Environmental Assessment

NON-NATIVE TROUT SUPPRESSION COONEY CREEK, MONTANA

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Environmental Assessment for Non-Native Trout Suppression in Cooney Creek, Montana

Proposed Action: Montana Fish, Wildlife & Parks (MFWP) in collaboration with the University of Montana and the MPG Ranch propose to remove non-native trout species using backpack electrofishing equipment in Cooney Creek. The proposed project would occur annually during the summer months (June, July, August, and September) starting in 2019. Funding for the project will be primarily provided by MPG Ranch with labor assistance from MFWP. The goal of the project is to suppress non-native rainbow trout and brook trout to benefit native westslope cutthroat and bull trout.

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Comment Period:
The public comment period will be through Friday, August 16th, 2019. Comments may be e-mailed to lrosenthal@mt.gov or written comments may be sent to the following address:

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1. INTRODUCTION

1.1. Background Information

Freshwater fisheries are in decline throughout North America (Burkhead 2012). In Montana, two species particularly at risk are westslope cutthroat trout (*Oncorhynchus clarkii lewisi*) and bull trout (*Salvelinus confluentus*). These species are managed as "species of conservation concern" by Montana Fish, Wildlife & Parks (MFWP 2013). They are also listed as "species of greatest concern" in the State Wildlife Action Plan (MFWP 2015), which outlines threats to Montana's fish and wildlife and recommends specific conservation actions. Threats to westslope cutthroat and bull trout populations in Montana include climate change, habitat loss, and non-native species (MFWP 2015). Recommended management actions include installing barriers to prevent invasion and removing non-native fish once an invasion has occurred (MFWP 2015).

One such invasion is actively occurring in Cooney Creek, a tributary of the upper Swan River in northwestern Montana (Fig. 1). The headwaters of Cooney Creek originate in the Flathead National Forest. At lower elevations, it flows through a mix of private land, including MPG North, a privately-owned conservation ranch. The goal of MPG North is to restore degraded habitat and promote the persistence of native species in western Montana. In pursuit of this goal, MPG North has been working in conjunction with local biologists since 2007 to monitor Cooney Creek fish populations. Non-native brook trout (*Salvelinus fontinalis*) occupy the lower 4.5 km of Cooney Creek. Their densities are highest in the lower 2 km of Cooney Creek, where they have displaced westslope cutthroat and reduced densities of bull trout relative to upstream reaches. Non-native rainbow trout (*Oncorhynchus mykiss*) first appeared in 2017 and rapidly expanded upstream in 2018. Widespread hybridization between rainbow and westslope cutthroat trout has been documented in the nearby Flathead River drainage (Boyer et al. 2008; Muhlfeld et al. 2009), and in portions of the Swan River basin (B. Gardner, unpublished data). To date, hybridization between these species has not been documented in Cooney Creek. To provide region-specific fisheries management direction, MFWP released the 2013–2018 Statewide Fisheries Management Plan. This plan recommends "isolation of westslope cutthroat trout populations if hybridization is a threat and habitat is sufficient to allow persistence" for the area encompassing Cooney Creek (MFWP 2013, pp. 116). Based on the management direction provided by MFWP and conservation goals of MPG North, action to protect westslope cutthroat trout in Cooney Creek is warranted.

The following Environmental Assessment describes the urgent need to suppress non-native brook and rainbow trout in Cooney Creek as a means of conserving native westslope cutthroat and bull trout populations. Alternative suppression actions are considered.

