PORTSMOUTH WATER SYSTEM

Climate Change

NORTHEAST US CLIMATE EXPECTATIONS

- Precipitation and Extreme Events
  - Increase in Total Rainfall (December – April)
  - Increased Rainfall Intensity
  - Increase in Drought and Flood Events
- Warmer Temperatures
  - Longer Growing Season
  - Shorter Frozen Period
  - Less Snow
- Sea Level Rise & Higher Storm Surge Levels

Photo By: Ron Sher

Photo By: Joel Ballestero

Reference: Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II, Chapter 18: Northeast, 2018

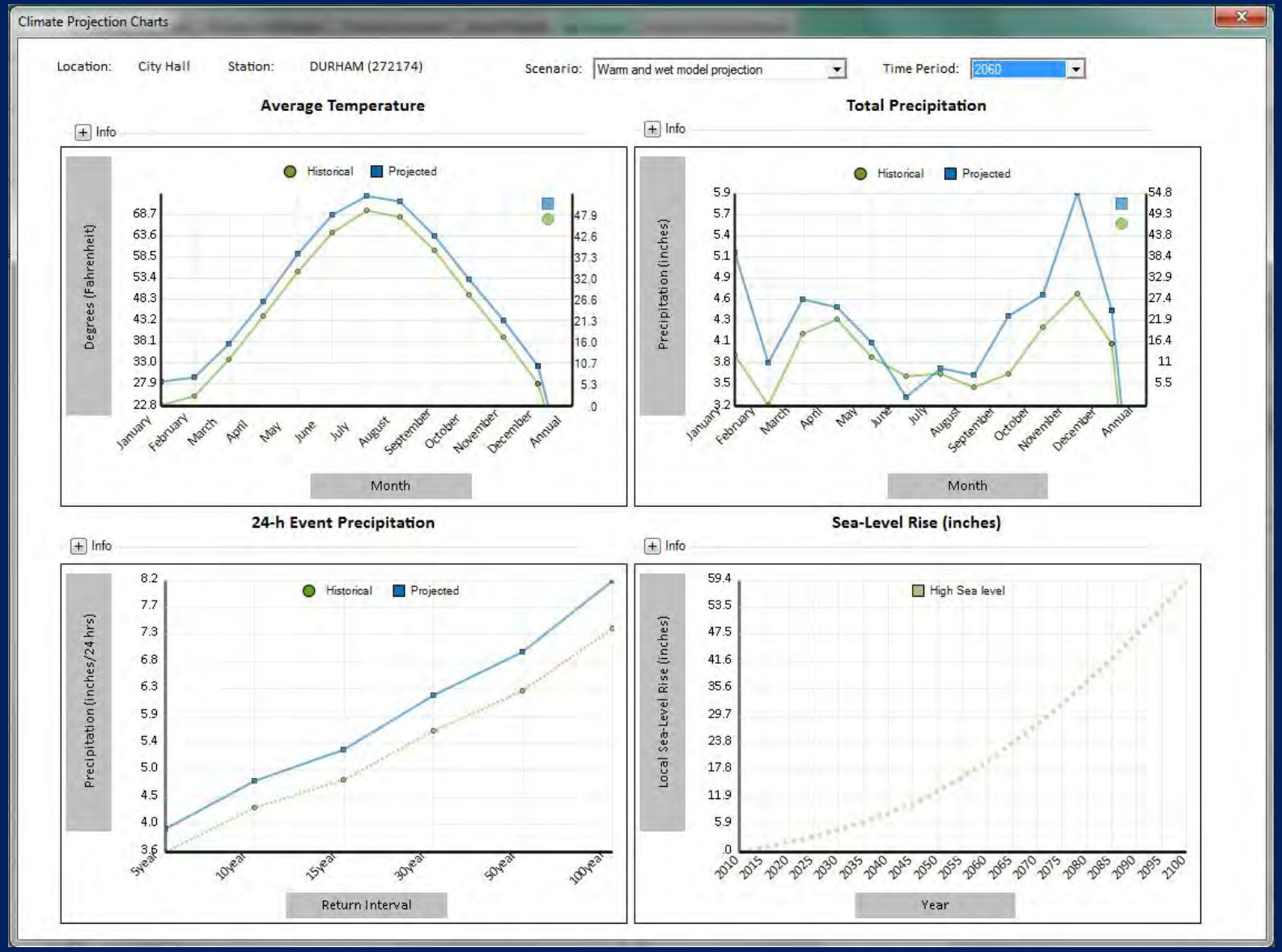
NORTHEAST US CLIMATE EXPECTATIONS

Climate Resilience Evaluation and Awareness Tool (CREAT)
Exercise Report, EPA 2015

Table 1: CREAT-Provided Data and projections for the City of Portsmouth

CLIMATE VARIABLE	HISTORICAL VALUES	CREAT 2060 PROJECTED VALUES (HOT AND DRY PROJECTION)	CREAT 2060 PROJECTED VALUES (CENTRAL MODEL PROJECTION)
Average Annual Temperature	46.63 degrees Fahrenheit	52.36 degrees Fahrenheit	51.39 degrees Fahrenheit
Total Annual Precipitation	46.79 inches	46.22 inches	50.12 inches
100-Year Storm	7.36 inches	8.08 inches	8.53 inches
Sea Level Rise	N/A	30 to 36 inches	30 to 36 inches

