UPDATE OF FLOOD-FLOW CHARACTERISTICS OF NANCY CREEK AT GEORGIA HIGHWAY 400 EXTENSION NEAR ATLANTA, GEORGIA

By T.C. STAMEY

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CONTENTS

ILLUSTRATIONS

TABLES

CONVERSION FACTORS

The inch-pound units used in this report can be converted to equivalent SI metric (International System) units as follows:

Multiply inch-pound units	By	To obtain metric units
foot (ft)	0.3048	meter (m)
foot per second (ft/s)	0.3048	meter per second (m/s)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
square foot (ft^2)	0.0929	square meter (m^2)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.59	square kilometer (km^2)

Sea Level

In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)--a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "Mean Sea Level Datumof 1929."

UPDATE OF FLOOD-FLOW CHARACTERISTICS OF NANCY CREEK AT PROPOSED GEORGIA HIGHWAY 400 EXTENSION NEAR ATLANTA, GEORGIA

By

T.C. Stamey

ABSTRACT

The Highway Division, Georgia Department of Transportation, has proposed to extend Georgia Highway 400 from Interstate 285 southward to Interstate 85. As part of this extension, the Highway Division would construct a bridge crossing Nancy Creek near Atlanta, Georgia, and relocate Nancy Creek at the proposed crossing.

The flood-flow characteristics of Nancy Creek near the proposed bridge crossing were determined by the U.S. Geological Survey as part of a study conducted in cooperation with the Highway Division. The flood frequency, elevation-discharge relations, flood profiles, floodway, and flood-flow effects were determined as a part of this study. Results indicate that the maximum backwater effect for the proposed bridge and relocated channel is 0.2 foot for the 100-year flood. The proposed channel relocation will shorten the flow length near the proposed Georgia Highway 400 Extension and reduce the 100-year flood elevation between 1 and 2 feet from existing conditions between the proposed crossing and Windsor Parkway.

INTRODUCTION

In 1987, U.S. Geological Survey (USGS), in cooperation with the Georgia Department of Transportation (GDOT), Highway Division, began a study on the flood-flow characteristics of Nancy Creek at the proposed Georgia Highway 400 Extension near Atlanta, Ga. The initial results of that study were documented in a report by Price and Hess (1987) which described the flood-flow characteristics of Nancy Creek for floods having recurrence intervals of 2-, 10-, 25-, 50-, and 100-years for the following conditions:

(1) Existing conditions;

(2) With a proposed 390-ft bridge with abutments skewed 45 degrees to the roadway, and parallel to flow and abutment slopes of 2 horizontal to 1 vertical. The relocation of the main channel of Nancy Creek would be from about 600 ft downstream from the proposed bridge to about 700 ft upstream from the proposed bridge. The relocated main channel would be 40 ft wide at the bottom and have channel side slopes of 2 horizontal to 1 vertical;

(3) Construction of a 380-ft bridge with abutments the same as in Condition 2. The channel relocation also would be the same as in Condition 2, except that channel side slopes would be 1.5 horizontal to 1 to 1 vertical.

The GDOT subsequently revised its construction plans to include a 422-ft bridge and relocation of a reach of the channel of Nancy Creek. In November 1989, the USGS began a supplemental study of flood-flow characteristics of Nancy Creek at the proposed crossing to evaluate the effects of the revised design on flood characteristics. Nancy Creek drains an area of 21.8 mi^2 at the proposed crossing site.

Purpose and Scope

This report describes the flood-flow characteristics of Nancy Creek at the proposed bridge site for floods having recurrence intervals of 2-, 10-, 25-, 50-, and 100-years for the following conditions:

(1) Existing conditions;

(2) With a proposed 422-ft bridge with abutments skewed 45 degrees to the roadway and parallel to the flow, and abutment slopes of 2 horizontal to 1 vertical, and relocation of the main channel of Nancy Creek from about 600 ft downstream from the proposed bridge to about 700 ft upstream from the proposed bridge. The relocated main channel would be 40 ft wide at the bottom with side slopes of 2 horizontal to 1 vertical.

This report includes the flood elevations, areas of bridge openings for selected high-water conditions, average velocities through the bridges, and backwater computations for the proposed bridge conditions reported by Price and Hess (1987). The location of the proposed bridge, cross sections used in flood routing, relocated channel, floodway, and 100-year boundary used in the analysis and described in this report are shown in figure 1.

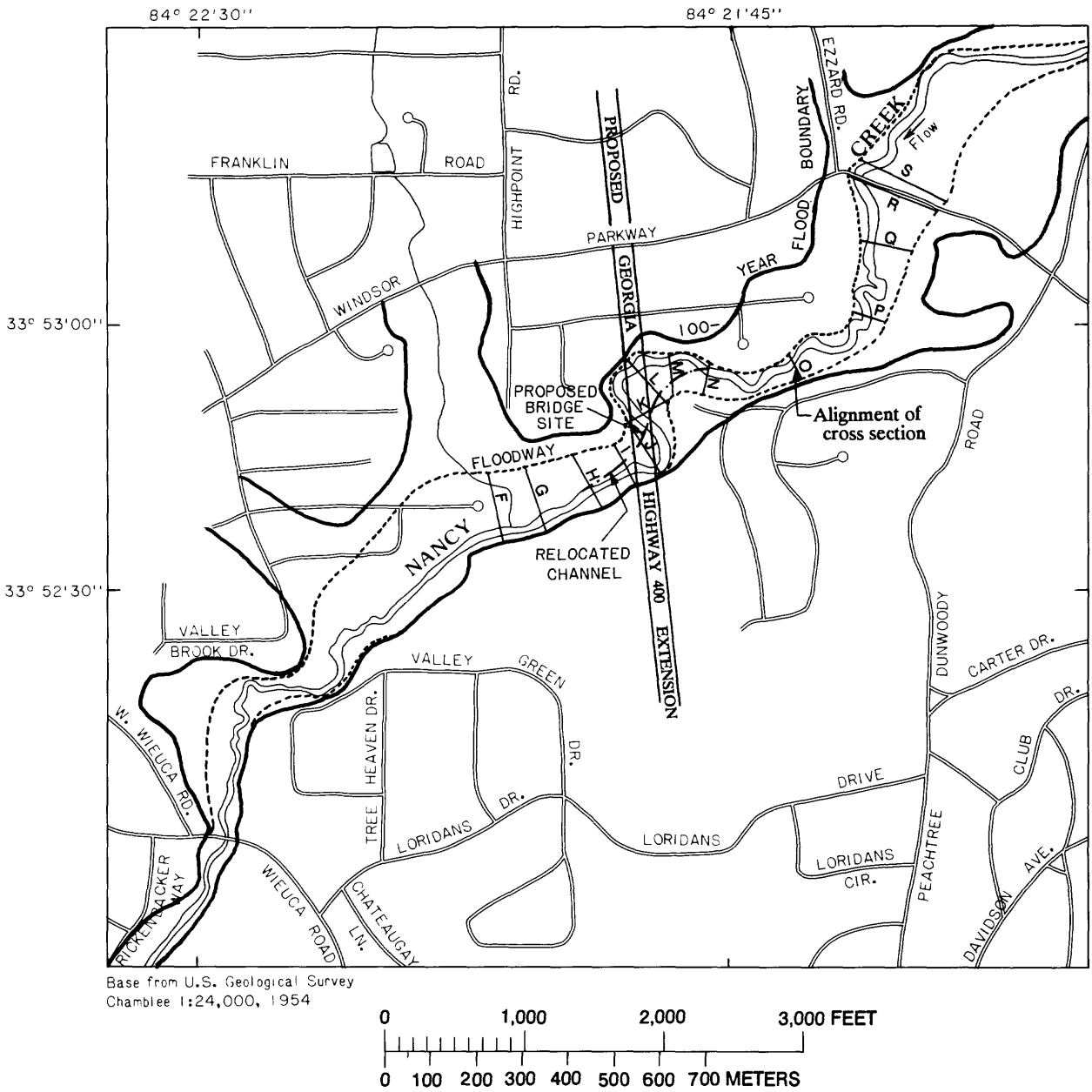

Figure 1:—Location of proposed bridge site, cross sections used in flood routing, relocated channel, FEMA (1981) floodway, and 100-year flood boundary.

