BONNEVILLE POWER ADMINISTRATION

Columbia River Operation Overview

FCRPS Background

- The US Army Corps of Engineers (USACE) and the Bureau of Reclamation (BOR) operate the 31 federal dams for multiple public purposes:
  - Flood Control
  - Navigation
  - Fish Operations (Endangered Species Act, Clean Water Act)
  - Irrigation
  - Recreation
  - Resource Integration
  - Reliability
  - Safety
- “High Priority Objectives” = Flood Control, Reliability, Safety Fish Operations,

Regional Stakeholders

- In addition to Bonneville, the Corps and Reclamation, there are a number of other stakeholders in the region
  - National Oceanic and Atmospheric Administration
    - National Marine Fisheries Service mission is to protect habitats under the Endangered Species Act (ESA)
  - States of Oregon, Washington, Idaho, and Montana
    - Federal and non-Federal hydro projects on rivers which pass through 4 states
  - Canada (BC Hydro manages water; Powerex markets power)
    - Watersheds in Canada feed into the Columbia River
    - Columbia River Treaty
  - Tribal interests
    - Columbia Basin Fish Accords – partnership between federal agencies, states and tribes to manage and protect natural resources in the Pacific Northwest
  - Recreation
    - Boating, camping, fishing, marinas, vacation homes, races
  - Irrigation
  - Resource Integration
  - Rate Payers

Planning and coordinating the operation of the FCRPS is very complex and involves many different competing interests

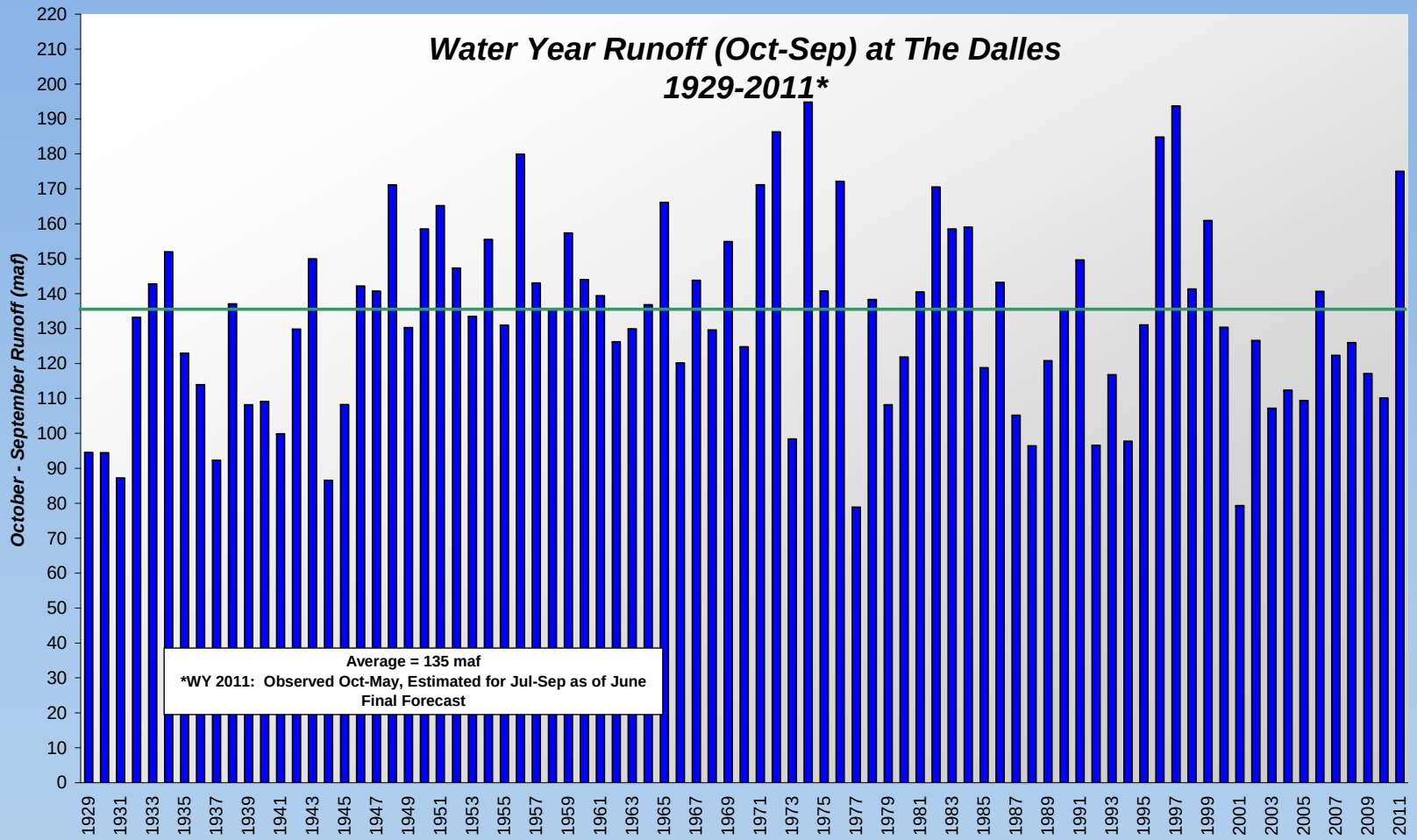
Uncertainty and Flexibility - Today

- **Uncertainty**
  - Streamflows: significant variation in annual average runoff as well as day-to-day streamflows
  - Loads: dependent upon accurate temperature forecasts
  - Contracts: counter-parties behavior dependent upon power market prices
  - Resource Performance: unit outages and intermittent resources
  - Project Operations:
    - Present and future BiOp requirements reduce FCRPS capability and flexibility
    - Non-Federal reservoir operations: Mid-Columbia, Hells Canyon, Canada
  - Flood control, recreation, irrigation, fish mitigation, etc…
  - Market Depth: is there sufficient depth in the market to handle resulting inventory?
- **Flexibility**
  - The ability of FCRPS resources to respond to changing conditions
  - More operational constraints = less operational flexibility

FCRPS Background

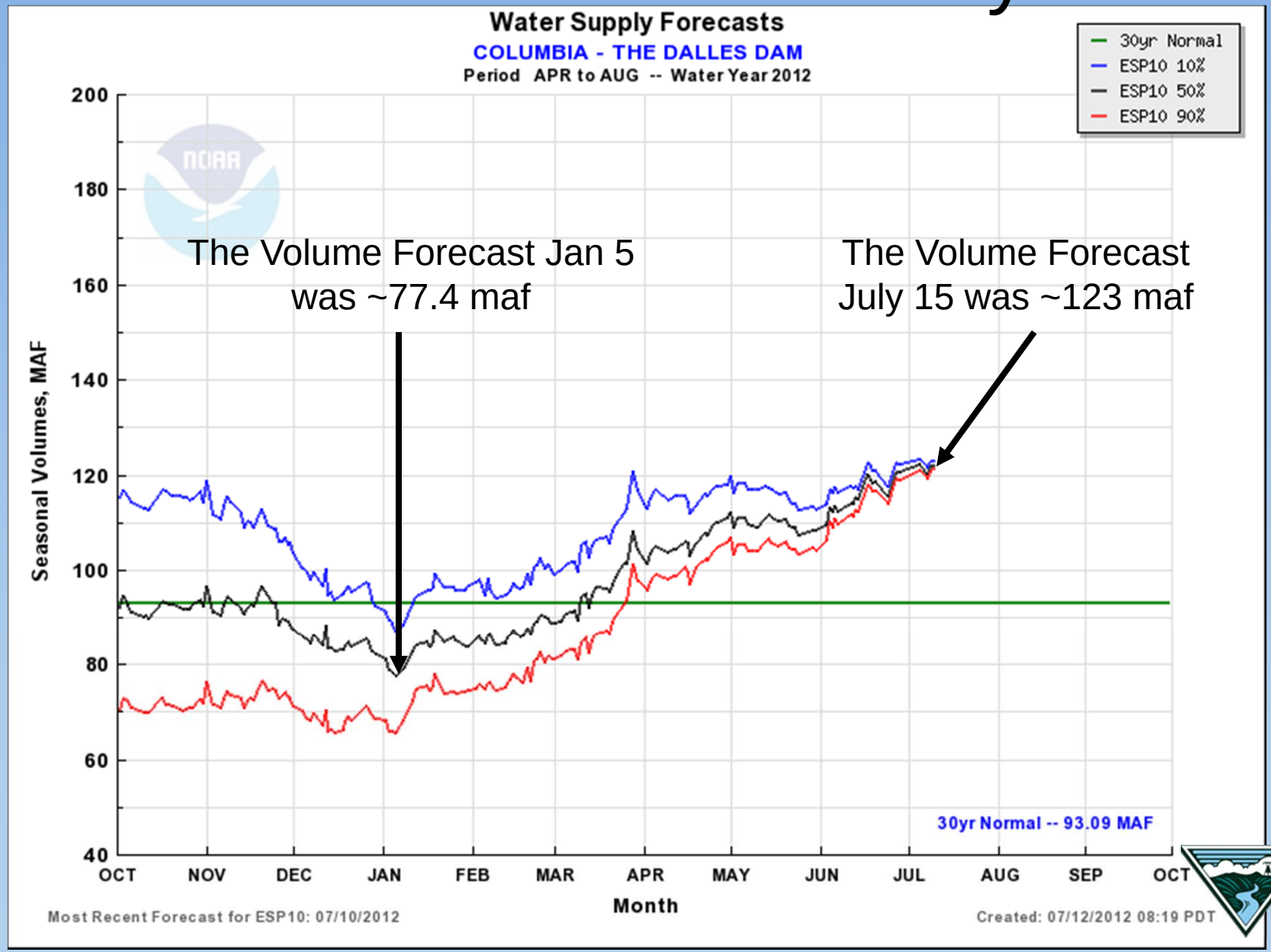
- October - September average runoff 133 million acre feet (Maf) measured at The Dalles (roughly ranges from 80 – 196 Maf)
  - Geographical differences between major sources of snowpack results in timing differences between when the runoff starts (called “runoff shape”)
- Federal storage about 30 Maf, which is a fraction of the annual runoff
  - The Colorado and Missouri systems can store two to three times the annual runoff

