National Park Service

US Department of the Interior

GLACIER NATIONAL PARK

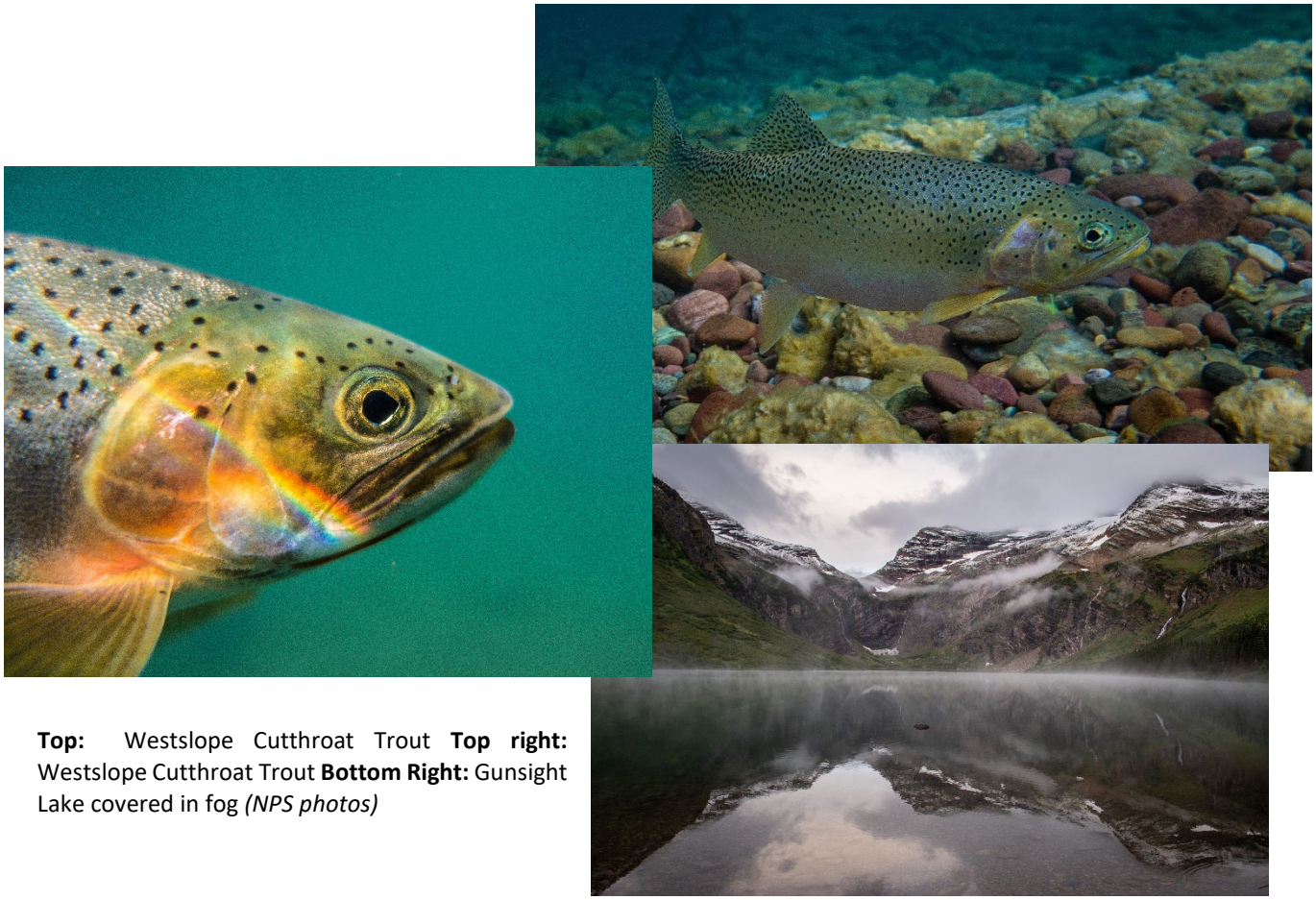
Montana

Waterton-Glacier International Peace Park

Westslope Cutthroat and Bull Trout Preservation in Gunsight Lake

Environmental Assessment

May 2023



Top: Westslope Cutthroat Trout **Top right:** Westslope Cutthroat Trout **Bottom Right:** Gunsight Lake covered in fog *(NPS photos)*

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CHAPTER 1 – PROPOSED ACTION AND NEED FOR ACTION

THE PROPOSED ACTION

The National Park Service (NPS) is proposing to remove non-native rainbow trout (*Oncorhynchus mykiss*) from Gunsight Lake (Gunsight or the lake) in Glacier National Park (Glacier or the park) using rotenone[1], an Environmental Protection Agency (EPA) approved fish toxicant. Following removal of rainbow trout, genetically pure[2] westslope cutthroat (*Oncorhynchus clarkii lewisi*) and bull trout (*Salvelinus confluentus*) (both native to the Saint [St.] Mary Drainage) would be translocated (i.e., stocked) into Gunsight Lake to establish the lake as secure habitat (i.e., refugia) for both species.

INTRODUCTION

Essential to Glacier's aquatic ecosystems are the historically native fish species bull trout, a federally listed threatened species under the Endangered Species Act (ESA), and westslope cutthroat trout, listed by the state of Montana as a species of concern (Liknes and Graham 1988; Behnke 1992; Shepard et al. 2005; Muhlfeld et al. 2016). Glacier supports approximately one-third of the remaining bull trout populations in the United States inhabiting natural lakes (Fredenberg et al. 2007). Westslope cutthroat trout and bull trout are essential to maintaining biodiversity throughout the Crown of the Continent Ecosystem, are part of a historic fishery that is fundamental to Glacier's designation as a biosphere reserve and World Heritage Site and have long been integral to the culture of native peoples as well as the park and surrounding communities.

Westslope cutthroat trout and bull trout are increasingly at risk from the severe, negative effects of non-native fish through competition, hybridization, and predation. Non-native fish were introduced to Glacier via fish stocking that began soon after the park was established in 1910 (and perhaps earlier) and continued until the early 1970s. Non-native fish have also migrated into park waters from lakes and streams outside the park. Gunsight Lake, at the headwaters of the St. Mary River, was historically fishless but stocked in 1916 with 35,000 non-native cutthroat trout and again from 1920 to 1936 with 224,000 rainbow trout. The rainbow trout established a self-sustaining population and are currently the only fish species present at the lake, since downstream waterfalls are barriers to upstream fish migration. The non-native rainbow trout at Gunsight Lake can migrate downstream and hybridize with native westslope cutthroat trout. Hybridization degrades native genetics, lowering adaptability and fitness within populations which can result in lower reproductive rates and individuals that are less resilient to disease and environmental stressors. Ongoing hybridization with non-native rainbow and Yellowstone cutthroat trout is occurring in almost every westslope cutthroat population in the St. Mary River drainage, but some still contain genetically pure individuals. Such populations are of high conservation value. Gunsight Lake presents a unique opportunity to establish native fish habitat that is secure against hybridization, since once removed, non-native fish would not be able to reinvade the lake due to the downstream waterfalls that prevent upstream fish migration.

The St. Mary River drainage is the only drainage in the United States where bull trout are found east of the Continental Divide. There are multiple threats to bull trout populations throughout the park, including non-native fish, juvenile bull trout mortality from irrigation systems outside the park, and climate change related habitat degradation (Mogen et. al. 2011). There is increased evidence that hybridization between bull trout and brook trout is threatening the genetic lineage of St. Mary bull trout. Climate change compounds the stressors to native fish, as changes in stream flow and warmer water temperatures stress native trout, degrade habitat, and favor non-native species. Given its high elevation, Gunsight Lake has a high likelihood of sustaining the cold-water habitat necessary for westslope cutthroat and bull trout to persist in a changing climate.

[1] Rotenone is the active chemical agent present in brand names such as CFT Legumine© and Prenfish©.
[2] For the continuation of this document, genetically pure means less than one or two percent non-native genes, and all stocked native westslope cutthroat and bull trout would meet this requirement.

PURPOSE AND NEED FOR ACTION

Action is needed to remove the ongoing risk of hybridization to native westslope cutthroat trout downstream of Gunsight Lake and provide westslope cutthroat and bull trout with habitat that is secure from the threats of hybridization and climate change. The purpose of the proposed action is to establish a native fish assemblage that is secure against the threats of non-native fish and climate-related habitat degradation and to support native trout genetics throughout the St. Mary River drainage system.

Objectives

- Conserve native, locally adapted, and genetically pure westslope cutthroat trout in the St. Mary River drainage.
- Conserve the genetic diversity of bull trout and westslope cutthroat trout east of the Continental Divide.
- Expand the long-term distribution and security of native westslope cutthroat and bull trout in the St. Mary River drainage and range wide.
- Complement ongoing native fish conservation efforts of Montana Fish Wildlife and Parks (MFWP), US Fish and Wildlife Service (USFWS), and the Blackfeet Nation.
- Protect and enhance recreational opportunities for anglers to fish for native westslope cutthroat trout in the St. Mary River drainage.

PROJECT AREA

The project area is the Gunsight Lake drainage, from the head of Gunsight Lake extending approximately three miles downstream, near Mirror Pond. This area encompasses the proposed rotenone treatment area and detoxification site. Gunsight Lake is located on the east side of Glacier National Park in the headwaters of the St. Mary River drainage and is within the park's 1974 recommended wilderness boundary. Gunsight Lake is 114 surface acres in size and sits at an elevation of 5,324 feet. Lake volume is estimated at 3,605 acre-feet and the lake has a maximum depth of 55 feet. The rotenone treatment area includes Gunsight Lake and a segment of the St. Mary River extending downstream from the foot of the lake to the detoxification site below an unnamed waterfall. The detoxification site would be approximately three miles downstream of the lake (***Figure 1***).

The project area also includes potential fish donor source locations under consideration for Gunsight Lake translocation efforts and includes several waters within the larger St. Mary River drainage. These streams include Jule, Roberts[3], Rose, Two Dog, Wild, Divide, Boulder, Swiftcurrent, Kennedy, Otatso, Midvale, and Lee Creek drainages, among other streams, as well as Slide and Red Eagle Lakes.

Recreational facilities within the project area include the Gunsight Pass Trail and one wilderness campground. The Gunsight Pass Trail begins at the Jackson Glacier Overlook trailhead on the east side of the Going-to-the-Sun Road and parallels the St. Mary River for a majority of its distance. The trail meets the foot of and then parallels Gunsight Lake to the south until it crests the Continental Divide, ultimately connecting to the Sperry Trailhead on the west side of the Going-to-the-Sun Road. It is a popular point-to-point, through-hike for visitors. The wilderness campground sits at the foot of Gunsight Lake and includes six tent sites, a food prep area, and pit toilets (refer to ***Figure 3*** in ***Chapter 3, Visitor Use and Experience***).

[3] Roberts Creek is located entirely on Blackfeet Tribal lands; Blackfeet are a potential partner in this project.

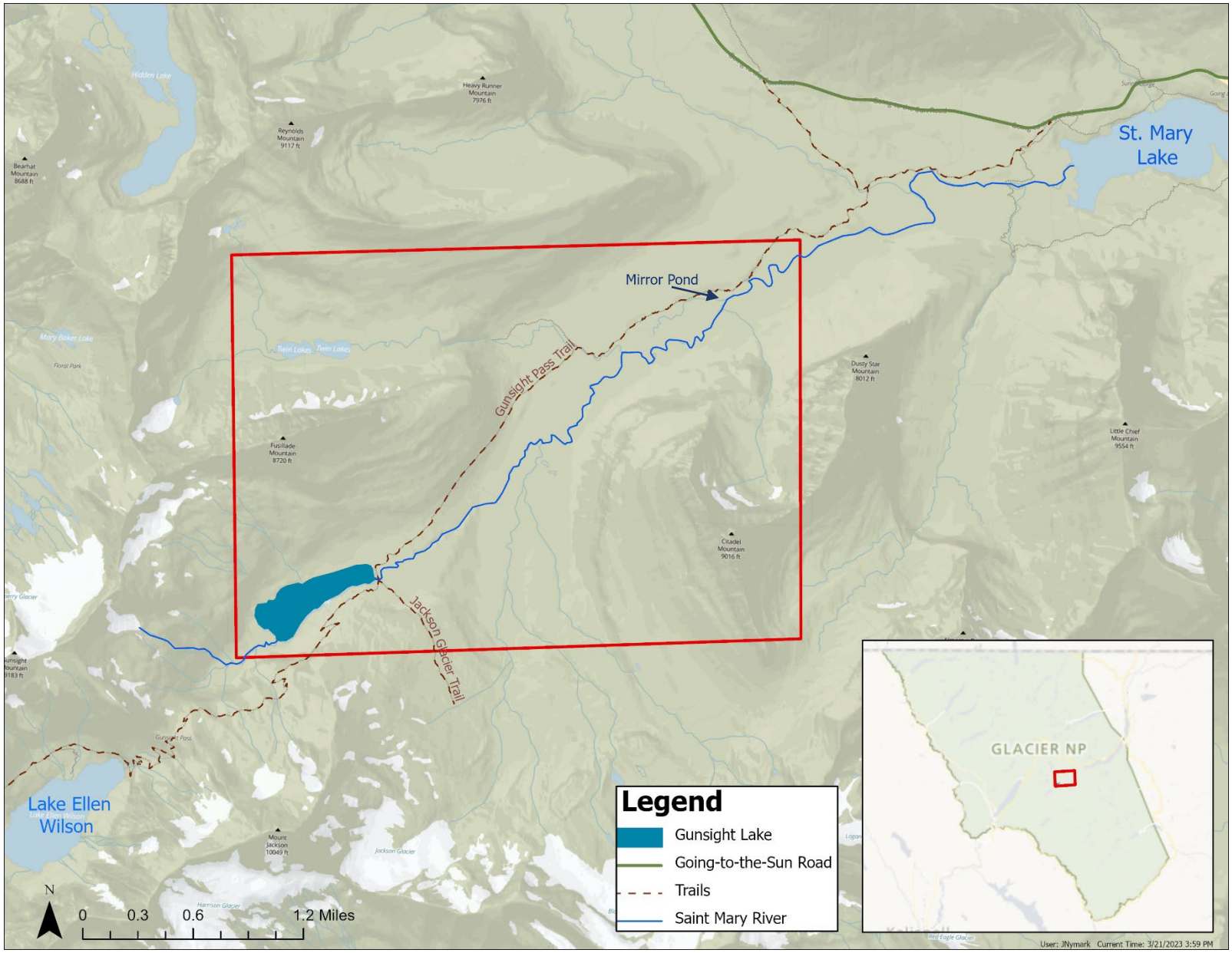

Figure 1: Project Area

CHAPTER 2 – ALTERNATIVES

Two alternatives, an action alternative (Alternative A) and a no-action alternative (Alternative B), have been carried forward for detailed analysis and are described below. In addition, one alternative and seven alternative elements were considered but dismissed from detailed analysis and are described in ***Appendix D***.

ALTERNATIVE A – PROPOSED ACTION AND PREFERRED ALTERNATIVE

Removal of Non-Native Trout and Translocation of Native Trout in Gunsight Lake

Alternative A has two components: 1) the removal of non-native rainbow trout from Gunsight Lake, followed by 2) the translocation of native westslope cutthroat and bull trout to Gunsight Lake.

Project Stage 1: Remove Rainbow Trout

Rotenone Application

Alternative A would remove[4] non-native rainbow trout from Gunsight Lake by means of rotenone. Rotenone is an EPA registered and approved fish toxicant applied with the intent of killing fish in water. Rotenone is the only fish toxicant that is currently registered and approved for use by the EPA (EPA 2007). It is proposed for this project because it would remove non-native fish in a period of days as opposed to years and would have the best chance at achieving a complete removal compared with mechanical methods of removing fish (e.g., netting, trapping, electrofishing, and angling). Rotenone removal would be supplemented by nets and electrofishing as necessary. Electrofishing would be employed in tributaries to augment and evaluate the success of tributary rotenone treatments. Electrofishing uses a battery to produce electrical current that is applied to water in a metered fashion using an electrical control box. Fish caught within the electrical field are temporarily stunned and immobilized, thereby allowing them to be netted. Similarly, gill nets may also be set in areas of freshwater input, like tributary mouths where rainbow trout might otherwise find refuge from the rotenone in the lake. Gill nets would be set in pre-designated areas and anchored in place with anchors placed in the water at both ends of the net, with no digging or disturbance to the stream bed. Nets would be checked periodically and cleared of fish to augment the effectiveness of the rotenone in areas of freshwater influence. Only non-native rainbow trout would be caught in the nets because this is the only species present.

Rotenone is extracted from the roots of several plant species in the bean family (*Leguminosae*). The chemical deprives aquatic gilled organisms of oxygen by interfering with cellular respiration and is highly toxic to fish. Ingestion of rotenone has a no effect on land animals and adult stage amphibians because the enzymes and acids of the digestive system break it down, thus limiting absorption into the bloodstream. Rotenone is naturally degraded by sunlight and water movement because it binds quickly (one to five hours) to sediments or organic matter in the water (Skaar et. al. 2017), resulting in a relatively rapid dissipation of rotenone from the environment; detoxification would be hastened with the addition of a neutralizing agent, potassium permanganate ($KMnO_4$) (USFWS 2015), as discussed below. During rotenone applications and mechanical removal, many of the dead fish typically remain submerged. Any dead fish that come to the surface would be collected and sunk in the lake.

The amount of rotenone used would be in accordance with product labeling and would be calculated based on lake volume derived from bathymetric mapping, stream flow measurements, and calculations of travel time (the amount of time it would take rotenone to flow a given distance). Prior to the application of rotenone, fluorescein, a non-toxic dye, would be applied to the stream and tracked to confirm the flow rate. Fluorescein dye is routinely used to study surface and groundwater flow patterns and is inert and non-toxic. The amount of dye used would be in accordance with accepted industry standards, product labeling, and protocols, and is estimated to be less

[4] Removal means the lethal elimination of rainbow trout by chemical or mechanical means; carcasses would remain in the lake or stream but would be sunk to remove them as wildlife attractants.

than a gallon. It is currently estimated that a total of approximately 1,200 gallons[5] of rotenone would be required to achieve 1 part per million (ppm) concentration.

The fish toxicant would be applied to the lake from motorized watercraft, such as an inflatable boat with an outboard motor or other small motorboat (by means of tubing extending into the water from a container in the boat), and to the stream from drip stations and backpack sprayers. One or two motorized boats would run intermittently for an estimated 8 to 12-hour period each day of the rotenone application period, estimated at two to four days. Approximately six drip stations are anticipated; the approximate locations are depicted in ***Figure 2.*** Drip stations are generally a simple, non-motorized apparatus such as a 5-gallon bucket or drip bag with tubing extending into the stream. Backpack sprayers would be used to apply rotenone to any off-channel fish-bearing habitat. Water pumps would be used to help distribute the rotenone to the deeper portions of the lake as needed. Slow-release rotenone mixtures consisting of rotenone and an inert substance (such as sand and unflavored gelatin) would be used in areas of upwelling to prevent target fish from avoiding exposure. The rotenone would be released as the mixture breaks down in the water; the mixture would be contained (in a burlap bag, for example) and removed at the end of the treatment.

Rotenone is often applied during low water periods, in late summer or early fall to reduce the volume of water that needs to be treated and minimize the likelihood of non-target organisms, such as larval amphibians, being present in the treatment area. The proposed treatment is anticipated to occur in early September of 2023. Given the extreme toxicity of rotenone to fish, it is expected that the majority (if not all) of rainbow trout would be removed. Some individual fish may survive in areas of groundwater inflow where the rotenone is unable to reach them. Post-treatment sampling (with nets, electrofishing, angling, and/or sampling DNA from the aquatic environment, for example) would be done to assess the effectiveness of the treatment. If rainbow trout are present during post-treatment sampling, a second application may be employed during the same or a following year to remove the remaining fish. Also, translocating westslope cutthroat on top of any remaining rainbow trout would result in genetic swamping, which would reduce the reproductive potential of any remaining rainbow trout (see discussion below for ***Project Stage 2: Translocate Native Westslope Cutthroat Trout and Bull Trout***). Genetic swamping is the replacement of one population or species with another through repeated, multi-year, stocking of a waterbody. Over generations, the reproduction of the stocked fish overtakes any remaining species genes (MFWP 2021). If a reapplication of rotenone is needed, reapplication methods and protocols (e.g., chemical concentrations and application methods, treatment areas, timeframes, etc.) would be as described above. If reapplication procedures change, resource management staff at the park would review them prior to implementation. Should review determine that impacts from reapplication would exceed those identified in this EA, separate environmental analysis and compliance would be completed.

Detoxification

Following application of the rotenone, potassium permanganate would be used to detoxify the stream and neutralize the rotenone before it reaches downstream native fish populations in the lower reaches of the St. Mary River and St. Mary Lake. Potassium permanganate is an odorless oxidizing agent, often used to remove foul tastes and odors from drinking water and reduce odors at wastewater treatment plants. Potassium permanganate is one of the most widely used inorganic chemicals for the treatment of municipal drinking water and wastewater. At the anticipated concentration of a 3:1 ratio of potassium permanganate to rotenone, it can be toxic to fish (USFWS 2015).

[5] This amount is approximate and could change as final calculations are made closer to the time of application.

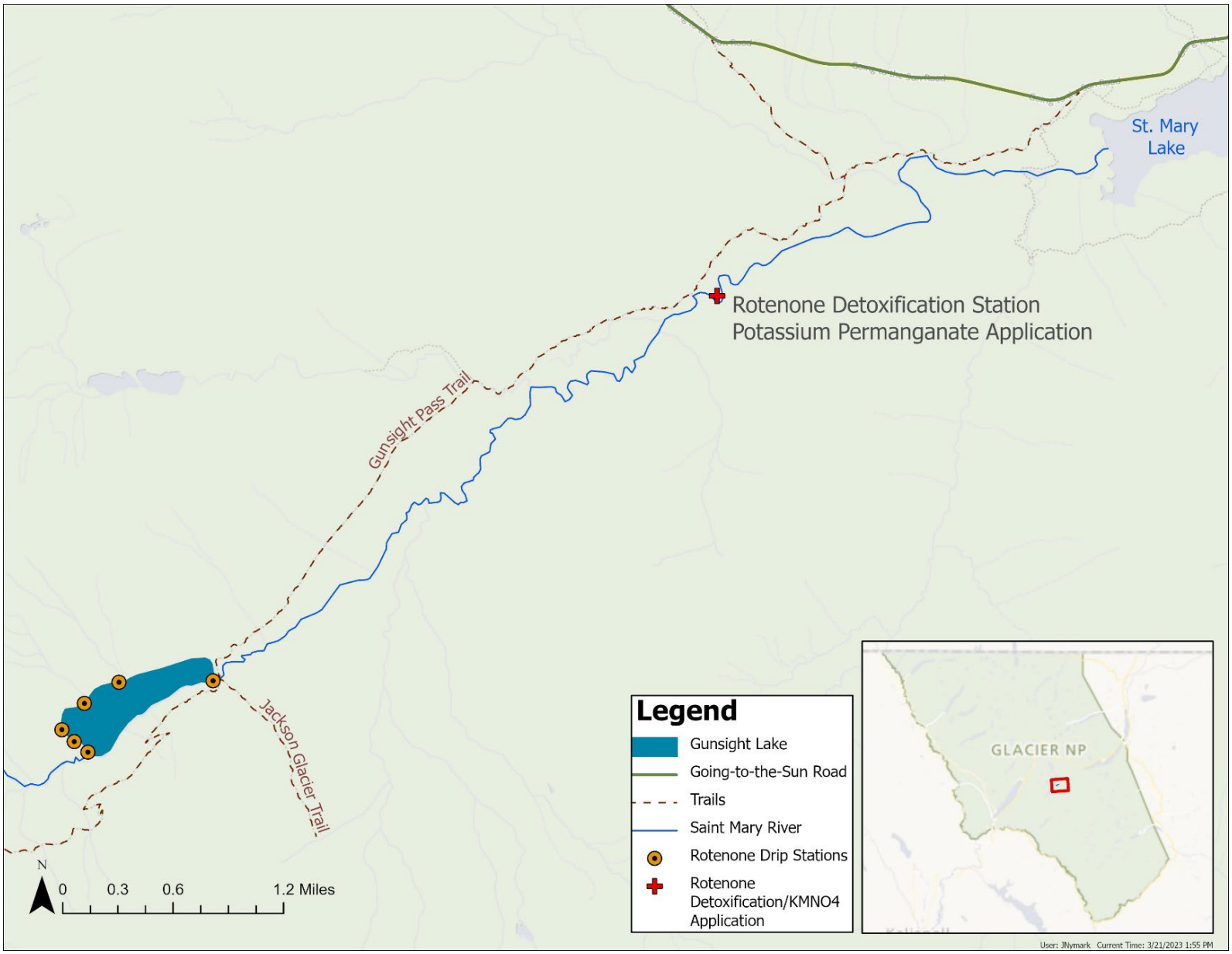

Figure 2: Anticipated general rotenone treatment and detoxification locations

The potassium permanganate would be applied to the St. Mary River below a waterfall approximately three miles downstream of Gunsight Lake (***Figure 2***). Rotenone treated water would therefore flow downstream for approximately three miles. Due to localized freshwater inputs in the reach downstream of the falls, the toxicity of the rotenone would likely be dramatically reduced by the time it reaches the detoxification site. The natural dilution of the rotenone would reduce the amount of detoxification by potassium permanganate that would be required. The potassium permanganate would be applied by means of an auger dispenser powered by a generator (anticipated to be 1000-3000 watts in size). The generator would operate continuously (24 hours a day, 7 days a week) until the rotenone detoxifies as determined by the survival of sentinel fish placed in cages in the creek both upstream and downstream of the detoxification site. Detoxification would occur at the same time as the Rotenone treatment and continue afterwards for an anticipated three to four weeks. The anticipated concentration would be a ratio of 3:1 potassium permanganate to rotenone (USFWS 2015). An estimate of approximately 2,500 pounds of potassium permanganate would be needed for detoxification. Detoxification would continue until sentinel fish survive for 24 hours without showing signs of distress at the detoxification site.

Certified Piscicide Applicators and trained staff would oversee the application of the rotenone and other chemicals, as required by the Montana Department of Agriculture, MFWP, and NPS policy (2006 Management Policies, Section 4.4.5.3).

Monitoring and Closures

Post-project monitoring would be done, likely in 2024 through 2026, to evaluate aquatic organism response and recovery rates. Pre-treatment biological surveys and monitoring for macroinvertebrates, plankton, and amphibians took place through 2022 to assess baseline community conditions in advance of post-project monitoring.

Approximately 15 project personnel would likely be on site during removal of rainbow trout and chemical applications. Personnel would camp at the wilderness campground at Gunsight Lake and near Mirror Pond (***Figure 3*** in ***Chapter 3, Visitor Use and Experience***) near the detoxification site for the duration of the rotenone application and detoxification period (anticipated two to four days for rotenone application and three to four weeks for detoxification with potassium permanganate).

The treatment area would be temporarily closed to the public during rotenone application and detoxification. The Gunsight Lake wilderness campground would be closed for the duration of the project, from early September 2023 to spring 2024. The Gunsight Pass Trail would be closed temporarily during rotenone treatment. At this time, the park anticipates closing the Gunsight Pass trail for approximately one week around the site preparation and rotenone treatment application period[6]; however, the trail closure may need to be in place longer depending on variables that could affect the length of the application period such as weather, equipment failures, etc. The closure would extend from Reynolds Campground junction on the east and from just east of Gunsight Pass from the west (***Figure 3*** in ***Chapter 3, Visitor Use and Experience***). The treatment area would be posted with no drinking water or recreating in water warning signs that would be posted along the trail and shoreline of Gunsight Lake, and the public would be informed of the project prior to implementation by means of media releases and postings on the park's website and at the wilderness permit office and visitor centers. Signs informing visitors of any temporary trail closures would be posted throughout the rotenone application timeframe at the Ellen Wilson and Reynolds Campgrounds, on the trail beyond Gunsight Pass from the west, and west of Reynolds Campground, and postings at Jackson Glacier Overlook and Sperry trailheads would be placed before and during the project. The closures would likely be a one-time event, possibly occurring a second season if reapplication of rotenone is necessary.

Project Stage 2: Translocate Native Westslope Cutthroat and Bull Trout

Following the removal of rainbow trout from Gunsight Lake, westslope cutthroat and bull trout would be translocated into the lake. This would be done not only to establish secure populations of westslope cutthroat and bull trout (since non-native fish cannot access the lake due to a downstream waterfall that prevents upstream

[6] Closure period does not equate to the rotenone application period, which is two to four days.

fish migration), but to also to conserve at-risk genetic diversity found in local St. Mary westslope cutthroat trout and bull trout populations. It would also serve to genetically swamp any remaining rainbow trout (remaining rainbow trout are anticipated to be at extremely low numbers) with genetically pure westslope cutthroat trout and reduce the reproductive potential of any remaining rainbow trout.

