Testimony of Carl Wilcox, P.E., Against

LD 1130 An Act to Advance Long-duration Energy Storage Within the State

April 2, 2025

Senator Lawrence, Representative Sachs, and distinguished members of the Joint Standing Committee on Energy, Utilities and Technology.

My name is Carl Wilcox, I'm a resident of Minot. I was born and raised in Maine and have lived in Maine for all but 7 of my 63 years. I am a Maine licensed professional environmental engineer, with over 35 years of experience.

As it is written, I am Against LD 1130.

I completely understand and support the concept of energy storage during periods of low cost power and its use when the cost of power is high.

LD 1130 proposes the following additions to state law 35 – A section 3145 promoting solely the use of battery storage.

1. "and, additionally, at least 300 megawatts of long-duration battery storage within the State by December 31, 2035."
2. "long-duration battery storage" means energy storage using a commercially available battery technology capable of storing energy for 8 hours or more for use at a later time."

As a Maine resident I continually see my electric bill increasing. I do not want electric energy storage limited to batteries. I want all solutions that the free marketplace may offer to be promoted as energy storage solutions. Let the free marketplace select the winner. The Legislature should not be pre-selecting or promoting a particular "energy storage system" technology over another.

In all three instances of the proposed use of "battery" it should be stricken and replaced with the more inclusive term, "energy" to read as energy storage

Additionally, existing section 3145 references definition section 3481 which adequately defines Energy Storage system meaning "a commercially available technology that uses mechanical, chemical or thermal processes for absorbing energy and storing it for a period of time for later use."

Battery is not defined in definition section 3481.

The Oxford Dictionary defines battery as – "a container consisting of one or more cells, in which chemical energy is converted into electricity and used as a power source.

All energy storage technologies have their pros and cons. Batteries may well become the leading energy storage solution. However, other technologies are available and in use.

- Flywheels – have round trip efficiencies exceeding 85%, with very fast energy transfer back to electricity. 20 MW flywheels have been operating

in New York and Pennsylvania for as long as 14 years. In 2024 China installed a 30 MW flywheel system, currently, the world's largest.

- Pumped Storage Hydropower (PSH) is where water is pumped up for storage and released when needed to produce electricity. The US Department of Energy in 2022 reported 96% of US utility scale energy storage was PSH. PSH was first used in the US in 1930. There are currently 43 PSH plants in the US with the potential to more than double the current PSH capacity.
- PSH has 80+% round trip cycle efficiency.
- The largest energy storage system of any kind in New England is the 1,168 MW PSH project in Northfield, Mass. Built in 1972, it has four reversible turbines that ramp up in 10-minutes passing 20,000 CFS that can deliver full power for 8-hours.

Maine with the Wyman and Flagstaff reservoirs has a half complete PSH system with the lower and upper reservoirs in existence with a large vertical drop between the two.

- Wyman hydro Dam and its reservoir was created in the early 1930s.

- Flagstaff Lake was a small very shallow lake until the Long Falls non-hydro Dam was constructed in the late 1950s flooding Flagstaff village and Dead River Plantation. The lake today has a maximum 48-feet depth.
- Long Falls Dam stores water in Flagstaff Lake for release down the Dead River to Wyman reservoir 664 feet lower. This water drop is 290 feet greater than the sum of all the water drops of the 8 dams on the Kennebec River below and including the Wyman Dam.
- Water leaving Flagstaff Lake does not generate power until it passes through Wyman Dam.
- In late winter Flagstaff Lake is drawn down 20 to 25 feet, sending the water to Wyman Reservoir to generate power in Wyman Dam. The lake refills with spring snowmelt. In early fall it is again drawn down 10 to 15 feet in advance of fall rains (Bigelow & Flagstaff Unit – 2007).
- From May through early October, Long Falls Dam releases water for rafting and to supply water to Wyman Reservoir.
- In 2025 there are 18 scheduled flow releases on weekends for rafting, ranging from 1,300 to 6,000 CFS. The flow changes nearly instantaneously from about 500 CFS to 6,000 CFS with the high flow maintained for about 8-hours for rafting trips.

