Consultation on MRC’s Hydropower Programme
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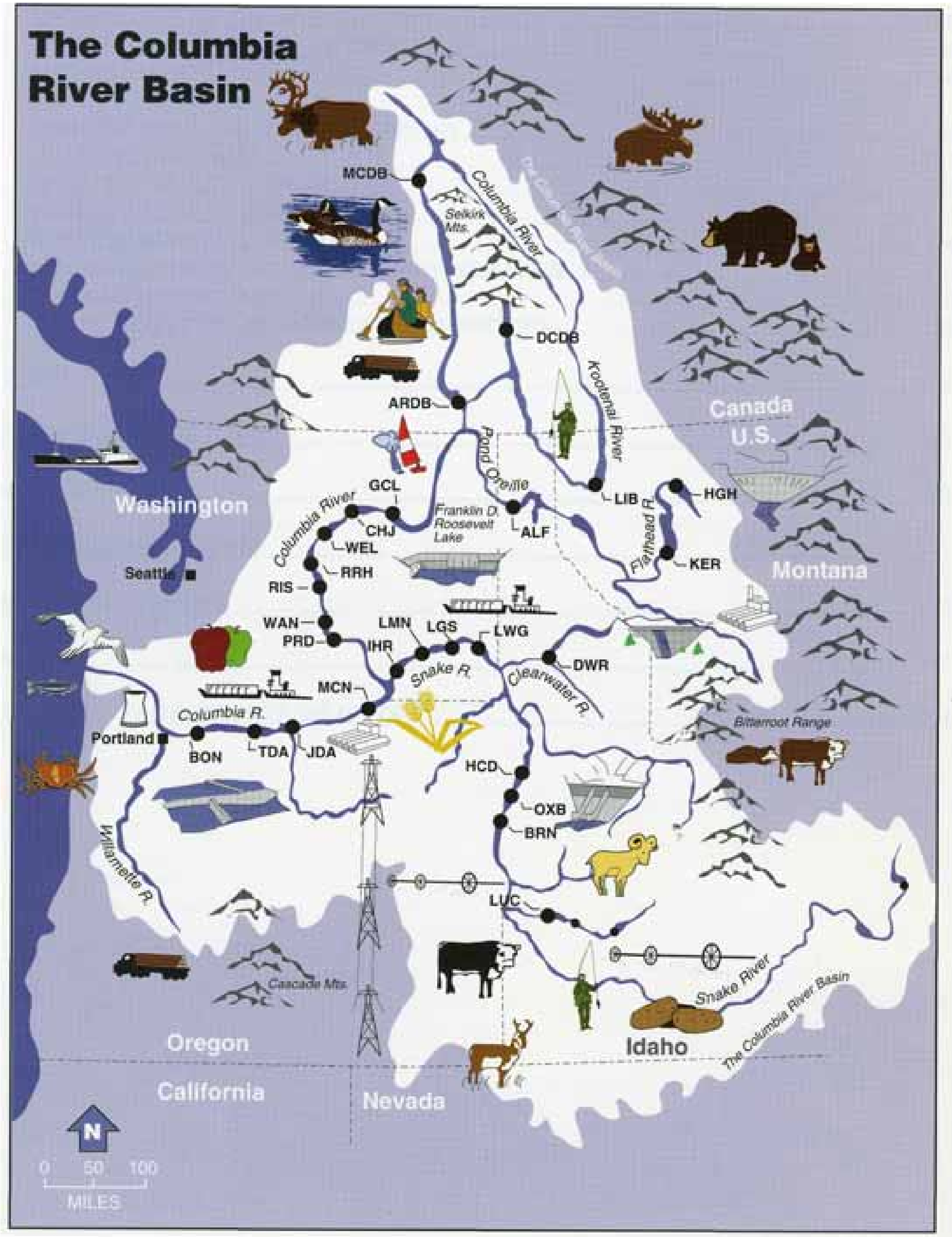
Overview of Columbia River System Operations for Hydropower and Fish Passage

By

Bolyvong Tanovan, PhD, PE

Chief, Water Management Power Branch
US Army Corps of Engineers Northwestern Division



- Largest US River discharging into Pacific Ocean

Mekong

- L= 1,954 km (4,800)

- A= 669,000 km^2 (760,000)

- 40% of US hydro-power potential

- Q_{ave}= 7,800 m^3/s (14,500)

- Ann. Runoff (mouth)= 244 km^3 (457)

HYDRO DEVELOPMENT

Pre1930's: single purpose

- 1930's: Rock Island, Bonneville, Grand Coulee

- World War II: Hanford; McNary, Albani Falls, Chief Joseph, The Dalles, Hungry Horse, Willamette

- Late 1950's: Libby, Dworshak, lower Snake and Willamette. Priest Rapids, Rocky Reach, Wanapum, and Wells. Other public and private utilities dams.

