Summary of Holly Pond Historical Documents

PREPARED FOR: Holly Pond Project Team

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DATE: February 10, 2009

PROJECT NUMBER: 373533

This memorandum summarizes Holly Pond's history and several studies obtained by the City of Stamford and other resources.

Timelines

This memorandum includes two versions of timelines for the project- graphic (Figure 1) and outlined.

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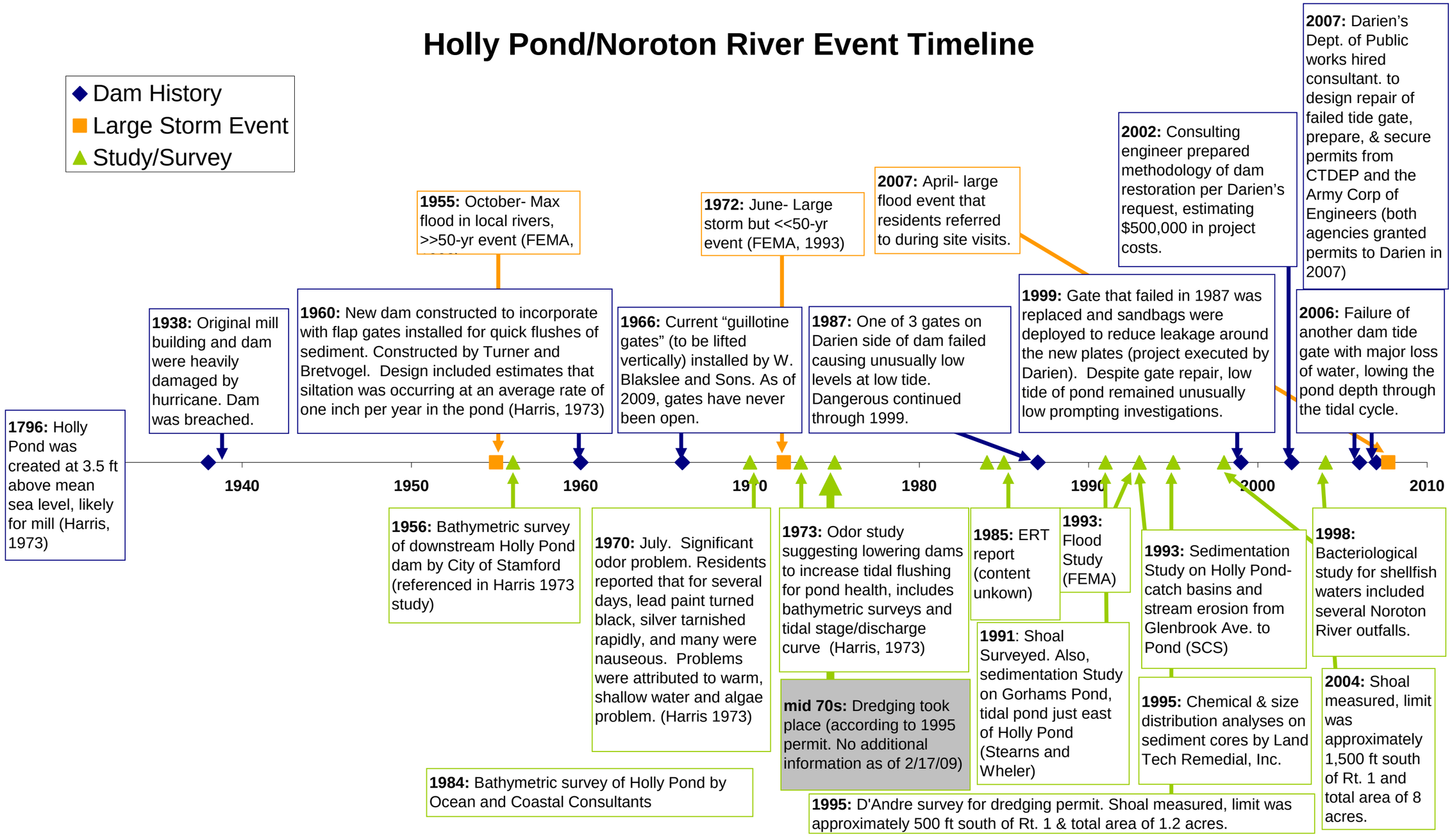
Figure 1 Timeline



Holly Pond Restoration Funding Timeline

Early 1900s	CTDEP applied for funding under the Intermodal Surface Transportation Efficiency Act to eliminate sediment discharge into Holly Pond and dredge sediment from pond. CTDEP developed concept of catch basins with sediment chambers to reduce sediment loading.
Mid 1970s	Dredging occurred (referenced in D'Andrea 1994 dredging application)
1994	D'Andrea, Inc. submitted dredging application. While the permit was issued, dredging from this application never did occur due to insufficient funding to locate a secure landfill that could accept levels of contaminants found in the soil.
1994	Because dredging was not feasible, CTDEP developed a sedimentation basin concept and a consultant was hired for the design. However, the design report indicated that stormwater volume generated from watershed was too large for CTDEP's sedimentation basin alternative.
2003	CTDEP and CTDOT proposed canceling project due to lack of progress and feasibility of construction.
2004	State representatives and other stakeholders objected and lead to reinstate appropriation in $500,000 for the project.
2005	CTDEP, CTDOT, and City of Stamford prepared scope for PE phase with the objective to remove accumulated sediment by dredging the shoal. However, CTDEP estimated that removal would be approximately 2 million dollars per acre to dredge, transport, and dispose of the material

Timeline of Dam History

(Compiled from Harris 1973 and City of Darien 2007 documents)

1796	Holly Pond was created at 3.5 ft above mean sea level, likely for mill (Harris, 1973)
1938	Original mill building and dam were heavily damaged by hurricane. Dam was breached.
1960	New dam constructed to incorporate with flap gates installed for quick flushes of sediment. Constructed by Turner and Bretvogel. Design included estimates that siltation was occurring at an average rate of one inch per year in the pond (Harris, 1973)
1966	Current "guillotine gates" (to be lifted vertically) installed by W. Blakslee and Sons. Gates have never been open
1987	One of 3 gates on Darien side of dam failed causing unusually low levels at low tide. Dangerous continued through 1999
1999	Gate was replaced and sandbags were deployed to reduce leakage around the new plates (project executed by Darien). Despite gate repair, low tide of pond remained unusually low prompting investigations

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2002 Consulting engineer prepared methodology of dam restoration per Darien's request, estimating $500,000 in project costs

2006 Failure of another dam tide gate with major loss of water, lowering the pond depth through the tidal cycle

2007 Darien's Dept. of Public works hired Ocean and Costal Consultants, Inc. to design repair of failed tide gate and assist town in preparation of applications and securing permits from CTDEP and the Army Corp of Engineers (both agencies granted permits to Darien in 2007)

Timeline Studies/Surveys/Large Storms related to Holly Pond and the Noroton River

1935 City of Stamford conducted bathymetric survey of Holly Pond

1955 October- Max flood in local rivers, >>50-yr event (FEMA, 1993)

1956 Bathymetric survey of downstream Holly Pond dam by City of Stamford (referenced in Harris, 1973, no images)

1970 July. Significant odor problem. Residents reported that for several days, lead paint turned black, silver tarnished rapidly, and many were nauseous. Problems were attributed to warm, shallow water and algae problem. (Harris 1973)

1973 Odor study suggesting lowering dams to increase tidal flushing for pond health, includes bathymetric surveys (Harris, 1973)

Mid 70s Dredging took place according to Land Application permit by D'Andrea in 1995 (CH2M HILL has not obtained plan or additional information regarding this as of 2/17/09)

1984 Bathymetric survey conducted by Ocean and Coastal Consultants

1985 ERT report on Holly Pond (content unknown)

1991 Bathymetric survey of Holly Pond completed (surveyor unknown, referenced in PE Scope from Ron Rozsa about dredging- have not obtained maps as of 2/17/09)

1991 Sedimentation Study on Gorhams Pond, tidal pond just east of Holly Pond (Stearns and Wheler)

1993 Flood Study (FEMA)

1993 Sedimentation Study on Holly Pond- catch basins and stream erosion from Glenbrook Ave. to Pond (Soil Conservation Service)

1994 D'Andrea surveys shoal for dredging permit. Shoal measured, limit was approximately 500 ft south of Rt. 1 and total area of 1.2 acres.

1995 Chemical and size distribution analyses were conducted on 8 sediment cores from shoal by Land Tech Remedial, Inc.

1998 Bacteriological study for shellfish waters included several Noroton River outfalls. Bacteriological results from the Norton outfall monitoring were variable, not totally

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rain dependent, and generally much higher than found in most storm drain waters. (Shellfish Commission of Stamford)

2004 Shoal measured, limit was approximately 1,500 ft south of Rt. 1 and total area of 8 acres.

2007 April 26, large storm with flooding of the Noroton River.

Flood Study by FEMA

As of 1993, the maximum flood occurred in October 1955, wiping out several bridges in the Noroton and was estimated to be greater than a 50-year event. June 1972 flood caused personal property damage but minimal structural damage and was estimated to be significantly less than a 50-yr event (FEMA, 1993). April 2007 also had a large storm event. Attachment 1 contains base flow flood values and profile section results from the Flood Study.

