

**Special Flood Hazard
Evaluation Report**

**City of Ravenna
Portage County, Ohio**

AD-A201 738



**Prepared
for the Ohio
Department of Natural Resources**



**US Army Corps
of Engineers
Buffalo District**

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SPECIAL FLOOD HAZARD
EVALUATION REPORT

UNNAMED TRIBUTARIES
CITY OF RAVENNA
PORTAGE COUNTY, OHIO

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SPECIAL FLOOD HAZARD EVALUATION REPORT

UNNAMED TRIBUTARIES CITY OF RAVENNA PORTAGE COUNTY, OHIO

INTRODUCTION

This Special Flood Hazard Evaluation Report was prepared by the Buffalo District, Corps of Engineers at the request of the Ohio Department of Natural Resources under the authority of Section 206 of the 1960 Flood Control Act, as amended. The study investigates the potential flood stage along two unnamed tributaries in the city of Ravenna, Ohio, which would occur from a 100-year flood event.

The city of Ravenna is located in Portage County, Ohio, in northeastern Ohio and is bordered to the west, north, east, and south by the towns of Franklin, Shalersville, Charlestown, and Rootstown, respectively.

The waterways studied include an unnamed tributary of the West Branch Mahoning River which, in this study, has been designated Freedom Creek. It was studied from its source near Highland Avenue, downstream to the corporate limit at Peck Road. The other stream is an unnamed tributary of Breakneck Creek, which flows into the Cuyahoga River. In this study, it was designated Hommon Creek. It was studied from the upstream study limit at Diamond Street downstream to its confluence with Wahoo Ditch. The hydraulic analysis, however, was extended downstream of Wahoo Ditch to determine any backwater effects of the Lakewood Road culvert.

The information developed by the Freedom Creek study will be used by local governments to manage future flood plain development in this area, especially in the upstream portion of the watershed which is being extensively developed as a residential area. The information developed by the Hommon Creek study will assist in development plans for the city of Ravenna's wastewater treatment plant as well as guide future flood plain development in the area.

While the report does not furnish a solution to flood problems, it does provide a suitable basis for adoption of land use controls to guide flood plain development, thereby preventing intensification of the flood damage problem. It will also aid in the development of other flood damage reduction techniques to modify flooding and reduce existing and future flood damages.

PRINCIPAL FLOOD PROBLEMS

The past history of flooding in northeastern Ohio indicates that flooding may occur during any season of the year. The majority of the major floods occur during winter and spring months and are usually the result of spring rains and/or snowmelt. Summer cyclonic storms, moving out of the southwest, have also produced rainfall of high intensity over the study area and caused widespread flooding. However, past flood events are not well documented within the city of Ravenna. The flooding along both streams occurs because of rather

small channel capacities. Also, undersized culverts elevate flood heights along Freedom Creek.

FUTURE FLOODS

Floods of the same or larger magnitude as those that have occurred in the past are likely to occur in the future. Floods larger than those that have occurred on the two creeks under study have been experienced in the past on other streams with similar geographical and physiographic characteristics. Similar combinations of rainfall and runoff which caused these floods could occur within the study area. Therefore, to assess the flooding potential within the study area, hydrologic analyses were carried out to establish the peak discharge-frequency relationship for a 100-year flood event on each creek.

Floods are classified on the basis of their frequency or return period. A 100-year flood is an event whose magnitude can be expected to be exceeded on the average of once every hundred years. The 100-year event has a 1 percent chance of exceedence in any given year. It is important to note that, while on a long-term basis the exceedence averages out to one per hundred years, floods of this magnitude can occur in any given year or even in consecutive years and within any given time interval. For example, there is a greater than 50 percent probability that a 100-year flood event will occur during a 70-year lifetime. Additionally, a house which is built at the 100-year flood level has about a one in four chance of being flooded in a 30-year mortgage life.

There are no USGS stream gaging stations in the vicinity of the study area; therefore, 100-year peak discharges for Freedom and Harmon Creeks were determined using a model developed by the Soil Conservation Service (Reference 1). This model, TR-20, is a computerized model that has the capability to develop runoff hydrographs, route hydrographs through channel reaches and reservoirs, and combines or separates hydrographs at confluences. Required input data for this model includes drainage area, runoff curve number, time of concentration, and the antecedent soil moisture condition for each subbasin. In addition, each channel reach must be a specified length and the elevation-discharge and end-area relationship must be specified.

Freedom Creek was divided into a total of six reaches for the hydrologic analyses. Reach 1 is located from the outlet of the pond in the upper part of the watershed to Sapp Road. Reach 2 extends from Sapp Road to Coe Road. Reach 3 is located along the channelized portion of Freedom Creek from the North Drive culvert to Coe Road. Reach 4 extends from the North Drive culvert to just upstream of the confluence with Harmon Brook. Reach 5 extends along Harmon Brook from its confluence with Freedom Creek upstream to Freedom Road. Reach 6 is located from the confluence of Harmon Brook to the inlet of the pond near Peck Road. Harmon Creek was also divided into two reaches, numbered 7 and 8. Reach 7 extends from the upstream study limit to Wahoo Ditch. Reach 8 extends from the Lakewood Road bridge to Wahoo Ditch.

A summary of the input data and the resulting 100-year peak discharges are shown in Table 1.

Table 1 - Summary of Input Data for TR-20 and 100-Year Peak Discharges

Flooding Source and Location	Drainage Area (Mi ²)	Runoff Curve Number	Main Stem Time of Concentration (hr)	Peak Discharge (cfs) 100-Year
<u>Freedom Creek</u>				
Reach 1	.12	73	1.11	70
Reach 2	.32	73	.81	115
Reach 3	.41	73	.30	120
Reach 4	.83	73	2.28	195
Reach 5	2.85	73	.66	1,625
(Harmon Brook)				
Reach 6	3.92	73	.65	1,630
<u>Hommon Creek</u>				
Reach 7	.99	73	1.11	115
Reach 8	3.65	73	.65	375

FLOODED AREA ANALYSES

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the 100-year recurrence interval.

Cross section data for the backwater analyses were obtained from field surveys and USGS topographic maps (Reference 2). All bridges and culverts were surveyed to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Plates 1 and 2) and Flooded Area Maps (Plates 3 and 4) where applicable.

Water surface elevations of the 100-year recurrence interval flood were computed using the COE HEC-2 step-backwater computer program (Reference 3). The starting water surface elevation for Freedom Creek was determined using critical depth at the weir structure located at Peck Road. The starting water surface elevation for Hommon Creek was determined using normal depth, approximately 950 feet downstream of its confluence with Wahoo Ditch.

Channel and overbank roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgement and were based on field observations of the streams and flood plain areas. The channel "n" values for the creeks studied are shown in Table 2, "Summary of Manning's "n".

Contraction and expansion coefficients, used in the backwater analyses for both creeks, can be found in Table 3, "Summary of Contraction and Expansion Coefficients."

The computed 100-year water surface profiles for Freedom Creek and Hommon Creek are shown on Plates 1 and 2, respectively. The flood plain boundaries are shown on Plates 3 and 4. These boundaries were delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using USGS topographic maps and spot elevations obtained during the field surveys. Small areas within the flood plain boundaries may be above the flood elevations, but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

Table 2 - Summary of Manning's "n"

Flooding Source	Manning's "n"	
	Channel	Overbank
Freedom Creek	.012-.07	.04-.15
Hommon Creek	.020-.045	.04-.07

Table 3 - Summary of Contraction and Expansion Coefficients

Flooding Source	Coefficients	
	Contraction	Expansion
Freedom Creek	.1-.4	.3-.8
Hommon Creek	.1-.3	.3-.5

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks established during the field surveys are shown on Plates 3 and 4; the descriptions of the marks for Freedom Creek and Hommon Creek are presented in Tables 4 and 5, respectively.

Table 4 - Elevation Reference Marks (Freedom Creek)

Reference Mark	Elevation (Feet NGVD)	Description of Location
RM-1	1,075.21	North corner of upstream headwall of Peck Road - Freedom Creek culvert.
RM-2	1,087.85	Elevation taken on top of nut on main steamer nozzle of fire hydrant located on south side of Lover's Lane (Loomis Parkway); approximately 1,650 feet east of St. Rt. 88.
RM-3	1,088.06	Chiseled triangle on downstream south headwall of Conrail RR - Freedom Creek box culvert.
RM-4	1,097.32	Elevation taken on top of nut on main steamer nozzle of fire hydrant located on west side of Freedom Road; approximately 200 feet north of railroad tracks.
RM-5	1,099.67	Chiseled square on northwest corner of upstream headwall of Coe Road - Freedom Creek culvert.
RM-6	1,114.01	Elevation taken on north rim of the top of the casting of sanitary manhole (F103) at end of Sapp Road, north side of street.
RM-7	1,124.71	Elevation taken on north rim of the top of the casting of sanitary manhole (F107) at intersection of Midland Avenue and Linden Street.

