



M E M O R A N D U M
OREGON DEPARTMENT OF FISH AND WILDLIFE
Malheur Fish District

DATE: November 18, 2013

TO: Oregon Fish and Wildlife Commission

FROM: Shannon Hurn, Malheur District Fish Biologist
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SUBJECT: Warmsprings Dam Hydroelectric Project Fish Passage Waiver – Benefit Analysis

Warmsprings Irrigation District (WID) has applied to the Federal Energy Regulatory Commission (FERC) to construct a hydroelectric project at the existing Warmsprings Dam on the Malheur 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 Warmsprings 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 WID'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 Warmsprings Dam. In order to perform this analysis, the Department must determine the benefits to native migratory fish from each scenario (passage at Warmsprings 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 the Warmsprings 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. The Warmsprings Dam is jointly owned and operated by WID and the Bureau of Reclamation (BOR), the Malheur River downstream of the waiver site is severely water limited outside of the irrigation season, and 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 Warm Springs 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 Warm Springs Dam.

Waiver Site

Description and Operation

Warm Springs Dam is jointly owned by WID and the Bureau of Reclamation (BOR) and is operated for irrigation and flood control. It was constructed from 1918-1919, modified in 1930 and 1939, and forms Warm Springs Reservoir at river mile 125. The dam is a 106 foot high thin concrete arch structure with a crest length of 469 feet, crest elevation at 3,409 feet above sea level (ASL) and a hydraulic height of 92 feet. Warm Springs Reservoir has a surface area of 4,600 acres and a maximum depth of 79 feet. Maximum flow capacity through the dam is 2000 cubic feet per second (cfs). There is no minimum flow resulting in little to no water in the Malheur River downstream of the dam outside of the irrigation season (October to April) to the confluence with the South Fork Malheur River 3.8 miles downstream. Fish passage and fish screening facilities are not present.

The Warm Springs Dam Hydroelectric Project will be a new hydroelectric facility with a hydraulic capacity of 425 cfs, a generating capacity of 2.7 MW, and an estimated annual power output of 7,442 MWH. The hydroelectric project will utilize water released for irrigation from Warm Springs Dam. The hydroelectric project will operate when irrigation flow ranges from 100 to 425 cfs. The hydroelectric project will not change dam operations.

WID typically operates the dam for irrigation between April 15th and October 15th. The length of season and amount of water delivered depends on weather conditions and snowpack in the mountains. During the irrigation season, releases generally remain between 150 and 400 cfs but can occasionally exceed 450 cfs. During the non-irrigation season, WID does not release any water from the Warm Springs Reservoir; thus after about mid-October the Malheur River channel is normally dry below the dam. BOR occasionally operates the dam for flood control during late winter and early spring.

Upstream and Downstream Conditions

Downstream of Warm Springs Dam, the Malheur River is heavily diverted for irrigation. The first of many irrigation diversion dams occurs 22 miles downstream of the dam. Six additional dam/headgates occur between the dam and the confluence with the Snake River. These diversion structures have various configurations, but all constitute upstream fish passage barriers for most, if not all, times of year. Eighty miles downstream of the confluence with the Snake River, Brownlee Dam forms the upper most dam within Idaho Power Company's Hells Canyon 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.

In-stream habitat conditions below Warm Springs Dam in the Malheur River are described as poor in the Malheur River Basin Fish Management Plan due to the artificial flow regime created by irrigation water impoundment and release. A typical discharge pattern at the dams consists of irrigation releases from mid-April through mid-October followed by a complete shut down for the remainder of the year. In the mainstem Malheur, most of the flow during non-irrigation season comes from the South Fork Malheur River. The river averages 100 feet wide in most sections and contains boulders, bedrock, and cobble substrate. Riparian condition in this section is considered good as most of the river is contained within narrow, rocky canyon walls. This section remains cool most of the year due to the bottom water withdrawal from Warm Springs Reservoir. In good water years, the Department stocks rainbow trout as a recreational fishery between Warm Springs Dam and the South Fork Malheur River.