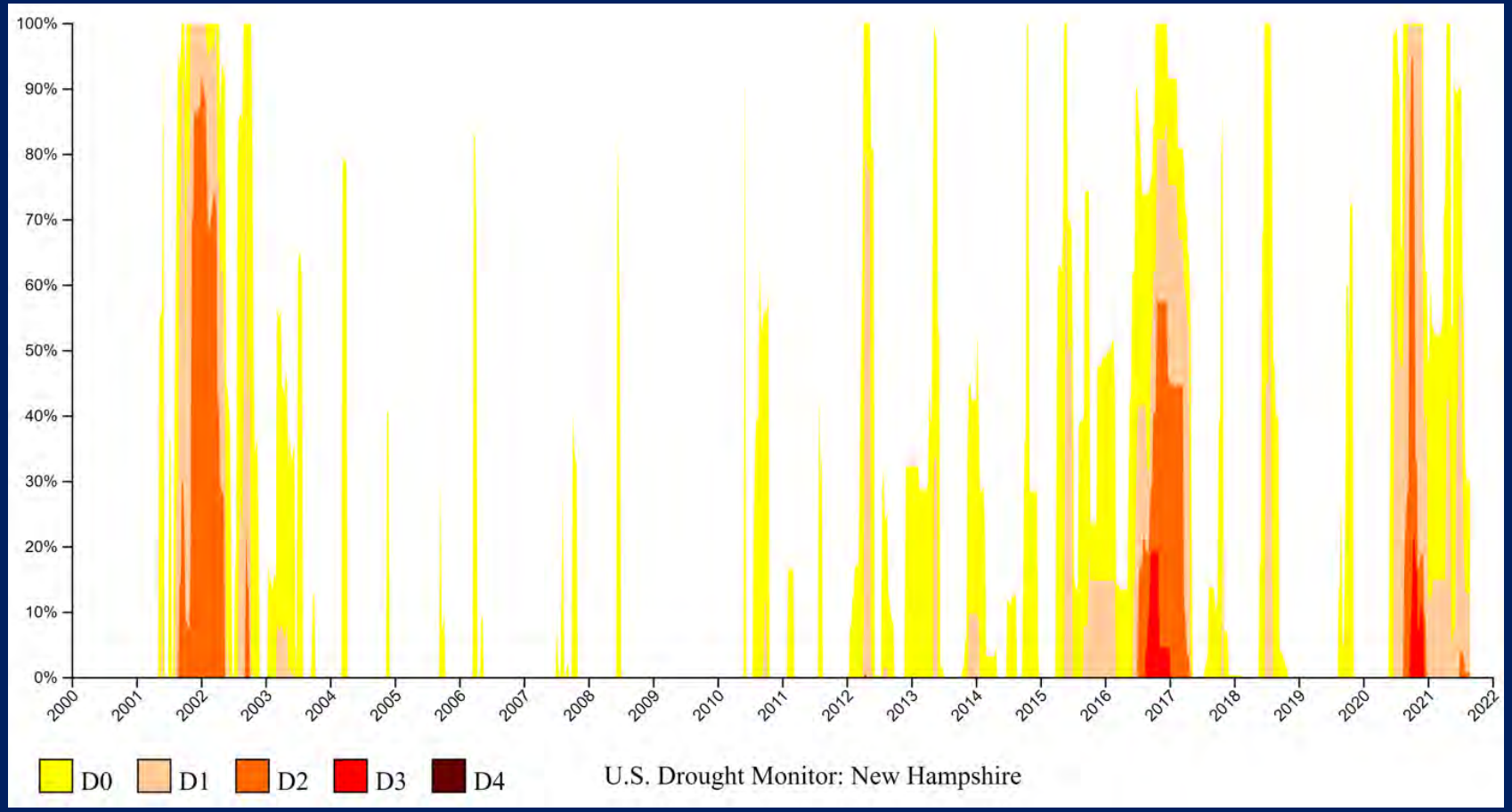
NORTHEAST US CLIMATE EXPECTATIONS



Reference: Climate Resilience Evaluation and Awareness Tool Exercise Report, EPA, 2015

EXTREME EVENTS

DROUGHT



"Since 2000, the longest duration of drought (D1-D4) in New Hampshire lasted 61 weeks beginning on June 23, 2020, and ending on August 17, 2021." National Integrated Drought Information System – US Drought Monitor