Table 1 1993 Flood Study Flow Discharges

Noroton River location	Drainage Area, Sq miles	Peak Discharges, cfs			
		10--yr	50-yr	100-yr	500-yr
At Conrail*	11.9	1,900*	3,900*	5,300*	9,700*
At Stamford-New Canaan Corp Limits	5.6	1,400	2,975	4,150	7,800
* Flows reported in FEMA report but produced by Leonard Jackson Associates					

Pond Bathymetry

Dave Emerson with the City of Stamford's Environmental Protection Board made this note in reference to pond hydraulics to Ron Rozsa (CTDEP) in a 2007 email:

> …of possible interest, is the potential impact of the artificial "spit" of land that intrudes across the channel approximately 300 ft or so south east of the dam on sedimentation and water circulation patterns. This feature, at elevation 6 NGVD, extends two-thirds the way across the outlet of the pond.

Prior to CH2M HILL's involvement in 2008, bathymetric surveys were completed most recently in 1994 by D'Andrea for a dredging permit, in 1991, and in 1985. To date, these bathymetric surveys have not been provided to CH2M HILL.

Fredric Harris, Inc. (Harris) compared the surveys Harris conducted in 1973 with the City of Stamford's from 1935. Bathymetric maps of 1935 and 1973 are provided in Attachment 2. Text below is Harris' comparison:

> Comparison of the April 1973 bathymetry with the August 1935 contours yield the following results: with the exception of the area behind the dam on the east side of the pond [downstream dam], the water depth of the estuary has decreased considerable. Accumulations as high as 5 ft can be seen immediately behind the east

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side of the dam. The average thickness of the deposition over the entire pond seems to be approximately two-three feet. In general, greater accretions are found on the east side than on the west side of the estuary. The implication is twofold:

1. A significant amount of material has been trapped in the estuary
2. A channeling of the flow on the Stamford side of the pond has occurred. The second conclusion is also supported by the position of the scour hole behind the dam on the Stamford side. The increase in depth at this point amounts to slightly less than 1 ft.

Sedimentation Studies

A dredging application for the Holly Pond shoal at the mouth of the Noroton River was submitted in 1994. The application was prepared by D'Andrea, though City of Stamford's Ed Gentile and the Friends of the Goodwives believe D'Andrea's volume estimate of 15,840 cubic yards to be under estimated. D'Andrea identified Scofield Park as the disposal site in the 1994 dredging application.

A sedimentation study was performed by the Soil Conservation Service (SCS) in 1993 as a requirements associated with a grant the City of Stamford obtained from the Long Island Sound Coves and Embankments Program for dredging the shoaling at the mouth of the Noroton River. The study includes maps and field notes of sediment deposits, erosion, and debris along the Noroton River from Glenbrook to the pond (maps are found in Attachment 3). These erosion areas do not always line up with those noted by the CH2M HILL December 2008 river assessment. The study also thoroughly identifies and characterizes material in more than 450 catch basins in Stamford and Darien. While the scanned report copy CH2M HILL has on file contains hand written notes from Jim Stewart (Town of Darien) stating that the study's concludes that most of the sedimentation in the pond is due to stream bed erosion, the report itself does not explicitly conclude this.

Stearns and Wheler studied the sedimentation of Gorhams Pond, a tidal pond just east of Holly Pond in Darien. Table 2 shows Sterns and Wheler's sedimentation estimates for the two tributaries over the entire Gorhams Pond area. The Gorhams Pond study was supporting the City of Darien's sediment management proposal that involved sedimentation basins with dredging at regular intervals. This study is in Appendix F of the SCS's 1993 report.

Table 2 Sediment volume estimates into Gorhams Pond by Stearns and Wheler, 1991

	Occurrence of storm event over the year	
	Low, cubic yards per year	High cubic yards per year
Stony Brook	400	850
Goodwives River	100	350
Total, cubic yards per year	500	1200

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Sediment Samples

Sediment samples were obtained in 1995 in conjunction with the 1995 dredging permit application prepared by Land Tech Remedial, Inc (Land Tech) included analyses of 8 sediment cores from the cove. The cores revealed minor concentrations of pesticides and base/neutral extractable compounds. All results are presented in the scanned file on server (see reference section for location). Figure 2 shows size distribution results from this study.

In 1973, sediment samples were taken from 4 locations in Holly Pond for grain-size distribution as part of the odor control study (Harris). Locations and results are shown in Attachment 2. Below is a summary:

- **Littoral material**: Primarily clean white sediment
- **Upstream of Dam, pond side**: large amounts of shell and very find sediment
- **Downstream side of Dam, sound side**: Large amounts of fragmented shell

Water Quality/Watershed

A total of 4.9 miles (sections CT7403-00_01 and CT7403-00_02) of the Noroton River are considered impaired based on section 303(d) of the Clean Water Act (CTDEP, 2006). The impairment is for Habitat for Fish, Other Aquatic Life and Wildlife. The impairment and cause are unknown and the TMDL priority is low.

2004 Annual Report for Connecticut's Nonpoint Source Management Program reported the following regarding the coastal watershed including Goodwives, Noroton, and Tokeneke Rivers:

> Land use in the watershed is mostly high-density residential development with a commercial strip along the Route 1/I-95 corridor. These watersheds are small in area and subject to very low mid-summer flows. The primary NPS pollutants of concern are sediments, nitrogen, and bacteria, resulting from urban stormwater, animal waste runoff, septic systems and residential lawn care products. Several local environmental organizations have hired a consulting firm to conduct a watershed study focusing on addressing the sedimentation problem and improving stormwater quality. To date, two small ponds have been dredged and restored.

In 1995 CH2M HILL prepared a Nonpoint Source Pollutant Trading Study for the Noroton and Rippowam watersheds.

Holly Pond water quality was reported to be in "an advanced state of eutrophication" in 1973 (Harris). The following are 1973 water quality results:

- Phosphorus ranging from 0.04 to 0.11 mg/L
- Ammonia nitrogen averaging 0.3 mg/L with a maximum of 1.1 mg/L
- Fecal coliform ranging from 102 to 104 mpn/100 ml.

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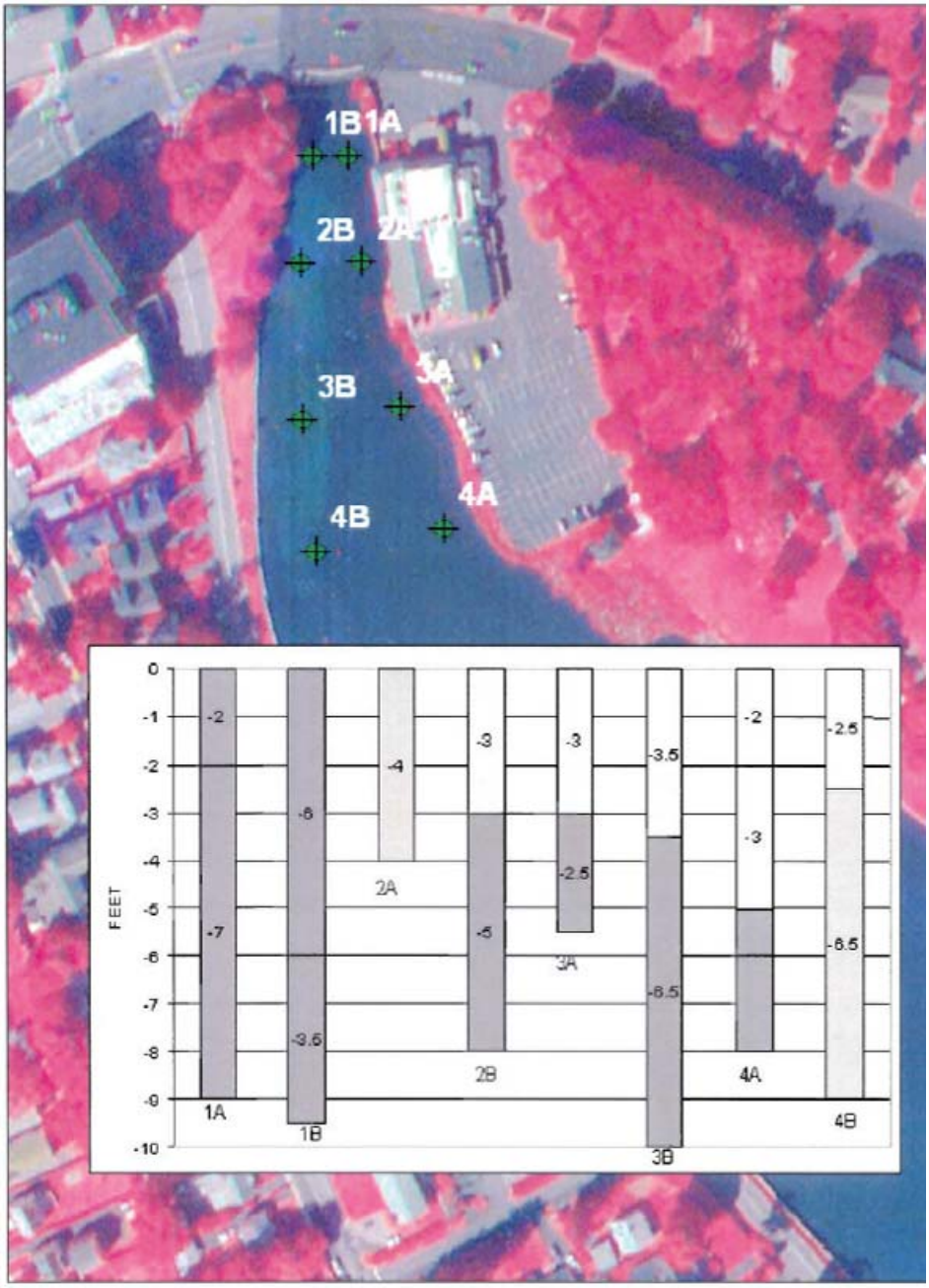
Figure 2 Particle results from Land Tech's 1995 analyses. CTDEP has the following caption "grey color corresponds to sandy sediments, dark grey representing sand and gravel (medium to coarse sand), and the wavy line symbol corresponds to organic silts". However, "Wavy line" is not found on figure.



