



**U.S. Army Corps
of Engineers**
Seattle District

Flow Plan Implementation Protocol Technical Team

**FINAL
Flow Plan**

for
2022 Sturgeon Operations at Libby Dam

May 6, 2022

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Background

The U.S. Army Corps of Engineers (Corps) owns and operates Libby Dam, a Congressionally authorized multi-purpose flood control and hydropower project in northwest Montana. The Bonneville Power Administration (BPA) markets power generated at Libby Dam, one of many dams that comprise the Federal Columbia River Power System (FCRPS). Kootenai River white sturgeon (sturgeon) were listed under the Endangered Species Act (ESA) as endangered in 1994, substantially because there has been almost no natural recruitment for many decades. On July 24, 2020, the U.S. Fish and Wildlife Service (USFWS) issued a Biological Opinion (BiOp) to the Corps and BPA (together, the “Action Agencies”) under Section 7 of ESA on the proposed operations and maintenance of the 14, multiple use dam and reservoir projects in the Columbia River System located in Washington, Oregon, Idaho, and Montana, and its effects on the bull trout (*Salvelinus confluentus*), Kootenai River white sturgeon (*Acipenser transmontanus*), and critical habitat for the bull trout and the Kootenai River white sturgeon. In their BiOp, USFWS concluded that the proposed operation of Libby Dam is not likely to jeopardize the continued existence of the Kootenai sturgeon and is not likely to destroy or adversely modify designated critical habitat for this species.

In accordance with RPM 16.1(e).2 of the BiOp, the Action Agencies are providing this Flow Plan Implementation Protocol (FPIP) Flow Plan to the USFWS to assist in preparation of a System Operation Request for Libby Dam sturgeon flow augmentation during the spring freshet in 2022. The objective of the FPIP is to provide a scientifically and operationally sound approach for testing different flow strategies (releases from Libby Dam) to assess their effectiveness in meeting the conservation and recovery needs for sturgeon. The FPIP process has been applied through each year’s annual flow plan and has been used to guide sturgeon flow augmentation operations since initial implementation under the 2006 BiOp.

Current Conditions

The Corps’ final April-August water supply forecast for May is 6.74 million acre-feet (MAF; 111% of average), a Tier 4 forecast with an associated sturgeon volume of 1.18 MAF.

Recommendations for 2022 Operations

Objectives

- 1) Provide river stage at Bonners Ferry of $\geq 1,760'$ + Mean Sea Level (MSL; flood stage is 1,764') for as many days as possible during the peak of the local tributary discharge downstream of Libby Dam (Figures 1, 2 and 3);
- 2) Provide flows at Bonners Ferry of $\geq 30,000$ cubic feet per second (cfs) for a duration concurrent with maximizing the duration of Kootenai River stage as per Objective 1 (Figure 4); and

- 3) Provide a sharply receding hydrograph upon completion of the flow augmentation operation following Biological Opinion ramping rates from peak discharge to summer discharge (9,000 cfs in Tier 4: Figure 4).

The precise means that will be utilized to meet these objectives are dependent on real-time conditions and in-season water management. Given these uncertainties, the Technical Team has developed the following guidelines for sturgeon operations in 2022:

- Libby Dam discharge will increase to full powerhouse capacity (~25,000 cfs) following BiOp ramping rates on May 16. After ~22 days at full powerhouse capacity, Libby Dam discharge will be reduced to 20,000 cfs for ~7 days, and then reduced to 9,000 cfs over ~9 days following BiOp ramping rates, at which time the sturgeon augmentation volume will be exhausted (Figure 2).
 - Bonners Ferry Stage \geq 1,760' MSL: ~16 days
 - 30,000+ cfs @ Bonners Ferry: ~30 days
- Selective Withdrawal System (SWS) gates at Libby Dam above elevation 2,326 feet mean sea level (MSL) will be installed immediately prior to, and during, the peak flow period, with the objective of passing the warmest water available in the forebay (surface and sub-surface) as it becomes available. Release of the warmest water possible from Libby Dam, in combination with lower volume of release, may allow the Kootenai River temperature to increase to appropriate temperatures at Bonners Ferry (9-10+°C) during the receding limb of the hydrograph to trigger spawning, and support incubation and proper early larval development while stimulating primary production to support food web dynamics.
- After the sturgeon flow augmentation volume has been exhausted, decrease discharge at Libby Dam towards stable summer flows, following BiOp ramping rates, to no less than bull trout minimum flows (9,000 cfs in Tier 4).
- As always, flood risk reduction operations supersede sturgeon flow augmentation, and dam managers will coordinate operations with regional sturgeon managers. The sturgeon augmentation discharge may be extended for additional days if the Corps elects to provide volume in excess of the minimum volume requirement in the 2020 BiOp to control the refill rate of Libby Dam.
- Additional recommendations may be provided as water supply forecasts are updated in order to provide stable or gradually declining discharge through the end of August following ramping rates and minimum flow guidelines in the 2020 BiOp.

