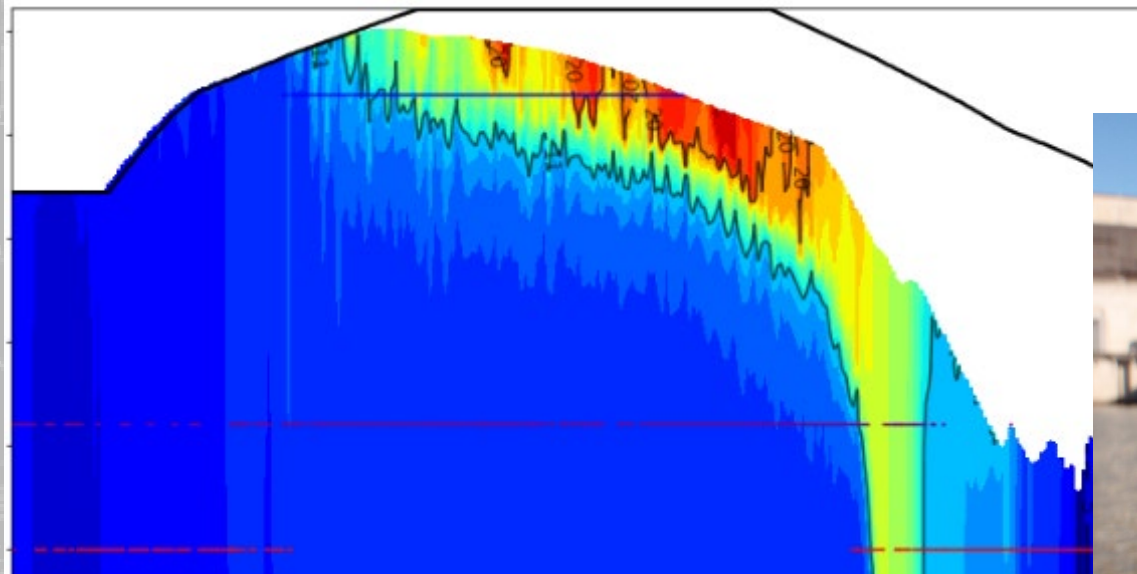


WATER QUALITY MODELING FOR THE WILLAMETTE VALLEY SYSTEM EIS AND BA

NORM BUCCOLA¹, LAUREL STRATTON GARVIN², STEWART ROUNDS², JOSH ROACH¹, DAN TURNER¹



WILLAMETTE FISHERIES SCIENCE REVIEW
APRIL 5, 2023



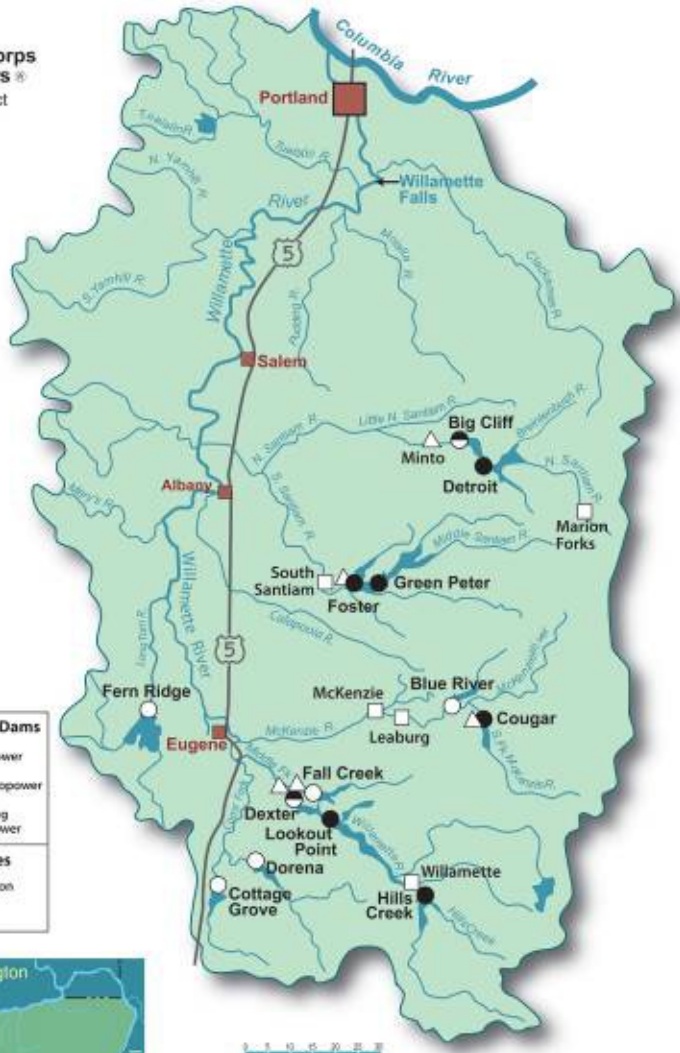
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¹U.S. Army Corps of Engineers

