Post- 2024 Expectations for Tributary Headwaters Management: Libby Dam Operations in a Changing Climate

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Columbia River Treaty

- Ratified in 1964 and goes through 2024
- Original focus was on power and flood control
  - Fish operations are far more important today
- Termination/renegotiation requires 10-year written notice (Sept. 2014)
- Both countries have ongoing efforts to examine possible futures for the Treaty
- Between the U.S. and Canada
  - United States Entity
    - The Bonneville Power Administration **(BPA)** and U.S. Army Corps of Engineers **(Corps)**
  - Canadian Entity
    - The British Columbia Hydro and Power Authority **(BC Hydro)**

Problem Overview

- Why focus on Libby?

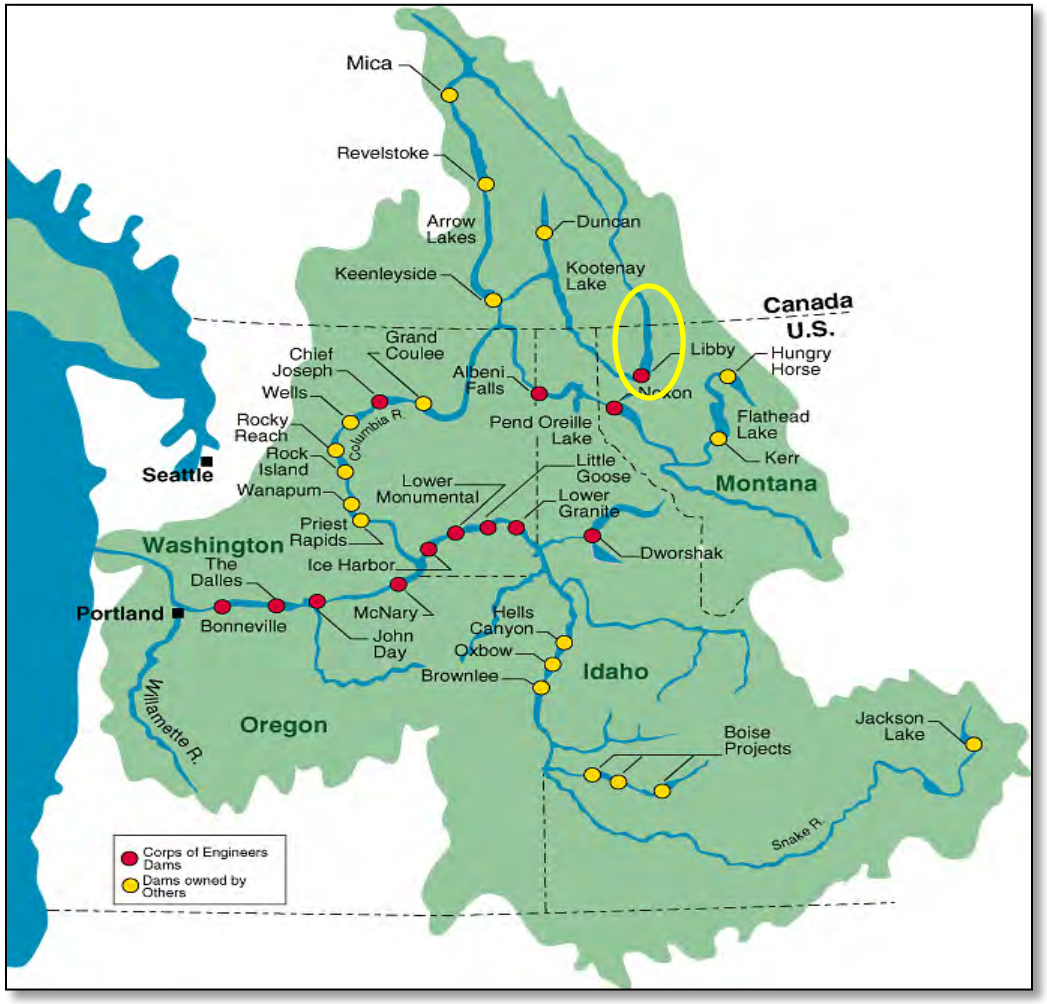
Canada is obligated to operate 8.45 MAF of reservoir storage (increased to 8.95 MAF in 1995 due to reallocation of Mica/Arrow storage) under a flood control operating plan that attempts to eliminate (or at least reduce) flood damages in both Canada and the U.S.

