UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

FLOOD-FLOW CHARACTERISTICS OF LULLWATER CREEK FROM PONCE DE LEON AVENUE TO PROPOSED PRESIDENTIAL PARKWAY, ATLANTA, GEORGIA

By McGlone Price

Open-File Report 84-060

Prepared in cooperation with the

HIGHWAY DIVISION
GEORGIA DEPARTMENT OF TRANSPORTATION

Doraville, Georgia

1983

UNITED STATES DEPARTMENT OF THE INTERIOR

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FLOOD-FLOW CHARACTERISTICS OF LULLWATER CREEK FROM PONCE DE LEON AVENUE TO THE PROPOSED PRESIDENTIAL PARKWAY, ATLANTA, GEORGIA

SUPERCEDES OPEN-FILE REPORT 83-690

By McGlone Price

ABSTRACT

The U.S. Geological Survey in cooperation with the Highway Division, Georgia Department of Transportation, determined the flood-flow characteristics of Lullwater Creek from Ponce de Leon Avenue to the proposed Presidential Parkway, at Atlanta, Georgia.

Flood discharges and flood profiles for the 2-, 5-, 10-, 25-, 50-, and 100-year floods were computed for existing and proposed conditions. The proposed construction of the Presidential Parkway and two pedestrian bridges would increase the flood profile elevations 0.1 foot from existing conditions throughout the reach except upstream from Section I, where a footbridge will be removed and Section K, where a culvert will be removed. However, the flood profiles for proposed conditions will be about the same as those for conditions prior to the removal of houses for the proposed construction of Interstate Highway 485.

INTRODUCTION

The September 1982 U.S. Geological Survey Open-File Report 83-690, "Flood-Flow Characteristics of Lullwater Creek from Ponce de Leon Avenue to the Proposed Presidential Parkway, Atlanta, Georgia," prepared at the request of the Georgia Department of Transportation, described the flood-flow characteristics at Lullwater Creek for floods having recurrence intervals of 2, 50, and 100 years for three alternate conditions.

A. Existing conditions.

B. Construction of a 200-ft bridge at the proposed Presidential Parkway crossing of Lullwater Creek between highway centerline stations 154+40 and 156+40.

C. Construction of a two-barrel box culvert with 8 ft by 6 ft openings, 157 ft long at the crossing site, with downstream and upstream invert elevations of 913.5 and 914.3 ft, respectively.

The Highway Division, Georgia Department of Transportation, requested by letter in November 1983, a supplemental study of the reach of Lullwater Creek from Ponce de Leon Avenue to the proposed Presidential Parkway for floods having recurrence intervals of 2-, 5-, 10-, 25-, 50-, and 100-years, which include the following alternate conditions:

D. Construction of a 94-ft bridge at the proposed Presidential Parkway crossing of Lullwater Creek between highway centerline stations 153+79 and 154+73. This alternate also includes the construction of a 36-ft pedestrian bridge crossing of Lullwater Creek, 200 ft upstream from the Presidential Parkway and the construction of a 30-ft pedestrian bridge over Lullwater Creek tributary, 50 ft upstream from its mouth. This alternate would also include a slight change in roadway alinement between Ponce de Leon Avenue and the Presidential Parkway bridge crossing Lullwater Creek and the removal of the footbridge at Section I and the culvert at Section K.

In addition, the study includes computations of flood elevations, area of opening under high-water conditions, average velocity through the drainage structures, and backwater for the 2-, 5-, 10-, 25-, 50-, and 100-year floods for existing and proposed conditions (Alternate D).

The Highway Division furnished plans for the proposed location of the Presidential Parkway, bridge and culvert geometry for the existing and proposed drainage structures, and a 2-ft contour map of the study reach. Locations of the proposed Presidential Parkway, proposed bridge crossings, and cross sections used in flood routing are shown in figure 1. Lullwater Creek drains an area of 0.99 mi^2 at Ponce de Leon Avenue and 0.26 mi^2 at the proposed Presidential Parkway. Lullwater Creek tributary drains an area of 0.64 mi^2 at its mouth.

All elevations listed in this report are to National Geodetic Vertical Datum of 1929, which is used by the Highway Division.

