New York State Canal
Flood Warning and Optimization System

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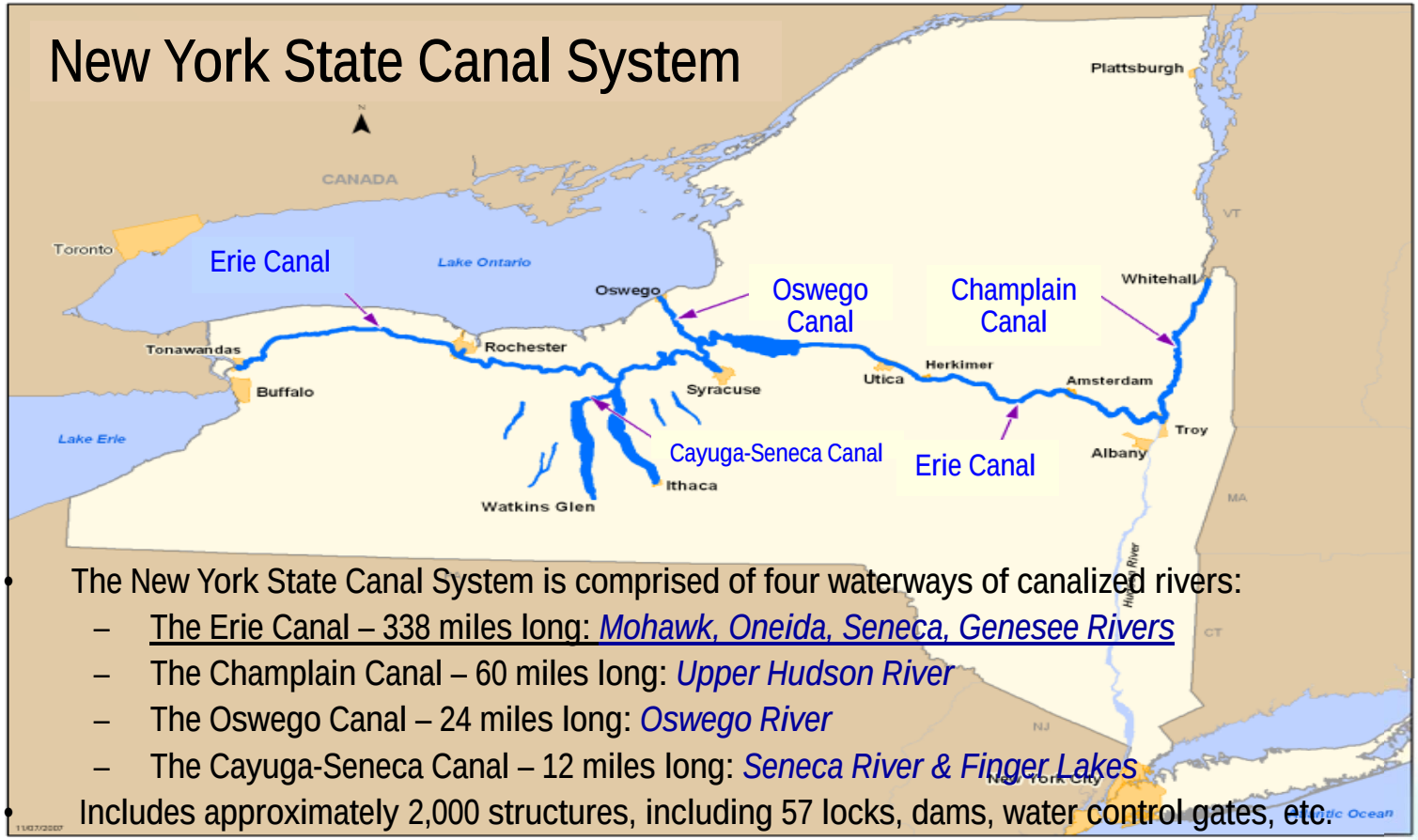
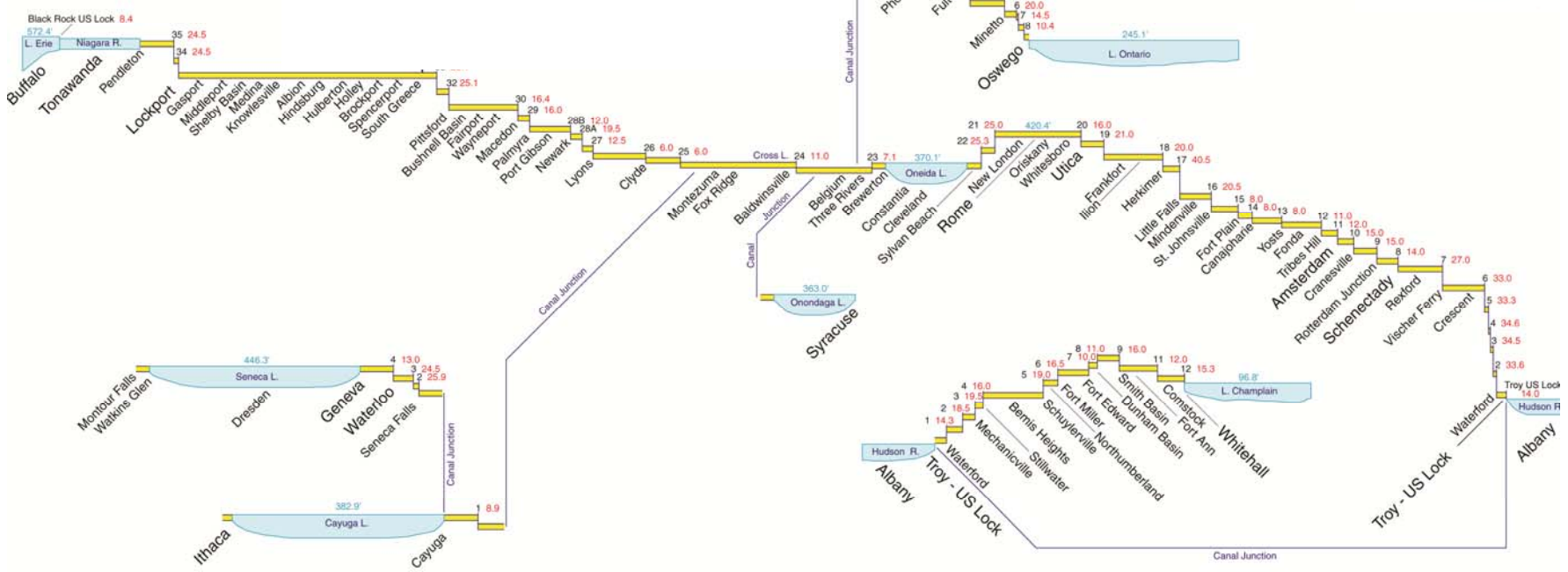
Canal Hydrologist

