Floodplain Management Tools and Techniques

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Agenda

- FEMA & Local Communities Roles and Responsibilities
- Common terminology
- Flood Hazard Mapping
- Widely used models

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FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)

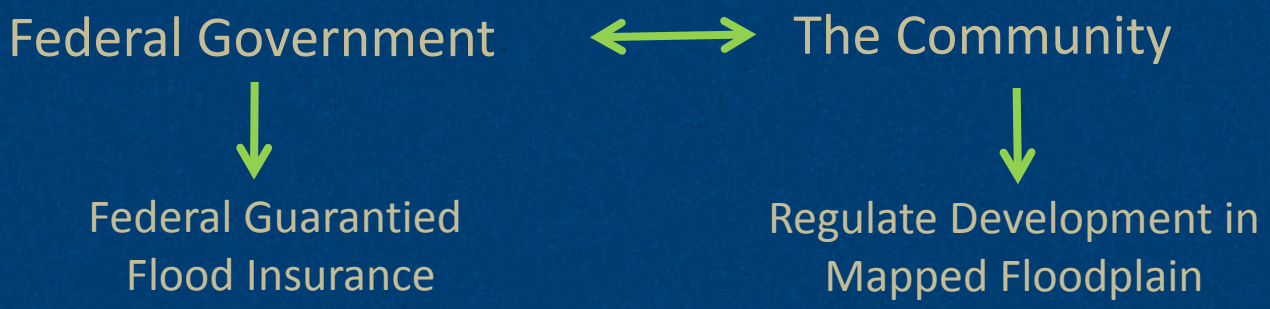
- History
- Current Role
- National Flood Insurance Program (NFIP)

FEMA Roles

- **Regional Offices**
  - Assist the state NFIP coordinating agencies
  - Assess community compliance with NFIP criteria
  - Mapping/Review and adapt new maps and data
- **Mitigation Directorate**
  - Set national policy for floodplain regulations
  - Research floodplain construction practices
- **Federal Insurance Administration**
  - Set flood insurance rates and establish coverage
  - Monitor applications and claims

How NFIP Works

- Managed by Mitigation Directorate
- Governed by Title 44 of the Code of Federal Register (CFR)
- Mandatory insurance for buildings in flood hazard areas to receive federal aid, disaster assistance, and loan from federally insured banks
- Mutual agreement between



Community Roles

A government body with statutory authority to enact and enforce development regulations

- Adopt and enforce FPM ordinance
- Issue or deny floodplain development/building permit
- Estimate flood elevations that were not determined by FEMA
- Require residential structures to be elevated at or above the 100-year flood elevation (BFE)
- Conduct field inspections and cite violations
- Establish variance procedures
- Advise FEMA when map updates are needed

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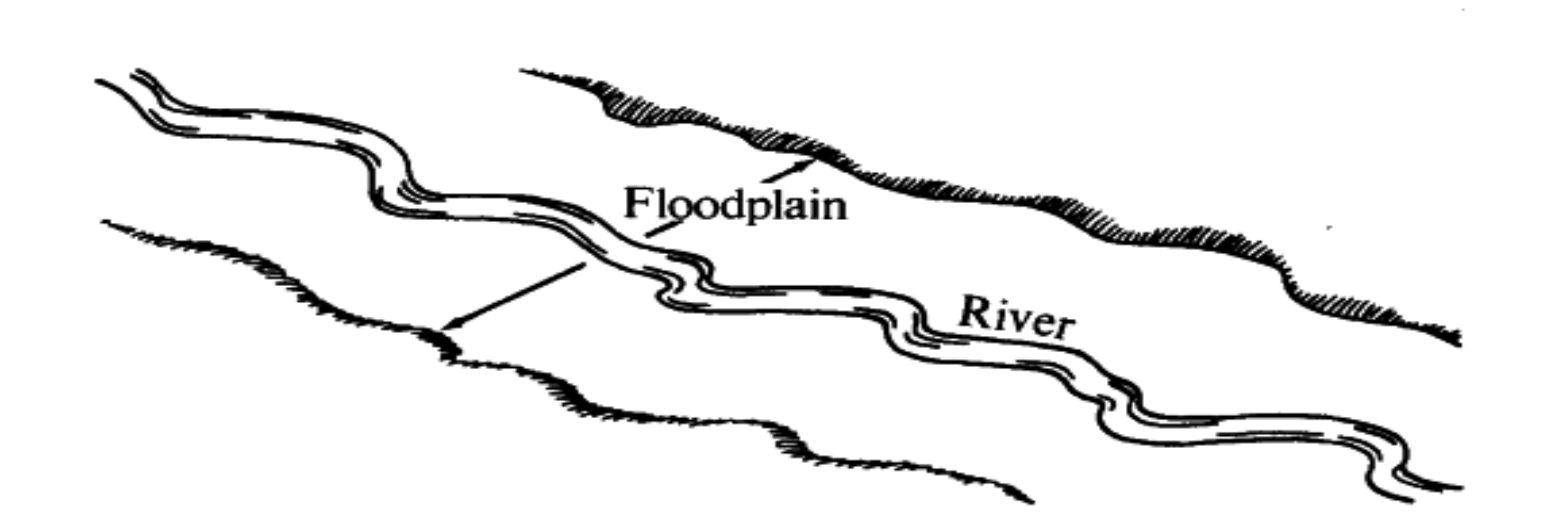
Floodplain Definition