FLOOD FREQUENCY

The flood-frequency relations for Lullwater Creek at Lullwater Parkway, Ponce de Leon Avenue, the Presidential Parkway, and Lullwater Creek tributary at its mouth have been computed using techniques described in U.S. Geological Survey Water-Resources Investigations Report 78-137, "Floods in Georgia, Magnitude and Frequency." These flood-frequency relations have been adjusted for the effects of urbanization using U.S. Geological Survey Open-File Report 77-57, "Preliminary Flood-Frequency Relations for Urban Streams, Metropolitan Atlanta," which includes known discharge records for gages on urban streams in the Atlanta area.

The urbanization adjustment factors used for existing conditions were based on an impervious area of 35 percent and the assumption that 50 percent of the area is served by storm sewers. The Highway Division has computed an impervious area of 37.5 percent for conditions in the Lullwater Creek basin before the removal of houses for the proposed construction of Interstate Highway 485, which was not built. They also computed an impervious area of

37.5 percent if the area is allowed to be redeveloped without the Presidential Parkway. They computed an impervious area of 38.5 percent if the Presidential Parkway and Library are constructed. The urbanization adjustment factors used for proposed conditions with the Presidential Parkway constructed were based on an impervious area of 38.5 percent and the assumption that 55 percent of the area is served by storm sewers.

The method of adjusting for the effects of urbanization were based mainly on U.S. Geological Survey Open-File Report 77-57, "Preliminary Flood-Frequency Relations for Urban Streams, Metropolitan Atlanta," which includes known discharge records for gages on urban streams in the Atlanta area.

The discharges computed for the requested floods on Lullwater Creek were as follows:

Lullwater Parkway - Drainage area = 1.24 mi^2.

	Prior to houses being removed	1983 conditions	After proposed parkway
	37.5 percent impervious area, 50 percent sewered	35 percent impervious area, 50 percent sewered	38.5 percent impervious area, 55 percent sewered
	Discharge (ft^3/s)	Discharge[1] (ft^3/s)	Discharge[2] (ft^3/s)
2-year flood	571	555	577
5-year flood	825	797	836
10-year flood	989	963	1,000
25-year flood	1,220	1,180	1,230
50-year flood	1,410	1,370	1,420
100-year flood	1,590	1,550	1,610

1 Discharges apply to Sections A-F; Lullwater Creek profiles (Alternate A)
2 Discharges apply to Sections A-F; Lullwater Creek profiles (Alternate D)

Ponce de Leon Avenue - Drainage area = 0.99 mi^2.

	Prior to houses being removed 37.5 percent impervious area, 50 percent sewered Discharge (ft^3/s)	1983 conditions 35 percent impervious area, 50 percent sewered Discharge[3] (ft^3/s)	After proposed parkway 38.5 percent impervious area, 55 percent sewered Discharge[4] (ft^3/s)
2-year flood	505	482	514
5-year flood	721	695	731
10-year flood	868	839	879
25-year flood	1,060	1,030	1,070
50-year flood	1,240	1,210	1,250
100-year flood	1,400	1,360	1,410

3 Discharges apply to Sections F-J; Lullwater Creek profiles (Alternate A)
4 Discharges apply to Sections F-J; Lullwater Creek profiles (Alternate D)

Presidential Parkway - Drainage area = 0.26 mi^2

	Prior to houses being removed 37.5 percent impervious area, 50 percent sewered Discharge (ft^3/s)	1983 conditions 35 percent impervious area, 50 percent sewered Discharge[5] (ft^3/s)	After proposed parkway 38.5 percent impervious area, 55 percent sewered Discharge[6] (ft^3/s)
2-year flood	226	217	230
5-year flood	325	314	329
10-year flood	391	379	396
25-year flood	482	469	487
50-year flood	559	545	565
100-year flood	638	622	645

5 Discharges apply to Sections J-O; Lullwater Creek profiles (Alternate A)
6 Discharges apply to Sections J-O; Lullwater Creek profiles (Alternate D)

The discharges computed for Lullwater Creek tributary at the mouth were:

Lullwater Creek tributary, mouth (Section J) - Drainage area = 0.64 mi^2

	Prior to houses being removed 37.5 percent impervious area, 50 percent sewered Discharge (ft^3/s)	1983 conditions 35 percent impervious area, 50 percent sewered Discharge[7] (ft^3/s)	After proposed parkway 38.5 percent impervious area, 55 percent sewered Discharge[8] (ft^3/s)
2-year flood	388	372	395
5-year flood	555	537	563
10-year flood	670	649	678
25-year flood	821	797	830
50-year flood	953	927	963
100-year flood	1,080	1,050	1,090

7 Discharges apply to Sections J-BB; Lullwater Creek tributary profiles (Alternate A)
8 Discharges apply to Sections J-BB; Lullwater Creek tributary profiles (Alternate D)

Based on these computations, the increase in discharge due to construction of the proposed Presidential Parkway compared to the urban conditions prior to the house removals for the proposed construction of Interstate Highway 485 would be insignificant. The increase in discharge due to construction of the Presidential Parkway from present conditions would be about 4 percent.