EXTREME EVENTS

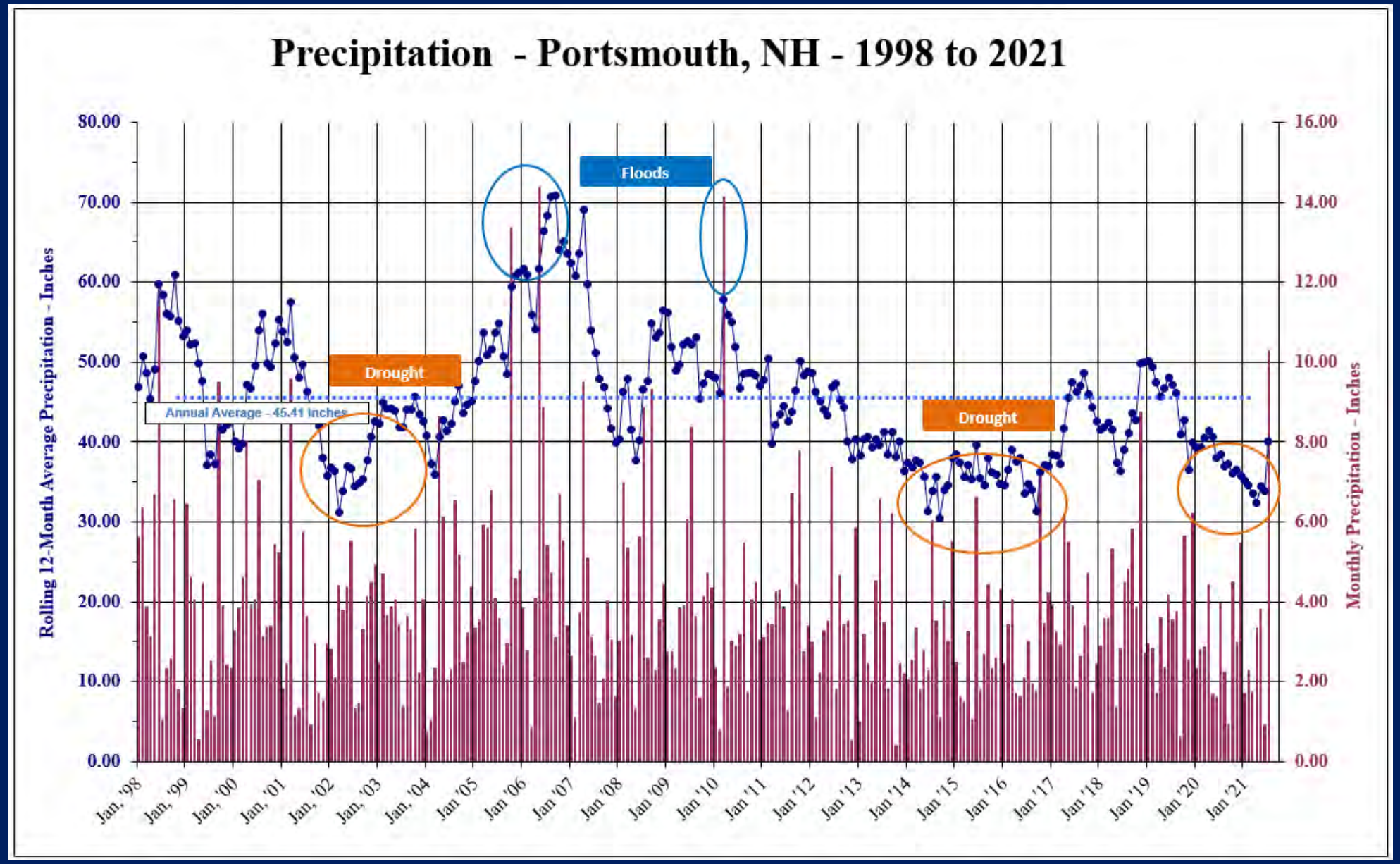
FLOODING

Major Flood Events

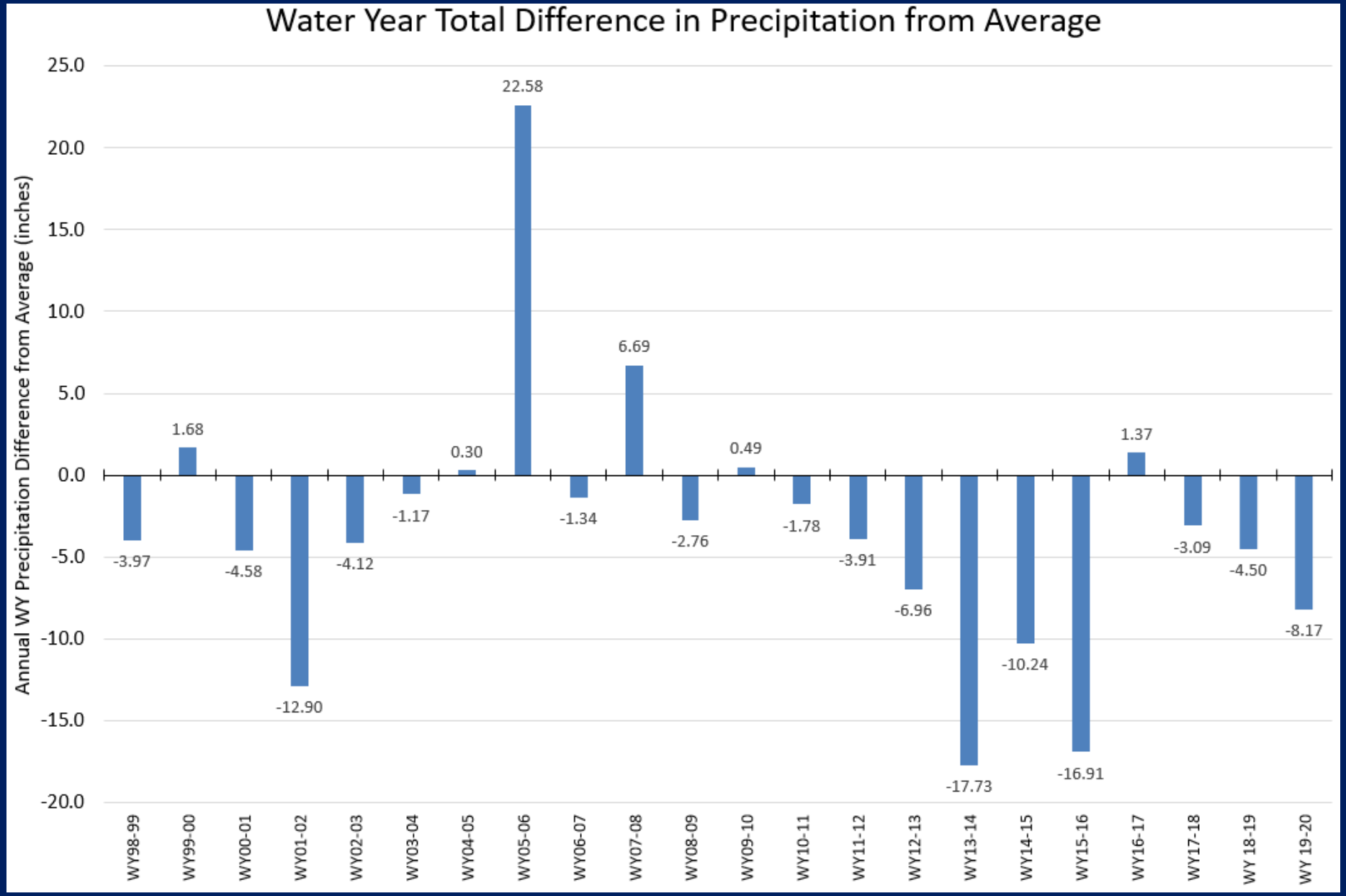
- November 1927
- March 1936
- September 1938
- May 2006
- April 2007