Available Data

Available hydrologic data for Nancy Creek include peak-stage and discharge data collected from 1963 to 1965 at the USGS crest-stage gage at Rickenbacker Drive, about 7,000 ft downstream from the proposed bridge site. Miscellaneous high-water information has been obtained by the USGS for major floods from 1961 to 1987 at several bridge crossings of Nancy Creek from its mouth to Tilly Mill Road. Data used in the previous study (Price and Hess, 1987) were collected during a field reconnaissance of the study reach by USGS personnel in 1987. The Manning's "n" values used by Price and Hess (1987) also were used in the step-backwater analyses for this study.

Acknowledgments

The author acknowledges the assistance provided by personnel of the GDOT who furnished the following information:

(1). Transverse profiles at the channel and floodway of the proposed bridge and location of the proposed bridge.

(2). Main channel, bridge, and roadway profiles at Wieuca Road, located about 5,000 ft downstream from the proposed bridge, and at Windsor Parkway, located about 3,500 ft upstream from the proposed bridge.

(3). Seventeen cross sections of the main channel in the reach between Wieuca Road and Windsor Parkway.

(4). A 2-ft contour map of the study reach.

(5). Input data from U.S. Army Corps of Engineers (1979) step-backwater computer program HEC-2 for the profile and floodway studies used in the Federal Emergency Management Agency (FEMA, 1981) study of unincorporated Fulton County.

Assistance also was provided by personnel with FEMA who supplied data for the HEC-2 computer program for the profile and floodway studies of Nancy Creek for their revised, "Flood Insurance Study, City of Atlanta, Fulton and DeKalb Counties, Georgia" (1985).

FLOOD-FLOW CHARACTERISTICS

Flood Frequency

Flood discharges at the proposed site were computed using techniques described by Inman (1983). Discharges computed using estimating equations developed from the USGS rainfall-runoff model (Dawdy and others, 1972) for the 2-, 10-, 25-, 50-, and 100-year floods were 2,620, 5,240, 6,700, 7,760, and 9,680 ft^3/s, respectively. Discharges also were computed using the Distributed Routing Rainfall-Runoff (DR3M) model (Alley and Smith, 1982) for the 2-, 10-, 25-, 50-, and 100-year floods. The discharges computed in this manner were 3,270, 6,440, 8,080, 9,890, and 11,700 ft^3/s, respectively. The computations were based on an impervious area of 35 percent and a channel slope of 17.5 ft/mi. The 2-, 10-, 25-, 50-, and 100-year flood discharges for the two models were computed to be 2,950, 5,840, 7,400, 8,900, and 10,700 ft^3/s, respectively. These discharges, except for the 100-year flood discharges, were used in all flood analyses described in this report because they reflect more current land-use conditions than the discharges used in the earlier study (FEMA, 1981). For the 100-year flood, the discharge of 10,900 ft^3/s from FEMA study (1981) was used for the analysis, because the present floodway was computed using this value and it is within 2 percent of that obtained by averaging the discharges computed from the two models described above and the equations described by Inman (1983). Frequency curves for FEMA (1981) and by the method described by Inman (1983) are shown in figure 2.

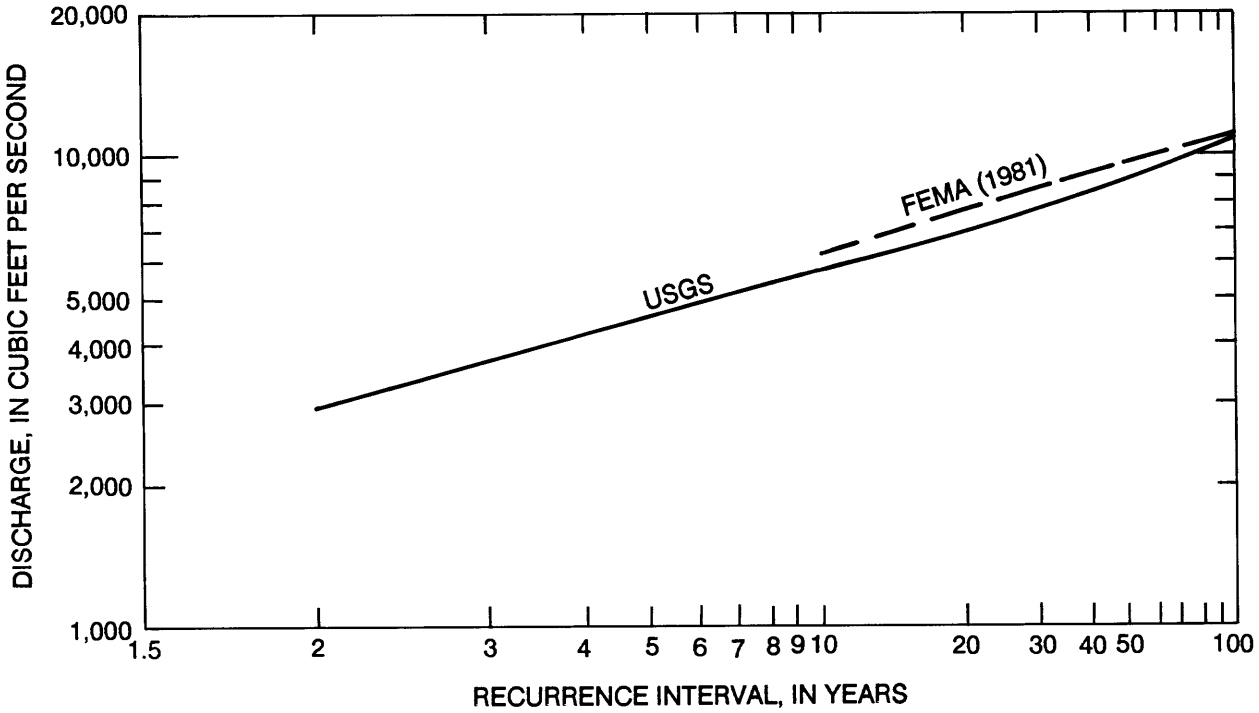

Figure 2.—Flood-frequency curves for Nancy Creek at proposed Georgia Highway 400 Extension bridge crossing Nancy Creek near Atlanta.