The Department's barrier database identifies only two barriers on the Malheur River above Warm Springs Reservoir; Drewsey Ditch just above the town of Drewsey and the Drewsey Ranch diversion structure located just downstream of the Highway 20 road crossing. The Drewsey Ditch was retrofitted with fish screening and fish passage facilities in 2009. However, at least twelve additional in-stream, full-spanning temporary diversion structures are known to exist above Warm Springs Reservoir. Most are small "push-up" type diversions that rely on annual excavation and placement of streambed materials within the channel to create a dam, and typically wash-out during high winter or spring flows. The diversion structures direct water into small irrigation canals and ditch lines. Above the Drewsey Ditch, three of the Dryer diversion ditches are screened.

The Middle Fork Malheur River above Warm Springs Reservoir can be split into two sections based on general habitat condition. From the headwaters downstream to approximately Wolf Creek the fish habitat is considered good overall and contains a number of native fish; including bull trout (*Salvelinus confluentus*), redband trout (*Oncorhynchus mykiss gairdnerii*), and mountain whitefish (*Prosopium williamsoni*). Habitat conditions in the Malheur River below Wolf Creek are described as poor in the Malheur River Basin Fish Management Plan due to intensive livestock grazing, water withdrawal, and poor water quality. Additionally the fish management plan states, "numbers of cold water fish decrease to virtually none in the downstream areas as water quality and quantity decrease during the irrigation season". This is clearly demonstrated in the twelve miles of the Middle Fork Malheur River from Highway 20 to Warm Springs Reservoir. It averages 50 feet wide, often is very turbid, and temperatures exceed lethal limits for trout several months each year.

Flow regimes in the Malheur River basin are out of sync with the regimes to which native migratory fish evolved and adapted. Historically, high flows arrived in the spring to facilitate the peak migration of spawning trout onto gravel beds and out-migrating juveniles to relocate downstream to unoccupied habitat. Flows would have increased again in the fall allowing fish to migrate to over-wintering habitat. Under the current irrigation-driven flow regime, water is removed from the Middle Fork Malheur River as early as late March and diverted into fields for flood irrigation, hindering migration, or impounded in Warm Springs Reservoir. Flows below

Warm Springs Dam are constant during the irrigation season from April to October, which eliminates migratory cues from natural flow patterns. River flow is then shut off completely in the fall through winter, which eliminates fish habitat, except for residual pools that may remain or form due to precipitation.

Fish Distribution and Management

The Malheur River currently and historically supported native migratory fish. Historically, the river supported summer steelhead (*O. mykiss*) and spring Chinook (*O. tshawytscha*). However, due to the Hells Canyon Complex Dams and other barriers in the Malheur Basin, these species are no longer present in the Malheur River. Bull trout, a federally threatened species, and redband trout, a state sensitive species, are currently present in the Malheur River drainage. Other native migratory species that are currently present include northern pikeminnow (*Ptychocheilus oregonensis*), suckers (largescale (*Catostomus macrocheilus*), and bridgelip (*C. columbianus*)) and mountain whitefish (*Prosopium willamsoni*). A complete list of species found in the Malheur River is included in Appendix E.

Bull trout distribution within the Malheur River basin is limited to upper Middle Fork Malheur River and North Fork Malheur River, above Agency Valley Dam. Fish passage facilities are not present at Agency Valley Dam. The Middle Fork and North Fork Malheur populations do not interact. Bull trout have been documented in the Middle Fork Malheur River 20 miles upstream of Warm Springs Reservoir. Radio-telemetry surveys conducted in the early 2000's documented bull trout residence in the upper Middle Fork Malheur River. One individual was tagged in an upper tributary and was subsequently relocated 30 miles downstream near Wolf Creek. Currently, the downstream limit of suitable habitat conditions for bull trout occurs near the confluence of the Middle Fork Malheur River and Wolf Creek. Further migration downstream is severely limited by poor water quality, high summer water temperatures, diversion structures, fish passage obstructions, and the presence of non-native piscivorous fish. Fluvial bull trout typically migrate upstream in late spring through fall to spawn (spawning occurs in fall), then migrate back downstream to find over-wintering habitat following spawning. Resident bull trout make smaller migrations in between the Middle Fork Malheur River and tributaries to spawn, and overwinter within a few miles of where they spawn.

