Lake Level Management: A Balancing Act

2024 Lakes Congress – June 6, 2024

Corey Clark – NHDES Dam Bureau
Chief Engineer

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Dam Bureau Overview

Dam Safety and Inspection Section

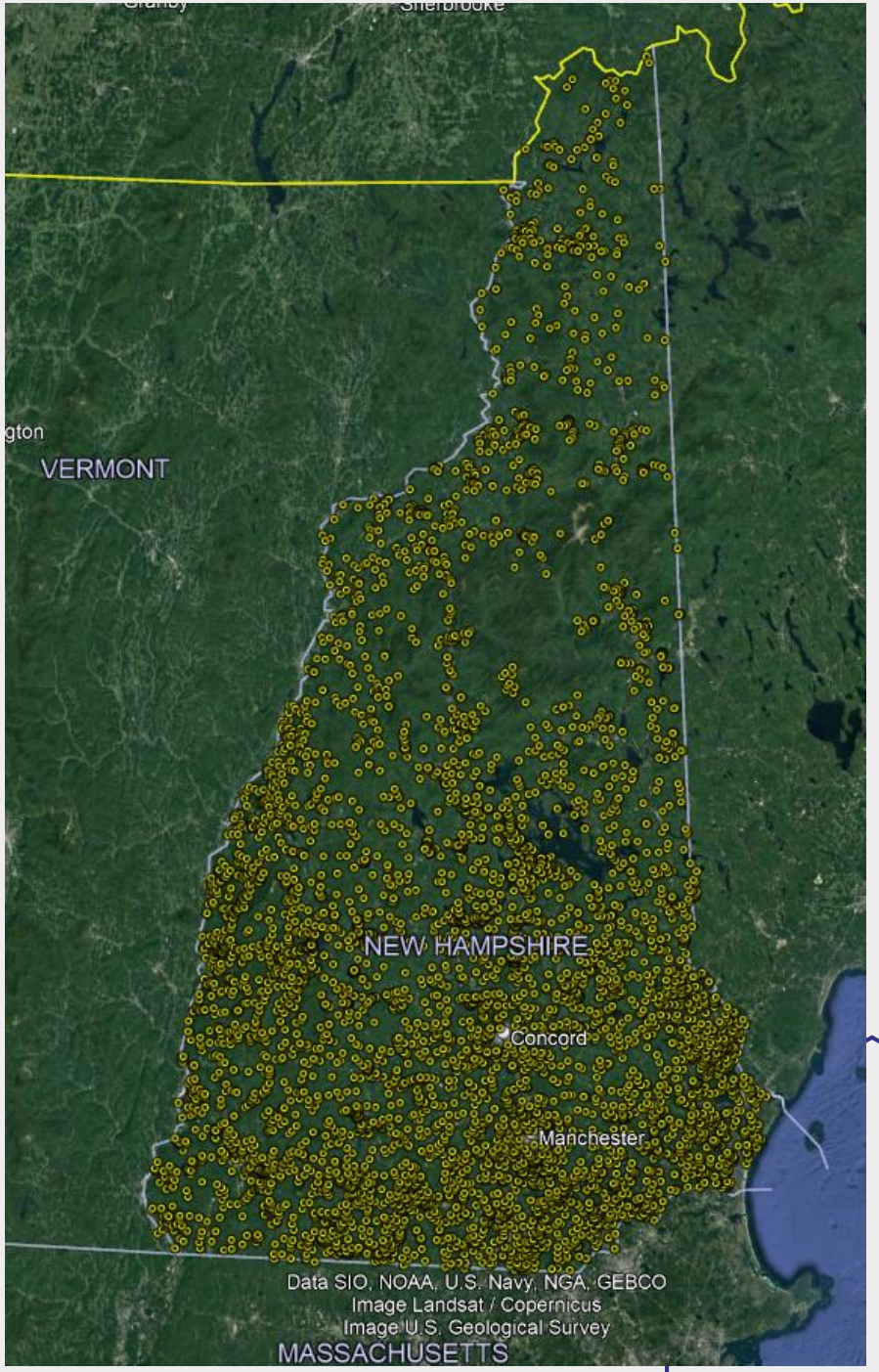
Operations and Maintenance Section

Engineering and Construction Section

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Dam Safety and Inspection Section

- Responsible for inspection of **over 2,600** privately and publicly owned dams. This includes routine inspections and construction inspections.
- Responsible for permitting of repairs on existing dams and permitting for new dam construction.



NEW HAMPSHIRE DEPARTMENT OF Environmental Services

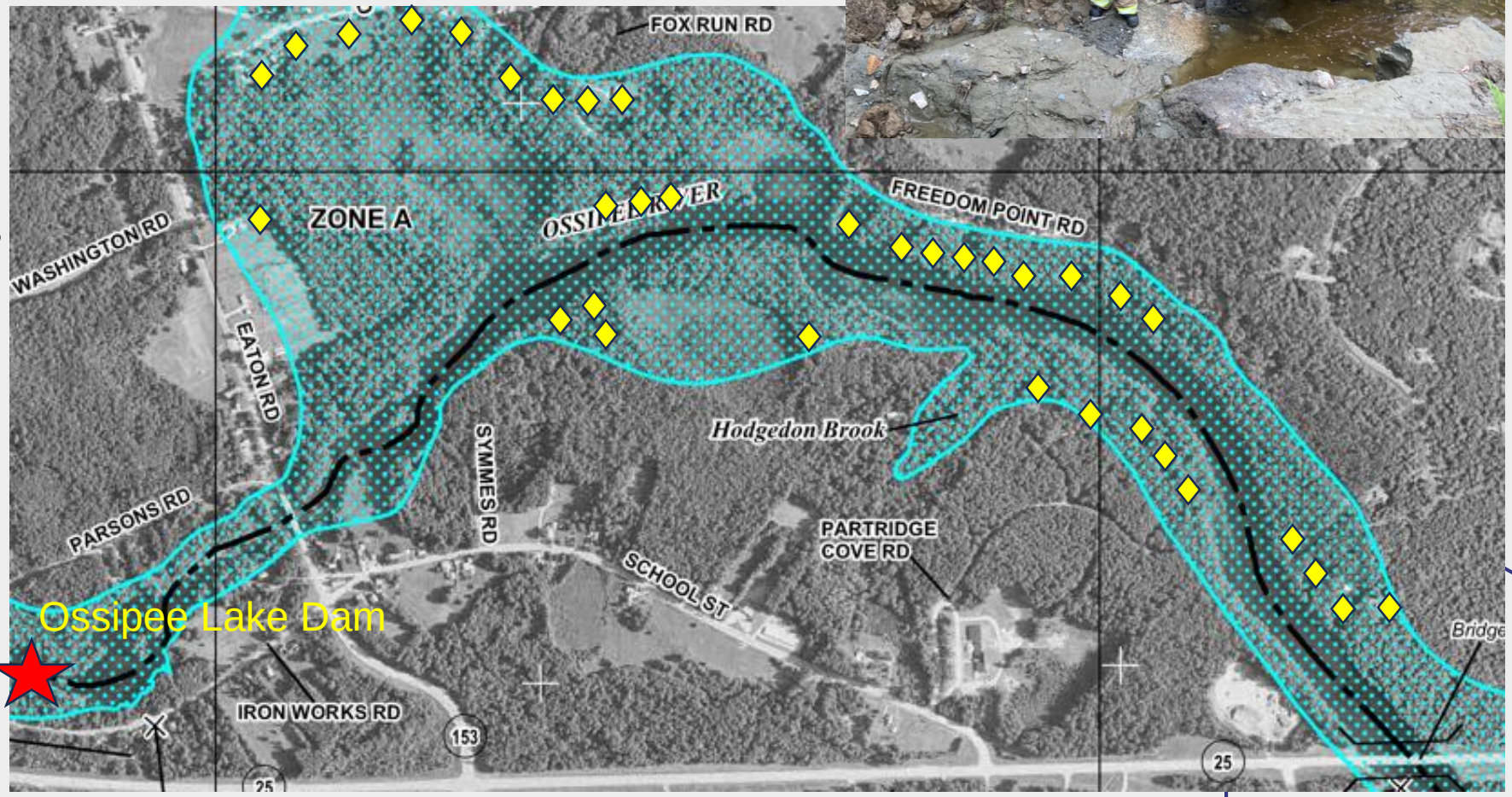
Dam Safety and Inspection Section

- Works with dam owners to ensure dams are operated and maintained in proper working order and works with AG's office on enforcement actions
- Coordinates with Federal Energy Regulatory Commission (FERC) on hydropower inspections and projects

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Dam Safety and Inspection Section

- Works directly with NH Homeland Security and Emergency Management on dam related emergency response
- Responds to public inquiries into flood related issues and dam failure incidents
- Reviews hazard classification and emergency action plans



NEW HAMPSHIRE DEPARTMENT OF Environmental Services

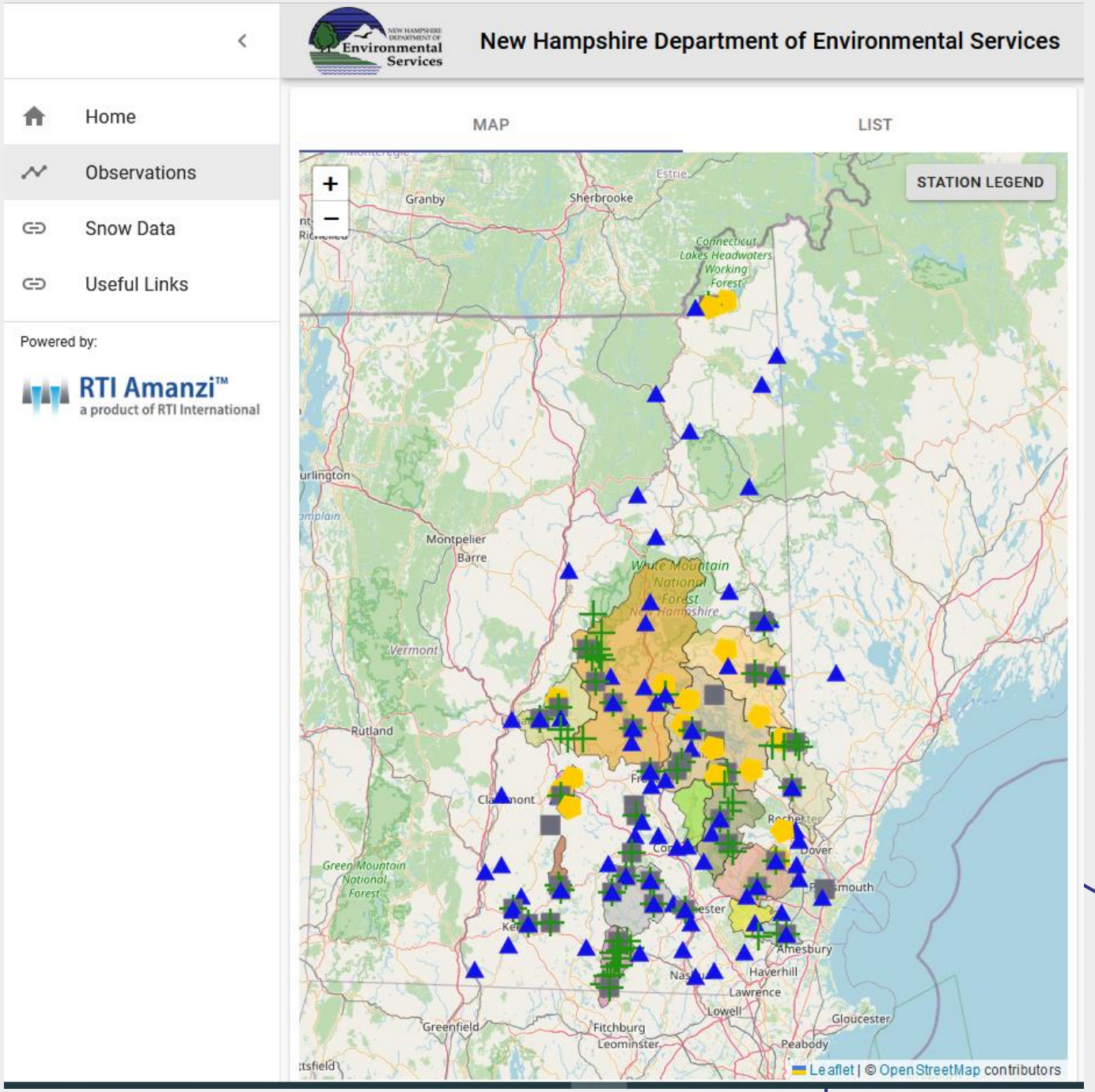
Operations and Maintenance Section

- Responsible for the operations and maintenance of **208 dams**.
- Responsible for maintaining dams and lake levels at the State's largest lakes (i.e., Lake Winnipesaukee, Lake Winnisquam, Squam Lake, Newfound Lake, Lake Sunapee, and Lake Ossipee)

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Operations and Maintenance Section

- Provides real time lake level, temperature, precipitation and discharge data at 23 lakes in NH through the https://nhdes.rtiamanzi.org/ web platform.



