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SURFACE WATER RESOURCES OF WAUPACA COUNTY

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DEPARTMENT OF NATURAL RESOURCES
MADISON, WISCONSIN
1971

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SURFACE WATER RESOURCES OF WAUPACA COUNTY

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INTRODUCTION

Americans, with ever increasing amounts of leisure time on their hands, are focusing more and more attention on our natural resources as a primary source of recreation. Our surface waters--lakes and streams--probably offer the most outdoor recreational potential. Here man can be angler, boater, water skier, swimmer, sailor, hunter or passive observer however he so chooses. As more and more people participate in an ever expanding variety of water uses there becomes less space available for each activity and each participant. To compound the problem domestic, agricultural, and industrial activities are demanding more water than ever before.

These various water uses are seldom in harmony. Use conflicts arise and often one interest may control water to the exclusion of others. A partial solution to this problem is to seek a method of apportioning water use that will maintain harmony and assure that the resource is equitably utilized. Recognizing the problem and proposed solution the Wisconsin State Legislature, in 1959, directed the Conservation Commission, now the Natural Resources Board, to develop a classification system for lakes according to use. In 1961, this responsibility was extended to include streams.

Before an actual classification system can be devised it is necessary to obtain information regarding number, size, physical and chemical characteristics as well as the present and potential uses of the water resource. A county waters inventory such as this one is the initial step in providing that information.

Each inventory is designed to present the quantity, quality, and character of the water resource with respect to its use for recreation and conservation. The inventory is best described as an extensive survey of surface water resources in Waupaca County. Due to the immensity of the task, data collection was carried on without regard for season and frequently limited to a single visit. Obviously, information such as water analysis, depth, bottom types, transparency, and fishery composition may not be complete. Regardless of the shortcomings, here for the first time is a collection of available data for the surface waters of Waupaca County, a set of vital statistics useful in measuring the present condition of the waters and in planning for their future management.

Data for this inventory, were gathered from many sources, principally aerial photographs, United States Geological Survey maps, Department of Natural Resources water files and forestry surveys, and field investigations. Comprehensive surveys were not possible because of definite time limits. The primary concern of this report is the recreational use and potential of the waters mentioned; little consideration was given industrial and agricultural uses except where major use conflicts were apparent.

The maps presented with this report should not be considered or used as factual or final authority from any legal or regulatory standpoint because of natural or man-made changes which may have occurred.

BRIEF HISTORY OF WAUPACA COUNTY

Waupaca County was created as a governmental unit by an Act of the Wisconsin Legislature approved on February 17, 1851, some three years after Wisconsin became a state. Several slight boundary relocations were made in the ensuing years until 1860 when the county acquired its present form. The name "Waupaca" is derived from the Menominee Indian phrase "Wau pa ka ho nak," variously translated as "Brave Young Hero," "White Sand Bottom," "pale river," or "tomorrow river."

The first Europeans to visit what is now Waupaca County were probably the early French explorers, missionaries, and fur traders. These people left little permanent record of their presence in the county. Nearly 200 years passed after the French first explored Waupaca County before any permanent settlement was made. In 1843, Alpheus Hicks made an exploratory trip up the Wolf River from Oshkosh to Shawano Lake and then back to Oshkosh. Then in 1848 Hicks and his mother-in-law, Mrs. Elizabeth Hicks, settled near what is now Fremont to become the first white settlers. Later that same year Robert Grignon signed a treaty with the Indians granting him a quarter section of land near the mouth of the Little Wolf River on which he built a sawmill. Additional sawmills began to appear all over the county--always near a good source of power and transportation, a major stream system.

Settlers followed the sawmills into Waupaca County or the "Tomorrow River Country" as it was then called in ever increasing numbers--much to the dismay of the Menominees who had not yet surrendered their lands. Finally, on June 1, 1852, over a year after the area was made a county, the Indians signed a treaty to relinquish their land rights. As settlers increased in number so did "squatters" and "claim jumpers." To protect the lands of the recognized landholders against these outsiders a committee was named to arbitrate any land disputes that might arise. Arbitration was often carried on amidst the sound of gunshots and the smell of black powder.

Towns and villages began to spring up around the sawmills. Soon Waupaca County became a booming center of the lumber industry. Pine from the north was floated down the Wolf and other major streams to be processed in Waupaca County. Lumber from the mills was shipped by water to Oshkosh, Appleton, and points south. In the 1850's and 1860's New London was at the hub of this activity and was one of the most prosperous towns in East Central Wisconsin. With the advent of railroads in the early 1870's the picture began to change drastically. Raw forest products were shipped farther south for processing while farming began to take over as the major source of income. Gristmills replaced sawmills and cheese, butter, wheat, and fruit replaced lumber as major exports. The rivers were no longer vital to Waupaca County's well-being.

Farming increased steadily until the 1920's when the depression and the lure of city jobs caused many to leave the farms. Today farming is still the county's single most important source of revenue. Recreation and industry are making inroads into the economic structure of the agricultural stronghold, however. Waupaca County's lakes, streams, and forests provide the key to future prosperity.

GENERAL SETTING OF WATERS IN WAUPACA COUNTY

The various physical and chemical characteristics of any surface water, be it lake, stream, or pond, are directly related to the natural history of the surrounding countryside. Man's land use practices that are superimposed on the natural features of an area are often reflected in the recreational use, both present and potential, of a particular lake or stream. For these reasons the following section contains a discussion of the geology, geography, climatology, and demography of Waupaca County as they relate to the surface water resources.

Topography

As related to surface waters, topography determines drainage patterns. Waupaca County contains three major topographic regions, the moraine--outwash area, the glacial lake area, and the bedrock area. Of these regions the moraine--outwash area is the largest, covering nearly three-fourths of the county. This region, characterized by hills and broad valleys, was formed by ice movement and stagnation. Locally, the land surface is pitted with kettles, many of which are filled with water to form lakes. The southeastern corner of the county lies within the glacial lake area, a flat marshy plain broken by drumlins and eskers. The Wolf River passes through this region. Just east of the glacial lake area lies a flat-topped highland known as the bedrock area. This is by far the smallest topographic region in the county (Berkstresser, 1964).

The land surface slopes from the northwest to the southeast. The general altitude of the northwestern portion of the county ranges between 950 and 1,050 feet, with some drumlins reaching elevations of 1,200 feet. The Wolf River Valley between New London and Fremont in the southeastern part of the county, is about 750 feet above mean sea level. Adjacent uplands range 100 to 200 feet higher (Weidman and Schultz, 1915).

Drainage

As Figure 1 depicts, all of Waupaca County lies within the Wolf River Drainage basin. Major subbasins within the county include the Little Wolf River, the Embarrass River, the Waupaca River, the Pigeon River, and Walla Walla Creek. Of these, the Little Wolf and its tributaries drain the largest portion of Waupaca County. Drainage patterns commonly align themselves from northwest to southeast.

Stream gradients vary considerably depending mainly on size of stream and location in county. The Wolf River, flowing through a marshy lowland in the southeastern part of the county has a gradient of about 0.2 feet per mile, while the upper one-third of the North Branch Little Wolf has a gradient of nearly 10 feet per mile. Generally, higher stream gradients are observed along the moranic hills in the western part of the county than along the lowland areas to the southeast. Figure 2 compares stream gradients of several of the major streams.

Geology

Of the many phases of geology this section of the report will deal mainly with the effects of bedrock and glacial deposits on Waupaca County's surface water resources. Figure 3 represents a cross-sectional view across Southern Waupaca County showing the relationship of the various rock types to each other and to the generalized glacial till that covers them.

Precambrian crystalline rocks, cambrian sandstones, and ordovician dolomites are the major bedrock types found in Waupaca County. Of these types the crystalline rocks cover nearly eighty percent of the county. The crystalline rocks are largely covered by glacial deposits except for a few isolated outcroppings near Big Falls, New London, and Waupaca. The remainder of the county, except for a small area near Fremont is covered by cambrian sandstones that overlay the crystalline rock. Small buried outliers of sandstone can be found in the northern part of the county near Iola and Manawa. These were probably created by differential rates of weathering. The extreme southeastern corner of the county contains a small area of ordovician age dolomites. Hills in this region are capped by a thin layer of dolomite. A few outcrops form bluffs and steep slopes. Figure 4 shows the spatial characteristics of Waupaca County's bedrock geology.

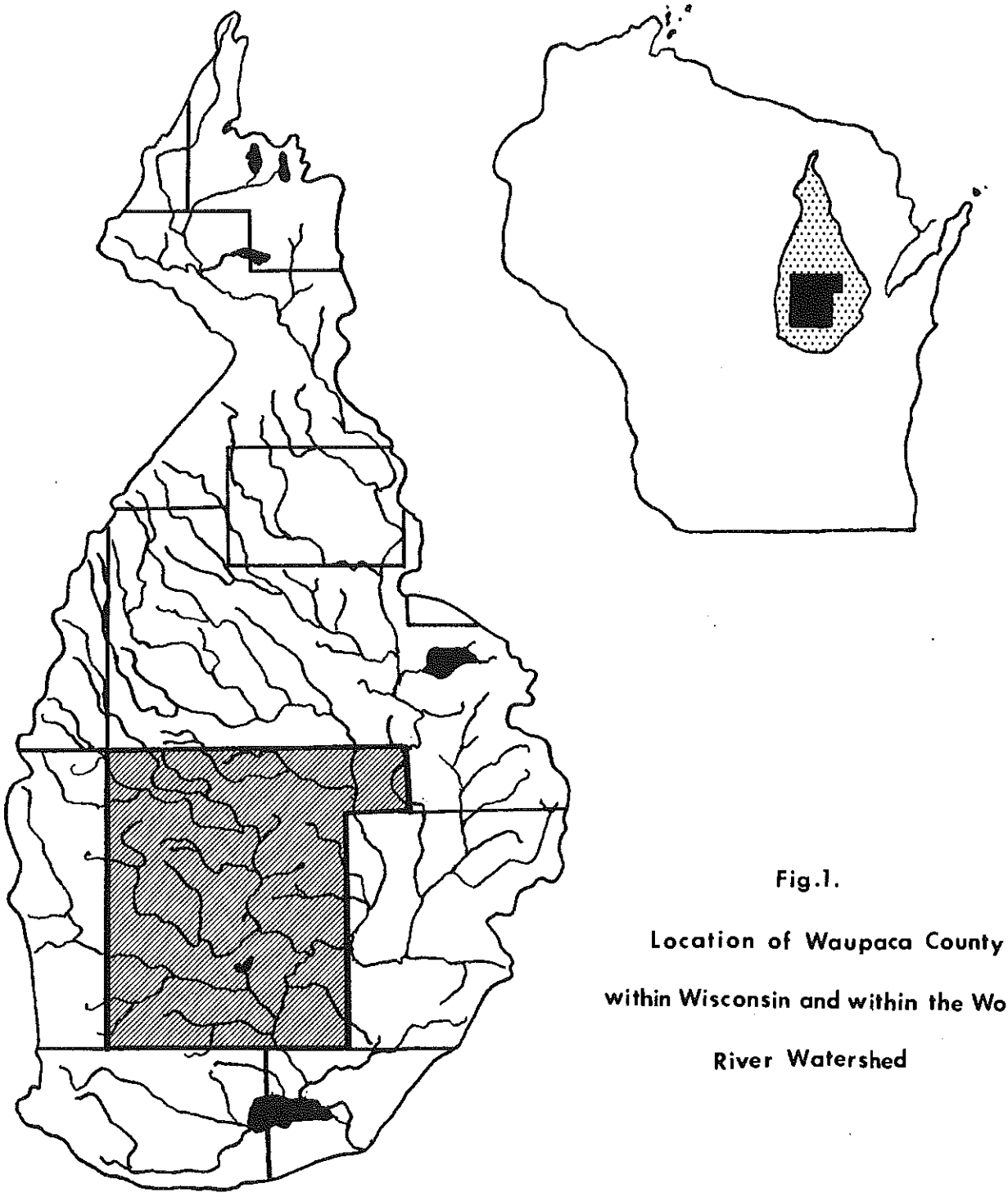


Fig.1.

Location of Waupaca County within Wisconsin and within the Wolf River Watershed

(after Olcott, 1968)

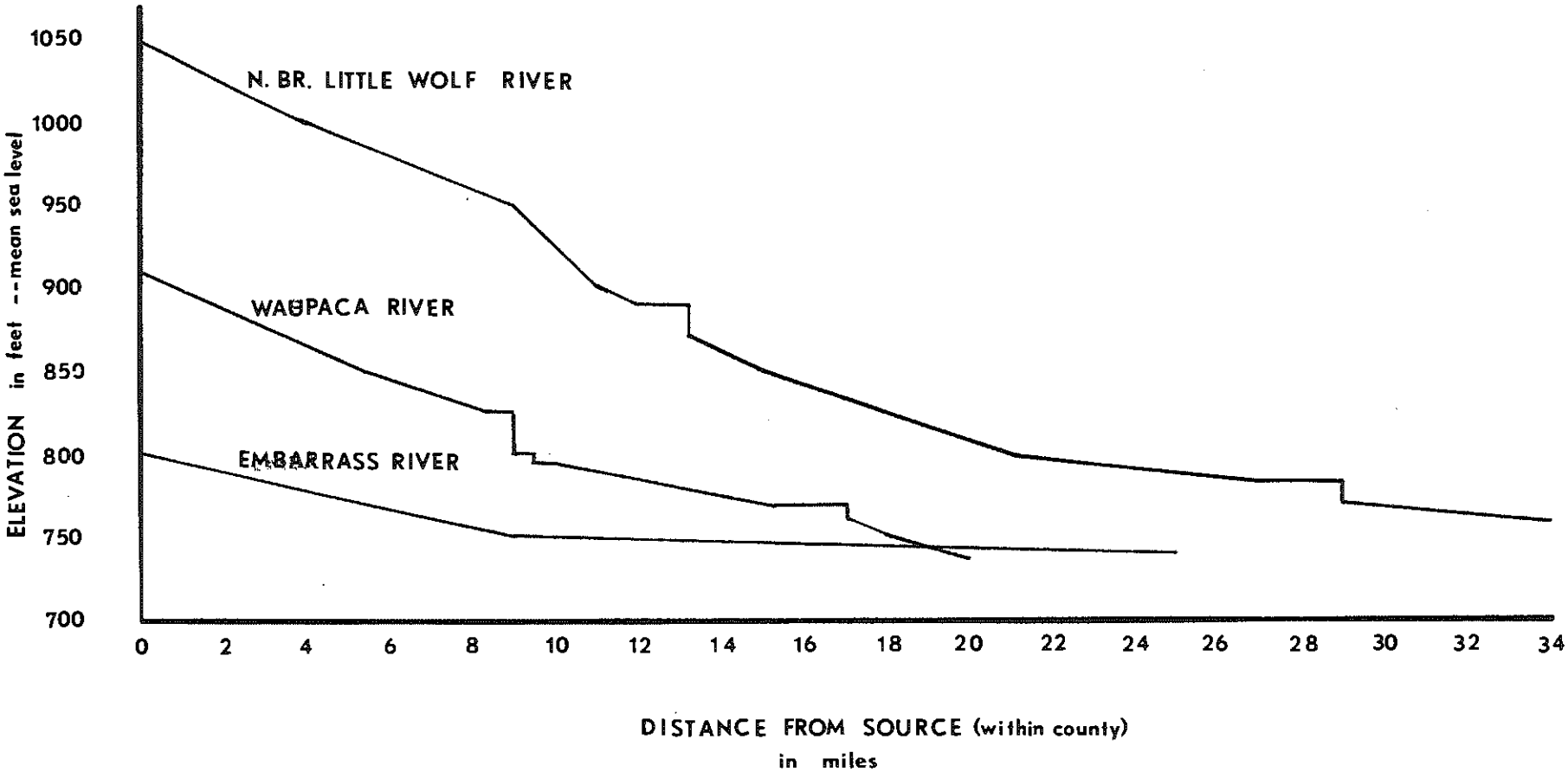
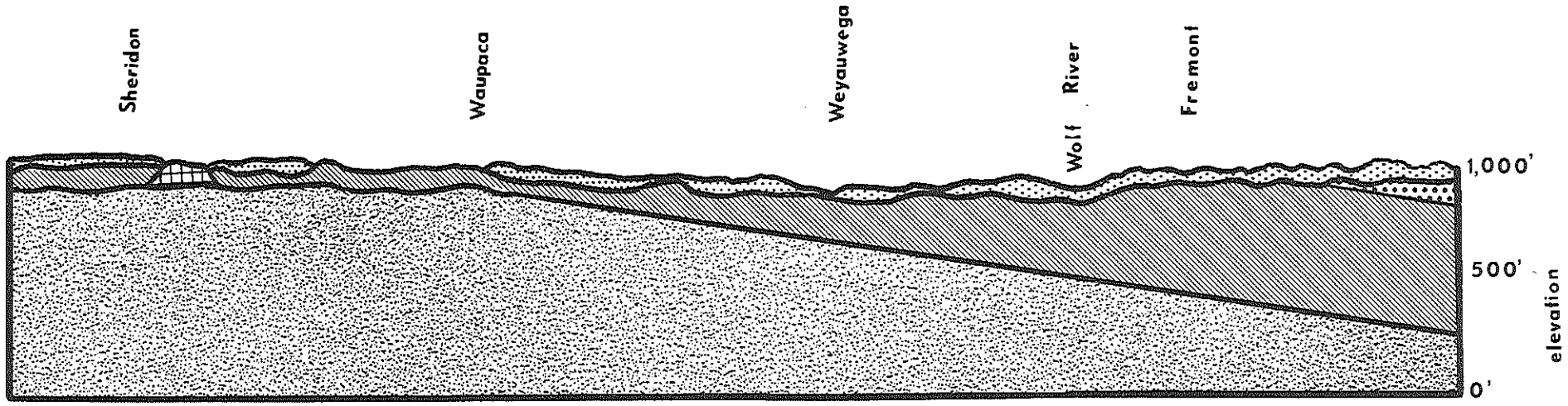


Fig. 2. Profiles of some Waupaca County streams



Key

- Precambrian granite
- Cambrian sandstone
- Ordovician dolomite
- Glacial till
- Cary end moraine

Fig. 3. Geologic section across southern Waupaca County

(after Weidman & Schultz, 1914)

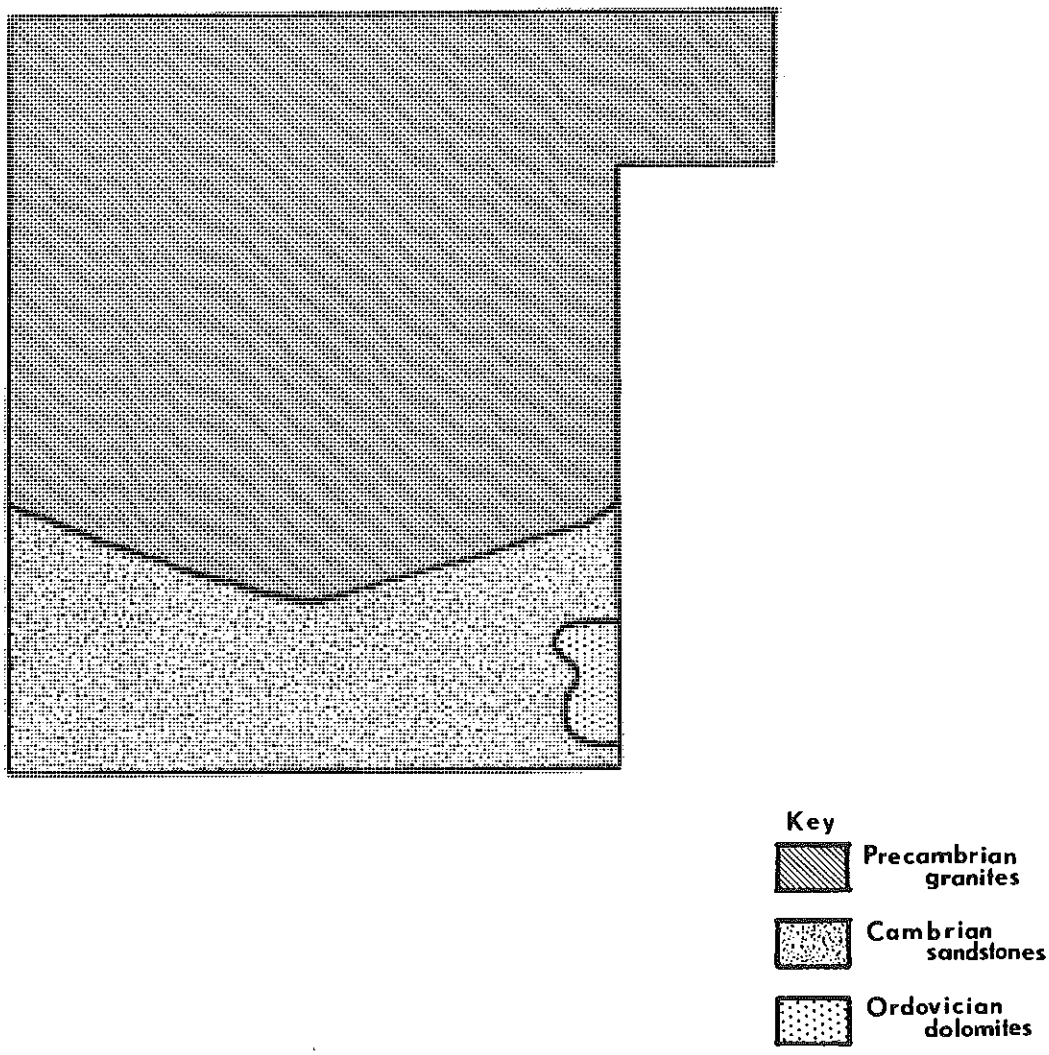


Fig. 4. General bedrock geology of Waupaca County

(after Bean, 1949)

The primary impact of the bedrock on the surface waters is the determination of major drainage patterns. Prior to glaciation Waupaca County looked similar to the driftless region of Southwestern Wisconsin. Erosion caused by the glaciers altered this landscape considerably but the major valleys were still prevalent. Rivers formed in these valleys. Today the Wolf and its major tributaries flow in these old pre-glacier valleys (Berkstresser, 1964; Weidman and Schultz, 1915).

Of the various geological features found in Waupaca County the most spectacular and the most readily observed are those associated with the several phases of the Wisconsin Glacier. The western half of Waupaca County is covered by the ground moraine of the Cary stage of the Wisconsin Glacier. The surface of this region is quite irregular, containing many drumlins and kettles. Nearly all of the natural lakes in the county are found in this region and are, in reality, flooded kettles. Most of Waupaca County streams begin in this region. The Cary End Moraine (or more accurately a recessional moraine) forms a series of low hills that bisects the region from north to south. To the east lie deposits laid down by the Valders or Mankato Glacier. This area is a gently rolling plain containing swamps and a few lakes. The lakes found in this region are quite shallow when compared to lakes found in the Cary deposits. Occasionally the Valders ground moraine is broken by traces of Valders End Moraine. A few drumlins are also present. Northeastern and southeastern Waupaca County are areas that were once covered by Later Lake Oshkosh, an extinct glacial lake. This region is characterized by large wetlands and few lakes, which are quite large and relatively shallow. White Lake, Partridge Lake, and Partridge Crop Lake; three of the largest lakes in the county are found in this region. The Wolf River also flows through the area. (After Thwaites, 1956; Finley, 1965). Figure 5 represents the glacial features found in Waupaca County.

Soils

Soils found in Waupaca County have been derived primarily from the weathering of various glacial deposits that cover the county. The glacial drift is composed of materials that originally came from bedrock types found to the north and east of Waupaca County. This, along with the fact that several massive ice movements have occurred over the county, accounts for the wide variation in soil types present.

The most predominant soils are the red loams of eastern Waupaca County. These are moderately heavy soils ranging in color from gray-brown to red-brown. Clay substrata can be found anywhere from the surface to two feet below the surface. Natural drainage is fair.

The western part of the county is generally covered with fine sandy loams. These soils have a yellow-brown subsoil covered by a light gray-brown topsoil. Drainage is good.

The extreme southwestern corner of the county contains some very sandy soils having excessive drainage characteristics. Surface soils in this region are gray-brown in color. These soils are poor agricultural soils.

The northeast portion of the county contains level sandy loams with excessive drainage. These soils are gray-brown in color and only fair agricultural soils.

Wet, peat-muck type soils are found in small areas around Waupaca, White Lake, Marion, and in a band from New London to Fremont. These soils have very poor drainage and are very poor agricultural soils (After Hole, 1954).

The wide variations in soil types is illustrated in Figure 6, a soil association map of Waupaca County.

Natural occurring minerals found in lakes and streams are direct products of the soils found within the drainage basins. Generally, surface waters located in regions of high soil fertility will have higher productivity rating than waters located in less fertile soil regions. In Waupaca County the most fertile lakes are located in the south and central portions of the county--areas of relatively high soil fertility. This general pattern has been altered somewhat by pockets of infertile soils and by eutrophication caused by pollution of various types.

Light soils found in Western Waupaca County readily allow water from excess precipitation and thawing snow and ice to infiltrate and percolate into the ground rather than run off directly into surface waters. This condition leads to continual recharge of ground water supplies and accounts for fairly stable stream flows observed in this portion of the county. In the eastern part of the county the opposite is true--heavy soils are not conducive to infiltration and percolation. Stream flows more readily reflect seasonal runoff rates. As a result, there are fewer permanent streams and more dry runs and intermittent tributary streams.

Ground Water

In Waupaca County lake levels and base stream flows are directly related to local ground water supplies. In the western portion of the county most of the ground water supply is found close to the surface as a result of a shallow soil mantle on bedrock. This region contains many spring seeps. Depending on the rate of discharge and the topography of the immediate area, the ground water may discharge into a stream or it may accumulate in a pond or marsh. Ground water seepage is largely responsible for the abundance of trout streams found in this part of the county. Further to the east and especially along the west bank of the Wolf River lies an area containing many artesian wells. While not contributing significantly to the volume of surface water lakes and streams, they are valuable in maintaining the large number of marshes and swamps present.

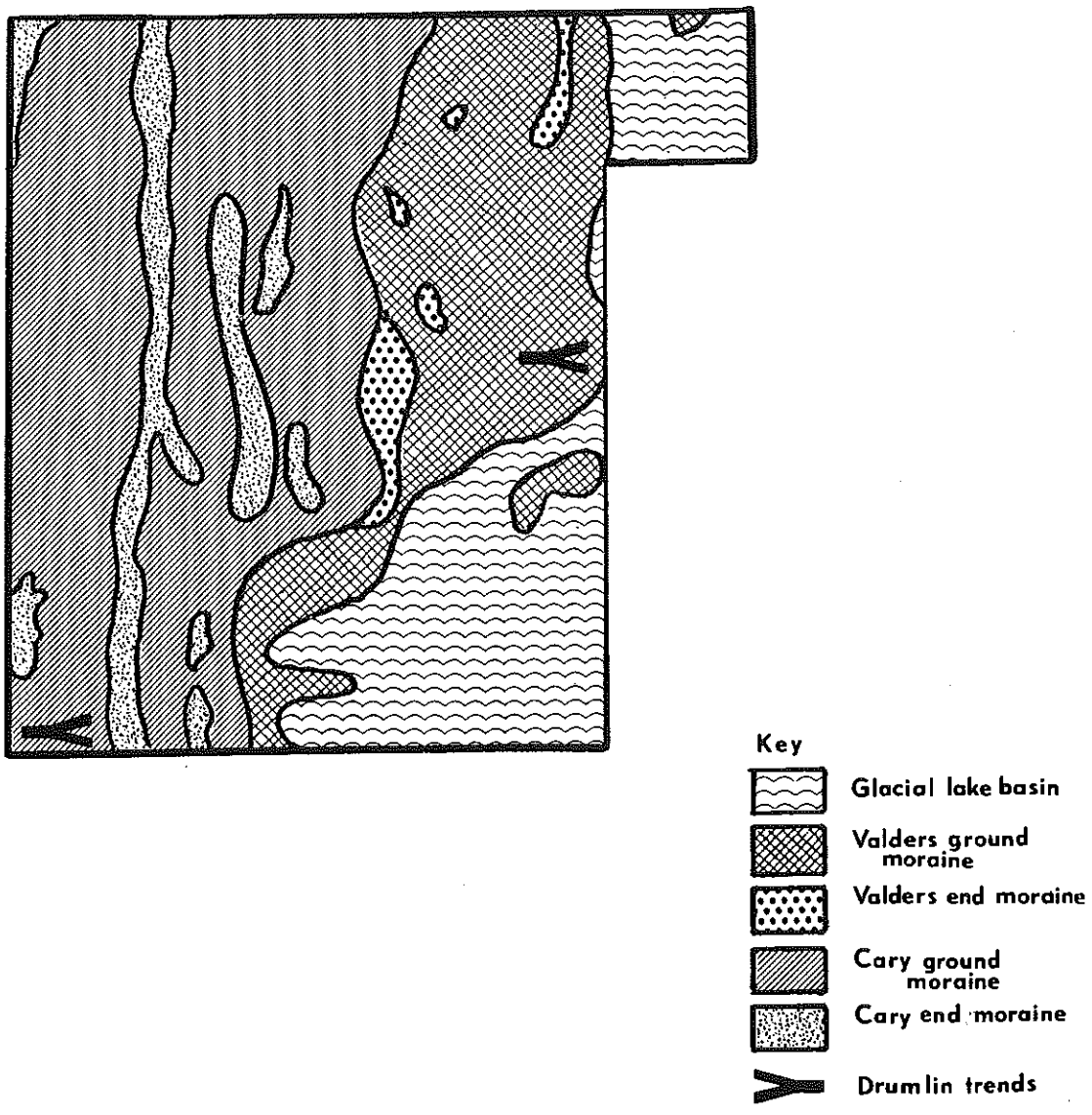


Fig. 5. Glacial geology of Waupaca County

(after Thwaites, 1956)

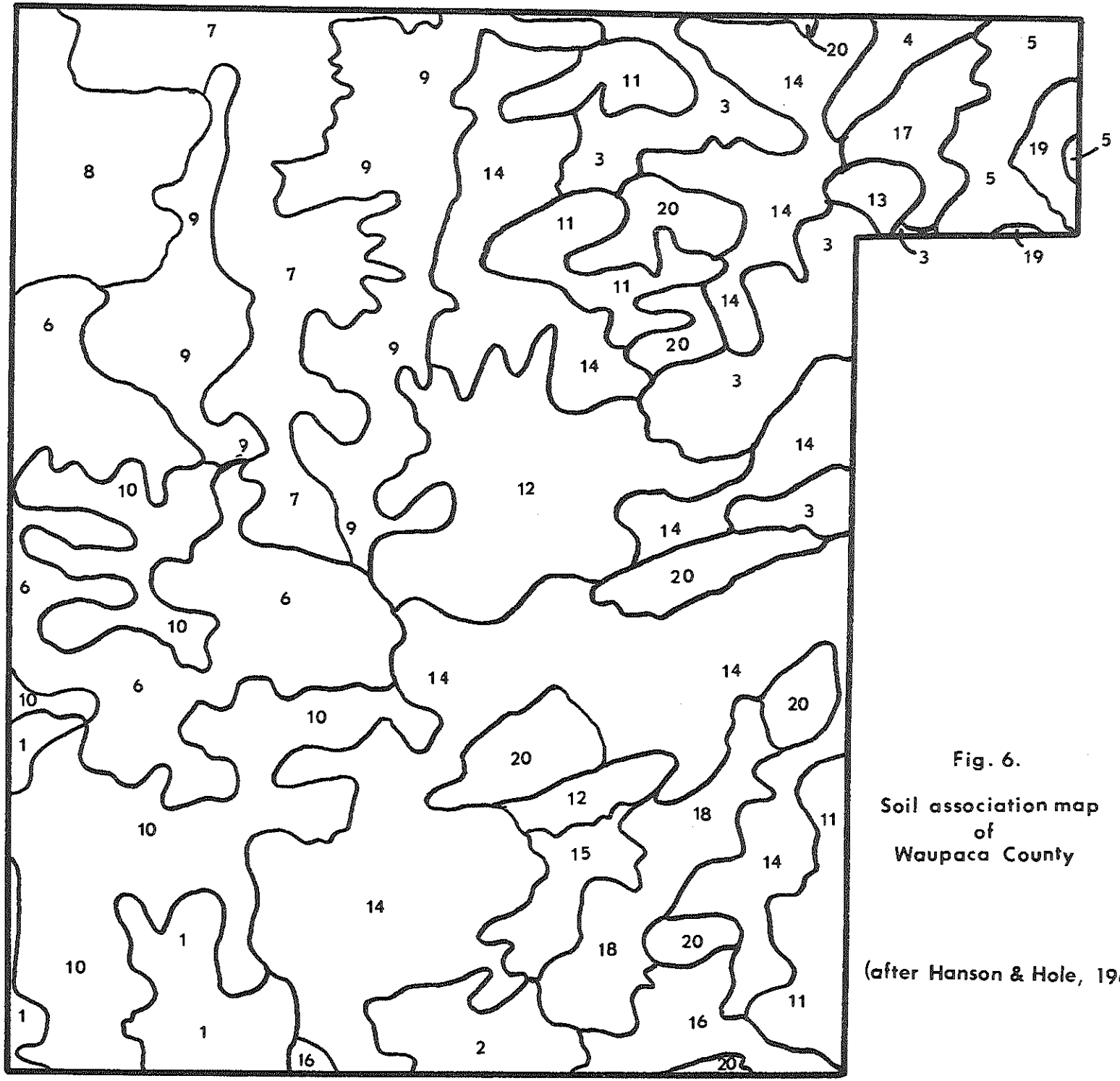


Fig. 6.

Soil association map
of
Waupaca County

(after Hanson & Hole, 1968)

Key to the Soils of Waupaca County

(After Hanson and Hole, 1961)

1. Loamy sand and sandy loam of rolling, hilly, undulating, and nearly level soils of uplands and plains.

   (Mecan, Wyocena, Plainfield, and Gotham)

2. Sand, loamy sand, and sandy loam of rolling, hilly, undulating and nearly level soils of uplands and plains.

   (Mecan, Wyocena, and Gotham)

3. Sandy loam, loamy fine sand, silty clay loam, peat, and muck soils of nearly level plains.

   (Shiocton, Tustin, Shawano, Oshkosh, and Poygan)

4. Loamy sand and sandy loam of nearly level plains.

   (Shawano, Keowns, Granby, and Au Gres)

5. Loamy sand, sandy loam, peat, and muck soils of nearly level plains.

   (Shawano and Granby)

6. Loam, sometimes stony, of hilly, rolling, and undulating uplands.

   (Kennan, Wyocena, and Onamia)

7. Loam and peat soils of rolling to undulating uplands with some broad valleys.

   (Kennan, Iron River, and Pence)

8. Sandy loam and peat soils of rolling to undulating uplands with some broad valleys.

   (Kennan, Wyocena, Onamia, and Bevent)

9. Loam, sandy loam, silt loam, and peat soils of undulating uplands.

   (Onamia, Chetek, and Antigo)

10. Sandy loam, silt loam, and peat soils of nearly level plains, pitted and unpitted.

    (Onamia, Chetek, and Antigo)

11. Silt loam of rolling to undulating uplands

    (Hortonville, Manawa, Poygan)

12. Loam, silt loam, and loamy sand of undulating plains.

    (Kewaunee, Manawa, Poygan, Hortonville and Tustin)

13. Silty clay loam and sandy loam of undulating plains.

    (Manawa, Poygan, Rimer, and Tustin)

14. Loam and fine sandy loam of undulating plains.

    (Hortonville, Manawa, Poygan, and Shiocton)

15. Silty clay loam of nearly level plains.

    (Kewaunee, Oshkosh, Manawa, and Poygan)

16. Silty clay loam and sandy loam of nearly level plains.

    (Oshkosh, Manawa, Poygan, and Tustin)

17. Loam and silt loam of nearly level plains.

    (Braham, Bloomford, and Dalbo)

18. Wet alluvial soils of nearly level bottoms.

    (Undifferentiated)

19. Sand, sandy loam, shallow peat soils of nearly level plains (wet mineral soils).

    (Granby, Shawano, and Emmet)

20. Slightly acid to alkaline sedgy and woody peat and muck, silt loam, and silty clay loam of nearly level plains (wet organic soils).

    (Prella, Poygan, and Brookston)

In most of Waupaca County the water table is at or just below the land surface, maintained at high levels by the shallow bedrock. Most of the lakes and swamps in the county may be considered as exposures of the water table (Berkstresser, 1964). Changes in ground water levels will cause corresponding changes in the level of lakes and streams. During extended dry periods when the water table is depressed many small streams and marshes may dry completely. During wet periods with elevated ground water levels streams have strong base flows, lakes are at maximum capacity, and marshes appear all over the landscape.

Further discussion of ground water resources can be found in later sections.

Climate

There is one cooperative weather reporting station in Waupaca County located near New London on the Waupaca-Outagamie County line. Climatological data from this station and other stations in nearby counties provide a representative cross-section of the general climate of the county. Table 1 is a compilation of the general climatic data from the area and nearby weather stations.

The climate of Waupaca County is typically continental having four definite seasons. Winters are cold and snowy while summers are often warm and humid. The succession of high and low pressure centers over the county from west to east brings a variety of weather during the entire year. Drastic changes in weather can be expected every few days, especially during the winter and spring months. July, with an average temperature of 72° F., is the warmest month while January with an average temperature of 17.6° F. is the coldest. The growing season averages about 143 days and runs from early May to late September. Prevailing winds are from the west-northwest-southwest during the winter months and from the southwest during the summer months. April and November are the most windy months and August is the least windy. It is interesting to note that during April and November, lakes can be expected to experience the greatest mixing and turnover. Strong thermoclines are established in August.

The average annual precipitation (including water content of snow) approximates 30.25 inches per year. Average annual snowfall is about 49 inches. About 55 percent of the average annual rainfall occurs from May through September with June being the wettest month. Figure 7 is a correlation of monthly precipitation and temperature occurring at New London.

Runoff and Flow Characteristics

Precipitation, the principal source of water, is absorbed into the soils to be used by plants or evaporated into the air (evapotranspiration), infiltrates the soil to recharge ground water supplies, (storage) and runs off directly into the surface water. An average of about approximately 31 inches of precipitation falls each year. Of this, 19 inches is lost through evapotranspiration and virtually none is lost to storage (net changes in ground water storage is zero) leaving about 11 inches to run off into the lakes and streams. This figure (11 inches) includes excess ground water that forms springs and seeps. (Olcott, 1968). More simply, runoff amounts to about 36 percent of the total precipitation or about 400 million gallons per day, of which a high percentage occurs during March, April and June.

Seasonal and regional fluctuations in runoff and subsequently stream flow are caused by soil conditions, temperature, vegetative cover and amount of precipitation. For example, the greatest stream flows occur in March and April, when winter snows are melting while soils are still frozen minimizing penetration into the soil and ground water supplies. Secondary peaks occur in June when rainfall is the greatest and ground water levels are highest. Minimal flows are recorded in August and September when plant development and evapotranspiration is high and precipitation is low. Figure 8 shows the hydrograph of some of the larger streams. Representative low flows of several streams can be found in Appendix II. Land forms and characteristics make Waupaca county a good aquifer. The impact of soil types on stream flow was discussed in a previous subsection.

Flow characteristics of some of the larger streams are modified by impoundments and power plants. Water is stored at times of peak runoff to be discharged later when flows would normally be minimal. The purpose of this activity is to augment natural stream flows to make hydro-power plants more efficient. This tends to minimize normal seasonal variations in stream flow. There also may be daily discharge peaks as power companies meet their peak electrical loads.

Area and Population

Waupaca County with an area of 751 square miles contains about 1.4 percent of Wisconsin's total land area. The county ranks 36th in size out of 72 Wisconsin counties.

In 1970, 37,780 persons resided in Waupaca County. This figure representing 0.85 percent of the population of Wisconsin, ranks Waupaca 28th among the counties. During the ten year period from 1960 to 1970 the population increased some 6.9 percent. Table 2 provides a comparison of population growth of Waupaca County with the State of Wisconsin. Like most counties in central Wisconsin, Waupaca County has experienced a general decrease in that segment of the population engaged in agricultural endeavors. Normally people who give up farming tend to leave the area to seek employment in industrial centers to the south and east but because Waupaca County saw a spurt of industrial growth it retained many of its ex-farmers. In recent years however, jobs in industry have not kept pace with available manpower. As a result there has been a slight outward migration from the county of working age persons (Waupaca County Resources, 1968).

