SURFACE WATER RESOURCES OF BROWN COUNTY

DEPARTMENT OF NATURAL RESOURCES
MADISON, WISCONSIN
1972

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SURFACE WATER RESOURCES OF BROWN COUNTY

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LAKE AND STREAM CLASSIFICATION PROJECT

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INTRODUCTION

Americans, largely freed from the everyday task of earning a living, are directing more leisure time energy toward our natural resources as a primary source of recreation. The surface waters of Wisconsin offer to many the most enjoyment, peace, and solitude attainable. On water man can be angler, boater, hunter, water skier, swimmer, sailor, or casual observer -- whatever his liking. Problems can and do arise. As people in ever-increasing numbers look to water for an ever-expanding variety of recreation uses,they find less space available for each activity and each participant. In addition, domestic, agricultural, and industrial activities demand more water than ever before.

Various water uses are seldom in harmony. Often one user may control water to the exclusion of others. Water use problems and conflicts are complex and call for complex solutions. The water resource planner must consider ecological and aesthetic qualities as well as economic factors when attempting to resolve problems and conflicts. Further, he must seek methods of water apportionment that will maintain harmony and assure equitable use.

In 1959, the Wisconsin State Legislature, directed the Conservation Commission to develop a classification system for lakes according to use. The responsibility was extended to include streams in 1961.

Before a classification system can be devised, it is necessary to obtain specific information about each lake and stream in the state. A county surface waters inventory, such as the one covering Brown County, is the initial step in providing such information. Each inventory is designed to present the quantity, quality, and character of the water resource with respect to its use for renewable resource production and recreation. Because of time limitations data was collected regardless of season and limited to single visits. Obviously information concerning water analysis, depth, bottom types, transparency, or fishery composition may be inadequate. In spite of shortcomings, this inventory presents for the first time a set of vital statistics useful in measuring the present condition of waters and in planning their future management.

Data for this inventory was gathered from many sources, principally, A.S.C.S. aerial photos, U.S.G.S. topographic maps, DNR files and surveys, and field investigations of primary concern when gathering data was the recreation use afforded by the waters mentioned. Little consideration was given industrial and agricultural use except where use conflicts were readily apparent.

Maps presented with this report should not be considered nor used as a final and factual authority from any legal or regulatory standpoint because of natural or man-made changes which may have occurred.

A BRIEF HISTORY OF BROWN COUNTY

The history of Brown County is virtually the history of Wisconsin. Since tremendous numbers of books and articles have been devoted to the history of this area only a brief account will be presented here.

Prior to the arrival of the first white man (Jean Nicolet, in 1634) what is now Brown County was the seat of the Winnebago Nation. The Winnebagoes were an aggressive tribe that used the Green Bay area as a base for raids. In later years other tribes moved into the region as they were displaced from their own lands further east.

In the years from 1634 to 1669 various French fur traders visited the area but left few records. St. Francis Xavier mission was established along Green Bay on December 2, 1669. The French established a post, Fort St. Francis or LaBaye, at the same site in the period between 1718 and 1721. In 1761 this fort was rebuilt and renamed Fort Edward Augustus.

The first permanent settler was Augustin de Langlade, who with his family of eight, moved to the area between 1744 and 1746. Forty years later the Bay colony settled by Langlade had a total population of 56. This grew to 252 by 1812 and to 500 by 1824 (not including the 600 troops stationed at Fort Howard).

Lewis Cass, governor of Michigan Territory, created Brown County on October 26, 1818. The new county was named after Major General Jacob Brown of the United States Army and included much of upper Michigan and all of Wisconsin from Lake Michigan to the Wisconsin River and south to Illinois.

In 1836 all lands north of the Menomonee River and Milwaukee County were set off. Later that same year Portage, Marquette, Fond du Lac, Calumet, Manitowoc, Sheboygan, and parts of Dodge and Washington counties were set off. Oconto, Outagamie, Door, and Waupaca counties were created from Brown County in 1851. The creation of Kewaunee County in 1852 and Ozaukee and Shawano in 1853 reduced Brown County to its present size.

The first county seat consisted of a log courthouse located at Menomineeville in 1825. This was moved to DePere in 1837 over Fox River ice. The county seat was transferred to Green Bay in 1854.

Quite obviously water resources have played an important role in the history and development of Brown County. Green Bay and the Fox River drew the earliest explorers and missionaries to the area and later brought in most permanent settlers. The same waterways served as a highway over which first furs, then agricultural products, and later industrial products could easily be transported to the eastern markets.

GENERAL SETTING OF WATERS IN BROWN COUNTY

The various physical and chemical characteristics of any surface water, whether lake, stream, or pond, are directly related to the natural history of the surrounding countryside. Man's land use and land abuse practices superimposed over natural features of an area are often reflected in the recreational use, both present and potential, of a particular lake or stream. This section discusses the geology, geography, climatology, and demography of Brown County as they relate to the surface water resources.

Topography

The Fox River Valley, a continuation of the same depression forming Green Bay, slopes gently for its length from Lake Winnebago to Green Bay. To the east a steep escarpment called the Niagara escarpment rises steeply to a height of 200 to 250 feet above the valley. East of this escarpment is a slightly rolling plain which drains toward Lake Michigan. West of the Fox River the surface rises gently from the river valley. Traces of an expanded Green Bay exist in the drift deposits of the Fox Valley, but these deposits have no characteristic morainic features.

Total land relief within the county ranges from 580 feet to 1,000 feet in the southeast portion of the county. Table 1 gives some representative elevations of various locations within Brown County.

Topography is important to surface waters because it affects the amount of surface runoff, and to a greater degree the direction of runoff. Topographic divides limit overland runoff toward streams, while land slope influences the amount of precipitation that will infiltrate the soil.

Drainage

All of Brown County lies within the Lake Michigan drainage system. The major watershed present is the Fox River watershed running north-south through the county. Minor watersheds include the East River watershed running close to and parallel to the Fox River, the Branch River watershed and Neshoto Creek watersheds in the southeast portion of the county, and the Duck Creek and Suamico River watersheds in the northwest. Figure 1 outlines the important watersheds and their locations in Brown County.

Table 1. Elevations of various locations throughout Brown County

Location	Elevation (feet)	Location	Elevation (feet)
Anston	743	Askeaton	749
Bellevue	759	Big Suamico	605
Cormier	602	Denmark	874
DePere	595	Duck Creek	589
Fox River (DePere lock, crest)	589	Green Bay	590
Greenleaf	725	Little Rapids	644
Midway	647	New Franken	810
Summit	791	Tremble	626
Wrightstown	657		

(After Martin, 1932)

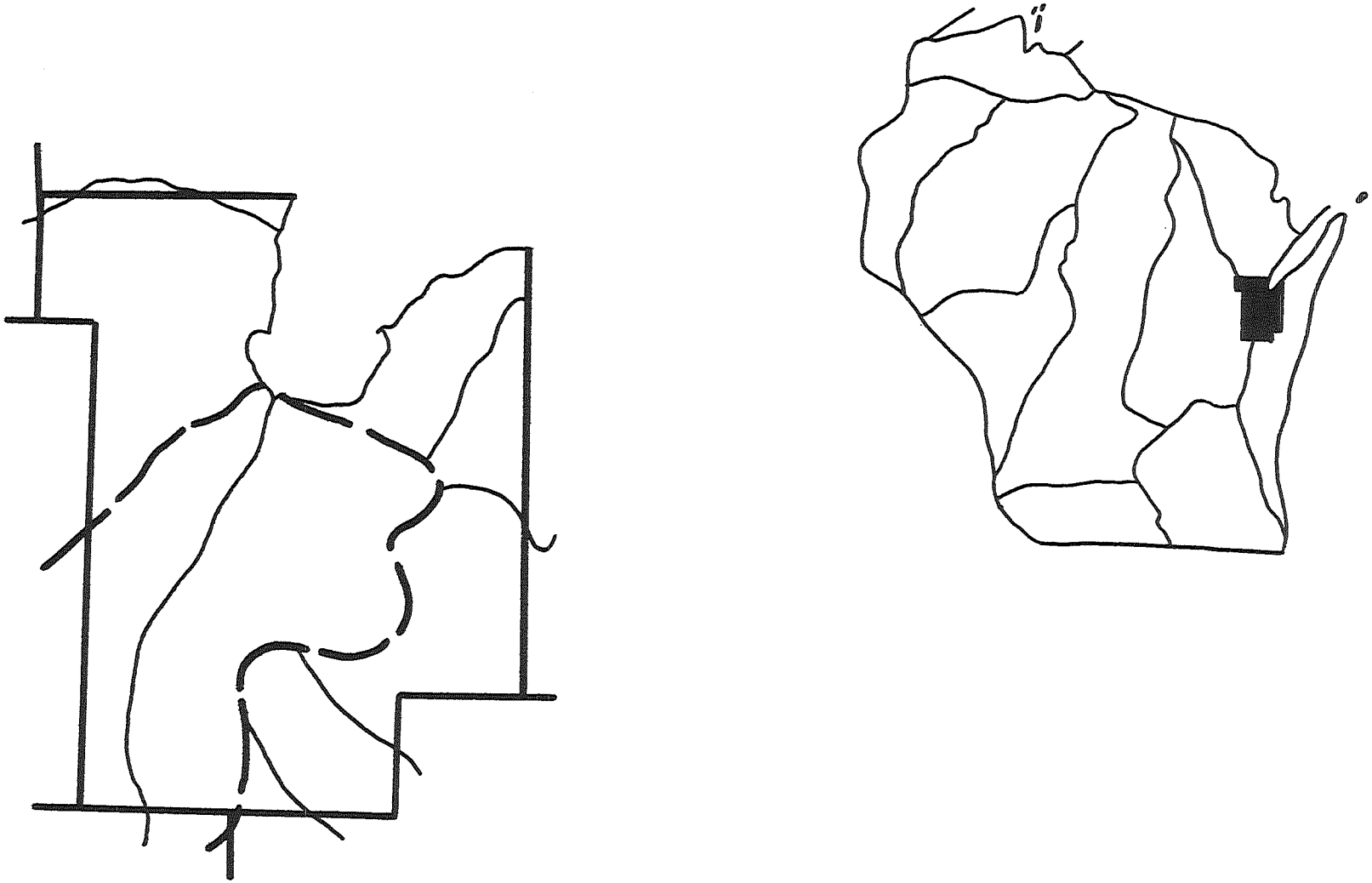

Fig. 1. Location of Brown County within the state and within the major watersheds

(SCS, 1966)

The Niagara escarpment separates the runoff between Lake Michigan and Green Bay. Streams west of the escarpment tend to have moderate to low gradients. The Fox River, for instance, has a total drop of 166 feet from Lake Winnebago in Winnebago County to its mouth at Green Bay, an average of about seven feet per mile. Many of the streams in this section are slow moving or intermittent. Streams east of the escarpment are few in number within Brown County and have moderate gradients.

Geology

The science of geology is too complex to include a comprehensive account of the geology of Brown County in this report. Only the impact of bedrock formations and glacial activity will be considered here. A cross-sectional view of Brown County depicting the basic geologic formations and their relationships to one another is presented in Figure 2.

Lying just beneath the drift material or exposed to the surface are three basic formations. West of the Fox River is a broad area of Platteville-Galena limestone. This layer slopes west to east and comes to lie beneath the other two layers in the eastern portion of the county. Extending along a line roughly following the Fox River is a narrow band of Maquoketa shale. East of the Fox River and rising abruptly to form a westerly facing escarpment is a layer of Niagara limestone. All layers are groundwater bearing areas, however, the principle sources of groundwater are the surface deposits of sand and gravel, and the sandstone layer underlying the Platteville-Galena dolomite. Figure 3 presents the bedrock geology of Brown County. The topography of eastern Brown County is strongly influenced by the superficial nature of the Niagara escarpment. The major waterway, the Fox, parallels this feature. As such the bedrock geology plays a major role in shaping drainage patterns in areas where it is near the surface.

Figure 4 depicts the glacial deposits of Brown County. The thickness of the surface deposits vary and consist primarily of red lacustrine and pebbly clay. The presence of deposits indicative of an extinct glacial lake around Green Bay show that at one time Green Bay was larger and deeper than it is today.

Glacial deposits act as a smoothing agent on the topography thereby affecting the runoff and infiltrati rates of surface waters. Glacial deposits consisting of heavy materials do not allow precipitation to seep into groundwater regions readily and act as confining layers for underlying aquifers. Glacial deposits also act as parent materials for most of the county's soils thus indirectly affecting water fertility and productivity.

Soils

Brown County's various soil types are closely related and not easily differentiated. They are mostly derived from glacial till and outwash deposits. These are basically rich heavy soils common to gently rolling countryside. They are well suited for the agricultural pursuits for which they are used. In the northwest portion of the county the soils are slightly lighter, containing a higher sand content, but remain good farmland. Organically derived peat soils are found around the south and west sides of Green Bay and in scattered locations throughout the county. Peat soils are not well drained naturally and make poor agricultural soils unless drained and fertilized. General soil types within Brown County are presented in Figure 5.

Naturally occurring minerals found in lakes and streams are most often direct products of the soils found within the drainage system. In general, surface waters located in regions of high soil fertility will have higher fertility ratings than those located in less fertile soil regions. As would be expected, the rich soils of Brown County produce fertile water conditions. This natural fertility is enhanced by fertility introduced from agricultural, industrial, and municipal sources which will be discussed in another section.

The heavy soils of Brown County are not conducive to infiltration and do not allow a large amount of water to seep into the water table. This is reflected by the general lack of springs as a water source for the county's small streams. The small streams carry heavy flows seasonally, during peak runoff periods and during heavy precipitation, but may be dry or contain stagnant water at other times.

Groundwater

Groundwater supplies play an important role in the maintenance of the surface water resources as well as being an important source of private, industrial and municipal water supply. Brown County's groundwater supplies are available in all the geologic formations, but mainly in the sandstone layers and the surface deposits of sand and gravel. The groundwater supplies under the sandstone layer are under tremendous pressure and the strongest artesian flows in Wisconsin were present originally at DePere and Green Bay. Today pumpage and leakage have reduced these flows to a fraction of their original amount. The few springs present arise from the Niagara escarpment and flow a short distance into Green Bay. Very few springs contribute volume to the county's streams accounting in part for the lack of suitable water quality to support trout.

During extended dry periods the groundwater level is depressed, lake levels drop, and streams reach low flows. Many small ponds, marshes, and small tributary streams may dry up completely. During wet periods the groundwater levels are elevated. At these times lakes and marshes tend to reach high water levels and streams reach peak flows.

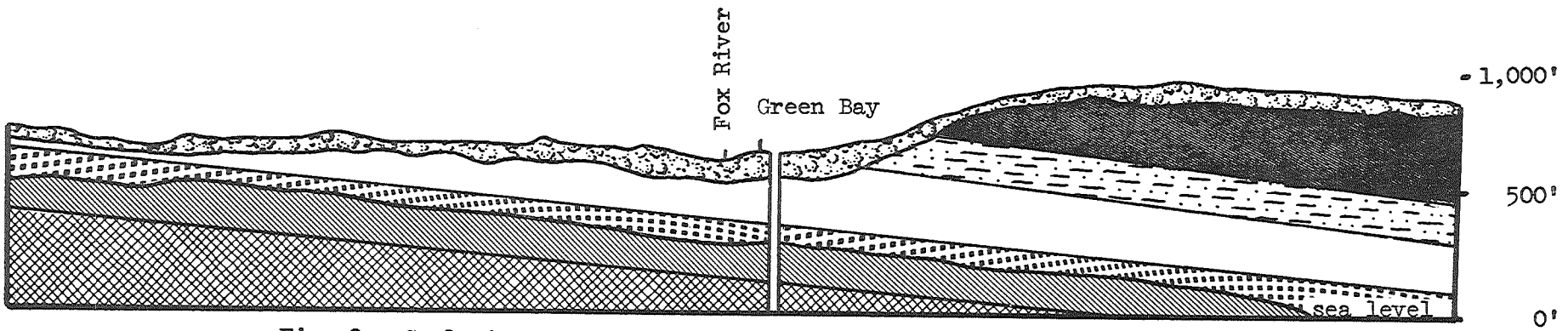

Fig. 2. Geologic section, east-west, across central Brown County

Upper Cambrian Sandstone

Lower Magnesian Limestone

St. Peter S. S.

Galena Platteville L. S.

Cincinnati Shale

Niagara L. S.