Water Circulation

Based on modeling, Harris constructed a likely circulation pattern of Holly Pond with 1973 conditions (Figure 3).

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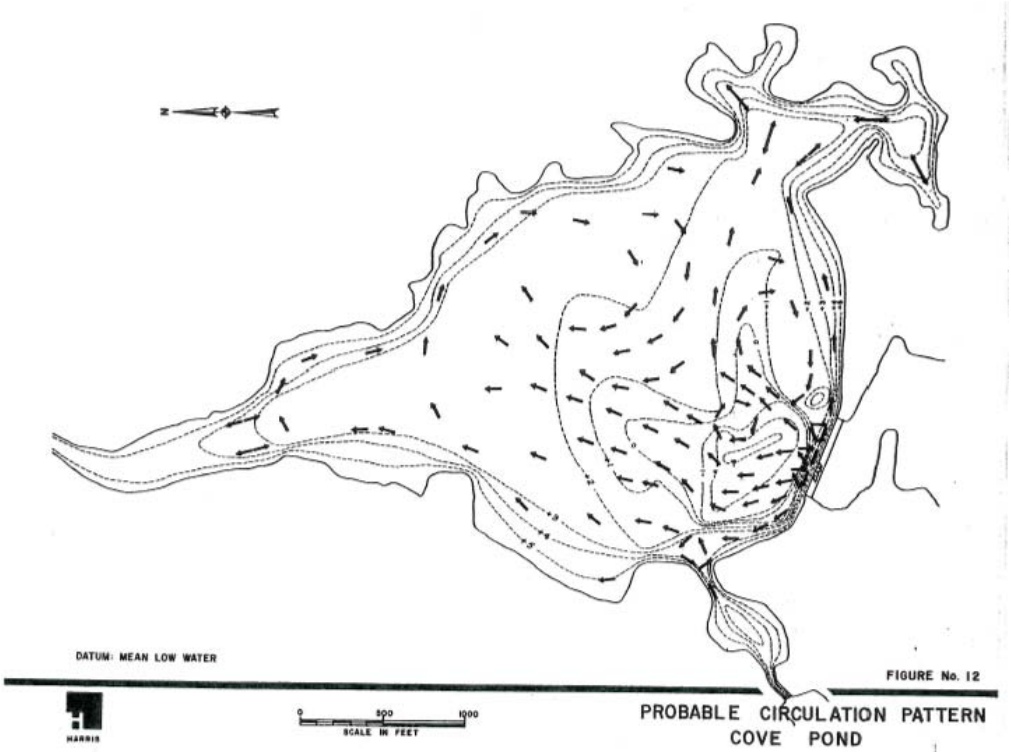
Figure 3 Probable circulation pattern of Holly Pond (Harris 1973)



Tidal Data

Harris also calculated a tidal/stage discharge relationship for the dam, presented in table 3 and Figure 4. The "gut" dam is the small dam connecting to the yacht canal in the southwestern Cove Island Park.

Table 3 Results from tidal stage/discharge relationship created by Harris 1973 for Holly Pond Dam, calculated using standard weir equation

	Using average tidal Data		
	Max flow, cfs	Average Velocity, fps	Approximate Maximum Velocity, fps
Main Dam	2,400	3.8	5.5
"Gut" dam	107	2.6	3.5

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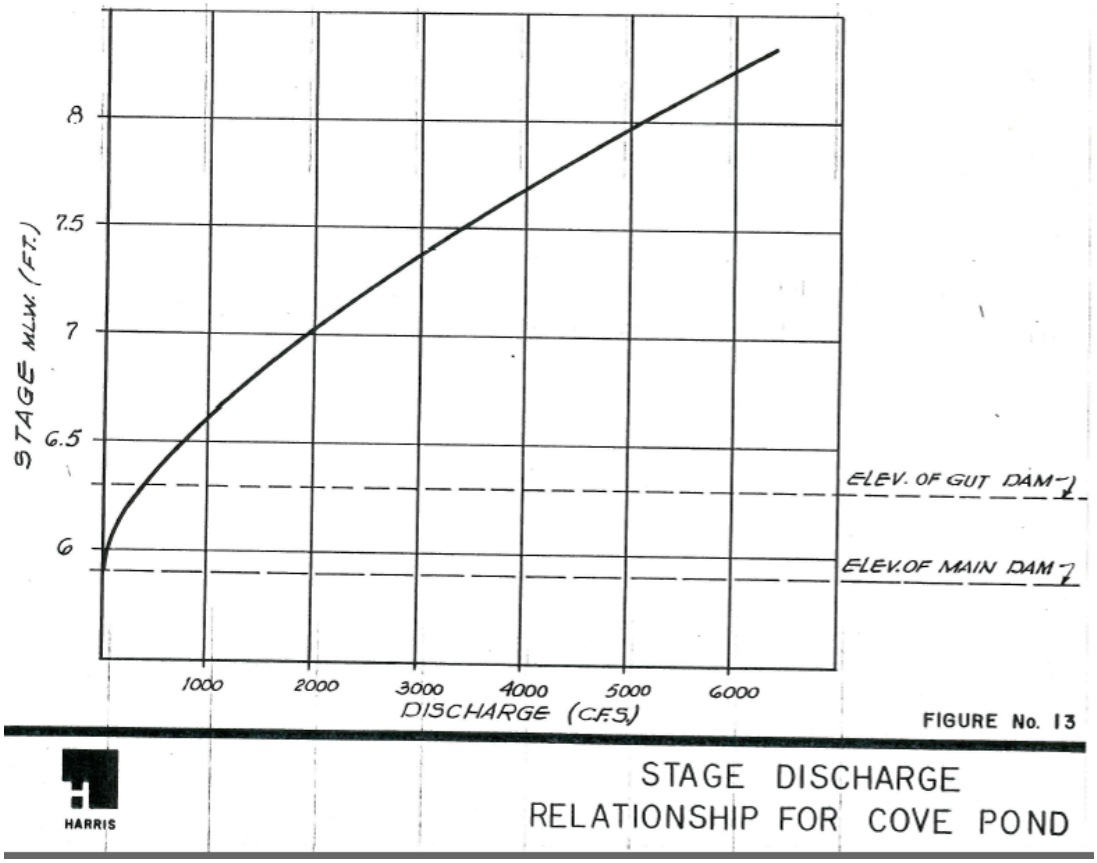
Figure 4 Tidal/stage discharge relationship for dam (Harris 1973)



Other Stakeholders

The Friends of the Goodwives River seem to be on good terms with the City's Ed Gentile. They submitted a letter to Mr. Gentile in 2004 discussing their agreement with Mr. Gentile that 15,000 cubic yards dredging estimate was too low, suggestions based on sedimentation basins and gabion weirs installed in the Goodwives River, adaptive re-use potential as a shoreline esplanade, and a watershed management plan.

The PE scope created by CTDEP and CTDOT outlines dredging methodology expected (file HollyPondDredging_DraftScope_forPreliminaryEngineeringPhase_June162005_RozsaEmail .pdf, here: \\Andromeda\proj\StamfordWPCA\373533HollyPond\Phase_1\Task_1.2\Dredging).

Outstanding Documents

The following are documents that have not been obtained that may be helpful.

- Dave Emerson indicated that he had a copy of the ERT 1985 report and the 1984 Ocean and Coastal Consultants bathymetric survey.

