NON-TREATY STORAGE AGREEMENT
ENVIRONMENTAL ASSESSMENT

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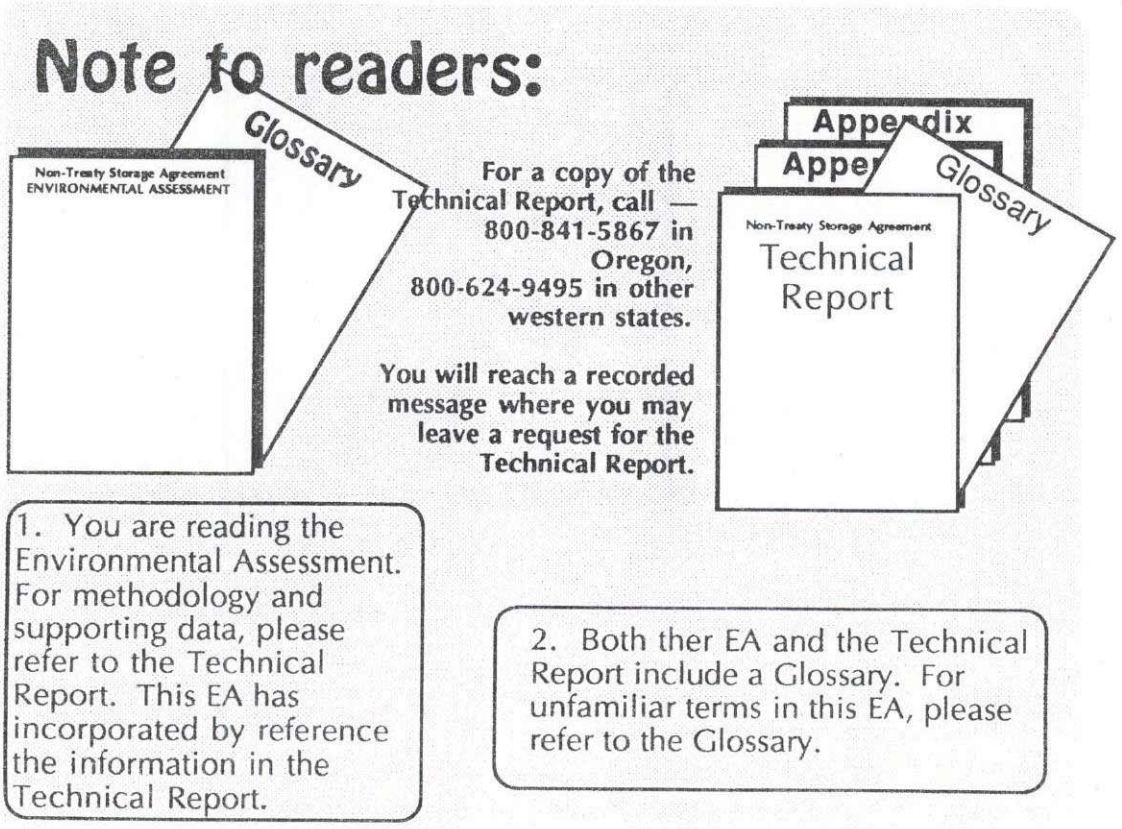

NON-TREATY STORAGE AGREEMENT
ENVIRONMENTAL ASSESSMENT

CHAPTER 1.0 — Introduction and need for action

1.1 Introduction

Bonneville Power Administration (BPA) is negotiating and proposes to enter into an agreement — the "Non-Treaty Storage Agreement (NTSA) — with British Columbia Hydro and Power Authority (BC Hydro). The NTSA will enhance hydroelectric power production and provide operational flexibility on both the U.S. and BC Hydro systems. Some actions that affect Columbia River flows at the U.S.-Canadian border, such as storing or releasing water from a Canadian reservoir, also may affect generation at the non-Federal mid-Columbia River projects. Therefore, BPA desires additional agreements with the owners of those projects and their power purchasers (the mid-Columbia participants) to enable them to participate in actions that would occur under the agreement between BPA and BC Hydro.

The existing NTSA, which has been in effect since 1984, is a model for the proposed NTSA. The proposed NTSA would expand the amount of already-existing non-Treaty storage space available to BPA and BC Hydro from the current 2.0 million acre-feet (MAF) to about 4.5 MAF, and would extend the agreement from 1993 — when the existing agreement ends — to the year 2003.

1.2 Need for Action

The underlying need to which BPA is responding with the proposed agreements is the need for marketable energy.

The proposed NTSA will provide the flexibility to use more effectively the existing storage space in Canada for generation of more marketable energy in both Canada and the United States. In addition, the agreement will reduce or offset revenue and power losses resulting from Water Budget operation to aid fish migration and survival. It will increase the operating flexibility of the Columbia River Power System within existing guidelines,

and help ensure an adequate, efficient, and economical power supply in the Pacific Northwest.

In meeting the underlying need, BPA will act consistently with its statutory responsibilities, including the Northwest Power Act, while taking into consideration the Pacific Northwest Power Planning Council's Power Plan and Fish and Wildlife Program.

1.3 Background

Coordination of the Pacific Northwest (PNW) and BC Hydro systems began in 1964 with the ratification of the Columbia River Treaty (Treaty). Under the Treaty, Canada was required to construct 15.5 MAF of storage at Mica and Arrow, on the Columbia River (Figure 1.1), and Duncan, on a tributary to the Kootenai River. The United States was allowed to construct 5 MAF of storage at Libby Dam on the Kootenai River. BC Hydro also built storage on the Columbia River system in excess of that required by the Treaty (termed non-Treaty storage), including Revelstoke Dam and an additional 5 MAF of usable storage at Mica. On occasion, BC Hydro also makes available 2 feet of storage in Arrow above the normal full elevation.

Agreements in addition to the Treaty are required to operate non-Treaty storage space on the Columbia River in Canada. Two short-term agreements were signed in 1983 between BPA and BC Hydro, along with companion agreements with mid-Columbia participants, to enable BPA to help initially fill Revelstoke reservoir. Currently, BPA and BC Hydro equally share 2 MAF of the Mica non-Treaty storage under the Non-Treaty Storage Agreement signed in 1984.

The potential environmental effects of the existing Non-Treaty Storage Agreement were evaluated in the Environmental Assessment for the Proposed Agreements to Resolve Revelstoke Filling Issues and Access Reservoir Storage Space in Canada (October 1983). Based on the EA and on the public comments received on the EA, a Finding of No Significant Impact was made on December 9, 1983. An Administrator's Record of Decision was issued in January 1984.

Up to the full 5 MAF of non-Treaty space in Mica may be available under the proposed agreement. Studies conducted for this environmental assessment include operation by BC Hydro and the U.S. and are based on

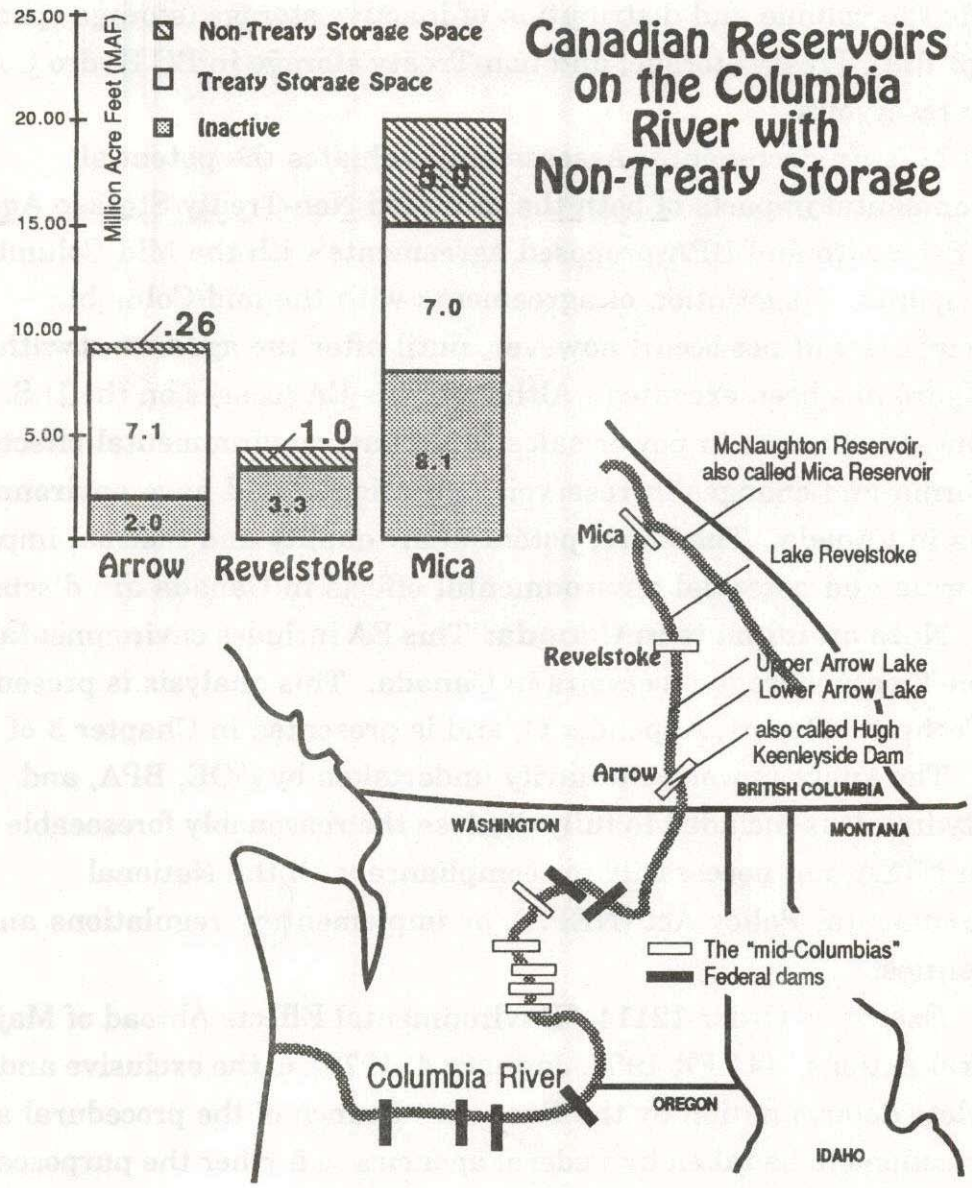

Figure 1.1. The proposed Non-Treaty Storage Agreement optimizes power generation over the whole length of the Columbia River within license and power constraints. BC Hydro proposes to make available about 4.5 MAF of non-Treaty storage behind Mica Dam, an increase of 2.5 MAF over the existing NTSA.

the full 5 MAF being available as active storage space. The proposed NTSA does not require any particular operation by the parties, and thus does not have any direct environmental effects. However, the NTSA may enable changes in hydrosystem operations, which may have environmental effects. It currently appears that 4.5 MAF actually will be available as active storage, with 0.5 MAF as potential recallable space. Figure 1.1

depicts the volume and distribution of inactive storage (storage space which is kept full), Treaty storage, and non-Treaty storage in BC Hydro Columbia River reservoirs.

This Environmental Assessment evaluates the potential environmental impacts of both the proposed Non-Treaty Storage Agreement with BC Hydro and BPA-proposed agreements with the Mid-Columbia Participants. Negotiation of agreements with the mid-Columbia participants will not occur, however, until after the agreement with BC Hydro has been executed. Although this EA focuses on the U.S. Pacific Northwest, changes in power sales could have environmental effects in California and changes in reservoir operations could have environmental effects in Canada. Therefore, potential air quality and thermal impacts in California and potential environmental effects in Canada are discussed.

Note on impacts in Canada: This EA includes environmental effects at non-Treaty storage reservoirs in Canada. This analysis is presented in the Technical Report, Appendix O, and is presented in Chapter 3 of this EA.

The analysis was voluntarily undertaken by DOE, BPA, and BC Hydro. It is included to fully disclose the reasonably foreseeable effects of the NTSA, not necessarily for compliance with the National Environmental Policy Act (NEPA), or implementing regulations and guidelines.

Executive Order 12114, "Environmental Effects Abroad of Major Federal Actions," (44 FR 1957, January 4, 1979), is the exclusive and complete determination by the Executive Branch of the procedural and other actions to be taken by Federal agencies to further the purposes of NEPA with respect to the environment outside the United States. The Executive Order designates a series of specific exemptions to its provisions, including actions not having a significant effect on the environment outside the United States, as determined by the Federal agency. Because the analysis presented in Appendix O clearly demonstrates that the proposed NTSA has no significant effect on the environment outside the United States, this action is exempt from the requirements of the Executive Order.