New York State Canal System

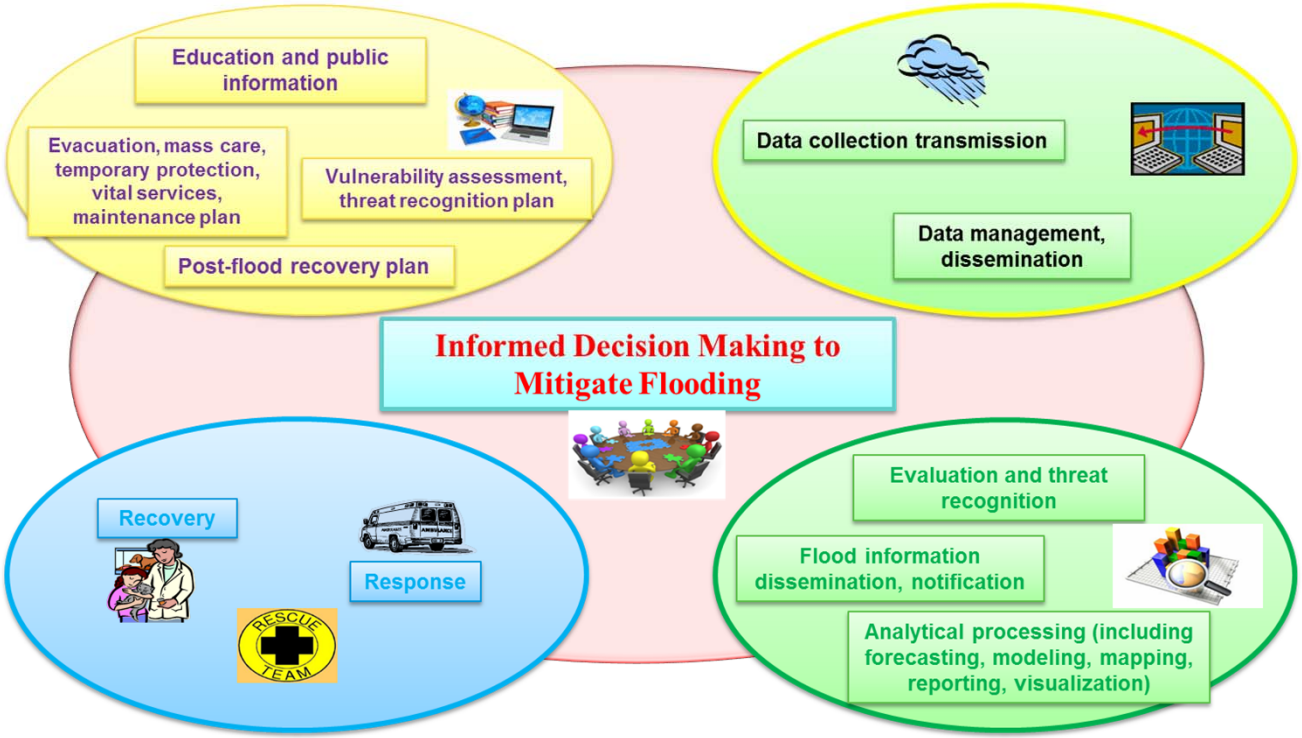


- The New York State Canal System is comprised of four waterways of canalized rivers:
  - The Erie Canal – 338 miles long: *Mohawk, Oneida, Seneca, Genesee Rivers*
  - The Champlain Canal – 60 miles long: *Upper Hudson River*
  - The Oswego Canal – 24 miles long: *Oswego River*
  - The Cayuga-Seneca Canal – 12 miles long: *Seneca River & Finger Lakes*
- Includes approximately 2,000 structures, including 57 locks, dams, water control gates, etc.

