COMMUNITY ASSISTANCE
PLANNING REPORT NO. 9
(2nd Edition)

# FLOODLAND INFORMATION REPORT FOR THE PEWAUKEE RIVER

## VILLAGE OF PEWAUKEE
## WAUKESHA COUNTY
## WISCONSIN



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Special acknowledgement is due Mr. Curtis R. Hulterstrum, Principal Water Resources Engineer, and Ronald J. Printz, Senior Water Resources Engineer, for their contributions to the preparation of this report.

COMMUNITY ASSISTANCE PLANNING REPORT
NUMBER 9
(Second Edition)

# FLOODLAND INFORMATION REPORT FOR THE PEWAUKEE RIVER

Village of Pewaukee
Waukesha County, Wisconsin

Prepared by the

Southeastern Wisconsin Regional Planning Commission
P. O. Box 769
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March 1985

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Outside Region $5.00

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March 17, 1985

President and Members of the Village Board
of the Village of Pewaukee
235 Hickory Street, Village Hall
Pewaukee, Wisconsin 53072

Dear President and Members of the Village Board:

The Commission is pleased to transmit to you herewith revised floodland information for Pewaukee Lake, the Pewaukee Lake outlet, and the Pewaukee River in the Village of Pewaukee. The information included in this document supersedes and replaces in its entirety the information set forth in the first edition of SEWRPC Community Assistance Planning Report No. 9, Floodland Information Report for the Pewaukee River.

The report transmitted herewith presents updated information on flood discharges and stages under existing and probable future land use conditions within the Village of Pewaukee. The study results included are based upon the more precise topographic information made available as a result of the Village Board's wise decision to prepare a large-scale topographic map of the central portion of the Village. In addition, this report incorporates new information on land use development throughout the tributary watersheds of the Pewaukee River system.

It is recommended that the information included in this report be formally transmitted to the Wisconsin Department of Natural Resources and the Federal Emergency Management Agency with a request from the Village that those agencies take the steps necessary to revise the federal flood insurance study for the Village of Pewaukee using the information contained herein. In addition, it is recommended that the information in this report be used as the basis for the revision of the floodland zoning regulations included in the Village Zoning Ordinance.

We wish to take this opportunity to express our appreciation to the Village for the cooperation received from the village staff in the conduct of this study. The Village is also to be commended for its foresight in providing the funds necessary to develop the topographic information that was essential to the proper analysis of the complex flood hazard problems existing in the Village, and ultimately to revision of the boundaries of the flood hazard areas, thereby facilitating the sound development of the Village.

The Commission staff stands ready to assist you in every way possible in utilizing the information contained in this report to guide development within the Village over the months and years ahead in the public interest.

Sincerely,

Kurt W. Bauer
Executive Director

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# Chapter I

# INTRODUCTION

The purpose of this report, and the supporting inventory and analyses, is to develop and present floodland information for the Pewaukee River and a tributary thereto--the Pewaukee Lake outlet--within and near the Village of Pewaukee, Waukesha County, Wisconsin. More specifically, this floodland information report presents flood discharges and stages, delineates a floodway and floodplain fringe, and presents draft floodland regulations in order to provide the Village of Pewaukee with the information necessary for the preparation and adoption of sound floodland use regulations in accordance with the requirements of the Wisconsin Floodplain Management Program and the federal flood insurance program administered by the Federal Emergency Management Agency, as well as for the conduct of sound community planning and development programs. This report is an extension and refinement of the Fox River watershed plan completed by the Southeastern Wisconsin Regional Planning Commission (SEWRPC) in 1970[1]; and of the floodland information report for the Village of Pewaukee prepared by the Commission in October 1976, presented in an earlier edition of this report.[2]

The first edition of this report was prepared by the Commission in response to formal requests made on May 27, 1975, and July 25, 1975, by the Village of Pewaukee. The study described in the first edition was conducted by the Commission from November 1975 through July 1976. Commission data and information on the natural resource base and man-made features of the Pewaukee area were used in the conduct of that study. This data base was supplemented with information provided by the Village of Pewaukee, the Waukesha Freeman, the Lake Country Reporter, the Pewaukee Post, and private citizens of the Village, as well as information provided by the Waukesha County Highway Department, the Waukesha County Park and Planning Department, the Wisconsin Department of Transportation, the U. S. Geological Survey, and the National Weather Service.

In order to develop flood flows and stages by application of hydrologic-hydraulic simulation techniques, as was done in this study, the various pertinent watershed characteristics, such as land use, soil type, and topography, must be determined. In preparing the first edition of this report, using the best topographic information available at that time, it was believed that floodwaters from Pewaukee Lake flowed easterly across Wisconsin Avenue, to significantly affect the peak flood discharges of the Pewaukee River. In reviewing the results of that first study, village officials expressed concern that the available information concerning the roadway profile along Wisconsin Avenue did not reflect the true conditions with sufficient precision and thus affected the information on flow patterns, the quantities across the roadway, and the location of re-entry into the river channel.

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[1]See SEWRPC Planning Report No. 12, A Comprehensive Plan for the Fox River Watershed, Volume One, Inventory Findings and Forecasts, and Volume Two, Alternative Plans and Recommended Plan.

[2]See SEWRPC Community Assistance Planning Report No. 9 (First Edition), Floodland Information Report for the Pewaukee River, Village of Pewaukee, Waukesha County, Wisconsin, October 1976.

Accordingly, in November 1982, the Commission was asked to act as an agent for the Village of Pewaukee in preparing a new one inch equals 50 feet scale, one-foot contour interval, topographic map of that portion of the Village of Pewaukee lying between the outlet of Pewaukee Lake and the Pewaukee River, including Wisconsin Avenue. Using funds provided by the Village, the Commission contracted with the firm of Owen Ayres and Associates, Inc., to prepare the necessary large-scale topographic map. That map was completed in February 1983 and provided additional, more detailed and up-to-date topographic information of this important area of the Village. In addition, the Village provided the Commission with supplemental field survey data for that segment of Wisconsin Avenue extending from the Chicago, Milwaukee, St. Paul & Pacific Railroad right-of-way to Oakton Avenue.

Thus, more detailed and up-to-date topographic information is in this revised study of the Village of Pewaukee floodlands, together with new data on land use in the tributary watersheds, reflecting 1980 conditions. In addition, the Commission incorporated eight more years--1975 through 1982--of meteorological data in the water resources simulation model used to develop the estimates of flood flows. All of this new information was combined with the historic information used in the preparation of the first edition of this report to provide the basis for the study results set forth in this second edition.

In addition to this introductory chapter, this report contains the following nine chapters which describe the inventory and analyses phases of the project or present study results:

- The Study Area: An Overview
- Historic Flood Events
- Hydrology of the Pewaukee River Subwatershed
- Hydraulics of the Pewaukee River Subwatershed
- The Hydrologic-Hydraulic Model
- Flood Discharges and Stages and the Natural Floodlands
- The Regulatory Floodlands
- Floodland Regulations
- Summary

Since some users of this report may not be completely familiar with the technical terminology used in the field of floodland management, a glossary of selected terms is included in Appendix A.

# Chapter II

# THE STUDY AREA: AN OVERVIEW

## FOX RIVER WATERSHED

The Pewaukee River originates in Section 26, Township 8 North, Range 19 East, in the Town of Lisbon in northeastern Waukesha County, flows in a southwesterly direction to the Village of Pewaukee, and then in a southeasterly direction through the Village to the Fox River. The Pewaukee River is, as shown on Map 1, a small headwater tributary of the Fox River. The Fox River drains a 942-square-mile area in Wisconsin and flows into Illinois just below Wilmot in Kenosha County.

The U. S. Geological Survey (USGS) stream gaging station (No. 05-5438.30) on the Fox River at Waukesha, which is cooperatively maintained by Waukesha County, the U. S. Geological Survey, and the Southeastern Wisconsin Regional Planning Commission (SEWRPC), and which has been in operation since January 1963, is the streamflow recordation station site closest to the Pewaukee River. It has a tributary area of 127 square miles and is located approximately 7.54 miles downstream from the Village of Pewaukee. The average discharge recorded at that location is 92 cubic feet per second, and the maximum flood flow recorded is an instantaneous flow of 2,260 cubic feet per second recorded on April 22, 1973. The minimum flow recorded at the Waukesha Station is 3.0 cubic feet per second recorded on January 1, 1964.

## PEWAUKEE RIVER SUBWATERSHED

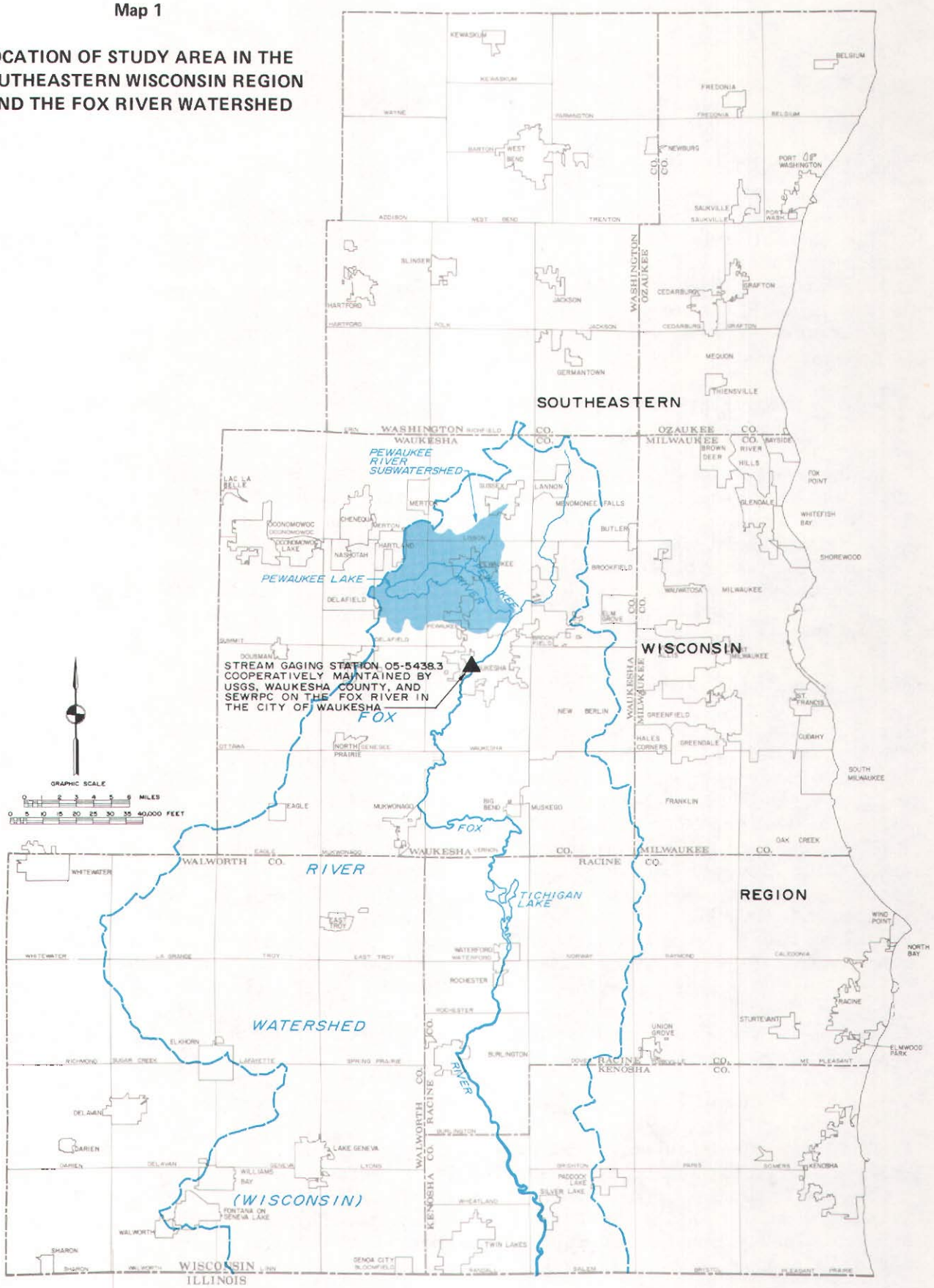
For purposes of this report, the Pewaukee River subwatershed, as shown on Map 2, is defined as that 38.35-square-mile drainage area tributary to the Pewaukee River at the point where it joins the Fox River in Section 26, Township 7 North, Range 19 East, in the Town of Pewaukee, about six miles downstream of the center of the Village of Pewaukee. Rural land uses predominate in the Pewaukee River subwatershed, with about 76 percent of the watershed area being devoted in 1980 to agricultural and agricultural-related uses, water, wetlands, woodlands, and other nonurban lands. In addition to the Village of Pewaukee, all of which is located within the subwatershed, the Pewaukee River subwatershed contains portions of three other incorporated municipalities--the City of Waukesha, the Village of Hartland, and the Village of Sussex--as well as portions of the Towns of Delafield, Lisbon, Merton, and Pewaukee. Pertinent data and information on natural resource base and man-made features of the Pewaukee River subwatershed are presented in Chapter IV of this report.

## VILLAGE OF PEWAUKEE

The Village of Pewaukee, which was incorporated in 1876, developed around early industries including a saw mill, a grist mill, a limestone quarry, a wheel-wright shop, and a pump factory. As of 1980, the Village encompassed about 2.9 square miles, all located within the Pewaukee River subwatershed, and contained a population of 4,637 people. The 1980 resident population was about 42 percent above the 1970 population of 3,271 people, and almost double

Map 1

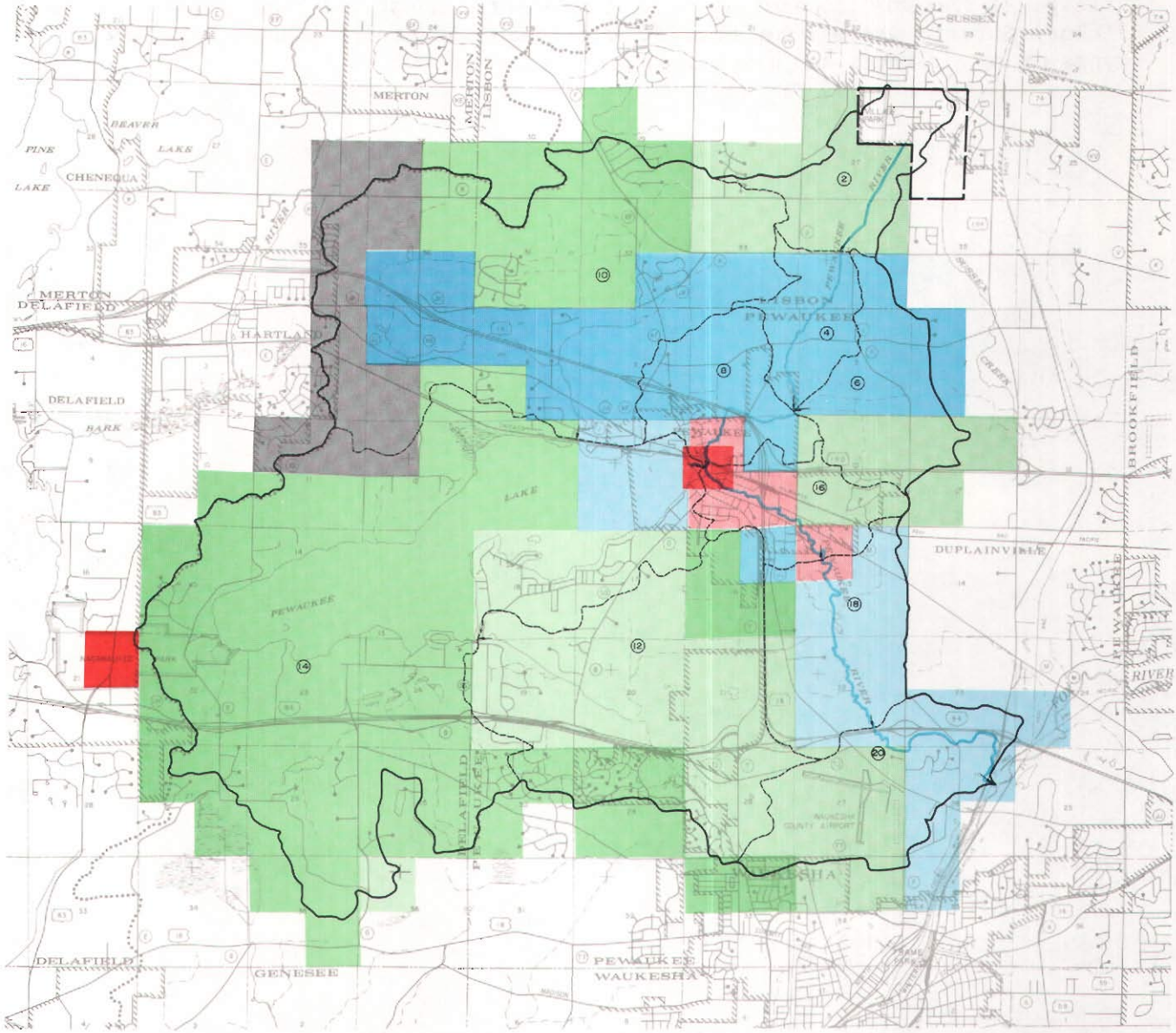
## LOCATION OF STUDY AREA IN THE SOUTHEASTERN WISCONSIN REGION AND THE FOX RIVER WATERSHED




Source: SEWRPC.

Map 2

## AVAILABILITY OF TOPOGRAPHIC MAPPING IN THE PEWAUKEE RIVER SUBWATERSHED




LEGEND

- SUBWATERSHED BOUNDARY
- SUBBASIN BOUNDARY
- SUBBASIN DISCHARGE
- (12) SUBBASIN IDENTIFICATION NUMBER
- PEWAUKEE RIVER REACH FOR WHICH FLOOD STAGE PROFILES AND FLOOD HAZARD MAPS WERE PREPARED

| TOPOGRAPHIC MAPPING AVAILIABLE FROM | SCALE | CONTOUR INTERVAL | DATE OF MAPPING |
|---|---|---|---|
| WISDOT | 1" = 100' | 2 FEET | 1968 |
| SEWRPC | 1" = 200' | 2 FEET | 1969 & 1976 |
| SEWRPC | 1" = 100' | 2 FEET | 1968 |
| WAUKESHA COUNTY | 1" = 200' | 2 FEET | 1981 – 1984 |
| WAUKESHA COUNTY | 1" = 200' | 5 FEET | 1960 |
| VILLAGE OF HARTLAND | 1" = 100' | 2 FEET | 1978 |
| VILLAGE OF PEWAUKEE | 1" = 50' | 1 FOOT | 1982 |
| VILLAGE OF PEWAUKEE | 1" = 100' | 2 FOOT | 1975 – 1976 |
| VILLAGE OF SUSSEX | 1" = 200' | 2 FOOT | 1974 – 1975 |

GRAPHIC SCALE
0 1 MILE
0 2000 4000 6000 8000 FEET

Source: SEWRPC.

the 1960 population of 2,485 people. Commission forecasts indicate that by the year 2000 the population of the Village may be expected to increase to about 9,250 people--approximately double the 1980 level. Industrial activity in the Village is largely concentrated in a 200-acre industrial park located along Hickory Street, where more than 20 different industries manufacture various types of metal, wood, and electrical products.

# Chapter III

# HISTORIC FLOOD EVENTS

## INTRODUCTION

The collection, collation, and analysis of historic flood information, which includes measurements or observations of flood flows, stages, areas of inundation, and flood damage, was an important element in the preparation of this floodland information report. This historic flood information was important primarily for two reasons. First, because the flood flows, stages, and areas of inundation were developed for this report primarily by the application of hydrologic-hydraulic simulation techniques, sound engineering practice requires comparison between the results obtained with these techniques and available, reliable observations of actual hydrologic-hydraulic behavior. Such comparisons permit adjustments to, and refinements of, the analytical work, and therefore result in a more accurate representation of the hydrology and hydraulics of the watershed. Second, experience indicates that public memory of, and concern over, flood problems tends to diminish rapidly with the passage of time after a major flood event. Consequently, both public and private development decisions tend to be made without sound, definitive knowledge of actual flood events. An effective way to bring the seriousness of flood problems into proper perspective is to inventory and document historic flood information.

## PROCEDURE

The inventory of historic flood events was initiated by examining annual instantaneous peak streamflows as measured by the U. S. Geological Survey at the Fox River gaging station at Waukesha in Waukesha County. Although this gaging station is located about seven and one-half miles downstream from the Village of Pewaukee, and monitors flow from a 127-square-mile drainage area significantly larger than the 38-square-mile Pewaukee River subwatershed, streamflow at the gaging station serves as a valuable index to the time of occurrence of flood events in the Pewaukee area. This information was used to verify the application of the hydrologic-hydraulic simulation model described later in this report to identify the times of occurrence of hydro-meteorologic conditions conducive to the flood events. Historic flood information assembled by the Commission in the conduct of comprehensive planning programs for the Fox River watershed, the Menomonee River watershed, located east of the Pewaukee River subwatershed, and the Rubicon River watershed, located northwest of the Pewaukee River subwatershed, were also examined during the historic flood event inventory.

After completing an initial reconnaissance, the Commission staff contacted village officials, business people and private citizens, the Waukesha County Historical Society, and the State Historical Society, and examined back issues of the Waukesha Freeman, the Lake Country Reporter, and the Pewaukee Post. These sources provided a variety of flood and flood-related information, including historic flood stages, identification of riverine areas that have been flooded, photographs of flooding, and newspaper accounts of flooding events. This information was used to prepare a comprehensive description of

major and minor flood events associated with flood problems in and near the Village of Pewaukee. The various information sources revealed the occurrence of four flood events of sufficient magnitude to warrant attention in the news media or to otherwise be recorded.

## JUNE 26, 1940 FLOOD

Runoff created by a violent thunderstorm resulted in several flooding problems in and near the Village of Pewaukee on June 26, 1940, including inundation of STH 16 east and west of Pewaukee and STH 19 west of Pewaukee. Pewaukee Lake levels rose such that the water threatened to overtop Wisconsin Avenue in the Village east of the lake, and, as a result, sandbagging operations were initiated along Wisconsin Avenue. Six pumps were operated to eliminate surcharging in the village sewer system.

## APRIL 1, 1960 FLOOD

Flooding occurred in Waukesha County on April 1, 1960. The Village reported the need for sandbagging to protect the Sentry Store located immediately adjacent to the Pewaukee River near the intersection of Oakton Avenue and Elm Street.

## SEPTEMBER 19, 1972 FLOOD

The September 19, 1972, flood event was caused by a combination of high winds and driving rain--with a total of 3.5 inches of rainfall being recorded in Pewaukee--and a one-foot rise in the level of Pewaukee Lake. Sandbagging operations were required at the Sentry Store parking lot in order to prevent flood damage. Basement flooding was reported and portions of local streets were inundated.

## APRIL 21-22, 1973 FLOOD

Heavy spring rains falling on an unusually wet ground caused extensive flooding and flood damage in southeastern Wisconsin on April 21 and 22, 1973. The level of Pewaukee Lake rose almost one foot and, as a result of high winds, waves moved easterly across the lake and water flowed over Wisconsin Avenue and into the commercial area of the Village at the east end of the lake. Wisconsin Avenue was closed temporarily until a sandbagging operation could be completed, and sandbags were also placed along the rear of commercial buildings located along the east edge of Wisconsin Avenue in order to prevent flood damage from high waters on the Pewaukee Lake outlet and the Pewaukee River. The Pewaukee River and the Pewaukee Lake outlet were well out of their channels throughout the village area, and basement flooding and backup from the sanitary sewers--with some basements reporting as much as eight feet of water--were reported throughout the Village, with the most serious problems being in the vicinity of Wisconsin Avenue and Park Avenue. Fire department pumping trucks were used to relieve surcharging of the sanitary sewerage system in the village area. Sandbagging and diking were used to prevent flooding at the Sentry Store. It was reported that almost every business in the downtown commercial section suffered some form of water damage. The Pewaukee River beneath the Capitol Drive bridge was intentionally blocked in order to make maximum utilization of the floodwater storage area immediately upstream in the village park.

## SUMMARY

Based on the available historic flood data, the Village of Pewaukee experienced its greatest flood of record in April 1973. A series of lesser flood events occurred in 1940, 1960, and 1972. Flood problems in the Village appear to be concentrated in the vicinity of the Pewaukee Lake outlet and include: overtopping of Wisconsin Avenue due to a combination of high lake levels and waves, overland flooding near the Pewaukee River-Pewaukee Lake outlet confluence, and basement flooding attributed in part to surcharging and backup of sanitary sewerage systems. Flood problems within the Village have been of sufficient magnitude to warrant several major flood-fighting efforts by the Village, including sandbagging operations[1] along Wisconsin Avenue, along Capitol Drive, and in the vicinity of the Sentry Store, and pumping from the sanitary sewerage system to relieve surcharge conditions.