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CHAPTER 2.0 — Alternatives

• **No Action** — This alternative assumes that no new NTSA is negotiated and that BPA and BC Hydro continue to operate under the existing agreement until termination in 1993, including shared operation of 2 MAF of Mica active non-Treaty storage. The analysis assumes the existing agreement will continue to be operated for opportunity storage until 1993, when the agreement expires. Non-Treaty storage has a refill requirement at the end of the agreement.

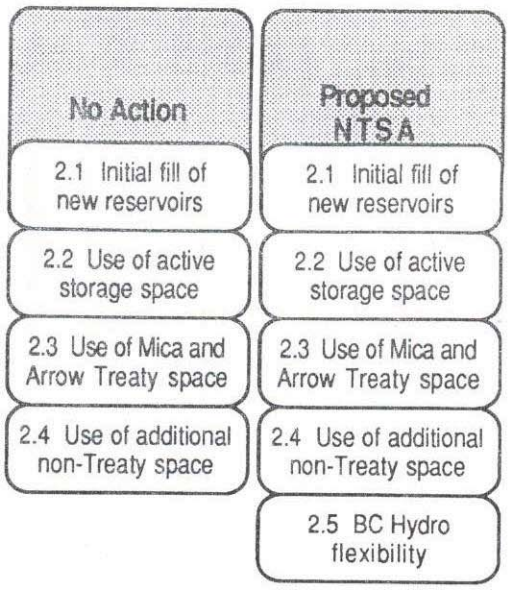
Before the current NTSA, BPA and BC Hydro had several short-term agreements for the storage and release of water in Canadian reservoirs on the Columbia River headwaters. See the Technical Report, Appendix A, for a list of those agreements. Following termination of the existing agreement, short-term agreements may be negotiated as needed to use some storage in Canada — agreements similar to those used prior to the existing NTSA. Potential future short-term agreements are not now proposed and are not analyzed in this EA. They will be analyzed in an appropriate procedure once their terms are proposed and can be fully evaluated.

• **Proposed NTSA** — This alternative extends the term of the agreement until 2003 and expands the use of existing non-Treaty storage space in Mica from 2 MAF to about 4.5 MAF. The primary advantage of the NTSA is that it provides the ability to store water in "non-Treaty" space in Canadian reservoirs for later release. This provides flexibility to meet marketing and operating objectives — for example, storing when energy values are low or the system is spilling water, and releasing water for generation when energy values are higher.

The proposed NTSA does not contain provisions for early termination, as does the existing agreement. Under the proposed NTSA, it may be possible to use Mica non-Treaty storage as either a firm resource or for opportunity storage. Both options are analyzed in this EA.

• **Comparison of the no-action and proposed NTSA alternatives** — Both the proposed NTSA and the no-action alternatives consist of four aspects, patterned after those in the existing NTSA. The four aspects

(described in sections 2.1 through 2.4), are considered together because none of the aspects on their own are sufficiently beneficial for all parties to justify a long-term agreement. In addition to the four aspects, the proposed NTSA alternative also has provisions (section 2.5) that allow BC Hydro to retain operational flexibility.



2.1 Initial Fill of New BC Hydro Reservoirs on the Columbia River

The magnitude of this potential storage is relatively small in the proposed agreement, less than 0.3 MAF. One of the main purposes for the existing NTSA was to resolve a dispute over initial filling of inactive storage at Revelstoke, Seven Mile, and potentially other BC Hydro reservoirs on the Columbia River. Initial filling of Revelstoke and Seven Mile has been completed. The proposed NTSA refers only to initial filling of remaining new reservoirs on the Columbia River, estimated to total less than 0.3 MAF of storage. Any such plant would be operated as a run-of-river plant.

No Action

The existing NTSA provides a mechanism for initial filling of future BC Hydro reservoirs that may be constructed during the term of the agreement. Under the existing agreement, BPA and BC Hydro share equally the obligation to fill future BC Hydro reservoirs on the Columbia River. BPA fulfills its obligation to fill those reservoirs by requesting that BC Hydro reduce the flow out of Canada and store the water in the reservoir to be filled. No energy is scheduled in either direction as a result of BPA's obligation. BPA will suffer any loss of energy production at U.S. projects and BC Hydro suffers any loss of energy production at Canadian projects. BC Hydro fulfills its obligation by reducing flow out of Canada and storing the water in the reservoir to be filled. BC Hydro delivers energy to BPA to compensate for lost energy production at U.S. projects. BPA delivers energy to MCP for lost generation as a result of filling by both BC Hydro and BPA. This operation fills BC Hydro's reservoirs, and compensates the U.S. for energy losses associated with BC Hydro's obligation.

Proposed NTSA

The resolution of disputes regarding initial filling of Seven Mile and Revelstoke occurred under the provisions of the existing NTSA and therefore is not an issue in the proposed NTSA. The proposed agreement provides for initial fill of Columbia River reservoirs in Canada if any such new reservoirs are constructed within the term of this agreement.
BC Hydro and the U.S. have an obligation to fill half of such space.

2.2 Use of Active Non-Treaty Storage Space

Of the types of storage addressed in the proposed NTSA, storage in active storage space in Mica is expected to be the most utilized as it has been in the existing agreement. It is to be available on a continuous basis, subject to operating limitations. The existing agreement provides for use of 2.0 MAF of active non-Treaty space in Mica to be shared equally by BPA and BC Hydro. The proposed NTSA would expand the usable volume of this existing storage to approximately 4.5 MAF, half to be used by BC Hydro, and half to be shared by U.S. utilities. Of the operational activities provided for in the agreement, use of active storage space is expected to have the greatest potential for environmental impacts due to its size and flexibility.

No Action

BC Hydro made 2.0 MAF of non-Treaty storage available to be equally shared by BPA and BC Hydro during the term of the agreement. BC Hydro may release water in active storage space and receive the generation produced at all projects downstream from the storage reservoir. When BC Hydro refills that space, it must compensate BPA for the loss of energy at U.S. projects. BPA then delivers energy to MCP for lost generation at mid-Columbia projects as a result of storing by BC Hydro. BPA may release water in active storage space and receive generation from BC Hydro projects downstream from the storage (Mica and Revelstoke) as well as from Federal projects. The MCP retain generation at their projects resulting from a BPA release. When BPA refills the space, it requests that flows be reduced at Mica and Revelstoke and compensates BC Hydro for the loss of energy at those two projects. The MCP absorb generation losses resulting from BPA's election to store in non-Treaty space. The amount of water that can be stored or released on any given day is limited by several factors, including minimum and maximum flow levels at the Canadian Projects (Mica, Revelstoke, and Arrow) and at projects downstream in the U.S. The parties are obligated to leave the 2.0 MAF full at the end of the 10-year term of the agreement. In the event either party is unable to comply there are provisions allowing storing to continue into (but not releasing from) this space for up to 7 years beyond initial termination. During the extended period, BPA will compensate BC Hydro for any reductions in energy production at Mica due to reduced head resulting from BPA's fill deficiency.

Proposed NTSA

Under the proposed agreement BC Hydro would make available 4.5 MAF of non-Treaty storage in Mica Reservoir to be shared equally between the U.S. and BC Hydro. The obligation to fill non-Treaty storage would be extended to the end of the agreement, 2003. The terms of the extension are the same as in the existing agreement. Similar mechanisms apply to use of non-Treaty storage as apply in the existing agreement. It is expected that the MCP would participate in energy deliveries when BPA releases or stores into non-Treaty storage space, and that the MCP would have control over a portion of the non-Treaty space.

2.3 Use of Mica and Arrow Treaty Space

The existing NTSA essentially replaced the year-by-year agreements which provided for storage in Mica Treaty space to enhance the refill of Mica. The existing agreement also allows BC Hydro to store water in Arrow Treaty space, providing rights similar to those BPA has under the Treaty. There are charges associated with releases of water from Treaty space under the agreement. The proposed NTSA continues the provisions for storage in Treaty space.

No Action

Treaty space in Mica is available any time that Mica's Treaty elevation is below its maximum flood control elevation. Each party has the right to store in one-half of the available space. Charges are assessed on energy returned when water is released from Mica Treaty space by either BPA or BC Hydro. Alternatively, BPA may compensate BC Hydro by additional energy deliveries at the time of storage into Mica Treaty space. The agreement also allows BC Hydro to store in Treaty space in Arrow. BPA does not require a similar right because it can store in Treaty space in Arrow up to its maximum flood control elevation under provisions of the Treaty. Treaty space is filled in the same manner as the refilling of active storage space. When a party stores water in Treaty space, it must compensate the other party for lost energy. When the water is released, the releasing party receives the energy generated at all generating projects downstream from the storage reservoir. Charges are assessed on energy deliveries to BC Hydro by BPA when BC Hydro releases water from Arrow Treaty space. This provision allows BPA and BC Hydro flexibility, which they do not have under the Treaty, to fill Treaty space. Under some runoff conditions, Mica Reservoir has a lower probability of refill than the U.S. Coordinated System. Mica also refills later in the year. At times, these conditions result in the desirability of storing in Mica when other Coordinated System reservoirs have a 95 percent confidence of refilling and Mica does not. BPA may use this provision to improve the probability of filling Mica Reservoir in years the inability to fill Mica might otherwise affect the level of Coordinated System Firm Energy Load Carrying Capability (FELCC). Enhancement of Mica refill occurred prior to the existing NTSA on an as-needed basis through short-term contractual arrangements between both parties.

Proposed NTSA

Provisions for use of Treaty storage space remain essentially unchanged from the existing agreement.

2.4 Use of Additional Non-Treaty Space

The existing NTSA replaced short-term agreements allowing BPA to store water into and release water from non-Treaty storage space which BC Hydro made available from time to time (termed recallable storage space). The proposed NTSA retains these provisions potentially allowing shared use of 0.5 MAF of non-Treaty storage in Mica and 0.26 MAF of non-Treaty storage in Arrow. The analyses for this EA assume that the 0.5 MAF of potential recallable space in Mica is operated as active storage.

No Action

BC Hydro may make additional non-Treaty storage space available from time to time. This space is shared equally between the parties. The mechanism for storage and release of water from the additional non-Treaty storage space is the same as for use of active storage space. This provision is a long-term arrangement for use of storage space that may become available on an interim basis. Prior to the present NTSA, such storage was handled through short-term agreements between the parties.

Proposed NTSA

As in the existing agreement, the proposed NTSA provides for use of additional non-Treaty storage space that BC Hydro may make available from time to time. In the proposed agreement, however, most of the non-Treaty space in Mica is designated as active storage space; therefore, additional non-Treaty recallable storage is 0.5 MAF in Mica and the 0.26 MAF (the top 2 feet) in Arrow. Mechanisms for storage and release remain the same as under the existing agreement.

2.5 BC Hydro Flexibility

Two operational provisions are included in the proposed agreement that are not included in the existing agreement. These provisions allow BC Hydro to retain operational flexibility on their system.

No Action	Proposed NTSA
N/A	(1) There is currently about 0.5 MAF of vacant non-Treaty storage space in Mica which is not part of the existing agreement. BC Hydro desires to retain the ability to fill this space with late runoff and, therefore, this space has been reserved for their use. This is the same 0.5 MAF of space which may also be made available by BC Hydro as recallable storage space. (2) BC Hydro currently uses flexibility on their system to move water between Mica and Arrow. This adjusts generation at Mica and Revelstoke to meet BC Hydro's loads. This operation is internal to BC Hydro's system and does not affect flows across the U.S.-Canadian border. Without these additional provisions, the proposed agreement could limit BC Hydro's ability to transfer water between their projects and thus their ability to serve load. The proposed agreement allows for use by BC Hydro of 0.05 MAF of storage in Mica and 1.0 MAF of storage in Revelstoke to be released only when Mica Treaty space is empty (i.e., rarely, and only at the end of a period of prolonged low flows).