²U.S. Geological Survey Oregon Water Science Center



The Willamette River Basin



WILLAMETTE VALLEY SYSTEM



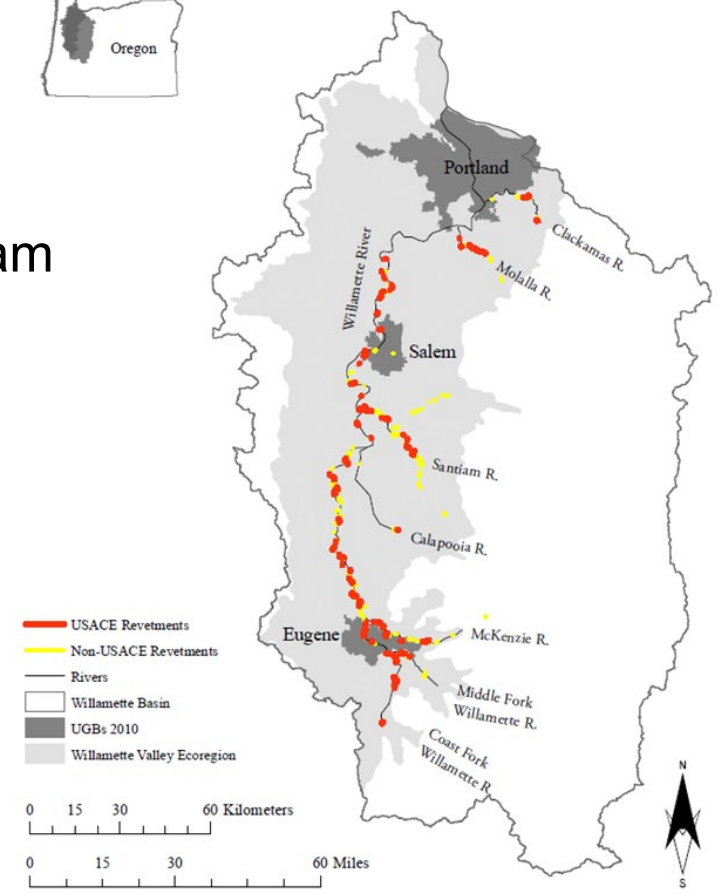
13 Reservoirs

- 11 Multiple-purpose
- 2 Re-regulating
- 8 hydropower

5 Fish Hatcheries

Willamette Bank Protection Program

- 100 miles of revetments
- Mainstem and tributaries





AUTHORIZED PURPOSES



Flood Risk Management



Hydropower



Navigation



Water Quality



Irrigation



Water Supply



Recreation



Fish and Wildlife

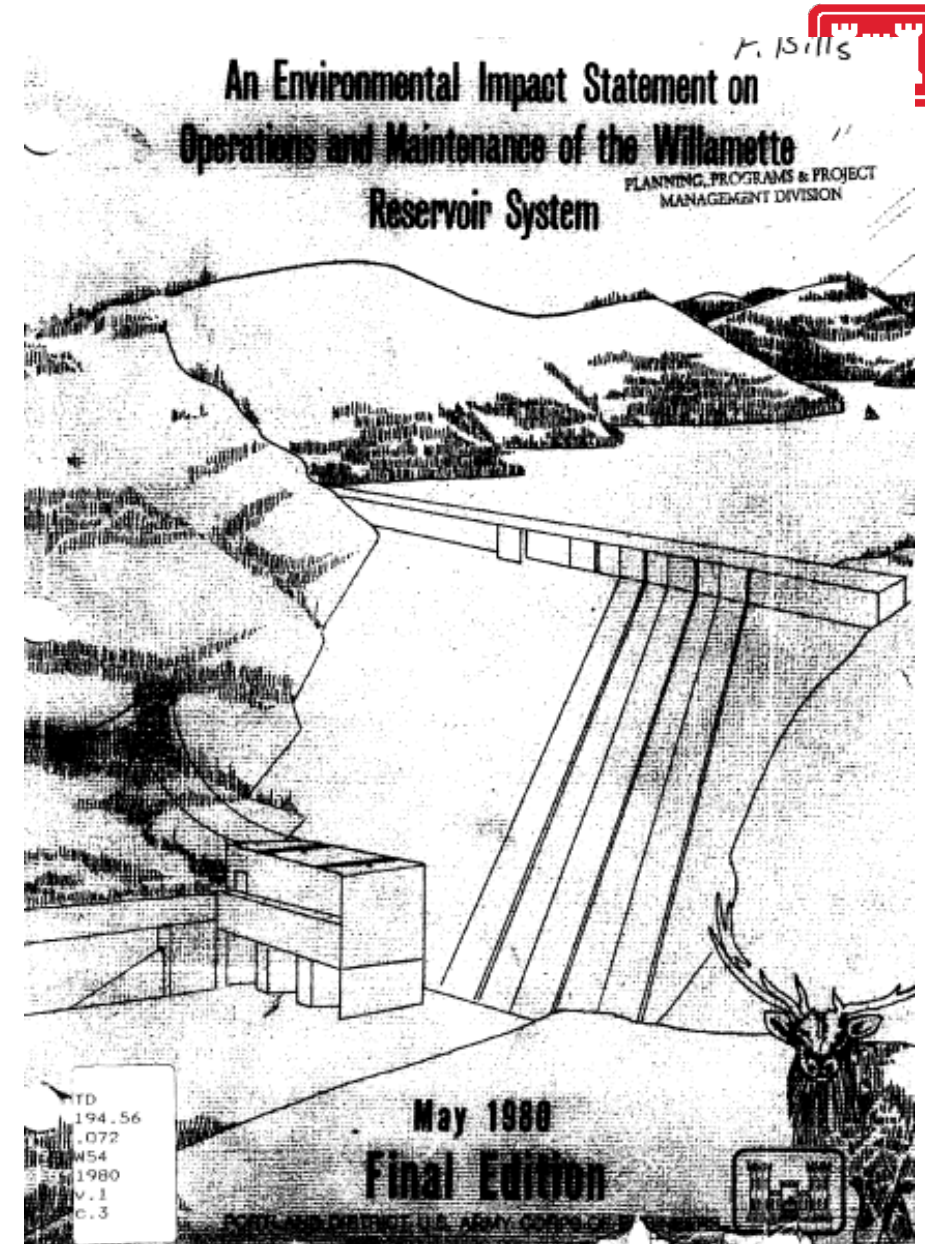


WHY IS THE CORPS PREPARING AN ENVIRONMENTAL IMPACT STATEMENT ?

System-wide evaluation of environmental impacts from operation and maintenance was last conducted in 1980.