Redband trout populations persist in tributaries upstream and downstream of Warm Springs Reservoir, but presence immediately downstream of the dam or in the reservoir has not been confirmed. Viable populations of redband trout exist in the headwaters of the North Fork Malheur River, Middle Fork Malheur River, South Fork Malheur River, and several direct tributaries of the Malheur River (i.e. Hog Creek and Cottonwood Creek below Juntura). *O. mykiss* sp. have been captured in the reservoir and lower river but they are believed to be hatchery stocked rainbow trout and not native redband trout, though genetic analysis has not been performed to rule out the presence of redband trout. Current the flow regime resulting from storage and withdrawal of irrigation water no longer matches the natural timing of migration associated with an unaltered hydrograph and is unsuitable for redband trout migration. Redband trout in the South Fork Malheur River could potentially migrate up the mainstem Malheur where they would encounter Warm Springs Dam. However, given the lack of water below the dam during spawning migrations (early spring), this is unlikely.

Warm Springs Reservoir is affected by irrigation drawdown, turbidity, high temperatures, and is lacking habitat to support native trout. The Department manages the reservoir for recreational fishing with annual stocking of rainbow trout and occasional stocking of warmwater species. The reservoir is regularly drained to minimum pool (1,400 acre-feet) when stored water is released for irrigation purposes. The fish community consists of hatchery rainbow trout (*O. mykiss*), northern pikeminnow (*Ptychocheilus oregonensis*), suckers (largescale and bridgelip), bass (largemouth (*Micropterus salmoides*) and smallmouth (*M. dolomieu*), bluegill (*Lepomis macrochirus*), channel catfish (*Ictalurus punctatus*), brown bullheads (*Ameiurus nebulosus*), yellow perch (*Perca flavescens*), white crappie (*Pomoxis annularis*), chiselmouth (*Acrocheilus alutaceus*), dace (*Rhinichthys* sp.) and redbreast shiner (*Richardsonius balteatus*). Currently, yellow perch appear to be the dominant species. In 2012, fifty spider-block structures were placed in Warm Springs Reservoir to add additional habitat for warmwater fish. However, these structures do little to provide habitat for native fish, particularly trout, whose abundance is limited by high temperatures and poor water quality within the reservoir. In good water years, the Department also stocks hatchery rainbow trout in the cold water tailrace of the dam.

Mountain whitefish distribution has not been thoroughly studied in the Malheur basin. However, historic Departmental angler survey and trapping records conducted within the Reservoir in the 1950's and 60's did not indicate any whitefish trapped or caught by anglers. Mountain whitefish were observed by the Department above the town of Drewsey, upstream of the reservoir, during electro-fishing sampling efforts in 1982-83 (Risso and Hill, 2012). Wynoski and Whitney (1979) state that typically whitefish inhabit "larger streams with average temperatures of 48-52 degrees fahrenheit," which supports the Department only observing mountain whitefish in the higher reaches of the Middle Fork Malheur where temperatures are cooler. Therefore, it is assumed that the distribution of mountain whitefish is limited to the Middle Fork Malheur River upstream of Warm Springs Dam.

Northern pikeminnow have been collected downstream of Warm Springs Dam, within Warm Springs Reservoir, and upstream of the reservoir. They are not found in high numbers in the reservoir or the lower Malheur River, but seem to prefer the colder water found in upper Middle Fork Malheur River and tributaries. Northern pikeminnow are also found in the North Fork Malheur River, Beulah Reservoir, and upper Middle Fork Malheur River.