Drift

(After Weidman and Schultz, 1915)

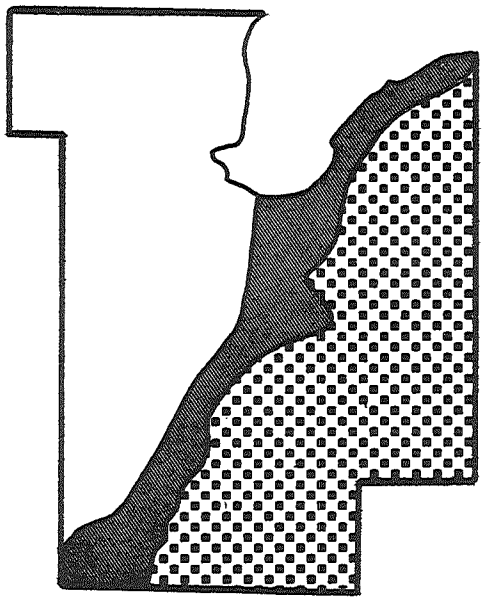

Fig. 3. Bedrock geology of Brown County (After Bean, 1949)

Platteville-Galena Dolomite W/Limestone

Maguoketa Formation Dolomitic Shale

Niagara Formation Dolomite

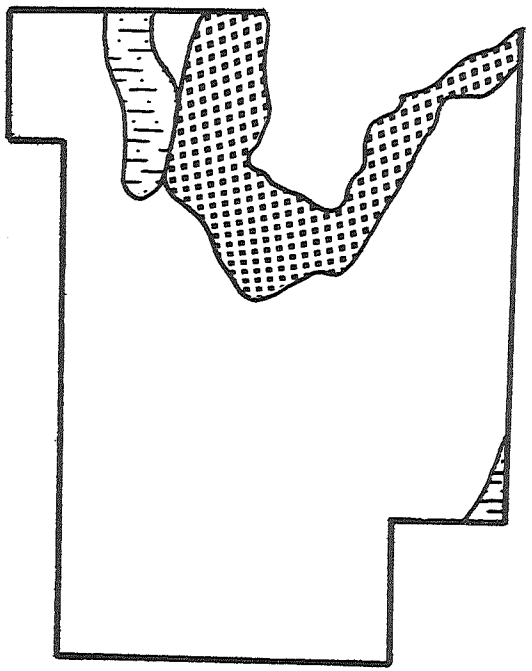

Fig. 4. Glacial geology of Brown County (After Thwaites)

Mankato Ground Moraine

Extinct Glacial Lake

Mankato End Moraine

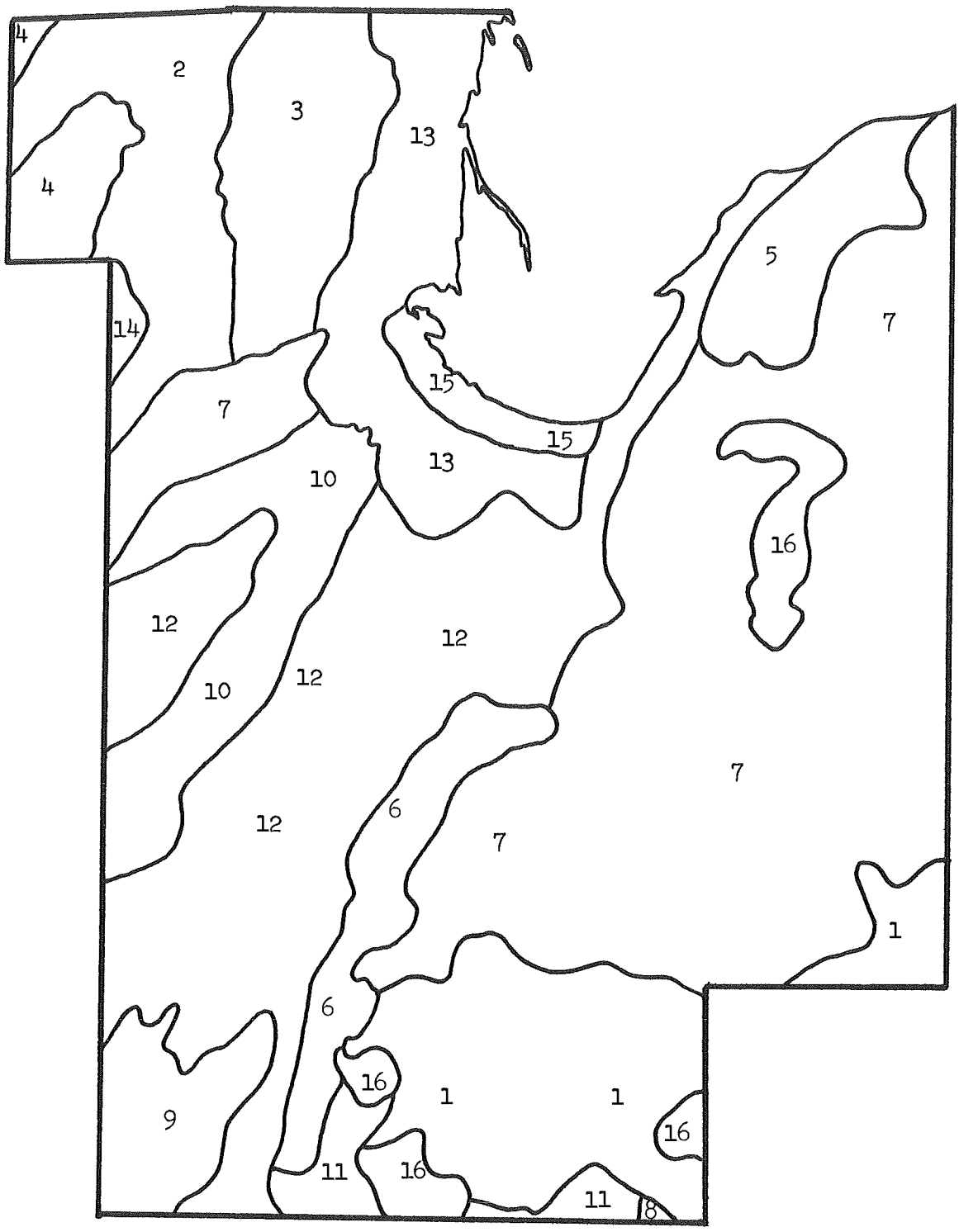

Fig. 5. Soils of Brown County

(Hanson, Hole, 1967)

Key to the soils of Brown County

1. Loess over dolomitic loam and sandy loam glacial till, outwash sand and gravel and lacustrine deposits.
(Theresa, Onaway, Fox and Salter silt loam and loams)

2. Pink sands and sandy loam calcareous glacial till with some acid outwash sand.
(Emmet loamy sand; Onaway loams; and Omega loamy sand)

3. Pink calcareous sandy loam glacial till and some acid outwash sand.
(Emmet and Onaway sandy loams; Solona and Angelica loams; Omega loamy sand)

4. Pink calcareous sandy loam and loam glacial till.
(Solona, Onaway, Hortonville, Shiocton, and Angelica loams)

5. Pink calcareous sandy loam and loam glacial till, in places shallow over limestone bedrock.
(Longrie, Summerville, Onaway and Bonduel loams; rock outcrops)

6. Thin calcareous reddish-brown glacial drift over limestone bedrock.
(Kolberg, Summerville, and Kewaunee silt loam and silty clay loams with limestone and shale rockland)

7. Reddish-brown calcareous clay and clay loam glacial till.
(Kewaunee Hortonville, Manawa and Poygan silt loam and silty clay loam)

8. Thin calcareous loam and clay loam glacial tills; course outwash with local loamy coverings.
(Onaway loam; Theresa, Hortonville, Fox and Casco loams)

9. Reddish-brown calcareous clay and silty clay glacial till with local loamy coverings.
(Kewaunee, Manawa, and Poygan silty clay loam)

10. Reddish-brown calcareous clay glacial till with coverings of silt loam, loam, and sandy loam.
(Kewaunee and Manawa silt loam and loam)

11. Reddish-brown calcareous loam and clay glacial till; local coverings of sandy material.
(Kewaunee, Manawa, Poygan and Hortonville loams and silt loam; Tustin loamy sand)

12. Reddish-brown calcareous clay glacial till and lacustrine sediments.
(Kewaunee, Oshkosh, Manawa and Poygan silty clay loam)

13. Neutral sandy glacial drift and lacustrine deposits; and organic material.
(Granby, Shawano and Emmet sand and sandy loam; and shallow peat soils)

14. Acid to neutral lacustrine and glacial drift materials with local sandy coverings.
(Wauseon, Keowns, Tustin and Rimer loams and sandy loam)

15. Vegetation of wetlands over acid sandy and loamy glacial drift.
(Acid sedge peat and muck soils; Au Gres, Newton and Morocco sand and loamy sand)

16. Vegetation of wetlands over loamy and clayey calcareous glacial drift.
(Slightly acid to alkaline sedgey and woody peat and muck soils; Pella, Poygan and Brookston silt loam and silty clay loam)

Climate

Green Bay is the only weather reporting station in Brown County. Climatological data from this and other stations located in nearby counties provide a representative cross-section of the general climate of the county. Table 2 is a compilation of general climatic data from the area.

Brown County has a modified continental climate. Physical features, principally Green Bay, Lake Michigan, and Lake Superior,have a modifying effect on the temperature causing less severe fluctuations than is common to northern Wisconsin.

July is the warmest month with a mean monthly temperature of 69.9° F. The coldest month is January with a mean monthly temperature of 16.1° F. The growing season is relatively short and best suited for vegetables and crops associated with the dairy industry.

Prevailing winds blow from a southwesterly direction most of the year except for March, April, and May when they blow predominately from the northeast. Winds are moderate with an annual average of 10.6 miles per hour. April and November are the windiest months with an average of 12.2 miles per hour and 12.6 miles per hour, respectively. August is the least windy with an average of 8.1 miles per hour. The greatest amount of turnover and mixing can be expected in April and November when winds are strongest.

More than half (55%) of the mean annual precipitation falls during the growing season, May through September. June is the wettest month; whereas, May is the driest month in this period. Annual average snowfall amounts to 39.8 inches. Figure 6 relates the mean monthly temperature to the mean monthly precipitation. The full impact of precipitation on the surface water resources of Brown County will be discussed in the next section.

Runoff and Flow Characteristics

The most important source of ground and surface water in Brown County is precipitation. Precipitation may return to the atmosphere by evaporation or by transpiration by plants, remain as soil moisture in the zone above the water table, run over the land surface into lakes and streams as runoff, or percolate downward to the saturation zone to become groundwater. Those streams maintaining a perennial flow depend on groundwater to maintain this flow. Brown County's intermittent streams depend directly on surface water runoff for their flows. Undoubtedly the flow in the Fox River is smoothed by storage in Lake Winnebago.

Drainage patterns and rates of runoff are influenced by the superficial characteristics of the land surface over which the water passes. Soil conditions, vegetative cover, and seasonal variations in temperature and precipitation all have an effect on stream flow. There are no monthly flow recording stations in Brown County. Information relating to the inflow into the Winnebago pool indicates that peak flows occur in April when winter snows are melting and the ground is frozen allowing little or no percolation. Lowest flow levels are reached in January and February when precipitation is in the form of snow, and again in August, when evapotranspiration is high and precipitation low. Appendix 2a presents flow data from several Brown County streams.

Lake levels are more stable than stream levels and are related more to the level of the water table than seasonal runoff rates. Major fluctuations in lake levels can be observed more readily on a yearly basis than a seasonal basis.

Population and Area

Brown County has a total land area of 525 square miles or one percent of the land area in the state. This ranks Brown County 54th among the 72 counties in size.

Table 2. Climatological data for stations in and near Brown County

Station	Precipitation (inches)			Temperature (°F.)		Growing Season (Days)	Average date of killing frost	
	Mean Rain	Days with Rain*	Mean Snow	Mean Monthly	Extremes		First	Last
Appleton	28.45	65	43.4	45.6	-30 to 107	164	October 14	May 3
GREEN BAY	26.56	117	39.8	43.6	-31 to 99	-	-	-
Oconto	26.80	60	39.8	44.9	-31 to 105	133	Sept. 27	May 17

(From Wisconsin Climatological Data, 1961)

* At Green Bay defined as .01 inches or more; at Appleton and Oconto defined as 10 inches or more.

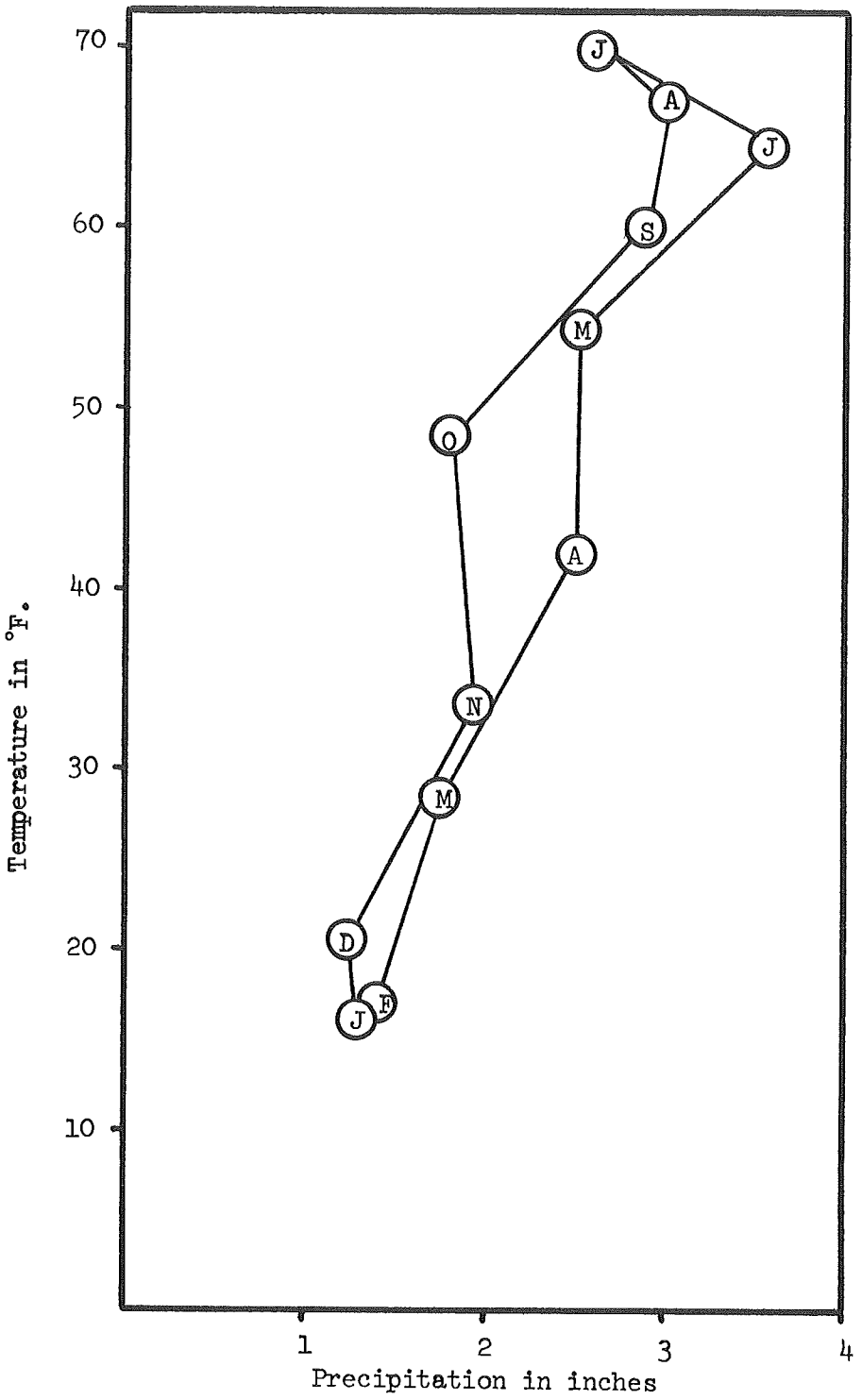

Fig. 6. Climograph of the mean monthly data recorded at Green Bay

(After Wis. Climatological Data, 1961)

Statistics from the 1970 census indicate that 158,244 people reside in Brown County. This is 3.6 percent of the state's population and places Brown County 5th in Wisconsin by population size. Projections indicate that Brown County will support a population of at least 215,893 by 1990, 36 percent above the 1970 population (Fuchs and Marshall, 1968). This increase is less than that expected for the state as a whole indicating a slowing trend in Brown County's growth. The county's average age is 25.4 years compared to 29.4 years for the state average. By 1980 it is projected that the 15--64 and 65 and over age groups will have increased nearly twice as fast as the 0-14 age group (Fuchs, et. al. 1966) reinforcing the indications that the area's population growth is slowing. (Population data is presented in Table 3).

Brown County has six incorporated cities and villages (Table 4). Three of these; DePere (population 13,309), Green Bay (population 87,809), and Howard (population 4,911) are large enough to be classified as urban areas (population greater than 2,500). These six municipalities contain 70 percent of the county's residents. Analysis of population growth in these municipalities is difficult because of continued changes in their corporate limits.

Because the surface water resources of Brown County are extremely small they assume greater importance in light of the large population. Nearby Lake Michigan and Green Bay receive most of the pressure, along with the Fox River. The remainder of the surface waters are simply too small or undesirable as sources of recreation forcing Brown County residents into adjacent counties in search of facilities. The limited resource provided by Green Bay and the Fox River has been hurt by industrial activity, development and other abuses directly related to a large population.

