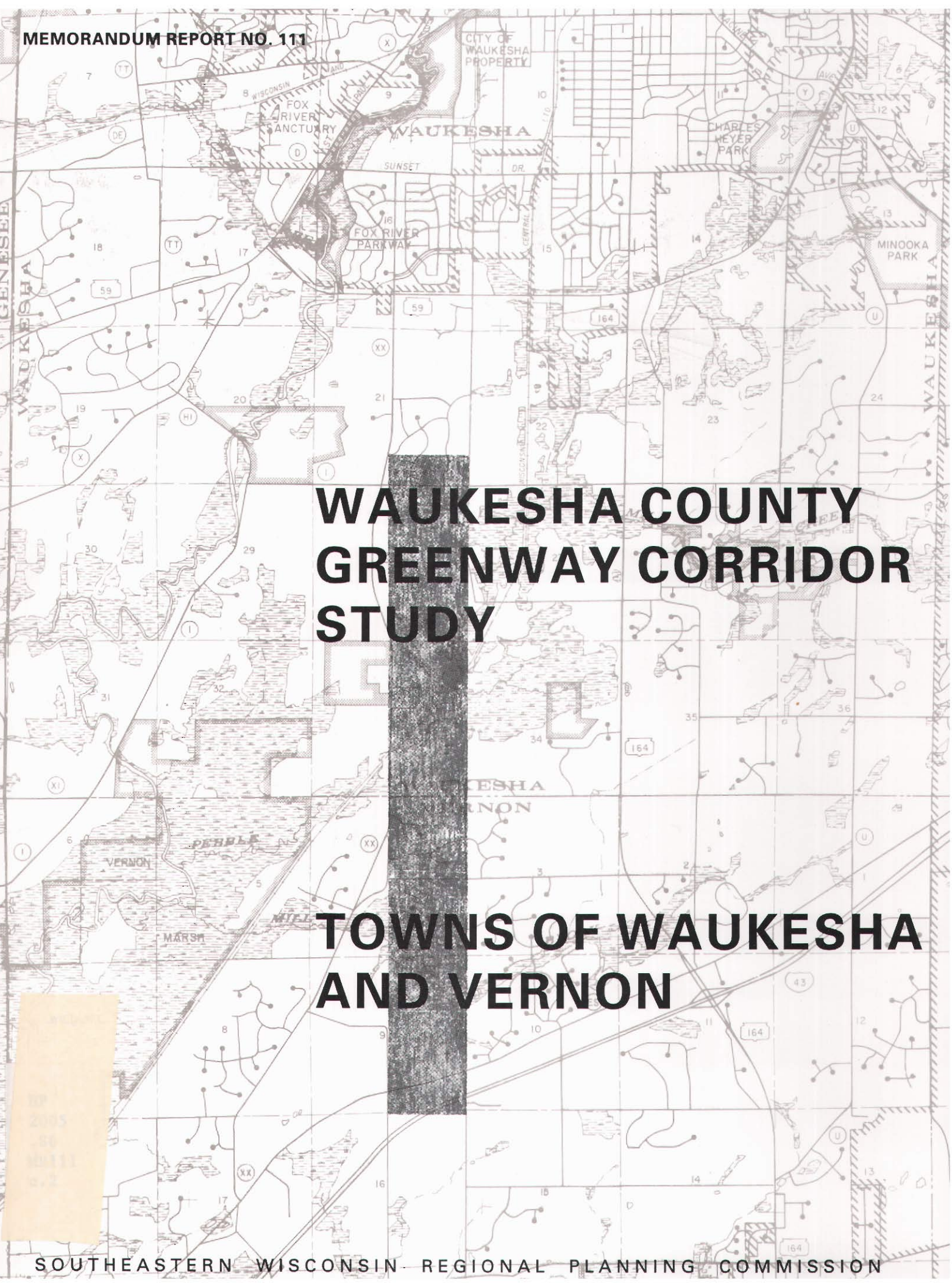
MEMORANDUM REPORT NO. 111



WAUKESHA COUNTY GREENWAY CORRIDOR STUDY

TOWNS OF WAUKESHA AND VERNON

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

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MEMORANDUM REPORT
NUMBER 111

WAUKESHA COUNTY GREENWAY CORRIDOR STUDY

TOWNS OF WAUKESHA AND VERNON

Prepared by the

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INTRODUCTION

At an interagency staff meeting held on June 5, 1992, and attended by representatives of the Waukesha County Park and Planning Department and the Southeastern Wisconsin Regional Planning Commission, the Commission staff was asked to undertake a study looking to the delineation of greenways along the Fox (Illinois) River, Mill Creek, Pebble Creek, and Redwing Creek located in parts of U. S. Public Land Survey Township 6 North, Range 19 East, Town of Waukesha; and Township 5 North, Range 19 East, Town of Vernon, Waukesha County, Wisconsin (see Map 1).

The specific purpose of the requested greenway plan was to refine the Commission's primary environmental corridors within the study area; identify sites suitable for access to the Fox River and its major tributaries, identify routes suitable for the establishment of a recreational trail system along the Fox River and its major tributaries; and identify lands suitable for public acquisition. Through a subsequent series of interagency staff meetings, criteria for the refinement of the Commission's adopted primary environmental corridors as a basis for the greenways; for the identification of lands suitable for public acquisition as county parks and parkways; for the identification of sites suitable to provide public access to the Fox River and its major tributaries; and for the selection of routes suitable for the location of recreational trails within and adjacent to the greenways were agreed upon. The Regional Planning Commission staff was to develop a methodology for the delineation of the greenways using the agreed upon criteria and the Commission's geographic information system (GIS). Final products would include a series of digital maps which clearly identified the location and areal extent of the proposed greenways; and related to those greenways identified the pertinent natural resource features concerned; areas suitable for public acquisition; and areas suitable for recreational improvements, including recreational trail development.

The Commission's GIS was viewed as a useful tool in the development of the County greenway plans since such plans require the identification of geographic areas meeting multiple criteria that involve both locational and attribute characteristics. Conceptually, the Commission defines a GIS as a computer-based system for capturing, storing, retrieving, analyzing, and reproducing geo-based data such as land use, soils, wildlife habitat, and floodplain data. Information stored in the Commission GIS can be organized around a "layer" concept in which groups of similar data sets such as, land use or soils, identified as mapping units, constitute a single "layer" within the data structure. Computer software may then be used to perform a variety of analytical operations on the graphic data sets that constitute the various layers. Typical analytical operations include the selection or identification of types of mapping units, reclassification of these types selected, overlay of data sets, and proximity or adjacency of one data set relative to a second data set.[1]

ENVIRONMENTAL CORRIDOR CONCEPT

Since 1966 the Commission has promulgated the environmental corridor concept within the Region. This concept, however, is not new in Southeastern Wisconsin. In effect, the environmental corridors concept was first introduced in the early 1900's with the proposal by Charles B. Whitnall to create a system of parkways within Milwaukee County. The stated purpose of these parkways were to preserve in essentially natural, open uses what the Regional Planning Commission terms environmental corridors along the Menomonee, Kinnickinnic and Root River and along the Oak Creek stream systems to preserve floodlands and related woodlands and wetlands, and to provide for recreational uses. In the early 1960's Phillip H. Lewis, Jr., a professor of landscape architecture at the University of Wisconsin at Madison, revitalized the environmental corridor concept in his professional work. Building on these earlier efforts the Commission promoted the practical

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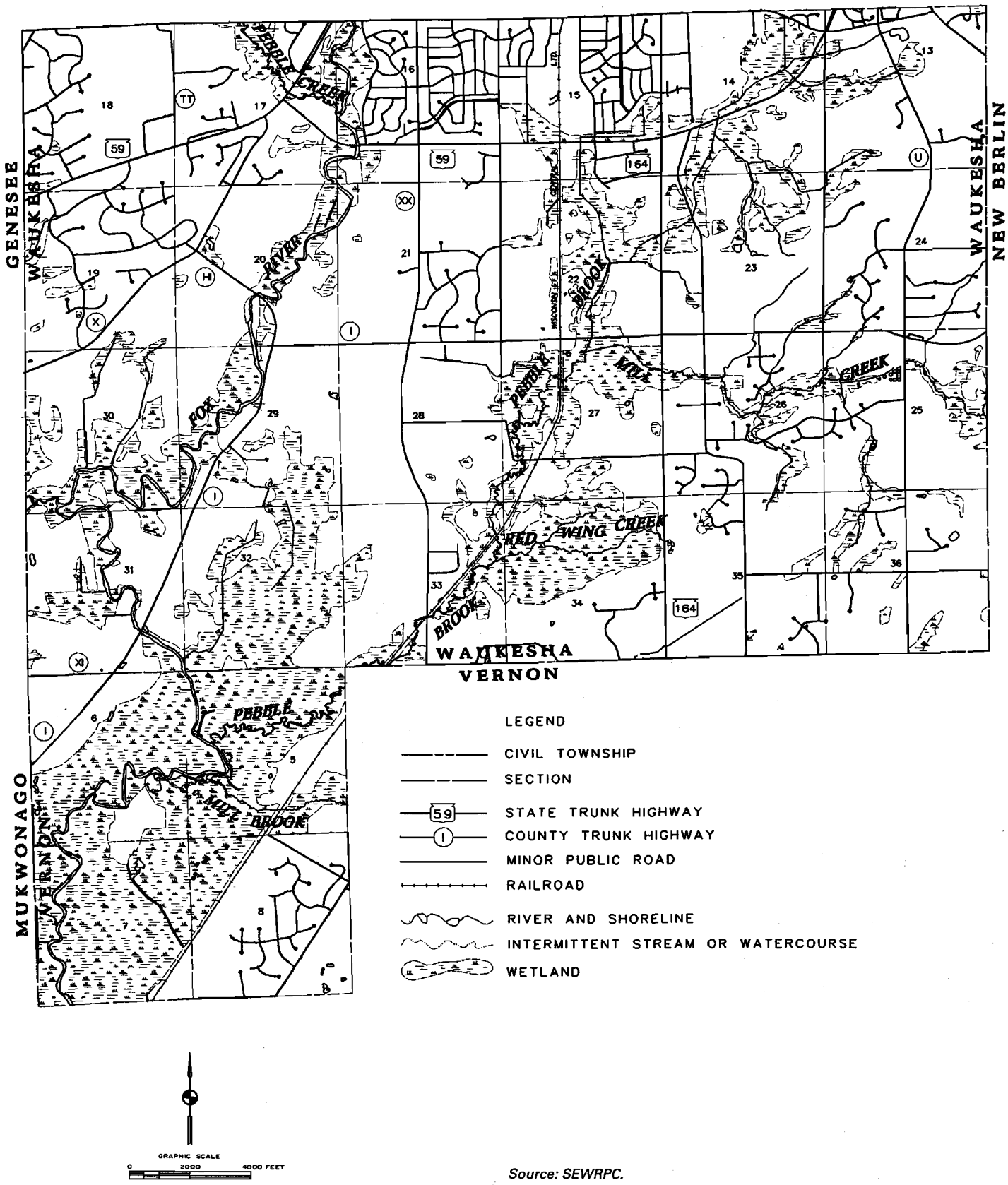
[1]*SEWRPC Memorandum, "Results of Demonstration of SEWRPC GIS to Identify Potential Wetland Mitigation Sites," March 1992.*

Map 1

WAUKESHA COUNTY GREENWAY STUDY AREA



Source: SEWRPC.

application of the environmental corridor concept based upon definitive mapped inventories of the resource features of the Southeastern Region. Detailed criteria for these delineations of the corridors were published by the Commission in 1981.[2] The mapped environmental corridors were adopted by the Commission as integral parts of the adopted plan elements.[3] Since 1966 the Southeastern Wisconsin Regional Planning Commission has, among other plan elements, prepared and adopted three regional land use plans, seven comprehensive watershed plans, a regional and seven county park and open space plans, and numerous local comprehensive and special purpose plans all of which include specific recommendations for the preservation and protection of the environmental corridors of the Region.