2022 Objectives Justification

- 1) *Provide river stage at Bonners Ferry of > 1,760' + Mean Sea Level (MSL; flood stage is 1,764') for as many days as possible during the peak of the local tributary discharge downstream of Libby Dam.*

While a portion of spawning adults migrate into improved habitat upstream of Bonners Ferry in most years, the majority continue to spawn at or below Bonners Ferry regardless of habitat improvements and steady mid-level flows. Very little natural recruitment has occurred even after improvements, as the earliest life stages continue to suffer very high mortality in the altered riverine ecosystem - likely from various biotic and abiotic factors. Since most of the remnant wild Sturgeon still predominantly spawn at or downriver of Bonners Ferry, improved ecosystem functionality via off channel connectivity in the lower river may be a better opportunity to boost early life stage survival, and thus natural recruitment. KTOI would like to evaluate ecosystem function effects on early life history of sturgeon, which necessitates higher flows to reconnect Habitat Restoration Projects such as Nimz Ranch Floodplain restoration. The property has yet to receive water on the fully restored landscape; however, KTOI data has demonstrated the ecological value of water on the landscape during 2018 and 2020. For example, during higher water in 2018, Burbot early life stages were released into the initial Nimz Ranch floodplain reconnection phase, and were more successful than anticipated, now contributing a substantial percentage of the recovered Burbot population. The reasons for success were warmer water temperatures supporting physiological development, and the increased plankton and invertebrate abundance providing an adequate food source. Biomonitoring data exhibit that colder than pre-dam April-through-June river temperatures subdue ecosystem productivity in the mainstem of the river, very likely affecting sturgeon early development, growth and survival. Ecosystem functionality for early life stage Sturgeon may be enhanced by providing connectivity to off-channel habitats such as Nimz Ranch.

Given recent development of a Parental Based Tagging (PBT) protocol for Kootenai Sturgeon with accuracy on par with the Kootenai Burbot PBT protocol, KTOI intends to request concurrence from USFWS to begin pilot releases and monitoring of experimental early life releases of Kootenai Sturgeon from KTOI facilities during June 2022 across a variety of habitat types along the lower Kootenai Ecosystem to evaluate habitat/recruitment dynamics. Also, building on recent successes doing so for the Burbot recovery, KTOI has an extensive early life release plan for several larval stages across habitats in Idaho and British Columbia for the 2022 year-class. KTOI staff will implement ecological monitoring of water chemistry, plankton, invertebrate and fish recapture at many of the release locations for Sturgeon and Burbot. By understanding how habitat dynamics support survival or perpetuate mortality, future BiOp-required habitat improvements and water management may be better engineered and implemented.

- 2) *Provide flows at Bonners Ferry of $\geq 30,000$ cubic feet per second (cfs) for a duration concurrent with maximizing the duration of Kootenai River stage as per Objective 1, and*
- 3) *Provide a sharply receding hydrograph upon completion of the flow augmentation operation following Biological Opinion ramping rates from peak discharge to summer discharge (9,000 cfs in Tier 4).*