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City of Darien, 2007. Notification of Application to Darien Environmental Protection Commission Re: Holly Pond Dam Tide Gate Repair. File name: Darien_Holly_Pond_Dam_Tide_Gate_Repair_Environ_Protection_Application_May11_2007.pdf; Location: \\Andromeda\proj\StamfordWPCA\373533HollyPond\Phase_1\Task_1.2\City_of_Darien

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CTDEP, 2006. Impaired Waters List(CT Waterbodies Not Meeting Water Quality Standards). File name: 2006 CT 303d.pdf; Location: \\Andromeda\proj\StamfordWPCA\373533HollyPond\Phase_1\Task_1.2\CTDEP

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Fredric Harris, Inc. 1973. Study of Cove Pond and Dam: Stamford- Darien, Connecticut. File name: Study_of_Cove_Pond_and_Dam_Stamford_Darien_Connecticut_Harris_1973.pdf Location: \\Andromeda\proj\StamfordWPCA\373533HollyPond\Phase_1\Task_1.2

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Soil Conservation Service. 1993. Holly Pond Sedimentation Study. Phillip Renn, coordinator. File name: HollyPondSedimentationStudy_Jan1993_USDASoilConservation.pdf Location: \\Andromeda\proj\StamfordWPCA\373533HollyPond\Phase_1\Task_1.2\City_of_Stamford

Shellfish Commission of Stamford. 1998. File name: Bacteriological CoveSurvey.pdf; Location: \\andromeda\proj\StamfordWPCA\373533HollyPond\Phase_1\Task_1.2\City_of_Stamford

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Toilsome Brook (continued)								
P	1.639[1]	70	156	5.5	110.8	110.8	110.8	0.0
Q	2.067[1]	12	42	10.6	124.5	124.5	124.5	0.0
R	2.114[1]	11	40	10.9	127.3	127.3	127.4	0.1
S	2.187[1]	45	233	1.8	130.1	130.1	130.7	0.6
T	2.311[1]	40	188	2.2	130.5	130.5	131.0	0.5
U	2.408[1]	28	138	2.7	131.3	131.3	131.8	0.5
V	2.555[1]	120	507	0.7	131.9	131.9	132.3	0.4
Laurel Brook								
A	0.03[2]	175/155[4]	1,120	4.5	244.1	243.8[6]	244.8	1.0
B	0.18[2]	100/60[4]	710	8.1	247.3	247.3	247.9	0.6
C	0.22[2]	100/70[4]	480	11.6	253.6	253.6	253.6	0.0
D	0.26[2]	100/50[4]	500	11.1	258.9	258.9	258.9	0.0
E	0.49[2]	100/60[4]	630	9.0	272.2	272.2	273.1	0.9
F	0.51[2]	100/60[4]	1,290	3.9	280.2	280.2	280.2	0.0
Noroton River								
A	580[3]	146[5]	998	5.3	13.3	13.3	13.3	0.0
B	1,500[3]	180[5]	1,416	3.7	23.1	23.1	23.1	0.0
C	3,100[3]	65[5]	642	8.3	24.2	24.2	24.2	0.0
D	3,539[3]	80[5]	715	7.4	27.4	27.4	27.4	0.0
E	4,100[3]	195[5]	2,289	2.3	36.9	36.9	36.9	0.0
F	4,850[3]	155[5]	1,479	3.6	39.9	39.9	39.9	0.0
G	5,700[3]	200[5]	1,527	3.5	40.7	40.7	40.8	0.1
H	6,580[3]	120[5]	1,055	5.0	41.5	41.5	41.5	0.0

[1]Miles above confluence with Rippowam River (Lower Reach)
[2]Miles above confluence with Rippowam River (Upper Reach)
[3]Feet above U.S. Route 1 centerline
[4]Width/width within corporate limits
[5]Width extends beyond corporate limits
[6]Elevation computed without consideration of backwater effects from Rippowam River (Upper Reach)

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF STAMFORD, CT
(FAIRFIELD CO.)

FLOODWAY DATA

TOILSOME BROOK - LAUREL BROOK - NOROTON RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Noroton River (continued)								
I	8,250	145	1,251	4.2	42.2	42.2	42.3	0.1
J	10,990	220	1,137	3.0	50.9	50.9	51.8	0.9
K	13,100	302	1,271	4.2	64.9	64.9	65.7	0.8
L	13,820	109	508	10.4	68.0	68.0	68.5	0.5
M	14,840	125	1,066	3.9	77.0	77.0	77.2	0.2
N	15,300	125	1,043	4.0	77.4	77.4	77.9	0.5
O	16,600	110	770	5.4	81.6	81.6	82.0	0.4
P	18,200	145	827	5.0	88.4	88.4	89.2	0.8
Q	18,600	340	3,444	1.2	93.9	93.9	93.9	0.0
R	19,650	190	1,312	3.2	94.1	94.1	94.2	0.1
S	20,700	172	938	4.4	96.9	96.9	97.6	0.7
T	21,100	190	1,003	4.1	98.9	98.9	99.8	0.9
U	21,650	155	623	6.7	99.8	99.8	100.8	1.0
V	21,950	221	1,214	3.4	101.6	101.6	102.4	0.8
W	22,700	470	1,852	2.2	102.8	102.8	103.6	0.8
X	23,650	140	587	7.1	106.8	106.8	107.1	0.3
Y	24,020	145	670	6.2	110.1	110.1	110.7	0.6

[1]Feet above U.S. Route 1 centerline
[2]Width extends beyond corporate limits

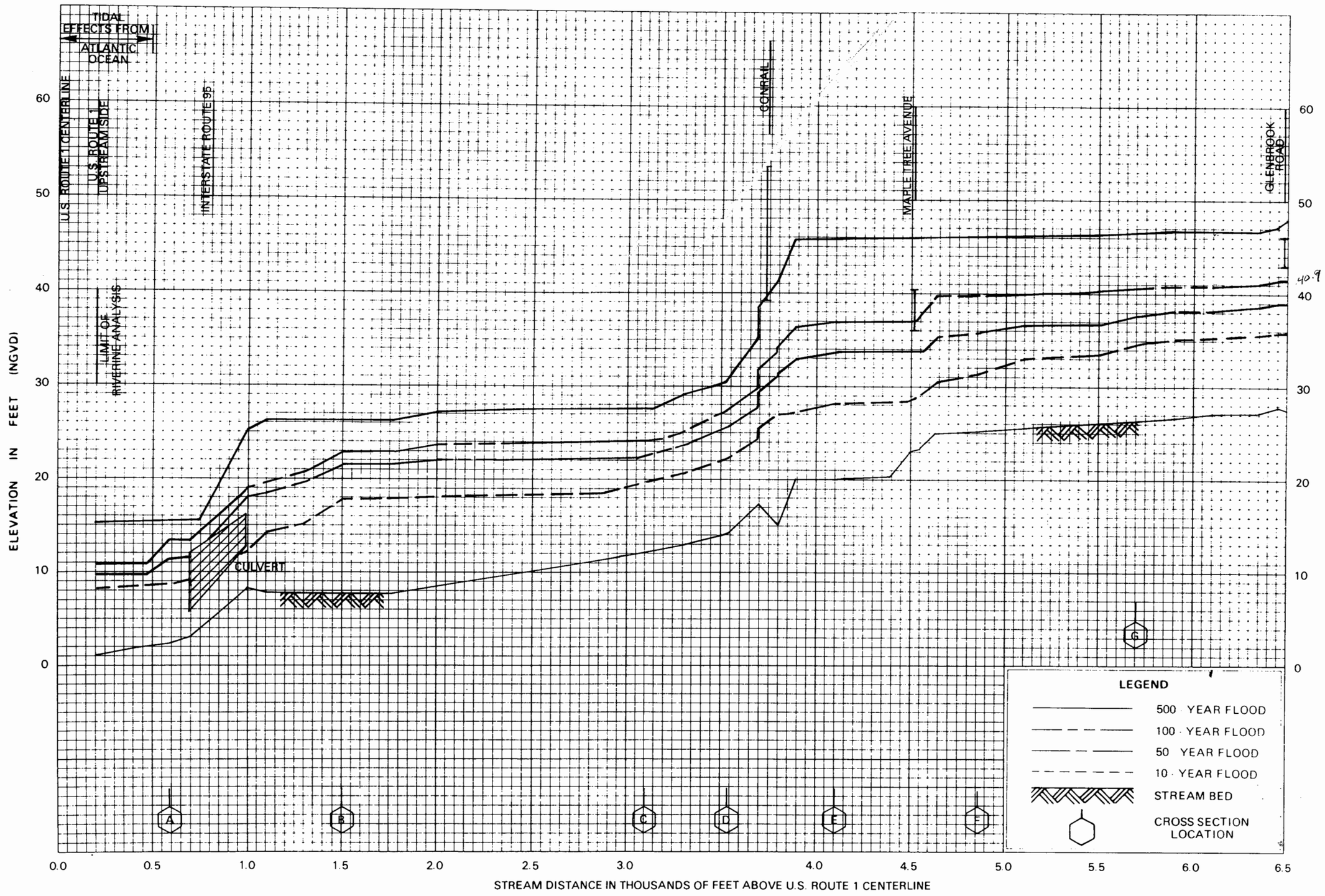
TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF STAMFORD, CT
(FAIRFIELD CO.)