As described later in this report, the stages and area of inundation associated with the flood of record--the April 1973 event--indicate that that event had a recurrence interval of approximately 30 years. The flood of record was therefore significantly less severe than the 100-year recurrence interval flood event specified for floodland regulation purposes. The absence of a flood of record approximating the 100-year recurrence interval event does not mean that such an event will not occur in the Pewaukee River subwatershed. Major floods or, more specifically, the meteorological events and other conditions that cause such floods are random events, and while it is possible for those events to occur in such a manner that major flooding does not occur in a particular geographic area for a relatively long period of time, such flooding may, in fact, occur at any time.

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[1]As used in this report, the term "sandbagging" is meant to include a wide variety of streamflow restriction activities, including traditional sandbagging to prevent floodwaters from occupying floodplains, the placement of obstructions to streamflow across the stream channel, and the construction of temporary dikes.

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# Chapter IV

# HYDROLOGY OF THE PEWAUKEE RIVER SUBWATERSHED

## INTRODUCTION

Hydrologic-hydraulic data constitute a key requirement of any flood study. While watershed hydrology and hydraulics may be inventoried and discussed separately, as is done in this report, they must be analyzed together since they function in an interrelated manner within a watershed to determine flood flows and stages. The findings of the necessary hydrologic inventory are presented in this chapter, while the findings of the hydraulic inventory are presented in Chapter V. The computer modeling techniques used to conduct the integrated analysis of watershed behavior are discussed in Chapter VI.

## METEOROLOGIC DATA

Precipitation within the subwatershed takes the form of rain, sleet, hail, and snow, and ranges from gentle showers of trace quantities to brief but intense and potentially destructive thunderstorms or major rainfall-snowmelt events causing property damage. Monthly and annual total precipitation and snowfall data for the Waukesha National Weather Service Station--the closest observation station to the Village of Pewaukee--are presented in Table 1. The average annual total precipitation in the subwatershed based on the City of Waukesha data is 32.02 inches, expressed as water equivalent, while the average annual snowfall and sleet measured as snow and sleet is 42.0 inches. Assuming that 10 inches of measured snowfall and sleet are equivalent to 1 inch of water, the average annual snowfall of 42.0 inches is equivalent to 4.2 inches of water, and, therefore, only about 13 percent of the average annual total precipitation occurs as snowfall and sleet. Average total monthly precipitation for the subwatershed ranges from 1.10 inches in February to 3.79 inches in August. The principal snowfall months are December, January, February, and March, during which 88 percent of the average annual snowfall may be expected to occur.

Use of the hydrologic-hydraulic model described later in this report required assembly of six types of meteorologic data--precipitation, temperature, solar radiation, wind movement, dewpoint temperature, and potential evaporation--for a continuous period extending from

**Table 1**

**MONTHLY PRECIPITATION CHARACTERISTICS OF THE PEWAUKEE RIVER WATERSHED[a]**

| Month | Average Total Precipitation 1951-1980[b] (inches) | Average Snow and Sleet 1958-1982 (inches) |
|---|---|---|
| January | 1.40 | 10.9 |
| February | 1.10 | 7.9 |
| March | 2.42 | 9.2 |
| April | 3.45 | 2.1 |
| May | 3.01 | 0.0 |
| June | 3.63 | 0.0 |
| July | 3.73 | 0.0 |
| August | 3.79 | 0.0 |
| September | 3.15 | 0.0 |
| October | 2.37 | 0.0 |
| November | 2.15 | 2.7 |
| December | 1.82 | 9.2 |
| Year | 32.02 | 42.0 |

[a] Based on observations at the City of Waukesha.

[b] The 30-year period 1951-1980 is the "standard normal" period, which conforms to the World Meteorological Organization standard for climatological normals.

Source: National Weather Service.

1940 through 1982. The meteorologic data set contains daily precipitation values as recorded at the Waukesha National Weather Service Station and hourly precipitation values calculated by examining the distribution of hourly rainfall recorded for the National Weather Service Station at Mitchell Field in Milwaukee. Daily maximum-minimum temperatures contained within the file are based on observations made at Waukesha from 1940 through 1982. The file contains daily solar radiation values which were calculated using percent sunshine observations made at the Mitchell Field National Weather Service Station. Daily wind movement data, based on measurements made at the Mitchell Field National Weather Service Station, are included in the meteorologic data base. The meteorologic data set also contains daily dewpoint temperature values based partly on direct measurements made at the Mitchell Field station and partly on calculations using temperature and atmospheric pressure measurements at Mitchell Field. Daily potential evaporation amounts included in the 43-year meteorologic data base were calculated as a function of average daily temperature, daily wind movement, daily solar radiation, and average daily dewpoint temperature for Mitchell Field in Milwaukee.

The 43-year meteorologic data set makes maximum use of historic meteorologic data for the Waukesha observation station, adding as needed meteorologic data collected at the National Weather Service Station at Mitchell Field. For purposes of hydrologic-hydraulic modeling, the meteorologic data from Waukesha and Mitchell Field, as included in the data base, are considered representative of the meteorology of the Pewaukee River subwatershed.

## RUNOFF

Measured streamflow data are not available for the Pewaukee River subwatershed. As already noted, the nearest gaging station is the U. S. Geological Survey installation located on the Fox River at Waukesha. To obtain a measure of the long-term runoff from the subwatershed, average annual runoff was estimated at 8.9 inches per year under existing land use conditions using the hydrologic-hydraulic model described later in this report, for an average annual discharge of 25.1 cubic feet per second.

## HYDROLOGIC SOIL GROUPS

The nature of the soils in the Pewaukee River subwatershed has been determined primarily by the interaction over time of parent glacial deposits covering the area and the topography, climate, plants, and animals of the area. The U. S. Soil Conservation Service (SCS), under a 1963 cooperative agreement with SEWRPC, has completed a detailed soil survey for the seven-county Southeastern Wisconsin Region, including the Pewaukee River subwatershed.

With respect to subwatershed hydrology, the most significant soil interpretation completed by SCS is the categorization of soils into four hydrologic soil groups: A, B, C, D. In terms of runoff characteristics, these four soil groups vary from group A soils, which generate relatively little runoff because of high infiltration capacity, high permeability, and good drainage, to group D soils, which generate relatively large amounts of runoff because of very low infiltration capacity, low permeability, and poor drainage.

The spatial distribution and extent of the four hydrologic soil groups within the Pewaukee River subwatershed is shown on Map 3. Hydrologic soil group A does not appear in the subwatershed. Hydrologic soil groups B, C, and D cover 58 percent, 10 percent, and 19 percent, respectively, of the subwatershed area, with the remaining 13 percent being covered with man-made land or with water features such as Pewaukee Lake. Pewaukee Lake covers 10 percent of the total area of the subwatershed. It is important to note that almost two-thirds of the subwatershed is covered by group B soils which, relative to other soil groups, generate only moderate runoff.

## LAND USE

The nature and distribution of land uses--both existing and planned--within a subwatershed constitute an important element of any hydrologic inventory since both the volume and timing of direct runoff to the stream system are influenced by land uses and land use changes. While the underlying hydrologic soil groups are generally the primary determinant of hydrologic response, the type of land uses superimposed on the soil group can significantly modify that response. This is particularly true when lands are converted from rural to urban uses, since such a conversion results in a large increase in impervious surface and, therefore, an increase in runoff volume and a decrease in runoff time. Since the Pewaukee River subwatershed is covered primarily by hydrologic soil group B, which exhibits moderate runoff volumes, it follows that the subwatershed or portions of it may be significantly and adversely affected by improperly planned urbanization.

Existing (1980) land use within the subwatershed is shown on Map 4. Urban land uses--such as residential, commercial, industrial, and transportation--cover 9.1 square miles, or 24 percent, of the subwatershed area. Although existing urban land uses are evident throughout most of the subwatershed, there is a concentration of such land uses around the periphery of Pewaukee Lake and along the IH 94 corridor.

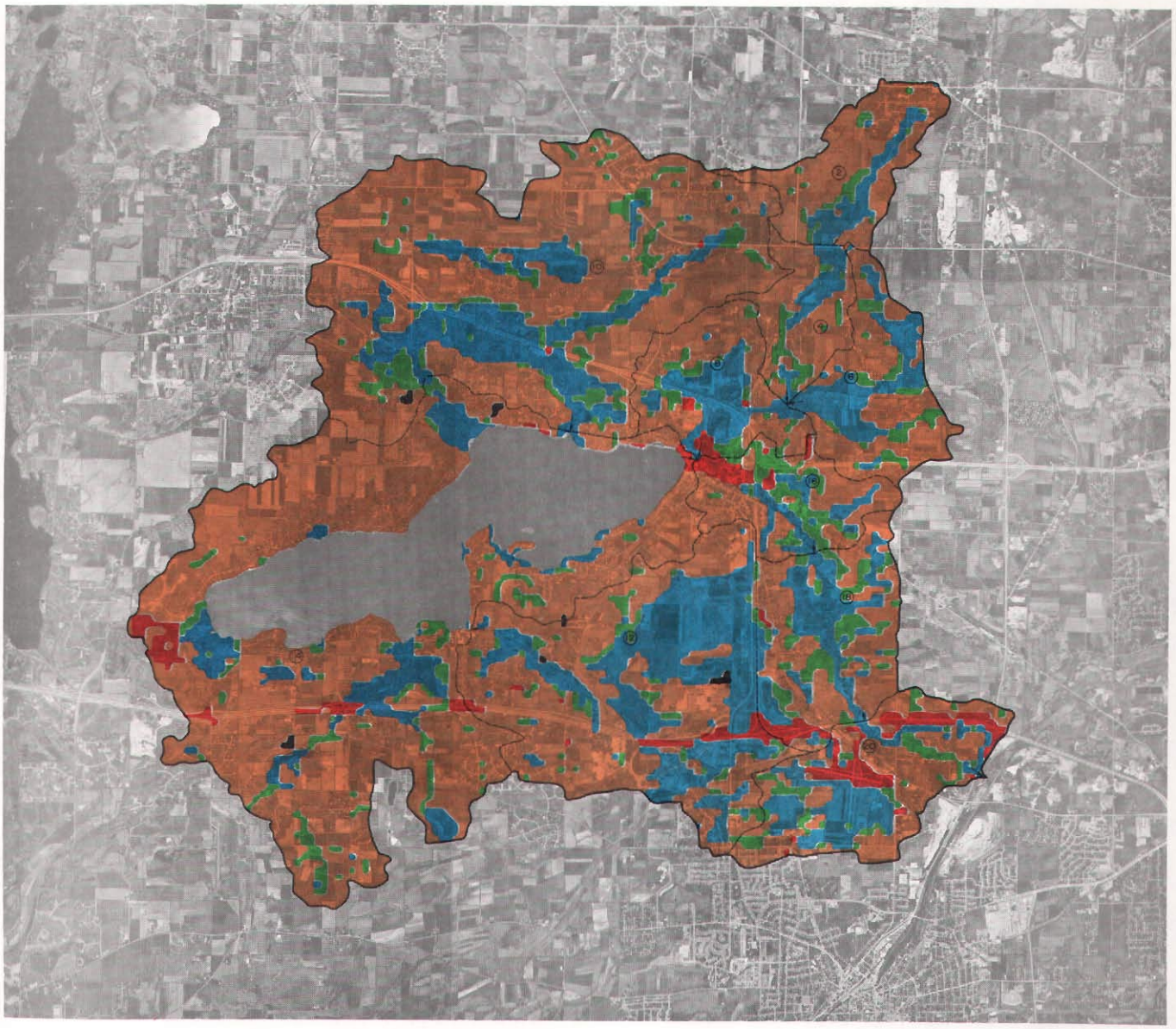
A year 2000 land use plan for the Pewaukee River subwatershed is shown on Map 5. This map was developed to help determine the probable impact of incremental urbanization on flood discharges and stages. Under year 2000 conditions, about 15.1 square miles, or about 39 percent of the Pewaukee River subwatershed, may be expected to be devoted to urban land uses if the plan recommendations are followed. This represents an increase of nearly 66 percent over the present amount of land devoted to urban use. Approximately 6.0 square miles of rural land may be expected to be converted to urban uses within the subwatershed between 1980 and the year 2000. Based on the land use plan for the subwatershed, incremental urban development would occur contiguous to existing urban development, particularly at the eastern end of Pewaukee Lake and along the IH 94 corridor.

## SUBBASINS

The Pewaukee River subwatershed was divided into smaller hydrologic units called subbasins to permit accurate representation of the watershed hydrology in the computer model used to compute flood discharges and stages. In effect, the subbasin is the "building block" within which watershed hydrologic characteristics are quantified prior to hydrologic modeling.

Map 3

## HYDROLOGIC SOIL GROUPS IN THE PEWAUKEE RIVER SUBWATERSHED



LEGEND

- SUBWATERSHED BOUNDARY
- SUBBASIN BOUNDARY
- SUBBASIN DISCHARGE
- (12) SUBBASIN IDENTIFICATION NUMBER
- (NONE) HYDROLOGIC SOIL GROUP A: VERY LITTLE RUNOFF BECAUSE OF HIGH INFILTRATION CAPACITY, HIGH PERMEABILITY, AND GOOD DRAINAGE
- HYDROLOGIC SOIL GROUP B: MODERATE AMOUNTS OF RUNOFF BECAUSE OF MODERATE INFILTRATION CAPACITY, MODERATE PERMEABILITY, AND GOOD DRAINAGE
- HYDROLOGIC SOIL GROUP C: LARGE AMOUNTS OF RUNOFF BECAUSE OF LOW INFILTRATION CAPACITY, LOW PERMEABILITY, AND MODERATE DRAINAGE
- HYDROLOGIC SOIL GROUP D: LARGE AMOUNTS OF RUNOFF BECAUSE OF VERY LOW INFILTRATION CAPACITY, LOW PERMEABILITY, AND POOR DRAINAGE
- MADE LAND
- GRAVEL PIT
- WATER

GRAPHIC SCALE

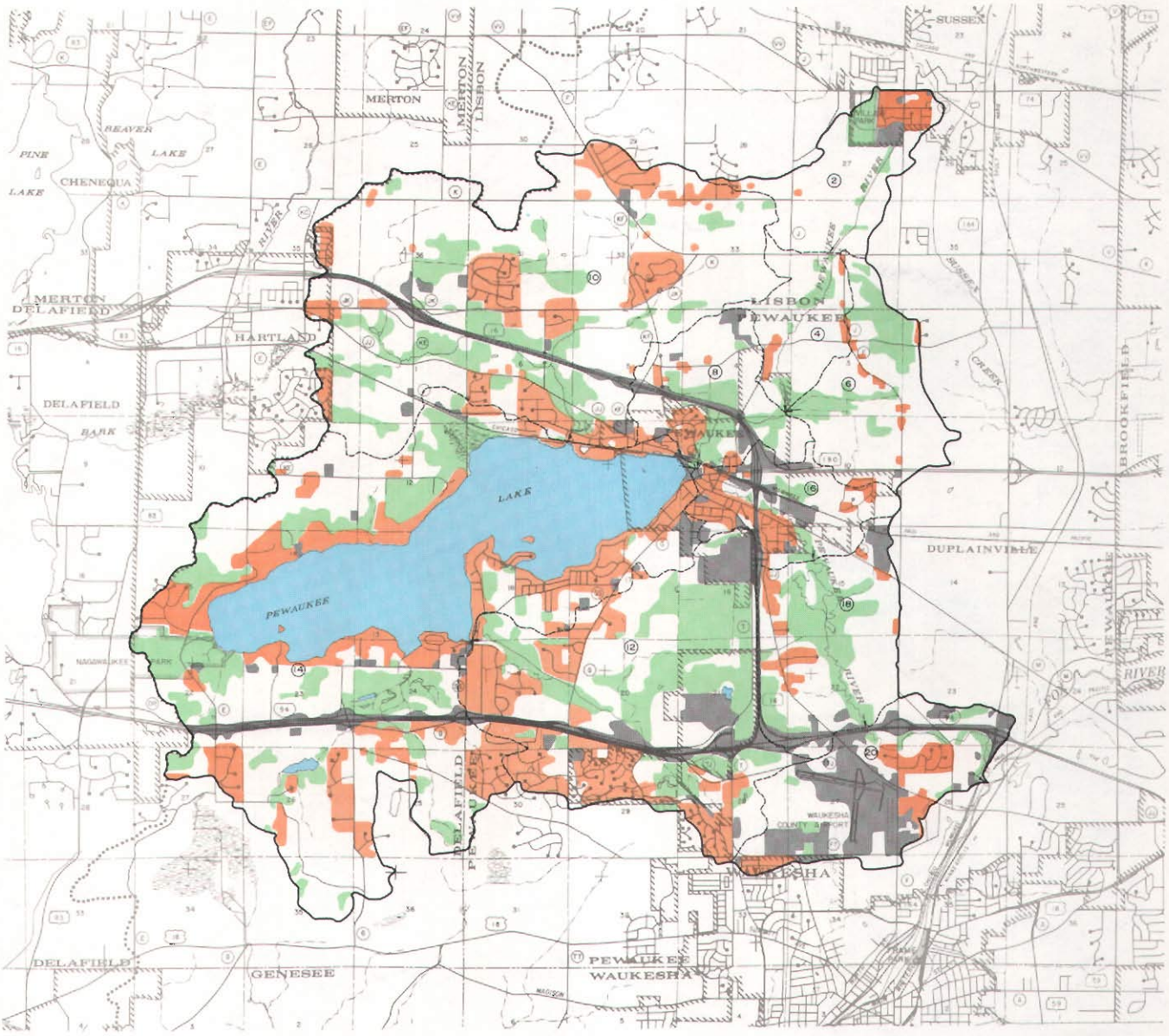
0 1/2 1 MILE

0 2000 4000 6000 8000 FEET

Source: U. S. Soil Conservation Service and SEWRPC.

Map 4

## EXISTING LAND USE IN THE PEWAUKEE RIVER SUBWATERSHED: 1980




LEGEND

- SUBWATERSHED BOUNDARY
- SUBBASIN BOUNDARY
- SUBBASIN DISCHARGE
- (12) SUBBASIN IDENTIFICATION NUMBER
- RESIDENTIAL
- COMMERCIAL, INSTITUTIONAL, INDUSTRIAL EXTRACTIVE, TRANSPORTATION AND OTHER URBAN
- ENVIRONMENTAL CORRIDORS AND OUTDOOR RECREATION
- WATER
- AGRICULTURAL AND OTHER OPEN

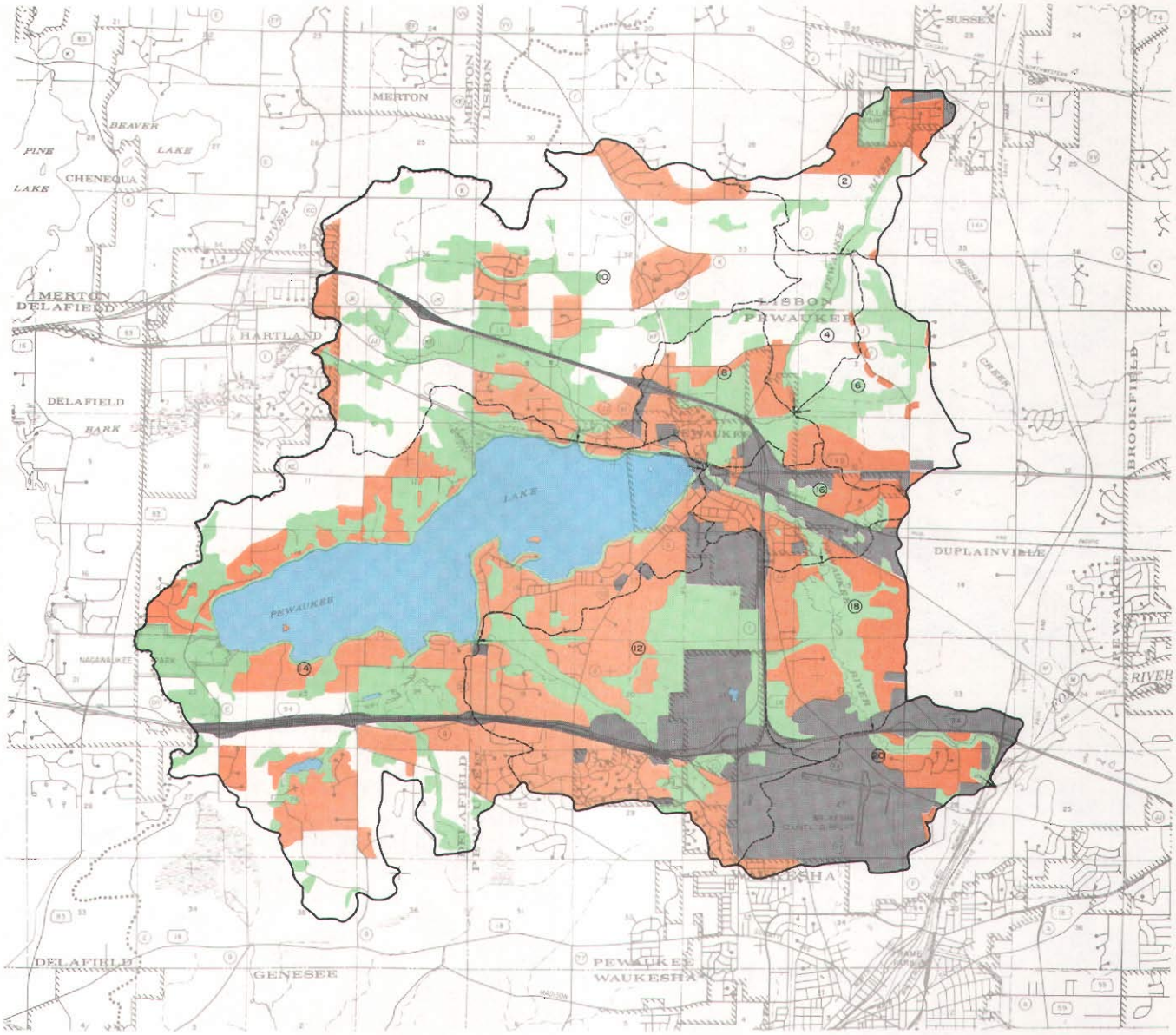
NOTE: MORE DETAILED EXISTING LAND USE MAPS FOR THE HARTLAND, PEWAUKEE, AND SUSSEX PORTIONS OF THE PEWAUKEE RIVER SUBWATERSHED ARE PRESENTED IN THE FOLLOWING SEWRPC COMMUNITY ASSISTANCE PLANNING REPORTS: NO. 49, A LAND USE AND TRAFFIC CIRCULATION PLAN FOR THE VILLAGE OF HARTLAND: 2000, MAP 15; NO. 76, A LAND USE PLAN FOR THE TOWN AND VILLAGE OF PEWAUKEE: 2000, MAP 15; AND NO. 51, A LAND USE PLAN FOR THE VILLAGE OF SUSSEX: 2000, MAP 15.

GRAPHIC SCALE
0 1/2 1 MILE
0 2000 4000 6000 8000 FEET

Source: SEWRPC.

Map 5

## PLANNED LAND USE IN THE PEWAUKEE RIVER SUBWATERSHED :2000




LEGEND

- SUBWATERSHED BOUNDARY
- SUBBASIN BOUNDARY
- SUBBASIN DISCHARGE
- (12) SUBBASIN IDENTIFICATION NUMBER
- RESIDENTIAL
- COMMERCIAL, INSTITUTIONAL, INDUSTRIAL EXTRACTIVE, TRANSPORTATION AND OTHER URBAN
- ENVIRONMENTAL CORRIDORS AND OUTDOOR RECREATION
- WATER
- AGRICULTURAL AND OTHER OPEN

NOTE: MORE DETAILED LAND USE PLAN MAPS FOR THE HARTLAND, PEWAUKEE, AND SUSSEX PORTIONS OF THE PEWAUKEE RIVER SUBWATERSHED ARE PRESENTED IN THE FOLLOWING SEWRPC COMMUNITY ASSISTANCE PLANNING REPORTS: NO. 49, A LAND USE AND TRAFFIC CIRCULATION PLAN FOR THE VILLAGE OF HARTLAND: 2000, MAP 28; NO. 76, A LAND USE PLAN FOR THE TOWN AND VILLAGE OF PEWAUKEE: 2000, MAP 38; AND NO. 51, A LAND USE PLAN FOR THE VILLAGE OF SUSSEX: 2000, MAP 28.

GRAPHIC SCALE
0 1/2 1 MILE
0 2000 4000 6000 8000 FEET

Source: SEWRPC.

The subwatershed was divided into 10 subbasins--ranging in size from 0.99 square mile to 13.12 square miles--as shown on Map 6. Numerous factors, in addition to topographic considerations, entered into delineation of the subbasins. The subbasins were delineated, for example, to define areas tributary to intermittent streams and drainageways, and to have their discharge points located at or near corporate limits and at hydraulic structures such as bridges.