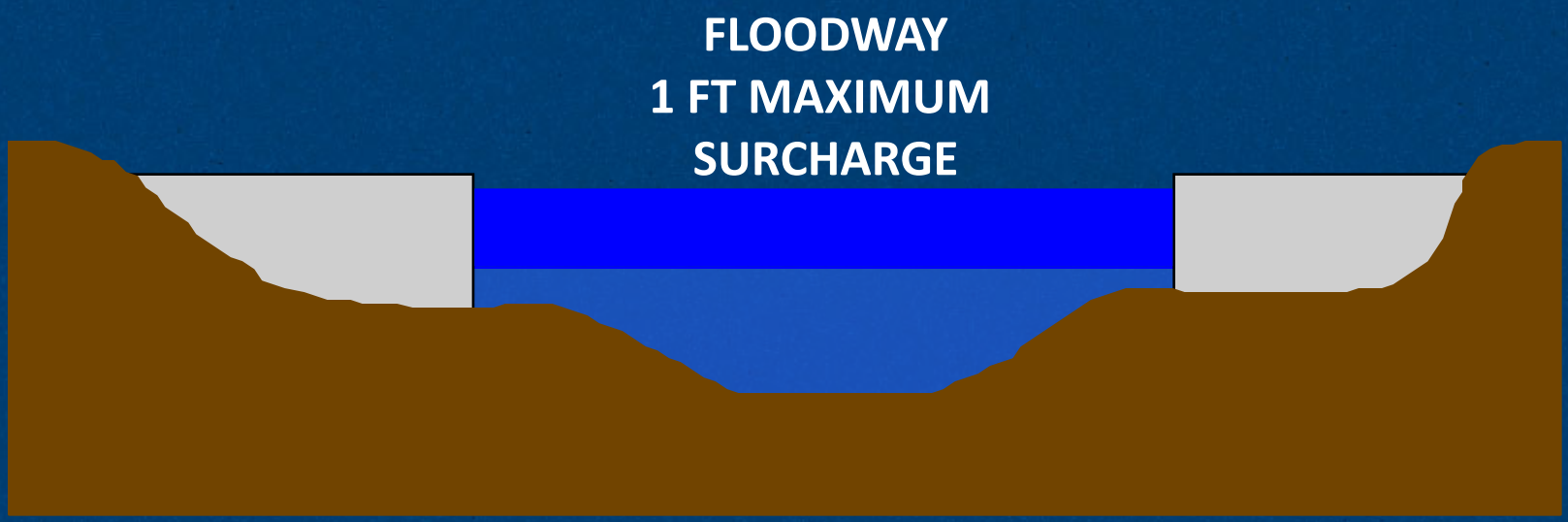
"The floodplain is defined as the flat bordering a stream, constructed by the river in the present climate and inundated during periods of high flow"
– Luna Leopold