Profile: NYS Canal System



Flood Warning System

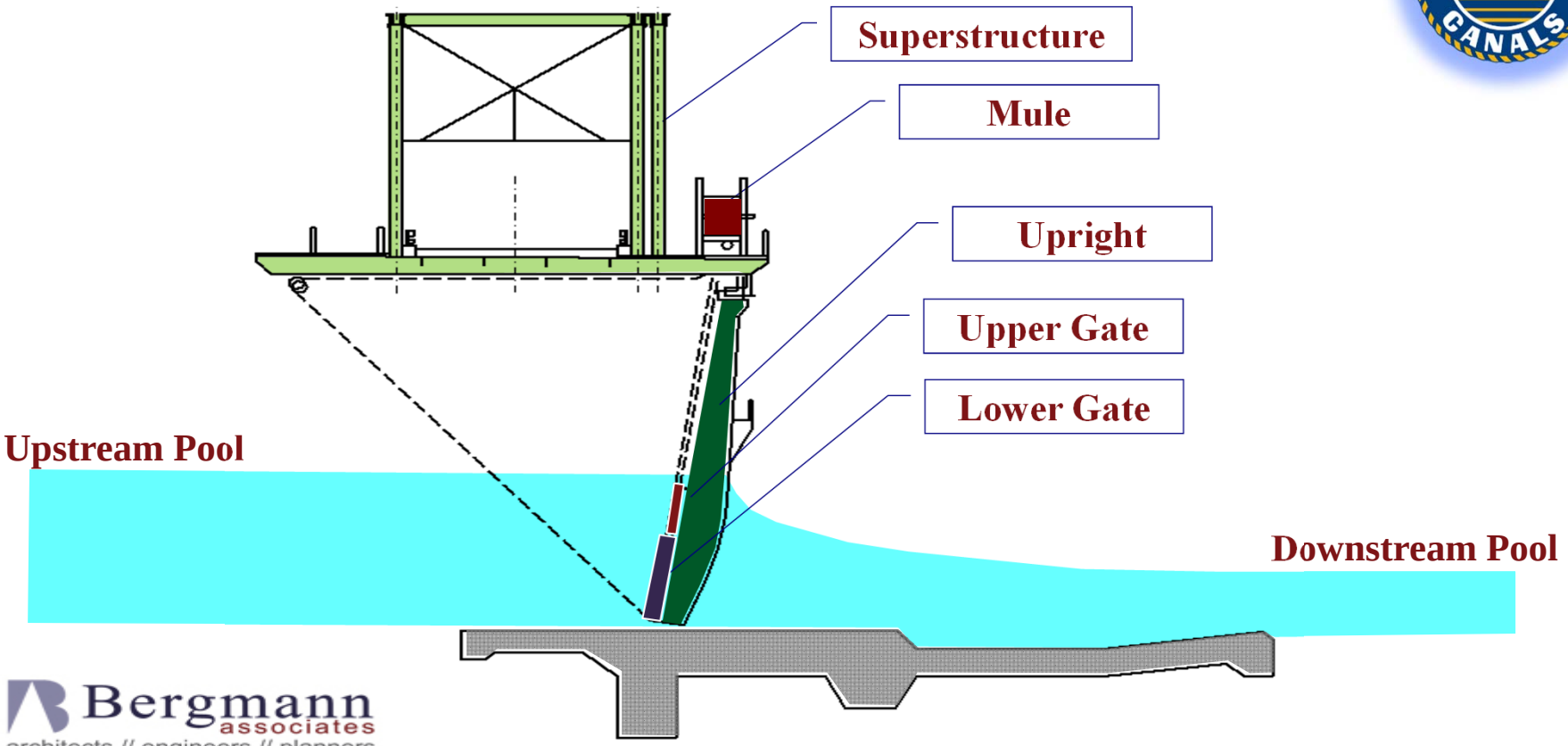


4 hours of warning can save ± 10% in flood damages

Erie Canal Locks and Dams

Mohawk Style: Movable Dams

Mohawk Style: Movable Dams



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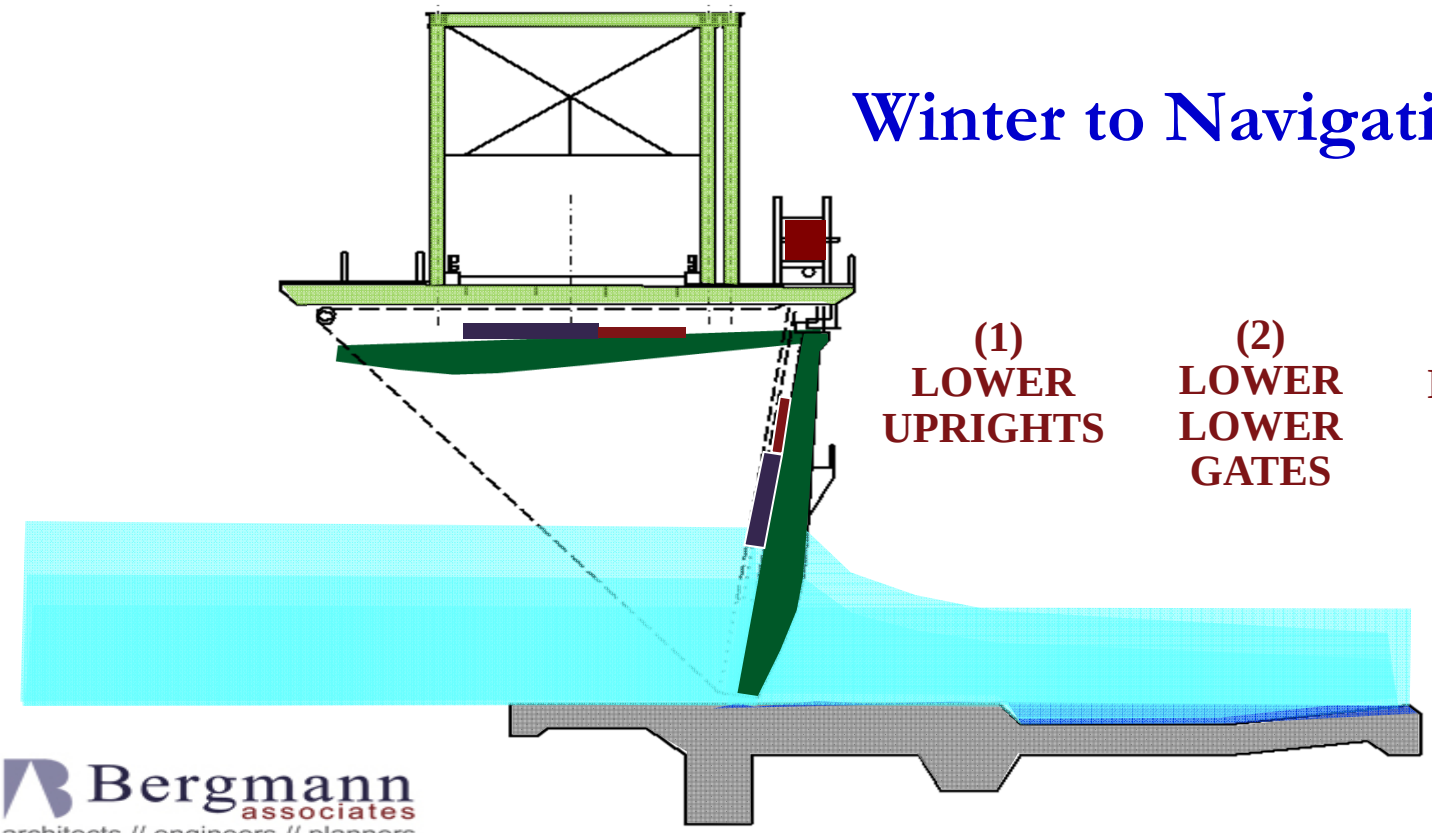
Movable Dam Operation

Winter to Navigation Season



(1) LOWER UPRIGHTS

(2) LOWER LOWER GATES

(3) LOWER UPPER GATES

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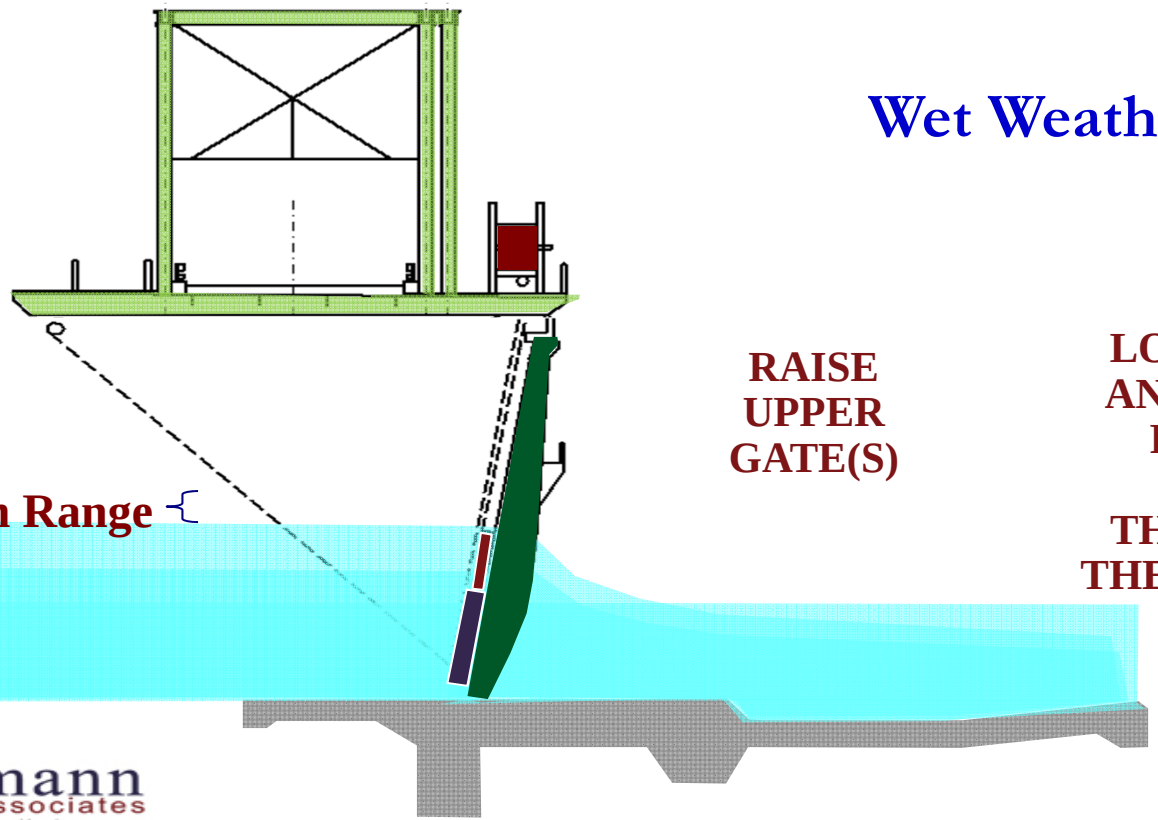
Movable Dam Operation

Wet Weather



+/-2 ft Navigation Range

RAISE UPPER GATE(S)

LOWER GATES AND UPRIGHTS REMAIN IN PLACE THROUGHOUT THE NAVIGATION SEASON

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NYS CANAL CORPORATION
FLOOD MITIGATION PROJECT

18 December 2012

44 CFR §9.8 for Executive Orders 11988 and 11990 New York State Thruway Authority / New York State Canal Corporation Erie Canal

RE: Floodplain mitigation project, Mohawk River, N.Y.

PUBLIC NOTICE Federal Emergency Management Agency In accordance with 44 CFR ?9.8 for Executive Orders 11988 and 11990 New York State Thruway Authority / New York State Canal Corporation Erie Canal floodplain mitigation project, Mohawk River, N.Y. Notification is hereby given to the public of the intent of the Federal Emergency Management Agency (FEMA) to provide assistance to the New York State Thruway Authority / New York State Canal Corporation, of modification of the Mohawk River / Erie Canal movable dams 4 through 11 roughly from Scotia to Fort Plain to create a "run of river" condition aka free of substantial obstructions during the navigation season (May 1st through November 15th) in anticipation of a major storm event (National Weather Service forecasts for flood events to exceed a 10% annual chance flood). The proposed action involves modifying the water control structures (movable dams) at Erie Canal Locks E-8 through E-15 from Scotia to Fort Plain to allow their full removal in advance of anticipated flooding events during the navigation season. Currently, the upper gates are opened / closed throughout the navigation season to maintain targeted water levels at each lock based on flow of water in the system to maintain navigation. The lower gates and uprights are currently unable to be removed during high water events due to structural and mechanical limitations. Currently, the raising or opening of the gates can require days. The proposed plan is to modify the movable dams so that the lower gates and uprights can be raised in anticipation of a major flood event. The modified gates will be able to be opened over a substantially compressed timeframe.