Libby Dam has altered the hydrology of the Kootenai River such that adult sturgeon are more likely to spawn below the Hwy 95 bridge at Bonners Ferry in poor habitat (mean = 71%), rather than migrating above the bridge to spawn in quality habitat (mean = 31%). The duration of peak flow, rather than the intensity or number of peaks, is the primary factor influencing the probability of an adult sturgeon migrating above the bridge during the spawning period (Hardy et al. 2020). Additionally, habitat projects completed by KTOI have increased movements of adult sturgeon above the bridge by approximately 11% (Hardy et al. 2020). Two days of peak flows (near or above 30 kcfs at Bonners Ferry) results in 11% of adult sturgeon migrating above the bridge on average. Each additional day of peak flows results in another 0.5% of adult sturgeon moving above the bridge on average, but this increase is higher when days are increased to 25, and lower when days are increased beyond 25 (i.e. diminishing returns). Increasing the days of peak flows from 10 to 15 results in an additional 5.1% of adults migrating above the bridge, whereas increasing the days from 25 to 30 results in an additional 2.3% of adults migrating above the bridge. The proportion of adult sturgeon migrating above the bridge in 2021 (15%) was below average given the number of days at peak flow (15 days; 25%). The period of peak flows should be followed by a rapid ramp-down to summer flows in mid-June to induce spawning (Hardy et al. 2020).

2022 Monitoring

The Kootenai Tribe of Idaho, Idaho Department of Fish and Game, and Montana Fish, Wildlife and Parks each have programmatic RM&E objectives associated with Kootenai sturgeon that encompass all aspects sturgeon life history as they relate to the recovery of the species in a regulated river ecosystem. The FPIP process has enabled the RM&E to inform other critical recovery actions linked to flow management, including conservation aquaculture and habitat design and connectivity. Specific to the 2022 FPIP Flow Plan, the following monitoring will take place during the 2022 sturgeon flow augmentation period:

- Nimz Ranch Connectivity and Inundation – KTOI will monitor physical and biological responses to floodplain connectivity and inundation throughout the sturgeon flow augmentation period and through the remainder of the water year.
- Sturgeon Movement and Spawning - IDFG currently has over 100 active *Vemco* V16 telemetry transmitters implanted in adult sturgeon residing in the Kootenai/y River and Kootenay Lake (B.C.). Fish locations and movement data will be obtained from an array of 92 stationary *Vemco* receivers that span from river kilometer (rkm) 18 in the North Arm of Kootenay Lake upstream to rkm 306 at Kootenai Falls, Montana (45 in Canada and 47 in the U.S.). In addition, fish movement data may be obtained from active telemetry tracking efforts within the spawning reach concurrent with sturgeon flow augmentation as needed to address specific research questions.
- Temperature - Corps Fishery Biologist will monitor temperature data throughout the period prior to, and during, flow augmentation operations, and make necessary selective withdrawal gate adjustments with Libby Dam Mechanical Staff personnel.
- Levees – River elevation 1,764' MSL at Bonners Ferry MSL is National Weather Service Flood Stage at Bonners Ferry. If it appears likely that 1,764' MSL may be exceeded, or there is a specific threat to human life, health, or safety at any river stage, the operation will be modified, as appropriate, to address the situation.