Hydrological Data

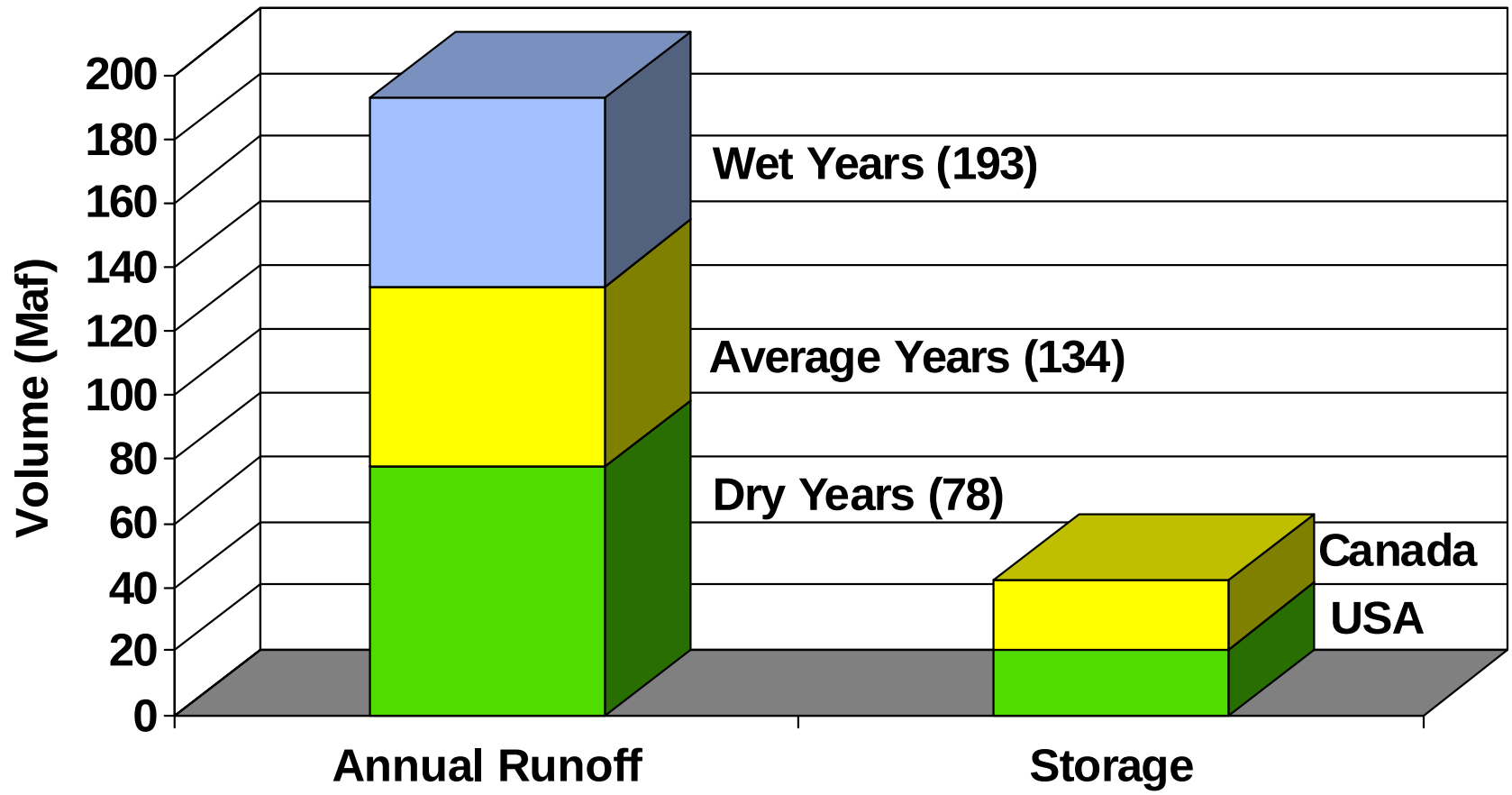


- 1 Maf is approximately equal to 1000 MW-mos but the amount of energy can vary depending upon where in the basin the water comes from