The flood-frequency curves computed for the four sites listed in the text for conditions prior to house removals, present conditions, and proposed urban conditions are shown in figure 2.

Logarithmic probability (normal)

Station number _____

Magnitude and frequency of annual peaks on Lullwater Creek at Presidential Parkway, Atlanta, Ga. Drainage area _____ sq. mi. Period _____

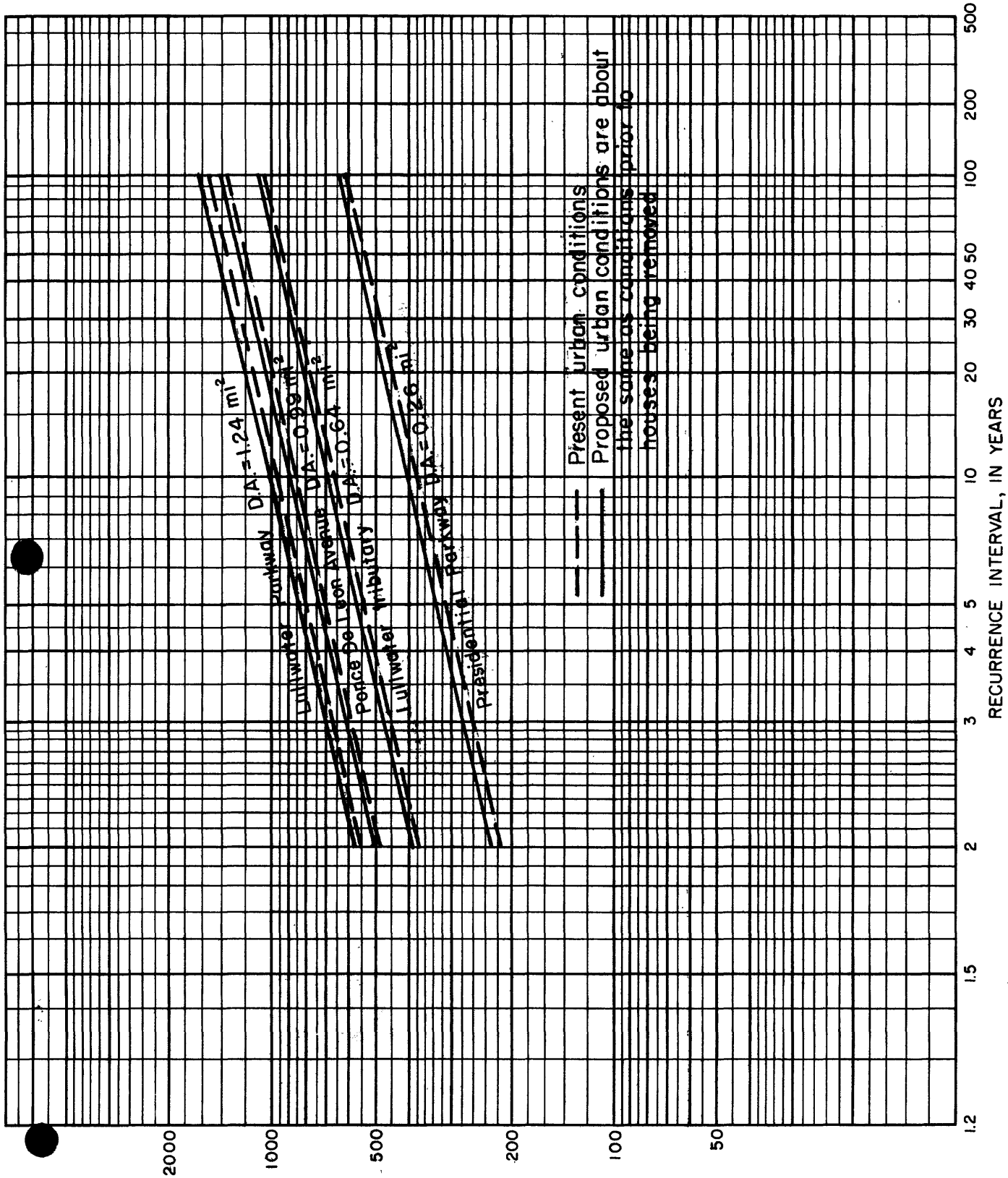

Figure 2.—Flood-frequency curves for Lullwater Creek and Lullwater Creek tributary at Atlanta, Ga.