Table 1. Climatological data for stations in and near Waupaca 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	28.5	65	43.4	45.6	-30,107	164	Oct. 14	May 3
Hancock	29.3	62	38.1	44.7	-43,112	135	Sept. 30	May 17
New London	30.3	66	49.0	45.6	-35,109	143	Sept. 30	May 10
Oshkosh	27.9	64	43.8	46.0	-32,107	148	Oct. 4	May 9
Stevens Point	31.4	66	47.9	45.1	-38,108	142	Oct. 1	May 11

(After Wisconsin Climatological Data, 1961)

Table 2. Population and area comparison of Waupaca County to the State of Wisconsin

	Area (Sq. Miles)	Population			Population per square mile 1970
		1950	1960	1970	
Waupaca County	751	35,056	35,340	37,780	50.3
State of Wisconsin	52,044	3,434,575	3,952,771	4,417,933	84.9

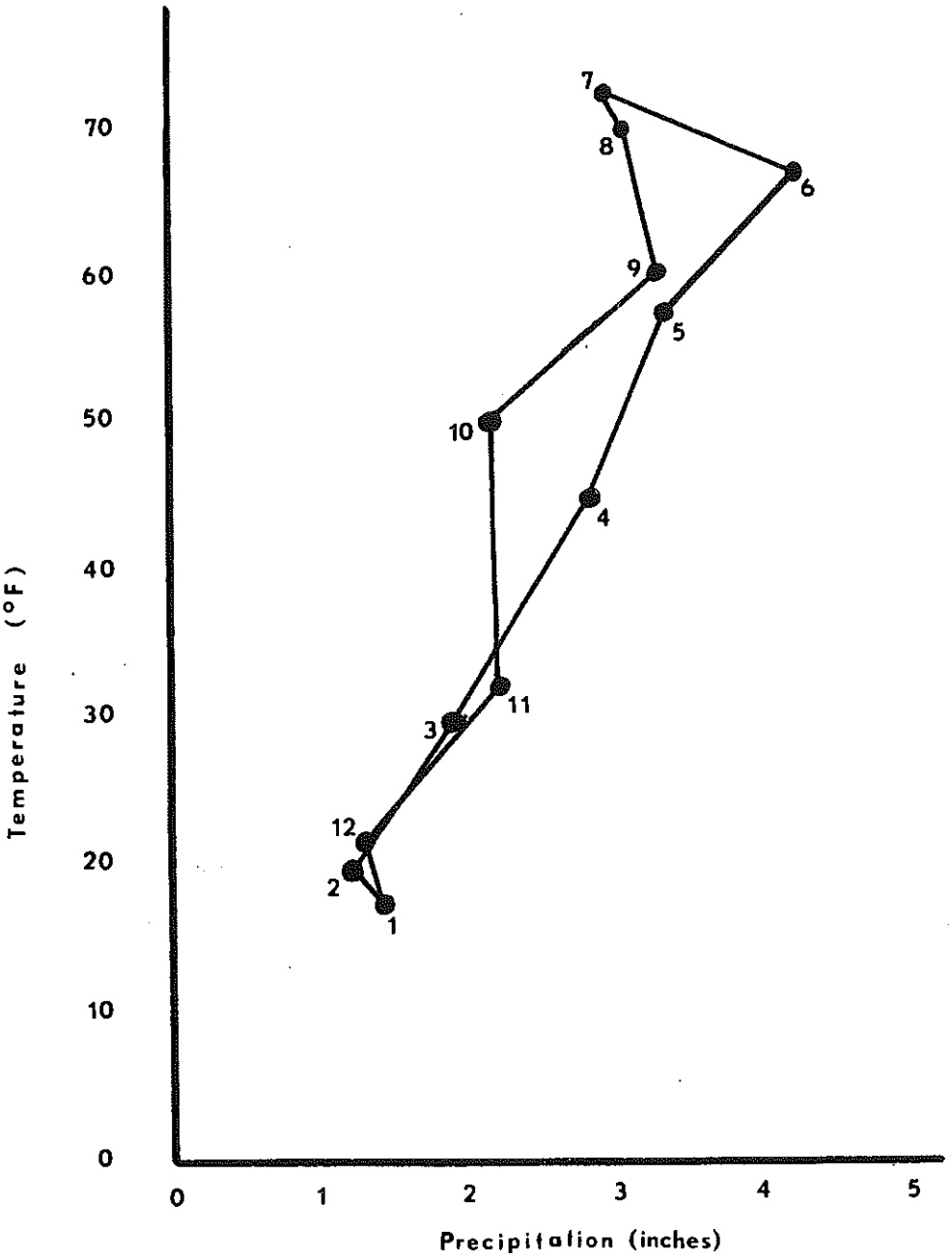
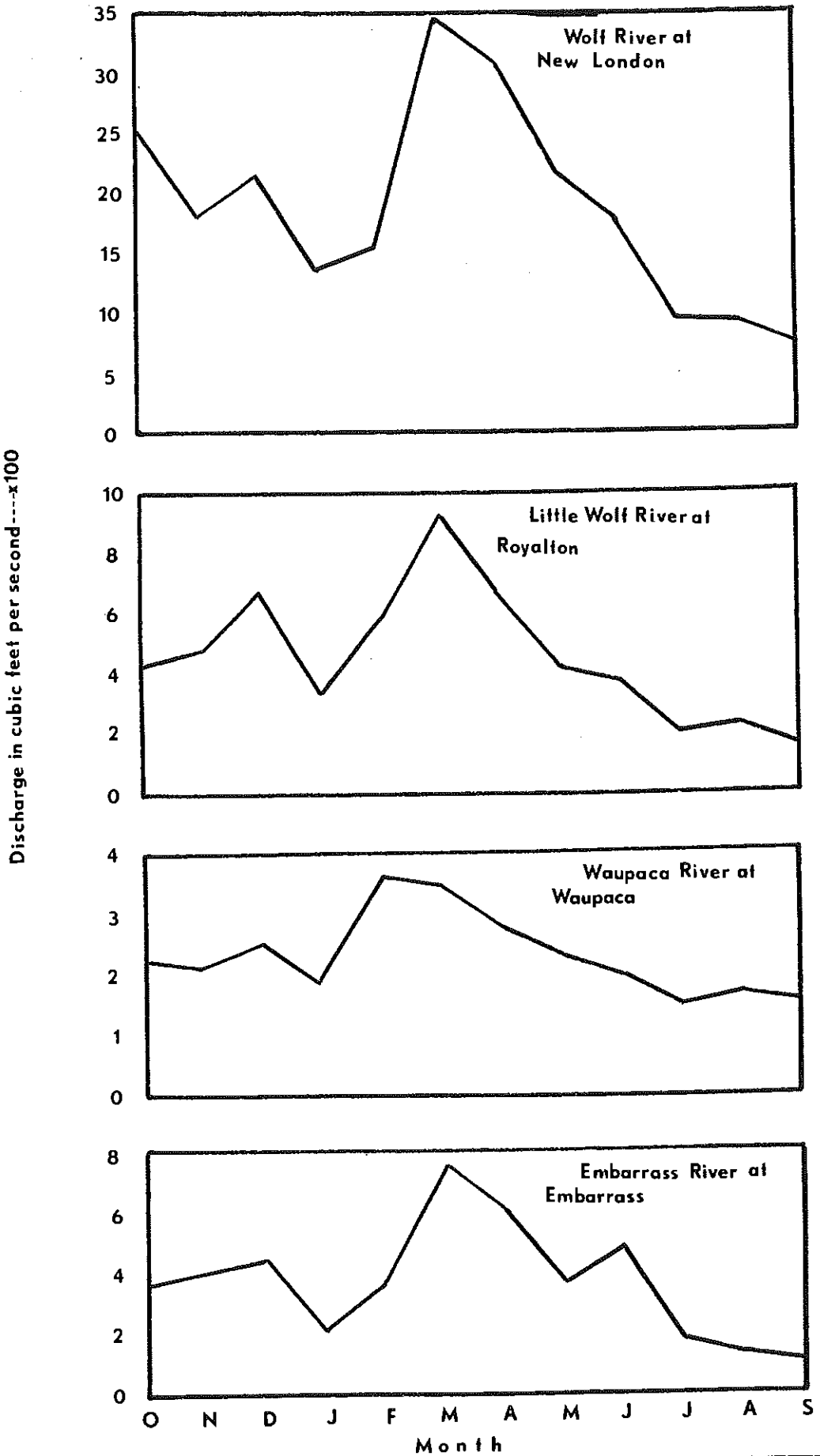


Fig. 7. Climograph for mean monthly data recorded at New London, Wis.

(after Wisconsin Climatological Data, 1961)

Fig.8. Mean monthly discharge of Waupaca County streams ----- water year 1965--1966



(after USGS, 1967)

The county contains twelve incorporated cities and villages. Of these, three are classed as urban areas (population greater than 2,500). About 55 percent of the county's residents live in incorporated municipalities. From 1950 to 1960 the population of the cities and villages increased about 3.5 percent--over four times the rate of the county as a whole. From 1960 to 1970 the municipal population grew some 6.0 percent, greater than the previous decade but less than the total county growth rate. Table 3 presents pertinent population data for Waupaca County cities and villages.

In Waupaca County there are about 4.2 persons per acre of water. The full impact of people on the surface water resources can be visualized, however, if one considers that over three-quarters of a million people reside within an hour's drive of Waupaca County. Such a large number of people demand and actually need a wide variety of recreational facilities. Waupaca County, with an excellent resource to work with, can, through wise planning, provide many needed recreational facilities.

Land Use

Drastic changes in land use have occurred during the past three decades. Farming, while occupying a majority of the total land areas has declined sharply in total land utilization (Table 4).

Along with the overall decline in total farm acreage there has been a slight decline in dairy production and related agricultural endeavors. At the same time there have been slight decreases in other forms of agricultural production. Table 5 provides a breakdown of 1964 agricultural land uses. The continual state of change of overall land uses limits a complete compilation of such data under one heading.

In addition to agricultural lands, Waupaca County contains over 147,600 acres of commercial forest lands--nearly one-third of the county's total land area (Wisconsin Conservation Department, 1954). Recreational, industrial, and residential lands; water; marshlands; rights-of-way; and "waste" lands make up the remainder of the county's total land areas.

The full impact of various land uses and their associated problems and benefits will be discussed throughout the remainder of this text as they relate to the county's surface waters.

Table 3. Population and percent change between 1950, 1960, and 1970 of cities and villages in Waupaca County

County and Incorporated Places	Population			Percent Change	
	1950	1960	1970	1950--1960	1960--1970
Waupaca County	35,056	35,340	37,780	+ 0.8	+ 6.9
Big Falls	146	119	112	-18.5	- 5.9
Clintonville	4,657	4,778	4,600	+ 2.6	- 3.4
Embarrass	303	306	472	+ 1.0	+54.2
Fremont	504	575	598	+14.1	+ 4.0
Iola	867	831	900	- 4.2	+ 8.3
Manawa	990	1,037	1,105	+ 7.7	+ 6.6
Marion	1,118	1,200	1,218	+ 0.1	+ 1.5
New London*	4,922	5,288	5,801	+ 7.4	
Ogdensburg	221	181	206	-18.1	+13.8
Scandinavia	286	266	268	- 6.9	+ 0.8
Waupaca	3,921	3,984	4,342	+ 1.6	+ 9.0
Weyauwega	1,207	1,239	1,377	+ 2.7	+11.1
Total:	19,142	19,804	20,999	+ 3.5	+ 6.0

*Includes that portion located in Outagamie County

Table 4. General census data for Waupaca County farms

	1935	1940	1950	1964
Number of farms	3,737	3,457	3,155	2,230
Area in farms (acres)	431,544	419,856	421,494	350,150
Percent of county in farms*	89.7	87.2	87.6	70.8
Average farm size (acres)	115.5	121.5	133.6	152.5

*Approximate area of Waupaca County is 480,640 acres.

(After Wisconsin Crop Reporting Service, 1954, and U. S. Census of Agriculture, 1964.)

Table 5. Some recent land use acreages in Waupaca County

Land Use	Acres (Approx.)
Total Farmland	340,150
Cropland	
Harvested	143,129
Pastured	29,501
Not harvested or pastured	23,808
Vegetables harvested	3,815
Woodland	
Pastured	31,354
Not pastured	59,567
Other Pasture	19,968
Irrigated land in farms	1,704
Irrigated cropland harvested	1,704
Farm ponds, pits, reservoirs, earthen tanks (137 ponds, etc.)	71

(After U. S. Census of Agriculture, 1964)

ALPHABETICAL LISTING AND DESCRIPTION OF LAKES AND STREAMS

Data presented in this and all following sections were collected from 1966 to 1968. For this reason some information such as number of cottages, or types of commercial facilities, or degree of public access, will differ from present conditions.

Lakes

For the purpose of this inventory all named lakes have been discussed in a brief narrative paragraph. Each lake is described by location (township, range, section, quarter section), area, degree of irregularity (S.D.F.), and known maximum depth. The fish species significant to the fishery are listed. Problems associated with the recreational use of the lake are identified. Wildlife values, bottom types, type of lake, water quality, and other pertinent data are also presented. The degree of public access is indicated and is depicted on access and public land maps. Additional data are presented in Appendix I. Data for the unnamed lakes, excluding farm ponds and private fish hatcheries, are presented in Appendix I, also. The Chain-O-Lakes is described in a special subsection following the other named lakes.

Allen Lake T-21-N, R-11-E, Sections 6--7, 8. Surface Acres = 18.2; S.D.F. = 1.38; Maximum Depth = 9 feet.

Allen Lake is a spring and seepage fed impoundment located in Hartman's Creek State Park. The entire shoreline is surrounded by a narrow cattail marsh. Sand, muck, and detritus are the predominate bottom types while smaller amounts of gravel and rubble are also present. Submerged aquatic vegetation is dense over the entire pond. Fish present are bass and panfish, however, fishing is allowed only for panfish. There is no designated boat launching site but small boats and canoes can easily be launched from anywhere around the shoreline. Operation of motor boats is prohibited. A small population of muskrats inhabit the impoundment. Hunting and trapping are not permitted. Camping, picnic and hiking facilities are located near Allen Lake. At one time this impoundment was used as a rearing pond for warm water fishes. The outlet flows through a concrete raceway once used for fish culture.

Bailey Lake T-21-N, R-12-E, Sections 19--7, 8. Surface Acres = 13.8; S.D.F. = 1.48; Maximum Depth = 30 feet.

This hard water lake is located on the upper end of a small tributary to McClean Creek. While a natural lake, water levels are maintained in part by a dam located on the northeast shore. A small inlet stream from a nearby pond and seepage provide most of the water supplied to Bailey's Lake. Littoral bottom materials consist of sand, muck, and marl. Largemouth bass, perch, bluegills, black crappies, green sunfish, and brown bullheads are the predominant species present. Investigations indicate that the lake could support trout. A small marsh on the southeast shore supports a significant population of muskrats. A few puddle ducks use this lake during spring and fall migrations. Hunting is not allowed. At the time the lake was surveyed no public access other than a navigable water access via the outlet was present. The shoreline has recently been subdivided, however, and a public access site was incorporated into the final plat. Three dwellings are the only developments present on the shoreline.

Bass Lake (T-22-N, R-11-E, Section 33-3) - See Chain-O-Lakes.

Bass Lake T-21-N, R-12-E, Sections 13, 14. Surface Acres = 18.7; S.D.F. = 1.22; Maximum Depth = 35 feet.

Bass Lake is a clear hard water lake located about five miles south of Waupaca. A two-foot dam located on an intermittent outlet to Spencer Lake helps maintain water levels. Seepage is the major water source. Muck is the predominate littoral bottom material; a small amount of sand is also present. Perch, bluegills, black crappie and rainbow trout are the most common fish present while northern pike, largemouth bass, green sunfish, black bullhead, and white sucker are present in lesser quantities. Slow-growing panfish handicap management. The lake has twice been treated with fish toxicants; once in 1960 to remove carp and redhorse and again in 1965 to reduce the panfish population. There is limited use by waterfowl and aquatic furbearers. Hunting is not allowed. Fifteen cottages are located along the shore. Access is available from an improved boat landing located on the south side of the lake.

Bear Lake T-22, 23-N, R-13-E, Sections 4, 5, 32, 33. Surface Acres = 193.7; S.D.F. = 1.86; Maximum Depth = 67 feet.

Marl, with lesser amounts of muck and sand, is the predominant bottom material in this hard water drainage lake. Spiegleberg Creek, a small tributary to the N. Br. Little Wolf River, flows through Bear Lake. Northern pike, largemouth bass, bluegill, perch, black crappie, green sunfish, rock bass, black bullhead, white sucker, and carp constitute the fishery. A few brown or rainbow trout are also present. Aquatic vegetation is not abundant. Great blue heron and bluewing teal use the lake as a nesting area. Puddle ducks can be found during spring and fall migrations. Aquatic furbearers are scarce. Hunting is allowed with permission. Use conflicts between fishermen and pleasure boaters has led to the establishment of a water skiing and speed boating zone. Developments include one resort,

one boat livery, 68 cottages, and one private campground. A public boat landing is maintained by Waupaca County on the south side of the lake. Heavy grazing causes erosion and siltation in some areas. Additional pollutants enter the lake in the form of barnyard drainage.

Beasley Lake - See Chain-O-Lakes.

Bestul (Brekke) Lake T-23-N, R-11-E, Sections 7--1, 2. Surface Acres = 42.6; S.D.F. = 1.29; Maximum Depth = 25 feet.

This clear, hard water seepage lake is completely landlocked. Gravel is the major littoral bottom material along with a few traces of sand. Northern pike, largemouth bass and bluegills are the predominant species present. There is no public access, however boat rental is available. One home is the only man-made development near the lake. During spring and fall migrations puddle ducks use Bestul Lake as a rest area.

Big Lake T-25-N, R-15-E, Section 4-2. Surface Acres = 12.4; S.D.F. = 1.40; Maximum Depth = 3 feet.

This hard water drainage lake is one of the few in Waupaca County that contains dark brown water. A series of dug channels connect Big Lake and Spring Lake, a sister basin, with the Embarrass River. The entire lake area is choked with dense mats of both submerged and floating aquatic vegetation. Sedge marshes are encroaching on the east end. Annual, complete winterkill precludes a fishery in this lake. A few puddle ducks nest here each summer. Hunting is allowed. Three dwellings are present on the north shore. There is no public access.

Big Falls Pond T-25-N, R-12-E, Sections 22, 23, 26. Surface Acres = 22.1; S.D.F. = 3.04; Maximum Depth = 12 feet.

Big Falls Pond is a hard water impoundment of the N. Br. Little Wolf River maintained by a dam 30 feet high. The fishery is composed of perch, largemouth bass, smallmouth bass, bluegill, black crappie, rock bass, black bullhead, green sunfish, and white sucker. The panfish are of little value to the sport fishery because of their small size. The entire pond, except for the main channel, is choked with dense growths of aquatic vegetation making boating and fishing difficult. Nesting bluewing teal and migrating puddle ducks use the pond. Hunting is allowed. Two dwellings are the only developments. Access is available from a public access site maintained by Waupaca County. Navigable water access is available via the inlet and the outlet. As is the case on many small impoundments silt is gradually filling the basin of Big Falls Pond.

Black (Knutson) Lake T-23-N, R-12-E, Section 8-7. Surface Acres = 3.7; S.D.F. = 1.30; Maximum Depth = 20 feet.

Seepage and springs maintain the water level in the clear, hard water drained lake. After leaving Black Lake the outlet stream flows south about one mile before joining Engebretson Creek. The entire littoral zone of this lake is lined with muck. Largemouth bass, bluegill, pumpkinseed, and green sunfish are the important fish species present. An occasional winterkill and natural fluctuating water levels pose problems to the management of this lake. Wood ducks nest here and occasional migrating puddle ducks use this lake as a resting area. Hunting is allowed. There are no public access sites or man-made developments. Black Lake is classed as a wilderness lake.

Blue Mountain (Goerke) Lake T-24-N, R-12-E, Section 13. Surface Acres = 8.4; S.D.F. = 1.21. Maximum Depth = 8 feet.

Muck and sand are the major littoral bottom materials of this landlocked lake containing soft, clear water. Bullheads are the only fish found in appreciable numbers. Severe winterkills occur almost every year thereby precluding the development of a fish population. In the past various attempts to initiate a good fishery have met with failure. In 1964 the lake was unsuccessfully treated with fish toxicants to remove the bullheads. Northern pike and perch stocked did not survive. Puddle ducks use the lake as a resting area during spring and fall migrations. This lake supports a significant population of muskrats. Hunting and trapping is allowed. Twelve cottages are present. An unimproved public access is located on the east side.

Buck Lake T-25-N, R-13-E, Section 19-3. Surface Acres = 4.7; S.D.F. = 1.91; Maximum Depth = 9 feet.

Buck Lake is one of two small basins located about two miles northeast of Big Falls. Water levels on this hard water impoundment are maintained by a seven-foot dam. Both the inlet and outlet are small streams. Much of the water supplied to Buck Lake comes directly from springs located around the shoreline. Littoral bottom materials consist of sand, gravel, and rock. The fishery consists of largemouth bass, bluegill, pumpkinseed, and green sunfish. Bluewing teal use the lake as a nesting area, while migrating puddle ducks and migrating divers use it as a resting area. Hunting with permission is allowed. One private camp and one resort are located on the lake. There is no public access.

Campbell Lake T-24-N, R-12-E, Section 14. Surface Acres = 38.0; S.D.F. = 1.52; Maximum Depth = 25 feet.

Seepage, marsh drainage and overflow from Price Lake provide most of the water necessary to maintain the level of this hard water drained lake. The predominant littoral bottom material is marl while the immediate shoreline is largely a brush swamp. Marl particles present impart a slight green tint to the otherwise clear water. The fishery consists of northern pike, perch, largemouth bass, bluegill, black crappie, warmouth, green sunfish, black bullhead, yellow bullhead, and white sucker. Winterkill occasionally affects the less hardy largemouth bass-panfish population. Dense beds of aquatic plants limit the recreational potential of this lake. Nesting bluewing teal utilize the lake as do fairly large numbers of migrating puddle ducks. Hunting is allowed. An unimproved access site with parking is located on the east edge of the lake. Navigable water access is available via Whitcomb Creek and the outlet stream provides additional access.

Cary Pond T-22-N, R-12-E, Section 32. Surface Acres = 26.4; S.D.F. = 1.52; Maximum Depth = 8 feet.

Cary Pond is a clear, hard water impoundment on the Crystal River located in the City of Waupaca. Water levels are controlled by an old mill dam about 8 feet high owned by the Cary Manufacturing Company. Sand and detritus are the predominant littoral bottom material. Northern pike, largemouth bass, smallmouth bass, bluegill, black crappie, rock bass, green sunfish, black bullhead, brown bullhead, white sucker, redhorse, bowfin, and carp are the major species present. To eliminate the problems caused by the presence of carp, Cary Pond is scheduled for a chemical rehabilitation project during the summer of 1971. Carp inhibit the growth of aquatic plants. Because the pond lies within the city limits, waterfowl use is very limited. A few muskrats are present. Hunting is not allowed. Developments on the pond are limited to ten dwellings and a hospital. Access is available from U. S. Highway 10 and County Highway E. Parking facilities are lacking.

Casey Lake T-22-N, R-12-E, Section 2. Surface Acres = 20.2; S.D.F. = 1.02; Maximum Depth = 42 feet.

Casey Lake is a hard water, seepage and spring fed drained lake with a small non-navigable outlet to the North Fork South Branch Little Wolf River. The lake is actually two basins connected by a navigable channel. The larger basin to the west is of the marl type exhibiting clear to milky white water color while a smaller, shallower basin to the east exhibits medium brown water color. Marl is the major bottom type. The primary game and panfish species present include northern pike, perch, largemouth bass, bluegill, and black crappie. Carp are present in sufficient numbers to create management problems. Migrating waterfowl use the lake as a resting area. Developments include two dwellings and two private campgrounds. A public access with parking facilities for about ten vehicles is located on the west end of the lake.

Cedar Lake T-24-N, R-13-E, Section 8. Surface Acres = 45.3; S.D.F. = 1.18; Maximum Depth = 50 feet.

Cedar Lake is a hard, clear water seepage fed lake with a small intermittent outlet to Whitcomb Creek. Littoral bottom materials consist of marl, sand, and muck. Northern pike, perch, largemouth bass, bluegill, black crappie, rock bass, green sunfish, and white sucker are the most abundant species. Other fish present in lesser numbers are walleye, yellow bullhead, brown trout and rainbow trout. According to local residents a conflict between water skiers and fishermen is becoming a serious problem. Developments include one resort and 12 cottages. An access without parking is located off a town road on the northeast side of the lake. Waterfowl use is restricted to limited resting by puddle ducks during spring and fall migrations.

Chapin Lake T-24-N, R-13-E, Section 20. Surface Acres = 8.9; S.D.F. = 1.01; Maximum Depth = 25 feet.

This is a small landlocked lake completely surrounded by a black spruce bog. The brown alkaline water is very soft and low in productivity. The littoral zone is quite limited and completely lined with muck. Largemouth bass, yellow bullhead, and bluegills are the major fish species present. Both wood ducks and bluewing teal use the lake as a nesting area. Puddle ducks rest here during spring and fall migrations while divers use the lake during fall migrations. Hunting is allowed. This wilderness lake has no developments nor does it have a public access.

Cinco Lake T-22-N, R-14-E, Section 33. Surface Acres = 169.2; S.D.F. = 1.07; Maximum Depth = 4 feet.

This hard, clear water lake is actually a bayou off the Wolf River. The entire lake is surrounded by a shrub-hardwood swamp. Swamp drainage and seepage contribute to the volume of the lake however water levels are probably directly dependent on the level of the Wolf River. Sand and detritus are the major littoral bottom types. During summer months carp, bluegills, northern pike, largemouth bass, and bullheads are present. Ice and a lack of oxygen prevents winter fishery. A large number of puddle ducks, especially bluewing teal nest on the lake. Duck blinds around the shoreline attest to the lake's value as a waterfowl area. Herons and terns also nest near the lake. Developments consist of one

cabin. The only public access is a navigable water access via the outlet and the Wolf River. The entire shoreline is posted against hunting. Very dense aquatic vegetation and shallow water limit boating.

Colic Bayou T-21-N, R-14-E, Section 6. Surface Acres = 50.5; S.D.F. = 4.77; Maximum Depth = 24 feet.

Colic Bayou is a turbid, hard water oxbow type lake directly connected to the Wolf River. The widest portion of the bayou is locally known as Pickerel Lake. Sand is the major littoral bottom material. The land adjacent to this water is a hardwood upland that is periodically flooded by overflow waters from the Wolf River. The desirable fish present are northern pike, largemouth bass, smallmouth bass, bluegill, black crappies, perch, walleye, and white bass. Less desirable species such as carp and white sucker are also present. Mallards, bluewing teal and great blue herons use the bayous for nesting. Migrating waterfowl make extensive use of the area during both spring and fall migrations. Most of the land adjacent to the water is posted against trespass. Development is limited to three cabins. The only public access is a navigable water access via the Wolf River.

ColumbianLake - See Chain-O-Lakes.

Crystal Lake T-21-N, R-11-E, Sections 21, 28. Surface Acres = 33.2; S.D.F. = 1.49; Maximum Depth = 12 feet.

Detritus is the predominate littoral bottom material of this landlocked hard water seepage lake. Water color is light brown. The fishery is comprised of northern pike, largemouth bass, bluegill, and perch. Occasional severe winterkills and dense growths of aquatic vegetation limit recreational values. Crystal Lake receives limited use by fall migrating puddle ducks. The lake supports a significant muskrat population. Four dwellings are present. A public access with parking is located on the north shore of this lake.

Dake Lake - See Chain-O-Lakes.

Driscol Lake T-23-N, R-14-E, Section 6. Surface Acres = 6.1; S.D.F. = 1.04; Maximum Depth = 10 feet.

This very soft water seepage lake is completely surrounded by a narrow band of cattails. The lake has no inlet or outlet. Detritus covers the entire littoral bottom. An annual complete winterkill prevents the establishment of a fishery. A few bluewing teal use the lake during spring migrations. Since about two-thirds of the shoreline is pastured it would appear that the main use is for cattle watering. There is no public access and there are no developments. The recreational use potential of this lake is very limited.

Duck Lake T-22-N, R-11-E, Section 25--3. Surface Acres = 4.9; S.D.F. = 1.07; Maximum Depth = 20 feet.

This hard water seepage lake is landlocked. Water color is light brown. Detritus and sand are the major littoral bottom materials. Forage minnows are the only known fish present. Occasionally, a partial winterkill occurs. There is no public access or other man-made development on this small wilderness lake.

Emmons Lake, North T-21-N, R-11-E, Sections 5--9, 12, 14. Surface Acres = 0.2; S.D.F. = 1.24; Maximum Depth = 21 feet.

This hard water seepage lake is connected to its sister basin, South Emmons Lake, by a wide navigable channel. Marl and detritus are the major bottom types found in the very limited littoral zone. A secchi disk reading of 17 feet indicates that the water is very clear and very transparent. Panfish are the predominant species with bluegill and pumpkinseed being most common. Dense aquatic vegetation and occasional partial winterkill limits the recreational value of this lake. There is no public access other than navigable water access from South Emmons Lake. One seasonal cottage is present. Hunting is allowed but aquatic furbearers and waterfowl make little use of this lake.

Emmons Lake, South T-21-N, R-11-E, Section 5--15. Surface Acres = 6.2; S.D.F. = 1.66; Maximum Depth = 23 feet.

This clear water drainage lake is joined to North Emmons Lake by a channel some 15 feet wide. A small outlet stream enters Emmons Creek a short distance from the lake. Sand, marl, and detritus are the major littoral bottom materials. The water is hard and highly productive. Panfish and forage fish are the dominant species present. Wildlife use is limited. Except for the one cabin present the shoreline of this lake is in a near wilderness condition. There is no means of public access.

Flynn Lake T-23-N, R-14-E, Section 19. Surface Acres = 15.5; S.D.F. = 1.07; Maximum Depth = 3 feet.

This landlocked seepage lake contains hard water that is light brown in color. The entire bottom is covered with muck. The lake is too shallow to support a fishery. Mallards, bluewing teal, and wood ducks nest on the lake shore. Fairly large numbers of puddle ducks and coots rest on the lake during spring and fall migrations. Hunting is allowed. There is no public access present and there are no developments on this small wilderness lake.

Foster Lake T-23-N, R-11-E, Section 31--8, 9. Surface Acres = 6.4; S.D.F. = 1.35; Maximum Depth = 16 feet.

Seepage and springs provide most of the water necessary to maintain the level of this clear, hard water wilderness lake. The lake is landlocked except for a channel connecting it with nearby Skunk Lake. Detritus is the major littoral bottom material. The recreational value of Foster Lake is limited by dense aquatic vegetation and an occasional partial winterkill. The fishery consists of northern pike, largemouth bass and bluegills. A few puddle ducks use the lake during spring and fall migrations. Beaver and muskrats are present. Hunting is allowed. There is no public access. Developments are absent.

Fox Lake T-22-N, R-13-E, Section 6--2. Surface Acres = 3.3; S.D.F. = 1.10; Maximum Depth = 14 feet.

Fox Lake is a small hard water wilderness lake with springs and drainage being the principle water sources. A wooded swamp completely surrounds this lake which probably accounts for the light brown water color. Littoral bottom materials consist entirely of muck. There is a small inlet and a small outlet that flows into Spiegelberg Creek. Panfish and forage species are the only known species present. Fox Lake suffers from periodic severe winterkill. Wood ducks, mallard, and blue-wing teal are known to nest here. Migratory puddle ducks and coots rest on the lake each spring and fall. Hunting is allowed. There are no developments nor is there a public access on Fox Lake.

Fremont Pond T-21-N, R-14-E, Section 30--11. Surface Acres = 1.8; S.D.F. = 1.12; Maximum Depth = 11 feet.

This small pond is an excavation located within the limits of the Village of Fremont. A well, seepage, and a few springs provide water to this hard water pond. The water is dark brown in color and is often quite turbid. The major fishery consists of bullheads and forage minnows. Walleyes were stocked a few years ago but apparently did not become established. In 1965 the pond was treated with toxaphene to remove a population of minnows and rough fish. Fremont Pond has also been treated with chemicals to kill algae. Because of the close proximity to Fremont, wildlife use is very limited. Hunting is not allowed. Developments consist of one home near the pond. There is no public access.

George Lake - See Chain-O-Lakes.

Gooseneck Lake T-21-N, R-11, 12-E, Sections 19, 24. Surface Acres = 19.2; S.D.F. = 1.76; Maximum Depth = 17 feet.

This clear, hard water lake is fed by seepage and springs. The lake is landlocked except for an intermittent channel to nearby McLean Lake. There is no outlet from the Gooseneck--McLean Lake basin. Sand and muck are the predominant littoral bottom materials. Basic management is for northern pike, largemouth bass, and panfish. The most common species present are perch, bluegill, and pumpkinseed. Other species present in lesser numbers include northern pike, largemouth bass, black crappie, green sunfish, and yellow bullhead. To alleviate a stunted panfish problem the lake was partially treated with fish toxicants in 1965. This treatment was temporarily successful as the number of small panfish has again reached sufficient numbers to be a problem. Natural fluctuating water levels also limit the management potential of this lake. Fairly large numbers of puddle ducks and diving ducks use the lake during spring and fall migrations. Hunting is permitted. Access is provided by one town road without parking and by one town boat landing with parking for 15--20 cars. Developments include four dwellings and a camp owned by the Wisconsin Odd Fellows.

Graham Lake T-24-N, R-11-E, Section 10. Surface Acres = 54.5; S.D.F. = 1.23; Maximum Depth = 32 feet.

Springs and seepage supply water to this clear, hard water drained lake. A small outlet flows a short distance before entering an unnamed tributary of Leer Creek. Muck and sand are the predominant littoral bottom materials. The fishery is composed of northern pike, perch, largemouth bass, bluegill, black crappie, green sunfish, brown bullhead, and white sucker. Blue-wing teal nest in the vicinity of the lake. Puddle ducks rest here during spring and fall migrations. The lake supports a significant number of muskrats. Hunting is allowed. Development is limited to one farm near the lake. Ownership of the existing access is presently being questioned; it may be private not public.

Grass Lake T-24-N, R-11-E, Sections 11, 12. Surface Acres = 36.9; S.D.F. = 1.43; Maximum Depth = 10 feet.

This clear, hard water drained lake has a very small outlet flowing into North Lake. Seepage and a few springs are the major water supply. The bottom of the littoral zone is covered with sand and muck. Occasional complete winterkills limit the management potential of Grass Lake. Fish present include northern pike, largemouth bass, bluegill, pumpkinseed, and black bullheads. Nesting mallards, wood ducks, and blue-wing teal are present during summer months. Migrating puddle ducks and coots rest on the lake. A significant population of muskrats is present. A county access with parking is located on the west end of the lake. No developments are present.

Gregerson Lake T-24-N, R-12-E, Sections 7, 18. Surface Acres = 34.9; S.D.F. = 1.51; Maximum Depth = 5 feet.

Drastic water level fluctuations are a major problem encountered on this hard water seepage lake. In 1959 the lake was completely dry. Annual complete winterkill precludes the establishment of a desirable fishery however the lake does provide habitat for waterfowl and aquatic furbearers. Wildlife inhabitants include a significant population of muskrats and nesting mallards and bluewing teal. Puddle and diving ducks are seen during the spring and fall migrations. Development consists of one farm near the lake. Gregerson Lake is landlocked.

Grenlie Lake T-23-N, R-11-E, Section 31--3. Surface Acres = 5.4; S.D.F. = 1.35; Maximum Depth = 40 feet.

This clear, hard water drained lake derives most of its water supply from seepage although a limited amount of marsh drainage enters the lake. A small outlet flows into Sannes Creek. Muck is the predominant littoral bottom material. Management of the lake is for bass and panfish. Largemouth bass, bluegill, green sunfish, brown bullhead, perch, and white sucker are present. The panfish population may be slow-growing. A few puddle ducks utilize the area during spring and fall migrations. Beaver activity causes slight water level fluctuations. No developments are present around the lake. There is no public access.

Gurholt Lake T-23-N, R-11-E, Section 21--13, 14, 15. Surface Acres = 30.4; S.D.F. = 1.25; Maximum Depth = 6 feet.

A culvert through which an intermittent outlet flows helps control the level of this clear, hard water seepage lake. Sand and muck are the predominant bottom types present in the littoral zone. An overabundance of small stunted bullheads indicate that the lake suffers from annual severe winterkills. Although not desirable for fishing, the lake is extensively used by migratory puddle ducks. Six dwellings are present. There is no public access.

Hatch Lake T-24-N, R-11-E, Sections 24, 25. Surface Acres = 112.3; S.D.F. = 1.19; Maximum Depth = 13 feet.

Hatch Lake is a clear, hard water seepage fed lake drained by the South Fork Blake Brook. Sand and muck are the primary littoral bottom materials. The fishery is composed of northern pike, perch, largemouth bass, bluegill, and brown bullhead. Severe partial winterkills occur every two to three years limiting the management potential of Hatch Lake. This problem is further compounded by natural water level fluctuations. The lake supports a significant population of muckrats and a few nesting bluewing teal. Fairly large numbers of both diving and puddle ducks utilize the lake and adjoining wetlands during spring and fall migrations. Twenty-nine cottages and dwellings are located around the lake. Access is available from two public landings located on the east side of the lake. Hunting is allowed.

Herman Lake T-23-N, R-12-E, Section 7--2, 5. Surface Acres = 12.4; S.D.F. = 1.46; Maximum Depth = 3 feet.

This landlocked seepage lake is near extinction being little more than a deep marsh. The water is hard, alkaline, and light brown in color. Silt and muck are the major bottom types. Because the lake freezes to the bottom nearly every winter there is no fishery present. Waterfowl make heavy use of the lake with broods of mallards, wood duck, and bluewing teal present on the day of investigation. Large numbers of puddle ducks and coots make use of the area during spring and fall migrations. Muskrats are present in significant numbers. There are no developments nor is there any public access facilities present. Hunting is permitted.

Holman Lake T-21-N, R-11-E, Section 22. Surface Acres = 18.0; S.D.F. = 1.09; Maximum Depth = 5 feet.

Runoff and seepage are the principal water sources of this landlocked hard water wilderness lake. Littoral bottom materials consist of sand, gravel and muck. The water is light brown in color and turbid. Annual complete winterkill prevents the establishment of a fishery. Dense aquatic vegetation is a major use problem. A few puddle ducks use the lake during fall migrations. Muskrats are present in significant numbers. Hunting is allowed with permission of the landowner. There is no public access and there are no developments.

Horseshoe Bayou T-22-N, R-14-E, Section 29--4. Surface Acres = 17.5; S.D.F. = 3.00; Maximum Depth = 8 feet.

Horseshoe Bayou is an old oxbow connected to the Wolf River. Water levels of this clear, hard water lake are directly dependent on the level of the Wolf River. Silt and sand are the only littoral bottom materials present. The surrounding hardwood upland is subject to seasonal inundation by flood waters from the Wolf River. The major sport fish present include northern pike, walleye, perch, largemouth bass, smallmouth bass, bluegill, white crappie, and white bass. Carp, redhorse, white sucker and other common river species are also present. The only public access to this wilderness lake is via navigable water from the Wolf River. A few ducks use the area for nesting. Hunting is allowed but the entire shoreline is posted against trespass.

Horseshoe Bayou, Little T-22-N, R-14-E, Section 20--16. Surface Acres = 7.4; S.D.F. = 2.52; Maximum Depth = 4 feet.

Like its sister basin, Horseshoe Bayou, it is an oxbow of the Wolf River. The water is turbid and sand is the major bottom material. An inlet and outlet connects this lake to various channels of the Wolf River. Most of the species of fish present in the Wolf River also inhabit the area. Nesting bluewing teal make use of the area. Hunting is permitted. Access to this wilderness lake is available by boat from the Wolf River.

Iola Millpond T-24-N, R-11-E, Sections 26, 35. Surface Acres = 205.9; S.D.F. = 2.36; Maximum Depth = 11 feet.

This hard water impoundment is fed by Mack (Brown) Creek, and two unnamed small feeder streams. The outlet stream is the South Branch Little Wolf River. Water levels are maintained by two dams, one 6 feet high, the other 5 feet high. The water is light brown in color. Northern pike, largemouth bass, bluegill, black crappie, green sunfish, brown trout, bullheads, and white sucker are the most important species present. Shallow water and dense aquatic vegetation limit boating opportunities on this impoundment. An excellent waterfowl marsh exists on the upper reaches of the impoundment. Mallards and bluewing teal use the area for nesting. Hunting is not allowed in that portion of the pond lying within the Village of Iola. Developments consist of one boat livery, two farms, and 15 dwellings. Additional cottages will probably be built because much of the upland around the impoundment has recently been platted. Access is available from a village park located on the south shore. Effluent from several septic tanks and from municipal storm sewers enters the pond contributing to its enrichment. Cattle are pastured along portions of the shore. Iola Millpond is noted for its fine fishing.

Jacklin Lake T-21-N, R-12-E, Section 31. Surface Acres = 3.0; S.D.F. = 2.31; Maximum Depth = 12 feet.

Jacklin Lake is a clear hard water spring pond flowing into Austin Creek. A large number of springs are located on the south and west ends of the pool area. Other than springs, there is no inlet. The lake is very shallow (less than two feet) except for four small isolated holes ranging in depth from 6 to 12 feet. Muck is the predominant bottom type with traces of sand and detritus also present. Basic management of this pond is for brook and brown trout. Other common species include northern pike, perch, rock bass, green sunfish, and white sucker. Dense mats of emergent and subemergent aquatic vegetation limit fishery potentials. A few mallards nest near the lake. Hunting is allowed. Access without parking is available from one town road near the outlet. The tamarack bogs and hardwood ridges surrounding Jacklin Lake are aesthetically pleasing.

Jackson Lake T-25-N, R-11-E, Section 15. Surface Acres = 10.5; S.D.F. = 1.08; Maximum Depth = 5 feet.

This soft, clear water seepage lake is completely landlocked. Muck is the only littoral bottom material present. Annual complete winterkill precludes the establishment of a fishery. Natural water level fluctuations limit other recreational uses of this lake. A few mallards nest on the lake while migrating puddle ducks use it as a resting area. Hunting is allowed. There is no public access nor are there developments present.

Jaquith Lake T-22-N, R-11-E, Section 25--8. Surface Acres = 5.6; S.D.F. = 1.23; Maximum Depth = 14 feet.

This landlocked, clear water seepage lake contains only forage minnows. Water hardness and fertility are moderate. Detritus is the predominant bottom type. A few muskrats are present. A small number of puddle ducks use the lake as a resting area during spring and fall migrations. Access is available across lands owned by the Wisconsin Department of Transportation.

Jenny Bayou T-21-N, R-13, 14-E, Sections 6, 7, 12. Surface Acres = 27.3; S.D.F. = 2.02; Maximum Depth = 13 feet.

At one time this hard water bayou was part of the main channel of the Wolf River. The medium brown water has low transparency. Muck is the predominate littoral bottom material. Aquatic vegetation is very dense in the shallow marginal zones. Fish present are bluegill, white bass, channel catfish, bullhead, perch, pumpkinseed, northern pike and largemouth bass. Mallards and bluewing teal nest in the marshes adjacent to Jenny Bayou. Access is available via navigable water from the Wolf River. Jenny Bayou is noted for both the summer and winter fishing it provides.

Jensen Lake T-21-N, R-11-E, Section 14. Surface Acres = 14.6; S.D.F. = 1.06; Maximum Depth = 9 feet.

Water levels of Jensen Lake are maintained by marsh drainage and seepage. The water is light brown in color and is hard indicating high fertility. An outlet stream flows to the southeast for about one and one-half miles before entering Spencer Lake. Muck is the only littoral bottom material present. Forage fish, mostly minnows, are the only fish known to be present. Jensen Lake suffers from occasional severe winterkill. Significant numbers of muskrats are present in the marshes adjoining the lake. A few puddle ducks use the lake during spring and fall migrations. Hunting is allowed but the entire shoreline is posted against trespass. Developments consist of one cottage. There is no public access.

Johnson Lake T-23-N, R-11-E, Section 19. Surface Acres = 12.0; S.D.F. = 1.55; Maximum Depth = 27 feet.