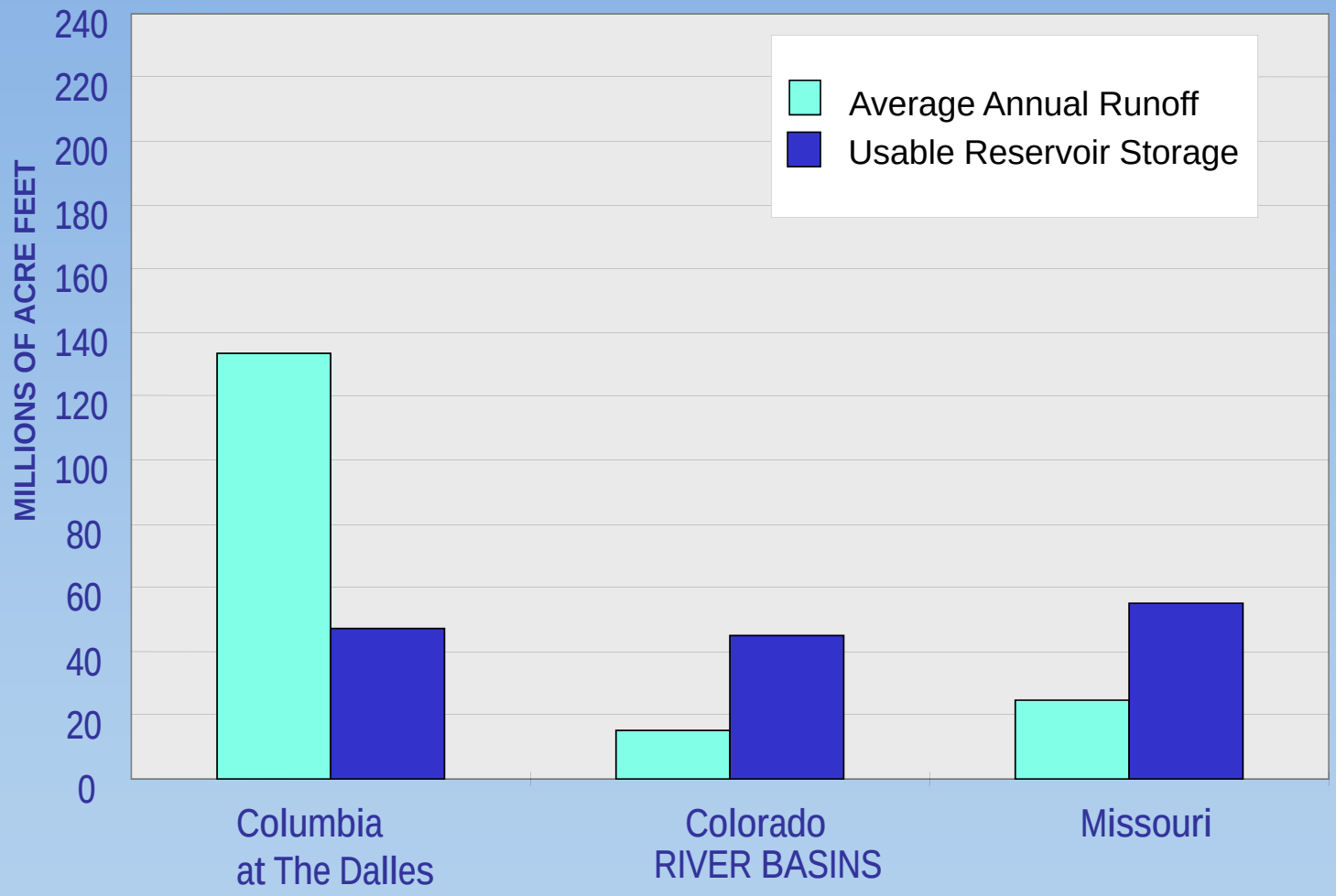
Streamflow Uncertainty



Comparison of Storage Volume to Variations in Runoff



Average Annual Runoff and Usable Reservoir Storage
Major Western River Basins



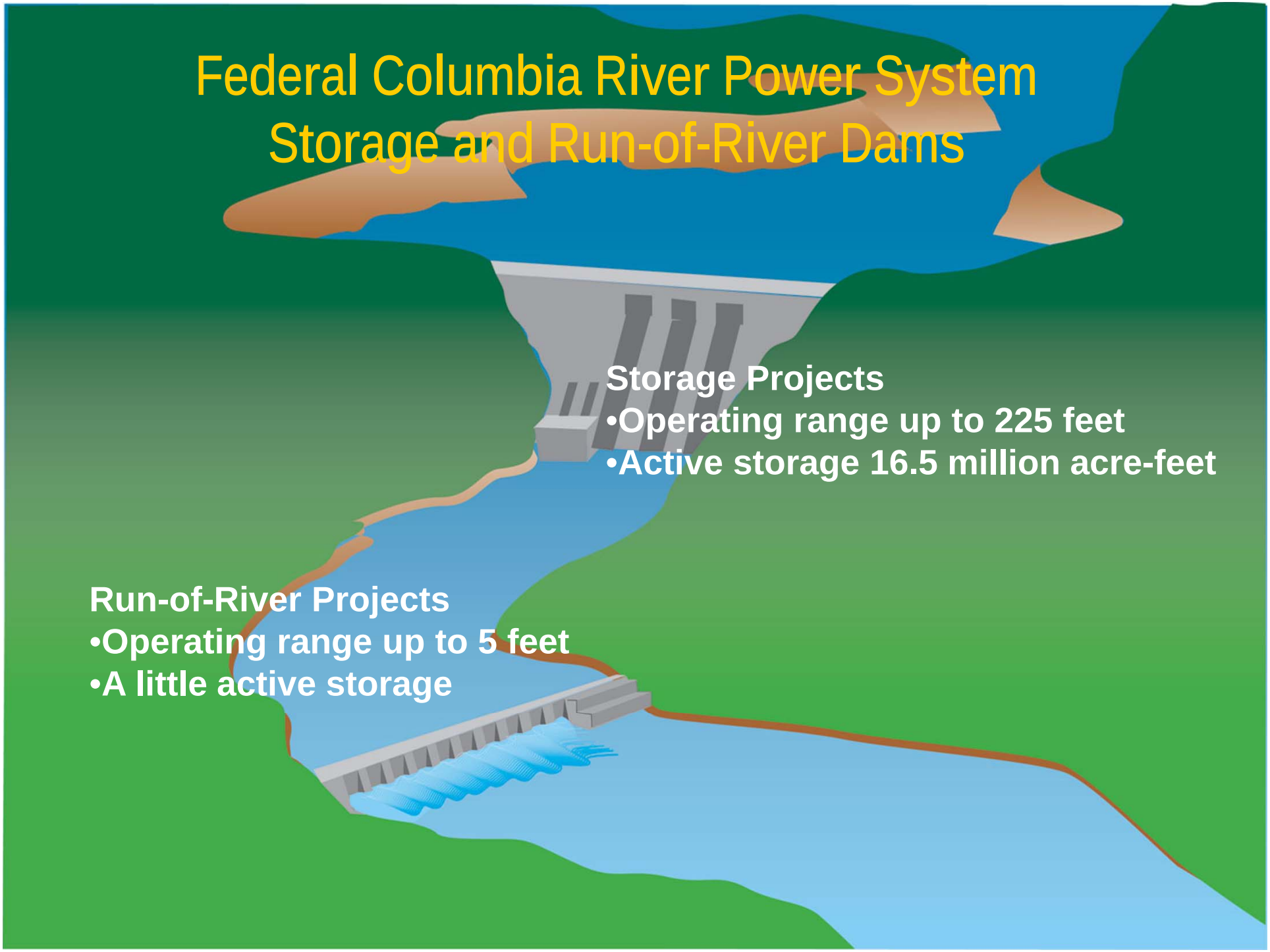
Columbia River Basin

Comparison of space available for system flood control storage

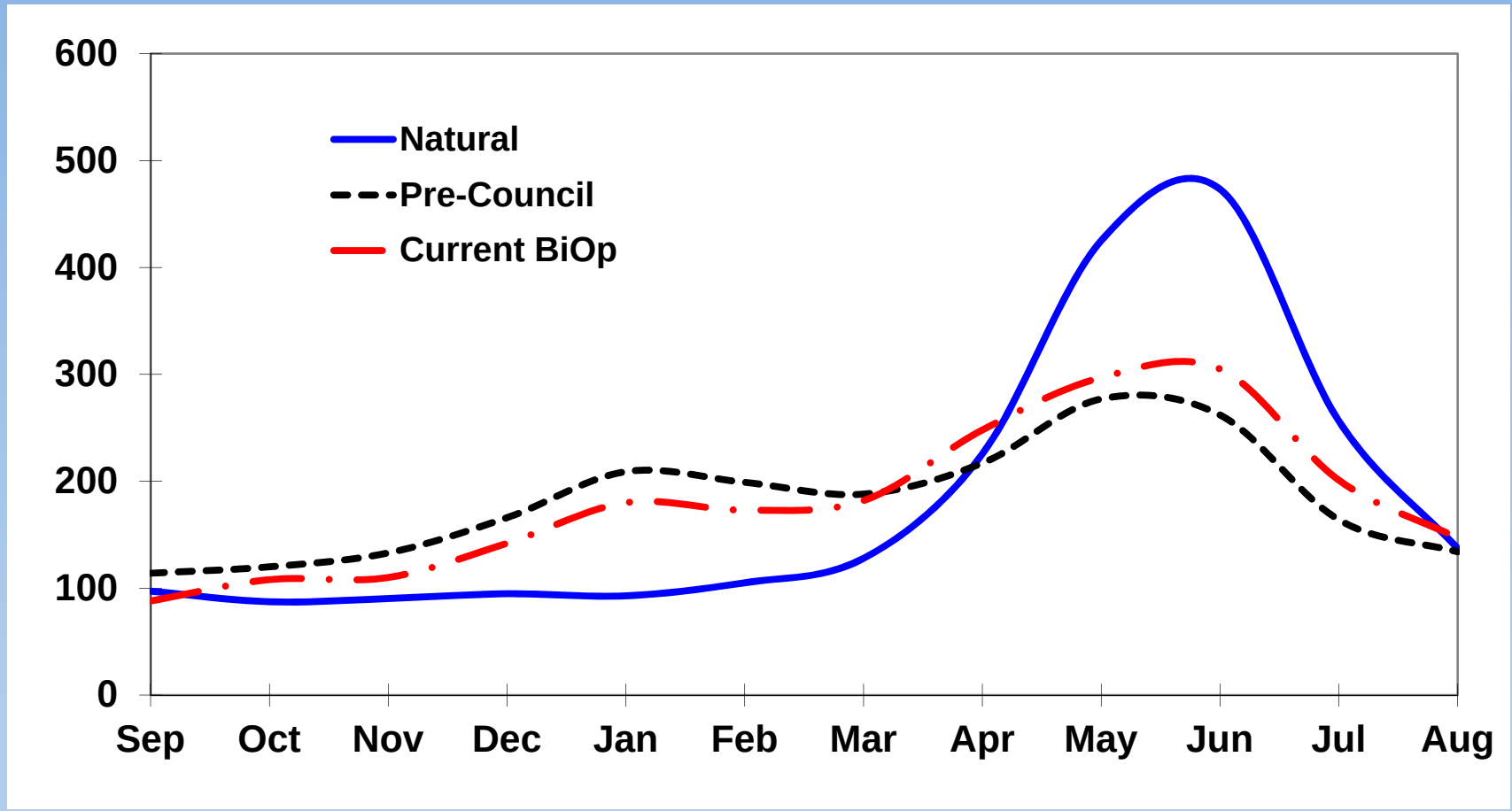
Total space available for flood control: 24.5 MAF

