Merrymeeting Dams Investigation and Assessment

New Hampshire Department of Environmental Services

Background

- Establish current conditions of 3 dams that are on the Merrymeeting river
  - Merrymeeting Lake Dam
  - Jones Dam
  - Alton Power Dam
- Downing Pond considered in the analysis
  - Improvements not considered (not in scope)
- Performed to evaluate current compliance with NHDES dam safety requirements

Merrymeeting Lake Dam

- Owner/Operator:
  - NH Fish and Game Department
- Hazard Classification: High
  - Classification relates to the downstream impact of failure.
- Condition Rating: Poor (2019)
- Total Length: 285 ft
  - Spillway Length: 22 ft
- Maximum Height: 22 ft
- Purpose: Recreation
- Constructed in 1924
  - Reconstructed in 1969, and 1983

Jones Dam

- Owner/Operator:
  - NH Fish and Game Department
  - NHDES Dam Bureau
- Hazard Classification: High
- Condition: Poor (2021)
- Total Length: 210 ft
  - Spillway Length: 66 ft
- Maximum Height: 21 ft
- Purpose: Recreation
- Constructed in 1924
  - Reconstructed in 1986

Alton Power Dam

- Owner/Operator:
  - NH Fish and Game Department
- Hazard Classification: High
- Condition: Poor (2018)
- Total Length: 190 ft
  - Spillway length: 80 ft
- Maximum Height: 16 ft
- Purpose: Recreation
- Constructed in 1923
  - Reconstructed in 1986

Site Investigation

- Topographic Survey Performed by Doucet Survey
- 8 Borings performed by NEBC/HDR
  - 4 at Merrymeeting Lake Dam
  - 2 at Jones Dam
  - 2 at Alton Power Dam
- 4 Piezometers installed
  - 2 at Merrymeeting Lake Dam
  - 1 at Jones Dam
  - 1 at Alton Power Dam

Dam Safety Requirements

New Hampshire Department of Environmental Services Dam Bureau regulates the repair, reconstruction, maintenance and operation of existing dams.

All dam owners must comply with state regulations to ensure public safety.

Env-Wr 303.10 Discharge Capacity

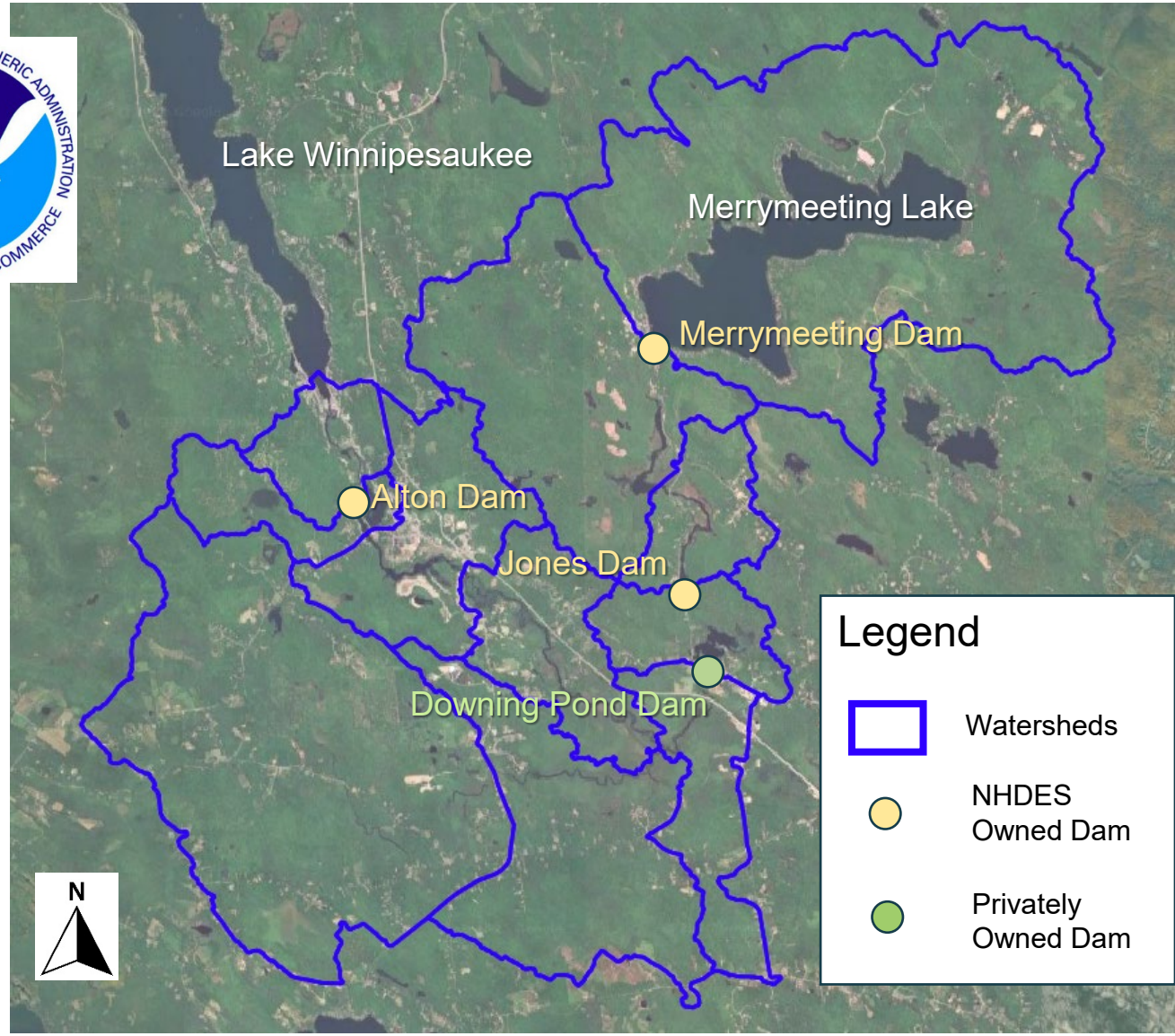
- All high hazard dams shall pass the 1,000-year design event with at least one foot of freeboard and without manual operations.

