FLOODPLAIN MANAGEMENT STUDY
WILLOW CREEK
WAUSHARA COUNTY, WISCONSIN

Prepared by:
United States Department of Agriculture
Soil Conservation Service
Madison, Wisconsin

In cooperation with:
Waushara County, Wisconsin
and the
Wisconsin Department of Natural Resources

April 1989

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Appendices

Waushara County Floodplain Management Study
Willow Creek

Introduction

The purpose of this study is to define the flood characteristics of Willow Creek from the Village of Auroraville to above the junction with the outlet of Bruce Creek. Waushara County requested the study through the Wisconsin Department of Natural Resources (DNR).

This report is prepared for use by the county in planning the use and regulation of the floodplain of Willow Creek.

The 100-year floodplain and the dam breach flood area have been delineated on the photomaps of Appendix A. The high water elevations and floodplain delineations are based on 5-year projected land use of the watershed, stream, floodplain, existing road crossings and a dam failure (breach) analysis.

The Soil Conservation Service carries out floodplain management studies in accordance with Federal Level Recommendation 3 of "A Unified National Program for Floodplain Management," and Section 6 of Public Law 83-566. The principles contained in Executive Order 11988, Floodplain Management, are addressed in this part.

In Wisconsin, the Soil Conservation Service coordinates floodplain management studies with the Wisconsin DNR, through a joint coordination agreement entered into in October 1978. The Wisconsin Water Resources Act (Chapter 614, Laws of Wisconsin, 1965) authorizes the DNR, Division of Enforcement, to establish and upgrade minimum standards for floodplain regulations.

Study Area Description

Willow Creek is located in east central Waushara County. Waushara County is located in central Wisconsin. The study area consists of the floodplain adjacent to 13.5 miles of Willow Creek.

The downstream study limit is the east section line of Sec. 7, T. 18 N., R. 13 E. The upstream study limit is approximately 1200 feet north and west of County Highway S bridge located on the section line between sections 1 and 12, T. 18 N., R. 11 E.

The drainage area is as follows:

Upstream Study Limit	46.15 square miles
Above Cedar Springs Creek	52.60 square miles
Above Warren Ditch	65.60 square miles
Downstream Study Limit (Auroraville)	73.50 square miles

Willow Creek is in Hydrologic Unit 04030202-180.

The climate is typically continental. January temperatures average 19 degrees F. July, the warmest month, has an average temperature of 73 degrees F. The average maximum for July is 85 degrees F with the average minimum at 61 degrees F. Precipitation averages 29 inches per year (7).

The soils of the watershed consist mostly of Plainfield-Okee-Richford association, described in the General Soil Map section of the Waushara County Soil Survey, which are strongly sloping to steep, somewhat excessively drained and excessively drained sandy soils on moraines. The lowlands are of the Kingsville-Mechan association, whose soils are nearly level and gently sloping, poorly drained and somewhat poorly drained, sandy, soils on outwash plains.

Natural and Beneficial Floodplain Values

The portion of Willow Creek in the study area is a class II brown trout stream up to the bridge in Section II in Warren Township. The Auroraville millpond has a surface area of 208.6 acres, an average depth of 3.5 feet, and is the third largest body of water in the county. Major fish species include northern pike, largemouth bass, bluegills, perch, sunfish and bullheads. Several waterfowl species and shorebirds use the millpond and surrounding wetlands.

Willow Creek flows through wooded corridors of willow, ash, boxalder and aspen with many adjacent wetlands of alder, cattails, and sedges with scattered open water areas. These wetlands provide important habitat for woodducks, sandhill cranes; mallards, bluewinged teal and other waterfowl, woodcock, muskrats, beaver, racoon, and mink. White-tailed deer, ruffed grouse, cottontail rabbits, fox, otter and numerous songbirds and raptors are also found in the area.

Along with providing wildlife habitat, the undeveloped floodplain and wetlands provides a buffer to help filter runoff from adjacent fields and provides a natural storage area for large amounts of flood water during peak flows.

There are two species in the study area that are listed on the state watch list; the pugnose shiner and the lake chubsucker. Both of these fish species have been found in the Auroraville millpond. They are in jeopardy statewide because of excessive siltation and turbidity. Floodplain management will help ensure the survival of these species. There is no prime farmland in the study area. There are no sites on the National Register of Historic places. Willow Creek is not listed as being eligible for the National Wild and Scenic Rivers Program.

Flooding Problems

No significant flash flooding occurs on the Willow Creek system. The numerous flowages, swamps, depressions, lakes and sandy soils store and release the water over a prolonged period. The increase in flow is handled by removing stoplogs or panels from the dam. Farmland along the Warren Ditch will flood if the dam at Auroraville is not operated properly or the flow exceeds the spillway capacity. A new structure is being built, which should make the operation more efficient.

Existing Floodplain Management

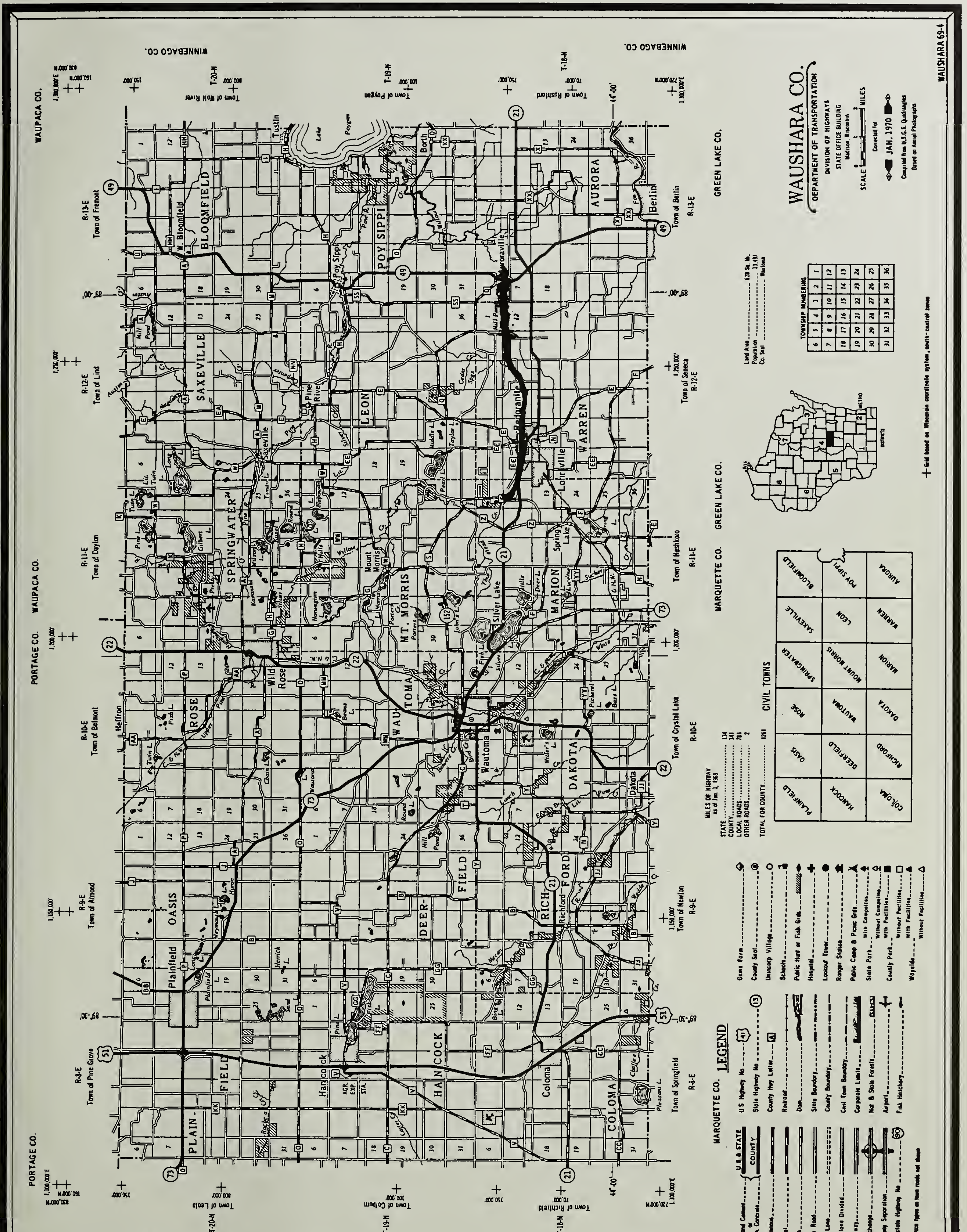
Waushara County adapted a floodplain ordinance in 1967. The ordinance was approved by state and federal agencies in May 1986. The county is ineligible for the National Flood Insurance Program and cannot receive disaster assistance or make federally insured loans in flood hazard areas.

Alternatives for Mitigating Flood Damages to Existing and Future Development

A. The county will incorporate the floodplain maps from this study into a floodplain ordinance and provide enforcement.

B. The county can apply existing standards set forth in the county's subdivision control ordinance to regulate development in nonsuitable areas and minimize erosion and diffused surface water runoff within the watershed.

C. The county can establish conservancy districts for those areas highly susceptible to erosion and unsuitable for development.


WAUSHARA CO.
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STATE OFFICE BUILDING
Madison, Wisconsin
SCALE
MILES
Corrected to JAN. 1970
Compiled from U.S.G.S. Quadrangles
Based on Aerial Photographs
WAUSHARA 69-4
WINNEBAGO CO.
GREEN LAKE CO.
MARQUETTE CO.
ADAMS CO.
PORTAGE CO.
WAUPACA CO.
CIVIL TOWNS
PLAINFIELD
OASIS
ROSE
SPRINGWATER
SAXEVILLE
BLOOMFIELD
HANCOCK
DEERFIELD
WAUTOMA
MOUNT MORRIS
LEON
POY SIPPI
COLOMA
RICHFORD
DAKOTA
MARION
WARREN
AURORA
TOWNSHIP NUMBERING
LEGEND
MILES OF HIGHWAY as of Jan. 1, 1969
STATE
COUNTY
LOCAL ROADS
OTHER ROADS
TOTAL FOR COUNTY
Land Area
Population
Co. Seat
Wautoma
Plainfield
Hancock
Coloma
Wild Rose
Redgranite
Lohrville
Berlin
Poy Sippi
Saxeville
Auroraville
Silver Lake
Richford
Dakota
Heffron
Pine River
Mount Morris
Tustin
Borth
W. Bloomfield
Lake Poygan
DISTRICTS
METRO
+ Grid based on Wisconsin coordinate system, south-central zone

Appendix A

FLOOD BOUNDARY MAPS

U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

LEGEND

1	SHEET COVERAGE
—	STREAM REACH STUDIED

VICINITY MAP

INDEX TO MAP SHEETS
WAUSHARA COUNTY
FLOOD PLAIN MANAGEMENT STUDY
WAUSHARA COUNTY, WISCONSIN

0 ½ 1
APPROX. SCALE-MILES

0 ½ 1
APPROX. SCALE-KILOMETERS

SOURCE:
1982 NHAP PHOTOGRAPHY AND
INFORMATION FROM SCS FIELD PERSONNEL.

FEBRUARY 1989 4-R-39583-1

USDA SCS NATIONAL CARTOGRAPHIC CENTER FT. WORTH, TX 1989

LEGEND

▨	100 Year Flood Hazard Area	⟶	Stream Channel
∼	Floodway	⬡ N	Valley Section
▨	Dam Breach Flood Plain Area	×	Reference Mark

NOTE:
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION

SCALE 0 400 800 FEET
0 100 200 METERS
APPROXIMATE

1982 NHAP Photography

SHEET 1 OF 10

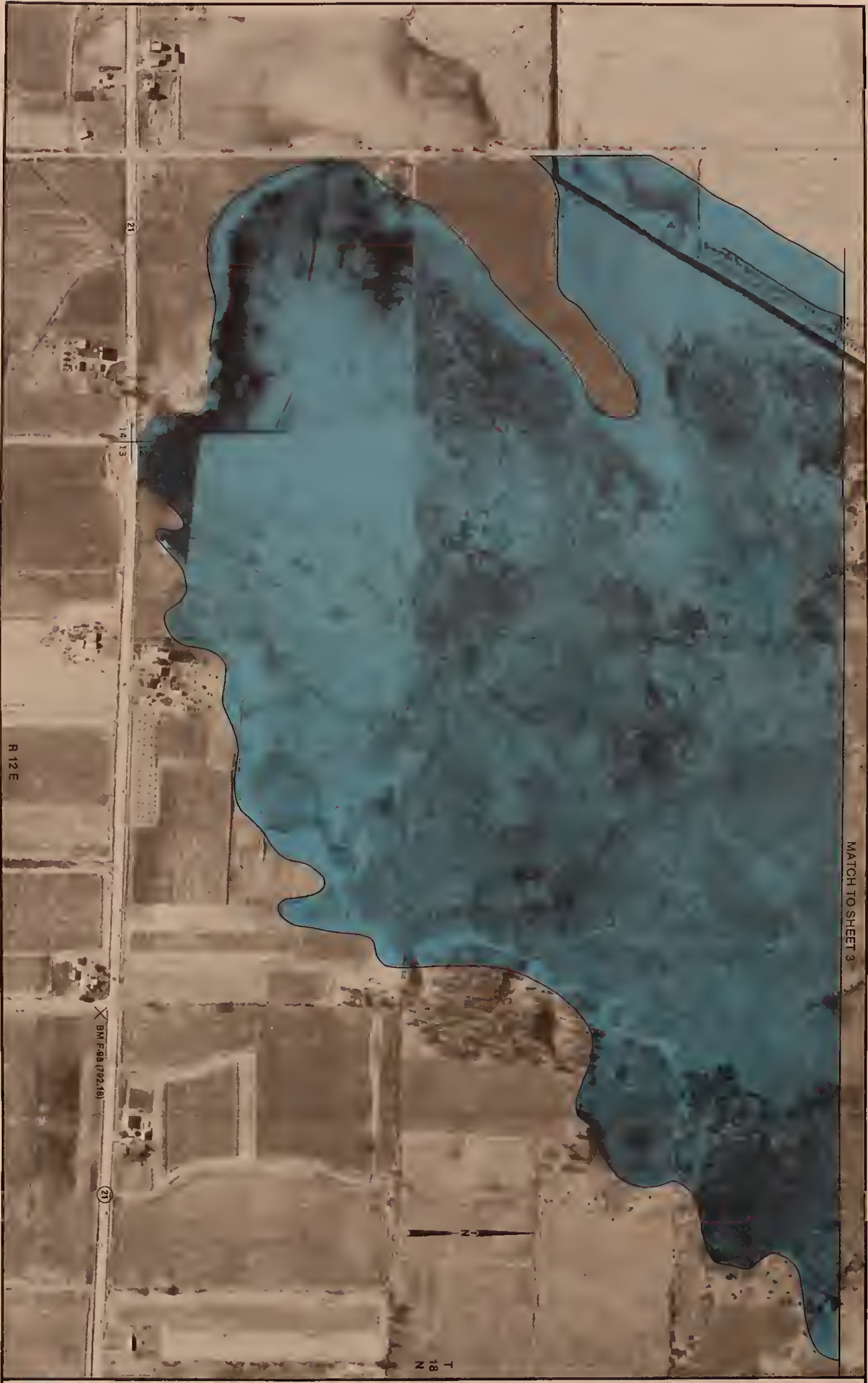
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
WAUSHARA COUNTY
FLOOD PLAIN MANAGEMENT STUDY AREA
WAUSHARA COUNTY, WISCONSIN

FLOOD HAZARD AREA

WILLOW CREEK

FEBRUARY 1989 4-R-39343

USDA SCS NATIONAL CARTOGRAPHIC CENTER, FT WORTH, Tx 1989



LEGEND

- 100 Year Flood Hazard Area
- Floodway
- Stream Channel
- Valley Section
- Reference Mark

NOTE
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION.