100-yr flood or Base flood

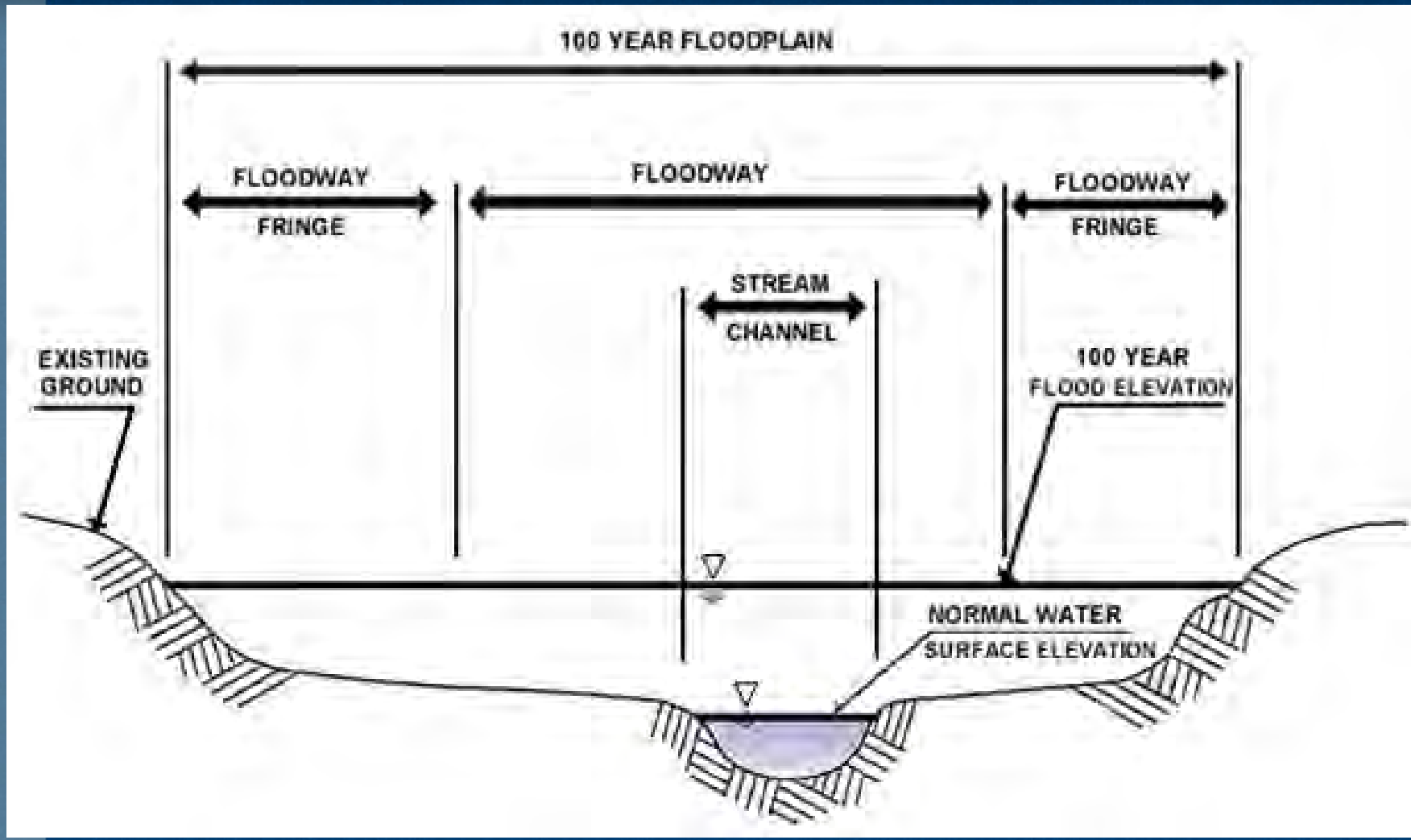
- 100-yr (base) flood: “1% chance of occurring in any given year.”
  - One could experience “100-yr flood” two times in the same year, two years in a row.
  - During a 30-yr mortgage a house:
    - Located in 100-yr floodplain, has a 26% chance of being hit by a 100-yr flood.
    - Has 1-2% chance of catching fire.
    - Is 27 times more likely to experience a flood than having a fire.

Floodway



The floodway is the stream channel and that portion of the floodplain that must remain open to permit the passage of the 100-yr flood.

Flood study terminology



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Flood Hazard Area Mapping

- FEMA is responsible for conducting flood studies and produce maps
  - –Flood Insurance Studies (FIS)
  - –Flood Insurance Rate Maps (FIRMs)

FLOOD INSURANCE STUDY (FIS)

- A flood insurance study (FIS) is a compilation and presentation of hydrologic and hydraulic determinations made for specific water courses within a municipality.
- The FIS delineates flood hazard areas and establishes flood elevations thereby serving as the basis for regulating floodplain development and providing flood insurance.