SEWRPC Planning Report No. 7, "The Regional Land Use—Transportation Study, Volume Two, Forecasts and Alternative Plans—1990," which set forth the first generation land use plan by the Commission in 1965, noted with respect to environmental corridors:

"The natural resources of an area are vital elements to its economic development and to its ability to provide a pleasant and habitable environment for human life. Moreover, natural resources not only condition but are conditioned by regional growth and urbanization. Any meaningful comprehensive regional planning effort must, therefore, recognize the existence of a limited natural resource base to which urban and rural development must be properly adjusted if serious environmental problems are to be avoided. This is particularly true in Southeastern Wisconsin where an increasing number of urbanites are becoming year-round residents of outlying areas of the Region, seeking not only the varied recreational opportunities that are offered by these areas, but also the feeling of open space which these areas lend to residential development. A sound evaluation and analysis of the resource capabilities is, therefore, particularly important to planning for the future development of the Region."

This report went on to state, "The most important elements of the regional resource base, including the best remaining forest; wildlife habitat; surface water; wetland areas; and historic, scenic, scientific sites, when combined, are found to occur in linear patterns or corridors. The preservation and protection of these environmental corridors will do much to maintain a good environment within the Region and to preserve its unique cultural and natural heritage, as well as natural beauty."

"Since these environmental corridors are endowed by nature and cannot be created by man, they constitute the only such areas that will ever exist within the Region. They must, therefore, serve the Region not only for today but for all time. Once lost, they are lost forever."

"Failure to properly adjust land use development within the Region to these environmental corridors will ultimately result in: loss of the remaining prime potential park and related open-space sites; deterioration or destruction of the best remaining wildlife habitat; encroachment of urban development upon the natural floodways and floodplains of streams and watercourses; loss of water impoundment areas and reduction of ground water recharge; loss of the largest and best remaining commercial and aesthetic forests; and continued deterioration of surface water within the Region."

Recognizing the importance and value of environmental corridors, the Commission, in its initial comprehensive land use plan and in succeeding planning programs, has recommended the protection and preservation of environmental corridors in essentially natural open uses. One of the principle objectives of the regional plan is the protection of the primary environmental corridors from additional intrusion by incompatible urban development, and the preservation of corridors for recreational use as well as for ecological purposes.

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[2]*Southeastern Wisconsin Regional Planning Commission Technical Report Volume 4, Number 2, "Refining the Delineation of Environmental Corridors in Southeastern Wisconsin," March 1981, pages 1 and 2.*

[3]*Southeastern Wisconsin Regional Planning Commission Planning Report No. 7, The Regional Land Use-Transportation Study, Volume Two, "Forecasts and Alternative Plans—1990," October 1966, pages 51 and 78.*

OBJECTIVES

The Waukesha County Board adopted the first generation regional land use plan and its recommendations concerning the preservation of environmental corridors on May 16, 1967. The Board adopted the second generation regional land use plan on August 21, 1979, and the land preservation plan on March 9, 1993. The County request for the delineation of greenways along certain streams and water courses represents an important step toward preservation of the environmental corridors within the County.

Building upon the action of the County Board, the requested greenway study has four objects. The first objective was to identify sites that are located in and adjacent to the Fox River and its major tributaries whose natural resource features merit protection through public acquisition. Such lands include woodlands, wetlands, natural areas, and rare and endangered and threatened species habitats.

The second objective was to identify potential public access sites to the Fox River and its major tributaries. The physical resource features and conditions present within the study area such as floodlands, wetlands, natural areas, steep slopes, and soils were used to identify such sites. Sites identified under this objective also include lands suitable for the location of outdoor recreational facilities.

The third objective was to define route areas suitable for the development of recreational trails in a manner that is compatible with the resource base.

A fourth and final objective was to locate sites within the study area which are suitable for wetland restoration and corridor enhancement and expansion. Ideally, this objective would recommend the enhancement of degraded wetland resource areas within the environmental corridors or in areas that could potentially be connected to the environmental corridor network.

In order to meet the objectives of the greenway study, the County and Commission staff determined that the delineation of the environmental corridors within the study area should be further refined. This refinement utilized as a point of departure the most recent the primary environmental corridor delineation by the Regional Planning Commission within the study area. Floodplain areas extending beyond the delineated primary environmental corridors, buffer zones to woodland and wetland sites; and ecological values for the habitat sites within the corridors were considered in the refinement process. The primary environmental corridors were selected as the present departure for the delineation of the greenways, since such corridors encompassed the major resource amenities in the study area and thereby concentrated the planning effort on the Fox River and its major tributaries. Floodland areas were incorporated into the corridor refinement process since such areas are not suitable for urban development, not only because of the flood hazard, but also because of the presence of high water tables and, generally, soils poorly suited for the support of urban uses. The floodland areas also typically contain important elements of the natural resource base. The need for buffer zones, or strips, providing additional protection for significant resource elements of such as woodlands, wetlands, natural areas, and critical species habitats was also considered. And finally, ecological values present were used to aid in identifying areas which may be sensitive to more intensive recreational uses.

STUDY AREA

The Waukesha County Greenway Plan project area consists of a 28 square mile area associated with the Fox (Illinois) River and its tributaries, which includes Mill Creek, Pebble Creek, and Redwing Creek, located, as noted above, in parts of the Towns of Waukesha and Vernon, Waukesha County, Wisconsin (see Map 1). More specifically, the study area consists of U. S. Public Land Survey Sections 12 through 36, Township 6 North, Range 19 East, Town of Waukesha; and Sections 5 through 8, Township 5 North, Range 19 East, Town of Vernon.

Because the primary environmental corridors in the area are all associated with the Fox River and its major tributaries, the study was concentrated on the riverain areas that is in the primary environmental corridors

and adjacent floodplain lands. A 300 foot wide buffer for woodlands and natural areas existing within the primary environmental corridors was identified, mapped, and included in the study area. As shown on Map 2, the study was accordingly concentrated on the Fox River, its major tributaries, and the immediate environment of the associated primary environmental corridors.

PROJECT DESIGN AND METHODOLOGY

The methodology used to identify lands suitable for public acquisition, for the provision of public access to the Fox River and its major tributaries, and for the location of recreational trails was designed to utilize the capability of GIS technology. That technology facilitated the use of the modulated basic digital inventories of resource information by permitting the ready spatial analysis and correlation of the inventory data to identify those geographic areas that could be considered suitable for inclusion in the greenways. To utilize the GIS as a planning tool a number of work elements need to be considered.

To develop the greenway plan, utilizing the Commission GIS, it was necessary for the staffs to prepare a study design that clearly set forth the scope of the work to be completed, assessed the available inventory data, and set forth criteria to be used in the identification of site locations. The end product of the study was to be a set of maps which clearly show lands suitable for public acquisition which include natural resource features suitable for recreational use.

An initial step in the process was to consider the natural resource and land use data in existing files that could be utilized to achieve the study objectives. The natural resource and land use data available in the Commission files and considered in the study included wetlands, woodlands, wildlife habitats, natural areas, soils, surface waters, floodlands, primary environmental corridors, and existing land uses. In addition data were available on the location and extent of the primary environmental corridors which represent composites of the various elements of the natural resource base. Each of these natural resource and land use inventories were originally delineated on Commission ratio and rectified aerial photographs at a scale of one inch equals 400 feet and were converted to digital form to provide the basic spatial data sets for the analytical process. Information on other natural resource base, or natural resource base and related elements not available, included ecological sites, a slope analyses and real property boundary ownerships. Such information was collected and mapped at suitable scales for inclusion in the Commission digital data base. The slope analyses and real property boundary ownerships were prepared using one inch equals 200 feet, 2 foot contour interval topographic and cadastral mapping.

The following definitions were uses for each of the inventoried features:

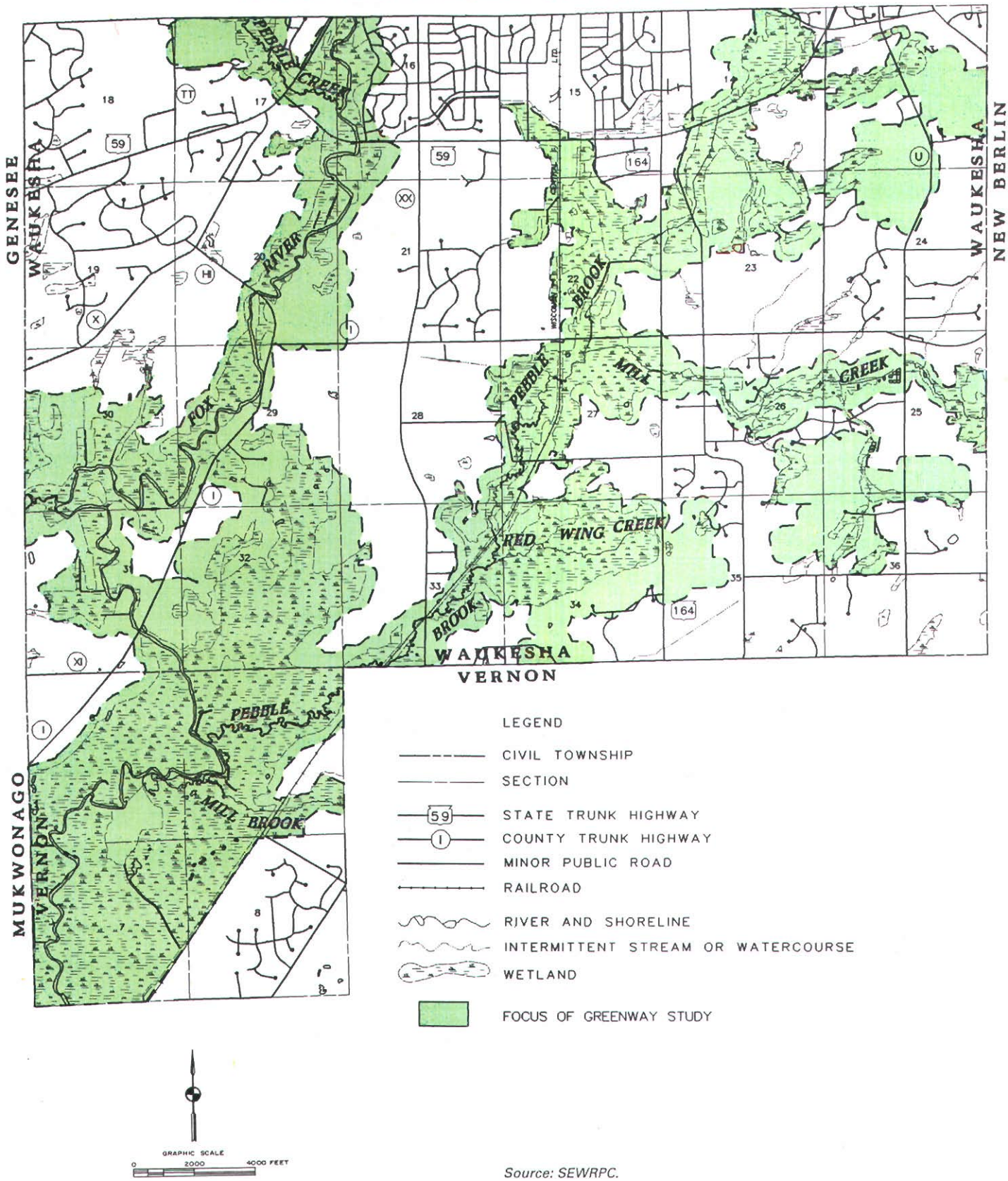
- Woodlands—Woodlands were defined as those upland areas one acre in size or larger which support 17 or more conifer or deciduous trees per acre, each tree measuring at least four inches in diameter at breast height (dbh), and having 50 percent or more tree canopy coverage.