This is a landlocked seepage, acid, lake containing light brown water of high fertility. Marl, detritus, and muck are the predominant littoral bottom materials. About five percent of the shoreline consists of an alder--cattail marsh, the remainder being a hardwood upland. Major species present are walleye, northern pike, bluegill, sunfish, and largemouth bass. The lake receives very little use by aquatic furbearers and waterfowl. There is no public access however a private unimproved boat landing is present on the north shore. Developments consist of one dwelling.

Jones Lake T-24-N, R-12-E, Section 28--10. Surface Acres = 6.6; S.D.F. = 1.28; Maximum Depth = 25 feet.

Jones Lake is a small clear water wilderness lake located on a tributary to the South Fork Blake Brook. The water is alkaline hard, and high in productivity. Muck is the major littoral bottom material. The fishery consists of northern pike, perch, largemouth bass, and bluegill. Mallards and bluewing teal nest on the lake and migrating puddle ducks use the lake as a rest area. Hunting is allowed. There is no public access and there are no developments.

Junction Lake T-21-N, R-11-E, Section 10--3, 8. Surface Acres = 15.6; S.D.F. = 1.35; Maximum Depth = 4 feet.

Junction Lake is a clear, hard water drainage basin that is actually an enlargement of the Crystal River. Radley Creek, a medium sized stream, also flows into the lake. Muck and silt are the major bottom materials present. The sport fishery consists of northern pike, largemouth bass, bluegill, black crappie, rock bass, pumpkinseed, and brown bullhead. White sucker and redhorse are present in sufficient numbers to be problem species. A high degree of siltation and dense aquatic vegetation tend to limit recreational values of this lake. While the value to waterfowl is very limited, Junction Lake does support a significant population of muskrat. Developments include six dwellings. Access is available from a town road located near the outlet and from navigable water via the Crystal River.

Kating Lake T-24-N, R-11-E, Section 36--14. Surface Acres = 17.3; S.D.F. = 1.13; Maximum Depth = 18 feet.

Kating Lake is a landlocked seepage basin containing turbid, medium hard water. Muck and marl are the predominant littoral bottom materials, however enough exposed gravel is present to provide adequate largemouth bass spawning areas. Fish present are largemouth bass, perch, and brown bullhead. Northern pike are also present, but in fewer numbers. Occasional partial winterkill occurs. Bluewing teal nest here and puddle ducks use the lake as a resting area during spring and fall migrations. Hunting is allowed on the lake. The Town of Iola has developed a park and swimming beach on the northeast shore of Kating Lake. A boat landing with adequate parking facilities has been incorporated into the park. Additional access without parking is available from State Highway 161. One cottage is present near the lake. Recreational use of Kating Lake is limited by heavy algae blooms and dense growth of aquatic vegetation. In the past, the lake has been treated with herbicide for control of the aquatic vegetation.

Keller Lake T-25-N, R-13-E, Section 18. Surface Acres = 20.5; S.D.F. = 2.13; Maximum Depth = 13 feet.

Keller Lake is a hard water impoundment of the South Branch Pigeon River. Water levels are maintained by a 19-foot dam. The water is low in transparency and displays light brown color. Gravel, rock, and muck are the predominant littoral bottom types present. Fish present are largemouth bass, smallmouth bass, rock bass, sunfish, brown bullhead, brown trout, rainbow trout, and white sucker. A Waupaca County Park occupies the entire shoreline east of County Highway "G", which provides camping and picnic facilities and a boat landing. Other access is available from CTH "G" and from navigable water via the inlet and outlet. Other developments include one cottage. Filling of the basin with silt is a management problem for this lake.

Kinney Lake T-25-N, R-13-E, Sections 7, 8. Surface Acres = 83.2; S.D.F. = 1.12; Maximum Depth = 10 feet.

Kinney Lake is a spring and seepage fed clear, hard water basin having an intermittent outlet but no inlet. While a natural lake basin, water levels are partially maintained by a low head dam constructed in the late 1950's. Littoral bottom materials consist of marl and sand. Northern pike, perch, largemouth bass, bluegill, pumpkinseed, black bullhead, and brown bullhead are present. Periodic severe winterkill is a major problem encountered in the management of this lake. A significant population of muskrats is found in the marsh that completely surrounds the lake. Mallards, bluewing teal and wood ducks nest on the lake shore. Fairly large numbers of puddle ducks and diving ducks use the lake as a rest area during spring and fall migrations. Hunting is allowed. A county owned access with parking is located on the southwest corner of the lake. There are no other developments present.

Knight Lake - See Chain-O-Lakes.

Knutson (Eickner) Lake T-23-N, R-12-E, Section 5--16. Surface Acres = 11.7; S.D.F. = 1.06; Maximum Depth = 35 feet.

Knutson Lake is a clear, hard water drainage lake located on a small tributary of the North Fork, South Branch Little Wolf River. Seepage, springs, and some drainage supply water to this basin. Littoral bottom materials includes marl and sand. Largemouth bass and various species of panfish are the only fish known to be present. Muskrats are present in significant numbers. Although no record of waterfowl use is available some puddle ducks probably use the area as a resting place during spring and fall migrations. Hunting is allowed. There are no cottages or other dwellings present. There is no public access, however an unimproved landing is present at the end of a private farm lane.

Krause (Lutz) Lake T-24-N, R-12-E, Section 18--3, 4. Surface Acres = 13.5; S.D.F. = 1.46; Maximum Depth = 21 feet.

This basin is a clear, hard water lake fed by seepage and springs. There is no inlet and the outlet flows only a short distance before entering Moon (Goodhal) Lake. In effect this lake system is landlocked. Muck is the only littoral bottom material present. Largemouth bass, bluegill, black crappie, and yellow bullheads are present. The lake supports nesting mallards and bluewing teal as well as a significant population of muskrats. Both diving ducks and puddle ducks use the lake as a rest area during spring and fall migrations. There is no public access. There are no developments present on the shoreline.

Lembke Lake T-25-N, R-13-E, Section 21--8, 9. Surface Acres = 3.2; S.D.F. = 1.12; Maximum Depth = 33 feet.

Lembke Lake is a small, clear, hard water drained basin with a navigable outlet to Long Lake. The main water source is seepage. There is no inlet stream present. Muck is the predominate littoral bottom material present. This lake is managed primarily for trout. Nesting bluewing teal and a limited number of migrating diving ducks and puddle ducks use the lake. Hunting is allowed. Access is available from a town park with a landing designed to handle small boats. Developments consist of one cottage.

Limekiln Lake - See Chain-O-Lakes.

Little Hope Millpond T-21-N, R-11-E, Section 1--12, 15. Surface Acres = 11.9; S.D.F. = 1.88; Maximum Depth = 8 feet.

Little Hope Millpond is a clear, hard water impoundment of the Crystal River located about two miles south of Waupaca. Water levels are maintained by a dam six feet high once used to provide power for a grist mill. A Waupaca County park offering access, camping, and picnic facilities is located along much of the south shore. Additional access is available off CTH "K". Seven cottages are also present along the impoundment. Little Hope Millpond is located on the Crystal River - Chain-O-Lakes Canoe Trail accounting for the heavy canoe and small boat traffic so prevalent during summer months. Because the area is heavily used, waterfowl and aquatic furbearers shy away from the Millpond. The fishery consists of northern pike, largemouth bass, bluegill, black crappie, rock bass, pumpkinseed, and brown bullhead. A high degree of siltation and dense mats of aquatic vegetation limit the recreational value of this impoundment. Littoral bottom materials consist of sand, gravel, rubble, and detritus.

Little Lake T-25-N, R-13-E, Sections 17, 18. Surface Acres = 24.7; S.D.F. = 1.08; Maximum Depth = 17 feet.

This is a clear, hard water, landlocked lake with occasional severe winterkills. Fish present are northern pike, perch, largemouth bass, bluegill, and black bullhead. Fingerling largemouth bass are stocked following severe winterkills. Bluewing teal are known to nest here. Migrating puddle ducks and diving ducks use the lake as a resting area. Seepage is the principle water source while marl, muck, sand, and gravel are the major littoral bottom types. There is no public access and there are no developments around the lake.

Long Lake (T-21-N, R-11-E, Section 4) - See Chain-O-Lakes.

Long Lake T-24-N, R-11-E, Sections 11, 12. Surface Acres = 41.7; S.D.F. = 1.17; Maximum Depth = 22 feet.

Long Lake is a landlocked, clear, hard water basin fed principally by seepage water. Muck, sand, and gravel are the predominant littoral bottom types. Recreational use of the lake is limited by dense aquatic vegetation and by natural water level of fluctuations. Black bullheads, largemouth bass, bluegills, and pumpkinseed are present. Prime wildlife cover is present in the form of a fairly large open marsh surrounding much of the lake. A large population of muskrats is present. Mallards and bluewing teal nest near the lake. Moderately large numbers of puddle ducks and diving ducks use the lake as a resting and feeding area during fall migrations. Hunting is allowed. One cottage is present on the lake. There is no public access.

Long Lake T-25-N, R-13-E, Sections 21, 22. Surface Acres = 13.2; S.D.F. = 1.65; Maximum Depth = 47 feet,

Long Lake is a clear, hard water basin fed principally by seepage and springs. Two inlets enter the lake; one from nearby Lembke Lake is large enough to be navigated by small boats, the

other is a very small stream coming from Michael Lake to the south. An outlet stream flows a short distance before entering the South Branch Pigeon River. The very restricted littoral zone is covered with marl. Suspended marl particles impart a greenish tint to the water. Largemouth bass, bluegill, black crappie, and pumpkinseed are common but northern pike, bullheads and white sucker are also present. Most of the lake is surrounded by a wetland consisting of open marsh (50 percent) and shrub swamp (50 percent). A fairly large muskrat population is found in the lake and adjacent wetlands. A few bluewing teal nest near the lake. Both puddle ducks and diving ducks rest on the water during spring and fall migrations. Hunting is allowed. Access is provided by one county road providing parking for about ten cars. Additional access is available via navigable water from Lembke Lake.

Manawa Millpond T-23-N, R-13-E, Sections 11, 14, 15. Surface Acres = 194.5; S.D.F. = 2.81; Maximum Depth = 12 feet.

Manawa Millpond is an impoundment on the North Branch Little Wolf River. The water is hard and medium brown in color. An impoundment of some type has existed from at least 1895 when the Eischner-Nelson Milling Works operated a grist and flour mill at this location. The mill still exists, however the river is no longer used as a source of power. Water levels of the impoundment are presently maintained by a dam about nine feet high. The extensive littoral zone has a predominately sand bottom. The immediate shoreline is almost completely upland types with about one-fourth of the shoreline lying in the City of Manawa. The remainder is a combination of upland hardwoods, pasture, and cultivated lands. Access is available from a county park, a city beach, and city landing. The newly developed beach receives heavy use. The North Branch Wolf River provides navigable water access for small boats and canoes. Twenty-four dwellings are located on the pond. Fish present are northern pike, largemouth bass, bluegill, bullhead and perch. Dense growths of aquatic vegetation limit the fishing and boating values afforded by this impoundment. No evidence of duck or aquatic furbearers was noted on the day of investigation. Hunting is restricted to the portions of the impoundment lying outside the City of Manawa.

Manomin Lake - See Chain-O-Lakes.

Marion Millpond T-25-N, R-13-E, Sections 2, 3. Surface Acres = 109.1; S.D.F. = 2.58; Maximum Depth = 11 feet.

Marion Millpond is an impoundment of the North Branch Pigeon River. Water levels are maintained by a 16-foot dam. Natural water color is light brown. Littoral bottom materials consist of sand and silt. The pond is managed for northern pike, largemouth bass, and panfish. Northern pike, perch, largemouth bass, bluegill, black crappie, green sunfish, bullhead, and brook trout are present. Stocking is occasionally necessary to replenish the fish population after a partial winterkill. The upper one-third of the pond is surrounded by marsh land supporting a large population of muskrats. Bluewing teal are known to nest on this pond. Large numbers of migrant puddle ducks use the lake as a nesting area. Hunting is allowed outside the corporate limits. Public recreational facilities include two small beaches, Wallace Park--a town park providing picnic and boat landing facilities--and three access roads with parking (one county and two villages). Navigable water access is provided by the inlet, Doty Creek, and the outlet North Branch Pigeon River. Heavy growths of rooted aquatic vegetation have limited the recreational values afforded by Marion Millpond.

A major renovation of Marion Pond was initiated in 1968 and should be completed in 1971. Physical work conducted included: pond drainage, stump removal, bottom sediment removal in part, bottom contouring and deepening, application of black plastic sheeting covered with gravel to retard aquatic vegetation, shoreline grading, shoreline rip-rapping, new beach location, and construction of boating facilities. Monitoring the effects of these physical changes will continue for several years to provide information regarding their worth for application in other waters. The renovation is a combined effort of the City of Marion, local clubs, University of Wisconsin, Department of Natural Resources, and the Upper Great Lakes Regional Commission.

Marl Lake (T-21-N, R-11-E, Section 5) - See Chain-O-Lakes.

Marl Lake T-23-N, R-11-E, Sections 32, 33. Surface Acres = 10.9; S.D.F. = 1.12; Maximum Depth = 65 feet.

Marl Lake is a small wilderness drained basin having exceptional depth for its size. The water is clear and hard with a high productivity rating. Seepage is the principal water source. The lake has three outlets--two intermittent and one perennial--flowing into Sannes Creek. The permanent outlet contains trout. There is no inlet. The predominant littoral bottom material is muck, but some sand and marl is also present. Fish present are perch, bluegill, black crappie, northern pike, largemouth bass, carp, and white sucker. Slow-growing panfish are a problem. Waterfowl make little use of the lake. There is no public access and there are no developments near the shoreline.

McAllister Lake T-21-N, R-11-E, Sections 13, 24. Surface Acres = 12.2; S.D.F. = 1.35; Maximum Depth = 30 feet.

The fishery of this landlocked lake consists of perch, largemouth bass, bluegill, and black crappie. Panfish are stunted. Waterfowl make very little use of this lake. Predominant bottom types of the restricted littoral zone include

sand, gravel, and detritus. Seepage and springs are the major water sources. The water is hard and light brown in color. Access without parking is available from two town roads along the western side of the lake. The owner of land adjacent to the lake permits trespass upon request.

McClean Lake T-21-N, R-11-E, Section 24--4, 13. Surface Acres = 15.5; S.D.F. = 1.59; Maximum Depth = 31 feet.

This water lies in a landlocked basin containing McClean Lake, Gooseneck Lake, and an unnamed pond. McClean Lake has two inlets; one is intermittent coming from the unnamed pond to the west; the second is a navigable channel connected to Gooseneck Lake. The water is clear, very transparent, and hard, indicating high fertility. The principal water sources are drainage, seepage and springs. A restricted littoral zone contains detritus and sand as the major bottom types. Northern pike, perch, largemouth bass, bluegill, black crappie, pumpkinseed, and yellow bullhead are present. In 1965, a toxicant was applied to reduce the stunted panfish population. Fishing improved following the treatment. The lack of suitable spawning habitat probably prevents the establishment of an adequate predator population. Natural water level fluctuations are also problems. A small shallow marsh provides nesting habitat for a limited number of puddle ducks. A few migrant puddle ducks use the lake as a rest area. A public landing on Gooseneck Lake provides access to McClean's Lake via a navigable channel. The entire shoreline of McClean Lake is owned by Wisconsin Odd Fellows.

McCrossen Lake - See Chain-O-Lakes.

Mead Lake T-23-N, R-11-E, Section 34--5, 6. Surface Acres = 9.9; S.D.F. = 1.22; Maximum Depth = 38 feet.

Mead Lake is a clear, very hard water drainage basin having a small outlet to Sannes Creek. Two streams flow into Mead Lake from a small pond located nearby. Marl is the predominant bottom type in the very restricted littoral zone. Drainage, seepage, and springs are the major water sources. Largemouth bass and bluegills are the most common fish present, but northern pike, perch, black crappie, rock bass, pumpkinseed, green sunfish, black bullhead, carp, and white sucker also are present. Trout are sometimes present. No record of waterfowl use is available. Much of the lake shore is in a wilderness condition. There is no public access nor are there any developments.

Michael Lake T-25-N, R-13-E, Section 28--9, 10. Surface Acres = 2.6; S.D.F. = 1.11; Maximum Depth = 22 feet.

This clear, hard water drained lake has a small outlet stream that flows north for about one and one-half miles before entering Long Lake. Major water sources include seepage and springs. Predominant littoral bottom materials are muck and marl. Stunted panfish are a problem. Largemouth bass, bluegill, black crappie, pumpkinseed, and green sunfish are present. The outlet stream contains only forage species. A few puddle ducks use the lake during spring migrations. There is no public access present. Developments are lacking. Michael Lake is classed as a wilderness lake.

Millers Bayou T-21-N, R-13-E, Section 24. Surface Acres = 15.9; S.D.F. = 2.15; Maximum Depth = 3 feet.

Millers Bayou is a river oxbow connected to the Wolf River. Water levels are directly related to the levels of the Wolf River. The water is clear, hard, and highly productive. A small stream arises east of CTH "H" in a wooded marsh and flows into Millers Bayou. Sand, silt, and detritus are the major bottom types. Because Millers Bayou is so shallow and weed choked it is doubtful that a permanent year round fishery exists. However, a good cover and suitable spawning habitat make the Bayou an ideal nursery area for game fish and some panfish. Bluewing teal make extensive use of the area as a nesting site. Large numbers of migrating puddle ducks also use the area. Great blue herons commonly use the Bayou as a feeding ground. Both muskrat and mink can be found in the area. Much of the shoreline is posted against trespass. The Wolf River provides navigable water access. A private, unimproved boat landing is located on the Bayou. One cabin is also present.

Miner Lake - See Chain-O-Lakes.

Mirror Lake T-22-N, R-12-E, Section 30--13. Surface Acres = 12.8; S.D.F. = 1.24; Maximum Depth = 43 feet.

Mirror Lake is a hard water drained basin lying within the corporate boundaries of the City of Waupaca. The water is turbid and oftentimes displays a heavy algae bloom. There is no inlet, however there is a navigable outlet to Shadow Lake and then to the Crystal River. Marl is the predominate littoral bottom material with lesser amounts of sand and detritus present.

The City of Waupaca applied a sand blanket along some of the shoreline in an attempt to control aquatic vegetation. Largemouth bass and bluegill are the principal species present. At one time brown trout and rainbow trout were stocked but stocking was discontinued in 1964. Carp and stunted panfish are a problem. Eradication by chemical treatment is planned for the summer of 1971. Two city roads with parking and a city park provide access. The park contains a public beach. Navigable water access is available from Shadow Lake. Private facilities consist of 25 cottages and dwellings. Because of the close proximity to the city, Mirror Lake receives little waterfowl use. Hunting is prohibited. The lake

is the source of the municipal water supply for the City of Waupaca and this constitutes the major use. Two water pumps, operating full time, provide water to the City of Waupaca.

Moon (Goodhal) Lake T-24-N, R-12-E, Sections 8, 17. Surface Acres = 32.4; S.D.F. = 1.36; Maximum Depth = 10 feet.

Moon Lake lies in a landlocked basin also containing Krause Lake. The two lakes are connected by a small stream. The water is clear, transparent and hard. The extensive littoral zone is a predominately marl bottom, but some sand is present. The fishery includes northern pike, perch, largemouth bass, bluegill, black crappie, green sunfish, and brown bullhead. The lake is noted for the abundance of large bluegills. Mallards and bluewing teal nest on the lake. Fairly large numbers of diving ducks and puddle ducks use the lake as a resting and feeding area during spring and fall migrations. A town road with parking facilities for 15 to 20 cars provides access. Fourteen cottages are located around the lake. Hunting is allowed.

Mountain Lake T-23-N, R-13-E, Sections 26, 27, 34. Surface Acres = 42.7; S.D.F. = 1.29; Maximum Depth = 7 feet.

Mountain Lake is a landlocked seepage basin containing clear, moderately hard water. Muck and gravel are found covering the extensive littoral zone. Severe natural water level fluctuations and annual complete winterkill precludes the establishment of a desirable fishery. Mallards nest on the lake and some puddle ducks rest there during spring and fall migrations. Hunting is allowed. There are no developments including public access. Mountain Lake is a wilderness type lake.

Mud Lake T-21-N, R-11-E, Section 21--3, 4. Surface Acres = 10.8; S.D.F. = 1.61; Maximum Depth = 3 feet.

Mud Lake is a wilderness type lake having no access and no man-made developments. Since complete winterkill occurs frequently no permanent fishery has been established. The plant community associated with this lake is very unusual. The immediate shoreline is surrounded by a nearly homogeneous stand of tamarack having no black spruce mixed with it. This condition is quite unique in Waupaca County. Nearly 90 percent of the lake bottom is occupied by wild rice. No record of waterfowl use is available but undoubtedly a large number of ducks concentrate on Mud Lake during the fall because of the abundant supply of duck food. Hunting is, however, restricted by the adjacent landowner. The water present in Mud Lake is clear, hard, and quite fertile. Major water source is seepage and springs. The lake has no inlet but does have a short outlet flowing into Radley Creek.

Mud Lake T-22-N, R-11-E, Section 31. Surface Acres = 15.8; S.D.F. = 1.02; Maximum Depth = 7 feet.

This is a landlocked wilderness lake surrounded by a tamarack--spruce bog and containing medium brown, hard water fed by seepage and springs. Detritus is the major bottom type. Annual winterkill prevents the establishment of a fishery. Waterfowl and aquatic furbearers make little use of the lake and immediate shoreline. There is no public access nor are there any cabins or developments present.

Mud Lake T-22-N, R-12-E, Section 10--16. Surface Acres = 0.9; S.D.F. = 1.20; Maximum Depth = 4 feet.

This small wilderness lake is landlocked and completely surrounded by a large bog and marsh. Marsh encroachment is rapidly closing in on the remaining open water. Cattails are quite common around the shoreline. Springs contribute significantly to the volume of this lake. Detritus is the predominant bottom type. Winterkill prevents a fishery from becoming established even though water from springs maintains an open water area through the winter. Beaver, muskrats, and deer make extensive use of the area. A few waterfowl use the lake during migration. There is no access. Hunting is permitted.

Mud Lake T-22-N, R-12-E, Section 17. Surface Acres = 3.4; S.D.F. = 1.02; Maximum Depth = 4 feet.

Mud Lake is a natural wilderness lake located on an artificial drainage ditch connecting Nichols Creek with the Waupaca River. Prior to construction of the drainage ditch this lake was probably landlocked. This is a small bog lake, which has abnormally hard water caused by drainage from agricultural lands. Detritus is the major bottom material. Fluctuating water levels and annual winterkill prevent establishment of a desirable fishery. Muskrats and migrating puddle ducks use the lake and adjacent wetlands. Hunting is allowed. There is no public access.

Mud Lake T-24-N, R-13-E, Section 1. Surface Acres = 13.0; S.D.F. = 1.48; Maximum Depth = 5 feet.

This is a moderately hard water drained lake located in the middle of a vast wetland known as Marble Swamp. Springs and seepage are the major water supplier. A small outlet stream flows in a northerly direction to join Shaw Creek less than a mile from Mud Lake. The water in Mud Lake is light brown in color. Muck is the predominant bottom type. Natural water level fluctuations and winterkill prevent a suitable fishery from becoming established. Muskrats are quite common. Nesting bluewing teal, mallards, and wood ducks utilize the ideal habitat found near Mud Lake. Puddle ducks and diving ducks make heavy use of these waters during spring and fall migrations. There is no public access; the lake is classified as a wilderness lake.

Mud Lake T-25-N, R-12-E, Section 18. Surface Acres = 29.5; S.D.F. = 1.18; Maximum Depth = 3 feet.

This Mud Lake is a very shallow bog-type wilderness lake, having an outlet but no inlet. The outlet is quite small and flows into the North Branch Little Wolf River. The clear, hard water is not typical of a lake of this type. Seepage and springs are the major water sources. Natural water level fluctuations and winterkill preclude a desirable fishery, however a few forage species are present. The lake supports a few nesting mallards and bluewing teal. Large numbers of diving ducks and puddle ducks use the lake during migrations. There is no public access but hunting is allowed.

Myklebust Lake T-23-N, R-11-E, Section 2. Surface Acres = 19.7; S.D.F. = 1.66; Maximum Depth = 37 feet.

This lake is a wilderness-marl type basin having exceptionally clear, hard water. Nearly 60 percent of the lake is bordered by a wetland consisting of open marsh and shrub swamp. A very short inlet (less than 100 yards long) enters the lake from an open marsh. A small outlet flows into the South Branch, Little Wolf River. Very little is known of the fishery except that stunted bluegills are common. Beaver are found but waterfowl make but little use of the available habitat. There is no public access.

Mynyard Lake T-21-N, R-11-E, Section 21. Surface Acres = 9.2; S.D.F. = 1.18; Maximum Depth = 4 feet.

Mynyard Lake is a shallow drained basin containing clear, medium hard water. While the lake has no inlet there is a fairly large outlet that flows into Radley Creek. The bottom is largely covered with detritus although there are some small patches of sand present. Little is known about the fishery but it is safe to assume that almost annual winterkill prevents a desirable fishery from becoming established. In the future it may become economically feasible to dredge this lake thus allowing for the establishment of a year round fishery. Black ducks, mallards, and bluewing teal are known to nest on the lake. Some puddle ducks make use of the area during fall migrations. Hunting is allowed. There is no public access nor are there any developments. Mynyard Lake is classed as a wilderness lake.

Nessling Lake - See Chain-O-Lakes.

NewsomePond T-21-N, R-11-E, Section 27. Surface Acres = 14.9; S.D.F. = 1.35; Maximum Depth = 5 feet.

NewsomePond as shown on the U.S.G.S. quadrangle map is no longer existent. The original lake basin is meadow type wetland. A very small dredged pond is located on the south edge of the extinct lake basin. This pond contains clear, moderately hard water and winterkill is common. Some forage fish are present. A few ducks may use the pond as a resting area during migrations. Detritus is the major bottom type with traces of sand and gravel also present. Submerged aquatic vegetation is dense limiting recreational use.

Norby Lake T-23-N, R-11-E, Section 1. Surface Acres = 20.0; S.D.F. = 1.12; Maximum Depth = 3 feet.

Norby Lake is a clear, soft water seepage basin, located just south of Iola. The basin is landlocked, having no inlet nor outlet. Bottom materials consist of muck and gravel. Winterkill prevents a fishery from becoming established. A few waterfowl use the lake as a resting area during migrations. Hunting is allowed. There is no public access and there are no developments. This lake is rapidly approaching extinction.

North Lake T-24-N, R-11-E, Section 11. Surface Acres = 68.5; S.D.F. = 1.11; Maximum Depth = 40 feet.

North Lake is a clear, hard water drainage basin with seepage as a major water source. Littoral bottom materials include sand, gravel, and marl. Game fish present are northern pike, walleye, and largemouth bass while panfish are represented by perch, bluegill, black crappie, pumpkinseed, and yellow bullhead. The lake supports a large population of muskrats and a few migrant puddle ducks. Hunting is allowed. Developments consist of one cottage and a county owned boat access. There is an inlet stream flowing from Grass Lake about one-fourth mile away. An outlet stream containing trout flows into Leer Creek about two miles from North Lake.

Northland Flowage T-25-N, R-11-E, Section 31. Surface Acres = 9.4; S.D.F. = 1.91; Maximum Depth = 6 feet.

Northland Flowage is a clear, hard water impoundment of Flume Creek maintained by a dam 4.5 feet high built in 1960. An impoundment has existed on this site since the late 1800's when a sawmill and grist mill was in operation. These facilities are no longer in existence. Sand, gravel, rubble, boulders, detritus, and silt are littoral bottom materials present. This impoundment is managed for trout with brook trout, brown trout, suckers, bullhead, and forage minnows present. Nesting wood ducks and bluewing teal utilize the excellent waterfowl habitat available. Spring and fall migrant puddle ducks use the pond for resting and feeding. The entire shoreline is publicly controlled. Picnic facilities are available. Hunting and the use of motor boats are not allowed. Dense weed growths limit recreation potential. One farm is located on the shoreline.

Ogdensburg Millpond T-23-N, R-12-E, Sections 21, 22. Surface Acres = 61.9; S.D.F. = 3.71; Maximum Depth = 9 feet.

Ogdensburg Millpond is a very irregularly shaped impoundment of Engebretson Creek and contains clear, hard water. Water levels are maintained by a four-foot dam owned by Beitzel' Mill. There are 3 spillways each creating a small outlet stream that eventually merge and form a navigable channel to the North Fork South Branch Little Wolf River. The inlet stream is navigable. Sand, gravel, boulder, rubble, and detritus are the predominant littoral bottom materials. Perch, largemouth bass, bluegill, black crappie, pumpkinseed, and bullhead are present. Northern pike and white sucker are less numerous. Natural water level fluctuations and occasional severe winterkills make good management difficult. Bullheads may become overabundant if there is a succession of severe winterkills. Abundant aquatic vegetation interferes with other types of recreational management of this pond. The upper one-half of the pond is surrounded by a marshy wetland supporting a significant population of muskrats. Mallards and bluewing teal nest near the lake and migrant puddle ducks stop over for resting and feeding. Hunting is allowed outside of the corporate limits. Access with parking is provided by one county road and two town streets. Two dwellings are present.

Old Taylor Lake T-22-N, R-11-E, Sections 25, 36. Surface Acres = 29.3; S.D.F. = 1.68; Maximum Depth = 17 feet.

This lake lies in a basin virtually landlocked except for a small inlet stream that drains a nearby marsh and shallow pond. There is no outlet. Old Taylor Lake contains two distinct basins connected by a wide channel. Both basins are about 15 feet deep but the largest basin to the west contains a more extensive littoral zone. Sand, gravel, and detritus are the major littoral bottom types. The seepage fed water is clear and soft. Fish present are perch and yellow bullhead. Winterkill is the major factor limiting the fish management potential. Waterfowl use is limited to resting and feeding by migrant puddle ducks. Hunting is allowed. Access is provided by one unimproved boat landing located on the northeast shore. Developments consist of five cottages.

Orlando Lake - See Chain-O-Lakes.

Otter Lake - See Chain-O-Lakes.

Ottman Lake - See Chain-O-Lakes.

Partridge Lake T-21-N, R-13-E, Sections 22, 27. Surface Acres = 1,124.3; S.D.F. = 2.13; Maximum Depth = 6 feet.

This is the largest body of water in Waupaca County. The hard, alkaline water is medium brown in color. Sand is the predominant bottom type providing a firm bottom ideal for brooding largemouth bass and bluegill. Aquatic vegetation is dense in the very shallow water areas. Sport fish present are northern pike, walleye, perch, largemouth bass, bluegills, black crappie, smallmouth bass, channel catfish and bullheads. Gar, carp, drum, burbot, white sucker, redhorse and various forage species are also present. The lake receives considerable fishing pressure in winter and spring primarily for bluegills. All but a small portion of the shoreline is composed of open marsh, shrub swamp, and hardwood swamp creating ideal conditions for muskrats, deer, mink, and waterfowl. Hunting is allowed except in the Village of Fremont. Access is provided by one town road with parking. The Village of Fremont maintains a beach and park providing swimming and picnic facilities. During the non-swimming season they allow boat launching at the beach for a fee. The Wolf River flows through Partridge Lake providing navigable water access. Additional navigable water access is provided by the Little River. Developments include 30 dwellings and one boat livery.

Partridge Crop Lake T-22-N, R-13, 14-E, Sections 30, 31, 35, 36. Surface Acres = 237.5; S.D.F. = 1.19; Maximum Depth = 8 feet.

Partridge Crop Lake is unique in that the Wolf River flows into and out of the basin at virtually the same location. In addition to drainage from the Wolf River, water levels are maintained by seepage from the large marsh around the lake. Sand is the predominant littoral bottom material however some muck is also present. There is very little development because most of the shoreland is low, subject to flooding, and without adequate access. Duck hunting was reportedly good until recent years. Wild celery, a prime duck food, was once abundant but is now scarce. On the date of investigation broods of wood ducks were seen. Undoubtedly the lake receives quite heavy use by migrant waterfowl. The lake is popular for bluegill fishing. Walleye and northern pike are also sought especially in the spring and during the ice fishing season. Other fish present include largemouth bass, black crappie, pumpkinseed, perch, bullhead, channel catfish, suckers, redhorse, gar, burbot, carp, bowfin, and white bass. The wetlands adjacent to the lake support a significant population of muskrats. Development consists of six dwellings. Guth's Resort and Landing located just south of the lake on the Wolf River provides a landing, a camping facility, and bait shop. There is no public access from land. The water in the lake is dark brown in color and highly fertile.

Pea Soup (Mill Cut) Bayou T-22-N, R-14-E, Sections 29, 30, 32. Surface Acres = 37.5; S.D.F. = 3.17; Maximum Depth = 19 feet.

Pea Soup Bayou is an old river channel which has been blocked off to maintain flow in the main portions of the Wolf River. The bayou is nearly devoid of vegetation except at the mouth of a marsh known as Lowell Bayou where vegetation is

dense. Silt and sand constitute the major bottom types. The littoral zone is very abrupt over a majority of the bayou except where silt and sand bars have been created. A minor flow into the bayou is created from seepage of the Wolf River under the rip-rapped dike at the north end of the bayou. The northern portion of the bayou is heavily laden with blown down trees however navigability is possible with small boats. The fish population is similar to that of the Wolf River. Fairly large numbers of bluewing teal nest here. Migrant puddle ducks make extensive use of the area as a resting and feeding ground. Hunting is allowed. Navigable water access is provided by the Wolf River. Pea Soup Bayou is a wilderness lake.

Peterson Creek Millpond T-23-N, R-11-E, Section 29. Surface Acres = 6.2; S.D.F. = 2.61; Maximum Depth = 4 feet.

Peterson Creek Millpond is a small, hard water impoundment of Peterson Creek maintained by a four-foot dam. The water is light brown in color. Silt is the major bottom type. The adjacent shoreland is heavily pastured and eroded--contributing to the siltation of the pond. During the past few years the dam has developed several serious leaks causing water levels to drop about one foot. Unsuccessful attempts have been made by local residents to raise money to repair the dam. The pond at the present time causes downstream trout water to be warmed thereby causing a decline in the stream water quality. The downstream trout fishery would be benefitted by removal of this dam. The present fishery consists of a few trout and many forage species. A few bluewing teal nest on the impoundment. Hunting is allowed but there is no public access. Developments consist of one farm.

Pfeiffer Lake T-25-N, R-14-E, Section 22. Surface Acres = 2.8; S.D.F. = 1.24; Maximum Depth = 20 feet.

Pfeiffer Lake is a dark brown hard water drainage basin located on a short tributary of Pigeon Lake. This small natural lake is surrounded by a predominantly tag alder marsh. A tamarack swamp is located near the inlet on the northwest corner of the lake. The littoral zone has a detritus over muck bottom. There is little emergent vegetation. Little is known about the fishery however on the day of investigation largemouth bass, bluegills, and bullheads were observed. A few muskrats inhabit the marshes surrounding the lake. Waterfowl use is minimal. Hunting is allowed however there is no public access. Developments are lacking on this wilderness lake.

Pigeon (Clintonville) Lake T-25-N, R-14-E, Sections 22, 23. Surface Acres = 217.7; S.D.F. = 3.14; Maximum Depth = 12 feet.

Pigeon Lake is a hard water impoundment of the Pigeon River located in the City of Clintonville. This water is light brown in color and highly productive. Water levels are maintained by a seven-foot dam. In addition to the Pigeon River two smaller streams enter the pond. Muck is the predominant littoral bottom material. Northern pike, largemouth bass, bluegill, black crappie, rock bass, pumpkinseed, bullhead, and white sucker are present. Occasionally the pond suffers from a partial winterkill but this does not cause any major management problems. There are no records on waterfowl or aquatic furbearer use available. Hunting is allowed outside of the city limits. Access is provided by three improved public boat landings, one public access without a landing, and by navigable water via the Pigeon River. Pickerel Point Memorial Park provides picnic facilities and two of the improved boat landings. This park is owned by the local school district.

Pope Lake - See Chain-O-Lakes.

Preuss Lake T-24-N, R-13-E, Section 19--12. Surface Acres = 3.1; S.D.F. = 1.01; Maximum Depth = 23 feet.

Preuss Lake is a clear, hard water drained lake located in the center of a fairly large wooded wetland. Springs are the major water source. The lake has no inlet but does have an outlet flowing into Blake Brook. Marl is the predominant littoral bottom material. Northern pike, largemouth bass, bluegill, black crappie, and pumpkinseed are present. The panfish are reported to be stunted. A few puddle ducks use the lake as a resting area during spring and fall migrations. Bluewing teal nest on the lake. Hunting is allowed. There is no public access, and there are no developments. Preuss Lake is classed as a wilderness lake.

Price Lake T-24-N, R-12-E, Sections 14--4, 13. Surface Acres = 15.6; S.D.F. = 1.17; Maximum Depth = 28 feet.

Price Lake is a clear, hard water drained basin fed primarily by marsh drainage and seepage. Originally the basin was landlocked but several years ago Waupaca County blasted a channel from Price Lake to nearby Campbell Lake. This venture was only partially successful however, because the channel soon silted in making navigation virtually impossible. A shrub swamp surrounds nearly 80 percent of the lake and provides cover for nesting bluewing teal and wood ducks. Migrant puddle ducks also use the lake as a rest area. Fish present are bluegill and largemouth bass, however, little is known of the overall fishery. Hunting is allowed but there is no public access. Three cottages are present.

Rainbow Lake - See Chain-O-Lakes

Rich Lake T-23-N, R-12-E, Section 23. Surface Acres = 16.6; S.D.F. = 1.63; Maximum Depth = 23 feet.

Rich Lake is a drained basin containing clear, hard, seepage and spring fed water. The lake has no inlet but has an outlet that flows into the North Fork, South Branch Little Wolf River, Muck

is the predominant littoral bottom material however there is a small amount of gravel present. Largemouth bass and various species of panfish are present. There is no record of waterfowl use. Hunting is allowed but there is no public access. One cabin is present along the shore.

Rolands (Bestul) Lake T-24-N, R-12-E, Section 25--7, 8. Surface Acres = 13.1; S.D.F. = 1.18; Maximum Depth = 19 feet.

Rolands Lake is a landlocked basin containing clear soft water low in productivity. The principle water source is seepage. Sand and muck are the major littoral bottom materials. The lake is managed for largemouth bass and panfish. Occasional partial winterkill occurs, however, winterkill generally does not cause problems. Both mallards and bluewing teal are known to nest here while migrant puddle ducks use the water as a resting and feeding area. Hunting is allowed. Dense aquatic vegetation and a lack of public access limit the recreational values. There are no cottages or other developments.

Rollofson Lake T-23-N, R-11-E, Section 7. Surface Acres = 39.3; S.D.F. = 1.14; Maximum Depth = 44 feet.

Rollofson Lake is a clear, hard water drained basin having an outlet to Peterson Creek, a trout stream. The entire littoral bottom is covered with marl. At one time marl was commercially mined, leaving a very irregular bottom in the western end of the basin. Seepage is the principle water source. Fish present are bluegill, largemouth bass, rock bass, and perch. Perch are reportedly stunted: other species present in lesser numbers include black crappie, northern pike, brook trout, and brown trout. White suckers are abundant. Fluctuating water levels may present problems in fish management. There is no record of waterfowl or aquatic furbearer use. Hunting is allowed. There is no public access however entry to the lake can be made by obtaining permission from the landowners to use the two private trails that run to the waters edge. There are no developments.

Round Lake (T-22-N, R-11-E, Section 33) - See Chain-O-Lakes.

Round Lake T-21-N, R-11-E, Section 29. Surface Acres = 13.8; S.D.F. = 1.06; Maximum Depth = 25 feet.

Information about the fishery in this small landlocked lake is lacking. The water is turbid and only moderately hard. Seepage is the principle water source. Sand and muck are the predominant littoral bottom types. Waterfowl use is limited to a few fall migrant puddle ducks. Muskrats are present. Hunting with permission is allowed. Development is limited to one small private park used for picnicking.

Round Lake T-24-N, R-11-E, Sections 12, 13. Surface Acres = 25.0; S.D.F. = 1.96; Maximum Depth = 3 feet.

Round Lake is a shallow, landlocked basin containing very soft, light brown water. Muck is the predominant bottom material with some sand also present. Annual complete winterkill precludes the possibility of a fishery from becoming established. An open marsh that surrounds about half of the lake provides cover to nesting bluewing teal. Moderate numbers of both puddle ducks and diving ducks make use of the lake during spring and fall migrations. Hunting is allowed. There is no public access and developments are lacking.

Rasmussen's Lake T-23-N, R-11-E, Section 9--3, 4. Surface Acres = 3.6; S.D.F. = 1.09; Maximum Depth = 6 feet.

This is a small landlocked lake containing soft dark brown water. Seepage is the main water supply. Muck, sand, and gravel are the major bottom types. No fishery has been established because of winterkill. A tag alder-leather leaf bog surrounds much of the lake providing cover for deer and a few furbearers. Waterfowl use is not known. There is no public access nor are there any developments.

Sand (Jensen) Lake T-23-N, R-11-E, Sections 28, 33. Surface Acres = 14.0; S.D.F. = 1.17; Maximum Depth = 29 feet.

Sand Lake is a landlocked, hard water basin fed by springs and seepage. The water is clear and exceptionally transparent with a secchi disk reading of 26 feet. Detritus and muck over sand and gravel are the predominate littoral bottom materials. Green sunfish, bluegill, largemouth bass, perch, and walleye are present. Largemouth bass are reported to be stunted. Records of waterfowl use and presence of aquatic furbearers are lacking. Hunting is allowed with permission. Six dwellings, a boat rental, and a private campground are developments located on the lake. A private beach is present in conjunction with the campground. This lake offers many opportunities for recreation.

Sand Bar Lake, East T-21-N, R-11-E, Section 28--3, 14. Surface Acres = 14.8; S.D.F. = 1.02; Maximum Depth = 6 feet.

This lake is a landlocked basin containing medium hard light brown water. Seepage is the major water source. Muck and sand are the major littoral bottom materials present. Annual severe winterkill precludes the establishment of a desirable fishery. Primary use of this lake is for duck hunting. Moderate numbers of puddle ducks use the lake during fall migrations. There is also a significant population of muskrats. There are no developments or public access.