Benefits of Fish Passage at Warm Springs Dam

As described in the introduction of this document, analyzing the benefits of fish passage at Warm Springs 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.

All native migratory species present above and below Warm Springs Dam would have the potential to use fish passage facilities if constructed. However, current native migratory fish

species presence at the dam is limited to northern pikeminnow, largescale sucker, and bridgelip sucker. During especially good water years it could be possible for redband trout to be present, though this species' presence has not been documented by the Department. Bull trout are not present, and it is very unlikely that bull trout would ever be present given current hydrology resulting from irrigation diversions and water storage, release strategies at Warm Springs Dam, and habitat conditions immediately up and downstream of the dam. The benefits from passage, or lack thereof, for each species is discussed below.

Native suckers: Bridgelip and largescale suckers are tolerant of warmer water temperatures and maintain viable populations above and below Warm Springs Dam. Upper lethal temperature limits for these species has been calculated at 85 degrees Fahrenheit (Scott and Crossman, 1973). While better able to tolerate the poor water quality they are still limited by poor spawning and rearing habitats and likely by the presence of large piscivorous fish such as bass. Typically suckers are easily preyed upon by larger predatory species and therefore could be affected by the presence of large predaceous fish (Scott and Crossman, 1973). Populations of native suckers persist upstream and downstream of the dam, therefore fish passage facilities at the dam would allow these currently separate populations the opportunity to migrate back and forth when migrational cues dictated. Suckers are spring spawners, but typically spawn later in the spring than redband, therefore they would likely be migrating when water is being released from Warm Springs Dam. Suckers spawn in deep sandy areas of streams, along the edges of downstream ends of pools containing fine gravel and sand, or in gravelly or sandy shoals in lakes (Scott and Crossman, 1973, Wydoski and Whitney, 1979). Substrate within Warm Springs Reservoir is mostly comprised of very fine silt and habitat upstream is mostly a combination of gravels and cobbles, but some suitable spawning habitat might exist in the reservoir and the Middle Fork Malheur River upstream of the reservoir. Immediately downstream of the dam substrate is mostly comprised of cobble and boulders and is not suitable for sucker spawning. The Department concludes that providing passage at Warm Springs Dam would result in a benefit to sucker species through increased population viability and genetic diversity by providing 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 native suckers abundance and distribution. It is expected that population dynamics would not change greatly due to poor habitat conditions, though a series of good water years or habitat improvements could lead to population scale benefits.

Northern pikeminnow: Northern pikeminnow are present both upstream and downstream of Warm Springs Dam, but are more prevalent in the cooler reaches of the the Middle Fork Malheur higher up in the basin. Northern pikeminnow spawn in the late spring through early summer and likely would be present during times of irrigation releases from Warm Springs Reservoir. Pikeminnow spawn in gravelly shallows and can also spawn in lakes near tributary streams (Scott and Crossman, 1973). It is unclear how current habitat conditions within the reservoir, upstream and downstream of the dam, and the assemblage of non-native fish affect northern pikeminnow populations. Suitable spawning habitats occur in project vicinity and the species is present above and below the dam. Therefore the Department concludes that providing passage at

Warm Springs Dam would likely benefit northern pikeminnow through increased population viability and genetic diversity by providing access to additional habitats and interaction 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 northern pikeminnow abundance and distribution. It is expected that population dynamics would not change greatly due to poor habitat conditions, though a series of good water years or habitat improvements could lead to population scale benefits.

Bull trout: It is very unlikely that the bull trout population would benefit from the installation of fish passage facilities at Warm Springs Dam. Current bull trout distribution is limited to high quality habitat located 20 miles upstream of the upper end of Warm Springs Reservoir. Habitat within and immediately upstream of the reservoir is unsuitable due to high summer water temperatures, low dissolved oxygen, low water quantity, water diversions and presence of piscivorous non-native fish. Connectivity with the North Fork Malheur population of bull trout is blocked by the Agency Valley Dam on the North Fork Malheur, and by the lack of water and overall poor habitat conditions present below Warm Springs Dam when fluvial bull trout would be seeking over-wintering habitats and making spawning migrations. The Department concludes that providing passage at Warm Springs Dam would have no benefit to bull trout.