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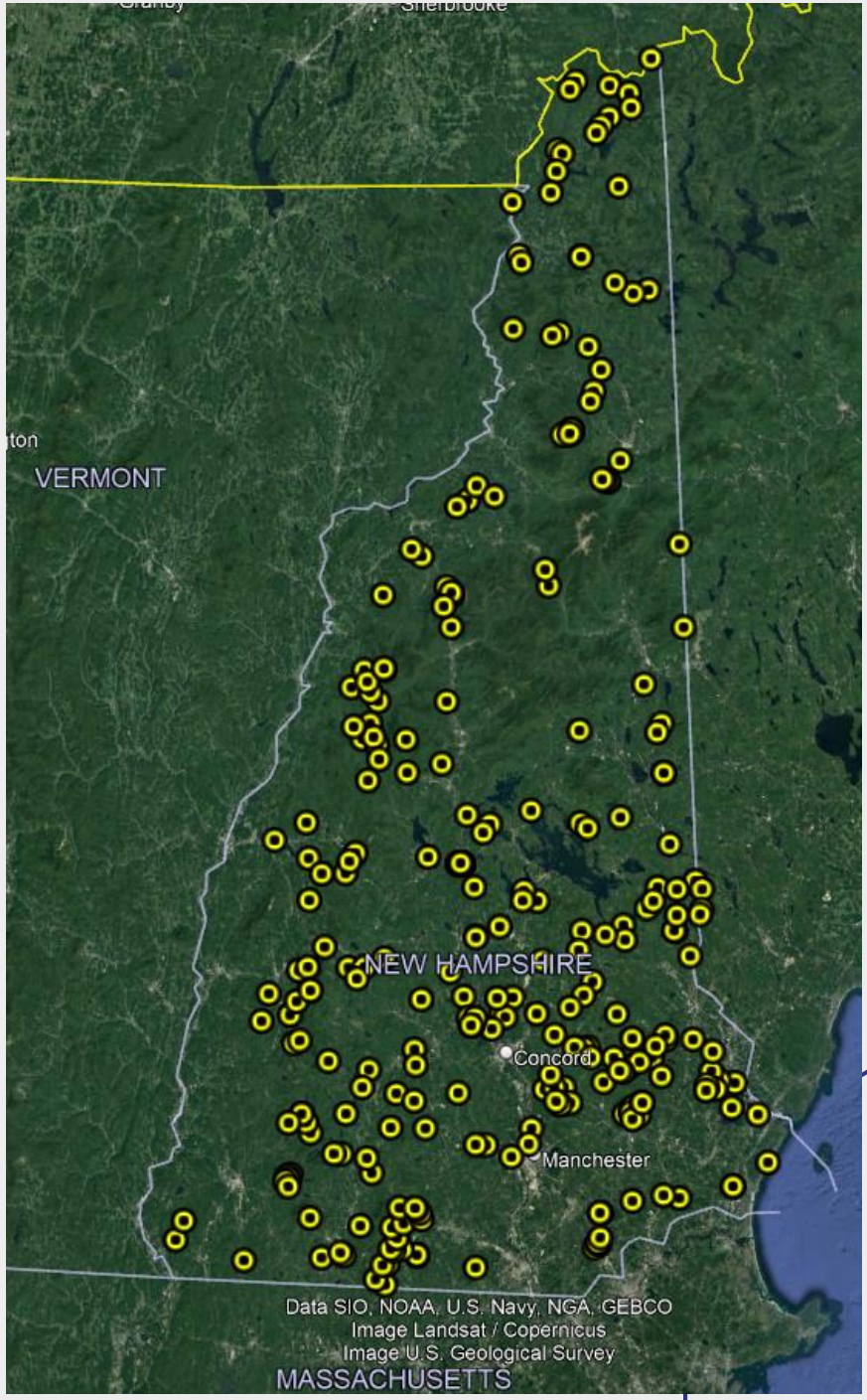
Operations and Maintenance Section

- Manages 9 leases and 26 water user agreements with hydropower developers for the use of State-owned facilities for hydropower and water usage

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Engineering and Construction Section

- Responsible for major repairs and reconstruction of **273 dams**. This includes preparing and managing contacts, budget estimates and long-term schedules.
- Maintains ownership records and easements necessary for dam operations and repairs through the Land Management group.



NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Engineering and Construction Section

- Oversees an in-house construction crew and design team for the repair and reconstruction of State-owned dams.
- Coordinates contracts with outside engineering firms and consultants on dam rehabilitation projects

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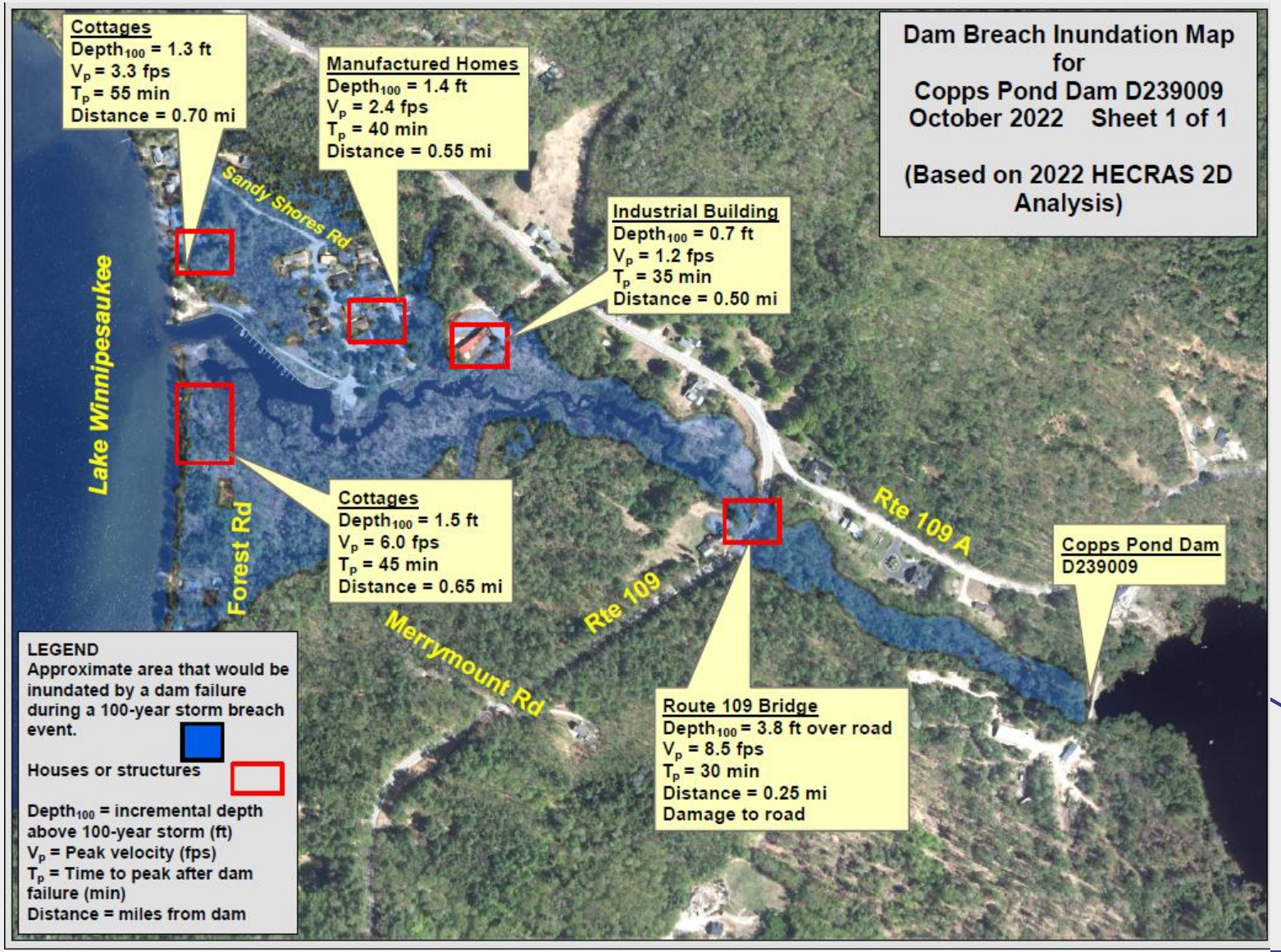
Engineering and Construction Section

- Prepares notification flow charts, emergency response procedures and inundation maps for Emergency Action Plans (EAP)s at 64 High and 34 Significant hazard dams.
- Reviews and updates plans in accordance with regulatory requirements



NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Balancing Lake Ossipee

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Ossipee Lake - Layout

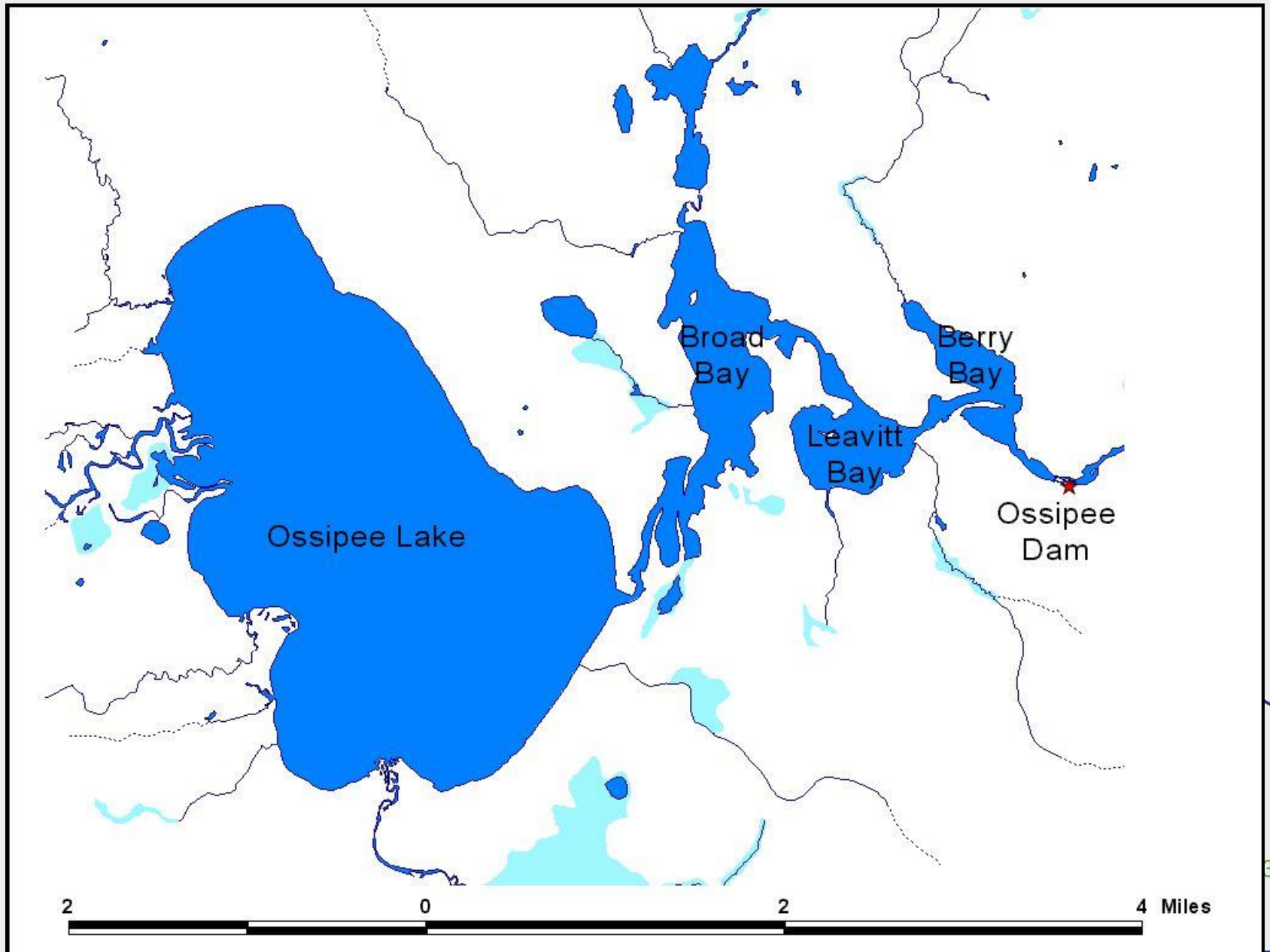
Ossipee Lake
- 3,200 acres

Broad Bay
- 385 acres

Leavitt Bay
- 255 acres

Berry Bay
- 255 acres

Total =4,095 acres



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Ossipee Lake Dam

- Lake level controlled by 2 adjacent dams
- Both dams work simultaneously to control flow out of the lake.

