

**Overview of the  
Pend Oreille River  
TDG and Temperature  
TMDL Studies**



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April 28, 2004**



## ***Overview of the Pend Oreille River Temperature and TDG TMDL Studies***



- Why a TMDL on the Pend Oreille River?
  - Temperature and total dissolved gas data exceed WA state water quality criteria
  - Clean Water Act requirements:
    - Listing of impaired waters where criteria are not met
    - Determine total maximum daily load of pollutants
  - TMDL = technical analysis + cleanup plan
  - Ecology to conduct technical studies this year to augment other data and studies



## ***Overview of the Pend Oreille River Temperature and TDG TMDL Studies***



### ➤ Geographic scope and jurisdictions

- Ecology is addressing Washington state waters
  - Idaho border to Canada border
- EPA lead for Kalispel Tribal waters
- EPA also coordinating interstate and international issues
  - Canada downstream
  - Idaho and Montana upstream





## ***Overview of the Pend Oreille River Temperature and TDG TMDL Studies***



### ➤ TDG Generation Process

- Plunging spills absorb dissolved air
- Powerhouse TDG usually the same as forebay
  - But, some powerhouse flows may entrain into spill
  - But, powerhouse ramping up/down can make TDG
- Spill water degasses in tailrace
- Degassing slows as water enters pool



## ***Overview of the Pend Oreille River Temperature and TDG TMDL Studies***



### ➤ Other TDG Processes

- Naturally plunging waterfalls can increase TDG
- Shallow water increases gas exchange
  - Natural waterfalls cascading over rocks strips TDG
- Decreasing air pressure raises TDG % saturation
- Increasing water temperature increases TDG pressure and % saturation
- High winds can increase gas exchange



## ***Overview of the Pend Oreille River Temperature and TDG TMDL Studies***



- Dams on the Pend Oreille River
  - Boundary Dam – Seattle City Light
  - Box Canyon Dam – Pend Oreille PUD
  - Albeni Falls Dam – Seattle Army Corps
  - Others upstream on the Clark Fork
- TDG listings in Idaho and Montana = TMDL?