Translocation would involve the collection of individual trout or trout gametes from donor streams inside and outside the park and propagating the fish in a hatchery outside the park before stocking them in Gunsight Lake and/or directly moving the fish to the lake without hatchery propagation. The lake would be restocked with genetically pure individuals, but if local donor sources in the St. Mary drainage can no longer provide fish of this level of purity due to ongoing hybridization, individuals of lesser genetic purity may be used. Donor streams could include Jule, Roberts, Rose, Two Dog, Wild, Divide, Boulder, Swiftcurrent, Kennedy, Otatso, Midvale, and Lee Creek drainages, among other streams, as well as Slide and Red Eagle Lakes. Bull trout would likely be spawned and released onsite, and the spawned/fertilized bull trout eggs would be taken to the hatchery to be hatched and raised. Westslope cutthroat trout would likely be taken to the hatchery where they would be spawned. Juvenile westslope cutthroat trout would also be stocked back into the donor source population to offset the removal of adults, and swamp existing hybridized trout in the donor population(s). Other spawning and rearing strategies may also be attempted, including streamside spawning and rearing in egg incubators. Streamside incubators are typically a small (approximately 8-inch x 8-inch) plastic basket or bucket or similar container that would be filled with gravel and eggs. Incubators would not require the use of any motorized equipment. If used, incubators would be in place until the eggs hatch (estimated at approximately two months) and would be checked approximately every two weeks and manually packed out upon fish dispersing. Fish health testing would be conducted before translocation, consistent with state and federal fish stocking requirements.

Collection of the donor fish for translocation would likely begin in 2024 using manual methods such as angling, dip netting, trapping, electrofishing and/or seining[7]. Selected donor water bodies[8] within the St. Mary River drainage are similar or near enough on the landscape to have undergone similar evolutionary pressures as the project area. Donor fish would be sourced from populations where evaluations have shown they are demographically strong enough to support the removal (i.e., the populations are large enough to withstand the removal of some fish) and no more than 10 percent of the population would be removed (C. Downs, personal communication).

Project personnel (an estimated five to ten-member crew) would be onsite collecting the donor fish from source populations over an approximately one to two-week period. Donor native fish collection could occur any time during spring, summer, or fall. Donor fish would be transported from the stream on foot and then by vehicle to the hatchery. The collection of donor fish may need to be repeated each year for an estimated three years depending on the success of hatchery propagation and the number of fish that can be translocated to Gunsight Lake at a given time.

Westslope cutthroat trout would be translocated to the lake first, possibly in 2025 at the earliest, three to four years before bull trout are introduced. This would allow the westslope cutthroat trout to reach sexual maturity and establish a reproducing population before adding additional competition and/or predation from bull trout. We anticipate introducing two- to four-year classes[9] of westslope cutthroat trout followed by two- to four-year classes of bull trout. Translocation would take place over multiple years (estimated six to eight) to establish multiple age classes of both species. Equipment used to transport fish (such as coolers) would be cleaned ahead of time in accordance with State of Montana rules and regulations for live fish transport. Translocated fish would be monitored, which could require marking them with tags, fin clips, or other means as well as periodic netting and electrofishing surveys. Personnel (an estimated two to five-member crew) may need to stay at one of the

[7] Seining is a method of fishing that employs a net that hangs vertically in the water with its bottom edge held down by weights and its top edge buoyed by floats, and then moved through the water manually or by boat.
[8] These streams include Jule, Roberts[8], Rose, Two Dog, Wild, Divide, Boulder, Swiftcurrent, Kennedy, Otatso, and Lee Creek drainages, among other streams, as well as Slide and Red Eagle Lakes.
[9] A year class is defined as each year the lake is restocked with translocated fish; all fish are of the same age.

campgrounds if translocation cannot be completed in one day. No area closures would be required during fish translocation or collection.

Project Transportation Needs

Project personnel would hike to the project area for all stages of the project (i.e., removal of rainbow trout, collection of donor fish, translocation of native fish, monitoring, etc.).

Equipment and gear would be packed to the lake on foot or by livestock whenever feasible (e.g., depending on weight and size of equipment, whether equipment can be safely packed on livestock, and whether trail conditions are conducive to livestock use). Helicopters would be necessary to transport boats, rotenone, the generator, water pumps, and possibly other equipment to and from the project area. Items to be packed versus flown-in by helicopter would be at the discretion of the NPS packers. Fish for translocation would likely need to be transported to the lake by helicopter to reduce the risk of mortality compared with transport on foot or with livestock. Helicopters would deliver and pick up equipment and fish by means of long-line sling loads, and/or fish could be aerially stocked.

The number of flights would depend on the size of helicopter available at the time (i.e., smaller helicopters could carry less weight, resulting in more flights). At this time, approximately 15 flights (estimated) may be required for the rotenone application and detoxification phases of the project. The number of flights for fish translocation is estimated at one to two flights per year over a period of approximately six to eight years. Glacier National Park limits administrative flights to 50 flights each year. The park would make every effort to include helicopter flights for this project within the 50-flight limit on administrative flights; however, for the purposes of impacts analysis, this EA evaluates flights for this project as if they were in addition to the 50-flight limit. Every effort would also be made to combine flights for this project with other administrative flights. This would also be the case if reapplication of the rotenone is necessary.

Summary of Project Phase Duration (estimated):

- Project Stage 1: Remove Rainbow Trout
    - Rotenone application: 2 to 4 days; would begin September 2023
    - Detoxification: 3 to 4 weeks; would begin during and after rotenone application
- Project Stage 2: Translocate Native Westslope Cutthroat and Bull Trout
    - Collection of donor fish: 1 to 2 weeks per year for three years; may begin in 2024 at the earliest
    - Translocation: 6 to 8 years; may begin in 2025 at the earliest

ALTERNATIVE B – NO ACTION ALTERNATIVE

Under Alternative B, the NPS would not remove rainbow trout from Gunsight Lake and would not translocate westslope cutthroat trout or bull trout to the lake.

CHAPTER 3 – AFFECTED ENVIRONMENT AND ENVIRONMENTAL IMPACTS

This chapter considers potential impacts to park resources that could occur due to the proposed action and for which a detailed analysis is necessary, along with analyzing the environmental impacts of not taking the action under consideration. The existing conditions for each resource are described followed by an analysis of impacts. Issues are retained for detailed analysis if they are pivotal or central to the proposed action, necessary to make a reasoned choice between alternatives, a major point of contention among the public or other agencies, and/or associated with resources that could be significantly affected if the proposed action is implemented. Direct, indirect, and cumulative impacts as applicable are discussed in this section. Impact topics that have been dismissed from detailed analysis are described in ***Appendix E***.

AQUATIC SPECIES

BULL TROUT – ESA LISTED THREATENED, MONTANA SPECIES OF CONCERN

Bull trout are a large char[10] native to the northwestern US and western Canada and are a top aquatic predator. Once abundant in the Columbia River basin, bull trout have declined in distribution and abundance in recent decades (USFWS 1999). The imperiled status of bull trout led the USFWS to list the species as threatened under the ESA in 1998. Glacier's waters are an important stronghold for bull trout, since the park contains approximately one-third of the remaining natural (i.e., undammed) lake core habitat areas supporting bull trout in the US (USFWS 2015).

The St. Mary River drainage is the only drainage in the U.S. where bull trout can be found east of the Continental Divide. As such, these "east-side" bull trout populations have high conservation value. The St. Mary Bull Trout Recovery Unit consists of four Core Areas: St. Mary River, Slide Lake, Cracker Lake, and Red Eagle Lake. The St. Mary River Core Area supports several bull trout populations including Kennedy Creek, Boulder Creek, and Divide Creek. The Kennedy Creek bull trout population is currently in dramatic decline, apparently driven by habitat and climate impacts, including an absence of spawning gravel and declining stream flows. The use of Divide Creek by bull trout occurs sporadically year by year (C. Downs, NPS, personal communication). Based on annual redd counts (i.e., spawning bed surveys), Boulder Creek supports the largest population of migratory bull trout in the South Saskatchewan drainage of the park. Redd counts averaged 41 (ranged 12 to 66 reds) over the period of record (1997 to 2022). The population appears fairly stable (approximately 100 spawning adults), but this stability is linked to adequate stream flow conditions (Kaeding and Mogen 2022) and climate driven changes in the annual hydrograph are a significant risk. Similarly, this population suffers losses of sub-adult/juvenile bull trout out-migrating from Boulder Creek into the St. Mary irrigation diversion system near Babb. Cracker and Slide Lakes are physically secured by barrier falls but their bull trout populations are small and non-migratory. Slide Lakes adult bull trout population generally exceeds 100 adults, similar to Boulder Creek (J. Mogen, USFWS, pers comm). Red Eagle Lake's bull trout population is vulnerable to invasive brook trout as there is no barrier blocking brook trout access.

Recent genetic evidence shows that hybridization with brook trout is threatening the genetic lineage of St. Mary bull trout. Hybridization between bull trout and brook trout has been recently documented in Boulder Creek and is particularly alarming as Boulder Creek represents the only remaining migratory bull trout population of any notable size in the St. Mary River drainage (J. Mogen, USFWS, personal communication). Warming climate increases the potential for brook trout to further expand their distribution in the St. Mary system, increasing the risk.

The threats to bull trout are being compounded by climate-related habitat alterations. Climate driven changes in precipitation patterns resulting in altered flow regimes have been shown to adversely impact bull trout populations in the St. Mary River drainage (Kaeding and Mogen 2022). Bull trout require among the lowest water temperatures for optimal growth of any North American trout or salmon species (Selong et al. 2001). Bull trout also require stable stream channels with gravel and cobble bottoms for spawning and rearing young; these conditions are at risk from climate-induced increases in sedimentation in the wake of more frequent forest fires and channel instability during rain-on-snow events. There is anecdotal information suggesting channel instability and the inability of the stream to retain appropriate size spawning gravel could be playing a role in reduced bull trout spawning activity in Kennedy Creek (J. Mogen, personal communication).

Future planned actions include periodic interagency native fish population assessments and Glacier fisheries management projects, which involve gill net surveys and annual electrofishing monitoring.

[10] Bull trout can reach up to 35 inches.

Environmental Impact – Bull Trout

Alternative A – Preferred Alternative

Alternative A would benefit bull trout through the establishment of a population that is secure from invasion of non-native fish and less vulnerable to habitat degradation occurring due to climate change. Establishing a secure population of bull trout in the St. Mary River drainage (via translocation) would also help compensate for losses and risks to other bull trout populations in the drainage (e.g., irrigation systems outside the park).

Given the small and non-migratory status of the Cracker and Slide Lake populations and the vulnerability of the Red Eagle Lake population, establishing bull trout in Gunsight Lake would increase the overall distribution and security of the bull trout in the St. Mary River drainage. The benefits of this would be regional because protection of core populations in the park is linked to the conservation of bull trout throughout the greater St. Mary River drainage. A secure bull trout population in the St. Mary River drainage would also support regional efforts by numerous State, Tribal, Federal, and Provincial entities to conserve bull trout.

There is no potential for adverse impacts to bull trout from the use of rotenone and potassium permanganate because there are currently no bull trout present in the rotenone treatment area. The nearest bull trout populations may occur in St. Mary Lake, over seven miles downstream of the project area, and the chemicals would be completely detoxified before reaching the lake. To date, no bull trout have been captured in monitoring gill nets in St. Mary Lake in the past 10 years and bull trout abundance, at best, is very low (C. Downs, NPS, personal communication). In the highly unlikely event that rotenone treated water did reach St. Mary Lake, it would be quickly diluted to a non-lethal concentration due to the large volume of water in St. Mary Lake. The potassium permanganate would not be expected to persist for more than 10 to 15 minutes of flow time (Engstrom-Heg 1971 and 1972). Potassium permanganate would rapidly degrade with interaction with the rotenone and the stream environment before reaching the lake and affecting bull trout. The same conclusion would hold if rotenone needed to be reapplied.

There would be some adverse impact to bull trout during translocation from capturing and handling adult bull trout as well as the removal of eggs from the donor system. Impacts would occur during handling (one to two weeks per year for an estimated three years). Population level impacts would not be expected from the removal of the eggs. This is because the removal of the eggs would be mitigated by partially spawning each female (only about 50 percent of the eggs would be taken from each female handled) to allow for some natural reproduction, producing only enough eggs to fully seed the available juvenile rearing habitat or supply the fish hatchery for rearing (see also ***Appendix B, Mitigation Measures***). Population-level impacts would also not be expected because donor fish would come from populations that are demographically strong enough to support the removal (i.e., the populations are large enough to withstand the removal of some fish) and no more than 10 percent of the population would be removed. This level of removal presents minimal chance of decreasing natural reproduction or the available genetic pool for the population. Based on previous work in collecting eggs from the Quartz system, adverse population level impacts are not expected. The park would work closely with USFWS to ensure the bull trout donor population is not harmed in the process.

Bull trout critical habitat is present in some donor streams and/or segments of donor streams from which bull trout and westslope cutthroat trout would be collected for translocation. The collection of donor fish would not impact bull trout critical habitat because the activity would not alter stream flows or stream banks, create sedimentation, change access for bull trout, increase access for bull trout competitors, or cause changes in bull trout prey composition.

Alternative A is consistent with the U.S. Fish and Wildlife Service (USFWS) Bull Trout Recovery Plan.

Alternative B – No Action Alternative

Under Alternative B, current management would continue. As a result, impacts to bull trout would be the same or similar to what is described in the Affected Environment, which includes a description of the current and expected future conditions of the species. Additionally, Alternative B would forego an opportunity to establish a secure population of bull trout in an area of habitat refugia. Losing such an opportunity is notable given the risks bull trout face in the St. Mary River system including hybridization with brook trout, limited dispersal capabilities due to natural barriers to upstream fish passage throughout the watershed, losses of bull trout to irrigation systems outside the park (Mogen et. al. 2011), and small population size as well as changes in habitat associated with climate change (e.g., changes in runoff and precipitation patterns, lower late summer stream flows, increased frequency of severe wildfire). Alternative B would not offset these threats to the St. Mary core recovery area and beyond, including regionally. The lost conservation opportunity would be especially notable if any of the small bull trout populations in the St. Mary system are extirpated or their numbers are diminished further over time. This alternative would not support the conservation goals of bull trout management partners in the region, including the USFWS, USFS, Blackfeet Indian Nation, MFWP, and Parks Canada.

WESTSLOPE CUTTHROAT - MONTANA SPECIES OF CONCERN

Historically the most abundant and widely distributed subspecies of cutthroat trout throughout the west, the westslope cutthroat trout currently occupies less than 30 percent of its historic range in Montana (Muhlfeld et al. 2016). Population declines are due to a variety of factors, including habitat loss or degradation, excessive harvest by anglers, and effects from non-native fish (Liknes and Graham 1988). Hybridization with non-native rainbow trout is one of the primary threats to westslope cutthroat trout (Muhlfeld et al. 2016). Non-hybridized populations of westslope cutthroat trout occupy less than ten percent of their historic range in the US (Shepard et al. 2005), and less than three percent in Montana (Liknes and Graham 1998). In the St. Mary River drainage, all but one (Roberts Creek) of the remaining westslope cutthroat trout populations have some level of hybridization with either rainbow or Yellowstone cutthroat trout. Non-native rainbow trout and brook trout are also believed to compete with westslope cutthroat trout for food and space (Shepard 2004; Hitt et al. 2003; Muhlfeld et al. 2016). Lake trout (*Salvelinus namaycush*) pose a major predation risk to westslope cutthroat trout in Glacier. These influences threaten the long-term persistence of westslope cutthroat trout throughout their occupied habitat in the park.

Climate change-induced habitat alterations are also impacting westslope cutthroat through increased rates of hybridization (Muhlfeld et al. 2014). Warmer stream temperatures may give non-native invasive fish an advantage, as with rainbow and brook trout, which tolerate higher water temperatures than native westslope cutthroat (Kovach et al. 2017). In the northern Rocky Mountains, warmer water temperatures may hasten or facilitate the ability of rainbow trout to spread and hybridize with native westslope cutthroat trout, likely due to multiple physiological, biological, and life-history factors, such as spawning and incubation times, combined with decreases in spring precipitation and runoff (Kovach et al. 2017). In areas near historical rainbow trout stocking areas, hybridization with native westslope cutthroat trout was more likely in waters with warmer water temperatures, lower spring precipitation and runoff, and higher rainbow trout numbers; cold-water sites were also susceptible to invasion (Kovach et al. 2017).

Westslope cutthroat trout are not currently present in the project area. The nearest known populations are in the tributaries to St. Mary Lake, such as Rose Creek, Wild Creek, and Divide Creek.

Future planned actions include periodic interagency native fish population assessments and Glacier fisheries management projects, which involve gill net surveys and annual electrofishing monitoring.

Environmental Impacts – Westslope Cutthroat Trout

Alternative A – Preferred Alternative

Alternative A would benefit westslope cutthroat trout long term by establishing a non-hybridized population in their native range. Translocation of genetically pure individuals from the donor sources

would preserve the St. Mary River drainage population's native genetic lineage by transplanting individuals to a location inaccessible to non-native fish downstream.

By removing non-native rainbow trout from Gunsight Lake, Alternative A would eliminate a potential source of hybridizing fish to the remaining downstream westslope cutthroat trout populations in the St. Mary River drainage. Long term, this alternative would provide a mechanism to gradually reverse existing levels of hybridization as pure westslope cutthroat trout move downstream from the newly established Gunsight Lake population and reproduce with fish from the wider St. Mary River drainage, in a process known as genetic swamping.

The collection of individual westslope cutthroat trout for translocation would impact the species from the removal of eggs and/or individuals from the donor populations. Impacts would occur for one to two weeks per year for an estimated three years. However, individuals would only be removed from populations large enough to support the removal of a small fraction (i.e., less than 10 percent) of the population. Because female westslope cutthroat trout mature at a relatively young age (three to five years old) and can spawn several hundred eggs each year (Downs 1995), they are relatively resilient to natural fluctuations in population abundance. It is not uncommon for stream-dwelling westslope cutthroat trout populations in Glacier National Park to naturally vary from year to year at levels greater than 10% (Downs et al. 2020). This level of removal presents minimal chance of decreasing natural reproduction or the available genetic pool for the population. Because of this, donor populations are expected to recover rapidly from the removal of a small number of individuals. Adverse impacts from translocation would be too low to change the long-term abundance or distribution of the donor population in any meaningful way and would not threaten its existence.

There would be no adverse impacts to westslope cutthroat trout from the use of rotenone and potassium permanganate because westslope cutthroat trout are not currently present in the project area.

Similar region-wide efforts to conserve westslope cutthroat trout are underway by MFWP, US Bureau of Land Management (BLM), and USFS across the range of westslope cutthroat trout in Montana. Alternative A would further the conservation efforts of these agencies.

Alternative B – No Action Alternative

Under Alternative B, current management would continue. As a result, impacts to westslope cutthroat trout would be the same or similar to what is described in the Affected Environment, which contains a description of the current and expected future conditions of current management. Additionally, Alternative B would allow non-native rainbow trout to continue to pose a direct risk of hybridization to downstream westslope cutthroat trout populations. Under Alternative B the NPS would not establish a genetically pure population of westslope cutthroat trout in an area of habitat that is secure against the risk of hybridization and the effects of climate change. As a result, ongoing threats and impacts to westslope cutthroat trout in the St. Mary River drainage would continue.

AMPHIBIANS

Surveys conducted by US Geological Survey (USGS) staff have documented the presence of the western toad (*Anaxyrus boreas*), long-toad salamander (*Ambystoma macrodactylum*), and the Columbia spotted frog (*Rana luteiventris*) in the upper St. Mary River drainage (B. Hossack, USGS, personal communication). In 2020, Glacier National Park conducted an amphibian survey at the outlet of Gunsight Lake and the headwaters of the St. Mary River in the vicinity of the rotenone treatment area. These surveys documented the presence of the Rocky Mountain tailed frog (*Acaphus montanus*), western toad, and Columbia spotted frog. Of these amphibians, the western toad is listed as a species of concern in the state of Montana. Given their physiological requirements, limited dispersal abilities, and hydrologically sensitive habitats, amphibians are likely to be highly sensitive to future climatic changes (Lawler et al 2010). Future planned actions include continued research, monitoring, and surveys.

Columbia spotted frogs range along the Rocky Mountains from Canada to central Idaho. They are a largely aquatic frog and found at water's edge, swampy wetlands, and may be at elevations at, or near tree line in some populations. Adults feed mainly in riparian habitat, occasionally in bordering meadow/woods, while juveniles will forage farther from water. Columbia spotted frog reproduction takes place in March to June depending on snow melt, temperature, and elevation. Egg masses are laid in shallow, still water, and upon hatching, tadpoles take cover in vegetation. Metamorphosis into frogs varies with location and environmental conditions averaging eight to 16 weeks; individuals undergoing metamorphosis can be found from late July through the first freeze. Columbia spotted frog populations are largely secure throughout the state of Montana, although the species is quite rare in parts of its range and/or suspected to be declining, MNHP 2023).

Rocky mountain tailed frogs are most often found within habitat of small, cold (less than 60 degrees Fahrenheit), fast, permanently forested streams. In Montana, adults breed via internal fertilization in streams during August or September. Females store sperm overwinter and deposit eggs the following June or July. Eggs hatch in August or September and tadpoles usually metamorphose in July to September in the third summer after hatching. In Montana, adults reproduce for the first time four or five years after metamorphosis (age 7-8) which is the latest of any North American amphibian. Rocky mountain tailed frog populations are largely secure throughout the state of Montana, although it is quite rare in parts of its range and/or suspected to be declining (MNHP 2023).

The western toad (also known as the boreal toad) is the most widely distributed amphibian in the park (Blake Hossack, USGS, personal communication). While the species is disappearing from parts of its Rocky Mountain range and is listed as a species of concern in Montana (MNHP 2020), there is no evidence that it is declining in Glacier. Western toads utilize a wide variety of habitats, including springs and streams, meadows, woodlands, mountain wetlands, beaver ponds, and marshes. Adults are terrestrial; egg and larvae development occur within slow-moving and shallow water, and tadpoles metamorphose in their first summer, generally documented from late July to mid-September (MNHP 2023). Western toad tadpoles are not a preferred prey item for fish because both adult toads and tadpoles secrete a toxic substance that deters predators (Ontario Nature 2017).

The long-toed salamander is the most widely distributed, common species of amphibian west of the Continental Divide. Their known range in Montana extends west of the Rocky Mountain Front, with limited understanding of their range east of the Divide (MNHP 2023). Based on this, the east side of the park and the project area are likely toward the eastern edge of the species' range. Adults inhabit several habitat types, including alpine meadows, forested areas, and rocky lakeshores. Adults are primarily subterranean outside of the breeding season but may occur in shallow water or under debris near water during breeding season. The species usually breeds in waters uninhabited by fish; larvae are mostly found in fishless, standing water. For this reason and since the species was not documented during survey of Gunsight Lake and the project area, there is a lower chance that long-toed salamanders are present in the project area when compared to other amphibians considered. Breeding tends to occur in early spring, with metamorphosis generally complete by August/September (MNHP 2023). Long-toed salamanders' populations are stable throughout the state of Montana and are common through most of their range (MNHP 2023).

Environmental Impacts – Amphibians

Alternative A – Preferred Alternative

Since rotenone and potassium permanganate affect gill-breathing organisms and amphibians breathe with gills during their larval/tadpole life stage, some larvae, if present, would be killed during the rotenone treatment. Electrofishing during rotenone application, collection of donor fish, and post-project monitoring would temporarily stun individual amphibians that are present, but as with fish during electrofishing, any affected amphibians would be expected to recover (C. Downs, personal communication). If a second application of rotenone is necessary, the impacts would be as described above.

Species affected during rotenone treatment could include the Columbia spotted frog, Rocky Mountain tailed frog, western toad, and long-toed salamander, if present. Impacts to the salamander are less likely because the species was not found during a survey of the project area and breeding and

larvae tend to occur in fishless water. The amount of amphibian larvae mortality during rotenone treatments depends in part on the time of year, with less mortality occurring if rotenone is applied later in the year when the larvae have metamorphosed into terrestrial adults. This would be the case for all amphibians present except tailed frogs, which spend multiple years as tadpole larvae. Studies have demonstrated an 80 to 100 percent tadpole mortality rate among tadpoles 24 hours after exposure to rotenone at a concentration of 1 ppm (the same concentration that would be used under Alternative A) (Grisak 2003a, Billman et. al. 2012). Conversely, lung-breathing adult spotted frogs experienced no mortality over 96-hour trials at concentrations as high as 4.5 mg/L (Grisak et al. 2007), and Billman et al. (2012) observed no mortality in juvenile/adult life stage amphibians after rotenone treatment.

Western toad adults would not be affected by rotenone or potassium permanganate because they are terrestrial and would not be present in the water. Most if not all western toad tadpoles would have matured into terrestrial juveniles by the time rotenone and potassium permanganate would be applied in late summer/early fall. While some western toad tadpoles could still be in the water and killed, the number would be too small to be of any measurable or lasting consequence to the population since most would have become terrestrial juveniles and would not be affected, and individuals that are killed would be rapidly replaced by the following year's hatch.

Despite larval/tadpole mortality, numerous field evaluations by MFWP indicate the persistence of amphibian populations following rotenone applications in the Flathead Basin and the South Fork of the Flathead (Fried et al. 2017). One year after Tom Tom Lake in the South Fork of the Flathead was treated with rotenone, a survey documented numerous spotted frog juveniles, Rocky Mountain tailed frogs, and long-toed salamander larvae (Grisak 2003b). Four amphibian species were monitored for two to four years pre-treatment in 10 alpine lakes in the South Fork of the Flathead watershed. Post-treatment comparisons between baseline detection frequencies revealed no significant changes in adult amphibian detection frequency, suggesting resiliency of amphibian populations to rotenone treatments (Fried et. al. 2017). Based on this information, impacts to amphibians would likely be limited to larval stages, with local population abundance likely recovering within a year or two. Adverse impacts would be reduced by implementing the project in late summer/fall when amphibian species, except for the tailed frog, have developed into terrestrial adults.

The change in fish species composition following translocation of westslope cutthroat trout and bull trout to Gunsight Lake would not result in new predatory influences that are noticeably different from that of the rainbow trout currently present. Any predation impacts have been ongoing since the lake was stocked with rainbow trout in the 1920s and 30s. In addition, westslope cutthroat trout and bull trout naturally co-exist with the park's native amphibian communities across much of the park. Therefore, the abundance, composition, and distribution of amphibians would likely be very similar to what currently exists, and there would be few, if any, impacts after translocation.

Alternative B – No Action Alternative

Under Alternative B, current management would continue. As a result, conditions for amphibians would be the same or similar to current and expected future conditions of the Affected Environment. Alternative B would have no impact on amphibians, including the western toad, because rotenone would not be applied and no mortalities of larval or adult amphibians would occur. If rainbow trout are preying on amphibians in Gunsight Lake, their continued presence would result in continued adverse impacts to amphibian populations. Since such impacts would have been occurring for some time, there would not be any noticeable changes to the existing status of amphibians in the lake. Predation by rainbow trout that migrate downstream of Gunsight Lake would also not notably affect amphibian populations, since amphibians in downstream waters are already exposed to predation by fish.

AQUATIC MACROINVERTEBRATES

Macroinvertebrates are any animal lacking a backbone and large enough to see without the aid of a microscope. Macroinvertebrates may be aquatic or terrestrial; the aquatic organisms often being larval or nymphal forms of otherwise terrestrial insect species (e.g., mayflies, stoneflies, and caddisflies) which emerge as winged adults. Macroinvertebrates provide an important food source for many other animals such as amphibians, birds, and fish. They also are also important decomposers in freshwater ecosystems (Michaluk 2022). Some species of macroinvertebrate species may have a narrow range of temperature tolerances because of where they are located on the landscape such as if they inhabit high elevation, cold water habitats. Research indicates that such species may be especially vulnerable to climate change (Giersch et. al. 2015).

Glacier supports a diversity of aquatic macroinvertebrates including mayflies, stoneflies, caddisflies, midges, mollusks, and worms, among others. Recent stream surveys have provided information on the distribution and abundance of several species at the parkwide scale (NPS data 2022; Giersch et al. 2017). The NPS sampled benthic macroinvertebrates (species inhabiting the bottom of water environments) in Gunsight Lake and the upper St. Mary River in 2019, 2021, and 2022 (NPS, unpublished data). Samples were evaluated to the genus level; species were not identified because there were not sufficient diagnostic physical features for definitive identification of larval and nymph stages. Results included a diversity of mayflies, stoneflies, caddisflies, midges, mollusks, and worms, among others. Aquatic macroinvertebrates in Gunsight Lake have likely been impacted by predation from introduced rainbow trout since the 1920s and 30s. Future planned actions include continued research, monitoring, and surveys.

Two species of ESA listed aquatic macroinvertebrates are present in Glacier: the western glacier stonefly (*Zapada glacier*) and the meltwater lednian stonefly (*Lednia tumana*). Both species live in limited, specific habitats in high-elevation, cold-water streams, near permanent snowpacks. Recent USGS and NPS (surveys did not detect either federally listed stonefly within the project area, and the project area does not provide typical habitat for either species. Since the species have not been detected in the project area and due to the very low likelihood that they are present, the western glacier and meltwater lednian stoneflies have been dismissed from further analysis (***Appendix F***).