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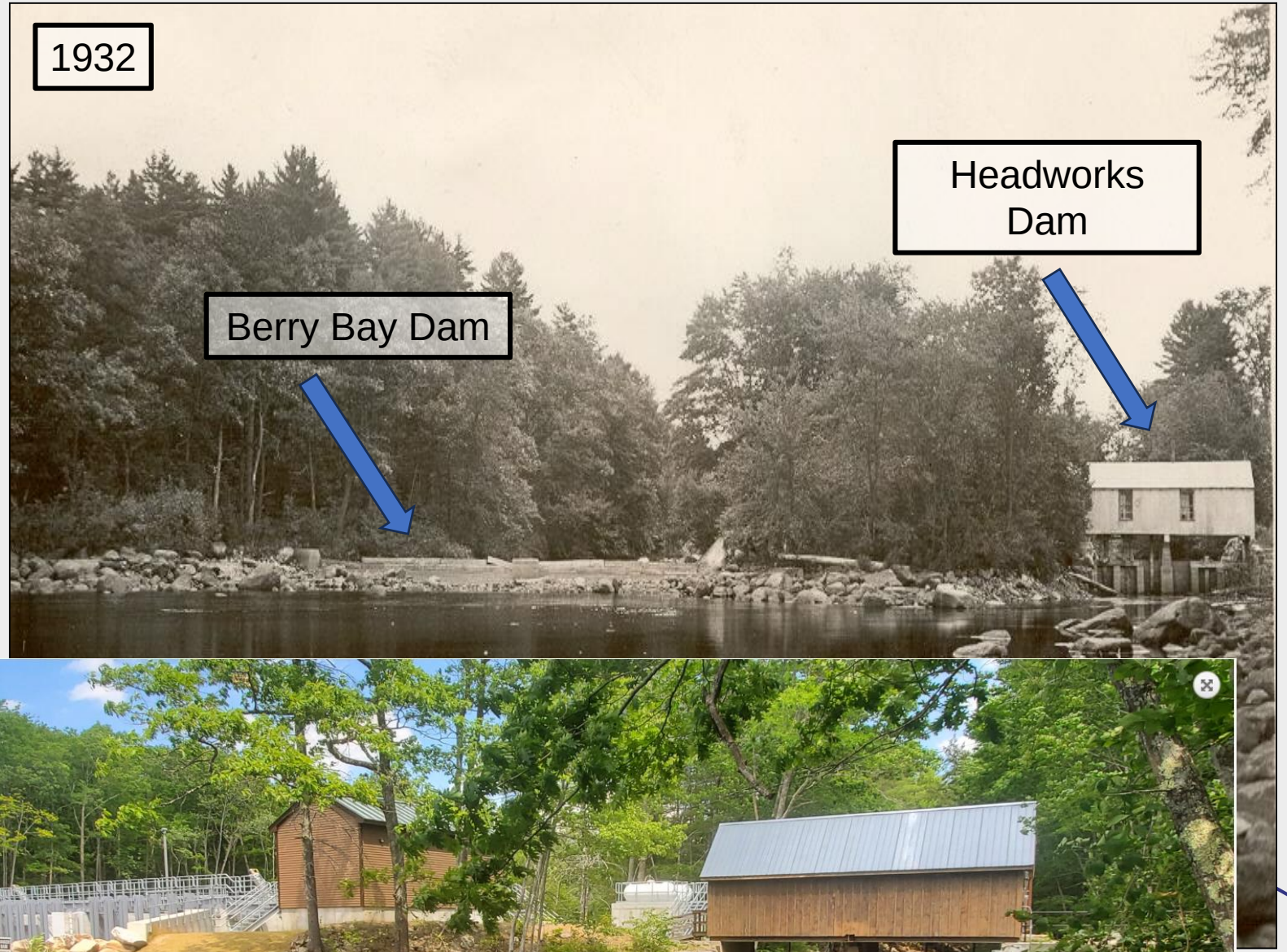
Ossipee Lake Dam

- 1790 - Iron Works
- 1875 - Wood and stone dam
- 1919 – Dam reconstructed
- 1944 – Dam reconstructed
- 1992 – Ownership transferred to NHDES
- 2020 – NHDES reconstructs Berry Bay Dam



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Ossipee Lake Operations

SUMMER (to the extent possible)

- Maintain Ossipee Lake at elevation 407.25ft for the summer recreational season

COLUMBUS DAY through Winter

- Start lowering gates to achieve full opening before ice formation
- Typical winter level is around 405 with gates fully open
- Close gates after spring runoff.

1938 agreement : water should not be below 405 (btwn 405 & 407) from July 1st – Sept 15th

Sept 1981 O&M plan – summer water level is generally maintained at 407.5+-1'

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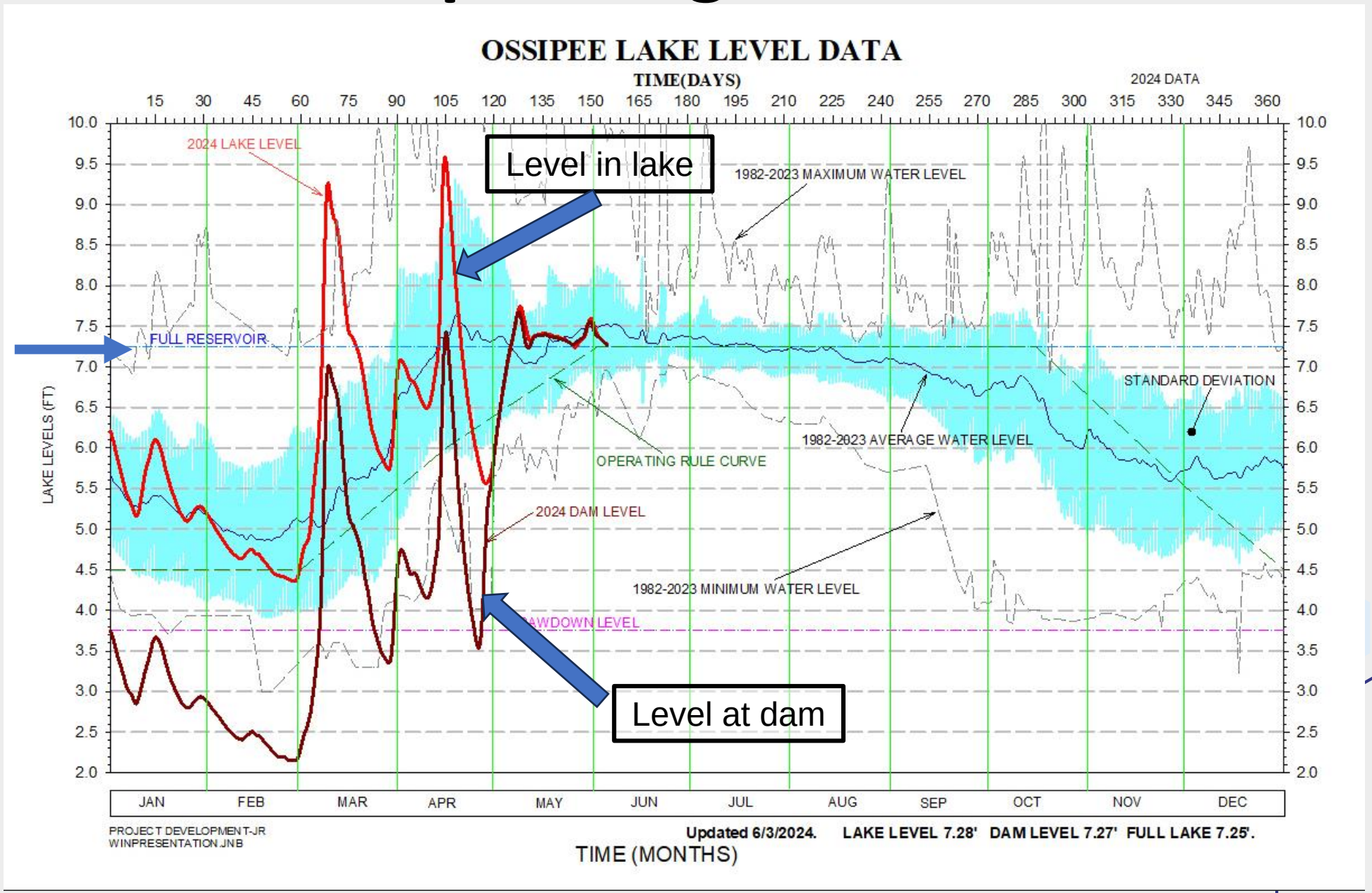
Ossipee Lake Dam Operating Curve

407.25



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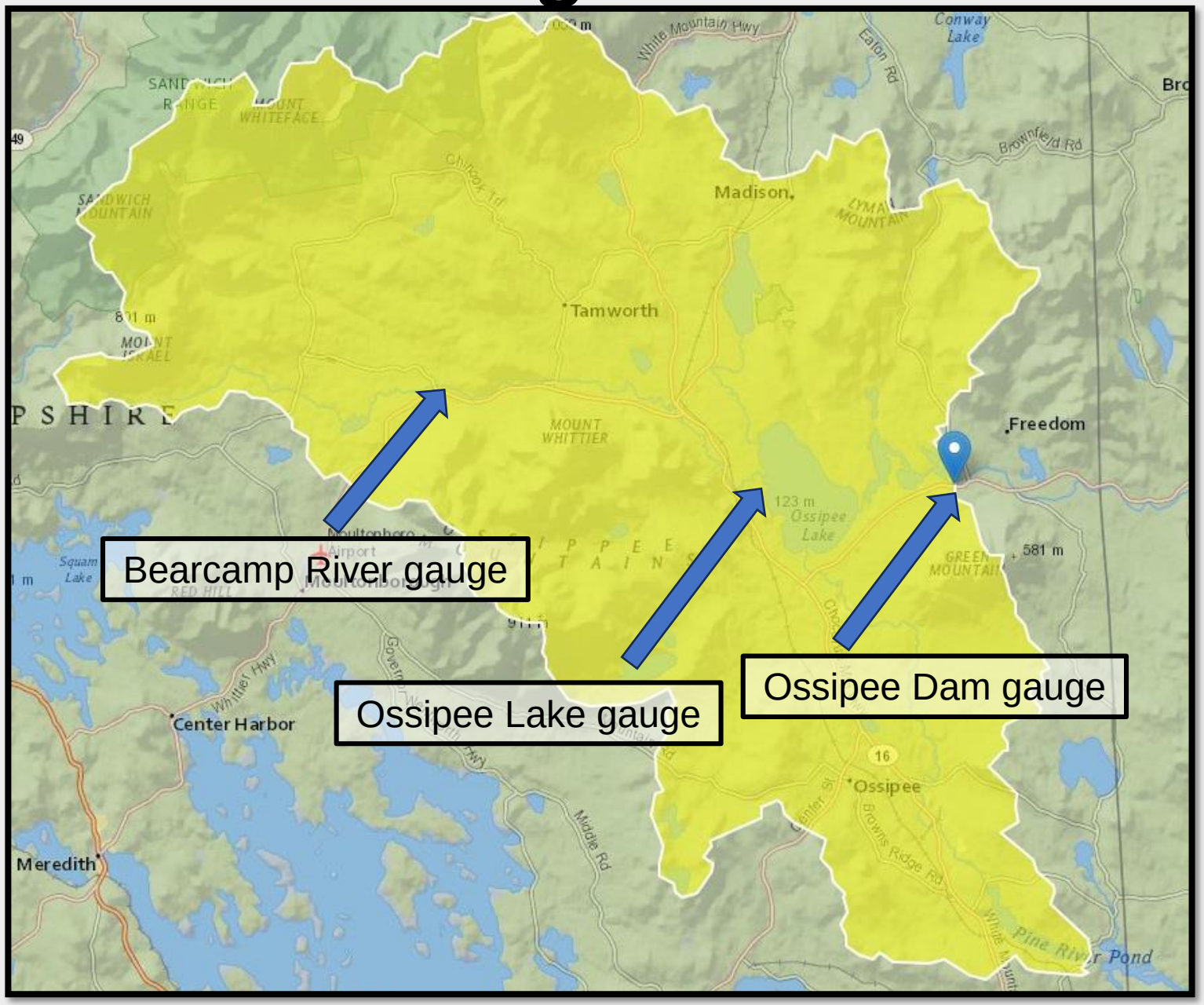
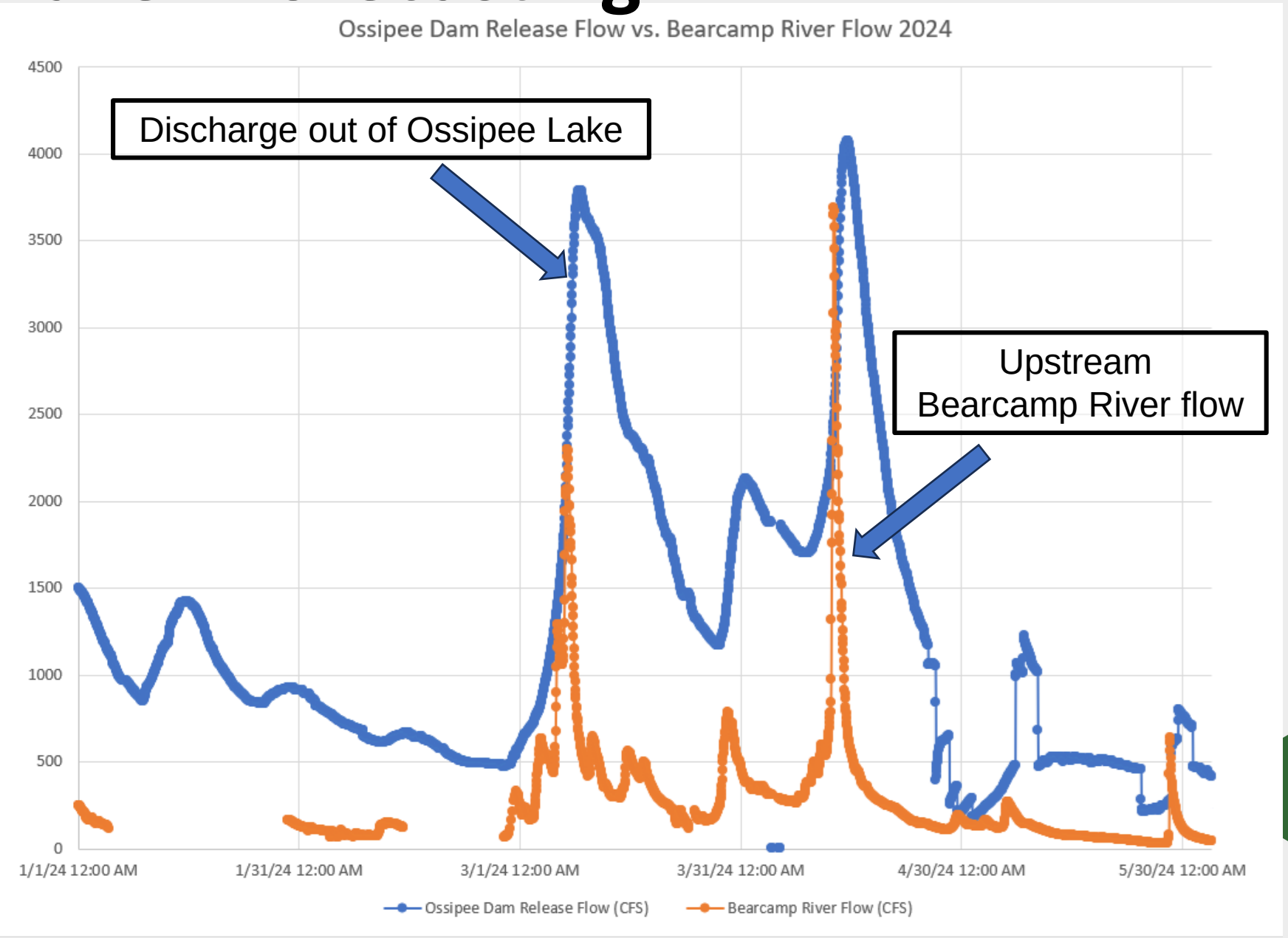
Ossipee Lake - Forecasting



NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Ossipee Lake - Forecasting



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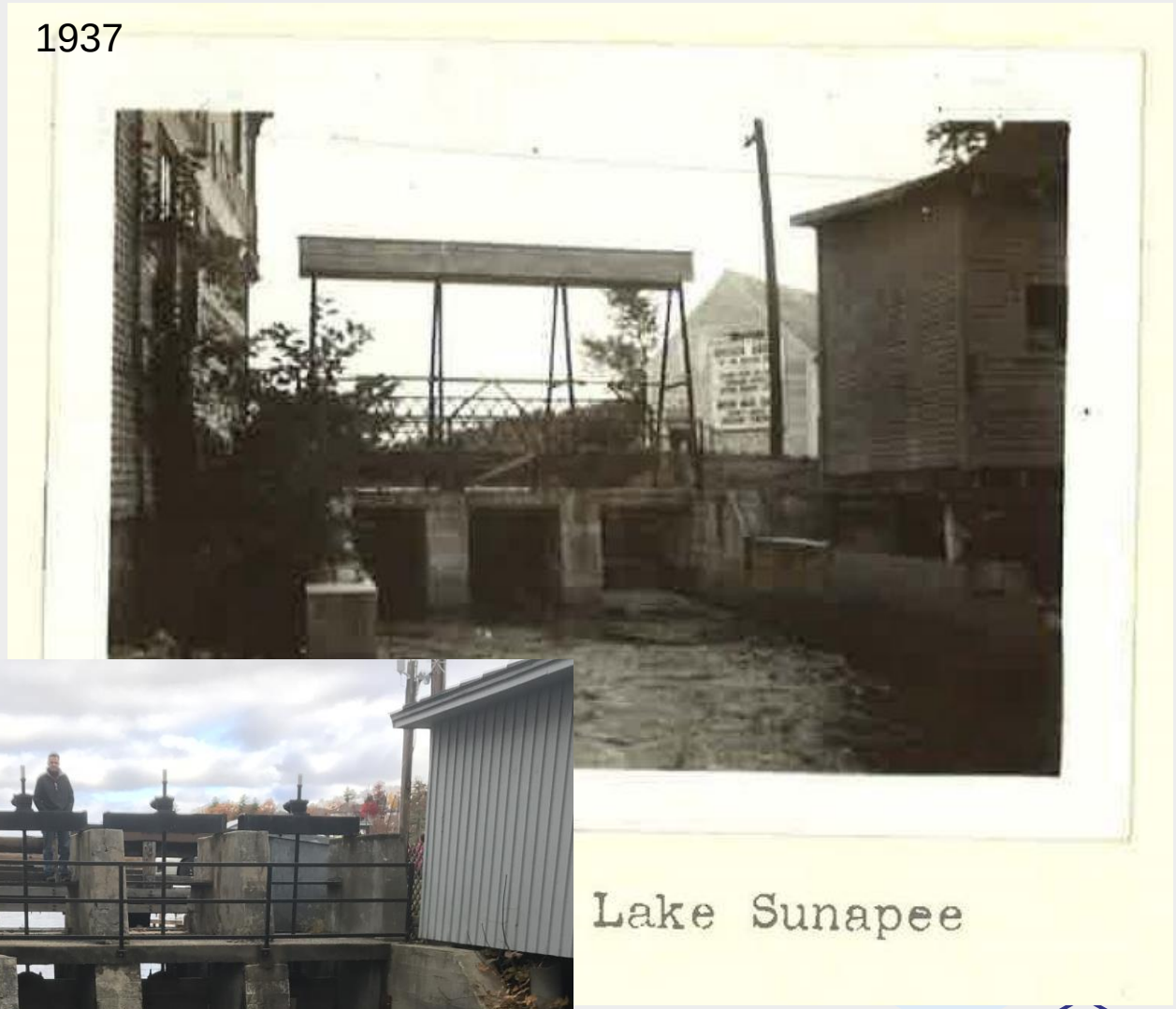
Balancing Lake Sunapee

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Lake Sunapee Dam

- Constructed in 1872
- Regulating flow into the Sugar River for mill use
- Outlet of Lake Sunapee deepened to allow for more drawdown than naturally possible
- Acquired by the State of NH in 1961 from the Sunapee Dam Corporation



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Lake Sunapee Dam

- Operations are conducted by manipulating three 10ftx5ft wooden gates in the dam.

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Lake Sunapee Operations

- Normal summer discharge 7 to 40cfs.
- Columbus Day begin drawdown to 8ft by March, using flows between 80-150 cfs.
- During spring refill keep below 9.5ft to ice out in mid April, and then fill to 10.5ft by June 1st.

1904 agreement - Maintain Lake Sunapee between 11.5ft and 8.5ft

1981 Plan - fill not higher than 11.0ft on the gauge by June 1st and discharge 40 cfs from June 1st through Labor Day.

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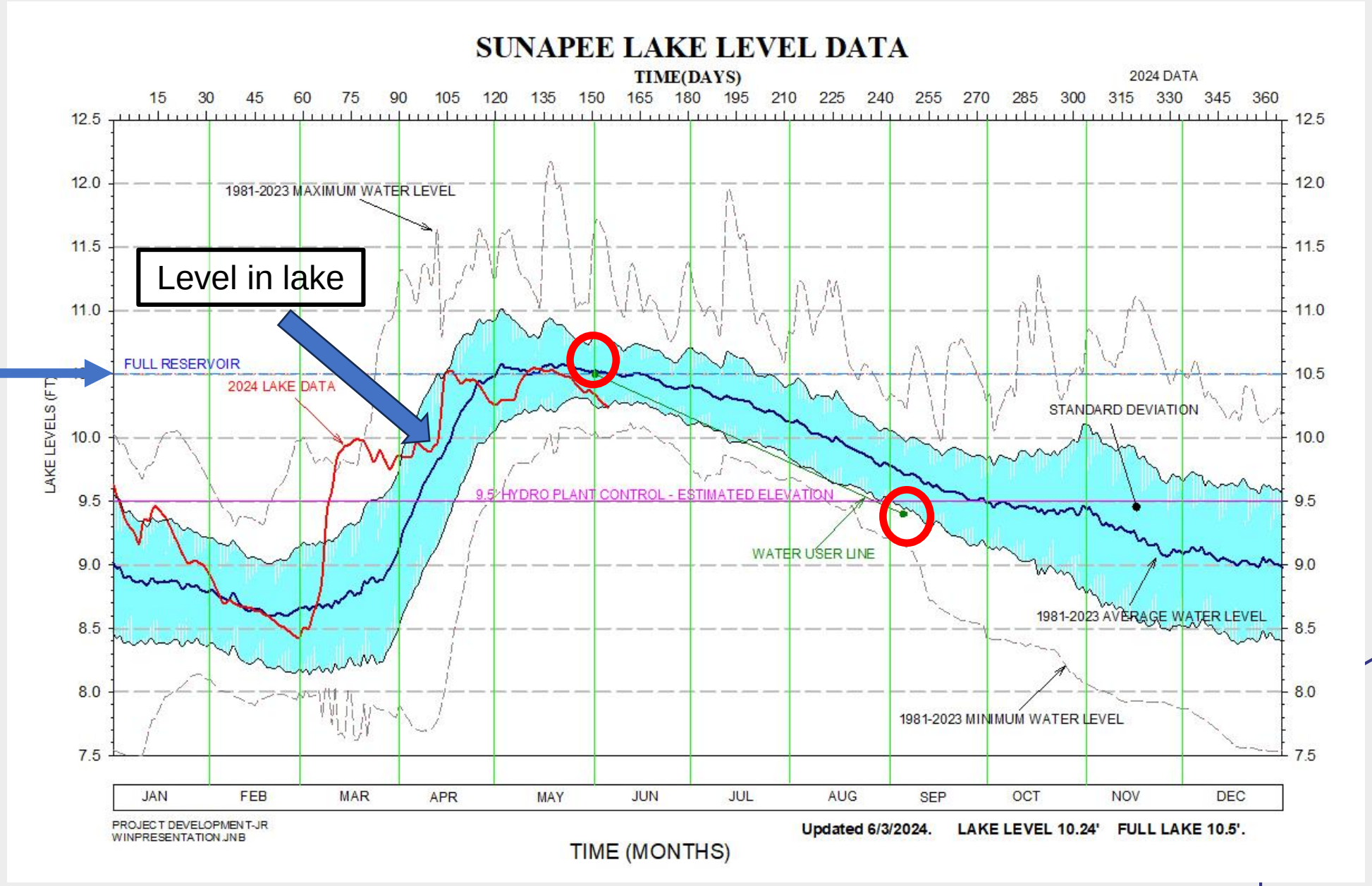
Lake Sunapee Operating Curve

10.5ft on gauge



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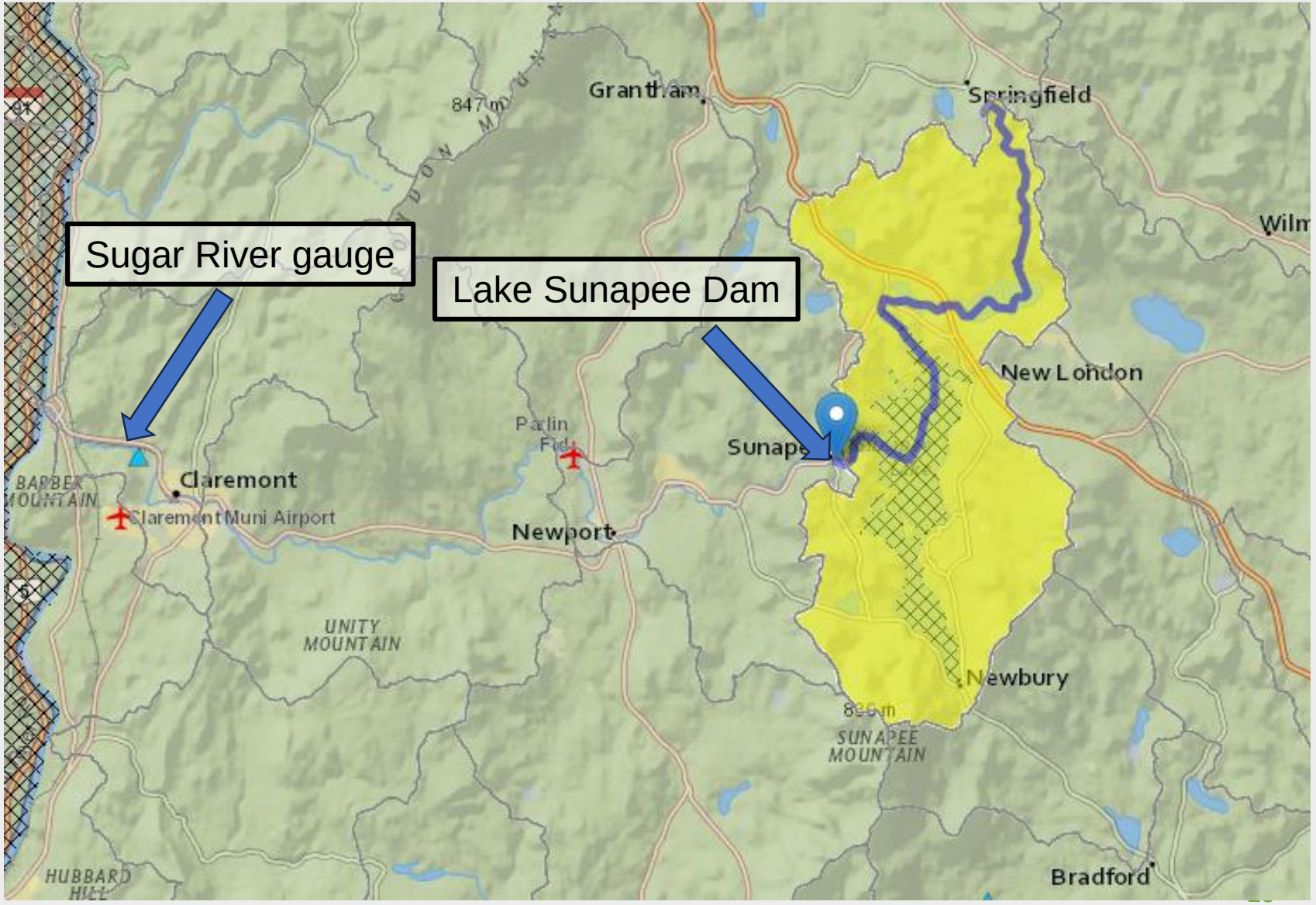
Lake Sunapee - Forecasting