Bellamy Dam “Mother’s Day Flood” 2006

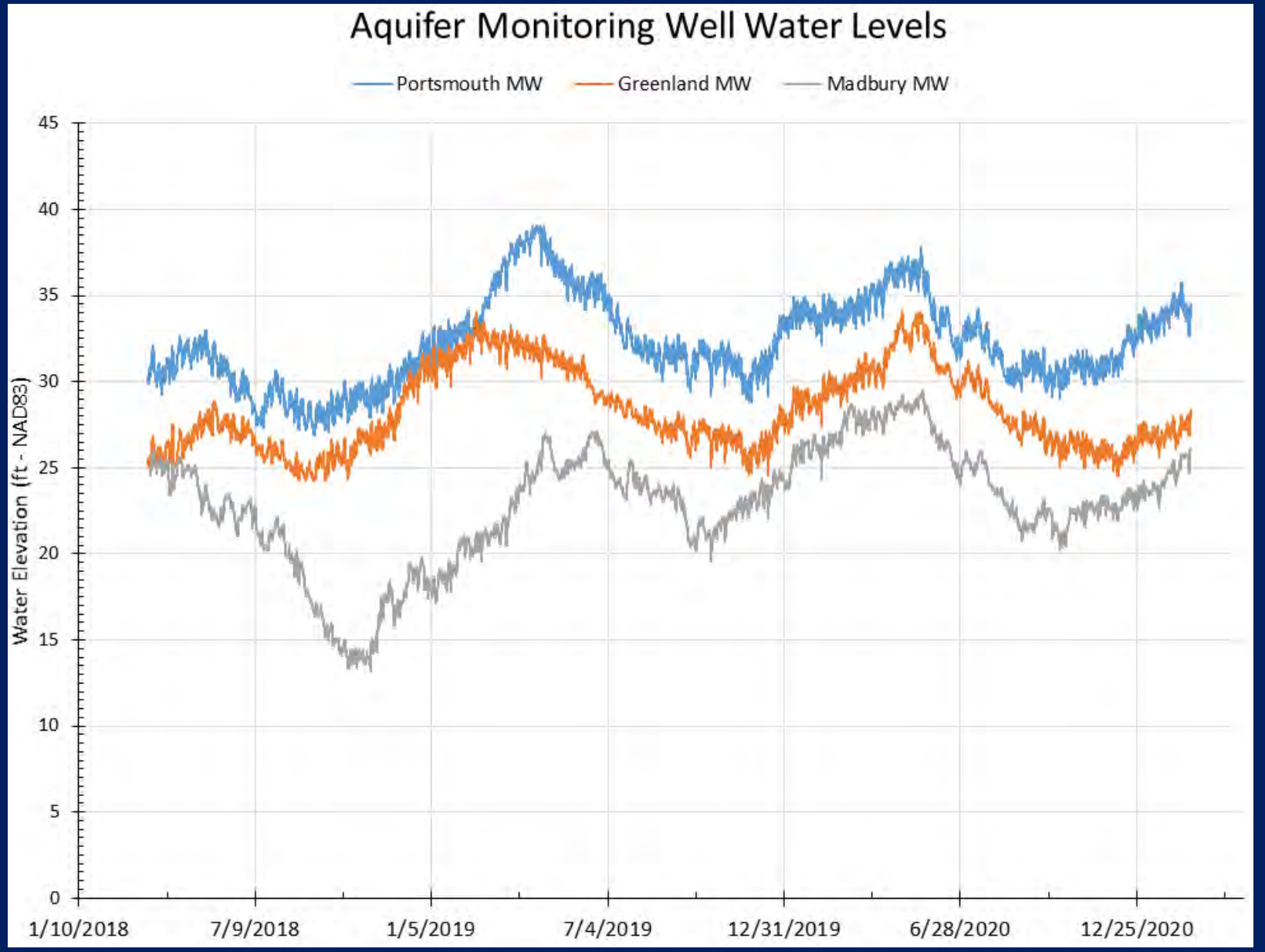
PRECIPITATION



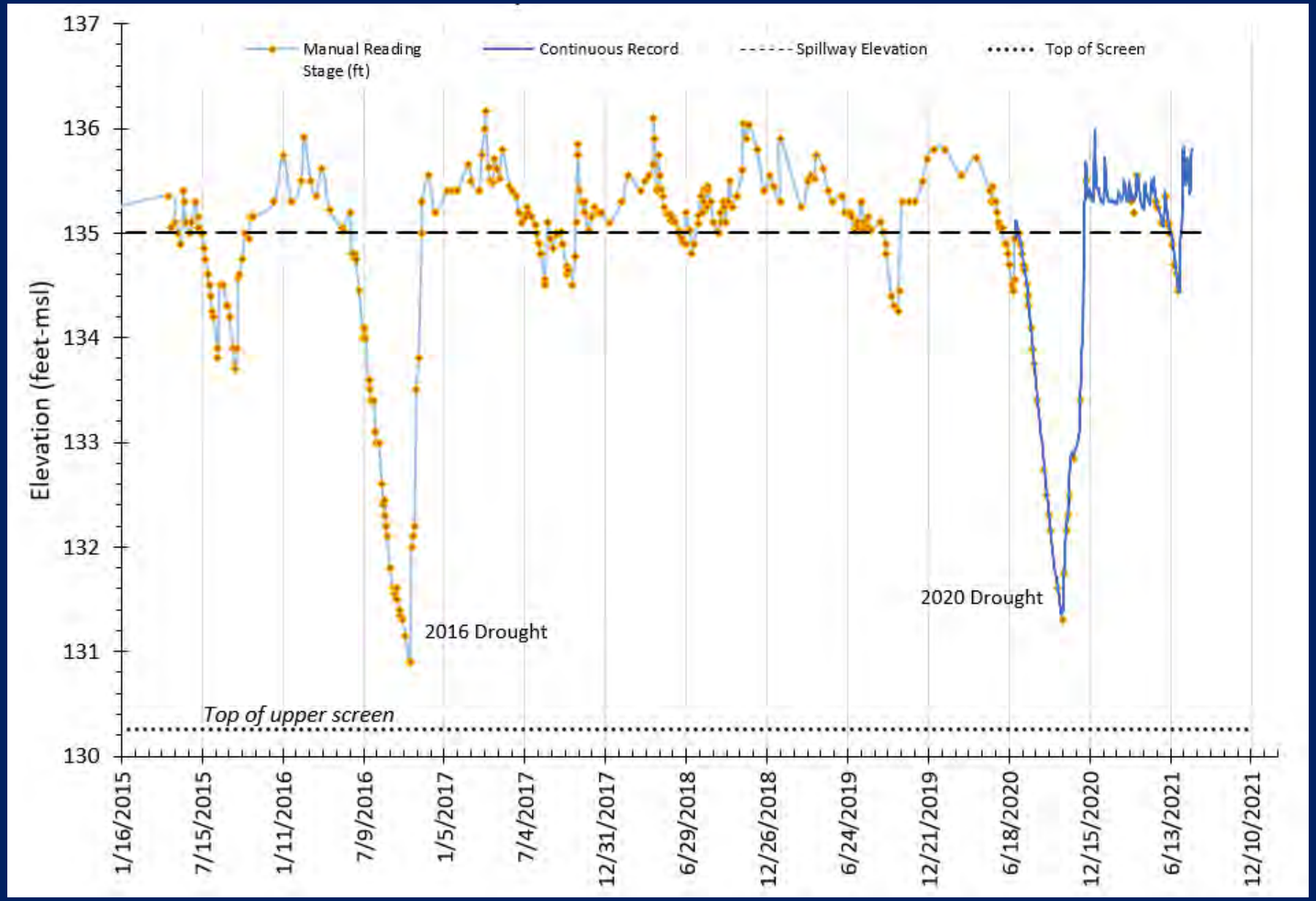
PRECIPITATION



GROUNDWATER LEVELS



BELLAMY RESERVOIR LEVEL

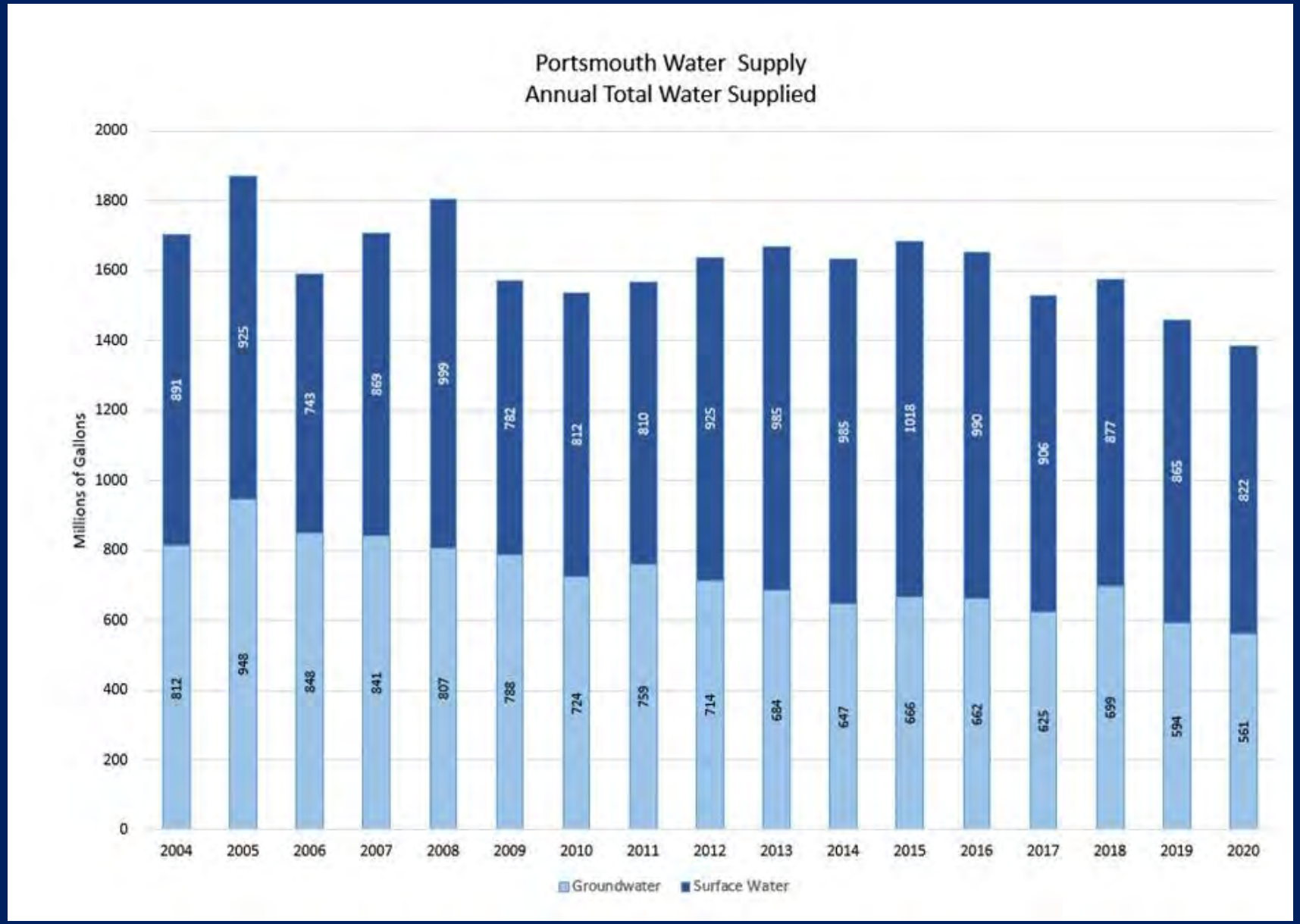


WATER SUPPLY SOURCES

Groundwater	% of System
Madbury Wells	11%
Portsmouth Well #1	8%
Collins Well	4%
Greenland Well	11%