- 1975: latest dam built on lower Snake

TODAY’S SYSTEM

- 31 Federal Dams (21 COE, 10 USBR)
- Federal Installed Capacity: 22,400 MW
- Av. Ann. Generation: 76,000 GWh
- Revenues: $2 - 3 Billion /yr
- Flood damages prevented: $14 Billion so far
- Irrigation: 3 million acres; Navigation: 465 miles

- Year-round TRANSMISSION (S summer and N winter)

- PLAYERS: Feds, Tribes, States, Interest Groups

- COE/USBR Generate; Bonneville Power Sell

HOW DID WE GET THERE?

- Local interests group and existing river basin study.

- Cost/Benefit Ratio; local cost-sharing commitments.

- Congress-controlled process: law, appropriation, oversight committee

- FERC Process for Non-Fed Projects

- No new federal dams since 1988 (Elk Cr. stopped @ $1/_3$)

- FERC Relicensing may lead to dam removal (Condit)

COLUMBIA RIVER TREATY

- Signed in 1961; implemented in 1964.

- 3 large storage projects built by Canada, 1 by the U.S.

- Doubled storage capacity of the river system.

- Good for flood control. Canada has 15% of watershed, but 30% of runoff. The U.S. paid Canada a one-time fee of $64 M (½ of estimated value of future flood control benefits. 1972 floods =$ 500 million)

- Good for power: extra 11.5 billion KWh/yr at U.S. downstream dams. Benefits are shared equally.

Pacific Northwest Coordination Agreement

- Coordination of water storage operation for power generation in the U.S.   17 fed, public, private members.

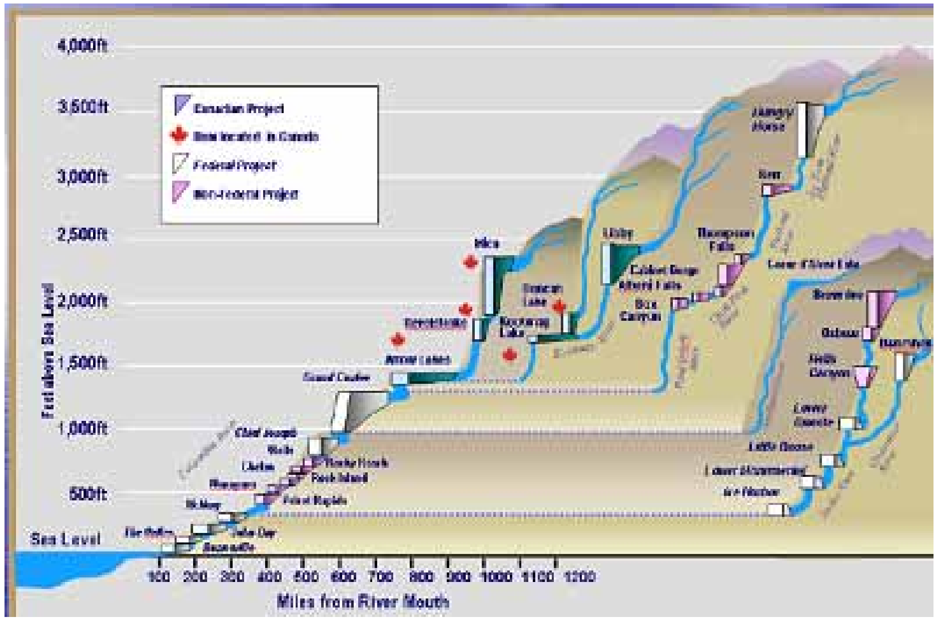
- Determination of rights and obligations of members via centralized annual planning.

- Allow for power exchange flexibility when shutdowns of transmission lines or turbines occur.

- Use single owner concept to synchronize operations and maximize power production.

OPERATIONS OF CASCADING DAMS

Different owners and operators, but hydraulically and electrically connected.
Maximum benefits achievable if system operation is well coordinated.



Three levels of coordination:
-System Operational Planning
-In-season Management,
- Real-time Scheduling

In-lieu energy agreement between downstream and Upstream parties. Release water OR deliver energy.