- From the hydrograph it appears that the Long Falls Dam operating permit requires a minimum base flow for aquatic life of 330 CFS.
- During the non-rafting season, October through April the Dead River flow bounces between 330 and 1200 CFS with about 700 CFS the average.

Figure 1 Dead River Hydrograph at Long Falls Dam Outlet

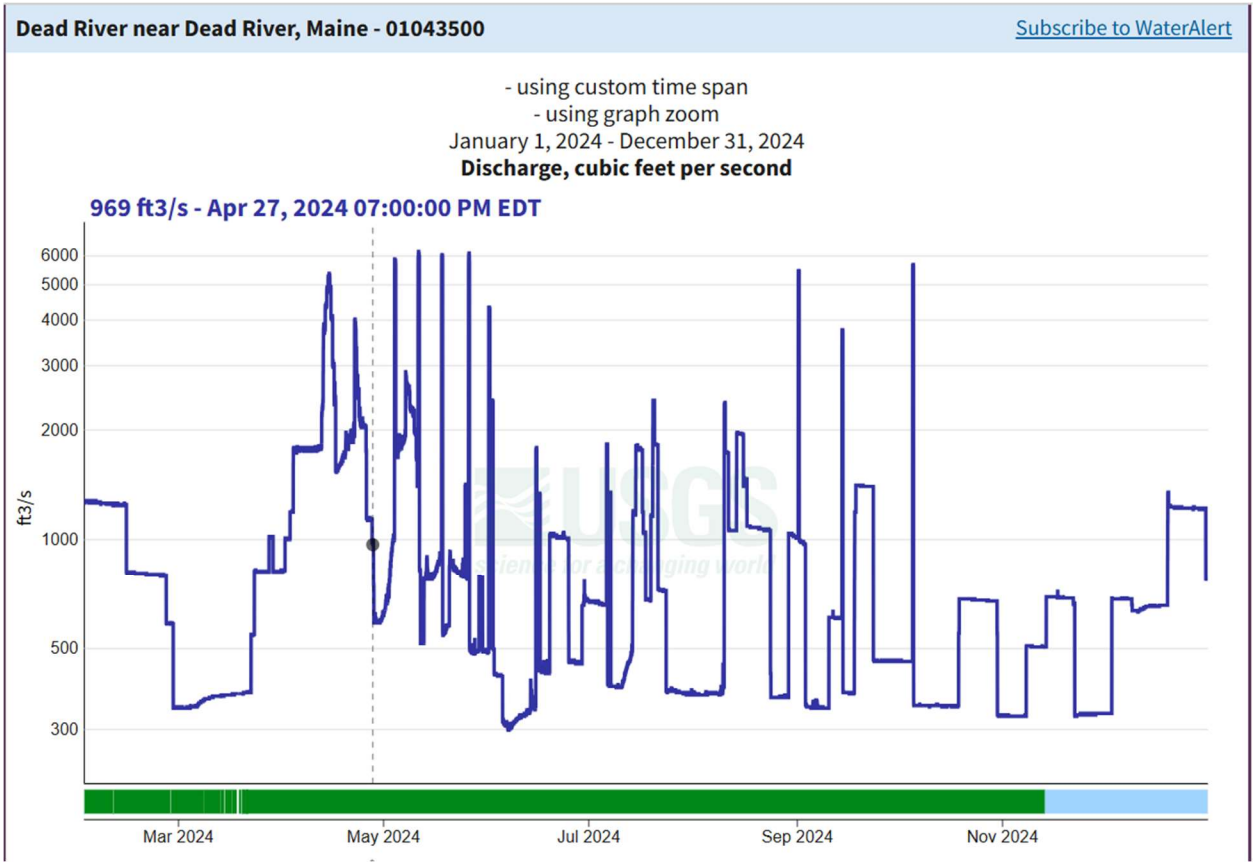


Figure 2 shows that the Wyman Dam discharge varies dramatically on a daily basis throughout the year. Figure 3 shows the daily flow out of Wyman Dam at

about 6:30 pm changes from 2,000 to 9,000 CFS for about 2-hours to supply power for the evening demand surge when wholesale electricity prices are higher.