- Wetlands—Wetlands were defined as those areas that are inundated or saturated by surface water or groundwater at a frequency, and with a duration and sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

- Wildlife Habitat—As part of the Commission's resource inventories wildlife habitat, areas in Southeastern Wisconsin were mapped and evaluated in terms of the diversity and type of animal species present, the territorial requirements of those species, the composition and structure of existing vegetation, proximity to other wildlife habitat areas, and the level of disturbance by human activities. Three classes of wildlife habitat were identified: 1) Class I habitats, which consist of areas that contain a good diversity of wildlife, that are of sufficient size to meet all of the habitat requirements for each species, and that are generally located in proximity to other wildlife habitat areas; 2) Class II habitats, which consist of wildlife habitat areas lacking one of the three criteria necessary for a Class I

Map 2

AREAS OF FOCUS FOR WAUKESHA COUNTY GREENWAY STUDY



Source: SEWRPC.

designation; and 3) Class III habitat, which consist of those wildlife habitat areas that are generally remnant in nature and that lack two of the three criteria necessary for Class I habitat designation.

- Natural Areas—Natural areas have been defined by the Wisconsin Natural Areas Preservation Council as tracts of land or water so little modified by human activity, or sufficiently recovered from the effects of such activity, that they contain intact native plant and animal communities believed to be representative of the landscape before European settlement. Natural areas sites are classified into one of three categories: State scientific areas, natural areas of Statewide or greater significance, natural areas of countrywide or regional significance, and natural areas of local significance. Classification of an area into one of these three categories is based upon consideration of the diversity of plant and animal species and community types present; the structure and integrity of the native plant or animal community; the extent of disturbance from human activity, such as logging and agricultural use, the commonness of the plant and animal community concerned; unique natural features; the size of the site; and the education value of the site.

- Ecological Sites—Ecological value of a site was based upon the quality of the biological characteristics of the site. The quality of the biological characteristics is "the extent to which a community corresponds with one concept of the identified natural community as it existed before settlement."[4] Ecological value was determined by species composition and structure. Specifically, an ecological value of 4.0 was assigned to sites large in areal extent and relatively undisturbed. A value of 1.0 was assigned to sites small in areal extent and highly disturbed. Thus, communities ecological value were assigned on a scale of 0 to 4.0; with 4.0 representing a natural quality believed to have existed before European settlement.

- Soils—Soils are classified by their significant characteristics such as wetness, mineral or organic composition, grain size, structure, chemical composition, and texture. The current classification has six categories including order, suborder, great group, subgroup, family, and series. Under this classification system, the criteria used as a basis for soil classification are soil properties that are observable and measurable.[5]

  The Commission in cooperation with the U. S. Department of Agriculture, Soil Conservation Service (SCS), completed a detailed soil survey of the Region in 1966. The resulting maps, delineated on aerial photographs provided by SCS at a scale of one inch equals 2000 feet, were subsequently digitized by the Commission. This digital file provides the basic spatial data set for the identification of all areas having the specific soil characteristics considered. The identification of those soil mapping units classified as "hydric" was made through a classification list provided to the Commission by the SCS. Slope categories of the soil mapping units were encoded directly into the soil unit identification and depth to bedrock was determined for each soil mapping unit through an attribute file maintained and distributed by the SCS.

- Slopes—For the purpose of the greenway project, slopes of 12 percent or greater were considered unsuitable for the location of recreational facilities and trail development. Slopes 0-12 percent were considered suitable for such location and development and slopes of 0-6 percent were considered suitable for the location and development of parking lots and roads.

- Surface Water Resources—Surface water resources in the study area consist of rivers, streams, and ponds 0.5 acres or larger in size and their associated floodlands.

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[4]*Curtis, John T., "The Vegetation of Wisconsin," UW Press, Madison, 1959, page 657.*

[5]*U. S. Department of Agriculture, Soil Conservation Service, "Soil Taxonomy—A Basic System of Soil Classification for Making and Interpreting Soil Survey," 1988.*

- Floodlands—The floodlands of a river or stream are the wide, gently sloping areas contiguous to, and usually lying on both sides of, a river or stream channel. Rivers and streams occupy their channels most of the time. However, during even minor flood events, stream discharges increase markedly, and the stream channels may not be able to contain and convey all of the flow. As a result, water levels increase and the river or stream spreads laterally over the floodlands. The periodic flow of a river onto its floodlands is a normal phenomenon and, in the absence of costly structural flood control works, will occur regardless of whether or not urban and recreational facility development exists in the floodland.

  For planning and regulatory purposes, floodlands are normally defined as those areas, excluding the stream channel, subject to inundation by the 100-year recurrence interval flood event. This is the event that may be expected to be reached or exceeded in severity once in every 100 years, or, stated another way, there is a 1 percent chance of this event being reached or exceeded in severity in any given year. The delineation of the floodlands in the study area was based upon hydrologic and hydraulic engineering studies of the Fox River and its major tributaries by the Commission in 1969.

- Primary Environmental Corridors—Under the Commission planning programs, primary environmental corridors are to certain seven elements of the natural resource base upon: 1) lakes, rivers, and streams and the associated shorelands and floodlands, 2) wetlands, 3) woodlands, 4) prairies, 5) wildlife habitat areas, 6) wet, poorly drained, and organic soils, and 7) rugged terrain and a high relief topography. In addition, certain other features which, although not a part of the natural resource base per se, are closely related to, or centered on, that base, are a determining factor in identifying and delineating areas with recreational, aesthetic, ecological, and cultural value. Specifically, these features include: 1) existing park and open space sites, 2) potential park and open space sites, 3) historic sites, 4) scenic areas and vistas, and 5) natural area sites. Primary environmental corridors are at least 400 acres in size, two miles in length, and 200 feet in width.

- Existing Land Use—Definitive information regarding existing land uses of an area is essential to any sound open space planning effort. Urban land uses include primarily residential, commercial, industrial, recreational, governmental and institutional, and transportation uses; while non urban land uses include agricultural lands, woodlands, woodlands, surface water, and other open lands.

- Real Property Ownership Boundaries—Real property boundary lines are based upon the examination and interpretation of all recorded subdivision plats and certified survey maps within the area concerned; of legal descriptions for unplatted areas; of plats of all major public utility easements; and of plats of all public street right-of-way openings, reservations, or dedications.[6] Cadastral maps have been produced for the County by the Commission using Commission-recommended standards. The geometric control for the cadastral maps was provided by a system of monumented U. S. Public Land Survey corners whose positions on the State Plane Coordinate System have been computed based upon high-order horizontal control survey.

The staff recognized that each of these resource elements needed to be identified and criteria applied to either protect environmentally sensitive resources areas or gain recreational uses from the natural resource within the greenway corridor. The wetlands, natural areas, high value wildlife habitat areas, and high value ecological sites were the primary types of natural resource areas considered for protection. Other natural resource features in and adjacent to the primary environmental corridors, woodlands, and the lower class wildlife habitat and ecological areas were considered for the location and maintenance of recreational facilities and trails without having significant adverse impacts on the existing natural resource elements. Floodlands, steep slopes, and certain types of erodible and organic soils were identified as areas unsuitable for most types of recreational development, but required to remain in essentially natural, open uses in order to protect water quality conditions within the study area.

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[6]*SEWRPC Community Assistance Planning Report No. 193, "A Land Information System Plan for Waukesha County," April 1991, page 35.*

Information on existing land use and on real property boundary ownership was considered necessary to any identification of areas for public acquisition. Adjacent land uses may have significant impacts on the ecology of natural areas. Typically, the more intense the human activity on adjacent lands the wider the protection buffer necessary to protect and preserve ecological processes on sensitive lands. Real property boundary ownership assist in the development of an acquisition element for lands suitable and necessary for resource protection and recreational uses.

DIGITAL INVENTORIES

For use in the GIS process, inventory information, historically maintained in the form of aerial photographs and maps, must be converted into a numeric, or digital, format. The process by which the conversion is completed is referred to as "board digitizing." Using a digitizer, maps are transformed through a machine system into a computer-readable format which facilitates the information for analytical manipulation and display. The transformation of mapped information, however, into computer-readable information requires that the maps used be related to a system of geometric control. In the case of the Commission's GIS system, the geometric control is tied into the State Plane Coordinate System. Each line on the map, then, is defined as a series of connected points. To identify each point, a cursor is used to assign an State Plane Coordinates System, x-y coordinate pair based on the position of the point relative to the known survey control stations used to scale and control the maps. Thus, each map line is stored in the system as a series of x-y coordinates. Further, each line or segment may be stored separately or combined with other segments to form closed mapping units with defined attributes and measurable areas. Once the initial map data are transformed into a digital format, a variety of analytical manipulations become possible.[7]

For the Waukesha County Greenway Plan several of the inventories had not been converted to a digital format. These inventories included the 1990 Commission wildlife habitat area, ecological sites, the real property ownership boundary, and the slope analyses. It should be added that of these inventories, the ecological sites and the slopes analyses needed to be identified and delineated before they were available for digitizing.

From the aforementioned inventory elements, the Commission staff used the GIS to analyze several data layers and combinations of data sets to identify the location of a refined primary environmental corridor project boundary; identify acquisition and access sites; and locate potential recreational trail routes. In addition, potential wetland restoration sites were identified.

The types of analytical operations used in the project were as follows:

- Identification—This operation is performed on a single data set or layer and maybe used to identify a specified subset of the layer. For example, all hydric soil types—very poorly drained, poorly drained, and certain somewhat poorly drained soils—may be identified from the detailed soil survey. These subsets may be selected for a mapped display or for analytical use in conjunction with some other data set.

- Reclassification—This operation may be used to generalize the categories of separation within a more detailed layer. For example, all detailed soil types for hydric soils may be reclassified into a single

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[7]*SEWRPC Community Assistance Planning Report No. 193, "A Land Information System Plan for Waukesha County," April 1991, page 35.*

Table 1

CRITERIA FOR PRESERVATION AREAS

Evaluation Criteria	Preservation area values, Grades and Distances
Ecological Sites	Values > 3.0
Wildlife Habitats	Class I
Buffer Distance from Ecological Values > 4.0	50′
Buffer Distance from Ecological Sites with Values 3.0 - 3.9	25′
Buffer Distance from Class I Wildlife Habitats	50′

hydric soil category. This operation is usually performed to reduce the detail contained in a data set either for mapping or to simplify the computations involved in additional analytical procedures.

- Overlay—This operation is performed between two or more layers in a data structure rather than within a single, this group of operation is based upon mathematical set theory and is used when determining correspondences, or lack thereof, between different coverage such as land use and soils. A variety of different overlay operations are possible, but the more common ones involve determining the intersection, the common areas occurring for all the polygon data sets under consideration, or the union, the areas occurring in at least one of the data sets under consideration.

- Proximity or adjacency—This operation is used to determine the location of one data set or individual mapping unit relative to a second data set or individual mapping unit. For example, the operation may be used to determine if one mapping unit lies within a specific distance of a second mapping unit; or, alternatively, if one mapping unit lies immediately adjacent to a second mapping unit.

Through these analytical processes the Commission produced a series of maps showing the location of potential acquisition and access sites and potential areas suitable for recreation trail location and development.

EVALUATION CRITERIA

To design a greenway plan in which the objectives are to protect environmentally sensitive lands while providing for recreational use, development of suitable and agreed upon site evaluation criteria was necessary. The County and Commission Staff agreed upon criteria set forth in Table 1 for the Type I and Type II Preservation Areas. An ecological value greater than 3.0, represented ecological sites which contained a virtually undisturbed to a nearly undisturbed species composition and structure. Class I wildlife habitat were determined to be a critical component of such sites since Class I habitats support range conditions necessary for the maximum support of wildlife within the study area.

