



# MEMORANDUM

OREGON DEPARTMENT OF FISH AND WILDLIFE

DATE: November 18, 2013

TO: Oregon Fish and Wildlife Commission

FROM: Tim Bailey, La Grande District Fish Biologist  
Elizabeth Moats, Northeast Region Hydropower Coordinator  
Greg Apke, Statewide Fish Passage Coordinator

SUBJECT: Mason Dam Hydroelectric Project Fish Passage Waiver – Benefit Analysis

Baker County has applied to the Federal Energy Regulatory Commission (FERC) to construct a hydroelectric project at the existing Mason Dam on the Powder River. The project triggers the requirement for fish passage under ORS 509.585. Pursuant to ORS 509.585, and OAR 635-412-0025, the applicant has applied to waive fish passage requirements (fish passage waiver). In order to qualify for a fish passage waiver the applicant must provide mitigation in lieu of fish passage, which provides a greater benefit to native migratory fish as compared to fish passage at the Mason Dam (trigger site).

The purpose of this net benefit analysis, and the purview of the Oregon Department of Fish and Wildlife (ODFW or Department), is to determine whether or not the proposed mitigation (as described by the applicant in Baker County's Fish Passage Waiver Application submitted November 1, 2013) provides a net benefit to native migratory fish as compared to the benefits of providing fish passage at Mason Dam. In order to perform this analysis, the Department must determine the benefits to native migratory fish from each scenario (passage at Mason Dam versus the proposed mitigation action), and then compare those benefits to form the analysis.

This fish passage waiver is non-typical as compared to other fish passage waivers the Department has processed. Generally fish passage waiver sites where anadromous fish are present below a barrier, generate net benefit analyses that evaluate the benefit of providing fish passage to unoccupied or under-seeded habitats upstream. These projects typically result in a mile-for-mile mitigation strategy where mitigation would be required to provide access to more miles of habitat as compared to providing fish passage at the waiver site. In this case, only resident species are present at the waiver site, and those species are present both up and downstream of Mason Dam. Therefore, a different analysis strategy was used by the Department, which is described in the body of this document.

This fish passage waiver is a complicated matter on many levels. Mason Dam is owned and managed by the Bureau of Reclamation (BOR), but a separate party (Baker County) is proposing to retro-fit the existing regulating outlet to operate their hydroelectric project. Therefore, even though the obstruction is owned and managed by the BOR, Baker County is the owner/operator

of the hydroelectric project and is responsible for meeting the requirements of this fish passage waiver. Further complicating matters, the Powder River downstream of the waiver site is water limited, suffers from high temperatures, and contains myriad fish passage obstructions. Upstream of Mason Dam, the reservoir and mining tailings create an area of less than desirable habitat for many native species. The proposed hydroelectric project (trigger) will not change any existing operations at the dam. These complications were considered in our net benefit analysis.

The Department has concluded that the proposed mitigation described herein provides a net benefit to native migratory fish as compared to providing fish passage at Mason Dam. The justification for this determination is contained within this document. The information presented in this benefit analysis represents our current knowledge of the system. We are basing our analysis on whether the proposed alternative mitigation will provide a net benefit to native migratory fish over providing passage at Mason Dam.

## **Waiver Site**

### Description and Operation

Mason Dam is owned by Bureau of Reclamation (BOR) and operated for flood control and irrigation. It was constructed from 1965-1968 and forms Phillips Reservoir at river mile 131. It is an earth-fill type dam with a structural height of 173 feet, crest elevation of 4,082 feet and hydraulic height of 159 feet. Phillips Reservoir has a surface area of 2,234 acres and maximum depth of 87 feet. Maximum flow through the dam is 875 cubic feet per second (cfs) and minimum flow is 10 cfs which is required when not operating for irrigation or flood control. Fish passage and screening facilities are not present.