Total active storage: 45 MAF

Federal Columbia River Power System
Storage and Run-of-River Dams



Changes in River Flows
(since 1980)



Monthly Operations in Average Water *(Sept. – Nov.)*

September:

- Refill to Grand Coulee 1283 ft. for Kokanee spawning
- Headwater Project finalize summer augmentation drafts and transition to minimum flows.

October:

- Vernita Bar Fall Chinook operation (50-100 kcfs)
- Prepare Grand Coulee to support the Bonneville Chum operation (125-145kcfs)
- Banks Lake irrigation pumping ends

November:

- Bonneville Chum and Vernita Bar Fall Chinook protection

Monthly Operations in Average Water *(Dec. – Feb.)*

December:

- High regional power demand
- Grand Coulee draft limited to 1270 ft. for power and Chum (1265 ft. during a cold snap)
- Vernita Bar operation continues
- Chum spawning operation ends ~12/31 transitions to protection operation.
- Headwater projects on minimum flows.
- Libby Dam

January

- High regional power demand
- Grand Coulee operation limited to 85% probability of refill to April 10 objective.
- Bonneville Chum & Vernita Bar operations continue
- Headwater projects on Minimum flows or drafting for Flood Control

February:

- Grand Coulee operation limited to 85% probability of refill to April 10 objective.
- Chum and Vernita Bar operations Continue
- Headwater projects on Minimum flows or drafting for Flood Control

Monthly Operations in Average Water *(Mar. – May)*

March:

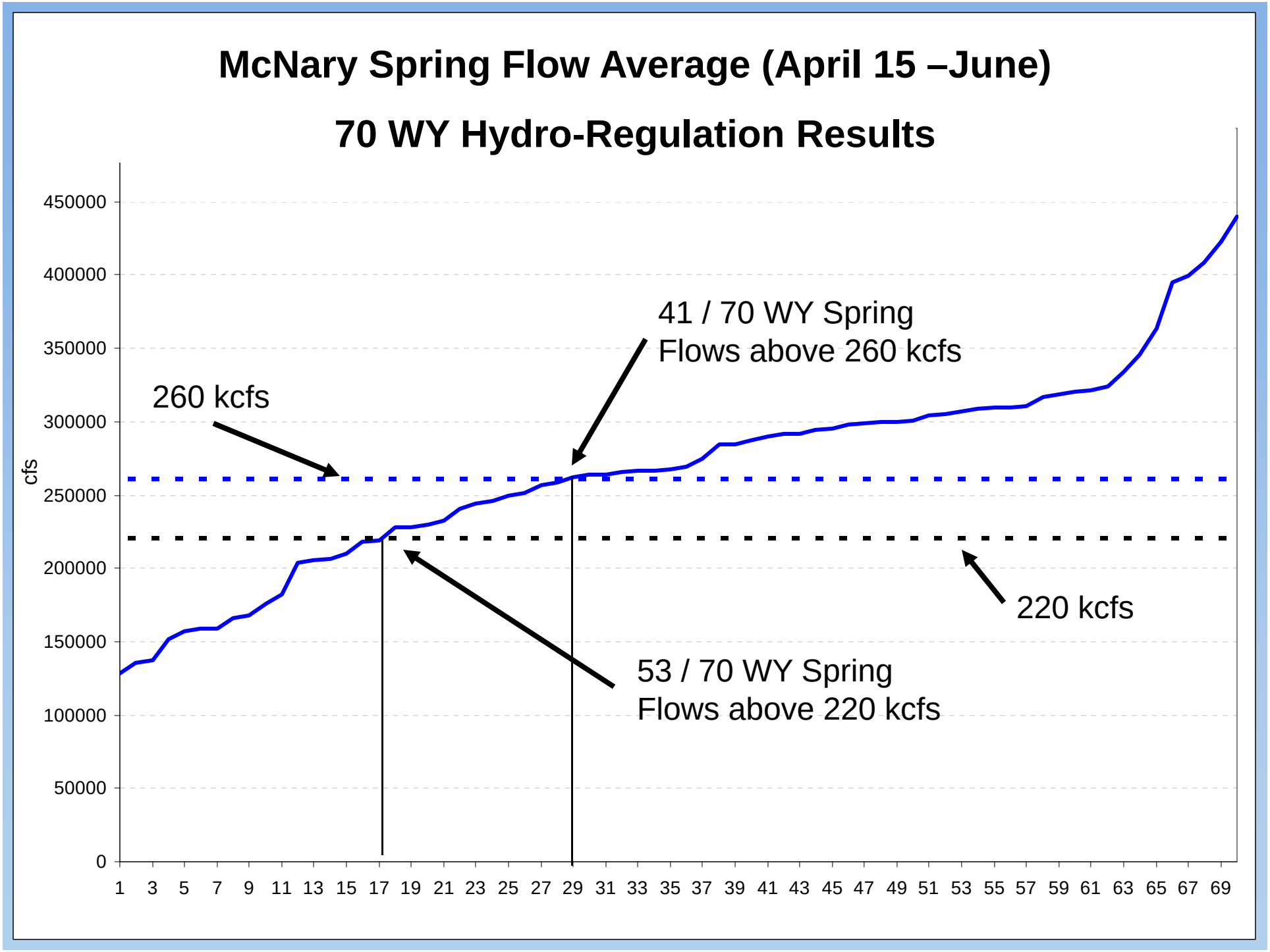
- Grand Coulee operation limited to 85% probability of refill to April 10 objective.
- Banks Lake irrigation pumping begins
- Vernita Bar & Chum operations continue

April:

- Refill / draft storage projects to April 10 elevation objective to maximize flows in the mid-Columbia for spring Steelhead and Chinook
- Draft storage projects to April 30 flood control elevations (all storage projects)
- Manage Grand Coulee to support the Priest Rapids Steelhead flow objective of 135 kcfs
- Snake River and Columbia River fish spill begins
- Spring McNary flow objective of 220 – 260 kcfs
- Chum operation ends
- MOP operation on the Lower Snake River begins

May:

- Maintain McNary and Priest Rapids flow objectives
- Support Vernita Bar stranding operations


McNary Spring Flow Average (April 15 –June)
70 WY Hydro-Regulation Results
cfs
450000
400000
350000
300000
250000
200000
150000
100000
50000
0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49 51 53 55 57 59 61 63 65 67 69
260 kcfs
41 / 70 WY Spring
Flows above 260 kcfs
220 kcfs
53 / 70 WY Spring
Flows above 220 kcfs

Monthly Operations in Average Water *(Jun. – Aug.)*

June:

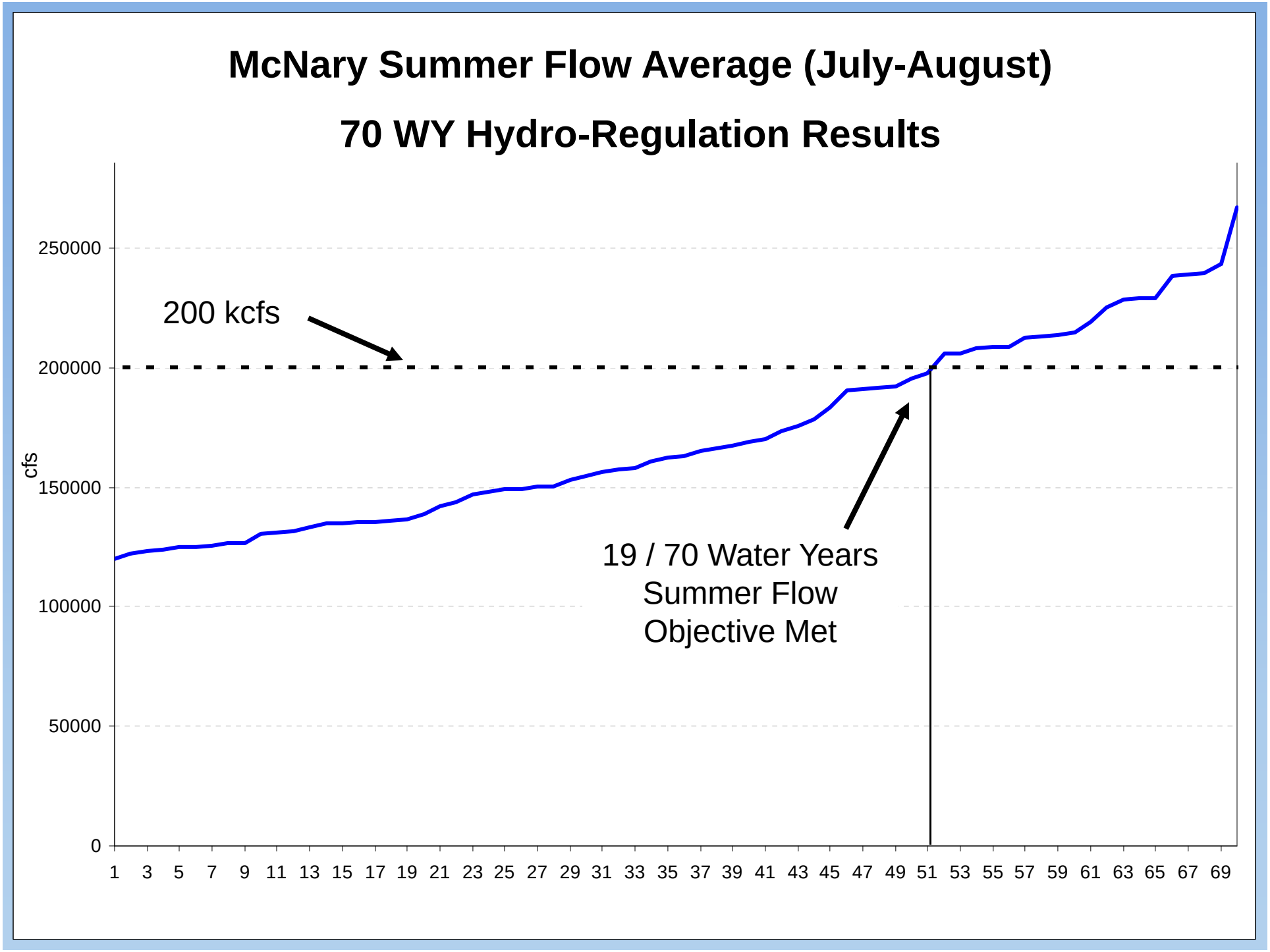
- Refill storage projects for summer recreation and summer flows
- Support McNary flow objective of 220 – 260 kcfs
- Support Vernita Bar stranding operation (typically ends some time in June)

July:

- Manage Storage projects to support McNary Flow objective of 200 kcfs

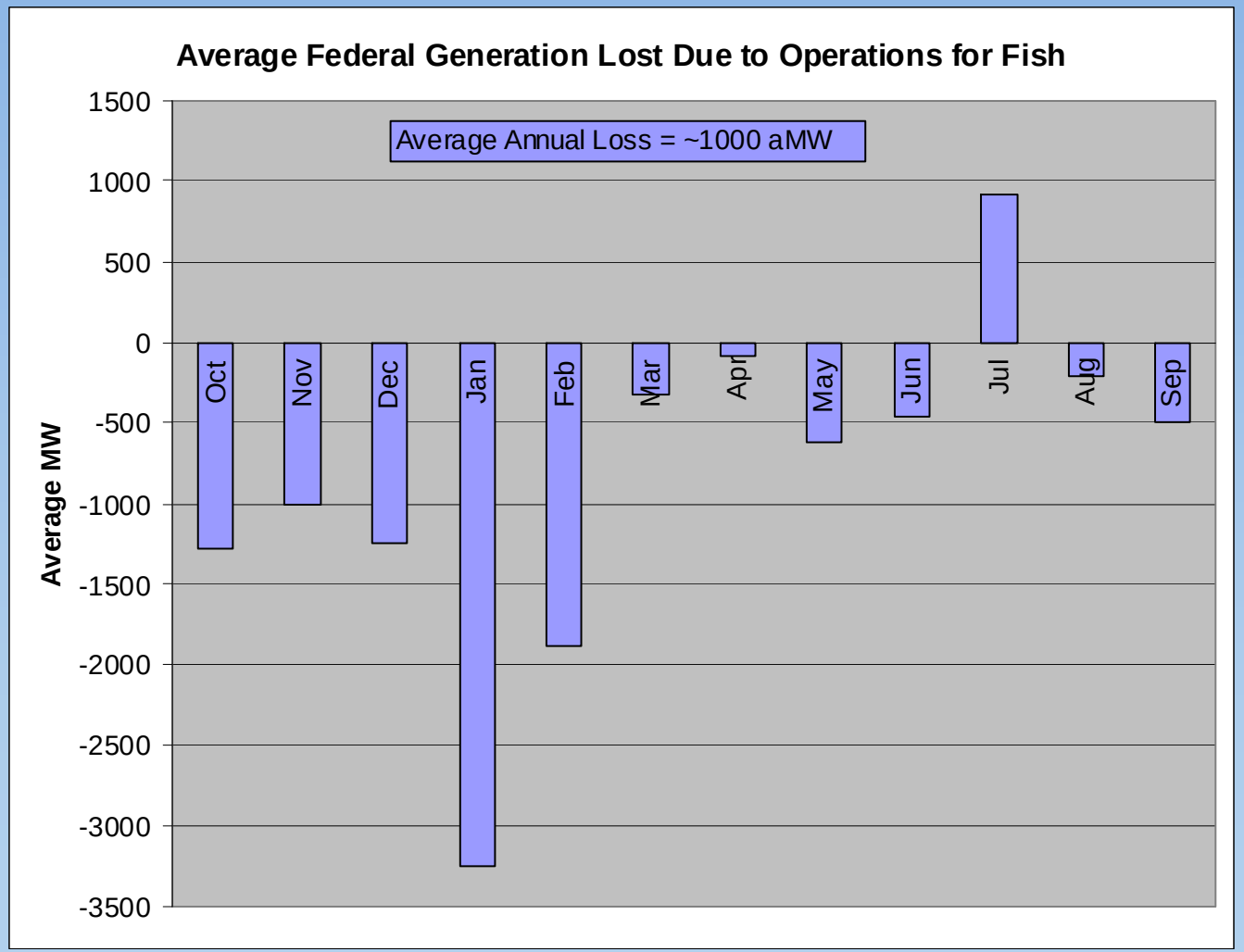
August:

- Draft storage projects for fish flow augmentation
- Fish spill ends at the end of August
- Banks Lake pumping reduced to draft 5’ for flow augmentation
- MOP operation on Lower Snake River ends


McNary Summer Flow Average (July-August)
70 WY Hydro-Regulation Results
250000
200000
150000
100000
50000
0
cfs
200 kcfs
19 / 70 Water Years
Summer Flow
Objective Met
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49 51 53 55 57 59 61 63 65 67 69

Changes in FCRPS Hydro Generation due to Fish Requirements (2008 NOAA BiOp)