Table 5 - Elevation Reference Marks (Hommon Creek)

Reference Mark	Elevation (Feet NGVD)	Description of Location
RM-1	1,062.96	Elevation taken on the north rim of the top of the casting of sanitary manhole B-1, located on south side of Hommon Road; approximately 1,200 feet west of Diamond St.
RM-2	1,058.20	Chiseled square (yellow) on downstream right abutment of Lakewood Road bridge over Hommon Creek.

CONCLUSION

This report presents local flood hazard information for Freedom and Hommon Creeks in Portage County. The U.S. Army Corps of Engineers, Buffalo District, will provide interpretation and limited technical assistance in the application of the data contained in this report, particularly as to its use in developing effective flood plain regulations. Requests should be coordinated through the Ohio Department of Natural Resources, Division of Water.

REFERENCES

1. U.S. Department of Agriculture, Soil Conservation Service, Technical Release 20 (TR-20) Computer Program for Project Formulation, Hydrology, May 1982.
2. U.S. Geological Survey, Topographic Maps, Scale 1:24000, Contour Interval 10 feet: Kent and Ravenna, Ohio, photorevised 1970.
3. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water-Surface Profiles Generalized Computer Program, Davis, California, updated 1984.

GLOSSARY

BACKWATER	The resulting high water surface in a given stream due to a downstream obstruction or high stages in an intersecting stream.
BASE FLOOD	A flood which has an average return interval in the order of once in 100 years, although the flood may occur in any year. It is based on statistical analysis of streamflow records available for the watershed and analysis of rainfall and runoff characteristics in the general region of the watershed. It is commonly referred to as the "100-year flood."
DISCHARGE	The quantity of flow in a stream at any given time, usually measured in cubic feet per second (cfs).
FLOOD	An overflow of lands not normally covered by water. Floods have two essential characteristics: The inundation of land is temporary and the lands are adjacent to and inundated by overflow from a river, stream, ocean, lake, or other body of standing water. Normally, a "flood" is considered as any temporary rise in streamflow or stage, but not the ponding of surface water, that results in significant adverse effects in the vicinity. Adverse effects may include damages from overflow of land areas, temporary backwater effects in sewers and local drainage channels, creation of unsanitary conditions or unfavorable situations by deposition of materials in stream channels during flood recessions, and rise of groundwater coincident with increased streamflow.
FLOOD FREQUENCY	A statistical expression of the percent chance of exceeding a discharge of given magnitude in any given year. For example, a <u>100-year flood</u> has a magnitude expected to be exceeded on the average of once every hundred years. Such a flood has a 1 percent chance of being exceeded in any given year. Often used interchangeably with RECURRENCE INTERVAL.
FLOOD PLAIN	The areas adjoining a river, stream, watercourse, ocean, lake, or other body of standing water that have been or may be covered by floodwater.
FLOOD PROFILE	A graph showing the relationship of water surface elevation to location; the latter generally expressed as distance upstream from a known point along the approximate centerline of a stream of water that flows in an open channel. It is generally drawn to show surface elevation for the crest of a specific flood, but may be prepared for conditions at a given time or stage.

GLOSSARY (Cont'd)