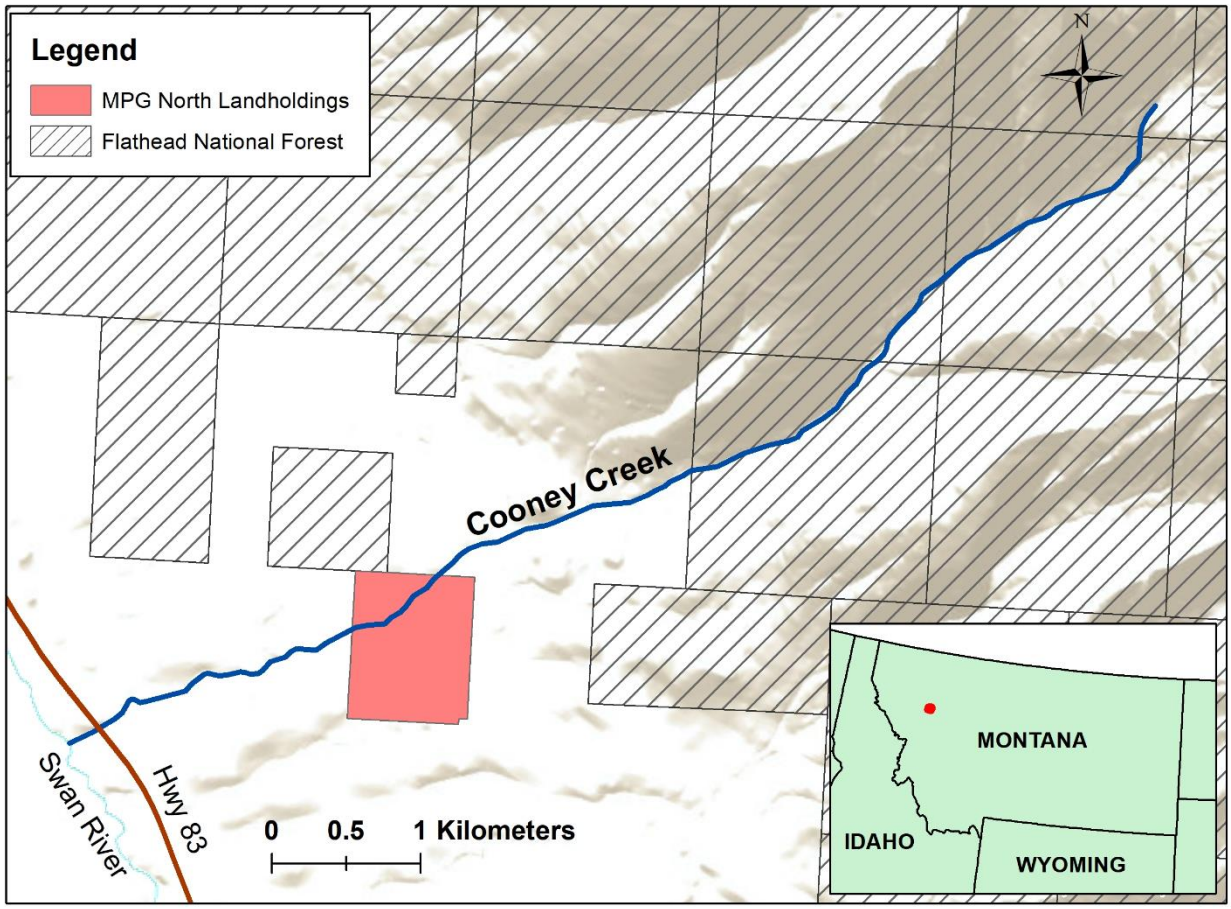

Fig. 1. Map showing location of Cooney Creek, a tributary to the Swan River in western Montana.

1.2. Authorities and Direction

Authority over the proposed action is provided by MFWP as they have jurisdiction over management of fisheries in Montana. MFWP must approve of suppression activities if they are to proceed. Additionally, because bull trout are listed as federally threatened under the Endangered Species Act, the U.S. Fish and Wildlife Service must approve any actions that may affect this species. Direction for the proposed action has been provided by biologists affiliated with MPG North, the University of Montana (UM), and MFWP.

