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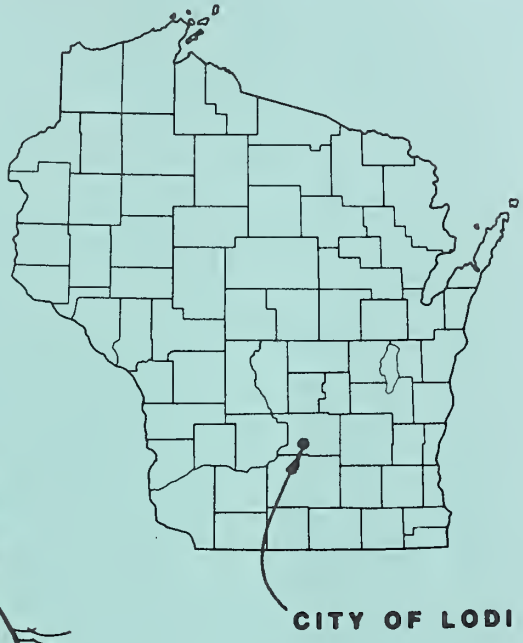
FLOOD HAZARD STUDY

CITY OF LODI

COLUMBIA COUNTY, WISCONSIN



PREPARED BY THE

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

MADISON, WISCONSIN

IN COOPERATION WITH

COLUMBIA COUNTY, WISCONSIN

AND THE

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

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City of Lodi Flood Hazard Study

Introduction

The purpose of this study is to define the flood characteristics of Spring Creek in the city of Lodi and vicinity. The city of Lodi requested the study through the Columbia County Land Conservation Committee and the Wisconsin Department of Natural Resources (DNR). The information acquired will enable them to develop an effective flood plain management program.

This report is prepared for use by the local people in planning the use and regulation of the Spring Creek flood plain in the city of Lodi and vicinity.

The 100-year and 500-year flood plains have been delineated. The high water elevations and flood plains are based on 5-year projected land use of the watershed, stream, flood plain, and existing road crossings.

The Soil Conservation Service carries out flood hazard studies under the authority of Section 6 of Public Law 83-566, as amended, in accordance with Executive Order 11988 (May 24, 1977) and Recommendation 9(c) of House Document No. 465, 89th Congress, 2d Session, "Regulation of Land Use."

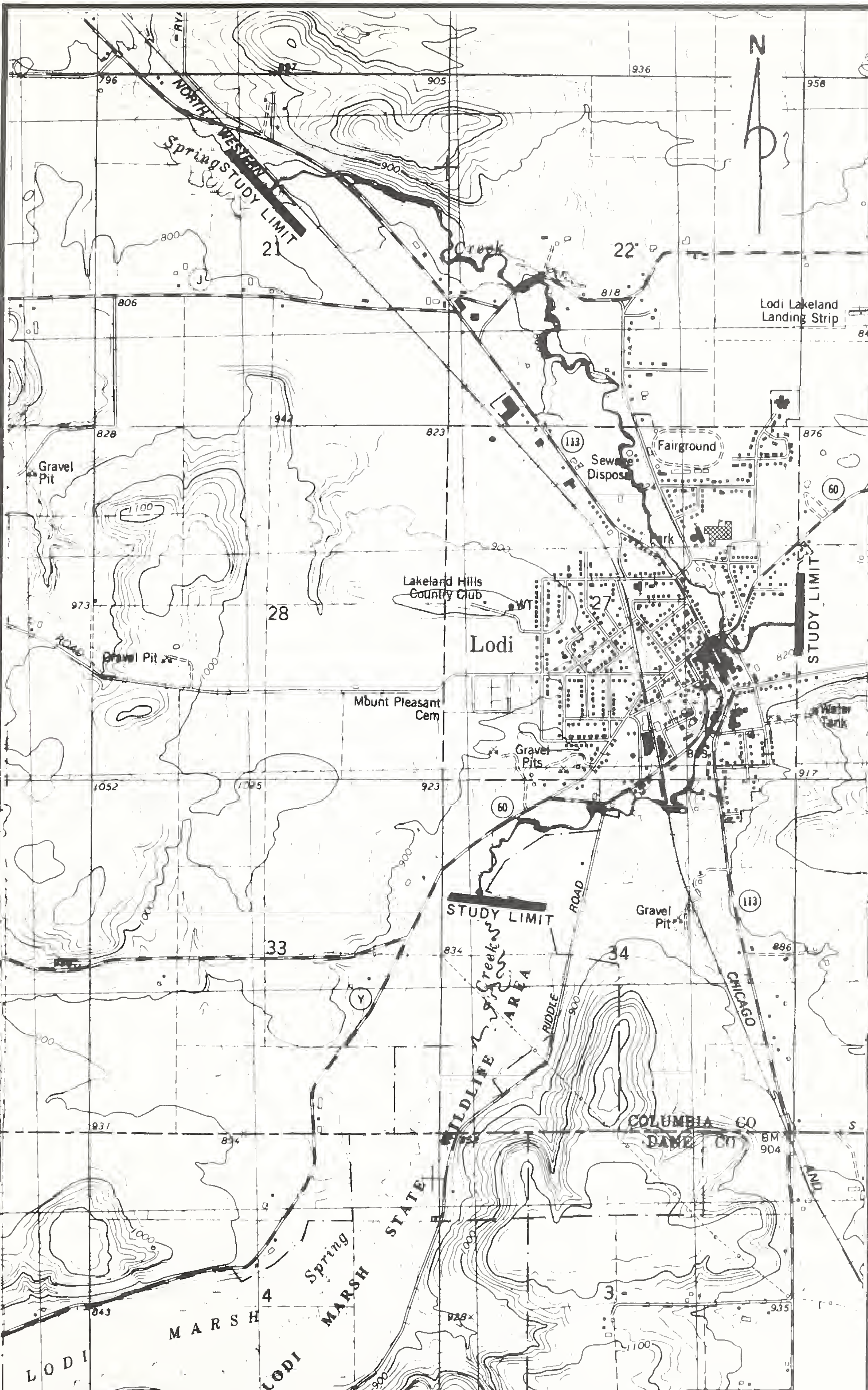
In Wisconsin the Soil Conservation Service coordinates flood hazard studies with the Wisconsin DNR, through a joint coordination agreement entered into in October 1978. The Wisconsin Water Resources Act (Chapter 614, Laws of Wisconsin, 1965) authorizes the DNR, Division of Enforcement, to establish and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

Study Area Description

The study area is located within the city of Lodi and vicinity, in south-central Wisconsin. This area consists of the flood plain that lies adjacent to approximately 3.0 miles of Spring Creek (see attached vicinity map). The downstream limit of the study is the Chicago & North Western Railroad in Section 21. The upstream limit is near the quarterline of Section 34, in the lower end of the Lodi Marsh. The tributary to theeast is to be run 800 feet above the confluence of Spring Creek. The drainage area at the downstream limit is 46.3 square miles. The drainage area at the lower end of Lodi Marsh is 24.7 square miles and the tributary entering Spring Creek from the east at Spring Street has a drainage area of 9.18 square miles. Spring Creek is in USGS Hydrologic Unit 07070005.

The climate is typically continental. January temperatures average 20.8° F. July, the warmest month, has an average temperature of 73.5° F. Precipitation averages 30 inches per year.

The soils of the watershed consist of the St. Charles-Ossian-Dodge Association which are well drained, moderately well drained, and poorly drained silty soils that have a silty subsoil, underlain by sandy loam glacial till or silty sediment.