The dominant hydrologic soil group, dominant land use, and nominal percent imperviousness of the various subbasins within the subwatershed were determined. Based on this information, four land segment types were identified--I, II, III, and IV--with a land segment type being defined as a unique combination of dominant hydrologic soil type, dominant land use, and nominal percent imperviousness. The characteristics of each of the four land segment types are set forth in Table 2, while the land segment types associated with each subbasin under existing and planned conditions are shown on Map 6. The land segment types associated with the given subbasin is the primary factor used to model direct and indirect runoff from that subbasin to a successive downstream subbasin or to the major stream system of the subwatershed.

**Table 2**

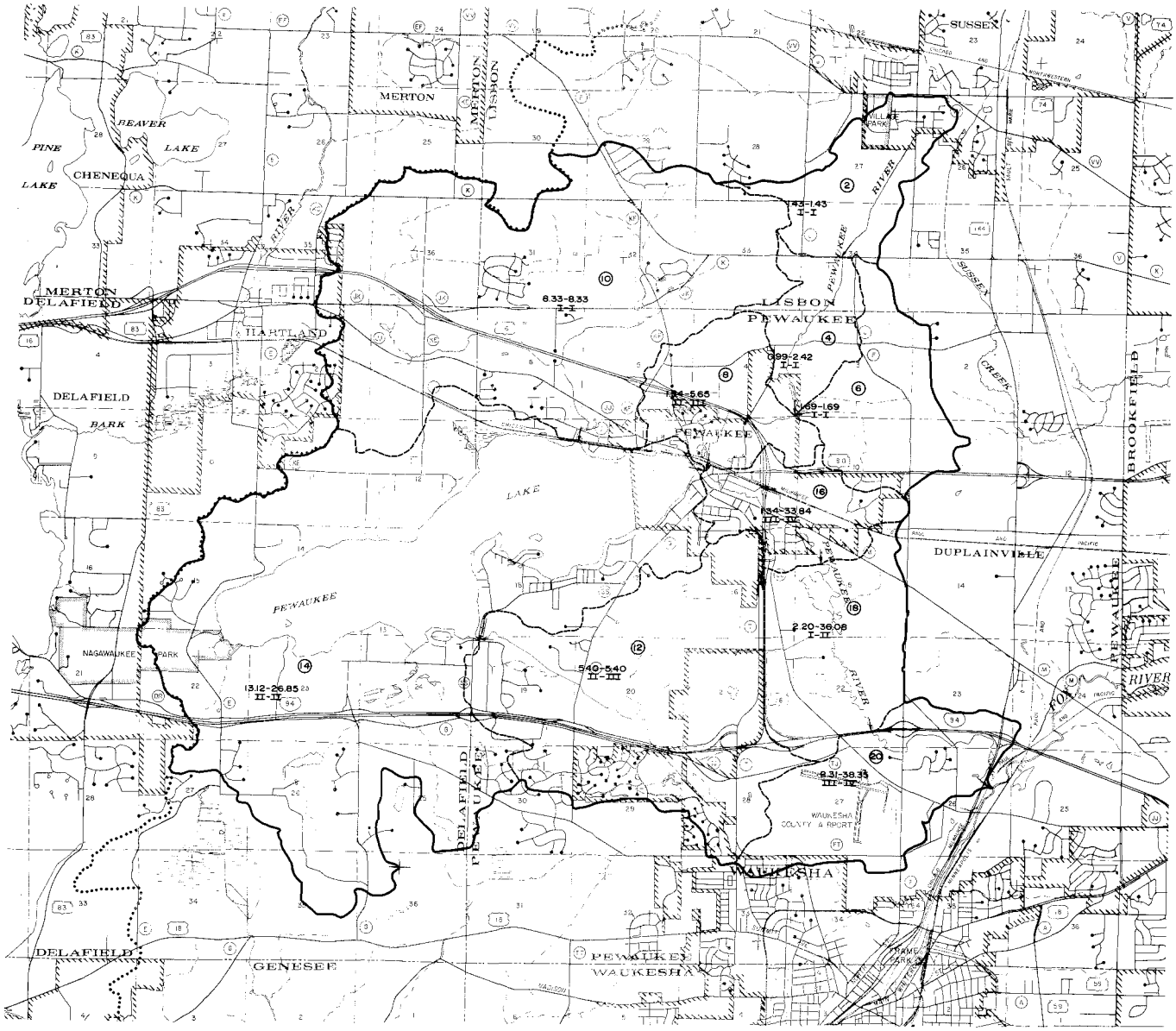
**LAND SEGMENT TYPES REPRESENTATIVE OF THE PEWAUKEE RIVER SUBWATERSHED**

| Identification | Dominant Hydrologic Soil Group | Dominant Land Use | Nominal Percent Imperviousness |
|---|---|---|---|
| I | B | Rural-agriculture and open space | 1 |
| II | B | Low-density residential with supporting urban land uses | 11 |
| III | B | Medium-density residential with supporting urban land uses | 20 |
| IV | B | Medium-density residential with supporting urban land uses | 30 |

Source: SEWRPC.

## Map 6

## SUBBASINS IN THE PEWAUKEE RIVER SUBWATERSHED




LEGEND

- SUBWATERSHED BOUNDARY
- SUBBASIN BOUNDARY
- SUBBASIN DISCHARGE
- (12) SUBBASIN IDENTIFICATION NUMBER

1.54-165 SUBBASIN AREA AND TOTAL AREA TRIBUTARY TO SUBBASIN DISCHARGE POINT IN SQUARE MILES

II-III LAND SEGMENT TYPE NUMBER FOR EXISTING LAND USE CONDITIONS AND LAND SEGMENT TYPE NUMBER FOR 2000 PLANNED LAND USE CONDITIONS

GRAPHIC SCALE
0 1/2 1 MILE
0 2000 4000 6000 8000 FEET

Source: SEWRPC.

# Chapter V

# HYDRAULICS OF THE PEWAUKEE RIVER SUBWATERSHED

## THE PEWAUKEE RIVER

The Pewaukee River originates in the Village of Sussex in the extreme northeast corner of its tributary watershed--the Pewaukee River subwatershed of the Fox River watershed. From its source, the Pewaukee River flows as an intermittent stream in a southwesterly direction for about 2.7 miles to the northern limits of the Village of Pewaukee. The Pewaukee River becomes a perennial stream approximately 0.5 mile downstream of the village limits, and a total of 3.3 miles of the river are contained within the corporate limits of the Village. The river leaves the Village at its southeast corner, and then flows in a southeasterly direction for 4.4 miles to its confluence with the Fox River approximately one mile upstream of the City of Waukesha. The total length of the Pewaukee River within the subwatershed is 10.6 miles, and the average fall of the channel bottom is about 6.7 feet per mile.

Flood flows were determined for selective points along the entire length of the Pewaukee River as well as for some tributary streams, and flood stage information suitable for detailed flood hazard mapping was developed for that 10.4-mile-long reach of the river extending from Station 383660,[1] about 2.5 miles upstream of the northern limits of the Village of Pewaukee, to Station 328500 at the confluence with the Fox River, about 4.4 miles downstream of the southern limits of the Village. The channel bottom falls about 80 feet in this distance at an average slope of 7.7 feet per mile.

Map 2 in Chapter II shows the areal extent of large-scale topographic mapping currently available for the Pewaukee River subwatershed, the source of the mapping, the scale and contour interval, and the date of preparation of the maps. This mapping is based upon a monumented survey control network which combines the State Plane Coordinate and U. S. Public Land Survey systems, meets National Map Accuracy Standards, and was prepared to specifications promulgated by SEWRPC.

## THE PEWAUKEE LAKE OUTLET

The Pewaukee Lake outlet is a short tributary of the Pewaukee River that originates at the eastern end of Pewaukee Lake within the Village and flows in a southeasterly direction a distance of about 0.1 mile to join the Pewaukee River within the Village. The average fall of the channel bottom over this short reach is 60 feet per mile. Detailed flood hazard information was developed for the Pewaukee Lake outlet because the entire length of the outlet is located within the Village.

## FLOODLAND CROSS-SECTIONS

The width, slope, and flow resistance of the channel and its floodplain are important hydraulic elements of any river, and are the primary determinants of

[1]Stationing in feet along the stream system referenced to the Wilmot Dam on the main stem of the Fox River in Kenosha County.

the stage at which a given flood discharge will occur. Channel-floodplain cross-sections were developed by combining information from the available large-scale topographic maps--Village of Pewaukee and SEWRPC maps as shown on Map 2 in Chapter II--with channel bottom data obtained as part of a hydraulic structure inventory conducted by field survey methods. A total of 121 channel-floodplain cross-sections were constructed along the Pewaukee River and the Pewaukee Lake outlet at an average spacing of 500 feet within the detailed study reaches for which large-scale topographic maps were available. These cross-sections, along with channel and floodplain Manning roughness coefficients determined by field inspection, were used as input to the flood flow simulation computer program.

## BRIDGES AND CULVERTS

Depending on the size of the waterway opening and the characteristics of the approaches, bridges and culverts can significantly influence the hydraulic behavior of a subwatershed stream system. Constrictions caused by bridges and culverts can, under flood discharge conditions, result in large backwater effects, thereby creating a floodland area upstream of the structure that is significantly larger than that which would exist in the absence of the bridge or culvert.

The Pewaukee River is, as shown in Table 3, crossed 18 times by existing pedestrian ways, roadways, and railways in the 10.62-mile reach extending from the Village of Sussex north of Pewaukee to the Fox River south of Pewaukee. The Pewaukee Lake outlet portion of the stream system contains one structure--the combination Pewaukee Lake dam and Wisconsin Avenue culvert. Existing structures were examined in order to incorporate data on all structures that might affect discharges or stages on the Pewaukee River and Pewaukee Lake outlet reaches selected for development of detailed flood hazard information. Based on that examination, certain bridges and culverts were determined to be hydraulically insignificant, either because they were located upstream of the detailed study reach or because they were of such size or elevation as not to influence flood stages more than 0.1 foot during 10- to 100-year recurrence interval flood events. A bridge or culvert is likely to be hydraulically insignificant if it simply spans a stream from bank to bank, has approach roads with little or no fill on the floodplain, and has a relatively small superstructure. Information such as waterway opening size, roadway profile, and channel bottom elevation were obtained for the hydraulically significant bridges and culverts from SEWRPC Fox River watershed planning program files supplemented with field data provided by the Village of Pewaukee, and was used as input to the hydrologic-hydraulic computer model used to compute flood discharges and stages.

## DAM

There is only one hydraulically significant dam located on the stream system within the Pewaukee River subwatershed and that is the control structure at the east end of Pewaukee Lake. This structure was replaced in 1975 in accordance with a recommendation in the Fox River watershed plan. Data such as spillway width and crest elevation and sluiceway position were obtained for this hydraulically significant structure and utilized as input to the computer model used to simulate watershed hydrology and hydraulics.

The Pewaukee Lake outlet control structure is equipped with a sluicegate that facilitates drawing down the level of Pewaukee Lake a distance of about 1.5 feet below the dam crest. Based on Wisconsin Department of Natural Resources operating regulations, this dam is to be operated so as to maintain the level of Pewaukee Lake at an elevation of 852.8 feet above National Geodetic Vertical Datum (Mean Sea Level Datum) during the period May 15 through October 1. During the October 1 to October 15 period the lake is to be drawn down to an elevation of 852.2 feet above National Geodetic Vertical Datum, and is to be maintained at that level for the period from October 15 through May 1. During the period from May 1 to May 15, the lake is to be gradually raised back to 852.8 feet. Therefore, the lake level is to be maintained within a very narrow range of only 0.6 foot. For the purpose of the hydrologic-hydraulic modeling, Pewaukee Lake was maintained at the two seasonal levels as prescribed by the Wisconsin Department of Natural Resources.

**Table 3**

**HYDRAULIC STRUCTURE INDEX FOR THE PEWAUKEE RIVER AND PEWAUKEE LAKE OUTLET IN AND NEAR THE VILLAGE OF PEWAUKEE**

| Pewaukee River | | | | | | | |
|---|---|---|---|---|---|---|---|
| Structure Number | Station[a] | Structure | Structure Type | | | Hydraulically Significant | |
| | | | Bridge | Culvert | Dam | Yes | No |
| 78 | 3288+00 | Chicago, Milwaukee, St. Paul & Pacific Railroad | X | -- | -- | X | -- |
| 77 | 3291+00 | STH 164 Bridge | X | -- | -- | X | -- |
| 76 | 3303+00 | Private Bridge | X | -- | -- | X | -- |
| 75 | 3342+00 | Busse Road Bridge | X | -- | -- | X | -- |
| 74 | 3372+00 | CTH F Bridge | X | -- | -- | X | -- |
| 73 | 3401+00 | IH 94 Bridge | X | -- | -- | X | -- |
| 72 | 3546+00 | CTH SS Bridge | X | -- | -- | X | -- |
| 71 | 3571+10 | STH 16 Bridge | X | -- | -- | -- | X |
| 70 | 3597+00 | Clark Street Bridge | X | -- | -- | X | -- |
| 69 | 3605+00 | Oakton Avenue Bridge | X | -- | -- | X | -- |
| 69a | 3613+00 | Chicago, Milwaukee, St. Paul & Pacific Railroad | X | -- | -- | X | -- |
| 69b | 3613+80 | Capitol Drive Bridge | X | -- | -- | X | -- |
| 69c | 3619+00 | Pedestrian Bridge | X | -- | -- | X | -- |
| 69d | 3643+40 | STH 16 Bridge | X | -- | -- | X | -- |
| 69e | 3654+40 | Cecilia Drive Bridge | X | -- | -- | X | -- |
| 69f | 3719+70 | Lindsay Road Bridge | -- | X | -- | X | -- |
| 69g | 3774+50 | CTH K Bridge | -- | X | -- | X | -- |
| 69h | 3824+20 | Private Bridge | -- | X | -- | X | -- |

| Pewaukee Lake Outlet | | | | | | | |
|---|---|---|---|---|---|---|---|
| Structure Number | Station[a] | Structure | Structure Type | | | Hydraulically Significant | |
| | | | Bridge | Culvert | Dam | Yes | No |
| 66 and 67 | 3616+00 | Pewaukee Lake Dam and Wisconsin Avenue Culvert | -- | X | X | X | -- |

[a]Stationing begins at Wilmot Dam.

Source: SEWRPC.

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# Chapter VI

# THE HYDROLOGIC-HYDRAULIC MODEL

## INTRODUCTION

In order to accomplish the objective of this floodland information report--that is, the delineation of a refined, revised regulatory floodplain and floodway for the Pewaukee River and the Pewaukee Lake outlet in and near the Village of Pewaukee--it was necessary to apply a suitable analytic technique to supplement the meager amount of available stream stage and floodland inundation data. A digital computer model capable of simulating the behavior of the hydrologic-hydraulic system of the Pewaukee River subwatershed was selected as that analytic technique.

## DESCRIPTION OF THE MODEL

The digital computer model used to simulate the hydrologic-hydraulic system of the subwatershed consists of three submodels operated in sequence, and is illustrated in Figure 1. All the necessary inputs to the hydrologic-hydraulic model were obtained from the inventory of the watershed hydrologic-hydraulic system as described in the two preceding chapters of this report. The principal function of the Hydrologic Submodel is to determine the volume and temporal distribution of runoff from the land to the stream system. As used here, the concept of runoff from the land is broadly interpreted to include direct or surface runoff, interflow, and groundwater flow to the streams. The amount and rate of runoff from the land to the watershed stream system is largely a function of two factors--the meteorologic events which determine the quantity of water available along or beneath the land surface and the nature and use of the land.[1]

The primary function of Hydraulic Submodel 1 is to accept as input the runoff from the hydrologic submodel, aggregate it in, and route it through the stream system, thereby producing a continuous series of discharge values at predetermined locations along the subwatershed stream system. In addition to output of the hydrologic submodel, operation of Hydraulic Submodel 1 requires data describing the physical characteristics of the stream channel and floodplain.

The primary function of Hydraulic Submodel 2 is to determine the flood stages commensurate with flood flows of specified recurrence intervals as obtained by the statistical analysis of the output from Hydraulic Submodel 1. In addition to the necessary flood flows, use of Hydraulic Submodel 2 requires detailed information concerning the hydraulics of the stream system, including channel-floodplain cross-sections; Manning roughness coefficients; and bridge, culvert, and dam data.[2]

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[1]Hydrocomp, Inc., Hydrocomp Simulation Programming (HSP) Operations Manual, Fourth Edition, January 1976.

[2]U. S. Army Corps of Engineers, Hydrologic Engineering Center, "HEC-2, Water Surface Profiles," Computer Program 723-X6-L202A, User's Manual, November 1976.

## USES OF THE MODEL

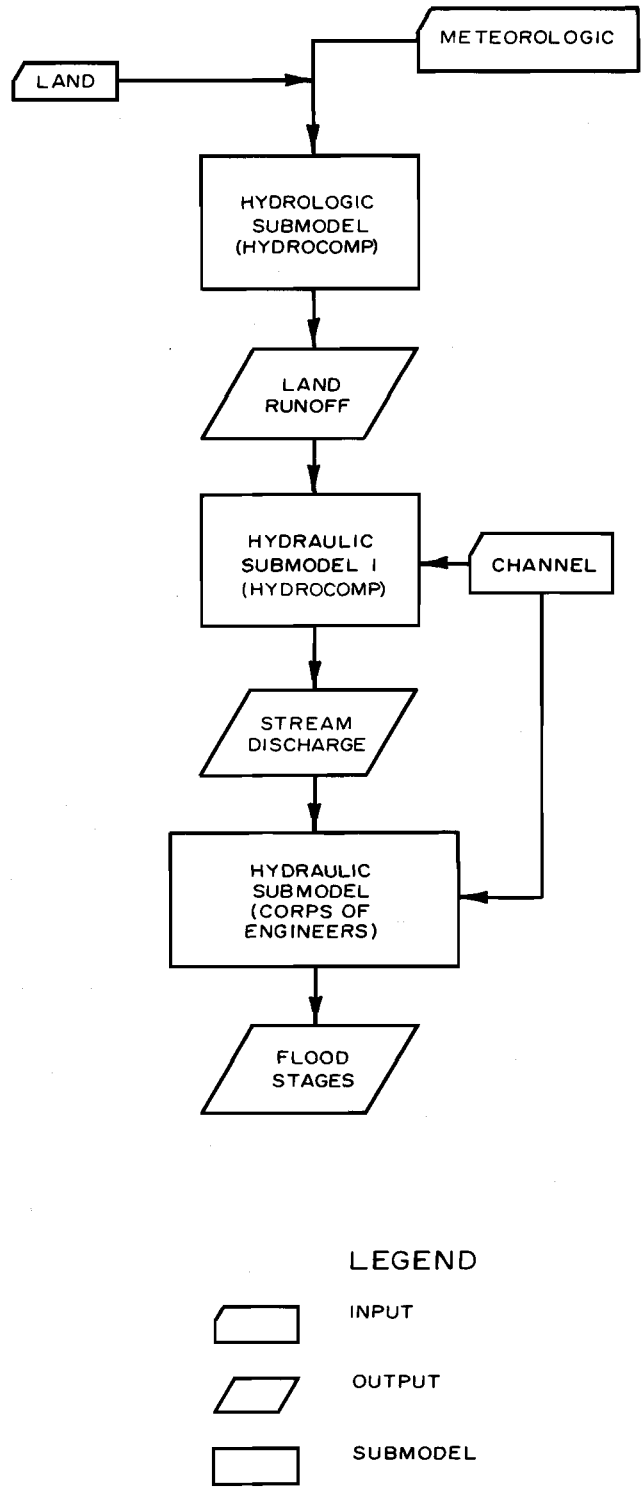
The hydrologic-hydraulic model was primarily used in a computation of Pewaukee River and Pewaukee Lake outlet discharges and stages in and near the Village of Pewaukee for 10-, 25-, 50-, 100-, and 500-year recurrence interval flood events under existing (1980) and year 2000 planned land use conditions. Flood discharges and stages were computed for 100-year recurrence interval flood conditions for land use regulatory purposes, while 10-, 25-, 50-, and 500-year recurrence interval events were simulated so as to yield a full spectrum of flood discharge stages in areas of inundation to be used for federal flood insurance purposes and for detailed local land use planning and engineering applications.

Sound land and water resources decision-making requires consideration of future, as well as existing, land uses which affect water resources in general and flood problems in particular. Flood flows were first simulated under existing land use conditions in order to determine the present flood characteristics of the Pewaukee River subwatershed in and near Pewaukee, and to establish a point of reference for the results of simulation runs based on the year 2000 planned land use conditions. The hydrologic-hydraulic response of the year 2000 planned land use conditions was modeled in order to test the sensitivity of the flow regime of the Pewaukee River and Pewaukee Lake outlet to the urbanization that is likely to occur, and to produce 100-year recurrence interval flood discharges and stages under planned future conditions for land use regulatory purposes.

It should be noted that year 2000 land use conditions apply to areas within the floodlands of the Pewaukee River and Pewaukee Lake outlet and its major tributaries, as well as to areas outside those floodlands. The plan assumes

**Figure 1**

**HYDROLOGIC–HYDRAULIC MODEL APPLIED TO THE PEWAUKEE RIVER SUBWATERSHED**




Source: SEWRPC.

that floodlands not yet occupied by urban uses will be retained in a natural or semi-natural condition and used for recreation, agriculture, and other open space uses. This aspect of the year 2000 plan is critical, since widespread floodland filling and development upstream of the Village of Pewaukee may, because of the loss of floodwater conveyance and storage capacity, be expected to increase flood discharges and stages within the Village.

After completion of the above simulation effort, Hydraulic Submodel 2 was used to delineate a regulatory floodway along the Pewaukee River and the Pewaukee Lake outlet through the Village of Pewaukee using the 100-year recurrence interval discharge under year 2000 planned land use conditions.

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# Chapter VII

# FLOOD DISCHARGES AND STAGES AND THE NATURAL FLOODLANDS

## INTRODUCTION

The purpose of this chapter is to present in tabular and graphic form the 10-, 25-, 50-, 100-, and 500-year recurrence interval flood discharges and stages for the Pewaukee River subwatershed under year 2000 planned land use conditions. The natural floodplain commensurate with year 2000 land use conditions is also described. All of this flood discharge, stage, and inundation information was developed using the hydrologic-hydraulic model described in the preceding chapter of this report.

## DISCHARGES AND STAGES

Peak flood discharge and peak flood stage information for 10-, 25-, 50-, 100-, and 500-year recurrence interval flood events under year 2000 planned land use conditions is presented in Table 4. Discharge data and flood stages are presented for the Pewaukee River reach extending from Station 328500 at the Pewaukee River-Fox River confluence upstream to Station 383660, about 1.2 miles upstream of CTH K. Discharge data and flood stages are presented in the table for the entire length of the Pewaukee Lake outlet.

The comparison of flood stages in the detailed study reaches under existing and year 2000 planned land use conditions indicates the increase in stages which may be expected to be associated with the planned land use pattern. Examination of existing condition and planned condition 100-year recurrence interval flood stages at the 121 cross-section locations at which flood stages were calculated indicated that stage increases will vary from 0.0 foot to 1.3 feet, as shown in Table 5. The relative insensitivity of flood discharges in and near Pewaukee to planned incremental urban development is due to the fact that the watershed is expected to continue to remain primarily rural in character. As already noted, only about 24 percent of the subwatershed is currently devoted to urban land use, and only about 39 percent is to be urbanized under the year 2000 land use plan. Flood stages, however, may be expected to increase more significantly because of the hydraulic characteristics of particular bridges.

## FLOOD STAGE PROFILES

Figures 2 and 3 present 10- and 100-year recurrence interval flood stage profiles under year 2000 planned land use conditions for the Pewaukee River and the Pewaukee Lake outlet. These profiles, which encompass the 10.4-mile-long Pewaukee River reach for which large-scale topographic maps are available and the entire 0.1-mile-long length of the Pewaukee Lake outlet, constitute a graphic representation of the flood stage data set forth in Table 4. In addition to providing an overall representation of flood stages relative to familiar points of reference, such as the channel bottom and bridge deck surfaces, the profiles, because they are continuous, permit the determination of flood stages at any point along the stream channels.

