

An aerial photograph of a dam and reservoir, likely the Banks Lake Dam. The image shows the dam structure, the reservoir, and surrounding terrain. The text is overlaid on the image.

Northwest Power and Conservation Council

Pumped Storage GRAC Meeting

Banks Lake Pumped Storage Project (North Dam)

FERC Project No. 14329

**Portland, Oregon
January 27, 2015**

Presented by:

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On behalf of:

Grand Coulee Project Hydroelectric Authority (GCPHA)

INTRODUCTION & ACKNOWLEDGEMENTS

- A Pre-feasibility analysis of the Banks Lake North Dam Pump/Generation Project is being jointly conducted by the following organizations:
 - Grand Coulee Project Hydroelectric Authority (GCPHA)
 - Kleinschmidt and Associates
 - Reed Consulting
 - Muchlinski Consulting
 - Lands Energy Consulting

PRESENTATION OUTLINE

- Overview of the Grand Coulee Project Hydroelectric Authority (GCPHA)
- Overview of the Banks Lake North Dam Pumped Storage Project
 - Purpose of the Project, current status and major stakeholders
 - Capacity, expected energy output
 - Barriers/challenges to development
 - Tentative timeline to operation/next steps

WHO AND WHAT IS THE GRAND COULEE PROJECT HYDROELECTRIC AUTHORITY (GCPHA)

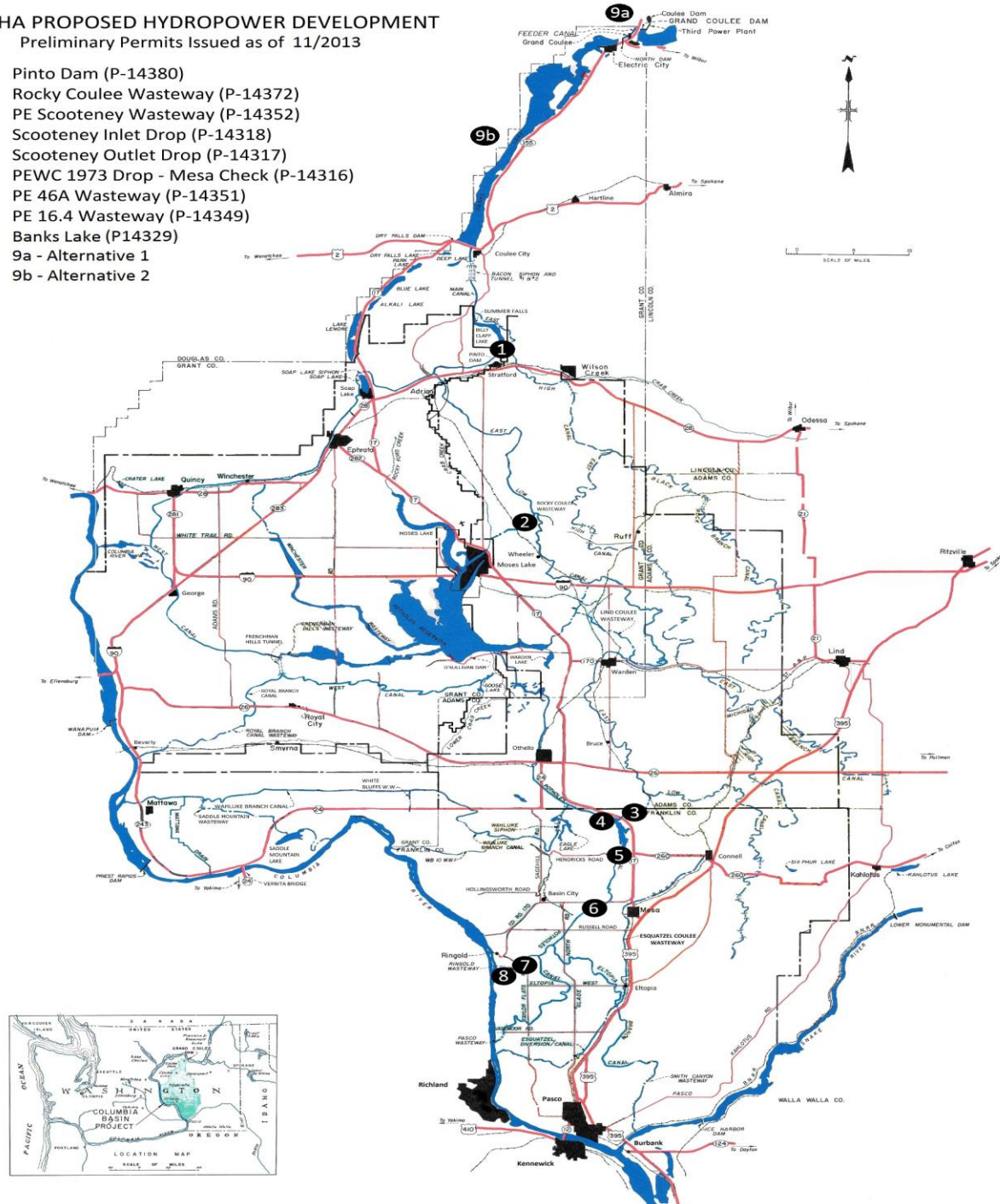
- Located in Ephrata, Washington, GCPHA is a sub-division of the three Columbia Basin Irrigation Districts in Washington State which are East Columbia Basin Irrigation District, South Columbia Irrigation District and Quincy Columbia Basin Irrigation District.
- GCPHA provides for administration, operations, and maintenance functions for hydroelectric projects that it owns.
- GCPHA's existing hydro projects range in size from 2 MW to the 92 MW Summer Falls project and have a combined overall generating capacity of 144.6 MW.

