

# Climate Change & Extreme Weather Pilot Project



**OFFICE OF STRATEGIC PLANNING AND PROJECTS  
CONNECTICUT DEPARTMENT OF TRANSPORTATION**

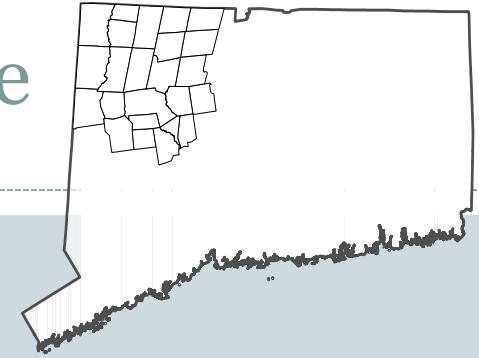
# NYC Climate March – September 2014



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# Project Background/Scope



- Work began in Spring 2013
- Least data available for structures in NWCT
  - Historically more susceptible to extreme weather events
- Structures between 6 and 20 feet long
- Sensitivity analyses of structures at a systems level & criticality assessment
- Chose a primary climate stressor
  - Increased precipitation from major storm events
    - ✦ Increased water flow through structures

# Methods



- **Dual Approach:**
  - Hydraulic Evaluations
    - ✦ Context based evaluation of adaptive capacity of structures:  
*sensitivity analyses*
  - Criticality Assessment
    - ✦ Analysis of social, spatial, and hydraulic factors to determine relative levels of risk to each structure

# Data Gathering/Analysis



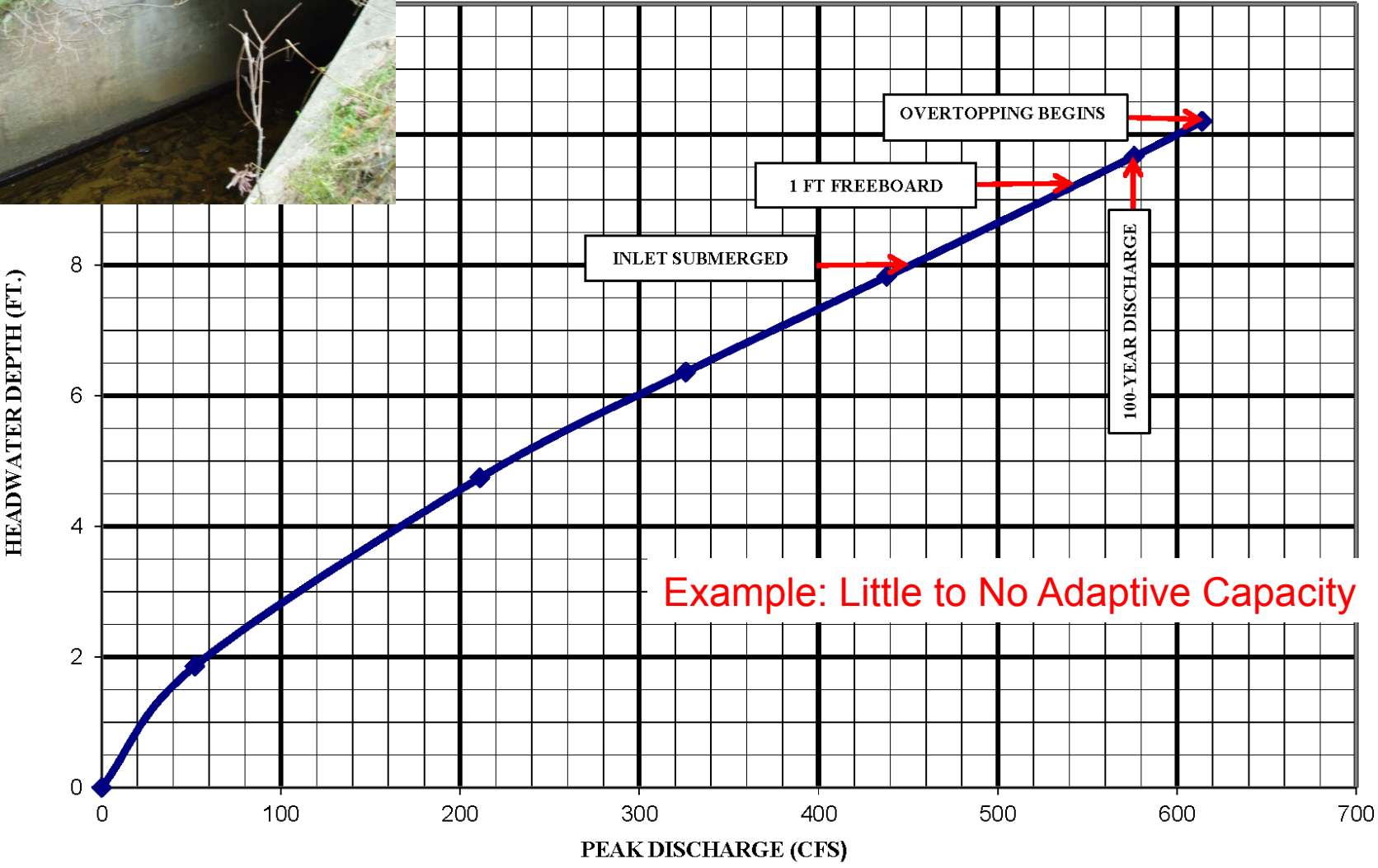
## Sensitivity Analyses:

- **Bridge assessments and field studies**
  - 60 were reviewed in the field
  - 52 of the structures were selected for further evaluation
  - Hydrologic calculations for sensitivity analyses

## Criticality Assessment:

- **Combined hydraulic assessments with spatial and social considerations**
  - Traffic and road data from HPMS
  - FEMA flood zones
  - Emergency facilities
  - Scour critical structures
  - Census- Including At-Risk Populations





# STRUCTURE NO. 02315 HEADWATER DEPTH VS. PEAK DISCHARGE



Example: Little to No Adaptive Capacity

# Low Adaptive Capacity Structure Barkhamsted- Route 44






## Legend

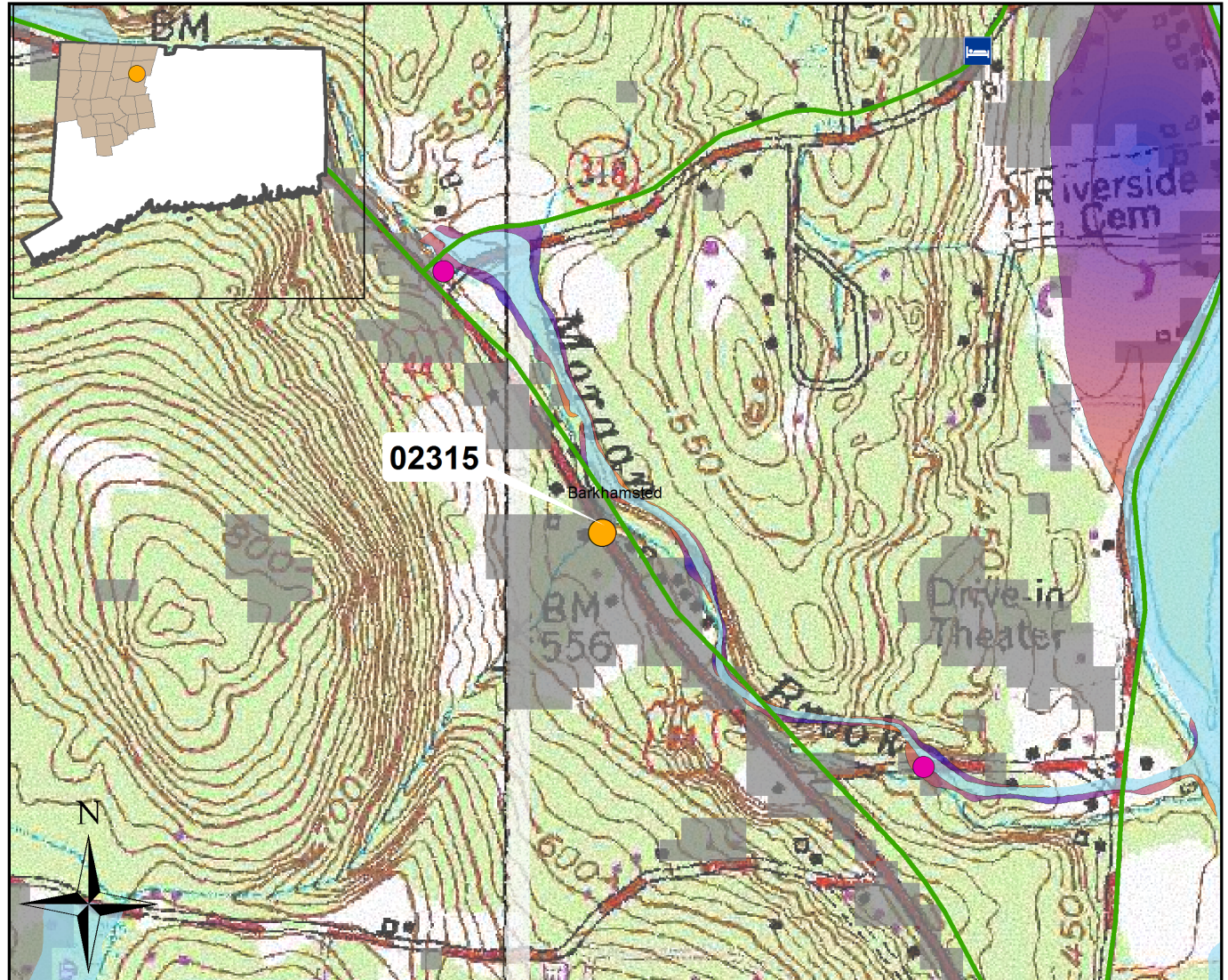
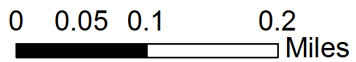
- Scour Critical Structures
- Climate Structures
- ▲ CTDOT Maintenance Facility
-  Police
-  Fire
-  Emergency Shelters
- ▲ Public Works
-  EMS