Elevation-Discharge Relation

The elevation-discharge relations at the downstream end of the proposed crossing of Nancy Creek were computed by the USGS Step-Backwater Computer Program J635 (Shearman, USGS, written commun., 1977) for (1) existing conditions, (2) existing conditions using the same floodway given in the FEMA (1981) report, and (3) with the proposed bridge and relocated channel in place (fig. 3). This computer program is an enhanced version of Program E431 (Shearman, 1976). The computations are based on starting elevations from an elevation-discharge relation for Nancy Creek at Wieuca Road (fig. 4). This elevation-discharge relation was established from high-water elevations for several floods at Wieuca Road and corresponding discharges at the USGS crest-stage gage at Rickenbacker Drive, and was extended above 4,500 ft^3/s by the slope-conveyance method (Bailey and Ray, 1966). Additional elevation data in the FEMA (1981) are discussed in the "Floodway Computations" section of this report.

Flood Profiles

The flood profiles for the 2-, 10-, 25-, 50-, and 100-year floods for Nancy Creek between Wieuca Road and Windsor Parkway are shown in table 1 and figures 5-7. The profiles were produced by using USGS Step-Backwater Computer Program J635 (Shearman, 1976), and are for (1) existing conditions, (2) existing conditions with the floodway given in FEMA (1981), and (3) proposed conditions, with the bridge and relocated channel in place.

The starting elevations are from the USGS elevation-discharge relation for Nancy Creek at Wieuca Road are based on USGS measurements (fig. 4). The starting elevation of the 100-year flood at the downstream side of the Wieuca Road crossing is about 3 ft higher than the 100-year flood elevation given in the FEMA (1981) report for Fulton County and the FEMA (1985) report for Atlanta.

The elevation-discharge relation for Nancy Creek at Windsor Parkway (fig. 8) is based on high-water elevations for floods at Windsor Parkway and corresponding discharges at the USGS crest-stage gage at Rickenbacker Drive. The elevation-discharge curve was extended above 4,300 ft^3/s by the slope-conveyance method (Bailey and Ray, 1966).

The Manning "n" roughness values used in the step-backwater analysis were initially assumed to be the same as those used by Price and Hess (1987). The "n" values betweeen Wieuca Road and Windsor Parkway were then adjusted until the step-backwater analysis reproduced the elevation-discharge relation at Windsor Parkway (fig. 8), using the Wieuca Road starting elevations.

In the revised construction plans, the channel between cross sections H and N (fig. 1) is to be relocated as shown in figure 9, and have a 40-ft bottom width with embankment slopes of 2 to 1. This relocation reduces the length of the main channel in this reach from 2,050 ft to 1,300 ft and will reduce the flood elevations between the proposed bridge and Windsor Parkway (figs. 5-7). These reductions im elevation are a result of the reduced length and lower roughness values of the relocated channel.

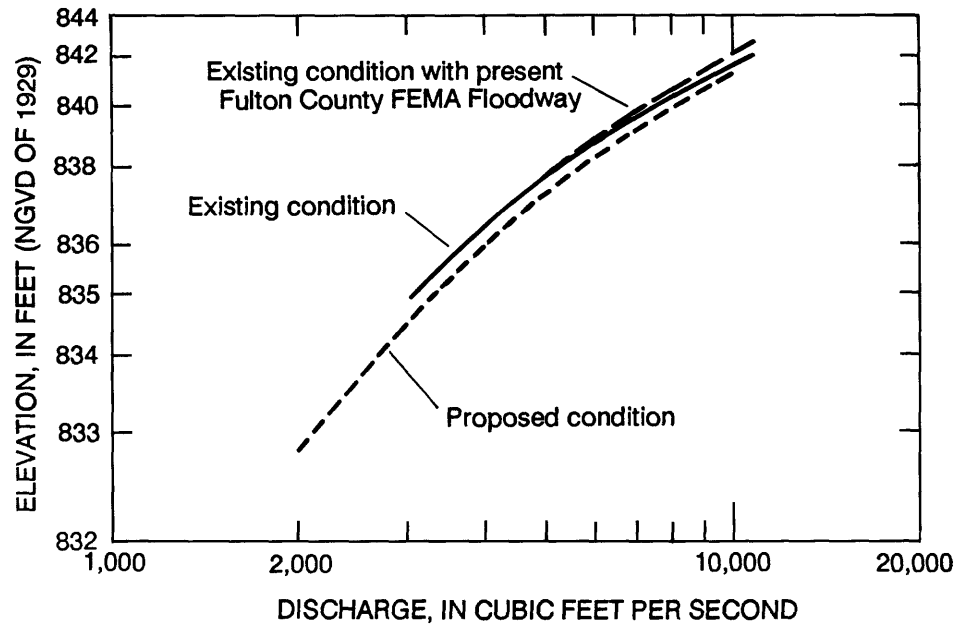

Figure 3.--Elevation-discharge relations for Nancy Creek at downstream side of proposed Georgia Highway 400 Extension bridge crossing Nancy Creek near Atlanta.

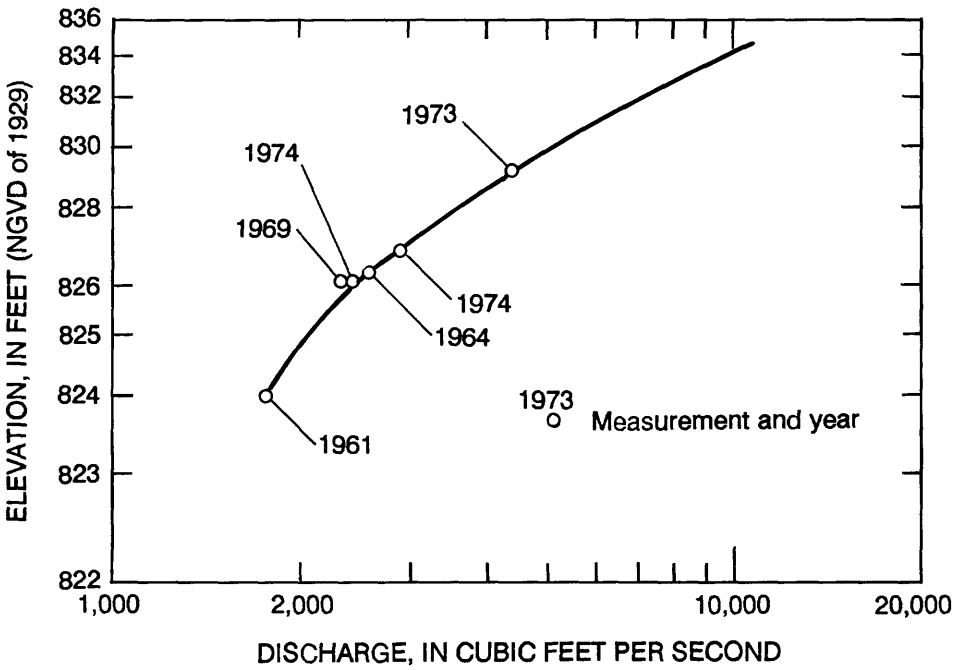

Figure 4.--Elevation-discharge relations for Nancy Creek at downstream side of Wieuca Road bridge crossing Nancy Creek near Atlanta.

