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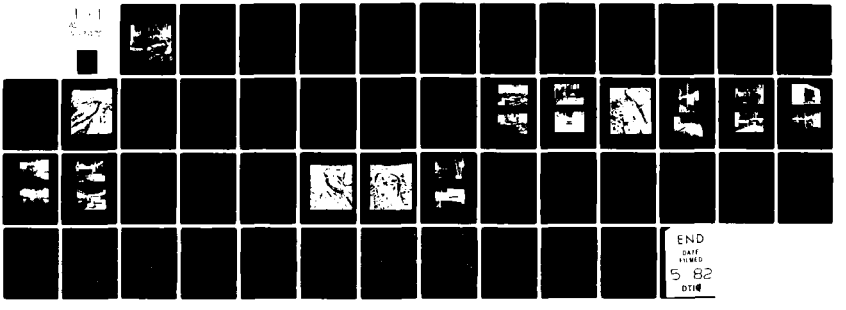

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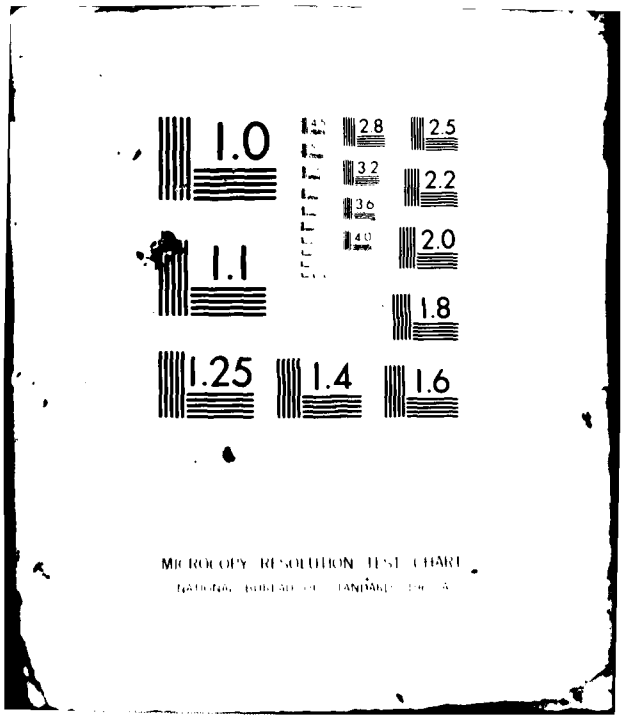
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REPORT OF FLOOD
14-16 MARCH 1978
CHAGRIN AND GRAND RIVERS
OHIO

U.S. ARMY ENGINEER DISTRICT, BUFFALO
JUNE 1978

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SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

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4. TITLE *(and Subtitle)* Report of Flood, 14-16 March 1978, Chagrin and Grand Rivers, Ohio.		5. TYPE OF REPORT & PERIOD COVERED FINAL
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19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Floods
Flooding
Chagrin River
Grand River

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

The period covered by this report is 14 through 16 March 1978, when a broad area of minor rainfall and snowmelt caused by a general warming trend resulted in flooding conditions in the areas described herin.

One teletype report on flooding conditions was submitted by this office to the Office Chief of Engineers, and Division Engineer, North Central Division. The teletype, dated 15 March 1978, is included as Exhibit 1

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

Cover Photograph:

View of flooding along Dodd Road, Willoughby Hills, Lake County, OH. This photograph taken 14 March 1978 depicts the force of the flood wave which moved both auto and house. Courtesy "THE TELEGRAPH," Painesville, OH.

This report was prepared by Donald Lawson of the Hydraulic Design Section of the Buffalo District Hydraulics and Hydrology Branch. Technical support was provided by Arthur Redenbach of the Hydraulic Design Section and by Thomas Sloan and Dennis Rimer of the Flood Plain Management Section of the Planning Branch.

CHAGRIN RIVER POST FLOOD

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PREFACE

1. This final report on the March 1978 flooding in northeast Ohio is made in accordance with Engineering Regulation 500-1-1 dated 1 September 1975. Specific instructions are contained in paragraph 72.72 of that document.

The period covered by this report is 14 through 16 March 1978, when a broad area of minor rainfall and snowmelt caused by a general warming trend resulted in flooding conditions in the areas described herein.

One teletype report on flooding conditions was submitted by this office to the Office Chief of Engineers, and Division Engineer, North Central Division. The teletype, dated 15 March 1978, is included as Exhibit 1.

2. General Description.

a. Chagrin River.

The portion of the Chagrin River affected is wholly in Ohio and extends from mile 0.0 at the mouth in the city of Eastlake through the village of Willoughby Hills at mile 12.9. The river bed is rather regular and has an average slope of seven feet per mile. The river drains an area of about 268 square miles in northeastern Ohio, and flows into Lake Erie about 15 miles east of Cleveland. The watershed is roughly elliptical in shape and is approximately 30 miles long north to south and 17 miles wide east to west. The river consists of the main stem and two major tributaries, as shown on Plate 1. The Aurora Branch drains about 57 square miles in the southern part of the basin and the East Branch drains about 51 square miles in the northeastern part of the basin.

The areas in the cities of Eastlake and Willoughby, and in the village of Willoughby Hills which are subject to flooding, lie close to the river channel. Although the area is over 29 miles long, it is generally very narrow and frequently crossed by river meanders. Damages in the upper reaches of the river generally occur where roads, residences and other development have been built along the low river banks or on the areas inside some of the river bends. The flooded area near the river mouth is much wider and more highly developed.

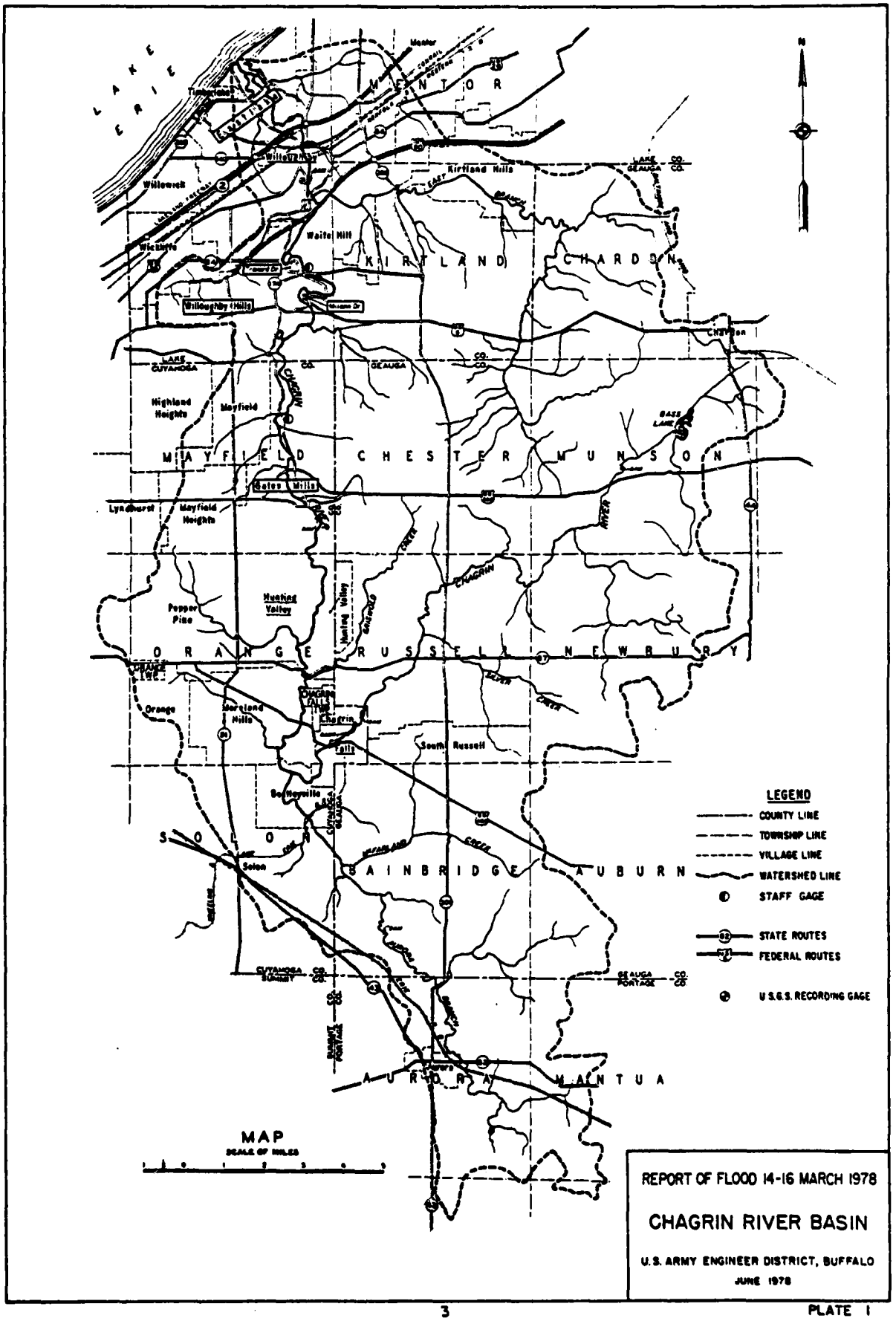
b. Grand River.

The Grand River is wholly located in the eastern portion of Ohio and has its source northwest of Warren. It flows in a general northerly direction to a point west of Jefferson, then in a westerly direction roughly paralleling Lake Erie to Painesville. It swings north again to the lake at Fairport Harbor, as shown on Plate 2. The river has several meanders on the long northward course through its wide valley and has numerous bends on the westward course in the restricted valley and on the approach to the lake. The average slope of the river in the broad valley is 1.6 feet per mile and in the lower portion is 5 feet per mile. The basin has a total drainage area of 713 square miles. The Grand River is largely in its natural state except for the development at Fairport Harbor at the mouth, an old mill dam at Painesville and a water supply dam at Harpersfield.

3. Past Floods.

a. Chagrin River.

Descriptions of large floods that have occurred on the Chagrin River are based upon field investigations, historical records, and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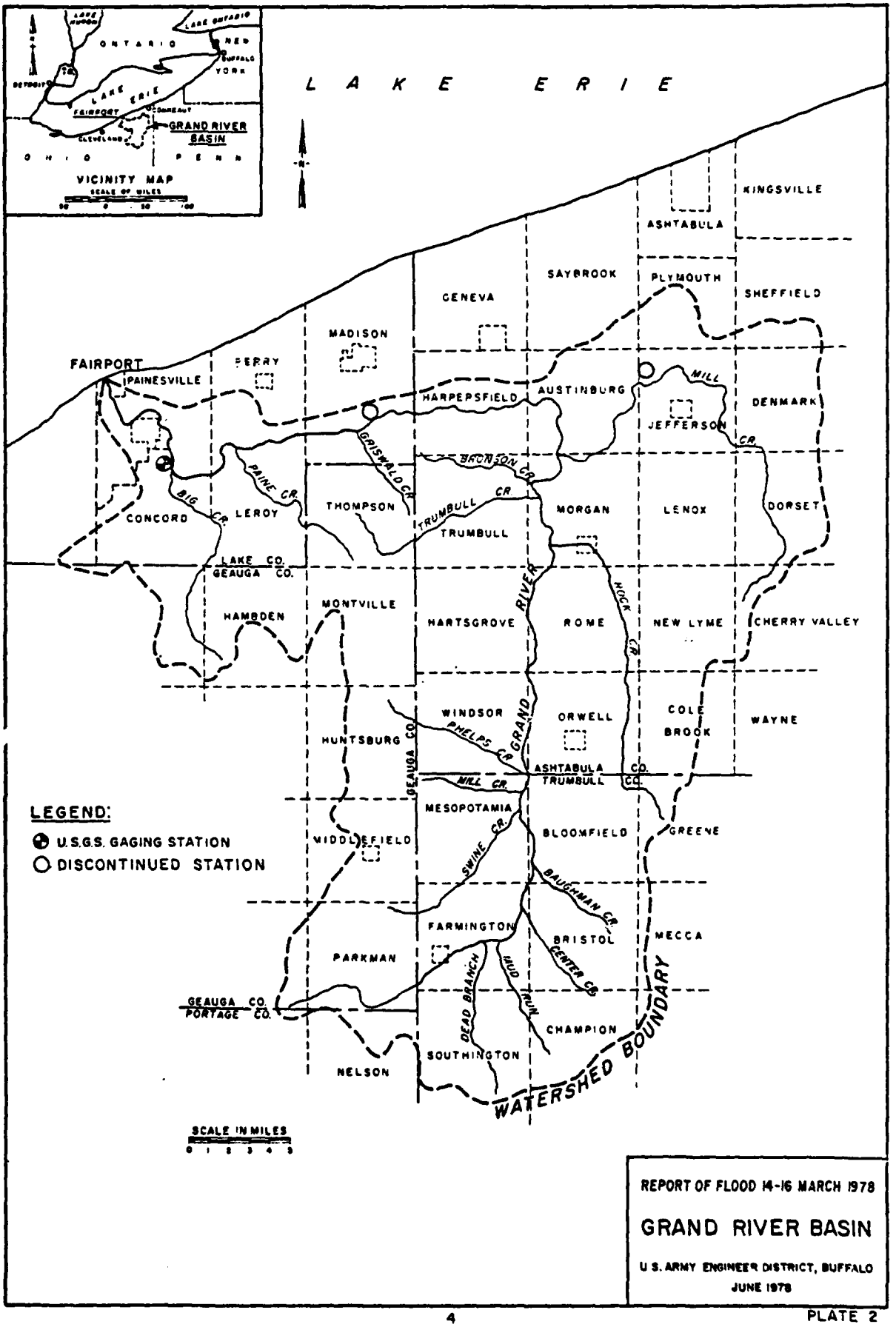
WILLOUGHBY
WILLOWICK
WILLOUGHBY HILLS
KIRTLAND
CHARDON
MAYFIELD
CHESTER
MUNSON
ORANGE
RUSSELL
NEWBURY
SOLON
BAINBRIDGE
AUBURN
AURORA
MANTUA
Willowick
Wickliffe
Wolfe Hill
East Kirtland Hills
Willoughby Hills
Highland Heights
Mayfield
Gates Mills
Lyndhurst
Mayfield Heights
Pepper Pike
Hunting Valley
Orange
Moreland Hills
Chagrin Falls
South Russell
Bentleyville
Solon
Aurora
LEGEND
COUNTY LINE
TOWNSHIP LINE
VILLAGE LINE
WATERSHED LINE
STAFF GAGE
STATE ROUTES
FEDERAL ROUTES
U.S.G.S. RECORDING GAGE
MAP
REPORT OF FLOOD 14-16 MARCH 1978
CHAGRIN RIVER BASIN
U.S. ARMY ENGINEER DISTRICT, BUFFALO
JUNE 1978

PLATE 1



REPORT OF FLOOD 14-16 MARCH 1978

GRAND RIVER BASIN

U. S. ARMY ENGINEER DISTRICT, BUFFALO

JUNE 1978

PLATE 2

newspaper accounts. Summaries of four floods are given in the following paragraphs.