ELEVATION-DISCHARGE RELATION

The elevation-discharge relation (fig. 3) for alternate condition D for proposed urban conditions was developed for the downstream end of the proposed Presidential Parkway (cross section M) crossing of Lullwater Creek based on routing studies using U.S. Geological Survey Step-Backwater Program J635 and U.S. Geological Survey Computer Program A526 for computation of flow through culverts.

A field reconnaissance of the study reach was made by U.S. Geological Survey personnel on November 4, 1983, and roughness values were estimated for use in step-backwater routing studies.

The elevations for the requested floods at the downstream end of the proposed Presidential Parkway for existing and alternate condition D are listed in tables 1 and 2, respectively.

FLOOD PROFILES

The flood-profile data for Lullwater Creek for the requested floods for alternate conditions A and D are shown in table 1 and figures 4 and 5. The profiles were produced using U.S. Geological Survey Step-Backwater Computer Program J635 and U.S. Geological Survey Computer Program A526 for computation of flow through culverts. The roughness "n" values used were based on present channel conditions.

The discharges used in the flood-profile routing of Lullwater Creek were as given in the section, "Flood Frequency."

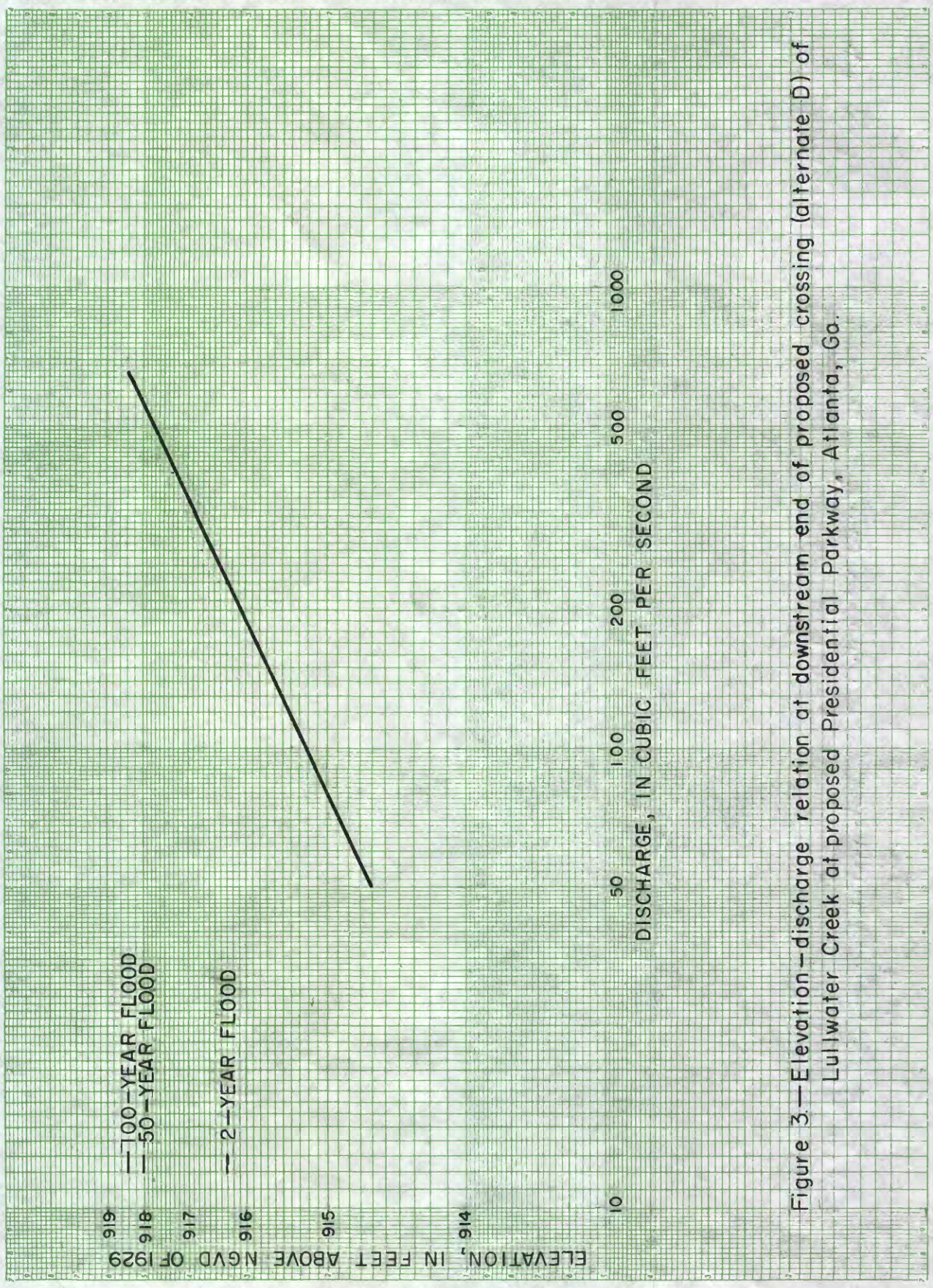

Figure 3.—Elevation—discharge relation at downstream end of proposed crossing (alternate D) of Lullwater Creek at proposed Presidential Parkway, Atlanta, Ga.

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Figure 4.—Flood profiles from sections E to O for Lullwater Creek near Presidential Parkway at Atlanta, Ga.

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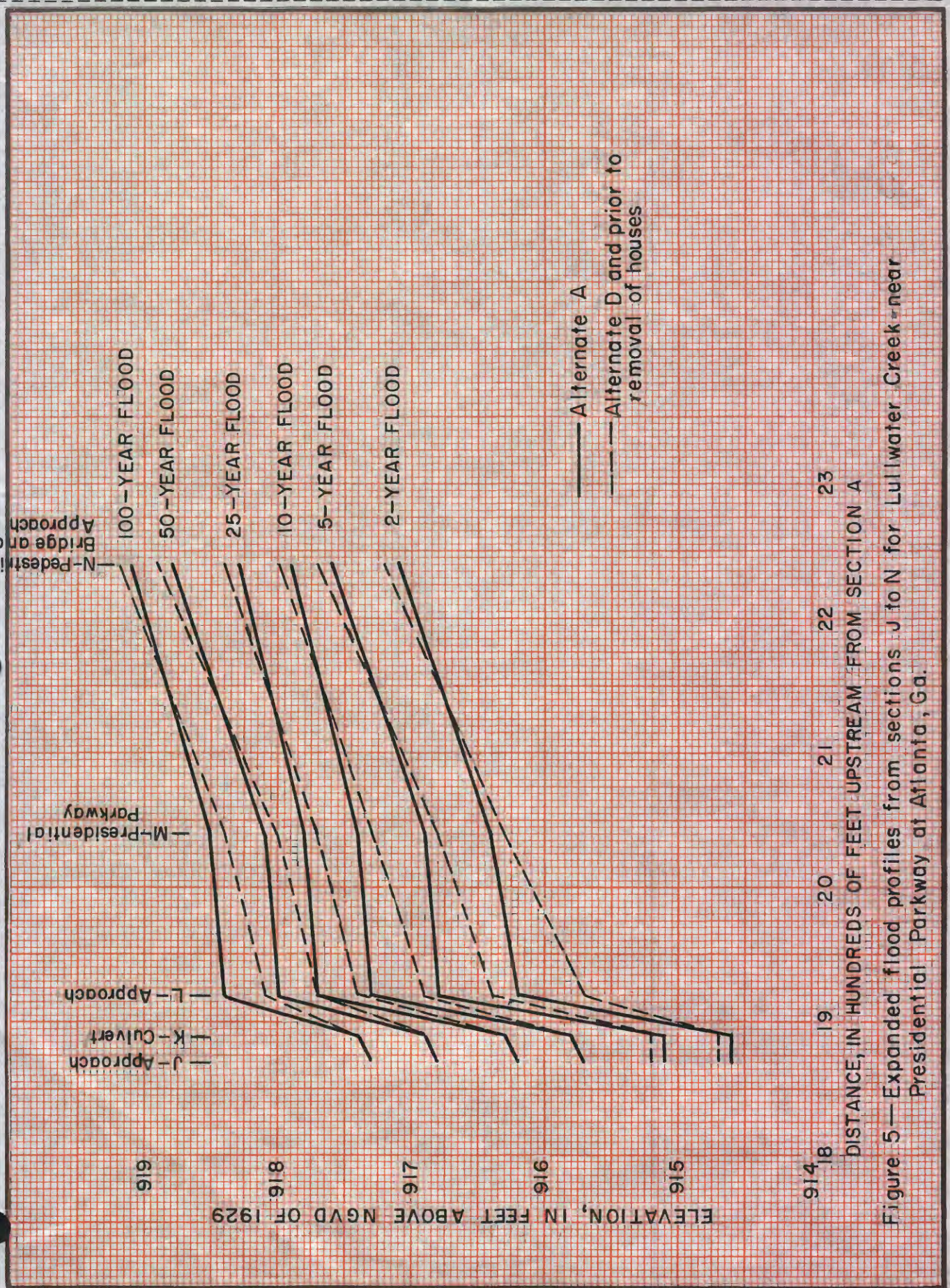