FLOODWAY DATA

NOROTON RIVER



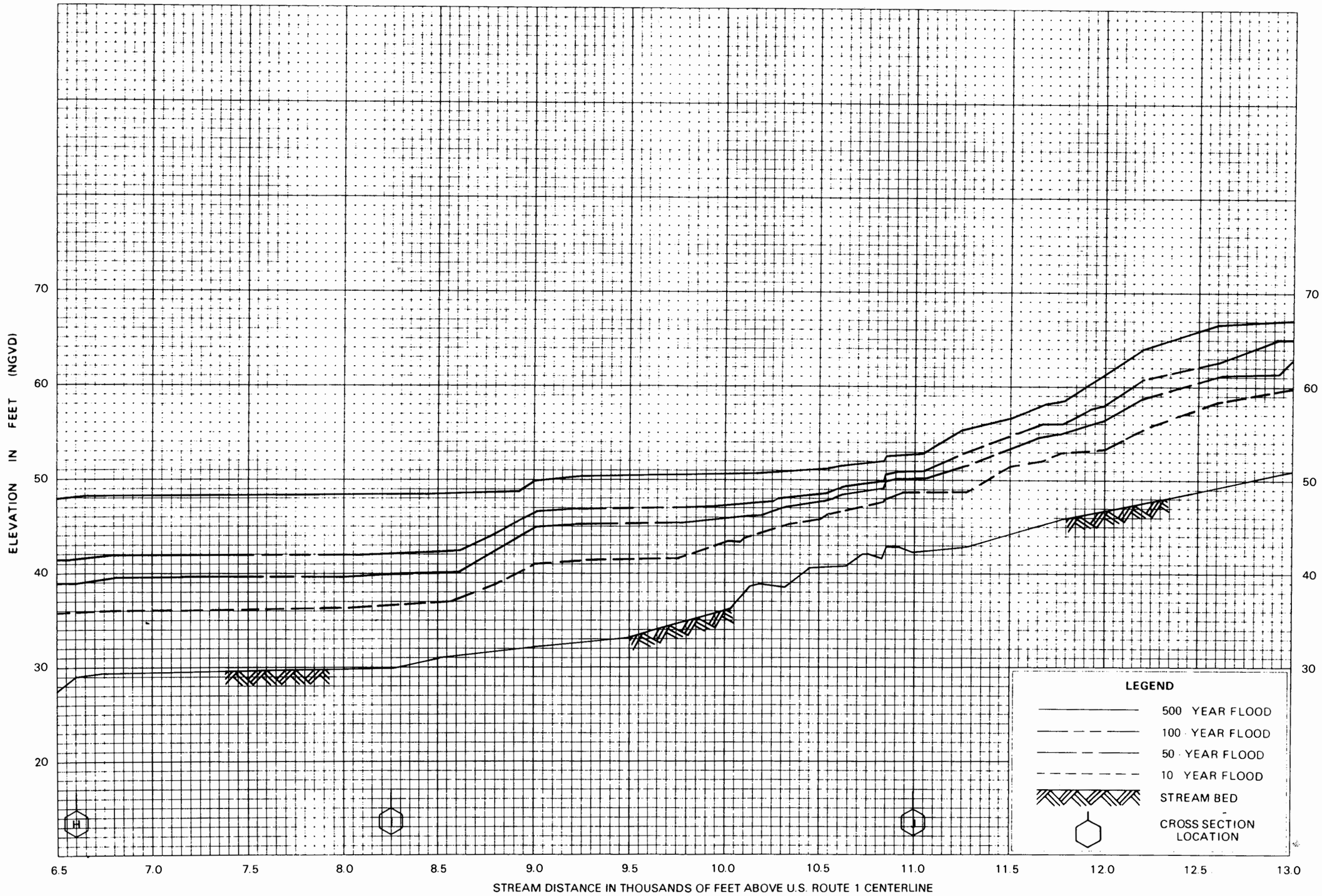
FLOOD PROFILES

NOROTON RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF STAMFORD, CT

(FAIRFIELD CO.)



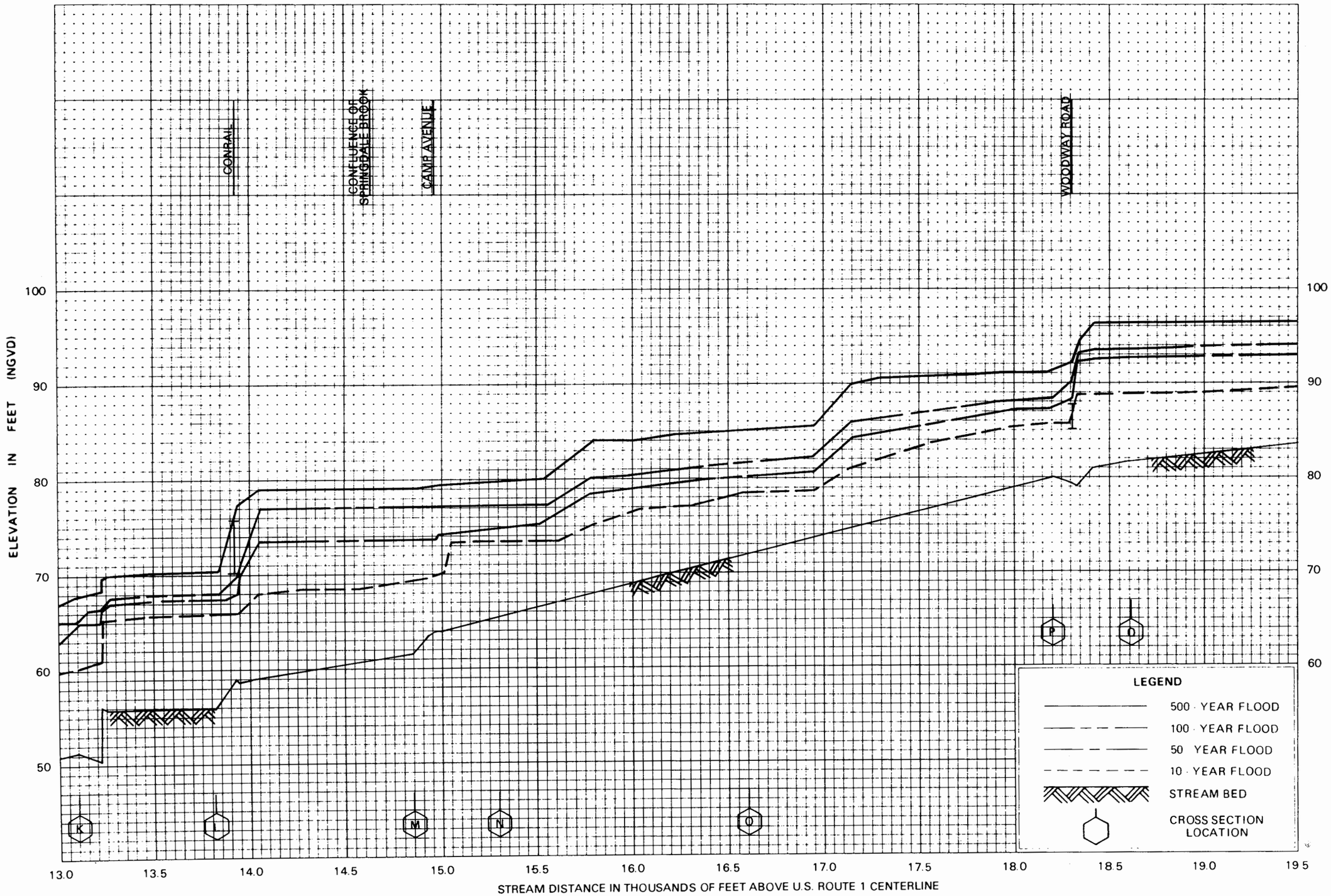
FLOOD PROFILES

NOROTON RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF STAMFORD, CT

(FAIRFIELD CO.)