LOCK E-10: HURRICANE IRENE

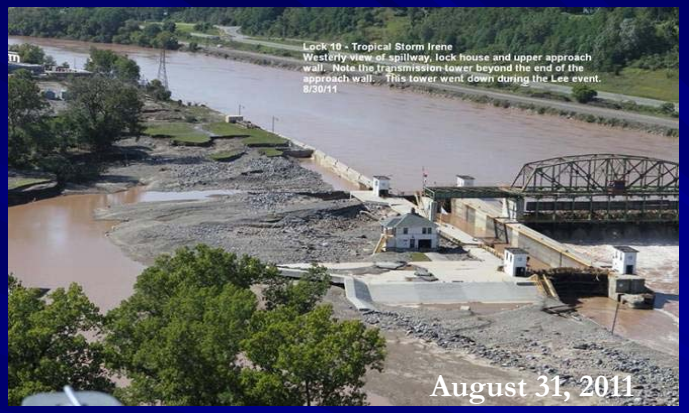
CRANESVILLE

Flood inundation during Hurricane Irene

Upstream

Upstream

LOCK E-10: Cranesville

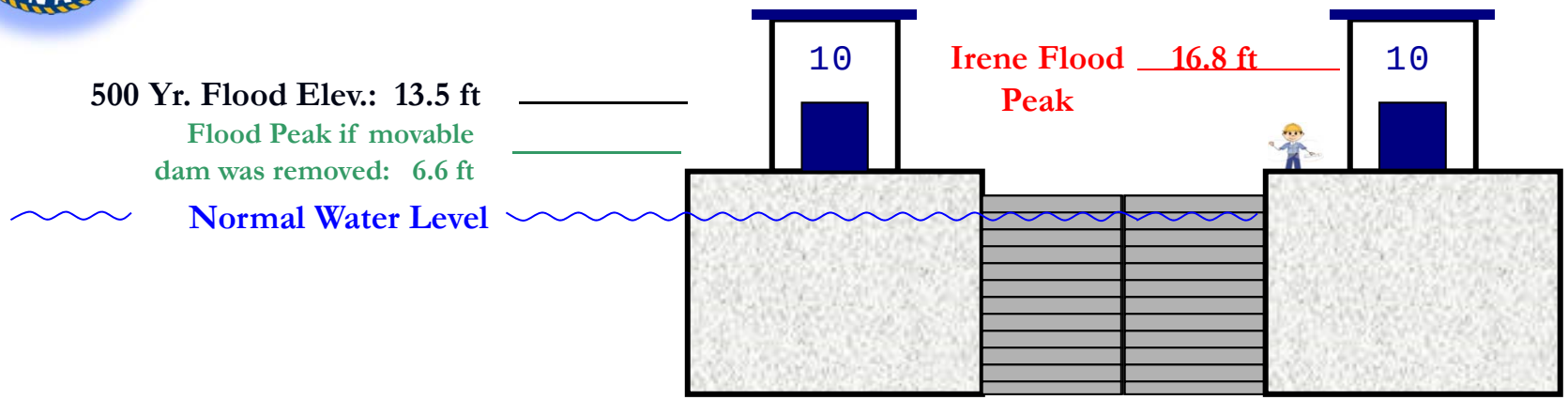


Hurricane Irene
DR-4020

Tropical Storm Lee
DR-4020

LOCK E-10: HURRICANE IRENE

Water level comparison



Values are in feet above normal level

PROPOSED FLOOD MITIGATION PLAN

Modify movable dams to allow the removal of the movable dam's lower gates and uprights in anticipation of a major flood event to remove the hydraulic obstruction and prevent debris accumulation.

- New, structurally-enhanced uprights
- Upgraded Mules
- New gate bearings
- Lighting (for 24-hour operation)
- Stage Gaging and Video Cameras at each dam
- **Operational Plan**

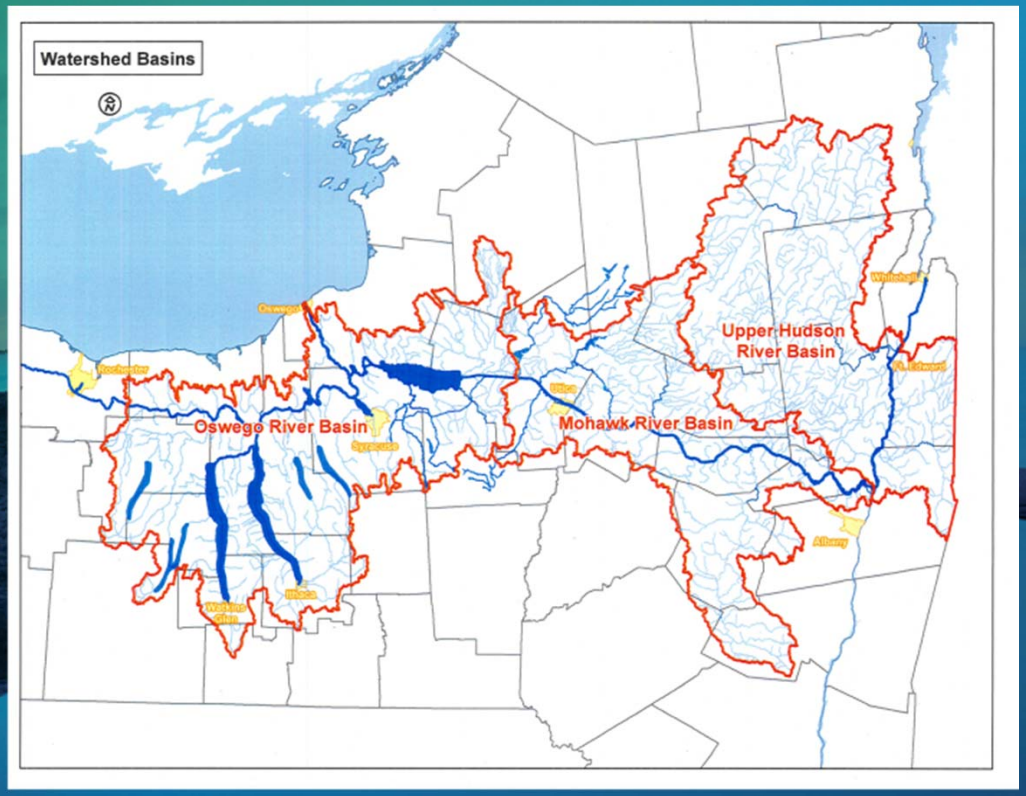
Cost: $28 Million

BENEFITS OF MITIGATION

- Substantial reduction in flood levels
- Removal of debris loading in the movable dams
- Reduction in flood damage along the canal and to property along the canal
- Allows the system return to operation much sooner
- Improved operator safety


NEW YORK
CANALS

New York State Canal Flood Warning and Operations System



Flooding has been a recurring problem in these basins:

- 1993, 1994, & 1996 - Oswego River Basin
- 2006-DR-1650: >$400 million
- 2011-DR-4020 & 4031: >$1.7 billion
- 2013-DR-4129: $32 million???

Forecasting is limited:

Managers do not have accurate information to safely and timely manage decision making in flood prone areas.

Flood Warning System: History

DPW

DEPARTMENT OF PUBLIC WORKS

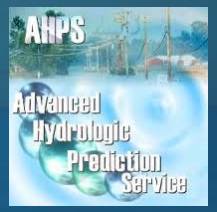
NEW YORK CANALS

National Weather Service

1997: Advanced Hydrologic Prediction Service (AHPS)

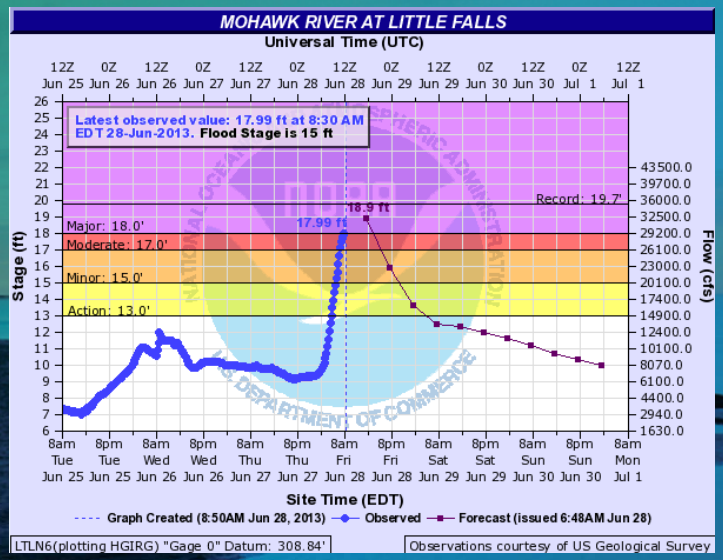
AHPS: National program to provide enhanced information and products through the infusion of new science and technology to improve flood warnings and water resource forecasts nationwide.