Figure 5—Expanded flood profiles from sections J to N for Lullwater Creek near Presidential Parkway at Atlanta, Ga.

Table 1.—Flood-profile data for two alternate conditions, A and D, for Lullwater Creek and Lullwater Creek tributary, near proposed Presidential Parkway

Cross section (See fig. 1.)	Distance (feet)	WATER SURFACE ELEVATION ABOVE NATIONAL VERTICAL DATUM OF 1929, IN FEET											
		2-year flood		5-year flood		10-year flood		25-year flood		50-year flood		100-year flood	
		Alt.A	Alt.D	Alt.A	Alt.D	Alt.A	Alt.D	Alt.A	Alt.D	Alt.A	Alt.D	Alt.A	Alt.D
Lullwater Creek:													
A - City bridge	0	Sections A-E used for convergence studies											
B - Approach	50												
C -	260												
D -	430												
E -	640	905.3	905.4	906.0	906.1	906.4	906.5	906.8	906.9	907.3	907.4	907.6	907.7
F - Ponce de Leon Avenue	900	906.7	906.8	907.3	907.4	907.7	907.8	908.1	908.2	908.5	908.6	908.8	908.9
G - Approach	1,070	907.4	907.5	908.0	908.1	908.3	908.4	908.8	908.9	909.2	909.3	909.5	909.6
H -	1,350	909.9	910.0	910.5	910.6	910.8	910.9	911.2	911.3	911.5	911.6	911.8	911.9
I - Footbridge	1,830	912.4	912.5	913.0	913.1	913.4	913.5	913.8	913.9	914.1	914.2	914.4	914.5
J - Approach	1,870	914.6	914.7	915.1	915.2	915.7	915.7	916.2	916.2	916.8	916.8	917.3	917.3
K - Small culvert	1,890	914.6	914.7	915.1	915.2	915.8	915.8	916.3	916.3	916.9	916.9	917.4	917.4
L - Approach	1,920	916.2	915.7	916.8	916.4	917.3	916.9	917.7	917.4	918.0	917.7	918.4	918.1
M - Presidential Parkway	2,040	916.4	916.3	916.9	916.8	917.4	917.3	917.8	917.7	918.1	918.0	918.5	918.4
N - Pedestrian bridge	2,240	917.1	917.2	917.6	917.7	917.9	918.0	918.3	918.4	918.8	918.9	919.1	919.2
O - Approach	2,340	918.1	918.2	918.6	918.7	919.0	919.1	919.5	919.6	919.8	919.9	920.1	920.2
Lullwater Creek tributary:													
J - Approach	1,870	914.6	914.7	915.1	915.2	915.7	915.7	916.2	916.2	916.8	916.8	917.3	917.3
JA - Pedestrian bridge	1,920	914.6	914.7	915.1	915.2	915.8	915.8	916.3	916.3	916.9	916.9	917.4	917.4
AA - Approach	2,010	915.1	915.2	915.6	915.7	916.0	916.1	916.5	916.6	917.1	917.2	917.5	917.6
BB -	2,280	916.3	916.4	916.7	916.8	917.0	917.1	917.4	917.5	917.8	917.9	918.3	918.4

Table 2.—Drainage structure computations for Lullwater Creek and Lullwater Creek tributary near Presidential Parkway