1.3. Purpose and Need for Action

Competition and hybridization between nonnative trout has caused declines of native westslope cutthroat and bull trout across their range (Dunham et al. 2002; Kanda et al. 2002; Fausch et al. 2009; Shepard et al. 2005). Hybridization is particularly concerning because it diminishes the genetic signature of a species, causing extirpation. Rainbow trout readily hybridize with westslope cutthroat trout and pose a significant threat to the persistence of genetically pure cutthroat trout populations (Boyer et al. 2008; Muhlfed et al. 2009; Corsi et al. 2013). Hybridization has led to declines of westslope cutthroat trout populations across their range (Shepard et al. 2005). Those that remain genetically pure have been protected by barriers to fish passage which have prevented invasion by rainbow trout (Shepard et al. 2005). In 2007, over 20 stakeholder groups signed a memorandum of

understanding to guide management of westslope cutthroat trout in Montana (MFWP 2007). In this memorandum, genetically pure westslope cutthroat trout are categorized as "core populations" of the species and receive the highest priority for conservation action (MFWP 2007). Westslope cutthroat trout in Cooney Creek currently represent one such core population.

Electrofishing and environmental DNA (eDNA) surveys conducted regularly since 2016 have documented displacement of native bull and westslope cutthroat trout by brook trout in the lower 2 km of Cooney Creek. These surveys also document a new invasion and rapid expansion of rainbow trout into Cooney Creek beginning in 2017 (Fig. 2). Suppression of rainbow trout is urgently needed to prevent hybridization between westslope cutthroat and rainbow trout before it occurs. If hybridization has already occurred, a quick response is crucial to minimize genetic admixture and maintain the genetic integrity of the westslope cutthroat trout population.

The purpose of the proposed project is to suppress non-native brook and rainbow trout in Cooney Creek, with an emphasis on removing rainbow trout from westslope cutthroat trout habitat in the upper portions of the stream. The ongoing research and monitoring efforts by MPG North, UM, and MFWP have provided a unique opportunity for rapid response to a rainbow trout invasion. Removal of non-native trout from core westslope cutthroat trout habitat would provide managers with enough time to develop and implement a long-term management strategy to prevent repeated invasions.

1.4. Project Site Description

Cooney Creek is a tributary of the Swan River in northwestern Montana (Fig. 1). It originates in the Flathead National Forest and flows through properties owned by MPG North and other private landowners. Suppression efforts in Cooney Creek would only occur upstream of Montana Highway 83 in areas constituting core westslope cutthroat trout habitat. The project site would therefore run from Montana Highway 83 to the upstream extent of brook and rainbow trout.

The distribution of brook and rainbow trout would be assessed prior to the project start date using eDNA sampling methods. This approach would ensure that suppression efforts encompass the current distribution of non-native trout and would avoid handling of fish in areas where non-native species are not present. Given the recent nature of the rainbow trout invasion, the span of the project area would likely be dictated by the upstream extent of brook trout. While the brook trout distribution may have changed over time, eDNA sampling in 2016 found that brook trout were not present more than 4.5 km upstream of Montana Highway 83. Suppression activities are therefore unlikely to span a stream reach much longer than 4.5 km. The full extent of the rainbow trout invasion has not been assessed. If rainbow trout are detected upstream of this point, the total treatment area would increase.