The Mason Dam Hydroelectric Project will be a new hydroelectric facility with a hydraulic capacity of 300 cfs, generating capacity of 3.4 MW and an estimated annual power output of 7,510 MWH. The hydroelectric project will utilize water released from Mason Dam for flood control and irrigation. In their FERC license application, Baker County does not propose to change dam operations.

The Mason Dam Hydroelectric Project will be operated as “run-of-release” whenever releases exceed 100 cfs. Water releases through Mason Dam typically range from 10 cfs to 300 cfs. Baker Valley Irrigation District operates Mason Dam for irrigation. Irrigation season starts in May and runs through September. Releases average approximately 10 cfs between October and January, increase to an average of 20 to 50 cfs during February and March, gradually increasing to 100 cfs during April to early-May. During the irrigation season, releases generally remain between 100 and 300 cfs.

### Upstream and Downstream Conditions

Downstream of Mason Dam, the Powder River is heavily diverted for irrigation throughout the Baker Valley. Water in the Powder River basin is fully appropriated and water levels become very low in the late summer. Eleven miles downstream of Mason Dam are the Smith and Shaw-Stewart diversions, the first of a number of irrigation diversions on the Powder River. The Shaw-Stewart diversion is a stanchion dam with a concrete apron and a jump height of about 18 inches. It is considered by the Department to be a complete barrier and fish passage facilities are not present. Downstream of this there are a large number of irrigation diversions that create a range of barriers. Approximately 50 miles downstream of the Shaw-Stewart Diversion the Powder River flows into Thief Valley Reservoir formed by Thief Valley Dam, a 73-foot high

concrete BOR dam without fish passage facilities. Downstream of Thief Valley Dam, the Powder River flows into Brownlee Reservoir on the Snake River. Brownlee Reservoir is formed by Brownlee Dam, the upper most dam within Idaho Power Company's Hells Canyon Hydroelectric Complex. Downstream of Brownlee Dam, are the Oxbow Dam and the Hells Canyon Dam. None of these facilities provide upstream passage of native migratory fish species. Hells Canyon Dam is the lowest dam within the Complex and constitutes the upper extent of anadromous fish distribution on the Snake River.

Water quality in the Powder River downstream of Mason Dam is impaired for aquatic uses. In 2012 the river was added to Oregon Department of Environmental Quality's (ODEQ) 303(d) list for dissolved oxygen during resident trout spawning (January 1-May 15). Reaches of the river downstream of Mason Dam are also listed for summer temperature, regularly exceeding temperature criteria for rearing salmonids. These water quality limitations are closely linked to agricultural land uses and low water availability which are prevalent throughout the Powder River basin.

Mason Dam is the upper most major dam within the Powder River basin. The lands surrounding Phillips Reservoir are managed by the United States Forest Service, Wallowa-Whitman National Forest. Much of the valley upstream of the reservoir has been mined for gold since the turn of the 20<sup>th</sup> century. Stream habitat and water quality upstream of the reservoir are highly degraded primarily due to dredge mining activities. The Powder River channel upstream of the reservoir remains in a maze of tailing piles. Fish habitat in the upper Powder River has also been affected by traditional land use practices of timber harvest, livestock grazing and out-of-stream water use. The river upstream of the reservoir has substantially reduced flow in summer months due to irrigation diversions. However, high quality habitats exist in areas that have not been negatively impacted by mining as evidenced by the presence of bull trout (*Salvelinus confluentus*).

#### Fish Distribution and Management

Historically, the Powder River provided habitat for summer steelhead (*Oncorhynchus mykiss*) and spring Chinook (*O. tshawytscha*). However, due to the construction of the Hells Canyon Complex dams, and other barriers on the Powder River, these anadromous species are no longer present. Bull trout are present in the upper Powder basin, above Mason Dam, in the North Powder River basin and in the Eagle Creek basin, but these populations are not connected. Fish passage barriers, water quality and habitat in the mainstem Powder River is unsuitable for bull trout, and bull trout populations in the Powder basin are isolated. Bull trout are not known to use the mainstem Powder River downstream of Mason Dam.