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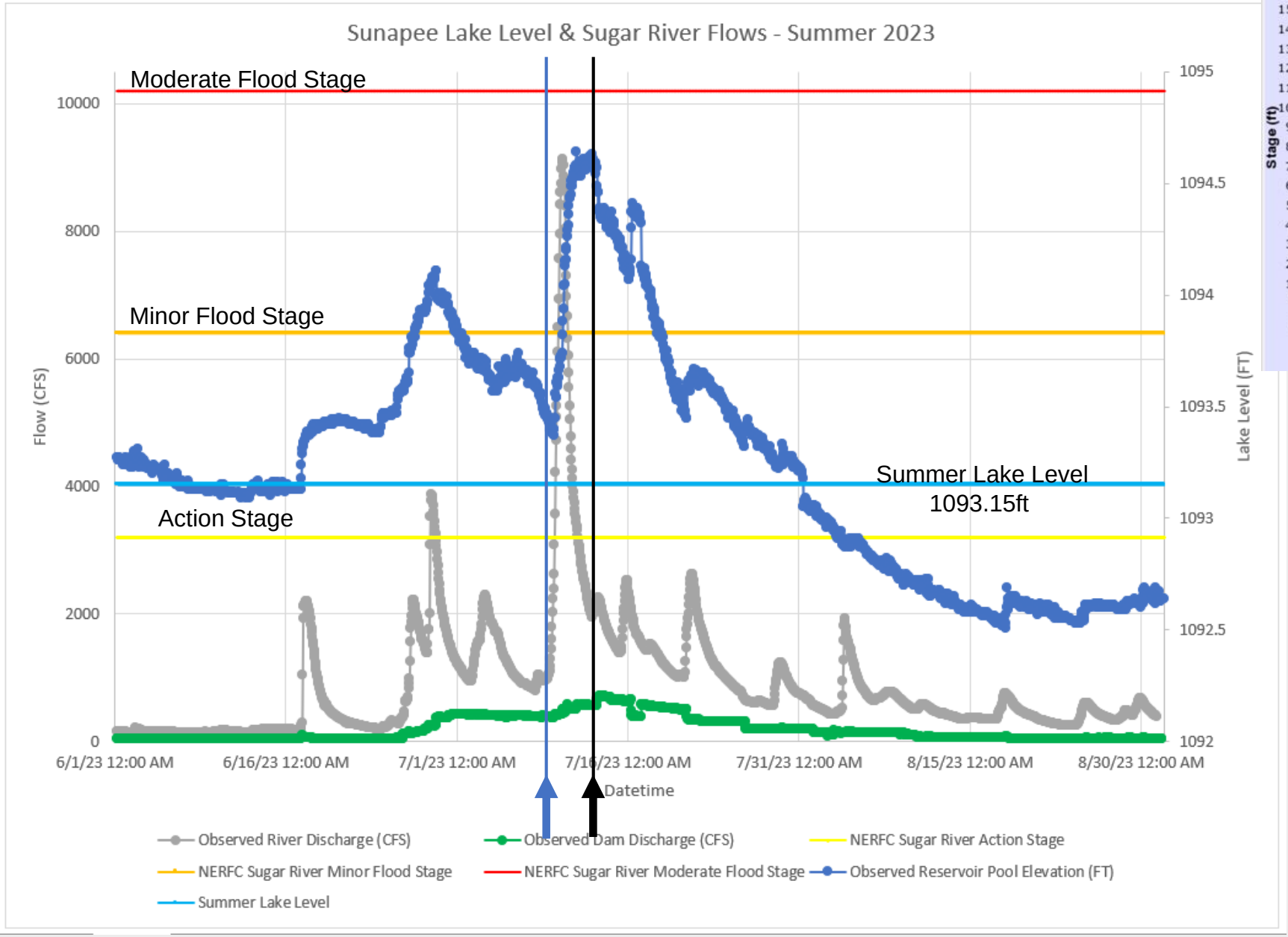
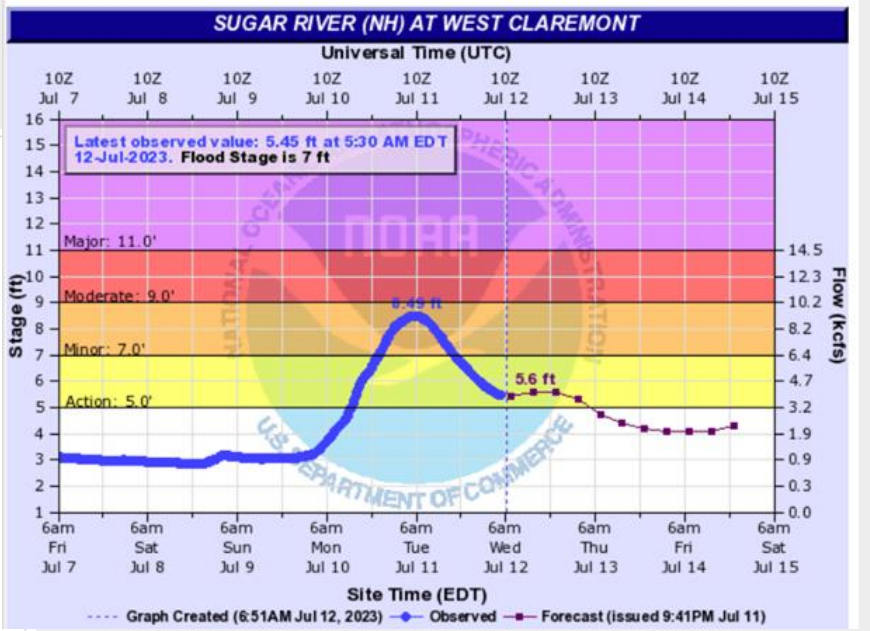
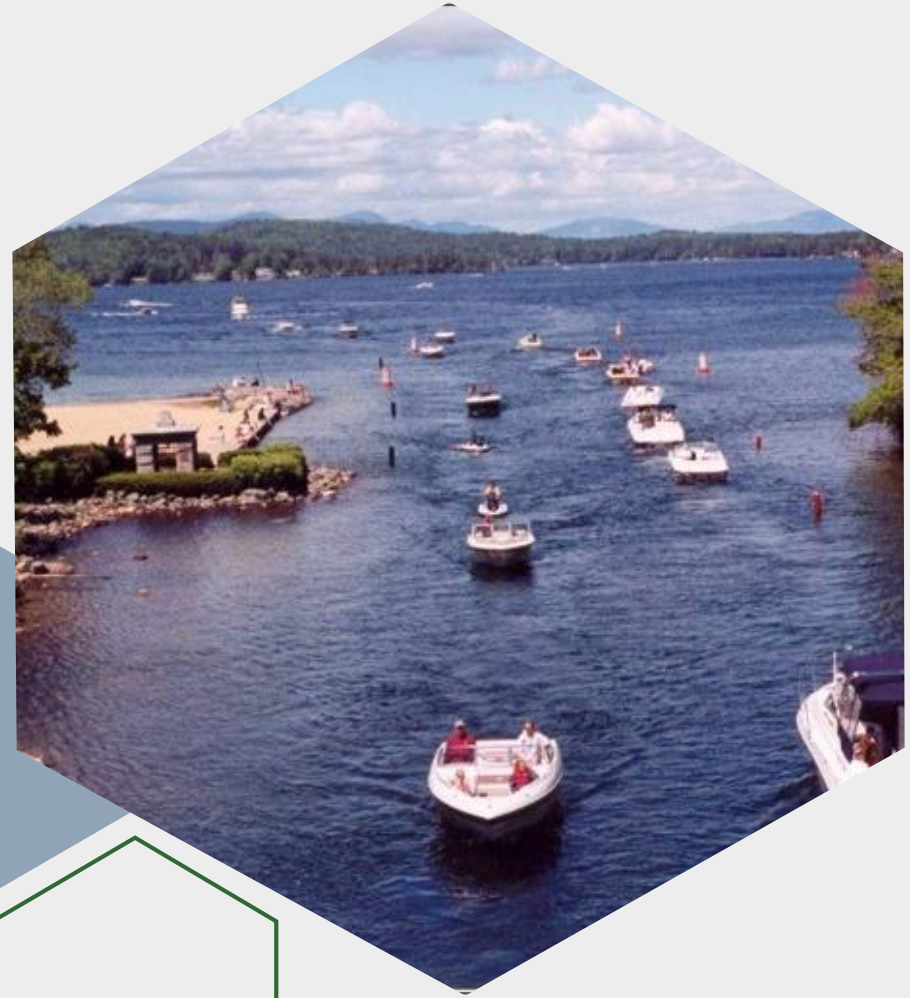
Lake Sunapee Forecasting





Balancing
Lake Winnipesaukee



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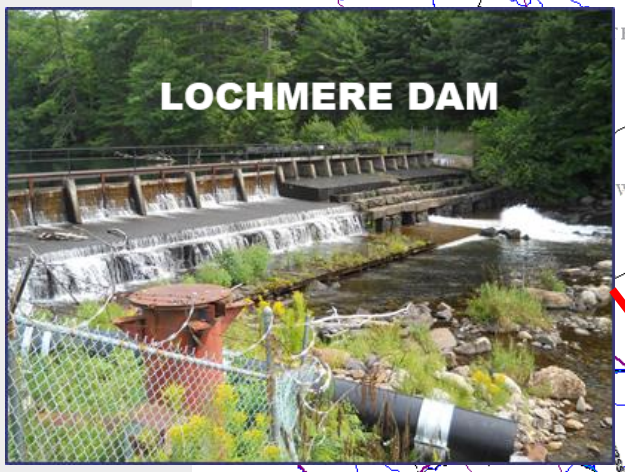
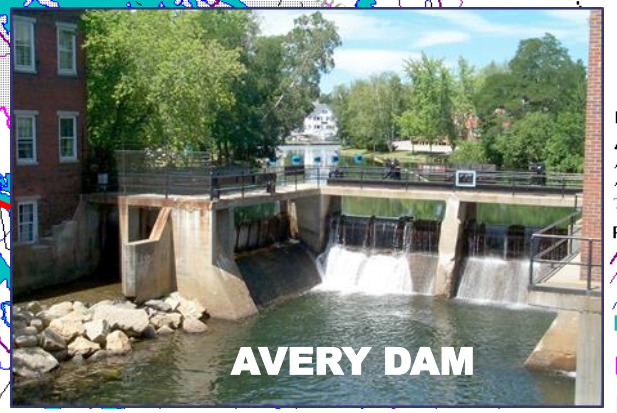
Environmental
Services

Winnipesaukee River Watershed





Lakeport Dam

- The first dam at Lakeport built around 1766
- Prior to that, Weirs Channel was a short, shallow river segment.
- There was a 3’-8” drop from Lake Winnipesaukee to Paugus Bay.
- Lake level was several feet lower than today.

