2006 Water Management Plan

Final May 17, 2006

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1 Introduction

1.1 Updated Proposed Action Biological Opinion and Preliminary Injunction Order

The Action Agencies (AA), consisting of the Corps of Engineers (COE), Bureau of Reclamation (BOR), responsible for operating the projects in the Federal Columbia River Power System (FCRPS), and Bonneville Power Administration (BPA), which markets the energy generated at those projects. In 2004 the Action Agencies prepared a Final Updated Proposed Action for the FCRPS Biological Opinion Remand (UPA). The UPA was formally transmitted to NOAA Fisheries (also known as National Marine Fisheries Service, NMFS) on November 24, 2004. NOAA released their Revised 2004 Biological Opinion (BiOp) on the Operation of the FCRPS and Upper Snake River flow augmentation on November 30, 2004. The UPA can be found at http://www.salmonrecovery.gov/implementation.shtml. The BiOp can be found at http://www.salmonrecovery.gov/R_biop_final.shtml.

On May 26, 2005, U.S. District Court James A. Redden, U.S. District Court, District of Oregon, invalidated the 2004 BiOp. On October 7, 2005 the Court remanded the FCRPS BiOp to NOAA Fisheries to produce a BiOp consistent with his order by October 2006. The Court also ordered NOAA Fisheries and the AA to collaborate with sovereign states and tribes on the development of a new proposed action and a jeopardy framework. During the remand, the Court left the 2004 Biological Opinion in effect. On December 29, 2005 the court ordered fish passage operations for 2006 (including spill) consistent with adaptive management provided for in the 2004 BiOp. The COE submitted a 2006 Fish Passage Implementation Plan on April 3, 2006 to the Court, which described the fish passage operations planned for 2006. This plan is an addendum to the 2006 Spring Summer Update.

In addition USFWS released the Fish and Wildlife Service Biological Opinion regarding the Effects of Libby Dam Operations on the Kootenai River White Sturgeon, Bull Trout and Kootenai Sturgeon Critical Habitat on February 18, 2006. The 2000 USFWS BiOp remains in place for the effects of the operation of the remaining FCRPS projects on listed resident species.

1.2 Preparation of Plans

The Action Agencies have prepared this Water Management Plan for 2006 as part of the implementation planning process outlined in the 2004 UPA/NOAA BiOp concerning the operation of FCRPS dams. This plan describes how the FCRPS dams and reservoirs will be operated for the 2006 water year (October 1, 2005 through September 30, 2006) to implement Biop's water management measures in a manner consistent with the actions proposed in the 2004 UPA/NOAA BiOP and in the USFWS BiOp, to implement the 2006 Fish Passage Implementation Plan and to make progress towards meeting the biological performance standards specified in the NOAA 2004 BiOp while also meeting other requirements and

purposes such as flood control, hydropower, irrigation, navigation, and recreation. The FCRPS hydrosystem performance standards are discussed in section 11.

The Action Agencies will prepare annually a 1-year Water Management Plan that covers FCRPS hydro operations in the upcoming water year. These plans will generally be drafted in July and completed by the end of September. The plan will cover the upcoming water year, which begins on October 1 and ends on September 30 the following year. This 1-year plan will be written when very little information is known about the future year's water supply. Therefore, the annual Water Management Plan will generically describe how the FCRPS will be operated during the year. It will also include any special operations (such as any special tests, flood control procedures planned for the year, etc.) that are known at the time the plan is developed. This year's Water Management Plan was delayed as a result of the litigation concerning the plaintiff's preliminary injunction.

The Action Agencies will also develop more detailed in-season action plans to describe how the FCRPS projects will be operated under actual conditions with current water supply forecasts. The first action plan will be prepared in the fall to address the fall/winter operation of the FCRPS projects. A spring update will be drafted in January and finalized in the March/April time period to address the spring and summer operation of the FCRPS projects. These action plans will take into account changes in the UPA due to water supply or other factors for this time frame.

The Corps of Engineers also prepares a Fish Passage Plan (FPP) each year that provides detailed operating criteria for project fish passage facilities, powerhouses, and spillways to allow for the efficient passage of migratory fish. The FPP contains appendices that describe special operations for studies, the juvenile fish transportation program, operation of units within 1% of best efficiency, spill for fish passage, total dissolved gas monitoring, and dewatering procedures. The plan is coordinated through the Fish Passage Operations and Maintenance Coordination Team (FPOM) and is available on the web at http://www.nwd-wc.usace.army.mil/tmt/documents/fpp/.

1.3 UPA, ESA, and Implementation Plan Strategies

This Water Management Plan addresses strategies to enhance juvenile and adult anadromous fish survival through a coordinated set of hydro project management actions to achieve performance standards, and to provide benefits to resident fish. The plan is structured to address water management actions associated with the following strategies and substrategies, as defined for anadromous and resident fish in the ESA 2004/2004-2008 Implementation Plan for the FCRPS. As mentioned above, this plan addresses operations consistent with the Court's December 29, 2005 Opinion and Order as described in the 2006 Fish Passage Implementation Plan.

1.3.1 2004 UPA Hydro Strategies for Listed Species of Anadromous Fish

Hydro Strategy 2 – Manage water to improve juvenile and adult fish survival

> Substrategy 2.1 – Reservoir operations to enhance fish survival: Actions under this substrategy are project operations that benefit fish at or near the project or its reservoir.

Substrategy 2.2 – System flow management to improve fish survival: This substrategy includes coordinated system operations for mainstem flow management and redd protection.

Substrategy 2.3 – Spill operations for project passage: This substrategy includes spill operations at individual projects to provide a better project passage for juvenile fish while avoiding high dissolved gas levels or adult fallback problems.

Substrategy 2.5 – Operate to achieve maximum fish benefits in a cost effective manner: This substrategy highlights the Action Agencies' objective to meet biological performance standards in a cost effective manner.

Hydro Strategy 3 – Operate and maintain fish passage facilities to improve fish survival

Substrategy 3.3 – Juvenile fish transport actions to enhance fish survival: This substrategy includes the transportation of juvenile fish around FCRPS dams.

1.3.2 ESA and Implementation Plan Strategies for Listed Species of Resident Fish

Strategy 1 – Promote the reproduction and recruitment of Kootenai River white sturgeon (KWS).

Substrategy 1.1 – Create conditions below Libby Dam that facilitate KWS natural reproduction and juvenile survival: This substrategy includes operations at and below Libby Dam that aid in KWS recovery.

Strategy 2 – Determine the impacts of the FCRPS on bull trout and mitigate for those impacts.

Substrategy 2.2 – Operate and modify FCRPS dams to protect, provide, and reconnect bull trout habitats: This substrategy includes actions to improve conditions for bull trout.

1.4 Non-BiOp Operations

Each year the Action Agencies implement water management actions that are not part of our ESA obligations, but are aimed at meeting other project requirements and purposes such as flood control, power generation, irrigation, navigation, recreation, and fish and wildlife not listed under the ESA. The table below includes fish and wildlife related non-ESA water management actions that may be implemented and the time of year such actions typically occur. These actions are further described in section 12.

Action	**Time of Year**
Keenlyside Dam (Arrow) - mountain whitefish actions	December – January
Keenlyside Dam (Arrow) - rainbow trout actions	April – June
Libby - burbot actions	December - February
Dworshak – flow increase for hatchery release	March
Grand Coulee – kokanee	September – October
Hanford Reach Protection Flows	March – June
Vernita Bar Protection Flows	November – April
McNary - waterfowl nesting	March – May
McNary - waterfowl hunting enhancement	October – January
John Day - goose nesting	March – May
John Day - waterfowl hunting enhancement	October – January
Bonneville - Tribal fishing	April – September
Bonneville - Spring Creek Hatchery release	March

1.5 Changes from Last Year's Plan

This plan is different than last year's as it incorporates operations in the USFWS 2006 BiOp and the 2006 Spill Implementation Plan developed by the COE in response to the Court's December 29, 2005 Opinion and Order.

2 Hydro System Operation

2.1 Priorities

The 2004 UPA and USFWS BiOp list the following strategies for flow management:

- Limit the winter/spring drawdown of storage reservoirs to increase spring flows and the probability of reservoir refill.
- Draft from storage reservoirs in the summer to increase summer flows.
- Provide minimum flows in the fall and winter to support mainstem spawning and incubation flow below Bonneville Dam.

The Action Agencies have reviewed these strategies and other actions called for in the 2004 UPA and applicable BiOp and developed the following priorities (in order) for flow management and individual reservoir operations:

1. Operate storage reservoirs (Hungry Horse and Libby) to meet minimum flow and ramp rate criteria for resident fish.
2. Refill the storage projects by June 30 to provide summer flow augmentation. A late snowmelt runoff may delay refill in order to avoid excessive spill.
3. Operate storage projects to be at their April 10 flood control elevations to increase available flows for spring flow management.
4. Provide fall and winter flows for chum salmon spawning and incubation.

