Ulster County NY Rising Community Group Committee Meeting #7

Monday, December 16, 2013

UCC, Business Resource Center, Kingston, NY

Flood Modeling Presentation

Introduction

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CDM Smith

Cambridge, MA

Where does modeling fit in?

- Conduct Risk Assessment to identify vulnerability of assets
  - Identify vulnerability of assets based on existing FIRMs
  - Evaluate the Effectiveness of Flood Reduction Actions
    - Flood Modeling
- Confirm CDBG- DR Eligibility
- Cost Benefit Analysis
- Refine Project List
- Prepare Draft Recovery/Reconstruction Plan
- Prepare Final Recovery/Reconstruction Plan

Outline

- Introduction
- Definitions
- Overview
- Details
- Application
- Discussion

Definitions

Hydrologic and Hydraulic Modeling

Commonly referred as H&H Modeling

(for classical music fans, this H&H is not to be confused with the Handel and Haydn Society, the second oldest musical organization in the United States)

Hydrology: Rainfall and Runoff—how much water gets to the river or stream. Used to calculate peak flow rates.

Hydraulics: How the flow is routed through streams and rivers, Used to calculate flood depths and extents

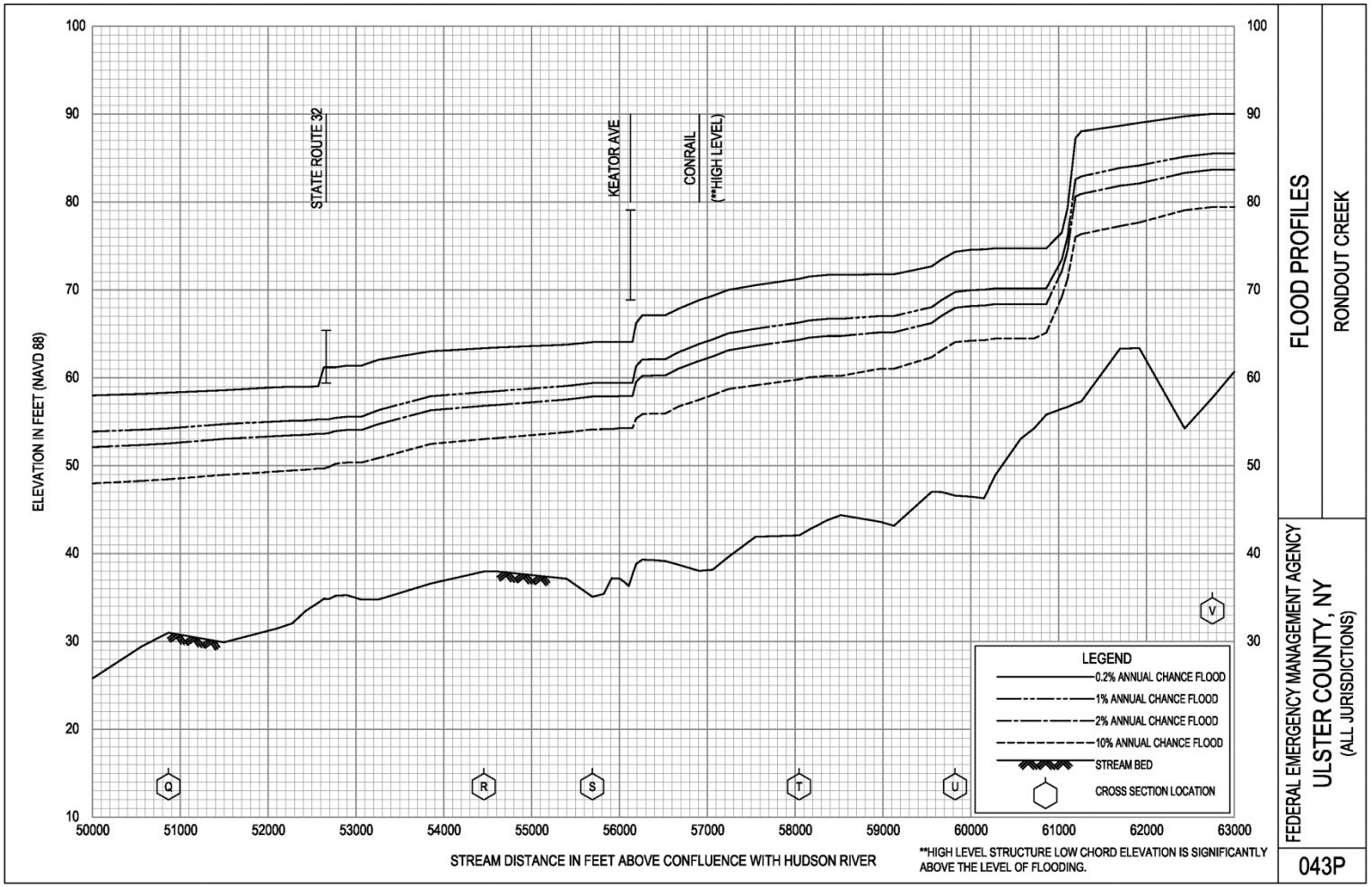
Ulster County Streams

Overview

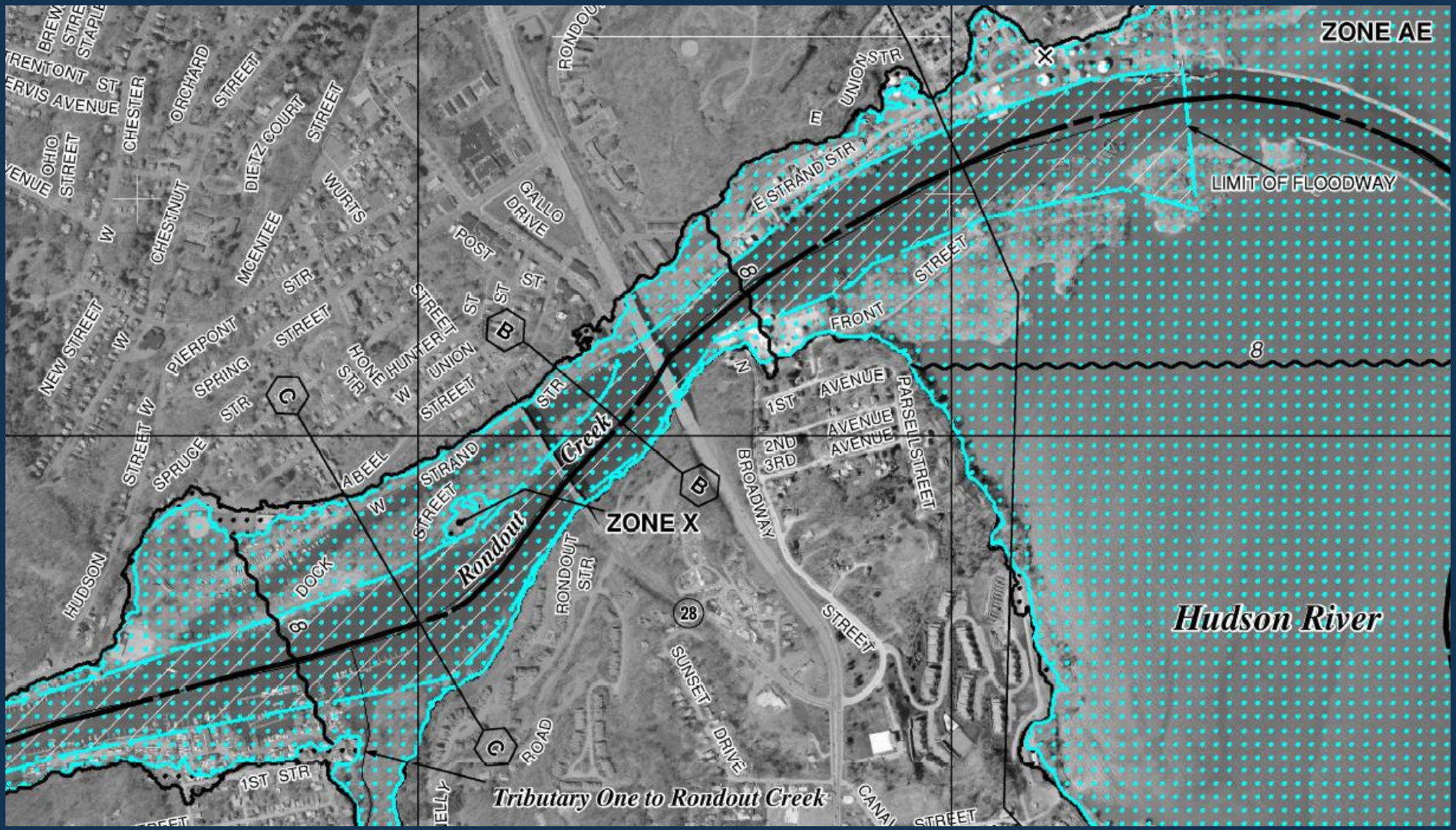
In general terms, a model is a mathematical simulation of rainfall, runoff and routing the flow of water as it makes its way through a drainage area.