WHO AND WHAT IS THE GRAND COULEE PROJECT HYDROELECTRIC AUTHORITY (GCPHA)

- GCPHA has filed for and received 10 preliminary FERC permits for new hydro generation facilities to be developed in the Columbia Basin.
- Two of the 10 preliminary permits are for pumped storage projects under the same FERC Project number; GCPHA internally refers to these two sites as the “Banks Lake North Dam” site and the “Brookfield” site.
- The primary focus of today’s presentation is the Banks Lake North Dam site.

GCPHA PROPOSED HYDROPOWER DEVELOPMENT
 Preliminary Permits Issued as of 11/2013

1. Pinto Dam (P-14380)
 2. Rocky Coulee Wasteway (P-14372)
 3. PE Scootene Wasteway (P-14352)
 4. Scootene Inlet Drop (P-14318)
 5. Scootene Outlet Drop (P-14317)
 6. PEWC 1973 Drop - Mesa Check (P-14316)
 7. PE 46A Wasteway (P-14351)
 8. PE 16.4 Wasteway (P-14349)
 9. Banks Lake (P14329)
- 9a - Alternative 1
 9b - Alternative 2



BANKS LAKE NORTH DAM PUMP/GENERATION PROJECT – FACTS & FIGURES

- The Project is located at the North Dam of Banks Lake in central Washington State near Grand Coulee Dam.
- The GCPHA's North Dam Project is a separate project from the Bureau of Reclamation's existing Keys pump-generation plant (which is sometimes referred to as the Banks Lake pumped storage plant).
- Generating Capacity: Up to 1,000 MW.
- Turbine Type: Four to six adjustable speed pump-generating units.
- Maximum project design flow: 50,000 CFS.
- Head: 280 to 360 feet (average = approx. 300 feet).

BANKS LAKE NORTH DAM PUMP/GENERATION PROJECT – FACTS & FIGURES

- Powerhouse: Underground, located on the west side of Lake Roosevelt just upstream of Grand Coulee Dam and near the BOR's existing Keys pump-generation plant.
- Estimated average annual generation: 1,430,000 Mwh.
- Upper Intake/Reservoir: Banks Lake.
- Lower intake/Reservoir: Lake Roosevelt.
- Main Tunnels: (2) 35 foot diameter tunnels approx. 9,000 feet in length.
- Branch (unit) Tunnels: Four to six 25 foot diameter tunnels approx. 900 feet in length.
- Transmission Interconnection: Grand Coulee Dam 230 kV or 500 kV switchyards.