Figure 2 Wyman Dam 1-Year Discharge Hydrograph

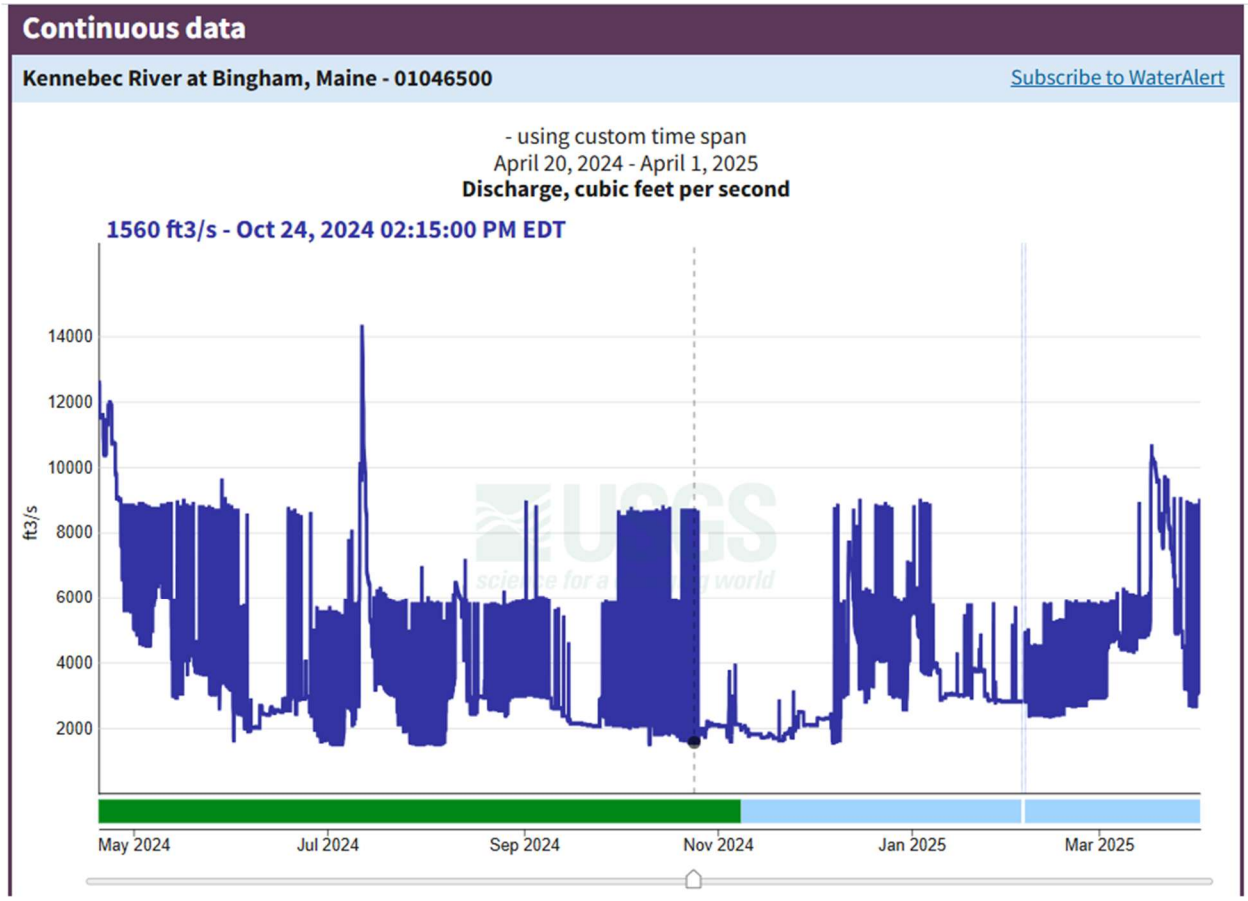
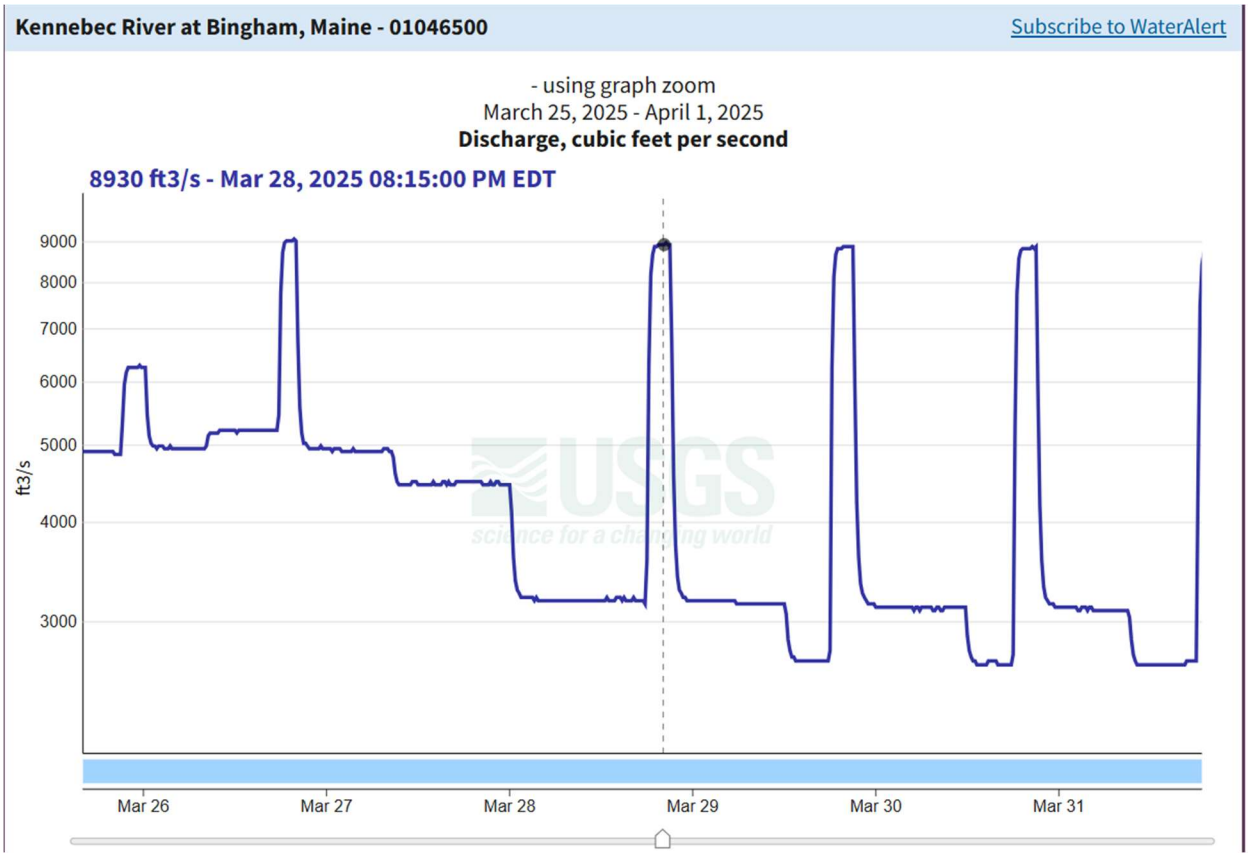