The Action Agencies implement several independent FCRPS project operations to benefit fish at or near each project or its reservoir. Reservoirs are to be operated to meet project minimum outflows, to reduce outflow fluctuations to avoid stranding fish and degrading fish habitat and productivity, to reduce cross sectional area to speed juvenile passage, and to make specific temperature releases to improve water temperatures for fish. These operations are generally the highest priority and not likely to change.

In an operating year that begins on October 1, the flow needs are not encountered in the same order as the BiOp priorities (e.g. the first decision to be made is for chum spawning flows which ultimately have a lower priority than summer flows). Therefore, the Action Agencies will attempt to operate chronologically during the year as follows.

The initial objective is to operate the storage reservoirs (Dworshak, Hungry Horse, Libby, and Grand Coulee) to be at flood control levels by early April. This level varies by runoff forecast. Reaching early April flood control levels will be affected by how much water was released for flood control, power generation, and fishery flows to support both lower Columbia chum and Hanford reach fall Chinook spawning, and to meet Columbia Falls minimum flow requirements.

The next objective is to refill the storage reservoirs by about June 30 without spill (unless required for flood control), in order to maximize available storage of water for the benefit of summer migrants. The June 30 refill general has priority over spring flow (April, May, June) objectives, while attempting to meet the spring flow objectives and other fish needs.

The final objective is the management of available storage to augment summer (July and August) flows to attempt to meet flow objectives and for water temperature moderation. The storage reservoirs will be drafted to their specified August 31 draft limits to augment summer flows and/or moderate river temperatures. At Dworshak the summer draft limit will be reached in September. Draft limits are a higher priority than the summer flow objectives in order to meet other project uses and reserve water in storage for the following year.

These objectives are intended as general guidelines in overall system operations. The UPA and BiOp also embrace the concept of adaptive management. Adaptive management is the concept that the operation of the system should be adjusted based on acquired knowledge about current conditions in the system and effects of our management actions on it, as opposed to following a rigid set of rules. Some items to be considered are current information on fish migration, stock status, biological requirements, biological effectiveness, and hydrologic and environmental conditions. System managers recognize that there is often insufficient water to meet all the actions specified in the UPA and BiOp while meeting other system uses such as flood protection, power system reliability, irrigation, recreation, and navigation needs. The use of water for any one fish species or project purpose will most likely affect the amount of water available for other fish species or project purposes. Therefore, the Action Agencies, in coordination with regional parties through the TMT, endeavor to consider the multiple uses of the system, while providing, as a high priority, the measures to benefit listed species.

2.2 Conflicts

As stated above, there often is not enough water available in the Columbia River basin to meet every action item stated in the UPA and BiOp while providing for other project purposes. Below are some of the main conflicts that may occur.

2.2.1 Flood control draft versus project refill

One way to maximize flood control is to provide abundant storage space in the event a large flood occurs. Conversely, the 2004 UPA/NOAA BiOp specify that the storage projects be as full as possible to increase the likelihood of refill and provide flows for spring flow management and summer flow augmentation.

Flood control procedures specify the amount of storage needed to provide flood protection. The space is provided to reduce the risk of forecast and runoff uncertainty. In an effort to reduce forecast error and to better anticipate the runoff timing or water supply for a given year, the BiOp calls for the Action Agencies to study system flood control requirements and forecast procedures to determine if they can be improved.

2.2.2 The provision of spring flows versus project refill and summer flow augmentation

Again, because water supply and runoff forecasts are not 100 percent accurate, it is difficult to estimate how much water is available for spring flows and still assure refill at the storage projects by June 30. If too much water is allowed to flow through the storage reservoirs in the spring, there is an increased risk of not refilling the projects. This will reduce the water supply available for summer flow augmentation. On the other hand, if the reservoirs fill too early in the spring, late season rain or snowmelt may cause flood damage downstream, or cause excessive spill and produce higher dissolved gas levels.

2.2.3 Chum tailwater elevations versus refill/spring flows

Setting the Bonneville tailwater elevation level for chum spawning and incubation for chum in the Ives Island complex in recognition of the spring refill priority is one of the decisions that the Action Agencies, in consultation with the interagency Technical Management Team (TMT), have to make with the least amount of reliable information. Decisions about the tailwater elevation level for chum spawning and incubation are made in the October/November time period, long before the Action Agencies have reliable information on the coming year's expected water supply. The early season Southern Oscillation Index (SOI) provides an indication of the upcoming year's water supply. If the tailwater elevation level selected is too high (causing higher flows), there is a risk of refill failure. Conversely, choosing to refill runs the risk of reducing the tailwater elevation that can be supported through the spawning season and dewatering chum redds. An adult chum seining project will take place below BON in fall 2006 . This program will move chum salmon into Duncan Creek and provide fish to the Washougal hatchery. This will ensure chum production in the unlikely event that chum flows cannot be provided. The area below Bonneville Dam is also utilized by fall chinook and coho (non-listed species) that spawn when water is provided to the spawning grounds.

2.2.4 Sturgeon pulse versus summer flow augmentation

Water released from Libby Dam for spring sturgeon flows (pulse) during April -through July may reduce the water available for summer flow augmentation from Libby, although VARQ has been implemented to minimize that possibility. If the pulsed water cannot be stored in Grand Coulee, spring flows will be provided, potentially at the expense of summer flows.

2.2.5 Fish operations versus other project uses

In addition to flood control operation, there are other project purposes that may compromise operations carried out for the purpose of enhancing fish survival. For example, keeping the flow steady below a project for resident and anadromous fish needs conflicts with the ability to use a project to follow electrical load changes; spilling water for juvenile fish passage reduces the amount of power that can be generated to meet demand; and augmenting flows during fish migration periods may be inconsistent with the shape of power demand. Additionally, irrigation demands and recreation elevations at headwater reservoirs may impact the amount of water available for spring flows. The development of the BiOps for the FCRPS included consultations with the federal operating agencies on hydrosystem operations and the impact on listed species.

These consultations included consideration of the multiple uses of the FCRPS. The multiple uses of the FCRPS are part of the foundation of the UPA and BiOp.

2.2.6 Conflicts and priorities

Challenges for the Action Agencies arise in meeting the multiple uses of the hydrosystem. Given these challenges, the priorities for flow management and individual reservoir operations outlined in section 2.1 will guide the Action Agencies in their operational decision-making when conflicts arise. Discussion of issues concerning operational requirements and alternatives for addressing such challenges will occur in TMT with disputes taken to IT, and when necessary, to the Federal Executives.

2.3 Emergencies

The 2004 UPA/NOAA BiOp and 2006 USFWS BiOp acknowledge that emergencies and other unexpected events occur and may cause deviations from fish operations. Such deviations may be short in duration, such as a deviation to respond to an unexpected unit outage or power line failure, or longer in duration, such as experienced in 2001 in response to the low water conditions and unprecedented power market conditions. The TMT has developed Emergency Protocols to be followed to respond to short-term emergencies. (See Appendix 1 or see TMT homepage at http://www.nwd-wc.usace.army.mil/TMT for current version of protocols.) Coordination of longer term emergencies may include the involvement of regional executives.

2.4 Research

Research studies sometimes require special operations that differ from routine operations otherwise described in the UPA and applicable BiOp. These studies are generally developed through technical workgroups of the Regional Forum (e.g., System Configuration Team (SCT)) and the Corps' Anadromous Fish Evaluation Program Fish Facilities Design Review Work Group (FFDRWG) and Studies Review Work Group (SRWG). They are further described in the Action Agencies' Implementation Plans. In most cases, operations associated with research entail relatively minor changes from routine operations and are coordinated in technical forums (e.g., TMT and FPOM). In some cases, the nature or magnitude of operational changes for research may require further coordination and review in policy forums (e.g., Implementation team (IT)). Generally, research planning and coordination occurs throughout the late fall and winter, with final research plans established by late winter/early spring. In extraordinary events such as extreme low runoff conditions or an emergency, planned research may be modified prior to implementation to accommodate anticipated unique circumstances and/or to reallocate resources to obtain the greatest value given the circumstances. The Northwest Power and Conservation Council's recommended changes in mainstem hydro operations will require the development of specific experimental designs that may be implemented in the future. These experiments are under development and may be incorporated into experimental protocols for special operations when they become available.

3 Decision Points and Water Supply Forecasts

3.1 Decision Points

Table 1 below lists the key water management decisions/actions and when they need to be made. Some decision points, such as setting flow objectives, are clearly articulated in the UPA and BiOp. Other decision points, such as setting weekly flow augmentation levels, require much discussion and coordination. The decision points given below are spelled out in the UPA or BiOp, or are based on experience. These decisions are made by the Action Agencies in consideration of actions called for in the UPA and BiOps, and input received through the Regional Forum (TMT, IT, Regional Executives).