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SOIL CONSERVATION SERVICE

City of Lodi Flood Hazard Study
Columbia County, Wisconsin

VICINITY MAP

FIGURE 1

Natural and Beneficial Flood Plain Values

The flood plain outside the existing built-up area is characterized by wet meadows of goldenrod, aster, grasses, and cattails, along with native grass pasture areas and some scattered croplands. There are narrow belts of trees along some portions of the stream and some scattered trees throughout the area. Major tree species are willow, box elder, oak, and cottonwood. The portion of Spring Creek in the study area is classified as a class II trout stream. The southwest leg of the area is part of the Lodi Marsh DNR wildlife area.

In terms of wildlife values, the wet meadows provide nesting cover for pheasants, ducks, and other ground nesting birds, as well as food and escape cover for a variety of wildlife. Although low in timber value, there are several good den trees in the area which are used by raccoon, squirrels, and cavity-nesting birds. The wooded stream corridor provides travel lanes for wildlife and also helps shade the stream to help keep water temperatures cool.

The entire flood plain provides a large natural storage area for floodwater. The flood plain also plays a role in water quality in that it allows sediment to be dropped and serves as a natural filter area.

Flooding Problems

Flood damage has occurred frequently in the city along Spring Creek but there is little documentation readily available. A storm on September 9, 1965 reportedly had the four to five inches of floodwater over the swimming pool in the park. Based on the hydraulic model the flow would be between 1,100 and 1,200 cfs, slightly less than the 10-year return frequency flow.

Existing Flood Plain Management

Lodi does not have a flood plain zoning ordinance primarily due to the lack of adequate mapping. They are in the emergency phase of the National Flood Insurance Program.

Alternatives for Mitigating Flood Damages to Existing and Future Development

A. Incorporate a comprehensive flood hazard analysis into the city zoning ordinance, delineating flood plain and flood fringe. This will provide standards for all development in the flood fringe and should restrict development in the floodway of Spring Creek to minimize adverse impact on life, health, and property.

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

C. Establish conservancy districts for those areas highly conducive to erosion and unsuitable for development.

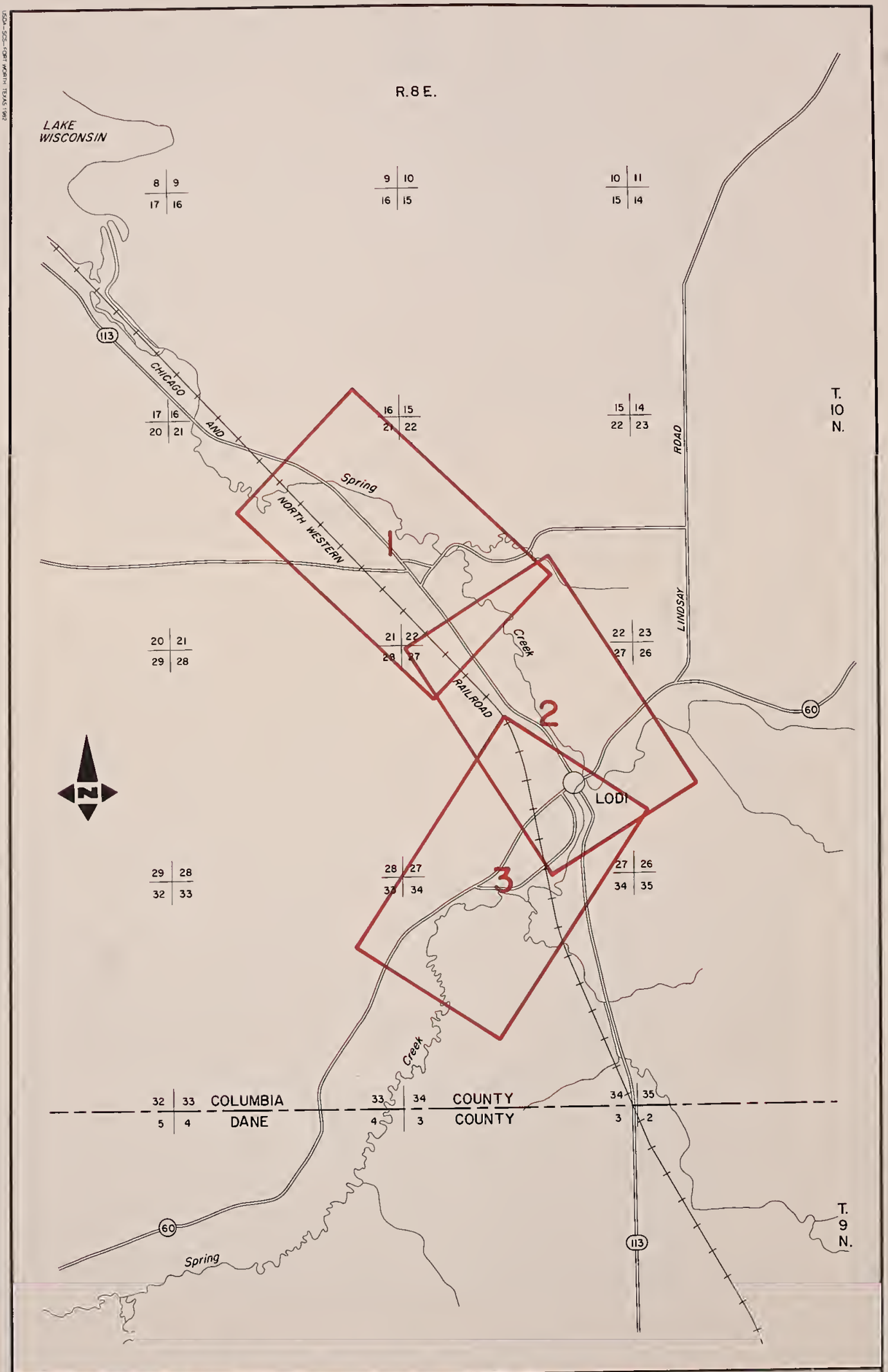
D. Relocate homes in the floodway and flood proof those existing homes in the flood fringe by elevating, filling basements, and providing dry land access during floods.

E. Construct levees, dikes, and dams to confine the 100-year floodflows within the stream channel on floodway. This alternative may have high installation and maintenance costs which should be thoroughly evaluated.

F. Stream channel improvement (snagging and clearing) within the city will improve floodflow capacity and minimize erosion and scour of the stream-banks.

Appendix A

Floodway and Flood Boundary Maps



LEGEND

2 Photomap Coverage

1000 0 1000 2000 3000 Feet

Scale 1:24000

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SOIL CONSERVATION SERVICE
CITY OF LODI
FLOOD HAZARD STUDY
Columbia Co, Wisconsin.