23-27 March 1913

The greatest precipitation and most widespread destruction from floods for which records are available occurred in March 1913. Flooding was accompanied by high winds. Heavy rains occurred during the periods of 13-15 and 20-21 March. These rains were only preliminary to the severe storm which developed during the period of 23-27 March. This storm extended from Texas to Lake Erie with its center over Bellefontaine, Ohio, 140 miles southwest of the Chagrin basin. Two low-pressure centers combined to form a long trough of low pressure which caused excessive rainfall in Ohio and neighboring States for about 60 hours. Bellefontaine recorded a total of 11.16 inches of rain in 92 hours. The Chagrin River basin lay under the northeast edge of the storm and received an average of 7.56 inches of rainfall during the storm period. The precipitation over the basin fell in two definite rainfall bursts which produced separate peak discharges. Total runoff at the USGS gaging site at Willoughby was estimated to have been 4.40 inches. In 1913, the lack of development in the flood plain limited the amount of damage.

21-22 March 1948

The first half of March 1948 was exceptionally cold and dry with the temperature dropping to near zero at the middle of the month. The trend of cold, dry weather was reversed and temperatures rose to a high of about 70° on the 19th with high winds and heavy rains. Average rainfall over the basin was 2.65 inches, but nearly 4.5 inches of rain fell in the village of Chardon during the storm period. A major portion of the total rainfall occurred within a relatively short period of time and was concentrated in the lower basin, which shortened inflow concentration time and produced a short runoff hydrograph with a high peak for a total runoff of 2.25 inches. People were evacuated from their homes as the Chagrin River spilled water across the lower valley area. Homes were inundated and several roads were overtopped. The estimated peak discharge at the USGS gaging station at Willoughby was 28,000 cfs. This discharge has a recurrence interval of once every 70 years. Approximately 60 homes were damaged in Willoughby Hills with a total estimated damage of $22,000.

21-22 January 1959

The storm of January 1959 developed from a large mass of cold air over northwestern Canada, a flow of warmer air from the southwest, and the associated frontal system. Heavy rains began on the 20th

when the moisture-laden air from the south converged with the cold front. Although total rainfall for the storm was not excessive, intensities were high; and runoff was increased by the frozen ground and the six-inch snow cover on the basin. The storm was centered south and west of the Chagrin River, and rainfall averaged 2.50 inches over the basin. Runoff from the rainfall and snow melt totaled 2.94 inches at the Willoughby gage. People were evacuated from their homes in Willoughby Hills by volunteer firemen, police, and Civil Defense personnel. The Trailard Drive and Milann Drive areas were especially hard hit. Many of the homes in these areas had several feet of water on the first floor. Five persons lost their lives along Milann Drive during rescue operations in Willoughby Hills because of the fast-moving current. Estimated peak discharge at the USGS gaging station at Willoughby was 22,000 cfs. This discharge has a recurrence interval of once every 25 years. Approximately 90 dwellings were affected with an estimated damage of $110,000.

24 February 1977

Blocks of ice jammed part of the swollen Chagrin River at the Horseshoe Glen near Trailard Drive, river mile 7.4, and at a reach upstream of the Dodd Road bridge. Twenty families from both Trailard Drive and Milann Drive and ten families from Mayfriars Drive were evacuated. Heavy rain compounded the flooding problem. The total estimated damage was approximately $140,000.

b. Grand River.

There has been no stream gaging station in the Painesville portion of the Grand River prior to 1974, therefore, no record of flood heights or discharge rates are available.

4. Flood Protection Measures.

A local flood control channel at the Horseshoe Glen area in Willoughby Hills (Photo 1) was completed in October 1960 at a cost of $15,000 to residents of the Trailard Drive area in an attempt to reduce flood damage and hazard such as occurred in the January 1959 flood, which claimed the lives of five local residents. The channel dimensions are approximately 900 feet long, 200 feet wide, and 6 feet deep. The channel was completed using private funds and donated land.

5. Flood Situation.

a. Chagrin River.

The USGS gaging station on the Chagrin River which is nearest to the flooded area is located one mile southeast of Willoughby, Lake

Photo 1 - Aerial view of the Chagrin River, Trailard Drive area showing local channel diversion project. Photo taken by Kucera & Associates, Mentor, Ohio, 16 March 1978

County, Ohio. The gage was installed in July 1925 and is approximately five miles from the river mouth.

In addition, two staff gages, one on the Eagle Road bridge located in the city of Willoughby Hills and the other in the village of Gates Mills, are monitored during flood flows by members of the Willoughby Hill Fire Department. Stage hydrographs for these three gages can be found on Plates 3 and 4.

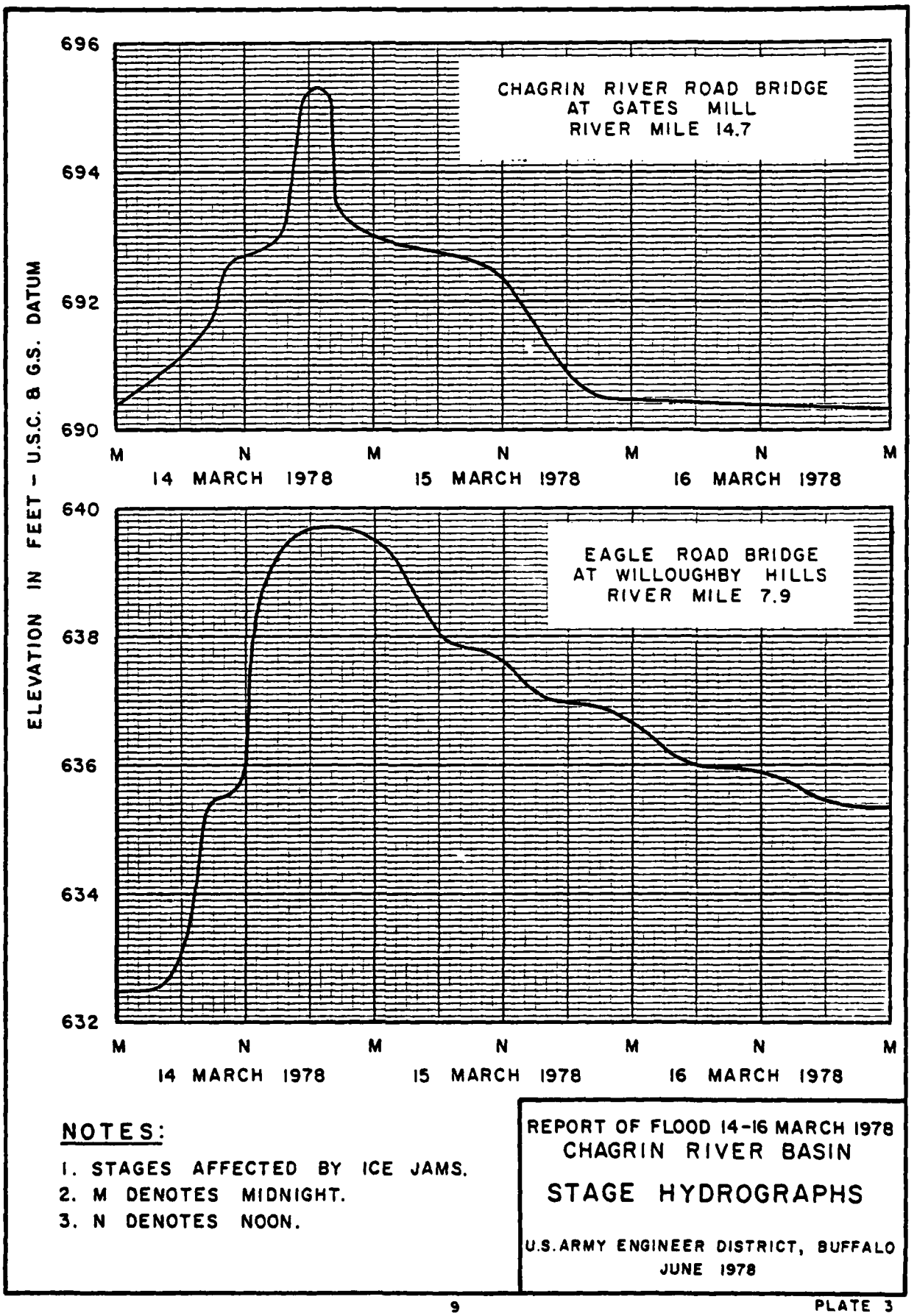
High water marks compiled by district personnel along with the readings at these gages were used to determine the flooded areas (Plates 6 and 7) and the water surface profile (Plate 8).

(1) Willoughby Hills - Throughout the winter months of 1977-1978, record snowfall combined with extremely cold temperatures produced a high probability of spring ice jam flooding. In February, frozen ice jams 10 to 12 feet thick existed in Willoughby Hills. The Chagrin River was completely ice-bound from just south of State Route 84 at the Waite Hill Road Bridge to one-half mile south of Eagle Road.

On 14 March, due to mild weather, water and ice began to move. Table 1 shows high and low daily temperatures preceeding the flood. Runoff was strictly attributable to warm temperatures. No significant precipitation occurred during the period. Officials in Willoughby Hills used dynamite in the Milann and Trailard Drive areas and an attempt was made to break up ice at the Eagle Road bridge by using a crane and wrecking ball. Hardest hit by flooding and ice were the houses in areas near river bends.

Table 1 - Temperatures During Flood Period

March	Degrees Fahrenheit	
	Daily High	Daily Low
11	44	25
12	39	25
13	46	22
14	48	34
15	42	32



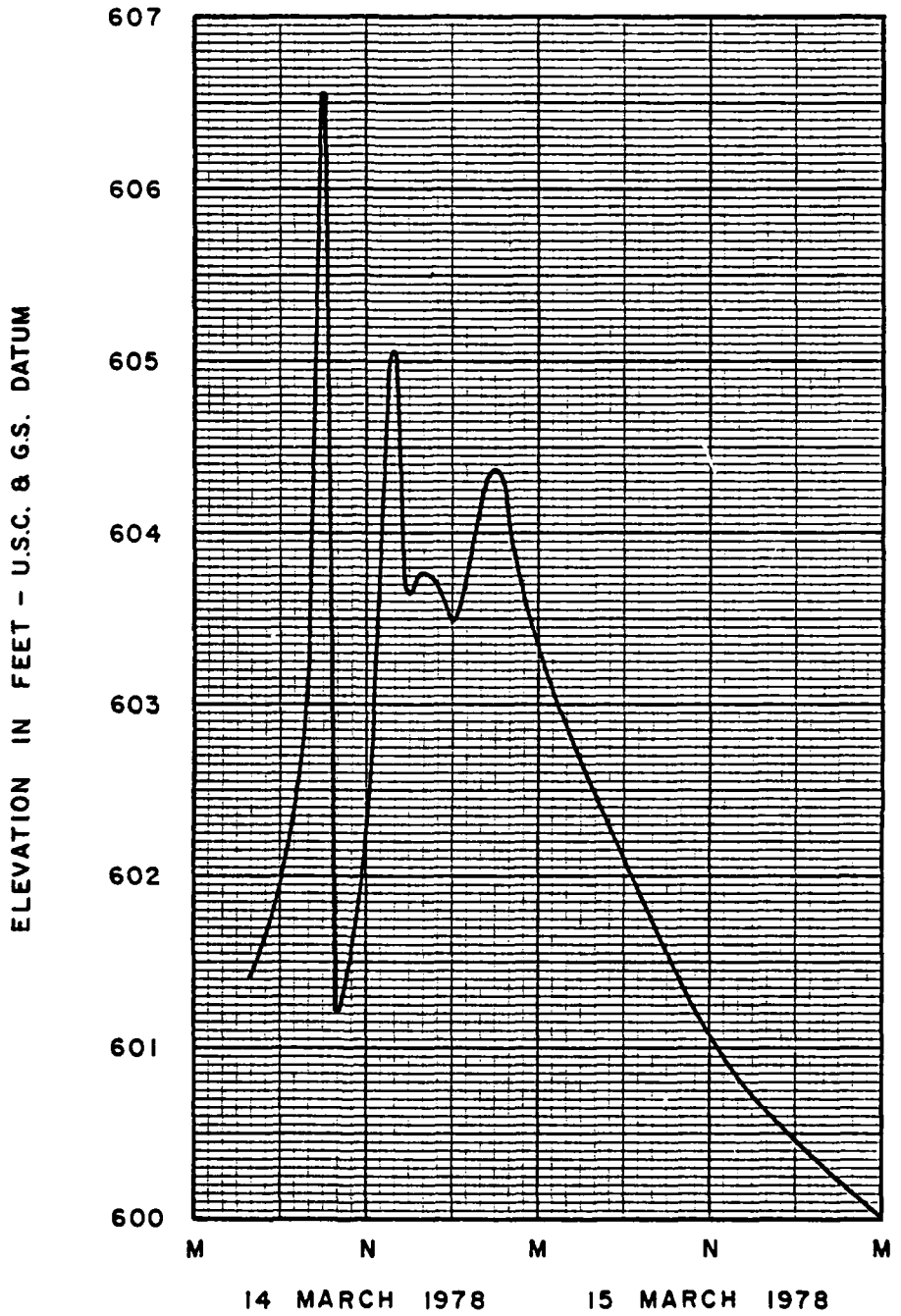
NOTES:

1. STAGES AFFECTED BY ICE JAMS.
2. M DENOTES MIDNIGHT.
3. N DENOTES NOON.

REPORT OF FLOOD 14-16 MARCH 1978
CHAGRIN RIVER BASIN

STAGE HYDROGRAPHS

U.S. ARMY ENGINEER DISTRICT, BUFFALO
JUNE 1978



NOTES:

1. ZERO OF GAGE IS EL. 594.57 U.S.C.&G.S. DATUM.
2. DRAINAGE AREA IS 246 SQUARE MILES.
3. STAGE AFFECTED BY ICE JAMS.
4. M DENOTES MIDNIGHT.
5. N DENOTES NOON.