U.S. purchase of this flood control operation expires in 2024.

Regardless of whether or not the treaty is terminated: Canadian flood control transitions to "Called Upon" status – meaning storage requests limited to floods that cannot be controlled by U.S. storage.

Limited Storage options on U.S. side so Libby becomes very important.

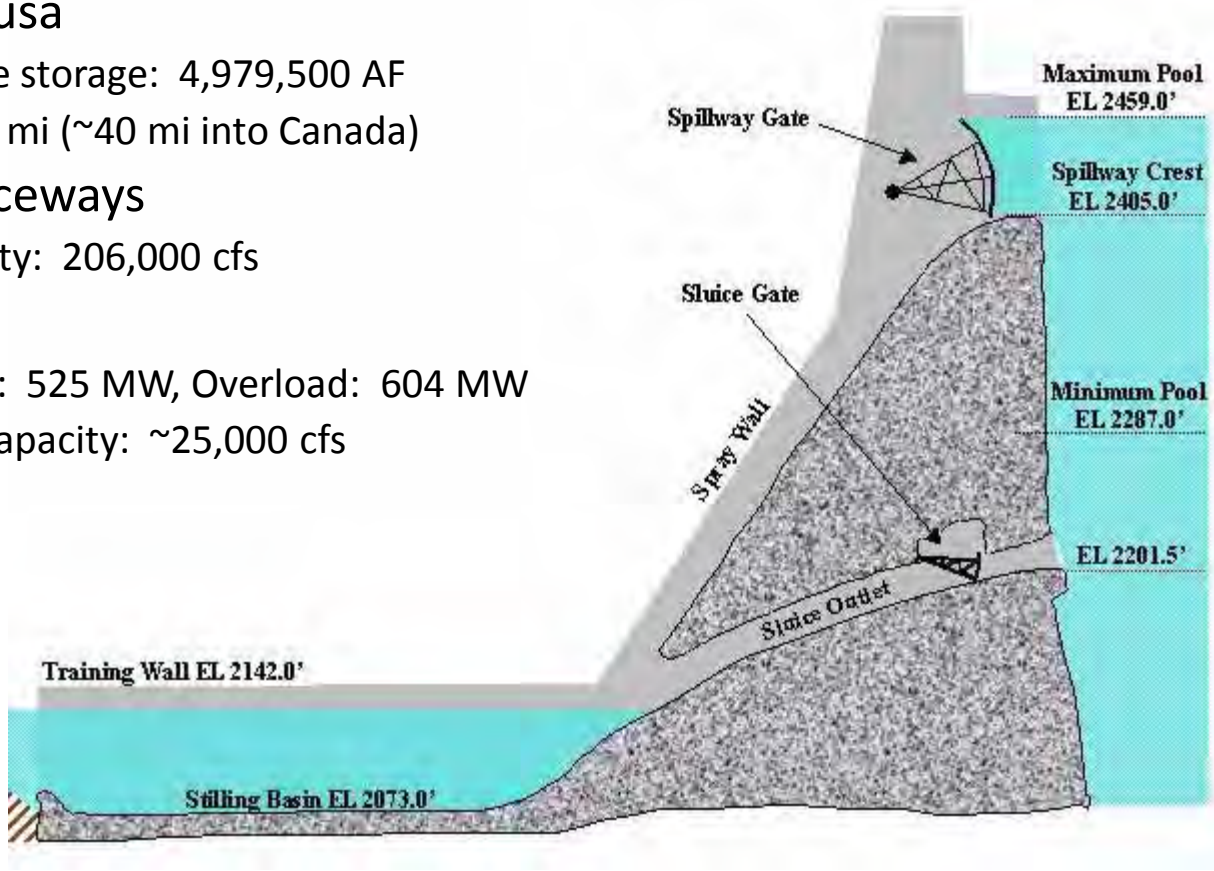
Libby – 1 of 4 Columbia River Treaty Dams along with Duncan Dam, Mica Dam, and Keenleyside Dam in Canada



