample points where a particular species did not occur in the Kelly Lakes: Abundant (density rating = 4 to 5). Common (density rating = 2 to 3), Scarce (density rating = 1), and - = Absent (density rating = 0).*

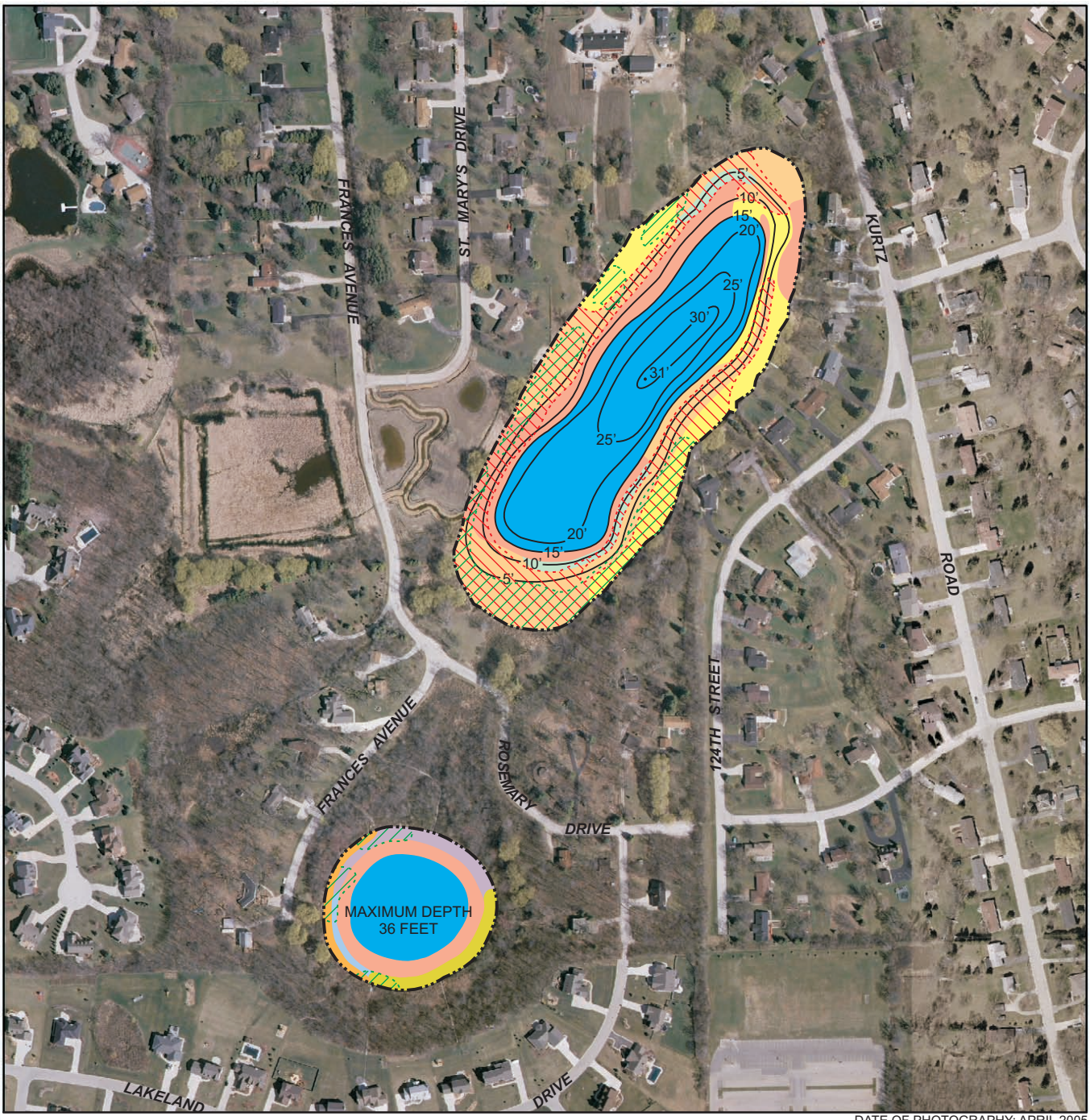
[b]*Information obtained from* A Manual of Aquatic Plants *by Norman C. Fassett and* Guide to Wisconsin Aquatic Plants*, Wisconsin Department of Natural Resources.*

[c]*Not measurable using the Jesson and Lound Survey Technique for Submerged Aquatic Plants.*

Source: SEWRPC.

Map C-4

AQUATIC PLANT COMMUNITY DISTRIBUTION IN UPPER AND LOWER KELLY LAKES: 2005



DATE OF PHOTOGRAPHY: APRIL 2005

— 20' — WATER DEPTH CONTOUR IN FEET

OPEN WATER

WATER LILIES

EURASIAN WATER MILFOIL

COONTAIL

COONTAIL, WATERWEED, NATIVE WATER MILFOIL, CURLY-LEAF PONDWEED, AND SAGO PONDWEED

COONTAIL, NATIVE WATER MILFOIL, AND SAGO PONDWEED

COONTAIL AND NATIVE WATER MILFOIL

COONTAIL, NATIVE WATER MILFOIL, AND FLAT-STEM PONDWEED

COONTAIL, MUSKGRASS, FLAT-STEM PONDWEED, LARGE-LEAF PONDWEED, LEAFY PONDWEED, FLOATING-LEAF PONDWEED, BLADDERWORT, AND SAGO PONDWEED

COONTAIL, MUSKGRASS, FLAT-STEM PONDWEED, SAGO PONDWEED, AND LEAFY PONDWEED

COONTAIL, FLAT-STEM PONDWEED, LARGE-LEAF PONDWEED, AND BLADDERWORT

GRAPHIC SCALE
0 200 400 FEET

Source: SEWRPC.

Eurasian water milfoil, *Myriophyllum spicatum*, also was present and widespread in Upper Kelly, and was especially dense in the shallower areas near the public access site. Eurasian water milfoil, one of the eight milfoil species found in Wisconsin, is an exotic, or nonnative species, known to have an accelerated rate of reproduction. It has been known to cause severe recreational use problems in lakes in the Southeastern Wisconsin Region. This exotic species often outcompetes the native aquatic vegetation of lakes in southeastern Wisconsin, reducing the biodiversity of the lakes, and degrading the quality of fish and wildlife habitats.[3] Notably, chara, flat-stemmed pondweed, and eel grass, which were recorded during the 1997 survey, were not seen during the 2005 survey. All of these plants are indicative of a disturbed lake ecosystem. This is supported by the urbanized surroundings of the Kelly Lakes, and the results of wetland surveys conducted by Commission staff in the areas surrounding the Kelly Lakes. These terrestrial systems also showed significant levels of previous disturbance.

The flora of the Lower Kelly Lake basin also was relatively impoverished compared with that of the wetlands connecting Upper Kelly and Lower Kelly Lakes. Lower Kelly Lake supported six submergent aquatic plant species during 2005, and three species of floating leaved aquatic plants, as summarized in Table C-2. The Lake was dominated by coontail, *Ceratophyllum demersum*, which can pose recreational use problems when it is abundant, especially if it grows to the water surface. Several of the pondweeds, which are a pollution tolerant species normally dominant or subdominant in disturbed ecosystems,[4] including *Potamogeton amplifolius*, *P. pectinatus*, and *P. zosterformis*, were common to abundant throughout the Lake. Water buttercup and eel grass, observed during the 1997 survey, were noted by their apparent absence. Curiously, Eurasian water milfoil, also observed during the 1997 survey, also appeared to be absent from Lower Kelly Lake.

Fisheries, Wildlife and Waterfowl

The most recent electrofishing survey,[5] conducted by Wisconsin Department of Natural Resources staff on Upper Kelly Lake during 1993, supported 1969 observations that panfish appeared to be relatively few in number and slow growing, and that carp were present in the Lake.[6] The 1993 survey results indicated that panfish remained small but were more numerous than during the 1969 survey. Likewise, carp continued to be present and large, but did not appear to be over-abundant. Largemouth bass, the only gamefish species known to be present in Upper Kelly Lake, were small and scarce. However, lake chubsuckers, an important forage fish and a Wisconsin threatened species, appeared in good numbers during both surveys. Other species present in order of abundance included bluegill, pumpkinseed, black crappie, yellow perch, warmouth, green sunfish, golden shiner, yellow bullhead, grass pickerel, and white sucker.

Given the single-family residential nature of the immediate shorelands of the Kelly Lakes and its highly urban location, it is likely that the wildlife community is comprised of small upland game animals, such as rabbit and squirrel; predators, such as fox and raccoon; marsh furbearers, such as muskrat; migratory and resident song birds; marsh birds, such as redwing blackbird and great blue heron; raptors, such as great horned owl and red-tailed hawk; and waterfowl. White-tailed deer have been reported in the area. The character of wildlife species, along with the nature of the habitat present in the planning area has undergone significant change since the time of European settlement and the subsequent clearing of forests, plowing of the prairie, and draining of wetlands for agricultural purposes. Modern practices that adversely affect wildlife and wildlife habitat include: the excessive

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[3] *Wisconsin Department of Natural Resources*, Eurasian Water Milfoil in Wisconsin: A Report to the Legislature, *1993.*

[4] *G.J. Davis and M.M. Brinson*, op. cit.

[5] *E.R. Schumacher and S. Beyler, WDNR Memorandum No. 3600,* Single-Run Electrofishing Survey on Upper Kelly Lake, *May 1993.*

[6] *D. Fago, Wisconsin Department of Natural Resources Report No. 148,* Retrieval and Analysis Used in Wisconsin's Statewide Fish Distribution Survey, *Second Edition, December 1988.*

use of fertilizers and pesticides, road salting, heavy traffic, the introduction of domestic animals, and the fragmentation and isolation of remaining habitat areas for urban and agricultural uses.

Recreation

The Kelly Lakes are multi-purpose recreational use waterbodies serving many forms of recreation, including boating, swimming, and fishing during the summer months, and cross-country skiing, snowmobiling, ice fishing, ice skating and, occasionally, "polar bear" swimming during the winter months. The Lakes are used year round as visual amenities: walking, bird-watching, and picnicking being popular passive recreational uses of the waterbody.

Recreational boating access to Upper Kelly Lake is limited at present to one boat launch site on the northeast corner of the Lake, off of Kurtz Road, as shown on Map C-5. There is no public parking currently provided at this site. Walk-in access to Upper Kelly Lake is available at a City Park in New Berlin, as shown on Map C-5. A boat survey conducted by Commission staff during June 1998 indicated that 16 boats were either moored in the water or stored on land adjacent to Upper Kelly Lake. The types of boats included paddleboats, rowboats, canoes and sailboats. A follow-up survey conducted during July 2005 suggested that the numbers of watercraft had increased to about 40 boats stored or moored at Upper Kelly Lake and about 20 watercraft stored or moored at Lower Kelly Lake, confirming that water-based recreational use of the Kelly Lakes remains a popular pastime in this lake-oriented community.

Local Ordinances

Based upon the constraints imposed by the limited open water acreage of Upper Kelly Lake, motorized vessels operated on that waterbody are not permitted to exceed no-wake speeds. Neither the Village of Hales Corners nor the City of New Berlin have boating ordinances. Boating traffic on both Lakes is governed by state law as set forth in Chapter 30, *Wisconsin Statutes*.

USE RESTRICTIONS IMPOSED BY AQUATIC PLANTS

As observed during both the initial and current planning periods, excessive plant growth in the main basin of Upper Kelly Lake impedes boating traffic. In particular, excessive plant growth in the riparian zone makes access to the open water difficult without some sort of plant control strategy. Plant growth recorded by Commission staff exceeded a density rating of 2.5 out of a possible 4.0, indicating a moderate density, with at least one species present in quantities rated common to abundant at most sites sampled within the waterbody, principally those having the heaviest infestations of the plants described above, including *Ceratophyllum demersum*, as shown in Table C-1. Such dense growths also restrict shoreline angling and swimming, and can adversely affect riparian property values and the aesthetic enjoyment of the residents and visitors to the Lake.

PAST AND PRESENT AQUATIC PLANT MANAGEMENT PRACTICES

The residents of the Kelly Lakes, in conjunction with the City of New Berlin and the Village of Hales Corners, have long recognized the importance of informed and timely action in the management of the Kelly Lakes. The initial action in this regard was the formation of the Kelly Lakes Association, which provides the forum for many of the lake management activities of the Lakes' residents. The Association is currently enrolled in the water quality monitoring program conducted under the auspices of the Wisconsin Department of Natural Resources Self-Help Monitoring Program.

The Kelly Lakes Association has undertaken a phased planning program to identify issues of concern relating to the Kelly Lakes. The earliest study, prepared for Kelly Lakes Association by IPS Environmental and Analytical Services, Inc., identified six issues of concern to be addressed by the Kelly Lakes community, including: public information and education, water quality assessment, watershed boundary delineation, aquatic plant management,

Map C-5

BATHYMETRIC MAP OF UPPER AND LOWER KELLY LAKES

DATE OF PHOTOGRAPHY: APRIL 2005

— 20' — WATER DEPTH CONTOUR IN FEET

MONITORING SITE

PUBLIC ACCESS SITE

GRAPHIC SCALE

0 200 400 FEET

Source: U.S. Geological Survey and SEWRPC.

phosphorus load estimation, and subdivision design and impact minimization.[7] Subsequent planning projects led to the development of more detailed investigations of aquatic plant, and stormwater and lake water quality, management issues of concern, and the preparation of the initial lake protection plan for the Kelly Lakes.[8] That plan set forth a recommended course of action that has subsequently guided the lake and watershed management interventions implemented by the Kelly Lakes Association in cooperation with the City of New Berlin, Village of Hales Corners, and Wisconsin Department of Natural Resources. This planning report updates and refines the recommendations set forth in the current lake protection plan for the Kelly Lakes.

The Kelly Lakes Association also maintains an active public information program and in-lake aquatic plant management program. The Association initiated aquatic plant harvesting operations on Upper Kelly Lake during the summer of 1997. In addition, the Association holds an annual membership meeting, open to all Kelly Lakes community residents and interested parties, to answer questions and provide information to persons interested in the Kelly Lakes. An occasional newsletter is also published and distributed by the Association. The Association is a participant in the Wisconsin Department of Natural Resources Self-Help Monitoring Program. Reports of water clarity trends within the Lakes are a regular feature of the annual membership meetings.

ALTERNATIVE METHODS FOR AQUATIC PLANT CONTROL

Various aquatic plant management techniques—manual, mechanical, physical, and chemical—are potentially viable on Upper Kelly Lake.[9] Consideration has been given to each of these techniques. A number of these methods have been employed with varying success on Upper Kelly Lake in the past. All of these interventions require Wisconsin Department of Natural Resources permits pursuant to Chapters NR 107 and NR 109 of the *Wisconsin Administrative Code*, although there are certain exemptions provided under Chapter NR 109 for manual harvesting of aquatic plants as set forth below.

The presence of nonnative and nuisance aquatic plant species within the Lake basins and along their shorelines is indicative of a further loss of ecosystem integrity and function, affecting submergent and emergent lacustrine vegetation. Various in-lake management actions may be considered to mitigate and manage the consequences of aquatic habitat degradation in the Kelly Lakes. Generally, aquatic plant management measures, designed to minimize the environmental and recreational impacts of degraded habitat, are classed into four groups: chemical measures which include the use of aquatic herbicides; mechanical measures which include harvesting and manual removal; biological control measures which include the use of various organisms, including insects; and, physical measures which include lake bottom coverings and water level management. Costs range from minimal for manual removal of plants using rakes and hand-pulling to upwards of $50,000 for the purchase of a mechanical plant harvester, for which the operational costs can approach $2,500 to $5,000 per year depending on staffing and operating policies. Harvesting is probably the measure best suited to large areas of open water, while chemical controls may be best suited for use in confined areas and for the initial control of invasive plants. Controlling Eurasian water milfoil by planting native plant species or by introducing the milfoil weevil, *Eurhychiopsis lecontei*, is largely experimental, while the use of other biological controls, such as grass carp, is prohibited in Wisconsin.

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[7]*IPS Environmental and Analytical Services, Inc.*, Phase I Lake Management Plan: Upper and Lower Kelly Lakes, Waukesha and Milwaukee Counties, Wisconsin, *March 1997.*

[8]*SEWRPC Memorandum Report No. 135,* A Lake Protection Plan for the Kelly Lakes, Milwaukee and Waukesha Counties, Wisconsin, *October 2000.*

[9]*The various methods referred to in the text are described in more detail in U.S. Environmental Protection Agency Report No. EPA-440/4-90-006,* The Lake and Reservoir Restoration Guidance Manual, *August 1990.*

Aquatic Herbicides
Chemical treatment with aquatic herbicides is a short-term method of controlling heavy growths of aquatic macrophytes and algae. Chemicals are applied to the growing plants in either liquid or granular form. The advantages of using chemical herbicides to control aquatic macrophyte growth are the relatively low-cost and the ease, speed, and convenience of application. However, the disadvantages associated with chemical control include unknown long-term effects on fish, fish food sources, and humans; a risk of increased algal blooms due to the eradication of macrophyte competitors; an increase in organic matter in the sediments, possibly leading to increased plant growth as well as anoxic conditions which can cause fish kills; adverse effects on desirable aquatic organisms; loss of desirable fish habitat and food sources; and, finally, a need to repeat the treatment the following summer due to existing seed banks and/or plant fragments. To minimize the collateral impacts of deoxygenation, loss of desirable plant species, and contribution of organic matter to the sediments, early spring or late fall applications should be considered. Such applications also minimize the concentration and amount of chemicals used due to the colder water temperatures that enhance the herbicidal effects. Because the Kelly Lakes do not have significant growths of nuisance plant species, chemical treatment is not recommended generally as a means of controlling aquatic plant growth.

Aquatic Plant Harvesting
Aquatic macrophytes may be mechanically harvested with specialized equipment consisting of a cutting apparatus, which cuts up to five feet below the water surface, and a conveyor system that picks up the cut plants and hauls them to shore. Mechanical harvesting appears to be a practical and efficient means of controlling plant growth as it removes the plant biomass and nutrients from a lake. Limited aquatic plant harvesting is currently carried out on Upper Kelly Lake. Because some plant fragments are lost during the harvesting process due to the hydrodynamic design of the harvester, the addition of a shoreline cleanup program to remove the plant fragments from the Lake should be considered.

The advantages of aquatic plant harvesting are that the harvester typically leaves enough plant material in the lake to provide shelter for fish and other aquatic organisms, and to stabilize the lake bottom sediments. The disadvantages of mechanical harvesting are that the harvesting operation may cause fragmentation and facilitate the spread of some plants, including Eurasian water milfoil, and may disturb loosely consolidated bottom sediments increasing turbidity and smothering fish breeding habitat and nesting sites. Disrupting the bottom sediments by plant removal also could increase the risk that an exotic species, such as Eurasian water milfoil, may colonize the disturbed area. Nevertheless, if done correctly and carefully, harvesting has been shown to be of benefit in ultimately reducing the regrowth of nuisance plants.

Operation of a harvester requires managerial oversight and a secure financial basis.[10] The formation of a public inland lake protection and rehabilitation district around the Kelly Lakes could be considered as one means of providing such an organizational basis.

Mechanical harvesting is considered a viable management option to continue as a control of aquatic plants in Upper Kelly Lake.

Manual Harvesting
Mechanical harvesting requires a minimum depth of water in which to operate the harvesting equipment. When the water depth is inadequate depth, as in shoreline areas, manual harvesting provides a reasonable alternative technique. Manual harvesting involves the use of specially designed rakes to remove aquatic plants. The advantage of the rakes is that they are relatively inexpensive, easy and quick to use, and immediately remove the plant material from the lake, without a waiting period. Removal of the plants from the lake avoids the accumulation of organic matter on the lake bottom, which adds to the nutrient pool that favors further plant growth. State permitting requirements for manual aquatic plant harvesting provide an exemption for a 30-feet

[10]*Wisconsin Lakes Partnership Publication No. FH-205-97,* Your Aquatic Plant Harvesting Program: A How-to Field Manual*, 1997.*

width along the shoreline within which the harvested material must be removed from the lake—there are no lakeward limits set under the provisions of the Chapter NR 109 of the *Wisconsin Administrative Code*.

Manual harvesting is recommended for use in small areas of Upper Kelly Lake, but is not recommended for use on Lower Kelly Lake unless nearshore aquatic plants around piers are perceived as a severe nuisance.

Biological Controls
An alternative approach to controlling nuisance plants, particularly Eurasian water milfoil, is biological control. Classical biological control techniques have been successfully used to control both nuisance plants and herbivorous insects.[11] Recent studies have shown that *Eurhychiopsis lecontei*, an aquatic weevil, has potential as a biological control agent for Eurasian water milfoil.[12] Based upon a reconnaissance conducted by the Wisconsin Department of Natural Resources during June 1997, this weevil appears to be naturally occurring in the Kelly Lakes. However, as very few studies have been completed using *Eurhychiopsis lecontei* as a means of aquatic plant management control, it is not recommended that it be added to the Lakes at this time.

Grass carp, *Ctenopharyngodon idella*, another potential biological control, are not permitted for use in Wisconsin.

Physical Controls
Lake bottom covers and screens provide limited control of rooted plants by creating a physical barrier which reduces or eliminates the amount of sunlight available to the plants. Placement of such barriers is typically seasonal, with the barriers needing to be removed during the winter months. In addition, the barriers can be susceptible to disturbance by wind and wave action and by boat motors, although this latter is limited in Upper Kelly Lake due to the slow-no-wake requirements imposed by the small surface area of the Lake. Due to the steeply sloping bathymetry of the Kelly Lakes, lake bottom coverings are not considered a viable plant management option.

Citizen Information and Education
In addition to these in-lake management measures, an ongoing campaign of community information will support the aquatic plant management program by encouraging the use of shoreland buffer strips, responsible use of household and garden chemicals, and adoption of environmentally friendly household and garden practices to minimize the input of nutrients from these riparian areas. Aquatic plant management usually centers on the eradication of nuisance aquatic plants for the improvement of recreational lake use. The majority of the public views all aquatic plants as “weeds” and residents often spend considerable time and money removing desirable plant species from a lake without considering the environmental impacts. Thus, public information is an important component of an aquatic plant management program. Posters and pamphlets are available from the University of Wisconsin-Extension and Wisconsin Department of Natural Resources that provide information about and illustrations of aquatic plants, detailing their importance in providing habitat and food resources in aquatic environments, and explaining the need to control the spread of undesirable and nuisance plant species.

RECOMMENDED AQUATIC PLANT MANAGEMENT PLAN

Harvesting Plan
The recommended aquatic plant management plan consists of an integrated mechanical and manual harvesting design to minimize the negative impacts on the ecologically valuable areas of the Lake, while providing the control needed to achieve the desired recreational and aesthetic uses of the Lake. In order to implement the recommended aquatic plant management program the following management actions are recommended:

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[11]*C.B. Huffacker, D.L. Dahlsen, D.H. Janzen, and G.G. Kennedy,* Insect Influences in the Regulation of Plant Population and Communities*, 1984, pp. 659-696; and C.B. Huffacker and R.L. Rabb, editors,* Ecological Entomology*, John Wiley, New York, New York, USA.*

[12]*Sally P. Sheldon, “The Potential for Biological Control of Eurasian Water Milfoil (*Myriophyllum spicatum*) 1990-1995 Final Report,” Department of Biology Middlebury College, February 1995.*

1. The Kelly Lakes Association should continue its limited harvesting operations. Use of contract harvesting, rather than operation of a wholly-owned machine, may be a viable alternative for the Kelly Lakes Association.

2. Monitoring of the Lakes and surrounding wetlands for the presence or spread of nuisance plant species such as Eurasian water milfoil and purple loosestrife should continue, with careful attention being paid to the presence of the *Eurhychiopsis lecontei*, an aquatic weevil species naturally occurring in the Kelly Lakes and believed to control Eurasian water milfoil.

3. In areas that are inaccessible to the harvester in Upper Kelly Lake, manual harvesting of plants around piers and docks is the recommended means of controlling milfoil and other nuisance species of plants in those areas given the small size of the Lake. In this regard, the Association could consider purchasing several specialty rakes designed for the removal of vegetation from shoreline property and make these available to riparian owners. This would allow the riparian owners to use the rakes on a trial basis before purchasing their own. The rakes cost approximately $90 each. However, should milfoil be determined to reach nuisance proportions, the use of chemical herbicides could be considered, but should be limited to small areas. Early spring or late fall treatments to control the growth of Eurasian water milfoil have proven effective in other lakes in southeastern Wisconsin and are recommended. Early spring herbicide treatments reduce the biomass subject to decomposition and limit the accumulation of organic materials on the Lake bottom.

4. Should Eurasian water milfoil be determined to reach nuisance proportions, the use of chemical herbicides should be considered. Early spring or late fall treatments to control the growth of Eurasian water milfoil have proven effective in other lakes in southeastern Wisconsin and are recommended. Early spring herbicide treatments reduce the biomass subject to decomposition and limit the accumulation of organic materials on the Lake bottom.

5. It is recommended that an aquatic plant survey continue to be conducted every three to five years in order to track the success of the current aquatic plant management program, as well as any other changes in the tributary drainage area that may affect the Kelly Lakes.

6. The Kelly Lakes Association, through an educational and informational program, should promote awareness of Lake residents, visitors, and watershed residents of good urban housekeeping practices, and the invasive nature of such exotic, nonnative species as Eurasian water milfoil and purple loosestrife. Participation in citizen-based control programs coordinated by the Wisconsin Department of Natural Resources and University of Wisconsin-Extension should be encouraged.

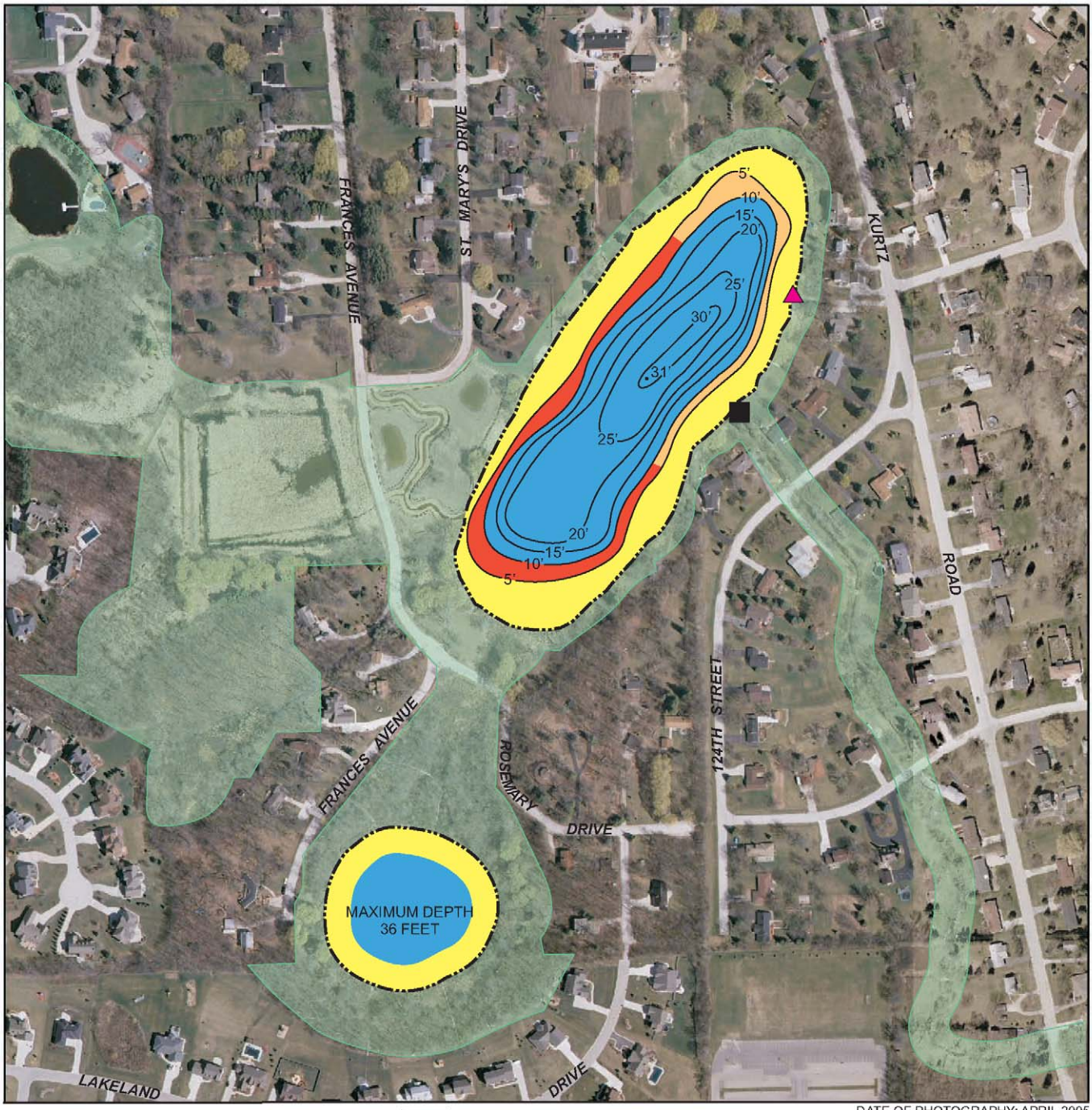
The recommended aquatic plant harvesting plan is graphically depicted on Map C-6. As indicated on the map, it is proposed that mechanical harvesting activities be restricted to depths greater than five feet for purposes of avoiding fish habitat and spawning areas, though boating access channels can be cut to the piers as long as the harvester leaves a minimum of two feet of vegetation standing. Because coontail (*Ceratophyllum demersum*), the most abundant aquatic plant in Upper Kelly Lake, is a light and buoyant plant and will bend over if the harvester moves too quickly, it is recommended that the harvester travel slowly in order to cut the plant.

Depth of Harvesting and Treatment of Fragments

The Aquamarine H-5 aquatic plant harvester has a maximum cutting depth of five feet. It is not the intention of the owners or operators of the equipment to denude the Lake of aquatic plants. Sufficient plant materials will be retained in the Lake to minimize resuspension of lake bottom sediments and to maintain desirable plant communities, such as those dominated, for example, by the low-growing muskgrass, *Chara* sp. All plant cuttings and fragments should be collected by means of a program set up by the Kelly Lakes Association. This is extremely important for preventing the spread of Eurasian water milfoil, which propagates rapidly through the rooting of plant fragments. Fragments can be used by homeowners as garden mulch.

Map C-6

RECOMMENDED AQUATIC PLANT MANAGEMENT PLAN FOR THE KELLY LAKES



DATE OF PHOTOGRAPHY: APRIL 2005

— 20' — WATER DEPTH CONTOUR IN FEET

PUBLIC ACCESS SITE

WATER LEVEL CONTROL STRUCTURE

AQUATIC PLANT MANAGEMENT

EURASIAN WATER MILFOIL CONTROL AREA
HARVESTING: HIGH PRIORITY
CHEMICALS: LIMITED

HARVEST ACCESS LANES
HARVESTING: MODERATE PRIORITY
CHEMICALS: NONE

SHALLOW WATER HABITAT AREA
HARVESTING: NONE
CHEMICALS: NONE

DEEP WATER AREA: NO CONTROL

LAND USE MANAGEMENT

PROTECT ENVIRONMENTALLY VALUABLE AREAS

- PROVIDE PUBLIC FISHING PIER
- RESTORE WETLAND FOR LAKE QUALITY PROTECTION

SHORELINE PROTECTION

- MAINTAIN EXISTING STRUCTURES
- PROTECT UNSTABLE AREAS AND RESTORE SHORELAND WETLANDS

LAKE MANAGEMENT

- ESTABLISH PUBLIC INLAND LAKE PROTECTION AND REHABILITATION DISTRICT

GRAPHIC SCALE
0 200 400 FEET

Source: SEWRPC.

Buoyage
Temporary markers may be used to direct harvesting operations in the lake basin by marking the areas to be cut. However, the size of the Lake generally precludes the need for such buoys. The harvester operators will be provided with a laminated copy of the harvesting plan and made familiar with the plan and local landmarks to the degree necessary to carry out the plan without the use of the buoyage. Harvesting operations should be regularly supervised by Association members.

Harvesting Plant Material, Disposal, and Transfer Sites
Plant cuttings and fragments are currently disposed of on the farm owned by Mr. Donald Peffer. Composting remains the recommended method of disposing of aquatic plant cuttings. However, should this site become unavailable as a disposal site, either a new farm or the City of New Berlin compost site will have to be explored as alternative sites. Plant material is collected to avoid the leaching of nutrients back into the Lake and to minimize the visual degradation of the environment near the boat launching site.

Precautions to Protect Wildlife and Ecologically Valuable Areas
Operators will be provided with a laminated copy of the approved harvesting plan map, showing the limits and priorities of harvesting operations. A copy of these items should be kept on the harvester at all times. To prevent disturbance of fish habitat and spawning areas, operations should not take place in depths less than five feet, other than to cut boat access paths to piers. Harvesting operations should leave at least two feet of vegetation in all areas to be cut, to minimize resuspension of the bottom sediments, and to allow low-growing native plants, such as muskgrass, to retain their competitive advantage over less-desirable invasive species, such as Eurasian water milfoil.

Public Information
It is the policy of the Kelly Lakes Association to maintain an active dialogue with the community. This dialogue is carried out through the medium of the public press, and in public fora through various Association meetings, public meetings, and other scheduled hearings.

EQUIPMENT NEEDS AND OPERATION

The Kelly Lakes Association currently owns and operates one Aquamarine H-5 harvester, with an anticipated 10-year life span. Replacement of this unit when necessary may be expected to cost about $50,000.

Maintenance Schedule, Storage, and Related Costs
Routine maintenance will be performed by the Kelly Lakes Association in accordance with the manufacturer's recommended maintenance schedule. Maintenance costs will be borne by the Kelly Lakes Association. Winter storage will be the responsibility of the Association.

Insurance Coverage
The Kelly Lakes Association currently holds an insurance policy worth $10,000 covering capital equipment and liability. The relevant certificates are held by the Association.

Operators, Training, and Supervision
The harvester will be owned and operated by the Kelly Lakes Association, who will be responsible for the day-to-day operations of the equipment. The Association will provide training as required.

EVALUATION AND MONITORING

Daily Record-Keeping Relating to the Harvesting Operation
Daily harvesting activities will be recorded by the operators of harvesting equipment in an operations log. An annual summary of the harvesting program will be submitted to the Kelly Lakes Association Board of Directors, or designated committee thereof, and made available to the public at that time. The summary will also be published at the annual meeting of the Association.

To determine the efficacy of the aquatic plant management plan and equipment, it is the intention of the Kelly Lakes Association to undertake a periodic, formal review of the harvesting program as set forth in the lake protection plan for the Kelly Lakes, a copy of which has been lodged with the Wisconsin Department of Natural Resources, South East Region office.

Daily Record-Keeping Relating to the Harvesters

Daily maintenance and service records showing engine hours, fuel consumed and oil used, will be recorded in a harvester operations log.

Appendix D

SEWRPC STAFF MEMORANDUM
STREAM RECREATION AND WETLAND RESTORATION PROJECT FOR UPPER KELLY LAKE

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SEWRPC Staff Memorandum

HYDRAULIC ANALYSIS, DATA ANALYSIS, AND RECOMMENDATIONS RELATING TO THE PROPOSED PHASE 2 WETLAND RESTORATION PROJECT FOR UPPER KELLY LAKE IN MILWAUKEE AND WAUKESHA COUNTIES

April 22, 2004

BACKGROUND

Pursuant to the November 11, 2003, letter request of Mr. Eric Nitschke, Division Engineer—Storm Water, City of New Berlin Department of Community Development, and subsequent meetings, the Southeastern Wisconsin Regional Planning Commission (SEWRPC) staff have performed a hydraulic analysis to evaluate the impacts of the proposed Phase 2 Wetland Restoration Project for Upper Kelly Lake as well as prepared design recommendations regarding the proposed wetland restoration and stream relocation project for the Kelly Lakes (see Exhibit B for complete project summary). This wetland restoration project necessitates remeandering approximately 450 feet of the existing Upper Kelly Lake Tributary, specifically, from the culvert at St. Mary's Drive to the confluence with Upper Kelly Lake as part of the proposed wetland restoration project. Hence, this memo includes stream channel survey data, description of analyses, and design recommendations regarding the wetland restoration and relocation of the Upper Kelly Lake Tributary. The subject wetland restoration project is located in the northeast quarter of U.S. Public Land Survey Section 36, Township 6 North, Range 20 East, City of New Berlin (Exhibit B).

The recommendations set forth herein are meant to provide guidance for the detailed design of the proposed wetland restoration project. The Kelly Lakes Association and associated consultants should use this guidance as appropriate in developing the detailed design for channel relocation and its subsequent implementation.

Following several field visits and site meetings during the period from April 2003 through March 2004, the Regional Planning Commission staff has identified two major goals to guide the preparation of the proposed recommendations for the wetland and stream restoration design:

1. To protect and minimize the negative effects of the wetland restoration stream relocation on the existing biodiversity in these communities.

2. To improve water quality and available habitat for this wetland and stream system through the enhancement of streambank stability, limitation of instream sediment deposition during pre- and post-construction conditions, implementation of mitigation techniques to moderate the effects of past channelization, and restoration of instream, wetland, and riparian habitat.[1]

Several key aspects associated with the environmental enhancements of the wetland and stream restoration in this project area were also identified:

- The proposed restoration and establishment of approximately three acres of wetland throughout the project area.