Simulation results are used to predict the depths and extents of flooding for various size storm events.

Depth of Flooding—Example Profile



Extent of Flooding—Example FIRM

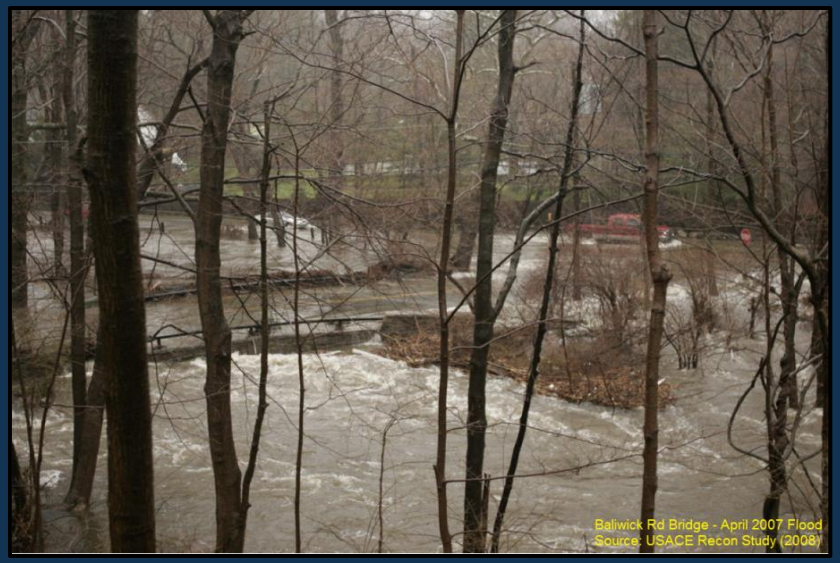


Overview

Models are Tools used to Assess the Effectiveness of Flood Reduction Actions

- Flood Reduction Options
  - Two basic ways to mitigate flooding
    - Increase Storage to reduce peak flow rates
    - Increase Conveyance to reduce flood depths

Flood Reduction Actions



- Flood Mitigation Alternatives
  - Floodplain improvements or reclamation (storage)
  - Channel and flood plain modifications
  - Replace/retrofit bridges, culverts, etc.
  - Diversion channels and conduits
  - Removal/relocation of encroaching structures
  - Flood proofing / Non Structural

Other Flood Mitigation Methods

Flood Proofing

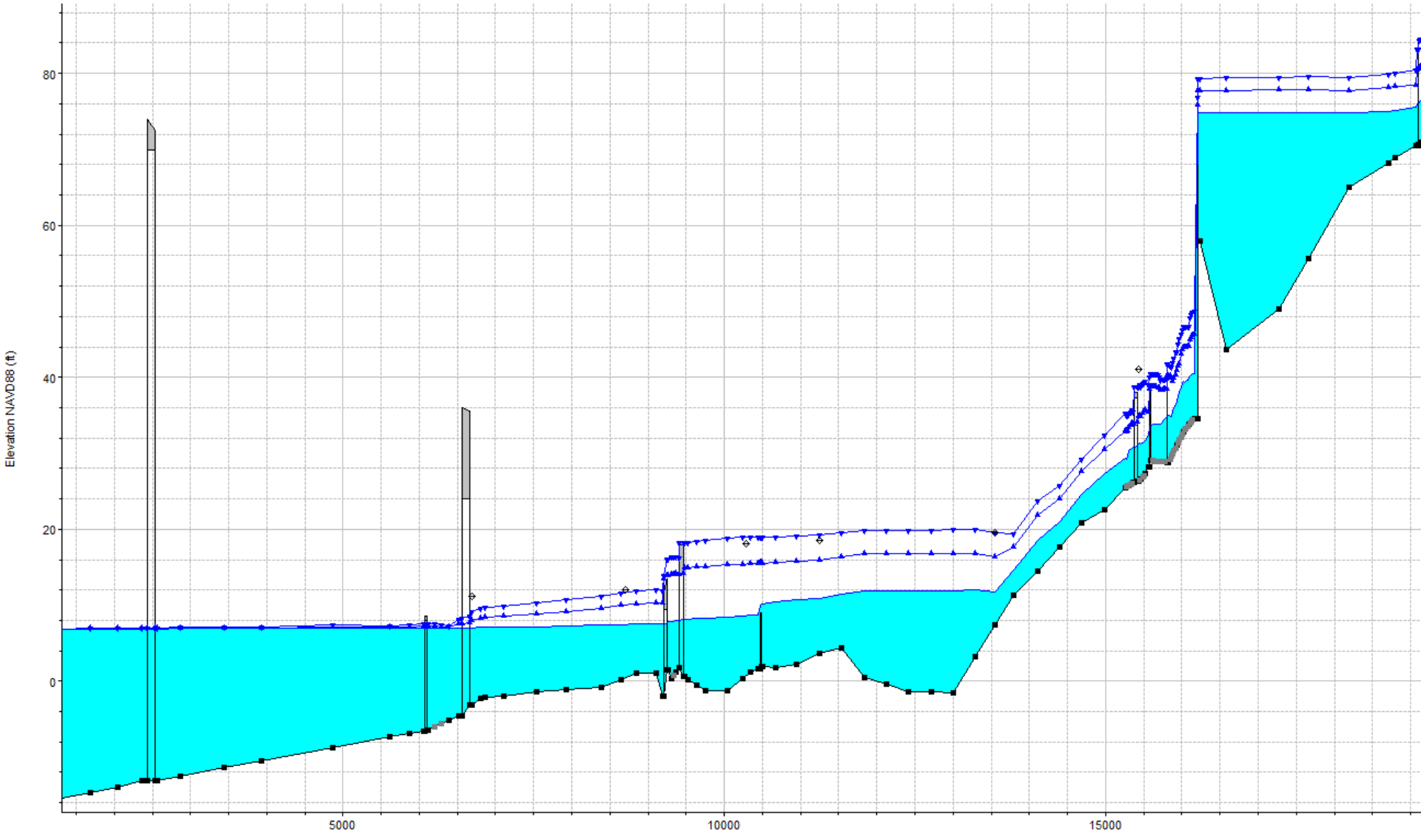
Raise Structures

Why Model

The model is used to simulate flood mitigation alternatives, evaluate and compare specific improvements in terms of reduced flooding depths and extents.