Non-anadromous native migratory fish species historically and currently present in the Powder River upstream and downstream of Mason Dam include inland redband trout (*O. mykiss gairdnerii*), native suckers (largescale (*Catostomus macrocheilus*), bridgelip (*C. columbianus*) and mountain (*C. platyrhynchus*)), and northern pikeminnow (*Ptychocheilus oregonensis*). The Department considers these populations self-sustaining. Mountain whitefish (*Prosopium williamsoni*) were also known to be historically present in the mainstem Powder River. The Department has limited information on this species and we cannot affirm their presence in the Powder River basin at this time. The Department supports a recreational rainbow trout fishery on the Powder River downstream of Mason Dam with annual stocking of sub adults.

There are two local bull trout populations in the upper Powder basin (Upper Powder River, consisting of Silver and Cracker Creeks, and Lake Creek). The majority of the bull trout in the upper Powder basin are thought to occur in Silver Creek. Bull trout have been located in Silver Creek from the headwaters to approximately 1.25 miles upstream of the confluence with Cracker Creek. Little Cracker Creek also supports bull trout, with the known occurrences 1.5 miles upstream of the confluence with Cracker Creek. The bull trout within Little Cracker Creek and Silver Creeks are thought to form one local population, although the degree of movement between these areas is limited by a physical barrier near the mouth of Silver Creek. Additionally, two bull trout were collected in Phillips Reservoir in spring of 2011. This is the only information indicating that bull trout use the reservoir. Therefore, due to the limited use of the reservoir by bull trout and habitat limitations below Mason Dam, bull trout are not expected to benefit from passage at Mason Dam.

Several species of non-native fish are present and self-sustaining both downstream and upstream of Mason Dam. These include largemouth bass (*Micropterus salmoides*), smallmouth bass (*M. dolomieu*), bluegill (*Lepomis macrochirus*), black capping (*Pomoxis nigromaculatus*), yellow perch (*Perca flavescens*), brown bullhead (*Ameiurus nebulosus*) and walleye (*Stizostedion vitreum*). The Department manages Phillips Reservoir for a recreational trout fishery. Historically, the reservoir supported a very popular rainbow trout fishery; however the illegal introduction of yellow perch has decimated the trout fishery. The Department's ongoing management efforts focus on rebuilding the trout fishery through trout stocking and suppression of perch. Tiger muskie and tiger trout have recently been stocked to control yellow perch abundance and create angling opportunities. The Department also stocks the reservoir annually with sub-adult and adult hatchery rainbow trout (*O. mykiss*) for recreational angling.

Current conditions within Phillips Reservoir are limiting to redband trout due to the overabundance of yellow perch. Yellow perch were illegally introduced into the reservoir in the late 1980's, first documented by ODFW in 1991. Through the 1990's, they rapidly became the most abundant fish species in the reservoir. Being highly efficient planktivores, yellow perch effectively eliminate the larger-sized zooplankton that are a primary prey item of hatchery-origin and naturally produced rainbow/redband trout in the reservoir. The introduction of yellow perch has led to a severe bottleneck in food availability for trout, meaning that growth and survival has been greatly reduced, which ultimately led to the crash in the recreational trout fishery.

The Department has implemented a number of management actions in an attempt to reduce yellow perch abundance in the reservoir and improve conditions for trout. Some have been unsuccessful in achieving management objectives (mechanical removal of yellow perch) and others have just recently been implemented (introduction of tiger muskie) without sufficient time to produce an effect. While tiger muskie are likely to prey on a small number of rainbow/redband trout, the overall effect of reducing perch abundance and increasing food supply is expected to outweigh the impacts of predation.