Figure 3 Wyman Dam 1 – Week Discharge Hydrograph



The salient points are:

1. The environmental damage of creating the Wyman and Flagstaff Reservoirs was done decades ago. For the cost of the past and ongoing damage environmental damage, society should maximize the benefits of these two reservoirs.
2. Routinely and spontaneously 6,000 CFS is sent down the Dead River to Wyman Reservoir. Whatever environmental and societal damage, if any, that sudden flow change creates is ongoing.

3. It is the same for Wyman Reservoir with the Kennebec River flow changing every evening for about 2-hours from 3,200 CFS to 9,000 CFS and back to 3,200 CFS or to even lower flows.
4. Flagstaff and Wyman Reservoirs are separated by 12-miles and 664 vertical feet.
5. A PSH system could be created as in Northfield, Mass, by a tunnel connecting the two with underground reversible turbines near Wyman Reservoir.
6. During periods of low cost power, water would be pumped from Wyman to Flagstaff Reservoir through the power tunnel.
7. A 12-mile tunnel long tunnel is not a difficult construction project.
8. There are 109 miles of tunnels below Chicago 8 to 33-feet in diameter constructed by tunnel boring machines (TBM) to store wastewater. The worlds' longest TBM constructed tunnel is a 35-mile-long train tunnel through the alps.
9. The tunnel would cross more than 100-feet underneath the Appalachian Trail.
10. At Wyman Dam there is an existing substation that has 4 - 115 kilovolt lines heading towards southern Maine. Its capacity for additional power is unknown to me.

11. A PSH system connecting the two reservoirs with a 6,000 CFS flow will generate about 295 MW. Nearly meeting LD 1130's goal of 300 MW. But unlike a battery system, the 6,000 CFS flow could continue not for hours but for days if needed.
12. With Flagstaff at full pond, a 6,000 CFS discharge flow would take about 1.8 - days to lower the reservoir by 1-foot.
13. During the 1.8 – day 1-foot drawdown 12,700 MWhr of power would be produced.
14. For comparison, the $100 million Cross Roads battery project in Gorham is a 175 MW project that can discharge for up to 2-hours providing 350 MWhr of power.
15. The proposed Lincoln, Maine project for a claimed $147 million is going to provide a long duration battery system providing 85 MW with a 100-hour discharge capacity to provide 8,500 MWhr.
16. With a PSH system, the Flagstaff Reservoir could be managed as today with no change in flows down the Dead River. During periods of low cost electricity, water would be pumped up from Wyman Reservoir to Flagstaff with that water volume subsequently released back down the tunnel to the Wyman Reservoir when power is needed.

17. Or, to utilize more existing hydro energy, for 7 – months of the year, October through April, there is no rafting on Dead River. Figure 1 shows for those 7 months the Dead River flow averages about 700 CFS. 330 CFS is required for aquatic life. The remaining 370 CFS could be sent down the power tunnel. Due to the 664 vertical foot drop, more power would be produced by that small flow than what the Brunswick – Androscoggin Dam produces in a year. In those 7 non-rafting season months, the 370 CFS flow down the tunnel would produce 93,000 MWhr of new additional power to the grid. Per Brookfield, the Brunswick dam owner, the Brunswick dam annually produces 90,696 MWhr.

18. The Wyman Reservoir could be operated as an open system with the power tunnel water discharge also flowing through Wyman Dam; or, as a closed system in which Wyman Reservoir is operated a few feet below the dam top to retain the power tunnel discharge water in the reservoir making it water immediately available to be pumped back up to Flagstaff Reservoir. With all the solar power being produced, the high cost morning energy demand peak is being followed by the mid-day hours of low demand and inexpensive power.

CLOSING:

Battery technology does have its pros such as being locationally flexible. Just locate it next to a transmission line, and its cycle efficiency of 90+% is high, and it is near instantaneous in its ability to put power onto the grid. However, its economic ability to provide sustained power during sustained periods of low solar or wind production is questionable.

All power storage technologies should be promoted – not just batteries.

Please revise the resolve's wording to be technology neutral by replacing battery storage with energy storage.

Additionally, please consider a separate resolution supporting the concept of utilizing Flagstaff and Wyman Reservoirs as a pumped storage hydropower system as a potentially lower cost alternative than batteries. In this can't get anything done NIMBY state, a legislative resolve may motivate the owner of Wyman, Long Falls, and Harris Dams and Wyman and Flagstaff Reservoirs, or another entity, to conduct an economic feasibility study of PSH at this location.

Sincerely,

Carl Wilcox, P.E.