REPORT OF FLOOD 14-15 MARCH 1978
CHAGRIN RIVER BASIN
STAGE HYDROGRAPH
U.S.G.S. GAGE AT WILLOUGHBY
U.S. ARMY ENGINEER DISTRICT, BUFFALO
JUNE 1978

PLATE 4

During the early morning hours on 14 March, the Milann Drive area was the first to feel the effects of the rising water when ice began to jam in the large river bend near the Dodd Road bridge. The river rose 2-1/2 feet within four hours, spilling huge ice cakes throughout the low-lying areas (see Photos 2 and 3). After 7:00 a.m., the Willoughby Hills Fire Department began evacuating people from the Milann, Trailard, Chagrin Drive and Dodd Road area. By late morning more than 70 families had evacuated from the area as the river continued to rise.

About 11:30 a.m., the jam broke sending a wall of water and tons of ice downstream toward the Dodd Road and Trailard Drive communities. The first house in the path of the wave on Dodd Road was lifted from its foundation and displaced several feet (Photo 7). A few hundred feet down Dodd Road other houses were flooded nearly to the first floor ceilings. The water rose so fast that automobiles were floated away and deposited elsewhere downriver.

The ice began to jam again just upstream from the bridge at Eagle Road. The rising water diverted around the jam through the Chagrin Drive area overtopping Eagle Road on the right bank (Mile 8). Heavy damage occurred here to 20 homes, some of which had several feet of water on the first floor. At approximately 12 noon, the water level at the Eagle Road staff gage rose to 16 feet, 3 feet above flood stage. At 8:00 p.m., fire department officials reported the river peaked at 18 feet, covering Dodd Road. Normal water level for the Eagle Road gage is 4 to 6 feet.

Residents of the Trailard Drive area (Horseshoe Glen) were not as severely affected as the other Willoughby Hills developments located upstream. The local river diversion project in the Horseshoe Glen area was probably instrumental in reducing damage there.

(2) Eastlake - The Eastlake community initially developed as a summer cottage and recreation-oriented area in the early 1920's. Since that time, construction of year-round residential units has increased in size and value while the number and predominance of vacation type homes declined.

Five major residential districts lie on the lower Chagrin River flood plain. These districts are the Admiral Drive area, located near the river mouth on the west bank between two marine recreation zones; the Woodland Boulevard area, located south of Lake Shore Boulevard and separated from the west river bank by a narrow strip of marine recreation land; North and South Riverview Drives area, located inland and west of the river near the southern limit of the project area; the harbor area, adjacent to the lake shore and east bank of the secondary river channel; and the Lake Shore Boulevard area,

located inland from the east river bank on either side of Lake Shore Boulevard. The five areas are basically comprised of ranch-style and split-level single family dwellings. Most of the residential structures are less than 20 years old and represent a part of the city of Cleveland's post-World War II suburban expansion.

The Chagrin River is zoned industrial-marine recreation and is the primary activity corridor for water-related recreation in the Eastlake area. The river is used for recreational navigation and sportfishing purposes in its lower reaches and also serves as a natural open space corridor through the community. The river and minor channels form access routes for approximately 1,000 small craft that comprise the locally based fleet.

Lands designated for marine recreation include the area directly west of the river mouth bounded by Lagoon Drive, Erie Road, and the Chagrin River; a large indentation of land west of the river bounded by Erie Road, Admiral Drive, and a line parallel to and approximately 900 feet south of Admiral Drive; a narrow strip of land adjacent to the river between Lake Shore Boulevard and Woodland Drive; all islands in the river channel; and a narrow strip of land on the east bank beside the river between the mouth of the secondary channel and Lake Shore Boulevard. Eastlake's eight marine facilities are located in the marine recreation areas and are the dominant type of development in the zone. Secondary local roads link the marine facilities with the surrounding community.

The U.S. Bureau of the Census reported a total of 5,678 housing units in the city of Eastlake in 1970 and approximately 230 of these are located on the flood plain. Homes with basements are not common, therefore, damage is not serious from shallow flooding depths.

The meandering nature of the Chagrin River near the mouth coupled with the natural silting action of Lake Erie makes the area prone to ice jam flooding. In February, an effort was made to alleviate spring flooding by opening the east branch of the mouth which had been closed by sand and silt. A crane was used to remove the sand and debris from the clogged channel.

Due to warm weather on 14 March, water began to rise about 9:30 a.m. Shortly after noon, the city's flood emergency program began. Volunteers in various neighborhoods were contacted and told to warn persons on their lists to evacuate. At 2:00 p.m., the city was declared in a state of emergency after Lake Shore Boulevard was closed and 12 families were taken from their homes. Ice had jammed in the main river channel at a turn about 2,000 feet downstream from the Lake Shore Boulevard bridge (mile 0.7). Flooding occurred in the Admiral Drive area and in a small trailer park on the left bank at mile 1.3. Also flooded was a portion of the Island Drive area.

Some 108 homes in Eastlake were affected but none suffered the extensive damage as those in Willoughby Hills. North and South Riverview Drives were spared from inundation.

Although ice damage is an annual occurrence to marina facilities along the river, exceptional damage was incurred this year to docks, buildings and walls accompanied with an unusually high degree of silting which will require more than the usual amount of dredging to remove. Many small boats and several cruisers were washed from their moorings causing extensive damage. Flooding in Eastlake was said to be second in severity compared to that of the January 1959 flood.

Photo 2 - Ice forced from river onto lawns and yards of Milann Drive residents at mile 10.3.
Photo taken 16 March 1978

Photo 3 - Ice had to be plowed from Milann Drive to permit access for emergency vehicles.
Photo taken 16 March 1978

Photo 4 - Residence on Milann Drive mile 10.2 barely escaped first floor inundation.
Photo taken 4 April 1978

Photo 5 - Same residence as above. Pressure of water and ice caused the collapse of the basement wall.
Photo taken 4 April 1978

Photo 6 - Aerial view of the ice jam just upstream of Eagle Road and subsequent inundation along Dodd Road. Photo taken by Kucera & Associates, Mentor, Ohio, 16 March 1978.

Photo 7 - Home on Dodd Road river mile 3.4 floated from foundation and lodged against tree.

Photo 8 - Living room floor of house in Photo 7 destroyed when house settled on front entrance steps.
Photo taken 6 April 1978

Photo 9 - Dodd Road residence, mile 8.3, taken shortly after peak flow, 15 March 1978

Photo 10 - Same residence as above showing high water mark. Photo taken 6 April 1978

Photo 11 - River front residence on Dodd Road, mile 8.3. Note high water mark visible on front windows.
Photo taken 6 April 1978

Photo 12 - Ice and debris float from the river, which inundates houses along Dodd Road at mile 8.3. Note large block of ice to the left of the house.
Photo taken 15 March 1978

Photo 13 - Houses on Chagrin Drive taken from Dodd Road, mile 8.1. Note sheets of ice lying in river on the left side of photo.

Photo taken 15 March 1978

Photo 14 - House on Chagrin Drive just downstream from area in above photo.

Photo taken 15 March 1978

Photo 15 - Residence on Trailard Drive, mile 7.9. Photo taken after peak flow had passed 16 March 1978.

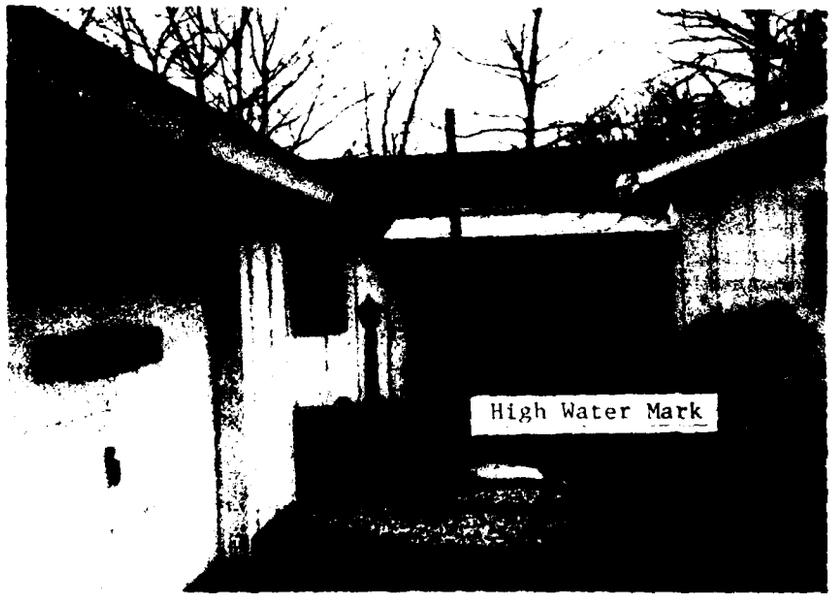


Photo 16 - Residence on Trailard Drive, mile 7.4, showing high water mark.
Photo taken 5 April 1978

b. Grand River.

(1) Painesville. The city of Painesville, located in the northeast corner of Ohio, is situated near the mouth of the Grand River, in Lake County. The portion of the Grand River in the vicinity of Painesville flows in a deep, broad valley varying from 400 to 2,600 feet wide. Within this portion, the stream bed slope is about 5 feet per mile. The flood plains in this valley remain, for the most part, undeveloped. The only exception to this are residential development which has occurred in the vicinity of Main Street, and the recreation park and golf course between Main and Erie Streets. A large apartment complex located on the right bank just downstream of the Main Street bridge has been constructed in recent years and suffered extensive damage from the March 1978 flood.

The significant obstructions on the Grand River in this area are three railroad and five highway bridges and the Main Street dam, which has been partially breached in past years.

As early as February it had been determined by local officials that spring flooding in Painesville was very likely to occur. The Grand River contained an unusually high amount of ice and Lake Erie was heavily frozen.

The first flooding began around 10:00 a.m. on 14 March when water began seeping into yards in front of the Millstone and Grist Mill apartments. This shortly began to recede and it was believed at the time to be the extent of the high water. At 6:30 a.m. the following day (15 March) heavy ice began to jam on the Route 2 bridge causing water at the apartments to rise four feet in two minutes. Many residents were trapped in their apartments by the fast rising water. Many of the residents had packed their bags the previous day and put them in their cars to make a fast getaway, only to see the vehicles become submerged in the rush of water.

Approximately 150 residents of houses and apartments near the Main Street bridge were evacuated. Firemen in a motorboat rescued about 30 residents of the Grist Mill and Millstone apartments after floods stranded them inside. About 30 cars were submerged in the apartment house parking lot.

A mile long ice jam developed and caused concern over the Richmond and St. Clair Street bridges leading to Fairport Harbor. Both bridges had been closed at midnight leaving only one means of access to Fairport Harbor. Sometime during the night the jam which had clogged the river at the Route 2 bridge broke up, causing high water to recede from around the flooded apartment complex.