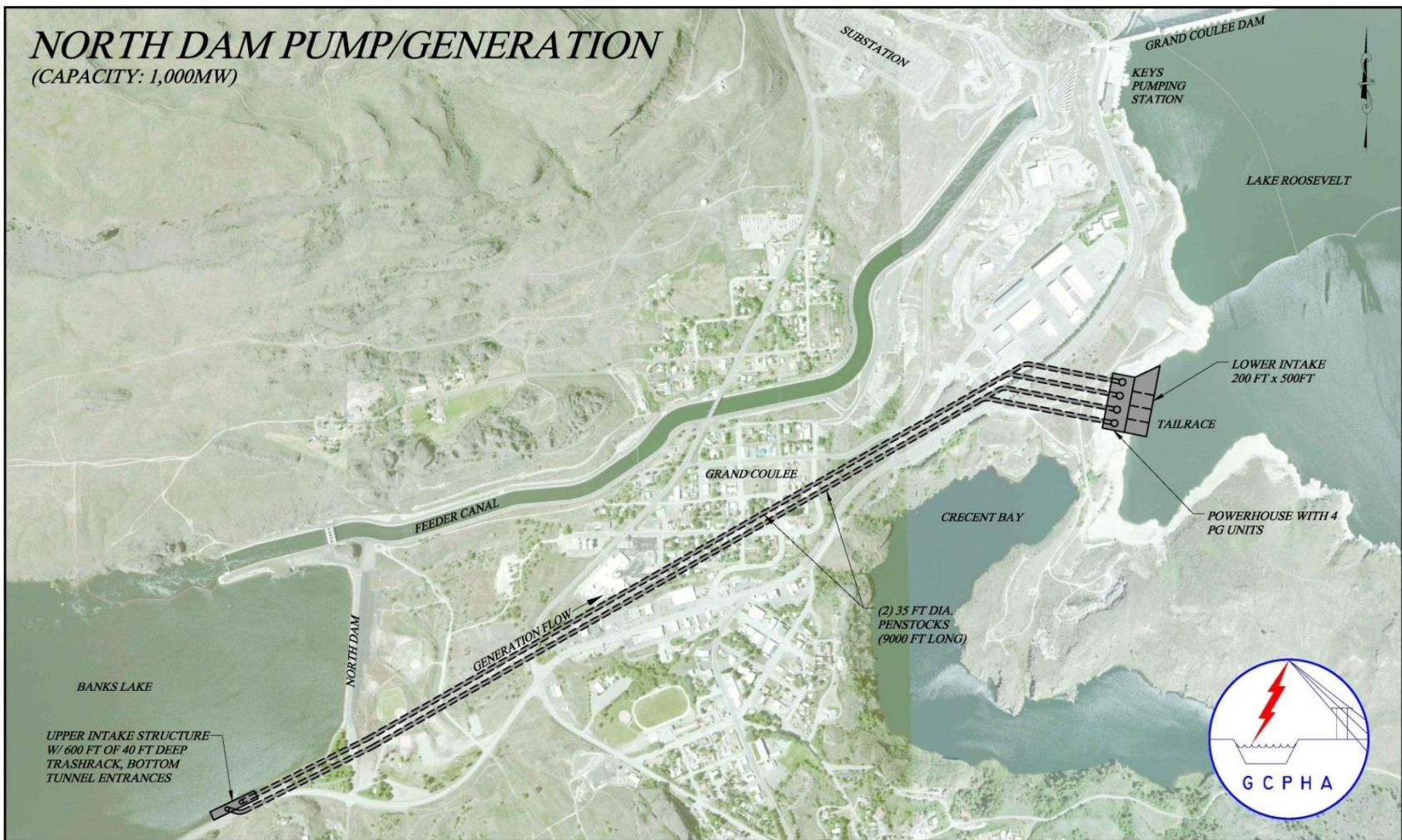


NORTH DAM PUMP/GENERATION

(CAPACITY: 1,000MW)

22x34 = FULL SCALE

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UPPER INTAKE STRUCTURE
W/ 600 FT OF 40 FT DEEP
TRASHRACK, BOTTOM
TUNNEL ENTRANCES

FEEDER CANAL

NORTH DAM

GENERATION FLOW

GRAND COULEE

SUBSTATION

GRAND COULEE DAM

KEYS
PUMPING
STATION

LAKE ROOSEVELT

CRECENT BAY

LOWER INTAKE
200 FT x 500 FT

TAILRACE

POWERHOUSE WITH 4
PG UNITS

(2) 35 FT DIA.
PENSTOCKS
(9000 FT LONG)



Kleinschmidt

400 0 400 800
SCALE IN FEET

GRAND COULEE PROJECT HYDROELECTRIC AUTHORITY
EPHRATA, WA

UNIQUE CHARACTERISTICS OF THE BANKS LAKE NORTH DAM PROJECT

- The Project would not require the construction of any new dams/reservoirs.