SCALE 0 400 800 FEET
0 100 200 METERS
APPROXIMATE

1982 NHAP Photography

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WAUSHARA COUNTY, WISCONSIN

FLOOD HAZARD AREA

WILLOW CREEK

FEBRUARY 1989 4-R-39583

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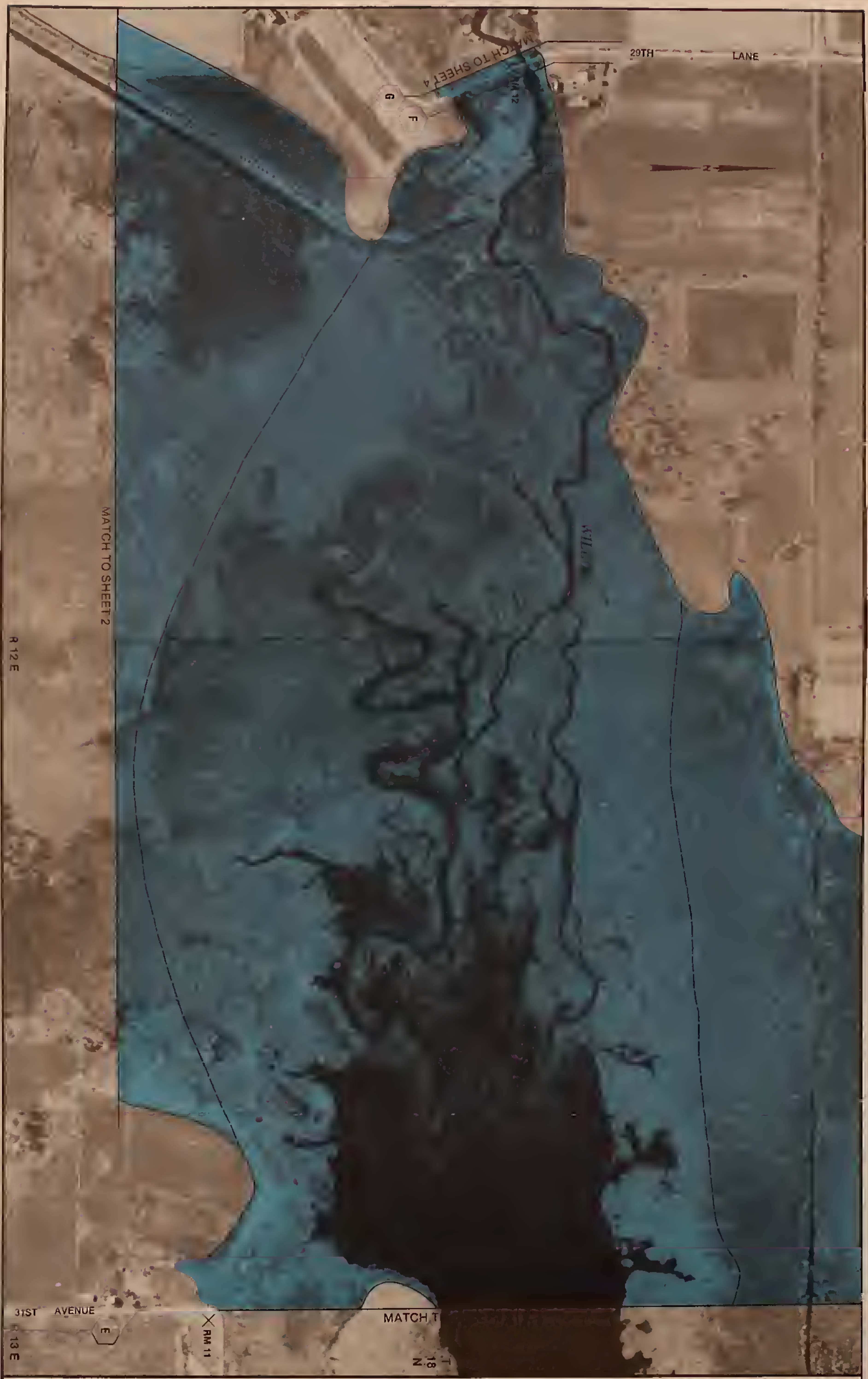

LEGEND

🟦	100 Year Flood Hazard Area
∼	Floodway
→	Stream Channel
⬡ N	Valley Section
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1982 NHAP Photography

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FEBRUARY 1989 4R-39583

LEGEND

🟦 100 Year Flood Hazard Area	Stream Channel
Floodway	Ⓝ Valley Section
	× Reference Mark

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SHEET 4 OF 10

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∿	Floodway
→	Stream Channel
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×	Reference Mark

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		×	Reference Mark

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LEGEND

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⁓	Floodway
⁓→	Stream Channel
⬡ N	Valley Section
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WILLOW CREEK

SHEET 7 OF 10

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LEGEND

▨	100 Year Flood Hazard Area
⁓	Floodway
→	Stream Channel
(N)	Valley Section
×	Reference Mark

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APPROXIMATE

1982 NHAP Photography

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WILLOW CREEK

USDA SCS NATIONAL CARTOGRAPHIC CENTER FT WORTH TX 1989

LEGEND

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⁓	Floodway
⁓→	Stream Channel
Ⓝ	Valley Section
✕	Reference Mark

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APPROXIMATE

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USDA-SCS NATIONAL CARTOGRAPHIC CENTER, FT. WORTH, TX 1987

USDA SCS NATIONAL CARTOGRAPHIC CENTER FT WORTH TX 1989

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- Floodway
- Stream Channel
- Ⓝ Valley Section
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WILLOW CREEK

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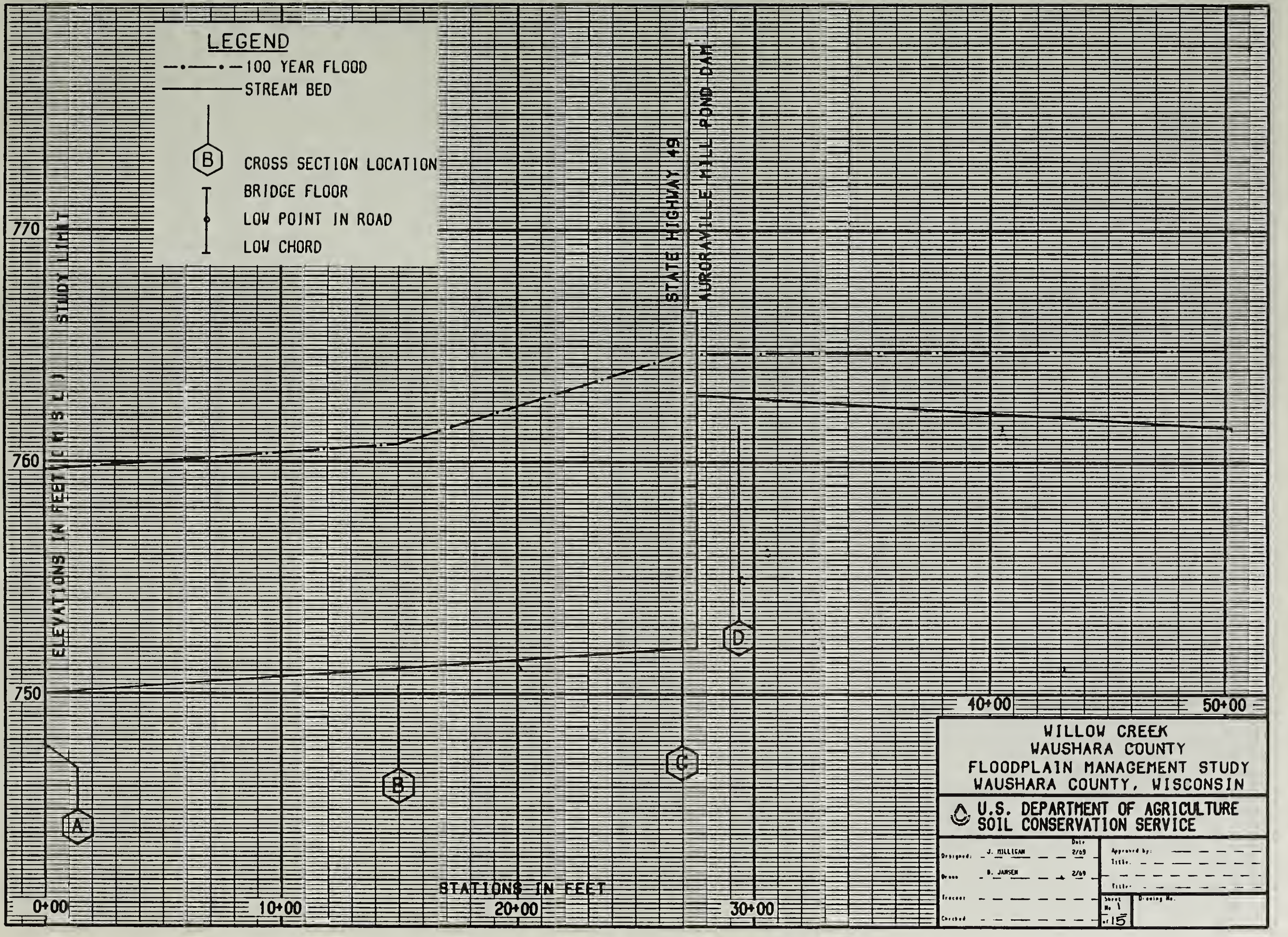
Appendix B

FLOOD PROFILES


LEGEND
—·—·—100 YEAR FLOOD
———STREAM BED
CROSS SECTION LOCATION
BRIDGE FLOOR
LOW POINT IN ROAD
LOW CHORD
B
A
B
C
D
STUDY LIMIT
STATE HIGHWAY 49
AURORAVILLE MILL POND DAM
ELEVATIONS IN FEET (M S L)
770
760
750
STATIONS IN FEET
0+00
10+00
20+00
30+00
40+00
50+00
WILLOW CREEK
WAUSHARA COUNTY
FLOODPLAIN MANAGEMENT STUDY
WAUSHARA COUNTY, WISCONSIN
U.S. DEPARTMENT OF AGRICULTURE
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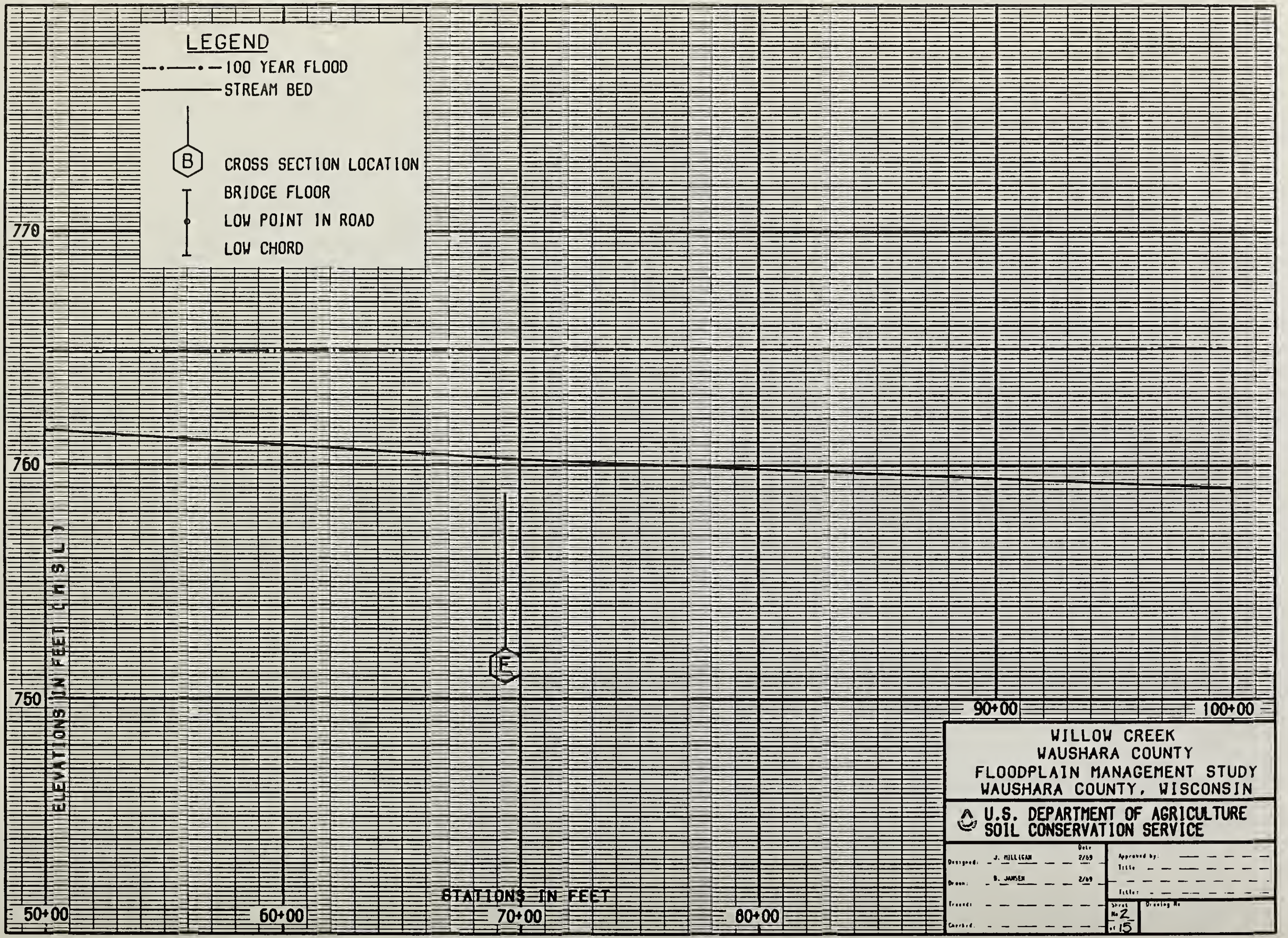

