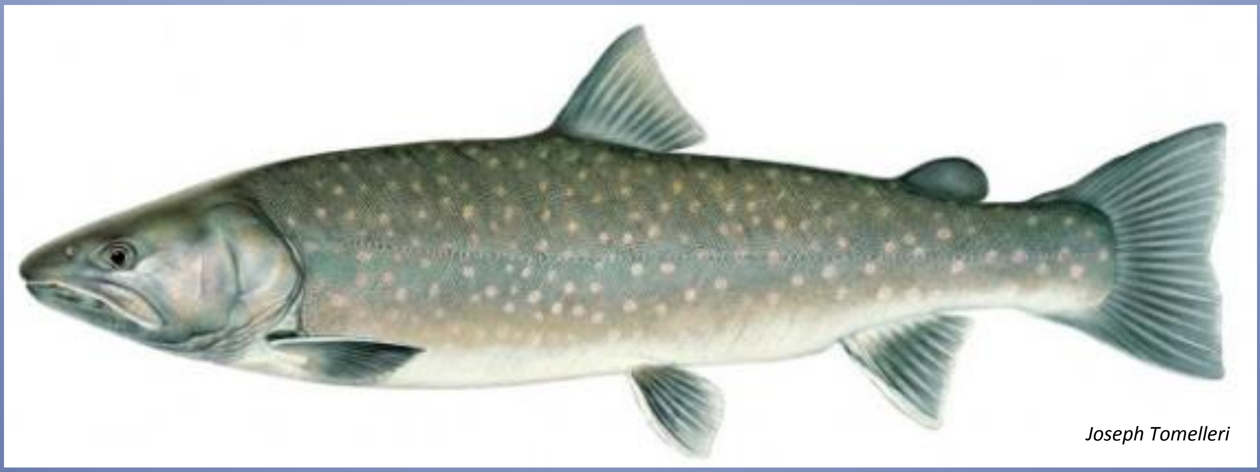

Upper Malheur Watershed Bull Trout Conservation Strategy

Malheur River Bull Trout Technical Advisory Committee - Prepared with assistance provided by QW Consulting, LLC

Revised: March 13, 2021

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Part I – Strategy Background

Upper Malheur Watershed Bull Trout Conservation Strategy

Malheur River Bull Trout Technical Advisory Committee

A. Contributing Agencies and Participants

Burns Paiute Tribe (BPT) - Erica Maltz, Kristopher Crowley, and Brandon Haslick

Oregon Department of Fish and Wildlife (ODFW) - David Banks and Benji Ramirez

U.S. Forest Service (USFS) - Steve Namitz, Kate Olsen, and Hazel Owens

U.S. Fish and Wildlife Service (USFWS) - Chris Allen, Suzanne Anderson, and Justin Martens

Bureau of Reclamation (BOR) - Dmitri Vidergar

B. Purpose

Goal: Restore and protect native fish populations in the Upper Malheur River Watershed while retaining angling opportunities for native fish in High Lake.

Objective: Remove non-native Brook Trout (*Salvelinus fontinalis*) from up to 10 waterways in the Upper Malheur River Watershed from 2018 to 2028.

Objective: Restore rehabilitated waterways with native species sourced from existing populations in the Upper Malheur River Watershed.

Objective: Establish angling opportunities for salmonids in High Lake by 2020.

This conservation strategy identifies geographic areas and actions to support recovery of Bull Trout in the Upper Malheur River Watershed (Figure 1). The actions are intended to address the primary threat of Brook Trout as identified in the USFWS's *Recovery Plan for the Coterminous United States Population of Bull Trout* (*Salvelinus confluentus*) (Recovery Plan) (USFWS 2015). This document serves as a foundation for the Malheur River Bull Trout Technical Advisory Committee's (TAC) effort to develop site-specific conservation strategies for the eradication of Brook Trout. Agencies participating in the TAC are also working independently to further Bull Trout restoration by addressing additional threats.

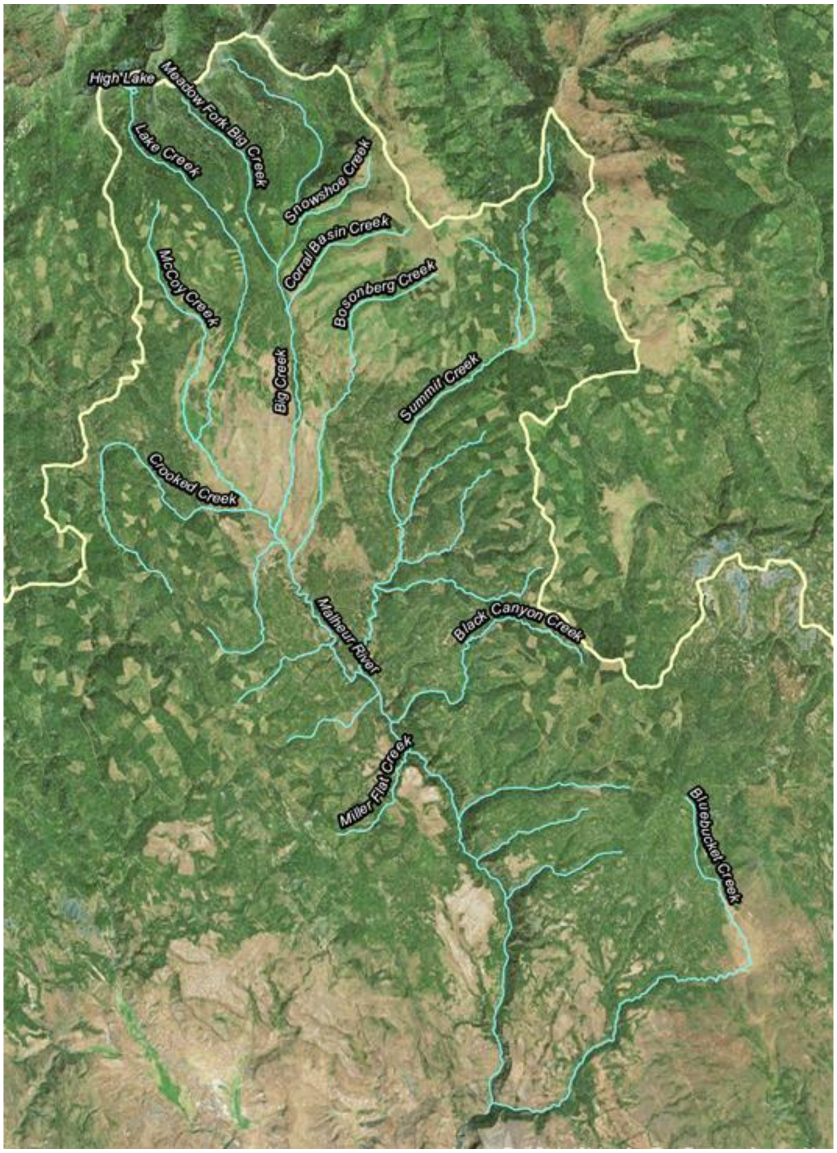

Figure 1. Map of the Upper Malheur River Watershed where the Malheur River Bull Trout Technical Advisory Committee plans to implement a Bull Trout conservation strategy.

C. Background and Problem Statement

C.1 Bull Trout Recovery Chronology

The coterminous United States population of Bull Trout was listed as threatened on November 1, 1999 (USFWS 1999). Following the listing, draft recovery plans were completed in 2002 (USFWS 2002) and 2004 (USFWS 2004); however the plans were never finalized. In 2008, a 5-year review (USFWS 2008) was released reaffirming the species status as threatened. On October 18, 2010, the USFWS published a final Critical Habitat designation (USFWS 2010), for the coterminous United States population of Bull Trout, followed by the release of the Recovery Plan in 2015.

Although the 2002 and 2004 draft recovery plans were not finalized, they laid the foundation for the Recovery Plan. At the core of the Recovery Plan are six geographically defined recovery unit implementation plans (RUIP) that identify conservation actions to address threats (e.g., loss of habitat connectivity and passage barriers, effects of poor land-management practices, non-native fish introgression, competition, and predation). To achieve recovery, the Recovery Plan requires management of primary threats identified in the RUIP. This conservation strategy includes proposed actions to address threats associated with Brook Trout introgression, competition, and predation occurring in the Upper Malheur River Core Area.

C.2 Malheur River Bull Trout Technical Advisory Committee Chronology

In an effort to annually convene federal and state agencies to present Malheur River-oriented Bull Trout recovery work and to coordinate multi-agency monitoring activities, the Malheur River Bull Trout Forum was initiated in 1997 through the BPT's Bonneville Power Administration (BPA)-funded resident fish Project 1997-019-00. Because the annual meetings were not adequate for developing collaborative actions, particularly those associated with Brook Trout removal, the USFS, ODFW, USFWS, BOR, and BPT formed the TAC in 2013.

C.3 Upper Malheur River Bull Trout Status and Trends

The Upper Malheur River Bull Trout Core Area represents one of two core areas in the Malheur River Watershed and includes all possible Bull Trout life history forms (i.e., resident, fluvial, and adfluvial) (USFWS 2015). Redd count surveys (Perkins 2000-2009) conducted in spawning tributaries suggest population trends are declining for the migratory life history form. Compared to other native and non-native species, the relative abundance of Bull Trout is also declining. Furthermore, introgression with Brook Trout and legacy effects of degraded land use, exacerbated by changing climate conditions, will likely affect Bull Trout population stability and growth in the future.

From data collected in 1991 and 1992 during multiple pass removal sampling, ODFW estimated the population of age-1+ Bull Trout was 4,132 individuals in the North Fork Malheur River (Buchanan et al. 1997). In the North Fork Malheur River, the USFWS (2002) estimated adult abundance was between 250 and 300 individuals based on observed spawner-to-redd ratios.

Developing accurate adult Bull Trout abundance estimates for the Upper Fork Malheur River is problematic. In 1993 and 1994, ODFW estimated the population of age-1+ Bull Trout was 3,554 individuals (Buchanan et al. 1997). Due to the presence of Brook Trout, Bull Trout redds cannot be distinguished from those of Brook Trout in the Upper Fork Malheur River (USFWS 2002). Subsequently, inferences have been made based on a calendar date. Perkins (2000-2009) identified redds observed before September 15th as being constructed by Bull Trout.

The TAC recognizes the population estimates for the North and Upper forks of the Malheur River as suspect since they are outdated and do not reflect population changes that may be a result of the prolonged drought that the region experienced.

C.4 Bull Trout Timing and Movement in the Upper Fork Malheur River

Through BPA Project 1997-019-00, the BPT has identified the timing and spatial extent (Figure 2) of seasonal movements for adult and sub-adult Bull Trout in the Upper Fork Malheur River Watershed (Schwabe 2000; Fenton and Schwabe 2003; Fenton 2004; Fenton 2005). Studies (Fenton and Schwabe 2003; Perkins 1999-2009) have shown that fluvial Bull Trout in the Upper Malheur River Watershed migrate into headwater areas from May to July/August, hold until spawning in late-August to mid-September, and migrate downstream into overwintering habitat by the end of September. Overwintering of adult migratory Bull Trout is thought to occur between river mile (RM) 170-187 (Fenton and Schwabe 2003). The majority of downstream

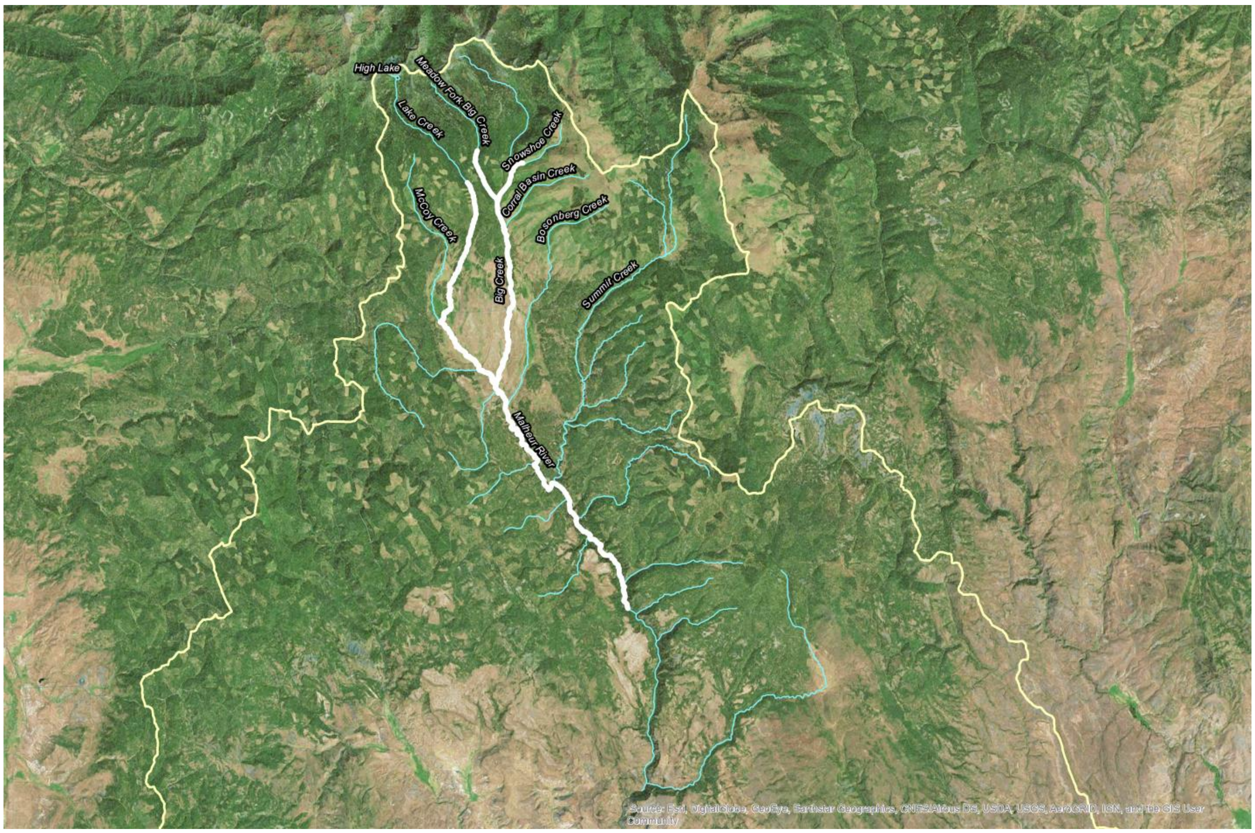

Figure 2. Spatial extent of adult and sub-adult Bull Trout movements observed during a telemetry study in the Upper Malheur River Watershed.

migration appears to occur prior to December; however, telemetry data suggest migration continues to occur throughout the winter months.

Fluvial migration into Big and Meadow Fork Big creeks has been documented; however, migratory movement into Lake Creek appears to be limited, potentially due to thermal barriers (Fenton and Schwabe 2003; DeHaan et al. 2010a). Suppositions of thermal impediments are supported by recorded mean monthly maximums of 69.8-75.2° F in the lower stretches of Lake Creek from June to August (BPT, unpublished data).

To date, there have been no investigations to evaluate the relative dominance of the fluvial or resident life history strategies. The TAC believes the adfluvial form does not exist in the Upper Malheur River Watershed due to proximity of the headwaters to the Warm Springs Reservoir and based on results from the BPT's 2000-2005 telemetry study in which no individuals were documented using the reservoir. Based on limited observations during the 2000-2005 telemetry study, Bull Trout in Lake Creek are assumed to be of the resident form.

C.5 Brook Trout/Bull Trout Interactions in the Upper Malheur River

C.5.1 Brook Trout Introductions

Non-native Brook Trout currently exist in high numbers throughout the Upper Malheur River and its tributaries. The source of Brook Trout in the Upper Malheur River is understood to be from authorized stockings in High Lake from as early as the 1930s as well as authorized and unauthorized stockings throughout the basin prior to the 1990s (Bowers et al. 1993). These stockings have led to a Brook Trout distribution in the Upper Malheur River Watershed (Figure 3) that completely overlaps that of native Bull Trout (Figure 4) and Redband Trout. Although the historic presence or absence of native fish cannot be proven, the TAC believes High Lake was fishless prior to the stocking efforts.

C.5.2 High Lake and Upper Lake Creek: Brook Trout Seed Sources

High Lake is a 5.8-acre lake located in the Strawberry Mountain Wilderness at an elevation of 7,500 feet (Figure 1). Except for a spring that delivers a small amount of perennial water, all stream flow into High Lake is ephemeral. The breeding population of Brook Trout in High Lake is a recognized source for downstream recruitment to Brook Trout clusters found in Bull Trout habitat located in the middle reaches of Lake Creek (Fenn 2004b; DeHaan et al. 2010a).

Lake Creek, High Lake's outflow, flows approximately 12.5 miles from High Lake to its confluence with Big Creek where the two form the Upper Malheur River (Figure 1). Located at RM 11 in Lake Creek is Lake Creek Falls which functions as a complete barrier to upstream fish passage. Much of the approximately 1.5 stream miles above Lake Creek Falls (Upper Lake Creek) are characterized by channel widths of 3.2-6.6 feet and moderate gradients (2-5%) with intermittent steep reaches (15-20%) that may prevent upstream fish passage. Lake Creek is joined by two small perennial streams within one mile of High Lake. Brook Trout are the only fish species present above Lake Creek Falls.

Brook Trout are found in abundance in High Lake and throughout Bull Trout spawning habitat downstream of Lake Creek Falls to Logan Valley (Table 1). Despite recent removal efforts, High Lake and Upper Lake Creek remain exclusively Brook Trout strongholds (Crowley 2016).

Figure 3. Known distribution of non-native Brook Trout in the Upper Malheur River Watershed.

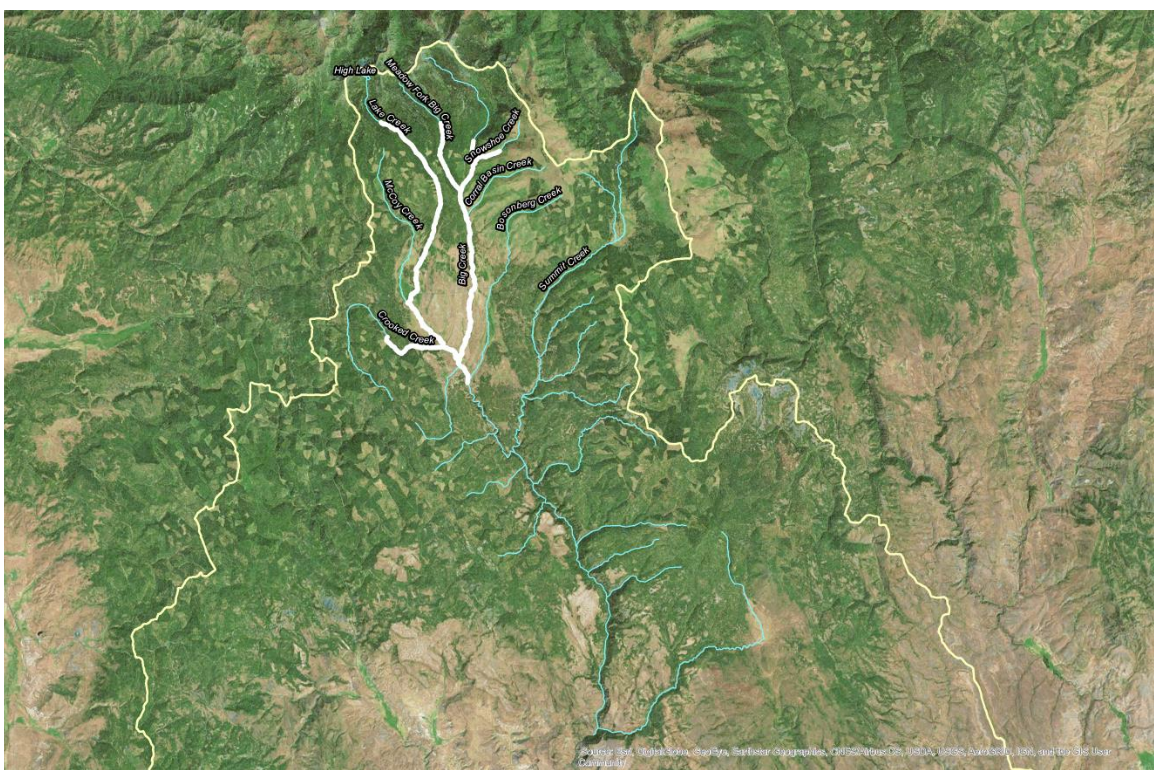

Figure 4. Known distribution of Bull Trout in the Upper Malheur River Watershed.