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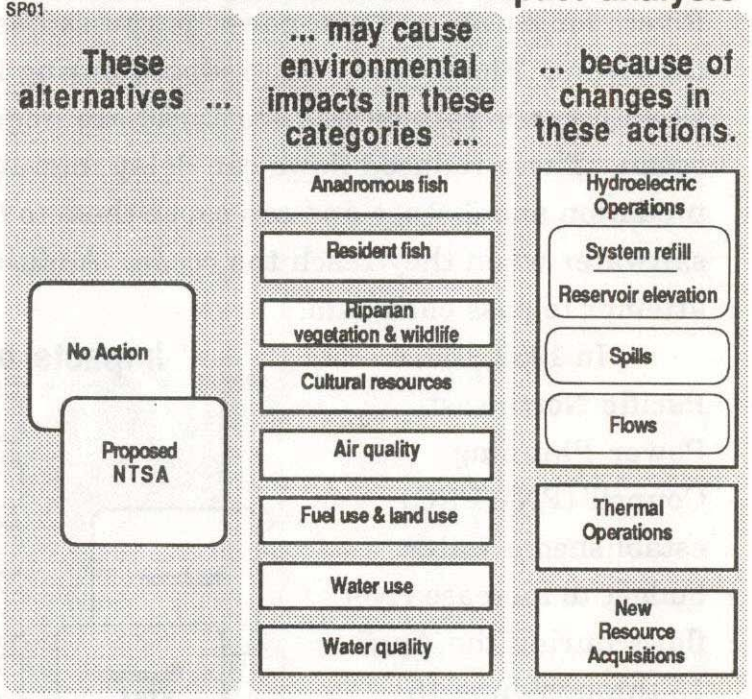
CHAPTER 3.0 — Impacts of alternatives

Operation of existing Federal dams on the Columbia and Snake Rivers will be similar to existing conditions. Projects will continue to operate within established constraints including those for flood control, irrigation ,navigation, recreation, and fisheries. Neither the proposed action nor the no-action alternative would result in operational changes that would cause these constraints to be violated.

Overview of environmental impact analysis



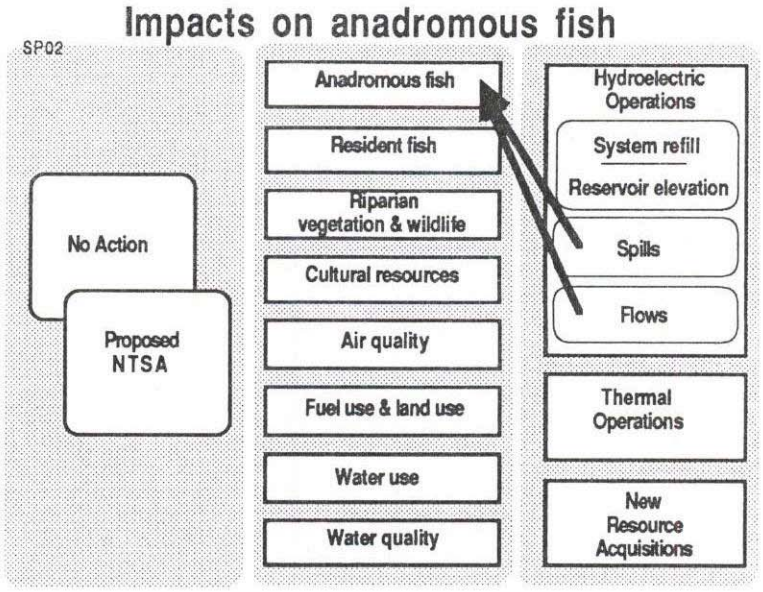
3.1 Anadromous fish

The Columbia River Basin supports a large number of anadromous fish (species that hatch in freshwater streams, migrate downriver to the ocean to mature, then return upstream to spawn). The principal anadromous fish runs in the Columbia River Basin are steelhead trout, and three species of salmon (chinook, coho, and sockeye). These fish are an important resource to the Pacific Northwest both for their substantial economic value to the sport and commercial fisheries, and for their high cultural and religious value to Columbia River Basin Tribes. There are no anadromous fish in the Columbia River above Chief Joseph Dam in Washington, thus there are no anadromous fish in the Columbia River in Canada.

Please refer to Technical Report §3.4.3, for methodology and supporting data on impacts on anadromous fish.

3.1.1 Water Budget and Flow

The development of storage projects on the Columbia and Snake Rivers for power and non-power purposes has reshaped the natural flows of the rivers. Flows have been reduced during the spring and early summer when juvenile salmon and steelhead are migrating downstream to the ocean. These reduced flows can delay migration, exposing juveniles to predation and disease and can cause them to lose their ability to adapt to saltwater when they reach the ocean. Additional mortality occurs as fish attempt to pass each dam.



In 1982, the Pacific Northwest Power Planning Council (PNWPPC) established a water budget to increase river flows during the April 15 through June 15 period. This coincides with the peak out-migration of spring fish, predominantly yearling chinook, steelhead, and sockeye, which depend on adequate river flow for a successful migration. The water budget is a specified volume of water totaling 4.64 MAF. Fish Passage Managers are responsible to call upon this volume to enhance flows when it will provide the greatest benefit to migrating fish. Separate water budgets were established for the mid-Columbia and Snake Rivers. Priest Rapids Dam, on the Columbia River, and Lower Granite Dam, on the Snake River, are the respective points of water budget measurement. The water budget itself is unaffected by the proposed NTSA.

BPA evaluated changes in flows using (1) the System Analysis Model (SAM, described in the Technical Report, Appendix B), (2) flow data from

the current agreement, and (3) the hydroregulation model. Monthly average flow data predicted by SAM matched closely with flow data from the current agreement.

No action. Under the no-action alternative, there would be no change in flows until 1993, when the existing NTSA expires. Then, Columbia River flows would be expected to be slightly lower in low water years. In typical water years, flows would be slightly lower in the fall (1-7 kcfs) and higher in the spring (1-6 kcfs). Snake River flows are not affected.

Proposed NTSA. The operation of non-Treaty storage for either opportunity purposes or as a firm resource has the potential for increasing monthly average flows slightly in low flow years and decreasing flows somewhat in average and high water years on the Columbia River. In typical water years, flow decreases during the spring period are expected to average 1-6 kcfs. During the primary period of juvenile anadromous fish migration, April 15 through June, Columbia River Treaty flow requirements at Mica limit the amount which may be stored in Mica non-Treaty storage space, on any day, to a maximum of 10 KSFD. Therefore, unless exceptionally high flows refill Treaty storage prior to June 30, the maximum decrease in flow that can take place on any day, or as a monthly average, is 10 kcfs during this period. In both average and high water conditions, spring flows at Priest Rapids remain well above 140 kcfs from May through July, while filling non-Treaty space. Typical monthly average flows at the Dalles are approximately 230 to 260 kcfs during the spring migration period.

Monthly average changes in Snake River flows are expected to be very small, with flow reductions being 1 kcfs or less.

The hydroregulation model was used to determine the maximum amount of storage that could occur during the spring and summer months based on the 50-year historical record. Some storage can occur in non-Treaty space between April and August in nearly all 50 of the water years of record. The probability of having water available for storage increases throughout the season, as reservoirs refill and more non-firm energy and overgeneration spill become available for storage. Again, storage amounts are limited by Treaty flow requirements at Mica (10 kcfs) until such time as

Mica is refilled, usually in July. The maximum potential storage which the model showed occurring in a single month was 59.8 KSFD per day. This occured in July of water year 1968. Flows at Priest Rapids were relatively high, averaging 160 kcfs during this period compared to an average flow of 145 kcfs in typical water years. Because this estimate does not include non-firm sales, displacement of medium-priced thermal plants, short-term operating requirements, or transmission line limitations between BPA and BC Hydro, such an amount could not be stored in actual practice. Thus, during the primary period of anadromous fish migration, mid-April through June, maximum flow reductions — even on a short-term (daily) basis — are expected to be 10 kcfs or less. This flow change would not adversely affect anadromous fish migration.

Summary: The small changes in Columbia and Snake River flows are not expected to significantly affect juvenile anadromous fish migration under either alternative.

3.1.2 Vernita Bar Flow Regulation

In 1988 BPA and the mid-Columbia operators signed a long term Vernita Bar Agreement which specifies protection requirements for fall chinook spawning, incubation, and emergence on Vernita Bar (in the Hanford Reach, downstream of Priest Rapids Dam). During the spawning season, about October 15 through November, mid-Columbia project operators are required to reverse load factor to maintain low daytime flows, provided inflows to Priest Rapids Dam are less than 125 kcfs. This action promotes lower spawning elevations on the bar as spawning occurs primarily during daylight hours. During the December through April period, flows required for incubation and emergence are determined by the spawning elevations that occurred the preceding fall, but are not required to exceed 70 kcfs.

No action. Under the no-action alternative, the likelihood of meeting the spring flow requirement at Vernita Bar (up to 70 kcfs) is reduced by about 1 percent.

Proposed NTSA. Priest Rapids flows seldom exceed 125 kcfs during the fall chinook spawning period, with or without the operation of

additional non-Treaty storage space. When non-Treaty storage is used for opportunity sales, flows are 0.85 percent less likely to exceed 125 kcfs during October and November and 0.98 percent more likely to remain above 70 kcfs December through April. However, when non-Treaty storage is used as a firm resource, flows are more likely to exceed 125 kcfs in the fall by 0.43 percent, and are 1.10 percent more likely to remain above 70 kcfs in the spring.

Summary: Neither the proposed NTSA nor the no-action alternative are expected to have a significant impact on the fall chinook spawned in the Hanford Reach, because the likelihood of not meeting flow requirements is so small. The additional flexibility created by the proposed NTSA makes it somewhat easier to comply with spring flow requirements.

3.1.3 Spill

Until adequate bypass systems are installed at the dams, spill remains a necessary means of moving juveniles downstream. Three types of spill occur: planned fish spill, forced spill, and overgeneration spill. Planned fish spill now includes the negotiated Spill Agreement as well as a restricted operation provided by the U.S. Army Corps of Engineers (Corps) at Bonneville Dam. Planned spill also includes spill levels specified by the Federal Energy Regulatory Commission for non-Federal projects. Planned spill does not include overgeneration spill and is not changed as a result of the proposed NTSA. Forced spill occurs when flows exceed the hydraulic capacity of the powerhouse at a particular project. Overgeneration spill is water that is spilled when energy markets are not sufficient to require powerhouse generation of all inflow. In that case, water in excess of that needed for generation is spilled. All three types of spill are useful in moving fish downstream. Changes in river operations have the greatest effect on overgeneration spill.

Monthly average reductions in overgeneration range from 0 to 45 megawatts (MW) during the April through August period are expected as a result of the proposed NTSA. Changes in overgeneration spill due to NTSA operation are small when compared to reductions of up to 900 MW examined in the Intertie Development and Use Final Environmental

Impact Statement (IDU Final EIS) which were found to be insignificant. The effects of the proposal on anadromous fish survival are presented in the next section, and includes the effects of spill changes and flow changes.

3.1.4 Survival

The analysis of downstream anadromous fish passage survival, as it may be affected by changes in spill and flows, was performed using a modified version of the Corps' FISHPASS model. BPA's version of FISHPASS has been revised to include the public utility district-owned dams on the mid-Columbia River and to accept spill and flow data from the SAM model.

FISHPASS simulates project-specific system survival for yearlings (spring chinook and Snake River summer chinook salmon), subyearlings (fall chinook and Mid-Columbia summer chinook salmon), steelhead trout, and sockeye salmon for each alternative. It then calculates the relative change in survival between each alternative.

No action. Because absolute survival values are highly dependent on model assumptions, and relative changes in survival are used to assess impacts, the no-action alternative is a reference point for comparing changes resulting from the proposed NTSA.

Proposed NTSA. Changes to flow and spill resulting from the proposal have little effect on anadromous fish migrating through the Columbia and Snake River systems. The analysis of survival changes under the opportunity storage alternative shows projected average relative changes in survival throughout the contract for all yearling, subyearlings, steelhead, and sockeye ranged respectively, from increases of 1.5, 1.0, 0.7, and 0.4 percent to decreases of 0.2, 0.9, 0.2, and 0.1 percent.

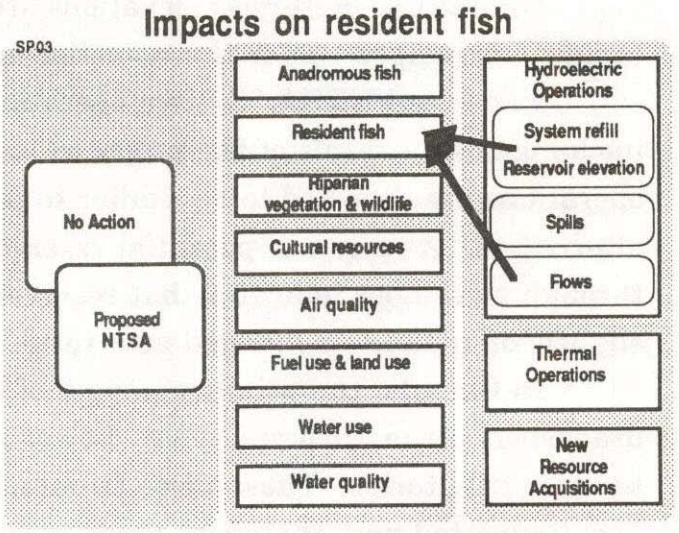
Under the firm resource alternative, projected average relative changes in survival throughout the contract for all yearling, subyearlings, steelhead, and sockeye ranged respectively, from increases of 0.8, 0.5, 0.6, and 0.4 percent to decreases of 0.2, 0.9, 0.2, and 0.0 percent.