Table 3. Population of Brown County and Wisconsin

	Area (Sq. Miles)	Population					Population per Square Mile 1970
		1950	1960	1970	1980*	1990*	
Brown County	525	98,314	125,082	158,244	181,328	215,893	301.4
State of Wisconsin	52,044	3,434,575	3,951,777	4,417,933	5,559,906	6,576,274	84.9

* Estimated

(From: Fuchs and Marshall, 1968; Advance Report on 1970 Census, 1971)

Table 4. Population of incorporated cities and villages of Brown County

Incorporation	Population			Percent Change	
	1950	1960	1970	1950 - 1960	1960 - 1970
Denmark	1,012	1,106	1,364	+ 9.3	+23.3
DePere	8,146	10,045	13,309	+23.3	+32.5
Green Bay*	52,735	62,888	87,809	+19.3	+39.6
Howard	2,447	3,485	4,911	+42.4	+40.9
Pulaski	1,210	1,540	1,717	+27.3	+11.5
Wrightstown	761	840	1,020	+10.4	+21.4
Totals:	66,311	79,904	110,130	+20.5	+37.8
Brown County	98,314	125,082	158,244	+27.2	+26.5

*County seat

Land Use and Land Cover

Brown County's vast forests (Figure 7) have given way to the axe and the plow. Today most of the trees are gone and agricultural crops and dairy cattle roam the once forested hills. Now 78.9 percent of Brown County's land area is farmed, almost six times as much as remains forested. Of the remaining forest land all is classified as commercial forest land, however, over half is used as grazing land to some degree (Figure 8 DNR, 1957). Dairying is the major agricultural use of the land. Following the state trend, the farm population and number of farms is declining while existing farms are getting larger. Total land utilization for farming is also declining. From 1964 to 1969 over 32,000 acres of land were removed from agricultural use. Table 5 provides a breakdown of agricultural land use as of 1964.

The remainder of the land area consists of marshland; rights-of-way; industrial, recreational, and residential lands; and water areas.

The total impact of various land uses will be discussed whenever necessary throughout the text.

Table 5. Agricultural land uses in Brown County

Land Use	Acres (Approx.)
Total farmland	280,793
Cropland	226,751
Harvested	178,665
Pastured	38,105
Not harvested or pastured	9,981
Vegetables harvested and other crops	5,223
Woodland	32,141
Pastured	20,438
Not pastured	11,702
Other pasture	8,064
Irrigated land in farms	261
Irrigated cropland harvested	27
Farm ponds, pits, reservoirs, earther tanks (number-acreage)	149-148

(From U. S. Census of Agriculture, 1966)

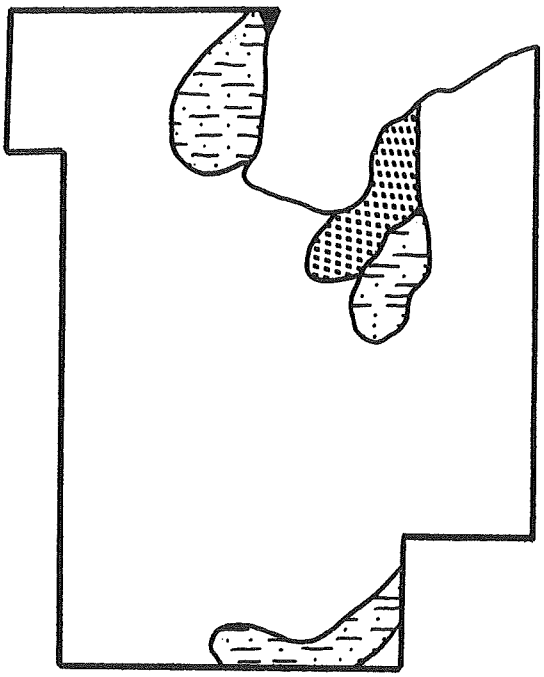

Fig. 7. Early vegetation of Brown County (After Hanson, 1965)

Sedge meadows

Pine barrons

Northern mesic forest

Conifer swamps

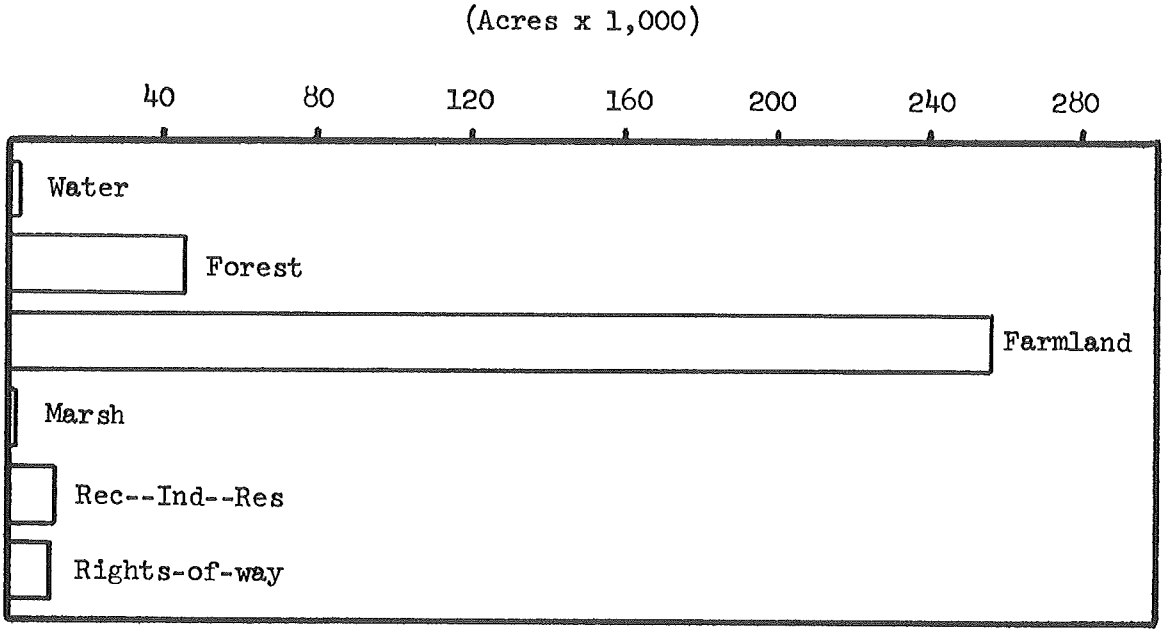

Fig. 8. Land cover of Brown County (After WCD, 1957)

ALPHABETICAL LISTING AND DESCRIPTION OF LAKES AND STREAMS

Data presented in this and many following sections is based primarily on information collected during the summer of 1971. Some factors change with time and may differ from present conditions (e.g. degree of public access). Certain discrepancies may therefore be noted. All named lakes and all streams are discussed in a brief paragraph. Data from unnamed lakes is presented in tabular form.

Each lake is described by location (township, range, section, and forty), area, maximum depth, and water clarity (secchi disk). Significant fish species are listed as are all problems associated with the recreational use of the lake. Wildlife values, littoral bottom materials (to depth of five feet), water source, water quality and other pertinent data are also presented. The degree of public access and public lands is indicated and presented on the access and public lands map. Additional data can be found in Appendix 1a and 1b. Private fish hatcheries and vernal ponds are not included but discussed collectively later in this report.

Streams are described by the location of their mouths (or where they leave the county), area, length within the county, and gradient. The major fishery is listed along with degree of public access, bottom types, bank vegetation, and water quality. Other conditions which may affect the recreational value of the stream are also presented. Additional physical and chemical data are shown in Appendix 2a and 2b. Streams are defined as all named water courses (both perennial and intermittent) and all unnamed perennial water courses greater than 1.0 miles in length.

Named Lakes

Green Bay T-24, 25-N, R-21, 22-E, Sections--many
Area = approx. 49,000 acres in Brown Co., Depth = approx. 26 feet.

Green Bay is by far the most important surface water resource in Brown County in terms of recreational potential. The bay served as a natural starting point for early settlement and transportation to the interior of Wisconsin via the Fox River. The Fox River is also very important as a determinant of the water quality in lower Green Bay. The bottom materials of the lower bay consist of a very loose, flocculent sediment. As a result the water clarity changes significantly over short periods of time due to the ease with which these materials become resuspended in the water.

Chemically Green Bay is a hard water alkaline basin which has a total alkalinity of 143 mg/l. Green Bay receives a large nutrient load from industrial, municipal, and agricultural sources. Nutrient levels consistently exceed 0.1 mg per liter of nitrogen and .02 mg per liter of phosphorus, enough to create bloom conditions. Heavy algae blooms are common and have caused oxygen depletion in some sections of the bay creating isolated fish kills during the summer months. In addition, the Bay has been used as a dumping grounds compounding the problem. Green Bay is heavily developed with permanent and seasonal dwellings along the southeast shore and in scattered sections on the west shore. Extensive wetlands in the southwest corner limit development and provide habitat for waterfowl and wildlife. This habitat is rapidly being diminished through the steady encroachment of man-deposited fill into the marsh.

The fishery of Green Bay has changed drastically in the past three decades. Once a fishery of carp, northern pike, drum, suckers, white bass, bullheads, catfish, and an abundance of perch was present. Today conditions in the area of Brown County have gotten so bad that only carp dominate the scene for in shore waters. Even the perch, which is noted for being able to tolerate very poor water quality, has been eliminated as a permanent feature of the fishery and furnishes a seasonal sport fishery near the mouths of oxygen bearing streams. The commercial fishery which formerly harvested mostly perch, whitefish, and some lake trout has now moved out of southern Green Bay in search of these fish species. The commercial catch for all of Green Bay has vacillated, declining from 15,768,000 pounds (61.7 percent of the total Lake Michigan catch) in 1949 to 6,636,000 pounds (31.6 percent of the total Lake Michigan catch) in 1963. In 1971 the yield jumped to 17,242,259 pounds primarily as a result of increased alewife harvest. Alewife now dominates the commercial catch. For additonal fishery information see the Fox River narrative. In the more stable years of the fishery yields to the commercial fishery for the Bay as a whole ranged between 10.4 and 19.6 pounds per acre.

Public access is available from several road endings, public hunting grounds, public access sites with boat ramps, and navigable water from the Suamico and Fox Rivers, and Duck Creek. There are also parks and waysides providing walk-in access. A 26 foot deep navigation channel 300-500 feet wide cuts through the south end of the bay and affords access of large ships to the city of Green Bay.

Lilly Lake T-23-N, R-22-E, Section 32 (2,3,4)
Area = 40.0 acres, Depth = 21 feet, Secchi Disk = 2 feet

Lilly Lake is a hard water seepage lake located ten miles east of DePere. Littoral bottom materials consist of peat, muck, and a small rubble area. Lilly Lake is subject to periodic winterkills resulting in a fishery consisting of bullheads and minnows. The lake was scheduled to be chemically treated in 1959 to remove a badly parasitized minnow and bullhead population and to re establish a game fish population; however,

opposition from the Brown County Arboretum Committee halted the project. The lake is very scenic, being completely surrounded by woods and bog. The entire lakeshore is owned by Brown County with a portion of this set aside as an arboretum and nature study area. Brown County is developing an access and park on the north side of the lake. The lake is undeveloped except for the park and a sportsmen's club clubhouse near the lake.

Middle Lake T-23-N, R-22-E, Section 32 (13)
Area = 6.9 acres, Depth = 8 feet, Secchi Disk = 3 feet

Middle Lake is a small hard water bog lake less than one-quarter mile from Lilly Lake. The lake is situated in a wilderness setting completely surrounded by bog and swamp. Small size and shallow depths suggest winterkill is a problem. A few minnow species were noted but nothing more is known of the fishery. The tangled bog and swamp around the lake makes access difficult even though the county Arboretum abuts the north edge. No other access is available. There are no developments.

Third Lake T-23-N, R-22-E, Section 33 (10, 11)
Area = 5.4 acres, Depth = 16 feet, Secchi Disk = 4 feet

Third Lake is another hard water seepage lake located in the same area as Lilly Lake. There is no inlet, however, an intermittent outlet is present. Littoral bottom materials consist of muck and detritus. The fishery of this lake is unknown but shallowness and lack of use suggest winterkill is a problem. One seldom used cottage is the only development. The lake is quite scenic with many hardwoods surrounding most of the lakeshore. Parts of the north and east side are pastured causing light shoreline damage. Deer and birds frequent the area. There is no public access.

Unnamed Lakes

Lake 20-14
Lake Type: Impoundment
Area: 0.6 acres
Depth: 4 feet
Water Source: Drainage
Fishery: Winterkill
Game: None
Public Access: None
Recreational Potential: None
Problems: Lack of depth
Adjacent Wetlands: None
Developments: None

Lake 22-11
Lake Type: Natural
Area: 0.6 acres
Depth: 15 feet
Water Source: Seepage
Fishery: Panfish
Game: Domestic waterfowl
Public Access: None
Recreational Potential: None
Problems: Dense vegetation
Adjacent Wetlands: None
Developments: Golf Course

Lake 2-8
Lake Type: Excavation
Area: 0.6 acres
Depth: 7 feet
Water Source: Seepage
Fishery: Unknown
Game: None
Public Access: None
Recreational Potential: Swimming
Problems: None
Adjacent Wetlands: None
Developments: One seasonal housetrailer

Lake 26-16a
Lake Type: Excavation
Area: 3.7 acres
Depth: 6 feet
Water Source: Seepage
Fishery: Largemouth bass, panfish
Game: None
Public Access: None
Recreational Potential: Fishing, swimming
Problems: None
Adjacent Wetlands: None
Developments: None

Lake 6-9
Lake Type: Impoundment
Area: 1.3 acres
Depth: 4 feet
Water Source: Well
Fishery: Unknown
Game: None
Public Access: None
Recreational Potential: None
Problems: None
Adjacent Wetlands: None
Developments: Airport

Lake 15-16
Lake Type: Excavation
Area: 4.6 acres
Depth: 4 feet
Water Source: Seepage
Fishery: None
Game: Waterfowl, muskrats
Public Access: St. Hwy. 57
Recreational Potential: None
Problems: Too close to city
Adjacent Wetlands: Approx. 0.5 acres
Developments: None

Lake 20-13
Lake Type: Excavation
Area: 2.7 acres
Depth: 25 feet
Water Source: Seepage
Fishery: Panfish
Game: None
Public Access: None
Recreational Potential: Swimming
Problems: Filling in along edges
Adjacent Wetlands: None
Developments: None

Lake 25-8
Lake Type: Impoundment
Area: 1.3 acres
Depth: 3 feet
Water Source: Drainage
Fishery: Forage species
Game: None
Public Access: Brown County Golf Course
Recreational Potential: Water hazard
Problems: None
Adjacent Wetlands: None
Developments: Golf course

Lake 25-10
Lake Type: Natural
Area: 1.0 acres
Depth: 4 feet
Water Source: Drainage
Fishery: Panfish
Game: None
Public Access: Brown County Golf Course
Recreational Potential: None
Problems: Winterkill
Adjacent Wetlands: None
Developments: Golf Course

Lake 10-15,16
Lake Type: Excavation
Area: 10.6 acres
Depth: 4 feet
Water Source: Drainage
Fishery: Carp
Game: Muskrats
Public Access: None
Recreational Potential: Hunting
Problems: Carp, fluctuating water levels
Adjacent Wetlands: None
Developments: One dwelling

Lake 15-6
Lake Type: Excavation
Area: 2.4 acres
Depth: 114 feet
Water Source: Seepage
Fishery: Panfish
Game: None
Public Access: None
Recreational Potential: Swimming
Problems: None
Adjacent Wetlands: None
Developments: Commercial swimming beach, one dwelling

Lake 15-16a
Lake Type: Excavation
Area: 2.6 acres
Depth: 10 feet
Water Source: Seepage
Fishery: None
Game: None
Public Access: None
Recreational Potential: None
Problems: Winterkill, dense vegetation
Adjacent Wetlands: None
Developments: None

Lake 15-6d
Lake Type: Excavation
Area: 2.0 acres
Depth: 45 feet
Water Source: Seepage
Fishery: Unknown
Game: None
Public Access: None
Recreational Potential: Swimming, fishing
Problems: Difficult access
Adjacent Wetlands: None
Developments: None

Lake 19-4
Lake Type: Excavation
Area: 1.1 acres
Depth: 14 feet
Water Source: Well
Fishery: None
Game: None
Public Access: None
Recreational Potential: Water hazard
Problems: None
Adjacent Wetlands: None
Developments: Golf course

Lake 20-6
Lake Type: Excavation
Area: 1.4 acres
Depth: 15 feet
Water Source: Seepage
Fishery: Northern pike, bass, panfish
Game: None
Public Access: Pamperin County Park
Recreational Potential: Fishing,swimming
Problems: None
Adjacent Wetlands: None
Developments: None

Lake 29 (Bay Beach Wildlife Area Lagoons)
Lake Type: Excavation
Area: 42.0 acres
Depth: 15 feet
Water Source: Drainage
Fishery: Northern pike, panfish
Game: Waterfowl
Public Access: Bay Beach City Park
Recreational Potential: Picnicking, aesthetics
Problems: Excessive bird guano, municipal pollution, road salt washed in by melting snow
Adjacent Wetlands: None
Developments: City park

The Bay Beach Wildlife lagoons are a series of dug ponds and connecting channels used as a wildlife sanctuary in Green Bay's Bay Beach Park. Not only do they serve as a summer abode, but some are maintained and kept open throughout the winter for the benefit of the waterfowl. Numerous ducks of various species as well as geese, frequent the ponds. The wildlife sanctuary encompasses approximately 200 acres including a newly developed nature trail. The complex is heavily used with as many as 5,000 visitors in an average day.