Source: Army Corps of Engineers

Characteristics of Dam/Reservoir

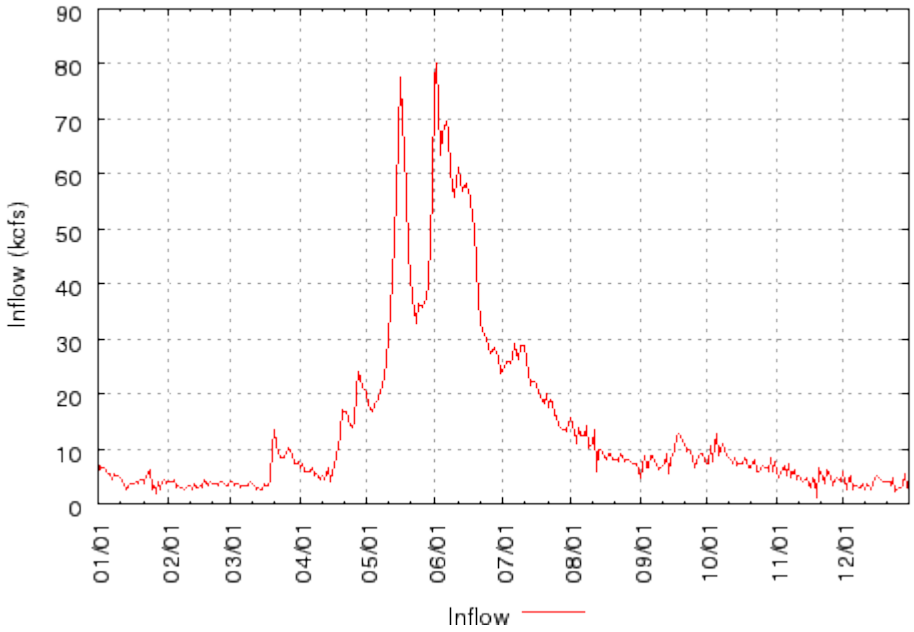
- Lake Koocanusa
  - Total usable storage: 4,979,500 AF
  - Length: 90 mi (~40 mi into Canada)
- Spillway/sluiceways
  - Max capacity: 206,000 cfs
- Powerhouse
  - Nameplate: 525 MW, Overload: 604 MW
  - Hydraulic capacity: ~25,000 cfs
  - 5 units