PHOTOMAP INDEX

SPRING CREEK - CITY OF LODI

SHEET 1 OF 1

LEGEND

100 Year Frequency Flood

500 Year Frequency Flood

X RM2 Reference Bench Marks

Streams Channel

(H) Valley Section Location

400 0 400

Scale in Feet

Photography 3-81

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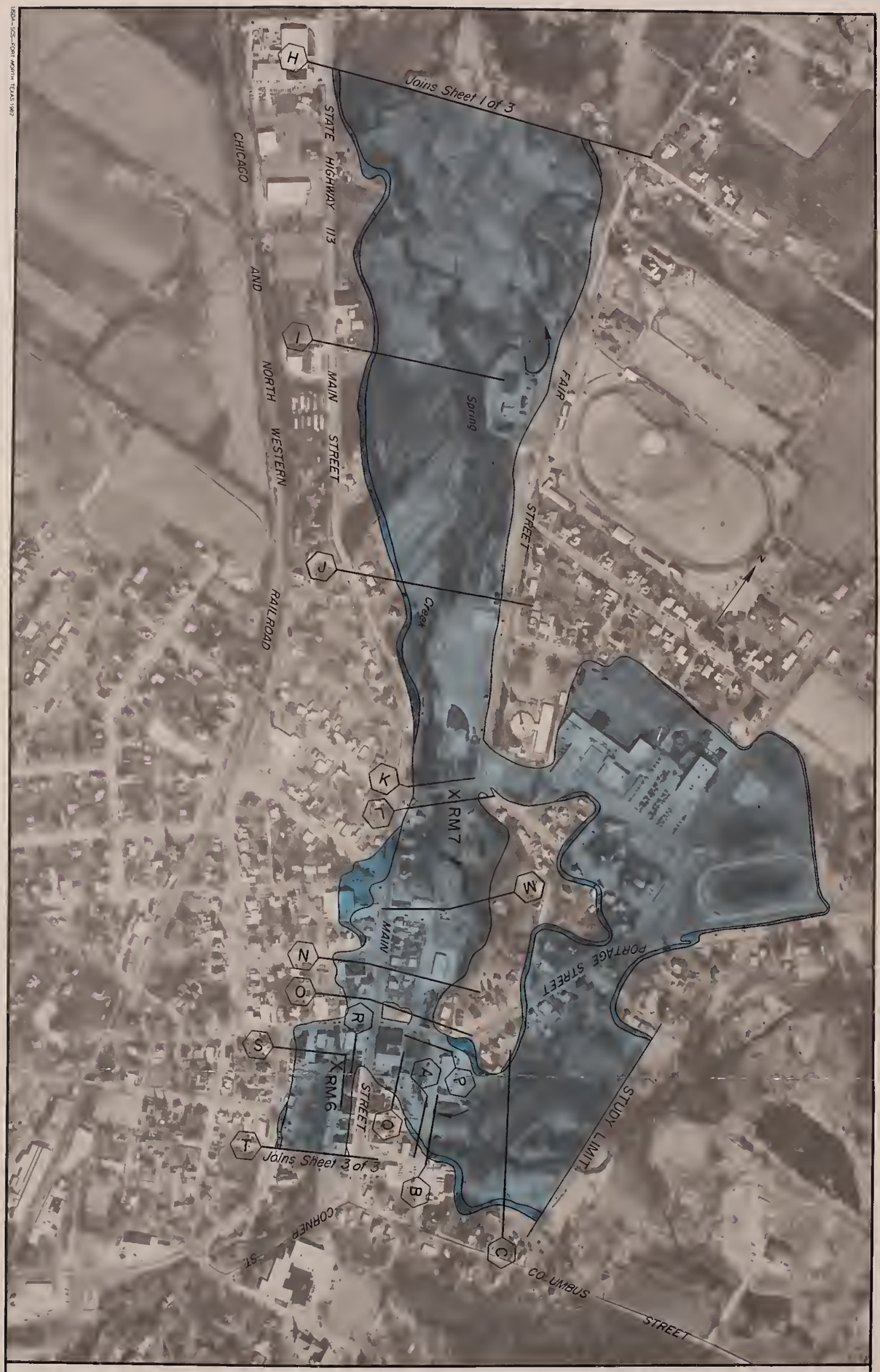
FLOOD HAZARD STUDY
Columbia Co, Wisconsin.

SHEET 1 OF 3

FLOOD HAZARD STUDY

SPRING CREEK - CITY OF LODI



LEGEND

100 Year Frequency Flood

500 Year Frequency Flood

X RM2 Reference Bench Marks

Streams Channel

H Valley Section Location

400 0 400

Scale in Feet

Photography 3-81

SHEET 2 OF 3

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Columbia Co, Wisconsin.

FLOOD HAZARD STUDY

SPRING CREEK - CITY OF LODI

LEGEND

100 Year Frequency Flood

500 Year Frequency Flood

X RM2 Reference Bench Marks

Streams Channel

H Valley Section Location

400 0 400

Scale in Feet

Photography 3-81

SHEET 3 OF 3

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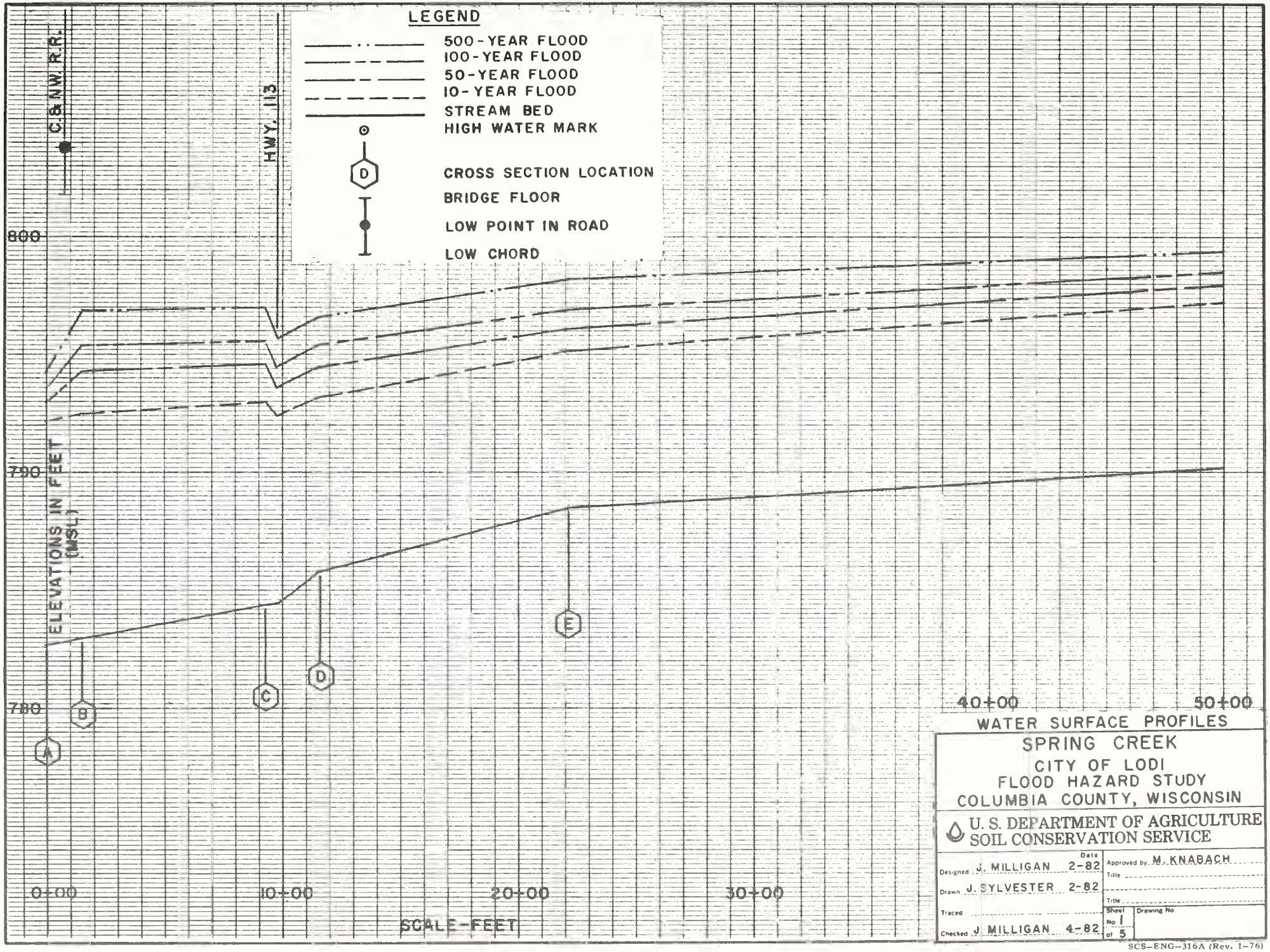
FLOOD HAZARD STUDY
Columbia Co, Wisconsin.