Two aquatic macroinvertebrates listed by the state of Montana as species of concern that could be present in the project area include the cordilleran forestfly (*Zapada cordillera*) and a rhyacophilan caddisfly (*Rhyacophila ebria*). Other state-listed aquatic macroinvertebrate species that were not detected in recent surveys and are highly unlikely to be present in the project area have been dismissed from detailed analysis (***Appendix F***).

Range wide, the cordilleran forestfly's known range is scattered from California, Oregon, Washington, Idaho, and Montana (Baumann et al. 1977), and possibly represents disjunct glacial refugium populations. The species inhabits very small streams and seeps and has been documented in the park, but not within the St. Mary River drainage (J. Giersch, personal communication). The cordilleran forestfly has been described as rare due to habitat specificity (Baumann et al. 1977) and is never abundant when collected. *Z. cordillera* could be present in seeps or small streams adjacent or downstream of Gunsight Lake, though likely not within the main channel (J. Giersch, personal communication). The species was not detected in earlier surveys of the project area, but *Zapada* species were detected in recent NPS surveys and could be *Z. cordillera*; DNA test results are pending.

The rhyacophilan caddisfly (henceforth referred to as *R. ebria*) is a northern Rocky Mountains endemic, known from locations in Montana, Alberta, and British Columbia. *R. ebria* larvae are a free-living form and move around rocks and boulders searching for prey. *R. ebria* requires very cold water and has a restricted distribution of high elevation areas associated with snow and ice-melt. The primary threat to this species is a warming climate and the resulting loss of its cold-water habitat that could impact the species population trend (MNHP 2023). The species was documented in the project area during surveys in 2018 and 2022.

Environmental Impacts – Aquatic Macroinvertebrates

Alternative A – Preferred Alternative

Aquatic insects in nymph life stages in the treatment area would be affected by rotenone and potassium permanganate because they rely on gills for respiration. In the case of rotenone, susceptibility varies by species, with caddisflies and mayflies generally more susceptible than stoneflies (Oplinger and Wagner 2014). Aquatic mollusks are more resistant since they can close their shells. Aquatic mollusks would likely be affected by rotenone treatment, including some mortality, but concentrations of rotenone required to kill snails are considerably higher than what is needed to remove trout (Oplinger and Wagner 2014). Numerous studies indicate that piscicides have temporary or minimal effects on adult form aquatic insects. Cook and Moore (1969) reported that the application of rotenone has little lasting effect on the insect community of a stream. Cushing and Olive (1956) reported that insects in a lake treated with rotenone exhibited only short-lived effects. Case studies conducted on Devine Lake in the Bob Marshall Wilderness from 1994 to 1996 indicate that following a rotenone treatment, aquatic invertebrates increased in number and, very slightly, increased in diversity (Rumsey et al. 1997). Cushing and Olive (1956) reported that oligochaete (aquatic worm) numbers increased after a rotenone treatment then became stable. Therefore, some mortality of aquatic invertebrates would be expected immediately following the application of rotenone and in the vicinity of the detoxification site, but it is likely that some would survive rotenone and potassium permanganate exposure within the treated waterbodies. Downstream drift and overland migration from untreated waters within the catchment would also aid recolonization and help mitigate effects. Extensive pre- and post-treatment monitoring from 13 alpine lakes and associated stream networks in the South Fork Flathead watershed have documented aquatic macroinvertebrate recovery in abundance and community composition within two to four years following piscicide application for even the most rare and sensitive taxa (Bourret et al. 2018; Schnee et al. 2021).

Impacts to state listed macroinvertebrates including the cordilleran forestfly and *R. ebria* are likely since the *Zapada* genus and *R. ebria* were detected in the rotenone treatment area in recent surveys (NPS 2019, 2021, 2022). *R. ebria* and cordilleran forestfly larvae and nymphs could be incidentally killed by the rotenone or potassium permanganate, causing adverse impacts at the individual level. Mitigation measures, including using the lowest effective rotenone concentration for trout (1ppm) and treating for the shortest effective duration, would minimize the potential for rotenone exposure to macroinvertebrates (see also ***Appendix B, Mitigation Measures***). For the reasons described, adverse impacts to macroinvertebrates from the application of rotenone would be anticipated; however, the loss of individuals from the treatment area would not have long term impacts to either *Zapada* species or *R. ebria* at the population level. Studies have shown rapid recolonization following rotenone treatments. Recolonization would occur from the migration of individuals from untreated upstream and downstream areas, as well as from individuals within the treatment area that survive the rotenone. If a second application of rotenone is necessary, the impacts would be as described above.

Collection of donor fish could cause individual mortality of some aquatic macroinvertebrates from trampling as personnel are walking through the stream. Any impacts would be limited to the individual level, with no changes to species distribution or abundance. The cordilleran forestfly may be present in donor streams, but any mortality would be limited to the individual level with no impacts at the population level. Electrofishing during rotenone application, collection of donor fish, and post-project monitoring would temporarily increase invertebrate drift (e.g., causing invertebrates to float), but there would be no lasting impacts or changes to species composition or abundance (Bisson 2011).

The presence of westslope cutthroat trout and bull trout would not result in predatory influences that are noticeably different from that of rainbow trout. Westslope cutthroat trout and juvenile bull trout have feeding preferences that are similar to those of rainbow trout, and prey on aquatic and terrestrial insects. Sub-adult and adult bull trout are less dependent on aquatic insects and prey primarily on other fish; therefore, translocation would cause few, if any, new predation impacts to aquatic macroinvertebrates.

Alternative B – No Action Alternative

Under Alternative B, current management would continue. As a result, future conditions for aquatic macroinvertebrates would be the same or similar to current and expected future conditions described in the Affected Environment. Alternative B would have no impact on macroinvertebrates because rotenone would not be applied, and no mortalities of nymph or adult insects would occur. Predation impacts to aquatic macroinvertebrates since the lake was stocked with rainbow trout in the 1920s and 30swould continue under Alternative B. Since these effects have been underway for some time, there would be no measurable change to the current status of aquatic macroinvertebrate populations in the lake. If rainbow trout migrate downstream, predation effects to aquatic macroinvertebrates in downstream waters would not be expected to differ much from what currently exists due to ongoing predation by other species of fish.

ZOOPLANKTON

Ellis et al. (1992) compared zooplankton abundance and species composition in both fish-bearing and fishless backcountry lakes in the park and noted populations of smaller zooplankton species (i.e., rotifers) in lakes where fish were introduced (similar to Gunsight Lake). Fish tend to graze on larger plankton species (copepods and cladocerans), impacting the relative abundance of zooplankton in a body of water and causing a shift in species that favors smaller species. Ellis et al. (1992) did not report sampling zooplankton in Gunsight Lake. More recent sampling was conducted in Gunsight Lake by the NPS in 2021 to 2022 using a 30-centimeter diameter plankton net with 64-micron mesh (same sampling equipment as used by Ellis et al. (1992)) in early September of each year. Samples were collected using shallow (17 feet) and deeper (55 feet) vertical hauls. The more recent plankton sampling results revealed a dominance of cladocerans and copepods, with rotifers also present but at a much lower density (C. Downs, NPS, personal communication). Climate warming and increased climatic variability are expected to alter snowpack, ice-free season length, and summer water temperatures in unproductive high-elevation ecosystems, thereby affecting their biodiversity and functioning (Parker et al. 2008). Predation of zooplankton by non-native rainbow trout is likely occurring at Gunsight Lake but it is not known to what degree zooplankton communities at the lake have changed since the lake was stocked with rainbow trout in the 1920s and 30s. There are no planned actions that would affect zooplankton in the analysis area.

Environmental Impacts- Zooplankton

Alternative A – Preferred Alternative

Anderson (1970) reported that comparisons between samples of zooplankton taken before and after a rotenone treatment did not change a great deal. Despite the inherent natural fluctuations in zooplankton communities, the application of rotenone had little effect on the zooplankton community. Kiser et al. (1963) reported that 20 of 22 zooplankton species re-established themselves to pretreatment levels within about four months of a rotenone application. Both Anderson (1970) and Kiser et al. (1963) reported that most plankton species survive a rotenone treatment via their highly resilient egg structures. Some female plankters are also capable of asexual reproduction, or reproduction without fertilization, which also greatly increases reproduction potential among zooplankton and, ultimately, density. MFWP sampling before and after rotenone treatment of 15 alpine lakes in the South Fork Flathead River drainage demonstrated a minor decline in zooplankton densities post-treatment, but no change in species diversity and a return to pre-treatment densities the following year (Schnee et al. 2021). Based on these studies, adverse impacts to zooplankton would be expected from rotenone, but they would be temporary until the following spring and of no meaningful consequence to zooplankton communities. Potassium permanganate may cause zooplankton mortality downstream of the detoxification site, but zooplankton primarily inhabit lakes, and few would be exposed to potassium permanganate in the stream. If a second application of rotenone is necessary, the impacts would be as described above.

Translocating westslope cutthroat trout and bull trout to Gunsight Lake would not noticeably change predation influences on zooplankton. This is because westslope cutthroat trout have similar feeding preferences as rainbow trout, and because bull trout do not typically forage on zooplankton as adults.

Therefore, impacts to zooplankton from translocation of westslope cutthroat trout and bull trout would be very slight, if they occur at all.

Alternative B – No Action Alternative

Under Alternative B, current management would continue, with conditions for zooplankton that are the same or similar to current and expected future conditions characterized in the Affected Environment. Under Alternative B, there would be no impact to zooplankton in Gunsight Lake because rotenone and potassium permanganate would not be applied. Predation of zooplankton by non-native rainbow trout would continue at Gunsight Lake. While changes to zooplankton communities at the lake from predation by rainbow trout are not known, any effects have been occurring for some time and no observable changes to the existing status of zooplankton communities in the lake would be expected. Any predation effects to zooplankton downstream from migrating rainbow trout would not likely differ noticeably from the existing effects of predation from other fish.

WILDLIFE

GRIZZLY BEARS - ESA LISTED THREATENED, MONTANA SPECIES OF CONCERN

Glacier is part of the Greater Glacier Area (GGA) in the northern third of the Northern Continental Divide Ecosystem (NCDE) Grizzly Bear (*Ursos arctos*) Recovery Zone. The GGA is defined from north to south by the Canadian border and the park's southern boundary, and from east to west by the Blackfeet Indian Reservation and the Whitefish Mountains (Kendal et al. 2008). Genetic analysis of hair samples collected during 1998 to 2000 resulted in a population estimate of 241 grizzly bears in the GGA (Kendall et al. 2008). No population estimate has been developed exclusively for Glacier. Data from the NCDE grizzly bear population trend monitoring project indicates that the ecosystem's grizzly bear population trend is increasing at 2.3 percent per year (data from 2004-2011; Costello et al. 2017).

Grizzly bear seasonal movements and habitat use are tied to the availability of different food sources. In spring, grizzly bears feed on dead ungulates and early greening herbaceous vegetation at lower elevations (Martinka 1972). During the summer, some bears move to higher elevations in search of glacier lilies and other roots, berries, and army cutworm moths. Avalanche chutes provide an important source of herbaceous forage for grizzly bears in the early summer and fall (Mace and Waller 1997). During the winter, grizzly bears hibernate in dens, typically at higher elevations on steep slopes where wind and topography cause an accumulation of deep snow. The denning season in the western portion of the NCDE usually begins in early October, and females might linger near dens until late May (Mace and Waller 1997).

The greatest number of reported grizzly bear observations in the park occur during May through August. The number of observations is likely correlated with high visitor use during this time period, however, and is not necessarily an indicator of relative grizzly bear presence and habitat use. Some bears have habituated to high levels of human activity and continue to use open habitats along roads and within sight of visitor facilities, roads, and park administrative offices when people are present. Some bears that are more sensitive to human disturbance probably avoid these areas entirely or concentrate their activity at night or in remote areas relatively free from human influence.

The remote, expansive backcountry in the upper St. Mary River drainage provides travel corridors, valuable habitat, and seclusion from human activity for resident and non-resident bears. Grizzly bear habitat modeling indicates high-value grizzly bear habitat in the upper St. Mary River drainage, especially in the spring (CEM 2004, based on findings from Mace et al. 1999). In summer and fall, habitat values are high in the upper drainage in the vicinity of Gunsight Lake, with decreased values in the lower and middle portions of the drainage. The Gunsight Lake area contains excellent bear habitat including numerous avalanche chutes and watering areas, and grizzly bears are routinely observed in the project area. Future planned actions include five-needle pine restoration, invasive plant control, fire management, bear management, and certain resource monitoring and research activities (such as those that involve specimen collection).

Environmental Impacts – Grizzly Bear

Alternative A – Preferred Alternative

Alternative A could have impacts to grizzly bears due to disturbance or displacement caused by noise and increased human activity. If present, grizzly bears could be displaced from travel routes and foraging areas. Some bears may avoid the project area and peripheral habitat. The potential for disturbance would be highest during helicopter long-line sling-load operations, aerial planting of native fish with a helicopter, the use of motorized watercraft, and other motorized equipment such as generators and water pumps. Adverse impacts during rotenone application and the detoxification process would be temporary, ending once treatment and detoxification is complete (after an estimated three to four weeks in the fall of 2023). The potential for disturbance impacts during helicopter long-line sling load operations would be highly intermittent, for a few minutes at a time for each flight, estimated at approximately 15 flights for the rotenone application and detoxification phase. Subsequent impacts from helicopter operations during native fish translocation would be intermittent and infrequent, with one to two flights anticipated every year over a period of approximately six to eight years. Impacts would occur at the individual level; there would be no population effects and no effects to the overall distribution of bears since project activity would be localized to Gunsight Lake and the stream during project implementation, with transitory effects along helicopter flight paths, leaving the vast majority of grizzly bear habitat in the park unaffected. The potential for disturbance to bears along flight paths would be mitigated by requiring helicopters to follow suggested flight paths away from sensitive areas and along road corridors and over developed areas whenever feasible (***Appendix B, Mitigation Measures***). No grizzly bear habitat would be lost because of the project and there would be no potential for grizzly bear mortality.

There is potential for grizzly bears to encounter people within the project area, possibly increasing the risk of dangerous bear-human encounters as project personnel work off trail in densely vegetated riparian areas and/or near rushing water where surprise encounters could occur. Gunsight Pass trail and Gunsight Lake campground are high-use visitor areas, however, and the campground is often fully booked throughout peak summer months. Therefore, the risk of a negative grizzly encounter with project personnel would not be meaningfully different from the existing risk presented by hikers, campers, and anglers. Bear safety training would be required for all project personnel, which would reduce the risk of dangerous encounters. The chance of a grizzly bear obtaining human sources of food would be extremely low, given the park's strict enforcement of attractant storage requirements.

The removal of rainbow trout and the establishment of native fish in Gunsight Lake would not change forage for grizzly bears. Grizzly bears are known to prey on non-native fish at Hidden and Otokomi Lakes, but there are no records of grizzly bears foraging on rainbow trout at Gunsight Lake and, in general, there is little to suggest that fish provide much of a food source for grizzly bears within Glacier (J. Waller, NPS, personal communication). During the removal of rainbow trout, sinking dead fish that do not remain submerged would eliminate much of the potential for grizzly bears to scavenge carcasses, but some scavenging could occur. Grizzly bears would not be affected by any consumption of fish killed by rotenone, nor by potassium permanganate, since treatment concentrations would be far below levels that are toxic to mammals (EPA 2007) (as described in ***Appendix E, Issues and Impact Topics Dismissed from Detailed Analysis, Wildlife***). California Department of Fish and Game (1994) studies of risk for terrestrial animals estimated that a 22-pound dog would have to drink 7,915 gallons of lake water within 24 hours or eat thousands of pounds of rotenone-killed fish to receive a lethal dose.

If a second application of rotenone is necessary, the impacts would be as described above. Alternative A would have no lasting or biologically meaningful adverse impacts to grizzly bears and would not affect the abundance or distribution of grizzly bears in the park or the project area.

Alternative B – No Action Alternative

Under Alternative B, current management would continue, with conditions for grizzly bears that are the same or similar to current and expected future conditions of the Affected Environment. Since no action would be taken under Alternative B, there would be no potential for impacts to grizzly bears.

COMMON LOONS – MONTANA SPECIES OF CONCERN

The common loon (*Gavia immer*) is a large, aquatic, migratory bird which occurs on lakes throughout the park from spring through fall. Glacier is inhabited by a high proportion of Montana's nesting pairs, making the park especially important to the viability of the state's loon population. Common loons feed primarily on fish but will also forage small amphibians or invertebrates. Common loons are very particular about nesting habitat and tend to reuse nest sites. Nesting habitat requires accompanying nursery areas for the chicks. Loons nest along shorelines or the water margin, typically within one meter of the water's edge, generally on lakes larger than 13 acres in size (McIntyre 1988). Loons in Glacier begin breeding and nesting in the spring typically laying their eggs in the beginning of June (J. Belt, personal communication) and are most vulnerable to disturbance-related nest failure during the critical nesting period in April through July. The brood-rearing period can continue into late August or early September.

Common loons have been documented in the St. Mary River drainage, with the majority of these observations being documented on St. Mary and Lower St. Mary Lakes. Detections at Gunsight Lake are fewer; documented observations of common loons occurred in 2008, 2016, and 2019. Nesting activity has not been documented on either St. Mary or Gunsight Lakes; both lakes are thought to be primarily used for supplemental foraging or by migratory individuals in the fall (J. Belt, NPS, personal communication). The nearest breeding/nesting pairs inside the park are all west of the Continental Divide (primarily in the North Fork) or on lakes on the Blackfeet Reservation (e.g., Babb Beaver Pond). There has been increased documentation of loons using Lake Ellen Wilson as a foraging site. Evidence of breeding has been documented outside the park on Lower St. Mary Lake and is thought to be the primary breeding waterbody in the St. Mary River drainage. It is possible that undocumented nesting has occurred on St. Mary Lake given the large size of the lake and the challenge of surveying it completely (J. Belt, NPS, personal communication). Because there are no breeding pairs in the St. Mary River or Gunsight drainages (other than a few observations on Lower St. Mary Lake), population trends are not known; however, it is unlikely that St. Mary or Gunsight Lakes influence loon populations in the overall area. Future planned actions include continued surveys and monitoring.

Environmental Impacts

Alternative A – Preferred Alternative

Elevations at Gunsight Lake are higher than what is considered optimal (under 5,000 feet elevation) nesting habitat for loons (Skar 1990), and there is no evidence of loons nesting. Given this, and because the project would be completed outside of the primary nesting season, it is highly unlikely that loons would be nesting at Gunsight Lake during the project. In addition. Loons nesting elsewhere (e.g., Lower St. Mary Lake) and migrating loons may forage at Gunsight Lake. There would be no direct effects to foraging loons from rotenone or potassium permanganate since treatment concentrations would be far below levels that are toxic to birds (as described in ***Appendix E, Issues and Impact Topics Dismissed from Detailed Analysis, Wildlife***). Rotenone would remove a source of food for any loons using the lake, since it would kill all fish at the lake as well as some amphibian and aquatic macroinvertebrate larvae. Potassium permanganate would also likely kill some larval amphibians and aquatic macroinvertebrates. Impacts would be temporary since amphibians are estimated to recover by the following year or two; and macroinvertebrates are estimated to recover abundance and community composition in two to four years. Fish would also again be available as a source of food for loons once translocated native fish become established. This could take several years, depending on how long it takes native fish to establish self-sustaining populations. The temporary absence of fish at Gunsight Lake would not measurably affect loon foraging opportunities or their distribution in the St. Mary River drainage, since loons would still be

able to forage in St. Mary Lake, Lower St. Mary Lake, and Lake Ellen Wilson on the west side of Gunsight Pass.

There would be some potential to disturb loons during helicopter long-line sling-load operations, translocating fish with a helicopter, the use of motorboats (or other motorized watercraft, such as an inflatable raft with an outboard motor), and the use of other motorized equipment such water pumps. Effects of disturbance could range from physiological stress responses without any observable behavioral changes, to interruptions of behavior, to physical displacement. The potential for disturbance from the boats would be sporadic, occurring intermittently over an estimated 8 to 12-hour period each day for approximately two to four days, ending once application of the rotenone is complete. The potential for disturbance during helicopter long-line sling-load and fish translocation would be highly intermittent, for a few minutes at a time for each flight, estimated at approximately 15 flights for the rotenone application and detoxification phase. Subsequent impacts from helicopter operations during native fish translocation would be intermittent and infrequent, with one to two flights anticipated every year over a period of approximately six to eight years. Since there would be undisturbed habitat at St. Mary and Lower St. Mary Lakes downstream of the treatment area and at Lake Ellen Wilson, disturbance or displacement would not meaningfully alter the availability of foraging habitat for loons.

There would be very little potential to disturb nesting loons since loons would not likely be nesting on the Gunsight Lake. Depending on the flight path, helicopter flights could disturb loons nesting at other lakes. Potential impacts because of this are unlikely since the elevation for the helicopter when in flight would likely be too high to present a threat to loons, most of the flights would not occur until late summer (early September) after the critical nesting period, and flights for translocation would be relatively infrequent. Since loons are not known to nest at Gunsight Lake, it is unlikely that fisheries personnel visiting the lake earlier in the season for pre-treatment activities (such as surveys or stream flow-monitoring) would encounter breeding or nesting loons. In the unlikely event that loons are breeding or nesting at the lake during early season surveys, the activities of personnel at this time would not be much different from existing activity already occurring from hikers and anglers. Fisheries personnel are also experienced in identifying and avoiding loons, which would minimize the potential for disturbance.

If reapplication of rotenone is necessary, the type and degree of impacts to common loons would remain as just described. Since reapplication would not occur during the critical nesting/brood-rearing season, the potential for disturbance would be temporary, and undisturbed habitat would be available at other nearby lakes. For the reasons described, Alternative A would have no lasting or biologically meaningful impacts to common loons, no population effects, and no changes to the abundance or distribution of the species.

Alternative B – No Action Alternative

Under Alternative B, current management would continue. As a result, conditions for common loons would be the same or similar to current and expected future conditions of the Affected Environment. Since no action would be taken, there would be no potential for impacts to common loons under Alternative B.

WATER BIRDS (DUCKS, SWANS, GEESE, GREBES, CORMORANTS, AND COOTS)

Most of the lakes and streams in Glacier provide prime breeding and foraging habitat for water birds (ducks, swans, geese, grebes, cormorants, and coots). Many of these species are migratory, arriving in April and May, whereas others such as Canada geese, common mergansers, goldeneyes, buffleheads, and mallards are year-round residents if waters remain ice-free. Breeding among these species typically begins in May, with nesting beginning in May or June and finishing by late July. The brood-rearing period, when chicks are out of the nest but still dependent on the adults, typically extends into August/September depending on the species.

In the St. Mary River drainage, primarily in St. Mary and Lower St. Mary Lakes, Barrow's goldeneyes (*Bucephala islandica*), common goldeneyes (*Bucephala clangula*), mallards (*Anas platyrhynchos*), common mergansers (*Mergus merganser*), buffleheads (*Bucephala albeola*), green-winged teals (*Anas carolinensis*), and Canada geese (*Branta canadensis*) have been documented (NPS files), but other species could use the area. While some water bird species feed almost exclusively on fish, some feed primarily on insects, and others are omnivorous, feeding also on aquatic vegetation. Although Glacier is important for breeding and foraging waterfowl, it is not known as a stopover location for migrating waterfowl. This is likely due to colder conditions and higher elevations that keep lakes in the park frozen when lakes outside the park have thawed. As a result, ducks and geese reported on lakes in Glacier in the spring and fall only number in the tens or hundreds at most (NPS files). This contrasts with the lakes and flooded agricultural fields in the Flathead Valley west of the park (C. Hammond, MFWP, personal communication) and Freezeout Lake area east of the park (Milewski and Schwitters 2018), where tens of thousands of waterfowl are reported annually during migration. Waterfowl are sensitive to human disturbance, especially those associated with loud noise and visible features, and are most vulnerable during the nesting, brood-rearing, molting, migration, and wintering periods of their annual cycle (Korschgen and Dahlgren 1992). In addition, climate change is expected to alter the bird communities, including waterbirds, within the park. Glacier is, or may become, home to 32 species that are highly sensitive to climate change across their range. Thirteen of these species may be extirpated from the park in at least one season (winter and/or summer) by 2050 (Langham et al. 2015).

Future planned actions include continued research, monitoring, and studies to better understand bird population trends, including through the ongoing Monitoring Avian Productivity and Survivorship project.

Environmental Impacts – Water Birds

Alternative A – Preferred Alternative

Impacts to other water birds would be as described above for common loons. The exception may be for water bird species that forage primarily on insects. For these species, use of rotenone would reduce a potential food source at Gunsight Lake; however, some aquatic macroinvertebrates would likely survive the rotenone treatment and the reduction in forage would be temporary until invertebrate populations recover (likely in two to four years). This type of prey would also be readily available at other, nearby lakes. Impacts to waterbirds from potential disturbance during project activities would be as described for common loons. Alternative A would have no lasting or biologically meaningful impacts to water birds, no effects to water bird populations, and no changes to species abundance, distribution, or composition.

There would be no direct impacts from rotenone or potassium permanganate, since treatments concentrations would be below levels that are toxic to birds. The concentration of rotenone that would be used (5-percent formulated product at 1 ppm), resulting in an active ingredient concentration of 0.05 milligrams per liter) is at least one order of magnitude lower than "No Observed Adverse Effect Levels" (NOEL) in mammals and birds, and well below the 200-parts per billion (ppb) maximum limit for rotenone treatments set by the American Fisheries Society (Finlayson et al. 2010).

Alternative B – No Action Alternative

Under Alternative B, current management would continue. As a result, conditions for water birds would be the same or similar to current and expected future conditions described in the Affected Environment. Since no action would be taken, Alternative B would have no potential for impact to water birds.

WATER QUALITY

The last comprehensive water quality study on Gunsight Lake occurred between 1984 to 1990 (Ellis et al. 1992). The authors concluded in the baseline water quality study that "the lakes selected for study clearly reflect the pristine attributes that stimulated the creation of Glacier National Park and its designation as a Biosphere Reserve". Gunsight Lake is oligotrophic, meaning it has very low productivity and clear, clean water, similar to

many alpine lakes in the park. Gunsight Lake's excellent water quality is reflected in the measured parameters from the Ellis et al. study (1992) (***Table 1***).

There are no future planned actions that would affect water quality in the project area. In general, water temps at waters in the park and surrounding region are predicted to increase with climate change (Jones et. al. 2017)

Table 1, Water quality observed in Gunsight Lake (Ellis et al. 1992)

pH	Alkalinity (mg/L)	Conductivity (umhos/cm	Turbidity (NTU)	Total P (ug/L)	Total N(ug/L)	Dissolved Organic Carbon (mg/L)
6.65-7.90	31.0-44.0	61.0-82.0	0.17-1.9	1.8-9.1	44-131	0.62-0.73

Environmental Impacts – Water Quality

Alternative A – Preferred Alternative

The inert ingredients associated with rotenone formulations are highly volatile and naturally degrade within one to five weeks depending on pH, temperature, alkalinity, UV light, and dilution by fresh water (Schnick 1974; Skaar 2001). Cold water can result in longer degradation time (Skaar 2001). Rotenone is not water soluble so it must be formulated with solvents. Rotenone breaks down into rotenolone, which is far less toxic to aquatic life but has a longer half-life (Finlayson et al. 2001). In studies of Lake Davis, California, Vasquez et al. (2012) showed rotenolone levels in the water dropping below detection levels within 60 days post-treatment. Rotenone binds to sediments, does not readily leach from soil, and its constituents have not been found in groundwater following treatment (Skaar 2001; EXTOXNET 1996). In California, studies where wells were placed in aquifers adjacent to and downstream of rotenone applications have never detected rotenone or any of the other organic compounds in the formulated products (CDFG 1994). Case studies in Montana have concluded that rotenone movement through groundwater does not occur. At Tetrault Lake in Montana, rotenone was not detected in a nearby domestic well sampled two and four weeks after applying 90 ppb rotenone to the lake (this well was chosen because it was down gradient from the lake and drew water from the same aquifer that fed and drained the lake) (G. Grisak, MFWP, personal communication). In 1998, a Kalispell area pond was treated with rotenone. Water from a well 65 feet from the pond was analyzed and no sign of rotenone was detected. In 2001, another Kalispell area pond was treated with rotenone and water from a well 200 feet away was tested four times over a 21-day period with no sign of contamination (G. Grisak, MFWP, personal communication).

Potassium permanganate is one of the most widely used inorganic chemicals for the treatment of municipal drinking water and wastewater. Potassium permanganate is a strong oxidizer that rapidly breaks down (half-life of 7-11 minutes) and is also used by water treatment plants to remove foul odors from drinking water. The break-down products are common in nature and have no deleterious environmental effects at concentrations used for neutralization of piscicides (Finlayson et al. 2000). When potassium permanganate is combined with rotenone, the rotenone is oxidized, and the potassium permanganate is reduced to potassium, manganese oxide (found naturally in the earth's crust), and water (USFWS 2015).