Results are depicted on Flood Profiles and Inundation maps

Model Result—Profile of Depths



Model Result—Extent of Flooding

Model Result-- Before and After Bridge Improvement

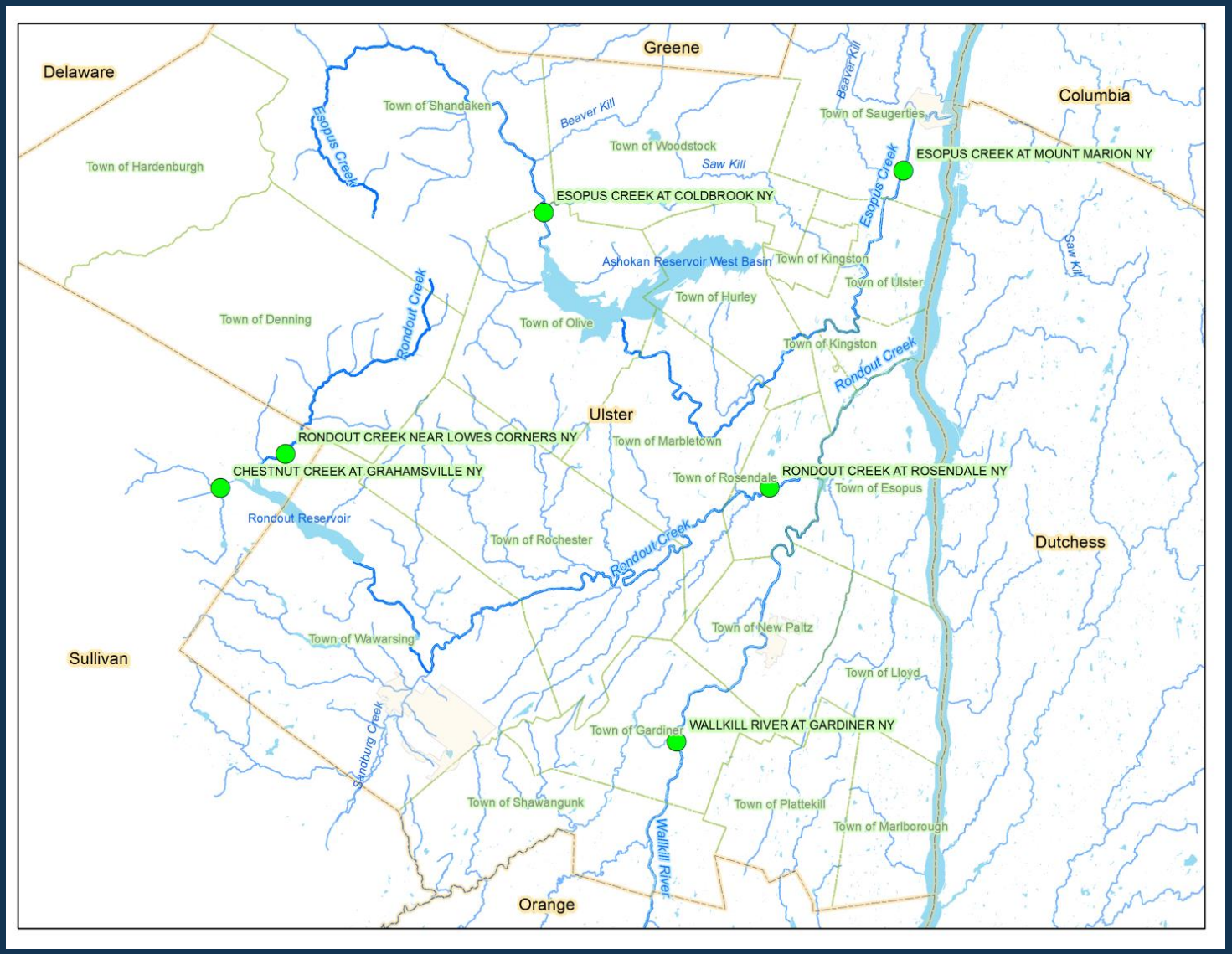
Modeling Details—Data Needs

- Physical Description of the stream and land surface
  - Updated Hydrology
  - Stream Centerline
  - Stream Cross-Sections
  - Structures (bridges, dams, weirs, buildings)
  - Stream and overbank roughness parameters
  - Topographic data -- contour maps, DEM
  - Reference base mapping (digital orthophotos)

Modeling Details—Data Sources

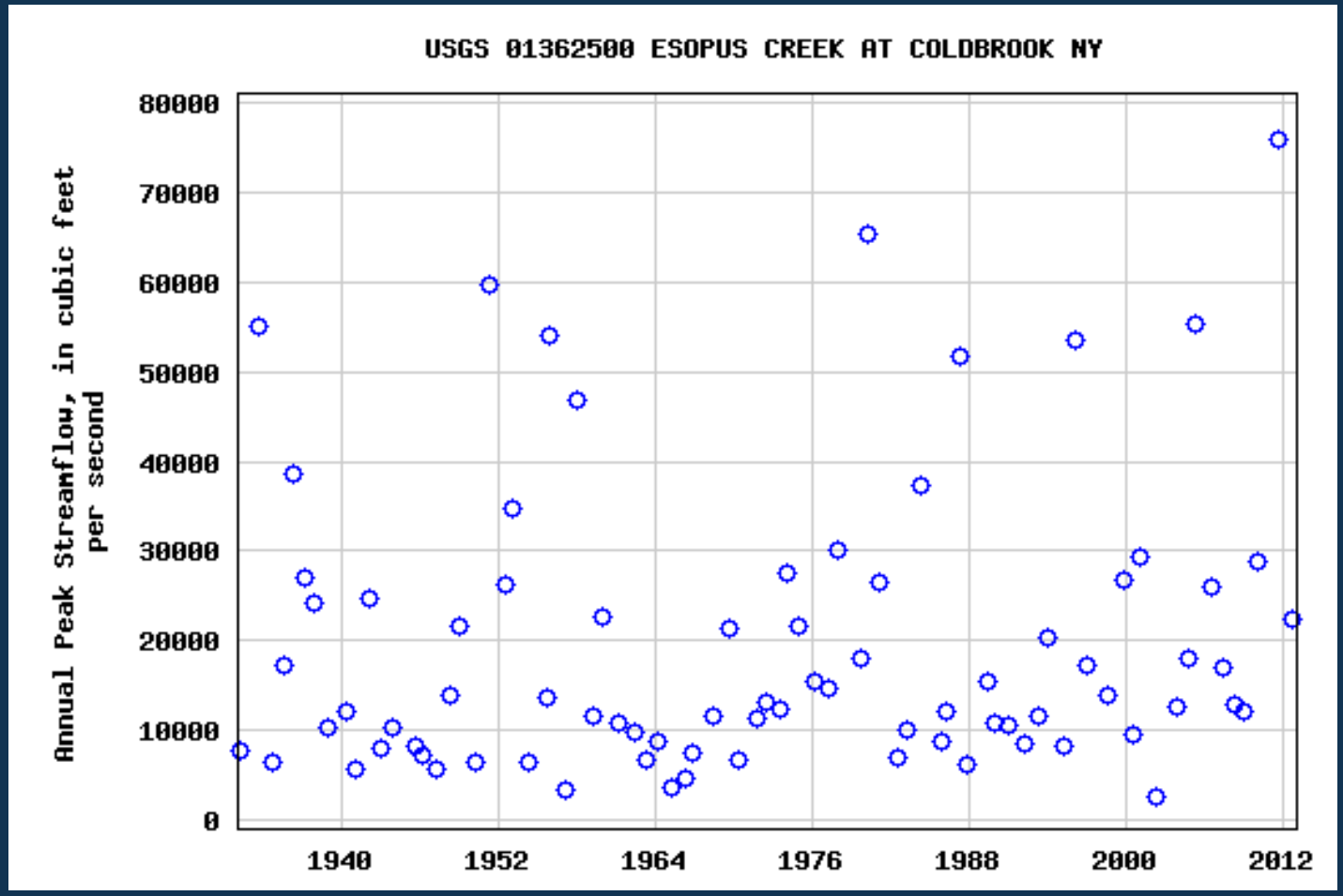
- Data Sources
  - Stream Gage data (hydrology)
  - As-Built drawings for structures
  - Previous detailed studies (by FEMA or others)
  - “Best Available” topographic data (community, county, state, USGS, FEMA)
  - Field survey
  - Community Meetings