FLOOD INSURANCE STUDY (FIS)

- Appraises a community's flood problems
- Estimates flood flow frequency
- Establishes flood elevation profiles
- Plots floodplain boundaries
- Provides data to delineate floodways
- Establishes insurance risk zones

FLOOD INSURANCE STUDY

VOLUME 1 OF 3

WESTCHESTER COUNTY, NEW YORK (ALL JURISDICTIONS)

COMMUNITY NAME	COMMUNITY NUMBER
ARDSLEY, VILLAGE OF	360902
BEDFORD, TOWN OF	360903
BRIARCLIFF MANOR, VILLAGE OF	360904
BRONXVILLE, VILLAGE OF	360905
BUCHANAN, VILLAGE OF	361534
CORTLANDT, TOWN OF	360906
CROTON-ON-HUDSON, VILLAGE OF	360907
DOBBS FERRY, VILLAGE OF	360908
EASTCHESTER, TOWN OF	360909
ELMSFORD, VILLAGE OF	360910
GREENBURGH, TOWN OF	360911
HARRISON, TOWN OF	360912
HASTINGS-ON-HUDSON, VILLAGE OF	360913
IRVINGTON, VILLAGE OF	360914
LARCHMONT, VILLAGE OF	360915
LEWISBORO, TOWN OF	361227
MAMARONECK, TOWN OF	360917
MAMARONECK, VILLAGE OF	360916
MOUNT KISCO, VILLAGE OF	360918
MOUNT PLEASANT, TOWN OF	360919
MOUNT VERNON, CITY OF	360920
NEW CASTLE, TOWN OF	360921
NEW ROCHELLE, CITY OF	360922
NORTH CASTLE, TOWN OF	360923
NORTH SALEM, TOWN OF	361240
OSSINING, TOWN OF	361241
OSSINING, VILLAGE OF	361021
PEEKSKILL, CITY OF	360924
PELHAM, VILLAGE OF	360925
PELHAM MANOR, VILLAGE OF	360926
PLEASANTVILLE, VILLAGE OF	360927
PORT CHESTER, VILLAGE OF	360928
POUND RIDGE, TOWN OF	360929
RYE, CITY OF	360931
RYE BROOK, VILLAGE OF	360930
SCARSDALE, VILLAGE OF	360932
SLEEPY HOLLOW, VILLAGE OF	361515
SOMERS, TOWN OF	361242
TARRYTOWN, VILLAGE OF	360933
TUCKAHOE, VILLAGE OF	360934
WHITE PLAINS, CITY OF	360935
YONKERS, CITY OF	360936
YORKTOWN, TOWN OF	360937