Given the degradability of the chemicals, rotenone and potassium permanganate's toxicity would decline rapidly as they react with the natural stream environment and would not be expected to persist for more than 10 to 15 minutes of flow time (Engstrom-Heg 1971 and 1972). The toxicity of the potassium permanganate would also decline as it reacts with the rotenone. Potassium permanganate would produce a temporary dark purple color to the creek, which usually dissipates in a few hundred yards. Both rotenone and potassium permanganate would dissipate to the point where there would be no detectable

long-term changes to water quality. There would also be no impacts to water quality from the dye test with fluorescein because fluorescein is inert, non-toxic, and completely degradable.

Decomposing dead fish in the lakes could potentially decrease dissolved oxygen in the immediate vicinity of the carcasses. Amphibian larvae and aquatic macroinvertebrates that survive the rotenone would be susceptible to changes in dissolved oxygen; however, since the fish carcasses would likely be spread out and not concentrated in any one area, areas of low dissolved oxygen would be small, and there would be areas in the lake where oxygen levels are unchanged. Oxygen sags large enough to cause meaningful impacts would be unlikely in Gunsight Lake due to the volume of water (3,600 acre-feet) that would compensate for changes. Any oxygen sags would be temporary, recovering to normal levels by the following spring. If a second application of rotenone is necessary, the impacts would be as described above.

A small number of hydrocarbons would be deposited into Gunsight Lake during operation of motorized watercraft. This impact would be unavoidable because outboard motors emit exhaust under water through the propeller. Water volumes in the lakes (3,600 acre-feet at Gunsight Lake) and water exchange through the inlets and outlets would be sufficient to dilute any hydrocarbon emissions to levels that would not be measurable or affect water quality in any meaningful way. The risk of contamination from gasoline or motor oil in the event of mechanical failure or spill would be low due to mitigation measures (***Appendix B***) that require inspection of the engine, fuel lines, and fittings prior to operating the boat each day. Absorbent supplies would also be required onsite to address any spills. Bulk fuel would be stored in spill/bear proof containers.

There would be no impacts to water quality from translocating native fish into Gunsight Lake because the helicopter tank and/or containers used to transport the fish prior to translocation would be cleaned of any contaminants prior to use. Only hatcheries that are regularly inspected for aquatic invasive species (AIS), certified to be free of pathogens, and/or treat the holding water to remove or kill any pathogens (such as with filters or UV light, for example) would be used.

Due to these factors described above and required mitigation measures (***Appendix B***) that would protect water quality, there would be no lasting or detectable impacts to water quality from the proposed project.

Alternative B – No Action Alternative

Under Alternative B, current management would continue, with conditions for water quality that are the same or similar to current and expected future conditions described in the Affected Environment. Since no action would be taken under Alternative B, there would be no impacts to water quality.

RECOMMENDED WILDERNESS

In 1973, Glacier completed a wilderness study and environmental impact statement (EIS) to comply with the 1964 Wilderness Act. The Wilderness Study/EIS identified 927,550 acres in Glacier (over 90 percent of the park) for Wilderness designation (NPS 1974) and resulted in a recommendation of same by the President of the United States to Congress. Congress has not enacted legislation to formally designate Glacier's wilderness recommendation as Wilderness. The NPS manages recommended wilderness to ensure that wilderness character is preserved and will take no action that would diminish the wilderness eligibility of any area possessing wilderness characteristics until the legislative process of wilderness designation has been completed (NPS Management Policies 2006). The upper St. Mary River drainage and entire project area are within recommended wilderness.

The defining qualities of wilderness derived from the Wilderness Act include untrammeled, undeveloped, natural, outstanding opportunities for solitude or a primitive and unconfined type of recreation, and other features of value including scientific, educational, scenic, or historical. Wilderness is managed according to these five different qualities of wilderness character; the following discussion describes the current status of each in Glacier. An initial wilderness character assessment has been conducted but data being gathered though the monitoring protocol is undergoing and a trend in wilderness character has not been determined. Future planned actions include five-

needle pine restoration, invasive plant control, fire management, bear management, and certain resource monitoring and research activities (such as those that involve specimen collection).

Untrammeled Quality

Untrammeled is defined as wilderness that is "essentially unhindered and free from the intentional actions of modern human control or manipulation," referencing the Wilderness Act's definition of wilderness as an area that "generally appears to have been affected primarily by the forces of nature" (Landres et al. 2015). Preserving the untrammeled quality hinges on restraint from the intentional manipulation of the biophysical environment. Recommended wilderness in Glacier, including the Gunsight drainage and project area, is a largely untrammeled, unmanipulated landscape; however, fish were stocked into Gunsight Lake by the NPS in the early 1900's. Past actions that manipulated the biophysical environment before an area was designated as wilderness are not considered trammeling actions because the provisions of the 1964 Wilderness Act do not apply to an area prior to designation. Some management of the biophysical environment occurs to protect other park resources and preserve the natural condition of wilderness character. Such management actions that have occurred or could occur in the St. Mary River drainage include but are not limited to controlling the spread of non-native invasive plants, fire suppression, and bear management.

Undeveloped Quality

The majority of Glacier's recommended wilderness is undeveloped, despite the presence of historic, administrative, and scientific structures and installations. Development in the St. Mary River drainage is limited to the Gunsight Pass Shelter. Scientific monitoring instruments and project equipment (i.e., remote cameras, tree markers, gill nets, water pumps, generators, drip stations, and data loggers) may occasionally be present in the project area but are temporary installations and removed when no longer in use. The park uses non-motorized, traditional hand tools and non-mechanical transport for administrative activities in recommended wilderness whenever feasible, but motorized equipment (i.e., chainsaws, portable generators, motorized trail brushers, etc.) must sometimes be used during trail and campsite maintenance. Motorboats are currently used at four lakes in the park's recommended wilderness, including Quartz and Logging Lakes for lake trout suppression (NPS 2014), and Bowman and Kintla Lakes where NPS Park Rangers maintain boats for administrative purposes (such as shuttles for trail crews and researchers) and emergencies. Motorboats have not previously been used at Gunsight Lake. Helicopters may also be used in the park's recommended wilderness to fly materials and equipment to remote project areas. Helicopter activity in the Gunsight drainage is relatively infrequent, but helicopters may fly over the area when travelling to other destinations. Landings have also been documented at Gunsight Lake for emergency purposes.

Natural Condition

The natural condition of recommended wilderness in Glacier is characterized by native plants and animals, healthy terrestrial and aquatic ecosystems, biodiversity, air and water quality, geologic processes, and other natural processes. Glacier is at the core of the Crown of the Continent ecosystem, one of the most ecologically intact areas remaining in the temperate regions of the world and is noted for its remarkable number and diversity of plant and animal species. The natural quality of the park's wilderness character is degraded by several influences, including non-native species, which can put the long-term persistence of native species and ecological integrity at significant risk. As described in ***Chapter 1*** of this EA, native westslope cutthroat and bull trout populations in the park are at risk due to the severely detrimental effects of non-native fish, among other threats. This includes the project area, where non-native rainbow trout are a direct threat to westslope cutthroat trout populations and brook trout threaten bull trout populations.

Solitude or Primitive and Unconfined Recreation

Glacier's recommended wilderness provides numerous outstanding opportunities for primitive and unconfined recreation including hiking, fishing, and backcountry camping. The park's recommended wilderness also gives visitors the opportunity to experience solitude and self-reliance. This quality of wilderness character depends on remoteness from the sights and sounds of human activity and the ability to recreate freely without constraints,

whereby visitors rely upon their own skills. Opportunities for solitude and unconfined recreation can be degraded by activities such as helicopter flights, NPS maintenance projects, scientific research, and increasing visitation. Managerial restrictions, such as requiring permits for overnight stays and temporary trail or area closures (during fire and bear management activities, for example) interfere with unconfined recreation. Recreational facilities such as trails, bridges, and wilderness campgrounds are necessary to provide for visitor use and experience and protect park resources but can also interfere with unconfined recreation and diminish a sense of primitiveness and solitude. Gunsight Lake and the St. Mary River drainage offer excellent opportunities for solitude and primitive recreation, even though the area is popular among visitors. Recreational facilities include the Gunsight Pass and Jackson Glacier Trails, and backcountry camping is regulated through permits at the designated campground at the base of Gunsight Lake.

Other Features of Value

The fifth quality of wilderness character focuses on the ecological, geological, or other features of scientific, educational, scenic, or historical value within recommended wilderness. While Glacier does possess identified features of values within its recommended wilderness, none of those identified values would be impacted by this project. As a result, this wilderness quality is not further analyzed within this document.

Environmental Impacts – Recommended Wilderness

Alternative A – Preferred Alternative

Untrammeled Quality

Alternative A would adversely impact the untrammeled quality of recommended wilderness because it would intentionally manipulate the biophysical environment in the project area through the removal of non-native rainbow trout, collecting donor fish, and translocating native westslope cutthroat and bull trout to Gunsight Lake. The intensity of impact would initially be dramatic, because rotenone would lethally remove all fish and other gill-breathing organisms from Gunsight Lake downstream to approximately Mirror Pond in a matter of days. These effects would be highly localized; limited to Gunsight Lake and approximately five miles downstream. This would be only approximately 0.8 percent of the total acreage (13,623.5 acres) of lakes in the park's recommended wilderness, and approximately 0.3 percent of the 1,550 miles of perennial stream in the park.

Impacts to the untrammeled quality would be temporary, occurring during three to four weeks of rotenone application and detoxification, for one to two weeks per year for an estimated three years during collection of donor fish, and continuing intermittently during translocation operations until translocation of native fish to Gunsight Lake is complete, within an estimated 6-8 years. If a reapplication of rotenone is needed the impacts to the untrammeled quality would be the same as above. Following treatment and translocation, the intensity of adverse impacts would dissipate over time as the area becomes once again "affected primarily by the forces of nature."

Undeveloped Quality

Alternative A would cause temporary adverse impacts to the undeveloped quality of recommended wilderness from the use of motorized watercraft, generators, water pumps, and helicopters, which are prohibited 4(c) uses unless determined the minimum necessary for the administration of wilderness. Long-line sling load operations and planting fish with helicopters would also be considered aircraft landings which are Section 4(c) prohibited uses under the Wilderness Act. Auger dispensers, remote incubators, signs along the trail, and fish monitoring devices, such as tags and fixed-location remote sensors, would also adversely impact this quality because they would be installations on an otherwise undeveloped landscape. Impacts would be temporary, ceasing once the rotenone has been detoxified and equipment can be removed from the project area (estimated three to four weeks). After this, adverse impacts would be infrequent and punctuated, occurring during long-line sling load and helicopter fish planting operations for translocation (estimated at one to two flights per year for approximately six to eight years). Post-treatment monitoring devices for translocated fish (e.g., the fish could be marked with

tags) would cause longer-term impacts, as they could be in place for several years; however, devices would be too small and concealed to noticeably change the undeveloped quality of wilderness character and would be removed upon monitoring completion. If a second application of rotenone is needed the impacts would be the same as described above.

Alternative A would not represent a change in the overall level and type of noise that already occurs in the park's recommended wilderness. Following the use of mechanized and motorized equipment, project activity that impacts the undeveloped quality of wilderness character would be substantially unnoticeable (e.g., post project monitoring). Water pumps and generators are used during backcountry operations such as trails maintenance, helicopters are used to support administrative work in recommended wilderness, and motorboats currently operate for NPS administrative support and on Quartz and Logging Lakes for lake trout suppression. While Alternative A could cause the number of administrative helicopter flights to exceed the park's annual limit of 50, any increase would not be permanent, occurring for one season, two at most if reapplication is necessary, and then infrequently for native fish translocation.

Natural Condition

Alternative A would benefit the natural condition by preserving and protecting indigenous species and ecological processes that are integral to wilderness character and essential to the value, integrity, and quality of Glacier's recommended wilderness. Benefits would extend regionally, since removing non-native rainbow trout would reduce the overall risk of hybridization in the broader St. Mary system, and because translocation would expand the distribution of native species. The removal of non-native rainbow trout would reduce downstream hybridization from continuing, expanding, and further eroding the native genome. These benefits would be permanent because the Gunsight Lake is secure against reinvasion of non-native fish and would provide a refuge from the detrimental habitat effects of climate change. Alternative A would also have adverse impacts to the natural condition from the mortality of aquatic invertebrates, amphibians, and individual native fish. As described in the analyses for these species, impacts would either be temporary and/or would not affect species at population levels. Additional adverse impacts would occur to the natural condition from noise impacts to natural soundscapes, discussed below.

Opportunities for Solitude or Primitive and Unconfined Recreation

Alternative A would have temporary adverse impacts to opportunities for unconfined recreation since the treatment area would be temporarily closed to public access during rotenone application. The Gunsight wilderness campground closure would be in place from late summer/early fall of 2023, when the project begins, until spring 2024, by which time the rotenone would be completely neutralized. The Gunsight Pass Trail would be temporarily closed to the public during rotenone application (anticipated temporary closure for approximately one week around the rotenone treatment application period); however, the trail closure may need to be in place longer depending on variables that could affect the application period such as weather, equipment failures, etc. Alternative A would also have the potential to adversely impact solitude due to noise from motorized watercraft, water pumps, generators, and helicopters (impacts from noise are discussed in detail below, under ***Natural Soundscapes***). Potential impacts to solitude from project noise would be temporary, since most of the noise would end following the rotenone portion of the project (two to four days) and would cease completely after helicopter long-line sling load and fish planting operations for translocation are completed (estimated at one to two flights per year for a period of approximately six to eight years). The occurrence of a dark purple color to the water during detoxification, from the application of potassium permanganate (see also analysis of impacts to Water Quality) could be visually disruptive to opportunities for solitude but is likely to go largely unnoticed given the separation of the stream and the trail and because the color to the creek usually dissipates in a few hundred yards. The presence of project personnel could have the potential to interfere with opportunities for solitude, but these impacts would not differ noticeably from the existing effects of campers, hikers, and anglers (please refer to ***Chapter 3, Visitor Use and Experience***). While adverse impacts would be noticeable for people seeking solitude or primitive and unconfined recreation at or near Gunsight Lake,

this quality would be affected in only a fraction of the park's recommended wilderness, with the vast majority of park's 927,550 acres of recommended wilderness unaffected.

If a second application of rotenone is necessary during the same year or in a following year, the type and degree of impacts to wilderness character would be as just described, with no meaningful increase in the type or degree of impact. This is because reapplication would follow the same general protocol as the initial application, and adverse impacts would remain temporary.

Because Alternative A would affect wilderness character and include uses prohibited under Section 4(c) of the Wilderness Act (motorized equipment and helicopter landings) within recommended wilderness, a minimum requirements analysis (MRA) is required by NPS policy. The MRA has been developed concurrently with the National Environmental Policy Act (NEPA) analysis and will be appended to the decision document.

Alternative B – No Action Alternative

Current management would continue under Alternative B, with impacts to recommended wilderness that are the same or similar to what is described in the Affected Environment, which describes the current and expected future conditions of recommended wilderness. Since no action would be taken, no manipulation of the biophysical environment, no use of motorized equipment or helicopters, no installations, and no area closures would occur. Therefore, there would be no new adverse impacts to the untrammeled and undeveloped qualities of recommended wilderness, nor to opportunities for solitude and unconfined recreation. These qualities of wilderness character would be preserved in their current condition. Alternative B would, however, adversely impact the natural condition by allowing non-native rainbow trout to continue to hybridize and compete with native westslope cutthroat trout. This would jeopardize westslope cutthroat populations in downstream tributaries, resulting in the continued loss of the few remaining westslope cutthroat conservation populations in the St. Mary River drainage, and put genetic lineages of the species at risk of permanent loss. Risks to bull trout populations from hybridization with brook trout would also persist. This would increase the overall risk to their long-term conservation, especially in the face of climate change.

NATURAL SOUNDSCAPES

An important part of the NPS mission is to preserve the acoustic resources and natural soundscapes of national parks and units. Natural soundscapes are the sounds of nature, a diminishing resource in an ever-modernizing world. Acoustic resources and natural sounds have intrinsic value as part of Glacier's unique environment, and they predominate throughout most of the park. Glacier's natural soundscapes are characterized by quiet and stillness as well as low decibel background sound, such as birdsong and the sound of wind, rain, and water. Natural soundscapes vary across the park, depending on elevation, proximity to water, vegetative cover, topography, time of year, weather, and other influences.

Noise intrusions from human activity can mask biologically important sounds, degrade habitat, cause behavioral and physiological changes among wildlife, and interfere with visitors' experience. The effects of noise typically diminish as the distance from the source of the noise increases, defined as attenuation. The project area is in the park's alpine/subalpine acoustic zone, where natural ambient sound levels range between 30 and 35 dBA (USDOT 2009). The acoustic environment in the area is characterized almost exclusively by natural sounds but are interrupted at times by hiking parties or park administrative activities, such as trail and wilderness campground maintenance, and by noise from NPS administrative flights, search and rescue flights, commercial air tours, and high-altitude aircraft traffic. With recent completion of Glacier National Park's Final Air Tour Management Plan and consistent with the park's 1999 General Management Plan, commercial air tours in the park will be phased out through attrition or until December 31, 2029, when all operating authority for the park will be terminated, whichever occurs first (NPS 2022). Until that time, existing commercial air tour operators are authorized to provide up to 144 air tours per year on a defined route no lower than 2,600 feet above ground level (AGL). Future planned actions in the project area include trail maintenance, invasive plant control, fire management, air tours, and administrative flights.

Environmental Impacts - Noise

Alternative A – Preferred Alternative

Alternative A would have temporary adverse impacts to natural soundscapes due to noise from motorized watercraft, water pumps, helicopters, and generators. Noise from motorized watercraft, water pumps, and helicopters would generally be sporadic, occurring intermittently with periods of relative quiet. Noise impacts from this activity would therefore occur intermittently, over an 8 to 12-hour period each day for approximately two to four days when motorized watercraft and water pumps are in use during the rotenone application period and for a few minutes at a time during helicopter long-line sling-load operations and fish translocation (estimated at one to two flights per year over a period of approximately six to eight years).

Continuous noise would occur during detoxification of the rotenone since the generator would run 24 hours a day, seven days a week to power the auger dispensing the potassium permanganate, for an estimated three to four weeks. Noise would be loudest at the source and attenuate over distance until it reaches background natural ambient sound levels (30-35 dBA). Noise would still be audible since noise typically remains audible until it attenuates to eight dB below the ambient level (64 Fed. Reg. 134 1999).

Motorboats would likely produce noise ranging from 60 to 90 dBA, and the generator would likely produce noise ranging from 53 to 68 dBA. The water pumps would be expected to produce noise at approximately 105 dBA. Noise levels from helicopters are highly variable depending on the type of aircraft used, so cannot be known at this time, but is likely to reach at least 90 dBA at distance of 50 feet. To provide context for these sound levels, ***Table 2*** below gives examples of common sound sources with the same average sound levels, measured in dBA.

The distance that noise under Alternative A would need to travel before attenuating to a natural ambient level of approximately 30 dBA are presented below in ***Table 2.*** and graphically illustrated in ***Appendix G***. The attenuation distances were derived from an attenuation calculator/sound modeling tool developed by the NPS Natural Sounds and Night Skies Division (NSNSD). Actual noise attenuation distances may be shorter than derived by the model, since the NSNSD attenuation calculator cannot account for changes in wind direction or terrain shielding, which also influence sound. The noise levels and attenuation distances presented are meant to provide the best possible approximations.

Table 2, Approximate distances over which noise would need to travel before attenuating to a natural ambient level of 30 dBA as derived from the NSNSD attenuation calculator.

Equipment	Estimated Attenuation Distance (to 30 dBA)
Motorboat	1.1 – 1.2 miles (1.8 – 1.9 kilometers)
Water pump	Unknown*
Generator	0.21 miles (341 meters)
Helicopter	1.6 to 4.4 miles (2.5 – 7.0 kilometers)

*data not available to model attenuation distances for a water pump.

The attenuation distance for motorboats is likely inflated since the modeling does not factor in changing weather conditions or the exact location of the motorboat. Also, the 4-stroke engine makes/models used to model noise levels and attenuation would not necessarily be the make or model used during Alternative A; these models were selected because they represent the same general type and dBA of motors that could be used. The NSNSD calculator also models the boats at full throttle, but motorboats would be operating at their lowest speeds producing sound levels toward the lower end of the possible range. To estimate attenuation of generator noise, the NSNSD calculator modeled a generator with an average sound level of 66 dBA, measured 165 feet (50 meters) away from the source. Modeling data was not available to estimate attenuation distances for a water pump.

The calculator estimates noise from three different models of helicopter. It is unknown at this time what model helicopter would be used for the proposed project. Helicopter noise would be most audible and disruptive as the helicopter hovers at low elevation during sling-load and fish translocation operations. Generally, helicopter noise goes up with the weight and size of the machine. For detailed helicopter noise analysis please refer to ***Appendix G Results of NPS Natural Sounds and Night Skies Division sound mapping tool and attenuation calculator***. While Alternative A could cause the number of administrative helicopter flights to exceed the park's annual limit of 50, any increase would not be permanent, occurring for one season, two at most if reapplication is necessary, and then infrequently for native fish translocation

Adverse impacts to natural soundscapes could disrupt a sense of solitude and the experience of natural backcountry sounds for visitors recreating near the treatment area and along the helicopter flight path to the project area. Day-use and through hikers utilizing Gunsight Pass Trail may hear equipment (e.g., generators, helicopter flights, and water pumps) during detoxification but the area would be closed to visitors during rotenone treatment application period. Noise from the generator, which would be situated near the stream, would be moderately masked by the ambient sound of moving water. Environmental factors would influence the amplitude of noise produced by Alternative A and the distance required for it to attenuate to at or below natural ambient sound level. Since sound travels over water and because Gunsight Lake is within a cirque-type basin where the topography would likely cause sound to bounce, noise from the motorboats, water pumps, and helicopters would likely be amplified in the cirque; however, the steep terrain surrounding the lakes would block the noise from reaching other areas of the park (known as terrain shielding), reducing its audibility outside the basin. Weather conditions, such as wind, would also have a masking effect. Vegetation may minimize noise levels somewhat, although vegetation is far less influential than terrain in shielding low frequency noise (dense foliage that completely blocks the line of sight along the sound propagation path can account for only a few decibels of attenuation).

Noise would also have the potential to displace animals, cause brief behavioral and physiological changes, and mask biologically important sounds (sounds that would alert animals to threats or foraging opportunities, for example). Noise would be too sporadic or, in the case of the generator, too localized and sufficiently masked to measurably interfere with biological processes or meaningfully change the overall character of soundscapes in the upper St. Mary River drainage. Noise impacts would also be temporary, with most of the noise ending at the end of the rotenone application/detoxification process in an estimated three to four weeks. After that, there would be some follow up noise from helicopter long-line sling-load operations and fish translocation, but this would be very infrequent (estimated at one to two flights per year for a period of about six to eight years). Because project noise would attenuate to ambient levels within approximately 3.5 miles (at most) of the treatment area (***Table 2***), soundscapes in much of the park would remain unaffected. If a second application of rotenone is necessary it would extend the duration of noise for another three to four weeks but all other impacts to natural soundscapes would be as just described, with no meaningful increase in the type or degree of impact.

Alternative B – No Action Alternative

Under Alternative B, current management would continue, with future conditions for soundscapes that are the same, or similar to current and expected future conditions of the Affected Environment. Since no action would be taken under Alternative B, no noise would be produced and there would be no potential for impacts to natural soundscapes.

VISITOR USE AND EXPERIENCE

Since Glacier was established in 1910, visitors have created a strong heritage of recreation in the park. Visitors from around the world come to Glacier to enjoy world-class backcountry recreational opportunities, such as hiking, backcountry camping, and mountain climbing, as well as a primitive wilderness experience. Remote, pristine, and spectacularly scenic, Glacier's backcountry lakes are especially popular destinations, including Gunsight Lake.

Fishing on lakes and streams is a popular activity for some visitors, and many come to the park for the opportunity to fish for native trout. Most fishing in the park is catch and release for native fish, but some non-native fish may be kept.

In general, most backcountry use in the park (approximately 70 percent) occurs during July and August and includes both day use and overnight camping. Approximately 30 percent of backcountry use occurs in June and September. Backcountry overnight use accounts for less than one percent of total visitation. There is one wilderness campground at Gunsight Lake which has a capacity for 28 people (six public and one administrative tent sites, limited to four people per site). Over a five-year period from 2015 to 2019, an average of 427 and 244 campers stayed at the Gunsight Lake wilderness campground during August and September, respectively, per year (NPS files). This represents approximately 3.2 percent of wilderness campground stays parkwide during August and 4.3 percent of wilderness campground stays parkwide during September for that time period. In addition, day hiking is a common activity on the Gunsight Pass Trail and several summits surrounding the drainage are popular with mountain climbers, including Gunsight Peak, Mount Jackson, and Citadel Mountain. Gunsight Lake is also used by recreational anglers (please refer to ***Figure 3, Visitor Use and Recreation Resources***). Future planned actions affecting visitor use and experience in the area include closures due to construction projects and other administrative actions, such as bear and fire management; and actions that can cause audible or visual disturbance such as trail maintenance, invasive plant control, air tours, administrative flights, road construction, and administrative projects.

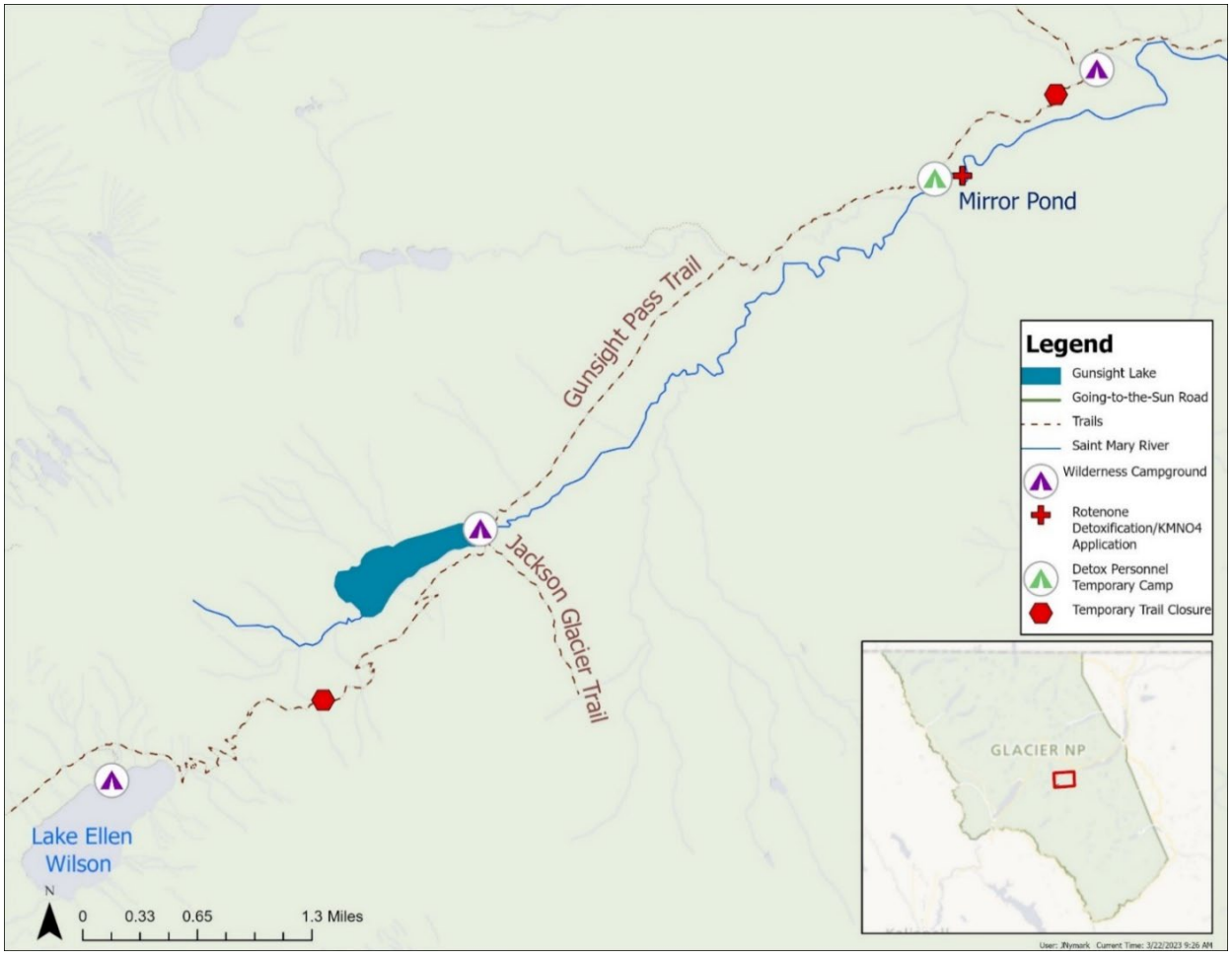

Figure 3: Visitor use and recreation resources and project treatment area

Environmental Impacts – Visitor Use and Experience

Alternative A – Preferred Alternative

Temporary closures of recreational resources during the project would adversely impact visitors who wish to camp at the Gunsight Lake wilderness campground in late summer, as well as hikers on the Gunsight Lake Trail and trails that are accessed from the Gunsight Lake Trail (i.e., Jackson Glacier trail). The Gunsight Lake wilderness campground would be closed the duration of the project (anticipated September 1 to spring 2024). The Gunsight Pass Trail would be temporarily closed to the public during rotenone application. At this time, the park anticipates closing the Gunsight Pass trail for approximately one week around the rotenone treatment application period; however, the trail closure may need to be in place longer depending on variables that could affect the application period such as weather, equipment failures, etc. When in place, the closure would extend from Reynolds Campground junction on the east and from just east of Gunsight Pass from the west during rotenone application. Visitors would still be able to access the high point of Gunsight Pass trail from the Sperry Trailhead during the trail closure. This would still allow day-use access to the pass and several higher-use climbing routes for peaks such as Gunsight Peak and Mount Jackson. Given the average number of backcountry campers at the Gunsight Lake campground over a recent five-year period (see above), closure of the campgrounds would not be expected to affect more than approximately 650 campers, at most. This is likely a considerable overestimate, since the average represents two months of camping, including early August. The campground closure would not begin until September 1, 2023, when the number of backcountry campers begins to decrease to notably fewer campers in mid- to late-fall. The number of campsites available for visitors would also be limited on occasion, such as during fish translocation. With 65 wilderness campgrounds in the park totaling 223 campsites and approximately 734 miles of trail that provide access to the park's backcountry, all but one (Gunsight Lake) of the 65 wilderness campgrounds and trails would remain open and available, and most backcountry campers and hikers would not be affected.