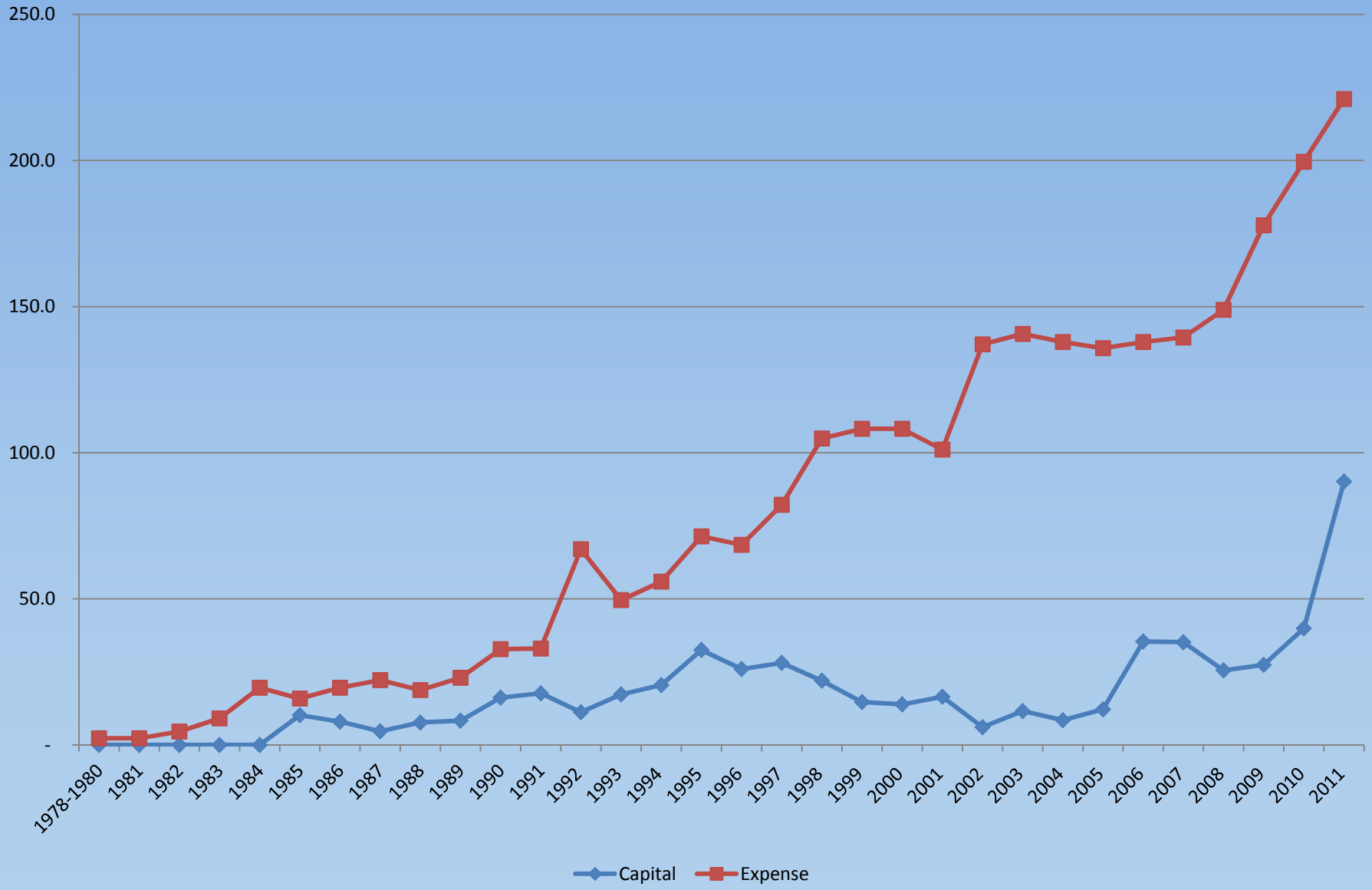
(Average of 70 water conditions)



B O N N E V I L L E P O W E R A D M I N I S T R A T I O N

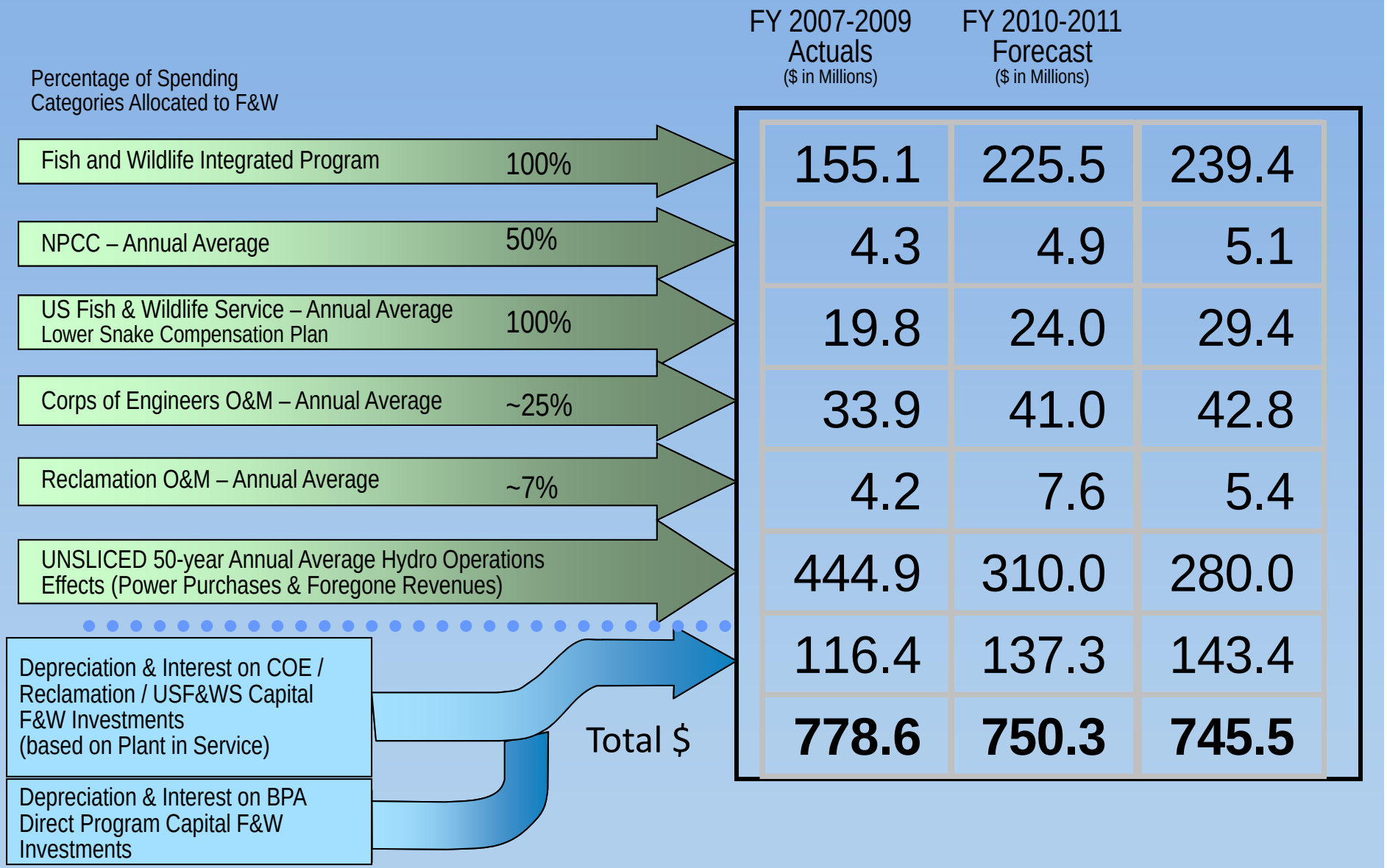
BPA Direct Fish & Wildlife Program

FY Expenditures (in Millions)