## VC Ratios 2009

- 0.00 - 0.91
- 0.91 - 1.00
- 1.00 - 5.00

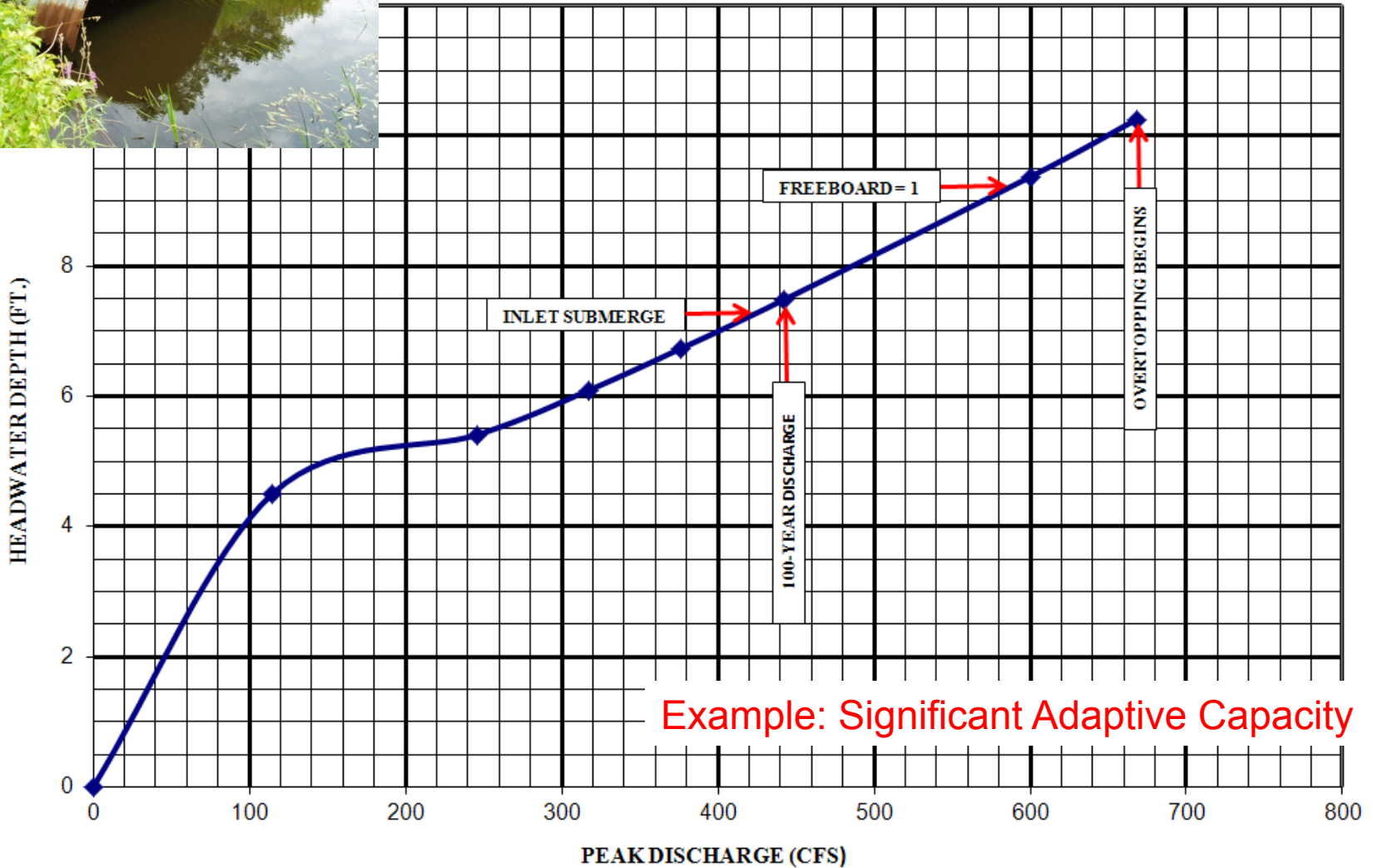
## FEMA Flood Zones

-  500 Year Flood Zone
-  100 Year Flood Zone
-  Floodway in Zone AE
-  Other Flood Areas
-  Impermeable Land Uses




















## STRUCTURE NO. 05417 HEADWATER DEPTH VS. PEAK DISCHARGE

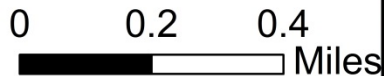




# High Adaptive Capacity Structure Morris- Route 109

## Legend

-  Climate Structures