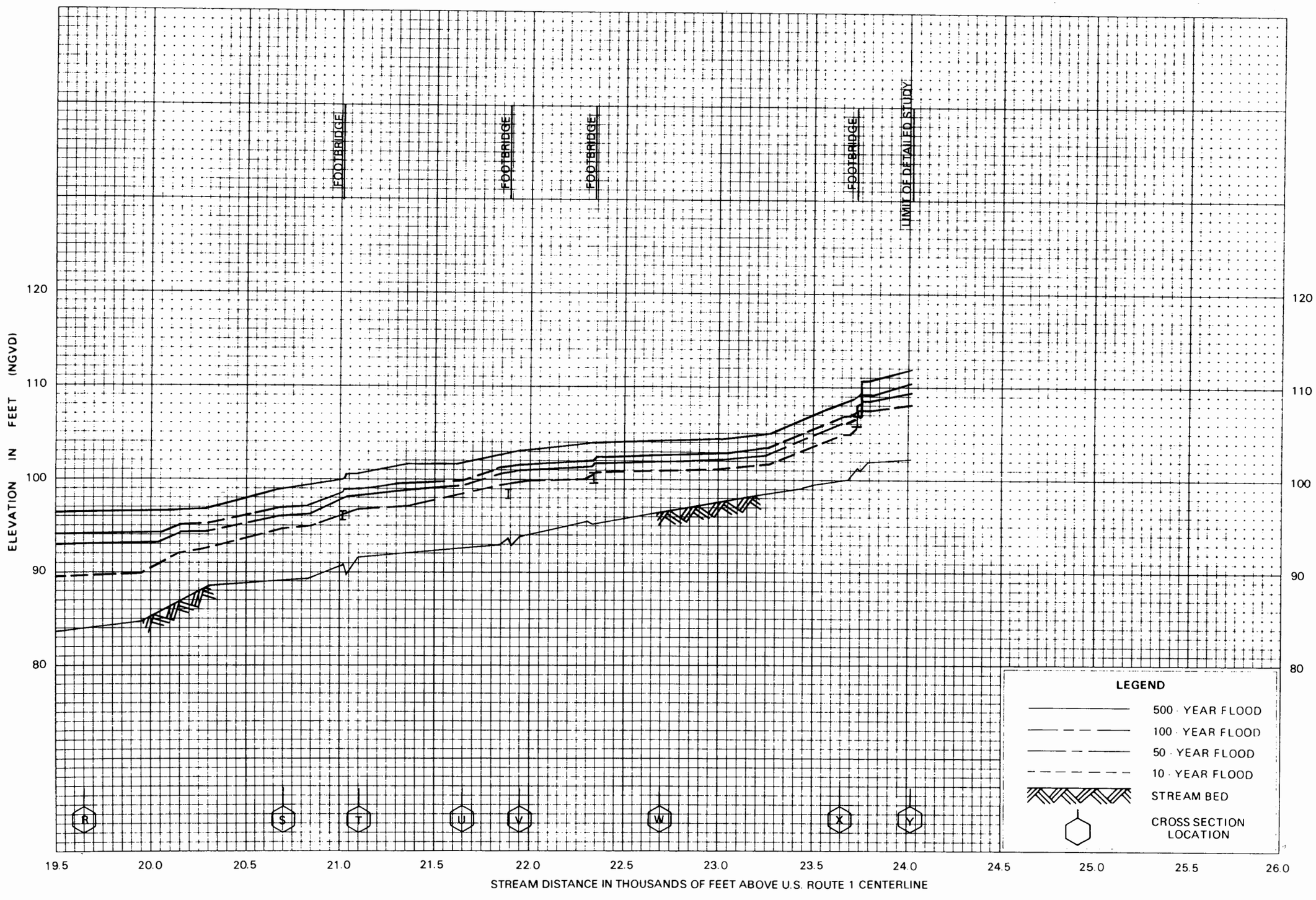
FLOOD PROFILES

NOROTON RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF STAMFORD, CT

(FAIRFIELD CO.)



FLOOD PROFILES

NOROTON RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF STAMFORD, CT

(FAIRFIELD CO.)

Attachment 2: Fredric Harris, Inc. 1973 Odor Study bathymetric maps, grain size distribution results

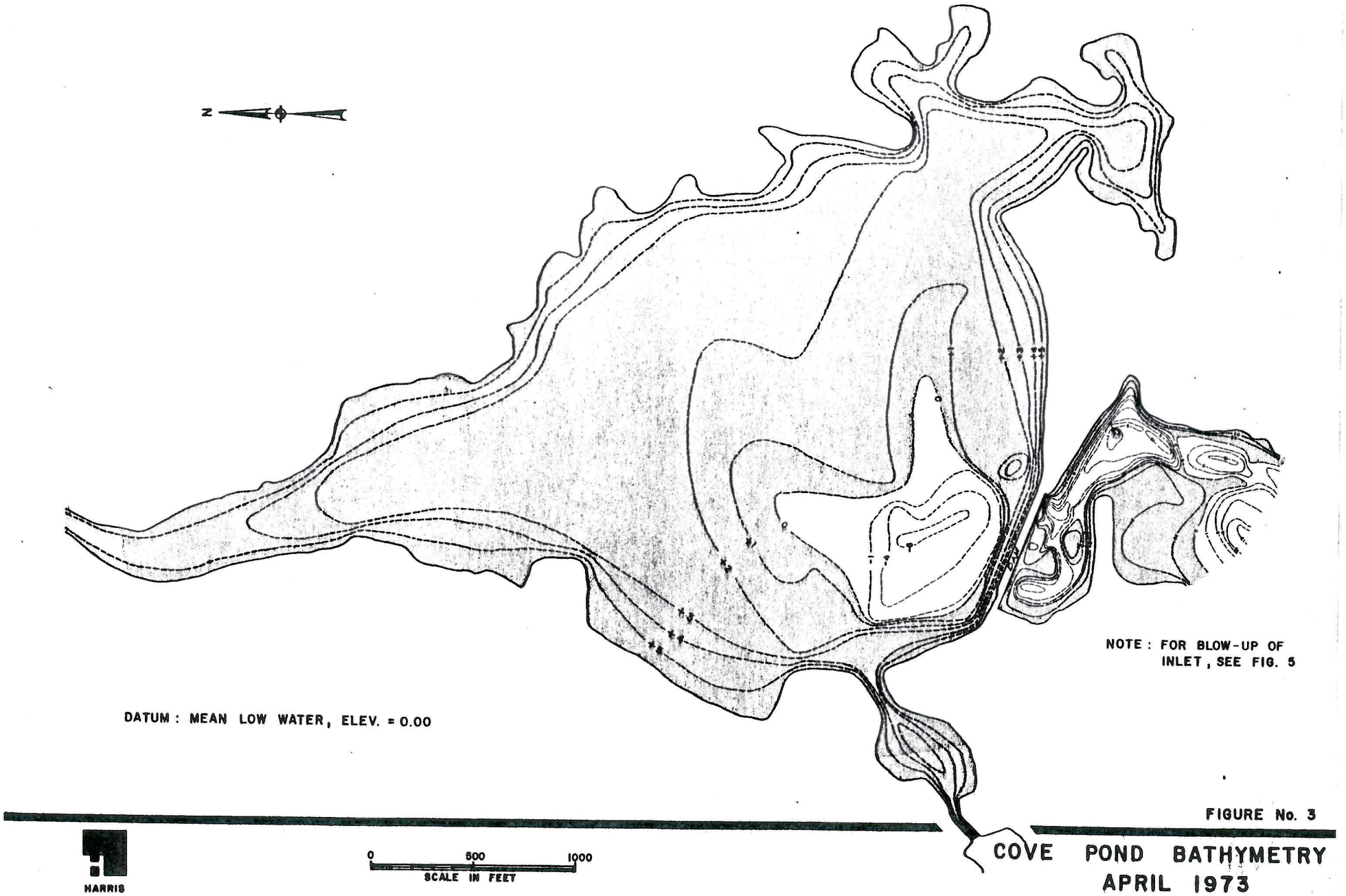
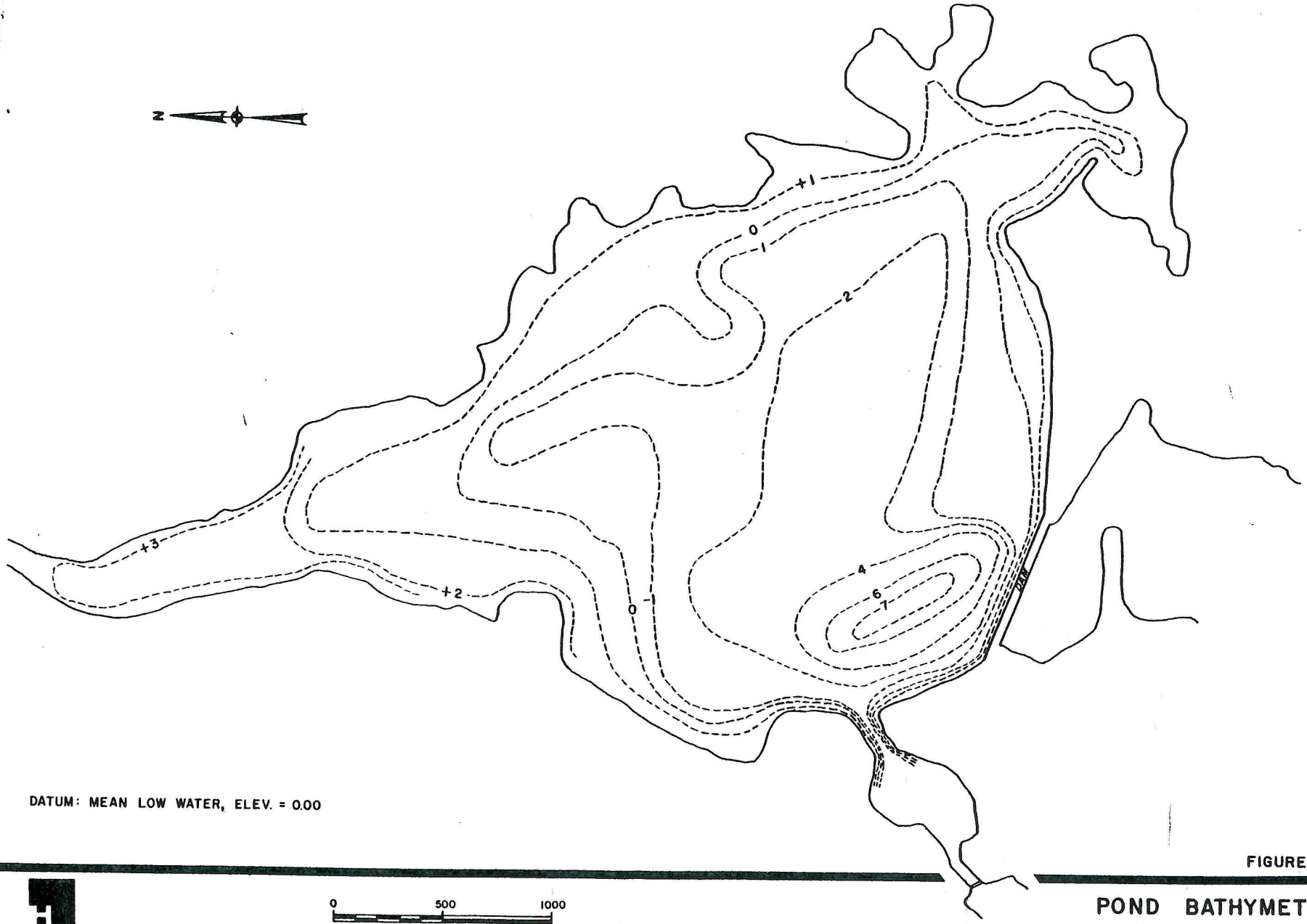