Redband trout: It is unlikely that the redband trout population would benefit from the installation of fish passage facilities at Warm Springs Dam without significant changes in dam operation, reservoir storage, and water management in the Malheur River basin. The current flow regime, poor water quality, and presence of non-native fish severely impedes the potential for redband trout to persist immediately upstream and downstream of the dam. Ideally passage at Warm Springs Dam would reconnect the Middle Fork Malheur population with those residing below the dam. If operational changes were made Warm Springs Dam to include a minimum instream flow, the potential may exist for redband trout to persist in the Malheur River below the dam. In their hydroelectric project proposal, WID is not proposing to change operations of the dam, therefore the flow regime is not expected to change. Further, the current genetic make up of *O. mykiss* sp. below the dam is unconfirmed. Rainbow trout captured in Warm Springs Reservoir and below the dam are believed to be hatchery stocked fingerlings and not native redband trout. Redband trout migrating out of the Middle Fork Malheur River and through the reservoir would encounter many miles of inhospitable habitat to reach another population of redband trout, and vice versa if migrating upstream to find suitable spawning habitat or cold water refuge. Given the altered flow regimes in the upper Malheur River, successful migration is unlikely. The Department concludes that very limited to no benefit to redband trout would exist from providing passage at Warm Springs Dam. Any potential redband trout passage would be limited to extremely good water years, when water would be released early from Warm Springs Reservoir for flood control. This is extremely rare, and even in these rare cases redband trout would still have to navigate through poor habitat and fish passage obstructions to reach suitable spawning habitat.

Mountain Whitefish: It is unlikely that the mountain whitefish population would benefit from the installation of fish passage facilities at Warm Springs Dam. Mountain whitefish distribution is

limited to the Middle Fork Malheur River upstream of the reservoir. According to Wynoski and Whitney (1979), they are generally found in riffle areas and pools of larger streams, and sometimes lakes. Similar to bull trout, mountain whitefish are fall spawners, with spawning occurring from October to as late as December, on gravel riffles in streams or shoals in lakes (Wynoski and Whitney, 1979). Based on this information, and the lack of empirical evidence suggesting otherwise, it is the Department's opinion that mountain whitefish are not found within Warmsprings Reservoir or immediately downstream due to insufficient habitat quality. Therefore, the Department concludes that providing fish passage at Warmsprings Dam would have no benefit to mountain whitefish.

Fish passage, if provided at Warmsprings Dam, would not likely provide benefits to redband trout, bull trout or mountain whitefish, and would only provide direct benefits to native sucker species and northern pikeminnow. Largescale and bridgeline suckers are the only native migratory fish species known to have substantial populations immediately upstream and downstream of the dam. They would be the primary species present to utilize fish passage facilities, along with limited use by northern pikeminnow. However, the existing populations of these species are persistent and do not appear to be directly limited by the obstruction created by Warmsprings Dam. The Department concludes that providing passage at Warmsprings Dam would potentially result in improved genetic diversity and increased population viability for native suckers and northern pikeminnow.

Proposed Mitigation in lieu of Fish Passage

In lieu of providing fish passage at Warmsprings Dam, WID proposes to improve passage conditions at the Dryer Diversion, located on the Middle Fork Malheur River 39 miles upstream of Warmsprings Dam at river mile 159. These passage improvements include: (1) replacing the existing Dryer push-up dam with a permanent rock diversion structure, known as a wing dam that will provide the head (differential water surface elevation) necessary to withdraw water, as well as provide passage around the diversion outside of the irrigation season and when summertime flow amounts allow; (2) installing a headgate structure to regulate water withdrawal into the Dryer Diversion ditch; (3) sizing/designing the wing dam to be stable during high flows to avoid mass failure at the site; and (4) providing long term maintenance of the diversion and fish passage during the lifetime of the hydroelectric project.

