



2014/2024 Review

Columbia River Treaty

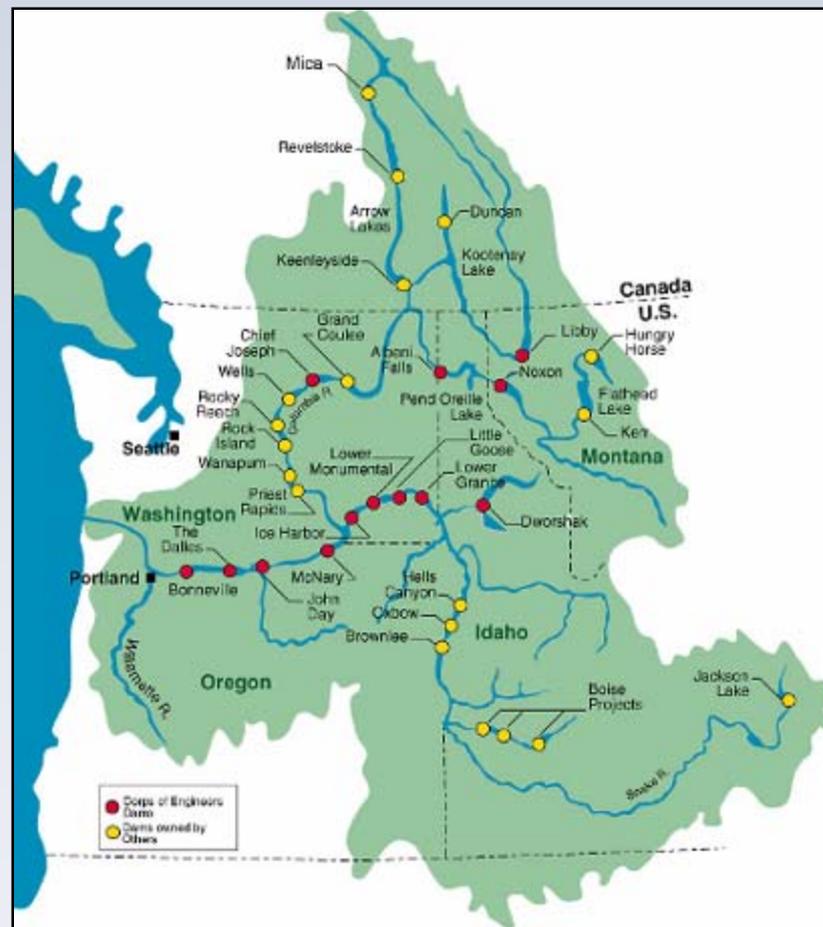
Columbia River Policy Advisory Group

March 31, 2011
Lacey, WA



Treaty Background

- About 15% of the Columbia River basin is in British Columbia (B.C), but 30% of average flows (as measured at The Dalles) come from Canada.
- Treaty required construction and operation of three large dams in B.C. to be operated for power and flood control benefits in Canada and U.S., and allowed U.S. to build Libby Dam in Montana.
- Treaty reservoirs, with 15.5 million acre-feet (Maf) in Canada and 5 Maf at Libby, more than doubled reservoir storage in the basin. Canada added another 5 Maf of non-Treaty storage.
- Today, the Columbia River basin has the most hydropower capacity (~37 GW) in North America.