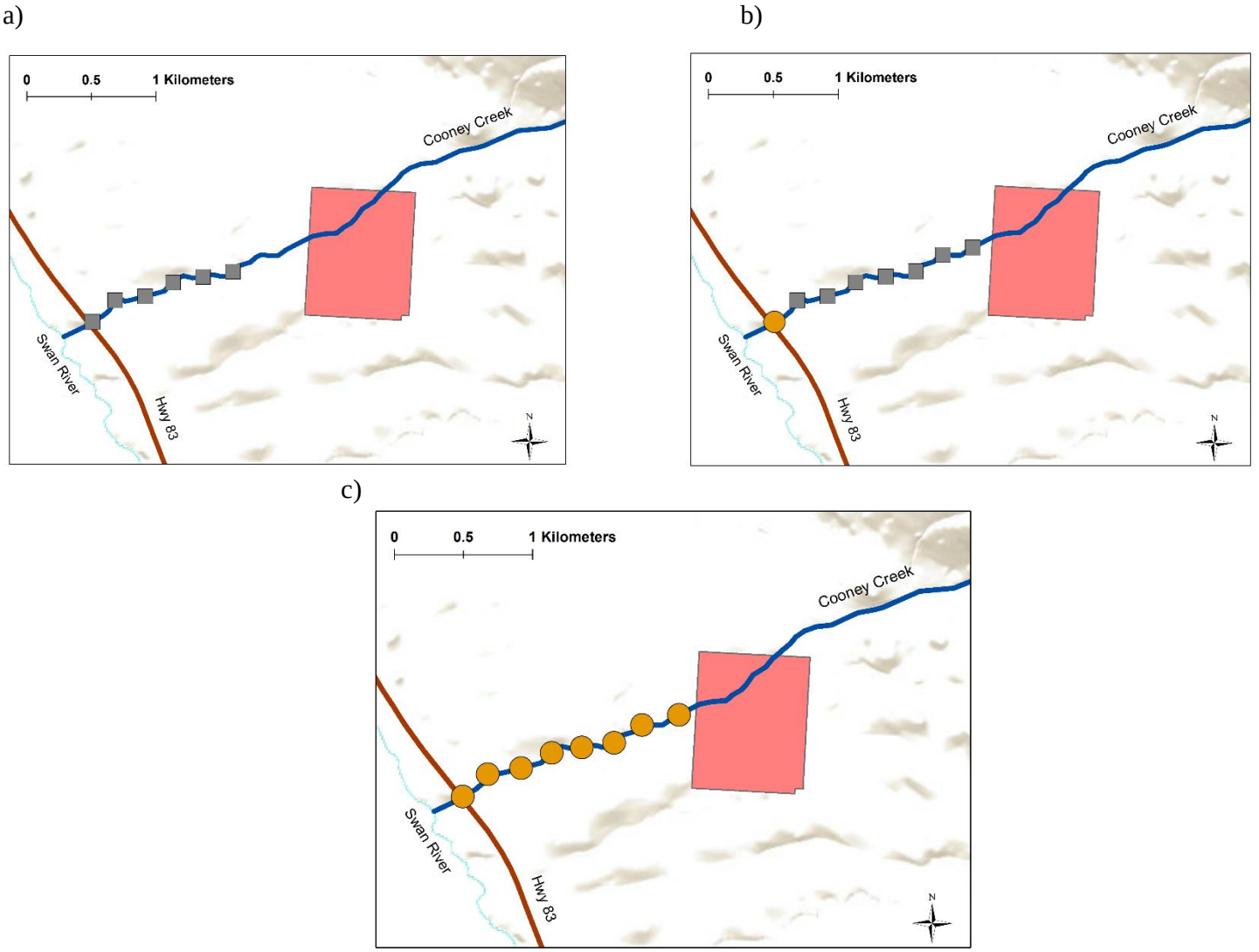

Fig. 2. Locations of eDNA monitoring for rainbow trout in Cooney Creek in September of 2016 (a), 2017 (b) and 2018 (c). Spacing between samples is 250 m. Yellow circles represent samples with positive detections of rainbow trout eDNA. Gray squares represent samples in which rainbow trout eDNA was not detected.

2. ALTERNATIVES

2.1. No Action Alternative

Taking no action to suppress brook and rainbow trout in Cooney Creek has the benefit of minimizing disturbance to all fish and the surrounding area. Specifically, taking no action would avoid stress imposed on native fish and minimize some disturbances to stream habitat immediately surrounding the proposed suppression actions (see Environmental Review of the Preferred Alternative for a discussion of impacts). However, these disturbances would be minor, and biologists anticipate that the preferred alternative will substantially benefit westslope cutthroat trout and bull trout populations in Cooney Creek. Taking no action would likely result in substantial impacts to westslope cutthroat and bull trout populations through interspecific competition and hybridization, and ultimately, extirpation of at least one if not both species in this system. All suppression efforts proposed here would be funded by MPG Ranch and would not incur any additional cost to private landowners or the state of Montana. Finally, allowing the invasion to continue would be at odds with the conservation goals of MPG North, the management goals of MFWP, and would further threaten the integrity of these species of concern throughout the Swan River drainage.