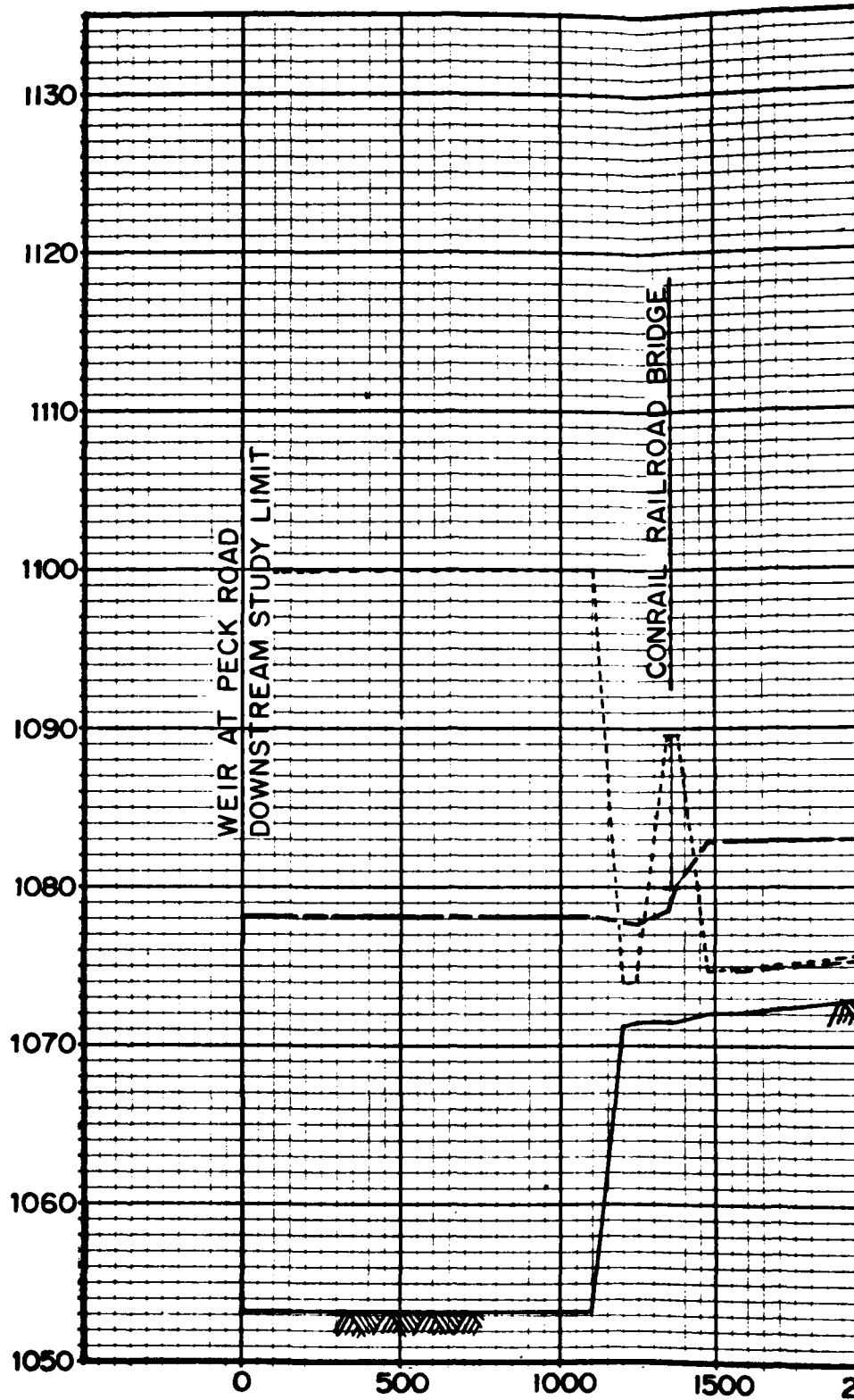
FLOOD STAGE

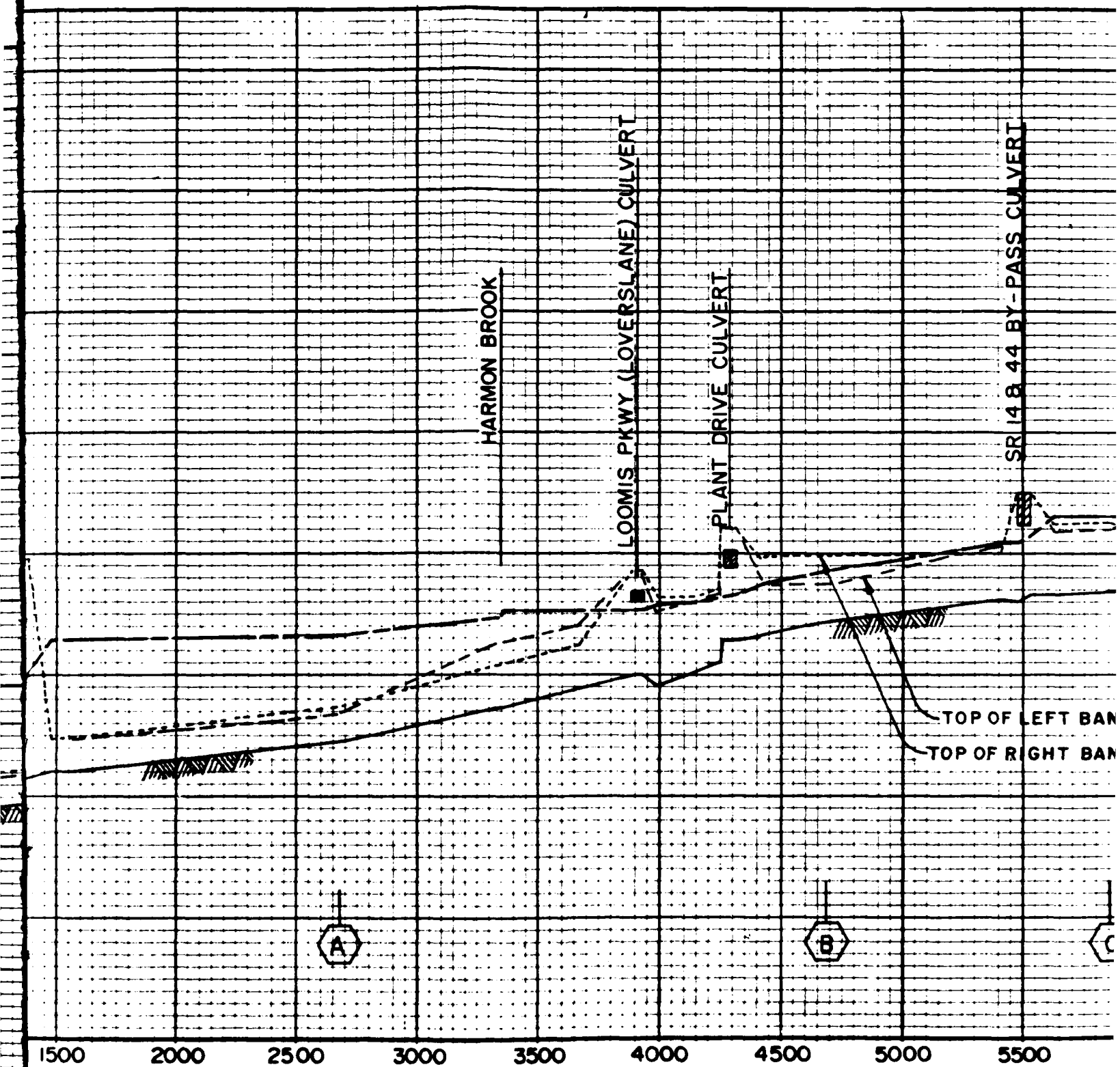
The stage or elevation at which overflow of the natural banks of a stream or body of water begins in the reach or area in which the elevation is measured.

RECURRENCE INTERVAL

A statistical expression of the average time between floods exceeding a given magnitude (see FLOOD FREQUENCY).