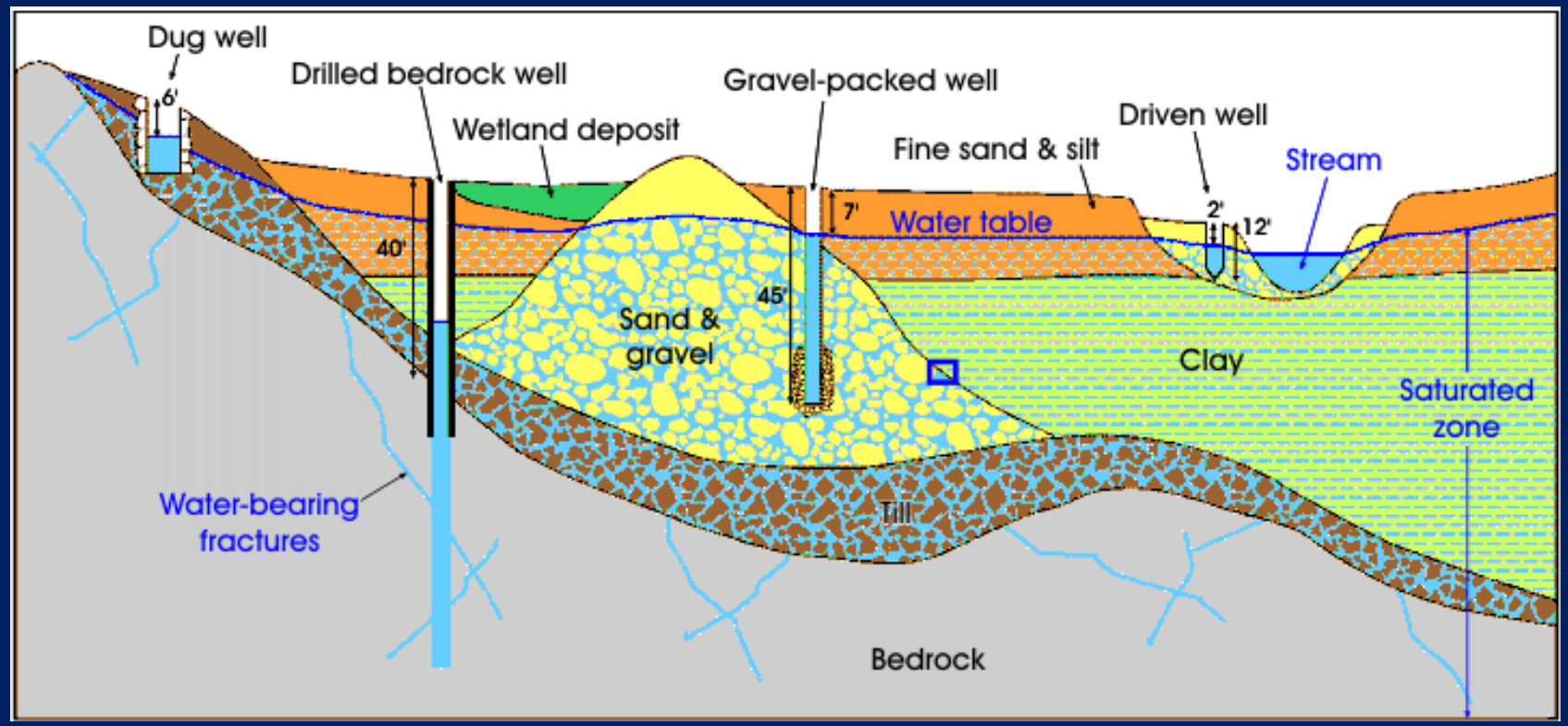
Surface Water	
Bellamy Reservoir	66%

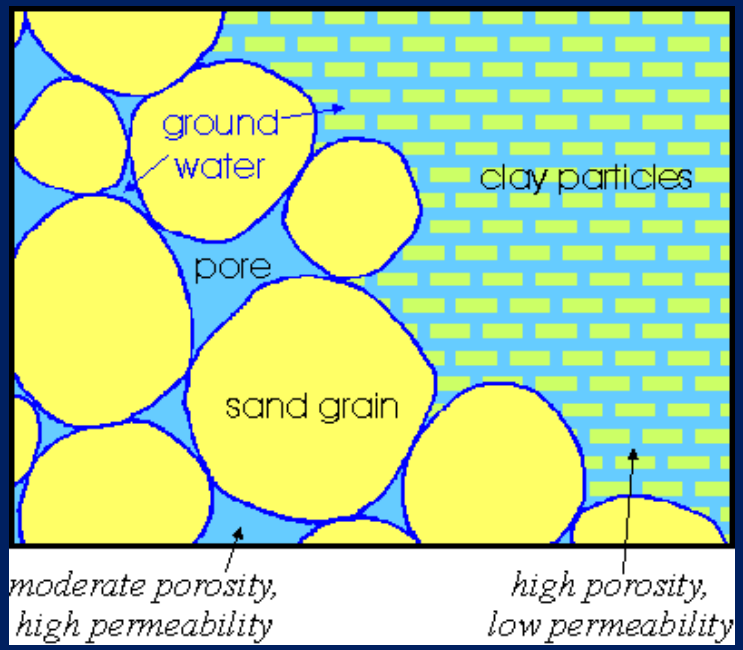
INTEGRATED MANAGEMENT



GROUNDWATER SUPPLY SOURCES

Sand & Gravel Wells vs. Bedrock Wells





Images from: Maine Department of Agriculture, Conservation & Forestry, 2005

GROUNDWATER SUPPLY SOURCES

POTENTIAL CLIMATE CHANGE IMPACT TO **WATER QUANTITY**

Aquifer Recharge

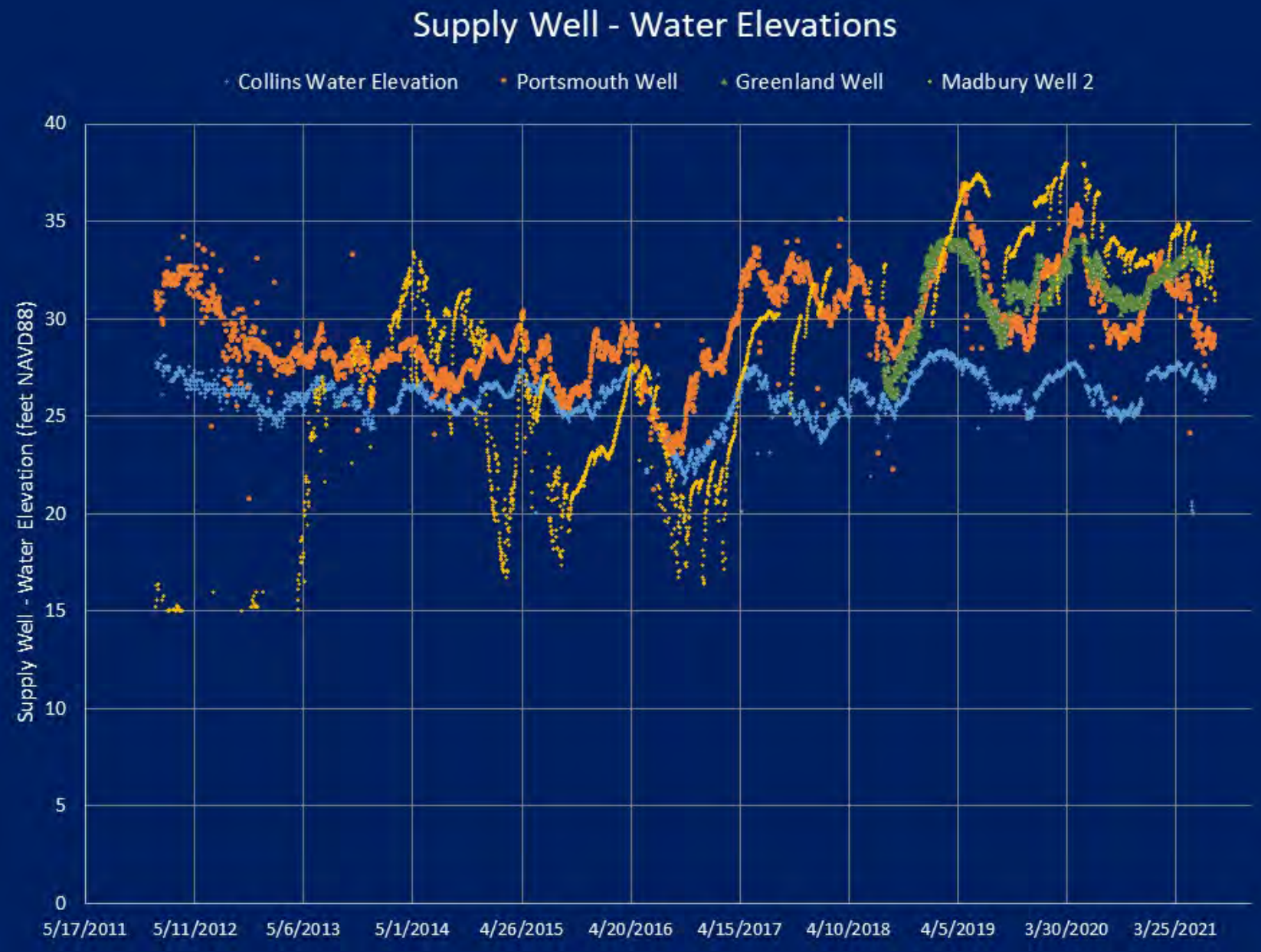
- Increase in Total Rainfall
  => *Potentially More Recharge*
- Increased Rainfall Intensity
  => *Potentially Less Recharge*
- Warmer Temperatures
  => *Shorter Frozen Period => Potentially More Recharge*
  => *Longer Growing Season => More Evapotrans. => Less Recharge*
  => *More Evaporation => Less Recharge*
  => *Less Snow => Potentially Less Recharge*