The extent of the redband trout population within the reservoir is unknown. However, naturally produced *O. mykiss sp.* are often collected during reservoir monitoring. The extent to which stocked hatchery rainbow trout reproduce and/or interbreed with native redband trout in the upper Powder River Basin is also unknown. Interspecific competition between yellow perch and *O. mykiss* (native and stocked) is thought to be a factor limiting trout growth, abundance and

productivity. Overall, the overabundant population of yellow perch in Phillips Reservoir makes the reservoir an unfavorable environment for native trout (redband and bull).

Benefits of Fish Passage at Mason Dam: Providing fish passage at the Mason Dam would reconnect the redband trout “sub” populations within the Powder River basin, as well as provide benefits to other native species such as northern pikeminnow and suckers.

As described in the introduction of this document, analyzing the benefits of fish passage at Mason Dam is complicated, and non-typical as compared to other projects, particularly where anadromous species are present. The Department looked into several strategies for quantifying the benefits of fish passage for each species present, but ultimately too many unknowns exist on site to accurately quantify benefits to each species. Therefore the Department took the approach of analyzing the benefits of passage on a species by species level; analyzing the quality and type of habitats present up and downstream, estimating current fish population dynamics within those habitats, and how population dynamics (population viability, distribution, abundance, genetic fitness) may change if passage were provided.

The Department considers the redband trout populations upstream and downstream of Mason Dam to be the affected “sub” populations for the net benefit analysis. We call these “sub” populations because these two groups of fish have been separated by Mason Dam for nearly 50 years, but we do not have genetics data to determine that they are distinct populations. The primary benefits to providing passage at Mason Dam would be to connect the redband trout populations within the Powder River basin (allow genetic exchange and interaction between them), and improve the opportunity for expression of fluvial (migratory) life histories. This would allow downstream populations access to upstream habitats, upstream populations access to downstream habitats, and interactions among currently separate up and downstream populations. These increases in genetic fitness and population viability will make the population less susceptible to catastrophic events such as drought, and lead to an overall healthier population. The Department was unable to quantify on a population scale, what the direct impact of passage would be on redband trout abundance and distribution. It is expected that population dynamics would not change greatly due to poor habitat conditions in proximity to Mason Dam, though a series of good water years or habitat improvements could lead to population scale benefits.

While fish passage at Mason Dam would reconnect redband trout populations upstream and downstream of the dam, there are limitations to the benefits of passage due to 1) habitat quality limitations upstream and downstream of Mason Dam, especially in the mainstem Powder River 2) current occupation of good quality habitat by existing redband trout populations, and 3) the generally poor conditions in Phillips Reservoir relative to redband trout survival and growth resulting from the presence of non-native fish species. Providing passage will allow genetic exchange and interaction of redband trout; however passage alone will not address these other significant limiting factors.

Eleven miles downstream of Mason Dam, the Shaw-Stewart Diversion creates a complete barrier to all upstream fish migration. This means that no migratory fish downstream of the Shaw-Stewart Diversion can access the habitat upstream. Also any fish moving downstream from the reach immediately below Mason Dam past the unscreened Shaw-Stewart diversion would be unable to travel back to their natal stream. Therefore the downstream “sub” population that

would be affected by passage at Mason Dam would be within this reach. Redband trout are expected to be distributed throughout this reach. The habitat within this reach is assumed to be fully occupied to the extent possible.

Downstream of Mason Dam, water quality is limiting for redband trout. The current dissolved oxygen standards required by ODEQ for this reach are for “cold water” fish use criteria. Water released through Mason Dam is withdrawn from the bottom of the Phillips Reservoir (87 feet below the surface). The dissolved oxygen of the water at the intake does not meet water quality standards during summer months. Under current operations, this water is re-aerated as it passes through the high pressure slide gates of the outlet works on Mason Dam. The water released during hydroelectric operations will be diverted through the hydroelectric facilities and not through the slide gates. Baker County predicts that water released from the hydroelectric facilities will not meet water quality standards during the summer. Baker County has proposed a Dissolved Oxygen Compliance Plan that will include monitoring dissolved oxygen at 0.16 miles downstream of the dam and adaptively implementing measures to increase the dissolved oxygen within this reach. Redband trout within this reach are expected to be impacted by low dissolved oxygen through the summer and will likely migrate into tributaries to find refuge or move downstream. Temperature within this reach would also be unfavorable for redband trout in the late summer causing them to seek out thermal refugia.