Table 1. - Brook Trout population estimates for the Upper Malheur River Watershed.

	Number of Brook Trout removed			Population estimates	
Year	Lake Creek weir	Lake Creek electrofishing	High Lake gillnetting	Lake Creek	High Lake
2010			2,206		6,621
2011	322	266	807		3,965
2012	139	1,386	711	11,797[a]	1,802
2013	56	2,640	0		
2014		901	1,782		3,477[b]
2015		1,606	0		
Total	7,316		5,506		

[a] 11,797, 95% confidence interval: 9,362-14,232 (Harper 2013)
[b] 3,477, 95% confidence interval: 2,598-4,766 (Crowley 2014)

In systems where Brook Trout and Bull Trout are sympatric, Bull Trout typically occupy headwater reaches while Brook Trout disperse further downstream (Paul and Post 2001). However, Adams et al. (2001) found that when Brook Trout are introduced into headwater lakes, they may be more widely distributed. Fenn (2003a) suggested that the type of distribution described by Adams et al. (2001) resembles that exhibited by Brook Trout in Lake Creek (i.e., High Lake and Upper Lake Creek are recognized as seed sources for recruitment of Brook Trout downstream into Bull Trout Critical Habitat in Lower Lake Creek and adjacent tributaries).

C.5.3 Big Creek

Brook Trout are also found in abundance in Big Creek (Fenn 2004a, 2004b), a known area of Bull Trout migration and rearing (Fenton and Schwabe 2003; Fenton 2004; Fenton 2005), as well as spawning (Perkins 1999-2009). Because Lake Creek is thought to have seasonal thermal barriers that may isolate the resident Bull Trout population (DeHaan et al. 2010a), the threat of Brook Trout in Big Creek is not as dire as in Lake Creek, as the distribution is consistent with patterns typical of streams lacking an upstream seed source (Paul and Post 2001). Regardless, limiting factors exist relative to Bull Trout spawning in Big Creek. Seasonally high stream temperatures may create thermal barriers to out-migrants (Abel 2008) and hybridization with Brook Trout has been documented (DeHaan et al. 2010a). The most common spawning area for Bull Trout in the Upper Malheur River Watershed is considered to be the Meadow Fork tributary of Big Creek (Perkins 1999-2009).

C.5.4 Bull Trout and Brook Trout Interactions: Hybridization

Hybridization between Brook Trout and Bull Trout has been documented in other basins (Leary and Allendorf 1991; Kanda et al. 2002); however, Leary et al. (1993) suggested occurrence beyond the F1 generation is believed to be uncommon. In contrast, mitochondrial DNA analyses have shown hybridization is occurring in the Upper Malheur River Watershed with involvement from both sexes of each species beyond the F1 generation and with incidences of reciprocal backcrossing (DeHaan et al. 2010a). In the Upper Malheur River Watershed, occurrence of hybridization is highest in Lake Creek, with a lower degree of hybridization found in Big Creek and its tributaries (DeHaan et al. 2010a), likely due to downstream recruitment from the High Lake population (DeHaan et al. 2010a).

Two factors may be contributing to the hybridization events. Even with introgressive hybridization, as is suggested to be occurring based on evidence provided for the Malheur and other basins (DeHaan et al. 2010a; Kanda et al. 2002), the problem has often been contextualized in terms of wasted reproductive effort on the part of female Bull Trout (Allendorf et al. 2001; Kanda et al. 2002). Additionally, earlier maturation among Brook Trout females may be exacerbating the rate of hybridization and competition over time (Leary et al. 1993; Gunckel et al. 2002; Adams 1999; Kennedy et al. 2003; McMahon et al. 2007).

C.5.5 Bull Trout and Brook Trout Interactions: Competitive Advantages

Competitive advantages of Brook Trout over Bull Trout have been documented (Gunckel et al. 2002; McMahon et al. 2007); however, habitat pressure and population level effects of Brook Trout presence on Bull Trout can be highly variable (Rieman et al. 2006). Rieman et al. (2006) theorized that Brook Trout may limit areas that Bull Trout occupy and ultimately displace remnant Bull Trout populations into headwater areas. Gunckel et al. (2002) found that Bull Trout, in the presence of Brook Trout, exhibited no shifts in feeding behavior after examining microhabitat in the Malheur and Powder rivers, and that Brook Trout exhibited competitive advantages through dominance and higher growth rates. Gunckel et al. (2002) and McMahon et al. (2007) found that Brook Trout were more aggressive than Bull Trout in areas of sympatric distribution. McMahon et al. (2007) found that at temperatures >57.7°F, Brook Trout exhibited growth advantages over Bull Trout and greater metabolic efficiency at 60.8-68°F. Competitive advantages for Bull Trout were not documented in cooler temperatures.

C.6 Genetics and Small Populations

Bull Trout spawning populations in the Upper Malheur River Watershed do not exist in isolation from each other. Other than Lake Creek Falls which blocks upstream migrations in the uppermost section of the Upper Malheur River Watershed, barriers to spawning habitat are absent elsewhere in the watershed. The belief that gene flow could be occurring among the populations is supported by the findings of Spruell et al. (2003), through which variation in Meadows Fork Big Creek (H_S = 0.359) was found to be high compared to the mean H_S (0.186) for 65 Bull Trout populations surveyed throughout the species range of distribution.

Whiteley et al. (2006) suggested that an understanding of existing genetic differentiation is important "to avoid mismanagement based on the assumption that fine-scale genetic differentiation is homogenous within distinct regions across a species range." The TAC recognizes caution must be exercised relative to interpreting the results from Spruell et al. (2003), as a limited number of populations and loci were screened. The limited understanding of the genetic population structure in the Upper Malheur River Watershed warrants a conservative management approach, as other studies have identified genetic differentiation among Bull Trout populations in close proximity (e.g., Leary et al. 1993; Spruell et al. 1999; Costello et al. 2003; Whiteley et al. 2006). Spruell et al. (2003) suggested local populations in close proximity typically are genetically distinct.

Multiple Bull Trout life history forms, including migratory forms, exist in the Upper Malheur River Watershed. Rieman and Dunham (2000) suggested maintaining such life history forms is important for Bull Trout persistence. Throughout the species range, the development of barriers that prevent passage of migratory fish or facilitate dispersal among tributaries has led to reduced gene flow and the loss of genetic diversity (Nerass and Spruell 2001; Costello et al. 2003; Whiteley et al. 2006; DeHaan et al. 2007; DeHaan and Hawkins 2009; DeHaan et al. 2010b).

To successfully implement the rotenone project (detailed discussion about rotenone application provided in Section D), temporary barriers must be installed to prevent Brook Trout from reentering treated areas. Although the barriers are intended to be temporary, the time periods for which the barrier will be functioning are unknown and the potential disruption of migratory corridors for Bull Trout must be addressed to conserve the existing life history forms. Because smaller Bull Trout populations (e.g., less than 100 spawning adults) may be prone to extinction if they are isolated (Rieman and McIntyre 1993; Dunham and Rieman 1999), actions will be implemented to avoid isolation and protect genetic variation and maintain the existing life history forms that exist within and among the populations.

To avoid an isolation scenario that could restrict gene flow and affect genetic variation and the expression of migratory life histories, the TAC intends to operate traps at each barrier. The traps will allow for fish to be successfully transferred during periods of migration.

C.7 Environmental Variations

Environmental variation affects the entire population and includes the biological and physical environment. Biological environment includes birth, death (i.e., population demographics), intra- and inter-species competition, food resources, and disease. Physical environment includes temperature, stream flow, migratory corridors and suitable habitat. Stable, predictable environments require fewer individuals in a population to persist over time than do highly variable environments. The combination of the loss of genetic diversity and environmental fluctuations pose survival risks for small populations.

C.8 Timeline of Past Brook Trout Removal Efforts

Through BPA Project 1997-019-00 and funding provided by the BOR Native Affairs, the BPT began to mechanically remove Brook Trout in 2010 (limited to electrofishing in Lake Creek and gillnetting in High Lake). In 2012, the Northwest Power and Conservation Council approved the BPT to implement a five-year Brook Trout removal effort using electrofishing, gillnetting, and weir operations with a targeted 50% reduction in adult/sub-adult Brook Trout. Through the effort, the BPT found that mechanical removal was not an effective method in Lake Creek due to stream channel complexity, instream vegetation/woody material, and yearly Brook Trout spawning success (Crowley 2016). Data indicate gillnetting in High Lake moderately controls Brook Trout populations if conducted annually; however, wildfires made consistency unattainable. From 2011-2013, a weir was operated seasonally in Lake Creek to capture migrating individuals. This effort was discontinued due to low capture numbers relative to staffing requirements as well as the potential of disrupting Bull Trout movements.

C.9 Climate Change Resilience and Habitat Restoration

In addition to habitat degradation resulting from land management practices, rivers and streams throughout the Pacific Northwest are threatened by the effects of climate change. The Rocky Mountain Research Station in Boise, Idaho has modeled stream temperatures throughout the region and determined that only the highest elevation headwater streams, like the headwaters in the Upper Malheur River Watershed, will provide suitable or near-suitable temperatures for salmonids (Figure 5) (NorWeST 2015).

Warming air temperatures associated with climate change will lead to warmer water temperatures. The extent to which air temperature influences water temperature is a result of not only the degree of warming, but also local and linear environmental variables. Specifically, the quality of riparian habitat directly influences water temperature through shading of solar radiation, storage of water in the floodplain, effect on channel geometry and other factors. Wondzell (2016) found that the potential for riparian restoration to buffer the impacts of climate change on streams is high (Figure 6). Initial results indicated that riparian restoration may have the potential to improve in-stream habitat to levels that will counter the projected impacts of climate change in the most extreme examples. Although climate change will improve the competitive advantage that Brook Trout hold over Bull Trout, the Upper Malheur River Watershed will retain some areas of refuge for Bull Trout as this system is groundwater-based. Although the potential impacts of climate change are projected to lead to a more impaired Upper Malheur River Watershed, habitat restoration actions would combat or minimize negative impacts of climate change on water temperatures. In addition, cold groundwater inputs will likely provide a natural buffer.

D. Proposed Action

As an interagency effort, the TAC proposes to salvage native fish from sections of the Upper Malheur River Watershed (Figure 7) and to treat the area with rotenone to eradicate Brook Trout. Efforts to eradicate Brook Trout will be completed through a 10-year effort during which an initial group of barriers will be installed to prevent the invasion of Brook Trout into treated areas (Figure 7).

Depending on the type of holding area used, monitoring fish for survival may be necessary. The TAC has high confidence that this will be successfully accomplished by holding fish in nearby streams, streamside holding tanks, or hatcheries. If deemed necessary, the TAC may choose to hold native fish in multiple locations to minimize the risk of total loss. When conditions permit, Bull Trout and other native fish will be returned to the treated reaches. Treatment of other action areas will occur at a later date and be dependent on the success of the initial effort.

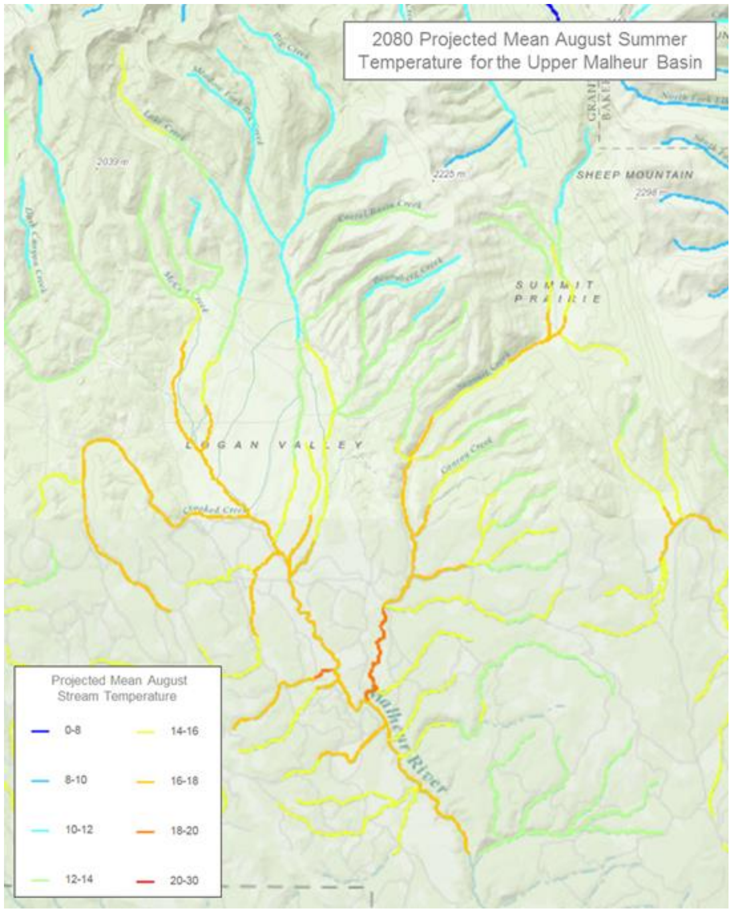

Figure 5. Projected Upper Malheur River Watershed stream temperatures for 2080 (NorWeST 2015).

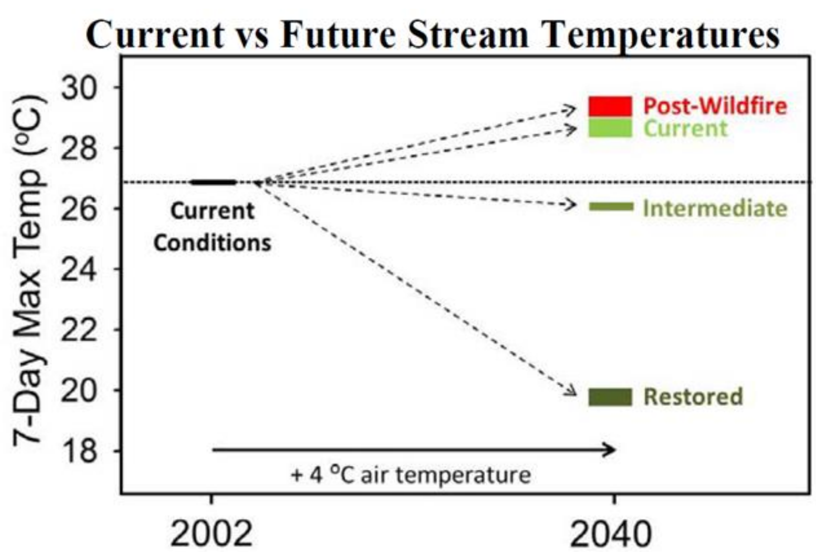

Figure 6. Results of model simulations using HeatSource calibrated to a base-year of 2002. Projections for 2040 are shown as colored boxes and represent ensembles of model runs with a single riparian vegetation scenario. Each box includes projections for high, current, and low discharge. The height of each box reflects the influence of ± 30% changes in discharge (Wondzell 2016).

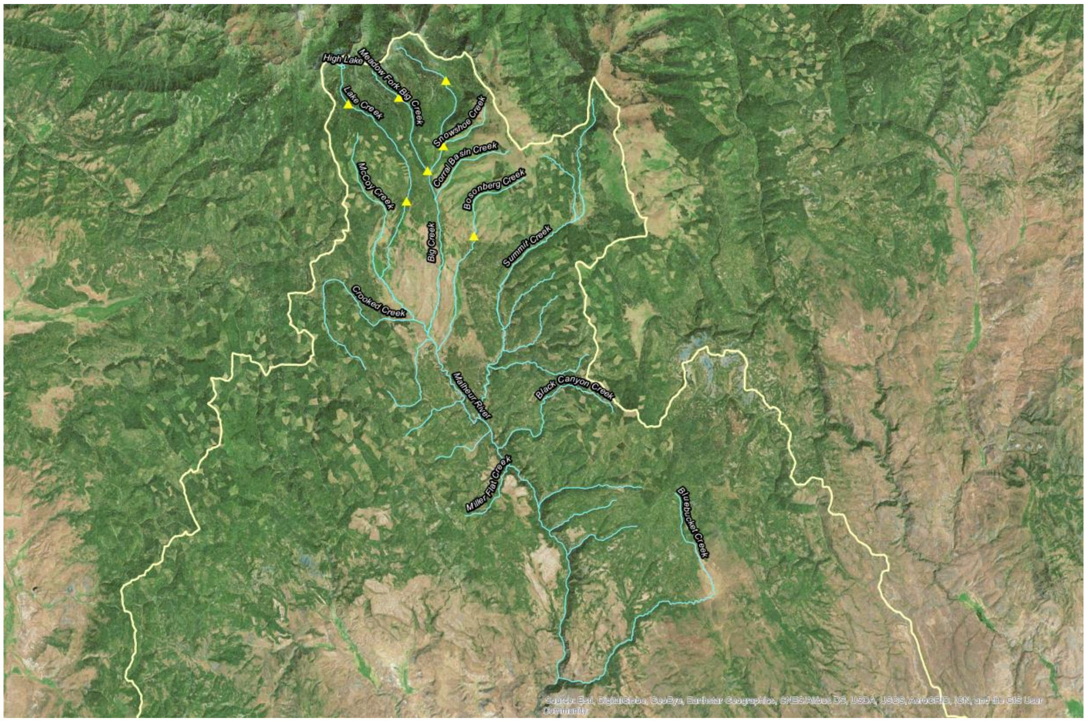

Figure 7. Action Area (Upper Action Area) in the Upper Malheur River Watershed that may be treated with rotenone to eradicate Brook Trout and potential sites, designated with triangles, at which barriers may be installed.

The following views contributed to the development of this strategy:

1) Brook Trout are a primary threat to the persistence of Bull Trout in the Upper Malheur River Watershed.

2) While other primary threats exist to Bull Trout in the Upper Malheur River Watershed, the reduction/removal/suppression of Brook Trout in conjunction with habitat restoration are the highest priority recovery actions in the watershed.

3) The eradication of Brook Trout from treated reaches, habitat restoration, and establishment/ maintenance of barriers are determined to be feasible actions with moderate to high chances of success in the reestablishment and persistence of Bull Trout and other native fish.

4) Brook Trout removal and habitat improvements must be addressed in tandem.

5) A solution will require interagency cooperation.