Condition	Discharge (ft^3/s) Bridge	Roadway	Downstream elevation, feet above NGVD of 1929	Area (ft^2)	Average velocity (ft^3/s)	Backwater (ft)
LULLWATER CREEK						
Ponce de Leon Avenue - six-barrel elliptical culvert						
Alternate A - Present urban conditions						
2-year flood	482		906.7	68	7.1	<0.1
5-year flood	695		907.3	92	7.6	<.1
10-year flood	829		907.7	104	7.9	<.1
25-year flood	1,030		908.1	121	8.5	<.1
50-year flood	1,210		908.5	136	8.9	<.1
100-year flood	1,360		908.8	149	9.1	<.1
Alternate D - Proposed urban conditions						
2-year flood	514		906.8	72	7.1	<0.1
5-year flood	731		907.4	95	7.7	<.1
10-year flood	879		907.8	108	8.1	<.1
25-year flood	1,070		908.2	125	8.6	<.1
50-year flood	1,250		908.6	139	9.0	<.1
100-year flood	1,410		908.9	153	9.2	<.1
Footbridge at Section I, 27 ft long						
Alternate A - Present urban conditions						
2-year flood	482		912.4	65	7.4	<0.1
5-year flood	695		913.0	82	8.5	<.1
10-year flood	779	(50)	913.3	90	8.6	.1
25-year flood	830	(200)	913.8	108	7.7	.1
50-year flood	870	(340)	914.1	118	7.8	.1
100-year flood	890	(470)	914.4	128	7.0	.1
Alternate D - Footbridge removed for proposed urban conditions						
Culvert at Section K, 15 ft irregular shaped						
Alternate A - Present urban conditions						
2-year flood	217		914.6	27	8.0	0.6
5-year flood	254	(50)	915.1	34	7.5	.5
10-year flood	259	(100)	915.8	34	7.6	.5
25-year flood	269	(200)	916.3	34	7.9	.4
50-year flood	275	(270)	916.9	34	8.1	.4
100-year flood	282	(340)	917.4	34	8.3	.4

Table 2.--Drainage structure computations for Lullwater Creek and Lullwater Creek tributary near Presidential Parkway--Continued

Condition	Discharge (ft^3/s) Bridge	Discharge (ft^3/s) Roadway	Downstream elevation, feet above NGVD of 1929	Area (ft^2)	Average velocity (ft^3/s)	Backwater (ft)
Alternate D - Culvert removed for proposed urban conditions						
Presidential Parkway - Alternate D - 94-ft bridge with vertical abutments from highway centerline stations 153+80 to 154+74						
Proposed urban conditions:						
2-year flood	230		916.3	36	6.4	<0.1
5-year flood	329		916.8	48	6.8	<.1
10-year flood	396		917.3	59	6.7	<.1
25-year flood	487		917.7	73	6.7	<.1
50-year flood	565		918.0	85	6.6	<.1
100-year flood	645		918.4	103	6.3	<.1
Pedestrian bridge - Alternate D - 36-ft bridge with vertical abutments						
Proposed urban conditions:						
2-year flood	230		917.2	31	7.4	<0.1
5-year flood	329		917.7	42	7.8	.1
10-year flood	396		918.0	50	7.9	.1
25-year flood	487		918.4	61	8.0	.1
50-year flood	565		918.9	74	7.6	.1
100-year flood	645		919.2	83	7.8	.1
LULLWATER CREEK TRIBUTARY						
Pedestrian bridge - Alternate D - 30-ft bridge with vertical abutments						
Proposed urban conditions:						
2-year flood	395		914.7	61	6.5	<0.1
5-year flood	563		915.2	75	7.5	<.1
10-year flood	678		915.8	90	7.5	<.1
25-year flood	830		916.3	104	8.0	<.1
50-year flood	963		916.9	120	8.0	<.1
100-year flood	1,090		917.4	134	8.1	<.1

The flood profiles for the requested floods for Lullwater Creek tributary for alternate conditions A and D are shown in table 1 and figure 6. The discharges used in the flood-profile routing for Lullwater Creek tributary are given in the section, "Flood Frequency."

The flood profiles for Alternate D are 0.1 ft higher than those for existing conditions (Alternate A) throughout the reach except for Sections J to M on Lullwater Creek, where the profiles were lowered by the removal of the footbridge at Section I and the removal of the culvert at Section K. The removal of the footbridge at Section I (Alternate D) will lower the water-surface elevation 0.1 ft at Sections J and K for the 10-, 25-, 50-, and 100-year floods. The removal of the culvert at Section K will lower the water surface at Sections L and M, as indicated in table 1 and figure 5.

The flood profiles for Alternate D and the condition before removal of the houses for the proposed construction of Interstate Highway 485 are identical, as increases in discharge are insignificant.