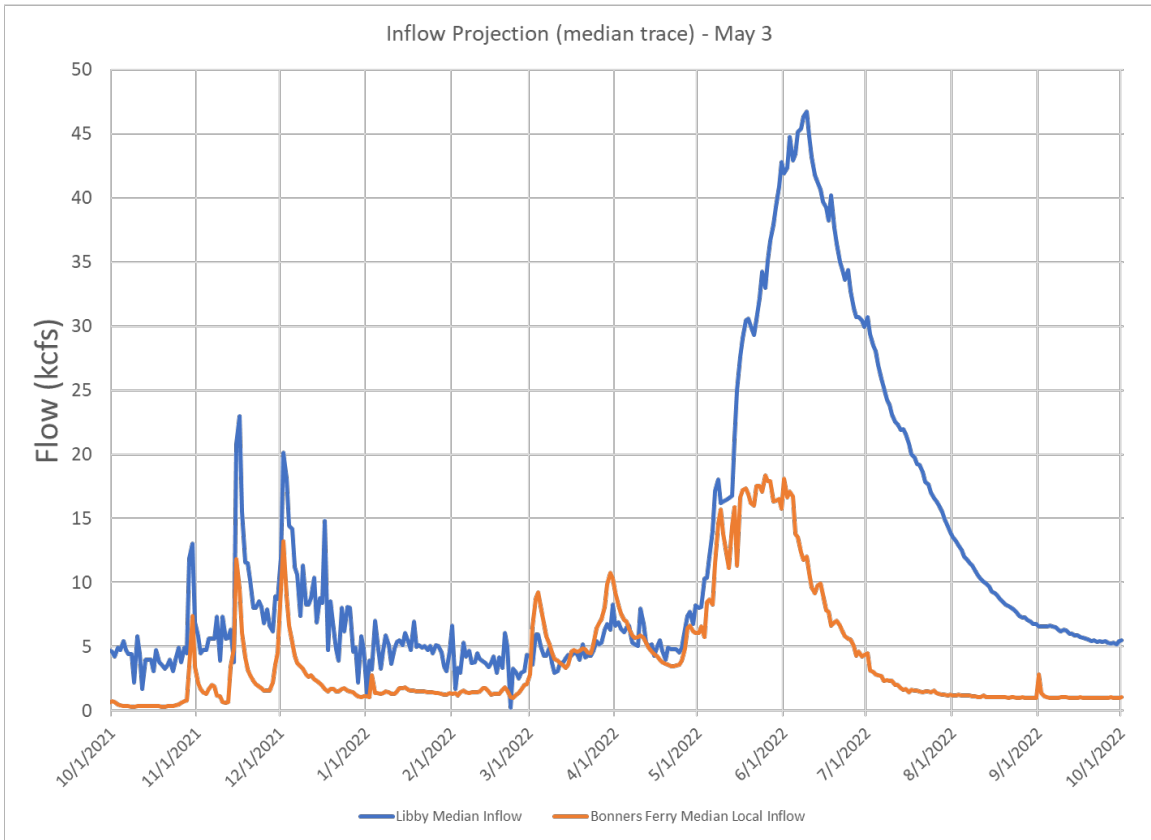


Figure 1. Projected Koocanusa Reservoir (blue) and downstream Kootenai River tributary (orange) inflows during the 2022 Kootenai River white sturgeon augmentation flow operation.