Redband trout upstream of Mason Dam are self-sustaining within the limited high quality habitat that is available. Seventy-five miles of redband trout habitat is identified upstream of Mason Dam, however approximately eight miles of that is inundated by Phillips Reservoir. Approximately eight additional miles of the mainstem Powder River is heavily impacted due to historic dredge mining activities and fish habitat within this reach is poor. Water availability is also limited within this reach, the lower portion of which is dewatered by mid-summer. Furthermore, an unknown amount of upstream tributaries are impacted by historic and current mining and other land uses. However, high quality habitat is available in some tributaries above Phillips Reservoir, primarily in the upper reaches and headwaters. Redband trout are expected to be abundant within these reaches.

Passage facilities at Mason Dam would also be used by native suckers (bridgelip and largescale) and northern pikeminnow, if it were designed to appropriate standards. These species have self-sustaining populations within the reservoir and are assumed to be present in the Powder River immediately downstream of Mason Dam. Since these species are present upstream and downstream of Mason Dam and the populations are self-sustaining, passage would not increase the species' distribution into unoccupied habitat. Further, because the aquatic resources upstream of Mason Dam are already being exploited, passage will not facilitate an increase in productivity. Therefore, the benefits of passage at Mason Dam for native suckers and northern pikeminnow would be limited.

### **Proposed Mitigation in lieu of Fish Passage**

Baker County proposes to provide alternative mitigation in lieu of fish passage at Mason Dam. The Department anticipates that if a fish passage waiver is granted by the Commission it will be included as a component of a comprehensive mitigation package negotiated with Baker County and other stakeholders. The mitigation package will be submitted by Baker County to FERC as a

proposal to address licensing issues. Baker County proposes the following measures for the fish passage waiver:

1) Silver Creek culvert replacement: Baker County proposes to replace an undersized culvert on Silver Creek at USFS Road 5540. This passage improvement project will provide access to about 5.3 miles of bull trout and redband trout habitat in this tributary to the Powder River upstream of Phillips Reservoir.

Bull trout presence has been confirmed in Silver Creek while, redband trout, and native suckers are expected to be present due to the high habitat quality. Distribution of bull trout within the upper Powder Basin is limited to three tributaries, Silver Creek, Little Cracker Creek and Lake Creek. The populations within Silver Creek and Little Cracker Creek are thought to form one local bull trout population. However, movement between these areas is limited due to a culvert approximately 0.75 miles upstream from the mouth of Silver Creek. This culvert will be replaced with an open bottom arch culvert designed and constructed to meet fish passage requirements. This will improve fish access to 5.3 miles of habitat that supports native migratory fish, specifically bull trout and redband trout. Increased interaction within this bull trout population will reduce its vulnerability to stochastic events. Additionally, this culvert replacement will improve access to adjacent US Fish and Wildlife Service designated Critical Habitat in Cracker Creek, which could potentially increase bull trout population abundance.

2) Improve passage at McCully Fork culvert: The current reinforced concrete box culvert (88-foot long, 10-foot wide, 6-foot high) on McCully Fork at Baker County Road 24 is undersized, which has resulted in a large scour pool and corresponding jump height between the culvert perch and the streambed of approximately 2 feet at the downstream end (outlet) of the culvert. Additionally, during summer low flow, the water through the culvert is only a few inches deep, which results in sheet flow that is impassable or problematic for fish to migrate upstream. Baker County proposes to implement a roughened channel design consistent with the Department's passage criteria immediately downstream of the McCully Fork culvert. This will allow fish to overcome the existing jump height and swim into the culvert. Within the existing culvert, Baker County proposes to place weirs and native streambed materials. The purpose of this treatment is to promote a stable channel bed, increase water depth at low flow, and simulate natural streambed conditions to improve fish passage through the culvert. Both treatments will be designed to meet fish passage design criteria