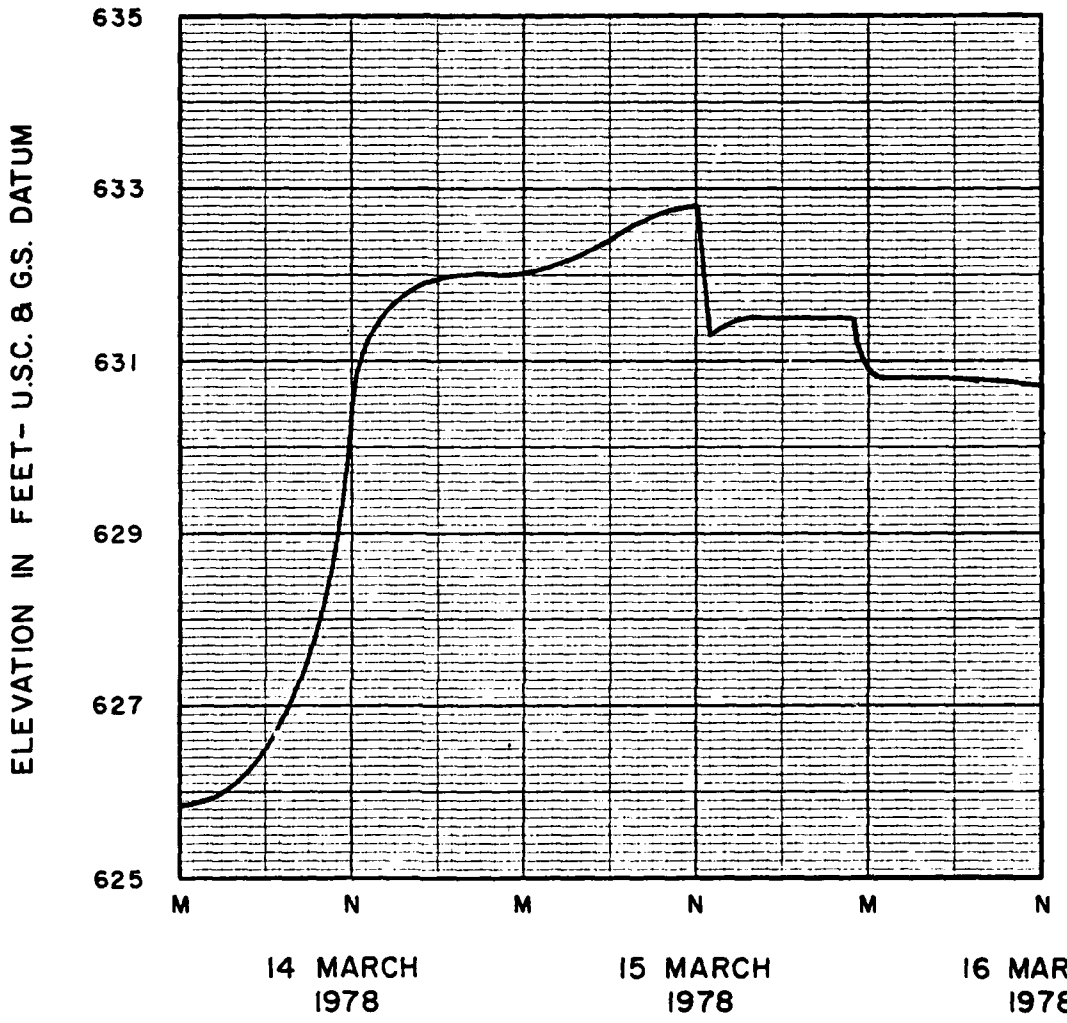
On 16 March, the Red Cross opened service centers in Painesville to aid flood victims who were in need of housing, food, clothing, and medical supplies. Portions of the apartment complex will be closed for several months for renovation.

(2) Fairport Harbor - Fairport Harbor, Ohio, is located on the shore of Lake Erie at the mouth of the Grand River, 33 miles east of Cleveland and 27 miles west of Ashtabula. The harbor comprises the lower 1.5 miles of the Grand River and a breakwater-protected outer harbor.

The harbor area was left with only one access road (Route 535) after police closed ice-endangered bridges leading into the village from St. Clair and Richmond Streets. Heavy ice flows from upstream had accumulated blocks of ice against the bridges.

Several marinas along the river in Fairport suffered extensive damage to docks, moored boats and adjacent buildings.

The Coast Guard Cutter NORTHWIND was scheduled to arrive at the Grand River about noon 16 March but was delayed until 5:30 p.m. by giant 40-foot "windrows" or ice ridges encountered in Lake Erie about two miles northwest of the river. The ship worked about 12 hours breaking the packed ice at the mouth and up the river to allow a free path for broken ice floes. Progress, however, was hampered in the river itself when heavy ice and shallow water were encountered. The following morning, the water was reported flowing freely under the ice and had again returned to below bank full stage.



NOTES:

1. ZERO OF GAGE IS EL. 620.37 U.S.C.& G.S. DATUM.
2. DRAINAGE AREA IS 701 SQUARE MILES.
3. STAGE AFFECTED BY ICE JAMS.
4. M DENOTES MIDNIGHT.
5. N DENOTES NOON.

REPORT OF FLOOD 14-16 MARCH 1978
GRAND RIVER BASIN
STAGE HYDROGRAPH
U.S.G.S. GAGE AT PAINESVILLE
U.S. ARMY ENGINEER DISTRICT, BUFFALO
JUNE 1978

PLATE 5

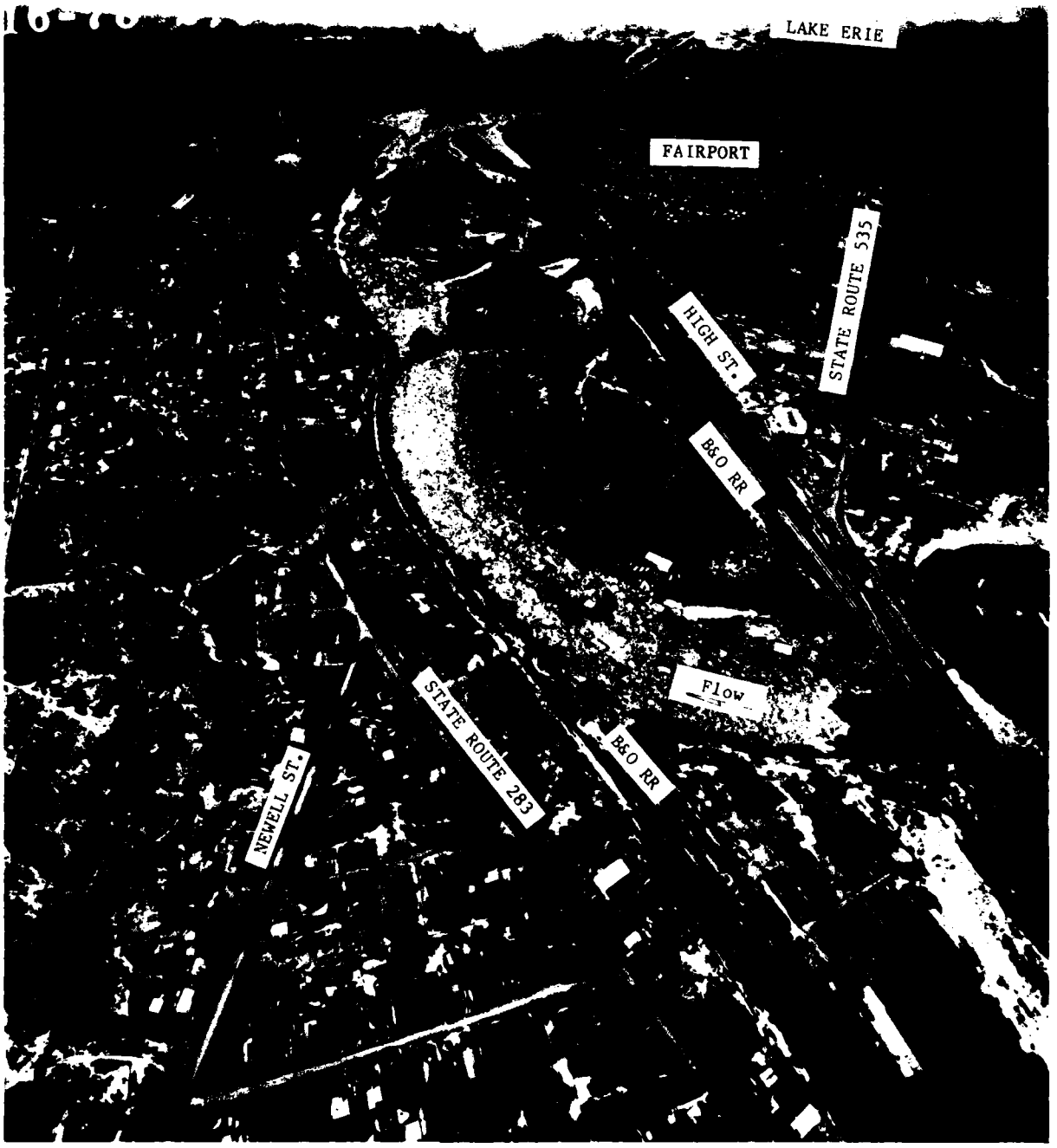


Photo 17 - The Grand River looking north from Painesville toward Fairport and Lake Erie. Photo taken by Kucera & Associates, Mentor, Ohio, 16 March 1978.

Photo 18 - The Grand River at Painesville showing low-lying apartments (center of photo). Taken by Kucera & Associates Inc., Mentor, Ohio, 16 March 1978.

Photo 19 - Apartment complex on the Grand River, Painesville, mile 6.9. Photo taken during flood on 15 March 1978.

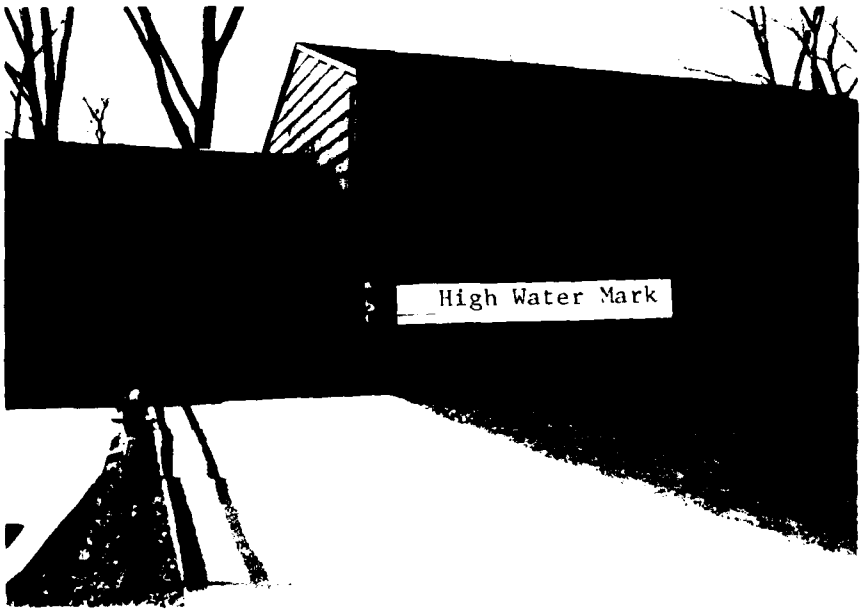


Photo 20 - Same apartments as above showing high water mark. Photo taken 7 April 1978

6. Hydraulics and Hydrology.

Stream flow data for the Chagrin River was obtained from the United States Geological Survey (USGS) water level recording gage located in the city of Willoughby. The gage has been in operation for 50 years.

Two staff gages are monitored by local officials during flood flows. Readings from these gages are used to generate stage hydrographs.

Because most flooding problems on the Chagrin River result from flow conditions influenced by ice jams the traditional stage-discharge relationship does not apply. Flood profiles were developed, based solely on high water marks, for both the March 1978 and the January 1959 floods and are shown on Plate 8. Also shown for comparative purposes is the 100-year free-flow profile. The March 1978 flood discharge at the USGS gaging station at Willoughby was estimated to be 6,500 cfs. This discharge under free flow conditions would have a recurrence interval of one year. As can be seen from the water surface profiles on Plate 8, in ice-jam affected areas, the stages resulting from this event approached the 100-year free-flow stage.

Discharge records have also been available on the Grand River at Painesville, where the USGS has maintained a gaging station since 1974. The stage hydrograph for the March 1978 flood is shown on Plate 5. The peak discharge for this event under free flow conditions is estimated to be 11,000 cfs and has a recurrence interval of three years.

7. Damages

Accurate damage estimates for any one given flood situation is seldom obtainable until several months later, if ever. The following damage figures were gathered with the assistance of local agencies, personal interviews and visual estimates. The total damage for this event for the Chagrin and Grand Rivers in the communities mentioned has been estimated at $1,516,000 and is proportioned as follows:

a. Willoughby Hills

(1) Residential - Property located in four distinct areas and effecting some 50 homes, $436,000.

(2) Commercial - One nursery and garden supply center, $4,000.

(3) Public and Other - Police and Fire Department traffic and rescue operations, $4,000.

b. Eastlake

(1) Residential - Less severe flooding took place to a wide number of homes throughout the community, $305,000.

(2) Commercial - Five marinas along the lower Chagrin River suffered more than the usual amount of ice damage due to the excessively cold winter, $230,000.

(3) Public and Other - Estimates were placed on extra police and clean-up efforts, $4,000.

c. Painesville

(1) Residential - Several homes and an 80-unit apartment complex had extensive damage, $450,000.

(2) Commercial - No commercial establishments damaged.

(3) Public and Other - Estimated police, fire and rescue operations, $5,000.

d. Fairport Harbor

(1) Residential - No damage reported.

(2) Commercial - Four marinas on the east bank in the village of Fairport and two marinas on the west bank in the village of Grand River, total damages, $40,000.

(3) Public and Other - Police, fire and minor clean-up operations, $2,000.

8. Corps of Engineers Involvement.

During the winter, as the Chagrin River became frozen, the communities of Willoughby Hills and Eastlake became quite concerned that the possible flooding during the springmelt would be greater than usual. These concerns were expressed to Buffalo District by the community officials, residents, and Congressmen. On several occasions District personnel inspected the area with local representatives to discuss and evaluate preparatory measures. Both communities have their own blasting crews and are organized for this frequent occurrence. At that time it was not practical or possible to commence any ice removal operations.