6) Watershed strategy for Brook Trout removal and habitat restoration is needed for success.

7) Education and outreach are needed to spread awareness of the problem and increase success of the project.

8) Removal treatments must incorporate the use of rotenone to maximize the chance of success.

9) Monitoring the response of Bull Trout following the removal of Brook Trout and habitat restoration will be essential to evaluate success, guide adaptive management actions, and direct similar efforts in the future. A committed effort prior to project implementation will ensure an appropriate level of monitoring has been identified.

D.1 General Summary of Precedent Projects

Table 2. Examples of rotenone efforts by ODFW, in Oregon, to eradicate non-native fish.

State	Waterbody	Target Species	Successful
Oregon	Summit Gravel Pond	Smallmouth Bass and crayfish	Yes
Oregon	McDermott Creek	Rainbow Trout	No[a]
Oregon	Diamond Lake	Tui Chub	No[a]
Oregon	Sun Creek	Brook Trout	Yes
Oregon	Diamond Lake	Tui Chub	No
Oregon	Walton Lake	Brown Bullhead	Yes
Oregon	South Twin Reservoir	Brown Bullhead	Yes
Oregon	Antelope Flat Reservoir	Brown Bullhead	Yes
Oregon	Crane Prairie Pond	Brown Bullhead	
Oregon	Lofton Reservoir	Tui Chub	Yes
Oregon	Beck-Kiwanis Pond	Carp and Goldfish	Yes
Oregon	North Twin Reservoir	Brown Bullhead	Yes
Oregon	Sun Creek	Brook Trout	Yes
Oregon	McDermitt Creek	Rainbow Trout, Brook Trout, Brown Trout	No
Oregon	Sage Creek	Rainbow Trout and Brook Trout	Yes

[a] Effort unsuccessful due to illegal releases following treatments

D.2 General Summary of Relevant Policies

- ODFW Native Fish Policy

- BPT Tribal Council - The BPT staff has multiple mandates to restore native fish populations within the boundaries of the former reservation. These include Tribal Council resolutions and broad sense goals for the Malheur River. Additionally, the BPT manages 8,000 acres of land including 14 miles of stream. The BPT also manages one BPA Resident Fish project that has provided a primary source of funding and coordination since its inception in 1997. The interest and commitment to the health of the native species of the Malheur River is demonstrated by these policies of the Tribal Council as well as the longevity of presence of BPT work in the Malheur River. The BPT manages its 8,000 acres consistent with best available conservation measures for fish and wildlife.

- USFS - In regards to managing wilderness, the Forest Service Manual (FSM), guides the USFS "to protect known populations of federally listed threatened or endangered species where necessary for their perpetuation and aid in their recovery in areas of previous habitation (FSM 2323.32)", identifying chemical treatment as a method for completing this goal. Although chemical treatment requires a Regional Forester signature, it "may be used to prepare waters for reestablishment of indigenous, threatened or endangered, or native species, or to correct undesirable conditions caused by human influence (FSM 2323.34f)". Restocking of fish prioritizes federally listed indigenous as a priority, followed by indigenous species, and under the circumstance that stocking is occurring in barren waters “only after determining that the scientific and research values of such barren waters will not be eliminated from a wilderness and documenting the desirability of such action in the forest plan (FSM 2323.34c)”. In this case, restocking will only occur in a limited number of high elevation lakes that have been barren, retaining this characteristic in other locations. The Malheur National Forest Land and Resource Management Plan (USDA 1990) identifies numerous goals that will be achieved by these actions, including but not limited to the following:

Fish and Wildlife (IV-2):

- 15. Assist in the identification, protection and recovery of threatened, endangered and sensitive species.
- 16. Coordinate fish and wildlife management activities with other agencies and organizations to achieve mutual resource goals and utilize project cost share opportunities.
- 18. Provide for improved habitat conditions to support increased populations of anadromous and resident fish.
- 19. Provide a diversity of habitat sufficient to maintain viable populations of all species.

The following guidance also exists in the FSM and is related to ODFW’s involvement in activities on USFS land:

- FSM 2600 (Exhibit 5) – The USFS shall recognize ODFW as being responsible for the management of all fish and wildlife species over which it has jurisdiction in the State of Oregon.
- FSM 2323.32 – Recognize that states have jurisdiction and responsibilities for the protection and management of wildlife and fish populations in wilderness.
- FSM 2323.34f – Chemical treatment may be used to prepare waters for establishment of indigenous, threatened, or endangered, or native species, or to correct undesirable conditions caused by human influence.
- FSM 2323.34 – Emphasize quality and naturalness in managing fisheries in wilderness.

D.3 Action Areas

To guide the development of sequential treatment strategies, the TAC has identified tributaries that are priorities for Brook Trout removal in the Upper Malheur River Watershed (Table 3 and Figure 7). Pending the success of the efforts in the initial tributaries, the TAC envisions treating middle and lower areas of the Upper Malheur River Watershed.

D.3.1 Upper Action Area

The Upper Action Area consists of tributaries that have a high conservation value for Bull Trout spawning and rearing, as well as being feasible for immediate treatment over a 10- year period.

As the 10-year threshold is approached, the TAC will evaluate treatment options for additional downstream locations.

Table 3. Tributaries located in the Upper Action Area of the Upper Malheur River Watershed that are priorities for habitat restoration and Brook Trout removal.

Action area	Stream		Miles
Upper	Frazier Creek		4.2
	Bosonberg Creek		9.3
	Corral Basin Creek		3.6
	Big Creek		1.3
	Snowshoe Creek		2.4
	Meadow Fork Big Creek		4.6
	Crooked Creek		9.8
	McCoy Creek		6.9
	Lake Creek		1.5
		Subtotal	43.6

The downstream terminus of the Upper Action Area is at the confluence of Bosonberg Creek with the Malheur River. To create treatment sections that are of a manageable size, several barriers will be installed upstream of the terminus. The terminus was selected due to the potential to install a barrier at this location. Maintenance of a barrier at the Bosonberg Creek crossing (the lowest barrier on the mainstem in place in perpetuity) would facilitate the eventual removal of upstream barriers following the verification that downstream treatments were successful at removing Brook Trout and that Brook Trout are prohibited from migrating upstream into the treated areas.

The Bosonberg Creek crossing barrier will have to be maintained for native fish (i.e., Redband Trout, Mountain Whitefish (*Prosopium williamsoni*), and Bull Trout) passage to retain fluvial life history strategies. The angling value of Brook Trout in the Upper Action Area is deemed low relative to more popular areas such as Lower Summit Creek, which was excluded. Upper portions of Summit Creek that may provide habitat suitable for Bull Trout (not currently occupied) and are located above partial passage barrier culverts (which may be easily modified to be passage barriers) could potentially be treated separately.

D.3.2 Middle Action Area

The Middle Action Area is located downstream of a putative barrier placement at the confluence of Bosonberg Creek and the Mainstem Malheur River to Malheur Ford (below the confluence with Summit Creek). This area includes Summit Creek with the possible exception of its headwaters. The action area is a migratory corridor for Bull Trout, connecting overwintering habitat downstream to upstream spawning grounds; however, limited data supports the idea that Bull Trout use this area during the summer. Treating this section would allow resident and migratory meta-populations to be connected and to use habitat recovery areas like those in Summit Creek. Work in this area would occur following the initial 10-year effort in the Upper Action Area.

D.3.3 Lower Action Area

The Lower Action Area includes the Mainstem Malheur River downstream of Malheur Ford to below the confluence with Bluebucket Creek. Although this area is feasible to treat from an implementation perspective, the associated cost would be significant. Work in this area would occur following the initial 10-year effort in the Upper Action Area.

D.4 Effects to Other Species and Native Salvages

D.4.1 Amphibians

Results from amphibian surveys (Haslick 2016b and unpublished data) conducted in High Lake and Lake Creek Meadow (984 feet downstream from High Lake) are presented in Table 4. During the 2-year study, only one Pacific Tree Frog (*Pseudacris regilla*) was collected from Lake Creek Meadow. Although vulnerable (state classification) Western Toads (*Anaxyrus boreas*) were not captured in High Lake in 2016, more than 1,500 tadpoles (multiple Gosner life stages) were captured in 2014. Adult Western Toads and Pacific Tree frogs were also observed while setting traps. The disparity in capture numbers, between the two years, highlights the importance of allowing for flexible rotenone treatment schedules to limit larval mortality. Additional surveys using cover boards, pitfall traps, and/or visual observation are likely required at nearby vernal pools to assess the presence of additional species. If additional species are identified, respective life history information will be used to guide treatment planning. (Supplement 3 provides additional discussions)

In 2015 and 2016, visual encounter surveys were conducted for Big, Lake, and McCoy creeks during which multiple life stages (i.e., egg mass, tadpole, and adult) of Columbia Spotted Frog (*Rana luteiventris*) were identified. Future surveys of these creeks may include the use of cover boards, pitfall traps, and/or visual encounter surveys at nearby vernal pools.

Due to the susceptibility of larval amphibians to rotenone applications (Lindahl and Oberg 1961), treatments will be conducted when that life stage is not present or substantially reduced. If factors do not allow for flexible treatment schedules to protect amphibians, results from studies (e.g., Billman et al. 2012) have shown amphibian populations are capable of recovering rapidly following treatments. Because rotenone is rapidly broken down by organic matter, sunlight, hydro turbulence, and other natural processes (Dawson et al. 1991; Brown and Zale 2012), direct effects on subsequent generations of amphibians are not expected. (Supplement 3 provides additional discussions)

To evaluate amphibian recovery in High Lake, larval specimens will be trapped, marked, and recaptured prior to treatment to determine estimated population sizes for each species. Following treatment, population estimates will be conducted annually. Recovery will not be considered complete until species assemblages and population estimates equal or exceed pre-treatment levels. If necessary, amphibian recovery will be monitored in other treatment reaches.

Table 4. Presence of amphibian species in Upper Malheur River Watershed areas proposed for rotenone treatments.

	High Lake/Upper Lake Creek			Upper Middle Fork Malheur tributaries (Big/Snowshoe to Bluebucket)				
Species	Confirmed present[a]	Reproduction observed[2]	Likelihood of occurrence[3]	Confirmed present[a]	Reproduction observed[b]	Likelihood of occurrence[c]	Origin	Conservation status
Anurans								
American Bullfrog	No		Low	No		Low	Introduced	Not listed
Columbia Spotted Frog	No		High	Yes (visually and audibly)	Yes		Native	Vulnerable (state)
Pacific Tree Frog	Yes (visually and audibly)	Yes		Yes (visually and audibly)	No		Native	Not listed
Western Toad	Yes (visually and audibly	Yes		No		High	Native	Vulnerable (state)
Great Basin Spadefoot Toad	No		High	No		High	Native	Not listed
Salamander								
Long-toed	No		High	No		Medium high	Native	Not listed
Easter Tiger	No		Low	No		Low	Likely both	Not listed

[a]Based on BPT visual encounter, minnow trapping, and incidental surveys from 2015 and 2016.
[b]Includes egg mass, tadpole, aquatic larvae, and/or metamorph visual confirmation. Tadpole and salamander larvae lethal susceptibility to chemical treatment stresses and importance of treatment timings to minimize tadpole exposure, if possible.
[c]Based on a combination of habitat needs, occurrence records, life history, and population dynamics.

D.4.2 Benthic Macroinvertebrates

Similar to amphibians, benthic macroinvertebrates are vulnerable to rotenone. Impacts of rotenone to benthic macroinvertebrate species are variable and depend on factors including concentration and duration, habitat use variability, and life history differences. Depending on the availability of upstream population sources and individual dispersal capabilities, benthic macroinvertebrate populations have been shown to recolonize and recover quickly following treatments (Magnum and Madrigal 1999; Hamilton et al. 2009; Vinson et al. 2010)). To monitor the impacts of the rotenone treatments, the BPT will sample benthic macroinvertebrates in Upper Lake Creek and other reaches after the treatments have been completed. Data will be compared to pre-treatment results to monitor progress towards achieving the goal of realizing post-treatment taxa diversity and population numbers that approximate pre-treatment estimates.

A total of 79 unique benthic macroinvertebrate taxa have been identified between High Lake and Lake Creek Falls (stream length of 1.5 miles), with the majority of the representatives being members of the order Arthropoda (classes Insecta, Arachnida, and Ostracoda); however, Mollusca, Annelida, Nemata, and Platyhelminthes were also present (Haslick 2016a). To compare benthic macroinvertebrate abundance along the 1.5 mile section of Lake Creek, the creek was partitioned into sampling reaches of .25 miles. The orders Ephemeroptera, Diptera, and Plecoptera were typically the most abundant in each reach (Figures 8-12).

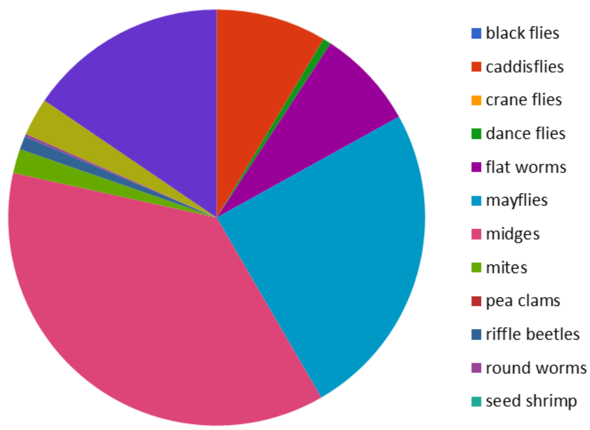

Figure 8. Lake Creek Reach 1 benthic macroinvertebrate percent abundance (Haslick 2016a).

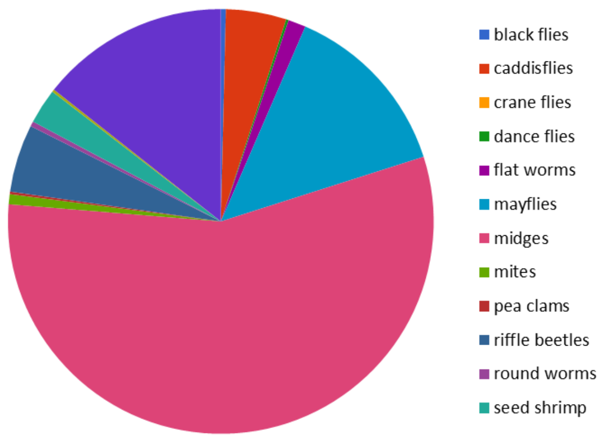

Figure 9. Lake Creek Reach 2 benthic macroinvertebrate percent abundance (Haslick 2016a).

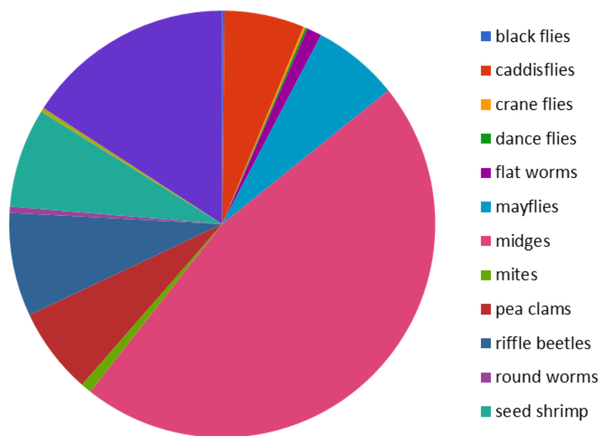

Figure 10. Lake Creek Reach 3 benthic macroinvertebrate percent abundance (Haslick 2016a).

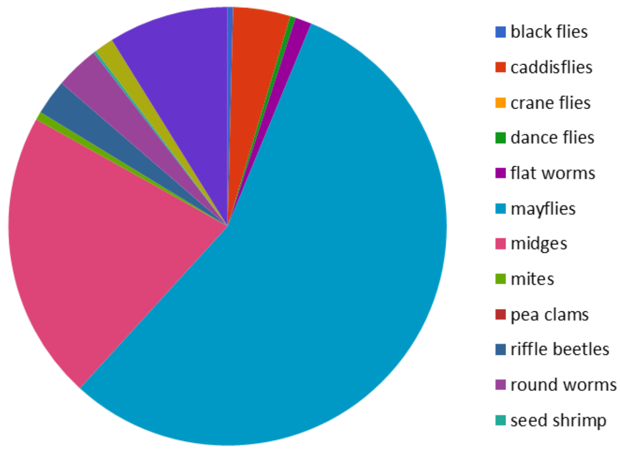

Figure 11. Lake Creek Reach 4 benthic macroinvertebrate percent abundance (Haslick 2016a).

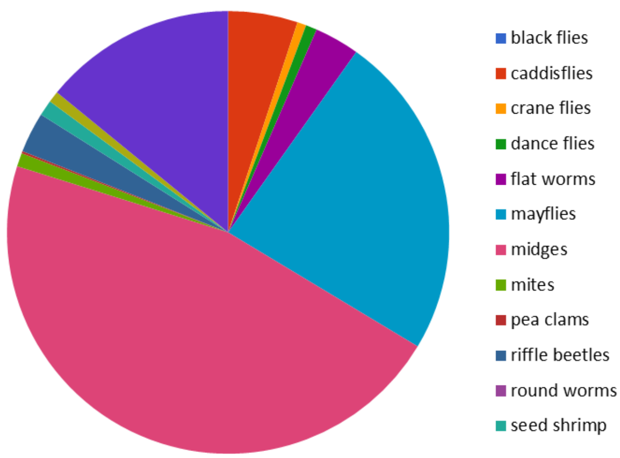

Figure 12. Lake Creek Reach 5 benthic macroinvertebrate percent abundance (Haslick 2016a).

Multiple feeding groups of benthic macroinvertebrates (i.e., predators, omnivores, parasites, collectors, shredders, and scrapers) have been identified in each reach between High Lake and Lake Creek Falls (Haslick 2016). Specimens collected from the high-elevation stream (6,600-7,450 feet) represented taxa characterized as having thermal preferences for cooler temperatures. Results indicated that sensitive and intolerant taxa exceeded tolerant taxa suggesting the aquatic ecosystem above Lake Creek Falls is relatively void of human disturbance. Results from Benthic Invertebrate Index of Biological Integrity tests (Table 5) classified each reach as ‘high biological integrity’ except Reach 5 which scored moderate (Haslick 2016a). Predator, scraper, and shredder richness, as well as percent collector and Chironomidae were limiting factors preventing many of the Lake Creek reach sites from being classified as ‘high biological integrity.’ Despite the limiting factors, all reach sites scored relatively highly when the additional parameters were included in the analyses.

Table 5. Benthic Invertebrate Index of Biological Integrity (BIBI)[a,b] and community composition results from sampling conducted in five reaches of Lake Creek (between Lake Creek Falls and High Lake) on 12 September 2014. Metric scores of 1, 3, and 5 represent ratings of low, moderate, and high, respectively.