- The proposed relocation of several hundred feet of the Upper Kelly Lake Tributary is intended to create a stable and more "natural" channel that is intended to reduce streambank erosion potential, enhance water quality, and improve habitat for wildlife.

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[1]*Wisconsin Department of Natural Resources Technical Bulletin No. 169,* A Review of Fisheries Habitat Improvement Projects in Warmwater Streams, with Recommendations for Wisconsin, *1990.*

This report has four primary components: 1) summary of the physical and hydrological characteristics of the Upper Kelly Lake Tributary; 2) summary of the hydraulic analysis to evaluate the impacts of the proposed wetland and stream restoration project; 3) recommendations and specifications to consider for the proposed wetland and stream design and construction for habitat restoration and water quality enhancement; and 4) recommendations for construction staging.

These recommendations are consistent with the adopted regional water quality management plan for Southeastern Wisconsin, the Waukesha County land and water resource management plan, the City of New Berlin stormwater management master plan, and the Kelly Lakes Protection Plan.[2]

SITE DESCRIPTION

The location of the proposed wetland and stream restoration for Upper Kelly Lake is shown on the aerial photograph attached hereto as Exhibit A. SEWRPC staff conducted a survey of the existing wetland and stream reach within the project area to determine the physical characteristics of the existing stream reach of the Upper Kelly Lake Tributary, including adjacent sites upstream of the project area. Methods utilized to select transect locations and measure appropriate channel features within this stream reach were developed from several sources and modified to meet the objectives of this stream relocation project.[3] A total of 12 transects were established in order to characterize the existing reach and develop appropriate design parameters for the relocated channel (see Proposed Channel Design Section below). This instream survey data, in combination with detailed site plan information provided by the Kelly Lakes Association, as well as file information from SEWRPC such as benchmark elevation survey information (Exhibit C), were used to characterize site conditions and develop recommendations for the proposed relocation of this reach of the Upper Kelly Lake Tributary, as summarized below.

HYDRAULIC ANALYSIS

A hydraulic analysis was made of the potential impacts of the proposed project on the 100-year recurrence interval flood profile along the Upper Kelly Lake Tributary. The analysis was designed to address requirements set forth in a November 3, 2003 letter from the Wisconsin Department of Natural Resources to the Kelly Lakes Association. That letter called for use of the U.S. Army Corps of Engineers (USCOE) HEC-RAS river analysis system model and for the project to cause no increase in 100-year flood stages.

The USCOE HEC-2 water surface profiles model of the Tributary that was developed under the November 6, 1996, Federal Emergency Management Agency flood insurance study (FIS) for the City of New Berlin was used as the base model for the analysis. The model was converted to USCOE HEC-RAS format. In the reach of the Tributary extending from Upper Kelly Lake upstream to cross section 1.55, which is located about 65 feet upstream of St. Mary's Drive, the model was revised to reflect existing (year 2000) elevation contours as

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[2]*SEWRPC Memorandum Report No. 93*, A Regional Water Quality Management Plan for Southeastern Wisconsin: An Update and Status Report, *March 1995*; *Waukesha County Department of Parks and Land Use*, Waukesha County Land and Water Resource Management Plan: 1999-2002, *January 1999*; *Camp, Dresser & McKee, Inc.*, Storm Water Master Plan for the City of New Berlin, *December 1998; and SEWRPC Memorandum Report No. 135*, A Lake Protection Plan for the Kelly Lakes: Milwaukee and Waukesha Counties, Wisconsin, *October 2000.*

[3]*United States Department of Agriculture*, Methods for Evaluating Stream, Riparian, and Biotic Conditions, *USDA General Technical Report INT-138, 1983; United States Department of Agriculture*, Guidelines for Evaluating Fish Habitat in Wisconsin Streams, *USDA Forest Service General Technical Report NC-164, 1994*; *United States Department of Agriculture*, Stream Channel Reference Sites: An Illustrated Guide to Field Techniques, *General Technical Report RM-245, 1994.*

determined from the Waukesha County digital terrain model (DTM), and cross sections were added to best represent the proposed meandered channel. Cross sections were included at the same locations in both the existing and proposed channel HEC-RAS models. (See Exhibit D for cross section locations.) The 100-year peak flood flows were taken from the 1996 FIS.

The 100-year floodplain boundaries under both existing and planned channel conditions are shown on Exhibit E. A comparison of 100-year flood stage elevations under existing and proposed channel conditions is set forth in Exhibit F. As seen from Exhibit F, the only flood stage increases of 0.01 foot or greater would be expected to occur at cross sections 0.6 and 0.8, and those increases would be contained on the project site. Thus, the proposed project meets the requirements of the City zoning ordinance and Chapter NR 116, "Wisconsin's Floodplain Management Program," of the *Wisconsin Administrative Code*, both of which call for activities in the 100-year floodway to not increase the 100-year flood stage by 0.01 foot or more, unless appropriate legal agreements are obtained from all affected property owners and municipalities.

A second issue that was considered is the impact of the project on floodwater storage volume along the Tributary. In discussions with Mr. Eric Nitschke, Division Engineer-Stormwater for the City of New Berlin, it was determined that the City intends for the proposed wetland restoration project to provide a sufficient increase in floodwater storage volume to offset filling in the Tributary floodplain associated with a proposed City of New Berlin Water Utility pump house located southeast of the intersection of W. Grange Avenue and Frances Avenue. Based on data provided by Ruekert & Mielke, Inc., the designer for the pump house, 1,100 cubic yards of fill would be placed in the tributary floodplain for construction of the pump house. The HEC-RAS analysis indicates that in the reach affected by the wetland restoration project, extending from Upper Kelly Lake to cross section 1.55, the net increase in floodwater storage volume in the 100-year floodplain east of Frances Avenue would be about 5.8 acre-feet. The analysis also indicates that the approximate average decrease in the 100-year flood stage would be 0.36 foot in the 14.2 acre floodplain/wetland area located west of Frances Drive and south of St. Mary's Drive extended (see Exhibit E). That decrease in flood stage, along with the placement of 1,100 cubic yards of fill for the pump house project, would result in a loss of floodwater storage of about 5.8 acre-feet. Thus, the gain and loss of storage balance and the existing floodwater storage volume would be adequately preserved.

Existing Wetland Conditions

Currently, the existing plant community within the project site consists of a disturbed moderate-to-low quality old field and second growth, Southern wet-mesic lowland hardwoods, and grades into disturbed fresh (wet) meadow next to Upper Kelly Lake, primarily due to past dumping and filling (see Exhibits B, H, and I). The test pitting and soil characterization of the existing wetland within the project site indicated the presence of a black organic peat layer that was covered with about two to four feet of clean fill material, exempt under NR 500.08 as clean soil fill (Exhibit H). This peat layer represents a known native soil for the site. No discoloration of the clean soil fill was noted in any of the test pits and none of the soil samples collected for field Photoionization Detector (PID) testing exhibited detectable PID values. Based upon these soil testing results there does not appear to be contaminated fill material currently on this project site. However, the peat layer provides an indication of the historic floodplain elevation to be restored.

Existing Channel Conditions

Currently, the amount, quality, and diversity of available instream fisheries and macroinvertebrate habitat within the Upper Kelly Lake Tributary may be considered to be generally limited. The Upper Kelly Lakes Tributary was channelized from Grange Road to the confluence with the Lake, however, the Tributary exhibits a distinct physical change at St. Mary's Drive. The reach upstream of St. Mary's Drive contains a channel bottom slope of 0.0074 and exhibits a relatively constant width and depth and gravel, cobble, and boulder substrates, as shown in the low flow channel characteristics appended hereto in Exhibit J. In contrast, the stream reach within the project area, downstream of St. Mary's Drive, contains a channel bottom slope of 0.0031 and shows a dramatic increase in width, depth, and silt and sand substrates to the confluence with Upper Kelly Lake. The low flow channel has, on average, a width of about nine feet and a depth of one-half feet versus a width of 17 feet and depth of two feet within the adjacent upstream reach and the project reach, respectively (Exhibit J). Survey data also indicated that

the water surface in Upper Kelly Lake and the stream reach within the project site was at elevation 806.0 feet above National Geodetic Vertical Datum, 1929 adjustment (NGVD29), which shows that under low flow conditions there is a backwater effect from Upper Kelly Lake that extends all the way up to the culvert at St. Mary's Drive (see Exhibit K). Based upon these observations the reach upstream of the project area is recommended to be utilized to establish conditions for the proposed stream dimensions and be hereinafter referred to as the "reference reach", because the stream reach within the project area has been overly modified and does not exhibit appropriate physical features to emulate for this stream restoration design.

Stream Morphology and Hydrology

The existing stream reach of the Upper Kelly Lake Tributary within the project limits is approximately 450 feet in length with a sinuosity of 1.2 and slope of 0.006. This low sinuosity is primarily due to historic channelization, and has resulted in a correspondingly limited pool/riffle structure within this reach.

The streambanks within this reach are moderately stable and, as outlined above, the limited data available and onsite observations indicate the stream has relatively good water quality. This stream segment is slightly entrenched with corresponding moderately steep banks. The bankfull channel characteristics of the reference reach, which are recommended to be used for this restoration design (see Section above), have an average width of 11.2 feet, an average depth of 2.7 feet, an average width to depth ratio of 4.2, and channel material comprised mainly of sand substrates (Exhibit J). These channel characteristics generally correspond to an "E5" stream channel type using the Rosgen stream channel classification system.[4]

The Rosgen classification system includes recognition of specific characteristics of channel morphology and the relationship between the stream channel and its floodplain. An "E5" channel type is characterized by the following features: a gradient of less than two percent; a meandering riffle-pool system with a sinuosity of greater than 1.5; a width to depth ratio of less than 12; a slightly entrenched channel with an entrenchment ratio of greater than 2.2; and a predominantly sand substrate.

Due to channelization within the project area, as noted above, the existing stream reach has a sinuosity of less than 1.5. Inspection of historic and current aerial photographs shows no evidence of the likely natural condition of this Tributary from St. Mary's Drive to the confluence with Upper Kelly Lake. Therefore, it was necessary to calculate a more appropriate sinuosity for this Unnamed Tributary based upon the measured values of channel width, depth and slope within the reference reach upstream of the study area (see Exhibit J), which is estimated to range from about 1.7 to 2.0.[5]

Based upon the "E5" classification, the Rosgen methodology would suggest that The Upper Kelly Lake Tributary is very sensitive to disturbances within the drainage area, with a good recovery potential. This classification also suggests that the potential for streambank erosion within this system is moderate to very high, with streambank vegetation having a very high controlling influence on moderating this erosion potential.[6] In terms of the potential for enhancing fish habitat, bank-placed boulders and brush bundles or tree revetments (see Exhibit L) are indicated as good for use in "E5" channels, opposing wing-deflectors as fair for use, and medium-stage weirs, boulder clusters, and single wing deflectors as poor. Therefore, fish habitat improvements in this system should be focused on bank-placed boulders, brush bundles, and/or similar treatments, including placement of root wads or tree revetments. For further information, refer to Exhibit L which outlines the description, use, installation procedures, and management considerations for such aforementioned treatments.

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[4] *D.L. Rosgen*, Applied River Morphology, *Wildland Hydrology, Colorado. 1996.*

[5] *G.W. Williams, "River Meanders and Channel Size,"* Journal of Hydrology, *volume 88, pages 147-164, 1986.*

[6] *D.L. Rosgen, "A Classification of Natural Rivers,"* op. cit.

Because the Upper Kelly Lakes Tributary does not contain a United States Geological Survey gauging station, it was necessary to obtain the physical cross section and elevation data as shown in Exhibits J and K. Given the existing cross-sectional area for the reference reach on the Tributary of about 31 square feet, a bankfull stage event, which is defined as a 1.5-year storm event, would correspond to a discharge of about 36 to 53 cubic feet per second based upon the Manning's equation and a roughness coefficient ranging from 0.065 to 0.045, respectively, which is the range of in channel roughness coefficients used for in the Upper Kelly Lake Tributary floodplain analysis.[7]

Water Quality

Upper Kelly Lake was found to be a eutrophic, moderately deep water lake of average quality.[8] As such, the Lake may be considered, by definition, to be in need of protection and rehabilitation if it is to support its current aesthetic and recreational uses. The adopted regional water quality management plan nonpoint source pollution abatement plan element for the Root River watershed generally recommends urban nonpoint source pollution control practices designed to reduce the pollutant loadings from nonpoint sources by about 50 percent, plus additional controls in the downstream portions of the drainage basin.[9]

Generally, the application of low-cost urban housekeeping practices may be expected to reduce nonpoint source loadings from urban lands by about 25 percent. Public informational programs are being developed and implemented by the Kelly Lakes Association to encourage such good urban housekeeping practices as restricted use of fertilizers and pesticides; improved pet waste and litter control; the substitution of plastic for galvanized steel and copper roofing materials and gutters; proper disposal of motor vehicle fluids; increased leaf collection; and reduced use of street deicing salt. In addition, the installation of an approximately three-acre wetland basin within a restored shallow-water marsh ecosystem at the headwaters of Upper Kelly Lake was recommended as a means of potentially further reducing phosphorus levels entering Upper Kelly Lake to meet the balance of the approximately 50 percent reduction goal. Implementation of this measure is confirmed in the City of New Berlin stormwater management plan.[10]

PROPOSED WETLAND DESIGN PARAMETERS

Based upon the foregoing observations and analyses, the proposed wetland restoration of approximately 3.0 acres of wetland is recommended to be completed in the project area. More specifically, this restoration project is further subdivided into three separate areas that include (see Exhibit M):

- 1.1 acres of existing wetland
- 1.4 acres of restored wet meadow
- 0.5 acres of shallow marsh

The proposed wetland, designated as Basin 2E071 in the City of New Berlin stormwater management plan, is estimated to receive approximately 100 tons of sediment, 340 pounds of phosphorus, and 250 pounds of lead on

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[7] *V.T. Chow*, Open-Channel Hydraulics, *McGraw Hill, New York, 1988.*

[8] *SEWRPC Memorandum Report No. 135*, op. cit.

[9] *SEWRPC Planning Report No. 30,* A Regional Water Quality Management Plan for Southeastern Wisconsin: 2000, *Volume One,* Inventory Findings, *September 1978; Volume Two,* Alternative Plans, *February 1979; and Volume Three,* Recommended Plan, *June 1979.*

[10] *Camp Dresser & McKee, Inc.,* Storm Water Master Plan for the City of New Berlin, *December 1998.*

an annual basis.[11] These loads represent between two percent and four percent of the total loads of these contaminants generated within the City. Implementation of this project is estimated to reduce loads of these contaminants by approximately 90 percent for sediment, 50 percent for phosphorus, and 70 percent for lead, contributing to an overall reduction of these contaminants from within the City of approximately two percent.

The project will require a significant amount of soil disturbance from excavation of historic fill materials prior to planting and/or seeding of native wetland vegetation. Consequently, the design considerations should include the issues identified in Exhibit B as well as the following:

- Detailed elevation survey of the site.
- Detailed schedule of excavation and fill quantities, access road locations, temporary onsite storage locations, planting list and quantities, construction methods, and implementation sequence.
- Detailed implementation schedule preferable accommodating a fall or spring seeding and planting, with an appropriate management plan to provide for seedbed preparation, watering, weeding, and related maintenance.
- Inspection and maintenance of erosion control measures.
- Monitoring plan for the Kelly Lakes Association properties for at least a five-year period to manage the restored plant community and reduce the likely occurrence of exotic invasive plant species on the site. Exhibit H indicates the recent occurrence of several alien or nonnative plant species of concern on or near the site.

PROPOSED CHANNEL DESIGN PARAMETERS

Based upon the foregoing observations and analyses, the proposed relocation of the Upper Kelly Lake Tributary should develop a bankfull channel with meanders and asymmetrical cross-sections to emulate the morphology of natural channels. Such construction would act to direct the flow and induce the development of pools and riffles so as to potentially produce a diverse range of habitats that will create a more biologically productive stream.

Proposed bankfull channel width and depth dimensions are based upon the range of the existing bankfull dimensions recorded within the reference reach as shown in Exhibit J. The proposed bankfull channel dimensions should approximate a width of 12.5 feet and depth of 2.5 feet with bank slopes no steeper than two feet horizontal distance on one foot vertical (2H:1V) as shown in Exhibit N. These dimensions would create a low flow channel width of approximately seven to eight feet, which is well within the range of the existing low flow channel widths (Exhibit N). In addition, low flow pool and riffle habitats would have a depth of approximately 1.0 foot and 0.5 foot, respectively. These depths also are within the range of existing depths observed within and adjacent to the project reach.

The proposed bankfull channel cross sectional profile shows the projected location and details of pool and riffle habitats within the relocated segment, as shown in Exhibit N. Pool habitats should be located at the bends of the meanders, and pools should be constructed with an asymmetrical cross-section using a 2:1 slope on the outside bank and a 3:1 slope on the inside bank to better mimic natural pool dimensions.[12] The asymmetric cross-section channel should serve to direct water during a high-flow event so as to cause scour near the bank having the 2:1 slope, while inducing deposition on a point bar adjacent to the bank with the 3:1 slope. Riffle habitats should be located within the straight sections between bends. Riffles should be constructed with a symmetrical cross-section

[11] Ibid., *see Section 8.3.2 and Table 8-5; see also SEWRPC Memorandum Report No. 135,* op. cit..

[12] *Ann L. Riley,* Restoring Streams in Cities: A Guide for Planners, Policymaker, and Citizens, *Island Press, 1998.*

profile with both banks having an approximately 2:1 slope. Consequently, the stream should be constructed as a series of point bars and scour areas, similar to that found in natural streams. It is also recommended that the toe of slope on the outside bends of pools be protected with either large field stone and/or natural fiber rolls or in combination with other bioengineering treatments. For a more complete description on the types and installation procedures and specifications for bioengineering treatments, see Exhibit L.

The riffle habitats should be utilized as natural gradient control structures to regulate the slope within the newly constructed stream reach, as shown in Exhibits O and P for the proposed riffle elevations and position along the length of the proposed new stream channel. In addition, about 0.5 foot of gravel should be placed in the riffle habitats to increase bottom grade, enhance hyporheic zone habitat,[13] and ensure the stability of the streambed (Exhibit N). The gravel substrate should consist of a variety of stone ranging from small-sized gravel with a diameter of 2.5 millimeters (0.1 inch) to large-sized gravels with a diameter of 50 millimeters (2.0 inches).

Based upon the recommended approaches to meander restoration design, empirical relationships were utilized to compute meander geometry as summarized below.[14] Using equations compiled by Leopold and Wolman,[15] the proposed meander lengths, based upon the maximum and minimum observed bankfull channel widths, should range from approximately 110 feet to 160 feet, with amplitude ranging from approximately 33 feet to 50 feet, and a radius of curvature ranging from 25 feet to 36 feet. Based upon equations 30 through 33 by Williams,[16] meander wavelengths within this segment should range from 84 to 126 feet, channel bend lengths from 57 to 85 feet, meander belt widths from 48 to 72 feet, and radius of curvature from 17 to 25 feet. Since there were no natural (i.e. unmodified) reaches upon which to compare these estimated parameters, it was not possible to compare model outputs with existing meander geometry within this Tributary. However, these models have been demonstrated to be a reasonably good estimate of relatively "natural" and stable meander geometry,[17] and therefore, it is recommended that the new channel conform to the range of estimated parameters above, as set forth in Exhibits N-P.

Channel Design Considerations

A single stage bankfull channel design is proposed for the relocated section. Flood-flows will be allowed to inundate the floodplain throughout this section, which is integral to the wetland mitigation design for this site. Exhibits F, M and N demonstrates the relationship between the relocated channel and wetland mitigation planting area. Based upon the elevations of the proposed stream channel and floodplain, which is estimated to be within approximately 807.5 and 808 feet above NGVD29, approximately two to three feet of material will need to be removed. However, bank slopes above the top of the bankfull height elevation are not recommended to exceed four feet horizontal on 1 foot vertical (4H: 1V). Such bank slopes should provide adequate stability for this proposed stream channel.

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[13]*Symposium on Small Stream Channels and Their Riparian Zone: Their Form, Function and Ecological Importance in a Watershed Context, Vancouver, British Columbia, February 19-20, 2002.*

[14]Federal Interagency Stream Restoration Working Group (FISRWG), Stream Corridor Restoration: Principles, Processes, and Practices, Chapter 8: Restoration Design, http://www.usda.gov/stream_restoration/newgra.html, 1998.

[15]*L.B. Leopold and M.G. Wolman*, "River Meanders," Geological Society of America Bulletin *71, 1964.*

[16]*G.W. Williams, "River Meanders and Channel Size,"* op. cit.

[17]*SEWRPC Staff Memorandum*, Data Analysis and Recommendations Relating to the Proposed Relocation of the West Branch of Nippersink Creek for The Lake Geneva Bypass—Stream Relocation Project in the Town of Linn, Walworth County, *November 13, 2003.*

The proposed stream channel elevations are limited to the existing streambed elevations imposed by the existing culvert upstream at St. Mary's Drive at an elevation of approximately 805.2 feet above NGVD29 and an elevation at the downstream confluence with Upper Kelly Lake of approximately 804.0 feet above NGVD29 (see Exhibits K and P).

The stream banks in this section should be stabilized through the planting of a random assortment of native plant seedings, as set forth in Exhibit B. Based upon observed conditions of the existing stream channel within the proposed wetland mitigation area, the banks are anticipated to be primarily composed of peat. The quantities and species of plants utilized for the bank stabilization and associated wetland mitigation plantings will need to be developed by a consultant.

DESIGN IMPLEMENTATION RECOMMENDATIONS

The realignment and enhancement of the stream channel within the Upper Kelly Lake Tributary project area is recommended to generally follow the construction sequence and procedures outlined below. The staging outline is meant to be indicative, but conceptually represent an appropriate timing and sequencing from an environmental point of view. The project designer and contractor should utilize the recommendations set forth herein as a point of departure in developing the project in a technically sound and structurally stable manner.

1. Install erosion control.

2. Clear and grub trees and shrubs.

3. Excavate new floodplain/wetland within the areas of the proposed new stream channel location.

4. Construct proposed bankfull channel (single-stage channel design).

    a. The existing channel should be utilized to convey normal flows during the entire construction phase of the new stream channel.

    b. The reference-line of the bankfull channel should be staked by the contractor for the entire length of the channel.

    c. The bankfull channel should be excavated in a downstream to upstream (northerly) direction, which will allow for water to drain off of the site in the event of a rainstorm.

    d. All excavated material associated with the construction of the new stream channel should be either stockpiled to be utilized as fill for the existing stream channel or removed from the project site entirely.

    e. Connections—The new channel should be connected at approximately 150 feet upstream of the confluence of Upper Kelly Lake of the existing stream and at the new downstream confluence as indicated in Exhibit M.

        1.) Both the banks at each connection in the new channel should be protected with riprap from the established low flow elevation of about 806 feet above NGVD29 in elevation down to the toe of slope, to reduce chances of erosion and failure.

        2.) The connection should be temporarily blocked-off with sandbags to prevent erosion and sedimentation from entering the existing stream channel during the construction and post-construction stages of the project.

3.) It is anticipated that there will be standing water within the newly constructed stream channel and it will not be possible to pump this water down during construction or post-construction, because this water level is maintained by the dam at Upper Kelly Lake.

f. All of the banks of the new channel should be excavated at a 2:1 slope from the established bankfull elevation to the toe of slope, except for outside bends of pool habitats and banks above the proposed bankfull elevation (see below and Exhibit N).

g. Streambanks above the bankfull elevation should be excavated at a 4:1 slope from the established bankfull elevation to the top of the existing ground elevation.

h. Install erosion control mat from the toe of slope to the top of the existing ground elevation on the stream banks in all areas, as indicated on the plan.

4. Construction of the typical riffle section

a. All of the banks of the new channel should be excavated at a 2:1 slope and constructed to match the dimensions of the typical riffle section (Exhibit N).

b. All streambank slopes above the height of the bankfull discharge should be excavated at a 4:1 slope.

c. Coarse aggregate, (see Glossary for definition) should be placed 0.5 foot deep on the bottom of the new channel, within indicated riffle sections only as indicated on the plan, immediately after the channel is excavated or by the end of that same day to match the appropriate elevation (see typical section).

d. All streambanks should be immediately protected with fabric by the end of that same day.

5. Construction of the typical pool section.

a. The bank slope of the inside meander should have coarse aggregate, placed on a portion of the streambed and banks to provide the 3:1 slope of the point bar up to the low flow discharge elevation (see typical cross section).

b. The bank slope of the outside meander, below the low flow discharge elevation, should be cut to a 1:1 slope, excavated material will be stockpiled for fill or removed from site, and the streambank should be immediately protected with fabric and riprap and/or natural fiber rolls (see typical cross section and Exhibit N).

c. Medium and small diameter riprap should be utilized to protect the toe of slope in this new channel.

d. Slopes above the low flow elevation on the outside meander should remain intact at a 2:1 slope, and be protected with fabric.

6. Seed and/or plant rootstock and shrubs on the stream bank, as indicated on the plan.

7. Complete excavation and seedbed preparation in wet meadow and shallow marsh areas as indicated on the plan.

8. Seed and plant rootstock in the wet meadow and shallow marsh areas indicated on the plan.

9. Install goose fence in areas indicated on the plan to protect the newly planted rootstock.

10. Open the channel-the temporary sand bag obstructions should be opened approximately one year after construction is completed, to allow for at least one full year of vegetation to establish on the constructed streambanks and wetland areas.

GLOSSARY

Bankfull Channel: The stream channel that is formed by the dominant discharge, also referred to as the active channel, which meanders across the floodplain as it forms pools and riffles. Defined by the discharge that occurs when water just begins to leave the channel and spread onto the floodplain (see typical sections in Exhibit N).

Coarse Aggregate: Aggregate that passes through the 25.0-mm sieve.

Floodplain: Any flat, or nearly flat lowland that borders a stream and is covered by its waters at flood stage.

Low Flow: Portion of the stream discharge that is derived from natural storage (i.e. groundwater outflow or other sources outside the net rainfall that creates surface runoff); discharge in a stream that will sustain aquatic organisms. The flow may vary seasonally.

Meander: A sinuous channel form in flatter river grades formed by the erosion on one side of the channel (pools) and deposition on the other (point bars) (see typical sections in Exhibit N).

Point Bar: A bank on the inside of a meander bend that has built up due to sediment deposition opposite a pool (see typical sections in Exhibit N).

Pool: A location in an active stream channel usually located on the outside bends of meanders, where the water is deepest and has reduced current velocities (see typical sections in Exhibit N)

Reference-Line: Line that bisects the center of the meander wavelength, which indicates the linear alignment and directional changes of the proposed stream channel. The line is used as a point of reference to construct the meander wavelength, amplitude, and radius of curvature of the proposed stream channel.

Riffle: A shallow rapids or area with increased current velocities, usually located at the crossover in a meander of the active channel (see typical sections in Exhibit N).

Single-Stage Channel Design: See Bankfull Channel.

Streambank: The portion of the channel cross section that restricts lateral movement of water at normal water levels.

Streambed: The bottom of a channel.

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LIST OF EXHIBITS

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Exhibit A

LOCATION OF THE PROPOSED WETLAND AND STREAM RESTORATION FOR UPPER KELLY LAKE: 2004

Source:SEWRPC.

DATE OF PHOTOGRAPHIC: MARCH 2000

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Exhibit B

PROPOSED LAKE PROTECTION GRANT WETLAND RESTORATION PROGRAM FOR UPPER KELLY LAKE MILWAUKEE AND WAUKESHA COUNTIES

PROJECT DESCRIPTION

INTRODUCTION

Upper Kelly Lake is a 12-acre lake located partially in the Village of Hales Corners in Milwaukee County and partially in the City of New Berlin in Waukesha County. The Lake is a drainage lake situated at the headwaters of the Root River system. In addition, Lower Kelly Lake, an internally drained three-acre seepage lake located entirely in the City of New Berlin, also drains through a series of wetlands and intermittent streams to the Root River system through Upper Kelly Lake. Both Lakes have been subjected to environmental stresses related to their urban location and urbanizing watershed, which have led to local concerns over water quality conditions. These concerns prompted the formation of a lake association around Upper and Lower Kelly Lakes.

The Kelly Lakes Association, Inc., a Chapter 181, *Wisconsin Statutes*, nonstock corporation has been instrumental since its foundation, and in conjunction with the City of New Berlin and Village of Hales Corners, in jointly requiring an environmental assessment of a proposed subdivision to be located south of Lower Kelly Lake, in developing a stormwater management ordinance for the City, and in promoting sound lake management within the residential community surrounding the Lakes. The Association has also been instrumental in the formulation of planning studies relating to the water quality of the two Lakes. This latter work was supported in part by phased Chapter NR 190 Lake Management Planning Grants awarded to the Kelly Lakes Association during 1995, 1997, and 2002. The Phase I studies were conducted by IPS Environmental & Analytical Services and the Resources Management Group,[1] and the Phase II studies were conducted by the Southeastern Wisconsin Regional Planning Commission (SEWRPC).[2] Phase III studies presently are ongoing and include further engineering design work associated with the wetland restoration project.

The lake protection plan, adopted during October 2000, recommended the acquisition and restoration of wetland areas, riparian to Upper Kelly Lake, for purposes of water quality protection. This grant application for Chapter NR 191 Lake Protection Grant wetland restoration funding is a direct outcome of that recommendation. The proposed wetland restoration, set forth below, follows directly the format of Section VI of the Grant application, Wisconsin Department of Natural Resources (WDNR) Form 8700-283 R. 1/03, including the required long-term land management plan, and is appended thereto.

DESCRIPTION OF THE PROJECT AREA

The lands proposed to be restored by the Kelly Lakes Association, Inc., include lands situated in the riparian zone of Upper Kelly Lake at the point of discharge of the unnamed stream draining to the Lake. These lands are located immediately west of the Upper Kelly Lake inlet, along South Francis Avenue, and include a significant proportion of the lands within the 100-year recurrence interval floodway at the point of their debouchment to Upper Kelly Lake. The lands encompass approximately two acres riparian to Upper Kelly Lake and are situated immediately

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[1] *IPS Environmental & Analytical Services, Inc.,* Phase I Lake Management Plan, Upper and Lower Kelly Lakes, Waukesha and Milwaukee Counties, Wisconsin, *March 1997.*

[2] *SEWRPC Memorandum Report No. 135,* A Lake Protection Plan for Upper and Lower Kelly Lakes, Milwaukee and Waukesha Counties, Wisconsin, *October 2000.*

north of the unnamed tributary that constitutes the inflow to Upper Kelly Lake, currently owned by the Association. A further two riparian parcels of approximately one acre in areal extent which are presently subject to an accepted offer to purchase by the Association, and will be brought into the project thereafter. All of these lands are partially situated within the floodway of the stream and form a project area of about eight acres in total areal extent.

All of the parcels also are located within the secondary environmental corridor delineated by the Southeastern Wisconsin Regional Planning Commission, and have been designated as Class I, high-value wildlife habitat by the Commission. The lands are currently vacant lands zoned as C-2 conservancy by the City of New Berlin. The area lies shoreward and adjacent to an area of the Lake designated as an ecologically valuable area in the lake protection plan. Both of the northern parcels have been acquired by the Kelly Lakes Association, and the Association currently holds fee simple title to the properties, while the southern parcels are presently at an advanced stage of acquisition by the Association.

Upper Kelly Lake has adequate public access as defined in Chapter NR 1 of the *Wisconsin Administrative Code*. A public recreational boating access site in located on the northeastern shore of the Lake, within the Village of Hales Corners, and a public park is located on the southern shore of the Lake, within the City of New Berlin.

The conduct of this project will reconnect the unnamed tributary stream flowing into Upper Kelly Lake with its floodplain, enhancing and restoring the natural shoreland wetland riparian to Upper Kelly Lake, and providing addition wildlife and fisheries habitat. The project will also restore a more natural meander to the unnamed stream flowing into the Lake, which characteristic was lost consequent to the urban development in the vicinity of the Lake since 1873, as documented in the aforereferenced lake protection plan. This unnamed stream system drains the whole of the upstream watershed tributary to Upper Kelly Lake, or about 950 acres.

REASON FOR THE PROPOSED PROJECT

The Kelly Lakes have experienced various water management problems in recent years, including variations in water quality potentially related, to some degree, to land use changes within the Lakes' watershed. A planning program, initiated during 1995 as part of a phased investigation and planning effort to develop a comprehensive lake management plan for the Kelly Lakes, focused on water quality related issues and development of baseline water quality information for Upper and Lower Kelly Lakes. This plan, summarized above, recommended the protection and rehabilitation of wetland areas adjacent to the Kelly Lakes as a primary means of resolving identified current and potential future water quality problems, especially those likely to impact Upper Kelly Lake.

This current project, proposed to be funded, in part, through an NR 191 Lake Protection Grant, is consistent with the recommendations set forth in the adopted regional land use plan,[3] the county development plan for Waukesha County and the Waukesha County land and water resources management plan,[4] the lake protection plan for Upper and Lower Kelly Lakes, and the City of New Berlin stormwater management plan.

PROJECT GOALS AND OBJECTIVES

The goals of the proposed planning project include the following:

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[3]*SEWRPC Planning Report No. 40,* A Regional Land Use Plan for Southeastern Wisconsin: 2020, *December 1997.*

[4]*SEWRPC Community Assistance Planning Report No. 209,* A Development Plan for Waukesha County, Wisconsin, *August 1996; Waukesha County,* Waukesha Cointy Land and Water Resource Management Plan: 1999-2002, *January 1999.*

1. To promote, through fee simple ownership of disturbed wetland areas riparian to Upper Kelly Lake, the essential structure and function of these wetland areas through the conduct of measures to restore and rehabilitate these wetland systems and to ensure positive water quality benefit to Upper Kelly Lake, as set forth in the adopted lake protection plan.

2. To facilitate the maintenance of wetland and wildlife habitat within the designated secondary environmental corridor riparian to Upper and Lower Kelly Lakes, as set forth in the relevant adopted regional and county land use and natural areas and critical species habitat protection and management plans.

3. To restore the hydrologic connection between the unnamed stream tributary to Upper Kelly Lake and its floodplain, which connection was disturbed by the historic placement of fill within the pre-existing shoreland wetland.

4. To encourage public knowledge and understanding of wetland ecosystems through the development of public informational programming, enhanced in part through public access to the lands proposed to be restored, focused primarily on youth both within the educational systems of the City of New Berlin and Village of Hales Corners, and through the active participation of nongovernmental organizations such as the Boy Scouts of America and similar youth-oriented organizations. The Kelly Lakes Association, Inc., would catalyze this programming in consultation with relevant institutions and agencies.

Accomplishment of these goals will result in the restoration and maintenance of an healthy wetland ecosystem and shoreland area capable of providing the desired water quality benefits to Upper Kelly Lake consistent with the objectives of Chapter NR 191 of the *Wisconsin Administrative Code*. Such benefits are consistent with the ongoing program of lake- and stream-related management actions being undertaken by the Kelly Lakes Association, the City of New Berlin, and the Village of Hales Corners, and with the recommendations set forth in the adopted regional water quality management plan.[5]

METHODS AND ACTIVITIES, DELIVERABLES, AND PUBLIC PARTICIPATION PLAN

The proposed shoreland wetland restoration project for Upper Kelly Lake is designed as part of the multi-phased program of information gathering, assessment, and response being undertaken by the Kelly Lakes Association, in cooperation with the City of New Berlin and the Village of Hales Corners. Some portions of the proposed program have been, or are being, undertaken by the Kelly Lakes Association, partly in cooperation with other local and State agencies. Such efforts include the conduct of the phased planning projects that established baseline conditions in the Kelly Lakes and which set forth the recommended actions proposed herein. The current wetland restoration project is proposed to be undertaken in two phases; namely, site preparation as Phase 1, which was funded through the Chapter NR 191 Lake Protection Wetland Restoration Incentive Grant Program during 2002, and the excavation and planting activities associated with the reconnection of the stream and the floodplain, which is proposed to be funded through this Chapter NR 191 Lake Protection Wetland Restoration Grant application as Phase 2 of the restoration project.

Wetland Alternatives Analysis for Chapter NR 103, *Wisconsin Administrative Code*, Compliance
Appendix E of the adopted lake protection plan for the Kelly Lakes documents an analysis of practicable alternatives performed for the wetland restoration measures, called for under the recommended plan, which involve significant disturbance of specific wetlands within the Kelly Lakes drainage area. This alternatives analysis was performed in the context of the system plan presented in the aforereferenced lake protection plan and

[5]*SEWRPC Memorandum Report No. 93,* op. cit.

is intended to fulfill the necessary requirements set forth in Chapter NR 107 of the *Wisconsin Administrative Code* in order to obtain conceptual approval of the lake management plan from the Wisconsin Department of Natural Resources. This analysis also complements the permitting required at the time the specific features of the recommended plan impacting wetland ecosystems in the Kelly Lakes drainage basin are implemented. The relevant State permits to implement the wetland restoration measures recommended under this plan have been applied for.

Under the recommended lake protection plan, restoration of an approximately two- to three-acre shallow water marsh floodplain is recommended within a portion of the 7.8-acre wetland which extends along the east side of Frances Avenue in the northeast quarter of U.S. Public Land Survey Section 36, Township 6 North, Range 20 East. The restoration of this shoreland marsh by remeandering the unnamed tributary stream would enhance the wildlife habitat in the area, and provide a biological filter for the Kelly Lakes, reducing, by as much as 50 percent, the suspended sediment and phosphorus loads reaching the Upper Kelly Lake.

The area draining to the wetland in which the shallow water marsh would be restored totals about 983 acres. The existing land uses, tributary to the wetland, are almost entirely urban, with medium-density residential land uses being predominant.