Table 1. Water Management Decision Points/Actions

	Early October	November	Winter (December – March)	Early April	Early May	June	Early July
Operations	• Assess potential of providing tailwater elevations/flows for chinook populations below Bonneville Dam *(Non-BiOp Action)* • Assess potential tailwater elevations / flow levels to support chum spawning below Bonneville Dam • Preliminary discussions of flood control/ project refill strategy • Albeni Falls fall/winter drawdown strategy discussion • Hanford Reach /Vernita Bar flows set *(Non-BiOp Action)*	• Early season forecast using SOI • Evaluate likely tier for sturgeon water volume • Consider Kootenai burbot operations	• Determine winter/spring chum flow levels below Bonneville Dam • Determine flood control and refill strategies, including any available flood control shifts • Minimum flows from Hungry Horse Dam and minimum Columbia Falls flows are set by April-August forecast • Begin discussing spring operations • Spring Creek Hatchery release – March *(Non-BiOp Action)* • Begin spring transport discussions • Hanford Reach operations *(non-BiOp action)* discussed, beginning in January.	• Spring flow objectives are set by the April final volume forecasts • Determine spring flow management strategy including priority for refill • Determine start dates and levels by project for spring spill • Determine start date for MOP at Lower Snake River projects • Determine John Day forebay elevations	• Use May final forecast to calculate the appropriate volume of the sturgeon tiered flow release from Libby using new, coordinated formula • Determine required outflow from Libby for bull trout.	• Summer flow objective at Lower Granite determined by June final volume forecast • Determine summer flow augmentation strategy (early June) • Complete Dworshak temperature modeling and determine release strategy • Decision on McNary juvenile fish transportation (late June) • Switch to 30% spill 24 hours a day at John Day.	• Grand Coulee summer reservoir draft limit determined by July Final April – August volume forecast

	Early October	November	Winter (December – March)	Early April	Early May	June	Early July
			Perform analysis to determine amount of flexibility Dworshak has to operate above minimum flow and still reach spring refill targets. Prepare outlook for meeting flow objectives. • Determine end of December flood control elevation at Libby, using December SOI –based forecast				
Plans	Develop fall/winter update to the annual water management plan		Preliminary work on spring/summer update to the annual water management plan	Start operational plans for Libby and Hungry Horse Dams	Libby and Hungry Horse operational plans due		
Forecasts			January, February, and March volume forecasts released by the RFC	April final forecast released by RFC	May final forecast released by RFC	June final forecast released by RFC	

3.2 Water Supply Forecasts

Water supply forecasts serve as a guide to how much water is available for fish and other operations. Flow projections are provided to the TMT regularly during the flow management season (April 3 – August 31).

The National Weather Service's Northwest River Forecast Center, USACE Northwestern Division Hydrologic Engineering Branch, Reclamation, and others prepare water supply forecasts to manage the Columbia River. Table 2 below lists the forecasts used to implement actions referenced in the UPA and BiOps.

Table 2. Water Supply Forecasts Used to Implement UPA and BiOp Actions

Forecast Point	Forecast period	Forecast	UPA actions determined
Hungry Horse	April – August	January, February, and March Final provided by Reclamation	Columbia Falls and Hungry Horse minimum flows
The Dalles	April – August	April Final	Spring flow objective at McNary Dam
Lower Granite	April – July	April Final	Spring flow objective at Lower Granite
Lower Granite	April – July	June Final	Summer flow objective at Lower Granite
The Dalles	April – August	July Final	Grand Coulee summer draft limit
Libby	April – August	Not Specified	Volume of water for sturgeon flow at Bonners Ferry and minimum bull trout flows between sturgeon and salmon flows

Table 3 summarizes the major fish-related reservoir and flow operations by project. More detailed descriptions of each of these operations follow.

Table 3. Major Reservoir and Flow Operations for ESA-listed fish species.

Project	Flood Control & Refill	Sturgeon	Bull Trout	Spring Anadromous	Summer Anadromous	Chum
Libby	Winter: Operate to VARQ flood control rule curve and achieve appropriate elevation by April 10 Spring: Refill by June 30 and operate to meet flow objectives	April – July Augment flows at Bonners Ferry for sturgeon pulse	Year Round: Operate to minimum flows and project ramping rates to minimize adverse affects of flow fluctuations	Operate to meet flow objectives and June 30 refill if possible without excessive spill	July/August: Draft for summer flow augmentation, not to exceed reservoir draft limit of 2,439 feet	Fall/winter storage may be used to support chum flows
Hungry Horse	Winter: Operate to VARQ flood control by April 10 Spring: Refill by June 30 if possible without excessive spill and operate to meet flow objectives		Year Round: Operate to Columbia Falls minimum flows and project ramping rates to minimize adverse affects of flow fluctuations	Draft from April 10 FC to April 30 FC to increase the likelihood of achieving spring flow objectives in the Lower Columbia river.	July/August: Draft for summer flow augmentation, not to exceed reservoir draft limit of 3,540 feet	Fall/winter storage may be used to support chum flows
Albeni Falls	Winter: Operate to flood control rule curve Spring: Refill by June 30 and operate to meet flow objectives		Fall/Winter: Reach 2055' by November 20 and maintain this elevation until kokanee fry emergence			Fall/winter storage may be used to support chum flows
Grand Coulee	Winter: Operate to 85% confidence of meeting April 10 flood control elevation Spring: Refill by June 30 and operate to meet flow objectives			Draft from April 10 FC to April 30 FC to increase the likelihood of achieving spring flow objectives in the Lower Columbia river. Operate to meet the Spring flow objective at Priest Rapids Dam.	July-August: Draft for summer flow augmentation, not to exceed reservoir draft limit of 1,280 feet (>/= 92 maf forecast at The Dalles) or 1,278 feet (< 92 maf forecast at The Dalles)	Fall/winter storage may be used to support chum flows

Project	Flood Control & Refill	Sturgeon	Bull Trout	Spring Anadromous	Summer Anadromous	Chum
Grand Coulee (continued)					July/August: Operate Banks Lake at elevation 5 feet less than full to provide more water for summer flow augmentation	
Dworshak	Winter: Operate to flood control rule curve by April 10 Spring: Refill by June 30 and operate to meet flow objectives				Draft for summer flow augmentation and water temperature reduction, not to exceed reservoir draft limit of 1,520 feet in September	Fall/winter storage may be used to support chum flows
Lower Granite				Flow objective of 85-100 kcfs Operate within 1 foot of MOP to reduce juvenile travel time Apr 1 – Oct 31 Operate within 1% of best efficiency	Flow objective of 50-55 kcfs Operate within 1 foot of MOP to reduce juvenile travel time Apr 1 – Oct 31 Operate within 1% of best efficiency	
Little Goose				Operate within 1 foot of MOP to reduce juvenile travel time Apr 1 – Oct 31 Operate within 1% of best efficiency	Operate within 1 foot of MOP to reduce juvenile travel time Apr 1 – Oct 31 Operate within 1% of best efficiency	
Lower Monumental				Operate within 1 foot of MOP to reduce juvenile travel time Apr 1 – Oct 31 Operate within 1% of best efficiency	Operate within 1 foot of MOP to reduce juvenile travel time Apr 1 – Oct 31 Operate within 1% of best efficiency	

Project	Flood Control & Refill	Sturgeon	Bull Trout	Spring Anadromous	Summer Anadromous	Chum
Ice Harbor				Operate within 1 foot of MOP to reduce juvenile travel time Apr 1 – Oct 31 Operate within 1% of best efficiency	Operate within 1 foot of MOP to reduce juvenile travel time Apr 1 – Oct 31 Operate within 1% of best efficiency	
McNary				Flow objective of 220-260 kcfs Apr 1 – Oct 31 Operate within 1% of best efficiency	Flow objective of 200 kcfs Apr 1 – Oct 31 Operate within 1% of best efficiency	
John Day				Apr 10-Sep 30 Operate within 1.5 feet of minimum level that provides irrigation pumping to reduce juvenile travel time Apr 1 – Oct 31 Operate within 1% of best efficiency	Apr 1 – Oct 31 Operate within 1% of best efficiency Operate within 1.5 feet of level that will allow irrigation to reduce juvenile travel time	
The Dalles				Apr 1 – Oct 31 Operate within 1% of best efficiency	Apr 1 – Oct 31 Operate within 1% of best efficiency	
Bonneville				Apr 1 – Oct 31 Operate within 1% of best efficiency	Apr 1 – Oct 31 Operate within 1% of best efficiency	If hydrologic conditions indicate system can likely maintain minimum flow below BON of 125 kcfs Nov 1 - April, implement mainstem chum flows. If not, provide flows below BON to enable access to creeks for spawning.

4 Hydrosystem Substrategy 2.1: Reservoir operations to improve fish survival

4.1 Lower Snake Projects (Lower Granite, Little Goose, Lower Monumental, and Ice Harbor)

4.1.1 Reservoir Operations

All Lower Snake projects will operate within 1 foot of Minimum Operating Pool (MOP) from approximately April 3 until small numbers of juvenile migrants are present. This normally occurs in late August. Lower Granite Dam will not return to normal operating pool until enough natural cooling has occurred in the fall, generally after October 1. The purpose of this action is to provide a smaller reservoir cross section to reduce juvenile salmon travel time and reduce flow fluctuations. Elevations may be modified to maintain the minimum navigation channel requirements.