2.2. Electrofishing Suppression Followed by Euthanasia (Preferred Alternative)

The preferred alternative action is to capture and euthanize all brook and rainbow trout in Cooney Creek's core westslope cutthroat trout habitat. This alternative is the best option for addressing the problem by removing non-native trout from the system entirely, rather than relocating or removing opportunistically during the course of usual monitoring activities. Suppression will ideally occur between July 29th and August 30$^{th.}$ Sampling in late summer is ideal for three reasons: 1) Brook Trout spawn in early fall and removing adults before spawning will increase the efficacy of removal. 2) Bull Trout also spawn in the fall and electrofishing prior to bull trout spawning will minimize impact on incubating eggs and larval Bull Trout. 3) Senescing vegetation in the fall will more easily clog and weigh down nets used to separate areas that have been treated from areas that have been untreated (see detailed methods below). Excessive vegetation caught in nets could cause the nets to collapse and allow invasive fish to distribute into the treated area.

Mechanical suppression would begin above the upstream extent and proceed in a downstream manner. Suppressing fish from the upper extent downstream would most effectively reduce the extent of habitat occupied by invasive species by targeting the leading edge of the invasion first. The upstream extent of brook and rainbow trout would be determined in early July using eDNA sampling. A total of 5 eDNA samples would be collected at 250 m intervals beginning at the upper limit of brook trout and extending upstream. This sampling interval has been proven effective at detecting fish in low abundance (Jane et al. 2014) and has been used to delineate trout distributions in headwater streams (McKelvey et al. 2016, see also Fig. 2 above). The suppression effort would occur over a two-week period sometime between July 29th and August 31st. (Exact dates will depend on availability of equipment and volunteers for the effort). Broadly, the suppression plan would focus on removing invasive fish within a single "active treatment zone" at a time. The active treatment zone would be broken up into 100 m segments with block nets at both ends to improve capture efficiency. Each 100 m segment would be electrofished with 3–4 passes. Once complete, a new active treatment zone would begin immediately downstream of the completed treatment zone.

The first active treatment zone would begin 200 m upstream of the uppermost eDNA detection of non-native trout. A block net would be set at the start point and 100 m downstream of the start point. Moving in a downstream manner, the field crew would work in tandem with two backpack electrofishers to collect all brook and rainbow trout, as well as all westslope cutthroat trout under 130 mm (see below). All other native fish incidentally captured would be released upstream of the block net at the top of the active treatment zone. Each 100 m segment would be electrofished with two-pass depletion. After two passes, an additional block net would be set 100 m further downstream to mark the bottom of the next segment for the next round of two-pass depletion. Two block nets would then be "leap-frogged" downstream to prevent fish from escaping a segment during treatment. The uppermost block net would be left intact to provide a refuge for native fish during treatment.
At the end of each treatment day, the upper- and lowermost block nets would be left intact to prevent fish outside the area from entering. The active treatment zone would be allowed to rest for 24 hours to enable uncaptured fish to recover and redistribute within the active treatment zone. The next day, field crews would repeat the suppression effort in the active treatment zone, beginning at the top of the treatment zone and work downstream in 100 m segments with block nets. Field crews would perform two passes on the second day only if depletion of invasive species on the third pass was greater than 10% of the total capture of non-native trout species in that segment. This limited electrofishing on the second day would help minimize stress on native fish that were not captured during previous passes.

After all segments in the active treatment zone have been electrofished with 3–4 passes, the treatment zone would be considered complete. At this point, the uppermost block net would be removed to allow native fish to redistribute into the completed treatment zone. Field crews would repeat the entire suppression process in a new treatment zone beginning immediately downstream of the completed treatment zone. Crews would remove non-native trout from the entire invaded portion of Cooney Creek, or over a total of eight days of field work, whichever comes first. Field crews would likely work in 4-day blocks to perform suppression. In between the work days, a block net would be left intact to separate treated and untreated sections of stream. The block nets would be cleaned of debris daily on days that crews are not working.