## Table 4

# FLOOD DISCHARGES AND STAGES FOR THE PEWAUKEE RIVER AND PEWAUKEE LAKE OUTLET IN AND NEAR THE VILLAGE OF PEWAUKEE FOR YEAR 2000 PLANNED LAND USE CONDITIONS

| Pewaukee River | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 10-Year Recurrence Interval Flood Event | | 25-Year Recurrence Interval Flood Event | | 50-Year Recurrence Interval Flood Event | | 100-Year Recurrence Interval Flood Event | | 500-Year Recurrence Interval Flood Event | |
| River [a] Station | Structure Name or Other Location Identification | Structure Number | Discharge (cubic feet per second) | Stage [b] (feet above mean sea level) | Discharge (cubic feet per second) | Stage [b] (feet above mean sea level) | Discharge (cubic feet per second) | Stage [b] (feet above mean sea level) | Discharge (cubic feet per second) | Stage [b] (feet above mean sea level) | Discharge (cubic feet per second) | Stage [b] (feet above mean sea level) |
| 328500 | Confluence with the Fox River | -- | 540 | 819.7 | 680 | 819.9 | 795 | 820.2 | 920 | 820.7 | 1,270 | 821.4 |
| 328750 | -- | -- | 540 | 819.7 | 680 | 819.9 | 795 | 820.2 | 920 | 820.7 | 1,270 | 821.4 |
| 328800 | Chicago, Milwaukee, St. Paul & Pacific Railroad Bridge | 78 | 540 | 821.0 | 680 | 821.5 | 795 | 821.7 | 920 | 821.9 | 1,270 | 822.2 |
| 328850 | -- | -- | 540 | 821.0 | 680 | 821.5 | 795 | 821.7 | 920 | 821.9 | 1,270 | 822.2 |
| 329100 | STH 164 Bridge | 77 | 540 | 821.3 | 680 | 822.4 | 795 | 822.9 | 920 | 823.5 | 1,270 | 825.3 |
| 329200 | -- | -- | 540 | 821.3 | 680 | 822.4 | 795 | 822.9 | 920 | 823.5 | 1,270 | 825.3 |
| 329630 | -- | -- | 540 | 821.4 | 680 | 822.5 | 795 | 823.0 | 920 | 823.6 | 1,270 | 825.3 |
| 330250 | -- | -- | 540 | 822.3 | 680 | 823.1 | 795 | 823.6 | 920 | 824.1 | 1,270 | 825.6 |
| 330300 | Private Bridge | 76 | 540 | 825.9 | 680 | 826.6 | 795 | 827.2 | 920 | 827.7 | 1,270 | 829.0 |
| 330400 | -- | -- | 540 | 825.9 | 680 | 826.6 | 795 | 827.2 | 920 | 827.7 | 1,270 | 829.0 |
| 330950 | -- | -- | 540 | 826.1 | 680 | 826.5 | 795 | 826.9 | 920 | 827.3 | 1,270 | 828.5 |
| 331450 | -- | -- | 540 | 830.1 | 680 | 830.7 | 795 | 831.1 | 920 | 831.5 | 1,270 | 832.4 |
| 332350 | -- | -- | 540 | 831.5 | 680 | 832.0 | 795 | 832.6 | 920 | 832.6 | 1,270 | 833.3 |
| 332850 | -- | -- | 540 | 832.5 | 680 | 832.8 | 795 | 833.1 | 920 | 833.3 | 1,270 | 833.9 |
| 333450 | -- | -- | 540 | 833.7 | 680 | 834.1 | 795 | 834.3 | 920 | 834.6 | 1,270 | 835.2 |
| 333950 | -- | -- | 540 | 834.2 | 680 | 834.6 | 795 | 834.9 | 920 | 835.2 | 1,270 | 835.8 |
| 334150 | -- | -- | 540 | 834.5 | 680 | 834.9 | 795 | 835.1 | 920 | 835.6 | 1,270 | 835.9 |
| 334200 | Busse Road Bridge | 75 | 540 | 836.0 | 680 | 836.6 | 795 | 837.1 | 920 | 837.6 | 1,270 | 839.2 |
| 334300 | -- | -- | 540 | 836.0 | 680 | 836.6 | 795 | 837.1 | 920 | 837.6 | 1,270 | 839.2 |
| 334820 | -- | -- | 540 | 837.1 | 680 | 837.6 | 795 | 838.0 | 920 | 838.4 | 1,270 | 839.7 |
| 335260 | -- | -- | 540 | 837.6 | 680 | 838.2 | 795 | 838.6 | 920 | 839.0 | 1,270 | 840.2 |
| 335700 | -- | -- | 540 | 838.2 | 680 | 838.7 | 795 | 839.1 | 920 | 839.5 | 1,270 | 840.6 |
| 336220 | -- | -- | 540 | 839.2 | 680 | 839.7 | 795 | 840.0 | 920 | 840.3 | 1,270 | 841.2 |
| 336660 | -- | -- | 540 | 839.6 | 680 | 840.0 | 795 | 840.4 | 920 | 840.7 | 1,270 | 841.4 |
| 337130 | -- | -- | 540 | 839.9 | 680 | 840.4 | 795 | 840.7 | 920 | 841.0 | 1,270 | 841.7 |
| 337200 | CTH F Bridge | 74 | 540 | 840.7 | 680 | 841.3 | 795 | 841.7 | 920 | 842.2 | 1,270 | 843.3 |
| 337300 | -- | -- | 540 | 840.7 | 680 | 841.3 | 795 | 841.7 | 920 | 842.2 | 1,270 | 843.3 |
| 338020 | -- | -- | 540 | 841.2 | 680 | 841.7 | 795 | 842.1 | 920 | 842.5 | 1,270 | 843.6 |
| 338720 | -- | -- | 540 | 841.4 | 680 | 841.9 | 795 | 842.3 | 920 | 842.7 | 1,270 | 843.7 |
| 339950 | -- | -- | 330 | 841.6 | 430 | 842.1 | 520 | 842.5 | 620 | 842.9 | 930 | 843.9 |
| 340100 | IH 94 Bridge | 73 | 330 | 841.7 | 430 | 842.3 | 520 | 842.8 | 620 | 843.3 | 930 | 844.7 |
| 340300 | -- | -- | 330 | 841.7 | 430 | 842.3 | 520 | 842.8 | 620 | 843.3 | 930 | 844.7 |
| 341060 | -- | -- | 330 | 841.7 | 430 | 842.4 | 520 | 842.9 | 620 | 843.3 | 930 | 844.8 |
| 341580 | -- | -- | 330 | 841.7 | 430 | 842.4 | 520 | 842.9 | 620 | 843.4 | 930 | 844.9 |
| 342650 | -- | -- | 330 | 841.9 | 430 | 842.5 | 520 | 843.0 | 620 | 843.5 | 930 | 844.9 |
| 343720 | -- | -- | 330 | 841.9 | 430 | 842.6 | 520 | 843.0 | 620 | 843.5 | 930 | 844.9 |
| 344330 | -- | -- | 330 | 842.0 | 430 | 842.6 | 520 | 843.1 | 620 | 843.6 | 930 | 845.0 |
| 345335 | -- | -- | 330 | 842.2 | 430 | 842.7 | 520 | 843.2 | 620 | 843.6 | 930 | 845.0 |
| 346415 | -- | -- | 330 | 842.3 | 430 | 842.8 | 520 | 843.2 | 620 | 843.7 | 930 | 845.1 |
| 349040 | -- | -- | 330 | 842.6 | 430 | 843.1 | 520 | 843.4 | 620 | 843.8 | 930 | 845.1 |
| 350080 | -- | -- | 345 | 843.1 | 450 | 843.6 | 545 | 843.9 | 650 | 844.2 | 960 | 845.3 |
| 350770 | -- | -- | 345 | 843.6 | 450 | 844.0 | 545 | 844.3 | 650 | 844.5 | 960 | 845.5 |
| 351570 | -- | -- | 345 | 843.9 | 450 | 844.2 | 545 | 844.5 | 650 | 844.7 | 960 | 845.5 |
| 352950 | -- | -- | 345 | 844.2 | 450 | 844.5 | 545 | 844.7 | 650 | 844.9 | 960 | 845.6 |
| 353820 | -- | -- | 345 | 844.6 | 450 | 844.8 | 545 | 845.0 | 650 | 845.2 | 960 | 845.9 |
| 354290 | -- | -- | 345 | 845.0 | 450 | 845.4 | 545 | 845.6 | 650 | 845.8 | 960 | 846.2 |
| 354520 | -- | -- | 345 | 845.3 | 450 | 845.7 | 545 | 845.9 | 650 | 846.1 | 960 | 846.6 |
| 354600 | CTH M Bridge | 72 | 345 | 845.8 | 450 | 846.8 | 545 | 847.5 | 650 | 848.2 | 960 | 848.6 |
| 354660 | -- | -- | 345 | 845.8 | 450 | 846.8 | 545 | 847.5 | 650 | 848.2 | 960 | 848.6 |
| 354960 | -- | -- | 345 | 845.9 | 450 | 846.8 | 545 | 847.5 | 650 | 848.2 | 960 | 848.6 |
| 355355 | -- | -- | 345 | 845.9 | 450 | 846.8 | 545 | 847.6 | 650 | 848.2 | 960 | 848.6 |
| 355800 | -- | -- | 345 | 845.9 | 450 | 846.9 | 545 | 847.6 | 650 | 848.3 | 960 | 848.7 |
| 356400 | -- | -- | 345 | 846.0 | 450 | 847.0 | 545 | 847.7 | 650 | 848.3 | 960 | 848.8 |
| 356700 | -- | -- | 345 | 846.1 | 450 | 847.0 | 545 | 847.7 | 650 | 848.3 | 960 | 848.8 |
| 356800 | -- | -- | 345 | 846.1 | 450 | 847.0 | 545 | 847.7 | 650 | 848.4 | 960 | 848.8 |
| 356820 | -- | -- | 345 | 846.1 | 450 | 847.0 | 545 | 847.7 | 650 | 848.4 | 960 | 848.8 |
| 356990 | -- | -- | 220 | 846.2 | 350 | 847.1 | 450 | 847.7 | 560 | 848.4 | 1,050 | 848.8 |
| 357110 | STH 16 Bridge | 71 | 220 | 846.2 | 350 | 847.1 | 450 | 847.8 | 560 | 848.4 | 1,050 | 849.0 |
| 357150 | -- | -- | 220 | 846.3 | 350 | 847.1 | 450 | 847.8 | 560 | 848.4 | 1,050 | 849.0 |
| 357600 | -- | -- | 220 | 846.3 | 350 | 847.2 | 450 | 847.9 | 560 | 848.5 | 1,050 | 849.2 |
| 358100 | -- | -- | 220 | 846.4 | 350 | 847.3 | 450 | 847.9 | 560 | 848.6 | 1,050 | 849.3 |
| 358600 | -- | -- | 220 | 846.5 | 350 | 847.4 | 450 | 848.0 | 560 | 848.6 | 1,050 | 849.4 |
| 359150 | -- | -- | 220 | 846.6 | 350 | 847.5 | 450 | 848.1 | 560 | 848.7 | 1,050 | 849.5 |
| 359600 | -- | -- | 220 | 846.7 | 350 | 847.6 | 450 | 848.2 | 560 | 848.8 | 1,050 | 849.7 |
| 359700 | Clark Street Bridge | 70 | 220 | 846.9 | 350 | 847.9 | 450 | 848.7 | 560 | 849.7 | 1,050 | 850.3 |
| 359750 | -- | -- | 220 | 846.9 | 350 | 847.9 | 450 | 848.7 | 560 | 849.7 | 1,050 | 850.3 |
| 359900 | -- | -- | 220 | 847.1 | 350 | 848.1 | 450 | 848.9 | 560 | 849.8 | 1,050 | 850.7 |
| 360100 | -- | -- | 220 | 847.1 | 350 | 848.1 | 450 | 849.0 | 560 | 849.9 | 1,050 | 850.7 |
| 360190 | -- | -- | 220 | 847.1 | 350 | 848.1 | 450 | 849.0 | 560 | 849.9 | 1,050 | 850.7 |
| 360350 | -- | -- | 220 | 847.1 | 350 | 848.1 | 450 | 849.0 | 560 | 849.9 | 1,050 | 850.7 |
| 360500 | Oakton Avenue Bridge | 69 | 220 | 847.3 | 350 | 848.4 | 450 | 849.2 | 560 | 849.9 | 1,050 | 850.8 |
| 360550 | -- | -- | 220 | 847.3 | 350 | 848.4 | 450 | 849.2 | 560 | 849.9 | 1,050 | 850.8 |
| 360690 | -- | -- | 220 | 847.3 | 350 | 848.5 | 450 | 849.2 | 560 | 849.9 | 1,050 | 850.8 |
| 360800 | -- | -- | 220 | 847.3 | 350 | 848.5 | 450 | 849.2 | 560 | 849.9 | 1,050 | 850.8 |
| 360850 | -- | -- | 220 | 847.4 | 350 | 848.5 | 450 | 849.2 | 560 | 849.9 | 1,050 | 850.8 |
| 360870 | -- | -- | 220 | 847.4 | 350 | 848.5 | 450 | 849.2 | 560 | 849.9 | 1,050 | 850.8 |
| 360900 | Confluence with the Pewaukee Lake Outlet | -- | 200 | 847.4 | 245 | 848.5 | 280 | 849.2 | 320 | 849.9 | 425 | 850.8 |
| 361250 | -- | -- | 200 | 847.4 | 245 | 848.5 | 280 | 849.2 | 320 | 849.9 | 425 | 850.8 |

## Table 4 (continued)

| Pewaukee River | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 10-Year Recurrence Interval Flood Event | | 25-Year Recurrence Interval Flood Event | | 50-Year Recurrence Interval Flood Event | | 100-Year Recurrence Interval Flood Event | | 500-Year Recurrence Interval Flood Event | |
| River[a] Station | Structure Name or Other Location Identification | Structure Number | Discharge (cubic feet per second) | Stage[b] (feet above mean sea level) | Discharge (cubic feet per second) | Stage[b] (feet above mean sea level) | Discharge (cubic feet per second) | Stage[b] (feet above mean sea level) | Discharge (cubic feet per second) | Stage[b] (feet above mean sea level) | Discharge (cubic feet per second) | Stage[b] (feet above mean sea level) |
| 361300 | Chicago, Milwaukee, St. Paul & Pacific Railroad Bridge | 69a | 200 | 847.6 | 245 | 848.7 | 280 | 849.6 | 320 | 850.4 | 425 | 851.6 |
| 361350 | -- | -- | 200 | 847.6 | 245 | 848.7 | 280 | 849.6 | 320 | 850.4 | 425 | 851.6 |
| 361380 | Capitol Drive Bridge | 69b | 200 | 847.7 | 245 | 848.9 | 280 | 849.6 | 320 | 850.4 | 425 | 851.6 |
| 361430 | -- | -- | 200 | 847.7 | 245 | 848.9 | 280 | 849.6 | 320 | 850.4 | 425 | 851.6 |
| 361850 | -- | -- | 200 | 847.8 | 245 | 848.9 | 280 | 849.6 | 320 | 850.4 | 425 | 851.6 |
| 361900 | Pedestrian Bridge | 69c | 200 | 848.0 | 245 | 848.9 | 280 | 849.6 | 320 | 850.5 | 425 | 851.7 |
| 361950 | -- | -- | 200 | 848.0 | 245 | 848.9 | 280 | 849.6 | 320 | 850.5 | 425 | 851.7 |
| 362650 | -- | -- | 200 | 848.1 | 245 | 848.9 | 280 | 849.6 | 320 | 850.5 | 425 | 851.7 |
| 363150 | -- | -- | 200 | 848.1 | 245 | 848.9 | 280 | 849.6 | 320 | 850.5 | 425 | 851.7 |
| 363650 | -- | -- | 200 | 848.1 | 245 | 848.9 | 280 | 849.7 | 320 | 850.5 | 425 | 851.7 |
| 363950 | -- | -- | 200 | 848.1 | 245 | 848.9 | 280 | 849.7 | 320 | 850.5 | 425 | 851.7 |
| 364240 | -- | -- | 80 | 848.1 | 120 | 848.9 | 150 | 849.7 | 195 | 850.5 | 335 | 851.7 |
| 364265 | STH 16 Bridge | 69d | 80 | 848.1 | 120 | 848.9 | 150 | 849.7 | 195 | 850.6 | 335 | 852.0 |
| 364430 | -- | -- | 80 | 848.1 | 120 | 849.0 | 150 | 849.7 | 195 | 850.6 | 335 | 852.0 |
| 364900 | -- | -- | 80 | 848.1 | 120 | 849.0 | 150 | 849.7 | 195 | 850.6 | 335 | 852.1 |
| 365340 | -- | -- | 80 | 848.3 | 120 | 849.0 | 150 | 849.7 | 195 | 850.6 | 335 | 852.1 |
| 365515 | -- | -- | 80 | 848.3 | 120 | 849.0 | 150 | 849.7 | 195 | 850.6 | 335 | 852.1 |
| 365565 | Cecilia Drive | 69e | 80 | 848.3 | 120 | 849.1 | 150 | 849.8 | 195 | 850.6 | 335 | 852.1 |
| 365693 | -- | -- | 80 | 848.3 | 120 | 849.1 | 150 | 849.8 | 195 | 850.6 | 335 | 852.1 |
| 366000 | -- | -- | 80 | 848.4 | 120 | 849.1 | 150 | 849.8 | 195 | 850.7 | 335 | 852.2 |
| 366500 | -- | -- | 80 | 848.8 | 120 | 849.5 | 150 | 850.0 | 195 | 850.8 | 335 | 852.2 |
| 367000 | -- | -- | 80 | 849.2 | 120 | 849.7 | 150 | 850.1 | 195 | 850.8 | 335 | 852.2 |
| 367500 | -- | -- | 80 | 849.5 | 120 | 849.9 | 150 | 850.2 | 195 | 850.8 | 335 | 852.2 |
| 367900 | -- | -- | 50 | 849.7 | 75 | 850.0 | 90 | 850.3 | 115 | 850.8 | 195 | 852.2 |
| 368400 | -- | -- | 50 | 849.8 | 75 | 850.0 | 90 | 850.3 | 115 | 850.9 | 195 | 852.2 |
| 368900 | -- | -- | 50 | 850.0 | 75 | 850.1 | 90 | 850.3 | 115 | 850.9 | 195 | 852.2 |
| 369400 | -- | -- | 50 | 850.3 | 75 | 850.4 | 90 | 850.5 | 115 | 850.9 | 195 | 852.2 |
| 369900 | -- | -- | 50 | 850.5 | 75 | 850.6 | 90 | 850.7 | 115 | 850.9 | 195 | 852.2 |
| 370400 | -- | -- | 50 | 852.1 | 75 | 852.3 | 90 | 852.3 | 115 | 852.3 | 195 | 852.3 |
| 370900 | -- | -- | 50 | 853.4 | 75 | 853.6 | 90 | 853.6 | 115 | 853.8 | 195 | 854.1 |
| 371400 | -- | -- | 50 | 854.6 | 75 | 854.8 | 90 | 854.9 | 115 | 854.9 | 195 | 855.2 |
| 371920 | -- | -- | 50 | 856.2 | 75 | 856.4 | 90 | 856.5 | 115 | 856.7 | 195 | 857.0 |
| 371970 | Lindsay Road Bridge | 69f | 50 | 857.3 | 75 | 857.9 | 90 | 858.2 | 115 | 858.8 | 195 | 860.9 |
| 372020 | -- | -- | 50 | 857.3 | 75 | 857.9 | 90 | 858.2 | 115 | 858.8 | 195 | 860.9 |
| 372170 | -- | -- | 50 | 857.4 | 75 | 857.9 | 90 | 858.2 | 115 | 858.8 | 195 | 860.9 |
| 372500 | -- | -- | 50 | 858.9 | 75 | 859.0 | 90 | 859.1 | 115 | 859.2 | 195 | 860.9 |
| 372820 | -- | -- | 50 | 860.6 | 75 | 860.7 | 90 | 860.8 | 115 | 860.9 | 195 | 861.0 |
| 373020 | -- | -- | 50 | 861.5 | 75 | 861.7 | 90 | 861.8 | 115 | 862.3 | 195 | 862.5 |
| 373600 | -- | -- | 50 | 863.3 | 75 | 863.5 | 90 | 863.6 | 115 | 863.7 | 195 | 864.0 |
| 374100 | -- | -- | 50 | 864.2 | 75 | 864.4 | 90 | 864.4 | 115 | 864.6 | 195 | 864.8 |
| 374600 | -- | -- | 50 | 865.8 | 75 | 866.0 | 90 | 866.0 | 115 | 866.1 | 195 | 866.3 |
| 375100 | -- | -- | 50 | 868.3 | 75 | 868.5 | 90 | 868.6 | 115 | 868.6 | 195 | 869.0 |
| 375600 | -- | -- | 50 | 870.7 | 75 | 870.8 | 90 | 870.9 | 115 | 871.0 | 195 | 871.2 |
| 376100 | -- | -- | 50 | 872.3 | 75 | 872.5 | 90 | 872.5 | 115 | 872.6 | 195 | 872.8 |
| 376600 | -- | -- | 50 | 874.3 | 75 | 874.4 | 90 | 874.4 | 115 | 874.5 | 195 | 874.7 |
| 377100 | -- | -- | 50 | 876.5 | 75 | 876.7 | 90 | 876.7 | 115 | 876.8 | 195 | 877.1 |
| 377400 | -- | -- | 40 | 878.9 | 55 | 879.2 | 70 | 879.4 | 90 | 879.6 | 145 | 880.1 |
| 377450 | CTH K Bridge | 69g | 40 | 880.0 | 55 | 880.6 | 70 | 881.2 | 90 | 882.1 | 145 | 885.1 |
| 377570 | -- | -- | 40 | 880.0 | 55 | 880.6 | 70 | 881.2 | 90 | 882.1 | 145 | 885.1 |
| 378260 | -- | -- | 40 | 882.7 | 55 | 882.8 | 70 | 882.9 | 90 | 883.1 | 145 | 885.1 |
| 379220 | -- | -- | 40 | 884.6 | 55 | 884.7 | 70 | 884.8 | 90 | 885.0 | 145 | 885.4 |
| 379710 | -- | -- | 40 | 885.1 | 55 | 885.2 | 70 | 885.3 | 90 | 885.4 | 145 | 886.1 |
| 380380 | -- | -- | 40 | 886.4 | 55 | 886.5 | 70 | 886.7 | 90 | 886.8 | 145 | 887.1 |
| 381000 | -- | -- | 40 | 887.3 | 55 | 887.4 | 70 | 887.5 | 90 | 887.6 | 145 | 887.8 |
| 381350 | -- | -- | 40 | 888.4 | 55 | 888.6 | 70 | 888.7 | 90 | 888.8 | 145 | 889.1 |
| 381780 | -- | -- | 40 | 889.8 | 55 | 889.9 | 70 | 890.0 | 90 | 890.2 | 145 | 890.5 |
| 382300 | -- | -- | 40 | 890.4 | 55 | 890.6 | 70 | 890.8 | 90 | 890.9 | 145 | 891.3 |
| 382420 | Private Bridge | 69h | 40 | 893.9 | 55 | 893.9 | 70 | 894.0 | 90 | 894.0 | 145 | 894.1 |
| 382590 | -- | -- | 40 | 893.9 | 55 | 893.9 | 70 | 894.0 | 90 | 894.0 | 145 | 894.1 |
| 383000 | -- | -- | 40 | 893.9 | 55 | 893.9 | 70 | 894.0 | 90 | 894.0 | 145 | 894.1 |
| 383660 | -- | -- | 40 | 893.9 | 55 | 893.9 | 70 | 894.0 | 90 | 894.0 | 145 | 894.1 |

| Pewaukee Lake Outlet | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 10-Year Recurrence Interval Flood Event | | 25-Year Recurrence Interval Flood Event | | 50-Year Recurrence Interval Flood Event | | 100-Year Recurrence Interval Flood Event | | 500-Year Recurrence Interval Flood Event | |
| River[a] Station | Structure Name or Other Location Identification | Structure Number | Discharge[c] (cubic feet per second) | Stage[b] (feet above mean sea level) | Discharge[c] (cubic feet per second) | Stage[b] (feet above mean sea level) | Discharge[c] (cubic feet per second) | Stage[b] (feet above mean sea level) | Discharge[c] (cubic feet per second) | Stage[b] (feet above mean sea level) | Discharge[c] (cubic feet per second) | Stage[b] (feet above mean sea level) |
| 361000 | Pewaukee Lake Outlet | -- | 80 | 847.4 | 305 | 848.5 | 415 | 849.2 | 505 | 849.9 | 605 | 850.8 |
| 361350 | -- | -- | 80 | 847.4 | 305 | 848.5 | 415 | 849.2 | 505 | 849.9 | 605 | 850.8 |

[a] Stationing in feet along the stream system referenced to the Wilmot Dam on the main stem of the Fox River in Kenosha County.

[b] Stages corresponding to structure locations are immediately upstream of the structure.

[c] Value indicated includes both the discharge from the Pewaukee Lake Outlet and the discharge over Wisconsin Avenue.

Source: SEWRPC.