4.1.2 Turbine Operations

To enhance juvenile passage survival, turbines at all Lower Snake projects will be operated within 1% of peak efficiency during the juvenile and adult migration seasons (April 1 through October 31). (See appendix C, Corps of Engineers 2006 Fish Passage Plan)

4.2 Lower Columbia Projects (McNary, John Day, The Dalles, Bonneville)

4.2.1.1 Turbine Operations

To enhance juvenile passage survival, turbines at all the Lower Columbia projects will be operated within 1% of peak efficiency during the juvenile and adult migration seasons (April 1 through October 31). John Day

4.2.1.2 Reservoir Operations

John Day pool will operate within a 1½-foot range of the minimum level that provides irrigation pumping from April 10 to September 30. The purpose of this action is to provide a smaller reservoir cross section to reduce juvenile salmon travel time.

5 Hydrosystem Substrategy 2.2: System flow management to improve fish survival

5.1 Flow Objectives

The purpose of the flow objectives is to aid in achieving the hydro system biological performance standards by providing better streamflow to aid in juvenile salmon and steelhead migration and enhance water quality. However, as recognized in the UPA and BiOp, it is not possible to achieve the flow objectives in many water years because there is limited water and

reservoir storage. This Water Management Plan strives to achieve the best possible mainstem passage conditions, recognizing the priorities established in this document and the need to balance the limited water and storage resources available in the region.

5.1.1 Lower Granite

5.1.1.1 Spring anadromous fish

The April final runoff volume forecast at Lower Granite Dam for April to July determines the spring flow objective at Lower Granite Dam. When the forecast is less than 16 million acre-feet (maf) the flow objective will be 85 kcfs. If the forecast is between 16 maf and 20 maf the flow objective will be linearly interpolated between 85 kcfs and 100 kcfs. If the forecast is greater than 20 maf the flow objective will be 100 kcfs. The planning dates for the spring flow objective are from April 3 to June 20.

5.1.1.2 Summer anadromous fish

The June final runoff volume forecast at Lower Granite Dam for April to July determines the summer flow objective at Lower Granite Dam. When the forecast is less than 16 maf the flow objective will be 50 kcfs. If the forecast is between 16 maf and 28 maf the flow objective will be linearly interpolated between 50 kcfs and 55 kcfs. If the forecast is greater than 28 maf the flow objective will be 55 kcfs. The planning dates for the summer flow objective are from June 21 to August 31.

5.1.2 Priest Rapids—Spring anadromous fish

The spring flow objective at Priest Rapids Dam is 135 kcfs. The planning dates are from April 10 to June 30. There is no summer flow objective for Priest Rapids Dam.

5.1.3 McNary

5.1.3.1 Spring anadromous fish

The spring flow objective at McNary Dam is set according to the April final runoff volume forecast at The Dalles Dam for April to August. When the forecast is less than 80 maf the flow objective will be 220 kcfs. If the forecast is between 80 maf and 92 maf the flow objective will be linearly interpolated between 220 kcfs and 260 kcfs. If the forecast is greater than 92 maf the flow objective will be 260 kcfs. The planning dates for the spring flow objective will be from April 10 to June 30.

Weekend flows are often lower than weekday flows due to less electrical demand in the region. During the spring and summer migration period (April through August), the Action Agencies will strive to maintain MCN flows during the weekend at a level which is at least 80% of the previous weekday average.

5.1.3.2 Summer anadromous fish

The summer flow objective at McNary Dam is 200 kcfs. The planning dates for the summer flow objective will be from July 1 to August 31.

5.2 All Storage Projects

The purpose of the following actions are to refill FCRPS storage projects as much as possible for spring flows, summer flow augmentation and to cool water temperatures.

The FCRPS dams will be operated during the winter season in order to achieve a high probability of water surface elevations within 0.5 foot of the flood control rule curve by April 10, and to refill by June 30, except as specifically provided by the TMT. The Action Agencies, in consideration of recommendations of the Technical Management Team, will determine the availability and amount of any additional FCRPS storage draft beyond the flood control rule curve for the purpose of flow augmentation, consistent with refill by June 30 for summer flow augmentation.

During the spring, the Action Agencies will operate the FCRPS to meet the flow objectives and refill the storage reservoirs (Albeni Falls, Dworshak, Grand Coulee, Hungry Horse, and Libby) by approximately June 30. If both these objectives cannot be achieved, the TMT will make an in-season recommendation, weighing considerations unique to each particular year. Because research results indicate that increased flows have more direct survival benefits for summer migrants than for spring migrants, modest reductions in spring flows to facilitate reservoir refill would generally be preferable to refill failure.

During the summer, the Action Agencies draft mainstem storage reservoirs (Libby, Hungry Horse, Dworshak, Grand Coulee, Banks Lake) within the NOAA BiOp's specified draft limits, based on flow recommendations provided by TMT. TMT considers a number of factors when developing its flow recommendations, such as: the status of the migration, attainment of flow objectives, water quality, and the effects that reservoir operations will have on other listed and resident fish populations.

5.3 Libby

5.3.1 Flood Control

The Corps will continue to use the new SOI forecast procedure in December to determine the December 31 flood control elevation. In below average water years the end of December draft elevation may be higher than 2411 feet.

Libby will be operated during the winter season in order to achieve a high probability of water surface elevations within 0.5 foot of the VARQ flood control elevation by April 10 and to refill by June 30 and avoid the risk of filling too quickly and having to spill, except as specifically provided by the TMT.

During the spring, the Action Agencies will operate Libby targeting refill by approximately June 30 while contributing to meeting the flow objectives and the pulse for sturgeon.

5.3.2 Summer anadromous fish

During the summer (July and August) the Action Agencies will operate Libby to help meet the flow objectives for juvenile salmon out-migration in the lower Columbia. The summer reservoir draft limit is 2,439 feet, which determines the maximum draft available for summer flow augmentation from Libby. Retention of July/August water in Lake Koocanusa is possible under a Libby-Canadian storage water exchange, but is not guaranteed. This exchange agreement also reduces the second flow peak created by July/August salmon flow through Kootenay Lake July and August. The purpose of this action is to reduce or eliminate the second peak in the Kootenai River, thus protecting bull trout and sturgeon. Additionally, the exchange agreement reduces the draft of Lake Koocanusa and increases upstream benefits (Note: This type of exchange is allowed under the current Libby Coordination Agreement, which was signed February 16, 2000. Because the operation must be mutually beneficial and the magnitude of the water year is not known earlier, the operation, if any, for a given water year is not finalized until June or July of that year.)

The Northwest Power and Conservation Council mainstem amendments call for an evaluation of the relative risks posed to resident fish versus the benefits provided to anadromous fish by drafting the reservoir to 2439' by September 30 in the lowest 20% of volume runoff years and to elevation 2449' by September 30 in all other years. The TMT will consider implementation of this plan during the late summer season.

5.4 Hungry Horse

5.4.1 Flood Control

Hungry Horse began operating using VARQ starting January 1, 2001. The purpose of this action is to provide more water for spring flow augmentation.

Hungry Horse will be operated during the months of January through March to achieve a high probability of water surface elevations within 0.5 foot of the flood control rule curve by April 10 and to refill by June 30, except as specifically provided by the TMT. The Bureau of Reclamation computes Hungry Horse Dam's April 10 elevation objective by linear interpolation between the March 31 and April 15 forecasted flood control elevations based on the March Final Water Supply Forecast (WSF). The April Final WSF is not received until April 7th of each year and then the flood control elevations must be computed by the Corps of Engineers. Real-time operations during the months of March, April and May must account for changes in flood control, avoiding spill and transmission limitation.

In many years the flow from Hungry Horse required to meet minimum flows at Hungry Horse and at Columbia Falls draft the Hungry Horse below flood control.

5.4.2 Refill

During the spring, the Action Agencies will operate Hungry Horse to contribute to meeting the flow objectives and refill by approximately June 30.

5.4.3 Summer anadromous fish

During the summer (July and August) Reclamation will operate Hungry Horse to help meet the flow objectives. The summer reservoir draft limit is 3,540 feet. This limit determines the maximum draft available for summer flow augmentation from Hungry Horse.

The Northwest Power and Conservation Council mainstem amendments call for an evaluation of the relative risks posed to downstream resident fish versus the benefits provided to anadromous fish by drafting the reservoir to 3,540 feet by September 30 in the lowest 20% of volume runoff years as measured at The Dalles Dam and to elevation 3550' by September 30 in all other years. The TMT will consider implementation of this plan during the fall season.

5.5 Albeni Falls

5.5.1 Fall draft for fish

The reservoir will be drafted by November 20th to elevation [2055] for Kokanee spawning. This elevation will be maintained as a minimum until Kokanee emergence ends.

5.5.2 Flood Control Draft

Albeni Falls will be operated during the winter season using standard flood control criteria.

5.5.3 Refill

During the spring, Albeni Falls will be refilled in accordance with standard flood control criteria. The Action Agencies will operate Albeni Falls to meet the flow objectives and refill by approximately June 30.

5.6 Upper Snake River Reservoir Operation for Flow Augmentation

The purpose of this action is to provide water from the upper Snake Reservoirs for flow augmentation.