The wetland proposed to be affected by the restoration of the shallow water marsh is currently classified as a disturbed shallow marsh, shrub-carr (willow thicket) and fresh (wet) meadow under the Commission's inventory. The existing vegetation on the site is dominated by reed canary grass and cattails.

The soils within the wetland site are classified as Wallkill silt loam. Wallkill silt loam is a poorly drained soil associated with a high water table. Wallkill silt loam originally developed as an organic soil. However, as a consequence of settlement and subsequent agricultural activity that led to erosion of topsoil from surrounding fields and deposition of the eroded material in depressional areas within the site, the soil on the site has taken on somewhat different characteristics from the original parent material. Restoration of this wetland would remove the disturbed surface soil, and help to reestablish the original organic soil that characterizes the site.

The wetland is in, and adjacent to, areas of special natural resource interest. Wildlife habitat at this site is classified as Class I habitat of high quality. The site is currently included within a wildlife corridor established in the vicinity of the Wood Field Park subdivision by the City of New Berlin, and is in conservancy use.

Degree of Prior Disturbance

As noted above, both the soils and vegetation currently observed on the site reflect a significant degree of prior disturbance. Much of the wetland site has been altered by filling and ditching, which activities have also altered the hydrology of the watercourses draining to and through the site, and which has dislocated the riparian floodland wetlands from the streamcourse. The proposed wetland restoration and enhancement program set forth below is designed, in part, to restore the natural character of the wetland system estimated to have previously existed on the site, and to restore the structure and function of the wetland ecosystem to the benefit of the Kelly Lakes system.

Wetland Restoration

In order to accomplish restoration of this wetland as a deep water marsh and to restore the water quality benefit provided by such a system upstream of Upper Kelly Lake, several further steps will have to be taken during the detailed design phase of the restoration project. A detailed plant survey of the area has been completed by Commission staff, as has been noted above. Selection of these species should include consideration of their ability to enhance the filtering function of the restored wetland. Additionally, "weed" species likely to exist or occur on the site will be identified, and measures set forth in the site plan to allow determination of proper control and eradication of undesirable species. Grading would be undertaken to establish an area of open water, and finally, revegetation would have to be undertaken to restore the area disturbed by grading.

Wetland Functional Values

The functional values of wetlands, identified by the State of Wisconsin, are set forth in Sections NR 103.03, NR 115.05(2)(e)4, and NR 117.05(4)(d) of the *Wisconsin Administrative Code*. These functional values include:

1. Storm- and floodwater storage;

2. Maintenance of dry season stream flows, and groundwater recharge;

3. Filtration and storage of sediments, nutrients, and other potential contaminants;

4. Protection of shoreline areas from erosion by dissipating wave energy;

5. Provision of habitat for aquatic organisms in the food web including, but not limited to, fish, crustaceans, mollusks, insects, annelids, planktonic organisms, and the plants and animals upon which these aquatic organisms feed and depend upon for their needs in all life stages;

6. Provision of habitat for resident and transient wildlife species, including mammals, birds, reptiles, and amphibians for breeding, resting, nesting, escape, cover, travel corridors, and food; and,

7. Recreational, cultural, educational, scientific, and natural aesthetic values and uses.

The functional values proposed to be restored as a result of this particular wetland restoration program include:

1. Restoration of storm- and flood-water storage capacity which has been diminished as a consequence of the prior disturbance of the site by prior filling, ditching and agricultural use and reconnection of the riparian wetlands to the stream and its floodlands;

2. Restoration of the integrity of the hydrologic, Wallkill silt loam soils necessary to support wetland vegetation, which has been disturbed by the deposition of eroded materials over the surface of the organic soil, and restoration of the hydrologic function of the land within the floodplain of the influent stream to Upper Kelly Lake.

3. Restoration of the wetland's capacity to filter and store sediments, nutrients, and other potential contaminants, and thereby reinstate the capacity of this wetland system to protect and enhance water quality in Upper Kelly Lake.

4. Restoration of erosion protection functions by buffering the Lake from flood flows that would currently enter the Lake without first passing through the wetland system.

5. Restoration of habitat for aquatic organisms and other plants and animals which depend upon aquatic organisms, including restoration of the hydraulic linkage between the wetland system and Upper Kelly Lake that will enhance the opportunity for the wetland to provide fish spawning area and juvenile fish habitat. Additionally, restoration of the aquatic habitat could help to control the populations of those insects that use wetland areas during certain stages of their life cycles.

6. Enhancement of habitat for resident and transient wildlife species consistent with the attributes of the area as a Class I wildlife habitat area, providing all of the necessary requirements of food, shelter, and nesting sites.

7. Provision of recreational, cultural, educational, scientific, and natural aesthetic values and uses is limited as the wetland site is situated on private property, although the wetland does, and will continue to, provide open space and aesthetic benefits within an urban environment.

Wetland Restoration Plan

Based upon these previously conducted planning programs, funding is now requested for the restoration of two riparian parcels, currently owned by the Association through outright purchase, pursuant to the recommendations set forth in the lake protection plan for the Kelly Lakes. The two riparian properties are, from north to south along the western shore of Upper Kelly Lakes, the former Tetzlaff property (Tax Key NBC 1293-986-001) and the former Spenser property (Tax Kay NBC 1293-986) located east of S. Frances Avenue, adjacent to the unnamed stream discharging to Upper Kelly Lake. Both properties are considered to be part of the Upper Kelly Lake wetland complex, and the proposed restoration area has been subjected to prior disturbances, including filling, mowing, ditching, and side-casting of dredge spoils, as noted in the vegetation survey attached hereto as Exhibits A and B. To the extent practicable, the proposed wetland restoration program will restore the properties as shoreland wetland, grading from a mesic prairie plant community in the upland portions to a shallow water marsh plant community in the nearshore areas. Two further properties located to the south of the unnamed tributary stream, the Gorsenger and Connolly-Schneider properties, are presently under contract to the Association and are awaiting closing.

The proposed wetland restoration project would encourage the removal of historic fill, leading to the recreation of wetland conditions consistent with the currently existing wetland plant communities in the vicinity of the Kelly Lakes, as described in the wetland plant community description set forth in Appendix B of the adopted lake protection plan. The current wetland restoration project is proposed to be undertaken in two phases as noted above. Each Phase is described in more detail below. Upon completion of both Phase 1 and Phase 2 activities, the project will recreate and enhance wetland areas adjacent to the unnamed tributary stream forming the inflow to Upper Kelly Lake, and reconnect the stream to its floodlands, through the selective removal of fill that has been placed historically at the site and by plantings of suitable wetland species known to occur in and around the Kelly Lakes area.

Phase 1 Project Description: Site Preparation

Funds previously provided during 2002 under the wetland restoration incentive grant program for Phase 1 project activities are being wholly applied to the site preparation and the planting of shoreland wetland plant species within the project area. During this Phase, nonnative and invasive species are being cleared from the site in order to prepare the site for restoration and enhancement of native wetland plant communities. An important element of this Phase of the project is the training of volunteers from the Kelly Lakes Association and other civic and community groups both in the identification of nonnative, invasive wetland plants as well as in the techniques for planting and maintaining native plants to be used in the enhancement project. These same volunteers will form the core of the Phase 2 wetland restoration effort, although this initial group will most likely be supplemented by new volunteers from within the community and civic groups during Phase 2. Large debris will be cleared and disposed of as appropriate. Materials requiring special disposal, such as concrete rubble, are proposed to be removed from the site by the City of New Berlin or other contractor and transported to an appropriate disposal site. Completion of this task will facilitate the excavation proposed to be carried out during Phase 2 of the wetland restoration project.

Phase 2 Project Description: Excavation and Wetland Restoration

Chapter NR 191 Lake Protection Grant Program wetland restoration funds are now requested for Phase 2 of the project. During Phase 2, fill removed from the site will be transported to stockpile areas maintained by the City of New Berlin, or other appropriate site. It is intended that the excavation be completed by the City of New Berlin, or other parties as may be contracted by the Kelly Lakes Association, City, or Stormwater Utility, as the principal element of the local contribution to the Chapter NR 191 Lake Protection wetland restoration grant project that complements this wetland restoration incentive grant program.

In terms of this proposal, developed by TN & Associates, Inc. (TN&A) and refined by Terra-Firma Landscape, Inc., in consultation with the Kelly Lakes Association, Inc., and SEWRPC, a wetland and floodland system,

shown in Figures 1 and 2, would be restored within the shoreland zone of Upper Kelly Lake to the east of S. Francis Avenue in the City of New Berlin, and the unnamed tributary stream remeandered within this corridor.[6] This plan includes remeandering of the river, reconnecting the stream to the floodlands and shoreland wetlands, and planting native plant species within the wetland, the major portion of which is proposed to be completed during this Phase 2 project. The wetland, hereinafter referred to as the East Wetland, is designed not only to restore and recreate wetland habitat adjacent to the Lake but also to create water quality benefit for the Lake ecosystem by absorbing stormwater flows and limiting the transport of contaminants to Upper Kelly Lake.

During Phase 2, the East Wetland would be graded as shown in Figure 2 to recreate at least one meander in the unnamed stream tributary to the Lake, and reconnect the stream to its floodlands by providing a water depth within the recreated shoreland wetland of 6 to 18 inches during low flow or base flow periods. A new bed and banks for the unnamed stream would be created within the currently existing deposits of side cast materials previously deposited on the site, would be constructed adjacent to the lake on the eastern half of the wetland, as shown in Figures 1 and 2. These restored bed and banks will allow flows to extend into the recreated floodland wetland, and discharge to the south side of the wetland, adjacent to the current unnamed tributary stream entering the Lake. By recreating the meander, the lengthened streamcourse will maximize detention time within the floodland wetland, providing better treatment of stormwater-borne pollutants by allowing more settling time and more extensive contact with the wetland plants.

Computations

The extent of excavation required to construct the East Wetland was computed by TN&A from a topographic map of the area (SEWRPC, 1989). Although this survey was completed using a different datum than that used by TN&A, it appears that approximately 11,000 cubic yards of soil will need to be excavated to construct the East Wetland.

Wetland Restoration

After construction activities are completed, all disturbed areas within the East Wetland would be re-vegetated with native plant species as shown in Figure 2 and described in Exhibit C. Areas with water levels expected to be greater that six inches and less than 2 feet would be planted with species listed in the "Deep Marsh Recommended Rootstock Planting List" below. Areas with water levels expected to be less than or equal to six inches would be planted with species listed in the "Shallow Marsh Recommended Rootstock Planting List" below. The restored bed and banks of the streamcourse would be planted with native shrubs species listed in the "Wet Meadow Recommended Seeding List" below.

Deep Marsh Recommended Rootstock Planting List

Scientific Name	Common Name	Preferred Water Depth (inches)
Pontederia cordata	pickerel weed	4"-18"
Sagittaria latifolia	broad-leaf arrowhead	4"-18"
Sparganium eurycarpum	giant bur reed	1"-18"
Nymphaea tuberosa	American white water-lily	12"-24"
Nuphar luteum	variegated yellow pond-lily	12"-24"
Potamogeton pectinatus	Sago pondweed	24"-96"
Potamogeton amplifolius	large-leaved pondweed	24"-96"

[6] *T N & Associates, Inc.*, Preliminary Site Investigation: Runoff Pollutant Loading Control, Upper Kelly Lake, *March 2002.*

Figure 1

LOCATION OF THE PROPOSED WETLAND AND STREAM RESTORATION FOR UPPER KELLY LAKES: 2003

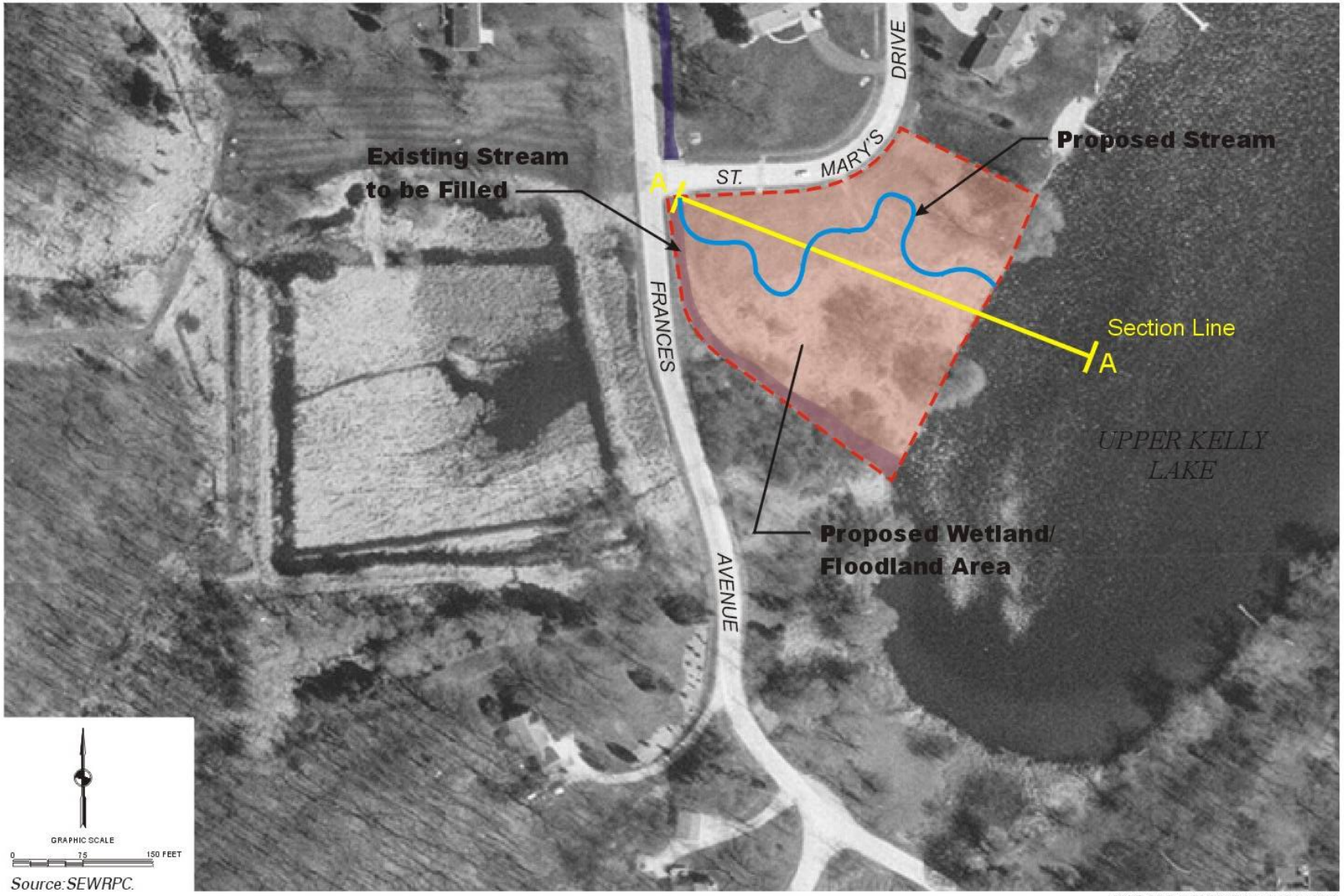
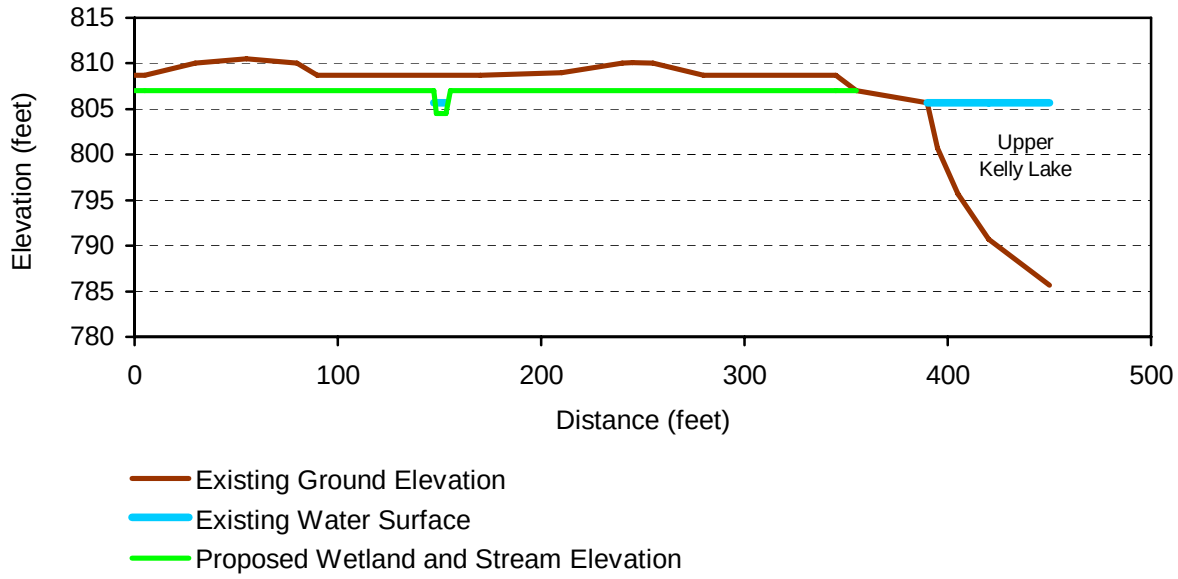


Figure 2

SECTION VIEW A-A (see Figure 1) FOR THE PROPOSED WETLAND AND STREAM RESTORATION ON UPPER KELLY LAKES: 2003



Source: SEWRPC.

Shallow Marsh Recommended Rootstock Planting List

Scientific Name	Common Name	Preferred Water Depth (inches)
Scirpus cyperinus	wool grass	1”-18”
Scirpus fluviatilis	river bulrush	1”-18”
Spartina pectinata	prairie cord grass	Damp to muddy
Alisma subcordatum	water plantain	Damp to muddy
Acorus calamus	sweet flag	Damp to muddy
Carex lacustris	lake sedge	Damp to muddy

Shrub Recommended Planting List

Scientific Name	Common Name
Spirea alba	meadow-sweet
Viburnum lentago	high bush cranberry
Cornus stolonifera	red osier dogwood

Wet Meadow Recommended Seeding List

Scientific Name	Common Name	Pounds Per Acre	
Scirpus americanus	true three square bulrush	Preferred water depth	4”-18”
Scirpus atrovirens	green bulrush	Preferred water depth	1”-18”
Juncus effusus	soft rush	Preferred water depth	1”-18”
Carex vulpinoidea	fox sedge	1.0	
Carex hystricina	porcupine sedge	1.0	
Elymus canadensis	Canada wild rye	3.0	

Elymus virginicus	Virginia wild rye	2.0
Glyceria striata	fowl manna grass	2.00
Aster simplex	marsh aster	0.75
Helenium autumnale	sneezeweed	0.75
Verbena hastata	blue vervain	0.75
Eupatorium perfoliatum	boneset	0.75

All plant materials should be nursery-grown stock, and not wild-collected,[7] from an area not to exceed 100 linear miles from the project site, and from within the State of Wisconsin. All plants should be healthy, one to two years old, with a well-developed root system.

Proposed Schedule of Construction

Rootstock, shrub planting, and seeding will be performed during the months of May or June, 2003. Wetland rootstock and shrubs will be planted on the day of delivery at the project site. In the event that this is not possible, the plants will be stored temporarily by placing them in a well-ventilated, cool, shaded, and moist storage space. The storage period will not exceed 48 hours.

Rootstock will be planted at a density of approximately one plant per square yard, in the appropriate water depth, and in the zones indicated on the plan. Wetland rootstock will be planted by hand with the use of a tree spud or other comparable method. Shrubs will be planted at a rate of one plant per three square yards at the locations shown on the plan, and will be planted by hand with the use of hand equipment. Recently planted rootstock and shrubs would not be disturbed by subsequent activities that could cause uprooting or injury.

After the shrubs and rootstock have been planted, all exposed areas that are not expected to be underwater should be seeded with the wet meadow seed mix. Native seed will be sown at a rate of 20 pounds per acre and cover crop seed at a rate of 60 pounds per acre. Seed such as annual ryegrass (*Lolium temulentum*), seed oats (*Avena sativa*) or rye (*Secale cereale*) would be used as a cover crop. After seed is placed, the area will be lightly raked to ensure proper seed to soil contact. Such seeding will not take place in areas that are inundated, or are likely to be inundated.

The construction of the East Wetland will result in effective wetland area of approximately two acres. This represents approximately one-quarter of one percent of the Upper Kelly Lake tributary drainage area. This ratio of wetland area to tributary area is smaller than the ratio recommended in guidance documents, providing an average storage time (hydraulic retention time) within the basin would be approximately two hours for a 1.5-inch rainfall over a 24-hour period.

Materials Management Plan

Access Points

Access to the East Wetland site will be via S. Frances Avenue to the western extent of St. Mary's Drive, from W. Grange Avenue.

Haul Routes

Because of the staging of the project, inbound and outbound materials will follow the same routing as noted above. Primary access from the supply sources will be from W. Grange Avenue, to S. Frances Avenue to St. Mary's Drive, thence onto the site. Fill removed from the site will be transported to the City of New Berlin materials storage area for use elsewhere in the City. Based upon the environmental assessment made at the time of

[7] *Plant materials may be wild-collected with appropriate permitting from the WDNR; however, use of wild-collected plant material is not recommended in order to avoid disturbance of existing native plant communities elsewhere in the Region.*

the acquisition of the properties upon which the wetland will be restored—required pursuant to the Chapter NR 191 Lake Protection Grant land acquisition program, the presence of contaminated soils is not anticipated.

Stockpile Areas
Topsoil will be stockpiled in the staging area on the site. Silt fence will protect the unnamed tributary stream draining to Upper Kelly Lake. Import of additional fill materials is not anticipated. Management of the wetland plant materials will conform to the planting plan set forth above. In managing water flows on the site following completion of the excavation and wetland restoration activities, maximum use will be made of existing berms present on the site. This will limit unnecessary disturbance of the existing remnant wetland vegetation along the lake shore and streamcourse.

Equipment Storage Areas
Equipment will be stored at staging areas or access points outside of the flood conveyance channel. The main staging area, located at the intersection of S. Frances Avenue and St. Mary's Drive is adjacent to the unnamed tributary draining to the Lake but outside of the 100-year recurrence interval floodway line under existing channel conditions. This floodway line is indicated in the aforereferenced adopted lake protection plan for the Kelly Lakes on Map 14. Access to this site will be through an existing access way located about 200 feet east of the intersection of S. Frances Avenue and St. Mary's Drive.

Machines will be fueled outside of the channel limits. Should an accidental fuel spill occur, spill kits containing absorbent materials will be located at the fueling location at the staging area. Absorbent materials will be used to soak up as much of the leakage as possible. The remaining contaminated soils will be excavated and removed to the City of New Berlin contaminated soil disposal area.

Excavation Methods
The mass excavation of soils and fill from the site will be achieved using a backhoe excavator. Materials will be transferred into dump trucks for transfer to the City of New Berlin stockpile site, or other appropriate site. If the excavated materials have free water present, the material will be stockpiled onsite to allow the water to dissipate. Approximately 11,000 cubic yards of historic fill are estimated to be removed during the wetland restoration project.

Protocol for Contaminant Testing
As noted above, it is not anticipated that contaminated soils will be found on the site. However, should visual evidence or olfactory evidence create the suspicion on contamination during the project period, operations will be terminated immediately and soils tested pursuant to the procedures set forth for solid waste in protocol B of Chapters NR 722 and NR 419 of the *Wisconsin Administrative Code*. Regular inspection of the project site will be conducted by City staff and officers of the Kelly Lakes Association during the project period.

Erosion Control Plan
Project Description
The project includes the restoration and recreation of the shoreland wetland adjacent to the north side of the unnamed tributary stream entering Upper Kelly Lake. The existing channel will be regraded and diverted within the restored wetland ecosystem within the area bounded by S. Frances Avenue on the west and St. Mary's Drive on the north. The unnamed tributary stream forms the southern boundary of the project site, and Upper Kelly Lake the easternmost extent of the project. Fabric encapsulated soil will be used to line the flow channel. The area will be planted and seeded as set forth in the wetland restoration plan. Construction will be conducted under dry conditions to the extent possible. This erosion control plan is intended to meet the requirements of Chapter 30, *Wisconsin Statutes*, and Chapter NR 216, *Wisconsin Administrative Code*.

Environmental Compliance
Regular inspection of the project site will be conducted by City staff and officers of the Kelly Lakes Association during the project period. Michael Cascio, President of the Kelly Lakes Association, Inc., will fulfill the responsibilities of the environmental compliance officer: telephone (262) 786-3084.

Anti-Erosion Methods and Sequence
Installation of erosion control devices will precede construction activities on the site. Placement of silt fences along the streamcourse and lake shore will be undertaken to limit the likelihood of soil being introduced into the aquatic systems. The integrity of the existing stream channel will be maintained during period of wetland restoration, which activity will require the greatest degree of soil disturbance. Removal of historic fill, grading, and planting of wetland plants to the extent practicable will be undertaken prior to diversion of the stream channel and final construction of the remeandered streamcourse. Portions of the shoreland wetland planting will be accomplished during the Phase 1 activities. It is intended that existing topography of the site be utilized to the greatest extent possible to minimize the potential impacts of the wetland restoration project on the Lake and stream. Silt fence will be utilized in disturbed area outside of the construction zone and adjacent to completed channel areas within the construction zone. Any soil stockpiles on the site will be protected by silt fence. As necessary to limit the tracking of soil onto roadways providing access to the site, tracking mats of stone or recycled concrete may be used. Soil deposited on the roadways will be cleaned using a truck-mounted sweeper as required. Seeding and mulching of the exposed soils will be undertaken in accordance with the planting plan set forth above. If required, a turbidity curtain will be utilized where construction activities occur next to or within a live channel or in the Lake.

Construction practices are intended to conform with the best management practices set forth in the *Wisconsin Construction Site Best Management Practices Handbook.* A significant portion of the wetland restoration site lies within the 100-year recurrence interval floodway. Work will be stopped during periods of rainfall and higher than base flow conditions to minimize erosion and soil loss from within the project site. Work will resume upon return to base flow conditions. Flow calculations were provided by the Southeastern Wisconsin Regional Planning Commission.

Final Stabilization
Completed work areas will be stabilized by seeding and planting within two workdays of final construction.

Maintenance of Erosion Controls
The Kelly Lakes Association, Inc., will ensure that erosion controls, as set forth above, are maintained. The erosion control officer will provide oversight and complete the erosion control inspection report.

CONSISTENCY WITH OTHER PLANS

Relationship to Water Quality Improvements in the Kelly Lakes
The following actions, among others, are recommended in the lake protection plan for the Kelly Lakes and relate directly to the acquisition and protection of the riparian wetlands to Upper Kelly Lake for water quality protection purposes:

1. The Kelly Lakes Association should support the preservation and rehabilitation of the secondary environmental corridor lands in the Kelly Lakes tributary drainage area. These lands, and especially their associated wetland areas, are recommended to be maintained in essentially natural, open spaces uses through their incorporation into the stormwater management system and related drainageways, or inclusion in site plans as local parks, recreational trails, or open spaces; and restoration to

reestablish their natural structure and function within the landscape.[8] Such preservation and rehabilitation should be promoted through the existing regulations and programs intended to protect such natural resources.[9]

2. The Kelly Lakes Association, in cooperation with the City of New Berlin and the Wisconsin Department of Natural Resources, should consider the acquisition of the wetlands adjacent to the southwest portion of Upper Kelly Lake and the restoration of their structure and functioning for purposes of protecting lake water quality in Upper Kelly Lake. Such an action would enhance the ecological value of the Commission-delineated secondary environmental corridor within which the wetland system is located. Outright purchase or the purchase of conservation easements are possible options.

3. The City of New Berlin, as the principal local authority within the drainage area, should give special recognition to the Kelly Lakes as surface water features within their municipal jurisdiction, and incorporate specific actions within their stormwater management plan for the protection of the surface water quality of the Kelly Lakes.

4. The Kelly Lakes Association, in conjunction with the City of New Berlin and Village of Hales Corners, should jointly develop a detailed local level plan for the acquisition and restoration of the structure and function of the wetland ecosystems adjacent to the Kelly Lakes, including the restoration of the natural flooding regime within the wetland west of Frances Avenue and the relocation of municipal infrastructure to facilitate restoration of the wetland between Lower and Upper Kelly Lakes on Rosemary Drive and the provision of adequate public recreational boating access to Upper Kelly Lake.

5. The City of New Berlin, pursuant to the adopted stormwater management plan, should consider the establishment of an approximately three-acre basin within a restored wetland ecosystem at the headwaters of Upper Kelly Lake to reduce phosphorus and sediment loads delivered to the Lake by up to 50 percent. Restoration of the wetland complex would be subject to State permitting requirements.

Relationship to Other Lake Management Efforts

The residents of the Kelly Lakes, in conjunction with the City of New Berlin and the Village of Hales Corners, have long recognized the importance of informed and timely action in the management of the Kelly Lakes. The initial action in this regard was the formation of the Kelly Lakes Association, which provides the forum for many of the lake management activities of the Lakes' residents. The Association is currently enrolled in the water quality monitoring program conducted under the auspices of the Wisconsin Department of Natural Resources Self-Help Monitoring Program. The Kelly Lakes Association has also undertaken a Phase I Planning Grant Program to identify issues of concern relating to the Kelly Lakes. The management plan prepared for Kelly Lakes Association by IPS Environmental and Analytical Services, Inc., as part of the Phase I, Chapter NR 190 Lake Management Planning Grant Program project, identified six issues of concern to be addressed by the Kelly Lakes community, including programming in the following areas: public information and education, water quality

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[8]*SEWRPC Community Assistance Planning Report No. 209,* A Development Plan for Waukesha County, Wisconsin, *August 1996.*

[9]*See SEWRPC Planning Report No. 40,* A Regional Land Use Plan for Southeastern Wisconsin—2010, *January 1992, as refined in SEWRPC Planning Report No. 45,* A Regional Land Use Plan for Southeastern Wisconsin: 2020, *December 1997, for a discussion of land use development objectives, principles, and standards; these plans are fully incorporated into SEWRPC Community Assistance Planning Report No. 209, op. cit., and SEWRPC Memorandum Report No. 135, op. cit.*

assessment, watershed boundary delineation, aquatic plant management, phosphorus load estimation, and subdivision design and impact minimization.[10] That report led to the development and conduct of a Phase II, Chapter NR 190 Lake Management Planning Grant Program project, involving a more detailed investigation of aquatic plant, and stormwater and lake water quality, management issues of concern. The Phase II planning program resulted in the preparation of a lake protection plan for the Kelly Lakes, which documents the findings and recommendations of a study requested by the Kelly Lakes Association, examines existing and anticipated conditions and potential management problems of the Kelly Lakes, and presents a recommended plan for the resolution of these problems. This lake protection plan is consistent with the recommendations set forth in the adopted regional water quality management plan,[11] and with the relevant recommendations set forth in the adopted Root River watershed plan.[12] Phase III planning activities are being initiated which will contribute to the final design of the reconnected stream and floodland wetland system, and enhance the formation of a stable and functioning ecosystem structure of this site.

The Kelly Lakes were found to be eutrophic, moderately deep water lakes of average quality located in close proximity to the Milwaukee metropolitan area and adjacent to an increasingly urban part of Waukesha County in which its tributary drainage area is almost entirely located. Surveys indicated that the Lakes and their tributary drainage area contain significant areas of ecological value, including numerous wetlands and high-quality wildlife habitat surrounding the Lakes.

The Kelly Lakes protection plan recommended actions be taken to limit further human impacts on the in-lake macrophyte beds and reduce human impacts on the ecologically valuable areas adjacent to the Lake and in its watershed. The development of adequate public parking to their access site to serve Upper Kelly Lake was also recommended. The plan recommended only limited aquatic plant management action, including selected manual removal and surveillance activities at this time, mainly in the cases where purple loosestrife and Eurasian water milfoil are present, with the limited use of chemical treatment only to treat such species, if needed. Consideration of public acquisition of, or acquisition of conservation easements over, lands within the primary environmental corridors to ensure the protection and preservation of these ecologically valuable areas was also recommended.

The recommended plan included continuation of an ongoing program of public information and education providing riparian residents and lake users. For example, additional options regarding household chemical usage, lawn and garden care, shoreland protection and maintenance, and recreational usage of the Lakes should be made available to riparian householders, thereby providing riparian residents with alternatives to traditional alternatives and activities.

The plan recommended reestablishment of the natural structure and function of the wetland system immediately upstream of Upper Kelly Lake to more effectively control nutrient and sediment loading rates into the Lake from the tributary drainage area.

While the recommended plan seeks to balance the demand for high-quality residential and recreational opportunities at the Kelly Lakes with the requirements for environmental protection, the Kelly Lakes Association is presently actively pursuing public participation opportunities relating to land use and stormwater management in the vicinity of the Kelly Lakes. Kelly Lakes Association Board of Directors members attend City of New Berlin Plan Commission and Public Works Committee meetings regarding the development of the plans and lands

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[10]*IPS Environmental and Analytical Services, Inc.,* Phase I Lake Management Plan: Upper and Lower Kelly Lakes, Waukesha and Milwaukee Counties, Wisconsin, *March 1997.*

[11]*SEWRPC Memorandum Report No. 93,* A Regional Water Quality Management Plan for Southeastern Wisconsin: An Update and Status Report, *March 1995.*

[12]*SEWRPC Planning Report No. 9,* A Comprehensive Plan for the Root River Watershed, *July 1966.*

within the drainage area tributary to the Kelly Lakes. The Association was an active participant in the planning process with respect to the establishment of the Woodfield Park Subdivision and associated environmental corridor southwest of Upper Kelly Lake within the City of New Berlin. In like manner, the Association is currently an active participant in the public process relating to the preparation of a stormwater management plan for the City of New Berlin.

The Kelly Lakes Association also maintains an active public information program and in-lake aquatic plant management program. The Association initiated aquatic plant harvesting operations on Upper Kelly Lake during the summer of 1997. In addition, the Association holds an annual membership meeting, open to all Kelly Lakes community residents and interested parties, to answer questions and provide information to persons interested in the Kelly Lakes. An occasional newsletter is also published and distributed by the Association. The Association is a participant in the Wisconsin Department of Natural Resources Self-Help Monitoring Program. Reports of water clarity trends within the Lakes are a regular feature of the annual membership meetings.

WETLAND AND UPLAND MANAGEMENT PLAN AND SITE MAINTENANCE

The principal aspects of the land management practices proposed to be undertaken within the project area are set forth in the lake protection plan, prepared for the Kelly Lakes Association, Inc. and the City of New Berlin, by the Southeastern Wisconsin Regional Planning Commission, and other relevant plans noted above. Both the shoreland and wetland sites will be maintained in a natural state. The actions proposed to be carried out by the Kelly Lakes Association in cooperation with public and private partners, in part identified below, will seek to protect and preserve the environmental corridors and wildlife habitat that comprise the shoreland and wetland lands proposed for acquisition. In this regard, the Association will initially focus attention on the protection and preservation of habitat suitable for the Butler's Garter Snake, a State-designated threatened species reported to occur in the vicinity of the Lakes, while developing detailed landscape designs for restoring the shoreland wetlands proposed to be acquired. In addition, the Kelly Lakes Association will continue to work with the City of New Berlin and other public partners to enhance passive recreational use of the sites for community and educational purposes.

Management of Shoreland Wetlands

With funds to be provided in part through the Chapter NR 191 Lake Protection Grant program for wetland restoration, the Kelly Lakes Association will remove fill from the wetland areas situated to the north of the unnamed influent stream, and to the east of S. Francis Street in the City of New Berlin. In so doing, the Kelly Lakes Association will work with the City of New Berlin to reestablish natural patterns of stream flows through the wetland by providing appropriate hydraulic connections between the unnamed stream and the wetland as set forth in the City's adopted stormwater management plan.

The wetland sites, following removal of the fill, will be planted with native plant materials as appropriate to establish and encourage a native plant community. Community schools and youth groups will be actively engaged in the process of native plant restoration. It is intended that Eagle Scout candidates from Troop 530, Boy Scouts of America, and other youth groups as may be identified in the future, assist with this restoration effort, which would use plant materials from local nursery sources to ensure continuity of the regional genetic stocks as recommended in the adopted regional natural areas and critical species habitat protection and management plan. Plant species selected will be chosen to reflect the composition and character of the best features of the wetlands currently existing in proximity to the site.

In the longer-term, the wetland sites will be monitored for evidence of invasive species, such as reed canary grass, purple loosestrife, and buckthorn, and appropriate control measures will be undertaken by the Kelly Lakes Association. The Kelly Lakes Association will work with students from Whitnall Park School to develop and carry out an appropriate monitoring program. The Kelly Lakes Association will encourage other area schools, namely Eisenhower High School and Elmwood Elementary School, to utilize these lands, possibly through their participation in the Project WET or the Wisconsin Adopt-A-Lake programs. Currently, the wetland sites contain

some nonnative species, about 20 to 30 percent of species inventories, and have suffered somewhat from prior agricultural activities that include harvesting of trees, filling, and ditching. No Federal- or State-designated rare, threatened, or endangered plant species were observed during the field inspections that were carried out by Regional Planning Commission staff during 1989, 1990, and 2002.