Table 1.--Flood-profile data for existing conditions, existing condition with floodway, and proposed conditions with bridge and channel relocation in place

[ft^3/s, cubic feet per second]

Cross section (see fig. 1)	Distance upstream from Wieuca Road (feet)		WATER-SURFACE ELEVATION IN FEET (NGVD OF 1929)		
	Existing conditions	Proposed conditions	Existing conditions	Existing floodway	Proposed conditions
			2-year flood, 2,950 ft^3/s		
A-Wieuca Road	0	0	826.9	826.9	826.9
B-Approach	120	120	827.1	827.1	827.1
C	790	790	827.7	827.7	827.7
D	1,500	1,500	828.8	828.8	828.8
E	2,180	2,180	830.1	830.1	830.1
F	3,700	3,700	833.0	833.0	833.0
G	4,000	4,000	833.6	833.6	833.6
H-Start relocated channel	4,400	*4,400	834.4	834.4	834.2
I	4,700	4,700	834.8	834.8	834.4
J-Proposed Georgia Highway 400 Extension	4,960	4,960	835.0	835.0	834.5
K	5,510	5,060	836.3	836.3	--
L-Approach	5,910	5,290	836.9	836.9	834.7
M	6,180	5,440	837.2	837.2	834.9
N-End relocated channel	6,450	*5,700	837.9	837.9	835.1
O	7,140	6,390	839.2	839.2	836.8
P	7,750	7,000	840.4	840.4	839.4
Q	8,250	7,510	841.3	841.3	840.7
R-Windsor Parkway	8,780	8,030	841.6	841.7	841.3
S	8,900	8,150	842.0	842.1	841.5
			10-year flood, 5,840 ft^3/s		
A-Wieuca Road	0	0	830.9	830.9	830.9
B-Approach	120	120	831.7	831.7	831.7
C	790	790	832.2	832.2	832.2
D	1,500	1,500	833.0	833.0	833.0
E	2,180	2,180	834.1	834.1	834.1
F	3,700	3,700	836.4	836.5	836.5
G	4,000	4,000	837.1	837.2	837.2
H-Start relocated channel	4,400	*4,400	837.6	837.8	837.6
I	4,700	4,700	838.1	838.3	837.9
J-Proposed Georgia Highway 400 Extension	4,960	4,960	838.4	838.6	838.0
K	5,510	5,060	839.5	839.6	--
L-Approach	5,910	5,290	840.3	840.4	838.3
M	6,180	5,440	840.6	840.7	838.4
N-End relocated channel	6,450	*5,700	841.2	841.4	838.6
O	7,140	6,390	842.8	842.9	840.4
P	7,750	7,000	844.1	844.2	843.1
Q	8,250	7,510	844.9	845.0	844.2
R-Windsor Parkway	8,780	8,030	845.1	845.3	844.6
S	8,900	8,150	845.2	845.4	844.7

Table 1.--Flood-profile data for existing conditions, existing condition with floodway, and proposed conditions with bridge and channel relocation in place--Continued

[ft^3/s, cubic feet per second]

Cross section (see fig. 1)	Distance upstream from Wieuca Road (feet)		WATER-SURFACE ELEVATION IN FEET (NGVD OF 1929)		
	Existing conditions	Proposed conditions	Existing conditions	Existing floodway	Proposed conditions
			25-year flood, 7,400 ft^3/s		
A-Wieuca Road	0	0	832.5	832.5	832.5
B-Approach	120	120	833.6	833.7	833.7
C	790	790	834.1	834.2	834.2
D	1,500	1,500	834.7	834.8	834.8
E	2,180	2,180	835.8	835.9	835.8
F	3,700	3,700	837.7	837.9	837.9
G	4,000	4,000	838.3	838.5	838.5
H-Start relocated channel	4,400	*4,400	838.8	839.1	838.9
I	4,700	4,700	839.4	839.6	839.3
J-Proposed Georgia Highway 400 Extension	4,960	4,960	839.7	840.0	839.4
K	5,510	5,060	840.8	841.0	--
L-Approach	5,910	5,290	841.6	841.8	839.7
M	6,180	5,440	842.0	842.1	839.8
N-End relocated channel	6,450	*5,700	842.5	842.8	840.0
O	7,140	6,390	844.2	844.4	841.9
P	7,750	7,000	845.5	845.8	844.5
Q	8,250	7,510	846.2	846.5	845.6
R-Windsor Parkway	8,780	8,030	846.4	846.8	846.0
S	8,900	8,150	846.5	846.9	846.1
			50-year flood, 8,940 ft^3/s		
A-Wieuca Road	0	0	833.3	833.4	833.4
B-Approach	120	120	834.5	834.7	834.7
C	790	790	835.0	835.2	835.2
D	1,500	1,500	835.7	835.9	835.9
E	2,180	2,180	836.8	837.0	837.0
F	3,700	3,700	838.7	839.0	839.0
G	4,000	4,000	839.2	839.5	839.5
H-Start relocated channel	4,400	*4,400	839.7	840.2	839.9
I	4,700	4,700	840.4	840.7	840.4
J-Proposed Georgia Highway 400 Extension	4,960	4,960	840.7	841.0	840.5
K	5,510	5,060	841.8	842.1	--
L-Approach	5,910	5,290	842.7	842.9	840.8
M	6,180	5,440	843.1	843.2	840.9
N-End relocated channel	6,450	*5,700	843.6	843.9	841.1
O	7,140	6,390	845.4	845.6	843.1
P	7,750	7,000	846.6	847.1	845.7
Q	8,250	7,510	847.2	847.8	846.8
R-Windsor Parkway	8,780	8,030	847.4	848.2	847.2
S	8,900	8,150	847.5	848.3	847.3

Table 1.--Flood-profile data for existing conditions, existing condition with floodway, and proposed conditions with bridge and channel relocation in place--Continued

[ft^3/s, cubic feet per second]

Cross section (see fig. 1)	Distance upstream from Wieuca Road (feet)		WATER-SURFACE ELEVATION IN FEET (NGVD OF 1929)		
	Existing conditions	Proposed conditions	Existing conditions	Existing floodway	Proposed conditions
			100-year flood, 7,400 ft^3/s		
A-Wieuca Rd.	0	0	834.2	834.3	834.4
B-Approach	120	120	835.4	835.8	835.9
C	790	790	836.1	836.5	836.5
D	1,500	1,500	836.8	837.4	837.3
E	2,180	2,180	837.9	838.4	838.4
F	3,700	3,700	839.8	840.4	840.3
G	4,000	4,000	840.2	840.8	840.8
H-Start relocated channel	4,400	*4,400	840.8	841.5	841.2
I	4,700	4,700	841.5	842.1	841.7
J-Proposed Georgia Highway 400 Extension	4,960	4,960	841.9	842.4	841.8
K	5,510	5,060	843.1	843.5	--
L-Approach	5,910	5,290	844.0	844.3	842.2
M	6,180	5,440	844.4	844.6	842.3
N-End relocated channel	6,450	*5,700	844.9	845.4	842.5
O	7,140	6,390	846.8	847.1	844.6
P	7,750	7,000	847.9	848.7	847.2
Q	8,250	7,510	848.4	849.4	848.3
R-Windsor Parkway	8,780	8,030	848.6	849.7	848.7
S	8,900	8,150	848.7	849.8	848.7

*Relocated channel between distances 4,400 and 5,700 ft for proposed conditions.