Sand Bar Lake, West T-21-N, R-11-E, Section 28--4, 13, 14. Surface Acres = 16.3; S.D.F. = 1.15; Maximum Depth = 13 feet.

This lake is very similar to its sister basin, East Sand Bar Lake. West Sand Bar Lake is a seepage fed landlocked basin containing clear, moderately hard water. Littoral bottom materials consist of sand, gravel, and detritus. Forage minnows are present. Muskrats and ducks inhabit the lake and adjacent wetlands. Primary use of the lake is for duck hunting. There is no public access and there are no developments.

Scandinavia Millpond T-23-N, R-11-E, Section 22--1. Surface Acres = 16.4; S.D.F. = 1.97; Maximum Depth = 6 feet.

Scandinavia Millpond is an impoundment of the South Branch Little Wolf River located in the Village of Scandinavia. Water levels are maintained by a seven-foot dam. The water is clear, hard, and productive. Siltation and water level fluctuations are problems in this pond. White suckers predominate. Other species include northern pike, largemouth bass, bluegill, black crappie, green sunfish, and various forage species. A village park having 150 feet of public frontage provides access. Navigable water access is provided by both the inlet and outlet. Other development consists of 22 cottages and homes located on the lake. Hunting is not allowed. Because the pond is located within the village limits, waterfowl use is very minor.

School Section Lake T-24-N, R-13-E, Sections 16, 21. Surface Acres = 39.3; S.D.F. = 1.76; Maximum Depth = 38 feet.

School Section Lake is a clear, hard water drained basin fed primarily by springs. A small outlet stream flows north into Whitcomb Creek. Four sub-basins lie within the main lake basin; depth of each basin is as follows: 20 feet, 30 feet, 35 feet and 38 feet. Marl is the predominant littoral bottom type. Management is for largemouth bass and panfish. The most common species present include largemouth bass, bluegill, black crappie, pumpkinseed, and perch. Northern pike are also present. The lake is noted for fine bass fishing. Nesting bluewing teal utilize the lake as do migrant puddle ducks and diving ducks. A significant population of muskrats is also found on the lake. Hunting is allowed. Developments include one public boat landing, two boat liveries, and three cottages.

Shadow Lake T-22-N, R-12-E, Sections 30, 31. Surface Acres = 42.2; S.D.F. = 1.25; Maximum Depth = 38 feet.

Shadow Lake is a clear, hard water drainage basin located within the City of Waupaca. The inlet stream originates in Mirror Lake located a very short distance to the north, while the outlet flows directly into the Crystal River. Both inlet and outlet are navigable. Marl is the predominant littoral bottom material present. Lesser amounts of sand and gravel are also found. Northern pike, largemouth bass, black crappie, pumpkinseed, bluegill, warmouth, perch, redhorse, and white sucker are present. Carp are sufficiently abundant to be a problem and therefore a chemical treatment project is planned for 1971. The lake will then be stocked with desirable species. Because the lake is located near much human activity, waterfowl and other game species make little use of the water. Lawnsand Beach, a city owned beach and picnic facility, encompasses nearly 50 percent of the shoreline. This park has an improved boat launching facility. Access without parking is available from County Highway K. Other developments on the lake include nine homes, one boat livery, and one church seminary. Because use conflicts between fishermen, swimmers, and boaters have arisen in the past, the City of Waupaca has imposed a five m.p.h. speed limit on all boats using Shadow Lake.

Shambeau (Woodnorth) Lake T-23-N, R-12-E, Sections 26, 27. Surface Acres = 17.4; S.D.F. = 1.10; Maximum Depth = 5 feet.

This landlocked seepage basin contains fairly soft turbid water. Muck is the predominant bottom material. Because of annual complete winterkill a fishery has never been established. The lake is also subject to natural water level fluctuations. Hunting is allowed but there is no record of appreciable waterfowl or game animal use. There is no public access nor are there any developments present. Shambeau Lake is classed as a wilderness lake.

Shaw Landing T-22-N, R-14-E, Section 21--3d. Surface Acres = 2.9; S.D.F. = 1.05; Maximum Depth = 11 feet.

Shaw Landing is a small, pothole type lake located just south of Tom Bayou. The immediate shoreline consists of a sedge-cattail marsh while the pond itself contains dense mats of submerged aquatic vegetation. The pond contains light brown water that is hard and highly productive. The main water supply is flood waters from the Wolf River. The only known fishery consists of very large numbers of small bullheads and some bluegills and largemouth bass. For its size the pond is intensively used by nesting and migrating puddle ducks. Hunting is allowed. A portion of the shoreline is used as a pasture by an adjacent landowner. There is no access nor are there any developments.

Selmer (Siemer) Lake T-24-N, R-11-E, Section 11. Surface Acres = 29.5; S.D.F. = 1.08; Maximum Depth = 9 feet.

Selmer Lake is a clear, soft water seepage basin that has no inlet nor outlet. Sand and muck are the predominant littoral bottom materials. The fishery includes perch, bluegills, pump-

kinseed, and largemouth bass. Very few of these fish ever reach desirable creel size because of periodic winterkill. Dense aquatic vegetation and fluctuating water levels further limit the recreational potential. Wetlands adjacent to the lake provide cover for nesting bluewing teal and a fairly large population of muskrats. Puddle ducks rest and feed on the lake during spring and fall migrations. Hunting is allowed. Six cabins are present on the lake. There is no public access.

Silver (Anderson) Lake T-22-N, R-11-E, Section 28. Surface Acres = 31.9; S.D.F. = 1.35; Maximum Depth = 11 feet.

This is a shallow, hard water lake containing light brown seepage fed water. Silver Lake is landlocked except for an intermittent outlet to a nearby marsh. Sand and gravel covered with muck are the predominant littoral bottom materials. During the survey largemouth bass, bluegill, and forage minnows were noted. Because the lake is quite shallow it probably suffers from at least occasional severe winterkill. There are no records of waterfowl use. There is no legal restriction against hunting. Although there are no developments on the lake it is located on lands owned by the Blessed Sacrament Fathers. This wilderness lake has high aesthetic values.

Silver Lake T-23-N, R-11-E, Sections 14, 15. Surface Acres = 69.8; S.D.F. = 1.05; Maximum Depth = 14 feet.

Silver Lake is a landlocked seepage basin containing clear, moderately hard water. Sand, gravel, and muck are the predominant littoral bottom types present. In 1967 the lake was treated with a fish toxicant to remove an undesirable population of small panfish and bullheads with partial success. Following chemical treatment Silver Lake suffered from a severe winterkill that eliminated several thousand bullheads. Walleye, northern pike, and largemouth bass have been stocked. Because the lake is located in the Village of Scandinavia waterfowl use is limited. Hunting is not allowed. A village park located on the northwest shore provides picnic and boat launching facilities. Four cottages are located on the lake.

Skunk Lake T-23-N, R-11-E, Section 36--6. Surface Acres = 11.0; S.D.F. = 1.12; Maximum Depth = 63 feet.

Skunk Lake lies in a basin containing this lake and Foster Lake. Except for a navigable channel between these two lakes, Skunk Lake is landlocked. The clear, very hard water is fed by seepage and springs. Sand and marl are the littoral bottom materials. Largemouth bass, northern pike, bluegill, perch and pumpkinseed are present. Records on waterfowl use are absent but the lake does support a limited beaver population. There is no public access to the wilderness lake but hunters and fishermen desiring to reach the water may obtain permission from the adjacent landowner.

Spencer Lake T-21-N, R-11, 12-E, Sections 13, 18. Surface Acres = 89.0; S.D.F. = 1.08; Maximum Depth = 52 feet.

Spencer Lake is a fairly large drainage basin containing hard alkaline water. Large amounts of suspended marl particles give the water a milky blue color. Two inlets, a perennial stream from Jensen Lake and an intermittent inlet from nearby Bass Lake. The outlet forms the head waters of Walla Walla Creek. Littoral bottom materials consist of marl and sand. The fishery of Spencer Lake is quite diverse. Warmwater species present are northern pike, walleye, perch, largemouth bass, smallmouth bass, bluegill, black crappie, green sunfish, bullhead, carp, and white sucker. Brook trout, rainbow trout, brown trout, cisco, and whitefish are the cold water species present. Carp are present in sufficient numbers to be a problem. Because of a high degree of development around the lake, waterfowl use is limited. Two town landings with adequate parking facilities provide public access. Seventy cottages and dwellings and the Spencer Lake Bible Camp are located on the lake. In an effort to minimize dangerous use conflicts from occurring, the Waupaca County Board has enacted an ordinance limiting the time when water skiing is allowed.

Spring Lake T-25-N, R-15-E, Section 4--3. Surface Acres = 6.5; S.D.F. = 2.07; Maximum Depth = 5 feet.

This small, dark brown, hard water drainage lake is located just east of Clintonville. An inlet in the form of a dredge channel connects Spring Lake with Big Lake to the north. The outlet, also dredged, flows through two small unnamed ponds then empties into the Embarrass River. Fishery values are not known. Much of the adjacent shoreline is a marsh that provides cover for nesting bluewing teal. Hunting is allowed but there is no public access. Spring Lake is classed as a wilderness lake. Detritus over peat is the primary bottom material.

Spring Pond T-23-N, R-11-E, Section 34--3. Surface Acres = 3.4; S.D.F. = 1.12; Maximum Depth = 37 feet.

Spring Pond is a small, clear, hard water basin fed by drainage and springs. A small inlet stream enters Spring Pond from the east. The outlet stream flows through Mud Lake and then into Peterson Creek. Muck and detritus are the littoral bottom materials. Fish present are northern pike, largemouth bass, bluegill, and pumpkinseed. Trout may be present. Puddle ducks make limited use of this pond during migrations. Nearly all of the adjacent lands are posted against trespass. There is no public access and there are no developments. Spring Pond is classed as a wilderness lake.

Stratton (Storm) Lake T-21-N, R-11-E, Sections 16, 17. Surface Acres = 87.2; S.D.F. = 1.44; Maximum Depth = 42 feet.

Northern pike, perch, largemouth bass, bluegill, white crappie, rock bass, pumpkinseed, green sunfish, and white sucker populate this lake. Some brown trout were stocked but because of very poor returns this program was discontinued in 1964. Stratton Lake is considered as a sterile marl lake with limited fish productivity. Because of a high degree of development, waterfowl use is limited. Hunting is not allowed. Stratton Lake contains clear, hard water fed primarily by springs. Water levels are maintained in part by a wooden dam about eight feet high. The lake has no inlet but there is a fairly large outlet to Radley Creek. The major littoral bottom material is marl. The marl deposits found in the lake have been mined commercially as a source of agricultural lime. Access with adequate parking is available from State Highway 22. Fifty cottages and homes and one private camp are located on the lake. Water skiing hours are restricted on this lake.

Strum (Storm) Lake T-23-N, R-13-E, Section 4--6, 7. Surface Acres = 15.5; S.D.F. = 1.09; Maximum Depth = 17 feet.

Strum Lake is a landlocked seepage lake containing clear, soft water. Muck and sand are the predominant littoral bottom materials. Winterkill and fluctuating water levels limit fish productivity. Species found are bluegill, pumpkinseed, green sunfish and black bullhead. Predatory species are lacking. Nesting mallards and bluewing teal use the lake as do otter and muskrats. Hunting and trapping is allowed. Primary use of the lake is for duck hunting. There is no public access and there are no developments.

Sunset Lake - See Chain-O-Lakes.

Taylor Lake - See Chain-O-Lakes.

Templeton Bayou T-21-N, R-13, 14-E, Sections 13, 18. Surface Acres = 68.1; S.D.F. = 4.15; Maximum Depth = 12 feet.

Templeton Bayou is a clear, hard water oxbow of the Wolf River. The major water supply is overflow from the Wolf River. This bayou is seasonally inundated by flood waters. Sand is the predominate littoral bottom material however some traces of muck are also present. The northern portions of Templeton Bayou provide excellent conditions for nesting waterfowl, especially bluewing teal. Muskrats and mink also inhabit this area. The bayou also provides an excellent spawning and rearing area for northern pike, largemouth bass, bluegills, and bullheads. In addition perch, walleye, black crappie, channel catfish, carp, redhorse, and white sucker are also present. Two resorts, two boat liveries, and 45 cottages are located on the shore attesting to the popularity of this area for recreation (fishing, hunting, and aesthetics) and homesite development. Some problems are caused by dense aquatic vegetation. Access is available from the Wolf River. There is no public access from land.

Tom Bayou T-22-N, R-14-E, Section 21--2, 3. Surface Acres = 4.5; S.D.F. = 1.68; Maximum Depth = 6 feet.

Unlike most bayous of the Wolf River, Tom Bayou does not have a direct water connection to the Wolf. Its water source is however entirely dependent on Wolf River flood flows. Muck is the major bottom material. A cattail marsh completely surrounds Tom Bayou and provides excellent nesting habitat for mallards and bluewing teal. The area receives heavy use by fall migrant puddle ducks. Perch, largemouth bass, northern pike, and bullheads are present however other species common in the Wolf River may occasionally be found. There is no public access nor are there any developments. Tom Bayou contains medium brown hard water.

Traders Bayou T-22-N, R-14-E, Sections 21, 28. Surface Acres = 22.9; S.D.F. = 5.05; Maximum Depth = 24 feet.

Traders Bayou is probably the most productive duck area in Waupaca County. On the date of investigation over 200 mallards, bluewing teal, and wood ducks were observed nesting on or near the pond. The presence of several duck blinds indicates heavy duck hunting pressure. While there is no public access adjacent landowners allow access to those asking permission. Dense growths of aquatic vegetation while favorable to ducks, limits other forms of recreational use. Seasonal overflow from the Wolf River is the major water source for Traders Bayou. Periodic flooding also allows fish from the Wolf to enter Traders Bayou. The water is medium brown, alkaline, and quite hard. One summer cottage is located on the bayou.

Twin Lake, North (Big) T-24-N, R-13-E, Section 7. Surface Acres = 27.2; S.D.F. = 1.01; Maximum Depth = 26 feet.

North Twin Lake and its sister, South Twin Lake lie within a common basin virtually landlocked except for an intermittent channel to Whitcomb Creek. An artificial channel connects the two lakes and allows boat traffic to pass between the two. North Twin Lake contains clear hard water, fed mainly by ground seepage. Muck is the predominant littoral bottom type. Aquatic vegetation and slow growing panfish are use problems. Fish present are northern pike, perch, largemouth bass, bluegill, black crappie, pumpkinseed, green sunfish, bullhead, and white sucker. Bluewing teal nest here and large numbers of puddle ducks and diving ducks use the area during spring and fall migrations. The lake and adjoining wetlands support a large population of muskrats. There is no public access but there is a boat livery. There are no other developments.

Twin Lake, South (Little) T-24-N, R-13-E, Section 7. Surface Acres = 10.5; S.D.F. = 2.64; Maximum Depth = 23 feet.

South Twin Lake is very similar in all respects to North Twin Lake. Fishery and wildlife values are identical and there is no public access. A boat livery located on South Twin also services North Twin. One cottage is present.

Vesey Lake T-23-N, R-12-E, Section 36--3. Surface Acres = 53.8; S.D.F. = 1.64; Maximum Depth = 8 feet.

Vesey Lake is a shallow landlocked basin containing clear, moderately soft water and is fed mainly by ground water seepage. Sand, gravel, and muck are predominate bottom materials. The lake contains a fishery consisting of perch, bullheads, and forage minnows. Winterkill and fluctuating water levels are fishery problems. The primary use of the lake is for duck hunting. Mallards and bluewing teal nest on the lake shore. Large number of migrant puddle ducks use the lake as a resting and feeding area. Hunting is allowed but there is no public access. There are no developments.

Waupaca Millpond T-22-N, R-12-E, Section 19. Surface Acres = 22.2; S.D.F. = 1.83; Maximum Depth = 5 feet.

Waupaca Millpond is a hard water impoundment of the Waupaca River maintained by a 21-foot dam. Both inlet and outlet are navigable. Tremendous volumes of silt enter the pond often making the water turbid. Over the years siltation has increased converting the pond to a marshy area. Silt is the predominate bottom material. Waupaca Millpond contains a very poor sport fishery consisting of perch, smallmouth bass, and green sunfish. Carp, white sucker and redhorse, all undesirable species are far more abundant. In order to improve the fishery Waupaca Millpond is scheduled for chemical treatment in 1971. Because the pond lies within the City of Waupaca it receives little waterfowl use. There are no buildings located on the pond but several homes and commercial establishments are located nearby. A city owned right of way provides public access.

Weyauwega Lake T-21-N, R-13-E, Sections 4, 5. Surface Acres = 274.2; S.D.F. = 1.93; Maximum Depth = 11 feet.

Weyauwega Lake is a very fertile, hard water impoundment of the Waupaca River containing light brown water. Sand and muck are the predominant littoral bottom types. The fishery is dominated by rough fish including carp, redhorse, white sucker, and bowfin. Game species present are bluegill, black crappie, perch, largemouth bass, smallmouth bass, northern pike, pumpkinseed, white bass, and rock bass. This lake is scheduled for chemical treatment in 1971 to rehabilitate the fishery. Bluewing teal nest on the lake but because of its close proximity to Weyauwega, waterfowl use is quite limited. Public facilities on the lake include a boat landing, an access without parking, and a swimming beach. A private park, Mullen Park, is open to the public. Included in this park are picnic areas, playgrounds, toilets, drinking water, shelters, and boat docks. Other access is provided by navigable water via the inlet and outlet. The lake is presently used as a water supply for an electric generating plant. About twenty dwellings are located on the lake. Several sources of pollution enter the lake including effluent from Waupaca County Hospital, storm sewers, and effluent from Ace Manufacturing. All contribute to the enrichment of Weyauwega Lake.

White Lake T-22-N, R-13-E, Sections 16, 20, 21, 22. Surface Acres = 1,026.2; S.D.F. = 1.29; Maximum Depth = 11 feet.

White Lake is the second largest lake in Waupaca County and contains medium brown, hard water. The lake is virtually landlocked except for small marsh drainage channels and an intermittent outlet. Sand, detritus, and muck are the predominant littoral bottom materials. Originally, White Lake was an excellent area for the reproduction of ducks. However, in the 1930's a dam (4-foot head) was installed to create more open water. As a result, bog recession occurred ruining many valuable duck food and cover areas. Waterfowl use declined but some mallards and bluewing teal still utilize the area for nesting. Thousands of diving ducks and hundreds of puddle ducks stop here during spring and fall migrations. Large expanses of very shallow water, dense weed growths, and a slow rate of water exchange are factors that combine to create an almost annual and severe winterkill. The present fish population consists of bullhead, largemouth bass, black crappie, bluegill, northern pike, perch, and white sucker. Quality fishing is rarely realized. In 1958 the lake was chemically treated to exterminate the existing fish population in an attempt to revitalize the fishery, however, winterkill minimized the effectiveness of this project. Over the years a rather serious use conflict between fishermen and duck hunters has developed. Duck hunters want lower water levels in hopes that more duck food and cover will be established. Fishermen want to dredge the lake and raise the water levels. Looking at the past history of the lake and the basic ecology of the lake itself would indicate that the lake is better suited for ducks rather than fish. Access to White Lake is available from one public boat landing, however, parking is limited. About 70 dwellings are present on the lake.

Woodnorth Lake T-22-N, R-13-E, Section 6--8. Surface Acres = 5.1; S.D.F. = 1.07; Maximum Depth = 27 feet.

Woodnorth Lake is a clear, hard water drained lake fed by springs and ground seepage. There is no defined inlet but there is a small outlet that flows into nearby Fox Lake. Woodnorth Lake contains a well balanced fishery of largemouth bass, bluegill, and black crappie. A few large carp are present but cause no problems. Waterfowl use is very limited. Hunting is allowed. Developments consist of one boat livery and a private day use area. There is no public access.

Youngs Lake - See Chain-O-Lakes.

CHAIN O'LAKES

The Waupaca "Chain O'Lakes" are a very important and unique surface water resource and are therefore discussed as a group. Much of the data were collected by Mr. Vernon A. Hacker, District Fishery Biologist at Oshkosh.

The Chain is a group of 22 interconnected lakes nestled in a series of moranic hills located about four miles southwest of the City of Waupaca. The relationship of one lake to another is shown in Figure 9. The natural history of these lakes dates back to the retreat of the Cary Glacier some 12,500 years ago. As the glacier advanced over this area large blocks of ice became buried in glacial-fluvial soils. Upon retreat of the glacier the ice blocks melted creating large pits or kettles, some of which filled with water to become the Chain O'Lakes (Juday, 1914).

Five major soil types lie adjacent to the Chain. These include peat, Plainfield sand, Plainfield sandy loam, Antigo fine sandy loam, and Kennan fine sandy loam. With the exception of peat which is a relatively young soil these soils are derived from glacial till of crystaline rock origin accounting, in part, for the relatively high water fertility of the Chain (Hanson and Hole, 1968).

Numerous springs and spring seeps flow into the Chain providing most of the water necessary to maintain the level of these lakes. Hartman's Creek, a small, silt laden stream enters Pope Lake along its northwest shore. Emmons Creek, a larger stream, empties into Long Lake and may play a significant part in maintaining water levels in the Chain. No streams enter the upper half of the basin. The entire Chain is drained by the Crystal River through an outlet on the southwest edge of Long Lake.

Morphologically, the Chain is divided into three distinct parts, the Upper Chain, Lower Chain, and Little Chain. Collectively, the Chain contains a total of 724 surface acres of water and is encompassed by 22.12 miles of shoreline. The Upper Chain is the largest on the basis of both area and volume while the Little Chain is the smallest. Various limnological and morphological parameters for each part of the Chain are presented in Table 6.

A feature found in most of the lakes is a gently sloping marginal shelf or shoal ranging to depths of 15 to 20 feet. Three to seven degree slopes are commonly encountered in this area. Beyond the marginal shelf, bottom slopes of 17 to 22 degrees are not uncommon (Juday, 1914). Most fish feeding and spawning activity takes place on the marginal shelf. Cross sectional views illustrating the nature of bottom contours of four of the larger lakes are depicted in Figure 10. Location of these contours are shown on Figure 9. It is interesting to note that thermoclines generally develop just below the marginal shelf areas.

The hard, alkaline waters found in the Chain are productive, however, the general lack of dense growths of aquatic vegetation (both phytoplankton and macrophitic plants) may indicate that excess fertility is not yet evident. Contrary to situations found on many highly developed lake systems the chemistry of Chain O'Lakes water has changed very little over the years (Table 7). This phenomenon may be explained at least in part by the fact that large volumes of water, principally from springs, flow through the system continually flushing excess nutrients and other chemicals out of the system, and calcium carbonate rich waters bind up and precipitate critical nutrients such as phosphates.

In all but the most shallow basins thermoclines generally develop at the 12-16 foot level and extend downward to depths of 30 to 35 feet. Dissolved oxygen concentrations and water temperatures are often suitable for good growth and survival of cold water fish species (Figure 11). In a few of the lakes (Long Lake and Knight Lake, for example) cold water fish can be found from the surface downward to the lower limits of the thermocline.

Because the Chain contains a wide variety of habitat types it is natural to assume that the lakes would also contain a wide variety of fish life. Largemouth bass, bluegills, and brown trout are the most common sport fishes present. Other species present are muskellunge, northern pike, walleye, perch, and cisco. In 1968 splake (lake trout-brook trout cross) were stocked in Columbia and Long Lakes. These fish have dispersed throughout the Chain and should provide fishing in the near future. A listing of all species present in the Chain is given in Table 8.

Zooplankton, small aquatic invertebrates, are an integral part of the biology of any aquatic environment. In addition to providing a basic food supply to fish and fish food organisms (such as insects), zooplankton play an important role in the recycling of organic nutrients within the ecosystem. Rotifers, nauplius, ceratium, copepods, and daphnia are among the most common zooplankters (Mackenthun and Bennington, 1940). Daphnia and copepods greater than one millimeter long are most important as fish food organisms. During daylight hours the greatest concentration of these forms are found just below the lower thermocline limits.

In 1965 and 1967 opossum shrimp were stocked in the Chain to provide an additional food supply for the cold water fish species present. To date, the success of this stocking has not been determined.

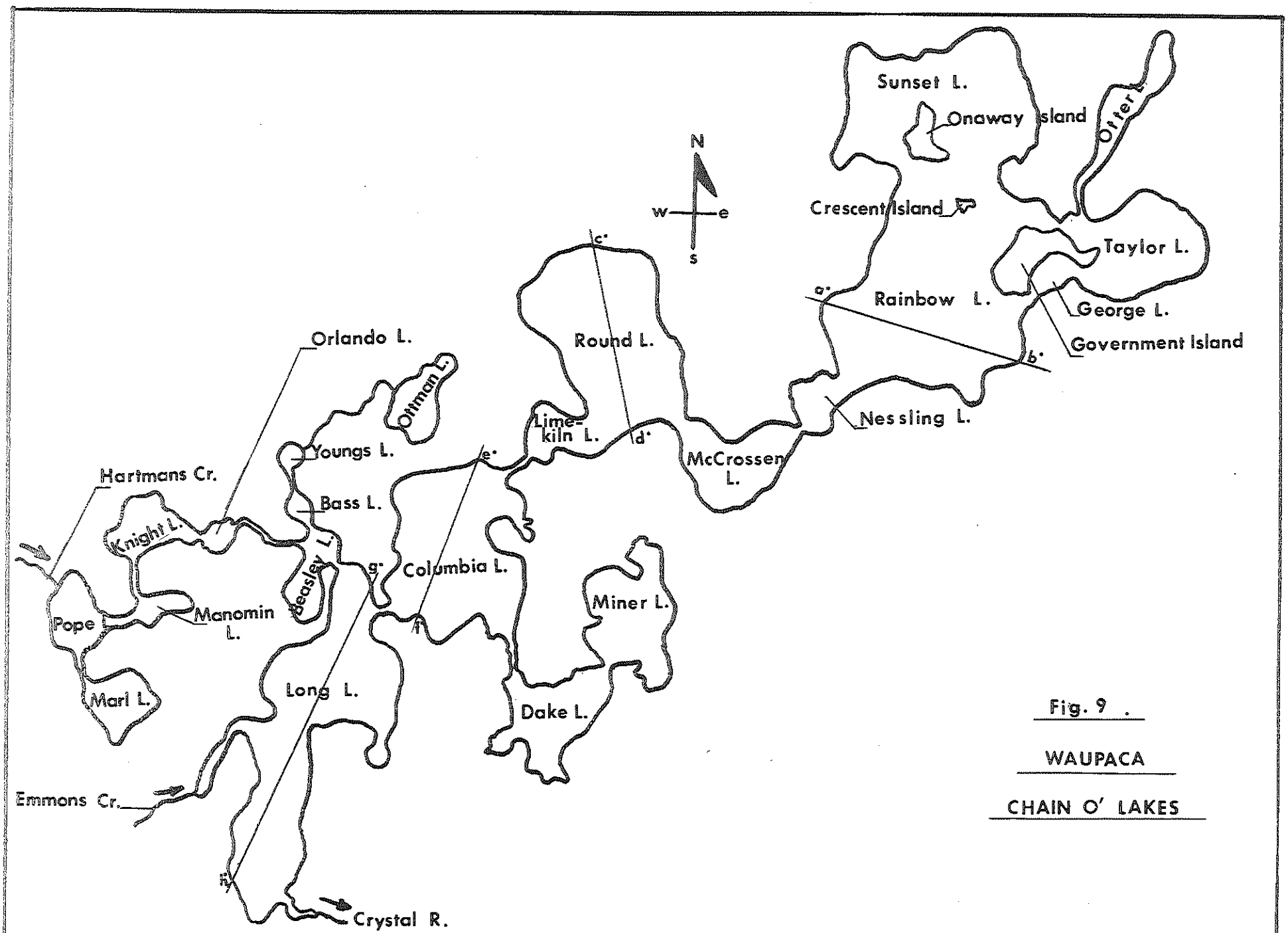


Fig. 9 .

WAUPACA

CHAIN O' LAKES

*see Fig-10.

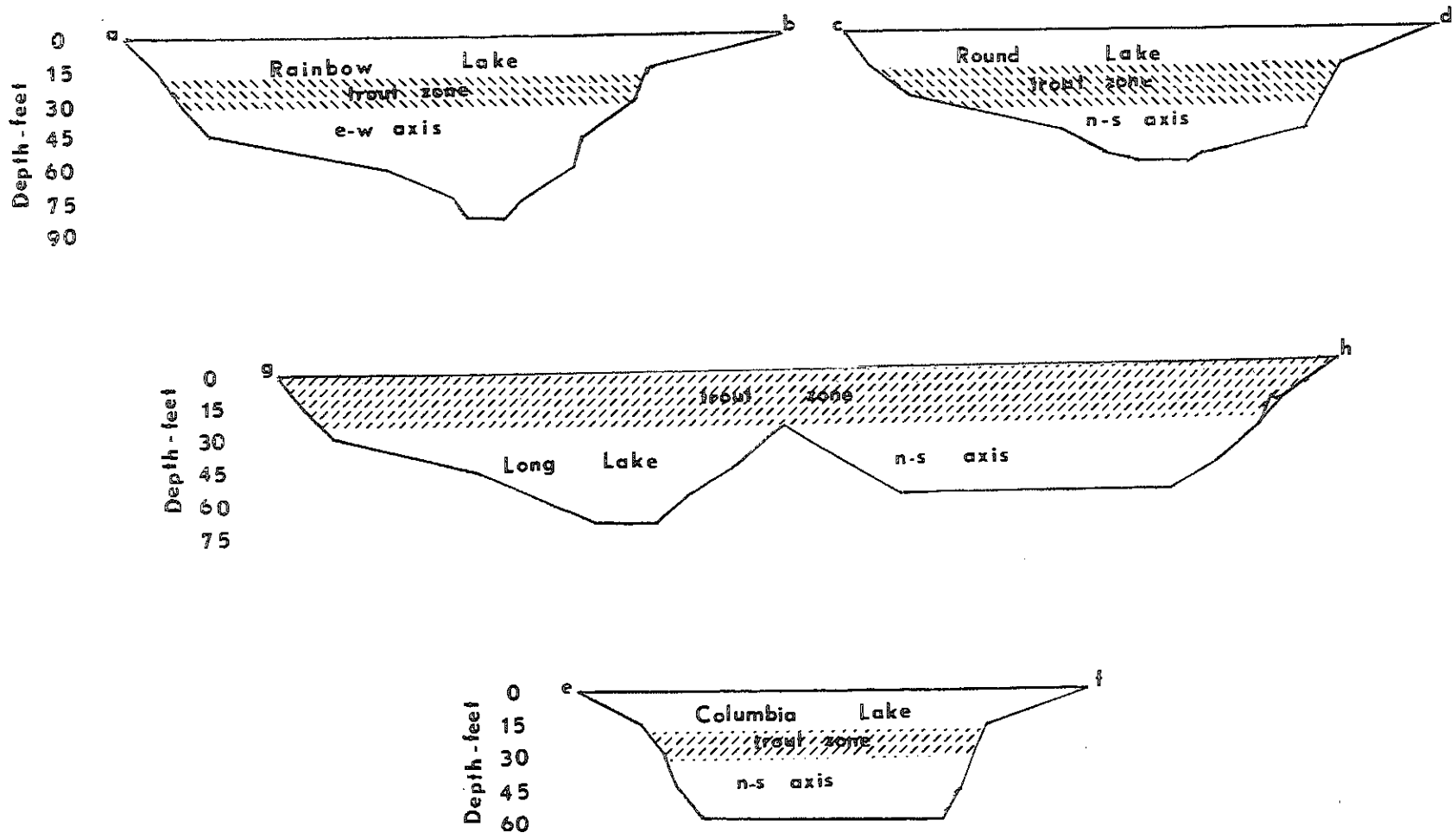


Fig.10 . Typical lake basins

(after Juday, 1914)

Fig. 11. Thermo-chemical profiles of selected lakes

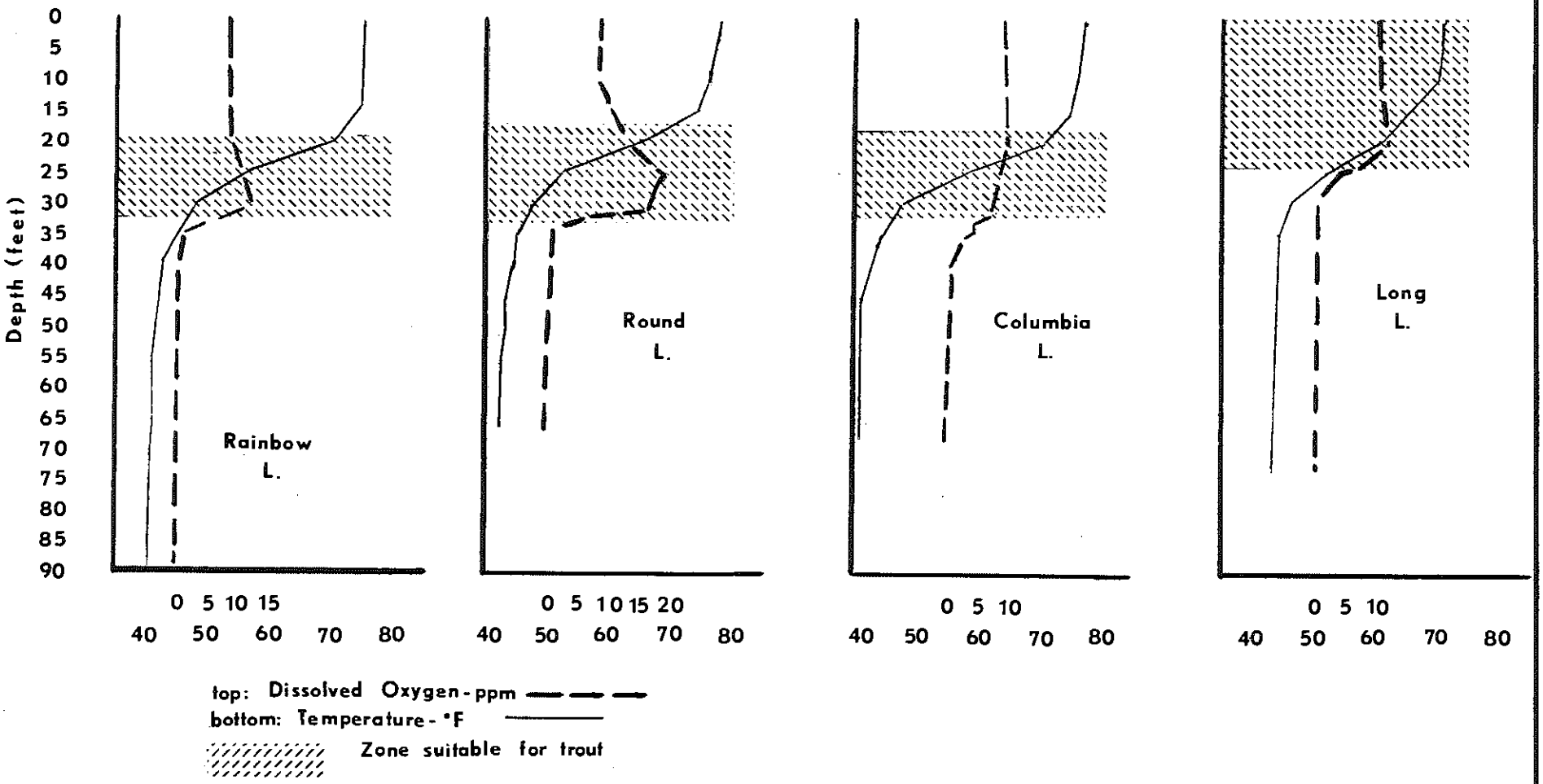


Table 6. Limnological parameters of the Chain O'Lakes

Basin	Area (Acres)	Max. Depth (feet)	Length (miles)	Width (miles)	Shoreline (miles)	Volume (acre feet)
Upper Chain	392.1				9.76	10,779.96
George L.	5.4	30	0.16	0.08	0.40	49.88
Limekiln L.	13.7	46	0.22	0.15	0.70	136.50
McCrossen L.	29.6	75	0.33	0.21	0.90	986.29
Nestling L.	9.6	55	0.16	0.14	0.46	199.72
Otter L.	14.4	40	0.42	0.09	1.10	193.06
Rainbow L.	115.5	95	0.65	0.45	2.00	4,280.00
Round L.	79.8	67	0.50	0.30	1.40	2,123.60
Sunset L.	89.2	63	0.49	0.41	1.70	2,307.20
Taylor L.	34.9	58	0.32	0.30	1.10	503.71
Lower Chain	281.9				9.06	6,531.68
Bass L.	2.5	8	0.09	0.06	0.30	10.00
Beasley L.	11.8	47	0.18	0.10	0.70	253.64
Columbia L.	80.6	72	0.49	0.37	1.84	2,028.29
Dake L*	32.1	26	0.36	0.31	1.20	317.00
Long L.	103.8	75	0.96	0.36	3.00	3,094.06
Miner L.*	35.5	52	0.40	0.20	1.20	731.70
Ottman L.**	13.1	15	0.22	0.15	0.58	81.80
Youngs L	2.5	15	0.24	0.15	0.24	14.49
Little Chain	50.0				3.30	898.60
Knight L.	8.5	42	0.24	0.14	0.60	158.20
Manomin L.	5.8	30	0.20	0.12	0.50	63.20
Marl L.	13.3	59	0.18	0.18	0.70	297.60
Orlando L.	8.6	39	0.23	0.08	0.60	117.40
Pope L.	13.8	40	0.21	0.18	0.90	262.20
Chain O'Lakes	724.0				22.12	18,210.24

*Dake and Miner Lakes while connected to each other were originally isolated from the chain. A channel has been constructed connecting Dake Lake with Columbia Lake.

**Orlando Lake is connected to Youngs Lake by a very small stream. In reality it is a separate basin not an integral part of the Chain.

Table 7. Chemical comparison of water samples collected in 1907 and 1967

Lake	Date Collected	Concentration--Parts per million					
		Ca	Mg	Na	K	SO_4	Cl
Long Lake	Sept. 9, 1907*	31.8	17.7	3.0	3.1	10.4	2.5
Long Lake	Sept. 7, 1967	27.8	23.4	2.4	0.4	10.0	1.7
Rainbow Lake	Sept. 9, 1907*	22.2	16.0	2.3	3.3	8.8	4.2
Rainbow Lake	Sept. 7, 1967	18.0	23.0	3.4	1.4	16.5	5.0

*Weidman and Schultz, 1915

Table 8. Fish species found in the Chain O'Lakes

Warmwater Game Fish	Warmwater Panfish
Muskellunge	Bluegill
Northern Pike	Black Crappie
Walleye	Green Sunfish
Largemouth Bass	Pumpkinseed
Smallmouth Bass	Rock Bass
	Warmouth
Cold water Game Fish	Perch
Brown Trout	Brown Bullhead
Rainbow Trout	Black Bullhead
Splake	Yellow Bullhead
Cisco	
Rough Fish	**Forage Fish**
White Sucker	Brook Silversides
Hog Sucker	Western Mudminnow
Largemouth Buffalo	Golden Shiner
Redhorse	Bluntnose Minnow
Dogfish	Central Stoneroller
	Northern Common Shiner
Other Fish	Northern Creek Chub
Lake Sturgeon	Blackside Darter

Aquatic vegetation is evenly distributed throughout the Chain. Potamogentons are the most predominant species present. Chara is common in the marl lakes (Little Chain) (Mackenthun and Bennington, 1946). Generally, aquatic vegetation does not reach sufficient density to adversely affect the recreational use of the lakes. Coontail (Ceratophyllum) and milfoil (Myriophyllum) reach problem densities in Bass, Manomin, Orlando, Ottman, and Youngs Lakes. Pelagic algae is a problem on Knights and Youngs Lakes.

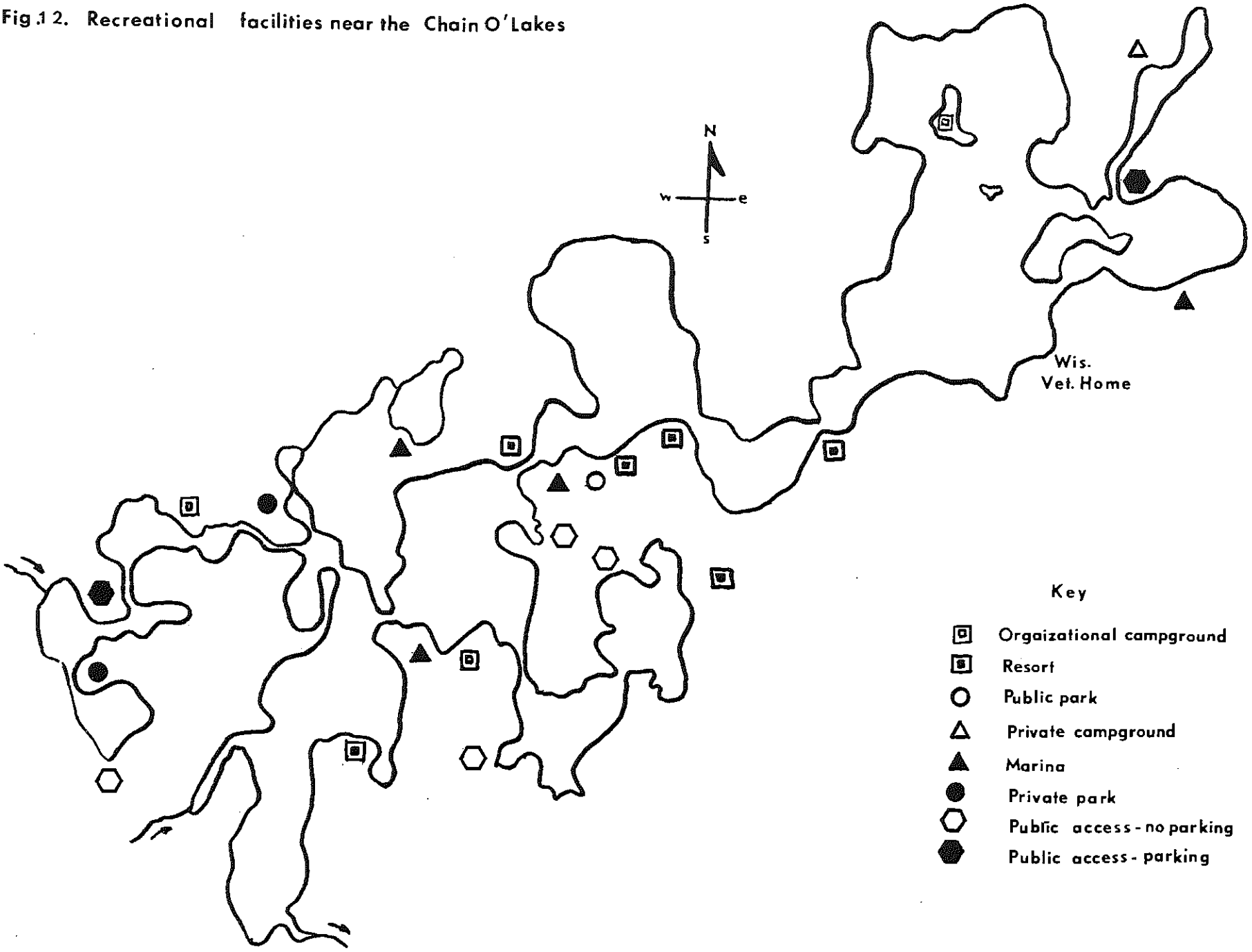
In 1964, over 750 cottages or dwellings were present along the shores of the Chain. The high degree of development consisting of conglomerations of many unsightly cabins, sheds, garages, and other buildings, greatly detract from the aesthetic value of the entire basin. There are some portions of the shoreline especially along the Little Chain that remain in a near wilderness state. Every effort should be made to preserve these in their present condition and present development.