Since 1980:

- Operations have been modified and structural improvements have been made.
- New information is available on the environmental impacts of operating and maintaining the system
- Large amount of new information gained regarding Endangered Species Act (ESA) listed species since the 2008 biological opinion, primarily obtained from the research, monitoring, and evaluation (RM&E) program that the Corps has implemented.
- In order to continue to operate the system, Corps must comply with ESA





PRIMARY EFFECTS OF WILLAMETTE VALLEY SYSTEM ON FISH



Fish

- Habitat isolation/disconnection
 - Dams block access to spawning habitat
 - In some basins 90% of spawning habitat upstream of dams
- Interaction of hatchery fish with wild fish
- Flow availability and physical habitat



Hydrology

- Lower winter and higher summer flow

Water Quality

- Temperatures that are too cool in the spring and too warm in the fall, impacting migration timing and survival of ESA-listed fish
- Elevated total dissolved gas, creating injury and mortality of ESA-listed fish





ENDANGERED SPECIES ACT COMPLIANCE



Photo credit: <https://www.fws.gov/oregonfwo/articles.cfm?id=149489411>

Aquatic Threatened & Endangered Species in the Willamette River Basin

- Bull trout
- Upper Willamette River winter steelhead
- Upper Willamette River spring Chinook salmon



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PREFERRED ALTERNATIVE



Integrated Water Management Flexibility and Endangered Species Act Listed Fish Alternative with Operational Downstream Fish Passage

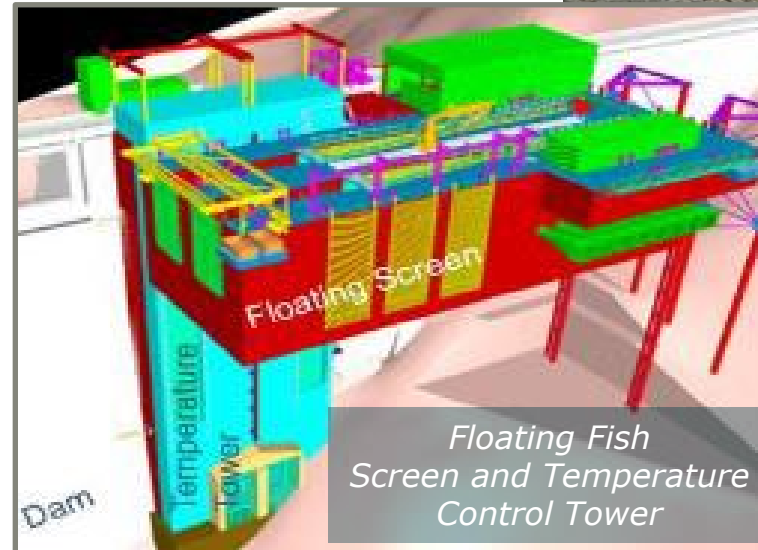
Overall Focus

- Improve fish passage with a **combination of modified operations and structural improvements**
- Measures to balance water management flexibility and meet ESA-listed fish obligations.

Key Defining Elements

- Floating Screen Structure and Temperature Control Tower at Detroit
- Spring spill and fall drawdown to RO and adult fish facility at Green Peter
- Downstream passage at Foster Dam
- Spring and fall draw down to diversion tunnel at Cougar Dam
- Floating Surface Collector at Lookout Point
- Pacific lamprey passage and infrastructure at AFFs
- Integrated habitat and temperature flow regime

Deep Drawdown at Cougar Reservoir



Floating Fish Screen and Temperature Control Tower



NEAR-TERM OPERATIONS MEASURE



A set of interim-term operations to improve conditions until the long-term action is in place.

North Santiam (Detroit & Big Cliff)

- Detroit spring/summer spill for downstream fish passage and water temperature management
- Detroit fall lower regulating outlet (RO) for downstream water temperature management
- Detroit winter upper RO for downstream fish passage
- Big Cliff split spill to reduce TDG

South Santiam (Green Peter & Foster)

- Green Peter spring spill for downstream fish passage
- Green Peter fall deep drawdown for downstream fish passage through ROs
- Foster spring delayed refill and spill for downstream fish passage
- Foster fall spill for downstream fish passage

McKenzie (Cougar)

- Fall drawdown for downstream fish passage through ROs
- Spring delayed refill for downstream fish passage through ROs

Middle Fork Willamette (Lookout Point, Dexter, & Fall Creek)

- Hills Creek winter night-time RO prioritization for fish passage
- Lookout Point/Dexter spring/summer spill for downstream fish passage and water temperature management
- Lookout Point fall deep drawdown for downstream fish passage through ROs
- Fall Creek extended winter deep drawdown for downstream fish passage
- Fall Creek spring delayed refill for downstream fish passage