The buffer distances established for each of the preservation areas were in the combined judgement of the staffs adequate to protect the environmentally sensitive areas from most urban related disturbances. Ecological values lying within the Class I wildlife habitat that were greater than 4.0 were buffered for a distance of 50 feet creating a Type I Preservation Area. Type II Preservation Area were established for areas with ecological values of 3.0 to 3.9 lying within the Class I wildlife habitat and buffered for a distance of 25 feet. The location and extent of the types of preservation areas were important considerations in identifying areas

Table 2

CRITERIA FOR RECREATIONAL TRAILS, PARKING LOTS AND ROADS

Evaluation Criteria Includes	Trails[a]	Parking Lots and Roads
Soils	Slight to Moderate Limitations	Slight to Moderate Limitations
Percent of Slopes	0 - 12	0 - 6
Ecological Sites (2 acres or larger)	Values < 3.0	Values < 2.5*
Wildlife Habitats (5 acres or larger)	Class II and III	Class III*
Buffer Distance from Residential Land Use	>50′	>50′

*No size requirement.

[a]*Includes hiking, bicycling, bridle, and cross-country skiing trails.*

for public acquisition, with a higher priority for the Type I Preservation Areas, since they contain the higher quality environmental resource base elements.

Criteria agreed upon for determining site suitability for recreational trails, roads, and parking lots are set forth in Table 2. Soils with slight to moderate soil limitations provide conditions that are capable of supporting recreational trails and support facilities. The staffs recommended that recreational trails should not be located on slopes in excess of 12 percent and that the access roads and parking lots not occur on slopes more than 6 percent. Sites with ecological values of less than 3.0 and wildlife habitat classes of II and III were recommended to be suitable for the location of recreational trails. Access roads and parking lots were determined to require less restriction on sites with ecological grades of less than 2.5 and wildlife habitat class values of III or less. A buffer distance greater than 50 feet from residential land use was the final criteria for recreational trails, access roads, and parking lots was established. These criteria have the potential to help provide recreational trails and support facilities which will contribute to a quality recreational experience, while at the same time maintain the ecological structure and integrity of the environmentally sensitive lands.

In addition, a set of criteria were developed for the selection of potential the wetland restoration sites. The Commission and County staffs determined that the Commissions established site selection criteria were appropriate for use in the greenway project. The evaluation criteria for selection of suitable wetland restoration sites include the following:

1. The presence of hydric soils on slopes less than 3 percent and with the depths to bedrock greater than five feet.

2. The absence of existing wetland or woodland plant communities.

3. Existing natural areas or critical species habitat sites are excluded from consideration.

4. Location in or adjacent to existing Class I, II, or III wildlife habitat areas.

5. Location in or within 200 feet of an existing primary environmental corridor as delineated by the Commission.

6. Location on existing agricultural or other open space lands.

In addition to the identification of potential wetland restoration sites, existing degraded woodlands suitable for enhancement were also identified for possible use in the planning efforts. Suitable degraded wetland enhancement sites were identified based upon the following criteria:

1. Location either on lands abandoned for agricultural uses, currently being farmed, or currently being grazed.

2. Location outside of existing natural areas or critical species habitat.

3. Location in or adjacent to existing Class I, II, III wildlife habitat areas.

4. Location in or within 200 feet of an existing primary environmental corridor as delineated by the Commission.

METHODOLOGY

In order to perform the GIS analysis, several data sets were needed from the Commission's digital inventories. The existing land use information, delineated on Commission ratioed and rectified aerial photographs at a scale of one inch equals 400 feet, were digitized. This digital inventory provided the basic spatial data sets necessary for the woodlands, wetlands, agricultural lands, other open space lands, and urban land uses. Following the land use conversion, other Commission inventories such as the environmental corridors, wildlife habitats, natural areas, and slopes were converted utilizing the land use delineations. In addition, Waukesha County provided the Commission with an ecological value inventory which was converted to digital format. From each of these digital inventories, basic data sets were formed which include the primary environmental corridors; Class I, II and II wildlife habitat areas; NA 1, NA 2, and NA 3 natural areas and critical species habitats;[8] ecological value provided by Waukesha County; and the slope analysis identifying 0 to 12 percent slopes.

FOCUSED GREENWAY STUDY AREA ANALYSIS

Basic digital inventories were used in conjunction with a set of logical operation steps to identify all those geographic areas that should potentially be included in a focused greenway system. These steps are diagrammed in Figure 1 and may be listed as follows:

1. Data set Number 1 was constructed for identifying the primary environmental corridors (Number 1). The primary environmental corridor mapping units were selected from the Commission environmental corridor database by the appropriate code to form the new data set.

2. Data set Number 2, Floodplain, was constructed by identifying the floodplain from the Commission's topographic digital inventory. By calling out the floodplain, a new data set was created by removing all common boundary lines from adjacent mapping units to simplify processing in later steps.

3. Data set Number 3, Woodlands, was created by accessing the Commission's land use digital graphic inventory. Woodland mapping units were identified from the database by appropriate land use code to form a new data set of woodlands.

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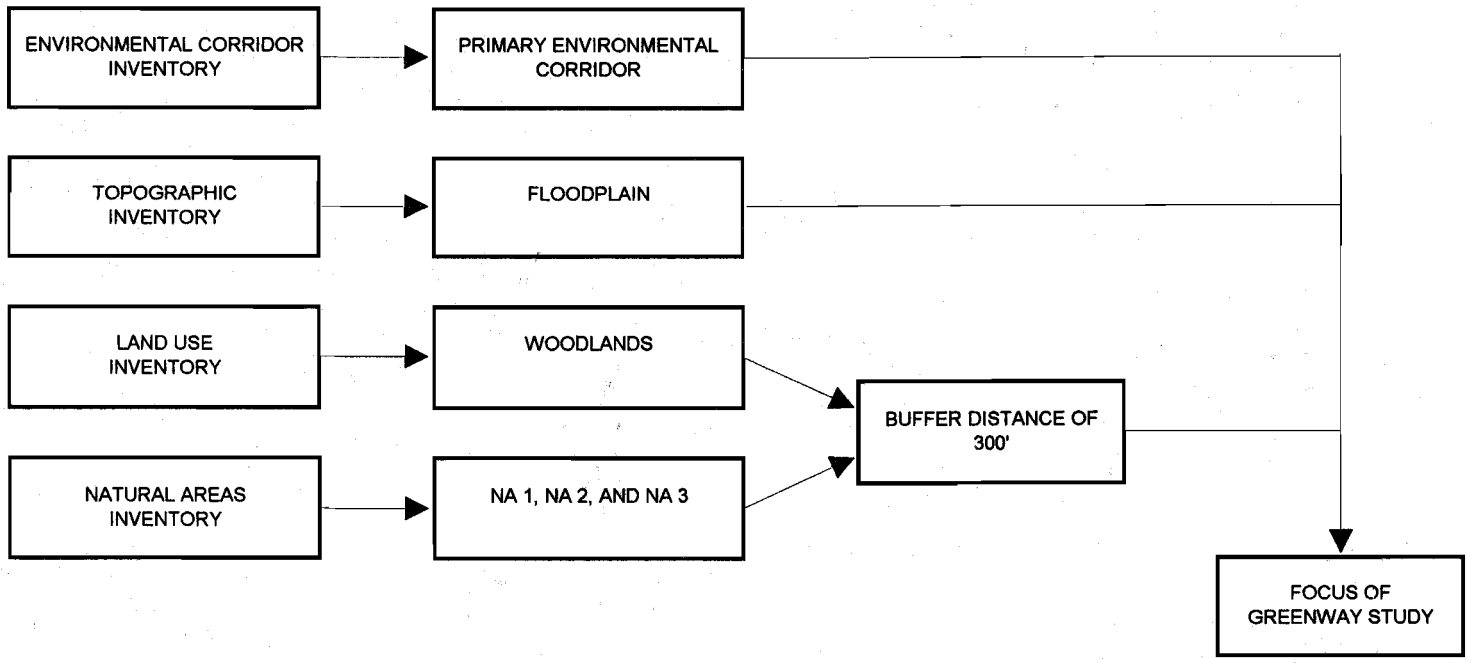
[8]*Natural area and critical species habitat information was obtained from SEWRPC Planning Report No. 43, A Natural Areas and Critical Species Habitat Protection and Management Plan for Southeastern Wisconsin, (in preparation).*

Figure 1

GENERALIZED FLOWCHART OF STUDY METHODOLOGY FOR THE FOCUS OF THE GREENWAY STUDY



Source: SEWRPC.

4. Data set Number 4, NA 1, NA 2, and NA 3, was developed by identifying the codes NA 1, NA 2, and NA 3 from the Commission's natural areas digital inventory. From these individual mapping units of natural area categories, a new data set was created by removing all common boundary lines from adjacent mapping units to simplify processing in later steps.

5. The GIS software was then used to create a buffer zone around both the Woodlands and the NA 1, NA 2, and NA 3 data sets. A buffer extending 300 lineal feet beyond the boundary of the Woodland and NA 1, NA 2, and NA 3 sites was created. Since the data set created by this operation may not be a mutually exclusive set, mapping unit intersections were computed and overlapping buffer zones were eliminated from the output. The resulting data sets, Numbers 5 and 6, comprised areas either totally within the Woodlands and NA 1, NA 2, and NA 3 sites or within 300 feet of their boundary lines.

6. Once the four data sets were assembled, they were utilized in the mapping unit processing operation to locate the refined greenway area. The analysis involved combining the four data sets in an overlay operation. GIS software commands were used to compute the mathematical intersection and union generating a derivative data set based on all mapping units in the Primary Environmental Corridors, Floodplain, Buffered Woodlands, and Buffered NA 1, NA 2, and NA 3 data sets. The resulting output was a final data set containing mapping units that included the primary environmental corridors, floodlands, buffered woodlands, and buffered NA 1, NA 2, and NA 3 sites. All mapping units were reclassified to the study area boundary and common boundaries were dissolved in order to simplify the data set. The resultant digital data set Number 7, Greenway Study Area Inventory, is shown on Map 2.

SUITABLE TYPE I AND II PRESERVATION AREA ANALYSIS

Type I and II Preservation Areas include areas within the study area that provide the necessary components essential for maintaining a high quality environmental base. To identify these areas three basic digital graphic inventories were used in the GIS analysis (see Figure 2) to identify suitable type I and II preservation areas. The selection process was conducted as follows:

1. An eighth data set, Study Area Boundary, was formed from the Greenway Study Area Inventory. The Study Area Boundary was developed by simply selecting for the Study Area Boundary code from the Greenway Study Area Inventory.

2. Data set Number 9, Ecological Values greater than 4.0, was identified by selecting and retrieving all mapped ecological sites with values 4.0 or greater from the ecological sites inventory. The resulting data set was reclassified and simplified for further processing by removing all common boundary lines.