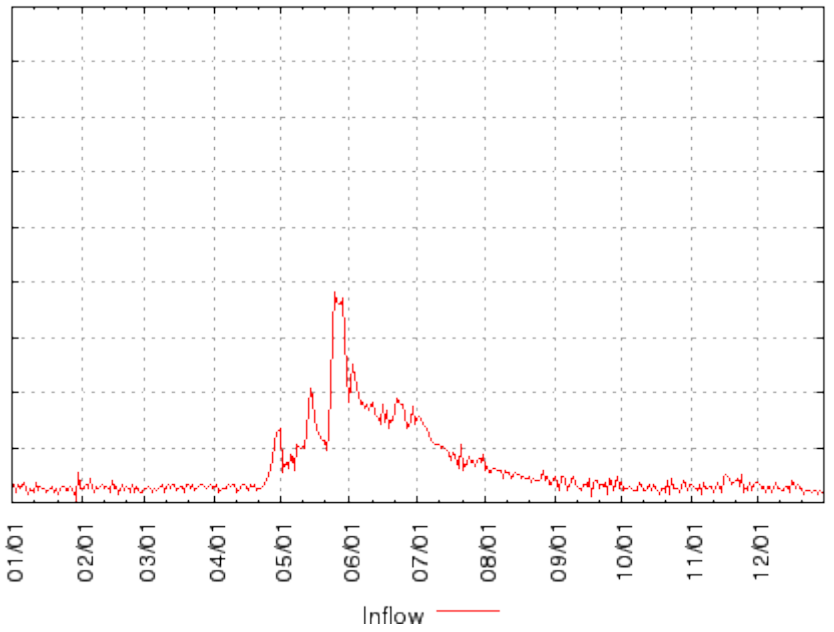
Source: Army Corps of Engineers

Natural Variations in Libby Inflows

1997 Inflow



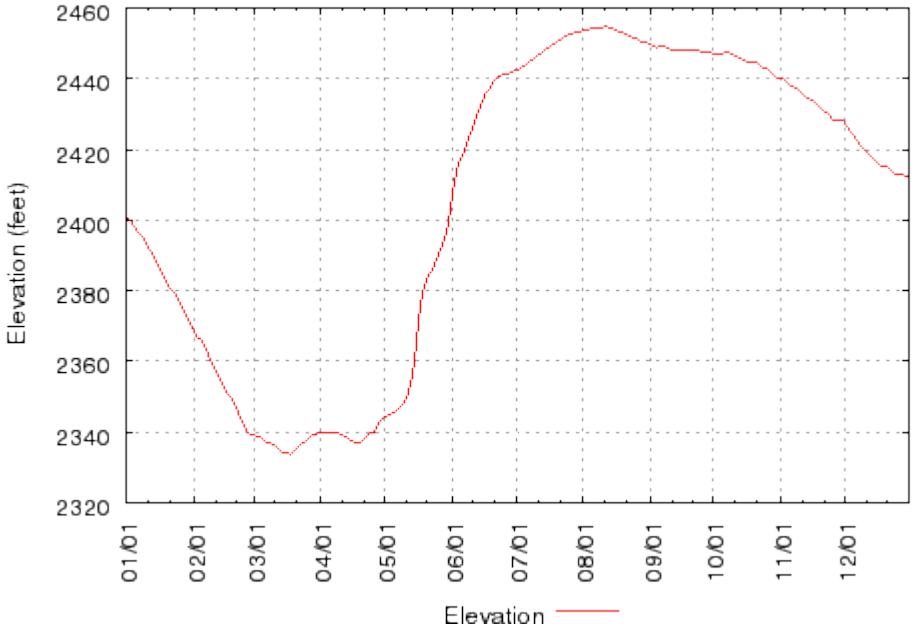
2001 Inflow



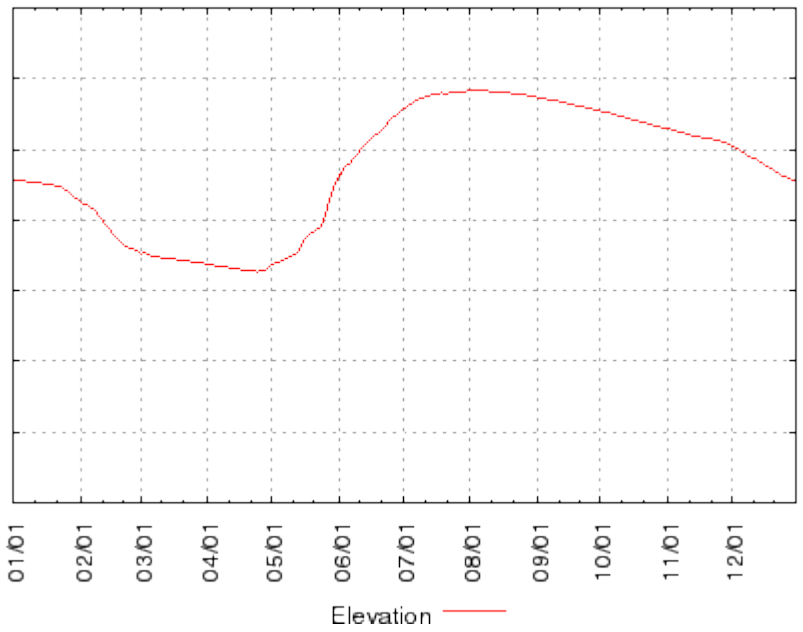
Source: Columbia River DART

Impact Lake Levels

1997 Elevation



2001 Elevation



Source: Columbia River DART

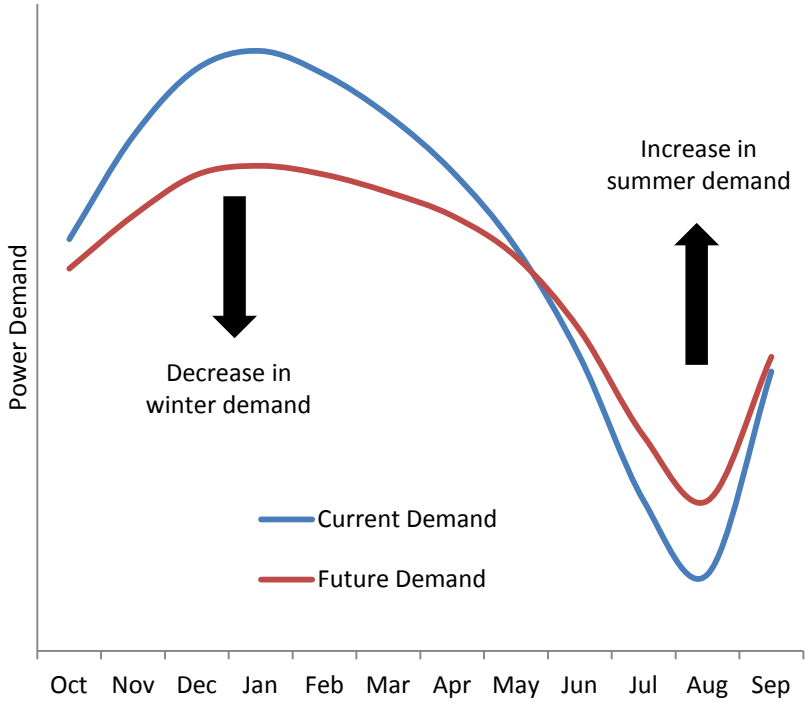
VarQ Operations (Others Rules?)

- Coordinated with Canada because Canadian land flooded by Koocanusa reservoir
- Libby releases benefit power and flood control downstream in Canada
- Power benefits belong to the country in which they occur
- April-August volume forecasts begin in December
- Are there better alternatives?
  - Sturgeon?

LA Times Photo

Climate Change

- Pacific Northwest could see a 2.5°F increase over the next 50 years
- Shift in power demand
- Peak flows are expected to occur sooner in spring and with greater magnitude
- Summer flows could dramatically decrease
- Shift in power supply from hydro to earlier in the spring