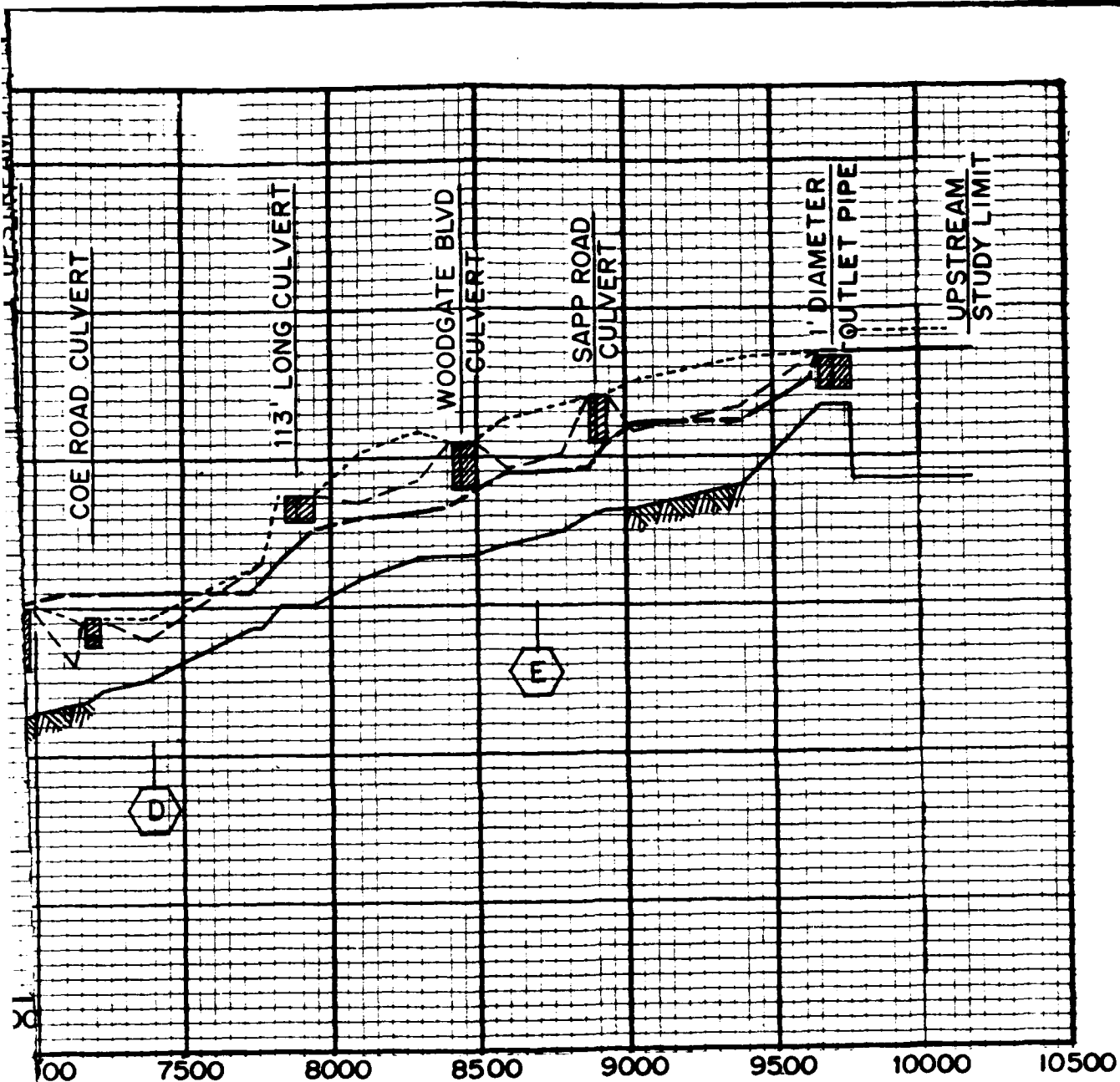
ELEVATION IN FEET - NGVD





DISTANCE IN FEET
FROM WEIR CREST AT PECK ROAD

2



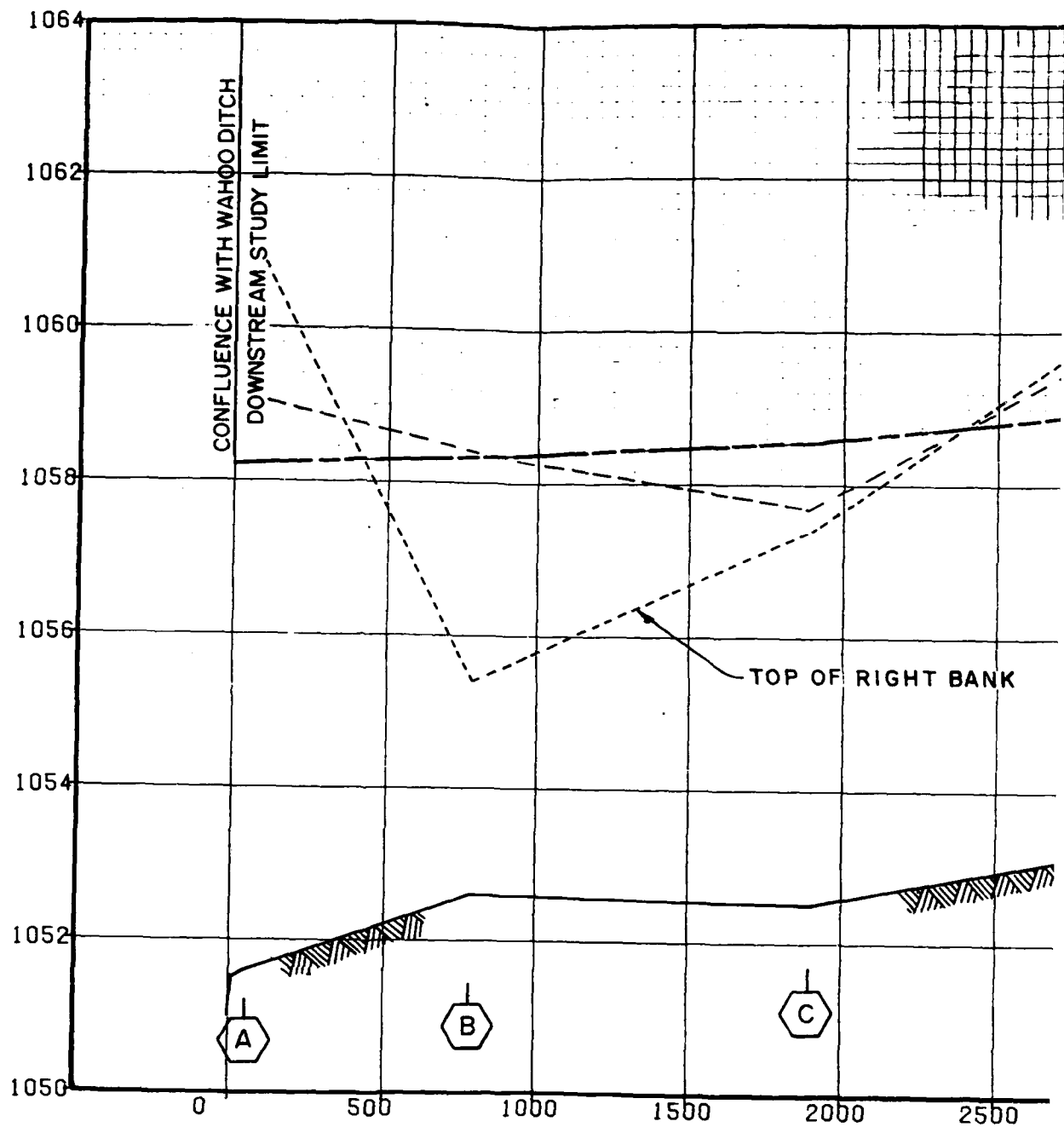
— 100-YEAR FLOOD
 - - - CHANNEL BOTTOM
 ... CROSS SECTION LOCATION

CITY OF RAVENNA, OHIO
 FLOOD HAZARD EVALUATION

FREEDOM CREEK
 FLOOD PROFILE

U.S. ARMY ENGINEER DISTRICT, BUFFALO
 SEPTEMBER 1988

ELEVATION IN FEET - NGVD



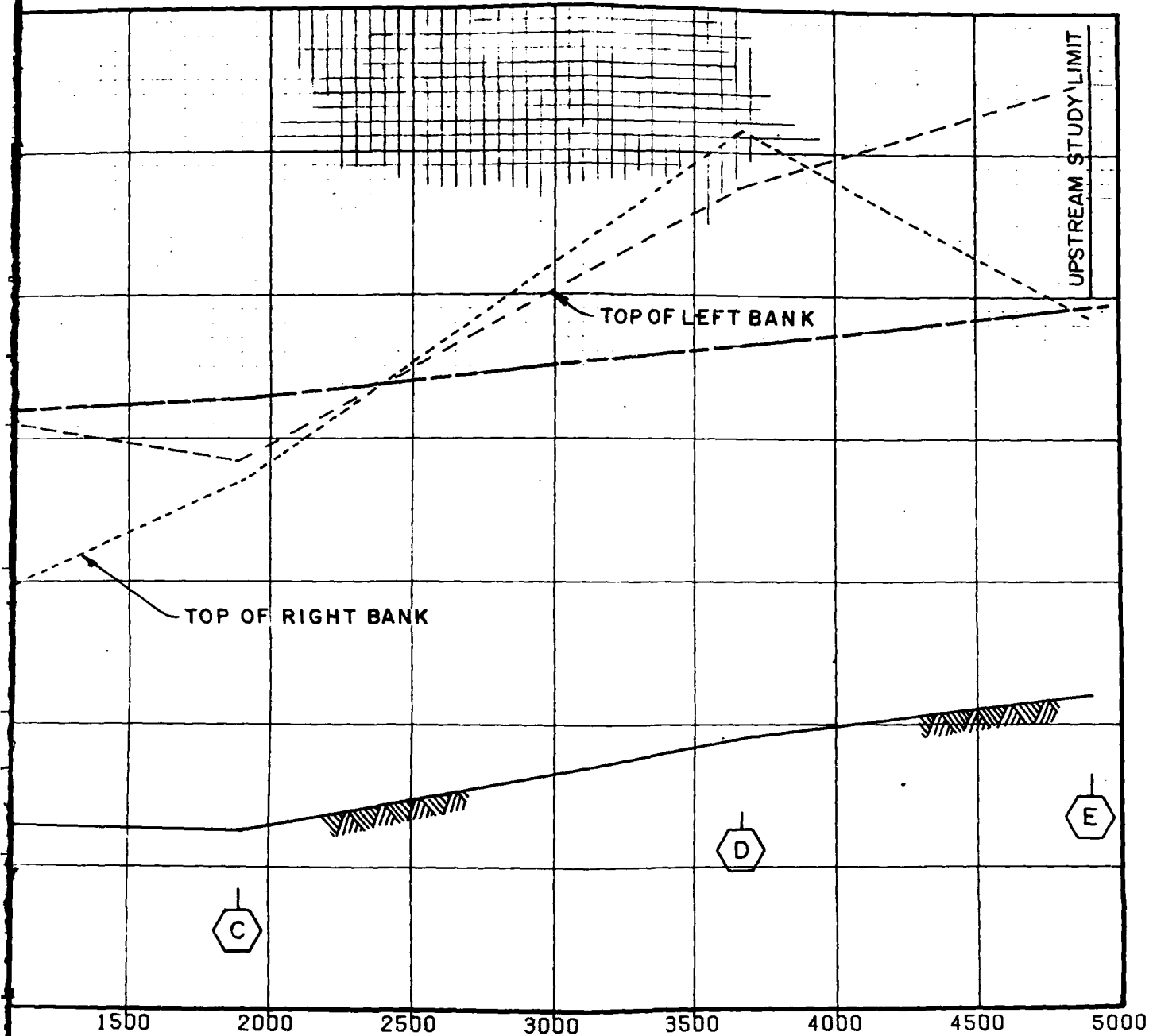
LEGEND:

—— 100-YEAR FLOOD

▨ CHANNEL BOTTOM

⬡ CROSS SECTION LOCATION

DISTANCE IN FEET
MEASURED FROM THE CONFLUENCE
WITH WAHOO DITCH

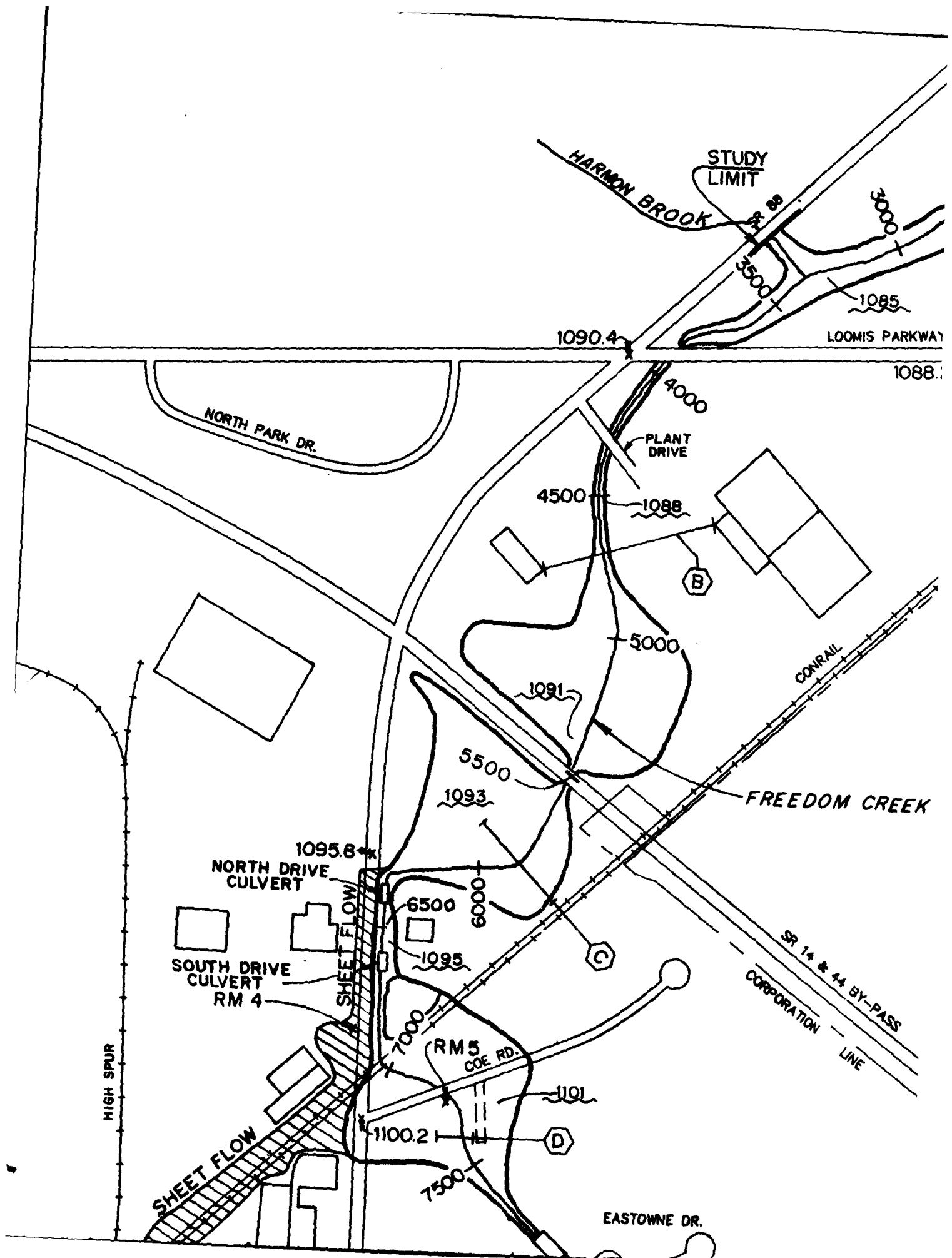


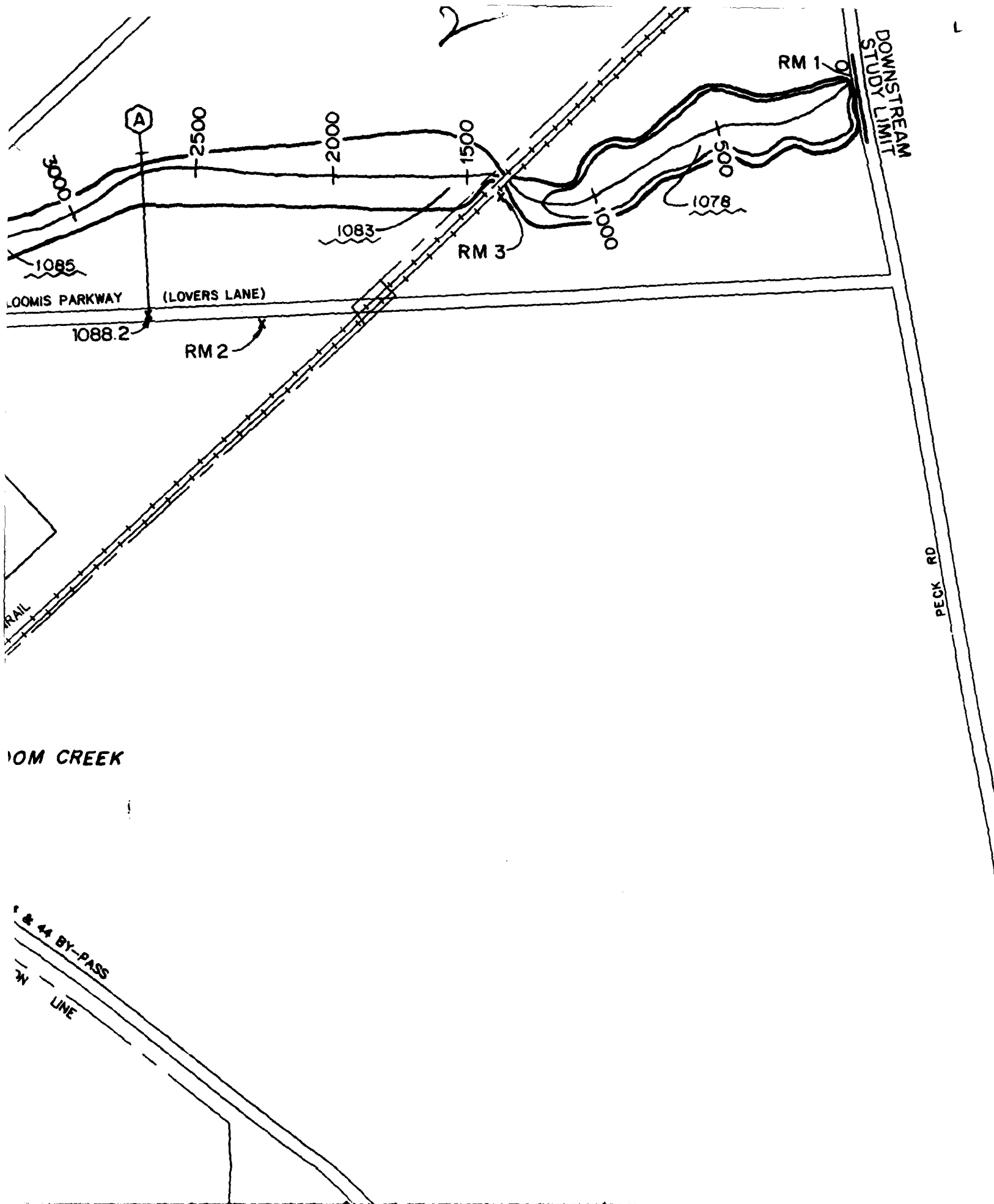
DISTANCE IN FEET
MEASURED FROM THE CONFLUENCE
WITH WAHOO DITCH

CITY OF RAVENNA, OHIO
FLOOD HAZARD EVALUATION