Lake 5-13
Lake Type: Excavation
Area: 0.6 acres
Depth: 3 feet
Water Source: Seepage
Fishery: None
Game: Muskrat
Public Access: None
Recreational Potential: None
Problems: Lack of depth
Adjacent Wetlands: None
Developments: One dwelling

Lake 20-15, 16
Lake Type: Impoundment
Area: 6.8 acres
Depth: 9 feet
Water Source: Drainage
Fishery: Unknown
Game: Terns
Public Access: None
Recreational Potential: Swimming
Problems: Lack of depth, aquatic vegetation
Adjacent Wetlands: None
Developments: One dwelling

Lake 32-13
Lake Type: Excavation
Area: 0.6 acres
Depth: 8 feet
Water Source: Seepage
Fishery: Panfish
Game: None
Public Access: None
Recreational Potential: Swimming
Problems: Winterkill
Adjacent Wetlands: None
Developments: None

Named Streams

Apple Creek T-22-N, R-19-E, S-25 (7)
Area = 10.2 acres, Length = 4.2 miles, Gradient = 4.8 feet/mile

When visited in August Apple Creek was dry except for scattered pools near road crossings. Bottom materials are silt, rubble, and gravel, with a few boulders. Aquatic invertebrates present include caddis fly, shrimp, and crayfish. As are many streams in Brown County this one is plagued by erosion. Cattle pasturing along streambanks and hills has caused them to be completely denuded of vegetation and heavy erosion is taking place. The only fishery noted were schools of small trapped bullheads, one or two inches long. Access is available from one county and one town road crossing.

Ashwaubenon Creek T-23-N, R-20-E, S-15 (3)
Area=17.6 acres, Length = 9.7 miles, Gradient = 4.1 feet/mile

This is a sluggish, hard water stream flowing through agricultural and residential Brown County. Bottom materials consist of rubble, gravel, and silt. A few boulders are present. The stream has little fishery value. In the agricultural portion of the stream the stream banks and hills are bare and erosion heavy due to cattle pasturing. In the residential area the stream is filled with litter and debris. The stream is very sluggish and turbid. The combination makes a very filthy and unappealing looking stream. Access is available from five county, two town, one state, and one federal road crossings.

Baird's Creek T-24-N, R-21-E, S-31 (16)
Area = 3.9 acres, Length = 4.0 miles, Gradient = 20.0 feet/mile

Baird's Creek is a clear hard water stream maintaining a moderate flow. Bottom materials consist mostly of bedrock, sand, and gravel. Some rubble areas are present. Instream cover includes undercut banks, rocks, logs, debris and aquatic vegetation. Invertebrates present are stone fly, shrimp, and crayfish. No fishery is known other than forage species. Bank erosion is light along this stream. Portions of the stream appear to be popular sites for small children to play. Two town and two county roads provide access.

Beaver Dam Creek T-24-N, R-20-E, S-15 (8)
Area = 4.2 acres, Length = 3.5 miles, Gradient = 8.6 feet/mile

This is a sluggish, very turbid hard water stream flowing through open pasture and agricultural lands. Bottom materials are gravel and rubble covered by silt. Rocks, debris, and aquatic vegetation are present, however, invertebrates are lacking. The stream has an odd color indicating some form of pollution present. Cattle pasturing is causing considerable damage to the shoreline of this stream. High water marks indicate frequent fluctuations in water levels. The stream is used as a source of water for irrigation. The fishery is unknown. Access is in the form of two town, one county, and two state road crossings.

Bower Creek T-23-N, R-20-E, S-24 (16)
Area = 4.4 acres, Length = 3.0 miles, Gradient = 5.0 feet/mile

Bower Creek is a turbid hard water stream draining sluggishly into the East River a short distance east of DePere. The stream drains highly agriculturalized land where it picks up the heavy silt load that composes the bottom material. Undercut banks and rocks provide instream cover. Shrimp are present and crayfish abound in this stream. The fishery consists of bluegills, bullheads, young-of-the-year northern pike, suckers, and an abundance of carp. The highly agriculturalized watershed makes very poor recreational waters out of this stream. Two county roads furnish public access.

Branch River T-21-N, R-21-E, S-35 (16)
Area = 16.4 acres, Length = 7.5 miles, Gradient = 6.7 feet/mile

The Branch River is a turbid, hard water stream flowing south out of the county in the southeastern part of the county and into the Manitowoc River. Streambanks throughout are heavily pastured. The bottom materials are buried under a heavy load of silt. Instream cover is available from undercut banks, logs, debris, and vegetation. Caddis flies and crayfish are abundant. Stone flies and shrimp are also present. Several large unidentified fish and minnows were noted, but the fishery is unknown. A large multiple use county park provides an excellent public access to this stream. Facilities include toilets, shelter house, tables, grills, playground, and large parking area. Five town and four county road crossings supply additional public access.

Duck Creek T-24-N, R-20-E, S-13
Area = 92.0 acres, Length = 13.8 miles, Gradient = 8.7 feet/mile

Duck Creek is a hard water stream flowing east through the northeastern portion of the county. Stream color varies from very turbid in sluggish deep sections to relatively clear in more shallow faster moving areas. Bottom types also vary in sections but include bedrock, boulder, rubble, gravel, and sand. Much of these materials are covered by silt. Instream cover is not common; invertebrates present are stone fly, caddis fly, and in some areas an abundance of crayfish. Little is known of the fishery except in the lower section where it enters Green Bay. Here panfish provide the most fishing. Carp are a problem in this portion. Access is provided by two large county parks. Facilities include picnic areas, playgrounds, shelter houses and concession stand, rest rooms, and large parking areas in both parks. In addition, Pamperin Park has a swimming area, and Brown County Recreation Park includes a golf course. Three state, one county, and one town road also provide public access.

Dutchman Creek T-23-N, R-20-E, S-11 (7)
Area = 16.7 acres, Length = 4.6 miles, Gradient = 2.2 feet/mile

Much of Dutchman Creek has been ditched and the course altered to accommodate residential and commercial developments beginning in the area. The water is very turbid and sluggish. It has very little to offer a fishery in its present condition. A little gravel is present, but silt is the basic bottom material. Fallen trees and brush, and debris are present. Crayfish are also present. One town, three county and one state highway provide public access to this stream.

East River T-24-N, R-21-E, S-30 (11)
Area = 102.4 acres, Length = 32.5 miles, Gradient = 5.8 feet/mile

The East River travels north through Brown County and roughly parallel to the Fox River. The water is hard and very turbid. There is very little velocity to this stream. Stream bank cover is very poor, much of the banks being pastured, badly eroded, and caving in. Significant amounts of agricultural fertility are added to this stream from pasturing and enriched runoff. Silt is the only observable bottom material. Instream cover is sparse and aquatic invertebrates scarce. Intermittency, sluggishness and pollutants rule against a fishery. There is no recorded fishery for this stream. Access is available from six state, six county, and twelve town road crossings.

Fox River T-24-N, R-21-E, S-19
Area = 1,381.8 acres, Length = 19.0 miles, Gradient = 4.3 feet/mile

The Fox River is the single most important stream resource in Brown County. The Fox River drains over 6,400 square miles in conjunction with the Wolf River, but not until it leaves Lake Winnebago does it begin its rapid and serious decline in water quality. Over fifty potential pollution sources are present between Lake Winnebago and Green Bay; these will be discussed in the next section. The river's importance is further compounded when its effect on lower Green Bay is considered (see Named Lakes--Green Bay narrative). The Fox River flows through either agricultural lands or urban areas within Brown County. The water is hard and very turbid. Bottom materials are mostly sand and silt.

The history of the fishery of the Fox River closely parallels the development of industry upstream from Green Bay. In 1674 a French priest wrote that the stench from the immense piles of drying fish was so great that church services could not be held. The Indians and later white fishermen built weirs across the Fox River from which they speared, hooked or netted northern pike, muskellunge, and sturgeon with little difficulty. Fish were so plentiful that large numbers were left to rot on shore. Today the water quality is so bad that fish that run upstream in spring cannot make it back to Green Bay before succumbing to oxygen depletion. There is no fishery most of the year except near the dam at DePere where the water is aerated by the dam.

The Fox River is developed heavily through DePere and Green Bay by industry and for homes. Public access is available from city and county parks and boat launching sites as well as one federal, three state, and one county road crossings. Scenic roads parallel the river and provide means of public access in some areas.

The Corps of Engineers maintains the Fox River to depths of 6 feet for navigation. There are three dams and associated navigation locks in Brown County, at DePere, Little Rapids and Rapide de Croch above Wrightstown. The river is maintained to depths of 24-20 feet as far upstream as DePere. In the past there was commercial barging on the river, but currently all navigation is recreational.

Neshota Creek T-22-N, R-22-E, S-36 (16)
Area = 20.1 acres, Length = 8.3 miles, Gradient = 4.8 feet/mile

This is a hard water stream carrying a moderate flow of water south out of the southeastern corner of the county. Rubble and silt are the most common bottom materials, however, sand, gravel, and boulders are also present. Instream cover is present, but stream bank cover is sparse in many areas. Invertebrates present include stone fly, caddis fly, and crayfish. There is no record of the fishery of this stream. Extensive pasturing is denuding the banks causing deterioration and crumbling of the stream banks. One state, two county, and five town roads provide public access to this stream.

Plum Creek T-21-N, R-19-E, S-2 (5)
Area = 67.1 acres, Length =12.3 miles, Gradient = 13.0 feet/mile

Plum Creek flows north from the southern Brown County line into the Fox River in Wrightstown. The water is very turbid and hard. A tributary near the town of Holland carries sewage and creamery waste into Plum Creek causing an extremely foul smelling odor at times. Banks are in very poor condition from overgrazing of cattle. Clay and silt are the predominant bottom materials. Rubble and gravel are present in some areas. Instream cover is common, but no invertebrates were found. The fishery is unknown. Public access is available from three county, and three town road crossings.

School Creek T-24-N, R-22-E, S-24 (1)
Area =2.5 acres, Length = 2.1 miles, Gradient = 14.3 feet/mile

School Creek is a small, hard water stream flowing east out of the county. The water is hard, sluggish, and very turbid. Silt is the basic bottom material. Little is available in the way of instream cover or invertebrates. Forage species are the only known fishery. Banks and upland areas are being damaged by pasturing and poor land use practices. Two town and one county road provide access.

Suamico River T-25-N, R-20-E, S-24 (1)
Area = 70.5 acres, Length = 19.4 miles, Gradient = 11.3 feet/mile

The Suamico River changes from a clear bubbling stream at its head waters to a sluggish, wide, and very turbid stream typical of Brown County's waters at its mouth. The upper two-thirds has a rubble and gravel bottom containing many invertebrates and an abundance of crayfish. The lower portion has a sand and silt bottom without many organisms. The fishery is the same as Green Bay on the lower end, changing to forage species upstream. Developments are confined to the portion around Suamico. Public access is available from one federal, one state, six county, and eight town road crossings. A large public hunting grounds, boat launching site and parking area is present near the mouth. An 8 foot deep navigation channel is maintained at the lower end of the stream. A town dump near the upper end is a potential source of pollution. Cattle pasturing is spoiling some of the banks along the stream.

Trout Creek T-24-N, R-20-E, S-19 (11)
Area = 6.7 acres, Length = 6.1 miles, Gradient = 16.4 feet/mile

Trout Creek is a slightly stained, hard water tributary to Duck Creek. Silt is the primary bottom material. Boulder, rubble, and gravel are also present. Instream cover is common; stone flies are common, and caddis flies are abundant. There is some history of a marginal trout fishery. Pasturing and cultivated fields right up to the stream edge are having a detrimental effect on this resource. Muskrats are present. Public access is available from two county and two town roads.

Unnamed Streams

Creek 25-11 T-21-N, R-19-E, S-25 (11)
Area = 2.7 acres, Length = 2.2 miles, Gradient = 36.4 feet/mile

This is by far the filthiest stream in Brown County. The Town of Holland Sanitary District and a dairy plant connected to it run overflow into the stream creating an open, slow-moving, and odorous sewer. As could be expected the water is very hard and extremely turbid. Silt, clay, and rubble comprise the bottom materials. Instream cover is adequate, but no bottom organisms are present. In addition, the surrounding area is pastured leaving many hillsides bare and erosion heavy. Clay banks are undercut and crumbling into the stream. Several teal and shorebirds were observed in or near the water. No fish were observed. Access is across private land only.

Creek 7-8 T-21-N, R-20-E, S-7 (8)
Area = 1.7 acres, Length = 3.5 miles, Gradient = 45.7 feet/mile

This is a sluggish, turbid, hard water tributary to the East River. Silt and clay are the basic bottom types. The surrounding area is completely agricultural consisting of field or fallow pasture. The fishery is unknown, but probably a few forage species are present. No game animals were observed. Access is available via one state, and three town road crossings.

Creek 36-11 T-21-N, R-21-E, S-36 (11)
Area = 0.3 acres, Length = 0.8 miles, Gradient = 12.8 feet/mile

Only a small section of this stream flows through the southeast corner of the county. The water is clear and hard with a moderate velocity. Sand and silt are the basic bottom materials; gravel areas are also present. Instream cover is sparse, however, shrimp and crayfish are common. Mats of watercress are present in some sections. The fishery is unknown. Access is from one town road crossing.

Creek 20-14 T-22-N, R-20-E, S-20 (14)
Area = 2.8 acres, Length = 3.8 miles, Gradient = 60.5 feet/mile

This is a slow moving, turbid tributary to the East River. Sand, gravel, rubble and silt are the basic bottom materials. Undercut banks, rocks, and debris provide instream cover. Caddis fly and crayfish are food organisms present. Bank and upland cover is open, consisting of pasture and fields. Heavy erosion is occurring due to streambank pasturing. Forage species is the only known fishery. One state road crossing provides public access.

Creek 20-15 T-22-N, R-20-E, S-20 (15)
Area = 0.2 acres, Length = 2.7 miles, Gradient = 88.9 feet/mile

This hard water turbid stream maintains just a trickle of water into the East River. Silt and gravel are the bottom materials. The stream travels through agricultural lands, accounting in part for its fertility. No bottom organisms were found. There is no fishery. Access is available from one state and two town road crossings.

Creek 28-4 T-22-N, R-20-E, S-28 (4)
Area = 0.3 acres, Length = 2.3 miles, Gradient = 87.0 feet/mile

This is a small fast moving tributary to Creek 20-14. The water is clear and hard. The stream drains open agricultural land. Silt is the main bottom type with scattered rubble areas. Crayfish are present. There is no known fishery. Access is available from one county road.

Creek 31-14 T-22-N, R-20-E, S-31 (14)
Area = 9.2 acres, Length = 6.3 miles Gradient = 22.2 feet/mile

This very turbid, sluggish stream joins the East River northwest of Greenleaf. The bottom is covered heavily by silt. Some of the banks are undercut. Pasturing is destroying much of the cover and erosion is occurring. No invertebrates were found. No fishery is known to be present. Public access may be obtained from two state, and two town road crossings.

Creek 23-11 T-22-N, R-22-E, S-23 (11)
Area = 0.7 acres, Length = 1.5 miles, Gradient = 106.7 feet/mile

This is a clear fast moving tributary to Neshota Creek. Gravel and rubble are the most common bottom materials with some sections silting in. Undercut banks are present but collapsing. Cattle pasturing is destroying the banks. There is no bank cover in many sections of the stream. Few aquatic invertebrates are present. Numerous minnows are present in the lower end. One town road provides access.

Creek 35-1 T-23-N, R-20-E, S-35 (1)
Area = 0.2 acres, Length = 2.0 miles, Gradient = 105.0 feet/mile

This stream is a clear, hard water tributary to the East River. Sand, gravel, and rubble are major bottom materials with siltation occurring. Undercut banks and debris are present in the stream. Caddis flies are abundant. The stream flows through agricultural lands, consisting of mostly open pasture. Heavy erosion is taking place along stream banks. There is no known fishery. One town road, and two county roads provide public access.

Creek 10-9 T-24-N, R-20-E, S-10 (9)
Area = 3.9 acres, Length = 4.6 miles, Gradient = 13.0 feet/mile

This is a cloudy hard water stream contributing a moderate flow to Duck Creek. Silt is the primary bottom material, however rubble and gravel are present. Rocks, logs, and debris are present in the stream. Invertebrates are varied consisting of stone flies, mayflies, shrimp, and crayfish. Stream cover is primarily open being mostly fallow field and shrub brush. No fishery is known to be present. Muskrats are present. Three county, one town, and two state road crossings provide public access.

Creek 10-14 T-24-N, R-20-E, S-10 (14)
Area = 2.9 acres, Length = 1.5 miles, Gradient = 3.4 feet/mile

This stream is basically a turbid, hard water ditch draining into Duck Creek. Silt constitutes the bottom material. Aquatic vegetation is abundant. There is very little flow, but the ditch is wide and almost a foot deep. There is no known fishery. Access consists of three county road crossings.

Creek 22-3 T-25-N, R-19-E, S-22 (3)
Area = 3.6 acres, Length = 3.7 miles, Gradient = 13.5 feet/mile

This is a clear but slow-moving tributary to the Suamico River. Rubble is the predominant bottom material. Boulder, gravel, and silt are also present. Rocks, logs, debris, and aquatic vegetation are all plentiful. Common invertebrates include stone flies, caddis flies, and crayfish. Bank cover is heavy in the form of overhanging brush and hardwoods. There is no record of a fishery. Access is from three town and two state road crossings.