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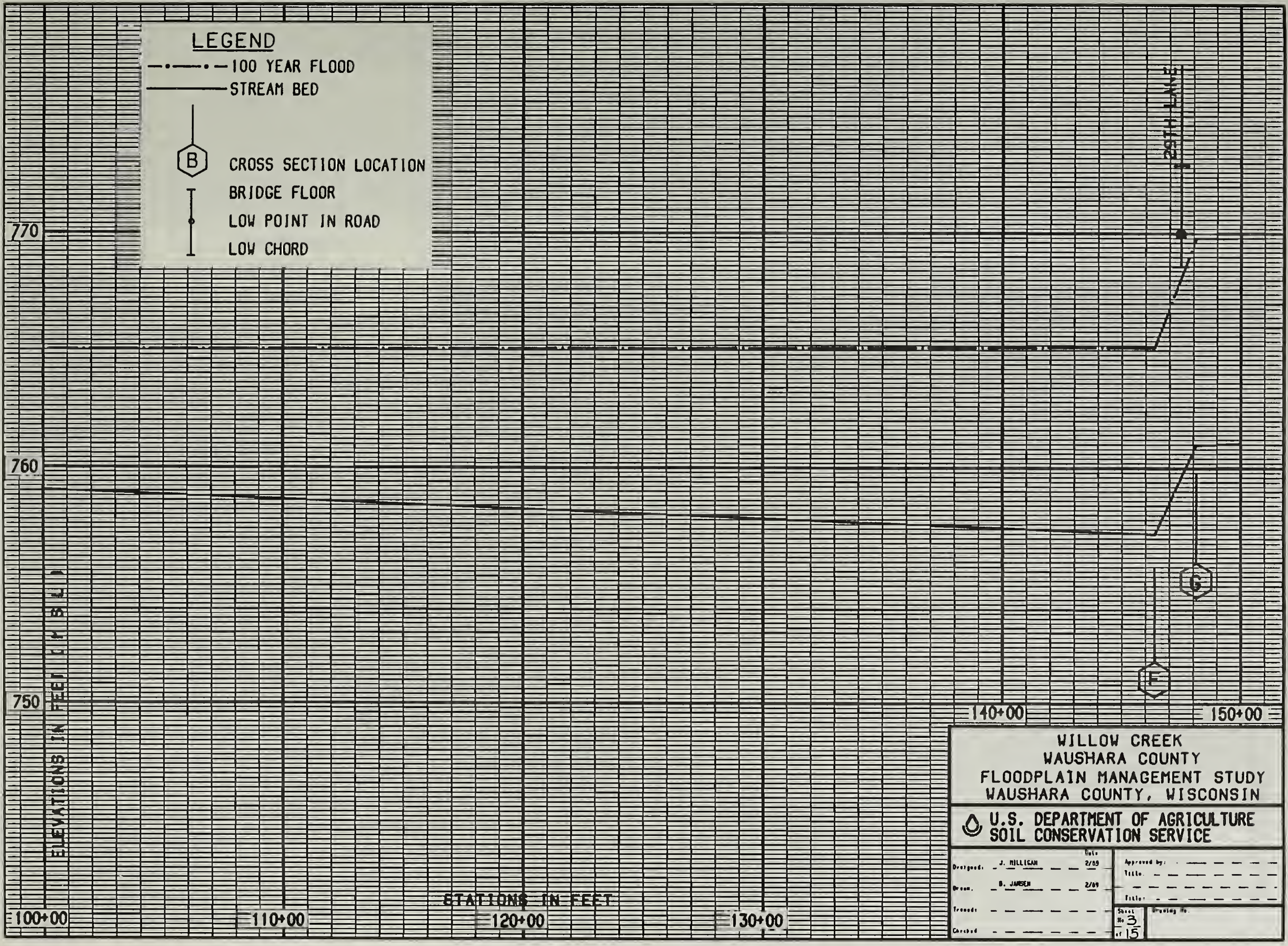

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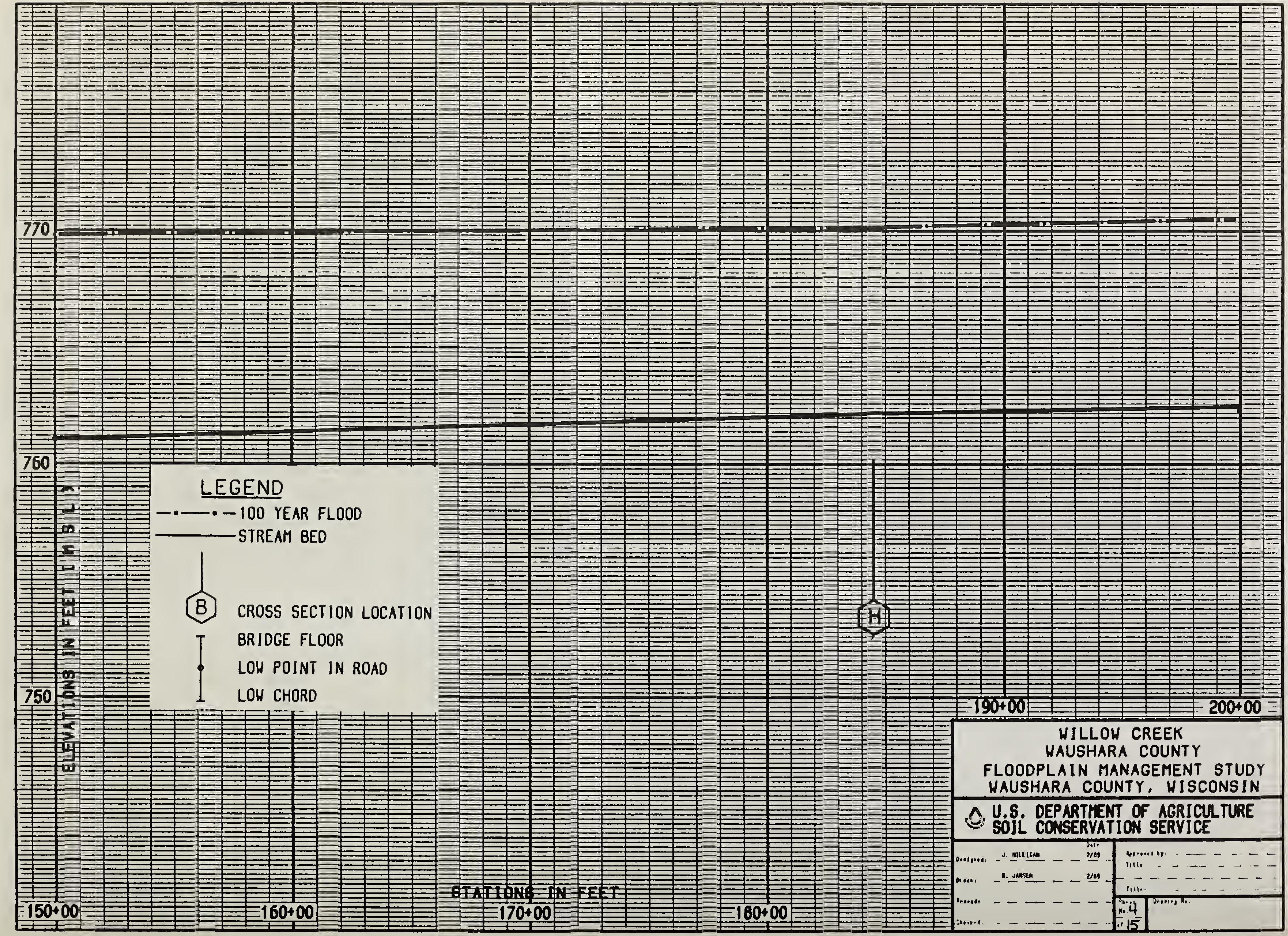

770
760
750
ELEVATIONS IN FEET (M S L)
150+00
160+00
170+00
180+00
190+00
200+00
STATIONS IN FEET
LEGEND
100 YEAR FLOOD
STREAM BED
B
CROSS SECTION LOCATION
BRIDGE FLOOR
LOW POINT IN ROAD
LOW CHORD
H
WILLOW CREEK
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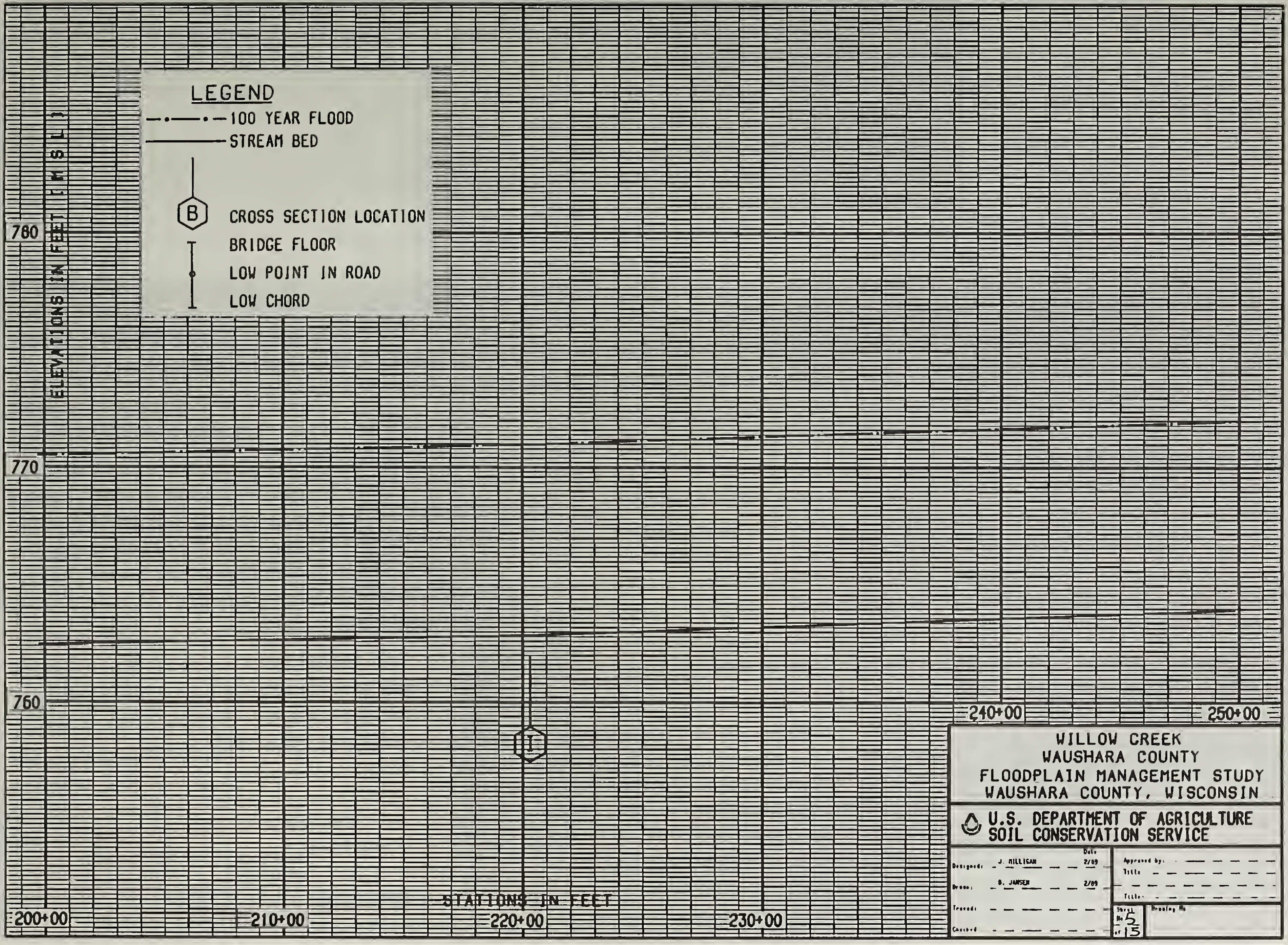
LEGEND
100 YEAR FLOOD
STREAM BED
B
CROSS SECTION LOCATION
BRIDGE FLOOR
LOW POINT IN ROAD
LOW CHORD
ELEVATIONS IN FEET (M S L)
780
770
760
I
STATIONS IN FEET
200+00
210+00
220+00
230+00
240+00
250+00
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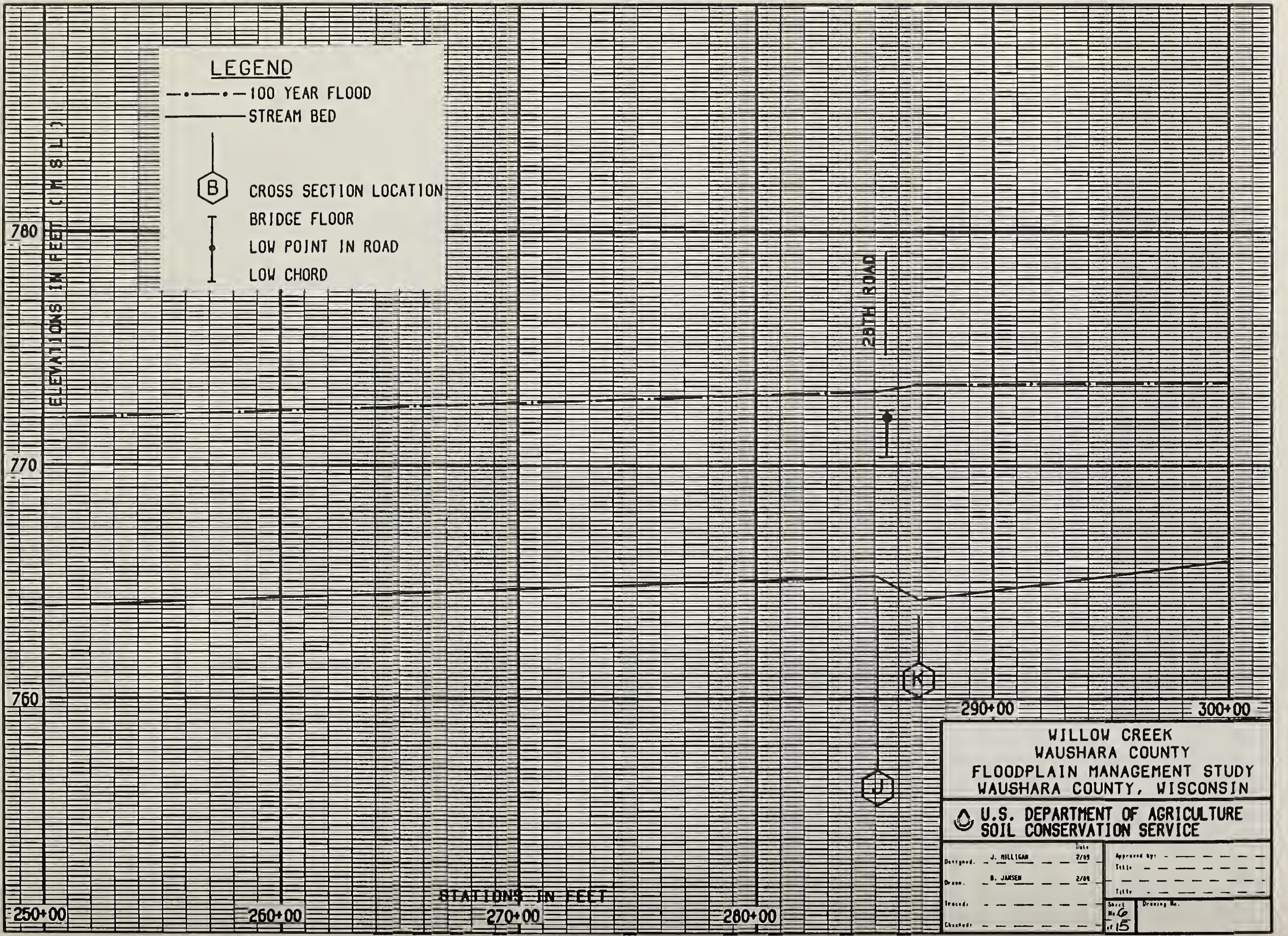
LEGEND
100 YEAR FLOOD
STREAM BED
CROSS SECTION LOCATION
BRIDGE FLOOR
LOW POINT IN ROAD
LOW CHORD
B
ELEVATIONS IN FEET (M S L)
780
770
760
28TH ROAD
K
J
STATIONS IN FEET
250+00
260+00
270+00
280+00
290+00
300+00
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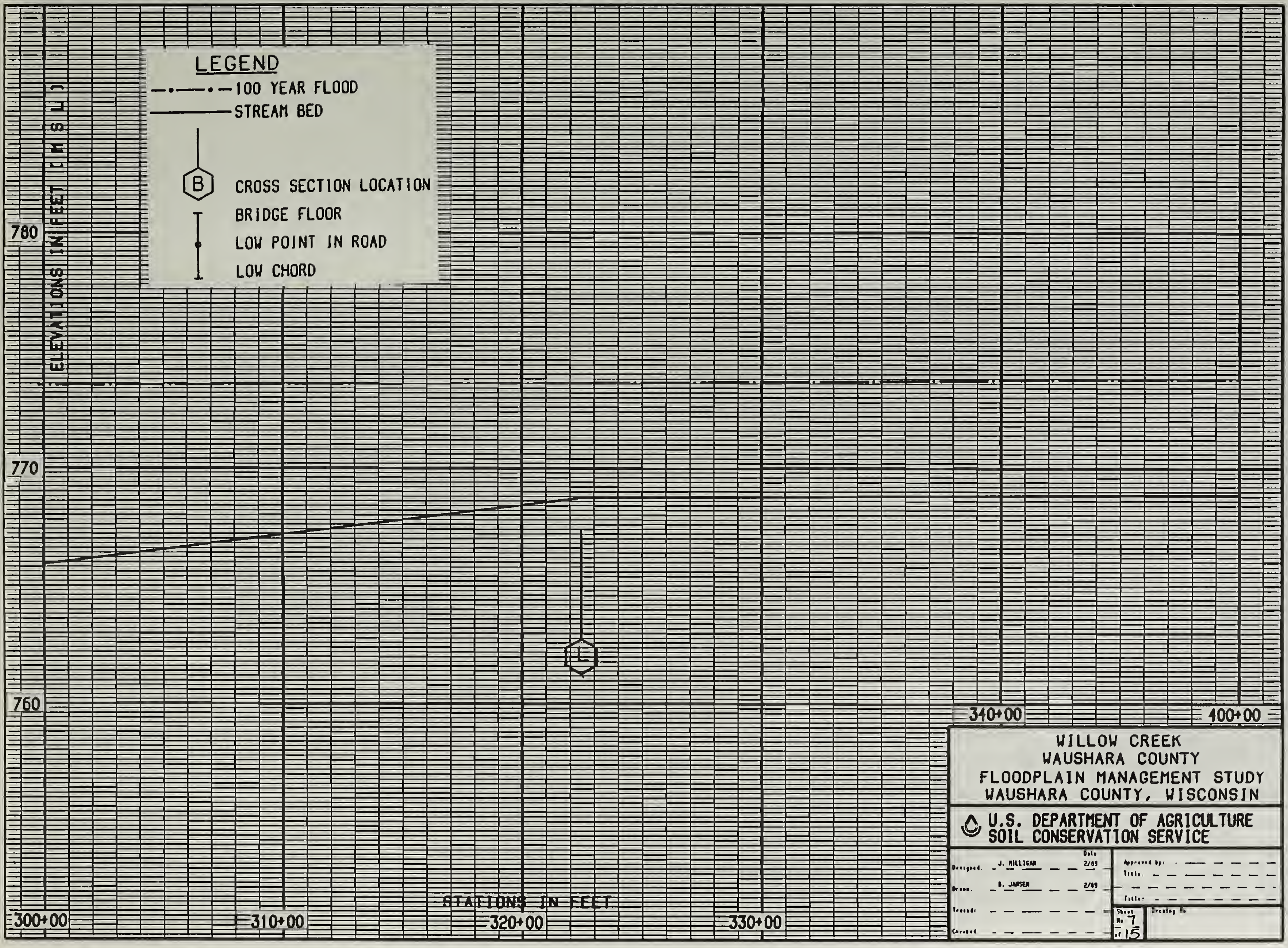