FLOOD HAZARD STUDY

SPRING CREEK - CITY OF LODI

Appendix B

Flood Profiles


LEGEND
500-YEAR FLOOD
100-YEAR FLOOD
50-YEAR FLOOD
10-YEAR FLOOD
STREAM BED
HIGH WATER MARK
D
CROSS SECTION LOCATION
BRIDGE FLOOR
LOW POINT IN ROAD
LOW CHORD
C.&N.W. R.R.
HWY. 113
800
790
780
ELEVATIONS IN FEET (MSL)
A
B
C
D
E
0+00
10+00
20+00
30+00
40+00
50+00
SCALE-FEET
WATER SURFACE PROFILES
SPRING CREEK
CITY OF LODI
FLOOD HAZARD STUDY
COLUMBIA COUNTY, WISCONSIN
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SOIL CONSERVATION SERVICE
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Approved by M. KNABACH
Title
Sheet No. 1 of 5
Drawing No
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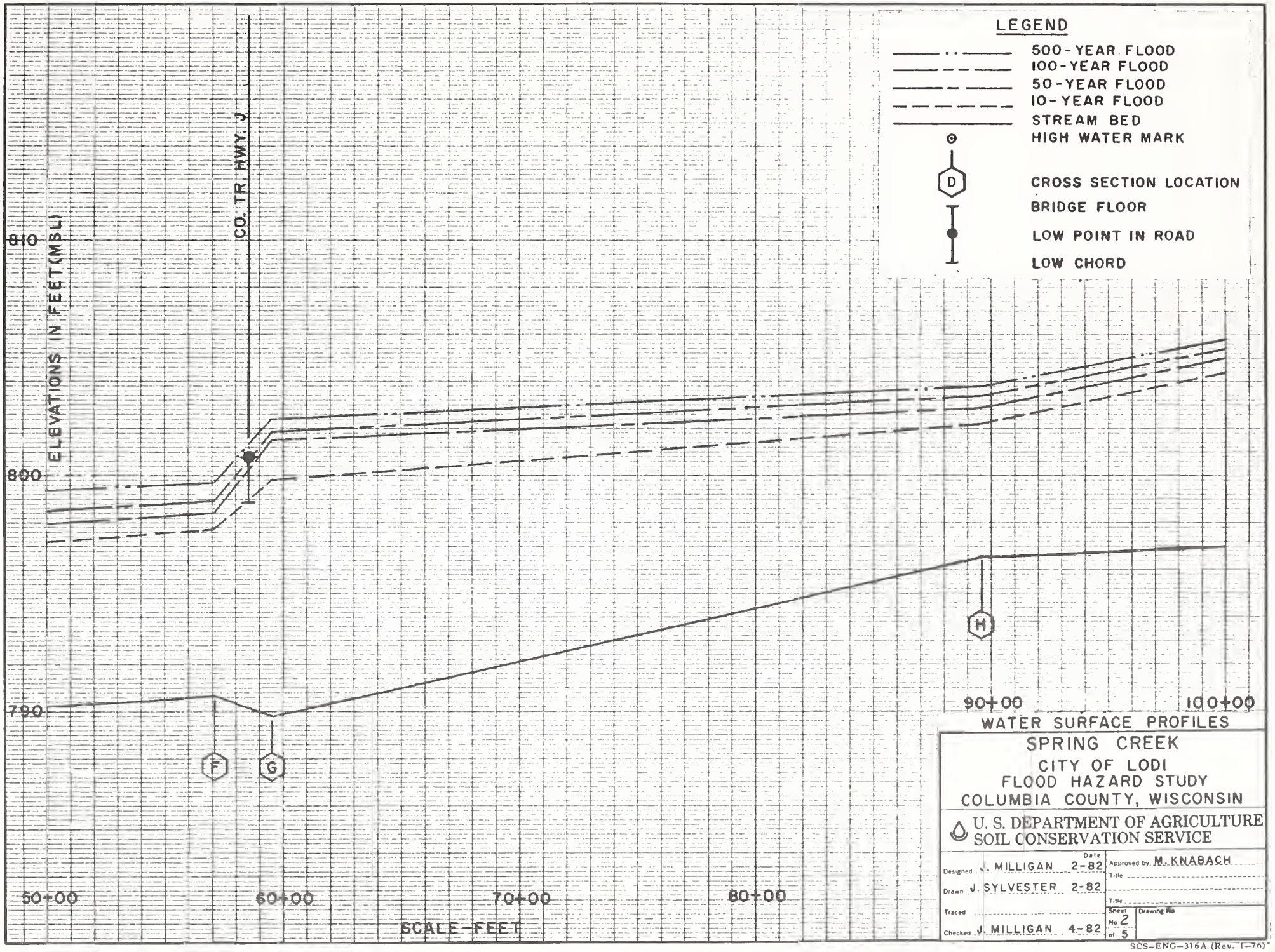

B-2

WATER SURFACE PROFILES

SPRING CREEK
CITY OF LODI
FLOOD HAZARD STUDY
COLUMBIA COUNTY, WISCONSIN

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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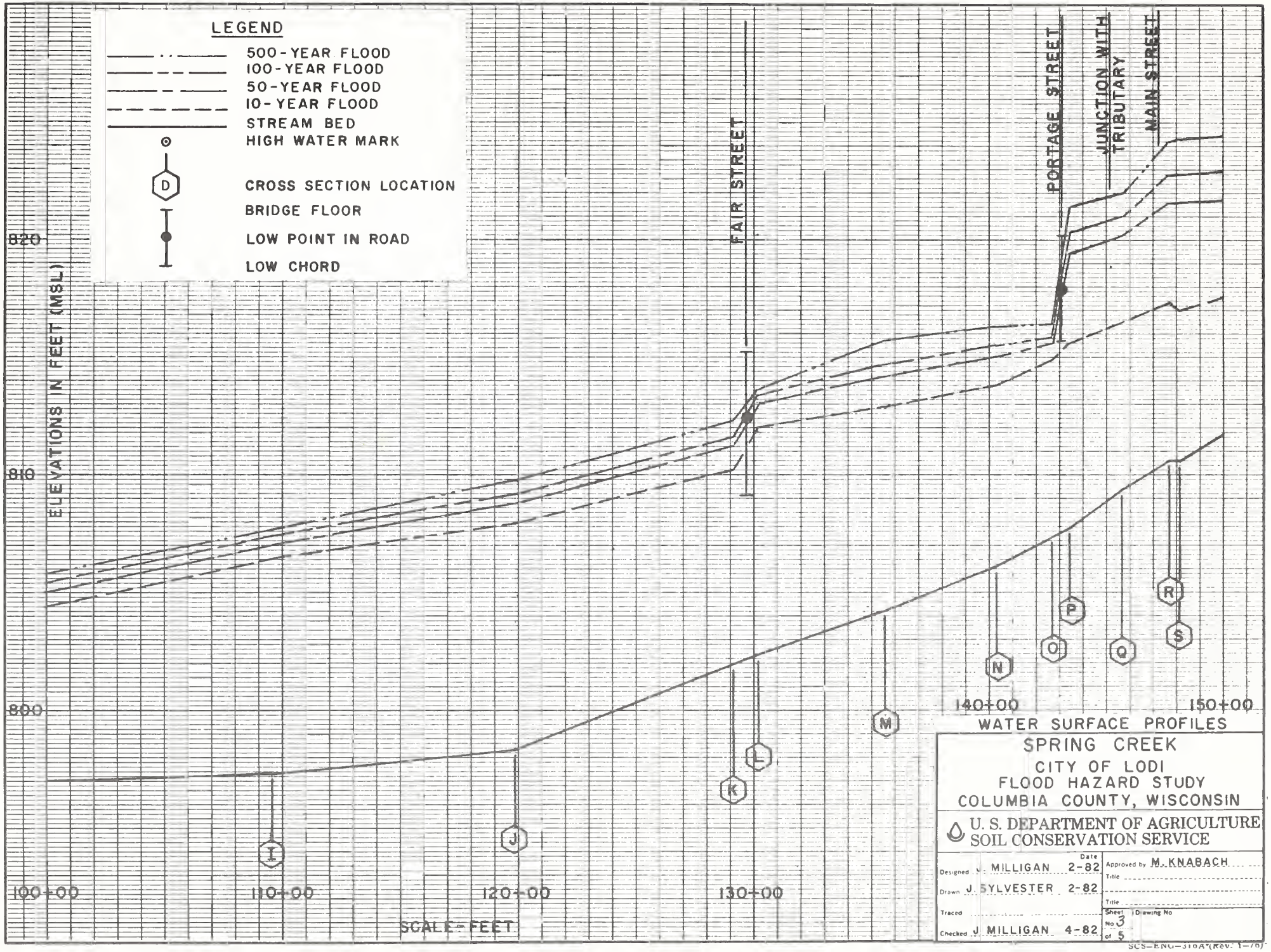