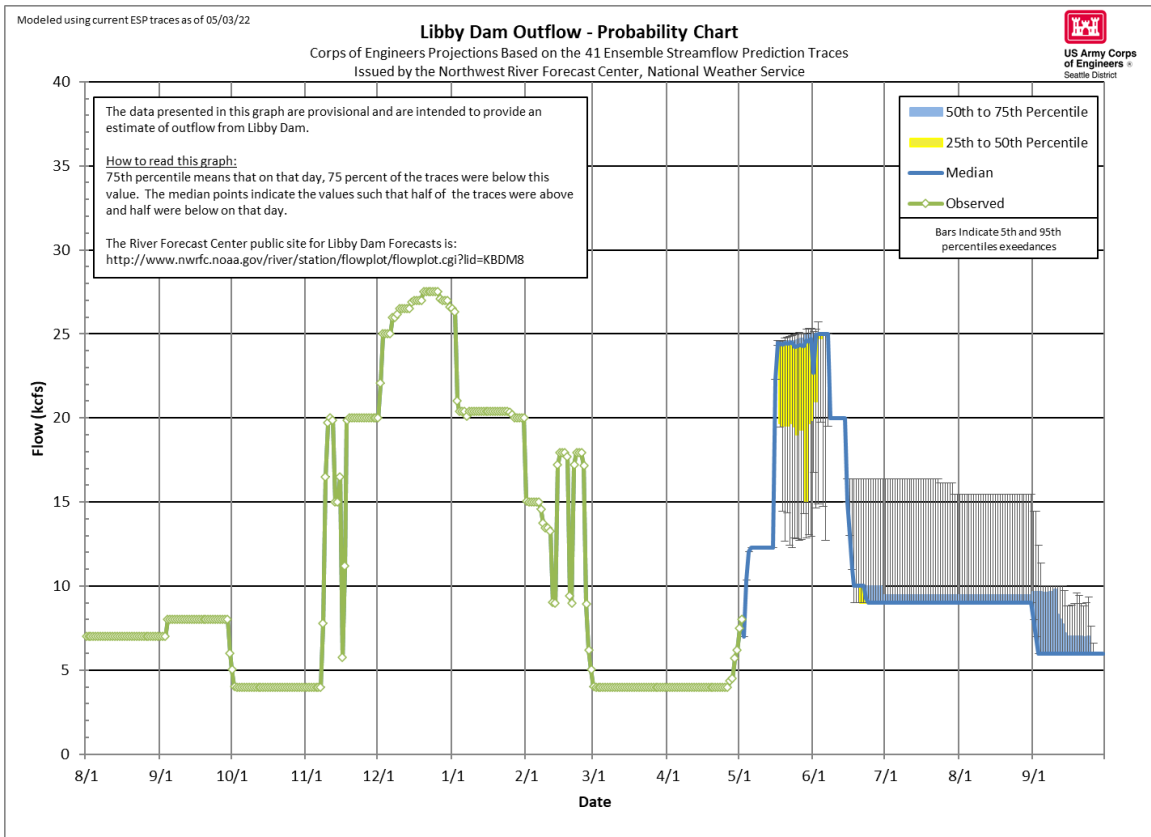


Figure 2. Proposed 2022 Kootenai River white sturgeon augmentation flow operation at Libby Dam. The shape of this hydrograph is approximate and may be altered based on real-time conditions.