Management of Shoreland Uplands

As part of the restoration activities on the upland areas to be acquired, the Kelly Lakes Association will work with the City of New Berlin to establish an environmentally sound management policy relating to mowing of the lands included in the project area. As noted above, the Kelly Lakes Association will encourage the active participation of community schools and youth groups in the process of native plant restoration. Restoration of the upland sites will include use of native prairie plants. It is intended that Eagle Scout candidates from Troop 530, Boy Scouts of America, and students from Whitnall School also develop and carry out an appropriate restoration and monitoring program in the upland areas of the site. The Kelly Lakes Association will encourage other area schools, namely Eisenhower High School and Elmwood Elementary School, to utilize these lands, possibly through their participation in the Project WILD program.

The Kelly Lakes Association will encourage public knowledge of, and participation in, the restoration project through informational programming and signage.

In the longer-term, the Kelly Lakes Association will continue to work with the City of New Berlin Parks and Recreational Department to ensure compatibility between the management of public lands and the management of the lands owned by the Kelly Lakes Association. This would include future development of the City pedestrian and bicycle trail proposed in the adopted park and open space plan linking Kelly Lake Park with other City parks and regional trail systems. In addition, the Kelly Lakes Association will continue to liaise with the Village of Hales Corners with respect to the future development of the public recreational boating access site located on the eastern shore of Upper Kelly Lake.

Public Informational Programming

In addition to actions designed to restore the natural structure and function of wetland systems upstream of Upper Kelly Lakes as a means of protecting water quality within the Kelly Lakes system, and the downstream Root River, additional actions can be undertaken to minimize nutrient loadings from source areas within the drainage area tributary to the Kelly Lakes. Based upon the aforereferenced findings of the U.S. Geological Survey, residential lawns form a major source of phosphorus to watercourses in urban areas. In some cases, this phosphorus source is enhanced as a consequence of the lawn care practices employed by householders within the drainage area. For this reason, informational programming directed at alternative and appropriate lawn care practices should be provided within this rapidly urbanizing drainage area. Such programming should be predicated upon the soil chemistry and soil nutrient requirements for urban residential lawns and gardens that can be determined through relatively simple soil testing conducted by the University of Wisconsin-Extension. Soil test results allow householders to apply appropriate levels of fertilization to their gardens, generally saving the householder some level of expense and effort, while providing additional protections to the Lakes. In addition, distribution of lawn care pamphlets within the drainage area, providing information on composting, yard care, and maintenance of the grassed swale stormwater system, would apprise householders of alternative means of maintaining their properties.

In addition, programming should be developed to keep the householders in the Kelly Lakes community informed of the current state of their Lakes' water quality. To this end, continued participation in the Wisconsin Department of Natural Resources Self-Help programs is recommended as a means of assessing the health of the Kelly Lakes on a regular basis. Such programs can provide an early warning of undesirable changes in lake water quality and aquatic species composition and initiate appropriate responses in a timely manner. In addition, data gathered through these programs can supplement and be coordinated with data gathered by the Wisconsin Department of Natural Resources under the current surface water monitoring strategy developed to conduct monitoring activities and to perform basic assessments for each watershed in the Region on an approximately five- to seven-year

rotating cycle.[13] Regular reports on the results of these studies have been featured at the annual meetings of the Kelly Lakes Association and should be continued as one means of informing residents of the current state of the Lakes during both Phase 1 and Phase 2 of the wetland restoration project.

WATER REGULATORY PERMITS

The relevant State permits to implement the wetland restoration measures recommended under this plan have been applied for.

TIMETABLE

The proposed restoration project will be carried out over a two-year period from October 1, 2003, through December 31, 2005. Management of the sites would be ongoing.

PROJECT COSTS

The local share will be provided through contributions of in-kind value by the service providers and through funds raised from the community by the Kelly Lakes Association. In-kind contributions from the youth and other groups utilizing the site for educational purposes are considered as part of the local share provided; specifically, Troop 530 of the Boy Scouts of America have committed a contribution of in-kind value to the planting and maintenance of wetland and floodland plants on the site to the value of $8,000 (1,000 hours of volunteer service on site at $8.00 per hour), as documented in the letter of support for the project from the Troop. The balance of the project costs will be met from public funds raised by Kelly Lakes Association, Inc. ($33,750).

Phase 2: Excavation and Planting

1. Site Clearing and Excavation costs	$ 59,450
2. Planting and Maintenance costs	$ 81,800
3. Miscellaneous (permit fees, legal costs)	$ 500
Total Expense	$141,750
State Share Requested	$100,000
Local Share Provided	$ 41,750

AUTHORIZING RESOLUTION AND LETTERS OF SUPPORT

The Resolution of the Kelly Lakes Association, together with letters of support from the City of New Berlin, Village of Hales Corners, and Waukesha County, is appended hereto. Additional letters of support are appended hereto from Troop 530, Boy Scouts of America, and from Whitnall School.

[13] *SEWRPC Memorandum Report No. 93,* op. cit.

NOTES

The following forms need to accompany this application:

1. Form 8700-283 R 3/01: Project Application

2. Form 1800-1 Environmental Hazards Assessment Report

The following additional documentation is required and need to accompany this application:

1. Resolution of Kelly Lakes Association, Inc.

2. Letters of support from the City of New Berlin, Village of Hales Corners, and Waukesha County, and from Troop 530, BSA (nongovernmental partner).

Water regulatory permit applications have been submitted to the WDNR in support of this application, including the following documentation:

1. Wetland Alternatives Analysis Compliance pursuant to Chapter NR 103, *Wisconsin Administrative Code*,

2. Wetland Restoration Plan pursuant to Sections NR 103.03, NR 115.05(2)(e)4, and NR 117.05(4)(d) of the *Wisconsin Administrative Code*.

3. Materials Management Plan

4. Materials Management Plan

5. Erosion Control Plan

#82322 V1 - UPPER KELLY LAKE WETLAND RESTORATION
300-1000
PCE/JAT/pk
05/06/03

Exhibit A

PRELIMINARY VEGETATION SURVEY

KELLY LAKES ASSOCIATION INC. PROPERTIES AT ST. MARY'S DRIVE , FRANCES AVENUE AND ROSEMARY DRIVE

Date: February 28, 2002

Observer: Rachel E. Lang, Senior Biologist
Southeastern Wisconsin Regional Planning Commission

Location: City of New Berlin in part of the Northeast one-quarter of U.S. Public Land Survey Section 36, Township 6 North, Range 20 East, Waukesha County, Wisconsin.

Species List: Plant Community Area No. 1

TYPHACEAE
Typha latifolia--Broad-leaved cattail

GRAMINEAE
Poa pratensis--Kentucky bluegrass
Phragmites communis--Tall reed grass
Elymus virginicus--Virginia wild rye
Phalaris arundinacea[1,2]--Reed canary grass

CYPERACEAE
Scirpus atrovirens--Green bulrush
Carex granularis--Pale sedge
Carex stricta--Tussock sedge
Carex comosa--Bristly sedge
Carex sp.--Sedge

SALICACEAE
Populus deltoides--Cottonwood
Salix babylonica[1]--Weeping willow
Salix nigra--Black willow
Salix exigua--Sand-bar willow

POLYGONACEAE
Rumex crispus[1,3]--Curly dock
Polygonum sp.--Smartweed

CRUCIFERAE
Barbarea vulgaris[1]--Yellow rocket
Hesperis matronalis[1]--Dames rocket

ROSACEAE
Geum canadense--White avens
Geum aleppicum--Yellow avens
Rosa multiflora[1]--Multiflora rose
Rosa palustris--Swamp rose
Rosa blanda--Wild rose

ANACARDIACEAE
Rhus glabra--Smooth sumac

ACERACEAE
Acer negundo--Boxelder

RHAMNACEAE
Rhamnus cathartica[1]--Common buckthorn
Rhamnus frangula[1]--Glossy buckthorn

VITACEAE
Vitis riparia--River-bank grape

ONAGRACEAE
Epilobium coloratum--Willow-herb

UMBELLIFERAE
Daucus carota[1,3]--Queen Anne's lace
Pastinaca sativa[1,3]--Wild parsnip

OLEACEAE
Fraxinus pennsylvanica--Green ash

ASCLEPIADACEAE
Asclepias incarnata--Marsh milkweed
Asclepias syriaca[3]--Common milkweed

CONVOLVULACEAE
Cuscuta glomerata--Dodder

VERBENACEAE
Verbena hastata--Blue vervain

LABIATAE
Stachys hispida--Marsh hedgenettle
Lycopus americanus--Cutleaf bugleweed

SOLANACEAE

Solanum dulcamara[1]--Deadly nightshade

CAPRIFOLIACEAE

Viburnum opulus[1]--European high bush-cranberry
Sambucus canadensis--Elderberry
Lonicera x bella[1]--Hybrid honeysuckle

COMPOSITAE

Helianthus grosseserratus--Sawtooth sunflower
Helenium autumnale--Sneezeweed
Bidens sp.--Beggars-ticks
Solidago gigantea--Giant goldenrod
Solidago altissima x *gigantea*--Hybrid goldenrod
Solidago altissima[3]--Tall goldenrod
Aster pilosus[3]--Frost aster
Aster lateriflorus--Calico aster
Aster simplex--Marsh aster
Conyza canadensis[3]--Horseweed
Eupatorium rugosum--White snakeroot
Arctium minus[1,3]--Common burdock
Carduus nutans[1]--Nodding thistle
Cirsium arvense[1]--Canada thistle
Cichorium intybus[1,3]--Chicory

Total number of plant species: 56
Number of alien, or nonnative, plant species: 17 (30 percent)

This approximately 2.0-acre plant community area is part of the Upper Kelly Lake upland and wetland complex consisting of disturbed old field, disturbed fresh (wet) meadow, shrub-carr (willow thicket) with scattered second growth, Southern wet to wet-mesic lowland hardwoods, and shallow marsh along the lakeshore edge. Disturbances to the plant community area include establishment of tire ruts; past filling; some mowing; water level changes due to past ditching and draining; and side casting of dredge spoil material. No Federal- or State-designated Special Concern, Threatened, or Endangered species were observed during the field inspection.

---

[1]Alien or nonnative plant species.
[2]Dominant plant species.
[3]Growing along the wetland edge.

Plant Community Area No. 2

TYPHACEAE
Typha latifolia--Broad-leaved cattail
Typha angustifolia--Narrow-leaved cattail
Typha glauca--Hybrid cattail

GRAMINEAE
Poa pratensis[1]--Kentucky bluegrass
Phalaris arundinacea[2]--Reed canary grass

CYPERACEAE
Scirpus atrovirens--Green bulrush
Carex stricta--Tussock sedge
Carex comosa--Bristly sedge

SALICACEAE
Populus deltoides--Cottonwood
Salix babylonica[2]--Weeping willow
Salix exigua--Sand-bar willow
Salix discolor--Pussy willow

JUGLANDACEAE
Juglans nigra[1]--Black walnut

ULMACEAE
Ulmus americana--American elm

POLYGONACEAE
Polygonum sp.--Smartweed

ROSACEAE
Geum canadense--White avens
Geum aleppicum--Yellow avens
Rubus occidentalis--Black raspberry
Pyrus sp.[1]--Apple

RHAMNACEAE
Rhamnus cathartica[2]--Common buckthorn
Rhamnus frangula[2]--Glossy buckthorn

UMBELLIFERAE
Daucus carota[1,2]--Queen Anne's lace
Cicuta maculata--Spotted water-hemlock

CORNACEAE
Cornus amomum--Silky dogwood
Cornus stolonifera--Red-osier dogwood

OLEACEAE
Fraxinus pennsylvanica--Green ash

CONVOLVULACEAE
Cuscuta glomerata--Dodder

VERBENACEAE
Verbena hastata--Blue vervain

CAPRIFOLIACEAE
Viburnum lentago--Nannyberry
Lonicera x *bella*[2]--Hybrid honeysuckle

COMPOSITAE
Helianthus strumosus[1]--Pale-leaved wood sunflower
Ambrosia trifida[1]--Giant ragweed
Solidago gigantea--Giant goldenrod
Solidago altissima x *gigantea*[1]--Hybrid goldenrod
Solidago altissima[1]--Tall goldenrod
Solidago graminifolia--Grassleaf goldenrod
Aster novae-angliae[1]--New England aster
Aster lucidulus--Swamp aster
Aster pilosus[1]--Frost aster
Aster simplex--Marsh aster
Eupatorium maculatum--Joe-pye weed
Carduus nutans[2]--Nodding thistle

Total number of plant species: 40
Number of alien, or nonnative, plant species: 7 (18 percent)

This approximately 1.0-acre plant community area is part of the Upper Kelly Lake upland and wetland complex consisting of manicured lawn, shallow marsh, shrub-carr (willow thicket) and second growth, Southern wet to wet-mesic lowland hardwoods. Disturbances to the plant community area include past filling and grading; and water level changes due to past ditching and draining. No Federal- or State-designated Special Concern, Threatened, or Endangered species were observed during the field inspection.

---

[1]Growing along the wetland edge
[2]Alien or non-native plant species

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#82322 V1 - UPPER KELLY LAKE WETLAND RESTORATION
300-1000
PCE/JAT/pk
05/06/03

Exhibit B

PRELIMINARY VEGETATION SURVEY
J. GORSENGER PROPERTY-UPPER KELLY LAKE WETLAND

Date: April 3, 1990

Observer: Donald M. Reed, Principal Biologist
Rachel E. Lang, Assistant Biologist
Southeastern Wisconsin Regional Planning Commission

Location: City of New Berlin in the Northeast one-quarter of U.S. Public Land Survey Section 36, Township 6 North, Range 20 East, Town of New Berlin, Waukesha County, Wisconsin.

Species List:

TYPHACEAE
Typha latifolia[1]--Broad-leaved cat-tail

GRAMINEAE
Bromus inermis[2,3]—Smooth brome grass
Poa pratensis--Kentucky bluegrass
Phalaris arundinacea[2]--Reed canary grass

CYPERACEAE
Carex blanda--Wood sedge
Carex sp.—Sedge

IRIDACEAE
Iris versicolor—Blue flag iris

SALICACEAE
Salix nigra--Black willow
Salix interior-- Sand-bar willow
Salix discolor—Pussy willow
Salix sp. –Willow

JUGLANDACEAE
Juglans nigra[3]—Black walnut

ULMACEAE
Ulmus americana—American elm

URTICACEAE
Urtica dioica—Stinging nettle

CRUCIFERAE
Alliaria officinalis[2]—Garlic-mustard

SAXIFRAGACEAE
Ribes americanum—Wild black current

ROSACEAE
Fragaria virginiana—Wild strawberry
Geum canadense--White avens
Rosa palustris--Swamp rose
Crataegus sp.[3]--Hawthorn

ANACARDIACEAE
Rhus glabra[3]--Smooth sumac

ACERACEAE
Acer saccharinum—Silver maple

VITACEAE
Vitis riparia--River-bank grape

UMBELLIFERAE
Daucus carota[2,3]--Queen Anne's lace

CORNACEAE
Cornus stolonifera—Red osier dogwood

OLEACEAE
Fraxinus pennsylvanica--Green ash

LABIATAE
Monarda fistulosa[3]—Wild bergamont

CAPRIFOLIACEAE
Sambucus canadensis--Elderberry
Lonicera x bella[2]--Hybrid honeysuckle

COMPOSITAE
Rudbeckia laciniata—Green-headed coneflower
Ambrosia trifida—Giant ragweed
Solidago gigantea--Giant goldenrod
Solidago altissima x *gigantea*[3]--Hybrid goldenrod

Total number of plant species: 33
Number of alien, or non-native, plant species: 5 (15 percent)

This approximately 0.25-acre wetland plant community area is part of the Upper Kelly Lake wetland complex and consists of shallow marsh, fresh (wet) meadow, shrub-carr (willow thicket) and scattered southern wet- to wet-mesic lowland hardwoods. Disturbances to this plant community include vegetation removal, side casting of dredge spoil, past wetland filling, and water level changes due to ditching. No federal- or state-designated rare, threatened, or endangered species were observed during the field inspection.

---

[1]Growing along the shoreland edge.
[2]Alien, or nonnative, plant species.
[3]Growing along the wetland edge.

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Exhibit C

PRELIMINARY WETLAND PLANTINGS LIST FOR SOUTHEASTERN WISCONSIN

Open Water/Deep Marsh (water depth of 6 inches to 3 feet):

COMMON NAME[14]	SPECIES	PLANTING RATE[15]
Yellow water lily	*Nuphar variegata*	10 rhizomes/acre
White water lily	*Nymphaea odorata*	10 rhizomes/acre
Pickerelweed	*Pontederia cordata*	1 shoot/sq. yard
Large-leaf pondweed	*Potamogeton amplifolius*	1 shoot/sq. yard
Sago pondweed	*Potamogeton pectinatus*	1 shoot/sq. yard
Clasping leaf pondweed	*Potamogeton richardsonii*	1 shoot/sq. yard
River bulrush	*Scirpus fluviatilis*	1 shoot/sq. yard
Softstem bulrush	*Scirpus validus*	1 shoot/sq. yard
Common bur-reed	*Sparganium eurycarpum*	1 shoot/sq. yard

Shallow Marsh/Nearshore emergent (water depth of less than 6 inches):

Water plantain	*Alisma subcordatum*	1 shoot/sq. yard
Bristly sedge	*Carex comosa*	1 shoot/sq. yard
Lake sedge	*Carex lacustris*	1 shoot/sq. yard
Needle spike-rush	*Eleocharis acicularis*	1 shoot/sq. yard
Blue flag iris	*Iris versicolor*	1 shoot/sq. yard
Water smartweed	*Polygonum amphibium*	1 shoot/sq. yard
Common arrowhead	*Sagittaria latifolia*	1 shoot/sq. yard

Fresh (wet) Meadow/Southern Sedge Meadow/Low Prairie/Shoreland emergent:

Green bulrush	*Scirpus atrovirens*	1 shoot/sq. yard
Big bluestem	*Andropogon gerardii*	2 lbs/acre
Marsh milkweed	*Asclepias incarnata*	1 lbs/acre
New England aster	*Aster novae-angliae*	1 lbs/acre
Marsh aster	*Aster simplex*	1 lbs/acre
Nodding bur marigold	*Bidens cernua*	1 lbs/acre
Tussock sedge	*Carex stricta*	10 lbs/acre
Fox sedge	*Carex vulpinoidea*	2 lbs/acre
Joe-pye weed	*Eupatorium maculatum*	1 lbs/acre

[14] *Planting rates may vary depending upon species chosen and desired plant density.*

[15] *Minimum planting rates.*

Fowl manna grass	*Glyceria striata*	1 lbs/acre
Sneezeweed	*Helenium autumale*	1 lbs/acre
Sawtooth sunflower	*Helianthus grosseserratus*	1 lbs/acre
Rice cut grass	*Leersia oryzoides*	2 lbs/acre
Green-headed coneflower	*Rudbeckia laciniata*	1 lbs/acre
Great water dock	*Rumex orbiculatus*	1 lbs/acre
Prairie cord grass	*Spartina pectinata*	5 lbs/acre
Tall meadowrue	*Thalictrum dasycarpum*	1 lbs/acre
Blue vervain	*Verbena hastata*	1 lbs/acre
Common ironweed	*Vernonia fasciculata*	1 lbs/acre

Source: SEWRPC.

Exhibit C

COPY

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

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FAX (262) 547-1103

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Mr. Michael R. Cascio
5661 S. Kurtz Road
Hales Corners, WI 53130

March 20, 1997

Dear Mr. Cascio:

Pursuant to your request made during your February 14, 1997, meeting with Commission staff in our offices, we have determined the regulatory maximum elevation referred to National Geodetic Vertical Datum of 1929--formally known as Mean Sea Level Datum--of Upper Kelly Lake located in Milwaukee and Waukesha Counties. The maximum elevation of 97.70 feet local datum was fixed by order number W.P.-229 of the Railroad Commission of Wisconsin dated December 31, 1925. The Commission staff has determined that the regulatory maximum elevation of the lake referenced to National Geodetic Vertical Datum of 1929 is 805.75 feet.

The regulatory maximum elevation as determined by the Commission staff was obtained by using the differences of the local datum elevations of benchmarks 607-C and 607-D located in the vicinity of Upper Kelly Lake as noted on the "Summary Sheet" provided to you by the Dam Safety Section of the Wisconsin Department of Natural Resources, a copy of which was provided to us by you; and by a spirit level survey conducted by the Commission staff on March 4, 1997.

It is important to note that the differences in elevations between benchmarks 607-C and 607-D as shown on the Summary Sheet agree with the differences in elevations between those benchmarks as determined by the Commission staff spirit level survey. However, the differences in elevation between benchmark 607-B and benchmarks 607-C and 607-D as shown on the Summary Sheet do not agree with the differences in elevation determined by the spirt level survey. This discrepancy may be due to the movement of bench mark 607-B through frost heave.

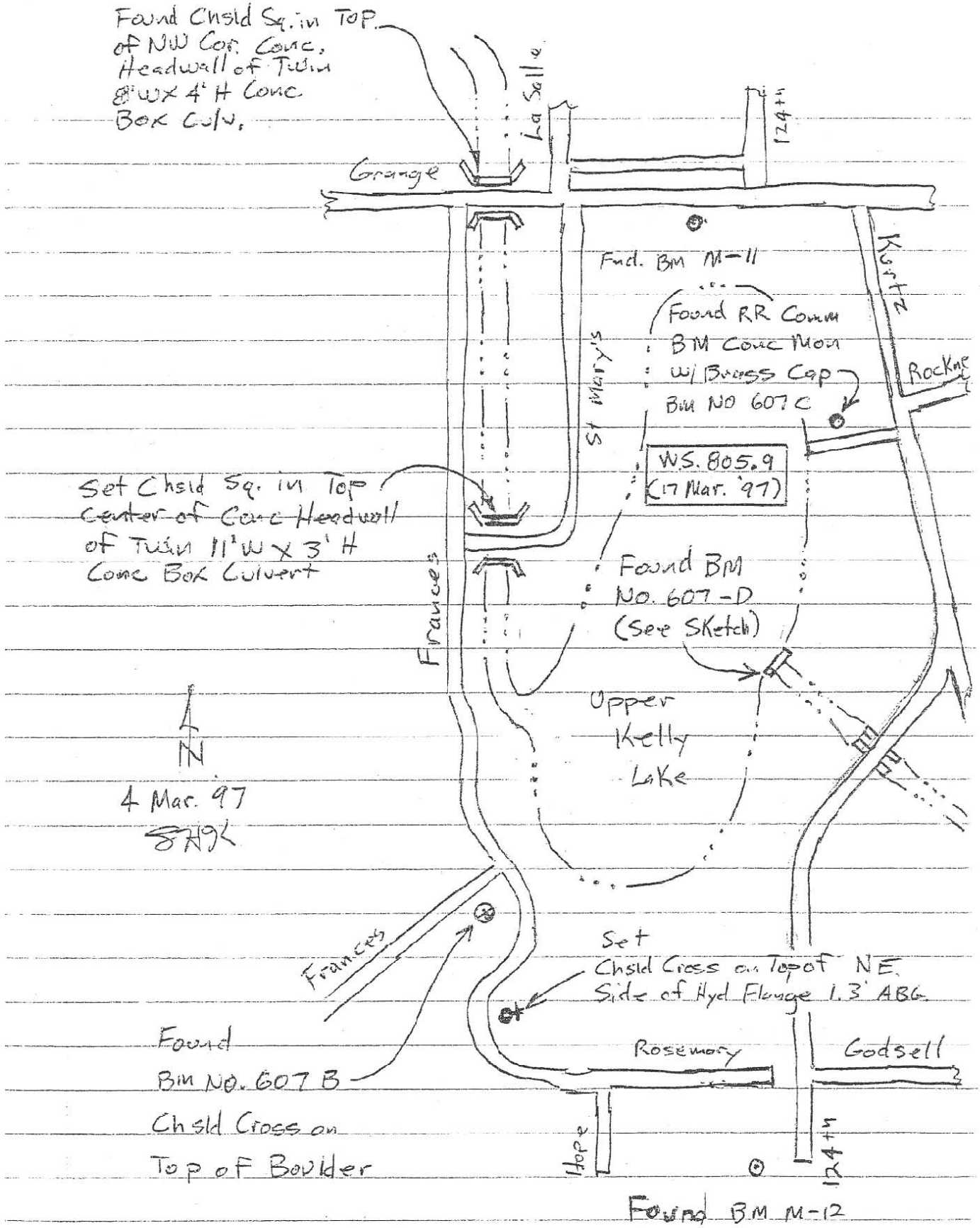
We are providing to you herewith copies of dossier sheets showing benchmarks 607-B, 607-C, and 607-D.

We trust that the foregoing information is fully responsive to your needs. Should you, however, have any further questions concerning this matter, please do not hesitate to call.

Sincerely,

Philip C. Evenson
Executive Director

PCE/LHK/rj
Enclosures
LHK/CASCIO.LTR
cc: Gloria L. McCutcheon, District Director, Southeast District,
Wisconsin Department of Natural Resources
bcc: L. H. Kreblin


Found Chsld Sq. in TOP of NW Cor. Conc. Headwall of Twin 8'W X 4' H Conc Box Culv.
La Salle
124th
Grange
Fnd. BM M-11
Found RR Comm BM Conc Mon w/ Brass Cap BM NO 607 C
St Mary's
Kent
Rockne
W.S. 805.9 (17 Mar. '97)
Set Chsld Sq. in Top Center of Conc Headwall of Twin 11'W X 3' H Conc Box Culvert
Frances
Found BM No. 607-D (See SKetch)
Upper Kelly Lake
N
4 Mar. 97
SHK
Frances
Set Chsld Cross on Top of NE Side of Hyd Flange 1.3' ABG
Found BM No. 607 B Chsld Cross on Top of Boulder
Rosemary
Godsell
Hope
124th
Found BM M-12

RECORD OF VERTICAL CONTROL STATION

SECTION 36 T 6 N, R 20 E, WAUKESHA COUNTY, WISCONSIN

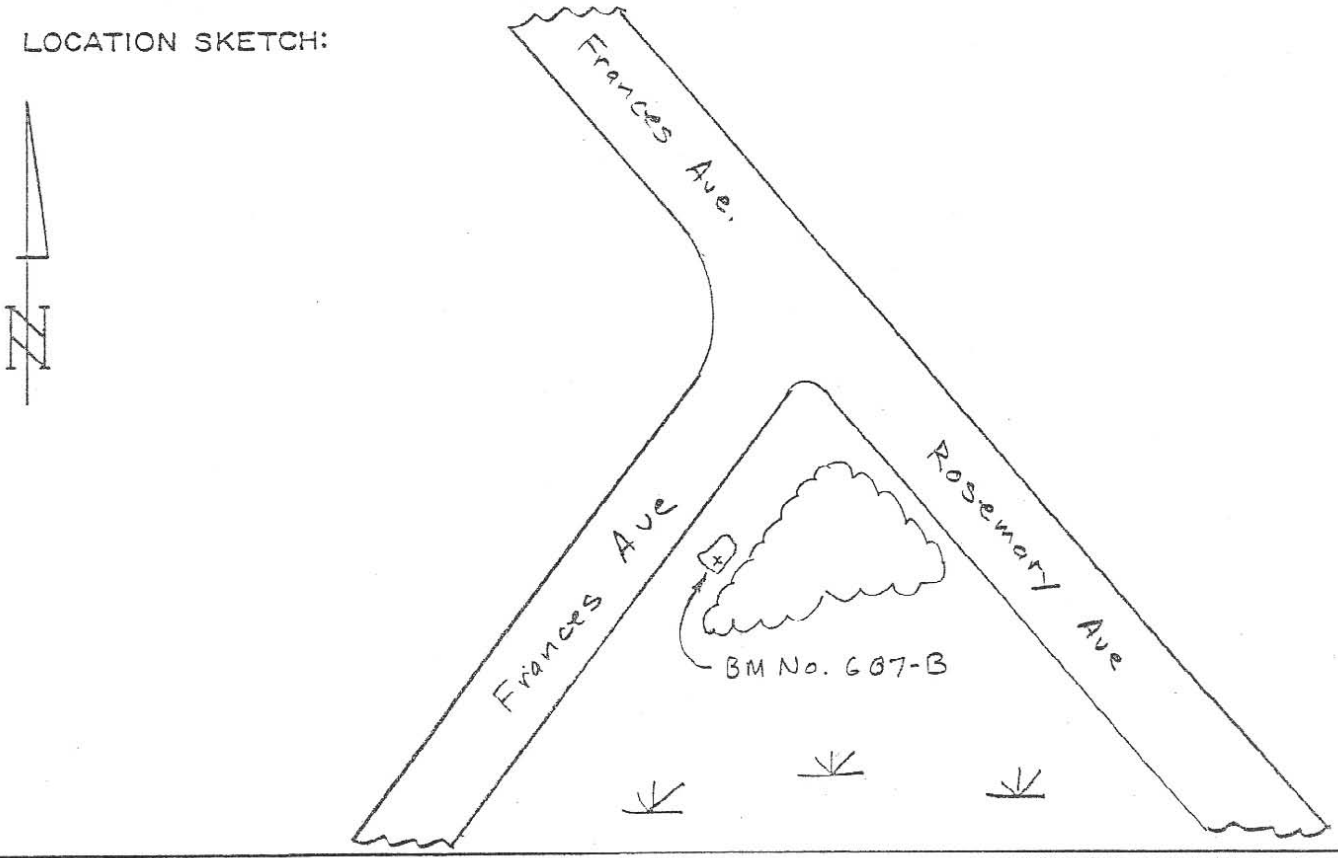
BENCH MARK NO. 607-B ELEVATION 810.38

REFERENCE BENCH MARK NO. _____ ELEVATION _____

VERTICAL DATUM: NATIONAL GEODETIC VERTICAL DATUM OF 1929

VERTICAL CONTROL ACCURACY: THIRD ORDER

LOCATION SKETCH:



DETAILED DESCRIPTION: BM 607-B is a chiseled cross found in the top of a boulder

DATE OF SURVEY: 4 March 1997

FORM PREPARED BY SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

RECORD OF VERTICAL CONTROL STATION

SECTION 31 T 6 N, R 21 E, MILWAUKEE COUNTY, WISCONSIN

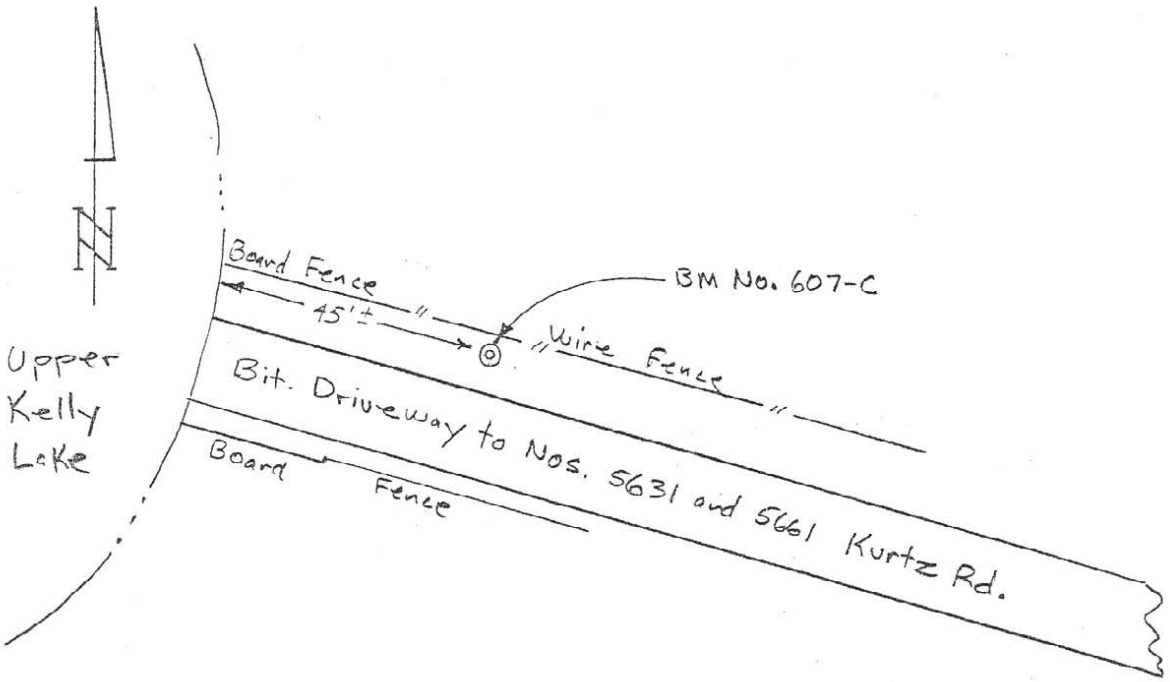
BENCH MARK NO. 607-C ELEVATION 810.03

REFERENCE BENCH MARK NO. _____ ELEVATION _____

VERTICAL DATUM: NATIONAL GEODETIC VERTICAL DATUM OF 1929

VERTICAL CONTROL ACCURACY: THIRD ORDER

LOCATION SKETCH:



DETAILED DESCRIPTION: BM 607-C is a concrete monument with Railroad Commission of Wisconsin brass cap.

DATE OF SURVEY: 4 March 1997

FORM PREPARED BY SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

RECORD OF VERTICAL CONTROL STATION

SECTION 31 T 6 N, R 21 E, MILWAUKEE COUNTY, WISCONSIN

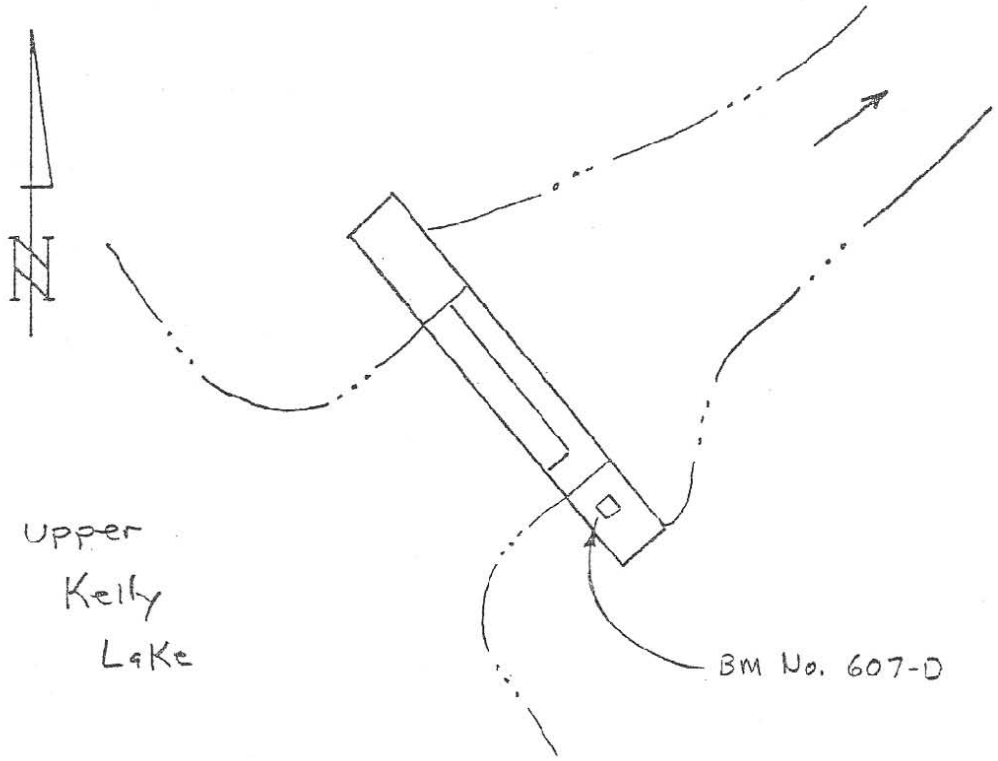
BENCH MARK NO. 607-D ELEVATION 806.53

REFERENCE BENCH MARK NO. _____ ELEVATION _____

VERTICAL DATUM: NATIONAL GEODETIC VERTICAL DATUM OF 1929

VERTICAL CONTROL ACCURACY: THIRD ORDER

LOCATION SKETCH:



DETAILED DESCRIPTION: BM 607-D is a chiseled square found in the top of the concrete water control structure.