WATER SURFACE PROFILES

SPRING CREEK
CITY OF LODI
FLOOD HAZARD STUDY
COLUMBIA COUNTY, WISCONSIN

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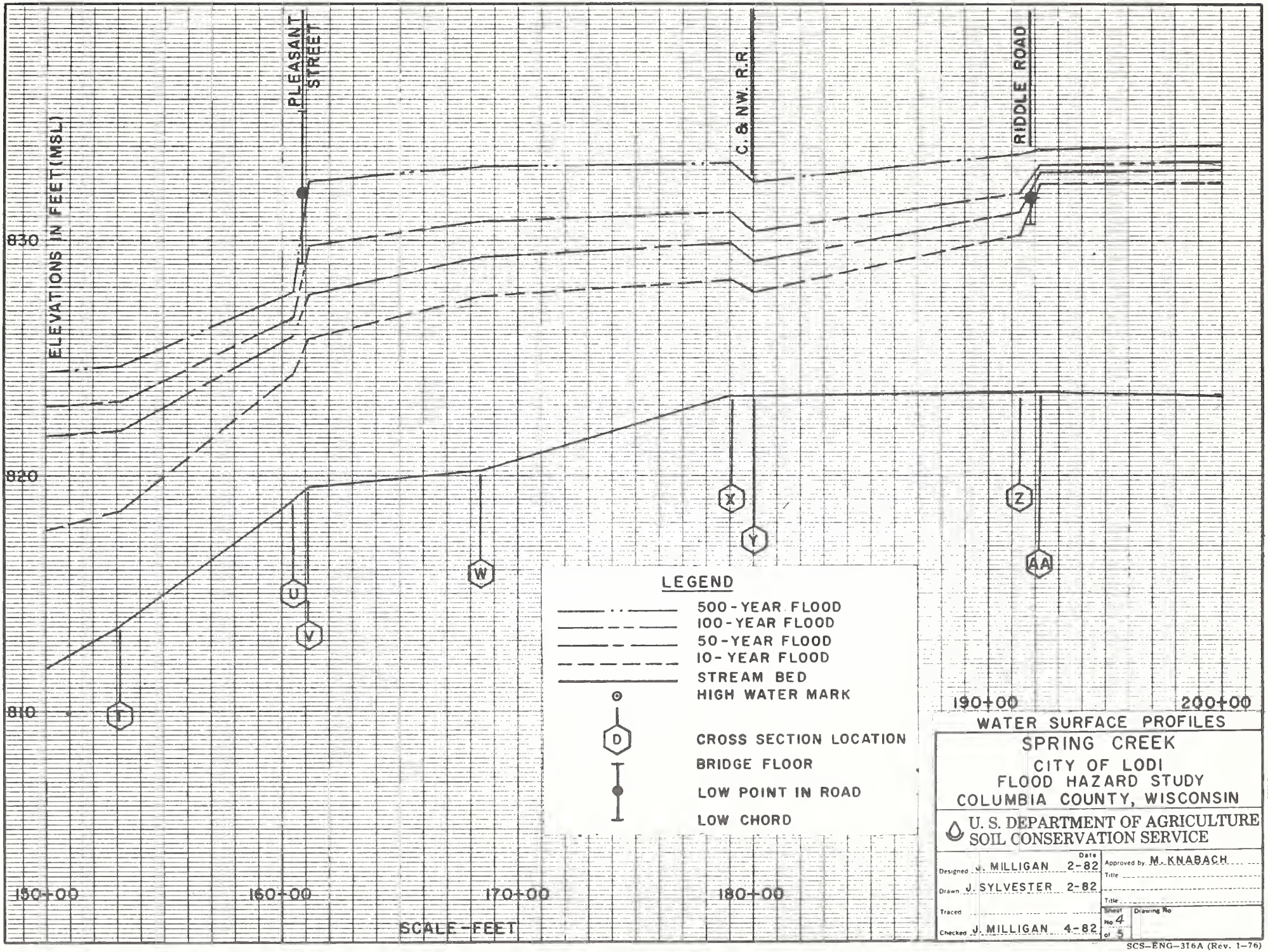

WATER SURFACE PROFILES

SPRING CREEK
CITY OF LODI
FLOOD HAZARD STUDY
COLUMBIA COUNTY, WISCONSIN

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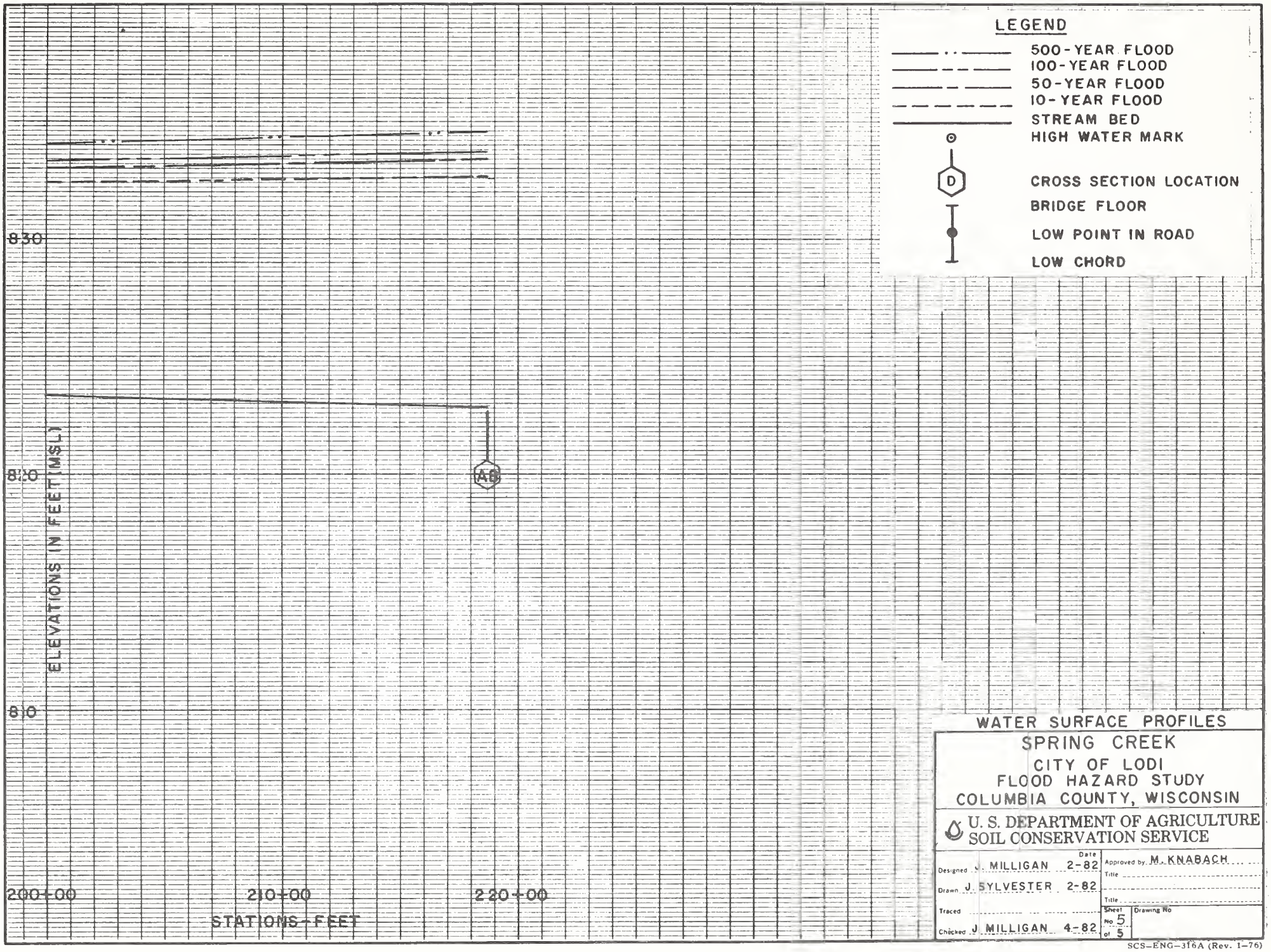