These effects were evaluated based on their stock assessment information (Appendix I) and were found to be insignificant.

Summary: Survival of anadromous fish stocks will not be compromised by the proposed NTSA.

3.2 Resident fish

Resident fish are freshwater fish that live and migrate within the streams and lakes of the Columbia River Basin but do not travel to the ocean, as do anadromous fish. They have become particularly important to areas where anadromous fish runs are blocked by natural or manmade obstructions.



Please refer to Technical Report §3.4.2, for methodology and supporting data on impacts on resident fish.

3.2.1 Production in reservoirs

Drawdown of reservoirs for power production, irrigation, or flood control can affect game fish populations by altering the physical and biological characteristics of the reservoir. Of particular interest in evaluating effects of the proposal on resident fish are changes that occur in the April through November period. Lowered elevations reduce the productive shallow areas near the shoreline. This can result in reduced habitat (particularly spawning habitat) for game fish and their food organisms. Reservoir fluctuations can change water temperatures or expose nests, killing the eggs.

The primary Federal reservoirs of concern are Hungry Horse and Libby in northwestern Montana, Grand Coulee in central Washington, and Dworshak reservoir in Idaho. Common game fish species in Hungry Horse include westslope cutthroat trout, Dolly Varden, and mountain

whitefish. Common game fish species in Libby Reservoir include western cutthroat trout, rainbow trout, Dolly Varden, and kokanee salmon. Grand Coulee supports an economically valuable recreational fishery for walleye and rainbow trout. Sport fish caught in Dworshak include kokanee salmon, rainbow trout, and smallmouth bass.

No action. Reservoir elevations are likely to decrease slightly or remain unchanged under the no-action alternative.

Proposed NTSA. System operating and planning requirements are unchanged as a result of the proposed agreement, therefore reservoir operations are expected to be similar to those under the no-action alternative. A review of potential reservoir elevation changes during April through November indicates that reservoir elevations are likely to increase slightly or remain unchanged as a result of the proposed agreement.

In Canada, the primary impact of the proposed NTSA is increased drawdown of the Mica reservoir. Lower reservoir levels may affect access to three tributaries. These three tributaries have natural barriers that are now inundated and, therefore, made passable to fish. The exposure of these barriers would impede migration and spawning of rainbow trout. Because rainbow trout spawning coincides with spring runoff, hence reservoir filling, it is probable that spawning would be delayed rather than halted. It is also likely that these three streams contribute little to overall production of the reservoir's rainbow trout population given the low water temperatures and turbid conditions prevalent in all three. In extremely dry conditions, migration barriers could be exposed during all or part of the spawning season for rainbow trout, Dolly Varden char, kokanee, and mountain whitefish. Kokanee production would probably not be affected as this species is not known to spawn in these cold glacial streams. Dolly Varden char and mountain whitefish production could be compromised. However, it is estimated that these streams only contribute between 5 and 10 percent of the overall reservoir production of these two species and would only be affected in extremely dry years. For additional information on impacts in Canada, refer to the Technical Report, Appendix O.

Arrow reservoir levels are essentially unchanged as a result of the proposed NTSA. As a result there are no anticipated impacts on fish using the reservoir.

Summary: Changes are not expected to significantly affect resident fish production in reservoirs, because (1) there is very little change to U.S. reservoirs; (2) production losses at Mica are small, in the context of overall reservoir production; and (3) reservoir levels at Arrow are essentially unchanged.

3.2.2 Production in streams

The Kootenai River below Libby Dam and the Flathead River below Hungry Horse Dam support important populations of resident game fish, including kokanee in the Flathead River system and westslope cutthroat, rainbow trout, and Dolly Varden in the Kootenai River. Reduced flows below the dams can interfere with spawning, incubation, emergence, rearing, and migration of resident fish and can lower the production of aquatic fish food organisms. In addition, lack of high spring flushing flows can create sediment problems. To protect fish populations in the Kootenai River, the Northwest Power Planning Council has recommended that Libby Dam be operated to provide a minimum flow of 4 kcfs except in years of extremely low runoff, when no less than 3 kcfs should be provided.

To aid reproduction of kokanee in the Flathead River, the Council has recommended that Hungry Horse Dam be operated to provide specified flows at Columbia Falls on the mainstem of the Flathead River. For spawning (October 15 through December 15), flows should be between 3.5 and 4.5 kcfs. An instantaneous minimum flow of at least 3.5 kcfs is recommended at Columbia Falls throughout the year.

The kokanee that spawn in the Flathead River system below Hungry Horse migrate upstream from Flathead Lake. Currently, this population of kokanee is severely depressed. The Montana Department of Fish, Wildlife & Parks is developing a mitigation plan for the Flathead system, which may or may not include re-building the kokanee population.

No action. The Council has recommended flow levels to protect fish populations downstream from Hungry Horse and Libby Dams. These flow levels will not be affected under the no-action alternative.

Proposed NTSA. Very little change in streamflow downstream of Libby and Hungry Horse dams occurs as a result of the proposed agreement, when operated as either opportunity storage or as a firm resource. There is little change in the frequency of flows less than 4.0 kcfs below Libby, although when used as a firm resource, the proposed agreement can cause flows to drop below 4.0 kcfs slightly more often during the months of June and July. There is little change in the frequency of flows at Columbia Falls less than 3.5 kcfs and only a very slight chance of flows greater than 4.5 kcfs, during October through December. These changes in streamflows below Libby and Hungry Horse are not expected to have any impact on resident fish populations.

In Canada, increased Mica outflows during the July through October period could result in increased entrainment of fish and plankton. These losses would likely be offset by positive incremental effects on fish stocks immediately below the dam. Decreased Arrow outflows during January through July would result in small decreases in discharge in the Columbia River downstream from the dam. Eggs deposited during high water periods may be exposed when late winter/early spring downward fluctuations in water depth occur. The maximum monthly average reduction in flow is expected to be less than 4 kcfs, however, and minimum project outflows would not be altered. For additional information on impacts in Canada, refer to the Technical Report, Appendix O.

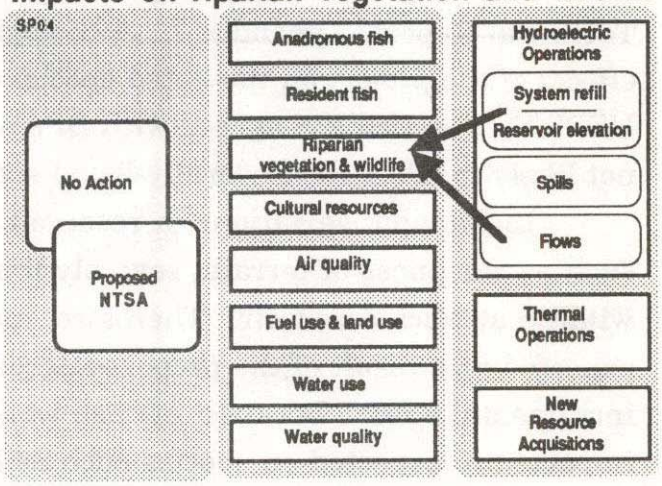
Summary: Changes in stream flows are small and are not expected to significantly affect resident fish production, because (1) flow changes at U.S. reservoirs are within the Council's Program; (2) losses to fishery resources in Mica due to entrainment of fish and food supply would likely be offset by increases in fish stocks immediately below the dam.

3.3 Riparian vegetation and wildlife

Reservoir water level fluctuation can affect wildlife and vegetation, both directly and indirectly, through the timing, duration, and amount of

releases from the reservoir. The proposed Non-Treaty Storage Agreement generally results in minimal change to reservoir fluctuations. All current and future reservoir operations will remain within the operational constraints set by the operating agencies and the physical characteristics of the dams.

Impacts on riparian vegetation and wildlife



The greatest effect on wildlife of reservoir water level fluctuations, in the Columbia Basin, is through effects on wildlife habitat. Any effect on prey or browse species will have a corresponding effect on wildlife species. This is especially important if vegetation is damaged at critical times of the year, such as when deer and elk need it for winter food or waterfowl need it for shelter or nesting. Erosion of islands also affects wildlife by decreasing habitat available for nesting birds and deer fawning. It may also decrease the amount of shoreline available for reptiles laying eggs. Land bridges may be formed during low water periods, allowing predators easy access to habitat that would otherwise be isolated. This is a particular concern when birds are nesting and deer fawning. Changes in reservoir levels which impact resident fish populations can also affect wildlife that use those fish as a primary food source. Changes in hydro operations can also affect vegetation along shorelines, on islands, and in the drawdown zones.

No action. Changes in hydro operations which could affect vegetation and wildlife are not expected to occur as a result of the no-action alternative. Fluctuations in reservoir elevations are minimal, within normal operating ranges, and are not expected to cause significant impact.

Proposed NTSA. Changes in hydro operations which could affect vegetation and wildlife are not expected to occur as a result of the proposed Non-Treaty Storage Agreement. Fluctuations in reservoir elevations are

minimal, within normal operating ranges, and are not expected to cause significant impact.

In accordance with the Endangered Species Act (16 USC 1536), BPA requested a list from the U.S. Fish and Wildlife Service (USFWS) of threatened and endangered species that may be present in areas affected by the Non-Treaty Storage Agreement. The list of species is included in the Technical Report, Appendix J. A Biological Assessment analyzing the effects of the project on the listed species was prepared and forwarded to the USFWS. The USFWS agreed with BPA's opinion that the proposed NTSA is not likely to affect the Federally-listed species or their habitats.

In Canada, variations in reservoir level, combined with other factors such as steepness of terrain, severely limit production of aquatic/wetland wildlife at Mica reservoir. Therefore, increased reservoir operating ranges expected as a result of the proposed agreement would have little incremental effect. Because few fish would be affected by the proposal, no impacts are expected on species such as bears and bald eagles which feed on spawners. Changes in aquatic productivity could affect certain wildlife species dependent on aquatic food chains. However, populations of these species at Mica reservoir are small and few individuals would be affected. No impacts are expected on any cross-river big game movements. Because Arrow reservoir elevation and flow changes are slight, no measurable impacts on wildlife habitat or populations are expected in the reservoir or the downstream area. For additional information on impacts in Canada, refer to the Technical Report, Appendix O.

Please refer to Technical Report §3.4.4, for methodology and supporting data on impacts on riparian vegetation and wildlife.

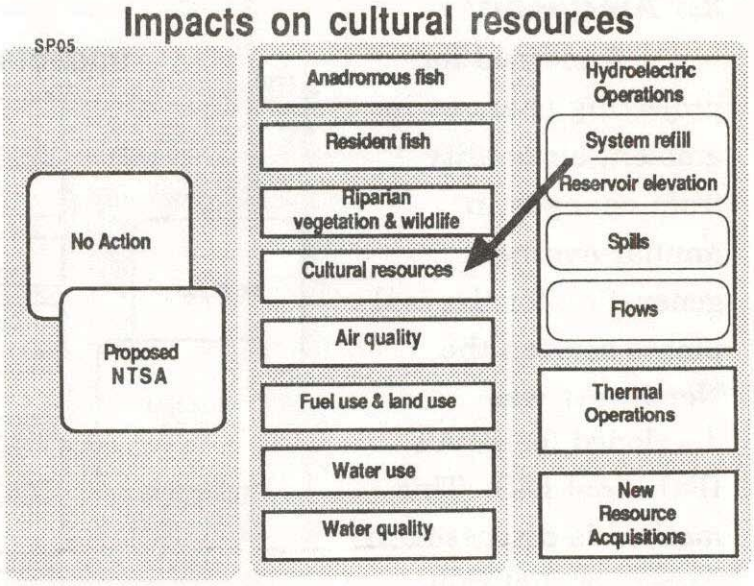
Summary: No significant impacts are expected on riparian vegetation and wildlife because (1) fluctuations in U.S. reservoirs are minimal and within usual operating ranges and (2) few species would be affected at Mica, reservoir changes at Arrow are small, with no impacts on bald eagles or other fish-eating species.