Reclamation will attempt to provide 487 kaf of flow augmentation from the Reclamation projects in the upper Snake River basin consistent with its Proposed Action as described in the November 2004 Biological Assessment for O&M of its projects in the Snake River basin above Brownlee. Reclamation's flow augmentation program is dependent on willing sellers and must be consistent with Idaho State law.

5.7 Brownlee, Dworshak, and Grand Coulee Flood Control

Opportunities to shift system flood control requirements from Brownlee and Dworshak to Grand Coulee will be considered. These shifts may be implemented after coordination with TMT. The purpose of this action is to provide more water for flow augmentation in the lower Snake River.

This will occur when the shifts will not compromise flood control and they have been coordinated.

5.8 Dworshak

5.8.1 Flood Control

Dworshak will be operated during the winter season in order to achieve a high probability of water surface elevations within 0.5 foot of the flood control rule curve by April 10 and to refill by June 30, except as specifically provided by the TMT.

5.8.2 Refill

During the spring, the Action Agencies will operate Dworshak to meet the flow objectives and refill by approximately June 30.

After summer fish operations are completed, flows from Dworshak will be limited to minimum one turbine operation (approximately 1,500 cfs) unless higher flows are required for flood control, emergencies, chum flows below Bonneville Dam, or other project uses. The purpose of these actions is to manage the filling of Dworshak reservoir while operating the project for multiple uses. Flows from Dworshak also may be maintained above minimum flow if Corps analysis determines there is flexibility to release a volume of water above minimum flow and still maintain a high reliability of meeting spring refill objectives.

5.8.3 Summer anadromous fish

During the summer (July and August) the Action Agencies will operate Dworshak to help meet the flow objectives. The summer reservoir draft limit is 1,520 feet. This limit determines the maximum draft available for summer flow augmentation from Dworshak. The Action Agencies will draft Dworshak to 1520 feet in September. The extension of the draft limit into September reflects assumed requirements for about 200 kaf to be released consistent with an agreement with the Nez Perce Tribe as a result of the Snake River Basin Adjudication process. If there is a change, the Action Agencies may revisit this aspect of the UPA, and revise as necessary through the implementation planning process.

5.8.4 Water quality

During the summer, releases will be made from Dworshak to attempt to maintain water temperatures at the Lower Granite tailrace fixed monitoring site at or below 68 F. Although a previous FCRPS BiOp stated the goal was to maintain the forebay at this temperature, modeling and experience have demonstrated that the tailrace temperature is more representative of river conditions and temperature exposure of migrating salmonids. The purpose of this action is to improve water quality (by lowering water temperature) in the Lower Snake River. This fishery action also assists in cooling the downstream lower Snake River closer to the state water temperature standards.

5.9 Grand Coulee

5.9.1 Flood Control

Grand Coulee will be operated during the months of January through March in order to achieve an 85% probability of water surface elevations within 0.5 foot of the flood control rule curve by April 10, and the TMT may recommend other specific operations. The Bureau of Reclamation computes Grand Coulee Dam's April 10 elevation objective by linear interpolation between the March 31 and April 15 forecasted flood control elevations based on the March Final Water Supply Forecast (WSF). The April Final WSF is not received until April 7th of each year and then the flood control elevations must be computed by the Corps of Engineers. Real-time operations during the months of April and May must account for the flows at Priest Rapids Dam, changes in the amount of flood control shift from Dworshak or Brownlee, changes in flood control and draft rate limitations.

5.9.2 Refill

During the spring, the Action Agencies will operate Grand Coulee to refill by approximately July 4.

5.9.3 Summer anadromous fish

During the summer (July and August) the Action Agencies will operate Grand Coulee to help meet the flow objectives for juvenile salmon out migration. The July Final forecast produced by RFC determines the summer reservoir draft limit. The draft limit is 1,280 feet in years when the April through August forecast for The Dalles is equal to or exceeds 92 maf. If the forecast is less than 92 maf the draft limit will be 1,278 feet. This limit determines the maximum draft available for summer flow augmentation from Grand Coulee.

4.9.4 Project Maintenance

4.9.4 Project Maintenance

Drum gate maintenance is planned to occur during April and May annually. The reservoir must be at or below elevation 1255 feet to accomplish this work. Typically the flood control elevations during this time of year provide the required elevations and sufficient time to accomplish this work. The drum gates are extremely important dam safety features and must be maintained at a satisfactory level. Therefore, there will be some years where the project must be operated to accomplish this work. Reclamation will coordinate such an operation with TMT.

5.10 Banks Lake Summer Draft

Banks Lake will be drafted to elevation 1,565 feet by the end of August. The purpose of this action is to provide more water for summer flow augmentation.

5.11 Bonneville Dam Chum Tailwater Elevations

The purpose of the following actions is to provide spawning areas and protect redds of chum salmon.

Tailwater elevations will be regulated below Bonneville Dam to support spawning of chum salmon if the best hydrologic data available by early October indicate that precipitation, runoff, and reservoir storage are likely to support the operation from the start of spawning (late October or early November) until the end of emergence (generally through the start of the spring flow management season in April). The SOI has been given consideration in previous years as a method to get a relative gage as to what the coming year's precipitation may be. The chum spawning operation cannot adversely affect implementation of NOAA's recommended higher priority actions or the parties' ability to comply with the Vernita Bar agreement. If these conditions cannot be met, the Action Agencies will work with NOAA Fisheries and the regional salmon managers to identify operations that would benefit salmon while maintaining these other fish protection measures. Such operations may include intentionally managing flows below what is necessary for mainstem spawning to discourage redds from being established in the area or shaping flows in a manner that would discourage redd development (reverse load factoring). In recent years, operating to the Bonneville tailwater gage during daylight hours was found to be an effective management tool. Operations with discharges more than 75 kcfs over the daytime discharge level have occurred without impacting where chum redds were placed. The tailwater gage better reflects the effects of tides, tributary inflow, and groundwater influence below Bonneville Dam. The Action Agencies intend to operate to a minimum Bonneville tailwater elevation to provide spawning flows as agreed to at TMT in operating year 2006. In recent years, the tailwater operation has started when chum are present in the area and this is the plan in 2006. .

If water supply conditions indicate that it is not possible to maintain this minimum tailwater elevation at Bonneville Dam, flow will be provided at times during the chum-spawning season to allow access to Hamilton and Hardy Creeks if the creeks are flowing. Details will be set through coordination in TMT.

From January 1 to the start of spring flows April 10, if the chum operation is possible, the minimum tailwater elevation at Bonneville Dam will be the daily minimum water surface elevation established by coordination in the TMT.

Chum salmon will be captured and used as broodstock to initiate/bolster a spawning population in the recently restored habitat of Duncan Creek. The Northwest Power and Conservation Council's Duncan Creek project outlines the logistics for a brood movement and fry-rearing program. The salvage operation would expand the numbers of fish captured and reared in this newly established brood collection program to make up for the lack of tributary or mainstem spawning

The Implementation Team sought criteria that NOAA Fisheries uses to make decisions regarding the provision of water for chum spawning. A memo responding to this request is attached in Appendix 5.

6 Hydrosystem Substrategy 2.3: Spill operations for project passage

This substrategy addresses spill at certain FCRPS projects to provide improved survival and better project passage for juvenile fish while avoiding adult fallback problems and creating greater than 120% saturation levels of total dissolved gas in the tail race and 115 % at the designated downstream monitoring stations at the forebay of the next dam downstream.

The dates for spring and summer spill for juvenile fish migration range in the Snake River are from April 3 to June 20 and June 21 – August 31 The dates for spring and summer spill for juvenile fish migration in the lower Columbia River are from April 10 to June 30 and July 1 – August 31. Details about the spill amounts are in the 2006 Fish Passage Implementation Plan which is an addendum to the Spring Summer Update to Water Management Plan.

7 Other actions to enhance water management

This includes water management related actions that are being done to improve fish survival, such as studies, water quality actions, and water conservation improvements.

7.1 Libby

7.1.1 TDG and Water temperature monitoring

Water temperature profiles in the south end (near-dam, or forebay area) of Lake Koocanusa during May and June will be monitored to provide information necessary for timing of sturgeon spawning/rearing flow augmentation. Also, water temperature profiles in the forebay are used to determine whether warmer temperatures may be provided to assist sturgeon spawning

During the summer of 2003, the COE Seattle District installed a TDG monitoring sensor at a fixed monitoring station below Libby Dam on the spillway side of the river (left bank, looking downstream) directly across the river from the USGS stage gage.

7.1.2 Libby VARQ

The purpose of VARQ is to better ensure reservoir refill and to reliably provide water for spring flows and summer flow augmentation without reducing flood control protection.