	Lake Creek Reach									
	1		2		3		4		5	
Metric	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score
Total number of taxa	53	5	50	5	59	5	51	5	40	3
Number of Ephemerotera taxa	11	5	12	5	11	5	6	3	6	3
Number of Plecoptera taxa	14	5	8	5	14	5	11	5	9	5
Number of Trocoptera taxa	9	3	6	3	10	5	10	5	5	3
Number of long-lived taxa	16	5	11	5	18	5	18	5	10	5
Number of intolerant taxa	22	5	18	5	23	5	21	5	15	5
Percentage of tolerant taxa	0.8	5	2.8	5	0.2	5	0.2	5	0	5
Percentage of predators	22	5	8.5	1	14	3	10	3	9.8	1
Number of clinger taxa	27	5	23	5	31	5	26	5	19	3
Percentage dominance (3 taxa)	24	5	47	5	38	5	39	5	52	3
Total score		48		44		48		46		36
Total abundance (m^2)	2057		1644		2625		4502		6305	
EPT taxa richness	34		26		35		27		20	
Predator richness	15		8		19		14		9	
Scraper richness	8		8		8		3		2	
Shredder richness	9		8		9		7		7	
Percentage of intolerant taxa	30		64		36		32		21	
Percentage of collectors	47		45		62		72		72	
Percentage of parasites	2.1		3.8		1		1.2		1.3	
Percentage of Oligochaeta	2.9		1.4		0.8		0.2		0.3	
Number of tolerant taxa	0		3		1		1		0	
Percentage of Simuliidae	0		0.4		0		0.4		0.2	
Percentage of Chironomidae	37		21		46		56		46	

[a] The BIBI is based on average/summation of three replicates, not an individual replicate

[b] Red cells represent BIBI scores between 0 and 24, yellow cells 25 to 39, and green cells represent scores >40

Results from (Haslick 2016a) suggest upper Lake Creek represents a healthy aquatic ecosystem for which impacts from rotenone treatments will be temporary. Numerous studies (e.g., Hamilton et al. 2009; Vinson et al. 2010) have shown benthic macroinvertebrates recover rapidly following rotenone treatments. Regardless, rigorous post-treatment monitoring and analyses will be implemented to ensure population numbers and taxa assemblages have recovered.

D.4.3 Native Fish Salvage

Prior to initiating rotenone treatments in the Upper Malheur River Subbasin, native fish salvage will occur by means of electrofishing, snorkeling, minnow traps, and/or other net-types. Because fish salvaged from the proposed treatment sites will be relocated to areas in the Upper Malheur River Watershed that are not being treated concurrently, multiple streams will be treated during the first year and repopulated when monitoring results indicate Brook Trout have been successfully removed.

D.5 Upper Malheur Species Presence/Absence

Known fish assemblages for the Upper Malheur River (Table 6) are largely based on BPT sampling efforts that have been focused on salmonid species; however, other species encountered were identified and recorded.

E. Alternative Actions Considered

The Recovery Plan lists Brook Trout as a primary threat to Bull Trout in the Upper Malheur River Core Area. Brook Trout are widely distributed throughout the Core Area, inhabiting an estimated 94 stream miles. Due to staffing, funding, and logistic requirements, it is not feasible to singly treat the entire area occupied by Bull Trout.

Without partitioning the areas that are to be treated, the likelihood of success is low for treatments of this size. Temporary barriers will be installed to segment the affected area into sizes that can be feasibly treated and are consistent with known use by Bull Trout. Barriers will remain in place if Brook Trout continue to exist in adjacent reaches or are known to seasonally access the treated reach. The treatments will be comprehensive to avoid assumptions that Brook Trout are not present in some areas.

Alternative management actions that have been considered include: no action, mechanical removal, biological control, and other chemicals.

E.1 No Action

No action will result in status quo of nearly ubiquitous Brook Trout with continued hybridization and no progress towards Bull Trout recovery within the Upper Malheur Core Area. With no action, hybridization and competition for limited resources will lead to declines in Bull Trout abundance and eventually extirpation.

E.2 Mechanical Removal

Electrofishing, gillnets, trammel nets, and trap nets are used extensively in fisheries to capture fish. Although the equipment is effective for sampling fish for the purpose of acquiring biological data, the gear is inefficient for use in long-term population suppression projects due to staffing/financial needs, gear biases, and environmental characteristics. Staffing needs (requires at least two staffers), annual effort in perpetuity, and financial costs render mechanical removal an ineffective approach to remove fish on a long-term basis (Table 7). Regarding gear biases, incorrect net mesh size can lead to smaller size classes not being captured. The effectiveness of mechanical methods can also be affected by lake bathymetry, channel complexity, substrate, and vegetation.

Since 2010, the BPT has been deploying gillnets in High Lake. Positive results were observed when the lake was sampled extensively and annually; however, wildfires resulted in the cancellation of sampling during 2013 and 2015. Crowley (2014) found missed annual sampling,

Table 6. Fish collected from the Upper Malheur River Watershed during sampling efforts.[a]

	Species										
Waterbody	Brook Trout	Bull Trout	Redband Trout	Sculpin	Redside Shiner	Speckled Dace	Long Nose Dace	Bridge Lip Sucker	Large Scale Sucker	Mountain Whitefish	Northern Pikeminnow
Lake	X	X	X	X	X	X	X	X	X	X	
Big	X	X	X	X	X	X	X	X	X	X	
Meadow Fork	X	X	X	X	X	X	X	X	X		
Summit	X		X		X	X	X	X	X		
Snowshoe	X	X	X								
McCoy	X										
Crooked	X		X	X	X	X	X	X	X		
Bosonberg	X		X	X							
Tureman	X		X	X							
Black Canyon	X		X								
Skookum			X								
Lee			X								
Bluebucket	X		X	X		X					
Wolf			X								
Corral Basin	X		X	X							
Pine			X		X						
Mainstem Malheur	X	X	X	X	X	X	X	X	X	X	X

[a] The list should not be viewed as a definitive measure of species presence or absence or inclusive of all tributaries.

Table 7. Examples of costs associated with mechanical removal projects to suppress non-native fish in Oregon.

Waterbody	Target species	Treatment type	Years	Investment
East Lake	Tui Chub	Trap net	2010-2011	446 staff hours/year and 319 volunteer hours/year
East, Paulina, and Lava lakes	Tui Chub	Trap net	2012-2013	$15,000
Diamond Lake	Golden Shiner	Electrofishing	2008-2013	45 staff hours/year
High Lake	Brook Trout	Gillnet	2010-2016	240 staff hours/year

during the years affected by the wildfires, led to the population expanding to near pre-removal abundance due in part to Brook Trout quickly reaching sexual maturity.

The BPT and ODFW have suggested that mechanical removal is not a viable or cost-effective option, respectively, to eradicate Brook Trout from High Lake. Given the environmental conditions (i.e., drought and wildfires), the BPT believes yearly sampling is neither sustainable nor a viable solution to eradicate Brook Trout. The ODFW has indicated that it likely is not possible to annually remove 50% of the Brook Trout with mechanical methods and that costs would outweigh benefits.

E.3 Biological Control

For a biological control to effectively reduce or eliminate unwanted species, it must remove the unwanted species faster than the species can reproduce. Sterile fish (i.e., tiger trout (Brown Trout *Salmo trutta* x Brook Trout), tiger musky (Muskellunge *Esox masquinongy* x Northern Pike *E.*

lucius), and hybrid striped bass (Striped Bass *Morone saxatilis* x *M.* chrysops) were the only biological controls considered for High Lake. The potential biological controls are the only sterile fish currently used by ODFW; however, the fish are unacceptable for several reasons. Tiger trout are not appropriate because their metabolism is too slow to effectively reduce Brook Trout numbers. Tiger musky and hybrid striped bass are not acceptable because they are non-native fish that do not meet ODFW's Native Fish Conservation Policy, Wild Fish Policy, and the Malheur Basin Plan. Furthermore, they are not biologically appropriate or suitable for the Upper Malheur River Watershed.

E.4 Chemical Control

Antimycin and rotenone have been used extensively by fisheries managers to remove undesirable species, restore native fish populations, removing genetic threats, and eradicate habitat altering fish species (Krueger and May 1991; McClay 2000, 2005).

E.4.1 Antimycin

Antimycin is an antibiotic that kills gill-breathing organisms by inhibiting respiration in the cell. Antimycin is effective at extremely low concentrations (parts per billion) and is not detectable by fish, preventing an avoidance response. The antibiotic is effective with short exposure time and has little impact on invertebrates. It biodegrades when exposed to high sun exposure, high water turbulence; and is ineffective in water with high alkalinity and at pH above 8.7. Antimycin is more expensive than rotenone and recently produced formulations have been found to be defective. Currently, antimycin is not available.

E.4.2 Rotenone

Rotenone is a botanical product found in the roots, seeds, and leaves of various plants that are members of the bean family *Leguminosae* found in Australia, Southern Asia, and South America (Finlayson et al. 2010). Rotenoid is a general term for processed plants containing rotenone, degulin, rotenolone, and tephorsin and up to 25 other rotenone-like compounds in end-use rotenone products (Fang and Casida 1999). However, most of the toxicity is due to rotenone (Fang et al. 1997).

Rotenone is absorbed through gills when applied to water and kills organisms by inhibiting respiration in the cell. Rotenone is readily available, stable in the environment, and does not degrade as rapidly as antimycin.

Due to acute inhalation and acute oral and aquatic toxicity, rotenone is classified as a Registered Use Pesticide. The sale of the product is regulated by the U.S. Environmental Protection Agency under the Federal Insecticide, Fungicide, and Rodenticide and Federal Food, Drug, and Cosmetic acts. To purchase rotenone in Oregon, a public pesticide applicators (PPA) license must be obtained from the Oregon Department of Agriculture (ODA). The PPA is issued by ODA after applicants have successfully passed federal/state laws and safety requirements and have demonstrated competency for use in aquatic habitats.

F. Outreach and Education

The success of a rotenone project extends beyond the application of the chemical. An intensive outreach and education campaign is mandatory prior to implementing any components of the project. Recognizing and addressing political and social concerns are essential to the project's long- and short-term success. The most common factor noted in the success or failure of rotenone projects has been the level of public understanding of the problem, transparency about the solution, and engagement throughout the process. Education and outreach are crucial for success in terms of the completion of regulatory processes, application of rotenone, and maintaining Brook Trout-free streams following the treatments.

The TAC recognizes that for anglers to accept the rotenone project, recreational fishing opportunities must be available in high-use areas following the removal of Brook Trout. Because illegal stockings by anglers commonly occurs after rotenone projects and subsequently contributes to project failure (Table 2), the TAC recognizes the importance of informing anglers that the treated areas will be restocked, ensuring that fishing opportunities will continue to exist.

F.1 Public Outreach

Public acceptance of management actions to benefit Bull Trout is crucial for recovery to occur. Understanding recreation interests in the treatment zone will help identify the respective demographics. Success of rotenone treatments, as defined by the persistence of Brook Trout absence in a treated reach, is dependent on education and outreach. Numerous streams within the Malheur National Forest wilderness are paralleled by trails that are frequently used by hikers, backpackers, hunters, anglers, and horseback riders. Such a network of trails exists around High Lake which is located in the Strawberry Mountain Wilderness Area. High Lake is a destination for hiking, backpacking, angling, horseback riding, viewing wildlife, exploring the outdoors, and enjoying the wilderness. The most common access point to the lake is from the Roads End Trailhead; however, many trailheads located across the wilderness provide access to High Lake. Access to the trailhead is dependent on spring snowmelt which can occur as early as May/June or as late as July. Most visitors are day users, though overnight and multi-day use does occur. Although there are no developed campgrounds near the lake, camping is a popular activity in this area. Peak use occurs from July to November.

Similarly, logging, ranching, and farming interests will be considered, as well as Grant and Harney County courts which serve communities such as John Day, Prairie City, Canyon City, Izee, Seneca, Juntura, Drewsey, and Burns-Hines. Outreach needs will also include non-governmental conservation organizations.

To achieve the public outreach goal of developing an understanding and support for the rotenone project, a neutral third-party will help the TAC implement the outreach strategy. Public involvement during the planning process will be crucial for creating public desire for the project. Attention will be directed to factors that influence public desire including: 1) concerns about chemical use, 2) comprehension of project goals, 3) concerns about environmental trade-offs, 4) concerns about management decisions, and 5) disagreement with fish management post-treatment. Keys to developing public desire for the project will be: 1) identification, 2) outreach, 3) communication, and 4) resolution.

The TAC has identified general public groups (Table 8) that will likely have an interest in the project. Individuals can be exclusive to one group (e.g., fishing) or multiple groups (e.g., hunting and ranching). Priority should be given to groups and organizations that have influential participants that interact with multiple groups within their communities. This overlap will have synergistic effects and reduce TAC efforts to spread the message and maintain activity within the communities, groups, and organizations.

Outreach objectives associated with groups and individuals listed in Table 8 are to: 1) make the group or individuals aware of the desire for a rotenone project, 2) build relationships of trust, 3) gage interest in participation during the public process, and 4) identify potential issues/concerns.

Table 8. Examples of groups that will be included in public outreach/education efforts.

Public	Location
Agricultural	John Day, Hines, and Drewsey
Anglers	John Day and Hines
ATV/UTV	John Day and Hines
Campers	John Day and Hines
Grant County Court	John Day
Harney County Court	Burns
Hikers	Various
Horseback/trail riders	John Day and Hines
Hunters	Various
Logging	John Day
Native Fish Society	Portland and Salem

F.2 Communication and Education

Broad communication and education to communities and outside groups will be accomplished through school groups, angling/hunting organizations, conservation groups, newspapers, radio, social media (e.g., Facebook and Twitter) and during public meetings. Communication objectives will be to: 1) inform the public about the current status of Bull Trout, 2) inform the public about beneficial management actions, and 3) identify the TAC as experts that can fix the Bull Tout issue. Information to communicate about the current status of Bull Trout includes: 1) when they were listed, 2) why they were listed, and 3) recovery status, primary threats, and actions identified in the current Recovery Plan.

The education component of this project will focus on facts about Bull Trout and Brook Trout including basic life history, hybridization tendencies, habitat requirements, results and costs associated with illegal introductions, restoration efforts, and focus areas. Information presented to the public, regarding beneficial actions for Bull Trout, should include past management actions to recover populations and possible actions that can be implemented. Specific expertise of the TAC should be highlighted during these discussions. Linking key actions that will help Bull Trout recover to the concept that groups and individuals are connected to this resource will be essential to securing public acceptance of proposed management actions. Political space for implementing Bull Trout restoration activities will be created as the TAC is able to connect communities, organizations, commercial interests, and governments with the concept that restoring Bull Trout will result in positive economic, commercial, and biological outcomes.

Resource connection is recognized as the key to securing public acceptance of the proposed management actions.

G. 10-year Implementation Plan (Upper Action Area)

See Part II – Supplement 1 for a detailed description.

H. Monitoring & Recovery Actions

Monitoring objectives will be defined by the TAC and implemented by each agency. Methods specific to each task will be defined in individual work plans or study plans and reviewed by the TAC when the long-term monitoring stage begins. The most appropriate agency, for each task, will take the lead and coordinate a review of the study plan with the TAC. Funding for monitoring efforts will not be provided from the TAC to accomplish the work. Instead, each agency will implement the monitoring within the scope of existing budgets and study plans.

H.1 Short-term Monitoring (<10 years)

Short-term monitoring results will be used to guide future annual project implementation. Per Finlayson et al. (2010), the following post-treatment attributes will be monitored: 1) effectiveness of the treatments, 2) macroinvertebrate colonization, 3) effects to amphibian populations, and 4) effects on non-target fish species. In addition, the barriers will be evaluated for their effectiveness in preventing the immigration of Brook Trout. If monitoring indicates low-risk implementation is successful, higher levels of risk would be considered for future years.

H.2 Long-term Monitoring (>10 years)

A rigorous long-term monitoring program will be an essential component of the Bull Trout restoration efforts in the Upper Malheur River Watershed. Data collected through the project will inform each phase of implementation. The long-term monitoring strategy will include:

- <u>Status of treated reaches</u> - Treated reaches will be monitored for absence of Brook Trout.
- <u>Index of Bull Trout trends</u> - Yearly spawning surveys will be conducted to evaluate Bull Trout populations in the Upper Malheur River Watershed. Surveys will allow for the evaluation of Bull Trout recovery while minimizing impacts associated with intrusive sampling efforts.
- <u>Presence and distribution of Brook Trout, Bull Trout, and/or other native species</u> - Use eDNA to detect the presence of Brook Trout while minimizing the impact of sampling activities on restoration efforts. Although electrofishing is an intensive sampling tool, its use will be necessary to evaluate the presence/absence of Brook Trout following the treatments. Electrofishing will likely occur every year; however, adaptive monitoring will dictate its use in streams or stream sections that are to be sampled. Streams or stream sections may be put into a rotational sampling strategy that would prevent them from

being heavily sampled each year while still having the capacity to evaluate changes in the native fish populations. Snorkel surveys may be used to assess native fish populations while minimizing the impact to these populations. Long-term monitoring efforts in the Upper Malheur River Watershed will take an adaptive management approach that allows for changes to be made as new data and tools become available.

- Genetics - Genetic studies will be conducted to investigate genetic purity of Bull Trout populations. When enough reaches have been treated, analyses will be conducted to assess the genetic diversity of all native species.

H.3 Habitat Restoration

Habitat degradation resulting from land management practices is a primary threat identified in the Recovery Plan. Management activities such as grazing, timber harvest, road construction, beaver trapping, and water withdrawals have altered stream and riparian conditions and reduced the quality of habitat to support Bull Trout in the Upper Malheur River Watershed.

Restoring habitat would reduce the competitive advantage of Brook Trout over Bull Trout. To address the primary threat, the USFS plans to work with its partners to implement habitat restoration activities to improve habitat for Bull Trout in Upper Malheur River Watershed streams (e.g., Summit Creek, Bosenberg Creek, Lake Creek, Big Creek, McCoy Creek, Crooked Creek, Corral Basin Creek, and the Malheur River). Implementation of activities listed in Appendix B will occur in coordination with non-native fish removals.

I. Temporary Barriers and Fish Passage for Migratory Native Fish

The highest level of uncertainty, from a technical standpoint, is the need to protect treated areas with temporary barriers following treatments. As a proactive measure, barriers will be installed prior to the treatments to prevent Brook Trout invasions. Intensive monitoring protocols will be implemented to evaluate the barriers' effectiveness relative to restricting Brook Trout passage and whether barriers are restricting access of migratory native fish to spawning areas, subsequently limiting the expression of life histories and gene flow. Without allowing immigration into these areas, genetic bottlenecks and low resiliency will have high likelihoods of occurring. Because of these potential challenges, adaptive management will be a key post-implementation component.

I.1 Temporary Barriers

Over 25 locations have been identified as potential sites for temporary barriers. The lowermost site, located below the Bluebucket Creek confluence, would be the only permanent barrier in the system. Attempts will be made to minimize the total number of barriers installed, with considerations to logistic feasibility and minimizing the footprint. An array of scenarios and potential locations (Figure 7) are being assessed.

Ensuring rapid recovery of native fish populations within the treated reaches is considered paramount for success. Maintaining access for native species to treated areas post-treatment will ensure an opportunity for populations to be robust and subsequently more resilient to stochastic events. Due to concerns associated with native fish migrations, consideration will be given to designs that incorporate selective fish passage and are capable of functioning during high-water events. In addition, other approaches such as permanent traps and trap and haul operations will be considered. Temporary barriers are assumed to last 5 to 20 years depending on baseline hydrology, seasonal weather events, and construction materials.