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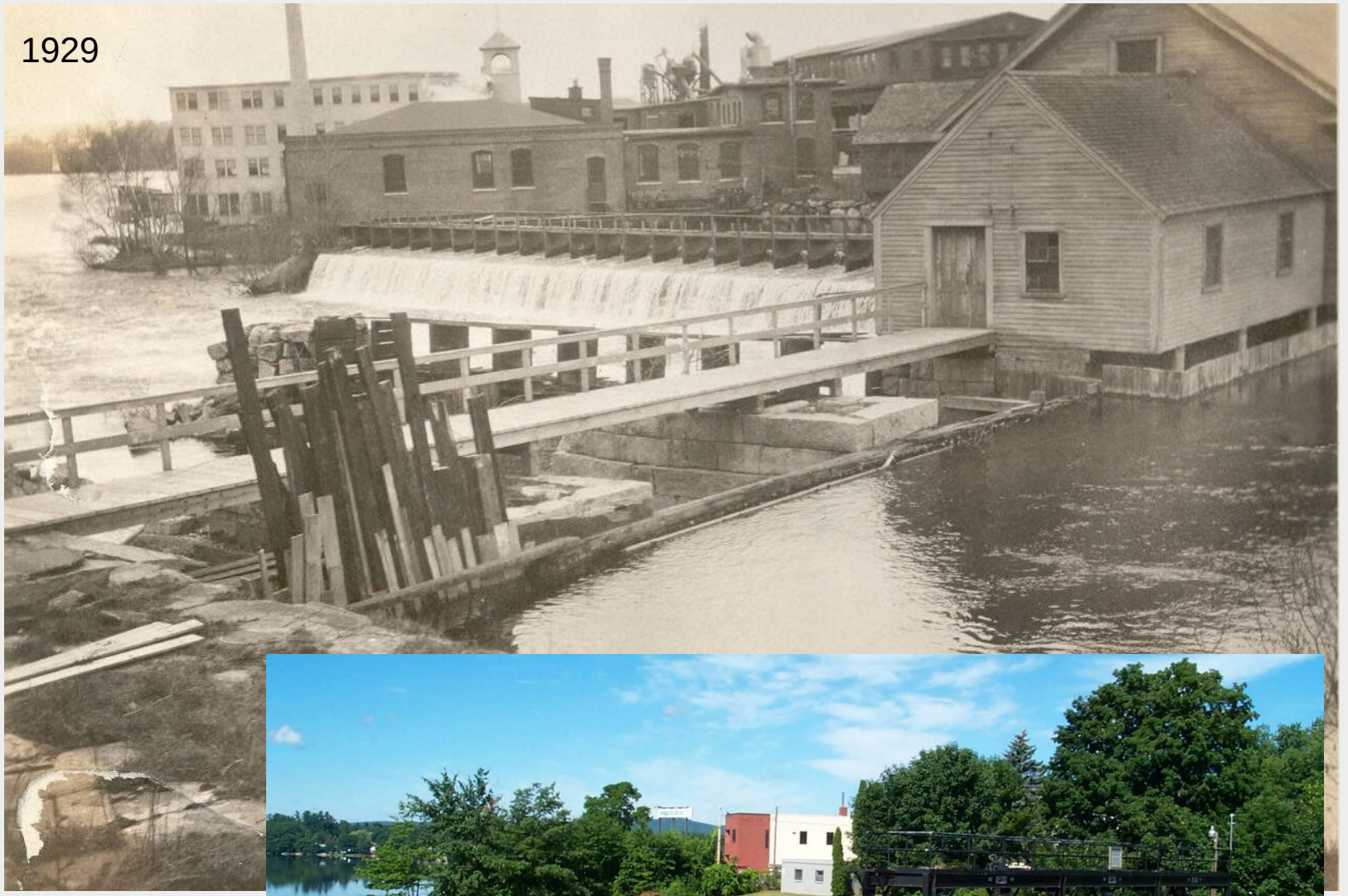
Lakeport Dam

- 1846, the outlet of Lake Winnipesaukee was widened and deepened.
- Additional dredging between 1846 and 1849, resulting in an added depth of 4’ – 6’.
- In 1859, farmers used axes and iron bars to attack the Lake Winnipesaukee dam



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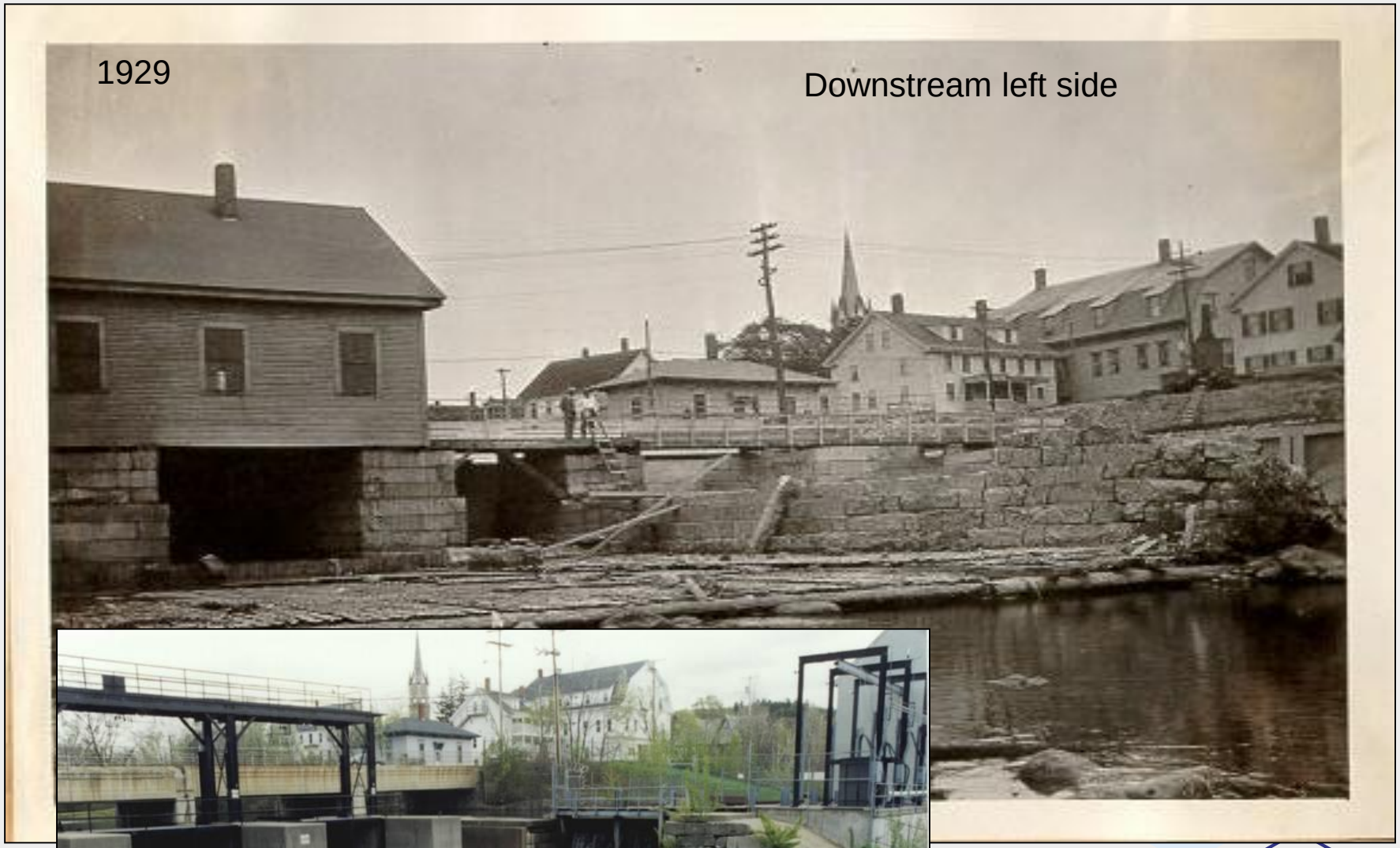
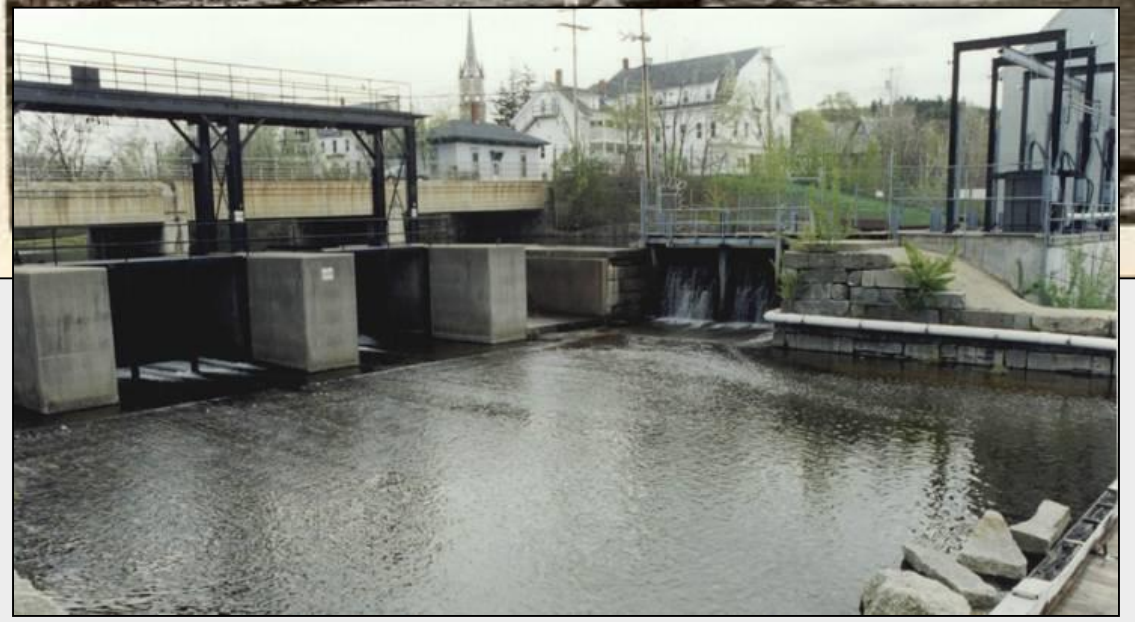
Lakeport Dam

- 3 slide gates, 18ft long by 10ft tall
- Ability to discharge over 5,000cfs of water
- 2.4 MkW-hr/year (~230 residences) hydro plant can discharge 1,000cfs





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Lakeport Dam

- Upstream flow measurement flume

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Lake Winnipesaukee Operational Considerations

SUMMER (to the extent possible)

- Reach 504.32ft by June 1st
- Maintain minimum discharge requirement of 250cfs

COLUMBUS DAY through Winter

- 2 week shutdown after Columbus Day to allow for maintenance
- Lake levels lowered 1 foot dependent on conditions.
- Refill after ice-out as snowpack melts off.

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LAKE WINNEPISSIOGEE

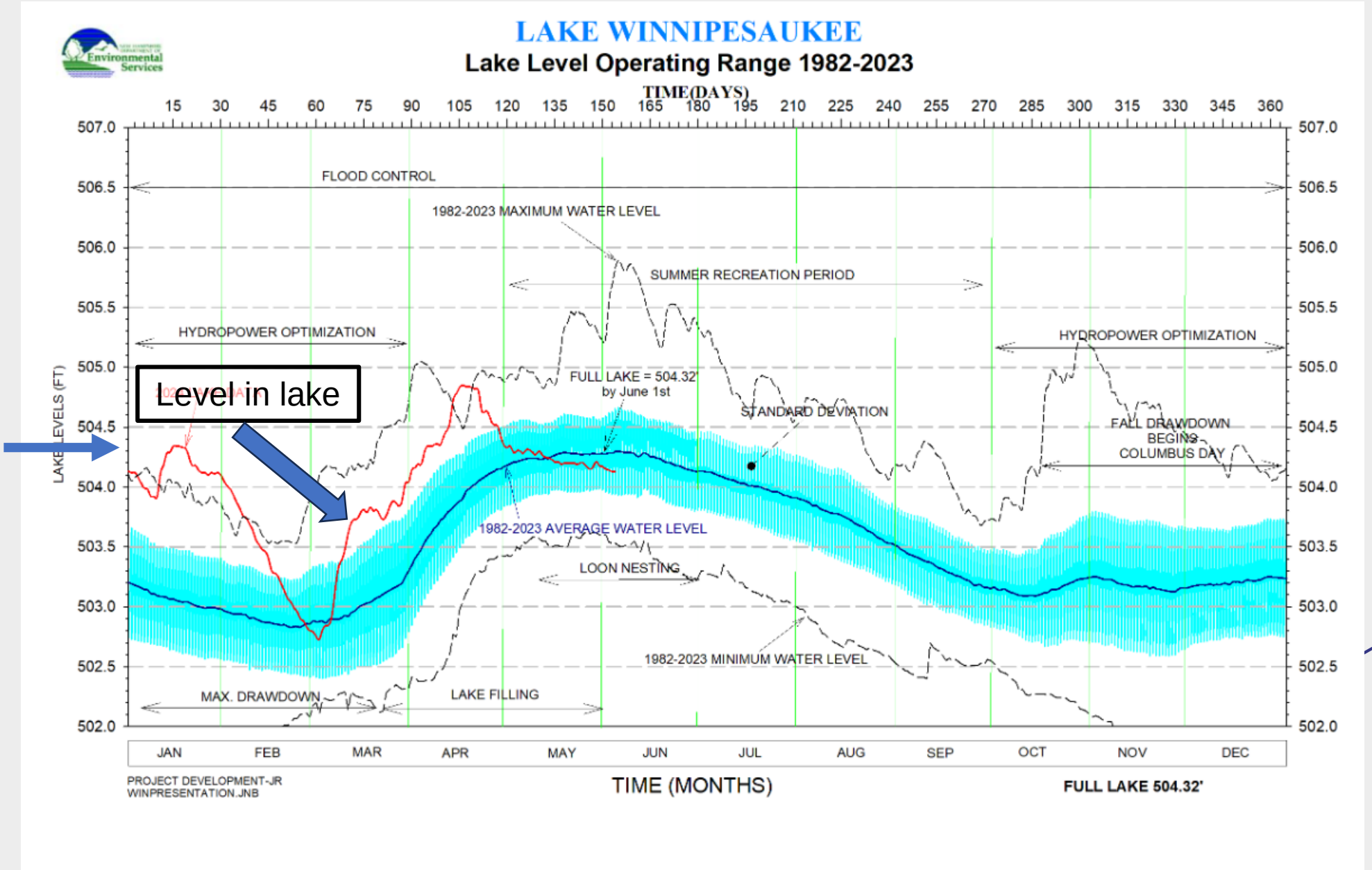
The following table taken from the Lake Company's Gauge Books, shows the height of water in inches above "O" (low water mark) at Lakeport, N. H., on the first day of every month from the year 1860 to the present time.