Creek 36-14 T-25-N, R-20-E, S-36 (14)
Area = 11.7 acres, Length = 4.6 miles, Gradient = 8.7 feet/mile

Except in the spring this stream depends on Green Bay to maintain its water level. The stream was ditched to provide water for wildlife ponds inland from Green Bay. Silt and sand compose the bottom. Instream cover is plentiful. Crayfish are the only invertebrates known to be present. The fishery is unknown, but probably derived from Green Bay. One state and two county roads cross this stream.

Creek 13-10 T-25-N, R-22-E, S-13 (10)
Area = 3.9 acres, Length = 4.0 miles, Gradient = 45.0 feet/mile

This is a clear, hard water stream draining into Green Bay in the northeast corner of Brown County. Long stretches of the stream bottom consist of limestone slabs. Other areas have sand, gravel, rubble, and fine limestone. Instream cover includes undercut banks, rocks, debris, and vegetation. Stone flies and mayflies are common Most of the watershed is agricultural in nature, but the limestone layer prevents a great deal of erosion. No fishery is recorded for this stream. Access is in the form of one state and two town road crossings.

SUMMARY AND EVALUATION OF DATA

The previous section of this report dealt primarily with each lake and stream on an individual basis. In this section data collected from each lake and stream during this and previous surveys, and extracted from previous reports have been summarized and presented to provide an overall view of the county's surface water resources. Significant problems that may affect the quality or quantity of the resource are discussed. Also discussed are the present and future potentials afforded the various recreational uses of the resource.

Water Quantity

Brown County contains 22 lakes and 29 streams with a total surface area of 1,999.4 acres. In addition, Green Bay provides a vast surface area. Lakes, excluding Green Bay, cover 138.8 acres; streams include 1,860.6 surface acres. Dry lakes and intermittent streams are excluded.

If all of the above acreage was ideal for recreational pursuits there would still be over 79 people for each acre of water in the county. The fact that very little of this surface area is satisfactory makes that figure much higher for recreational water.

Surface waters treated as lakes have been classified as natural lakes, impoundments, or excavations. Table 6 presents a breakdown of various lake types. It is interesting to note that of the 22 lakes included, 17 of them are man-made.

The largest lake in Brown County at 40 acres is Lily Lake. The remainder of the lakes are less than ten acres in size with the exception of one unnamed lake, and the Bay Beach Wildlife lagoons which consist of several dug ponds (see Appendix 1a). Lakes less than ten acres account for 86 percent of the total number of lakes but only 33 percent of the total surface area of lakes.

Lake 15-6 at 114 feet is the deepest lake in the county. Two other lakes, Lake 20-13 and Lake 5-6d at 25 feet and 45 feet, respectively, are greater than 25 feet deep. Two-thirds of the remaining lakes are less than ten feet deep. All lakes over 25 feet deep are man-made. Table 7 presents depth classes of Brown County lakes.

The total length of streams in Brown County is 193.5 miles covering 1,860.6 surface acres. The largest stream in the county is the Fox River with 1,381.8 surface acres and 19 miles in length. The East River with 102.4 surface acres and 32.5 miles in length is the longest stream in the county. Table 8 provides a breakdown of Brown County's streams by width. Many streams in the late summer contain little or no flow due to the low gradients or lack of a groundwater source.

Water Quality and Pollution

During field investigations water samples were collected and analyzed for pH, total alkalinity, and specific conductance (see Appendix 1b, 2b, and 3).

The pH (a measurement of hydrogen ion concentration in water and indicative of acidic or alkaline conditions) values for Brown County lakes range from 6.6 to 8.9 and streams from 6.6 to 9.4. All surface water except one stream have pH values greater than 7.0 and are alkaline. The exception is one stream which carries an exceptionally heavy pollution load from a dairy company and a sewage plant. The mean pH for lakes is 8.4, streams 7.8, and all waters 8.1.

Table 6. Origin of Brown County lakes*

Category	Number	% Total Number	Area (Acres)	% Total Area (Lakes)	% Total Area (All Waters)
Natural Lakes	5	22.7	53.9	38.8	2.7
Impoundments	4	18.2	10.0	7.2	0.5
Excavations	13	59.1	74.9	54.0	3.7
Total:	22		138.8		6.9

* Does not include Green Bay

Table 7. Depth classes of Brown County lakes*

Depth Class (feet)	Number	% Total Number	Area (Acres)	% Total Area	Shoreline (Miles)	% Total Shoreline
< 5	7	31.8	20.0	14.4	2.35	19.1
5 - 9	5	22.7	18.6	13.4	1.65	13.4
10 - 14	2	9.1	3.7	2.7	0.42	3.4
15 - 19	4	18.2	49.4	35.6	5.78	47.1
20 - 24	1	4.5	40.0	28.8	1.23	10.0
25 - 49	2	9.1	4.7	3.4	0.60	4.9
50 - 99	0	-	-	-	-	-
> 100	1	4.5	2.4	1.7	0.25	2.0
Total:	22		138.8		12.28	

* Does not include Green Bay

Table 8. Size classes of Brown County streams by width

Average Width (feet)	Number	% Total Number	Area (Acres)	% Total Area	Length (Miles)	% Total Length
< 5.0	6	20.7	3.4	0.2	12.8	6.6
5.0 - 9.9	6	20.7	24.8	1.3	26.2	13.5
10.0 - 19.9	8	27.6	59.9	3.2	35.8	18.5
20.0 - 40.0	6	20.7	231.6	12.4	73.6	38.0
> 40.0	3	10.3	1,540.9	82.8	45.1	23.3
Total:	29		1,860.6		193.5	

Total alkalinity is an expression of the available carbonates, bicarbonates, and hydroxides recorded as milligrams per liter of water and is a measurement of water hardness and fertility. All Brown County's surface waters but one have hard water ranging in alkalinity from 102 mg/l to 407 mg/l. The exception is Lake 5-13, a small excavation with an alkalinity of 12 mg/l. The mean alkalinity for all waters is 200. Hard surface waters are generally fertile and productive.

Specific conductance reflects the amount of total dissolved electrolytes present in the water and is expressed in µmhos/cm @ 77° F. When excessive amounts of strong electrolytes such as dissolved acids, alkalies, or metal salts enter water they may be detrimental to aquatic life. Specific conductance readings should normally be two to three times as great as total alkalinity readings. Higher specific conductance readings indicate excessive amounts of dissolved electrolytes are present. Only one stream, Creek 25-11, has an extremely unbalanced ratio. This stream was surveyed after a rain and a local dairy plant and a sewage treatment plant were bypassing raw wastes directly into the stream accounting for this variance.

The surface waters of Brown County, particularly the streams, show the effects of long time abuse from many sources. Of particular interest are the Fox River and lower Green Bay. The final 39 miles of the Fox River has at least 55 potential sources of industrial or municipal pollution (DNR, 1968). Of these (Figure 9) 21 are located in Brown County. It should be noted that all of the sewage type wastes receive secondary treatment and the industrial waste sources also have treatment facilities. All of these were (and many still are) discharging inadequately treated wastes into the Fox River and its tributaries. A recent study indicates that the pollution load carried by the Fox River may affect Green Bay for a distance of five miles or more (Sager, 1971).

The surveys conducted in 1967 and 1968 led to the issuance of orders requiring polluters to implement more effective waste treatment measures. A mathematic model has been developed for the Fox River which indicates that the existing water quality standards will be met if the state orders are complied with. Intensive water quality surveys were conducted in 1972 to further refine and validate the mathematical model. These surveys were supplemented by data from five automatic monitoring stations on the river that includes hourly readings of temperature, pH, turbidity, conductivity and dissolved oxygen.

In spite of these efforts pollution continues at an excessive rate. Municipal sewage treatment plants bypass partially or untreated sewage during heavy rains directly into surface waters when treatment facilities become overloaded. Highway drainage and storm sewer runoff also contribute large amounts of nutrient material and road salt into the surface waters of Brown County.

Municipal and industrial sources are not the only type of pollution in Brown County. Because the county is so heavily agriculturalized, by-products such as manure, fertilizer, pesticides, herbicides, and silt enter the surface waters and underground water supplies through runoff and seepage. Silt is the most easily demonstrated agricultural pollutant. Twenty-two of the 29 streams included in this report have water colors described as turbid. Clayey soil types and poor land use practices can be directly related to this problem. Cattle pasturing along stream banks has stripped the cover leaving bare ground to erode into gullies. Fields in many cases are cultivated right up to the water's edge.

Poor agricultural practices also contribute to enrichment of the surface water resources by allowing nutrient-rich runoff easy access to the surface waters. This coupled with municipal and industrial sources is in part responsible for the enrichment of the Fox River and lower Green Bay, although it should be noted that the river was highly eutrophic when initially viewed by the early explorers. The result in lower Green Bay has been occasional fish kills from decomposing algae using up the available oxygen during the summer months.

This brief discussion illustrates that the water quality throughout the county is very poor and that this poor quality can be traced to a number of sources. Improvements in water quality will be made only after the citizenry is made aware of the problem and informed of the corrective measures that need to be taken. Significant progress has been made in this area in recent years as greater fractions of the pollutants are removed. Measures finding employment besides conventional waste treatment include evaporation and burning organic wastes, and aeration through turbines at dam sites.

The Fox River watershed covers approximately 20 percent of the state, finally draining into Green Bay. This is one reason why one must not only consider the problems in Brown County, but the remainder of the watershed as well. County shoreline and floodplain zoning ordinances go a long way towards improving and protecting the water quality and adjacent landscape. Like all laws these ordinances will only be as good as their enforcement. It is too early to tell what impact they will have on the quality of Brown County's surface water resources in the future.

Wetlands

Information taken from U.S.G.S. topographic maps indicate that over 4,400 acres of wetlands were present in Brown County during surveys in 1954 (see Figure 10*). There have been no recent wetland surveys in Brown County; however, it is obvious that much of these wetlands are disappearing.

Over 2,000 acres of wetland are present around the west and south sides of Green Bay. These are the most important areas in the county and also the most prone to be eliminated. One piece in the northeast corner of the Village of Howard has been given to the state and should be preserved. Long Tail Point is another such case. The area in the most danger is located near Green Bay, west of the mouth of the Fox River. This is the largest contiguous mass of wetlands in the county, but plans are being considered to use part of the area as a landfill site and turn it into a city park. It is projects like this that must be curtailed if the wetlands and their wildlife values are to be saved.

The remainder of the wetlands in Brown County are relatively small and scattered. These areas do not have great recreational value, but do play an important role in the maintenance of the wildlife values of the county.

*Figure appears at the end of the narrative

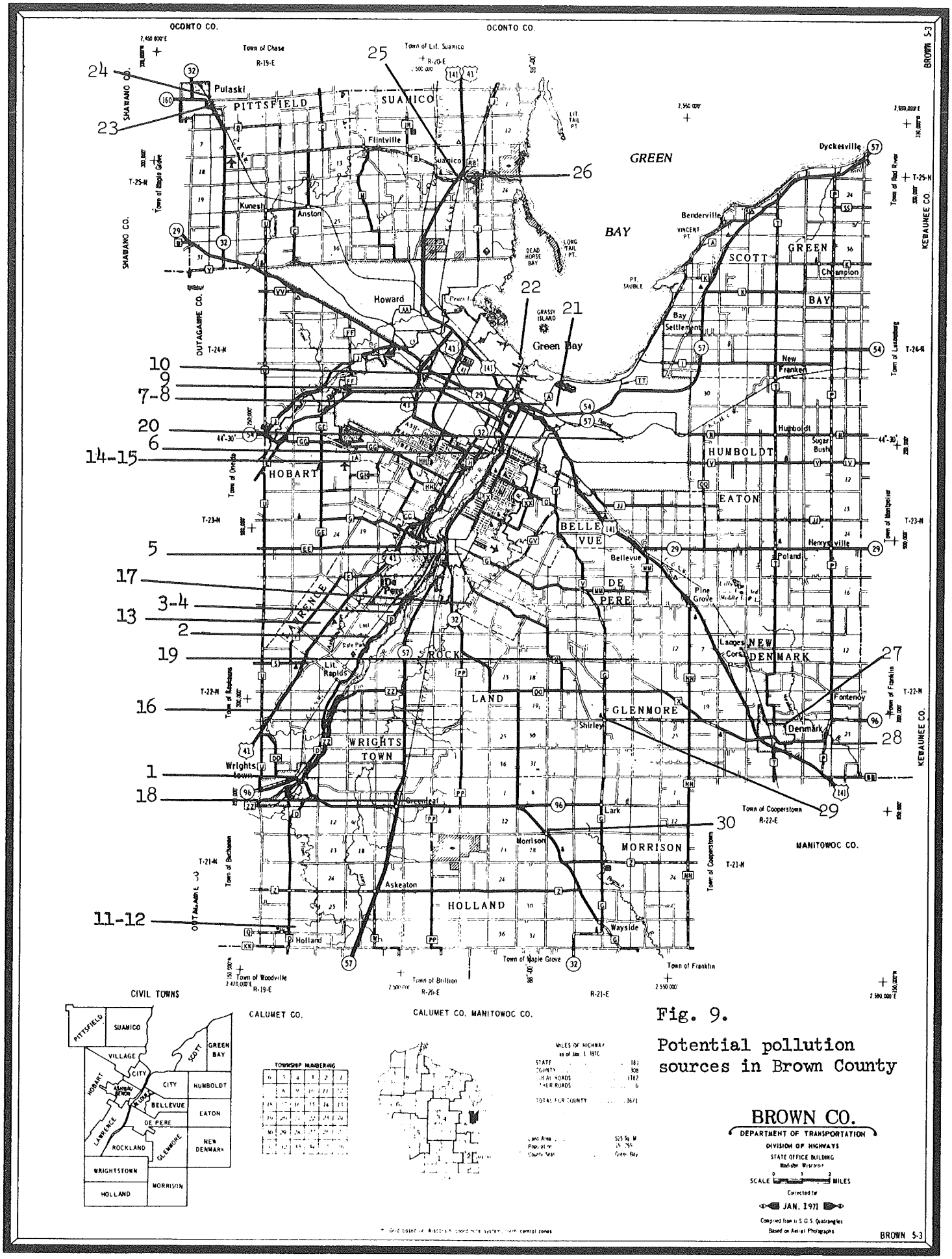

Fig. 9.

Potential pollution sources in Brown County

Key to Figure 9

Map No.	Source	Type of Waste	Waters Receiving Discharge
1	Village of Wrightstown	Sewage	Fox River
2	Hickory Grove Sanitorium	Sewage	Fox River
3	Nicolet Paper Corp.	Paper Waste	Fox River
4	U. S. Paper Mills Corp.	Paper Waste	Fox River
5	City of DePere	Sewage	Fox River
6	Fort Howard Paper Co.	Paper Waste, Sewage	Fox River
7	American Can Co.	Paper Waste	Fox River
8	Charmin Paper Products Co.	Paper Waste	Fox River
9	Green Bay Packaging, Inc.	Paper Waste	Fox River
10	Green Bay Metropolitan Sewerage District	Sewage	Fox River
11	White Clover Dairy Co.	Dairy Waste	Creek 25-11
12	Town of Holland Sanitary District No. 1	Sewage	Creek 25-11
13	Fox River Valley Co-op Creamery	Dairy Waste	Ashwaubenon Creek
14	Austin Straubel Airport	Sewage	Dutchman Creek
15	Paper Converting Machine Co.	Sewage	Dutchman Creek
16	Rockland Riverview Cheese Factory	Dairy Waste	East River
17	Scrays Cheese Co.	Dairy Waste	East River
18	Town of Wrightstown Sanitary District No. 1	Sewage	Creek 31-14
19	Shirley Co-op Cheese Factory	Dairy Waste	Bower Creek
20	Liebman Packing Co.	Animal Waste	Possibly Bairds Creek
21	Chicago Northwestern Railroad	Oil	Fox River
22	Pulliam Power Plant	Thermal	Green Bay
23	Our Best Canning Co.	Canning	Little Suamico River
24	Village of Pulaski	Sewage	Little Suamico River
25	Valentine Fisheries, Inc.	Fish and Sewage	Suamico River
26	Village of Suamico	Sewage	Suamico River
27	Village of Denmark	Sewage	Creek 23-11
28	Schuster Construction Co.	Gravel Wash	Neshota River
29	Shirley Farmers Co-op Cheese Factory	Milk	Bower Creek
30	Morrison Dairy Co-op	Milk	Branch River

(DNR, Div. Res. Dev., 1968)

In seeking a cure for the losses of wetlands it should be determined why this loss is occurring. Land developers and real estate agents have contributed significantly to the loss of wetlands in order to create valuable land areas for development especially in such places as Green Bay. Marshes may be filled and converted to home and industrial sites. Municipal government has also helped contribute to wetland losses by allowing lowlands to be used as dumps and industrial waste disposal sites such as those west of Green Bay.

Preservation of these wetlands, especially those along Green Bay, is vital. Wetlands serve as production areas for a wide range of wildlife species by providing nesting, feeding, and cover areas. If the long-range goal for Green Bay is to improve the water quality to the point where a game fishery may be reestablished, then these wetlands, which provide spawning areas for walleyes, northern pike, and other species, will be necessary for the well-being of the restored fishery. Once lost, wetlands are seldom regained and their benefits are lost forever.

In addition to the obvious benefits to fish and wildlife, wetlands are beneficial in more subtle ways. They act as nature's purifiers, filtering nutrients, silt, and other polluting agents from surface water runoff. They also retard the flow of runoff, thereby assisting flood control. When a marsh is drained, filled, or ditched, these benefits are lost.