BACKWATER EFFECT

The computed flood elevation, area of opening under high-water conditions, average velocity, and backwater for the requested floods for alternate conditions A and D for the drainage structures within the study reach are listed in table 2.

The proposed construction of the Presidential Parkway and two pedestrian bridges would create less than 0.1 ft of backwater, as indicated in table 2.

The removal of the footbridge at Section I and the culvert at Section K would lower the water-surface elevation upstream from these structures, as indicated in table 1.

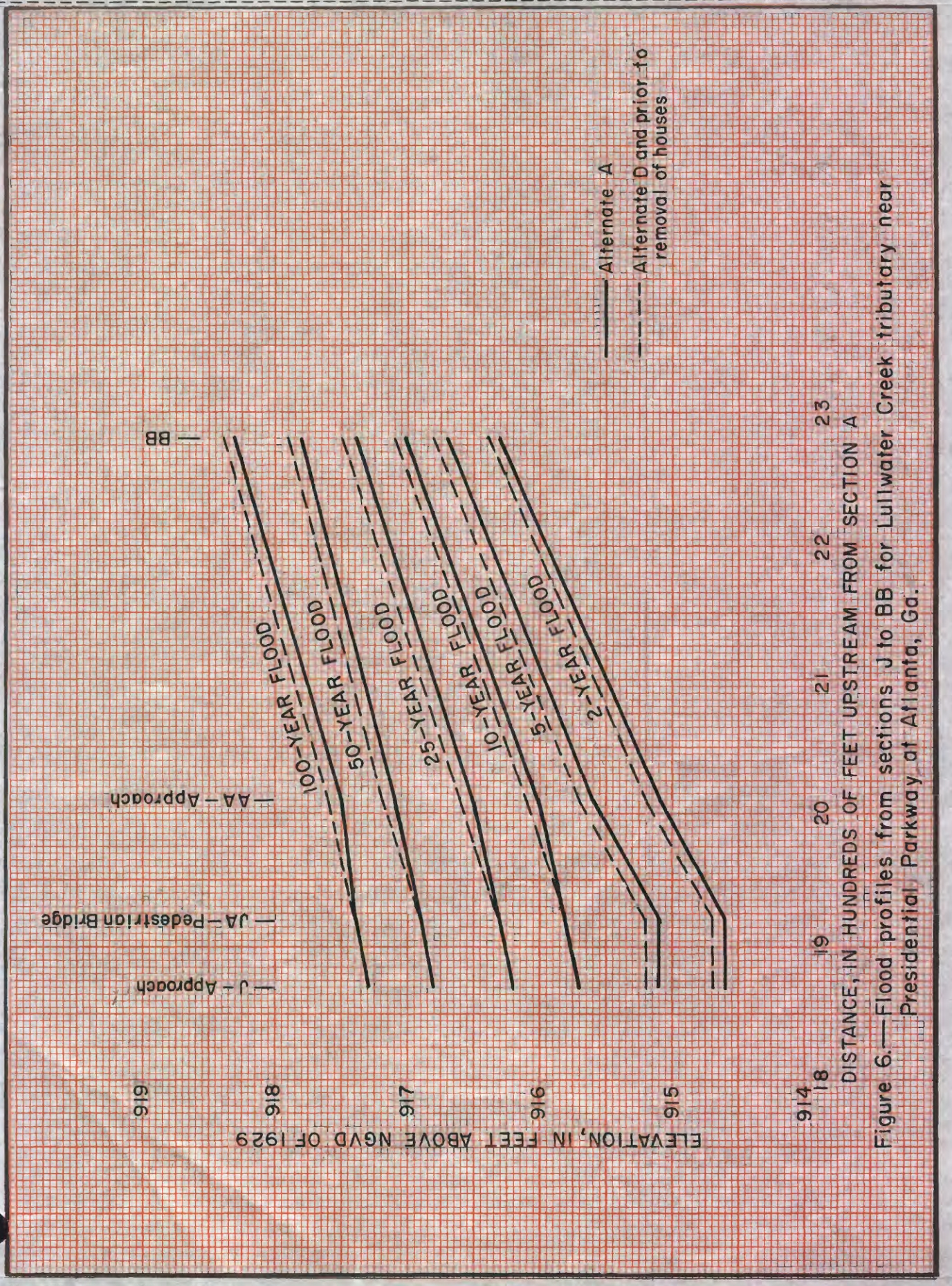

Figure 6.—Flood profiles from sections J to BB for Lullwater Creek tributary near Presidential Parkway at Atlanta, Ga.

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