Also shows precipitation for each year. "O" denotes low water. "44" denotes full Lake. "F" Lake was full that year. "N" not full. — (Minus mark) indicates below "O".

		Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Precipitation.
N	1860	14	11	12	24	29	28	29	26	24	21	20	20	36.40
N	1861	35	29	23	36	40	35	34	34	29	26	26	30	42.56
N	1862	29	25	24	23	40	40	42	39	34	31	26	32	43.51
N	1863	33	36	36	36	42	40	38	41	38	33	34	38	48.31
N	1864	37	34	29	36	40	36	32	23	20	13	11	17	36.49
N	1865	23	26	24	37	38	40	38	35	18	3	0	1	41.44
N	1866	3	2	14	23	31	34	38	34	26	26	22	23	39.70
F	1867	27	25	30	30	43	42	42	37	43	34	31	29	39.22
F	1868	28	23	14	25	36	44	41	36	32	40	37	40	41.54
N	1869	36	35	34	27	40	42	43	40	32	25	37	39	46.61
F	1870	43	38	37	36	44	42	39	30	20	1	0	1	38.98
N	1871	-2	-5	-2	14	22	31	27	26	21	15	14	16	40.34
F	1872	21	21	15	12	32	38	42	37	38	43	41	40	48.19
F	1873	39	35	26	22	40	42	38	37	27	21	29	30	43.16
F	1874	35	37	36	34	39	44	43	43	36	31	23	16	43.65
N	1875	7	3	0	4	30	38	40	36	37	24	27	31	44.04
F	1876	33	38	37	36	43	44	42	38	22	17	6	6	44.92

Lake Winnipesaukee Operating Curve

504.32



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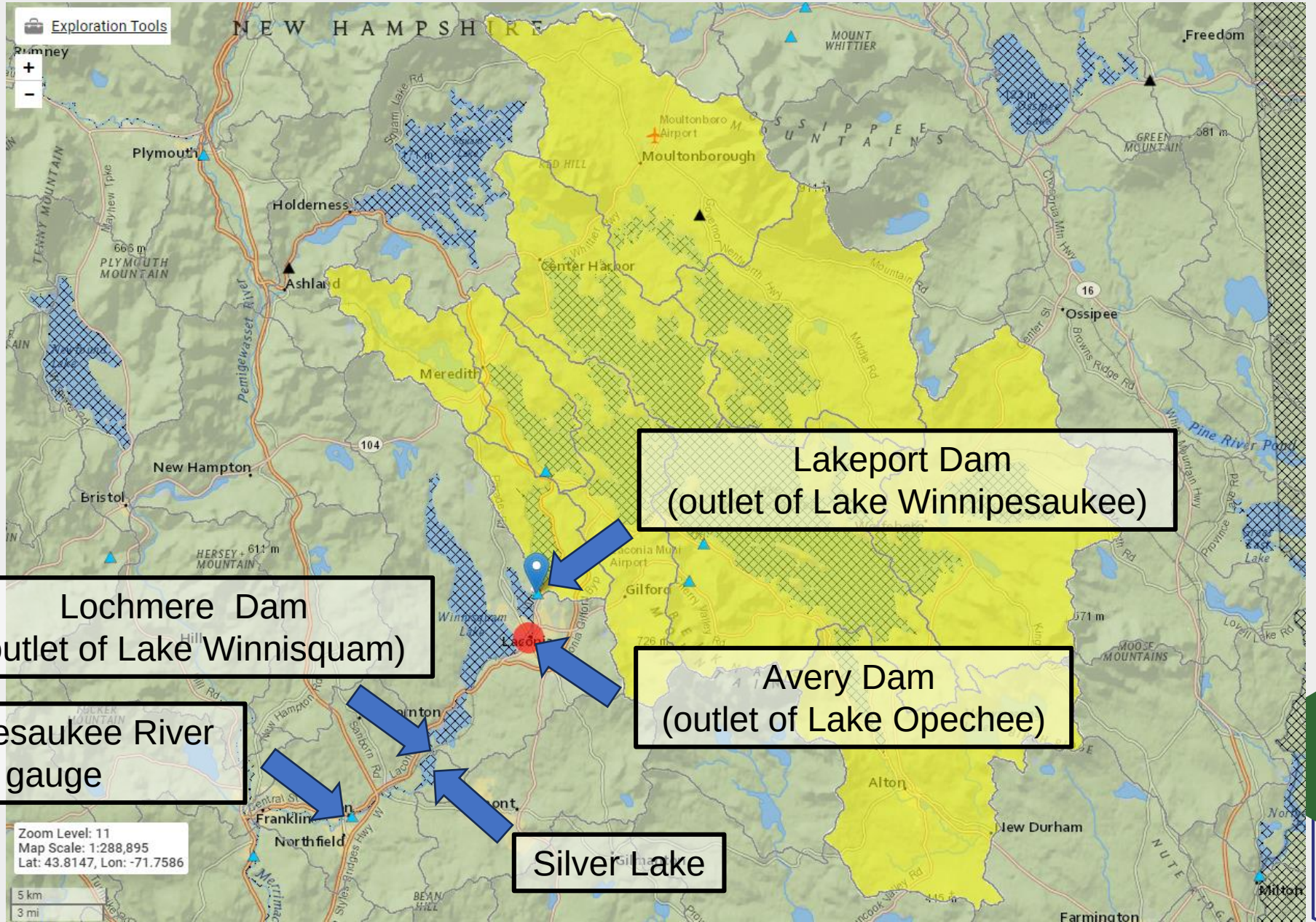
Lake Winnipesaukee Forecasting



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Lake Winnipesaukee Forecasting

- Managing levels in Lake Winnipesauke , Lake Winnisquam, Lake Opechee, and Silver Lake
- Limiting damage to property owners due to high water
- Managing discharge for hydropower entities with water user agreements

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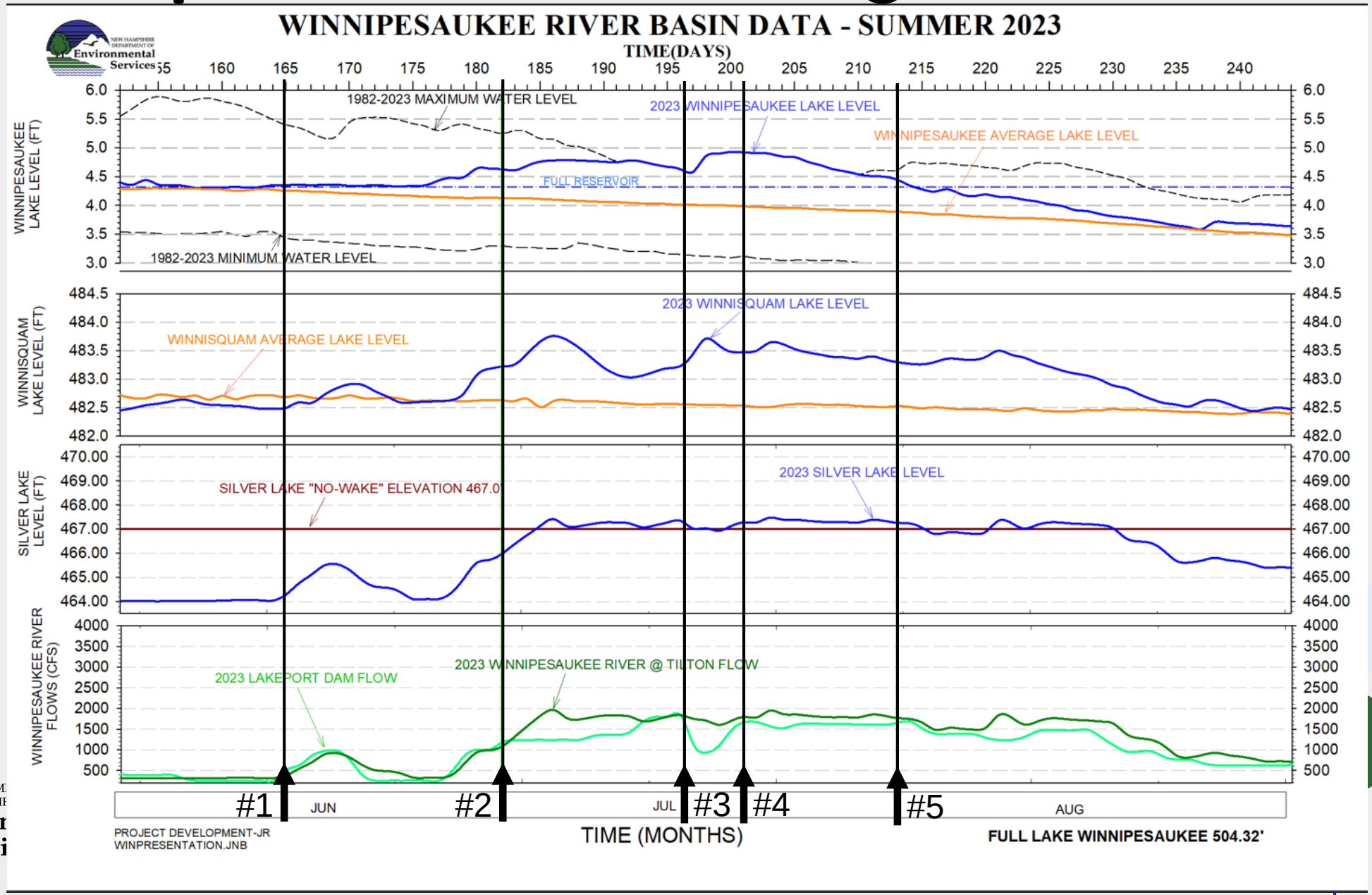
Lake Winnipesaukee Forecasting