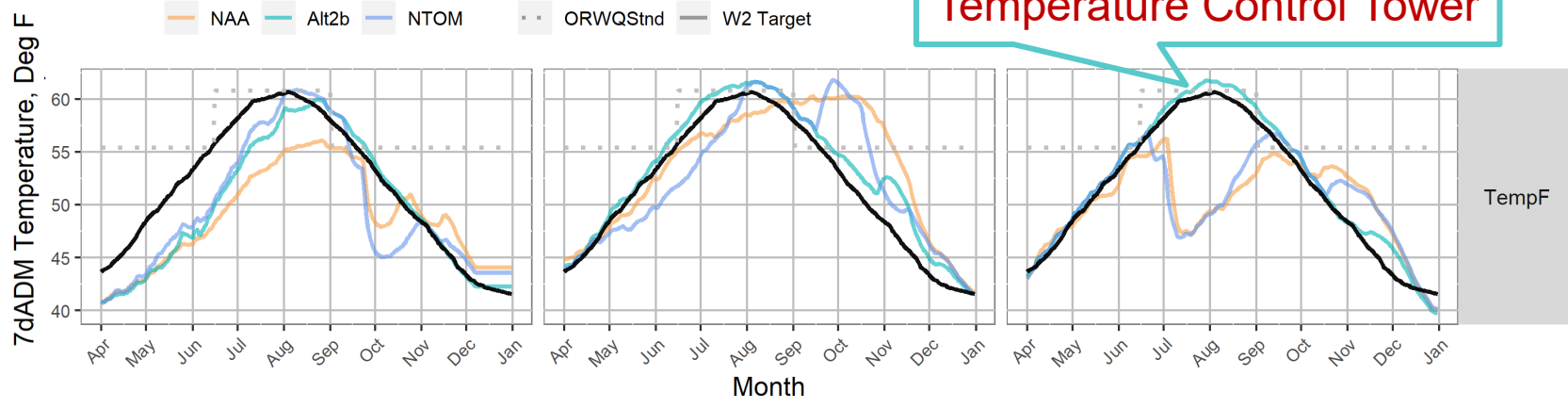
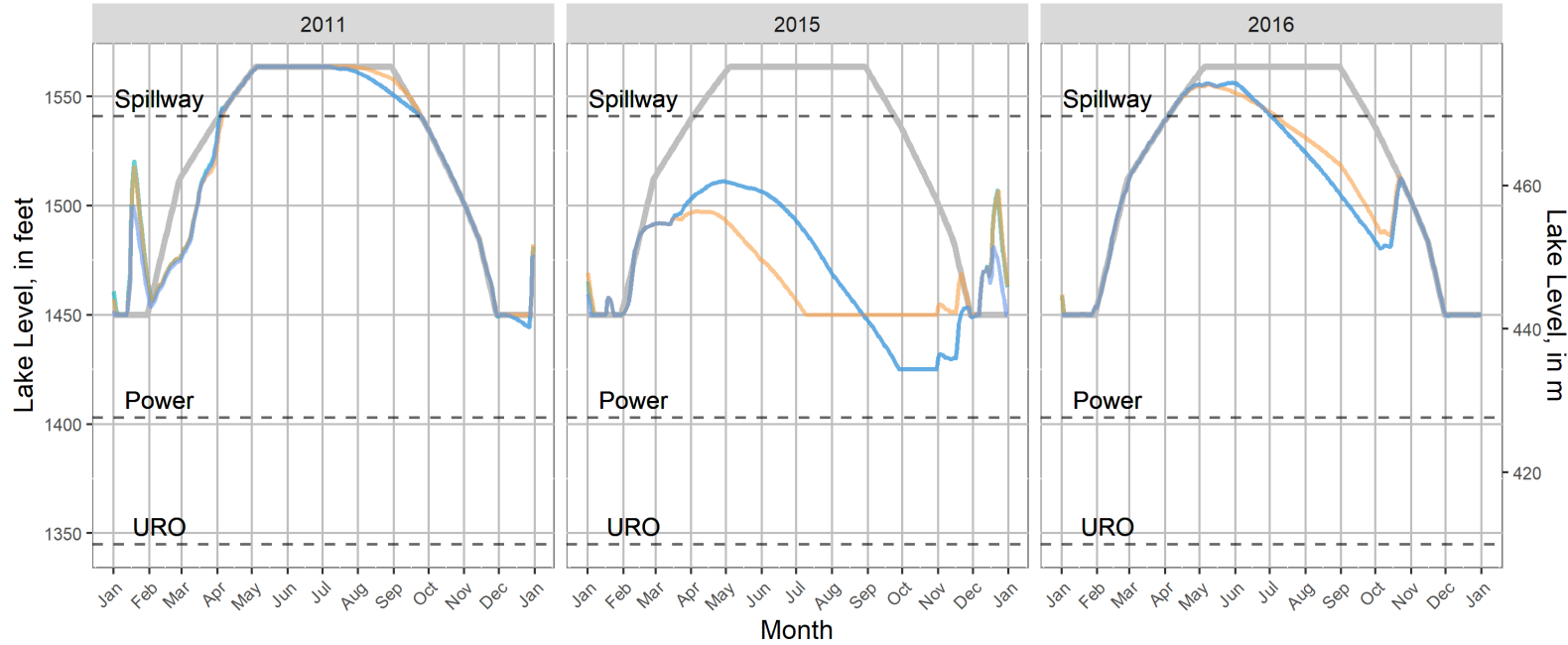