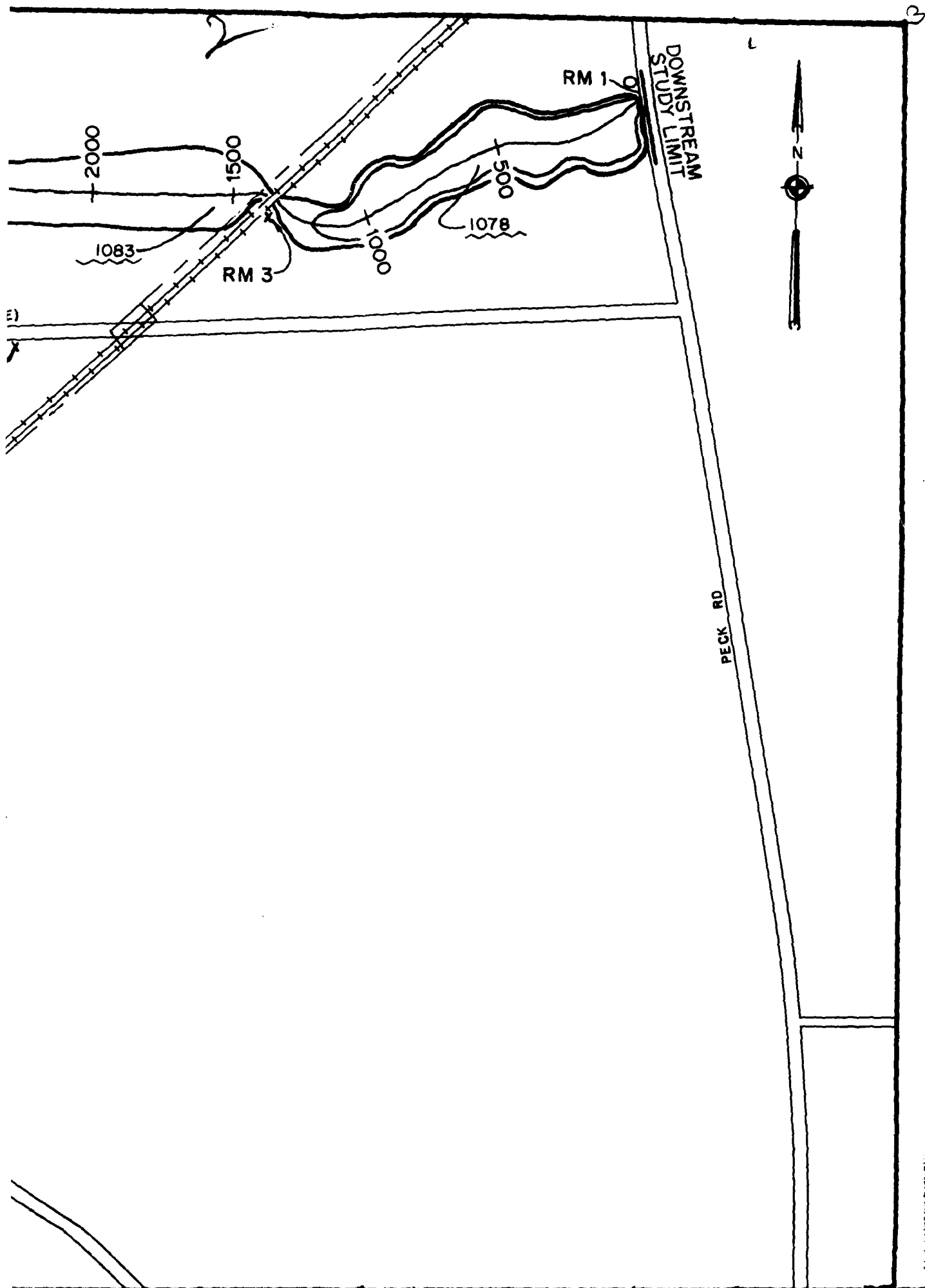
HOMMON CREEK
FLOOD PROFILE

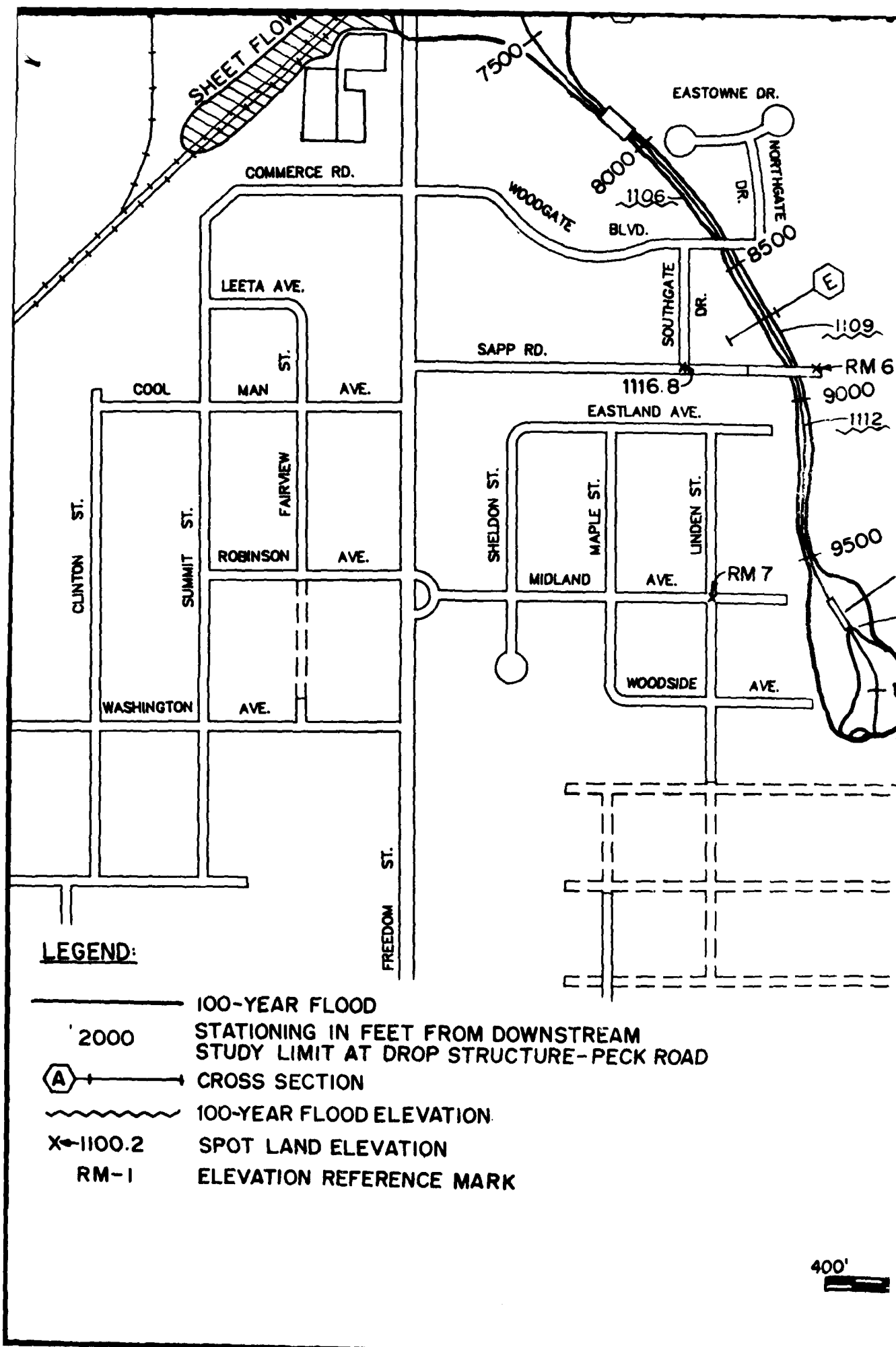
U.S. ARMY ENGINEER DISTRICT, BUFFALO
SEPTEMBER 1988

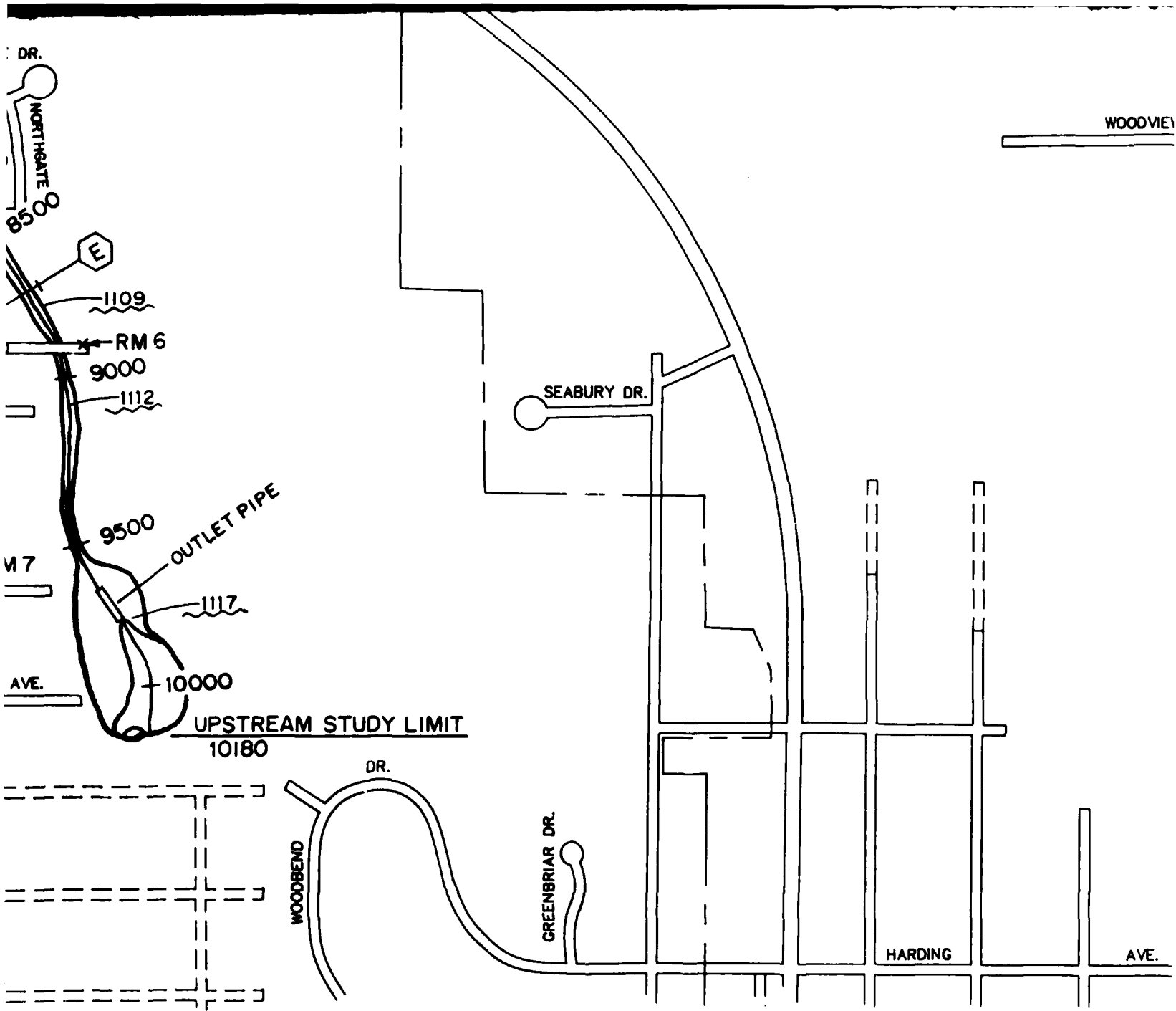




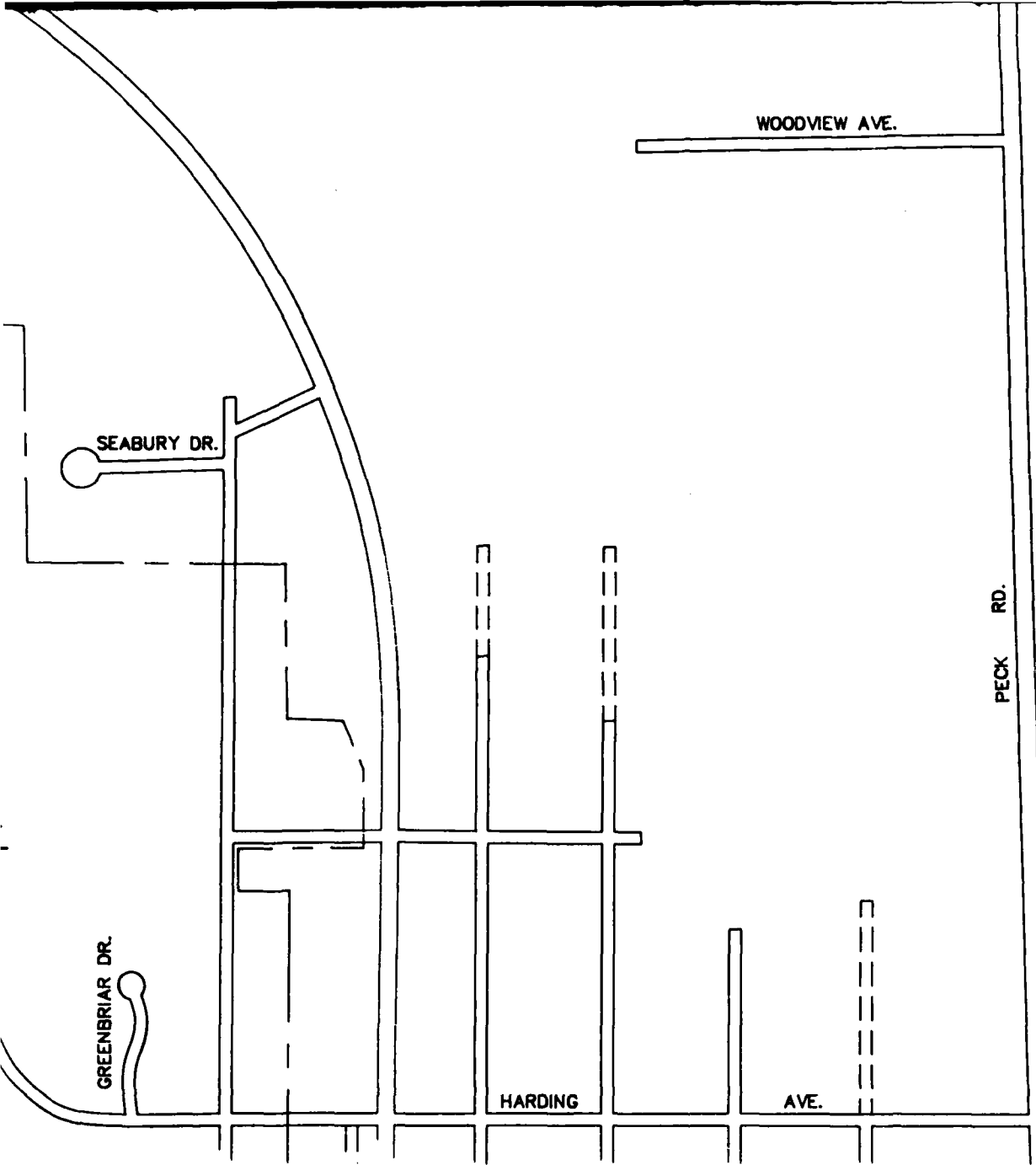
OM CREEK



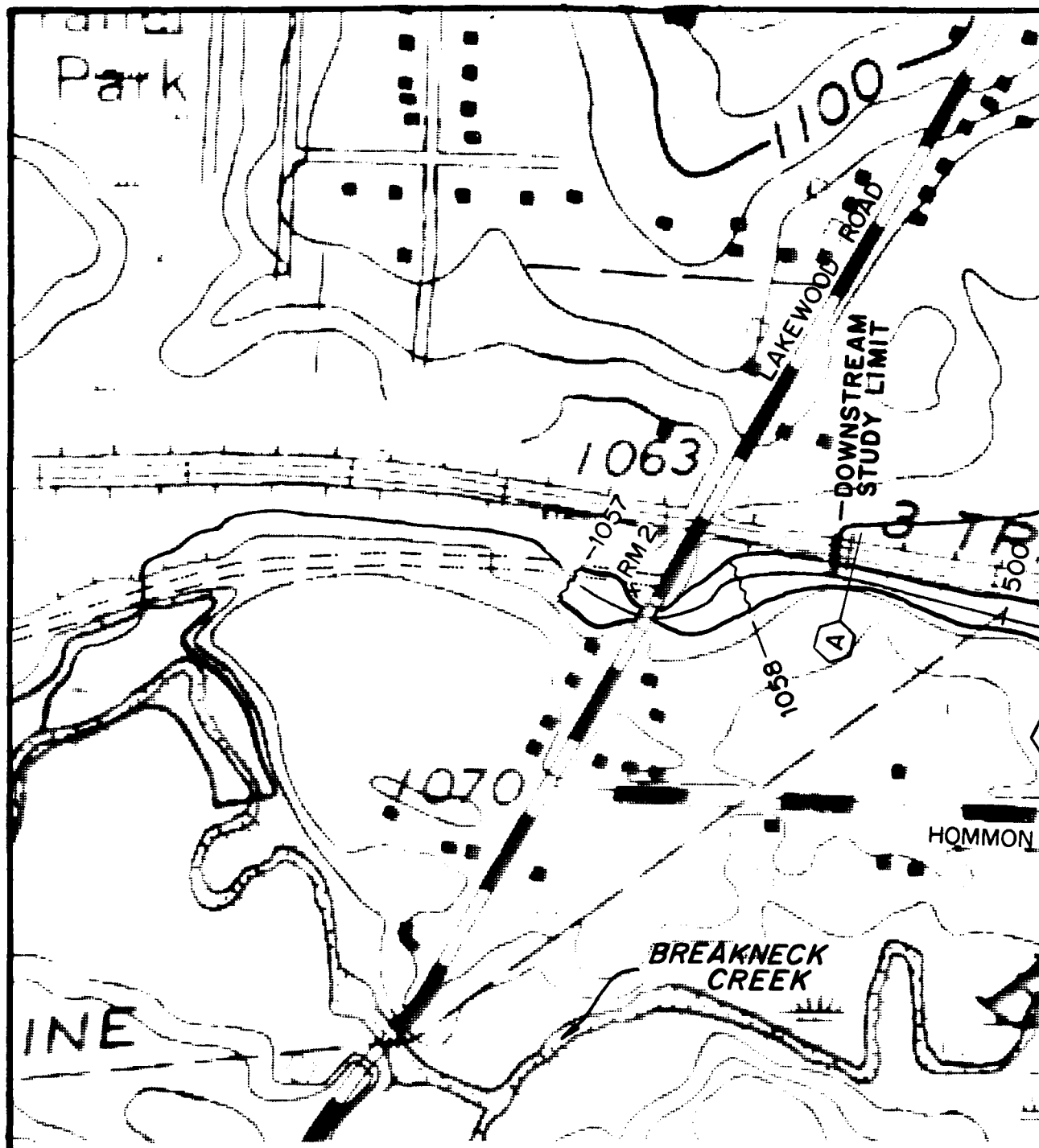