All captured fish would be anesthetized with 25–100 mg/l of MS-222 (tricain methanesulfanate). Fish would be identified to species and measured (total length). Fin clips would be collected from all westslope cutthroat trout ≤ 130 mm to assess for hybridization with rainbow trout. (Previous research in Cooney Creek indicates that fish under 130 are age 2 or younger, meaning they were spawned after the first documented rainbow trout arrived in Cooney Creek, and could be hybrids.) Westslope cutthroat and bull trout would be allowed to recover in a live car with fresh stream water. Once recovered, they would be released in Cooney Creek upstream of the uppermost block net. All brook and rainbow trout would receive an overdose of MS-222. A subset of brook and rainbow trout carcasses would be retained for additional research at the University of Montana. All lethally sampled fish not kept for research would be secured in trash bags and discarded in municipal solid waste disposal.

Mechanical suppression of invasive trout typically requires multiple years of effort (Rytwinski et al. 2019). Environmental DNA samples collected every September will be used to monitor the

persistence of invasive brook and rainbow trout throughout the treated length of stream. Mechanical suppression will occur annually only in areas where non-native trout persist. Mechanical suppression efforts will cease when brook and rainbow trout are no longer detected in Cooney Creek above the culvert at Montana Highway 83 with eDNA.

2.3. Electrofishing Suppression with a Swan River Release Site

This alternative is the same as the preferred alternative, but instead of euthanizing non-native trout, they would be released into the Swan River. Releasing rather than euthanizing would minimize impacts to the individual trout being suppressed and provide a minor boost to the brook and rainbow trout fisheries on the Swan River over the short term. However, this is not preferred because presence of non-native fish is a concern in the Swan River drainage and a continuing threat to native species. Release of nonnative fish anywhere in Montana is in direct conflict with the MPG's conservation strategy and MTFWP management plans. Furthermore, transport of rainbow and brook trout from Cooney Creek to other locations would require extensive testing to ensure that no transport of disease or parasites would occur in the process.

2.4. Actions Considered but Not Selected as Possible Alternatives

2.4.1. Electrofishing Suppression with a Lower Cooney Creek Release Site

This action is the same as the preferred alternative, but instead of euthanizing non-native trout, they would be released into Cooney Creek below Montana Highway 83 the downstream extent of core westslope cutthroat trout habitat). Because fish would be translocated within the stream of origin, there would be no concern over introductions of novel diseases or parasites from an outside source. However, until an effective barrier to upstream dispersal is in place, non-native trout would likely move back into the suppressed stream reach due to natural migration to natal spawning grounds, and to escape higher population densities at the release site. As a result, this alternative was not selected as an option.

2.4.2. Opportunistic Suppression Alternative

The action is the same as the preferred alternative of electrofishing followed by euthanasia but would only be performed opportunistically in the process of usual monitoring activities. If non-native trout are encountered they would be euthanized. No stream-wide suppression effort would be pursued, and potential environmental impacts would therefore be minimized. However, given the limited frequency of electrofishing in Cooney Creek, brook and rainbow trout would continue to displace native bull and westslope cutthroat trout, and hybridization between rainbow and westslope cutthroat trout would inevitably occur.

2.4.3. Electrofishing Suppression Followed by Euthanasia on MPG North Property Only

This action is that same as the preferred alternative, but instead of capturing and euthanizing non-native trout in all of Cooney Creek's core westslope cutthroat trout habitat, suppression would only occur in the reach passing through MPG North property. However, there are no barriers to dispersal separating the reach on MPG North property from the rest of Cooney Creek. As a result, brook and

rainbow trout would likely reinvade the treatment area. This alternative would therefore be ineffective and was not selected as an option.

2.4.4. Chemical Removal with Trout Reintroduction Alternative

Chemical suppression with rotenone is a method commonly used to suppress non-native fish populations and may increase the probability of eradicating all brook and rainbow trout in the creek. This method is often more thorough and requires fewer repeated treatments than mechanical suppression with electrofishing. However, this action was not considered because it is non-selective. A chemical treatment would eliminate all aquatic species, including native trout and others species that the proposed suppression aims to protect. To minimize loss of native fish, bull trout and westslope cutthroat trout could be temporarily translocated upstream of the treatment section during the chemical application. However this alternative would only protect a subset of native fish in the system because capturing all native fish would be nearly impossible, and the portion of stream used as temporary refuge may not be able to support the abundance of fish from downstream for the duration of the chemical treatment. Furthermore, chemical treatment efforts are expensive, require more personnel than mechanical suppression, and are often viewed negatively be the public. For these reasons, this alternative was not considered as an option.