DATE OF SURVEY: 4 March 1997

FORM PREPARED BY SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

RECORD OF VERTICAL CONTROL STATION

SECTION 36 T 6 N, R 20 E, WAUKESHA COUNTY, WISCONSIN

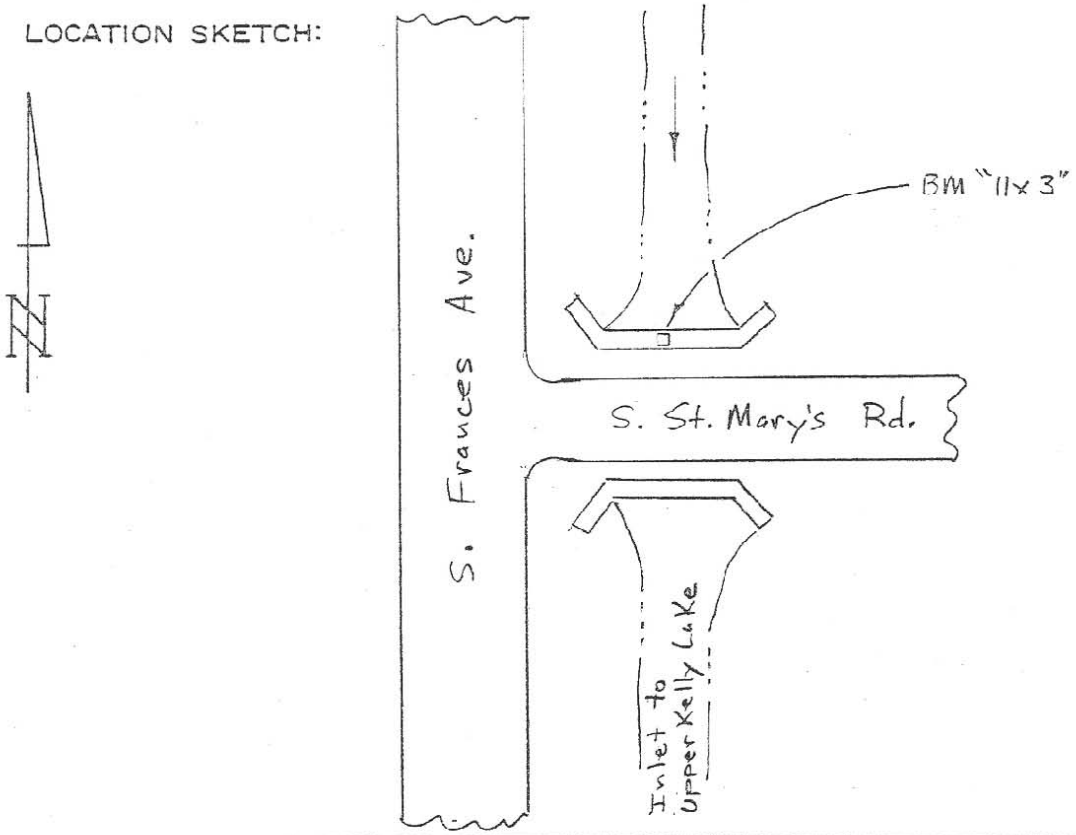
BENCH MARK NO. 11 X 3 ELEVATION 809.72

REFERENCE BENCH MARK NO. _____ ELEVATION _____

VERTICAL DATUM: NATIONAL GEODETIC VERTICAL DATUM OF 1929

VERTICAL CONTROL ACCURACY: THIRD ORDER

LOCATION SKETCH:



DETAILED DESCRIPTION: BM "11x3" is a chiseled square set in the top of the concrete headwall of a twin 11' wide x 3' high concrete box culvert.

DATE OF SURVEY: 4 March 1997

FORM PREPARED BY SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

RECORD OF VERTICAL CONTROL STATION

SECTION 36 T 6 N, R 20 E, WAUKESHA COUNTY, WISCONSIN

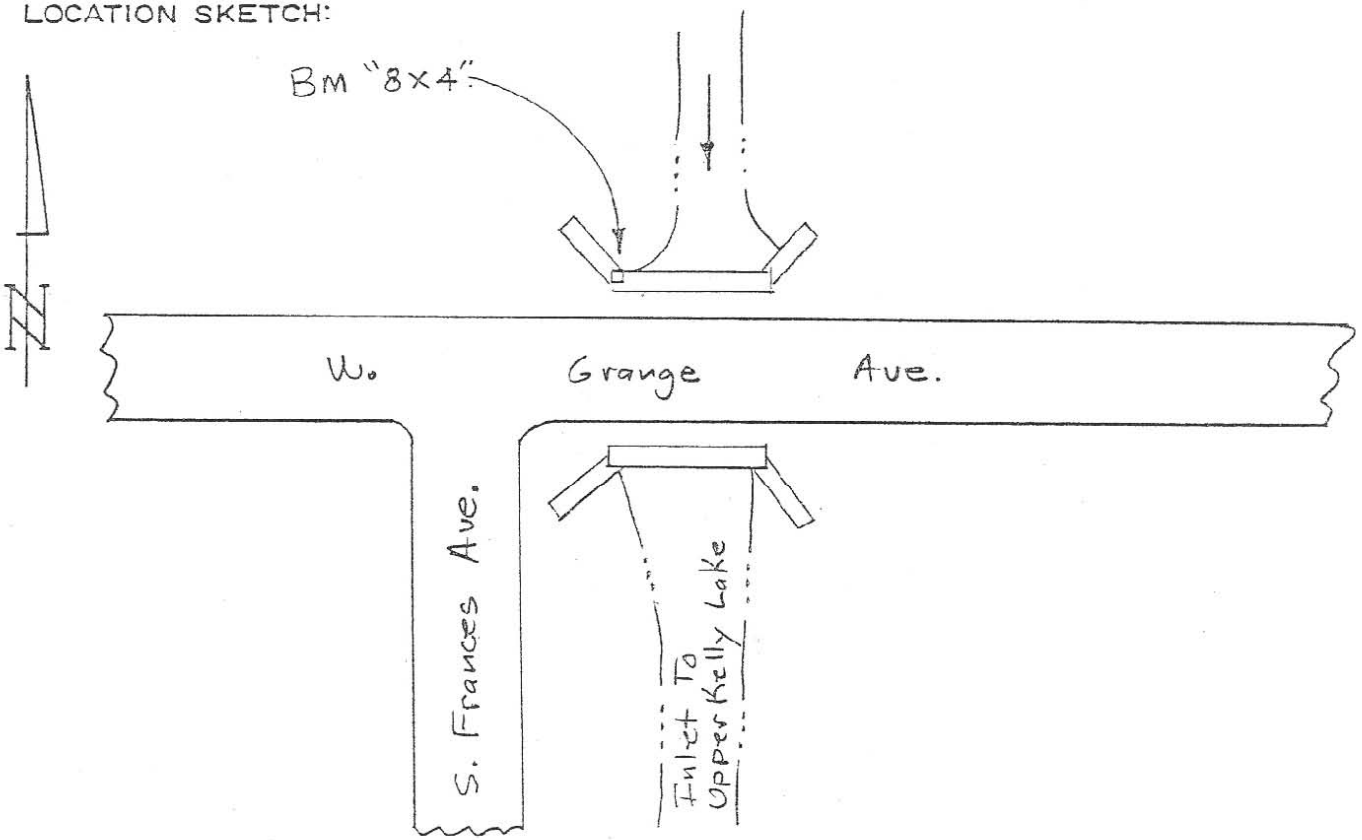
BENCH MARK NO. 8X4 ELEVATION 821.25

REFERENCE BENCH MARK NO. _____ ELEVATION _____

VERTICAL DATUM: NATIONAL GEODETIC VERTICAL DATUM OF 1929

VERTICAL CONTROL ACCURACY: THIRD ORDER

LOCATION SKETCH:



DETAILED DESCRIPTION: BM "8X4" is a chiseled square found in the top of the northwest corner of the concrete headwall of a twin 8' wide X 4' high concrete box culvert.

DATE OF SURVEY: 4 March 1997

FORM PREPARED BY SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

RECORD OF VERTICAL CONTROL STATION

SECTION 36 T 6 N, R 20 E, WAUKESHA COUNTY, WISCONSIN

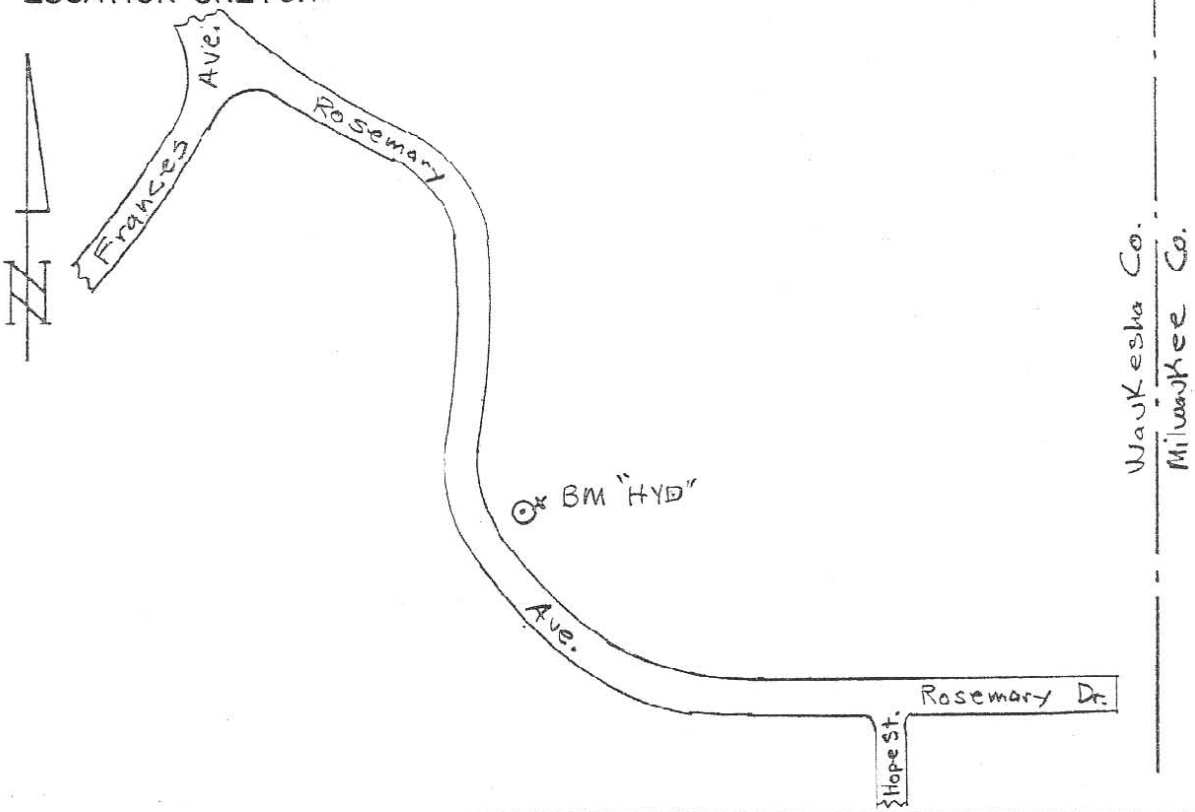
BENCH MARK NO. HYD ELEVATION 812.66

REFERENCE BENCH MARK NO. _____ ELEVATION _____

VERTICAL DATUM: NATIONAL GEODETIC VERTICAL DATUM OF 1929

VERTICAL CONTROL ACCURACY: THIRD ORDER

LOCATION SKETCH:



DETAILED DESCRIPTION: BM "HYD" is a chiseled cross set in the top of the northeast side of the flange of a hydrant, 1.3' above grade.

DATE OF SURVEY: 4 March 1997

FORM PREPARED BY SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

RECORD OF VERTICAL CONTROL STATION

SECTION 31 T 6 N, R 21 E, MILWAUKEE COUNTY, WISCONSIN

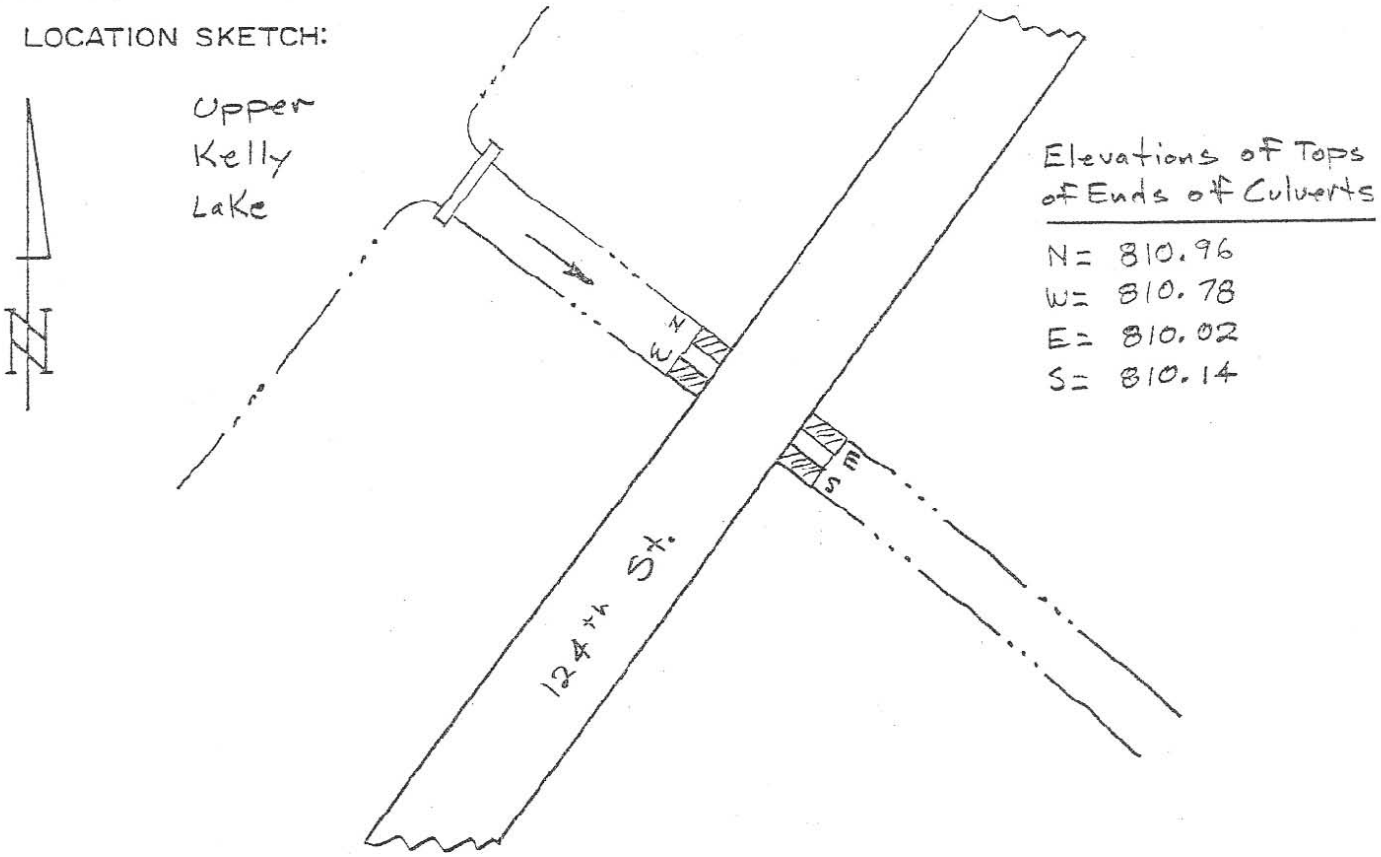
BENCH MARK NO. CULVERTS ELEVATION (See Below)

REFERENCE BENCH MARK NO. _____ ELEVATION _____

VERTICAL DATUM: NATIONAL GEODETIC VERTICAL DATUM OF 1929

VERTICAL CONTROL ACCURACY: THIRD ORDER

LOCATION SKETCH:



Elevations of Tops of Ends of Culverts

N = 810.96
W = 810.78
E = 810.02
S = 810.14

DETAILED DESCRIPTION: Twin 6' diameter corrugated metal culvert pipes.

DATE OF SURVEY: 4 March 1997

FORM PREPARED BY SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

Summary Sheet

Name of Dam Kurtze (Kelly) Lake File No. 40.6 County Milwaukee

Location SW ¼ NW ¼ Section 31 T 6 N, R 21 E Dam

Stream Outlet of Kurtze Lake Name of Lake Held by Dam Durtze

Present Owner Kelly Brothers & Henry Eckel

Existing Bench Marks

Benchmark 607-A is a cross cut in the top of a 3-foot boulder 20 feet south of the inlet canal and 60 feet from the lake shore. Elevation 100'.

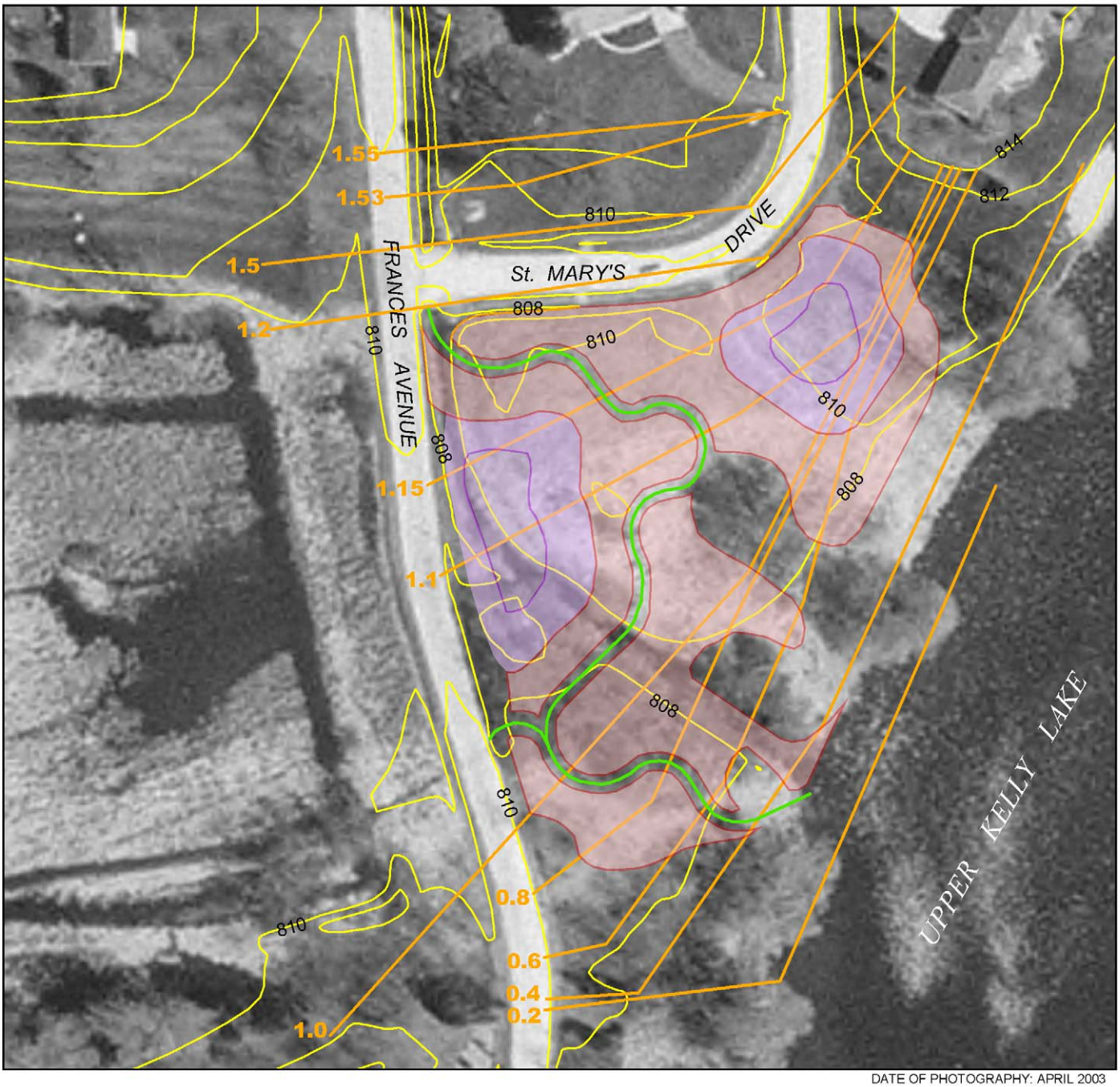
Benchmark 607-B is a cross cut in the top of a 4-foot checked gray boulder 4 feet high at the south end of the lake about 150 feet south of the lake shore. Elevation 101.

Benchmark BM 607-C is redescribed as follows: a bronze RR Commission tablet 2 inches above ground level, 76 feet SW of the NW corner of new addition to Cottage, 66.7 feet SW of SE corner of cottage (original corner), 28.7 feet NW of power pole in lot across lake access road 3 inches south of fence line. ELEV. = 101.94

Benchmark 607-D is a two-inch square cut in the right abutment one foot from the gate of the dam. ELEV = 98.48

Exhibit D

PROPOSED UPPER KELLY LAKE TRIBUTARY AND WETLAND RESTORATION CONDITIONS AND CROSS SECTION LOCATIONS FOR HEC RAS MODELING FOR THE UPPER KELLY LAKE RESTORATION PROJECT



DATE OF PHOTOGRAPHY: APRIL 2003

PROPOSED CHANNEL

WET MEADOW

SHALLOW MARSH

PROPOSED CONTOUR AT 807.5 FEET

PROPOSED CONTOUR AT 806.5 FEET

0.2 CROSS SECTION AND NUMBER

TOPOGRAPHIC LINES AT TWO FOOT CONTOURS BASED ON YEAR 2000 WAUKESHA COUNTY DIGITAL TERRAIN MODEL

Source: SEWRPC.

N

GRAPHIC SCALE

0 25 50 100 Feet

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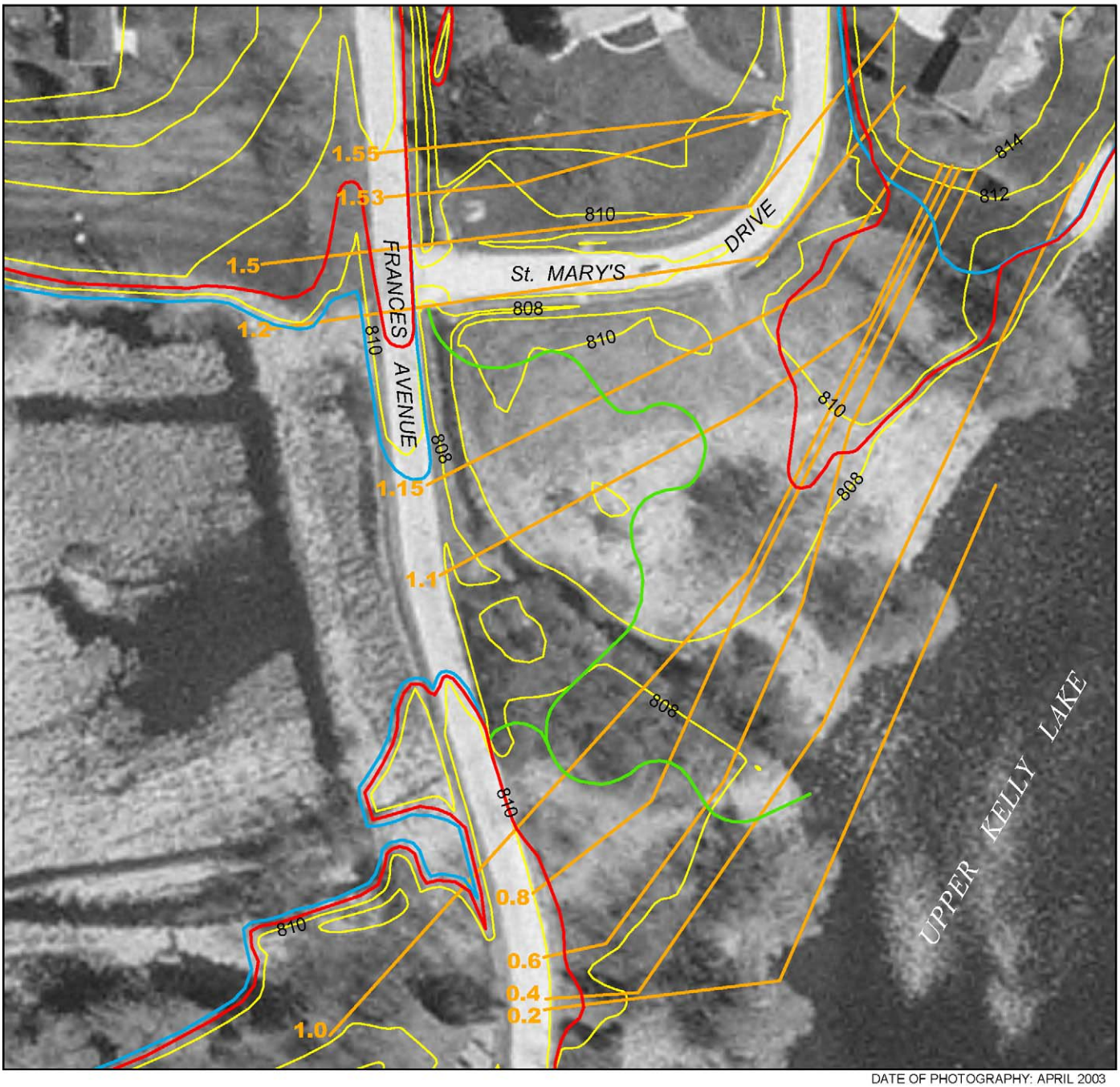
Exhibit E

UPPER KELLY LAKE AND UPPER KELLY LAKE TRIBUTARY FLOODPLAIN BOUNDARIES FOR EXISTING AND PROPOSED CONDITIONS



DATE OF PHOTOGRAPHY: APRIL 2003

PROPOSED CHANNEL

EXISTING 100-YEAR FLOODPLAIN

PROPOSED 100-YEAR FLOODPLAIN (WHERENOT COINCIDENT WITH EXISTING FLOODPLAIN)

TOPOGRAPHIC LINES AT TWO FOOT CONTOURS BASED ON YEAR 2000 WAUKESHA COUNTY DIGITAL TERRAIN MODEL

N

GRAPHIC SCALE
0 25 50 100 Feet

Source: SEWRPC.

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Exhibit F

**COMPARISON OF UPPER KELLY LAKE TRIBUTARY FLOOD STAGES
EXISTING CHANNEL AND PLANNED WETLAND RESTORATION PROJECT CHANNEL CONDITIONS**

Cross-Section Designation	Stream Station for Existing Conditions[a] (feet)	Stream Station for Planned Conditions[a] (feet)	Cross-Section Location	100-Year Recurrence Interval Flood Stage (feet NGVD29)		
				Existing Channel Conditions	Planned Channel Conditions with Proposed Excavation of Wetland and Stream Channel	Change in Stage (feet)
0.2	0	0	Upper Kelly Lake	809.20	809.20	0.00
0.4	50	60	- -	809.19	809.19	0.00
0.6	90	100	- -	809.21	809.23	0.02
0.8	130	140	- -	809.25	809.28	0.03
1.0	160	215	- -	809.37	809.36	-0.01
1.1	295	465	- -	809.89	809.65	-0.24
1.15	353	545	- -	810.08	809.72	-0.36
1.2	463	695	Downstream side of St. Mary's Drive	810.37	809.81	-0.56
1.5	513	745	Upstream side of St. Mary's Drive	810.64	810.42	-0.22
1.53	543	775	- -	810.68	810.45	-0.23
1.55	573	805	- -	810.95	810.95	0.00
1.8	838	1070	- -	812.5	812.5	0.00

[a]*Measured relative to cross-section 0.2 in Upper Kelly Lake.*

Source: SEWRPC.

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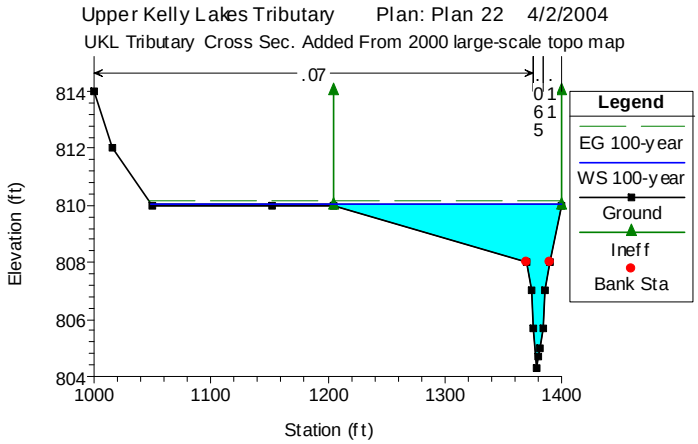
Exhibit G

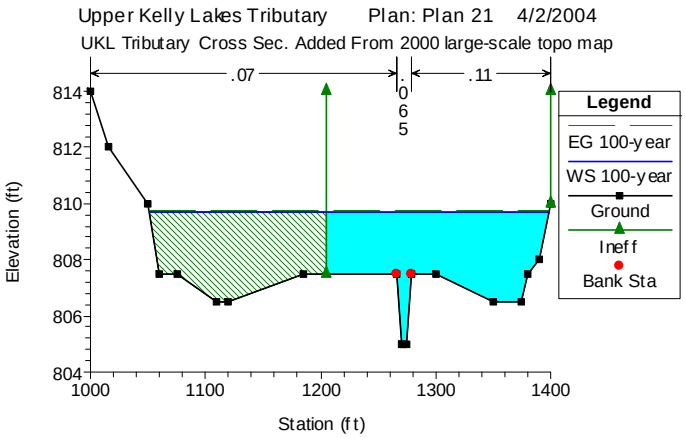
HEC RIVER ANALYSIS SYSTEM (RAS) CROSS SECTIONS OUTPUT OF EXISTING VERSUS PLANNED CONDITIONS FOR THE UPPER KELLY LAKE TRIBUTARY RESTORATION PROJECT FOR STATIONS 1.15 THROUGH 0.4 (SEE EXHIBIT D FOR LOCATIONS)

Existing Conditions

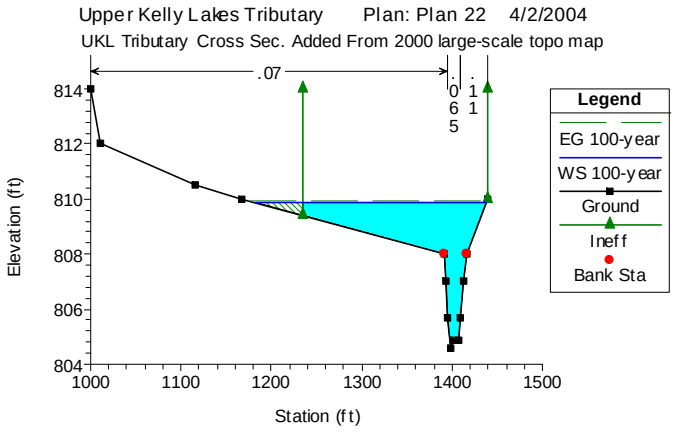
Proposed Conditions

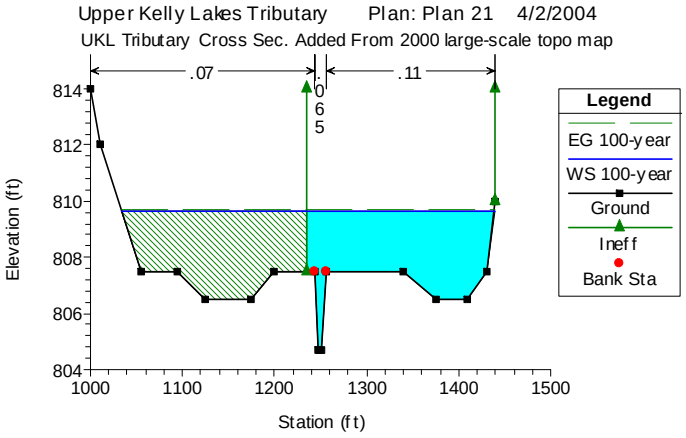
Station 1.15



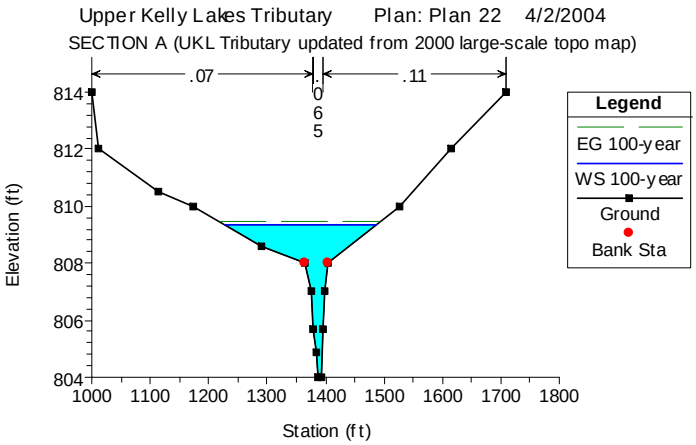


Station 1.1





Station 1.0



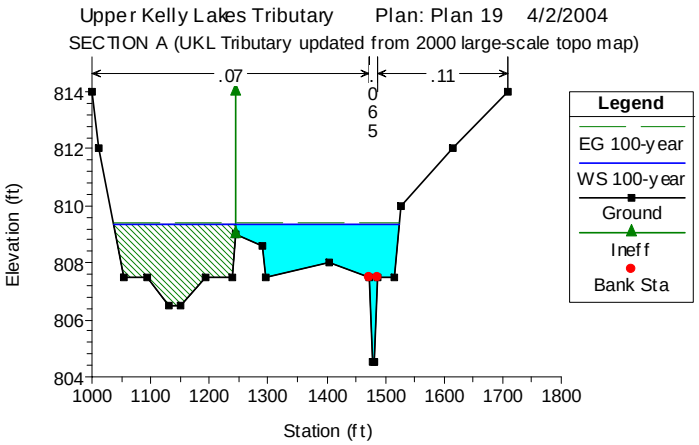
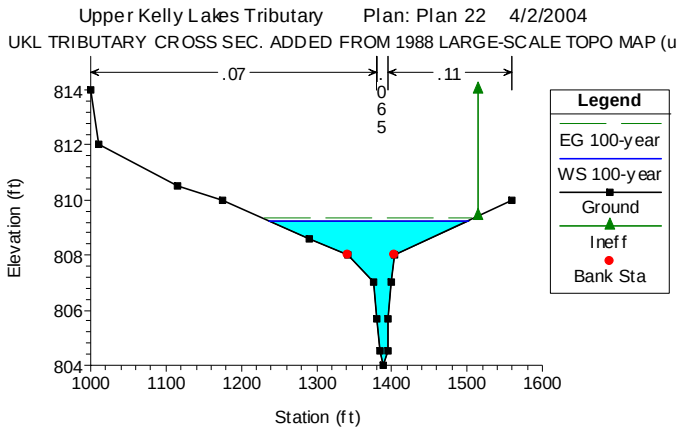


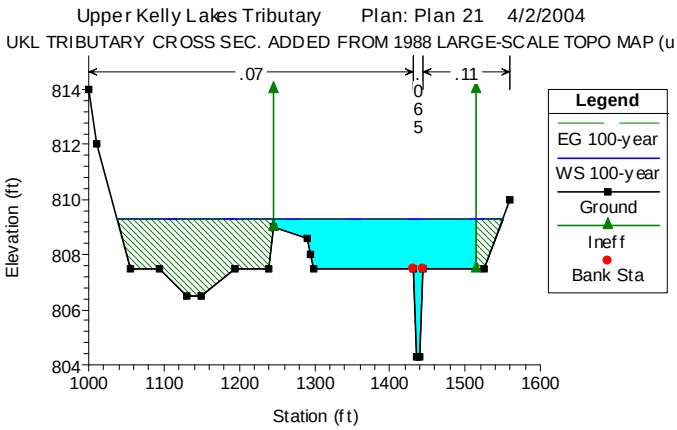
Exhibit G (continued)

Existing Conditions

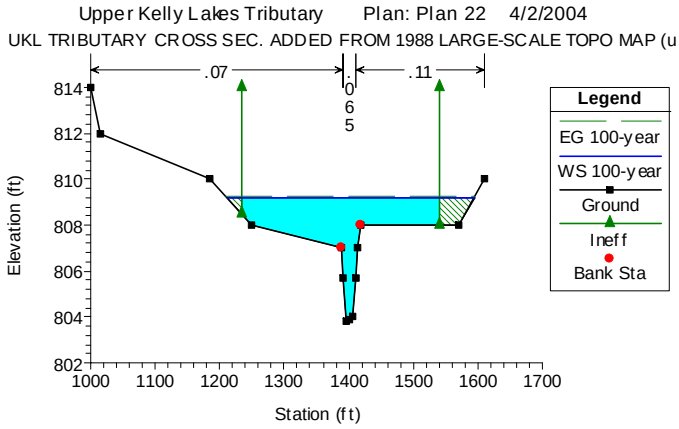
Proposed Conditions

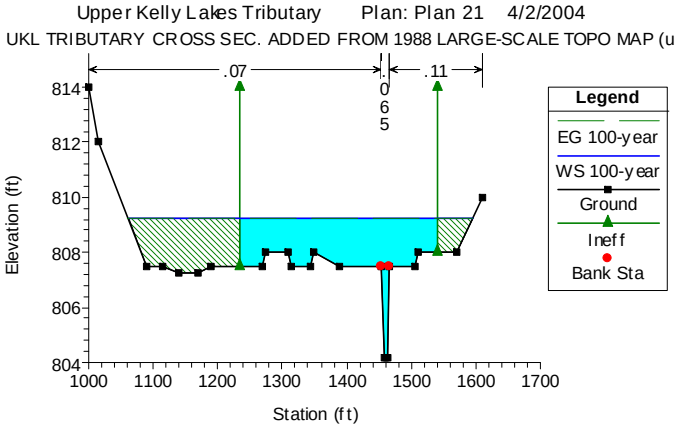
Station 0.8



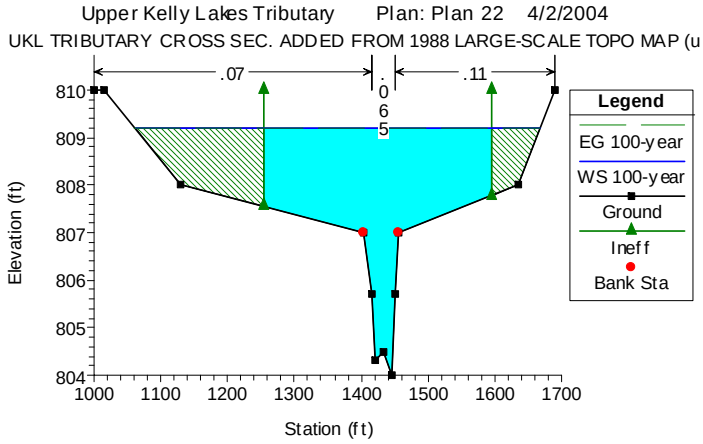


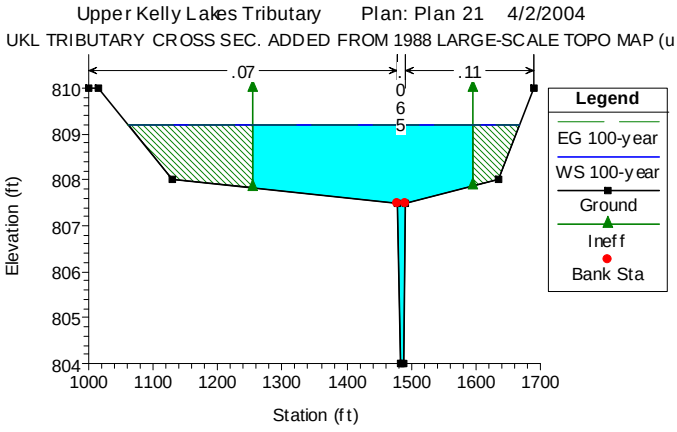
Station 0.6





Station O.4





Note: River station cross sections are positioned looking downstream from left to right.