Prevention of valuable marsh destruction can and should be carried out on many fronts. People first have to be made aware of the benefits of marshland. A second front would be to reduce economic incentives and public agency pressures for destruction.

Brown County has enacted a floodplain and shoreland zoning ordinance that may help with proper enforcement. Such an ordinance should at least prevent indiscriminate development of wetlands for home and industrial sites.

One of the best approaches to keep wetlands from being destroyed is public acquisition of easements or fee title ownership of prime wetland areas. Harmful development and exploitation can be halted through public ownership and eased by taxation consistent with land use.

Private ownership by clubs dedicated to waterfowl hunting and conservation, private fish hatcheries, game farms, fur farms and similar organizations also help preserve wetlands although most are not open to the public. The only problem with these types of holdings is that they can and do change ownership. The new owners will not necessarily be as receptive to wetland conservation as the former owners were.

Cooperation between agencies and an understanding of ecology are important to wetland management and preservation. It is the responsibility of all citizens of Brown County to prevent continued destruction of a most valuable resource.

Fish and Fishing

The major fish species found in Brown County were discussed in the individual lake and stream narratives and will not be repeated here. This section will be concerned with problems and utilization of the fishery.

Probably the greatest problem for Brown County's fishery is the lack of sufficient water quality to support a good fishery. The Fox River, East River, and Green Bay are the surface waters with the most potential. The pollution load of the Fox River is so great that there is not sufficient dissolved oxygen to support a fishery much of the year. Erosion of clayey upland soils has created very turbid conditions in both the Fox and East Rivers compounding their problems. Factors such as erosion of shorelands, siltation of pools, excess rates of eutrophication, and destruction of wetlands have contributed to habitat decline. Spawning habitat cover and feeding areas have been destroyed or drastically reduced in quality as dock lines have replaced marsh edge or plant covered littoral. All of these factors affect Green Bay because the streams enter the bay.

Winterkill is a major factor in most of Brown County's surface waters. Those waters affected are usually shallow ponds and excavations of little recreational value. The only natural inland lake with a fishery potential is Lily Lake. Winterkill has been a major management problem in this lake, reducing the fishery to one dominated by bullheads and forage species.

Summerkills of fish are also common in the Fox River and Green Bay. These kills can be attributed to oxygen depletion due to algae die-offs and to industrial pollution. In the spring of 1971 Brown County residents were encouraged to see white bass and perch in the Fox River as far upstream as the Rapide Croche dam. These fish could survive as long as surface runoff was providing a large volume of water and the dam was aerating the water spilling over it, and good fishing was supplied to area youngsters. However, as surface waters reached normal levels, the dissolved oxygen level downstream reached zero. The result was a summerkill among the fish trying to return to Green Bay; only those fish remaining near the dam survived.

Historically Green Bay fish populations had access to spawning grounds in the Fox River. Damming and pollution shut them off. Decline of sturgeon in Green Bay can be attributed to this factor. Runs of walleye, northern pike and suckers were undoubtedly also affected.

Records of fishing license sales from 1964 to 1970 are presented in Figure 11. County license sales vary, but have shown a tremendous upsurge in the last five years. This rise may be due in part to the close proximity of Brown County to the fishery of Lake Michigan. County nonresident license sales are low and relatively static. Less than 350 nonresident fishing licenses were sold in Brown County in 1970.

Fishing pressure within Brown County is light. A few small excavations provide limited fishing to area youngsters, but the majority of fishermen must look elsewhere. Lake Michigan, of course, receives much of this attention. Lakes and streams to the west and north also receive some of this pressure. Overcrowding of Brown County's surface waters is not usually a problem for these reasons. Unless surface waters are cleaned up to the point where a desirable fishery can survive, managing a fishery is not possible.

Wildlife and Hunting

With the exception of those adjacent to Green Bay, the wetlands and surface waters of Brown County are not suitable for large numbers of wildlife. The wetlands along the west side of Green Bay including Long Tail Point and Sensiba Wildlife Area provide nesting and resting areas for numerous marsh birds and waterfowl. Mallards, teal, shovelers and various divers use these wetlands and the open bay. The brush and marsh also provide habitat for numerous migrating and nesting songbirds.

Game species common to these areas include muskrats, mink, and deer. Upland species in the county include deer, grouse, Hungarian partridge, squirrels, rabbits, pheasants, fox and raccoon. Only 112 deer were taken during the 1971 deer gun season in Brown County showing the relative unimportance of this county in maintaining the deer herd.

Within Brown County hunting probably ranks ahead of fishing in importance as a recreational endeavor. County hunting license sales generally follow statewide trends showing moderate increases over the past several years with the exception of 1969 (Figure 11). With only 1,500 acres of public hunting grounds much of the hunting pressure is taken up by private lands and by nearby counties.

Decreasing wildlife habitat (in both quantity and quality) and increasing use demands are problems facing the land-wildlife manager throughout the state and particularly in areas such as Brown County. Waterfowl are not nearly as abundant as they were a few years ago. This can be explained in part by the general decrease in waterfowl populations in North America. Other factors such as destruction of marshes, destruction of aquatic vegetation such as wild rice, and declines in water quality further limit waterfowl and other wildlife populations. Agricultural practices such as intensive cultivation, stream bank pasturing, and roadside brush cutting are directly responsible for much habitat destruction and subsequent wildlife declines. More subtle factors such as the spread of carp, and the increase in boat traffic may also have an effect. The impact, if any, of snowmobiles and ATV's has not yet been fully evaluated.

Through sound education programs and economic assistance programs (ACP, for example) some of these problems may be overcome. Quality recreation, whether it be hunting, fishing or bird-watching, is achieved only when the number of participants can be kept at desirable levels. Provisions to control the number of participants of any recreational endeavor, and especially hunting, may have to be instituted in the near future to preserve any semblance of quality.

Public Lands and Access

During field investigation all lakes and streams were classified by degree of public access as shown in Figure 12*. Of the 23 lakes examined, 15 were found to have no means of public access. Four lakes had walk-in access, and two had multiple use areas providing access. Green Bay has numerous access sites of all kinds including boat launching areas, parks, and public hunting grounds. Public access to Brown County's lakes is generally adequate to meet demands but demands are low due to the poor recreational value of most of the lakes.

Primary access to most streams is provided by highway and road bridges. The Fox River and Duck Creek are served by boat launching areas and several multiple use parks are located on each one. The Suamico and Branch Rivers have wayside parks providing public access. Stream access is also adequate to meet demands but demands are low due to the poor recreational quality of the water. The lack of a sport fishery in the Fox River precludes the need for further access development.

*Figure appears at the end of the narrative

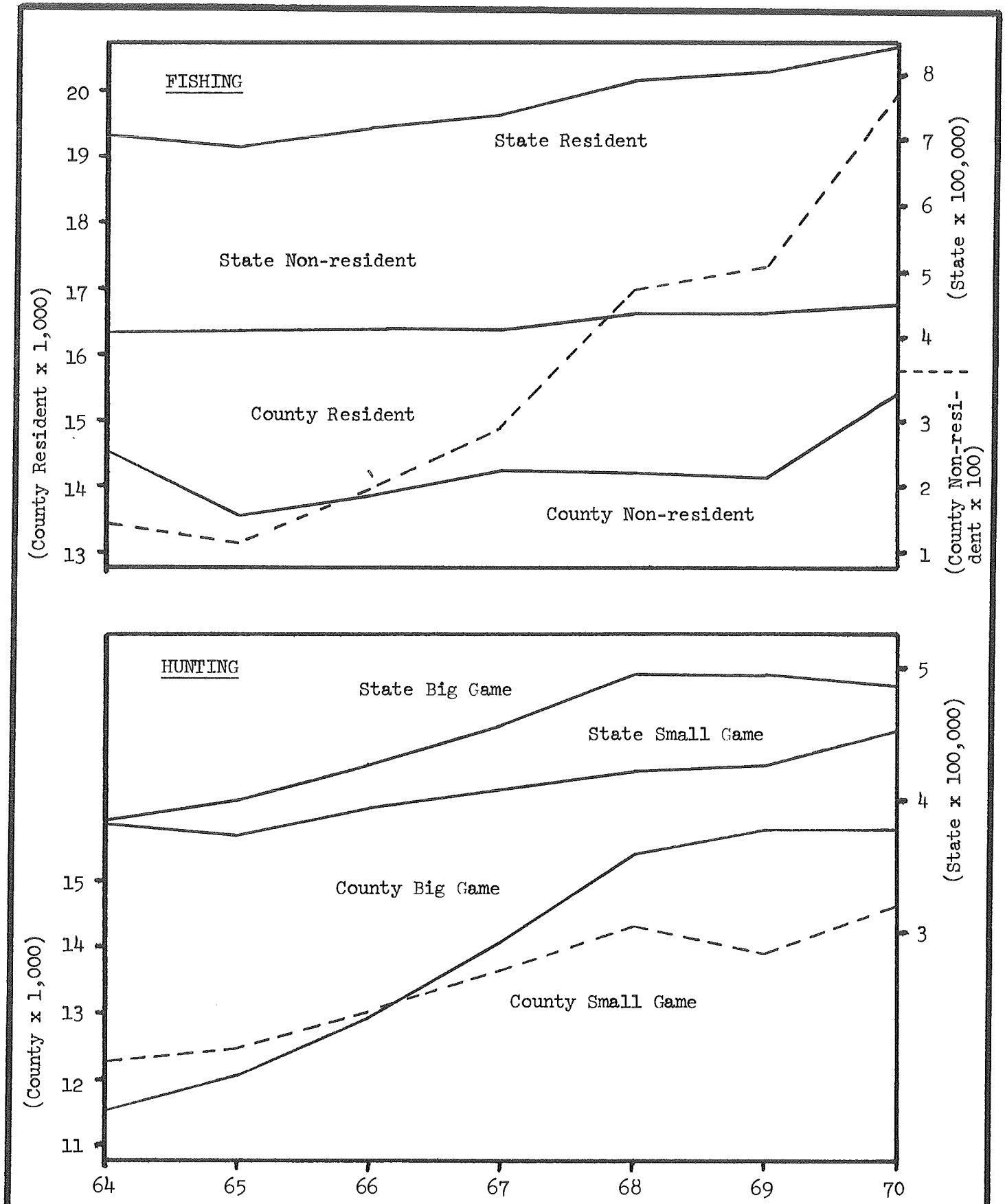

Fig. 11. Hunting and fishing licenses issued in Brown County

Public lands within the county are depicted in Figure 12* and summarized in Table 9. Not all lands shown are recreation lands; some are institutional lands, dumps, and educational lands. Public frontage on lakes totals 7.9 miles. There is 4.5 miles of public stream frontage making a total of 12.4 miles of water frontage in Brown County. As recreational uses of public lands expand (advent of snowmobiles and ATV's, for example), and as hunting pressures increase, the need for more and larger public use areas will be required, especially near population centers such as Green Bay. The few wetland areas along Green Bay should be preserved for wildlife and hunting areas because of the general lack of such areas in Brown County.

Shorelands

Brown County's inland lakes provide 12.3 miles of water frontage. Green Bay with 34.5 miles coupled with 193.5 miles of stream make additional water frontage available. Very little frontage has great development value. A complete list of shoreline lengths is presented in Appendix 1a and 2a.

Public frontage on surface waters is generally quite limited (Appendix Table 1a and 2a). Green Bay has only .52 mile in the 34.5 miles of frontage. The best picture appears on Lily Lake where the entire shore is public. On the 193.5 miles of stream only 4.46 miles of public frontage occurs. This is a very limited amount to furnish access, aesthetic values and habitat protection.

Table 9. Summary of public lands in Brown County

State Lands	
Holland Public Hunting Grounds	426.0 acres
Long Tail Point	103.0 acres
Sensiba Wildlife Area	299.7 acres
Miscellaneous and Wetlands	664.3 acres
Total:	1,493.0 acres
County Lands**	
Brown County Recreation Park	266.9 acres
Brown County Reforestation Camp	1,620.0 acres
County Arboretum	100.0 acres
Lily Lake County Park	25.0 acres
Pamperin County Park	53.6 acres
Way-Morr County Park	28.1 acres
Miscellaneous County Land	105.0 acres
Total:	2,198.6 acres
City and Township Lands**	
Total - Entire County	292.6 acres
Grand Total:	3,984.2 acres

*Figure appears at the end of the narrative
**Does not include all lands within corporate boundaries

The degree of shoreline development depends on several factors. The most important include shoreline development factor (S.D.F.), depth of water, and nature of shoreline. Shoreline developments on Brown County's inland waters varies from light to nonexistent. The inland lakes are too small and shallow to be of value as development sites. Many of the streams are developed not for their recreation or aesthetic value but simply because they were in the way of Green Bay's urban sprawl. Several small meandering streams have become casualties of this development and are now straightened, unsightly ditches. Most of the shoreline development has taken place along the south and east shores of Green Bay. Here the development is heavy and many dwellings are packed tightly together.

In an attempt to prevent further haphazard shoreland development, Brown County and the City of Green Bay have enacted shoreline and floodplain zoning ordinances. Enforcement is the key to these ordinances, and their effectiveness remains to be seen.

Farm Ponds and Private Fish Hatcheries

Brown County contains 149 farm ponds covering 148 surface acres (1964 Census of Agriculture). The majority of these are used for agricultural purposes such as irrigation, or stock watering; a few are used for hunting and fishing. Because of their small size (usually less than one acre) farm ponds should be designed and used for one purpose, not a number of simultaneous uses. Too often a small farm pond is used for fishing, hunting and cattle watering -- uses which are not compatible with one another. As a result of the multiple use concept of farm ponds, these ponds often become a liability rather than an asset. These ponds can be very valuable especially in a county such as this where surface water resources available for use is so limited. The recent expanding interest in farm ponds by private individuals is largely due to the fact that technical and financial assistance is available from various agencies of the United States Department of Agriculture.

DNR files indicate that there are only nine licensed private fish hatcheries in Brown County. These hatcheries contain eleven ponds covering approximately eight acres. None are classified as commercial hatcheries. Figure 10 shows the location of the private fish hatcheries in Brown County. Licensing of private fish hatcheries is closely regulated by Wisconsin law. Navigable streams, lakes, and springs cannot be licensed if such action will be detrimental to public interest. No area larger than 160 contiguous acres may be included in one license.

Boating

Recent boat registration information indicates that 7,768 boats are registered in Brown County. Of this number only 136 or 1.7 percent are fleet boats available for rent to the public. The remainder are private boats used mainly for pleasure and fishing on Green Bay and the Fox River, or transported to neighboring counties and Lake Michigan. Outboard motors are by far the most popular mode of power with inboard motors and sails running a distant second and third, respectively. Boat registration information is presented in Table 10.

Because the inland lakes are of little value as recreation resources, Green Bay, Lake Michigan and the surface waters of nearby counties are the most important source of boating pleasure.

The Fox River is also heavily used by recreation craft. Information from the Army Corps of Engineers indicates that 4,154 boats used the three locks present on the Fox River in Brown County during the 1971 boating season. Therefore the people of Brown County contribute significantly not only to a crowding problem in Brown County, but to neighboring counties as well.

Other Uses and Problems

Cohee (1969) estimates that over 50 percent of those using surface water resources engage in some type of beach activity. No developed beach facilities are located in Brown County. Most of the demand for swimming facilities is taken up by public swimming pools. Some quarries and excavations are used for swimming, but these are not supervised. Such use should not be encouraged because of obvious dangers that exist. The primary reason for the absence of developed natural beaches is the lack of suitable sites. Desirable characteristics for a beach include clear, unpolluted water, firm sand or gravel bottoms, and a lack of heavy algae blooms or dense weed growth. These are rare commodities in Brown County.

Brown County contains only one developed campground (DNR, 1971). The Brown County Fairgrounds is located on the Fox River in West DePere and offers camping for 225 units.

Flooding is not a serious problem in Brown County. Excessive runoff during spring snow melts and during heavy rainfall occasionally cause some streams to overflow. Damage is usually limited to a flooded field or basement or an occasional bridge washout. High water on the Fox River sometimes disrupts industries located in low-lying portions of the floodplain, but is not a major problem.

OVERVIEW

The lakes, streams, and wetlands are basic elements vital to the overall well being of a quality environment in Brown County. As use demands, in the form of numbers of people and economic considerations (marsh vs. sanitary landfill), confront these resources at ever accelerating rates the integrity of these lakes, streams, and marshes will depend on public attitude and conscience. In order to preserve and enhance the quality of the environment, the public must allow ecological considerations equal weight with economic considerations when "developing" any segment of the natural resources. Sound planning, considering all facets of a given problem, should back any future development of the resource to assure extended optimum use as well as maximum protection. Plans can change or be changed, but once a resource is destroyed, it is nearly always lost forever.

As use demands increase, conflicts of interest will become greater and more widespread. State, county, and local regulations protecting the quality of the resource and minimizing use conflicts must be enacted and enforced. Needs and demands change calling for flexible regulations able to change with the times.

Drainage of wetlands, poor land use practices, ditching of streams, and pollution are some of the factors threatening the county's water-based resources. With a slight change in public attitude these abuses can be corrected. The dollar sign will have to take a seat behind natural laws in the minds of the public. When man fully realizes that what he does today will be the legacy left to his children he may begin to save and improve what remains.