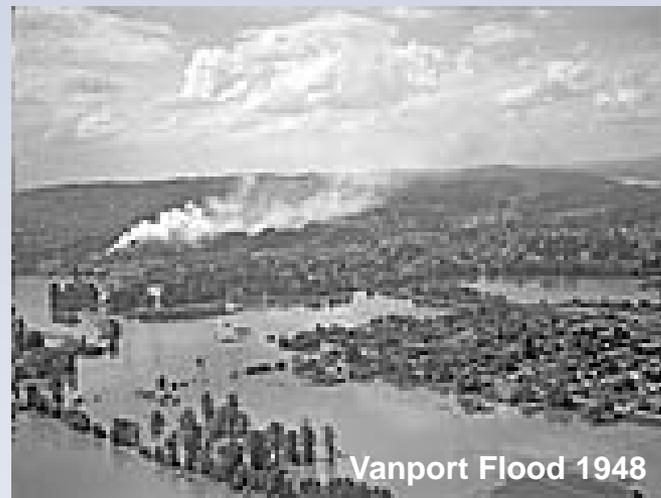
Treaty Power Provisions

- Canada must operate 15.5 Maf of their Treaty storage for optimum power generation downstream in Canada AND the United States. Canadian storage increases generation at U.S. projects by reducing spill, increasing head, shifting flows to higher value time periods, and augmenting low inflows.
- U.S. must deliver electric power to Canada equal to one-half the estimated U.S. power benefits (Canadian Entitlement) from the operation of Canadian Treaty storage, currently 536 average annual MW.
- U.S. purchased the Canadian Entitlement to U.S. power benefits in 1964 for \$254 million for first 30 years of operation. Return of full Entitlement to Canada began in 2003.
- Province of B.C. owns Canadian Entitlement, and BPA (on behalf of the U.S. Entity) delivers the power based on daily schedules set by B.C.
- Owners of five Mid-Columbia non-federal hydro projects deliver 27.5% of Canadian Entitlement to BPA for delivery to B.C.



Treaty Flood Control Provisions

- Canada is obligated to operate 8.45 Maf of reservoir storage (increased to 8.95 Maf in 1995 due to reallocation of Mica/Arrow storage) under a flood control operating plan that attempts to eliminate, or if not possible then reduce, all flood damages in both Canada and the U.S.
- Canada must also operate all additional storage on an on-call basis (as requested and paid for). This has never been used to date.
- As the dams were completed, the U.S. paid Canada \$64.4 million for one-half the present worth of the expected future U.S. flood damages prevented from 1968 through 2024.
- This U.S. purchase of 8.45 Maf of flood control operation expires in 2024.



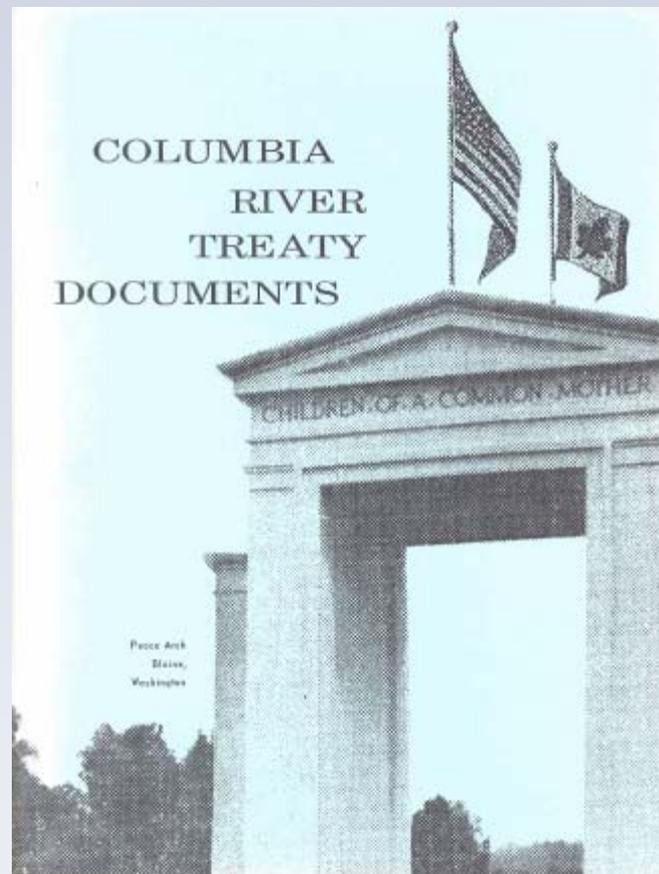
Vanport Flood 1948



Portland Flood 1996

Why a 2014/2024 Review?