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WATER SURFACE PROFILES

SPRING CREEK
CITY OF LODI
FLOOD HAZARD STUDY
COLUMBIA COUNTY, WISCONSIN

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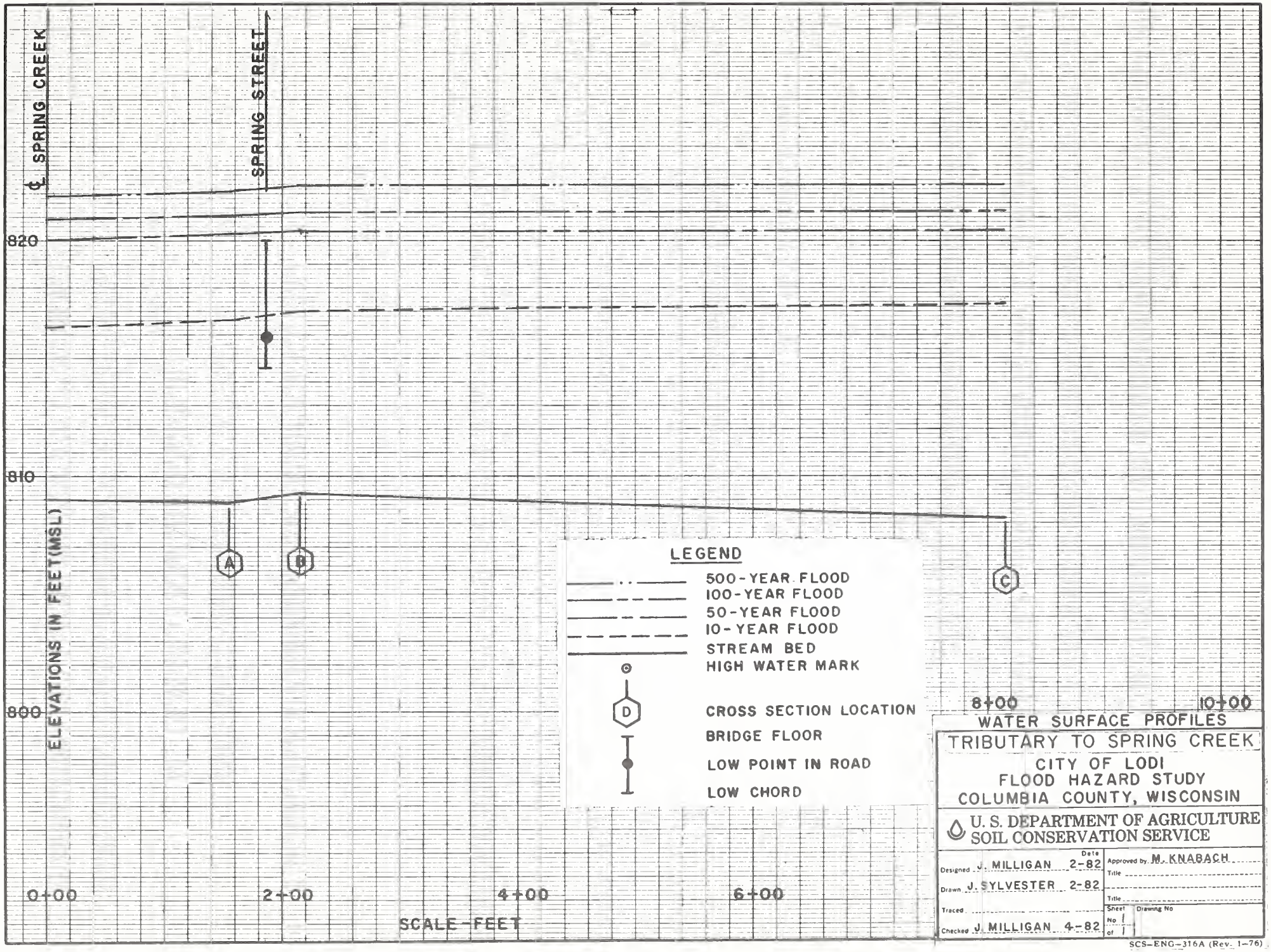