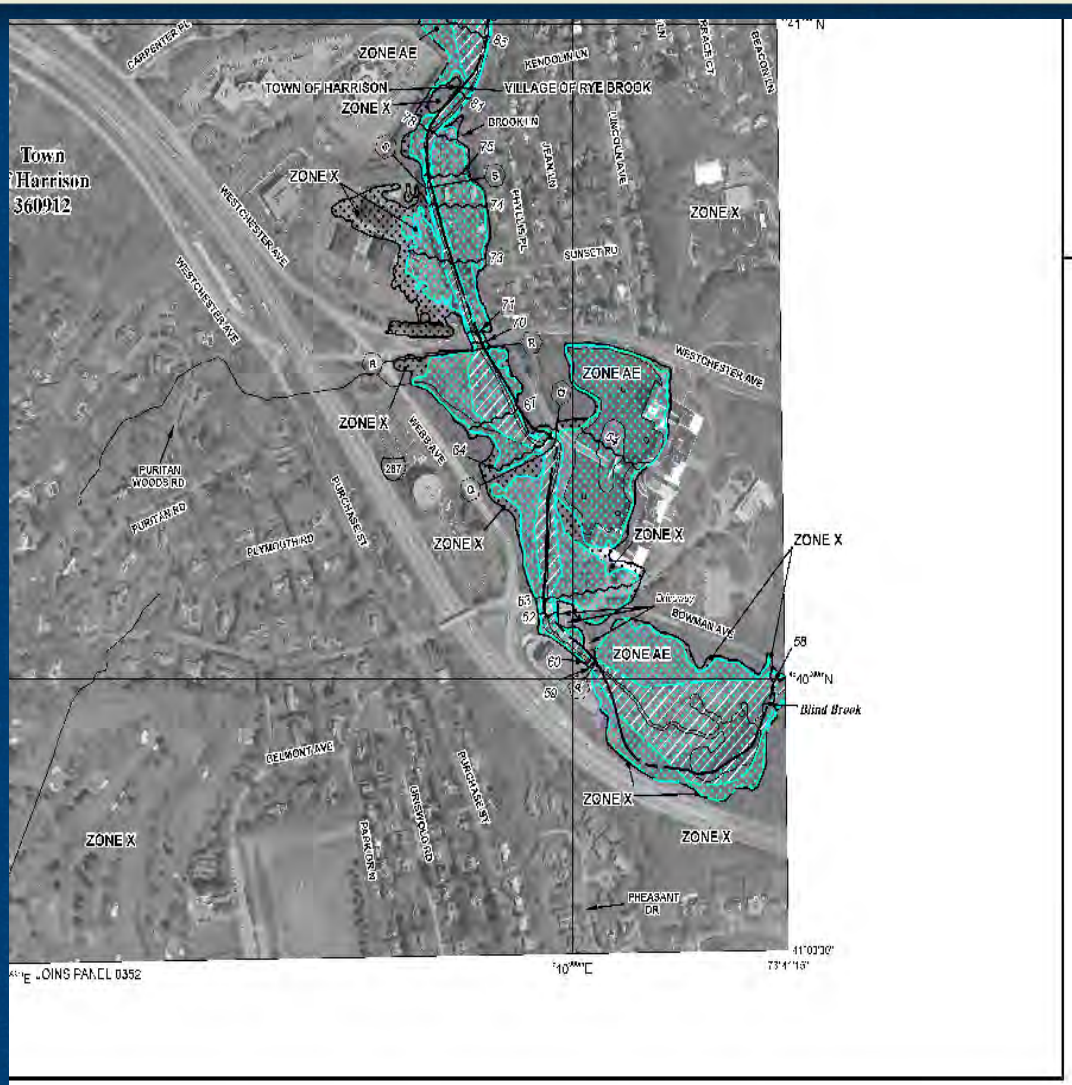
EFFECTIVE:
SEPTEMBER 28, 2007

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
36119CV001A

Flood Insurance Rate Map (FIRM)

- Is used to:
  - Identify Special Flood Hazard Areas (SFHA)
  - Identify the location of a specific property
  - Estimate flood elevation at a specific site
  - Determine the location of the floodway



For communities map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0289F

FIRM

FLOOD INSURANCE RATE MAP

for WESTCHESTER COUNTY, NEW YORK (ALL JURISDICTIONS)

CONTAINS:

COMMUNITY	NUMBER
HARRISON, TOWN OF	360912
RYE BROOK, VILLAGE OF	360930

PANEL 289 OF 426

MAP SUFFIX: F

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
36119C0289F

EFFECTIVE DATE
SEPTEMBER 28, 2007

Federal Emergency Management Agency

FIRM Zones

Zone A	The 100-year floodplain. There are six types of A zones: **A :** Approximate floodplain; No base flood elevations (BFE) are determined. **AE:** Base floodplains where BFEs are determined. **AO:** Base floodplain with sheet flow, ponding, or shallow flooding. Base flood depths are provided. **AH:** Shallow flooding base floodplain. BFEs are provided. **A99:** Area to be protected from the base flood by levees or Federal Flood Protection Systems under construction; No BFEs **AR:** The base floodplain that results from the decertification of a previously accredited flood protection system that is in the process of being restored to provide a 100-yr or greater level of flood protection.
Zone V and VE	**V:** The coastal areas subjected to wave action; No BFEs **VE:** The coastal areas subjected to wave action; BFEs are provided
Zone B and Zone X (Shaded)	Area of moderate flood hazard, usually the area between the limits of 100-, and 500-yr floods.
Zone C and Zone X (Unshaded)	Area of minimum flood hazard; Usually depicted above 500-yr flood level.
Zone D	Area of undetermined but possible flood hazards.

FIRM Zones

- Approximate Flood Areas
  - Approximate methods are used
  - BFEs are not determined
- Detailed Flood Areas
  - Detailed methods (analysis, models) are used
  - BFEs and velocities are determined