3.4 Cultural resources

Operating hydroelectric projects may affect cultural resources in and around storage reservoirs in the Federal Columbia River Power System — Grand Coulee (Lake Roosevelt), Dworshak, Libby (Lake Koocanusa), and Hungry Horse. Changes in elevations at these reservoirs may change the rate of site erosion and may make cultural resource sites more or less accessible to vandals. Other hydroelectric project reservoirs in the FCRPS are operated either as run-of-river or primarily for flood control and their operation is not expected to be affected by the NTSA.

No action and proposed NTSA. BPA is continuing to develop a Programmatic Agreement with the Advisory Council on Historic Preservation; the Idaho, Montana, and Washington State Historic Preservation Officers; the Bureau of Reclamation; the Corps; and others to survey, evaluate, and protect potentially affected cultural resources. Although this Programmatic Agreement was initiated as mitigation for potential impacts on these cultural resources from marketing activities analyzed in BPA's IDU Final EIS, it will satisfy BPA's responsibilities under section 106 of the National Historic Preservation Act (16 U.S.C. 470, *et seq.*) for all Federal actions taken with respect to hydroelectric operations at Grand Coulee, Dworshak, Libby, Albeni Falls, and Hungry Horse.

There are no substantial differences between reservoir levels expected with the no-action alternative and the proposed NTSA. Changes in reservoir levels that could affect cultural resources are minimal. All current and future reservoir operations will remain within existing constraints.



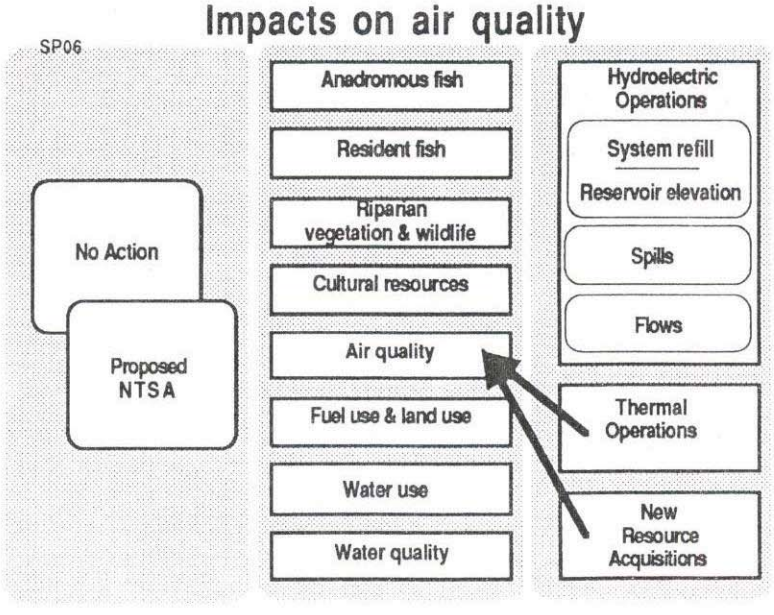
The Programmatic Agreement also will insure consistency with the American Indian Religious Freedom Act (42 U.S.C. 1996), by providing for BPA participation in the disposition of Native American burials if such sites are discovered.

In Canada, the two documented heritage sites at Mica reservoir would remain inundated with the increased reservoir drawdown expected from the proposed NTSA. Therefore, no effects on these resources is expected. In Arrow reservoir and downstream, most known heritage sites have been affected by present reservoir operation. No further effects are expected from implementation of the proposed NTSA. For additional information on impacts in Canada, refer to the Technical Report, Appendix O.

Summary: No impacts to cultural resources in the U.S. or Canada are expected under either alternative because (1) a Programmatic Agreement will mitigate effects at the major Federal storage projects for all Federal Columbia River Power System operations; (2) projects will continue to be operated within existing constraints and changes in reservoir levels are minimal; (3) at Mica, known sites will remain inundated; and (4) other sites in Canada are already affected and no further effects are expected.

3.5 Air quality

A method for projecting changes in ambient air quality from changes in annual average generation for the coal plants serving the Northwest was developed for BPA's IDU Final EIS. This method is discussed in Appendix G of that EIS. In this method,



there are linear relationships between average annual generation in average megawatts (aMW) and ambient concentrations of the air pollutants sulfur dioxide (SO_2) and total suspended particulate (TSP). Differences in computed ambient concentrations of these pollutants were compared to ambient air quality standards and Prevention of Significant Deterioration criteria. The IDU Final EIS analysis showed, in all cases, very small or negligible effects on air quality in the environs impacted by the coal-fired power plants supplying the Pacific Northwest — Boardman, Valmy, Bridger, Centralia, Colstrip, and Corette — which were the same ones as are addressed in this analysis of the proposed NTSA.

No action. Plants will continue to operate within existing design limits and permit requirements. Based on projected changes in generation, air quality changes are expected to be very small and not significant.

Proposed NTSA. For all plants except Valmy and Boardman, larger differences in generation between alternatives were projected in the analysis for the IDU Final EIS than are projected in the analysis of the proposed NTSA for this EA. The air quality changes identified in the IDU Final EIS analysis were very small and found to be not significant. Therefore, it can be concluded that air quality impacts of the proposed NTSA with respect to coal-fired plants other than Valmy and Boardman are very small or negligible. For Valmy, the largest differences in annual average ambient air quality that are projected from the NTSA analysis (i.e., computed using the largest difference in annual generation between no-action alternative and the proposed NTSA using the methodology of the IDU Final EIS) are increases of 0.022 micrograms per cubic meter ($\mu g/m^3$) for SO_2 and 0.00075 $\mu g/m^3$ for TSP in 1993 with NTSA used as a firm resource. Similarly, for Boardman, the maximum impacts are increases of 0.018 $\mu g/m^3$ for SO_2 and 0.0016 $\mu g/m^3$ for TSP in 1993 with NTSA used as a firm resource. These impacts are negligible when compared with Prevention of Significant Deterioration criteria (19 $\mu g/m^3$ for TSP, and 20 $\mu g/m^3$ for SO_2) or ambient air quality standards.

Air quality impacts of the Corette plant (near Billings, Montana) were not quantitatively analyzed in the IDU Final EIS or for this

Environmental Assessment (EA). However, in both cases, the changes in generation between alternatives for the small Corette plant were very small (at most 1 aMW in the analysis for this document), and when considering the small effects shown by the air quality analysis of the other plants, are not significant.

A methodology for analyzing air quality impacts from changes in generation from existing combustion turbine facilities included in the SAM had not been developed for the IDU Final EIS.

Only the Beaver facility is potentially affected in the SAM analysis of the proposed NTSA (See Technical Report section 3.4.7.1). A field measurement program using sulfur hexaflouride (SF_6) as a tracer showed that ambient air concentrations of nitrogen oxides and sulfur dioxide from the Beaver combustion turbine facility, when operated in combined cycle mode, are far below the air quality regulatory standards (Air Quality Impact Study of Combined Cycle Operation at the Beaver Combustion Turbine Plant, Phase I: Summary of Field Measurement Programs, Portland General Electric, 12/80).

Since the above study indicates that ambient concentrations of air pollutants from the Beaver combustion turbine facility are small in comparison with air quality standards, an increase in generation of up to 18.4 aMW in one year, the projected largest increase in Beaver's generation resulting from the proposed NTSA, is not expected to make any substantial difference in annual average concentrations of air pollutants. Maximum air quality impacts from the plant would not be affected by any of the alternatives since these could occur at any time the plant is operated at capacity coincident with adverse dispersion conditions.

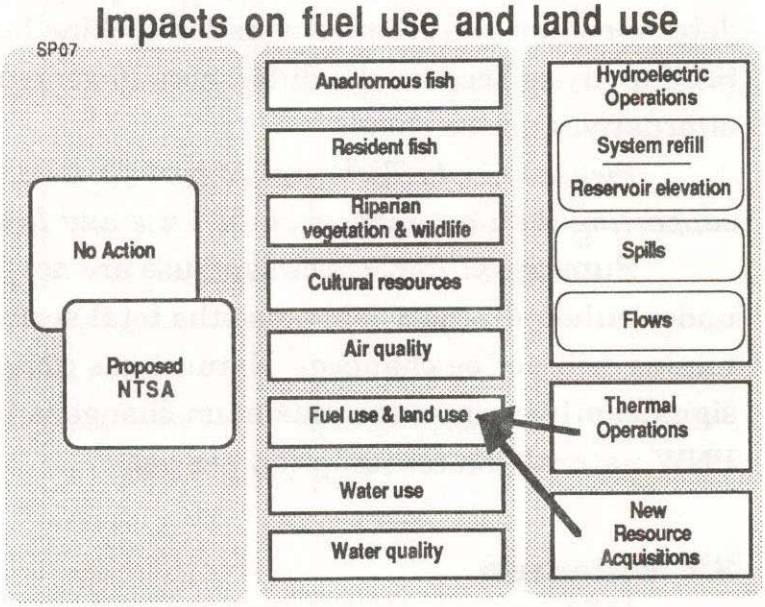
Please refer to Technical Report §3.4.7.2, for methodology and supporting data on air quality impacts.

In Canada, it is expected that the proposed NTSA would result in additional displacement of the Burrard thermal plant in British Columbia. This could result in some slight improvement in air quality in British Columbia. For additional information on impacts in Canada, refer to the Technical Report, Appendix O.

Summary: Under either alternative, impacts on air quality are not expected to be significant because changes in thermal generation and air pollutants are very small in the context of overall thermal generation and air quality standards.

3.6 Fuel use and land use

The IDU Final EIS contained a method by which coal consumption by specific coal-fired power plants serving the Pacific Northwest can be estimated. Amounts of land which would be disturbed by mining to produce the coal can be estimated. These methods are described in Appendix F, Part 2 of the IDU Final EIS.



Technical Report, Table 3.4.11, shows the total amounts of coal consumed by each Pacific Northwest coal-fired power plant. Technical Report, Table 3.4.12, shows the total amounts of land that would be disturbed by mining over the course of the study, 1989 through 2008, with no-action compared to the Proposed NTSA. Information to derive such information for Corette was not available from the IDU Final EIS. However, differences from no-action in the operation of that plant with the proposed NTSA were very small and the plant obtains coal from the same mine as the Colstrip plant. The impacts on coal consumption and land disturbance for mining are not large on a percentage basis. It is likely that the total surface area ultimately disturbed for coal mining will be

unchanged because mining will tend to continue until all economically recoverable coal is mined.

The only combustion turbine expected to be affected by the proposed NTSA is Beaver. Natural gas consumption in total over the period 1989 through 2008 for the Beaver combustion turbine facility is projected to increase relative to the no-action alternative by about 8.580 billion cubic feet (bcf) (0.429 bcf per year) when the proposed NTSA is used as a firm resource, an increase of about 7.1 percent assuming combined cycle operation. When the proposed NTSA is used for opportunity storage, natural gas consumption at Beaver in total for 1989 through 2008 is reduced relative to no-action by about 22.9 bcf (1.14 bcf per year), a reduction of about 19 percent. For comparison, total Northwest gas consumption currently is about 270 bcf per year. Differences in fuel consumption were not determined for the other combustion turbine facilities addressed in the SAM analysis because the differences in generation between the alternatives are so small.

Please refer to Technical Report §3.4.7.3, for methodology and supporting data on impacts on fuel use and land use.

Summary: Impacts on land use are not expected to be significant under either alternative because the total surface area disturbed for coal mining will not be changed. Natural gas consumption will not change significantly because the maximum change is less than 0.5 percent of total PNW natural gas consumption per year.

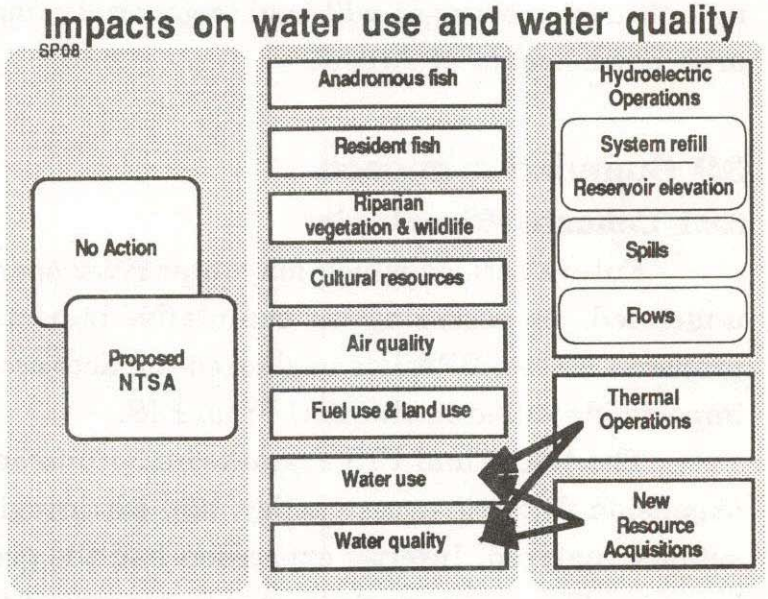
3.7 Water use

Technical Report, Table 3.4.13, shows maximum impacts of the proposed NTSA on surface water use, and Technical Report, Table 3.4.14, shows maximum impacts on groundwater use. (Valmy is the only plant in the analysis which uses groundwater.) The water consumption analysis is based on the maximum differences (positive and negative) in average annual generation between operation under the proposed NTSA and the no-action alternative for the 20 years of the analysis.