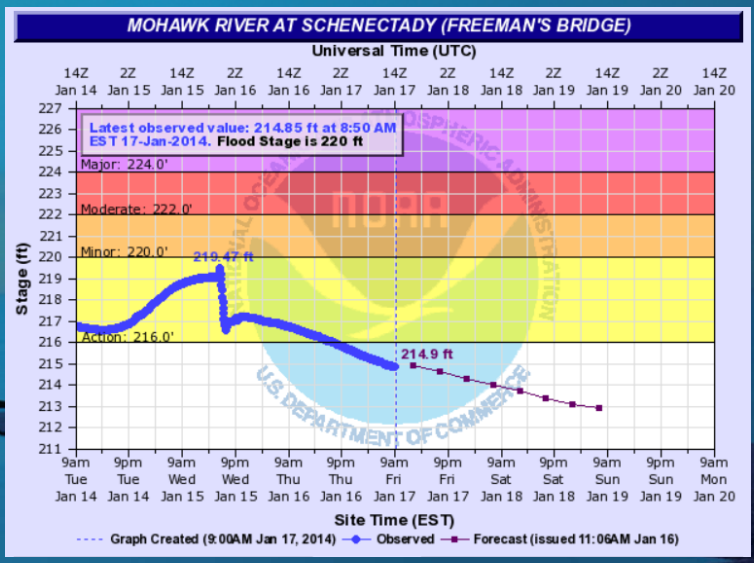
- ***Better forecast accuracy***
- ***More specific and timely information on fast-rising floods***
- ***New types of forecast information***
- ***Longer forecast horizons***
- ***Easier to use products***
- ***Increased, more timely, and consistent access to products and information***
- ***Expanded outreach***