-  Scour Critical Structures
-  Police
-  Fire
-  Emergency Shelters
-  Public Works
-  EMS
-  Impermeable Land Uses
-  0.00 - 0.91
-  0.91 - 1.00
-  1.00 - 5.00
-  100 Year Flood Zone
-  500 Year Flood Zone
-  Floodway in Zone AE
-  Other Flood Areas



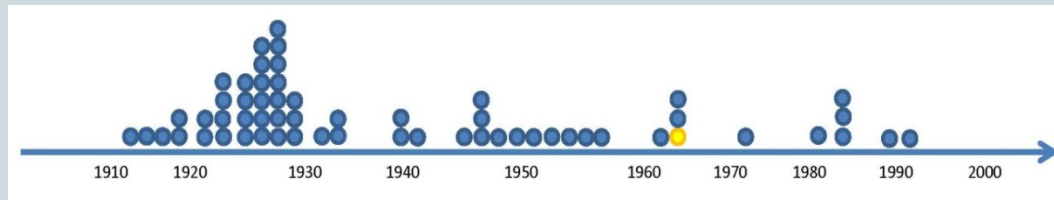
# Criticality Matrix



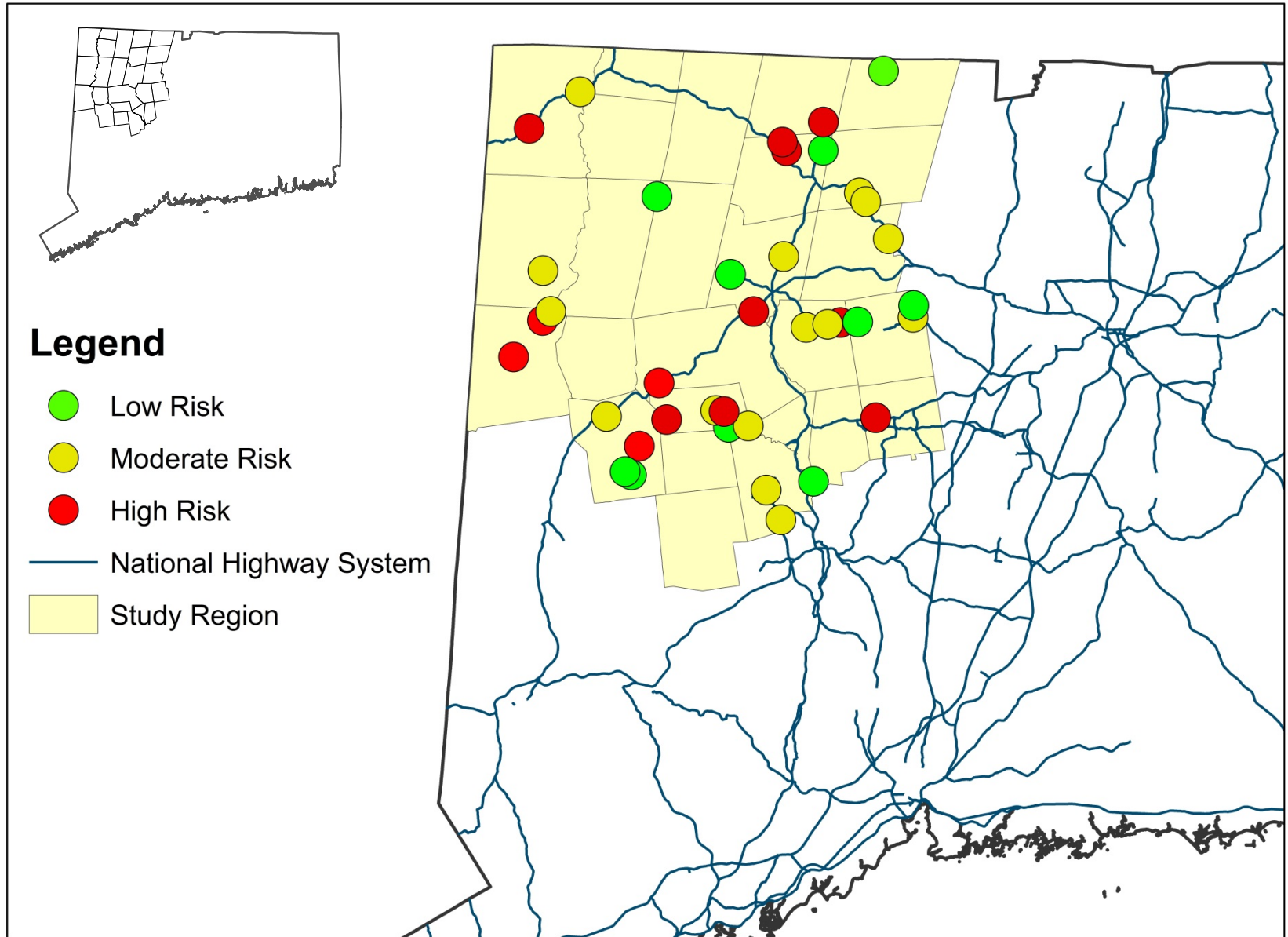
**Structure:** 06712  
**Location:** Watertown