WATER SURFACE PROFILES

TRIBUTARY TO SPRING CREEK

CITY OF LODI
FLOOD HAZARD STUDY
COLUMBIA COUNTY, WISCONSIN

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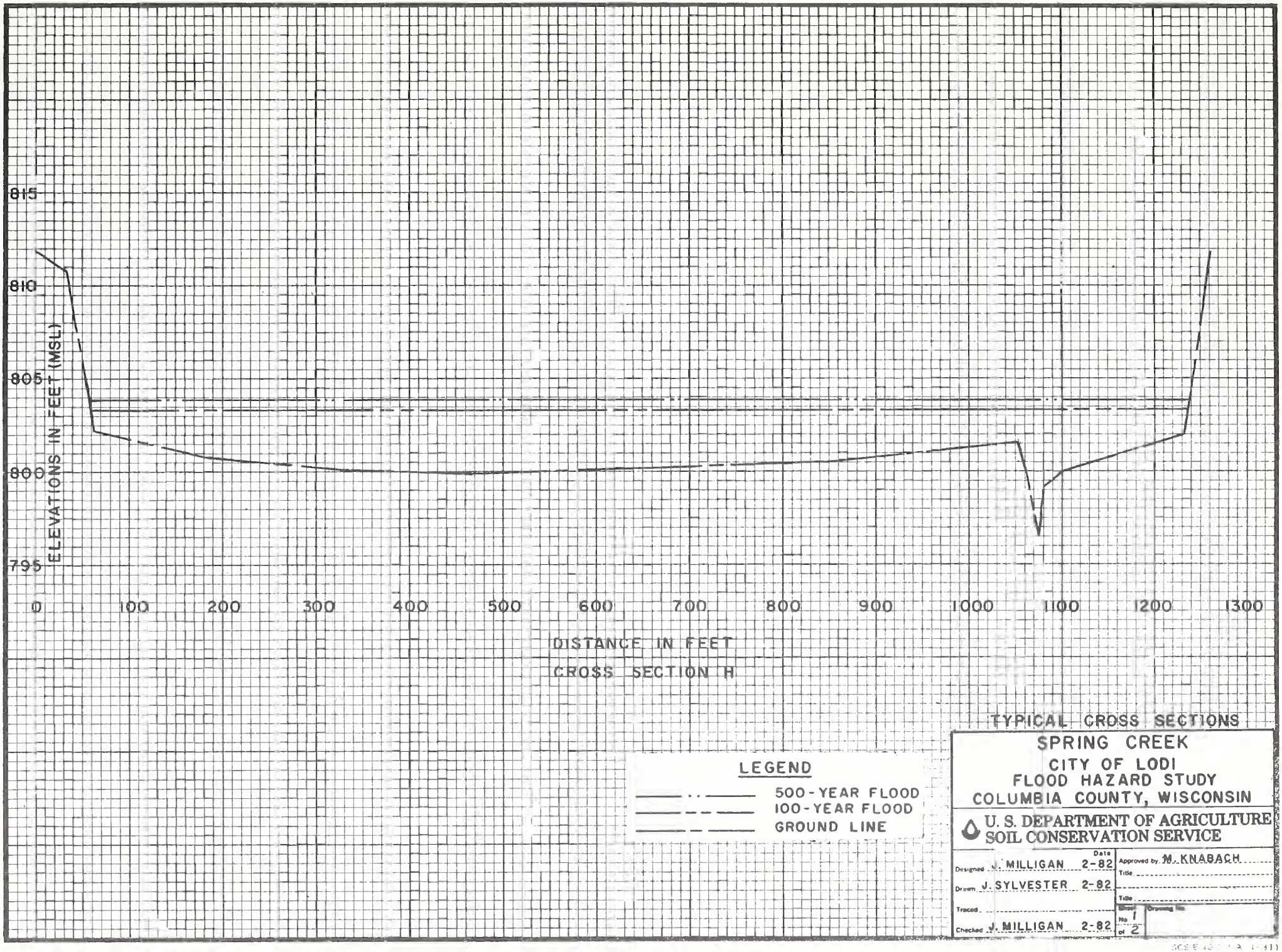
Appendix C

Typical Sections



TYPICAL CROSS SECTIONS

SPRING CREEK
CITY OF LODI
FLOOD HAZARD STUDY
COLUMBIA COUNTY, WISCONSIN

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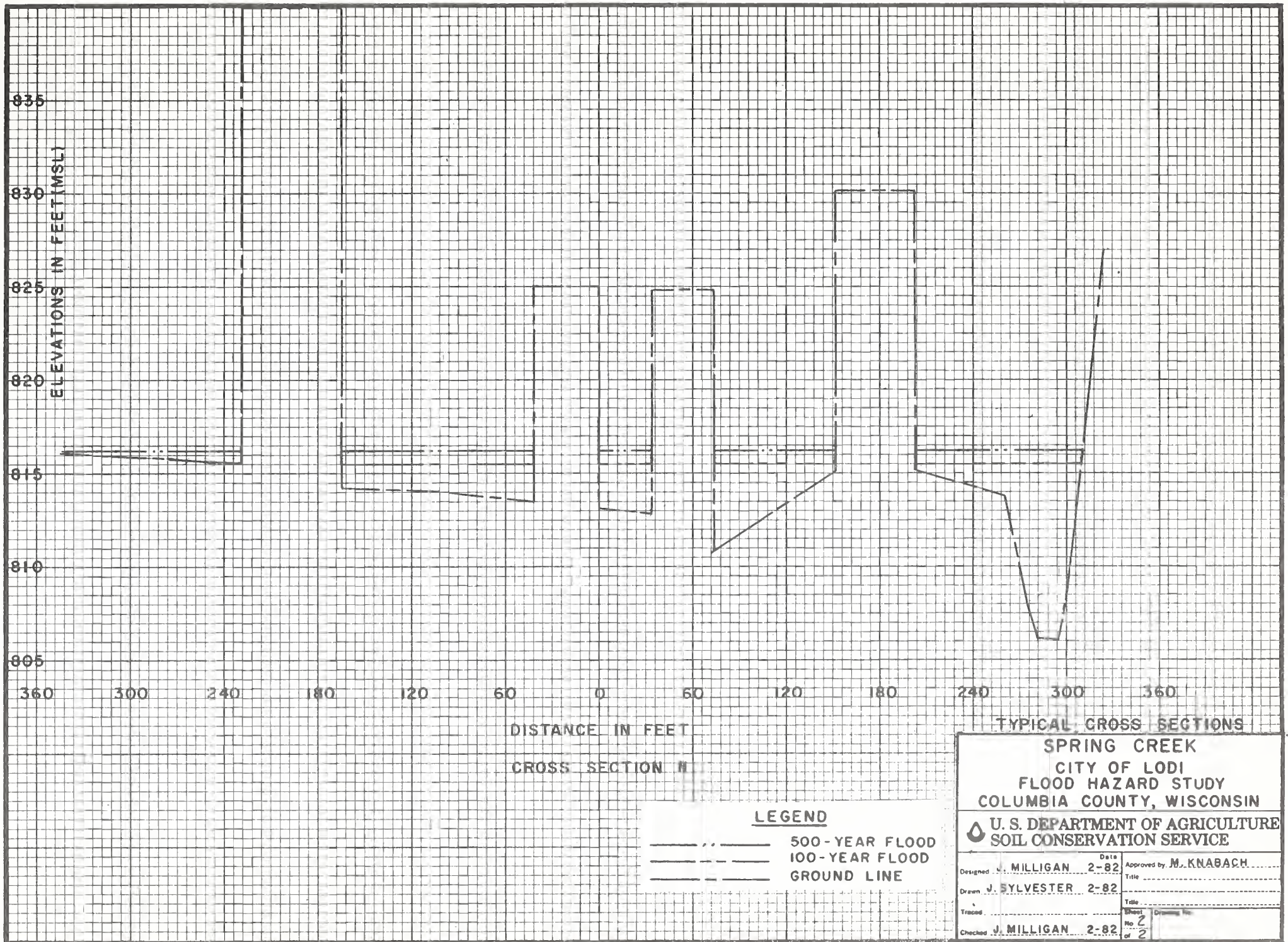

TYPICAL CROSS SECTIONS

SPRING CREEK
CITY OF LODI
FLOOD HAZARD STUDY
COLUMBIA COUNTY, WISCONSIN

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Appendix D

List of Bench Marks

Elevation Reference Marks
City of Lodi

Reference Mark	Elev. (MSL)	Description
1	832.77	USGS - Orange painted square on S.E. bridge wing-wall. The bridge is an extension of Pleasant Street between Highway 113 (Corner Street) and Highway 60 (Water Street).
2	801.57	Top of round headed bolt in the center of the south "curb" timber of county highway "J" bridge over Spring Creek.
3	810.06	Right end of upstream curb of Highway 113 bridge, in northeast quarter of section 21, northwest of Lodi.
4	830.10	Top of outlet end of north pipe arch culvert under Riddle Road. Approximately 100 feet south of Highway "60", NW1/4 of sec. 34, T. 10 N., R 8 E.
5	836.64	Upstream left curb of concrete endwall of culvert on STH "60", approximately 0.5 mile southwest of railroad crossing, south edge of Lodi, NW 1/4, sec. 34.
6	815.76	Southwest end of catch basin grate, north end of parking lot west of stores, west of Main Street and adjacent to right side of river.
7	812.41	Catch basin grate at southeast corner of Fair Street bridge, north end of Lodi.
8	833.45	Centerline of south curb of overpass, 29 feet above west rail of Chicago and Northwestern Railroad, NW 1/4, sec. 21.