FIGURE No. 3

COVE POND BATHYMETRY
APRIL 1973



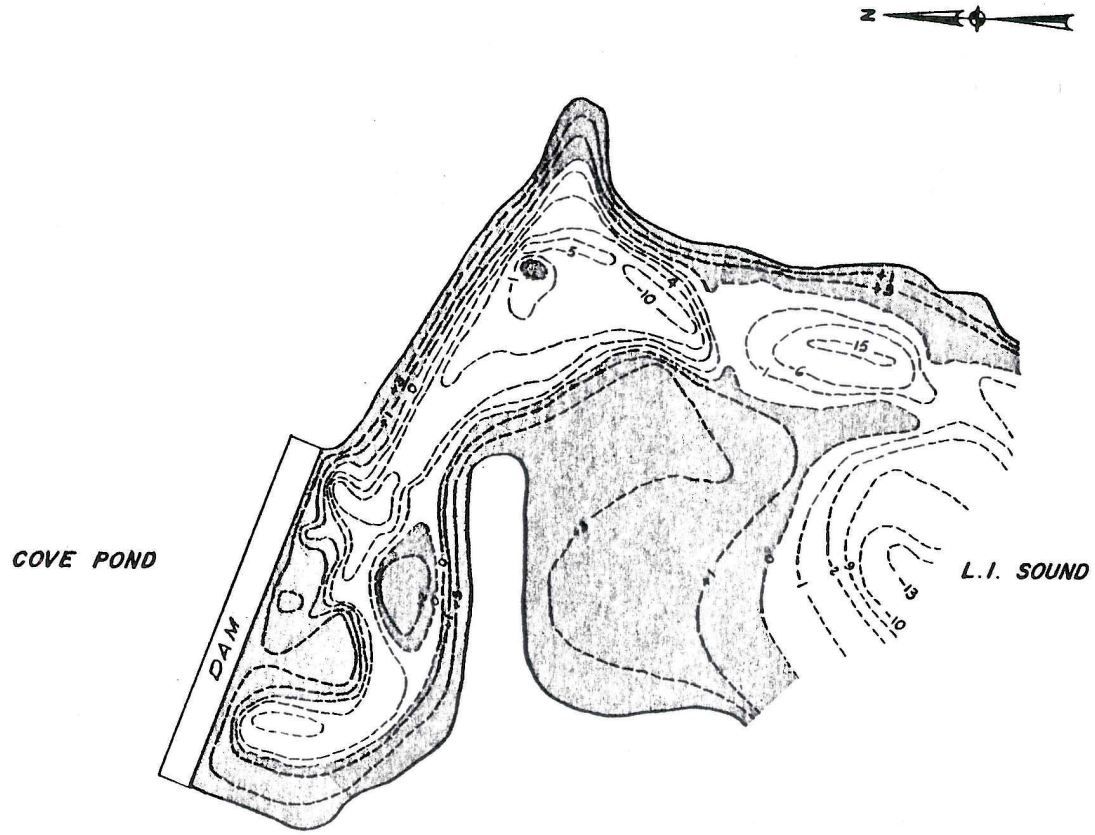
DATUM: MEAN LOW WATER, ELEV. = 0.00

HARRIS

0 500 1000
SCALE IN FEET

FIGURE No. 4

POND BATHYMETRY
AUGUST 1935



DATUM: MEAN LOW WATER, ELEV. = 0.00

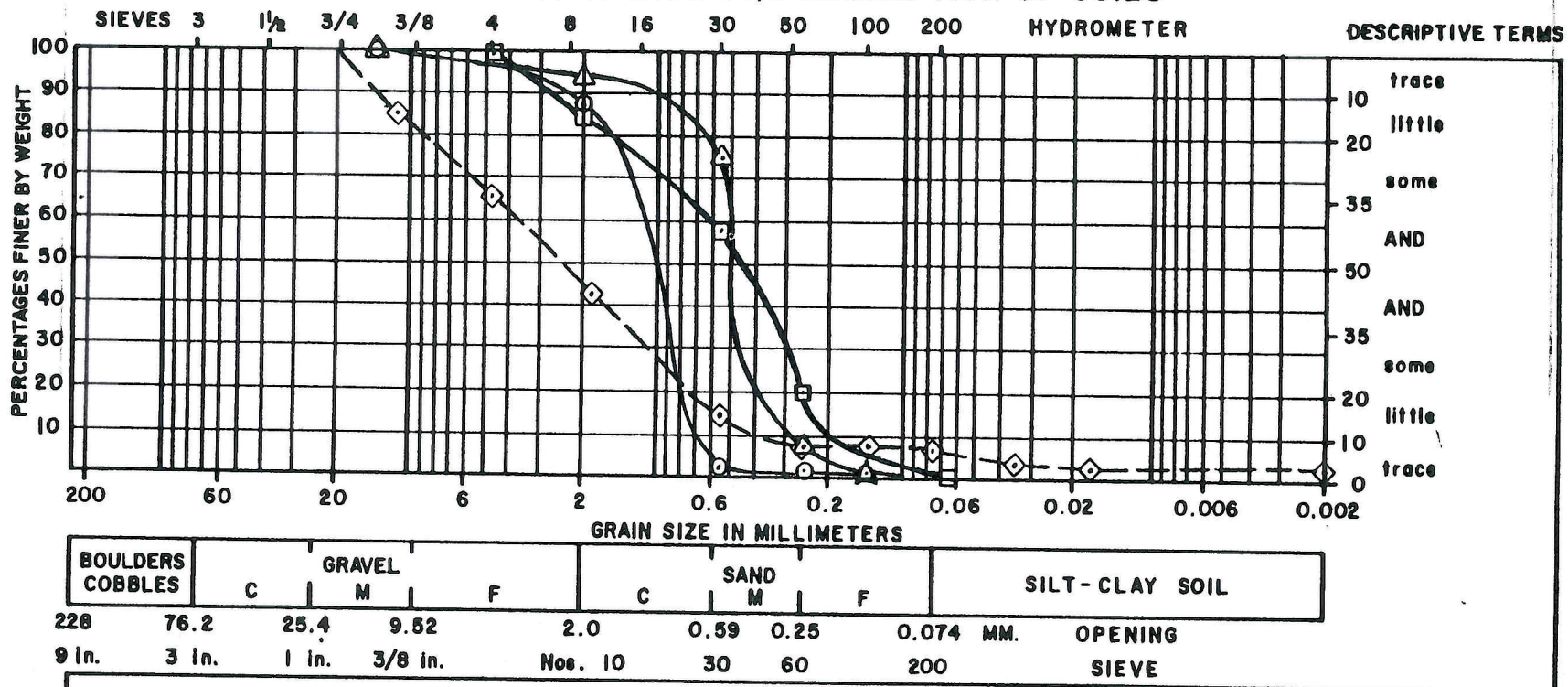
FIGURE. No. 5

HARRIS

50 0 100 200 300
SCALE IN FEET

INLET BATHYMETRY
APRIL 1973

GRAIN SIZE ANALYSIS
IDENTIFICATION AND DESCRIPTION OF SOILS



SYMBOL	SAMPLE	DESCRIPTION
□	1	Littoral Material - (Stamford)
△	2	Littoral Material - (Darien)
○	3	Inlet Sample
◇	4	Pond Side of Dam