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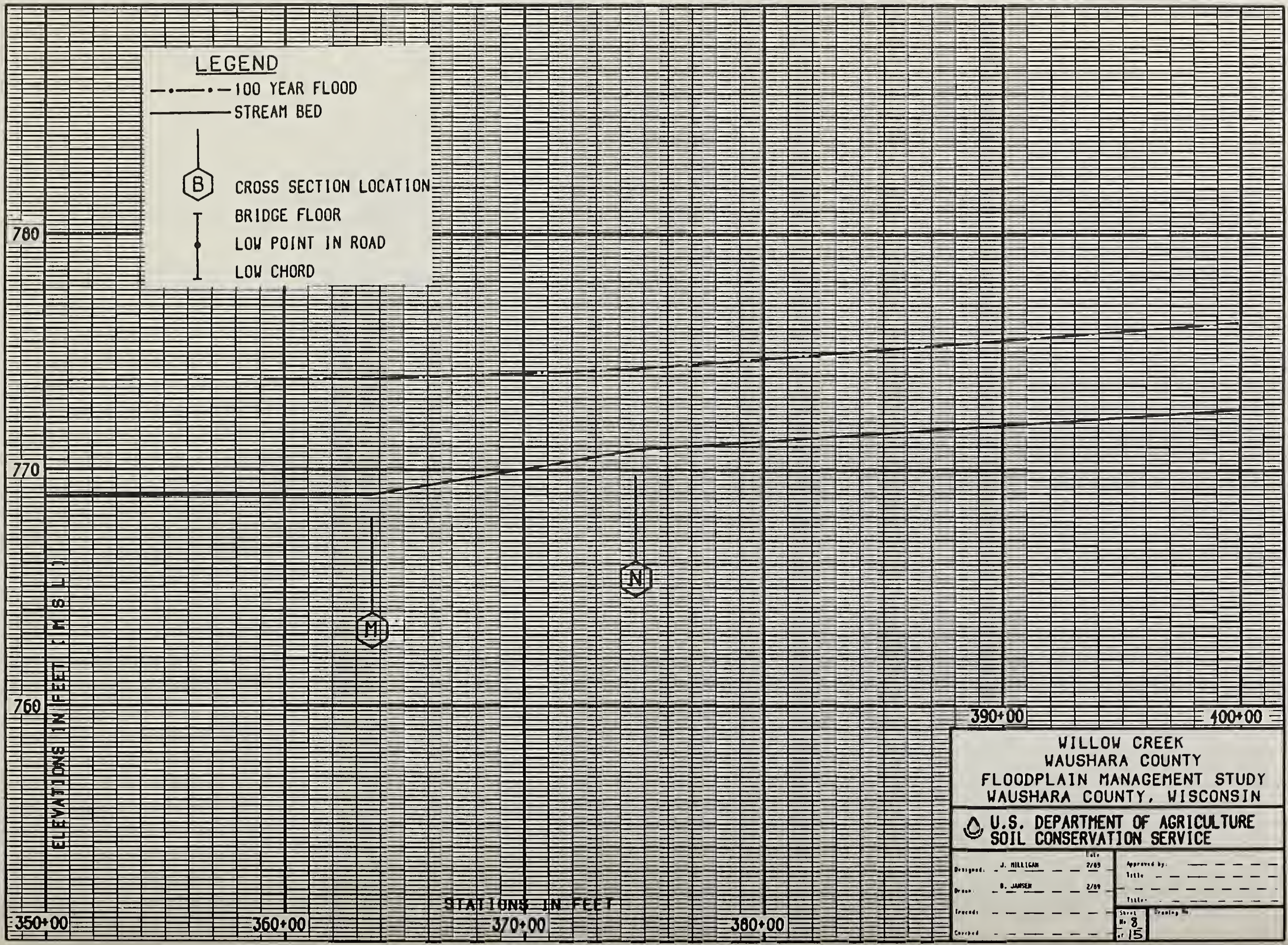

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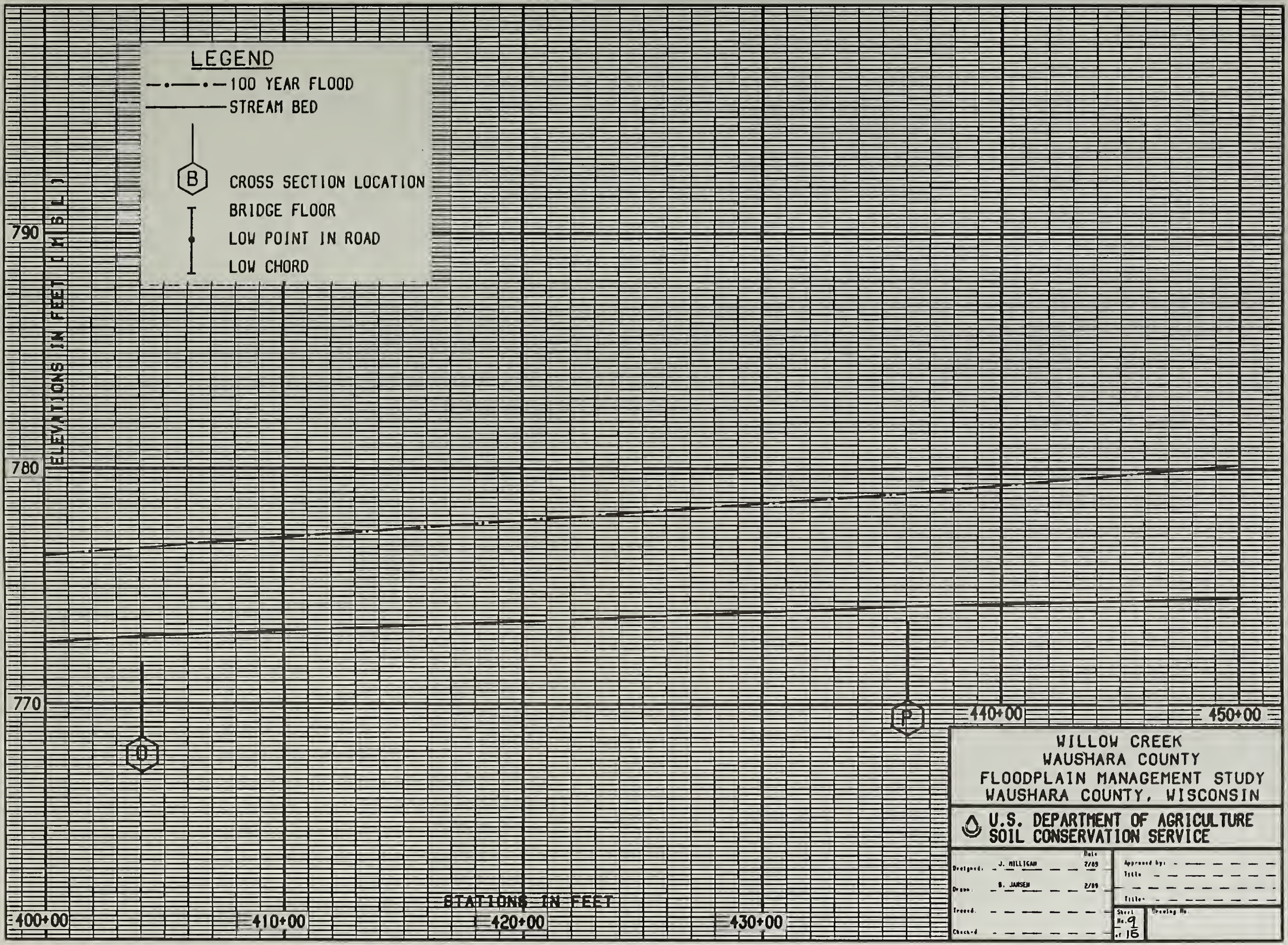

