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Madison-Hebgen: Stakeholder Engagement

September 15, 2022

2188 License Conditions

- Relicensing took about 10 years during the 1990s
- Conditions based on years of study
- License conditions developed upon EQUAL CONSIDERATION to the purposes of energy conservation, the protection, mitigation of damages to, and enhancement of, fish and wildlife (including related spawning grounds and habitat), the protection of recreational opportunities, and the preservation of other aspects of environmental quality
- License conditions have successfully dictated operations for the last 21.5 years very effectively

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Potential Operational Modifications

- Any proposed modifications need to provide equal consideration to all resources
- Options developed by NorthWestern are based on our collective knowledge and experience over the last 20+ years
- Operational modification options are developed for water conservation during
  - Years of drought
  - All years

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Drought.gov:

- Drought is generally defined as “a deficiency of precipitation over an extended period of time (usually a season or more), resulting in a water shortage.”
- As different definitions illustrate, though, drought can be difficult to define—so difficult, in fact, that in the early 1980s researchers found more than 150 published definitions of drought, reflecting differences in regions, needs, and approaches.
- Some drought definitions are conceptual—an idea or concept—which can be important in establishing drought policy. Others are operational, describing how drought functions or operates in ways that can be measured (NDMC).

What is a drought?

Oxford Dictionary:

- a prolonged period of abnormally low rainfall, leading to a shortage of water.

Merriam-Webster Dictionary:

- A period of dryness especially when prolonged.

American Meteorological Society:

- "A period of abnormally dry weather sufficiently long enough to cause a serious hydrological imbalance."

NOAA's National Weather Service:

- A deficiency of moisture that results in adverse impacts on people, animals, or vegetation over a sizeable area.

Relative to operations

- Environmental conditions leading to a shortage of water potentially resulting in NorthWestern's inability to maintain all license conditions

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Metrics Defining a Drought

- Need to develop a metric, that once met, signifies drought condition

- Metric needs to be:
  - Based on consistently available information,
  - Related to water supply, and
  - Scheduled during a time when reasonable changes to operations could be made.

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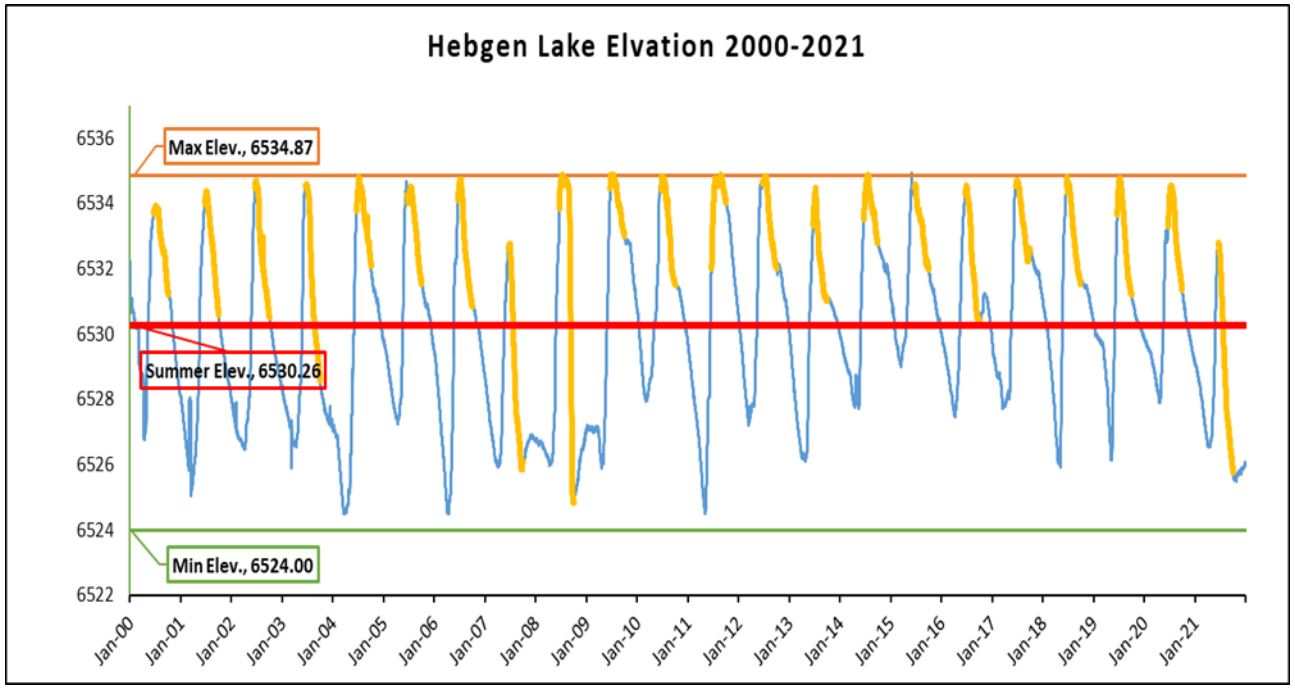
- October 1 Hebgen Reservoir elevation
  - Have a long period of record to compare to
  - Critical time when flows are established and sustained through the fall and winter to protect brown trout spawning
  - Storage volume in Hebgen is sole resource used to provide flows during this time