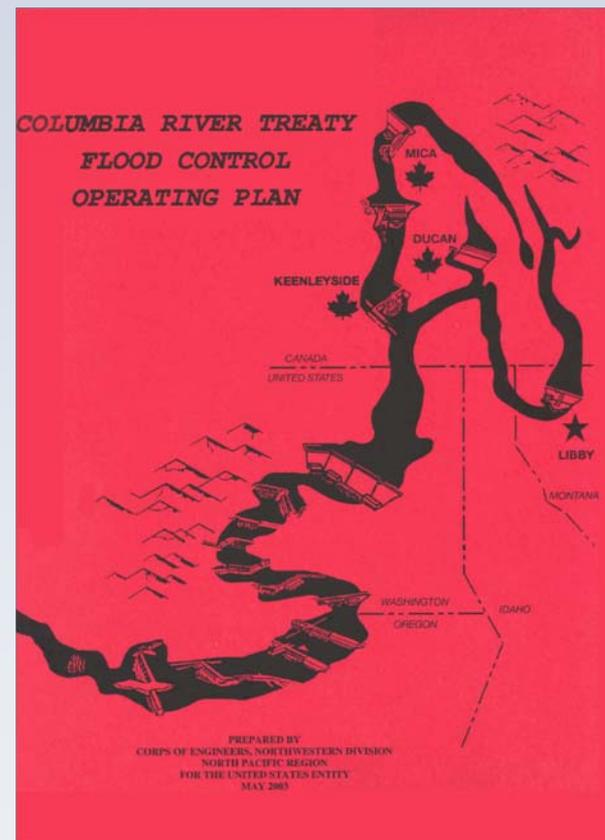
1. The Treaty has no specified end date; however, either nation can terminate most of the provisions of the Treaty as early as Sep 2024, with a minimum 10 years' written notice.
2. Current assured annual flood control operating procedures will end in 2024, independent of Treaty decision.



Post-2024 Flood Control

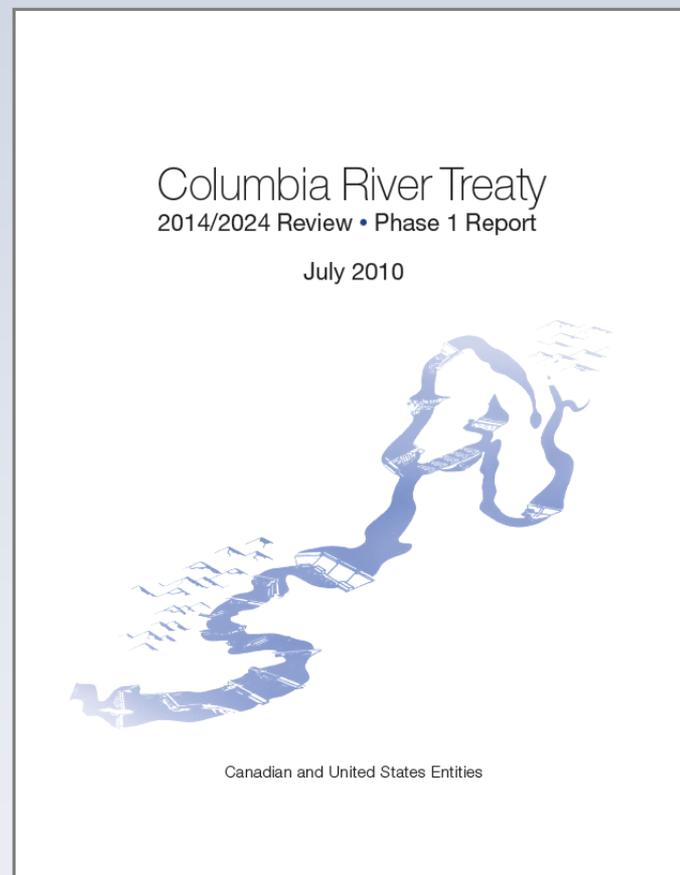
Regardless of Whether the Treaty Continues or is Terminated:

- Flood control provided by Canadian projects transitions to a “Called Upon” operation after 2024 for the life of the projects:
- U.S. requests for called upon storage limited to potential floods that cannot be adequately controlled by all related (effective) U.S. storage
- Canada must be consulted prior to a called upon action
- Called upon storage to provide no greater degree of flood control after 2024 than prior to 2024
- U.S. must pay for operating costs and any economic losses in Canada due to the called upon operation



Phase 1 Studies: *Project Overview*

1. The Phase 1 studies were joint studies by the U.S. and Canadian Entities.
2. The purpose of the studies was to provide fundamental information about post-2024 conditions, with and without the Treaty.
3. These initial studies only addressed power and flood control. This was necessary to allow an informed regional discussion regarding how to model other factors such as fisheries mitigation and additional irrigation withdrawals over these existing base operations.