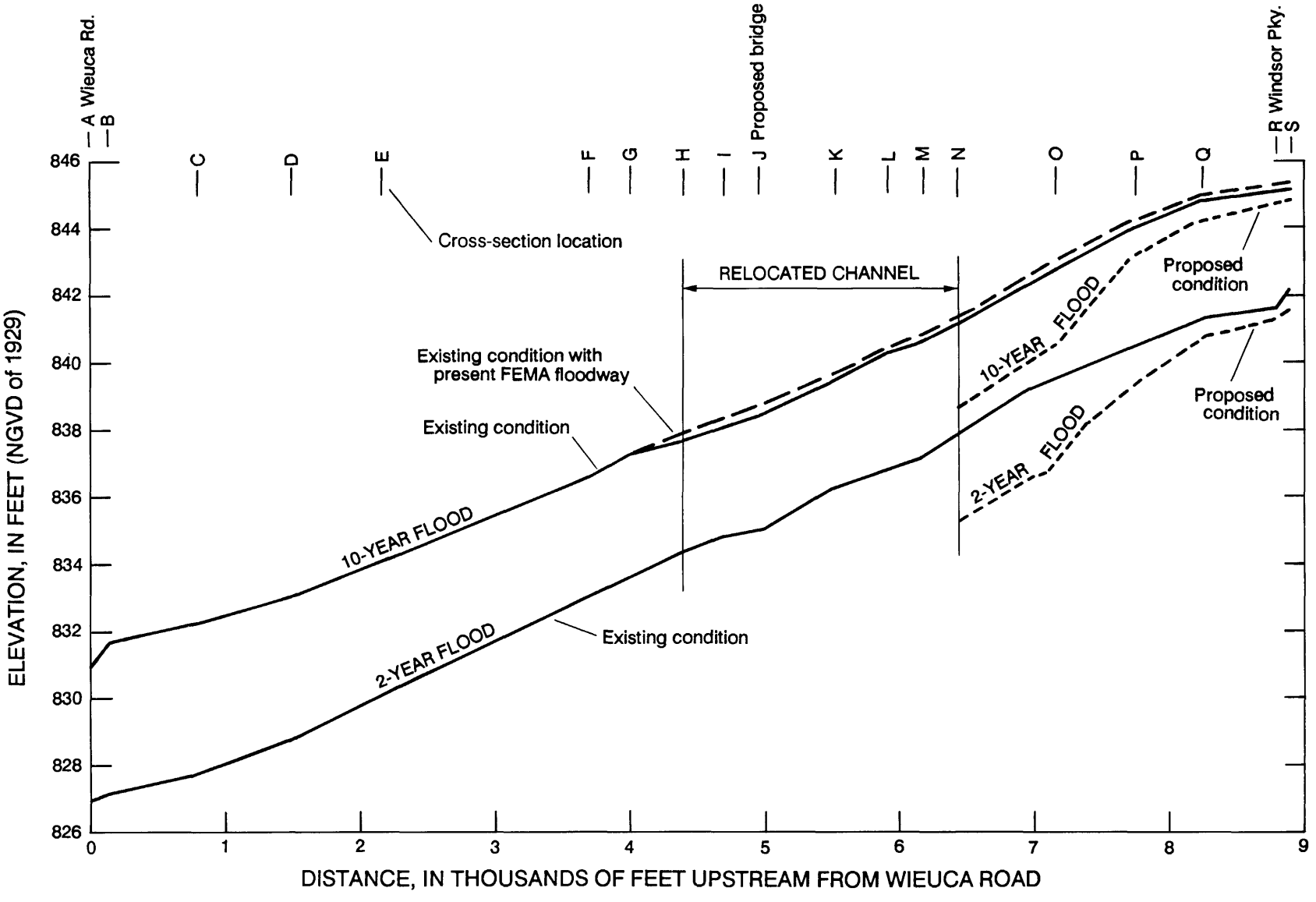

Figure 5.—Flood profiles of the 2- and 10-year floods on Nancy Creek near proposed Georgia Highway 400 Extension near Atlanta.

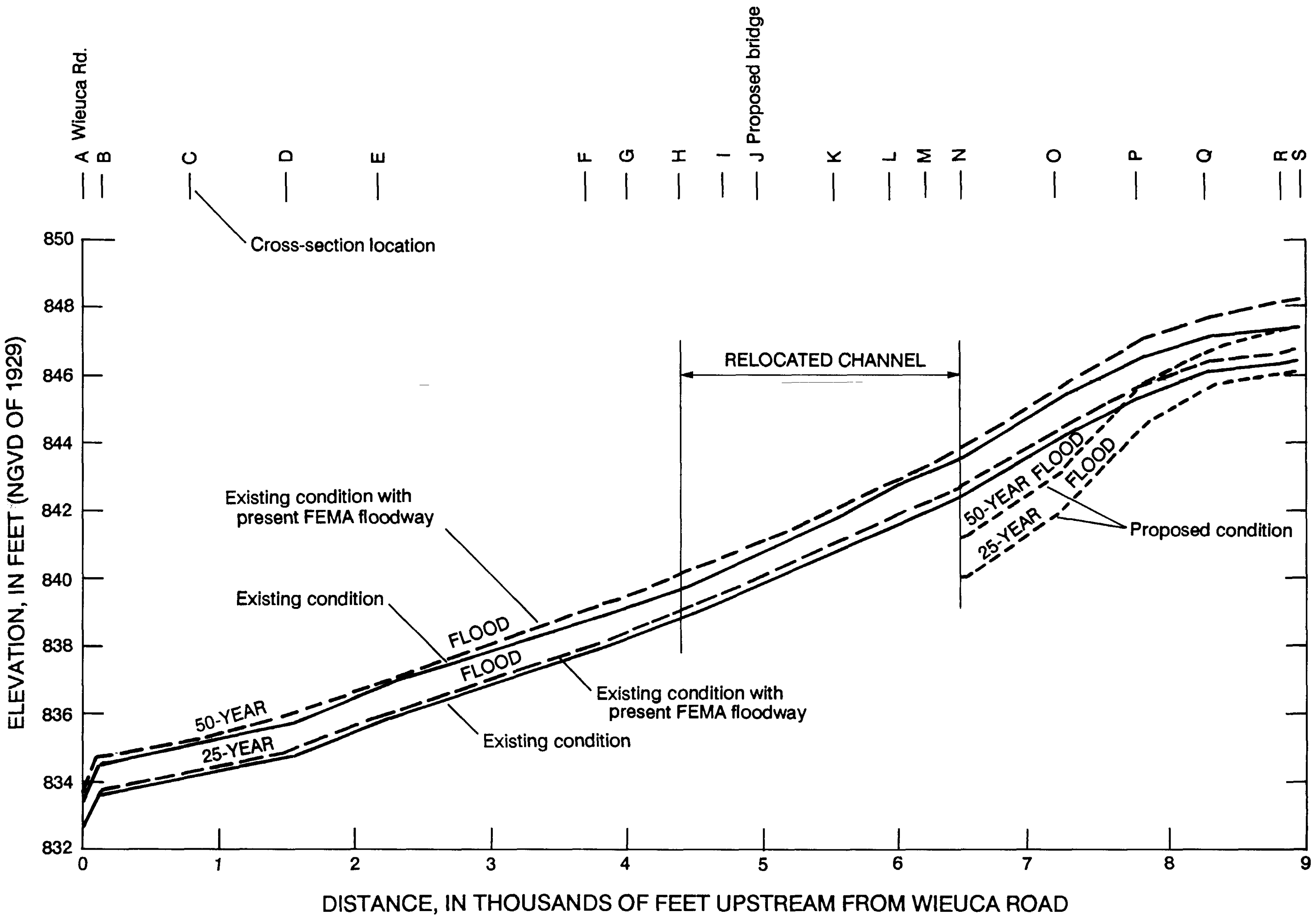

Figure 6.—Flood profiles of the 25- and 50-year floods on Nancy Creek near proposed Georgia Highway 400 Extension near Atlanta.