In early March, a meeting, called by the area's State senator, was attended by the concerned communities, Lake County Disaster Services, Lake County Highway Department, Ohio Department of Natural Resources, and the Corps of Engineers. The purpose of this meeting was to discuss the various authorities of the attending agencies and the possible solutions to the problem. No total resolution was determined.

Each community continued their customary plan of blasting the usual ice jam areas immediately prior to a forecasted thaw by the National Weather Service.

During the flood, Buffalo District personnel were on the scene for reconnaissance and to provide technical assistance as required. The Buffalo District distributed approximately 12,000 sandbags to Lake County and loaned one Crisafulli pump to the city of Eastlake.

The communities of Eastlake and Willoughby Hills have developed emergency plans to prepare for this almost annual occurrence. This year, as in previous years, these communities performed advanced measures, within their capabilities, to minimize flood damages. It is not possible to accurately predict the severity or timing of floods of this type which are caused by the co-occurrence of adverse natural forces. The fact that extensive flood damage was experienced this year makes the efforts of these communities no less commendable.

9. Other Agencies.

American Red Cross - On 14 March, the Lake County Chapter of the American Red Cross sent personnel and supplies to public shelters in Eastlake and Willoughby Hills. Early on 15 March, a third shelter was opened in Painesville. It was determined on 16 March that the

shelters could no longer continue to house families, because of limited sanitary facilities and potential health problems. Families were then transferred to area motels. Total Red Cross expenditures were $36,000, which include $26,700 for food, clothing and lodging. The remaining costs were allocated for mass care, household items and medical assistance.

10. Damages That Could Have Been Prevented by Corps of Engineers Projects.

In 1965, Congress authorized the U.S. Army Corps of Engineers to design a flood control, navigation, and recreational project for the Chagrin River at Eastlake which would protect residents from further flooding while providing navigation and recreational benefits to the community.

The most feasible plan called for straightening and widening the river channel and building levees and floodwalls along the lower two miles of the Chagrin River.

This plan, which yielded a benefit-cost ratio of 2.2 to 1, would provide good flood protection but according to the U.S. Fish and Wildlife Service the cost to the environment would be too high. The lower Chagrin River serves as an extremely valuable spawning ground for several species of fish. Channelization would destroy the habitats these fish need to reproduce.

Had the project been built, it is estimated that some 80 percent of the damages incurred by the March 1978 flood, or approximately $430,000, could have been prevented.

No detailed Corps of Engineers studies have been made for potential projects in any of the other areas covered by this report.

JOINT MESSAGEFORM						SECURITY CLASSIFICATION: UNCLASSIFIED			
PAGE	DRAFTER OR RELEASER TIME	PRECEDENCE ACT	PRECEDENCE INFO	LMF	CLASS	CIC	FOR MESSAGE CENTER/COMMUNICATIONS CENTER ONLY	DATE – TIME	MONTH / YR
1 OF 2	151730Z	RR			UU			15	MAR 78
BOOK	MESSAGE HANDLING INSTRUCTIONS								

FROM: DISTENGR BFLO NY //NCBDP/PM//

TO: DA WASH DC // DAEN-CWD-E //

AND

DIVENGR NOCEN CHGO IL //NCDCO-MO//

INFO: ET AL

UNCLAS

SUBJ: ICE JAM FLOODING, OHIO, CATEGORY B, REPORT NO. 1 - FINAL

1. SITUATION: ON 14 MARCH, AREA WAS COVERED WITH ABOVE FREEZING TEMPERATURES AND RAIN AMOUNTING TO 1/2" - 1" IN 24 HOURS. CONDITIONS WERE FAVORABLE FOR ICE JAM FLOODING. RAIN HAS NOW STOPPED AND TEMPERATURE IS IN LOW 30's. NO RAIN IN FORECAST FOR NEXT FEW DAYS.

2. FLOODING OCCURRED AT THE FOLLOWING LOCATIONS. DISTRICT PERSONNEL WERE ON SCENE FOR RECONNAISSANCE AND TECHNICAL ASSISTANCE.

LAKE COUNTY - CHAGRIN RIVER. JAMS CAUSED FLOODING IN WILLOUGHBY HILLS AND EASTLAKE RESULTING IN THE EVACUATION OF 30-40 FAMILIES IN EACH COMMUNITY. COUNTY HIGHWAY DEPARTMENT ATTEMPTED TO BREAK ONE JAM AT A WILLOUGHBY HILLS BRIDGE WITH A HEADACHE BALL AND CRANE. EACH COMMUNITY ENGAGED IN BLASTING OPERATIONS FOR A FEW DAYS PRIOR TO FORECASTED THAW. 12,000 SAND BAGS WERE

DISTR:

DRAFTER TYPED NAME, TITLE, OFFICE SYMBOL, PHONE & DATE	SPECIAL INSTRUCTIONS
HENRY A. VITALE, NCBDP/PM	
RELEASER: TYPED NAME, TITLE, OFFICE SYMBOL AND PHONE: DANIEL D. LUDWIG COL CE NCBDE	
SIGNATURE: 32	SECURITY CLASSIFICATION / DATE TIME GROUP

DD FORM 173 REPLACES DA FORM 12-12, 1 JUL 68, WHICH IS OBSOLETE.

EXHIBT 1

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JOINT MESSAGEFORM							SECURITY CLASSIFICATION: UNCLASSIFIED		
PAGE	DRAFTER OR RELEASER TIME	PRECEDENCE ACT	PRECEDENCE INFO	LMF	CLASS	CAC	FOR MESSAGE CENTER/COMMUNICATIONS CENTER ONLY	DATE - TIME	MONTH / YR
2 OF 2	151730Z	RR			UU			15	MAR 78

BOOK | MESSAGE HANDLING INSTRUCTIONS

FROM:

TO:

UNCLAS

SUBJ: ICE JAM FLOODING, OHIO, CATEGORY B, REPORT NO. 1 - FINAL

PROVIDED TO THE COUNTY BY BUFFALO DISTRICT.

MINOR STREAMS FLOODED AND THREATENED SUBDIVISIONS IN THE FOLLOWING COUNTIES. CORPS SAND BAGS WERE DISTRIBUTED AS FOLLOWS:

FULTON - 7,500 BAGS

HANCOCK - 5,000 BAGS

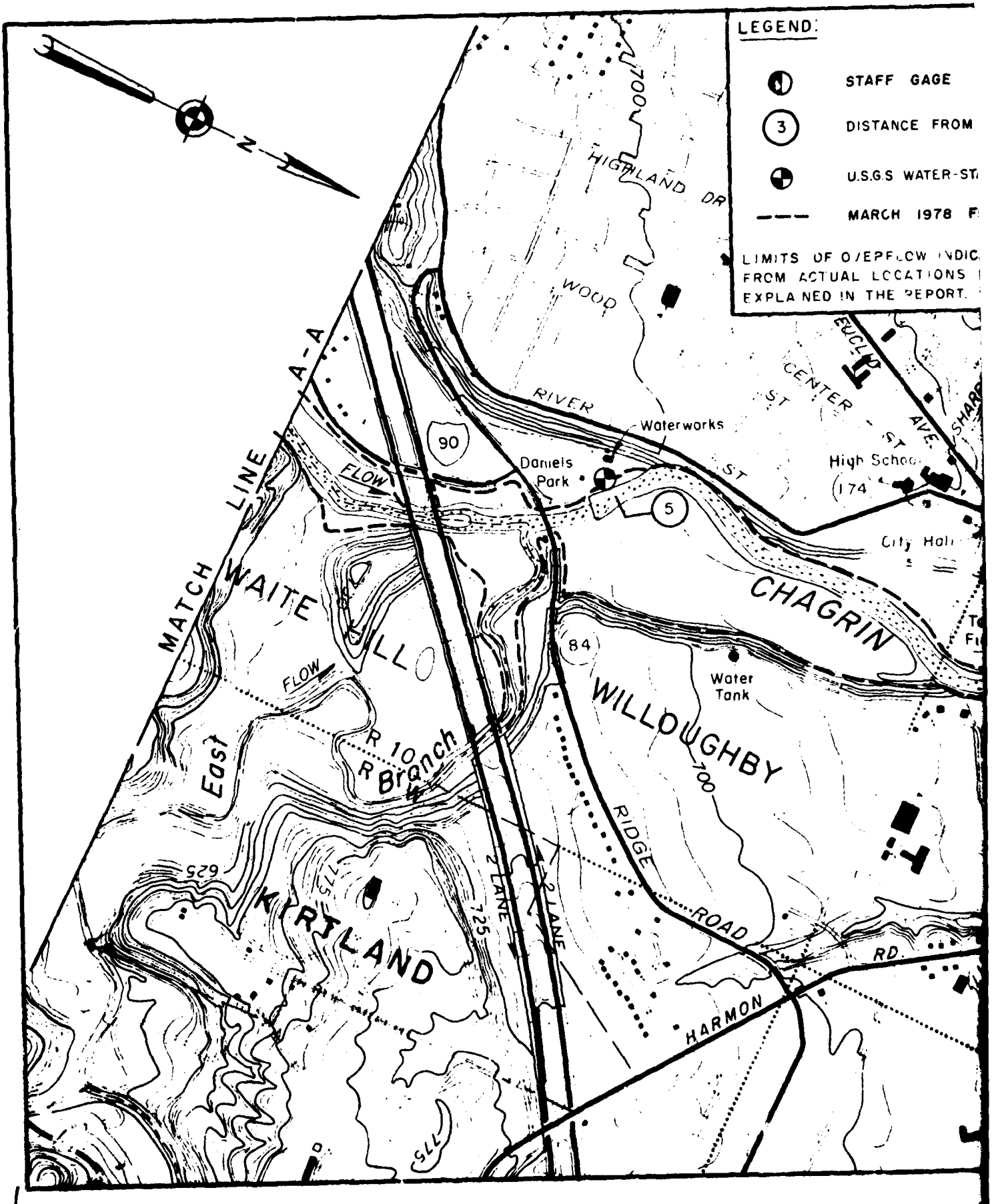
LUCAS - 500 BAGS

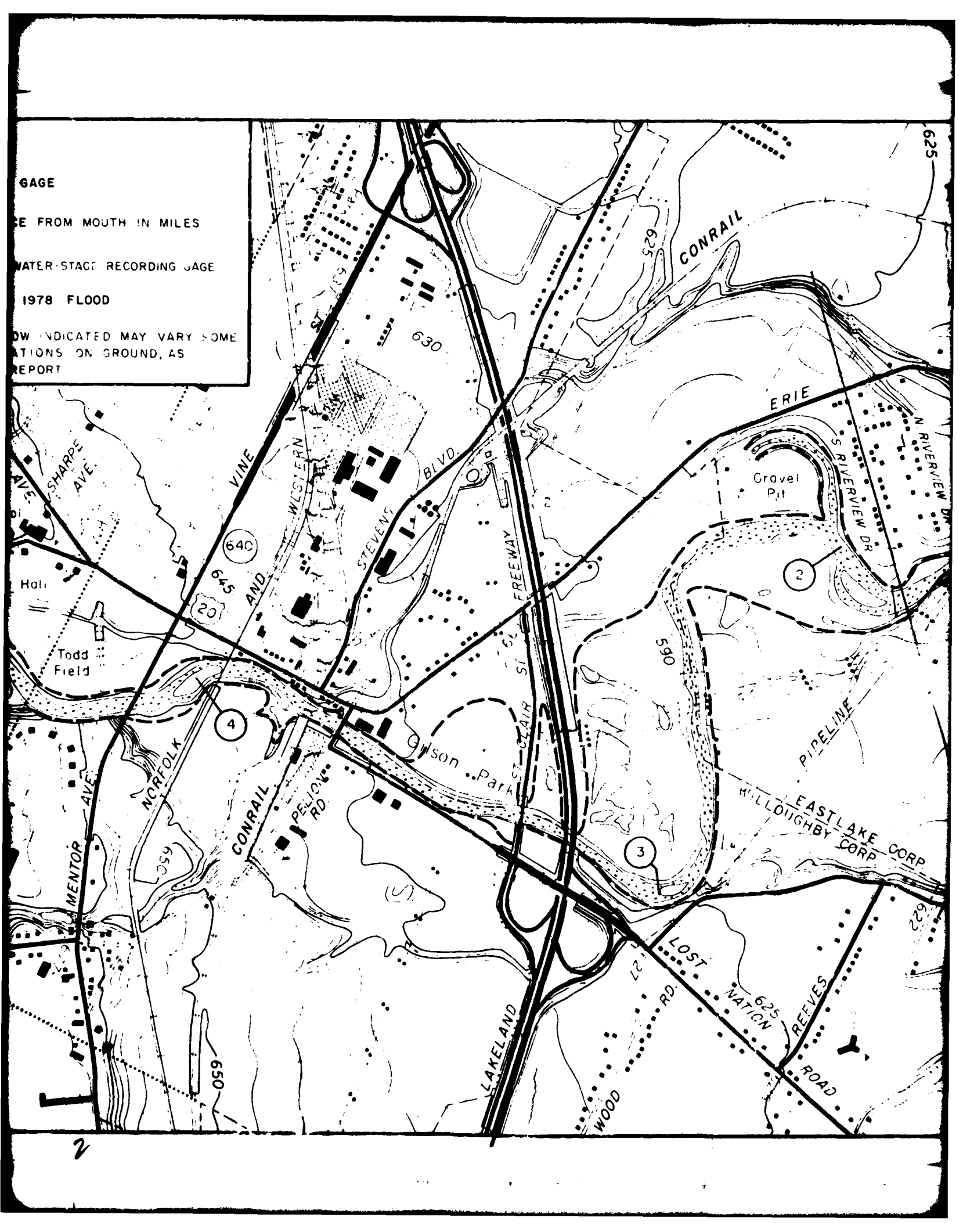
DISTR:

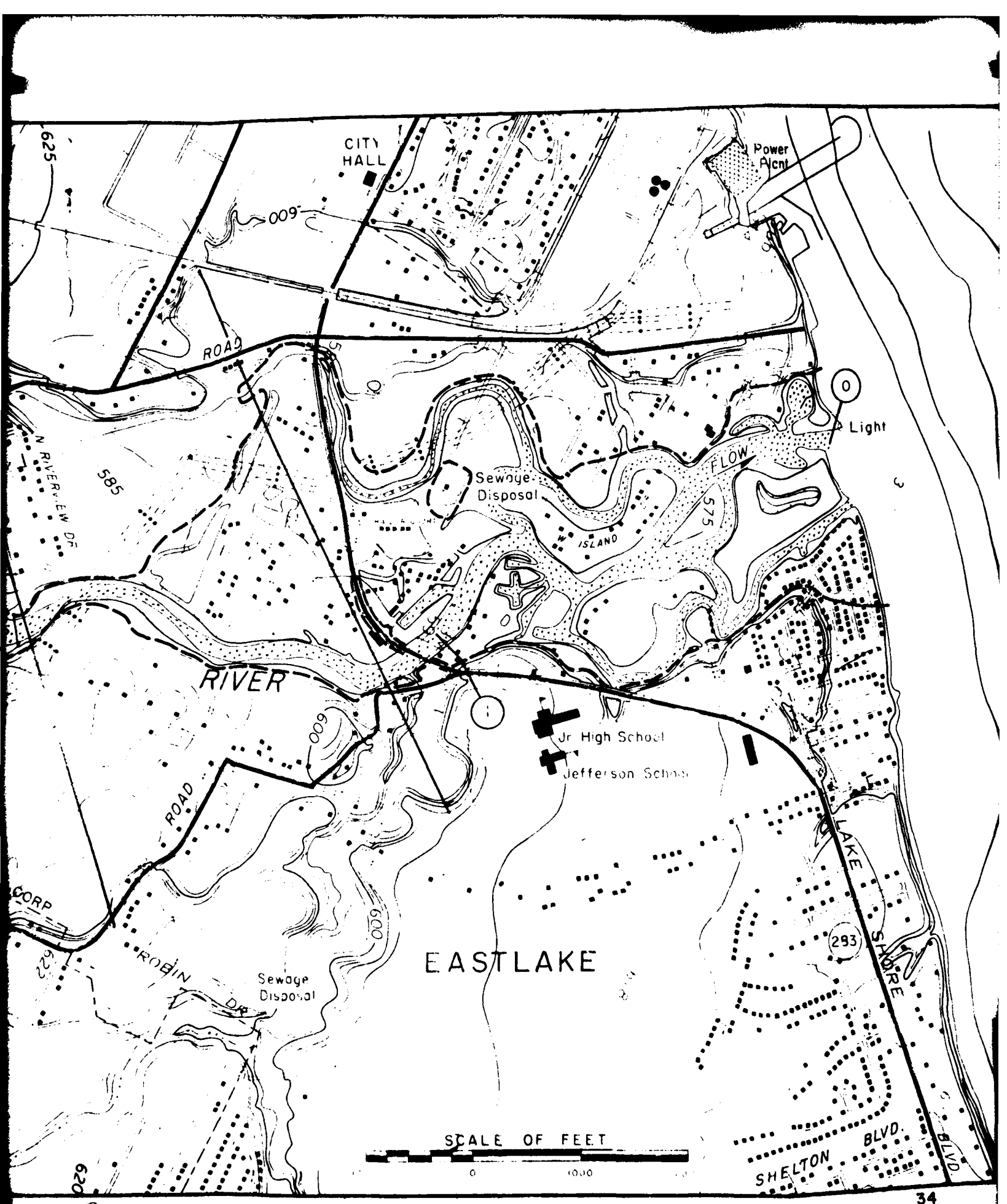
DRAFTER TYPED NAME, TITLE, OFFICE SYMBOL, PHONE & DATE	SPECIAL INSTRUCTIONS	
RELEASER: TYPED NAME, TITLE, OFFICE SYMBOL AND PHONE 33		
SIGNATURE	SECURITY CLASSIFICATION	DATE TIME GROUP

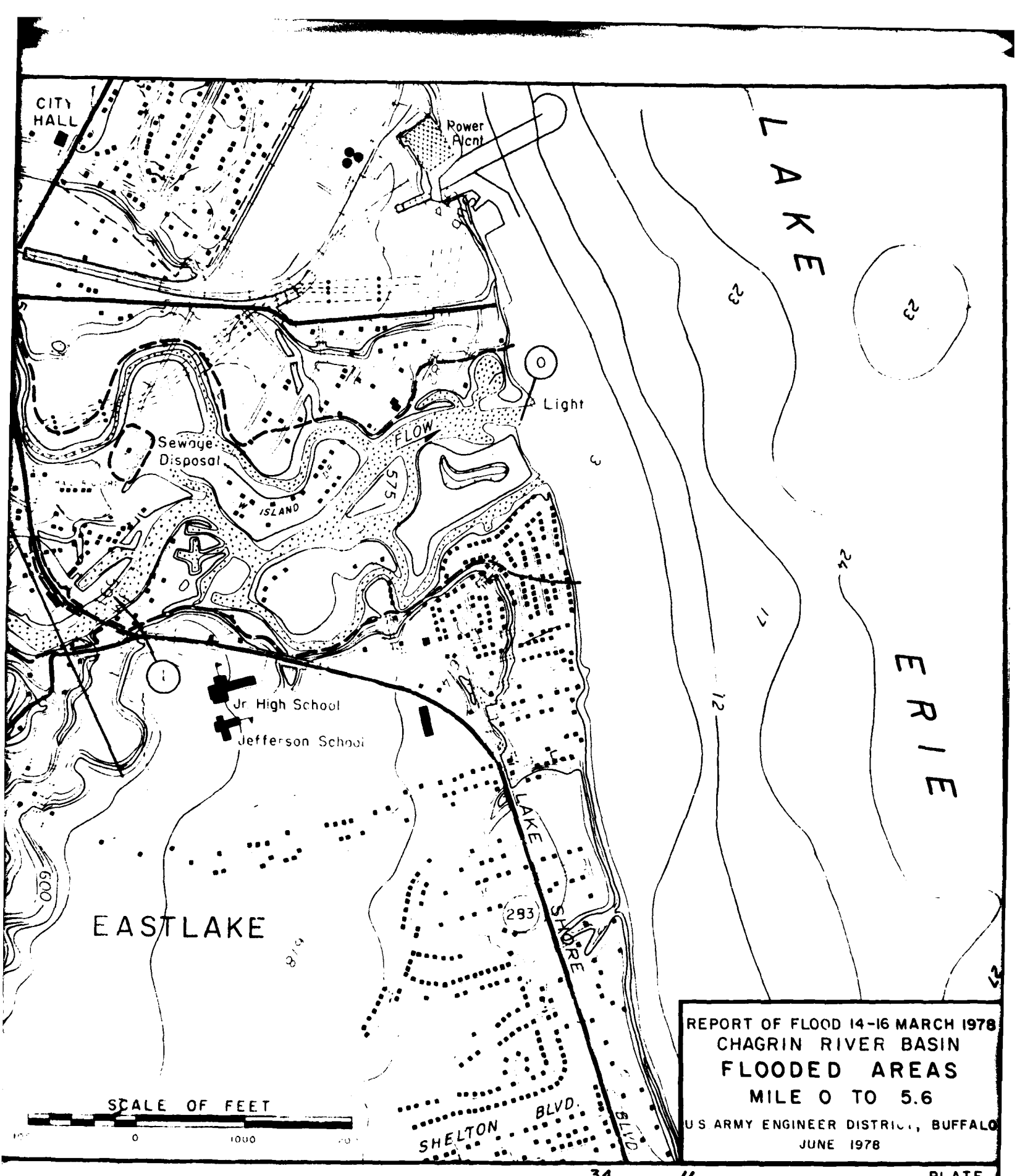
DD FORM 1 OCT 72 173

EXHIBIT 1 Cont'd

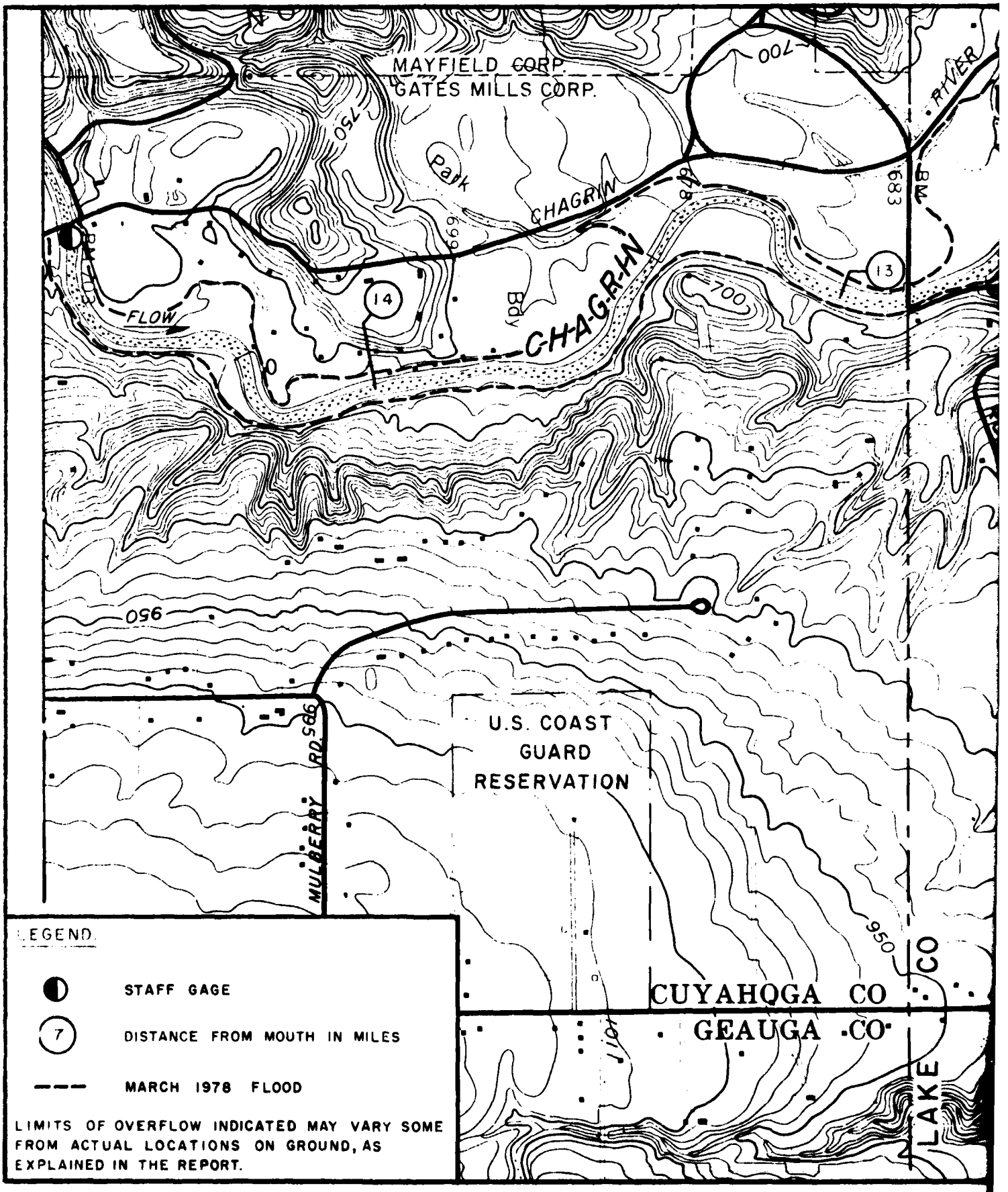

LEGEND:
STAFF GAGE
DISTANCE FROM
U.S.G.S WATER-ST
MARCH 1978 F
LIMITS OF O/EPFLOW INDIC
FROM ACTUAL LOCATIONS
EXPLANED IN THE REPORT.
N
MATCH LINE A-A
WAITE HILL
KIRTLAND
WILLOUGHBY
CHAGRIN
HIGHLAND DR
WOOD
RIVER
Waterworks
Daniels Park
High Schoo
City Hall
Water Tank
East R Branch
RIDGE ROAD
HARMON RD
EUCLID
CENTER ST
SHARP AVE
FLOW
2 LANE
700
725
625
90
84
174
5
10