Planning is the real key to the future of Brown County's surface water resources. Formulating a wise, but flexible regional plan and following it will assure orderly development; thereby, giving the environment a chance in tomorrow's world.

ACKNOWLEDGEMENT

Grateful appreciation is extended to personnel of the Department of Natural Resources and other state, local, and federal agencies for their assistance in the preparation of this inventory.

Table 10. Boats registered in Brown County (December 31, 1969)

	Outboard Motor	Sail	Inboard Motor	Total	Percent of State Total
Brown County					
Original	7,246	163	223	7,632	3.5
Fleet	132	2	2	136	0.4
Total:	7,378	165	225	7,768	3.1
Percent of State Total:	3.1	3.3	4.2	3.1	---
State of Wisconsin					
Original	206,578	4,480	5,195	216,253	86.4
Fleet	33,811	466	162	34,439	13.6
Total:	240,389	4,946	5,357	250,692	---

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Appendix 1a. Physical and chemical characteristics of Brown County lakes

Lake	Location T-N, R-E, Sec.	Area (Acres)	Length (Miles)	Width (Miles)	Maximum Depth (Feet)	Est. Mean Depth (Feet)	% 20' Deep	% 3' Deep	Public Frontage (Miles)	Miles of Shoreline	Shoreline Development Factor (SDF)
Green Bay	24, 25-21, 22	-	-	-	26	12	40	10	0.52	34.50	-
Lilly Lake	23-22-32 (2,3,4)	40.0	0.48	0.23	21	15	2	5	1.23	1.23	1.39
Middle Lake	23-22-32 (13)	6.9	0.19	0.11	7	5	-	5	0.17	0.38	1.03
Third Lake	23-22-33 (10,11)	5.4	0.15	0.09	15	9	-	5	-	0.38	1.17
Lake 20-14	21-20-20 (14)	0.6	0.05	0.03	4	2	-	85	-	0.13	1.21
Lake 22-11	22-19-22 (11)	0.6	0.06	0.01	15	10	-	30	-	0.15	1.39
Lake 2-8	22-21-2 (8)	0.6	0.05	0.03	7	5	-	20	-	0.21	1.95
Lake 26-16a	22-22-26 (16a)	3.7	0.19	0.05	6	4	-	10	-	0.42	1.56
Lake 6-9	23-20-6 (9)	1.3	0.10	0.02	4	2	-	75	-	0.25	1.56
Lake 15-16	23-20-15 (16)	4.6	0.11	0.09	4	2	-	70	-	0.32	1.07
Lake 20-13	23-21-20 (13)	2.7	0.12	0.08	25	17	10	2	-	0.37	1.61
Lake 25-8	24-19-25 (8)	1.3	0.06	0.05	3	2	-	100	0.29	0.29	1.82
Lake 25-10	24-19-25 (10)	1.0	0.10	0.02	4	3	-	10	0.22	0.22	1.57
Lake 10-15, 16	24-20-10(15,16)	10.6	0.31	0.19	4	2	-	90	-	0.99	2.17
Lake 15-6	24-20-15 (6)	2.4	0.06	0.06	114	65	100	-	-	0.25	1.15
Lake 15-6a	24-20-15 (6a)	2.6	0.11	0.08	10	8	-	2	0.23	0.23	1.02
Lake 15-6d	24-20-15 (6d)	2.0	0.08	0.07	45	30	50	2	-	0.23	1.12
Lake 19-4	24-20-19 (4)	1.1	0.06	0.04	14	12	-	2	-	0.19	1.29
Lake 20-6	24-20-20 (6)	1.4	0.08	0.04	15	10	-	5	0.20	0.20	1.21
Lake 29 (Bay Beach Lagoons)	24-21-29	42.0	0.78	0.30	15	7	-	50	5.05	5.05	5.56
Lake 5-13	25-20-5 (13)	0.6	0.06	0.02	3	2	-	100	-	0.15	1.39
Lake 20 (15,16)	25-20-20 (15,16)	6.8	0.23	0.06	9	5	-	20	-	0.51	1.39
Lake 32 (13)	25-22-32 (13)	0.6	0.04	0.04	8	6	-	-	-	0.13	1.20

Appendix 1b. Physical and chemical characteristics of Brown County lakes

Lake	Lake Type	pH	Total Alkalinity (mg/l $CaCO_3$)	Specific Conductance (μmhos/cm @ 77° F.)	Color	Secchi Disk (feet)	Sampling Date	Water Source	Watershed (sq. mi.)	Direct Drainage (sq. mi.)
Green Bay								Drainage		
Lilly Lake	Natural	8.3	164	340	Med. Brown	2	6-18-71	Seepage	< 1	< 1
Middle Lake	Natural	8.2	167	333	Lt. Brown	3	6-21-71	Seepage	< 1	< 1
Third Lake	Natural	8.2	154	331	Med. Brown	4	6-18-71	Seepage	< 1	< 1
Lake 20-14	Impoundment	8.0	313	657	Turbid	1	6-17-71	Drainage	< 1	< 1
Lake 22-11	Natural	8.9	102	341	Turbid	1	6-22-71	Seepage	< 1	< 1
Lake 2-8	Excavation	7.9	292	727	Clear	4	6-17-71	Seepage	1	1
Lake 26-16a	Excavation	8.0	208	534	Clear	6	6-17-71	Seepage	< 1	< 1
Lake 6-9	Impoundment	9.4	151	383	Clear	4	6-22-71	Well	< 1	< 1
Lake 15-16	Excavation	9.1	125	535	Turbid	1	6-21-71	Seepage	< 1	< 1
Lake 20-13	Excavation	8.9	136	357	Turbid	3	6-17-71	Seepage	< 1	< 1
Lake 25-8	Impoundment	8.2	241	596	Turbid	1	6-22-71	Drainage	9	3
Lake 25-10	Natural	8.6	153	392	Turbid	2	6-22-71	Drainage	< 1	< 1
Lake 10-15, 16	Excavation	8.0	210	501	Turbid	1	6-23-71	Drainage	150	1
Lake 15-6	Excavation	8.4	156	461	Clear	7	6-24-71	Spring	< 1	< 1
Lake 15-6a	Excavation	7.5	365	855	Clear	6	6-23-71	Seepage	< 1	< 1
Lake 15-6d	Excavation	8.4	138	504	Clear	5	6-23-71	Seepage	< 1	< 1
Lake 19-4	Excavation	8.5	227	559	Clear	4	6-22-71	Well	< 1	< 1
Lake 20-6	Excavation	8.2	195	501	Clear	4	6-23-71	Seepage	< 1	< 1
Lake 29	Excavation	8.5	154	552	Turbid	1	6-25-71	Drainage	2	2
Lake 5-13	Excavation	9.0	12	81	Med. Brown	2	6-23-71	Seepage	< 1	< 1
Lake 20-15, 16	Impoundment	8.7	148	339	Clear	3	6-24-71	Drainage	1	1
Lake 32-13	Excavation	8.0	138	550	Clear	8	6-21-71	Seepage	< 1	< 1

Appendix 2a. Physical and chemical characteristics of Brown County streams

Stream	Location T-N	R-E	Sec.	Area (Acres)	Length (Miles)	Ave. Width (Feet)	Flow (CFS)	Public Frontage (Mi. of Stream)	Drainage System
Apple Creek	22	19	25(7)	10.2	4.2	20	-	-	Fox River
Ashwaubenon Creek	23	20	15(3)	17.6	9.7	15	-	-	Fox River
Baird's Creek	24	21	31(16)	3.9	4.0	8	2.5	-	East River
Beaver Dam Creek	24	20	15(8)	4.2	3.5	10	-	-	Duck Creek
Bower Creek	23	20	24(16)	4.4	3.0	12	-	-	East River
Branch River	21	21	35(16)	16.4	7.5	18	7.9	0.13	Manitowoc River
Duck Creek	24	20	13	92.0	13.8	55	-	2.50	Green Bay
Dutchman Creek	23	20	11(7)	16.7	4.6	30	-	-	Fox River
East River	24	21	30(11)	102.4	32.5	26	-	0.60	Fox River
Fox River	24	21	19	1,381.8	19.0	600	-	0.41	Green Bay
Neshota Creek	22	22	36(16)	20.1	8.3	20	2.2	-	Lake Michigan
Plum Creek	21	19	2(5)	67.1	12.3	45	6.0	-	Fox River
School Creek	24	22	24(1)	2.5	2.1	10	-	-	Kewaunee River
Suamico River	25	20	24(1)	70.5	19.4	30	-	0.19	Green Bay
Trout Creek	24	20	19(11)	6.7	6.1	9	2.0	-	Duck Creek
Creek 25-11	21	19	25(11)	2.7	2.2	10	1.4	-	Plum Creek
Creek 7-8	21	20	7(8)	1.7	3.5	4	-	-	East River
Creek 36-11	21	21	36(11)	0.3	0.8	3	0.4	-	Branch River
Creek 20-14	22	20	20(14)	2.8	3.8	6	0.5	-	East River
Creek 20-15	22	20	20(15)	0.2	2.7	0.5	< 0.5	-	East River
Creek 28-4	22	20	28(4)	0.3	2.3	1	< 0.5	-	East River
Creek 31-14	22	20	31(14)	9.2	6.3	12	< 0.5	-	East River
Creek 23-11	22	22	23(11)	0.7	1.5	4	1.1	-	Neshota Creek
Creek 35-1	23	20	35(1)	0.2	2.0	1	< 0.5	-	East River
Creek 10-9	24	20	10(9)	3.9	4.6	7	1.4	-	Duck Creek
Creek 10-14	24	20	10(14)	2.9	1.5	16	< 0.5	-	Duck Creek
Creek 22-3	25	19	22(3)	3.6	3.7	8	-	-	Suamico River
Creek 36-14	25	20	36(14)	11.7	4.6	21	-	0.63	Green Bay
Creek 13-10	25	22	13(10)	3.9	4.0	8	6.9	-	Green Bay

Appendix 2b. Physical and chemical characteristics of Brown County streams

Stream	pH	Total Alkalinity (mg/l $CaCO_3$)	Specific Conductance (μmhos/cm @ 77° F.)	Color	Sampling Date	Gradient (feet/mile)	Watershed Area (sq. miles)	Drainage Area (sq. miles)
Apple Creek	7.4	300	875	Turbid	8-24-71	4.8	51	3
Ashwaubenon Creek	8.2	193	468	Turbid	8-31-71	4.1	30	13
Baird's Creek	8.4	275	795	Clear	8-17-71	20.0	18	16
Beaver Dam Creek	7.8	231	540	Turbid	8-31-71	8.6	6	4
Bower Creek	8.2	220	520	Turbid	8-17-71	5.0	38	38
Branch River	7.9	247	522	Turbid	8-27-71	6.7	46	44
Duck Creek	7.8	218	396	Turbid	9-2-71	8.7	152	18
Dutchman Creek	7.9	200	417	Turbid	8-31-71	2.2	32	29
East River	7.8	210	550	Turbid	9-3-71	5.8	143	66
Fox River	7.3	139	385	Turbid	9-3-71	4.3	6,443	23
Neshota Creek	7.7	270	615	Turbid	8-25-71	4.8	51	36
Plum Creek	7.8	146	350	Turbid	8-23-71	13.0	26	6
School Creek	7.8	260	530	Turbid	8-17-71	14.3	9	9
Suamico River	8.0	200	375	Turbid	9-1-71	11.3	64	53
Trout Creek	8.9	275	455	Med. Brown	9-2-71	16.4	18	5
Creek 25-11	6.6	407	2,300	Turbid	8-24-71	36.4	7	3
Creek 7-8	7.6	214	580	Turbid	8-24-71	45.7	2	2
Creek 36-11	7.4	269	492	Clear	8-25-71	12.8	4	4
Creek 20-14	7.7	284	508	Turbid	8-29-71	60.5	5	3
Creek 20-15	8.0	399	540	Turbid	8-29-71	88.9	1	1
Creek 28-4	7.8	365	610	Clear	8-29-71	87.0	2	2
Creek 31-14	7.5	312	750	Turbid	8-29-71	22.2	8	6
Creek 23-11	7.6	273	670	Clear	8-29-71	106.7	2	2
Creek 35-1	8.0	346	875	Clear	8-17-71	105.0	2	2
Creek 10-9	7.8	190	360	Turbid	9-2-71	13.0	12	8
Creek 10-14	7.4	212	405	Turbid	9-2-71	3.4	6	2
Creek 22-3	7.6	214	400	Clear	9-2-71	13.5	11	7
Creek 36-14	8.1	127	265	Turbid	9-1-71	8.7	6	5
Creek 13-10	8.0	275	580	Clear	8-17-71	45.0	4	4

Appendix 3. Physical and chemical characteristics of Brown County lakes and streams - summary

Parameter	Lakes	Streams	Total
Number	23	29	52
Area (acres)	138.8*	1,860.6	1,999.4
Length (streams)			
Total (miles)	-	193.5	-
Average (miles)	-	6.7	-
Average gradient (feet/mile)	-	26.7	-
Shoreline Length (lakes)	46.78	-	-
Public Frontage (total miles)	7.91	4.46	12.37
pH			
Average	8.4*	7.8	8.1
Total Alkalinity (mg/l)			
Average	180*	251	220
Specific Conductance (μmhos/cm @ 77°)			
Average	474*	591	540

* Excludes Green Bay

Appendix 4. DEFINITIONS

aesthetics - scenic qualities of water and related resources.

alkalinity - a measure of carbonates, bicarbonates, and hydroxides present in water, expressed as milligrams per liter of calcium carbonate. Alkalinity was determined with the acid-base indicator methyl purple and is assumed to represent total alkalinity.

aquatic vegetation - plants that grow in or very near water. For this report aquatic vegetation was categorized as follows:

a. submergent - plants commonly found growing beneath the surface (pond weeds, coontail, algae, etc.).
b. floating - plants, at least portions of which float on the water's surface (lily, water shield, duckweed).
c. emergent - rooted vegetation commonly found in shallow water or along lake margins. Much of the plant stands out of the water.

aquifer - any geological formation capable of bearing or storing ground water.

artesian well - wells in which the water encountered is under sufficient hydraulic pressure to force it to the surface.

coldwater fishery - a fish population composed of species generally requiring water temperatures of 75° F. or less to survive for more than a few days (trout--cisco).

crystalline rock - igneous rocks of precambrian age composed of granular interlocking minerals such as feldspar, orthoclase, and mica.

dolomite - a sedimentary rock containing a large amount of $CaMg(CO_3)_2$.

ecosystem - the entire realm of both living and nonliving materials within a given area.

environment - all external influences and conditions affecting the life and development of an organism.

eutrophication - the enrichment or natural aging of lakes. Man through pollution has greatly increased the rate of eutrophication on many waters.

fertility classification - as follows:

Total Alkalinity	Classification	Productivity	Waters Are
0 - 14	very soft	low	infertile
15 - 49	soft	low-medium	infertile
50 - 99	medium hard	medium-high	fairly fertile
100 - 199	hard	high	moderately fertile
over 200	very hard	high	very fertile

forest land - commercial forest land capable of producing standard size pulpwood within 100 years.

forest land - noncommercial forest land not capable of producing standard size pulpwood within 100 years.

glacial features:

ground moraine - extended sheets of glacial till deposited in the path of former glaciers. These fairly level areas are composed of sand, gravel, clay, and boulders and often contain shallow marshy lakes.
kettle - a depression formed by melting of a block of stagnant ice buried by glacial drift. Many are filled with water to form lakes.
outwash plain - gently sloping fans of various sediments deposited by water flowing from a stationary glacial ice sheet.
recessional moraine - a deposit similar to a terminal moraine only deposited during a temporary halt of a retreating glacier.
terminal moraine - a ridge of glacial till marking the furthest advance of a particular glacier or lobe of a glacier.

lake types:

drainage - having both an inlet and outlet and deriving most of its volume from inflowing surface waters.
drained - having an outlet but no appreciable inlet.
seepage - having no inlets or outlets. Water levels are maintained by nearby ground water supplies.

spring pond - having either marginal or internal springs which form the bulk of the water supply. Often no inlets are present but outlets are always present.

littoral bottom materials - bottom sediments lying in water less than five feet deep and are classified as follows:

sand - particles to 1.0 mm in diameter.
gravel - a mixture of round coarse material of various sizes, mostly larger than sand, ranging in size from 2.0 mm to 3.0 inches.
rubble - broken rocks 3.0 inches to 10.0 inches in diameter.
boulders - rocks over 10.0 inches in diameter.
bedrock - solid rock shelf.
clay - a dense gummy material consisting of very fine particles less than 0.0039 mm in diameter.
hardpan - compressed clay.
detritus - decaying organic matter.
silt - fine soil particles 0.0039 mm to 0.0624 mm in diameter.
marl - very fine calcareous deposits usually whitish in color.

limnology - the study of freshwater lakes and streams.

panfish - the smaller species of game fish such as perch, bluegills, and crappies.

piscicides - chemicals formulated for the specific purpose of killing fish (rotenone and antimycin are examples).

shale - a sedimentary rock formed of layers of compressed, hardened clay.

shoreline development figure (S.D.F.) - a method of expressing degree of shoreline irregularity. It is the ratio of the length of the shoreline of a lake to the circumference of a circle of the same area. An S.D.F. of 1.00 indicates a circle.
Greater values reflect shoreline irregularities.

specific conductance - a measure of water's ability to conduct an electrical current. It indicates relative amounts of dissolved electrolytes present in water and is expressed in micromhos per centimeter at 77° F.

thermocline - the layer of water in which the drop in temperature equals or exceeds 1 degree centigrade for each meter of depth.

vernal pond - a small pond that contains water only during certain seasons of the year.

warm water fishery - a fish population composed of species able to tolerate extended periods when water temperatures exceed 75° F.

wetland - any area where the ground is too wet to raise an agricultural crop without major drainage. Wetlands are classified as follows:

deep marsh - water from six inches to three feet deep during growing seasons. Cattails, reeds, bulrushes, spike rushes, and pond weeds are common.
shallow marsh - water present during part of the growing season. Cattails, river rush, spike rush, and bulrush are typical vegetative types.
fresh meadow - soggy ground, often seasonally flooded. Vegetation of smartweed, grass, sedge, bur reed.
shrub swamp - waterlogged soil with occasional standing water. Tamarack, black spruce, black ash, and elm are common trees.

wilderness lake - a lake located over 200 feet from any building, road, commercial facility, etc. The shoreline is not developed.

winterkill - death of fishes resulting from inadequate dissolved oxygen conditions under ice.