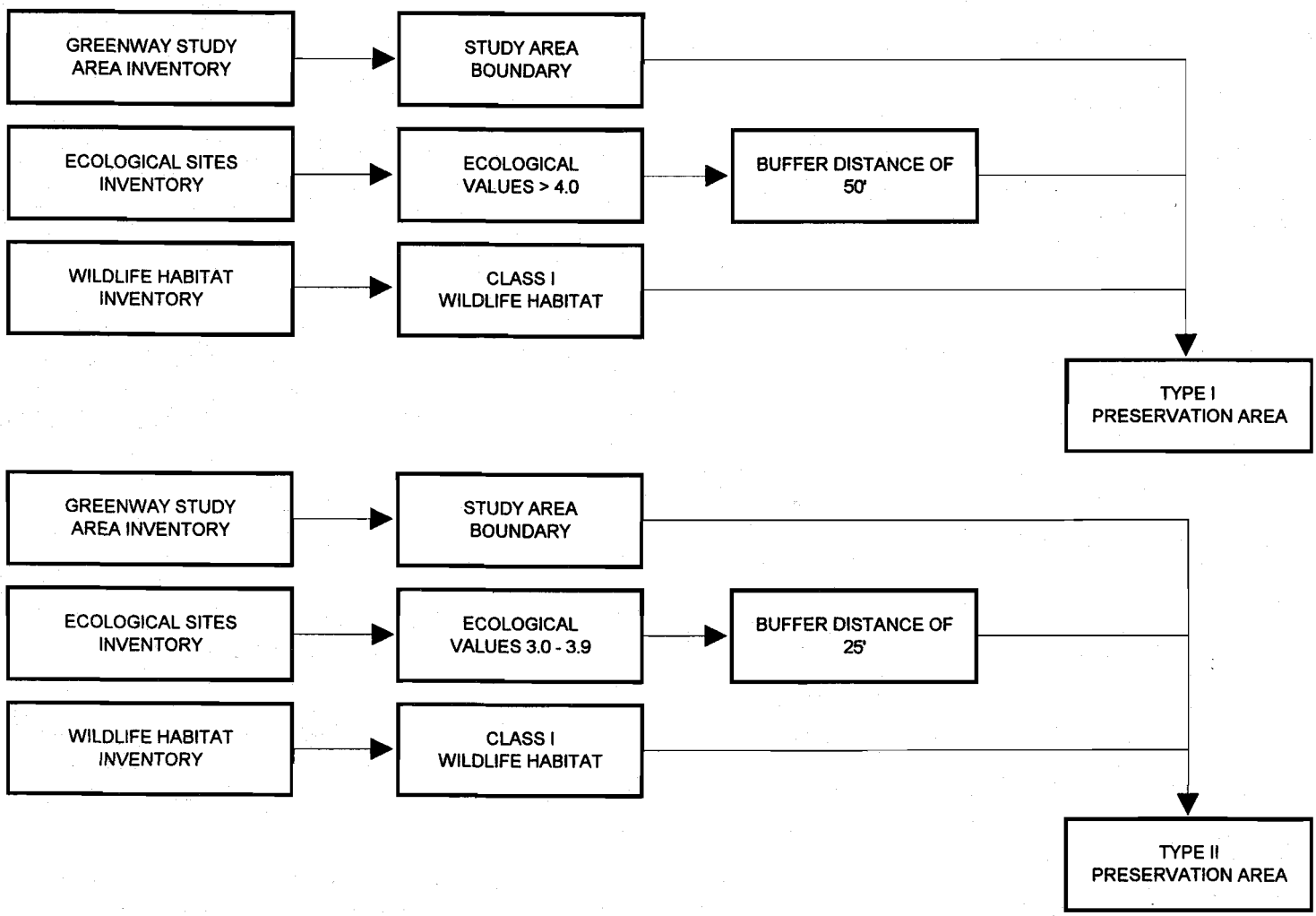
3. Next, the Ecological Values greater than 4.0 data set was buffered with the GIS software extending the boundary outward 50 lineal feet. This process provided data set Number 10, Buffered Ecological Values greater than 4.0.

4. Data set Number 11, was developed by selecting the Class I wildlife habitat from the Commission's wildlife habitat digital inventory. Once again, the resulting data set was reclassified and simplified for further processing by removing all common boundary lines.

5. In order to identify those areas suitable for potential Type I Preservation Areas, the data sets study area boundary, buffered ecological values greater than 4.0, and Class I wildlife habitat data sets were overlaid. GIS software commands were used to compute the mathematical intersection generating a derivative data set based on these data sets. The results were suitable Type I Preservation Areas which included Class I wildlife habitat and ecological values of greater than 4.0 with a buffer of 50 feet that were located within the greenway study area boundary.

Figure 2

GENERALIZED FLOWCHART OF STUDY METHODOLOGY FOR THE SUITABLE TYPE I AND II PRESERVATION AREAS



Source: SEWRPC.

6. Repeating steps 2 and 3, but replacing the ecological values selected to the range between 3.0 and 3.9, adding a 25 feet buffer area, produced data sets Number 13, Values 3.0 to 3.9, and Number 14, Buffered Ecological Values 3.0 to 3.9.

7. Step 5 was then repeated using data sets Study Area Boundary, Buffered Ecological Values 3.0 to 3.9, and Class I wildlife habitat areas. The result were suitable Type II Preservation Areas which included Class I wildlife habitat and 3.0 to 3.9 ecological values with a buffer of 25 feet located within the greenway study area boundary.

SUITABLE RECREATIONAL TRAIL DEVELOPMENT AREAS ANALYSIS

The methodology used to determine suitable recreational trail route location and development areas includes criteria for hiking, bicycling, bridle, and cross-country skiing trails. The steps used in the identification process are shown in Figure 3 and may be summarized as follows:

1. Data set Number 8, Study Area Boundary, was previously acquired from step 1 of the second analysis.

2. Data set Number 16, Ecological Values less than 3.0 on sites of greater than 2 Acres, was created by selecting and retrieving all ecological sites having values 3.0 or less and which have an areal extent greater than 2 acres using the ecological sites inventory. The resulting data set was reclassified and simplified for further processing by removing all common boundary lines.

3. Data set Number 17, Class II and III wildlife habitat with areas greater than 5 Acres, was developed by selecting the Class II and III wildlife habitats that were larger than 5 acres using the wildlife habitat digital inventory. Once again, the resulting data set was reclassified and simplified for further processing by removing all common boundary lines.

4. Data set Number 18 was constructed selecting the 0 to 12 percent slopes from the slope analysis digital inventory. By selecting these slopes, a new data set was created by removing all common boundary lines from adjacent mapping units to simplify processing in later steps.

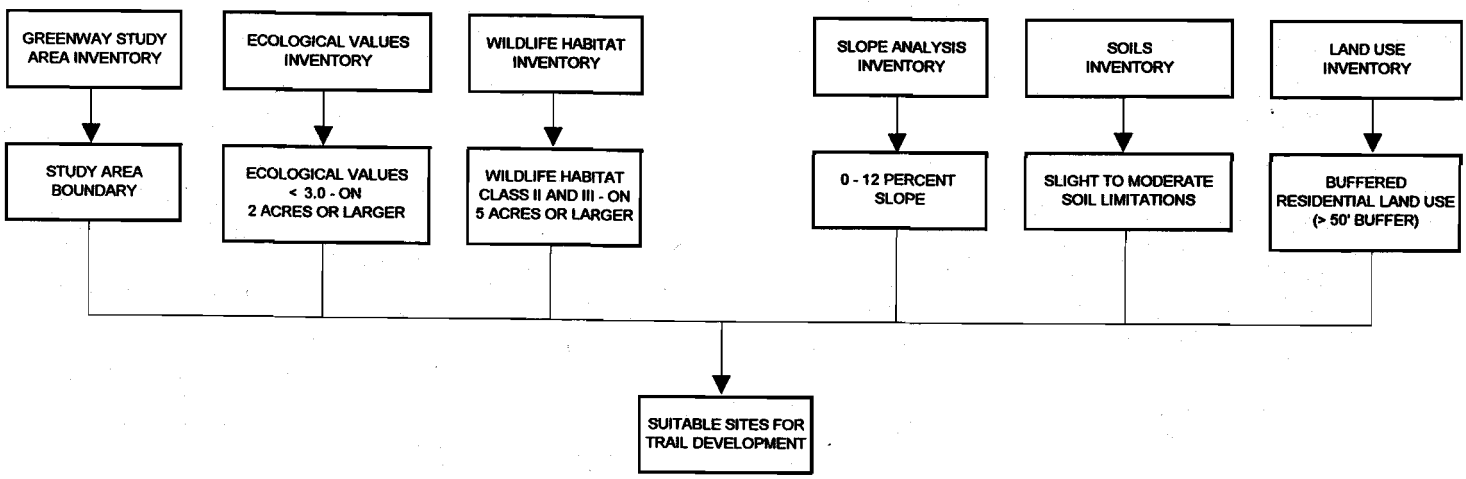
5. Data set Number 19, Slight to Moderate Limitations, was created by selecting and retrieving from the soils attribute table all soils with slight to moderate limitations for hiking, bicycling, bridle, and cross-country skiing trails. The resulting data set was reclassified and simplified for further processing by removing all common boundary lines.

6. The final data set Number 20, Buffered greater than 50 feet Residential Land Use, was created in a slightly different manner from the other data sets. First, residential mapping units were selected from the land use digital inventory and combined to build a data set for the entire study area. Next, a buffer extending 50 lineal feet outside the boundary of the initial residential land use area was created using the GIS software. Since the data set created by this operation may not be a mutually exclusive set, mapping unit intersections were computed and overlapping buffer zones were eliminated from the output. The resulting data set comprised an area totally within 50 feet of the original boundary line.

7. Once these six data sets were collected, they were processed using an overlay operation to locate suitable sites for trail development. GIS software commands were used to compute the mathematical intersections of all mapping units in data sets prepared in the previous 6 steps. From this analysis, a data set was built that met all of the following criteria for suitable trail development: a) sites located within the greenway study area boundary; b) sites with areas greater than 2 acres and having ecological values less than 3.0; c) sites with areas greater than 5 acres and supporting Class II and III wildlife habitat; d) sites with areas on 0 to 12 percent slopes; e) sites located in areas with slight to moderate soils limitations; and f) sites located at least 50 feet from any residential land uses.

Figure 3

GENERALIZED FLOWCHART OF STUDY METHODOLOGY FOR THE SUITABLE TRAIL DEVELOPMENT AREAS



Source: SEWRPC.

SUITABLE PARKING LOT AND ACCESS ROAD AREAS ANALYSIS

To identify areas suitable for consideration as parking lots and access roads, the following steps were used (see Figure 4):

1. As in the previous analysis, the data sets study area boundary, soils with slight to moderate limitations, and buffered greater than 50 feet residential land uses were used.

2. Data set Number 22, Ecological Values less than 3.0, was created by selecting and retrieving all ecological sites with 3.0 or less values from the ecological sites inventory. The resulting data set was reclassified and simplified for further processing by removing all common boundary lines.

3. Data set Number 23 was developed by selecting the Class III wildlife habitats from the Wildlife Habitat digital inventory. Once again, the resulting data set was reclassified and simplified for further processing by removing all common boundary lines.

4. Data set Number 24 was prepared by selecting the 0 to 6 percent slopes from the slope analysis digital inventory. By selecting these slopes from the file, a new data set was created by removing all common boundary lines from adjacent mapping units to simplify processing in later steps.

5. From these six data sets, an overlay process was used to locate suitable sites for parking lots and access road development. GIS software commands were used to compute the mathematical intersections of all mapping units in the Study Area Boundary, Ecological Values less than 3.0, Class III wildlife habitat areas on 0 to 6 percent slope, areas with slight to moderate soil limitations, and 50 feet buffered residential land use data sets. From this analysis, a data set was built that met all of the following criteria for suitable trail development: a) sites located within the greenway study area boundary; b) sites with ecological values less than 3.0; c) sites located within areas of Class III wildlife habitat; d) sites with areas on 0 to 6 percent slopes; e) sites located on soils with slight to moderate limitations; and f) sites located at least 50 feet from any residential land uses.