BONNEVILLE POWER ADMINISTRATION

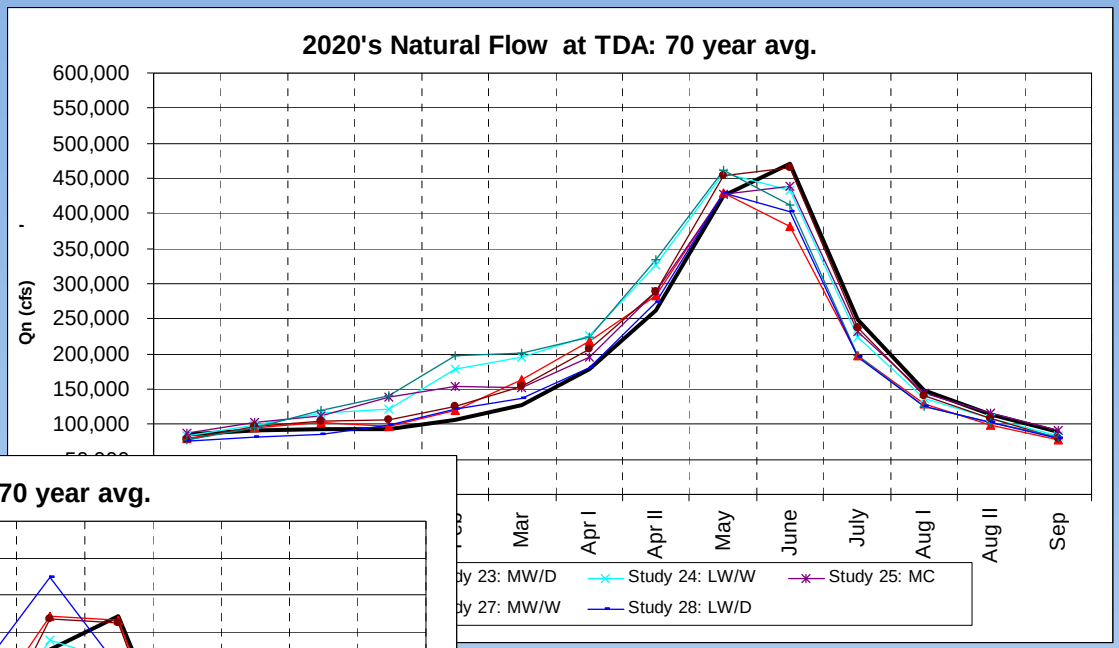
Total Annual Average Cost of BPA Fish & Wildlife Actions

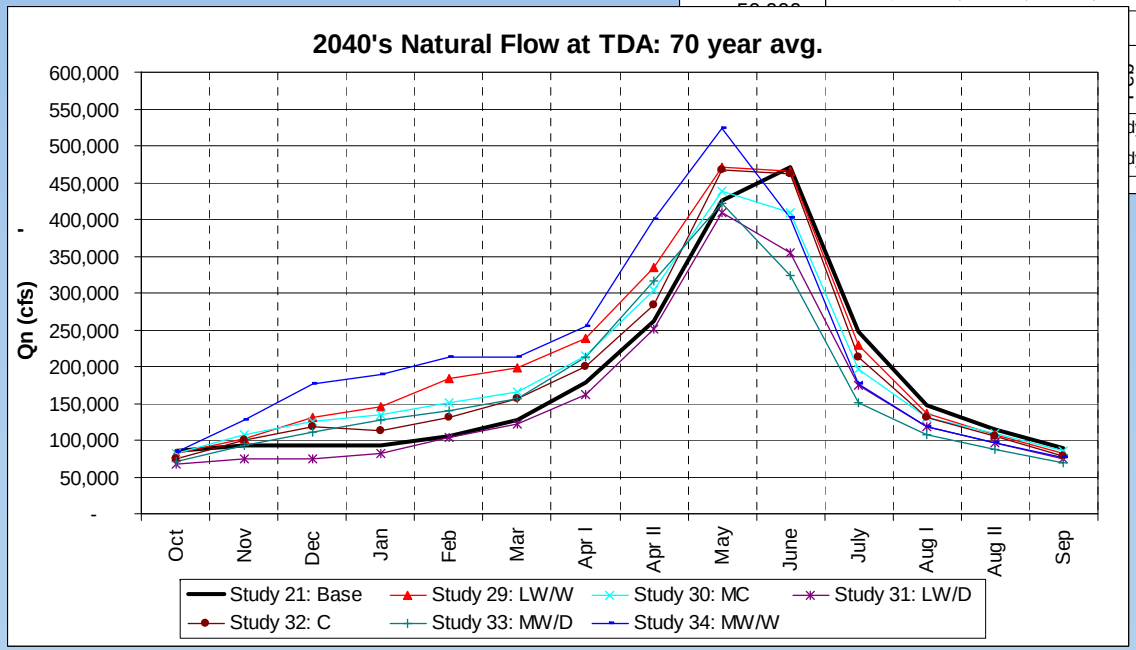


Model Input: Natural Streamflows at The Dalles for 2020's & 2040's

Climate Change scenarios result in higher natural streamflows in the winter to spring period…

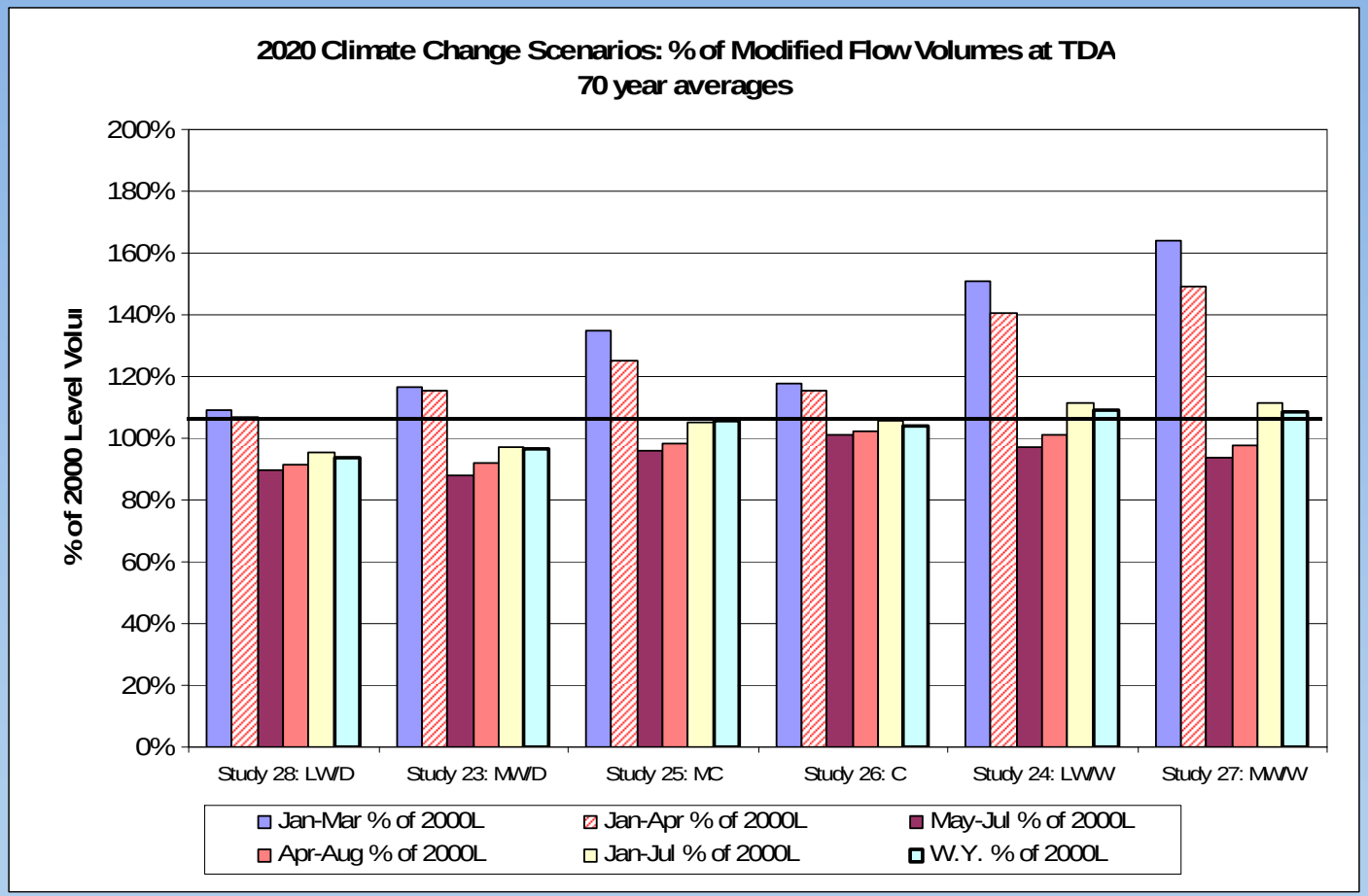
and lower streamflows in the summer, generally speaking