Source: SEWRPC.

Exhibit H

PRELIMINARY VEGETATION SURVEY No. SVY2860

UPPER KELLY LAKE ACCESS UPLAND

Date: March 18, 2004

Observer: Donald M. Reed, Ph.D., Chief Biologist
Southeastern Wisconsin Regional Planning Commission

Location: City of New Berlin in parts of the Northeast one-quarter of U.S. Public Land Survey Section 36, Township 6 North, Range 20 East, Waukesha County, Wisconsin.

Species List:

CUPRESSACEAE
- Thuja occidentalis--White cedar

GRAMINEAE
- Poa pratensis[1]--Kentucky bluegrass
- Phalaris arundinacea[2]--Reed canary grass

CYPERACEAE
- Carex stricta--Tussock sedge

SALICACEAE
- Salix nigra--Black willow
- Salix discolor--Pussy willow

JUGLANDACEAE
- Juglans nigra--Black walnut

ULMACEAE
- Ulmus americana--American elm

RANUNCULACEAE
- Anemone virginiana--Thimbleweed

CRUCIFERAE
- Barbarea vulgaris[2]--Yellow rocket
- Alliaria officinalis[2]--Garlic-mustard

ROSACEAE
- Potentilla simplex--Old field cinquefoil
- Rubus occidentalis--Black raspberry
- Rosa palustris--Swamp rose
- Prunus sp.--Cherry
- Pyrus malus[2]--Apple
- Crataegus sp.--Hawthorn

FABACEAE
Melilotus sp.[2]--Sweet clover

ANACARDIACEAE
Rhus glabra--Smooth sumac

RHAMNACEAE
Rhamnus cathartica[2]--Common buckthorn
Rhamnus frangula[2]--Glossy buckthorn

VITACEAE
Vitis riparia--River-bank grape

HYPERICACEAE
Hypericum (perforatum?)[2]--Common St. John's wort

UMBELLIFERAE
Daucus carota[2]--Queen Anne's lace
Pastinaca sativa[2]--Wild parsnip

CORNACEAE
Cornus amomum--Silky dogwood
Cornus stolonifera--Red-osier dogwood
Cornus racemosa[1]--Grey dogwood

OLEACEAE
Fraxinus pennsylvanica--Green ash

BORAGINACEAE
Hackelia virginiana--Stickseed

LABIATAE
Prunella vulgaris--Selfheal
Monarda fistulosa--Wild bergamot

CAPRIFOLIACEAE
Viburnum opulus[2]--European high bush-cranberry
Viburnum lentago--Nannyberry
Lonicera X bella[2]--Hybrid honeysuckle
Triosteum perfoliatum--Tinkers weed

COMPOSITAE
Rudbeckia hirta--Black-eyed Susan
Solidago gigantea--Giant goldenrod
Solidago altissima--Tall goldenrod
Solidago graminifolia--Grassleaf goldenrod
Aster sagittifolius--Arrowleaf aster
Aster lateriflorus--Calico aster

Total number of plant species: 42

Number of alien, or nonnative, plant species: 12 (29 percent)

This approximately 0.25-acre plant community area consists of old field and second growth, Southern wet-mesic lowland hardwoods, and grades into disturbed fresh (wet) meadow next to the lake. Disturbances to the plant community area include past dumping and filling. No Federal- or State-designated Special Concern, Threatened, or Endangered species were observed during the field inspection.

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[1]Co-dominant plant species
[2]Alien or nonnative plant species

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BLS ENVIROMENTAL, INC.

Upper Kelly Lake Association

Permit Application for Stream Relocation

Test Pitting
"Soil Characterization of Strata"

Mr. Mike Cascio/ Association President
5661 S. Kurtz Road
Hales Corners, WI 53130

I, Randy Rogness hereby certify that I am a hydrogeologist as that term is defined in s. NR 712.03(1), Wis. Adm. Code, and that, to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in the Wis. Adm. Code.

Randy W. Rogness 12/18/03

Randy W. Rogness Date

BLS ENVIROMENTAL, INC.

December 18, 2003

Mr. Mike Cascio
President, Kelly Lakes Association
5661 S. Kurtz Road
Hales Corners, Wisconsin 53130

RE: Test Pit Observations – Upper Kelly Lake

Dear Mr. Cascio;

On November 28, 2003, Mr. Randy Rogness of BLS Environmental, Inc. (BLS) observed the excavation of eight test pits in the area south of St. Mary's Drive and east of St. Frances Avenue near Upper Kelly Lake. The Test Pits were conducted in response to a letter from the Wisconsin Department of Natural Resources (WDNR), dated October 7, 2003, detailing the testing requirements needed for your Chapter 30, Wisconsin Statutes permit application.

Figure 1 presents the site plan on an aerial photo. Figure 2 presents the Test Pit locations. The Test Pits were conducted along the proposed pathway for relocating the streambed. The copy of the aerial photo available to BLS required removal of two lines drawn on the photo, one line located south of Test Pit 4 and one line located west of Test Pit 7. "White-out" was used to erase the lines, creating the discolorations seen on Figures 1 and 2.

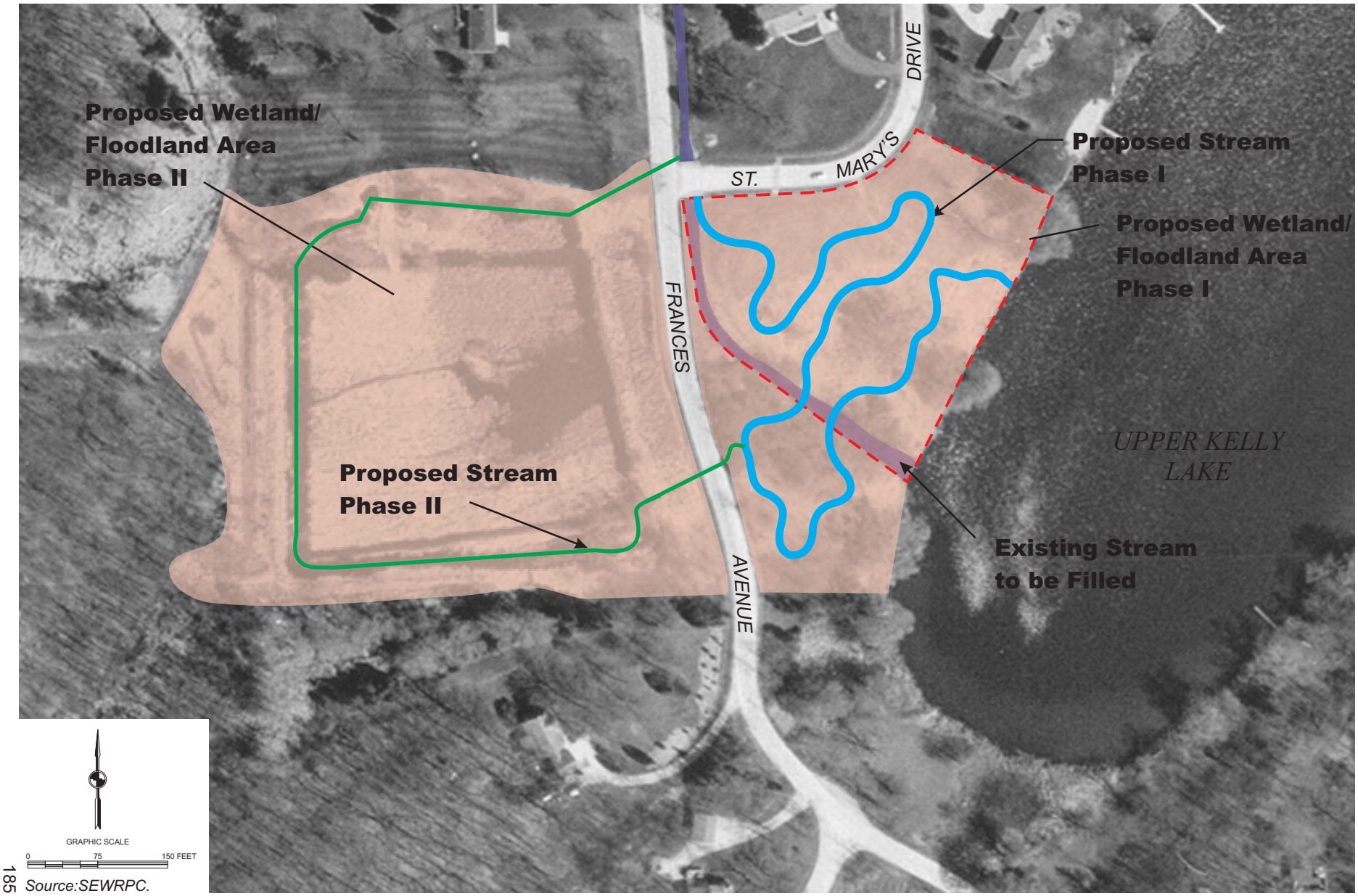
Each of the Test Pits was excavated utilizing a backhoe. Test Pits 1 and 2 were excavated to a depth of 6 feet below grade. Test Pit 1 encountered a black, organic peat layer at 4.5 feet below grade, with groundwater entering the excavation at 3.5 feet below grade. Test Pit 2 encountered the black organic peat layer at 2.5 feet below grade, with groundwater entering the excavation at 3 feet below grade.

The peat layer identified in Test Pits 1 and 2 represented a known native soil for the site. Due to the high carbon content of the peat and it's ability to attenuate most contaminates, the peat layer was defined as being the base of any fill activities and potential contaminants at the site. Therefore, subsequent Test Pits were only excavated to the peat layer.

Attachment A contains the Test Pit logs for the eight Test Pits conducted at the site. Attachment B contains photographs of the Test Pit area and Test Pit side walls. Soils encountered during the Test Pit excavating were classified according to the Unified Soil Classification System. Each soil strata was also visually inspected for non-exempt materials per NR 500.08.

Figure 1

SITE PLOT PLAN FOR KELLY LAKES ASSOCIATION

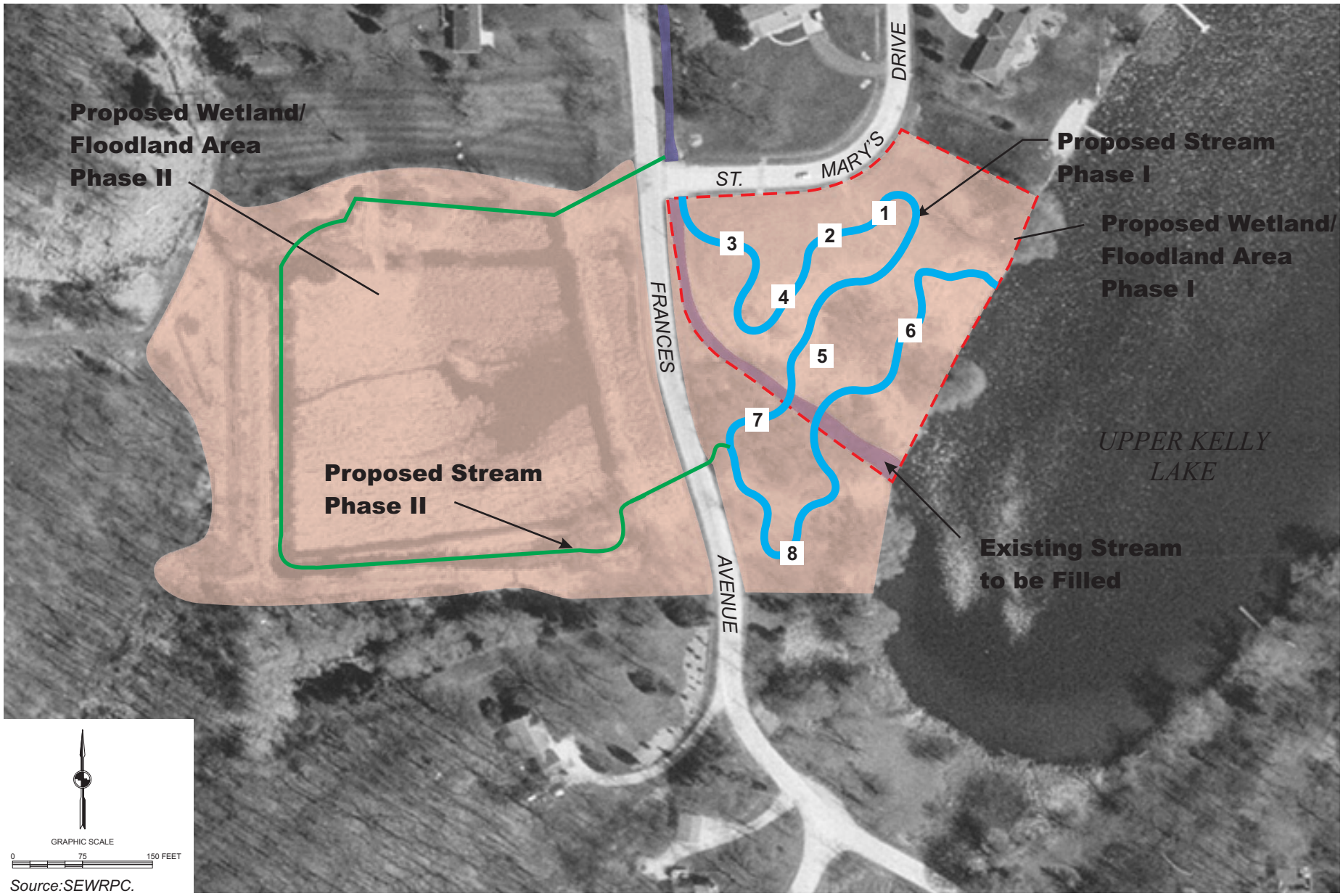


Source:SEWRPC.

DATE OF PHOTOGRAPHIC: MARCH 2000

Figure 2

TEST PIT LOCATIONS FOR KELLY LAKES ASSOCIATION



Source:SEWRPC.

DATE OF PHOTOGRAPHIC: MARCH 2000

Soil samples from each strata encountered were screened in the field with a Photoionization Detector (PID) equipped with a 10.3 millivolt (mV) lamp calibrated for a direct response to 0.0 parts-per-million (ppm) standard air and 100 ppm isobutylene span gas. As part of this screening process, a portion of each sample was transferred into a quart size "Ziploc" plastic bag, and allowed to equilibrate in a relatively warm location for at least one-half hour. After equilibrium, the probe of the PID extension was inserted into the bag and the highest stable reading occurring within 10 to 20 seconds was recorded. PID headspace readings collected during the soil sampling activities are recorded on the Test Pit Log.

SUMMARY

A series of eight (8) Test Pits were excavated within the 4-acre project area. The Test Pits were excavated along the proposed path of the relocated stream. Soils within the Test Pit were classified according to the Unified Soil Classification System, visually inspected for non-exempt NR 500.08 material, and field screened for potential volatile organic contaminants.

NR 500.08 exempt asphalt material (ranging in size from 4-inches to 6-inches) was noted in Test Pit 1 at a depth of between 1-foot and 2-feet below grade. No other non-soil material was encountered in the Test Pit. PID results for the sample collected from this interval did not exhibit any detectable values.

NR 500.08 exempt material was noted on the surface at Test Pit 2 (concrete pieces), Test Pit 4 a 4-foot x 2-foot x 4-inch concrete slab was noted on the surface, and Test Pit 6 small concrete pieces and red bricks were also noted on the surface.

It is believed that all soils encountered above the black, organic peat layer are fill material, exempt under NR 500.08 as clean soil fill. No discoloration of the soils was noted in any of the Test Pits. In addition, none of the soil samples collected for field PID testing exhibited detectable PID values.

No NR 500.08 non-exempt materials were noted in any of the Test Pits or on the surface of the project area.

Recommendations

Based upon the information obtained from the Test Pits at the site, BLS makes the following recommendations for the project site:

- Relocation of the stream be permitted to proceed. No non-exempt NR 500.08 material was encountered within the Test Pits, providing reasonable assurance that contaminated material will not seep out of the new stream channel.

- A soil scientist be present during the stream channel excavation activities to assist in identifying any potentially contaminated or non-exempt material which may be

encountered. **The Test Pit information is only accurate for the location of the Test Pit itself, and conditions may vary across the site.**

Limitations of Liability

This report was prepared under constraints of cost, time, and scope, and reflects a limited assessment and evaluation rather than a full, total, complete, or extensive assessment and evaluation.

Our assessment was performed using the degree of care and skill ordinarily exercised, under similar circumstances, by Professional Consultants practicing in this or similar localities. No warranty or guarantee, expressed or implied, is made as to the conclusions and professional advise included in this report.

The findings of this report are valid as of the present date of the assessment. However, changes in the condition of the property can occur with the passage of time, whether due to natural processes or the works of man and this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation, from the broadening of knowledge, or from other reasons. Accordingly, the findings of this report may be invalidated, wholly or partially, due to changes outside our control.

The interpretations and conclusions contained in this report are based upon the result of independent laboratory tests and analysis intended to detect the presence and/or concentrations of certain chemical constituents in the samples taken from the subject property. BLS has no control over such testing and analyses and therefore disclaims and any responsibility for errors and omissions arising therefore.

A subsurface exploration was performed and presented in this report. However, subsurface exploration cannot reveal totally what is below the surface. Depending upon the sampling method and frequency, every soil condition may be observed, and some materials or layers that are present in the subsurface may not detected.

This report is issued with the understanding that it is the responsibility of the owner(s) to ensure that the information and recommendations contained herein are brought to the attention of the appropriate regulatory agency (ies).

This report has been prepared specifically for Mr. Mike Cascio of the Kelly Lakes Association. Reproduction or distribution of this report should not be performed without the written consent of Mr. Cascio and BLS Environmental, Inc.

ATTACHMENT A

TEST PIT LOGS

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TEST PIT LOG

Test Pit # 1 Site Name: Upper Kelly Lake Date: 12-18-03

Location: SEE Figure Map 2

Geologist: Randy Rogness Company: BLS Environmental Inc.

DEPTH	USCS	DESCRIPTION	TSF	PID
0 6"	CL	Silty Clay - Redish - Brown Color, some fine grained Sand grains, Trace Jagged gravel, No Visual Staining, No odor concrete piece on surface		0
6" 1.0'				0
1.0' 1.5'	CL	Silty Clay - Brownish Color, Soft to medium consistency, fine sand grains, Trace to Some small to midium gravel, Some 4" to 6" Chuncks of Asphalt, No Visual Soil Staining, No odor		0
1.5' 2.0'				0
2.0' 2.5'	CL	Silty Clay - Brownish to Lt. Brown in Color, fine sand grain, at 42" a Coarse Sand lenze, H2O seeping Through, this H2O is clear, No Sheen, No odor, No Visual Staining, No odor on this Stata		0
2.5' 3.0'				0
3.0' 3.5'				0
3.5' 4.0'				0
4.0 4.5'	pt	Peat - Starts at 48" - Black - organic		0
— —		Total Depth of Test Pit 4'6"		
— —				
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TEST PIT LOG

Test Pit # 2 Site Name: Upper Kelly Lake Date: 12/18/03

Location: See Figure Map 2

Geologist: Randy Rogness Company: BLS Environmental Inc.

DEPTH	USCS	DESCRIPTION	TSF	PID
0 6"	SM	Silty Sand - Lt. Brown Color, Trace to Some fines (clay), fine Sand grains, Trace fine to medium gravel, No Visual Stainning, No odor, No H2O		0
6" 12"				0
1.0' 1.5'	CL	Silty Clay - Brown Color, some fine Sand grains, Trace to Some fine to medium gravel, No Visual Stainning, No odor, H2O Seeping in at 30", H2O Cleary No sheen, No odor		0
1.5' 2.0'				0
2.0 2.5'				0
2.5' 3.0'	Pt	Peat - Black Color, Organic		0
— —		Total Depth of Test Pit 3.0'		

TEST PIT LOG

Test Pit # 3 Site Name: Upper Kelly Lake Date: 12/18/03

Location: See Figure Map 2

Geologist: Randy Rogness Company: BLS Environmental Inc.

DEPTH	USCS	DESCRIPTION	TSF	PID
0 6"	CL	Silty Clay - Dark Brown Color, fine sand grains, Trace medium gravel, Trace Organics, No Stain, No odor		0
6" 1.0'	SW GW	Sand & Gravel - fine to Coarse sand grains, fine to Coarse gravel, Trace to some fines (clay), No Visual, no odor on soils, H_2O accumulating at 30", Clear H_2O, No Sheen, No odor		0
1.0' 1.5'				0
1.5' 2.0'				0
2.0' 2.5'	Pt	Peat - Blackish-DK. - Brown in color, organics.		0
		Total Depth of Test Pit 2.5'		

TEST PIT LOG

Test Pit # 4 Site Name: Upper Kelly Lake Date: 12/18/03

Location: See Figure Map

Geologist: Randy Rogness Company: BLS Environmental Inc.

DEPTH	USCS	DESCRIPTION	TSF	PID
0 6"	Pt	Peat - Brown in Color, some organics, a 2" sand seam with gravel, H_2O seeping through this horizon, Clear, No odor.		0
6" 1.0'				0
1.0' 1.5'	Pt	Peat - Black Color, Organics, H_2O Accumulating fast, No sheen, No odor on H_2O, No Stain & No odor on Soil		0
1.5' 2.0'				0
— —		Total Depth of Test Pit 2.0		

TEST PIT LOG

Test Pit # 5 Site Name: Upper Kelly Lake Date: 12/18/03

Location: See Figure Map

Geologist: Randy Rogness Company: BLS Environmental Inc.

DEPTH	USCS	DESCRIPTION	TSF	PID
0 6"	SW	Sand & Gravel - Lt. Brown to Brown color, fine to coarse sand grains, fine to coarse gravel, No visual		0
6" 1.0'	GW	staining & No odors, Soils become		0
1.0' 1.5'		very moist at 20"		0
1.5' 2.0'				0
2.0' 2.5'	Pt	Peat - Black color, organic, very wet,		0
2.5' 3.0'		H20 puddling Quickly, No Sheen, No visual, No odor		0
— —		Total Depth of Test Pit 3.0'		
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TEST PIT LOG

Test Pit # 6 Site Name: Upper Kelly Lake Date: 12/18/03

Location: See Figure Map 2

Geologist: Randy Rogness Company: BLS Environmental Inc.

DEPTH	USCS	DESCRIPTION	TSF	PID
0 6"	CL	Silty Clay - LT. Brown to Brown in color, fine sand grains, Trace to some fine to medium gravel, Trace organics, No visual staining, NO odor ON Soils. Concrete Pieces and Red Brick pieces on surface. H2O accumulating at 32' to 36".		0
6" 1.0'				0
1.0' 1.5'				0
1.5' 2.0'				0
2.0' 2.5'				0
2.5' 3.0'				0
3.0 3.5'	Pt	Peat - Black, organics present, H2O Clear, No Sheen, No odor.		0
3.5' 4.0'				0
— —		Total Depth of Test Pit 4.0'		

TEST PIT LOG

Test Pit # 7 Site Name: Upper Kelly Lake Date: 12/18/03

Location: See Figure Map 2

Geologist: Randy Rogness Company: BLS Environmental Inc.

DEPTH	USCS	DESCRIPTION	TSF	PID
0 6"	—	Sandy loam - Dark Brownish - Black color, fine sand, No gravel, No Stain, No odor		0
6" 1.0'	CL	Silty Clay - Tannish - Brown color, some fine sand grains, Trace To Some medium round gravel, Turns grayish Silver at depth, Stiffer, No foreign objects on Surface or in State Column. No Visual Staining, No odor		0
1.0' 1.5'				0
1.5' 2.0'				0
2.0' 2.5'				0
2.5' 3.0'	Pt	Peat - Blackish color, Organics, H_2O seeping in, H_2O is Clear, H_2O Sheen No Sheen or displays any odor		0
3.0' 3.5'				0
— —		Total Depth of Test Pit 3.5'		

TEST PIT LOG

Test Pit # 8 Site Name: Upper Kelly Lake Date: 12/18/03

Location: Upper Kelly Lake – See Figure Map 2

Geologist: Randy Rogness Company: BLS Environmental Inc.

DEPTH	USCS	DESCRIPTION	TSF	PID
0 6"	—	Sandy loam - fine to medium coarse sand grains, Trace fine gravel, No Visual Stains No odor		0
6" 1.0'				0
1.0' 1.5'	CL	Silty Clay - Silva-grayish color, STIFF, fine sand grains, Trace fine round gravel. A 1" seam of coarse sand and gravel at depth, H2O shown NO signs of a sheen, NO Odor, NO foreign objects from surface to depth		0
1.5' 2.0'				0
2.0' 2.5'				0
2.5' 3.0'				0
3.0' 3.5'				0
— —		Total Depth of Test Pit 3.5'		

ATTACHMENT B

PHOTOGRAPHS

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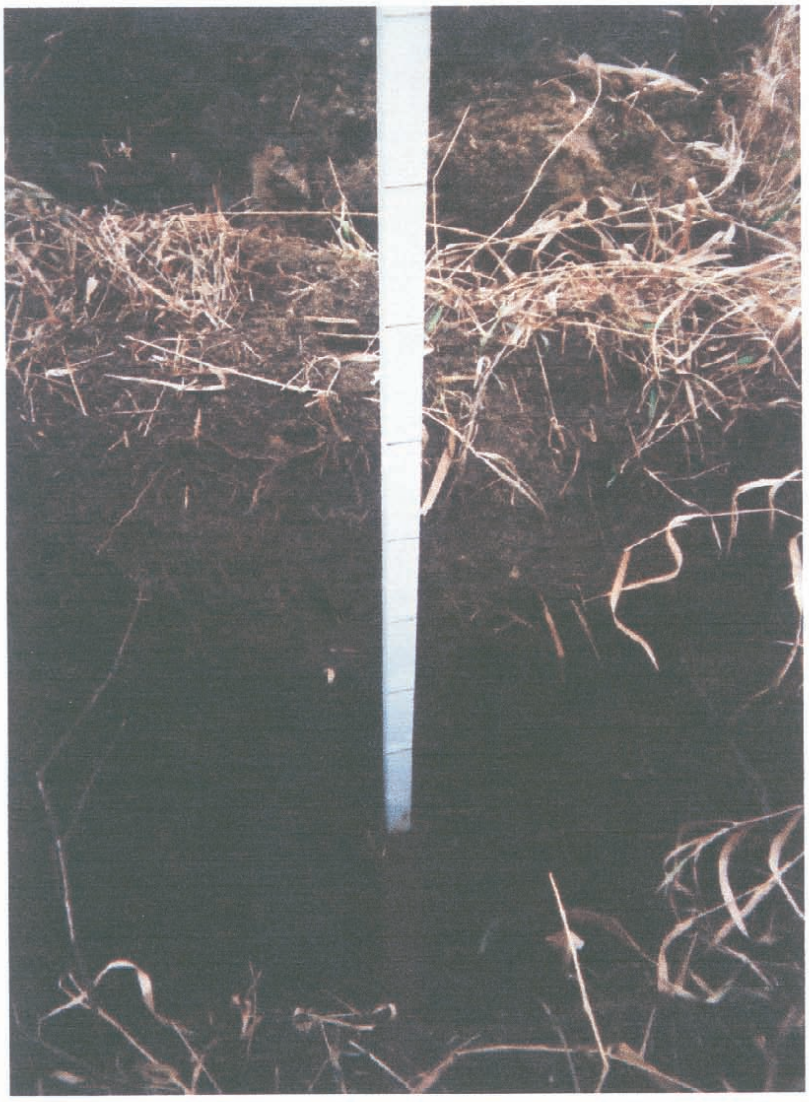
TEST PIT #1 – Note 4" to 6" asphalt pieces. Groundwater encountered at 3.5 feet below grade. See Test Pit Log for soil profile description.

TEST PIT #2 – Concrete pieces on ground surface. No foreign material within soil profile. Groundwater encountered at 3 feet. See Test Pit Log for soil profile description.

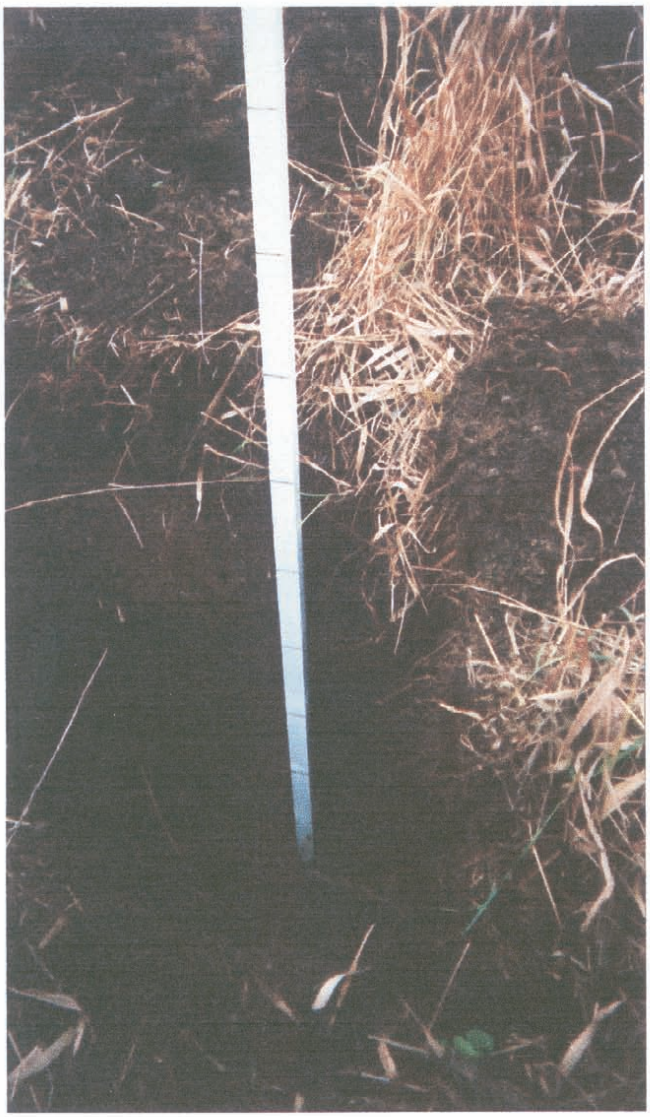
TEST PIT #3 – No foreign material within soil profile. Groundwater encountered at 2.5 feet below grade. See Test Pit Log for soil profile description.

TEST PIT #4 – Concrete slab (3' x 2' x 4") on ground surface. No foreign material within soil profile. Groundwater encountered at 1 foot below grade. See Test Pit Log for soil profile description.



TEST PIT #5 – No foreign material within soil profile. Groundwater encountered at 2 feet below grade. See Test Pit Log for soil profile description.

TEST PIT #6 – Small concrete pieces and red bricks on surface and within soil profile. Groundwater encountered 15" below grade. See Test Pit Log for soil profile description.



TEST PIT #7 – No foreign material in soil profile. Groundwater encountered at 3.5 feet below grade. See Test Pit Log for soil profile description.

TEST PIT #8 – No foreign material within soil profile. Groundwater encountered at 2.5 feet below grade. See Test Pit Log for soil profile description.

Backhoe operator Steve Thelen excavating test pit.

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#92873 v1 - EXHIBIT J
300-1000
TMS/pk
11/13/02

Exhibit J

PHYSICAL CHARACTERISTICS OF THE UPPER KELLY LAKE TRIBUTARY: 2003-04

Location	Description	Bankfull Channel[a]				Low Flow Channel[b]			
		Width (feet)	Depth (feet)		Width/Depth Ratio	Width (feet)	Depth (feet)		Dominant Sediment
			Mean	Max			Mean	Max	
Upstream of project area	About 115 feet upstream of St. Mary's Drive	10.8	2.97	3.08	3.6	8.8	0.89	1.0	Sand/gravel/ cobble
	About 100 feet upstream of St. Mary's Drive	11.7	2.61	2.83	4.5	9.5	0.78	1.0	Sand/boulde r
	About 85 feet upstream of St. Mary's Drive	9.9	1.86	1.92	5.3	7.0	0.07	0.08	Gravel/cobbl e/boulder
	About 70 feet upstream of St. Mary's Drive	9.8	2.67	2.75	3.7	7.6	0.36	0.58	Sand/gravel/ boulder
	About 50 feet upstream of St. Mary's Drive	11.0	2.61	2.67	4.2	7.0	0.11	0.17	Sand/gravel
	About 25 feet upstream of St. Mary's Drive	14.1	3.61	3.67	3.9	12.1	0.53	0.67	Sand/gravel
Subtotals	Minimum	9.8	1.86	1.92	3.6	7.0	0.07	0.08	- -
	Maximum	14.1	3.61	3.67	5.3	12.1	0.89	1.0	- -
	Average	11.2	2.72	2.82	4.2	8.7	0.46	0.58	- -
Within proposed relocated project reach	About 75 feet downstream of St. Mary's Drive	- -	- -	- -	- -	13.1	1.35	1.92	Silt/sand
	About 155 feet downstream of St. Mary's Drive	- -	- -	- -	- -	8.1	1.34	1.72	Silt/sand
	About 210 feet downstream of St. Mary's Drive	- -	- -	- -	- -	14.8	1.15	1.33	Silt/sand
	About 315 feet downstream of St. Mary's Drive	- -	- -	- -	- -	14.6	168	2.01	Silt/sand
	About 365 feet downstream of St. Mary's Drive	- -	- -	- -	- -	16.3	1.66	2.04	Silt/sand
	About 400 feet downstream of St. Mary's Drive					18.1	2.07	2.16	Silt/sand
	About 445 feet downstream of St. Mary's Drive	- -	- -	- -	- -	35.2	1.7	2.01	Silt/sand

Exhibit J (continued)

Location	Description	Bankfull Channel[a]				Low Flow Channel[b]			
		Width (feet)	Depth (feet)		Width/Depth Ratio	Width (feet)	Depth (feet)		Dominant Sediment
			Mean	Max			Mean	Max	
Subtotals	Minimum	- -	- -	- -	- -	8.1	1.15	1.33	- -
	Maximum	- -	- -	- -	- -	35.2	2.07	2.16	- -
	Average	- -	- -	- -	- -	17.2	1.56	1.88	- -

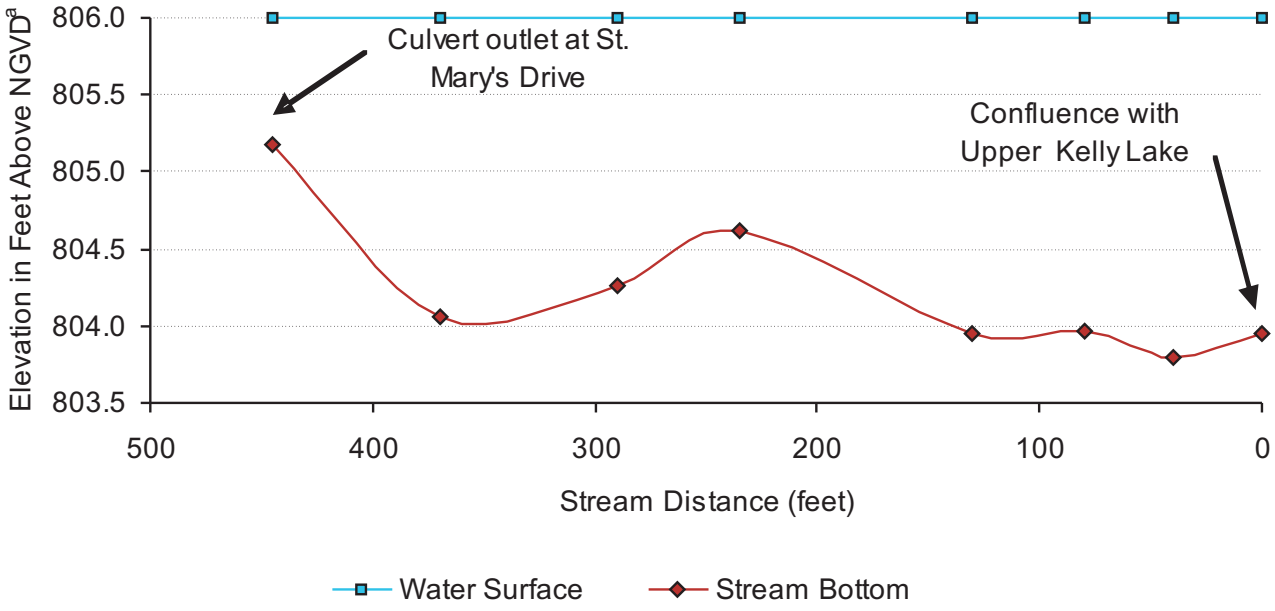
[a]*Bankfull channel is defined by the bankfull discharge, which occurs when water just begins to leave the channel and spread onto the floodplain. The data for the bankfull channel characteristics were obtained by SEWRPC staff on April 18, 2003.*

[b]*Low Flow channel is the portion of the stream that is derived from natural storage i.e., groundwater outflow and the drainage of large lakes and swamps or other source outside the net rainfall that creates surface runoff; discharge in a stream that will sustain aquatic organisms. The flow may vary seasonally. Data for the low flow channel characteristics were obtained by SEWRPC on April 18, 2003, for areas above St. Mary's Drive and January 23, 2004, for areas downstream of St. Mary's Drive.*

Source: SEWRPC.