GROUNDWATER SUPPLY SOURCES

POTENTIAL CLIMATE CHANGE IMPACT TO **WATER QUALITY**

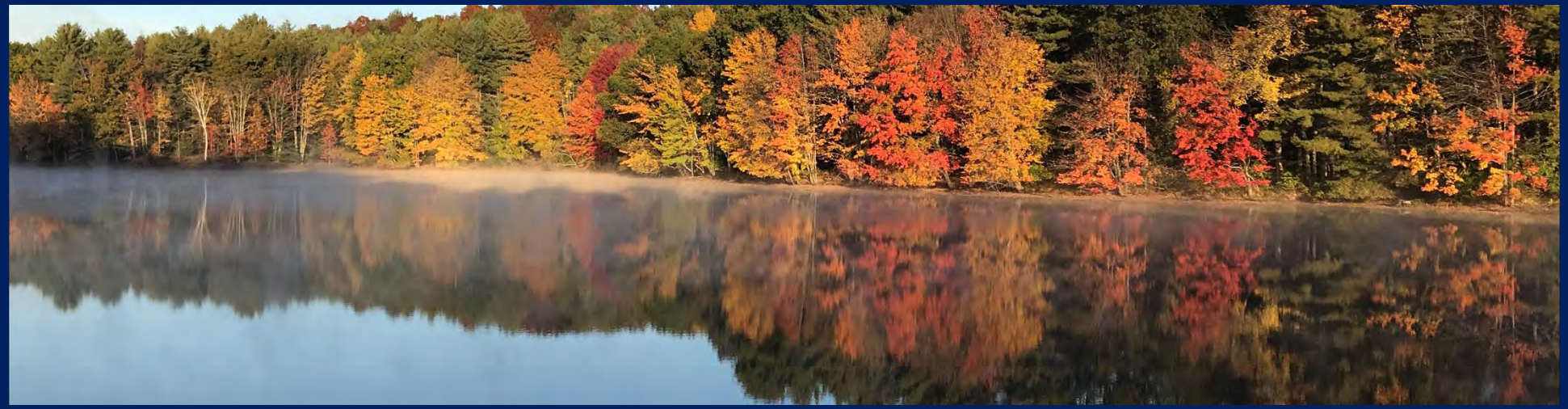
- Lower Groundwater Table
  => *Potential for Greater Zone of Influence*
- Warmer Temperatures
  => *Potential for More Ice Events => Potentially More Road Salt*
- Sea Level Rise & Storm Surge
  => *Potential for Salt Water Intrusion*

GROUNDWATER LEVELS

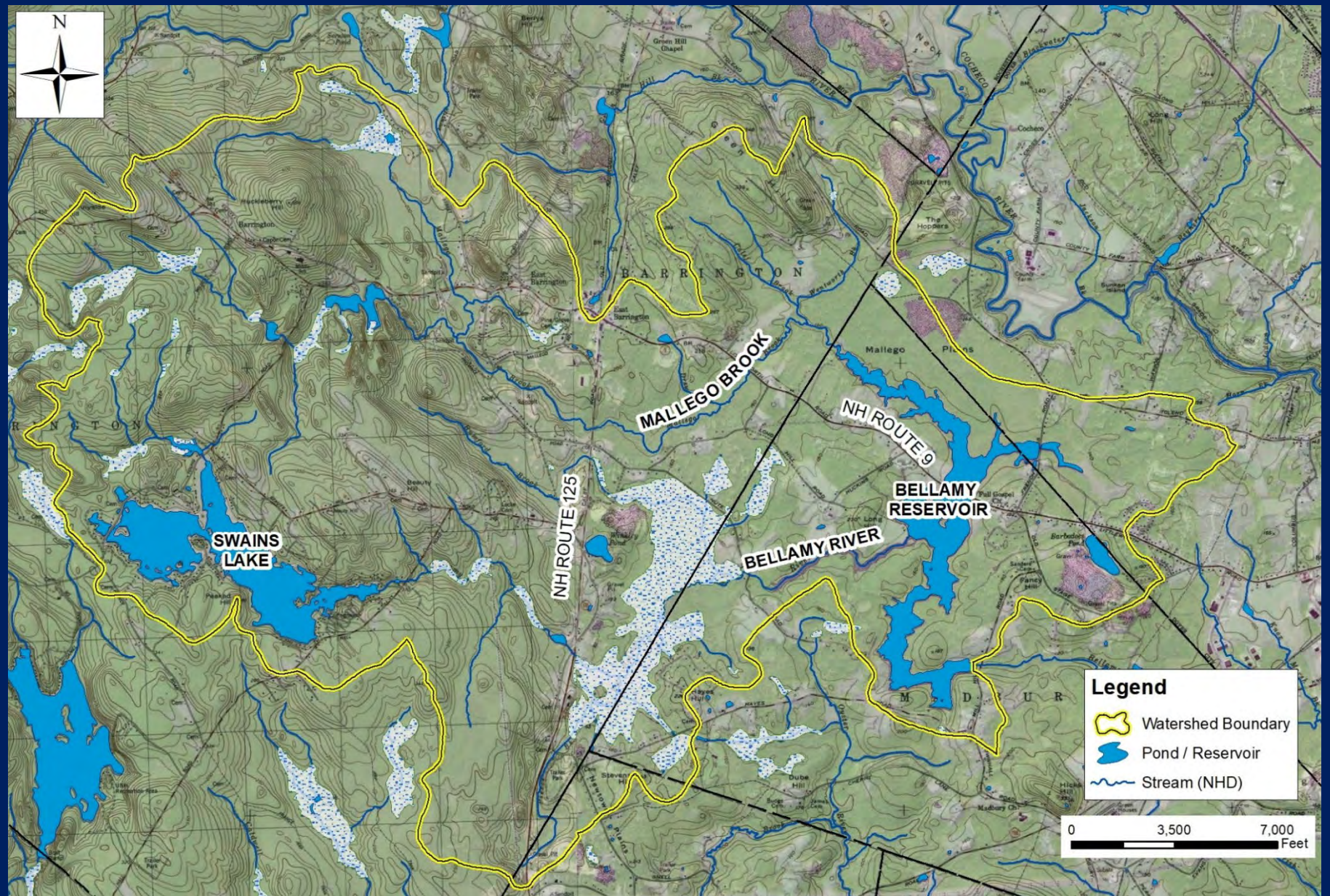


BELLAMY RESERVOIR STATS

- ~333 acre reservoir
- 22 square mile watershed
- Flushing rate = ~15 x/year
- ~773 million gallon full capacity
  = 309 day supply (average day demand)