POTENTIAL WETLAND RESTORATION AND ENHANCEMENT SITES ANALYSIS

The final and most complicated analysis conducted under the Waukesha County greenway study involved the identification of the potential wetland restoration and enhancement sites. The study methodology steps for this analysis are diagrammed in Figure 5 and Figure 6 and are described as follows:

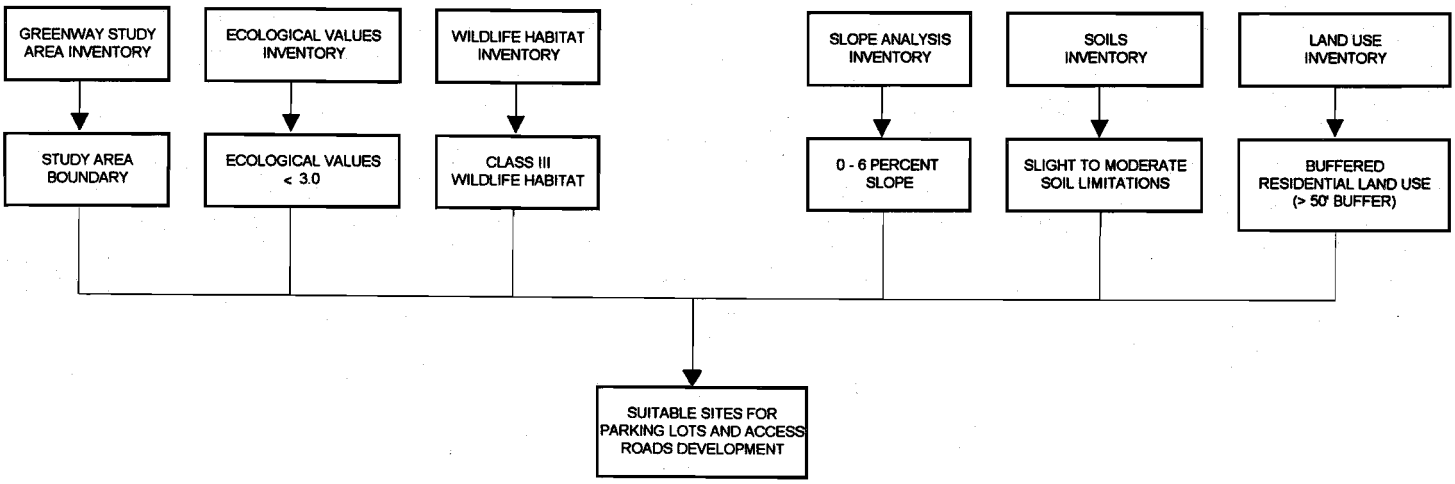
1. Data set Number 8, Study Area Boundary, was a previously acquired in step 1 of the second analysis.

2. Data set Number 26, Suitable Soils, was created by first identifying the maximum areal extent of all soil units having suitable soil conditions for wetland restoration. In order for a soil unit to be eligible for potential wetland restoration, all of the following conditions needed to be met: a) the soil unit must be classified as a hydric soil; b) the soil unit must be on a slope of 3 percent or less; and c) the soil unit must have depth to bedrock equal to or greater than five feet. Non-graphic data files containing attributes of soil mapping units were used to identify all soil types meeting this combination of criteria. The digital soil map for the study area was then compared against this criteria set to identify the location of all those individual soil units meeting the prescribed conditions. Once all individual soil mapping units having suitable soil conditions were identified, a new data set was formed by reclassifying these soil units. Any adjacent soil units having the identical criteria suitable for inclusion in the set had all common boundary lines identified and removed in order to simplify processing in later steps of the analysis.

3. Data set Number 27, Suitable Land Uses, was created by identifying the maximum areal extent of all land use mapping units having suitable existing uses for potential wetland restoration sites. In

Figure 4

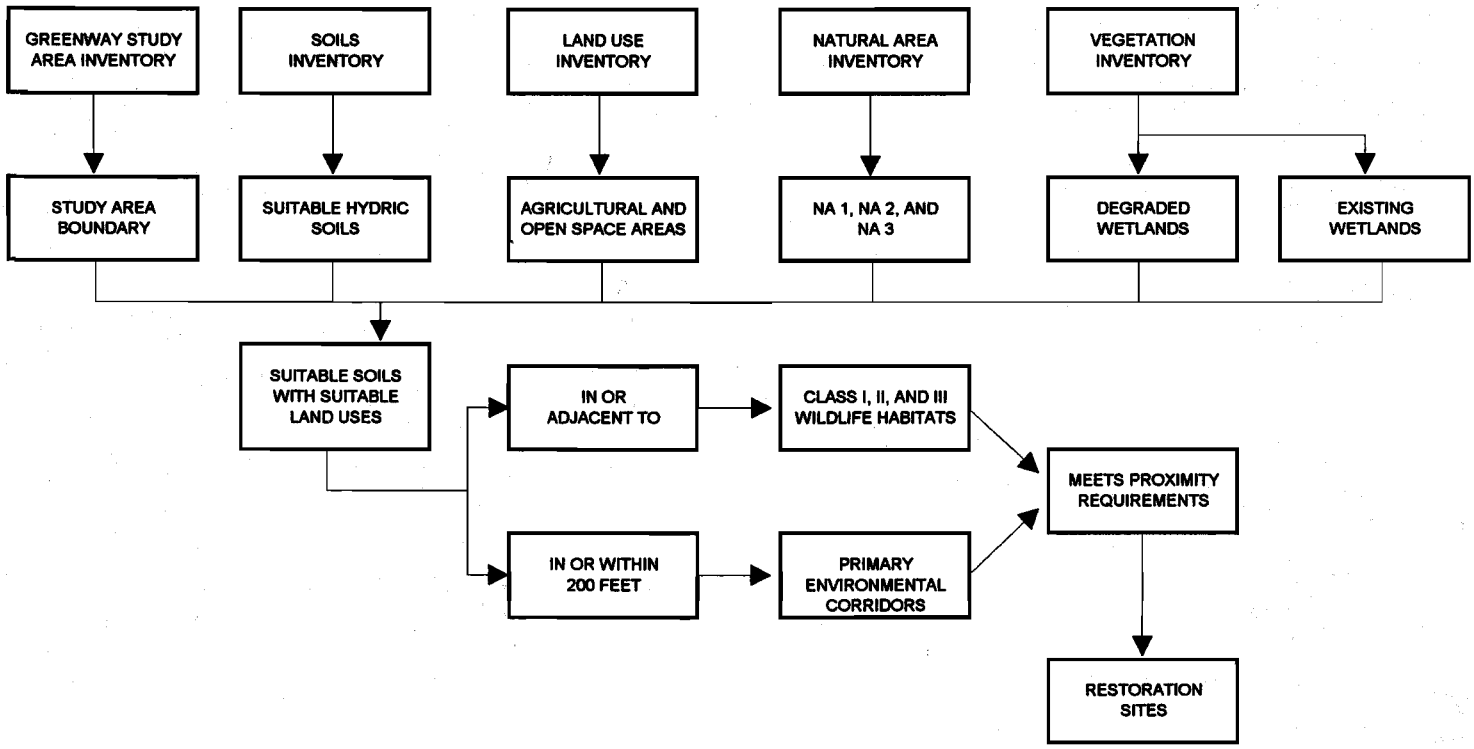
GENERALIZED FLOWCHART OF STUDY METHODOLOGY FOR THE SUITABLE PARKING LOTS AND ACCESS ROADS DEVELOPMENT AREAS



Source: SEWRPC.

Figure 5

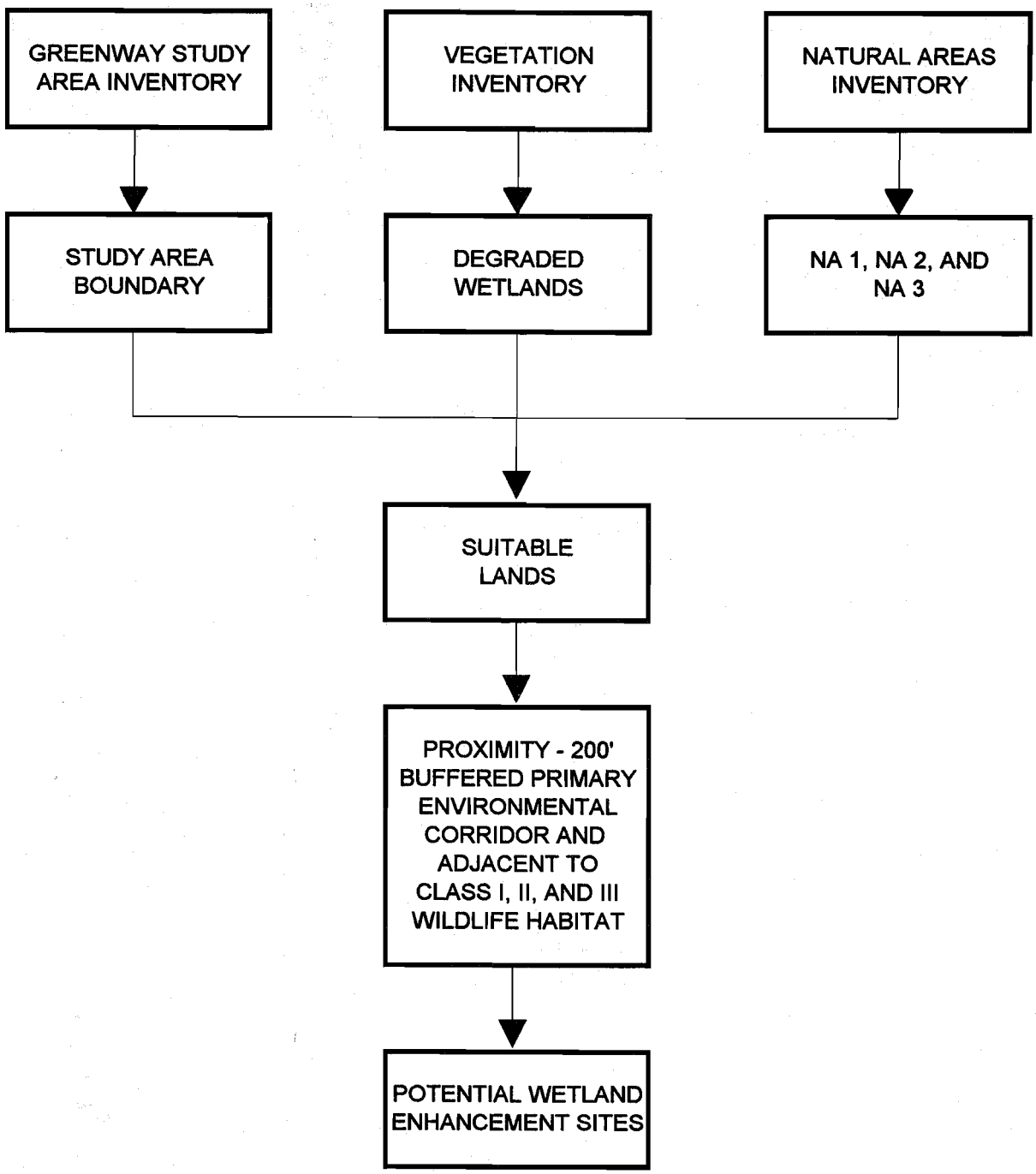
GENERALIZED FLOWCHART OF THE POTENTIAL WETLAND RESTORATION AND ENHANCEMENT SITES



Source: SEWRPC.

Figure 6

GENERALIZED FLOWCHART OF THE POTENTIAL WETLAND ENHANCEMENT SITES



Source: SEWRPC.

order to be considered as having a suitable use, one of the following conditions needed to be met: a) the existing land use must be agricultural; or b) the existing land use must be open space. The land use codes attached to the land use mapping units in the digital land use inventory were identified and used to make this extraction. All existing wetlands—areas not suitable for wetland restoration—were removed in this step. Since land uses are mutually exclusive, the identification of only agricultural and open space uses excluded existing wetlands from consideration as potential restoration sites. Once identification as an area having a suitable existing land use for possible restoration use, a new data set was formed by reclassifying the selected land uses similar to the procedure in step 2. As with the soils, this was done in order to simplify mapping unit processing in later steps of the analysis.

4. The next data set, Natural Areas, was built in the first analysis that identified the Greenway Study Area.

5. Data set Number 28, Existing Wetlands, was created by accessing a graphic database of Wisconsin Wetland Inventory maps prepared by and digitized as part of the Commission resource inventory. Wetland mapping units were selected from the database by appropriate vegetation code to form a new data set of existing wetlands. Once again, all common boundary lines between existing mapping units were removed to simplify later processing.

6. Data set Number 29, Degraded Wetlands, was then created by identifying the maximum areal extent of all degraded wetlands having suitable characteristics for potential wetland enhancement sites. In order for a wetland to be considered as a potential wetland enhancement site, one of the following conditions needed to be met: a) the wetland must have been abandoned from cultivation; b) the wetland must be currently farmed; or c) the wetland must be currently grazed. Wisconsin Wetland Inventory codes were used to select and retrieve the appropriate wetland mapping units from the digitized database. This data set was also processed by removing all common boundary lines between existing mapping units.