TEMPERATURE MODELING

DET Lake Levels



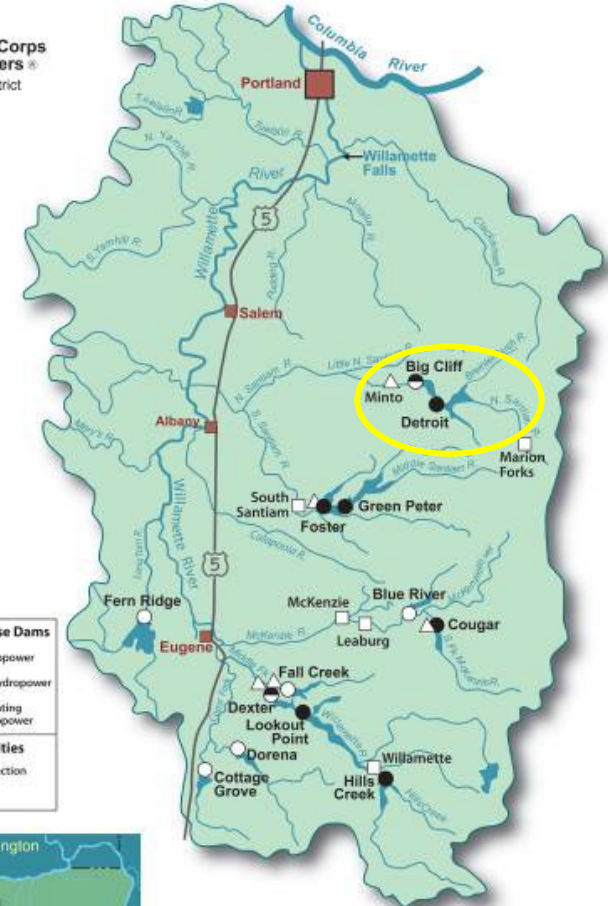
NAA Alt2b NTOM



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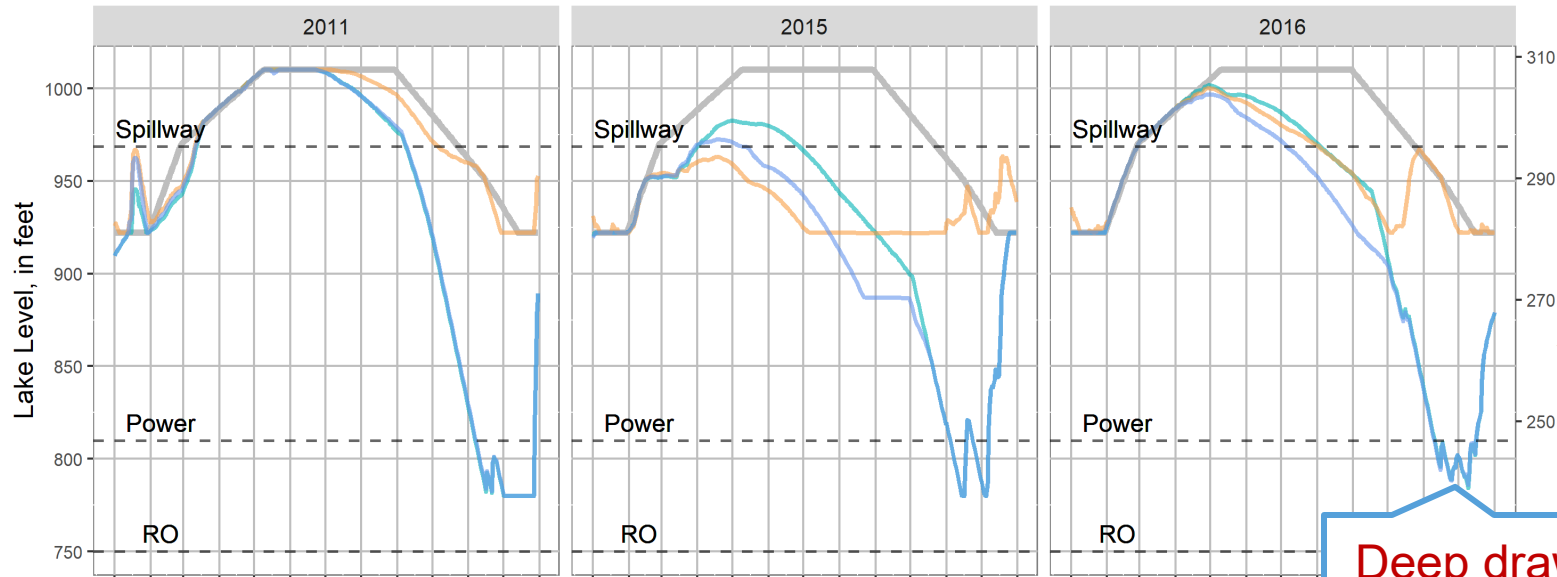