## EFFECT OF CHANGING LAND USE ON FLOOD DISCHARGES AND STAGES FOR THE PEWAUKEE RIVER AND PEWAUKEE LAKE OUTLET

| Pewaukee River | | | | | | |
|---|---|---|---|---|---|---|
| | | | Existing Land Use | | Year 2000 Land Use | |
| River[a] Station | Structure Name or Other Location Identification | Structure Number | Regulatory Flood Discharge (cubic feet per second) | Stage[b] (feet above mean sea level) | Regulatory Flood Discharge (cubic feet per second) | Stage[b] (feet above mean sea level) |
| 328500 | Confluence with the Fox River and Downstream Limits of Large-Scale Mapping | -- | 645 | 820.7 | 920 | 820.7 |
| 328750 | -- | -- | 645 | 820.7 | 920 | 820.7 |
| 328800 | Chicago, Milwaukee, St. Paul & Pacific Railroad Bridge | 78 | 645 | 821.6 | 920 | 821.9 |
| 328850 | -- | -- | 645 | 821.6 | 920 | 821.9 |
| 329100 | STH 164 Bridge | 77 | 645 | 822.5 | 920 | 823.5 |
| 329200 | -- | -- | 645 | 822.5 | 920 | 823.5 |
| 329630 | -- | -- | 645 | 822.5 | 920 | 823.6 |
| 330250 | -- | -- | 645 | 823.1 | 920 | 824.1 |
| 330300 | Private Bridge | 76 | 645 | 826.4 | 920 | 827.7 |
| 330400 | -- | -- | 645 | 826.4 | 920 | 827.7 |
| 330950 | -- | -- | 645 | 826.4 | 920 | 827.3 |
| 331450 | -- | -- | 645 | 830.5 | 920 | 831.5 |
| 332350 | -- | -- | 645 | 831.9 | 920 | 832.6 |
| 332850 | -- | -- | 645 | 832.8 | 920 | 833.3 |
| 333450 | -- | -- | 645 | 834.0 | 920 | 834.6 |
| 333950 | -- | -- | 645 | 834.6 | 920 | 835.2 |
| 334150 | -- | -- | 645 | 834.8 | 920 | 835.6 |
| 334200 | Busse Road Bridge | 75 | 645 | 836.4 | 920 | 837.6 |
| 334300 | -- | -- | 645 | 836.4 | 920 | 837.6 |
| 334820 | -- | -- | 645 | 837.5 | 920 | 838.4 |
| 335260 | -- | -- | 645 | 838.1 | 920 | 839.0 |
| 335700 | -- | -- | 645 | 838.6 | 920 | 839.5 |
| 336220 | -- | -- | 645 | 839.6 | 920 | 840.3 |
| 336660 | -- | -- | 645 | 839.9 | 920 | 840.7 |
| 337130 | -- | -- | 645 | 840.3 | 920 | 841.0 |
| 337200 | CTH F Bridge | 74 | 645 | 841.2 | 920 | 842.2 |
| 337300 | -- | -- | 645 | 841.2 | 920 | 842.2 |
| 338020 | -- | -- | 645 | 841.6 | 920 | 842.5 |
| 338720 | -- | -- | 645 | 841.8 | 920 | 842.7 |
| 339950 | -- | -- | 555 | 842.0 | 620 | 842.9 |
| 340100 | IH 94 Bridge | 73 | 555 | 842.4 | 620 | 843.3 |
| 340300 | -- | -- | 555 | 842.4 | 620 | 843.3 |
| 341060 | -- | -- | 555 | 842.5 | 620 | 843.3 |
| 341580 | -- | -- | 555 | 842.5 | 620 | 843.4 |
| 342650 | -- | -- | 555 | 842.6 | 620 | 843.5 |
| 343720 | -- | -- | 555 | 842.7 | 620 | 843.5 |
| 344330 | -- | -- | 555 | 842.8 | 620 | 843.6 |
| 345335 | -- | -- | 555 | 843.0 | 620 | 843.6 |
| 346415 | -- | -- | 555 | 843.0 | 620 | 843.7 |
| 349040 | -- | -- | 555 | 843.3 | 620 | 843.8 |
| 350080 | -- | -- | 530 | 843.9 | 650 | 844.2 |
| 350770 | -- | -- | 530 | 844.2 | 650 | 844.5 |
| 351570 | Downstream Pewaukee Village Limits | -- | 530 | 844.4 | 650 | 844.7 |
| 352950 | -- | -- | 530 | 844.7 | 650 | 844.9 |
| 353820 | -- | -- | 530 | 845.0 | 650 | 845.2 |
| 354290 | -- | -- | 530 | 845.6 | 650 | 845.8 |
| 354520 | -- | -- | 530 | 845.9 | 650 | 846.1 |
| 354600 | CTH M Bridge | 72 | 530 | 847.4 | 650 | 848.2 |
| 354660 | -- | -- | 530 | 847.4 | 650 | 848.2 |
| 354960 | -- | -- | 530 | 847.4 | 650 | 848.2 |
| 355355 | -- | -- | 530 | 847.4 | 650 | 848.2 |
| 355800 | -- | -- | 530 | 847.5 | 650 | 848.3 |
| 356400 | -- | -- | 530 | 847.6 | 650 | 848.3 |
| 356700 | -- | -- | 530 | 847.6 | 650 | 848.3 |
| 356800 | -- | -- | 530 | 847.6 | 650 | 848.4 |
| 356820 | -- | -- | 530 | 847.6 | 650 | 848.4 |
| 356990 | -- | -- | 530 | 846.6 | 560 | 848.4 |
| 357110 | STH 16 Bridge | 71 | 530 | 847.7 | 560 | 848.4 |
| 357150 | -- | -- | 530 | 847.7 | 560 | 848.4 |
| 357600 | -- | -- | 530 | 847.8 | 560 | 848.5 |
| 358100 | -- | -- | 530 | 847.9 | 560 | 848.6 |
| 358600 | -- | -- | 530 | 847.9 | 560 | 848.6 |
| 359150 | -- | -- | 530 | 848.0 | 560 | 848.7 |
| 359600 | -- | -- | 530 | 848.2 | 560 | 848.8 |
| 359700 | Clark Street Bridge | 70 | 530 | 848.7 | 560 | 849.7 |
| 359750 | -- | -- | 530 | 848.7 | 560 | 849.7 |
| 359900 | -- | -- | 530 | 848.9 | 560 | 849.8 |
| 360100 | -- | -- | 530 | 849.0 | 560 | 849.9 |
| 360190 | -- | -- | 530 | 849.0 | 560 | 849.9 |
| 360350 | -- | -- | 530 | 849.0 | 560 | 849.9 |
| 360500 | Oakton Avenue Bridge | 69 | 530 | 849.2 | 560 | 849.9 |
| 360550 | -- | -- | 530 | 849.2 | 560 | 849.9 |
| 360690 | -- | -- | 530 | 849.2 | 560 | 849.9 |
| 360800 | -- | -- | 530 | 849.2 | 560 | 849.9 |
| 360850 | -- | -- | 530 | 849.2 | 560 | 849.9 |
| 360870 | -- | -- | 530 | 849.2 | 560 | 849.9 |
| 360900 | Confluence with the Pewaukee Lake Outlet | -- | 265 | 849.2 | 320 | 849.9 |
| 361250 | -- | -- | 265 | 849.2 | 320 | 849.9 |
| 361300 | Chicago, Milwaukee, St. Paul & Pacific Railroad Bridge | 69a | 265 | 849.5 | 320 | 850.4 |
| 361350 | -- | -- | 265 | 849.5 | 320 | 850.4 |
| 361380 | Capitol Drive Bridge | 69b | 265 | 849.6 | 320 | 850.4 |
| 361430 | -- | -- | 265 | 849.6 | 320 | 850.4 |
| 361850 | -- | -- | 265 | 849.6 | 320 | 850.4 |
| 361900 | Pedestrian Bridge | 69c | 265 | 849.6 | 320 | 850.5 |
| 361950 | -- | -- | 265 | 849.6 | 320 | 850.5 |
| 362650 | -- | -- | 265 | 849.6 | 320 | 850.5 |
| 363150 | -- | -- | 265 | 849.6 | 320 | 850.5 |
| 363650 | -- | -- | 265 | 849.6 | 320 | 850.5 |
| 363950 | -- | -- | 265 | 849.6 | 320 | 850.5 |
| 364240 | -- | -- | 195 | 849.6 | 195 | 850.5 |

**Table 5 (continued)**

| Pewaukee River | | | | | | |
|---|---|---|---|---|---|---|
| | | | Existing Land Use | | Year 2000 Land Use | |
| River[a] Station | Structure Name or Other Location Identification | Structure Number | Regulatory Flood Discharge (cubic feet per second) | Stage[b] (feet above mean sea level) | Regulatory Flood Discharge (cubic feet per second) | Stage[b] (feet above mean sea level) |
| 364265 | STH 16 Bridge | 69d | 195 | 849.7 | 195 | 850.6 |
| 364430 | -- | -- | 195 | 849.7 | 195 | 850.6 |
| 364900 | -- | -- | 195 | 849.8 | 195 | 850.6 |
| 365340 | -- | -- | 195 | 849.7 | 195 | 850.6 |
| 365515 | -- | -- | 195 | 849.8 | 195 | 850.6 |
| 365565 | Cecilia Drive | 69e | 195 | 849.8 | 195 | 850.6 |
| 365693 | -- | -- | 195 | 849.8 | 195 | 850.6 |
| 366000 | -- | -- | 195 | 849.9 | 195 | 850.7 |
| 366500 | -- | -- | 195 | 850.2 | 195 | 850.8 |
| 367000 | -- | -- | 195 | 850.3 | 195 | 850.8 |
| 367500 | -- | -- | 195 | 850.4 | 195 | 850.8 |
| 367900 | -- | -- | 115 | 850.4 | 115 | 850.8 |
| 368400 | -- | -- | 115 | 850.4 | 115 | 850.9 |
| 368900 | -- | -- | 115 | 850.5 | 115 | 850.9 |
| 369400 | -- | -- | 115 | 850.6 | 115 | 850.9 |
| 369900 | -- | -- | 115 | 850.8 | 115 | 850.9 |
| 370400 | -- | -- | 115 | 852.4 | 115 | 852.3 |
| 370900 | -- | -- | 115 | 853.8 | 115 | 853.8 |
| 371400 | -- | -- | 115 | 854.9 | 115 | 854.9 |
| 371920 | -- | -- | 115 | 856.6 | 115 | 856.7 |
| 371970 | Lindsay Road Bridge | 69f | 115 | 858.0 | 115 | 858.8 |
| 372020 | -- | -- | 115 | 858.8 | 115 | 858.8 |
| 372170 | -- | -- | 115 | 858.8 | 115 | 858.8 |
| 372820 | -- | -- | 115 | 860.9 | 115 | 860.9 |
| 373020 | -- | -- | 115 | 862.2 | 115 | 862.3 |
| 373600 | -- | -- | 115 | 863.7 | 115 | 863.7 |
| 374100 | -- | -- | 115 | 864.6 | 115 | 864.6 |
| 374600 | -- | -- | 115 | 866.1 | 115 | 866.1 |
| 375100 | -- | -- | 115 | 868.6 | 115 | 868.6 |
| 375600 | -- | -- | 115 | 871.0 | 115 | 871.0 |
| 376100 | -- | -- | 115 | 872.6 | 115 | 872.6 |
| 376600 | -- | -- | 115 | 874.5 | 115 | 874.5 |
| 377100 | -- | -- | 115 | 876.8 | 115 | 876.8 |
| 377400 | -- | -- | 90 | 879.6 | 90 | 879.6 |
| 377550 | CTH K Bridge | 69g | 90 | 882.1 | 90 | 882.1 |
| 377570 | -- | -- | 90 | 882.1 | 90 | 882.1 |
| 378260 | -- | -- | 90 | 883.1 | 90 | 883.1 |
| 379220 | -- | -- | 90 | 885.0 | 90 | 885.0 |
| 379710 | -- | -- | 90 | 885.4 | 90 | 885.4 |
| 380380 | -- | -- | 90 | 886.8 | 90 | 886.8 |
| 381000 | -- | -- | 90 | 887.6 | 90 | 887.6 |
| 381350 | -- | -- | 90 | 888.8 | 90 | 888.8 |
| 381780 | -- | -- | 90 | 890.2 | 90 | 890.2 |
| 382300 | -- | -- | 90 | 890.9 | 90 | 890.9 |
| 382420 | Private Bridge | 69h | 90 | 894.0 | 90 | 894.0 |
| 382590 | -- | -- | 90 | 894.0 | 90 | 894.0 |
| 383000 | -- | -- | 90 | 894.0 | 90 | 894.0 |
| 383660 | -- | -- | 90 | 893.9 | 90 | 894.0 |

| Pewaukee Lake Outlet | | | | | | |
|---|---|---|---|---|---|---|
| | | | Existing Land Use | | Year 2000 Land Use | |
| River[a] Station | Structure Name or Other Location Identification | Structure Number | Regulatory Flood Discharge[c] (cubic feet per second) | Stage[b] (feet above mean sea level) | Regulatory Flood Discharge[c] (cubic feet per second) | Stage[b] (feet above mean sea level) |
| 361000 | -- | -- | 470 | 849.2 | 505 | 849.9 |
| 361350 | -- | -- | 470 | 849.2 | 505 | 849.9 |

[a]Stationing in feet along the stream system referenced to the Wilmot Dam on the main stem of the Fox River in Kenosha County.

[b]Stages corresponding to structure locations are immediately upstream of the structure.

[c]Value indicated includes both the discharge from the Pewaukee Lake outlet and the discharge over Wisconsin Avenue.

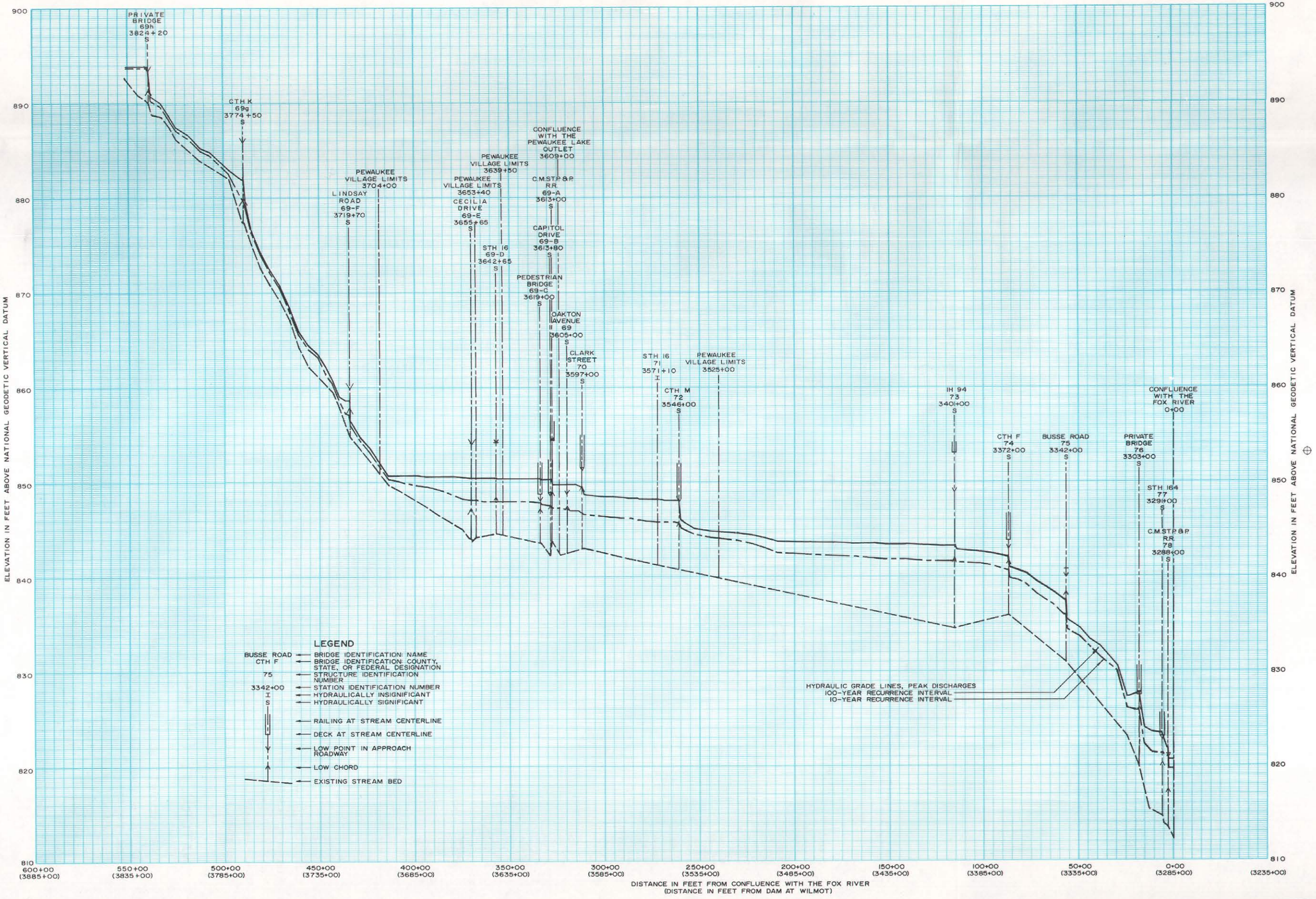
Source: SEWRPC.

## NATURAL FLOODPLAIN

The natural floodplain as it would exist under year 2000 land use conditions is shown on Map 7, placed in the pocket attached to the inside back cover of the report. This map was prepared using the flood stage data in Table 4 and the flood stage profiles in Figures 2 and 3, and it encompasses 5.2 miles of the Pewaukee River extending from Station 350080 (0.3 mile downstream of the south corporate limits of Pewaukee) to Station 377570 (1.3 miles upstream of the north corporate limits of Pewaukee). The map also includes the entire 0.1-mile-long reach of the Pewaukee Lake outlet.

Figure 2

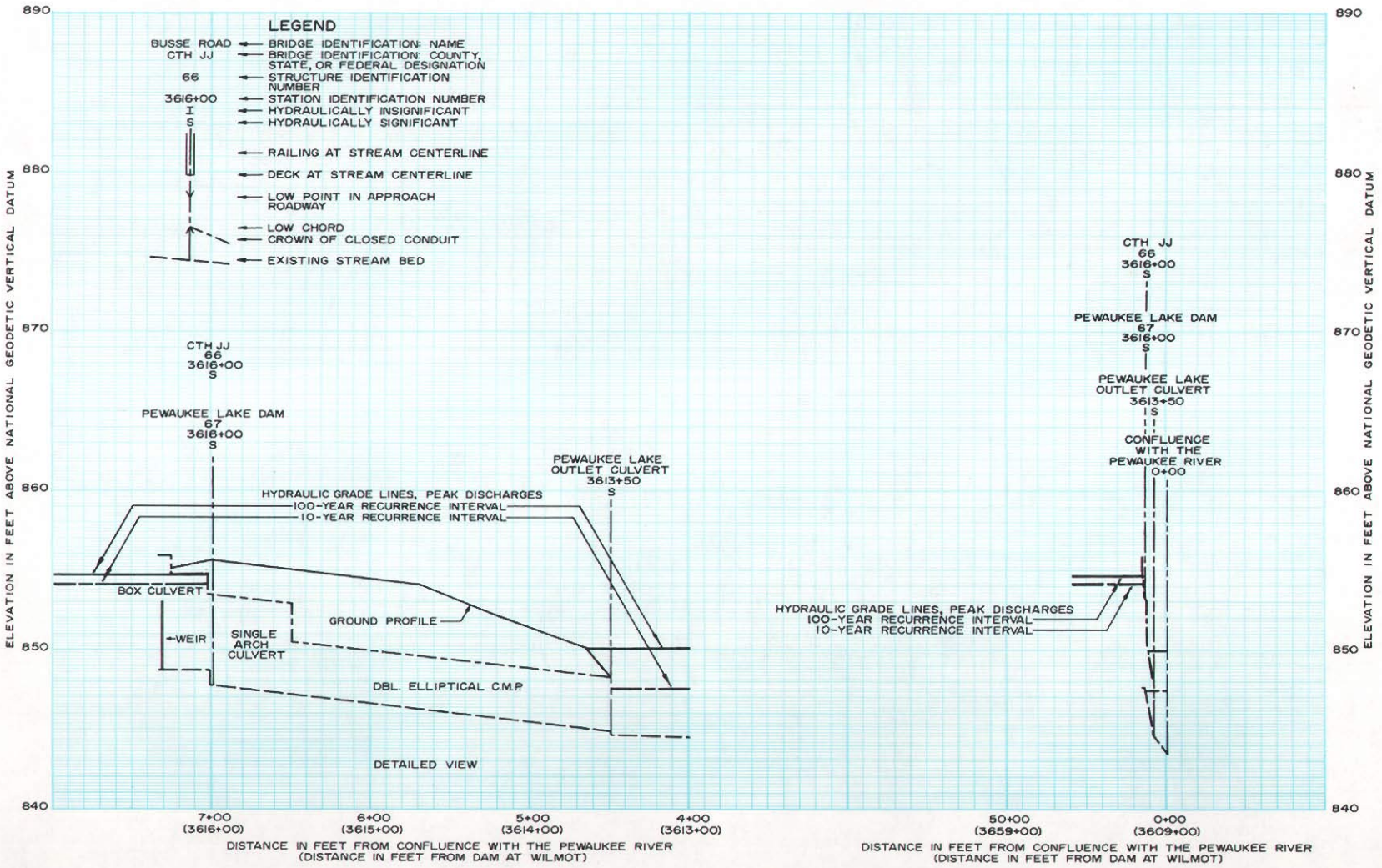
## FLOOD STAGE PROFILES FOR THE PEWAUKEE RIVER IN AND NEAR THE VILLAGE OF PEWAUKEE: YEAR 2000




Source: SEWRPC.

Figure 3

## FLOOD STAGE PROFILES FOR THE PEWAUKEE LAKE OUTLET IN THE VILLAGE OF PEWAUKEE: YEAR 2000




Source: SEWRPC.

Review of the flood hazard map indicates that 45 major structures within the Village of Pewaukee may be expected to be affected by overland flooding of the Pewaukee River and the Pewaukee Lake outlet during a 100-year recurrence interval flood event. These findings are consistent with the results of the historic flood survey which, as discussed earlier in this report, revealed flood damage to structures for historic floods less severe than the 100-year recurrence interval event.

# Chapter VIII

# THE REGULATORY FLOODLANDS

## INTRODUCTION

Floodland regulations in urban areas, such as the Village of Pewaukee, are normally based on a two-district floodway-floodplain fringe approach because the two-district concept recognizes the quite different hydraulic function of, as well as the different flood hazard in, the floodways as opposed to the fringes or outer areas of the regulatory floodlands. The rational nature of the two-district approach enhances the likelihood of public acceptance because it minimizes the number of existing structures that will be affected by the regulations.

## THE FLOODWAY AND FLOODPLAIN FRINGE

The floodway was delineated for the Pewaukee River and Pewaukee Lake outlet in and near the Village of Pewaukee in order to satisfy one of the stated objectives of this report--that is, the determination of a floodway which, in combination with the delineated floodplain fringe, can form the basis for preparation and adoption of floodland regulations that will meet minimum State of Wisconsin requirements while carrying out the adopted comprehensive plan for the Fox River watershed. The floodway, which is shown on Map 7, was delineated for the 3.3 miles of the Pewaukee River (Station 351570 to Station 363950 and Station 365340 to Station 370400), as well as for the entire 0.1-mile-long length of the Pewaukee River outlet. The floodplain fringe, which lies adjacent to the floodway, is also shown on Map 7.

## FLOODWAY DETERMINATION FACTORS

The floodplain of the river is essentially a natural feature consisting of a floodway and a floodplain fringe, the identification of which is accomplished by hydrologic-hydraulic analysis. The floodway consists of the channel and that portion of the floodplain adjoining the channel required to convey an expected flood flow. The floodplain fringe is the remaining portion of the floodplain which provides floodwater storage. Thus, the natural floodplain in or near the Village of Pewaukee is a unique feature of the riverine area determined by the flow regime of the river and the adjacent topography. Its limits were determined by the technical methods described in earlier sections of this report.

The regulatory floodway, in contrast to the natural floodway, is designed to convey the regulatory, or 100-year recurrence interval, discharge with small, acceptable increases over the stages that would exist when the flood flow occupies the entire natural floodway. The regulatory floodway is neither a natural nor a unique feature in that many possible floodways could be delineated. The determination of regulatory floodway limits, therefore, involves the judicious blend of hydraulic and nonhydraulic factors, the net effect of which is to provide for the safe passage of major floods, while recognizing the problems and plans of the community in general, and riverine property owners in particular. Some of the hydraulic and nonhydraulic factors considered in the delineation of the Village of Pewaukee floodway are discussed below.