3. ENVIRONMENTAL REVIEW OF THE PREFERRED ALTERNATIVE

3.1. Physical Environment

3.1.1. Land Resources

Suppression activities are not expected to have any impact on land resources.

3.1.2. Air Resources

Suppression activities are not expected to have any impact on air resources.

3.1.3. Water Resources

There would be some very short-term turbidity (lasting less than 1 hour) caused by walking through the stream while electrofishing. No impacts to water chemistry or hydrology are expected.

3.1.4. Vegetation

Some trampling of streamside vegetation may occur. However, based on the impacts of prior monitoring efforts this is expected to be minimal. Suppression activities would take place during a season when streamflow is low and most travel would occur along exposed streambed, minimizing soil damage and compaction. Most streamside vegetation would have senesced by this point in the season and would be minimally damaged by travel to and from the work area.

3.1.5. Fish/Wildlife

A major impact on fish is expected. Non-native trout would be removed from the system and euthanized. Native fish would experience a minimal amount of stress during electrofishing, but full recovery of > 99% fish captured with electrofishing has been observed during all prior Cooney Creek sampling activities. Care would be taken to minimize stress placed on native fish by avoiding excessive handling. Terrestrial predators may experience short-term prey reductions in due to decreased fish biomass. Native fish populations are expected to expand following removal of brook and rainbow trout, thereby restoring the previous prey density.

3.2. Human Environment

3.2.1. Noise/Electrical

A minor degree of noise is expected while suppression activities are occurring. Noise would be limited to the streambed while crews are actively removing fish and would not be audible more than 10 m from their location in the stream. The electric field from electrofishing units would extend no more than 5 m upstream or downstream of field crews.

3.2.2. Land Use

Suppression activities are not expected to have any impact on land use.

3.2.3. Risk/Health Hazards

There are minor risks to human health associated with the proposed suppression actions. Electrofishing units release an electrical charge through water in which crews would be working. However, the risk of shock is low as all individuals would be wearing rubber waders to insulate themselves from electrical charges. The resulting shock would be minor if one were exposed by accident. A second hazard is the use of MS-222 to euthanize fish. Research has not thoroughly assessed that impacts of MS-222 on human or animal health. However, long term, repeated exposure to the anesthetic has been linked to retinal damage (Bernstein et al. 1997). Care would be taken to minimize exposure and water mixed with MS-222 for euthanasia would be disposed by dispersing over land at least 100 m from the stream. All fish euthanized with MS-222 will be disposed of in municipal trash to ensure that the chemical is not retained in the environment or available to predators surrounding Cooney Creek.

3.2.4. Community/Local Economy

Fish numbers would temporarily decrease following suppression, having minor impact on recreational fishing (see Recreation/Aesthetics below). However, westslope cutthroat trout are an important native fishery in Montana and protecting the genetically pure population in Cooney Creek may provide long-term benefits to the community and local economy.

3.2.5. Recreation/Aesthetics

We expect a minor, short-term impact to recreational fisheries in Cooney Creek. The density of fish would be lower immediately following suppression as non-native fish are removed from the system. This may limit fishing opportunities in the stream until native fish populations rebound. However,

angler use in Cooney Creek is low, and there are no public fishing access sites on the stream. This impact is therefore unlikely to be noticed by most, if not all anglers in the area.

4. CONCLUSION

Local biologists have documented a longstanding brook trout invasion and a very recent rainbow trout invasion in Cooney Creek. These non-native species threaten native populations of westslope cutthroat (listed as species of greatest concern by MFWP) and bull trout (listed as federally threatened under the ESA). Introgressive hybridization between rainbow trout and the genetically pure westslope cutthroat trout population in Cooney Creek is particularly concerning. Suppression actions must be taken quickly to prevent hybridization. The preferred alternative action presented here provides the most effective means of controlling the invasion while minimizing the spread of non-native species throughout the Swan River drainage.