Therefore, the results shown in Technical Report, Tables 3.4.13, and 3.4.14, are only for two particular years, which are not necessarily the same

for each plant. Differences in water use for all other years of the analysis are of smaller magnitude than those shown in the Tables. Water use impacts for the Boardman and Colstrip plants tend to be very small because they draw their water from relatively large rivers, the Columbia and the Yellowstone. Water withdrawal as a percentage of stream flow was calculated as though minimum flows occur all year. This results in a very conservative analysis.

Please refer to Technical Report §3.4.7.4, for methodology and supporting data on impacts on water use.



Summary: The impacts on both ground and surface water of the proposed NTSA relative to the no-action alternative are very small. The largest changes in water use by any plant relative to a very conservatively estimated minimum annual flow in the stream used as the water source (or, for the Valmy plant, aquifer recharge) are less than 3 percent.

3.8 Water quality

Water quality impacts of thermal power plants are typically well regulated and, therefore, are not expected to be altered by the proposed NTSA.

Please refer to Technical Report §3.4.7.4, for methodology and supporting data on impacts on water quality.

In Canada, the only area where water quality is a present concern is the Columbia River downstream of Arrow, due mainly to the effects of the Celgar pulp mill effluent. Recent legislation requires additional effluent treatment which will improve future water quality in the vicinity of the

Celgar pulp mill. In general, water quality will be improved with or without the proposed agreement by the work required on the pulp mill effluent treatment system. For additional information on impacts in Canada, refer to the Technical Report, Appendix O.

Summary: Impacts on water quality under either alternative are not expected to be significant because water quality impacts of thermal power plants are typically well regulated and, in Canada, improvements in pulp mill effluent treatment will lead to generally improved water quality in the area downstream of Arrow.

3.9 Cumulative impacts

3.9.1 Columbia River basin

Future actions which may alter river operations are, as of yet, undefined. In assessing the cumulative impacts associated with the proposed NTSA, BPA has evaluated impacts as cumulative beyond the impacts identified in the IDU Final EIS.

The IDU Final EIS examined environmental impacts of Intertie expansion, Intertie access policy, and extra-regional marketing. Of the actions analyzed, Intertie expansion had the greatest environmental impacts. Therefore, environmental impacts of the proposed NTSA combined with Intertie expansion, were compared to pre-IDU conditions.

The proposed NTSA is not expected to create any cumulative impacts on resident fish beyond those reported in the IDU Final EIS. Reservoir levels were not significantly different from what was reported in section 3.3. U.S. reservoirs remain consistently higher with non-Treaty storage available than without. There was very little change in the frequency of flows downstream of Libby dropping below 4.0 kcfs, or in the frequency of flows at Columbia Falls being greater than 4.5 kcfs and less than 3.5 kcfs.

Cumulative effects on anadromous fish from the proposed Non-Treaty Storage Agreement are expected to be negligible. Flow changes are not significantly different from what was reported in sections 3.2.1 and 3.2.2. Columbia River streamflows generally increase in the fall and are slightly less throughout the spring and summer months. There is no

change in the system's ability to meet the Columbia River water budget or in the frequency of meeting Vernita Bar requirements.

Increased Intertie capacity examined in the IDU Final EIS had a large effect on overgeneration spill. Overgeneration spill decreased by nearly 78 percent, April through August, as a result of the Intertie upgrade and expansion. The proposed NTSA decreases overgeneration spill an additional 3.3 percent beyond the expanded Intertie size case, during this same time period. Technical Report, Table 3.8.1, shows the changes in overgeneration spill as a result of increased Intertie capacity and the proposed NTSA.

Likewise, increased Intertie capacity had effects on anadromous fish survival, particularly subyearling chinook. Average decreases in the relative survival values were frequently greater than one percent for subyearling chinook, and reached as high as 5 percent for subyearlings entering Lower Granite pool. The proposed Non-Treaty Storage Agreement used as an opportunity resource, with the signed Spill Agreement, improved the survival of yearling chinook and sockeye salmon, and made little change in the relative survival of subyearling chinook and steelhead when compared with the pre-IDU case.

Summary: No significant cumulative impacts are expected. The proposed NTSA decreases overgeneration during the April through August period by only 3.3 percent beyond that resulting from Intertie expansion. Increased Intertie capacity did not affect stream flows or reservoir levels; therefore, there is no cumulative effect beyond the effect identified for the proposed NTSA. There is no change in the ability to meet the Columbia River water budget, or the Vernita Bar requirements.

3.9.2 Thermal resource operations and Global warming

The analysis for this EA generally relies on the IDU Final EIS analysis to determine the impacts of changes in thermal resource operations for the PNW and California. The analysis shows only minute changes in environmental conditions with the proposed NTSA. The IDU Final EIS, while dealing with substantially larger changes in thermal resource operations than predicted for the proposed NTSA, showed only

very small or negligible changes in environmental conditions related to thermal resource operations. The total effect of the NTSA in conjunction with actions taken under the IDU Final EIS with respect to thermal resource operations would continue to be very small or negligible.

Carbon dioxide (CO_2) emissions from fossil fuel-fired power plants may be one of the major factors leading to global warming. With the proposed NTSA, CO_2 production by operation of fossil fuel-fired power plants in the Northwest, Canada, and California may be affected. The global warming analysis evaluates changes in coal and gas-fired generation in the PNW, British Columbia, and California. It is assumed that energy sales from the PNW and BC Hydro to California reduce generation by California's gas-fired plants.

When the proposed NTSA is used for opportunity storage, generation by PNW coal-fired plants generally increases, while generation at PNW combustion turbine (CT) plants generally decreases relative to the no-action alternative. Generation from Burrard, a gas-fired steamplant owned by BC Hydro, is expected to be reduced.

PNW plus BC Hydro sales to California displace operation of California resources fired with gas (or oil when it is economical). Most of these resources are steam cycle plants. When the proposed NTSA is used for opportunity storage, resource displacement in California is reduced compared to the no-action alternative. This is a very slight change representing about 0.4 percent of the total displacement by PNW and BC Hydro sales.

Emissions of CO_2 from Beaver and from steam cycle gas fired plants such as are displaced in California and British Columbia are about 60 percent of those from a coal-fired plant per unit of electrical energy produced. On average, for the 20-year study period, coal generation is expected to increase by about 56 aMW while gas-fired generation is expected to decrease by about 75 aMW. After adjusting for differences in CO_2 production between coal and gas-fired plants, the net result is an increase in CO_2 production equivalent to that produced by about 10 aMW of coal-fired generation. This is a minor change when compared to the total coal and gas-fired generation on the West Coast.

When the proposed NTSA is used as a firm resource, both PNW coal plant and CT generation increase on average for the study period. Coal generation increases by 50-60 aMW (1 to 2 percent) while CT generation averages a 4 aMW increase. This additional energy is used to serve additional PNW load rather than to displace California generating plants. In British Columbia, an average of about 40 aMW of Burrard generation is displaced and some new resources are deferred. Sales by the PNW and BC Hydro to displace California gas (or oil) resources decrease by about 4 percent.

Whether or not this increase in PNW coal and California resource generation is deleterious depends partially on what other resource would have been developed to serve PNW load. In effect, with use of the proposed NTSA as a firm resource, 165 aMW of firm energy is produced by operating about 60 aMW, on average, of additional coal-fired generation per year and some small amount of additional CT generation. If a 165 aMW coal-fired resource would have been developed, a net benefit relative to CO_2 emissions would be expected.

Summary: The total effect of the proposed NTSA in addition to actions taken under the IDU Final EIS with respect to thermal resource operations would continue to be very small or negligible.

Although the correlation between CO_2 production and global warming is not well-defined, it is assumed that increased CO_2 production could lead to an increase in global warming. This analysis of coal and gas-fired generation levels indicates that the proposed NTSA, used for opportunity storage or as a firm resource, would result in little net change in CO_2 production on the West Coast. Therefore, it is reasonable to conclude that the proposed NTSA would not contribute significantly to global warming.

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CHAPTER 4.0 — Environmental consultation, review, and permit requirements

4.1 National environmental policy

This environmental assessment (EA) was prepared pursuant to the National Environmental Policy Act (42 USC 4321 *et seq.*) and implementing regulations, which require Federal agencies to assess the impacts that their proposed actions may have on the environment. Under NEPA, BPA has the option to prepare an Environmental Assessment to provide evidence and analysis for determining whether to prepare an Environmental Impact Statement (EIS) or a Finding of No Significant Impact (FONSI). A decision whether to prepare an EIS will be based on the potential environmental effects presented in this EA and its attachments.

4.2 Endangered and threatened species and critical habitat

BPA has consulted with USFWS regarding the potential effects of the proposed NTSA on plant and animal species and critical habitat protected by the Endangered Species Act (16 USC 1536). A list of species is included in the Technical Report, Appendix J. A Biological Assessment analyzing the effects of the project on the listed species was prepared and forwarded to the USFWS. The USFWS agreed with BPA's opinion that the proposed NTSA is not likely to affect the Federally-listed species or their habitats.

4.3 Fish and wildlife conservation

The Fish and Wildlife Conservation Act of 1980 (16 USC 2901 et seq.) encourages Federal agencies to conserve and promote conservation of non-game fish and wildlife species and their habitats. Because fluctuations in reservoir elevations caused by the proposed NTSA are minimal, changes which could affect vegetation or non-game fish and wildlife will not occur. The Fish and Wildlife Coordination Act (16 USC 661 et seq.) requires Federal agencies undertaking projects affecting water resources to consult with the U.S. Fish and Wildlife Service in order to conserve or improve wildlife resources. However, changes in hydrosystem operation which could affect wildlife and wildlife habitat are not expected to occur under either of the alternatives.

The Pacific Northwest Electric Power Planning and Conservation Act (16 USC 839 et seq.) contains provisions intended to protect, mitigate, and enhance fish and wildlife of the Columbia River and its tributaries. Because changes in impacts of operating Federal hydroelectric facilities would be insignificant, and considering the need to assure an adequate, efficient, economical, and reliable power supply, and considering BPA's ongoing and substantial investments in fish and wildlife protection, mitigation, and enhancement (in particular considering the continuing increases in fish passage survival), BPA is meeting its obligation to provide equitable treatment for fish and wildlife.

4.4 Heritage conservation

BPA is now in the process of developing a Programmatic Memorandum of Agreement with (1) the Advisory Council on Historic Preservation, (2) the Idaho, Montana, and Washington State Historic Preservation Officers, (3) the Bureau of Reclamation, (4) the Army Corps of Engineers, and (5) others, to survey, evaluate, and protect potentially affected cultural resources at the five major Federal storage reservoirs. Although this Programmatic Agreement was initiated as mitigation for potential impacts on these cultural resources from marketing activities analyzed in BPA's IDU EIS, it will satisfy BPA's responsibilities under Section 106 of the National Historic Preservation Act (16 USC 470) for the proposed NTSA. The Programmatic Agreement will also ensure BPA's consistency with the American Indian Religious Freedom Act (42 USC 1996) by providing for BPA participation in the disposition of Native American burials if such sites are discovered.

4.5 State, areawide, and local plans and program consistency

Neither of the alternatives includes any Federal financial assistance or direct Federal development and neither is affected by any state, areawide, or local plans, programs, or projects. In accordance with Executive Order 12372, this EA will be circulated to clearinghouses for State and local agency review and consultation.

4.6 Coastal zone plan consistency

The Coastal Zone Management Act of 1972 requires that Federal actions be consistent, to the maximum extent practicable, with approved state Coastal Zone Management Programs. Neither of the alternatives directly or indirectly affects the coastal zone of Oregon or Washington and neither requires a consistency determination.