While the label requirements for rotenone state that public entry into the treatment area could occur immediately after application, the Gunsight Pass Trail would be temporarily closed (anticipated one week duration conditions dependent) to visitors, no drinking water or recreating in water warning signs would be posted along the trail and shoreline of Gunsight Lake, and news releases would be issued ahead of time to minimize the chance of public exposure upon area reopening. The public would also be informed of implementation of the project through the park's website, wilderness permit office, and visitor centers. The closures would likely be a one-time event, possibly occurring a second season if reapplication of rotenone is necessary.

Since the trail and campground would be closed during rotenone application most visitors would not be near enough to detect most of the project noise during the application period. Visitors on nearby trails, including the St. Mary Falls trail (approximately five miles downstream) and open sections of the Gunsight Pass Trail (e.g., between the head of Gunsight Lake and Lake Ellen Wilson), may detect noise from the motorboats during the rotenone application period; however, the noise would be expected to attenuate, or reduce in amplitude, to ambient levels within approximately 1.2 mile (NPS Natural Sounds and Night Skies Division 2021). Water pumps may be audible, given the relatively higher noise level they produce (approximately 105 dBA); however, pumps would be used intermittently, resulting in only sporadic audibility that would be reduced by terrain shielding, distance, and possibly weather conditions. Helicopters could be audible, since a longer distance would be required for helicopter noise to attenuate to ambient levels, up to approximately 4.4 miles, depending on the type of helicopter (NPS NSNSD 2021). Helicopters may also be required to fly over hiking trails and climbing routes, depending on the flight path. Noise from the helicopter in flight would be highly transient, dissipating in a matter of minutes (or less, depending on masking effects from weather conditions, such as wind). Noise from helicopter long-line sling load operations and fish planting with a helicopter in the treatment area would likely be too distant and sufficiently dampened by terrain shielding to be more than barely audible and would occur for only a few minutes at a time. While Alternative A could cause the number of administrative helicopter flights to

exceed the park's annual limit of 50, any increase would not be permanent, occurring for one season, two at most if reapplication is necessary, and then infrequently for native fish translocation Hikers on the Gunsight Pass Trail may be able to detect noise from the generator and other equipment during detoxification. But as previously explained in the analysis of impacts to Natural Soundscapes, noise from the generator, which would be situated near the stream, would be masked by the ambient sound of moving water. Off-trail recreationists within one to three miles of the treatment area could potentially detect project noise.

The presence of project personnel would not be noticeable to visitors during the rotenone application portion of the project since the treatment area would be closed to the public. The presence and activities of personnel during detoxification and native fish translocation would not be notably different from that of current campers, hikers, and anglers use. The number of personnel (anticipated two to five during translocation) is less than the capacity of the Gunsight Lake wilderness campground and the area is popular with hikers and anglers. While the translocation portion of the project could require the presence of personnel every year for several years (estimated six to eight years), crews would likely only be in the area for relatively short periods of time (estimated one to two weeks). The presence of personnel during post rotenone treatment and translocation monitoring would also be of low intensity and similar in nature to visitor activities, as well as ongoing resource management activities throughout the park. The occurrence of a dark purple color to the water during detoxification, from the application of potassium permanganate (see also analysis of impacts to Water Quality) could be visually disruptive but is likely to go largely unnoticed given the separation of the stream and the trail and because the color to the creek usually dissipates in a few hundred yards. The park would provide educational information to visitors to the area explaining the project and potential visual effects of potassium permanganate.

The loss of opportunities to fish for rainbow trout at Gunsight Lake would adversely impact some anglers who choose to harvest fish; Glacier's fishing regulations state that native fish must be catch and release and non-natives (i.e., rainbow trout) can be harvested. Adverse impacts would be slight because most angling opportunities throughout the park would remain unaffected. The translocation of westslope cutthroat and bull trout would also benefit anglers by providing future opportunities to fish for native trout. These benefits would extend downstream, as non-hybridized westslope cutthroat and bull trout migrate downstream into the St. Mary River system, protecting opportunities to fish for these species for the long term.

If rotenone reapplication is necessary, impacts to visitor use and experience from the area closure, noise, and changes to angling opportunities would be as described above.

CUMULATIVE IMPACTS

Only resources determined to have a cumulative impact (adverse or beneficial) are continued for discussion below. There are no past, present, or foreseeable actions within the project area affecting amphibians, stoneflies, zooplankton, or water quality so there are no cumulative impacts to these resources as a result of this action combined with past, present or foreseeable actions.

Westslope Cutthroat and Bull Trout

Past, present, and reasonably foreseeable actions with impacts to westslope cutthroat trout and bull trout include periodic interagency native fish population assessments and Glacier fisheries management projects, which involve gill net surveys and annual electrofishing monitoring. Electrofishing monitoring is designed to not harm individual fish, although some mortality may occur; any electrofishing mortality that occurs is at the individual level and immeasurable at the population scale. Ongoing operation of the Bureau of Reclamation (BOR) Milk River Irrigation Project outside the park, including Sherburne Dam and the St. Mary Diversion Works near Babb, is negatively impacting bull trout through the loss of juvenile fish in the St. Mary Irrigation Diversion and habitat effects from fluctuations in reservoir elevations and the dewatering of Swiftcurrent creek in the winter (Kaeding 2016; Mogen et. al. 2011). When the impacts of Alternative A are combined with those of past, present, and reasonably foreseeable actions, the cumulative impacts to westslope cutthroat trout and bull trout would primarily be

beneficial, since Alternative A would offset the negative effects of irrigation systems outside the park by providing habitat refugia and furthering the conservation of bull and westslope cutthroat trout locally and at a range-wide scale. Region-wide efforts to conserve westslope cutthroat and bull trout are underway by MFWP, BLM, tribal and provincial entities, and USFS across their ranges in Montana; Alternative A would further the conservation efforts of these agencies. Alternative A could contribute incremental adverse impacts from the effects to bull trout and westslope cutthroat trout of capture and handling during translocation.

Under Alternative B current management and impacts described in the Affected Environment would continue. When the impacts of Alternative B are combined with those of past, present, and reasonably foreseeable actions, the cumulative impacts to westslope cutthroat trout and bull trout would primarily be adverse since Alternative B would not offset ongoing impacts.

Grizzly Bears, Common Loons, and Waterbirds

Past, present, and reasonably foreseeable actions with impacts to grizzly bears, common loons, and waterbirds include trail maintenance, visitor use, invasive plant control, fire management, bear management, air tours, administrative flights, and backcountry scientific research and monitoring. When the impacts of Alternative A are combined with those of past, present, and reasonably foreseeable actions, the cumulative impacts to grizzly bears, common loons, and waterbirds would continue to be adverse, with Alternative A contributing a small and temporary degree of impact. This is because motorboat and generator operations, personnel presence, and helicopter flights in the Gunsight Lake drainage would be underway for approximately three to four weeks in September of 2023, and infrequent, occurring one to two days a year for approximately six to eight years following.

Under Alternative B current management would continue and since there would be no direct or indirect impacts, there would be no cumulative impacts and the species' future conditions would be as described in the Affected Environment sections.

Recommended Wilderness

Past, present, and reasonably foreseeable future research and monitoring projects have the potential to both negatively and beneficially impact recommended wilderness in the park. Fish passage barriers on Quartz and Akokala Creeks, lake trout suppression at Quartz and Logging Lakes, bull trout translocation at Grace Lake, five-needle pine restoration, invasive plant control, fire management, bear management, and certain resource monitoring and research activities (such as those that involve specimen collection) temporarily adversely impact the untrammeled quality of wilderness character because they intentionally control or manipulate the biophysical environment. These actions also benefit the natural condition because they directly protect natural resources and/or inform management decisions regarding the protection of those resources. Installations for these actions (e.g., bear traps, tree markers, remote cameras, radio collars, weather stations, etc.) and for other NPS administrative operations (e.g., radio repeaters) adversely impact the undeveloped quality. Temporary area closures for fire and bear management cause temporary adverse impacts to unconfined recreation.

The use of chainsaws, generators, water pumps, and other motorized equipment during maintenance of backcountry trails, campgrounds, and historic structures, and NPS administrative flights, search and rescue flights, fire management flights, and commercial air tours adversely impact natural soundscapes, opportunities for solitude, and the undeveloped quality. The use of motorized equipment would be sporadic and temporary and would not represent a change in the type and level of noise or motorized use that already occurs in the park's recommended wilderness, and because there would be no permanent increase to the park's annual limit of 50 administrative flights. As a result, when combined with the impacts of other past, present, and reasonably foreseeable future actions, Alternative A would slightly and intermittently contribute to an overall cumulative adverse effect on untrammeled and undeveloped wilderness character, as well as opportunities for solitude and primitive and unconfined recreation, throughout the life of the project (up to 6 to 8 years). However, Alternative A would not notably change the number and degree of cumulative adverse impacts already occurring and would contribute a greater degree of cumulative beneficial impact once the project is complete because it would provide increased protection of the natural condition from the preservation of native westslope cutthroat trout and bull trout. The use of motorized equipment would be sporadic and temporary and would not represent a change in

the type and level of noise or motorized use that already occurs in the park's recommended wilderness, and because there would be no permanent increase to the park's annual limit of 50 administrative flights.

Under Alternative B, current management would continue and since there would be no direct or indirect impacts to the untrammeled and undeveloped qualities and to opportunities for solitude and unconfined recreation, there would be no cumulative impacts to these qualities of wilderness character, and future conditions would be as described in the Affected Environment section. For the natural condition of recommended wilderness, when the impacts of Alternative B are combined with those of past, present, and reasonably foreseeable actions, the cumulative impacts would primarily be adverse, since Alternative B would not offset ongoing impacts.

Natural Soundscapes

Past, present, and reasonably foreseeable actions with impacts to natural soundscapes in the project area include trail maintenance, invasive plant control, fire management, air tours, and administrative flights. Noise from chainsaws, generators, water pumps, and other motorized equipment during maintenance of backcountry trails, campgrounds, and historic structures, and NPS administrative flights, search and rescue flights, fire management flights, and commercial air tours adversely impact natural soundscapes. With recent completion of Glacier National Park's Final Air Tour Management Plan and consistent with the park's 1999 General Management Plan, commercial air tours in the park will be phased out through attrition or until December 31, 2029, when all operating authority for the Park will be terminated, whichever occurs first (NPS 2022). Until that time, existing commercial air tour operators are authorized to provide up to 144 air tours per year on a defined route no lower than 2600 feet AGL. The phasing out of commercial air tours will lessen and ultimately eliminate the potential for cumulative effects to natural soundscapes from administrative flights combined with commercial air tours. As a result, when combined with the impacts of other past, present, and reasonably foreseeable future actions, Alternative A would slightly and intermittently contribute to an overall cumulative adverse effect on natural soundscapes throughout the life of the project (up to 6 to 8 years). The use of motorized equipment would be sporadic and temporary and would not represent a change in the type and level of noise or motorized use that already occurs in the park or the project area, and there would be no permanent increase to the park's annual limit of 50 administrative flights.

Under Alternative B current management would continue and since there would be no direct or indirect impacts, there would be no cumulative impacts and future conditions to natural soundscapes would be as described in the Affected Environment.

Visitor Use and Experience

Past, present, and reasonably foreseeable actions with impacts to visitor use and experience include area closures due to construction projects and other administrative actions, such as bear and fire management; and actions that can cause audible or visual disturbance such as trail maintenance, invasive plant control, air tours, administrative flights, road construction, and administrative projects in recommended wilderness. Trail and area closures can have effects on visitor access to certain areas of the park at certain dates and/or times, potentially requiring some visitors to alter trip plans and itineraries. Visitor access to the North Fork region (Polebridge Ranger Station, Bowman, Kintla, Quartz, and Logging Lakes) of Glacier will be limited by intermittent closures during bridge rehabilitation projects. There will be a full closure of the North Lake McDonald Road at the intersection with the Going-to-the-Sun Road during replacement of the upper McDonald Creek Bridge. This will temporarily limit visitor access to the northwest shore of Lake McDonald. NPS administrative flights, fire management flights, commercial air tours, and trail and campground maintenance, can adversely impact visitors due to noise from motorboats, helicopters, chainsaws, and other equipment needed for such actions. Foreseeable NPS administrative actions and resource monitoring and research can adversely impact visitors due to visible equipment, such as radio repeaters, weather stations, radio collars, and remote cameras, on an otherwise mostly undeveloped landscape. When the impacts of Alternative A are combined with those of past, present, and reasonably foreseeable actions, impacts to visitor use and experience would continue to be adverse, with other actions contributing the majority of impacts. This is because impacts from the Gunsight Lake area closure under Alternative A would be short-term (during the rotenone application period) and localized to the project area, and project noise would also be short-

term, ending once the project has concluded. Flights for Alternative A would be relatively few compared to the total number of commercial and administrative flights in the park.

Under Alternative B current management would continue and since there would be no direct or indirect impacts, there would be no cumulative impacts and future conditions to visitor use and experience would be as described in the Affected Environment.

LIST OF AGENCIES AND PERSONS CONSULTED

US Fish and Wildlife Service
Montana Fish, Wildlife and Parks
Montana State Historic Preservation Office
Blackfeet Nation
Confederated Salish and Kootenai Tribes

EA PREPARERS AND CONTRIBUTORS

Name/Title	**Contribution**
Lisa Bate, Wildlife Biologist, Glacier National Park	Provided technical support on black swifts, common loons, and other water birds.
Jami Belt, Biologist, Crown of the Continent Research Learning Center, Glacier National Park	Provided technical support on common loons and other water birds.
Mark Biel, Natural Resources Program Manager, Glacier National Park	Provided technical support on wildlife.
Chris Downs, Fisheries Biologist/Program Manager, Glacier National Park	Developed proposed action; prepared sections on native fish and aquatic species, fisheries BA for section 7 consultation with USFWS.
Katie Eaton, Natural Resources Assistant, Glacier National Park	Prepared EA in cooperation with subject matter experts and coordinated internal review.
Dawn LaFleur, Restoration Biologist, Glacier National Park	Provided technical support on vegetation, soils, and wetlands.
Joe Giersch, Aquatic Entomologist, US Geological Survey, Northern Rocky Mountain Science Center	Provided technical support on aquatic invertebrates.
Kathryn Neussly, Ecologist, Natural Sounds Night Skies Division, National Park Service	Provided technical support on natural soundscapes.
Amy Secrest, Branch Manager of Environmental Planning and Compliance, Glacier National Park	Provided oversight, reviewed and edited EA, coordinated EA schedule, agency consultation, and public review.
Jessica Nymark, Environmental Protection Specialist/Natural Resources Specialist, Glacier National Park	Provided oversight, reviewed and edited EA.
Brad Blickhan, Wilderness and Wild and Scenic River Coordinator	Reviewed and edited EA, provided technical support and guidance on wilderness status and analysis.
John Waller, Wildlife Biologist, Glacier National Park	Provided technical support on grizzly bears and Canada lynx.

As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U. S. administration. March 2019. **Printed on *recycled paper***.

APPENDICES

Appendix A – References

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Appendix B – Mitigation Measures

Westslope Cutthroat and Bull Trout, Amphibians, Macroinvertebrates, & Zooplankton

- To minimize impacts to bull trout from the removal of eggs during translocation, females would be only partially spawned, with only about 50 percent of the eggs taken from each female handled. This would allow for some natural reproduction, producing enough eggs to fully seed the available juvenile rearing habitat.
- Genetically pure juvenile westslope cutthroat trout raised in the hatchery may be returned to the donor stream(s) to offset population losses from taking adult westslope cutthroat into the hatchery system.
- During native fish collection and transport, the oxygen levels and cold-water temperatures of containers would be maintained to prevent fish mortality (e.g., fish could be temporarily held in tubs submerged in stream water during collection until they are transported in coolers to the hatchery, and/or containers transporting fish would contain sufficient water to maintain oxygen and temperature levels).
- Monitor post-treatment to ensure recovery of aquatic macroinvertebrates.
- If post treatment sampling indicates populations of aquatic macroinvertebrates or amphibians have been lost from the treatment area, efforts would be made to re-establish the populations using a nearest neighbor approach (i.e., translocate individuals from nearby, similar habitat).
- A spill plan would be developed and followed in case of a fuel or hazardous material leak. The plan would be reviewed by the Glacier's Safety Office. Personnel would inspect boat engines, fuel lines, and fittings as well as other equipment for leaks prior to beginning project activities each day. Appropriate absorbent supplies would be on site to address a spill on shore and on the water. Petroleum products would be properly stored, to include the use of spill-proof and bear-proof containers.
- Treat at the lowest effective rotenone concentration for trout (1ppm) to minimize impacts to the western glacier stonefly, other aquatic macroinvertebrates, amphibians, and zooplankton.
- Treat the inlet streams for the shortest effective duration to minimize impacts to non-target aquatic organisms.
- Treat only those areas where field sampling has confirmed the presence of non-native rainbow trout to minimize impacts to non-target aquatic species.
- A site-specific plan for collecting bull trout gametes from the St. Mary drainage would be created in consultation with USFWS.

Water Quality

- The cleanest burning outboard motors feasible (reduced emission 4-stroke technology) to minimize the release of hydrocarbons would be used.
- A spill plan would be developed and followed in case of a fuel or hazardous material leak. The plan would be reviewed by the Glacier's Safety Office. Personnel would inspect boat engines, fuel lines, and fittings as well as other equipment for leaks prior to beginning project activities each day. Appropriate absorbent supplies would be on site to address a spill on shore and on the water. Petroleum products would be properly stored, to include the use of spill-proof and bear-proof containers.
- Protocols to prevent aquatic invasive species (AIS) (such as zebra and quagga mussels, and Eurasian watermilfoil) from entering the St. Mary River drainage would be followed at all times, in accordance with Glacier's AIS Action Plan (NPS 2018a).

- Prior to being loaded with fish and water from the hatchery, helicopter tanks and all fish transport containers would be cleaned in accordance with state of Montana rules and regulations for live fish transport. Only hatcheries that are regularly inspected for AIS, certified to be free of pathogens, and/or treat the holding water to remove or kill any pathogens (such as with filters or UV light, for example) will be used.

Wetlands

- The project area would be surveyed for wetland resources before the project begins to identify the presence and extent of wetlands; sensitive wetland resources would be marked and avoided.
- All equipment and materials would be cleaned and inspected prior to entering the park to prevent the spread of non-native invasive plants and AIS.
- Best Management Practices listed in NPS Procedural Manual #77-1, Appendix 2, would be followed

Wildlife

- Prior to applying rotenone, the park would survey Gunsight Lake for common loons. In the off chance that loons have nested on the lake and are raising chicks, the application of rotenone would be scheduled as late as possible, allowing more time for the juvenile birds to acquire the ability to fly to nearby lakes for forage. Rotenone could not be applied later than September 1 due to fall weather considerations, by which time any juvenile loons would likely be able to fly.
- Project personnel would be trained on appropriate behavior in the presence of bears and other wildlife and would adhere to Glacier's regulations concerning proper storage of food, garbage, and other attractants.
- The following conservation measures as agreed to with the USFWS in Glacier's programmatic BA for administrative flights (NPS 2023) are required for all park administrative flights and would be followed for any flights associated with this plan:
    - Flights would follow suggested flight paths away from sensitive areas. Where possible, flight paths would follow road corridors and occur over developed areas. The flight manager would be responsible for coordinating with the park biologist to identify sensitive sites prior to the flight.
    - Flights would occur one hour after sunrise and one hour before sunset from 1 May to 1 October to minimize impacts to grizzly bears. Grizzly bear denning activity peaks during den emergence from 15 March to 15 May and during den construction from 15 October to 15 November. No flights would occur over known dens or potential den habitat during den emergence and den construction. In order to conserve prey species, flights would avoid ungulate winter range from 15 January to 1 May when wintering ungulates are most vulnerable.
    - Restricting flights to the 1 May to 1 October period, or minimizing them outside that period, would eliminate or minimize impacts to sensitive wildlife.
    - The helicopter would fly at a minimum of 2000 feet AGL over the park whenever possible, depending on mountainous topography, weather, and except when it is landing or taking off or when it is delivering supplies via long line or during fish planting operations.
    - To minimize impacts on denning Canada lynx, no flights would be permitted over known den sites from 1 May to 30 Aug.
    - Flight paths would be designated so as to avoid open alpine meadows, talus slopes, or other areas where grizzly bears congregate but do not have access to cover. If a low-level flight or

landing is needed in an alpine area and a bear is seen, the flight would be postponed. If the flight cannot be postponed, the flight would keep a maximum distance from the bear(s).

Recommended Wilderness

- Motorized equipment would not be used for overland transport.
- Project personnel would enter the project area on foot or by livestock.
- Project personnel would practice principles of "Leave No Trace" outdoor ethics in order to minimize impacts to park resources and visitor experiences.

Vegetation

- The project area would be surveyed for rare plants before work begins; locations of rare plants would be marked and avoided.
- The project area would be surveyed for non-native, invasive plant species (the Gunsight Lake area has known populations of orange hawkweed, Canada thistle, and yellow toadflax) before work begins; locations of identified invasive species would be treated prior to project implementation or avoided during implementation to prevent further spread.
- Project personnel would stay on trails, rocky surfaces, or bare ground whenever possible and avoid the creation of social trails.
- If necessary, areas of disturbance would be rehabilitated and restored through consultation with the park's Vegetation Management Specialist. Only seeds and plants originating from the park or from approved sources would be used in restoration activities.
- All equipment and materials would be cleaned and inspected prior to entering the park to prevent the spread of non-native invasive plants.

Natural Soundscapes

- To minimize administrative flights over recommended wilderness, the park would make every effort to include helicopter flights for this project within the 50-flight limit on administrative flights as described above. Flights would be considered with other proposed administrative flights, coordinated with other projects, and combined with other hauling needs whenever possible.
- Boat motors and other motorized equipment would be selected for the lowest possible noise production while still using equipment that would meet project objectives. Equipment would also be selected to reduce the number of flights required to implement the project.

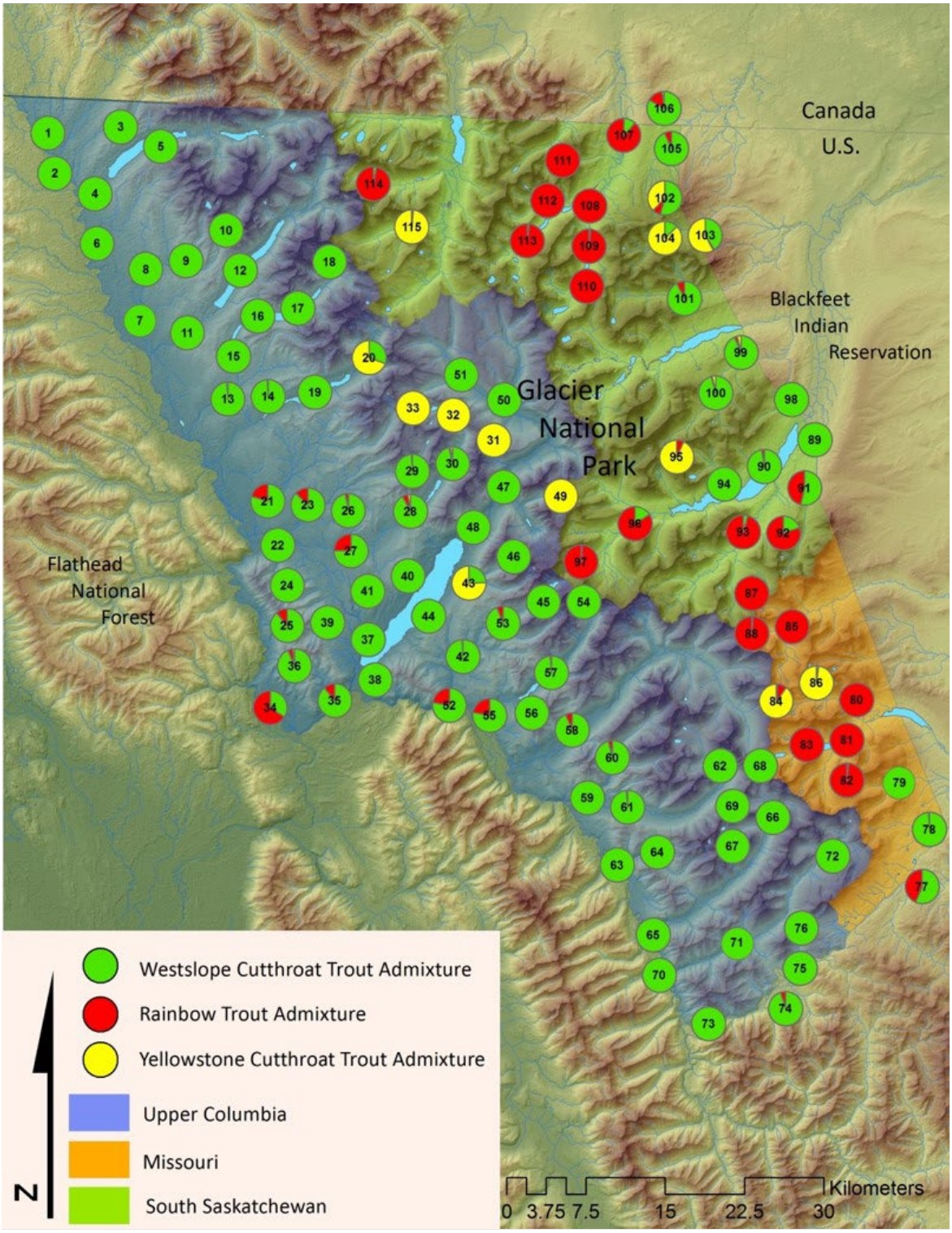
Visitor Use and Experience

- The public would be informed of the project prior to implementation by means of media releases and postings on the park's website, backcountry permit office, and visitor centers. Signs informing visitors of the project and temporary area closures would be posted at the Sperry, Gunsight Pass, and Jackson Glacier Trail trailheads before and during the project.
- Interpretive programs and materials would be considered to educate visitors about project activities and native aquatic ecosystem conservation.
- Glacier's Wilderness Permit Office would be notified in advance of the projected rotenone application dates for Gunsight Pass Trail closures so visitors can be notified before their wilderness itineraries commence in order to minimize inconvenience for visitors.

Health and Human Safety

- All appropriate personal protective equipment (PPE) would be worn by applicators when handling chemicals.
- All product guidelines and instructions would be followed according to product labels.
- Warning signs notifying the public to not consume or recreate within Gunsight Lake or the St. Mary River would be placed frequently along the whole Gunsight Pass Tail downstream of Gunsight Lake and along the lake shoreline, as recommended by product labels.

Appendix C – Hybridization of native westslope cutthroat trout and non-native rainbow and Yellowstone cutthroat trout across Glacier National Park.



Appendix D – Elements of Alternatives Considered but Dismissed from Detailed Analysis

The following alternative and alternative elements to the project were considered but eliminated from further analysis. The following is a brief description, including reasons for dismissal.

Alternatives

Remove non-native trout but do not translocate native trout in Gunsight Lake Returning Gunsight Lake to its historically fishless state was considered as a means of eliminating the downstream threats of hybridization. This approach was dismissed because it does not fully meet the project's purpose and need. Returning the lake to a fishless state would not establish a reserve population capable of providing a genetic refuge aiding in the preservation and protection of genetically unaltered populations of bull trout and westslope cutthroat trout. Additionally, this Alternative would fail to secure native fish habitat, or habitat refugia where westslope cutthroat trout and bull trout would be protected from both non-native fish and climate-related habitat degradation. Limiting an action Alternative to only removing non-native rainbow trout and restoring Gunsight Lake to a fishless condition has, therefore, been dismissed from further analysis because of an inability to fully meet project objectives and resolve the purpose and need for taking action.