Exhibit K

EXISTING ELEVATION PROFILE FOR THE UPPER KELLY LAKE TRIBUTARY: JANUARY 2004



[a]NGVD is defined as the National Geodetic Vertical Datum. For a description of benchmark elevation survey locations, see Exhibit G in this document.

Source: SEWRPC.

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#83734 V1 - LEITHOFF/EXHIBIT L
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Exhibit L

STREAMBANK BIOENGINEERING GUIDE

Source: *Bentrup, G, Hoag, C. The Practical Streambank Bioengineering guide, Wisconsin United States Department of Agriculture,* ***http://plant-materials.nrcs.usda.gov/pubs/idpmcpustguid.pdf****, May 1998.*

Additional References: *Eubanks, C.E.Meadows, D. A soil bioengineering guide for Streambank and Lakeshore Stabilization United States Department of Agriculture Forest Service.* ***<http:// http://www.fs.fed.us/publications/soil-bio-guide/>****.*

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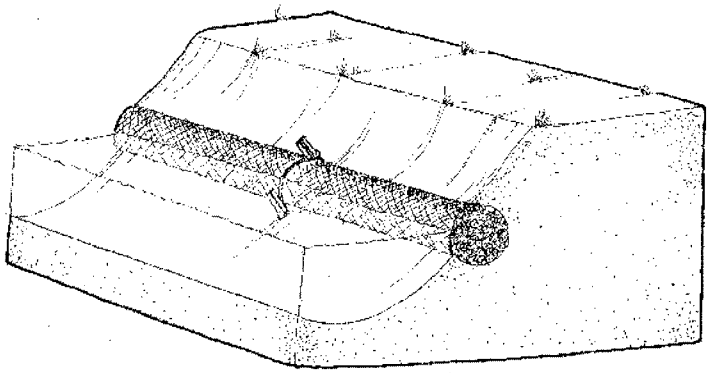
FIBERSCHINE



Materials:

- fiber rolls or biologs
- 10-12 gauge wire
- wood stakes
- sledgehammer
- 2 person minimum

Description and Use

This technique uses a coconut-fiber roll product to protect the streambank by stabilizing the toe of the slope and by trapping sediment from the sloughing streambank. Cuttings and herbaceous riparian plants are planted into the fiberschine and behind it. By the time the fiberschine decomposes, riparian vegetation will have stabilized the streambank.

How to Install

1. Determine the length of treatment area and acquire the necessary amount of fiberschines from a supplier. Common tradenames for fiberschines include Biologs and Fiber Rolls. Be sure to order enough fiberschine to allow for a 5 foot extension past each end of the treatment area.
A list of suppliers can be obtained from the International Erosion Control Association listed in the Resource section of this guide. Fiberschines can be purchased in various diameters, with the 12 inch diameter being one of the more popular sizes.

2. Place the fiberschine along the toe of the streambank at approximately the low flow line. Submerge the fiberschine so that approximately ½ the fiberschine is below the water line. Place other fiberschines along the bank. Tie the ends of adjacent fiberschines together with strong twine.

3. It is critical to key the ends of the fiberschine into the bank to prevent flows from getting behind it. Both ends should then be protected with something hard such as rock to prevent the ends from being scoured.

4. Secure the fiberschine with 24 to 36 inch long wedge-shaped wooden stakes on both sides of the fiberschine at 5 foot intervals. Cut a 3/4" deep notch in each stake about 5" from the top. Tie twine or wire around each pair of stakes at the notches. Drive the stakes in so that the twine is secured against the top of the fiberschine.
Another option for securing the fiberschines is to use cable and soil anchors. This method will probably secure the fiberschine more firmly into the streambank.

5. Backfill behind the fiberschine by knocking down the top of the streambank onto the fiberschine.

6. Plant herbaceous wetland plants or willows into and behind the fiberschine. Herbaceous plants should be planted approximately 0.5-1 foot on center (see other Technique Sheets).

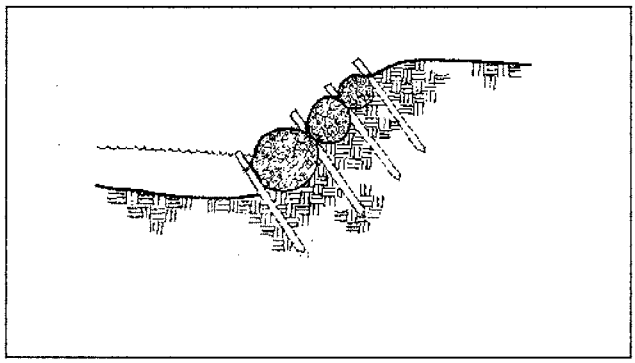
FIBERSCHINE

Inventory & Planning Considerations

1. Installation of the fiberschine can usually be accomplished throughout the year. High water periods should be avoided for safety reasons.

2. The fiberschine should extend upstream and downstream past the eroded area being treated to prevent flows from getting behind the fiberschine. Analysis and calculations may reveal that additional toe protection is necessary[1]. In many cases, rock may be appropriate if placed properly.
Improperly placed rock can result in erosion problems on the opposite streambank as well as downstream.

3. Be sure to key the upstream and downstream end of the fiberschine into the streambank and secure it with some hard materials such as tree trunks or large rocks.



Tiered Fiberschine Construction

4. If this method is used in a highly erodible area and bank shaping is not possible, a tiered fiberschine technique may be necessary. Three fiberschines of different diameters are often used but various numbers and combinations of sizes can be used.

5. Never disturb the site unnecessarily. Remember the goal is to stabilize a site. The less it is disturbed, the easier it will be to restore.

Management

To ensure the highest success for the treated area, determine the land management practices that created the eroded streambanks and modify those land use practices necessary.

If the area is grazed, restrict livestock from treated areas to allow the eroded section of streambank to heal. Exclosure fences are the most efficient means to accomplish this goal. Managers should resist the temptation to put the exclosure fences at the high water line. The exclosure areas should include enough of the riparian zone to allow the stream to shift naturally over time.

If the area is farmed, a riparian buffer strip should be established and maintained. A buffer strip on both sides of the stream should be set aside to allow for natural riparian vegetation and stream function. A wider buffer strip is strongly encouraged and will yield greater benefits.

Check with your local NRCS district conservationist for cost-share programs and volunteers for fencing, planting, and other restoration activities.

Finally, a stream is an interconnected system and landuse practices both upstream and downstream will affect the success of your bioengineering work. Talk with your neighbors and work together to create a healthier riparian and stream system that can benefit everyone.

Monitoring & Maintenance

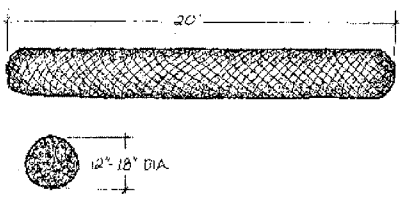
Do not ignore the project after it has been installed. Periodic monitoring of the project will provide valuable insight into the stabilization process and may offer important information for future projects. Periodic maintenance includes checking on the fiberschine to ensure that the posts and wire are holding the fiberschine in place. Additional native plantings may be necessary to accelerate the healing process.

FIBERSCHINE

Fiberschine Installation Procedure

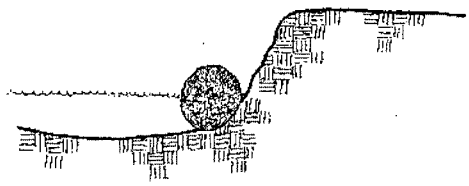
Step One: Acquisition of fiberschines

Acquire the amount of fiberschines needed for the project.



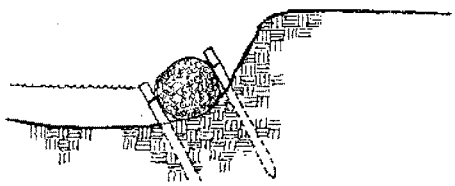
Step Two: Excavate Trench

Place fiberschine at the toe of the streambank at the low water line. Key in the ends of the fiberschine. See "How to Install".



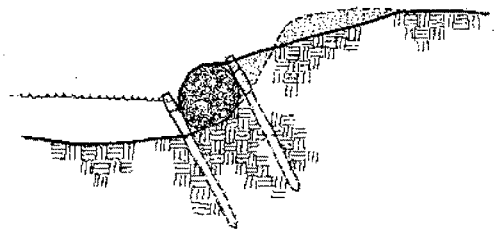
Step Three: Secure fiberschines

Drive notched wooden stakes at 5' intervals on each side of the fiberschine. Tie twine between each pair of notched stakes. Drive stakes in until twine is tight across the top of the fiberschine.



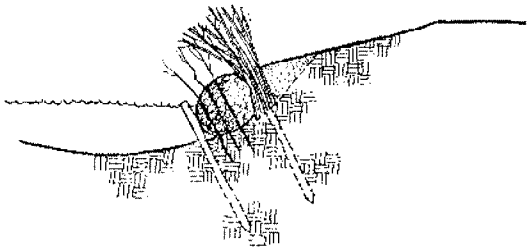
Step Four: Backfill

Backfill behind the fiberschine.



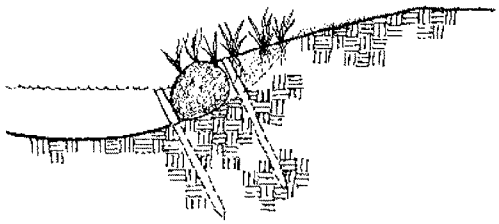
Step Five: Willow Plantings

Willow cuttings should be planted into and behind the fiberschine before backfilling.

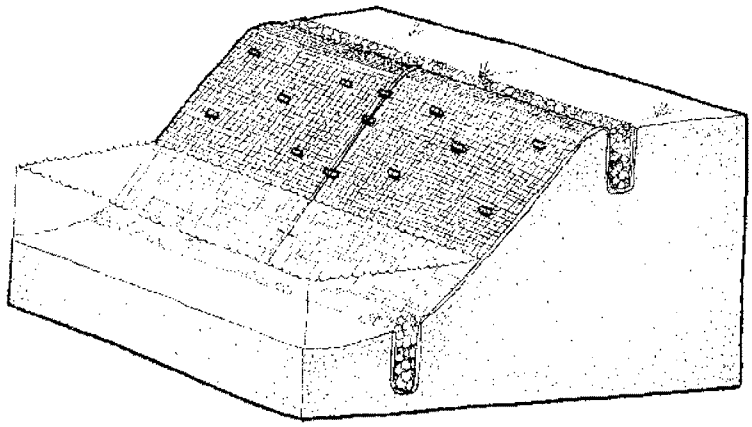


Step Six: Herbaceous Wetland Plantings

Herbaceous wetland plants should be planted into the roll and the soil after backfilling. Make sure the root systems are in saturated soil.



EROSION CONTROL FABRIC



Materials:

- erosion control fabric
- shovel
- sledgehammer
- wedge-shaped wood stakes
- 1 person minimum

Description and Use

Erosion control fabrics are commercially-available products that can be used to prevent erosion on slopes until vegetation establishes and has a chance to stabilize the slope. The fabrics are constructed of a variety of materials from coconut fiber or jute to straw mulch encased in plastic netting. For stream applications, a tightly woven coconut fiber blanket is the most durable option. Woody cuttings and herbaceous plants can be planted into the fabric and seed can be placed underneath the fabric. By the time the blanket decomposes (usually 2 to 5 years depending on local climate), vegetation will have significantly stabilized the streambank.

NOTE: Although this technique can be used by itself in a stream system, it is probably best to use this material with other techniques.

How To Install

Determine the square footage of the treatment area and acquire the necessary amount of fabric from a supplier. Order extra material to allow for overlap. A list of suppliers can be obtained from the International Erosion Control Association.

1. Seed the streambank with native herbaceous seed and rake to ensure good seed-soil contact. Fabrics are most effective on slopes that are no steeper than 2H:1V.

2. Excavate two trenches, one at the toe of the slope and the other at the top of the bank. The trench at the toe should be 12 inches deep and 6 to 8 inches wide. The trench at the top of the bank should be located at least a foot from the edge and should be 12 inches deep and 6 to 8 inches wide.

3. A key trench at the upstream end should be excavated perpendicular to the flow, connecting the ends of the other trenches (See illustrations).

4. The fabric should be placed on the streambank with the ends of the fabric in the trench so that the fabric is touching the three sides of the trench. Use a wedge-shaped wood stake to secure the fabric to the bottom of the trench.

5. Continue to cover the rest of the streambank with the fabric blanket. Install the blankets so the edge overlaps are shingled away from the direction of the current. Overlap the blanket edges approximately 12 inches and secure with wedge-shaped wooden stakes. Secure the blanket to the slope according to manufacturer specifications. Usually, a triangular spacing of 24" on center is suitable for stream applications. The upstream end of the blanket should be keyed into the final trench.

6. Backfill the trenches with excavated soil or small cobble and compact it

EROSION CONTROL FABRIC

Inventory & Planning Considerations

1. An important step with this technique is to ensure the upstream and downstream ends of the erosion control blanket are well keyed into the bank to prevent high flows from pulling the blanket out. Cobble should be placed in the key trenches to prevent the fabric from being pulled out.

2. Another important step is where the fabric overlaps, it should be shingled away from the direction of the current to prevent flows from pulling at the fabric.

3. Never disturb the site unnecessarily. Remember the goal is to stabilize a site. The less it is disturbed, the easier it will be to restore.

Management

To ensure the highest success for the treated area, determine the land management practices that created the eroded streambanks and modify those practices as necessary.

If the area is grazed, restrict livestock from treated areas to allow the eroded section of streambank to heal. Exclosure fences are the most efficient means to accomplish this goal. Managers should resist the temptation to put the exclosure fences at the high water line. The exclosure areas should include enough of the riparian zone to allow the stream to shift naturally over time.

If the area is farmed, a riparian buffer strip should be established and maintained. A buffer strip on both sides of the stream should be set aside to allow for natural riparian vegetation and stream function. A wider buffer strip is strongly encouraged and will yield greater benefits.

Check with your local NRCS district conservationist for cost-share programs and volunteers for fencing, planting, and other restoration activities.

Finally, a stream is an interconnected system and land use practices both upstream and downstream will affect the success of your bioengineering work. Talk with your neighbors and work together to create a healthier riparian and stream system that can benefit everyone.

Monitoring & Maintenance

Do not ignore the project after it has been installed. Periodic monitoring of the project will provide valuable insight into the stabilization process and may offer important information for future projects.

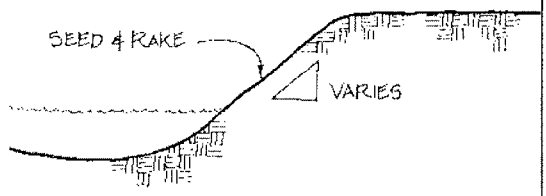
Periodic maintenance includes making sure the staples and key trenches are still securing the fabric blanket to the streambank. The upstream end should be carefully checked to make sure flows are not getting behind the blanket.

EROSION CONTROL FABRIC

Erosion Control Installation Procedure

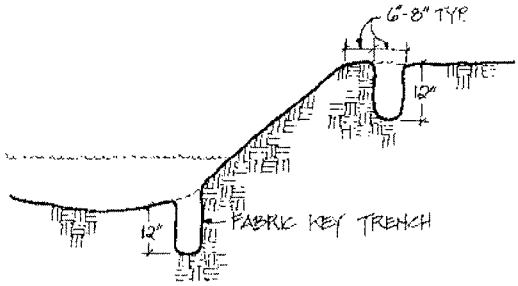
Step One: Seeding

Seed the streambank with native herbaceous seed and rake in to ensure good seed-soil contact. Slope varies-See "How to Install".



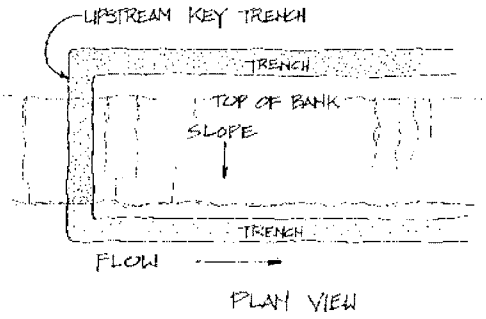
Step Two: Excavate Trench

Excavate two trenches as shown.



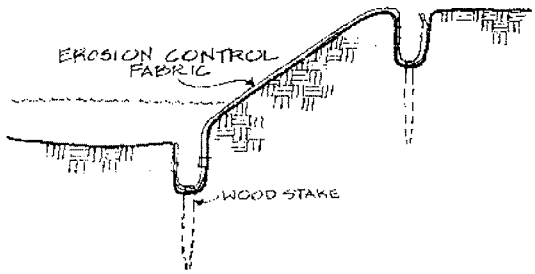
Step Three: Upstream Key Trench

Excavate an upstream key trench perpendicular to flows.



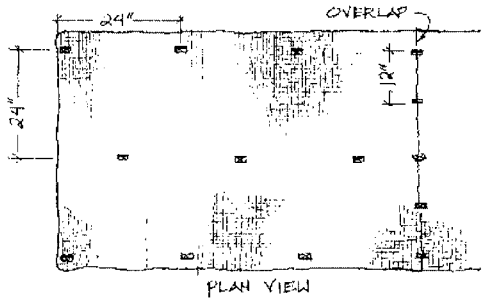
Step Four: Fabric Placement

Place fabric on streambank and in trenches and secure with a wedge-shaped wooden stake..



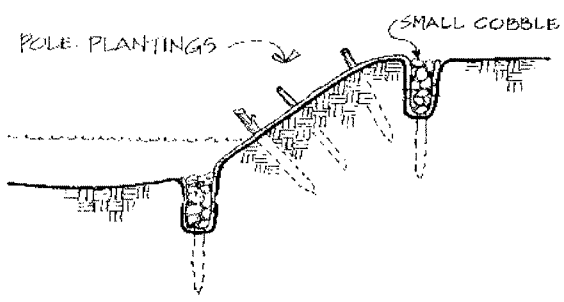
Step Five: Suggested Stake Layout

After laying out the blanket, secure the fabric with wedge-shaped wooden stakes according to manufactures specs or suggested pattern.

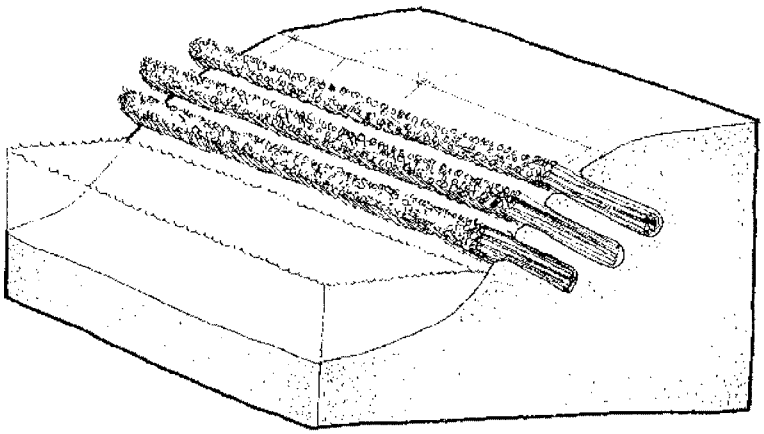


Step Six: Backfill

Backfill all trenches with excavated soil or small cobble and compact it.



BRUSH LAYERING



Materials:

- willow cuttings
- clothesline cord or wire
- chainsaw or loppers (to harvest willow)
- shovel
- 1 person minimum

Description and Use

This technique uses bundles of willow cuttings (Salix spp.) in buried trenches along the slope of an eroding streambank. This willow "terrace" is used to reduce the length of slope of the streambank. The willow cuttings will sprout and take root, thus stabilizing the streambank with a dense matrix of roots. Some toe protection such as a wattle, fiberschine, or rock may be necessary with this technique.

How To Install

1. Harvest willow cuttings from a local, native stand that is in healthy condition taking no more than 2/3 of each plant. Cuttings should be at least a 1/2 inch diameter or larger to ensure an adequate supply of stored energy for rooting, but there should be a good mixture of various sizes. This is to ensure better entrapment of sediment which will promote better root growth.

Ideally, cuttings should be collected during the dormant season to ensure the highest success rate. Cuttings can be collected during the growing season if all the leaves are removed from the stem, although establishment success will be lowered. Spring plantings are more successful than fall plantings.

2. The cuttings may be tied into bundles to facilitate transportation to the project site. The terminal bud should be removed so that stem energy will be re-routed to the lateral buds for more efficient root and stem sprouting.

3. Soak the bundles for 4 to 5 days.

4. Toe protection if needed should be installed prior to excavation. Excavate a horizontal trench into the streambank along the length of the area to be treated. The trench should be located between the annual low and high water levels. The trench should be approximately 2 to 3 feet deep and the back portion must reach the permanent water table. The surface of the trench should be sloped 10 to 20 degrees such that the outside edge is higher than the inside.

5. Cut the twine on the bundles and place the cuttings in the trench. Make sure the basal cut ends reach the back of the trench. Spread the cuttings in the trench until desired thickness is achieved. In general, the thicker and denser the cuttings, the better the technique will work.

6. Slough the bank down on to the cuttings and pack the soil into the cuttings. To remove air pockets around the cuttings, water the soil when backfilling. The cuttings should extend no more than 12 to 18 inches from the bank to prevent them from being ripped out during high flows. Trim off the excess.

7. Create another terrace for cuttings behind the first layer as shown in the illustrations. Repeat the trenching and layering process until the streambank is sufficiently covered with brush layers.

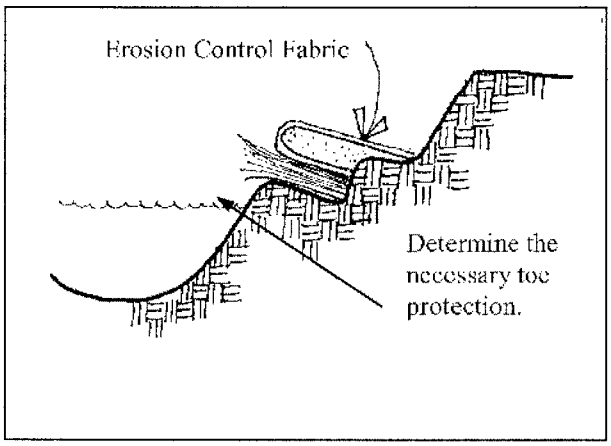
BRUSH LAYERING

Inventory & Planning Considerations

1. Coyote willow (Salix exigua) is a particularly good species for this method because of its' dense rooting system. This technique can also be used with a mixture of redoiser dogwood (Cornus sericea) and willow but to encourage rooting in the dogwood, the stems will need to be manually nicked or cut and treated with rooting hormone.

2. A critical inventory step is to determine the availability of moisture for the cuttings. This technique is best applied to areas with bank seepage to supply enough moisture for the cuttings. In our semi-arid to arid region, the upper portion of the streambank may not have enough permanent moisture to establish the cuttings, and thus, other techniques may be required.

3. Another critical step with this technique is to determine if toe protection is necessary. Analysis and calculations will provide some guidance[1]. In many cases rock will be necessary to provide adequate protection. In addition to toe protection, erosion control fabric can be used to protect the soil.



Brush Layering with Erosion Control Fabric

4. Give careful attention to the upstream and downstream ends of the treatment area to prevent flows from getting behind the layers. Tying into existing features on site such as trees and rocks or the additional placement of brush and rocks are possible solutions.

Management

To ensure the highest success for the treated area, determine the land management practices that created the eroded streambanks and modify those practices as necessary.

If the area is grazed, restrict livestock from treated areas to allow the eroded section of streambank to heal. Exclosure fences are the most efficient means to accomplish this goal. Managers should resist the temptation to put the exclosure fences at the high water line. The exclosure areas should include enough of the riparian zone to allow the stream to shift naturally over time.

If the area is farmed, a riparian buffer strip should be established and maintained. A buffer strip on both sides of the stream should be set aside to allow for natural riparian vegetation and stream function. A wider buffer strip is strongly encouraged and will yield greater benefits.

Check with your local NRCS district conservationist for cost-share programs and volunteers for fencing, planting, and other restoration activities.

Finally, a stream is an interconnected system and land use practices both upstream and downstream will affect the success of your bioengineering work. Talk with your neighbors and work together to create a healthier riparian and stream system that can benefit everyone.

Monitoring & Maintenance

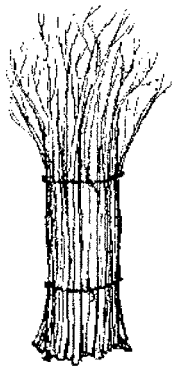
Do not ignore the project after it has been installed. Periodic monitoring of the project will provide valuable insight into the stabilization process and may offer important information for future projects.

Periodic maintenance includes making sure the streambank is not eroding close to the side of the trench. It may be determined that some additional protection is necessary to allow more time for the cuttings to take root and stabilize the streambank.

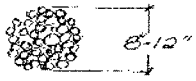
BRUSH LAYERING

Brush Layering Installation Procedure

Step One: Acquire Willow



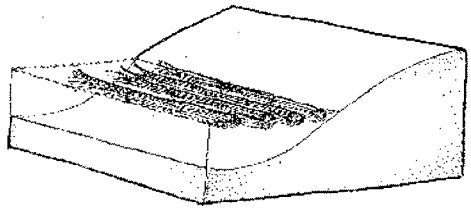
Harvest the willows and remove terminal bud.



Tie cuttings into bundles using 2 pieces of twine to facilitate transportation.

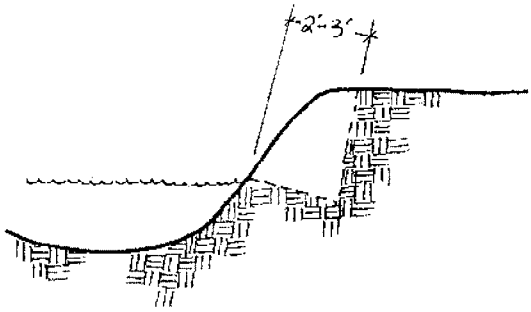
Step Two: Soak Willow Bundles

Soak the bundles for 5 to 7 days before planting. Remove from water before roots emerge.



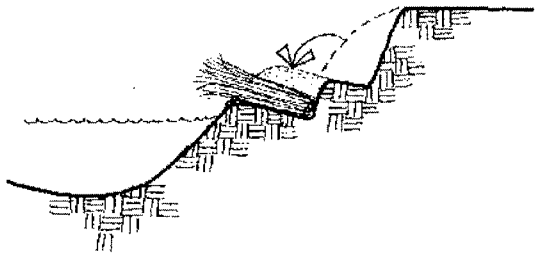
Step Three: Excavate Trench

Install the selected toe protection. Excavate the trench and make sure the trench slopes back..



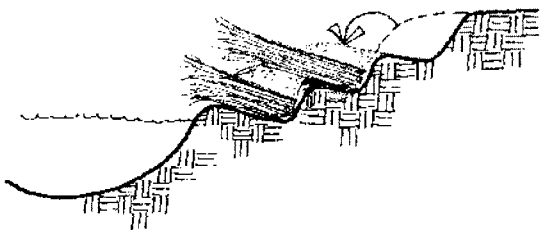
Step Four: Layer Placement

Lay out the cuttings along the trench and slough the bank onto the cuttings. Work the soils into the cuttings.



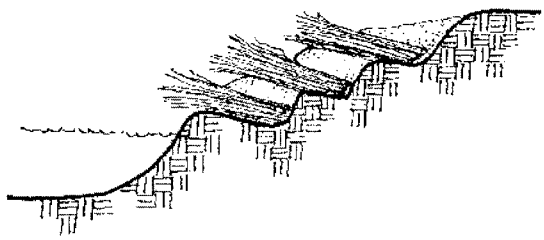
Step Five: 2nd Layer Placement

Create another terrace as shown and place the cuttings. Slough the bank on to the cuttings.

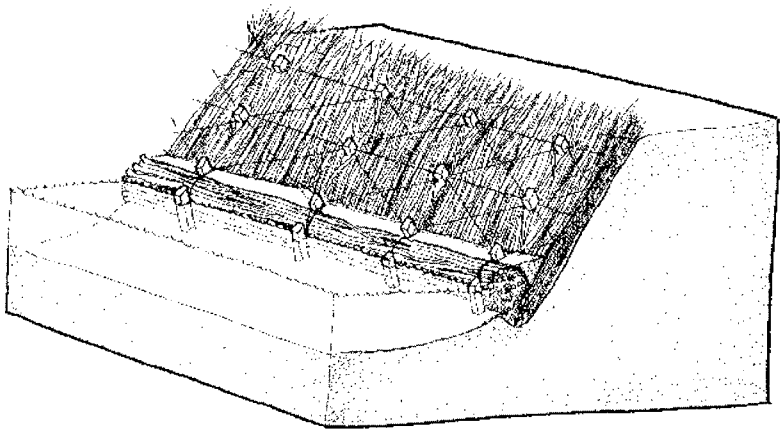


Step Six: 3rd Layer Placement

Repeat the process until the final layer is placed.



BRUSH MATTRESS



Materials:

- willow cuttings
- clothesline cord or wire
- chainsaw or loppers (to harvest willow)
- shovel
- 10-12 gauge wire
- wood stakes
- 2 person minimum

Description and Use

This technique uses a mat of willow cuttings along the slope of an eroding streambank. The cut ends of the willows are placed in a trench at the toe of the slope and are anchored with a wattle (See other techniques). A grid of wire and wooden stakes is used to secure the mat to the slope. The willow cuttings will sprout and take root, thus stabilizing the streambank with a dense matrix of roots.

How To Install

See Willow Wattle/Fascine techniques for information on collecting willow cuttings for the wattle and brush mattress.

1. Prepare the slope of the streambank by clearing away large debris, however, do not remove woody debris from the stream channel because this provides important fish habitat. The brush mattress technique is probably most effective on slopes no steeper than 2H:1V. Excavate a horizontal trench, 8 to 12 inches deep, at the toe of the streambank along the length of the area to be treated.

2. Place willow cuttings in the trench. Make sure the cut ends reach the bottom of the trench. Spread the cuttings along the face of the slope until a thickness of 4 to 6 inches is achieved.

3. Pound in a grid of 24 to 36 inch long wooden stakes into the mattress every 3 to 4 foot centers (See illustrated procedure). Use longer stakes in less cohesive soil. Secure the brush mattress by using 10-12 gauge galvanized annealed wire or clothesline cord tied in horizontal runs and then diagonally between each row of stakes. Tie the wire to the stakes in such a manner that if the wire breaks between two stakes, the integrity of the remaining wiring is maintained.

4. After wiring the mattress, drive the stakes in further to compress the mattress tightly against the streambank.

5. Construct a wattle the length of the area to be treated (refer to Willow Wattle techniques). Make sure the wattle is tightly tied together. Place the wattle in the trench over the cut ends of the brush mattress. Secure the wattle with 18 to 48 inch long wedge-shaped wooden stakes every 5 feet as shown the illustrated sequence. Use longer stakes in less cohesive soil. In some instances, a rock toe may be used instead of a willow wattle to anchor the cut ends of the mattress.

6. Backfill around the wattle and mattress by using material excavated from the trench, making sure to work soil into the branches. Use buckets of water to wash the soil down into the stems. Key the upstream end of the mattress and wattle into the streambank to prevent high flows from getting behind the mattress. It is a good idea to protect this area with some revetment, large rocks, or tree trunks.

BRUSH MATTRESS

Inventory & Planning Considerations

1. Make sure the upstream end of the wattle and mattress is keyed back into the bank to prevent high flows from scouring behind the mattress. Brush revetment, rock barbs, large rocks, and tree trunks can be used in front of this area to protect the mattress.

2. Be sure to pound in the stakes after wiring the mattress in order to compress the mattress tightly against the streambank.

3. Coyote willow (Salix exigua) is a particularly good species for this method because of its' dense rooting system.

4. Rooting hormones and fertilizers do not significantly improved success compared to the cost of the materials.

5. Never disturb the site unnecessarily. Remember the goal is to stabilize a site. The less it is disturbed, the easier it will be to restore.

Saw a 2 x 4 diagonally to produce 2 stakes. The length will vary based on soil conditions. Use longer stakes in less cohesive soil(i.e. sandy soils).

Management

To ensure the highest success for the treated area, determine the land management practices that created the eroded streambanks and modify those practices as necessary.

If the area is grazed, restrict livestock from treated areas to allow the eroded section of streambank to heal. Exclosure fences are the most efficient means to accomplish this goal. Managers should resist the temptation to put the exclosure fences at the high water line. The exclosure area should include enough of the riparian zone to allow the stream to shift naturally over time.

If the area is farmed, a riparian buffer strip should be established and maintained. A buffer strip on both sides of the stream should be set aside to allow for natural riparian vegetation and stream function. A wider buffer strip is strongly encouraged and will yield greater benefits.

Check with your local NRCS district conservationist for cost-share programs and volunteers for fencing, planting, and other restoration activities.

Finally, a stream is an interconnected system. Land use practices both upstream and downstream will affect the success of your bioengineering work. Talk with your neighbors and work together to create a healthier riparian and stream system that can benefit everyone.

Monitoring & Maintenance

It is important to monitor the project after it has been installed. Periodic monitoring of the project will provide valuable insight into the stabilization process and may offer important information for future projects.

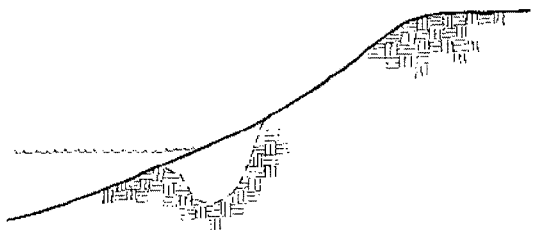
Periodic maintenance includes making sure the stakes and wire are still securing the mattress to the streambank. The upstream end should be carefully checked to make sure flows are not getting behind the mattress.

BRUSH MATTRESS

Brush Mattress Installation Procedure

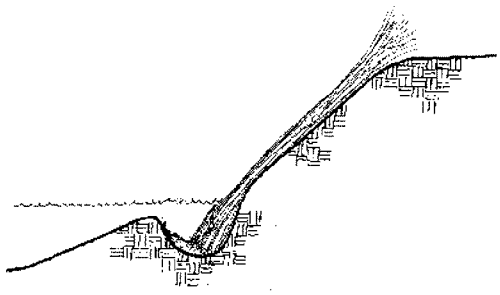
Step One: Excavate Trench

Willow collection, soaking and wattle construction should occur prior to excavation of the trench. See "How to Install".



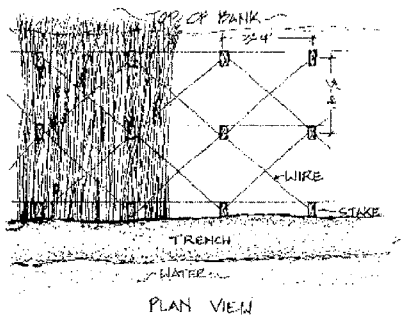
Step Two: Mattress Placement

Place willows in the trench, making sure the cut ends reach the bottom.



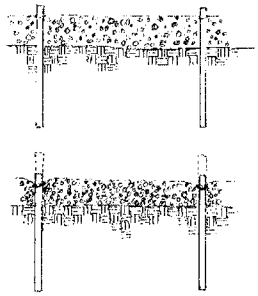
Step Three: Stake Placement and Wiring

Establish a gird of wedge-shaped wooden stakes and wire as shown.



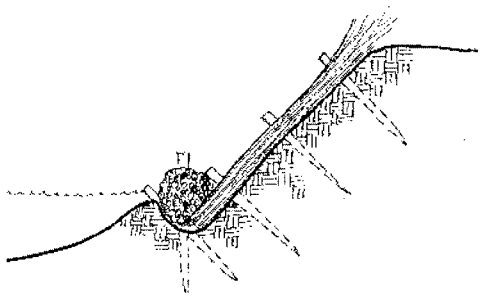
Step Four: Mattress Compression

After wiring the mattress, drive the stakes in further to compress the mattress against the streambank.



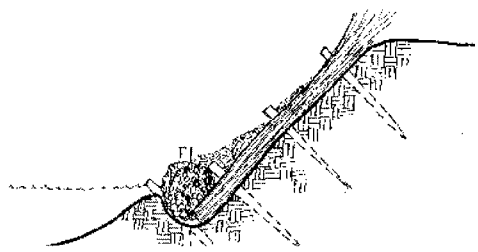
Step Five: Secure Wattle

Place wattle in trench. Secure wattle with 2 wedge-shaped wooden stakes as shown

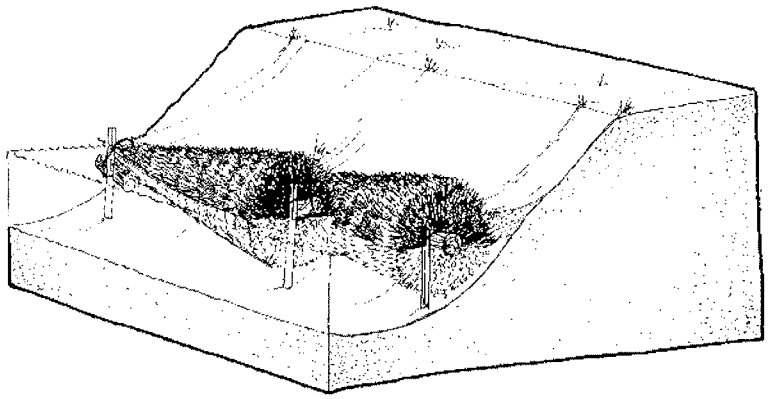


Step Six: Backfill

The mattress and wattle should be partially covered with soil, making sure to work the soil into the voids. Leave parts of the blanket exposed for sprouting.