Commercial enterprises offering recreational facilities include four marinas or boat liveries, one campground, two day use areas (picnic, concessions, sunbathing, etc.), and six resorts. Many cottages are for rent on a weekly basis. Three organizational camps and the Wisconsin Veterans Home are located on the Chain. Public recreational facilities include one county park, two boat launching facilities (with parking), and four walk-in access sites. Location of the facilities mentioned here are shown on Figure 12.

A current major problem is excessive and conflicting boating use. As a solution Waupaca County, in 1968, enacted a very restrictive ordinance governing the operation of boats on the Chain. This regulation should improve conditions.

The economic and aesthetic values of the Chain O'Lakes are very important not only to the immediate area but to the entire state. Therefore, action to preserve, protect and improve these values is urgently needed. Some of the items needing attention include water pollution, especially from effluent from the Wisconsin Veterans Home, and zoning to curtail development of wild shore areas. The responsibilities in these areas should be shared by local, county and state levels of government.

Fig. 12. Recreational facilities near the Chain O'Lakes



Streams

Narrative summaries for the named streams are provided in this sub-section. The location of each stream is listed by township, range, section, and quarter section in which the mouth is located or, in some instances, where the stream leaves the county. The major fishery is listed along with the degree of public access and any conditions which may affect the recreational value of the stream. Additional physical and chemical data are presented in Appendix II. Data for unnamed streams are found in Appendix II.

Allen Creek T-21-N, R-11-E, Section 5--6; Surface Acres = --; Length = -- miles; Gradient = -- feet/mile.

Allen Creek is a small feeder stream tributary to Hartman's Creek. A small pond, lake 6-2, is located about one-half mile from its mouth. The stream contains some trout. Very little is known about Allen Creek because it flows underground for much of its length.

Austin Creek T-21-N, R-12-E, Section 36--16; Surface Acres = 3.90; Length = 2.3 miles.

Austin Creek is a clear, hard water stream that originates in Waushara County, loops into Waupaca County and returns to Waushara County to join Magdanz Creek. While sand is the predominant bottom material, silt from adjoining farmland has caused some habitat depreciation. The stream is managed for brook and brown trout. The upper half of the stream is rated as class I trout water while the lower half is class II trout water. In addition to trout, forage minnows and northern pike are present. Jacklin Lake, a spring pond on Austin Creek provides habitat for waterfowl and furbearers. The only public access available is from two town road bridges and from CTH "E".

Bailey (Bradley) Creek T-25-N, R-11-E, Section 7 --11; Surface Acres = 0.25; Length = 0.2 mile.

Bailey Creek is a clear, hard water stream with head waters in Portage County and flows a short distance in Waupaca County before entering the North Branch, Little Wolf River. The stream contains brook and brown trout and forage minnows. It is rated as class I trout water. There is no public access in Waupaca County.

Basteen Creek T-23-N, R-12-E, Section 22--14; Surface Acres = 1.44; Length = 1.7 miles.

Heading in two small ponds located in Section 28, Basteen Creek flows in a northerly direction and enters Engebretson Creek just below Ogdensburg Millpond. Sand, gravel, and muck are the predominant bottom material and the water is clear and hard. The entire stream is class I trout water with brook and brown trout present. Portions of the stream offer good habitat improvement potential while other portions are heavily silted. Unrestricted access to the stream by cattle has caused deterioration of trout habitat. Public access is restricted to one town road crossing and one county highway crossing.

Bear Creek T-24-N, R-14-E, Section 24--1; Surface Acres = --; Length = 4.2 miles.

Bear Creek originates in a large wooded marsh that at one time was part of Marble Marsh. This brown, hard water stream flows over a bottom consisting of silt, muck, gravel, and sand. Bear Creek eventually flows out of the county to join the Embarrass River in Outagamie County. Bear Creek supports a warm water fishery of forage minnows. A few wood ducks undoubtedly rest near the upper end of the stream. Access is available from three town roads and state highway 22.

Bestul Creek T-23-N, R-11-E, Section 15--14 Surface Acres= 1.21; Length = 2.0 miles.

Bestul Creek is a clear, hard water stream that joins the S. Br. Little Wolf River in the Village of Scandinavia. The stream supports a limited population of brook and brown trout with the lower one mile rated as class II trout water. The upper portion of the stream is non-trout water and contains only forage minnows. Trout production is limited by the small size of the stream and by the lack of suitable habitat. Cattle using the stream as a watering facility, and silt from adjacent agricultural lands, combine to destroy or reduce the available trout habitat. In addition to silt, sand, gravel, some rubble can be found on the bottom of the stream. Muskrats inhabit the stream. Access is available from two road crossings.

Blake Brook T-24-N, R-13-E, Section 34--15; Surface Acres = 15.09; Length = 8.3 miles.

Blake Brook is one of the major tributaries of the North Branch, Little Wolf River in Waupaca County. The stream contains clear, hard water. From the junction of the North and South Branches down-stream to State Highway 161, Blake Brook is considered class II trout water. Stocking is necessary to maintain the trout fishery. Brook, brown, and rainbow trout are present. The stream below 161 contains a warmwater fishery consisting of perch, bluegill, pumpkinseed, green sunfish, and bullhead. The lower portion of Blake Brook is badly silted. Sand, gravel, and bedrock are other bottom materials found in the stream. Cattle watering and irrigation are primary uses of Blake Brook waters. Since a portion of the stream flows through forest lands it may support a few nesting wood ducks. Access is available from four state highway crossings, one county road crossing, and two town road crossings. There are no other public lands. Three small feeder streams and the North and South Forks are tributary to Blake Brook.

North Fork Blake Brook T-24-N, R-12-E, Section 23--10; Surface Acres = 2.12; Length = 2.5 miles.

The North Fork Blake Brook is a clear, hard water tributary of Blake Brook. The entire stream is rated as class II trout water. Brook and brown trout are present. In order to maintain a sport fishery the stream must be stocked. Sand, gravel, and bedrock are the major bottom materials present. Much of the stream flows through a wooded area. Some marsh and shrub swamp borders the stream. Seasonally the stream receives excess waters from the Goodhal-Krause lake complex. Access is provided by one town road and one county highway.

South Fork Blake Brook T-24-N, R-12-E, Section 23--10; Surface Acres = 8.99; Length = 5.3 miles.

The South Fork Blake Brook forms the outlet of Hatch Lake. After leaving the lake this stream drains through two small ponds (Lake 24--13 and 19--7) and eventually joins Blake Brook. A small stream that drains Jones Lake and two ponds (27--5 and 27--8) enters the South Fork about three-fourths of a mile from its mouth. The tributary is class I trout water as is the South Fork except for the lower mile which is class II water. Brook and brown trout are present. Sand, gravel and silt are the most common bottom materials present. Access is available from four county road crossings and from two town road crossings.

Cedar Creek T-22-N, R-14-E, Section 3--14; Surface Acres = 2.91; Length = 3.0 miles.

Cedar Creek, a small tributary of the Wolf River located north and west of New London. The stream is an excellent spawning area for several species of fish since it lies in a vast wetland area adjacent to the Wolf River. Northern pike are probably the most numerous. The stream provides excellent cover for nesting puddle ducks and for puddle ducks during fall migrations. Muskrats are common. Muck is the predominant bottom material and the stream contains clear, hard water. The lower portion of the stream is broken into a maze of ditches, part of which lie in Wilderness Springs, a private hunting preserve. Access is available from one county and one state highway.

Comet Creek T-25-N, R-11-E, Section 24--11; Surface Acres = 14.06; Length = 5.8 miles.

Comet Creek is a light brown, hard water stream flowing from Shawano County into Waupaca County to join the North Branch, Little Wolf River. Jones Creek, a small spring feeder, enters Comet Creek about one-half mile from the Little Wolf. Sand, gravel and muck are the predominant bottom types. Brook, brown and rainbow trout are the most common game fish present. Brook and brown trout are stocked while the rainbows are probably immigrants from the Little Wolf. The upper two miles of Comet Creek is class II trout water while the lower 3.8 miles is class I trout water. Siltation is a problem in the vicinity of several small dams located $1\frac{1}{2}$ miles from the mouth. Quality of the trout water could be increased by the installation of devices designed to increase the rate of flow. Muskrats are common along the stream. Access is available from two town road crossings.

Crystal River T-22-N, R-12-E, Section 35--5; Surface Acres = 22.12; Length = 7.3 miles.

The Crystal River is a clear, hard water stream that forms the outlet of the Chain O'Lakes. After leaving Long Lake (part of the Chain) the Crystal River flows through Junction Lake, Little Hope Millpond, and Cary Pond before joining the Waupaca River east of the City of Waupaca. Radley Creek and Naylor Creek are tributaries of the Crystal River. The entire stream above Cary Pond is rated as class II trout water. The trout fishery is maintained by annual stocking of brown trout. In addition to trout, the Crystal River also supports a warm water fishery consisting of northern pike, largemouth bass, smallmouth bass, bluegill, rock bass, pumpkinseed, green sunfish, and forage minnows. Below Little Hope Millpond the river contains carp in sufficient numbers to be a problem. This portion of the river is scheduled for rehabilitation by chemical treatment in 1971. Waterfowl are known to nest on the river and adjacent wetlands. Muskrats are common, especially near the ponds and adjacent wetlands. Access is available from the Chain O'Lakes, a county park at Little Hope and from the Waupaca River. Additional access is available from one federal highway, two state highways, three county highways, and four town roads. One of the major uses of the Crystal River is canoeing. Several organizations offer group and individual float trips on a fee basis. The Crystal River is listed in the Department of Natural Resourses, Publication No. 104, "Wisconsin Water Trails".

Doty Creek T-25-N, R-13-E, Section 3--7; Surface Acres = 1.31; Length = 2.7 miles.

Doty Creek is a clear, hard water stream with head waters in Shawano County upon entering Waupaca County it flows southeast into Marian Millpond. Mehlberg Creek and the Kinney Lake outlet are tributary streams (Mehlberg Creek lies in Shawano County except for the lower 200 yards.) Sand and gravel are the predominant bottom types forming excellent trout spawning grounds. Natural reproduction is very successful, therefore the stream rates as class I trout water. Brook trout are the most numerous and browns occur in lesser numbers. Some trout fishermen claim that Doty Creek is one of the best trout streams in East Central Wisconsin. About one-half mile of stream is in public ownership while much of the remainder lies within a leased public hunting grounds. Two county highways provide additional access.

Embarrass River T-25-N, R-15-E, Section 32--12; Surface Acres = 148.36; Length = 8.0 miles.

While the Embarrass River is a fairly large river system only a small portion of it lies within Waupaca County. Maple Creek, Bear Creek, and Pigeon River are Waupaca County stream systems tributary to the Embarrass River. This stream joins the Wolf River in the City of New London. Sand is the predominant bottom material. The stream contains light brown hard water. It is classed as a smallmouth bass stream. In addition to smallmouth bass the stream contains northern pike, walleye, white bass, channel catfish, carp, mooneye, white sucker, sheepshead, and various other warm water species. The stream supports nesting mallards, blue-winged teal, and wood ducks. Muskrats are also present. Access is available from two state highways, three county highways and two town roads.

Emmons Creek T-21-N, R-11-E, Section 5--16; Surface Acres = 5.02; Length = 2.3 miles.

Emmons Creek is a class I trout stream containing a large population of brown trout. Brook and rainbow trout are present in fewer numbers. Heading in Portage County, Emmons Creek flows east-northeast into the Chain O'Lakes. Gravel and sand bottom materials provide excellent trout spawning areas. The stream contains clear hard water. Access is available from three town roads. About one-half mile of stream lies within lands owned by the State of Wisconsin.

Engebretson (Stenson) Creek T-23-N, R-12-E, Section 23--12; Surface Acres = 1.45; Length = 4.0 miles.

Engebretson Creek is a crystal clear hard water tributary of the North Fork, South Branch, Little Wolf River. An impoundment, Ogdensburg Millpond, is located on the stream. The stream above this impoundment is class I trout water containing an excellent population of brook trout. Even though the stream is heavily fished natural reproduction maintains the fishery without supplemental stocking. As is the case in many small streams, fishing is often difficult because of very thick brush. Ducks and muskrats inhabit the stream just above the millpond. Shoreland in this area is marshy. Below the millpond the stream supports a limited warm water fishery. The Black Lake outlet, Basteen Creek, and the outlet of Lake 17--15 are tributaries to Engebretson Creek. All tributaries are class I trout water. Access is available--three town road crossings and three county highway crossings. Portions of the stream are posted against trespass.

Flume Creek T-25-N, R-11-E, Section 27--11; Surface Acres = 18.98; Length = 5.4 miles.

A clear, hard water stream, Flume Creek starts in Portage County and flows east to join the North Branch Little Wolf River. Northland Flowage, an impoundment is located on the Flume Creek. One small tributary stream enters the Flume Creek about a mile from its mouth. Sand and muck are the predominant bottom materials but enough gravel and rubble is present to provide trout spawning areas. Brook and brown trout are common and rainbow trout are present in lesser numbers. Various forage species are also present. About two and one-half miles of stream are in public control (ownership and easement). Additional access is available from two county highways and three town road crossings.

Geske (S. Fk. S. Br. Pigeon Riv.) Creek T-25-N, R-12-E, Section 12--15; Surface Acres = 2.34; Length = 2.7 miles.

Geske Creek is a hard water tributary of the South Branch Pigeon River. Sand is the predominant bottom material. The stream is rated as class II trout water with brown trout present in fair numbers. Nearly all of the stream flows through a forested area giving the stream a high aesthetic value. Access is available from one town road and one county highway.

Griffin Creek T-24-N, R-11-E, Section 16--10; Surface Acres = 0.84; Length = 2.3 miles.

Griffin Creek is a small, clear, hard water trout stream that joins with Leer Creek to form Mack (Brown) Creek. Sand and gravel are the predominant bottom materials and are excellent materials for trout redds. The entire stream is rated as class I trout water with brook trout the major species present. A small portion of the extreme lower end of the stream is under state easement. Access to the remainder of the stream is available from one county highway and two town road crossings.

Hartman's Creek T-21-N, R-11-E, Section 5--5; Surface Acres = 0.59; Length = 0.7 mile; Gradient = --

Hartman's Creek is a short stream that drains several ponds located in Hartman's Creek State Park and then flows into the Chain O'Lakes. The upper portion of the stream has been impounded to create three small ponds including Allen Lake. Originally, these ponds were operated as a private fish hatchery; but in 1938 the state acquired the property and operated the hatchery which is no longer in operation. A few trout are present in the stream below the ponds. Sand, gravel, and rock rubble are the predominant bottom materials. All but about 0.25 mile of stream lies within Hartman's Creek State Park. There is no other access.

Hatton Creek T-24-N, R-12-E, Section 24--16; Surface Acres = 6.69; Length = 2.7 miles.

Hatton Creek is a clear, hard water stream that acts as the outlet of Clarks Millpond in Waushara County. After leaving the millpond, Hatton Creek enters Waupaca County and then flows into Walla Walla Creek about five miles west of Partridge Lake. Muck is the major bottom material.

Fishery values are limited. Occasional northern pike, largemouth bass, and various panfish occur in Hatton Creek. Forage minnows, suckers, and redhorse are by far the most common species present. Two town road crossings provide access.

Hyde Creek T-25-N, R-14-E, Section 6--9;
Surface Acres = 1.60; Length = 1.2 miles.

All but the lower portion of Hyde Creek lies in Shawano County. The stream is rated as class II trout water containing brook and brown trout. Warm water species such as largemouth bass, northern pike, burbot, and many varieties of forage minnows are also present. Sand and gravel are the predominant bottom materials present providing spawning areas for the trout. Locally, siltation of pools is a problem. Habitat improvement work to halt siltation and speed the flow of water would benefit this stream. Hyde Creek, a tributary of the North Branch Pigeon River, contains clear, hard water. Access is available from two town roads.

Jackson Creek T-25-N, R-11-E, Section 17--4;
Surface Acres = 4.00; Length = 3.3 miles.

Jackson Creek is a class I trout stream containing brook trout heading in Shawano County and is a tributary to the North Branch Little Wolf River. The stream does not require stocking because natural reproduction maintains the fishery. Fishing pressure is limited as the stream banks are very brushy and also because woodticks are very numerous. Overall the stream has good cover and suitable habitat for trout; locally siltation is a problem. Sand, gravel and muck are predominant bottom materials. About one and one-half miles of stream are under public ownership or easement. Two town road crossings provide additional access.

Jones Creek T-25-N, R-11-E, Section 24--7;
Surface Acres = 0.95; Length = 1.3 miles.

Jones Creek is a clear, hard water tributary to Comet Creek. Even though the stream is quite small it is an important source of brook trout for Comet Creek. It is a class I brook trout stream supported entirely by natural reproduction. Forage minnows are also present. Sand and gravel are the major bottom materials providing excellent spawning areas. However, some portions of the upper end are badly silted. Access is available from one town road.

Leer Creek T-24-N, R-11-E, Section 16--10;
Surface Acres = 4.04; Length = 3.7 miles.

Leer Creek starts in a series of springs and small spring feeders located in S-7, T-24-N, R-11-E, and then flows to the southeast to join Griffin Creek. Below the junction of Griffin and Leer Creeks, the stream is known as Mack Creek. Because Leer Creek contains a self-supporting population of native brook trout, it is rated as class I trout water. A tributary stream, the North Lake Outlet, contains warm water species. Silt, sand, gravel, and peat are major bottom materials. Portions of the stream are silted and eroded because livestock have unlimited access. There are several rather unique pools, which are deep, spring-fed, kettle-like holes carved out of peat. Both trout and aquatic invertebrates are common to abundant in them. All but about one mile of Leer Creek is publicly controlled--either easement or owned. Three town roads also cross the stream providing additional access.

Little Creek T-23-N, R-13-E, Section 11--5;
Surface Acres = 3.64; Length = 3.0 miles.

Little Creek is a small warm water tributary of the North Branch Little Wolf River located just north of Manawa Millpond. Silt is the predominant bottom material and the stream contains light brown hard water. The fishery is composed of forage minnows. The stream has little recreational value. County Highway "A" provides access.

Mack (Brown) Creek T-24-N, R-11-E, Section 26--7;
Surface Acres = 4.73; Length = 2.6 miles.

Mack Creek is formed by the junction of Leer Creek and Griffin Creek and then flows into Iola Millpond. The stream below Iola Millpond is known as South Branch Little Wolf River. Sand, gravel, and silt are the predominant bottom materials. In lower sections of the stream sand and silt have filled many holes destroying valuable fish habitat, which could be improved by installing devices designed to speed water flow and provide cover. Mack Creek above a town road in $SE\frac{1}{4}$ $SE\frac{1}{4}$ S-21 is class I trout water; below this road downstream to Iola Millpond the stream is class II trout water. (Olson Creek, a tributary stream, is also class I trout water.) Brook and brown trout are common. Northern pike, white sucker, perch, largemouth bass and bluegill are also present. About one mile of stream is under public fishing easement. Four town road crossings provide additional access.

Maple (Jasman) Creek T-23-N, R-14-E, Section 13--4
Surface Acres = 2.67; Length = 4.4 miles.

Maple Creek is a brown, hard water stream. It flows east out of Waupaca County emptying into Bear Creek, which in turn enters the Embarrass River in Outagamie County. Rubble and gravel are the major bottom materials present. In Waupaca County this stream is too warm to support trout and too small to support a significant warm water fishery. Access is available from three town roads, one county highway, and one federal highway.

McClean Creek T-21-N, R-12-E, Section 18--13;
Surface Acres = 2.21; Length = 2.6 miles.

McClean Creek is a clear, hard water tributary of Walla Walla Creek and receives overflow water from Bailey Lake through an old cranberry marsh. Muck and rubble are the predominant bottom materials. The trout population is limited by poor habitat and heavy infestations of gill lice. Brook trout are the most common species, but some browns

occur. Abuse of this stream is very evident. The stream has been ditched, used for cattle watering, and acts as a catch basin for eroded materials from adjacent farm lands. The stream needs better protection. Access is available from two town roads and one county highway.

Mosquito Creek T-21-N, R-13-E, Section 27--5; Surface Acres = 2.51; Length = 2.3 miles.

Mosquito Creek is a hard brown colored stream heading in Waushara County and flows north into Partridge Lake. About one-fourth mile of stream lies within lands owned by the Village of Fremont. Adjoining lands have been used as a village dump. Seepage and drainage from the dump undoubtedly drains into Mosquito Creek and Partridge Lake. The entire stream flows through an open marsh that provides habitat for muskrats and nesting mallards and blue-winged teal. Migrant puddle ducks use the area for feeding and nesting. The lower portion of the stream provides spawning habitat for various warm water fish, especially northern pike. The stream itself supports little more than a forage minnow population. Muck is the major bottom material. Access is available from five town road crossings and from one federal highway.

Murray (N. Fk. Radley) Creek T-21-N, R-11-E, Section 29--6; Surface Acres = 1.07; Length = 1.1 miles. Semi-lighted trace

Murray Creek is a clear, hard water stream that heads in Portage County and flows east to join with Radley Creek. The stream is rated as class I trout water and contains a large population of brown trout. A few brook trout are also present. The stream contains very few forage fish. Sand, rubble, and silt are the predominant bottom materials. Because Murray Creek flows through a farming area it does not have high game or aesthetic values. Access is available from one town road. A pond used for irrigation is located just west of the access road.

Nace (Trout) Creek T-24-N, R-11-E, Section 34--5; Surface Acres = 6.79; Length = 4.0 miles.

Like most streams in western Waupaca County, Nace Creek begins in Portage County and flows east into Waupaca County. Nace Creek joins the S. Br. Little Wolf River about a mile below Iola Millpond. It contains clear, hard water and is rated as class I trout water above highway 161. Brook trout is the most common species present followed closely by brown trout. White sucker and various forage fish are also present. Sand and gravel are common bottom materials that provide spawning areas for the trout. Silt has caused a decline in the quality of trout habitat present. About one and one-half miles of stream are publicly controlled through conservation easements. Three town roads, one county highway, and one state road provide additional access.

Naylor Creek T-21-N, R-11-E, Section 1--11; Surface Acres = 0.85; Length = 1.0 mile.

Naylor Creek is a small class I trout stream that contains brown trout. It flows through agricultural lands and is badly silted. Gravel is the predominant bottom material however, the gravel is covered by a 5 to 6 inch layer of silt. The fishery potential of the stream could be improved by narrowing the channel and by speeding the flow of water to remove silt. The small size of the stream limits the recreational value. One town road provides access.

Nichols Creek T-22-N, R-12-E, Section 9--4; Surface Acres = 3.85; Length = 5.3 miles.

Nichols Creek is a dark brown, hard water stream tributary to the South Branch Little Wolf River. The creek heads in a large marsh located a few miles northwest of Waupaca and then flows east through marshes and agricultural lands. Two drainage ditches and a very small stream enters Nichols Creek. At one time the stream was populated by brook trout but presently contains only small forage fish. Muskrats and a few ducks utilize food and cover found in adjacent marsh lands. Four town roads and one state highway provide access.

Olson Creek T-24-N, R-11-E, Section 21--7; Surface Acres = 0.15; Length = 0.3 mile.

Olson Creek is a very small class I trout stream tributary to Mack Creek that contains an excellent brook trout fishery. Brown trout are present in fewer numbers. This creek is heavily fished but does not require supplemental stocking. Sand and gravel are the predominant bottom materials. Some muck and silt is also present. Access is available from county highway P. Most of Olson Creek is publicly owned.

Pearl (S. Fk. Radley) Creek T-21-N, R-11-E, Section 29--6; Surface Acres = 2.27; Length = 1.7 miles.

This is a clear, hard water stream that joins Murray Creek to form Radley Creek. The stream begins in Portage County and flows northeast into Waupaca County. Sand and gravel are the predominant bottom materials and provide excellent material for trout redds. Brown trout are present in fairly large numbers. A few brook trout are also present. The stream receives heavy fishing pressure and receives supplemental stockings of brown trout. Like many brown trout streams. Pearl Creek contains a very low minnow population. Access is provided by one town road and state highway 22. There are no public lands present.

Pesthouse Creek T-22-N, R-12-E, Section 31--2; Surface Acres = 0.68; Length = 0.8 miles.

Pesthouse Creek is a small tributary of Shadow Lake lying largely within the city of Waupaca. Once the stream was considered trout water but recent changes caused by highway

construction has diverted water away from Pesthouse Creek. There is little or no flow present. Water level in the stream is directly related to the levels of Shadow Lake. Water levels are also influenced by runoff from a concrete ditch coming from the north along county highway K. Bluegills, largemouth bass, and forage fish are the most common species present. The lower one-fourth of the stream lies within a city park. County highway K provides additional access.

Peterson Creek T-23-N, R-11-E, Section 29--16; Surface Acres = 11.44; Length = 5.9 miles.

Peterson Creek is a tributary of South Branch Little Wolf River that starts in Portage County. It contains light brown, hard water. Sand, gravel, and muck are the predominant bottom materials. Peterson Creek is class I trout water containing both brook and brown trout. A small impoundment is located near the middle of Peterson Creek. This detracts from the quality of downstream trout water. About two miles of stream is in public ownership. Additional access is available from four town roads and two county highways.

Pigeon River T-25-N, R-15-E, Section 20--11; Surface Acres = 31.90; Length = 4.7 miles.

The Pigeon River is a dark brown, hard water stream formed by the confluence of the North and South Branches. Three other very small streams enter Pigeon River, a tributary of the Embarrass River. Pigeon Lake, an impoundment located in Clintonville, is situated on this river. The Pigeon River is classed as a smallmouth bass stream containing smallmouth bass, northern pike, various panfish, and forage species. Sand, gravel, and muck are the predominant bottom materials present. At times, the stream carries a heavy silt load, much of which is deposited in Pigeon Lake. The Pigeon River receives effluents from the city of Clintonville municipal sewage treatment plant and from the Shawano Canning Company. Both effluents receive adequate treatment to prevent pollution. Access is available from one state highway, one county highway, and one town road.

Pigeon River, North Branch T-25-N, R-14-E, Section 8--12; Surface Acres = 8.97; Length = 3.7 miles.

This clear, hard water stream originates in Shawano County and flows southeast to join the Pigeon River. Doty Creek and Hyde Creek are major tributaries. The entire stream is listed as class I trout water. Native brook trout are the most common species. The North Branch receives the effluent from the City of Marion sewage primary treatment plant. As of 1964, the effluent was considered not to be adequately treated to prevent pollution. Major bottom types are sand, gravel, and silt. Access is provided by two town road crossings and from a small county wayside park located just outside of Marion.

South Branch Pigeon River T-25-N, R-14-E, Section 8--12; Surface Acres = 27.27; Length = 9.0 miles.

The South Branch Pigeon River is a clear, hard water tributary of the Pigeon River. It is fed by the North Fork, South Fork, Geske Creek, the Long Lake outlet, and three small, unnamed streams. An impoundment known as Keller Lake is located near the junction of the North and South Forks. Below Keller Lake the stream is classified as a smallmouth bass stream containing smallmouth bass, northern pike, panfish, and forage minnows. Above the impoundment a few brown trout may be present. Cattle have access to much of the stream causing siltation, and stream bank erosion. Silt, rubble, and gravel are the predominant bottom materials. A county park on Keller Lake provides access as does two county highways, one state highway, one federal highway, and four town roads.

N. Fk. S. Br. Pigeon River T-25-N, R-12-E, Section 12--16; Surface Acres = 4.75; Length = 3.3 miles.

The North Fork, South Branch, Pigeon River is a clear hard water tributary of the S. Br. Pigeon River. The stream is rated as class II trout water containing brown trout. Stocking is necessary to maintain the fishery at fishable levels. Game values are quite limited. Access is available from one county highway and one town road.

S. Fk. S. Br. Pigeon River T-25-N, R-12-E, Section 2--4; Surface Acres = 0.65; Length = 1.8 miles.

This is a clear, hard water tributary of the North Fork rated as class II trout water. Brown trout are present in low numbers. Stocking is necessary to maintain the fishery. The stream suffers from a lack of suitable trout cover that could be corrected by the installation of habitat improvement devices if the need ever arises. At best the stream is marginal trout water that does not offer much recreational potential. Silt is the major bottom material. Access is available from one county highway.

Potters Creek T-22-N, R-14-E, Section 33--4; Surface Acres = 3.42; Length = 4.7 miles.

Potters Creek is a brown stained hard water stream tributary to the Wolf River. The stream is a series of deep pools connected by small riffle areas. In dry years the stream flow is intermittent. Forage fish are the only known fish species present. Three town roads and two county highways provide access. Muck is the major bottom material.

Radley Creek T-21-N, R-11-E, Section 10--3; Surface Acres = 8.73; Length = 4.0 miles.

Radley Creek is a tributary of Junction Lake and the Crystal River formed by the junction of Murray Creek and Pearl Creek. The stream contains clear, hard water and the major bottom materials are sand, gravel, muck, and rubble. The entire stream

is trout water with that portion above Stratton Lake Road rated as class I; below this road rated as class II. Brown trout are very common while brook trout are present. Portions of the stream have received habitat improvement to provide additional cover and to speed the flow of water. During summer months the stream is used as a water supply for irrigation systems. In addition to the major tributaries Radley Creek receives water from springs, three lake outlets, and two smaller streams. About two and one-half miles of stream is publicly owned. Additional access is provided by one state highway and two town roads.

Sannes Creek T-23-N, R-11-E, Section 29--16; Surface Acres = 2.84; Length = 1.8 miles.

Sannes Creek is a tributary to Peterson Creek that starts in Portage County and then flows in a westerly direction. The upper one mile is rated as a class I trout stream while the remainder is class II trout water. Brook and brown trout are the most common fish species present. Cattle have caused stream bank erosion and siltation of many pools. A shifting sand bottom further reduces trout habitat. Remaining pool cover is only fair. The installation of proper habitat improvement devices could increase the recreational potential. Two smaller streams are tributaries to Sannes Creek. Sand, gravel, rock and silt are predominant bottom materials. Access is available from two town road crossings. Wood ducks nest along the stream.

Shaw Creek T-24-N, R-13-E, Section 14--16; Surface Acres = 4.36; Length = 6.0 miles.

Most of Shaw Creek, a brown stained, hard water stream, flows through a vast wetland known as Marble Marsh. The stream is tributary to the North Branch, Little Wolf River. Game values associated with Shaw Creek are more important than are fishery values. The stream provides habitat for blue-winged teal, mallards, wood ducks, otter, beaver, muskrats, mink, and deer. The fishery is composed of forage fish. The Mud Lake outlet acts as a tributary. Sand and silt are predominant bottom materials. Access is provided by two town road crossings and two county road crossings.

Spaulding Creek T-25-N, R-12-E, Section 26--4; Surface Acres = 11.37; Length = 6.7 miles.

Spaulding Creek is a clear, hard water stream that enters the North Branch, Little Wolf River just below the Big Falls Dam. The lower one and one-half miles of stream is listed as class II trout water while the remainder is class I. Native brook trout are the most common game fish present. Brown trout were introduced and have become established. Sand, rubble, and muck are predominant bottom materials. Game values are limited. About two miles of stream are publicly controlled by easement and purchase, additional access is available from three county highway bridges and two town road crossings.

Spiegleberg Creek T-23-N, R-13-E, Section 28--14; Surface Acres = 0.61; Length = 2.5 miles.

Spiegleberg Creek starts as outlets from Fox Lake and Woodnorth Lake, then flows through Bear Lake and eventually joins the North Branch, Little Wolf River. The stream contains only forage fish; game values are also minimal. Silt and sand are the predominant bottom materials. Two town road crossings provide access. This stream offers very low recreational values.

Thiel Creek T-23-N, R-13-E, Section 28--14; Surface Acres = 6.00; Length = 3.3 miles.

Thiel Creek is a spring fed tributary to the North Branch, Little Wolf River containing brown stained hard water. The stream has little recreational value containing a fishery composed of forage fish. Game values are also limited. Sand is the predominant bottom material with traces of silt and rubble also present. In general, the stream is characterized by having deep wide pools and very little flow. During dry years many pools near the lower end become stagnant. Four town road bridges and one county highway bridge provides access.

Walla Walla Creek T-21-N, R-13-E, Section 27--5 Surface Acres = 27.39; Length = 11.3 miles.

Walla Walla Creek begins as the Jenson Lake outlet, flows through Spencer Lake, and eventually joins Partridge Lake. The stream is fed by McClean Creek, Hatton Creek and Mosquito Creek. The water is clear and hard. Sand is the major bottom type. Cattle watering has caused erosion and stream siltation in several portions. Stream bank fencing and devices to speed the flow of water could remedy these adverse conditions. That portion of Walla Walla Creek between Spencer Lake and County Highway X is rated as class II trout water with brook trout, brown trout, and rainbow trout present. Forage minnows are abundant. The lower portion of the stream contains northern pike, largemouth bass, bluegill, perch, carp, and suckers, but does not provide good sport fishing. Ducks and muskrats utilize habitat found in adjacent wetlands. Access is available by eight town road crossings, five county highway bridges and one federal highway bridge.

Waupaca River T-21-N, R-13-E, Section 11--13; Surface Acres = 197.60; Length = 24.7 miles.

This stream heads in Portage County where it is known as the Tomorrow River. As it crosses the county line it becomes the Waupaca River, an Indian term meaning "tomorrow". Next to the Wolf River, the Waupaca River is the largest stream in Waupaca County. The Waupaca is a tributary of the Wolf River, joining it at Gills Landing. Tributary streams include the Crystal River, Naylor Creek, and several small unnamed creeks. Waupaca Millpond and Weyauwega Lake are impoundments located on this stream. As of 1964 potential sources of

pollution along this stream included the effluents from the Waupaca and Weyauwega municipal sewerage treatment plants and the Weyauwega Dairy. Treatment facilities at the City of Waupaca and Weyauwega Dairy were considered inadequate. That portion of the Waupaca River above U.S. Highway 10 is rated as class II trout water. Brown trout are present. The remainder of the river is classed as a smallmouth bass stream but also contains northern pike, panfish, catfish, and various rough fish. Carp are present in sufficient numbers to be a problem. The stream is scheduled for rehabilitation by chemical treatment during the summer of 1971. Access is available from Gills Landing, a public park in Weyauwega, a parcel of state land adjacent to Highway 10, eight town roads, two county highways, three state highways, and one federal highway. One of the major uses of this stream is that of boating and canoeing. The river is listed in Wisconsin Canoe Trails.

Whitcomb Creek T-24-N, R-13-E, Section 9--8
Surface Acres = 15.04; Length = 7.3 miles.

Whitcomb Creek is a hard water tributary of the North Branch Little Wolf River formed by the junction of the North and South Branches. Whitcomb Creek also receives water from creek 10-5, and the outlets from Campbell Lake, School Section Lake, and Cedar Lake. That portion of stream lying between creek 10-5 and the junction of the North and South Branches is rated as class I trout water with brook trout the dominant fish species present. From creek 10-5 downstream to the range line between R-12-E and R-13-E the stream is class II trout water with brook trout and brown trout present. Below this point warm water species dominate, especially forage minnows. Access is available from three county highway bridges and from three town road bridges. A dam located just upstream from county highway E causes extreme water temperature fluctuations limiting downstream trout water. Portions of the stream are subjected to heavy siltation further limiting trout water.

Whitcomb Creek, North Fork T-24-N, R-12-E, Section 3--6; Surface Acres = 2.91; Length = 4.0 miles.

This stream is a hard water tributary of Whitcomb Creek. The entire creek is class I trout water containing brook and brown trout. Siltation of pools is a factor limiting trout habitat. Most of the stream flows through a wooded area adjacent to agricultural lands. This situation makes the area ideal for wood ducks, mink, deer, and grouse. About one-half mile of stream lies within lands controlled by the Department of Natural Resources. Three town roads provide additional access.

Whitcomb Creek, South Branch T-24-N, R-12-E, Section 3--6; Surface Acres = 3.27; Length = 3.0 miles.

Like the North Branch this stream is a hard water tributary of Whitcomb Creek. It is a class I trout stream containing brook and brown trout. All but about one-fourth mile of stream flows through woodlands thus providing ideal habitat for deer, mink, wood ducks, and grouse. Access to the stream is provided by one county highway and one town road.

Wolf River T-21-N, R-13-E, Section 36--16;
Surface Acres = 706.06; Length = 23.3 miles.

The Wolf River is the largest and probably the most important stream in Waupaca County. The entire county lies within the Wolf River watershed. Flooding occasionally occurs in the bottom lands of this low gradient river. The City of New London, the Village of Fremont and low lying agricultural areas have experienced flood damage. Major tributaries of the Wolf include Pigeon River, Embarrass River, Waupaca River, Little Wolf River, and Walla Walla Creek. There are numerous small tributary streams and bayous. Nearly all of the Wolf in Waupaca County flows through a vast pothole and bayou rich wetland. Muskrats, beaver, otter, mink, deer and other wildlife species abound in the wetlands. The annual harvest of muskrats has been an important economic asset to the community. Large numbers of blue-winged teal, mallards, and wood ducks nest in the marshes. Large numbers of migratory waterfowl also use the area during spring and fall migrations. The Wolf and adjacent wetlands also provide excellent spawning habitat and feeding areas for many species of warm water game fish including northern pike, walleye, perch, smallmouth bass, largemouth bass, bluegill, black crappie, rock bass, pumpkinseed, warmouth, green sunfish, white bass, channel catfish, flathead catfish, bullheads, and sturgeon. The spring spawning migrations of walleye and white bass annually attract thousands of anglers. The walleye run occurs shortly after the ice leaves and therefore the walleye run offers fishermen the first major open water fishing in Wisconsin. Rough fish species include carp, buffalo, burbot, bowfin, various suckers, and redhorse.

Pollution and continued marsh drainage are major threats to the well being of the Wolf River and its recreational values. Marsh drainage destroys valuable fish and wildlife habitat while pollution enriches the water, can cause fish kills, and may make water unsafe for human contact. Both the City of New London and Village of Fremont discharge inadequately treated sewage into the Wolf. In addition to hunting and fishing, boating and canoeing is a popular form of recreation on the Wolf. The Wolf River is part of the Wolf River Water Trail. Access is available from Gills Landing, a county park, two state highway crossings, and two federal highway crossings. About six miles of bank frontage is owned by the State of Wisconsin. Several resorts and boat rental facilities are also present.

Wolf River, Little T-22-N, R-14-E, Section 16--4;
Surface Acres = 59.28; Length = 7.3 miles.

The Little Wolf River is clear, hard water tributary of the Wolf River formed by two large tributaries known as the North Branch and the South Branch. The Little Wolf drains about two-thirds of Waupaca County. The Little Wolf itself is a low gradient stream flowing through a heavily farmed area. The only wetlands present are those

found on the lower end of the stream in a tract of state owned land. One town road, one county highway, and one state highway, provide additional access. The fishery is similar to that of the Wolf River proper. It is classed as smallmouth bass stream. Furbearers, deer, and ducks are common in and near the wetlands at the lower end of the river. Rubble along with sand and gravel are the major bottom material.

Wolf River, North Branch, Little T-22-N, R-13-E, Section 3--1; Surface Acres = 132.79; Length = 31.3 miles.

The North Branch of the Little Wolf River is a hard water river tributary to the Little Wolf River. Major tributary streams include Blake Brook, Whitcomb Creek, Spaulding Creek, Comet Creek, Flume Creek, and Jackson Creek; portions of all are classed as trout streams. All of the North Branch above S-18, T-25-N, R-11-E is a class I trout stream containing a self-sustaining population of brook trout. The remainder down to the NE¼ S-28 T-25-N, R-12-E, is a class II trout stream with both brook and brown trout. Downstream from this point it is classed as smallmouth bass stream and also contains large-mouth bass, rock bass, northern pike, and forage fish. Two warm water impoundments, Big Falls Pond and Manawa Millpond, are located on this stream. Beaver, muskrats, mink, deer, and ducks are quite common on or near the river. Canoeing is very popular. The aesthetic values are very high. About four miles of stream is available to public use by means of a conservation easement purchased by the Department of Natural Resources. Six town roads, seven county highways, and four state highways provide additional access. As of 1964 the Symco Cheese Corp., City of Manawa, and the Little Wolf Rest Home were potential sources of pollution but treatment was considered adequate.

Wolf River, South Branch, Little T-22-N, R-13-E, Section 3--1; Surface Acres = 141.06; Length = 25.3 miles.

The South Branch Little Wolf River begins as the outlet of Peterson Millpond. Above the mill-pond the stream is known as Brown Creek. Sannes Creek and the North Fork are major tributary streams. That portion from the junction of Sannes Creek downstream through S-5, T-22-N, R-12-E, is rated as a class II trout stream. Brown trout predominate. This portion of stream contains excellent trout cover--deep peat pools, rapids, and undercut banks. Stocking is necessary because natural reproduction is not adequate to support the fishery. Cattle's trampling of banks have destroyed much cover. The remainder is rated as a smallmouth bass stream containing a fishery similar to the North Branch. Effluent from the Village of Iola Municipal Sewage treatment plant and from the Scandinavia Creamery Company enter the South Branch. As of 1964 treatment was not considered adequate for protection of the resource. Access is available from six town roads, four county roads, and two state highways.