5. Public Participation

The public will be notified in the following ways to comment on the draft EA for the Cooney Creek Non-Native Trout Removal Project:

- **i.** Legal notices will be published in the Kalispell Daily Inter Lake, the Seeley/Swan Pathfinder, the Missoulian, and Helena Independent Record. News releases will be given to the same newspapers and other media outlets.
- **ii.** Legal notice and the draft EA will be posted on the FWP web site: http://fwp.mt.gov/publications.
- **iii.** Draft EAs will be available at the FWP Region 1 Headquarters in Kalispell and the FWP State Headquarters in Helena.

This level of public involvement is appropriate for a project of this scale.

The following is a list of agencies and other entities consulted in preparation of this EA:

U.S. Fish and Wildlife Service, Montana Field Office, Creston
The Native Fish Subcommittee of the Swan Lands Coordinating Committee

Copies of this environmental assessment will be distributed to the neighboring landowners and interested parties to ensure their knowledge of the proposed project.

Duration of comment period, if any:
The public comment period will be through Friday, August 16th, 2019. Comments may be e-mailed to lrosenthal@mt.gov or written comments may be sent to the following address:

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Literature Cited

Bernstein, P.S., Digre, K.B., and Creel D.J. (1997). Retinal toxicity associated with occupational exposure to the fish anesthetic MS-222. *American Journal of Opthamology* 124, 843-844.

Boyer, M.C., Muhlfeld, C.C. and Allendorf, F.W. (2008). Rainbow trout (*Oncorhynchus mykiss*) invasion and the spread of hybridization with native westslope cutthroat trout (*Oncorhynchus clarkii lewisi*). *Canadian Journal of Fisheries and Aquatic Sciences* 65, 658–669.

Burkhead, N.M. (2012) Extinction rates in North American freshwater fishes, 1900-2010. *Bioscience* 62, 798-808.

Corsi, M.P., Eby, L.A. and Barfoot, C.A. (2013). Hybridization with rainbow trout alters life history traits of native westslope cutthroat trout. *Canadian Journal of Fisheries and Aquatic Sciences* 70, 895–904.

Dunham, J. B., S. B. Adams, R. E. Schroeter, and D. C. Novinger. 2002. Alien invasions in aquatic ecosystems: Towards an understanding of brook trout invasions and potential impacts on inland cutthroat trout in weastern North America. *Reviews in Fish Biology and Fisheries* 12:373–391.

Fausch, K. D., B. E. Rieman, J. B. Dunham, M. K. Young, and D. P. Peterson. 2009. Invasion versus isolation: tradeoffs in managing native salmonids with barriers to upstream movement. *Conservation Biology* 23:859–870.

Kanda, N., R. F. Leary, and F. W. Allendorf. 2002. Evidence of introgressive hybridization between bull trout and brook trout. *Transactions of the American Fisheries Society* 131:772-782.

Montana Fish, Wildlife & Parks (2007). Memorandum of Understanding and Conservation Agreement for Westslope Cutthroat Trout and Yellowstone Cutthroat Trout in Montana. http://fwp.mt.gov/fwpDoc.html?id=28662

Montana Fish, Wildlife & Parks (2015). State Wildlife Action Plan. http://fwp.mt.gov/fishAndWildlife/conservationInAction/swap2015Plan.html.

Montana Fish, Wildlife & Parks (2013). Montana Statewide Fisheries Management Plan, 2013–2018. http://fwp.mt.gov/fishAndWildlife/management/fisheries/statewidePlan/.

Muhlfeld, C.C., McMahon, T.E., Boyer, M.C. and Gresswell, R.E. (2009). Local habitat, watershed, and biotic factors influencing the spread of hybridization between native westslope cutthroat trout and introduced rainbow trout. *Transactions of the American Fisheries Society* 138, 1036–1051.

Shepard, B.B., May, B.E. and Urie, W. (2005). Status and conservation of westslope cutthroat trout within the western United States. *North American Journal of Fisheries Management* 25, 1426–1440.