SURFACE WATER RESOURCE PUBLICATIONS

Adams County	1966
Ashland County	1966
Barron County	1964
Bayfield County	1970
Brown County	1972
Burnett County	1966
Calumet County	1971
Chippewa County	1963
Clark County	1965
Columbia County	1965
Dane County	1962
Dodge County	1965
Door County	1966
Dunn County	1962
Eau Claire County	1964
Florence County	1971
Fond du Lac County	1969
Grant County	1972
Green County	1961
Green Lake County	1970
Iowa County	1969
Iron County	1970
Jackson County	1968
Jefferson County	1969
Juneau County	1969
Kenosha County	1961
Kewaunee County	1966
Lafayette County	1967
Manitowoc County	1969
Marquette County	1963
Menominee County	1963
Milwaukee County	1964
Monroe County	1969
Oneida County	1966
Ozaukee County	1964
Polk County	1961
Portage County	1972
Racine County	1961
Richland County	1970
Rock County	1970
St. Croix County	1961
Sawyer County	1969
Shawano County	1968
Sheboygan County	1968
Taylor County	1970
Trempealeau County	1970
Vilas County	1963
Walworth County	1961
Washington County	1962
Waukesha County	1963
Waupaca County	1971
Waushara County	1970
Wood County	1967

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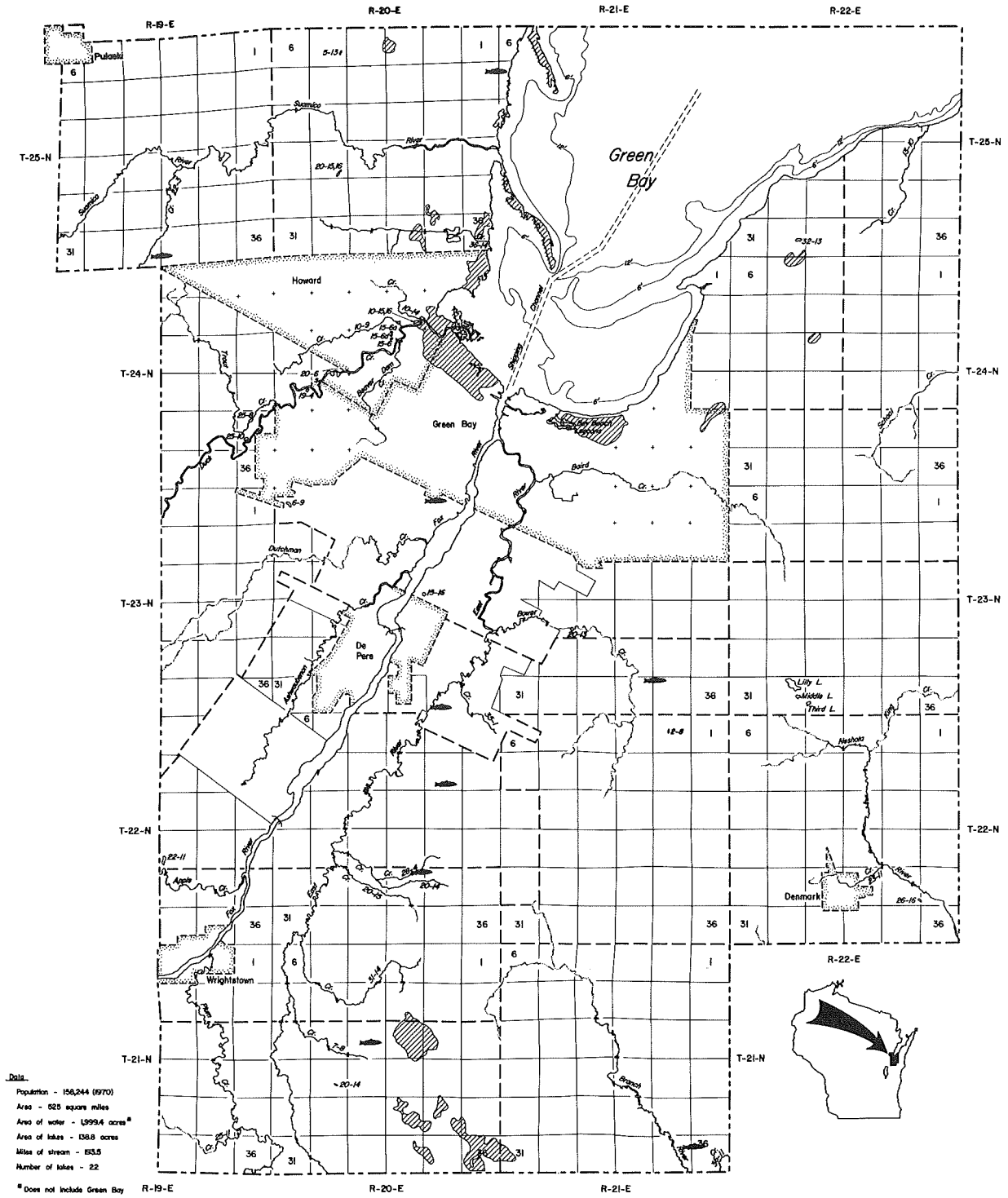
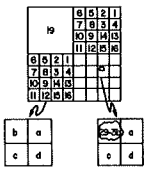


Data

Population - 158,244 (1970)
Area - 525 square miles
Area of water - 1,999.4 acres*
Area of lakes - 138.8 acres
Miles of stream - 153.5
Number of lakes - 22

* Does not include Green Bay

Numbering System for Unnamed Lakes and Streams



Legend

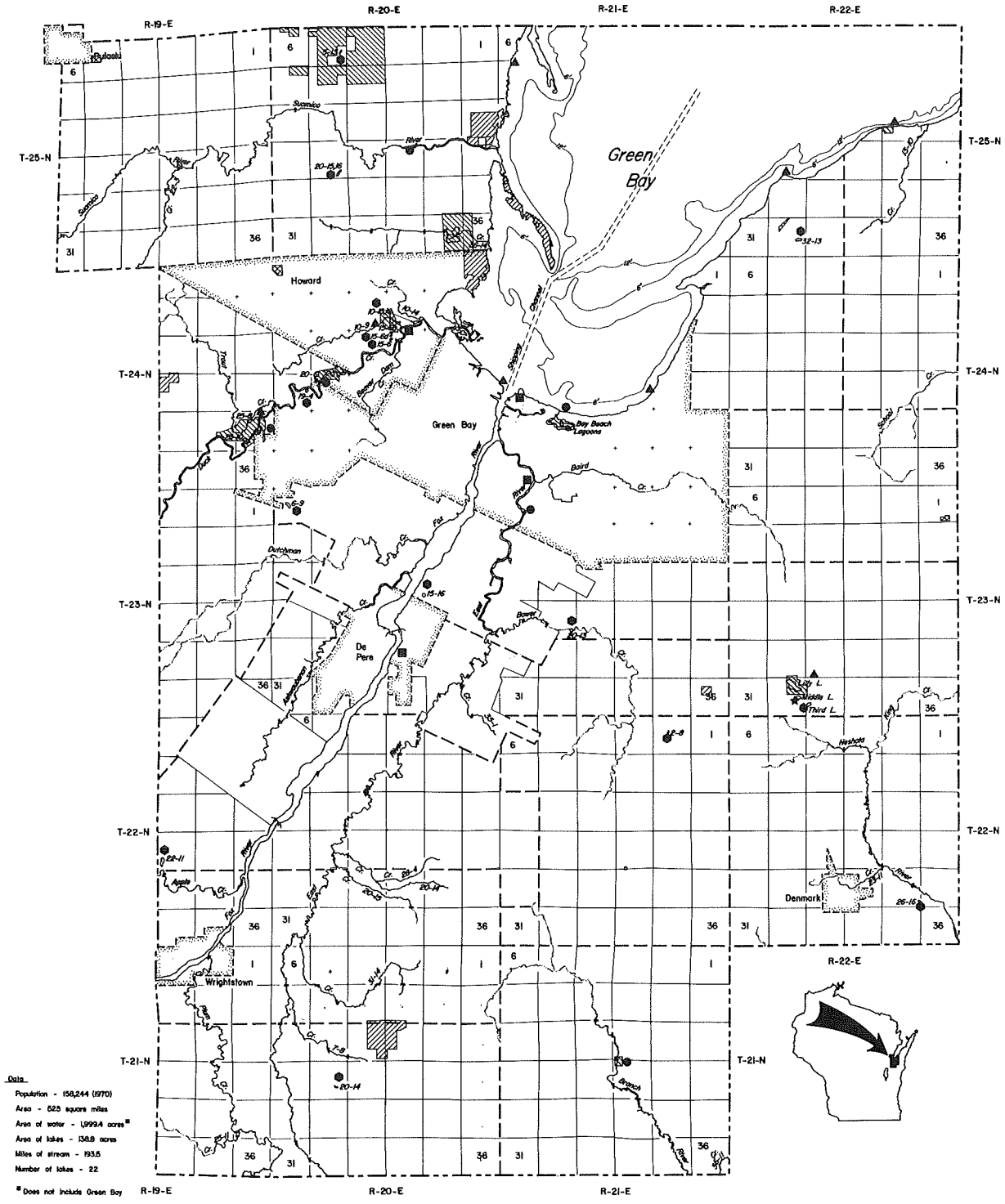
- Intermittent flow
- Bridge
- Dam
- Stream < 10' wide
- Stream 10'- 20' wide
- Stream 21'- 40' wide
- Stream > 40' wide
- County boundary
- Civil town boundary
- Corporate limits

LAKES AND STREAMS OF BROWN COUNTY

Prepared by:
Wisconsin Department of Natural Resources
Bureau of Fish Management
Biologist: Ronald L. Fassbender
Draftsman: A. N. Philpot
Date: August, 1971

FIGURE 10. PRIVATE FISH HATCHERIES and WETLANDS.

- Private fish hatchery
- Generalized wetlands



Data

Population - 158,244 (1970)
Area - 525 square miles
Area of water - 1,999.4 acres*
Area of lakes - 1388 acres
Miles of stream - 193.5
Number of lakes - 22

* Does not include Green Bay

Numbering System for Unnamed Lakes and Streams

Legend

- Intermittent flow
- Bridge
- Dam
- Stream < 10' wide
- Stream 10' - 20' wide
- Stream 21' - 40' wide
- Stream > 40' wide
- County boundary
- Civil town boundary
- Corporate limits

LAKES AND STREAMS OF BROWN COUNTY

Prepared by:
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Date: August, 1971

Scale in miles 0 1 2 3

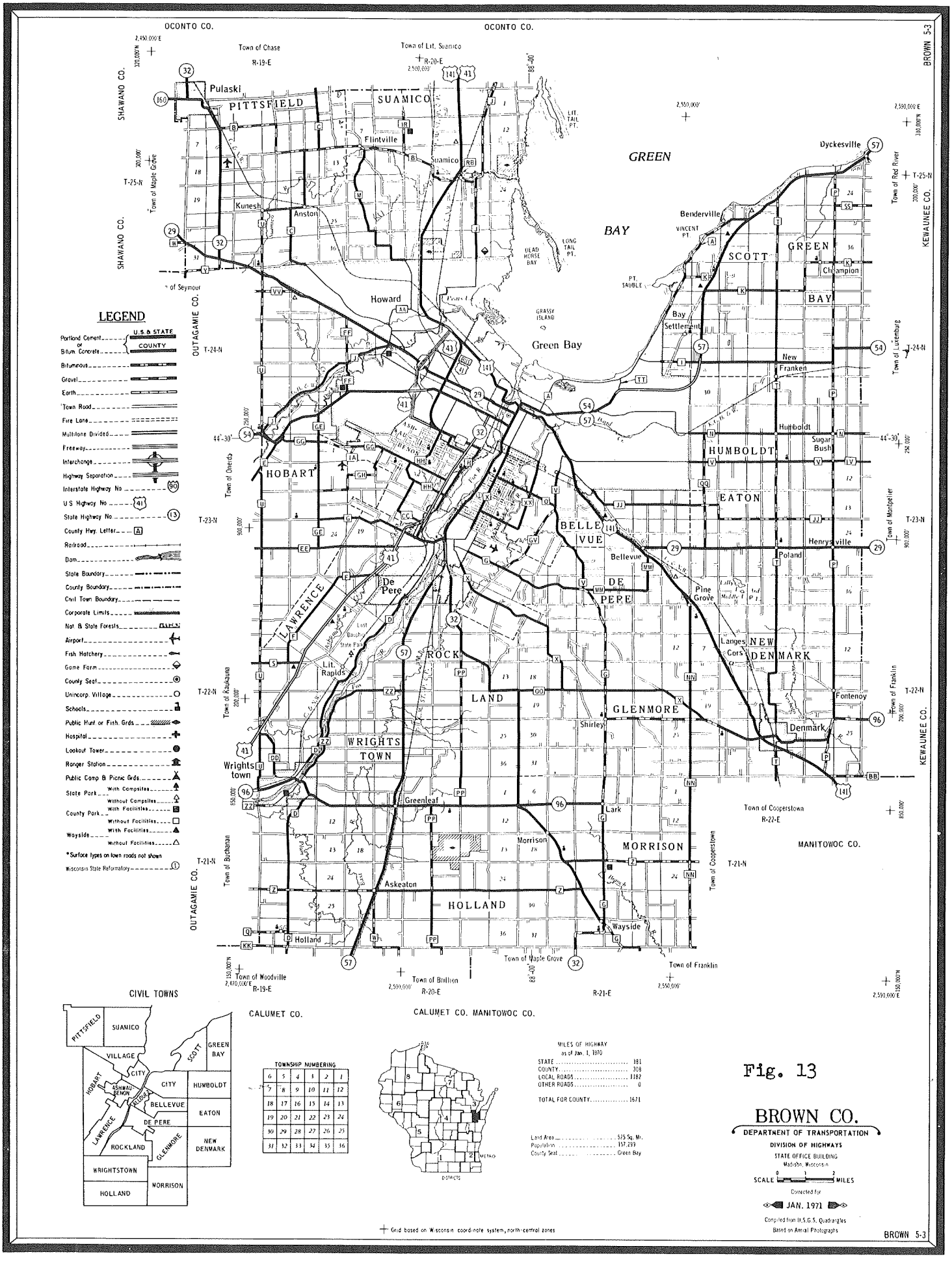
FIGURE 12. PUBLIC LANDS and ACCESS.

Public Land

- State
- County
- Local

Public Access

- Multiple use
- Boat launching site
- Wilderness - Public land
- Walk-in
- None



LEGEND

- Portland Cement or Bitum. Concrete — U.S. & STATE / COUNTY
- Bituminous
- Gravel
- Earth
- Town Road
- Fire Lane
- Multilane Divided
- Freeway
- Interchange
- Highway Separation
- Interstate Highway No. (90)
- U.S. Highway No. (41)
- State Highway No. (13)
- County Hwy. Letter (A)
- Railroad
- Dam
- State Boundary
- County Boundary
- Civil Town Boundary
- Corporate Limits
- Nat. & State Forests
- Airport
- Fish Hatchery
- Game Farm
- County Seat
- Unincorp. Village
- Schools
- Public Hunt. or Fish. Grds.
- Hospital
- Lookout Tower
- Ranger Station
- Public Camp & Picnic Grds.
- State Park — With Campsites / Without Campsites / With Facilities
- County Park — Without Facilities / With Facilities
- Wayside — Without Facilities

*Surface types on town roads not shown

Wisconsin State Reformatory (1)

CIVIL TOWNS

TOWNSHIP NUMBERING

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

MILES OF HIGHWAY as of Jan. 1, 1970

STATE	181
COUNTY	308
LOCAL ROADS	1182
OTHER ROADS	0
TOTAL FOR COUNTY	1671

Land Area	525 Sq. Mi.
Population	157,299
County Seat	Green Bay

Fig. 13

BROWN CO.

DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STATE OFFICE BUILDING
Madison, Wisconsin

SCALE 0 1 2 MILES

Corrected for JAN. 1971

Compiled from U.S.G.S. Quadrangles
Based on Aerial Photographs

Grid based on Wisconsin coordinate system, north-central zones

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