Wolf River, North Fork, South Branch, Little T-23-N, R-12-E, Section 11--1; Surface Acres = 11.64; Length = 12.0 miles.

North Fork South Branch Little Wolf River is a clear, hard water tributary of the South Branch Little Wolf River. Muck and peat are predominant bottom materials. That portion above the town road crossing in S-14, T-23-N, R-12-E, is rated as a class II trout stream. Stocked brown trout provide the major fishery. Below this point a warm water fishery of northern pike, bass, and panfish is available. Siltation and bank erosion are problems. Several small lake outlets and Engebretson Creek are tributaries. Access is available from one state highway, four county highways, and five town roads.

SUMMARY OF DATA

Basic data for each body of water surveyed, excluding private fish hatcheries and artificial farm ponds, have been summarized to update the available information on Waupaca County's surface water resources. Information extracted from these data is presented in the following pages.

Surface Water Resources

Waupaca County contains 240 lakes and 74 streams having a total surface area of over 8,972 acres. Lakes contain 7,240.5 acres while streams contain some 1,732.4 acres.

Those waters treated as lakes are categorized in Table 9 and include natural lakes, impoundments, and excavations.

Partridge Lake (1,124.3 acres) and White Lake (1,026.2 acres) are the largest and account for nearly one-third of the total lake acreage. Collectively the Chain O' Lakes with 724 acres is the third largest. There are 13 lakes over 100 acres in size containing a total of 4,083.9 acres or 56.4 percent of the total area. Lakes larger than 100 acres comprise only 5.4 percent of the total number and 129 lakes are less than 10 acres in size. These lakes constitute 53.8 percent of the total number but only 5.8 percent of the total acreage. Information concerning size categories of lakes is presented in Table 10.

Rainbow Lake, a part of the Chain O' Lakes, is the deepest lake having a depth of 95 feet. Other fairly deep lakes include Lake 25-13-22 (7,8) at 77 feet, Long Lake and McCrossen Lake (both part of the Chain) at 75 feet, Columbia Lake (part of the Chain) at 72 feet, Bear Lake at 67 feet, Marl Lake at 65 feet, and Skunk Lake at 63 feet. Lakes over 25 feet deep constitute only 21.7 percent of the total number while just over 50 percent are less than ten feet deep. Generally, the shallow lakes less than 10 feet deep fall into three categories--small bog lakes nearing extinction, impoundments that have been subjected to years of siltation, and small marsh and swamp potholes. Many very shallow basins were not surveyed because they are in reality marshes, swamps, or bogs instead of lakes. Also, many small, shallow basins of a vernal nature located adjacent to the Wolf River were not surveyed. If all of these small ponds were included the number of lakes less than 10 feet deep would be over 75 percent of the total number present. Table 11 summarizes depth information for Waupaca County lakes.

The shoreline development factor (S.D.F.) used to describe lakes indicates the extent to which lakes deviate from a circle in surface configuration. An S.D.F. of 1.00 indicates a perfect circle; large numbers indicate greater shoreline irregularity. The S.D.F. of Waupaca County lakes vary from 1.00 (several unnamed lakes) to 5.05 (Traders Bayou). In general, lakes with very irregular shorelines are impoundments or bayous. They often have marshy or swampy shorelines. Lakes with fairly regular shorelines are bog lakes or small kettle lakes of glacial origin. A listing of shoreline development factors can be found in Appendix I.

The 74 streams have a total combined length of over 340 miles with an average width of 66 feet and an average length of about five miles. The Wolf River is the largest stream accounting for about 41 percent of the total stream acreage in the county. Table 12 gives further details on the size categories of Waupaca County streams.

Water Quality

General water quality data as related to various surface water categories can be found in Table 13.

Total alkalinity; an expression of available carbonates, bicarbonates, and hydroxides recorded in milligrams per liter of water; is one factor used in the measurement of water fertility. With few exceptions the waters of Waupaca County are fertile and classed as medium hard to very hard. Very soft to soft water is found in a few lakes, most of which are located southwest of the City of Waupaca. On the basis of alkalinity, streams and impoundments are generally harder and more fertile than are natural lakes. The reason for this is obvious since streams and impoundments are encompassed by larger watersheds than are the natural lakes and receive more nutrient rich runoff waters than do the lakes. Fertility classifications of Waupaca County waters are shown on Figure 13.*

The pH (hydrogen ion concentration) values recorded for Waupaca County waters are quite diverse--from 5.9 to 9.6. Most waters are alkaline with pH values over 7.0.

The specific or electrical conductance is a measurement reflecting the total dissolved electrolytes present in the water. Specific conductance is expressed as mmhos per centimeter at 77 degrees Fahrenheit. When excessive amounts of dissolved acids, alkalies, or salts enter water they may be detrimental or lethal to aquatic life. Specific conductance offers a quick and convenient method of determining the degree of electrolyte pollution. In Waupaca County no waters were found to have excessive specific conductance readings.

*Map placed at the end of narrative.

Table 9. Categories of Waupaca County lakes as treated in the inventory

Category	No.	Percent of Total Lakes	Acres	Acres	
				Percent of Total Lakes	Percent of Total Waters
Natural Lakes	199	82.9	4,799.7	66.3	53.5
Excavations	14	5.8	38.5	0.5	0.4
Impoundments	27	11.3	2,402.3	33.2	26.8
	240		7,240.5		80.7

Table 10. Size classes of Waupaca County lakes

Average Class	No.	Percent of Total Number	Acreage	Percent of Total Acreage	Shoreline (Miles)	Percent of Total Shoreline	Public Frontage (Miles)	Public Frontage (Percent of Total)
Less than 5	100	41.7	226.1	3.1	24.77	12.0	1.53	20.1
5-- 9.9	29	12.1	196.8	2.7	15.38	7.5	0.83	10.9
10-- 19.9	51	21.3	727.8	10.1	38.18	18.6	2.00	26.3
20-- 49.9	34	14.2	1,069.8	14.8	42.99	20.9	2.88	37.8
50-- 99.9	13	5.4	936.1	12.9	28.82	14.0	0.10	1.3
100--199.9	7	2.9	998.1	13.8	21.62	10.5	0.19	2.5
200--499.9	4	1.7	935.3	12.9	18.28	8.9	0.07	0.9
500 and above	2	0.8	2,150.5	29.7	15.78	7.7	0.01	0.1
	240		7,240.5		205.82		7.61	

Table 11. Depth classes of Waupaca County lakes

Depth class (feet)	No.	Percent of Total Number	Area (Acres)	Percent of Total Area	Shoreline (Miles)	Percent Total Shoreline
Less than 5	50	20.8	442.1	6.1	21.32	10.4
5--10	72	30.0	2,214.7	30.6	57.54	28.0
11--15	35	14.6	2,293.3	34.4	52.17	25.3
16--20	14	5.8	180.2	2.5	9.75	4.7
21--25	17	7.1	284.6	3.9	16.72	8.1
26--50	37	15.4	726.4	10.0	27.69	13.5
51-100	15	6.3	899.2	12.4	20.63	10.0
	240		7,240.5		205.82	

Table 12. Size classes of Waupaca County streams*

Acreage Class	No.	Percent of Total Number	Acreage	Percent of Total Acres	Length (Miles)	Percent Total Length	Ave. Width
Less than 5	46	65.7	89.75	5.2	107.7	32.0	7
5-- 9.9	7	10.0	51.19	3.0	25.3	7.5	17
10-- 19.9	7	10.0	97.62	5.6	51.4	15.3	17
20-- 49.9	4	5.7	108.68	6.3	32.3	9.6	32
50-- 99.9	1	1.4	59.28	3.4	7.3	2.2	67
100--199.9	4	5.7	619.81	35.8	89.3	26.5	75
200 and larger	1	1.4	706.06	40.8	23.3	6.9	250
	70		1,732.39		336.6		66

*Four streams with incomplete data were not included in this table.

Table 13. Water fertility characteristics for Waupaca County lakes and streams

Water		Total Alkalinity* (Mg/liter)	pH*	Specific Conductance (μmhos/cm @ 77°F)
	$\bar{x}$ =	123	7.9	252
Natural lakes	# =	199	199	199
	R =	4-253	5.9 - 9.6	22-641
	$\bar{x}$ =	114	8.1	230
Excavations	# =	14	14	14
	R =	22-197	6.9 - 8.7	71-382
	$\bar{x}$ =	164	8.0	322
Impoundments	# =	27	27	27
	R =	87-230	8.4 - 7.2	159-471
	$\bar{x}$ =	200	8.0	389
**Streams	# =	72	72	72
	R =	45-292	6.8 - 8.5	184-540

$\bar{x}$ = Average

= Number

R = Range

**Two streams with incomplete data were omitted

Detailed analysis of water samples collected from selected Waupaca County lakes are presented in Table 14. The chemical characteristics recorded are the ranges that normally would be expected in waters lying within the igneous rock and Cambrian sandstone formations. Nitrogen and phosphorus levels are generally sufficient to produce luxurient aquatic plant growths providing other factors (substrate, water clarity, etc.) conducive to plant growth are present. The ions indicative of pollution (sodium, potassium, chloride, sulfate) occur in slightly higher average concentrations than would normally be expected. Since many of the chemicals used in agriculture contain high levels of these ions, it is believed that runoff and leeching carry many of them into the surface waters.

Wetland Resources

A current and complete inventory and classification of wetlands has not been prepared for Waupaca County. For this report a generalized map of wetlands has been compiled from U.S.G.S. topographic and planimetric maps. (Figure 14a).*

About 18.7 percent of the county or over 89,000 acres is composed of wetlands as based on information collected in 1937 (Wisconsin Crop Reporting Service, 1954). Of this total marshes account for some 38,500 acres and swamps for over 51,000 acres. Chief swamp types are hardwood swamps (black ash and elm) and conifer swamps (tamarack). Many swamps have black spruce, and this area marks the southern boundary of its range. Sedge, tag alder, and grass are the most common types of marsh vegetation. Some leatherleaf bog and cattail marsh are also present. Commercial cranberry marshes were once common but none are presently operating in the county. (Because of marsh drainage continuously occurring over the years the wetland data may not accurately represent conditions as they exist today).

Swamps are scattered all over the county but the towns of Wyoming, Mukwa, and Matteson have the most swamp land acreage. Towns in the southeast lead in marsh land acreage. Swamps and marshes adjacent to the Wolf River represent the largest wetland complex in the county.

The Wolf River marshes are remnants of Later Lake Oshkosh, a vast glacial lake that once covered about one-fifth of Waupaca County. Natural drainage of Later Lake Oshkosh following the retreat of the Wisconsin Glacier left a complex of swamps and marshes. Several thousand years later man attempted to drain the marshes and use the rich land for farms, the Wolf River marshes being no exception. To preserve at least a portion of the remaining wetlands and keep them in a natural condition the Department of Natural Resources has obtained control of approximately 2,500 acres of the Wolf River wetland complex. The areas owned by the Department are designated as public hunting and fishing areas.

Competition for marshlands is keen. To many people; namely farmers, some federal agencies, and real estate developers, a marsh or swamp is a costly wasteland that should be filled or drained for farms and home sites. But for fish and wildlife wetlands are important in providing food, cover, and nesting areas for waterfowl and shore birds; habitat for aquatic furbearers; and spawning areas for fish. In addition, wetlands help reduce runoff, soil erosion, control floods, and improve water quality. A living wetland is viewed as a very valuable natural resource.

Wildlife production expected from Waupaca County wetlands varies considerably depending on the type of wetland and the species of wildlife being considered. Pheasants, rabbits, ruffed grouse, ducks, coots, and deer are some of the wildlife animals that use Waupaca County wetlands as breeding areas. Of these only the production of ducks and coots is well documentated. In Waupaca County 13 to 38 pairs of ducks per 100 acres of occupied wetland produce 42 to 124 ducklings per 100 acres per year. Since 12 to 18 percent of all wetlands are "occupied" total annual production would be from 4,500 to 19,900 ducks or from 4,500 to 17,300 coots (Jahn and Hunt, 1964). These production figures are based on the total 1939 wetland area of 89,000 acres. Actual production today may be considerably less because of wetland loss and destruction over the years. Production of waterfowl in Waupaca County is low to average when compared with the entire state and very low when compared to top producing areas such as the pothole regions of Canada or the Dakotas. Fall migration concentrations for most duck species are generally low in Waupaca County wetlands when compared to other areas of Wisconsin.

Fishery Resources

Fishery composition of the county's various surface waters is depicted on the resource maps (Figures 14a and 14b).*

*Maps placed at the end of narrative.

Table 14. Chemical analysis of water from some Waupaca County lakes

Lake	Date of Analysis	pH	Total Alkalinity $CaCO_3$ (mg/l)	Specific Conductance (mmohs/cm)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K (mg/l	Fe Total (mg/l)	NO_3-N (mg/l)	PO_4 Total (mg/l)	PO_4 (Dissolved) (mg/l)	Cl (mg/l)	SO_4 (mg/l)
Bear	7-12-60	7.9	169	406	35.0	19.0	2.1	3.0	0.04	0.40	0.12	0.02	4.2	14.0
Chain	9- 7-67	7.9	163	335	22.6	23.2	3.1	1.1	0.03	0.19	0.10	0.03	4.6	15.7
Kinney	4-17-64	7.8	183	355	20.8	21.4	2.5	1.3	0.05	0.03	0.07	0.01	5.3	9.1
Long	7-12-60	8.1	170	425	33.0	20.5	2.0	0.9	0.04	0.93	0.12	0.02	2.1	3.0
Long (24-11)	8- 1-62	6.7	38	69	5.0	1.6	0.7	0.5	2.00	0.35	-----	0.02	2.0	5.1
Mirror	7-12-60	8.1	174	413	31.0	19.0	4.7	4.1	0.04	0.17	0.14	0.02	10.6	8.5
Round	7-12-60	8.6	145	324	25.0	20.5	1.9	1.2	0.05	0.65	0.08	0.02	4.4	5.0
School Section	4-17-64	7.6	179	408	43.2	21.6	2.3	3.2	0.06	0.04	0.31	0.02	4.0	1.0
Silver	7-12-60	7.1	67	161	13.5	7.5	1.3	3.7	0.12	0.27	0.14	0.02	4.2	2.0
Spencer	7-12-60	8.5	168	355	30.5	17.5	1.7	1.3	0.04	0.15	0.17	0.02	2.0	11.0
White	7-12-60	9.3	112	252	22.0	13.5	2.7	1.7	0.08	0.25	0.10	0.02	3.9	9.0
Average for County	-----	8.0	143	318	25.6	16.8	2.3	2.0	0.23	0.31	0.14	0.02	4.3	7.6
Average for Igneous Rock Province	----	6.9	31.2	71.8	12.0	5.1	1.7	1.0	0.27	0.10	0.13	0.03	1.5	7.7
Average for Sand-	----	7.6	81.0	188.1	18.8	10.6	2.6	1.6	0.32	0.22	0.37	0.09	3.2	8.5

(after Poff, 1961, and Poff, 1967)

Approximately 71 percent of the named lakes support a significant fishery. Largemouth bass and northern pike are the most common game fish species present. The most common panfish are bluegill, perch, and bullhead. Trout of various species are found in about 12 percent of the named lakes. Carp, a major problem species, are found in about 11 percent of the named lakes. The Chain O'Lakes contain muskellunge. Winterkill occurs in 37% of the named lakes in varying frequency and severity. Slightly more than 7 percent contain no significant fish population. Figure 15 indicates the frequency of occurrence of the more common fish species found in named lakes (note: for the purpose of this table the Chain O'Lakes is considered one lake). Of the unnamed lakes only about 22 percent contain a significant fishery, notably either trout or bass--panfish species. Eighty-eight percent are winterkill lakes that contain no fishery or are lakes whose fishery has not been determined.

The fishery of Waupaca County streams is quite diverse. Trout are found in nearly 220 miles of stream. The larger streams and rivers contain a wide range of warmwater species. The Wolf, for example, is famous for its walleye, sturgeon, and white bass runs. Crystal River, Embarrass River, Little Wolf River system, Pigeon River, Waupaca River, and Wolf River are classed as smallmouth bass streams. A number of smaller streams support only forage species.

Access and Public Lands

During field investigations all lakes inspected were categorized by degree of public access as shown on Figure 16.* Categories used were improved access, unimproved or difficult access, no access, or wilderness. Of the 242 lakes inspected only 38 had improved public access facilities. Unimproved public access sites were found on 22 lakes. There were 138 lakes, 67 of them named, without public access sites. Of these, 30 were accessible by navigable water. Fifty lakes, nearly all of which are located on private land, were classed as wilderness lakes. Generally, the lakes with no access or just unimproved access were the smaller less important lakes in the county. Most of the large, highly developed lakes have some means of public access.

Public parks provide access to several lakes. City parks are located on seven lakes, four lakes have county park access, and six lakes are in state parks.

Approximately 35 miles of stream are owned or controlled by the Department of Natural Resources which includes ownership on the streams or portions thereof. In addition to public lands access is available to most streams from town, county, state, or federal highways.

*Map placed at the end of narrative.

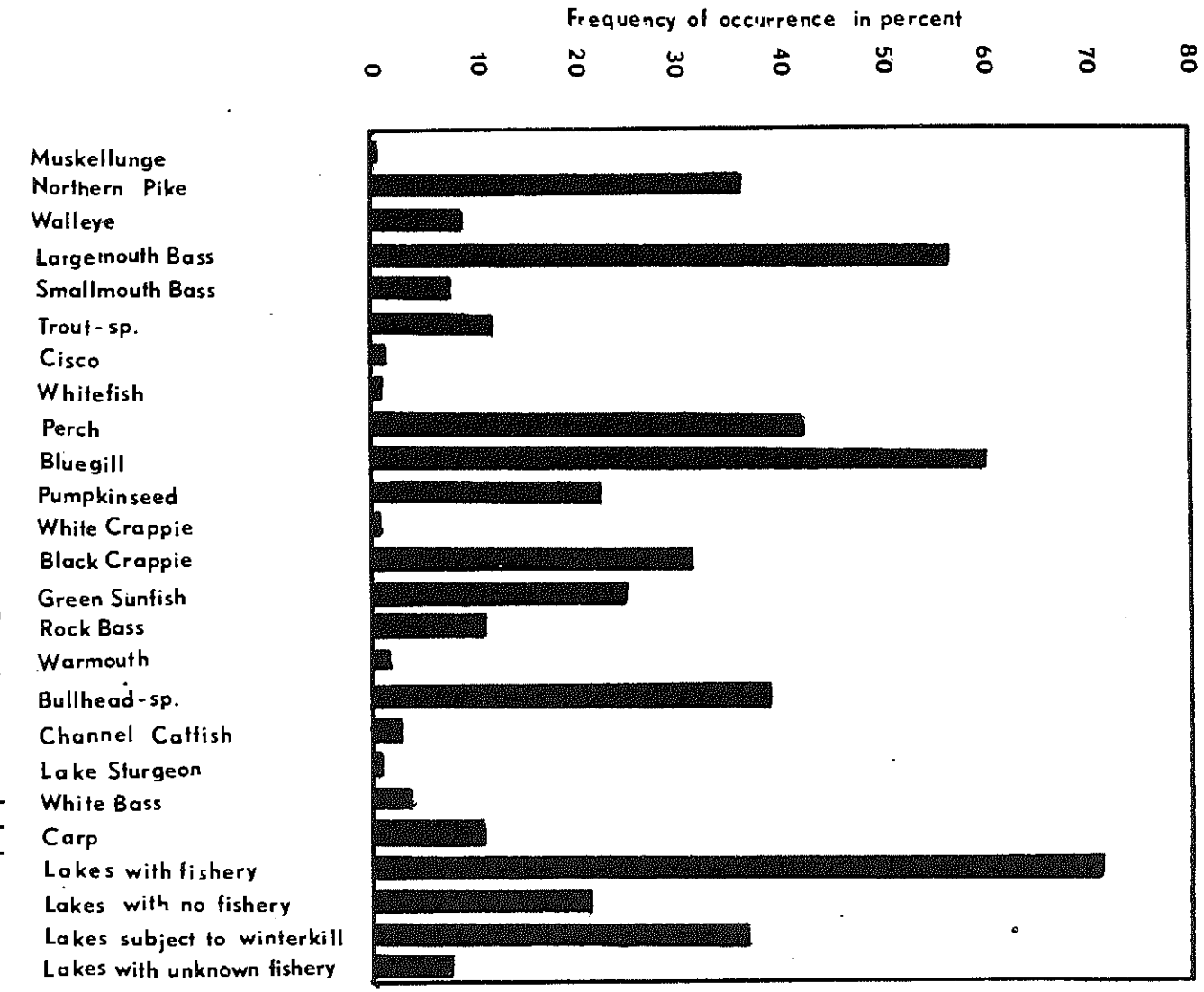


Fig. 15. Fish commonly found in Waupaca County named lakes

PRESENT AND POTENTIAL USES OF SURFACE WATERS

One of the major functions of a general waters inventory is to obtain sufficient data to provide an insight into the present and potential use levels afforded by the described waters. A brief discussion of the present and potential recreational activities carried out on Waupaca County waters is contained in this section.

Fishing

Records of fishing license sales in Waupaca County from 1960 through 1968 reflect statewide trends. During this time period annual resident license sales have fluctuated between 10,000 and 12,200, figures considerably higher than most nearby counties. Nonresident license sales increased sharply during the nine year period. The number of nonresident licenses sold rose from about 4,500 in 1960 to nearly 13,000 in 1968. The tremendous increase in nonresident license sales is indicative of the fine surface water resources present in Waupaca County. Figure 17 reflects the fishing license sale trends in both Waupaca County and the State of Wisconsin.

As mentioned in a previous section, the lakes and streams of Waupaca County provide a wide variety of fish and fishing. Generally, the larger lakes which contain the best fisheries and the best public access facilities support the heaviest lake oriented fishing pressure. The Wolf River supports the county's most important fishery and supports the most fishing activity of any water in the county. The second most important fishery, from a biological standpoint at least, is trout. The importance of the Wolf River and the trout fishery is substantiated by the fact that nearly all Bureau of Fish Management acquisition projects are directed to preserving these fisheries.

If the present trend toward increased use of surface waters continues it is evident that existing lakes with present limited use will have to be managed to provide additional area for water based recreation. Increased fisheries may be provided by annual stocking of panfish in winterkill lakes having suitable water quality and public access. Many small natural lakes could be managed this way. Fish rehabilitation by chemical treatment could be increased to improve conditions on lakes that have inadequate or unbalanced fish populations. In the past, such projects have been conducted on seven Waupaca County lakes. At least seven additional lakes are being considered for treatment with fish toxicants in the near future.

Boating

The 1970 boat registration records for Waupaca County list 3,937 outboards, 18 sailboats, and 53 inboards, for a total of 4,008 boats. There are 721 registered as fleet boats. Generally, these boats are for rent to the public.

The intensity of boating use for pleasure, water skiing and fishing is concentrated around the larger lakes having adequate launching facilities and access. Aerial counts of active boats conducted on July 4, 1964, are indicative of boat usage on a particular lake and reflect the importance of lake size, water quality, and aesthetics when discussing boating characteristics (Table 15).

As is characteristic of other recreational demands, boating and its allied activities are rapidly increasing. Accelerated trends in outboard motor sales closely parallel growing leisure time and increased average income. The increase in number and size of boats is expected to continue. The number of boats and the spatial requirements for associated activities--fishing, sailing, speed boating, water skiing, and sight-seeing-- are resulting in use conflicts and overcrowding, especially on waters such as the Chain O'Lakes and the Wolf River. The Waupaca County Board realizing that problems do exist, adopted an ordinance limiting boating speeds and water skiing hours on the Chain O'Lakes, Stratton Lake and Spencer Lake. Less restrictive regulations have been applied to all lakes in the Towns of Farmington and Dayton (Waupaca County 1968).

The need for adequate boating space can be emphasized by the following examples. The minimum turning radius for a boat traveling 15 miles per hour is often in excess of 150 feet. A water skiing unit, consisting of boat and skier, will generally be about 65 feet long requiring a much greater turning radius. On moderate size lakes (20-50 acres) speeds in excess of 20 miles per hour cannot be maintained for more than a few seconds. A round lake would have to be over 100 acres to take more than a few minutes to cross at 30 miles per hour.

The limited number of lakes over 100 acres in size (13) will require close use evaluation to assess potential dangerous use conflicts and to determine the maximum public use these lakes will be able to accommodate. It is entirely possible that the county boating ordinance now in effect will have to be extended to other lakes.

Swimming

Over half of the people utilizing surface water resources engage in beach activities--swimming, bathing, wading, or sunbathing. Beach uses and demands are expected to increase nearly 50 percent by 1980 (Cohee 1969). Waupaca County contains very few developed beach areas. Nearly all of the large towns have at least one municipal beach and a few of the private campgrounds have beach facilities. However, these beaches are often overcrowded and are not adequate to meet future demands. More beaches, both public and private, may have to be developed. If municipalities of Waupaca County fail to meet demands then private enterprises should be encouraged to develop beaches open to the public on a fee basis.

Table 15. Observations of boat use on six Waupaca County lakes

Lake	Area	Number of Active Boats	Available Acres Per Boat
Chain O'Lakes	725	114	6
Crystal Lake	33	1	33
Shadow Lake	42	2	21
Stratton Lake	87	6	14
Weyauwega Lake	274	2	137
White Lake	1,026	6	171

Taken from Bureau of Law Enforcement Boating Activity Forms. July 4, 1964

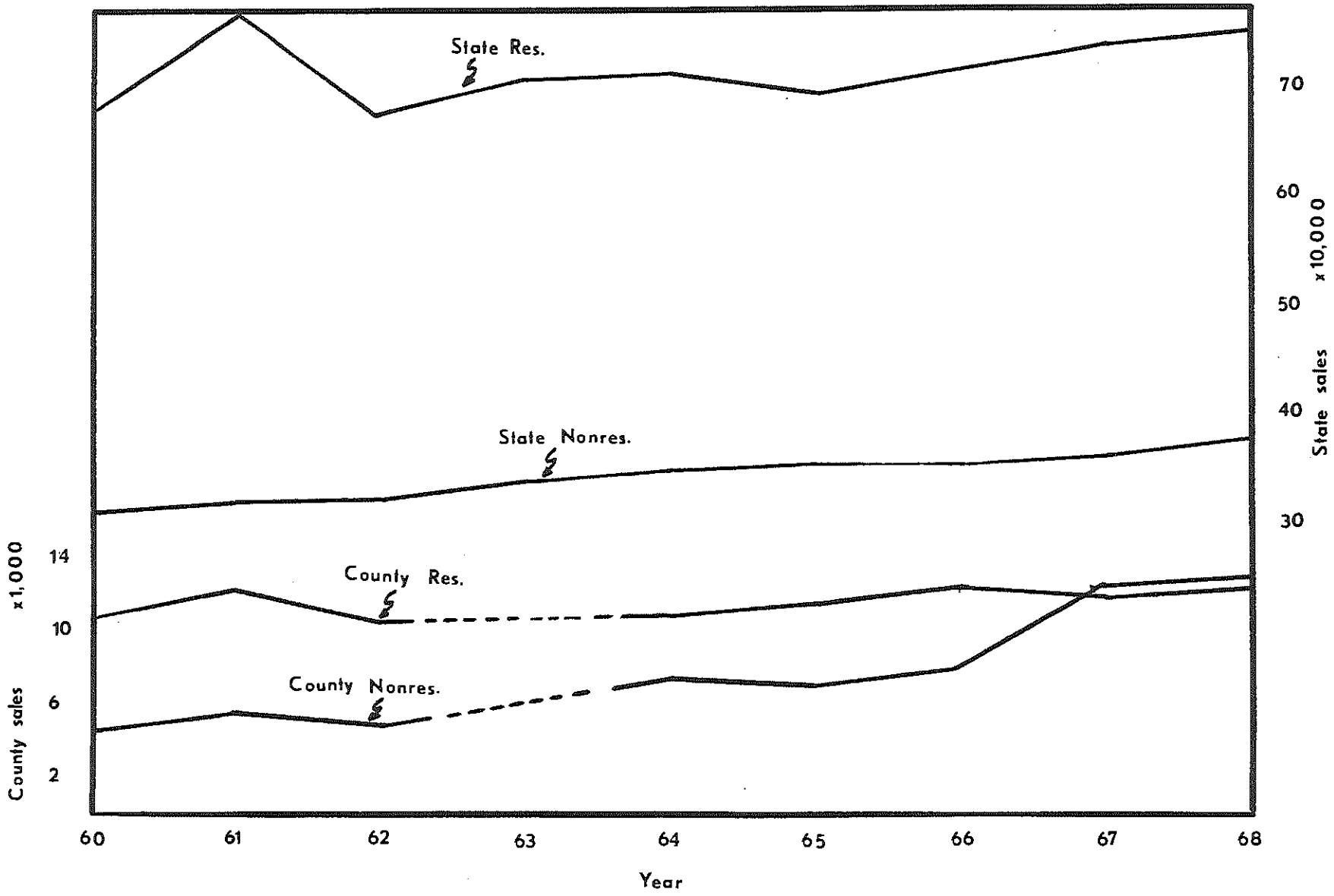


Fig. 17. Fishing license sales for the state and county

The amount of water frontage required for swimming is less than most other facilities require but considerable backland is needed for sunbathing areas, game fields, picnic grounds, and parking facilities, if optimum use is to be achieved. Municipal park planners estimate that five acres is the minimum size for an adequate facility in a small community while regional planners use ten acres per 1,000 persons as a guide when planning a beach facility.

Clear, clean water with a firm sandy bottom, and the absence of alga blooms and dense weed growths are desirable characteristics of a beach or swimming facility. Many lakes in Waupaca County have these characteristics. Lack of public lands limits the development of public beaches but should have no adverse effects on private beach development.

Camping

Waupaca County contains 13 developed campgrounds of which seven are publicly owned and six are private enterprises. Hartman's Creek State Park is the largest public park area providing camping facilities. Circle J Ranch, a private campground contains 150 units making it the largest in the county. Nearly all of the campgrounds are near some type of surface water. About half offer swimming and fishing facilities. Camping facilities are adequate to handle present demands but may need expansion to handle projected future demands.

Hunting

Waupaca County is known throughout the Midwest for excellent deer hunting. For the past several years it has led all Wisconsin counties in number of deer taken during the deer gun season. The wetlands along the Wolf often provide excellent duck hunting. Many years ago, White Lake was famous for waterfowl hunting. In addition to deer and waterfowl Waupaca County contains excellent squirrel and ruffed grouse habitat.

Hunting opportunities in portions of the county are sometimes restricted by the posting of privately owned lands. Two large public hunting grounds are being developed in wetland areas adjacent to the Wolf River. A large block of leased land near Marion is also being developed as a public hunting ground. Most public fishing areas owned by the State of Wisconsin are also open to public hunting. For those who prefer a more controlled style of hunting, Waupaca County has six licensed shooting preserves encompassing about 1,100 acres of land. This type of hunting will probably increase as more and more land owners prohibit hunting.

During field investigations it was found that nearly all lakes and streams and adjacent wetlands supported some type or types of game animals. Waterfowl were most common followed by muskrats, deer, grouse, squirrels, and mink.

Aesthetics

"Aesthetics" is defined as the study and philosophy of beauty, a fairly abstract definition at best. What one individual may find innately beautiful another may find totally repugnant. For this report aesthetics is considered to be the attraction of the eye and ear to nature's ever changing panorama of sights and sounds. Most people associate aesthetics with water, hills, trees, and rocks, all of which abound in Waupaca County. Small bog ringed wilderness lakes, morainic hills, swift streams, marshes, and rock outcroppings are a few of Waupaca County's natural attributes which are aesthetically satisfying. All lend variety to the landscape and impress the observant passerby that nature is truly a most diverse and talented artist.

Shoreland and Homesite Development

Home and cottage development and establishment of private hunting and fishing areas have increased sharply over the past few years. This trend is not likely to reverse itself. Choice property on larger lakes offering multiple recreational opportunities is becoming scarce. The Chain O'Lakes for example, is one of the more popular lakes exhibiting high density shoreland occupancy.

As lakeshore frontage increases in value many people tend to choose alternate sights affording a lesser degree of multiple use opportunities. The lure of water is still prevalent though. Subdivisions near the better lakes and streams are becoming more numerous each year. Recently land developers have been acquiring frontage on wilderness or near wilderness lakes for subdivisions. This activity downgrades aesthetic quality of many areas. Development has not yet reached saturation limits on many waters, especially in the northwest portion of the county.

Future development on county waters should be governed by a wise resource management plan. Among the items to be included in such a plan are:

1. Insurance that existing water quality is not lessened.
2. Provisions for the protection of innate aesthetic qualities.
3. Insurance that the needs of fish and wildlife are protected.
4. Insurance that adequate public access will be provided.

Segments of wild shore on each body of water should be preserved to protect those areas vital to the maintenance of aesthetic values and fish and wildlife values--the attributes which lure people to the lakes and the attributes most often destroyed by man.

Farm Ponds and Private Fish Hatcheries

Farm ponds and private fish hatcheries have not been mentioned in this report but because of their impact on the overall water resource a discussion is in order.

In 1970, 59 private fish hatcheries were licensed and contained over 190 ponds encompassing about 100 acres of water. Nearly 40 percent of the ponds are licensed as commercial hatcheries so that the owners can lawfully sell fish produced. The remainder are noncommercial hatcheries. Fish cannot be sold from these ponds but the license holder has the right to stock fish, set seasons and establish bag limits on all licensed ponds, regardless of existing state fishing laws. Location of private fish hatcheries is shown on the fishery resource map (Figure 145).*

Licensing of private fish hatcheries is provided by the Wisconsin Statutes and they are regulated by the Department of Natural Resources. Navigable streams, lakes, ponds, and springs cannot be licensed if, after an investigation and hearing, it is found that such licensing will be detrimental to public interests and rights. No single license shall include more than 160 acres of contiguous land.

There are 137 farm ponds containing about 71 acres of water area present in Waupaca County. Most are used for either irrigation, stock watering, fishing, hunting, or wildlife areas. A carefully planned and developed farm pond can be a valuable asset but frequently farm ponds, because of poor design, construction, or location, actually detract from the value of adjacent properties. Because of the small size (generally less than one-half acre) farm ponds should be used for only one basic purpose. A fishing pond deteriorates rapidly if it is subjected to repeated use as a cattle watering pond.

The interest shown in farm ponds by private landowners is due largely to the fact that most ponds are constructed with financial and technical assistance from various agencies of the United States government. These agencies also provide assistance to persons wishing to manage a pond for a specific purpose, fishing for example.

In order to protect public waters from degradation often caused by poorly planned farm ponds, a series of laws has been enacted requiring that under certain conditions permits must be obtained for pond construction. No pond can be built within 500 feet of a navigable lake or stream, unless a permit has been issued. If a pond may interfere with public rights a hearing will be held to discuss the vital issues. A permit will not be granted if the pond will affect public use of a navigable lake or stream.

*Map placed at the end of narrative.

MAJOR SURFACE WATER PROBLEMS

Specific problems related to individual waters have been discussed in narratives of named lakes and streams. Significant problems faced more generally in the county are discussed in the following paragraphs.

Pollution

In 1964 the State Committee on Water Pollution (now the Division of Environmental Protection of the Department of Natural Resources) identified 16 sources of potential industrial and municipal pollution. Of these, nine were discharging inadequately treated wastes. The Waupaca River, Little Wolf River, and Wolf River were the principal recipients of inadequately treated wastes. The 1964 surveys were followed by the issuance of orders requiring polluters to install adequate treatment facilities. The Division of Environmental Protection periodically resurveys the areas to determine compliance of the orders and to determine if any new sources of pollution are present. To date a report on the latest survey is not available.

Cities and industries are not the only sources of pollution. Poor agricultural practices, such as undesirable manure disposal, use of excess fertilizer, misuse of pesticides and herbicides, and lack of soil conservation practices, can decrease the water quality of surface waters and underground water supplies through runoff and seepage. The magnitude of the agricultural problem can be seen in fertile silt laden mill ponds and impoundments scattered throughout the county.

Seepage from septic tanks (or in some instances direct discharge of human waste) increases the eutrophication (nutrient enrichment) process in surface waters. The end result is the excessive growth of undesirable aquatic plants and generally a less desirable fish population.

Chemicals have been applied to several lakes to control rooted aquatic vegetation and algae but the benefits derived are of short duration. The real solution lies in preventing the eutrophication process from accelerating. The cooperation of everyone in the county is necessary in this effort. Industries, local communities, farmers, and cottage owners must all meet the challenge and be willing to preserve our water resources.

Lack of Access

Fifty-eight percent of Waupaca County's lakes have no means of public access. While most of these lakes are small and often contain no significant fishery they do represent a virtually untapped resource that could, if the demand becomes great, be made available to the public through the development of public accesses. Special steps should be taken to insure that access development on small lakes does not destroy their inherent beauty and serenity. State assistance is available to local governments wishing to develop public access sites.

Several large lakes, White Lake for example, have inadequate public access facilities. Existing access sites should be expanded or new sites developed in order to make the resource readily available to the public.

Twenty-one percent of the lakes are classified as wilderness lakes. To dedicated ecologists and naturalists wilderness lakes are things of unique beauty and value. Their enthusiasm and delight cannot be shared with the general public however, because most wilderness lakes are located on private lands. Because of high land values it is doubtful that many wilderness lakes will be open to the public. Counties and townships are not anxious to spend relatively large sums of money to provide access to areas that will be used by relatively few people.

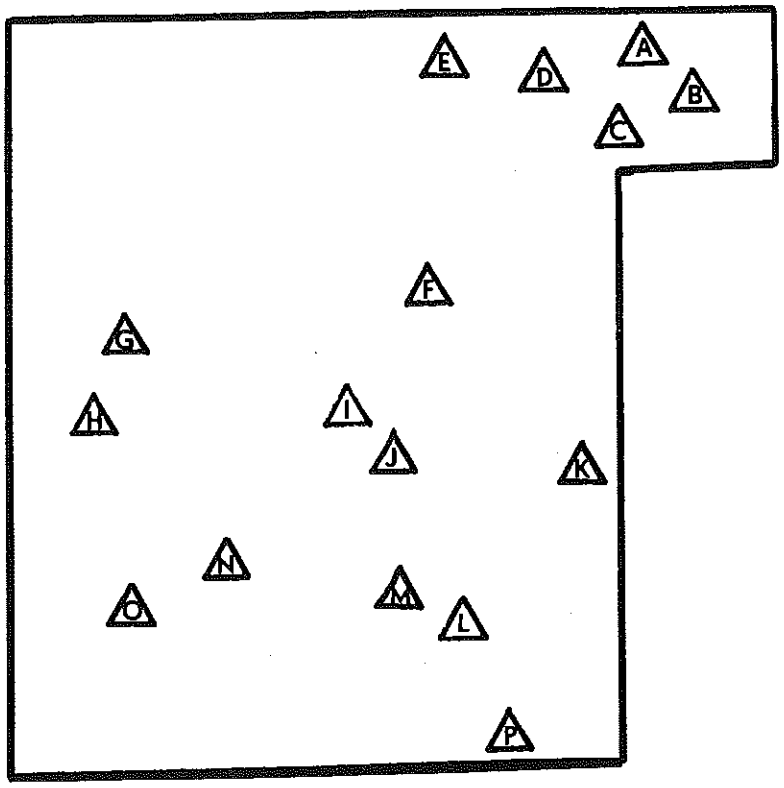
Flooding

Flooding occurs along the Wolf River and naturally is of great concern to property owners. Each spring melting snow and rains raise the water levels adversely affecting many cottages and cropland located in the floodplain. Although these floods cause relatively light property damage they invariably raise complaints from those who mistakenly developed there in the first place. Flood damage along the Wolf could be reduced considerably if people located structures above the floodplain. Proper zoning and development offer the best flood damage control techniques. According to figures from the United States Geological Survey (Olcott, 1968) a major flood can be expected on the Wolf once in every seven years. Very severe floods are expected once in fifty years. In areas other than the Wolf River basin flooding is not a major problem.

Wetland Drainage, Erosion, and Siltation

Drainage of marshes and other wetlands is one of the factors contributing to the flood flows of several streams, especially the Wolf. When a marsh is drained it is no longer able to store large quantities of excess runoff and as such contributes to increased runoff rates. Marsh drainage is also responsible for the destruction of valuable fish and game habitat (see section on "Wetland Resources"). Strict enforcement of state laws and county zoning ordinances may be able to reduce or eliminate environmental destruction such as this.

Fig.18. Potential sources of pollution in Waupaca County



(after Com. on Water Pollution, 1964)

Key to Pollution Map (Fig. 18)

Ref.	Source	Type	Treatment	Affected Waters
A*	Village of Embarrass	Municipal Waste	Primary--disinfected effluent	Embarrass River
B	Matteson Cheese and Butter Company	Whey and Associated Waste	Seepage ditches	Embarrass River
C	City of Clintonville	Municipal Waste	Activated sludge	Pigeon River
D	Shawano Canning Company	Liquid Canning Waste	Spray Irrigation	Pigeon River
E*	City of Marion	Municipal Waste and Cheese Factory Wastes	Primary--disinfected effluent	N. Br. Pigeon River
F	Symco Cheese Corp.	Cheese Wastes	Ridge and furrow	N. Br. Little Wolf River
G*	Village of Iola	Municipal Waste and Dairy Plant Wastes	Primary--disinfected effluent--pre-aeration	S. Br. Little Wolf River
H*	Scandinavia Creamery Company	Cheese Waste	Septic tank--holding pond	S. Br. Little Wolf River
I	City of Manawa	Municipal Waste and Dairy Wastes	Activated sludge	N. Br. Little Wolf River
J.	Little Wolf Rest Home	Human Waste	Septic Tank--soil absorbtion	N. Br. Little Wolf River
K*	City of New London	Municipal, Dairy, Canning Wastes	Trickling Filter	Wolf River
L	City of Weyauwega	Municipal, Dairy, Meat Plant Wastes	Activated sludge	Waupaca River
M*	Weyauwega Dairy	Dairy Waste	None	Waupaca River
N*	City of Waupaca	Municipal and Paper Wastes	Primary--disinfected effluent	Waupaca River
O*	Grand Army Home	Human Waste	Sedimentation--land irrigation	Chain O'Lakes--Crystal River
P*	Village of Fremont	Human and Industrial Waste	None	Wolf River

*Regarded as inadequate treatment for present (1964) needs.