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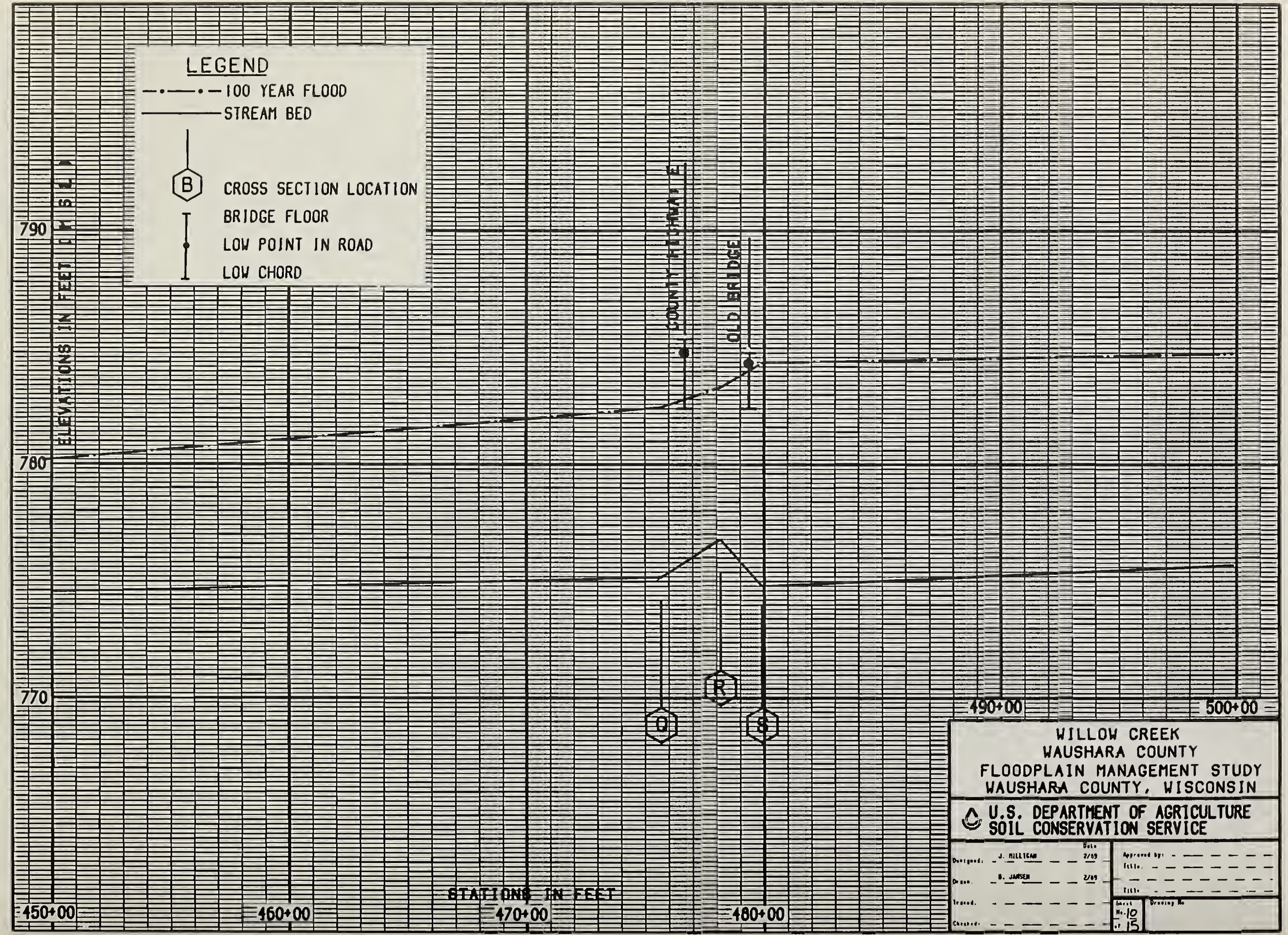

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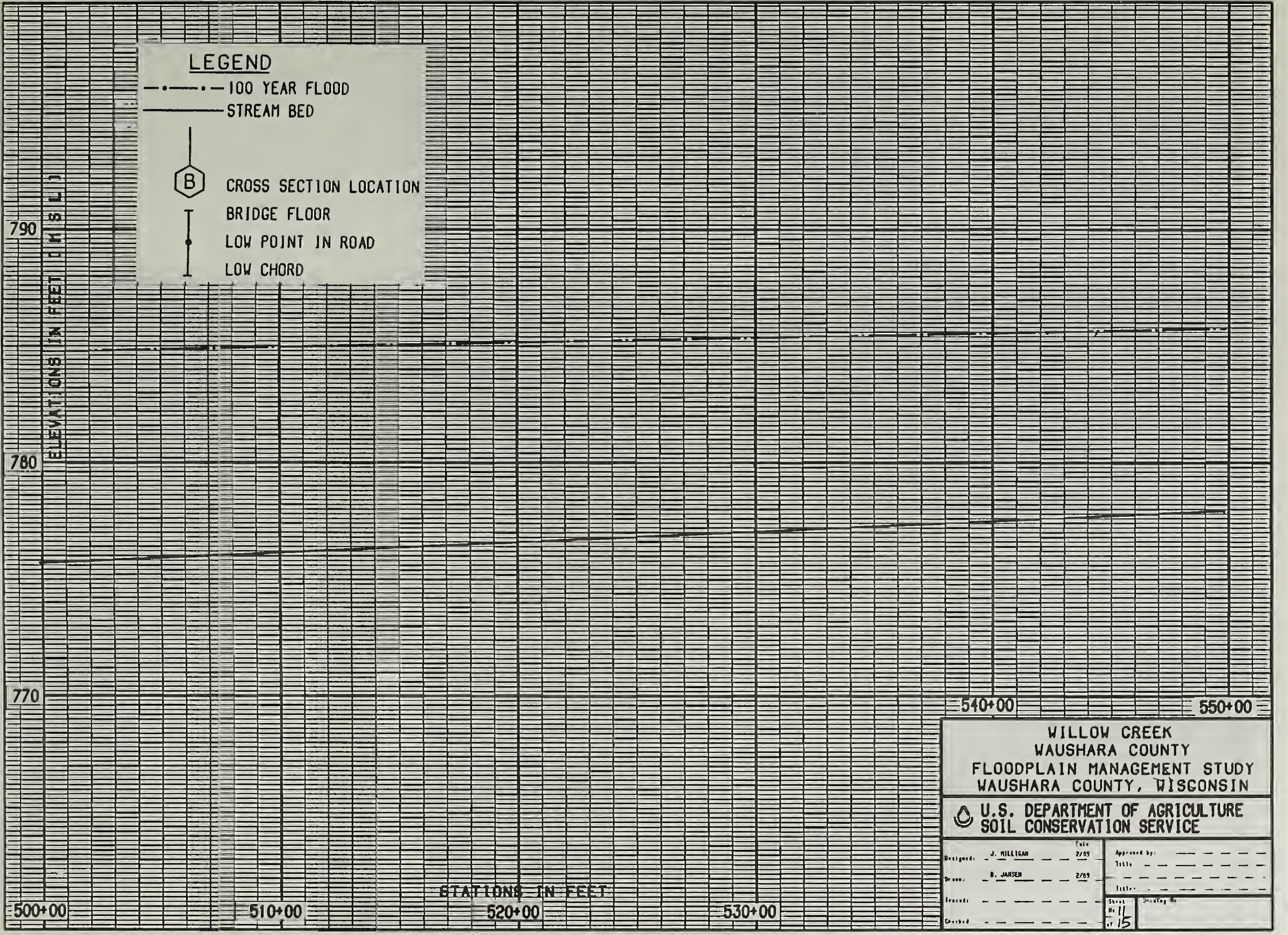

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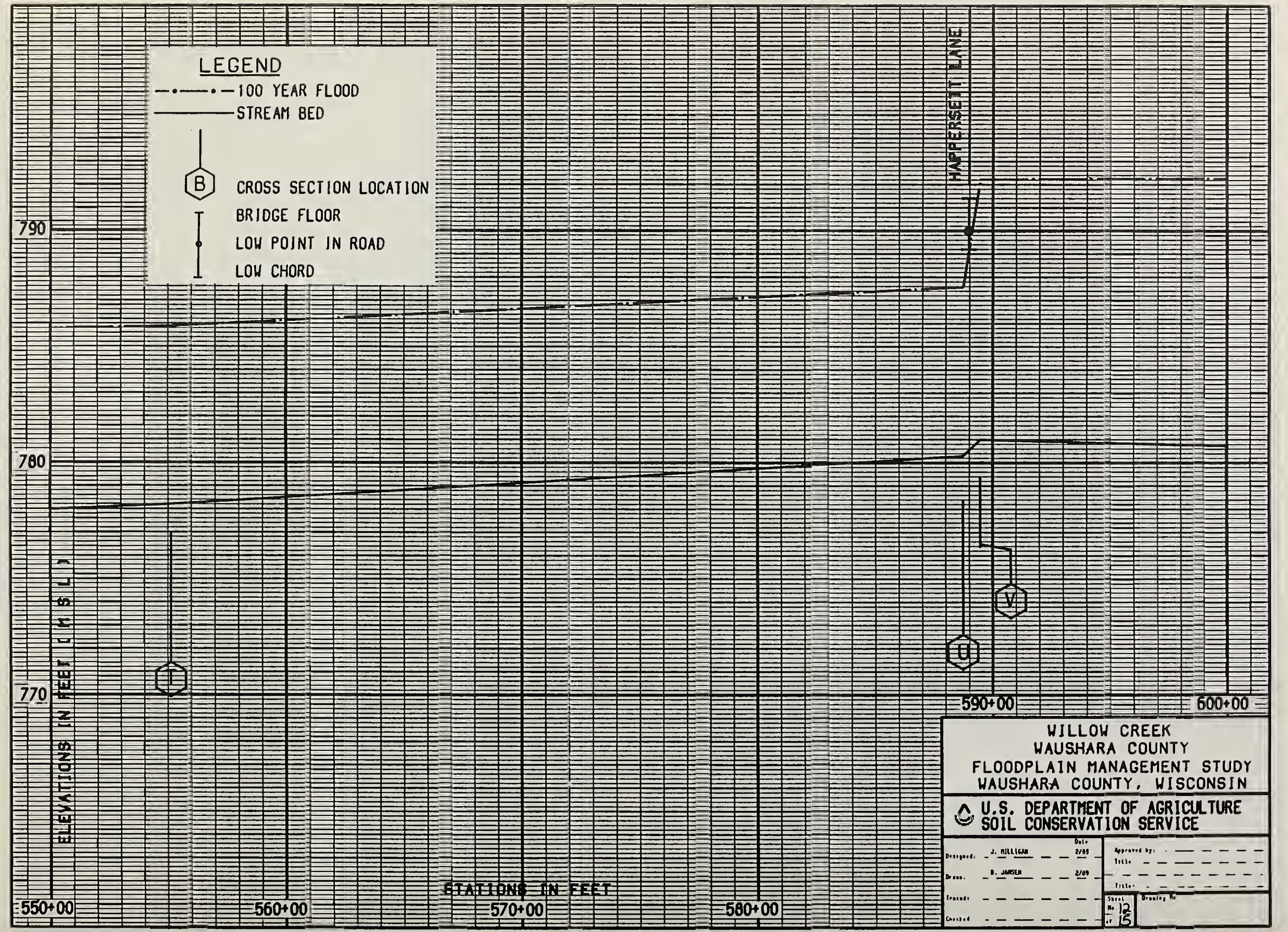
LEGEND
—·——·—100 YEAR FLOOD
———STREAM BED
B CROSS SECTION LOCATION
BRIDGE FLOOR
LOW POINT IN ROAD
LOW CHORD
HAPPERSETT LANE
T
U
V
790
780
770
ELEVATIONS IN FEET (M S L)
550+00
560+00
570+00
580+00
590+00
600+00
STATIONS IN FEET
WILLOW CREEK
WAUSHARA COUNTY
FLOODPLAIN MANAGEMENT STUDY
WAUSHARA COUNTY, WISCONSIN
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Date
Designed: J. MILLIGAN 2/89
Drawn: B. JANSEN 2/89
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Title
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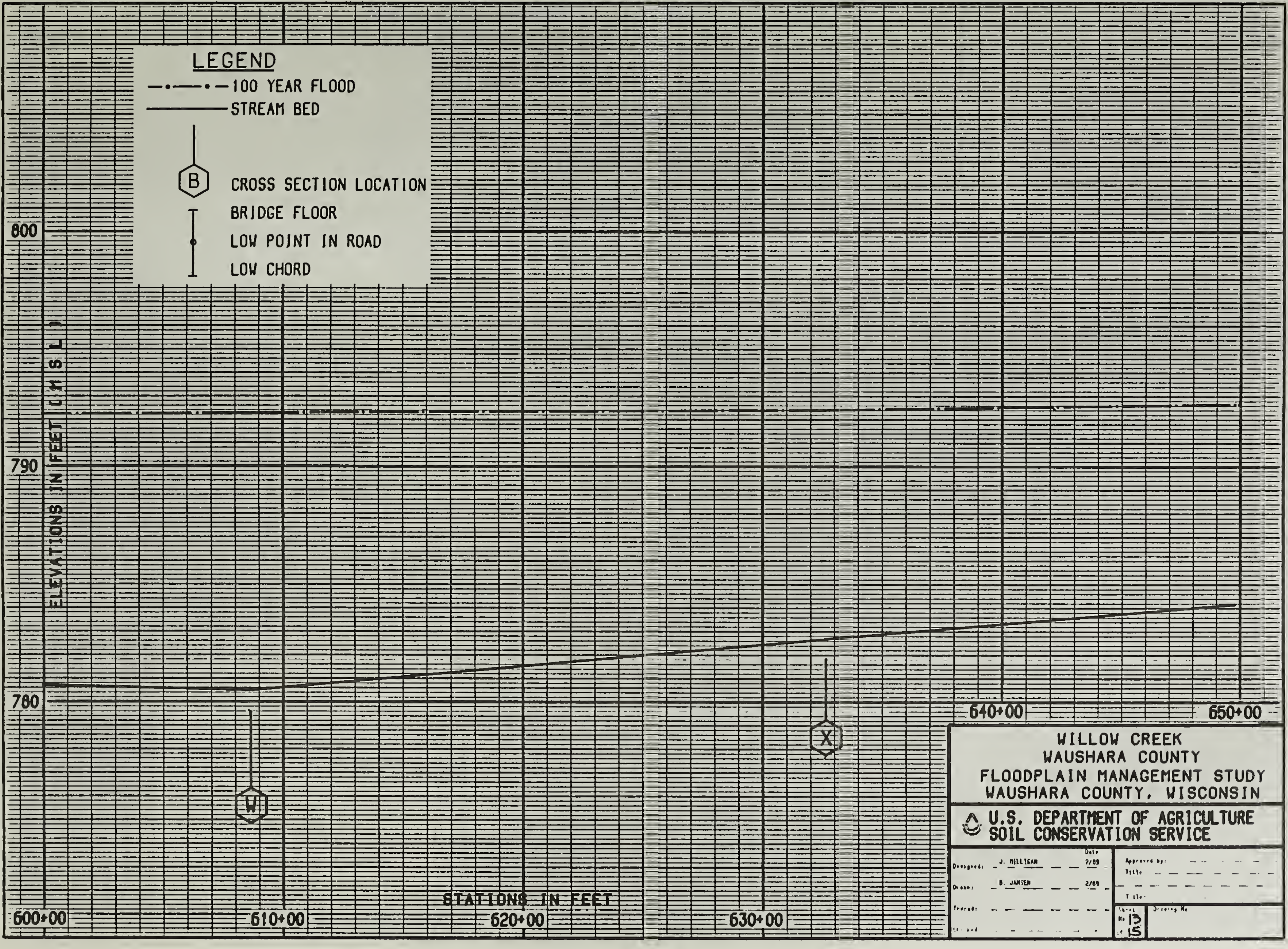
Sheet No. 12 of 15
Drawing No.