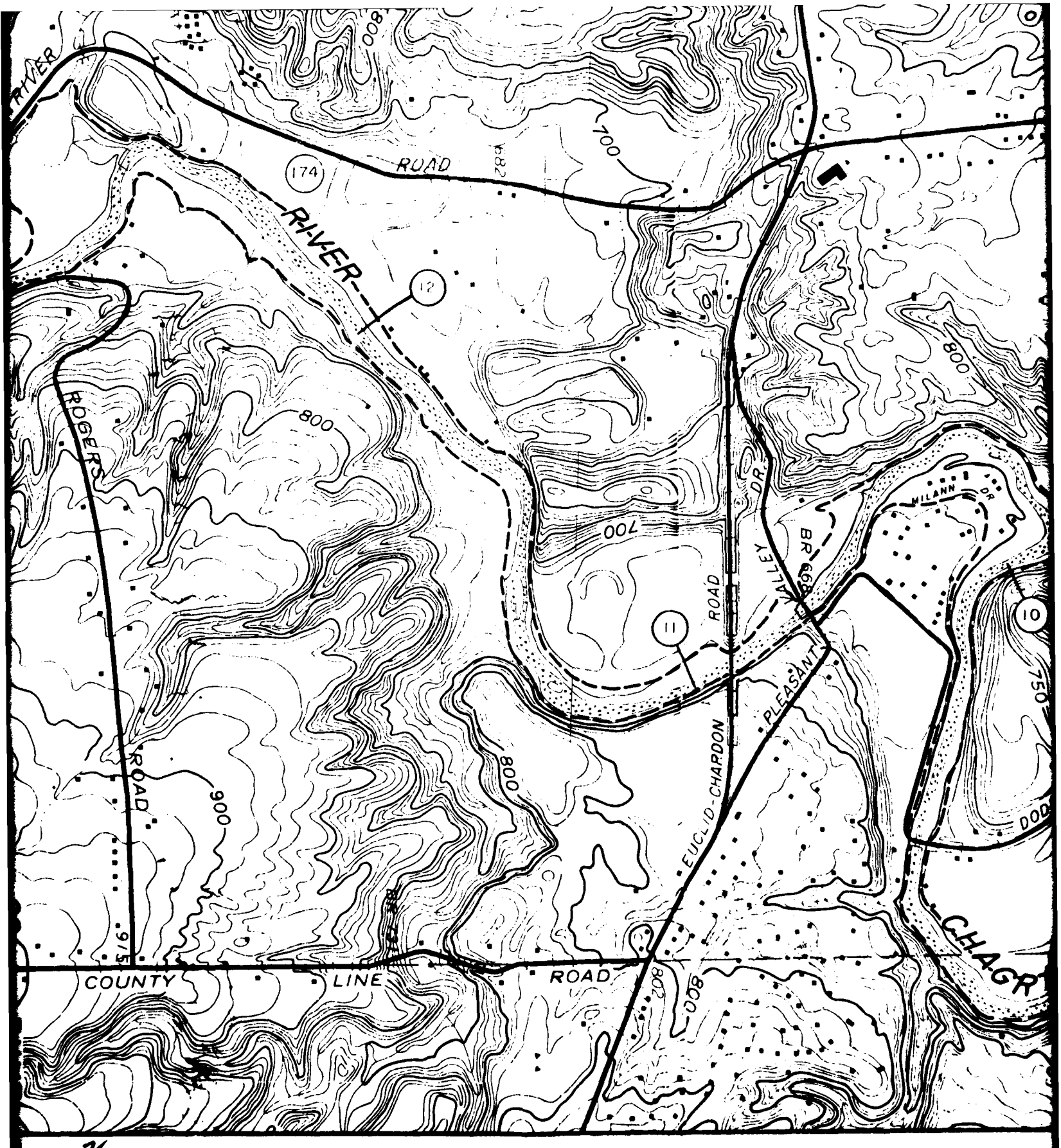

GAGE
E FROM MOUTH IN MILES
WATER-STAGE RECORDING GAGE
1978 FLOOD
OW INDICATED MAY VARY SOME
ATIONS ON GROUND, AS
EPORT
625
CONRAIL
629
630
ERIE
SHARPE AVE.
VINE
WESTERN
STEVENS
BLVD.
640
645
AND
20
FREEWAY
S RIVERVIEW DR
N RIVERVIEW DR
Gravel Pit
Hall
Todd Field
590
PIPELINE
4
2
3
Wilson Park
NORFOLK
CONRAIL
PELTON RD
MENTOR AVE
659
650
WILLOUGHBY
EASTLAKE CORP
LOST NATION
REEVES
ROAD
LAKELAND
WOOD RD.
622
27
2

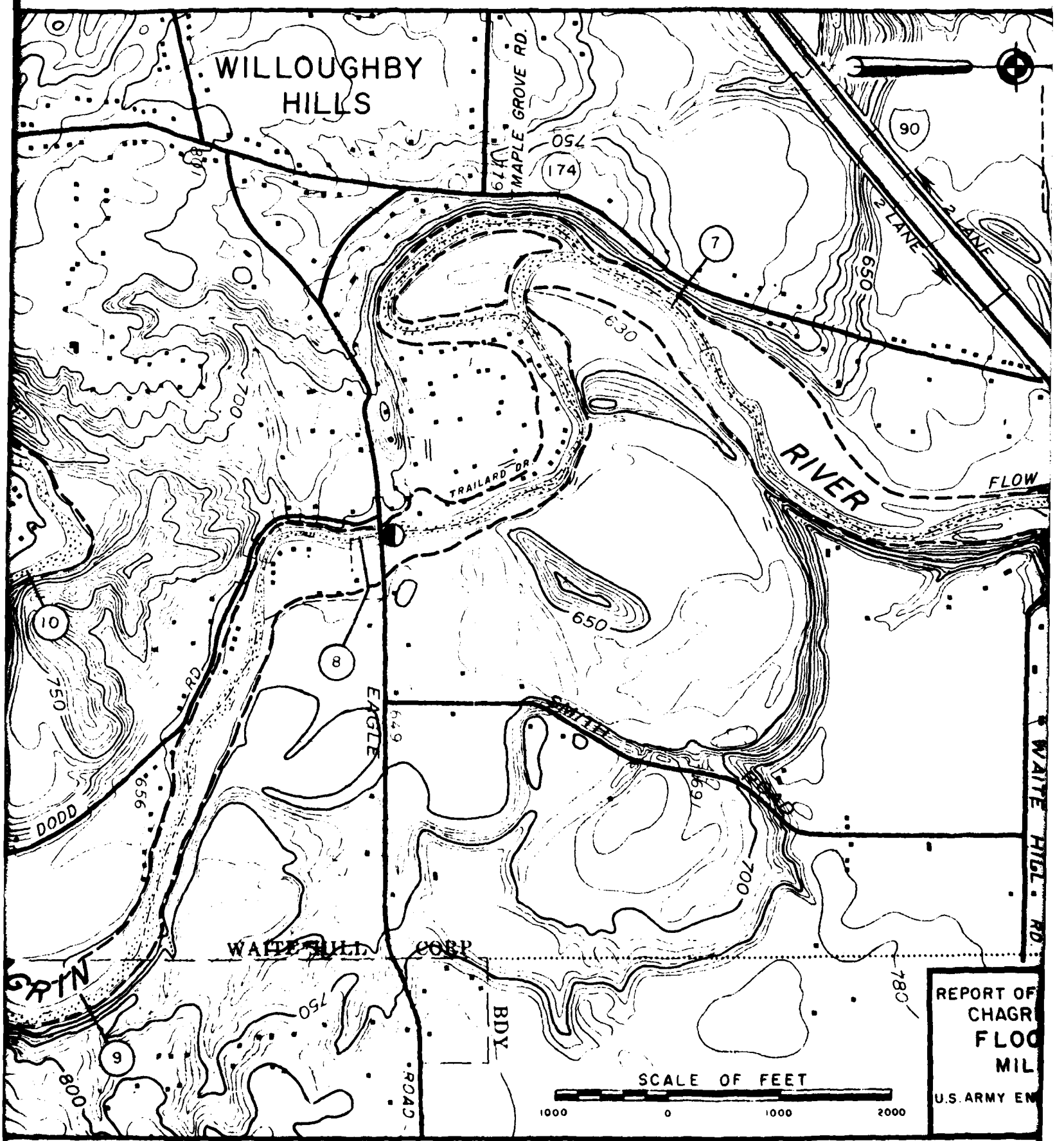

CITY HALL
Power Plant
625
609
ROAD
585
N RIVERVIEW DR
Sewage Disposal
FLOW
575
W ISLAND
Light
RIVER
609
Jr High School
Jefferson School
ROAD
CORP
600
ROBIN DR
Sewage Disposal
EASTLAKE
LAKE SHORE
293
SHELTON BLVD.
BLVD
SCALE OF FEET
0
1000
620

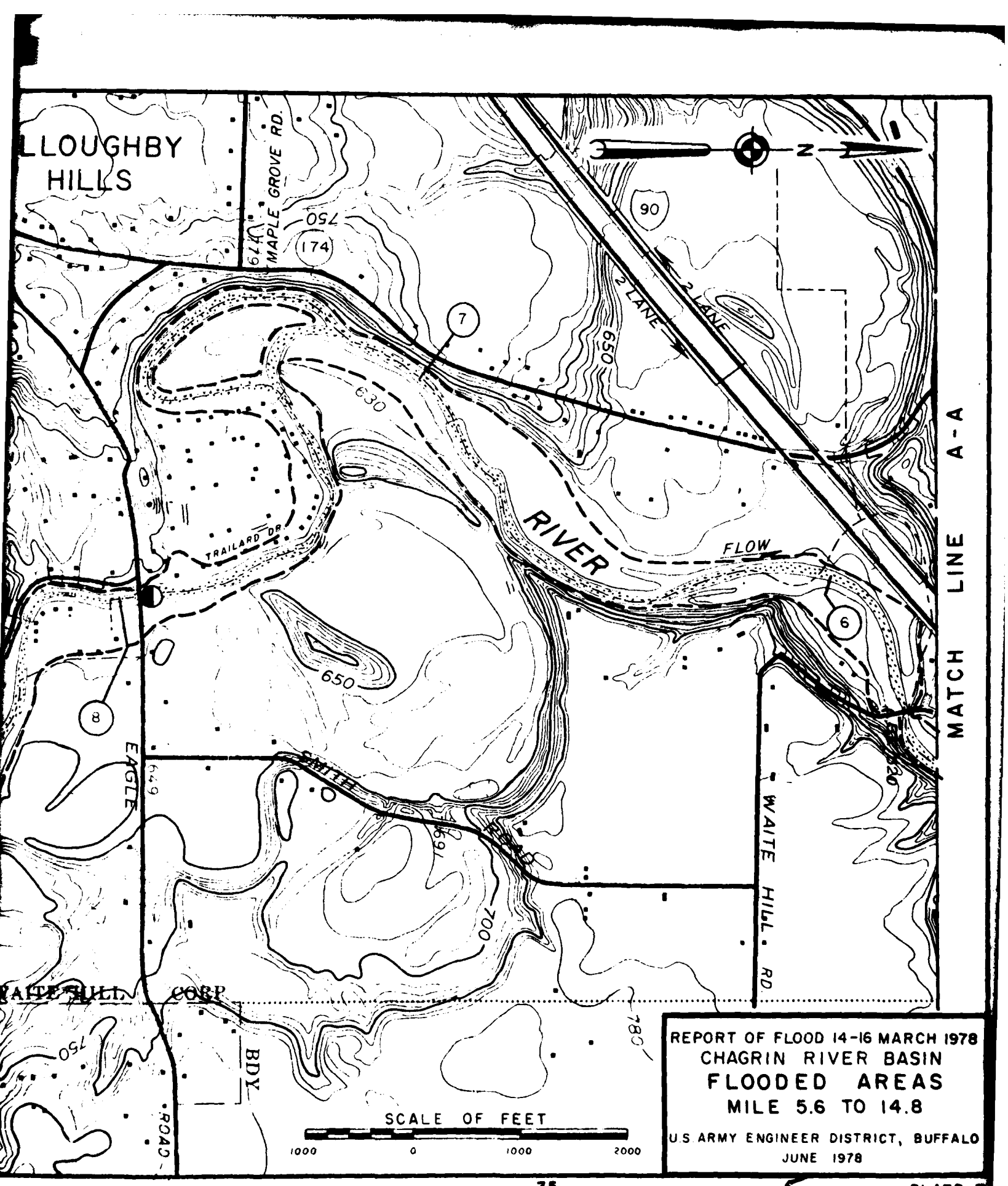


REPORT OF FLOOD 14-16 MARCH 1978
CHAGRIN RIVER BASIN
FLOODED AREAS
MILE 0 TO 5.6
U S ARMY ENGINEER DISTRICT, BUFFALO
JUNE 1978