FISH MITIGATION MEASURES

Endangered Species Act

Habitat

Hatcheries

Harvest

Hydro Dams

A. Structural: fish screens, fish passage facilities, removable spillway weirs, flip-lips
B. Operational: transportation, predator control, TDG and water temperature monitoring, adult attraction flows
C. Equipment: fish-friendly turbines
D. Reservoir operations: spill for-fish-passage, fish flow augmentation, adaptive river management, power interchange

FUTURE CHALLENGES

- Operation dominated by Salmon recovery
- Disagreement between interest groups, for different reasons
- Opposition to dam-building
- More fish listings; Less flexibility for multi-purpose functions; Priorities shift (flood control, fish, power); Push for dam removal; More flows for fish migration, for longer periods; More spill for more days; More law suits

- Need to implement adaptive management

Most dams have served their original intended purposes. If they were rebuilt today, they would look different and be operated differently.

CONCLUSIONS

- Complicated pluralistic, institutional structure

- River system is interconnected, must be managed comprehensively

- Columbia River now serves more purposes than initially anticipated.

- With more demands on the river, population growth, and environmental priorities shift, the system will continue to be hard pressed to fully meet all the needs.

Corps of Engineers – Fish Passage

Lessons Learned:

Researcher

- Know how management is going to use the data.
- Collect a strong baseline data set.
- Have a plan and follow it - Avoid “Silver Bullet” syndrome.
- Use a diversity of expertise – collaborate with others.
- Advances in technology help move research forward.

Manager

Good research takes time but costs less in the long run.

Corps of Engineers – Fish Passage

Lessons Learned:

Manager

- Know the goal - in terms that can be measured.
- Have a plan for how decisions will be made.
- Know what type of data and precision will be used.
- Include researchers to help develop Decision Plans.

Researcher

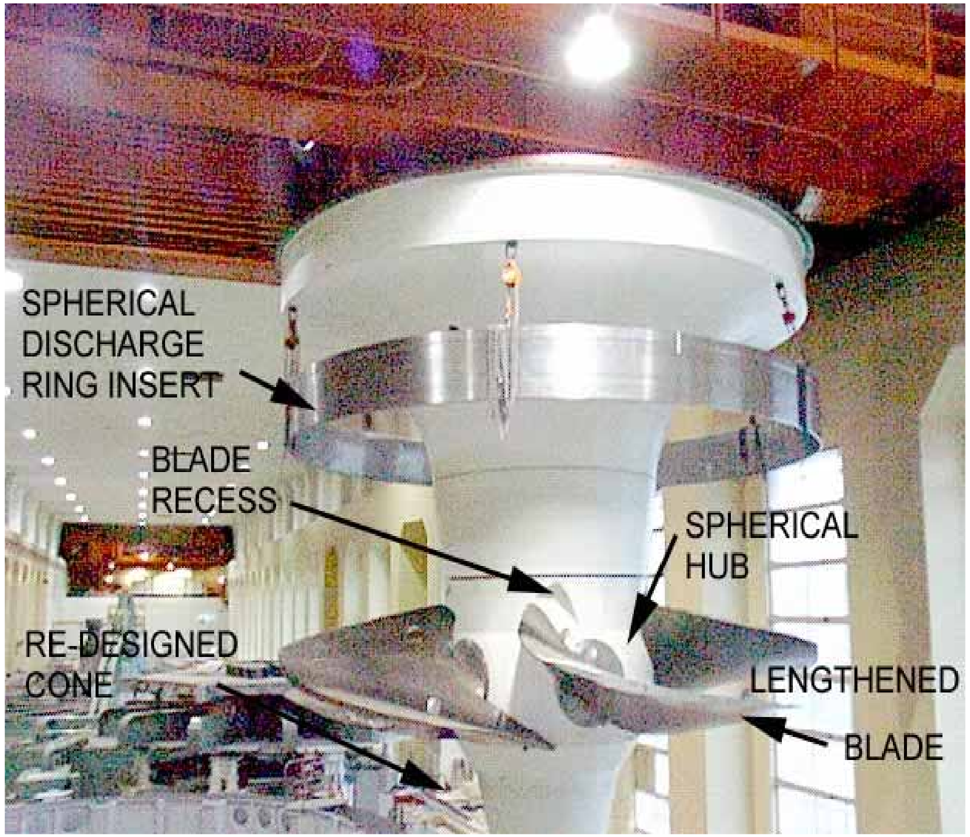
- Be situationally aware – make sure research is on focus.
- Realize managers are under public pressure to solve problems.

Corps of Engineers – Fish Research

<u>Turbine – Research</u>

Turbine Survival Program

- **Defining Mechanisms of Injury and Mortality**
- **Operational Improvements**
- **Design Improvements**
- **Fish Friendly Turbine**



A panoramic view of the Columbia River near Portland, Oregon