Remove rainbow trout manually (i.e., electrofishing, gill nets, and/or trap nets) instead of rotenone. At 114 acres and 55 feet of depth, Gunsight Lake is too large for electrofishing and/or angling to remove rainbow trout to any measurable degree. Gill and/or trap netting would also be necessary for any observable reduction. Such methods have been successful in removing non-native fish from small lakes and short reaches of stream elsewhere (Knapp et al. 2007; Pacas and Taylor 2015; and Vredenburg 2004). For example, in Banff National Park, non-native brook trout were successfully removed from a 57.1-acre lake (23.1-hectares), a 23.9-acres lake (9.7-hectares), and a 2.8-mile (4.5-kilometer) downstream stretch of river using electrofishing and gill nets deployed from a rowboat (Pacas and Taylor 2015). Similarly, Shepard et al. (2002) removed brook trout using backpack electrofishing from a relatively short, small, and simplified (through riparian vegetation removal) stream in Montana to benefit westslope cutthroat trout; however, these efforts required year-round net sets and/or electrofishing for five to eight years (Pacas and Taylor 2015; Shepard et al. 2002). Using motorized watercraft to deploy and work the gill nets would increase efficiency but would still likely require five years or more to successfully reduce the population. Gill netting also rarely achieves complete removal of the target population and is generally more useful for suppressing non-native fish numbers (i.e., reducing them such that they pose a decreased threat to native species but are not necessarily eliminated). This is especially the case for lakes that are also inhabited by native fish, since non-native fish can be targeted while native fish are avoided. Complete removal of the rainbow trout population from the lake is necessary to reduce the overall risk of hybridization downstream and to provide secure habitat for translocated westslope cutthroat and bull trout. The mortality of individual native fish downstream would be a tradeoff that would not affect native fish at the population level (Please refer to ***Chapter 3, Bull Trout and Westslope Cutthroat Trout*** and ***Other Native Fish*** in ***Appendix E***) and would be mitigated by collecting and moving as many native fish as possible to untreated waters.

Because the exclusive use of manual means such as electrofishing, angling, gill or trap netting to remove rainbow trout from the project area would not result in the complete removal of rainbow trout, the park would be unable to secure translocated bull trout or westlope cutthroat trout from the threats non-native fish, including hybridization, or expand the long-term distribution and security of these species in the face of climate change. Therefore, this alternative has been dismissed from further analysis because it would not meet project objectives or resolve the purpose and need for taking action.

Use recreational angling only to remove non-native rainbow trout from Gunsight Lake. The purpose of the project is to completely remove rainbow trout from Gunsight Lake in order to reduce the overall risk of hybridization downstream and provide secure habitat for translocated westslope cutthroat and bull trout. As evidenced by previous creel surveys and angler use information (NPS file data and Montana MFISH database),

there is not sufficient fishing activity in the upper St. Mary River drainage for recreational anglers to achieve the complete removal of rainbow trout from the project area. An attempt to use angling to reduce brook trout from Quirk Creek in Alberta was unsuccessful, despite skilled anglers putting in hundreds of rod-hours each year over several years (Paul et al. 2003). Further, angling alone has not been sufficient to reduce non-native fish populations on other, more heavily fished waters outside the park such as Swan Lake, Flathead Lake, or Lake Pend Oreille, which have excellent access for anglers with boats. For example, despite a $15/lake trout bounty on Lake Pend Oreille in Idaho for almost a decade, anglers alone have not been able to suppress (let alone completely remove) lake trout from the lake. Similarly, despite mandatory kill regulations for lake trout on Yellowstone Lake, anglers have not been able to eliminate or even substantially reduce lake trout. Commercial-scale gill netting has been employed in both circumstances to supplement angler removal. Lake trout fishing regulations on Flathead Lake have been relaxed and annual fishing contests (Mack Days) with substantial cash prizes have been held since 2002, yet the lake trout population has not declined (CSKT 2014). Complete removal of the rainbow trout population from the lake is necessary to reduce the overall risk of hybridization downstream and to provide secure habitat for translocated westslope cutthroat and bull trout. Because recreational angling would not result in the complete removal of rainbow trout, the park would be unable to secure translocated bull trout or westlope cutthroat trout from the threats non-native fish, including hybridization, or expand the long-term distribution and security of these species in the face of climate change. Therefore, the use of anglers alone to remove rainbow trout has, therefore, been dismissed from further analysis because of an inability to meet project objectives and resolve the purpose and need for taking action.

Elements

Introduce other non-native species to prey upon rainbow trout. Introducing other non-native fish species (such as various species of whitefish, or *Corogonids*) to control non-native fish has been suggested for previous fisheries management projects in the park. This approach would conflict with long-standing management objectives to prevent non-native species from establishing populations in park waters. The ecological results of introducing another non-native species would be uncertain and difficult to reverse in the event of unexpected outcomes. The history of non-native fish stocking across the western US is fraught with examples of well-intended introductions of non-native fish species that have resulted in major negative impacts to local native species. For example, the widespread stocking of non-native rainbow and brook trout outside of their native range has led to the demise of native cutthroat trout in many waters, and the initial stocking of lake trout in the early 1900s in Flathead Lake is the root cause of the largest threat facing bull trout in Glacier (Liknes and Graham 1988; Marnell 1988; Fredenberg 2002; NPS 2016). Introducing a non-native species to prey upon rainbow trout was dismissed from further analysis due to the potential for unintended environmental impacts that could be more environmentally damaging than those associated with using rotenone.

Use electric trolling motors for the boats instead of gas-powered outboard motors. This element to Alternative A was considered as a means of reducing impacts to natural soundscapes and wilderness character. It was dismissed because the battery life of electric trolling motors would not be sufficient for the estimated two to four days necessary to apply rotenone and there would not be a way to rapidly recharge the batteries due to the remote location. Electric trolling motors have been dismissed because they would not be feasible.

Use livestock only to transport materials instead of helicopters. This element to Alternative A was considered as a means of reducing impacts to natural soundscapes and wilderness character. It was dismissed, however, due to the impacts and feasibility associated with the number of pack strings required to transport project materials. It is estimated that approximately 12,000 pounds of rotenone (each barrel weighing 300 pounds, well over the weight mules or livestock can carry) and 2,500 pounds of potassium permanganate would need to be moved to Gunsight Lake in addition to the other gear required for application and detoxification. Based on these approximate weights, it is estimated that 20 mule strings of six head each would be required to get the supplies into Gunsight Lake with a lesser amount also required to move project materials back out of the site. Several weeks would be needed to move the entirety of these materials into Gunsight Lake. Due to the storage requirements of rotenone and other project materials, the Gunsight Lake trail and campground would

need to be closed at least two weeks earlier (mid-August) allowing for staff to stay at the campsite to monitor materials. The use of stock only to transport project materials was dismissed due to technical infeasibility.

Translocate only westslope cutthroat trout without also translocating bull trout. Part of the purpose of the project is to establish secure bull trout populations that are secure against non-native fish (i.e., hybridization with brook trout) and climate change, and to expand the overall, long-term distribution of bull trout. Gunsight Lake cannot be invaded by non-native fish due to downstream waterfalls that prevent upstream fish migration. The lake therefore presents a valuable opportunity to establish secure habitat for bull trout. Bull trout and westslope cutthroat trout populations coexist in multiple waters throughout the park. Both species have evolved together over thousands of years, and there is sufficient habitat diversity (i.e., stream habitat, spring channels, shallow lake habitat, deep lake habitat) for translocation of both species to succeed. The translocation of westslope cutthroat trout alone was dismissed from further analysis because it would not fully meet project objectives or resolve the purpose of taking action.

Swamp Gunsight Lake with genetically pure westslope cutthroat trout without removing Rainbow trout with rotenone. Only stocking genetically pure westslope cutthroat trout on top of a well-established and healthy rainbow trout population would likely result in a hybrid swarm of hybridized trout. Annual stocking of pure westslope cutthroat trout for multiple generations would be required under this approach, with a low probability of success of establishing a genetically pure population of westslope cutthroat in the end. This alternative would also be limited by the availability of donor sources and would cause greater impacts to donor sources from annual long-term removal of sub-adult fish to provide spawning stock. The number of donor fish that would be required for a treatment area of this size and the logistics of transporting the high number of fish is prohibitive. Genetic swamping is included as part of the preferred alternative and would occur by means of translocation; translocation is in part being proposed not only to establish secure populations of native westslope cutthroat trout and bull trout, but also to genetically swamp any rainbow trout that remain after rotenone treatments. The chances of successfully swamping out any remaining rainbow trout genes would be greatly increased by first dramatically reducing the number of rainbow trout in the lake. A major limitation of swamping is that it is a multi-generational, dilution tactic and it is not possible to completely remove non-native genes in a target population with swamping alone (MFWP 2021); therefore, this alternative was dismissed from detailed analysis because it would not remove the threat of hybridization and, as a result, would not resolve the purpose and need for taking action.

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Appendix E – Issues and Impact Topics Dismissed from Detailed Analysis

The following impact topics have not been analyzed in detail because the issues associated with these resources are not pivotal or central to the proposal, a detailed analysis of impacts to these resources is not necessary to make a reasoned choice between alternatives, these topics are not contentious among the public or other agencies, and/or there would be no potentially significant impacts to these resources.

Other Native Fish (i.e. excluding westslope cutthroat trout, and bull trout)

Westslope cutthroat trout and bull trout have been carried forward for detailed analysis in ***Chapter 3***. Other species of native fish in the St. Mary River drainage include lake trout, northern pike, mountain whitefish, lake whitefish, longnose and white suckers, spoonhead sculpin, deep-water sculpin, troutperch, and lake chub. These species would not be affected by the proposed action because they are not present in the rotenone treatment area. Also, none of these species would be translocated so they would not be affected by translocation. Because other species of native fish would not be affected, they have dismissed from detailed analysis.

Wetlands

Wetland habitat is present in the project area, primarily associated with the lakeshores and stream channel. Wetland soils and vegetation in the project area would be at some risk of trampling. Impacts from trampling would be slight and would not measurably exceed the existing human influence from hikers and anglers. Project personnel (with a crew size estimated at approximately 15 people) would primarily use the shoreline around the lakes and stream intermittently during rotenone application for a period not likely to exceed two to four days. The potential for impacts from trampling would be very fleeting during activities such as surveys, monitoring, and preliminary site preparations. There would be a higher potential for trampling during the detoxification period since project personnel would be at the detox site for a longer period of time (estimated at up to three to four weeks). The intensity of impacts would remain low because the work would occur in late summer (early September), when wetland vegetation begins entering dormancy for the season and is less susceptible to permanent damage. This would also be the case if a second application is necessary in the same year or a following year.

Personnel would be working for an estimated one to two weeks each year for three years along streambanks and lakeshores during the collection of native fish for translocation, which could occur any time during spring, summer, or fall. The activity would be dispersed, rather than concentrated in any one area. Any trampling that occurs would be short enough in duration for wetland soils and vegetation to recover independently, without restoration measures. Surveys for rare wetland vegetation would occur prior to implementing the project, and any identified locations would be marked and avoided. This combined with mitigation measures requiring personnel to stay on trails and unvegetated surfaces whenever possible and avoid the creation of social trails would reduce the potential for trampling to the point that any effects that do occur would be barely noticeable and would not affect wetland vegetation permanently or at a community or population level. In the unlikely event that wetland plants or soils are trampled or compacted to the degree that they cannot recover on their own, the site would be restored.

The use of rotenone would not affect wetland vegetation, since rotenone is not known to be toxic to plants at the concentration that would be used (Finlayson et al. 2010). Similarly, potassium permanganate would not negatively impact wetland vegetation at the levels proposed (approximately 3 ppm). Potassium permanganate is a strong oxidizer that rapidly breaks down (half-life of 7 to 11 minutes) into potassium, manganese, and water, and is also used by water treatment plants to remove foul odors from drinking water. The break-down products are common in nature and have no deleterious environmental effects at concentrations used for neutralization of piscicides (Finlayson et al. 2001). As a non-persistent chemical, rotenone breaks down quickly and does not accumulate in the water, soil, plants, or surviving animals. Rotenone has low to slight mobility in soil, with an expected leaching distance of about two centimeters, and binds readily to organic matter (ODFW

2019). The likelihood of the chemical leaching into groundwater is extremely low (see ***Chapter 3, Water Quality***). None of the project activities would cause physical alterations to water flow patterns within wetlands.

Rotenone would cause mortality among aquatic insects, other invertebrates, and zooplankton, but numerous studies indicate temporary effects on these organisms from the use of piscicides; aquatic invertebrates would be expected to recover abundance and community composition in two to four years (see ***Chapter 3, Macroinvertebrates***). Overall, the project would benefit wetlands because it would protect native fish habitat for the long term (see ***Chapter 3, Bull Trout and Westslope Cutthroat Trout***).

Impacts to wetlands have been dismissed from detailed analysis because impacts from trampling would occur late in the season, be temporary, and too slight to noticeably change wetland communities; wetland vegetation would recover without the need for restoration; sites would be restored if they cannot regenerate on their own; rotenone and potassium permanganate are not toxic to plants; impacts to invertebrates would be temporary; and the protection of native fish habitat would benefit wetlands for the long term.

Soils and Vegetation

Potential impacts to soils and vegetation from trampling and measures to mitigate any impacts would be as described above for ***Wetlands***. The project area would be surveyed for non-native invasive plant species (the Gunsight Lake area has known populations of orange hawkweed, Canada thistle, and yellow toadflax) before work begins; locations of identified invasive species would be treated prior to project implementation or avoided during implementation to prevent further spread. Otherwise, there would be no ground disturbance or other activities that would cause noticeable or measurable impacts to soils and vegetation; therefore, this topic has been dismissed from detailed analysis. Plant species of concern that have been dismissed from detailed analysis are addressed in ***Appendix F***.

Floodplains

The use of rotenone and detoxification of the rotenone with potassium permanganate would not affect floodplain function or value, nor present a risk to life/safety or capital investment. Floodplains have, therefore, been dismissed from detailed analysis, and an SOF for floodplains is not required.

Wild and Scenic Rivers

The use of rotenone would not affect any designated or recommended wild and scenic rivers. No wild and scenic rivers are in the project area. This topic has, therefore, been dismissed from detailed analysis.

Wildlife (excluding common loons, other water birds, and grizzly bears carried forward for detailed analysis)

The use of rotenone would not affect wildlife because, while highly toxic to fish and aquatic gilled organisms, rotenone has been shown to have much lower toxicity to mammals and birds. The concentration of rotenone that would be used (5-percent formulated product at 1 ppm), resulting in an active ingredient concentration of 0.05 milligrams per liter) is at least one order of magnitude lower than “No Observed Adverse Effect Levels” (NOEL) in mammals and birds, and well below the 200-ppb maximum limit for rotenone treatments set by the American Fisheries Society (Finlayson et al. 2010). Studies of rats showed a No Observed Effect Level of 7.5 ppm. Mallards and pheasants had an LD50 (lethal dose needed to kill 50% of the test subjects) of 2,000 ppm and 1,680 ppm, respectively (Negerhbon 1959). These are unrealistically high doses that would not be achieved by either birds or mammals under proper label application. California Department of Fish and Game (1994) studies of risk for terrestrial animals estimated that a 22-pound dog would have to drink 7,915 gallons of lake water within 24 hours or eat thousands of pounds of rotenone-killed fish to receive a lethal dose. The State of Washington reported that a half-pound mammal would need to consume 12.5 milligrams of pure rotenone to receive a lethal dose (Bradbury 1986). There would be insufficient quantities of rotenone to represent a risk of acute effects in terrestrial animals that may scavenge and consume fish killed by rotenone or rotenone treated water (EPA 2007). The potential for wildlife to scavenge on rotenone-killed fish would also be low, since dead fish that do not remain submerged would be sunk in the lake.

The application of potassium permanganate to detoxify the rotenone would not impact wildlife because concentrations would be far below levels that are toxic to birds and mammals. An average rat weighing about 0.5 pound would need to drink, at one time, between 84 to 253 liters of potassium permanganate-treated water to receive a lethal dose. Therefore, at the anticipated neutralization rate (2 to 4 milligrams per liter) that would be used for this project, it will not be possible for birds or mammals in the treatment area to receive an acute dose. Toxic effects to wildlife are also not possible over the long term because potassium permanganate would only be applied for a period of approximately three to four weeks, and its components will completely dissipate over time (by the following spring if not sooner).

Human activity and noise from helicopters, motorboats, and a generator(s) could disturb or displace individual wildlife within or near the project area (see ***Chapter 3, Natural Soundscapes*** for a detailed analysis of anticipated noise impacts). Effects could range from physiological responses (e.g., increased heart rate) with no observable physical displacement, to disruptions of behaviors such as foraging, to the observable physical displacement of one or more individuals. The extent and duration of displacement would vary depending on the species. Smaller animals may find undisturbed habitat only a short distance away (e.g., a few feet or meters), while larger animals may need to travel further to achieve a comfortable distance from the source of disturbance. The potential for displacement would be temporary, lasting until the project concludes. Project activities are estimated to be underway for approximately three to four weeks but could be longer in duration if a second application is immediately necessary (i.e., during the same year). Any temporarily displaced wildlife would likely resume use of the area after the project, and several individual animals would probably continue to use the area while work is underway. There would be no impacts to nesting or denning, since the project would occur in the late summer/early fall (September), when critical nesting/denning periods for most species are over. This would also be the case if reapplication is necessary.

Removing rainbow trout from Gunsight Lake would remove a source of food for wildlife that prey on fish. The effects would be temporary, since the lake would be restocked with native fish, which would be available to fish-eating wildlife in an estimated three to four years. The temporary absence of fish-based prey in the lake would not cause an observable change to food availability since other kinds of prey/forage would remain available for generalist predators, and since fish would be available in other nearby lakes.

Rotenone treatments could cause reduced emergences of flying aquatic insects. But this would not measurably affect forage for bats, birds, and other wildlife species since a multitude of non-aquatic insects would remain; aquatic insects would be available in nearby, untreated waters and would migrate overland; other sources of food relied upon by non-insectivorous species (i.e., seeds, berries, vegetation) would remain unaffected; and aquatic insect species composition and abundance would likely return to pre-treatment conditions in two to four years.

Wildlife has been dismissed from detailed analysis because there would be no adverse impacts from rotenone or potassium permanganate; any disturbance or displacement effects would be temporary; and impacts to the availability of fish and aquatic insects as a source of food would be temporary and of little consequence given the availability of other prey and/or fish in nearby lakes. Impacts would occur only at the individual level, with no effects at the population level or to the distribution, composition, and abundance of wildlife within or surrounding the project area. State-listed species of concern and federally listed species that have been dismissed from detailed analysis are discussed in ***Appendix F***.

Cultural Resources, including historic structures, cultural landscapes, archeological resources, and ethnographic resources

There is one historic structure within the upper St. Mary River drainage, the South Circle Trail (T-052B) from Sperry Chalet to Sun Point which is listed with the National Register of Historic Places. There are also a number of archeological sites and trust resources. None of the project activities under Alternative A would have any potential to affect any of these resources. There would be no ground disturbance and no potential to impact archeological resources. The South Circle Trail (T-052B) has not been evaluated under cultural landscape

criteria, but effects to the trail are not anticipated beyond possible visibility of equipment. Visual effects would not be permanent since all equipment would be removed at the end of the project and may not be detectable since the treatment area would be closed during rotenone application and detoxification. Ethnographic resources exist in the project area. Rotenone is plant based and breaks down rapidly (approximate half-life of seven days). It does not travel well in ground water and rapidly binds to organic matter. These properties limit the ability of rotenone to accumulate in the surrounding plant communities used for traditional gathering. Glacier recognizes that the tribes hold a body of knowledge that may result in the future identification of ethnographic resources in or near the project area; consultation with the tribes would continue during implementation of the project to identify any necessary mitigation measures. Tribal consultation is underway and any issues identified by the tribes would be addressed as the NPS completed the NEPA review. For these reasons, cultural resources have been dismissed from detailed analysis.

Visual Resources

Project equipment, including watercraft and helicopters during long-line sling load and fish planting operations, would be visible in the project area. Most effects to visual resources would not be observable because the treatment area would be closed to the public during rotenone application and detoxification. The visibility of helicopters would have adverse impacts to visual resources along the flight path, with an estimated 15 flights needed during the approximately four weeks of rotenone application and detoxification phase of the project, followed by an estimated one to two flights per year for six to eight years for translocation. The effects from the flights would be episodic and short-lived, occurring only when the helicopter is in the area, and becoming infrequent after rotenone application. Otherwise, observable impacts to visual resources would generally be limited to the activities of personnel and equipment, such as motorboats, drip stations, electrofishing gear, trap nets, and remote monitoring stations. These impacts would be localized to the project area with no effects to the park's landscape and scenery. Apart from equipment needed to monitor translocated fish, equipment would be removed at the end of the project and any observable impacts would be temporary. Given the low intensity and duration of impacts, visual resources have been dismissed from detailed analysis.

Human Health and Safety

Rotenone is registered with the EPA and approved for use as a fish toxicant (Finlayson et al. 2010). Acute oral toxicity for humans would require a 150-pound person to eat between 5 and 71 ounces of pure formulation in order to die (Bradbury 1986). Gleason et al. (1969) estimated the lowest dose for human lethality would require a 60-kilogram (130 pounds) person to consume 180,000 liters (47,550 gallons) of water containing 0.1 milligram per liter rotenone or eat 180 kilograms (397 pounds) of rotenone-killed fish at one sitting. The EPA standard for safe drinking water threshold is 40 ppb rotenone, which is 20 percent below the 1 ppm target application concentration (M. Boyer, MFWP, personal communication). Given a half-life of rotenone of up to seven days, this concentration would be achieved in less than a week. Finlayson et al. (2001) 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." While the label requirements for rotenone state that public entry into the treatment area could occur immediately after application, the treatment area would be temporarily closed to visitors, warning signs would be posted, and news releases would be issued ahead of time to minimize the chance of public exposure.

When potassium permanganate is combined with rotenone, the rotenone is oxidized, and the potassium permanganate is reduced to potassium, manganese oxide (found naturally in the earth's crust), and water (USFWS 2015). The recommended daily allowance for potassium is 4,700 milligrams per day for an average adult. At the project concentration of 1 to 3 milligrams per liter potassium the amount of potassium would be far too low to present any threat of toxicity. Manganese is an essential element in humans and is required at low levels but chronic exposure at doses may be harmful. The recommended daily intake is 2 to 5 milligrams per day for an adult. At the concentrations that would be used for this project a person would have to drink more than three liters of water from the treatment area every day for life at undiluted levels (the concentration would dilute over time) for a potential effect (USEPA and HECD 2004). Since potassium permanganate would

only be applied for an estimated three to four weeks, this level of exposure is not possible. In addition, the project area would be closed to the public, so humans would not be exposed to water treated with potassium permanganate. Only trained personnel would apply rotenone. Application would follow all labeled instructions. Any risk to human safety during application would be avoided through training, personal protective equipment, and adherence to the Montana Department of Agriculture application requirements. Application requirements would also be followed when handling potassium permanganate, which can be an irritant to eyes, skin, respiratory system, and the gastrointestinal tract when handled improperly. Prior to use of any chemicals, emergencies procedures would be developed, provided to personnel, and kept on site during implementation.

Socioeconomics and Environmental Justice

The project would not alter spending, environmental justice, income, or employment in the local or regional economy. Socioeconomics would not, therefore, be affected and this topic has been dismissed. The proposed action would not contribute to any disproportionately high health and environmental risks found among low-income and minority communities.

Night Skies

There would be no impacts to night skies since the project would not require the use of nighttime lighting (except as necessary for overnight camping, e.g., headlamps, etc.). Night skies have, therefore, been dismissed from further analysis.

Climate Change

GHG emissions would occur during the proposed action due to transportation of equipment, and operation of motorboats, generators, and water pumps usage by burning fossil fuels. The EPA's GHG Equivalencies Calculator was used to estimate the project's GHG emissions based on fuel consumption. The project is estimated to emit approximately 32,000 pounds (15 metric tons) of carbon dioxide equivalent. GHG emissions would be temporary and sporadic throughout the project life over and estimated six to eight years. The project is not removing carbon sinks (i.e., forests holding carbon dioxide) or contributing long-term to GHG emissions. A release of approximately 15 metric tons of GHG is insignificant compared to the 6.4 million metric tons released by the US yearly, accounting for 0.0002% of US emissions (EPA 2022). Given existing and ongoing GHG emissions in the park from high levels of vehicle traffic and other activities, including administrative helicopter flights and motorboat use, the temporary use of gas-powered equipment for this project is not expected to notably change or increase GHG emissions in the park. The project would not undermine or cancel the benefits of ongoing efforts to reduce GHG emissions parkwide. For these reasons, climate change has been dismissed from further analysis.

Approximate fuel consumption estimated by NPS staff. These numbers are an approximation and could be greater or less than, depending on model usage and duration of the project

Vehicle	Fuel Usage	Total Gallons of Fuel
Transportation Needs		
Pickup Truck (4)	50 gallons/tank	200
Pickup Truck (1)	50 gallons/tank over three weeks	150
Helicopter (UH-1 or equivalent)	90 gallons/hour	900
Helicopter (Bell 407 or equivalent)	45 gallons/hour	225
Operations Needs		
Portable water pump (2)	2 gallons/hour	50
Generator (2200 watt)	30 days	90
Motorboat (4-stroke, 20 horsepower)	1.75 gallons/ hours	21
Total Fuel		**1,636 gallons**

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Appendix F – Federally and State Listed Species Dismissed from Detailed Analysis

Species and Special Listing Status	**Habitat type, distribution, and documentation in Glacier National Park**	**Impacts and reason for dismissal from detailed analysis**
Native Lake Trout (*Salvelinus namaycush*) state listed species of concern	Lake trout are native to the South Saskatchewan River drainage of the park. In where both lake and bull trout are native, lake trout are the dominant species in lake habitats almost to the exclusion of bull trout (NPS 2018). Lake trout are non-native and introduced to the Missouri River drainage and the west side of the park. Lake trout inhabit very deep, cold lakes, living in water up to 200 feet deep.	Lake trout are not present in the project area.
Pygmy whitefish (*Prosopium coulterii*) State listed species of concern	Pygmy whitefish are a native salmonid in northwestern Montana. In Glacier, they are native to some of the waters in the Middle Fork of the Flathead River drainage (Lake McDonald and Harrison Lake) and the South Saskatchewan River drainage (Upper Waterton Lake).	Pygmy whitefish do not inhabit the upper St. Mary River drainage and are not present in the project area.
Deepwater sculpin (*Myoxocephalus tompsonii*) State listed species of concern	Deepwater sculpin have only been documented in Upper Waterton Lake in the South Saskatchewan River (Hudson Bay) drainage of Glacier and Waterton Lakes National Park, Alberta (Sheldon et al. 2008). As a glacial relict species, the isolated distribution of this fish in Montana is a result of glaciers and ancient fragmentation of aquatic habitats. The next nearest population of deepwater sculpin is more than 500 kilometers to the north (Sheldon et al. 2008).	Deepwater sculpin are only known to inhabit the park in Upper Waterton Lake. The species are not, therefore, present in the project area.
Spoonhead sculpin (*Cottus ricei*) State listed species of concern	Spoonhead sculpin are found only in the St. Mary and Waterton River drainages of Glacier and the adjacent Blackfeet Indian Reservation. Like the deepwater sculpin, spoonhead sculpin have a much wider distribution in Canada, extending eastward beyond the Great Lakes.	Spoonhead sculpin are not present in the project area.

Species and Special Listing Status	**Habitat type, distribution, and documentation in Glacier National Park**	**Impacts and reason for dismissal from detailed analysis**
Troutperch (*Percopsis omiscomaycus*) State listed species of concern	Troutperch is a species of limited distribution and is native to St. Mary and Waterton Lakes in the South Saskatchewan River (Hudson Bay) drainage of Glacier, as well as the adjacent Blackfeet Indian Reservation.	Troutperch are not present in the project area.
Monarch Butterfly (*Danaus plexippus*) State listed species of concern and a candidate for listing under the ESA	Monarch butterflies are a long-range, migrating butterfly found throughout the continental United States particularly associated with open, native prairies, foothills, valley bottoms, roadsides, pastures, and wet meadows. In Glacier, monarchs have been reported in mesic montane meadows (Montana Field Guide 2023).	Habitat for monarchs does exist within the project area and adult individuals may pass through during project activities; however, no part of a monarch's life-stage occurs in water, so no larvae would be harmed. Additionally, no nectar feeding plants or host plant species for monarch butterflies or caterpillars will be removed during project activities. Montana Heritage Data has no recorded observations. No impacts to vegetation or monarch habitat are proposed for the project.
Northern Rocky Mountain Refugium Stonefly (*Soyedina potteri*) State listed species of concern	This stonefly is found in small streams and springs and has been documented in both Montana and Idaho (Baumann et al. 1977). Based on collection locations, it is likely a cold-water obligate species with a narrow temperature tolerance (less than 10 degrees Celsius, 50 degrees Fahrenheit) (MNHP 2020a). In Montana, the species has generally been collected in small, forested streams that are either fishless or contain westslope cutthroat trout (MNHP 2020a). A scattered distribution of this stonefly has been documented in the park; surveys conducted in 2018 failed to detect this species in the project area.	There is some chance the northern Rocky Mountain refugium stonefly could be present in the project area. In the off chance that the stonefly is present, its larvae could be killed by the rotenone or potassium permanganate, causing adverse impacts at the individual level. The loss of individuals from the treatment area would not have long term impacts to the northern Rocky Mountain refugium stonefly at the population level, because studies have shown rapid recolonization following rotenone treatments. Recolonization would occur from the migration of individuals from untreated upstream and downstream areas, as well as from individuals within the treatment area that survive the rotenone. For this reason and given the very low likelihood that it is present in the project area, the species is dismissed from detailed analysis.