I.2 Permanent Fish Traps at Barrier Sites

In areas where it is highly likely that a large migratory population component will exist, the installation of fish traps at the barrier is the most feasible solution. These areas will require the assistance from TAC agencies to pass fish, within a reasonable time, during peak migration seasons. Design would include the ability to close the trap while maintaining a 100% barrier during winter months and times when migration is likely to be low. The Big Creek and Meadow Fork drainages are most appropriate for such a design and monitoring scheme as Bull Trout are most likely to utilize a migratory life history strategy in these streams based on the availability of suitable spawning habitat. In these reaches, peak upstream migration for Bull Trout occurs from June to August. Subsequently, June to August is recognized as the minimum period during which fish traps should be operated.

Permanent traps will require maintenance to assure effectiveness. Maintenance will be performed by the TAC agencies under the guidance of the lead agency for each individual barrier.

I.3 Trap and Haul

In consideration of the high level of agency commitment associated with operating traps at barriers, areas with lower migratory expression may suffice to have less intensive approaches. For areas where barriers are necessary for project success and migration may be a lower probability among native fish, trap and haul methodologies are most appropriate. In such streams, electrofishing or other collection methods will be used, below barrier sites, to collect fish. Captured native fish will be released upstream of the barrier site. This methodology will provide the opportunity for immigration into isolated populations. The use of this methodology will differ depending on the stream and determined need based on captures below barriers.

Using monitoring results, the TAC will address the need to modify barrier design, adjust fish passage efforts, and/or decommission barriers. The need for barriers will be continually evaluated as eradication efforts precede throughout the Upper Malheur River Watershed.

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K. Acronyms

BIBI - Benthic Invertebrate Index of Biological Integrity

BLM - Bureau of Land Management

BOR - Bureau of Reclamation

BPA - Bonneville Power Administration

BPT - Burns Paiute Tribe

CDFW - California Department of Fish and Wildlife

FSM - Forest Service Manual

NPS - National Park Service

ODA - Oregon Department of Agriculture

ODFW - Oregon Department of Fish and Wildlife

PPA - Public Pesticide Applicators

Recovery Plan - Recovery Plan for the Coterminous United States Population of Bull Trout (*Salvelinus confluentus*)

RM - River Mile

RUIP - Recovery Unit Implementation Plan

RUP - Registered Use Pesticide

TAC - Technical Advisory Committee

USDA - U. S. Department of Agriculture

USFS - U. S. Forest Service

USFWS - U. S. Fish and Wildlife Service

USGS - U. S. Geological Survey

Appendix A

Table 1. Summary of aquatic habitat surveys completed in the Upper Malheur River Watershed since 2013. Cells highlighted in yellow represent reaches that meet standards for in-stream habitat, while the reds cells represent reaches that have substandard habitat conditions.

	Waterbody						
	Black Canyon Creek	Bluebucket Creek	Lee Creek	Skookum Creek	Malheur River – Below Ford		
Reach	1	1	1	1	1	2	3
Wetted width	3	4	4	5			
Large wood source	MHW[a]	MHW	MC[b]	MC	MC	MC	MC
Bankful W:D							
Pools per mile							
% fines					UD	UD	UD
LWM per mile (LM:S)							
Bank stability (%)							
July shade					X	UD[c]	UD

[a] Meadow hardwood
[b] Mixed conifer
[c] Undetermined

Table 2. Summary of aquatic habitat surveys completed in the Upper Malheur River Watershed since 2013. Cells highlighted in yellow represent reaches that meet standards for in-stream habitat, while the reds cells represent reaches that have substandard habitat conditions.

	Waterbody						
	Bosenberg Creek				West Summit		
Reach	2	3	4	5	2	3	4
Wetted width	8	15	7	6	4	3	3
Large wood source	CL[a]	UD[b]	CL	CL	MHW[c]	MHW	MC[d]
Bankful W:D							
Pools per mile							
% fines		UD				UD	
LWM per mile (LM:S)					NA	NA	
Bank stability (%)	UD	UD	UD	UD			
July shade		UD				UD	

[a] Conifer Lodgepole
[b] Undetermined
[c] Meadow hardwood
[d] Mixed conifer

Table 3. Summary of aquatic habitat surveys completed in the Upper Malheur River Watershed since 2013. Cells highlighted in yellow represent reaches that meet standards for in-stream habitat, while the reds cells represent reaches that have substandard habitat conditions.

	Waterbody										
	Summit										
Reach	1	2	3	4	5	6	7	8	9	10	11
Wetted width	13	11	12	10	9	9	8	4	5	5	6
Large wood source	MC[a]	CP[b]	CP	CL[c]	CL	CL	CL	CL	MHW[d]	MC	MC
MCBankful W:D						10	9	7	8	10	7
Pools per mile											
% fines											
LWM per mile (LM:S)											
Bank stability (%)											
July shade											

[a] Mixed conifer
[b] Conifer Ponderosa
[c] Conifer Lodgepole
[d] Meadow hardwood

Appendix B

Table 1. Restoration activities the USFS plans to implement with its partners in the Upper Malheur River Watershed to improve habitat conditions for Bull Trout.

Habitat restoration activity	Objective
Enhance native hardwood riparian vegetation in Bull Trout spawning, rearing and migration areas	Increase canopy and riparian cover Provide a reliable source of large hardwood beaver forage Maintain or improve effective shade Reduce stream temperatures Improve thermal connectivity across the Malheur stream network Improve habitat to support biodiversity Enhance resiliency to natural disturbance(s) and climate change
Implement channel restoration projects in degraded stream reaches of designated Critical Habitat	Increase large wood Increase habitat complexity Increase floodplain connectivity Enhance resiliency to natural disturbance(s) and climate change
Implement meadow restoration projects in degraded wet meadows within the Upper Malheur River Watershed	Increase cool water storage in the floodplain Increase floodplain connectivity Reduce stream temperatures Enhance hydric vegetation and groundwater-dependent ecosystems Improve thermal connectivity across the Malheur stream network Enhance resiliency to natural disturbance(s) and climate change
Remove connectivity barriers within in Bull Trout spawning, rearing and migration areas	Fix/restore passage barriers on forest service roads (e.g. culverts) Improve connectivity across the Malheur stream network Enhance resiliency to natural disturbance(s) and climate change
Install appropriate fish screens, where needed, in Bull Trout spawning, rearing and migration areas	Reduce entrainment Improve connectivity across the Malheur stream network
Improve and secure instream flows affecting Critical Habitat streams	Restore connectivity and opportunities for migration Increase base flows to moderate stream temperature changes and increase habitat availability
Reduce grazing impacts along Critical Habitat streams	Reduce grazing pressure on riparian areas and stream to support habitat recovery
Reduce the density of forest roads within riparian areas, where appropriate, within the Upper Malheur Watershed	Reduce chronic sediment delivery from roads Enhance vegetation recovery on compacted surfaces to increase stream shade Increase floodplain connectivity

Part II – Supplement 1

Brook Trout Removal Planning 10-Year Perspective

Malheur River Bull Trout Technical Advisory Committee

A. Contributing Agencies and Participants

Burns Paiute Tribe (BPT) - Erica Maltz, Kristopher Crowley, and Brandon Haslick

Oregon Department of Fish and Wildlife (ODFW) - David Banks and Benji Ramirez

U.S. Forest Service (USFS) - Steve Namitz, Kate Olsen, and Hazel Owens

U.S. Fish and Wildlife Service (USFWS) - Chris Allen, Suzanne Anderson, and Justin Martens

Bureau of Reclamation (BOR) - Dmitri Vidergar

B. Introduction

This strategic plan introduces actions to remove or reduce Brook Trout numbers within prioritized areas of the Upper Malheur River Basin Core Area (Table 1). The TAC believes the 10-year perspective provides an adequate timescale for prioritizing actions that will affect Brook Trout eradication. The strategy addresses the array of variables affecting the length of time required to successfully eradicate Brook Trout in any stream segment, let alone multiple segments within a stream combined with the reconnection of multiple streams. Other variables that have been considered include funding, staff availability, and differing work priorities among the participating agencies.

C. Planning Assumptions

The following assumptions were used to develop the 10-year plan for removing Brook Trout from the Upper Malheur River Basin Bull Trout Core Area:

- The proposed 10-year period will be from 2018 to 2028.
- All stream reaches will be extensively surveyed prior to treatment to identify any springs, seeps, tributaries, or other variables that may affect the treatment logistics.
- Temporary barriers (Figure 1) will be used to partition the streams into logistically treatable stream segments.

Table 1. Sites listed in prioritized treatment order for a 10-year period. Segment lengths are based on single channels and do not account for stream braiding and other variables so actual stream mileage per treatment reach is expected to be larger. The size of High Lake was estimated based on maps and Google Earth and the Burns Paiute Tribe.

Treatment order	Site	Segment	Segment length (miles)	Barrier construction required
1a	High Lake	High Lake	40.6 Acre Feet (volume)	None needed if treated in conjunction with 1b
1b	Lake Creek	High Lake to natural barrier	1.65	None needed due to natural barrier
2	Lake Creek	Natural barrier to 1648 rd	4.25	Barrier constructed at 1648 rd
3	Meadow Fork of Big Creek	Natural barrier to 021 rd bridge	3.09	Barrier constructed at the 021 rd bridge
4	Bosonberg Creek	Headwaters to railroad grade barrier	3.16*	None needed if railroad grade is a complete barrier
5	Big Creek/ Snowshoe Creek	Natural Barrier to Big/Snowshoe confluence and all of Snowshoe Creek	Big = 2.59 Snowshoe = 1.84[a]	Barrier constructed just below Big and Snowshoe Creeks confluence
6	Summit, Crooked, Corral or McCoy Creeks	TBD	TBD	TBD

[a]Stream length for Bosonberg and Snowshoe creeks are estimates. The actual stream mileage will be decided prior to treatment after locating upstream boundaries for fish presence.

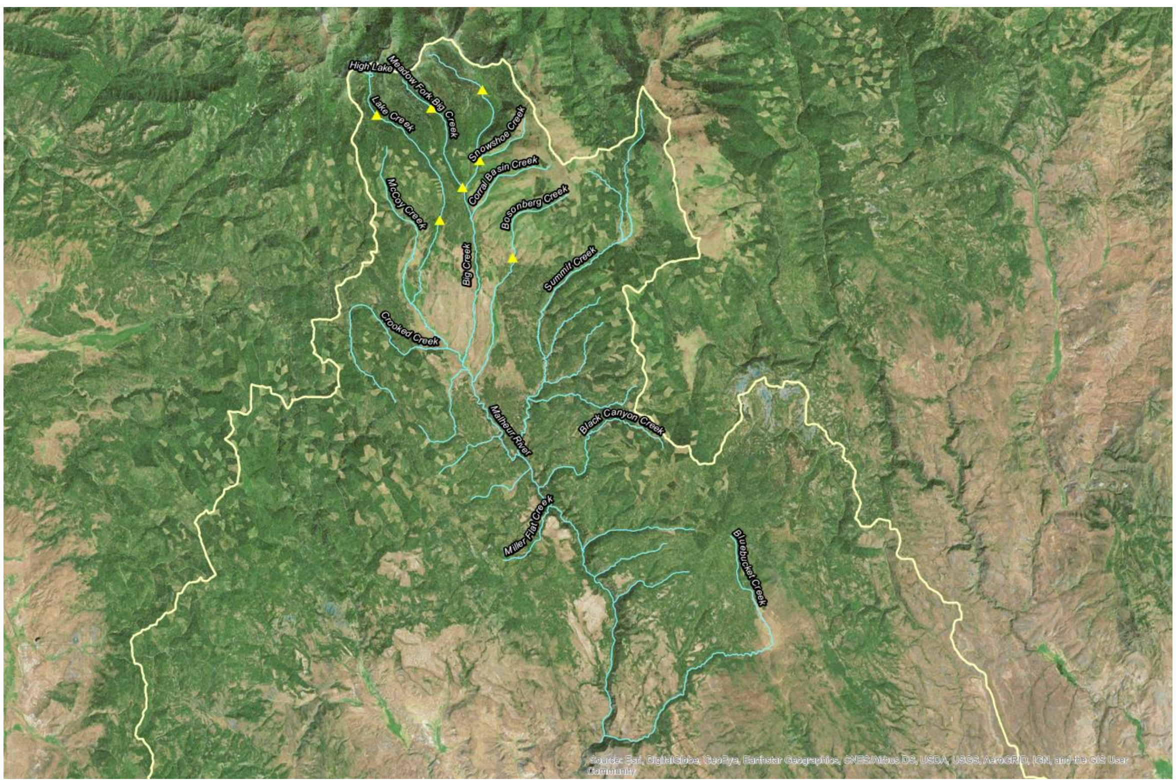

Figure 1. Potential locations of barriers (yellow triangles) for the 10-year rotenone treatment to remove Brook Trout from sections of the Upper Malheur River Watershed.

    - National Environmental Policy Act, Endangered Species Act, fill removal (Department State Lands), MRDG, and any other requirements or permits will be completed prior to construction of any barriers.
    - Temporary is a relative term concerning barrier construction and could entail some barriers remaining in place for 5 to 30 years.
    - Barriers will be removed from treated stream segments once downstream barriers are capable of preventing reinvasion by Brook Trout
    - The TAC will work to facilitate passage for native species above barriers as staff time and funding are available and as specific needs arise.
- Streams will be treated once each year with treatments for each segment of stream occurring consecutively for two years.
- The ODFW will be the lead for all rotenone treatments with assistance from TAC members.
- A variety of sampling techniques will be used to remove pure Bull Trout from stream segments prior to treatment. Pure Bull Trout will be translocated to streams that have already been treated and in sections above barriers that will effectively prevent reinvasion by Brook Trout.
    - Pure Bull Trout will be identified by trained staff using peer reviewed methods.
    - The initial treatments in some streams will coincide with second-year treatments in other reaches.
    - A staggered approach will allow movement of salvaged Bull Trout into streams that have already been treated.
    - Lake Creek has a small pure Bull Trout population so initializing treatments in that system will create fishless segments of stream to transfer salvaged Bull Trout from other streams prior to their treatments.
- The TAC members will work to mimic connected Bull Trout populations while barriers are in place to reduce the likelihood of reduced genetic variability.

D. Probability of Success

Risk and uncertainty are inherent in nearly all natural resource related projects and subsequently must be weighed and considered prior to implementation. The TAC has been diligent in seeking to discover the level of risk and uncertainty inherent in each aspect of this conservation strategy. The TAC concludes that this plan has a moderate to high probability of both short-term and long-term success in the eradication of Brook Trout from treated streams. This conclusion is based on extensive research of similar projects throughout the West, including efforts in Oregon (Table 2), the TAC members combined experience with such projects, and the vetting of this plan through a panel of fisheries and rotenone project design experts. To further ensure the highest likelihood of success, the use of rotenone will follow the American Fisheries Society's *Planning and Standard Operating Procedures Manual for the Use of Rotenone in Fish Management* (Finlayson et al. 2010).

Table 2. Examples of rotenone efforts by ODFW, in Oregon, to eradicate non-native fish.

State	Waterbody	Target Species	Successful
Oregon	Summit Gravel Pond	Smallmouth Bass and crayfish	Yes
Oregon	McDermott Creek	Rainbow Trout	No[a]
Oregon	Diamond Lake	Tui Chub	No[a]
Oregon	Sun Creek	Brook Trout	Yes
Oregon	Diamond Lake	Tui Chub	No
Oregon	Walton Lake	Brown Bullhead	Yes
Oregon	South Twin Reservoir	Brown Bullhead	Yes
Oregon	Antelope Flat Reservoir	Brown Bullhead	Yes
Oregon	Crane Prairie Pond	Brown Bullhead	
Oregon	Lofton Reservoir	Tui Chub	Yes
Oregon	Beck-Kiwanis Pond	Carp and Goldfish	Yes
Oregon	North Twin Reservoir	Brown Bullhead	Yes
Oregon	Sun Creek	Brook Trout	Yes
Oregon	McDermitt Creek	Rainbow Trout, Brook Trout, Brown Trout	No
Oregon	Sage Creek	Rainbow Trout and Brook Trout	Yes

[a] Effort unsuccessful due to illegal releases following treatments

E. Application of Rotenone

The application procedure for rotenone is straightforward and generally highly successful when label instructions are closely followed, including the detoxification of rotenone appropriately at the end of the treatment area. In many streams, native fish salvage may also be necessary prior to treatment. Depending on the type of holding area used, monitoring fish for survival may be necessary. The TAC has high confidence that this will be successfully accomplished by holding fish in nearby streams, streamside holding tanks, or hatcheries. If deemed necessary, the TAC may choose to hold native fish in multiple locations to minimize the risk of total loss.

E.1 Rotenone Project Phases

Any rotenone project has three phases; pre-treatment, treatment, and post-treatment. Pre-treatment, treatment, and post-treatment activities for rotenone projects in the Upper Malheur River Watershed Phase 1 Area will be similar across streams within this area.

E.1.1 Pre-Treatment Phase

Pre-treatment activities will include: 1) determination of treatment area and project area, 2) obtain permits/authorization for treatment in the wilderness, 3) identification of drip can locations, 4) streamflow measurements, 5) stream travel-time using fluorescein dye, 6) native fish salvage, 7) placement of sentinel fish throughout the treatment area, 8) preliminary and final calculations of rotenone and potassium permanganate, 9) ordering rotenone and potassium permanganate, 10) determination of personnel needs, 11) personnel assignments for the treatment, 12) signing (restricted access) at access points, 13) area closures as needed (work with USFS), 14) project implementation review, and 15) safety meeting (day before). Pre-treatment activities for High Lake will be similar to streams, but will include the calculation of lake area volume, staging a boat (helicopter), pump, fuel, backpack sprayers, and liquid rotenone.

E.1.2 Treatment Phase

Treatment activities will occur in stages proceeding from High Lake downstream to two hours of flow travel-time below the detoxification station/waterfall barrier. High Lake will be treated during the stream treatment and vice versa. High Lake will require a three- or four-person team (Table 3), two on the boat (use of a helicopter is the prefererd technique) dispersing rotenone into the lake and one or two walking the perimeter of the lake spraying the edges. The backpack crew will spray until they have treated the entire perimeter of High Lake. The boat crew will apply rotenone into High Lake until all rotenone is gone. The stream team will consist of two to four personnel (Table 3) starting and monitoring drip stations at as few as five and as many as eight locations. Drips will occur over a four-hour period and drip flow rates will be monitored hourly. The detoxification station and check station will require two individuals (Table 3). One person will be stationed at the detoxification station while the other will monitor sentinel fish at various flow times below the detoxification station. One to three individuals will be used to distribute sand mixed with rotenone to springs and stagnant water areas within the treatment area. Treatments are planned to occur for two years, with one each July. Projected costs for the project are listed in Table 4.

Table 3. Staffing and time requirements for rotenone treatments in the Upper Malheur River Watershed.

Treatment area	Crew	Number of personnel	Number of days
High Lake	Boat[a]	2	1
	Spray	2	1
Lake Creek (High Lake to Lake Creek Falls)	Drip station	3	1
	Detoxification station	1	2 to 10
	Detoxification check station	1	1
	Equipment runner/ miscelaneous	1	1
	Sand crew	3	1

[a] Use of a helicopter is the prefererd technique for application of rotenone in High Lake

E.1.3 Post-Treatment Phase

E.1.3.1 Short-term Monitoring (<10 years)

Short-term monitoring results will be used to guide future annual project implementation. Per Finlayson et al. (2010), the following post-treatment attributes will be monitored: 1) effectiveness of the treatments, 2) macroinvertebrate colonization, 3) effects to amphibian populations, and 4) effects on non-target fish species. In addition, the barriers will be evaluated for their effectiveness in preventing the immigration of Brook Trout. If monitoring indicates low-risk implementation is successful, higher levels of risk would be considered for future years.