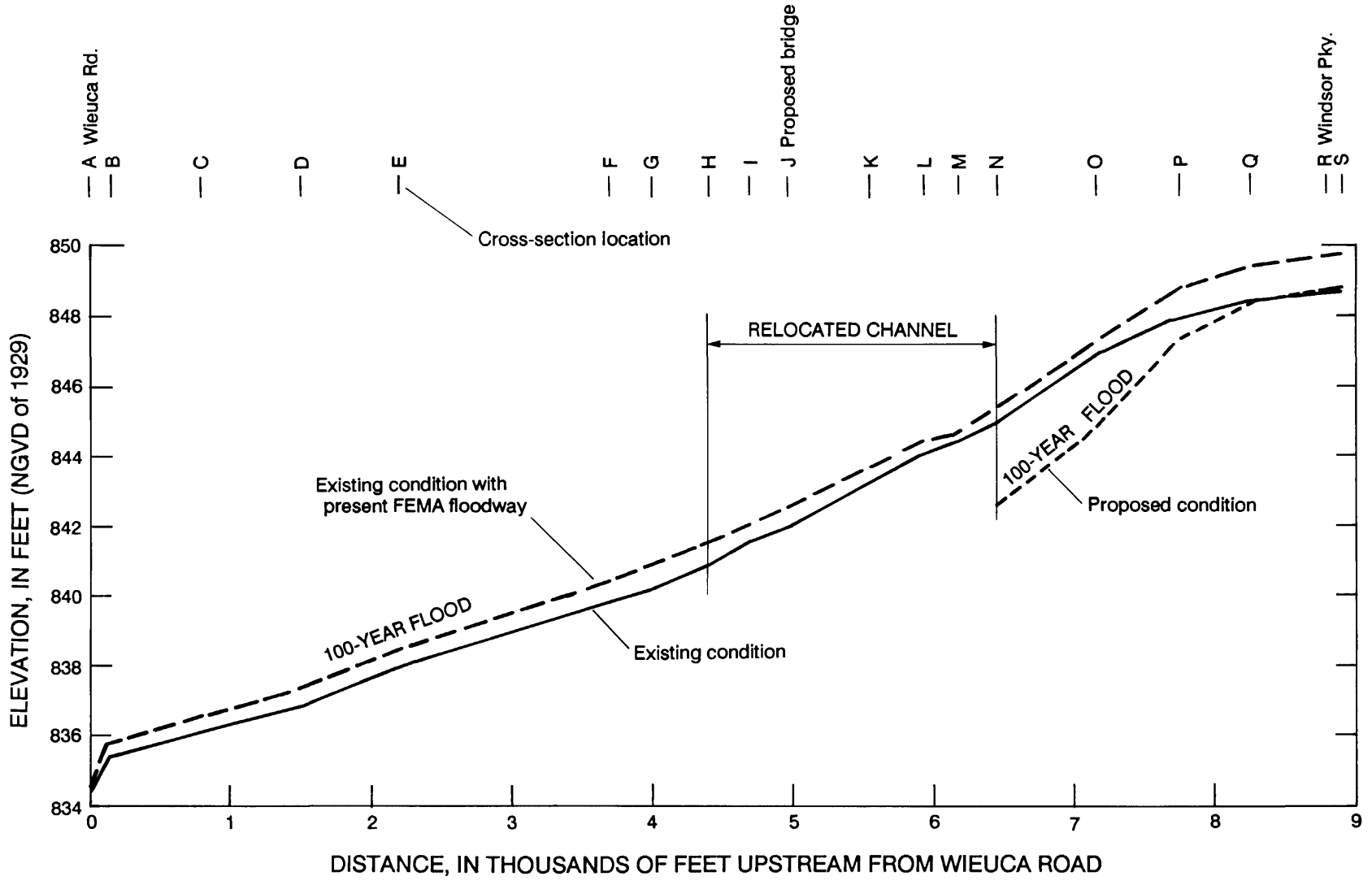

Figure 7.—Flood profiles for the 100-year flood on Nancy Creek near proposed Georgia Highway 400 Extension near Atlanta.

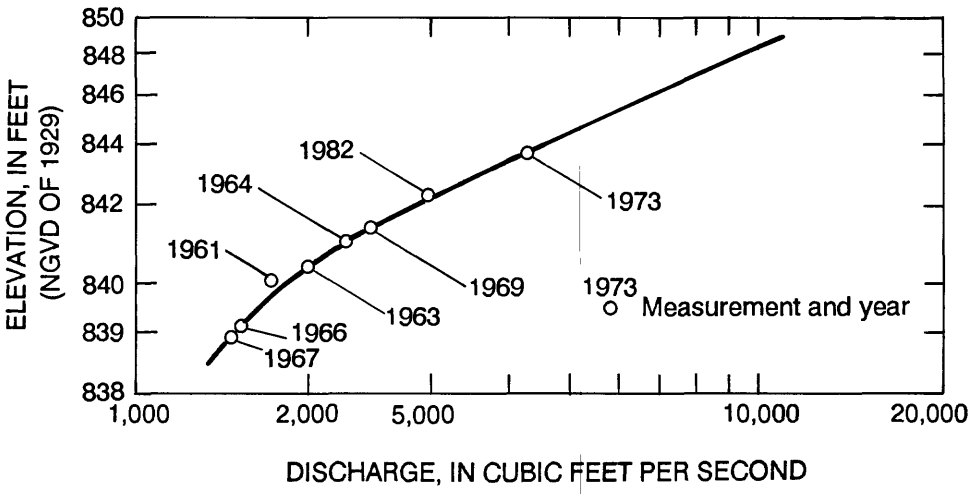

Figure 8.--Elevation-discharge relation for Nancy Creek at downstream side of Windsor Parkway bridge crossing Nancy Creek near Atlanta.