WILLOW CREEK
WAUSHARA COUNTY
FLOODPLAIN MANAGEMENT STUDY
WAUSHARA COUNTY, WISCONSIN

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date
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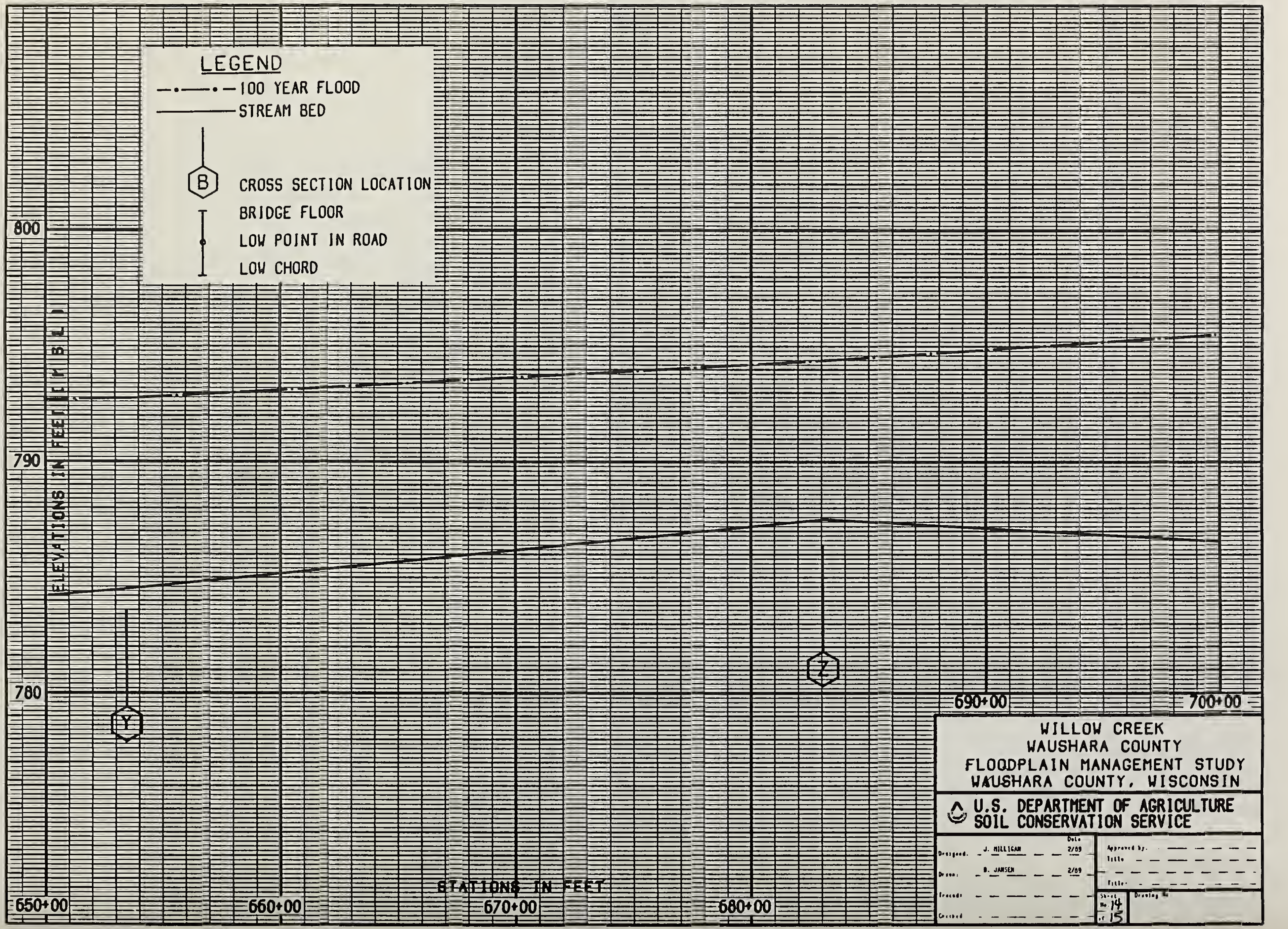
LEGEND
100 YEAR FLOOD
STREAM BED
B
CROSS SECTION LOCATION
BRIDGE FLOOR
LOW POINT IN ROAD
LOW CHORD
800
790
780
ELEVATIONS IN FEET (M S L)
Y
Z
650+00
660+00
670+00
680+00
690+00
700+00
STATIONS IN FEET
WILLOW CREEK
WAUSHARA COUNTY
FLOODPLAIN MANAGEMENT STUDY
WAUSHARA COUNTY, WISCONSIN
U.S. DEPARTMENT OF AGRICULTURE
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Designed: J. MILLIGAN Date 2/89
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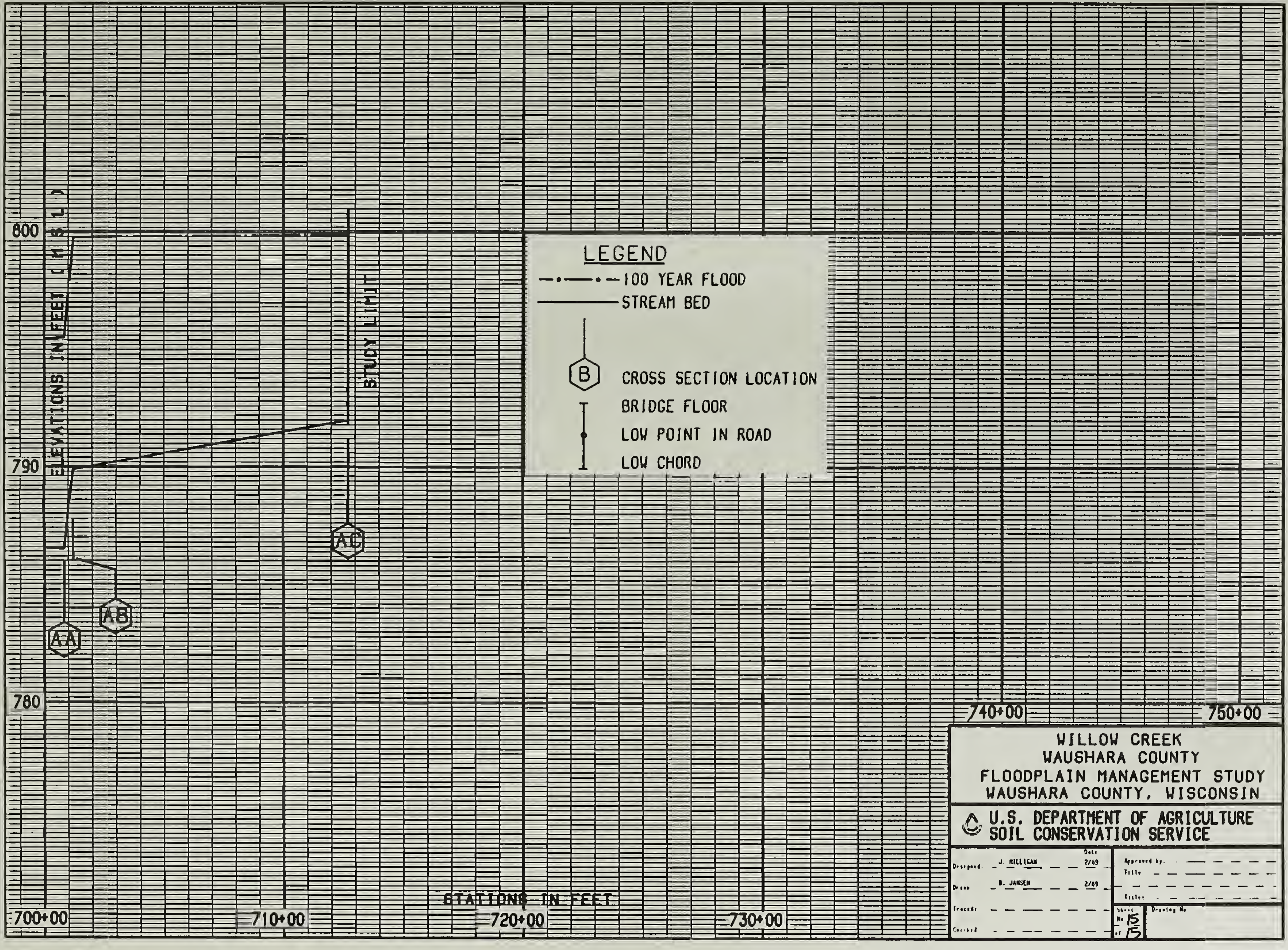
Sheet No. 14 of 15
Drawing No.



WILLOW CREEK
WAUSHARA COUNTY
FLOODPLAIN MANAGEMENT STUDY
WAUSHARA COUNTY, WISCONSIN

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed. J. MILLIGAN Date 2/69
Drawn B. JANSEN 2/89
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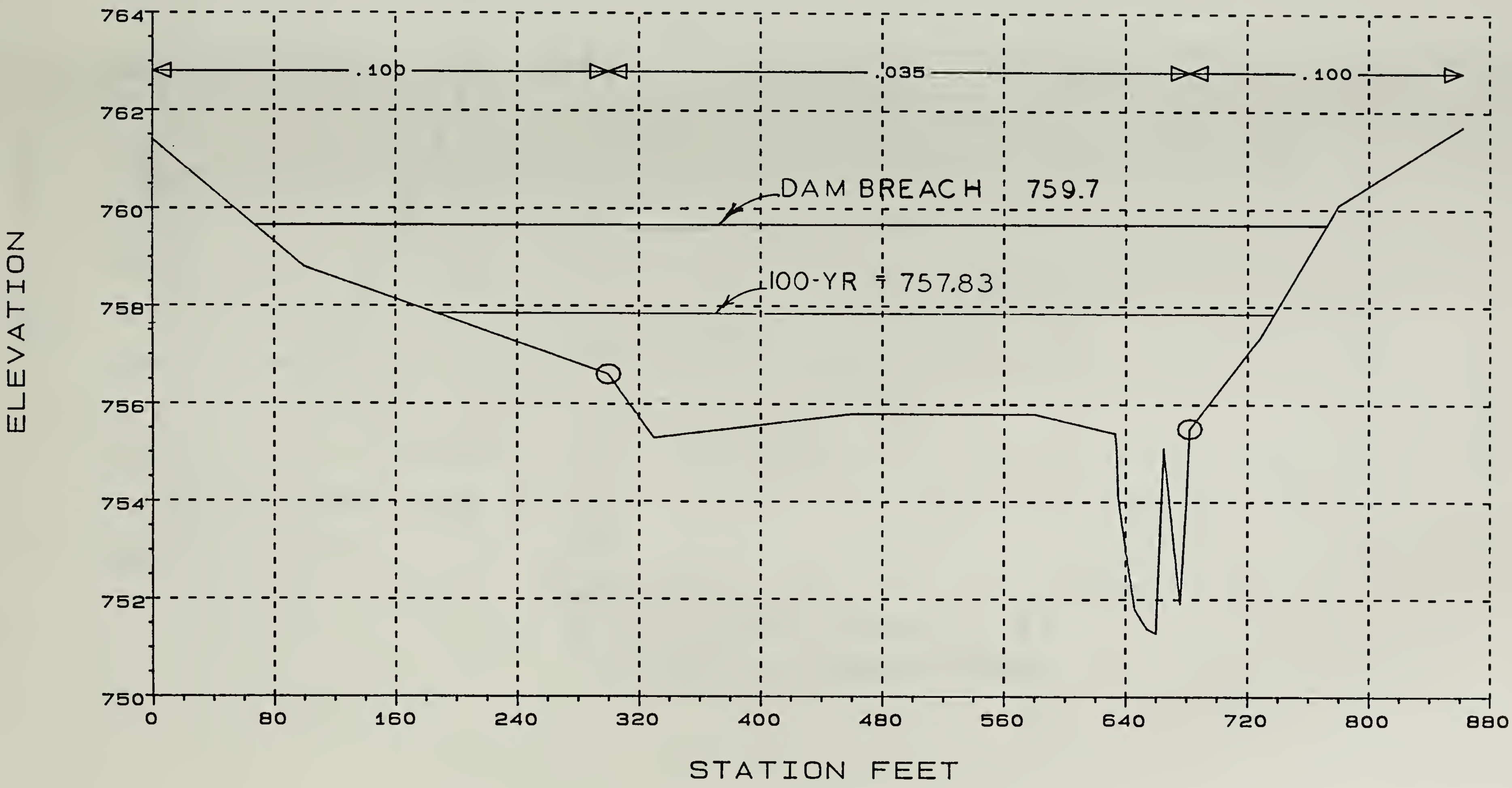
Appendix C

TYPICAL SECTIONS

WILLOW CREEK FPMS
WAUSHARA COUNTY, WI
CROSS-SECTION NO. 1.000 "A"



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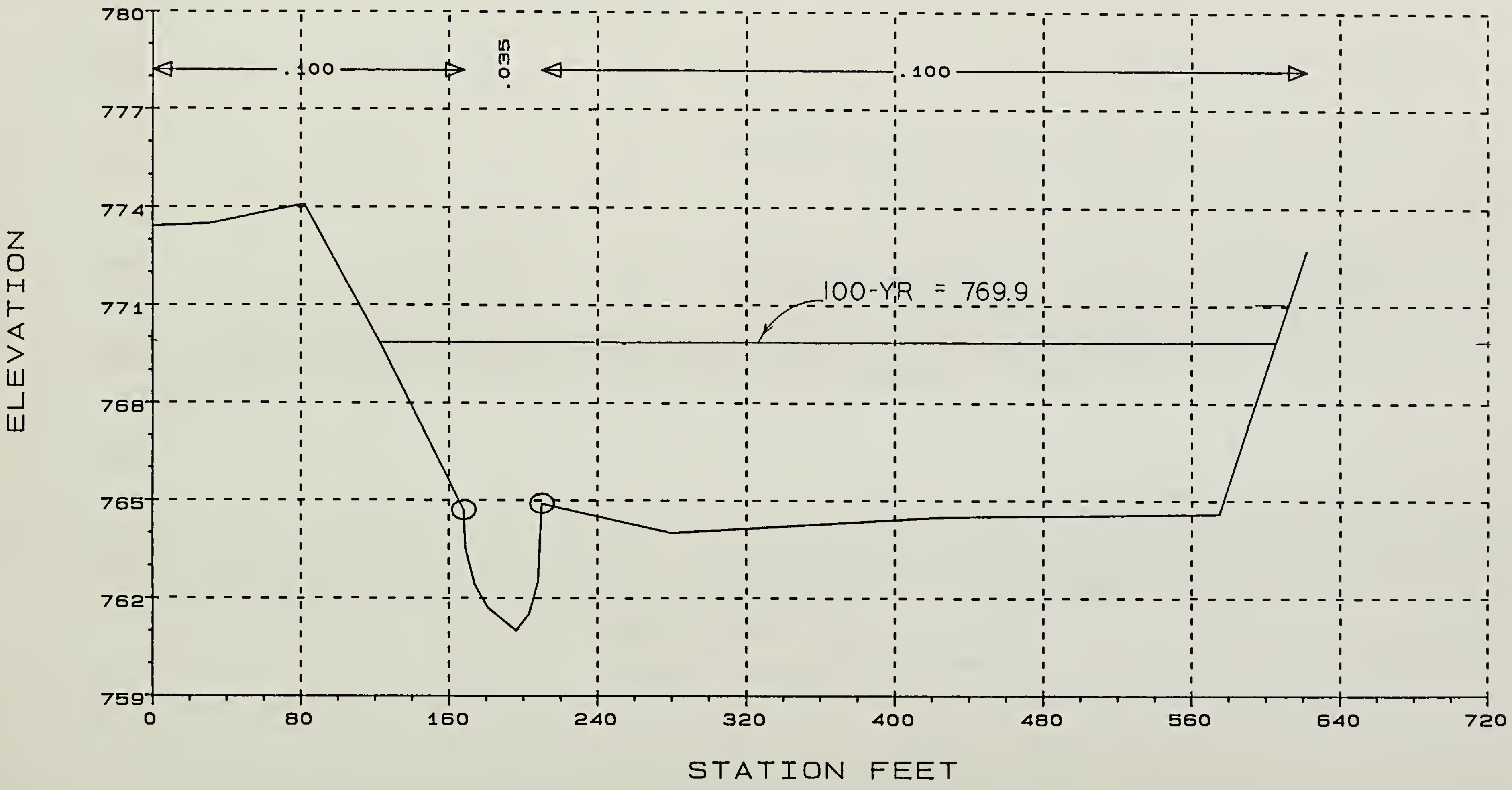
WAUSHARA COUNTY, WI
CROSS-SECTION NO. 9.000 "G"