The Upper Columbia Alternative Flood Control and Fish Operations Environmental Impact Statement (EIS) has been prepared and additional public and Canadian (including Columbia River Treaty) coordination is underway before a decision on long-term implementation of VARQ at Libby and Hungry Horse dams is made. VARQ will continue to be implemented on an interim basis until a final decision is made. The final EIS was made available for public review on April 28, 2006. It incorporates and evaluates two new alternatives consistent with recommendations in the 2006 USFWS Biological Opinion. Those alternatives include the new preferred alternative (VARQ flood control with fish flows including spill at Libby ranging up to

10,000 cfs above powerhouse capacity); and a Standard flood control alternative with the same fish flow parameters. A record of Decision is scheduled to be signed this summer.

For 2006 operations, the Corps plans to provide stacked flows, releasing full powerhouse capacity on top of the local freshet (peak input from tributaries below the dam) in mid to late May to evaluate this operations effectiveness for providing habitat attributes necessary for sturgeon. The operation will be timed to optimize temperature conditions to the extent possible with matching peak flows.

7.1.3 Libby Storage Reservation Diagram and Runoff Volume Forecast Procedure

The purpose of the Libby storage reservation diagram study and investigation of a new forecast procedure and the investigation into a variable 31 December draft point was to see if more water could be made available for spring flows without reducing flood control protection. The investigation of the forecast procedure has been completed and the December forecast is being used to determine an appropriate end of December flood control elevation. WY 2005 was the first year this procedure was used. If the December water supply forecast is well below average, the Libby end of December flood control target may be higher than elevation 2411 feet. Forecasts were done in water year 2006 using this method.

7.1.4 Coordination

The Action Agencies will continue to coordinate Libby operations at TMT.

7.2 Hungry Horse Coordination

Reclamation will fulfill the USFWS recommendation for annual and monthly reporting by contributing to the annual water management plan and presenting weekly and biweekly reports of Hungry Horse operations through the TMT process.[1]

Reclamation will also fulfill the USFWS recommendation for reporting actual operations by making available pertinent historic elevations and flows as related to Hungry Horse Dam through its current website at http://www.usbr.gov/pn/hydromet/esatea.html.

Reclamation began operating with VARQ flood control at Hungry Horse in 2001, pending completion of an Environmental Impact Statement. As stated above, the VARQ FEIS was made available for public review on April 28, 2006.

7.3 Water Quality Actions

7.3.1 Water Quality Plans

Consistent with the TDG spill variances provided by the states of Oregon and Washington, the Corps completed a comprehensive Water Quality Plan that would outline the physical and operational changes that could be used to improve the overall water quality in the mainstem waters of the Clearwater, Snake, and Columbia Rivers. The plan was first completed in April 2003 and updated in December 2003. The goals of the water quality plan are as follows

- To assist in our understanding of system wide loading capacity and loading allocation by assessing the existing effects at Federal and non-Federal dams and tributaries.

- To provide an organized, coordinated approach to improving water quality, with the long-term goal of meeting water quality standards that the states and Tribes can integrate into their water quality management programs.

- To provide a framework for identifying, evaluating, and implementing reasonable actions for dam operators to use as they work toward reducing temperature and dissolved gas levels.

- To provide a record of the actions that are and are not feasible for structural and operational improvements aimed at improving water quality conditions and meeting water quality standards. This information may provide a basis for future beneficial use and water quality criteria revisions.

- To bring basin wide information into the decision processes regarding dissolved gas and temperature, and to provide technical assessment of a project's relative value in terms of water quality.

- To integrate dissolved gas and temperature work into one process for both Federal and non-Federal dams on the mainstem Columbia River and Snake River system.

Over the long term, with a focus on water quality, Plan implementation anticipates that EPA, NOAA, and the Federal Action Agencies will properly integrate implementation of the Plan to ongoing TMDL development activities on the mainstem and in the sub-basins.

7.3.2 Total Dissolved Gas Monitoring

Exposure to high levels of TDG over long periods of time can be harmful or lethal to fish. Environmental monitoring at the dams is necessary where voluntary spill is employed for juvenile fish passage to ensure that gas levels do not exceed TDG thresholds established in the NOAA BiOp, and variance levels established by the state water quality agencies.

There are two purposes for the Corps to monitor total dissolved gas (TDG) and water temperature at 10 Columbia River Basin dams: 1) to monitor project performance in relation to water quality standards, and 2) to provide water quality data for anadromous fish passage at Columbia/Snake mainstem dams. The monitoring program is considered an integral part of the Corps' Reservoir Control Center water management activities.

The physical TDG monitoring program is to include the QA/QC provisions stipulated in the "Data Quality Criteria for Fixed Monitoring Stations" completed in 2002 and approved by the Water Quality Team. This report describes the accuracy, precision, and completeness of data required at each fixed monitoring station. To achieve these goals, procedural methodologies are specified. These methodologies are characterized in three parts: calibration protocols (data quality control), data review and corrections (data quality assurance), and completeness of data (a substitute quality assurance program for station redundancy). Each fixed monitoring station will be assessed at the end of the monitoring season against these criteria and a performance report will be included in the Annual Dissolved Gas and Water Temperature Monitoring Report provided to the states of Oregon and Washington.

TDG is the primary water quality parameter monitored. High saturation level TDG can cause physiological damage to fish. Water temperature is also measured because it affects TDG saturation levels, and because it influences the health of fish and other aquatic organisms. Both TDG and water temperature are closely linked to project water management operations (e.g., water released over the spillways, releases through the powerhouses and other facilities, and forebay and tailwater water surface elevations).

One component of the water quality strategy was for the Corps to take the actions necessary to implement the spill program at the dams indicated in the UPA, including obtaining variances from appropriate State water quality agencies. A modification the TDG standard to assist out-migrating threatened and endangered juvenile salmon smolts by spilling water at McNary, John Day, The Dalles, and Bonneville dams was provided by the Oregon Environmental Quality Commission at a March 2003 meeting. This rule modification is in effect from April 1st to August 31st through the 2007 fish passage season. In March 2005, Washington Department of Ecology (WDOE) provided an adjustment in the Washington State TDG standard for all spills related to fish passage through March 31st, 2008. These rule modifications/adjustments provide for a revision of the total dissolved gas standard from 110% to a revised standard of 115% in the forebays and 120% in the tailwaters of Lower Columbia and Snake River projects. The 115% and 120% caps are based on the 12 highest hourly measurements per calendar day. Also, a cap of total dissolved gas of 125%, based on the one highest hour (Washington) or highest two hours (Oregon), is in effect. The State of Idaho was approached in 2001 concerning a variance to their TDG water quality standards. The Corps will continue to operate Dworshak reservoir to the 110% TDG state standard in 2006.

The Reservoir Control Center is responsible for monitoring the TDG and water temperature conditions in the forebays and the tailwaters of the lower Columbia River/lower Snake River dams, and selected river sites. The operational water management guidelines in Oregon are to change spill levels and, subsequently, spill patterns at the dams (daily if necessary) so that the forebays are as close to, but do not exceed, daily (12 highest hours) average of 115% TDG, and the tailwater levels are close to, but do not exceed, daily (12 highest hours) average of 120% TDG.

The Corps prepares a Total Dissolved Gas Management Plan each year (see Appendix 4). It is a supporting document for the Water Management Plan. The Plan summarizes the roles and responsibilities of the Corps as they relate to dissolved gas monitoring. The Plan stipulates what to measure, how, where, and when to take the measurements, and how to analyze and interpret

the resulting data. The Plan also provides for periodic review and alteration or redirection of efforts when monitoring results and/or new information from other sources justifies a change. The Plan identifies channels of communication with other cooperating agencies and interested parties.

7.4 Canadian Storage for Flow Augmentation

The purpose of the actions below is to see if more water from Canadian storage projects can be obtained for flow augmentation.

One (1) maf of Treaty storage will be requested and negotiated when available with BC Hydro to be provided and released during the migration season.

BPA will continue to work with BC Hydro to negotiate a non-Treaty storage agreement to provide for storage during the spring with subsequent release in July and August, for flow enhancement as long as operations forecasts indicate that water stored in the spring can be released in July and August.

A study regarding the shaping and release of water behind Canadian Treaty storage projects in July and August was completed in 2001.

7.5 Albeni Falls Coordination

The Action Agencies, the USFWS, and Idaho Department of Fish & Game will meet annually to evaluate Lake Pend Oreille kokanee monitoring results and make necessary adjustments through subsequent in-season management. The purpose of this action is to review IDFG monitoring results and to ensure winter lake operation protocol is addressing the needs of kokanee spawning and hence, threatened bull trout, which feed on kokanee. IDFG has proposed an annual decision tree as guidance for winter elevations of Lake Pend Oreille.

7.6 Public Coordination

The purpose of the following actions is to provide for better regional coordination.

Actions in the Water Management Plan will be coordinated with NOAA Fisheries, USFWS, and the states and tribes in preseason planning and in-season management of flow and spill operations. This coordination will occur in the Technical Management Team process.

At all appropriate decision points, the Action Agencies will routinely seek timely input and concurrence from the USFWS on all matters affecting USFWS listed fish through the Columbia River Treaty, International Joint Commission Orders, and all other decision making processes involving transboundary waters in the Columbia River basin. This will include notification of all meetings and decision points and provision of opportunities to advise the Action Agencies during meetings and in writing, as appropriate.