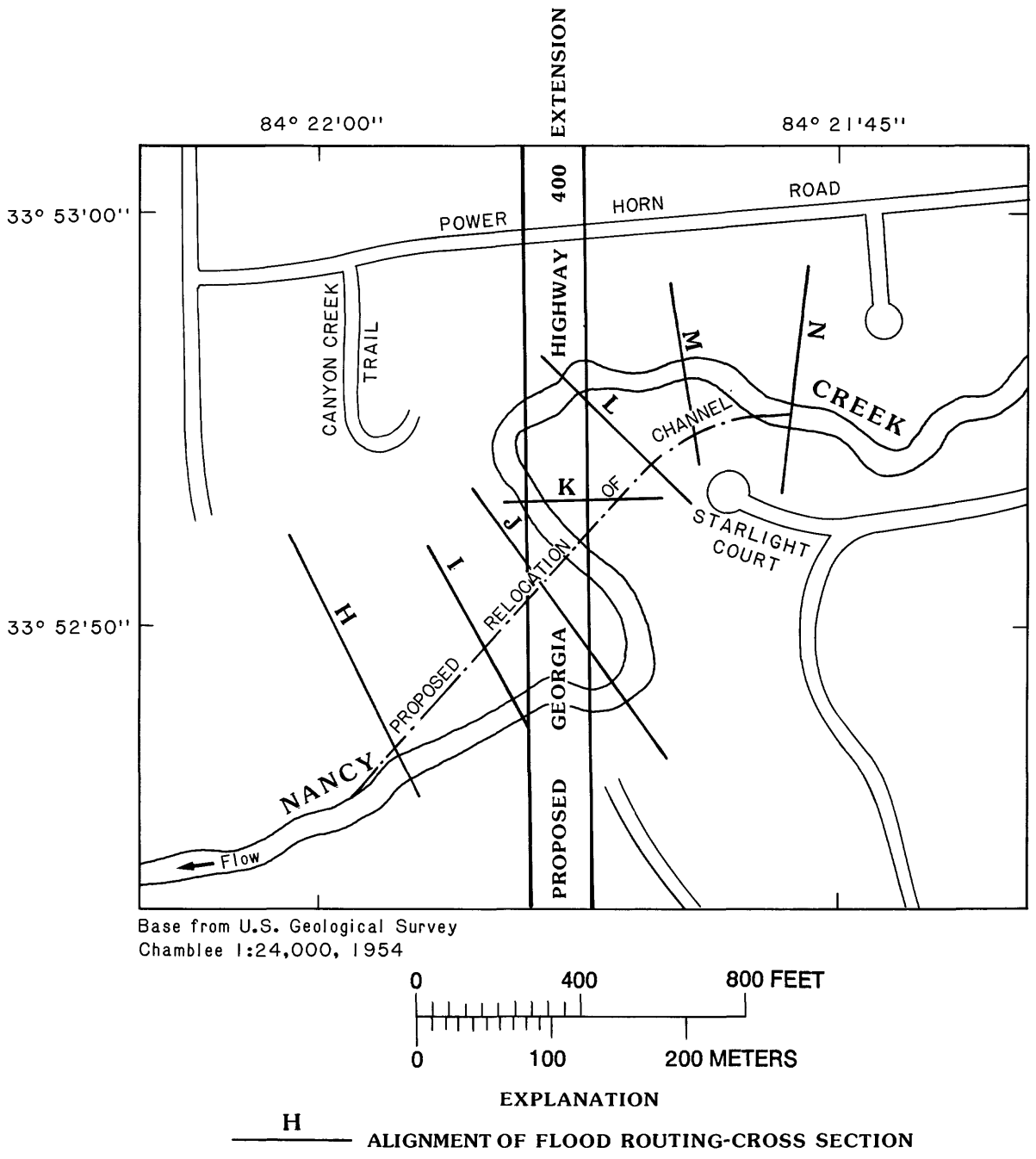

Figure 9.—Location of relocated channel, proposed Georgia Highway 400 Extension, and cross sections used in flood routing for Nancy Creek near Atlanta.

Floodway Computations

The floodway elevations for Nancy Creek used in the FEMA (1981) report for Fulton County were adjusted to agree with the known elevations at the downstream side of Wieuca Road. The floodway used in the FEMA (1981) report was used with the data for 18 additional cross sections between Wieuca Road and Windsor Parkway to obtain revised floodway computations.

The revised floodway computations were made by using the step-backwater computer program HEC-2 (U.S. Army Corps of Engineers, 1979). Floodway computations include the addition of the proposed bridge on Nancy Creek and the relocated channel in the vicinity of the crossing. Floodway computations for the proposed conditions are listed in table 2. The maximum increase in flood elevation in the reach of Nancy Creek from Wieuca Road to Windsor Parkway was determined to be 0.9 ft (table 2).

FLOOD FLOW EFFECTS

Backwater Effect

The computed flood elevations, areas of opening under high-water conditions, average velocities, and backwater for the 2-, 10-, 25-, 50-, and 100-year floods for (1) existing conditions, (2) existing conditions with the floodway, and (3) proposed conditions, with and without the floodway, are listed in table 3. These computations were made with USGS Step-Backwater Computer Program J635 (Shearman, 1976).

The results of the analyses indicate that the maximum backwater that would be created by the proposed bridge and relocated channel would be about 0.2 ft for the 100-year flood. The relocated channel will shorten the flow length in the vicinity of the proposed extension, thus reducing the 100-year flood elevation between 1 to 2 ft between the proposed bridge site and Windsor Parkway (fig. 7).

The distribution of flow through the proposed bridge and flow over the road at Windsor Parkway overflow for selected flood recurrence intervals are given in table 3. The distribution of flow through the proposed bridge and flow over the roadway for the 10-, 25-, 50-, and 100-year floods are considered estimates because the water-surface slope in the vicinity of the bridges is insufficient for an accurate determination of flows (table 3).

Channel Relocation Effects

Three analyses were used to determine the effect that channel relocation (reduction in channel length) and the loss of storage in the flood plain (from filling the original channel and bridge fill approaches) will have on the magnitude of the 100-year flood.

The first analysis, based on a technique of Inman (1986), used a dimensionless hydrograph requiring lagtime and peak discharges. For existing conditions, a lagtime of 4.39 hours was computed by the equation (Inman, 1986)

$$TL = 161\ A^{.22}S^{-.66}IA^{-.67}, \quad (1)$$

where

TL = lagtime in hours,
A = drainage area in square miles,
S = slope of the main channel in feet per mile, and
IA = the percentage of impervious area in the basin.

For proposed conditions, the lag time was reduced from 4.39 hours to 4.30 hours based on a decrease in channel length of 750 ft (2,050 to 1,300 ft) and an estimated velocity of about 3 ft/s. Based on this recomputed lag time and the volume of flow for the 100-year flood, the peak discharge was computed to be 11,100 ft^3/s, an increase of 200 ft^3/s from the peak discharge of the 100-year flood without the channel relocation.

The second analysis used the diffusion analogy routing method (Doyle and others, 1983). The input for existing conditions was (1) a routing interval of 1.0 hour, (2) a reach length of 0.39 mile, (3) a wave celerity of 4 ft/s, and (4) a wave dispersion coefficient of 7,570 ft^2/s. For proposed conditions, the reach length was 0.25 mile, the wave celerity 4.5 ft/s, and the wave dispersion coefficient 6,280 ft^2/s. This routing indicated that with the proposed construction and the reduction in channel length and reduced flood-plain storage, the 100-year discharge of 10,900 ft^3/s would be increased by 130 ft^3/s.

The third analysis, based on USGS computer program A697, "Downstream-upstream reservoir routing" (Jennings, 1977), assumed that Nancy Creek acts as a reservoir at cross section H, the downstream end of the relocated channel. This analysis requires (1) an inflow hydrograph, (2) an outflow rating curve, and (3) a reservoir-capacity curve. The inflow hydrograph was computed using techniques described in the first analysis. The outflow elevation-discharge rating curve at cross section H (downstream end of relocated channel) was computed by step-backwater routing as given in the FEMA (1985) report. The computation of the elevation-capacity storage curve at cross section H was based on cross sections upstream. This analysis indicated that with the proposed construction the 100-year discharge of 10,900 ft^3/s would be increased by 170 ft^3/s.

Based on these analyses, the 100-year flood discharge would be increased by about 200 ft^3/s, or 2 percent, by the proposed construction and, associated reduction in channel length and flood-plain storage. This calculated increase in flow is insignificant because the method used to calculate the 100-year flood is accurate only within about 20 percent. Moreover, an additional increase in the 100-year discharge of 200 ft^3/s would subsequently increase the computed proposed elevation of the 100-year flood in the reach only about 0.1 ft.