WID's proposal is to replace the push-up dam with a permanent rock wing dam diversion and bypass channel in order to meet Department fish passage criteria while providing for the water user to exercise their appropriated water right. Currently, the push-up dam is constructed annually as early as mid-June or as late as August (depending on stream flows) using heavy equipment in the stream channel, creating a barrier to fish passage and requiring extensive stream bed disturbance. The push-up dam completely blocks upstream (and sometimes downstream) fish passage after its construction and often remains in place after the irrigation season until it is washed out by high flows in late winter or early spring. Overall, the construction and use of the push-up dam is a cause of stream bank failure, erosion and sedimentation, potential oil and fuel contamination, and can block fish passage for a substantial portion of the year.

The proposed rock wing dam diversion will direct irrigation water along the west bank of the river and into the forebay of the new headgate. The headgate structure will be adjustable to withdraw the allowable irrigation flow and the remaining water will bypass the rock diversion along the east side of the river. This excess flow will provide fish passage via a bypass channel that will mimic stream simulation conditions in the Middle Fork Malheur River, meaning the bypass channel will have gradient characteristics and bed material consistent with the existing natural channel. Other features may be designed into the bypass channel to simulate the hydrodynamics found in a natural stream, such as hydraulic shadow, channel roughness elements, a simulated thalweg and complex flow to dissipate energy and to provide adequate hydraulics necessary for fish passage.

The Dryer Diversion site is located within bull trout and redband trout habitat. Bridgelip and largescale suckers, northern pikeminnow, and mountain whitefish are also assumed to be present because they have been documented to occupy stream reaches in the proximity of the mitigation area. Department staff believes that the benefits of year-round volitional fish passage at the Dryer Diversion, the construction of a permanent diversion that avoids yearly disturbances to the stream channel, and inclusion of a new headgate at the point of diversion will be more beneficial to native migratory fish than providing passage at Warm Springs Dam.

Benefit Analysis

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

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

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 measures described above will address native migratory fish population limitations by:

- Improving passage conditions for native migratory fish while water is available;
- Supporting full expression of bull trout life histories;
- Maintaining connectivity among native migratory fish populations;
- Limiting excessive diversion of water and fish entrainment during winter months with the new headgate structure; and
- Eliminating the need for annual in-stream disturbance associated with push-up dams.

Within the proximity of the mitigation area all native migratory species present in the basin have been documented occupying and/or migrating in the Middle Fork Malheur River. All native migratory species present in the basin will benefit from improved passage at the Dryer Diversion site by maintaining connectivity between populations and allowing the full expression of life-histories. The benefits to these species are discussed below.

Native suckers and northern pikeminnow: Largescale sucker, bridgelip sucker, and northern pikeminnow all spawn during the late spring to late summer months depending on water temperature. Suckers and pikeminnow have been documented making migrations up rivers to spawn. Under current operation, the Dryer Diversion push-up dam is in place during the spawning period, limiting the migration of these species, which are currently distributed both above and below the Dryer Diversion. By providing year-around passage these fish can access more spawning members of their species and locate better spawning habitat thereby increasing their genetic fitness and maintaining more robust populations. Providing passage at Warm Springs Dam would result in limited benefits to suckers and northern pikeminnow through increased population viability and genetic diversity, whereas the mitigation actions at the Dryer Diversion discussed in the previous section will allow these species improved access to higher quality habitats, as compared to passage at Warm Springs Dam. It is the Department's opinion that the mitigation actions discussed herein will provide a benefit to suckers and northern pikeminnow through increased access to spawning and rearing habitats, increased population viability, and improved genetic diversity. These benefits will occur in the upper reaches of the Middle Fork Malheur River where habitat quality and non-native predators are less prevalent; therefore, the Department has determined that the mitigation actions described provide a net benefit to suckers and northern pikeminnow as compared to fish passage at Warm Springs Dam.