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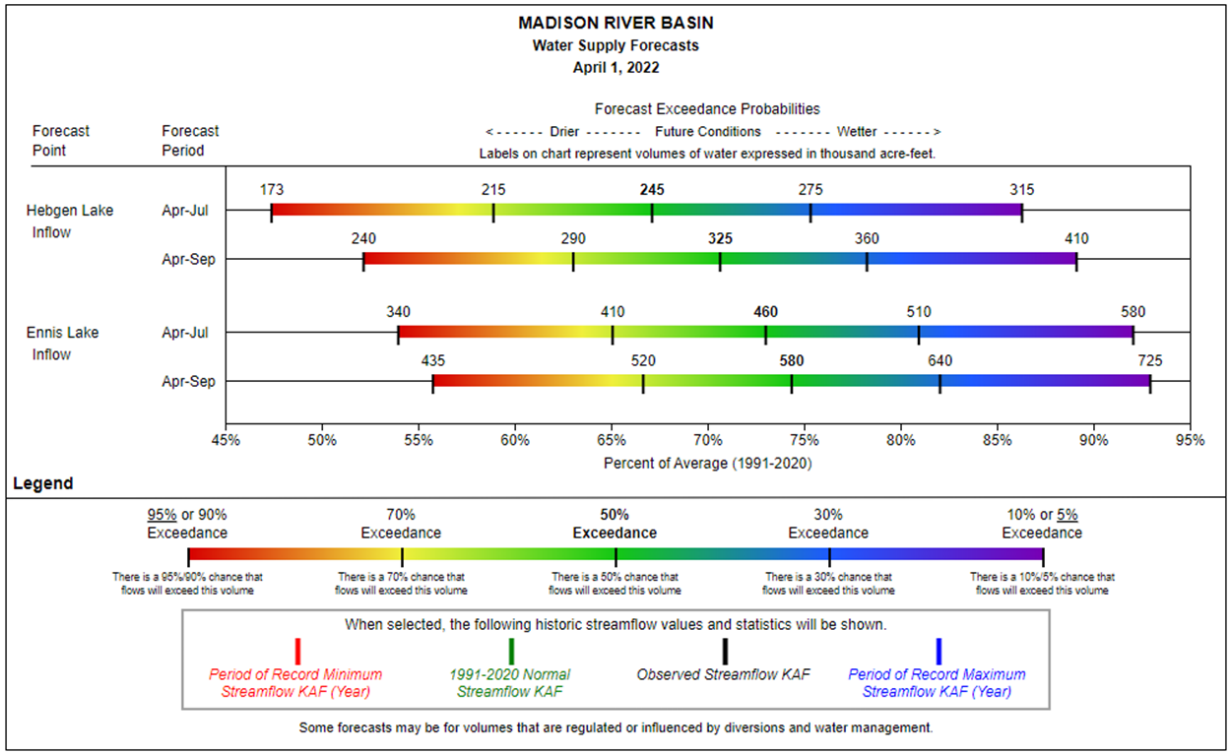
- April NRCS Runoff Forecasts
  - Provides comparison to 30-year average
  - Incorporates SNOTEL snow water equivalence
  - Critical time after brown trout emerge but before rainbow trout spawn



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Modified Operatinos During Drought

- Reduced minimum flows:
  - 550 cfs at Kirby (current is 600 cfs)
  - 950 cfs at Madison (current is 1100 cfs)
- Increase summer operating range of Ennis Lake to two feet, 4,839-4,841 ft. This is an increase from the current one foot (4,840-4,841 ft.)
- Change the Hebgen summer elevation (6530.24 ft) from June 20 – October 1 to June 20 - Labor Day.