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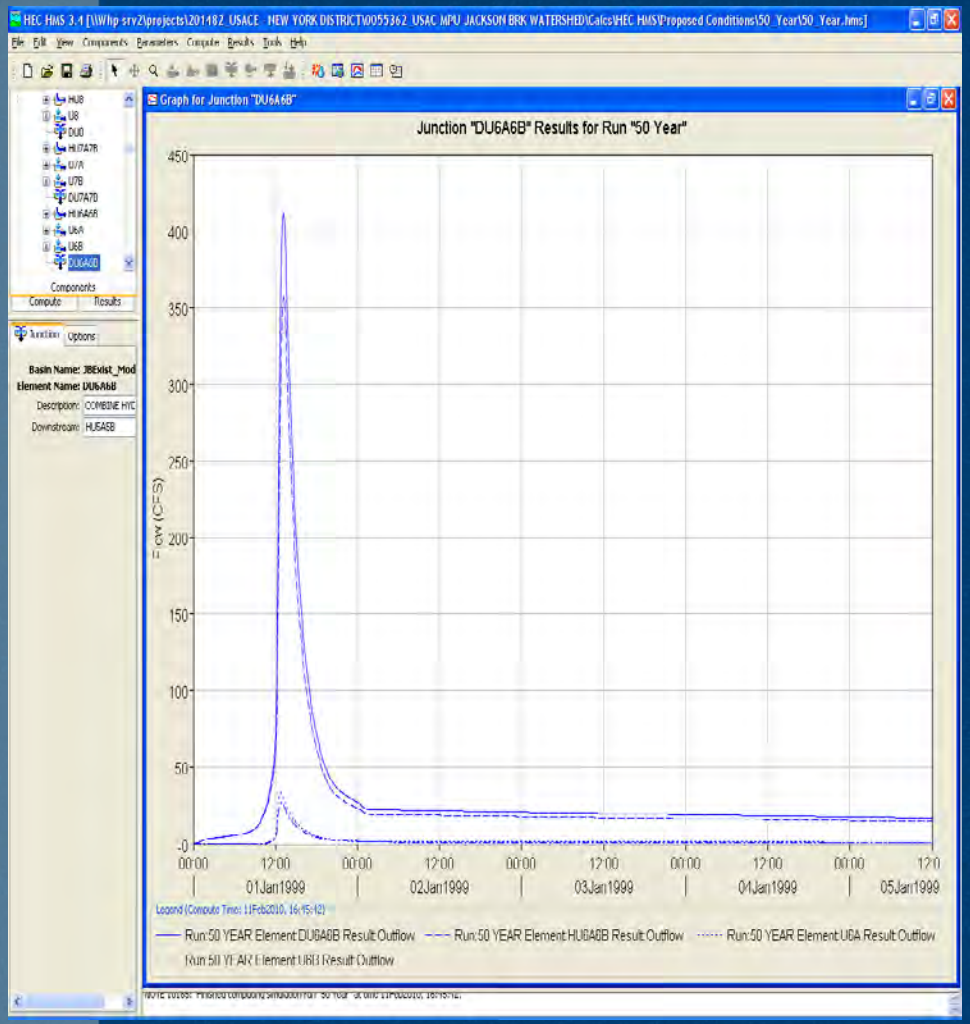
Hydrologic Models

- Hydrology
  - Determination of amount of water at a given location
  - Hydrologic analysis determines flood flows and frequencies (1-yr flow, 100-yr flow etc)

TABLE 4 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCEN
BEAVER SWAMP BROOK (continued)					
Upstream Metro North Railroad	2.34	454	816	968	1400
Upstream of Locust Avenue	1.6	414	751	892	1300
Upstream of Park Drive	0.9	344	631	752	1145
BLIND BROOK					
At mouth	10.9	1,660	2,731	3,265	4,426
At USGS Gage	9.6	1,521	2,497	2,984	4,042
At Purchase Street	8.80	1,434	2,353	2,812	3,807
At upstream corporate limit	8.32	1,374	2,255	2,694	3,645
Upstream of confluence with East Branch Blind Brook	7.80	1,317	2,160	2,580	3,490

HEC-1/HEC-HMS Models



- Input includes
  - Precipitation
  - Soil Conditions
  - Impervious Areas
  - Storage Areas
- Output Includes
  - Flow Hydrograph
  - Peak Flows

Hydraulic Models

- Hydraulics
  - Determines flood elevations
  - Determines floodway

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Blind Brook								
A	1,088	111	558	5.9	12.5	4.1[2]	4.1	0.0
B	1,756	113	954	3.4	12.5	5.2[2]	5.3	0.1
C	2,026	112	898	3.6	12.5	8.5[2]	8.6	0.1
D	5,473	431	2,318	1.4	12.5	9.8[2]	10.1	0.3
E	5,620	425	2,569	1.3	12.5	10.8[2]	11.1	0.3
F	8,617	376	1,854	1.8	12.5	11.7[2]	12.3	0.6
G	8,791	376	1,635	2.0	13.0	13.0	13.3	0.3
H	9,945	178	790	4.1	14.0	14.0	14.5	0.5
I	10,132	115	737	4.4	16.7	16.7	17.0	0.3
J	11,475	91	525	6.2	18.5	18.5	19.4	0.9
K	11,556	191	960	3.4	21.1	21.1	21.3	0.2
L	12,248	223	1,051	2.8	22.5	22.5	23.3	0.8
M	12,977	90	1,265	2.4	30.3	30.3	30.3	0.0
N	18,371	120	770	3.5	32.1	32.1	32.9	0.8
O	20,679	46	218	11.8	35.0	35.0	35.7	0.7
P	22,113	50	546	4.7	58.7	58.7	58.9	0.2
Q	23,398	127	484	4.9	63.4	63.4	63.7	0.3
R	24,205	59	339	7.0	69.4	69.4	70.4	1.0
S	25,074	37	238	10.0	74.3	74.3	75.2	0.9
T	27,024	89	378	5.7	88.8	88.8	88.8	0.0
U	27,556	117	554	3.9	94.5	94.5	94.9	0.4
V	27,943	123	297	7.3	99.1	99.1	99.1	0.0
W	28,525	53	247	8.7	104.4	104.4	105.2	0.8
X	31,426	54	169	9.1	126.8	126.8	126.8	0.0
Y	31,959	47	155	9.9	133.2	133.2	133.2	0.0
Z	32,143	70	461	3.3	139.0	139.0	139.0	0.0