Phase 1 Studies

Key Driving Assumptions: Flood Control

- 1. Methodologies and Requirements of Called Upon Flood Control:**
Called Upon procedures used in the Phase 1 studies provided a starting point for refining future modeling of Called Upon. The Phase 1 Called Upon methodology is just one preliminary look at this procedure.
- 2. Maximum Flow Objective:**
Studies looked only at two alternative flood control maximum flow objectives (600 and 450 kcfs at The Dalles) in the Phase 1 studies represented only a range of potential flow objectives. Refining of the actual flood control need will be done through future studies and the Corps' Flood Risk Management effort.
- 3. Effective Use of U.S. Reservoirs:**
U.S. Entity can “call upon Canada to operate storage only to control potential floods in the U.S. that could not be adequately controlled by all the related storage facilities in the U.S...”
- 4. Called Upon Cost:**
No calculation of Canadian operating costs and economic losses were done in the Phase 1 studies.

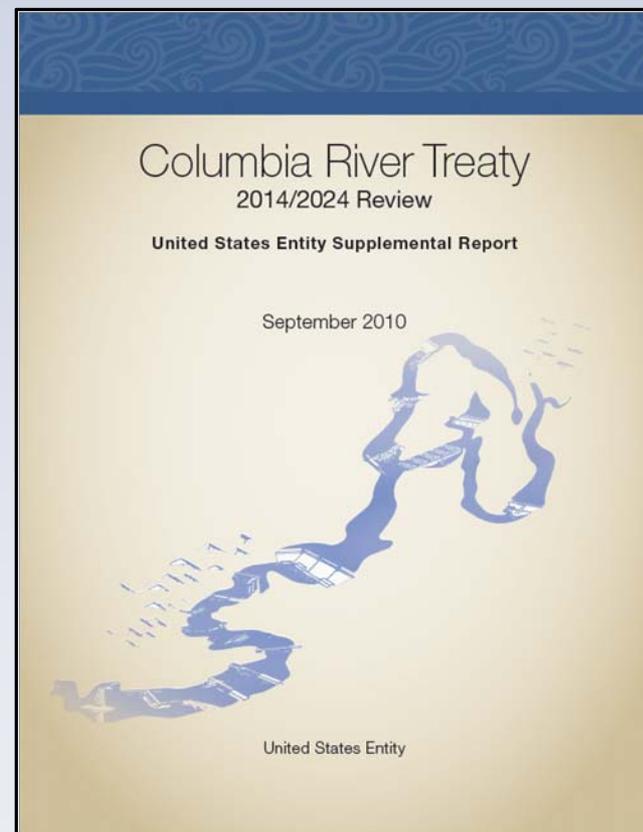
Phase 1 Results:

Flood Control and Reservoir Impacts

1. The number of times Called Upon flood control assistance is needed from Canada depends on what level of flood control protection, or the maximum flow objective, is needed as measured at The Dalles Dam on the lower Columbia River.
2. In order to show “effective use” of U.S. storage before calling upon Canadian storage, the U.S. projects had to draft deeper more often during Called Upon years than is required with the current flood control operations.
3. In the Phase 1 studies, implementation of effective use of U.S. projects also caused a few additional refill failures during Called Upon years.
4. In high water years, Called Upon operations provide similar draft as regulation for U.S. power.
5. Canadian reservoirs gained some degree of operating flexibility with or without the Treaty.

U.S. Entity Supplemental Report *Overview*

1. The joint Phase 1 studies did not include the ESA Biological Opinions and other fish operations at U.S. projects, and as such, they did not depict realistic results for flows, reservoir levels, and generation in the U.S.
2. The Supplemental Report is a U.S. Entity developed companion report to the jointly developed Columbia River Treaty 2014/2024 Review Phase 1 Report.
3. Purpose of the Supplemental studies was to overlay current Biological Opinions and other fish operations to the Phase 1 studies.



U.S. Entity Supplemental Report

Results

1. With or without the Treaty, looking across all of the scenarios, the addition of fish operations to the Phase 1 studies reduced U.S. system generation by approximately 1600 annual aMW.
2. Terminating the Treaty reduced U.S. average annual generation over the 70 water years studied by about 90 to 94 aMW, a relatively small amount. However, the month-to-month shape changed, with more generation in the winter-spring, and less in the summer-fall (especially in low water years).
3. In the driest 20 years, terminating the Treaty resulted in a U.S. system generation loss of about 1460 aMW in the summer and 230 aMW annually and a decrease in the U.S. system's ability to meet fish flow objectives during the summer months.
4. The difference in average U.S. reservoir drawdown (minimum) elevations for the Supplemental studies was driven by the assumed flood control flow objective at The Dalles, not by continuing or terminating the Treaty.
5. Assumptions about U.S. flood control needs and Canadian Called Upon operations were a stronger influence on the ability of the U.S. reservoirs to meet fish operating criteria than other variables relating to Treaty continuation versus termination.