Species and Special Listing Status	**Habitat type, distribution, and documentation in Glacier National Park**	**Impacts and reason for dismissal from detailed analysis**
Western Glacier Stonefly *(Zapada glacier*) State listed species of concern and listed as threatened under the ESA	The western glacier stonefly is associated within the outlet streams of glacially fed lakes and glacier-associated streams. The species has an extremely limited distribution and is only known from a handful of sites in Glacier and the Teton Mountain Range in Wyoming (Giersch et al. 2017). The western glacier stonefly has a restricted distribution in the park. Despite parkwide surveys, the species has not been documented in the project area.	It is highly unlikely that the western glacier stonefly is present in the treatment area given the species' limited distribution and the distance between the treatment area and permanent snow and ice sources. Recent surveys have failed to document the presence of this species in the treatment area, and the treatment area does not provide typical habitat. For these reasons, the western glacier stonefly has been dismissed from further analysis.
Meltwater Lednian Stonefly (*Lednia tumana*) State listed species of concern and listed as threatened under the ESA	The meltwater lednian stonefly is found in extremely cold glacier/snowmelt-fed springs and streams at high elevations, within a few hundred meters of snowfields. It is believed to be endemic to the Banff National Park and Glacier areas, with collections occurring in Glacier or on nearby US Forest Service and Confederated Salish and Kootenai Tribal lands (Giersch et al. 2017). The species has been documented within the Gunsight Lake drainage but only in upstream areas that would not be treated with rotenone.	Recent surveys have failed to document the presence of the meltwater lednian stonefly in the treatment area. Water temperatures in Gunsight Lake and downstream of Gunsight Lake are likely too warm and the treatment area is not typical habitat for the species. The species is dismissed from detailed analysis because it is not likely present.

Species and Special Listing Status	**Habitat type, distribution, and documentation in Glacier National Park**	**Impacts and reason for dismissal from detailed analysis**
Alberta Snowfly (*Isocapnia integra*) State listed species of concern	Very little information exists about the ecology of the Alberta snowfly. Early records report specimens in Banff National Park and the North Fork of the Flathead River, which are both cold water systems. The Alberta snowfly is a groundwater species, tending to inhabit floodplains. The species has only been collected twice in the interior of the park, at Preston Park (J. Giersch, personal communication), though multiple records exist from the mainstem Middle Fork and North Fork of the Flathead River bordering Glacier National Park (Zenger and Baumann 2004). Surveys conducted in 2018 failed to detect this species in the project area.	The Alberta snowfly could be present in the treatment area. In the off chance that the species is present, its larvae could be killed by the rotenone or potassium permanganate, causing adverse impacts at the individual level. The loss of individuals from the treatment area would not have long term impacts to the Alberta snowfly at the population level, because studies have shown rapid recolonization following rotenone treatments. Recolonization would occur from the migration of individuals from untreated upstream and downstream areas, as well as from individuals within the treatment area that survive the rotenone. For these reasons and because it is not likely present, the Alberta snowfly has been dismissed from detailed analysis.
Hooked Snowfly (*Isocapnia crinita*) State listed species of concern	The hooked snowfly is a stonefly with very limited and/or potentially declining population numbers, range and/or poorly sampled habitat. As with the Alberta snowfly, the hooked snowfly is a groundwater species, inhabiting floodplain habitat in larger streams and rivers (Zenger and Baumann 2004; J. Giersch, personal communication). Surveys conducted in 2018 failed to detect this species in the project area.	The species has been found in the park but is not likely in the treatment area given the absence of suitable habitat (J. Giersch, personal communication). In the off chance that the species is present, its larvae could be killed by the rotenone or potassium permanganate, causing adverse impacts at the individual level. The loss of individuals from the treatment area would not have long term impacts to the hooked snowfly at the population level, because studies have shown rapid recolonization following rotenone treatments. Recolonization would occur from the migration of individuals from untreated upstream and downstream areas, as well as from individuals within the treatment area that survive the rotenone. The hooked snowfly has been dismissed from detailed analysis for these reasons, and because the species is not likely present.

Species and Special Listing Status	**Habitat type, distribution, and documentation in Glacier National Park**	**Impacts and reason for dismissal from detailed analysis**
Springs Stripetail (*Isoperla petersoni*) State listed species of concern	The springs stripetail is a rare cold-water stonefly occurring in small springs and spring-fed creeks with nymphs occupying large woody debris accumulations and mossy cobbles. The species has limited distribution in Montana but is found elsewhere in the Northern and Southern Rocky Mountains, including Alberta, British Columbia, Wyoming, Idaho, and Utah. The species has been collected in the park, but is not likely in the treatment area because most records are from lower elevations (J. Giersch, personal communication). Surveys conducted in 2018 failed to detect this species in the project area.	The springs stripetail has been collected in the park but is not likely in the treatment area because most records are from lower elevations (J. Giersch, personal communication). In the off chance that the species is present, its larvae could be killed by the rotenone or potassium permanganate, causing adverse impacts at the individual level. The loss of individuals from the treatment area would not have long term impacts to the springs stripetail at the population level, because studies have shown rapid recolonization following rotenone treatments. Recolonization would occur from the migration of individuals from untreated upstream and downstream areas, as well as from individuals within the treatment area that survive the rotenone. For these reasons and because the species is not likely present, the springs stripetail has been dismissed from detailed analysis.
Three species of caseless caddisflies (*Rhyacophila glaciera; R. potteri; R. rickeri*) State listed species of concern	*Rhyacophila glaciera, R. potteri*, and *R. rickeri* are all high-elevation and cold-water dependent species (J. Giersch, personal communication). Specimens from the genus *Rhyacophil*a have been collected in the park during MFWP sampling in 2016, but enough information was not available for definitive species identification of larval stages (M. Schnee, MFWP, personal communication). These species have not been documented within the rotenone treatment area during 2018 surveys	As with cold-water stoneflies described above (western glacier stonefly, meltwater lednian stonefly, Northern Rocky Mountain refugium stonefly), there is a remote chance that these species could be present in the treatment area. In the off chance that any of these caddisfly species are present, their larvae could be killed by the rotenone or potassium permanganate, causing adverse impacts at the individual level. The loss of individuals from the treatment area would not have long term impacts to any of these four species at the population level, because studies have shown rapid recolonization following rotenone treatments. Recolonization would occur from the migration of individuals from untreated upstream and downstream areas, as well as from individuals within the treatment area that survive the rotenone. Therefore, and because the species is not likely present, these four caddisfly species have been dismissed from detailed analysis.

Species and Special Listing Status	**Habitat type, distribution, and documentation in Glacier National Park**	**Impacts and reason for dismissal from detailed analysis**
Canada lynx (*Lynx Canadensis*) State listed species of concern and listed as threatened under the ESA	Preliminary lynx habitat modeling for the park defined moist conifer forest above 4,000 feet in elevation as most likely to support lynx. Habitat throughout the park meets these criteria and the park has documented lynx presence in the North Fork, McDonald, Saint Mary, Many Glacier, and Two Medicine Valleys. No lynx den sites have been documented, but family groups have been observed via remote camera stations, and winter tracking has indicated the presence of resident lynx populations in the North Fork, Middle Fork, Many Glacier, and Two Medicine Valleys and elsewhere on the east side of the Continental Divide. There is suitable habitat in the St. Mary River drainage and recent research detected one individual at the head of St. Mary Lake (Anderson et al. 2023).	If individual lynx are in the project area during project activities, they could be disturbed or displaced by noise and activity. Displacement effects would be temporary, with no measurable change in lynx behavior or essential activities. The proposed action would not affect lynx prey, and except for helicopter flights for translocation (estimated at one or two flights per year for three to six to eight years), would not occur during the sensitive denning period in the spring. For these reasons, any adverse impacts would be negligible or less, potentially affecting Canada lynx only at the individual level, with no effects to distribution, population, or abundance.
Wolverine (*Gulo gulo*) State listed species of concern and proposed for federal listing as threatened under the ESA	The wolverine is a wide-ranging mustelid that uses a range of habitats, including alpine areas, mature forests, ecotonal areas, and riparian areas. Wolverine typically inhabit high-elevation areas that maintain deep snow late into the warmer months of the year. Glacier's alpine areas provide very high-quality wolverine habitat, and the species is well documented within the park. There are records of wolverine observations at Gunsight Pass as well as in the St. Mary River drainage below Gunsight Lake (MNHP 2020b). It is anticipated that the species will use the drainage sporadically.	If individual wolverines are in the project area during project activities, they could be disturbed or displaced by noise and activity. Displacement effects would be temporary, with no measurable change in behavior or essential activities. The proposed action would not affect wolverine prey and except for helicopter flights during translocation (estimated at one or two flights per year for three to six to eight years), would not occur when wolverine are denning in the spring. For these reasons, any adverse impacts would be negligible or less, potentially affecting wolverines only at the individual level, with no effects to distribution, population, or abundance.

Species and Special Listing Status	**Habitat type, distribution, and documentation in Glacier National Park**	**Impacts and reason for dismissal from detailed analysis**
Fisher (*Pekania pennanti*) State listed species of concern	The fisher is a large mustelid that prefers densely forested habitat. Based on surveys, it is highly unlikely that fishers are residents of the park. Previous credible reports may have been individuals dispersing from areas outside the park (Waller 2018).	Because there is no recent evidence of fishers in the park, the species would not likely be present in the project area. Any fisher presence would likely be dispersing individuals and would, therefore, be sporadic. In the unlikely event that individuals are disturbed or displaced by noise or human activity, widespread areas of undisturbed habitat would be readily available. Any effects would, therefore, be temporary, with no measurable change in fisher behavior or essential activities.
Little Brown Bat (*Myotis lucifugus*) State listed species of concern	Little brown bats use a variety of habitats, and frequently forage over water. The species uses buildings, bridges, caves, abandoned mines, snags, and loose bark for hibernacula, maternity roosts, and/or day roosts. Little brown bats are common in the park, with numerous recorded observations. There are no recorded observations from the upper St. Mary River drainage (MNHP 2020b).	Little brown bats could be present in the project area, and potentially be at risk of disturbance or displacement due to project noise and activity. But bats are highly mobile, and undisturbed adjacent habitat would be available. Any displaced bats would likely resume use of the area once human activity has stopped, and/or continue to use habitat in the project area while work is underway. Rotenone treatments could cause reduced emergences of flying aquatic insects. But this would not measurably affect foraging for bats, since bats also feed on non-aquatic insects, of which a multitude would remain. Aquatic insect species composition and abundance would also likely return to pre-treatment conditions in two to four years. Rotenone treatments would occur in late summer/early fall, after pups have left maternity roosts. For these reasons, any adverse impacts would be negligible, with potential to only affect the little brown bat at the individual level and no biologically meaningful effects to essential activities such as roosting or foraging, no measurable effects to overall distribution, and no effects to population and abundance.
Bald Eagle (*Haliaeetus leucocephalus*) State listed species of concern	Bald eagles are well documented in Glacier and nest at several of the park's larger lakes. The park is also within a major bald eagle migration corridor (McClelland et al. 1994, Yates et al. 2001). Bald eagles have been documented at Gunsight Lake (MNHP 2020b), but nesting has not been observed. Gunsight Lake is likely too small to support nesting pairs of bald eagles.	Migrating bald eagles as well as eagles nesting elsewhere in the park may occasionally use lake Gunsight Lake for forage. But given numerous large lakes on the east side of the park, including St. Mary, and several tributaries that provide optimal forage for bald eagles, Gunsight Lake is not likely an essential foraging area. Bald eagles may be disturbed by helicopters flights. Through consultation with the park's wildlife staff, locations of active nests and eagle migration routes would be avoided whenever possible during flights. This would reduce the risk of impacts such that any adverse impacts would be negligible, with potential to only affect bald eagles the individual level, with no biologically meaningful effects to essential activities such as nesting or foraging, no measurable effects to overall distribution, and no effects to bald eagle population and abundance.

Species and Special Listing Status	**Habitat type, distribution, and documentation in Glacier National Park**	**Impacts and reason for dismissal from detailed analysis**
Northern Hawk Owl (*Surnia ulula*) State listed species of concern	Northern hawk owls are found in moderately dense coniferous or mixed coniferous-deciduous forests with suitable perch sites, often adjacent to wet meadows and marshes or openings. The species is present in Glacier, with strong association with burned forests. There are no records of this species from the upper St. Mary River drainage (MNHP 2020b).	If present, individual hawk owls could be disturbed or displaced by project noise and activity. The project would occur after the breeding and nesting period, however, and would not alter the availability of forage. Any displaced individuals would likely resume use of the area once human activity has stopped, and/or continue to use the area while work is underway. For these reasons, any adverse impacts would be negligible, potentially affecting the species only at the individual level, with no biologically meaningful effects to essential activities such as nesting or foraging, no measurable effects to overall distribution, and no effects to populations and abundance.
Northern Goshawk (*Accipiter gentilis*) State listed species of concern	Northern goshawks prefer mature conifer forest with a dense canopy cover. Nesting occurs in a variety of forest types with nest sites constructed high up in larger diameter trees. The species is known to nest within the park, although there are no records of this species in the upper St. Mary River drainage (MNHP 2020b).	Goshawks could be present in the project area, and potentially be at risk of disturbance or displacement due to project noise and activity. But the project would not occur until after the breeding and nesting period. Goshawks would likely resume use of the area once human activity has stopped. The project would not alter the availability of goshawk prey. For these reasons, any adverse impacts would be negligible, with potential to only affect goshawks at the individual level, and no biologically meaningful effects to essential activities such as nesting or foraging, no measurable effects to overall distribution, and no effects to population and abundance.
Great Gray Owl (*Strix nebulosi*) State listed species of concern	Known to use lodgepole pine/douglas-fir habitats; nesting occurs in the tops of large broken-off tree trunks, old nests of other large birds, or in dwarf mistletoe platforms. The species is known to nest within Glacier, although there are no records of this species in the upper St. Mary River drainage (MNHP 2020b).	Great gray owls could be present in the project area, and potentially be at risk of disturbance or displacement due to project noise and activity. But the project would not occur until after the breeding and nesting period. Individual owls may continue to use habitat in the project area while work is underway or would likely resume use of the area once human activity has stopped. The project would not alter the availability of prey. For these reasons, any adverse impacts would be negligible, with potential to affect the species only at the individual level. There would be no biologically meaningful effects to essential activities such as nesting or foraging, no measurable effects to overall distribution, and no effects to population and abundance.
Great Blue Heron (*Ardea herodias*) State listed species of concern	Great blue herons' nest in colonies in cottonwoods along rivers and lakes. The birds may use ponderosa pines or nest on the ground on treeless islands, and feed on fish, amphibians, invertebrates, reptiles, and small birds and mammals. The species is present in the park and has been recorded below Gunsight Lake in the St. Mary River drainage (MNHP 2020b).	Great blue herons could be present in the project area, and potentially be at risk of disturbance or displacement due to project noise and activity. But project activities would not occur until after the breeding and nesting period. Great blue herons would likely resume use of the area once human activity has stopped. The project would not alter the availability of prey for great blue herons. For these reasons, any adverse impacts would be negligible, with potential to only affect the species at the individual level, and no biologically meaningful effects to essential activities such as nesting or foraging, no measurable effects to overall distribution, and no effects to populations and abundance.

Species and Special Listing Status	**Habitat type, distribution, and documentation in Glacier National Park**	**Impacts and reason for dismissal from detailed analysis**
Horned grebe (*Podiceps auritus*) State listed species of concern	Horned grebes are found in freshwater ponds and marshes and use large bodies of water (rivers and lakes) in spring and fall. Grebes prey on aquatic insects and crustaceans. Horned grebes have been recorded on numerous lakes in the park, including St. Mary (MNHP 2020b); there are no records of the species from Gunsight Lake.	If present, horned grebes could be disturbed by project noise and activity. But the project would not occur until after the breeding and nesting period. Rotenone could alter the availability of aquatic insect prey. But this would be temporary, as aquatic insect species composition and abundance would be expected to return to pre-treatment conditions in two to four years. For these reasons, there would be no biologically meaningful or noticeable impacts to the species.
Black Swift (*Cypseloides niger*) State listed species of concern	Black swifts typically nest behind or near waterfalls on steep cliff faces where the nests are inaccessible to predators and there are unobstructed flyways. Black swifts forage over open water feeding primarily on flying insects and arthropods. The species is known to nest in the park. There are two records of black swift nests in the waterfalls above Gunsight; habitat in the vicinity of the project area is considered optimal (MNHP 2020b).	If black swifts are present in the rotenone treatment area, the application of rotenone could cause a localized reduction in their prey, since rotenone would result in a reduced emergence of caddisflies, stoneflies, and other flying aquatic insects within the treatment area. These impacts would not occur until late in the summer (early September), when juvenile birds have an increased ability to fly and forage outside the treatment area. The treatment area would be surveyed for black swift nests prior to rotenone application. Since juvenile swifts could still be somewhat dependent on the nesting site for forage, if nests are present, rotenone would be applied as late in the summer as practicable (e.g. without missing optimal temperature and weather windows, for example), to further minimize potential impacts. Any reduction in prey would be temporary, as aquatic insect species composition and abundance would be expected to return to pre-treatment conditions in two to four years. This combined with the availability of foraging habitat beyond the treatment area and the presence of insects that would not be affected by rotenone, adverse impacts would be negligible, with potential to only affect black swifts at the individual level. There would be no biologically meaningful or lasting effects to essential activities such as nesting or foraging, no measurable effects to overall distribution throughout the park, and no effects to populations and abundance.
Varied Thrush *(Ixoreus naevius*) State listed species of concern	The varied thrush typically breeds in mature and old-growth mixed-coniferous forests and nests on the branches of conifers, the ground, or shrubs and vines. Varied thrushes forage on ground-swelling arthropods, as well as fruits and berries. The species is known to nest within Glacier and is generally common to the park. Varied thrushes have been observed in the St. Mary River drainage below Gunsight Lake (MNHP 2020b).	If present, individual varied thrushes could be disturbed or displaced by project noise and activity. The project would occur after the breeding and nesting period, however, and would not alter the availability of forage, which is not aquatic dependent. Any displaced individuals would likely resume use of the area once human activity has stopped, and/or continue to use the area while work is underway. For these reasons, any adverse impacts would be negligible, with potential to only affect the species at the individual level, with no biologically meaningful effects to essential activities such as nesting or foraging, no measurable effects to overall distribution, and no effects to population and abundance.

Species and Special Listing Status	**Habitat type, distribution, and documentation in Glacier National Park**	**Impacts and reason for dismissal from detailed analysis**
Boreal Chickadee *(Poecile hudsonicus*) State listed species of concern	Boreal chickadees prefer boreal coniferous and mixed forest habitat. Nests are typically constructed in natural cavities or abandoned woodpecker holes within one meter of the ground. Boreal chickadees forage on conifer and birch seeds and insects. The species is known to nest within Glacier. Boreal chickadees have been observed in the St. Mary River drainage below Gunsight Lake (MNHP 2020b).	If present, individual boreal chickadees could be at risk of disturbance or displacement from noise and human activity associated with the project. The project would occur after the breeding and nesting period, however, and would not alter the availability of forage, which is not aquatic dependent. Any displaced individuals would likely resume use of the area once human activity has stopped, and/or continue to use the area while work is underway. For these reasons, any adverse impacts would be negligible, possibly affecting boreal chickadees at the individual level, with no biologically meaningful effects to essential activities such as nesting or foraging, no measurable effects to overall distribution, and no effects to population and abundance.
Cassin's Finch (*Haemorhous cassinii*) State listed species of concern	Cassin's finches use a wide variety of forest habitats but prefer ponderosa pine and post-fire forests. Nests are typically constructed near the end of a tree branch. Cassin's finches feed primarily on seeds with a portion of their diet consisting of invertebrates. The species is known to nest within the park and has been recorded in the St. Mary River drainage below Gunsight Lake (MNHP 2020b).	Cassin's Finches could be present in the project area, and potentially be at risk of disturbance or displacement due to noise and activity. But project activities would not occur until after the breeding and nesting period. Cassin's finches would likely continue to use habitat in the area while work is underway or would resume use of the area once human activity has stopped. The project would not alter the availability of seeds or other forage. For these reasons, any adverse impacts would be negligible or less, potentially affecting the Cassin's finch at only the individual level, with no biologically meaningful effects to essential activities such as nesting or foraging, no measurable effects to overall distribution, and no effects to population and abundance.
LeConte's Sparrow (*Ammodramus leconteii*) State listed species of concern	Documented to use wet meadows within peatland habitats. Nests are typically constructed on or just above the ground in thick clumps of grass. LeConte's sparrows feed primarily on insects and seeds. LeConte's sparrows are known to nest within the park, although there are no observation records in the St. Mary River drainage (MNHP 2020b).	LeConte's sparrows are not likely to be present in the project area; if present they could be disturbed or displaced by project noise and activity. But project activities would not occur until after the breeding and nesting period. Individuals would likely continue to use habitat in the area while work is underway or would resume use of the area once human activity has stopped. Insect abundance could be reduced after treatment with rotenone, but this would not meaningfully affect the availability of forage for the LeConte's sparrow, since the species also relies on seeds. Aquatic insect populations would also recover within two to four years. For these reasons, any adverse impacts would be negligible, with potential to only affect the LeConte's sparrow at the individual level, and no biologically meaningful effects to essential activities such as nesting or foraging, no measurable effects to overall distribution, and no effects to population and abundance.

Species and Special Listing Status	**Habitat type, distribution, and documentation in Glacier National Park**	**Impacts and reason for dismissal from detailed analysis**
Evening Grosbeak (*Coccothraustes vespertinus*) State listed species of concern	Prefer habitats in mixed coniferous and spruce-fir forests. Nests are typically constructed in the upper portions of coniferous trees. Evening grosbeaks forage on invertebrates, seeds, and fruits. The species known to nest within the park, although there are no observation records in the upper St. Mary River drainage (MNHP 2020b).	Evening grosbeaks are not likely to be present in the project area, if present they could be at risk of disturbance or displacement due to noise and activity. But the project would not occur until after the breeding and nesting period. Individual evening grosbeaks would likely continue to use habitat in the area while work is underway or would resume use of the area once human activity has stopped. The project would not alter the availability of forage. For these reasons, any adverse impacts would be negligible, potentially only affecting evening grosbeaks at the individual level, with no biologically meaningful effects to essential activities such as nesting or foraging, no measurable effects to overall distribution, and no effects to population and abundance.
Pileated Woodpecker (*Dryocopus pileatus*) State listed species of concern	Inhabit late successional coniferous or deciduous forests. Roost and nest trees are typically larger diameter snags often with broken tops. Pileated woodpeckers primarily forage on wood-dwelling carpenter ants extracted from down woody material and standing live or dead trees. The species is known to nest within the park and has been recorded in the St. Mary River drainage below Gunsight Lake (MNHP 2020b).	This species could be present in the project area, and potentially be at risk of disturbance or displacement due to noise and activity. But project activities would not occur until after the breeding and nesting period. Pileated woodpeckers would likely continue to use habitat in the area while work is underway or would resume use of the area once human activity has stopped. The project would not alter the availability of prey. For these reasons, any adverse impacts would be negligible, with potential to only affect the species at the individual level, and no biologically meaningful effects to essential activities such as nesting or foraging, no measurable effects to overall distribution, and no effects to population and abundance.
Black-backed Woodpecker (*Picoides arcticus*) State listed species of concern	Inhabit early successional mixed conifer burned forests; nests are typically constructed in western larch/douglas-fir forests with an old-growth component. Black-backed woodpeckers feed on wood-boring beetle larvae and other insects. The species is known to nest within the park and has been recorded below Gunsight Lake (MNHP 2020b).	Black-backed woodpeckers could be present in the project area, and potentially be at risk of disturbance or displacement from noise and activity. But project activities would not occur until after the breeding and nesting period. Individual woodpeckers would likely continue to use habitat in a given area while work is underway or would resume use once human activity has stopped. The project would not alter the availability of forage for black-backed woodpeckers. For these reasons, any adverse impacts would be negligible, potentially affecting the species only at the individual level, with no biologically meaningful effects to essential activities such as nesting or foraging, no measurable effects to overall distribution, and no effects to population and abundance.

Species and Special Listing Status	**Habitat type, distribution, and documentation in Glacier National Park**	**Impacts and reason for dismissal from detailed analysis**
Lewis' Woodpecker *(Melanerpes lewis*) State listed species of concern	Typically prefer open forest habitats, including old-growth cottonwood forests and burned forests, with standing snags for nest cavities, dead or downed woody debris, perch sites, and abundant insects. During summer, the species forages opportunistically on adult emergent insects. Lewis' woodpeckers are known to nest within Glacier; although there have been no observation records in the St. Mary River drainage (MNHP 2020b).	Lewis' woodpeckers are not likely to be present in the project area, if present they could be at risk of disturbance or displacement due to noise and activity. But project activities would not occur until after the breeding and nesting period. Individual woodpeckers would likely continue to use habitat in the area while work is underway or would resume use once human activity has stopped. The project would not alter the availability of prey. For these reasons, any adverse impacts would be negligible, with potential to only affect Lewis' woodpeckers at the individual level, and no biologically meaningful effects to essential activities such as nesting or foraging, no measurable effects to overall distribution, and no effects to populations and abundance.
Water Howellia (*Howellia aquatilis*) State listed species of concern	Water howellia is a wetland species that has been documented in northwest Montana. However, there are no known locations of the species within the park, despite multiple survey efforts over the years.	If water howellia is documented during onsite wetland inventories prior to project implementation, the location of the plant(s) would be marked and avoided. Water howellia has been dismissed from detailed analysis because it has not been documented in the park, suggesting a low likelihood of presence, and there would be no effect to the species since, if detected during surveys, any locations would be marked and avoided.
Spalding's Campion (*Silene spaldingii*) State listed species of concern	Spalding's campion is an open grassland species that has been documented in northwest Montana. However, there are no known locations of the species within the park, despite multiple survey efforts over the years.	If Spalding's campion is documented during onsite wetland inventories prior to project implementation, the location of the plant(s) would be marked and avoided. Spalding's campion has been dismissed from detailed analysis because it has not been documented in the park, suggesting a low likelihood of presence, and there would be no effect to the species since, if detected during surveys, any locations would be marked and avoided.
Whitebark Pine (*Pinus albicaulis*) Federally listed as threated under the ESA and a state listed species of concern.	Whitebark pine are present in forested environments at elevations between 5000 and 7000 feet. The species is well documented in Glacier. There are seven records of whitebark pine along the ridges surrounding Gunsight Lake (MNHP 2018).	At approximately 5,200 Gunsight Lake is at the lower elevation zone for whitebark pine. If whitebark pine is present at or near the lakes, it would not be affected since the proposed action does not involve any ground or vegetation disturbing activities.
Moonworts (*Botrychium* spp.) State listed species of concern	Moonworts are found in wet areas. Seven species have been found in the park. There are no observations of the moonworts (*Botrychium* spp.) from along Gunsight Lake.	Moonworts could occur in the project area and be at risk of trampling. Surveys for rare plants, including moonworts, would occur prior to implementing the project. Any identified locations would be marked and avoided. The species would not, therefore, be affected.

Species and Special Listing Status	**Habitat type, distribution, and documentation in Glacier National Park**	**Impacts and reason for dismissal from detailed analysis**
Arctic Sweet Coltsfoot (*Petasites frigidus var. frigidus*) State listed species of concern	Found in swamps, fen margins, and riparian seeps within open forest and meadows in valley and foothill zones. The species is rare in Montana, where it is at the southern edge of its range and is known from a few widely scattered sites in the northwest corner of the state. Four populations have been documented in the park, but there are no records of the species along Gunsight Lake.	The species could occur in the project area and be at risk of trampling. Project areas where arctic sweet coltsfoot could be affected would be surveyed, and any identified locations would be marked and avoided. The species would not, therefore, be affected.
Tufted club-rush (*Tricophorum cespitosum)* State listed species of concern	Found in wet meadows and sphagnum-dominated fens in montane to alpine zones. The species is rare in Montana, where it is currently documented from over a dozen fens and wet meadows in the mountainous portion of western Montana. Four populations have been documented in the park. There are no records of the species in along Gunsight Lake.	The species could occur in the project area and be at risk of trampling. Project areas where the species could be affected would be surveyed, and any identified locations would be marked and avoided. The species would not, therefore, be affected.