- Both of the Project's upper and lower reservoirs have very large storage capabilities relative to other proposed PNW pumped storage facilities.
 - Banks Lake active storage = 715,000 acre-feet.
 - Lake Roosevelt active storage = 4,200,000 acre-feet.

- The Project would utilize adjustable-speed pump/generators which would allow the plant's pumping load to be varied in real-time (in addition to being able to vary generation output in real-time).

- The Project might have the capability to provide back-up pumping services to the BOR's existing Keys pump-generation plant.

UNIQUE CHARACTERISTICS OF THE BANKS LAKE NORTH DAM PROJECT

- The Project would have the ability to conduct energy shifting/arbitrage operations across a weekly timeframe.

- The Project would have a very long (for a hydro pumped storage plant) sustained peaking capability due to the large size of the upper reservoir (Banks Lake).
 - The Project could generate at its maximum capacity of 1,000 MW for approx. 35 continuous hours assuming a maximum five foot drawdown at Banks Lake.

- The Project would have the capability of rapidly releasing water into Lake Roosevelt that could in turn be utilized to augment discharges thru Grand Coulee Dam.

UNIQUE CHARACTERISTICS OF THE BANKS LAKE NORTH DAM PROJECT

- Flow Augmentation could occur during periods when Grand Coulee Dam is approaching or at its daily draft limit.
- Flow Augmentation could be utilized to increase the energy and sustained peaking capability of the PNW hydro system from Grand Coulee Dam and downstream dams during regional power system stress events (i.e. high loads, generation/transmission outages, etc.)
- Overall observation: Due to the above noted characteristics, the Banks Lake North Dam Project can likely provide a greater level of overall value as compared to similarly sized pumped storage plants.

PROJECT COST ESTIMATES

- Preliminary cost estimates for the Banks Lake North Dam Project are currently under development.
- Relatively high tunneling costs may partially offset the advantage of not having to construct any new dams or reservoirs.
- Additional cost of having to construct full intake structures (including fish screens and trash racks) at both the upper and lower reservoirs.
- The cost of adjustable speed pump/generators is approximately 20-25% higher than the cost of comparably sized single-speed units.

PROJECT COST ESTIMATES

- The overall \$/KW installation cost of the Banks Lake North Dam Site may turn out to be somewhat higher than other similarly sized pumped storage facilities.
- Need to be careful to make an “apples to apples” comparison regarding adjustable-speed versus single-speed P/G units.
- It is anticipated that additional value (relative to other proposed pumped storage plants) can be derived from the unique characteristics of the Banks Lake North Dam site.

BARRIERS/CHALLENGES TO THE BANKS LAKE NORTH DAM PROJECT DEVELOPMENT

- High initial capital cost.
- Relative long development timeline (approx. 7-10 years).
- Relatively large up-front investment needed to proceed from the pre-feasibility stage to the design stage.
- The Project's overall cost will be highly dependent upon site-specific conditions (especially geological) that have not yet been fully evaluated.
- Existing operational and/or environmental constraints at Lake Roosevelt and Banks Lake.

BARRIERS/CHALLENGES TO THE BANKS LAKE NORTH DAM PROJECT DEVELOPMENT

- GCPHA must secure the cooperation of the BOR, BPA, the Upper Columbia River Tribes and potentially other partners/stakeholders.
- Pumped storage plants in general are very complex to analyze from both an operational and economic perspective.
- Valuation of the capacity and ancillary service products that the Project can provide is challenging due to the lack of liquid spot and forward markets for these products in the PNW region.
- The Project will need to enter into one or more long-term contracts with off-takers in order to secure bond financing.

NEXT STEPS

- Finalize pre-feasibility study by early 2015.

- Based on the results of the study:
 - Meet with the BOR and BPA to discuss operational issues and considerations.
 - Meet with regional utilities to gauge level of interest.
 - Perform more detailed valuation studies that include potential regional benefits.
 - Begin preliminary engineering evaluation.
 - Refine Project costs.
 - Submit applicable filings to the FERC.

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