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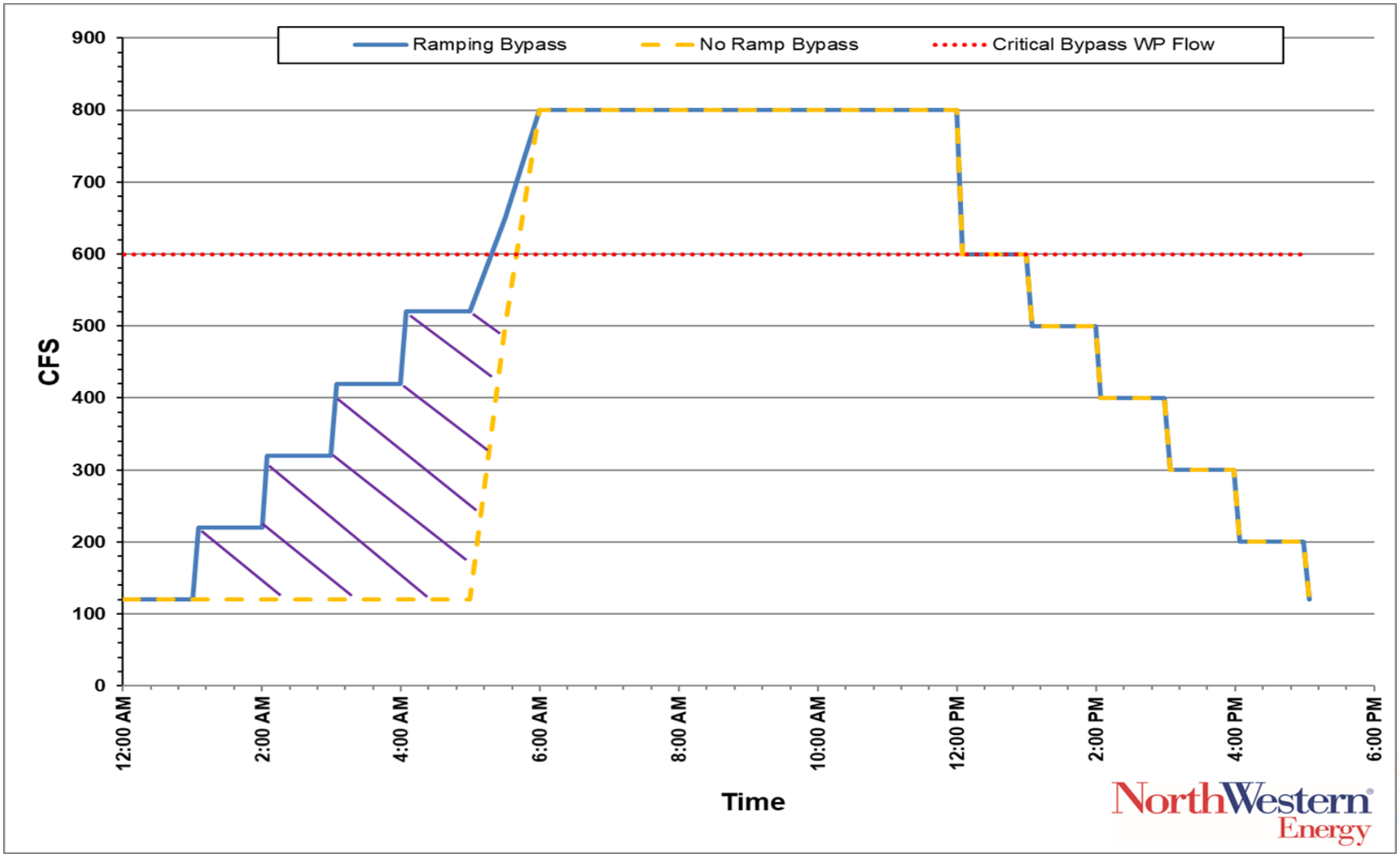
Modified Operations to Conserve Water in All Years

- Eliminate the ramping rate in the Madison bypass for flow increases



Modified Operations to Conserve Water in All Years

- Allow for 5% hourly flow increases from Hebgen Dam (currently 10% per day).
- Provide a range of operating elevations at Ennis Lake during the winter time. Currently have to operate at 4839.
- Provide a small margin or range for minimum flows at Kirby

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