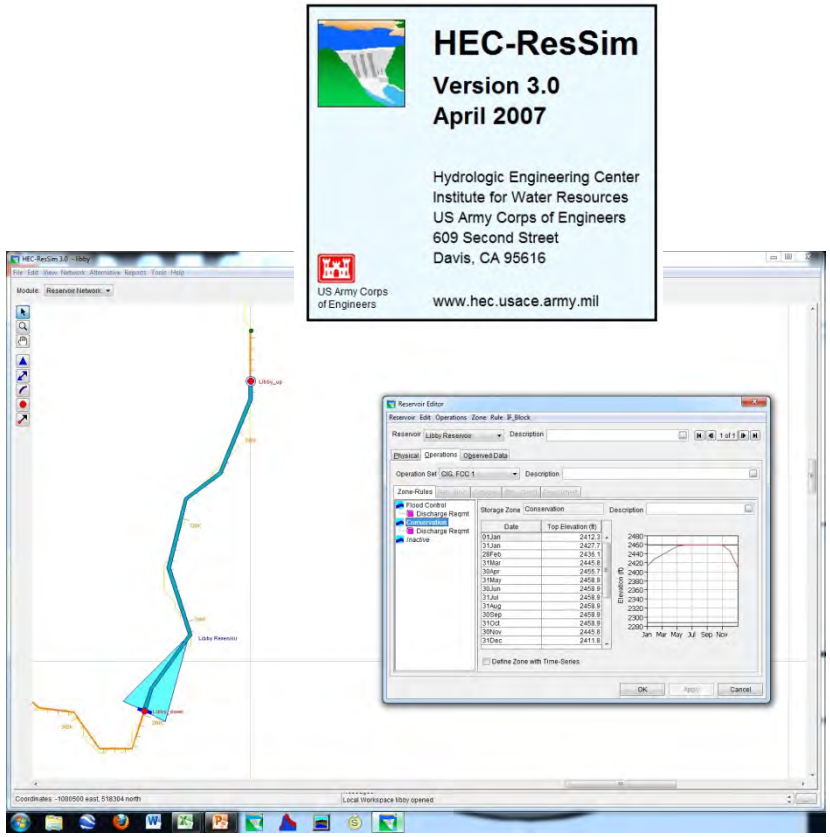


Managing Beyond Hydropower and Flood Control

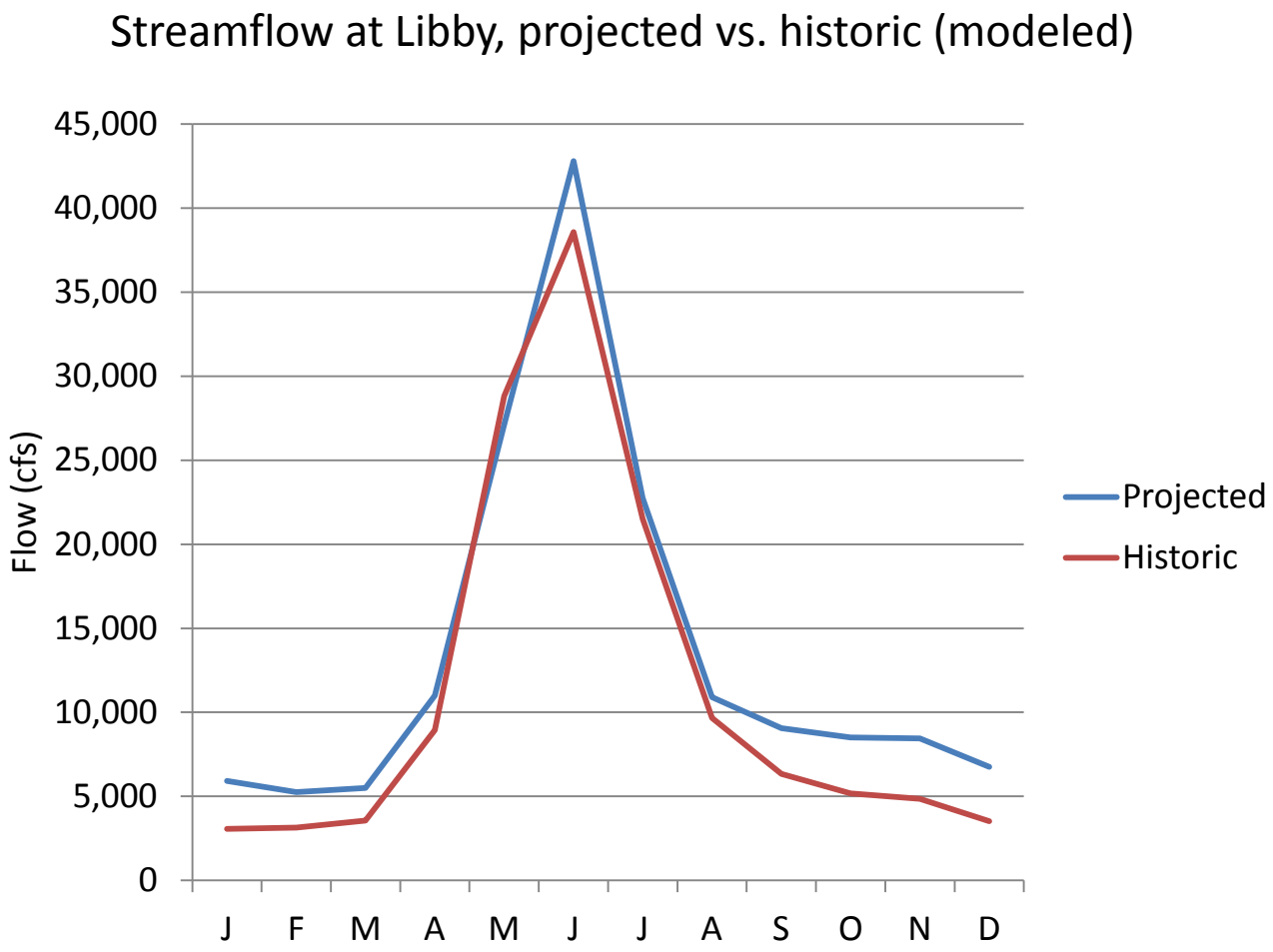
- World has changed significantly since 1960's
  - Agricultural implications
  - Municipal water supplies
  - Tribal and First Nation concerns
  - ESA
  - Ecosystem valuation
  - Recreation
  - Stakeholder involvement in processes