E.1.3.2 Long-term Monitoring (>10 years)

A rigorous long-term monitoring program will be an essential component of the Bull Trout restoration efforts in the Upper Malheur River Watershed. Data collected through the project will inform each phase of implementation. The long-term monitoring strategy will include:

- Status of treated reaches - Treated reaches will be monitored for absence of Brook Trout.
- Index of Bull Trout trends - Yearly spawning surveys will be conducted to evaluate Bull Trout populations in the Upper Malheur River Watershed. Surveys will allow for the evaluation of Bull Trout recovery while minimizing impacts associated with intrusive sampling efforts.
- Presence and distribution of Brook Trout, Bull Trout, and/or other native species - Use eDNA to detect the presence of Brook Trout while minimizing the impact of sampling activities on restoration efforts. Although electrofishing is an intensive sampling tool, its use will be necessary to evaluate the presence/absence of Brook Trout following the treatments. Electrofishing will likely occur every year; however, adaptive monitoring will dictate its use in streams or stream sections that are to be sampled. Streams or stream sections may be put into a rotational sampling strategy that would prevent them from being heavily sampled each year while still having the capacity to evaluate changes in the native fish populations. Snorkel surveys may be used to assess native fish populations while minimizing the impact to these populations. Long-term monitoring efforts in the Upper Malheur River Watershed will take an adaptive management approach that allows for changes to be made as new data and tools become available.
- Genetics - Genetic studies will be conducted to investigate genetic purity of Bull Trout populations. When enough reaches have been treated, analyses will be conducted to assess the genetic diversity of all native species.

Table 4. Projected costs and probability of success for efforts associated with the Upper Malheur River Watershed rotenone project.

Project component/concern	Cost	Probability of scuccess (high, moderate, low)	Mitigation or actions
Public education and outreach	$50,000	Moderate	TAC agencies as well as third party facilitator participate in activity engaging the public, demonstarting the problem, and addressing concerns
Native fish salvage/holding	$50,000	Moderate-high	Fish may be stored in hatcheries, in streamside holding tanks, or in Brook Trout-free streams reaches
Rotenone application/Brook Trout eradication	$250,000	High	ODFW rotenone application team oversee application
Barrier design/installation	$500,000	Moderate	Include design components that restrict fish passage under all foreseeable environmental conditions and Incorporate components that will allow for selective fish passage
Barrier maintenance/fish passage	$50,000	Moderate	Adaptively manage barriers based on effectiveness and native fish ppoulation concerns
Post-implementation monitoring	$50,000	High	Monitor fish, macroinvertebrates, and amphibian populations post-treatment to ensure native species re-establishment

F. References

Finlayson, B., R. Schnick, D. Skaar, J. Anderson, L. Demong, D. Duffield, W. Horton, and J. Steinkjer. 2010. Planning and standard operating procedures for the use of rotenone in fish management—rotenone SOP manual. American Fisheries Society, Bethesda, Maryland.

G. Acronyms

BOR - Bureau of Reclamation

BPT - Burns Paiute Tribe

ODFW - Oregon Department of Fish and Wildlife

TAC - Technical Advisory Committee

USFWS - U. S. Fish and Wildlife Service

USFS - U. S. Forest Service

Part III – Supplement 2

Public Outreach and Rotenone Treatment Planning

Malheur River Bull Trout Technical Advisory Committee

A. Contributing Agencies and Participants

Burns Paiute Tribe (BPT) - Erica Maltz, Kristopher Crowley, and Brandon Haslick

Oregon Department of Fish and Wildlife (ODFW) - David Banks and Benji Ramirez

U.S. Forest Service (USFS) - Steve Namitz, Kate Olsen, and Hazel Owens

U.S. Fish and Wildlife Service (USFWS) - Chris Allen, Suzanne Anderson, and Justin Martens

Bureau of Reclamation (BOR) - Dmitri Vidergar

B. Rotenone Project Planning Stages

The TAC will follow the *Planning and Standard Operating Procedures for the Use of Rotenone in Fish Management – Rotenone SOP Manual* (SOP) (Finlayson et al. 2010) as the minimum mandatory standard for the planning and implementation of the Upper Malheur River Watershed rotenone project. The proposed planning and implementation processes (Figure 1) associated with the TAC's rotenone project were adapted from the Arizona Game and Fish Department's (AGFD) *Piscicide Treatment Planning and Procedures Manual* (AGFD 2012), and comply with the SOP, product labels, and applicable laws and regulations.

B.1 Stage 1 - Internal Review and Approval

B.1.1 Internal Review and Approval

The project will receive internal review and approval by the appropriate Executives of each TAC member prior to convening the initial public meeting. Executives will be sent a briefing upon approval.

STAGE 1

- Step 1- Conduct internal review and approval
- Step 2- Submit briefing to Executives for review and approval

STAGE 2

- Step 1- Convene initial public meeting(s)
- Step 2- Submit briefing to Executives for review and approval
- Step 3- Develop Preliminary Treatment and Public Involvement plans
- Step 4- Submit briefing to Executives for review and approval
- Step 5- Convene public education meeting(s) and develop briefing (non-NEPA)
- Step 6- Submit briefing to Executives for review and approval

STAGE 3

- Step 1- Intermediate planning and public involvement procedures
- Step 2- Convene NEPA public meeting(s) and develop briefing
- Step 3- Submit briefing to Executives for review and approval

STAGE 4

- Step 1- Initiate and complete project implementation and evaluation

Figure 1. Stages associated with the proposed planning and implementation processes for the use of rotenone to eradicate non-native Brook Trout from the Bull Trout Upper Malheur River Core Area located in the Upper Malheur River Watershed, Oregon. Process adapted from AGFD (2012).

B.2 Stage 2 - Preliminary Planning and Public Involvement

B.2.1 Initial Public Meeting(s)

An initial public meeting will be convened prior to developing the Preliminary Treatment Plan (PTP) and Public Involvement Plan (PIP). If controversy results from the initial meeting, additional meetings may be necessary before submitting the Public Meeting Briefing (briefing) for approval. Following the initial public meeting, and any additional meeting, a briefing will be approved by the Executives prior to the development of the PTP and PIP.

B.2.2 Preliminary Treatment and Public Involvement Plans

The PTP and PIP will be initiated after the following criteria are met: 1) the Internal Review and Approval Form is approved and 2) the initial public meeting is convened and the briefing has been approved. Once completed, the PTP and PIP will be submitted to the Executives for approval prior to initiating intermediate planning. Environmental compliance will be initiated upon approval.

B.2.3 Public Education Meetings

Once the PTP and PIP are approved, at least one non-National Environmental Policy Act (NEPA) related public meeting will be convened before initiating intermediate planning. If controversy results from the meeting, additional meetings will be convened before initiating the project. A briefing describing the level of support or opposition for the project will be provided to the Executives for approval before starting the Intermediate Planning Stage.

B.3 Stage 3 - Intermediate Planning and Public Involvement

The Intermediate Planning Stage will be initiated when the Executives have approved the: 1) PTP, 2) PIP, and 3) the briefing for all public education meetings held during the Preliminary Treatment and Public Involvement Planning Stage. During this stage, all necessary environmental compliance will be completed to further define the treatment plan. Public meetings convened during this stage will be NEPA-oriented. Once NEPA and all associated environmental compliance is completed (including Finding of no Significant Impact (FONSI), Endangered Species Act (ESA), Environmental Assessment (EA), and National Pollution Discharge Elimination System (NPDES) compliance), the Intermediate Planning and Public Involvement Proposal (IPPIP) will be reviewed by at least two individuals with applicator experience. Following the applicators' reviews, the IPPIP and briefing will be submitted to the Executives for review and approval at least two months prior to treatment.

B.4 Stage 4 - Project Implementation and Evaluation

The project will be implemented per the IPPIP once all applicable state and federal compliance activities are completed and the IPPIP is approved. The post-treatment evaluation is a critical part of the treatments and will assist the TAC in improving planning and implementation of future projects. A Project Evaluation Report and documentation will be submitted to the Executives within 60 days following the final treatment.

C. Project Planning and Public Involvement

C.1 Stage 1 - Project Internal Review and Approval

The proposed project will receive internal review, input, and approval before seeking public input (following SOP, page 15).

C.1.1 Internal Review and Approval Template

The Internal Review and Approval Stage will be completed and approved by the Executives before initiating the next stage. The Executives will be provided a briefing that includes the following information:

1. Project supervisor (this will be the primary contact for the project and will submit all documents identified in this planning guide).

2. Project location (including description of proposed treatment area).

3. Project timeline (month and year; although this is pre-NEPA, will provide best estimate).

4. Statement of purpose (will include threat of target species on surrounding waters).

5. Target species for removal.

6. List of conflicts with management objectives, recovery plans, etc.

7. Sensitive, endemic, and listed species that may be potentially impacted by the project.

8. Fish removal alternatives attempted and/or justification/explanation of why alternatives were not considered as viable fish removal options.

9. Proposed piscicide that will be used and method of application (will include neutralization chemical and application method).

10. Land ownership.

11. Current use of the water body (will include a description of angling, recreational, and agricultural use) and water uses potentially affected by the project.

12. Interested parties potentially affected by the project.

13. Downstream areas potentially affected by project.

14. Likely supporting and opposing groups and individuals.

15. Supporting and regulatory agencies affected.

16. Determination of applicable laws and regulations the project will require (will identify if environmental compliance issues exist).

17. Chance of success to meet management objectives and number of treatments/years required for success.

18. Signature page for Executives.

C.2 Stage 2 - Preliminary Treatment and Public Involvement Plan

C.2.1 Initial Public Meeting (non-NEPA related)

The initial public meeting will be convened when the internal review and approval are completed. If controversy exists during the public meeting, additional meetings may be required to inform and resolve the issues before developing the PTP and PIP. The need for additional initial public meetings will be determined by the TAC.

The purpose of the initial public meeting is to acquaint the public and elected officials, in the proposed project area, with the proposed project and to explain the: 1) background, 2) management objectives for the Upper Malheur River Watershed, 3) desired conditions, 4) problem, 5) alternatives considered, 6) major issues, and 7) process to the public to ensure they understand how they will be involved in the decision making process. The purpose will also be to identify public concerns/issues and consider how to address them. The outcome of the initial public meeting will help guide development of the PIP.

Following the initial public meeting, a briefing will be submitted to the Executives for approval before initiating the Preliminary Treatment and Public Involvement Planning Stage. If multiple meetings are convened, one briefing will be submitted summarizing the outcome of the multiple meetings.

When planning the initial public meeting, the following items will be considered/presented:

1. The meeting will be convened after the proposed project received internal review and approval. The meeting will occur prior to developing the PTP and PIP.

    a. Input received during the meeting will be used to develop the PIP.

2. Information will be provided regarding the alternatives, rotenone and their associated impacts (nontechnical at this stage), and anticipated benefits to the resource and the public. Opportunities will be provided for interaction between stakeholders and the TAC.

3. Public input will be solicited relative to alternatives considered. This is a proposed project and it will be conveyed to the public as such.

4. The meeting will be of an informal open-house style that uses displays, handouts, maps, and other materials designed to expose the public to the project information and ideas. The meeting will provide a chance for the public to react and express feedback in oral or written form. The following will be completed:

    a. Educate the public by using language easily understood by laypersons.

b. Public participation that is meaningful to the public (incorporate awareness, education, input, and decision-making).

c. Document comments in the meeting minutes.

d. Encourage attendance by angling groups, agencies, and other partners.

e. Incorporate feedback and response from initial public meeting(s) into the PIP.

5. At any of the public meetings, the following information will be presented:

a. Description of the current problem and the desired condition for the Upper Malheur River Watershed.

b. Description of the project as it relates to fisheries management objectives.

c. Alternatives for consideration.

d. Description of potential benefits if the project moves forward.

e. Description of the geographic area.

f. Identification of recreational activities/interests in the Upper Malheur River Watershed.

g. An identification of water uses in the project area (includes agriculture/ranching).

h. Description of prior public participation activities undertaken in developing the project.

i. Identification of partners.

j. Description of the steps and general timeframe for the project.

C.2.2 Project Public Meeting Briefing Template

The briefing template will be used to describe the outcome of all public meetings to the Executives. The following information will be included in every briefing:

1. Date, time, and location of the meeting.

2. Number of participants.

3. Stakeholders invited and the method of publication notification of the meeting.

4. Brief description of the meeting format and information presented.

5. Documentation of the public, staff, landowner, permittee, and downstream user support, opposition, concerns, and/or feedback from the meeting. Also included in the briefing will be:

a. A tally of the number of previous public meetings held in association with the project.

b. Feedback from previous meetings as a comparison to feedback from the current meeting (if required).

c. Explanations describing whether more public meetings are or are not necessary.

d. Documentation of stakeholders that chose not to become involved at the meeting, or did not show up at a meeting. If additional public meetings are necessary, an updated meeting and/or communication strategy will be provided to ensure better stakeholder engagement.

6. Brief justification why the project is ready to enter the next stage, or why more public meetings may be necessary before initiating the next stage.

7. Signature page for Executives.

C.2.3 Preliminary Treatment Plan

The PTP will be initiated after the following criteria are met: 1) the Project Internal Review and Approval Form is approved and 2) the initial public meeting is held and the briefing has been approved by the Executives.

C.2.4 Preliminary Treatment Plan Template

Prior to submitting the PTP for approval, it will be reviewed by at least two individuals with rotenone application experience. The PTP will be submitted with the PIP and approved by the Executives before moving forward with an additional public meeting (non-NEPA) and intermediate planning. Applicable environmental compliance (e.g., NEPA) will be initiated once the PTP and PIP are approved.

The following detail will be provided in the PTP:

1. Project supervisor(s).

2. Treatment location and project area (SOP, pages 65-66) in the Upper Malheur River Watershed including a map highlighting these areas.

3. Physical and chemical characteristics of the Upper Malheur River Watershed (SOP, page 15) including a map highlighting these characteristics in the treatment areas.

4. Barriers, ownership, and obstructions in the Upper Malheur River Watershed (SOP, pages 15-16). Included will be a description of the barriers/obstructions to fish (hydrological) and human movement (topographical and legal). A map of the Upper

Malheur River Watershed will be provided highlighting these characteristics in the treatment areas.

5. Rotenone and neutralization (mandatory because the treatment is associated with flowing water) formulations that will be used and how concentrations will be determined (SOP and product labels).

6. Identification of public and commercial interests of those that use the Upper Malheur River Watershed (SOP, page 16). Land ownership of land surrounding the treatment areas will be documented and mapped.

   a. Permittees/landowners/water users within treatment area will be documented as will the owners of domestic wells or ponds within treatment area (SOP, page 29).

7. Interagency responsibilities (SOP, page 16).

8. Determination of applicable laws and regulations the project will require (these will likely be the same for most treatments; identify potential environmental compliance issues; SOP, page 15).

9. Protocols and monitoring plan for groundwater or surface water connections to treatment areas (SOP, pages 121-123).

10. Logistics:

   a. Methods associated with rotenone application (SOP, chapters 5-14) and neutralization. Planned methods of application (e.g., drip station, spray unit) and where each method will be included.

   b. Staff needs.

   c. Equipment needs.

   d. Required permits and approvals.

   e. Biological and chemical monitoring required; lab(s) that will conduct analyses, if applicable (SOP, pages 115-117).

11. Description of the restocking plan including the monitoring that will occur to determine when conditions are best for restocking.

12. Project budget including costs for equipment, staff, environmental compliance, chemical, etc.

13. Signature page for the Executives.

C.2.5 Public Involvement Plan

The PIP will be initiated after the following criteria are met: 1) the Project Internal Review and Approval Form is approved; and 2) the initial public meeting is held and the associated briefing has been approved.

The purpose of the PIP is to create public awareness relative to the project goals, objectives, and process, while providing opportunities for public participation in decisions relating to wildlife management, human health, and the environment in reference to the proposed project. In general, it is the TAC's goal to generate awareness, consensus, and support for the proposed project. To do so, results from the initial public meeting will be considered when developing the PIP.

C.2.6 Public Involvement Plan Template

The PIP must be submitted for approval by the Executives before convening additional public meetings and prior to initiating intermediate planning.

The following information will be included in the PIP:

1. Description of the proposed project.

2. Identification of the PIP objectives.

3. Public involvement team roster (including roles and responsibilities) to identify opportunities for public engagement.

4. Description of the level of public concern or interest. The following will be considered:

    a. What was the public feedback from the initial public meeting?

    b. What is the anticipated level of conflict, controversy, opportunity or concern about the proposed project or rotenone use?

    c. How much do the major stakeholders care about the issues or project?

    d. What is the potential for public impact on the potential decision or project?

5. Determination and description of the level of public participation. The number of public meetings will be dependent on perceived public opinions of the project.

6. Identification of stakeholders:

    a. Key individuals, groups, stakeholders, area public officials, and agencies will be identified. Securing a broad representation of public interests will extend beyond just inviting the general public. Subsequently, a diverse and broad group of stakeholders will be targeted to ensure the process is not dominated by any single interest group.

7. Description of public involvement tools (e.g., meeting type – open-house style, large meetings, and neighborhood meetings). Additional outreach methods will be identified for audiences that are not engaged in public networks.

8. Schedule of public participation activities.

9. Signature page for Executives.

C.2.7 Public Educational Meetings (non-NEPA related)

Public educational meetings will be held once the PTP and PIP are approved. The purpose of meetings during this stage will be to inform the public that the use of rotenone is the preferred alternative for the project, disclose information about rotenone, seek public input, and answer questions or concerns raised by the public. These meetings are not associated with the NEPA process (i.e., they are not public scoping meetings held in conformance with NEPA). When significant controversy exists during a meeting, more public meetings will be convened to inform and resolve the issues before moving forward to the intermediate planning stage. The need for additional meetings will be determined by the TAC.

Following a meeting, a briefing will be submitted to the Executives for approval before initiating intermediate planning. This briefing can be used to summarize the outcome of multiple meetings.

At each meeting, the following items will be included and/or considered:

1. Description of the current problem and the desired condition/objective.

2. Description of the project as it relates to fisheries management objectives.

3. Discussion of the alternatives that have been considered and why a rotenone application is preferred as the fish removal method.

4. Discussion about the impacts of rotenone and neutralization to humans, the environment, and non-target organisms.

5. Description of potential benefits if the project moves forward.

6. Description of the geographic area.

7. Identification of recreational activities and interests in the watershed.

8. Identification of water uses in the project area (including agriculture/ranching).

9. Identification of partners.

10. Description of the steps and general timeframe for the project.

11. Opportunities for questions and answers.

D. Intermediate Planning and Public Involvement Procedures

The intermediate planning stage will be initiated after the following criteria are met: 1) PTP and PIP have been approved and 2) the briefing for any public meeting held during the preliminary planning stage has been approved by the Executives.

Prior to submitting the IPPIP for approval, it will be reviewed by at least two individuals with rotenone application experience.

D.1 Intermediate Planning and Public Involvement Proposal Template

The IPPIP must be reviewed and approved by Executives at least two months prior to the start of treatment. For any public meeting held during the Intermediate Planning Stage, a briefing will be submitted to the Executives with the IPPIP. There will be at least one NEPA related public meeting during this planning stage and others if determined necessary.

The SOP and product label for guidance will be consulted and sufficient detail will be provided for each step.