## Hydraulic Considerations

Floodway limits were made smooth and continuous to reflect the expected flow pattern of the deeper, more rapidly moving portions of the Pewaukee River and the Pewaukee Lake outlet for floods up to and including the 100-year recurrence interval event. Smooth hydraulic transitions are provided wherever the floodway width undergoes large changes over short distances, such as in the vicinity of the STH 16 bridge where the Pewaukee River, during flood stage, is constricted as it passes through the bridge waterway opening and abruptly expands to occupy the wide natural floodplain downstream of the structure.

The regulatory floodway determination procedure included computation of flood stage increases that would occur as a result of laterally constricting the regulatory flood discharge so as to confine it within the floodway limits rather than allowing the flood flow to utilize the entire width of the natural floodway. Floodland regulation based on the two-district floodway-floodplain fringe approach must incorporate the higher flood stages, since completion of the filling and urbanization of the floodplain fringe would mean that essentially all conveyance potential would be removed from the area so that the regulatory flood discharge would, in effect, be forced to pass within the floodway limits. Chapter NR 116 of the Wisconsin Administrative Code specifies that, as a general rule, the maximum allowable 100-year recurrence interval flood stage increase in urban areas is 0.1 foot attributable to a floodway delineation. The hydrologic-hydraulic model was used to obtain flood stages under regulatory floodway conditions and to assure that the stage increase limitation would be satisfied by the Pewaukee floodway. Flood stage data for natural and regulatory floodway conditions are presented in Table 6.

Floodwater depth and velocity are two hydraulic characteristics that exhibit significant variation across the floodlands between major flood events. Depths and velocities are generally greatest in and near the channel area, while they decrease across the natural floodplain with increased distance from the channel. The floodway is intended to encompass those floodland areas that may be expected to exhibit floodwater depths at velocities of such magnitude as to constitute a threat not only to floodland structures and facilities but, more importantly, to the safety and well-being of floodland inhabitants. If structures, primarily private residences, exist or are allowed to be placed in areas having large floodwater depths and high velocities, the potential danger to human safety and life is greatly increased since structure inhabitants or users may be swept off their feet when they attempt to move to and from structures during flood events. Velocities of four feet per second in combination with floodwater depths of three or four feet, for example, develop dynamic forces sufficient to sweep persons off their feet. An attempt was made to identify the probable location of such danger zones so that they could be included within the confines of the regulatory floodway.

Due cognizance must be given during and after the floodway selection process to the maintenance of lateral drainageways so as to prevent the development of stormwater drainage problems along those drainage courses. Any development that is to be permitted in the floodplain fringe must be executed in such a manner so as not to diminish the carrying capacity of the drainage courses lying within or passing through those areas.

Table 6

## HYDRAULIC EFFECT OF THE PEWAUKEE RIVER FLOODWAY AND THE PEWAUKEE LAKE OUTLET FLOODWAY IN THE VILLAGE OF PEWAUKEE UNDER YEAR 2000 PLANNED LAND USE CONDITIONS

| Pewaukee River | | | | | | |
|---|---|---|---|---|---|---|
| River[a] Station | Structure Name or Other Location Identification | Structure Number | Regulatory Flood Discharge (cubic feet per second) | Flood Stages Under Natural Floodplain Conditions (feet above mean sea level) | Flood Stages Under Floodway Conditions (feet above mean sea level) | Stage Increase Attributable to Floodway (feet) |
| 351570 | -- | -- | 650 | 844.7 | 844.7 | 0.0 |
| 352950 | -- | -- | 650 | 844.9 | 844.9 | 0.0 |
| 353820 | -- | -- | 650 | 845.2 | 845.2 | 0.0 |
| 354290 | -- | -- | 650 | 845.8 | 845.8 | 0.0 |
| 354520 | -- | -- | 650 | 846.1 | 846.1 | 0.0 |
| 354600 | CTH M Bridge | 72 | 650 | 848.2 | 848.2 | 0.0 |
| 354660 | -- | -- | 650 | 848.2 | 848.2 | 0.0 |
| 354960 | -- | -- | 650 | 848.2 | 848.2 | 0.0 |
| 355355 | -- | -- | 650 | 848.2 | 848.2 | 0.0 |
| 355800 | -- | -- | 650 | 848.3 | 848.3 | 0.0 |
| 356400 | -- | -- | 650 | 848.3 | 848.3 | 0.0 |
| 356700 | -- | -- | 650 | 848.3 | 848.4 | 0.1 |
| 356800 | -- | -- | 650 | 848.4 | 848.4 | 0.0 |
| 356820 | -- | -- | 650 | 848.4 | 848.4 | 0.0 |
| 356990 | -- | -- | 560 | 848.4 | 848.4 | 0.0 |
| 357110 | STH 16 Bridge | 71 | 560 | 848.4 | 848.4 | 0.0 |
| 357150 | -- | -- | 560 | 848.4 | 848.4 | 0.0 |
| 357600 | -- | -- | 560 | 848.5 | 848.5 | 0.0 |
| 358100 | -- | -- | 560 | 848.6 | 848.6 | 0.0 |
| 358600 | -- | -- | 560 | 848.6 | 848.7 | 0.1 |
| 359150 | -- | -- | 560 | 848.7 | 848.7 | 0.0 |
| 359600 | -- | -- | 560 | 848.8 | 848.8 | 0.0 |
| 359700 | Clark Street Bridge | 70 | 560 | 849.7 | 849.7 | 0.0 |
| 359750 | -- | -- | 560 | 849.7 | 849.7 | 0.0 |
| 359900 | -- | -- | 560 | 849.8 | 849.9 | 0.1 |
| 360100 | -- | -- | 560 | 849.9 | 849.9 | 0.0 |
| 360190 | -- | -- | 560 | 849.9 | 849.9 | 0.0 |
| 360350 | -- | -- | 560 | 849.9 | 849.9 | 0.0 |
| 360500 | Oakton Avenue Bridge | 69 | 560 | 849.9 | 850.2 | 0.3 |
| 360550 | -- | -- | 560 | 849.9 | 850.2 | 0.3 |
| 360690 | -- | -- | 560 | 849.9 | 850.2 | 0.3 |
| 360800 | -- | -- | 560 | 849.9 | 850.2 | 0.3 |
| 360850 | -- | -- | 560 | 849.9 | 850.2 | 0.3 |
| 360870 | -- | -- | 560 | 849.9 | 850.2 | 0.3 |
| 360900 | Confluence with the Pewaukee Lake Outlet | -- | 320 | 849.9 | 850.2 | 0.3 |
| 361250 | -- | -- | 320 | 849.9 | 850.2 | 0.3 |
| 361300 | Chicago, Milwaukee, St. Paul & Pacific Railroad Bridge | -- | 320 | 850.4 | 850.7 | 0.3 |
| 361350 | -- | -- | 320 | 850.4 | 850.7 | 0.3 |
| 361380 | Capitol Drive Bridge | -- | 320 | 850.4 | 850.7 | 0.3 |
| 361430 | -- | -- | 320 | 850.4 | 850.7 | 0.3 |

Table 6 (continued)

| Pewaukee River | | | | | | |
|---|---|---|---|---|---|---|
| River[a] Station | Structure Name or Other Location Identification | Structure Number | Regulatory Flood Discharge (cubic feet per second) | Flood Stages Under Natural Floodplain Conditions (feet above mean sea level) | Flood Stages Under Floodway Conditions (feet above mean sea level) | Stage Increase Attributable to Floodway (feet) |
| 361850 | -- | -- | 320 | 850.4 | 850.7 | 0.3 |
| 361900 | Pedestrian Bridge | -- | 320 | 850.5 | 850.7 | 0.2 |
| 361950 | -- | -- | 320 | 850.5 | 850.7 | 0.2 |
| 362650 | -- | -- | 320 | 850.5 | 850.7 | 0.2 |
| 363150 | -- | -- | 320 | 850.5 | 850.7 | 0.2 |
| 363650 | -- | -- | 320 | 850.5 | 850.7 | 0.2 |
| 363950 | -- | -- | 320 | 850.5 | 850.7 | 0.2 |
| 364240 | -- | -- | 195 | 850.5 | 850.7 | 0.2 |
| 364265 | STH 16 Bridge | -- | 195 | 850.6 | 850.9 | 0.3 |
| 364430 | -- | -- | 195 | 850.6 | 850.9 | 0.3 |
| 364900 | -- | -- | 195 | 850.6 | 850.9 | 0.3 |
| 365340 | -- | -- | 195 | 850.6 | 850.9 | 0.3 |
| 365515 | -- | -- | 195 | 850.6 | 850.9 | 0.3 |
| 365565 | Cecilia Drive | 69e | 195 | 850.6 | 850.9 | 0.3 |
| 365693 | -- | -- | 195 | 850.6 | 850.9 | 0.3 |
| 366000 | -- | -- | 195 | 850.7 | 851.0 | 0.3 |
| 366500 | -- | -- | 195 | 850.8 | 851.0 | 0.2 |
| 367000 | -- | -- | 195 | 850.8 | 851.1 | 0.3 |
| 367500 | -- | -- | 195 | 850.8 | 851.1 | 0.3 |
| 367900 | -- | -- | 115 | 850.8 | 851.1 | 0.3 |
| 368400 | -- | -- | 115 | 850.9 | 851.1 | 0.2 |
| 368900 | -- | -- | 115 | 850.9 | 851.1 | 0.2 |
| 369400 | -- | -- | 115 | 850.9 | 851.1 | 0.2 |
| 369900 | -- | -- | 115 | 850.9 | 851.1 | 0.2 |
| 370400 | -- | -- | 115 | 852.3 | 852.1 | 0.2 |
| Pewaukee Lake Outlet | | | | | | |
| River[a] Station | Structure Name or Other Location Identification | Structure Number | Regulatory Flood Discharge[b] (cubic feet per second) | Flood Stages Under Natural Floodplain Conditions[c] (feet above mean sea level) | Flood Stages Under Floodway Conditions[c] (feet above mean sea level) | Stage Increase Attributable to Floodway (feet) |
| 361000 | -- | -- | 505 | 849.9 | 850.2 | 0.3 |
| 361350 | -- | -- | 505 | 849.9 | 850.2 | 0.3 |

[a]Stationing in feet along the stream system referenced to the Wilmot Dam on the main stem of the Fox River in Kenosha County.

[b]Value indicated includes both the discharge from the Pewaukee Lake Outlet and the discharge over Wisconsin Avenue.

[c]Stages corresponding to structure locations are immediately upstream of the structure.

Source: SEWRPC.

## Nonhydraulic Considerations

An attempt was made to minimize the number and value of existing structures that would be located within the floodway zone. Recommended floodland regulations would make such structures nonconforming uses, with the intent that they be eventually removed from the floodway. The floodway, as delineated and shown on Map 7, encompasses none of the 45 major structures located within the limits of the 100-year recurrence interval floodplain within the Village.

Another nonhydraulic factor incorporated into the Pewaukee River and Pewaukee Lake outlet floodway determination was existing and committed uses in the regulatory floodplain. The floodway was delineated to incorporate, to the maximum extent practicable, riverine areas already in open space uses such as the park along the Pewaukee River north of Capitol Drive, certain outdoor storage areas, and parking lots, such as those in the commercial area of the Village, inasmuch as such uses are compatible with periodic inundation. Placement of these types of riverine land within the confines of the floodway facilitates the exclusion from the floodway of other, more developed areas.

Another nonhydraulic factor considered in the floodway selection process was the equal degree of encroachment concept. Whenever hydraulically acceptable and otherwise feasible, the floodway was positioned within the natural floodplains so as to reduce the conveyance capacity by an approximately equal amount on both sides of the natural floodway. In this way, the land use restrictions associated with the floodway more equitably impact the landowners on both sides of the stream.

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# Chapter IX

# FLOODLAND REGULATIONS

## INTRODUCTION

The data developed under this study have been incorporated into suggested draft floodland zoning and land division regulations for the Village of Pewaukee. These regulations are set forth in full in Appendices B and C and are intended to replace in part previously adopted floodplain regulations in the Village of Pewaukee. The regulations embody sound land use planning and regulatory concepts, and have been designed to ensure that the Village of Pewaukee meets all minimum floodplain management requirements set forth by the Department of Natural Resources in Chapter NR 116 of the Wisconsin Administrative Code. The regulations also meet all floodplain management requirements under the national flood insurance program administered by the Federal Emergency Management Agency. The draft regulations set forth in Appendices B and C were initially prepared by the SEWRPC staff and have been reviewed and revised by the Village Plan Commission and the Village Administrative Engineer.

## PROPOSED REGULATORY APPROACH

The suggested draft floodland zoning regulations for the Village of Pewaukee divide the delineated 100-year recurrence interval floodlands of the Pewaukee River and the Pewaukee Lake outlet throughout the Village into three distinct regulatory areas:

1. The floodway, which has been placed into a suggested Floodway District.

2. The developed floodplain fringe, which has been placed into a suggested Floodplain Fringe Overlay District.

3. The undeveloped floodplain fringe, which has been placed into a suggested Floodplain Conservancy Zoning District.

The boundaries of the three floodland regulatory areas are identified on Map 7, attached to the back cover of this report.

The proposed FW Floodway District is intended to be used to protect people and property from flood damage by prohibiting the erection of structures that would impede the flow of water during periodic flooding. Open space and related uses such as parks, marinas, navigational structures, public water measuring and control facilities, bridges and approaches, parking lots, and loading areas may be permitted in the floodway if such uses will not impede drainage, cause ponding, obstruct the floodway, increase flood flow velocities, increase the flood stage, or retard the movement of floodwaters.

The floodplain fringe lands designated for placement in the FFO Floodplain Fringe Overlay District are located largely in the central area of the Village and are already intensively developed. The proposed regulations for this District require that, with respect to future development, the lands in question

be filled to an elevation of at least two feet above the elevation of the 100-year recurrence interval flood, or that appropriate floodproofing measures be taken to eliminate major flood damage.

The floodplain fringe lands designated for placement in the FC Floodplain Conservancy Zoning District are located primarily in the northern, undeveloped portion of the Village. The proposed regulations for this District are intended to preserve, in essentially open space and natural uses, lands which are unsuitable for intensive urban development because of poor natural soil conditions and periodic flood inundations.

As noted above, the enactment of the proposed floodland zoning regulations by the Village of Pewaukee will serve to assure that the Village will meet all applicable federal and state floodplain management standards and carry out the floodland management recommendations set forth in the adopted comprehensive plan for the Fox River watershed. Enactment of the proposed zoning regulations will represent an important step toward development of a sound riverine area land use policy by the Village, and thus will serve as an important input to the subsequent preparation of detailed plans for use of riverine and contiguous land.

The suggested draft amendments to the land division regulations for the Village of Pewaukee provide that no land shall be subdivided for residential use which is determined to be unsuitable for such use by the Village Plan Commission for reasons such as flooding or inadequate drainage. The amendments require that lots containing floodlands meet specific standards regarding the amount of nonfloodland area. Also, the amendments require that all certified survey maps containing floodlands show 100-year recurrence interval floodplain limits.

## LAND USE

The nature and distribution of land uses--both existing and planned--within a subwatershed constitute an important element in a hydrologic inventory since both the volume and timing of direct runoff to the stream system are influenced by land uses and land use changes. While the underlying hydrologic soil groups are generally the primary determinant of hydrologic response, the types of land use superimposed on the soil group can significantly modify that response. This is particularly true when lands are converted from rural to urban uses, since such a conversion results in a large increase in impervious surface and, therefore, an increase in runoff volume and a decrease in runoff time. Since the Pewaukee River subwatershed is covered primarily by hydrologic soil group B, which exhibits moderate runoff volumes, it follows that the subwatershed or portions of it may be significantly and adversely affected by improperly planned urbanization.

Existing 1980 land use within the subwatershed is shown on Map 4. As already noted, urban land uses--such as residential, commercial, industrial, and transportation development--cover 9.1 square miles, or about 24 percent of the subwatershed area. Although existing urban land uses are evident throughout most of the subwatershed, there is a concentration of such land uses around the periphery of Pewaukee Lake and along the IH 94 corridor.

A year 2000 land use plan for the Pewaukee River subwatershed is shown on Map 5. The plan is actually a compilation of portions of the adopted land use plans for the Villages of Hartland, Pewaukee, and Sussex and for the Town of Pewaukee as documented in Community Assistance Planning Report No. 49, A Land Use and Traffic Circulation Plan for the Village of Hartland: 2000; Community Assistance Planning Report No. 51, A Land Use Plan for the Village of Sussex: 2000; and Community Assistance Planning Report No. 76, A Land Use Plan for the Town and Village of Pewaukee: 2000. Map 5 was utilized to determine the probable impact of incremental urbanization on flood discharges and stages.

Under year 2000 conditions, a total of about 15.1 square miles, or about 39 percent, of the Pewaukee River subwatershed may be expected to be devoted to urban land uses if the recommendations shown on Map 5 are followed. This would represent an increase of about 66 percent over the amount of land devoted to urban land use in 1980. About 6.0 square miles of land presently in rural land use may be expected to be converted to urban uses within the subwatershed between 1980 and the year 2000. The year 2000 plan for the subwatershed indicates that incremental urban development may be expected to occur east and west of STH 16, between existing urban development in the Village of Pewaukee and in the City of Waukesha; north of Pewaukee Lake at the western edge of the Village of Pewaukee; and along the IH 94 corridor.

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# Chapter X

# SUMMARY

The purpose of this report is to present floodland information for the Pewaukee River and the Pewaukee Lake outlet within and near the Village of Pewaukee, Waukesha County, Wisconsin, so that village officials and concerned citizens can better make decisions concerning sound floodland uses. The data are designed to permit the Village to adopt sound floodland zoning regulations, to meet federal flood insurance regulations, and to facilitate various local planning and engineering efforts. This report is intended to refine and detail floodland management recommendations set forth in SEWRPC Planning Report No. 12, A Comprehensive Plan for the Fox River Watershed, and in SEWRPC Community Assistance Planning Report No. 9 (First Edition), Floodland Information Report for the Pewaukee River, Village of Pewaukee, Waukesha County, Wisconsin.

The Pewaukee River, which is a headwater tributary of the Fox River watershed, originates northeast of the Village of Pewaukee and flows in a generally south-southwesterly direction to the Village, after which it flows in a generally southeasterly direction to join the Fox River. The Pewaukee Lake outlet is a 0.1-mile-long stream located entirely within the Village of Pewaukee and connecting Pewaukee Lake to the Pewaukee River.

The Pewaukee River subwatershed is defined as that 38.35-square-mile area tributary to the Pewaukee River at its confluence with the Fox River. Rural land uses are dominant in the subwatershed, accounting for about 76 percent of the watershed area in 1980. As of 1980, the Village of Pewaukee encompassed about 2.9 square miles and had a population of 4,637 people. Pewaukee is expected to grow to a population of almost 9,250 by the year 2000.

An inventory of historic flood data and information revealed that the Village of Pewaukee has experienced several floods since 1940 which have caused damage and disruption within the Village, the most serious being that of April 1973. The principal types of problems associated with historic flooding are basement flooding and closure of local streets and highways.

Inasmuch as Pewaukee River and Pewaukee Lake outlet flood characteristics were the principal concern of this report, a detailed inventory was conducted of the Pewaukee River subwatershed hydrologic-hydraulic system. The inventory of hydrologic elements of the system included the collection and collation of definitive data on meteorologic conditions, runoff, soils, and land use and the delineation of subbasins. Hydraulic data collected and collated under the inventory phase of the project included stream channel profiles; floodland cross-sections and roughness coefficients; and bridge, culvert, and dam descriptions.

The above hydrologic-hydraulic system data provided input to the hydrologic-hydraulic model, a digital computer program that was used to simulate the flow regime of the stream system. This model consists of a Hydrologic Submodel that generates flow from the land to the stream system; Hydraulic Submodel 1, which routes those flows down through the stream system; and Hydraulic Submodel 2, which determines the stages associated with discharges of specified recurrence interval.

The hydrologic-hydraulic model was used to determine 10- through 500-year recurrence interval flood discharges and stages under existing (1980) and planned (2000) land use conditions. This detailed flood hazard information was developed for the 10.4-mile-long reach of the Pewaukee River in and near the Village of Pewaukee and for the 0.1-mile-long reach of the Pewaukee Lake outlet. The hydrologic-hydraulic inventory and analyses were conducted to readily permit extension of the detailed flood hazard information upstream and downstream of Pewaukee as new riverine area large-scale topographic maps become available.

Model applications indicated that the incremental urbanization anticipated between 1980 and the year 2000 if the regional land use plan is implemented may be expected to have a relatively small effect on flood flows, although a more significant effect on the flood stages, in the Village of Pewaukee.

The model also was used to delineate a regulatory floodway and corresponding floodplain fringe area for the Pewaukee River and the Pewaukee Lake outlet in the Village of Pewaukee. Delineation of the floodway involved consideration of hydraulic factors, such as smooth transitions and allowable stage increases, as well as nonhydraulic factors, such as existing land use and the number of structures in the floodway.

The floodway-floodplain fringe data, which, in effect, define the area subject to floodland zoning regulations as required by the State of Wisconsin, were used to prepare new draft floodland regulations for the Village of Pewaukee. These regulations meet the minimum requirements established by the Wisconsin Department of Natural Resources, and reflect sound riverine area land use planning concepts. The draft regulations are intended to replace, in part, floodland regulations previously adopted by the Village of Pewaukee. The information in this report on 10- through 500-year recurrence interval flood discharges and stages and 100-year recurrence interval flood areas of inundation will enable the Village of Pewaukee to meet the requirements of the national flood insurance program administered by the Federal Emergency Management Agency. Finally, the floodland data in this report will be useful to the Village for detailed local land use planning and engineering applications.

# APPENDICES

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## Appendix A

## GLOSSARY OF TERMS

Channel--The linear, continuous, low-lying area normally occupied by a river or stream.

Floodlands, Natural--The area encompassed by the channel plus the natural floodplain.

Floodlands, Regulatory--The area encompassed by the regulatory floodway, including the channel and the floodplain fringe. In the absence of a regulatory floodway, the regulatory floodlands are identical to the natural floodlands.

Floodplain Fringe--That portion of the floodplain lying outside the floodway. Floodwater depths and velocities are small in this area relative to the floodway; therefore, in a developed urban area, further development may be permitted, although restricted and regulated to minimize flood damage. Because the regulatory floodway may result in increases in the stage of the regulatory flood relative to that which would occur under natural conditions, the floodplain fringe may include at its edges areas that would not be subject to inundation under natural conditions, but would be subject to inundation under regulatory floodway conditions.

Floodplain, Natural--Wide, flat to gently sloping area contiguous with and usually lying on both sides of the channel. The floodplain, which is normally bounded on its outer edges by higher topography, is formed over a long period of time by the river. A river may be expected to overflow its channel banks and occupy some portion of its floodplains on the average of once every two years. How much of the natural floodplain will be occupied by any given flood will depend upon the severity of that flood and, more particularly, upon its elevation or stage. Thus, an infinite number of outer limits of the natural floodplain may be delineated, each related to a specified flood recurrence interval. The Southeastern Wisconsin Regional Planning Commission recommends, therefore, that the natural floodplains of a river or stream be more specifically defined as those corresponding to a flood having a recurrence interval of 100 years.

Flood Stage Profile--A graph of peak water surface elevation as a function of position along a river or stream. The profile usually corresponds either to a flood event of specified recurrence interval or to a historic flood event. The channel bottom, as well as bridges, culverts, and dams, is also normally depicted on the flood stage profile.

Floodway--The channel of a river or stream and those portions of the floodplain adjoining the channel required to convey the discharge associated with a particular flood event. The floodway is that portion of the floodlands not suited for human habitation. All fill, structures, and other development that would impair floodwater conveyance by adversely increasing flood stages or velocities, or would itself be subject to flood damage, should be prohibited in the floodway.

Regulatory Floodway--A designated portion of the regulatory floodlands that will safely convey the regulatory flood discharge with small, acceptable upstream and downstream stage increases, generally limited in Wisconsin to 0.1 foot.

Hydraulics--Study of the physical behavior of water as it flows within stream channels and associated natural floodlands; under and over bridges, culverts, and dams; and through lakes and other impoundments.

Hydrology--Study of the physical behavior and amount of water from its occurrence as precipitation to its entry into streams, lakes, and other impoundments or its return to the atmosphere via evapotranspiration.

Regulatory (100-Year) Flood--The 100-year recurrence interval flood event; that is, the flood event that would be reached or exceeded once on the average of every 100 years or, stated differently, would have a 1 percent chance of being reached or exceeded in any given year. According to State of Wisconsin law, all counties, cities, and villages are required to adopt regulations for land subject to inundation by the regulatory flood.