[1]Feet above confluence with Long Island Sound
[2]Elevation computed without consideration of backwater effects from Long Island Sound

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

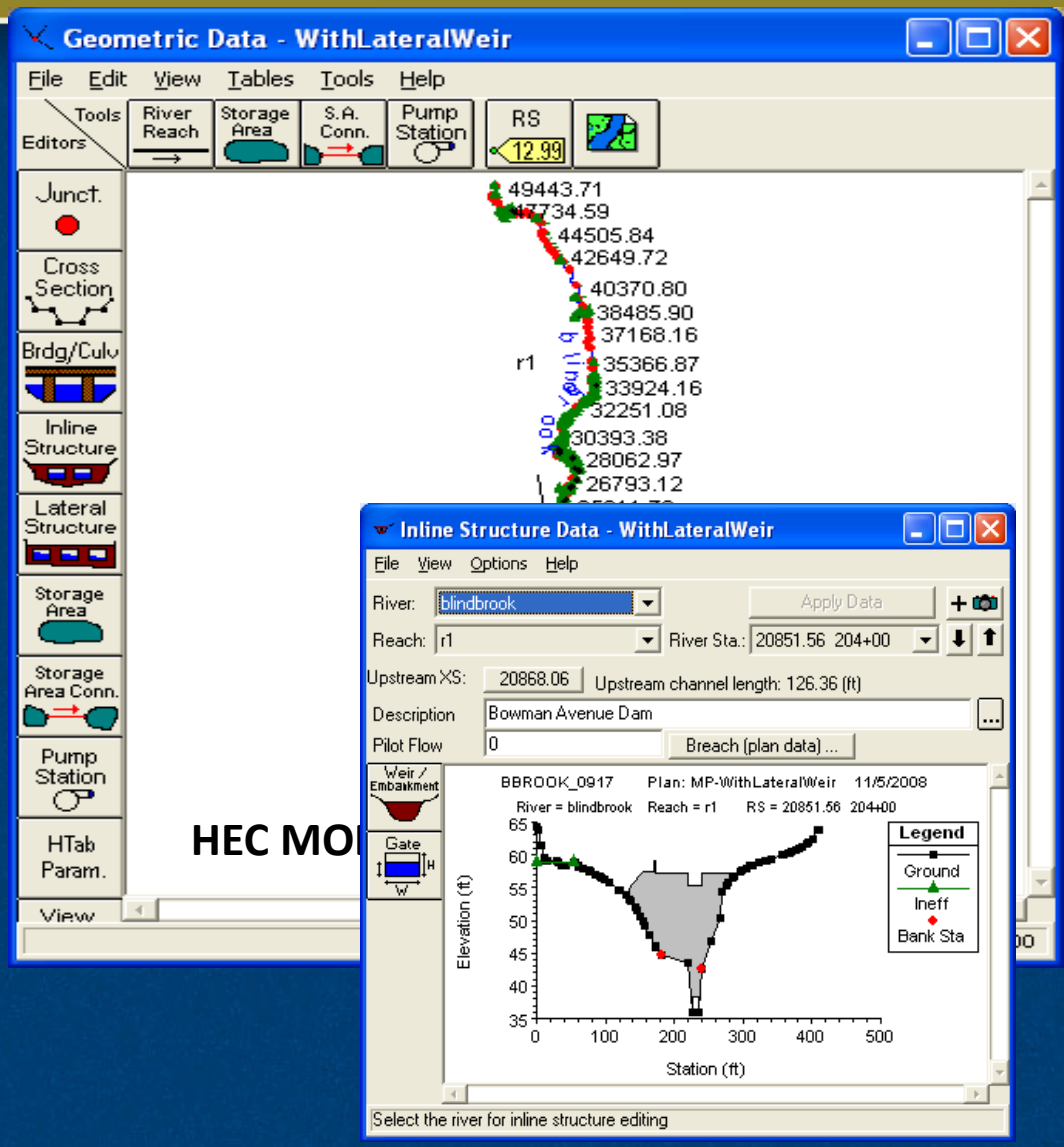
WESTCHESTER COUNTY, NY
(ALL JURISDICTIONS)