Bull trout: The bull trout population in the Middle Fork Malheur River includes fluvial (migratory) and resident portions. The fluvial life-history appears to be waning. The population expressing this life history appears to have experienced an increase in mortality rate due to entrainment into irrigation diversions, inability to migrate out of poor quality habitat, and predation by non-native fish. The fluvial life history allows for recolonization of habitat, expansion of the population, and increased genetic fitness. Fluvial fish are often larger and more fecund than their resident counterparts. Under current operation, the Dryer Diversion push-up dam is in place during the bull trout fall spawning migration, blocking spawners from returning to spawning grounds. Additionally fluvial bull trout that moved downstream in the spring would be unable to relocate above the barrier to seek cold water refugia. Providing passage at Warm Springs Dam would result in no appreciable benefit to bull trout, whereas the mitigation actions at the Dryer Diversion discussed in the previous section will provide benefits by allowing access to spawning grounds and cool water refugia habitats. It is the Department's opinion that the mitigation actions discussed herein, will provide a benefit to bull trout through increased population viability, increased access to spawning grounds, and improved access to cool water rearing habitats, which could increase bull trout abundance and distribution. Therefore, the Department has determined that the mitigation actions described provide a net benefit to bull trout as compared to fish passage at Warm Springs Dam.

Redband trout: While not a cold-water obligate, redband trout are becoming isolated to the headwater basins due to climate change, non-native predation, entrainment into diversion ditches and passage barriers. Under current operation, the Dryer Diversion is often in place after the peak spawning period of mid-April. However, in some years, particularly low water years when a portion of the dam may still be in place, fish residing below the dam may be partially blocked or delayed from accessing good spawning habitat resulting in a loss of genetic fitness. The addition of a headgate to the Dryer ditch will help reduce redband trout entrainment. Providing passage at Warm Springs Dam would result in no to very limited appreciable benefit to redband

trout, whereas the mitigation actions at the Dryer Diversion discussed in the previous section will provide benefits by allowing improved access to spawning grounds and cool water refugia habitats for those fish moving upstream from other downstream tributaries and habitats. It is the Department's opinion that the mitigation actions discussed herein, will provide a benefit to redband trout through improved population viability, increased access to spawning grounds, and higher quality rearing habitats, which could increase redband trout abundance. Therefore, the Department has determined that the mitigation actions described provide a net benefit to redband trout as compared to fish passage at Warm Springs Dam.

Mountain whitefish: Mountain whitefish prefer the cooler reaches of streams and are much more likely to be present at the mitigation site. Given the spawning and migration timing for mountain whitefish (fall), it is likely that the Dryer Diversion is currently a complete barrier during their upstream spawning migration. Habitat in this reach, especially upstream of the Dryer Diversion, is much more suitable for mountain whitefish as compared to habitat in the proximity of Warm Springs Dam and Reservoir. Therefore, it is the Department's opinion that the mitigation actions discussed herein, will provide a benefit to mountain whitefish through increased population viability, access to spawning grounds, and improved access to cool water rearing habitats, which could increase mountain whitefish abundance and distribution. Therefore, the Department has determined that the mitigation actions described provide a net benefit to mountain whitefish as compared to fish passage at Warm Springs Dam.

In addition to the species specific benefits, the mitigation project will provide benefits to the riverine ecosystem. These benefits include the installation of a headgate structure and elimination of annual in-stream disturbance. The installation of a headgate will allow accurate regulation of water diverted. Currently, the water user diverts as much water as needed and adjusts the amount diverted with a notch in the push-up dam. The headgate will allow the water user to have greater control over the amount of water diverted and to ensure that stream flow in excess of the water right will remain in-stream. The elimination of annual stream bed disturbance caused by constructing the push-up dam will reduce sedimentation and erosion in the Middle Fork Malheur River.

Further, the landowner and water user have been very proactive in partnering with the Department and US Fish and Wildlife Service to improve in-stream conditions on the Middle Fork Malheur River. This project will help support ongoing progress to improve conditions in the basin.