Modeling Efforts

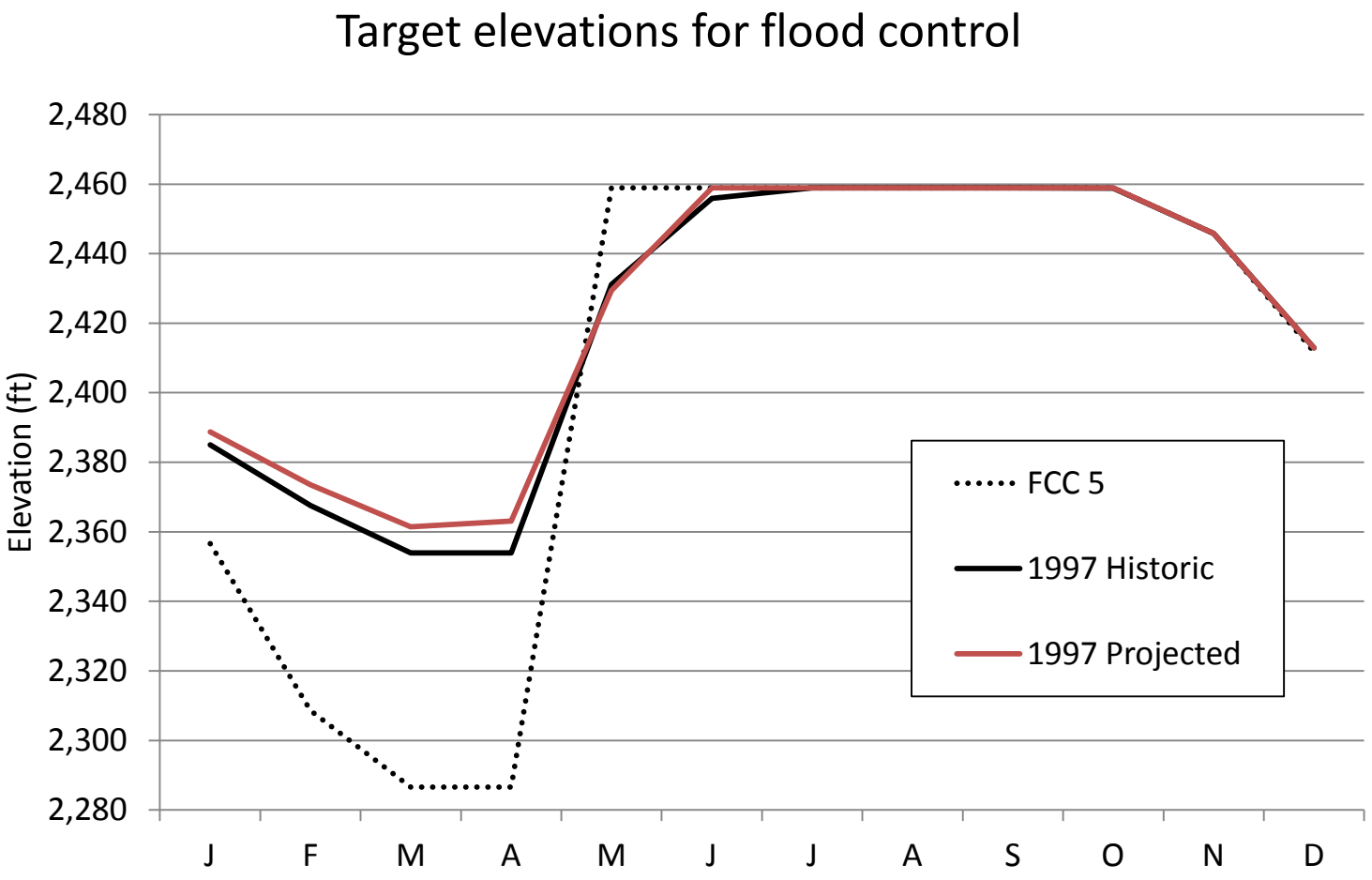
- HEC-ResSim model
  - Single-reservoir model
  - Uses Corps' rule curves for target elevations
  - Input streamflows are based on VIC output for upstream of Libby Dam
  - Modeled years are 1970-2006
  - Climate projections to the mid-2030's