## Appendix B

## SUGGESTED FLOODLAND ZONING REGULATION AMENDMENTS TO CHAPTER 17 OF THE VILLAGE OF PEWAUKEE ZONING CODE

1. Repeal and re-create Section 17.02 to read as follows:

17.02 PURPOSE. In accordance with Sections 61.35, 62.23 (7), and 87.30 of the Wisconsin Statutes and amendments thereto, this Code is enacted for the purpose of creating a more compatible environment so as to promote the health, safety, morals, prosperity, and general welfare of this community and this region.

2. Repeal and re-create Section 17.03 to read as follows:

17.03 INTENTION. It is the general intent of this Ordinance to regulate and restrict the use of all structures, lands, and waters; regulate and restrict lot coverage, population distribution, and density, and the size and location of all structures so as to lessen congestion in and promote the safety and efficiency of streets and highways; secure safety from fire, flooding, panic, and other dangers; provide adequate light, air, sanitation, and drainage; prevent overcrowding; prevent flood damage to persons and property and minimize expenditures for flood relief and flood control projects; avoid undue population concentration; facilitate the adequate provision of public facilities and utilities; stabilize and protect property values; further the appropriate use of land and conservation of natural resources; preserve and promote the beauty of the community; and implement the community's comprehensive plan or plan components. It is further intended to provide for the administration and enforcement of this Ordinance and to provide penalties for its violation.

3. Repeal and re-create Section 17.06 to read as follows:

17.06 SEVERABILITY AND NONLIABILITY

(1) IF ANY SECTION, clause, provision, or portion of this Code is adjudged unconstitutional or invalid by a court of competent jurisdiction, the remainder of this Code shall not be affected thereby.

(2) IF ANY APPLICATION OF THIS CODE to a particular structure, land, or water is adjudged unconstitutional or invalid by a court of competent jurisdiction, such judgment shall not be applicable to any other structure, land, or water not specifically included in said judgment.

(3) THE VILLAGE DOES NOT GUARANTEE, warrant, or represent that only those areas designated as floodlands will be subject to periodic inundation, and hereby asserts that there is no liability on the part of the Village Board, its agencies, or employees for any flood damages, sanitation problems, or structural damages that may occur as a result of reliance upon, and conformance with, this Code.

4. Repeal and re-create Section 17.10 to read as follows:

17.10 COMPLIANCE. No structure, development, land, water, or air shall hereafter be used and no structure or part thereof shall hereafter be located, erected, moved, substantially improved, extended, enlarged, converted, or structurally altered without a zoning permit, except minor structures, and without full compliance with the provisions of this Code and all other applicable local, county, and state regulations. However, no structure or development in a floodland district shall be exempt from obtaining a zoning permit, and any work that does qualify for an exemption under this section shall be required to comply with the applicable setback, yard, height, and other requirements set forth in this Code.

OTHER PERMITS. It is the responsibility of permit applicant to secure all other necessary permits required by any state, federal, or local agency. This includes, but is not limited to, a water use permit pursuant to Chapters 30 and 31 of the Wisconsin Statutes or a wetland fill permit pursuant to Section 404 of the Federal Water Pollution Control Act.

ARCHITECTURAL BOARD APPROVAL SHALL BE OBTAINED.

THE DUTIES AND POWERS OF THE ZONING INSPECTOR shall consist of the following:

(1) MAINTAIN RECORDS of all permits issued, inspections made, work approved, and other official actions.

(2) RECORD THE LOWEST FLOOR ELEVATIONS of all structures erected, moved, altered, or improved in the floodland districts.

(3) ESTABLISH THAT ALL NECESSARY PERMITS that are required for floodland uses by state and federal law have been secured.

(4) TO HAVE INSPECTED all structures, lands, and waters as often as necessary to assure compliance with this Code.

(5) INVESTIGATE all complaints made relating to the location of structures and the use of structures, lands, and waters, give notice of all violations of this Code to the owner, resident agent, or occupant of the premises, and report uncorrected violations to the Village Attorney in a manner specified by him.

(6) ASSIST THE VILLAGE ATTORNEY in the prosecution of Code violations.

(7) ISSUE ZONING PERMITS upon application for the erection or use of a structure, land, or water where such erection or use complies with all provisions of this Code.

(8) ACCESS to premises and structures during reasonable hours to make those inspections as deemed necessary to ensure compliance with this Code. If, however, the Village Zoning Inspector is refused entry after presentation of identification, he may procure a special inspection warrant in accordance with Section 66.122 of the Wisconsin Statutes, except in cases of emergency.

(9) PROHIBIT the use or erection of any structure, land, or water until inspected and approved for such use or erection.

(10) RECOMMEND to the Village Board and Plan Commission any additional use regulations as deemed necessary.

(11) REQUEST ASSISTANCE and cooperation from the Village Police Department and Village Attorney.

5. Create Section 17.11a to read as follows:

CERTIFICATE OF COMPLIANCE REQUIRED IN FLOODLANDS.

(1) NO VACANT FLOODLAND shall hereafter be occupied, used, or developed; and no building or premises within a floodland shall be erected, altered, moved, or substantially improved or its use changed; and no nonconforming use within a floodland use shall be maintained, renewed, changed, or extended until a certificate of compliance has been issued by the Zoning Inspector. Such certificates shall show that the structure or premises or use is in conformance with the provisions of this Code and shall be accompanied by a certification by a registered professional engineer or land surveyor that the floodplain regulations set forth in this Code have been fully complied with. Such certificate shall be applied for at the time a party occupies any floodland or structure within a floodland or when there is a renewal or change in a floodland nonconforming use.

(2) APPLICATION FOR CERTIFICATE OF COMPLIANCE shall be made in the same manner as for a zoning permit pursuant to Section 17.11 of this Code.

(3) EXISTING USES. Upon written request from the owner, the Zoning Inspector shall issue a certificate of compliance for any building or premises existing at the time of the adoption of this Code, certifying, after inspection, the extent and kind of use made of the building or premises and whether or not such use conforms to the provisions of this Code.

6. Repeal and re-create Section 17.17(1) to read as follows:

17.17 ESTABLISHMENT. For the purpose of this Code, the Village is hereby divided into the following general categories of zoning districts: Residential, Business, Industrial, Agricultural, Conservancy, Recreational, and Floodplain. The location and boundaries of the districts are hereby established as shown on the "Zoning Map-Village of Pewaukee, Wisconsin" dated _____ _____, and the "Supplementary Floodland Zoning Map-Village of Pewaukee, Wisconsin" dated _____, and both maps are herewith made a part of this Code. Such boundaries shall follow lot lines, lines 50 feet upland from the high water mark, or center lines of streets and alleys, unless otherwise specified. The boundaries of the FW Floodway District shall be determined by use of the scale contained on the Supplementary Floodland Zoning Map. The boundaries of the FC Floodplain Conservancy District and the FFO Floodplain Fringe Overlay District shall be determined by the floodland limits shown on the Supplementary Floodland Zoning Map. The flood stages, under floodway conditions, contained on the Supplementary Floodland Zoning Map were developed from technical data contained in the Flood Insurance Study--Village of Pewaukee, Waukesha County,

Wisconsin, published by the Federal Emergency Management Agency (FEMA) and dated June 15, 1982. The information contained in the flood insurance study is further illustrated on the Floodway and Flood Boundary Map and on the Flood Insurance Rate Map, both maps dated June 15, 1982. Where a conflict exists between the floodland limits as shown on the Supplementary Floodland Zoning Map and actual field conditions, the elevations from the 100-year recurrence interval flood profile under floodway conditions shall be the governing factor in locating the regulatory floodland limits.

7. Repeal and re-create Section 17.17(4) to read as follows:

(4) ANNEXATIONS. Annexations to or consolidations with the Village subsequent to August 21, 1963, shall be placed in the agricultural district if undeveloped and within one year the Village Planning Commission shall evaluate and recommend a permanent zoning district classification to the Village Board. Where the area is already developed, the Planning Commission shall either recommend a permanent zoning district at the time of annexation or place it in the agricultural district for a period not to exceed one year. Annexations or consolidations containing floodland shall be placed in the following districts:

(a) All floodways shall be placed in the FW Floodway District.

(b) All other floodlands shall be placed in the FC Floodplain Conservancy District.

8. Repeal and re-create Section 17.29 to read as follows:

17.29 FLOODPLAIN DISTRICTS

(1) FW FLOODWAY DISTRICT. The FW Floodway District is intended to be used to protect people and property from flood damage by prohibiting the erection of structures that would impede the flow of water during periodic flooding. Permitting use of the floodway would increase damages in the broader floodplain by increasing flood stages. In delineating the FW Floodway District, the effects of development within the associated flood fringe shall be computed utilizing the equal degree of hydraulic encroachment principle. No increase in flood stage shall be permitted to exceed one foot. Flood stage increases exceeding 0.1 foot in height shall not be permitted unless the Village of Pewaukee has made appropriate legal arrangements with all affected units of government and all property owners affected by the stage increase, and until all such affected units of government have amended their water surface profiles and floodland zoning maps to reflect the increased flood elevations.

(a) PRINCIPAL USES. Any of the following uses provided that such use shall not involve the erection or placement of a structure: drainage and movement of water, navigation, fishing, stream bank protection, flood overflows, grazing, horticulture, pasturing, sod farms, truck farming, viticulture, wild crop harvesting, wildlife preserves, and park and recreational areas.

Permitted principal uses also include utility poles, towers, and underground conduit for transmitting electricity, telephone, cable TV, natural gas, and similar products and services.

(b) CONDITIONAL USES. See Section 17.36a

(c) MAINTENANCE OF DRAINAGEWAYS. No development in the FW Floodway District shall adversely affect the channels or floodways of the Pewaukee River and any tributary thereto, drainage ditches, or other lands lying outside the floodlands.

(d) DUMPING AND FILLING PROHIBITED. Lands lying within the FW Floodway District shall not be used for dumping and shall not be filled, except as authorized to permit establishment of approved bulkhead lines or to accommodate bridge approaches.

(e) DANGEROUS MATERIALS STORAGE PROHIBITED. Lands lying within the FW Floodway District shall not be used for the storage of materials that are buoyant, flammable, explosive, or injurious to human, animal, or plant life.

(f) INCOMPATIBLE USES PROHIBITED. Lands lying within the FW Floodway District shall not be used for any solid waste disposal site, onsite soil absorption sanitary sewerage system site, or the construction of any well which is used to obtain water for ultimate human consumption.

(g) MOBILE HOMES PROHIBITED. No mobile home, mobile home park, or trailer camp shall be placed or moved onto lands lying in the FW Floodway District.

(2) FC FLOODPLAIN CONSERVANCY DISTRICT. The FC Floodplain Conservancy District is intended to preserve in essentially open space and natural uses lands which are unsuitable for intensive urban development purposes because of poor natural soil conditions and periodic flood inundations. The proper regulation of these areas will serve to maintain and improve water quality, prevent flood damage, protect wildlife habitat, and prohibit the location of structures on soils which are generally not suitable for such use. In delineating the FC District, consideration shall be given to the maintenance of flood storage capacity and preventing significant increases in the flood discharges identified in the Village's flood insurance study. Significant increases are those which result in a rise in the regional flood profile of greater than 0.1 foot.

(a) PRINCIPAL USES. Any of the following uses provided that such use shall not involve the erection or placement of a structure: drainage and movement of water, navigation, fishing, stream bank protection, flood overflows, grazing, horticulture, pasturing, sod farms, truck farming, viticulture, wild crop harvesting, wildlife preserves, and park and recreational areas.

Permitted principal uses also include: utility poles, towers, and underground conduit for transmitting electricity, telephone, cable TV, natural gas and similar products and services.

(b) CONDITIONAL USES. See Section 17.36a.

(c) MAINTENANCE OF DRAINAGEWAYS. No development in the FC Floodplain Conservancy District shall adversely affect the channels or floodways of the Pewaukee River and any tributary thereto, drainage ditches, or other lands lying outside the floodlands.

(d) DUMPING AND FILLING PROHIBITED. Lands lying within the FC Floodplain Conservancy District shall not be used for dumping or shall not be filled, except as authorized to permit establishment of approved bulkhead lines or to accommodate bridge approaches.

(e) DANGEROUS MATERIALS STORAGE PROHIBITED. Lands lying within the FC Floodplain Conservancy District shall not be used for the storage of materials that are buoyant, flammable, explosive, or injurious to human, animal, or plant life.

(f) INCOMPATIBLE USES PROHIBITED. Lands lying within the FC Floodplain Conservancy District shall not be used for any solid waste disposal site, onsite soil absorption sanitary sewerage system site, or the construction of any well which is used to obtain water for ultimate human consumption.

(g) MOBILE HOMES PROHIBITED. No mobile home, mobile home park, or trailer camp shall be placed or moved onto lands lying in the FC Floodplain Conservancy District.

(3) FFO FLOODPLAIN FRINGE OVERLAY DISTRICT. The FFO Floodplain Fringe Overlay District is intended to provide for and encourage the most appropriate use of land and water in areas subject to periodic flooding and to minimize flood damage to people and property.

(a) PRINCIPAL USES. Any use of land, except structures, that is permitted in the underlying basic use district. Examples of such use would be croplands in an agricultural district, required yards in a residential district, or parking or loading areas in a commercial or industrial district, provided that inundation depths for parking and loading areas do not exceed two feet or that such areas are not subjected to flood velocities greater than four feet per second upon the occurrence of a 100-year recurrence interval flood.

(b) CONDITIONAL USES. See Section 17.36a.

(c) MAINTENANCE OF DRAINAGEWAYS. No filling or development in the FFO Floodplain Fringe Overlay District shall adversely affect the channels, floodways, or shorelands of the Pewaukee River and tributary thereto, drainage ditches, or other lands lying outside the floodlands.

(d) INCOMPATIBLE USE PROHIBITED. Lands lying within the FFO Floodplain Fringe Overlay District shall not be used for any solid waste disposal site, onsite soil absorption sanitary sewerage system site, or the construction of any well which is used to obtain water for ultimate human consumption.

(e) MOBILE HOMES PROHIBITED. No mobile home, mobile home park, or trailer camp shall be placed or moved onto lands lying in the FFO Floodplain Fringe Overlay District.

9. Repeal and re-create Section 17.30(3) to read as follows:

(3) DESCRIPTION OF THE SUBJECT SITE by lot, block, and recorded subdivision or by metes and bounds; address of the subject site; type of structure; proposed operation or use of the structure or site; number of employees; and

the zoning district within which the subject site lies. In areas subject to inundation by floodwaters the following information shall also be provided:

(a) Storage of materials, floodproofing measures, and the relationship of the proposed project to the location of the channel.

(b) A typical valley cross-section showing the channel of the stream, elevation of land areas adjoining each side of the channel, cross-sectional areas to be occupied by the proposed development, and high water information.

(c) Profile showing the slope of the bottom of the channel or flow line of the stream.

(d) Specifications for building construction and materials, floodproofing, filling, dredging, grading, channel improvements, storage of materials, water supply, and sanitary facilities.

10. Repeal and re-create Section 17.30(4) to read as follows:

(4) PLAT OF SURVEY.

(a) A plat of survey shall be prepared by a registered land surveyor showing all of the information required under Section 17.11 for a Zoning Permit and, in addition, the following: mean and historic high water lines on or within 40 feet of the subject premises, and existing and proposed landscaping.

(b) In areas subject to inundation by floodwaters, the plat of survey shall also include first floor elevations, utility elevations, historic and probable future floodwater elevations, depth of inundation, floodproofing measures, and plans for proposed structures giving dimensions and elevations pertinent to the determination of the hydraulic capacity of the structures or its effects on flood flows. Where floodproofing is required, the applicant shall submit a plan or document certified by a registered professional engineer that the floodproofing measures are adequate to withstand the flood forces and velocities associated with the 100-year recurrence interval flood. Prior to the issuance of a certificate of compliance, the applicant shall also submit a certification by the registered professional engineer that the finished floodproofing measures were accomplished in compliance with the provisions of this Code.

11. Repeal and re-create Section 17.30(8) to read as follows:

(8) A PUBLIC HEARING on each such application shall be held at a reasonable time and place and public notice shall be given at least 10 days prior and due notice shall be given to the neighboring landowners. A copy of all notices for public hearings on applications for conditional uses in the floodplain districts, including a copy of the application, shall be transmitted to the Wisconsin Department of Natural Resources (DNR) for review and comment. Final action on floodplain applications shall not be taken for 30 days or until the DNR has made its recommendation, whichever comes first.

12. Repeal and re-create Section 17.30(9) to read as follows:

(9) DECISIONS. A copy of all floodplain conditional use decisions shall be transmitted to the DNR within 10 days of their effective date.

13. Renumber Sections 17.30(9) through 17.30(11) as Sections 17.30(10) through 17.30(12), respectively.

14. Create Section 17.36a to read as follows:

17.36a FLOODPLAIN CONDITIONAL USES. The following floodplain uses are conditional uses and may be permitted as specified:

(1) OPEN SPACE AND RELATED USES may be permitted in the FW Floodway and FC Floodplain Conservancy Districts provided that the applicant shows that such use or improvement will not impede drainage, will not cause ponding, will not obstruct the floodway, will not increase flood flow velocities, will not increase the flood stage, and will not retard the movement of floodwaters. When permitted, all structures shall be floodproofed and constructed so as not to catch or collect debris nor be damaged by floodwaters. Certification of floodproofing shall be made to the Zoning Inspector and shall consist of a plan or document certified by a registered professional engineer that the floodproofing measures are consistent with the flood velocities, forces, depths, and other factors associated with the 100-year recurrence interval flood.

(a) Marinas.

(b) Navigational structures, public water measuring and control facilities, and bridges and approaches.

(c) Parking lots, loading areas, accessory to permitted uses but not including new or used vehicle sales or storage areas. Parking lots and loading areas shall not be permitted if inundation depths exceed two feet or in areas where flood velocities greater than four feet per second occur during a 100-year recurrence interval flood event.

(d) Filling as authorized by the Department of Natural Resources to permit establishment of approved bulkhead lines.

(e) Other open space uses consistent with the purpose and intent of the district and compatible with uses in adjacent districts, not including structures.

(2) ACCESSORY STRUCTURES IN THE FC FLOODPLAIN CONSERVANCY DISTRICT, provided that the structure is not designed for human habitation, has a low flood damage potential, is constructed and placed to provide minimum obstruction of flood flows (whenever possible, accessory structures should be placed with their longitudinal axis parallel to the flow of floodwaters), is firmly anchored to prevent it from floating away and restricting bridge openings, and has all service facilities (such as electrical and heating equipment) at an elevation that is at least two feet above the 100-year recurrence interval flood.

(3) RESIDENTIAL AND COMMERCIAL STRUCTURES in the FFO Floodplain Fringe Overlay District, provided that the structure is permitted in the underlying basic use district and provided that such floodplain fringe areas shall be filled to an elevation at least two feet above the elevation of the 100-year recurrence interval flood. Such fill shall extend for at least 15 feet beyond the limits of the structure placed thereon and shall be contiguous to lands outside the floodplain where the depths and duration of floodwaters are sufficient to cause rescue and relief problems. The finished surface of the lowest floor (including basement) shall be constructed or placed at an elevation that is at least two feet above the elevation of the 100-year recurrence interval flood. Structures placed on fill may be removed from the Floodplain Fringe Overlay District provided that the fill is contiguous to lands lying outside the floodlands, and further provided that the property owner, or his agent, has complied with all the requirements for amending the zoning map, as set forth in Section 17.70 of this Code.

(4) INDUSTRIAL STRUCTURES and structures that are accessory to other permitted uses and structures in the FFO Floodplain Fringe Overlay District, provided that the structure is permitted in the underlying district, and provided that the fill requirements for residential structures in the FFO District are complied with. However, when the intent and purpose of this Code cannot be fulfilled by filling the floodplain fringe because of existing and committed development, and when the Plan Commission has made a finding to this effect, all new structures and all additions to existing structures in the Floodplain Fringe Overlay District shall be floodproofed to a point two feet above the elevation of the 100-year recurrence interval flood. Certification of floodproofing shall be made to the Zoning Inspector and shall consist of a plan or document certified by a registered professional engineer that the floodproofing measures are consistent with the flood velocities, forces, depths, and other factors associated with the 100-year recurrence interval flood level for the particular stream reach. Structures placed on fill may be removed from the Floodplain Fringe Overlay District provided that the fill is contiguous to lands lying outside the floodlands and further provided that the property owner, or his agent, has complied with all the requirements for amending the zoning map as set forth in Section 17.70 of this Code.

(5) MUNICIPAL WATER SUPPLY AND SANITARY SEWERAGE SYSTEMS IN ANY FLOODLAND DISTRICT, provided that the system is floodproofed to an elevation at least two feet above the elevation of the 100-year recurrence interval flood, and is designed to eliminate or minimize infiltration of floodwaters into the system. Certification of floodproofing shall be made to the Zoning Inspector and shall consist of a plan or document certified by a registered professional engineer that the floodproofing measures are consistent with the flood velocities, forces, depths, and other factors associated with the 100-year recurrence interval flood level for the particular stream reach.

(6) FILLING TO REMOVE LANDS from the FFO Floodplain Fringe Overlay District, provided that such fill shall be to an elevation at least two feet above the elevation of the 100-year recurrence interval flood and further provided that such lands are contiguous to lands lying outside the floodlands. No such Floodplain Fringe Overlay District shall be removed from the Supplementary Floodland Zoning Map until the filling is complete and until the property owner, or his agent, has complied with all the requirements for amending the zoning map, as set forth in Section 17.70 of this Code.

15. Repeal and re-create Section 17.57(1)(d) to read as follows:

(d) FLOODLAND NONCONFORMING USES. Floodland nonconforming uses repaired or altered under the nonconforming use provisions of this Code shall provide for floodproofing to those portions of structures involved in such repair or alteration. The portions of such structures involved in repairs or alterations shall be placed on fill at least two feet above the elevation of the regulatory flood and such fill shall be contiguous to lands lying outside the floodlands.

16. Repeal and re-create Section 17.69(4)(d) to read as follows:

(d) FLOODPLAIN MAPPING DISPUTES. To hear and decide upon the delineation of floodland districts where it is alleged there is a difference between the elevation of the floodplain and lands shown within the floodplain on the Supplementary Floodland Zoning Map based upon field surveys.

17. Renumber Sections 17.69(4)d through g as 17.69(4)e through h.

18. Repeal and re-create Section 17.69(4)(g) to read as follows:

(g) POWERS LIMITED IN THE FLOODPLAIN DISTRICTS. The Board of Zoning Appeals will not grant a variance or any order where:

(1) Filling and development contrary to the purpose and intent of the FW Floodway District and FC Floodplain Conservancy District would result.

(2) A change in the boundaries of the FW Floodway District, FC Floodplain Conservancy District, or FFO Floodplain Fringe Overlay District would result.

(3) A lower degree of flood protection than a point two feet above the 100-year recurrence interval flood for the particular area would result.

(4) Any action contrary to the provisions of the Wisconsin Statutes or the Wisconsin Administrative Code would result.

19. Repeal and re-create 17.69(6) to read as follows:

(6) HEARINGS. The Board of Zoning Appeals shall fix a reasonable time and place for the hearing, give public notice thereof at least 10 days prior, and shall give due notice to the parties of interest, including the Village Attorney and the Village Plan Commission. At the hearing, the appellant or applicant may appear in person, by agent, or by attorney. In addition, the Board of Zoning Appeals shall transmit a copy of all notices of appeals or variances to the floodland provisions of this Ordinance to the Wisconsin Department of Natural Resources (DNR) for review and comment. Final action on floodland appeals and variance requests shall not be taken for 30 days or until the DNR has made its recommendation, whichever comes first.

20. Create Section 17.69(7)(d) to read as follows:

(d) ECONOMIC HARDSHIP, SELF-IMPOSED HARDSHIP NOT GROUNDS FOR VARIANCE. No variance shall be granted solely on the basis of economic gain or loss. Self-imposed hardships shall not be considered as grounds for the granting of the variance.

21. Repeal and re-create Section 17.69(8) to read as follows:

(8) DECISION. The Board of Zoning Appeals shall decide all appeals within 30 days after the final hearing and shall transmit a signed copy of the Board's decision to the appellant or applicant, Building Inspector and Planning Commission. A copy of all decisions on floodplain appeals or variance requests shall be transmitted to the DNR within 10 days of their effective date.

22. Repeal and re-create Section 17.69(9) to read as follows:

(9) MAPPING DISPUTES. The following procedure shall be used by the Board of Zoning Appeals in settling disputes of a floodplain zoning district boundary:

(a) The floodplain district boundary shall be determined by use of the flood profiles contained in an engineering study or, where such information is not available, by experience, flood maps, or any other evidence available to the Board.

(b) The person contesting the location of the district boundary shall be given the opportunity to present his own technical evidence. Where it is determined that the floodplain is incorrectly mapped, the Board of Appeals shall advise the Village Plan Commission of its findings and the Plan Commission shall proceed to petition the Village Board for a map amendment.