TEMPERATURE MODELING



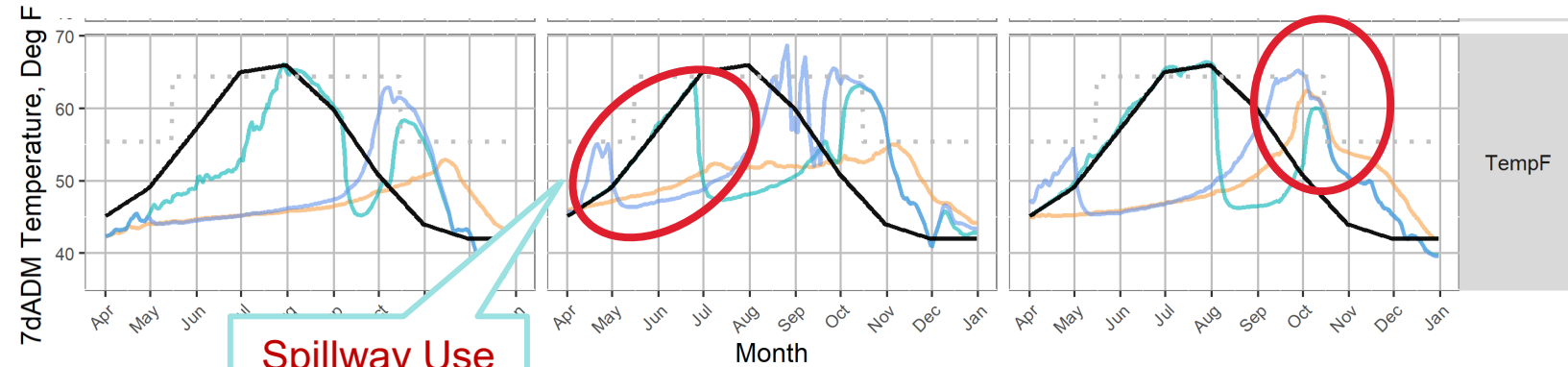
GPR Lake Levels

NAA Alt2b NTOM



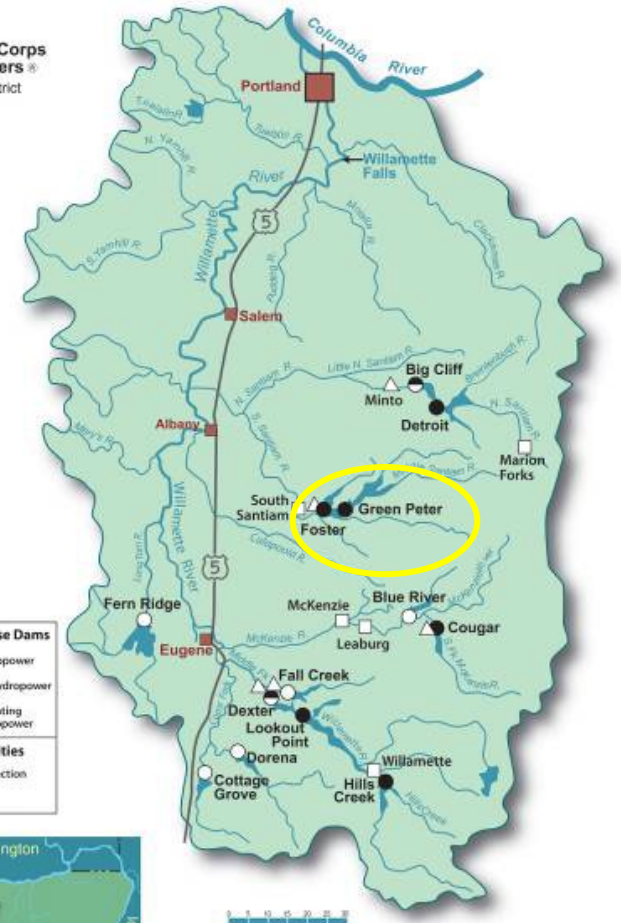
Deep drawdown

NAA Alt2b NTOM ORWQStnd W2 Target



Spillway Use

The Willamette River Basin



- Multipurpose Dams**
 - With Hydropower
 - Without Hydropower
 - ◐ Regulating with Hydropower
- Fish Facilities**
 - △ Adult Collection
 - Hatchery



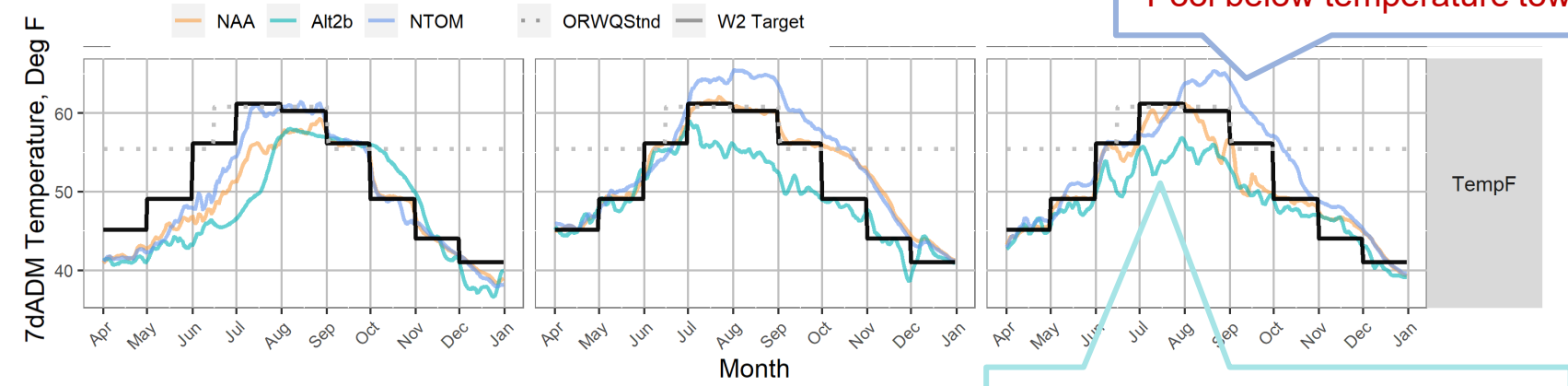
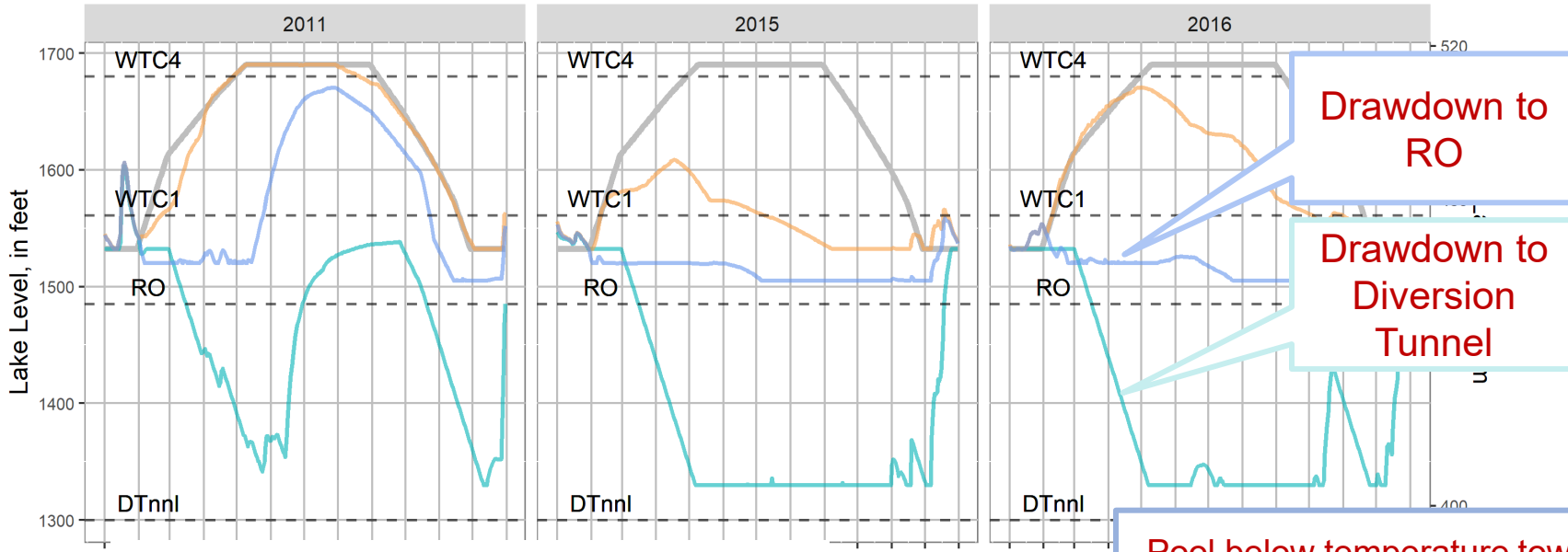