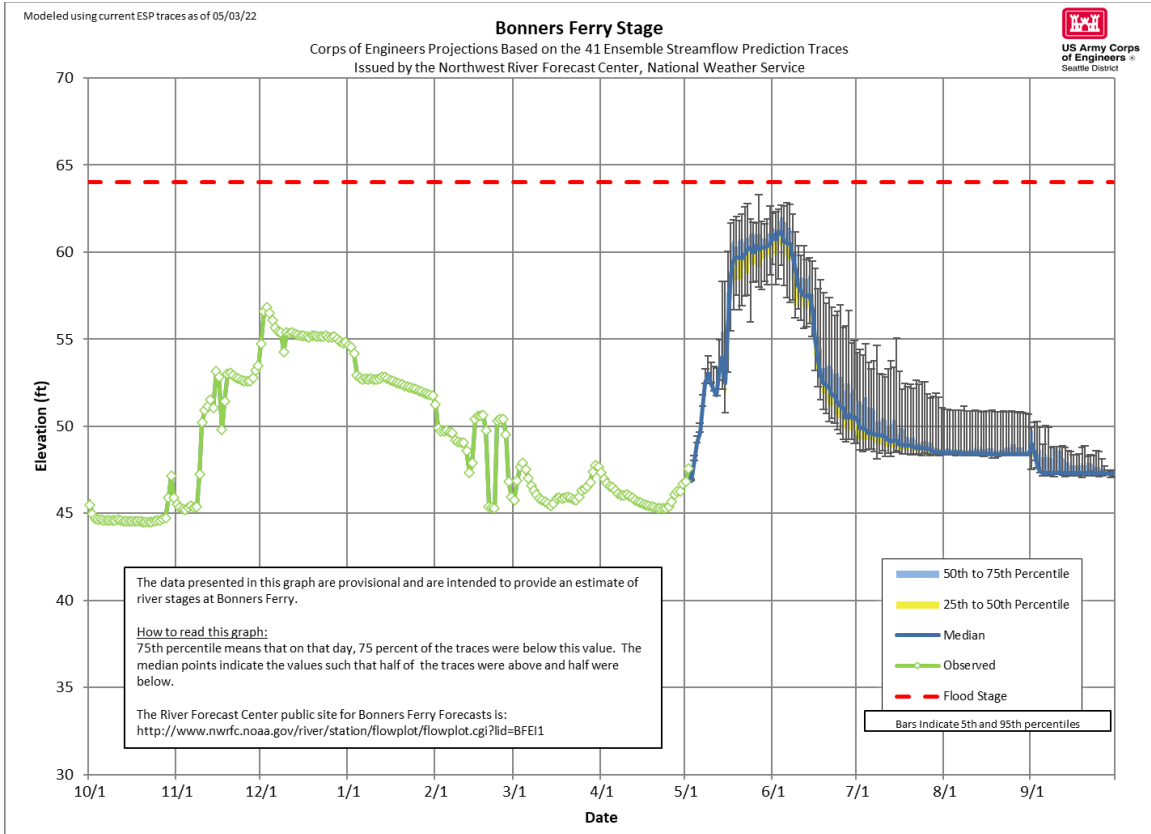


Figure 3. Modeled Kootenai River stage at Bonners Ferry, Idaho, during the 2022 Kootenai River white sturgeon augmentation flow operation. The shape of this hydrograph is approximate and may be altered based on real-time conditions.

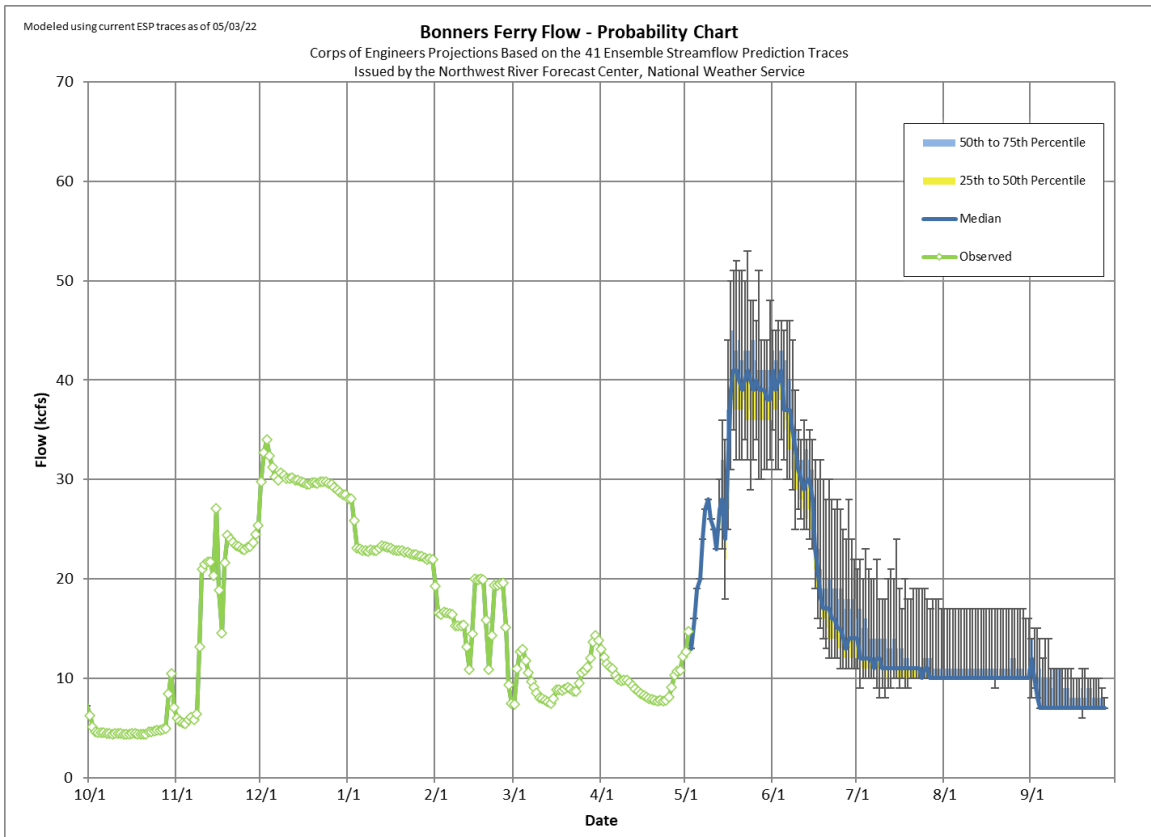


Figure 4. Modeled Kootenai River flow at Bonners Ferry, Idaho, during the 2022 Kootenai River white sturgeon flow augmentation operation. The shape of this hydrograph is approximate and may be altered based on real-time conditions.