Model Input: Shape of Runoff for 2020's

Note that the 2040's have similar shaping characteristics

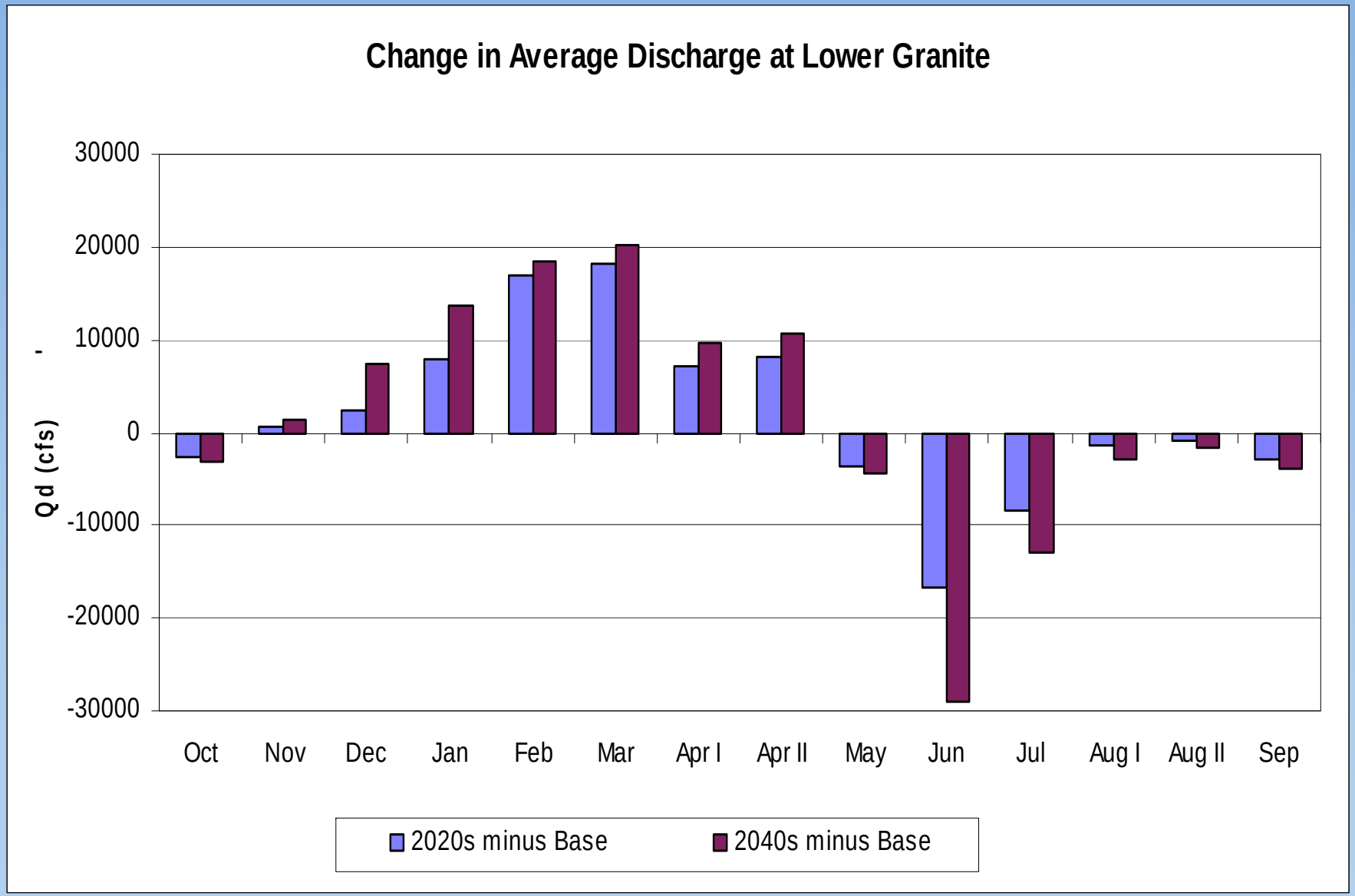


2000L Base Case Volumes @ TDA

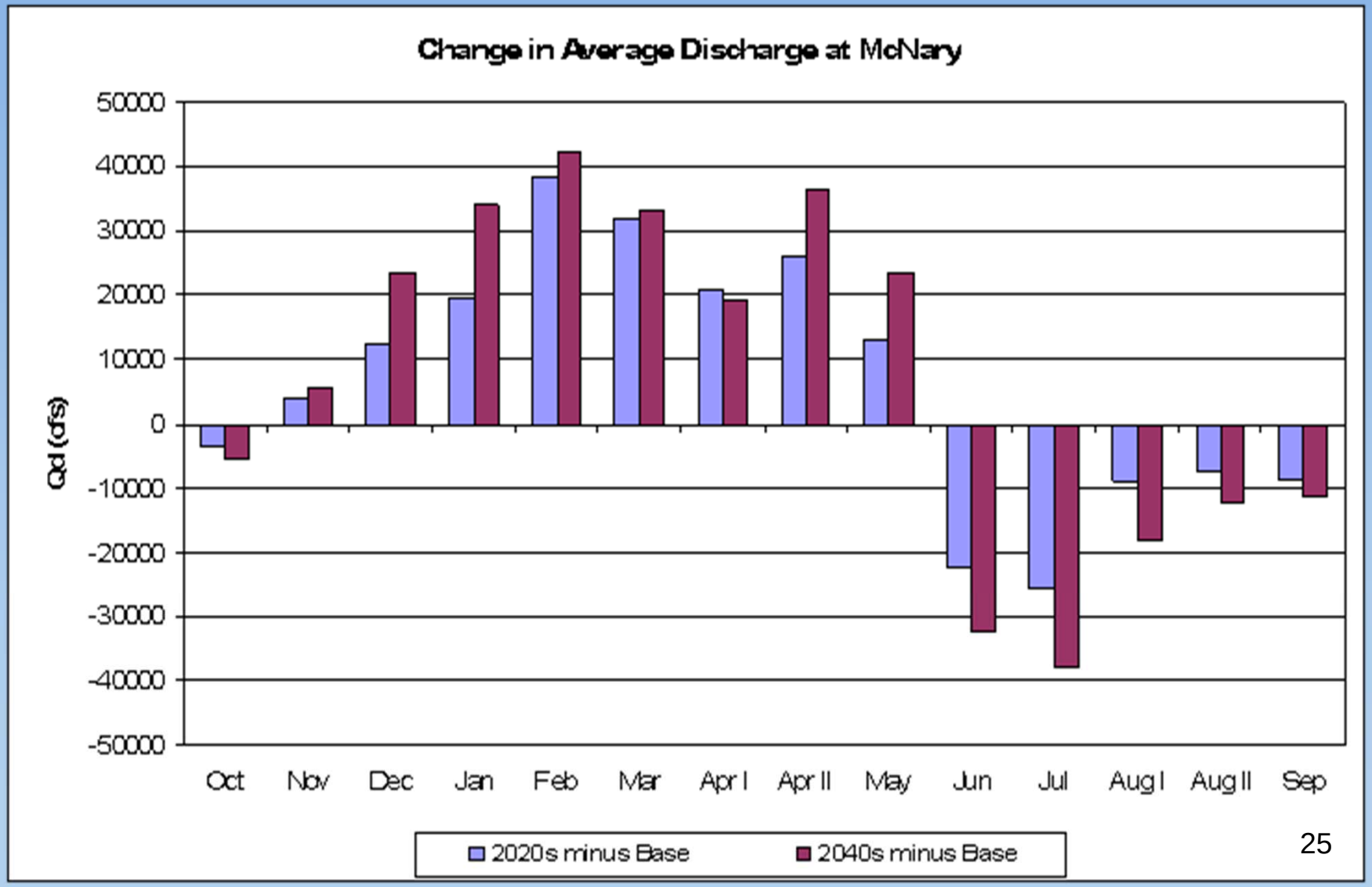
Period	Vol (MAF)
Jan-Mar	19.5
Jan-Apr	32.5
May-July	69.4
Apr-Aug	90.5
Jan-July	101.9
Oct-Sep	131.7

Note that the Jan-April period is higher than current levels, the May-July period is lower (earlier runoff)

Lower Granite Discharge Comparisons to Base Case



McNary Discharge Comparisons to Base Case



Summary of Potential CC Impacts

Changes to:	Winter	Summer
Flows	Higher	Lower
Demand	Lower	Higher
Impacts to:		
Power	Better	Worse
Fish	Neutral	Worse
Revenue	Higher	Lower

BPA Partnerships and Investments

- BPA is supportive of the Oregon Solutions and other like initiatives and will work to continue improved coordination in support of these efforts.
- Commitments through our Accord agreements with the Umatilla Tribe as well as other project sponsors in the basin are critical to meeting our fish and wildlife mitigation objectives
- Significant investments have been made and planning for future like investments is underway. BPA would have concerns about initiatives that are at cross purposes with current and anticipated achievements.