4.7 Floodplain management

Executive Order 11988 (Floodplain Management) and Department of Energy (DOE) regulations implementing the Executive Order (10 CFR Part 1022) direct BPA to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. Neither alternative will affect floodplains beyond that which already occurs under the existing operation of the FCRPS.

4.8 Wetlands protection

Executive Order 11990 (Protection of Wetlands) and Department of Energy regulations implementing the Executive Order (10 CFR Part 1022) direct BPA to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. Neither of the alternatives will affect wetlands beyond that which would already occur under the existing operation of the FCRPS.

4.9 Farmland protection

The Farmland Protection Policy Act (7 USC 4201 et seq.) requires Federal agencies to identify and take into account the adverse effects of their programs on the preservation of farmlands. Neither of the alternatives includes an action which would convert farmlands to other uses or cause physical deterioration and/or reduction in productivity of farmlands. Therefore, a farmlands assessment is not necessary.

4.10 Recreation resources

Neither of the alternatives affects a component of the National Wild and Scenic Rivers System or the National Trails System; a U.S. Forest

Service or Wilderness Area or roadless area; a Bureau of Land Management Wilderness Area or Area of Critical Environmental Concern; or a park or other area of ecological, scenic, recreational, or aesthetic importance. Neither alternative converts property acquired or developed with assistance from the Land and Water Conservation Fund to other than outdoor public recreation uses.

4.11 Permits for structures in navigable waters

Neither of the alternatives includes a structure or work in, under, or over a navigable water of the United States; a structure or work affecting a navigable water of the United States; or the deposit of fill material or an excavation that in any manner alters or modifies the course, location, or capacity of any navigable water of the United States. Therefore, a Section 10 Permit under the Rivers and Harbors Appropriations Act of 1899 is not required from the U.S. Army Corps of Engineers.

4.12 Permits for discharges into waters of the United States

Neither of the alternatives would include discharge of dredged or fill material into waters of the United States. Therefore a Section 404 Permit (Permit for Discharges into the Waters of the United States) under the Federal Water Pollution Control Act (Clean Water Act) of 1972 as amended is not required from the U.S. Army Corps of Engineers.

4.13 Permits for rights-of-way on public lands

The proposed NTSA does not include the use of public lands not in accordance with the primary objective of the management of those lands. Therefore, under the Federal Land Policy and Management Act (43 USC 1701 et seq.), a permit for a right-of-way across such lands is not required.

4.14 Pollution control at Federal facilities

4.14.1 Procurement

The proposed NTSA does not include the procurement of goods, services, or materials from a facility on the EPA's List of Violating Facilities. Therefore, the contract compliance provisions of the Clean Air and Clean Water Acts do not apply.

4.14.2 Clean Air Act

Neither of the NTSA alternatives would cause the violation of air quality standards promulgated under National Ambient Air Quality Standards (primary and secondary), State Implementation Plans, New Source Performance Standards, Class I designations, National Emission Standards for Hazardous Air Pollutants, or emission limitations in Air Quality Control Regions.

4.14.3 Clean Water Act and Safe Drinking Water Act

Neither alternative will result in the discharge of pollutants into the waters of the United States either from point or non-point sources. Therefore, the provisions of the Clean Water Act are not applicable. Neither alternative is affected by standards of the Safe Drinking Water Act because there are no pollutants which could reach drinking water supplies.

4.14.4 Resource Conservation and Recovery Act

Solid waste disposal standards under any of the solid waste programs are not applicable because the NTSA alternatives do not result in the storage, treatment, transport, or disposal of solid waste. Neither alternative is affected by EPA or DOT regulations on hazardous waste identification, generation, transportation, treatment, storage, or disposal facility operation, or permits. Therefore, the provisions of the Resource Conservation and Recovery Act (42 USC 6921 *et seq.*) do not apply.

4.14.5 Noise Control Act

Neither of the alternatives cause noise emissions. Therefore, Federal, state, and local noise regulations do not apply.

4.14.6 Federal Insecticide, Fungicide, and Rodenticide Act

Neither of the NTSA alternatives directly or indirectly effects the purchase, use, storage, or disposal of pesticides. Therefore, the provisions of the Federal Insecticide, Fungicide, and Rodenticide Act do not apply.

4.14.7 Toxic Substances Control Act

The proposed NTSA is not affected by standards under the Toxic Substances Control Act because none of the alternatives involves the distribution, use, or disposal of polychlorinated biphenyls.

4.14.8 Energy Conservation at Federal Facilities

Neither of the alternatives includes the operation, maintenance, or retrofit of an existing Federal building or the construction or lease of a new Federal building. Neither alternative would affect energy conservation practices at a Federal facility.

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CHAPTER 5.0 — Persons and agencies consulted

BPA has consulted the persons and agencies listed below regarding issues associated with the proposed NTSA. An asterisk (*) indicates those persons or agencies who have commented on the proposed NTSA; a double asterisk (**) denotes those who have attended a consultation meeting. BPA distributed this EA to all known interested and affected persons and agencies for comment on the proposed action, the alternatives, the analysis, and the environmental impacts.

Federal Agencies

* ** US Army Corps of Engineers, Portland, OR
USDA, Forest Service, Salmon, ID
USDA, Forest Service, Hungry Horse, MT
USDA, Forest Service, Missoula, MT
* ** USDOC, National Marine Fisheries Service, Portland, OR
* ** USDOC, National Marine Fisheries Service, Seattle, WA
USDOI, Bureau of Indian Affairs, Wellpinit, WA
USDOI, Bureau of Land Management, Portland, OR
USDOI, Bureau of Reclamation, Boise, ID
USDOI, US Fish and Wildlife Service, Boise, ID
USDOI, US Fish and Wildlife Service, Helena, MT
USDOI, US Fish and Wildlife Service, Olympia, WA
* USDOI, US Fish and Wildlife Service, Portland, OR
* ** USDOI, US Fish and Wildlife Service, Vancouver, WA
USDOJ, US Attorney's Office, Portland, OR

State Agencies

* State of Idaho, Department of Fish and Game, Boise, ID
State of Idaho, Department of Parks and Recreation, Boise, ID
State of Idaho, Office of the Governor, Boise, ID
State of Idaho, Department of Health and Welfare, Boise, ID
State of Idaho, Department of Water Resources, Boise, ID
* State of Idaho, Historical Society, Boise, ID

		State of Idaho, Public Utilities Commission, Boise, ID
*		State of Montana, Department of Fish, Wildlife, and Parks, Kalispell, MT
		State of Montana, Department of Health and Environmental Sciences, Helena, MT
		State of Montana, Department of Natural Resources and Conservation, Helena, MT
*		State of Montana, Historical Society, Helena, MT
		State of Montana, Intergovernmental Review Clearinghouse, Helena, MT
*		State of Montana, Office of the Governor, Helena, MT
*		State of Oregon, Department of Fish and Wildlife, Portland, OR
*		State of Oregon, Historical Society, Salem, OR
*		State of Oregon, Clearinghouse, Salem, OR
*		State of Washington, Department of Ecology , Olympia, WA
*	**	State of Washington, Department of Fisheries, Olympia, WA
*	**	State of Washington, Department of Wildlife, Olympia, WA

Tribes

*	**	Columbia River Inter-Tribal Fish Commission, Portland, OR
*		Confederated Tribes of the Colville Reservation, Nespelem, WA
		Couer d'Alene Tribes, Plummer, ID
		Kalispell Tribe of Indians, Usk, WA
		Kootenai Tribes, Bonners Ferry, ID
		Nez Perce Tribes, Lapwai, ID
*	**	Shoshone-Bannock Tribes, Fort Hall, ID
		Spokane Tribes, Wellpinit, WA
		Yakima Indian Nation, Toppenish, WA

Customers/Utility Groups

*	**	Chelan County PUD No 1, Wenatchee, WA
*	**	Direct Services Industries, Inc. Portland, OR
*		Douglas County PUD No 1, East Wenatchee, WA
*	**	Eugene Water and Electric Board, Eugene, OR
*	**	Grant County PUD No 2, Ephrata, WA
	**	Idaho Power Company, Boise, ID
	**	Inter Company Pool, Spokane, WA
	**	Mid-Columbia PUD, Portland, OR
	**	Northwest Power Pool, Portland, OR

*	**	Pacific Gas and Electric Company, San Francisco, CA
*	**	Pacific Northwest Utilities Conference Committee, Portland, OR
	**	Pacific Northwest Generating Company, Portland, OR
	**	Pacific Power and Light Company, Portland, OR
	**	Portland General Electric Company, Portland, OR
*		Public Generating Pool, Seattle, WA
*	**	Public Power Council, Portland, OR
*	**	Puget Sound Power & Light Company, Bellevue, WA
	**	Seattle City Light, Seattle, WA
*	**	Southern California Edison Company, Rosemead, CA
	**	Tacoma City Light Company, Tacoma, WA
*	**	Washington Water Power Company, Spokane, WA

Interest Groups

*	**	Columbia Basin Fish and Wildlife Authority, Fish Passage Center, Portland, OR
		Friends of the Earth, Seattle, WA
		National Wildlife Federation, Portland, OR
		Natural Resources Defense Council, San Francisco, CA
		Northwest Conservation Act Coalition, Seattle, WA
*		Northwest Environmental Defense Center, Portland, OR
*		Northwest Resource Information Center, Inc., Eagle, ID
*		Oregon Natural Resources Council, Portland, OR
		Sierra Club, Corvallis, OR

Others

	**	British Columbia Hydro and Power Authority, Vancouver, BC
*	**	Merrill Schultz and Associates, Seattle, WA (representing the Mid-Columbia Participants)
	**	Northwest Power Planning Council, Portland, OR
*		Pacific Fisheries Management Council, Portland, OR
		Powerex, Vancouver, BC
*		Eric Smith, Jacksonville, OR
	**	Triton Environmental Consultants, Ltd., Burnaby, BC

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GLOSSARY

The words below are defined for the reader as they are used in this Environmental Assessment.

aMW — (see Average megawatts)

Acre-foot — The volume of water that will cover an area of 1-acre to a depth of 1 foot.

Active Storage Space — Non-Treaty space that is available on a continuous basis.

Ambient Air — Ambient air is the air surrounding a particular spot, such as a power plant.

Anadromous Fish — Fish species that spawn and initially rear in fresh water, migrate and mature in the ocean and return to fresh water as adults.

Aquifer — Any geological formation containing water, especially one that supplies water to wells, springs, etc.

Average Megawatts (aMW) — The average amount of energy (number of megawatts) supplied or demanded over a specified period of time.

Baseload — In a demand sense, a load that varies only slightly in level over a specified time period. In a supply sense, a plant that operates most efficiently at a relatively constant level of generation.

Bypass System — A channel or conduit in a dam that provides a route for fish to move through or around the dam without going through the turbine units.

cfs — (see Cubic feet per second)

Capacity — The amount of power that can be produced by a generator or carried by a transmission facility at any instant. Also, the service whereby one utility delivers firm energy during another utility's period of peak usage with return made during the second utility's offpeak periods; compensation for this service may be with money, energy or other services.

Combustion Turbine (CT) — An electrical generator powered by an oil or gas-fired turbine. Normally characterized by low capitol costs and short construction lead times, but having a high operating cost.

Critical Stock — Those stocks which are substantially below escapement goals, are not increasing on a clear trend, and for which harvest and production management actions reflect the stock's critical condition.

Cubic Feet Per Second (cfs) — A unit of measurement pertaining to flow of water. One cfs is equal to 449 gallons per minute.

Cultural Resources — The nonrenewable evidence of human occupation or activity as seen in any district, site, building, structure, artifact, ruin, object, work of art, architecture, or natural feature that was important in human history at the national, state, or local level.

DSI — (see Direct-service industries)

Dam Passage — The percentage of fish which get from one side of a dam to the other alive.

Decremental Cost — The cost that a utility could avoid by not operating a power plant; a utility's decremental cost is considered by some regulators to be a "fair" rate for the utility to pay for purchased power.

Direct-Service Industries (DSIs) — Industrial customers, primarily aluminum smelters, that buy power directly from BPA at relatively high voltages.

Dispatch — The monitoring and regulation of an electrical system to provide coordination; or the sequence by which electrical generating resources are called upon to generate power to serve changing amounts of load.

Displacement — The substitution of less expensive energy (usually hydroelectric energy transmitted from the Pacific Northwest or Canada) for more expensive thermal energy produced in California. Such displacement means that the thermal plants may reduce or shut down their production, saving money and often reducing air pollution as well.

Downstream Migrant Survival — The survival of an individual juvenile salmon or steelhead from the time it enters the mainstem Snake or Columbia Rivers, until it gets below Bonneville Dam.