BRUSH OR TREE REVETMENT



Materials:

- dead/live brush or trees such as junipers or hawthorns
- 10-12 gauge wire
- poly rope
- 7-1/2'metal T-posts
- wire cutters
- post pounder
- chainsaw (for cutting brush)
- 2 person minimum

Description and Use

Brush or trees are secured to the streambanks slow excessive erosion by diverting the current away from the bank edge's. The revetment also traps sediment from the stream and sloughing streambank and provides overhead cover for fish habitat. The revetment material does not need to sprout (most species used will not). Always plant live willows or other quickly sprouting species behind the revetment to provide permanent cover and roots.

How To Install

1. Collect trees or brush and stage at treatment area. Use trees with dense branching such as junipers, because they will collect more sediment. Place the first tree with the stump pointing upstream at the top of the treatment area along the top of the bank. Overlap the next tree trunk into the main branches of the first one. Continue this process until a linear row of brush the length of the treatment area is created.

2. Secure the revetment together by tightly wiring at the overlap sections. Overlap by about 1/3 at each end. Wire main trunks together, leaving branches loose.

3. Pound temporary T-posts along the top of the streambank behind the revetment every 12 to 15 feet. At each post, tie an 8 to 10 foot section of rope to the revetment and wrap it around the post.

4. Pound a permanent T-post at the toe of the slope of the streambank at the upstream end of the treatment area. Lower the upper end of the revetment and secure it to the post in stream with wire.

5. Lever the revetment into the stream, while using the rope at each of the posts to control placement and to secure it temporarily. Continue the process until revetment is placed along the streambank.

6. Pound T-posts on the outside edge (stream side) of the revetment at overlap areas. Secure the revetment to posts with wire. Remove rope and temporary posts on the top of the streambank.

7. Fill in the space between the streambank and revetment with additional branches or wattles to form a dense matrix of brush.

8. (Optional) To enhance recovery of treated area, knock down the sloughing streambank on the revetment to create a more gentle streambank slope. Make sure the revetment has enough brush material to catch the soil. If not, add additional brush before shaping the bank. Willow cuttings or other quickly sprouting species should then be planted on the new slope using techniques such as willow wattles, brush mattress, vertical bundles, or willow pole plantings (see other techniques).

NOTE: Illustrated procedure is shown on page 3. Revetment can be constructed in the water by permanently installing one tree at a time.

BRUSH OR TREE REVETMENT

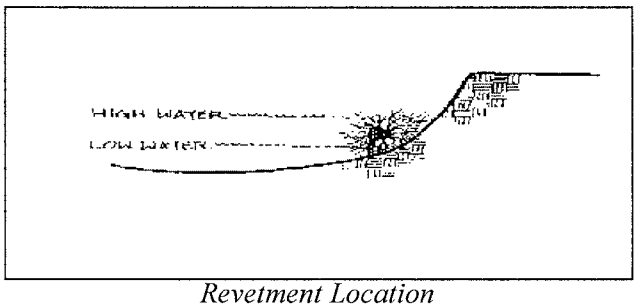
Inventory & Planning Considerations

1. Installation of brush or tree revetment can usually be accomplished throughout the year. For safety reasons, avoid high water periods.

2. Typically, the trunks of the revetment should be placed between the annual low and high water levels.

In areas of extreme fluctuation in water levels, it may be necessary to place a second row of revetment at the high water line in order to prevent scouring behind the revetment during flood events.

3. It is critical that the revetment extend upstream and downstream at least 1 to 3 tree lengths past the eroded area being treated to prevent flows from getting behind the revetment. Key the upstream and downstream ends of the revetment into the bank and reinforced with additional brush or rock. These endpoints are the sections most likely to fail and require substantial protection.



Revetment Location

4. Never disturb the site unnecessarily. Remember that the goal is to stabilize a site. The less it is disturbed, the easier it will be to restore.

Management

To ensure the highest success for the treated areas, determine the land management practices that created the eroded streambanks and modify those land use practices as necessary.

If the area is grazed, restrict livestock from treated areas to allow the eroded section of streambank to heal. Exclosure fences are the most efficient means to accomplish this goal. Managers should resist the temptation to put exclosure fences at the high water line. The exclosure areas should include enough of the riparian zone to allow the stream to shift naturally over time.

If the area is farmed, a riparian buffer strip should be established and maintained. A buffer strip on both sides of the stream should be set aside to allow for natural riparian vegetation and stream function. A wider buffer strip is strongly encouraged and will yield greater benefits for the streambanks and the riparian area as a whole.

Check with your local NRCS district conservationist for cost-share programs, volunteers for fencing, planting, and other restoration activities.

Finally, a stream is an interconnected system. Land use practices both upstream and downstream will affect the success of your bioengineering work. Talk with your neighbors and work together to create a healthier riparian and stream system that will benefit everyone.

Monitoring & Maintenance

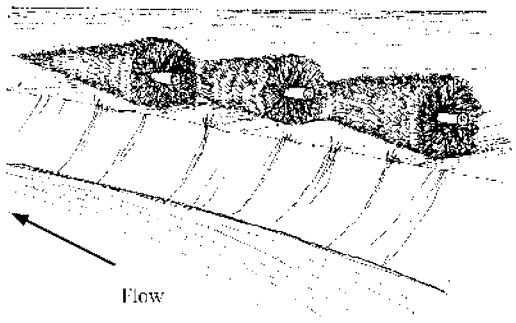
Do not ignore the project after it has been installed. Periodic monitoring of the project will provide valuable insight into the stabilization process and may offer important information for future projects. Periodic maintenance for brush or tree revetment includes checking the revetment to ensure that the posts and wire are holding it in place. If significant erosion is still occurring in sections of the treated area, additional brush should be added to the revetment.

BRUSH OR TREE REVETMENT

Brush or Tree Revetment Installation Procedure – Option A

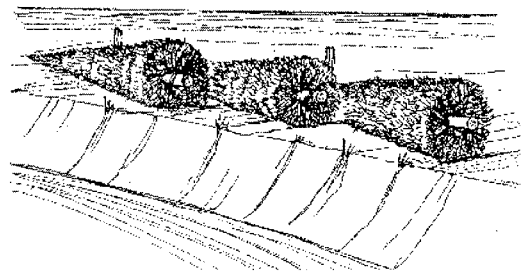
Step One: Harvest & Stage Material

Overlap the trunk of one tree into the main branches of the next tree.



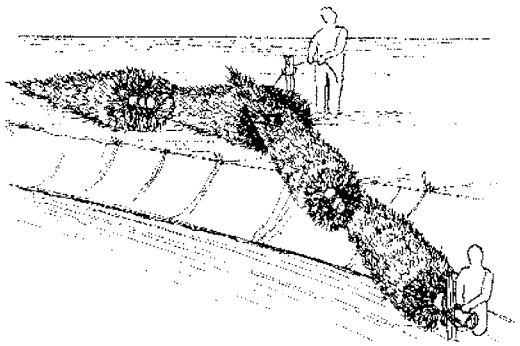
Step Two: Fastening Revetment

Secure the trees together at the main trunks using wire. Place T-posts along the revetment and secure rope from the posts to the revetment



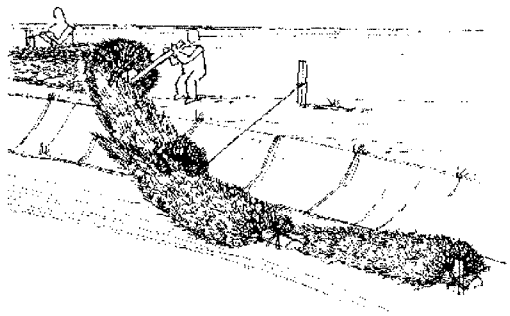
Step Three: Begin Placement

Lower revetment into stream and fasten end of revetment to a T-post placed at toe of bank.



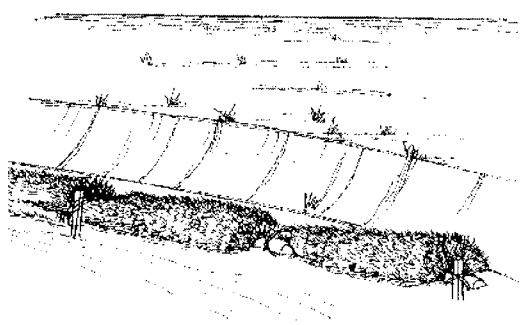
Step Four: Final Placement

Lever the rest of the revetment into the stream, temporarily securing the revetment to the T-posts.



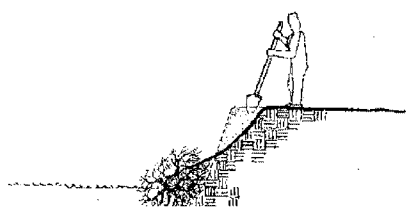
Step Five: Final T-Post Placement

Pound T-posts next to the revetment and secure revetment to posts with wire.



Step Six: Optional Bank Shaping

Streambank can be knocked down on to the revetment. Slope should be seeded with grass and planted with willows.
The slope can also be treated with techniques like brush mattress. See other techniques.

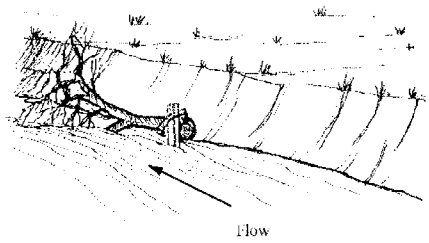


BRUSH OR TREE REVETMENT

Brush or Tree Revetment Installation Procedure – Option B

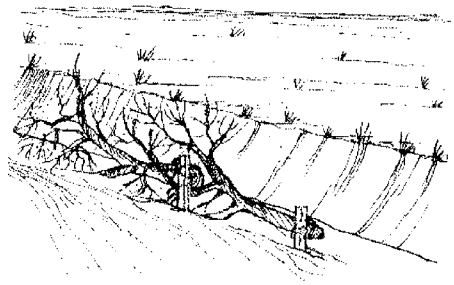
Step One: Placement of First Tree

Pound a T-post at the downstream end and secure the trunk of the first tree to the post using wire.



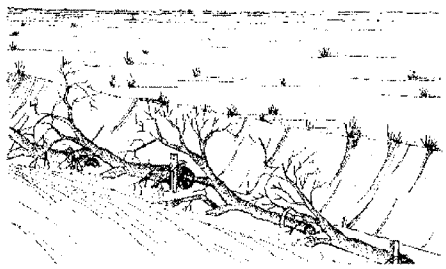
Step Two: Placement of Second Tree

Overlap the second tree onto the first tree so that no large gaps exist. Wire the trunks together.



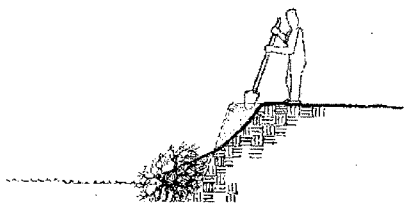
Step Three: Continue Placement

Pound a T-post near the second tree and secure tree to post. Continue placement of trees and posts till area is treated.



Step Four: Optional Bank Shaping

Streambank can be knocked down on to the revetment. Slope should be seeded with grass and planted with willows.
The slope can also be treated with techniques like brush mattress. See other techniques.



How To Install

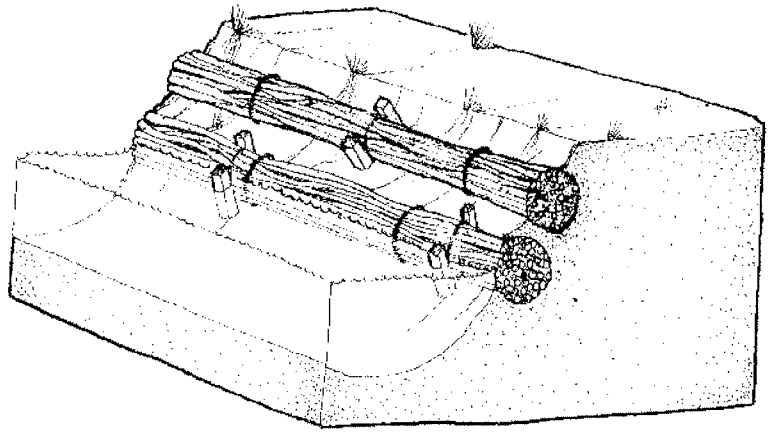
1. Harvest the trees for the revetment and stage near site. Pound a T-post at the downstream end of the site. Secure the first tree to the post with the trunk pointing upstream.

2. Place the second tree so the branches overlap the trunk of the first tree. The goal is to provide for a continuous row of dense branches to protect the streambank. Wire the main trunks together, leaving the branches loose. Pound in another T-post to secure the trunk of the second tree.

3. Continue the process of placing and securing trees until area is treated. Fill in the space between the bank and the revetment with branches to create a dense matrix of brush or willow wattles.

4. (Optional) To enhance recovery of the treated area, knock down the sloughing streambank on to the revetment to create a more gentle streambank slope. Plant willow cuttings on the new slope using techniques such as willow wattles, vertical bundles or willow pole plantings (see other techniques).

WILLOW WATTLES OR FASCINES



Materials:

- willow cuttings
- clothesline cord or wire
- wood stakes
- chainsaw or loppers (to harvest willow)
- shovel
- 1 person minimum

Description and Use

Willow wattles (Salix spp.) or live fascines are cigar or sausage-like bundles of live cuttings tied together and inserted into a shallow trench dug into the streambank. The willow bundles will sprout and take root, thus stabilizing the streambank with a dense matrix of roots. This is a good technique to break up slope length and minimize erosion.

How To Install

1. Harvest willow cuttings from a local stand that is in healthy condition taking no more than 2/3 of each plant. Cuttings should be at least a 1/2 inch diameter or larger to ensure an adequate supply of stored energy for rooting, but there should be a good mixture of various sizes. This is to ensure better entrapment of sediment that will promote better root growth.
Ideally cuttings should be collected during the dormant season to ensure the highest success rate. Cuttings can be collected during the growing season if all the leaves are removed from the stem, although establishment success will be lowered.

2. The cuttings can be tied into bundles to facilitate transportation to the project site. The terminal bud should be removed so that energy will be re-routed to the lateral buds for more efficient root and stem sprouting.

3. Soak the bundles for 5 to 7 days before planting.

4. After soaking, the bundles should be laid out in one, long sausage-shaped bundle with the cut ends placed in alternating directions. The bundle should be tied every 18 inches.

5. Excavate a horizontal trench 2/3 the diameter of the wattle in the streambank at approximately the low flow line.

6. Place the wattle in the trench and stake every 3 to 4 feet with 24 to 42 inch wedge-shaped wooden stakes Stake length will depend on soil conditions. Place stakes on both sides of the wattle and wire across the bundle. Backfill around the wattle by knocking the top of the bank on to the wattle, making sure to work soil into the branches.

Often a second wattle is placed up the bank behind the first wattle. If the streambank consists of saturated soils for most of the growing season, a series of wattles can be established up the streambank. However, in the arid and semi-arid regions, there is normally not enough moisture near the surface to establish several layers of wattles. Pole plantings[2] might be a good option behind the initial wattle since the poles will reach the permanent watertable. It should also be noted that some additional toe protection such as rock may be necessary for this technique.

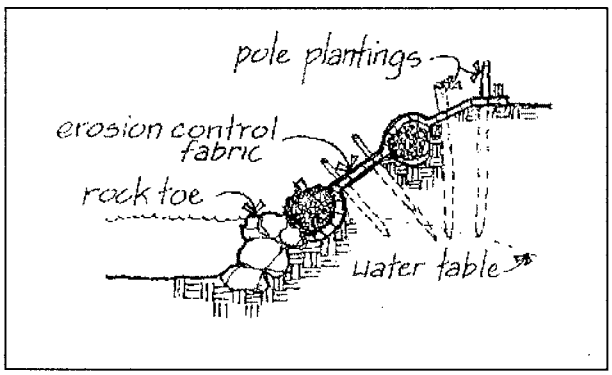
WILLOW WATTLES OR FASCINES

Inventory & Planning Considerations

1. Coyote willow (Salix exigua) is a particularly good species for this method because of its' dense root system. This technique can also be used with a mixture of redoiser dogwood (Cornus spp) and willows. To encourage rooting in the dogwood, the stems need to be manually nicked or cut and treated with rooting hormone.

2. If this method is used in a highly erodible area, some protection should be placed in front of the wattles to prevent scour. Analysis and calculations of forces will provide guidance for suitable toe protection[1]. In some cases, brush revetment or fiberschines may be adequate (see other techniques), while other situations may require rock. If no other protection is used, the wattle should be 12 to 24 inches in diameter.

3. Another variation of this technique is to cover the wattles with erosion control fabric to prevent the soil from being washed away from the wattles.
Secure the fabric under the first wattle. Poles can be planted into the permanent water table between the wattles. The following illustration also shows the use of a rock toe to prevent scour.



Wattles with Fabric and Pole Planting

4. Rooting hormones and fertilizers do not significantly improved success for the cost of the materials.

5. Never disturb the site unnecessarily. Remember that the goal is to stabilize a site. The less it is disturbed, the easier it will be to restore.

Management

To ensure the highest success for the treated area, determine the land management practices that created the eroded streambanks and modify those practices as necessary.

If the area is grazed, restrict livestock from treated areas to allow the eroded section of streambank to heal. Exclosure fences are the most efficient means to accomplish this goal. Managers should resist the temptation to put the exclosure fences at the high water line. The exclosure areas should include enough of the riparian zone to allow the stream to shift naturally over time.

If the area is farmed, a riparian buffer strip should be established and maintained. A buffer strip on both sides of the stream should be set aside to allow for natural riparian vegetation and stream function. A wider buffer strip is strongly encouraged and will yield greater benefits.

Check with your local NRCS district conservationist for cost-share programs and volunteers for fencing, planting, and other restoration activities.

Finally, a stream is an interconnected system and land use practices both upstream and downstream will affect the success of your bioengineering work. Talk with your neighbors and work together to create a healthier riparian and stream system that can benefit everyone.

Monitoring & Maintenance

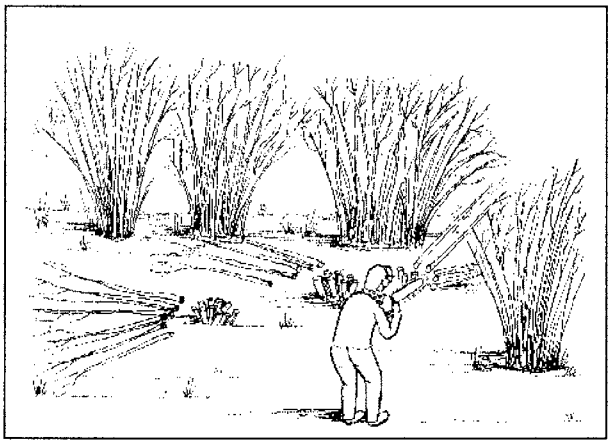
Do not ignore the project after it has been installed. Periodic monitoring of the project will provide valuable insight into the stabilization process and may offer important information for future projects.

Periodic maintenance includes making sure the wattle is secured to the streambank and that some soil cover remains on the wattle. Additional plantings may be necessary to speed up the rate of vegetative establishment and spread.

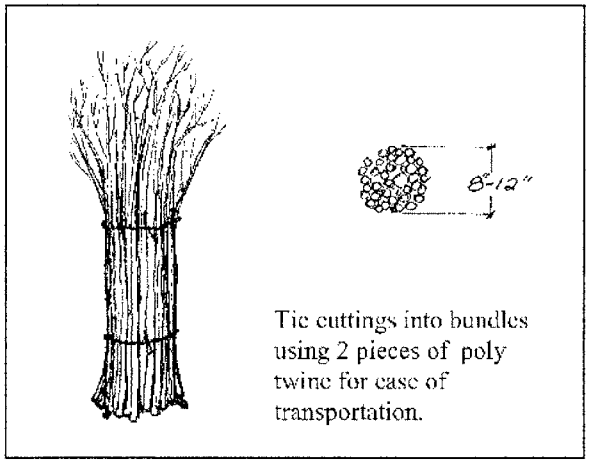
WILLOW WATTLES OR FASCINES

Willow Wattles or Fascines Installation Procedure

Step One: Harvest Willow Cuttings

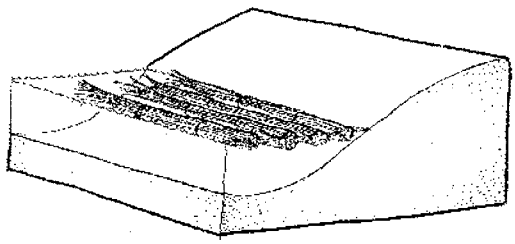


Step Two: Create Wilow Bundles



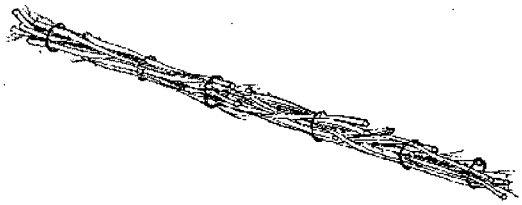
Step Three: Soak Willow Bundles

Soak bundles for 5 to 7 days. Remove them from water before roots emerge.



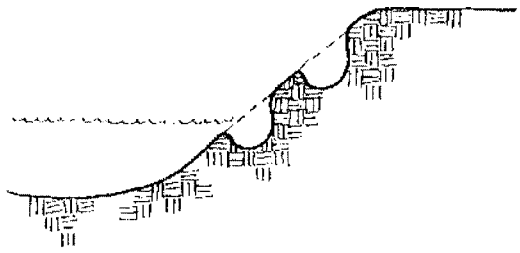
Step Four: Build Wattle

Build one long sausage-shaped bundle with the cut ends alternating directions. The bundle should be tied every 18 inches.



Step Five: Excavate Trench

Excavate a horizontal trench 2/3 the diameter of the wattle along the streambank at approximately the low flow line at the toe of the bank.



Step Six: Place Wattle

Place the wattle in the trench and stake with wedge-shaped stakes. Backfill around the wattle by knocking the top of the bank onto the wattle. Leave some of the branches exposed to sprout.

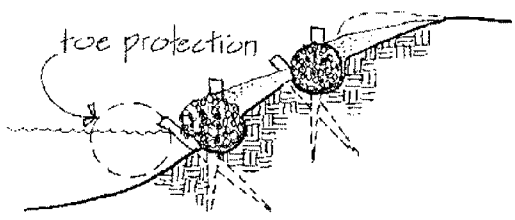


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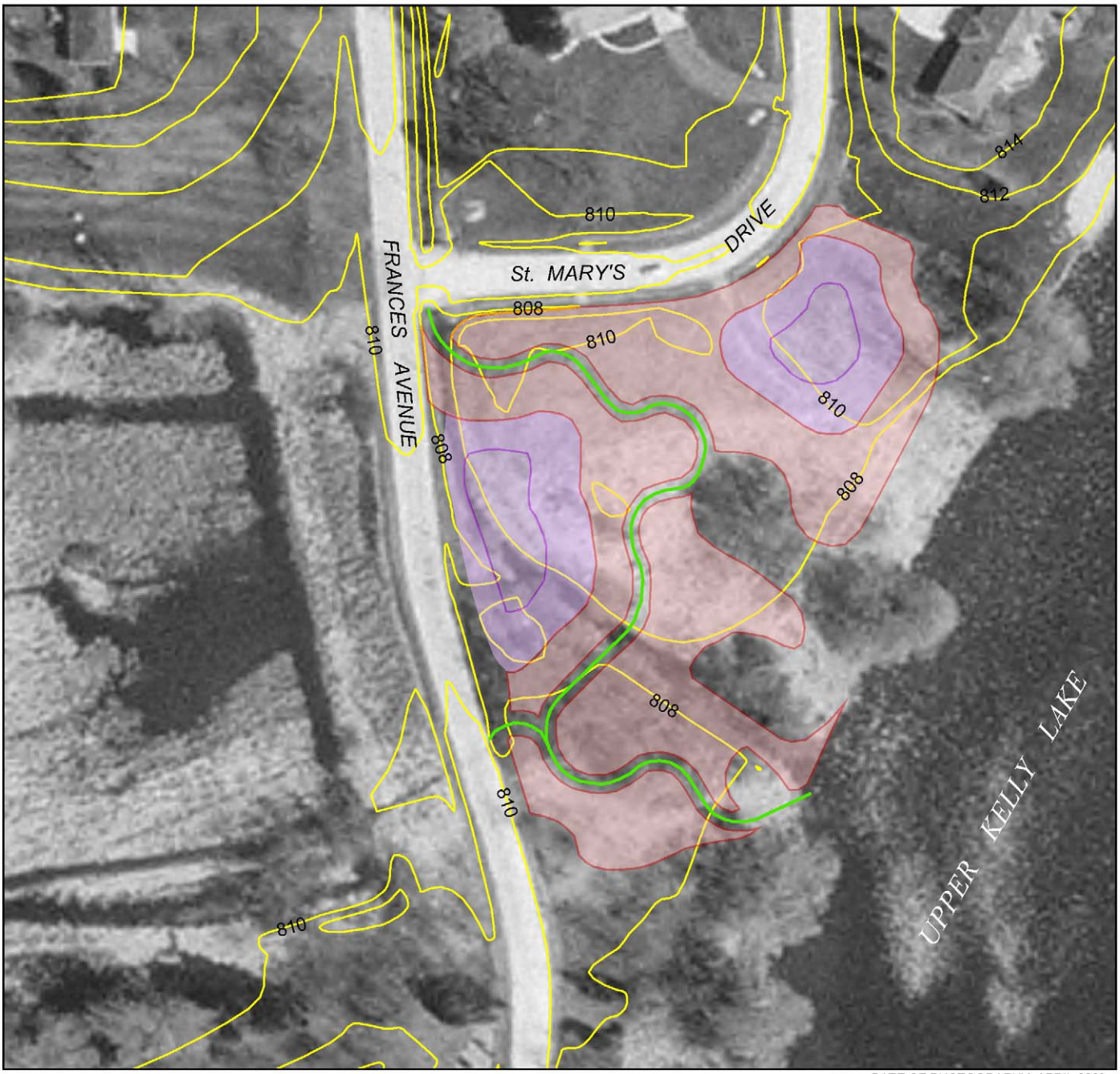
Exhibit M

PROPOSED LOCATIONS OF THE UPPER KELLY LAKE TRIBUTARY AND EXTENT OF WETLAND RESTORATION AREAS FOR UPPER KELLY LAKE RESTORATION PROJECT



DATE OF PHOTOGRAPHY: APRIL 2003

PROPOSED CHANNEL
WET MEADOW
SHALLOW MARSH
PROPOSED CONTOUR AT 807.5 FEET
PROPOSED CONTOUR AT 806.5 FEET
TOPOGRAPHIC LINES AT TWO FOOT CONTOURS

N

GRAPHIC SCALE
0 25 50 100 Feet

Source: SEWRPC.

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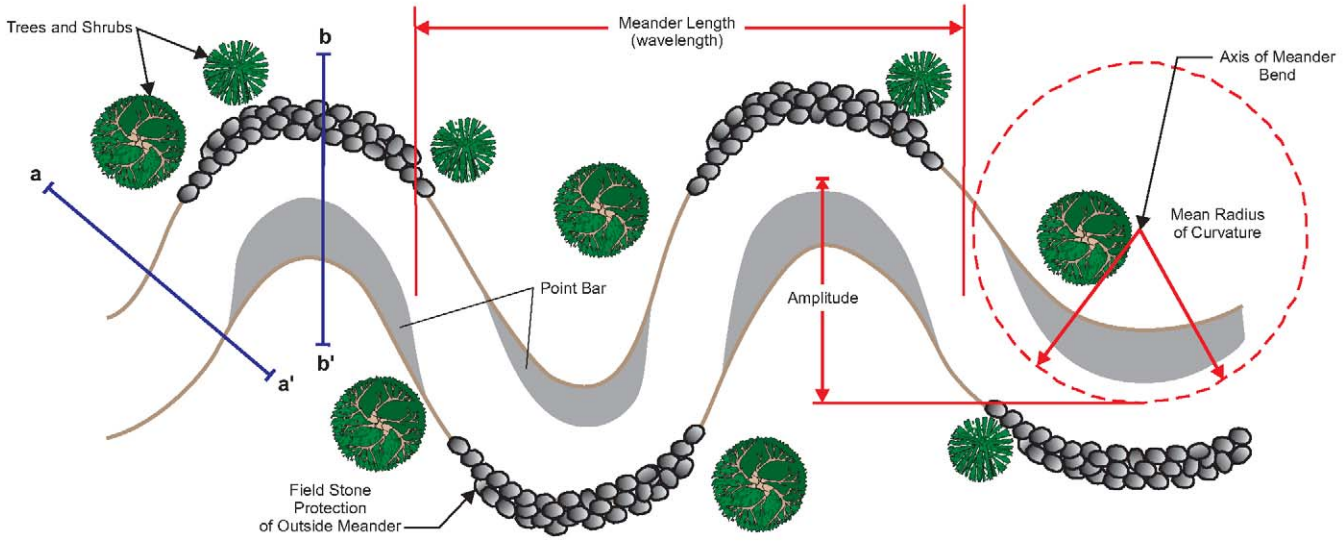
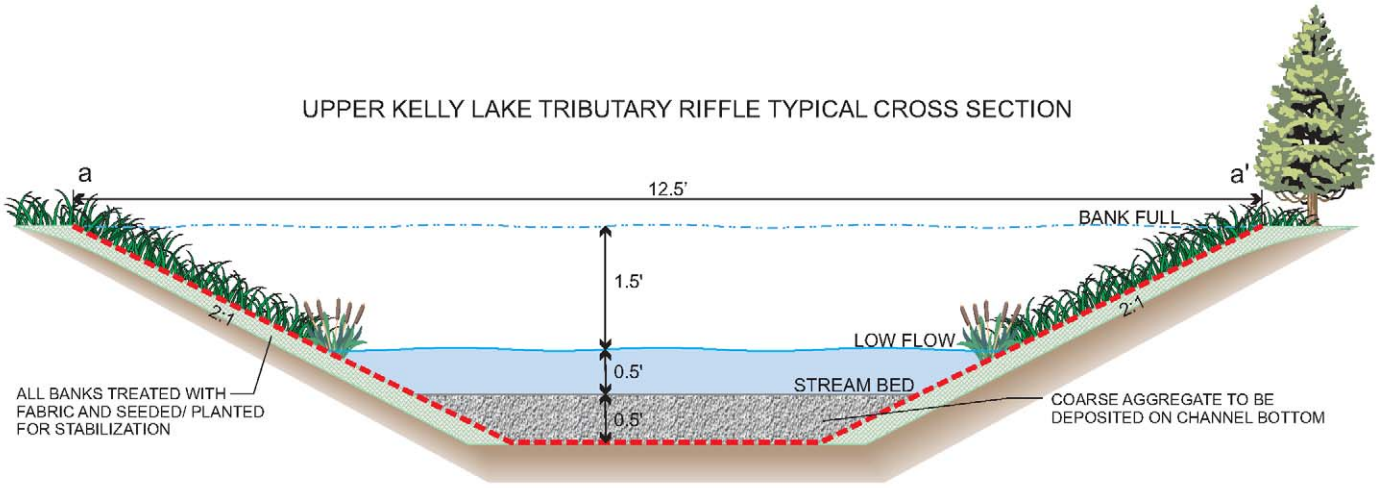
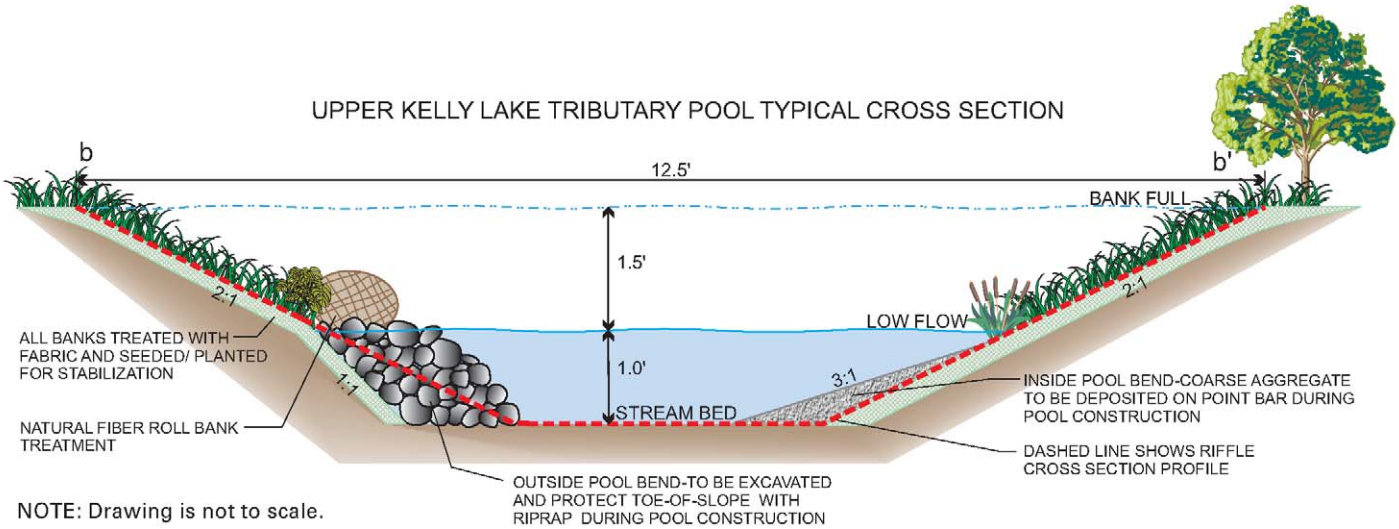
Exhibit N

SCHEMATIC OF STREAM MEANDER AND CROSS SECTIONAL PROFILES FOR REFERENCE POOL AND RIFFLE FEATURES







NOTE: Drawing is not to scale.

Source: SEWRPC.

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Exhibit O

PROPOSED DESIGN RADIUS OF CURVATURES AND RIFFLE HABITAT LOCATIONS FOR THE UPPER KELLY LAKES TRIBUTARY

DATE OF PHOTOGRAPHY: APRIL 2003

PROPOSED CHANNEL
CENTER OF RIFFLE HABITAT
RADIUS OF CURVITURE

N

GRAPHIC SCALE
0 25 50 100 Feet

Source: SEWRPC.

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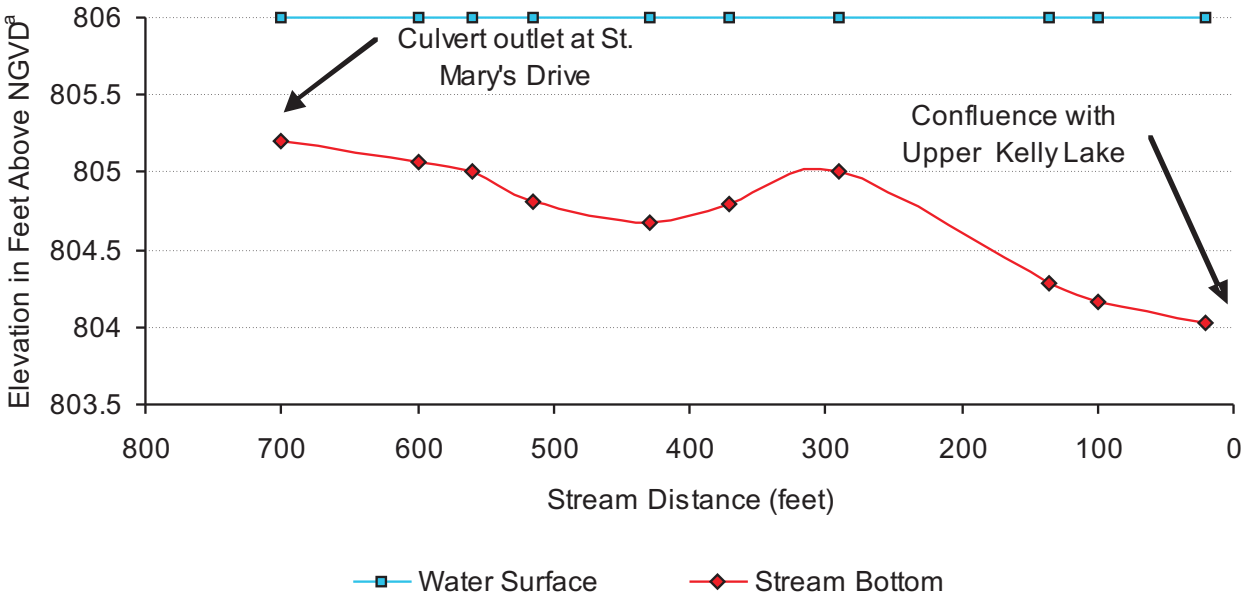
Exhibit P

PROPOSED ELEVATION PROFILE FOR THE UPPER KELLY LAKE TRIBUTARY POSITIONED AT THE CENTER OF SPECIFIED RIFFLE HABITAT LOCATIONS (see Exhibit O): 2004



[a]NGVD is defined as the National Geodetic Vertical Datum. For a description of benchmark elevation survey locations, see Exhibit G in this document.

Source: SEWRPC.