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WAUAHARA COUNTY, WI
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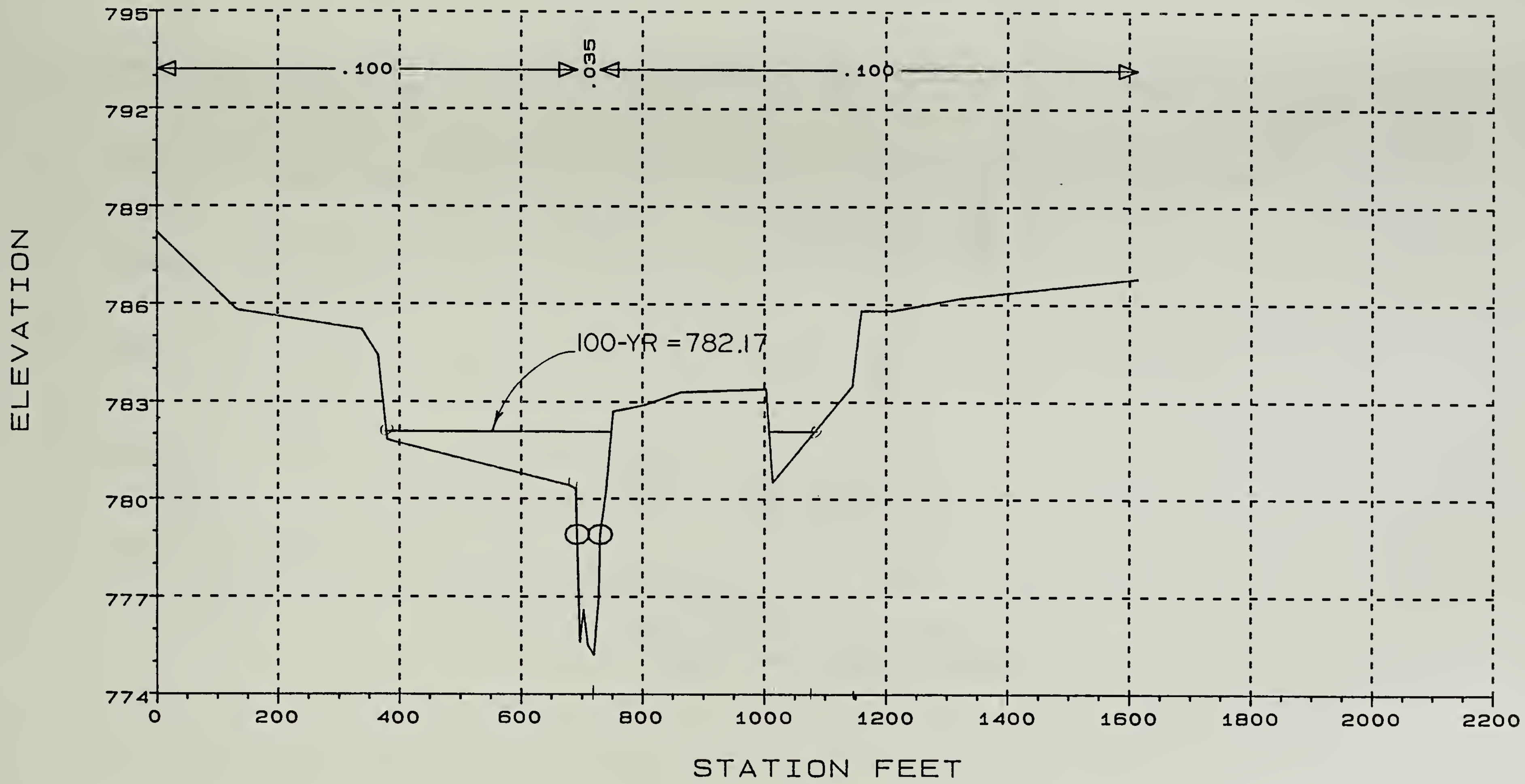
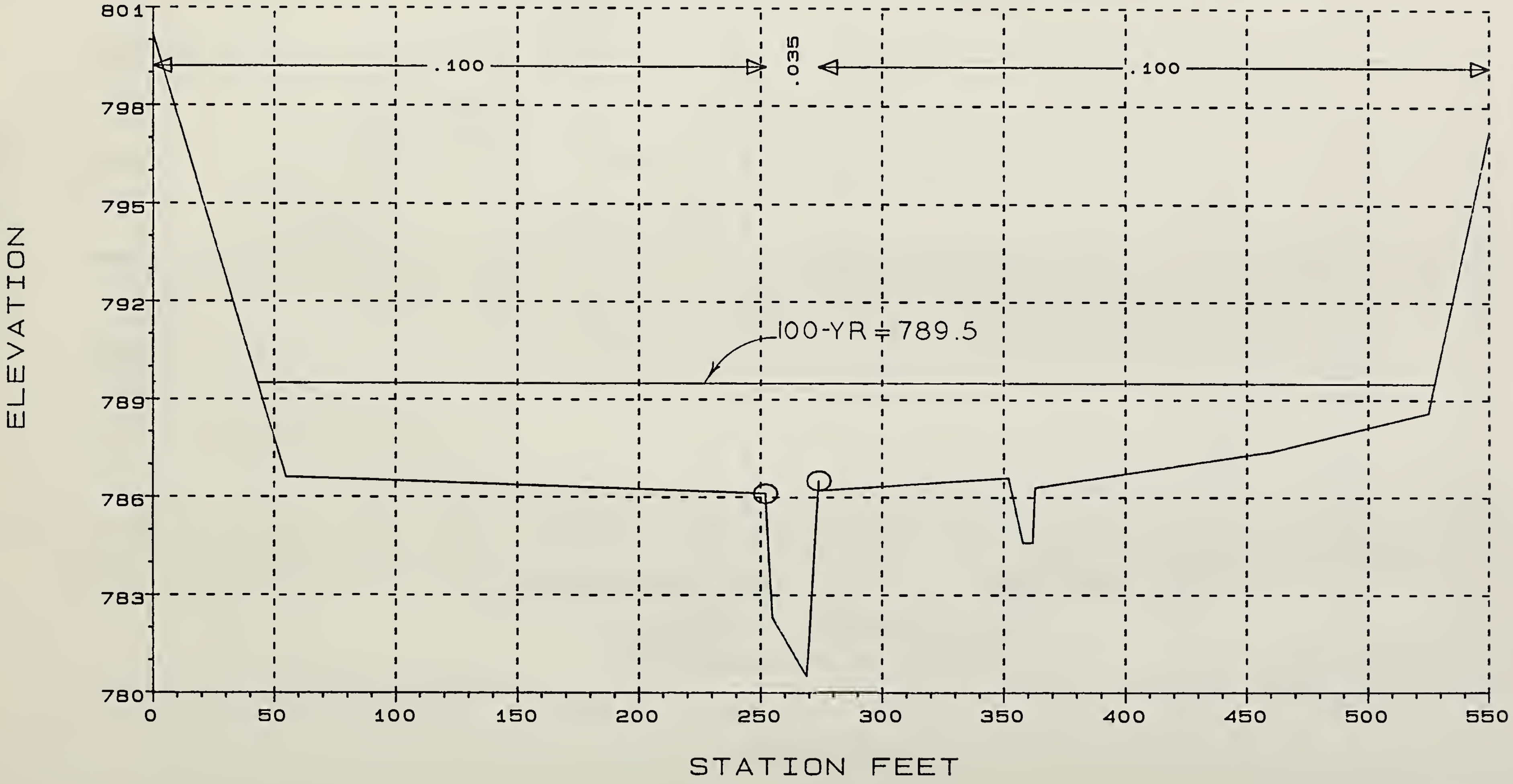


WILLOW CREEK FPMS
WAUSHARA COUNTY, WI
CROSS-SECTION NO. 29.000 "W"



Appendix D

ELEVATION REFERENCE MARKS

ELEVATION REFERENCE MARKS

Reference Mark	Elev. (MSL)	Description
1	767.22	USGS BM-J-98 At Auroraville on the east side of Highway 49. A standard brass plate, located on concrete intake to turbine, located in Olsen's Mill.
2	788.535	USGS BM-D-98 Located in Red Granite opposite the southwest end of the Chicago & Northwestern Railroad station at the crossing of State Highway 21, 80 feet southeast of the centerline of the track, 33 feet northeast of the centerline of the highway, and 6 feet northeast of a power transmission line pole located on the north side of Main Street.
3	767.35	TBM-1 The top of a 1" dia. iron pipe, approximately 18" above ground, 20 feet east of the SE corner of the brown tavern located on the north side of Cottonville Court at the junction with HY-49 in Auroraville. Page 4, Book 1.
4	759.25	TBM-2 The top of the north end of a 24" dia. culvert pipe crossing Cottonville Court Road at a curve to the east, approximately 1000 feet east of Auroraville. Page 4, Book 1.
5	758.21	TBM-3 A spike on the west side of the west pole of two poles of a power transmission line on the north side of Cottonville Court at cross section no. 2(B). Page 4, Book 1.
6	769.69	TBM-4 A spike on the east side of power pole no. 1540 on the north side of Cottonville Court at cross section no. 1(A).
7	766.25	TBM-5 A nail on the south side of South Brey Park sign post on the north side of Cottonville Court, approximately 900' west of Auroraville. Page 5, Book 1.
8	768.25	TBM-6 The top south end of a 21" dia. cmp culvert, approximately 75 feet west of a small white house on the north side of Cottonville Court. Approximately 1200 feet west of Auroraville. Page 6, Book 1.

9	770.94	TBM-7 The top east end of a 12" dia. cmp under a field entrance to the north of Cottonville Court and approximately 250 feet east of a brown house and red barn. Page 6, Book 1.
10	766.84	TBM-8 The east flowline of a 30" dia. cmp culvert, located under the Wessley Belter Driveway entrance. Page 6, Book 1.
11	764.69	TBM-9 The top south end of a 30" dia. cmp culvert crossing Cottonville Court at a curve to the south on 31st Ave. Page 6, Book 1.
12	770.23	TBM-10 A spike on the east side of a power pole, located 50 feet south of 29th Lane bridge on the west side of the road. Page 8, Book 1.
13	770.68	TBM-11 The top south end of "buried" cmp culvert, located approximately 300 feet east of Marshall residence on 29th Court. Page 8, Book 1.
14	775.68	TBM-12 A spike on the north side of power pole no. 18-12-11 38/39, located on the south side of Cottonville Court, approximately 70 feet west of the intersection with 29th Lane to the south and east. Page 8, Book 1.
15	772.92	TBM-13 A nail on the north side of Wisconsin Power & Light Co. (WP&L) power pole number 26/39, approximately 50 feet west of the D. Daniels mail box on the south side of Cottonville Court on the south end of cross section no. 10(H). Page 9, Book 1.
16	772.69	TBM-14 A nail on the north side of Wisconsin Power & Light Co. power pole no. 3/38 on the south side of Cottonville Court, approximately 250 feet east of curve to south. Page 9, Book 1.
17	779.12	TBM-15 A nail on the north side of WP&L power pole no. 37/2 on the south side of Cottonville Court. approximately 250 feet west of the Hackney residence. Page 12, Book 1.
18	772.44	TBM-16 The top northwest wingwall, 4 inches north of the Armco guardrail, of the 28th Road bridge. Page 13, Book 1.

19	775.05	TBM-17 A nail on the west side of WP&L power pole no. 13/32, on the east R-O-W of 28th Road, west & north of the 28th road bridge. Page 13, Book 1.
20	776.96	TBM-18 A nail on the south side of a yellow no trespassing sign on the NW "40" corner of the SW 1/4 of the SW 1/4 of section 9, T18N, R12E, Warren Township. Page 14, Book 1.
21	775.65	TBM-19 A nail on the south side of a 4"x4" leaning oak "no trespassing" sign post approximately 700 feet east of TBM-18. Page 15, Book 1.
22	799.34	TBM-23 The top of the northeast wingwall of the bridge crossing the Willow Creek and located on CTH-"S". Page 18, Book 1.
23	797.21	TBM-24 The top southeast wingwall of a multiplate arch crossing CTH-"S" and located on "Bruce Creek". Page 18, Book 1.
24	801.96	TBM-27 A spike on the north side of a stump, located on the south side of Cottonville Court, approximately 1100 feet west of the intersection with CTH-"S". Page 20, Book 1.
25	801.16	TBM-29 A spike in power pole no. 22/22, located on the south side of Highway 21 in a row of white pine trees, approximately 800 feet east of the intersection of CTH-"S" and Highway 21. Page 21, Book 1.
26	800.75	TBM-30 The top of a brown western most fencepost, located in a fence on the north side of Highway 21 in a wayside rest area, between Red Granite and the intersection of Highway 21 and CTH-"S". Page 21, Book 1.
27	797.67	TBM-31 A spike on the east side of a single power pole on the north R-O-W of Highway 21, located next to an older cream colored two story house about 200 feet west of cross section 29(X). Page 21, Book 1.
28	790.05	TBM-32 The top of a bolt on the east end of a multiplate arch culvert where the Willow Creek crosses Happersett Lane. Page 23, Book 1.