Corps of Engineers Flood Risk Management Considerations



Considerations for Future Flood Risk Management Studies

1. The importance of risk-based approaches to flood management

- a) All key variables, parameters and components of flood management are subject to probability-based analysis
- b) Focus on uncertainties of variables having significant impact on study conclusions
- c) Must include:
 - Depth-damage relationships
 - Discharge associated with exceedence frequencies from hydrologic studies
 - Structural and geotechnical performance of levees and other structures
 - System-wide analysis and probability estimates of Estimated Annual Damages (EAD) and Annual Exceedence Probability (AEP)

2. Systems Approach

- a) Canadian storage drafts must be viewed within a systems approach to flood risk management in which this is one tool in a suite of tools to manage flooding in the Columbia River Basin in the U.S.
- b) Other tools include U.S. Reservoir Storage and local flood measures



U.S. Entity Flood Risk Management Considerations

Primary metrics incorporating uncertainty to be estimated and used to characterize flood risk in the evaluation of alternatives considered in the CRT 2014/2014 Review:

- **Expected Annual Damages (EAD):** Average annual damages over a long period of time reflecting a range of potential flood events.
- **Annual Exceedance Probabilities (AEP):** The probability that flooding will occur at a given location in any given year considering the full range of possible annual floods and project (levee) performance.
- **Conditional Non-exceedance Probabilities (CNPs):** Also known as “assurance”, is the probability that a target stage will not be exceeded during the occurrence of a given flood event.
- **Long-term Risk:** Also referred to as inherent, or natural, hydrologic risk, characterizes the likelihood of one or more exceedances of a selected target or capacity in a specified duration.
- **Residual Risk:** Typically captured as residual EADs, is risk that emerges or increases as a result of mitigating another risk or when reduction of risk in one region of a system transfers the risk burden to another region in the system.

***Phase 1 Recommendations:
Specific Flood Control Considerations
for Future Studies***

- a) Re-evaluate use of a pre-determined maximum flood flow objective as a “trigger” for CU storage;
- b) Limit Canadian draft volumes used in CU operations;
- c) Re-evaluate priority of drafting Canadian projects during CU;
- d) Define procedures for returning Canadian projects to planned operation after CU operations;
- e) Refine procedures for adjusting to volume runoff forecast changes in CU years;
- f) Establish strategies for prioritizing between winter and spring flood control;
- g) Refine procedures for incorporating Canadian local flood control;
- h) Consider effects of Canadian flex on CU;
- i) Develop strategies for knowledge and assurance of Canadian operations;
- j) Better define “Effective Use” of U.S. reservoir storage;
- k) Estimate Canadian economic losses and operating costs for CU

Key Flood Management Questions to be Answered...

1. What is the residual flood risk in the Columbia River Basin under the current Flood Control Operating Plan?
2. Can we adequately manage flood risk through a “called upon” system for Canadian storage?
3. What are the implications of climate change for basin hydrology and flood risk between now and 2024? After 2024?
4. What is the economic value of Canadian flood control storage to the U.S.?
5. What are the potential non-economic (especially environmental) consequences for other river uses and benefits associated with flood risk management alternatives?

Flood Risk Management Studies

1. Phase 2A: Flood Risk Assessment

a) Objectives:

- Collect and manage data and develop tools and processes necessary to produce quantifiable estimates of flood risk management benefits and costs
- Characterize current level of flood risk under base conditions

b) Complete by September 2011

2. Phase 2B: Flood Risk Management

a) Objective: Evaluate flood risk management benefits and costs associated with alternative Treaty strategies