Conclusion and Recommendations

Department staff have analyzed the mitigation measures proposed by WID in lieu of constructing fish passage facilities at Warm Springs Dam and 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 native migratory fish habitat, improve population fitness, and maintain healthy populations resulting in a benefit to native migratory fish in the Middle Fork Malheur River. Construction of fish passage facilities at Warm Springs would lead to genetic and population viability benefits for suckers and northern pikeminnow. Suckers and northern pikeminnow will also benefit from the mitigation measures, through genetic fitness and population viability increases, but will also see improved access to higher quality

habitats as compared to passage at Warm Springs Dam. Access to these higher quality habitats are more likely to lead directly to increases in species abundance and distribution. In addition, bull trout, redband trout and mountain whitefish will benefit from the mitigation measures, but would not be affected by passage facilities at Warm Springs Dam. Therefore, the proposed mitigation will result in a net benefit to native migratory fish in the Malheur 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 Warm Springs Irrigation District will provide a net benefit to native migratory fish populations compared to constructing fish passage facilities at Warm Springs 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.

APPENDIX E

Fish Species^a Found in the Malheur River Basin

Common name		Scientific name
GAMEFISH		
Trouts--Family Salmonidae		
Redband trout		<i>Oncorhynchus sp.</i>
Rainbow trout		<i>Oncorhynchus mykiss</i>
(Oak Springs Hatchery strain) ^b		
(Cape Cod Hatchery strain) ^b		
(Eagle Lake Hatchery strain) ^b		
Cutthroat trout		<i>Oncorhynchus clarki</i>
(Mann Lake Lahontan strain) ^b		
Brook trout ^b		
Bull trout		<i>Salvelinus confluentus</i>
Mountain whitefish		<i>Prosopium williamsoni</i>
Sunfishes--Family Centrarchidae		
Largemouth bass ^b		<i>Micropterus salmoides</i>
Smallmouth bass ^b		<i>Micropterus dolomieu</i>
Black crappie ^b		<i>Promoxis nigromaculatus</i>
White crappie ^b		<i>Promoxis annularis</i>
Warmouth ^b		<i>Lepomis gulosus</i>
Bluegill ^b		<i>Lepomis macrochirus</i>
Pumpkinseed ^b		<i>Lepomis gibbosus</i>
Perches--Family Percidae		
Yellow perch ^b		<i>Perca flavescens</i>
Bullhead catfishes--Family Ictaluridae		
Channel catfish ^b		<i>Ictalurus punctatus</i>
Brown bullhead ^b		<i>Amieurus nebulosus</i>
Flathead catfish ^b		<i>Pylodictis olivaris</i>

^a Common and scientific names of fishes based on: Robins, C.R., Chairman. 1980. A list of common and scientific names of fishes from the United States and Canada, 4th edition. American Fisheries Society (Committee on Names of Fishes) Special Publication 12, Bethesda, Maryland.

^b Introduced species.

Common name		Scientific name
Crayfish		Crayfishes--Family Asticidae <i>Pacifasticus gambeli</i> <i>Pacifasticus leniusculus</i>
Bullfrog	Bullfrogs--Family Ranidae	<i>Rana catesbeiana</i>
NONGAME FISH		
Bridgelip sucker Largescale sucker	Suckers--Family Catostomidae	<i>Catostomus columbianus</i> <i>Catostomus macrocheilus</i>
Common carp ^b Chiselmouth Redside shiner Longnose dace Speckled dace Northern pikeminnow <i>oregonensis</i> Tui chub	Minnnows--Family Cyprinidae	<i>Cyprinus carpio</i> <i>Acrocheilus alutaceus</i> <i>Richardsonius balteatus</i> <i>Rhinichthys cataractae</i> <i>Rhinichthys osculus</i> <i>Ptychocheilus</i> <i>Gila bicolor</i>
Mottled sculpin	Sculpins--Family Cottidae	<i>Cottus bairdi</i>

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