29	799.53	TBM-33 The top of a 3 inch square wood post, approximately 3 feet above ground on the north side of Highway 21 at the intersection of CTH-EE. TBM-33 is located on the south end of cross section 25(U). Page 24, Book 1.
30	790.62	TBM-34 An "X" mark on the concrete side walk, approximately 4 feet south of the west telephone booth located at the city park on the north side of Highway 21, approximately 100 feet west of the intersection with Pine River Street. Page 26, Book 1.
31	764.98	TBM-42 The top of section corner post for sections 6,5,7,8. Page 37, Book 1.
32	790.96	TBM-43 The top bolt of a hydrant located on the NW corner of the intersection of Bonnerman Ave. and Wood Street. Page 40, Book 1.
33	787.75	TBM-44 A spike in the north side of power transmission line pole no. 41/26 located on the south R-O-W of Highway 21 approximately 200 feet SE of the Edgewood Restaurant. Page 40, Book 1.
34	786.27	TBM-45 The top of telephone inspection box, located on the south side of a power pole that is located on the north R-O-W of Highway 21 at the south end of cross section 17(N). Page 41, Book 1.
35	777.72	TBM-46 A spike in the south side of power pole no. 33/39, located on the north R-O-W of Highway 21, approximately at the south end of cross section 16(M). Page 41, Book 1.
36	773.03	TBM-47 A spike in the south side of WP&L power pole no. 51/39, located in the north R-O-W of Highway 21, opposite the driveway to an auto salvage yard, located in the northeast corner of the SE 1/4 of the NE 1/4 of section 16, T18N, R12E. Page 42, Book 1.
37	778.04	TBM-48 A spike in the south side of power pole no. 13/39, located on the NE corner of the intersection of 28th Lane and Highway 21. Page 8, Book 1.

38	768.18	DNR BM Top of a steel cylinder type bridge support pier under the SW corner of the bridge crossing the Willow Creek on 29th Lane. Page 8, Book 1.
39	792.58	BM-6 The top of a hydrant, located on the north side of Main Street, approximately 600 feet east of Highway 21, in Red Granite. Established in Nov. 1975
40	792.33	BM-11 The top of a hydrant, located on the north side of Main Street at the corner of Lang Street and Highway 21. Page 28, Book 1. Village of Red Granite.
41	794.30	BM-16 The top of a fire hydrant located north east of the corner of Pine Street and Highway 21 in Red Granite. Page 26, Book 1.
42	789.27	BM-25 The top of a fire hydrant located west of the corner of Pine River Street and Lafayette Street, Red Granite. Page 27, Book 1.
43	786.56	BM-27 The top of the fire hydrant located west of the sewerage plant on Pine River Street, Red Granite. Page 27, Book 1.
44	790.28	BM-46 The top of fire hydrant located northwest of the corner of Wood and Main Streets, Red Granite. Pages 14 and 28, Book 1.

Appendix E

TABULATION OF
WATER SURFACE ELEVATIONS
DISCHARGES
AND
FLOODWAY TABLES

FLOODING SOURCE		DISCHARGE - ELEVATION							
CROSS SECTION	DISTANCE 1/	10 YEAR		50 YEAR		100 YEAR		500 YEAR	
		Q CFS	ELEV MSL	Q CFS	ELEV MSL	Q CFS	ELEV MSL	Q CFS	ELEV MSL
A	0	870.00	757.15	1360.00	757.67	1550.00	757.83	1930.00	759.18
B	1500	870.00	757.71	1360.00	758.37	1550.00	758.57	1930.00	759.56
C	2700	870.00	757.84	1360.00	758.54	1550.00	758.77	1930.00	759.71
	2800	MILL POND DAM & HWY 49							
D	2940	930.00	763.44	1300.00	764.20	1550.00	764.70	2000.00	765.80
E	6940	930.00	764.01	1300.00	764.55	1550.00	764.99	2000.00	766.00
F	14640	930.00	764.21	1300.00	764.73	1550.00	765.14	2000.00	766.10
	14702	29TH LANE							
G	14815	930.00	767.81	1300.00	769.10	1550.00	769.90	2000.00	771.23
H	18455	930.00	768.43	1300.00	769.55	1550.00	770.29	2000.00	771.54
I	22035	930.00	769.82	1300.00	770.61	1550.00	771.16	2000.00	772.18
J	28515	930.00	772.38	1300.00	772.99	1550.00	773.34	2000.00	773.92
	28577	28TH ROAD							
K	28690	730.00	772.70	1020.00	773.27	1200.00	773.56	1570.00	774.05
L	32250	730.00	772.86	1020.00	773.42	1200.00	773.71	1570.00	774.21
M	36370	730.00	773.17	1020.00	773.66	1200.00	773.93	1570.00	774.41
N	37470	730.00	774.07	1020.00	774.21	1200.00	774.35	1570.00	774.68
O	40410	730.00	776.31	1020.00	776.57	1200.00	776.66	1570.00	776.77
P	43610	730.00	778.49	1020.00	778.79	1200.00	778.98	1570.00	779.35
Q	47570	700.00	781.70	970.00	782.21	1150.00	782.46	1500.00	782.87
	47682	CTY HWY E							
R	47820	700.00	782.06	970.00	782.72	1150.00	783.10	1500.00	783.82
	47932	OLD BRIDGE							
S	47995	700.00	782.40	970.00	783.22	1150.00	783.72	1500.00	784.80
T	55515	700.00	784.87	970.00	785.46	1150.00	785.81	1500.00	786.46
U	58875	700.00	786.75	970.00	787.29	1150.00	787.59	1500.00	788.11
	58912	HAPPERSETT LANE							
V	58949	700.00	789.31	970.00	791.30	1150.00	792.20	1500.00	794.56
W	60869	600.00	789.53	920.00	791.42	1100.00	792.30	1420.00	794.62
X	63269	600.00	789.80	920.00	791.56	1100.00	792.42	1420.00	794.68
Y	65349	600.00	790.61	920.00	791.97	1100.00	792.74	1420.00	794.83
Z	68309	600.00	793.10	920.00	793.89	1100.00	794.37	1420.00	795.69
AA	70049	600.00	794.33	920.00	795.17	1100.00	795.57	1420.00	796.49
	70086	COUNTY HWY. S							
AB	70124	600.00	796.71	920.00	798.43	1100.00	799.34	1420.00	800.79
AC	71274	600.00	797.02	920.00	798.60	1100.00	799.47	1420.00	800.88

1/ Distances are measured from the downstream study limit.

WAUSHARA COUNTY FLOODPLAIN MANAGEMENT STUDY
WAUSHARA COUNTY, WISCONSIN

WILLOW CREEK

TABLE 2
FLOODWAY DATA

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION 2/			
CROSS SECTION	DISTANCE 1/	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WITHOUT FLOODWAY WITH DAM BREAK	WITHOUT FLOODWAY	WITH 3/ FLOODWAY AND DAM BREACH	INCREASE
WILLOW CREEK								
A	0	549	1096	3.11	759.66	757.83	757.83	0
B	1500	560	1588	1.86	760.77	758.57	758.57	0
C	2700	298	1372	1.39	764.68	758.77	758.77	0
D	2940	340	628	2.54	764.70	764.70	764.70	0
E	6940	2006	5557	.40	764.99	764.99	764.99	0
F	14640	428	636	4.31	765.14	765.14	765.14	0
G	14815	482	2494	1.59	769.80	769.80	769.80	0
H	18455	507	2108	2.02	770.17	770.17	770.17	0
I	22035	704	1355	3.20	771.02	771.02	771.02	0
J	28515	785	1877	2.59	773.22	773.22	773.22	0
K	28690	1392	3454	1.40	773.52	773.52	773.52	0
L	32250	2450	6343	.65	773.68	773.68	773.68	0
M	36370	2425	3358	1.43	773.91	773.91	773.91	0
N	37470	2750	1944	2.69	774.34	774.34	774.34	0
O	40410	2033	2192	2.17	776.66	776.66	776.66	0
P	43610	893	1100	4.09	778.98	778.98	778.98	0
Q	47570	374	717	3.76	782.46	782.46	782.46	0
R	47820	401	964	2.63	783.32	783.32	783.32	0
S	47995	494	1287	2.08	784.37	784.37	784.37	0
T	55515	549	1490	2.37	785.88	785.88	785.88	0
U	58875	213	437	4.83	787.58	787.58	787.58	0
V	58949	370	1948	1.67	792.20	792.20	792.20	0
W	60869	504	2822	1.19	792.30	792.30	792.30	0
X	63269	412	1880	1.68	792.42	792.42	792.42	0
Y	65349	199	766	3.39	792.74	792.74	792.74	0
Z	68309	307	848	3.21	794.37	794.37	794.37	0
AA	70086	204	639	4.03	795.57	795.57	795.57	0
AB	70124	495	2339	1.49	799.78	799.78	799.78	0
AC	71274	243	1271	1.85	799.88	799.88	799.88	0

1/ Distance in feet from the study limit.
2/ Water surface elevation without debris or ice blockage.
3/ Elevations used for Appendix B profiles

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
WAUSHARA COUNTY FLOODPLAIN MANAGEMENT STUDY
WAUSHARA COUNTY, WISCONSIN

FLOODWAY DATA

WILLOW CREEK

Appendix F

INVESTIGATIONS AND ANALYSIS

Investigation and Analysis

The Willow Creek watershed is relatively flat with many kettle depressions, swamps and lakes. The soils are sandy and rapidly permeable. Due to the nature of the watershed a single storm event model would not produce a reasonable floodflow. Using runoff only would not be realistic because it would be difficult to predict the amount of meltwater entering the soil. The 100-year March snowpack has eight inches of water equivalent (6). Should the snowpack melt rapidly a major flood could result. The USGS regression formula approach would give a more realistic floodflow (1). This approach is based on historical gage records of streams grouped in areas of similar topography. The gage records include the snowmelt and groundwater combined flows. The Auroraville dam is being replaced as part of the upgrading of Highway 49. The new structure was breached as part of the hydraulics analysis performed by Wisconsin Department of Transportation (DOT). The results of the breach analysis is included as part of this study. The hydraulic analysis was performed utilizing the Army Corp of Engineers hydrology program HEC-1 (9).

The resultant flows used in the study are listed for each cross section and frequency in Appendix E.

The flows and surveyed cross sections data were modeled in a step backwater computer program HEC-2 (10). The resultant water surface elevations for each cross section are listed in Appendix E and the profiles combined with the dam breach water surface are shown in Appendix B. The regulatory flood level is the higher of the 100-yr or the dam breach flood (Table 2 Appendix E).

The floodplain, floodway limits and cross section locations are shown on photomaps in Appendix A.

Appendix G

GLOSSARY

GLOSSARY

CHAPTER NR. 116, WISCONSIN'S FLOODPLAIN MANAGEMENT PROGRAM
NR. 116.03 DEFINITIONS

Channel. A channel is a natural or artificial watercourse with definite bed and banks to confine and conduct the normal flow of water.

Department. Department refers to the State of Wisconsin Department of Natural Resources.

Encroachment. An encroachment is any fill, structure, building, use, accessory use, or development in the floodway.

Encroachment/Floodway Lines. Encroachment/floodway lines are limits of obstruction to floodflows. These lines are on both sides of and generally parallel to the river or stream. The lines are established by assuming that the area landward (outside) of the encroachment/floodway lines will be ultimately developed in such a way that it will not be available to convey floodflows.

Flood. A general and temporary condition of partial or complete inundation of normally dry land areas caused by the overflow or rise of rivers, streams, or lakes.

Flood Frequency. The term flood frequency is a means of expressing the probability of flood occurrences and is generally determined from statistical analyses. The frequency of a particular floodflow is usually expressed as occurring, on the average, once in a specified number of years. Any particular floodflow could, however, occur more frequently than once in any given year.

Flood Fringe. The flood fringe is that portion of the floodplain outside of the floodway, which is covered by floodwaters during the regional flood; it is generally associated with standing water rather than rapidly flowing water.

Floodplain. The floodplain is the land which has been or may be hereafter covered by floodwater during the regional flood. The floodplain includes the floodway and the flood fringe.

Floodplain Management. Floodplain management involves the full range of public policy and action for insuring wise use of floodplains. It includes everything from the collection and dissemination of flood control information to actual acquisition of floodplain lands; and the enactment and administration of codes, ordinances, and statutes for land use in the floodplain.

Flood Proofing. Flood proofing involves any combination of structural provisions, changes, or adjustments to properties and structures subject to flooding, primarily for the purpose of reducing or eliminating flood damage to properties, water and sanitary facilities, structures and contents of buildings in flood hazard areas.

Flood Protection Elevation. The flood protection elevation shall correspond to a point 2 feet of freeboard above the water surface profile associated with the regional flood and the official floodway lines. Also see: Freeboard.

Floodway. The floodway is the channel of a river or stream and those portions of the floodplain adjoining the channel required to carry and discharge the floodwater or floodflows associated with the regional flood.

Freeboard. Freeboard is a factor of safety usually expressed in terms of a certain amount of feet above a calculated flood level. Freeboard compensates for the many unknown factors that contribute to flood heights greater than the height calculated. These unknown factors include, but are not limited to, ice jams, debris accumulation, wave action, obstruction of bridge openings and floodways, the effects of urbanization on the hydrology of the watershed, loss of flood storage areas due to development and aggradation of the river or streambed.

High Flood Damage Potential. High flood damage potential is associated with any danger to life or health and any significant economic loss to a structure or building or its contents.

Hydraulic Floodway Lines. Hydraulic floodway lines shall delineate the channel of the river or stream and those portions of the adjoining floodplains which are reasonably required to carry and discharge the regional floodflow without any measurable increase in flood heights.

Hydraulic Reach. A hydraulic reach along a river or stream is that portion of the river or stream extending from one significant change in the hydraulic character of the river or stream to the next significant change. These changes are usually associated with breaks in the slope of the water surface profile, and may be caused by bridges, dams, expansion and contraction of the waterflow, and changes in streambed slope or vegetation.

Levee. A levee is a continuous dike or embankment of earth constructed parallel to a river or stream to prevent flooding of certain areas of land.

Official Floodway Lines. Official floodway lines are those lines which have been adopted by the county, city, or village, approved by the department, and which are shown on the official floodplain zoning maps and used for regulatory purposes.

Regional Flood. The regional flood is 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 regional flood is based upon a statistical analysis of streamflow records available for the watershed and/or an analysis of rainfall and runoff characteristics in the general watershed region. 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. During a typical 30-year mortgage period, the regional flood has a 26 percent chance of occurring.

__Structure__. A structure is any manmade object with form, shape, and utility, either permanently or temporarily attached to or placed upon the ground, riverbed, streambed, or lakebed.

__Watershed__. A watershed is a region or area contributing ultimately to the water supply of a particular watercourse or body of water.

__Water Surface Profile__. The water surface profile is a graphical representation of the height of the water surface throughout a county, city, or village based upon a certain flow passing through the river or stream. A water surface profile based upon flows occurring during a regional flood is used in regulating the floodplain areas.

Appendix H

BIBLIOGRAPHY

Bibliography and Related References

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2. State of Wisconsin, Blue Book, Wisconsin Legislative Reference Bureau, 1975.

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