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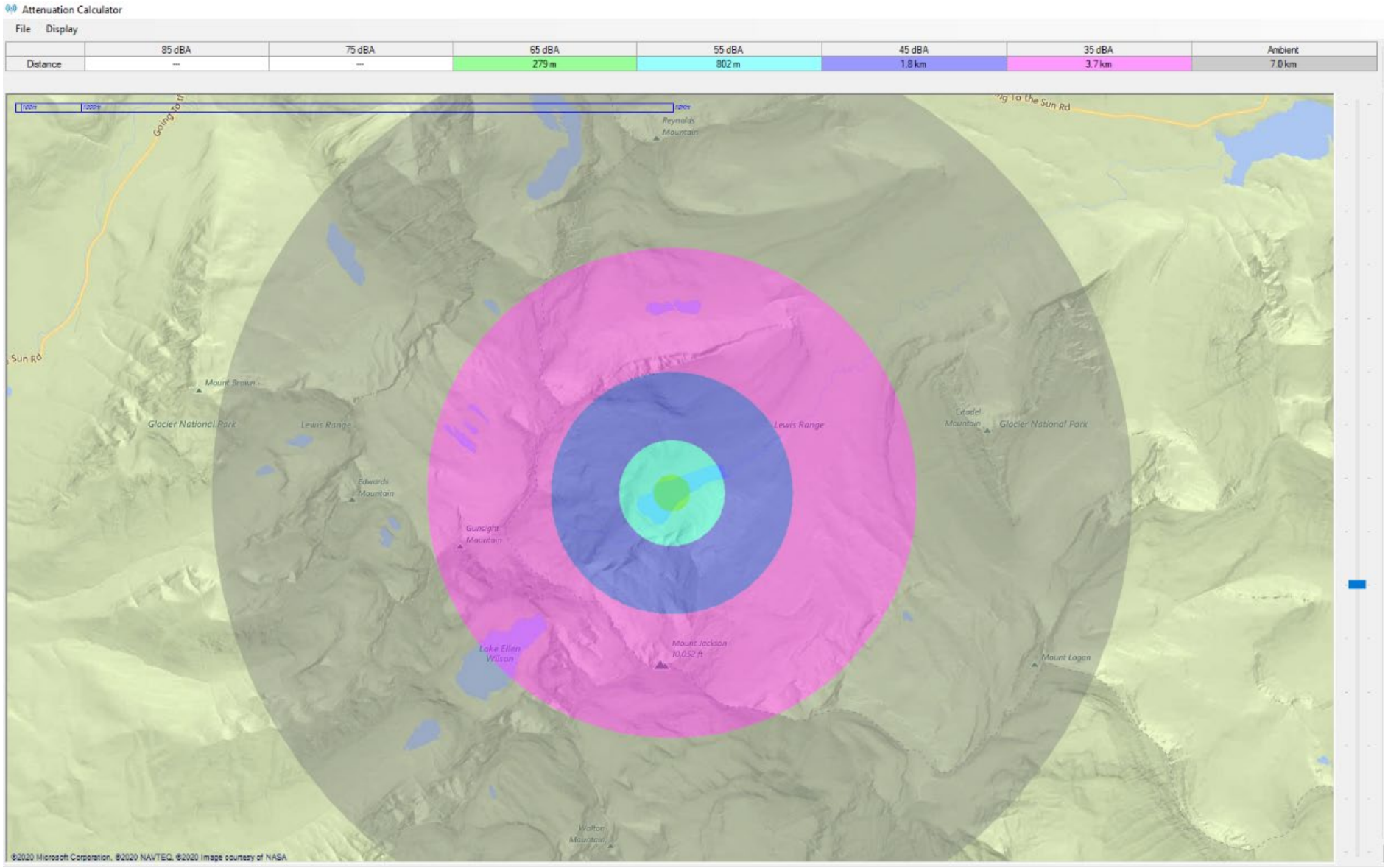
Appendix G – Results of NPS Natural Sounds and Night Skies Division sound mapping tool and attenuation calculator

The following graphics illustrate coarse approximations of the distances over which noise produced under Alternative A would need to travel before it attenuates to a natural ambient level of 30 dBA. Actual attenuation distances may be different than shown in the graphics because the exact make and model of helicopters, motorboats, and generator are not known at this time and so cannot be factored into the sound modeling. The model also only calculates noise produced at Gunsight Lake. Therefore, these graphics provide approximations and a comparison between the different attenuation distances for equipment that would be used. The makes and models of the equipment for each graphic are only examples, selected because they represent the same general type and sound level of equipment that would be used under Alternative A, and because noise data was obtainable for these models.

The NPS Natural Sounds and Night Skies Division incorporates a standard method of calculating the attenuation of noise with distance using a sound mapping tool and attenuation calculator. The attenuation calculator accounts for the effects of divergence or spreading loss, which accounts for a 20 dB decrease in level for every 10-fold increase in distance (spherical spreading is assumed). The frequency-dependent effects of atmospheric attenuation are also computed, with attenuation coefficients calculated according to standard formulae (ISO 9613-2 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation). Finally, the software utilizes a simplified method to approximate ground absorption along the transmission path. Sound propagation conditions are affected by the height of the source (AGL) and receiver (e.g. a person or animal receiving the sound), receiver height values, the ambient temperature, relative humidity, and atmospheric pressure values, and the porous ground values. The ISO 9613-2 standard assumes that sounds are propagating downwind, or equivalently, under a moderate temperature inversion favorable to long-range propagation. Under weather conditions that produce inversions, the attenuation calculator will underestimate the noise produced by the noise source.

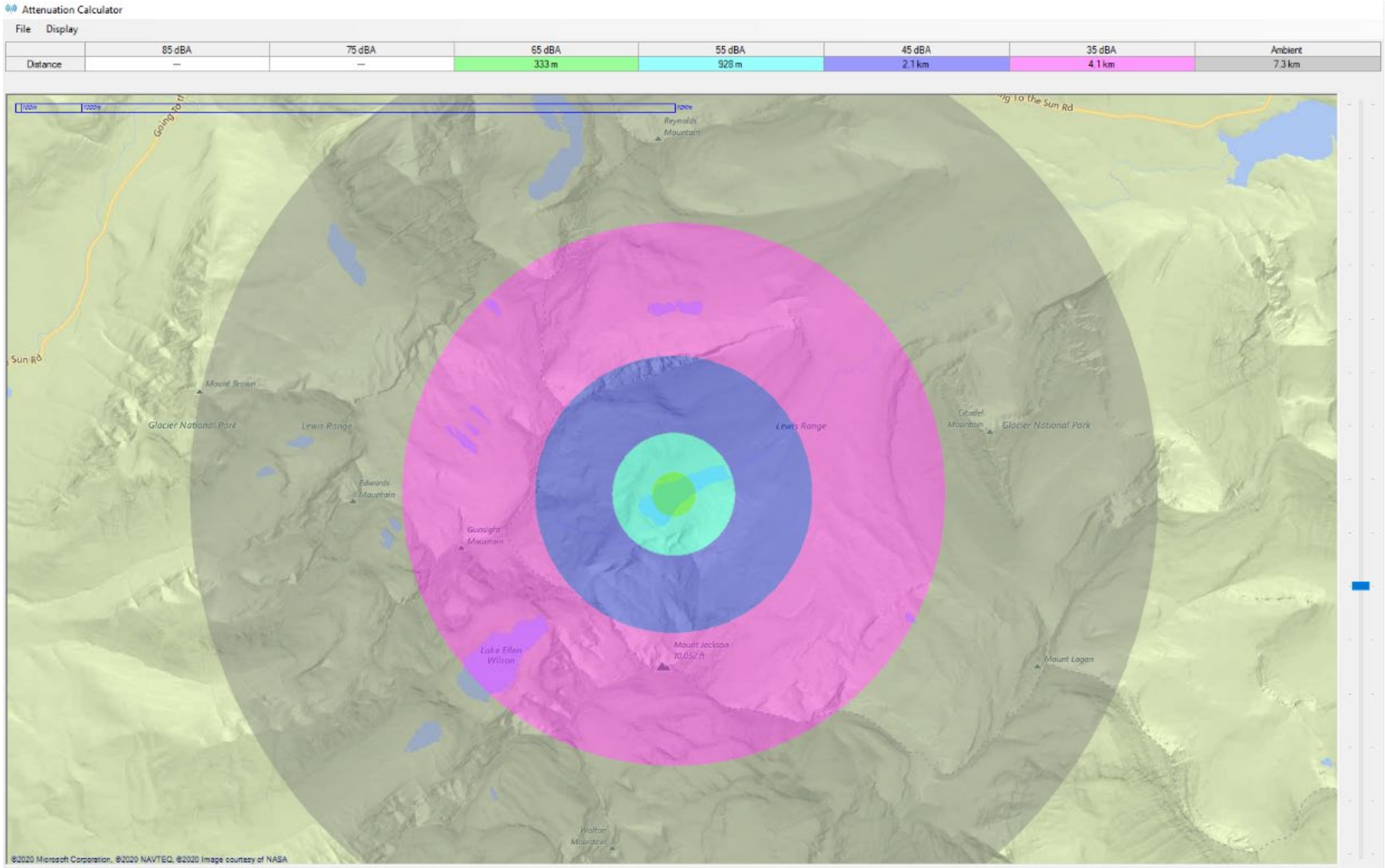
Helicopter A350

Noise would attenuate to ambient level (30 dBA) at approximately 7.0 kilometers (4.4 miles).



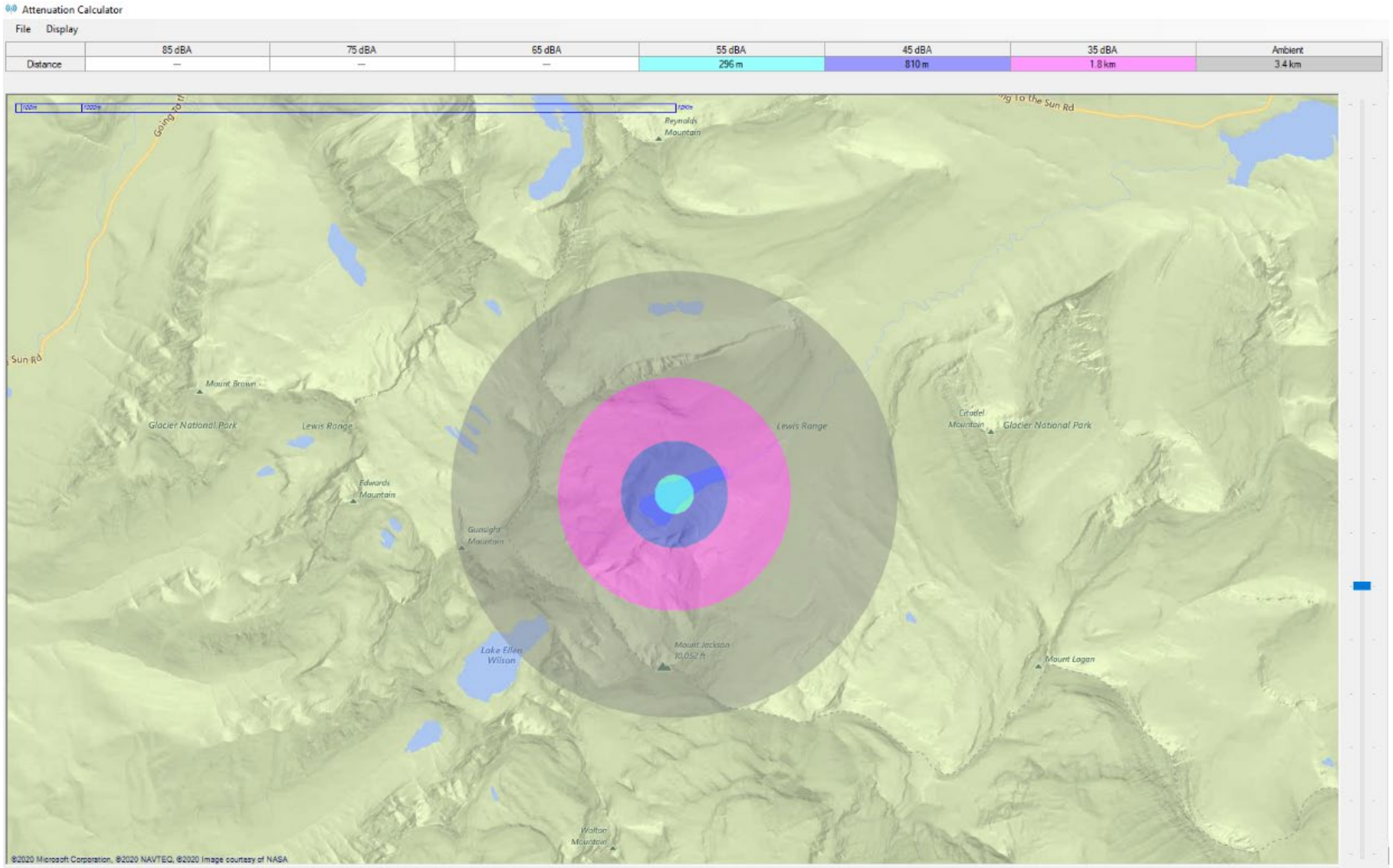
Helicopter B260B

Noise would attenuate to ambient level (30 dBA) at approximately 7.3 kilometers (4.5 miles).



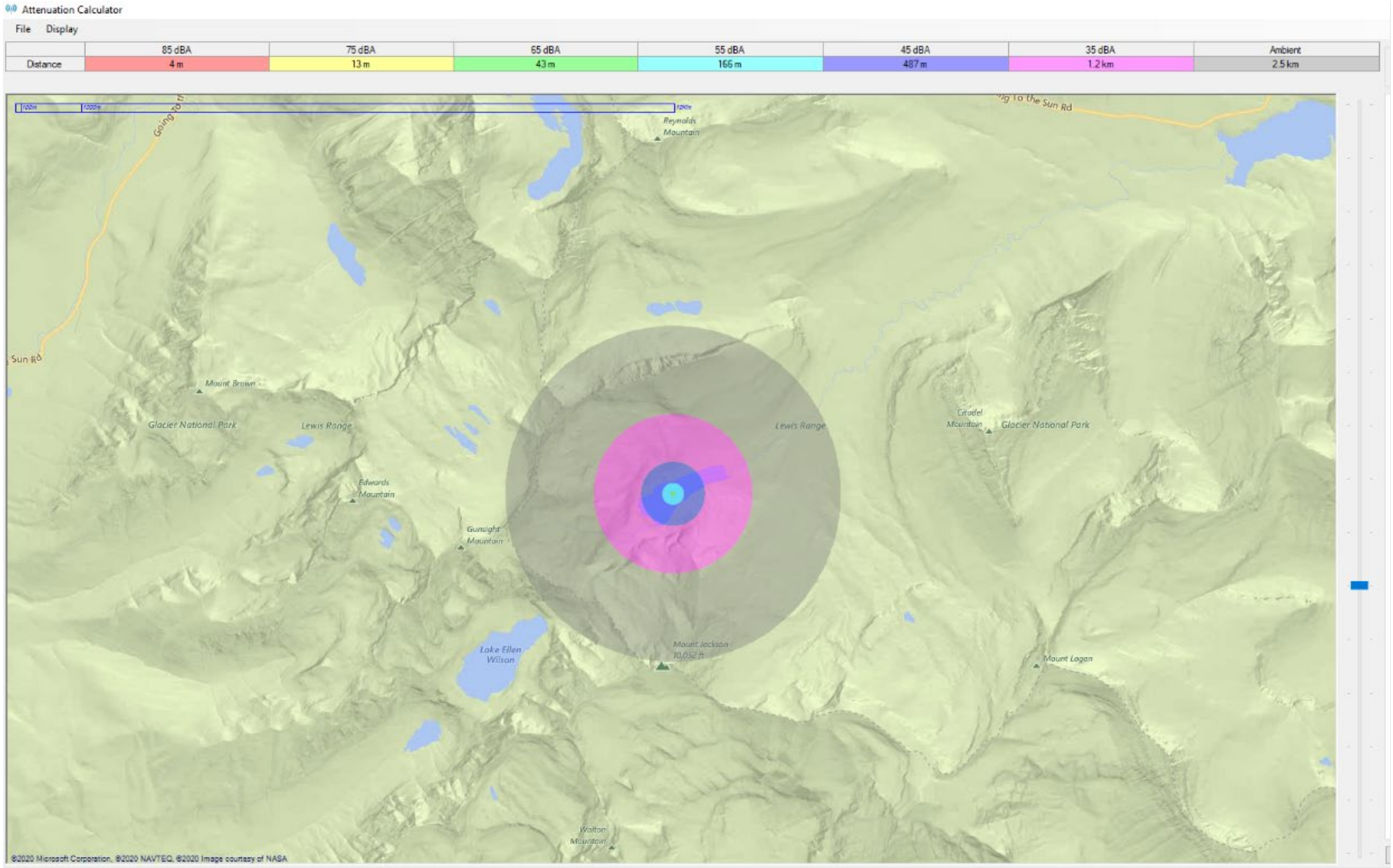
Helicopter B260L

Noise would attenuate to ambient level (30 dBA) at approximately 3.4 kilometers (2.1 miles).



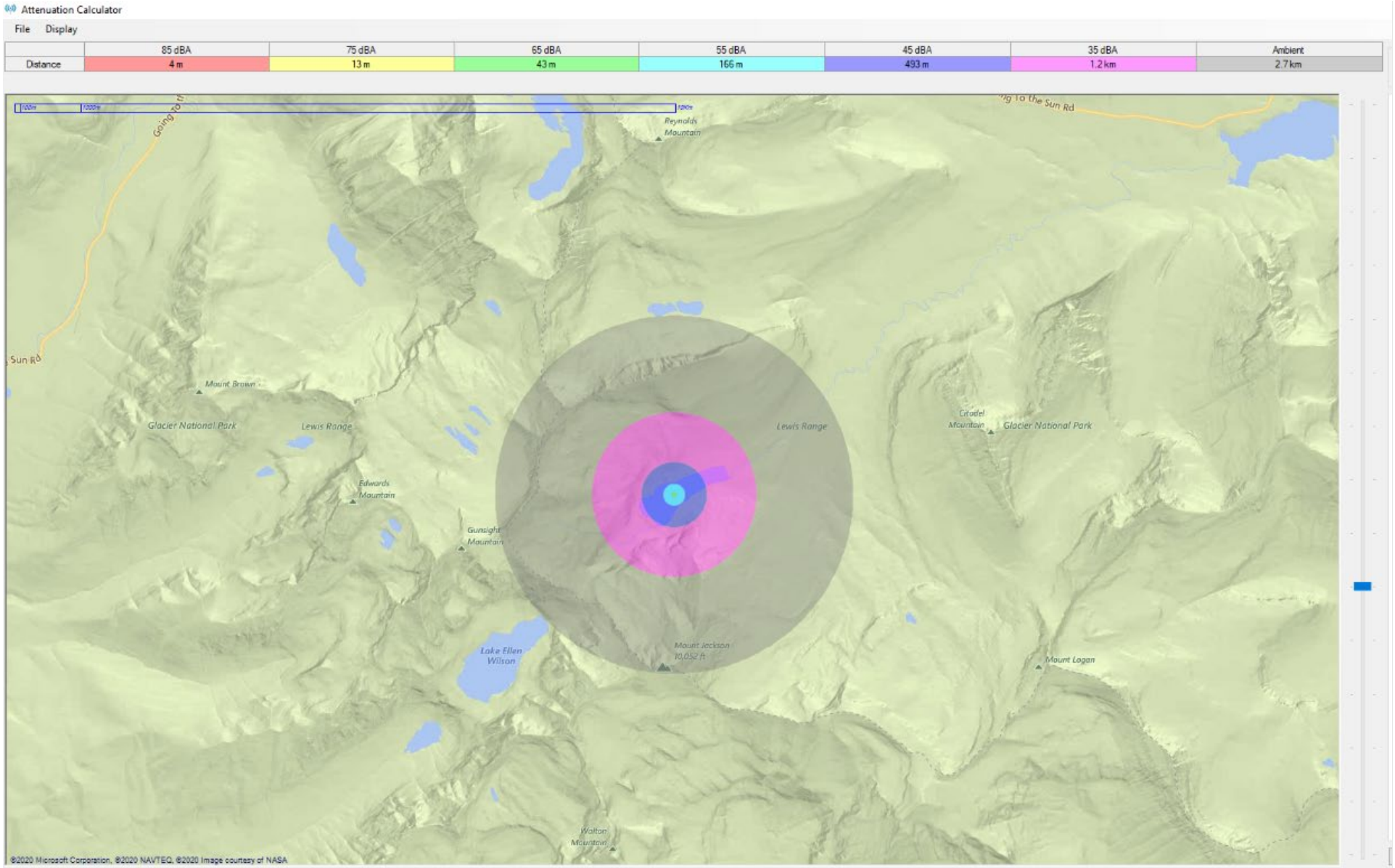
Motorboat (Kawasaki 1100 STX DI QT (66.5 dB), 4 stroke, direct injection, full throttle)

Noise would attenuate to ambient level (30 dBA) at approximately 2.5 kilometers (1.6 miles).



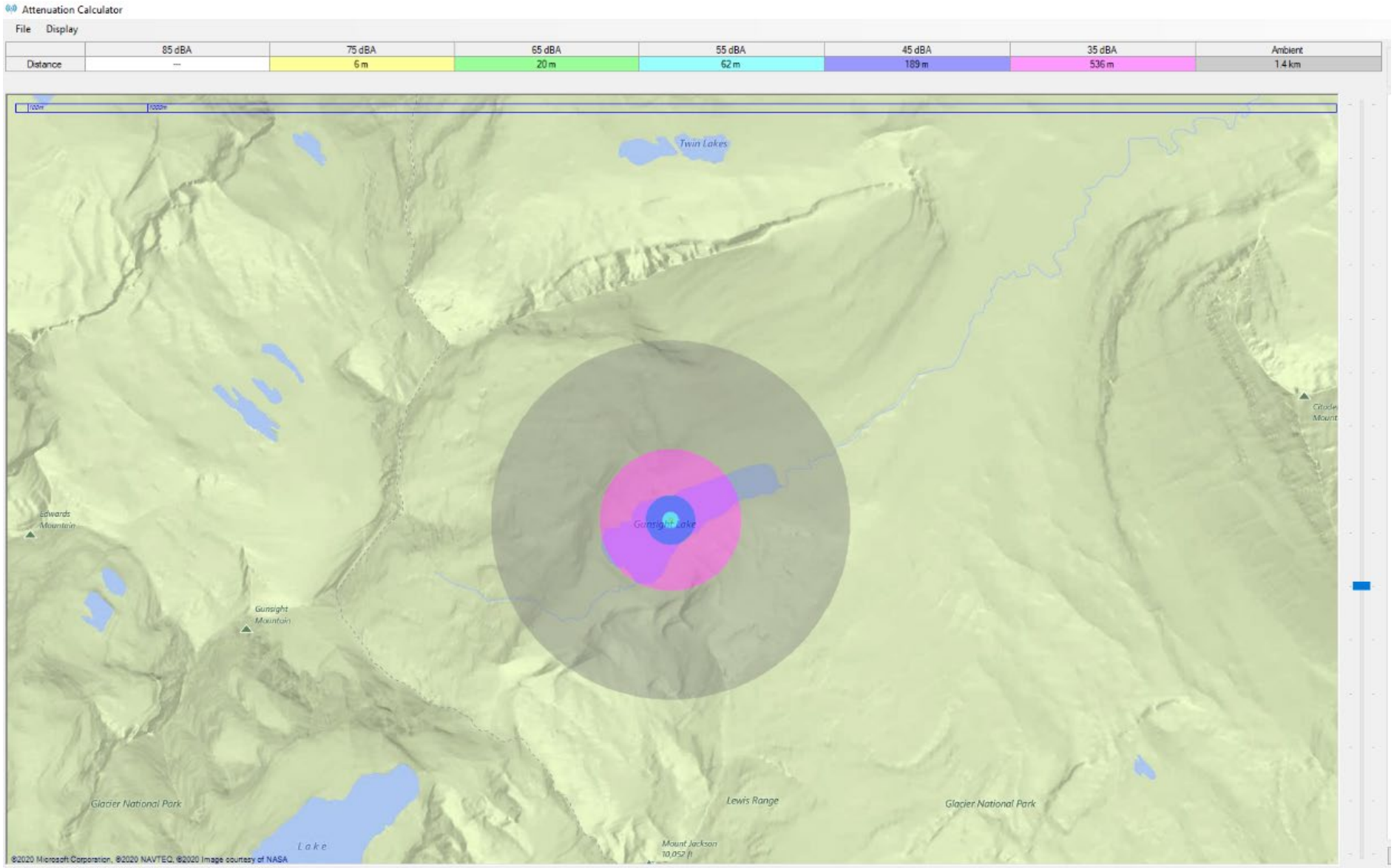
2001 Sea-Doo GTX DI QT (66.6 dB), 4 stroke, direct injection, full throttle

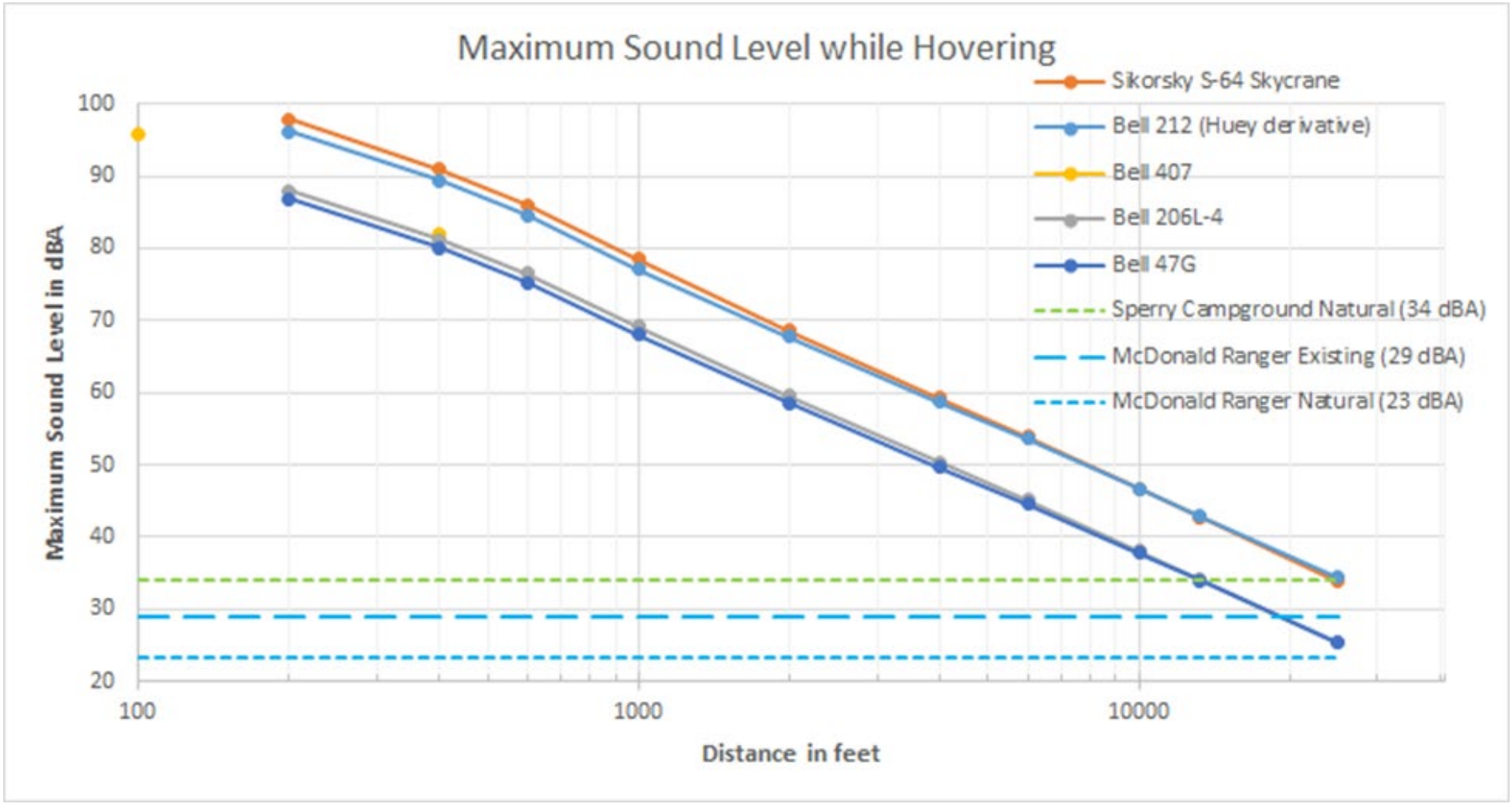
Noise would attenuate to ambient level (30 dBA) at approximately 2.7 kilometers (1.7 miles).



Generator, 67dBA $LA_{eq, 1s}$

Noise would attenuate to ambient level (30 dBA) at approximately 1.4 kilometers (0.87 mile).




Maximum Sound Level while Hovering
Sikorsky S-64 Skycrane
Bell 212 (Huey derivative)
Bell 407
Bell 206L-4
Bell 47G
Sperry Campground Natural (34 dBA)
McDonald Ranger Existing (29 dBA)
McDonald Ranger Natural (23 dBA)
Maximum Sound Level in dBA
100
90
80
70
60
50
40
30
20
100
1000
10000
Distance in feet