2024 Lake Level Outlook

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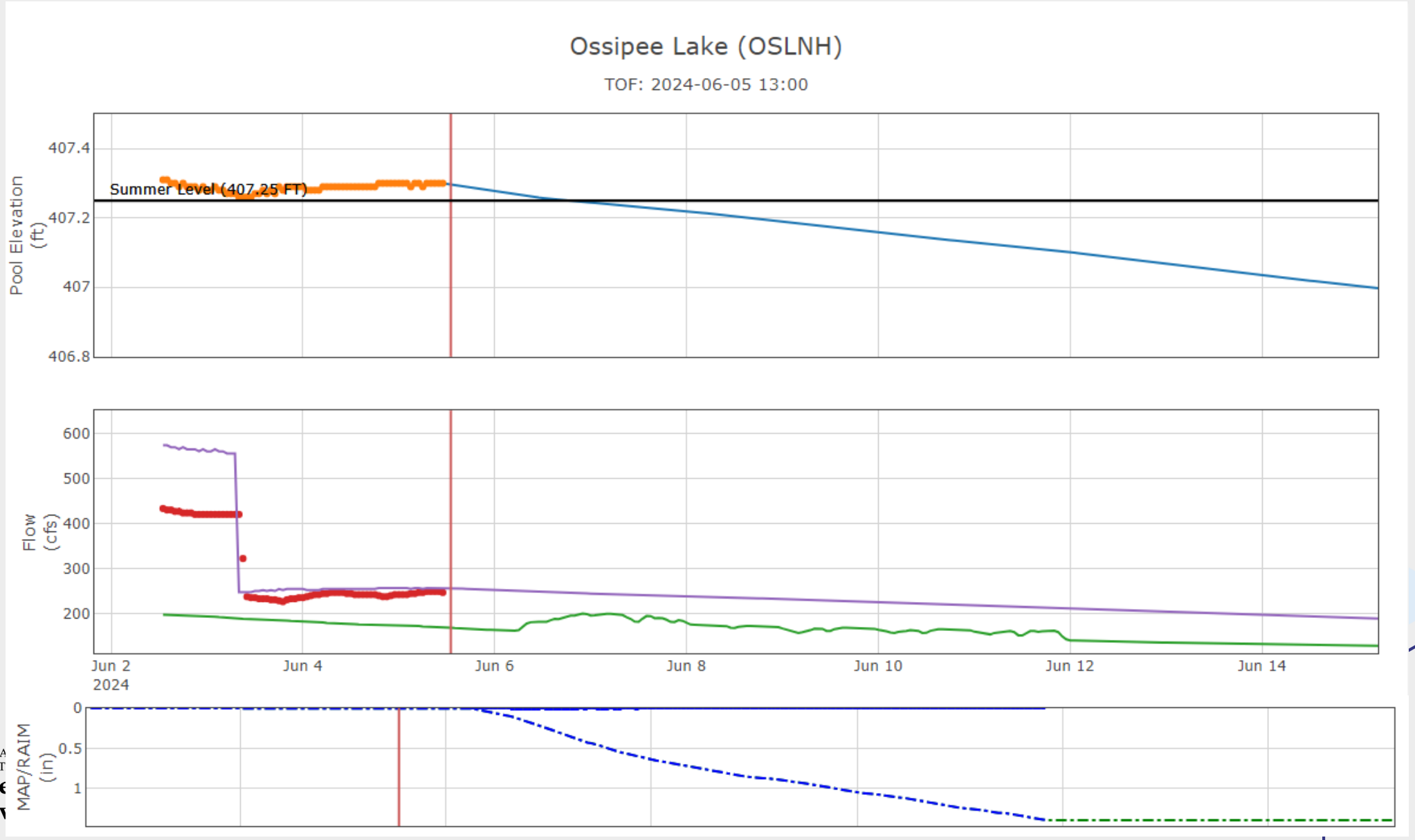
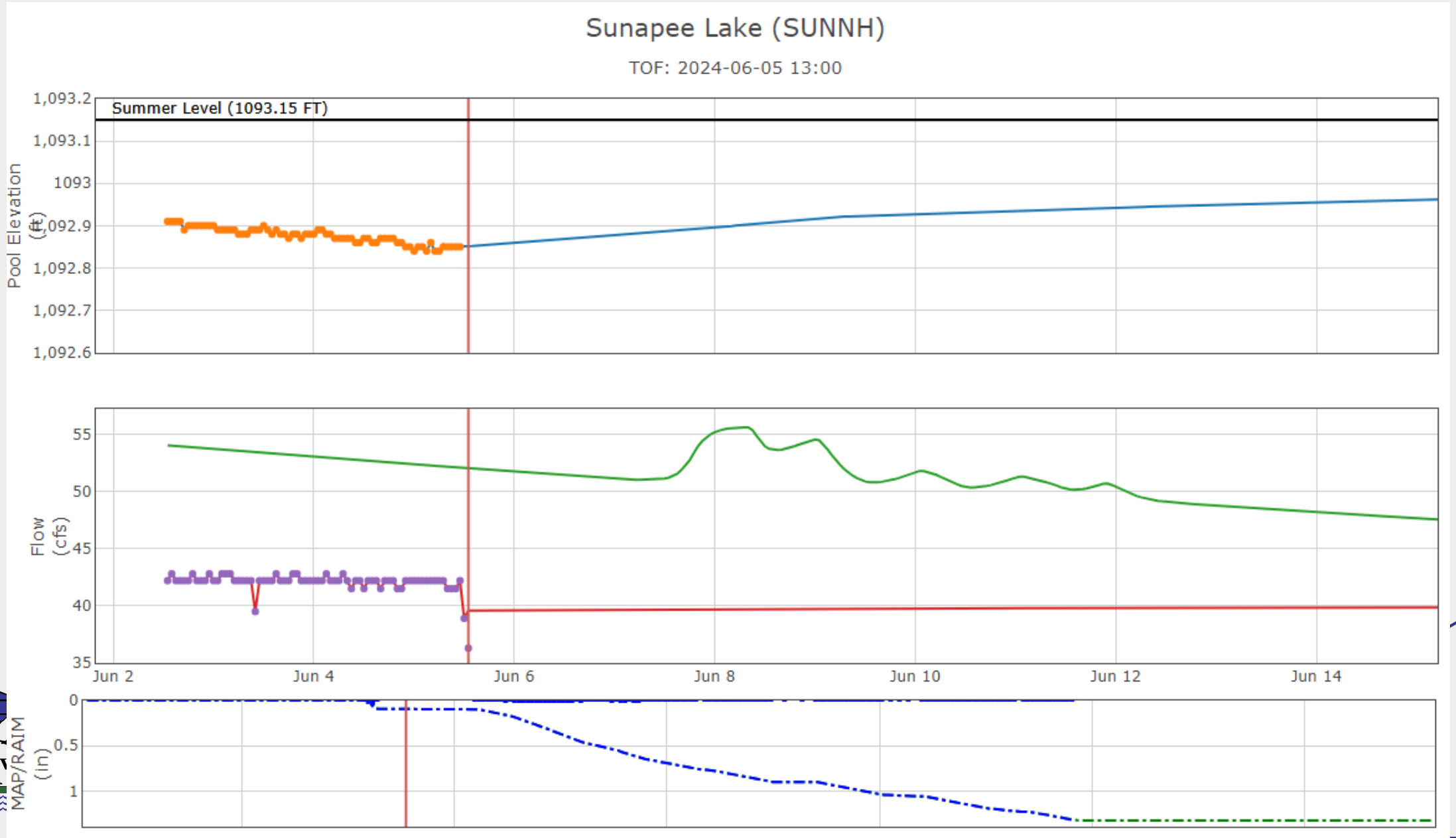
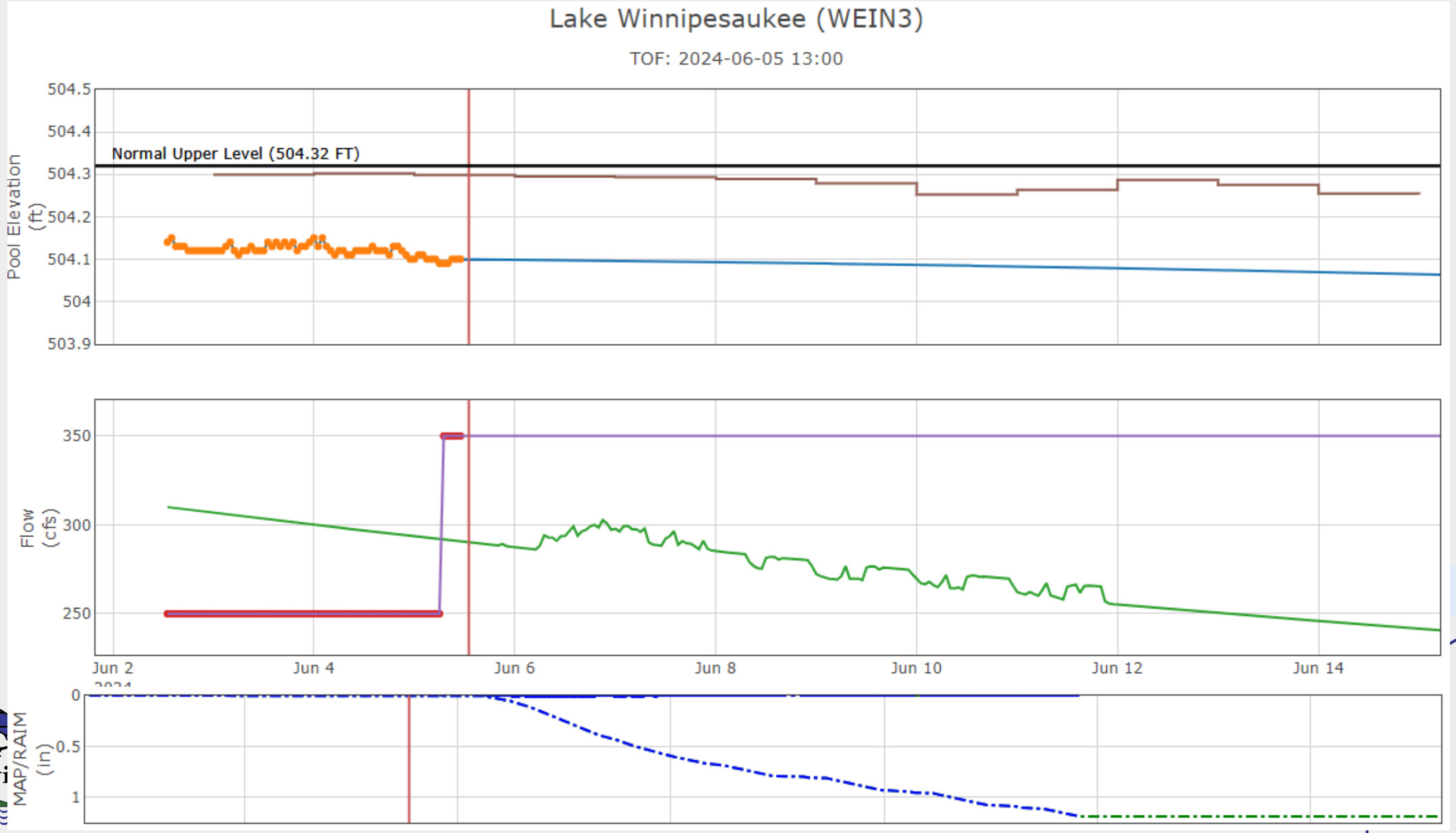
Current Status – Lake Ossipee



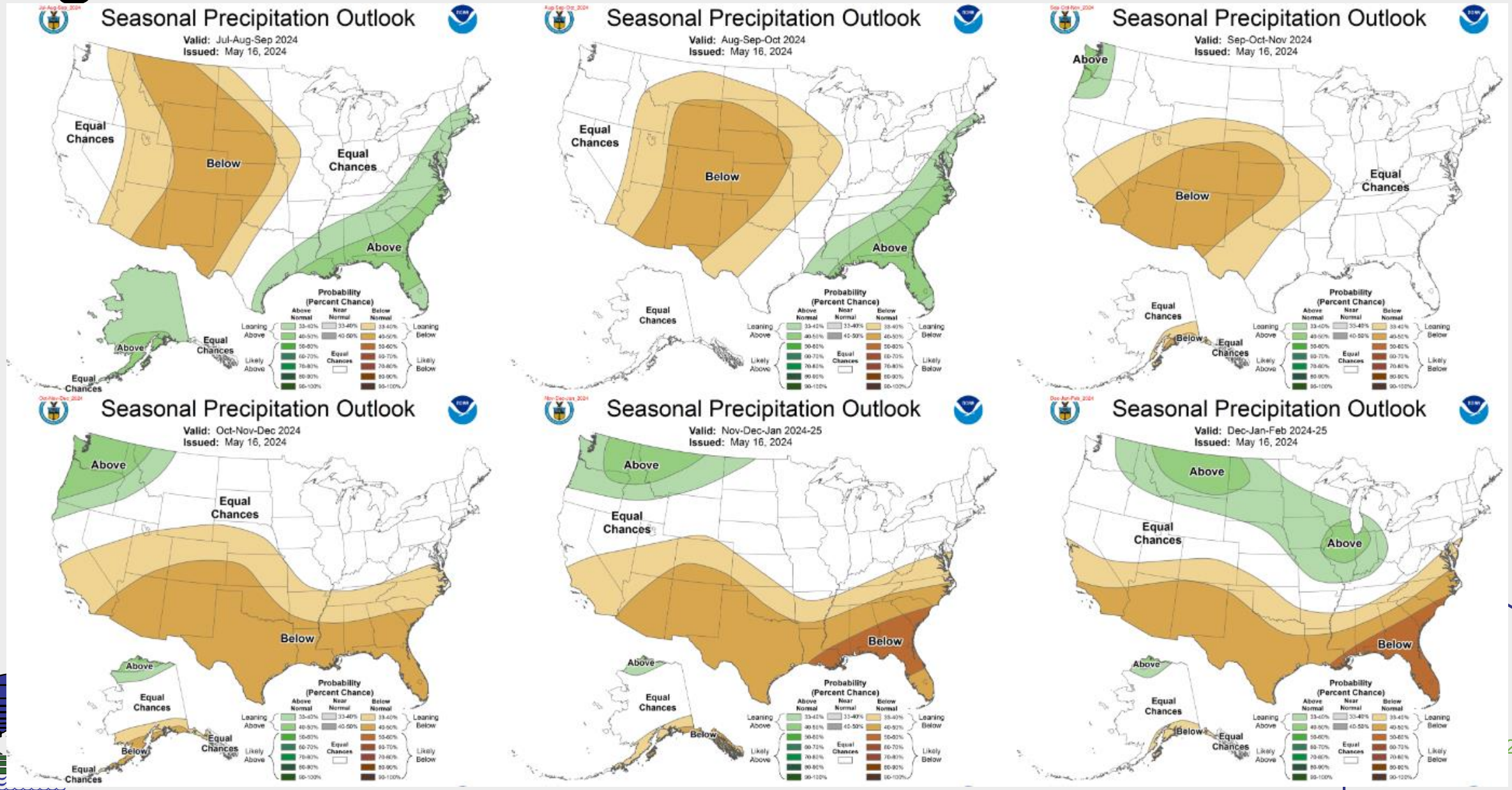
Current Status – Lake Sunapee



Current Status – Lake Winnipesaukee



Long Term Outlook



NHDES Dam Bureau – A Balancing Act

Continue ensuring that State-owned dams are managed to protect the recreational, economical and natural resources upstream and downstream of the dams

Thank you

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603-271-1961

https://nhdes.rtiamanzi.org/

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