Hydrology: Stream Gage Data

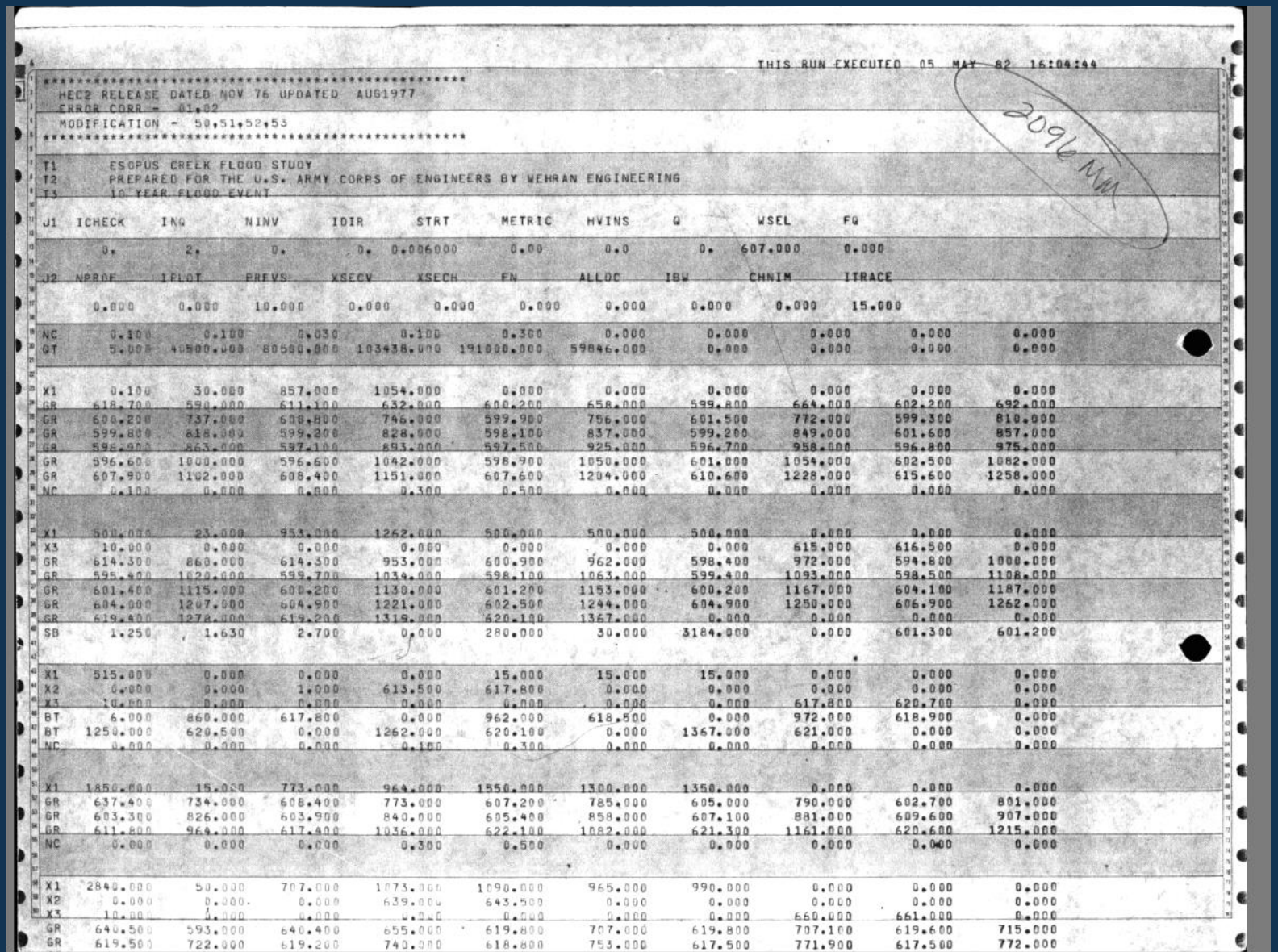


Updated Hydrology

Stream Gage Data



HEC-2 Model Data



THIS RUN EXECUTED 05 MAY 82 16:04:44

2096 MM

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  HEC2 RELEASE DATED NOV 76 UPDATED  AUG1977
  ERROR CORR -  01.02
  MODIFICATION -  50,51,52,53
**************************************************

T1      ESOPUS CREEK FLOOD STUDY
T2      PREPARED FOR THE U.S. ARMY CORPS OF ENGINEERS BY WEHRAN ENGINEERING
T3      10 YEAR FLOOD EVENT

J1  ICHECK      INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ
        0.        2.        0.        0.  0.006000      0.00      0.0       0.   607.000     0.000
J2  NPROF       IPLOT     PRFVS     XSECV     XSECH     FN        ALLOC     IBW       CHNIM     ITRACE
        0.000     0.000    10.000     0.000     0.000     0.000     0.000     0.000     0.000    15.000

NC      0.100     0.100     0.030     0.100     0.300     0.000     0.000     0.000     0.000     0.000
QT      5.000 40500.000 80500.000 103438.000 191000.000 59846.000     0.000     0.000     0.000     0.000

X1      0.100    30.000   857.000  1054.000     0.000     0.000     0.000     0.000     0.000     0.000
GR    618.700   590.000   611.100   632.000   600.200   658.000   599.800   664.000   602.200   692.000
GR    600.200   737.000   600.800   746.000   599.900   756.000   601.500   772.000   599.300   810.000
GR    599.800   818.000   599.200   828.000   598.100   837.000   599.200   849.000   601.600   857.000
GR    596.900   863.000   597.100   893.000   597.500   925.000   596.700   958.000   596.800   975.000
GR    596.600  1000.000   596.600  1042.000   598.900  1050.000   601.000  1054.000   602.500  1082.000
GR    607.900  1102.000   608.400  1151.000   607.600  1204.000   610.600  1228.000   615.600  1258.000
NC      0.100     0.000     0.000     0.300     0.500     0.000     0.000     0.000     0.000     0.000

X1    500.000    23.000   953.000  1262.000   500.000   500.000   500.000     0.000     0.000     0.000
X3     10.000     0.000     0.000     0.000     0.000     0.000     0.000   615.000   616.500     0.000
GR    614.300   860.000   614.300   953.000   600.900   962.000   598.400   972.000   594.800  1000.000
GR    595.400  1020.000   599.700  1034.000   598.100  1063.000   599.400  1093.000   598.500  1108.000
GR    601.400  1115.000   600.200  1130.000   601.200  1153.000   600.200  1167.000   604.100  1187.000
GR    604.000  1207.000   604.900  1221.000   602.500  1244.000   604.900  1250.000   606.900  1262.000
GR    619.400  1278.000   619.200  1319.000   620.100  1367.000     0.000     0.000     0.000     0.000
SB      1.250     1.630     2.700     0.000   280.000    30.000  3184.000     0.000   601.300   601.200

X1    515.000     0.000     0.000     0.000    15.000    15.000    15.000     0.000     0.000     0.000
X2      0.000     0.000     1.000   613.500   617.800     0.000     0.000     0.000     0.000     0.000
X3     10.000     0.000     0.000     0.000     0.000     0.000     0.000   617.800   620.700     0.000
BT      6.000   860.000   617.800     0.000   962.000   618.500     0.000   972.000   618.900     0.000
BT   1250.000   620.500     0.000  1262.000   620.100     0.000  1367.000   621.000     0.000     0.000
NC      0.000     0.000     0.000     0.100     0.300     0.000     0.000     0.000     0.000     0.000

X1   1850.000    15.000   773.000   964.000  1550.000  1300.000  1350.000     0.000     0.000     0.000
GR    637.400   734.000   608.400   773.000   607.200   785.000   605.000   790.000   602.700   801.000
GR    603.300   826.000   603.900   840.000   605.400   858.000   607.100   881.000   609.600   907.000
GR    611.800   964.000   617.400  1036.000   622.100  1082.000   621.300  1161.000   620.600  1215.000
NC      0.000     0.000     0.000     0.300     0.500     0.000     0.000     0.000     0.000     0.000

X1   2840.000    50.000   707.000  1073.000  1090.000   965.000   990.000     0.000     0.000     0.000
X2      0.000     0.000     0.000   639.000   643.500     0.000     0.000     0.000     0.000     0.000
X3     10.000     1.000     0.000     0.000     0.000     0.000     0.000   660.000   661.000     0.000
GR    640.500   593.000   640.400   655.000   619.800   707.000   619.800   707.100   619.600   715.000
GR    619.500   722.000   619.200   740.000   618.800   753.000   617.500   771.900   617.500   772.000
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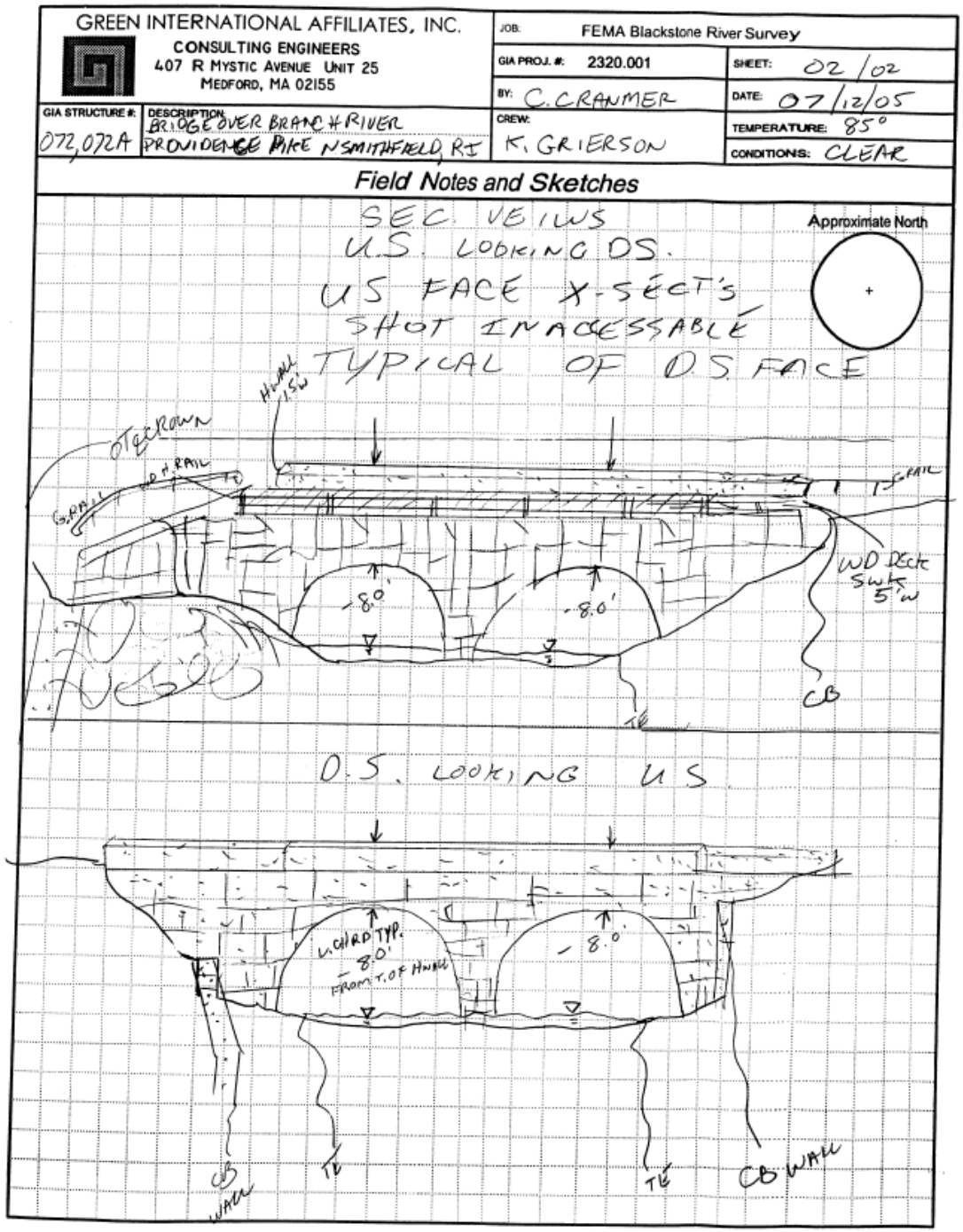
Field Survey