Nearly every stream--big and small--in Waupaca County has an erosion problem of some magnitude. Erosion, caused largely by poor farming practices, is responsible for much fish habitat destruction and contributes to the siltation of small impoundments. Many impoundments and millponds, for years settling basins for tons of silt, presently resemble deep marshes. Recreational values are not high for such waters.

Fishery Problems

Winterkill, slow-growing panfish, and carp are major problems encountered in the fish management of Waupaca County waters. Almost all lakes and ponds smaller than ten acres experience annual complete winterkill. Several larger lakes are subject to partial winterkill during severe winters. Installation of air guns and air coils, instruments designed to eliminate winterkill by circulating lake water, may be desirable on larger heavily used lakes subject to winterkill.

The improvement of existing fisheries often warrants removal of undesirable species such as carp or slow-growing panfish. The application of a fish toxicant is often the most economical method of fish removal. Several lakes have been treated primarily for the removal or reduction of slow-growing panfish populations. Success of these projects has varied. Much of the Waupaca--Crystal River system is scheduled for chemical treatment to remove carp within the next few years. Generally, carp removal projects are very successful.

Prime trout habitat on some streams has been damaged or eliminated through unwise use of the resource. Damming or draining headwater springs reduces water quality while pasturing and other poor agricultural practices has promoted increased fertility, erosion, and siltation.

OVERVIEW

The lakes, streams, rivers, and impoundments are the basic elements vital to the recreational potential of Waupaca County. As use demands confront these resources at ever accelerating rates the integrity of the waters will depend on public attitude and conscience. Wise planning must precede any future developments of these resources in order to assure optimum use and maximum protection.

As lake and stream use intensifies use conflicts will take on greater magnitude. State, county, and local ordinances will have to be enacted to keep conflicts minimal. A county ordinance presently applied to a few select waters should be expanded to include other waters. Items that should be included in such ordinances include restrictions on speed limits, water skiing hours, and establishment of fishing and swimming zones.

Major lakes in the county providing multiple use opportunities have public access. As needs increase, acquisition of new access on secondary waters and improvement of access and parking facilities at existing sites will be required. The need for additional access must be reconciled with quality considerations.

The possibility of pollution presents a constant threat to surface waters everywhere. While problems and consequences of pollution have been recognized the need to develop and implement adequate techniques to treat industrial, municipal, agricultural, and domestic wastes is necessary. Zoning and shoreland planning offer some potential for improving existing conditions. It is necessary to amplify efforts and encourage innovations aimed at pollution prevention in order to maintain the quality, recreational value, and use opportunities extended by the county's surface water resources.

Planning is the key to the future of Waupaca County surface waters. Building a wise use plan and following it will assure that Waupaca County's lakes and streams remain in a natural and aesthetic condition--items future generations will increasingly search for.

ACKNOWLEDGEMENTS

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APPENDIX I. Physical and Chemical Characteristics of Waupaca County Lakes

Name	Location T-N	Location R-E	Section	Area (acres)	Length (miles)	Width (miles)	Known Max. Depth (feet)	% Depth Over 20 feet	% Depth less than 3 feet	Shoreline length (miles)	Shoreline Development Factor (SDF)	Lake Type	Public Frontage (miles)	pH	Total Alkalinity (ppm $CaCO_3$)	Specific Conductance (Mmhos/cm 77°F)	Water Color	Sampling Date
Allen Lake	21	11	6 (7,8)	18.3	0.31	0.13	9	0	10	0.83	1.38	2	0.83	8.4	144	267	1	7-2-68
Bailey's Lake	21	12	19 (7,8)	13.8	0.26	0.14	30	25	20	0.77	1.48	1	0.00	8.8	148	229	1	10-3-67
Bass Lake	21	11	13,14	18.7	0.28	0.13	35	-	-	0.74	1.22	1	0.05	8.5	170	349	1	10-3-67
Bear Lake	22,23	13	4,5,32,33	193.7	1.27	0.40	67	50	17	3.62	1.86	1	0.01	7.4	186	400	5	7-25-68
Bestul (Brekke) Lake	23	11	7(1,2)	42.6	0.42	0.28	25	5	2	1.18	1.29	1	0.00	8.6	125	235	1	6-21-66
Big Falls Pond	25	12	22,23,26	22.1	0.62	0.11	12	0	20	2.00	3.04	2	0.02	7.9	159	300	2	8-10-65
Big Lake	25	15	4(2)	12.4	0.29	0.08	3	0	100	0.69	1.40	1	0.00	6.8	115	232	4	7-22-68
Black (Knutson) Lake	23	12	8(7)	3.7	0.15	0.06	20	15	2	0.35	1.30	1	0.00	7.7	195	366	1	6-21-66
Blue Mountain (Goerke) Lake	24	12	13	8.4	0.19	0.10	8	0	30	0.49	1.21	1	0.01	7.2	30	70	1	8-24-65
Buck Lake	25	13	19(3)	4.7	0.24	0.06	9	0	30	0.58	1.91	2	0.00	8.3	142	292	2	8-24-65
Campbell Lake	24	12	14	38.0	0.52	0.15	25	-	-	1.31	1.52	1	0.02	8.0	100	179	1	8-19-65
Cary Pond	22	12	32	26.4	0.40	0.15	8	0	10	2.60	3.61	2	0.00	8.3	148	315	1	10-11-67
Casey Lake	22	12	2	20.2	0.21	0.20	42	47	12	0.64	1.02	1	0.01	8.1	185	377	1	6-22-66
Cedar Lake	24	13	8	45.3	0.46	0.19	50	0	0	1.11	1.18	1	0.01	8.7	118	218	1	8-19-65
Chain O'Lakes				724.0						22.12								
Bass	22	11	33(11)	2.5	0.09	0.06	8	0	32	0.30	1.36	1	0.00	8.9	145	232	1	10-4-67
Beasley	21	11	4(6)	11.8	0.18	0.10	47	70	2	0.70	1.45	1	0.00	8.7	169	490	1	10-4-67
Columbia	21,22	11	4,33	80.6	0.49	0.37	72	44	14	1.84	1.46	1	0.01	8.3	138	285	1	9-7-67
Dake	21	11	4(3,4,14)	32.1	0.36	0.31	26	15	5	1.20	1.51	1	0.01	8.5	120	250	1	9-8-67
George	22	11	34(1,4)	5.4	0.16	0.08	30	19	28	0.40	1.23	1	0.00	8.5	131	270	1	9-7-67
Knight	21,22	11	5,32	8.5	0.24	0.14	42	46	22	0.60	1.47	1	0.00	8.6	181	362	1	10-4-67
Limekiln	22	11	33	13.7	0.22	0.15	46	20	48	0.70	1.35	1	0.00	8.5	152	285	1	9-7-67
Long	21	11	4,5	103.8	0.96	0.36	75	58	17	3.00	2.10	1	0.02	8.3	168	333	1	9-7-67
Manomin	21	11	5(2,3)	5.8	0.20	0.12	30	40	10	0.50	1.48	1	0.00	8.3	179	369	1	10-4-67
Marl	21	11	5(3,4)	13.3	0.18	0.18	59	60	15	0.70	1.37	1	0.01	8.7	149	273	1	10-4-67
McCrossen	22	11	34	29.6	0.33	0.21	75	67	7	0.90	1.18	1	0.00	8.5	129	270	1	9-7-67
Miner	21	11	4	35.5	0.40	0.20	52	20	5	1.20	1.44	1	0.01	8.6	122	244	1	9-8-67
Nessling	22	11	34	9.6	0.16	0.14	55	47	17	0.46	1.06	1	0.00	7.8	153	357	1	1-28-70
Orlando	21	11	5(1)	8.6	0.23	0.08	39	30	22	0.60	1.46	1	0.00	8.4	179	362	1	10-4-67
Otter	22	11	26,35	14.4	0.42	0.09	40	27	20	1.10	2.07	1	0.00	7.9	190	389	1	9-7-67
Ottman	22	11	33	13.1	0.22	0.15	15	0	10	0.58	1.14	1	0.00	9.0	81	189	1	8-13-68
Pope	21	11	5	13.8	0.21	0.18	40	45	10	0.90	1.73	1	0.00	8.3	177	362	2	10-4-67
Rainbow	22	11	34	115.5	0.65	0.45	95	64	10	2.00	1.33	1	0.00	8.4	131	293	1	9-7-67
Round	22	11	33	79.8	0.50	0.30	67	60	10	1.40	1.12	1	0.00	8.5	152	285	1	9-7-67
Sunset	22	11	27,34	89.2	0.49	0.41	63	62	13	1.70	1.29	1	0.00	8.6	128	270	1	9-7-67
Taylor	22	11	34,35	34.9	0.32	0.30	58	26	34	1.10	1.33	1	0.02	8.5	131	273	1	9-7-67
Young's	21	11	32,33	2.5	0.24	0.15	15	0	20	0.24	1.08	1	0.00	8.3	130	303	1	9-8-67
Chapin Lake	24	13	20	8.9	0.18	0.09	25	80	1	0.42	1.01	1	0.00	8.5	12	38	3	8-19-65
Cinco Lake	22	14	33	169.2	0.70	0.54	4	0	-	1.95	1.07	1	0.00	8.1	176	405	1	8-12-68
Colic Bayou	21	14	6	50.5	1.86	0.15	24	-	-	4.75	4.77	1	0.00	8.0	149	308	5	8-15-68
Crystal Lake	21	11	21,28	33.2	0.38	0.20	12	0	10	1.20	1.49	1	0.01	7.7	86	163	2	10-9-67
Driscol Lake	23	14	6	6.1	0.15	0.07	10	0	10	0.36	1.04	1	0.00	7.2	17	61	2	5-11-68
Duck Lake	22	11	25(3)	4.9	0.11	0.10	20	0	5	0.33	1.07	1	0.00	7.5	108	254	2	9-25-67
Emmons Lake, North	21	11	5(9,12,14)	0.2	0.02	0.02	21	20	2	0.08	1.24	1	0.00	7.6	155	296	1	9-26-67
Emmons Lake, South	21	11	5(15)	6.2	0.22	0.07	23	10	2	0.58	1.66	1	0.00	7.5	153	296	1	9-26-67
Flynn Lake	23	14	19	15.5	0.23	0.16	3	0	99	0.59	1.07	1	0.00	7.8	97	204	2	6-22-66
Foster Lake	23	11	31(8,9)	6.4	0.21	0.08	16	0	40	0.48	1.35	1	0.00	7.3	190	373	1	8-28-67

APPENDIX I. Physical and Chemical Characteristics of Waupaca County Lakes - continued

Name	T-N	Location R-E	Section	Area (acres)	Length (miles)	Width (miles)	Known Max. Depth (feet)	% Depth Over 20 feet	% Depth less than 3 feet	Shore-line length (miles)	Shoreline Development Factor (SDF)	Lake Type	Public Frontage (miles)	pH	Total Alkalinity (ppm $CaCO_3$)	Specific Conductance (Mmhos/cm 77°F)	Water Color	Sampling Date
Fox Lake	22	13	6(2)	3.3	0.10	0.07	14	0	5	0.28	1.10	1	0.00	8.2	193	372	2	6-22-65
Fremont Pond	21	14	30(11)	1.8	0.07	0.06	11	0	0	0.21	1.12	3	0.00	8.7	167	358	5	8-1-68
Gooseneck Lake	21	11,12	19,24	19.2	0.32	0.19	17	0	44	1.09	1.76	1	0.01	8.5	117	201	1	10-3-67
Graham Lake	24	11	10	54.5	0.45	0.31	32	25	5	1.27	1.23	1	0.02	8.7	127	212	1	8-10-65
Grass Lake	24	11	11,12	36.9	0.44	0.22	10	0	15	1.22	1.43	1	0.04	8.1	149	264	1	8-10-65
Gregerson Lake	24	12	7,18	34.9	0.50	0.14	5	0	60	1.25	1.51	1	0.00	8.5	112	204	1	8-17-65
Grenlie Lake	23	11	31(3)	5.4	0.18	0.07	40	40	20	0.44	1.35	1	0.00	7.9	204	336	1	8-28-67
Gurholt Lake	23	11	21(13,14,15)	30.4	0.37	0.20	6	0	24	0.97	1.25	1	0.00	8.1	40	84	1	8-28-67
Hatch Lake	24	11	24,25	112.3	0.61	0.42	13	0	25	1.77	1.19	1	0.02	8.9	103	196	1	8-17-65
Herman Lake	23	12	7(2,5)	12.4	0.31	0.09	3	0	95	0.72	1.46	1	0.00	7.5	135	270	2	6-21-66
Holman Lake	21	11	22	18.0	0.23	0.17	5	0	25	0.65	1.09	1	0.00	7.9	90	168	5	10-9-67
Horseshoe Bayou	22	14	29(4)	17.5	0.86	0.05	8	0	-	1.76	3.00	1	0.00	7.9	157	324	1	8-12-68
Horseshoe Bayou, Little	22	14	20(16)	7.4	0.48	0.05	4	0	40	0.96	2.52	1	0.00	7.2	163	316	5	8-12-68
Iola Millpond	24	11	26,35	205.9	0.73	0.39	11	0	63	4.74	2.36	2	0.03	8.4	186	370	2	6-24-68
Jacklin Lake	21	12	31	3.0	0.18	0.10	12	0	85	0.56	2.31	1	0.00	7.4	180	380	1	7-9-68
Jackson Lake	25	11	15	10.5	0.17	0.13	5	0	90	0.49	1.08	1	0.00	7.1	21	45	2	8-10-65
Jaquith Lake	22	11	25(8)	5.6	0.18	0.06	14	0	5	0.41	1.23	1	0.00	7.5	52	123	1	10-10-67
Jenny Bayou	21	13,14	6,7,12	27.3	1.07	0.05	13	0	5	1.48	2.02	1	0.00	7.4	142	296	3	8-19-68
Jensen Lake	21	11	14	14.6	0.22	0.09	9	0	2	0.57	1.06	1	0.00	8.2	127	246	2	9-26-67
Johnson Lake	23	11	19	12.0	0.33	0.10	27	40	5	0.75	1.55	1	0.00	7.8	116	249	2	7-5-68
Jones Lake	24	12	28(10)	6.6	0.19	0.08	25	38	5	0.46	1.28	1	0.00	8.3	194	366	1	8-18-65
Junction Lake	21	11	10(8,3)	15.6	0.29	0.18	4	0	60	0.75	1.35	1	0.00	8.4	173	346	1	10-4-67
Kating Lake	24	11	36(14)	17.3	0.20	0.20	18	0	-	0.66	1.13	1	0.05	8.9	65	133	5	8-17-65
Keller Lake	25	13	18	20.5	0.51	0.11	13	0	28	1.35	2.13	2	1.35	8.3	197	376	3	8-24-65
Kinney Lake	25	13	7,8	83.2	0.56	0.37	10	0	38	1.43	1.12	2	0.01	8.1	156	294	1	8-24-65
Knutson Lake	23	12	5(16)	11.7	0.20	0.13	35	65	1	0.51	1.06	1	0.00	8.2	194	382	1	6-22-66
Krause (Lutz) Lake	24	12	18(3,4)	13.5	0.22	0.11	21	5	10	0.75	1.46	1	0.00	8.1	135	242	1	6-17-65
Lembke Lake	25	13	21(8,9)	3.2	0.11	0.06	33	50	2	0.28	1.12	1	0.04	8.1	182	348	1	6-24-65
Little Hope Millpond	21	11	1(15,12)	11.9	0.30	0.20	8	0	5	0.91	1.88	2	0.04	7.8	165	321	1	9-26-67
Little Lake	25	13	17,18	24.7	0.27	0.20	17	-	-	0.75	1.08	1	0.00	8.1	182	348	1	8-24-65
Long Lake	24	11	11,12	41.7	0.43	0.22	22	5	30	1.06	1.17	1	0.00	7.1	21	50	1	8-10-65
Long Lake	25	13	21,22	13.2	0.38	0.07	47	45	2	0.84	1.65	1	0.01	8.4	196	374	1	8-24-65
Manawa Millpond	23	13	11,14,15	194.5	1.72	0.52	12	0	23	5.50	2.81	2	0.04	7.7	164	345	3	7-10-68
Marion Millpond	25	13	2,3	109.1	1.49	0.32	11	0	15	3.78	2.58	2	0.10	8.1	168	316	2	8-24-65
Marl Lake	23	11	32,33	10.9	0.22	0.12	65	60	15	0.52	1.12	1	0.00	8.4	164	349	1	8-29-67
McAllister Lake	21	11	13,24	12.2	0.23	0.12	30	40	2	0.66	1.35	1	0.00	8.9	106	176	2	10-3-67
McLean Lake	21	11,12	24(4,13)	15.5	0.26	0.17	31	15	2	0.88	1.59	1	0.00	8.4	78	145	1	10-3-67
Meed Lake	23	11	34(5,6)	9.9	0.19	0.13	38	60	1	0.54	1.22	1	0.00	8.2	214	433	1	8-29-67
Michael Lake	25	13	28(9,10)	2.6	0.90	0.60	22	5	5	0.25	1.11	1	0.00	8.3	219	451	5	8-24-65
Miller's Bayou	21	13	24	15.9	0.48	0.09	3	0	85	1.20	2.15	1	0.00	7.2	150	287	1	8-14-68
Mirror Lake	22	12	30(13)	12.8	0.25	0.11	43	60	5	0.62	1.24	1	0.15	8.4	142	298	5	10-11-67
Moon (Goodhal) Lake	24	12	8,17	32.4	0.56	0.17	10	0	45	1.36	1.71	1	0.01	8.3	137	270	1	8-17-65
Mountain Lake	23	13	26,27,34,35	42.7	0.36	0.31	7	0	50	1.18	1.29	1	0.00	7.8	82	175	1	6-22-66
Mud Lake	21	11	21(3,4)	10.8	0.30	0.10	3	0	80	0.74	1.61	1	0.00	7.4	132	261	1	10-10-67
Mud Lake	22	11	21	15.8	0.19	0.17	7	0	30	0.57	1.02	1	0.00	6.7	17	27	3	9-25-67
Mud Lake	22	12	10(16)	0.9	0.06	0.03	4	0	60	0.16	1.20	1	0.00	8.2	74	121	3	9-27-67
Mud Lake	22	12	17	3.4	0.11	0.08	4	0	70	0.25	1.02	1	0.00	8.4	173	350	2	5-10-68
Mud Lake	24	13	1	13.0	0.18	0.18	5	0	99	0.75	1.48	1	0.00	7.3	73	156	2	8-25-65

APPENDIX I. Physical and Chemical Characteristics of Waupaca County Lakes - continued

Name	T-N	Location R-E	Section	Area (acres)	Length (miles)	Width (miles)	Known Max. Depth (feet)	% Depth Over 20 feet	% Depth less than 3 feet	Shore-line length (miles)	Shoreline Development Factor (SDF)	Lake Type	Public Frontage (miles)	pH	Total Alkalinity (ppm $CaCO_3$)	Specific Conductance (Mmhos/cm 77°F)	Water Color	Sampling Date
Mud Lake	25	12	18	29.5	0.30	0.23	3	0	100	0.90	1.18	1	0.00	8.3	152	271	1	8-10-65
Myklebust Lake	23	11	2	19.7	0.43	0.13	37	45	5	1.03	1.66	1	0.00	8.0	219	436	1	6-21-66
Mynyard Lake	21	11	21	9.2	0.20	0.11	4	0	50	0.50	1.18	1	0.00	8.8	77	135	1	9-26-67
Newsom Pond	21	11	27	14.9	0.25	0.14	5	0	10	0.73	1.35	3	0.00	7.9	80	180	1	6-5-68
Norby Lake	23	11	1	20.0	0.28	0.17	3	0	99	0.70	1.12	1	0.00	6.4	10	22	1	6-21-66
North Lake	24	11	11	68.5	0.43	0.16	40	20	29	1.29	1.11	1	0.01	8.5	151	248	1	8-10-65
Northland Flowage	25	11	31	9.4	0.32	0.07	6	0	70	0.82	1.91	2	0.82	7.6	165	319	5	8-10-65
Ogdensburg Millpond	23	12	21,22	61.9	1.95	0.14	9	0	66	4.09	3.71	2	0.00	7.8	206	381	2	9-27-67
Old Taylor Lake	22	11	25,36(2,5,8)	29.3	0.44	0.17	17	0	20	1.27	1.68	1	0.00	7.4	32	79	1	10-10-67
Partridge Lake	21	13	22,27	1,124.3	2.02	1.55	6	0	6	9.98	2.13	1	0.00	8.2	145	290	3	8-13-68
Partridge Crop Lake	22	13,14	30,31,35,36	237.5	0.91	0.60	8	0	10	2.56	1.19	1	0.00	8.2	110	253	4	7-5-68
Pea Soup (Mill Cut) Bayou	22	14	29,30, 32	37.5	1.14	0.03	19	0	5	2.72	3.17	1	0.00	8.0	150	317	5	8-15-68
Peterson Creek Millpond	23	11	29	6.2	0.41	0.06	4	0	90	0.91	2.61	2	0.00	8.4	209	423	1	7-9-68
Pfeiffer Lake	25	14	22	2.8	0.12	0.06	20	0	5	0.29	1.24	1	0.00	7.1	161	308	4	7-16-68
Pigeon (Clintonville Millpond) Lake	25	14	22,23	217.7	2.03	0.77	12	-	-	6.50	3.14	2	0.02	8.2	191	388	2	7-11-68
Preuss Lake	24	13	19(12)	3.1	0.10	0.07	23	15	5	0.25	1.01	1	0.00	8.3	222	405	1	8-19-65
Price Lake	24	12	14(4,13)	15.6	0.26	0.16	28	35	5	0.65	1.17	1	0.00	8.1	105	200	1	8-19-65
Rich Lake	23	12	23	16.6	0.39	0.11	23	30	2	0.93	1.63	1	0.00	8.1	187	359	1	6-22-66
Rolands (Bestul) Lake	24	12	25(7,8)	13.1	0.22	0.12	19	0	5	0.60	1.18	1	0.00	7.3	38	75	1	8-24-65
Rollofson, Lake	23	11	7	39.3	0.35	0.20	44	21	62	1.00	1.14	1	0.00	8.0	188	381	1	6-20-66
Round Lake	21	11	29	13.8	0.18	0.18	25	50	2	0.55	1.06	1	0.00	8.2	66	167	5	10-9-67
Round Lake	24	11	12,13	25.0	0.22	0.09	3	0	99	0.55	1.96	1	0.00	7.5	7	32	2	8-10-65
Rosmussen's Lake	23	11	9(3,4)	3.6	0.11	0.07	6	0	50	0.29	1.09	1	0.00	6.4	14	44	4	6-21-66
Sand (Jensen) Lake	23	11	28,33	14.0	0.20	0.17	29	40	5	0.62	1.17	1	0.00	8.4	90	188	1	7-3-68
Sand Bar Lake, East	21	11	28(3,14)	14.8	0.18	0.13	6	0	35	0.55	1.02	1	0.00	7.6	70	136	2	10-9-67
Sand Bar Lake, West	21	11	28(4,13,14)	16.3	0.21	0.19	13	0	15	0.65	1.15	1	0.00	8.3	72	147	1	10-9-67
Scandinavia Millpond	23	11	22(1)	16.4	0.53	0.10	6	0	85	1.12	1.97	2	0.03	7.8	230	471	1	6-21-66
School Section Lake	24	13	16,21	39.3	0.40	0.25	38	50	1	1.54	1.76	1	0.01	8.3	151	295	1	8-19-65
Shadow Lake	22	12	30,31	42.2	0.44	0.23	38	50	10	1.14	1.25	1	0.47	8.2	150	306	1	10-11-67
Shambeau (Woodnorth) Lake	23	12	26,27	17.4	0.26	0.15	5	0	25	0.64	1.10	1	0.00	8.4	31	77	5	6-22-66
Shaw Landing	22	14	21(3d)	2.9	0.08	0.06	11	0	25	0.25	1.05	1	0.00	7.9	147	306	2	8-1-68
Siemer (Selmer) Lake	24	11	11	29.5	0.28	0.26	9	0	15	0.82	1.08	1	0.00	7.1	7	32	1	8-10-65
Silver (Anderson) Lake	22	11	28	31.9	0.37	0.25	11	0	12	1.07	1.35	1	0.00	8.3	103	213	2	8-28-68
Silver Lake	23	11	14,15	69.8	0.45	0.31	14	0	2	1.25	1.05	1	0.02	8.2	61	139	1	6-21-66
Skunk Lake	23	11	31(6)	11.0	0.19	0.15	63	40	20	0.52	1.12	1	0.00	8.1	210	379	1	10-28-67
Spencer Lake	21	11,12	13,18	89.0	0.52	0.39	52	63	14	1.43	1.08	1	0.02	8.8	157	322	5	10-3-67
Spring Lake	25	15	4(3)	6.5	0.21	0.12	5	0	65	0.74	2.07	1	0.00	6.7	108	190	4	12-22-68
Spring Pond	23	11	34(3)	3.4	0.10	0.08	37	40	5	0.29	1.12	1	0.00	8.2	214	412	1	8-30-67
Stratton Lake	21	11	16,17	87.2	0.72	0.22	42	15	30	1.88	1.44	1	0.01	8.3	106	193	1	10-9-67
Sturm (Storm) Lake	23	13	4(6,7)	15.5	0.22	0.16	17	0	10	0.60	1.09	1	0.00	6.9	32	70	1	8-25-65
Templeton Bayou	21	13,14		68.1	1.79	0.07	12	0	50	4.80	4.15	1	0.00	7.2	130	267	2	8-14-68
Tom Bayou	22	14	21(2,3)	4.5	0.20	0.04	6	0	75	0.50	1.68	1	0.00	7.3	149	294	3	8-1-68
Traders Bayou	22	14	21,28	22.9	0.63	0.11	24	2	30	3.39	5.05	1	0.00	7.1	144	309	3	8-6-68
Twin Lake, North	24	13	7	27.2	0.23	0.20	26	35	5	0.74	1.01	1	0.00	8.5	154	295	1	8-19-65
Twin Lake, South	24	13	7	10.5	0.20	0.11	23	25	5	0.12	2.64	1	0.00	8.5	136	266	1	8-19-65
Vesey Lake	23	12	36(3)	53.8	0.53	0.28	8	0	-	1.69	1.64	1	0.00	9.3	47	108	1	10-25-65
Waupaca Millpond	22	12	19	22.2	0.48	0.13	5	0	-	1.21	1.83	2	0.01	8.4	183	363	5	6-19-68
Weyauwega Lake	21	13	4,5	274.2	1.56	0.60	11	0	15	4.48	1.93	2	0.02	8.5	177	338	2	7-29-68
White Lake	22	13	16,20,21,22	1,026.2	2.02	1.24	11	0	45	5.80	1.29	2	0.01	8.6	122	254	3	7-26-68
Woodnorth Lake	22	13	6(8)	5.1	0.13	0.08	27	80	2	0.34	1.07	1	0.00	8.1	228	443	1	6-22-66

APPENDIX I. Physical and Chemical Characteristics of Waupaca County Lakes

Name	Location T-N	R-E	Sec.	Area (acres)	Length (miles)	Width (miles)	Known Max. Depth (feet)	% Depth Over 20 feet	% Depth less than 3 feet	Shoreline Length (miles)	Shoreline Development Factor (SDF)	Lake Type	Public Frontage (miles)	pH	Total Alkalinity (ppm $CaCO_3$)	Specific Conduct. tance (mmhos/ cm 77°F)	Water Color	Sampling Date	Fishery	Game	Access	Water Source
Unnamed Lakes	21	11	2(9)	3.7	0.14	0.05	4	0	0	0.32	1.19	3	0.00	7.4	132	278	3	9-26-67	1	3	1	Drainage
	21	11	4(3)	0.6	0.05	0.02	4	0	10	0.13	1.20	1	0.00	6.0	8	62	4	10-4-67	1	1	1	Seepage
	21	11	4(9)	2.1	0.07	0.06	15	0	2	0.21	1.03	1	0.00	7.3	21	45	3	10-4-67	1	3	1	Seepage
	21	11	6(2)	4.9	0.13	0.11	4	0	10	0.38	1.23	2	0.38	7.4	103	205	3	7-3-68	6	3	3	Drainage
	21	11	6(3)	14.1	0.19	0.19	7	0	10	0.82	1.56	2	0.82	8.3	155	263	1	7-2-68	6	2	3	Drainage
	21	11	6(4)	22.6	0.34	0.14	8	0	15	0.88	1.32	2	0.88	8.2	145	263	1	7-2-68	6	2,3	3	Drainage
	21	11	6(8)	2.5	0.09	0.05	5	0	20	0.23	1.04	3	0.23	8.3	134	244	1	7-2-68	6	2	3	Drainage
	21	11	10(6,7)	5.1	0.31	0.05	4	0	20	0.87	2.75	2	0.00	7.9	162	323	1	9-26-67	9	-	5	Drained
	21	11	10(11)	4.5	0.11	0.09	5	0	50	0.35	1.18	1	0.00	8.8	76	190	1	10-10-67	1	1	1	Seepage
	21	11	13(14)	1.3	0.06	0.03	2	0	100	0.16	1.00	1	0.00	8.4	153	325	1	10-3-67	1	3	1,6	Springs
	21	11	17(1)	5.7	0.13	0.09	14	0	2	0.38	1.13	1	0.00	7.1	32	69	2	9-26-67	1	3	1	Drainage
	21	11	19(11)	2.1	0.13	0.05	6	0	30	0.30	1.48	2	0.00	7.7	152	338	2	10-10-67	9	3	1	Drainage
	21	11	19(13)	1.5	0.07	0.04	3	0	60	0.18	1.05	1	0.00	7.8	101	198	2	10-10-67	1	3	1	Seepage
	21	11	21(14)	0.5	0.04	0.02	4	0	15	0.12	1.21	1	0.00	6.2	11	40	2	10-10-67	1	3	1	Seepage
	21	11	34(8)	19.1	0.39	0.12	7	0	85	1.00	1.63	1	0.00	6.5	31	84	2	6-5-68	1	3	6	Seepage
	21	12	19(7)	3.1	0.07	0.05	4	0	85	0.25	1.01	1	0.00	7.4	64	103	1	10-3-67	1	1	1,6	Springs
	21	12	19(8c)	2.9	0.07	0.03	15	0	2	0.24	1.01	1	0.00	8.0	124	265	5	10-3-67	-	1	1	Drainage
	21	12	19(10c)	2.7	0.06	0.03	9	0	10	0.23	1.00	1	0.00	8.5	136	303	2	6-6-68	-	1	1	Seepage
	21	13	25(2,3)	3.0	0.17	0.04	15	0	20	0.40	1.65	1	0.00	7.3	146	343	4	8-19-68	-	3	5	Drained
	21	14	30(10b,c)	1.8	0.08	0.04	5	0	30	0.19	1.01	1	0.00	8.1	215	515	3	6-20-68	1	3	1	Seepage
	21	14	30(10c)	3.2	0.09	0.06	2	0	100	0.26	1.04	1	0.00	8.7	226	490	3	6-20-68	2	1	1	Drainage
	22	11	1(15)	0.5	0.04	0.02	11	0	20	0.11	1.11	3	0.00	7.6	22	149	2	6-26-68	1	1	1	Seepage
	22	11	11(7,10)	1.7	0.13	0.05	2	0	100	0.30	1.65	1	0.00	7.9	215	416	1	9-25-67	1	3	1,6	Springs
	22	11	11(12,15)	3.0	0.09	0.07	3	0	85	0.26	1.07	1	0.00	6.3	25	31	2	9-25-67	1	2	1,6	Springs
	22	11	25(9,12)	10.3	0.21	0.13	6	0	15	0.52	1.16	1	0.00	7.6	39	56	1	9-25-67	1	1	1	Seepage
	22	11	25,30(13,10)	3.0	0.10	0.07	9	0	10	0.31	1.28	1	0.00	8.1	149	291	1	9-25-67	6	1	1	Springs
	22	11	26(12)	1.7	0.08	0.04	14	0	2	0.26	1.43	1	0.00	7.1	90	265	4	10-11-67	1	3	5	Springs
	22	11	27(3,8)	6.2	0.15	0.08	7	0	20	0.38	1.09	1	0.00	8.8	118	253	1	9-25-67	2	1	1,6	Springs
	22	11	32(1)	2.0	0.06	0.03	5	0	10	0.20	1.01	1	0.00	7.2	34	81	2	5-10-68	1	1	1	Seepage
	22	11	34(6)	1.9	0.11	0.04	5	0	80	0.27	1.40	1	0.00	6.9	6	33	3	10-11-67	1	1	1	Seepage
	22	11	34(7)	1.2	0.07	0.04	9	0	5	0.17	1.10	1	0.00	6.2	4	25	4	10-11-67	1	1	1,6	Seepage
	22	12	8(14a)	1.8	0.06	0.05	15	0	2	0.20	1.06	3	0.00	8.1	197	370	1	9-27-67	2	1	1	Springs
	22	12	8(14b)	1.5	0.06	0.05	18	0	0	0.18	1.05	3	0.00	8.4	183	382	1	6-19-68	2	1	1	Seepage
	22	12	8(14c)	2.2	0.08	0.06	8	0	10	0.23	1.11	3	0.00	8.4	150	300	1	8-30-67	1	-	1	Seepage
	22	12	13(9)	1.5	0.07	0.02	1	0	100	0.18	1.05	1	0.00	7.8	175	355	3	6-12-68	1	2,3	1	Seepage
	22	12	29(5,6)	11.1	0.51	0.06	5	0	80	1.32	2.83	2	--	8.4	183	363	3	6-19-68	6	1	5	Drainage
	22	12	30(7)	1.9	0.08	0.04	5	0	0	0.20	1.03	1	0.00	7.4	126	265	2	6-10-68	1	2,3	1,6	Seepage
	22	12	33(2a)	3.0	0.10	0.06	22	5	5	0.30	1.24	3	0.00	8.4	162	162	1	6-13-68	2	3	1	Springs
	22	12	33(2b)	1.2	0.05	0.02	32	85	0	0.16	1.04	3	0.00	8.3	171	357	1	6-13-68	2	1	5	Springs
	22	12	33(12)	1.1	0.11	0.03	3	0	100	0.23	1.56	1	0.00	7.4	93	234	2	9-27-67	1	2,3	1	Drainage
	22	14	2(15b)	1.5	0.05	0.05	3	0	100	0.18	1.05	1	0.00	7.3	210	442	3	7-30-68	2	1	1	Seepage
	22	14	4(6c)	1.5	0.06	0.06	3	0	100	0.28	1.64	1	0.00	9.6	82	215	1	7-30-68	1	1	1	Seepage
	22	14	11(1d)	1.0	0.05	0.03	3	0	100	0.20	1.43	1	0.00	7.5	206	594	2	7-30-68	1	3	1	Seepage
	22	14	11(5)	2.0	0.09	0.05	3	0	100	0.22	1.11	1	0.83	7.2	127	641	3	7-30-68	-	3	6	Drainage
	22	14	20(4)	5.0	0.35	0.03	6	0	10	0.83	2.64	1	0.00	8.0	163	348	3	8-15-68	6	-	5	Seepage
	23	11	2(11)	1.6	0.05	0.02	5	0	35	0.18	1.02	1	0.00	7.7	230	492	1	6-27-68	-	1	5,6	Springs
	23	11	4(11)	3.1	0.09	0.06	5	0	75	0.23	1.01	1	0.00	7.9	131	274	3	6-21-66	1	1	1,6	Seepage
	23	11	10(12)	4.2	0.12	0.07	12	0	0	0.31	1.08	1	0.00	8.5	20	86	4	8-29-67	1	1	1	Seepage
	23	11	20(1)	3.5	0.11	0.06	11	0	0	0.29	1.11	1	0.00	8.4	16	39	4	8-29-67	1	1	1	Seepage
	23	11	28(15)	1.0	0.04	0.02	5	0	60	0.14	1.00	1	0.00	7.2	212	421	1	6-26-68	1	1	6	Seepage
	23	11	31(5)	1.0	0.06	0.05	5	0	80	0.15	1.07	1	0.00	8.7	124	233	1	8-28-67	1	3	3	Seepage
	23	11	32(2)	3.1	0.09	0.07	20	0	15	0.26	1.05	1	0.00	8.5	170	313	3	8-29-67	1	1	1,6	Seepage

APPENDIX I. Physical and Chemical Characteristics of Waupaca County Lakes - continued

Name	T-N	R-E	Sec.	Area (acres)	Length (miles)	Width (miles)	Known Max. Depth (feet)	% Depth Over 20 feet	% Depth less than 3 feet	Shoreline Length (miles)	Shoreline Development Factor (SDF)	Lake Type	Public Frontage (miles)	pH	Total Alkalinity (ppm $CaCO_3$)	Specific Conductance (mmhos/cm 77°F)	Water Color	Sampling Date	Fishery	Game	Access	Water Source
Unnamed Lakes	23	11	34(6c)	2.0	0.10	0.02	3	0	95	0.25	1.23	1	0.00	8.3	236	446	1	8-29-67	1	3	1	Drainage
	23	11	35(14)	1.9	0.08	0.04	10	0	15	0.21	1.09	1	0.00	8.0	138	266	1	8-30-67	1	2	3,6	Seepage
	23	12	3(1,4)	4.4	0.13	0.07	5	0	10	0.32	1.08	1	0.00	7.1	32	63	2	9-27-67	1	3	3	Drainage
	23	12	3(8)	7.2	0.15	0.10	8	0	20	0.40	1.06	1	0.00	6.6	21	46	4	9-27-67	1	3	1,6	Seepage
	23	12	5(11)	4.0	0.10	0.06	3	0	100	0.29	1.03	1	0.00	7.1	30	74	3	6-25-68	1	3	1	Seepage
	23	12	8(4)	0.5	0.05	0.03	10	0	60	0.12	1.21	1	0.00	8.0	202	405	1	6-25-68	1	1	1,6	Drainage
	23	12	10(3)	10.5	0.22	0.11	10	0	2	0.52	1.15	1	0.00	7.7	105	183	2	9-27-67	2	1	1,6	Drainage
	23	12	17(10)	2.8	0.08	0.07	3	0	100	0.24	1.03	2	0.00	7.2	87	159	4	6-22-66	1	2,3	1,6	Seepage
	23	12	17(15)	1.8	0.10	0.05	2	0	100	0.25	1.33	1	0.00	7.7	235	452	4	6-22-66	1	2,3	1,6	Springs
	23	12	28(10a)	1.6	0.07	0.05	7	0	50	0.19	1.08	1	0.00	8.4	253	513	2	7-9-68	1	1	1	Drainage
	23	12	28(10d)	1.6	0.07	0.04	1	0	100	0.18	1.02	1	0.00	7.9	247	536	1	7-9-68	1	1	1	Seepage
	23	12	31(2)	1.7	0.06	0.02	3	0	100	0.20	1.10	3	0.00	8.3	33	71	5	6-26-68	1	1	1	Seepage
	23	12	34(3,4)	5.9	0.12	0.10	3	0	100	0.36	1.06	1	0.00	6.1	11	27	3	9-27-67	1	2,3	3,6	Seepage
	23	13	2(9)	3.8	0.23	0.02	4	0	80	0.67	2.45	1	0.00	7.8	200	413	2	7-10-68	2	3	5,6	Seepage
	23	13	8(13)	0.5	0.05	0.04	27	40	5	0.14	1.41	1	0.00	6.8	25	88	3	7-10-68	1	1	1,6	Seepage
	23	13	15(14c)	1.4	0.06	0.04	5	0	10	0.17	1.03	3	--	8.3	46	114	4	7-10-68	-	1	3	Seepage
	24	11	19(2)	2.4	0.09	0.06	10	0	1	0.23	1.06	1	0.00	8.2	58	109	1	8-17-65	1	2,3	1,6	Seepage
	24	11	21(3)	0.5	0.03	0.02	8	0	10	0.11	1.11	1	0.01	7.3	185	337	2	8-17-65	1	3	3,6	Seepage
	24	11	22(8)	2.6	0.09	0.06	1	0	100	0.24	1.06	1	0.00	6.0	15	37	2	8-17-65	1	3	1,6	Seepage
	24	11	24(13,14)	2.5	0.14	0.04	5	0	95	0.35	1.58	1	0.00	7.3	232	438	1	8-17-65	3	2,3	1,6	Springs
	24	11	25(9,12)	3.6	0.13	0.06	3	0	95	0.31	1.16	1	0.00	6.9	14	31	3	8-17-65	1	3	1,6	Seepage
	24	11	25(10)	5.6	0.13	0.12	4	0	90	0.37	1.16	1	0.00	8.9	127	207	2	8-17-65	1	3	1	Seepage
	24	12	14(14,15)	0.8	0.06	0.03	4	0	98	0.13	1.04	1	0.00	7.4	150	271	5	8-19-65	1	3	1,6	Seepage
	24	12	19(7)	1.3	0.06	0.05	12	0	2	0.16	1.00	1	0.00	7.8	210	381	3	8-17-65	1	2,3	1	Drainage
	24	12	27(5c)	3.9	0.19	0.05	21	30	5	0.34	1.23	1	0.01	8.3	212	400	2	8-24-65	9	3,4	3	Springs
	24	12	27(8a)	2.0	0.07	0.05	8	0	90	0.20	1.01	1	0.01	8.3	165	306	2	8-18-65	1	3,4	3	Seepage
	24	12	32(14,15)	0.8	0.05	0.03	4	0	99	0.16	1.28	1	0.00	7.7	165	320	2	8-18-65	1	3	1,6	Springs
	24	13	14(10,11)	5.8	0.18	0.06	4	0	60	0.44	1.30	1	0.00	8.3	202	370	2	8-25-65	1	3	1	Seepage
	24	13	17(14)	0.7	0.05	0.03	27	80	0	0.12	1.02	1	0.00	5.9	10	57	4	8-19-65	1	3	1	Seepage
	24	13	17(15)	2.8	0.16	0.04	15	0	1	0.33	1.41	1	--	6.3	14	57	4	8-19-65	1	-	-	Seepage
	24	13	18(2)	1.2	0.06	0.05	17	0	5	0.17	1.10	1	0.00	7.7	201	366	1	8-19-65	3	3	1,6	Springs
	24	13	19(13,14)	1.7	0.08	0.04	15	0	5	0.19	1.04	1	0.00	8.3	161	329	5	8-19-65	1	3	1,6	Seepage
	25	11	5(1)	3.7	0.14	0.05	3	0	100	0.38	1.41	2	0.00	7.7	163	346	1	8-10-65	1	2,3,4	1	Drainage
	25	11	5(10)	0.8	0.05	0.04	11	0	2	0.19	1.52	3	0.00	6.9	67	112	3	8-10-65	1	1	1	Seepage
	25	11	30(1)	1.6	0.10	0.04	5	0	30	0.25	1.42	1	0.00	6.9	56	116	3	8-10-65	1	3	1,6	Drainage
	25	12	8(1)	2.9	0.09	0.06	6	0	20	0.25	1.05	1	0.02	7.7	40	83	5	8-10-65	1	3	3	Seepage
	25	12	17(8)	1.2	0.09	0.04	2	0	100	0.22	1.43	1	0.00	7.7	163	297	1	8-10-65	1	3	1,6	Springs
	25	13	19(2)	5.1	0.12	0.10	5	0	40	0.34	1.07	2	0.00	7.3	157	302	3	8-24-65	3	3	1	Springs
	25	13	22(7,8)	2.8	0.08	0.06	77	95	1	0.24	1.03	1	0.00	7.3	25	68	5	8-25-65	1	1	1,6	Seepage
	25	14	2(7)	1.5	0.07	0.03	8	0	10	0.18	1.05	3	0.00	8.5	55	144	3	7-15-68	1	1	1	Seepage
	25	14	14(13)	2.8	0.09	0.07	4	0	80	0.24	1.03	1	0.00	9.6	83	176	1	7-15-68	1	3	1	Seepage
	25	14	23(11)	1.0	0.09	0.06	3	0	100	0.30	2.14	1	0.00	7.1	171	363	3	7-16-68	1	2	3	Drainage
	25	15	4(6,7,8)	2.3	0.17	0.03	7	0	5	0.40	1.88	1	0.00	6.8	112	214	4	7-18-68	2	1	1	Drainage
	25	15	4(8d)	0.6	0.06	0.03	5	0	5	0.16	1.48	1	0.00	6.6	122	218	4	7-18-68	1	3	1,6	Drainage
Named Total:	144			6,932.1						177.36												
Ave.:				48.1	0.43	0.19	23							8.0	133	266						
Unnamed Total:	96			308.4						28.46												
Ave.:				3.2	0.11	0.05	8							7.7	119	247						
Lakes Total:	240			7,240.5						205.82			7.61									
Ave.:				30.2	0.30	0.14	17							7.9	127	258						