7. Data set Number 30, Wildlife Habitat, was constructed by selecting all Class I, Class II, and Class III wildlife habitat mapping units from a digital graphic inventory developed and maintained by the Commission. The resulting data set was also reclassified and simplified for further processing by removing all common boundary lines.

8. The final data set, Buffered Primary Environmental Corridors, was created in a slightly different manner from the other data sets. First, primary environmental corridor mapping units were selected from the environmental corridor inventory and combined to build a data set. Next, a buffer extending 200 lineal feet beyond the boundary of the initial primary environmental corridor was created by the GIS software. Since the data set created by this operation may not be a mutually exclusive set, mapping unit intersections were computed and overlapping buffer zones were eliminated from the output. The resulting data set comprised an area either totally within the primary environmental corridor or within 200 feet of corridor boundary lines.

9. Once the eight data sets had been collected, they were utilized in two intensive mapping unit processing operations to locate both potential wetland restoration sites and potential wetland enhancement sites. The first step in the process of locating potential restoration sites involved combining data sets in steps 1 through 6 in a data overlay operation. GIS software commands were used to compute the mathematical intersections of all mapping units in the Study Area Boundary, Suitable Soils, Suitable Land Uses, Natural Areas, Existing Wetlands, and Degraded Wetlands data sets. From this intermediate data set formed by the combination of mapping unit these data sets, mapping units were extracted that met all of the following criteria: a) located in suitable soils; b) located in suitable land uses; c) not located in a natural area; d) not located in an existing wetland; e) not located in a degraded wetland; and f) located in the greenway study area. The resulting output was an additional intermediate data set containing mapping units that were in the study area, that

had suitable characteristics of soils and land uses, but did not occur in natural areas, existing wetlands, or degraded wetlands.

10. The second intermediate data set from the above step was then processed with data sets in steps 7 and 8. The GIS software was used to perform a proximity analysis of the second intermediate data set with the Wildlife habitat and Buffered Primary Environmental Corridor data sets. This operation eliminated those mapping units from the second intermediate data set that either did not lie within or did not touch wildlife habitat mapping units and the primary environmental corridor with its buffer zone.

    The result of this analysis provided the final set of mapping units identifying the locations of potential wetland restoration sites. These sites are geographic areas located within the greenway study area having both suitable soil conditions and suitable existing land uses, that are not located within natural areas, existing wetlands, or degraded wetlands, but are located wholly or within, partially within, or immediately adjacent to wildlife habitats and a 200 lineal feet buffer zone surrounding primary environmental corridors.

11. The second major mapping unit processing operation was used to identify potential wetland enhancement sites. Since these potential sites were be based upon existing degraded wetlands, the Degraded Wetland and Natural Area data sets were combined in a GIS overlay operation, and an intermediate data set formed by selecting those mapping units that were located on degraded woodlands but were not located in natural areas. This intermediate data set was then processed with the Study Area, Wildlife Habitat, and Buffered Primary Environmental Corridor data sets in the same type of proximity analysis described above.

    The resulting data set represented the locations of potential wetland enhancement sites. These sites are geographic areas located in the study area having the characteristics of degraded wetlands, that are not located within natural areas, but are located wholly within, partially within, or immediately adjacent to wildlife habitats and a 200 lineal feet buffer zone surrounding primary environmental corridors.

SUMMARY, RESULTS, AND RECOMMENDATIONS

A greenway planning effort was undertaken by the Southeastern Wisconsin Regional Planning Commission at the request of Waukesha County within a 28-square-mile study area. The planning effort consisted of an analysis conducted with the assistance of the Regional Planning Commission geographic information system to: 1) refine the primary environmental corridors initially delineated by the Regional Planning Commission within the study area; 2) identify sites suitable for the provision of public access to the Fox River and its major tributaries; 3) identify routes suitable for the establishment of a recreational trail system along the Fox River and its major tributaries within the study area; and 4) identify environmentally sensitive lands and lands suitable for public recreational use warranting public acquisition. The planning effort culminated in the preparation of a Greenway Plan identifying all lands containing within the study area woodlands, wetlands, floodlands, natural areas, and rare and endangered and threatened plant and animal species habitat proposed for protection through public acquisition. The Greenway Plan also identified sites suitable for public acquisition for outdoor recreation use; and identified route areas suitable for the development of recreational trails which excluded wetlands, floodlands, areas of steep slopes, and areas of poor soils. Finally, the Greenway Plan identified sites within the study area suitable for wetland restoration and environmental corridor enhancement and expansion.

The study area consisted of a 28 square mile area along the Fox (Illinois) River, Mill Creek, Pebble Creek, and Redwing Creek located in parts of U. S. Public Land Survey Township 6 North, Range 19 East, Town of Waukesha; and Township 5 North, Range 19 East, Town of Vernon, Waukesha County, Wisconsin. Within that study area, the greenway planning effort focused on the riverine areas of the Fox River and its major

tributaries, and the immediate environment of the associated primary environmental corridors. These riverine areas encompassed a total of about 13 square miles, or about 46 percent of the total study area.

Type I and II Preservation Areas were identified in the Greenway Plan as sites that were located in and adjacent to the Fox River and its major tributaries whose natural resource features merit protection through public acquisition. Such lands included woodlands, wetlands, floodlands, natural areas, and rare and endangered and threatened species habitats. The Type I Preservation Areas were assigned a higher priority for public acquisition than the Type II Areas, since they contain higher quality resources. The analyses made by application of the geographic information system of the Regional Planning Commission identified approximately 645 acres as Type I Preservation Areas, and approximately 2,123 acres as Type II Preservation Areas. These areas are shown on Map 3.

Areas suitable for the development of recreational trails and public access sites to the Fox River and its major tributaries were identified. The physical resource features and conditions present within the study area such as wetlands, floodlands, natural areas of steep slopes, and areas of poor soils were used to identify such areas. The analyses identified approximately 1,516 acres of land suitable for the development of recreational trails. The analyses also identified approximately 690 acres as suitable for the provision of public access to waterways, and for the location of outdoor recreational facilities. These areas are shown on Map 4.

The analyses also identified approximately 719 acres as suitable for wetland restoration sites; and approximately 355 acres suitable for wetland enhancement sites within the study area. If so utilized, these sites would serve to: 1) achieve continuity with other habitat areas; 2) help to preserve related natural processes needed to support habitat; 3) increase the likelihood of success on the part of the restoration effort; and 4) ensure the long-term preservation of the habitat created from the restoration. These areas are shown on Map 5.

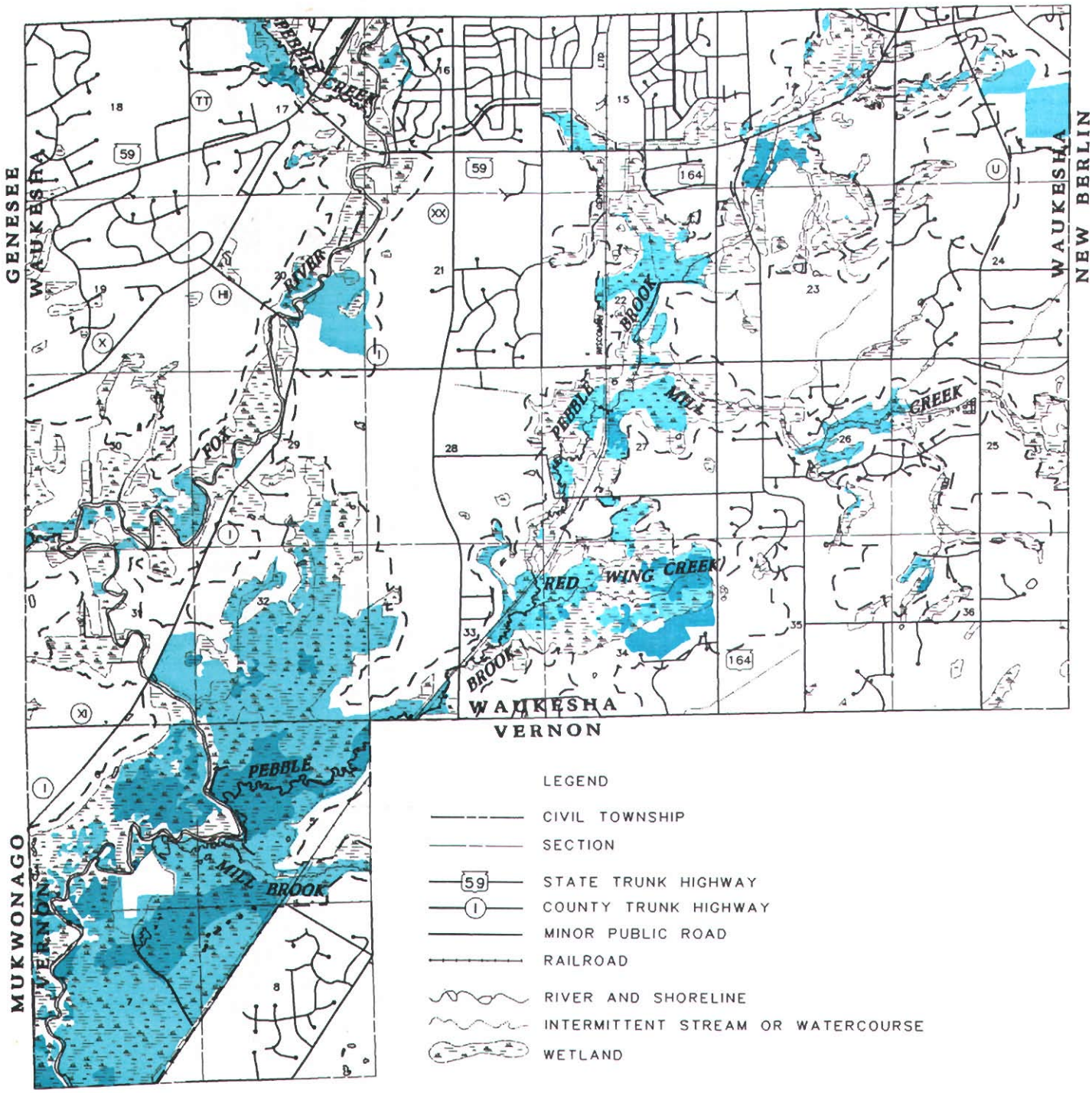
The Greenway Plan recommends that Waukesha County, considering the mapped results from each analysis and real property ownership boundaries, acquire the lands identified for preservation. Further analyses utilizing the geographic information system could aid in plan implementation. For example, such analyses could be used to determine more specifically width and buffer requirements for recreational trails, and for specific acquisition boundaries for neighborhood, community, and regional park and open space sites. Uplands preservation areas could be more specifically identified on the basis of type, size, proximity, and buffer. And finally, natural area boundaries could be more specifically determined on the basis of real property ownership boundaries and buffer requirements. All such analyses would provide the means to identify lands suitable for the protection and enhancement of the environmental corridors within Waukesha County and Southeastern Wisconsin.

CONCLUSION

Within the Towns of Waukesha and Vernon, the Fox (Illinois) River and its tributaries provide important natural corridors for fish and wildlife movements and opportunities for recreational activities. However, areas along the river have become fragmented as a result of various intensive land use activities. To date, most of these impacts have been rural in nature. However, with the continuing encroachment of urban land uses a significant threat to the integrity of the riverine areas exists. The Waukesha County Greenway Plan provides a means for preserving the riverine areas of the Towns of Waukesha and Vernon in natural open uses. Analyses utilizing the Regional Planning Commission geographic information system facilitate the use of natural resource information to identify those geographic areas that should be considered for inclusion in a County Greenway System (see Map 6). By applying the environmental corridor concept, the County will be in a position to help protect and manage the riverine ecology, as well as provide recreational opportunities for residents of the area.