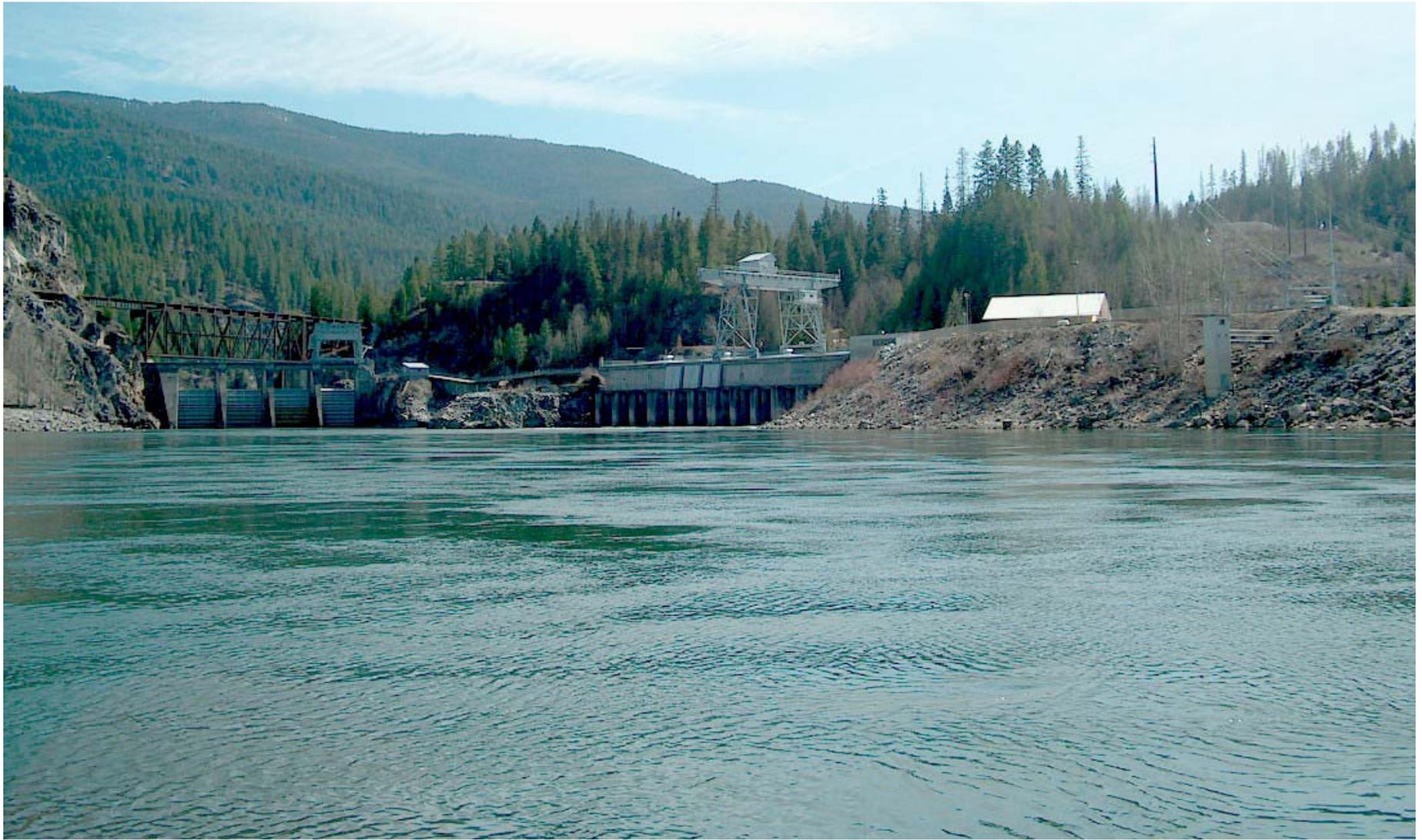
Albeni Falls Dam



Route 2 Bridge near Newport looking upstream



Pend Oreille River below Newport



Box Canyon Dam Tailrace



Box Canyon Dam Spillway

Box Canyon  
Dam Spill Gate





Boundary Dam



Boundary Dam Sluice Gates

Boundary Dam  
Spillway





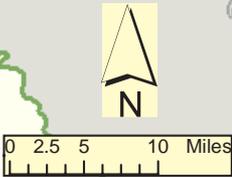
Boundary Dam spilling



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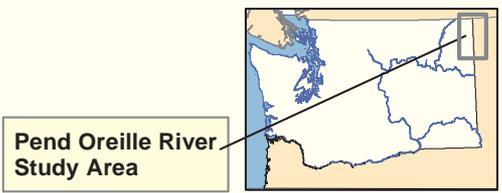


- TDG technical study
  - TDG monitoring by dam owners
    - Albeni Falls, Box Canyon, Boundary
    - Forebay and Tailrace
  - Ecology paired monitoring
    - About every two weeks – “snapshot”
    - Newport, Box Cyn forebay, Boundary forebay
  - Ecology continuous monitoring
    - Near Blueslide, Ruby, or Jared
- Project Plan is available



**Legend**

	International_Boundary		Highways
	County Boundaries		Rivers
	Towns		Dams
	Tribal Lands		Ecology TDG station
			Project TDG stations





## ***Overview of the Pend Oreille River Temperature and TDG TMDL Studies***



### ➤ TDG TMDL Development

- Analyze TDG generation processes
- Analyze effect of natural influences
  - Barometric pressure, wind
  - Water temperature, dissolved oxygen from plants
- Spreadsheet analysis or modeling
  - Isolate effects of each dam? OR
  - Evaluate system-wide effects



## ***Overview of the Pend Oreille River Temperature and TDG TMDL Studies***



- What's the problem with Temperature?
  - Sun heats a wide, open river
  - High temperatures harmful to aquatic life
    - Bull trout and other fish and organisms
  - Temperature WQ Standard set by USEPA and WA Dept of Ecology to prevent harm to life
  - Temperature in Pend Oreille River exceeds WQ criteria
    - 20° C (68°F) as 7-day average of daily maximum



## ***Overview of the Pend Oreille River Temperature and TDG TMDL Studies***



### ➤ Temperature Processes

- Sun heats water directly
- Heat exchanges with air and sky
- Ground water inflows cool water
- Tributary inflows can add cool or warm water
- Reservoirs store heat – deeper, slower flow
- Point sources can add heat (esp. cooling water)



## ***Overview of the Pend Oreille River Temperature and TDG TMDL Studies***



- Temperature Standards address changes
  - How have conditions changed from natural?
    - Natural = no human influences
  - Changes in Lake Pend Oreille outflows
  - Changes in reservoir depth and flow velocity
  - Changes in groundwater inflow
  - Changes in tributary inflow
  - Changes in point source heat loads
- Standards set increment of change from natural



## ***Overview of the Pend Oreille River Temperature and TDG TMDL Studies***



- Temperature technical study
  - Water temperature monitoring
    - Ecology continuous monitoring in P.O. River
    - Kalispel Tribe monitoring in tributaries
  - Evaluation of ground water influence
  - Meteorological and flow data
  - Modeling of River – current vs. natural
- Project Plan available later in spring



## ***Overview of the Pend Oreille River Temperature and TDG TMDL Studies***



### ➤ Review and submittal of TMDLs

- TMDL = technical analysis
  - + implementation plan
- Close coordination with stakeholders
- Informal review of preliminary draft TMDL
- Formal review and public comment of final draft TMDL
- WA issues for state waters and submits to EPA
- EPA adopts for tribal waters



## ***Overview of the Pend Oreille River Temperature and TDG TMDL Studies***



➤ Questions?

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