TEMPERATURE MODELING



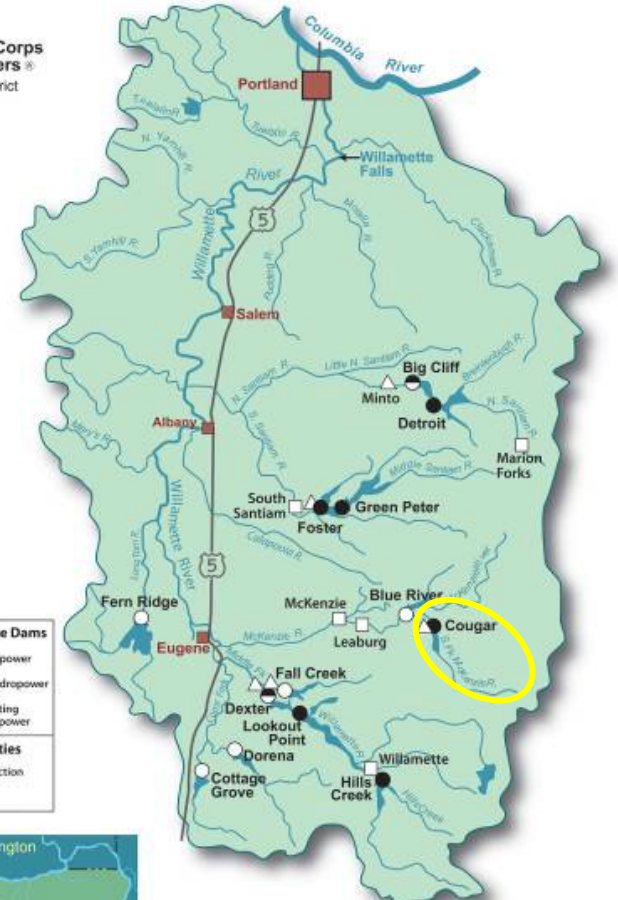
CGR Lake Levels

NAA Alt2b NTOM



Smaller pool, shorter residence time

The Willamette River Basin



- Multipurpose Dams**
 - With Hydropower
 - Without Hydropower
 - ◐ Re - Regulating with Hydropower
- Fish Facilities**
 - △ Adult Collection
 - Hatchery





EFFECTS ANALYSIS - TEMPERATURE



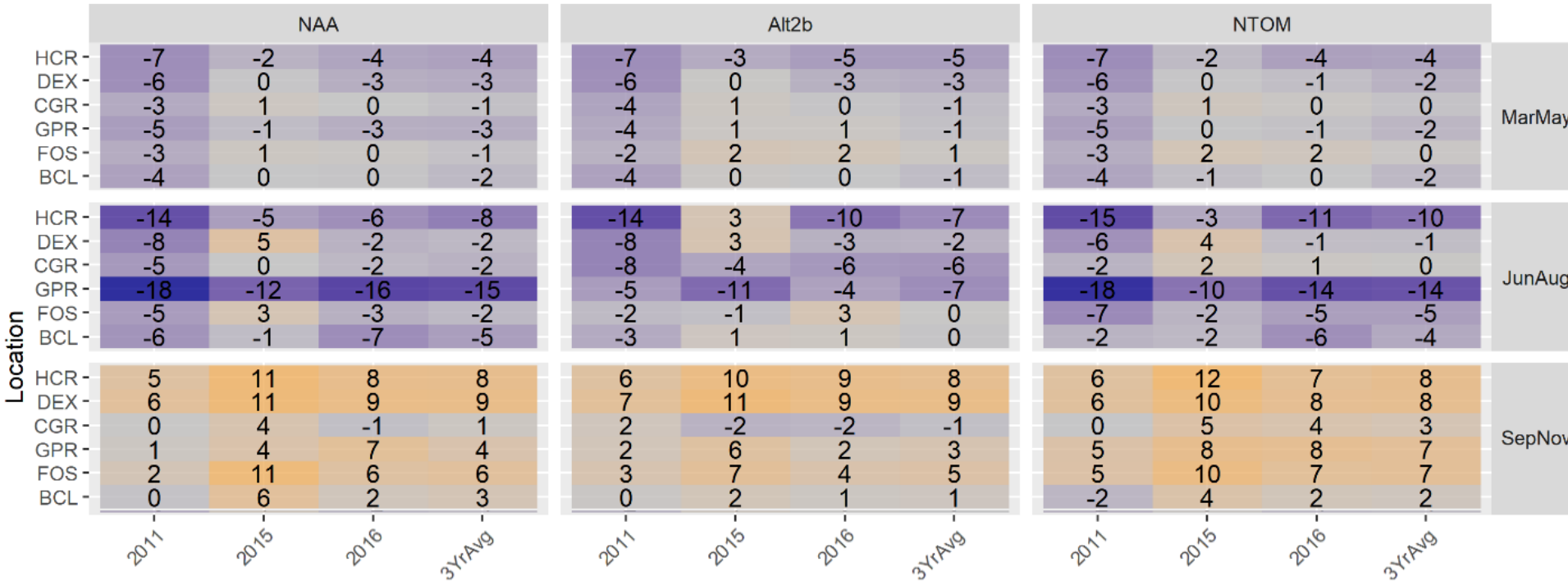
Alternative 2B Highlights

Warmer spring/summer temperatures below Cougar, Detroit/Big Cliff, Green Peter/Foster
Cooler fall temperatures below Cougar, Detroit/Big Cliff, Green Peter/Foster