**Year Built:** 1966  
**Criticality Ranking:** 4

		Very Low to Low			Moderate				Critical to Very Critical		
		1	2	3	4	5	6	7	8	9	10
Hydraulic	High adaptive capacity	High adaptive capacity			Moderate adaptive capacity				Low adaptive capacity		
	No history of closure	No history of closure			History of periodic closures				Significant history of closure		
	Satisfies WSE criteria	Satisfies WSE criteria			Adjacent to scour critical structures				Does not satisfy WSE criteria		
Spatial	Outside FEMA flood zones	Outside FEMA flood zones			Within 500 year FEMA flood zone				Within 100 year FEMA flood zone		
	Low concentration of impervious surfaces	Low concentration of impervious surfaces			Moderate concentration of impermeable surfaces				High concentration of impermeable surfaces		
Social	Low ADT & V/C	Low ADT & V/C			Moderate ADT & V/C				High ADT & V/C		
	0-4 accidents	0-4 accidents			5 or more accidents				Emergency route		
	Non-NHS, non-emergency route	Non-NHS, non-emergency route			NHS route				Emergency services cluster		



# Study Structures: Criticality Scores

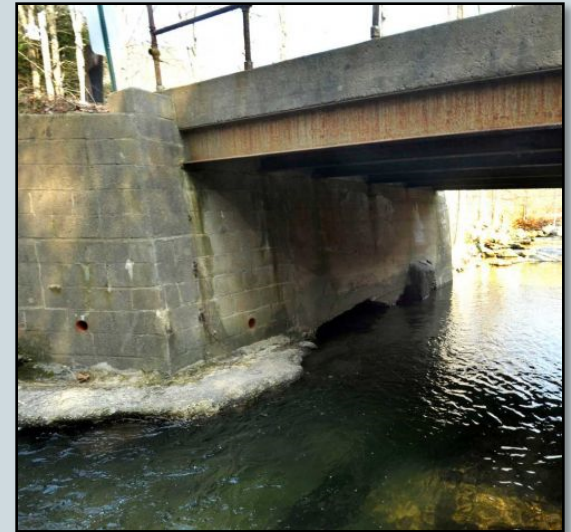


# Lessons Learned



Other factors identified as important to a structure's resiliency:

- Scour
  - Mapped scour critical structures
  - Velocity during storm events contributes to scour
- Susceptibility to debris accumulation
- Excessive backwater, i.e. upstream pooling
- Precipitation projections
  - Precip.net vs. TP-40
  - Broad percentages vs. incremental increases
    - ✦ Incremental increases better gauge adaptive capacity



Example of bridge scour,  
New Milford

# Results



- 34 study structures satisfy design water surface elevation criteria
  - 13 of those vulnerable to scour
- 18 study structures do not satisfy the hydraulic design criteria
- 14 structures are critical, 12 of those lack adaptive capacity

# Next Steps



- Identify priorities for structure replacement
- Create a mechanism to alert officials of critical structures



# Thank you



## Project Contacts

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