The following will be included in the IPPIP:

1. Project supervisor(s) and crew leader responsibilities and training (will include contact information). Project supervisor(s) and crew leader(s) will have the appropriate training (SOP, pages 33-36).

2. Map identifying the location of the project location, including descriptions and stream length of the treatment areas. For High Lake, the volume of water will be provided. Also included will be descriptions of land ownership (SOP, pages 65-66).

3. Project background, intended outcome, and statement of purpose (will include threat of targeted species (SOP, page 14).

4. Project species:

    a. Target fish species for removal.

    b. Target fish species for reintroduction.

    c. List the non-target species within treatment area (include aquatic and terrestrial species that may be impacted by the treatment).

5. Fisheries management objectives and Bull Trout Recovery Plan (description of how project ties into management objectives and recovery plan).

6. Project partners, primary roles, and contact information:

a. Description of meetings that have occurred among partners related to the project (will include dates and outcomes).

7. Alternative methods/tools evaluated and why rotenone application is the preferred method for fish removal.

8. Project Internal Review and Approval Form, PIP, and briefing.

9. Rotenone application plan that will include:

a. Application rates for rotenone and potassium permanganate and how these were determined. Calculations will be provide for estimated site volumes, surface acres, and water flows and methods for measuring flows, water volumes, travel times, and for calibrating neutralization equipment to achieve effective concentrations of potassium permanganate. In addition, the estimated total volume of rotenone and permanganate required for the project will also be provided. Criteria will be provided that is used to determine when neutralization can be safely discontinued. Labels from the rotenone and neutralization products labels will be included.

b. Proposed treatment dates and duration.

c. Estimated crew size and logistics description.

10. Site safety plan will include:

a. Details on the planned hazard communication briefing to those involved in rotenone treatment (SOP, pages 37-39), as well as the identification of the individuals involved in presenting the briefings and how MSDS will be posted/distributed.

i. Description of the personal protective equipment that will be required, per product labels, that will be distributed to the treatment staff.

ii. All training requirements will be included in the briefing (SOP, page 40.

b. A spill contingency plan (SOP, pages 56-57).

11. Communications/site security plan (SOP, pages 29-31) will include:

a. Information on notification and monitoring requirements when a hydrologic connection between treatment water and domestic wells may exist (product labels and SOP, pages 121-122).

b. Information on proposed area closures and notification plans for treatment area closures.

12. Fish removal and disposal plan (SOP, pages 119-120).

13. Crisis management plan (SOP, page 22).

14. Description of post-treatment monitoring and evaluation (SOP, pages 23-24) to determine project success and methods for critique. The post-treatment evaluation report will be submitted no later than 60 days after the final treatment.

15. Applicable laws and regulations:

a. State of Oregon Department of Environmental Quality Permit 2300-A.

i. Prepare and attach Notice of Intent (NOI) and Pesticide Discharge Management Plan (PDMP) (if applicable; may develop the draft NOI and PDMP during this planning stage).

b. NEPA analysis:

i. Project scoping notice description, dates, and outcome. Describe public concerns, support, and/or opposition to the proposed project.

ii. Biological Assessment, Environmental Assessment (EA), and Pesticide Use Plan (describe process, list meeting dates, attach when completed):

1) Ensure sufficient public outreach during public comment on draft EA; ensure local informative meeting(s); ensure public comments are addressed and the final EA is accurate (describe; attach final EA).

2) FWS Biological Opinion (BO) – ensure the BO supports the best EA alternative (describe and provide issuance date; attach).

3) Finding of No Significant Impact (FONSI) or Record of Decision (ROD)(if Environmental Impact Statement) – ensure the FONSI or ROD supports the best EA alternative (describe and provide decision date; attach).

4) Public notice on final EA, BO, and FONSI/ROD – ensure sufficient public notice on finalization of environmental documents (describe and provide dates; attach).

5) If there is a formal request for an appeal, conform with appeal comment period in cooperation with federal action agency (describe and provide dates).

a. FWS Section 7 approval (provide signature date; attach if applicable).

17. Issue media releases and publish planned action decision (e.g., FONSI) (describe and provide dates). Guidance on media release subject content will follow SOP, page 29.

18. List the names of at least two individuals with rotenone application experience that reviewed the intermediate plan.

19. Signature for the Executives.

D.2 Public Scoping Meetings (during NEPA process)

When preparing an EA, the federal agency has discretion as to the level of public involvement required and time period for review. For many rotenone projects, the agencies have to provide the public, at a minimum, a 30-day review period pre-decisional EA. Persons who offer oral or written comments on the EA or who otherwise express an interest in the project will have the right to appeal a subsequent decision on its implementation following a published legal notice of the decision. Public scoping meetings may also be held to solicit input on the proposed project and alternatives.

For all meetings held during the Intermediate Planning Stage that are held during the NEPA process, a briefing will be submitted to the Executives with the IPPIP. This briefing may summarize the outcome of multiple meetings.

E. Project Implementation and Evaluation

E.1 Project Implementation

1. Finalize project logistics, staff needs, treatment dates, and alternative dates.

2. Issue general press release(s) to media outlets within the Upper Malheur River Watershed and adjoining areas a maximum of three weeks and a minimum of one week in advance to treatment (SOP, page 29, information will be included in press release).

3. Notify known users of domestic wells within the treatment area (including neutralization zone) of impending treatment at least 7 to 14 days prior to treatment (SOP,

pages 2, 121-122). Notification and/or communication records and dates will be included in the Project Evaluation Report.

4. Adequately notify permittees and landowners within treatment area (including neutralization zone) of impending treatment at least 7-14 days prior to treatment. Notification and/or communication records and dates will be included in the Project Evaluation Report.

5. Implement project per treatment plan.

E.2 Project Evaluation

The post-treatment evaluation will be a critical part of the project to determine success of the treatment, plan for additional renovations if the treatment was not successful, plan for restoration of fish and other aquatic organisms if the treatment was successful, and to help the TAC's plan and implement future projects. Evaluations will be led by the TAC who will assign individual tasks to the appropriate agency.

E.3 Project Evaluation Report Template

The Project Evaluation Report will be completed and submitted to the Executives no later than 60 days after the final treatment. The evaluation report will be prepared when the project is completed, not following each treatment.

The Project Evaluation Report will include the following components per the SOP, pages 23-24:

1. Description of signage posted, closures, notification of domestic well users (if applicable), notification of permittees and landowners within treatment area (if applicable), and public contact that occurred in the treatment area during treatment.

2. For the post-treatment summary, the following will be included:

    a. Dates of treatments and length of time area was closed to the public.

    b. Names of project manager and crew leaders, as well as the number of participants.

    c. Description of treatment and neutralization (will include duration of treatment/neutralization, amount of rotenone and oxidizer used, and concentrations applied).

    d. Conditions at the time of the project, explanation of problems encountered, recommendations for future treatments, and observations noted by the participants, as well as any changes to the treatment plan and the explanation (e.g., due to changes in weather, environmental conditions).

e. Description of post-treatment monitoring (including water quality tests) and treatment success.

3. Report findings, as required, to involved parties.

F. References

Arizona Game and Fish Department. 2012. Piscicide Treatment Planning and Procedures Manual – May 2012.

Finlayson, B., R. Schnick, D. Skaar, J. Anderson, L. Demong, D. Duffield, W. Horton, and J. Steinkjer. 2010. Planning and standard operating procedures for the use of rotenone in fish management – rotenone SOP manual. American Fisheries Society, Bethesda, Maryland.

G. Acronyms

AGFD - Arizona Game and Fish Department

BO – Biological Opinion

BOR - Bureau of Reclamation

BPT- Burns Paiute Tribe

EA - Environmental Assessment

ESA - Endangered Species Act

FONSI - Finding of No Significant Impact

IPPIP - Intermediate Planning and Public Involvement Proposal

NEPA - National Environmental Policy Act

NOI - Notice of Intent

NPDES - National Pollution Discharge Elimination System

ODFW - Oregon Department of Fish and Wildlife

PIP - Public Involvement Plan

PTP - Preliminary Treatment Plan

SOP - Standard Operating Procedures

TAC - Technical Advisory Committee

USFWS - U. S. Fish and Wildlife Service

USFS - U. S. Forest Service

Part IV – Supplement 3

Potential Effects of Rotenone Treatments

Malheur River Bull Trout Technical Advisory Committee

A. Contributing Agencies and Participants

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B. Introduction

The Malheur River Bull Trout Technical Advisory Committee (TAC) compiled the information presented in this document to serve as a source to: 1) complete the planning stages described in Supplement 2 (i.e., *Public Outreach and Rotenone Treatment Planning*) and 2) assist with completing future assessments. This review provides an initial analysis of potential effects associated with treating multiple sites in the Upper Malheur River Watershed (Figure 1 and Table 1) with rotenone to remove non-native Brook Trout (*Salvelinus fontinalis*) in an effort to protect threatened Bull Trout (*S. confluentus*). Eradicating Brook Trout would eliminate their impacts (i.e., predation, competition, and hybridization) on Bull Trout in the Upper Malheur River Core Area and help with recovery efforts, as the Upper Malheur River Watershed has been designated as critical habitat for Bull Trout.

C. Affected Environment and Potential Concerns

This section identifies and describes potential ecological and human health impacts of the proposed rotenone treatments. Potential impacts have been organized into the following subject areas: 1) physical environment, 2) biological environment, and 3) human health.

The following definitions relate to the perceived threat-level associated with potential impacts.

Unknown - It cannot be determined at this time whether or not there will be impacts, positive or negative, to the specified resources.

None - There will be no impacts, positive or negative, to the specified resources. Generally, this means the specified resource will not be exposed to the action and its environmental consequences.

Minor - The effects are beneficial, insignificant, or discountable. Beneficial effects have contemporaneous positive effects without any adverse effects to the specified resource. Insignificant effects relate to the size of the impact and include those effects that are undetectable, not measurable, or cannot be evaluated. Discountable effects are those extremely unlikely to occur.

Potentially Significant - The specified resource is likely to be exposed to the action or its environmental consequences and has the potential to respond in a negative manner to the exposure.

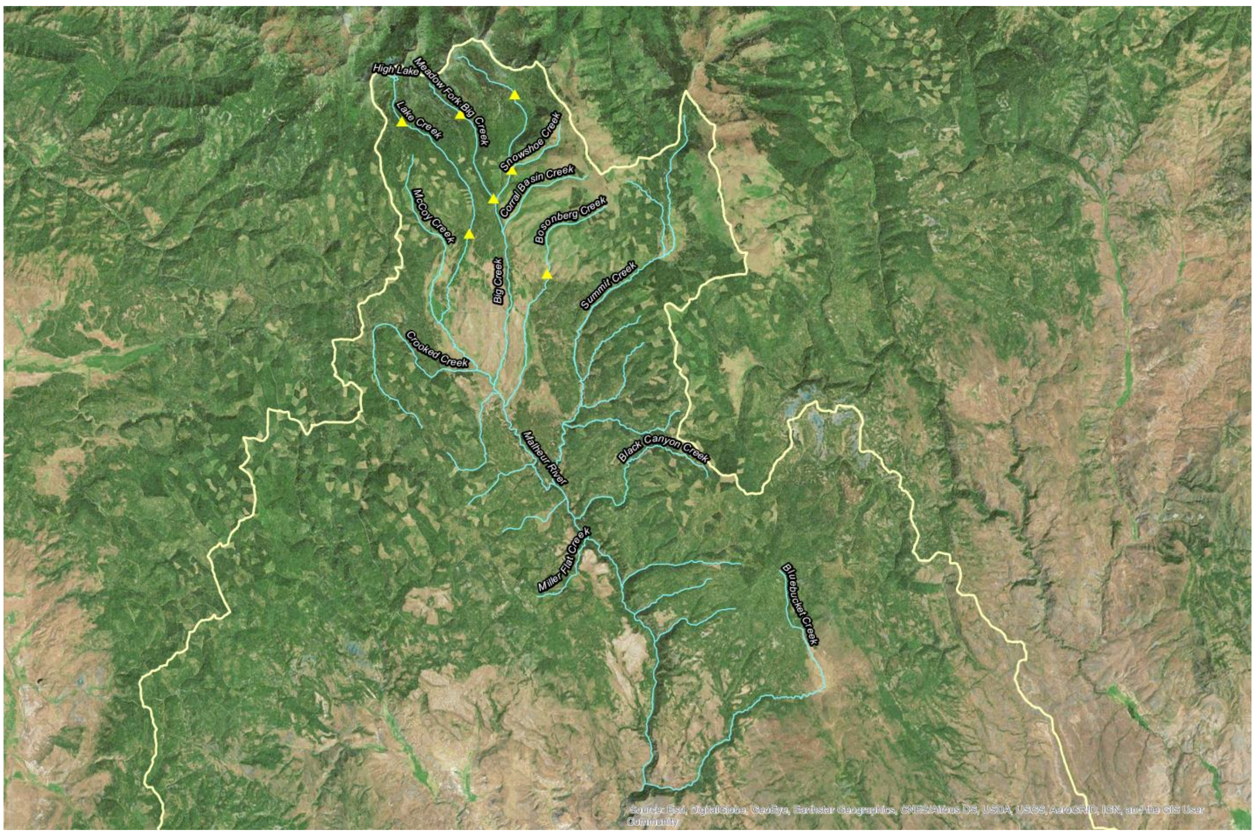

Figure 1. Potential treatment barrier locations (yellow triangles) for the 10-year rotenone treatment to remove Brook Trout from sections of the Upper Malheur River Watershed.

Table 1. Sites listed in prioritized treatment order for a 10-year period. Segment lengths are based on single channels and do not account for stream braiding and other variables so actual stream mileage per treatment reach is expected to be larger. The size of High Lake was estimated based on maps and Google Earth.

Treatment order	Site	Segment	Segment length (miles)	Barrier construction required
1a	High Lake	High Lake	40.6 Acre Feet (volume)	None needed if treated in conjunction with 1b
1b	Lake Creek	High Lake to natural barrier	1.65	None needed due to natural barrier
2	Lake Creek	Natural barrier to 1648 road	4.25	Barrier constructed at 1648 road
3	Meadow Fork of Big Creek	Natural barrier to 021 road bridge	3.09	Barrier constructed at the 021 road bridge
4	Bosonberg Creek	Headwaters to railroad grade barrier	3.16*	None needed if railroad grade is a complete barrier
5	Big Creek/ Snowshoe Creek	Natural Barrier to Big/Snowshoe confluence and all of Snowshoe Creek	Big = 2.59 Snowshoe = 1.84[1]	Barrier constructed just below Big and Snowshoe Creeks confluence
6	Summit, Crooked, Corral or McCoy Creeks	TBD	TBD	TBD

[1]Stream length for Bosonberg and Snowshoe creeks are estimates. The actual stream mileage will be decided prior to treatment after locating upstream boundaries for fish presence.

C.1 Physical Environment

C.1.1 Land Resources

Will the proposed action result in:	Unknown	None	Minor	Potentially significant	Can impact be mitigated
a. Soil instability or changes in geologic substructure?		X			
b. Disruption, displacement, erosion, compaction, moisture loss, or over-covering of soil which could reduce productivity or fertility?		X			
c. Destruction, covering, or modification of any unique geologic or physical features?		X			
d. Changes in siltation, deposition, or erosion patterns that may modify the channel of a river or stream or the bed or shore of a lake?		X			

C.1.2 Water Resources

Will the proposed action result in:	Unknown	None	Minor	Potentially significant	Can impact be mitigated
a. Discharge into, or any alteration of, surface water quality including but not limited to temperature, dissolved oxygen, or turbidity?			X	X	C.1.2a
b. Changes in drainage patterns or rate and amount of surface runoff?		X			
c. Alteration of the course or magnitude of flood water or other flows?		X			
d. Changes in the amount of surface water in any water body or creation of a new water body?		X			
e. Exposure of people or property to water related hazards such as flooding?		X			C.1.2e
f. Changes in the quality of groundwater?		X			C.1.2f
g. Changes in the quantity of groundwater?		X			
h. Increase in risk of contamination of surface or groundwater?			X	X	C.1.2a, C.1.2f
i. Effects on any existing water right or reservation?		X			
j. Effects on other water users as a result of any alteration in surface or groundwater quality?		X			
k. Will the project affect a designated floodplain?		X			
l. Will the project result in any discharge that will affect federal or state water quality regulations?			X	X	C.1.2a, C.1.2l

Comment C.1.2a - Rotenone treatments would result in short-term effects to water quality. Three ways in which rotenone can be detoxified include: 1) basic dilution, 2) detoxification, and 3) natural breakdown. Basic dilution, by fresh water, is accomplished by fresh groundwater or surface water flowing into the waterways, whereas detoxification involves the application of an oxidizing agent (i.e., potassium permanganate). The most common method is to allow rotenone to naturally breakdown, as rotenone is susceptible to natural detoxification through mechanisms such as water chemistry and temperature, organic load, and exposure to oxygen and sunlight (Loeb and Engstrom-Heg 1971; Engstrom-Heg 1972; Gilderhus et a1. 1986; Ware 2002; ODFW 2008).

High Lake Treatments

Because High Lake does not have a significant surface water inlet to detoxify the lake water and groundwater recharge rates are unknown, the preferred detoxification method will be to allow the rotenone to degrade naturally over time. With colder temperatures, toxic effects associated with rotenone can last 4 to 5 weeks; however, since the treatment is planned for July, the TAC anticipates that all rotenone in High Lake would detoxify over a shorter period of time.

Following the rotenone treatments, there may be a substantial quantity of dead Brook Trout carcasses in High Lake. Project personnel will recover and dispose of all surfacing dead fish, at regular intervals, until no dead fish are observed.

A secondary effect of the treatment would be a temporary increase in the nutrient input to the lake as a result of decomposing fish. Following the treatment, an algae bloom may occur, an event Bradbury (1986) observed for 9 of 11 Washington waterways treated with rotenone. Bradbury (1986) suggested approximately 70% of the phosphorus in the dead fish would be released into the lakes through bacterial decay, a process that UDWR (2007) suggested as a benefit to stimulate plankton growth. The changes or impacts to the water quality may last for approximately two weeks, during which the nutrients would be rapidly assimilated by aquatic macroinvertebrate populations.

Project Stream Treatments

For Lake Creek (below Lake Creek Falls), Meadow Fork of Big Creek, Bosonberg Creek, Big Creek, Snowshoe Creek Summit Creek, Crooked Creek, and Corral/McCoy creeks (Project Streams), direct effects should be short-term, as rotenone naturally detoxifies in flowing waters relatively quickly (often within 24 hours) due to dilution and increased rates of hydrolysis and photolysis (Finlayson et al. 2000). Detoxification stations (potassium permanganate) will be installed at the end of each treatment section to prevent rotenone from affecting downstream resources. At the concentrations used, the potassium permanganate will degrade to nontoxic, common compounds or elements shortly after application. The neutralization is not immediate in space, but requires a short mixing zone where the potassium permanganate is in contact with and oxidizes the rotenone. Downstream of this mixing zone, both fish and aquatic macroinvertebrates would not be affected.

Comment C.2.2e – Studies indicate acute exposure to rotenone is not harmful to humans at concentrations used to eradicate fish. Sousa et al. (1987) suggested a 132-pound human would have to consume, at one sitting, over 15.85 gallons of treated water for the dose to be lethal. Extensive testing has not shown rotenone to be carcinogenic (Bradbury 1986).