FLOODWAY DATA

BLIND BROOK

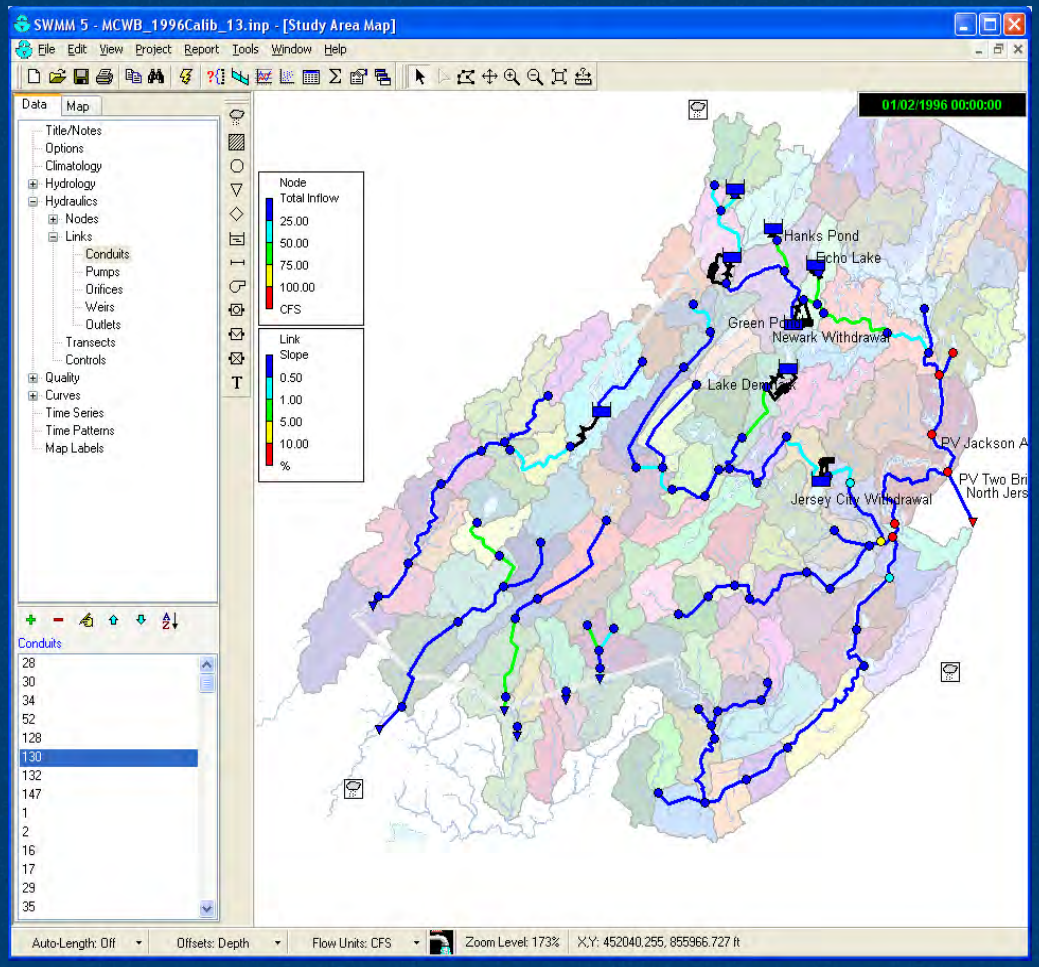
HEC-2/HEC-RAS Model

- Computes flood depths and velocities
  - Input includes:
    - Flows
    - Stream Geometry
    - Boundary Condition
    - Roughness Coefficients (Manning's n etc)
  - Output Includes:
    - Flood depths (Profiles)
    - Flow velocities



Storm Water Management Model (SWMM)

- SWMM is EPA tool
  - Available in the public domain
  - Both pipe and open channel hydraulics
  - Versions of SWMM Info works
  - 2D Model



EPA - SUSTAIN

- Placement of BMPS
- Interface using ArcGIS
- Available in the public domain