Appendix E

Tabulation of
Water Surface Elevations
and
Discharges

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
Spring Creek									
A	0	1964	792.2	2947	793.0	3601	793.6	4677	794.3
	75	Chicago and Northwestern Railroad							
B	150	1964	792.5	2947	794.3	3601	795.4	4677	796.9
C	925	1964	793.0	2947	794.6	3601	795.6	4677	797.0
	975	State Highway 113							
D	1155	1964	793.2	2947	794.5	3601	795.4	4677	796.6
E	2205	1972	795.1	2957	796.1	3614	796.9	4694	798.2
F	5705	1925	797.7	2888	798.4	3530	798.9	4584	799.7
	5855	County Trunk Highway J							
G	5955	1925	799.8	2888	801.5	3530	801.9	4584	802.4
H	8955	1974	802.2	2961	802.9	3619	803.4	4700	803.8
I	10955	2016	806.4	3024	807.0	3696	807.4	4800	807.7
J	11995	2037	807.9	3056	808.8	3735	809.2	4850	809.8
K	12915	2067	810.2	3100	811.2	3790	811.6	4922	812.3
	12965	Fair Street							
L	13015	2067	812.0	3100	813.1	3790	813.4	4922	813.6
M	13555	2067	812.9	3100	814.2	3790	814.7	4922	815.7
N	14035	2067	813.8	3100	815.0	3790	815.5	4922	816.3

1/ Distance in feet from downstream study limit

TABLE 1

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
CITY OF LODI FLOOD HAZARD STUDY
COLUMBIA COUNTY, WISCONSIN

DISCHARGE - ELEVATION DATA

SPRING CREEK

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
Spring Creek (Cont'd)									
O	14255	1773	814.9	2660	815.6	3250	815.9	4222	816.4
	14305	Portage Street (State Highway 60)							
P	14345	1815	815.6	2723	819.5	3328	820.3	4322	821.4
Q	14565	1082	816.5	1624	820.2	1985	821.0	2578	822.0
	14725	Main Street (State Highway 113)							
R	14765	1082	817.3	1624	821.6	1985	822.8	2578	824.2
S	14815	1339	817.0	2008	821.6	2455	822.8	3188	824.3
T	15315	1339	818.5	2008	821.9	2455	823.1	3188	824.6
U	16055	1344	824.3	2016	825.9	2464	826.7	3200	827.8
	16085	Pleasant Street							
V	16115	1344	825.8	2016	827.7	2464	829.7	3200	832.5
W	16845	1421	827.6	2131	829.3	2605	830.8	3383	833.1
X	17905	1421	828.3	2131	829.9	2605	831.2	3383	833.3
Y	18005	1421	827.8	2131	829.1	2605	830.4	3383	832.5
Z	19135	1205	830.2	1808	831.2	2210	832.0	2870	833.7
	19175	Riddle Road							
AA	19215	1205	832.4	1808	832.9	2210	833.2	2870	833.9
AB	21865	1205	832.7	1808	833.4	2210	833.7	2870	834.6

TABLE 1

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
CITY OF LODI FLOOD HAZARD STUDY
COLUMBIA COUNTY, WISCONSIN

DISCHARGE - ELEVATION DATA

SPRING CREEK

Flooding Source		Discharge - Elevation							
Cross section	Distance 1/	10-year		50-year		100-year		500-year	
Tributary at Spring Street		Q CFS	Elev. MSL	Q CFS	Elev. MSL	Q CFS	Elev. MSL	Q CFS	Elev. MSL
A	155	966	816.6	1449	820.3	1771	821.1	2300	822.1
	185	Spring Street							
B	215	966	817.0	1449	820.3	1771	821.2	2300	822.3
C	815	966	817.3	1449	820.5	1771	821.3	2300	822.4

TABLE 1

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
CITY OF LODI FLOOD HAZARD STUDY
COLUMBIA COUNTY, WISCONSIN

DISCHARGE - ELEVATION DATA

TRIBUTARY AT SPRING STREET

Appendix F

Investigations and Analysis

Investigation and Analysis

A hydraulic model of Spring Creek was put together utilizing cross section survey data provided by the city and supplemented with additional survey data. A computer program setup to compute the water depth for a given flow called WSP2 Computer Program, Technical Release No. 61, was used to compute rating curves for the various surveyed cross sections and bridges.

The drainage basin was divided into smaller subbasins to provide the appropriate flow figures at selected locations. The physical data for each basin such as soils, slope, type of land use, channel length, and rainfall were modeled into a computer program called (Computer Program for Project Formulation, Hydrology-SCSTR20). Four rainfalls were used in the model. The 10-year, 50-year, 100-year, and 500-year return frequencies were obtained from the U.S. Weather Bureau Technical Paper No. 40. The flows were compared to previous work done for the sewage plant, which included US Geologic Service gaged watersheds of similar characteristics. The high water on September 9, 1965 was traced to a rainfall of 4.7 inches recorded at Prairie du Sac. It is not known whether the storm was uniform over the entire watershed or not. The flow at the swimming pool was between 1,100 and 1,200 cfs based on the hydraulic model. This flow is slightly less than the 10-year return frequency flow. Lodi Marsh reduces the peak flow from 8,000 cfs to 2,200 cfs. The marsh east of Spring Street tempers the peak such that there is no increase in the peak as the drainage area increases from 7 square miles to 9 square miles. The additional water spreads out and is stored in the flat marsh and does not contribute to the peak flow.

The floodflows were inserted into the water surface profile model producing the water surface elevation at each cross section and bridge. The discharges and elevations for each cross section are shown in appendix E. The cross section locations and flood boundaries are shown on photo maps in appendix A. The photomaps were made from aerial photo contact prints flown in 1979 by the Wisconsin Department of Transportation. Comparing the 100-year flood elevation (known as the regional flood) with the contour maps, it was discovered flow would occur through the alleys onto Lodi Street bypassing the Main Street bridge. The diverted flow was subtracted from the flow downstream of Main Street. The same thing occurs at Portage Street. The diverted flow proceeds down Main Street (Highway 113) and rejoins the stream north of Second Street.

The water surface profiles are shown in appendix B.

Appendix G

Glossary

GLOSSARY

CHAPTER NR. 116, WISCONSIN'S FLOOD PLAIN 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.

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 other side of a river or stream for a hydraulic reach. This computation assures that property owners up, down, or across the river or stream will have the same rights of hydraulic encroachment. Encroachments are analyzed on the basis of the effect upon hydraulic conveyance, not upon the distance the encroachment extends into the floodway. Also see: Hydraulic Reach.

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 flood plain 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.

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

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

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 flood plain 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 flood plains 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 flood plain 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 flood plain areas.

Appendix H

Bibliography

Bibliography and Related References

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United States
Department of
Agriculture

Soil
Conservation
Service

4601 Hammersley Road
Madison, Wisconsin 53711

March 4, 1983

Deputy Director for Technical
Information Systems
Science and Education Administration
NAL Building, Room 200
Beltsville, Maryland 20705

Dear Sir:

Enclosed is a copy of the recently completed "Flood Hazard Study Report, City of Lodi, Columbia County, Wisconsin." This study was made at the request of the city of Lodi through the Columbia County Land Conservation Committee and the Wisconsin Department of Natural Resources in accordance with the Department's October 1978 joint coordination agreement with the Soil Conservation Service.

This study was carried out under the authority of Section 6 of Public Law 83-566, in accordance with Executive Order 11988, and House Document No. 465, 89th Congress, 2d Session, especially recommendation 9(c), "Regulation of Land Use." The purpose of the study is to make flood hazard and land use information available to the local government and citizens to encourage land use appropriate to the degree of hazard involved.

The Soil Conservation Service's objective in developing these technical data is to help reduce present and potential flood damages through wise use of flood plain lands thereby improving the health, safety, economy, and environmental conditions of the county.

Sincerely,

Cliffton A. Maguire
State Conservationist

Enclosure

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