CITY OF
FLOOD HAZARD
FLOOD
100-YEAR
FREE
U.S. ARMY ENGINEERS

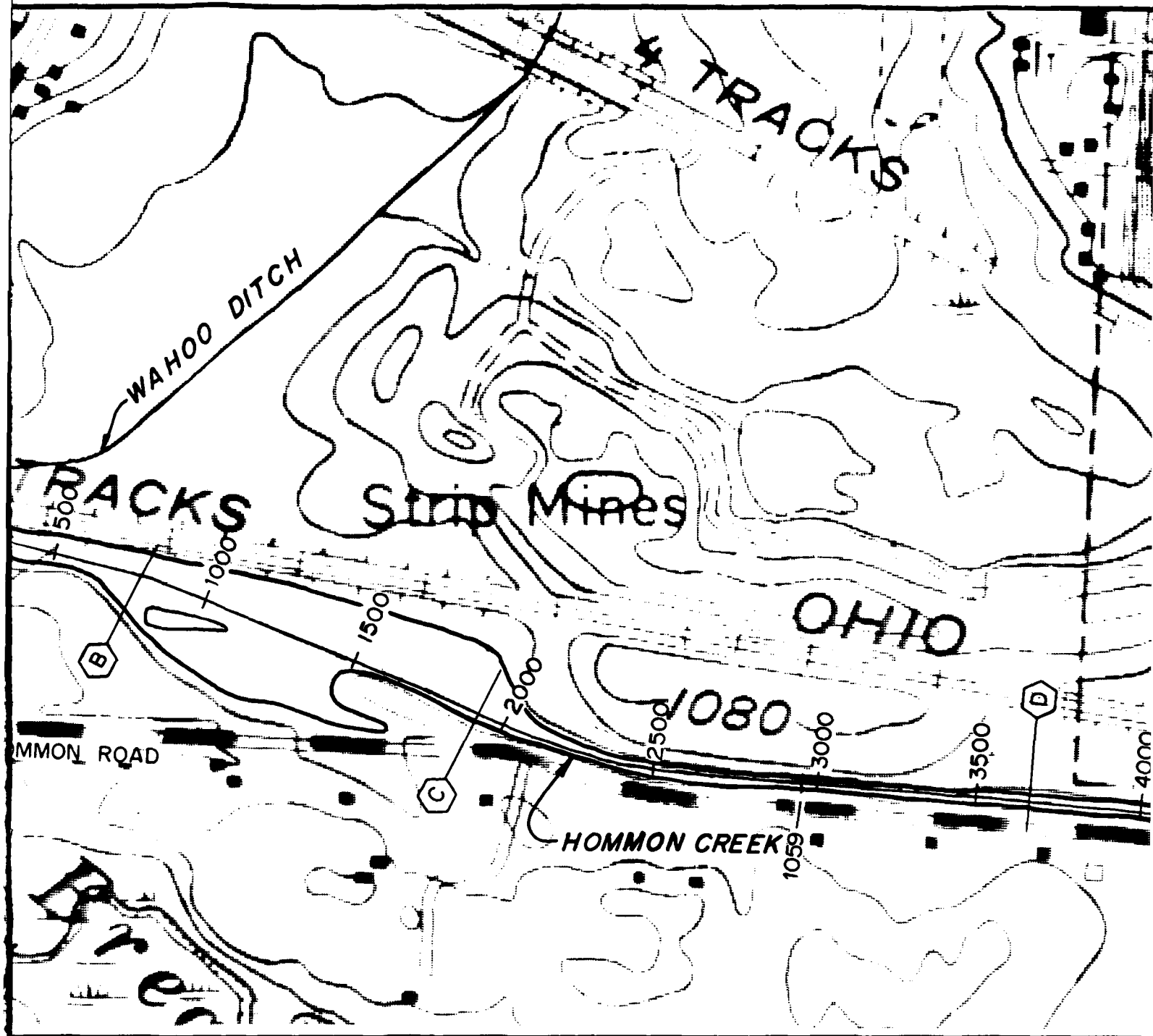


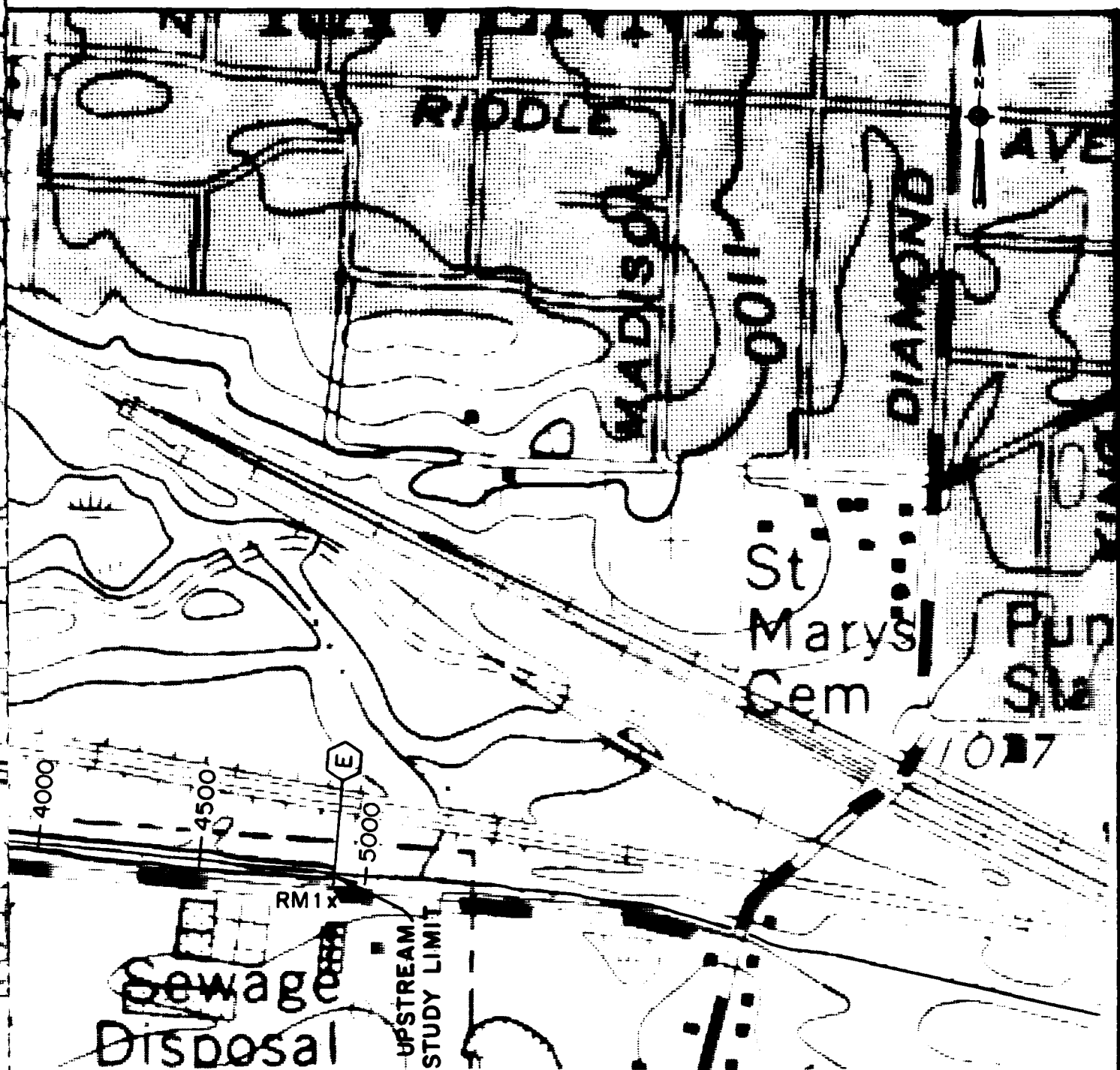
CITY OF RAVENNA, OHIO
FLOOD HAZARD EVALUATION
FLOODED AREA MAP
100-YEAR FLOOD
FREEDOM CREEK
U.S. ARMY ENGINEER DISTRICT, BUFFALO
SEPTEMBER 1988



LEGEND

-  100-YEAR FLOOD
-  2000 STATIONING IN FEET FROM DOWNSTREAM STUDY LIMIT AT WAHOO DITCH
-  CROSS SECTIONS
-  100-YEAR FLOOD ELEVATIONS
-  RM-1 ELEVATION REFERENCE MARK





CITY OF RAVENNA, OHIO
FLOOD HAZARD EVALUATION
FLOODED AREA MAP
100-YEAR FLOOD
HOMMON CREEK

U.S. ARMY ENGINEER DISTRICT, BUFFALO
SEPTEMBER 1988