8 Hydrosystem Substrategy 3.3: Juvenile fish transport actions to improve fish survival

This substrategy addresses actions to collect juvenile fish at some FCRPS projects while providing a balance between transported and in-river juvenile fish migration. Details of the juvenile transportation program are included in the 2006 Fish Passage Implementation Plan which is an addendum to the Spring Summer Update.

9 Resident Fish Substrategy 1.1: Create conditions below Libby Dam that facilitate Kootenai River white sturgeon (KRWS) natural reproduction and juvenile survival

9.1 Libby

9.1.1 Sturgeon

The purpose of the actions below is to provide water for sturgeon spawning and recruitment.

Water will be stored in Libby reservoir and used to supply water volume during May and June for sturgeon flows, following the "tiered" approach as defined in the 2004 Supplemental Biological Assessment (BA supplement) and 2006 USFWS Biological Opinion, and as summarized in the table below. This water will be in addition to storage needs for listed bull trout, salmon, and will be measured above the 4,000 cfs minimum releases from Libby Dam. Accounting on these total tiered volumes will begin when the USFWS determines benefits to conservation of sturgeon are most likely to occur. Sturgeon flows will generally be initiated between mid-May and the end of June to augment lower basin runoff entering the Kootenai River below Libby Dam, consistent with the Supplemental BA, Kootenai River Ecosystem Function Restoration Flow Plan Implementation Protocol and 2006 BiOp.

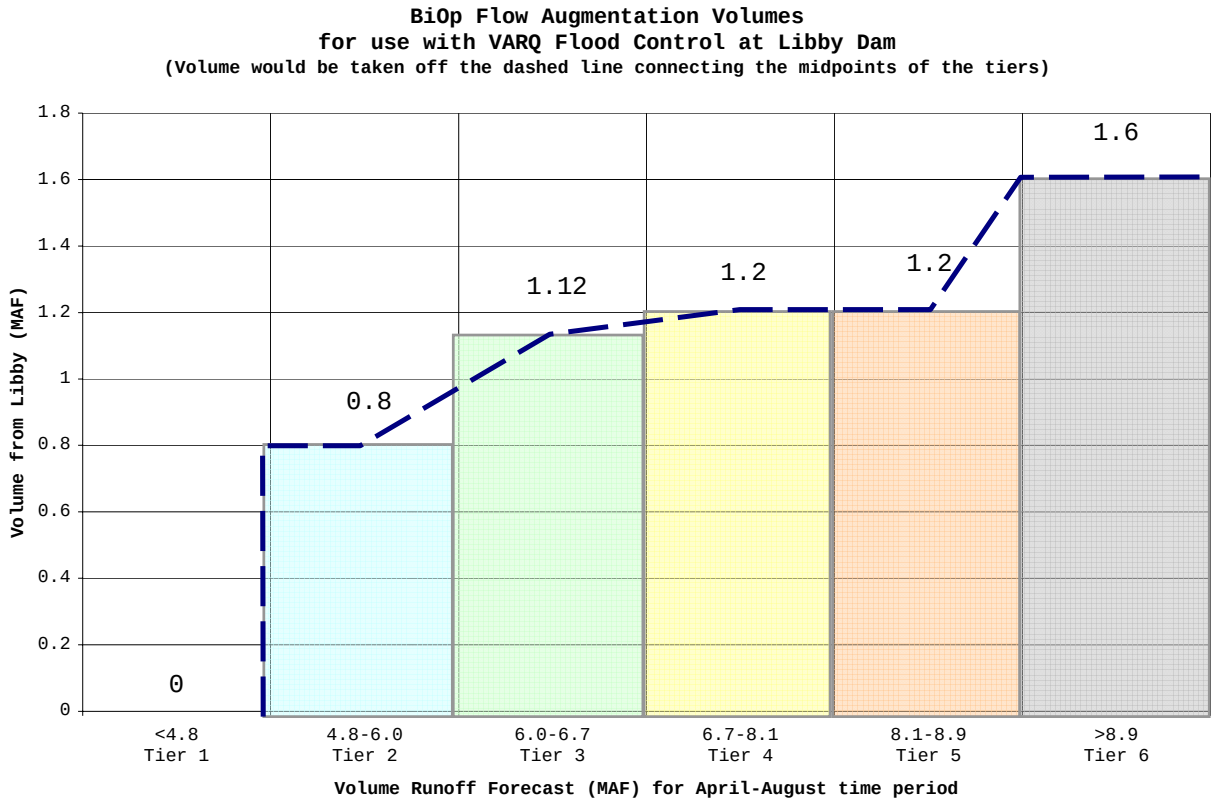

Table 5. "Tiered" volumes of water for sturgeon flow enhancement to be released from Libby Dam according to the Libby May final forecast of April - August volume. Actual flow releases would be shaped according to seasonal requests from the USFWS and in-season management of water actually available.

For 2006 operations, the Corps plans to provide stacked flows, releasing full powerhouse capacity on top of the local freshet (peak input from tributaries below the dam) beginning in mid to late May to evaluate this operation's effectiveness for providing habitat attributes necessary for sturgeon. The operation will be timed to optimize temperature conditions to the extent possible with matching peak flows.

Efforts will be coordinated to attempt to limit sturgeon-spawning flows so they do not exceed a river stage elevation of 1,764 feet at Bonners Ferry. (Note: This may not always be possible during periods of unusual local runoff that may be beyond the control of Libby Dam.)

During sturgeon recruitment flow periods, local inflow will be allowed to supplement Libby Dam releases to the maximum extent feasible, while assuring public safety by monitoring water levels throughout relevant areas of the Kootenai River basin.

The AAs will coordinate 2006 BiOp sturgeon operations with the TMT.

9.1.2 Coordination

Libby Dam flows will be regulated consistent with existing treaties, Libby Project authorization for public safety, other laws, and the 1938 International Joint Commission order to achieve water volumes, water velocities, water depths, and water temperature at a time to maximize the probability of allowing significant sturgeon recruitment.

10 Resident Fish Substrategy 2.2: Operate and modify FCRPS dams to protect, provide, and reconnect bull trout habitats

10.1 Libby

Per the 2006 USFWS BiOP, bull trout minimum flows of 6,000 cfs will be provided from 15 May through 30 September, and minimum flows of 4,000 cfs will be provided for the rest of the year.

Table 6. Minimum bull trout releases from Libby Dam.

Forecast runoff Volume (maf*) at Libby	Min bull trout flows between sturgeon and salmon flows
0.00 < forecast < 4.80	6 kcfs
4.80 < forecast < 6.00	7 kcfs
6.00 < forecast < 6.70	8 kcfs
6.70 < forecast < 8.10	9 kcfs
8.10 < forecast < 8.90	9 kcfs
8.90 < forecast	9 kcfs

**maf = million acre-feet*

10.1.1 Ramp Rates and Daily Shaping

The purpose of the following actions is to provide better conditions for resident fish by limiting the flow fluctuations and setting minimum flow levels. These new ramp rates were proposed in the BA supplement to minimize impacts to bull trout and are included in the 2006 USFWS Biop.

The following ramp rates will guide project operations to meet various purposes, including power production.

Table 7. Prescribed ramp rates to protect resident fish and their food organisms, and to minimize levee erosion, in the Kootenai River.

		Summer (05/01 - 09/31)	
		Hourly	Daily
Ramp Up	4-6 kcfs	2500 cfs	1 unit
	6-9 kcfs	2500 cfs	1 unit
	9-16 kcfs	2500 cfs	2 units
	16-QPHC	5000 cfs	2 units
Ramp Down	4-6 kcfs	500 cfs	500 cfs
	6-9 kcfs	500 cfs	1000 cfs
	9-16 kcfs	1000 cfs	2000 cfs
	16-QPHC	3500 cfs	1 unit

		Winter (10/01 - 04/30)	
		Hourly	Daily
Ramp Up	4-6 kcfs	2000 cfs	1 unit
	6-9 kcfs	2000 cfs	1 unit
	9-16 kcfs	3500 cfs	2 units
	16-QPHC	7000 cfs	2 units
Ramp Down	4-6 kcfs	500 cfs	1000 cfs
	6-9 kcfs	500 cfs	2500 cfs
	9-16 kcfs	1000 cfs	1 unit
	16-QPHC	3500 cfs	1 unit

(USFWS 2006 BiOp at Description of the proposed action, page 7, Table 1.

Daily and hourly ramping rates may be exceeded during flood emergencies to protect health and public safety and in association with power or transmission emergencies.

Variances to these ramping rates during years when water supply forecasting errors overestimate actual runoff, or variances are necessary to provide augmentation water for other listed species or other purposes, will be coordinated through the TMT process. This is expected in only the lowest 20th percentile water years.

Note: From a project point of view the ramp rates will be followed except when they would cause a unit(s) to operate in the rough zone, a zone of chaotic flow in which all parts of a unit are subject to increased vibration and cavitation that could result in premature wear or failure of the units. In this case the project will utilize a ramp rate, which allows all units to operate outside the rough zone.