Draft — To remove water or energy from a reservoir. Also the quantity of water or energy that has been removed from a reservoir.

Drawdown — The distance that the water surface of a reservoir is lowered from a given elevation as water is released from the reservoir (drafted).

DSI First (or top) Quartile — The 25 percent of the DSI's load which is interruptible. The other 75 percent is considered firm.

Economy Energy — Nonfirm energy that can be generated on a partially loaded generating unit, or purchases of energy, at a price less than decremental cost. Economy energy is unconditionally interruptible.

Emergence — Migration of hatched salmon fry up through the gravel of a redd preparatory to continuing their life cycle in open water.

Endangered — A plant or animal species which is in danger of extinction throughout all or a significant portion of its range because its habitat is threatened with destruction, drastic modification, or severe curtailment, or because of overexploitation, disease, predation, or

other factors; federally endangered species are officially designated by the U.S. Fish and Wildlife Service and published in the Federal Register.

Energy Content Curve (ECC) — A set of end-of-month reservoir contents which assure a high probability of refilling the reservoirs.

Export Sales — The sales of electricity from one region to another.

Extraregional — Any entity or place not within the Pacific Northwest.

Federal Columbia River Power System (FCRPS) — The hydroelectric dams on the Columbia River financed by the U.S. Treasury, which operate as a coordinated generation system, and for which BPA serves as the power marketer.

FELCC — (see Firm Energy Load Carrying Capability)

Firm — In the power industry, guaranteed or assured. May refer to a guaranteed supply of power, to guaranteed access to a means to transmit power, or, with reference to loads, to guaranteed service for a defined need. Usually defined for a given period of time.

Firm Energy Load Carrying Capability — The maximum level of energy that can be produced and shaped to load during the period it would take reservoirs to be drafted from full to empty under critical streamflow conditions.

Firm Resource Use of Non-Treaty Storage — Using non-Treaty space to provide firm energy on a planning basis. In this document, BC Hydro's use of non-Treaty storage is restricted to service of firm loads. The U.S. portion of non-Treaty storage is drafted and filled along with PNW reservoirs and has a refill obligation.

Fish Guidance Efficiency (FGE) — The percentage of the total number of fish approaching a turbine intake that are deflected from a dam's units by a fish guidance device such as a turbine intake screen.

FISHPASS — Model used to evaluate the relative system survival of anadromous fish as they pass through the Columbia and Snake Rivers.

Fish Spill Plan — A plan to provide a certain percentage of the total flow of a project as spill, for Federal and non-Federal projects.

Flood Control Elevation — An elevation below which a reservoir's forebay must be maintained to provide protection from downstream flooding. The Corps of Engineers determine these elevations.

Fossil Fuel — A combustible, carbonaceous material formed from the remains of ancient plants and animals. Common fossil fuels include coal, natural gas, and derivatives of petroleum such as fuel oil and gasoline.

Game Fish — Fish which are sought by recreational fishermen.

Groundwater — The supply of fresh water under the earth's surface in an aquifer or soil.

Head — (see Hydraulic Head)

Head Losses — The loss of energy experienced due to a reduction in head. Specifically, a given volume of water released from Mica will produce less energy if non-Treaty space is not full. The amount of the reduction is the head loss.

Hydroelectric — With reference to a power system, the production of electric power through use of the gravitational force of falling water.

Hydroregulator — A computer model simulating the operation of the PNW electric power system that incorporates the historical streamflow record, monthly loads, thermal and other non-hydro resources, hydroelectric plant data for each project, and the constraints limiting each projects operation.

IDU EIS or IDU Final EIS — The Intertie Development and Use Final Environmental Impact Statement which was released in April of 1988.

Inactive Storage — Space that is filled when the reservoir initially fills and is unavailable thereafter due to physical or operating constraints.

Incremental Cost — The additional cost that a utility would incur by operating a power plant.

Incubation — The period between fertilization of an egg and its hatching.

Inland Southwest (ISW) — For the purposes of this EA, the States of Nevada, Arizona, Colorado, Utah, and New Mexico.

Intertie Access Policy — The policy developed by BPA to allocate use of the Federal portion of the Intertie.

Juvenile — The stage in the life cycle of anadromous fish when they migrate downstream to the ocean.

kcfs — One thousand cubic feet per second. A measure of speed and volume of water flow. (see Cubic feet per second)

KSFD — thousand second foot days--a volume of water sufficient to provide a flow of 1 Kcfs for a 24-hour period.

Least Cost Mix Linear Program Model (LCMM) — A linear program computer model that estimates the amount of regional generation and conservation resources that should be acquired to yield a least-cost resource mix to meet a given firm load over a 20-year planning horizon.

Load — The amount of electric power or energy delivered or required at any specified point or points on a system. Load originates primarily at the energy-consuming equipment of the customers.

Load Growth — Increase in demand for electricity.

Load/Resource Balance — The point at which the demand for electricity matches or balances the amount and type of resources available to serve that demand.

MAF — (see Million Acre-Feet)

MW — (see Megawatts)

MW-mo — The amount of energy needed to supply a one MW load for one month.

Marginal Energy Costs — For a generating resource, the cost to produce one more kilowatthour of electricity.

Megawatts (MW) — A megawatt is one million watts, an electrical unit of power.

Mid-Columbia Participants — Any utility which owns a share of the generation of the five Mid-Columbia projects.

Million Acre-Feet — A volume of water equal to 504 KSFD. (See Acre-foot.)

NF Rate — The nonfirm energy (NF) rate schedule is used for the sale of nonfirm energy both inside and outside the U.S.

Nonfirm Energy — Energy available due to water conditions better than critical, sold on an interruptible (nonguaranteed) basis.

Non-Treaty Storage Agreement — An agreement between BPA and BC Hydro, which allows both parties to share in the use of existing Canadian storage space which is otherwise unusable to both parties.

Northwest Power Act — (see Pacific Northwest Electric Power Planning and Conservation Act)

NTSA — (see Non-Treaty Storage Agreement)

NTSA Discussion Paper — A paper released at a March 14, 1989, public consultation meeting, which presented preliminary results from the NTSA studies.

Operating Year — The 12-month period from September 1 through August 31.

Opportunity Storage — Using non-Treaty space to store energy when markets are poor, and release it when markets are better. Decisions to store or release are made based on economics and no restrictions are placed on how the energy may be used. There is no annual refill requirement for non-Treaty space.

Overgeneration — Energy that would be produced by the system, for which there is not market or other use. This energy must, therefore, be spilled. (Overgeneration spill.)

PNW — (see Pacific Northwest)

PSD — (see Prevention of Significant Deterioration increments)

Pacific Northwest (PNW) — For this EA, the States of Washington, Oregon, and Idaho; the portion of Montana west of the Continental Divide;

and areas in Montana, Nevada, and Wyoming surrounding coal plants that serve the PNW.

Pacific Northwest Coordination Agreement (PNCA) — An agreement signed by most of the PNW utilities in 1961 which provides for coordinated system operations, resulting in greater efficiencies than if each system ran independently. Several types of energy exchanges are provided for under this agreement.

Pacific Northwest Electric Power Planning and Conservation Act — Signed into law December 5, 1980, the Act provides for coordinated planning of the Pacific Northwest's energy future, through a Regional Planning Council with representation from Oregon, Idaho, Montana, and Washington.

Passage Survival — The survival rate of migratory fish through, around, or over dams or other obstructions in a stream or river.

Prevention of Significant Deterioration (PSD) criteria — Any one of several incremental changes in ambient total suspended particulate or sulfur dioxide concentrations established by the Environmental Protection Agency to protect existing air quality from being degraded significantly through new developments, such as construction and operation of a new air pollution source.

Real Discount Rate — The factor used to compute the present value of a future amount, which adjusts solely for the time value of money and does not include price inflation.

Recallable Storage Space — Non-Treaty space that BC Hydro may, but is not obligated to, make available from time to time.

Record of Decision — The document notifying the public of a decision taken on a power project, together with the reasons for the choices entering into that decision. The Record of Decision may be published in the Federal Register.

Relative — Considered in relation to a base case condition; comparative; not absolute or independent (opposed to absolute).

Relative Change in Survival — The difference in survival between the two alternatives divided by the base case survival value. The change in survival in relation to the base case survival.

Relic Collecting — The seeking out and removal of artifacts or other cultural resources by private persons. The practice consequently excludes opportunities for study or preservation of the site, and often results in destruction of artifacts, the site itself, and/or nearby sites.

Renewable Resources — Resources for energy which are continually replenished. Water, for instance, is a renewable resource, while coal which is converted into carbon dioxide, water, and ash when burned is not.

Reservoir Draft Rate — The rate at which water, released from storage behind a dam, reduces the pool elevation of the reservoir.

Reservoir Elevations — The various levels reached by water stored behind a dam.

Reservoir Mortality — (see Pool Mortality)

Resident Fish — Fish species that reside in fresh water during their entire life cycle.

Runoff — The volume of water expected to pass a point in a specified time period. Normally the January 1 through July 31 volume flowing past The Dalles.

Run-of-River Plant — A hydroelectric plant with little or no ability to regulate flow.

SAM — (see System Analysis Model)

Sensitivity Study — Studies run using SAM which examine the sensitivity of the study results to certain modeling assumptions.

Simulation — The representation of an actual system by analogous characteristics of some device easier to construct, modify, or understand, or by mathematical equations.

SP Rate — The short-term surplus firm power rate is the rate applied to short-term sales of firm power that is excess to BPA's needs.

Spawning — The act of fish releasing and fertilizing eggs.

Spill (forced) — Water for which there is not storage capability in the system reservoirs and which could not be used for power production because the resulting flows would exceed turbine capacity.

Spill (inadvertent/overgeneration) — An amount of water which could have been used to generate electricity but was not because of lack of available market, and inability to store for later use.

Spill (programmed or planned) — Water intentionally passed through a hydroelectric project without producing electricity. This is usually done for fisheries mitigation purposes.

Spot Market — A market for electricity characterized by negotiation almost solely on the basis of price, for relatively short-term sales.

Storage Reservoirs — Reservoirs maintained behind dams for the purpose of retaining excess water readily available during springtime flows as snow melts. Retained water is then released, as necessary, during periods of lower flow in order to maintain necessary levels of power production. (Water may also be released for other purposes, such as navigation, irrigation, and maintenance of life support for fish.)

Subyearling — A juvenile salmonid, normally a fall or summer chinook salmon, that hatches and migrates to the ocean in the same year.

System Analysis Model (SAM) — SAM simulates, monthly for 20 years, the operation of the Pacific Northwest hydro/thermal system. It provides information regarding the expected operation of the hydro

system and individual thermal resources, the reliability of the system, production costs, the amount of California sales, and the revenues generated by California sales.

System Refill — The coordinated hydro system is considered full, for the purposes of the EA modeling, when the amount of water stored in reservoirs is equal to 94 percent of the total available space.

System Stock Survival — The survival of migrating juvenile salmon or steelhead of a particular fish stock from the point of entry into the hydroelectric system to a point below Bonneville Dam.

Thermal Resources — Generating plants which convert heat energy into electric energy. Coal, oil, and gas-fired power plants and nuclear power plants are common thermal resources.

Total Suspended Particulates (TSP) — An air pollution term referring to all matter contained in a sample of air which is in solid or liquid form regardless of its particle size or chemical composition.

Treaty Storage — Treaty storage is the 15.5 MAF of storage that Canada was required to build under the Columbia River Treaty signed in 1964.

Variable Costs — The costs that are incurred or are increased when a power plant operates, as opposed to the fixed costs that are incurred whether the plant runs or not.

Vernita Bar — Gravel bar located downstream of Priest Rapids Dam. It is a prime spawning ground for fall chinook salmon.

Water Budget — A part of the Pacific Northwest Power Planning Council's Fish and Wildlife Program calling for a volume of water to be reserved on a planning basis and released when and if needed to augment stream flows in order to assist in the downstream migration of juvenile salmon and steelhead.

Water Conditions — The overall supply of water to operate the Pacific Northwest hydroelectric generating system at any given time, taking into account reservoir levels, snowpack, needs to provide water or retain water to meet various operating constraints (such as the Water Budget, flood control, flow constraints, etc.), weather conditions, and other factors.

Whitebook Studies — Also called the Pacific Northwest Loads and Resources Study. This study evaluates the loads and resources of the Federal system and the Pacific Northwest region and projects the yearly average energy consumption and resource availability for the next 20 years.

Yearlings — Juvenile salmon and steelhead that migrate to the ocean, often spending a full year rearing in fresh water.

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