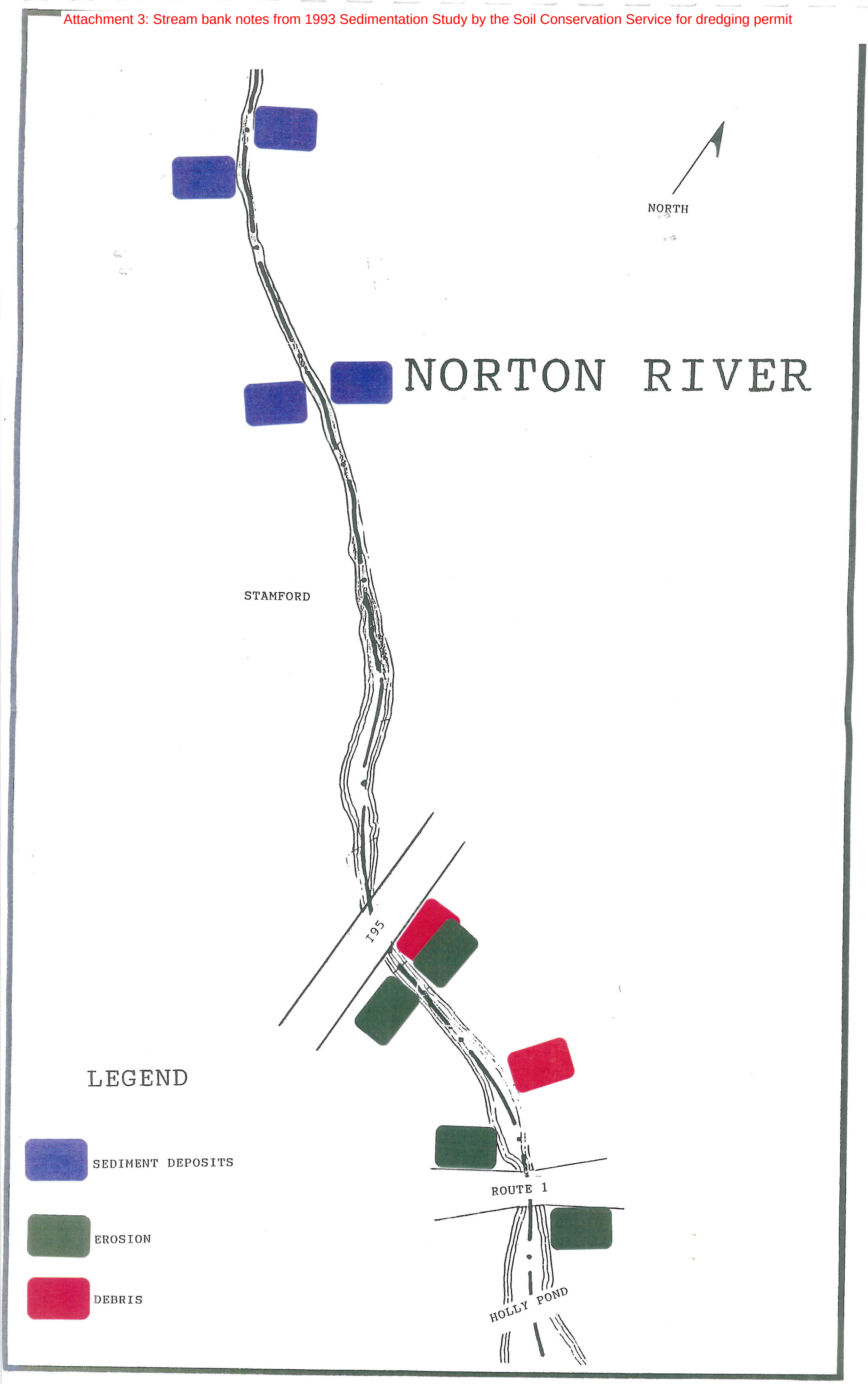
FRH 522

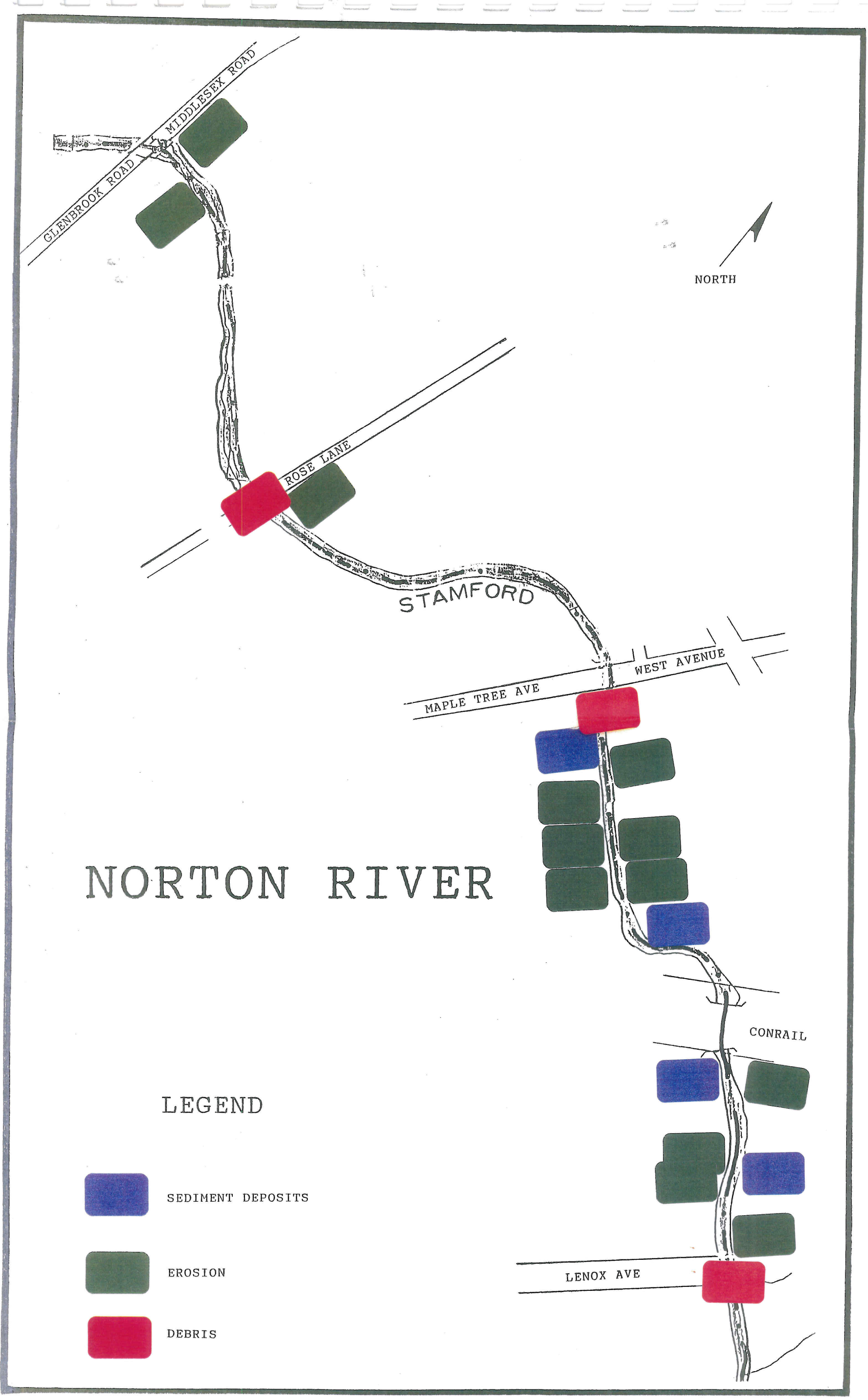
HARRIS

SEDIMENT SIZE DISTRIBUTION

FIGURE No II

Attachment 3: Stream bank notes from 1993 Sedimentation Study by the Soil Conservation Service for dredging permit




GLENBROOK ROAD
MIDDLESEX ROAD
NORTH
ROSE LANE
STAMFORD
WEST AVENUE
MAPLE TREE AVE
NORTON RIVER
CONRAIL
LENOX AVE
LEGEND
SEDIMENT DEPOSITS
EROSION
DEBRIS