Near Term Operations Highlights

Warmer spring/summer temperatures below Detroit
Warmer summer-fall temperatures below Cougar
Cooler fall temperatures below Detroit/BigCliff

Seasonal Average Difference From W2 Temperature Target (degrees F)

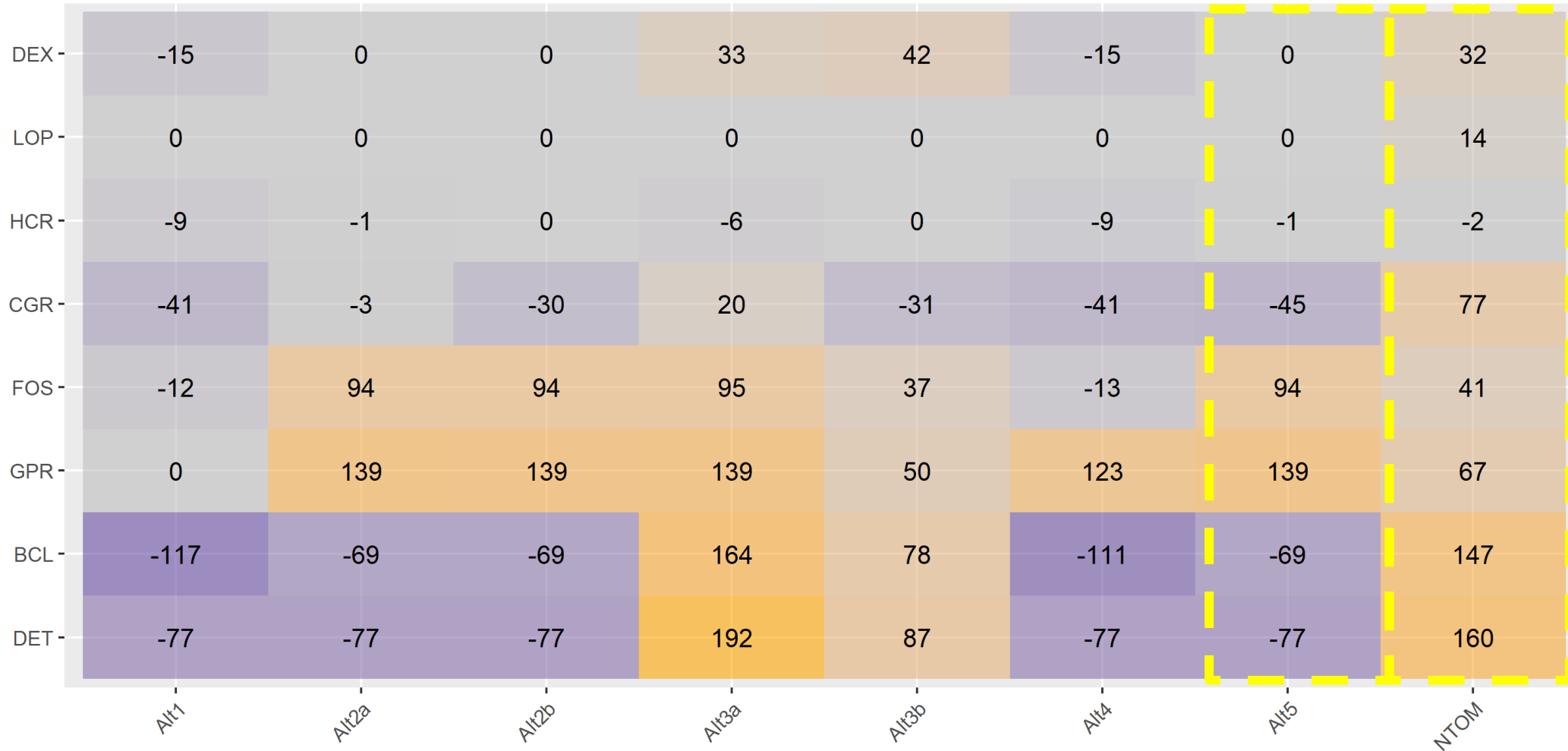


Downstream Gages:
HCR: Hills Creek
DEX: Dexter
CGR: Cougar
FOS: Foster
GPR: Green Peter
BCL: Big Cliff



EFFECTS ANALYSIS – TOTAL DISSOLVED GAS

Annual Difference in Number of Days Above 110% TDG Compared to NAA



DEX: Dexter
 LOP: Lookout Point
 HCR: Hills Creek
 CGR: Cougar
 FOS: Foster
 GPR: Green Peter
 BCL: Big Cliff
 DET: Detroit



EFFECTS ANALYSIS – TOTAL DISSOLVED GAS

Preferred Alternative (Alt5/Alt2b) TDG Highlights

- Spring and fall spill operations for downstream fish passage and temperature management at Green Peter/Foster ***will likely increase TDG****
- Proposed structures at Detroit ***likely to reduce TDG***
- Deep drawdown at Cougar to diversion tunnel ***will likely reduce TDG***

Near Term Operations Measure (NTOM) TDG Highlights

- Spring and fall spill operations for downstream fish passage and temperature management at Detroit/BigCliff, Green Peter/Foster, Cougar, Lookout Point/Dexter ***will likely increase TDG****
- Big Cliff split spill operation included in all Alternatives ***will likely reduce TDG***

* ***trade off for fish passage, supplementing instream flows below dams, and water temperature management below Detroit***



QUESTIONS?

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THANK YOU

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