GREEN INTERNATIONAL AFFILIATES, INC.
CONSULTING ENGINEERS
407 R MYSTIC AVENUE UNIT 25
MEDFORD, MA 02155

JOB:	FEMA Blackstone River Survey
GIA PROJ. #:	2320.001
SHEET:	02 / 02
BY:	C. CRANMER
DATE:	07/12/05
CREW:	K. GRIERSON
TEMPERATURE:	85°
CONDITIONS:	CLEAR
GIA STRUCTURE #:	072, 072A
DESCRIPTION:	BRIDGE OVER BRANCH RIVER PROVIDENCE PIKE N SMITHFIELD, RI

Field Notes and Sketches

SEC. VIEWS
U.S. LOOKING DS.
US FACE X-SECT'S SHOT INACCESSABLE
TYPICAL OF DS FACE

Approximate North

HWAY 1.5%
TOP OF CROWN
T/RAIL
T/RAIL
WD DECK SLOPE 5%
-8.0'
-8.0'
CB
TB

D.S. LOOKING US

U. GIRD. TYP. -8.0' FROM T. OF HWAY
-8.0'
CB WALL
TB
TB
CB WALL

Community Meetings

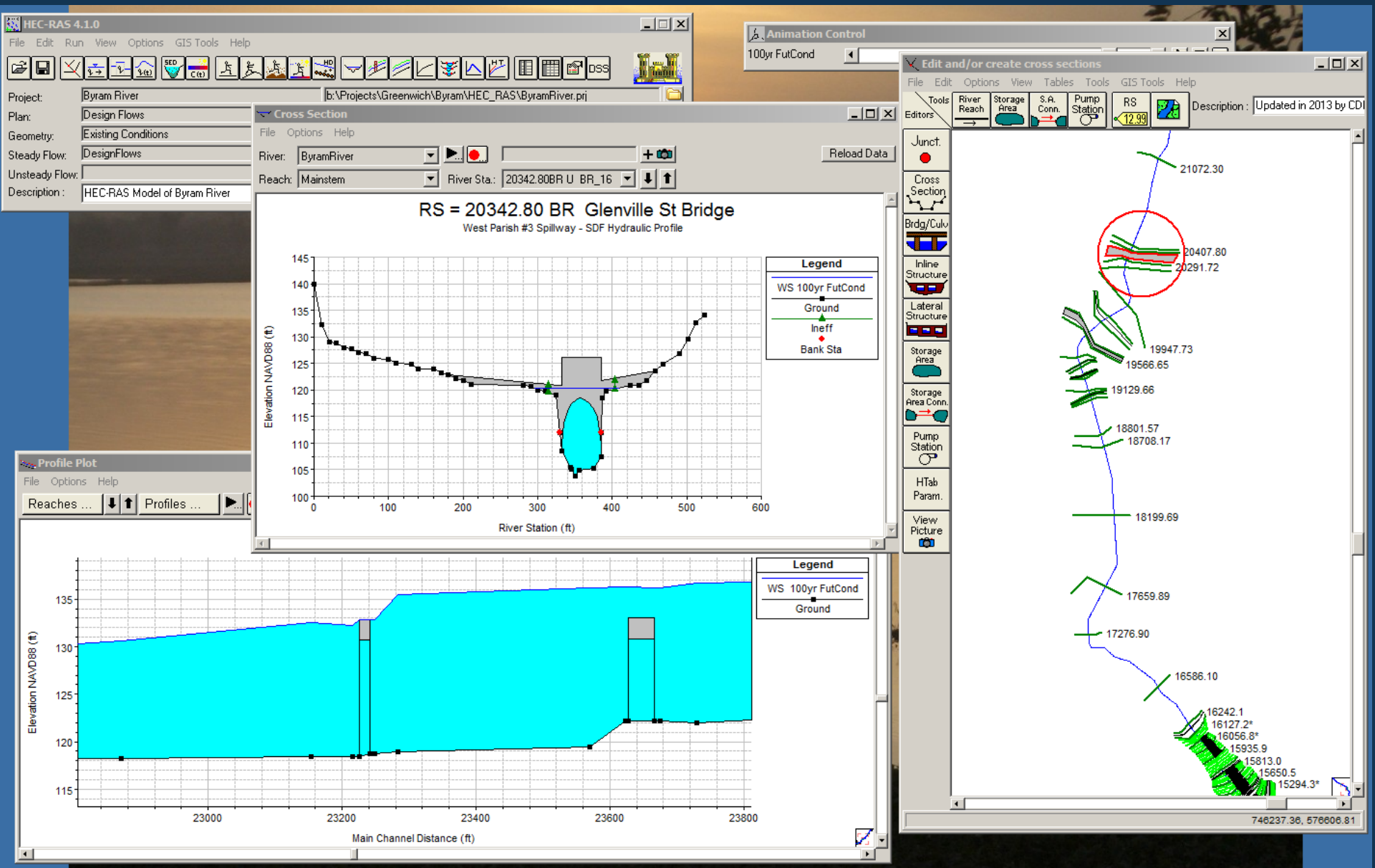
Model Development

- Begin with existing or effective model
- Create a “Duplicate Effective Model”
  - Results must match effective model and FIS profiles
  - Required for LOMR (FIRM Update)
- Update the model to a Current Conditions Model
  - Incorporate physical changes since effective model
  - Update hydrologic data based on longer record
  - Incorporate best available topographic data