Comment C.1.2f - No contamination of groundwater is anticipated to result from the treatments. Rotenone binds readily to sediments and is broken down in soil and water (Engstrom-Heg 1971; Engstrom-Heg 1976; Skaar 2001; Ware 2002). Because rotenone binds strongly to organic matter, its mobility through soil is low. With a leaching distance of approximately 1 inch in most types of soil, it is unlikely rotenone would enter the groundwater. Case studies in Montana have concluded that rotenone movement through groundwater does not occur (MFWP 2008). In addition, rotenone breaks down rapidly into temporary residues that would not persist as pollutants of groundwater (Turner et al. 2007). Ultimately, rotenone breaks down into carbon dioxide and water. Regardless, there are no known groundwater wells in close proximity to High Lake and the Project Streams that will be treated. The nearest groundwater wells to the project site are located approximately 14 miles to the northwest (Dean Creek), 17 miles to the west-southwest (Seneca), and 22 miles south (Wolf Creek).

Comment C.1.2l - Treatments will be confined to High Lake and Project Streams. Detoxification stations will be installed to prevent discharge of treated water beyond the treatment area. As required by state regulation, the TAC will submit a 2300-A pesticide general permit application to the Oregon Department of Environmental Quality which must be approved prior to treating High Lake and Project Streams with rotenone.

C.2 Biological Environment

C.2.1 Air Resources

Will the proposed action result in:	Unknown	None	Minor	Potentially significant	Can impact be mitigated
a. Emission of air pollution or deterioration of ambient air quality?		X			
b. Creation of odors?			X		C.2.1b
c. Alteration of air movement, moisture, or temperature patterns or any change in climate, either locally or regionally?		X			
d. Adverse effects on vegetation, including crops, due to increase emissions of pollutants?		X			
e. Will the project result in any discharge which will conflict with federal or state air quality regulations?		X			

Comment C.2.1a - Finlayson et al. (2000) indicated the EPA found that the use of rotenone for fish control does not present a risk of unreasonable adverse effects to humans. Relative to air quality, the EPA noted no public health effects had been reported relative to the use of rotenone as a piscicide.

Comment C.2.1b - Impacts caused by odors would be short-term and minor. Rotenone contains solvents that make it soluble in water. The odor from these solvents can last from several hours to several days, depending on air conditions. Rotenone consists of relatively "heavy" organic solvent compounds that tend to sink or remain close to the ground and move downwind. Newer rotenone formulations are virtually odor-free, as a number of solvents have been removed. The California Department of Pesticide Regulation (CDPR 1998, cited in Finlayson et al. 2000) found no health effects from odors from rotenone formulations that consisted of greater solvent concentrations than that found in the products that will be used in this project. Applicators would have the greatest potential contact with odors; however, per product label guidelines, they will wear respirators for protection. The Brook Trout carcasses from this project may cause odors.

Collecting and/or sinking dead fish in the lake will help mitigate this, making the effects from these odors short-term and minor.

C.2.2 Vegetation

Will the proposed action result in:	Unknown	None	Minor	Potentially significant	Can impact be mitigated
a. Changes in the diversity, productivity, or abundance of plant species (including trees, shrubs, grass, crops, and aquatic plants?			X		C.2.2a
b. Alteration of a plant community?		X			
c. Adverse effects on any unique, rare, threatened, or endangered species?		X			
d. Reduction in acreage or productivity of any agricultural land?		X			
e. Establishment or spread of noxious weeds?		X			
f. Adverse effects on wetlands or prime and unique farmland?		X			

<u>Comment C.2.2a</u> - Although High Lake is located in the Strawberry Mountain Wilderness, established trails and campsites will be used for access and staging, respectively. For High Lake, rotenone will be applied by personnel using backpack sprayers while walking the perimeter of the lake and either via helicopter or boat. Due to existing trail systems, trampling of vegetation around the perimeter of the lake and from High Lake to Lake Creek Falls would be minimal. Access and staging for treatments of Project Streams will be facilitated by National Forest roads and an existing network of trails. Subsequently, trampling of vegetation will be minimal.

No direct, immediate, or long-term impacts to vegetation would occur as rotenone does not affect plants at the concentrations necessary to kill fish.

C.2.3 Fish and Wildlife

Will the proposed action result in:	Unknown	None	Minor	Potentially significant	Can impact be mitigated
a. Deterioration of critical fish or wildlife habitat?		X			
b. Changes in the diversity or abundance of big game animals or migratory waterfowl?			X	X	C.2.3b
c. Changes in the diversity or abundance of other species?			X	X	C.2.3c
d. Introduction of new species into the area?			X	X	C.2.3d
e. Creation of a barrier to the migration or movement of animals?			X	X	C.2.3e
f. Adverse effects on any unique, rare, threatened, or endangered species?			X	X	C.2.3f
g. Increase in conditions that stress wildlife		X			

populations or limit abundance (including harassment, legal or illegal harvest, or other human activity)?			
h. Implementation in any area in which threatened and endangered species are present, and will the project affect any threatened and endangered species or their habitat?	X	X	C.2.3h
i. Will the project introduce or export any species not presently or historically occurring in the receiving location?	X	X	C.2.3i

Comment C.2.3b - Fish: This project is designed to eradicate non-native Brook Trout. Based on annual surveys conducted by the BPT, no fish species other than Brook Trout inhabit High Lake and Lake Creek from Lake Creek Falls to High Lake.

Native game (i.e., Bull Trout and Redband Trout (*Oncorhynchus mykiss gairdneri*)) and non-game fish (e.g., Redside Shiner (*Richardsonius balteatus*), Speckled Dace (*Rhinichthys osculus*), Sculpin species (*Cottus spp*.) inhabit Project Streams. Prior to treating Project Streams, native fish will be salvaged and relocated to Project Streams that have been treated.

Big Game: Mule deer (*Odocoileus hemionus*), elk (*Cervus canadensis*), black bears (*Ursus americanus*), and mountain lions (*Puma concolor*) are found in the area but are not dependent on fish from High Lake or Project Streams for food. Human activity related to project implementation and removal of dead fish, resulting from this project, would reduce the potential for these species to consume rotenone-killed fish. If rotenone-killed fish were consumed, there would be no adverse effects because the rotenone would be degraded by enzymes in the animals' digestive tracts (Finlayson et al. 2000; AFS 2002; EPA 2007). Following rotenone treatment, daily monitoring of the lake, to collect dead fish, would limit fish carcasses from becoming an attractant. The project would have no impact on big game.

Although big game may use High Lake and Project Streams as water sources, ingestion of treated waters by terrestrial wildlife should have no adverse effects due to the enzymatic action as discussed in Finlayson et al. (2000), AFS (2002), and EPA (2007).

Migratory waterfowl: During the proposed treatment period, most waterfowl will have already migrated from the treated areas. The remaining waterfowl that could be present during the proposed treatment may be temporarily displaced from the High Lake area, but the availability of other waters in close proximity to the project area should minimize any impacts. It is possible that these birds may feed on rotenone-killed fish carcasses shortly after treatment. However, research has indicated it is not physiologically possible for birds to consume a sufficient quantity of rotenone-killed fish to result in a lethal dose (Finlayson et al. 2000; EPA 2007).

Rotenone residues in dead fish are generally very low (<0.1 ppm), unstable, and not readily absorbed through the gut of animals eating fish (Finlayson et al. 2000). For example, the EPA suggested that a bird weighing 2.2 pounds would have to consume thousands of fish to consume a lethal dose (EPA 2005, 2006).

Other Birds: Dead fish will result from this project. Birds common to the area that could potentially consume dead fish include raptors. It is possible that some of these birds would consume rotenone-killed fish; however, efforts to remove rotenone-killed fish, that surface following treatment, will minimize risks to these birds. Subsequently, impacts would be negligible. Long-term impacts from removing High Lake's Brook Trout population would not have a significant impact on birds.

Comment C.2.3c - Non-game species that might be present during this project include: zooplankton, aquatic insects, amphibians, some birds, and select small mammals.

Invertebrates: Rotenone was historically used as an insecticide. Impacts of rotenone to benthic macroinvertebrate species are variable and depend on factors including concentration and duration, habitat use variability, and life history differences. A dramatic short-term impact may occur with immediate effects on population and taxonomic diversity levels.

Although the mechanisms are different, impacts from rotenone may be similar to other natural disturbances such as floods, or drought as these events cause catastrophic drift and/or very high mortality for a majority of benthic taxa. Numbers of aquatic invertebrates important to the aquatic ecosystem may be locally suppressed for variable periods of time after the disturbance. Refuge from disturbance, such as areas upstream, off-stream habitats (Hynes 1972) and the hyporheic zone (Marmonier et al. 1997) can provide a source for recolonization.

Depending on the availability of upstream population sources and individual dispersal capabilities, benthic macroinvertebrate populations have been shown to recolonize and recover quickly following treatments (Magnum and Madrigal 1999). Studies have found that following rotenone treatments, macroinvertebrate abundance returns to pretreatment densities within a few months to a year; however, recovery times of taxa richness or diversity can be slower (see Vinson et al. 2010). Monitoring studies reviewed by Vinson et al. (2010) ranged from 2 to 5 years. California Department of Fish and Game (1994) suggested most invertebrate species would repopulate a treated area within one or two years. Recolonization in the High Lake and Project Streams is expected to include aerial dispersal of adult invertebrates from adjacent areas of the project area (e.g., mayflies and caddisflies).

Amphibians: Pacific Tree Frog (*Pseudacris regilla*), Western Toad (*Anaxyrus boreas*), and Columbia Spotted Frog (*Rana luteiventris*) are the only amphibians that have been collected during previous surveys (see Part I-Section D.4.1 for a review of life stages observed during surveys). Additional surveys using cover boards, pitfall traps, and/or visual observation are required to assess the presence of other species. If additional species are identified, respective life history information will be used to guide treatment planning.

Adult frogs are generally more resistant to the effects of rotenone than fish. Grisak et al. (2007) conducted laboratory studies on Long-toed Salamanders (*Eurycea longicauda*), Rocky Mountain Tailed Frogs (*Ascaphus montanus*), and Columbia Spotted Frogs and concluded that the adult life stages of these species would not suffer an acute response to rotenone, but larval and tadpole stages could be affected by rotenone at fish killing concentrations. If factors do not allow for flexible treatment schedules to protect amphibians, results from studies (e.g., Billman et al. 2012) have shown amphibian populations are capable of recovering rapidly following treatments. Because rotenone is rapidly broken down by organic matter, sunlight, hydro turbulence, and other natural processes (Dawson et al. 1991; Brown and Zale 2012), direct effects on subsequent generations of amphibians are not expected.

<u>Small mammals</u>: Various mammals (e.g., North American River Otter (*Lontra Canadensis*)) could be present and scavenge on rotenone killed fish or drink treated lake and Project Streams. The TAC expects the impacts to non-target organisms to range from non-existent to short-term. Although short-term, the impact to North American River Otter could be significant. Efforts to mitigate impacts may include relocating animals to nearby waterways during the treatment.

<u>Comment C.2.3e</u> - Temporary barriers will be used to partition the streams into logistically treatable segments; however, National Environmental Policy Act, Endangered Species Act, fill removal (Department State Lands) and any other requirements or permits will be completed prior to construction of any barrier. The barriers will be removed from treated stream segments once downstream barriers are capable of preventing reinvasion by Brook Trout. Personnel will facilitate passage for native species as staff time and funding are available and needs arise.

<u>Comment C.2.3f,h</u> - Treatments below Lake Creek Falls will occur in locations where threatened Bull Trout exist. By staggering the treatments, Bull Trout will be salvaged from the site that is to be treated and transferred to previously treated sites. Using this approach will eliminate the need of having to utilize off-site facilities for holding fish and introducing them to additional stressors.

<u>Comment C.2.3i</u> – High Lake is believed to have been historically void of fish prior to the stocking of Brook Trout in the 1930s. Following the eradication of Brook Trout, salmonids will be released into High Lake to provide angling opportunities.

C.3 Human Environment

C.3.1 Recreational and Land Use

Will the proposed action result in:	Unknown	None	Minor	Potentially significant	Can impact be mitigated
a. Alteration or interference with the productivity or profitability of the existing land use area?		X			
b. Conflict with a designated natural area or area of unusual scientific or educational importance?		X			
c. Conflict with any existing land use whose presence would constrain or potentially prohibit the proposed action?		X			
d. Adverse effects on the relocation of residences?		X			

C.3.2 Public and Worker Safety and Health

Will the proposed action result in:	Unknown	None	Minor	Potentially significant	Can impact be mitigated
a. Risk of an explosion or release of hazardous substances (including, but limited to oil, pesticides, chemicals, or radiation) in the event of an accident or other forms of disruption?			X		C.3.2a
b. Affect an existing emergency response or emergency evacuation plan or create a need for a new plan?		X			
c. Creation of any human health hazard or potential hazard?			X		See C.3.2a, C.3.2c
d. Will any chemical toxicants be used?			X		See C.3.2c

Comment C.3.2a - The principal risk of human exposure to rotenone and potassium permanganate would be limited to the rotenone applicators.

The ODFW will monitor all actions associated with the application of rotenone and take corrective action to remedy unsafe activities. All personnel involved with the project will have received safety training prior to the treatment day. Training will cover safe application and transportation of rotenone and potassium permanganate, including potential hazards of the project. Personnel applying chemicals will have obtained their pesticide applicator license. All personnel will have reviewed the safety precautions for each product level before the application and all project participants will be involved in identifying other hazards and actions that may jeopardize safety during the project

Comment C.3.2b - Accidental spillage is a concern and appropriate spill response plans will be developed for the project prior to treatment. The TAC will prepare a rotenone treatment plan that addresses all aspects of safety for personnel on the application team. Elements of the plan include establishing a clear chain of command, training, delegation and assignment of responsibility, clear lines of communication between members, spill contingency, first aid, emergency responder information, personal protective equipment, monitoring and quality control, and other details. Implementing this project would have no impact on existing emergency plans. With the implementation plan, the risk of emergency response would be minimal and any affects to potential emergency responders would be short-term and minor.

Comment C.3.2c - Rotenone is an EPA registered pesticide under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (EPA 2007). Although rotenone is commonly used to control unwanted fish species, public concerns are often raised regarding health and human safety. As with any pesticide, direct exposure or consumption of rotenone at full-strength may have harmful or fatal effects on humans if mishandled.

Public health issues surrounding the use of rotenone have been studied extensively (EPA 2007). In general, the EPA through the FIFRA certification process has concluded the use of rotenone for fish control does not present unreasonable risks. Finlayson et al. (2000) reported that the EPA "has concluded that the use of rotenone for fish control does not present a risk of unreasonable adverse effects to humans and the environment." In relation to air quality, they noted that "no public health effects from rotenone use as a piscicide have been reported."

The major risks to human health from rotenone come from accidental exposure during application, as this is the only time when humans are exposed to concentrations that are greater than those needed to eradicate fish and when inhalation or the dermal exposure risk is greatest. To prevent accidental exposure to rotenone, personnel will: 1) participate in safety meetings led by trained and certified pesticide applicators, 2) work under the direct supervision of trained and certified pesticide applicators, 3) wear proper safety gear including a fitted respirator, eye protection, rubberized gloves, and a hazardous material suit, 4) possess product labels during use, 5) store materials in approved containers that are properly labeled, and 6) adhere to product label requirements for storage, handling, and application.

People recreating in the general area likely would not be exposed to the treatments because a temporary access closure would preclude them from being in the project area. Public notification through news releases, signs, and TAC personnel in the project area is expected to be sufficient to prevent recreationists from being exposed to any treated waters. Dead fish that surface would be collected and removed from the site on a daily basis until they are no longer present.

C.3.3 Aesthetics and Recreation

Will the proposed action result in:	Unknown	None	Minor	Potentially significant	Can impact be mitigated
a. Alteration of any scenic vista or creation of an aesthetically offensive site or effect that is open to public view?			X		C.3.3a
b. Alteration of the aesthetic character of a community or neighborhood?		X			
c. Alteration of the quality or quantity or recreational/tourism opportunities and settings?			X		C.3.3a, c
d. Designated or proposed wild and scenic rivers or wilderness areas be impacted?			X		C.3.3a, c, d

Comment C.3.3a - Public access to High Lake (wilderness area) and Project Streams is on land owned by the USFS. Following *Planning and Standard Operating Procedures for the Use of Rotenone in Fish Management – Rotenone SOP Manual* (Finlayson et al. 2010), the TAC will place signs around the treatment sites denoting that the waterways are closed due to the use of rotenone. Signs will include closure period dates, formulation used, and purpose of the treatment. Project personnel present will be in charge of discussing the treatment with any members of the public arriving onsite during the treatment. Through public notices, public access will be discouraged immediately before, during, and immediately after the treatments.

It is possible that following the treatment, offending odors may result from the rotenone and/or decomposing fish. Rotenone odors would dissipate within a few days after treatment. Removal of fish carcasses post-treatment will minimize offensive odors.

Comment C.3.3c - Eliminating the Brook Trout fishery in High Lake and Project Streams could lead to anglers experiencing lost angling opportunities. The loss of Brook Trout fishing opportunities could be significant, as surrounding waters likely will not provide a comparable fishing experience in terms of catch rates. To mitigate for the loss of the High Lake Brook Trout fishery, salmonids will be stocked into the lake following rotenone treatment. Native sport fish salvaged from Project Streams will be returned to the waterways following the treatments. Recreational opportunities and access may be limited during the period of application.

Comment C.3.3d - While staging and implementing the High Lake treatment, existing trail networks and campgrounds will be used to minimize impacts to the designated wilderness area. Rotenone will not affect vegetation associated with the treated areas or wildlife that may use the sites as a water source.

C.3.4 Evaluation of Significance

Will the proposed action, considered as a whole:	Unknown	None	Minor	Potentially significant	Can impact be mitigated
a. Have impacts that are individually limited, but cumulatively considerable? (A project or program may result in impacts on two more separate resources which creates a significant effect when considered together or in total).		X			
b. Involve potential risks or adverse effects which are uncertain but extremely hazardous if they were to occur?				X	C.3.4b
c. Potentially conflict with the substantive requirements of any local, state, or federal law, regulation, standard, or formal plan?		X			
d. Establish a precedent or likelihood that future actions with significant environmental impacts will be proposed		X			
e. Generate substantial debate or controversy about the nature of the impacts that would be created?	X			X	C.3.4e
f. Have organized opposition or generate substantial public controversy?	X			X	C.3.4f

<u>Comment C.3.4b</u> - The potential that a crisis or emergency could result from this project due to unforeseen accidents or acts of vandalism must always be considered. The site, safety, and storage plans developed will minimize the risk that a crisis or emergency occurs. The plans will provide a structured and planned response should a crisis or emergency occur.

<u>Comment C.3.4e and f</u> - The use of rotenone may create some controversy. Outreach efforts will help to inform and educate the public on the safe and effective use of rotenone. It is not known if this project will have organized opposition.

D. References

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F. Acronyms

AFS - American Fisheries Society

BOR - Bureau of Reclamation

BPT- Burns Paiute Tribe

CDPR - California Department of Pesticide Regulation

EPA - Environmental Protection Agency

FIFRA - Federal Insecticide, Fungicide, and Rodenticide Act

MFWP - Montana Fish, Wildlife, and Parks

ODFW - Oregon Department of Fish and Wildlife

SOP - Standard Operating Procedures

TAC - Technical Advisory Committee

UDWR - Utah Division of Wildlife Resources

USFWS - U. S. Fish and Wildlife Service