Changes at Libby



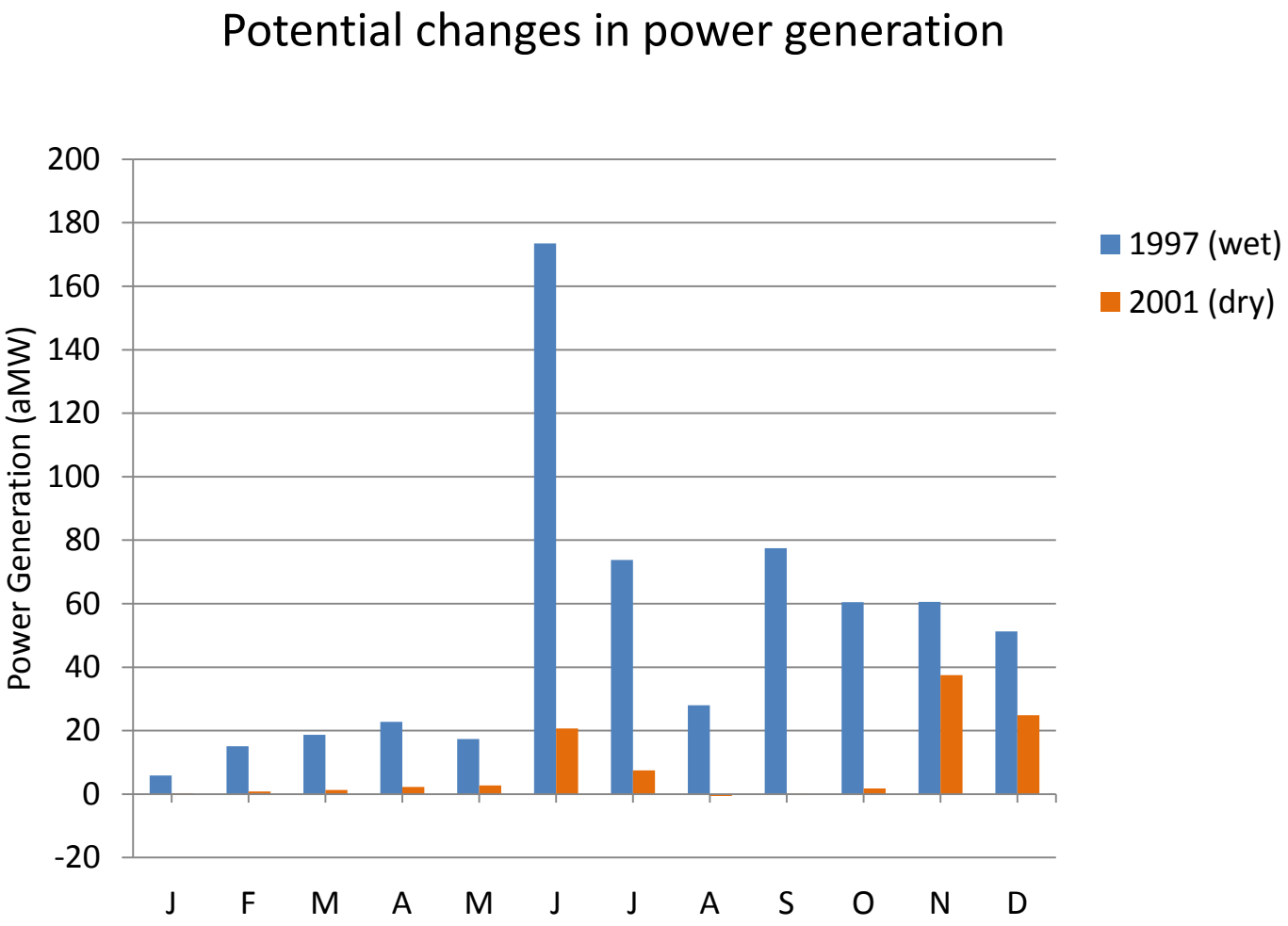
Libby Model Results



Libby Model Results

- April to August volumes increased in 31 of the 37 years by an average of ~500,000 AF
- Average decrease for the other 6 years was ~175,000 AF
- Implications:
  - Draft could occur sooner in the year and be greater in magnitude
  - Lower spring levels in Koocanusa

Model Results



Drawdown Concerns

- Consideration of community issues
- Potential impacts on dykes
- Does downstream focus factor in local flood issues
- Archaeological concerns for first nations
- Economic development implications
- Energy Issues

Conclusions

- More accurate projections of snowmelt runoff will be needed to effectively operate reservoirs
  - It appears more energy can be produced – is there demand?
- Integration of alternative electricity supplies will become increasingly difficult as operational flexibility decreases
- Evaluation of off-channel storage options will be scrutinized
- Economical hydropower generation potential should be re-evaluated
- Libby drawdown must be examined for negative and positive impacts

Questions?

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