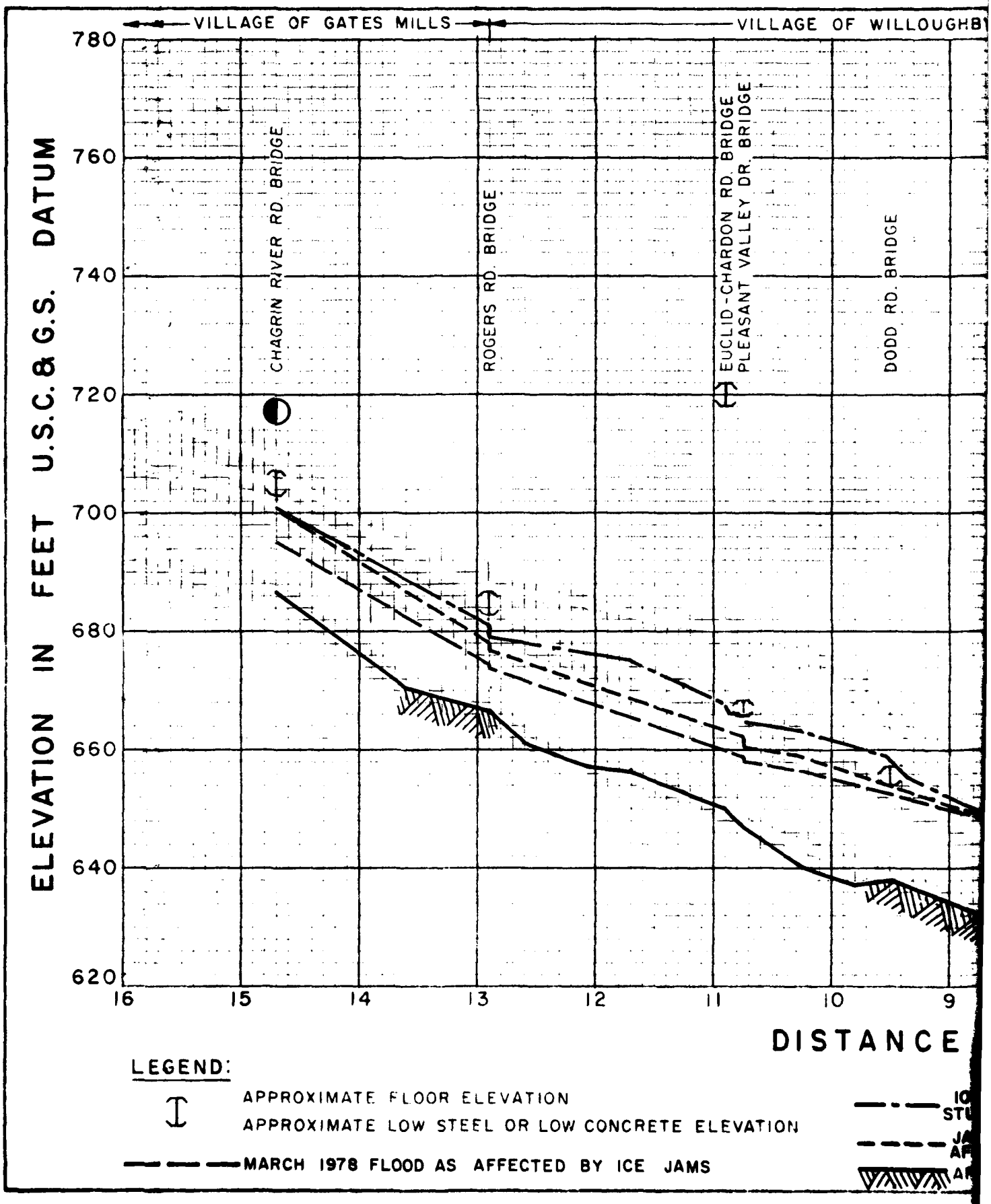

MAYFIELD CORP.
GATES MILLS CORP.
CHAGRIN
RIVER
Park
Bdy
C-H-A-G-R-I-N
FLOW
U.S. COAST
GUARD
RESERVATION
MULBERRY RD.
CUYAHOGA CO
GEAUGA CO
LAKE CO
LEGEND
STAFF GAGE
DISTANCE FROM MOUTH IN MILES
MARCH 1978 FLOOD
LIMITS OF OVERFLOW INDICATED MAY VARY SOME FROM ACTUAL LOCATIONS ON GROUND, AS EXPLAINED IN THE REPORT.

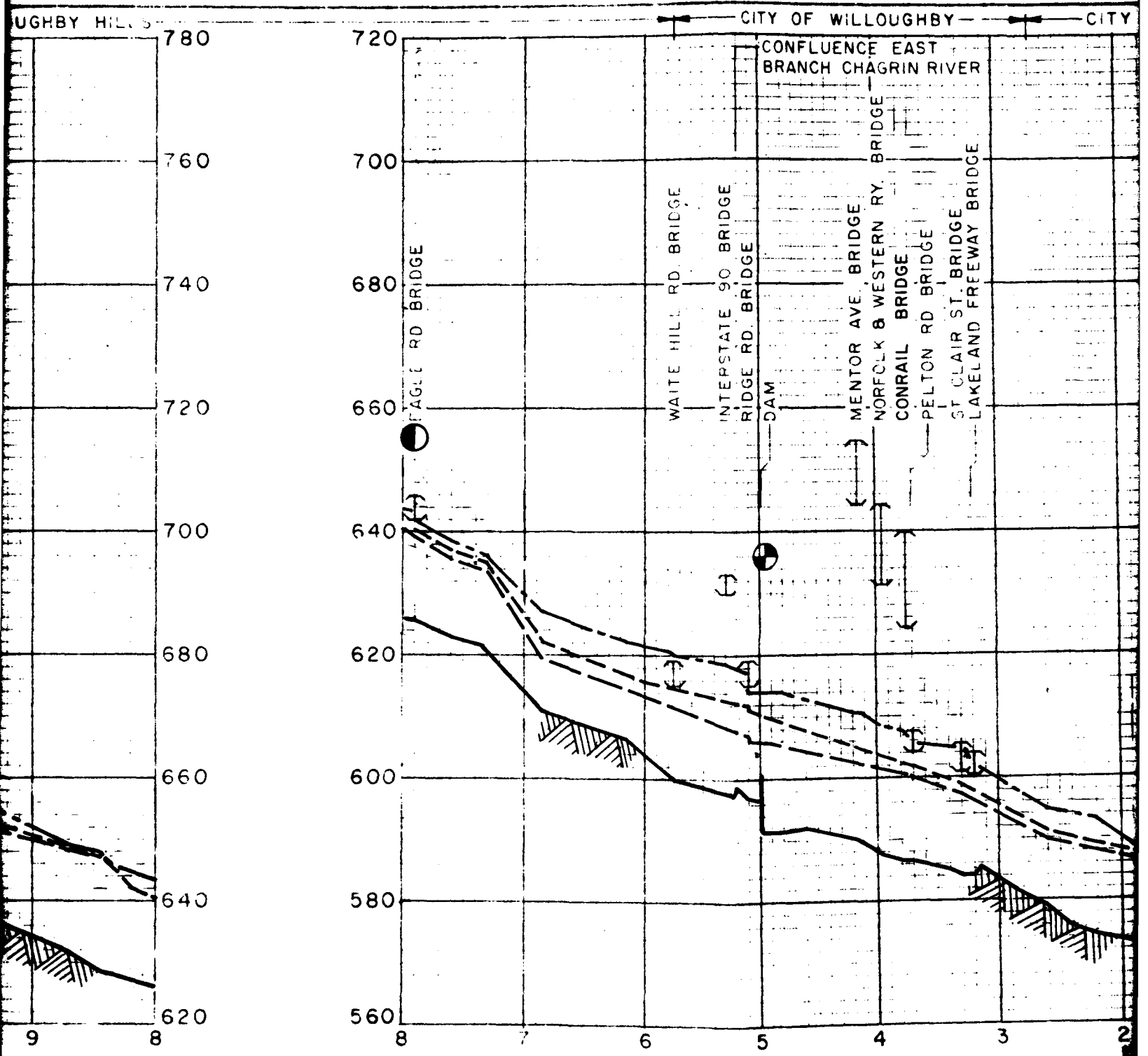

RIVER
800
700
ROAD
174
RIVER
12
800
ROGERS
700
VALLEY DR
BR 68
WILANN DR
11
ROAD
10
750
PLEASANT
800
EUCLID-CHARDON
ROAD
900
915
COUNTY
LINE
ROAD
800
CHAGR

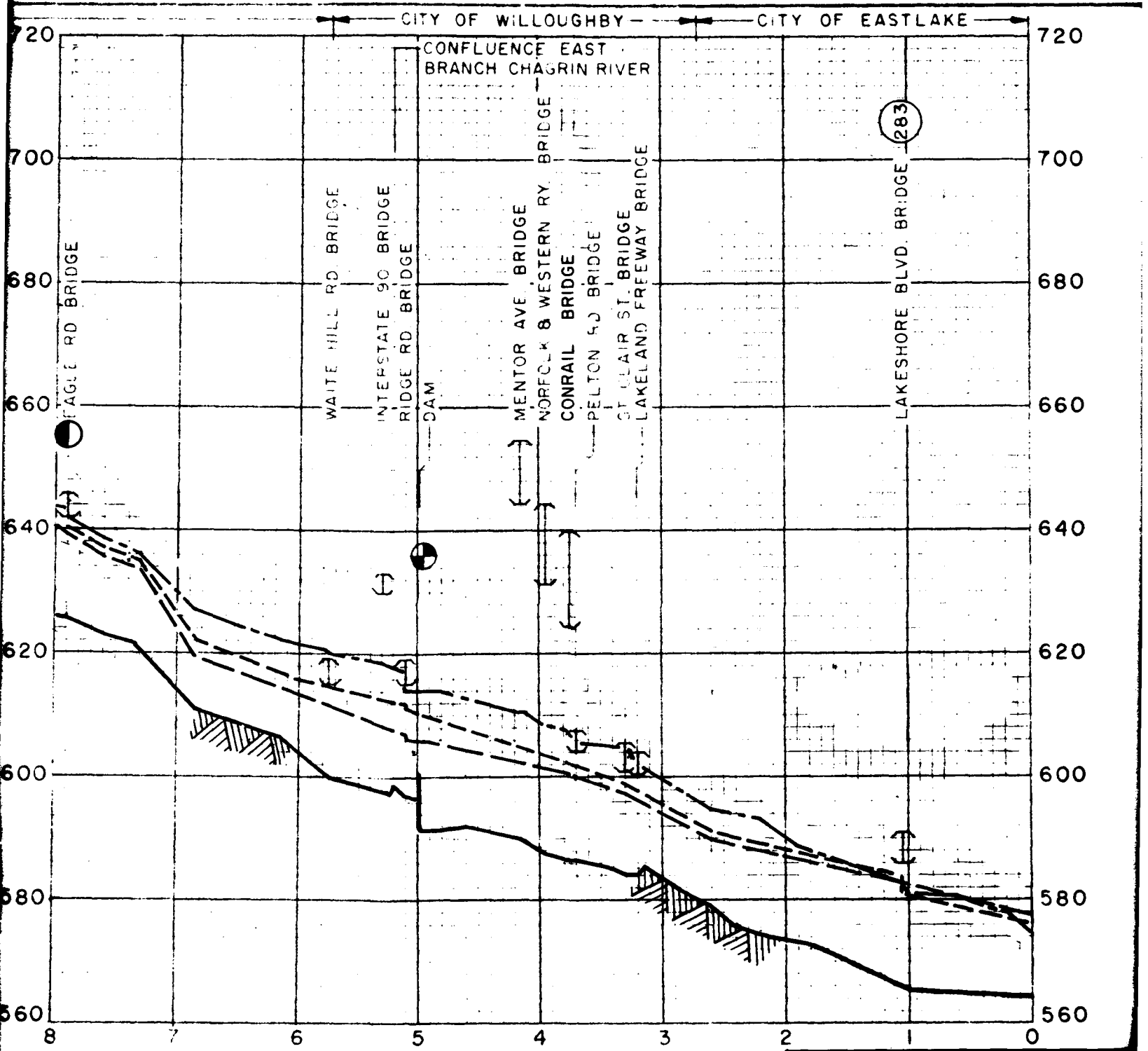

WILLOUGHBY HILLS
MAPLE GROVE RD.
174
90
2 LANE
2 LANE
650
630
7
RIVER
FLOW
TRAILARD DR
650
10
8
EAGLE RD
750
DODD
656
649
SMITH
699
700
WAITE HIGH. RD.
WAITE HILL CORP
BDY.
ROAD
780
GRIN
750
9
800
SCALE OF FEET
1000
0
1000
2000
REPORT OF
CHAGR
FLOO
MIL
U.S. ARMY EN



REPORT OF FLOOD 14-16 MARCH 1978
CHAGRIN RIVER BASIN
FLOODED AREAS
MILE 5.6 TO 14.8
U.S. ARMY ENGINEER DISTRICT, BUFFALO
JUNE 1978


VILLAGE OF GATES MILLS
VILLAGE OF WILLOUGHB
780
760
740
720
700
680
660
640
620
ELEVATION IN FEET U.S.C.&G.S. DATUM
CHAGRIN RIVER RD. BRIDGE
ROGERS RD. BRIDGE
EUCLID-CHARDON RD. BRIDGE
PLEASANT VALLEY DR. BRIDGE
DODD RD. BRIDGE
16
15
14
13
12
11
10
9
DISTANCE
LEGEND:
APPROXIMATE FLOOR ELEVATION
APPROXIMATE LOW STEEL OR LOW CONCRETE ELEVATION
MARCH 1978 FLOOD AS AFFECTED BY ICE JAMS


UGHBY HILLS
CITY OF WILLOUGHBY
CITY
CONFLUENCE EAST BRANCH CHAGRIN RIVER
EAGLE RD BRIDGE
WAITE HILL RD. BRIDGE
INTERSTATE 90 BRIDGE
RIDGE RD. BRIDGE
DAM
MENTOR AVE. BRIDGE
NORFOLK & WESTERN RY. BRIDGE
CONRAIL BRIDGE
PELTON RD BRIDGE
ST. CLAIR ST. BRIDGE
LAKELAND FREEWAY BRIDGE
780
760
740
720
700
680
660
640
620
720
700
680
660
640
620
600
580
560
9
8
8
7
6
5
4
3
2
CE FROM MOUTH IN MILES
100 YEAR FLOOD (FLOOD INSURANCE STUDY, 1978-FREE FLOW CONDITIONS)
JANUARY 1959 FLOOD AS AFFECTED BY ICE JAMS
APPROXIMATE STREAM BED
U.S.G.S. WATER STAGE RECORDING GAGE
LOCATED ON LEFT BANK, 150 FEET
DOWNSTREAM OF DAM
STAFF GAGE



UTH IN MILES

CE
NS)

U.S.G.S. WATER STAGE RECORDING GAGE
LOCATED ON LEFT BANK 150 FEET
DOWNSTREAM OF DAM

STAGE GAGE

REPORT OF FLOOD 14-16 MARCH 197
CHAGRIN RIVER BASIN
PROFILES
MILE 0 TO 16.0
U.S. ARMY ENGINEER DISTRICT, BUFFA
JUNE 1978