Model Application Software

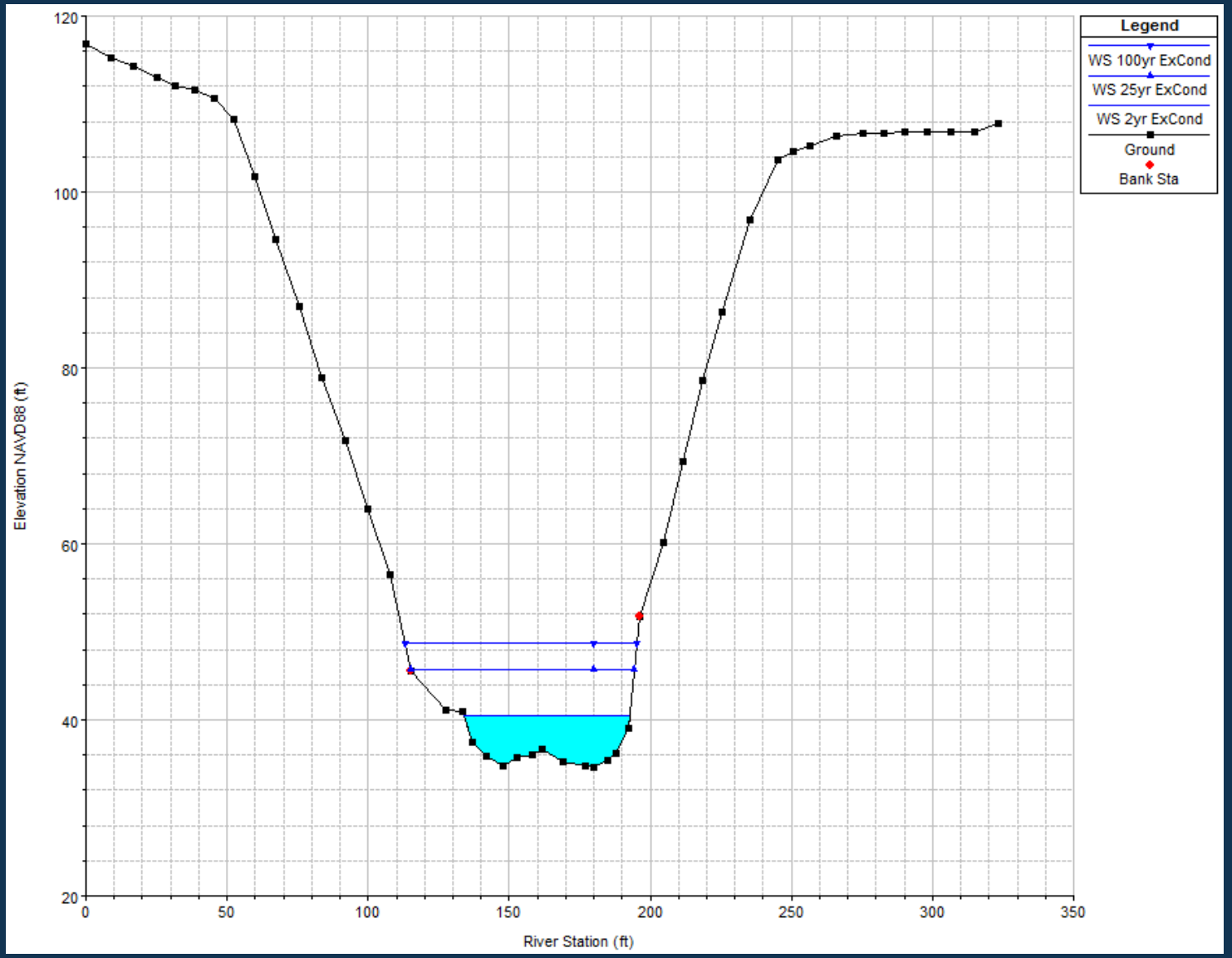
- FEMA Approved Listing Includes
  - US Army Corps of Engineers Models
    - HEC-HMS (hydrologic model application)
    - HEC-RAS (hydraulic model application)
    - HEC-GeoRAS (GIS add-on used to create models and to produce inundation maps)