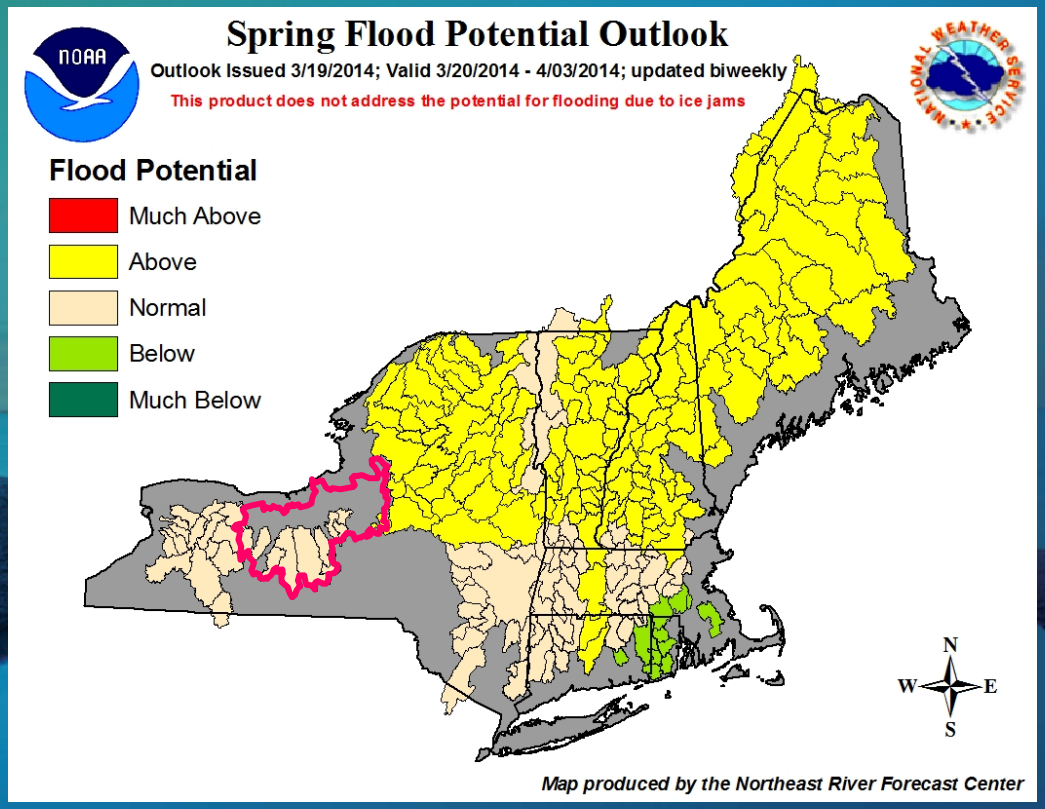


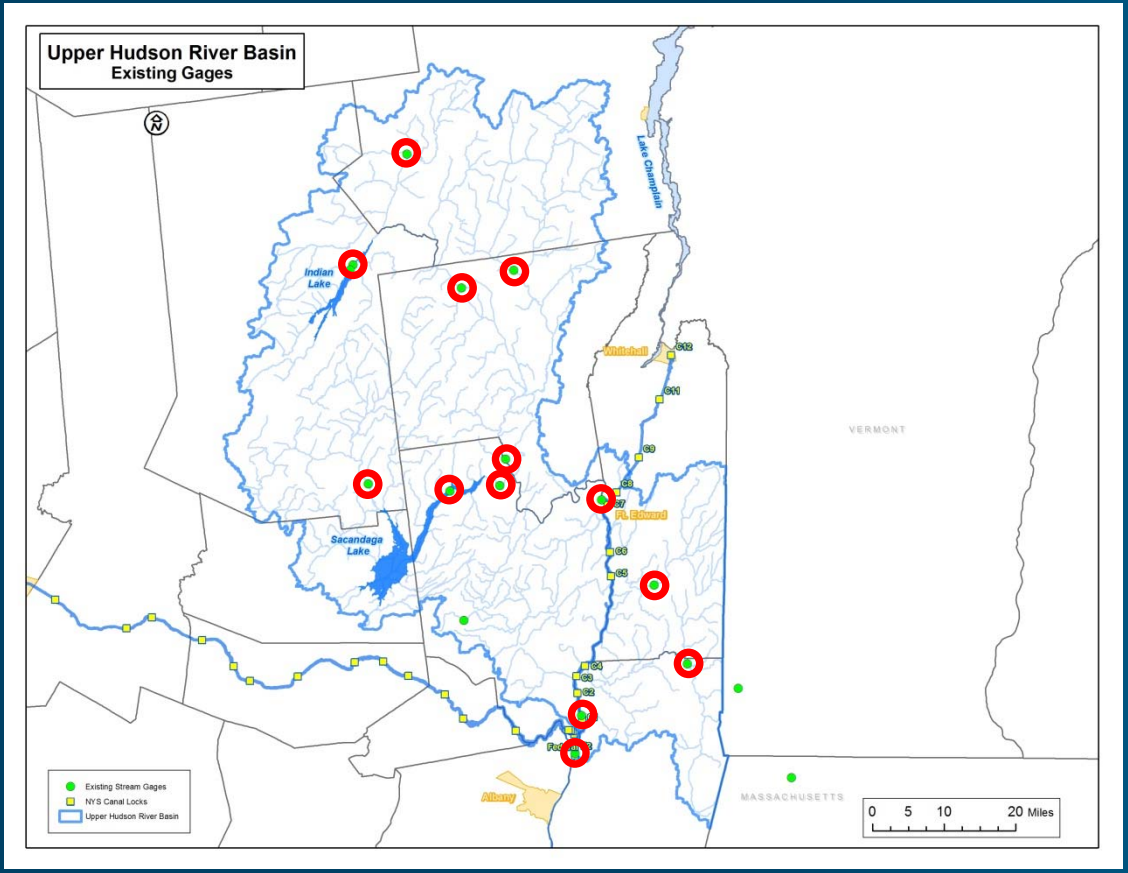
National Weather Service

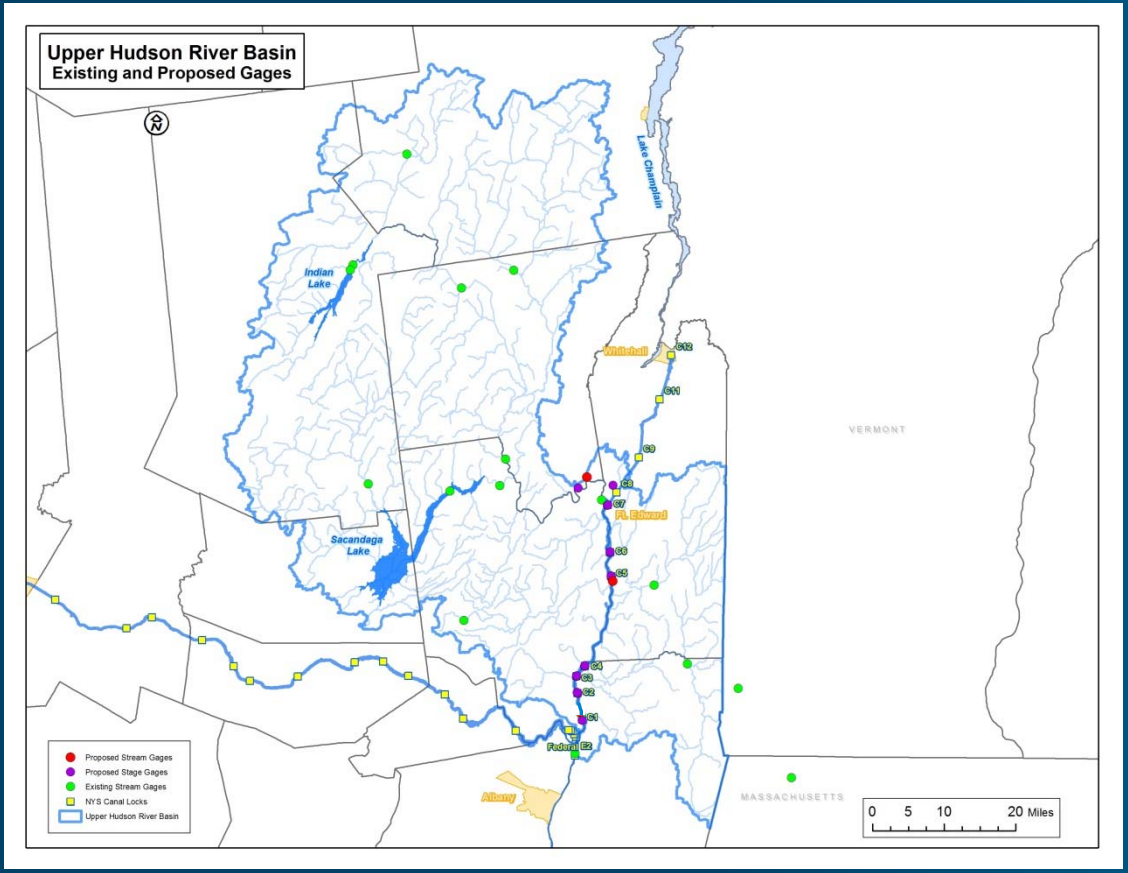
1997: Advanced Hydrologic Prediction Service (AHPS)





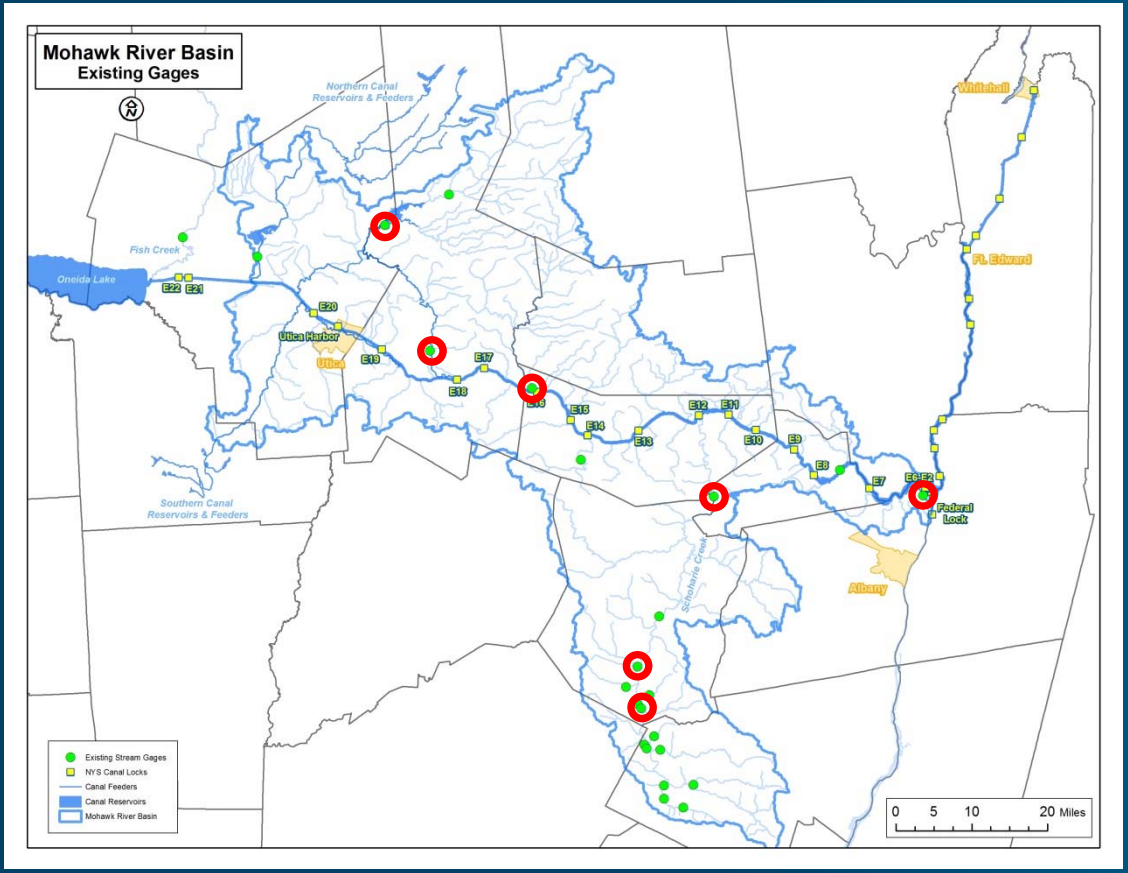

Spring Flood Potential Outlook
Outlook Issued 3/19/2014; Valid 3/20/2014 - 4/03/2014; updated biweekly
This product does not address the potential for flooding due to ice jams
Flood Potential
Much Above
Above
Normal
Below
Much Below
N
W
E
S
Map produced by the Northeast River Forecast Center