CODES:

Lake Type
(1) Natural
(2) Impoundment
(3) Excavation

Water Color
(1) Clear
(2) Light Brown
(3) Medium Brown
(4) Dark Brown
(5) Turbid

Fishery
(1) Winterkill, forage
(2) Panfish
(3) Bass, panfish
(4) Northern pike, panfish
(5) Walleye, panfish
(6) Bass, panfish, northern pike
(7) Bass, walleye, panfish
(8) Bass, panfish, northern pike, walleye
(9) Trout
(10) Smallmouth bass, catfish

Access
(1) None
(2) Improved multiple use
(3) Unimproved or difficult
(4) Improved boat launch
(5) Navigable water
(6) Wilderness

Game
(1) None
(2) Muskrats
(3) Ducks
(4) Beaver

APPENDIX II Physical and Chemical Characteristics of Waupaca County Streams

Name	Location T-N	R-E	Sec.	Area (Acres)	Length (Miles)	Width (Feet)	Flow (CFS)	Miles Public Frontage	Watershed	Fishery	pH	Total Alkalinity (ppm $CaCO_3$)	Specific Conductance (Mmhos/cm 77° F)	Water Color	Sampling Date Mo.	Day	Year
Austin Cr.	21	12	36 (16)	3.90	2.3	14	3.3	0.0	-	1	7.9	180	345	Clear	VIII	12	1965
Bailey (Bradley) Cr.	25	11	7 (11)	0.25	0.2	15	-	0.0	N. Br. Little Wolf	1	8.0	152	341	Lt. Brown	IX	5	1968
Basteen Cr.	23	12	22 (14)	1.44	1.7	7	1.2	0.0	Engebretson Cr.	1	8.1	232	460	Clear			
Bear Cr.	24	14	24 (1)	-	4.2	-	-	0.0	Embarrass R.	7	7.9	273	526	Brown	VIII	13	1965
Bestul Cr.	23	11	15 (14)	1.21	2.0	5	-	0.0	S. Br. Little Wolf	1, 7	8.1	244	457	Clear			
Blake Brook	24	13	34 (15)	15.09	8.3	15	-	0.0	N. Br. Little Wolf	1, 2	8.1	220	410	Brown	VIII	13	1965
Blake Brook, N. Fk.	24	12	23 (10)	2.12	2.5	7	1.3	0.0	Blake Br.	1	8.1	176	332	-	VI	30	1966
Blake Brook, S. Fk.	24	12	23 (10)	8.99	5.3	14	2.8	0.0	Blake Br.	1	8.2	192	370	-	VI	30	1966
Cedar Cr.	22	14	3 (14)	2.91	3.0	8	0.04	0.0	Wolf R.	4	8.1	285	526	Clear			
Comet Cr.	25	11	24 (11)	14.06	5.8	20	13.5	0.0	N. Br. Little Wolf	1	8.1	187	368	Clear	VIII	3	1965
Crystal River	22	12	32 (5)	22.12	7.3	25	66.9	0.0	Waupaca R.	1, 4	7.8	192	359	Clear			
Doty Cr.	25	13	3 (7)	1.31	2.7	4	-	0.5	Marion Mpd	1	8.0	235	463	Clear	VIII	3	1965
Embarrass River	25	15	32 (12)	148.36	8.0	153	-	0.0	Wolf R.	4, 6	8.5	195	362	Lt. Brown	VIII	3	1965
Emmons Cr.	21	11	5 (16)	5.02	2.3	18	19.2	0.4	Long L.	1	8.2	186	351	Clear	VII	2	1965
Engebretson (Stenson) Cr.	23	12	23 (12)	1.45	4.0	3	1.1	0.0	N. Fk. S. Br. Little Wolf	1	8.1	210	399	Clear			
Flume Cr.	25	11	27 (1)	18.98	5.4	29	19.3	2.0	N. Br. Little Wolf	1	8.6	182	346	Clear	VIII	2	1965
Geske (S. Fk., S. Br. Pigeon R.) Cr.	25	12	12 (15)	2.34	2.7	7	2.5	0.0	S. Br. Pigeon R.	1	8.0	194	369	-	VIII	3	1965
Griffin Cr.	24	11	16 (10)	0.84	2.3	3	-	0.0	S. Br. Little Wolf	1	8.3	224	413	Clear	VIII	2	1965
Hartman's Cr.	21	11	5 (5)	0.59	0.7	7	1.2	0.4	Pope L.	1, 7	8.4	160	269	Clear	VIII	2	1965
Hatton Cr.	21	12	24 (16)	6.69	2.7	20	5.0	0.0	Walla Walla Cr.	4	8.4	173	309	Clear	VIII	12	1965
Hyde Cr.	25	14	6 (9)	1.60	1.2	11	3.2	0.0	N. Br. Pigeon R.	1, 4	8.2	216	436	Clear	VIII	3	1965
Jackson Cr.	25	11	17 (4)	4.00	3.3	10	1.7	0.3	N. Br. Little Wolf	1	8.0	210	386	Clear	VIII	3	1965
Jones Cr.	25	11	24 (7)	0.95	1.3	6	-	0.0	Comet Cr.	1	8.2	220	420	Clear	VIII	3	1965
Leer Cr.	24	11	16 (10)	4.04	3.7	9	3.4	1.0	Mack Cr.	1	8.0	208	400	Clear	VIII	2	1965
Little Cr.	23	13	11 (5)	3.64	3.0	10	-	0.0	N. Br. Little Wolf	7	8.0	274	522	Lt. Brown	VIII	13	1965
Mack (Brown) Cr.	24	11	26 (7)	4.73	2.6	15	-	1.8	S. Br. Little Wolf	4	7.9	244	450	Lt. Brown	VIII	2	1965
Maple (Jasman) Cr.	23	14	13 (4)	2.67	4.4	5	-	0.0	Bear Cr.	7	7.3	204	481	Brown	VIII	13	1965
McClean Cr.	21	12	18 (13)	2.21	2.6	7	2.0	0.0	Walla Walla Cr.	1	7.7	164	312	Clear	VIII	12	1965
Mosquito Cr.	21	13	27 (5)	2.51	2.3	9	0.3	0.15	Partridge L.	4, 7	7.2	209	357	Brown	VIII	12	1965
Murray (N. Fk. Radley Cr.) Cr.	21	11	29 (6)	1.07	1.1	8	3.5	0.0	Radley Cr.	1	7.9	165	310	Clear	VIII	2	1965
Nace (Trout) Cr.	24	11	34 (15)	6.79	4.0	14	4.7	1.0	S. Br. Little Wolf	1	7.9	248	457	Clear	VIII	2	1965
Naylor Cr.	21	11	1 (11)	0.85	1.0	7	-	0.0	Crystal R.	1	8.0	168	359	Clear	VI	30	1966
Nichols Cr.	22	12	9 (4)	3.85	5.3	6	1.4	0.0	S. Br. Little Wolf	7	8.0	222	427	Dk. Brown	VI	30	1966
Olson Cr.	24	11	21 (7)	0.15	0.3	4	-	0.2	Mack Cr.	1	8.1	226	414	Clear	VIII	2	1965
Pearl (S. Fk. Radley Cr.) Cr.	21	11	29 (6)	2.27	1.7	11	-	0.0	Radley Cr.	1	7.6	150	325	Clear	IX	11	1968
Pesthouse Cr.	22	12	31 (2)	0.68	0.8	7	0	0.0	Shadow L.	3	6.8	45	392	Clear	IX	5	1968
Peterson Cr.	23	11	29 (16)	11.44	5.9	16	19.3	1.6	S. Br. Little Wolf	1	7.9	222	414	Lt. Brown	VIII	2	1965
Pigeon R.	25	15	20 (11)	31.90	4.7	56	-	0.0	Embarrass R.	4	7.6	191	389	Dk. Brown	VIII	3	1965
N. Br. Pigeon R.	25	14	8 (12)	8.97	3.7	20	12.5	0.0	Pigeon R.	1	8.1	197	408	Clear	VIII	3	1965
S. Br. Pigeon R.	25	14	8 (12)	27.27	9.0	25	8.3	0.0	Pigeon R.	1, 4	8.2	205	387	Clear	VIII	3	1965
N. Fk. S. Br. Pigeon R.	25	12	12 (16)	4.75	3.3	12	-	0.0	S. Br. Pigeon R.	1	-	-	-	Clear		-	
S. Fk. S. Br. Pigeon R.	25	12	2 (4)	0.65	1.8	3	0	0.0	N. Fk. S. Br. Pigeon R.	1	7.4	167	324	Clear	VIII	3	1965
Potters Cr.	22	14	33 (4)	3.42	4.7	6	0	0.0	Wolf River	7	7.9	204	380	Brown	VIII	12	1965
Radley Cr.	21	11	10 (3)	8.73	4.0	18	13.7	1.8	Crystal R.	1	7.9	154	297	Clear	VIII	12	1965
Sannes Cr.	23	11	29 (16)	2.84	1.8	13	3.1	0.0	Peterson Cr.	1	8.2	230	446	Clear	VIII	2	1965
Shaw Cr.	24	13	14 (16)	4.36	6.0	6	0.8	0.0	N. Br. Little Wolf	7	8.3	223	430	Brown	VIII	13	1965
Spaulding Cr.	25	12	26 (4)	11.37	6.7	14	2.9	1.8	N. Br. Little Wolf	1	8.1	186	368	Clear	VIII	2	1965
Spiegleberg Cr.	23	13	28 (14)	0.61	2.5	2	-	0.0	N. Br. Little Wolf	7	7.5	198	374	Clear	VIII	13	1965
Thiel Cr.	23	13	28 (8)	6.00	3.3	15	0	0.0	N. Br. Little Wolf	7	7.8	292	540	Brown	VIII	13	1965

APPENDIX II Physical and Chemical Characteristics of Waupaca County Streams (Continued)

Name	T-N	Location R-E	Sec.	Area (Acres)	Length (Miles)	Width (Feet)	Flow (CFS)	Miles Public Frontage	Watershed	Fishery	pH	Total Alkalinity (ppm CaCo3)	Specific Conductance (Mmhos/cm 77° F)	Water Color	Sampling Date Mo.	Day	Year
Walla Walla Cr.	21	13	27 (5)	27.39	11.3	20	13.4	0.0	Partridge L.	1, 4	8.5	172	340	Clear	VIII	12	1965
Waupaca River	21	13	11 (13)	197.60	24.7	66	-	0.3	Wolf R.	1, 4, 6	8.5	180	328	Turbid	VIII	13	1965
Whitcomb Cr.	24	13	9 (8)	15.04	7.3	17	7.6	0.0	N. Br. Little Wolf	1	8.4	182	353	-	VI	29	1966
N. Fk. Whitcomb Cr.	24	12	3 (6)	2.91	4.0	6	-	0.5	Whitcomb Cr.	1	8.4	200	-	-		-	
S. Fk. Whitcomb Cr.	24	12	3 (6)	3.27	3.0	9	1.2	0.0	Whitcomb Cr.	1	8.4	234	347	-	VI	29	1966
Wolf River	21	13	36 (16)	706.06	23.3	250	-	8.0	Fox R.	4, 6	7.8	139	256	Brown	VIII	3	1965
Little Wolf River	22	14	16 (4)	59.28	7.3	67	-	0.0	Wolf R.	4, 6	8.5	187	347	Clear	VIII	13	1965
N. Br. Little Wolf River	22	13	3 (1)	132.79	31.3	35	7.4	1.0	Little Wolf R.	1, 4	8.0	198	378	-		-	
S. Br. Little Wolf River	22	13	3 (1)	141.06	25.3	46	56.6	0.0	Little Wolf R.	4	8.2	230	435	Lt. Brown	VIII	13	1965
N. Fk. S. Br. Little Wolf River	23	12	11 (1)	11.64	12.0	8	-	0.0	S. Br. Little Wolf	1, 4	7.7	174	375	Clear	IX	5	1968
Unnamed Streams																	
	21	13	3 (13)	1.26	1.3	8	-	0.0	Waupaca River	8	7.8	210	441	Brown	VIII	12	1965
	21	13	25 (15)	1.09	1.5	6	-	0.0	Wolf River	8	7.0	160	311	Brown	VIII	12	1965
	21	14	2 (1)	0.61	1.0	5	-	0.0	Potters Cr.	7	8.0	254	483	Clear	VIII	12	1965
	22	12	35 (16)	-	2.4	-	-	0.0	Waupaca River	8	8.1	182	397	-		-	
	22	13	1 (5)	-	3.0	-	-	0.0	Little Wolf River	8	7.7	256	507	Lt. Brown	VIII	13	1965
	22	13	25 (9)	0.24	2.0	1	-	0.0	Partridge Crop L.	8	7.5	84	184	-	VIII	13	1965
	22	13	25 (12)	0.36	1.0	3	-	0.0	Partridge Crop L.	8	7.5	164	291	Clear	VIII	13	1965
	22	14	7 (5)	1.60	1.1	12	-	0.0	Little Wolf R.	8	7.6	135	314	Clear	VIII	13	1965
	23	14	16 (16)	0.65	2.7	2	-	0.0	Maple Cr.	7	7.4	124	213	Brown	VIII	13	1965
	24	11	26 (7)	0.73	1.5	4	-	0.0	Iola Millpond	8	7.9	244	450	Clear	VIII	2	1965
	24	12	10 (5)	1.45	2.0	6	1.1	0.1	Whitcomb Cr.	1	8.2	216	395	-		-	
	25	12	2 (1)	3.07	2.3	11	1.9	0.0	N. Fk. S. Br. Pigeon R.	1	8.0	204	395	Clear	VIII	3	1965
	25	13	23 (2)	1.21	2.5	4	0.4	0.0	S. Br. Pigeon R.	8	8.0	230	505	-	VI	29	1966
	25	14	16 (6)	-	2.7	-	-	0.0	N. Br. Pigeon R.	8	8.1	260	504	-	VIII	3	1965
	25	15	7 (3)	1.09	3.0	3	-	0.0	Embarrass R.	8	8.2	240	450	-	VIII	3	1965

Fishery Code

1. Trout
2. Panfish
3. Bass, Panfish
4. Bass, Panfish, Northern Pike
5. Panfish, Northern Pike
6. Walleye
7. Forage Minnows
8. Unknown

Averages

Total Area . . . . . 1,731.4 acres

Avg. Area . . . . . 27.4 acres

Total Length . . . . . 334.8 miles

Avg. Length . . . . . 4.6 miles

Miles Public Frontage . 22.85 miles

Avg. pH 8.0

Avg. Tot. Alk. . . . . 200 mg/l

Avg. Spec. Cond. . . . 389 mmhos/cm @ 77° F.

Appendix III

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 (pondweeds, coontail, algae, etc.).
b. floating - plants at least portions of which float on the surface (lily, water shield, duckweed).
c. emergent - rooted vegetation commonly found in shallow water or along lake margins. A major portion of the plant stands out of the water.

aquifer - Any geological formation capable of bearing 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^{o} 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, 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 of water. Man through pollution has greatly increased the rate of eutrophication on many waters.

fertility classification -

Total Alkalinity	Classification	Productivity	Waters Area
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
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:

drumlin - Low "whale shaped" mounds of clays, gravel, and boulders formed and moulded by glacial ice sheets.
esker - Low, meandering ridges of sand and gravel laid down by glacial streams and rivers.
grand 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.
outwash plain - Gently sloping fans of various sediments deposited by water flowing from a static 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 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 - Having either marginal or internal spring which form the bulk of the water supply. Often no inlets are present but outlets are present and reflect spring volume.

littoral bottom materials - Bottom sediments lying in water less than five feet deep and classified as follows:
sand - Particles 0.0625 mm to 1.9 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.

muskellunge waters - classification:
a. Prime muskellunge waters supporting good muskellunge populations often without supplemental stocking.
b. Good muskellunge waters. Stocking often necessary to maintain a suitable population.
c. Waters that contain muskellunge but not in high numbers.

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

shoreline development figure - 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.

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 micomhos per centimeter at 25° C.

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

trout stream classification:
a. High grade trout water with adequate natural reproduction to maintain the fishery.
b. Good streams with some native trout but lack enough native fish to support a fishery. Stocking is necessary.
c. Marginal streams with little food, cover, or habitat. Stocking is necessary to provide fishing.

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.

water table - The upper surface of the saturation zone of a ground water supply.

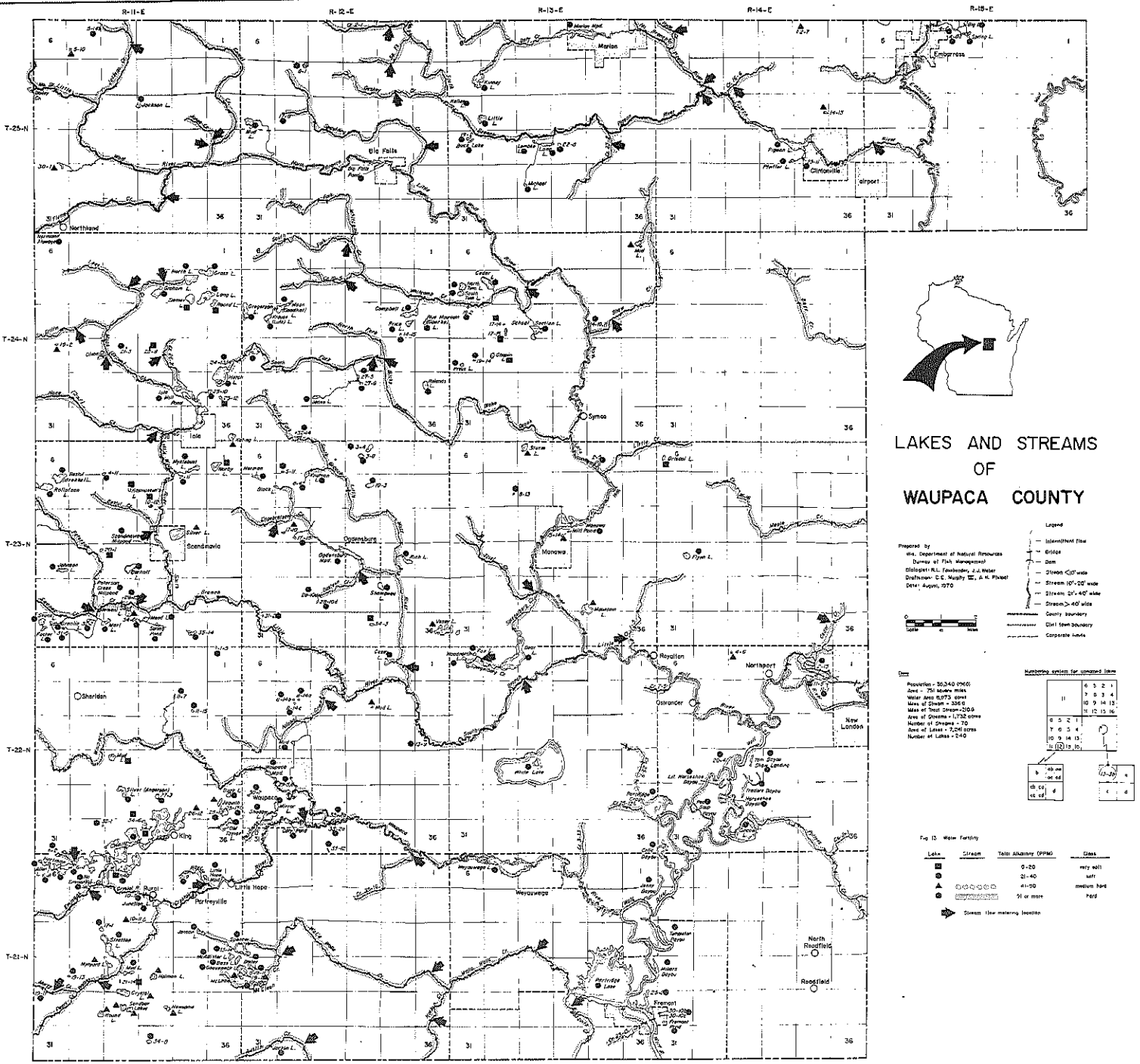
wetland - Any area where the ground is too wet to raise an agricultural crop. Wetlands are classified as follows:
deep marsh - Water from six inches to three feet deep during growing seasons. Cattails, reeds, bulrushes, spike rushes, and pondweeds are common.
shallow marsh - Water present during part 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 - Water logged 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 unfavorable dissolved oxygen conditions under ice.

SURFACE WATER RESOURCE PUBLICATIONS

Adams County	1966
Ashland County	1966
Barron County	1964
Bayfield County	1970
Burnett County	1966
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
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
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



LAKES AND STREAMS OF WAUPACA COUNTY

Prepared by
Wis. Department of Natural Resources
Bureau of Fish Management
Biologist: R.L. Fewlender, J.J. Weber
Draftsmen: D.C. Murphy III, A.H. Pickel
Date: August, 1970

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

Scale: 1 inch = 2 miles

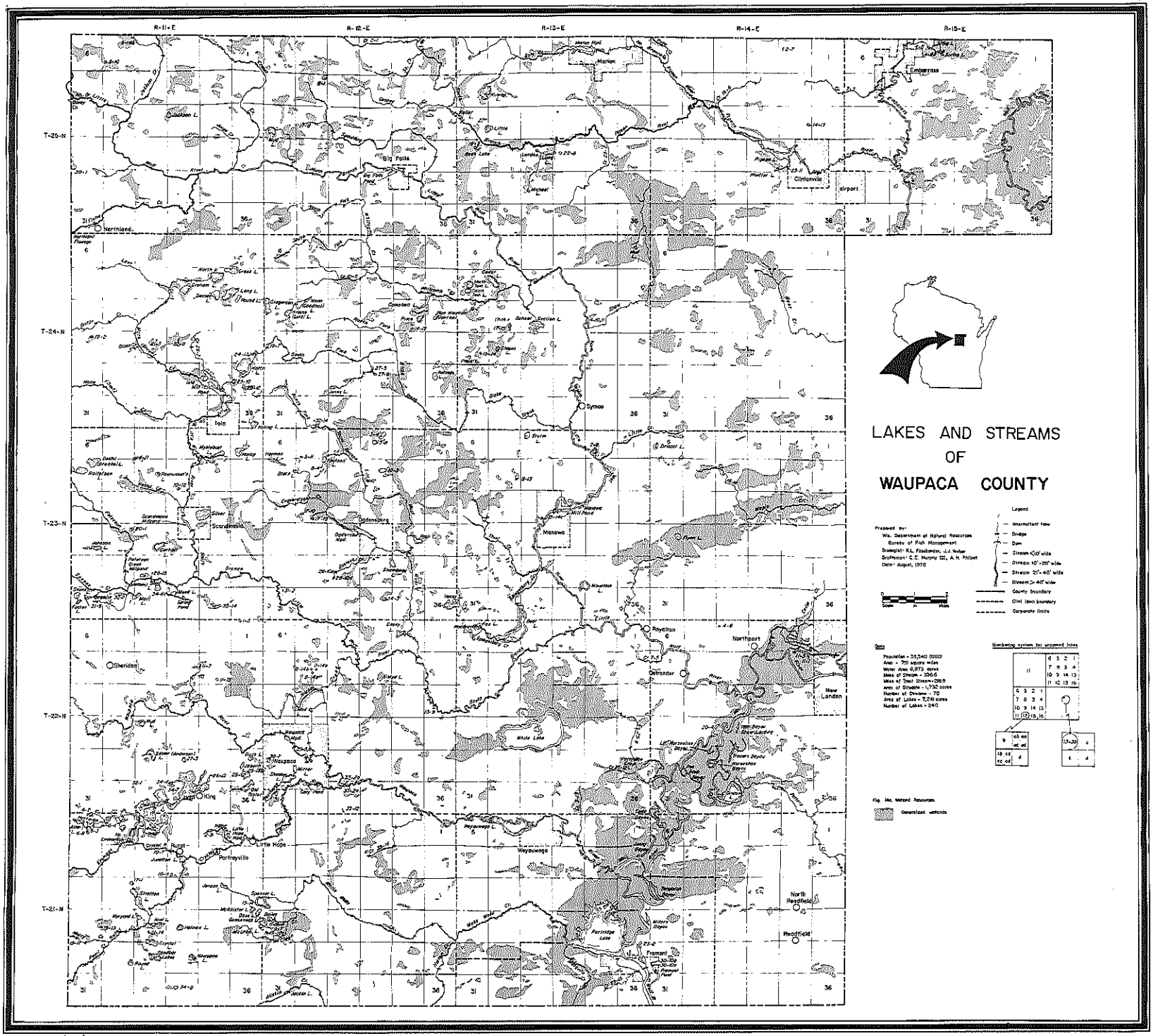
Data
Population - 38,340 (1960)
Area - 751 square miles
Water Area 8,973 acres
Miles of Stream - 336.9
Miles of Trout Stream-20.8
Area of Streams - 1,732 acres
Number of Streams - 70
Area of Lakes - 7,241 acres
Number of Lakes - 240

Numbering system for unnamed lakes

Fig 13 Water Fertility

Lake	Stream	Total Alkalinity (PPM)	Class
		0-20	very soft
		21-40	soft
		41-90	medium hard
		91 or more	hard

Stream flow metering location



LAKES AND STREAMS OF WAUPACA COUNTY

Prepared by:
Wis. Department of Natural Resources
Bureau of Fish Management
Biologist: R.L. Freudenstein, J.J. Weber
Draftsmen: C.C. Murphy III, A.H. Philpot
Date: August, 1970

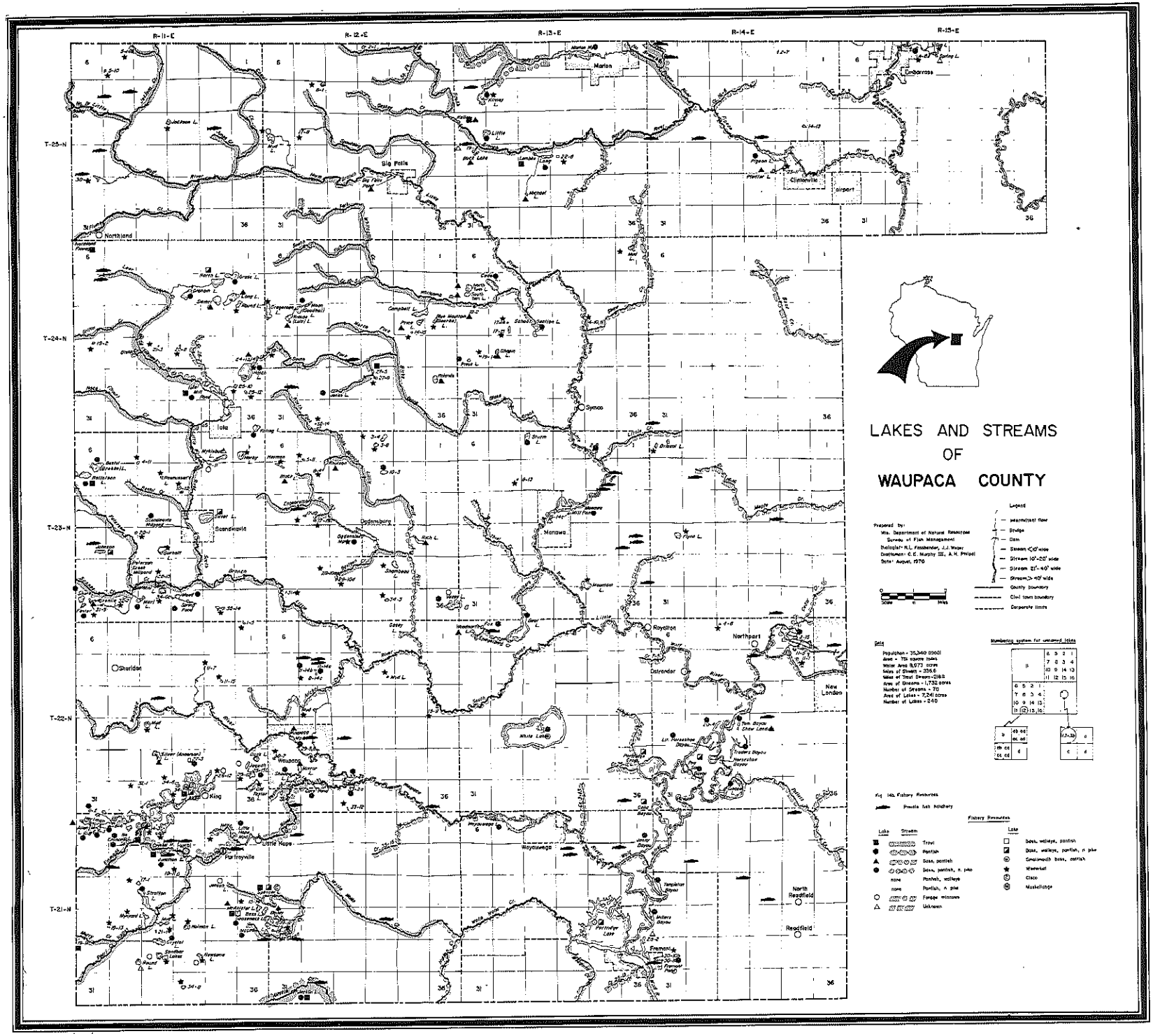
Legend
- Intermittent flow
- Bridge
- Dam
- Stream <10' wide
- Stream 10'-20' wide
- Stream 21'-40' wide
- Stream >40' wide
- County boundary
- Civil town boundary
- Corporate limits

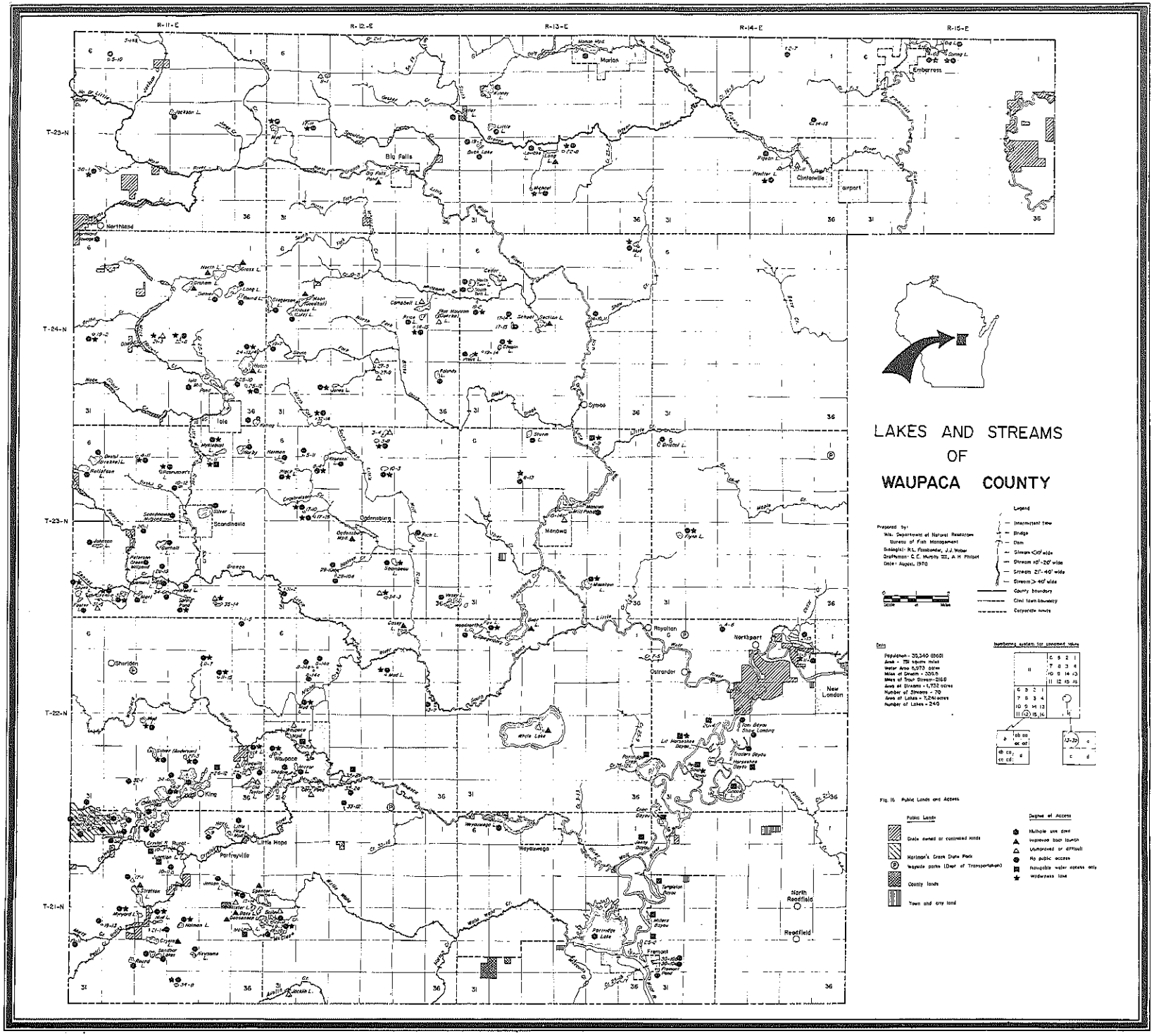
Scale 0 1 2 Miles

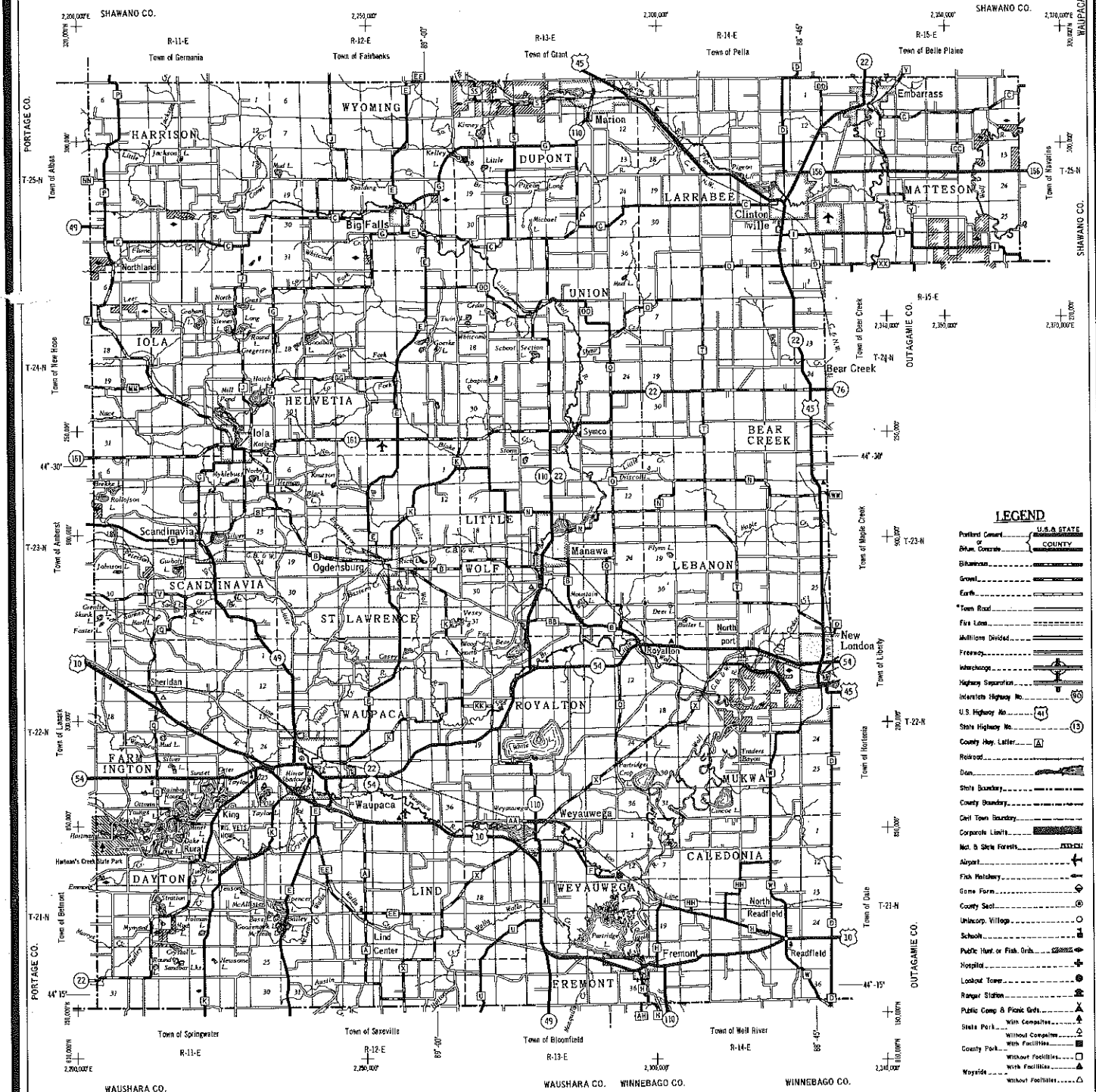
Data
Population - 38,540 (1970)
Area - 731 square miles
Water Area 6,973 acres
Miles of Stream - 356.6
Miles of Trout Stream - 258.9
Area of Streams - 1,732 acres
Number of Streams - 70
Area of Lakes - 2,241 acres
Number of Lakes - 240

Numbering system for unsurveyed lakes

Fig. No. Wetland Resources.
Generalized wetlands


R-11-E
R-12-E
R-13-E
R-14-E
R-15-E
T-25-N
T-24-N
T-23-N
T-22-N
T-21-N
Marion
Embarrass
Big Falls
Clintonville
Airport
Northland
Iola
Symco
Scandinavia
Dodensburg
Menasha
Royalton
Northport
Sheridan
Ostrander
New London
White Lake
Waupaca
King
Little Hope
Portryoville
Waupaca
North Readfield
Readfield
Fremont
LAKES AND STREAMS
OF
WAUPACA COUNTY
Legend
Prepared by
Wis. Department of Natural Resources
Bureau of Fish Management
Biologist- R.L. Fassbender, J.J. Weber
Draftsman- C.E. Murphy III, A.H. Priebe
Date- August, 1976
Scale
Miles
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
Data
Population - 35,340 (1960)
Area - 756 square miles
Water Area 9,973 acres
Miles of Stream - 2366
Miles of Trout Stream-2183
Area of Streams - 1,732 acres
Number of Streams - 70
Area of Lakes - 7,241 acres
Number of Lakes - 240
Numbering system for unnamed lakes
Fig. 140. Fishery Resources
Private fish hatchery
Fishery Resources
Lake
Stream
Trout
Panfish
Bass, panfish
Bass, panfish, n. pike
none
Panfish, walleye
none
Panfish, n. pike
Forage minnows
Unknown
Lake
Bass, walleye, panfish
Bass, walleye, panfish, n. pike
Smallmouth bass, catfish
Muskellunge





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
- School
- Public Hunt. or Fish. Grds.
- Hospital
- Lookout Tower
- Ranger Station
- Public Camp & Picnic Grds.
- State Park — With Campsites / Without Campsites
- County Park — With Facilities / Without Facilities
- Wayside — With Facilities / Without Facilities

*Surface type on town roads not shown.

CIVIL TOWNS

HARRISON	WYOMING	DUPONT	LARRABEE	MATTESON
IOLA	HELVETIA	UNION	BEAR CREEK	
SCANDINAVIA	ST. LAWRENCE	LITTLE WOLF	LEBANON	
FARMINGTON	WAUPACA	ROYALTON	MUKWA	
DAYTON	LIND	WEYAUWEGA	CALEDONIA	
		FREMONT		

County Seat..... Waupaca
Population..... 35,340
Area..... 751 Sq. Mi.

MILES OF HIGHWAY as of Jan. 1, 1969

STATE	184
COUNTY	342
LOCAL ROADS	975
OTHER ROADS	4
TOTAL FOR COUNTY	1505

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

+ Grid based on Wisconsin coordinate system, south-central zones.

Fig. 19.
County Highway Map
WAUPACA CO.

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

SCALE 0 1 2 MILES

Corrected for
JAN. 1970

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

WAUPACA 68-4