HEC-RAS Screen

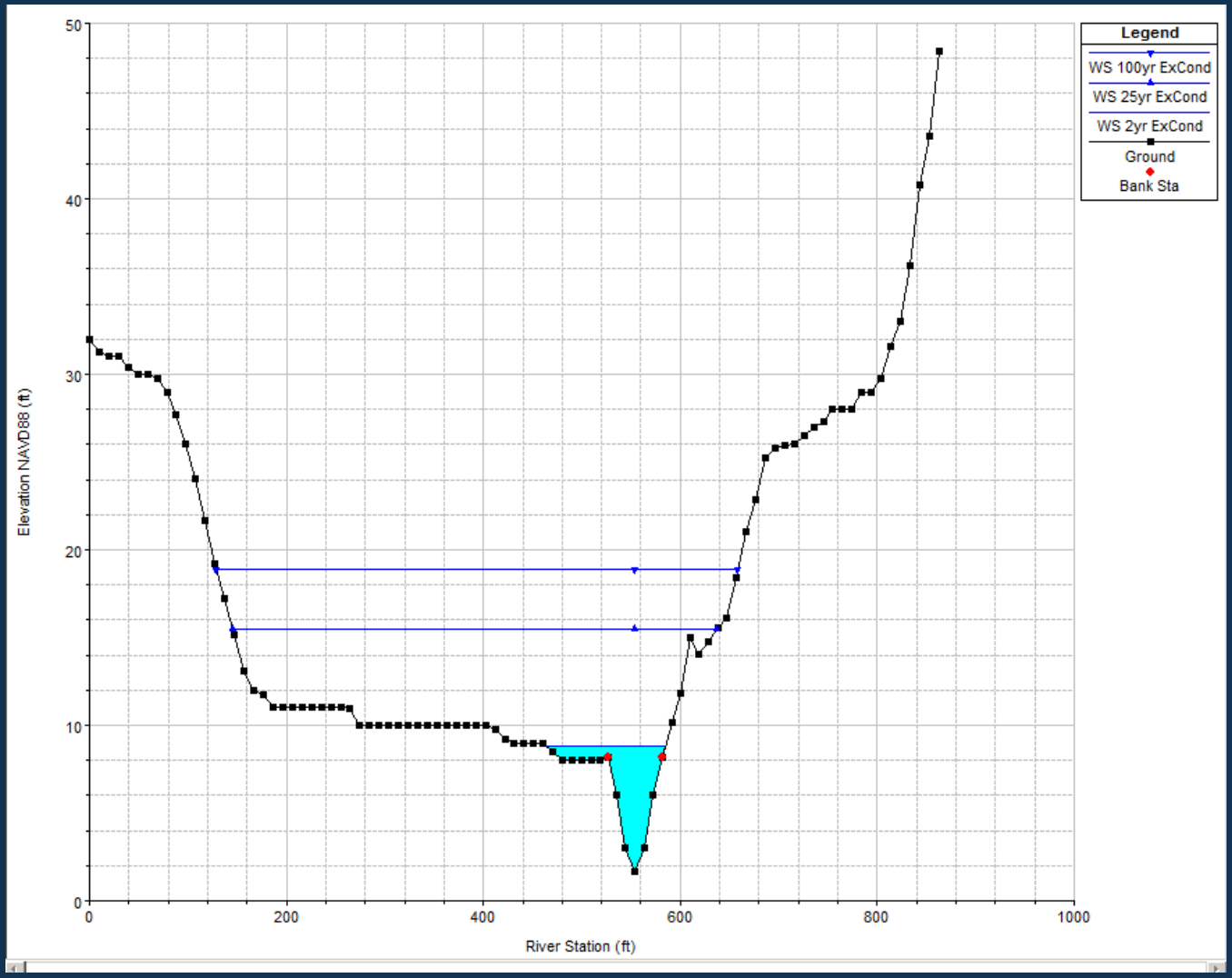


Geo-RAS Preprocessing

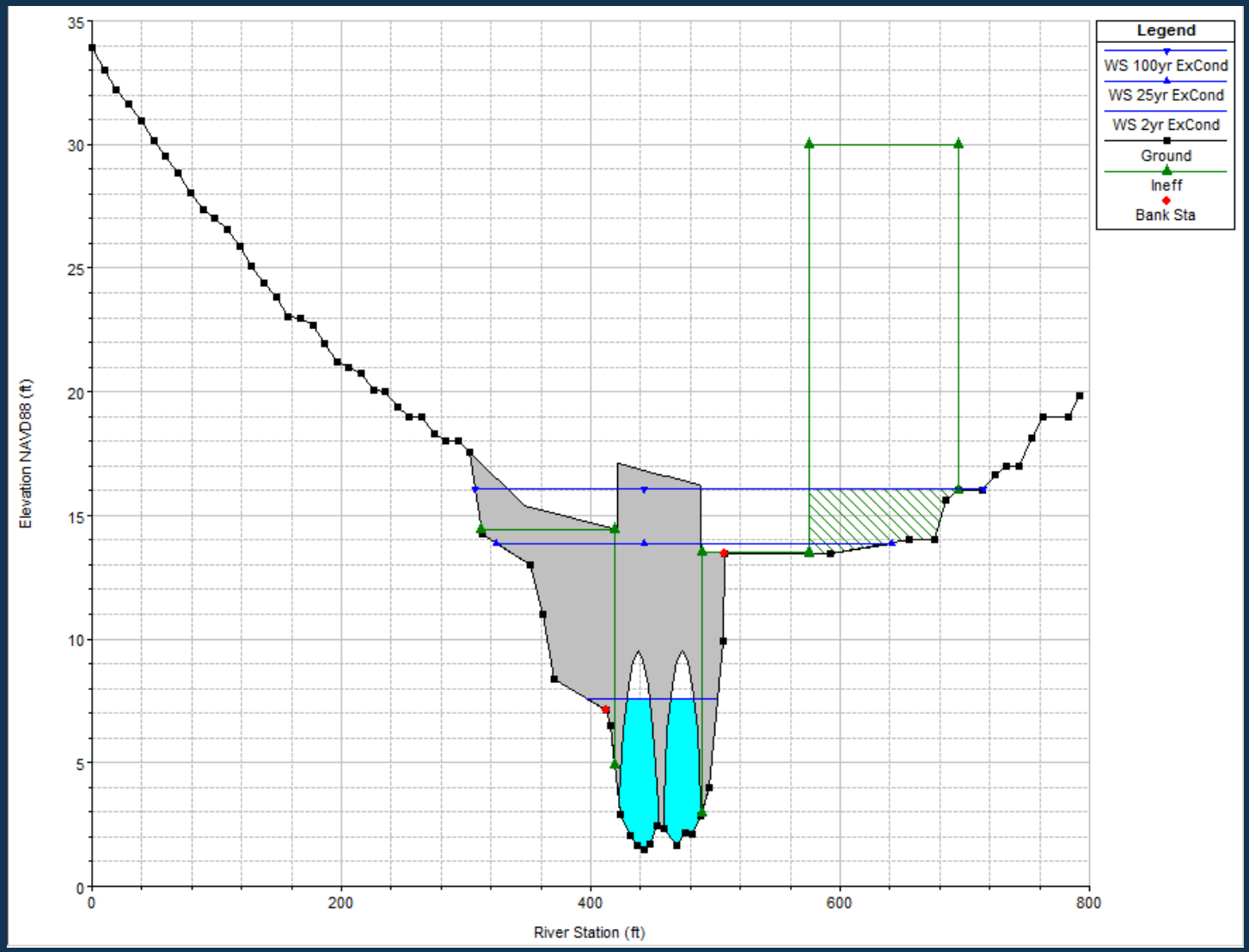
Channel Cross-section



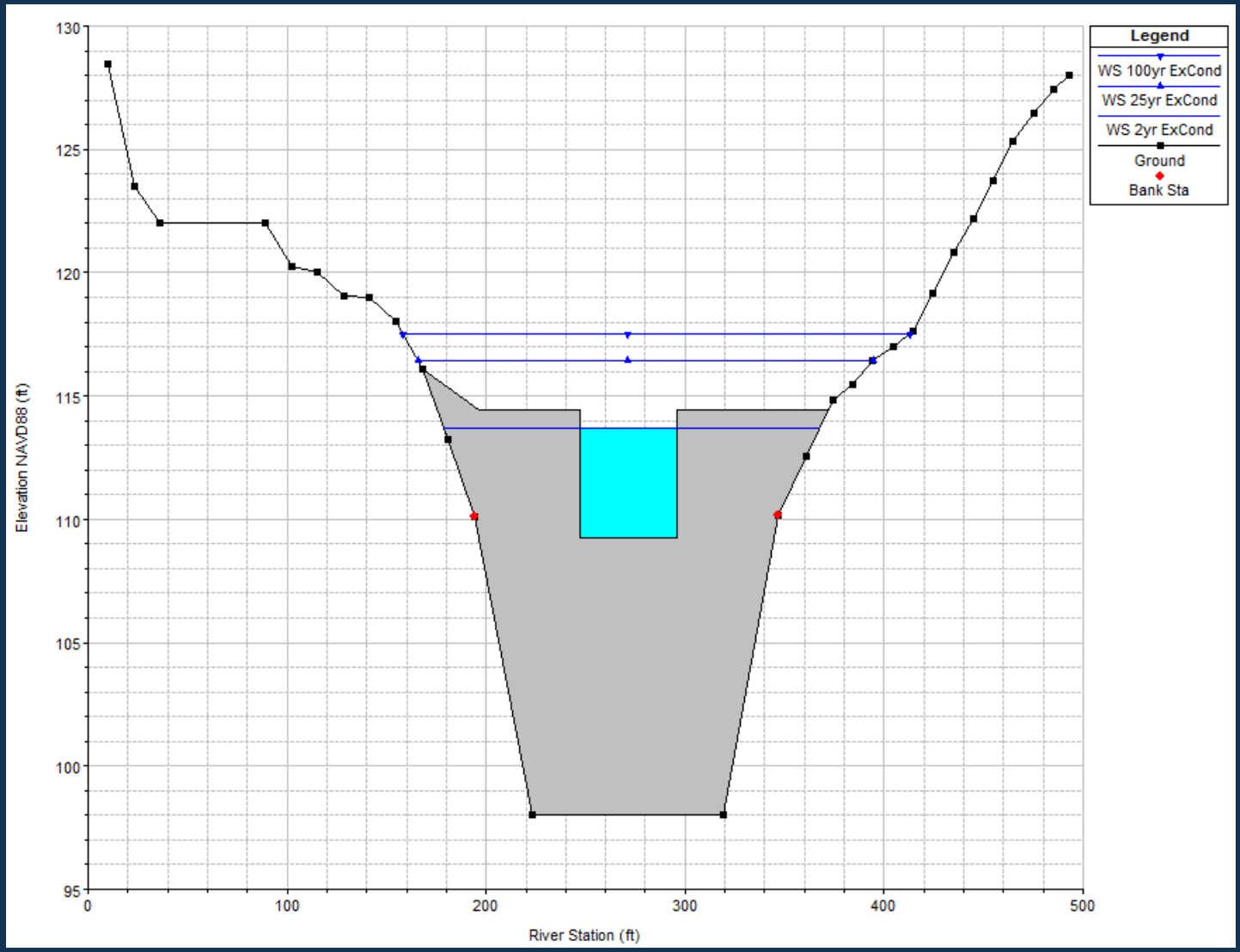
Cross-section with Flood Plain Overbank



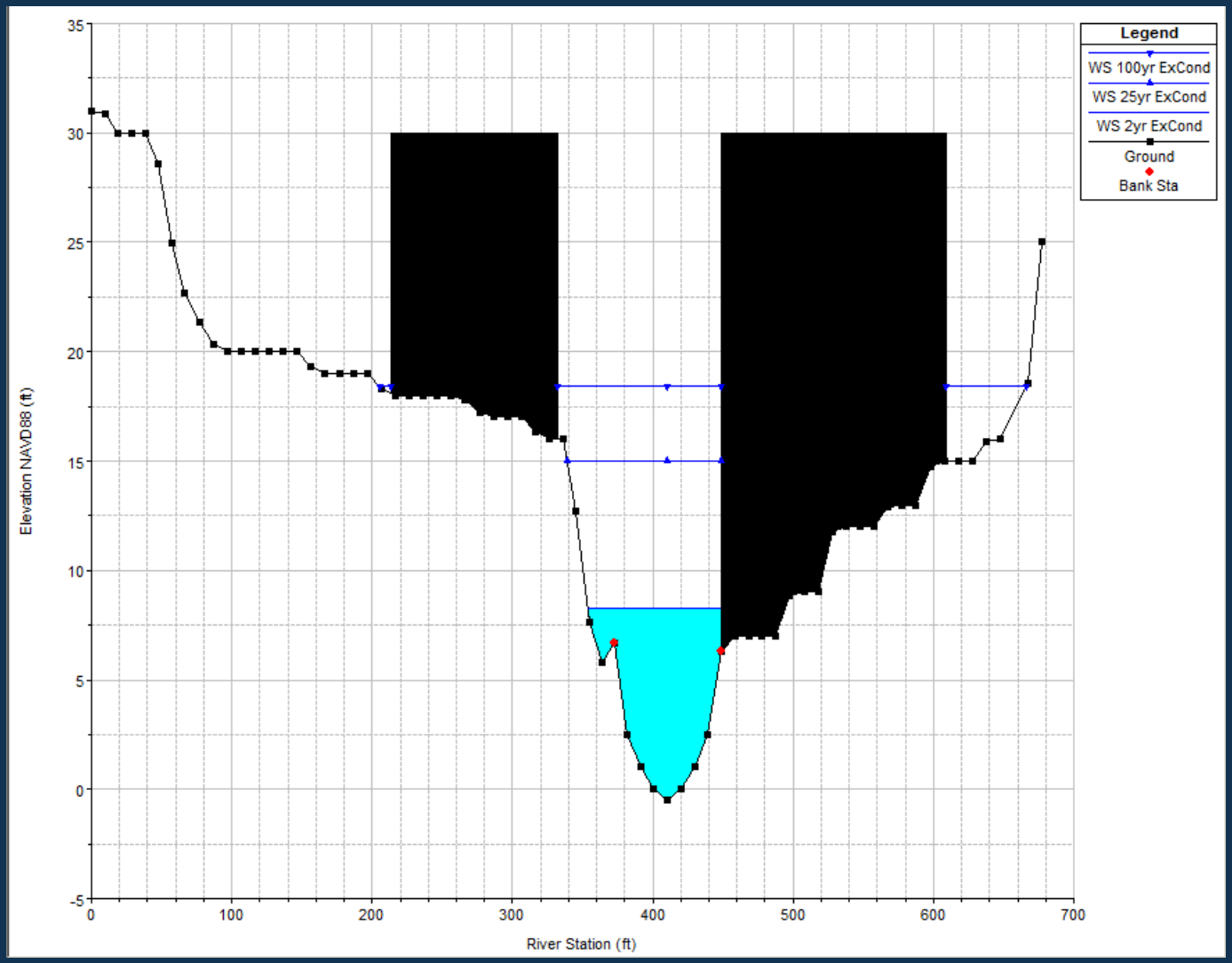
Bridge Cross-section



Dam Cross-section

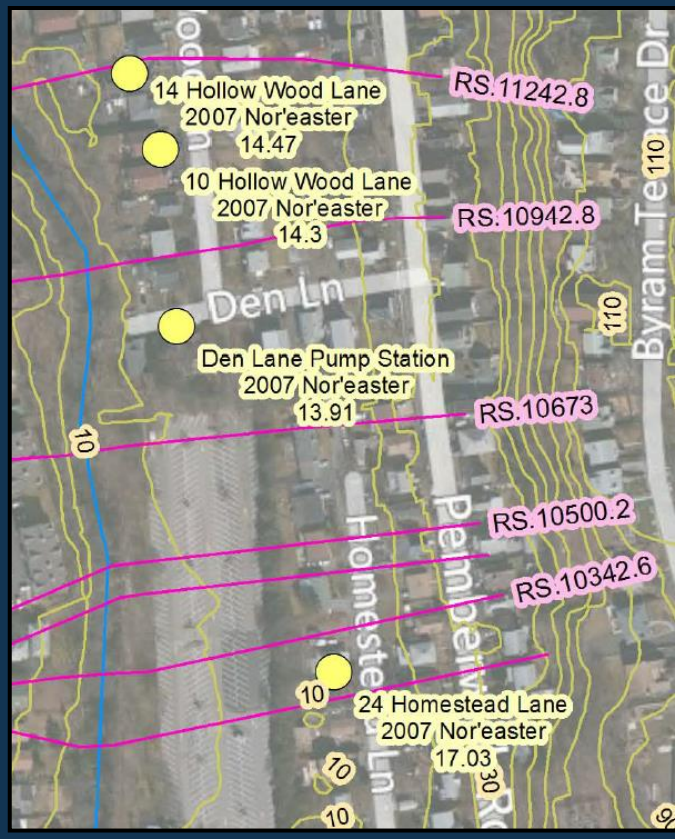


Cross-section with Obstructions



Verify Model

- Simulate storm events and compare model results with observed data
  - Stream gage data
  - Observed high water marks
  - Flooding extents
- Adjust model parameters until good agreement with observed data is obtained

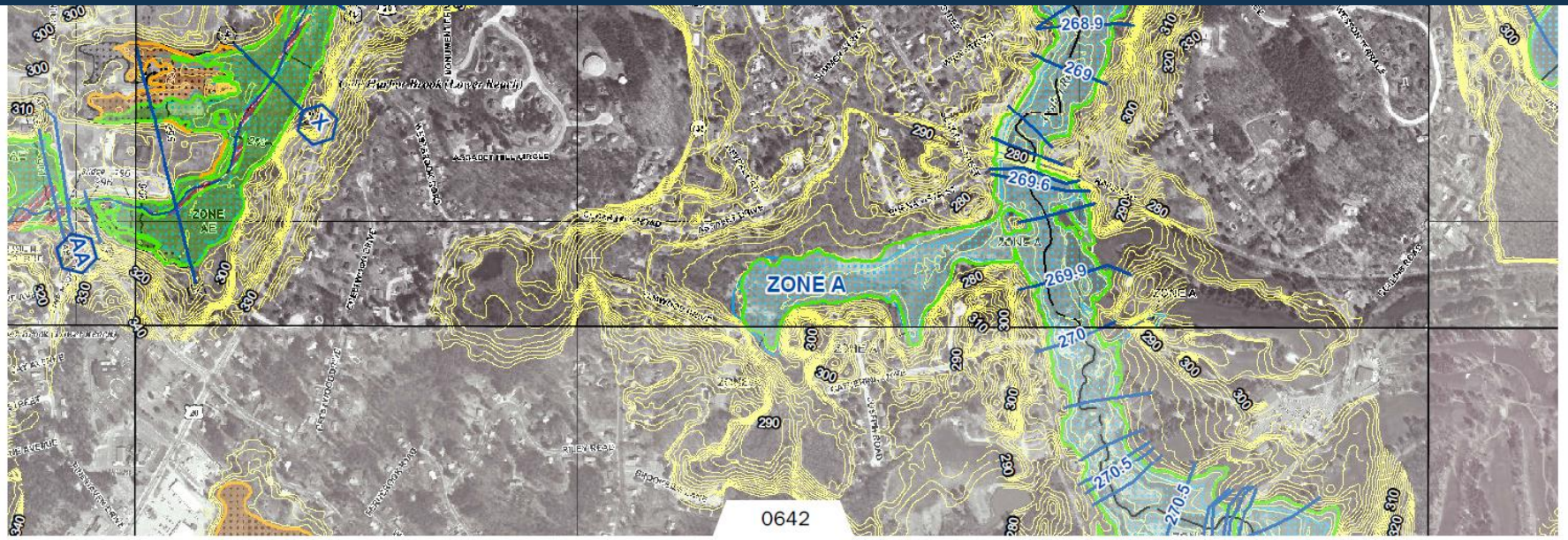


Workmaps

- Simulate various recurrence interval flow conditions
  - Typically 2- 10- 50- 100- and 500 year events
  - Note that FEMA terminology for the often called 100 year event is "1% Annual Chance Flood Event"
- Create working maps showing the 1% annual chance flood elevations and extents.

Geo-RAS Flood Inundation Mapping

Portion of a Workmap



LEGEND

Proposed Study
- Base Flood Elevation (Redelineation Areas)
- Cross Sections with 1% Annual Chance
- Profile Baseline Detailed
- Profile Baseline Approximate
- Levee, Dike or Floodwall
- HUC 8 Concord River Watershed Boundary
- ZONE AE (Detailed Flooding)
- ZONE AE with Floodway
- ZONE A (Approximate Flooding)
- ZONE X (0.2 % Flooding)

Effective Study
- Base Flood Elevation
- Cross section line
- 1% Annual Chance Floodplain Boundary
- 0.2% Annual Chance Floodplain Boundary
- Floodway Boundary
- Zone Breaks
- Political Line
- Special Flood Hazard Areas (SFHAs) Subject to Inundation by the 1% Annual Chance Flood