Table 2.--Floodway computations for Nancy Creek at proposed Georgia Highway 400 Extension near Atlanta, using floodway with revised starting elevations

[ft, feet; ft^2, square feet; ft/s, feet per second; N/A, not applicable; --, no data]

Cross sections (See fig. 1)	Distance upstream from Wieuca Road	Width (ft)	Section area (ft^2)	Mean velocity (ft/s)	Water surface elevation for 100-year floods in ft (NGVD 0f 1929)		
					With floodway	Without floodway	Difference
B	120	250	3,780	2.9	835.8	835.4	0.4
C	790	380	4,400	2.5	836.4	835.9	.5
D	1,500	303	3,190	3.4	837.4	836.8	.6
E	2,180	382	4,140	2.6	838.5	837.7	.8
F	3,700	550	3,890	2.8	840.4	839.6	.8
G	4,000	500	4,570	2.4	840.9	840.1	.8
H	4,400	380	3,580	3.0	841.7	840.8	.9
I	4,700	350	4,010	2.7	841.8	840.9	.9
J	4,900	390	4,280	2.5	841.8	841.0	.8
K	N/A	--	--	--	--	--	--
L	5,290	360	3,590	2.5	843.1	842.4	.7
M	5,440	262	2,520	3.6	843.0	842.4	.7
N	5,700	222	1,980	4.5	843.2	842.5	.7
O	6,390	193	1,790	5.0	844.1	843.6	.5
P	7,000	339	2,580	3.5	846.2	845.6	.6
Q	7,510	435	4,330	2.1	847.1	846.4	.7
R	8,030	613	6,200	1.5	847.5	846.6	.9
S	8,456	616	7,110	1.3	847.7	846.8	.9

Table 3.--Hydraulic comparisons of drainage structures for Nancy Creek near proposed Georgia Highway 400 Extension near Atlanta

[ft^3/s, cubic feet per second; ft, feet; ft^2, square feet; ft/s, feet per second; --, no backwater]

Conditions	Discharge (ft^3/s) Bridge	Discharge (ft^3/s) Overflow	Downstream elevation in feet (NGVD of 1929)	Area (ft^2)	Average velocity (ft/s)	Backwater (ft)
WIEUCA ROAD - 68-ft bridge						
Existing conditions -- no floodway						
2-year flood	2,950	0	826.9	751	3.9	<0.1
10-year flood	5,840	0	830.9	929	6.3	.5
25-year flood	6,590	810	832.5	929	7.1	.7
50-year flood	6,750	2,150	833.4	929	7.3	.7
100-year flood	6,620	4,280	834.2	929	7.1	.5
Existing conditions -- with floodway						
2-year flood	2,950	0	826.9	751	3.9	<0.1
10-year flood	5,840	0	830.9	929	6.3	.5
25-year flood	6,720	580	832.5	929	7.3	.8
50-year flood	7,340	1,560	833.4	929	7.9	1.0
100-year flood	7,750	3,150	834.3	929	8.3	.9
GEORGIA HIGHWAY 400						
Existing conditions -- no floodway -- no bridge						
2-year flood	2,950	0	835.0	1,220	2.4	--
10-year flood	5,840	0	838.4	2,520	2.3	--
25-year flood	7,400	0	839.7	3,030	2.4	--
50-year flood	8,900	0	840.7	3,450	2.6	--
100-year flood	10,900	0	841.9	3,950	2.8	--
Existing conditions -- with floodway -- no bridge						
2-year flood	2,950	0	835.1	1,240	2.4	--
10-year flood	5,840	0	838.6	2,560	2.3	--
25-year flood	7,400	0	839.9	3,110	2.4	--
50-year flood	8,900	0	841.0	3,550	2.5	--
100-year flood	10,900	0	842.4	4,080	2.7	--
PROPOSED CONDITION-- 422-ft bridge skewed 45 degrees to roadway with abutment slope 2 to 1, and relocated channel 40-ft wide with 2 to 1 embankment slopes						
With floodway						
2-year flood	2,950	0	834.5	702	4.2	<0.1
10-year flood	5,840	0	838.0	1,130	5.2	.1
25-year flood	7,400	0	839.4	1,310	5.7	.2
50-year flood	8,900	0	840.5	1,460	6.1	.2
100-year flood	10,900	0	841.8	1,650	6.6	.2
No floodway						
2-year flood	2,950	0	834.5	700	4.2	<0.1
10-year flood	5,840	0	838.0	1,120	5.2	.1
25-year flood	7,400	0	839.3	1,280	5.8	.2
50-year flood	8,900	0	840.4	1,410	6.3	.2
100-year flood	10,900	0	841.7	1,570	6.9	.2

Table 3.--Hydraulic comparisons of drainage structures for Nancy Creek near proposed Georgia Highway 400 Extension near Atlanta--Continued

[ft^3/s, cubic feet per second; ft, feet; ft^2, square feet; ft/s, feet per second; --, no backwater]

Conditions	Discharge (ft^3/s) Bridge	Discharge (ft^3/s) Overflow	Downstream elevation in feet (NGVD of 1929)	Area (ft^2)	Average velocity (ft/s)	Backwater (ft)
WINDSOR PARKWAY - 58-ft bridge						
Existing conditions -- no floodway						
2-year flood	2,950	0	841.6	607	4.9	0.3
10-year flood	1,900	3,940	845.1	607	3.1	<.1
25-year flood	*1,200	*6,200	846.4	607	2.0	<.1
50-year flood	*1,000	*7,900	847.4	607	1.6	<.1
100-year flood	*1,000	*9,900	848.6	607	1.6	<.1
Existing conditions - with floodway						
2-year flood	2,950	0	841.7	607	4.9	0.3
10-year flood	*2,000	*3,840	845.3	607	3.2	<.1
25-year flood	*1,400	*6,000	846.8	607	2.3	<.1
50-year flood	*1,200	*7,700	848.2	607	2.0	<.1
100-year flood	*1,200	*9,700	849.7	607	2.0	<.1
Proposed Condition -- with floodway						
2-year flood	2,950	0	841.3	607	4.9	0.3
10-year flood	*2,810	*3,030	844.7	607	4.6	.1
25-year flood	*2,400	*5,000	846.0	607	3.7	<.1
50-year flood	*1,900	*7,000	847.3	607	3.2	<.1
100-year flood	*1,900	*9,000	848.7	607	3.0	<.1
Proposed Condition -- no floodway						
2-year flood	2,950	0	841.2	607	4.9	0.2
10-year flood	*2,850	*2,590	844.5	607	4.7	.1
25-year flood	*2,300	*5,100	845.8	607	3.8	<.1
50-year flood	*2,100	*6,800	846.7	607	3.5	<.1
100-year flood	*2,100	*8,800	847.7	607	3.5	<.1

***Estimated--Fall-through bridge not sufficient for accurate determination.**

SUMMARY

The Georgia Department of Transportation, Highway Division, has proposed to extend Georgia Highway 400 from Interstate 285, southward to Interstate 85, near Atlanta. The proposed extension includes construction of a 422-ft bridge crossing Nancy Creek, and the relocation of about 1,300 ft of the main channel in the vicinity of the proposed crossing. The U.S. Geological Survey, as part of a cooperative program of water-resources investigations with the Highway Division, studied the flood-flow characteristics of Nancy Creek at the proposed crossing. The flood-frequency, elevation-discharge relations, flood profiles, backwater effects, and floodway were determined.

The maximum backwater effect for the proposed bridge and relocated channel was 0.2 ft for the 100-year flood. The relocated channel will shorten the flow length near the proposed State Highway 400 Extension and reduce the 100-year flood elevation between 1 and 2 ft between the proposed crossing and Windsor Parkway. Analyses indicated that the proposed construction and reduction of the channel length and flood-plain storage would increase the 100-year discharge about 200 ft^3/s, and this increase in discharge would add only about 0.1 ft to the computed proposed 100-year flood elevation.

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