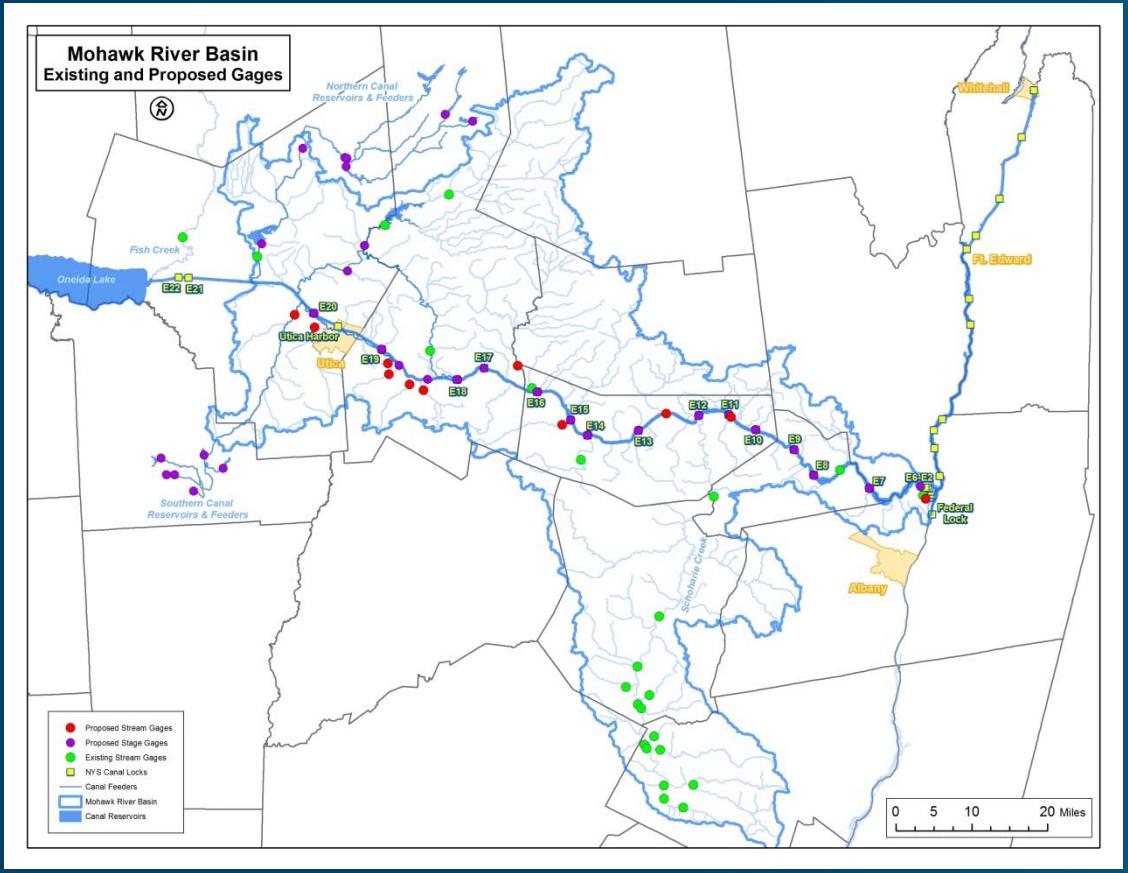

Upper Hudson River Basin
Existing Gages
Lake Champlain
Indian Lake
Whitehall
C12
C11
C10
C9
C8
C7
Pt. Edward
C6
C5
C4
C3
C2
C1
Sacandaga Lake
Albany
VERMONT
MASSACHUSETTS
Existing Stream Gages
NYS Canal Locks
Upper Hudson River Basin
0 5 10 20 Miles



Include installation of:

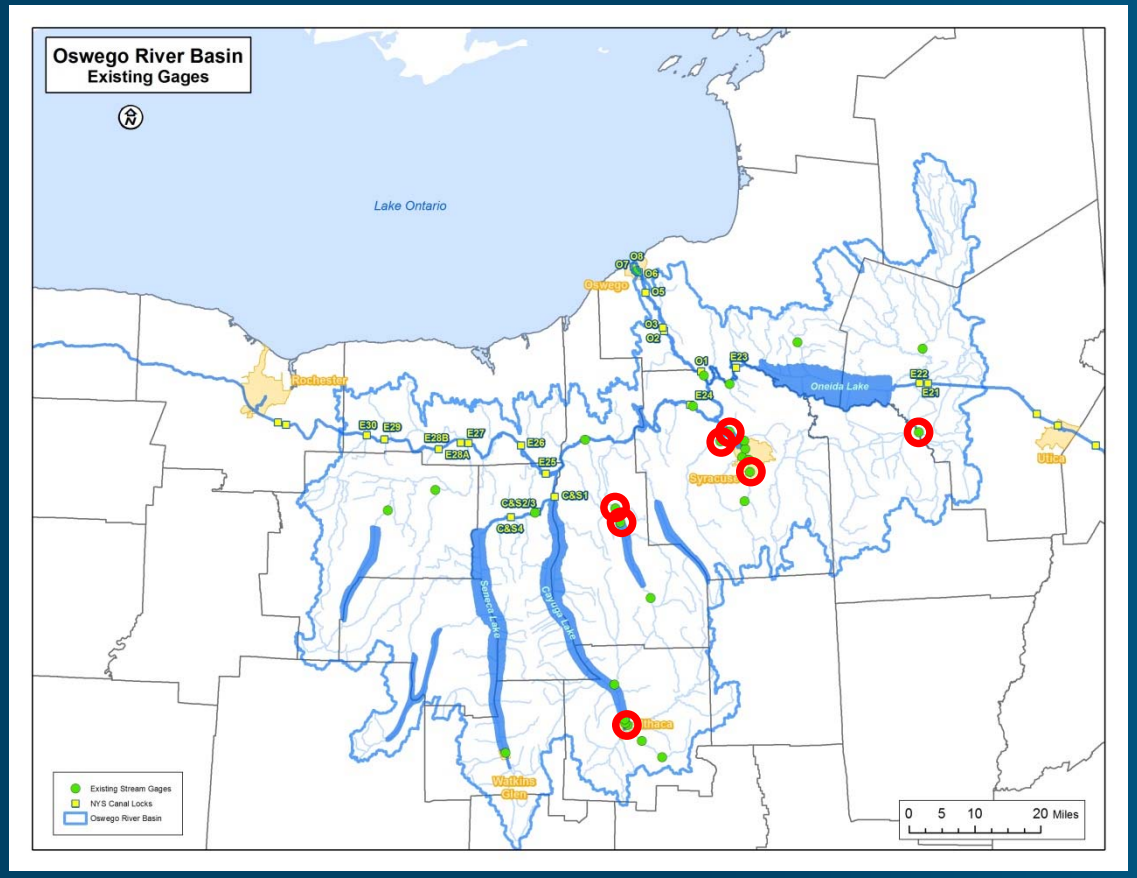
- 2 USGS stream gages
- 15 Stage gages
- 9 Precipitation gages

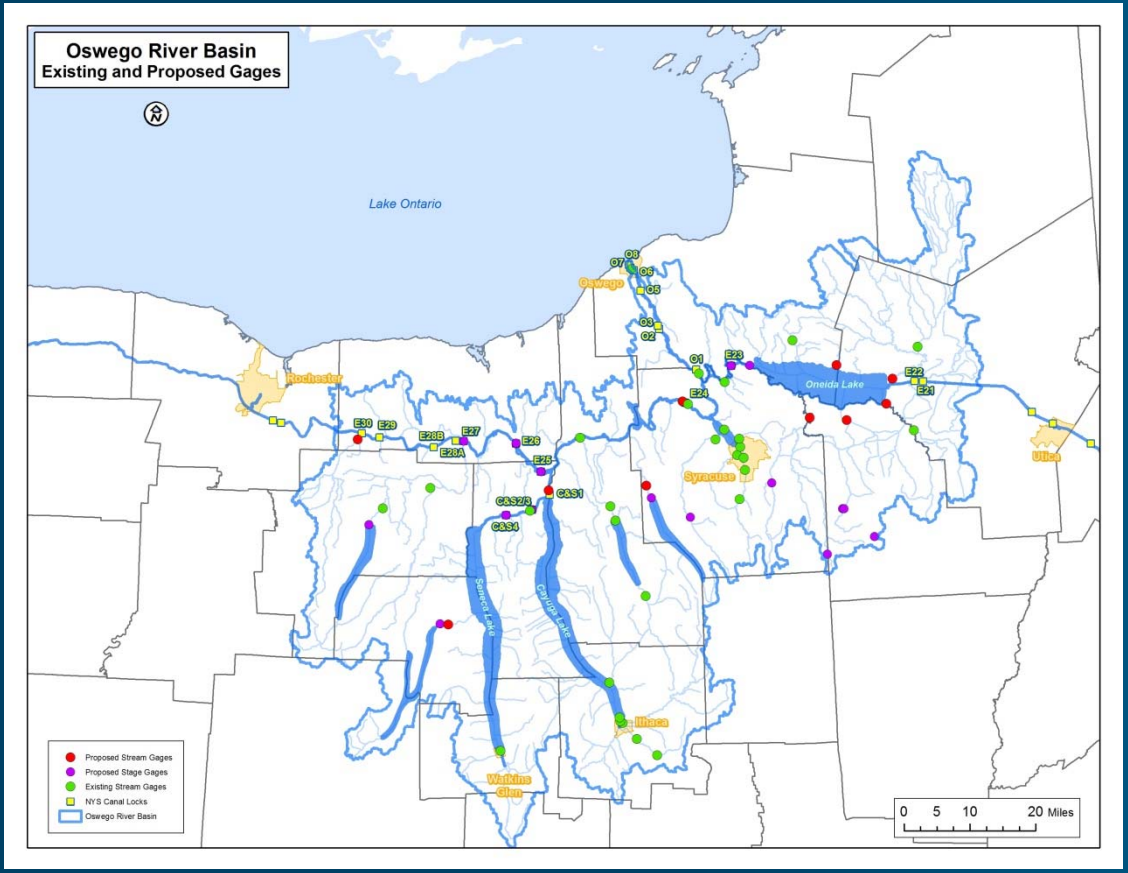

Mohawk River Basin
Existing Gages
Northern Canal Reservoirs & Feeders
Southern Canal Reservoirs & Feeders
Oneida Lake
Fish Creek
E22
E21
E20
Utica Harbor
Utica
E19
E17
E18
E16
E15
E14
E13
E12
E11
E10
E9
E8
E7
E6
E5
E4
E3
E2
E1
Whitehall
Ft. Edward
Federal Lock
Albany
Schoharie Creek
Existing Stream Gages
NYS Canal Locks
Canal Feeders
Canal Reservoirs
Mohawk River Basin
0 5 10 20 Miles