b) Complete by January 2013

3. Phase 2C: Flood Risk Communication

a) Objective: Prepare Decision Documents needed to inform U.S. Treaty decision

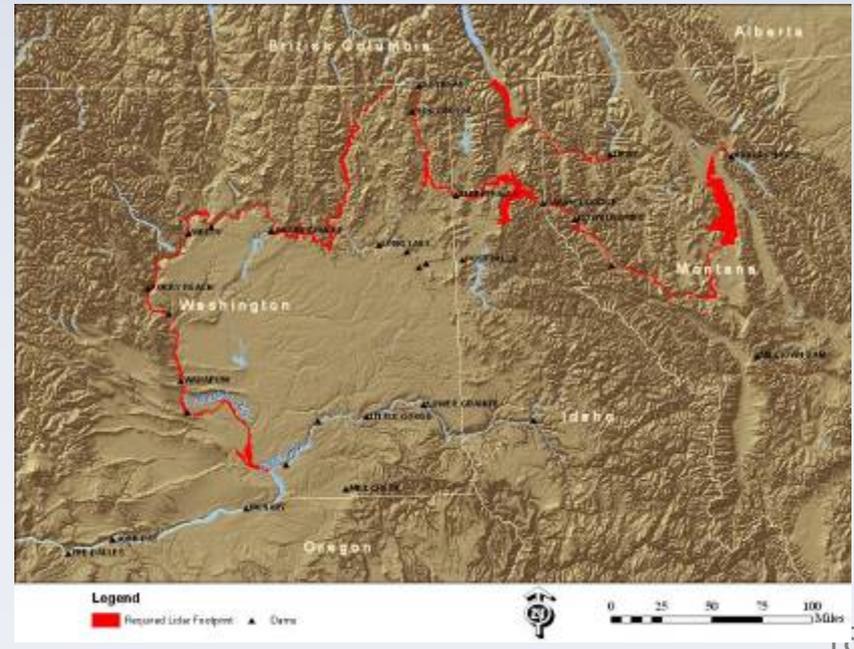
b) September 2013

Phase 2a Flood Risk Assessment: *Products and Deliverables*

Inventory and analyze existing floodplain data...

- a) Floodplain Mapping and Surveying
- b) Levee Assessments
- c) Economic Surveys

- 3000 sq. miles
- 4 states
- 42 counties
- 180,000 structures
- 160 levee systems
- 1600 river miles
- 9 points per sq. meter



Columbia River Treaty

Treaty Perspective

- The lack of coordinated hydro operations on an international river system such as the Columbia could result in additional uncertainty for downstream U.S. power, flood control, fisheries, and other non-power river uses and operations.
- Expectations are that Called Upon will be needed post-2024, but how much is needed, how it will be implemented, and how it will be paid for are still uncertain and will need to be evaluated in future work.
- U.S. reservoirs in the PNW may have to be operated much differently for flood control post-2024, and this could have significant implications for interests around those reservoirs.
- Due to the amount of planned conservation and renewables in PNW resource plans, the size of the Entitlement return will not decrease at the rate originally expected when the Treaty was put in place. If the Treaty is terminated, the U.S. will retain this 300 - 500 average annual MW of energy and 1300 -1500 MW of capacity as a carbon-free resource.
- Many of the current U.S. operations (e.g. BiOp objectives) are not considered when determining the Entitlement return to Canada.

Columbia River Treaty

Next Steps

- Consistent with responsibility for implementing the Treaty, the U.S. Entity (BPA Administrator and Corps' Northwestern Division Engineer) is continuing to conduct the CRT 2014/2024 Review with input from and coordination with other federal agencies, states, tribes, and regional stakeholders.
- Other regional concerns such as ecosystem health, water supply and quality, climate change, cultural resources, recreation, navigation, irrigation, and other needs will need to be considered.
- The Corps of Engineers continues to work on its comprehensive Flood Risk Management (FRM) project.
- Climate change data sets (streamflows, temperatures) are completed, will be part of next phase of modeling and scenario development.
- Expectations are that the U.S. Entity will provide a recommendation on the Treaty future to the Department of State by late 2013.

Engagement Plan

Design and Implement an Engagement Plan that meets the needs of the PNW region to define sovereign and stakeholder interests regarding various Treaty future scenarios and evaluation. This process must address the interests of key parties as well as general stakeholders in the region.

Sovereign Review Team:

1. States: OR, WA, ID, MT
2. NW Tribes: 5 representatives (USRT, CRITFC, UCUT, Cowlitz, CSKT)
3. Federal Agencies: NMFS, USFWS, BOR, USACE, BPA, BLM, EPA, USFS, USGS, BIA, NPS)

NW Stakeholders:

Plan must take into consideration stakeholder concerns and input. This may be done in several ways:

- Regional workshops
- Joint Sovereign Review Team/Stakeholder meetings
- Technical consultation with regional experts among stakeholder groups

For more information:

Matt Rea
Program Manager
U.S. Army Corps of Engineers
503-808-4750
matt.t.rea@usace.army.mil

Nancy Stephan
Program Manager
Bonneville Power Administration
503-230-5296
nlstephan@bpa.gov

Website: <http://www.crt2014-2024review.gov>