23. Renumber Sections 17.69(9) and 17.69(10) as Sections 17.69(10) and 17.69(11), respectively.

24. Repeal the current Section 17.70(7) PROTEST and Section 17.70(8) NOTICE TO DEPARTMENT NATURAL RESOURCES, and re-create and renumber the Protest section as Section 17.70(8) PROTEST.

25. Repeal and re-create Section 17.70(7) to read as follows:

(7) FLOODPLAIN DISTRICT BOUNDARY CHANGES LIMITED. (a) The Village Board shall not permit changes to the floodplain district boundaries that are inconsistent with the purpose and intent of this Code, or in conflict with the applicable rules and regulations of the Wisconsin Department of Natural Resources (DNR) and the Federal Emergency Management Agency (FEMA).

(b) Changes in the FW Floodway District boundaries shall not be permitted where the change will increase the flood stage elevation in excess of one foot. Flood stage increases exceeding 0.1 foot in height shall not be permitted unless the petitioner has made appropriate legal arrangements with all affected units of government and all property owners affected by the stage increase. Petitions for FW Floodway District changes shall show the effects of the change within the associated flood fringe utilizing the equal degree of encroachment principle, and shall provide adjusted water surface profiles and adjusted floodland limits to reflect the increased flood elevations.

Changes in the FC Floodplain Conservancy District boundaries shall not be permitted where the change will increase flood discharges that will result in increased downstream flood stage elevations in excess of one foot. Flood stage

increases exceeding 0.1 foot in height shall not be permitted unless the petitioner has made appropriate legal arrangements with all affected units of government and all property owners affected by the stage increase. Petitions for FC Floodplain Conservancy District changes shall show the effects of the change on flood discharges and associated flood elevations utilizing the planned degree of hydrologic encroachment principle, and shall provide adjusted water surface profiles and adjusted floodland limits to reflect the increased flood elevations.

(c) Removal of land from the floodland districts shall not be per mitted unless the land has been filled to an elevation at least two feet above the elevation of the 100-year recurrence interval flood and provided that such land is contiguous to lands lying outside the floodlands.

(d) No River or stream shall be altered or relocated until a floodland zoning change has been applied for and granted in accordance with the requirements of this Section, and until all adjacent communities have been requested to review and comment on the proposed alteration or relocation. The flood-carrying capacity within an altered or relocated watercourse shall not be reduced to less than the flood-carrying capacity of the river or stream prior to the alteration or relocation.

(f) Notice to DNR and FEMA. A copy of all notices for amendments or rezoning in the floodland districts shall be transmitted to the Wisconsin Department of Natural Resources (DNR) and the Federal Emergency Management Agency (FEMA). Amendments to the floodland district boundaries or regulations shall not become effective until approved by the DNR and the FEMA. In the case of floodland district boundary changes, an official letter of map amendment (LOMA) from the FEMA shall also be required.

26. Repeal Section 17.29(6) and add the following definitions in their appropriate alphabetical order in Section 17.71.

A Zones
Areas of potential flooding shown on the Village's "Flood Insurance Rate Map" which would be inundated by the regional flood as defined herein. These areas may be numbered as A0, A1 to A99. The numbered A Zones are reflective of specific flood profiles.

Development
Any man-made change to improve or unimprove real estate, including but not limited to construction of or additions or substantial improvements to buildings, other structures, or accessory uses, mining, dredging, filling, grading, paving, excavation or drilling operations, or disposition of materials.

District, Basic
A part or parts of the Village for which the regulations of this Code governing the use and location of land and buildings are uniform (such as the Residential, Commercial, and Industrial District classifications).

District, Overlay
Overlay districts provide for the possibility of superimposing certain additional requirements upon a basic zoning district without disturbing the requirements of the basic district. In the instance of conflicting requirements, the more strict of the conflicting requirements shall apply.

Equal Degree of Hydraulic Encroachment

The effect of any encroachment into the floodway must be computed by assuming an equal degree of hydraulic encroachment on the opposite side of a river or stream for a significant hydraulic reach, in order to compute the effect of the encroachment upon hydraulic conveyance. This computation assures that property owners up, down, or across the river or stream will have the same right of hydraulic encroachment.

Flood

A temporary rise in streamflow or stage that results in water overtopping its banks and inundating areas adjacent to the channel.

Flood Insurance Study

An examination, evaluation, and determination of flood hazards, and, if appropriate, corresponding water surface elevations; or an examination, evaluation, and determination of mudslide (i.e., mud flow) and/or flood-related erosion hazards. Such studies shall result in the publication of a Flood Insurance Rate Map showing the intensity of flood hazards in either numbered or unnumbered A Zones.

Flood Profile

A graph showing the relationship of the floodwater surface elevation of a flood event of a specified recurrence interval to the stream bed and other significant natural and man-made features along a stream.

Flood-Protection Elevation

A point two feet above water surface elevation of the 100-year recurrence interval flood. This safety factor, also called "freeboard," is intended to compensate for the many unknown factors that contribute to flood heights greater than those computed. Such unknown factors may include ice jams, debris accumulation, wave action, and obstructions of bridge openings.

Flood Stage

The elevation of the floodwater surface above the officially established datum plane, which is the National Geodetic Vertical Datum (NGVD) (Mean Sea Level, 1929 Adjustment), on the Supplementary Floodland Zoning Map.

Floodlands

For the purpose of this Code, the floodlands are all lands contained in the "regional flood" or 100-year recurrence interval flood. For the purpose of zoning regulation, the floodlands are divided into the Floodway District, the Floodplain Conservancy District, and the Floodplain Fringe Overlay District.

Floodplain Fringe

Those floodlands outside the floodway subject to inundation by the 100-year recurrence interval flood. For the purpose of this Code, the floodplain fringe includes the Floodplain Conservancy District and the Floodplain Fringe Overlay District.

Floodproofing

Measures designed to prevent and reduce flood damage for those uses which cannot be removed from, or which, of necessity, must be erected in the floodplain, ranging from structural modifications through installation of special equipment or materials to operation and management safeguards, such as the

following: reinforcing of basement walls; underpinning of floors; permanent sealing of all exterior openings; use of masonry construction; erection of permanent watertight bulkheads, shutters, and doors; treatment of exposed timbers; elevation of flood-vulnerable utilities; use of waterproof cement; adequate fuse protection; sealing of basement walls; installation of seal-tight windows and doors; installation of wire-reinforced glass; location and elevation of valuable items; waterproofing, disconnecting, elevation, or removal of all electric equipment; avoidance of the use of flood-vulnerable areas; temporary removal or waterproofing of merchandise; postponement of orders or rescheduling of freight shipments; operation of emergency pump equipment; closing of backwater sewer valve; placement of plugs and flood drain pipes; placement of movable watertight bulkheads; and the shoring of weak walls or structures. Floodproofing of structures shall be extended at least to a point two feet above the elevation of the regional flood. Any structure that is located entirely or partially below the flood protection elevation shall be anchored to protect it from larger floods.

Floodway

A designated portion of the 100-year flood that will safely convey the regulatory flood discharge with small, acceptable upstream and downstream stage increases, limited in Wisconsin to 0.1 foot unless special legal measures are provided. The floodway, which includes the channel, is that portion of the floodplain not suited for human habitation. All fill, structures, and other development that would impair floodwater conveyance by adversely increasing flood stages or velocities or would itself be subject to flood damage should be prohibited in the floodway.

Letter of Map Amendment (LOMA)

Official notification from the Federal Emergency Management Agency (FEMA) that a Flood Hazard Boundary Map or Flood Insurance Rate Map has been amended.

Planned Degree of Hydrologic Encroachment

Any floodplain development may have a significant effect on the storage capacity of the floodplain and may significantly increase flood discharges to downstream urban areas. Where comprehensive watershed plans have been prepared, the impact of floodplain development may be significantly reduced by designating areas in the watershed as floodplain conservancy areas. These areas may consist of large wetland areas, water retention and detention basins, lakes, or other areas not committed to urban development. The analysis of the capacity of floodplain conservancy areas to maintain and protect floodplain storage may be referred to as the "planned degree of hydrologic encroachment." In the alternative, floodplain storage may be maintained by providing an equal volume of floodplain storage in nonfloodplain areas adjacent to the floodplain area proposed to be removed as compensating storage.

Reach

A longitudinal segment of a stream generally including those floodlands wherein flood stages are primarily and commonly controlled by the same man-made or natural obstruction to flow.

Regional Flood

A flood determined to be representative of large floods known to have generally occurred in Wisconsin and which may be expected to occur on a particular stream because of like physical characteristics. The flood frequency

of the regional flood is once in every 100 years; this means that in any given year, there is a 1 percent chance that the regional flood may occur or be exceeded. During a typical 30-year mortgage period, the regional flood has a 26 percent chance of occurrence.

Substantial Improvement

Any repair, reconstruction, or improvement of a structure, the cost of which equals or exceeds 50 percent of the present equalized assessed value of the structure either before the improvement or repair is started or, if the structure has been damaged and is being restored, before the damage occurred. The term does not, however, include either (a) any project for improvement of a structure to comply with existing state or local health, sanitary, or safety code specifications which are solely necessary to assure safe living conditions, or (b) any alteration of a structure or site documented as deserving preservation by the Wisconsin State Historical Society or listed on the National Register of Historic Places. Ordinary maintenance repairs are not considered structural repairs, modifications, or additions; such ordinary maintenance repairs include internal and external painting, decorating, and paneling, and the replacement of doors, windows, and other nonstructural components.

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# Appendix C

## SUGGESTED LAND DIVISION REGULATION AMENDMENTS TO CHAPTER 18 OF THE VILLAGE OF PEWAUKEE SUBDIVISION AND PLATTING CODE

Repeal and re-create Section 18.12 to read as follows:

18.12 LAND SUITABILITY.

(1) No land shall be subdivided for residential use which is held unsuitable for such use by the Village Plan Commission for reason of flooding, inadequate drainage, adverse soil or rock formation, unfavorable topography, or any other feature likely to be harmful to the health, safety, or welfare of the future residents of the proposed subdivision or of the community. The Village Plan Commission, in applying the provisions of this Section, shall in writing recite the particular facts upon which it bases its conclusion that the land is not suitable for residential use and afford the subdivider an opportunity to present evidence regarding such unsuitability if he so desires. Thereafter, the Village Plan Commission may affirm, modify, or withdraw its determination of unsuitability. More specifically:

(2) No lot served by public sanitary sewer facilities shall have less than 50 percent of its required lot area below an elevation of at least two feet above the elevation of the 100-year recurrence interval flood. No lot one acre or less in area served by an onsite sanitary sewage disposal system (septic tank) shall contain floodlands. All lots more than one acre in area served by a septic tank system shall contain not less than 40,000 square feet of land which is at least two feet above the elevation of the 100-year recurrence interval flood, or, where such data are not available, five feet above the maximum flood of record.

Repeal and re-create Section 18.38 to read as follows:

18.38 ADDITIONAL INFORMATION. The map shall show correctly on its face, in addition to the information required by Section 236.34, Wisconsin Statutes, the following:

(1) All existing buildings, watercourses, drainage ditches, and other features pertinent to proper division.

(2) Setbacks or building lines required by the Village Plan Commission.

(3) All lands reserved for future acquisition.

(4) Date of map.

(5) Graphic scale.

(6) Name and address of the owner, subdivision, and surveyor.

(7) If the land to be divided contains floodlands, the subdivider shall show the floodplain limits and the contour line lying a vertical distance of two feet above the elevation of the 100-year recurrence interval flood, or, where such data are not available, five feet above the elevation of the maximum flood of record.

(8) Where the Plan Commission finds that it requires additional information relative to a particular problem presented by a proposed development to review the certified survey map, it shall have the authority to request in writing such information from the subdivider.

PEWAUKEE LAKE 100-YEAR RECURRENCE INTERVAL FLOOD ELEVATION 854.7 NGVD.

LEGEND

- FLOODWAY DISTRICT
- FLOODPLAIN FRINGE OVERLAY DISTRICT
- 100-YEAR RECURRENCE INTERVAL FLOOD HAZARD LINE
- (34,016) DISTANCE IN FEET FROM CONFLUENCE WITH FOX RIVER
- [402,516] DISTANCE IN FEET FROM WILMOT DAM ON FOX RIVER IN KENOSHA CO.
- 850.2 100 YEAR RECURRENCE INTERVAL FLOOD ELEVATION IN FEET ABOVE NATIONAL GEODETIC VERTICAL DATUM UNDER FLOODWAY CONDITIONS

NOTE: THE INFORMATION SHOWN ON THIS MAP FOR THE CENTRAL AREA OF THE VILLAGE OF PEWAUKEE IS THE BASIS FOR THE FW FLOODWAY DISTRICT AND FPO FLOODPLAIN FRINGE OVERLAY DISTRICT BOUNDARIES WITHIN THE CENTRAL AREA, AS SHOWN ON THE ZONING MAP OF THE VILLAGE OF PEWAUKEE. THE SUPPLEMENTARY FLOODLAND ZONING MAP FOR THE CENTRAL AREA IS AN INFORMATIONAL RESOURCE AND IS INTENDED TO ASSIST IN THE DETERMINATION OF THE PRECISE LOCATION OF THE FW FLOODWAY DISTRICT AND FPO FLOODPLAIN FRINGE OVERLAY DISTRICT BOUNDARIES ON INDIVIDUAL PROPERTIES.

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

COMBINATION SCALE AND SEA LEVEL REDUCTION FACTOR: 0.99990728.

HORIZONTAL DATUM IS BASED ON THE WISCONSIN STATE PLANE COORDINATE SYSTEM, SOUTH ZONE

VERTICAL DATUM IS NATIONAL GEODETIC VERTICAL DATUM OF 1929.

BASE MAP COMPILED TO NATIONAL MAP ACCURACY STANDARDS UTILIZING STEREO-PHOTO-GRAMMETRIC METHODS. DATE OF PHOTOGRAPHY: DECEMBER 6, 1983

FLOOD HAZARD DATA USED IN THE PREPARATION OF THIS MAP WERE DEVELOPED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) AND SEWRPC. THE FEMA FINDINGS ARE SET FORTH IN THE FLOOD INSURANCE STUDY - VILLAGE OF PEWAUKEE, WAUKESHA COUNTY, WISCONSIN. THE SEWRPC FINDINGS ARE SET FORTH IN SEWRPC COMMUNITY ASSISTANCE PLANNING REPORT NO. 9, SECOND EDITION, FLOODLAND INFORMATION REPORTS FOR THE PEWAUKEE RIVER, VILLAGE OF PEWAUKEE, WAUKESHA COUTY, WISCONSIN

# SUPPLEMENTARY FLOODLAND ZONING MAP OF THE CENTRAL AREA OF THE VILLAGE OF PEWAUKEE

BEING A PART OF U.S. PUBLIC LAND SURVEY TOWNSHIP 7 NORTH, RANGE 19 EAST
WAUKESHA COUNTY, WISCONSIN

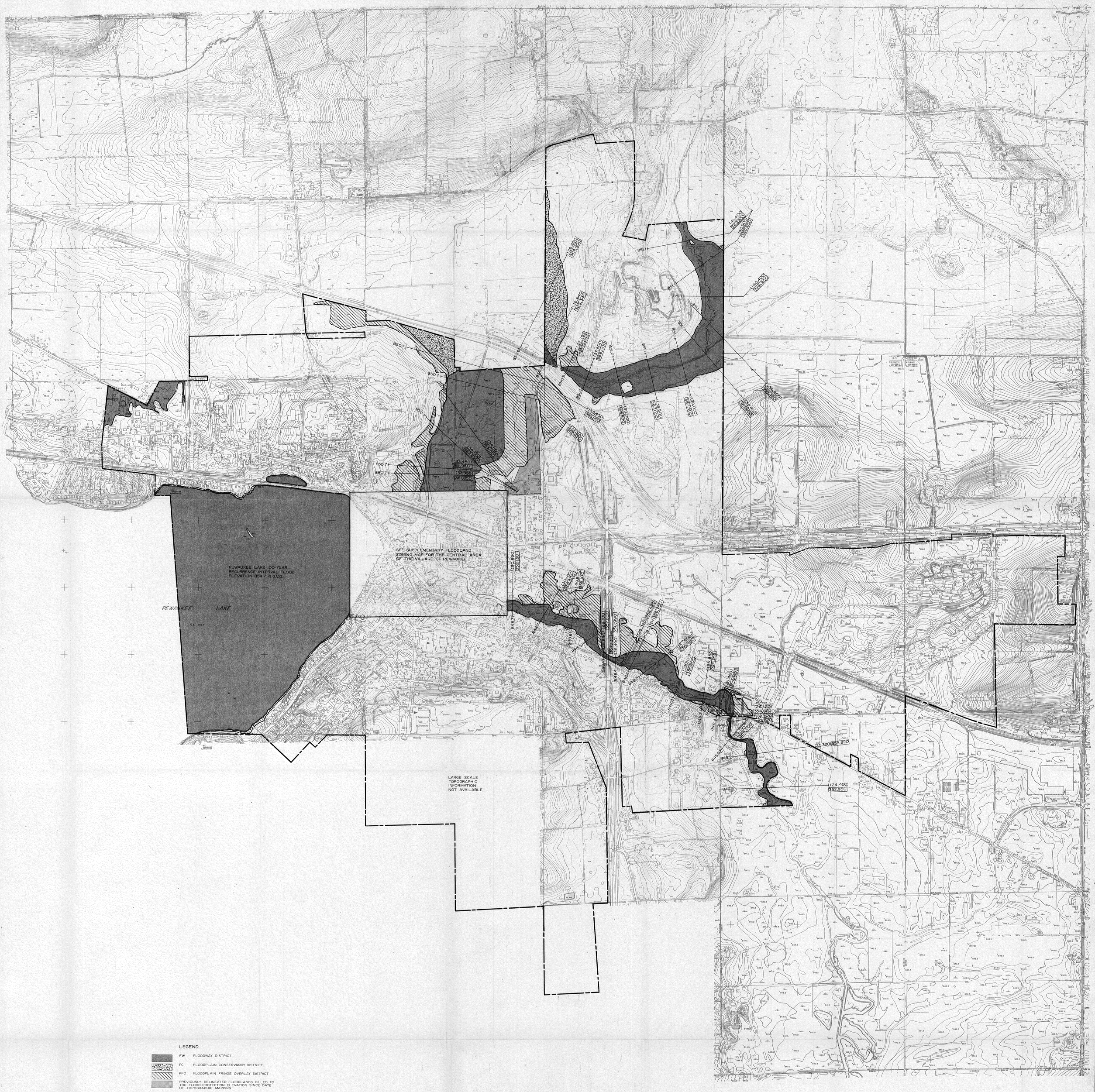
GRID NORTH / TRUE NORTH +0°19' 11" 40"

SCALE: 1" = 50'
CONTOUR INTERVAL 1'

50 0 50 100 150
SCALE IN FEET

THIS IS MAP NO. 1 IN A SERIES OF THREE MAPS,
MAP NO.1 - ZONING MAP OF THE VILLAGE OF PEWAUKEE.
MAP NO.2 - SUPPLEMENTARY FLOODLAND ZONING MAP OF THE VILLAGE OF PEWAUKEE.
MAP NO.3 - SUPPLEMENTARY FLOODLAND ZONING MAP OF THE CENTRAL AREA OF THE VILLAGE OF PEWAUKEE.

BASE MAP DESIGN: K. W. BAUER
DRAWN BY: J.C.JOHNSON, R.H.HEINEN DATE: FEB. 14, 1984
CHECKED BY: L. H. KREBLIN & R.B.UNTCH DATE: FEB. 15, 1984
APPROVED BY: [signature] DATE: FEB. 20, 1984




LEGEND

- FW — FLOODWAY DISTRICT
- FC — FLOODPLAIN CONSERVANCY DISTRICT
- FFO — FLOODPLAIN FRINGE OVERLAY DISTRICT
- PREVIOUSLY DELINEATED FLOODLANDS FILLED TO THE FLOOD PROTECTION ELEVATION SINCE DATE OF TOPOGRAPHIC MAPPING
- 100-YEAR RECURRENCE INTERVAL FLOOD HAZARD LINE
- (30,100) — DISTANCE IN FEET FROM CONFLUENCE WITH FOX RIVER
- 358,600 — DISTANCE IN FEET FROM WILMOT DAM ON FOX RIVER IN KENOSHA COUNTY
- 845.2 — 100-YEAR RECURRENCE INTERVAL FLOOD ELEVATION IN FEET ABOVE NATIONAL GEODETIC VERTICAL DATUM UNDER FLOOD CONDITIONS
- VILLAGE OF PEWAUKEE CORPORATE LIMITS

NOTE: THE INFORMATION SHOWN ON THIS MAP IS THE BASIS FOR THE FW FLOODWAY DISTRICT, FC FLOODPLAIN CONSERVANCY DISTRICT AND FFO FLOODPLAIN FRINGE OVERLAY DISTRICT BOUNDARIES WITHIN THE VILLAGE, EXCLUDING THE CENTRAL AREA, AS SHOWN ON THE ZONING MAP OF THE VILLAGE OF PEWAUKEE. THE SUPPLEMENTARY FLOODLAND ZONING MAP IS AN INFORMATIONAL RESOURCE AND IS INTENDED TO ASSIST IN THE DETERMINATION OF THE PRECISE LOCATION OF FW FLOODWAY, FC FLOODPLAIN CONSERVANCY AND FFO FLOODPLAIN FRINGE OVERLAY DISTRICT BOUNDARIES ON INDIVIDUAL PROPERTIES.

**SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION**

COMBINATION SCALE AND SEA LEVEL REDUCTION FACTOR: 0.99990667.

HORIZONTAL DATUM IS BASED ON THE WISCONSIN STATE PLANE COORDINATE SYSTEM, SOUTH ZONE

VERTICAL DATUM IS NATIONAL GEODETIC VERTICAL DATUM OF 1929.

BASE MAP PREPARED BY PHOTOGRAPHIC REDUCTION OF 1"=100' AND 1"=200' SCALE, 2' CONTOUR INTERVAL, TOPOGRAPHIC MAPS WHICH WERE COMPILED TO NATIONAL MAP ACCURACY STANDARDS BY STEREOPHOTOGRAMMETRIC METHODS.

SECS. 3,4,5, NE1/4 SEC 9, NW 1/4 SEC 10, NE 1/4 SEC 16 -- 1"= 100' SCALE, SOURCE: SEWRPC, DATE OF PHOTOGRAPHY: SPRING OF 1967.

NW, SW, SE 1/4'S SEC 9; SW 1/4 SEC 10, NW 1/4 SEC 15 -- 1"=200' SCALE, SOURCE: VILLAGE OF PEWAUKEE, DATE OF PHOTOGRAPHY SPRING OF 1975.

NE, NW, SE 1/4'S SEC. 8; NE, SW, SE 1/4'S SEC. 15 -- 1"=200' SCALE, SOURCE: SEWRPC, DATE OF PHOTOGRAPHY: SPRING OF 1975.

FLOOD HAZARD DATA USED IN THE PREPARATION OF THIS MAP WERE DEVELOPED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) AND SEWRPC. THE FEMA FINDINGS ARE SET FORTH IN THE FLOOD INSURANCE STUDY: VILLAGE OF PEWAUKEE, WAUKESHA COUNTY, WISCONSIN. THE SEWRPC FINDINGS ARE SET FORTH IN COMMUNITY ASSISTANCE PLANNING REPORT NO 9, SECOND EDITION, FLOODLAND INFORMATION REPORT FOR THE PEWAUKEE AREA, VILLAGE OF PEWAUKEE, WAUKESHA COUNTY, WISCONSIN.

# SUPPLEMENTARY FLOODLAND ZONING MAP OF THE VILLAGE OF PEWAUKEE

BEING A PART OF U.S. PUBLIC LAND SURVEY TOWNSHIP 7 NORTH, RANGE 19 EAST
WAUKESHA COUNTY, WISCONSIN

GEOD NORTH / GRID NORTH +0° 11' 32"

SCALE: 1" = 400' CONTOUR INTERVAL 2'

400 0 400 800 1200
SCALE IN FEET

THIS IS MAP NO.2 IN A SERIES OF THREE MAPS,
MAP NO.1 - ZONING MAP OF THE VILLAGE OF PEWAUKEE.
MAP NO.2 - SUPPLEMENTARY FLOODLAND ZONING MAP OF THE VILLAGE OF PEWAUKEE.
MAP NO.3 - SUPPLEMENTARY FLOODLAND ZONING MAP OF THE CENTRAL AREA OF THE VILLAGE OF PEWAUKEE.

| | |
|---|---|
| BASE MAP DESIGN: K. W. BAUER | |
| DRAWN BY: K. P. TOMSYCK | DATE: FEB. 14, 1984 |
| CHECKED BY: L. H. KREBLIN & R.B. UNTCH | DATE: FEB. 15, 1984 |
| APPROVED BY: Kurt W. Bauer | DATE: FEB. 20, 1984 |