BELLAMY RESERVOIR WATERSHED



SURFACE WATER SUPPLY SOURCE

POTENTIAL CLIMATE CHANGE IMPACT TO **WATER QUANTITY**

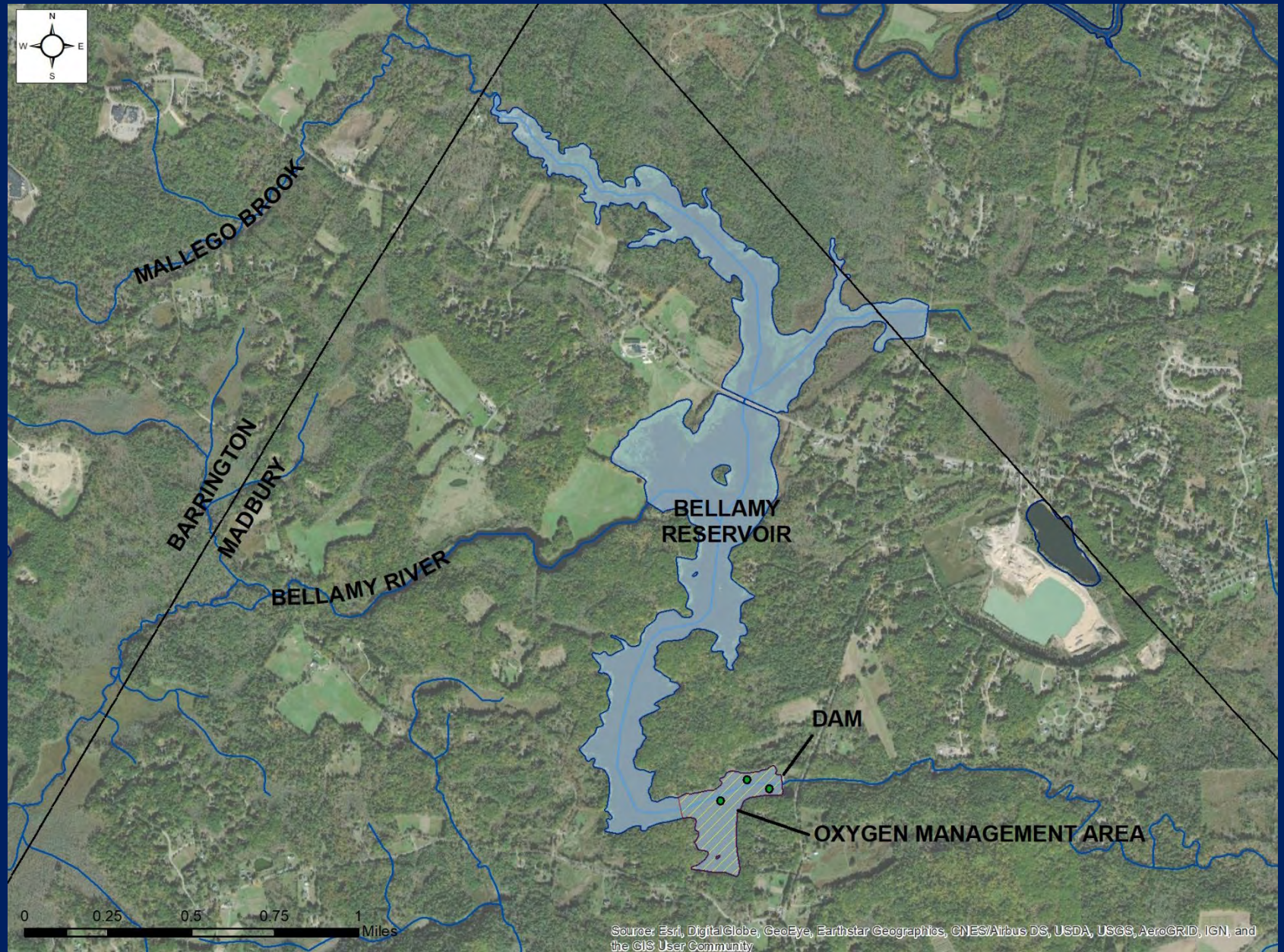
Reservoir Recharge

- Increase in Total Rainfall
  => *More Recharge*
- Extreme Weather
  => *Drought => Reduced Capacity*
- Warmer Temperatures
  => *Longer Growing Season => More Evapotrans. => Less Recharge*
  => *More Evaporation => Less Recharge*
  => *Less Snow => Potentially Less Recharge*