10.2 Hungry Horse

10.2.1 Ramp Rates

The following ramp rates will guide project operations to meet various purposes, including power production.

Table 8. Ramp rates prescribed for Hungry Horse Dam releases to protect resident fish and their food organisms in the Flathead River.

Daily and Hourly Maximum Ramp Up Rates for Hungry Horse Dam (as measured by daily flows, not daily averages, restricted by hourly rates).		
Flow Range (measured at Columbia Falls)	**Ramp Up Unit (Daily Max)**	**Ramp Up Unit (Hourly max)**
3,200 - 6,000 cfs	Limit ramp up 1,800 cfs per day	1,000 cfs/hour
> 6,000 - 8,000 cfs	Limit ramp up 1,800 cfs per day	1,000 cfs/hour
> 8,000 - 10,000 cfs	Limit ramp up 3,600 cfs per day	1,800 cfs/hour
> 10,000 cfs	No limit	1,800 cfs/hour

Daily and Hourly Maximum Ramp Down Rates for Hungry Horse Dam (as measured by daily flows, not daily averages, restricted by hourly rates)		
Flow Range (measured at Columbia Falls)	**Ramp Down Unit (Daily max)**	**Ramp Down Unit (Hourly max)**
3,200 - 6,000 cfs	Limit ramp down to 600 cfs per day	600 cfs/hour
> 6,000 - 8,000 cfs	Limit ramp down to 1,000 cfs per day	600 cfs/hour
> 8,000 - 12,000 cfs	Limit ramp down to 2,000 cfs per day	1,000 cfs/hour
> 12,000 cfs	Limit ramp down to 5,000 cfs per day	1,800 cfs/hour

Daily and hourly ramping rates may be exceeded during flood emergencies to protect health and public safety and in association with power or transmission emergencies.

Variances to ramping rates during years where runoff forecasting or storage shortfalls occur, or variances are necessary to provide augmentation water for other listed species, will be coordinated through the TMT process. This is expected in only the lowest 20th percentile water years.

Note: The ramp rates will be followed except when they would cause a unit(s) to operate in a zone that could result in premature wear or failure of the units. In this case the project will utilize a ramp rate, which allows all units to operate outside the rough zone. The Action Agencies will provide additional information to the USFWS describing operations outside the "rough zone."

The minimum outflow for Hungry Horse Dam will be determined monthly based on the Reclamation Water Supply Forecast (WSF) for the inflows into Hungry Horse for the period April 1 to August 31. The minimum flows is set monthly starting with the January forecast, and then set for the remainder of the year based on the March final runoff forecast. These forecasts will be provided by Reclamation to the TMT. If the April to August forecast is greater than 1,790 kaf, the minimum flow will be 900 cfs. If the forecast is less than 1,190 kaf, the minimum flow will be 400 cfs. If the forecast is between 1,190 and 1,790 kaf, the minimum flow will be linearly interpolated between 400 and 900 cfs.[2] The minimum flow from Hungry Horse can be lowered to 300 cfs for flood control operations in the Flathead Valley. The flood stage in the river at Columbia Falls reaches flood level is 14 feet but Reclamation operates to 13 feet when feasible.

The minimum flow at Columbia Falls will be determined monthly based on the Reclamation Water Supply Forecast (WSF) for the inflows into Hungry Horse for the period April 1 to August 31. The minimum flow is set monthly starting with the January forecast, and then set for the remainder of the year based on the March final runoff forecast.. If the April to August forecast is greater than 1,790 kaf, the minimum flow will be 3,500 cfs. If the forecast is less than 1,190 kaf, the minimum flow will be 3,200 cfs. If the forecast is between 1,190 and 1,790 kaf, the minimum flow will be linearly interpolated between 3,200 and 3,500 cfs.

10.3 Albeni Falls

10.3.1 Lake winter elevation

IDFG has presented a decision-tree proposal to TMT for possible use in 2007 to choose an appropriate operation of Lake Pend Oreille in the fall/winter of the 2006/2007 season. Albeni Falls Dam will operate to the elevation that is decided upon.

11 FCRPS Hydrosystem Performance Standards

The Action Agencies will operate the FCRPS hydrosystem as described in this Water Management Plan, in an adaptive management framework, to make progress towards meeting biological performance goals. Those goals are contained in the 2004 UPA and addressed in the 2004 NOAA Fisheries Biological Opinion. Adult and juvenile fish survival estimates from research, monitoring, and evaluation studies will be considered in annual planning as future plans are developed.

12 Fish and Wildlife Related Non-BiOp Actions

The following non-BiOp actions are typically options available to be addressed by TMT during the water management year.

[2] USFWS BiOp at Section 3.A.1 Page 6

12.1 Keenlyside Dam (Arrow)

12.1.1 Mountain Whitefish

Spawning flow levels are set the third week in December between 45 and 55 kcfs. Spawning continues through mid-January. Egg protection flows are set 5 to 15 kcfs lower than the spawning flow through the end of March.

12.1.2 Rainbow Trout

Rainbow trout spawning begins in April. Protection levels begin somewhere between 15 and 25 kcfs. The goal is to have stable flows or ever-increasing flows through June.

12.2 Libby

12.2.1 Burbot

Providing low flows from Libby Dam to aid upstream migration of burbot to spawning areas above Kootenay Lake on the Kootenai River in Idaho is considered each winter. These low flows may occur over several periods of time or may last for an extended period from December through February. The details of this operation for 2006 are being developed and may be included in the fall/winter update. An interagency Memorandum of Agreement for this species was completed in June 2005. Use of VARQ and implementation of the variable end of December flood control target elevation may aid this operation in years with below average runoff forecasts, this variable December draft limit may help when it is implemented.

12.3 Dworshak

12.3.1 Flow increase for Dworshak National Fish Hatchery release.

Release 4 – 6 kcfs from Dworshak in order to move juvenile fish into the mainstem Clearwater River during the spring hatchery release.

12.4 Grand Coulee

12.4.1 Kokanee

Fill Grand Coulee to 1,283 feet by September 30 and maintain an elevation 1,283 to 1,285 feet or greater through the middle of November for brood stock collection, spawning access to tributaries, and increased retention time during a critical period for zooplankton production.

12.5 Hanford Reach Protection Flows

Grant County PUD limits outflow from Priest Rapids Dam to minimize juvenile fish stranding.

12.6 Vernita Bar Protection Flows

Flow management occurs from Priest Rapids Dam in the fall to ensure that fall chinook salmon establish redds (spawn) at an elevation that enables the redds to have a high likelihood of not being dewatered prior to emergence of fry. Daytime flows are regulated to a range between 50 and 70 kcfs during October and November when redds are being established. Flow fluctuations are limited from the time of fish emergence in early April through early June. (Note: This is included pursuant to the Vernita Bar Settlement Agreement and the annual Hanford reach stranding agreement.)

12.7 McNary

12.7.1 Waterfowl nesting

To improve waterfowl nesting conditions in the McNary pool between March and May each year, we operate the pool in the top 1 foot of the pool range for several hours every 4 days.

12.7.2 Waterfowl hunting enhancement

In order to enhance Waterfowl hunting, we hold the McNary pool constant several times a week from October to January.

12.8 John Day

12.8.1 Goose nesting

To encourage geese to nest in areas that are not typically inundated by frequent fluctuations in the John Day pool between March and May each year, we operate the pool in the top 1 foot of the pool range for several hours every 4 days.

12.8.2 Waterfowl hunting enhancement

In order to enhance Waterfowl hunting, we hold the John Day pool constant several times a week from October to January.

12.8.3 Tribal Fishing

To accommodate tribal fishing, the John Day pool may operate within a 1.5 foot operation range during tribal fishing seasons.

12.9 Bonneville

12.9.1 Tribal Fishing

To accommodate tribal fishing, the Bonneville pool is normally held between elevation 75 and 76.5 feet during tribal fishing seasons.

12.9.2 Spring Creek Hatchery Release

The U.S. Fish and Wildlife Service typically releases between 7 and 8 million tule fall chinook fry from the Spring Creek National Fish Hatchery upstream of Bonneville Dam in March. In 2006 the Action Agencies plan to operate Bonneville Dam with a powerhouse 2 priority, to operate all units with fish screens, and to operate the bypass facility in order to provide project passage for this hatchery release. The B2 Corner Collector will be operated for a period of days (to be determined) during the March 2006 release. The Fish and Wildlife Service, Corps of Engineers and Bonneville Power Administration reached mutual agreement on an operation at Bonneville Dam for the March 2004 release of sub-yearling chinook from Spring Creek Hatchery in support of a two-treatment evaluation in which the effectiveness of spill as compared to operation of the new B2 corner collector was evaluated. The agreement was reached in exchange for a commitment to no spill for March Spring Creek releases in 2005 and 2006 (unless we see significant problems with the new B2 corner collector, in which case we will revisit 2005 and 2006 operations for the March hatchery release).

13 Conclusion

This final 2006 Water Management Plan has been coordinated with the Technical Management Team. Seasonal action plans will be developed as described in the introduction to this plan. Additionally, operations may be adjusted in-season based on recommendations from the TMT.