McCully Fork is within redband trout habitat. Native suckers, and northern pikeminnow are expected to be present as well. The current culvert is a complete barrier to upstream migration of native migratory fish species. The barrier limits the expression of migratory life history of redband trout within the upper Powder basin. Any fish moving downstream through the culvert are unable to travel back to the headwaters of McCully Fork. Therefore, migratory redband trout are lost to the local McCully Fork population and the remaining population is comprised of only resident fish. The proposed fish passage improvements will improve access to 5.6 miles of high quality habitat in McCully Fork. This mitigation action will allow redband trout produced in McCully Fork to return to their natal stream for spawning which will potentially increase redband trout productivity and abundance within the upper Powder basin. The mitigation action will also allow passage of native suckers and

northern pikeminnow through the culvert, enhancing interaction within the populations and increasing available spawning habitat.

## **Benefit Analysis**

In the Mason Dam fish passage benefits section, it was concluded that the primary benefits of fish passage to native migratory fish were:

- Increased population viability for redband trout, suckers, and pikeminnow
- Increased genetic fitness for redband trout, suckers, and pikeminnow
- Potential increases in abundance and distribution, particularly in good water years or if habitat restoration occurs for redband trout.

Therefore the mitigation must provide benefits to suckers and northern pikeminnow that are greater than the benefits listed above in order to meet ODFW's requirements. The benefits of the proposed mitigation are discussed below.

### Benefits of Proposed Mitigation

The two fish passage mitigation measures for Mason Dam will address native migratory fish population limitations by;

- Improving access to 5.3 miles of tributary bull trout habitat;
- Improving access to 11.0 miles of redband trout, sucker and pikeminnow habitat;
- Increasing bull trout genetic exchange and interaction within Critical Habitat;
- Increasing opportunity for migratory life history expression of redband trout;
- Improving spawning opportunities for native migratory fish in both McCully Fork and Silver Creek above the culverts.

These mitigation measures specific to the fish passage waiver proposal are considered one element of the larger proposed mitigation package that will be submitted to FERC for licensing of the Mason Dam Hydroelectric Project.

### Conclusion and Recommendations

Department staff have analyzed the mitigation measures proposed by Baker County in lieu of constructing fish passage facilities at Mason Dam. We believe that the proposed mitigation provides fish passage improvements that will address multiple populations of native migratory fish. The proposed mitigation will increase accessibility to habitat for redband and bull trout, which will improve population fitness and life history diversity and maintain healthy trout populations. Native suckers and northern pikeminnow will also benefit from increased accessibility to high quality habitat, supporting healthy and genetically diverse populations. Construction of fish passage facilities at Mason Dam would lead to genetic and population viability benefits for redband trout, suckers, and northern pikeminnow. Redband trout could also see some population scale benefits, though those benefits are difficult to quantify and largely dependant on the quality of habitat to which they are being provided access. The mitigation will provide redband trout, and all other species present, access to these higher quality habitats that are more likely to lead directly to increases in species abundance and distribution. Bull trout would not benefit from fish passage facilities at Mason Dam, but bull trout passage will be improved by the proposed mitigation measures. Therefore, the proposed mitigation will result in a net benefit to native migratory fish in the upper Powder River Basin.

Pursuant to the fish passage statutes (ORS 509.580 through 509.585) and Department rules (OAR 635-412-0020 through 0025), Department staff have concluded that the measures proposed by Baker County will provide a net benefit to native migratory fish populations compared to constructing fish passage facilities at Mason Dam. The Department recommends that a fish passage waiver be granted, provided the mitigation actions are fully implemented and maintained consistent with Oregon's fish passage rules and regulations.