SURFACE WATER SUPPLY SOURCE

POTENTIAL CLIMATE CHANGE IMPACT TO **WATER QUALITY**

BELLAMY RESERVOIR



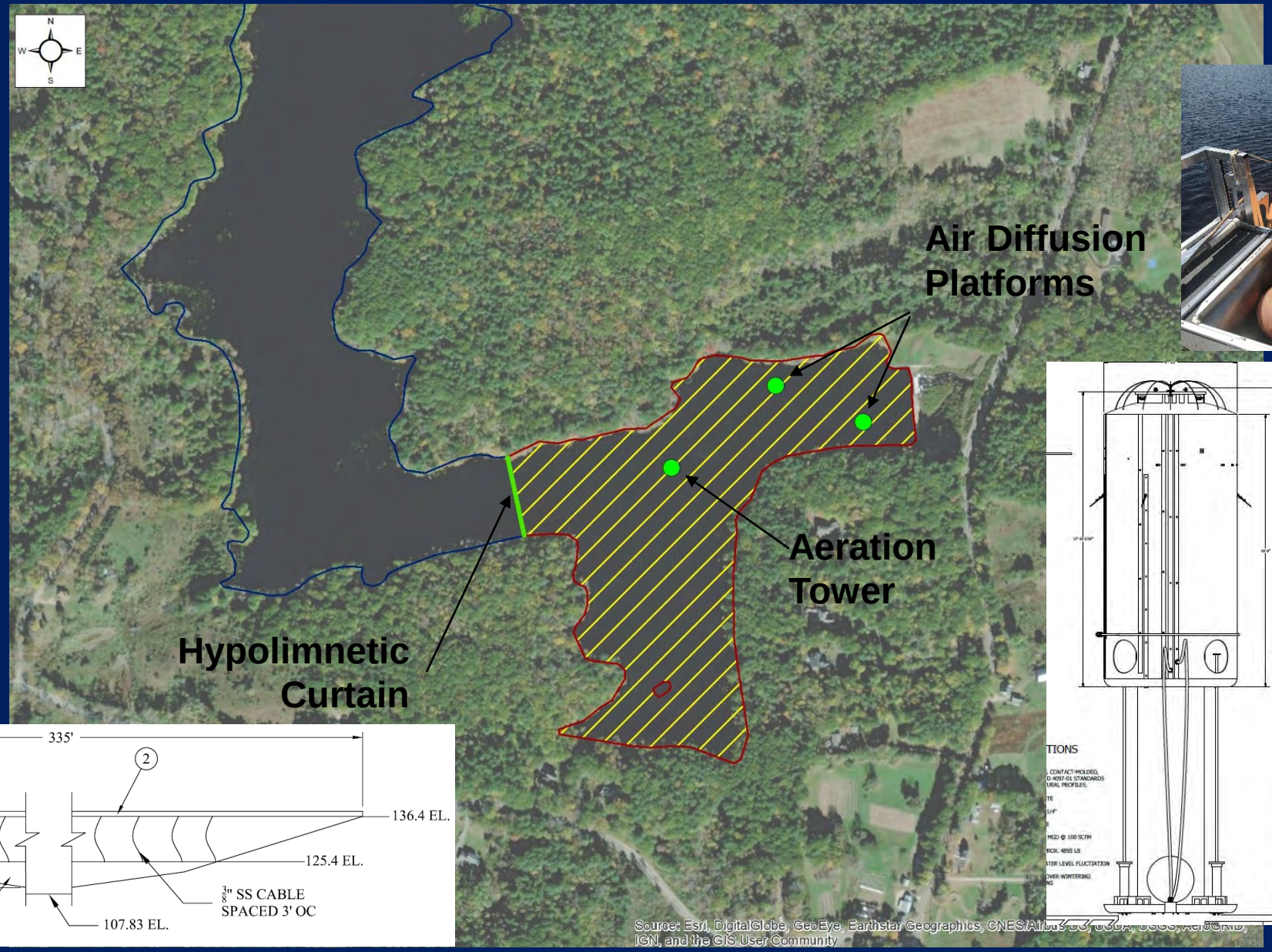
RESERVOIR DYNAMICS

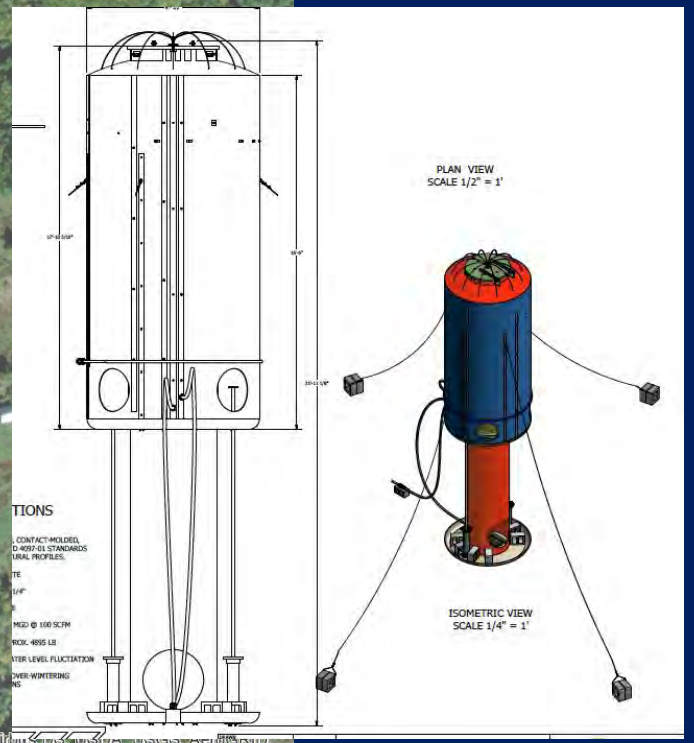
GROWTH => ORGANICS => TREATMENT PLANT LOAD

DECOMPOSITION => UPTAKE OF DISSOLVED OXYGEN IN HYPOLIMNION

ANAEROBIC CONDITIONS -> IRON, MANGANESE & PHOSPHORUS DISSOLUTION

BELLAMY RESERVOIR





SURFACE WATER SUPPLY SOURCE

POTENTIAL CLIMATE IMPACT TO **WATER QUALITY**

- Increase in Total Rainfall & Increased Storm Intensity
  - ⇒ *More Nutrients*
    - ⇒ *More Organics, Fe & Mn, and Less Dissolved Oxygen*
  - ⇒ *Higher Flushing Rate*
- Extreme Weather
  - => *Drought => More Manageable Oxygen*
  - => *Flooding => More Organics/ Runoff Load*
- Warmer Temperatures
  - => *More Algal Growth => More Organics*
  - => *Longer Period of Algal Growth*

OPERATIONAL CONCERNS

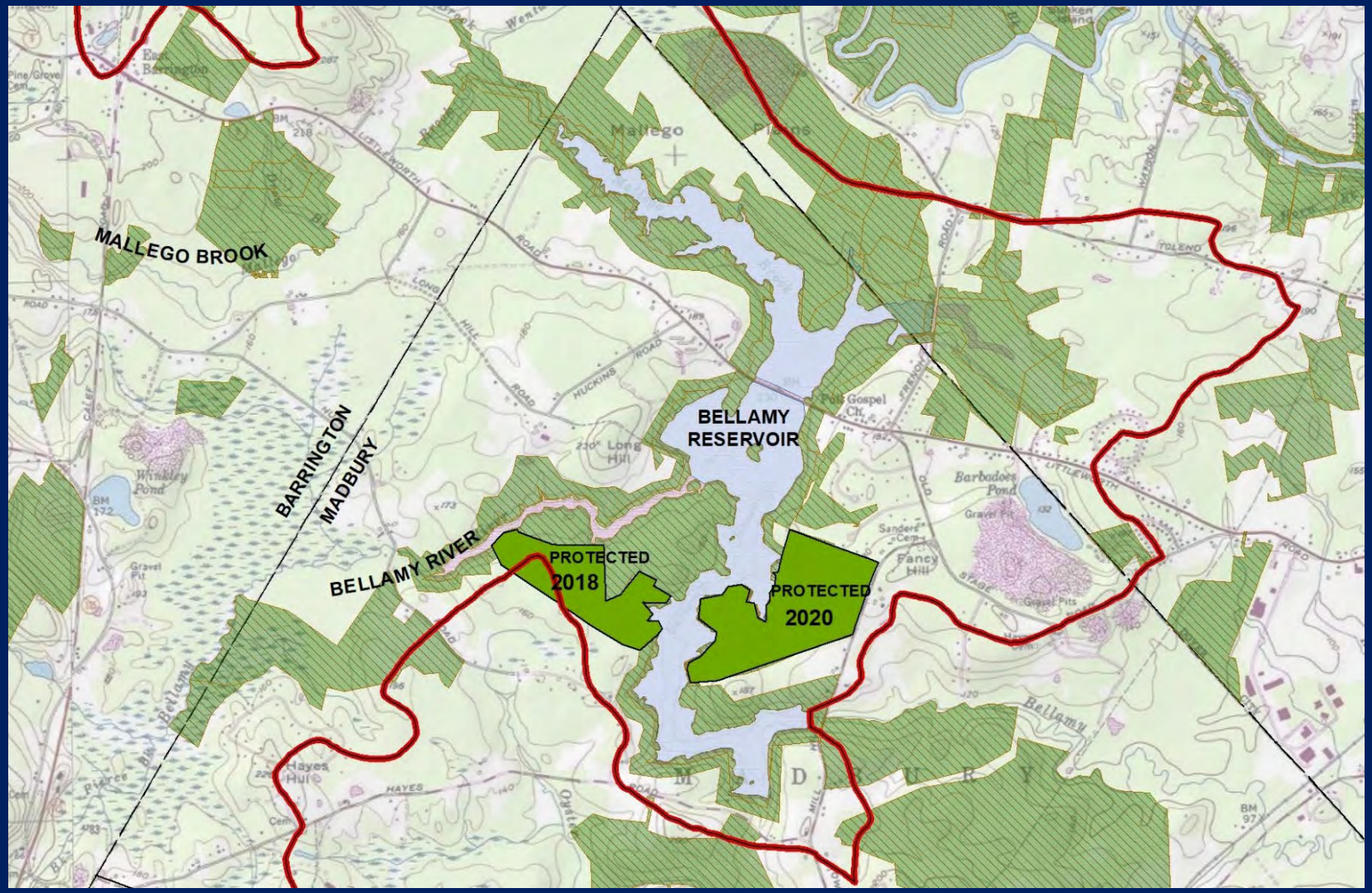
- Power Outages
- Transportation – Facility Access
- Treatment Chemical Supplies

ONGOING PROJECTS

- Groundwater Source Enhancement
  - Madbury Wells 4r and 5
  - Collins Well Improvement
- Water Treatment Facility Improvements
  - Backwash Tank & Wash-Water Recirculation System
- Surface Water Quality Management
  - Enhanced Mixing and Oxygen Input Systems
  - Watershed Management / Property Protection

SURFACE WATER SUPPLY SOURCE

Land Protection




QUESTIONS?