- Floodway Areas in Zone AE
- Other Flood Areas

PANEL LOCATOR

0631 0632 0651
0633 0634 0653
0641 0642 0661
N

COMMENTS

The new Base Flood Elevations (BFEs) are not shown on this workmap, however the water surface elevation at the newly modeled cross sections are shown.

"This map is a DRAFT product, and is subject to change before the Preliminary issuance. Questions related to the product can be addressed to the CDM Smith Project Manager at workmap.comments@cdmsmith.com."

Map Projection:
NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

1 inch = 1,000 feet 1:12,000

0 245 490 980 1,470 1,960 Feet

0 120 240 480 Meters

RIVERINE WORKMAP

Panel Contains:
WORCESTER COUNTY, MA

COMMUNITY	NUMBER
NORTHBOROUGH, TOWN OF	250321

PANEL 0634 of 1075

SCALE
1:12,000

MAP NUMBER
0634F

RELEASE DATE
7/23/2012

CDM Smith

Model Application

- Use the current conditions model to evaluate flood mitigation alternatives
  - Widening stream channel
  - Raise or enlarge bridge openings
  - Divert flow through alternate channel/conduit
  - Provide additional storage/flood plain area
  - Dredge stream channel
- Simulate with and without improvement, compare depths and extents of flooding
- Determine upstream and downstream impacts

Before and After Bridge Improvement

Closing Remarks

- Flood studies assume clear channels and structure openings unimpeded by debris
- Improved mapping will aid in identification of flood risks to homes and businesses
- Detailed study and flood risk mapping does not change the existing flood risk. Is does better define the areas at risk.

Discussion