Map 3

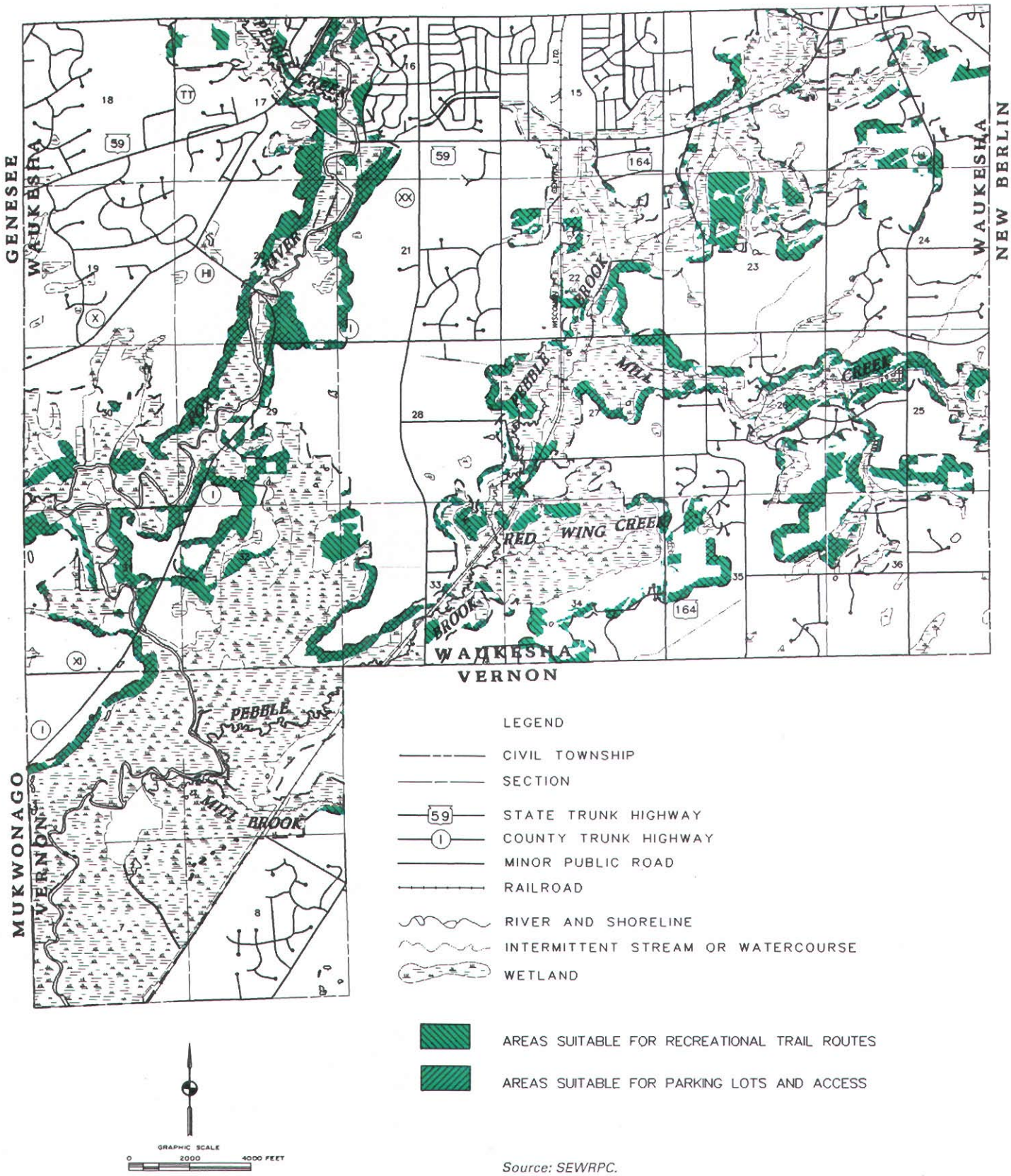
AREAS SUITABLE FOR TYPE I AND II PRESERVATION WITHIN THE WAUKESHA COUNTY GREENWAY STUDY AREA



Source: SEWRPC,

Map 4

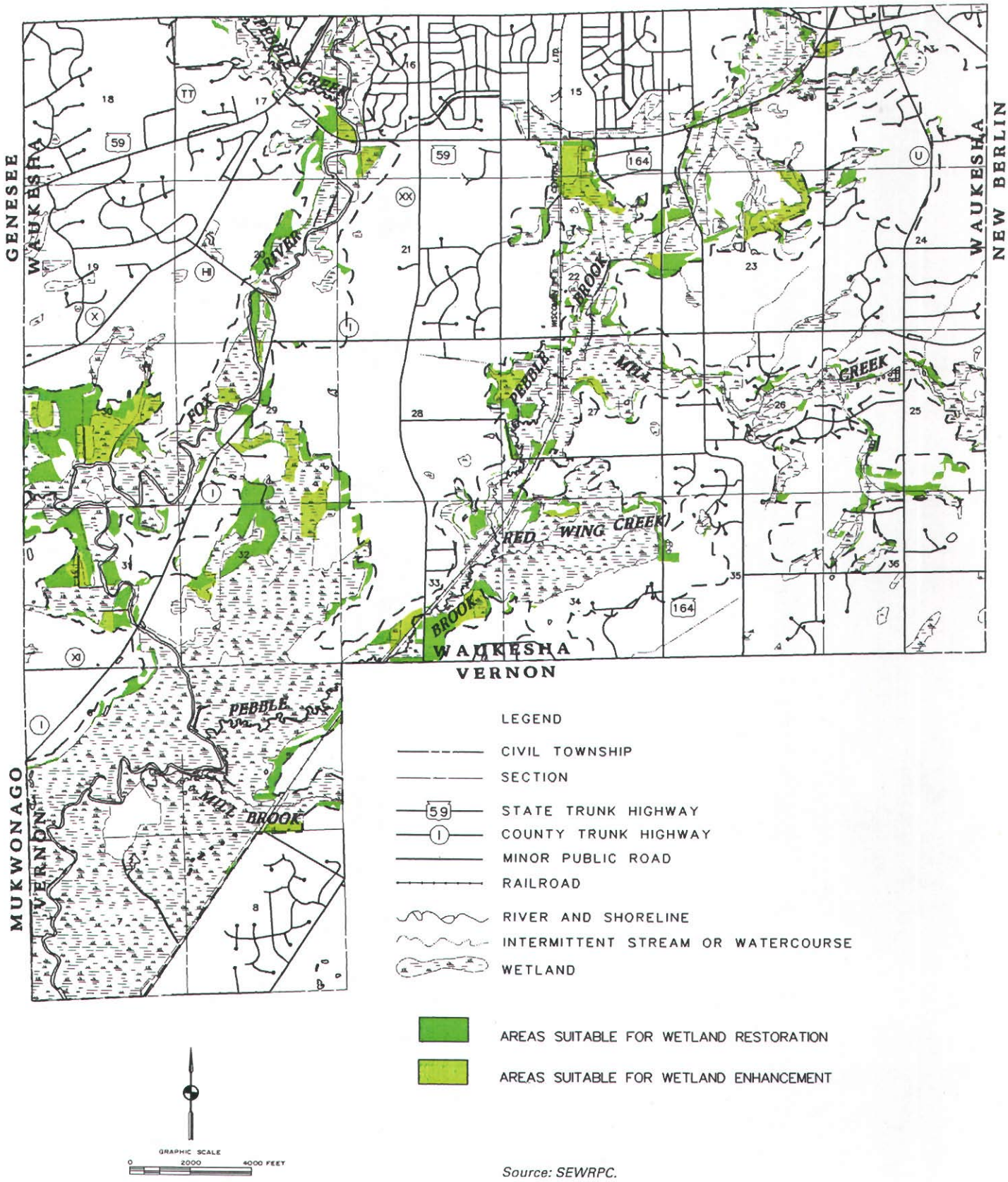
AREAS SUITABLE FOR RECREATION TRAIL ROUTES AND PARKING LOTS AND ACCESS WITHIN THE WAUKESHA COUNTY GREENWAY STUDY AREA



Source: SEWRPC.

Map 5

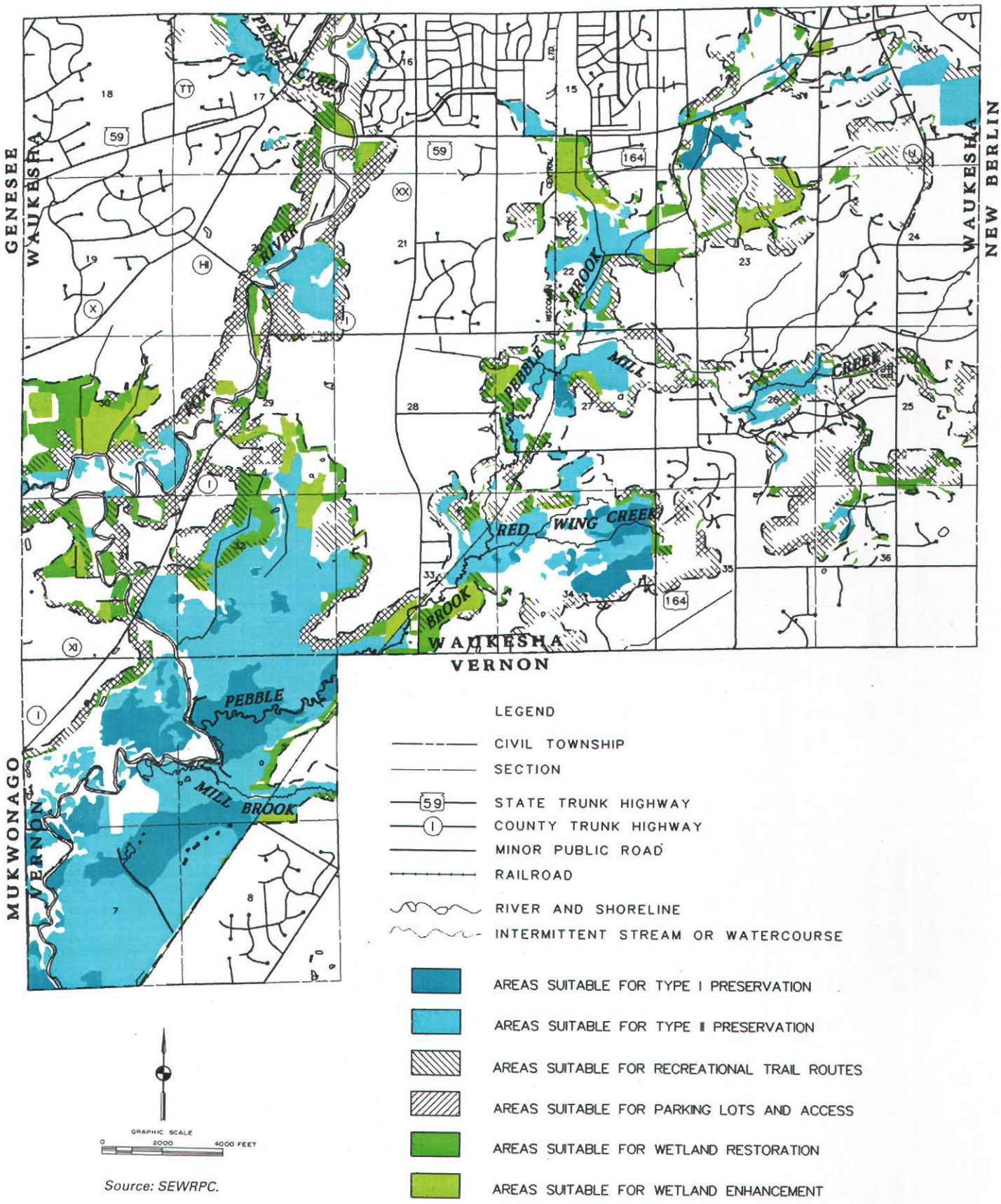
AREAS SUITABLE FOR WETLAND RESTORATION AND ENHANCEMENT WITHIN THE WAUKESHA COUNTY GREENWAY STUDY AREA



Source: SEWRPC.

Map 6

COMPOSITE OF PLAN ANALYSES FOR THE WAUKESHA COUNTY GREENWAY STUDY



Source: SEWRPC.