What is the “1,000-year design event”?

- The 1,000-year design event is the flood that has a has 0.1% percent chance of being equaled or exceeded in any given year.

How is the 1000-year design event determined?

- National Oceanic Atmospheric Administration (NOAA) provides rainfall estimates across the United States.
- At Merrymeeting Dam:
  - NOAA estimates the 1000-year event over 24-hours to be 10.90 inches of rain.
- This rainfall is then simulated in computer software across the watersheds to predict the discharge at each dam.



Hydrologic and Hydraulic Analyses Results

1000-Year Design Flood Results

Dam	Elevation When Water First Begins to Overtop	Predicted Maximum Water Surface Elevation Behind Dam	Overtopping Depth (feet)	Overtopping Duration (hours)
Merrymeeting Lake Dam	649.5	650.5	1.0	24.0
Jones Dam	588.5	587.2	1.3	9.0
Alton Power Dam	525.6	523.8	1.8	56.5

All dams overtop during the 1000-year event and do not meet NHDES requirements.

Preliminary Geotechnical and Structural Analysis

- Slope Stability Analysis
  - 3 analysis sections, 1 from each dam
    - Merrymeeting Embankment
    - Jones Dam Left Embankment
    - Alton Power Dam Left embankment

- Gravity Stability Analysis
  - 3 Analysis section
    - 1 on Alton Dam
    - 2 on Jones Dam
      - Spillway Crest
      - Right Abutment

Slope Stability Loading Condition	Required Minimum Factor of Safety	Slope to be Analyzed
End of Construction Condition	1.3	Upstream and Downstream
Sudden Drawdown from Spillway Crest or Top of Flashboards	1.2	Upstream
Steady Seepage with Maximum Storage Pool	1.5	Upstream and Downstream
Steady Seepage with Surcharge Pool	1.4	Downstream
Earthquake (pseudo static analysis)	> 1.0	Upstream and Downstream

Gravity Stability Loading Condition	Minimum Required F.S. (Cohesion)	Minimum Required F.S. (No Cohesion)
I - Usual	3.0	1.5
II - Unusual	2.0	1.5
IIA – Unusual (ice)	2.0	1.5
III - Post Earthquake	1.3	1.3

Preliminary Slope-Stability Analysis

- Guidance: NHDES/FERC Engineering Guidelines – Chapter 4

Loading Condition	Analysis	Calculated Factor of Safety		Minimum Factor of Safety	Slope to be Analyzed
		Upstream	Downstream		
Sudden Drawdown from Spillway Crest or Top of Flashboards	Merrymeeting		✓	1.2	Upstream
	Alton Power		✓		
	Jones		X		
Steady Seepage with Maximum Storage Pool	Merrymeeting	✓	✓	1.5	Upstream and Downstream
	Alton Power	✓	✓		
	Jones	X	X		
Steady Seepage with Surcharge Pool	Merrymeeting		✓	1.4	Downstream
	Alton Power		✓		
	Jones		X		
Earthquake (pseudo-static analysis)	Merrymeeting	✓	✓	> 1.0	Upstream and Downstream
	Alton Power	✓	✓		
	Jones	X	X		

"✓" = Meets Current Criteria "X" = Does Not Meet Minimum Criteria

Preliminary Gravity Stability Analysis

- Guidance: NHDES/FERC Engineering Guidelines – Chapter 3

Loading Condition	Analysis	Calculated Factor of Safety (No Cohesion)		Minimum Required Factor of Safety
		With Flashboard	No Flashboard	
Normal Operating Condition (Usual)	Jones Spillway	X	✓	1.5
	Jones Right Abutment	✓	✓	
	Alton Power Spillway	X		
IDF (Unusual)	Jones Spillway	X	X	1.3
	Jones Right Abutment	✓	✓	
	Alton Power Spillway	X		
Normal Operating + Ice (Unusual)	Jones Spillway	X	X	1.5
	Jones Right Abutment	✓	✓	
	Alton Power Spillway	X		
Post Seismic	Jones Spillway	X	✓	1.3
	Jones Right Abutment	✓	✓	
	Alton Power Spillway	X		

"✓" = Meets Current Criteria "X" = Does Not Meet Minimum Criteria

Preliminary Investigation and Assessment Results

Dam Name	H&H	Slope Stability	Gravity Stability
Merrymeeting Lake Dam	X	✓	N/A
Jones Dam	X	X	X*
Alton Power Dam	X	✓	X
* Jones Dam fails gravity stability requirements when the flashboards are added to the analysis			

"✓" = Meets Current Criteria "X" = Does Not Meet Minimum Criteria

Next Steps

- Dams do not meet current dam safety criteria
- Evaluation of options to address deficiencies
  - Remediate Dams
  - Remove Dam(s) (Jones and Alton)

NH Department of Environmental Services

Questions?

Thank you!