Include installation of:

- 11 USGS stream gages
- 30 Stage gages
- 16 Precipitation gages


Oswego River Basin
Existing Gages
Lake Ontario
Oswego
Rochester
Oneida Lake
Syracuse
Utica
Ithaca
Watkins Glen
Seneca Lake
Cayuga Lake
O8
O7
O6
O5
O3
O2
O1
E23
E22
E21
E24
E30
E29
E28B
E28A
E27
E26
E25
CAS1
CAS2/3
CAS4
Existing Stream Gages
NYS Canal Locks
Oswego River Basin
0 5 10 20 Miles



Include installation of:

- 9 USGS stream gages
- 23 Stage gages
- 20 Precipitation gages

Key Features

- Increased Real-Time Monitoring: Streamflow, Stage, and Precipitation
- Improved Weather Forecasting
- Development of Basin-Wide Hydrologic & Hydraulic Models
- Database Management: Robust Collection/Transmission/Dissemination of Data
- Flood Forecasting, Integrated with NWS Forecasts: Increase Precision
- Presentation of Information: GIS-Based Interactive Mapping
- System Optimization: Scenario Mapping

Goal: Provide operators, emergency managers, and the pubic with accurate information to safely manage decision making in flood prone areas

Cost: $8.5 Million

Consultant Team:
New York State Canal
Flood Warning and Operations System

RIVERSIDE

global science solutions

DHI

Bergmann associates

architects // engineers // planners

GOMEZ AND SULLIVAN Engineers, P.C.

Engineers and Environmental Scientists

H2H Associates

PRUDENT ENGINEERING

NEW YORK CANALS

Output: Real-Time Inundation Mapping

Flood Warning System Benefits

Accurate forecasts will be able to answer the following questions:

- Where flooding will occur, and when?
- How high will the water rise?
- When will the water begin to recede?

Increase the forecast precision of both rainfall and water levels.

Improve the operational decision making for the water control devices.

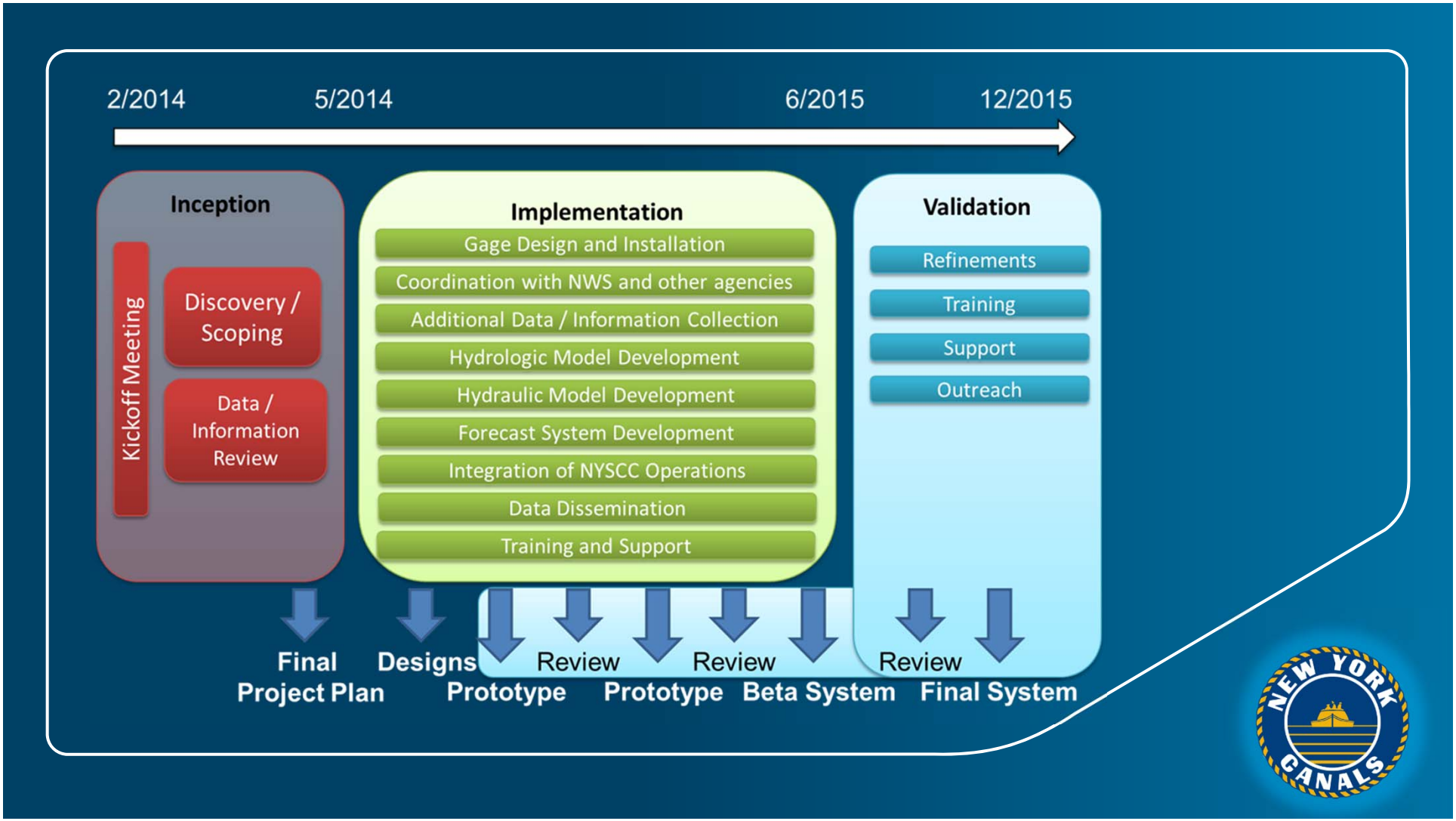
Provide information to operators, emergency managers, and the public in a format that is readily useable.

Collaborations

New York State Resilience Institute for Storms & Emergencies (NYS RISE), a new “applied think tank” led by New York University and Stony Brook University that will serve as a hub of research and education on emergency preparedness, as well as a clearinghouse of information regarding extreme weather and natural disasters.

NYS Mesonet

New York State: State-of-the-Art Weather Detection System: University at Albany Department of Atmospheric and Environmental Sciences and Atmospheric Sciences Research Center


2/2014
5/2014
6/2015
12/2015
Inception
Kickoff Meeting
Discovery / Scoping
Data / Information Review
Implementation
Gage Design and Installation
Coordination with NWS and other agencies
Additional Data / Information Collection
Hydrologic Model Development
Hydraulic Model Development
Forecast System Development
Integration of NYSCC Operations
Data Dissemination
Training and Support
Validation
Refinements
Training
Support
Outreach
Final Project Plan
Designs
Review
Prototype
Review
Prototype
Beta System
Review
Final System
NEW YORK CANALS

THANK YOU

New York State Canal
Flood Warning and Operations System

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